OCEANCREST HEALTH AND REHABILITATION CENTER

170-BED NURSING HOME AND MEMORY CARE FACILITY

MINTON ROAD AT HERITAGE OAKS BLVD., WEST MELBOURNE, FLORIDA

PROJECT MANUAL VOL II

APRIL 2025

ACI Job #1966

(DIVISIONS 220000 TO 339999)

ARCHITECTURAL CONCEPTS INC
Architecture, Planning, Interior Design & Development Management
architecturalconceptsweb.com AA0001251 / EB0005890

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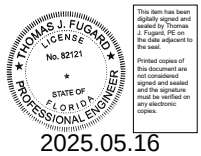
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1.1 DESIGN PROFESSIONALS OF RECORD

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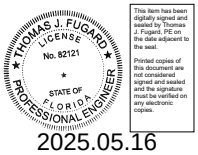
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2. PE98351
3. Responsible for 21000-21999.



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B. Plumbing Engineer:

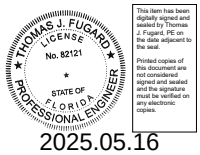
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C. HVAC Engineer:

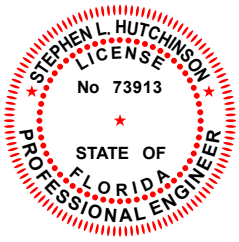
1. Thomas Fugard.
2. PE98351
3. Responsible for 23000-23999.



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D. Electrical Engineer:

1. Stephen Hutchinson.
2. PE73913.
3. Responsible for 26000-28999.



This item has been electronically signed and sealed by Stephen L. Hutchinson, PE on using a Digital Signature.

Printed Copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by Stephen L Hutchinson
DN: CN=Stephen L Hutchinson, dnQualifier=A01410C0000018FBF38A949000EAE8E,O=MPS Engineering, C=US
Reason: I am the author of this document
Date: 2025.05.19 08:57:19-04'00'

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SECTION 210517

SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating or Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves or Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves or Galvanized-steel-pipe sleeves.

2. Concrete Slabs-on-Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

   b. Piping NPS 6 and Larger: Galvanized-steel wall sleeves with sleeve-seal system, Galvanized-steel-pipe sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves.

      1) Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs above Grade:

   a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
   b. Piping NPS 6 and Larger: Galvanized-steel-pipe sleeves.

4. Interior Partitions:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 210517

SECTION 210518

ESCUTCHEONS FOR FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. One-Piece, Stamped-Steel Type: With chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

    a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
    b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
    c. Insulated Piping: One-piece, stamped-steel type.
    d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
    f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
    g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 210518

SECTION 210553

IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 3/8 inch thick, with predrilled holes for attachment hardware.
2. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
3. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
4. Minimum Letter Size: 3/8 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
5. Fasteners: Stainless-steel rivets or self-tapping screws.
6. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number, Drawing numbers where equipment is indicated (plans, details, and schedules), and the Specification Section number and title where equipment is specified.

C. Equipment-Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules) and the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 3/8 inch thick, with predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 3/8 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ActionCraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
2. Brady Corporation.
3. Carlton Industries, LP.
4. Champion America.
5. Craftmark.
6. LEM Products Inc.
7. Marking Services Inc.
8. Seton Identification Products.

B. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service and showing flow direction.

C. Self-adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping-system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 3/8 inch for viewing distances up to 72 inches and proportionately larger lettering for greater viewing distances.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.2 LABEL INSTALLATION REQUIREMENTS

A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.

B. Coordinate installation of identifying devices with locations of access panels and doors.

C. Install or permanently fasten labels on each major item of mechanical equipment.

D. Locate equipment labels where accessible and visible.

E. Piping: Painting of piping is specified in Section 099123 "Interior Painting." or Section 099600 "High-Performance Coatings."

F. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection excluding short takeoffs. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations and on both sides of through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit a view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

END OF SECTION 210553

SECTION 211119

FIRE-DEPARTMENT CONNECTIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exposed-type fire-department connections.

1.2 ACTION 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 fire-department connection.

PART 2 - PRODUCTS

2.1 EXPOSED-TYPE FIRE-DEPARTMENT CONNECTION

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Elkhart Brass Mfg. Company, Inc.
2. GMR International Equipment Corporation.
3. Guardian Fire Equipment, Inc.

B. Standard: UL 405.

C. Type: Exposed, projecting, for wall mounting.

D. Pressure Rating: 175 psig minimum.

E. Body Material: Corrosion-resistant metal.

F. Inlets: Brass with threads according to NFPA 1963 and matching local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.

G. Caps: Brass, lugged type, with gasket and chain.

H. Escutcheon Plate: Round, brass, wall type.

I. Outlet: Back, with pipe threads.

J. Number of Inlets: Two.

K. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE."

L. Finish: Rough brass or bronze.

M. Outlet Size: NPS 4.

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 fire-department connections.

B. Examine roughing-in for fire-suppression standpipe system to verify actual locations of piping connections before fire-department connection installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install wall-type fire-department connections.

B. Install two protective pipe bollards around each fire-department connection. Comply with requirements for bollards in Section 055000 "Metal Fabrications."

C. Install automatic (ball-drip) drain valve at each check valve for fire-department connection.

END OF SECTION 211119

SECTION 211313

WET-PIPE SPRINKLER SYSTEMS

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. Pipes, fittings, and specialties.
2. Fire-protection valves.
3. Sprinklers.
4. Alarm devices.
5. Pressure gages.

B. Related Sections:

1. Section 211119 "Fire-Department Connections" for exposed-, flush-, and yard-type fire-department connections.

1.3 DEFINITIONS

A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175 psig maximum.

1.4 SYSTEM DESCRIPTIONS

A. Wet-Pipe Sprinkler System: Automatic sprinklers are attached to piping containing water and that is connected to water supply through alarm valve. Water discharges immediately from sprinklers when they are opened. Sprinklers open when heat melts fusible link or destroys frangible device. Hose connections are included if indicated.

1.5 PERFORMANCE REQUIREMENTS

A. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.

B. Sprinkler system design shall be approved by authorities having jurisdiction.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
2. Sprinkler Occupancy Hazard Classifications:

    a. Building Service Areas: Ordinary Hazard, Group 1
    b. Electrical Equipment Rooms: Ordinary Hazard, Group 1
    c. General Storage Areas: Ordinary Hazard, Group 1
    d. Laundries: Ordinary Hazard, Group 1
    e. Mechanical Equipment Rooms: Ordinary Hazard, Group 1
    f. Office and Public Areas: Light Hazard
    g. Residential Living Areas: Light Hazard
    h. Restaurant Service Areas: Ordinary Hazard, Group 1

3. Minimum Density for Automatic-Sprinkler Piping Design:

    a. Light-Hazard Occupancy: 0.10 gpm over 1500-sq. ft. area.
    b. Ordinary-Hazard, Group 1 Occupancy: 0.15 gpm over 1500-sq. ft. area.

4. Maximum Protection Area per Sprinkler:

    a. Residential Areas: 400 sq. ft.
    b. Office Spaces: 120 sq. ft. 225 sq. ft.
    c. Storage Areas: 130 sq. ft.
    d. Mechanical Equipment Rooms: 130 sq. ft.
    e. Electrical Equipment Rooms: 130 sq. ft.
    f. Other Areas: According to NFPA 13 recommendations unless otherwise indicated.

5. Total Combined Hose-Stream Demand Requirement: According to NFPA 13 unless otherwise indicated:

    a. Light-Hazard Occupancies: 100 gpm for 30 minutes.
    b. Ordinary-Hazard Occupancies: 250 gpm for 60 to 90 minutes.

C. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13 and ASCE/SEI 7.

1.6 SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For wet-pipe sprinkler systems. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

C. Qualification Data: For qualified Installer and professional engineer.

D. Approved Sprinkler Piping Drawings: Working plans, prepared according to NFPA 13, that have been approved by authorities having jurisdiction, including hydraulic calculations if applicable.

E. Welding certificates.

F. Fire-hydrant flow test report.

G. Field Test Reports and Certificates: Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."

H. Field quality-control reports.

I. Operation and Maintenance Data: For sprinkler specialties to include in emergency, operation, and maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications:

1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.

a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by a qualified professional engineer.

B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. 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.

D. NFPA Standards: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following:

1. NFPA 13, "Installation of Sprinkler Systems."
2. NFPA 24, "Installation of Private Fire Service Mains and Their Appurtenances."

1.8 COORDINATION

A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.

1.9 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, and fitting materials, and for joining methods for specific services, service locations, and pipe sizes.

2.2 STEEL PIPE AND FITTINGS

A. Standard Weight, Galvanized- and Black-Steel Pipe: ASTM A 53/A 53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.

B. Schedule 30, Galvanized- and Black-Steel Pipe: ASTM A 135; ASTM A 795/A 795M, Type E; or ASME B36.10M, wrought steel; with wall thickness not less than Schedule 30 and not more than Schedule 40. Pipe ends may be factory or field formed to match joining method.

C. Thinwall Galvanized- and Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, threadable, with wall thickness less than Schedule 30 and equal to or greater than Schedule 10. Pipe ends may be factory or field formed to match joining method.

D. Schedule 10, Black-Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.

E. Schedule 5 Steel Pipe: ASTM A 135 or ASTM A 795/A 795M, lightwall, with plain ends.

F. Galvanized- and Black-Steel Pipe Nipples: ASTM A 733, made of ASTM A 53/A 53M, standard-weight, seamless steel pipe with threaded ends.

G. Galvanized and Uncoated, Steel Couplings: ASTM A 865, threaded.

H. Galvanized and Uncoated, Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.

I. Malleable- or Ductile-Iron Unions: UL 860.

J. Cast-Iron Flanges: ASME 16.1, Class 125.

K. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.

L. Steel Welding Fittings: ASTM A 234/A 234M and ASME B16.9.

M. Grooved-Joint, Steel-Pipe Appurtenances:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Corcoran Piping System Co.
c. National Fittings, Inc.
d. Shurjoint Piping Products.
e. Tyco Fire & Building Products LP.
f. Victaulic Company.

2. Pressure Rating: 175 psig minimum.
3. Galvanized and Uncoated, Grooved-End Fittings for Steel Piping: ASTM A 47/A 47M, malleable-iron casting or ASTM A 536, ductile-iron casting; with dimensions matching steel pipe.
4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213, rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

N. Steel Pressure-Seal Fittings: UL 213, FM-approved, 175-psig pressure rating with steel housing, rubber O-rings, and pipe stop; for use with fitting manufacturers' pressure-seal tools.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Victaulic Company.

2.3 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free.

1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.4 LISTED FIRE-PROTECTION VALVES

A. General Requirements:

1. Valves shall be UL listed or FM approved.
2. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig.
3. Minimum Pressure Rating for High-Pressure Piping: 250 psig.

B. Check Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AFAC Inc.
b. American Cast Iron Pipe Company; Waterous Company Subsidiary.
c. Anvil International, Inc.
d. Clow Valve Company; a division of McWane, Inc.
e. Crane Co.; Crane Valve Group; Crane Valves.
f. Crane Co.; Crane Valve Group; Jenkins Valves.
g. Crane Co.; Crane Valve Group; Stockham Division.
h. Fire-End & Croker Corporation.
i. Fire Protection Products, Inc.
j. Fivalco Inc.
k. Globe Fire Sprinkler Corporation.
l. Groeniger & Company.
m. Kennedy Valve; a division of McWane, Inc.
n. Matco-Norca.
o. Metraflex, Inc.
p. Milwaukee Valve Company.
q. Mueller Co.; Water Products Division.
r. NIBCO INC.
s. Potter Roemer.
t. Reliable Automatic Sprinkler Co., Inc.
u. Shurjoint Piping Products.
v. Tyco Fire & Building Products LP.
w. United Brass Works, Inc.
x. Venus Fire Protection Ltd.
y. Victaulic Company.
z. Viking Corporation.
aa. Watts Water Technologies, Inc.

2. Standard: UL 312.
3. Pressure Rating: 250 psig minimum.
4. Type: Swing check.
5. Body Material: Cast iron.
6. End Connections: Flanged or grooved.

C. Iron OS&Y Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Crane Valves.
e. Crane Co.; Crane Valve Group; Jenkins Valves.
f. Crane Co.; Crane Valve Group; Stockham Division.
g. Hammond Valve.

h. Milwaukee Valve Company.
i. Mueller Co.; Water Products Division.
j. NIBCO INC.
k. Shurjoint Piping Products.
l. Tyco Fire & Building Products LP.
m. United Brass Works, Inc.
n. Watts Water Technologies, Inc.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast or ductile iron.
5. End Connections: Flanged or grooved.

D. Indicating-Type Butterfly Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. Fivalco Inc.
c. Global Safety Products, Inc.
d. Kennedy Valve; a division of McWane, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Shurjoint Piping Products.
h. Tyco Fire & Building Products LP.
i. Victaulic Company.

2. Standard: UL 1091.
3. Pressure Rating: 175 psig minimum.
4. Valves NPS 2 and Smaller:

a. Valve Type: Ball or butterfly.
b. Body Material: Bronze.
c. End Connections: Threaded.

5. Valves NPS 2-1/2 and Larger:

a. Valve Type: Butterfly.
b. Body Material: Cast or ductile iron.
c. End Connections: Flanged, grooved, or wafer.

6. Valve Operation: Integral electrical, 115-V ac, prewired, single-circuit, supervisory switch indicating device.

E. NRS Gate Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.

b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kennedy Valve; a division of McWane, Inc.
f. Mueller Co.; Water Products Division.
g. NIBCO INC.
h. Tyco Fire & Building Products LP.

2. Standard: UL 262.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Cast iron with indicator post flange.
5. Stem: Nonrising.
6. End Connections: Flanged or grooved.

F. Indicator Posts:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. American Cast Iron Pipe Company; Waterous Company Subsidiary.
b. American Valve, Inc.
c. Clow Valve Company; a division of McWane, Inc.
d. Crane Co.; Crane Valve Group; Stockham Division.
e. Kennedy Valve; a division of McWane, Inc.
f. Mueller Co.; Water Products Division.
g. NIBCO INC.
h. Tyco Fire & Building Products LP.

2. Standard: UL 789.
3. Type: Horizontal for wall mounting.
4. Body Material: Cast iron with extension rod and locking device.
5. Operation: Wrench.

2.5 TRIM AND DRAIN VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating: 175 psig minimum.

B. Angle Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Protection Products, Inc.
b. United Brass Works, Inc.

C. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Affiliated Distributors.
b. Anvil International, Inc.
c. Barnett.
d. Conbraco Industries, Inc.; Apollo Valves.
e. Fire-End & Croker Corporation.
f. Fire Protection Products, Inc.
g. Flowserve.
h. FNW.
i. Jomar International, Ltd.
j. Kennedy Valve; a division of McWane, Inc.
k. Kitz Corporation.
l. Legend Valve.
m. Metso Automation USA Inc.
n. Milwaukee Valve Company.
o. NIBCO INC.
p. Potter Roemer.
q. Red-White Valve Corporation.
r. Southern Manufacturing Group.
s. Stewart, M. A. and Sons Ltd.
t. Tyco Fire & Building Products LP.
u. Victaulic Company.
v. Watts Water Technologies, Inc.

D. Globe Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire Protection Products, Inc.
b. United Brass Works, Inc.

E. Plug Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Southern Manufacturing Group.

2.6 SPECIALTY VALVES

A. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.

2. Pressure Rating:

    a. Standard-Pressure Piping Specialty Valves: 175 psig minimum.
    b. High-Pressure Piping Specialty Valves: 250 psig minimum.

3. Body Material: Cast or ductile iron.
4. Size: Same as connected piping.
5. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AFAC Inc.
    b. Globe Fire Sprinkler Corporation.
    c. Reliable Automatic Sprinkler Co., Inc.
    d. Tyco Fire & Building Products LP.
    e. Venus Fire Protection Ltd.
    f. Victaulic Company.
    g. Viking Corporation.

2. Standard: UL 193.
3. Design: For horizontal or vertical installation.
4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, retarding chamber, and fill-line attachment with strainer.
5. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AFAC Inc.
    b. Reliable Automatic Sprinkler Co., Inc.
    c. Tyco Fire & Building Products LP.

2. Standard: UL 1726.
3. Pressure Rating: 175 psig minimum.
4. Type: Automatic draining, ball check.
5. Size: NPS 3/4.
6. End Connections: Threaded.

2.7 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Anvil International, Inc.
b. National Fittings, Inc.
c. Shurjoint Piping Products.
d. Tyco Fire & Building Products LP.
e. Victaulic Company.

2. Standard: UL 213.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
5. Type: Mechanical-T and -cross fittings.
6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.
8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AGF Manufacturing Inc.
b. Reliable Automatic Sprinkler Co., Inc.
c. Tyco Fire & Building Products LP.
d. Victaulic Company.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

C. Branch Line Testers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Elkhart Brass Mfg. Company, Inc.
b. Fire-End & Croker Corporation.
c. Potter Roemer.

2. Standard: UL 199.
3. Pressure Rating: 175 psig.
4. Body Material: Brass.
5. Size: Same as connected piping.
6. Inlet: Threaded.
7. Drain Outlet: Threaded and capped.
8. Branch Outlet: Threaded, for sprinkler.

D. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. AGF Manufacturing Inc.
    b. Triple R Specialty.
    c. Tyco Fire & Building Products LP.
    d. Victaulic Company.
    e. Viking Corporation.

2. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
3. Pressure Rating: 175 psig minimum.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

E. Adjustable Drop Nipples:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. CECA, LLC.
    b. Corcoran Piping System Co.
    c. Merit Manufacturing; a division of Anvil International, Inc.

2. Standard: UL 1474.
3. Pressure Rating: 250 psig minimum.
4. Body Material: Steel pipe with EPDM-rubber O-ring seals.
5. Size: Same as connected piping.
6. Length: Adjustable.
7. Inlet and Outlet: Threaded.

F. Flexible, Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Fivalco Inc.
    b. FlexHead Industries, Inc.
    c. Gateway Tubing, Inc.

2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175 psig minimum.
5. Size: Same as connected piping, for sprinkler.

2.8 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFAC Inc.
2. Globe Fire Sprinkler Corporation.
3. Reliable Automatic Sprinkler Co., Inc.
4. Tyco Fire & Building Products LP.
5. Venus Fire Protection Ltd.
6. Victaulic Company.
7. Viking Corporation.

B. General Requirements:

1. Standard: UL's "Fire Protection Equipment Directory" listing or "Approval Guide," published by FM Global, listing.
2. Pressure Rating for Residential Sprinklers: 175 psig maximum.
3. Pressure Rating for Automatic Sprinklers: 175 psig minimum.
4. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig minimum.

C. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: UL 1767.
2. Nonresidential Applications: UL 199.
3. Residential Applications: UL 1626.
4. Characteristics: Nominal 1/2-inch orifice with Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.

D. Sprinkler Finishes:

1. Chrome plated.
2. Bronze.
3. Painted.

E. Special Coatings:

1. Wax.
2. Lead.
3. Corrosion-resistant paint.

F. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.

1. Ceiling Mounting: Chrome-plated steel, one piece, flat or Chrome-plated steel, two piece, with 1-inch vertical adjustment.
2. Sidewall Mounting: Chrome-plated steel, one piece, flat.

G. Sprinkler Guards:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Reliable Automatic Sprinkler Co., Inc.
   b. Tyco Fire & Building Products LP.
   c. Victaulic Company.
   d. Viking Corporation.

2. Standard: UL 199.
3. Type: Wire cage with fastening device for attaching to sprinkler.

2.9 ALARM DEVICES

A. Alarm-device types shall match piping and equipment connections.

B. Electrically Operated Alarm Bell:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. Fire-Lite Alarms, Inc.; a Honeywell company.
   b. Notifier; a Honeywell company.
   c. Potter Electric Signal Company.

2. Standard: UL 464.
3. Type: Vibrating, metal alarm bell.
4. Size: 6-inch minimum- diameter.
5. Finish: Red-enamel factory finish, suitable for outdoor use.

C. Water-Flow Indicators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. ADT Security Services, Inc.
   b. McDonnell & Miller; ITT Industries.
   c. Potter Electric Signal Company.
   d. System Sensor; a Honeywell company.
   e. Viking Corporation.
   f. Watts Industries (Canada) Inc.

2. Standard: UL 346.
3. Water-Flow Detector: Electrically supervised.
4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
5. Type: Paddle operated.

6. Pressure Rating: 250 psig.
7. Design Installation: Horizontal or vertical.

D. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Fire-Lite Alarms, Inc.; a Honeywell company.
b. Kennedy Valve; a division of McWane, Inc.
c. Potter Electric Signal Company.
d. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.

E. Indicator-Post Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Potter Electric Signal Company.
b. System Sensor; a Honeywell company.

2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.10 PRESSURE GAGES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AMETEK; U.S. Gauge Division.
2. Ashcroft, Inc.
3. Brecco Corporation.
4. WIKA Instrument Corporation.

B. Standard: UL 393.

C. Dial Size: 3-1/2- to 4-1/2-inch diameter.

D. Pressure Gage Range: 0 to 250 psig minimum.

E. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

PART 3 - EXECUTION

3.1 PREPARATION

A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.

B. Report test results promptly and in writing.

3.2 SERVICE-ENTRANCE PIPING

A. Connect sprinkler piping to water-service piping for service entrance to building.

B. Install shutoff valve, check valve, pressure gage, and drain at connection to water service.

3.3 PIPING INSTALLATION

A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.

1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

B. Piping Standard: Comply with requirements for installation of sprinkler piping in NFPA 13.

C. Install seismic restraints on piping. Comply with requirements for seismic-restraint device materials and installation in NFPA 13.

D. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions adjacent to each valve in pipes NPS 2 and smaller.

F. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

G. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.

H. Install sprinkler piping with drains for complete system drainage.

I. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.

J. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.

K. Install alarm devices in piping systems.

L. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.

M. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to freezing.

N. Fill sprinkler system piping with water.

O. Install electric heating cables and pipe insulation on sprinkler piping in areas subject to freezing. Comply with requirements for heating cables in Section 210533 "Heat Tracing for Fire-Suppression Piping" and for piping insulation in Section 210700 "Fire-Suppression Systems Insulation."

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 210518 "Escutcheons for Fire-Suppression Piping."

3.4 JOINT CONSTRUCTION

A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.

B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.

D. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

E. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.

F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.

G. 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.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

H. Twist-Locked Joints: Insert plain end of steel pipe into plain-end-pipe fitting. Rotate retainer lugs one-quarter turn or tighten retainer pin.

I. Steel-Piping, Pressure-Sealed Joints: Join lightwall steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

J. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.

1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.

K. Steel-Piping, Cut-Grooved Joints: Cut square-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe joints.

L. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.

M. Steel-Piping, Pressure-Sealed Joints: Join Schedule 5 steel pipe and steel pressure-seal fittings with tools recommended by fitting manufacturer.

N. Copper-Tubing, Pressure-Sealed Joints: Join copper tube and copper pressure-seal fittings with tools recommended by fitting manufacturer.

O. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.5 VALVE AND SPECIALTIES INSTALLATION

A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.

B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.

D. Specialty Valves:

1. General Requirements: Install in vertical position for proper direction of flow, in main supply to system.
2. Alarm Valves: Include bypass check valve and retarding chamber drain-line connection.

3.6 SPRINKLER INSTALLATION

A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.

C. Install sprinklers into flexible, sprinkler hose fittings and install hose into bracket on ceiling grid.

3.7 IDENTIFICATION

A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

B. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
4. Energize circuits to electrical equipment and devices.
5. Coordinate with fire-alarm tests. Operate as required.
6. Coordinate with fire-pump tests. Operate as required.
7. Verify that equipment hose threads are same as local fire-department equipment.

C. Sprinkler piping system will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

3.9 CLEANING

A. Clean dirt and debris from sprinklers.

B. Remove and replace sprinklers with paint other than factory finish.

3.10 PIPING SCHEDULE

A. Piping between Fire-Department Connections and Check Valves: Galvanized, standard-weight steel pipe with threaded ends; cast-iron threaded fittings; and threaded or grooved ends; grooved-end fittings; grooved-end-pipe couplings; and grooved joints.

B. Sprinkler specialty fittings may be used, downstream of control valves, instead of specified fittings.

C. CPVC pipe; Schedule 40 CPVC fittings; and solvent-cemented joints may be used for residential occupancies.

D. Standard-pressure, wet-pipe sprinkler system, NPS 2 and smaller, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
2. Standard-weight or Schedule 30, black-steel pipe with plain ends; uncoated, plain-end-pipe fittings; and twist-locked joints.
3. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

E. Standard-pressure, wet-pipe sprinkler system, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.

F. Standard-pressure, wet-pipe sprinkler system, NPS 5 and larger, shall be one of the following:

1. Standard-weight or Schedule 30, black-steel pipe with cut- or roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
2. Standard-weight or Schedule 30, black-steel pipe with plain ends; steel welding fittings; and welded joints.
3. Thinwall or Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.
4. Thinwall or Schedule 10, black-steel pipe with plain ends; welding fittings; and welded joints.

3.11 SPRINKLER SCHEDULE

A. Use sprinkler types in subparagraphs below for the following applications:

1. Rooms without Ceilings: Upright sprinklers.
2. Rooms with Suspended Ceilings: Pendent, recessed, flush, and concealed sprinklers as indicated.

3. Wall Mounting: Sidewall sprinklers.
4. Spaces Subject to Freezing: Upright, pendent, dry sprinklers; and sidewall, dry sprinklers as indicated.
5. Special Applications: Extended-coverage, flow-control, and quick-response sprinklers where indicated.

B. Provide sprinkler types in subparagraphs below with finishes indicated.

1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
2. Flush Sprinklers: Bright chrome, with painted white escutcheon.
3. Recessed Sprinklers: Bright chrome, with bright chrome escutcheon.
4. Residential Sprinklers: Dull chrome.
5. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 211313

SECTION 220513

COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and polyphase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 220513

SECTION 220517

SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves.
2. Sleeve-seal systems.
3. Grout.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 SLEEVES

A. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop unless otherwise indicated.

B. Galvanized-Steel Wall Pipes: ASTM A 53/A 53M, Schedule 40, with plain ends and welded steel collar; zinc coated.

C. Galvanized-Steel-Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, with plain ends.

D. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness; round tube closed with welded longitudinal joint.

2.2 SLEEVE-SEAL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Advance Products & Systems, Inc.
2. CALPICO, Inc.
3. Metraflex Company (The).
4. Pipeline Seal and Insulator, Inc.
5. Proco Products, Inc.

B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.

1. Sealing Elements: EPDM-rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
2. Pressure Plates: Stainless steel.
3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION

A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.

B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide 1-inch annular clear space between piping and concrete slabs and walls.

1. Sleeves are not required for core-drilled holes.

C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.

1. Cut sleeves to length for mounting flush with both surfaces.

a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.

2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

D. Install sleeves for pipes passing through interior partitions.

1. Cut sleeves to length for mounting flush with both surfaces.
2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.

3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint. Comply with requirements for sealants specified in Section 079200 "Joint Sealants."

E. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials. Comply with requirements for firestopping specified in Section 078413 "Penetration Firestopping."

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building.

B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.3 SLEEVE AND SLEEVE-SEAL SCHEDULE

A. Use sleeves and sleeve seals for the following piping-penetration applications:

1. Exterior Concrete Walls above Grade: Cast-iron wall sleeves, Galvanized-steel wall sleeves or Galvanized-steel-pipe sleeves.

2. Exterior Concrete Walls below Grade: Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.

    a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

3. Concrete Slabs-on-Grade: Galvanized-steel wall sleeves with sleeve-seal system or Galvanized-steel-pipe sleeves with sleeve-seal system.

    a. Select sleeve size to allow for 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.

4. Concrete Slabs above Grade: Galvanized-steel-pipe sleeves.

5. Interior Partitions:

    a. Piping Smaller Than NPS 6: Galvanized-steel-pipe sleeves.
    b. Piping NPS 6 and Larger: Galvanized-steel-sheet sleeves.

END OF SECTION 220517

SECTION 220518

ESCUTCHEONS FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

C. Split-Casting Brass Type: With polished, chrome-plated and rough-brass finish and with concealed hinge and setscrew.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

B. Split-Casting Floor Plates: Cast brass with concealed hinge.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of insulated piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.
b. Chrome-Plated Piping: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type or split-plate, stamped-steel type with concealed hinge.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass or split-casting brass type with polished, chrome-plated or rough-brass finish.

2. Escutcheons for Existing Piping:

a. Chrome-Plated Piping: Split-casting brass type with polished, chrome-plated finish.
b. Insulated Piping: Split-plate, stamped-steel type with concealed hinge.
c. Bare Piping at Wall and Floor Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
d. Bare Piping at Ceiling Penetrations in Finished Spaces: Split-casting brass type with polished, chrome-plated finish.
e. Bare Piping in Unfinished Service Spaces: Split-casting brass type with polished, chrome-plated or rough-brass finish.
f. Bare Piping in Equipment Rooms: Split-casting brass type with polished, chrome-plated or rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.
2. Existing Piping: Split-casting, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 220518

SECTION 220519

METERS AND GAGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Bimetallic-actuated thermometers.
2. Liquid-in-glass thermometers.
3. Thermowells.
4. Dial-type pressure gages.
5. Gage attachments.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Product Certificates: For each type of meter and gage.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For meters and gages to include in operation and maintenance manuals.

PART 2 PRODUCTS

2.1 BIMETALLIC-ACTUATED THERMOMETERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Trerice, H. O. Co.
2. Weiss Instruments, Inc.
3. Weksler Glass Thermometer Corp.

B. Standard: ASME B40.200.

C. Case: sealed type(s); stainless steel with 3-inch nominal diameter.

D. Dial: Nonreflective aluminum with permanently etched scale markings and scales in deg F and deg C.

E. Connector Type(s): Union joint, adjustable angle, with unified-inch screw threads.

F. Connector Size: 1/2 inch, with ASME B1.1 screw threads.

G. Stem: 0.25 or 0.375 inch in diameter; stainless steel.

H. Window: Plain glass.

I. Ring: Stainless steel.

J. Element: Bimetal coil.

K. Pointer: Dark-colored metal.

L. Accuracy: Plus or minus 1 percent of scale range.

2.2 LIQUID-IN-GLASS THERMOMETERS

A. Metal-Case, Compact-Style, Liquid-in-Glass Thermometers:
1. Standard: ASME B40.200.
2. Case: Cast aluminum; 6-inch nominal size.
3. Case Form: Back angle unless otherwise indicated.
4. Tube: Glass with magnifying lens and blue organic liquid.
5. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
6. Window: Glass or plastic.
7. Stem: Aluminum or brass and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
8. Connector: 3/4 inch, with ASME B1.1 screw threads.
9. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

B. Metal-Case, Industrial-Style, Liquid-in-Glass Thermometers:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Trerice, H. O. Co.
   b. Weiss Instruments, Inc.
   c. Weksler Glass Thermometer Corp.
2. Standard: ASME B40.200.
3. Case: Cast aluminum; 7-inch nominal size unless otherwise indicated.
4. Case Form: Adjustable angle unless otherwise indicated.
5. Tube: Glass with magnifying lens and blue organic liquid.
6. Tube Background: Nonreflective aluminum with permanently etched scale markings graduated in deg F and deg C.
7. Window: Glass.
8. Stem: Aluminum and of length to suit installation.
   a. Design for Thermowell Installation: Bare stem.
9. Connector: 1-1/4 inches, with ASME B1.1 screw threads.
10. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.

2.3 THERMOWELLS

A. Thermowells:
1. Standard: ASME B40.200.
2. Description: Pressure-tight, socket-type fitting made for insertion into piping tee fitting.
3. Material for Use with Copper Tubing: CNR or CUNI.
4. Material for Use with Steel Piping: CRES or CSA.
5. Type: Stepped shank unless straight or tapered shank is indicated.
6. External Threads: NPS 1/2, NPS 3/4, or NPS 1, ASME B1.20.1 pipe threads.
7. Internal Threads: 1/2, 3/4, and 1 inch, with ASME B1.1 screw threads.
8. Bore: Diameter required to match thermometer bulb or stem.
9. Insertion Length: Length required to match thermometer bulb or stem.

10. Lagging Extension: Include on thermowells for insulated piping and tubing.
11. Bushings: For converting size of thermowell's internal screw thread to size of thermometer connection.

B. Heat-Transfer Medium: Mixture of graphite and glycerin.

2.4 PRESSURE GAGES

A. Direct-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Trerice, H. O. Co.
   b. Weiss Instruments, Inc.
   c. Weksler Glass Thermometer Corp.
2. Standard: ASME B40.100.
3. Case: Sealed Open-front, pressure relief type(s); cast aluminum or drawn steel; 4-1/2-inch nominal diameter.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal Brass.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

B. Remote-Mounted, Metal-Case, Dial-Type Pressure Gages:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. Trerice, H. O. Co.
   b. Weiss Instruments, Inc.
   c. Winters Instruments - U.S.
2. Standard: ASME B40.100.
3. Case: Sealed type; cast aluminum or drawn steel; 4-1/2-inch nominal diameter with back flange and holes for panel mounting.
4. Pressure-Element Assembly: Bourdon tube unless otherwise indicated.
5. Pressure Connection: Brass, with NPS 1/2, ASME B1.20.1 pipe threads and bottom-outlet type unless back-outlet type is indicated.
6. Movement: Mechanical, with link to pressure element and connection to pointer.
7. Dial: Nonreflective aluminum with permanently etched scale markings graduated in psi and kPa.
8. Pointer: Dark-colored metal.
9. Window: Glass.
10. Ring: Metal.
11. Accuracy: Grade A, plus or minus 1 percent of middle half of scale range.

2.5 GAGE ATTACHMENTS

A. Snubbers: ASME B40.100, brass; with NPS 1/2, ASME B1.20.1 pipe threads and piston-type surge-dampening device. Include extension for use on insulated piping.

B. Valves: Brass ball, with NPS 1/2, ASME B1.20.1 pipe threads.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install thermowells with socket extending to center of pipe and in vertical position in piping tees.

B. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

C. Install thermowells with extension on insulated piping.

D. Fill thermowells with heat-transfer medium.

E. Install direct-mounted thermometers in thermowells and adjust vertical and tilted positions.

F. Install remote-mounted thermometer bulbs in thermowells and install cases on panels; connect cases with tubing and support tubing to prevent kinks. Use minimum tubing length.

G. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

H. Install remote-mounted pressure gages on panel.

I. Install valve and snubber in piping for each pressure gage for fluids.

J. Install thermometers in the following locations:
   1. Inlet and outlet of each water heater.
   2. Inlets and outlets of each domestic water heat exchanger.
   3. Inlet and outlet of each domestic hot-water storage tank.
   4. Inlet and outlet of each remote domestic water chiller.

K. Install pressure gages in the following locations:
   1. Building water service entrance into building.
   2. Inlet and outlet of each pressure-reducing valve.
   3. Suction and discharge of each domestic water pump.

L. Install meters and gages adjacent to machines and equipment to allow service and maintenance of meters, gages, machines, and equipment.

M. Adjust faces of meters and gages to proper angle for best visibility.

3.2 THERMOMETER SCALE-RANGE SCHEDULE

A. Scale Range for Domestic Cold-Water Piping: 0 to 100 deg F and minus 20 to plus 50 deg C.

B. Scale Range for Domestic Cold-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.

C. Scale Range for Domestic Cold-Water Piping: 30 to 240 deg F and 0 to plus 115 deg C.

D. Scale Range for Domestic Hot-Water Piping: 0 to 250 deg F and 0 to 150 deg C.

E. Scale Range for Domestic Cooled-Water Piping: 0 to 150 deg F and minus 20 to plus 70 deg C.

3.3 PRESSURE-GAGE SCALE-RANGE SCHEDULE

A. Scale Range for Water Service Piping: 0 to 200 psi and 0 to 1400 kPa.

B. Scale Range for Domestic Water Piping: 0 to 200 psi and 0 to 1400 kPa.

END OF SECTION 220519

SECTION 220523

GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Brass ball valves.
2. Bronze ball valves.
3. Bronze swing check valves.

1.2 QUALITY ASSURANCE

A. ASME Compliance: ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.

B. NSF Compliance: NSF 61 for valve materials for potable-water service.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Refer to valve schedule articles for applications of valves.

B. Valve Pressure and Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.

C. Valve Sizes: Same as upstream piping unless otherwise indicated.

D. Valves in Insulated Piping: With 2-inchstem extensions and the following features:
1. Ball Valves: With extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:

1. Flanged: With flanges according to ASME B16.1 for iron valves.
2. Solder Joint: With sockets according to ASME B16.18.
3. Threaded: With threads according to ASME B1.20.1.

2.2 BRASS BALL VALVES

A. Two-Piece, Full-Port, Brass Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Crane Co.; Crane Valve Group; Crane Valves.
b. Crane Co.; Crane Valve Group; Jenkins Valves.
c. Hammond Valve.
d. Kitz Corporation.
e. Milwaukee Valve Company.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Forged brass.
f. Ends: Threaded.
g. Seats: PTFE or TFE.
h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.3 BRONZE BALL VALVES

A. Two-Piece, Full-Port, Bronze Ball Valves with Stainless-Steel Trim:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.; Apollo Valves.
b. Crane Co.; Crane Valve Group; Crane Valves.
c. Hammond Valve.
d. Lance Valves; a division of Advanced Thermal Systems, Inc.
e. Milwaukee Valve Company.
f. NIBCO INC.
g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.

2. Description:

a. Standard: MSS SP-110.
b. SWP Rating: 150 psig.
c. CWP Rating: 600 psig.
d. Body Design: Two piece.
e. Body Material: Bronze.
f. Ends: Threaded.
g. Seats: PTFE or TFE.

h. Stem: Stainless steel.
i. Ball: Stainless steel, vented.
j. Port: Full.

2.4 BRONZE SWING CHECK VALVES

A. Class 125, Bronze Swing Check Valves with Bronze Disc:

1. Description:

a. Standard: MSS SP-80, Type 3.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: Bronze.

B. Class 125, Bronze Swing Check Valves with Nonmetallic Disc:

1. Description:

a. Standard: MSS SP-80, Type 4.
b. CWP Rating: 200 psig.
c. Body Design: Horizontal flow.
d. Body Material: ASTM B 62, bronze.
e. Ends: Threaded.
f. Disc: PTFE or TFE.

PART 3 - EXECUTION

3.1 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves in horizontal piping with stem at or above center of pipe.

D. Install valves in position to allow full stem movement.

E. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

3.2 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valve applications are not indicated, use the following:

1. Shutoff Service: Ball valves.
2. Throttling Service: ball valves.
3. Pump-Discharge Check Valves:

    a. NPS 2and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

B. If valves with specified SWP classes or CWP ratings are not available, the same types of valves with higher SWP class or CWP ratings may be substituted.

C. Select valves, except wafer types, with the following end connections:

1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.3 DOMESTIC, HOT- AND COLD-WATER VALVE SCHEDULE

A. Pipe NPS 2and Smaller:

1. Bronze and Brass Valves: May be provided with solder-joint ends instead of threaded ends.
2. Bronze Swing Check Valves: Class 125, bronze disc.

END OF SECTION 220523

SECTION 220529

HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Fiberglass pipe hangers.
4. Metal framing systems.
5. Fiberglass strut systems.
6. Thermal-hanger shield inserts.
7. Fastener systems.
8. Pipe stands.
9. Pipe positioning systems.
10. Equipment supports.

B. Related Sections:

1. Section 055000 "Metal Fabrications" for structural-steel shapes and plates for trapeze hangers for pipe and equipment supports.
2. Section 220516 "Expansion Fittings and Loops for Plumbing Piping" for pipe guides and anchors.
3. Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" or Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment" for vibration isolation devices.

1.2 DEFINITIONS

A. MSS: Manufacturers Standardization Society of The Valve and Fittings Industry Inc.

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for plumbing piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.

2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.4 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following; include Product Data for components:

1. Trapeze pipe hangers.
2. Metal framing systems.
3. Fiberglass strut systems.
4. Pipe stands.
5. Equipment supports.

C. requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of trapeze hangers.
2. Design Calculations: Calculate requirements for designing trapeze hangers.

1.5 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.6 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.

4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 FIBERGLASS PIPE HANGERS

A. Clevis-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 1, steel pipe hanger except hanger is made of fiberglass or fiberglass-reinforced resin.
2. Hanger Rods: Continuous-thread rod, washer, and nuts made of stainless steel.

B. Strap-Type, Fiberglass Pipe Hangers:

1. Description: Similar to MSS SP-58, Type 9 or Type 10, steel pipe hanger except hanger is made of fiberglass-reinforced resin.
2. Hanger Rod and Fittings: Continuous-thread rod, washer, and nuts made of stainless steel.

2.4 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Allied Tube & Conduit.

b. Cooper B-Line, Inc.
c. Flex-Strut Inc.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut Corporation; Tyco International, Ltd.
g. Wesanco, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with in-turned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
7. Metallic Coating: Hot-dipped galvanized.

B. Non-MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Anvil International; a subsidiary of Mueller Water Products Inc.
b. Empire Industries, Inc.
c. ERICO International Corporation.
d. Haydon Corporation; H-Strut Division.
e. NIBCO INC.
f. PHD Manufacturing, Inc.
g. PHS Industries, Inc.

2. Description: Shop- or field-fabricated pipe-support assembly made of steel channels, accessories, fittings, and other components for supporting multiple parallel pipes.
3. Standard: Comply with MFMA-4.
4. Channels: Continuous slotted steel channel with in-turned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
6. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.
7. Coating: Zinc.

2.5 FIBERGLASS STRUT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Tube & Conduit.
2. Champion Fiberglass, Inc.
3. Cooper B-Line, Inc.
4. SEASAFE, INC.; a Gibraltar Industries Company.

B. Description: Shop- or field-fabricated pipe-support assembly similar to MFMA-4 for supporting multiple parallel pipes.

1. Channels: Continuous slotted fiberglass or other plastic channel with in-turned lips.
2. Channel Nuts: Fiberglass nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

2.6 THERMAL-HANGER SHIELD INSERTS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Carpenter & Paterson, Inc.
2. Clement Support Services.
3. ERICO International Corporation.
4. National Pipe Hanger Corporation.
5. PHS Industries, Inc.
6. Pipe Shields, Inc.; a subsidiary of Piping Technology & Products, Inc.
7. Piping Technology & Products, Inc.
8. Rilco Manufacturing Co., Inc.
9. Value Engineered Products, Inc.

B. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

C. Insulation-Insert Material for Hot Piping: Water-repellent treated, ASTM C 533, Type I calcium silicate with 100-psig, ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

D. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

E. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

F. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.7 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, stainless-steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.8 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece plastic or stainless-steel base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: Stainless steel.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounting-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.9 PIPE POSITIONING SYSTEMS

A. Description: IAPMO PS 42, positioning system of metal brackets, clips, and straps for positioning piping in pipe spaces; for plumbing fixtures in commercial applications.

2.10 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.11 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Fiberglass Pipe-Hanger Installation: Comply with applicable portions of MSS SP-69 and MSS SP-89. Install hangers and attachments as required to properly support piping from building structure.

D. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

E. Fiberglass Strut System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled fiberglass struts.

F. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

G. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

H. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.

2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

I. Pipe Positioning-System Installation: Install support devices to make rigid supply and waste piping connections to each plumbing fixture.

J. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

K. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

L. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

M. Install lateral bracing with pipe hangers and supports to prevent swaying.

N. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, [NPS 2-1/2] <Insert size> and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

O. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

P. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

Q. Insulated Piping:

1. Attach clamps and spacers to piping.

    a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
    b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
    c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

    a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

    a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
    b. NPS 4: 12 inches long and 0.06 inch thick.
    c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
    d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
    e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports, metal trapeze pipe hangers and metal framing systems and attachments for general service applications.

F. Use stainless-steel pipe hangers and fiberglass pipe hangers and fiberglass strut systems and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Steel Pipe Clamps (MSS Type 4): For suspension of cold and hot pipes NPS 1/2 to NPS 24 if little or no insulation is required.
5. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4, to allow off-center closure for hanger installation before pipe erection.

6. Adjustable, Swivel Split- or Solid-Ring Hangers (MSS Type 6): For suspension of non-insulated, stationary pipes NPS 3/4 to NPS 8.
7. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
8. Adjustable Band Hangers (MSS Type 9): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
9. Adjustable, Swivel-Ring Band Hangers (MSS Type 10): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
10. Split Pipe Ring with or without Turnbuckle Hangers (MSS Type 11): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 8.
11. Extension Hinged or Two-Bolt Split Pipe Clamps (MSS Type 12): For suspension of non-insulated, stationary pipes NPS 3/8 to NPS 3.
12. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
13. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
14. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
15. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
16. Adjustable Pipe Saddle Supports (MSS Type 38): For stanchion-type support for pipes NPS 2-1/2 to NPS 36 if vertical adjustment is required, with steel-pipe base stanchion support and cast-iron floor flange.
17. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
18. Adjustable Roller Hangers (MSS Type 43): For suspension of pipes NPS 2-1/2 to NPS 24, from single rod if horizontal movement caused by expansion and contraction might occur.
19. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.
20. Pipe Roll and Plate Units (MSS Type 45): For support of pipes NPS 2 to NPS 24 if small horizontal movement caused by expansion and contraction might occur and vertical adjustment is not necessary.
21. Adjustable Pipe Roll and Base Units (MSS Type 46): For support of pipes NPS 2 to NPS 30 if vertical and lateral adjustment during installation might be required in addition to expansion and contraction.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

3. Swivel Turnbuckles (MSS Type 15): For use with MSS Type 11, split pipe rings.
4. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
5. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Restraint-Control Devices (MSS Type 47): Where indicated to control piping movement.
2. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
3. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
4. Spring Sway Braces (MSS Type 50): To retard sway, shock, vibration, or thermal expansion in piping systems.
5. Variable-Spring Hangers (MSS Type 51): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from hanger.
6. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.
7. Variable-Spring Trapeze Hangers (MSS Type 53): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from trapeze support.
8. Constant Supports: For critical piping stress and if necessary to avoid transfer of stress from one support to another support, critical terminal, or connected equipment. Include auxiliary stops for erection, hydrostatic test, and load-adjustment capability. These supports include the following types:

    a. Horizontal (MSS Type 54): Mounted horizontally.
    b. Vertical (MSS Type 55): Mounted vertically.
    c. Trapeze (MSS Type 56): Two vertical-type supports and one trapeze member.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Comply with MFMA-103 for metal framing system selections and applications that are not specified in piping system Sections.

R. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

S. Use pipe positioning systems in pipe spaces behind plumbing fixtures to support supply and waste piping for plumbing fixtures.

END OF SECTION 220529

SECTION 220548.13

VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.

g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth, Ribbed or Waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.

d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top housing with attachment and leveling bolt or threaded mounting holes and internal leveling device or elastomeric pad.

2.6 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top plate with threaded mounting holes or elastomeric pad.
c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.

4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.7 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Vibration Eliminator Co., Inc.
    g. Vibration Isolation.
    h. Vibration Mountings & Controls, Inc.

2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.

2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.9 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and re-insertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.10 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.11 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Kinetics Noise Control, Inc.
d. Mason Industries, Inc.

e. Vibration Eliminator Co., Inc.
f. Vibration Isolation.
g. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete." or Section 033053 "Miscellaneous Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 220548.13

SECTION 220553

IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.
2. Warning signs and labels.
3. Pipe labels.

1.2 ACTION SUBMITTAL

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

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number. Equipment schedule shall be included in operation and maintenance data.

2.2 WARNING SIGNS AND LABELS

A. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.

B. Letter Color: White.

C. Background Color: Red.

D. Maximum Temperature: Able to withstand temperatures up to 160 deg F.

E. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.

F. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.

G. Fasteners: Stainless-steel rivets or self-tapping screws.

H. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

I. Label Content: Include caution and warning information, plus emergency notification instructions.

2.3 PIPE LABELS

A. General Requirements for Manufactured Pipe Labels: Preprinted, color-coded, with lettering indicating service, and showing flow direction.

B. Pre-tensioned Pipe Labels: Pre-coiled, semirigid plastic formed to cover full circumference of pipe and to attach to pipe without fasteners or adhesive.

C. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.

D. Pipe Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings, pipe size, and an arrow indicating flow direction.

1. Flow-Direction Arrows: Integral with piping system service lettering to accommodate both directions, or as separate unit on each pipe label to indicate flow direction.
2. Lettering Size: At least 1-1/2 inches high.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3 PIPE LABEL INSTALLATION

A. Piping Color-Coding: Painting of piping is specified in Section 099123 "Interior Painting." or Section 099600 "High-Performance Coatings."

B. Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.
2. Near each branch connection, excluding short takeoffs for fixtures and terminal units. Where flow pattern is not obvious, mark each pipe at branch.
3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.
4. At access doors, manholes, and similar access points that permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced at maximum intervals of 50 feet along each run. Reduce intervals to 25 feet in areas of congested piping and equipment.
7. On piping above removable acoustical ceilings. Omit intermediately spaced labels.

C. Pipe Label Color Schedule:

1. Compressed-Air Piping:

a. Background Color: Yellow.
b. Letter Color: Black.

2. Domestic Cold Water Piping:

a. Background Color: Green.
b. Letter Color: White.

3. Domestic Hot Water Supply and Return Piping:

    a. Background Color: Yellow.
    b. Letter Color: Black.

4. Sanitary Waste and Storm Drainage and Vent Piping:

    a. Background Color: Green.
    b. Letter Color: White.

5. Natural Gas Piping:

    a. Background Color: Yellow.
    b. Letter Color: Black.

END OF SECTION 220553

SECTION 220719

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following plumbing piping services:

1. Domestic hot-water piping.
2. Domestic recirculating hot-water piping.
3. Sanitary waste piping exposed to freezing conditions.
4. Storm-water piping exposed to freezing conditions.
5. Roof drains and rainwater leaders.
6. Supplies and drains for handicap-accessible lavatories and sinks.

B. Related Sections:

1. Section 220716 "Plumbing Equipment Insulation."

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.
2. Detail attachment and covering of heat tracing inside insulation.
3. Detail insulation application at pipe expansion joints for each type of insulation.
4. Detail insulation application at elbows, fittings, flanges, valves, and specialties for each type of insulation.
5. Detail removable insulation at piping specialties, equipment connections, and access panels.
6. Detail application of field-applied jackets.
7. Detail application at linkages of control devices.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84 by a testing agency acceptable to authorities having

jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

B. Comply with the following applicable standards and other requirements specified for miscellaneous components:

1. Supply and Drain Protective Shielding Guards: ICC A117.1.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Piping Insulation Schedule, General," "Indoor Piping Insulation Schedule," "Outdoor, Aboveground Piping Insulation Schedule," and "Outdoor, Underground Piping Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

G. Mineral-Fiber, Preformed Pipe Insulation:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Fibrex Insulations Inc.; Coreplus 1200.
b. Johns Manville; Micro-Lok.
c. Knauf Insulation; 1000-Degree Pipe Insulation.
d. Manson Insulation Inc.; Alley-K.
e. Owens Corning; Fiberglas Pipe Insulation.

2. Type I, 850 Deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

2.2 INSULATING CEMENTS

A. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Ramco Insulation, Inc.; Ramcote 1200 and Quik-Cote.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated, unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

D. ASJ Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
    b. Eagle Bridges - Marathon Industries; 225.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-20.
    d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Dow Corning Corporation; 739, Dow Silicone.
    b. Johns Manville; Zeston Perma-Weld, CEEL-TITE Solvent Welding Adhesive.
    c. P.I.C. Plastics, Inc.; Welding Adhesive.
    d. Speedline Corporation; Polyco VP Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
    b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
    b. Eagle Bridges - Marathon Industries; 550.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
    d. Mon-Eco Industries, Inc.; 55-50.
    e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
    d. Mon-Eco Industries, Inc.; 44-05.
    e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
    b. Eagle Bridges - Marathon Industries; 405.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
    d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.

4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. ASJ Flashing Sealants and PVC Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: White.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. ASJ: White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
2. ASJ-SSL: ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Thickness is indicated in field-applied jacket schedules.

1. Products: Subject to compliance with requirements, provide one of the following:

   a. Johns Manville; Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.

2. Adhesive: As recommended by jacket material manufacturer.
3. Color: Color-code jackets based on system. Color as selected by Architect.
4. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

a. Shapes: 45- and 90-degree, short- and long-radius elbows, tees, valves, flanges, unions, reducers, end caps, soil-pipe hubs, traps, mechanical joints, and P-trap and supply covers for lavatories.

2.8 TAPES

A. ASJ Tape: White vapor-retarder tape matching factory-applied jacket with acrylic adhesive, complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 428 AWF ASJ.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0836.
c. Compac Corporation; 104 and 105.
d. Venture Tape; 1540 CW Plus, 1542 CW Plus, and 1542 CW Plus/SQ.

2. Width: 3 inches.
3. Thickness: 11.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.
6. Tensile Strength: 40 lbf/inch in width.
7. ASJ Tape Disks and Squares: Precut disks or squares of ASJ tape.

B. PVC Tape: White vapor-retarder tape matching field-applied PVC jacket with acrylic adhesive; suitable for indoor and outdoor applications.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 370 White PVC tape.
b. Compac Corporation; 130.
c. Venture Tape; 1506 CW NS.

2. Width: 2 inches.
3. Thickness: 6 mils.
4. Adhesion: 64 ounces force/inch in width.
5. Elongation: 500 percent.
6. Tensile Strength: 18 lbf/inch in width.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

2.10 PROTECTIVE SHIELDING GUARDS

A. Protective Shielding Pipe Covers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. McGuire Manufacturing.
b. Plumberex.
c. Truebro; a brand of IPS Corporation.
d. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic wraps for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with Americans with Disabilities Act (ADA) requirements.

B. Protective Shielding Piping Enclosures:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Truebro; a brand of IPS Corporation.
b. Zurn Industries, LLC; Tubular Brass Plumbing Products Operation.

2. Description: Manufactured plastic enclosure for covering plumbing fixture hot- and cold-water supplies and trap and drain piping. Comply with ADA requirements.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

P. For above-ambient services, do not install insulation to the following:

1. Vibration-control devices.
2. Testing agency labels and stamps.
3. Nameplates and data plates.
4. Cleanouts.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for

above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.

8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:

1. Install pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 INSTALLATION OF MINERAL-FIBER PREFORMED PIPE INSULATION

A. Insulation Installation on Straight Pipes and Tubes:

1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward clinched staples at 6 inches o.c.
4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:

1. Install preformed pipe insulation to outer diameter of pipe flange.
2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.8 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.

a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.9 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.10 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.11 INDOOR PIPING INSULATION SCHEDULE

A. Domestic Cold Water subject to freezing:

1. NPS 1 and Smaller: Insulation shall be the following:

a. Flexible Elastomeric: 1/2 inch thick.

2. NPS 1-1/4 and Larger: Insulation shall be the following:

a. Flexible Elastomeric: 1 inch thick.

B. Domestic Hot Water and Hot Water Return:

1. NPS 1-1/4 and Smaller: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

2. NPS 1-1/2nd Larger: Insulation shall be the following:

a. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1-1/2 inch thick.

C. Domestic Hot and Recirculated Hot Water: Insulation shall be the following:

1. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

D. Stormwater and Overflow: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

E. Roof Drain and Overflow Drain Bodies: Insulation shall be one of the following:

1. Flexible Elastomeric: 1 inch thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 1 inch thick.

F. Exposed Sanitary Drains, Domestic Water, Domestic Hot Water, and Stops for Plumbing Fixtures for People with Disabilities: Insulation shall be the following:

1. Flexible Elastomeric: 1/2 inch thick.

G. Sanitary Waste Piping Where Heat Tracing Is Installed: Mineral-fiber, preformed pipe insulation, Type I, 1-1/2 inches thick.

3.12 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Domestic Water Piping: Insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Flexible Elastomeric: 2 inches thick.
3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

B. Domestic Hot and Recirculated Hot Water: Insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Flexible Elastomeric: 2 inches thick.
3. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

C. Sanitary Waste Piping Where Heat Tracing Is Installed: Insulation shall be one of the following:

1. Cellular Glass: 2 inches thick.
2. Mineral-Fiber, Preformed Pipe Insulation, Type I: 2 inches thick.

3.13 OUTDOOR, UNDERGROUND PIPING INSULATION SCHEDULE

A. Sanitary Waste Piping, All Sizes, Where Heat Tracing Is Installed: Cellular glass, 2 inches thick.

3.14 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC, Color-Coded by System: 30 mils thick.

3.15 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. PVC: 30 mils thick.
2. Aluminum, Smooth or Corrugated with Z-Shaped Locking Seam: 0.024 inch thick.

3.16 UNDERGROUND, FIELD-INSTALLED INSULATION JACKET

A. For underground direct-buried piping applications, install underground direct-buried jacket over insulation material.

END OF SECTION 220719

SECTION 221116

DOMESTIC WATER PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes under-building-slab and aboveground domestic water pipes, tubes, and fittings inside buildings.

1.2 ACTION SUBMITTALS

A. Product Data: For transition fittings and dielectric fittings.

1.3 INFORMATIONAL SUBMITTALS

A. System purging and disinfecting activities report.

B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

B. Potable-water piping and components shall comply with NSF 14 and NSF 61. Plastic piping components shall be marked with "NSF-pw."

2.2 COPPER TUBE AND FITTINGS

A. Hard Copper Tube: ASTM B 88, Type L and ASTM B 88, Type M water tube, drawn temper.

B. Soft Copper Tube: ASTM B 88, Type L water tube, annealed temper.

C. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.

D. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, wrought-copper pressure fittings.

E. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.

F. Copper Unions:

1. MSS SP-123.
2. Cast-copper-alloy, hexagonal-stock body.
3. Ball-and-socket, metal-to-metal seating surfaces.
4. Solder-joint or threaded ends.

G. Copper Pressure-Seal-Joint Fittings:

1. Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.
2. Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

H. Copper Push-on-Joint Fittings:

1. Cast-copper fitting complying with ASME B16.18 or wrought-copper fitting complying with ASME B 16.22.
2. Stainless-steel teeth and EPDM-rubber, O-ring seal in each end instead of solder-joint ends.

2.3 PVC PIPE AND FITTINGS

A. PVC Pipe: ASTM D 1785, Schedule 40.

B. PVC Socket Fittings: ASTM D 2466 for Schedule 40.

C. PVC Schedule 80 Threaded Fittings: ASTM D 2464.

2.4 PIPING JOINING MATERIALS

A. Pipe-Flange Gasket Materials:

1. AWWA C110/A21.10, rubber, flat face, 1/8 inch thick or ASME B16.21, nonmetallic and asbestos free unless otherwise indicated.
2. Full-face or ring type unless otherwise indicated.

B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys.

D. Flux: ASTM B 813, water flushable.

E. Brazing Filler Metals: AWS A5.8/A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.

F. Solvent Cements for Joining CPVC Piping and Tubing: ASTM F 493.

1. CPVC solvent cement shall have a VOC content of 490 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

G. Solvent Cements for Joining PVC Piping: ASTM D 2564. Include primer according to ASTM F 656.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

H. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.

2.5 TRANSITION FITTINGS

A. General Requirements:

1. Same size as pipes to be joined.
2. Pressure rating at least equal to pipes to be joined.
3. End connections compatible with pipes to be joined.

B. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

C. Plastic-to-Metal Transition Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Charlotte Pipe and Foundry Company.
b. Harvel Plastics, Inc.
c. Spears Manufacturing Company.

2. Description:

a. PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.
b. One end with threaded brass insert and one solvent-cement-socket or threaded end.

D. Plastic-to-Metal Transition Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Colonial Engineering, Inc.
b. NIBCO Inc.
c. Spears Manufacturing Company.

2. Description:

    a. PVC four-part union.
    b. Brass or stainless-steel threaded end.
    c. Solvent-cement-joint or threaded plastic end.
    d. Rubber O-ring.
    e. Union nut.

2.6 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Jomar International.
    e. Matco-Norca.
    f. McDonald, A. Y. Mfg. Co.
    g. Watts; a division of Watts Water Technologies, Inc.
    h. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Pressure Rating: 125 psig minimum at 180 deg F.
4. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Capitol Manufacturing Company; member of the Phoenix Forge Group.
    b. Central Plastics Company.
    c. Matco-Norca.
    d. Watts; a division of Watts Water Technologies, Inc.
    e. Wilkins; a Zurn company.

2. Standard: ASSE 1079.
3. Factory-fabricated, bolted, companion-flange assembly.
4. Pressure Rating: 125 psig minimum at 180 deg F.
5. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

D. Dielectric-Flange Insulating Kits:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Central Plastics Company.
d. Pipeline Seal and Insulator, Inc.

2. Nonconducting materials for field assembly of companion flanges.
3. Pressure Rating: 150 psig.
4. Gasket: Neoprene or phenolic.
5. Bolt Sleeves: Phenolic or polyethylene.
6. Washers: Phenolic with steel backing washers.

E. Dielectric Nipples:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Elster Perfection Corporation.
b. Grinnell Mechanical Products; Tyco Fire Products LP.
c. Matco-Norca.
d. Precision Plumbing Products, Inc.
e. Victaulic Company.

2. Standard: IAPMO PS 66.
3. Electroplated steel nipple complying with ASTM F 1545.
4. Pressure Rating and Temperature: 300 psig at 225 deg F.
5. End Connections: Male threaded or grooved.
6. Lining: Inert and noncorrosive, propylene.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of domestic water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."

C. Install ductile-iron piping under building slab with restrained joints according to AWWA C600 and AWWA M41.

D. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each domestic water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."

E. Install shutoff valve immediately upstream of each dielectric fitting.

F. Install water-pressure-reducing valves downstream from shutoff valves. Comply with requirements for pressure-reducing valves in Section 221119 "Domestic Water Piping Specialties."

G. Install domestic water piping level without pitch and plumb.

H. Rough-in domestic water piping for water-meter installation according to utility company's requirements.

I. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

J. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.

K. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

L. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.

M. Install piping to permit valve servicing.

N. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.

O. Install piping free of sags and bends.

P. Install fittings for changes in direction and branch connections.

Q. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.

R. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."

S. Install thermostats in hot-water circulation piping. Comply with requirements for thermostats in Section 221123 "Domestic Water Pumps."

T. Install thermometers on inlet and outlet piping from each water heater. Comply with requirements for thermometers in Section 220519 "Meters and Gages for Plumbing Piping."

U. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

V. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

W. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, 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.
2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

D. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.

E. Soldered Joints for Copper Tubing: Apply ASTM B 813, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 or CDA's "Copper Tube Handbook."

F. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.

G. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for domestic water service. Join flanges with gasket and bolts according to ASME B31.9.

H. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.
2. PVC Piping: Join according to ASTM D 2855.

I. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.

3.4 TRANSITION FITTING INSTALLATION

A. Install transition couplings at joints of dissimilar piping.

B. Transition Fittings in Underground Domestic Water Piping:

1. Fittings for NPS 1-1/2 and Smaller: Fitting-type coupling.
2. Fittings for NPS 2 and Larger: Sleeve-type coupling.

C. Transition Fittings in Aboveground Domestic Water Piping NPS 2 and Smaller: Plastic-to-metal transition fittings or unions.

3.5 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Dielectric Fittings for NPS 2 and Smaller: Use dielectric couplings or nipples.

C. Dielectric Fittings for NPS 2-1/2 to NPS 4: Use dielectric flanges, flange kits or nipples.

D. Dielectric Fittings for NPS 5 and Larger: Use dielectric flange kits.

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger, support products, and installation in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Vertical Piping: MSS Type 8 or 42, clamps.
2. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

3. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
4. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support vertical piping and tubing at base and at each floor.

D. Rod diameter may be reduced one size for double-rod hangers, to a minimum of 3/8 inch.

E. Install hangers for copper tubing with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 3/4 and Smaller: 60 inches with 3/8-inch rod.
2. NPS 1 and NPS 1-1/4: 72 inches with 3/8-inch rod.

3. NPS 1-1/2 and NPS 2: 96 inches with 3/8-inch rod.
4. NPS 2-1/2: 108 inches with 1/2-inch rod.
5. NPS 3 to NPS 5: 10 feet with 1/2-inch rod.
6. NPS 6: 10 feet with 5/8-inch rod.
7. NPS 8: 10 feet with 3/4-inch rod.

F. Install supports for vertical copper tubing every 10 feet.

G. Install vinyl-coated hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 2 and Smaller: 48 inches with 3/8-inch rod.
2. NPS 2-1/2 to NPS 3-1/2: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6: 48 inches with 3/4-inch rod.
5. NPS 8: 48 inches with 7/8-inch rod.

H. Install supports for vertical PVC piping every 48 inches.

I. Support piping and tubing not listed in this article according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. When installing piping adjacent to equipment and machines, allow space for service and maintenance.

C. Connect domestic water piping to exterior water-service piping. Use transition fitting to join dissimilar piping materials.

D. Connect domestic water piping to water-service piping with shutoff valve; extend and connect to the following:

1. Domestic Water Booster Pumps: Cold-water suction and discharge piping.
2. Water Heaters: Cold-water inlet and hot-water outlet piping in sizes indicated, but not smaller than sizes of water heater connections.
3. Plumbing Fixtures: Cold- and hot-water-supply piping in sizes indicated, but not smaller than that required by plumbing code.
4. Equipment: Cold- and hot-water-supply piping as indicated, but not smaller than equipment connections. Provide shutoff valve and union for each connection. Use flanges instead of unions for NPS 2-1/2 and larger.

3.8 IDENTIFICATION

A. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."

B. Label pressure piping with system operating pressure.

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Piping Inspections:

a. Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.
b. During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

1) Roughing-in Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.
2) Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Piping Tests" Subparagraph below and to ensure compliance with requirements.

c. Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections and arrange for reinspection.
d. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

2. Piping Tests:

a. Fill domestic water piping. Check components to determine that they are not air bound and that piping is full of water.
b. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.
c. Leave new, altered, extended, or replaced domestic water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.
d. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
e. Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.
f. Prepare reports for tests and for corrective action required.

B. Domestic water piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.10 ADJUSTING

A. Perform the following adjustments before operation:

1. Close drain valves, hydrants, and hose bibbs.

2. Open shutoff valves to fully open position.
3. Open throttling valves to proper setting.
4. Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

    a. Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.
    b. Adjust calibrated balancing valves to flows indicated.

5. Remove plugs used during testing of piping and for temporary sealing of piping during installation.
6. Remove and clean strainer screens. Close drain valves and replace drain plugs.
7. Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.
8. Check plumbing specialties and verify proper settings, adjustments, and operation.

3.11 CLEANING

A. Clean and disinfect potable domestic water piping as follows:

1. Purge new piping and parts of existing piping that have been altered, extended, or repaired before using.
2. Use purging and disinfecting procedures prescribed by authorities having jurisdiction; if methods are not prescribed, use procedures described in either AWWA C651 or AWWA C652 or follow procedures described below:

    a. Flush piping system with clean, potable water until dirty water does not appear at outlets.
    b. Fill and isolate system according to either of the following:

        1) Fill system or part thereof with water/chlorine solution with at least 50 ppm of chlorine. Isolate with valves and allow to stand for 24 hours.
        2) Fill system or part thereof with water/chlorine solution with at least 200 ppm of chlorine. Isolate and allow to stand for three hours.

    c. Flush system with clean, potable water until no chlorine is in water coming from system after the standing time.
    d. Repeat procedures if biological examination shows contamination.
    e. Submit water samples in sterile bottles to authorities having jurisdiction.

B. Prepare and submit reports of purging and disinfecting activities. Include copies of water-sample approvals from authorities having jurisdiction.

C. Clean interior of domestic water piping system. Remove dirt and debris as work progresses.

3.12 PIPING SCHEDULE

A. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.

B. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

C. Under-building-slab, domestic water, building-service piping, NPS 3 and smaller, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

D. Under-building-slab, domestic water, building-service piping, NPS 4 to NPS 8 and larger, shall be one of the following:

1. Soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

E. Under-building-slab, domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard or soft copper tube, ASTM B 88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. PVC, Schedule 40; socket fittings; and solvent-cemented joints.

F. Aboveground domestic water piping, NPS 2 and smaller, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper push-on-joint fittings; and push-on joints.

G. Aboveground domestic water piping, NPS 2-1/2 to NPS 4, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; copper pressure-seal-joint fittings; and pressure-sealed joints.
3. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; grooved-joint, copper-tube appurtenances; and grooved joints.

H. Aboveground domestic water piping, NPS 5 to NPS 8, shall be one of the following:

1. Hard copper tube, ASTM B 88, Type L; cast- or wrought-copper, solder-joint fittings; and soldered joints.
2. Hard copper tube, ASTM B 88, Type L or ASTM B 88, Type M; grooved-joint, copper-tube appurtenances; and grooved joints.
3. Galvanized-steel pipe and nipples; galvanized, gray-iron threaded fittings; and threaded joints.

END OF SECTION 221116

SECTION 221119

DOMESTIC WATER PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backflow preventers.
2. Water pressure-reducing valves.
3. Temperature-actuated, water mixing valves.
4. Strainers.
5. Outlet boxes.
6. Hose stations.
7. Hose bibbs.
8. Wall hydrants.
9. Drain valves.
10. Water-hammer arresters.
11. Air vents.
12. Trap-seal primer devices.
13. Flexible connectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For domestic water piping specialties.

1. Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For domestic water piping specialties to include in emergency, operation, and maintenance manuals.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PIPING SPECIALTIES

A. Potable-water piping and components shall comply with NSF 61 and NSF 14. Mark "NSF-pw" on plastic piping components.

2.2 PERFORMANCE REQUIREMENTS

A. Minimum Working Pressure for Domestic Water Piping Specialties: 125 psig unless otherwise indicated.

2.3 BACKFLOW PREVENTERS

A. Reduced-Pressure-Principle Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.
    b. Conbraco Industries, Inc.
    c. FEBCO; a division of Watts Water Technologies, Inc.
    d. Flomatic Corporation.
    e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1013.
3. Operation: Continuous-pressure applications.
4. Pressure Loss: 12 psig maximum, through middle third of flow range.
5. Size: Match pipe size shown on Drawings.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, steel with interior lining that complies with AWWA C550 or that is FDA approved or stainless steel for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight-through; vertical-inlet, horizontal-center-section, and vertical-outlet; or vertical flow.
9. Accessories:

    a. Valves NPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
    b. Valves NPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.
    c. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

B. Double-Check, Backflow-Prevention Assemblies:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Ames Fire & Waterworks; a division of Watts Water Technologies, Inc.

b. Conbraco Industries, Inc.
c. FEBCO; a division of Watts Water Technologies, Inc.
d. Flomatic Corporation.
e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
f. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1015.
3. Operation: Continuous-pressure applications unless otherwise indicated.
4. Pressure Loss: 5 psig maximum, through middle third of flow range.
5. Size: Match pipe size shown on Drawings.
6. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, steel with interior lining that complies with AWWA C550 or that is FDA approved, or stainless steel for NPS 2-1/2 and larger.
7. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
8. Configuration: Designed for horizontal, straight-through flow.
9. Accessories:

a. ValvesNPS 2 and Smaller: Ball type with threaded ends on inlet and outlet.
b. ValvesNPS 2-1/2 and Larger: Outside-screw and yoke-gate type with flanged ends on inlet and outlet.

C. Beverage-Dispensing-Equipment Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Conbraco Industries, Inc.
b. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
c. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1022.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

D. Carbonated-Beverage-Dispenser, Dual-Check-Valve Backflow Preventers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cash Acme; a division of Reliance Worldwide Corporation.
b. Lancer Corporation.
c. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1032.
3. Operation: Continuous-pressure applications.
4. Size: NPS 1/4 or NPS 3/8.
5. Body: Stainless steel.
6. End Connections: Threaded.

2.4 WATER PRESSURE-REDUCING VALVES

A. Water Regulators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Cash Acme; a division of Reliance Worldwide Corporation.
    b. Conbraco Industries, Inc.
    c. Honeywell International Inc.
    d. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    e. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1003.
3. Pressure Rating: Initial working pressure of 150 psig.
4. Size: Match pipe size shown on Drawings.
5. Design Inlet Pressure: 100 psig.
6. Design Outlet Pressure Setting: 50 psig.
7. Body: Bronze with chrome-plated finish for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved for NPS 2-1/2 and NPS 3.
8. Valves for Booster Heater Water Supply: Include integral bypass.
9. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and NPS 3.

2.5 TEMPERATURE-ACTUATED, WATER MIXING VALVES

A. Water-Temperature Limiting Devices:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Armstrong International, Inc.
    b. Conbraco Industries, Inc.
    c. Legend Valve.
    d. Leonard Valve Company.
    e. Powers; a division of Watts Water Technologies, Inc.
    f. Symmons Industries, Inc.
    g. TACO Incorporated.
    h. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    i. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig.
4. Type: Thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F, unless otherwise shown on Drawings.
9. Valve Finish: Chrome plated.

B. Primary, Thermostatic, Water Mixing Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Armstrong International, Inc.
    b. Lawler Manufacturing Company, Inc.
    c. Leonard Valve Company.
    d. Powers; a division of Watts Water Technologies, Inc.
    e. Symmons Industries, Inc.

2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Cabinet-type (unless otherwise noted on the Drawings), thermostatically controlled, water mixing valve.
5. Material: Bronze body with corrosion-resistant interior components.
6. Connections: Threaded union inlets and outlet.
7. Accessories: Manual temperature control, check stops on hot- and cold-water supplies, and adjustable, temperature-control handle.
8. Tempered-Water Setting: 110 deg F, unless otherwise shown on Drawings.
9. Valve Finish: Polished, chrome plated or Rough bronze.
10. Piping Finish: Copper.
11. Cabinet: Factory fabricated, stainless steel, for recessed mounting and with hinged, stainless-steel door.

C. Individual-Fixture, Water Tempering Valves:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Cash Acme; a division of Reliance Worldwide Corporation.
    b. Conbraco Industries, Inc.
    c. Honeywell International Inc.
    d. Lawler Manufacturing Company, Inc.
    e. Leonard Valve Company.
    f. Powers; a division of Watts Water Technologies, Inc.
    g. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    h. Zurn Industries, LLC; Plumbing Products Group; Wilkins Water Control Products.

2. Standard: ASSE 1016, thermostatically controlled, water tempering valve.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Body: Bronze body with corrosion-resistant interior components.
5. Temperature Control: Adjustable.
6. Inlets and Outlet: Threaded.
7. Finish: Rough or chrome-plated bronze.
8. Tempered-Water Setting: 110 deg F.

2.6 STRAINERS FOR DOMESTIC WATER PIPING

A. Y-Pattern Strainers:

1. Pressure Rating: 125 psig minimum unless otherwise indicated.
2. Body: Bronze for NPS 2 and smaller; cast iron with interior lining that complies with AWWA C550 or that is FDA approved, epoxy coated and for NPS 2-1/2 and larger.
3. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
4. Screen: Stainless steel with round perforations unless otherwise indicated.
5. Perforation Size:

    a. Strainers NPS 2 and Smaller: 0.020 inch.
    b. Strainers NPS 2-1/2 to NPS 4: 0.045 inch.
    c. Strainers NPS 5 and Larger: 0.10 inch.

6. Drain: Plug end or Factory-installed, hose-end drain valve.

2.7 OUTLET BOXES

A. Clothes Washer Outlet Boxes:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Acorn Engineering Company.
    b. Guy Gray Manufacturing Co., Inc.
    c. IPS Corporation.
    d. LSP Products Group, Inc.
    e. Oatey.
    f. Plastic Oddities.
    g. Symmons Industries, Inc.
    h. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.
    i. Whitehall Manufacturing; a div. of Acorn Engineering Company.
    j. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel, epoxy-painted-steel, or plastic box and faceplate.
4. Faucet: Combination valved fitting or separate hot- and cold-water valved fittings complying with ASME A112.18.1. Include garden-hose thread complying with ASME B1.20.7 on outlets.
5. Supply Shutoff Fittings: NPS 1/2 gate, globe, or ball valves and NPS 1/2 copper, water tubing.
6. Drain: NPS 1-1/2 standpipe and P-trap for direct waste connection to drainage piping.

B. Icemaker Outlet Boxes:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Acorn Engineering Company.

b. IPS Corporation.
c. LSP Products Group, Inc.
d. Oatey.
e. Plastic Oddities.

2. Mounting: Recessed.
3. Material and Finish: Enameled-steel, epoxy-painted-steel, or plastic box and faceplate.
4. Faucet: Valved fitting complying with ASME A112.18.1. Include NPS 1/2 or smaller copper tube outlet.
5. Supply Shutoff Fitting: NPS 1/2 gate, globe, or ball valve and NPS 1/2 copper, water tubing.

2.8 HOSE BIBBS

A. Hose Bibbs:

1. Standard: ASME A112.18.1 for sediment faucets.
2. Body Material: Bronze.
3. Seat: Bronze, replaceable.
4. Supply Connections: NPS 1/2 or NPS 3/4 threaded or solder-joint inlet.
5. Outlet Connection: Garden-hose thread complying with ASME B1.20.7.
6. Pressure Rating: 125 psig.
7. Vacuum Breaker: Integral or field-installation, nonremovable, drainable, hose-connection vacuum breaker complying with ASSE 1011.
8. Finish for Equipment Rooms: Rough bronze, or chrome or nickel plated.
9. Finish for Service Areas: Rough bronze, Chrome or nickel plated].
10. Finish for Finished Rooms: Chrome or nickel plated.
11. Operation for Equipment Rooms: Wheel handle or operating key.
12. Operation for Service Areas: Wheel handle.
13. Operation for Finished Rooms: Operating key.
14. Include operating key with each operating-key hose bibb.
15. Include integral wall flange with each chrome- or nickel-plated hose bibb.

2.9 WALL HYDRANTS

A. Non-freeze Wall Hydrants:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Josam Company.
b. MIFAB, Inc.
c. Prier Products, Inc.
d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
e. Tyler Pipe; Wade Div.
f. Watts Drainage Products.
g. Woodford Manufacturing Company; a division of WCM Industries, Inc.
h. Zurn Industries, LLC; Plumbing Products Group; Light Commercial Products.
i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rod: Of length required to match wall thickness. Include wall clamp.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed, with integral vacuum breaker and garden-hose thread complying with ASME B1.20.7.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Operating Keys(s): One with each wall hydrant.

B. Non-freeze, Hot- and Cold-Water Wall Hydrants:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Josam Company.
    b. Prier Products, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products.
    f. Woodford Manufacturing Company; a division of WCM Industries, Inc.
    g. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASME A112.21.3M for concealed-outlet, self-draining wall hydrants.
3. Pressure Rating: 125 psig.
4. Operation: Loose key.
5. Casing and Operating Rods: Of length required to match wall thickness. Include wall clamps.
6. Inlet: NPS 3/4 or NPS 1.
7. Outlet: Concealed.
8. Box: Deep, flush mounted with cover.
9. Box and Cover Finish: Polished nickel bronze.
10. Vacuum Breaker:

    a. Nonremovable, manual-drain-type, hose-connection vacuum breaker complying with ASSE 1011 or backflow preventer complying with ASSE 1052.
    b. Garden-hose thread complying with ASME B1.20.7 on outlet.

11. Operating Keys(s): One with each wall hydrant.

2.10 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:

1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.

5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.11 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. AMTROL, Inc.
    b. Josam Company.
    c. MIFAB, Inc.
    d. Precision Plumbing Products, Inc.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    g. Tyler Pipe; Wade Div.
    h. Watts Drainage Products.
    i. Zurn Industries, LLC; Plumbing Products Group; Specification Drainage Products.

2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

2.12 TRAP-SEAL PRIMER DEVICE

A. Supply-Type, Trap-Seal Primer Device:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. MIFAB, Inc.
    b. Precision Plumbing Products, Inc.
    c. Sioux Chief Manufacturing Company, Inc.
    d. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    e. Watts; a division of Watts Water Technologies, Inc.; Watts Regulator Company.

2. Standard: ASSE 1018.
3. Pressure Rating: 125 psig minimum.
4. Body: Bronze.
5. Inlet and Outlet Connections: NPS 1/2 threaded, union, or solder joint.
6. Gravity Drain Outlet Connection: NPS 1/2 threaded or solder joint.
7. Finish: Chrome plated, or rough bronze for units used with pipe or tube that is not chrome finished.

2.13 FLEXIBLE CONNECTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Flex-Hose Co., Inc.
2. Flexicraft Industries.
3. Flex Pression, Ltd.
4. Flex-Weld Incorporated.
5. Hyspan Precision Products, Inc.
6. Mercer Gasket & Shim, Inc.
7. Metraflex, Inc.
8. Proco Products, Inc.
9. TOZEN Corporation.
10. Unaflex.Universal Metal Hose; a Hyspan company.

B. Bronze-Hose Flexible Connectors: Corrugated-bronze tubing with bronze wire-braid covering and ends brazed to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded copper pipe or plain-end copper tube.
3. End Connections NPS 2-1/2 and Larger: Flanged copper alloy.

C. Stainless-Steel-Hose Flexible Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing.

1. Working-Pressure Rating: Minimum 200 psig.
2. End Connections NPS 2 and Smaller: Threaded steel-pipe nipple.
3. End Connections NPS 2-1/2 and Larger: Flanged steel nipple.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install backflow preventers in each water supply to mechanical equipment and systems and to other equipment and water systems that may be sources of contamination. Comply with authorities having jurisdiction.

1. Locate backflow preventers in same room as connected equipment or system.
2. Install drain for backflow preventers with atmospheric-vent drain connection with air-gap fitting, fixed air-gap fitting, or equivalent positive pipe separation of at least two pipe diameters in drain piping and pipe-to-floor drain. Locate air-gap device attached to or under backflow preventer. Simple air breaks are unacceptable for this application.
3. Do not install bypass piping around backflow preventers.

B. Install water regulators with inlet and outlet shutoff valves and bypass with memory-stop balancing valve. Install pressure gages on inlet and outlet.

C. Install water-control valves with inlet and outlet shutoff valves and bypass with globe valve. Install pressure gages on inlet and outlet.

D. Install balancing valves in locations where they can easily be adjusted.

E. Install temperature-actuated, water mixing valves with check stops or shutoff valves on inlets and with shutoff valve on outlet.

1. Install cabinet-type units recessed in or surface mounted on wall as specified.

F. Install Y-pattern strainers for water on supply side of each control valve, water pressure-reducing valve, solenoid valve, and pump.

G. Install outlet boxes recessed in wall or surface mounted on wall. Install 2-by-4-inch fire-retardant-treated-wood blocking, wall reinforcement between studs. Comply with requirements for fire-retardant-treated-wood blocking in Section 061000 "Rough Carpentry."

H. Install water-hammer arresters in water piping according to PDI-WH 201.

I. Install supply-type, trap-seal primer valves with outlet piping pitched down toward drain trap a minimum of 1 percent, and connect to floor-drain body, trap, or inlet fitting. Adjust valve for proper flow.

3.2 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Fire-retardant-treated-wood blocking is specified in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical connections.

3.3 LABELING AND IDENTIFYING

A. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Test each pressure vacuum breaker, reduced-pressure-principle backflow preventer, double-check, backflow-prevention assembly and double-check, detector-assembly backflow preventer according to authorities having jurisdiction and the device's reference standard.

B. Domestic water piping specialties will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.5 ADJUSTING

A. Set field-adjustable pressure set points of water pressure-reducing valves.

B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

END OF SECTION 221119

SECTION 221123

DOMESTIC WATER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. In-line, seal less centrifugal pumps.

1.2 ACTION SUBMITTALS

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

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

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.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 IN-LINE, SEALLESS CENTRIFUGAL PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation.
3. Grundfos Pumps Corp.
4. TACO Incorporated.
5. WILO USA LLC - WILO Canada Inc.

B. Description: Factory-assembled and -tested, in-line, close-coupled, canned-motor, seal less, overhung-impeller centrifugal pumps.

C. Pump Construction:

1. Pump and Motor Assembly: Hermetically sealed, replaceable-cartridge type with motor and impeller on common shaft and designed for installation with pump and motor shaft horizontal.
2. Casing: Bronze, with threaded or companion-flange connections.
3. Impeller: Plastic.
4. Motor: Single speed, unless otherwise indicated.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.3 CONTROLS

A. Thermostats: Electric; adjustable for control of [hot-water circulation] <Insert application> pump.

1. Type: Water-immersion temperature sensor, for installation in piping.
2. Range: 50 to 125 deg F.
3. Enclosure: NEMA 250, Type 4X.
4. Operation of Pump: On or off.
5. Transformer: Provide if required.
6. Power Requirement: 24 V, ac.
7. Settings: Start pump at 105 deg F and stop pump at 120 deg F.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

A. Comply with HI 1.4.

B. Install in-line, seal less centrifugal pumps with shaft horizontal unless otherwise indicated.

C. Install continuous-thread hanger rods and spring hangers of size required to support pump weight.

1. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

D. Install thermostats in hot-water return piping.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to pumps to allow service and maintenance.

C. Connect domestic water piping to pumps. Install suction and discharge piping equal to or greater than size of pump nozzles.

1. Install flexible connectors adjacent to pumps in suction and discharge piping of the following pumps:

    a. Horizontally mounted, in-line, close-coupled centrifugal pumps.
    b. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."

2. Install shutoff valve and strainer on suction side of each pump, and check, shutoff, and throttling valves on discharge side of each pump. Install valves same size as connected piping. Comply with requirements for strainers specified in Section 221119 "Domestic Water Piping Specialties."
3. Install pressure gage at suction of each pump and pressure gage at discharge of each pump. Install at integral pressure-gage tappings where provided or install pressure-gage connectors in suction and discharge piping around pumps. Comply with requirements for pressure gages and snubbers specified in Section 220519 "Meters and Gages for Plumbing Piping."

D. Connect thermostats to pumps that they control.

3.3 ADJUSTING

A. Adjust domestic water pumps to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature set points.

C. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

END OF SECTION 221123

SECTION 221123.13

DOMESTIC-WATER PACKAGED BOOSTER PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Multiplex, constant-speed booster pumps.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: For booster pumps. Include plans, elevations, sections, details, and attachments to other work.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

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.

B. ASME Compliance: Comply with ASME B31.9 for piping.

C. UL Compliance for Packaged Pumping Systems:

1. UL 508, "Industrial Control Equipment."
2. UL 508A, "Industrial Control Panels."
3. UL 778, "Motor-Operated Water Pumps."
4. UL 1995, "Heating and Cooling Equipment."

D. Booster pumps shall be listed and labeled as packaged pumping systems by testing agency acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 MULTIPLEX, CONSTANT-SPEED BOOSTER PUMPS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Armstrong Pumps Inc.
2. Bell & Gossett Domestic Pump; ITT Corporation.
3. Goulds Pumps; ITT Corporation.
4. Grundfos Pumps Corporation U.S.A.
5. Patterson Pump Company; a subsidiary of the Gorman-Rupp Company.
6. TIGERFLOW Systems, Inc.

B. Description: Factory-assembled and -tested, fluid-handling system for domestic water, with pumps, piping, valves, specialties, and controls, and mounted on base.

C. Pumps:

1. Type: End suction as defined in HI 1.1-1.2 and HI 1.3 for end-suction, close-coupled, single-stage, overhung-impeller, centrifugal pump.
2. Casing: Radially split; bronze or stainless steel.
3. Impeller: Closed, ASTM B 584 cast bronze or stainless steel; statically and dynamically balanced and keyed to shaft.
4. Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve and deflector.
5. Seal: Mechanical.
6. Orientation: Mounted horizontally or vertically.

D. Motors: Single speed, with grease-lubricated or pre-greased, permanently shielded, ball-type bearings. Select motors that will not overload through full range of pump performance curve.

E. Piping: Copper tube and copper fittings, Stainless-steel pipe and fittings, and Stainless-steel pipe and fitting headers and copper tube and copper fittings between headers and pump.

F. Valves:

1. Shutoff Valves NPS 2 and smaller: Gate valve or two-piece, full-port ball valve, in each pump's suction and discharge piping.
2. Shutoff Valves NPS 2-1/2 and Larger: Gate valve or lug-type butterfly valve, in each pump's suction and discharge piping and in inlet and outlet headers.
3. Check Valves NPS 2 and smaller: Silent or swing type in each pump's discharge piping.
4. Check Valves NPS 2-1/2 and Larger: Silent type in each pump's discharge piping.
5. Control Valves: Adjustable, automatic, pilot-operated or direct-acting, pressure-reducing type in each pump's discharge piping.
6. Thermal-Relief Valve: Temperature-and-pressure relief type in pump's discharge header piping.

G. Dielectric Fittings: With insulating material isolating joined dissimilar metals.

H. Control Panel: Factory installed and connected as an integral part of booster pump; automatic for multiple-pump, constant-speed operation, with load control and protection functions.

1. Control Logic: Electromechanical system with switches, relays or Solid-state system with transducers, programmable microprocessor, and other devices in the controller.
2. Electromechanical Motor Controller: NEMA ICS 2, general-purpose, Class A, full-voltage, combination-magnetic type with undervoltage release feature, motor-circuit-protector-type disconnect, and short-circuit protective device.

    a. Control Voltage: 24-V ac, with integral control-power transformer.

3. Solid-State Motor Controller: NEMA ICS 2, solid-state, reduced-voltage type.

    a. Control Voltage: 24-V ac, with integral control-power transformer.

4. Enclosure: NEMA 250, Type 1.
5. Motor Overload Protection: Overload relay in each phase.
6. Starting Devices: Hand-off-automatic selector switch for each pump in cover of control panel, plus pilot device for automatic control.

    a. Duplex, Automatic, Alternating Starter: Switches lead pump to lag main pump and to two-pump operation.
    b. Triplex, Sequence (Lead-Lag-Lag) Starter: Switches lead pump to one lag main pump and to three-pump operation.

7. Pump Operation and Sequencing: Current- or pressure- sensing method.

    a. Time Delay: Controls pump on-off operation; adjustable from 1 to 300 seconds.

8. Instrumentation: Suction and discharge pressure gages.
9. Lights: Running light for each pump.
10. Alarm Signal Device: Sounds alarm when backup pumps are operating.

    a. Time Delay: Controls alarm operation; adjustable from 1 to 300 seconds, with automatic reset.

11. Thermal-bleed cutoff.
12. Low-suction-pressure cutout.
13. High-suction-pressure cutout.
14. Low-discharge-pressure cutout.
15. High-discharge-pressure cutout.
16. Building Automation System Interface: Provide auxiliary contacts for interface to BACnet building automation system. Building automation systems are specified in Section 230900 "Instrumentation and Control for HVAC." Include the following:

    a. On-off status of each pump.
    b. Alarm status.

I. Base: Structural steel.

2.2 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors.

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in NFPA 70.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

1. Install booster pumps on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation devices specified in Section 220548.13 "Vibration Controls for Plumbing Piping and Equipment."

B. Support connected domestic-water piping so weight of piping is not supported by booster pumps.

C. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect domestic-water piping to booster pumps. Install suction and discharge pipe equal to or greater than size of system suction and discharge headers or piping.

1. Install shutoff valves on piping connections to booster-pump suction and discharge headers or piping. Install ball, butterfly, or gate valves same size as suction and discharge headers or piping. Comply with requirements for general-duty valves specified in Section 220523 "General-Duty Valves for Plumbing Piping."
2. Install union, flanged, or grooved-joint connections on suction and discharge headers or piping at connection to domestic-water piping. Comply with requirements for unions and flanges specified in Section 221116 "Domestic Water Piping."
3. Install valved bypass, same size as and between piping, at connections to booster-pump suction and discharge headers or piping. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

4. Install flexible connectors, same size as piping, on piping connections to booster-pump suction and discharge headers or piping. Comply with requirements for flexible connectors specified in Section 221116 "Domestic Water Piping."
5. Install piping adjacent to booster pumps to allow service and maintenance.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Perform visual and mechanical inspection.
2. Leak Test: After installation, charge booster pump and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start booster pumps to confirm proper motor rotation and booster-pump operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Pumps and controls will be considered defective if they do not pass tests and inspections.

D. Prepare test and inspection reports.

3.5 ADJUSTING

A. Adjust booster pumps to function smoothly and lubricate as recommended by manufacturer.

B. Adjust pressure set points.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting booster pump to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.6 DEMONSTRATION

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

END OF SECTION 221123.13

SECTION 221223

FACILITY INDOOR POTABLE-WATER STORAGE TANKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel, pressure, potable-water storage tanks.
2. Steel, non-pressure, potable-water storage tanks.
3. Steel, precharged, potable-water storage tanks.
4. Insulated, steel, potable-water storage tanks.
5. Plastic, pressure, potable-water storage tanks.
6. Plastic, nonpressure, potable-water storage tanks.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Source quality-control reports.

C. Purging and disinfecting reports.

1.4 QUALITY ASSURANCE

A. ASME Compliance for Steel Tanks: Fabricate and label steel, ASME-code, potable-water storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," Division 1.

B. Comply with NSF 61, "Drinking Water System Components - Health Effects," for potable-water storage tanks. Include appropriate NSF marking.

PART 2 - PRODUCTS

2.1 STEEL, PRESSURE, POTABLE-WATER STORAGE TANKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Adamson Global Technology Corporation.
2. Aldrich Company, Inc.
3. Cemline Corporation.
4. Flo Fab inc.
5. GSW Water Heating.
6. HESCO Bastion Ltd.
7. Lochinvar Corporation.
8. Precision Boilers.
9. PVI Industries, LLC.
10. Raypak.
11. RBI; a Mestek company.
12. RECO USA.
13. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
14. State Industries, Inc.
15. Weben-Jarco, Inc.
16. Wendland Manufacturing Corp.
17. Wessels Company.
18. Wood, John Co.

B. Description: Steel, vertical, pressure-rated tank with cylindrical sidewalls.

C. Construction: ASME code, steel, constructed with nontoxic welded joints, for 125-psig working pressure.

D. Manhole: Watertight, for tank more than 36 inches in diameter; same pressure rating as tank.

E. Tappings: Factory-fabricated stainless steel, welded to tank before testing and labeling.

1. NPS 2 and Smaller: ASME B1.20.1, with female thread.
2. NPS 2-1/2 and Larger: ASME B16.5, flanged.

F. Specialties and Accessories: Include tappings in tank and the following:

1. Pressure relief valve.
2. Pressure gage.
3. Thermometer.
4. Air-charging connection.
5. Gage glass, brass fittings, compression stops, and gage-glass guard.

G. Vertical Tank Supports: Factory-fabricated steel legs or steel skirt, welded to tank before testing and labeling.

H. Tank Interior Finish: Materials and thicknesses complying with NSF 61 barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

1. Coating: Epoxy resin or Glass.

I. Exterior Coating: Manufacturer's standard enamel paint.

2.2 STEEL, NONPRESSURE, POTABLE-WATER STORAGE TANKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Adamson Global Technology Corporation.
2. Highland Tank & Manufacturing Company, Inc.
3. RECO USA.
4. Steel Tank and Fabricating.
5. Wood, John Co.

B. Description: Steel, vertical, nonpressure-rated tank with cylindrical sidewalls.

C. Construction: Steel, constructed with nontoxic welded joints.

D. Manhole: Watertight, for tank more than 36 inches in diameter.

E. Cover for Open Tank: Steel, with lining same as or similar to tank lining and with shape that encloses top of tank.

F. Tappings: Factory-fabricated stainless steel, welded to tank.

1. NPS 2 and Smaller: ASME B1.20.1, with female thread.
2. NPS 2-1/2 and Larger: ASME B16.5, flanged.

G. Specialties and Accessories: Include tappings in the tank and the following:

1. Vacuum relief valve.
2. Free air vent with insect screen.
3. Thermometer.
4. Gage glass, brass fittings, compression stops, and gage-glass guard.

H. Vertical Tank Supports: Factory-fabricated steel legs or steel skirt, welded to tank before testing and labeling.

I. Tank Interior Finish: Materials and thicknesses complying with NSF 61 barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

1. Coating: Epoxy resin or Glass.

J. Exterior Coating: Manufacturer's standard enamel paint.

2.3 STEEL, PRECHARGED, POTABLE-WATER STORAGE TANKS

A. Steel, Precharged, Diaphragm, Water Storage Tanks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. AMTROL, Inc.
b. Armstrong Pumps, Inc.

c. Flexcon Industries; Plumbing & Heating Division.
d. Flo Fab inc.
e. Myers; Pentair Pump Group.
f. State Industries, Inc.
g. Taco, Inc.
h. Wessels Company.

2. Description: Steel, vertical, pressured-rated tank with cylindrical sidewalls and with air-charging valve and air precharge.
3. Operation: Factory-installed, butyl-rubber diaphragm.

B. Construction: ASME code, steel, constructed with nontoxic welded joints, for 125-psig working pressure.

C. Tappings: Factory-fabricated stainless steel, welded to tank before testing and labeling.

1. NPS 2 and Smaller: ASME B1.20.1, with female thread.
2. NPS 2-1/2 and Larger: ASME B16.5, flanged.

D. Specialties and Accessories: Include tappings in tank and the following:

1. Pressure gage.

E. Vertical Tank Supports: Factory-fabricated steel legs or steel skirt, welded to tank before testing and labeling.

F. Tank Interior Finish: Materials and thicknesses complying with NSF 61 barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

1. Coating: Epoxy resin or Glass.

G. Exterior Coating: Manufacturer's standard enamel paint.

2.4 INSULATED, STEEL, POTABLE-WATER STORAGE TANKS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. GSW Water Heating.
2. HESCO Bastion Ltd.
3. Laars Heating Systems Company.
4. Lochinvar Corporation.
5. Precision Boilers.
6. PVI Industries, LLC.
7. RBI; a Mestek company.
8. Rheem Manufacturing Company.
9. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
10. State Industries, Inc.
11. Vaughn Manufacturing Corporation.
12. Wessels Company.

B. Description: Steel, vertical, pressure-rated tank with cylindrical sidewalls.

C. Construction: ASME code, steel, constructed with nontoxic welded joints, for 125-psig working pressure.

D. Manhole: Watertight, for tank more than 36 inches in diameter; same pressure rating as tank.

E. Tappings: Factory-fabricated stainless steel, welded to tank before testing and labeling.

1. NPS 2 and Smaller: ASME B1.20.1, with female thread.
2. NPS 2-1/2 and Larger: ASME B16.5, flanged.

F. Specialties and Accessories: Include tappings in tank and the following:

1. Pressure relief valve.
2. Pressure gage.
3. Thermometer.
4. Air-charging connection.
5. Gage glass, brass fittings, compression stops, and gage-glass guard.

G. Vertical Tank Supports: Factory-fabricated steel legs or steel skirt, welded to tank before testing and labeling.

H. Tank Interior Finish: Materials and thicknesses complying with NSF 61 barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

1. Coating: Epoxy resin or Glass.

I. Insulation: Factory-installed fiberglass or polyurethane foam; surrounding entire tank except connections and other openings; suitable for tank operating temperature; and complying with ASHRAE/IESNA 90.1.

J. Jacket: Steel, with manufacturer's standard finish unless otherwise indicated.

2.5 PLASTIC, PRESSURE, POTABLE-WATER STORAGE TANKS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Norwesco.
2. Pentair, Inc.
3. Tankinetics, Inc.

B. Description: FRP, vertical, pressure-rated tank with cylindrical sidewalls.

C. Construction: ASME code, composite FRP, Composite FRP, thermosetting-resin tank for 125-psig (860-kPa) working pressure.

1. Tank Lining Material: Nontoxic HDPE complying with NSF 61 Annex G barrier materials for potable-water tanks.

D. Manhole: Watertight, for tank more than 36 inches in diameter; same pressure rating as tank.

E. Tappings: Factory-fabricated, FRP flanged-end nozzle.

1. NPS 2 and Smaller: Include plastic-to-steel transition fitting from tank nozzle flange to ASME B1.20.1, female thread.
2. NPS 2-1/2 and Larger: ASME B16.5, flanged.

F. Specialties and Accessories: Include tappings in tank and the following:

1. Pressure relief valve.
2. Pressure gage.
3. Thermometer.

G. Vertical Tank Supports: Factory-fabricated steel legs or FRP skirt attached by FRP brackets to tank sidewall.

H. Tank Interior Finish: Materials and thicknesses complying with NSF 61 Annex G barrier materials for potable-water tank linings. Extend finish into and through tank fittings and outlets.

2.6 PLASTIC, NONPRESSURE, POTABLE-WATER STORAGE TANKS

A. FRP Potable-Water Storage Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. AMTROL, Inc.
b. Belding Tank Technologies, Inc.
c. Palmer Manufacturing and Tank Company.

2. Description: FRP, vertical, nonpressure-rated water tank; complying with NSF 61 Annex G barrier materials for potable-water tanks.

3. Construction: ASTM D4097, contact-molded FRP.
4. Tappings: Factory-fabricated, FRP flanged-end nozzle.

a. NPS 2 and Smaller: Include plastic-to-steel transition fitting from tank nozzle flange to ASME B1.20.1, female thread.

b. NPS 2-1/2 and Larger: Flanged.

5. Vertical Tank Support: Separate factory-fabricated steel stand capable of supporting tank.

B. PE Potable-Water Storage Tanks:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Amprotec, Inc.
b. Chem-Tainer Industries.

c. Norwesco.
d. Premier Plastics Inc.
e. Snyder Industries, Inc.

2. Description: PE, vertical, flat-bottom, nonpressure-rated water tank; complying with NSF 61 Annex G barrier materials for potable-water tanks.

3. Construction: ASTM D1998, molded PE.
4. Tappings: Factory-fabricated bulkhead fittings attached to tank.

a. NPS 2 and Smaller: With female thread.
b. NPS 2-1/2 and Larger: Flanged.

5. Vertical Tank Support: Separate factory-fabricated steel stand capable of supporting entire bottom of tank.

C. Manhole: Watertight, for tank more than 36 inches in diameter.

D. Cover for Open Tank: Plastic, same as or similar to tank material and with shape that encloses top of tank.

E. Specialties and Accessories: Include tappings in the tank and the following:

1. Vacuum relief valve.
2. Free air vent with insect screen.
3. Thermometer.
4. Gage glass, brass fittings, compression stops, and gage-glass guard.

2.7 SOURCE QUALITY CONTROL

A. Test and inspect potable-water storage tanks according to the following tests and inspections and prepare test reports:

1. Pressure Testing for ASME-Code, Potable-Water Storage Tanks: Hydrostatically test to ensure structural integrity and freedom from leaks. Fill tanks with water, vent air, pressurize to 1-1/2 times tank pressure rating, disconnect test equipment, hold pressure for 30 minutes with no drop in pressure, and check for leaks.
2. Pressure Testing for Non-ASME-Code, Pressure, Potable-Water Storage Tanks: Hydrostatically test to ensure structural integrity and freedom from leaks at pressure of 50 psig above system operating pressure, but not less than 150 psig. Fill tanks with water, vent air, pressurize tanks, disconnect test equipment, hold pressure for two hours with no drop in pressure, and check for leaks.
3. Testing for Nonpressure, Potable-Water Storage Tanks: Fill tanks to water operating level to ensure structural integrity and freedom from leaks. Hold water level for two hours with no drop in water level.

B. Repair or replace tanks that fail test with new tanks, and repeat until test is satisfactory.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install water storage tanks on concrete bases, level and plumb, firmly anchored. Arrange so devices needing servicing are accessible.

B. Anchor tank supports and tanks to substrate.

C. Install thermometers and pressure gages on water storage tanks and piping if indicated. Thermometers and pressure gages are specified in Section 220519 "Meters and Gages for Plumbing Piping."

D. Install the following devices on tanks where indicated:

1. Pressure relief valves.
2. Temperature and pressure relief valves.
3. Vacuum relief valves.
4. Tank vents on non-pressure tanks.
5. Connections to accessories.

E. After installing tanks with factory finish, inspect finishes and repair damages to finishes.

3.2 CONNECTIONS

A. Piping installation requirements are specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to potable-water storage tanks to allow service and maintenance.

C. Connect water piping to water storage tanks with unions or flanges and with shutoff valves. Connect tank drains with shutoff valves and discharge over closest floor drains.

1. General-duty valves are specified in Section 220523 "General Duty Valves for Plumbing Piping."

a. Valves NPS 2 and Smaller: Gate or ball.
b. Valves NPS 2-1/2 and Larger: Gate or butterfly.
c. Drain Valves: NPS 3/4 gate or ball valve. Include outlet with, or nipple in outlet with, ASME B1.20.7, 3/4-11.5NH thread for garden-hose service, threaded cap, and chain.

2. Water Piping Connections: Make connections to dissimilar metals with dielectric fittings. Dielectric fittings are specified in Section 221116 "Domestic Water Piping."
3. Connect air piping to hydro-pneumatic tanks with unions or flanges and gate or ball valves. Make connections to dissimilar metals with dielectric fittings, which are specified in Section 221513 "General-Service Compressed-Air Piping."

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform the following final checks before filling:

1. Verify that air precharge in precharged tanks is correct.
2. Test operation of tank accessories and devices.
3. Verify that pressure relief valves have correct setting.
    a. Manually operate pressure relief valves.
    b. Adjust pressure settings.
4. Verify that vacuum relief valves are correct size.
    a. Manually operate vacuum relief valves.
    b. Adjust vacuum settings.

B. Filling Procedures: Follow manufacturer's written procedures. Fill tanks with water to operating level.

3.5 CLEANING

A. Clean and disinfect potable-water storage tanks.

B. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed, use procedure described in AWWA C652 or as described below:

1. Purge water storage tanks with potable water.
2. Disinfect tanks by one of the following methods:
    a. Fill tanks with water-chlorine solution containing at least 50 ppm of chlorine. Isolate tanks and allow to stand for 24 hours.
    b. Fill tanks with water-chlorine solution containing at least 200 ppm of chlorine. Isolate tanks and allow to stand for three hours.
3. Flush tanks, after required standing time, with clean, potable water until chlorine is not present in water coming from tank.
4. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination made by authorities having jurisdiction shows evidence of contamination.

C. Prepare written reports for purging and disinfecting activities.

END OF SECTION 221223

SECTION 221316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

C. Adhesive Primer: ASTM F 656.

D. Solvent Cement: ASTM D 2564.

2.3 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company; a division of MCP Industries, Inc.
        4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.

    b. Standard: ASTM C 1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. Sleeve Materials:

        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Non-pressure Transition Couplings:

    a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

        1) Cascade Waterworks Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company; a division of MCP Industries, Inc.

    b. Standard: ASTM C 1460, C-564.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

I. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

J. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated:

1. Building Sanitary Drain: 2 percent downward in direction of flow for piping NPS 3 and smaller; 1 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Sanitary Drainage Piping: 2 percent downward in direction of flow.

3. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

K. Install aboveground PVC piping according to ASTM D 2665.

L. Install underground PVC piping according to ASTM D 2321.

M. Plumbing Specialties:

1. Install backwater valves in sanitary waste gravity-flow piping. Comply with requirements for backwater valves specified in Section 221319 "Sanitary Waste Piping Specialties."
2. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Comply with requirements for cleanouts specified in Section 221319 "Sanitary Waste Piping Specialties."
3. Install drains in sanitary drainage gravity-flow piping. Comply with requirements for drains specified in Section 221319 "Sanitary Waste Piping Specialties."

N. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

O. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

P. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Plastic, Non-pressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Drainage Piping: Shielded, non-pressure transition couplings.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Install individual, straight, horizontal piping runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.

G. Install supports for vertical PVC piping every 48 inches.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.6 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:

1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.

3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves with cleanout cover flush with floor.
6. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221319 "Sanitary Waste Piping Specialties."
7. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections NPS 2-1/2 and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:

1. Install unions, in piping NPS 2 and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping NPS 2-1/2 and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.7 IDENTIFICATION

A. Identify exposed sanitary waste and vent piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.8 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
6. Prepare reports for tests and required corrective action.

3.9 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed PVC Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

3.10 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

B. Soil, waste and vent piping shall be:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

END OF SECTION 221316

SECTION 221319

SANITARY WASTE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cleanouts.
2. Floor drains.
3. Roof flashing assemblies.
4. Miscellaneous sanitary drainage piping specialties.
5. Flashing materials.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and accessories for grease interceptors.

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Exposed Cast-Iron Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Josam Company.
b. MIFAB, Inc.
c. Smith, Jay R. Mfg. Co.
d. Watts Drainage Products.
e. Zurn Plumbing Products Group.

2. Standard: ASME A112.36.2M for cast iron or cleanout test tee.
3. Size: Same as connected drainage piping
4. Body Material: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.

5. Closure: Countersunk, brass plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Cast-Iron Wall Cleanouts:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Josam Company; Josam Div.
    b. MIFAB, Inc.
    c. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    d. Tyler Pipe; Wade Div.
    e. Watts Drainage Products Inc.
    f. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.36.2M. Include wall access.
3. Size: Same as connected drainage piping.
4. Body: Hub-and-spigot, cast-iron soil pipe T-branch or Hubless, cast-iron soil pipe test tee as required to match connected piping.
5. Closure: Countersunk or raised-head, drilled-and-threaded plug.
6. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
7. Wall Access: Round, flat, chrome-plated brass or stainless-steel cover plate with screw.
8. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.2 FLOOR DRAINS

A. Cast-Iron Floor Drains:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Commercial Enameling Co.
    b. Josam Company; Josam Div.
    c. MIFAB, Inc.
    d. Prier Products, Inc.
    e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    f. Tyler Pipe; Wade Div.
    g. Watts Drainage Products Inc.
    h. Zurn Plumbing Products Group; Light Commercial Operation.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3 with backwater valve, where shown on the Drawings.
3. Pattern: Floor drain.
4. Body Material: Gray iron.
5. Clamping Device: Required where installed in slab above grade.
6. Outlet: Side.
7. Backwater Valve: Integral, ASME A112.14.1, swing-check type, where required.
8. Sediment Bucket: Required.
9. Top of Body and Strainer Finish: Polished bronze.

10. Top Shape: Round.
11. Top Loading Classification: Extra Heavy-Duty.
12. Trap Material: Cast iron.
13. Trap Pattern: Deep-seal P-trap.
14. Trap Features: Trap-seal primer valve drain connection.

B. Cast-Iron Floor Drain, Sanitary (Floor Sink):

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Commercial Enameling Co.
    b. Josam Company; Josam Div.
    c. MIFAB, Inc.
    d. Prier Products, Inc.
    e. Smith, Jay R. Mfg. Co.; Division of Smith Industries, Inc.
    f. Tyler Pipe; Wade Div.
    g. Watts Drainage Products Inc.
    h. Zurn Plumbing Products Group; Light Commercial Operation.
    i. Zurn Plumbing Products Group; Specification Drainage Operation.

2. Standard: ASME A112.6.3 with backwater valve, where shown on the Drawings.
3. Pattern: Sanitary drain.
4. Body Material: Gray iron.
5. Clamping Device: Required where installed in slab above grade.
6. Outlet: Side.
7. Backwater Valve: Integral, ASME A112.14.1, swing-check type, where required.
8. Coating on Interior and Exposed Exterior Surfaces: Acid-resistant enamel.
9. Sediment Bucket: Required.
10. Top of Body and Strainer Finish: Nickel bronze.
11. Top Shape: Square.
12. Top Loading Classification: Extra Heavy-Duty.
13. Trap Material: Cast iron.
14. Trap Pattern: Deep-seal P-trap.
15. Trap Features: Trap-seal primer valve drain connection.

2.3 ROOF FLASHING ASSEMBLIES

A. Roof Flashing Assemblies:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Acorn Engineering Company; Elmdor/Stoneman Div.
    b. Thaler Metal Industries Ltd.

2. Description: Manufactured assembly made of 4.0-lb/sq. ft., 0.0625-inch- thick, lead flashing collar and skirt extending at least 6 inches from pipe, with galvanized-steel boot reinforcement and counterflashing fitting.

a. Open-Top Vent Cap: Without cap.
b. Low-Silhouette Vent Cap: With vandal-proof vent cap.
c. Extended Vent Cap: With field-installed, vandal-proof vent cap.

2.4 MISCELLANEOUS SANITARY DRAINAGE PIPING SPECIALTIES

A. Open Drains:

1. Description: Shop or field fabricate from ASTM A 74, Service class, hub-and-spigot, cast-iron, soil-pipe fittings. Include P-trap, hub-and-spigot riser section; and where required, increaser fitting joined with ASTM C 564, rubber gaskets.
2. Size: Same as connected waste piping with increaser fitting of size indicated.

B. Air-Gap Fittings:

1. Standard: ASME A112.1.2, for fitting designed to ensure fixed, positive air gap between installed inlet and outlet piping.
2. Body: Bronze or cast iron.
3. Inlet: Opening in top of body.
4. Outlet: Larger than inlet.
5. Size: Same as connected waste piping and with inlet large enough for associated indirect waste piping.

C. Sleeve Flashing Device:

1. Description: Manufactured, cast-iron fitting, with clamping device, that forms sleeve for pipe floor penetrations of floor membrane. Include galvanized-steel pipe extension in top of fitting that will extend 1 inch above finished floor and galvanized-steel pipe extension in bottom of fitting that will extend through floor slab.
2. Size: As required for close fit to riser or stack piping.

D. Stack Flashing Fittings:

1. Description: Counterflashing-type, cast-iron fitting, with bottom recess for terminating roof membrane, and with threaded or hub top for extending vent pipe.
2. Size: Same as connected stack vent or vent stack.

2.5 FLASHING MATERIALS

A. Lead Sheet: ASTM B 749, Type L51121, copper bearing, with the following minimum weights and thicknesses, unless otherwise indicated:

1. General Use: 4.0-lb/sq. ft., 0.0625-inch thickness.
2. Vent Pipe Flashing: 3.0-lb/sq. ft., 0.0469-inch thickness.
3. Burning: 6-lb/sq. ft., 0.0938-inch thickness.

B. Fasteners: Metal compatible with material and substrate being fastened.

C. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

D. Solder: ASTM B 32, lead-free alloy.

E. Bituminous Coating: SSPC-Paint 12, solvent-type, bituminous mastic.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install cleanouts in aboveground piping and building drain piping according to the following, unless otherwise indicated:

1. Size same as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate at each change in direction of piping greater than 45 degrees.
3. Locate at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate at base of each vertical soil and waste stack.

B. For floor cleanouts for piping below floors, install cleanout deck plates with top flush with finished floor.

C. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

D. Install floor drains at low points of surface areas to be drained. Set grates of drains flush with finished floor, unless otherwise indicated.

1. Position floor drains for easy access and maintenance.
2. Set floor drains below elevation of surrounding finished floor to allow floor drainage. Set with grates depressed according to the following drainage area radii:

    a. Radius, 30 Inches or Less: Equivalent to 1 percent slope, but not less than 1/4-inch total depression.
    b. Radius, 30 to 60 Inches: Equivalent to 1 percent slope.
    c. Radius, 60 Inches or Larger: Equivalent to 1 percent slope, but not greater than 1-inch total depression.

3. Install floor-drain flashing collar or flange so no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes where penetrated.
4. Install individual traps for floor drains connected to sanitary building drain, unless otherwise indicated.

E. Install roof flashing assemblies on sanitary stack vents and vent stacks that extend through roof.

F. Install flashing fittings on sanitary stack vents and vent stacks that extend through roof.

G. Assemble open drain fittings and install with top of hub 1 inch above floor.

H. Install deep-seal traps on floor drains and other waste outlets, if indicated.

I. Install floor-drain, trap-seal primer fittings on inlet to floor drains that require trap-seal primer connection.

1. Exception: Fitting may be omitted if trap has trap-seal primer connection.
2. Size: Same as floor drain inlet.

J. Install air-gap fittings on draining-type backflow preventers and on indirect-waste piping discharge into sanitary drainage system.

K. Install sleeve flashing device with each riser and stack passing through floors with waterproof membrane.

L. Install vent caps on each vent pipe passing through roof.

M. Install traps on plumbing specialty drain outlets. Omit traps on indirect wastes unless trap is indicated.

3.2 CONNECTIONS

A. Comply with requirements in Section 221316 "Sanitary Waste and Vent Piping" for piping installation requirements. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment to allow service and maintenance.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of lead sheets 6.0-lb/sq. ft., 0.0938-inch thickness or thicker. Solder joints of lead sheets 4.0-lb/sq. ft., 0.0625-inch thickness or thinner.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching pipe size, with minimum length of 10 inches, and skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Install flashing for piping passing through roofs with counterflashing or commercially made flashing fittings, according to Section 076200 "Sheet Metal Flashing and Trim."

F. Extend flashing up vent pipe passing through roofs and turn down into pipe, or secure flashing into cast-iron sleeve having calking recess.

3.4 LABELING AND IDENTIFYING

A. Equipment Nameplates and Signs: Install engraved plastic-laminate equipment nameplate or sign on or near each grease interceptor.

B. Distinguish among multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to identifying unit. Nameplates and signs are specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.5 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221319

SECTION 221323

SANITARY WASTE INTERCEPTORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Grease interceptors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of metal interceptor indicated.

B. Shop Drawings: For each type and size of precast-concrete interceptor indicated.

PART 2 - PRODUCTS

2.1 GREASE INTERCEPTORS

A. Grease Interceptors: Precast concrete complying with ASTM C 913.

1. Include rubber-gasketed joints, vent connections, manholes, compartments or baffles, and piping or openings to retain grease and to permit wastewater flow.
2. Structural Design Loads:

a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
d. Walkway Load: Comply with ASTM C 890, A-03.

3. Resilient Pipe Connectors: ASTM C 923, cast or fitted into interceptor walls, for each pipe connection.
4. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals. Omit steps if total depth from floor of interceptor to finished grade is less than 60 inches.
5. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, to match diameter of manhole frame and cover.
6. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch-minimum width flange and 26-inch- diameter cover.

a. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.

b. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
c. Include indented top design with lettering cast into cover, using wording equivalent to “GREASE INTERCEPTOR".

2.2 PRECAST-CONCRETE MANHOLE RISERS

A. Precast-Concrete Manhole Risers: ASTM C 478, with rubber-gasket joints.

1. Structural Design Loads:

a. Light-Traffic Load: Comply with ASTM C 890, A-8 (ASSHTO HS10-44).
b. Medium-Traffic Load: Comply with ASTM C 890, A-12 (ASSHTO HS15-44).
c. Heavy-Traffic Load: Comply with ASTM C 890, A-16 (ASSHTO HS20-44).
d. Walkway Load: Comply with ASTM C 890, A-03.

2. Length: From top of underground concrete structure to grade.
3. Riser Sections: 3-inch minimum thickness and 36-inch diameter.
4. Top Section: Eccentric cone, unless otherwise indicated. Include top of cone to match grade ring size.
5. Gaskets: ASTM C 443, rubber.
6. Steps: Individual FRP steps, FRP ladder, or ASTM A 615/A 615M, deformed, 1/2-inch steel reinforcing rods encased in ASTM D 4101, PP, wide enough to allow worker to place both feet on one step and designed to prevent lateral slippage off step. Cast or anchor steps into sidewalls at 12- to 16-inch intervals.

B. Grade Rings: Reinforced-concrete rings, 6- to 9-inch total thickness, diameter matching manhole frame and cover, and height as required to adjust the manhole frame and cover to indicated elevation and slope.

C. Manhole Frames and Covers: Ferrous; 24-inch ID by 7- to 9-inch riser with 4-inch- minimum width flange and 26-inch- diameter cover.

1. Ductile Iron: ASTM A 536, Grade 60-40-18, unless otherwise indicated.
2. Gray Iron: ASTM A 48, Class 35, unless otherwise indicated.
3. Include indented top design with lettering cast into cover, using wording equivalent to the following:

a. Grease Interceptors in Sanitary Sewerage System: " GREASE INTERCEPTOR."

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavating, trenching, and backfilling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION

A. Install precast-concrete interceptors according to ASTM C 891. Set level and plumb.

B. Install manhole risers from top of underground concrete interceptors to manholes and gratings at finished grade.

C. Set tops of manhole frames and covers flush with finished surface in pavements. Set tops 3 inches above finish surface elsewhere, unless otherwise indicated.

D. Set metal interceptors level and plumb.

E. Set tops of metal interceptor covers flush with finished surface in pavements. Set tops 3 inches above finish surface elsewhere, unless otherwise indicated.

3.3 CONNECTIONS

A. Piping installation requirements are specified in Section 221316 "Sanitary Waste and Vent Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Make piping connections between interceptors and piping systems.

3.4 IDENTIFICATION

A. Identification materials and installation are specified in Section 312000 "Earth Moving." Arrange for installation of green warning tapes directly over piping and at outside edges of underground interceptors.

1. Use warning tapes or detectable warning tape over ferrous piping.
2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

END OF SECTION 221323

SECTION 221413

FACILITY STORM DRAINAGE PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipe, tube, and fittings.
2. Specialty pipe fittings.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping System Components and Related Materials," for plastic piping components. Include marking with "NSF-drain" for plastic drain piping and "NSF-sewer" for plastic sewer piping.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.2 PVC PIPE AND FITTINGS

A. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

B. Cellular-Core PVC Pipe: ASTM F 891, Schedule 40.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.

1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

E. Solvent Cement: ASTM D 2564.

1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

2.3 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified-piping-system fitting.
3. Unshielded, Non-pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Dallas Specialty & Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company; a division of MCP Industries, Inc.
4) Plastic Oddities; a division of Corporate Technologies, Inc.

b. Standard: ASTM C 1173.
c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
d. Sleeve Materials:

1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.

4. Shielded, Non-pressure Transition Couplings:

a. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cascade Waterworks Mfg. Co.
2) Fernco Inc.
3) Mission Rubber Company; a division of MCP Industries, Inc.

b. Standard: ASTM C 1460, C-564.
c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 - EXECUTION

3.1 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations from layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping at indicated slopes.

F. Install piping free of sags and bends.

G. Install fittings for changes in direction and branch connections.

H. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 220548.13 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

I. Make changes in direction for storm drainage piping using appropriate branches, bends, and long-sweep bends. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

J. Lay buried building storm drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping

upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

K. Install storm drainage piping at the following minimum slopes unless otherwise indicated:

1. Building Storm Drain: 1 percent downward in direction of flow for piping NPS 3 and smaller; 2 percent downward in direction of flow for piping NPS 4 and larger.
2. Horizontal Storm-Drainage Piping: 2 percent downward in direction of flow.

L. Install aboveground PVC piping according to ASTM D 2665.

M. Install underground PVC piping according to ASTM D 2321.

N. Plumbing Specialties:

1. Install backwater valves in storm drainage gravity-flow piping. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."
2. Install cleanouts at grade and extend to where building storm drains connect to building storm sewers in storm drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in storm drainage force-main piping. Comply with requirements for cleanouts specified in Section 221423 "Storm Drainage Piping Specialties."
3. Install drains in storm drainage gravity-flow piping. Comply with requirements for drains specified in Section 221423 "Storm Drainage Piping Specialties."

O. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 JOINT CONSTRUCTION

A. Plastic, Non-pressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendixes.
3. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.4 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:

1. Install transition couplings at joints of piping with small differences in OD's.
2. In Underground Drainage Piping: Unshielded, non-pressure transition couplings.
3. In Aboveground Drainage Piping: Shielded, non-pressure transition couplings.

3.5 VALVE INSTALLATION

A. Backwater Valves: Install backwater valves in piping subject to backflow.

1. Horizontal Piping: Horizontal backwater valves. Use normally closed type unless otherwise indicated.
2. Install backwater valves in accessible locations.
3. Comply with requirements for backwater valves specified in Section 221423 "Storm Drainage Piping Specialties."

3.6 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements for seismic-restraint devices specified in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."

B. Comply with requirements for pipe hanger and support devices and installation specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

1. Install carbon-steel pipe hangers for horizontal piping in noncorrosive environments.
2. Install stainless-steel pipe hangers for horizontal piping in corrosive environments.
3. Install carbon-steel pipe support clamps for vertical piping in noncorrosive environments.
4. Install stainless-steel pipe support clamps for vertical piping in corrosive environments.
5. Vertical Piping: MSS Type 8 or Type 42, clamps.
6. Individual, Straight, Horizontal Piping Runs:

    a. 100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.
    b. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.
    c. Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

7. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.
8. Base of Vertical Piping: MSS Type 52, spring hangers.

C. Support horizontal piping and tubing within 12 inches of each fitting, valve, and coupling.

D. Support vertical piping and tubing at base and at each floor.

E. Rod diameter may be reduced one size for double-rod hangers, with 3/8-inch minimum rods.

F. Install hangers for PVC piping with the following maximum horizontal spacing and minimum rod diameters:

1. NPS 1-1/2 and NPS 2: 48 inches with 3/8-inch rod.
2. NPS 3: 48 inches with 1/2-inch rod.
3. NPS 4 and NPS 5: 48 inches with 5/8-inch rod.
4. NPS 6 and NPS 8: 48 inches with 3/4-inch rod.
5. NPS 10 and NPS 12: 48 inches with 7/8-inch rod.

G. Install supports for vertical PVC piping every 48 inches.

H. Support piping and tubing not listed above according to MSS SP-69 and manufacturer's written instructions.

3.7 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect interior storm drainage piping to exterior storm drainage piping. Use transition fitting to join dissimilar piping materials.

C. Connect storm drainage piping to roof drains and storm drainage specialties.

1. Install test tees (wall cleanouts) in conductors near floor, and floor cleanouts with cover flush with floor.
2. Install horizontal backwater valves with cleanout cover flush with floor or in pit with pit cover flush with floor.
3. Comply with requirements for backwater valves, cleanouts and drains specified in Section 221423 "Storm Drainage Piping Specialties."

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.8 IDENTIFICATION

A. Identify exposed storm drainage piping. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.9 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
2. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
3. Test Procedure: Test storm drainage piping, except outside leaders, on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
4. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
5. Prepare reports for tests and required corrective action.

3.10 CLEANING

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

3.11 PIPING SCHEDULE

A. Flanges and unions may be used on aboveground pressure piping unless otherwise indicated.

A. Aboveground storm drainage piping shall be:

1. Solid-wall or Cellular-core PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Shielded, non-pressure transition couplings.

B. Underground storm drainage piping shall be:

1. Solid-wall PVC pipe, PVC socket fittings, and solvent-cemented joints.
2. Dissimilar Pipe-Material Couplings: Unshielded, non-pressure transition couplings.

END OF SECTION 221413

SECTION 221423

STORM DRAINAGE PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Roof drains.
2. Miscellaneous storm drainage piping specialties.
3. Cleanouts.
4. Flashing materials.

1.2 ACTION SUBMITTALS

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

1.3 QUALITY ASSURANCE

A. Drainage piping specialties shall bear label, stamp, or other markings of specified testing agency.

PART 2 - PRODUCTS

2.1 METAL ROOF DRAINS

A. Cast-Iron, Large-Sump, General-Purpose Roof Drains:

1. Standard: ASME A112.6.4, for general-purpose roof drains.
2. Body Material: Cast iron.
3. Dimension of Body: Nominal 14-inch diameter.
4. Combination Flashing Ring and Gravel Stop: Required.
5. Flow-Control Weirs: Required.
6. Outlet: Bottom.
7. Underdeck Clamp: Required.
8. Dome Material: Aluminum.
9. Water Dam: Not required.

B. Cast-Iron, Large-Sump, Overflow Roof Drains:

1. Standard: ASME A112.6.4, for general-purpose roof drains.
2. Body Material: Cast iron.
3. Dimension of Body: Nominal 14-inch diameter.

4. Combination Flashing Ring and Gravel Stop: Required.
5. Flow-Control Weirs: Required.
6. Outlet: Bottom.
7. Underdeck Clamp: Required.
8. Dome Material: Aluminum.
9. Water Dam: 2 inches high.

2.2 MISCELLANEOUS STORM DRAINAGE PIPING SPECIALTIES

A. Conductor Nozzles:

1. Description: Bronze body with threaded inlet and bronze wall flange with mounting holes.
2. Size: Same as connected conductor.

2.3 CLEANOUTS

A. Test Tees:

1. Standard: ASME A112.36.2M and ASTM A 74, ASTM A 888, or CISPI 301, for cleanout test tees.
2. Size: Same as connected drainage piping.
3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or Hubless, cast-iron soil-pipe test tee as required to match connected piping.
4. Closure Plug: Countersunk, brass.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.

B. Wall Cleanouts:

1. Standard: ASME A112.36.2M, for cleanouts. Include wall access.
2. Size: Same as connected drainage piping.
3. Body Material: Hub-and-spigot, cast-iron soil-pipe T-branch or Hubless, cast-iron soil-pipe test tee as required to match connected piping.
4. Closure: Countersunk or raised-head, drilled-and-threaded brass plug.
5. Closure Plug Size: Same as or not more than one size smaller than cleanout size.
6. Wall Access: Round, nickel-bronze, copper-alloy, or stainless-steel wall-installation frame and cover.

2.4 FLASHING MATERIALS

A. Copper Sheet: ASTM B 152/B 152M, 12 oz./sq. ft.

B. Zinc-Coated Steel Sheet: ASTM A 653/A 653M, with 0.20 percent copper content and 0.04-inch minimum thickness unless otherwise indicated. Include G90 hot-dip galvanized, mill-phosphatized finish for painting if indicated.

C. Elastic Membrane Sheet: ASTM D 4068, flexible, chlorinated polyethylene, 40-mil minimum thickness.

D. Fasteners: Metal compatible with material and substrate being fastened.

E. Metal Accessories: Sheet metal strips, clamps, anchoring devices, and similar accessory units required for installation; matching or compatible with material being installed.

F. Solder: ASTM B 32, lead-free alloy.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install roof drains at low points of roof areas according to roof membrane manufacturer's written installation instructions.

1. Install flashing collar or flange of roof drain to prevent leakage between drain and adjoining roofing. Maintain integrity of waterproof membranes where penetrated.
2. Install expansion joints, if indicated, in roof drain outlets.
3. Position roof drains for easy access and maintenance.

B. Install conductor nozzles at exposed bottom of conductors where they spill onto grade.

C. Install cleanouts in aboveground piping and building drain piping according to the following instructions unless otherwise indicated:

1. Use cleanouts the same size as drainage piping up to NPS 4. Use NPS 4 for larger drainage piping unless larger cleanout is indicated.
2. Locate cleanouts at each change in direction of piping greater than 45 degrees.
3. Locate cleanouts at minimum intervals of 50 feet for piping NPS 4 and smaller and 100 feet for larger piping.
4. Locate cleanouts at base of each vertical soil and waste stack.

D. For cleanouts located in concealed piping, install cleanout wall access covers, of types indicated, with frame and cover flush with finished wall.

E. Install test tees in vertical conductors and near floor.

F. Install wall cleanouts in vertical conductors. Install access door in wall if indicated.

G. Install sleeve flashing device with each conductor passing through floors with waterproof membrane.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221413 "Facility Storm Drainage Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

3.3 FLASHING INSTALLATION

A. Fabricate flashing from single piece of metal unless large pans, sumps, or other drainage shapes are required. Join flashing according to the following if required:

1. Lead Sheets: Burn joints of 6.0-lb/sq. ft. lead sheets, 0.0938-inch thickness or thicker. Solder joints of 4.0-lb/sq. ft. lead sheets, 0.0625-inch thickness or thinner.
2. Copper Sheets: Solder joints of copper sheets.

B. Install sheet flashing on pipes, sleeves, and specialties passing through or embedded in floors and roofs with waterproof membrane.

1. Pipe Flashing: Sleeve type, matching the pipe size, with a minimum length of 10 inches and with skirt or flange extending at least 8 inches around pipe.
2. Sleeve Flashing: Flat sheet, with skirt or flange extending at least 8 inches around sleeve.
3. Embedded Specialty Flashing: Flat sheet, with skirt or flange extending at least 8 inches around specialty.

C. Set flashing on floors and roofs in solid coating of bituminous cement.

D. Secure flashing into sleeve and specialty clamping ring or device.

E. Fabricate and install flashing and pans, sumps, and other drainage shapes.

3.4 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt or debris and to prevent damage from traffic or construction work.

B. Place plugs in ends of uncompleted piping at end of each day or when work stops.

END OF SECTION 221423

SECTION 221429

SUMP PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Submersible sump pumps.
2. Wet-pit-volute sump pumps.

1.2 ACTION SUBMITTALS

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

B. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

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.

B. UL Compliance: Comply with UL 778 for motor-operated water pumps.

PART 2 - PRODUCTS

2.1 SUBMERSIBLE SUMP PUMPS

A. Submersible, Fixed-Position, Single-Seal Sump Pumps:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Bell & Gossett Domestic Pump; ITT Corporation.
b. Flo Fab inc.
c. Goulds Pumps; ITT Corporation.
d. Grundfos Pumps Corp.
e. Liberty Pumps.
f. Little Giant Pump Co.
g. Pentair Pump Group; Hydromatic Pumps.

h. Pentair Pump Group; Myers.
i. Stancor, Inc.
j. Sta-Rite Industries, Inc.
k. Weil Pump Company, Inc.
l. Weinman Division; Crane Pumps & Systems.
m. Zoeller Company.

2. Description: Factory-assembled and -tested sump-pump unit.
3. Pump Type: Submersible, end-suction, single-stage, close-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.
4. Pump Casing: Cast iron, with strainer inlet, legs that elevate pump to permit flow into impeller, and vertical discharge for piping connection.
5. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron, ASTM A 532/A 532M, abrasion-resistant cast iron and ASTM B 584, cast bronze, semi-open design for clear wastewater handling, and keyed and secured to shaft.
6. Pump and Motor Shaft: Stainless steel or steel, with factory-sealed, grease-lubricated ball bearings.
7. Seal: Mechanical.
8. Motor: Hermetically sealed, capacitor-start type; with built-in overload protection; lifting eye or lug; and three-conductor, waterproof power cable of length required and with grounding plug and cable-sealing assembly for connection at pump.

9. Rod-and-Float Controls:

a. Enclosure: NEMA 250, Type 1 in dry locations, Type 4X in wet locations.
b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
c. Automatic Alternator (for duplex pump units): Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

10. Float Switch and Pressure Switch Controls:

a. Enclosure: NEMA 250, Type 4X; wall-mounted.
b. Switch Type: Mechanical-float or Pressure type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
c. Automatic Alternator (for duplex pump units): Start pumps on successive cycles and start multiple pumps if one cannot handle load.
d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

11. Control-Interface Features:

a. Remote Alarm Contacts: For remote alarm interface.

b. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

1) On-off status of pump.
2) Alarm status.

2.2 WET-PIT-VOLUTE SUMP PUMPS

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

2. Armstrong Pumps Inc.
3. Chicago Pump Company; a division of Yeomans Chicago Corporation.
4. Flo Fab inc.
5. PACO Pumps; Grundfos Pumps Corporation, U.S.A.
6. Peerless Pump, Inc.
7. Pentair Pump Group; Aurora Pump.
8. Weil Pump Company, Inc.

B. Description: Factory-assembled and -tested sump-pump unit.

C. Pump Type: Wet-pit-volute, single-stage, separately-coupled, overhung-impeller, centrifugal sump pump as defined in HI 1.1-1.2 and HI 1.3.

D. Pump Casing: Cast iron, with strainer inlet and threaded connection for NPS 2 and smaller and flanged connection for NPS 2-1/2 and larger discharge piping.

E. Impeller: Statically and dynamically balanced, ASTM A 48/A 48M, Class No. 25 A cast iron, ASTM A 532/A 532M, abrasion-resistant cast iron and ASTM B 584, cast bronze, semi-open design for clear wastewater handling, and keyed and secured to shaft.

F. Sleeve Bearings: Bronze. Include oil-lubricated, intermediate sleeve bearings at 48-inch maximum intervals if basin depth is more than 48 inches, and grease-lubricated, ball-type thrust bearings.

G. Pump and Motor Shaft Coupling: Flexible, capable of absorbing torsional vibration and shaft misalignment.

H. Pump Discharge Piping: Factory or field fabricated, galvanized, ASTM A 53/A 53M, Schedule 40, steel pipe with ASME B16.1, Class 125, cast-iron flanges and flanged fittings or ASME B16.4, Class 125, gray iron threaded fittings.

I. Support Plate: Cast iron or coated steel and strong enough to support pumps, motors, and controls. Refer to Part 2 "Sump-Pump Basins and Basin Covers" Article for requirements.

J. Shaft Seal: Stuffing box, with graphite-impregnated braided-yarn rings and bronze packing gland.

K. Motor: Single-speed; grease-lubricated ball bearings and mounting on vertical, cast-iron pedestal.

1. Rod-and-Float Controls:

    a. Enclosure: NEMA 250, Type 1 in dry locations, Type 4X in wet locations.
    b. Switch Type: Pedestal-mounted float switch with float rods and rod buttons.
    c. Automatic Alternator (for duplex pump units): Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    d. Float Guides: Pipe or other restraint for floats and rods in basins of depth greater than 60 inches.
    e. High-Water Alarm: Cover-mounted, compression-probe alarm, with electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

2. Float Switch and Pressure Switch Controls:

    a. Enclosure: NEMA 250, Type 4X; wall-mounted.
    b. Switch Type: Mechanical-float or Pressure type, in NEMA 250, Type 6 enclosures with mounting rod and electric cables.
    c. Automatic Alternator (for duplex pump units): Start pumps on successive cycles and start multiple pumps if one cannot handle load.
    d. High-Water Alarm: Rod-mounted, NEMA 250, Type 6 enclosure with mechanical-float, or pressure switch matching control and electric bell; 120-V ac, with transformer and contacts for remote alarm bell.

L. Control-Interface Features:

1. Remote Alarm Contacts: For remote alarm interface.
2. Building Automation System Interface: Auxiliary contacts in pump controls for interface to building automation system and capable of providing the following:

    a. On-off status of pump.
    b. Alarm status.

2.3 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 220513 "Common Motor Requirements for Plumbing Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Motors for submersible pumps shall be hermetically sealed.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation and filling are specified in Section 312000 "Earth Moving."

3.2 INSTALLATION

A. Pump Installation Standard: Comply with HI 1.4 for installation of sump pumps.

END OF SECTION 221429

SECTION 223100

DOMESTIC WATER SOFTENERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial water softeners.
2. Chemicals.
3. Water-testing sets.

1.2 ACTION SUBMITTALS

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

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for water softeners.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Salt for Brine Tanks: Furnish in same form as and at least four times original load, but not less than 200 lb.
2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

1.6 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended application.

B. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, where indicated.

C. UL Compliance: Fabricate and label water softeners to comply with UL 979, "Water Treatment Appliances."

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softeners that fail in materials or workmanship within specified warranty period.

1. Commercial Water Softeners, Warranty Period: From date of Substantial Completion.

a. Mineral Tanks: Five years.
b. Brine Tanks: 10 years.
c. Control Valve: One year(s).

PART 2 - PRODUCTS

2.1 COMMERCIAL WATER SOFTENERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Aquion Water Treatment Products.
2. Culligan International Company.
3. Diamond Water Conditioning; a Griesbach company.
4. Diamond Water Systems, Inc.
5. Ecodyne Water Treatment, Inc.
6. Integration Separation Solutions, LLC.
7. Kinetico Incorporated.
8. Marlo Incorporated.
9. Springsoft International, Inc.
10. Water King.
11. WaterSoft; a division of Amtrol, Inc.

B. Description: Factory-assembled, pressure-type water softener.

1. Standard: Comply with NSF 61, "Drinking Water System Components - Health Effects."
2. Configuration: Single unit with one mineral tank or twin unit with two mineral tanks and one brine tank.
3. Mounting: On skids.
4. Wetted Components: Suitable for water temperatures from 40 to at least 100 deg F.

5. Mineral Tanks: Steel, electric welded; pressure-vessel quality.

    a. Pressure Rating: 100 psig minimum.
    b. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
    c. Handholes: 4 inches round or 4 by 6 inches elliptical, in top head and lower sidewall of tanks 30 inches and smaller in diameter.
    d. Manhole: 11 by 15 inches in top head of tanks larger than 30 inches in diameter.
    e. Support Legs or Skirt: Constructed of structural steel, welded to tank before testing and labeling.
    f. Finish: Exterior of tank spray-painted with rust-resistant prime coat, 2- to 3-mil dry film thickness. Interior sandblasted and lined with epoxy-polyamide coating, 8- to 10-mil dry film thickness.
    g. Upper Distribution System: Single, point type, fabricated from galvanized-steel pipe and fittings.
    h. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, non-clogging PE strainers, and arranged for even flow distribution through resin bed.
    i. Liner: PE, ABS, or other material suitable for potable water.

6. Controls: Fully automatic; factory wired, and factory mounted on unit.

    a. Adjustable duration of various regeneration steps.
    b. Push-button start and complete manual operation.
    c. Electric time clock and switch for fully automatic operation, adjustable to initiate regeneration at any hour of day and any day of week or at fixed intervals.
    d. Sequence of Operation: Multiport pilot-control valve automatically pressure-actuates main operating valve through steps of regeneration and return to service.
    e. Pointer on pilot-control valve shall indicate cycle of operation.
    f. Includes means of manual operation of pilot-control valve if power fails.

7. Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:

    a. Slow opening and closing, non-slam operation.
    b. Diaphragm guiding on full perimeter from fully open to fully closed.
    c. Isolated, dissimilar metals within valve.
    d. Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.
    e. Sampling cocks for soft water.
    f. Special tools are not required for service.

8. Flow Control: Automatic, to control backwash and flush rates over wide variations in operating pressure; does not require field adjustments.

    a. Demand-Initiated Control: Each mineral tank of twin mineral-tank unit is equipped with automatic-reset-head water meter that electrically activates cycle controllers to initiate regeneration at preset total in gallons. Head automatically resets to preset total in gallons for next service run. Electrical lockout prevents simultaneous regeneration of both tanks.

9. Brine Tank: Combination measuring and wet-salt storing system.

    a. Tank and Cover Material: Fiberglass, 3/16 inch thick; or molded PE, 3/8 inch thick.
    b. Brine Valve: Float operated, and plastic fitted for automatic control of brine withdrawal and freshwater refill.
    c. Size: Large enough for at least four regenerations at full salting.

10. Factory-Installed Accessories:

    a. Piping, valves, tubing, and drains.
    b. Sampling cocks.
    c. Main-operating-valve position indicators.
    d. Water meters.

2.2 CHEMICALS

A. Mineral: High-capacity, sulfonated-polystyrene, ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock.

1. Exchange Capacity: 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.

B. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are unacceptable.

1. Form: Processed, food-grade salt pellets.

2.3 WATER-TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus and chemicals with testing procedure instructions. Include metal container suitable for wall mounting.

PART 3 - EXECUTION

3.1 WATER SOFTENER INSTALLATION

A. Equipment Mounting:

1. Install commercial water softeners on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

B. Install brine lines and fittings furnished by equipment manufacturer but not specified to be factory installed.

C. Prepare mineral-tank distribution system and under-bed for minerals and place specified mineral into mineral tanks.

D. Install water-testing sets mounted on wall, unless otherwise indicated, and near water softeners.

3.2 CONNECTIONS

A. Comply with requirements for piping specified in Section 221116 "Domestic Water Piping." Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to equipment, allow space for service and maintenance of equipment.

C. Install shutoff valves on raw-water inlet and soft-water outlet piping of each mineral tank, and on inlet and outlet headers.

1. Metal general-duty valves are specified in Section 220523 "General Duty Valves."
2. Plastic valves are specified in Section 221116 "Domestic Water Piping."
3. Exception: Water softeners with factory-installed shutoff valves at locations indicated.

D. Install pressure gages on raw-water inlet and soft-water outlet piping of each mineral tank. Pressure gages are specified in Section 220519 "Meters and Gages for Plumbing Piping."

1. Exception: Water softeners with factory-installed pressure gages at locations indicated.

E. Install valved bypass in water piping around water softeners.

1. Metal general-duty valves are specified in Section 220523 "General Duty Valves."
2. Plastic valves are specified in Section 221116 "Domestic Water Piping."
3. Water piping is specified in Section 221116 "Domestic Water Piping."

F. Install drains as indirect wastes to spill into open drains or over floor drains.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Prepare test and inspection reports.

3.5 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

B. Add water to brine tanks and fill with the following form of salt:

1. Commercial Water Softeners: Processed, plain salt pellets.

C. Sample water softener effluent after startup and at three consecutive seven-day intervals (total of four samples) and prepare certified test reports for required water performance characteristics. Comply with the following:

1. ASTM D 859, "Test Method for Silica in Water."
2. ASTM D 1067, "Test Methods for Acidity or Alkalinity of Water."
3. ASTM D 1068, "Test Methods for Iron in Water."
4. ASTM D 1126, "Test Method for Hardness in Water."
5. ASTM D 1129, "Terminology Relating to Water."
6. ASTM D 3370, "Practices for Sampling Water from Closed Conduits."

3.6 DEMONSTRATION

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

END OF SECTION 223100

SECTION 223400

FUEL-FIRED, DOMESTIC-WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Commercial, atmospheric, gas-fired, storage, domestic-water heaters.
2. Commercial, power-burner, gas-fired, storage, domestic-water heaters.
3. Commercial, grid-type, finned-tube, gas-fired, domestic-water heaters.
4. Domestic-water heater accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type and size of domestic-water heater indicated.

B. Shop Drawings:

1. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

B. Domestic-Water Heater Labeling: Certified and labeled by testing agency acceptable to authorities having jurisdiction.

C. Source quality-control reports.

D. Field quality-control reports.

E. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

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.

B. ASHRAE/IESNA Compliance: Fabricate and label fuel-fired, domestic-water heaters to comply with ASHRAE/IESNA 90.1.

C. ASME Compliance:

1. Where ASME-code construction is indicated, fabricate and label commercial, domestic-water heater storage tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
2. Where ASME-code construction is indicated, fabricate and label commercial, finned-tube, domestic-water heaters to comply with ASME Boiler and Pressure Vessel Code: Section IV.

D. NSF Compliance: Fabricate and label equipment components that will be in contact with potable water to comply with NSF 61, "Drinking Water System Components - Health Effects."

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of fuel-fired, domestic-water heaters that fail in materials or workmanship within specified warranty period.

1. Warranty Periods: From date of Substantial Completion.

a. Commercial, Gas-Fired, Storage, Domestic-Water Heaters:

1) Storage Tank: Three years.
2) Controls and Other Components: One year(s).

b. Commercial, Finned-Tube, Gas-Fired, Domestic-Water Heaters:

1) Heat Exchanger: Three years.
2) Controls and Other Components: One year(s).
3) Separate Hot-Water Storage Tanks: Three years.

c. Compression Tanks: Five years.

PART 2 - PRODUCTS

2.1 COMMERCIAL, GAS-FIRED, STORAGE, DOMESTIC-WATER HEATERS

A. Commercial, Atmospheric, Gas-Fired, Storage, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. HESco Industries, Inc.
b. Lochinvar Corporation.
c. PVI Industries, LLC.
d. Rheem Manufacturing Company.

e. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

2. Standard: ANSI Z21.10.3/CSA 4.3.
3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges, and according to ASME B16.24 for copper and copper-alloy flanges.

b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

4. Factory-Installed Storage-Tank Appurtenances:

a. Anode Rod: Replaceable magnesium.
b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
e. Jacket: Steel with enameled finish.
f. Burner: For use with atmospheric, gas-fired, domestic-water heaters and natural-gas> fuel.
g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
h. Temperature Control: Adjustable thermostat.
i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.
6. Draft Hood: Draft diverter, complying with ANSI Z21.12.

B. Commercial, Power-Burner, Gas-Fired, Storage, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. HESco Industries, Inc.
b. Precision Boilers.
c. PVI Industries, LLC.
d. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

2. Standard: ANSI Z21.10.3/CSA 4.3.

3. Storage-Tank Construction: ASME-code steel with 150-psig working-pressure rating.

    a. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

        1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
        2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

    b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

4. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rod: Replaceable magnesium.
    b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
    c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
    d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    e. Jacket: Steel with enameled finish.
    f. Burner: UL 795 for power-burner, gas-fired, domestic-water heaters and natural-gas fuel.
    g. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, electric, automatic, gas-ignition system.
    h. Temperature Control: Adjustable thermostat.
    i. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
    j. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

5. Special Requirements: NSF 5 construction.

2.2 COMMERCIAL, FINNED-TUBE, GAS-FIRED, DOMESTIC-WATER HEATERS

A. Commercial, Grid-Type, Finned-Tube, Gas-Fired, Domestic-Water Heaters:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Bradford White Corporation.
    b. HESco Industries, Inc.
    c. Lochinvar Corporation.
    d. Raypak; a Rheem company.

e. RBI Water Heaters; a Mestek company.
f. RECO USA.
g. Rheem Manufacturing Company.
h. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.

2. Standard: ANSI Z21.13/CSA 4.9 for hot-water-supply boilers.
3. Description: Packaged unit with boiler, storage tank, pump, piping, and controls.
4. Boiler Construction: ASME code with 160-psig working-pressure rating for hot-water-boiler-type, domestic-water heater.

    a. Heat Exchanger: Horizontal, straight, finned-copper tubes with bronze headers.
    b. Connections: Factory fabricated of materials compatible with boiler. Attach to boiler before testing.

        1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
        2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

5. Boiler Appurtenances:

    a. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire boiler except connections and controls.
    b. Jacket: Steel with enameled finish.
    c. Burner: For use with grid-type, finned-tube, gas-fired, domestic-water heaters and natural-gas fuel.
    d. Automatic Ignition: ANSI Z21.20/CSA C22.2 No. 199, intermittent electronic-ignition system.
    e. Temperature Control: Adjustable, storage-tank temperature-control fitting and flow switch, interlocked with circulator and burner.
    f. Safety Control: Automatic, high-temperature-limit cutoff device or system.

6. Support: Steel base or skids.
7. Automatic Damper: ANSI Z21.66/CSA 6.14-M, electrically operated, automatic-vent-damper device with size matching draft hood.
8. Hot-Water Storage Tank: Connected with piping to circulating pump and domestic-water heater.

    a. Construction: According to ASME Boiler and Pressure Vessel Code: Section VIII, steel with 150-psig working-pressure rating.
    b. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.

        1) NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
        2) NPS 2-1/2 and Larger: Flanged ends according to ASME B16.5 for steel and stainless-steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

    c. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.

9. Factory-Installed Storage-Tank Appurtenances:

    a. Anode Rods: Factory installed, magnesium.
    b. Drain Valve: Corrosion-resistant metal complying with ASSE 1005, factory installed.
    c. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
    d. Jacket: Steel with enameled finish.
    e. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.

10. Circulating Pump: UL 778, all-bronze, centrifugal, overhung-impeller, separately coupled in-line pump as defined in HI 1.1-1.2 and HI 1.3. Include mechanical seals, 125-psig minimum working-pressure rating, and 225 deg F continuous-water-temperature rating.
11. Piping: Copper tubing; copper, solder-joint fittings; and brazed or flanged joints.
12. Mounting: Domestic-water heater, tank, and accessories factory mounted on skids.

2.3 DOMESTIC-WATER HEATER ACCESSORIES

A. Domestic-Water Compression Tanks:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. AMTROL Inc.
    b. Smith, A. O. Water Products Co.; a division of A. O. Smith Corporation.
    c. Taco, Inc.

2. Description: Steel, pressure-rated tank constructed with welded joints and factory-installed butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.
3. Construction:

    a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread.
    b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
    c. Air-Charging Valve: Factory installed.

B. Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC 3. Include dimensions not less than base of domestic-water heater, and include drain outlet not less than NPS 3/4 with ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

C. Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1 or ASHRAE 90.2.

D. Heat-Trap Fittings: ASHRAE 90.2.

E. Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

F. Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include 1/2-psig pressure rating as required to match gas supply.

G. Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

H. Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input, and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

I. Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

1. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
2. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

J. Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

2.4 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect assembled domestic-water heaters and storage tanks specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.

B. Hydrostatically test commercial domestic-water heaters and storage tanks to minimum of one and one-half times pressure rating before shipment.

C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

D. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 DOMESTIC-WATER HEATER INSTALLATION

A. Commercial, Domestic-Water Heater Mounting: Install commercial domestic-water heaters on concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."

1. Exception: Omit concrete bases for commercial domestic-water heaters if installation on stand, bracket, suspended platform, or directly on floor is indicated.

2. Maintain manufacturer's recommended clearances.
3. Arrange units so controls and devices that require servicing are accessible.
4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
6. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
7. Install anchor bolts to elevations required for proper attachment to supported equipment.
8. Anchor domestic-water heaters to substrate.

B. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.

1. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General Duty Valves for Plumbing Piping."

C. Install gas-fired, domestic-water heaters according to NFPA 54.

1. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
2. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
3. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
4. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."

D. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

E. Install combination temperature-and-pressure relief valves in water piping for domestic-water heaters without storage. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.

F. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221119 "Domestic Water Piping Specialties."

G. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.

I. Fill domestic-water heaters with water.

J. Charge domestic-water compression tanks with air.

3.2 CONNECTIONS

A. Comply with requirements for domestic-water piping specified in Section 221116 "Domestic Water Piping."

B. Comply with requirements for gas piping specified in Section 231123 "Facility Natural-Gas Piping."

C. Drawings indicate general arrangement of piping, fittings, and specialties.

D. Where installing piping adjacent to fuel-fired, domestic-water heaters, allow space for service and maintenance of water heaters. Arrange piping for easy removal of domestic-water heaters.

3.3 IDENTIFICATION

A. Identify system components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for retesting and reinspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.

C. Prepare test and inspection reports.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain commercial, gas-fired, storage, domestic-water heaters.

END OF SECTION 223400

SECTION 224100

RESIDENTIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Bathtubs.
2. Faucets.
3. Lavatories.
4. Showers.
5. Kitchen sinks.
6. Disposers.
7. Water closets.
8. Toilet seats.
9. Supply fittings.
10. Waste fittings.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted plumbing fixtures.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 BATHTUBS

A. Bathtubs with shower:

1. Enameled Cast-Iron Bathtubs:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Kohler Co.
2) Eljer, Inc.

2. FRP Bathtubs:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Clarion Bathware.
2) Florestone Products Co., Inc.
3) Praxis Industries, LLC.
4) Sterling.
5) Swan Corporation (The).

3. PMMA (Acrylic) Bathtubs:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Acryline USA, Inc.
2) American Standard America.
3) Aqua Bath Company, Inc.
4) Aqua Glass Corporation.
5) Aquatic Industries, Inc.
6) Crane Plumbing, L.L.C.
7) Florestone Products Co., Inc.
8) Kohler Co.
9) Mansfield Plumbing Products LLC.
10) Swan Corporation (The).

4. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron and enameled-steel bathtubs.
b. Standard: ANSI Z124.1.2 for FRP and PMMA bathtubs.
c. Bathing Surface: Slip resistant according to ASTM F 462.
d. Size: as indicated on Drawings.
e. Color: White.
f. Drain Location: As indicated on Drawings.
g. Drain: NPS 1-1/2; chrome-plated-brass, pop-up waste and overflow.

5. Faucet: See "Bathtub Faucets" Article.
6. Supply Fittings: Included in faucet.
7. Tub Filler: Chrome-plated-brass diverter spout.
8. Waste Fittings:

a. Standard: ASME A112.18.2/CSA B45.125.2.
b. Drain: Stainless steel or chrome-plated brass, removable strainer.

c. Overflow: Chrome-plated-brass escutcheon with toggle drain-plug device.
d. Drain Piping: Schedule 40 PVC, NPS 1-1/2 P-trap and waste.

2.2 BATHTUB FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Bathtub Faucets: Single handle, pressure balance or thermostatic.

1. Pressure-Balance Faucets:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Gerber Plumbing Fixtures LLC.
3) Kohler Co.
4) Leonard Valve Company.
5) Moen Incorporated.
6) Zurn Industries, LLC; AquaSpec Commercial Faucet Products.

2. Thermostatic Faucets:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Lawler Manufacturing Co., Inc.
3) Leonard Valve Company.
4) Powers.

3. Standards: ASME A112.18.1/CSA B125.1 and ASSE 1016.
4. Faucet:

a. Body Material: Solid brass.
b. Finish: Polished chrome plate.
c. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
d. Mounting: Concealed.
e. Operation: Single handle, twist or rotate control, with hot- and cold-water indicators.
f. Antiscald Device: Integral with mixing valve.
g. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.
h. Diverter: In-tub filler spout.
i. Supply Connections: NPS 1/2.

5. Shower Head:

a. Standard: ASME A112.18.1/CSA B125.1.

b. Type: Ball joint with arm and flange.
c. Backflow-Prevention Device: ASSE 1014.
d. Shower Head Material: Metallic with chrome-plated finish.
e. Spray Pattern: Fixed.
f. Temperature Indicator: Integral with faucet.

6. Bathtub Filler Spout: Chrome-plated brass.

2.3 LAVATORIES

A. Lavatories: Oval, counter mounted.

1. Vitreous-China Lavatories:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Gerber Plumbing Fixtures LLC.
3) Kohler Co.
4) TOTO USA, INC.

2. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron and -steel lavatories.
b. Standard: ANSI Z124.3 for PMMA lavatories.
c. Standard: ANSI Z124.3 and ANSI/ICPA SS-1 for solid-surface lavatories.
d. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel lavatories.
e. Standard: ASME A112.19.2/CSA B45.1 for vitreous-china lavatories.
f. Type: Flat-rim with ledge.
g. Oval Nominal Size: 19 by 16 inches.
h. Faucet-Hole Punching: Three holes, 4-inch centers.
i. Faucet-Hole Location: Rim.
j. Color: White.

3. Faucet: Refer to "Lavatory Faucets" Article.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

B. Lavatories: Rectangular, counter mounted.

1. Vitreous-China Lavatories:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Gerber Plumbing Fixtures LLC.
3) Kohler Co.

4) TOTO USA, INC.

2. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron and -steel lavatories.
b. Standard: ANSI Z124.3 for PMMA lavatories.
c. Standard: ANSI Z124.3 and ANSI/ICPA SS-1 for solid-surface lavatories.
d. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel lavatories.
e. Standard: ASME A112.19.2/CSA B45.1 for vitreous-china lavatories.
f. Type: Flat-rim with ledge.
g. Rectangular Nominal Size: 18 by 15 inches.
h. Faucet-Hole Punching: Three holes, 4-inch centers.
i. Faucet-Hole Location: Rim.
j. Color: White.

3. Faucet: Refer to "Lavatory Faucets" Article.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

C. Lavatories: Round, counter mounted.

1. Vitreous-China Lavatories:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Gerber Plumbing Fixtures LLC.
3) Kohler Co.
4) TOTO USA, INC.

2. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron and -steel lavatories.
b. Standard: ANSI Z124.3 for PMMA lavatories.
c. Standard: ANSI Z124.3 and ANSI/ICPA SS-1 for solid-surface lavatories.
d. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel lavatories.
e. Standard: ASME A112.19.2/CSA B45.1 for vitreous-china lavatories.
f. Type: Flat-rim with ledge.
g. Round Nominal Size: 19 inches in diameter.
h. Faucet-Hole Punching: Three holes, 4-inch centers.
i. Faucet-Hole Location: Rim.
j. Color: White.

3. Faucet: Refer to "Lavatory Faucets" Article.
4. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
5. Waste Fittings: Comply with requirements in "Waste Fittings" Article.

2.4 LAVATORY FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Two-handle mixing valve.

1. General-Duty, Solid-Brass Faucets:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Chicago Faucets.
3) Delta Faucet Company.
4) Elkay Manufacturing Co.
5) Just Manufacturing.
6) Kohler Co.
7) Moen Incorporated.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
4. Body Material: General-duty, solid brass.
5. Finish: Polished chrome plate.
6. Maximum Flow Rate: 0.5 gpm.
7. Centers: 4 inches.
8. Mounting: Deck, exposed.
9. Valve Handle(s): Lever.
10. Inlet(s): NPS 3/8 tubing, plain end.
11. Spout: Rigid.
12. Spout Outlet: Aerator.
13. Operation: Noncompression, manual.
14. Drain: Pop up.

2.5 SHOWERS

A. Showers: Standard with base and faucet.

1. FRP Showers:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Aqua Glass Corporation.
2) Clarion Bathware.
3) Florestone Products Co., Inc.
4) LASCO Bathware.
5) MAAX.
6) Praxis Industries, LLC.

7) Sterling.
8) Swan Corporation (The).

2. PMMA (Acrylic) Showers:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Acryline USA, Inc.
2) Aqua Bath Company, Inc.
3) Aqua Glass Corporation.
4) Aquatic Industries, Inc.
5) Clarion Bathware.
6) Crane Plumbing, L.L.C.
7) Jacuzzi, Inc.
8) Kohler Co.
9) LASCO Bathware.
10) MAAX.
11) Praxis Industries, LLC.

3. Standard: ANSI Z124.1.2.
4. Nominal Size: Refer to Drawings.
5. Surround: One piece or sealed, multiple piece.
6. Bathing Surface: Slip resistant according to ASTM F 462.
7. Color: White.
8. Faucet: Refer to "Shower Faucets" Article.

B. Showers: Accessible with seat, grab bar, base, and faucet.

1. FRP Showers:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Aqua Glass Corporation.
2) Clarion Bathware.
3) Florestone Products Co., Inc.

2. PMMA Showers:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Aqua Bath Company, Inc.
2) Aqua Glass Corporation.
3) Clarion Bathware.
4) Crane Plumbing, L.L.C.

3. Standards: ANSI Z124.1.2 and ICC/ANSI A117.1 for roll-in shower compartments.
4. Nominal Size: Refer to Drawings.
5. Surround: One piece.

6. Bathing Surface: Slip resistant according to ASTM F 462.
7. Color: White.
8. Drain Location: Refer to Drawings.
9. Accessibility Options: Include grab bar and bench.
10. Faucet: Shower See "Shower Faucets" Article.
11. Drain: Grid, NPS 2.

2.6 SHOWER FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Shower Faucets: Single handle, thermostatic, mixing valve.

1. Single-Handle, Pressure-Balance Faucets:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Ferguson Enterprises, Inc.
3) Gerber Plumbing Fixtures LLC.
4) Kohler Co.
5) Lawler Manufacturing Co., Inc.
6) Leonard Valve Company.
7) Moen Incorporated.
8) Symmons Industries, Inc.

2. Single-Handle, Thermostatic Faucets:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Lawler Manufacturing Co., Inc.
3) Leonard Valve Company.
4) Powers.

3. Fixture:

a. Standard: ASME A112.18.1/CSA B125.1 and ASSE 1016.
b. General: Include hot- and cold-water indicators; check stops; and hand head complying with ASSE 1014 with arm, flange, hose, and bracket. Coordinate faucet inlets with supplies.
c. Body Material: Solid brass with nonmetallic trim.
d. Finish: Polished chrome plate.
e. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
f. Mounting: Concealed.
g. Backflow-Prevention Device for Hand-Held Shower: Required.
h. Operation: Non-compression, manual.

i. Antiscald Device: Integral with mixing valve.
j. Check Stops: Check-valve type, integral with or attached to body; on hot- and cold-water supply connections.

4. Supply Connections: NPS ½.
5. Shower Head:

a. Type: Hand-held, slide-bar mounted.
b. Shower Head Material:[Metallic, Combined, metallic and nonmetallic with chrome-plated finish.
c. Spray Pattern: Adjustable.
d. Integral Volume Control: Required.
e. Shower-Arm, Flow-Control Fitting: 1.5 gpm.

2.7 KITCHEN SINKS

A. Kitchen Sinks: One, Two, Three bowl, counter mounted, stainless steel.

1. Enameled Cast-Iron Kitchen Sinks:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Commercial Enameling Company.
2) Eljer, Inc.
3) Kohler Co.

2. Enameled-Steel Kitchen Sinks:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Briggs Plumbing Products, Inc.
3) Eljer, Inc.
4) Mansfield Plumbing Products LLC.

3. PMMA Kitchen Sinks:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Gerber Plumbing Fixtures LLC.
2) Lyons Industries, Inc.

4. Solid-Surface Kitchen Sinks:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Aristech Surfaces.

2) DuPont.
3) Formica Corporation.
4) InPro Corporation (IPC).
5) Swan Corporation (The).

5. Stainless-Steel Kitchen Sinks:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) Elkay Manufacturing Co.
2) Just Manufacturing.
3) Kohler Co.
4) Revere Sink.
5) Sterling.

6. Fixture:

a. Standard: ASME A112.19.1/CSA B45.2 for enameled cast-iron and-steel kitchen sinks.
b. Standard: ANSI Z124.3 for PMMA kitchen sinks.
c. Standard: ANSI Z124.3 and ANSI/ICPA SS-1 for solid-surface kitchen sinks.
d. Standard: ASME A112.19.3/CSA B45.4 for stainless-steel kitchen sinks.
e. Metal Thickness: 0.038 inch or 0.050 inch.
f. Bowl:

1) Dimensions: See schedule
2) Drain: 3-1/2-inch crumb cup

a) Location: Centered in bowl.

g. Left Bowl:

1) Dimensions: See schedule
2) Drain: 3-1/2-inch crumb cup

a) Location: Centered in bowl.

h. Right Bowl:

1) Dimensions: See schedule
2) Drain: 3-1/2-inch crumb cup

a) Location: Centered in bowl.

i. Center Bowl:

1) Dimensions: See schedule
2) Drain: 3-1/2-inch crumb cup

a) Location: Centered in bowl.

7. Faucet: American Standard Model #6409 Gooseneck Faucet.
8. Supply Fittings: Comply with requirements in "Supply Fittings" Article.
9. Waste Fittings: Comply with requirements in "Waste Fittings" Article, except include continuous waste for multibowl sinks.

    a. Disposer: Not required.
    b. Dishwasher Air-Gap Fitting: Comply with requirements in "Dishwasher Air-Gap Fittings" Article.

2.8 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Sink Faucets: Solid brass, kitchen sink, bar sink.

1. General-Duty, Solid-Brass Faucets:

    a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

        1) American Standard America.
        2) Delta Faucet Company.
        3) Elkay Manufacturing Co.
        4) Kohler Co.
        5) Moen Incorporated.

2. General-Duty, Copper-Underbody Faucets:

    a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

        1) American Standard America.
        2) Delta Faucet Company.
        3) Ferguson Enterprises, Inc.
        4) Moen Incorporated.
        5) Sterling.

3. Standard: ASME A112.18.1/CSA B125.1.
4. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
5. Kitchen Sink Option: Separate hand spray complying with ASSE 1025.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 2.5 gpm unless otherwise indicated.
8. Mixing Valve: Single control.
9. Backflow-Prevention Device for Hand Spray: Not required.
10. Centers: 8 inches.
11. Mounting: Deck.
12. Handle(s): Wrist blade, 4 inches.
13. Spout Type: Swivel gooseneck.

14. Spout Outlet: Swivel aerator/spray.
15. Drain: Grid.

2.9 DISHWASHER AIR-GAP FITTINGS

A. Dishwasher Air-Gap Fittings:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. B & K Industries, Inc.
    b. Brass Craft Manufacturing; a subsidiary of Masco Corporation.
    c. BrassTech Inc.
    d. Dearborn Brass.
    e. Sioux Chief Manufacturing Company, Inc.
    f. Watts Brass & Tubular; a division of Watts Water Technologies, Inc.

2. Standard: ASSE 1021.
3. Description: Device designed to prevent backflow of contaminated liquid into domestic dishwashers.
4. Material: Plastic body with chrome-plated-brass cover.
5. Hose Connections: 5/8-inch- ID inlet and 7/8-inch- ID outlet.
6. Capacity: At least 5 gpm; at inlet pressure of at least 5 psig and at temperature of at least 140 deg F.
7. Mounting: Deck.
8. Hoses: Rubber and suitable for temperature of at least 140 deg F.

    a. Inlet Hose: 5/8-inch ID and 48 inches long.
    b. Outlet Hose: 7/8-inch ID and 48 inches long.

2.10 DISPOSERS

A. Disposers: Continuous-feed household, food waste.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. American Standard America.
    b. InSink Erator.
    c. KitchenAid.
    d. Maytag.

2. Standards: ASSE 1008 and UL 430, and listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
3. General: Include reset button; wall switch; corrosion-resistant chamber with jam-resistant, cutlery- or stainless-steel grinder or shredder; NPS 1-1/2 outlet; quick-mounting, stainless-steel sink flange; anti-splash guard; and combination cover/stopper.
4. Model: Sound-insulated chamber and stainless-steel outer shell.
5. Motor: 115 V ac, 1725 rpm, 1 hp with overload protection.

2.11 WATER CLOSETS

A. Water Closets: Floor mounted, floor outlet, close coupled (gravity tank), vitreous china.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Gerber Plumbing Fixtures LLC.
c. Kohler Co.
d. TOTO USA, INC.
e. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard Bowl:

a. Standards: ASME A112.19.2/CSA B45.1, ASME A112.19.5, and ASSE 1037.
b. Bowl Type : Siphon jet.
c. Height: Standard.
d. Rim Contour: Elongated.
e. Water Consumption: Water saving.
f. Color: White.

3. Handicapped/elderly Bowl:

a. Standards: ASME A112.19.2/CSA B45.1, ASME A112.19.5, and ASSE 1037.
b. Bowl Type: Siphon jet.
c. Height: Handicapped/elderly.
d. Rim Contour: Elongated.
e. Water Consumption: Water saving.
f. Color: White.

4. Toilet Seat: See "Toilet Seats" Article.
5. Supply Fittings:

a. Standard: ASME A112.18.1/CSA B125.1.
b. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
c. Stop: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

1) Operation: Wheel handle.

d. Riser:

1) Size: NPS 3/8.
2) Material: Chrome-plated, soft-copper flexible tube or ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose riser.

2.12 TOILET SEATS

A. Toilet Seats:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Bemis Manufacturing Company.
    b. Church Seats.
    c. Olsonite Seat Co.

2. Standard: IAPMO/ANSI Z124.5.
3. Material: Plastic.
4. Type: Residential.
5. Shape: Elongated rim.
6. Configuration: Closed front with cover.
7. Hinge Type: Check.
8. Hinge Material: Noncorroding metal.
9. Color: White.

2.13 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Lavatory, Kitchen Sink and Laundry Tray Supply Fittings:

1. Supply Piping: Chrome-plated-brass pipe or chrome-plated-copper tube matching water-supply piping size. Include chrome-plated wall flange.
2. Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression stop with inlet connection matching water-supply piping type and size.

    a. Operation: Wheel handle.

3. Risers:

    a. Size: NPS 3/8 for lavatories.
    b. Size: NPS 1/2 for kitchen sinks and laundry trays.
    c. Material: Chrome-plated, soft-copper flexible tube where exposed or ASME A112.18.6, braided- or corrugated-stainless-steel flexible hose where concealed.

2.14 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset tailpiece for accessible lavatories.

C. Drain: Pop-up type with NPS 1-1/4 straight tailpiece as part of faucet for standard lavatories.

D. Drain: Grid type with NPS 1-1/2 offset tailpiece for accessible kitchen sinks.

E. Drain: Grid type with NPS 1-1/2 straight tailpiece for standard kitchen sinks and laundry trays.

F. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4 for lavatories.
2. Size: NPS 1-1/2 for kitchen sinks and laundry trays.
3. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated-brass or -steel wall flange where exposed or ASTM F 409 PVC two-piece trap and waste to wall and wall flange where concealed.

2.15 GROUT

A. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.

B. Characteristics: Non-shrink; recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install plumbing fixtures level and plumb according to roughing-in drawings.

B. Install floor-mounted water closets on closet flange attachments to drainage piping.

C. Install counter-mounting fixtures in and attached to casework.

D. Install pedestal lavatories on pedestals and secured to wood blocking in wall.

E. Install water-supply piping with stop on each supply to each fixture to be connected to water distribution piping. Attach supplies to supports or substrate within pipe spaces behind fixtures. Install stops in locations where they can be easily reached for operation.

1. Exception: Use ball or gate valves if supply stops are not specified with fixture. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

F. Install tanks for accessible, tank-type water closets with lever handle mounted on wide side of compartment.

G. Install toilet seats on water closets.

H. Install faucet flow-control fittings with specified flow rates and patterns in faucet spouts if faucets are not available with required rates and patterns. Include adapters if required.

I. Install shower flow-control fittings with specified maximum flow rates in shower arms.

J. Install traps on fixture outlets.

1. Exception: Omit trap on fixtures with integral traps.
2. Exception: Omit trap on indirect wastes unless otherwise indicated.

K. Install disposer in outlet of each sink indicated to have disposer. Install switch where indicated or in wall adjacent to sink if location is not indicated.

L. Install dishwasher air-gap fitting at each sink indicated to have air-gap fitting. Install in sink deck or on countertop at sink. Connect inlet hose to dishwasher and outlet hose to disposer.

M. Set bathtubs and shower receptors in leveling bed of cement grout.

N. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

O. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

P. Seal joints between plumbing fixtures, counters, floors, and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.2 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

D. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories and sinks. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 ADJUSTING

A. Operate and adjust plumbing fixtures and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.4 CLEANING AND PROTECTION

A. After completing installation of plumbing fixtures, inspect and repair damaged finishes.

B. Clean plumbing fixtures, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed plumbing fixtures and fittings.

D. Do not allow use of plumbing fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224100

SECTION 224216.13

COMMERCIAL LAVATORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Lavatories.
2. Shampoo bowls.
3. Faucets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lavatories and faucets to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 VITREOUS-CHINA, COUNTER-MOUNTED LAVATORIES

A. Lavatory: Oval, self rimming, vitreous china, counter mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Briggs Plumbing Products, Inc.
c. Capizzi.
d. Crane Plumbing, L.L.C.
e. Ferguson Enterprises, Inc.; ProFlo Brand.
f. Gerber Plumbing Fixtures LLC.
g. Kohler Co.
h. Mansfield Plumbing Products LLC.
i. Peerless Pottery Sales, Inc.
j. TOTO USA, INC.
k. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:

    a. Standard: ASME A112.19.2/CSA B45.1.
    b. Type: Self-rimming for above-counter mounting.
    c. Nominal Size: Oval, 19 by 17 inches.
    d. Faucet-Hole Punching: Match faucet.
    e. Faucet-Hole Location: Top.
    f. Color: White.
    g. Mounting Material: Sealant.

3. Faucet: Refer to "Solid-Brass, Manually Operated Faucets" Article.

B. Lavatory: Round, self rimming, vitreous china, counter mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. American Standard America.
    b. Briggs Plumbing Products, Inc.
    c. Capizzi.
    d. Crane Plumbing, L.L.C.
    e. Ferguson Enterprises, Inc.; ProFlo Brand.
    f. Gerber Plumbing Fixtures LLC.
    g. Kohler Co.
    h. Mansfield Plumbing Products LLC.
    i. Peerless Pottery Sales, Inc.
    j. TOTO USA, INC.
    k. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:

    a. Standard: ASME A112.19.2/CSA B45.1.
    b. Type: Self-rimming for above-counter mounting.
    c. Nominal Size: Round, 19 inches.
    d. Faucet-Hole Punching: Match faucet.
    e. Faucet-Hole Location: Top.
    f. Color: White.
    g. Mounting Material: Sealant.

3. Faucet: Refer to "Solid-Brass, Manually Operated Faucets" Article.

C. Lavatory: Oval, vitreous china, undercounter mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. American Standard America.
    b. Capizzi.
    c. Crane Plumbing, L.L.C.
    d. Ferguson Enterprises, Inc.; ProFlo Brand.
    e. Gerber Plumbing Fixtures LLC.

f. Kohler Co.
g. Mansfield Plumbing Products LLC.
h. Peerless Pottery Sales, Inc.
i. TOTO USA, INC.
j. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For undercounter mounting.
c. Nominal Size: Oval, 19 by 16 inches.
d. Faucet-Hole Punching: No holes.
e. Faucet-Hole Location: On countertop.
f. Color: White.
g. Mounting Material: Sealant and undercounter mounting kit.

3. Faucet: Refer to "Solid-Brass, Manually Operated Faucets" Article.

2.2 VITREOUS-CHINA, WALL-MOUNTED LAVATORIES

A. Lavatory: Vitreous china, wall mounted, with back.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Briggs Plumbing Products, Inc.
c. Crane Plumbing, L.L.C.
d. Ferguson Enterprises, Inc.; ProFlo Brand.
e. Gerber Plumbing Fixtures LLC.
f. Kohler Co.
g. Mansfield Plumbing Products LLC.
h. Peerless Pottery Sales, Inc.
i. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: Oval, 19 by 16 inches.
d. Faucet-Hole Punching: Match faucet.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting Material: Chair carrier.

3. Faucet: Refer to "Solid-Brass, Manually Operated Faucets" Article.
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier

B. Lavatory: Ledge back, vitreous china, wall mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Briggs Plumbing Products, Inc.
c. Crane Plumbing, L.L.C.
d. Ferguson Enterprises, Inc.; ProFlo Brand.
e. Gerber Plumbing Fixtures LLC.
f. Kohler Co.
g. Mansfield Plumbing Products LLC.
h. Peerless Pottery Sales, Inc.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: For wall hanging.
c. Nominal Size: Oval, 19 by 16 inches.
d. Faucet-Hole Punching: Match faucet.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting Material: Chair carrier.

3. Faucet: Refer to "Solid-Brass, Manually Operated Faucets" Article.
4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier

C. Lavatory: Wheelchair, vitreous china, wall mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. American Standard America.
b. Crane Plumbing, L.L.C.
c. Ferguson Enterprises, Inc.; ProFlo Brand.
d. Gerber Plumbing Fixtures LLC.
e. Kohler Co.
f. Mansfield Plumbing Products LLC.
g. Peerless Pottery Sales, Inc.

2. Fixture:

a. Standard: ASME A112.19.2/CSA B45.1.
b. Type: Slab or wheelchair.
c. Nominal Size: Rectangular, 27 by 20 inches.
d. Faucet-Hole Punching: Three holes, 2-inch centers.
e. Faucet-Hole Location: Top.
f. Color: White.
g. Mounting: For concealed-arm carrier.

3. Faucet: Refer to "Solid-Brass, Manually Operated Faucets" Article.

4. Support: ASME A112.6.1M, Type II, concealed-arm lavatory carrier with rectangular, steel uprights.

2.3 SHAMPOO BOWLS

A. Shampoo Bowls: Enameled, cast iron.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. Belvedere, LLC.
   b. Takara Belmont.

2. Fixture:

   a. Standard: ASME A112.19.2/CSA B45.1.
   b. Bowl: Shaped for head rest.
   c. Nominal Size: 19 by 19 by 10 inches.
   d. Color: White.

3. Faucet: Manufacturer's standard with vacuum breaker complying with ASME A112.18.3 and with hose spray head.
4. Waste Fittings: Comply with requirements in "Waste Fittings" Article except as follows:

   a. Drain: Cup type with hair basket and NPS 1-1/2 tailpiece.
   b. Trap Size: NPS 1-1/2.

5. Mounting Material: Bracket or devices for attaching to counter or Wall bracket, as applicable.

2.4 SOLID-BRASS, MANUALLY OPERATED FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet materials that will be in contact with potable water.

B. Lavatory Faucets: Manual-type, single-control mixing, commercial, general-duty, solid-brass valve.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

   a. American Standard America.
   b. Bradley Corporation.
   c. Chicago Faucets.
   d. Delta Faucet Company.
   e. Elkay Manufacturing Co.
   f. Grohe America, Inc.
   g. Just Manufacturing.
   h. Kohler Co.
   i. Moen Incorporated.

j. Speakman Company.
k. T & S Brass and Bronze Works, Inc.
l. Zurn Industries, LLC; Commercial Brass and Fixtures.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and fixture receptor.
4. Body Type: Centerset.
5. Body Material: Commercial, solid brass.
6. Finish: Polished chrome plate.
7. Maximum Flow Rate: 0.5 gpm.
8. Maximum Flow: 0.25 gal. per metering cycle.
9. Mounting Type: Deck, exposed.
10. Valve Handle(s): Single lever.
11. Spout: Rigid type.
12. Spout Outlet: Aerator.
13. Drain: Not part of faucet.

2.5 SUPPLY FITTINGS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for supply-fitting materials that will be in contact with potable water.

B. Standard: ASME A112.18.1/CSA B125.1.

C. Supply Piping: Chrome-plated-brass pipe or chrome-plated copper tube matching water-supply piping size. Include chrome-plated-brass or stainless-steel wall flange.

D. Supply Stops: Chrome-plated-brass, one-quarter-turn, ball-type or compression valve with inlet connection matching supply piping.

E. Operation: Wheel handle.

F. Risers:

1. NPS 3/8.
2. Chrome-plated, soft-copper flexible tube riser where exposed, or ASME A112.18.6, braided- or corrugated-stainless-steel, flexible hose riser where concealed.

2.6 WASTE FITTINGS

A. Standard: ASME A112.18.2/CSA B125.2.

B. Drain: Grid type with NPS 1-1/4 offset and straight tailpiece.

C. Trap:

1. Size: NPS 1-1/2 by NPS 1-1/4.
2. Material: Chrome-plated, two-piece, cast-brass trap and swivel elbow with 0.032-inch-thick brass tube to wall; and chrome-plated, brass or steel wall flange.

3. Material: Stainless-steel, two-piece trap and swivel elbow with 0.012-inch- thick stainless-steel tube to wall; and stainless-steel wall flange.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before lavatory installation.

B. Examine counters and walls for suitable conditions where lavatories will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install lavatories level and plumb according to roughing-in drawings.

B. Install supports, affixed to building substrate, for wall-mounted lavatories.

C. Install accessible wall-mounted lavatories at handicapped/elderly mounting height for people with disabilities or the elderly, according to ICC/ANSI A117.1.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

E. Seal joints between lavatories and counters and walls using sanitary-type, one-part, mildew-resistant silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

F. Install protective shielding pipe covers and enclosures on exposed supplies and waste piping of accessible lavatories. Comply with requirements in Section 220719 "Plumbing Piping Insulation."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust lavatories and controls. Replace damaged and malfunctioning lavatories, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

C. Install fresh batteries in battery-powered, electronic-sensor mechanisms.

3.5 CLEANING AND PROTECTION

A. After completing installation of lavatories, inspect and repair damaged finishes.

B. Clean lavatories, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed lavatories and fittings.

D. Do not allow use of lavatories for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.13

SECTION 224216.16

COMMERCIAL SINKS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Service basins.
2. Sink faucets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Counter cutout templates for mounting of counter-mounted lavatories.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

PART 2 - PRODUCTS

2.1 SERVICE BASINS

A. Service Basins: Plastic, floor mounted.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Mustee, E. L., & Sons, Inc.
b. Swan Corporation (The).
c. Zurn Industries, LLC; Light Commercial Specialty Plumbing Products.

2. Fixture:

a. Standard: IAPMO/ANSI Z124.6.
b. Material: Cast polymer.
c. Nominal Size: As indicated on the Drawings.
d. Tiling Flange: Where required.

e. Rim Guard: On front top surfaces.
f. Drain: Grid with NPS 3 outlet.

3. Mounting: On floor and flush to wall.
4. Faucet: See "Sink Faucets" Article.

2.2 SINK FAUCETS

A. NSF Standard: Comply with NSF/ANSI 61, "Drinking Water System Components - Health Effects," for faucet-spout materials that will be in contact with potable water.

B. Sink Faucets: Manual type, two-lever-handle mixing valve.

1. Commercial, Solid-Brass Faucets:

a. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1) American Standard America.
2) Chicago Faucets.
3) Delta Faucet Company.
4) Elkay Manufacturing Co.
5) Just Manufacturing.
6) Kohler Co.
7) Moen Incorporated.
8) Speakman Company.
9) T & S Brass and Bronze Works, Inc.
10) Zurn Plumbing Products Group.

2. Standard: ASME A112.18.1/CSA B125.1.
3. General: Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture hole punchings; coordinate outlet with spout and sink receptor.
4. Body Material: Commercial, solid brass.
5. Maximum Flow Rate: 2.2 gpm.
6. Handle(s): Cross, four arm.
7. Mounting Type: Back/wall, exposed.
8. Spout Type: Rigid, solid brass with wall brace.
9. Vacuum Breaker: Required for hose outlet.
10. Spout Outlet: Hose thread according to ASME B1.20.7.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in of water supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before sink installation.

B. Examine walls, floors, and counters for suitable conditions where sinks will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install sinks level and plumb according to roughing-in drawings.

B. Set floor-mounted sinks in leveling bed of cement grout.

C. Install water-supply piping with stop on each supply to each sink faucet.

1. Exception: Use ball or gate valves if supply stops are not specified with sink. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."
2. Install stops in locations where they can be easily reached for operation.

D. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons if required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

3.3 CONNECTIONS

A. Connect sinks with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Operate and adjust sinks and controls. Replace damaged and malfunctioning sinks, fittings, and controls.

B. Adjust water pressure at faucets to produce proper flow.

3.5 CLEANING AND PROTECTION

A. After completing installation of sinks, inspect and repair damaged finishes.

B. Clean sinks, faucets, and other fittings with manufacturers' recommended cleaning methods and materials.

C. Provide protective covering for installed sinks and fittings.

D. Do not allow use of sinks for temporary facilities unless approved in writing by Owner.

END OF SECTION 224216.16

SECTION 224716

PRESSURE WATER COOLERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pressure water coolers and related components.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of pressure water cooler.

B. Shop Drawings: Include diagrams for power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For pressure water coolers to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filter Cartridges: Equal to twenty-five percent of quantity installed for each type and size indicated, but no fewer than one of each.

PART 2 - PRODUCTS

2.1 PRESSURE WATER COOLERS

A. Pressure Water Coolers: Freestanding.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. Elkay Manufacturing Co.
b. Halsey Taylor.
c. Haws Corporation.
d. Tri Palm International, LLC; Oasis Brand.
e. Tri Palm International, LLC; Sunroc Brand.

2. Standards:

    a. Comply with NSF 61.
    b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethene) refrigerant unless otherwise indicated.

3. Cabinet: All stainless steel.
4. Bubbler: One, with adjustable stream regulator, located on deck.
5. Control: Push button.
6. Drain: Grid with NPS 1-1/4 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
10. Cooling System: Electric, with pre-cooler, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    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.

11. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics:

        1) Motor Horsepower: 1/4.
        2) Volts: 120-V ac.
        3) Phase: Single.
        4) Hertz: 60.

B. Pressure Water Coolers: Flush to wall.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Elkay Manufacturing Co.
    b. Halsey Taylor.
    c. Haws Corporation.
    d. Tri Palm International, LLC; Oasis Brand.
    e. Tri Palm International, LLC; Sunroc Brand.

2. Standards:

    a. Comply with NSF 61.

b. Comply with ASHRAE 34, "Designation and Safety Classification of Refrigerants," for water coolers. Provide HFC 134a (tetrafluoroethene) refrigerant unless otherwise indicated.

3. Cabinet: All stainless steel.
4. Bubbler: One, with adjustable stream regulator, located on deck.
5. Control: Push button.
6. Drain: Grid with NPS 1-1/4 tailpiece.
7. Supply: NPS 3/8 with shutoff valve.
8. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
9. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
10. Cooling System: Electric, with pre-cooler, hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    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.

11. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics:

        1) Motor Horsepower: 1/4.
        2) Volts: 120-V ac.
        3) Phase: Single.
        4) Hertz: 60.

C. Pressure Water Coolers: Wall mounted, standard.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Elkay Manufacturing Co.
    b. Halsey Taylor.
    c. Haws Corporation.
    d. Tri Palm International, LLC; Oasis Brand.
    e. Tri Palm International, LLC; Sunroc Brand.

2. Cabinet: Single, all stainless steel.
3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
4. Control: Push bar.
5. Drain: Grid with NPS 1-1/4 tailpiece.
6. Supply: NPS 3/8 with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.

8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

    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.

10. Capacities and Characteristics:

    a. Cooled Water: 8 gph.
    b. Ambient-Air Temperature: 90 deg F.
    c. Inlet-Water Temperature: 80 deg F.
    d. Cooled-Water Temperature: 50 deg F.
    e. Electrical Characteristics:

        1) Motor Horsepower: 1/4.
        2) Volts: 120-V ac.
        3) Phase: Single.
        4) Hertz: 60.

11. Support: ASME A112.6.1M, Type I water-cooler carrier.

D. Pressure Water Coolers: Wall mounted; wheelchair accessible.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. Elkay Manufacturing Co.
    b. Halsey Taylor.
    c. Haws Corporation.
    d. Tri Palm International, LLC; Oasis Brand.
    e. Tri Palm International, LLC; Sunroc Brand.

2. Cabinet: Bi-level with two attached cabinets and with a bi-level skirt kit where required, all stainless steel.
3. Bubbler: One, with adjustable stream regulator, located on each cabinet deck.
4. Control: Push bar.
5. Drain: Grid with NPS 1-1/4 tailpiece.
6. Supply: NPS 3/8 with shutoff valve.
7. Waste Fitting: ASME A112.18.2/CSA B125.2, NPS 1-1/4 brass P-trap.
8. Filter: One or more water filters complying with NSF 42 and NSF 53 for cyst and lead reduction to below EPA standards; with capacity sized for unit peak flow rate.
9. Cooling System: Electric, with hermetically sealed compressor, cooling coil, air-cooled condensing unit, corrosion-resistant tubing, refrigerant, corrosion-resistant-metal storage tank, and adjustable thermostat.

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.

10. Capacities and Characteristics:

a. Cooled Water: 8 gph.
b. Ambient-Air Temperature: 90 deg F.
c. Inlet-Water Temperature: 80 deg F.
d. Cooled-Water Temperature: 50 deg F.
e. Electrical Characteristics:

1) Motor Horsepower: 1/4.
2) Volts: 120-V ac.
3) Phase: Single.
4) Hertz: 60.

11. Support: ASME A112.6.1M, Type I water-cooler carrier.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine roughing-in for water-supply and sanitary drainage and vent piping systems to verify actual locations of piping connections before fixture installation.

B. Examine walls and floors for suitable conditions where fixtures will be installed.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install fixtures level and plumb according to roughing-in drawings. For fixtures indicated for children, install at height required by authorities having jurisdiction.

B. Set freestanding pressure water coolers on floor.

C. Install off-the-floor carrier supports, affixed to building substrate, for wall-mounted fixtures.

D. Install water-supply piping with shutoff valve on supply to each fixture to be connected to domestic-water distribution piping. Use ball or gate valve. Install valves in locations where they can be easily reached for operation. Valves are specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

E. Install trap and waste piping on drain outlet of each fixture to be connected to sanitary drainage system.

F. Install wall flanges or escutcheons at piping wall penetrations in exposed, finished locations. Use deep-pattern escutcheons where required to conceal protruding fittings. Comply with escutcheon requirements specified in Section 220518 "Escutcheons for Plumbing Piping."

G. Seal joints between fixtures and walls using sanitary-type, one-part, mildew-resistant, silicone sealant. Match sealant color to fixture color. Comply with sealant requirements specified in Section 079200 "Joint Sealants."

3.3 CONNECTIONS

A. Connect fixtures with water supplies, stops, and risers, and with traps, soil, waste, and vent piping. Use size fittings required to match fixtures.

B. Comply with water piping requirements specified in Section 221116 "Domestic Water Piping."

C. Install ball or gate shutoff valve on water supply to each fixture. Install valve upstream from filter for water cooler. Comply with valve requirements specified in Section 220523.12 "Ball Valves for Plumbing Piping" and Section 220523.15 "Gate Valves for Plumbing Piping."

D. Comply with soil and waste piping requirements specified in Section 221316 "Sanitary Waste and Vent Piping."

3.4 ADJUSTING

A. Adjust fixture flow regulators for proper flow and stream height.

B. Adjust pressure water-cooler temperature settings.

3.5 CLEANING

A. After installing fixture, inspect unit. Remove paint splatters and other spots, dirt, and debris. Repair damaged finish to match original finish.

B. Clean fixtures, on completion of installation, according to manufacturer's written instructions.

C. Provide protective covering for installed fixtures.

D. Do not allow use of fixtures for temporary facilities unless approved in writing by Owner.

END OF SECTION 224716

SECTION 230513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes general requirements for single-phase and poly-phase, general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2 COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 - PRODUCTS

2.1 GENERAL MOTOR REQUIREMENTS

A. Comply with NEMA MG 1 unless otherwise indicated.

2.2 MOTOR CHARACTERISTICS

A. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 feet above sea level.

B. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

2.3 POLYPHASE MOTORS

A. Description: NEMA MG 1, Design B, medium induction motor.

B. Efficiency: Energy efficient, as defined in NEMA MG 1.

C. Service Factor: 1.15.

D. Multispeed Motors: Variable torque.

1. For motors with 2:1 speed ratio, consequent pole, single winding.
2. For motors with other than 2:1 speed ratio, separate winding for each speed.

E. Rotor: Random-wound, squirrel cage.

F. Bearings: Re-greasable, shielded, antifriction ball bearings suitable for radial and thrust loading.

G. Temperature Rise: Match insulation rating.

H. Insulation: Class F.

I. Code Letter Designation:

1. Motors 15 HP and Larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

J. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

2.4 POLYPHASE MOTORS WITH ADDITIONAL REQUIREMENTS

A. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

B. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

2.5 SINGLE-PHASE MOTORS

A. Motors larger than 1/20 hp shall be one of the following, to suit starting torque and requirements of specific motor application:

1. Permanent-split capacitor.
2. Split phase.
3. Capacitor start, inductor run.
4. Capacitor start, capacitor run.

B. Multispeed Motors: Variable-torque, permanent-split-capacitor type.

C. Bearings: Pre-lubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

D. Motors 1/20 HP and Smaller: Shaded-pole type.

E. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device shall automatically reset when motor temperature returns to normal range.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230513

SECTION 230518

ESCUTCHEONS FOR HVAC PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Escutcheons.
2. Floor plates.

1.2 ACTION SUBMITTALS

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

PART 2 - PRODUCTS

2.1 ESCUTCHEONS

A. One-Piece, Cast-Brass Type: With polished, chrome-plated and rough-brass finish and setscrew fastener.

B. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped brass with chrome-plated finish and spring-clip fasteners.

2.2 FLOOR PLATES

A. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install escutcheons for piping penetrations of walls, ceilings, and finished floors.

B. Install escutcheons with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. Escutcheons for New Piping:

a. Piping with Fitting or Sleeve Protruding from Wall: One-piece, deep-pattern type.

b. Chrome-Plated Piping: One-piece, cast-brass type with polished, chrome-plated finish.
c. Insulated Piping: One-piece, stamped-steel type.
d. Bare Piping at Wall and Floor Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
e. Bare Piping at Ceiling Penetrations in Finished Spaces: One-piece, cast-brass type with polished, chrome-plated finish.
f. Bare Piping in Unfinished Service Spaces: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.
g. Bare Piping in Equipment Rooms: One-piece, cast-brass type with polished, chrome-plated or rough-brass finish.

C. Install floor plates for piping penetrations of equipment-room floors.

D. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.

1. New Piping: One-piece, floor-plate type.

3.2 FIELD QUALITY CONTROL

A. Replace broken and damaged escutcheons and floor plates using new materials.

END OF SECTION 230518

SECTION 230529

HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal pipe hangers and supports.
2. Trapeze pipe hangers.
3. Thermal-hanger shield inserts.
4. Fastener systems.
5. Equipment supports.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Design supports for multiple pipes capable of supporting combined weight of supported systems, system contents, and test water.
2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
3. Design seismic-restraint hangers and supports for piping and equipment and obtain approval from authorities having jurisdiction.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: Signed and sealed by a qualified professional engineer. Show fabrication and installation details and include calculations for the following: include Product Data for components:

1. Trapeze pipe hangers.
2. Equipment supports.

C. Delegated-Design Submittal: For trapeze hangers indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

1.5 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 - PRODUCTS

2.1 METAL PIPE HANGERS AND SUPPORTS

A. Carbon-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Galvanized Metallic Coatings: Pre-galvanized or hot dipped.
3. Nonmetallic Coatings: Plastic coating, jacket, or liner.
4. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
5. Hanger Rods: Continuous-thread rod, nuts, and washer made of carbon steel or stainless steel.

B. Stainless-Steel Pipe Hangers and Supports:

1. Description: MSS SP-58, Types 1 through 58, factory-fabricated components.
2. Padded Hangers: Hanger with fiberglass or other pipe insulation pad or cushion to support bearing surface of piping.
3. Hanger Rods: Continuous-thread rod, nuts, and washer made of stainless steel.

C. Copper Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of copper-coated steel or stainless steel.

2.2 TRAPEZE PIPE HANGERS

A. Description: MSS SP-69, Type 59, shop- or field-fabricated pipe-support assembly made from structural carbon-steel shapes with MSS SP-58 carbon-steel hanger rods, nuts, saddles, and U-bolts.

2.3 THERMAL-HANGER SHIELD INSERTS

A. Insulation-Insert Material for Cold Piping: ASTM C 552, Type II cellular glass with 100-psig or ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength and vapor barrier.

B. Insulation-Insert Material for Hot Piping: ASTM C 591, Type VI, Grade 1 polyisocyanurate with 125-psig minimum compressive strength.

C. For Trapeze or Clamped Systems: Insert and shield shall cover entire circumference of pipe.

D. For Clevis or Band Hangers: Insert and shield shall cover lower 180 degrees of pipe.

E. Insert Length: Extend 2 inches beyond sheet metal shield for piping operating below ambient air temperature.

2.4 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated or stainless- steel anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

2.5 EQUIPMENT SUPPORTS

A. Description: Welded, shop- or field-fabricated equipment support made from structural carbon-steel shapes.

2.6 MISCELLANEOUS MATERIALS

A. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; black and galvanized.

B. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, non-shrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Non-staining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi, 28-day compressive strength.

PART 3 - EXECUTION

3.1 HANGER AND SUPPORT INSTALLATION

A. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

B. Metal Trapeze Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Arrange for grouping of parallel runs of horizontal piping, and support together on field-fabricated trapeze pipe hangers.

1. Pipes of Various Sizes: Support together and space trapezes for smallest pipe size or install intermediate supports for smaller diameter pipes as specified for individual pipe hangers.
2. Field fabricate from ASTM A 36/A 36M, carbon-steel shapes selected for loads being supported. Weld steel according to AWS D1.1/D1.1M.

C. Thermal-Hanger Shield Installation: Install in pipe hanger or shield for insulated piping.

D. Fastener System Installation:

1. Install powder-actuated fasteners for use in lightweight concrete or concrete slabs less than 4 inches thick in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.

E. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

F. Equipment Support Installation: Fabricate from welded-structural-steel shapes.

G. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

H. Install lateral bracing with pipe hangers and supports to prevent swaying.

I. Install building attachments within concrete slabs or attach to structural steel. Install additional attachments at concentrated loads, including valves, flanges, and strainers, NPS 2-1/2 and larger and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

J. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

K. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

L. Insulated Piping:

1. Attach clamps and spacers to piping.

a. Piping Operating above Ambient Air Temperature: Clamp may project through insulation.
b. Piping Operating below Ambient Air Temperature: Use thermal-hanger shield insert with clamp sized to match OD of insert.
c. Do not exceed pipe stress limits allowed by ASME B31.9 for building services piping.

2. Install MSS SP-58, Type 39, protection saddles if insulation without vapor barrier is indicated. Fill interior voids with insulation that matches adjoining insulation.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

3. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.

a. Option: Thermal-hanger shield inserts may be used. Include steel weight-distribution plate for pipe NPS 4 and larger if pipe is installed on rollers.

4. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2: 12 inches long and 0.048 inch thick.
b. NPS 4: 12 inches long and 0.06 inch thick.
c. NPS 5 and NPS 6: 18 inches long and 0.06 inch thick.
d. NPS 8 to NPS 14: 24 inches long and 0.075 inch thick.
e. NPS 16 to NPS 24: 24 inches long and 0.105 inch thick.

5. Pipes NPS 8 and Larger: Include wood or reinforced calcium-silicate-insulation inserts of length at least as long as protective shield.
6. Thermal-Hanger Shields: Install with insulation same thickness as piping insulation.

3.2 EQUIPMENT SUPPORTS

A. Fabricate structural-steel stands to suspend equipment from structure overhead or to support equipment above floor.

B. Grouting: Place grout under supports for equipment and make bearing surface smooth.

C. Provide lateral bracing, to prevent swaying, for equipment supports.

3.3 METAL FABRICATIONS

A. Cut, drill, and fit miscellaneous metal fabrications for trapeze pipe hangers and equipment supports.

B. Fit exposed connections together to form hairline joints. Field weld connections that cannot be shop welded because of shipping size limitations.

C. Field Welding: Comply with AWS D1.1/D1.1M procedures for shielded, metal arc welding; appearance and quality of welds; and methods used in correcting welding work; and 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. Finish welds at exposed connections so no roughness shows after finishing and so contours of welded surfaces match adjacent contours.

3.4 ADJUSTING

A. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

B. Trim excess length of continuous-thread hanger and support rods to 1-1/2 inches.

3.5 PAINTING

A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

3.6 HANGER AND SUPPORT SCHEDULE

A. Specific hanger and support requirements are in Sections specifying piping systems and equipment.

B. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified in piping system Sections.

C. Use hangers and supports with galvanized metallic coatings for piping and equipment that will not have field-applied finish.

D. Use nonmetallic coatings on attachments for electrolytic protection where attachments are in direct contact with copper tubing.

E. Use carbon-steel pipe hangers and supports and metal trapeze pipe hangers and attachments for general service applications.

F. Use stainless-steel pipe hangers and stainless-steel or corrosion-resistant attachments for hostile environment applications.

G. Use copper-plated pipe hangers and copper or stainless-steel attachments for copper piping and tubing.

H. Use padded hangers for piping that is subject to scratching.

I. Use thermal-hanger shield inserts for insulated piping and tubing.

J. Horizontal-Piping Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of non-insulated or insulated, stationary pipes NPS 1/2 to NPS 30.
2. Yoke-Type Pipe Clamps (MSS Type 2): For suspension of up to 1050 deg F, pipes NPS 4 to NPS 24, requiring up to 4 inches of insulation.
3. Carbon- or Alloy-Steel, Double-Bolt Pipe Clamps (MSS Type 3): For suspension of pipes NPS 3/4 to NPS 36, requiring clamp flexibility and up to 4 inches of insulation.
4. Adjustable, Steel Band Hangers (MSS Type 7): For suspension of non-insulated, stationary pipes NPS 1/2 to NPS 8.
5. U-Bolts (MSS Type 24): For support of heavy pipes NPS 1/2 to NPS 30.
6. Pipe Saddle Supports (MSS Type 36): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate.
7. Pipe Stanchion Saddles (MSS Type 37): For support of pipes NPS 4 to NPS 36, with steel-pipe base stanchion support and cast-iron floor flange or carbon-steel plate, and with U-bolt to retain pipe.
8. Single-Pipe Rolls (MSS Type 41): For suspension of pipes NPS 1 to NPS 30, from two rods if longitudinal movement caused by expansion and contraction might occur.
9. Complete Pipe Rolls (MSS Type 44): For support of pipes NPS 2 to NPS 42 if longitudinal movement caused by expansion and contraction might occur but vertical adjustment is not necessary.

K. Vertical-Piping Clamps: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8): For support of pipe risers NPS 3/4 to NPS 24.
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): For support of pipe risers NPS 3/4 to NPS 24 if longer ends are required for riser clamps.

L. Hanger-Rod Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F piping installations.

M. Building Attachments: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Welded-Steel Brackets: For support of pipes from below, or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb.
    b. Medium (MSS Type 32): 1500 lb.
    c. Heavy (MSS Type 33): 3000 lb.

8. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
9. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.

N. Saddles and Shields: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Steel-Pipe-Covering Protection Saddles (MSS Type 39): To fill interior voids with insulation that matches adjoining insulation.
2. Protection Shields (MSS Type 40): Of length recommended in writing by manufacturer to prevent crushing insulation.
3. Thermal-Hanger Shield Inserts: For supporting insulated pipe.

O. Spring Hangers and Supports: Unless otherwise indicated and except as specified in piping system Sections, install the following types:

1. Spring Cushions (MSS Type 48): For light loads if vertical movement does not exceed 1-1/4 inches.
2. Spring-Cushion Roll Hangers (MSS Type 49): For equipping Type 41, roll hanger with springs.
3. Variable-Spring Base Supports (MSS Type 52): Preset to indicated load and limit variability factor to 25 percent to allow expansion and contraction of piping system from base support.

P. Comply with MSS SP-69 for trapeze pipe-hanger selections and applications that are not specified in piping system Sections.

Q. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

END OF SECTION 230529

SECTION 230548.13

VIBRATION CONTROLS FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each vibration isolation device.

1. Include design calculations for selecting vibration isolators.

PART 2 - PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.

g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth, Ribbed or Waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Mounting Plates:

a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.

3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.

d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Description: All-directional isolator with restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.

a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.

a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top housing with attachment and leveling bolt or threaded mounting holes and internal leveling device.

2.6 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Isolation.
h. Vibration Mountings & Controls, Inc.

2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top plate with threaded mounting holes.
c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.

4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.7 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Ace Mountings Co., Inc.
    b. California Dynamics Corporation.
    c. Isolation Technology, Inc.
    d. Kinetics Noise Control, Inc.
    e. Mason Industries, Inc.
    f. Vibration Eliminator Co., Inc.
    g. Vibration Isolation.
    h. Vibration Mountings & Controls, Inc.

2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.

    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.

3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch- thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.

2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.9 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch- thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and re-insertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.10 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Isolation Technology, Inc.
d. Kinetics Noise Control, Inc.
e. Mason Industries, Inc.
f. Vibration Eliminator Co., Inc.
g. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.11 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression: .

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Ace Mountings Co., Inc.
b. California Dynamics Corporation.
c. Kinetics Noise Control, Inc.
d. Mason Industries, Inc.

e. Vibration Eliminator Co., Inc.
f. Vibration Isolation.
g. Vibration Mountings & Controls, Inc.

2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
9. Self-centering hanger rod cap to ensure concentricity between hanger rod and support spring coil.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete" or Section 033053 "Miscellaneous Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

END OF SECTION 230548.13

SECTION 230553

IDENTIFICATION FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Equipment labels.

PART 2 - PRODUCTS

2.1 EQUIPMENT LABELS

A. Plastic Labels for Equipment:

1. Material and Thickness: Multilayer, multicolor, plastic labels for mechanical engraving, 1/8 inch thick, and having predrilled holes for attachment hardware.
2. Letter Color: White.
3. Background Color: Black.
4. Maximum Temperature: Able to withstand temperatures up to 160 deg F.
5. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 by 3/4 inch.
6. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches, and proportionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-fourths the size of principal lettering.
7. Fasteners: Stainless-steel rivets or self-tapping screws.
8. Adhesive: Contact-type permanent adhesive, compatible with label and with substrate.

B. Label Content: Include equipment's Drawing designation or unique equipment number.

C. Equipment Label Schedule: For each item of equipment to be labeled, on 8-1/2-by-11-inch bond paper. Tabulate equipment identification number and identify Drawing numbers where equipment is indicated (plans, details, and schedules), plus the Specification Section number and title where equipment is specified. Equipment schedule shall be included in operation and maintenance data.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond of identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

3.2 EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

END OF SECTION 230553

SECTION 230593

TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Balancing Air Systems:

a. Constant-volume air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TABB: Testing, Adjusting, and Balancing Bureau.

E. TAB Specialist: An entity engaged to perform TAB Work.

1.3 INFORMATIONAL SUBMITTALS

A. Strategies and Procedures Plan: Within 30 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

B. Certified TAB reports.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC, NEBB or TABB.

1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC, NEBB or TABB.
2. TAB Technician: Employee of the TAB contractor and who is certified by AABC, NEBB or TABB as a TAB technician.

B. Certify TAB field data reports and perform the following:

1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.

2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard TAB contractor's forms approved by Architect, Owner, Construction Manager, and/or Commissioning Authority.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

E. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

F. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.7.2.3 - "System Balancing."

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that locations of these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they meet the leakage class of connected ducts as specified in Section 233113 "Metal Ducts" and Section 233116 "Nonmetal Ducts" and are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine equipment performance data including fan and pump curves.

1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.
2. Calculate system-effect factors to reduce performance ratings of HVAC equipment when installed under conditions different from the conditions used to rate equipment performance. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," or in SMACNA's "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

J. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

K. Examine operating safety interlocks and controls on HVAC equipment.

L. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes strategies and step-by-step procedures.

B. Complete system-readiness checks and prepare reports. Verify the following:

1. Permanent electrical-power wiring is complete.
2. Automatic temperature-control systems are operational.
3. Equipment and duct access doors are securely closed.
4. Balance, smoke, and fire dampers are open.
5. Ceilings are installed in critical areas where air-pattern adjustments are required and access to balancing devices is provided.
6. Windows and doors can be closed so indicated conditions for system operations can be met.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC's "National Standards for Total System Balance", ASHRAE 111, NEBB's "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems", and SMACNA's "HVAC Systems - Testing, Adjusting, and Balancing" and in this Section.

1. Comply with requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.

1. After testing and balancing, patch probe holes in ducts with same material and thickness as used to construct ducts.
2. Install and join new insulation that matches removed materials. Restore insulation, coverings, vapor barrier, and finish according to Section 230713 "Duct Insulation," Section 230716 "HVAC Equipment Insulation," Section 230719 "HVAC Piping Insulation."

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) and metric (SI) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of systems' "as-built" duct layouts.

C. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

D. Check airflow patterns from the outdoor-air louvers and dampers and the return- and exhaust-air dampers through the supply-fan discharge and mixing dampers.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check dampers for proper position to achieve desired airflow path.

H. Check for airflow blockages.

I. Check condensate drains for proper connections and functioning.

J. Check for proper sealing of air-handling-unit components.

K. Verify that air duct system is sealed as specified in Section 233113 "Metal Ducts."

3.5 PROCEDURES FOR CONSTANT-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.

1. Measure total airflow.

    a. Where sufficient space in ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow.

2. Measure fan static pressures as follows to determine actual static pressure:

    a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
    b. Measure static pressure directly at the fan outlet or through the flexible connection.

c. Measure inlet static pressure of single-inlet fans in the inlet duct as near the fan as possible, upstream from the flexible connection, and downstream from duct restrictions.
d. Measure inlet static pressure of double-inlet fans through the wall of the plenum that houses the fan.

3. Measure static pressure across each component that makes up an air-handling unit, rooftop unit, and other air-handling and -treating equipment.

a. Report the cleanliness status of filters and the time static pressures are measured.

4. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
5. Review Record Documents to determine variations in design static pressures versus actual static pressures. Calculate actual system-effect factors. Recommend adjustments to accommodate actual conditions.
6. Obtain approval from Architect, Owner, Construction Manager, and Commissioning Authority for adjustment of fan speed higher or lower than indicated speed. Comply with requirements in Sections for air-handling units for adjustment of fans, belts, and pulley sizes to achieve indicated air-handling-unit performance.
7. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, submain ducts, and major branch ducts to indicated airflows within specified tolerances.

1. Measure airflow of submain and branch ducts.

a. Where sufficient space in submain and branch ducts is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow for that zone.

2. Measure static pressure at a point downstream from the balancing damper, and adjust volume dampers until the proper static pressure is achieved.
3. Remeasure each submain and branch duct after all have been adjusted. Continue to adjust submain and branch ducts to indicated airflows within specified tolerances.

C. Measure air outlets and inlets without making adjustments.

1. Measure terminal outlets using a direct-reading hood or outlet manufacturer's written instructions and calculating factors.

D. Adjust air outlets and inlets for each space to indicated airflows within specified tolerances of indicated values. Make adjustments using branch volume dampers rather than extractors and the dampers at air terminals.

1. Adjust each outlet in same room or space to within specified tolerances of indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
2. Adjust patterns of adjustable outlets for proper distribution without drafts.

3.6 PROCEDURES FOR CONDENSING UNITS

A. Verify proper rotation of fans.

B. Measure entering- and leaving-air temperatures.

C. Record compressor data.

3.7 PROCEDURES FOR HEAT-TRANSFER COILS

A. Measure, adjust, and record the following data for each electric heating coil:

1. Nameplate data.
2. Airflow.
3. Entering- and leaving-air temperature at full load.
4. Voltage and amperage input of each phase at full load and at each incremental stage.
5. Calculated kilowatt at full load.
6. Fuse or circuit-breaker rating for overload protection.

B. Measure, adjust, and record the following data for each refrigerant coil:

1. Dry-bulb temperature of entering and leaving air.
2. Wet-bulb temperature of entering and leaving air.
3. Airflow.
4. Air pressure drop.
5. Refrigerant suction pressure and temperature.

3.8 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:

1. Supply, Return, and Exhaust Fans and Equipment with Fans: Plus or minus 10 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.9 REPORTING

A. Initial Construction-Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article, prepare a report on the adequacy of design for systems' balancing devices. Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: Prepare biweekly progress reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.10 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into separate sections for tested systems and balanced systems.

1. Include a certification sheet at the front of the report's binder, signed and sealed by the certified testing and balancing engineer.
2. Include a list of instruments used for procedures, along with proof of calibration.

B. Final Report Contents: In addition to certified field-report data, include the following:

1. Manufacturers' test data.
2. Field test reports prepared by system and equipment installers.
3. Other information relative to equipment performance; do not include Shop Drawings and product data.

C. General Report Data: In addition to form titles and entries, include the following data:

1. Title page.
2. Name and address of the TAB contractor.
3. Project name.
4. Project location.
5. Architect's name and address.
6. Engineer's name and address.
7. Contractor's name and address.
8. Report date.
9. Signature of TAB supervisor who certifies the report.
10. Table of Contents with the total number of pages defined for each section of the report. Number each page in the report.
11. Summary of contents including the following:

    a. Indicated versus final performance.
    b. Notable characteristics of systems.
    c. Description of system operation sequence if it varies from the Contract Documents.

12. Nomenclature sheets for each item of equipment.
13. Data for terminal units, including manufacturer's name, type, size, and fittings.
14. Notes to explain why certain final data in the body of reports vary from indicated values.
15. Test conditions for fans and pump performance forms including the following:

    a. Settings for outdoor-, return-, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet- and dry-bulb conditions.
    d. Fan drive settings including settings and percentage of maximum pitch diameter.

e. Settings for supply-air, static-pressure controller.
f. Other system operating conditions that affect performance.

D. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present each system with single-line diagram and include the following:

1. Quantities of outdoor, supply, return, and exhaust airflows.
2. Duct, outlet, and inlet sizes.
3. Position of balancing devices.

3.11 ADDITIONAL TESTS

A. Within 90 days of completing TAB, perform additional TAB to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial TAB procedures were not performed during near-peak summer and winter conditions, perform additional TAB during near-peak summer and winter conditions.

END OF SECTION 230593

SECTION 230713

DUCT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following duct services:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Related Sections:

1. Section 230719 "HVAC Piping Insulation."
2. Section 233113 "Metal Ducts" for duct liners.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Comply with requirements in "Duct Insulation Schedule, General," "Indoor Duct and Plenum Insulation Schedule," and "Aboveground, Outdoor Duct and Plenum Insulation Schedule" articles for where insulating materials shall be applied.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

F. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Sheet, K-Flex Gray Duct Liner, and K-FLEX LS.

G. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

a. CertainTeed Corp.; SoftTouch Duct Wrap.
b. Johns Manville; Microlite.
c. Knauf Insulation; Friendly Feel Duct Wrap.
d. Manson Insulation Inc.; Alley Wrap.
e. Owens Corning; SOFTR All-Service Duct Wrap.

H. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; Commercial Board.
    b. Fibrex Insulations Inc.; FBX.
    c. Johns Manville; 800 Series Spin-Glas.
    d. Knauf Insulation; Insulation Board.
    e. Manson Insulation Inc.; AK Board.
    f. Owens Corning; Fiberglas 700 Series.

2.2 FIRE-RATED INSULATION SYSTEMS

A. Fire-Rated Blanket: High-temperature, flexible, blanket insulation with FSK jacket that is tested and certified to provide a 2-hour fire rating by an NRTL acceptable to authorities having jurisdiction.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. CertainTeed Corp.; FlameChek.
    b. Johns Manville; Firetemp Wrap.
    c. 3M; Fire Barrier Wrap Products.
    d. Unifrax Corporation; FyreWrap.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Aeroflex USA, Inc.; Aeroseal.
    b. Armacell LLC; Armaflex 520 Adhesive.
    c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

    a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-127.
    b. Eagle Bridges - Marathon Industries; 225.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-60/85-70.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
b. Eagle Bridges - Marathon Industries; 225.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
d. Mon-Eco Industries, Inc.; 22-25.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

1. For indoor applications, use mastics that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-80/30-90.
b. Vimasco Corporation; 749.

2. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.

5. Color: White.

C. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-10.
b. Eagle Bridges - Marathon Industries; 550.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 46-50.
d. Mon-Eco Industries, Inc.; 55-50.
e. Vimasco Corporation; WC-1/WC-5.

2. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
3. Service Temperature Range: Minus 20 to plus 180 deg F.
4. Solids Content: 60 percent by volume and 66 percent by weight.
5. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 95-44.
d. Mon-Eco Industries, Inc.; 44-05.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Fire- and water-resistant, flexible, elastomeric sealant.
4. Service Temperature Range: Minus 40 to plus 250 deg F.
5. Color: Aluminum.
6. For indoor applications, use sealants that have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.6 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:

1. FSK Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.

2.7 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
   b. ITW Insulation Systems; Aluminum and Stainless-Steel Jacketing.
   c. RPR Products, Inc.; Insul-Mate.

2. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper, 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick polysurlyn.
5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick polysurlyn.

D. Self-Adhesive Outdoor Jacket: 60-mil- thick, laminated vapor barrier and waterproofing membrane for installation over insulation located aboveground outdoors; consisting of a rubberized bituminous resin on a crosslaminated polyethylene film covered with stucco-embossed aluminum-foil facing.

2.8 TAPES

A. FSK Tape: Foil-face, vapor-retarder tape matching factory-applied jacket with acrylic adhesive; complying with ASTM C 1136.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.

2. Width: 3 inches.
3. Thickness: 6.5 mils.
4. Adhesion: 90 ounces force/inch in width.
5. Elongation: 2 percent.

6. Tensile Strength: 40 lbf/inch in width.
7. FSK Tape Disks and Squares: Precut disks or squares of FSK tape.

B. Aluminum-Foil Tape: Vapor-retarder tape with acrylic adhesive.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ABI, Ideal Tape Division; 488 AWF.
b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0800.
c. Compac Corporation; 120.
d. Venture Tape; 3520 CW.

2. Width: 2 inches.
3. Thickness: 3.7 mils.
4. Adhesion: 100 ounces force/inch in width.
5. Elongation: 5 percent.
6. Tensile Strength: 34 lbf/inch in width.

2.9 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. Insulation Pins and Hangers:

1. Metal, Adhesively Attached, Perforated-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Perforated Base Insul-Hangers.
2) GEMCO; Perforated Base.
3) Midwest Fasteners, Inc.; Spindle.

b. Baseplate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.

d. Adhesive: Recommended by hanger manufacturer. Product with demonstrated capability to bond insulation hanger securely to substrates indicated without damaging insulation, hangers, and substrates.

2. Self-Sticking-Base Insulation Hangers: Baseplate welded to projecting spindle that is capable of holding insulation, of thickness indicated, securely in position indicated when self-locking washer is in place. Comply with the following requirements:

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; Tactoo Self-Adhering Insul-Hangers.
2) GEMCO; Peel & Press.
3) Midwest Fasteners, Inc.; Self Stick.

b. Baseplate: Galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
c. Spindle: Copper- or zinc-coated, low-carbon steel, fully annealed, 0.106-inch-diameter shank, length to suit depth of insulation indicated.
d. Adhesive-backed base with a peel-off protective cover.

3. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick, galvanized-steel sheet, with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

a. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

1) AGM Industries, Inc.; RC-150.
2) GEMCO; R-150.
3) Midwest Fasteners, Inc.; WA-150.
4) Nelson Stud Welding; Speed Clips.

b. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in exposed locations.

C. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

D. Wire: 0.062-inch soft-annealed, stainless steel.

2.10 CORNER ANGLES

A. Aluminum Corner Angles: 0.040 inch thick, minimum 1 by 1 inch, aluminum according to ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

B. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Keep insulation materials dry during application and finishing.

G. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

H. Install insulation with least number of joints practical.

I. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.

J. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

K. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.

3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches o.c.

    a. For below ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

L. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

M. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

N. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

E. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.5 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

    a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
    b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
    c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
    d. Do not overcompress insulation during installation.
    e. Impale insulation over pins and attach speed washers.
    f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch

o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches o.c.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

B. Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.
2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
b. On duct sides with dimensions larger than 18 inches, space pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
d. Do not overcompress insulation during installation.
e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1-inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch- wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies. Fire-stop systems are specified in Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 DUCT INSULATION SCHEDULE, GENERAL

A. Plenums and Ducts Requiring Insulation:

1. Indoor, concealed supply and outdoor air.
2. Indoor, exposed supply and outdoor air.
3. Indoor, concealed return located in unconditioned space.
4. Indoor, exposed return located in unconditioned space.
5. Indoor, concealed, Type I, commercial, kitchen hood exhaust.
6. Indoor, exposed, Type I, commercial, kitchen hood exhaust.
7. Indoor, concealed oven and warewash exhaust.
8. Indoor, exposed oven and warewash exhaust.
9. Indoor, concealed exhaust between isolation damper and penetration of building exterior.
10. Indoor, exposed exhaust between isolation damper and penetration of building exterior.
11. Outdoor, concealed supply and return.
12. Outdoor, exposed supply and return.

B. Items Not Insulated:

1. Fibrous-glass ducts.
2. Metal ducts with duct liner of sufficient thickness to comply with energy code and ASHRAE/IESNA 90.1.
3. Factory-insulated flexible ducts.
4. Factory-insulated plenums and casings.
5. Flexible connectors.
6. Vibration-control devices.
7. Factory-insulated access panels and doors.

3.10 INDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Concealed, single-wall supply-air, return-air, outdoor-air and exhaust-air (between isolation damper and penetration of building exterior) duct and plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.0-lb/cu. ft. nominal density.

B. Concealed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated blanket; thickness as required to achieve 2-hour fire rating.

C. Exposed, single-wall, round and flat-oval, supply-air, return-air, outdoor-air and exhaust-air (between isolation damper and penetration of building exterior) duct and plenum insulation shall be the following:

1. Mineral-Fiber Blanket: 2 inches thick and 1.0-lb/cu. ft. nominal density.

D. Exposed, single-wall, rectangular, supply-air, return-air, outdoor-air and exhaust-air (between isolation damper and penetration of building exterior) duct and plenum insulation shall be the following:

1. Mineral-Fiber Board: 2 inches thick and 3-lb/cu. ft. nominal density.

E. Exposed, Type I, Commercial, Kitchen Hood Exhaust Duct and Plenum Insulation: Fire-rated board; thickness as required to achieve 2-hour fire rating.

3.11 ABOVEGROUND, OUTDOOR DUCT AND PLENUM INSULATION SCHEDULE

A. Insulation materials and thicknesses are identified below. If more than one material is listed for a duct system, selection from materials listed is Contractor's option.

B. Single-wall supply-air, return-air, outdoor-air and exhaust-air duct and plenum insulation shall be the following:

1. Flexible Elastomeric: 2 inches thick and 6.0 minimum installed R-value.

C. INDOOR, FIELD-APPLIED JACKET SCHEDULE

D. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

E. If more than one material is listed, selection from materials listed is Contractor's option.

F. Ducts and Plenums, Concealed:

1. None.

G. Ducts and Plenums, Exposed:

1. Aluminum, Stucco Embossed: 0.024 inch thick.

3.12 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Ducts and Plenums, Concealed:

1. Aluminum, Stucco Embossed: 0.024 inch thick.

D. Ducts and Plenums, Exposed, up to 48 Inches in Diameter or with Flat Surfaces up to 72 Inches:

1. Aluminum, Stucco Embossed: 0.024 inch thick.

E. Ducts and Plenums, Exposed, Larger Than 48 Inches in Diameter or with Flat Surfaces Larger Than 72 Inches:

1. Aluminum, Stucco Embossed with 2-1/2-Inch- Deep Corrugations or 4-by-1-Inch Box Ribs: 0.032 inch thick.

END OF SECTION 230713

SECTION 230719

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes insulating the following HVAC piping systems:

1. Refrigerant suction and hot-gas piping, indoors and outdoors.

B. Related Sections:

1. Section 230713 "Duct Insulation."

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

PART 2 - PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aerocel.
b. Armacell LLC; AP Armaflex.
c. K-Flex USA; Insul-Lock, Insul-Tube, and K-FLEX LS.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Aeroflex USA, Inc.; Aeroseal.
b. Armacell LLC; Armaflex 520 Adhesive.
c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
d. K-Flex USA; R-373 Contact Adhesive.

2. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.3 SEALANTS

A. Joint Sealants:

1. Joint Sealants for Cellular-Glass Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-76.
b. Eagle Bridges - Marathon Industries; 405.

c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 30-45.
d. Mon-Eco Industries, Inc.; 44-05.
e. Pittsburgh Corning Corporation; Pittseal 444.

2. Materials shall be compatible with insulation materials, jackets, and substrates.
3. Permanently flexible, elastomeric sealant.
4. Service Temperature Range: Minus 100 to plus 300 deg F.
5. Color: White or gray.
6. For indoor applications, sealants shall have a VOC content of 420 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealants shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.4 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; Metal Jacketing Systems.
b. ITW Insulation Systems; Aluminum and Stainless-Steel Jacketing.
c. RPR Products, Inc.; Insul-Mate.

2. Sheet and roll stock ready for shop or field sizing or Factory cut and rolled to size.
3. Finish and thickness are indicated in field-applied jacket schedules.
4. Moisture Barrier for Indoor Applications: 1-mil- thick, heat-bonded polyethylene and kraft paper, 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick polysurlyn.
5. Moisture Barrier for Outdoor Applications: 3-mil- thick, heat-bonded polyethylene and kraft paper or 2.5-mil- thick polysurlyn.
6. Factory-Fabricated Fitting Covers:

a. Same material, finish, and thickness as jacket.
b. Preformed 2-piece or gore, 45- and 90-degree, short- and long-radius elbows.
c. Tee covers.
d. Flange and union covers.
e. End caps.
f. Beveled collars.
g. Valve covers.
h. Field fabricate fitting covers only if factory-fabricated fitting covers are not available.

2.5 SECUREMENTS

A. Aluminum Bands: ASTM B 209, Alloy 3003, 3005, 3105, or 5005; Temper H-14, 0.020 inch thick, 3/4 inch wide with wing seal or closed seal.

1. Products: Subject to compliance with requirements, provide one of the following:

a. ITW Insulation Systems; Gerrard Strapping and Seals.
b. RPR Products, Inc.; Insul-Mate Strapping, Seals, and Springs.

B. Staples: Outward-clinching insulation staples, nominal 3/4-inch- wide, stainless steel or Monel.

C. Wire: 0.062-inch soft-annealed, stainless steel.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

B. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system as specified in insulation system schedules.

C. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

D. Install insulation with longitudinal seams at top and bottom of horizontal runs.

E. Install multiple layers of insulation with longitudinal and end seams staggered.

F. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

G. Keep insulation materials dry during application and finishing.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:

1. Draw jacket tight and smooth.
2. Cover circumferential joints with 3-inch- wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 2 inches 4 inches o.c.

    a. For below-ambient services, apply vapor-barrier mastic over staples.

4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

N. Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.3 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.

1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

F. Insulation Installation at Floor Penetrations:

1. Pipe: Install insulation continuously through floor penetrations.
2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly

against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:

1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.

3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
5. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.
2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Install insulation to flanges as specified for flange insulation application.
4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.6 FIELD-APPLIED JACKET INSTALLATION

A. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.7 FINISHES

A. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

B. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

C. Do not field paint aluminum or stainless-steel jackets.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Inspect pipe, fittings, strainers, and valves, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to three locations of straight pipe, three locations of threaded fittings, three locations of welded fittings, two locations of threaded strainers, two locations of welded strainers, three locations of threaded valves, and three locations of flanged valves for each pipe service defined in the "Piping Insulation Schedule, General" Article.

C. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.9 PIPING INSULATION SCHEDULE, GENERAL

A. Acceptable preformed pipe and tubular insulation materials and thicknesses are identified for each piping system and pipe size range. If more than one material is listed for a piping system, selection from materials listed is Contractor's option.

B. Items Not Insulated: Unless otherwise indicated, do not install insulation on the following:

1. Drainage piping located in crawl spaces.
2. Underground piping.
3. Chrome-plated pipes and fittings unless there is a potential for personnel injury.

3.10 PIPING INSULATION SCHEDULE

A. Refrigerant Suction and Hot-Gas Piping: Insulation shall be the following:

1. Flexible Elastomeric: 3/4 inches thick.

3.11 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed:

1. None.

D. Piping, Exposed:

1. Aluminum, Corrugated: 0.024 inch thick.

END OF SECTION 230719

SECTION 230800

COMMISSIONING OF HVAC

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. Drawings and general provisions of the Contract, including General Conditions and Division-1 Specifications Sections, apply to Work of this section.

B. Certain building systems on this project are to be commissioned using a team approach. The intent of the commissioning program is to provide documentation, testing, and training to help insure that the project meets the needs of the Owner and the Engineer’s intent and to satisfy the Code requirements for commissioning. The commissioning program includes:

1. Start up and testing of specified equipment and systems in accordance with the commissioning plan, FIV & FPT approved forms.

2. Identification of and documentation of equipment and system deficiencies and normal operating parameters.

3. Corrective actions and acceptance of corrected equipment and systems.

4. Operation and maintenance manuals.

5. Preventative maintenance equipment and system data collection.

6. Equipment and systems use and maintenance training.

1.2 WORK INCLUDED

A. Participate in the Commissioning program as outlined in this section.

1.3 COMMISSIONING PROGRAM CRITERIA

A. Intent:

1. The intent of System Commissioning is to assure delivery to the Owner of HVAC and plumbing systems that are fully functioning in accordance with all specifications, and which the Owner's personnel are fully trained and equipped to operate, maintain and troubleshoot.

2. The General Contractor and all sub-contractors shall participate in the Commissioning Program, which delivers the intended results of System Commissioning, using whatever personnel, time, equipment and resources are required.

3. This Section provides minimum program requirements; however, the Contractor shall exceed those requirements whenever necessary to achieve the intent of Building Commissioning.

B. Commissioning Authority (CxA):

1. The Commissioning Authority is contracted directly with the Owner and is responsible for the overall enforcement and implementation of the Commissioning Program. The Commissioning Authority will schedule and chair all commissioning meetings and be responsible for all documentation and final acceptance of the commissioning phase of the project.

C. Mechanical Trade Representative:

1. The Mechanical Contractor shall assign a qualified individual to function as the Trade Representative to coordinate the Commissioning Program. The Trade Representative reports to the Commissioning Authority.

D. Definitions and Abbreviations:

1. Maintenance Orientation and Inspection: At prescribed times during the Work the Contractor will walk the Owner's Maintenance personnel through the Work, orient them to equipment types and locations, assist access for any requested inspections, answer all questions concerning performance of the Work, workmanship standards and quality control.

2. Equipment Placement Completion: Stage of the Work at which the major items of Division 23 equipment have been placed at final locations, but have not received ductwork, piping and electrical connections. Major equipment includes, but is not limited to, heating and cooling equipment such as Chillers, Boilers, Water Heaters, Cooling towers, Pumps and air-handling units.

3. Distribution Completion: Stage of the Work at which distribution piping and ductwork have been installed and tested, but not insulated or concealed by further work.

4. O&M Manuals: Operation and Maintenance Manuals as specified in Contract Documents.

5. TAB: Testing, Adjusting and Balancing of Division 23 equipment as specified in Contract Documents.

6. Trade Representative: Person who competently represents the work force engaged by the Contractor for the individual trade named. This person shall be completely familiar with the work performed for this Contract at all levels of detail of his trade and with coordination to other trades. This person shall be capable of and have authority to execute all commissioning responsibilities of the trade as described in these Contract Documents.

7. Participate: Attend commissioning events, provide technical expertise or knowledge, equipment, measurements and observation needed or requested by the Commissioning Authority or Owner. Provide follow-up analysis, equipment data, design data, or other trade or professional service needed in response to commissioning events.

8. Verify: To positively determine that the measured or observed quantity satisfies all required criteria. Simply performing the test, measurement or observation does not constitute "verification". The test result must also pass all Contract criteria. Tests that fail must be repeated at no additional cost to the Owner after repairs or adjustments are made, until full verification is achieved.

9. Pre-functional Testing: Ensure that individual pieces of equipment are capable of performing in accordance with the Specifications, Drawings, and manufacturers' requirements. This is documented with a Field Installation Verification checklist provided by the CxA and completed by the contractor. The Commissioning Authority shall overview this testing.

E. Scope: For coordination purposes, the entire commissioning scope involving all parties is described here. The responsibilities of Division 23 Trades with respect to commissioning are separated out under Section 3.03 - RESPONSIBILITIES.

1. Document HVAC design intent.

2. Verify that equipment and systems have been properly installed in accordance with the contract documents and manufacturer's written installation instructions.

3. Verify that piping systems have been properly cleaned.

4. Verify that duct systems have been properly cleaned.

5. Verify that equipment has been placed into operation with manufacturer's oversight and approval.

6. Verify that adjusting, balancing and system testing has been properly done in accordance with Testing, Adjusting and Balancing requirements.

7. Assemble contract documents and record drawings.

8. Assemble operation and maintenance instructions and submittal data.

9. Perform Pre-Functional testing

10. Verify the performance of each piece of equipment and each system through functional testing.

11. Train Owner's personnel in the proper operation of each piece of equipment and each system.

12. Document warranty start and end dates.

13. Assemble all records of Code authority inspections and approvals.

14. Monitor and enforce accessibility of all work versus maintenance requirements of each piece of equipment.

15. Identify, document and report all deficiencies of the work versus Contract specifications and performance requirements

F. Commissioning Cost:

1. Each Trade and supplier of equipment shall include in his quoted price the cost of furnishing the material requested and manpower necessary for the operation and maintenance manuals, training and system verification as specified under this section.

PART 2 - PRODUCTS

2.1 NOT APPLICABLE.

PART 3 - EXECUTION

3.1 PREPARATION OF COMMISSIONING PLAN

A. The Commissioning Plan shall be prepared by the CxA. The plan shall take full cognizance of all intent and specific requirements for the Commissioning Program described in the Contract Documents.

B. The Commissioning Plan shall be submitted to the Owner and shall be subject to approval in all aspects by the Owner. The Owner reserves the right to require changes in the Commissioning Plan or personnel assigned at any time to satisfy the Owner's quality assurance within the Commissioning Program.

3.2 COMMISSIONING TEAM

A. A Commissioning Team shall be designated consisting of all members needed to execute the approved Commissioning Program. Membership shall include:

1. CxA

2. General Contractor

3. Mechanical Trade Representative

4. Electrical Trade Representative

5. Testing, Adjusting and Balancing Trade Representative

6. Facility Management and Control System (FMCS) Trade Representative

7. Owner's Representative

8. Owner’s HVAC Maintenance Representative

9. Architect and Engineer of Record

B. The Contractor's personnel shall be made available to execute all aspects of the Commissioning Program until the Owner accepts final results. Commissioning Program tasks and meetings may be repeated until the Owner is satisfied and will not be fixed as one-time, one-chance events for the Contractor.

3.3 RESPONSIBILITIES

A. Owner:

1. Assign maintenance and engineering personnel and schedule them to participate in the various meetings, training sessions and inspections as required:

B. Commissioning Authority:

1. Prepare Commissioning requirements sections of the Contract.

2. Prepare the Commissioning Plan. Include list of all Trade Representatives for commissioning events by name, firm and trade specialty.

3. Execute the Commissioning Plan, through organization of all meetings, tests, demonstrations, training events and performance verifications described in the Contract Documents and approved Commissioning Plan. Organizational responsibilities include preparation of agendas, attendance lists, arrangements for facilities and timely notification to participants for each commissioning events. The Commissioning Authority shall act as chairman at all commissioning events and assure execution of all agenda items. The Commissioning Authority shall prepare minutes of every commissioning event and send copies to all attendees within 5 workdays of the event.

4. Review the plans and specifications with respect to their completeness in all areas relating to the commissioning program. This includes ensuring that the commissioning guidelines have been followed

5. The plan and specification review by the Commissioning Authority does not include any responsibility for the system evaluation, adequacy of the system to meet design intent, capacity of the system, quality control check or any of the other elements of the system design which are the strict responsibility of the Engineer of record.

6. Schedule a pre-commissioning coordination meeting within 90 days of the award of the contract, at some convenient location and at a time suitable to the Mechanical Contractor and Engineer of Record. This pre-commissioning meeting will be for the purpose of reviewing the complete commissioning program and establishing tentative schedules for Maintenance orientation and inspections, O&M submittals, training sessions, system flushing and testing, job completion, system start-up, test, adjust and balance work, and functional testing

7. Receive and review operation and maintenance (O&M) manuals as submitted by the contractor through the Engineer of Record.

8. Adequate accessibility for maintenance and component replacement or repair is the Mechanical Contractor's responsibility and will be checked by the Commissioning Authority at shop drawings, and during initial and final phases for each item of equipment.

9. Witness the piping test and flushing procedure. Incorporate the documentation in the final commissioning report. Prepare report of this observation, with separate summary of deficiency findings by the Commissioning Authority.

10. Witness ductwork testing and cleaning. Document the results and incorporate it in the final commissioning report.

11. Schedule a meeting with the test, adjust and balance (TAB) Trade Representative prior to the start of the test, adjust and balance procedure. This meeting should be attended by the Owner, mechanical Trade Representative, Commissioning Authority, Engineer of Record and TAB Trade Representative. The TAB Trade Representative will outline the TAB procedure and get concurrence from the Engineer of Record and Commissioning Authority. Ensure that the TAB Trade Representative has all forms required for the job and understands their importance and use.

12. Schedule regular commissioning coordination meetings during construction.

13. Schedule the Owner training sessions. These training sessions are to be attended by the Owner, Commissioning Authority, Engineer of Record, Mechanical Contractor, Trade Representatives and equipment suppliers as necessary. The format will follow the outline in the O&M Manuals.

14. Upon receipt of notification from the Mechanical Contractor that the system has been started, that all air, water and control systems have been started, tested, adjusted and balanced, that the systems and equipment are functioning as designed and specified, and that all Field Installation Verification forms and checklists have been completed, schedule the verification demonstrations. These demonstrations will be conducted by the Contractor and the TAB and controls Trade Representative and witnessed by the Commissioning Authority. Prepare minutes of each verification event, with separate summary of deficiency findings by the Commissioning Authority. Distribute to attendees.

15. Prepare final commissioning report and submit to Owner. Schedule final review with Owner. Present all documentation and turn over signed acceptance of the system to the Owner.

C. Engineer of Record:

1. Provide HVAC system Basis of Design Narrative. Incorporate in the appropriate sections of the O&M Manual.

2. Attend initial pre-commissioning coordination meeting to be scheduled by the Commissioning Authority within 90 days of the award of the contract.

3. Verify adequate maintenance accessibility for each piece of equipment in shop drawings and actual installation. Visit site periodically and inspect construction.

4. Conduct the first HVAC training session on the overview of the system design, the system design goals and the reasoning behind the selection of equipment.

5. Review O&M Manuals submitted by the Mechanical Contractor. Insert Design Narrative.

6. Attend initial meetings with TAB Trade Representative as scheduled by Commissioning Authority.

7. Review TAB report from Contractor against design requirements. Issue a report noting deficiencies requiring correction to the Commissioning Authority.

D. Mechanical Contractor:

1. Include cost for commissioning requirements in the contract price.

2. Include commissioning requirements in the mechanical and electrical sub-contracts and ensure full cooperation of all parties in the commissioning program.

3. Provide an approved Plan to the Commissioning Authority to prepare and coordinate execution of the Commissioning Program. Provide the Commissioning Authority with means and authority to execute Commissioning Program.

4. Coordinate the interface of the Commissioning Program.

5. Prepare record drawings as required by contract documents and submit to the Owner.

E. Mechanical Trade Representative:

1. Include requirements for submittal data, O & M data and training in each purchase order or sub-contract written.

2. Ensure cooperation and participation of specialty sub-Trade Representatives such as Ductwork, Piping, Testing, Adjusting and Balancing, Chemical treatment and Refrigeration.

3. Ensure participation of major equipment manufacturers and their representatives.

4. Coordinate this commissioning program with the Electrical Trade Representative.

5. Attend initial pre-commissioning coordination meeting scheduled by the Commissioning Authority. Prepare necessary preliminary schedule for Maintenance orientation and inspections, O & M manual submission, training sessions, pipe and duct system testing, flushing and cleaning, equipment start-up, test, adjust and balance start and job completion for use by the Commissioning authority. Update schedule as appropriate throughout the construction period.

6. Obtain O & M data on all equipment and assemble in binders using tabs as required. Submit to Engineer of Record for approval prior to the Distribution completion stage.

7. Notify the Commissioning Authority of the time for the duct and piping system pressure tests and piping system flushing.

8. Notify the Commissioning Authority of the time for all equipment start up activities.

9. Notify the Commissioning Authority of the time for start of the TAB work. Attend the initial TAB meeting for the review of the TAB procedures.

10. Conduct and schedule vendors and other Trade Representatives to participate in the training sessions set up by the Commissioning Authority.

11. Attend all regularly scheduled commissioning coordination meetings.

12. Provide written certification and completed Field Installation Verification forms and checklists documenting that the following work has been completed in accordance with the plans and specifications and that they are functioning as designed. Where the Work has been sub-contracted, the sub-Trade Representative shall be responsible for the initial certification with the Mechanical Trade Representative recertifying that he has inspected the Work and that it has been completed and functioning as designed. This certification must be submitted to the Commissioning Authority prior to the final verification and functional testing.

    a. All mechanical systems and equipment including air handling units, fans, ductwork, piping, dampers, air terminal units and air devices.

    b. Chillers, boilers, and water heaters.

    c. Pumps.

    d. Fuel supply systems

    e. Fire stopping in the fire rated construction including fire and smoke damper installation, caulking, gasketing and sealing of smoke barriers.

    f. Facility Management and Control System (FMCS).

13. Demonstrate the performance of each piece of equipment to the Commissioning Authority. Schedule the TAB, FMCS and other sub-Trade Representatives as may apply to demonstrate the performance of the equipment and systems.

14. Provide set of record mark-ups to the Engineer of Record for inclusion into record documents.

F. Testing, Adjusting and Balancing Trade Representative:

1. Include cost for commissioning requirements in the contract price.

2. Attend initial pre-commissioning coordination meeting scheduled by the Commissioning Authority.

3. Attend the TAB review meeting scheduled by the Commissioning Authority. Be prepared to discuss the TAB procedures that will be followed in testing, adjusting and balancing the HVAC system.

4. Attend regularly scheduled commissioning meetings.

5. Participate in training sessions as set up by the Commissioning Authority.

6. At the completion of the TAB work, notify the Mechanical Trade Representative, and demonstrate to the Commissioning Authority the performance of the equipment covered by the TAB sub-contract as specified under "Verification of Performance" in this Section.

7. Repeat any measurement contained in the TAB report where required by the Commissioning Authority for verification or diagnostic purposes.

G. Facility Management and Control System (FMCS) Trade Representative:

1. Include cost for commissioning requirements in the contract price.

2. Attend initial pre-commissioning coordination meeting scheduled by the CxA.

3. Attend regularly scheduled commissioning meetings.

4. Participate in training sessions as set up by the Commissioning Authority.

5. At the completion of the Facility Management and Control System start-up and adjustment work, provide a complete start-up report and notify the Mechanical Trade Representative, and demonstrate to the Commissioning Authority the performance of the systems through functional performance tests developed by the commissioning authority.

6. Coordinate with TAB subcontractor to obtain control settings that are determined from balancing procedures. Record the following control settings as obtained from TAB contractor and note any TAB deficiencies in the FMCS start-up report.

a. Optimum duct static pressure setpoints for VAV air handling units.

b. Minimum outside air damper settings for air handling units.

c. Optimum differential pressure setpoints for variable speed pumping systems.

d. Calibration parameters for flow control devices such as VAV boxes and flow measuring stations.

3.4 OPERATION AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals:

1. Initial preparation shall be made by the Mechanical Trade Representative.

2. Quantity: provide four (4) hard copies of the manual and One (1) electronic copy in PDF format on a CD.

3. Format: 3" thick, 8-1/2" x 11 loose leaf binders. Provide as many as required. Binders shall not be overloaded.

4. Content:

    a. Cover sheet.

    b. Table of contents (as follows):

    c. Description of systems: The description of systems will be provided by the Engineer of Record for insertion at the time of review and before turn-over to the Commissioning Authority.

    d. Contract Mechanical Specifications.

    e. Wiring and control diagrams, with data to explain detailed operation and control of each component.

    f. Control sequences describing start-up, all modes of operation, and shutdown.

    g. Installation instructions.

    h. Operating Instructions.

    i. Preventative Maintenance Instructions.

    j. Maintenance and overhaul instructions.

    k. Lubricating schedule including type, grade, temperature, and frequency range.

    l. Corrected shop drawings and submittal data.

    m. Product information identifying all performance curves, rating data, features, and options on all installed equipment

    n. Copies of approved certifications and laboratory test reports.

    o. Copies of warranties.

    p. Test procedures.

    q. Parts list, including source of supply and recommended spare parts.

    r. Name, address, and 24-hour telephone number of each subcontractor who installed equipment and systems and local representative for each type of equipment for each system.

s. Other pertinent data applicable to the operation and maintenance of particular systems or equipment and/or other data specified in technical sections of the specification.

t. Uninterruptible power supplies, including a list of equipment and design kW load on each.

u. Emergency power generation, including a list of equipment and design kW load on each.

v. The documentation during the construction phase shall be updated to match the equipment supplied on the project.

w. Procedures for starting, operation, and shutdown for every system, including all required emergency instructions and safety precautions.

5. Detailed Preparation Requirements:

a. The cover sheet shall list: project name, location, names of the project manager, architect, structural engineer, mechanical engineer and electrical engineer, name of the firms, address and telephone number.

b. Each major heading in the table of contents shall have a large distinctive, clearly marked, non-erasable, plastic encased tab.

c. Each section shall have the following sub-tabs. Sub-tabs shall be similar to the main tabs but of a different color.

1) Specifications: The specification shall be copied and inserted complete with all addenda.

2) Submittal and Product Data: This section shall include all approved submittal data. If submittal was not required for approval, descriptive product data shall be included.

3) Installation Instructions: If the product, such as pipe, etc., does not have any written installation instructions, include a statement "Manufacturer's Written Installation Instructions Not Available - Product Installed in Accordance with Specifications and Good Practice".

4) Operation and Maintenance Instructions: These shall be the written manufacturer's data edited to omit reference to products or data not applicable to this installation.

5) Parts List: These shall be edited to omit reference to items, which do not apply to this installation.

6) Equipment Supplier: This section shall include the name, address and telephone number of the manufacturer's agent and/or service agency supplying or installing and starting up of the equipment.

7) Field Installation Verification forms, checklists, and Commissioning Checklist: This will be filled out by the Contractor with the specified data and submitted data and inserted into the manual for submission to the Engineer of Record. A copy shall be given to the test, adjust and balance (TAB) Trade Representative so that (TAB) data can be added. Upon completion of this entry, the form shall be forwarded with the certification of system completion and commissioning request.

8) System Description: This section shall include that portion of the overall description included in the beginning of the manual as it applies to each sub-section. In sections such as pumps, the pump designations and their use shall be listed as shown in the equipment schedule.

9) Controls Description: This will be included in each section covering controlled equipment. It will include the description from the approved temperature control submission, complete with schematic diagram showing piping arrangement and control location on 8-1/2" x 11" or 11" x 17" sheet. This data shall be provided by the FMCS Trade Representative in a form suitable for insertion into the O&M Manuals by the Mechanical Trade Representative and for review by the Engineer of Record.

10) Condensed Operating Instructions: This section shall include condensed instructions for start-up, shut-down, emergency operation, safety precautions, unusual features and troubleshooting suggestions. Where control is clearly covered in controls description, it is not to be duplicated here.

11) Preventative Maintenance Instructions: This section shall include condensed typewritten excerpts from the manufacturers written instructions on weekly, monthly, quarterly, annually, etc. This summary shall be prepared by the mechanical Trade Representative with help from the equipment supplier. It will be reviewed by the Engineer of Record prior to turning over to the Commissioning Authority. It shall be prepared for all items listed under "Condensed Operating Instructions" above.

d. Testing, Adjusting and Balancing shall contain the following sections:

1) Specifications.

2) Submittal.

3) TAB Data: This shall be the final TAB data. It will have to be added after the owner has received his training and the O&M manuals.

e. Commissioning of Mechanical Systems shall be prepared by the Commissioning Authority and shall contain the following sections:

1) Specifications.

2) Commissioning Plan.

3) Final Report of the Commissioning Authority.

B. Submittal Requirement:

1. The O&M manuals shall be submitted prior to the start of functional testing and prior to the start of any Owner's training.

3.5 TRAINING OF OWNERS OPERATORS:

A. The owners shall be given comprehensive training in the understanding of the systems and the operation and maintenance of each major piece of equipment.

B. The FMCS contractor shall provide 8 hours of detailed training for people provided by the Commissioning Authority in the design, programming and operation of the FMCS system and equipment. This training shall be provided within two months after award of a contact. FMCS contractor shall provide to the CxA and install on a computer designated by the CxA one copy of all software required to access, program, manipulate or otherwise interface with the control system.

C. The CxA, in cooperation with the Engineer of Record and Contractor, will be responsible for scheduling the training which shall start with classroom sessions followed by hands on training on each piece of equipment. Hands on training shall include start-up, operation in all modes possible, shutdown and any emergency procedures.

D. Classroom sessions shall include the use of overhead projections, slides, video and audio taped material as might be appropriate.

E. The training sessions shall follow the outline in the Table of Contents of the operation and maintenance manual.

F. The Engineer of Record will conduct the first session on the overall system design concept and the design concept portion of each equipment section.

G. The manufacturer's representative shall provide the instructions on each major piece of equipment. These sessions shall use the printed installation, operation and maintenance instruction material included in the O&M manuals and shall include a review of the written O&M installations emphasize safe and proper operating requirements and preventative maintenance. Training will be included for all major pieces of equipment including pumps, chillers, boilers, hot water heaters, heat rejection equipment, air conditioning units, air handling units, fans, air terminals, controls and water treatment systems. Qualified service engineers employed by the manufacturers or their qualified sales representatives shall do equipment training. The operation and function of the equipment in the system shall be discussed.

H. Each classroom training session shall be followed by an inspection, explanation and demonstration of the equipment. The start-up and shut-down modes of operation shall be demonstrated.

I. The Contractor shall attend all sessions and shall add to each session any special information relating to the details of installation of the equipment as it might impact the operation and maintenance.

J. The FMCS Trade Representative shall attend all sessions and be prepared to conduct the controls portion of the training as it relates to each equipment section.

K. The FMCS Trade Representative shall conduct the training session on the controls system hardware and software.

L. The piping, insulation and sheet metal Trade Representatives shall conduct sessions on their respective trades with emphasis on any peculiarities of the systems, pressure limitations and maintenance requirements.

M. The TAB Trade Representative shall conduct a training session reviewing the procedures and methods used in the TAB process, shall review the TAB data and shall demonstrate use of test equipment which may have been turned over to the owner and shall point out the locations of all pitot traverse locations for the owner's future use.

N. The Commissioning Authority shall conduct a final session summarizing the commissioning program.

3.6 NOTIFICATION OF SYSTEM COMPLETION AND REQUEST FOR FINAL HVAC SYSTEM COMMISSIONING VERIFICATION

A. When systems are ready for final commissioning verification, the mechanical Trade Representative shall notify the Commissioning Authority in writing and provide completed Field Installation Verification forms and checklists. Commissioning data sheets must be complete through the column labeled "Balanced" and included with the request.

B. Should the verification test reveal that the equipment is not performing as specified or control operation is not acceptable, the Contractor will be entitled to one re-inspection of any failed item at no additional cost.

C. Should the verification test determine that the equipment is still not performing as specified or control operation is not acceptable on the second inspection, the time and expenses to make further verification shall be considered as additional cost to the Owner. The total sum of such costs shall be deducted from the final payment to the Contractor.

3.7 VERIFICATION OF PERFORMANCE

A. Verification of performance will take place after certification of the completion of the construction, and completion of all functional test form checklists. Performance demonstration shall be done by the mechanical Trade Representative, the TAB Trade Representative, or the FMCS Trade Representative as appropriate, and shall be witnessed by the CxA and/or the Owner's Representative.

B. Test and Balance Work

1. Verification to include demonstration of performance listed in Testing, Adjusting and Balancing. The specified, submitted and as balanced data shall be entered on the Commissioning Data Sheets by the Contractor as included in the Commissioning Plan prior to the verification. The witnessed performance data shall be added to the data sheet at the time of verification.

2. The original TAB contractor will execute the checks, witnessed by the Commissioning Authority. The TAB contractor will use the same test instruments as used in the original TAB work. All test instruments shall have had certified calibration within the past 12 months.

3. A failure of more than 10% of the selected items of a given system shall result in the failure of acceptance of the system TAB report and the TAB contractor shall be responsible to rebalance the system, provide a new system TAB report and repeat random verifications of the new TAB report. The contractor shall pay for all commissioning costs associated with repeat verifications of the new TAB report.

    a. Failure of airflow and water flow is defined as a deviation of more than 10% from report data or from design value.

    b. Failure of temperature reading is defined as a deviation of more than 1 degree from report data or design value.

    c. Failure of air and water pressure is defined as a deviation of more than 5% from report data or design value.

4. The following tests and checks will be conducted:

    a. A random sample of up to 25% of air terminal units and diffusers including air flow, water flow, differential pressure, sound, and electrical data.

    b. TAB readings for all major pieces of equipment including air handling units, fans, chillers, boilers, pumps, etc.

    c. Major Duct flow and pressure - The TAB Trade Representative shall identify all places where temperature, pressure and/or velocity readings were taken. On up to 20% of the locations, performance, as listed in the TAB Report, shall be demonstrated

    d. Verification that final settings of all valves, splitters, dampers and other adjustment devices have been permanently marked by the TAB Contractor.

    e. Verification that the air system is being controlled to the lowest possible static pressure while still meeting design loads, less diversity. This shall include a review of TAB methods, control set points established by TAB and a physical verification of at least one leg from fan to diffuser having all balancing dampers wide open and that during full cooling of all terminal units (TUs) taking off downstream of the static pressure sensor, the TU on the critical leg has its damper 90% or more open.

    f. Verification that the water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity. This shall include a review of TAB methods, control setpoints established by TAB and a physical verification of at least one leg from the pump to the coil having all balancing valves wide open and that during full cooling the cooling coil valve of that leg is 90% or more open

C. Performance Tests

1. For all pieces of equipment test each sequence in the sequence of operations, and other significant modes and sequences not mentioned; including but not limited to startup, shutdown, unoccupied & manual modes and power failure. Test functionality of equipment and system in all control strategies, interfaces with other systems, and interlocks with which it is associated. The Commissioning Authority will prepare detailed descriptions of the test procedures that the Contractor will perform to demonstrate conformance of the completed mechanical systems to the plans and specifications.

2. Provide trend logs for any control system monitored point as requested to demonstrate system performance.

   a. The Commissioning Authority will analyze trend logs of the system operating parameters to evaluate normal system functionality. The contractor shall establish requested trends, ensure they are being stored properly, and forward the data in electronic format to the commissioning Authority.

   b. Data shall include a single row of field headings, and the data thereafter shall be contiguous. Each record shall include a date and time field. Recorded parameters for a given piece of equipment or component shall be trended at the same intervals and be presented in a maximum of two separate two dimensional formats with time being the vertical axis and field name being the horizontal axis. Data shall be forwarded in Microsoft Excel format.

   c. Trend graphs shall generally be used during the acceptance phase to facilitate and document testing. Prepare controller and workstation software to display graphical format trends during the acceptance period. Trend graphs shall demonstrate compliance with contract documents. Trended values and intervals shall be the same as those specified for the functional performance tests.

   d. Lines shall be labeled and shall be distinguishable from each other by using either different line types or different line colors.

   e. Indicate engineering units on the y-axis values, e.g. degrees F., inches WG, percent open, etc.

   f. The y-axis scale shall be chosen so that all trended values are in a readable range. Do not mix trended values on one graph if their unit ranges are incompatible.

   g. Trend outside air temperature, humidity and enthalpy during each period in which any other points are trended.

   h. All points trended or one HVAC subsystem shall be trended during the same trend period.

   i. Each graph shall be clearly labeled with system title, date and times.

3. Demonstrate capacity of installed equipment where requested with temperature, pressure and flow measurements as required.

4. FMCS Trade Representative shall demonstrate calibration of all sensors and measurement devices as requested by the Commissioning Authority. Calibration means FMCS readout vs. field measurement with a handheld calibrated instrument. Instruments shall be provided by the FMCS Trade Representative and approved by the Commissioning Authority.

    a. Instruments shall be traceable to the National Institute for Standards and Technology, and shall be at least twice as accurate as the device to be calibrated (i.e. if field device is ±0.5% accurate the test equipment shall be ±0.25% accurate over the same range).

5. In addition to equipment control, FMCS Trade Representative shall demonstrate all specified features and capabilities of the FMCS including graphics, communications to remote sites, setpoint changing features and functions, security features, O&M schedules and alarms, trending, etc.

6. If a piece of equipment fails a functional performance test the contractor will repair the equipment and will schedule a retest with the commissioning agent. The contractor will be responsible for all commissioning costs for retesting.

7. Acceptance criteria –

    a. For the conditions, sequences and modes tested, the equipment, integral components and related equipment shall respond to varying loads and changing conditions and parameters appropriately as expected, as specified and according to acceptable operating practice.

    b. In general, equipment with supporting systems shall be able to maintain temperature set points within 1.0F either side of the deadband of the current set point without excessive hunting. Air and water pressures and flows shall be controlled to not drift more than an amount equal to 5% of the setpoint value either side of the deadband without excessive hunting.

    c. Calibration of sensors, transmitters and other control devices (FMCS readout vs. handheld calibrated instrument) shall be within ±0.5 degrees for temperature, ±4% for humidity, ±4% for pressures and flows and ±5% for CO_2 measurement.

8. Fire and smoke damper installation and operation - All dampers shall be inspected and checked for proper operation. Smoke detectors shall be checked for proper performance. Smoke dampers shall be checked for proper operation. Fire damper operation shall be checked by removing fusible link and demonstrating closure.

9. FMCS Contactor is to provide access to the FMCS system to the Commissioning Authority through the Internet at whatever access level requested.

3.8 PHASING OF CONSTRUCTION AND COMMISSIONING:

A. The commissioning plan shall take into account the staged start-up of each phase. Commissioning documentation and verification to begin with each phase completion.

3.9 COMMISSIONING DATA SHEETS

A. The Commissioning Data Sheets for various equipment shall be as provided in the Commissioning Plan. They shall be completed as described in Para. 3.07 - Verification of Performance.

3.10 REPORT REQUIREMENTS

A. The Commissioning Authority shall document each commissioning event with meeting minutes or a report. The documents shall separately list deficiencies observed or discovered during the event. The document shall be distributed to Commissioning Team.

B. The Commissioning Authority shall prepare a final formal report to the Owner which will include a narrative in the form of an Executive Summary of the results of program, impressions of the training sessions and the level of operating competence and a certification that the verification of each item is complete, and all systems are operating as intended.

C. Transmitted with the report shall be edited Operation and Maintenance Manuals including:

1. Commissioning Data Sheets.

2. Warranties.

3. Permits and Inspection Reports.

4. TAB Reports

END OF SECTION 23 08 00

SECTION 230900

CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Complete System of Automatic Controls.

B. Control Devices, Components, Wiring and Material.

C. Instructions for Owners.

D. Remodeling.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years' experience.

B. TCC: Company specializing in the work of this section with minimum five years temperature control experience.

C. Technician: Minimum five years' experience installing commercial temperature control systems.

D. TCCs are limited to firms regularly employing a minimum of five full-time temperature control technicians within 100 miles (160 km) of the job site.

1.3 REFERENCES

A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ANSI/ASHRAE Standard 135-2001: BACnet® - A Data Communication Protocol for Building Automation and Control Networks, including all amendments.

D. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 volts Maximum).

E. ANSI/NFPA 70 - National Electrical Code.

F. ANSI/NFPA 90A - Installation of Air-Conditioning and Ventilation Systems.

G. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.

H. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.

I. ANSI/ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

J. ANSI/ASTM B32 - Solder Metal.

K. ASTM B280 - Seamless Copper Tube for Air Conditioning & Refrigeration Field Service.

L. ASTM D1693 - Environmental Stress - Cracking of Ethylene Plastics.

1.4 SUBMITTALS

A. Equipment Coordination:

1. The Controls Contractor shall obtain approved equipment submittals from other contractors to determine equipment wiring connections, to choose appropriate controllers, and to provide programming.
2. Control valve selections shall be based on flow rates shown in approved shop drawings.
3. Coordinate the control interface of all equipment with the equipment manufacturers prior to submittal submission.

B. Shop Drawings:

1. Submit shop drawings per Section 230500. In addition, submit an electronic copy of the shop drawings in Adobe Acrobat (.pdf) format to the Owner for review.
2. Cross-reference all control components and point names in a single table located at the beginning of the submittal with the identical nomenclature used in this section.
3. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.
4. System Architecture: Provide riser diagrams of wiring between central control unit and all control panels. This shall include specific protocols associated with each level within the architecture. Identify all interface equipment between CPU and control panels. The architecture shall include interface requirements with other systems including, but not limited to, security systems, lighting control, fire alarm, elevator status, and power monitoring system.
5. Diagrams shall include:

    a. Wiring diagrams and layouts for each control panel showing all termination numbers.
    b. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
    c. Identification of all control components connected to emergency power.
    d. Schematic diagrams for all field sensors and controllers.
    e. A schematic diagram of each controlled system. The schematics shall have all control points labeled. The schematics shall graphically show the location of all control elements in the system.

f. A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, label it with the same name. Label all terminals.
g. A tabular instrumentation list for each controlled system. The table shall show element name, type of device, manufacturer, model number and product data sheet number.
h. All installation details and any other details required to demonstrate that the system will function properly.
i. All interface requirements with other systems.

6. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system enhancement with minimal infrastructure modifications.
7. Sequences: Submit a complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system. The wording of the control sequences in the submittal shall match verbatim that included in the construction documents to ensure there are no sequence deviations from that intended by the Architect/Engineer. Clearly highlight any deviations from the specified sequences on the submittals.
8. Points List Schedule: Submit a complete points list of all points to be connected to the TCS and FMCS. The points list for each system controller shall include both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, the location of the I/O device, and reference drawings. Where a control point is the same as that shown on the control system schematic, label it with the same name. Points list shall specifically identify alarms, trends, event history, archive, totalization, graphic points, and all mapped points from other systems (security systems, lighting control, fire alarm, etc.). Provide points lists, point naming convention, and factory support information for systems provided and integrated into the FMCS.
9. Damper Schedule: Schedule shall include a separate line for each damper and a column for each of the damper attributes:

a. Damper Identification Tag.
b. Location.
c. Damper Type.
d. Damper Size.
e. Duct Size.
f. Arrangement.
g. Blade Type.
h. Velocity.
i. Pressure Drop.
j. Fail Position.
k. Actuator Identification Tag.
l. Actuator Type.
m. Mounting.

10. Valve Schedule: Valve manufacturer shall size valves and create a valve schedule. Schedule shall include a separate line for each valve and a column for each of the valve attributes:

a. Valve Identification Tag.
b. Location.
c. Valve Type.
d. Valve Size.
e. Pipe Size.
f. Configuration.
g. Flow Characteristics.
h. Capacity.
i. Valve C_V.
j. Design Pressure Drop.
k. Pressure Drop at Design Flow.
l. Fail Position.
m. Close-off Pressure.
n. Valve and Actuator Model Number and Type.

11. Airflow Measuring Station Schedule:

    a. The manufacturer's authorized representative shall prepare the airflow measuring station submittal, or review and approve in writing the submittal prepared by the TCC prior to submission to the Architect/Engineer and prior to installation. The representative shall review air handling equipment submittals and duct fabrication drawings to ensure that all AFMS locations meet the appropriate parameters to achieve proper installation and the specified accuracy. Comply with all manufacturer's installation requirements including straight up and downstream duct lengths. Install airflow straighteners if required by the manufacturer based on installation constraints. The Architect/Engineer shall be notified for approval of any deviations.
    b. Submit product data sheets for airflow measuring devices indicating minimum placement requirements, sensor density, sensor distribution, and installed accuracy to the host control system.
    c. Submit installation, operation, and maintenance documentation.

12. Product Data Sheets: Required for each component that includes: unique identification tag that is consistent throughout the submittal, manufacturer's description, technical data, performance curves, installation/maintenance instructions, and other relevant items. When manufacturer's literature applies to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements.
13. Provide PICS files indicating the BACnet functionality and configuration of each device.
14. Provide documentation of submitted products that have been tested and listed by the BACnet Testing Laboratory (BTL), or provide a letter on the manufacturer's company letterhead indicating the anticipated date by which testing is expected to be completed. If, for any reason, BTL testing and listing has not been completed, a written commitment to upgrade installed controls to a version that meets BTL testing and listing requirements if problems are found during BTL testing is required.
15. Graphic Display: Include a sample graphic of each system and component identified in the points list with a flowchart (site map) indicating how the graphics are to be linked to each other for system navigation.

16. Software: A list of operating system software, operator interface software, color graphic software, and third-party software.
17. Control System Demonstration and Acceptance: Provide a description of the proposed process, along with all reports and checklists to be used.
18. Clearly identify work by others in the submittal.
19. Quantities of items submitted may be reviewed but are the responsibility of the Contractor to verify.

C. Operation and Maintenance Manual:

1. In addition to the requirements of Section 230500, submit an electronic copy of the O&M manuals in PDF format.
2. Provide three complete sets of manuals.
3. Each O&M manual shall include:

    a. Table of contents with indexed tabs dividing information as outlined below.
    b. Definitions: List of all abbreviations and technical terms with definitions.
    c. Warranty Contacts: Names, addresses, and 24-hour telephone numbers of contractors installing equipment and controls and service representatives of each.
    d. Licenses, Guarantees, and Warranties: Provide documentation for all equipment and systems.
    e. System Components: Alphabetical list of all system components, with the name, address, and telephone number of the vendor.
    f. Operating Procedures: Include procedures for operating the control systems; logging on/off; enabling, assigning, and reporting alarms; generating reports; collection, displaying, and archiving of trended data; overriding computer control; event scheduling; backing up software and data files; and changing setpoints and other variables.
    g. Programming: Description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.
    h. Engineering, Installation, and Maintenance: Explain how to design and install new points, panels, and other hardware; recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions; how to debug hardware problems; and how to repair or replace hardware. A list of recommended spare parts.
    i. Original Software: Complete original issue CDs for all software provided, including operating systems, programming language, operator workstation software, and graphics software.
    j. Software: One set of CDs containing an executable copy of all custom software created using the programming language, including the setpoints, tuning parameters, and object database.
    k. Graphics: A glossary or icon symbol library detailing the function of each graphic icon and graphics creation and modification. One set of CDs containing files of all color graphic screens created for the project.

D. Training Manual:

1. Provide a course outline and training manuals for each training class.

E. Record Documents:

1. Submit record documentation per Section 230500.
2. Provide a complete set of "as-built" drawings and application software on CDs. Provide drawings as AutoCAD™ or Visio™ compatible files. Provide two copies of the "as-built" drawings with revisions clearly indicated in addition to the documents on compact disk. All as-built drawings shall also be installed on the FMCS server in a dedicated directory. Provide all product data sheets in PDF format.
3. Submit two hard copies and one electronic copy of as-built versions of the shop drawings, including product data and record drawings with revisions clearly indicated. Provide floor plans showing actual locations of control components including panels, thermostats, sensors, and hardware.
4. Provide all completed testing and commissioning reports and checklists, along with all trend logs for each system identified in the points lists.
5. Submit printouts of all graphic screens with current values (temperatures, pressures, etc.) to the Architect/Engineer verifying completion and proper operation of all points.

1.5 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

B. Factory-Mounted Components: Where control devices specified in this section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

1.6 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Control Valves.

B. Flow Switches.

C. Temperature Sensor Sockets.

D. Gauge Taps.

E. Automatic Dampers.

F. Flow Meters.

1.7 AGENCY AND CODE APPROVALS

A. All products shall have the following agency approvals. Provide verification that the approvals exist for all submitted products with the submittal package.

1. UL-916; Energy Management Systems.
2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "Signal Equipment."

3. EMC Directive 89/336/EEC (European CE Mark).
4. FCC, Part 15, Subpart J, Class A Computing Devices.

1.8 ACRONYMS

A. Acronyms used in this specification are as follows:

1. B-AAC BACnet Advanced Application Controller
2. B-ASC BACnet Application Specific Controller
3. BTL BACnet Testing Laboratories
4. DDC Direct Digital Controls
5. FMCS Facility Management and Control System
6. GUI Graphic User Interface
7. IBC Interoperable BACnet Controller
8. IDC Interoperable Digital Controller
9. LAN Local Area Network
10. NAC Network Area Controller
11. ODBC Open DataBase Connectivity
12. OOT Object Oriented Technology
13. OPC Open Connectivity via Open Standards
14. PICS Product Interoperability Compliance Statement
15. PMI Power Measurement Interface
16. POT Portable Operator's Terminal
17. TCC Temperature Control Contractor
18. TCS Temperature Control System
19. WAN Wide Area Network
20. WBI Web Browser Interface

1.9 SUMMARY

A. Provide new standalone FMCS for this project.

B. Niagara Framework/Tridium Based Control System: The TCS provided by the TCC must use the BACnet communication protocol over the standard network. All DDC controllers used in the HVAC controls and lighting controls must be provided with Tridium AX Wizards for use within the Niagara framework.

C. Extend Existing System:

1. Extend the existing FMCS for this project.
2. All controllers and accessories shall interface with the existing FMCS.

D. Owner Furnished System:

1. Owner will furnish FMCS panels, sensors, etc. installed under this contract. Reference control diagrams issued with these documents for required monitoring by this system.

2. The Temperature Control Contractor (TCC) shall receive, store, protect and install the FMCS products supplied by the Owner. These will consist of FMCS panels and subassemblies, prewired outboard gear cabinets (prewired to terminal strips), and those input sensors identified in the project points lists. All work to install this equipment, as well as the necessary piping and wiring, are the responsibility of the TCC. The TCC shall also receive control system drawings provided by the FMCS system manufacturer. The TCC shall create integrated system drawings showing all work provided by the TCC and by the Owner. The Owner will provide a completely functioning operating software package for each FMCS Panel. The Owner will employ the manufacturer to commission the FMCS system hardware. The TCC shall provide manpower at the jobsite whenever the Owner's FMCS supplier is commissioning the system.

E. TCC shall furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management and Control System (FMCS) using Direct Digital Controls as shown on the drawings and as described herein.

F. All labor, material, equipment and software not specifically referred to herein or on the plans that is required to meet the intent of this specification shall be provided without additional cost to the Owner.

G. The Owner shall be the named license holder of all software associated with any and all incremental work on the project.

1.10 SYSTEM DESCRIPTION

A. The entire TCS shall be comprised of a network of interoperable, standalone digital controllers communicating via the following protocol to an NAC. Temperature Control System products shall be as specified below.

B. The FMCS shall include Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the Owner's local or wide area network, depending on configuration. Provide access to the system, either locally in each building or remotely from a central site or sites, through standard Web browsers, via the Internet, and/or via local area network.

C. Provide materials and labor necessary to connect factory supplied control components.

D. Provide central and remote hardware, software, and interconnecting wire and conduit.

E. The FMCS shall include automated alarming software capable of calling e-mail compatible cellular telephones and pagers. The e-mail alarm paging system shall be able to segregate users, time schedules, and equipment and be capable of being programmed by the Owner.

F. For the dedicated configuration tool provided, it is preferable that it be launched from within the applicable Network Management Software. If not, include any software required for controller configuration as a leave-behind tool with enough license capability to support the installation.

G. For each operator workstation provided, furnish one legal copy of all software tools, configuration tools, management tools, and utilities used during system commissioning and installation. All tools shall be readily available in the market. Contractor shall convey to the Owner all software tools and their legal licenses at project closeout.

H. Niagara Framework (Definition):

1. Niagara Framework: A set of hardware and software specifications for building and utility control owned by Tridium Inc. and licensed to multiple vendors. The framework consists of front end (M&C) software, web-based clients, field level control hardware, and engineering tools.
2. Niagara Framework Supervisory Gateway: DDC hardware component of the Niagara Framework. A typical Niagara architecture has Niagara-specific supervisory gateways at the IP level and other (non-Niagara specific) controllers on field networks (TP/FT-10, MS/TP, etc.) beneath the Niagara supervisory gateways. The Niagara specific controllers function as a gateway between the Niagara framework protocol (Fox protocol) and the field network beneath. These supervisory gateways may also be used as general-purpose controllers and also have the capability to provide a web-based user interface. Note that different vendors refer to this component by different names. The most common name is "JACE", which is used in this specification generically; other names include (but are not limited to)"EC-BOS", "FX-40", "TMN", "SLX" and "UNC".

I. Connection:

1. Wireless control systems/functions are acceptable.

a. Wireless System Architecture:

1) The system communications between the network controller(s) and the thermostats shall be a wireless mesh network architecture.
2) The wireless mesh network configuration must adhere to the IEEE 802.15.4 specification and operate in the band of 2.4GHz as a frequency hopping, spread spectrum network.
3) The wireless mesh network shall constitute a wireless communications path between the wireless coordinator(s) and wireless thermostat backplates.
4) The line of site (LOS) range from a wireless coordinator and the wireless thermostat backplate shall be specified at 3,000 feet (915 meters) or greater, and the LOS range from backplate to backplate shall be specified at 1,000 ft (305 meters).
5) Each wireless thermostat backplate shall incorporate wireless mesh network 'hopping' technology, allowing the communications to 'hop' from one backplate to the next.
6) The wireless mesh network configuration must be 'self-healing', attempting to finding alternate paths to the end destination of the communications in the event a known primary path is unavailable.
7) Contractor is responsible to add all equipment necessary (e.g., repeaters) to make system complete and operating. Wireless repeaters shall extend the range of the mesh network and shall provide multiple data routes. Repeaters shall have 15 user-selectable channels. Wireless repeaters shall support up to 15 devices. Power requirements shall be 110 VAC standard outlet (converted to 3.3 VDC by repeater internal adaptor) or 5-30 VDC external DC power supply. Operating frequency band shall be 2.4 GHz ISM Band. Repeaters shall be equipped with omni-directional dipole antennas at 2.4 to 2.5 GHz. Units shall operate at 32degF (0degC) to 122degF (50degC) conditions.

b. Components allowed for wireless:

1) Room sensors (e.g., thermostats, RH, CO2).
2) Application specific controllers.

c. Spaces/areas where wireless is not allowed:

1) Pharmacy
2) Cleanroom
3) Data center

d. Battery shall be replaceable with expected operating life of 15 years based on 30-second transmission frequency.

e. Wireless Testing: The Contractor shall conduct all system testing. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments or corrective action that may be required to provide a complete system that provides the specified performance and all required system features and functions listed herein and as further detailed on the drawings.

1) At a minimum, the installer shall perform the following inspections and tests of the installed wireless controls system:

a) Verify that all features and functionality are operating properly.
b) Verify that the system receives signal from source and synchronizes all devices as specified. If not, Contractor is responsible to add all equipment necessary (e.g., repeaters) to make system complete and operating.
c) Verify that each device receives proper signals.
d) Verify that all controls are properly labeled, and interconnecting wires and terminals are identified.

1.11 SOFTWARE LICENSE AGREEMENT

A. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s). In addition, the Owner shall receive ownership of all job-specific configuration documentation, data files, configuration tools, and application-level software developed for the project. This shall include, but is not limited to, all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use with the NAC, FMCS Server(s), and any related LAN/WAN/intranet and/or Internet connected routers and devices. Provide the Owner with all required IDs and passwords for access to any component or software program. The Owner shall determine which organizations shall be named in the SI organization ID ("orgid") of all software licenses. Owner shall be free to direct the modification of the "orgid" in any software license, regardless of supplier.

B. For Niagara based systems, it is the express goal of this specification to implement an open system that will allow products from various suppliers to be integrated into a unified system in order to provide flexibility for expansion, maintenance, and service of the system. The Owner shall be the named license holder of all software associated with any and all incremental work on the project(s).

1. All Niagara Framework components have an unrestricted interoperability license with a Niagara Compatibility Statement (NiCS) following the Tridium Open NiCS Specification and have a value of "ALL" for "Station Compatibility In", "Station Compatibility Out", "Tool Compatibility In", and "Tool Compatibility Out". Note that this will result in the following entries in the license file:

    a. accept.station.in="*"
    b. accept.station.out="*"
    c. accept.wb.in="*"
    d. accept.wb.out="*"

2. The Owner shall be free to direct the modification of the any software license, regardless of supplier. In addition, the Owner shall receive ownership of all job specific software configuration documentation, data files, and application-level software developed for the project. This shall include all custom, job-specific software code and documentation for all configuration and programming that is generated for a given project and/or configured for use within Niagara Framework (Niagara)-based controllers and/or servers and any related LAN/WAN / intranet and internet connected routers and devices. Any and all required IDs and passwords for access to any component or software program shall be provided to the Owner. Provide all software necessary for developing software algorithms in all supervisory, programmable, and application specific direct digital controllers that are licensed to the Owner.
3. Programming tools for programmable and application specific controllers that use the Niagara Framework shall not be restricted to any specific brand of JACE. Tools and controllers shall be able to connect to any brand of JACE that are provided under this specification section.

    a. For each application generic controller with a Niagara Framework Wizard and for each application specific controller, provide Niagara Framework Wizards.
    b. For each Niagara Framework Supervisory Gateway, provide a backup of all software within the Niagara Framework Supervisory Gateway, including configuration settings. This backup must be sufficient to allow restoration of the Niagara Framework Supervisory Gateway or the replacement of the Niagara Framework Supervisory Gateway.
    c. Provide a Niagara Framework Engineering Tool. Submit software user manuals with the Niagara Framework Engineering Tool submittal.
    d. Provide the Niagara Station ID for each Niagara Framework Supervisory Gateway.

C. The energy metering system is a Tridium-based system using JACE's with I/O modules for single inputs and direct communications to meters that provide multiple points of data. All meters, metering points, and wiring are furnished and installed by the TCC.

1.12 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It is this Contractor's responsibility to check the Contract Documents for possible conflicts between the Work of this section and that of other crafts in equipment location; pipe, duct and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

1.13 WARRANTY

A. Refer to Section 230500 for warranty requirements.

B. Within the warranty period, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this Contractor at no expense to the Owner.

C. Warranty requirements include furnishing and installing all FMCS software upgrades issued by the manufacturer during the one-year warranty period.

D. Update all software and back-ups during warranty period and all user documentation on the Owner's archived software disks.

1.14 WARRANTY ACCESS

A. The Owner shall grant to this Contractor reasonable access to the TCS and FMCS during the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. BACnet Protocol with Tridium Niagara Platform:

1. Alerton
2. Automated Logic: WebCTRL
3. Delta Controls: ORCA
4. Honeywell
5. Johnson Controls: Metasys Extended Architecture
6. Siemens Building Technologies: DESIGO
7. Schneider Electric - EcoStruxure Building Operation
8. Trane Tracer SC
9. Distech Controls

2.2 SYSTEM ARCHITECTURE

A. General:

1. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall consist of a network of interoperable, standalone digital controllers, a computer system, graphic user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein.
2. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

B. Open, Interoperable, Integrated Architectures:
   1. All components and controllers supplied under this Division shall be true "peer-to-peer" communicating devices. Components or controllers requiring "polling" by a host to pass data are not acceptable.
   2. The supplied system must be able to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs are not acceptable.
   3. Hierarchical or "flat" topologies are required to have system response times as indicated below and to manage the flow and sharing of data without unduly burdening the customer's internal intranet network.

      a. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network connected user interfaces.
      b. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

A. The Local Area Network (LAN) shall be a 100 megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP. Provide support for multiple Network Area Controllers (NACs), user workstations and, if specified, a local server.

B. Local area network minimum physical and media access requirements:

   1. Ethernet; IEEE Standard 802.3.
   2. Cable; 100 Base-T, UTP-8 wire, Category 6.
   3. Minimum throughput; 100 Mbps.

C. Communication conduits shall not be installed closer than six feet from 110VAC or higher transformers or run parallel within six feet (1800 mm) of electrical high-power cables. Route the cable as far from interference generating devices as possible. Where communication wire must cross 110VAC or higher wire, it must do so at right angles.

D. Ground all shields (earth ground) at one point only to eliminate ground loops. Provide all shield grounding at the controller location, with the shield at the sensor/device end of the applicable wire being left long and "safed" off in an appropriate manner.

E. There shall be no power wiring more than 30 VAC rms run in conduit with communications wiring. In cases where signal wiring is run in conduit with communication wiring, run all communication wiring and signal wiring using separate twisted pairs (24awg) in accordance with the manufacturer's wiring practices.

2.4 REMOTE NETWORK ACCESS

A. For Local Area Network installations, provide access to the LAN from a remote location via the Internet. The Owner shall provide a connection to the Internet to enable this access via high-speed cable modem, asynchronous digital subscriber line (ADSL) modem, ISDN line, T1 Line or via the customer's intranet to a corporate server providing access to an Internet Service Provider (ISP). Customer agrees to pay monthly access charges for connection and ISP.

2.5 NETWORK AREA CONTROLLER (NAC)

A. The TCC shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of NACs required depends on the type and quantity of devices provided under Divisions 23 and 26. The TCC shall determine the quantity and type of devices.

B. NAC shall be provided with open connectivity to any manufacturer's BACnet programmable or application specific direct digital controllers. These controllers shall be JACE 8000 Series models or the identical hardware private label equivalent. The programmable controllers and application specific controllers provided under this section shall be able to be programmed by their respective engineering software application tools through the Niagara-based supervisory controllers from the Ethernet level network. The engineering software application tools shall be able to be loaded on a personal computer with Ethernet connectivity, and no additional hardware shall be required to connect to and download any programmable or application specific controller.

C. Each NAC shall provide the interface between the LAN or WAN and the field control devices and shall provide global supervisory control functions over the control devices connected to the NAC. It shall execute application control programs to provide:

1. Calendar functions.
2. Scheduling.
3. Trending.
4. Alarm monitoring and routing.
5. Time synchronization.
6. Integration of all controller data.
7. Network Management functions.

D. The Network Area Controller shall provide the following hardware features as a minimum:

1. One Ethernet Port - 10/100 Mbps.
2. One RS-232 port.
3. One LonWorks Interface Port - 78KB FTT-10A (for LonWorks systems only).
4. One RS-485 port.
5. Battery backup.
6. Flash memory for long-term data backup. (If battery backup or flash memory is not supplied, the controller shall contain a hard disk with at least 1 gigabyte storage capacity.)
7. The NAC must be capable of operation over a temperature range of 32°F (0°C) to 122°F (50°C).

8. The NAC must be capable of withstanding storage temperatures of between 0°F (0°C) and 158°F (70°C).
9. The NAC must be capable of operation over a humidity range of 5% RH to 95% RH, non-condensing.

E. The NAC shall provide multiple user access to the system and support for ODBC or SQL. Databases resident on the NAC shall be ODBC-compliant or must provide an ODBC data access mechanism to read and write data stored within it.

F. The NAC shall support standard Web browser access via the Internet or an intranet and a minimum of five (5) simultaneous users.

G. Event Alarm Notification and Actions:

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a LAN, remote via dial-up telephone connection, or WAN.
3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:

    a. Alarm
    b. Normal

4. Provide for the creation of a minimum of eight alarm classes with different routing and acknowledgement properties, e.g. security, HVAC, Fire, etc.
5. Provide timed (scheduled) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object "runtime" and/or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

H. Treat control equipment and network failures as alarms and annunciated.

I. Annunciate alarms in any of the following manners as defined by the user:

1. Screen message text.
2. E-mail of the complete alarm message to multiple recipients. Provide the ability to route and e-mail alarms based on:

    a. Day of week.
    b. Time of day.
    c. Recipient.

3. Pagers via paging services that initiate a page on receipt of e-mail message.
4. Graphic with flashing alarm object(s).
5. Printed message, routed directly to a dedicated alarm printer.

J. The FMCS shall record the following for each alarm:

1. Time and date.
2. Location (building, floor, zone, office number, etc.).

3. Equipment tag.
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

K. Give defined users proper access to acknowledge any alarm.

L. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

M. Provide a "query" feature to allow review of specific alarms by user-defined parameters.

N. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

O. An error log to record invalid property changes or commands shall be provided and available for review by the user.

2.6 LONWORKS FMCS

A. Provide a peer-to-peer networked, standalone, distributed control system with the capability to integrate LonWorks technology, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices within the system. In addition, adherence to industry standards, including LonMark to assure interoperability between all system components, is required. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file and a resource file for the device.

C. Systems employing a "flat" architecture shall encapsulate LonTalk packets into TCP/IP messages to increase network bandwidth.

D. Interoperable Digital Controller (IDC):

1. Controls shall be microprocessor based Interoperable LonMarkä or LonWorks Controllers (IDC). Where possible, all Interoperable Digital Controllers shall bear the applicable LonMarkä interoperability logo on each product delivered.
2. HVAC control shall be accomplished using LonMarkä based devices where the application has a LonMark profile defined. Where LonMark devices are not available for a particular application, devices based on LonWorks are acceptable. For each LonWorks device that does not have LonMark certification, the device supplier must provide an XIF file for the device. Publicly available specifications for the Applications Programming Interface (API) must be provided for each LonWorks/LonMark controller defining the programming or setup of each device. The Contractor shall provide all programming, documentation and programming tools necessary to set up and configure the supplied devices per the specified sequences of operation.

3. The Contractor shall connect the LonWorks network trunk to the nearest Network Area Controller (NAC). Coordinate locations of the NACs to ensure that maximum network wiring distances, as specified by the LonWorks wiring guidelines, are not exceeded. A maximum of 126 devices may occupy any one LonWorks trunk and must be installed using the appropriate trunk termination device. All LonWorks and LonMark devices must be supplied using FTT-10A LonWorks communications transceivers.
4. The NAC shall provide all scheduling, alarming, trending, and network management for the LonMark / LonWorks based devices.
5. The IDCs shall communicate with the NAC at a baud rate of not less than 78.8K baud. The IDC shall provide LED indication of communication and controller performance to the technician without cover removal.
6. All IDCs shall be fully application programmable and shall at all times maintain their LonMark certification, if so certified. Controllers offering application selection only (non-programmable) require a 10% spare point capacity to be provided for all applications. All control sequences within or programmed into the IDC shall be stored in non-volatile memory that does not depend on a battery to be retained.
7. The Contractor supplying the IDCs shall provide documentation for each device, with the following information at a minimum:

    a. Network Variable Inputs (NVIs); name and type.
    b. Network Variable Outputs (NVOs); name and type.
    c. Network configuration parameters (NCI, NCO); name and type.

8. The Contractor shall ensure that the proper Network Variable Inputs and Outputs (NVI and NVO) are provided in each IDC as required by the points list.

9. The supplier of any programmable IDC shall provide one copy of the manufacturer's programming tool, with documentation, to the Owner.

E. LonWorks Network Management:

1. The GUI software shall provide a complete set of integrated LonWorks network management tools for working with LonWorks networks. These tools shall manage a database for all LonWorks devices by type and revision, and shall provide a software mechanism for identifying each device on the network. These tools shall also be capable of defining network data connections between LonWorks devices, known as "binding." Systems requiring the use of third-party LonWorks network management tools shall not be accepted.

2. Network management shall include the following services:

    a. Device identification.
    b. Device installation.
    c. Device configuration.
    d. Device diagnostics.
    e. Device maintenance.
    f. Network variable binding.

3. The network configuration tool shall also provide diagnostics to identify devices on the network, to reset devices, and to view health and status counters within devices.

4. These tools shall provide the ability to "learn" an existing LonWorks network, regardless of what network management tool(s) were used to install the existing network, so that existing LonWorks devices and newly added devices are part of a single network management database.
5. The network management database shall reside in the NAC, ensuring that anyone with proper authorization has access to the network management database at all times. Systems employing network management databases that are not resident at all times within the control system are not acceptable.

2.7 BACNET FMCS

A. The intent of this specification is to provide a peer-to-peer networked, standalone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices in the system. Adherence to industry standards including the latest ANSI/ASHRAE Standard 135 (BACnet) to assure interoperability between all system components is required. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP) and/or RS-485 (BACnet MSTP).

C. Interoperable BACnet Controller (IBC):

1. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the latest ANSI/ASHRAE Standard 135. Provide IBCs for unit ventilators, fan coils, heat pumps, terminal air boxes (TAB) and other applications. The application control program shall reside in the same enclosure as the input/output circuitry that translates the sensor signals. Provide a PICS document showing the installed system's compliance level to ANSI/ASHRAE Standard 135. Minimum compliance is Level 3.
2. The IBCs shall be listed by the BACnet Testing Laboratory (BTL) as follows:

    a. BACnet Building Controller(s) (B-BC).
    b. BACnet Advanced Application Controller(s) (B-AAC).
    c. BACnet Application Specific Controller(s) (B-ASC).

3. The IBCs shall communicate with the NAC via an Ethernet connection at a baud rate of not less than 10 Mbps.
4. Each IBC sensor shall connect directly to the IBC and shall not use any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the POT.

5. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable) require a 10% spare point capacity to be provided for all applications. Store all control sequences within or programmed into the IBC in non-volatile memory that does not depend on a battery to be retained.
6. The Contractor supplying the IBCs shall provide documentation for each device, with the following information at a minimum:

    a. BACnet Device; MAC address, name, type and instance number.
    b. BACnet Objects; name, type and instance number.

7. It is the responsibility of the Contractor to ensure that the proper BACnet objects are provided in each IBC.

D. Object Libraries:

1. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
2. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
3. In addition to the standard libraries specified here, the system supplier shall maintain an on-line accessible (over the Internet) library, available to all registered users, to provide new or updated objects and applications as they are developed.
4. All control objects shall conform to the control objects specified in the BACnet specification.
5. The library shall include applications or objects for the following functions, at a minimum:

    a. Scheduling Object: The schedule must conform to the schedule object as defined in the BACnet specification, providing seven-day plus holiday and temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphic sliders to speed creation and selection of on-off events.
    b. Calendar Object: The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphic "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
    c. Override Object: Provide override object that is capable of restarting equipment turned off by other energy saving programs to maintain occupant comfort or for equipment protection.
    d. Start-Stop Time Optimization Object: Provide a start-stop time optimization object to start equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled unoccupied time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start-stop time object properties based on historical performance.

e. Demand Limiting Object: Provide a demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, gas, etc.). The object shall be able to monitor a demand value and predict (using a sliding window prediction algorithm) the demand at the end of the user-defined interval period (1 to 60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user-defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment setpoints to provide the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the setpoint, display a message on the user's screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to provide both equipment protection and occupant comfort.

6. The library shall include control objects for the following functions:

a. Analog Input Object: Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
b. Analog Output Object: Minimum requirement is to comply with the BACnet standard for data sharing.
c. Binary Input Object: Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment runtime by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.
d. Binary Output Object: Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as start-to-start delay must be provided. Incorporate the BACnet Command Prioritization priority scheme to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide 16 levels of priority as a minimum. Systems not employing the BACnet method of contention resolution are not acceptable.
e. PID Control Loop Object: Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable to allow proportional control only, or proportional with integral control, or proportional, integral and derivative control.
f. Comparison Object: Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
g. Math Object: Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.

h. Custom Programming Objects: Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including, but not limited to, math and logic functions and string manipulation. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for reuse.
i. Interlock Object: Provide an interlock object that provides a means of coordination of objects within a piece of equipment, such as an air handler or other similar types of equipment. An example is to link the return fan to the supply fan such that, when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming, thereby eliminating nuisance alarms during the off period.
j. Temperature Override Object: Provide an object whose purpose is to override a binary output to an "on" state in the event a user-specified high or low limit value is exceeded. Link this object to the desired binary output object as well as to an analog object for temperature monitoring to cause the override to be enabled. This object will execute a start command at the Temperature Override level of start/stop command priority, unless changed by the user.
k. Composite Object: Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphic shell of this container.

7. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). Provide the following as part of the standard library included with the programming software:

a. LonMark/LonWorks Devices: These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. Support all network variables defined in the LonMark profile. The device manufacturer shall provide information (type and function) regarding network variables not defined in the LonMark profile.
b. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file, and documentation for the device to facilitate device integration.
c. For BACnet devices, provide the following objects:

1) Analog In.
2) Analog Out.
3) Analog Value.
4) Binary.
5) Binary In.

6) Binary Out.
7) Binary Value.
8) Multi-State In.
9) Multi-State Out.
10) Multi-State Value.
11) Schedule Export.
12) Calendar Export.
13) Trend Export.
14) Device.

d. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.
e. For BACnet devices, provide the following support at a minimum:

1) Segmentation.
2) Segmented Request.
3) Segmented Response.
4) Application Services.
5) Read Property.
6) Read Property Multiple.
7) Write Property.
8) Write Property Multiple.
9) Confirmed Event Notification.
10) Unconfirmed Event Notification.
11) Acknowledge Alarm.
12) Get Alarm Summary.
13) Who-has.
14) I-have.
15) Who-is.
16) I-am.
17) Subscribe COV.
18) Confirmed COV notification.
19) Unconfirmed COV notification.
20) Media Types.
21) Ethernet.
22) BACnet IP Annex J.
23) MSTP.
24) BACnet Broadcast Management Device (BBMD) function.
25) Routing.

2.8 DATA COLLECTION AND STORAGE (TRENDING REQUIREMENTS)

A. The NAC shall be able to collect data for any property of any object and store resident in the NAC that shall have, at a minimum, the following configurable properties:

1. Designating the log as interval or deviation.
2. For interval logs, configure the object for time of day, day of week and the sample collection interval.
3. For deviation logs, configure the object for the deviation of a variable to a fixed value. This value, when reached, will initiate logging of the object.

4. For all logs, provide the ability to set the maximum number of data stores for the log and to set whether the log will stop collecting when full or rollover the data on a first-in, first-out basis.
5. Each log shall have the ability to have its data cleared on a time-based event or by a user-defined event or action.

B. Store all log data in a relational database in the NAC that is accessible from a server (if the system is so configured) or a standard Web browser.

C. All log data, when accessed from a server, shall be capable of being manipulated using standard SQL statements.

D. All log data shall be available to the user in ALL the following data formats:

1. HTML.
2. XML.
3. Plain text.
4. Comma or tab separated values.

E. The NAC shall archive its log data either locally (to itself) or remotely to a server or other NAC on the network. Provide the ability to configure the following archiving properties:

1. Archive on time of day.
2. Archive on user-defined number of data stores in the log (buffer size).
3. Archive when log has reached its user-defined capacity of data stores.
4. Provide ability to clear logs once archived.

2.9 AUDIT LOG

A. Provide and maintain an audit log that tracks all activities performed on the NAC. Provide the ability to specify a buffer size for the log and the ability to archive log based on time or when the log has reached its user-defined buffer size. Provide the ability to archive the log locally (to the NAC), to another NAC on the network, or to a server. For each log entry, provide the following data:

1. Time and date.
2. User ID.
3. Change or activity: i.e., change setpoint, add or delete objects, commands, etc.

2.10 DATABASE BACKUP AND STORAGE

A. The NAC shall automatically backup its database on a user-defined time interval.

B. Store copies of the current database and, at the most, the recently saved database in the NAC. The age of the most recently saved database shall depend on the user-defined database save interval.

C. Store the NAC database in XML format to allow viewing and editing. Other formats are acceptable as long as XML format is supported.

2.11 GRAPHIC USER INTERFACE SOFTWARE

A. Operating System:

1. Provide computer with the most current Microsoft-based operating system with which the GUI has proven compatibility.

B. The GUI shall employ browser-like functionality for ease of navigation. It shall include a tree view (similar to Windows Explorer) for quick viewing of, and access to, the hierarchical structure of the database. In addition, menu pulldowns and toolbars shall employ buttons, commands and navigation to permit the operator to perform tasks with basic computing skills. These shall include, but are not limited to, forward/backward buttons, home button, and a context sensitive locator line (similar to a URL line) that displays the location and the selected object identification.

C. Point Organization: Organize points by equipment categories, location, or other means acceptable to Owner.

D. Real-Time Displays: The GUI shall support the following graphic features and functions:

1. Graphic screens shall be developed using any drawing package capable of generating a GIF, BMP, or JPG file. Use of proprietary graphic file formats is not acceptable. In addition to, or in lieu of, a graphic background, the GUI shall support the use of scanned pictures.
2. Graphic screens shall be able to contain objects for text, real-time values, animation, color spectrum objects, logs, graphs, HTML or XML document links, schedule objects, hyperlinks to other URLs, and links to other graphic screens.
3. Graphics shall support layering, and each graphic object shall be configurable for assignment to a layer. A minimum of six layers shall be supported.
4. Modifying common application objects, such as schedules, calendars, and setpoints, shall be accomplished graphically.

    a. Schedule times shall be adjusted using a graphic slider without requiring any keyboard entry from the operator.
    b. Holidays shall be set by using a graphic calendar without requiring any keyboard entry from the operator.

5. Commands to start and stop binary objects shall be made by selecting the object and the appropriate command from a pop-up menu. No text entry shall be required.
6. Adjustments to analog objects, such as setpoints, shall be made by selecting the object and using a graphic slider to adjust the value. No text entry shall be required.

E. System Configuration: At a minimum, the GUI shall include the necessary software and components to enable the operator to perform the following tasks with proper password access:

1. Create, delete or modify control strategies.
2. Add/delete objects.
3. Tune control loops by adjusting control loop parameters.
4. Enable or disable control strategies.
5. Generate hard copy records or control strategies on a printer.
6. Select alarm points and define the alarm state.

7. Select points to be trended and initiate the recording of values automatically.
8. View any trend as a graph.

F. On-Line Help: Provide a context sensitive, on-line help system to assist the operator in operation and editing of the system. On-line help shall be available for all applications and shall provide the relevant data for that particular screen. Additional help information shall be available using hypertext. All system documentation and help files shall be in HTML format.

G. Security: Each operator shall be required to log on to that system with a username and password to view, edit, add, or delete data. System security shall be selectable for each operator. The system administrator shall be able to set passwords and security levels for all other operators. Each operator password shall be able to restrict the operator's access for viewing and/or changing each system application, full screen editor, and object. Each operator shall be automatically logged off the system if no keyboard or mouse activity is detected. This auto log-off time shall be set per operator password. Store all system security data in an encrypted format.

H. System Diagnostics: The system shall automatically monitor the operation of all workstations, printers, modems, network connections, building management panels, and controllers. Annunciate the failure of any device to the operator.

I. Alarm Console:

1. The system shall have a dedicated alarm window or console. This window will notify the operator of an alarm condition, and allow the operator to view details of the alarm and to acknowledge the alarm.
2. When the alarm console is enabled, a separate alarm notification window will supersede all other windows on the desktop and shall not be capable of being minimized or closed by the operator. This window will notify the operator of new alarms and un-acknowledged alarms. Alarm notification windows or banners that can be minimized or closed by the operator are not acceptable. The use of the alarm console can be enabled or disabled by the system administrator.

2.12 WEB BROWSER CLIENTS

A. The system shall be capable of supporting an unlimited number of clients using a standard Web browser such as Internet Explorer™, Firefox™, or Chrome. Systems requiring additional software to enable a standard Web browser to reside on the client machine, or manufacturer-specific browsers, are not acceptable.

B. The Web browser shall provide the same view of the system, in terms of graphics, schedules, calendars, logs, etc., and provide the same interface methodology as is provided by the Graphic User Interface. Systems that require different views or that require different means of interacting with objects, such as schedules or logs, are not permitted.

C. The Web browser client shall provide:

1. User log-on identification and password shall be required. If an unauthorized user attempts access, display a blank web page. Implement security using Java authentication and encryption techniques to prevent unauthorized access.

2. Graphic screens developed for the GUI shall be the same screens used for the Web browser client. The web browser interface shall support all animated graphic objects supported by the GUI.
3. HTML programming shall not be required to display system graphics or data on a Web page. HTML editing of the Web page shall be allowed if the user desires a specific look or format.
4. Store all graphic screens in the Network Area Controller (NAC) without requiring any graphics storage on the client machine.
5. Real-time values displayed on a Web page shall update automatically without requiring a manual "refresh" of the Web page.
6. Users shall have administrator-defined access privileges. Depending on the access privileges assigned, the user shall be able to perform the following:

    a. Modify common application objects, such as schedules, calendars, and setpoints, graphically.

        1) Schedule times shall be adjustable using a graphic slider, without requiring any keyboard entry from the operator.
        2) Holidays shall be set using a graphic calendar, without requiring any keyboard entry from the operator.

    b. Commands to start and stop binary objects shall be made by right-clicking the selected object and selecting the appropriate command from a pop-up menu. No text entry shall be required.
    c. View logs and charts.
    d. View and acknowledge alarms.
    e. Setup and execute SQL queries on log and archive information

7. The system shall be able to specify a user's (as determined by the log-on user identification) home page. Provide the ability to limit a specific user to just his/her defined home page. From the home page, links to other views or pages in the system shall be possible, if allowed by the system administrator.
8. Graphic screens on the Web Browser client shall support hypertext links to other locations on the Internet or on intranet sites by specifying the Uniform Resource Locator (URL) for the desired link.

2.13 SERVER FUNCTIONS AND HARDWARE

A. Provide a central server located at Main IT room. The server shall support all NACs connected to the customer's network whether local or remote.

B. Local connections shall be via an Ethernet LAN. Remote connections can be via ISDN, ADSL, T1, or dial-up connection.

C. It shall be possible to provide access to all NACs via a single connection to the server. In this configuration, each NAC can be accessed from a remote GUI or from a standard WBI by connecting to the server.

D. The server shall provide the following functions:

1. Global Data Access: The server shall provide complete access to distributed data defined anywhere in the system.
2. Distributed Control: The server shall provide the ability to execute global control strategies based on control and data objects in any NAC in the network, local or remote.
3. The server shall include a master clock service for its subsystems and provide time synchronization for all NACs.
4. The server shall accept time synchronization messages from trusted precision atomic clock Internet sites and update its master clock based on this data.
5. The server shall provide scheduling for all Network Area Controllers and their underlying field control devices.
6. The server shall provide demand limiting that operates across all NACs. The server must be capable of running multiple demand programs for sites with multiple meters and/or multiple sources of energy. Each demand program shall be able to support separate demand shed lists.
7. The server shall implement the BACnet Command Prioritization scheme (16 levels) for safe and effective contention resolution of all commands issued to NACs.
8. Each NAC supported by the server shall be able to automatically archive its log data, alarm data and database to the server. Archiving options shall be user-defined, including archive time and archive frequency.
9. The server shall provide central alarm management for all NACs supported by the server. Alarm management shall include:

    a. Routing alarms to display, printer, e-mail, and pagers.
    b. Viewing and acknowledging alarms.
    c. Querying alarm logs based on user-defined parameters.

10. The server shall provide central management of log data for all NACs supported by the server. Log data shall include process logs, runtime and event counter logs, audit logs and error logs. Log data management shall include:

    a. Viewing and printing log data.
    b. Exporting log data to other software applications.
    c. Querying log data based on user-defined parameters.

11. Reports shall be generated automatically or manually, and directed to LCD displays, printers, or disk files. The system shall allow the user to easily obtain the following types of reports:

    a. List all points in network.
    b. List all points in alarm.
    c. List all off-line points.
    d. List all points in override status.
    e. List all disabled points.
    f. List all points that are locked out.
    g. List all items defined in a "follow-up" file.
    h. List all weekly and holiday schedules.
    i. List all limits and deadbands.

E. Server Hardware Requirements:

1. Provide a High-Mid Range CPU as defined by www.cpubenchmark.net (minimum processing speed of 2.9 GHz with 8.0 GB RAM and a 1-terabyte minimum hard drive). It shall include one parallel port, one asynchronous serial port and four USB ports. Include a 21" minimum flat panel color monitor, 8ms response time.
2. The server operating system shall be the latest version of Microsoft Windows and Microsoft internet browser.
3. Connect to the FMCS network via an Ethernet network interface card, 1 Gbps.
4. Provide a color laser printer with a minimum 600 x 600-dpi resolution and 12 ppm print speed.
5. For dedicated alarm printing, provide a continuous feed printer using roll or fan-fed microperforated paper. The printer shall have a parallel port interface.

2.14 GRAPHIC USER INTERFACE COMPUTER HARDWARE (LAPTOP COMPUTER)

A. Provide a High-Mid Range CPU as defined by www.cpubenchmark.net with 8 GB RAM and 750-gigabyte minimum hard drive. Laptop computer shall be equipped with minimum 15" screen.

B. The workstation operating system shall be the latest version of Microsoft Windows and Microsoft internet browser.

C. Connect to the FMCS network via a 10/100 Mbps Ethernet network interface card.

D. Provide a color laser system printer with a minimum 600 x 600-dpi resolution and 12 ppm print speed.

2.15 UNINTERRUPTIBLE POWER SUPPLY (UPS)

A. A UPS shall be provided for each of the following:

1. FMCS workstations and servers.
2. Network area controllers.

B. Provide a 120-volt 60 Hz line-interactive uninterruptible power supply with backup battery capacity for two (2) minutes at 100% load. UPS shall have hot swappable batteries, automatic battery self-test and start-on-battery capabilities. Batteries shall be valve regulated, sealed lead acid type. UPS shall have sine wave shape output waveform. UPS shall be UL 1778 list and comply with FCC Part 15, Class A.

C. Manufacturers:

1. Sola/Hevi-Duty
2. Eaton Powerware
3. APC

2.16 SYSTEM PROGRAMMING

A. The GUI software shall perform system programming and graphic display engineering. Access to the GUI software shall be through password access as assigned by the system administrator.

B. Provide a library of control, application, and graphic objects to enable creation of all applications and user interface screens. Applications shall be created by selecting the control objects from the library, dragging or pasting them on the screen, and linking them together using a built-in graphic connection tool. Completed applications may be stored in the library for future use. GUI screens shall be created in the same fashion. Data for the user displays shall be obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Provide all software tools or processes to create applications and user interface displays.

C. Programming Methods:

1. Provide the capability to copy objects from the supplied libraries or from a user-defined library to the user's application. Link objects with a graphic linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; e.g., internal, external, hardware, etc.
2. Configuration of each object shall be done through the object's property sheet using fill-in-the-blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration is not acceptable.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real time. Systems requiring the uploading, editing, and downloading of database objects are not allowed.
5. The system shall support object duplication in a customer's database. An application, once configured, can be copied and pasted for easy reuse and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.17 DDE DEVICE INTEGRATION

A. The NAC shall support the integration of device data via Dynamic Data Exchange (DDE) over the Ethernet network. The NAC shall act as a DDE client to another software application that functions as a DDE server.

B. Provide the required objects in the library included with the Graphic User Interface programming software to support the integration of these devices into the FMCS. Objects provided shall include, at a minimum:

1. DDE Generic AI Object.

2. DDE Generic AO Object.
3. DDE Generic BO Object.
4. DDE Generic BI Object.

2.18 MODBUS SYSTEM INTEGRATION

A. The NAC shall support integration of device data from Modbus RTU, ASCII, and TCP control system devices. Connect to the Modbus system via an RS-232, RS485, or Ethernet IP as required by the device.

B. Provide the required objects in the library included with the GUI programming software to support the integration of the Modbus system data into the FMCS. Objects provided shall include, at a minimum:

1. Read/Write Modbus AI Registers.
2. Read/Write Modbus AO Registers.
3. Read/Write Modbus BI Registers.
4. Read/Write Modbus BO Registers.

C. The NAC shall perform all scheduling, alarming, logging and global supervisory control functions of the Modbus system devices.

D. The FMCS supplier shall provide a Modbus system communications driver. The equipment system vendor that provided the equipment using Modbus shall provide documentation of the system's Modbus interface and shall provide factory support at no charge during system commissioning.

2.19 OPC SYSTEM INTEGRATION

A. The Network Area Controller shall act as an OPC client and shall support the integration of device data from OPC servers. The connection to the OPC server shall be Ethernet IP. The OPC client shall support third-party OPC servers compatible with the Data Access 1.0 and 2.0 specifications.

B. Provide the required objects in the library included with the GUI programming software to support the integration of the OPC system data into the FMCS. Objects provided shall include:

1. Read/Write OPC AI Object.
2. Read/Write OPC AO Object.
3. Read/Write OPC BI Object.
4. Read/Write OPC BO Object.
5. Read/Write OPC Date/Time Input Object.
6. Read/Write OPC Date/Time Output Object.
7. Read/Write OPC String Input Object.
8. Read/Write OPC String Output Object.

C. The NAC shall perform all scheduling, alarming, logging and global supervisory control functions of the OPC system devices.

D. The FMCS supplier shall provide an OPC client communications driver. The vendor that provided the equipment using OPC shall provide documentation of the system's OPC server interface and shall provide free factory support during system commissioning.

2.20 SOFTWARE

A. IDC/IBCs shall operate totally standalone and independent of a central computer for all specified control applications.

B. Software shall include a complete operating system (OS), communications handler, point processing, energy management application packages as specified herein, standard control algorithms and specific control sequences (IDC/IBC) and an Owner/user custom control calculation package complete with interpreter.

C. OS software shall be PROM resident, operate in real time, provide prioritized task scheduling, control time programs, monitor and manage communications, and scan inputs and outputs.

D. Each IDC/IBC panel shall include the following energy management routines:

1. Time of day scheduling.
2. Optimum start/stop.
3. Peak demand limiting.
4. Economizer control.
5. PID control.
6. Supply air reset.
7. Outdoor air reset.

E. Input/output point processing software shall include:

1. Update of all connected input and output points at least once per second.
2. Analog to digital conversion, scaling and offset, correction of sensor non-linearity, sensing no response or failed sensors, and conversion of values to 32-bit floating point format. Retain both the maximum and minimum values sensed for each analog input in memory. It shall be possible to input subsets of standard sensor ranges to the A/D converter and assign gains to match the full-scale 32-bit conversion to achieve high accuracy readout.
3. A reasonability check on all analog inputs against previous values and discarding of values falling outside preprogrammed reasonability limits.
4. Assignment of proper engineering units and status conditions to all inputs and outputs.
5. Analog input alarm comparison with the ability to assign two individual sets of high and low limits (warning and alarm) to an input or to assign a set of floating limits (alarm a reset schedule or FMCS control point) to the input. Assign each alarm a unique differential to prevent a point from oscillating in and out of alarm. Make alarm comparisons of each scan cycle.
6. Adjustment of timing from two seconds to two minutes in one-second increments to eliminate nuisance alarms on startup.

F. Command Control software shall manage the receipt of commands from the server and from control programs.

1. Provide command delay to prevent simultaneous energizing of loads. Delay must be programmable from 0 to 30 seconds.
2. Assign each command a command and residual priority to manage conflicts created by multiple programs having access to the same command point. Allow only outputs with a higher command priority to execute. Whenever a command is allowed to execute, its assigned residual priority shall replace the existing residual priority.
3. A "fixed mode" option (override) shall allow inputs to and outputs from control programs to set to a fixed state or value. When in the "fixed mode", assign inputs and outputs high residual command priority to prevent override by application programs.

G. Alarm lockout software shall prevent nuisance alarms. On initial start-up of mechanical equipment, assign a "timed lockout" period to analog points to allow them to reach a stable condition before activating alarm comparison logic. Lockout period shall be programmable for each point from 0 to 90 minutes in one-minute increments.

H. A "hard lockout" shall also be provided to positively lock out alarms when equipment is turned off or when a true alarm depends on the condition of an associated point. Hard lockout points and lockout initiators shall be operator programmable.

I. Runtime shall be accumulated based on the status of a digital input point. It shall be possible to totalize either on time or off time up to 10,000 hours with one-minute resolution. Runtime counts shall reside in non-volatile memory and have DCP resident runtime limits assignable through the operator's terminal.

J. A transition counter shall count the number of times a device is cycled on or off. Counter shall be non-volatile and capable of counting 600,000 cycles. Limits shall be assignable to counts to provide maintenance alarm printouts.

K. Custom IDC/IBC programs shall meet the control strategies called for in the sequence of operation of these specifications. Each IDC/IBC shall have resident in its memory and available to the programs a full library of IDC/IBC algorithms, intrinsic control operators, arithmetic, logic, and relational operators. Provide the following features:

1. Proportional Control, Proportional plus Integral (PI), Proportional plus Integral plus Derivative (PID), and Adaptive Control (self-learning). Use Adaptive Control where the controlled flow rate is variable (such as TAB units and variable flow pumping loops). The adaptive control algorithm shall monitor the loop response to output corrections and adjust the loop response characteristics in accordance with the time constant changes imposed by variable flow rates. The algorithm shall operate in a continuous self-learning manner and shall retain in memory a stored record of the system dynamics so that, on system shutdown and restart, the learning process starts from where it left off. Standard PID algorithms are not acceptable substitutes for variable flow applications since they will provide satisfactory control at only one flow rate and will require continued manual fine tuning.
2. All IDC/IBC setpoints, gains and time constants associated with IDC/IBC programs shall be available to the operator for display and modification via the operator workstation.
3. The execution interval of each IDC/IBC loop shall be adjustable from 2 to 120 seconds in one-second increments.
4. IDC/IBC control programs shall assign initialization values to all outputs so controlled devices assume a failsafe position on start-up.

L. Provide time and event programming (TEP) capability to initiate a controlled sequence of events for execution at a specific time or upon the occurrence of an event. Minimum program features required are:

1. Analog points commandable to a specific value.
2. Digital points commandable to a specific state, e.g. on or off; fast, slow or off.
3. Initiator to be a specific day and time or a specific event, e.g. an alarm.
4. Manual initiation via operator's command.
5. Commands must honor command delays (to prevent current surges), and assigned minimum ON and OFF times.
6. Commands must honor command and residual priority structures allowing higher priority commands (like smoke control) to override lower priority commands (like time-of-day scheduling) and residual priority.
7. Ability to chain TEPs.
8. Ability to enable and disable TEPs individually.
9. Ability to enable/disable TEP initiators.

M. Store Energy Management application programs and associated data files in non-volatile or 72-hour battery backed RAM memory. Individual programs shall be accessible from the operator workstation for enabling/disabling and program parameter modification and shall include:

1. Time Programs:

   a. Provide an independent start and stop program time for each system identified in the points list.
   b. It shall be possible to assign two independent start and stop times/days to any equipment connected to a controller.

2. Exception Day Scheduling:

   a. Provide an Exception Day program for holiday and other planned exceptions to time programs. Exception schedules shall be DSC resident and operator programmable up to one year in advance.
   b. The program shall allow definition of up to 32 exception time spans. Define each span by calendar start day and calendar stop day.

3. An IDC/IBC resident temporary scheduler shall allow operators to modify present time program control of equipment. Minimum feature set required is:

   a. Ability to alter time schedules as much as six days in advance.
   b. Ability to alter either start time, stop time or both for each day.
   c. Temporary schedule shall be in effect for all days specified.
   d. Automatically delete the temporary schedule and restore program to normal schedule after execution.
   e. Ability to assign schedule changes as permanent as well as temporary.

N. The IDC/IBC shall have built-in, non-descriptive, self-test procedure for checking the indication lights, digital display, and memory. It shall display advisories for maintenance, performance, and/or software problems.

O. All electronics shall be:

1. Standard locally stocked modular boards.
2. Plug-in type.
3. Furnish all ROM programs unlocked.

2.21 CONTROL DAMPERS

A. Rectangular Control Dampers - Standard Construction:

1. Shall be licensed to bear the AMCA Certified Rating Seal.
2. Test leakage and pressure drop per AMCA 500.
3. Frame: Hat-shaped channel, minimum 12 gauge (2.05 mm) extruded aluminum, and minimum 4" (100 mm) deep. Caulk or weld seams to prevent leakage.
4. Blades: Minimum 12 gauge (2.05 mm) extruded aluminum airfoil design, minimum 6" (150 mm) wide, and overlapping blades and blade seals (overlapping blade seals only is unacceptable).
5. Shaft: Non-cylindrical, solid aluminum or zinc plated steel with opening in blade to match profile of shaft. Shaft shall be securely fastened to the blade and of sufficient length to mount direct-coupled actuator. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
6. Bearings: Acetal (Delrin/Celcon) inner bearing fixed to an aluminum shaft, rotating within a polycarbonate outer bearing inserted in the frame. Provide thrust bearings for vertical damper applications.
7. Blade Seals: Extruded silicone gaskets secured in an integral slot within the blade.
8. Side Seals: Stainless steel compression type or extruded silicone gasket secured in an integral slot within the frame.
9. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft. Blades linked for opposed operation, unless noted otherwise on the drawings. Blades shall close evenly. Use one direct-coupled actuator per damper section. Jack-shafting is not acceptable.
10. Size Limits: 48" (1220 mm) maximum horizontal blade length, 24 square foot (2.2 m2) maximum area per damper. Total cross-sectional area of dampers in ducts shall be at least as large as the duct without the use of blank-off sections.
11. Maximum Leakage: Class 1A at 1" w.c. (0.25 kPa) pressure differential for a 24" (600 mm) x 24" (600 mm) damper.
12. Maximum Pressure Drop for Opposed Blade Damper: 0.15" (0.04 kPa) for 8,000 CFM (3775 L/s) through a 24" (600 mm) x 24" (600 mm) damper (2000 fpm (10 m/s)).
13. Maximum Pressure Drop for Parallel Blade Damper: 0.08" (0.02 kPa) for 8,000 CFM (3775 L/s) through a 24" (600 mm) x 24" (600 mm) damper (2000 fpm (10 m/s)).

B. Thermally Insulated Control Damper:

1. Shall be licensed to bear the AMCA Certified Rating Seal.
2. Test leakage and pressure drop per AMCA 500.
3. Frame: Extruded aluminum, minimum 4" (100 mm) deep, 0.080" (2 mm) minimum thickness.
4. Thermally Broken Frame: Extruded aluminum, minimum 4" (100 mm) deep, 0.080" (2 mm) minimum thickness, flanged to duct. Entire frame shall be thermally broken using polyurethane resin pockets, complete with thermal cuts.

5. Blades: Minimum 12 gauge (2.05 mm) extruded aluminum airfoil design, minimum 6" (150 mm) wide, internally insulated with expanded polyurethane foam and thermally broken, with overlapping blades and blade seals (overlapping blade seals only is unacceptable).
6. Shaft: Non-cylindrical, solid aluminum or zinc plated steel shaft with opening in blade to match profile of shaft. Shaft shall be securely fastened to the blade and of sufficient length to mount direct-coupled actuator. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
7. Bearings: Acetal (Delrin/Celcon) inner bearing fixed to an aluminum shaft, rotating within a polycarbonate outer bearing inserted in the frame. Provide thrust bearings for vertical damper applications.
8. Side Seals: Stainless steel compression type or extruded silicone gasket secured in an integral slot within the frame.
9. Linkage: Shall be concealed in the frame, constructed of aluminum or corrosion-resistant zinc plated steel, and securely fastened to shaft. Blades linked for opposed operation, unless noted otherwise on the drawings. Blades shall close evenly. Use one direct-coupled actuator per damper section. Jack-shafting is not acceptable.
10. Size Limits: 48" (1220 mm) maximum horizontal blade length, 24 square foot (2.2 m2) maximum area per damper. Total cross-sectional area of dampers in ducts shall be at least as large as the duct without the use of blank-off sections.
11. Maximum Leakage: Class 1A at 1" w.c. (0.25 kPa) pressure differential for a 24" (600 mm) x 24" (600 mm) damper.
12. Maximum Pressure Drop: 0.21" (0.05 kPa) for 8,000 CFM (3775 L/s) through a 24" (600 mm) x 24" (600 mm) damper (2000 fpm (10 m/s)).

C. Round Galvanized Steel Control Dampers:

1. Test leakage and pressure drop per AMCA 500.
2. Frame: Minimum 20 gauge (1.0 mm) galvanized steel, 10" (250 mm) long.
3. Bearings: Provide thrust bearings for vertical damper applications.
4. Blades: Two-layer galvanized steel, equivalent 14-gauge (2.0 mm) thickness with neoprene or polyethylene foam seal enclosed in two-piece blade construction up to 24" (600 mm), 10-gauge (3.57 mm) steel over 24" (600 mm).
5. Linkage: Stainless steel, minimum 1/2" (12 mm) diameter shaft through 24" (600 mm), 3/4" (20 mm) shaft over 24" (600 mm) size. Stainless steel bearings. Shaft shall be securely keyed to blades and of sufficient length to mount direct-coupled actuator. Install damper with the shaft horizontal to the floor. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
6. Maximum Leakage: 8 CFM (3.8 L/s) maximum at 1" w.c. (0.25 kPa) pressure differential for a 24" (600 mm) x 24" (600 mm) damper.
7. Maximum Pressure Drop: 0.10" (0.02 kPa) for 6,280 CFM (2960 L/s) through a 24" (600 mm) damper (2,000 fpm (10 m/s)).

D. Round Stainless-Steel Control Dampers:

1. Test leakage and pressure drop per AMCA 500.
2. Frame: Hat-shaped channel, minimum 10-gauge (3.57 mm) Type 304 stainless steel (304L or 316L for welded duct). Caulk or weld seams to prevent leakage.
3. Bearings: Provide thrust bearings for vertical damper applications.
4. Blades: Minimum 12-gauge (2.78 mm) Type 304 stainless steel construction. No seals are required.

5. Linkage: Stainless steel, minimum 1/2" (12 mm) diameter shaft through 12" (300 mm), 3/4" (20 mm) shaft through 24" (600 mm), 1" (25 mm) shaft over 24" (600 mm) size. Stainless steel bearings. Shaft shall be securely keyed to blades and of sufficient length to mount direct-coupled actuator. Install damper with the shaft horizontal to the floor. Damper manufacturer shall provide drive pin extensions and outboard bearing support brackets as required.
6. Maximum Leakage: 26 CFM (12 L/s) maximum at 1" w.c. (0.25 kPa) pressure differential for a 24" (600 mm) x 24" (600 mm) damper.
7. Maximum Pressure Drop: 0.15" (0.04 kPa) for 6,280 CFM (2960 L/s) through a 24" (600 mm) damper (2,000 fpm (10 m/s)).

2.22 DAMPER ACTUATORS

A. Damper Actuators - Electronic:

1. Actuator shall be UL 873 or 60730 listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation. Mount actuator by means of a V-bolt dual nut clamp with a V-shaped toothed cradle, directly couple and mount to the valve bonnet stem, or ISO-style direct-coupled mounting pad. Actuators shall be capable of being mechanically and electrically paralleled to increase torque, if required.
2. Actuators shall be warranted for a period of five (5) years from the date of production, with the first two (2) years unconditional.
3. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.
4. Fail-Safe Dampers: Where shown on the drawings or sequences, fail-safe mechanism shall operate the damper to the fail position following power interruption.

    a. Mechanical/Spring: Mechanical spring return mechanism to drive controlled drive to an end position (open or close) on loss of power.
    b. Electronic: Electronic fail-safe shall incorporate an active balancing circuit to maintain equal charging rates among the capacitors. The power fail position shall be proportionally adjustable between 0 to 100% in 10 percent increments with a 10 second operational delay.
5. Feedback: Where shown on drawings or sequences, provide analog feedback signal for positive position indication.
6. Damper End Switches: Where shown on the drawings or sequences, provide end switches to prove damper reaches open/closed position.

2.23 CONTROL INSTRUMENTATION

A. Temperature Measuring Devices:

1. Electric Thermostats:

    a. Single Temperature - Line Voltage Electric: Integral manual ON/OFF/AUTO selector switch, minimum dead band of 5°F (3°C), concealed temperature adjustment, locking cover, rated for load, single or double pole as required.

b. Single Temperature - Low Voltage Electric: Integral manual ON/OFF/AUTO selector switch, minimum dead band of 5°F (3°C), anticipator circuits, concealed temperature adjustment, locking cover, 24 V control transformer (if not included with unit under control), single or double pole as required.

2. Low Limit Switch:

a. Provide one foot (3400 mm) of sensing element for each one square foot (square meter) of coil area, maximum element length, 25 feet (7600 mm) of the vapor tension type, so that any point along the entire length of measuring element can trigger the switch.
b. Provide 3" (80 mm) minimum radius capillary support clips at each turn.
c. Furnish each thermostat with one single pole, single throw normally-opened switch and one single pole, single throw normally-closed auxiliary switch.
d. Setpoint range shall be 15°F (-9°C) to 55°F (13°C) with a permanent stop at 35°F (2°C).
e. Differential shall be fixed at approximately 5°F (3°C) and supplied with manual reset.

B. Temperature Sensors:

1. Room Temperature Sensor:

a. Sensor Only: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F (7°C) to 90°F (32°C) operating range, ± 0.50°F (0.25°C) accuracy, no setpoint adjustment or override button.
b. Sensor with Setpoint Adjustment: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F (7°C) to 90°F (32°C) operating range, ± 0.50°F (0.25°C) accuracy, with exposed single setpoint adjustment (no numeric temperature scale - provide with a single warmer/cooler or red/blue visual scale), no override button.
c. Sensor with Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F (7°C) to 90°F (32°C) operating range, ± 0.50°F (0.25°C) accuracy, occupied/unoccupied override button with LED, no setpoint adjustment.
d. Sensor with Setpoint Adjustment and Override: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F (7°C) to 90°F (32°C) operating range, ± 0.50°F (0.25°C) accuracy, with exposed single setpoint adjustment (no numeric temperature scale - provide with a warmer/cooler or red/blue visual scale), occupied/unoccupied override button with LED.

2. Duct Temperature Sensor:

a. RTD type averaging sensor. 1000-ohm platinum RTD; accuracy: minimum +/- 1.2°F (0.6°C); range -40°F-220°F (4°C-104°C).
b. Sensing element shall have a minimum of 1 foot (0.3 m) of sensor length for each 2 square feet (0.2 square meter) of duct or coil area. Sensor shall be arranged evenly across the duct or coil such that no point in the duct or coil is more than 1 foot (0.3 m) away from the sensor.

c. Probe type thermistors are acceptable in VAV box duct applications downstream of reheat coils.

3. Water Temperature Sensor:

a. RTD type. 1000-ohm platinum RTD; accuracy: minimum +/- 0.65°F (0.4°C); range -40°F-220°F (4°C-104°C).
b. Thermowell: RTD must be installed within a 316 stainless steel thermowell using a non-hardening heat conducting paste. Thermowell shall be rated for a minimum static pressure of 500 psig (3447 kpa) at the maximum operating temperature and be capable of withstanding water velocities of up to 27 fps (8.2 mps). The sensor shall be mounted so that it extends into the flow stream to a minimum of 1/3 of the diameter of the pipe. For pipes greater than 10-inch (250 mm) diameter, thermowell shall be installed in a position 45 degrees from the bottom of the pipe. Separate thermometers, as specified elsewhere, shall be installed within 2 feet (600 mm) of each temperature sensor.

C. Humidity Measuring Devices:

1. Humidity Sensors:

a. Humidity Sensors: Fully electronic with no moving parts or parts requiring periodic service. Accuracy shall be minimum of 2.0 %RH accuracy from 0-90 %RH and 2.5 %RH accuracy from 90-100 %RH humidity at temperatures from 50°F (10°C) to 104°F (40°C).

2. Humidistats:

a. Room Humidistats: Wall-mounted, proportioning type, with adjustable 2% RH throttling range, operating range from 30% to 80% at temperatures up to 110°F (43°C), cover with concealed setpoint. Accuracy shall be minimum of 1.5 %RH accuracy from 0-90 %RH and 2.5 %RH accuracy from 90-100 %RH at temperatures from 50°F (10°C) to 104°F (40°C).
b. Duct Humidistats: Proportioning insertion type, with adjustable 2% RH throttling range and operating range from 20% to 80% at temperatures up to 150°F (66°C). Accuracy shall be minimum of 1.5 %RH accuracy from 0-90 %RH and 2.5 %RH accuracy from 90-100 %RH at temperatures from 50°F (10°C) to 104°F (40°C).
c. High Limit Duct Humidistat: 2-position insertion type, with differential maximum 2% RH.

D. Combination Room Temperature/Humidity Sensors:

1. Wall-mounted two-piece construction, plastic enclosure, off-white color with temperature and humidity measurement, exposed single setpoint adjustment and occupant override. Large display with temperature and %RH readout display, occupied/unoccupied override button with LED, and membrane keypad and gasketing for wipe-down cleaning.
2. Temperature Component: Thermistor sensing element or resistance temperature device (RTD), 45°F (7°C) to 90°F (32°C) operating range, ± 0.50°F (0.25°C) accuracy.
3. Humidity Component: Proportioning type, with adjustable 2% RH throttling range, operating range from 0% to 90% at temperatures up to 110°F (43°C). Accuracy shall be minimum of 2.0 %RH accuracy from 0-90 %RH.

E. Enthalpy Sensors: Duct-mounted enthalpy sensor shall include solid state temperature and humidity sensors with electronics that shall output a 4-20 ma signal input to the controller upon a varying enthalpy (total heat) to enable economizer modes of operation when outside air enthalpy is suitable for free cooling.

F. Pressure Measuring Devices

1. Differential Pressure Switches:

a. Standard Pressure Switches:

1) Diaphragm-activated gauge with 4-3/4" (120 mm) dial, cast aluminum case, sealed interior, designed to resist shock and vibration, and rated for 15 psig (105 kPa gauge).
2) Accuracy shall be ± 3% of full-scale maximum throughout entire range at 70°F (21°C).
3) Provide mounting brackets, probes, and shutoff valves required for proper installation.
4) The range and service shall be as required for application or as noted on the drawings.

2. Pressure Transmitters/Transducer:

a. Air-to-Air:

1) Provide transducer having the following minimum performance for measuring duct static pressure for VFD control or measuring differential pressure across filter banks:

a) Accuracy: ±1.0% FS
b) Non-Linearity, BFSL: ±0.96% FS
c) Hysteresis: 0.10% full scale
d) Non-Repeatability: 0.05% full scale
e) Thermal Effects (compensated range): 0°F to +150°F (-17°C-66°C)
f) Maximum Line Pressure: 10 PSI (69kPa)
g) Zero/Span Shift: 0.033%FS/°F
h) Long Term Stability: 0.5%FS/1year

2) Provide transducer with the following minimum performance for measuring differential pressure across piezometer fan inlet airflow measuring stations:

a) Unit shall come factory equipped with static tube attached.
b) Unit shall include: (1) LCD shall display differential pressure on face of sensor enclosure over the entire operational range, and (2) IPCC-rated polycarbonate enclosure with short circuit proof outputs and reverse polarity protected inputs.
c) Accuracy at 72°F (22°C): ±0.25% FS
d) Stability: ±0.25% full scale per year
e) Temperature Error: (1) Zero: ±0.025% full scale per °C, (2) Span: Maximum ±0.03% full scale per °C
f) Environmental Operating Range: 32°F to 140°F (0°C-60°C).

g) Overpressure: Proof: (1) 2 psi (17 kPa), (2) Burst: 3 psi (159 kPa)
h) Humidity: 0% to 95% RH non-condensing.

G. Flow Measuring Devices:

1. Airflow Measuring Stations:

a. Duct Mounted Airflow Measuring Stations (AFMS) - Thermal Dispersion:
1) Transmitters:
a) Option 4: LonWorks Free Topology

b. Fan Inlet Airflow Measuring Stations (AFMS) - Thermal Dispersion:

1) Sensor assemblies shall be mounted on 304 stainless steel housings.
2) Mounting rods shall be field adjustable to fit the fan inlet and constructed of nickel-plated steel.
3) Mounting feet shall be constructed of 304 stainless steel and securely riveted in place to prevent loosening over time due to vibration.
4) The operating airflow range shall be 0 to 10,000 FPM (50 m/s) unless otherwise indicated on the plans.
5) Transmitters

a) The transmitter shall have an integral 16-character alphanumeric LCD display capable of simultaneously displaying individual airflow and temperature.
b) The transmitter shall be capable of field configuration and diagnostics using an on-board interface and LCD display.
c) The operating temperature range for the transmitter shall be -20° F (29°C) to 120° F (71°C).
d) The transmitter shall be capable of communicating with other devices using one of the following interface options:
e) Option 1: Linear analog output signals for airflow and temperature: Field selectable, fuse protected and isolated, 0-10VDC/4-20mA (4-wire)
f) Option 2: RS-485: Field selectable BACnet-ARCNET, BACnet-MS/TP, Modbus-RTU or Johnson Controls N2-Bus. BACnet devices shall provide analog variables for airflow and temperature containing individual sensor airflow rate and temperature data.
g) Option 3: 10 Base-T Ethernet: Field selectable BACnet Ethernet, BACnet-IP, Modbus-TCP and TCP/IP. Provide dynamic link libraries and VBA functions to interface Ethernet devices to Microsoft Excel for remote monitoring of airflow and temperature using a Windows 2000 or Windows XP based PC.
h) Option 4: LonWorks Free Topology

6) The AFMS shall be UL listed as an entire assembly.

c. Fan Inlet Airflow Measuring Stations - Differential Pressure:

1) Fan Inlet Measuring Station Pressure Sensors, Transmitters and Transducers:

a) Select for appropriate pressure range, fan type, inlet velocity, and airflow volume.
b) Transmitter features and minimum performance requirements shall be as follows: (1) Combined Accuracy: ± 0.50%, (2) Terminal Point Nonlinearity: ± 0.40%, (3) Hysteresis: ± 0.02%., (4) Non-repeatability: ± 0.05%, (5) Compensation Range - Zero Shift: ±0.025% FS/°F (±0.050% FS/°C), Span Shift: 0.025% FS/°F (0.050% FS/°C), (6) Differential Overpressure: 5 psi (35 kPa) proof and 25 psi (170 kPa) burst pressure, (7) Output signal: 0 to 10 VDC.
c) Each transducer shall be provided with an integral manual zeroing valve to allow for field calibration of the zero-reference value without the need for shutting the operating system down.
d) System airflow (measured in CFM (L/s)) shall be continuously displayed on an LCD display meter (0.5 inches (12 mm) high by 3.5 digits) located on the face of the air volume/velocity transducer control enclosure.

d. Mounting of fan inlet static pressure sensing elements shall be in accordance with manufacturer's published installation instructions to ensure accuracy of readings.
e. Current Measuring Devices:

2. Current Switches for Constant Speed Motors:

a. Digital device rated for amperage load of motor or device with split core design, adjustable high and low trip points, 600 VAC rms isolation, induced power from the monitored load, LED indicator lamps for output status and sensor power. The device shall sense overloading, belt-loss, and power failure with a single signal.

3. Current Switches for Motors Controlled by VFD:

a. Digital device rated for amperage load of motor or device with split core design, factory programmed to detect motor undercurrent conditions on variable or constant volume loads, self-calibrating, positive status indication, LED indicator lamps, 600 VAC rms isolation, induced power from the monitored load with NO output. The current sensor shall store the motor current operating parameters in non-volatile memory and have a pushbutton reset to clear the memory if the operating parameters change or the sensor is moved to another load. The device shall sense overloading, belt-loss, and power failure with a single signal. The sensor shall be mounted on the load side of variable frequency drives.

H. Carbon Dioxide Sensors:

1. Microprocessor based non-dispersive infrared sensor with range of 0 to 2,000 ppm CO2 with ± 100 ppm accuracy, maximum drift (compensated) of ± 5% full scale in five years, VOC software and hardware sensing, duct mounting where applicable, 0-10V dc or 4-20 mA output directly proportional to ppm, adjustable alarm limit, membrane filter, and terminal block. The diffusion gas chamber in the sensor shall incorporate a reflective light pipe or wave guide surrounded by a gas permeable membrane that prevents particulate contamination of the sensor. Unit shall have selectable IAQ mode with output signal and sum of CO2 and VOC levels.

I. Miscellaneous Devices:

1. Application Specific Controller Power Supply:

a. For use with fan coil unit.
b. Provide multiple enclosures with the following accessories and components as required to provide 24VAC power to terminal air boxes, differential pressure monitors, damper actuators, valve actuators, and other components and devices as required.
c. NEMA-1 steel enclosures (12" (300 mm)x12" (300 mm)x6" (150 mm)) with separate high and low voltage compartments and separate access covers.
d. Either one 300 VA power supply with three 100 VA Class 2 outputs, or one 500 VA power supply with five 100 VA Class 2 outputs.
e. Primary side shall receive 480/277/240/120 input to 24 VAC ungrounded, isolated output on the secondary side.
f. Each secondary output shall include a 4-amp breaker, on/off switch, and LED indicator. Terminal blocks shall accept 16-22 AWG wire.
g. Acceptable Manufacturer:

1) RIB Functional Devices Model MSH300A-LVC or PSH500A-LVC

2. Control Relays:

a. Form "C" contacts rated for the application with "push-to-test" contact transfer feature and an integral LED to indicate coil energization.
b. Mount all relays and power supplies in a NEMA 1 enclosure beside the FMCS panel or controlled device and clearly label their functions.

3. Thermostat and Sensor Enclosures:

a. Clear plastic guard with lock. Wire guard with tamperproof screws. Setpoint shall be adjustable with cover in place. Fasten to wall separately from thermostat. Provide guards in all corridors, gymnasiums, locker rooms, toilet rooms, assembly halls and as noted on the drawings.
b. Heavy Duty Enclosure:

1) Perforated steel, tamperproof locking thermostat and control device enclosure.
2) Box shall be nominally 8"x6"x2" (200x150x50 mm) deep or sized as required to fit devices to be enclosed.
3) Perforated cover shall be 16-gauge (1.52 mm) steel with maximum 3/16" (5 mm) perforations on maximum 1/4" (6 mm) staggered centers for a 55% free area.
4) Secure to wall from inside of box. Cover shall be secured by tamperproof screws to frame.
5) Color shall match electrical devices. Verify color with the Electrical Contractor.

4. Twist Timers:

    a. Wall-mounted heavy duty, with rotary dial and face graduated in minutes or hours as noted. Unit shall fit behind standard "decorator" wall plate. Color of timer and face plate shall match remainder of project. Verify with Electrical Contractor. Provide wall plate and engraved plastic label indicating service.
    b. Switch shall be rated for 20 amps at 125 volts (10 amps at 277 volts) and fit standard 2-1/2" (65 mm) deep electrical box.
    c. Provide time cycle noted on the drawings or in the specifications; up to 12 hours.
    d. Manufacturers:

        1) Paragon SWD Series
        2) Tork A500 Series
        3) Intermatic FD Series
        4) Marktime Series 93

5. Drain Pan Condensate Overflow Switch: Float with integral magnet overflow switch conforming to UL508. No standby power required.

J. Outdoor Weather Station:

1. Outdoor rated ventilated plastic enclosure, off-white color, radiation shield including the following parameters.
2. Measured Parameters:

    a. Temperature Sensor: Thermistor sensing element or resistance temperature device (RTD).

        1) Operating Range: -40°F (-40°C) to 140°F (60°C)
        2) Accuracy: ± 0.54°F (0.3°C) at 68°F (20°C)

    b. Humidity Sensors: Fully electronic with no moving parts or parts requiring periodic service.

        1) Measurement Range: 0-100% RH
        2) Accuracy:

            a) ± 3% of reading from 0%-90% RH at 50°F (10°C) to 86°F (30°C)
            b) ± 5% of reading from 0%-90% RH at -4°F (-20°C) to 50°F (10°C) and 86°F (30°C) to 140°F (60°C).

3. Calculated Parameters:

    a. Dew Point Temperature in °F (°C)
    b. Wet Bulb Temperature in °F (°C)
    c. Enthalpy. Enthalpy sensor shall output a 4-20 ma signal input to the controller upon a varying enthalpy (total heat) to enable economizer modes of operation when outside air enthalpy is suitable for free cooling.

2.24 CONDUIT AND BOXES

A. Conduit and Boxes: Refer to Electrical Section 260533 for materials, sizing, and other requirements

B. Conduit and Box Identification (Color and Labeling):
1. Refer to Electrical Section 260553 for raceway and box labeling requirements.

2.25 WIRE AND CABLE

A. Wire and Cable: Refer to Electrical Section 260513 for wire and cable materials.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Verify that systems are ready to receive work. Beginning of installation means installer accepts existing conditions.

B. Install system and materials in accordance with manufacturer's instructions.

C. Drawings of the TCS and FMCS network are diagrammatic only. Any apparatus not shown but required to meet the intent of the project documents shall be furnished and installed without additional cost.

D. Install all operators, sensors, and control devices where accessible for service, adjustment, calibration, and repair. Do not install devices where blocked by piping or ductwork. Devices with manual reset or limit adjustments shall be installed below 6'-0" (1800 mm) if practical to allow inspection without using a ladder.

E. Verify locations of wall-mounted devices (such as thermostats, temperature and humidity sensors, and other exposed sensors) with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Maximum height above finished floor shall not exceed ADA mounting requirements.

F. Provide valves over 3/4" (20 mm) size with position indicators and pilot positioners where sequenced with other controls.

G. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room.

H. After completion of installation, test and adjust control equipment.

I. Check calibration of instruments. Recalibrate or replace.

J. Furnish and install conduit, wire, and cable per the National Electric Code, unless noted otherwise in this section.

K. All controls associated with the proper operation of air handling units, pumps, or other mechanical equipment served by emergency power shall be connected to the emergency power system. Control components shall be powered from the optional standby branch of emergency power. In no instance shall panel be connected to the life safety branch of the emergency power system. Panels may be connected to a common 20-amp, 120-volt circuit provided the total load on the circuit does not exceed 16 amps. Circuit conductors shall be sized per the table below. All power connections to the control panels shall be performed by a licensed electrician at the cost of this Contractor. Submit circuit information (total amperage on circuit, conductors length, and panel) for control panels to the Architect/Engineer for approval.

Circuit Load (Amps)	Circuit Max Length	Feeder Size
≤ 5	≤ 200ft60m	2#12 & 1#12 ground in 3/4"20 mm conduit.
≤ 10	≤ 100ft30m	2#12 & 1#12 ground in 3/4"20 mm conduit.
≤ 16	≤ 75ft23m	2#12 & 1#12 ground in 3/4"20 mm conduit.
≤ 200	≤ 325ft100m	2#10 & 1#10 ground in 3/4"20 mm conduit.
≤ 100	≤ 160ft49m	2#10 & 1#10 ground in 3/4"20 mm conduit.
≤ 75	≤ 100ft30m	2#10 & 1#10 ground in 3/4"20 mm conduit.

L. All hardware, software, equipment, accessories, wiring (power and sensor), piping, relays, sensors, power supplies, transformers, and instrumentation required for a complete and operational FMCS system, but not shown on the electrical drawings, are the responsibility of the TCC.

M. Labels For Control Devices:

1. Provide labels indicating service of all control devices in panels and other locations.
2. Labels may be made with permanent marking pen in the control panels if clearly legible.
3. Use engraved labels for items outside panel such as outside air thermostats.
4. Labels are not required for room thermostats, damper actuators and other items where their function is obvious.

N. VFDs:

1. This project includes several variable frequency drives to control the flow of fans and/or pumps based on a control variable.
2. Verify output signal required, 4-20 mA or 0-10V dc, with the EC.
3. If VFD has a bypass feature, auxiliary contacts on the drive may not be used for motor status. A separate relay must be used to indicate motor rotation in either hand or auto positions.
4. If a separate current transmitter or switch is indicated for status, install this device between the VFD and the motor. In this case, the drive status may be connected to the auxiliary contacts in the VFD.
5. Some devices, such as low limits and fire alarm shutdown relays, must be hardwired to the fan motor. Make connections such that fan will shut down whether in hand or auto position if the unit has a bypass feature.

O. Airflow Stations:

1. The transmitter shall be installed at a location that is protected from weather, water, and vibration.
2. Mount transmitter where they can easily be read (36" (900 mm) to 66" (1680 mm) above floor). Do not fasten transmitters directly to ductwork or compromise duct insulation.
3. The manufacturer's authorized representative shall visit the project site during construction prior to station installations to confirm all submitted sizes, mounting requirements and locations. Size adjustments shall be made at no additional cost. The representative shall meet on site with the TCC to support and train them on proper installation procedures and calibration.
4. Install labels at each sensor and transmitter identifying its service.

3.2 GRAPHIC DISPLAY

A. Create a customized graphic for each piece of equipment indicated on the itemized points list.

B. Components shall be arranged on graphic as installed in the field.

C. Include each graphic point listed in the itemized points list using real time data.

D. Provide a graphic representation of the following:

1. Where there are multiple buildings, color code the campus map by the systems serving that building. The building graphic shall be linked to the graphic for that building's systems.
2. Where there are multiple floors, provide color codes/designations for the areas served by each AHU and TAB by floor.
3. Where multiple AHUs serve one floor, color code the areas served by each AHU. The area shall be linked to the graphic for that area's AHU.
4. Provide an overall floor plan of each floor of the building color coded by zone linked to the TAB for that zone. The zone shall be linked to the graphic for that zone's TAB graphic.
5. Show the location of each thermostat on the floor plan.
6. Provide separate graphics showing the chilled and heating water system flow diagram. Show temperatures and flows on the flow diagram. Each piece of equipment shown on the flow diagram shall be linked to the graphic for that piece of equipment.
7. Provide a graphic showing the steam system flow diagram. Show pressures and flows on the flow diagram. Each piece of equipment shown on the flow diagram shall be linked to the graphic for that piece of equipment.

E. The FMCS shall include full graphic operator interface to display the following graphics as a minimum:

1. Home page to include a minimum of six critical points: Outside Air Temperature, Outside Air Relative Humidity, Enthalpy, KWH, KW, etc.
2. Graphic floor plans accurately depicting rooms, walls, hallways, and showing accurate locations of space sensors and major mechanical equipment.
3. Detailed graphics for each mechanical system including AHUs, ERUs, EFs, chillers, and boilers, as a minimum.

4. Access corresponding system drawings, technical literature, and sequences of operations directly from each system graphic.

F. The FMCS shall include individual graphical buttons to access the following data stored in PDF format:

1. Project control as-built documentation including all TCS drawings, diagrams and sequences of operation.
2. TCS Bill of Material for each system, e.g. AHU, RTU, FCU, boiler, etc.
3. Technical literature specification data sheets for all components listed in the TCS Bill of Material.

3.3 CONDUIT AND BOXES INSTALLATION

A. Conduit and Box Installation: Refer to Electrical Section 260533 for execution and installation.

B. Conduit and Box Identification (color and labeling) installation. Refer to Electrical Section 260553 for raceway and box identification installation.

C. Outlet Box Schedule: Thermostat/temperature sensor:

1. Dry Interior Locations: Provide 4" (100mm) square galvanized steel with raised cover to fit flush with finished wall line. When located in concrete block walls, provide square edge title cover of sufficient depth to extend out to face of block or masonry boxes.
2. Other Conditions: Refer to Electrical Section 260533 for requirements.

3.4 WIRE AND CABLE INSTALLATION

A. Wire and Cable Installation: Refer to Electrical Section 260513 for execution and installation.

B. Field Quality Control:

1. Inspect wire and cable for physical damage and proper connection.
2. Torque test conductor connections and terminations to manufacturer's recommended values.
3. Perform continuity test on all conductors.
4. Protection of cable from foreign materials:

a. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.

b. Overspray of paint on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

C. Installation Schedule:

1. Conduit terminations to all devices installed in applications with rotating equipment, expansion/contraction or vibration shall be made with flexible metallic conduit, unless noted otherwise. Final terminations to exterior devices installed in damp or wet locations shall be made with liquidtight flexible metallic conduit. Terminations in hazardous areas, as defined in the National Electrical Code, shall be made with flexible conduit rated for the environment.

3.5 COMMISSIONING

A. Upon completion of the installation, this Contractor shall load all system software and start up the system. This Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.

B. This Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the FMCS system operation.

C. This Contractor shall prove that the controls network is functioning correctly and within acceptable bandwidth criteria and shall test the system with an approved protocol analysis tool. Provide a log and statistics summary showing that each channel is within acceptable parameters. Each channel shall be shown to have at least 25% spare capacity for future expansion.

D. Upon completion of the performance tests described above, repeat these tests, point by point, as described in the validation log above in the presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

E. System Acceptance: Satisfactory completion is when this Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.6 PREPARATION FOR BALANCING

A. Verify that all dampers are in the position indicated by the controller (e.g., open, closed or modulating).

B. Check the calibration and setpoints of all controllers.

C. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.

D. Check that all sequences operate as specified. Verify that no simultaneous heating and cooling occurs, unless specified. Observe that heating cannot begin at TAB reheat terminals until the unit is at the minimum CFM (airflow).

E. Verify the operation of all interlock systems.

3.7 TEST AND BALANCE COORDINATION

A. The Contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.

B. The Contractor shall provide a minimum of four (4) hours training for the Balancing Contractor in the use of these tools.

C. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process until the first 20 terminal units are balanced.

D. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

3.8 DEMONSTRATION AND ACCEPTANCE

A. At completion of installation, provide two days minimum instruction for operators. Demonstrate operation of all controls and systems. Describe the normal operation of all equipment.

3.9 TRAINING

A. On-Site:

1. After completion of commissioning, the manufacturer shall provide training on consecutive days for Owner's representatives. The training course shall enable the Owner's representatives to perform Day-to-Day Operations as defined herein. A factory-trained instructor with experience in presenting the training material and the system programmer for this project shall perform the training.
2. One month after completion of commissioning, the manufacturer shall provide training on consecutive days for Owner's representatives. The training course shall enable the Owner's representatives to perform Advanced Operations and System Management as defined herein. A factory-trained instructor with experience in presenting the training material and the system programmer for this project shall perform the training.
3. Six months after completion of commissioning or one month prior to the end of the warranty period, the manufacturer shall provide training on consecutive days for Owner's representatives. The training course shall update the Owner's representatives on Day-to-Day Operations as defined herein. A factory-trained instructor with experience in presenting the training material and the system programmer for this project shall perform the training.

B. Day-to-Day Operations - Training Description:

1. Proficiently operate the system.
2. Understand control system architecture and configuration.
3. Understand FMCS systems components.
4. Understand system operation, including FMCS system control and optimizing routines (algorithms).
5. Operate the workstation and peripherals.
6. Log-on and off the system.
7. Access graphics, point reports, and logs.
8. Adjust and change system setpoints, time schedules, and holiday schedules.
9. Recognize malfunctions of the system by observation of the printed copy and graphic visual signals.
10. Understand system drawings and Operation and Maintenance manual.
11. Understand the job layout and location of control components.
12. Access data from FMCS controllers and ASCs.
13. Operate portable operator's terminals.

C. Advanced Operations - Training Description:

1. Make and change graphics on the workstation.
2. Create, delete, and modify alarms, including annunciation and routing of these.
3. Create, delete and modify point trend logs and graph or print these both on and ad-hoc basis and at user-definable time intervals.
4. Create, delete, and modify reports.
5. Add, remove, and modify system's physical points.
6. Create, modify and delete programming.
7. Add panels when required.
8. Add operator interface stations.

9. Create, delete, and modify system displays, both graphic and others.
10. Perform FMCS system field checkout procedures.
11. Perform FMCS controller unit operation and maintenance procedures.
12. Perform workstation and peripheral operation and maintenance procedures.
13. Perform FMCS system diagnostic procedures.
14. Configure hardware including PC boards, switches, communication, and I/O points.
15. Maintain, calibrate, troubleshoot, diagnose, and repair hardware.
16. Adjust, calibrate, and replace system components.

D. System Management - Training Description:

1. Maintain software and prepare backups.
2. Interface with job-specific, third-party operator software.
3. Add new users and understand password security procedures.

E. Provide course outline and materials in accordance with the "SUBMITTALS" article in Part 1 of this section. The instructor(s) shall provide one copy of training material per student.

3.10 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for the environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

E. Averaging sensors and low limits shall be installed at the top of the assembly with the element on a slight downward incline away from the sensor making a serpentine pattern over the cross-sectional area with elements spaced not over 12" (300 mm) apart and within 6" (150 mm) of the top and bottom of the area.

F. All pipe-mounted temperature sensors shall be installed in immersion wells. Install all liquid temperature sensors with heat-conducting fluid in thermal wells.

G. Install outdoor air temperature sensors on exterior of north wall, complete with sun shield at designated location approved by Architect/Engineer. TCC shall prime and paint the device enclosure. Color selection by Architect.

H. Install all wall-mounted CO2 sensors between 3 feet and 6 feet above the floor.

END OF SECTION 230900

SECTION 23 0993

SEQUENCE OF OPERATIONS FOR HVAC CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes control sequences for HVAC systems, subsystems, and equipment.

1.2 DEDICATED OUTDOOR AIR ROOF TOP UNITS (Constant Volume w/Energy recovery)

A. This unit is a constant volume, 100% outside air, DX cooling unit with gas heating. The packaged unit consists of outside air dampers, filters, natural gas-fired heat exchanger, DX evaporative coil, refrigerant compressors with hot gas reheat, condenser section, energy wheel, electric preheat coil, exhaust and supply fan.

B. Start/Stop: The supply fan operation shall generally run continuously 24/7 except DOAS-1 which serves the 1st floor public space, which shall shut down from 10:00pm-5:00 am (Adj.). When the fan is running, the OA damper shall be fully open and provide outside airflow as scheduled. Whenever the fan is off, all dampers shall assume their failed positions.

C. Fan Speed: The supply fan and exhaust fan speed shall be constant to maintain the scheduled air flow.

D. Outside Air Control: Outside air damper shall be fully open to provide design air flow.

E. Supply Air Dewpoint: Unit-mounted sensors shall monitor the discharge air temperature and dewpoint. In cooling mode, the unit shall cycle the refrigeration compressors to maintain a cooling coil leaving air dewpoint of 55 deg F(adj.) and the hot gas reheat valve shall be modulated to maintain a leaving air temperature of 68 deg F(adj.). In heating mode, the heat exchanger gas valve shall be modulated to maintain supply air temperature set point- 70 deg F(adj.).

F. Energy recovery: When outdoor air enthalpy is more than the exhaust air enthalpy, the energy wheel shall be enabled, and the bypass damper shall be closed. The energy wheel shall operate to maintain the discharge air temperature. When the dew point sensor at the exhaust air stream leaving the energy wheel is close to wheel surface temperature, energy wheel shall slows down to maintain dew point below wheel surface temperature.

G. Economizer: When the outdoor air temperature is greater than 50 deg F (adj.) and the outdoor air enthalpy is less than the exhaust air enthalpy, the unit shall initiate economizer mode. During the economizer mode, the energy wheel shall be disabled, and the bypass damper shall be fully open to maintain the mixed air temperature at the discharge air temperature. Mixed air temperature set point shall be reset up as outside air temperature goes down.

H. Condenser: Compressors shall be staged on to maintain the discharge temperature when outdoor is greater than 55 deg F (adj.). Condensing unit/compressors will be lockout at 35 deg F, unless otherwise allowed per MFR's recommendation.

I. Indirect fired gas burner: Gas valve shall be modulated to maintain the discharge air temperature of 68 deg F (adj.) when outdoor is less than 50 deg F (adj.).

J. Energy wheel Defrost: When dew point sensor downstream the exhaust air leaving energy wheel reaches saturation condition, electric preheat coil shall be energized. If it is frost condition still exists, VFD shall modulate to slow down energy wheel.

K. Safeties/Alarms:

1. Low temperature shutdown: A unit supplied low temperature detection thermostat, manual reset, located downstream of the heat exchanger, will be hardwired to the fan circuit. Upon detection of a low temperature condition below 35°F (adj.) the supply fan will shut down, the outside air dampers will close, and a low temperature alarm will be activated.

2. Loss of Air Flow: When the pressure differential across the supply fan indicates a no air flow condition and the fan is commanded "ON" a fan failure alarm will be indicated at the remote-control panel.

3. Fire/Smoke Operation: When the duct mounted smoke detectors alarm, they will send a signal to the local fire alarm panel, which will signal an "alarm condition", the signal from the fire alarm panel will shut down the supply air fan.

L. Off Mode

1. Unit will run continuously during scheduled hours unless there is a fire alarm shutting down the unit.

2. Supply and exhaust fans are off and the outside air damper is closed.

1.3 SPLIT SYSTEMS (constant volume)

A. This system is constant volume, DX heat pump unit with electric heating. The split system consists of filters, electric heating coil, DX evaporative coil, refrigerant compressors, supply fan and outdoor heat pump unit.

B. Start/Stop: The supply fan operation shall generally run continuously, but can be controlled through the space sensor. Whenever the fan is off, all dampers shall assume their failed positions.

C. Fan Speed: The supply fan speed shall be constant to maintain the supply air flow.

D. Supply Air Temperature: A space temperature sensor shall monitor the room air temperature and send an input signal to the unitary controls. The output signal from the unitary controls shall modulate the refrigeration compressors in the cooling mode and stage the electric heating coil in the heating mode to maintain the room temperature set-point (adjustable). Thermostats in

resident rooms can be adjusted by user, while those in public space can only be adjusted by maintenance staff:

1. Summer indoor temperature: 75 deg F (adj.)

2. Winter indoor temperature: 70 deg F (adj.)

E. Safeties/Alarms:

1. Low temperature shutdown: A unit supplied low temperature detection thermostat, manual reset, located downstream of the heat exchanger, will be hardwired to the fan circuit. Upon detection of a low temperature condition below 35°F (adj.) the supply fan will shut down, and a low temperature alarm will be activated.

2. Loss of Air Flow: When the pressure differential across the supply fan indicates a no air flow condition and the fan is commanded "ON" a fan failure alarm will be indicated at the remote-control panel.

3. Fire/Smoke Operation: When the duct mounted smoke detectors alarm (unit more than 2000 cfm), they will send a signal to the local fire alarm panel, which will signal an “alarm condition”, the signal from the fire alarm panel will shut down the supply air fan.

F. Off Mode

1. Occurs in the unoccupied mode.

2. Supply fan is off.

1.4 MINI-SPLIT SYSTEMS

A. This unit is a constant volume cooling only unit with remote controls.

B. Start/Stop: The supply fan and transfer air fan operation shall be interlock to operate simultaneously. The operation of the supply fan shall be determined by a fan switch on the thermostat that allows either manual or automatic control. When the fan switch is in the manual “on” position, the supply fan and transfer air fan shall run continuously. When the fan switch is in the automatic position, the supply fan and transfer air fan shall cycle on and off with the mini-split fan coil unit to maintain temperature set point.

C. Cooling Mode: Upon a space temperature greater than the room set point temperature, the mini-split system refrigeration compressor shall cycle on and off to maintain the set point temperature. Upon a drop in room temperature below the set point temperature, the supplemental electric resistance heat will be energized to warm the space. The supplemental heaters have integral thermostat controls.

1.5 EXHAUST FAN

A. Kitchen Exhaust Fans and Makeup Air Units: Fans and MAU’s shall be interlocked with the respective kitchen hood switch(es).

B. Salon exhaust fan: Exhaust fan shall run continuously.

C. Nail table exhaust fan: This fan shall be switched on and off.

1.6 ELECTRIC WALL HEATER, CEILING HEATER AND UNIT HEATER

A. Heater shall be energized to maintain set space temperature setpoint, 65 deg F(adj.) in heating season.

1.7 PACKAGED TERMINAL AIR CONDITIONER

A. PTAC shall be energized to maintain space temperature of 75 deg F in Summer and 70 deg F in Winter. These settings shall be adjustable by resident in the unit.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 230993

SECTION 231123

FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pipes, tubes, and fittings.
2. Piping specialties.
3. Piping and tubing joining materials.
4. Valves.
5. Pressure regulators.

1.2 PERFORMANCE REQUIREMENTS

A. Minimum Operating-Pressure Ratings:

1. Piping and Valves: 100 psig minimum unless otherwise indicated.
2. Service Regulators: 65 psig minimum unless otherwise indicated.

B. Natural-Gas System Pressure within Buildings: 0.5 psig or less.

C. Natural-Gas System Pressures within Buildings: Two pressure ranges. Primary pressure is more than 0.5 psig but not more than 2 psig, and is reduced to secondary pressure of 0.5 psig or less.

D. Delegated Design: Design restraints and anchors for natural-gas piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings: For facility natural-gas piping layout. Include plans, piping layout and elevations, sections, and details for fabrication of pipe anchors, hangers, supports for multiple pipes, alignment guides, expansion joints and loops, and attachments of the same to building structure. Detail location of anchors, alignment guides, and expansion joints and loops.

C. Delegated-Design Submittal: For natural-gas piping and equipment indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Detail fabrication and assembly of seismic restraints.
2. Design Calculations: Calculate requirements for selecting seismic restraints.

1.4 INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

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

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. 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.

PART 2 - PRODUCTS

2.1 PIPES, TUBES, AND FITTINGS

A. Steel Pipe: ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.

1. Malleable-Iron Threaded Fittings: ASME B16.3, Class 150, standard pattern.
2. Wrought-Steel Welding Fittings: ASTM A 234/A 234M for butt welding and socket welding.
3. Unions: ASME B16.39, Class 150, malleable iron with brass-to-iron seat, ground joint, and threaded ends.
4. Protective Coating for Underground Piping: Factory-applied, three-layer coating of epoxy, adhesive, and PE.

    a. Joint Cover Kits: Epoxy paint, adhesive, and heat-shrink PE sleeves.

B. Corrugated, Stainless-Steel Tubing: Comply with ANSI/IAS LC 1.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. OmegaFlex, Inc.
    b. Parker Hannifin Corporation; Parflex Division.
    c. Titeflex.
    d. Tru-Flex Metal Hose Corp.

2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
3. Coating: PE with flame retardant.

    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) Flame-Spread Index: 25 or less.
        2) Smoke-Developed Index: 50 or less.

4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
5. Striker Plates: Steel, designed to protect tubing from penetrations.
6. Manifolds: Malleable iron or steel with factory-applied protective coating. Threaded connections shall comply with ASME B1.20.1 for pipe inlet and corrugated tubing outlets.
7. Operating-Pressure Rating: 5 psig.

C. Annealed-Temper Copper Tube: Comply with ASTM B 837, Type G.

1. Copper Fittings: ASME B16.22, wrought copper, and streamlined pattern.
2. Flare Fittings (where allowed by authorities having jurisdiction): Comply with ASME B16.26 and SAE J513.

    a. Copper fittings with long nuts.
    b. Metal-to-metal compression seal without gasket.
    c. Dryseal threads complying with ASME B1.20.3.

3. Protective Coating for Underground Tubing: Factory-applied, extruded PE a minimum of 0.022 inch thick.

D. PE Pipe: ASTM D 2513, SDR 11.

1. PE Fittings: ASTM D 2683, socket-fusion type or ASTM D 3261, butt-fusion type with dimensions matching PE pipe.
2. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D 2513, SDR 11; and steel pipe complying with ASTM A 53/A 53M, black steel, Schedule 40, Type E or S, Grade B.
3. Anodeless Service-Line Risers: Factory fabricated, and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet.
    b. Casing: Steel pipe complying with ASTM A 53/A 53M, Schedule 40, black steel, Type E or S, Grade B, with corrosion-protective coating covering. Vent casing aboveground.
    c. Aboveground Portion: PE transition fitting.
    d. Outlet shall be threaded or suitable for welded connection.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

4. Transition Service-Line Risers: Factory fabricated, and leak tested.

    a. Underground Portion: PE pipe complying with ASTM D 2513, SDR 11 inlet connected to steel pipe complying with ASTM A 53/A 53M, Schedule 40, Type E or S, Grade B, with corrosion-protective coating for aboveground outlet.
    b. Outlet shall be threaded or suitable for welded connection.
    c. Bridging sleeve over mechanical coupling.
    d. Factory-connected anode.
    e. Tracer wire connection.
    f. Ultraviolet shield.
    g. Stake supports with factory finish to match steel pipe casing or carrier pipe.

2.2 PIPING SPECIALTIES

A. Appliance Flexible Connectors:

1. Indoor, Fixed-Appliance Flexible Connectors: Comply with ANSI Z21.24.
2. Indoor, Movable-Appliance Flexible Connectors: Comply with ANSI Z21.69.
3. Outdoor, Appliance Flexible Connectors: Comply with ANSI Z21.75.
4. Corrugated stainless-steel tubing with polymer coating.
5. Operating-Pressure Rating: 0.5 psig.
6. End Fittings: Zinc-coated steel.
7. Threaded Ends: Comply with ASME B1.20.1.
8. Maximum Length: 72 inches

B. Quick-Disconnect Devices: Comply with ANSI Z21.41.

1. Copper-alloy convenience outlet and matching plug connector.
2. Nitrile seals.
3. Hand operated with automatic shutoff when disconnected.
4. For indoor or outdoor applications.
5. Adjustable, retractable restraining cable.

C. Y-Pattern Strainers:

1. Body: ASTM A 126, Class B, cast iron with bolted cover and bottom drain connection.
2. End Connections: Threaded ends for NPS 2 and smaller.
3. Strainer Screen: 40-mesh startup strainer, and perforated stainless-steel basket with 50 percent free area.
4. CWP Rating: 125 psig.

D. Weatherproof Vent Cap: Cast- or malleable-iron increaser fitting with corrosion-resistant wire screen, with free area at least equal to cross-sectional area of connecting pipe and threaded-end connection.

2.3 JOINING MATERIALS

A. Joint Compound and Tape: Suitable for natural gas.

B. Welding Filler Metals: Comply with AWS D10.12/D10.12M for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

C. Brazing Filler Metals: Alloy with melting point greater than 1000 deg F complying with AWS A5.8/A5.8M. Brazing alloys containing more than 0.05 percent phosphorus are prohibited.

2.4 MANUAL GAS SHUTOFF VALVES

A. See "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles for where each valve type is applied in various services.

B. General Requirements for Metallic Valves, NPS 2 and Smaller: Comply with ASME B16.33.

1. CWP Rating: 125 psig.
2. Threaded Ends: Comply with ASME B1.20.1.
3. Dryseal Threads on Flare Ends: Comply with ASME B1.20.3.
4. Tamperproof Feature: Locking feature for valves indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Listing: Listed and labeled by an NRTL acceptable to authorities having jurisdiction for valves 1 inch and smaller.
6. Service Mark: Valves 1-1/4 inches to NPS 2 shall have initials "WOG" permanently marked on valve body.

C. One-Piece, Bronze Ball Valve with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated brass.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Separate packnut with adjustable-stem packing threaded ends.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

D. Two-Piece, Full-Port, Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE; blowout proof.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

E. Two-Piece, Regular-Port Bronze Ball Valves with Bronze Trim: MSS SP-110.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. BrassCraft Manufacturing Company; a Masco company.
    b. Conbraco Industries, Inc.; Apollo Div.
    c. Lyall, R. W. & Company, Inc.
    d. McDonald, A. Y. Mfg. Co.
    e. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: Bronze, complying with ASTM B 584.
3. Ball: Chrome-plated bronze.
4. Stem: Bronze; blowout proof.
5. Seats: Reinforced TFE.
6. Packing: Threaded-body packnut design with adjustable-stem packing.
7. Ends: Threaded, flared, or socket as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
8. CWP Rating: 600 psig.
9. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
10. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

F. Bronze Plug Valves: MSS SP-78.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Lee Brass Company.
b. McDonald, A. Y. Mfg. Co.

2. Body: Bronze, complying with ASTM B 584.
3. Plug: Bronze.
4. Ends: Threaded, socket, as indicated in "Underground Manual Gas Shutoff Valve Schedule" and "Aboveground Manual Gas Shutoff Valve Schedule" Articles.
5. Operator: Square head or lug type with tamperproof feature where indicated.
6. Pressure Class: 125 psig.
7. Listing: Valves NPS 1 and smaller shall be listed and labeled by an NRTL acceptable to authorities having jurisdiction.
8. Service: Suitable for natural-gas service with "WOG" indicated on valve body.

G. PE Ball Valves: Comply with ASME B16.40.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Kerotest Manufacturing Corp.
b. Lyall, R. W. & Company, Inc.
c. Perfection Corporation; a subsidiary of American Meter Company.

2. Body: PE.
3. Ball: PE.
4. Stem: Acetal.
5. Seats and Seals: Nitrile.
6. Ends: Plain or fusible to match piping.
7. CWP Rating: [80 psig] <Insert pressure>.
8. Operating Temperature: [Minus 20 to plus 140 deg F] <Insert temperature range>.
9. Operator: Nut or flat head for key operation.
10. Include plastic valve extension.
11. Include tamperproof locking feature for valves where indicated on Drawings.

H. Valve Boxes:

1. Cast-iron, two-section box.
2. Top section with cover with "GAS" lettering.
3. Bottom section with base to fit over valve and barrel a minimum of 5 inches in diameter.
4. Adjustable cast-iron extensions of length required for depth of bury.
5. Include tee-handle, steel operating wrench with socket end fitting valve nut or flat head, and with stem of length required to operate valve.

2.5 MOTORIZED GAS VALVES

A. Electrically Operated Valves: Comply with UL 429.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. ASCO Power Technologies, LP; Division of Emerson.
b. Dungs, Karl, Inc.
c. Eclipse Combustion, Inc.
d. Goyen Valve Corp.; Tyco Environmental Systems.
e. Magnatrol Valve Corporation.
f. Parker Hannifin Corporation; Climate & Industrial Controls Group; Skinner Valve Div.
g. Watts Regulator Co.; Division of Watts Water Technologies, Inc.

2. Pilot operated.
3. Body: Brass or aluminum.
4. Seats and Disc: Nitrile rubber.
5. Springs and Valve Trim: Stainless steel.
6. 120-V ac, 60 Hz, Class B, continuous-duty molded coil, and replaceable.
7. NEMA ICS 6, Type 4, coil enclosure.
8. Normally closed.
9. Visual position indicator.

2.6 PRESSURE REGULATORS

A. General Requirements:

1. Single stage and suitable for natural gas.
2. Steel jacket and corrosion-resistant components.
3. Elevation compensator.
4. End Connections: Threaded for regulators NPS 2 and smaller.

B. Line Pressure Regulators: Comply with ANSI Z21.80.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Actaris.
b. American Meter Company.
c. Eclipse Combustion, Inc.
d. Fisher Control Valves and Regulators; Division of Emerson Process Management.
e. Invensys.
f. Maxitrol Company.
g. Richards Industries; Jordan Valve Div.

2. Body and Diaphragm Case: Cast iron or die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber resistant to gas impurities, abrasion, and deformation at the valve port.
6. Orifice: Aluminum; interchangeable.
7. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
8. Single-port, self-contained regulator with orifice no larger than required at maximum pressure inlet, and no pressure sensing piping external to the regulator.

9. Pressure regulator shall maintain discharge pressure setting downstream, and not exceed 150 percent of design discharge pressure at shutoff.
10. Overpressure Protection Device: Factory mounted on pressure regulator.
11. Atmospheric Vent: Factory- or field-installed, stainless-steel screen in opening if not connected to vent piping.
12. Maximum Inlet Pressure: 5 psig.

C. Appliance Pressure Regulators: Comply with ANSI Z21.18.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Canadian Meter Company Inc.
    b. Eaton Corporation; Controls Div.
    c. Harper Wyman Co.
    d. Maxitrol Company.
    e. SCP, Inc.

2. Body and Diaphragm Case: Die-cast aluminum.
3. Springs: Zinc-plated steel; interchangeable.
4. Diaphragm Plate: Zinc-plated steel.
5. Seat Disc: Nitrile rubber.
6. Seal Plug: Ultraviolet-stabilized, mineral-filled nylon.
7. Factory-Applied Finish: Minimum three-layer polyester and polyurethane paint finish.
8. Regulator may include vent limiting device, instead of vent connection, if approved by authorities having jurisdiction.
9. Maximum Inlet Pressure: 2 psig.

2.7 DIELECTRIC UNIONS

A. Dielectric Unions:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Capitol Manufacturing Company.
    b. Central Plastics Company.
    c. Hart Industries International, Inc.
    d. Jomar International Ltd.
    e. Matco-Norca, Inc.
    f. McDonald, A. Y. Mfg. Co.
    g. Watts Regulator Co.; a division of Watts Water Technologies, Inc.
    h. Wilkins; a Zurn company.

2. Description:
    a. Standard: ASSE 1079.
    b. Pressure Rating: 125 psig minimum at 180 deg F.
    c. End Connections: Solder-joint copper alloy and threaded ferrous.

2.8 LABELING AND IDENTIFYING

A. Detectable Warning Tape: Acid- and alkali-resistant, PE film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored yellow.

PART 3 - EXECUTION

3.1 OUTDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Install underground, natural-gas piping buried at least 36 inches below finished grade. Comply with requirements in Section 312000 "Earth Moving" for excavating, trenching, and backfilling.

1. If natural-gas piping is installed less than 36 inches below finished grade, install it in containment conduit.

C. Install underground, PE, natural-gas piping according to ASTM D 2774.

D. Steel Piping with Protective Coating:

1. Apply joint cover kits to pipe after joining to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.
3. Replace pipe having damaged PE coating with new pipe.

E. Copper Tubing with Protective Coating:

1. Apply joint cover kits over tubing to cover, seal, and protect joints.
2. Repair damage to PE coating on pipe as recommended in writing by protective coating manufacturer.

F. Install fittings for changes in direction and branch connections.

G. Install pressure gage downstream from each service regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

3.2 INDOOR PIPING INSTALLATION

A. Comply with NFPA 54 and the International Fuel Gas Code for installation and purging of natural-gas piping.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements are used to size pipe and calculate friction loss,

expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

C. Arrange for pipe spaces, chases, slots, sleeves, and openings in building structure during progress of construction, to allow for mechanical installations.

D. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

E. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

F. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

G. Locate valves for easy access.

H. Install natural-gas piping at uniform grade of 2 percent down toward drip and sediment traps.

I. Install piping free of sags and bends.

J. Install fittings for changes in direction and branch connections.

K. Verify final equipment locations for roughing-in.

L. Comply with requirements in Sections specifying gas-fired appliances and equipment for roughing-in requirements.

M. Drips and Sediment Traps: Install drips at points where condensate may collect, including service-meter outlets. Locate where accessible to permit cleaning and emptying. Do not install where condensate is subject to freezing.

1. Construct drips and sediment traps using tee fitting with bottom outlet plugged or capped. Use nipple a minimum length of 3 pipe diameters, but not less than 3 inches long and same size as connected pipe. Install with space below bottom of drip to remove plug or cap.

N. Extend relief vent connections for service regulators, line regulators, and overpressure protection devices to outdoors and terminate with weatherproof vent cap.

O. Conceal pipe installations in walls, pipe spaces, utility spaces, above ceilings, below grade or floors, and in floor channels unless indicated to be exposed to view.

P. Use eccentric reducer fittings to make reductions in pipe sizes. Install fittings with level side down.

Q. Connect branch piping from top or side of horizontal piping.

R. Install unions in pipes NPS 2 and smaller, adjacent to each valve, at final connection to each piece of equipment.

S. Do not use natural-gas piping as grounding electrode.

T. Install strainer on inlet of each line-pressure regulator and automatic or electrically operated valve.

U. Install pressure gage downstream from each line regulator. Pressure gages are specified in Section 230519 "Meters and Gages for HVAC Piping."

V. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

W. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

X. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.3 VALVE INSTALLATION

A. Install manual gas shutoff valve for each gas appliance ahead of corrugated stainless-steel tubing or copper connector.

B. Install underground valves with valve boxes.

C. Install regulators and overpressure protection devices with maintenance access space adequate for servicing and testing.

D. Install earthquake valves aboveground outside buildings according to listing.

E. Install anode for metallic valves in underground PE piping.

3.4 PIPING JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints:

1. Thread pipe with tapered pipe threads complying with ASME B1.20.1.
2. Cut threads full and clean using sharp dies.
3. Ream threaded pipe ends to remove burrs and restore full inside diameter of pipe.
4. Apply appropriate tape or thread compound to external pipe threads unless dryseal threading is specified.
5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Welded Joints:

1. Construct joints according to AWS D10.12/D10.12M, using qualified processes and welding operators.
2. Bevel plain ends of steel pipe.
3. Patch factory-applied protective coating as recommended by manufacturer at field welds and where damage to coating occurs during construction.

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

F. Flared Joints: Cut tubing with roll cutting tool. Flare tube end with tool to result in flare dimensions complying with SAE J513. Tighten finger tight, then use wrench. Do not overtighten.

G. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.

1. Plain-End Pipe and Fittings: Use butt fusion.
2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.5 HANGER AND SUPPORT INSTALLATION

A. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Comply with requirements for pipe hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

C. Install hangers for horizontal steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 1 and Smaller: Maximum span, 96 inches; minimum rod size, 3/8 inch.
2. NPS 1-1/4: Maximum span, 108 inches; minimum rod size, 3/8 inch.
3. NPS 1-1/2 and NPS 2: Maximum span, 108 inches; minimum rod size, 3/8 inch.

D. Install hangers for horizontal, corrugated stainless-steel tubing with the following maximum spacing and minimum rod sizes:

1. NPS 3/8: Maximum span, 48 inches; minimum rod size, 3/8 inch.
2. NPS 1/2: Maximum span, 72 inches; minimum rod size, 3/8 inch.
3. NPS 3/4 and Larger: Maximum span, 96 inches; minimum rod size, 3/8 inch.

3.6 CONNECTIONS

A. Connect to utility's gas main according to utility's procedures and requirements.

B. Install natural-gas piping electrically continuous, and bonded to gas appliance equipment grounding conductor of the circuit powering the appliance according to NFPA 70.

C. Install piping adjacent to appliances to allow service and maintenance of appliances.

D. Connect piping to appliances using manual gas shutoff valves and unions. Install valve within 72 inches of each gas-fired appliance and equipment. Install union between valve and appliances or equipment.

E. Sediment Traps: Install tee fitting with capped nipple in bottom to form drip, as close as practical to inlet of each appliance.

3.7 LABELING AND IDENTIFYING

A. Comply with requirements in Section 230553 "Identification for HVAC Piping and Equipment" for piping and valve identification.

B. Install detectable warning tape directly above gas piping, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.8 FIELD QUALITY CONTROL

A. Test, inspect, and purge natural gas according to NFPA 54 and the International Fuel Gas Code and authorities having jurisdiction.

B. Natural-gas piping will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.9 OUTDOOR PIPING SCHEDULE

A. Underground natural-gas piping shall be one of the following:

1. PE pipe and fittings joined by heat fusion; service-line risers with tracer wire terminated in an accessible location.
2. Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.
3. Annealed-temper copper tube with wrought-copper fittings and brazed joints. Coat pipe and fittings with protective coating for copper tubing.

B. Aboveground natural-gas piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.
3. Annealed-temper copper tube with wrought-copper fittings and brazed joints.

C. Branch Piping in Cast-in-Place Concrete to Single Appliance: Annealed-temper copper tube with wrought-copper fittings and brazed or flared joints. Install piping embedded in concrete with no joints in concrete.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

3.10 INDOOR PIPING SCHEDULE

A. Aboveground, branch piping NPS 1 and smaller shall be one of the following:

1. Corrugated stainless-steel tubing with mechanical fittings having socket or threaded ends to match adjacent piping (where allowed by authorities having jurisdiction).
2. Annealed-temper copper tube with wrought-copper fittings and brazed or flared joints.
3. Steel pipe with malleable-iron fittings and threaded joints.

B. Aboveground, distribution piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

C. Underground, below building, piping shall be one of the following:

1. Steel pipe with malleable-iron fittings and threaded joints.
2. Steel pipe with wrought-steel fittings and welded joints.

D. Containment Conduit: Steel pipe with wrought-steel fittings and welded joints. Coat pipe and fittings with protective coating for steel piping.

E. Containment Conduit Vent Piping: Steel pipe with malleable-iron fittings and threaded or wrought-steel fittings with welded joints. Coat underground pipe and fittings with protective coating for steel piping.

3.11 UNDERGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Connections to Existing Gas Piping: Use valve and fitting assemblies made for tapping utility's gas mains and listed by an NRTL.

B. Underground: PE or Bronze plug valves.

3.12 ABOVEGROUND MANUAL GAS SHUTOFF VALVE SCHEDULE

A. Valves for pipe sizes NPS 2 and smaller at service meter shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

B. Distribution piping valves for pipe sizes NPS 2 and smaller shall be[one of] the following:

1. One-piece, bronze ball valve with bronze trim.
2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

C. Valves in branch piping for single appliance shall be one of the following:

1. One-piece, bronze ball valve with bronze trim.

2. Two-piece, full-port, bronze ball valves with bronze trim.
3. Bronze plug valve.

END OF SECTION 231123

SECTION 232300

REFRIGERANT PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

1.2 PERFORMANCE REQUIREMENTS

A. Line Test Pressure for Refrigerant R-410A:

1. Suction Lines for Air-Conditioning Applications: 300 psig.
2. Suction Lines for Heat-Pump Applications: 535 psig.
3. Hot-Gas and Liquid Lines: 535 psig.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control test reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX, "Welding and Brazing Qualifications."

B. Comply with ASHRAE 15, "Safety Code for Refrigeration Systems."

C. Comply with ASME B31.5, "Refrigeration Piping and Heat Transfer Components."

1.6 PRODUCT STORAGE AND HANDLING

A. Store piping in a clean and protected area with end caps in place to ensure that piping interior and exterior are clean when installed.

1.7 COORDINATION

A. Coordinate size and location of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."

PART 2 - PRODUCTS

2.1 COPPER TUBE AND FITTINGS

A. Copper Tube: ASTM B 88, Type K or L and ASTM B 280, Type ACR.

B. Wrought-Copper Fittings: ASME B16.22.

C. Wrought-Copper Unions: ASME B16.22.

D. Solder Filler Metals: ASTM B 32. Use 95-5 tin antimony or alloy HB solder to join copper socket fittings on copper pipe.

E. Brazing Filler Metals: AWS A5.8.

2.2 VALVES AND SPECIALTIES

A. Service Valves:

1. Body: Forged brass with brass cap including key end to remove core.
2. Core: Removable ball-type check valve with stainless-steel spring.
3. Seat: Polytetrafluoroethylene.
4. End Connections: Copper spring.
5. Working Pressure Rating: 500 psig.

B. Thermostatic Expansion Valves: Comply with ARI 750.

1. Body, Bonnet, and Seal Cap: Forged brass or steel.
2. Diaphragm, Piston, Closing Spring, and Seat Insert: Stainless steel.
3. Packing and Gaskets: Non-asbestos.
4. Capillary and Bulb: Copper tubing filled with refrigerant charge.
5. Suction Temperature: 40 deg F.
6. Superheat: Nonadjustable.
7. Reverse-flow option (for heat-pump applications).
8. End Connections: Socket, flare, or threaded union.
9. Working Pressure Rating: 700 psig.

C. Moisture/Liquid Indicators:

1. Body: Forged brass.
2. Window: Replaceable, clear, fused glass window with indicating element protected by filter screen.
3. Indicator: Color coded to show moisture content in ppm.
4. Minimum Moisture Indicator Sensitivity: Indicate moisture above 60 ppm.

5. End Connections: Socket or flare.
6. Working Pressure Rating: 500 psig.
7. Maximum Operating Temperature: 240 deg F.

D. Permanent Filter Dryers: Comply with ARI 730.

1. Body and Cover: Painted-steel shell.
2. Filter Media: 10 micron, pleated with integral end rings; stainless-steel support.
3. Desiccant Media: Activated alumina or charcoal.
4. Designed for reverse flow (for heat-pump applications).
5. End Connections: Socket.
6. Access Ports: NPS 1/4 connections at entering and leaving sides for pressure differential measurement.
7. Maximum Pressure Loss: 2 psig.
8. Working Pressure Rating: 500 psig.
9. Maximum Operating Temperature: 240 deg F.

2.3 REFRIGERANTS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Atofina Chemicals, Inc.
2. DuPont Company; Fluorochemicals Div.
3. Honeywell, Inc.; Genetron Refrigerants.
4. INEOS Fluor Americas LLC.

C. ASHRAE 34, R-410A: Pentafluoroethane/Difluoromethane.

PART 3 - EXECUTION

3.1 PIPING APPLICATIONS FOR REFRIGERANT R-410A

A. Suction Lines NPS 1-1/2 and Smaller for Conventional Air-Conditioning Applications: Copper, Type ACR, annealed-temper tubing and wrought-copper fittings with brazed or soldered joints.

B. Hot-Gas and Liquid Lines, and Suction Lines for Heat-Pump Applications: Copper, Type ACR or L, annealed- or drawn-temper tubing and wrought-copper fittings with brazed or soldered joints.

3.2 VALVE AND SPECIALTY APPLICATIONS

A. Install service valves for gage taps at inlet and outlet of hot-gas bypass valves and strainers if they are not an integral part of valves and strainers.

B. Install thermostatic expansion valves as close as possible to distributors on evaporators.

1. Install valve so diaphragm case is warmer than bulb.
2. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
3. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

C. Install moisture/liquid indicators in liquid line at the inlet of the thermostatic expansion valve or at the inlet of the evaporator coil capillary tube.

D. Install filter dryers in liquid line between compressor and thermostatic expansion valve, and in the suction line at the compressor.

3.3 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems; indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Shop Drawings.

B. Install refrigerant piping according to ASHRAE 15.

C. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

D. Install piping indicated to be exposed and piping in equipment rooms and 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 adjacent to machines to allow service and maintenance.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Select system components with pressure rating equal to or greater than system operating pressure.

J. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

K. Arrange piping to allow inspection and service of refrigeration equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

L. Install refrigerant piping in protective conduit where installed belowground.

M. Install refrigerant piping in rigid or flexible conduit in locations where exposed to mechanical injury.

N. Slope refrigerant piping as follows:

1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps and double risers to entrain oil in vertical runs.
4. Liquid lines may be installed level.

O. When brazing or soldering, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion-valve bulb.

P. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation.

Q. Install sleeves for piping penetrations of walls, ceilings, and floors.

3.4 PIPE JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide), during brazing or welding, to prevent scale formation.

D. Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Brazed Joints: Construct joints according to AWS's "Brazing Handbook," Chapter "Pipe and Tube."

1. Use Type BcuP, copper-phosphorus alloy for joining copper socket fittings with copper pipe.
2. Use Type BAg, cadmium-free silver alloy for joining copper with bronze or steel.

3.5 HANGERS AND SUPPORTS

A. Hanger, support, and anchor products are specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Install the following pipe attachments:

1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Roller hangers and spring hangers for individual horizontal runs 20 feet or longer.

3. Pipe Roller: MSS SP-58, Type 44 for multiple horizontal piping 20 feet or longer, supported on a trapeze.
4. Spring hangers to support vertical runs.
5. Copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.

C. Install hangers for copper tubing with the following maximum spacing and minimum rod sizes:

1. NPS 1/2: Maximum span, 60 inches; minimum rod size, 1/4 inch.
2. NPS 5/8: Maximum span, 60 inches; minimum rod size, 1/4 inch.
3. NPS 1: Maximum span, 72 inches; minimum rod size, 1/4 inch.
4. NPS 1-1/4: Maximum span, 96 inches; minimum rod size, 3/8 inch.
5. NPS 1-1/2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
6. NPS 2: Maximum span, 96 inches; minimum rod size, 3/8 inch.
7. NPS 2-1/2: Maximum span, 108 inches; minimum rod size, 3/8 inch.
8. NPS 3: Maximum span, 10 feet; minimum rod size, 3/8 inch.
9. NPS 4: Maximum span, 12 feet; minimum rod size, 1/2 inch.

D. Install hangers for steel piping with the following maximum spacing and minimum rod sizes:

1. NPS 2: Maximum span, 10 feet; minimum rod size, 3/8 inch.
2. NPS 2-1/2: Maximum span, 11 feet; minimum rod size, 3/8 inch.
3. NPS 3: Maximum span, 12 feet; minimum rod size, 3/8 inch.
4. NPS 4: Maximum span, 14 feet; minimum rod size, 1/2 inch.

E. Support multi-floor vertical runs at least at each floor.

3.6 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. Comply with ASME B31.5, Chapter VI.
2. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure if they are not rated above the test pressure.
3. Test high- and low-pressure side piping of each system separately at not less than the pressures indicated in Part 1 "Performance Requirements" Article.

    a. Fill system with nitrogen to the required test pressure.
    b. System shall maintain test pressure at the manifold gage throughout duration of test.
    c. Test joints and fittings with electronic leak detector or by brushing a small amount of soap and glycerin solution over joints.
    d. Remake leaking joints using new materials, and retest until satisfactory results are achieved.

3.7 SYSTEM CHARGING

A. Charge system using the following procedures:

1. Install core in filter dryers after leak test but before evacuation.
2. Evacuate entire refrigerant system with a vacuum pump to 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
3. Break vacuum with refrigerant gas, allowing pressure to build up to 2 psig.
4. Charge system with a new filter-dryer core in charging line.

3.8 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of air-conditioning controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:

1. Verify that compressor oil level is correct.
2. Open compressor suction and discharge valves.
3. Open refrigerant valves except bypass valves that are used for other purposes.
4. Check open compressor-motor alignment and verify lubrication for motors and bearings.

END OF SECTION 232300

SECTION 233113

METAL DUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Rectangular ducts and fittings.
2. Round ducts and fittings.
3. Sheet metal materials.
4. Duct liner.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.2 PERFORMANCE REQUIREMENTS

A. Delegated Duct Design: Duct construction, including sheet metal thicknesses, seam and joint construction, reinforcements, and hangers and supports, shall comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" and performance requirements and design criteria indicated in "Duct Schedule" Article.

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.3 ACTION SUBMITTALS

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

B. Shop Drawings:

1. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
2. Factory- and shop-fabricated ducts and fittings.
3. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.
4. Elevation of top of ducts.
5. Dimensions of main duct runs from building grid lines.
6. Fittings.

7. Reinforcement and spacing.
8. Seam and joint construction.
9. Penetrations through fire-rated and other partitions.
10. Equipment installation based on equipment being used on Project.
11. Locations for duct accessories, including dampers, turning vanes, and access doors and panels.
12. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Duct installation in congested spaces, indicating coordination with general construction, building components, and other building services. Indicate proposed changes to duct layout.
2. Suspended ceiling components.
3. Structural members to which duct will be attached.
4. Size and location of initial access modules for acoustical tile.
5. Penetrations of smoke barriers and fire-rated construction.
6. Items penetrating finished ceiling including the following:

    a. Lighting fixtures.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Access panels.
    f. Perimeter moldings.

B. Welding certificates.

1.5 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.
2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.
3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 - PRODUCTS

2.1 RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2 ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Lindab Inc.
b. McGill AirFlow LLC.
c. SEMCO Incorporated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Transverse Joints in Ducts Larger Than 60 Inches in Diameter: Flanged.

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams,"

for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

1. Fabricate round ducts larger Than 90 inches in diameter with butt-welded longitudinal seams.

D. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Carbon-Steel Sheets: Comply with ASTM A 1008/A 1008M, with oiled, matte finish for exposed ducts.

D. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or 316, as indicated in the "Duct Schedule" Article; cold rolled, annealed, sheet. Exposed surface finish shall be No. 2B, No. 2D, No. 3, or No. 4 as indicated in the "Duct Schedule" Article.

E. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

F. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

G. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A or NFPA 90B.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Aeroflex USA Inc.
    b. Armacell LLC.
    c. Rubatex International, LLC

2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.
3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

    a. For indoor applications, adhesive shall have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
    b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Insulation Pins and Washers:

1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.135-inch- diameter shank, length to suit depth of insulation indicated with integral 1-1/2-inch galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized steel; with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

C. Shop Application of Duct Liner: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 7-11, "Flexible Duct Liner Installation."

1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not apply liner in rectangular ducts with longitudinal joints, except at corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams in ducts with air velocity of 2500 fpm.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:

    a. Fan discharges.
    b. Intervals of lined duct preceding unlined duct.

c. Upstream edges of transverse joints in ducts where air velocities are higher than 2500 fpm or where indicated.

9. Secure insulation between perforated sheet metal inner duct of same thickness as specified for outer shell. Use mechanical fasteners that maintain inner duct at uniform distance from outer shell without compressing insulation.

a. Sheet Metal Inner Duct Perforations: 3/32-inch diameter, with an overall open area of 23 percent.

10. Terminate inner ducts with buildouts attached to fire-damper sleeves, dampers, turning vane assemblies, or other devices. Fabricated buildouts (metal hat sections) or other buildout means are optional; when used, secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Solids Content: Minimum 65 percent.
3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

C. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
7. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

D. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

E. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.6 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cables for Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.

F. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

G. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

H. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

PART 3 - EXECUTION

3.1 DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA's "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3 ADDITIONAL INSTALLATION REQUIREMENTS FOR COMMERCIAL KITCHEN HOOD EXHAUST DUCT

A. Install commercial kitchen hood exhaust ducts without dips and traps that may hold grease, and sloped a minimum of 2 percent to drain grease back to the hood.

B. Install fire-rated access panel assemblies at each change in direction and at maximum intervals of 20 feet in horizontal ducts, and at every floor for vertical ducts, or as indicated on Drawings. Locate access panel on top or sides of duct a minimum of 1-1/2 inches from bottom of duct.

C. Do not penetrate fire-rated assemblies except as allowed by applicable building codes and authorities having jurisdiction.

3.4 DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Outdoor, Supply-Air Ducts: Seal Class A.
3. Outdoor, Exhaust Ducts: Seal Class C.
4. Outdoor, Return-Air Ducts: Seal Class C.
5. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
6. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
7. Unconditioned Space, Exhaust Ducts: Seal Class C.
8. Unconditioned Space, Return-Air Ducts: Seal Class B.
9. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
10. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
11. Conditioned Space, Exhaust Ducts: Seal Class B.
12. Conditioned Space, Return-Air Ducts: Seal Class C.

3.5 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.

1. Where practical, install concrete inserts before placing concrete.
2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.

3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
4. Do not use powder-actuated concrete fasteners for lightweight-aggregate concretes or for slabs less than 4 inches thick.
5. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports.

E. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

F. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.6 CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.7 START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.8 DUCT SCHEDULE

A. Supply Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

    a. Pressure Class: Positive 1-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 12
    d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Constant-Volume Air-Handling Units:

    a. Pressure Class: Positive 2-inch wg.
    b. Minimum SMACNA Seal Class: A.
    c. SMACNA Leakage Class for Rectangular: 6 12.

d. SMACNA Leakage Class for Round and Flat Oval: 6 12.

3. Ducts Connected to Variable-Air-Volume Air-Handling Units:

a. Pressure Class: Positive 4-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

4. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive 4-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

B. Return Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg.
b. Minimum SMACNA Seal Class: A C.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 12.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:

a. Pressure Class: Negative 1-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.

c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

3. Ducts Connected to Commercial Kitchen Hoods: Comply with NFPA 96.

a. Exposed to View: Type 304, stainless-steel sheet, No. 4 finish.
b. Concealed: Type 304, stainless-steel sheet, No. 2D finish or Carbon-steel sheet.
c. Welded seams and joints.
d. Pressure Class: Positive or negative 4-inch wg.
e. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
f. SMACNA Leakage Class: 3.

4. Ducts Connected to Dishwasher Hoods:

a. Type 304, stainless-steel sheet.
b. Exposed to View: No. 4 finish.
c. Concealed: No. 2D finish.
d. Welded seams and flanged joints with watertight EPDM gaskets.
e. Pressure Class: Positive or negative 2-inch wg.
f. Minimum SMACNA Seal Class: Welded seams, joints, and penetrations.
g. SMACNA Leakage Class: 3.

5. Ducts Connected to Clothes Dryers (ASHRAE 62.1, Class 2) Air:

a. Pressure Class: Negative 1-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

6. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 4-inch wg.
b. Minimum SMACNA Seal Class: A if negative pressure, and A if positive pressure.
c. SMACNA Leakage Class for Rectangular: 6.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

D. Outdoor-Air (Not Filtered, Heated, or Cooled) Ducts:

1. Ducts Connected to Fan Coil Units, Furnaces, Heat Pumps, and Terminal Units:

a. Pressure Class: Positive or negative 1-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 12.
d. SMACNA Leakage Class for Round and Flat Oval: 6.

2. Ducts Connected to Air-Handling Units:

a. Pressure Class: Positive or negative 2-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 6.

d. SMACNA Leakage Class for Round and Flat Oval: 3.

3. Ducts Connected to Equipment Not Listed Above:

a. Pressure Class: Positive or negative 4-inch wg.
b. Minimum SMACNA Seal Class: A.
c. SMACNA Leakage Class for Rectangular: 3.
d. SMACNA Leakage Class for Round and Flat Oval: 3.

E. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel or carbon steel coated with zinc-chromate primer.

2. Stainless-Steel Ducts:

a. Exposed to Airstream: Match duct material.
b. Not Exposed to Airstream: Galvanized Match duct material.

3. Aluminum Ducts: Aluminumor galvanized sheet steel coated with zinc chromate.

F. Elbow Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-2, "Rectangular Elbows."

a. Radius Type RE 1 with minimum 1.5 radius-to-diameter ratio.
b. Radius Type RE 3 with minimum 1.0 radius-to-diameter ratio and two vanes.
c. Mitered Type RE 2 with vanes complying with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-3, "Vanes and Vane Runners," and Figure 4-4, "Vane Support in Elbows."

2. Round Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-4, "Round Duct Elbows."

a. Minimum Radius-to-Diameter Ratio and Elbow Segments: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 3-1, "Mitered Elbows." Elbows with less than 90-degree change of direction have proportionately fewer segments.

1) Radius-to Diameter Ratio: 1.5.

b. Round Elbows, 12 Inches and Smaller in Diameter: Stamped or pleated.
c. Round Elbows, 14 Inches and Larger in Diameter: Standing seam or Welded.

G. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."

a. Rectangular Main to Rectangular Branch: 45-degree entry.
b. Rectangular Main to Round Branch: Spin in.

2. Round: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.

    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION 233113

SECTION 233300

AIR DUCT ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Backdraft and pressure relief dampers.
2. Manual volume dampers.
3. Control dampers.
4. Fire dampers.
5. Smoke dampers.
6. Combination fire/smoke dampers.
7. Flange connectors.
8. Turning vanes.
9. Duct-mounted access doors.
10. Flexible connectors.
11. Flexible ducts.
12. Duct accessory hardware.

B. Related Requirements:

1. Section 233723 "HVAC Gravity Ventilators" for roof-mounted ventilator caps.
2. Section 283111 "Digital, Addressable Fire-Alarm System" for duct-mounted fire and smoke detectors.
3. Section 283112 "Zoned (DC-Loop) Fire-Alarm System" for duct-mounted fire and smoke detectors.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For duct accessories. Include plans, elevations, sections, details and attachments to other work.

1. Detail duct accessories fabrication and installation in ducts and other construction. Include dimensions, weights, loads, and required clearances, and method of field assembly into duct systems and other construction. Include the following:
   a. Special fittings.
   b. Manual volume damper installations.
   c. Control-damper installations.
   d. Fire-damper and smoke-damper installations, including sleeves; and duct-mounted access doors.
   e. Wiring Diagrams: For power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.
2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304, and having a No. 2 finish for concealed ducts and finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 BACKDRAFT AND PRESSURE RELIEF DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Pottorff.
4. Ruskin Company.

B. Description: Gravity balanced.

C. Maximum Air Velocity: 1500 fpm.

D. Maximum System Pressure: 3-inch wg.

E. Frame: Hat-shaped, 0.063-inch- thick extruded aluminum, with welded corners or mechanically attached and mounting flange.

F. Blades: Multiple single-piece blades, end pivoted, maximum 6-inch width, 0.050-inch- thick aluminum sheet with sealed edges.

G. Blade Action: Parallel.

H. Blade Seals: Extruded vinyl or Neoprene, mechanically locked.

I. Blade Axles:

1. Material: Aluminum.
2. Diameter: 0.20 inch.

J. Tie Bars and Brackets: Aluminum.

K. Return Spring: Adjustable tension.

L. Bearings: Steel ball or synthetic pivot bushings.

M. Accessories:

1. Adjustment device to permit setting for varying differential static pressure.
2. Counterweights and spring-assist kits for vertical airflow installations.
3. Electric actuators.
4. Screen Mounting: Rear mounted.
5. Screen Material: Galvanized steel or Aluminum.
6. Screen Type: Bird.
7. 90-degree stops.

2.4 MANUAL VOLUME DAMPERS

A. Standard, Steel, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Flexmaster U.S.A., Inc.
b. McGill AirFlow LLC.
c. Nailor Industries Inc.
d. Pottorff.
e. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.

4. Frames:

    a. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel.
    b. Mitered and welded corners.
    c. Flanges for attaching to walls and flangeless frames for installing in ducts.

5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Galvanized-steel, 0.064 inch thick.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze, Molded synthetic or Oil-impregnated stainless-steel sleeve.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Galvanized steel.

B. Standard, Aluminum, Manual Volume Dampers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. McGill AirFlow LLC.
    b. Nailor Industries Inc.
    c. Pottorff.
    d. Ruskin Company.

2. Standard leakage rating, with linkage outside airstream.
3. Suitable for horizontal or vertical applications.
4. Frames: Hat-shaped, 0.10-inch- thick, aluminum sheet channels; frames with flanges for attaching to walls and flangeless frames for installing in ducts.
5. Blades:

    a. Multiple or single blade.
    b. Parallel- or opposed-blade design.
    c. Stiffen damper blades for stability.
    d. Roll-Formed Aluminum Blades: 0.10-inch- thick aluminum sheet.
    e. Extruded-Aluminum Blades: 0.050-inch- thick extruded aluminum.

6. Blade Axles: Galvanized steel.
7. Bearings:

    a. Oil-impregnated bronze.
    b. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

8. Tie Bars and Brackets: Aluminum.

C. Jackshaft:

1. Size: 0.5-inch solid hex or square rod.
2. Material: Galvanized-steel pipe rotating within pipe-bearing assembly mounted on supports at each mullion and at each end of multiple-damper assemblies.
3. Length and Number of Mountings: As required to connect linkage of each damper in multiple-damper assembly.

D. Damper Hardware:

1. Zinc-plated, die-cast core with dial and handle made of 3/32-inch- thick zinc-plated steel, and a 3/4-inch hexagon locking nut.
2. Include center hole to suit damper operating-rod size.
3. Include elevated platform for insulated duct mounting.

2.5 CONTROL DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arrow United Industries; a division of Mestek, Inc.
2. Greenheck Fan Corporation.
3. Nailor Industries Inc.
4. Ruskin Company.

B. Frames:

1. Hat shaped.
2. 0.094-inch- thick, galvanized sheet steel.
3. Mitered and welded or Interlocking, gusseted corners.

C. Blades:

1. Multiple blade with maximum blade width of 6 inches 8 inches.
2. Parallel- and opposed-blade design.
3. Galvanized-steel.
4. 0.0747-inch- thick dual skin.
5. Blade Edging: Closed-cell neoprene.

D. Blade Axles: 1/2-inch- diameter; stainless steel; blade-linkage hardware of zinc-plated steel and brass; ends sealed against blade bearings.

1. Operating Temperature Range: From minus 40 to plus 200 deg F.

E. Bearings:

1. Oil-impregnated bronze or Oil-impregnated stainless-steel sleeve.
2. Dampers in ducts with pressure classes of 3-inch wg or less shall have axles full length of damper blades and bearings at both ends of operating shaft.

3. Thrust bearings at each end of every blade.

2.6 FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Ruskin Company.

B. Type: Static and dynamic; rated and labeled according to UL 555 by an NRTL.

C. Closing rating in ducts up to 4-inch wg static pressure class and minimum 2000-fpm velocity.

D. Fire Rating: 1-1/2 and 3 hours.

E. Frame: Multiple-blade type or Curtain type with blades outside airstream except when located behind grille where blades may be inside airstream; fabricated with roll-formed, 0.034-inch-thick galvanized steel; with mitered and interlocking corners.

F. Mounting Sleeve: Factory- or field-installed, galvanized sheet steel.

1. Minimum Thickness: 0.138 inch or 0.39 inch thick, as indicated, and of length to suit application.
2. Exception: Omit sleeve where damper-frame width permits direct attachment of perimeter mounting angles on each side of wall or floor; thickness of damper frame must comply with sleeve requirements.

G. Mounting Orientation: Vertical or horizontal as indicated.

H. Blades: Roll-formed, interlocking, galvanized sheet steel. In place of interlocking blades, use full-length, 0.034-inch- thick, galvanized-steel blade connectors. Thickness required by UL listing R-5531.

I. Horizontal Dampers: Include blade lock and stainless-steel closure spring.

J. Heat-Responsive Device: Replaceable, 165 deg F rated, fusible links.

2.7 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.
2. Nailor Industries Inc.
3. Ruskin Company.

B. General Requirements: Label according to UL 555S by an NRTL.

C. Smoke Detector: Integral, factory wired for single-point connection.

D. Frame: Hat-shaped, 0.094-inch- thick, galvanized sheet steel, with welded, interlocking, gusseted or mechanically attached corners and mounting flange.

E. Blades: Roll-formed, horizontal, interlocking or overlapping, 0.034-inch- thick, galvanized sheet steel.

F. Leakage: Class I.

G. Rated pressure and velocity to exceed design airflow conditions.

H. Mounting Sleeve: Factory-installed, 0.05-inch- thick, galvanized sheet steel; length to suit wall or floor application with factory-furnished silicone calking.

I. Damper Motors: Modulating or two-position action.

J. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Nonspring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

K. Accessories:

1. Auxiliary switches for signaling fan control or position indication.
2. Test and reset switches, damper mounted.

2.8 COMBINATION FIRE/SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Greenheck Fan Corporation.

2. Nailor Industries Inc.
3. Ruskin Company.

B. Description: Front access combination fire smoke dampers with integral accessories cabinet designed for supply or return ducts with grille outlet and providing through-the-grille access to the damper and heat-actuated components, meeting the requirements of the latest edition of UL Standard 555 and UL Standard 555S.

C. Fire Resistance Rating: 1-1/2 hours in accordance with UL555.

D. Leakage: Class II, leaking no more than 20 cfm at 4 in. wg differential pressure.

E. Rated pressure and velocity to exceed design airflow conditions or 2,000 feet per minute, whichever is greater.

F. Frame: Hat-shaped, 0.0625-inch- thick, roll formed, galvanized sheet steel, with welded, interlocking, gusseted or mechanically attached corners and mounting flange.

G. Sleeve: Factory-installed with external fire-resistant insulation and including an integral accessories cabinet containing all required accessories.

1. Thickness: 20 gauge, minimum.
2. Length: Minimum 14-inch with front flange.

H. Blades:

1. Style: True airfoil-shaped, single piece, double skin or single skin triple-v-groove depending on model.
2. Action: Opposed.
3. Material: Minimum 14-gauge equivalent thickness, galvanized steel for airfoil blades or minimum 16-gauge galvanized steel for triple-v-groove.
4. Width: Maximum 6-inches.

I. Bearings: Self-lubricating stainless-steel sleeve, turning in extruded hole in frame.

J. Seals:

1. Blade: Inflatable silicone fiberglass material to maintain smoke leakage rating to a minimum of 450°F and galvanized steel for flame seal to 1,900°F. Mechanically attached to blade edge (glue-on or grip type seals are not acceptable).
2. Jamb: Stainless steel, flexible metal compression type.

K. Linkage: Concealed in frame.

L. Axles: Minimum ½ inch diameter plated steel, hex-shaped, mechanically attached to blade.

M. Mounting: Vertical.

N. Temperature Release Device: Heat-Actuated, Quick Detect.

1. Close (in a controlled manner) and lock damper during test, smoke detection, power failure, or fire conditions through actuator closure spring. At no time shall actuator disengage from damper blades.
2. Allow damper to be automatically and remotely reset after test or power failure conditions. After exposure to high temperature or fire, inspect damper before reset to ensure proper operation.
3. Controlled closing and locking of damper in 7 to 15 seconds to allow duct pressure to equalize. Instantaneous closure is not acceptable.

O. Release Temperature: 165 Deg F rated.

P. Damper Motors: Modulating or two-position action.

Q. Finish: Mill galvanized.

R. Damper Motors: Modulating or two-position action, fail-close.

S. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
2. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in Section 230900 "Instrumentation and Control for HVAC."
3. Permanent-Split-Capacitor or Shaded-Pole Motors: With oil-immersed and sealed gear trains.
4. Spring-Return Motors: Equip with an integral spiral-spring mechanism where indicated. Enclose entire spring mechanism in a removable housing designed for service or adjustments. Size for running torque rating of 150 in. x lbf and breakaway torque rating of 150 in. x lbf.
5. Outdoor Motors and Motors in Outdoor-Air Intakes: Equip with O-ring gaskets designed to make motors weatherproof. Equip motors with internal heaters to permit normal operation at minus 40 deg F.
6. Non-spring-Return Motors: For dampers larger than 25 sq. ft., size motor for running torque rating of 150 in. x lbf and breakaway torque rating of 300 in. x lbf.
7. Electrical Connection: 115 V, single phase, 60 Hz.

T. Accessories:

1. Auxiliary switches for signaling fan control or position indication.
2. Test and reset switches, wall-mounted.

2.9 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.

2. Nexus PDQ; Division of Shilco Holdings Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Description: Add-on or roll-formed, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.10 TURNING VANES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. METALAIRE, Inc.
4. SEMCO Incorporated.
5. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

C. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

D. General Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 4-3, "Vanes and Vane Runners," and 4-4, "Vane Support in Elbows."

E. Vane Construction: Single or Double wall.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. American Warming and Ventilating; a division of Mestek, Inc.
2. Ductmate Industries, Inc.
3. Flexmaster U.S.A., Inc.
4. Greenheck Fan Corporation.
5. McGill AirFlow LLC.
6. Nailor Industries Inc.
7. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"; Figures 7-2, "Duct Access Doors and Panels," and 7-3, "Access Doors - Round Duct."

1. Door:

a. Double wall, rectangular.
b. Galvanized sheet metal with insulation fill and thickness as indicated for duct pressure class.
c. Vision panel.
d. Hinges and Latches: 1-by-1-inchbutt or piano hinge and cam latches.
e. Fabricate doors airtight and suitable for duct pressure class.

2. Frame: Galvanized sheet steel, with bend-over tabs and foam gaskets.
3. Number of Hinges and Locks:

a. Access Doors Less Than 12 Inches Square: No hinges and two sash locks.
b. Access Doors up to 18 Inches Square: Two hinges or Continuous and two sash locks.
c. Access Doors up to 24 by 48 Inches: Three hinges or Continuous and two compression latches with outside and inside handles.
d. Access Doors Larger Than 24 by 48 Inches: Four hinges or Continuous and two compression latches with outside and inside handles.

C. Pressure Relief Access Door:

1. Door and Frame Material: Galvanized sheet steel.
2. Door: Single wall or Double wall with insulation fill to match duct insulatiuon, with metal thickness applicable for duct pressure class.
3. Operation: Open outward for positive-pressure ducts and inward for negative-pressure ducts.
4. Factory set at 3.0- to 8.0-inch wg 10-inch wg.
5. Doors close when pressures are within set-point range.
6. Hinge: Continuous piano.
7. Latches: Cam.
8. Seal: Neoprene or foam rubber.
9. Insulation Fill: 1-inch- thick, fibrous-glass or polystyrene-foam board.

2.12 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Flame Gard, Inc.
3. 3M.

B. Labeled according to UL 1978 by an NRTL.

C. Panel and Frame: Minimum thickness 0.0528-inch carbon 0.0428-inch stainless steel.

D. Fasteners: Carbon Stainless steel. Panel fasteners shall not penetrate duct wall.

E. Gasket: Comply with NFPA 96; grease-tight, high-temperature ceramic fiber, rated for minimum 2000 deg F.

F. Minimum Pressure Rating: 10-inch wg, positive or negative.

2.13 FLEXIBLE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ductmate Industries, Inc.
2. Duro Dyne Inc.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Materials: Flame-retardant or noncombustible fabrics.

C. Coatings and Adhesives: Comply with UL 181, Class 1.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene.

1. Minimum Weight: 26 oz./sq. yd.
2. Tensile Strength: 480 lbf/inch in the warp and 360 lbf/inch in the filling.
3. Service Temperature: Minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone.

1. Minimum Weight: 24 oz./sq. yd.
2. Tensile Strength: 530 lbf/inch in the warp and 440 lbf/inch in the filling.
3. Service Temperature: Minus 50 to plus 250 deg F.

2.14 FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Flexmaster U.S.A., Inc.
2. McGill AirFlow LLC.
3. Ward Industries, Inc.; a division of Hart & Cooley, Inc.

B. Noninsulated, Flexible Duct: UL 181, Class 1, 2-ply vinyl film supported by helically wound, spring-steel wire.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 10 to plus 160 deg F.

C. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.

1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
2. Maximum Air Velocity: 4000 fpm.
3. Temperature Range: Minus 20 to plus 210 deg F.
4. Insulation R-value: Comply with ASHRAE/IESNA 90.1.

D. Flexible Duct Connectors:

1. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.
2. Non-Clamp Connectors: Adhesive plus sheet metal screws.

2.15 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for metal ducts and in NAIMA AH116, "Fibrous Glass Duct Construction Standards," for fibrous-glass ducts.

B. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

C. Install backdraft and control dampers at inlet of exhaust fans or exhaust ducts as close as possible to exhaust fan unless otherwise indicated.

D. Install volume dampers at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

1. Install steel volume dampers in steel ducts.
2. Install aluminum volume dampers in aluminum ducts.

E. Set dampers to fully open position before testing, adjusting, and balancing.

F. Install test holes at fan inlets and outlets and elsewhere as indicated.

G. Install fire and smoke dampers according to UL listing.

H. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:

1. On both sides of duct coils.
2. Upstream and downstream from duct filters.
3. At outdoor-air intakes and mixed-air plenums.
4. At drain pans and seals.
5. Downstream from manual volume dampers, control dampers, backdraft dampers, and equipment.
6. Adjacent to and close enough to fire or smoke dampers, to reset or reinstall fusible links. Access doors for access to fire or smoke dampers having fusible links shall be pressure relief access doors and shall be outward operation for access doors installed upstream from dampers and inward operation for access doors installed downstream from dampers.
7. At each change in direction and at maximum 50-foot spacing.
8. Upstream and downstream from turning vanes.
9. Upstream or downstream from duct silencers.
10. Control devices requiring inspection.
11. Elsewhere as indicated.

I. Install access doors with swing against duct static pressure.

J. Access Door Sizes:

1. One-Hand or Inspection Access: 8 by 5 inches.
2. Two-Hand Access: 12 by 6 inches.
3. Head and Hand Access: 18 by 10 inches.
4. Head and Shoulders Access: 21 by 14 inches.
5. Body Access: 25 by 14 inches.
6. Body plus Ladder Access: 25 by 17 inches.

K. Label access doors according to Section 230553 "Identification for HVAC Piping and Equipment" to indicate the purpose of access door.

L. Install flexible connectors to connect ducts to equipment.

M. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions.

N. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

O. Connect flexible ducts to metal ducts with adhesive plus sheet metal screws.

P. Install duct test holes where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Operate dampers to verify full range of movement.
2. Inspect locations of access doors and verify that purpose of access door can be performed.
3. Operate fire and smoke dampers to verify full range of movement and verify that proper heat-response device is installed.
4. Inspect turning vanes for proper and secure installation.

END OF SECTION 233300

SECTION 233423

HVAC POWER VENTILATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Centrifugal roof ventilators.
2. Centrifugal wall ventilators.
3. Ceiling-mounted ventilators.
4. In-line centrifugal fans.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.4 QUALITY ASSURANCE

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.

B. AMCA Compliance: Fans shall have AMCA-Certified performance ratings and shall bear the AMCA-Certified Ratings Seal.

PART 2 - PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. PennBarry.

B. Housing: Removable, spun-aluminum, dome top and outlet baffle, extruded-aluminum, rectangular top or galvanized steel, mushroom-domed top; square, one-piece, aluminum base with venturi inlet cone.

1. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains and grease collector.
2. Hinged Subbase: Galvanized-steel hinged arrangement permitting service and maintenance.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Non-fusible type, with thermal-overload protection mounted inside fan housing, factory wired through an internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.

F. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch- thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base.
1. Configuration: Built-in raised cant and mounting flange.
2. Overall Height: 8 inches or 14 inches, where used for grease exhaust.
3. Pitch Mounting: Manufacture curb for roof slope.
4. Metal Liner: Galvanized steel.
5. Mounting Pedestal: Galvanized steel with removable access panel.
6. Vented Curb: Unlined with louvered vents in vertical sides.

2.2 CENTRIFUGAL WALL VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. PennBarry.

B. Housing: Heavy-gage, removable, spun-aluminum, dome top and outlet baffle; venturi inlet cone.

C. Fan Wheel: Aluminum hub and wheel with backward-inclined blades.

D. Belt Drives:

1. Resiliently mounted to housing.
2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
4. Pulleys: Cast-iron, adjustable-pitch motor pulley.
5. Fan and motor isolated from exhaust airstream.

E. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Disconnect Switch: Nonfusible type, with thermal-overload protection mounted inside fan housing, factory wired through internal aluminum conduit.
3. Bird Screens: Removable, 1/2-inch mesh, aluminum or brass wire.
4. Wall Grille: Ring type for flush mounting.
5. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in wall sleeve; factory set to close when fan stops.
6. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.3 CEILING-MOUNTED VENTILATORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. PennBarry.

B. Housing: Steel, lined with acoustical insulation.

C. Fan Wheel: Centrifugal wheels directly mounted on motor shaft. Fan shrouds, motor, and fan wheel shall be removable for service.

D. Grille: Plastic, louvered grille with flange on intake and thumbscrew attachment to fan housing.

E. Electrical Requirements: Junction box for electrical connection on housing and receptacle for motor plug-in.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Manual Starter Switch: Single-pole rocker switch assembly with cover and pilot light.
3. Time-Delay Switch: Assembly with single-pole rocker switch, timer, and cover plate.
4. Motion Sensor: Motion detector with adjustable shutoff timer.
5. Ceiling Radiation Damper: Fire-rated assembly with ceramic blanket, stainless-steel springs, and fusible link.
6. Isolation: Rubber-in-shear vibration isolators.
7. Manufacturer's standard roof jack or wall cap, and transition fittings.

2.4 IN-LINE CENTRIFUGAL FANS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Acme Engineering & Manufacturing Corporation.
2. Greenheck Fan Corporation.
3. Loren Cook Company.
4. PennBarry.

B. Housing: Split, spun aluminum with aluminum straightening vanes, inlet and outlet flanges, and support bracket adaptable to floor, side wall, or ceiling mounting.

C. Direct-Drive Units: Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing; with wheel, inlet cone, and motor on swing-out service door.

D. Belt-Driven Units: Motor mounted on adjustable base, with adjustable sheaves, enclosure around belts within fan housing, and lubricating tubes from fan bearings extended to outside of fan housing.

E. Fan Wheels: Aluminum, airfoil blades welded to aluminum hub.

F. Accessories:

1. Variable-Speed Controller: Solid-state control to reduce speed from 100 to less than 50 percent.
2. Volume-Control Damper: Manually operated with quadrant lock, located in fan outlet.
3. Companion Flanges: For inlet and outlet duct connections.
4. Fan Guards: 1/2- by 1-inch mesh of galvanized steel in removable frame. Provide guard for inlet or outlet for units not connected to ductwork.
5. Motor and Drive Cover (Belt Guard): Epoxy-coated steel.

6. Vibration Isolators:

    a. Type: Elastomeric hangers.
    b. Static Deflection: 1 inch.

7. Spark Arrestance Class: A.

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

    1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

B. Enclosure Type: Totally enclosed, fan cooled.

2.6 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301, "Methods for Calculating Fan Sound Ratings from Laboratory Test Data." Factory test fans according to AMCA 300, "Reverberant Room Method for Sound Testing of Fans." Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating." Label fans with the AMCA-Certified Ratings Seal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Equipment Mounting:

    1. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
    2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

B. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. See Section 077200 "Roof Accessories" for installation of roof curbs.

C. Ceiling Units: Suspend units from structure; use steel wire or metal straps.

D. Support suspended units from structure using threaded steel rods and elastomeric hangers, spring hangers or spring hangers with vertical-limit stops having a static deflection of 1 inch.

Vibration-control devices are specified in Section 230548 "Vibration and Seismic Controls for HVAC." or Section 230548.13 "Vibration Controls for HVAC."

E. Install units with clearances for service and maintenance.

F. Label units according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to power ventilators to allow service and maintenance.

C. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

D. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

B. Tests and Inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
5. Adjust belt tension.
6. Adjust damper linkages for proper damper operation.
7. Verify lubrication for bearings and other moving parts.
8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
10. Shut unit down and reconnect automatic temperature-control operators.
11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

3.4 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Adjust belt tension.

C. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing procedures.

D. Replace fan and motor pulleys as required to achieve design airflow.

E. Lubricate bearings.

END OF SECTION 233423

SECTION 233433

AIR CURTAINS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes air curtains.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: For air curtains. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.3 INFORMATIONAL SUBMITTALS

A. Warranties: Sample of special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

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.

B. Comply with AMCA 220, "Laboratory Methods of Testing Air Curtains for Aerodynamic Performance Ratings," for airflow, outlet velocity, and power consumption.

C. Comply with NSF 37, "Air Curtains for Entranceways in Food and Food Service Establishments."

PART 2 - PRODUCTS

2.1 AIR-CURTAIN UNIT

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Berner International.
2. King Company; a company of Mestek, Inc.
3. Loren Cook Company.
4. Marley Engineered Products.
5. Mars Air Products; Dynaforce Division.
6. Mars Air Products; Mars Air Door Division.
7. Mestek, Inc.; L. J. Wing Division.

B. Housing:

1. Materials: Heavy-gage, electroplated-zinc steel with welded construction and polyester-coated finish.
2. Discharge Nozzle: Integral part of the housing, containing fixed air-directional vanes.

C. Mounting Brackets: Steel, for wall or ceiling mounting, as applicable.

D. Air-Intake:

1. Grille: Integral part of and same material as the housing.
2. Insect Screen: Aluminum or Stainless steel, removable.

E. Fans:

1. Centrifugal, forward curved, double width, double inlet.
2. Galvanized steel, Painted steel, or Aluminum.
3. Statically and dynamically balanced.
4. Direct drive or Belt drive and equipped with belt guards and adjustable sheaves and pulleys.

F. Motors: Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

1. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

G. Filters:

1. Disposable Panel Filters: Factory-fabricated, viscous-coated, flat-panel-type, disposable air filters with glass-fiber media sprayed with nonflammable adhesive in cardboard or galvanized-steel frame.
2. Washable Panel Filters: Removable, stainless-steel, baffle-type filters with spring-loaded fastening; with minimum 0.0781-inch- thick, stainless-steel filter frame.

3. Mounting Frames: Welded, galvanized steel with gaskets and fasteners and suitable for bolting together into built-up filter banks.

H. Controls:

1. Automatic Door Switch: Roller type, Combination roller-plunger type, or Plunger type installed in door area to activate air curtain when door opens and to deactivate air curtain when door closes.

2.2 SOURCE QUALITY CONTROL

A. Source Quality Control: Test to 300 psig and to 200 psig underwater.

B. Testing: Test and inspect steam coils according to ASHRAE 33.

C. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install air curtains with clearance for equipment service and maintenance.

B. Equipment Installation: Install air curtains. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for."

C. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

D. Drawings indicate general arrangement of piping, fittings, and specialties.

E. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.2 FIELD QUALITY CONTROL

A. Perform tests and inspections.

1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
2. After installing air curtains completely, perform visual and mechanical check of individual components.
3. After electrical circuitry has been energized, start unit to confirm motor rotation and unit operation. Certify compliance with test parameters.
4. Inspect for water leaks.
5. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Air-curtain unit will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 233433

SECTION 233713

DIFFUSERS, REGISTERS, AND GRILLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ceiling Diffusers.
2. Linear Outlets
3. Registers and Grilles

B. Related Sections:

1. Section 089116 "Operable Wall Louvers" and Section 089119 "Fixed Louvers" for fixed and adjustable louvers and wall vents, whether or not they are connected to ducts.
2. Section 233300 "Air Duct Accessories" for fire and smoke dampers and volume-control dampers not integral to diffusers, registers, and grilles.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product indicated, include the following:

1. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
2. Diffuser, Register, and Grille Schedule: Indicate drawing designation, room location, quantity, model number, size, and accessories furnished.

PART 2 - PRODUCTS

2.1 CEILING DIFFUSERS

A. Square 3-Cone Ceiling Diffusers:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

a. METALAIRE, Inc.
b. Nailor Industries Inc.
c. Price Industries.
d. Titus.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material: Aluminum.

4. Finish: Baked enamel, white.
5. Face Size: 24 by 24 inches.
6. Face Style: Three cone.
7. Mounting: T-bar.
8. Pattern: Fixed.

2.2 LINEAR OUTLETS

A. Linear Slot Diffuser:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. METALAIRE, Inc.
    b. Nailor Industries Inc.
    c. Price Industries.
    d. Titus.

2. Devices shall be specifically designed for variable-air-volume flows.
3. Material - Shell: Steel, insulated.
4. Material - Pattern Controller and Tees: Aluminum.
5. Finish - Face and Shell: Baked enamel, black.
6. Finish - Pattern Controller: Baked enamel, black.
7. Finish - Tees: Baked enamel, white.
8. Slot Width: 1/2-inch, 3/4 inch, 1 inch, or 1-1/2 inches as indicated on the Drawings.
9. Number of Slots: One, Two, Three, or Four as indicated on the Drawings.
10. Length: 24 inches or 48 inches as indicated on the Drawings.
11. Accessories: T-bar slot.

2.3 REGISTERS AND GRILLES

A. Double Deflection Supply Register:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. METALAIRE, Inc.
    b. Nailor Industries Inc.
    c. Price Industries.
    d. Titus.

2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Blade Arrangement: Vertical spaced 3/4 inch apart.
5. Rear-Blade Arrangement: Horizontal spaced 3/4 inch apart.
6. Frame: 1-1/4 inches wide.
7. Mounting: Countersunk screw.
8. Damper Type: Adjustable opposed blade; and NRTL listed, opposed blade, spring closing, and with fusible link for 160 deg F where installed in fire rated assembly.

9. Accessories:

    a. Rear-blade gang operator.

B. Eggcrate Return Grille:

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

    a. METALAIRE, Inc.
    b. Nailor Industries Inc.
    c. Price Industries.
    d. Titus.

2. Material: Aluminum.
3. Finish: Baked enamel, white.
4. Face Arrangement: 1/2-by-1/2-by-1/2-inch grid core.
5. Mounting: Lay in or Surface, as indicated on the Drawings.

2.4 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practical. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

3.2 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

END OF SECTION 233713

SECTION 235100

BREECHINGS, CHIMNEYS, AND STACKS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Breechings.

B. Vent Dampers.

1.2 REFERENCES

A. ANSI Z181.1 (UL 959) - Medium Heat Appliance Factory Built Chimneys.

B. ANSI Z21.66 - Electrically Operated Automatic Vent Damper Devices for Use with Gas-Fired Appliances.

C. ANSI Z223.1 (NFPA 54) - The National Fuel Gas Code.

D. ANSI/ASTM C64 - Refractories for Incinerators and Boilers.

E. ANSI/UL 103 - Standard for Factory Built Chimneys for Residential Type and Building Heating Appliances.

F. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances.

G. UL 378 - Standard for Draft Equipment

H. UL 441 - Standard for Gas Vents.

I. UL 641 - Standard for Type L Low-Temperature Venting Systems.

1.3 SUBMITTALS

A. Submit shop drawings per Section 230500. Include general construction, dimensions, weights, support and layout of breechings. Where factory-built units are used submit layout drawings indicating plan view and elevations.

B. Submit product data indicating factory-built chimneys, including dimensional details of components and flue caps, dimensions and weights.

C. Submit engineering report and manufacturer's certificate that refractory lined metal stacks meet specified requirements.

D. Submit manufacturer's installation instructions.

1.4 DEFINITIONS

A. Breeching or Vent Connector: Conducts the flue gases from the flue collar of an appliance to a chimney or vent, and may include a draft control device.

B. Chimney: Primarily vertical shaft enclosing at least one vent for conducting flue gases outdoors.

C. Combustion Air: Air that is supplied to combustion appliances to be used in the combustion of fuels and the process of venting combustion gases.

D. Smoke Pipe: Round, single wall vent connector.

E. Vent: Conveys flue gases directly outdoors from a vent connector or from an appliance when a vent connector is not used.

1.5 DESIGN REQUIREMENTS

A. Factory built vents and chimneys used for venting natural draft appliances shall comply with NFPA 211 and be UL listed and labeled.

PART 2 - PRODUCTS

2.1 POSITIVE PRESSURE GAS VENTS AND INTAKE (CONDENSING AND HIGH EFFICIENCY)

A. Stainless Steel (AL29-4C):

1. The venting system shall be ANSI/UL 1738.
2. The venting system shall be double wall metal with a minimum of 1" (25 mm) air space between the walls. Outer wall shall be Type 430 stainless steel.
3. The inner pipe shall be AL29-4C.
4. Vent flue pipe shall be UL listed for Category III and IV appliances with operating temperatures of up to 480°F (249°C). The closure system to be rated as gas tight for 5" w.c. (125 Pa) positive pressure flue gas service.
5. Fasteners to be same material as piping and shall maintain 1" (25 mm) air space between walls.
6. The joints shall be gas tight to prevent leakage of flue or condensate.
7. Vent system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
8. Furnish roof flashing with vent cap.
9. Usage: Condensing and high efficiency boiler positive pressure gas vent and combustion air intake.
10. Manufacturers:

    a. AMPCO
    b. DuraVent

c. Hart & Cooley
d. Heat Fab
e. Metal-Fab
f. Schebler
g. Selkirk/Metalbestos
h. Van-Packer
i. Security (M&G Group)

B. Chlorinated Polyvinyl Chloride Piping (CPVC):

1. Type BH Class IIB Vent.
2. Vent flue pipe shall be UL listed for Category IIB appliances with operating temperatures of up to 195°F (90°C). The closure system to be rated as gas tight for 5" w.c. (125 Pa) positive pressure flue gas service.
3. Tubing: Virgin rigid chlorinated polyvinyl chloride (CPVC). Copper tube size (CTS) manufactured to standard dimensional ratio (SDR) 11, ASTM D1784: ASTM D2846, NSF Certified.
4. Joints: Solvent cement and primers shall be certified for flue gas venting applications.
5. Fittings: Same as tubing. Fittings and tubing shall be a system provided by the same manufacturer. Threaded adapters for threaded valves shall be metal threaded adapter with solvent socket.
6. Limitations: Shall not be used in a return air plenum unless specifically listed to ASTM E84/UL723.
7. Vent system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
8. Usage: Condensing and high efficiency boiler combustion air intake and vent. Include boiler manufacturer's written approval for use as a vent material.
9. Furnish roof flashing with vent cap.

C. Polypropylene Piping:

1. Vent flue pipe shall be Intertek / ETL listed to ULC-S636 Listed as a Class IIA, IIB, and IIC vent system with operating temperatures of up to 230°F (110°C). The closure system to be rated as gas tight for 5" w.c. (125 Pa) positive pressure flue gas service.
2. Pipe: Polypropylene; for use with ANSI Category II and IV gas-burning appliance.
3. Joints: Polypropylene socket fused or electrofusion.
4. Fittings: Same as pipe
5. Limitations: Shall not be used in a plenum unless listed ≤ 25/50 per ASTM E84/UL723.
6. Vent system is to be sized in accordance with manufacturer's recommendations and the current edition of NFPA 54/ANSI Z223.1: National Fuel Gas Code and ASHRAE recommendations.
7. Usage: Condensing and high efficiency boiler combustion air intake and vent. Include boiler manufacturer's written approval for use as a vent material.
8. Furnish roof flashing with vent cap.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Prior to putting boilers into operation, Contractor shall provide full penetration welds for the entire length of each pipe section for all inner and outer shell seams to prevent leakage of flue gases. Riveted, tack, or spot-welded seams are not permitted.

B. Install all products in accordance with manufacturer's instructions.

C. Install in accordance with recommendations of ASHRAE - Handbook, Chapter "Chimney, Gas Vent, and Fireplace Systems", NFPA 211, and ANSI Z223.1 (NFPA 54).

D. Install breechings with minimum of joints. Align accurately at connections, with internal surfaces smooth.

E. Support breechings from building structure, rigidly with suitable ties, braces, hangers and anchors to hold to shape and prevent buckling. Guide vertical breechings, chimneys, and stacks at 12 foot (3.6 m) spacing, to adjacent structural surfaces, or at floor penetrations. Refer to SMACNA HVAC Duct Construction Standards - Metal and Flexible for duct support configuration and size. Provide expansion compensation approved by the manufacturer.

F. Pitch breechings with positive slope up from fuel-fired equipment to chimney or stack.

G. Install vent dampers near draft hood collars and secured to breechings.

H. Level and plumb chimneys and stacks. Provide 3/4" (20 mm) condensate drain at base of all chimneys and stacks over 12" (300 mm) diameter. Pipe condensate to nearest floor drain.

I. Clean breechings, chimneys, and stacks during installation, removing dust and debris.

J. Provide slip joints permitting removal of appliances without removal or dismantling of breechings, chimneys, or stacks.

END OF SECTION 235100

SECTION 236200

PACKAGED COMPRESSOR AND CONDENSER UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged, air-cooled, refrigerant compressor and condenser units.

1.2 ACTION SUBMITTALS

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

B. LEED Submittals:

1. Product Data for Prerequisite EA 2: Documentation indicating that units comply with applicable requirements in ASHRAE/IESNA 90.1.
2. Product Data for Credit EA 4: Documentation indicating that compressor and condenser units and refrigerants comply.

C. Shop Drawings: For compressor and condenser units. Include plans, elevations, sections, details, and attachments to other work.

1. Wiring Diagrams: For power, signal, and control wiring.

1.3 QUALITY ASSURANCE

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.

B. Fabricate and label refrigeration system according to ASHRAE 15, "Safety Standard for Refrigeration Systems."

C. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6, "Heating, Ventilating, and Air-Conditioning."

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of compressor and condenser units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Compressor failure.
   b. Condenser coil leak.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 1 TO 5 TONS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carrier Corporation; Commercial HVAC Systems.
2. Lennox International Inc.
3. Trane; a business of American Standard Companies.
4. YORK; a Johnson Controls company.

B. Description: Factory assembled and tested; consisting of compressor, condenser coil, fan, motors, refrigerant reservoir, and operating controls.

C. Compressor: Scroll, hermetically sealed, with rubber vibration isolators.

1. Motor: Single speed, and includes thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
2. Two-Speed Compressor: Include manual-reset, high-pressure switch and automatic-reset, low-pressure switch.
3. Accumulator: Suction tube.

D. Refrigerant: R-410A.

E. Condenser Coil: Seamless copper-tube, aluminum-fin coil; circuited for integral liquid sub-cooler, with removable drain pan and brass service valves with service ports.

F. Condenser Fan: Direct-drive, aluminum propeller fan; with permanently lubricated, totally enclosed fan motor with thermal-overload protection and ball bearings.

G. Accessories:

1. Coastal Filter: Mesh screen to protect condenser coil from salt damage.
2. Crankcase heater.
3. Cycle Protector: Automatic-reset timer to prevent rapid compressor cycling.
4. Electronic programmable thermostat or Low-voltage thermostat and subbase to control compressor and condenser unit and evaporator fan.
5. Evaporator Freeze Thermostat: Temperature-actuated switch that stops unit when evaporator reaches freezing temperature.
6. Filter-dryer.
7. High-Pressure Switch: Automatic-reset switch cycles compressor off on high refrigerant pressure.
8. Liquid-line solenoid.
9. Low-Ambient Controller: Cycles condenser fan to permit operation down to 30 deg F with time-delay relay to bypass low-pressure switch.

10. Low-Pressure Switch: Automatic-reset switch cycles compressor off on low refrigerant pressure.
11. PE mounting base.
12. Pre-charged and insulated suction and liquid tubing.
13. Sound Hood: Wraps around sound attenuation cover for compressor.
14. Thermostatic expansion valve.
15. Time-Delay Relay: Continues operation of evaporator fan after compressor shuts off.
16. Reversing valve.

H. Unit Casing: Galvanized steel, finished with baked enamel; with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Mount service valves, fittings, and gage ports on exterior of casing.

2.2 COMPRESSOR AND CONDENSER UNITS, AIR COOLED, 6 TO 120 TONS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carrier Corporation; Commercial HVAC Systems.
2. Lennox International Inc.
3. Trane; a business of American Standard Companies.
4. YORK; a Johnson Controls company.

B. Description: Factory assembled and tested, air cooled; consisting of casing, compressors, condenser coils, condenser fans and motors, and unit controls.

C. Compressor: Hermetic scroll compressor designed for service with crankcase sight glass, crankcase heater, and back-seating service access valves on suction and discharge ports.

1. Capacity Control: Hot-gas bypass.

D. Refrigerant: R-410A.

E. Condenser Coil: Seamless copper-tube, aluminum-fin coil, including sub-cooling circuit and backseating liquid-line service access valve. Factory pressure test coils, then dehydrate by drawing a vacuum and fill with a holding charge of nitrogen or refrigerant.

F. Condenser Fan: Propeller-type vertical discharge; either directly or belt driven. Include the following:

1. Permanently lubricated, ball-bearing totally enclosed motors.
2. Separate motor for each fan.
3. Dynamically and statically balanced fan assemblies.

G. Operating and safety controls include the following:

1. Manual-reset, high-pressure cutout switches.
2. Automatic-reset, low-pressure cutout switches.
3. Low-oil-pressure cutout switch.
4. Compressor-winding thermostat cutout switch.

5. Three-leg, compressor-overload protection.
6. Control transformer.
7. Magnetic contactors for compressor and condenser fan motors.
8. Timer to prevent excessive compressor cycling.

H. Accessories:

1. Electronic programmable thermostat or Low-voltage thermostat and subbase to control compressor and condenser unit and evaporator fan.
2. Low-Ambient Controller: Cycles condenser fan to permit operation down to 0 deg F with time-delay relay to bypass low-pressure switch.
3. Gage Panel: Package with refrigerant circuit suction and discharge gages.
4. Hot-gas bypass kit.
5. Part-winding-start timing relay, circuit breakers, and contactors.
6. Reversing valve.

I. Unit Casings: Designed for outdoor installation with weather protection for components and controls and with removable panels for required access to compressors, controls, condenser fans, motors, and drives. Additional features include the following:

1. Steel, galvanized or zinc coated, for exposed casing surfaces; treated and finished with manufacturer's standard paint coating.
2. Perimeter base rail with forklift slots and lifting holes to facilitate rigging.
3. Gasketed control panel door.
4. Non-fused disconnect switch, factory mounted and wired, for single external electrical power connection.
5. Condenser coil hail guard.

2.3 SOURCE QUALITY CONTROL

A. Energy Efficiency: Equal to or greater than prescribed by ASHRAE/IESNA 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings," Section 6, "Heating, Ventilating, and Air-Conditioning."

B. Testing Requirements: Factory test sound-power-level ratings according to ARI 270 and ARI 370.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, firmly anchored in locations indicated.

B. Install roof-mounting units on equipment supports specified in Section 077200 "Roof Accessories."

C. Equipment Mounting:

1. Install compressor and condenser units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete." or Section 033053 "Miscellaneous Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."
3. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

D. Maintain manufacturer's recommended clearances for service and maintenance.

E. Loose Components: Install electrical components, devices, and accessories that are not factory mounted.

3.2 CONNECTIONS

A. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test. Certify compliance with test parameters.
2. Leak Test: After installation, charge system with refrigerant and oil and test for leaks. Repair leaks, replace lost refrigerant and oil, and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor operation and unit operation, product capability, and compliance with requirements.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
5. Verify proper airflow over coils.

C. Verify that vibration isolation and flexible connections properly dampen vibration transmission to structure.

END OF SECTION 236200

SECTION 237416.11

PACKAGED, SMALL-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

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 packaged, small-capacity, rooftop air-conditioning units (RTUs) with the following components:

1. Casings.
2. Fans, drives, and motors.
3. Rotary heat exchangers.
4. Coils.
5. Refrigerant circuit components.
6. Air filtration.
7. Dampers.
8. Electrical power connections.
9. Controls.
10. Roof curbs.
11. Accessories.

1.3 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, small-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.4 ACTION SUBMITTALS

A. Product Data: For each RTU.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, dimensions, required clearances, characteristics, and furnished specialties and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.

5. Fans:

    a. Include certified fan-performance curves with system operating conditions indicated.
    b. Include certified fan-sound power ratings.
    c. Include fan construction and accessories.
    d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.
7. Include filters with performance characteristics.
8. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each packaged, small-capacity, rooftop air-conditioning unit.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Sample Warranty: For manufacturer's warranty.

C. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Source quality-control reports.

E. System startup reports.

F. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of filters for each unit.
2. Gaskets: One set(s) for each access door.
3. Fan Belts: One set(s) for each belt-driven fan.

1.8 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. UL Compliance: Comply with UL 1995.

G. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mounting and restraints for RTUs, including comprehensive engineering analysis.

1. Design RTU supports to comply with wind performance requirements.

H. Wind-Restraint Performance: Refer to structural Drawings.

2.2 MANUFACTURERS

1. AAON, Inc.
2. Addison Products Company.
3. Carrier Corporation.
4. Daiken North America.
5. Lennox Industries Inc.
6. Trane; American Standard Companies, Inc.
7. YORK International Corporation.

2.3 UNIT CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced single-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Single-Wall Construction:

1. Casing Wall: Galvanized steel, minimum 18 gauge thick with manufacturer's standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
2. Floor Plate: G90 galvanized steel, minimum 18 gauge thick.
3. Casing Insulation:

    a. Materials: Flexible fiberglass bonded with a phenolic binder; neoprene coated on the air side.
    b. Insulation Thickness: 1/2 inch.
    c. Insulation Density: 1-1/2-lb.
    d. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. Panels and Doors:

1. Panels:

    a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.

b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
c. Gasket: Neoprene, applied around entire perimeters of panel frames.
d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

2. Access Doors:

a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
b. Gasket: Neoprene, applied around entire perimeters of panel frames.
c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components.

3. Locations and Applications:

a. Fan Section: Doors.
b. Access Section: Doors.
c. Coil Section: Inspection and access panels.
d. Damper Section: Doors.
e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
f. Mixing Section: Doors.

E. Condensate Drain Pans:

1. Location: Each type of cooling coil.
2. Construction:

a. Single-wall, galvanized-steel or noncorrosive polymer or stainless-steel sheet.

3. Drain Connection:

a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
b. Minimum Connection Size: NPS 3/4.

4. Slope: Minimum 0.125-in./ft. slope, to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
5. Length: Extend drain pan downstream from leaving face for distance to comply with ASHRAE 62.1.
6. Width: Entire width of water producing device.
7. Depth: A minimum of 2 inches deep.
8. Pan-Top Surface Coating for Galvanized-Steel Drain Pans: Asphaltic waterproofing compound.
9. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.4 FANS, DRIVES, AND MOTORS

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.

1. Shafts: With field-adjustable alignment.

a. Turned, ground, and polished hot-rolled steel with keyway.

2. Shaft Bearings:

a. Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.

3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.

4. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
5. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
6. Shaft Lubrication Lines: Extended to a location outside the casing.
7. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch- thick, galvanized-steel sheet.

a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

C. Drives, Direct: Factory-mounted, direct drive.

D. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
2. Belts: Oil resistant, non-sparking and non-static; in matched sets for multiple-belt drives.
3. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch- thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.

E. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated multispeed or ECM motors.

F. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Enclosure Type: Open, dripproof or Totally enclosed, fan cooled.
4. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.5 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow for removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Supply-Air Refrigerant Coil:

1. Tubes: Copper.
2. Fins:

    a. Material: Aluminum.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Galvanized steel or Stainless steel.
6. Coatings: Corrosion-resistant coating.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

    a. Working Pressure: Minimum 300 psig.

C. Electric-Resistance Heating Coils: Comply with UL 1995.

1. Casing Assembly: Slip-in or Flanged type with galvanized-steel frame.
2. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
3. Overtemperature Protection: Disk-type, automatically resetting, thermal-cutout, safety device; serviceable through terminal box without removing heater from coil section.
4. Secondary Protection: Load-carrying, manually resetting or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
5. Control Panel: Unit mounted with disconnecting means and overcurrent protection.

a. Magnetic or Mercury contactor.
b. Solid-state, stepless pulse controller.
c. Toggle switches, one per step.
d. Step controller.
e. Time-delay relay.
f. Pilot lights, one per step.
g. Airflow proving switch.

2.6 REFRIGERANT CIRCUIT COMPONENTS

A. Compressor: Hermetic, variable-speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

B. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.
10. Four-way reversing valve with a replaceable magnetic coil, thermostatic expansion valves with bypass check valves, and a suction line accumulator.

2.7 AIR FILTRATION

A. Particulate air filtration is specified in Section 234100 "Particulate Air Filtration."

B. Panel Filters:

1. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
4. Filter-Media Frame: Beverage board with perforated metal retainer, or metal grid, on outlet side.

2.8 DAMPERS

A. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed or parallel-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected

with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg.

B. Barometric relief dampers.

C. Damper Operators: Comply with requirements in Section 230923.12 "Control Dampers."

2.9 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2.11 ROOF CURBS

A. Roof curbs with vibration isolators and wind or seismic restraints are specified in Section 230548 "Vibration and Seismic Controls for HVAC."

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

    a. Materials: ASTM C1071, Type I or II.
    b. Thickness: 1 inch.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

    a. Liner Adhesive: Comply with ASTM C916, Type I.
    b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
    c. Liner materials applied in this location shall have airstream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
    d. Liner Adhesive: Comply with ASTM C916, Type I.

C. Curb Dimensions: Height of 14 inches.

2.12 ACCESSORIES

A. Electric heater with integral thermostat maintains minimum 50 deg F temperature in gas burner compartment.

B. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

C. Low-ambient kit using staged or variable-speed condenser fans for operation down to minus 20 deg F.

D. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

E. Remote potentiometer to adjust minimum economizer damper position.

F. Return-air bypass damper.

G. Factory- or field-installed, demand-controlled ventilation.

H. Safeties:

1. Smoke detector.
2. Condensate overflow switch.
3. Phase-loss reversal protection.
4. High- and low-pressure control.
5. Electric coil airflow-proving switch.

I. Hail guards of galvanized steel, painted to match casing.

J. Door switches to disable heating or reset set point when open.

K. Outdoor-air intake weather hood.

L. Oil separator.

2.13 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 1000-hour salt-spray test according to ASTM B117.

1. Standards:

a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of 100 in-lb.
c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: Immersion.
3. Thickness: 1 mil.
4. Gloss: Minimum gloss of 60 on a 60-degree meter.

2.14 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. Comply with AHRI 210/240 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
3. Comply with AHRI 270 for testing and rating sound performance for RTUs.
4. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested according to AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

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 RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

1. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified with concrete.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

3.4 DUCT CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.5 ELECTRICAL CONNECTIONS

A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
2. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.7 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections:

1. After installing RTUs and after electrical circuitry has been energized, test units for compliance with requirements.
2. Inspect for and remove shipping bolts, blocks, and tie-down straps.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. RTU will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.8 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Inspect for visible damage to unit casing.
3. Inspect for visible damage to furnace combustion chamber.
4. Inspect for visible damage to compressor, coils, and fans.
5. Inspect internal insulation.
6. Verify that labels are clearly visible.
7. Verify that clearances have been provided for servicing.
8. Verify that controls are connected and operable.
9. Verify that filters are installed.
10. Clean condenser coil and inspect for construction debris.

11. Remove packing from vibration isolators.
12. Inspect operation of barometric relief dampers.
13. Verify lubrication on fan and motor bearings.
14. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
15. Adjust fan belts to proper alignment and tension.
16. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

17. Inspect and record performance of interlocks and protective devices; verify sequences.
18. Operate unit for an initial period as recommended or required by manufacturer.
19. Calibrate thermostats.
20. Adjust and inspect high-temperature limits.
21. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
22. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

23. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
24. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

    a. Supply-air volume.
    b. Return-air volume.
    c. Relief-air volume.
    d. Outdoor-air intake volume.

25. Simulate maximum cooling demand and inspect the following:

    a. Compressor refrigerant suction and hot-gas pressures.
    b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

26. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-temperature limit on gas-fired heat exchanger.
    b. Low-temperature safety operation.
    c. Filter high-pressure differential alarm.
    d. Economizer to minimum outdoor-air changeover.
    e. Relief-air fan operation.
    f. Smoke and firestat alarms.

27. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.9 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.10 CLEANING

A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.11 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. RTU will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.12 DEMONSTRATION

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

END OF SECTION 237416.11

SECTION 237416.13

PACKAGED, LARGE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged, large-capacity, rooftop air conditioning units (RTUs) with the following components:

1. Casings.
2. Fans, drives, and motors.
3. Coils.
4. Refrigerant circuit components.
5. Air filtration.
6. Dampers.
7. Electrical power connections.
8. Controls.
9. Roof curbs.
10. Accessories.

1.2 DEFINITIONS

A. RTU: Rooftop unit. As used in this Section, this abbreviation means packaged, large-capacity, rooftop air-conditioning units. This abbreviation is used regardless of whether the unit is mounted on the roof or on a concrete base on ground.

1.3 ACTION SUBMITTALS

A. Product Data: For each RTU.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Include rated capacities, dimensions, required clearances, characteristics, furnished specialties, and accessories.
3. Include unit dimensions and weight.
4. Include cabinet material, metal thickness, finishes, insulation, and accessories.
5. Fans:

    a. Include certified fan-performance curves with system operating conditions indicated.
    b. Include certified fan-sound power ratings.
    c. Include fan construction and accessories.
    d. Include motor ratings, electrical characteristics, and motor accessories.

6. Include certified coil-performance ratings with system operating conditions indicated.

7. Include filters with performance characteristics.
8. Include gas furnaces with performance characteristics.
9. Include factory selection calculations for each antimicrobial ultraviolet lamp installation.
10. Include dampers, including housings, linkages, and operators.

B. Shop Drawings: For each packaged, large-capacity, rooftop air-conditioning units.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For RTU supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Detail mounting, securing, and flashing of roof curb to roof structure. Indicate coordinating requirements with roof membrane system.
3. Wind-Restraint Details: Detail fabrication and attachment of wind and seismic restraints and snubbers. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Floor plans and other details, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.

B. Sample Warranty: For manufacturer's warranty.

C. Product Certificates: Submit certification that specified equipment will withstand wind forces identified in "Performance Requirements" Article and in Section 230548 "Vibration and Seismic Controls for HVAC."

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculations.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of wind force and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Source quality-control reports.

E. System startup reports.

F. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For RTUs to include in emergency, operation, and maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters: One set(s) of filters for each unit.
2. Gaskets: One set(s) for each access door.
3. Fan Belts: One set(s) for each belt-driven fan.
4. Filters: One set(s) of filters for each unit.

1.7 WARRANTY

A. Warranty: Manufacturer agrees to repair or replace components of outdoor, semi-custom, air-handling unit that fail in materials or workmanship within specified warranty period.

1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of RTUs and components.

C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

D. ASHRAE 15 Compliance: For refrigeration system safety.

E. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

F. UL Compliance: Comply with UL 1995.

G. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design mounting and restraints for RTUs, including comprehensive engineering analysis.

1. Design RTU supports to comply with wind performance requirements.

H. Wind-Restraint Performance: Refer to Structural Drawings.

2.2 MANUFACTURERS

1. AAON, Inc.
2. Addison Products Company.
3. Carrier Corporation.
4. Daiken North America.
5. Lennox Industries Inc.
6. Trane; American Standard Companies, Inc.
7. YORK International Corporation.

2.3 UNIT CASINGS

A. General Fabrication Requirements for Casings: Formed and reinforced double-wall insulated panels, fabricated to allow removal for access to internal parts and components, with joints between sections sealed.

B. Single-Wall Construction:

1. Casing Wall: Galvanized steel, minimum 18 gauge thick with manufacturer's standard finish, with pitched roof panels and knockouts with grommet seals for electrical and piping connections and lifting lugs.
2. Floor Plate: G90 galvanized steel, minimum 18 gauge thick.
3. Casing Insulation:

    a. Materials: Flexible fiberglass bonded with a phenolic binder, neoprene coated on the air side.
    b. Insulation Thickness: 1/2 inch.
    c. Insulation Density: 1-1/2-lb.
    d. Thermal Break: Provide continuity of insulation with no through-casing metal in casing walls, floors, or roof of unit.

C. Airstream Surfaces: Surfaces in contact with airstream shall comply with requirements in ASHRAE 62.1.

D. Panels and Doors:

1. Panels:

    a. Fabrication: Formed and reinforced with same materials and insulation thickness as casing.
    b. Fasteners: Two or more camlock type for panel lift-out operation. Arrangement shall allow panels to be opened against air-pressure differential.
    c. Gasket: Neoprene, applied around entire perimeters of panel frames.
    d. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.

2. Access Doors:

    a. Hinges: A minimum of two ball-bearing hinges or stainless-steel piano hinge and two wedge-lever-type latches, operable from inside and outside. Arrange doors to be opened against air-pressure differential.
    b. Gasket: Neoprene, applied around entire perimeters of panel frames.
    c. Size: Large enough to allow inspection and maintenance of air-handling unit's internal components. Dimensions to be at least 18 inches wide by full height of unit casing up to a maximum height of 60 inches.

3. Locations and Applications:

    a. Fan Section: Doors.
    b. Access Section: Doors.
    c. Coil Section: Inspection and access panels.
    d. Damper Section: Doors.
    e. Filter Section: Doors large enough to allow periodic removal and installation of filters.
    f. Mixing Section: Doors.

E. Condensate Drain Pans:

1. Location: Each type of cooling coil.
2. Construction:

    a. Single-wall, galvanized-steel or noncorrosive polymer or stainless-steel sheet.

3. Drain Connection:

    a. Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
    b. Minimum Connection Size: NPS 3/4.

4. Slope: Minimum 0.125-in./ft. slope, to comply with ASHRAE 62.1, in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and from humidifiers and to direct water toward drain connection.
5. Length: Extend drain pan downstream from leaving face for distance to comply with ASHRAE 62.1.
6. Width: Entire width of water producing device.
7. Depth: A minimum of 2 inches deep.
8. Pan-Top Surface Coating for Galvanized-Steel Drain Pans: Asphaltic waterproofing compound.
9. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.4 FANS, DRIVES, AND MOTORS

A. Fan and Drive Assemblies: Statically and dynamically balanced and designed for continuous operation at maximum-rated fan speed and motor horsepower.

B. Supply-Air Fans: Centrifugal, rated according to AMCA 210; galvanized or painted steel; mounted on solid-steel shaft.

1. Shafts: With field-adjustable alignment.

a. Turned, ground, and polished hot-rolled steel with keyway.

2. Shaft Bearings:

a. Heavy-duty, self-aligning, pillow-block type with an L-50 rated life of minimum 100,000 hours according to ABMA 9.

3. Housings: Formed- and reinforced-steel panels to form curved scroll housings with shaped cutoff and spun-metal inlet bell.

a. Bracing: Steel angle or channel supports for mounting and supporting fan scroll, wheel, motor, and accessories.

4. Centrifugal Fan Wheels: Inlet flange, backplate, and shallow blades with inlet and tip curved forward in direction of airflow and mechanically fastened to flange and backplate; steel or aluminum hub swaged to backplate and fastened to shaft with setscrews.
5. Mounting: For internal vibration isolation. Factory-mount fans with manufacturer's standard vibration isolation mounting devices having a minimum static deflection of 1 inch.
6. Shaft Lubrication Lines: Extended to a location outside the casing.
7. Flexible Connector: Factory fabricated with a fabric strip minimum 3-1/2 inches wide, attached to two strips of minimum 2-3/4-inch-wide by 0.028-inch- thick, galvanized-steel sheet.

a. Flexible Connector Fabric: Glass fabric, double coated with neoprene. Fabrics, coatings, and adhesives shall comply with UL 181, Class 1.

C. Drives, Direct: Factory-mounted, direct drive.

D. Drives, Belt: Factory-mounted, V-belt drive, with adjustable alignment and belt tensioning, and with 1.5 service factor based on fan motor.

1. Pulleys: Cast iron or cast steel with split, tapered bushing, dynamically balanced at the factory.
2. Belts: Oil resistant, non-sparking and non-static; in matched sets for multiple-belt drives.
3. Belt Guards: Comply with requirements specified by OSHA and fabricate according to SMACNA's "HVAC Duct Construction Standards"; 0.146-inch- thick, 3/4-inch diamond-mesh wire screen, welded to steel angle frame; prime coated.

E. Condenser-Coil Fan: Variable-speed propeller, mounted on shaft of permanently lubricated multispeed or ECM motors.

F. Relief-Air Fan: Propeller, Forward curved or Backward inclined, shaft mounted on permanently lubricated motor.

G. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
3. Enclosure Type: Open, dripproof or Totally enclosed, fan cooled.
4. Motor Pulleys: Adjustable pitch for use with 5-hp motors and smaller; fixed pitch for use with motors larger than 5 hp. Select pulley size so pitch adjustment is at the middle of adjustment range at fan design conditions.
5. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

2.5 COILS

A. General Requirements for Coils:

1. Comply with AHRI 410.
2. Fabricate coils section to allow removal and replacement of coil for maintenance and to allow in-place access for service and maintenance of coil(s).
3. Coils shall not act as structural component of unit.

B. Supply-Air Refrigerant Coil:

1. Tubes: Copper.
2. Fins:

    a. Material: Aluminum.

3. Fin and Tube Joints: Mechanical bond.
4. Headers: Seamless-copper headers with brazed connections.
5. Frames: Galvanized steel or Stainless steel.
6. Coatings: Corrosion-resistant coating.
7. Ratings: Designed, tested, and rated according to ASHRAE 33 and AHRI 410.

    a. Working Pressure: Minimum 300 psig.

C. Electric-Resistance Heating Coils: Comply with UL 1995.

1. Casing Assembly: Slip-in or Flanged type with galvanized-steel frame.
2. Open Heating Elements: Resistance wire of 80 percent nickel and 20 percent chromium supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in galvanized-steel frame.
3. Overtemperature Protection: Disk-type, automatically resetting, thermal-cutout, safety device; serviceable through terminal box without removing heater from coil section.
4. Secondary Protection: Load-carrying, manually resetting or manually replaceable, thermal cutouts; factory wired in series with each heater stage.
5. Control Panel: Unit mounted with disconnecting means and overcurrent protection.

a. Magnetic or Mercury contactor.
b. Solid-state, stepless pulse controller.
c. Toggle switches, one per step.
d. Step controller.
e. Time-delay relay.
f. Pilot lights, one per step.
g. Airflow proving switch.

2.6 REFRIGERANT CIRCUIT COMPONENTS

A. Number of Refrigerant Circuits: Two.

B. Compressor: Hermetic, variable speed scroll, mounted on vibration isolators; with internal overcurrent and high-temperature protection, internal pressure relief, and crankcase heater.

C. Refrigeration Specialties:

1. Refrigerant: R-410A.
2. Expansion valve with replaceable thermostatic element.
3. Refrigerant filter/dryer.
4. Manual-reset high-pressure safety switch.
5. Automatic-reset low-pressure safety switch.
6. Minimum off-time relay.
7. Automatic-reset compressor motor thermal overload.
8. Brass service valves installed in compressor suction and liquid lines.
9. Low-ambient kit high-pressure sensor.

2.7 AIR FILTRATION

A. Panel Filters:

1. Description: Pleated factory-fabricated, self-supported, disposable air filters with holding frames.
2. Filter Unit Class: UL 900.
3. Media: Interlaced glass, synthetic or cotton fibers coated with nonflammable adhesive and antimicrobial coating.
4. Filter-Media Frame: Beverage board with perforated metal retainer, or metal grid, on outlet side.

2.8 DAMPERS

A. Outdoor- and Return-Air Dampers: Low-leakage, double-skin, airfoil-blade, galvanized-steel dampers with compressible jamb seals and extruded-vinyl blade edge seals in opposed or parallel-blade arrangement with zinc-plated steel operating rods rotating in sintered bronze or nylon bearings mounted in a single galvanized-steel frame, and with operating rods connected with a common linkage. Leakage rate shall not exceed 4 cfm/sq. ft. at 1-inch wg and 8 cfm/sq. ft. at 4-inch wg.

B. Damper Operators: Comply with requirements in Section 230923.12 "Control Dampers."

2.9 ELECTRICAL POWER CONNECTIONS

A. RTU shall have a single connection of power to unit with unit-mounted disconnect switch accessible from outside unit and control-circuit transformer with built-in overcurrent protection.

2.10 CONTROLS

A. Control equipment and sequence of operation are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC."

2.11 ROOF CURBS

A. Wind and Seismic Restraints: Metal brackets compatible with the curb and casing, painted to match RTU, used to anchor unit to the curb, and designed for loads at Project site. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for wind-load requirements.

B. Materials: Galvanized steel with corrosion-protection coating, watertight gaskets, and factory-installed wood nailer; complying with NRCA standards.

1. Curb Insulation and Adhesive: Comply with NFPA 90A or NFPA 90B.

    a. Materials: ASTM C1071, Type I or II.
    b. Thickness: 1 inch.

2. Application: Factory applied with adhesive and mechanical fasteners to the internal surface of curb.

    a. Liner Adhesive: Comply with ASTM C916, Type I.
    b. Mechanical Fasteners: Galvanized steel, suitable for adhesive attachment, mechanical attachment, or welding attachment to duct without damaging liner when applied as recommended by manufacturer and without causing leakage in cabinet.
    c. Liner materials applied in this location shall have air-stream surface coated with a temperature-resistant coating or faced with a plain or coated fibrous mat or fabric depending on service air velocity.
    d. Liner Adhesive: Comply with ASTM C916, Type I.

C. Curb Dimensions: Height of 14 inches.

2.12 ACCESSORIES

A. Electric heater with integral thermostat maintains minimum 50 deg F temperature in gas burner compartment.

B. Duplex, 115-V, ground-fault-interrupter outlet with 15-A overcurrent protection. Include transformer if required. Outlet shall be energized even if the unit main disconnect is open.

C. Low-ambient kit using staged or variable-speed condenser fans for operation down to minus 20 deg F.

D. Filter differential pressure switch with sensor tubing on either side of filter. Set for final filter pressure loss.

E. Remote potentiometer to adjust minimum economizer damper position.

F. Return-air bypass damper.

G. Factory- or field-installed demand-controlled ventilation.

H. Safeties:

1. Smoke detector.
2. Condensate overflow switch.
3. Phase-loss reversal protection.
4. High- and low-pressure control.
5. Electric coil airflow-proving switch.

I. Hail guards of galvanized steel, painted to match casing.

J. Concentric diffuser with white louvers and polished aluminum return grilles, insulated diffuser box with mounting flanges, and interior transition.

K. Vertical vent extensions to increase the separation between the outdoor-air intake and the flue-gas outlet.

L. Door switches to disable heating or reset set point when open.

M. Outdoor air intake weather hood.

2.13 MATERIALS

A. Steel:

1. ASTM A36/A36M for carbon structural steel.
2. ASTM A568/A568M for steel sheet.

B. Stainless Steel:

1. Manufacturer's standard grade for casing.
2. Manufacturer's standard type, ASTM A240/A240M for bare steel exposed to airstream or moisture.

C. Galvanized Steel: ASTM A653/A653M.

D. Aluminum: ASTM B209.

E. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating.

F. Corrosion-Resistant Coating: Coat with a corrosion-resistant coating capable of withstanding a 6000-hour salt-spray test according to ASTM B117.

1. Standards:

a. ASTM B117 for salt spray.
b. ASTM D2794 for minimum impact resistance of 100 in-lb.
c. ASTM B3359 for cross-hatch adhesion of 5B.

2. Application: Immersion.
3. Thickness: 1 mil.
4. Gloss: Minimum gloss of 60 on a 60-degree meter.

2.14 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. Comply with AHRI 340/360 for testing and rating energy efficiencies for RTUs.
2. Comply with AHRI 270 for testing and rating sound performance for RTUs.
3. Comply with AHRI 1060 for testing and rating performance for air-to-air exchanger.

B. AMCA Compliance:

1. Comply with AMCA 11 and bear the AMCA-Certified Ratings Seal for air and sound performance according to AMCA 211 and AMCA 311.
2. Damper leakage tested in accordance with AMCA 500-D.
3. Operating Limits: Classify according to AMCA 99.

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 RTUs.

B. Examine roughing-in for RTUs to verify actual locations of piping and duct connections before equipment installation.

C. Examine roofs for suitable conditions where RTUs will be installed.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Roof Curb: Install on roof structure or concrete base, level and secure, according to NRCA's "NRCA Roofing Manual: Membrane Roof Systems." Install RTUs on curbs and coordinate roof

penetrations and flashing with roof construction specified in Section 077200 "Roof Accessories." Secure RTUs to upper curb rail, and secure curb base to roof framing or concrete base with anchor bolts. Coordinate sizes and locations of roof curbs with actual equipment provided.

1. Install normal-weight, 3000-psi, compressive strength (28-day) concrete mix inside roof curb, 4 inches thick. Concrete, formwork, and reinforcement are specified with concrete.

3.3 PIPING CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where installing piping adjacent to RTU, allow space for service and maintenance.

C. Connect piping to unit mounted on vibration isolators with flexible connectors.

D. Connect condensate drain pans using NPS 1-1/4, ASTM B88, Type M copper tubing. Extend to nearest equipment or roof drain. Construct deep trap at connection to drain pan and install cleanouts at changes in direction.

3.4 DUCT CONNECTIONS

A. Comply with duct installation requirements specified in other HVAC Sections. Drawings indicate the general arrangement of ducts. The following are specific connection requirements:

1. Install ducts to termination at top of roof curb.
2. Remove roof decking only as required for passage of ducts. Do not cut out decking under entire roof curb.
3. Connect supply ducts to RTUs with flexible duct connectors specified in Section 233300 "Air Duct Accessories."
4. Install return-air duct continuously through roof structure.

3.5 ELECTRICAL CONNECTIONS

A. Connect electrical wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

C. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.

D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
1. Nameplate shall be laminated acrylic or melamine plastic signs as layers of black with engraved white letters at least 1/2 inch high.
2. Locate nameplate where easily visible.

3.6 CONTROL CONNECTIONS

A. Install control and electrical power wiring to field-mounted control devices.

B. Connect control wiring according to Section 260523 "Control-Voltage Electrical Power Cables."

3.7 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

B. Complete installation and startup checks according to manufacturer's written instructions.

1. Inspect for visible damage to unit casing.
2. Inspect for visible damage to furnace combustion chamber.
3. Inspect for visible damage to compressor, coils, and fans.
4. Inspect internal insulation.
5. Verify that labels are clearly visible.
6. Verify that clearances have been provided for servicing.
7. Verify that controls are connected and operable.
8. Verify that filters are installed.
9. Clean condenser coil and inspect for construction debris.
10. Remove packing from vibration isolators.
11. Verify lubrication on fan and motor bearings.
12. Inspect fan-wheel rotation for movement in correct direction without vibration and binding.
13. Adjust fan belts to proper alignment and tension.
14. Start unit according to manufacturer's written instructions.

    a. Start refrigeration system.
    b. Do not operate below recommended low-ambient temperature.
    c. Complete startup sheets and attach copy with Contractor's startup report.

15. Inspect and record performance of interlocks and protective devices; verify sequences.
16. Operate unit for an initial period as recommended or required by manufacturer.
17. Calibrate thermostats.
18. Adjust and inspect high-temperature limits.
19. Inspect outdoor-air dampers for proper stroke and interlock with return-air dampers.
20. Start refrigeration system and measure and record the following when ambient is a minimum of 15 deg F above return-air temperature:

    a. Coil leaving-air, dry- and wet-bulb temperatures.
    b. Coil entering-air, dry- and wet-bulb temperatures.
    c. Outdoor-air, dry-bulb temperature.
    d. Outdoor-air-coil, discharge-air, dry-bulb temperature.

21. Inspect controls for correct sequencing of heating, mixing dampers, refrigeration, and normal and emergency shutdown.
22. Measure and record the following minimum and maximum airflows. Plot fan volumes on fan curve.

a. Supply-air volume.
b. Return-air volume.
c. Relief-air volume.
d. Outdoor-air intake volume.

23. Simulate maximum cooling demand and inspect the following:

a. Compressor refrigerant suction and hot-gas pressures.
b. Short circuiting of air through condenser coil or from condenser fans to outdoor-air intake.

24. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

a. High-temperature limit on gas-fired heat exchanger.
b. Low-temperature safety operation.
c. Filter high-pressure differential alarm.
d. Economizer to minimum outdoor-air changeover.
e. Relief-air fan operation.
f. Smoke and firestat alarms.

25. After startup and performance testing and prior to Substantial Completion, replace existing filters with new filters.

3.8 ADJUSTING

A. Adjust damper linkages for proper damper operation.

B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.

C. Occupancy Adjustments: When requested within [12] <Insert number> months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to [two] <Insert number> visits to Project during other-than-normal occupancy hours for this purpose.

3.9 CLEANING

A. After completing system installation and testing, adjusting, and balancing RTUs and air-distribution systems and after completing startup service, clean RTUs internally to remove foreign material and construction dirt and dust. Clean fan wheels, cabinets, dampers, coils, and filter housings, and install new, clean filters.

3.10 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. RTU will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.11 DEMONSTRATION

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

END OF SECTION 237416.13

SECTION 237433

DEDICATED OUTDOOR-AIR UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes factory-packaged units capable of supplying up to 100 percent outdoor air and providing cooling and heating.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Include plans, elevations, sections, and attachment details.

C. Delegated-Design Submittal: For design of vibration isolation and wind restraints, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof-curb mounting details, drawn to scale, and coordinated with each other, using input from installers of the items involved:

B. Startup service reports.

C. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 WARRANTY

A. Special Warranty: Manufacturer agrees to replace components of units that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Compressors: Five years from date of Substantial Completion.
2. Warranty Period for Heat Exchangers: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide [product indicated on Drawings] <Insert manufacturer's name; product name or designation> or comparable product by one of the following:

1. AAON.
2. Addison.
3. Carrier.
4. Desert Aire.

2.2 PERFORMANCE REQUIREMENTS

A. General Fabrication Requirements: Comply with requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," and Section 7 - "Construction and System Start-up."

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design vibration isolation and wind restraints.

C. Wind-Restraint Performance: (Refer to Structural Drawings)

D. Cabinet Thermal Performance:

1. Maximum Overall U-Value: Comply with requirements in ASHRAE/IESNA 90.1.
2. Include effects of metal-to-metal contact and thermal bridges in the calculations.

E. Cabinet Surface Condensation:

1. Cabinet shall have additional insulation and vapor seals if required to prevent condensation on the interior and exterior of the cabinet.
2. Portions of cabinet located downstream from the cooling coil shall have a thermal break at each thermal bridge between the exterior and interior casing to prevent condensation from occurring on the interior and exterior surfaces. The thermal break shall not compromise the structural integrity of the cabinet.

F. Maximum Cabinet Leakage: 0.5 percent of the total supply-air flow at a pressure rating equal to the fan shut-off pressure.

G. Cabinet Deflection Performance:

1. Walls and roof deflection shall be within 1/200 of the span at the design working pressure equal to the fan shut-off pressure. Deflection limits shall be measured at any point on the surface.
2. Floor deflections shall be within 1/240 of the span considering the worst-case condition caused by the following:
   a. Service personnel.
   b. Internal components.
   c. Design working pressure defined for the walls and roof.

H. 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 CABINET

A. Construction: Double wall.

B. Exterior Casing Material: Galvanized steel with paint finish or stainless steel.

C. Interior Casing Material: Galvanized or stainless steel.

D. Lifting and Handling Provisions: Factory-installed shipping skids and lifting lugs.

E. Base Rails: Galvanized or stainless-steel rails for mounting on roof curb or pad as indicated.

F. Access for Inspection, Cleaning, and Maintenance: Comply with requirements in ASHRAE 62.1.

1. Service Doors: Hinged access doors with gaskets. Material and construction of doors shall match material and construction of cabinet in which doors are installed.

G. Roof: Standing seam or membrane; sloped to drain water.

H. Floor: Reinforced, metal surface; reinforced to limit deflection when walked on by service personnel. Insulation shall be below metal walking surface.

I. Cabinet Insulation:

1. Type: Fibrous-glass duct lining complying with ASTM C 1071, Type II or flexible elastomeric insulation complying with ASTM C 534, Type II, sheet materials.
2. Thickness: 2 inches.
3. Insulation Adhesive: Comply with ASTM C 916, Type I.
4. Mechanical Fasteners: Suitable for adhesive, mechanical, or welding attachment to casing without damaging liner and without causing air leakage when applied as recommended by manufacturer.

J. Condensate Drain Pans:

1. Shape: Rectangular, with 1 percent slope in at least two planes to direct water toward drain connection.
2. Size: Large enough to collect condensate from cooling coils including coil piping connections, coil headers, and return bends.

a. Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
b. Depth: A minimum of 2 inches deep.

3. Configuration: Double wall, with space between walls filled with foam insulation and moisture-tight seal.
4. Material: Stainless-steel sheet.

5. Drain Connection:

    a. Located on one end or both ends of pan, at lowest point of pan.
    b. Terminated with threaded nipple.
    c. Minimum Connection Size: NPS 1.

6. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

K. Surfaces in Contact with Airstream: Comply with requirements in ASHRAE 62.1 for resistance to mold and erosion.

L. Roof Curb: Full-perimeter curb of sheet metal, minimum 12 inches high, with wood nailer, neoprene sealing strip, and welded Z-bar flashing.

1. Comply with requirements in "The NRCA Roofing Manual."

2.4 SUPPLY FAN

A. Forward-Curved Fan Type: Centrifugal; statically and dynamically balanced.

1. Fan Wheel Material: Galvanized steel, mounted on solid-steel shaft.
2. Bearings: Self-aligning, permanently lubricated ball bearings or Pillow-block bearings rated L_{50} for 200,000 hours and having external grease fittings.

B. Plenum Fan Type: Single width, non-overloading, with backward-inclined or airfoil blades.

1. Fan Wheel Material: Aluminum; attached directly to motor shaft.
2. Fan Wheel Drive and Arrangement: Direct drive, AMCA Arrangement 4.
3. Fan panel and frame Material: Powder-coated steel, stainless steel, or aluminum.
4. Fan Enclosure: Easily removable enclosure around rotating parts.
5. Fan Balance: Precision balance fan below 0.08 inch/s at design speed with filter in.

C. Service Factor for Belt Drive Applications: Multiple V-belt drive with matching fan pulley and adjustable motor sheaves and belt assembly with minimum 1.5 service factor.

D. Motors:

1. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
2. Enclosure: Open dripproof or Totally enclosed.

E. Mounting: Fan wheel, motor, and drives shall be mounted to fan casing with spring isolators.

2.5 COOLING COILS

A. Capacity Ratings: Comply with ASHRAE 33 and ARI 410 and coil bearing the ARI label.

B. Coil Casing Material: Manufacturer's standard material.

C. Tube Material: Copper.

D. Tube Header Material: Manufacturer's standard material.

E. Fin Material: Aluminum.

F. Fin and Tube Joints: Mechanical bond.

G. Leak Test: Coils shall be leak tested with air underwater.

H. Refrigerant Coil Capacity Reduction: Circuit coils for face, row or interleaved control.

I. Refrigerant Coil Suction and Distributor Header Materials: Seamless copper tube with brazed joints.

J. Coating: Phenolic epoxy corrosion-protection coating after assembly.

2.6 REFRIGERATION SYSTEM

A. Comply with requirements in ASHRAE 15, "Safety Standard for Refrigeration Systems."

B. Refrigerant Charge: Factory charged with refrigerant and filled with oil.

C. Compressors: Scroll compressors with integral vibration isolators, internal overcurrent and overtemperature protection, internal pressure relief, and crankcase heater.

D. Refrigerant: R-410A.

1. Classified as Safety Group A1 according to ASHRAE 34.
2. Provide unit with operating charge of refrigerant.

E. Refrigeration System Specialties:

1. Expansion valve with replaceable thermostatic element.
2. Refrigerant dryer.
3. High-pressure switch.
4. Low-pressure switch.
5. Thermostat for coil freeze-up protection during low ambient temperature operation or loss of air.
6. Brass service valves installed in discharge and liquid lines.

F. Capacity Control:

1. Variable speed compressor with evaporator and condenser coil within the refrigerant section to provide initial pre-cooling and to reheat for humidity control.

G. Refrigerant condenser and reheat condenser coils:

1. Capacity Ratings: Complying with ASHRAE 33 and ARI 410 and coil bearing the ARI label.
2. Tube Material: Copper.

3. Fin Material: Aluminum.
4. Fin and Tube Joint: Mechanical bond.
5. Leak Test: Coils shall be leak tested with air underwater.
6. Coating: Phenolic epoxy corrosion-protection coating after assembly.

H. Condenser Fan Assembly:

1. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades.
2. Fan Motors:

    a. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
    b. Motor Enclosure: Totally enclosed non-ventilating (TENV) or totally enclosed air over (TEAO) enclosure.

3. Fan Safety Guards: Steel with corrosion-resistant coating.

I. Safety Controls:

1. Compressor motor and condenser coil fan motor low ambient lockout.
2. Overcurrent protection for compressor motor.

2.7 INDIRECT-FIRED GAS FURNACE HEATING

A. Furnace Assembly:

1. Factory assembled, piped, and wired.
2. Comply with requirements in NFPA 54, "National Fuel Gas Code," and ANSI Z21.47, "Gas-Fired Central Furnaces."
3. AGA Approval: Designed and certified by and bearing label of AGA.

B. Burners:

1. Heat-Exchanger Material: Aluminized steel with stainless-steel inserts or Stainless steel with a minimum thermal efficiency of 80 percent.
2. Fuel: Natural gas.
3. Ignition: Electronically controlled electric spark with flame sensor.

C. Heat-Exchanger Drain Pan Material: Stainless steel.

D. Venting: Gravity vented.

E. Venting: Power vent with integral, motorized centrifugal fan interlocked with gas valve.

F. Safety Controls:

1. Gas Control Valve: Electronic modulating.
2. Gas Train: Single-body, regulated, redundant, 24-V ac gas valve assembly containing pilot solenoid valve, pilot filter, pressure regulator, pilot shutoff, and manual shutoff.

2.8 OUTDOOR-AIR INTAKE HOOD

A. Type: Manufacturer's standard hood or louver.

B. Materials: Match cabinet.

C. Bird Screen: Comply with requirements in ASHRAE 62.1.

D. Configuration: Designed to inhibit wind-driven rain and snow from entering unit.

2.9 FILTERS

A. Extended-Surface, Disposable Panel Filters:

1. Comply with NFPA 90A.
2. Factory-fabricated, dry, extended-surface type.
3. Minimum Merv: 13, according to ASHRAE 52.2.
4. Media: Fibrous material formed into deep-V-shaped pleats with antimicrobial agent and held by self-supporting wire grid.

B. Mounting Frames:

1. Panel filters arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or from access plenum.
2. Extended surface filters arranged for flat orientation, removable from access plenum.
3. Galvanized or stainless steel with gaskets and fasteners, suitable for bolting together into built-up filter banks with space for prefilter.

2.10 ELECTRICAL POWER CONNECTIONS

A. General Electrical Power Connection Requirements: Factory-installed and -wired switches, motor controllers, transformers, and other necessary electrical devices shall provide a single-point field power connection to unit.

B. Enclosure: NEMA 250, Type 3R, mounted in unit with hinged access door in unit cabinet having a lock and key or padlock and key,

C. Wiring: Numbered and color-coded to match wiring diagram.

D. Wiring Location: Install factory wiring outside an enclosure in a raceway.

E. Power Interface: Field power interface shall be to NEMA KS 1, heavy-duty, non-fused disconnect switch.

F. Factory Wiring: Branch power circuit to each motor and to controls with one of the following disconnecting means:

1. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
2. NEMA KS 1, heavy-duty, non-fusible switch.

3. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

G. Factory-Mounted, Overcurrent-Protection Service: For each motor.

H. Transformer: Factory mounted with primary and secondary fuses and sized with enough capacity to operate electrical load plus spare capacity.

I. Controls: Factory wire unit-mounted controls where indicated.

J. Lights: Factory wire unit-mounted lights.

K. Receptacle: Factory wire unit-mounted, ground fault interrupt (GFI) duplex receptacle.

L. Control Relays: Auxiliary and adjustable time-delay relays.

2.11 CONTROLS

A. Control Wiring: Factory wire connection for controls' power supply.

B. Control Devices: Sensors, transmitters, relays, switches, detectors, operators, actuators, and valves shall be manufacturer's standard items to accomplish indicated control functions.

C. Unit-Mounted Status Panel:

1. Cooling/Off/Heating Controls: Control operational mode.
2. Damper Position: Indicate position of outdoor-air dampers in terms of percentage of outdoor air.
3. Status Lights:

    a. Filter dirty.
    b. Fan operating.
    c. Cooling operating.
    d. Heating operating.
    e. Smoke alarm.
    f. General alarm.

4. Digital Numeric Display:

    a. Outdoor airflow.
    b. Supply airflow.
    c. Outdoor dry-bulb temperature.
    d. Outdoor dew point temperature.
    e. Space temperature.
    f. Supply temperature.
    g. Space relative humidity.
    h. Space carbon dioxide level.

D. Control Dampers:

1. Damper Location: Factory installed inside unit for ease of blade axle and bushing service. Arrange dampers located in a mixing box to achieve convergent airflow to minimize stratification.
2. Damper Leakage: Comply with requirements in AMCA 500-D. Leakage shall not exceed 6.5 cfm per sq. ft. at a static-pressure differential of 4.0 inches water column when a torque of 5-inch pounds per sq. ft. is applied to the damper jackshaft.
3. Damper Rating: Rated for close-off pressure equal to the fan shutoff pressure.
4. Damper Label: Bear the AMCA seal for both air leakage and performance.
5. Blade Configuration: Unless otherwise indicated, use parallel blade configuration for two-position control and equipment isolation service and use modulating control when mixing two airstreams. For other applications, use an opposed-blade configuration.
6. Damper Frame Material: Extruded aluminum, galvanized steel or stainless steel.
7. Blade Type: Single-thickness metal reinforced with multiple V-grooves or hollow-shaped airfoil.
8. Blade Material: Extruded aluminum, galvanized steel or stainless steel.
9. Maximum Blade Width: 6 inches.
10. Maximum Blade Length: 48 inches.
11. Blade Seals: Replaceable, continuous perimeter vinyl seals and jambs with stainless-steel compression-type seals.
12. Bearings: Thrust bearings for vertical blade axles.
13. Airflow Measurement:

    a. Monitoring System: Complete and functioning system of airflow monitoring as an integral part of the damper assembly where indicated.
    b. Remote Monitoring Signal: 0-10 volt or 4-20 mA scaled signal.
    c. Accuracy of flow measurement: Within 5 percent of the actual flow rate between the range of the scheduled minimum and maximum airflow. For units with a large range between minimum and maximum airflow, configure the damper sections and flow measurement assembly as necessary to comply with accuracy.
    d. Straightening Device: Integral to the flow measurement assembly if required to achieve the specified accuracy as installed.
    e. Flow measuring device: Suitable for operation in untreated and unfiltered outdoor air. If necessary, include temperature and altitude compensation and correction to maintain the accuracy.

E. Damper Operators:

1. Factory-installed electric operator for each damper assembly with one operator for each damper assembly mounted to the damper frame.
2. Operator capable of shutoff against fan pressure and able to operate the damper with sufficient reserve power to achieve smooth modulating action and proper speed of response at the velocity and pressure conditions to which the damper is subjected.
3. Maximum Operating Time: Open or close damper 90 degrees in 60 seconds.
4. Adjustable Stops: For both maximum and minimum positions.
5. Position Indicator and Graduated Scale: Factory installed on each actuator with words "OPEN" and "CLOSED," or similar identification, at travel limits.
6. Spring-return operator to fail-safe; either closed or open as required by application.
7. Operator Type: Direct coupled, designed for minimum 60,000 full-stroke cycles at rated torque.

8. Position feedback Signal: For remote monitoring of damper position.
9. Coupling: V-bolt and V-shaped, toothed cradle.
10. Circuitry: Electronic overload or digital rotation-sensing circuitry.

F. Refrigeration System Controls:

1. Unit-mounted enthalpy controller shall lock out refrigerant system when outdoor-air enthalpy is less than 28 Btu/lb of dry air or outdoor-air temperature is less than 60 deg F.
2. Outdoor-air sensor de-energizes dehumidifier operation when outdoor-air temperature is less than 60 deg F.
3. Relative-humidity sensor energizes dehumidifier operation when relative humidity is more than 50 percent.

G. Furnace Controls:

1. Factory-mounted sensor in supply outlet with sensor adjustment located in control panel to modulate gas furnace burner to maintain space temperature.
2. Electromechanical or Electronic Burner Control: 20 to 100 percent modulation of the firing rate; 10 to 100 percent with dual-furnace units.

H. Integral Smoke Alarm: Smoke detector installed in supply air.

I. DDC Temperature Control: Standalone control module for link between unit controls and DDC temperature-control system. Control module shall be compatible with control system specified in Section 230900 "Instrumentation and Control for HVAC." Links shall include the following:

1. Start/stop interface relay, and relay to notify DDC temperature-control system alarm condition.
2. Hardware interface or additional sensors for the following:

a. Room temperature.
b. Discharge-air temperature.
c. Refrigeration system operating.
d. Furnace operating.

J. BAS Interface: Factory-installed hardware and software to enable the BAS to monitor, control, and display unit status and alarms.

1. Hardwired Points:

a. Monitoring: On-off status, common trouble alarm.
b. Control: On-off operation, supply temperature set-point adjust.

2. ASHRAE 135 (BACnet) communication interface with the BAS shall enable the BAS operator to remotely control and monitor the unit from an operator workstation. Control features and monitoring points displayed locally at unit control panel shall be available through the BAS.

2.12 ACCESSORIES

A. Service Lights and Switch: Factory installed in each accessible section with weatherproof cover. Factory wire lights to a single-point field connection.

B. Duplex Receptacle: Factory mounted in unit supply-fan section, with 20 amp 120 V GFI duplex receptacle and weatherproof cover.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's rigging and installation instructions for unloading units and moving to final locations.

B. Curb Support: Install roof curb on roof structure according to "The NRCA Roofing Manual."

1. Install and secure units on curbs and coordinate roof penetrations and flashing with roof construction.
2. Coordinate size, installation, and structural capacity of roof curbs, equipment supports, and roof penetrations. These items are specified in Section 077200 "Roof Accessories."
3. Coordinate size, location, and installation of unit manufacturer's roof curbs and equipment supports with roof Installer.

C. Install wall- and duct-mounted sensors furnished by manufacturer for field installation. Install control wiring and make final connections to control devices and unit control panel.

D. Install 3000-psi, compressive-strength (28-day) concrete base inside roof curb, 4 inches thick. Concrete and reinforcement are specified with concrete.

E. Comply with requirements for gas-fired furnace installation in NFPA 54, "National Fuel Gas Code."

F. Install separate devices furnished by manufacturer and not factory installed.

G. Install new filters at completion of equipment installation and before testing, adjusting, and balancing.

H. Install drain pipes from unit drain pans to sanitary drain.

1. Drain Piping: Drawn-temper copper water tubing complying with ASTM B 88, Type L, with soldered joints.

2. Pipe Size: Same size as condensate drain pan connection.

3.2 CONNECTIONS

A. Where installing piping adjacent to units, allow space for service and maintenance.

B. Gas Piping Connections:

1. Comply with requirements in Section 231123 "Facility Natural-Gas Piping."
2. Connect gas piping to furnace, full size of gas train inlet, and connect with union, pressure regulator (where required), and shutoff valve with sufficient clearance for burner removal and service.
3. Install AGA-approved flexible connectors.
4. valve and union or flange on each return connection.

C. Duct Connections:

1. Comply with requirements in Section 233113 "Metal Ducts."
2. Drawings indicate the general arrangement of ducts.
3. Connect ducts to units with flexible duct connectors. Comply with requirements for flexible duct connectors in Section 233300 "Air Duct Accessories."

D. Electrical Connections: Comply with requirements for power wiring, switches, and motor controls in electrical Sections.

1. Install electrical devices furnished by unit manufacturer but not factory mounted.

3.3 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Inspect units for visible damage to furnace combustion chamber.
3. Perform the following operations for both minimum and maximum firing and adjust burner for peak efficiency:

    a. Measure gas pressure at manifold.
    b. Measure combustion-air temperature at inlet to combustion chamber.
    c. Measure flue-gas temperature at furnace discharge.
    d. Perform flue-gas analysis. Measure and record flue-gas carbon dioxide and oxygen concentration.
    e. Measure supply-air temperature and volume when burner is at maximum firing rate and when burner is off. Calculate useful heat to supply air.

4. Verify operation of remote panel including pilot-light operation and failure modes. Inspect the following:

    a. High-limit heat exchanger.
    b. Alarms.

5. Inspect units for visible damage to refrigerant compressor, condenser and evaporator coils, and fans.
6. Start refrigeration system when outdoor-air temperature is within normal operating limits and measure and record the following:

    a. Cooling coil leaving-air, dry- and wet-bulb temperatures.

b. Cooling coil entering-air, dry- and wet-bulb temperatures.
c. Condenser coil entering-air dry-bulb temperature.
d. Condenser coil leaving-air dry-bulb temperature.

7. Simulate maximum cooling demand and inspect the following:

a. Compressor refrigerant suction and hot-gas pressures.
b. Short-circuiting of air through outside coil or from outside coil to outdoor-air intake.

8. Inspect casing insulation for integrity, moisture content, and adhesion.
9. Verify that clearances have been provided for servicing.
10. Verify that controls are connected and operable.
11. Verify that filters are installed.
12. Clean coils and inspect for construction debris.
13. Clean furnace flue and inspect for construction debris.
14. Inspect operation of power vents.
15. Purge gas line.
16. Verify bearing lubrication.
17. Clean fans and inspect fan-wheel rotation for movement in correct direction without vibration and binding.
18. Adjust fan belts to proper alignment and tension.
19. Start unit.
20. Inspect and record performance of interlocks and protective devices including response to smoke detectors by fan controls and fire alarm.
21. Operate unit for run-in period.
22. Calibrate controls.
23. Adjust and inspect high-temperature limits.
24. Verify operational sequence of controls.
25. Measure and record the following airflows. Plot fan volumes on fan curve.

a. Supply-air volume.
b. Outdoor-air flow.

B. After startup, change filters, verify bearing lubrication, and adjust belt tension.

C. Remove and replace components that do not properly operate and repeat startup procedures as specified above.

D. Prepare written report of the results of startup services.

3.4 ADJUSTING

A. Adjust initial temperature and humidity set points.

B. Set field-adjustable switches and circuit-breaker trip ranges as indicated.

C. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

END OF SECTION 237433

SECTION 238113

PACKAGED TERMINAL AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes packaged terminal air conditioners and their accessories and controls, in the following configurations:

1. Through-the-wall air conditioners.
2. Heat-pump units.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: For packaged terminal air conditioners. Include plans, elevations, sections, details for wall penetrations, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
2. Wiring Diagrams: For power, signal, and control wiring.

C. Color Samples: For unit cabinet, discharge grille, and exterior louver, and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

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.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - "Ventilation Rate Procedures," and Section 7 - "Construction and Startup."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of packaged terminal air conditioners that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Sealed Refrigeration System: Manufacturer's standard, but not less than five years from date of Substantial Completion, including components and labor.
2. Warranty Period for Non-sealed System Parts: Manufacturer's standard, but not less than five years from date of Substantial Completion, including only components and excluding labor.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Carrier Corporation; a United Technologies company.
2. ClimateMaster, Inc.
3. Friedrich Air Conditioning Co.
4. General Electric Company; GE Consumer & Industrial - Appliances.
5. Trane; a business of American Standard Companies.

2.2 MANUFACTURED UNITS

A. Description: Factory-assembled and -tested, self-contained, packaged terminal air conditioner with room cabinet, electric refrigeration system, heating, and temperature controls; fully charged with refrigerant and filled with oil; with cord-connected chassis.

2.3 CHASSIS

A. Cabinet: 0.052-inch- thick steel with removable front panel with concealed latches.

1. Finish: Epoxy coating or baked enamel.
2. Access Door: Hinged door in top of cabinet for access to controls.
3. Cabinet Extension: Matching cabinet in construction and finish, allowing diversion of airflow to adjoining room; with grille.
4. Finish of Interior Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
5. Subbase: Enameled steel with adjustable leveling feet and adjustable end plates, with factory-installed and -wired, fused disconnect switch and receptacle sized for unit.
6. Wall Sleeves: Galvanized steel with polyester finish.

B. Refrigeration System: Direct-expansion indoor coil with capillary restrictor; and hermetically sealed scroll compressor with vibration isolation and overload protection.

1. Indoor and Outdoor Coils: Seamless copper tubes mechanically expanded into aluminum fins with capillary tube distributor on indoor coil.
2. Accumulator.
3. Constant-pressure expansion valve.
4. Reversing valve.
5. Charge: R-410A.

C. Indoor Fan: Forward curved, centrifugal; with motor and positive-pressure ventilation damper with concealed manual operator.

D. Condensate Drain: Drain pan and piping to direct condensate to building waste and vent piping.

1. Comply with ASHRAE 62.1 for drain pan construction and connections.

E. Outdoor Fan: Forward curved, centrifugal or propeller type with separate motor.

1. Indoor and Outdoor Fan Motors: Two speed; comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

a. Fan Motors: Permanently lubricated split capacitor.
b. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
c. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.

F. Electric-Resistance Heating Coil: Nickel-chromium-wire, electric-resistance heating elements with contactor and high-temperature-limit switch.

2.4 CONTROLS

A. Control Module: Unit-mounted digital panel with touchpad temperature control and with touchpad for heating, cooling, and fan operation. Include the following features:

1. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg F outdoor air temperature.
2. Heat-Pump Ambient Control: Field-adjustable switch changes to heat-pump heating operation above 40 deg F and to supplemental heating below plus 25 deg F.
3. Temperature-Limit Control: Prevents occupant from exceeding preset setback or setup temperature.
4. Reverse-Cycle Defrost: Solid-state sensor monitors frost buildup on outdoor coil and reverses unit to melt frost.

B. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage adjustable thermostat with heat anticipator, heat-off-cool-auto switch, and on-auto fan switch.

C. Outdoor Air: Manual intake damper.

2.5 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Factory test to comply with ARI 300, "Sound Rating and Sound Transmission Loss of Packaged Terminal Equipment."

B. Unit Performance Ratings: Factory test to comply with ARI 310/380/CSA C744, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb, maintaining manufacturer's recommended clearances and tolerances.

B. Install wall sleeves in finished wall assembly, seal and weatherproof. Joint-sealant materials and applications are specified in Section 079200 "Joint Sealants."

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Inspect for and remove shipping bolts, blocks, and tie-down straps.
2. After installing packaged terminal air conditioners and after electrical circuitry has been energized, test for compliance with requirements.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Packaged terminal air conditioners will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION 238113

SECTION 238126

SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes split-system air-conditioning and heat-pump units consisting of separate evaporator-fan and compressor-condenser components.

1.2 ACTION SUBMITTALS

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

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

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.

B. ASHRAE Compliance:

1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."
2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 4 - "Outdoor Air Quality," Section 5 - "Systems and Equipment," Section 6 - " Procedures," and Section 7 - "Construction and System Start-up."

C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts: One year(s) from date of Substantial Completion.
c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Carrier
B. Daiken
C. Trane

2.2 INDOOR UNITS (5 TONS OR LESS)

A. Concealed Evaporator-Fan Components:

1. Chassis: Galvanized steel with flanged edges, removable panels for servicing, and insulation on back of panel.
2. Insulation: Faced, glass-fiber duct liner.
3. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
4. Electric Coil: Helical, nickel-chrome, resistance-wire heating elements; with refractory ceramic support bushings, automatic-reset thermal cutout, built-in magnetic contactors, manual-reset thermal cutout, airflow proving device, and one-time fuses in terminal box for overcurrent protection.
5. Fan: Forward-curved, double-width wheel of galvanized steel; directly connected to motor.
6. Fan Motors:

a. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230513 "Common Motor Requirements for HVAC Equipment."
b. Multi-tapped, multispeed with internal thermal protection and permanent lubrication.
c. Wiring Terminations: Connect motor to chassis wiring with plug connection.

7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
8. Filters: Permanent, cleanable.

9. Condensate Drain Pans:

    a. Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.

        1) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
        2) Depth: A minimum of 2 inches deep.

    b. Single-wall, stainless-steel sheet.
    c. Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.

        1) Minimum Connection Size: NPS 1.

    d. Units with stacked coils shall have an intermediate drain pan to collect condensate from top coil.

2.3 OUTDOOR UNITS (5 TONS OR LESS)

A. Air-Cooled, Compressor-Condenser Components:

1. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
2. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.

    a. Compressor Type: Scroll.
    b. Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
    c. Refrigerant: R-410A.
    d. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.

3. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
4. Fan: Aluminum-propeller type, directly connected to motor.
5. Motor: Permanently lubricated, with integral thermal-overload protection.
6. Low Ambient Kit: Permits operation down to 45 deg F.
7. Mounting Base: Polyethylene.

2.4 ACCESSORIES

A. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:

1. Compressor time delay.

2. 24-hour time control of system stop and start.
3. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
4. Fan-speed selection including auto setting.

B. Automatic-reset timer to prevent rapid cycling of compressor.

C. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.

D. Monitoring:

1. Monitor constant and variable motor loads.
2. Monitor variable-frequency-drive operation.
3. Monitor economizer cycle.
4. Monitor cooling load.
5. Monitor air distribution static pressure and ventilation air volumes.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units level and plumb.

B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.

C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

D. Equipment Mounting:

1. Install ground-mounted, compressor-condenser components on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

E. Install and connect pre-charged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

C. Duct Connections: Duct installation requirements are specified in Section 233113 "Metal Ducts." Drawings indicate the general arrangement of ducts. Connect supply and return ducts to split-system air-conditioning units with flexible duct connectors. Flexible duct connectors are specified in Section 233300 "Air Duct Accessories."

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Tests and Inspections:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning units and retest as specified above.

D. Prepare test and inspection reports.

3.4 DEMONSTRATION

A. Train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 238126

SECTION 238129

VARIABLE REFRIGERANT FLOW HVAC SYSTEMS

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 complete VRF HVAC system(s) including, but not limited to the following components to make a complete operating system(s) according to requirements indicated:

1. Recessed, ceiling-mounted (360 cassette) indoor units.
2. Exposed, wall-mounted indoor units.
3. Under ceiling/wall indoor units.
4. Under ceiling indoor units.
5. Recessed, 4-way ceiling cassette indoor units.
6. Mini 4-way ceiling cassette indoor units.
7. Recessed, slim 1-way ceiling cassette indoor units.
8. Concealed, ceiling-mounted, ducted indoor units (MSP Duct).
9. Concealed, ceiling-mounted, ducted indoor units (HSP Duct 24K – 54K).
10. Concealed, ceiling-mounted, ducted indoor units (HSP Duct 76K – 96K).
11. Concealed, ceiling-mounted, slim, ducted indoor units.
12. Indoor, concealed, dedicated outside air units (OAP).
13. Indoor, multi-position air handling units for ducting.
14. Cased, floor-standing, indoor units.
15. Concealed, floor-standing, indoor units.
16. Indoor, hydronic heat exchangers.
17. Indoor, hydronic heat-pump units.
18. Indoor, hydronic heat recovery units.
19. Outdoor, air-source heat-pump units.
20. Outdoor, air-source heat recovery units.
21. Mode control units for heat recovery systems.
22. Electronic expansion valve kits for multi-zone heat pump systems.
23. Electronic expansion valve kits for single zone heat pump systems and heat recovery systems.
24. System controls.
25. System refrigerant and oil.
26. System condensate drain piping.
27. System hydronic piping.
28. System refrigerant piping.
29. Metal hangers and supports.
30. Metal framing systems.

31. Fastener systems.
32. Pipe stands.
33. Miscellaneous support materials.
34. Piping and tubing insulation.
35. System control cable and raceways.

1.3 DEFINITIONS

A. Air-Conditioning System Operation: System capable of operation with all zones in cooling only.

B. EEPROM: Electrically erasable programmable read-only memory.

C. Electronic Expansion Valve (EEV): EEV's are used in heat pump and heat recovery systems.

D. Heat Pump (HP) System Operation: System capable of operation with all zones in either heating or cooling, but not with simultaneous heating and cooling zones that transfer heat between zones.

E. Heat Recovery (HR) System Operation: System capable of operation with simultaneous heating and cooling zones that transfer heat between zones.

F. HSP: High static pressure.

G. Mode Control Unit (MCU): MCU's are used in heat recovery VRF HVAC systems to manage and control refrigerant between indoor units to provide simultaneous heating and cooling zones.

H. MSP: Medium static pressure.

I. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

J. OAP: Outside air processing.

K. PCB: Printed circuit board.

L. Plenum: A space forming part of the air distribution system to which one or more air ducts are connected. An air duct is a passageway, other than a plenum, for transporting air to or from heating, ventilating, or air-conditioning equipment.

M. Three-Pipe System Design: One high pressure refrigerant vapor line, one low pressure refrigerant vapor line, and one refrigerant liquid line connect a single outdoor unit or multiple manifold outdoor units in a single system to associated system MCUs. One liquid line and refrigerant vapor line connect MCUs to associated indoor units.

N. VRF: Variable refrigerant flow.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for indoor and outdoor units.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
3. Include operating performance at design conditions and at extreme maximum and minimum outdoor ambient conditions.
4. Include description of system controllers, dimensions, features, control interfaces and connections, power requirements, and connections.
5. Include system operating sequence of operation in narrative form for each unique indoor- and outdoor-unit control.
6. Include description of control software features.
7. Include total refrigerant required and a comprehensive breakdown of refrigerant required by each system installed.
8. Include refrigerant type and data sheets showing compliance with requirements indicated.
9. For system design software.
10. Indicate location and type of service access.

B. Sustainable Design Submittals:
1. Product Data for EA Prerequisite 2, "Minimum Energy Performance": Indicating compliance with minimum energy performance requirements.
2. Product Data for EA Prerequisite "Minimum Energy Performance": Indicating compliance with minimum energy performance requirements.
3. Product Data: For minimum energy performance.
4. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
5. ASHRAE/IES 90.1 compliance.
6. Air-Balance Report: Documentation indicating that Work complies with ASHRAE 62.1, Section 7.2.2 - "Air Balancing."
7. HVAC Flush Report: Documentation indicating that building HVAC system flush complies with Green Globes v1.4, Section 3.2.4.4 - "IAQ during Construction."

8. Product Data for EA Prerequisite 3, "Fundamental Refrigerant Management": For refrigerants, indicating compliance with refrigerant management practices.
9. Product Data for EA Prerequisite "Fundamental Refrigerant Management": For refrigerants, indicating compliance with refrigerant management practices.
10. Product Data: For refrigerants, indicating compliance with refrigerant management practices.
11. Product Data for EA Credit 1, "Optimize Energy Performance": Indicating that system meets efficiency requirements.
12. Product Data for EA Credit "Optimize Energy Performance": Indicating that system meets efficiency requirements.
13. Product Data for EA Credit 4, "Enhanced Refrigerant Management": Indicating that products meet requirements for refrigerant management.
14. Product Data for EA Credit "Enhanced Refrigerant Management": Indicating that products meet requirements for refrigerant management.

15. Product Data for EA Credit 5, "Measurement and Verification": For continuous metering equipment.
16. Product Data for EA Credit "Advanced Energy Metering": For continuous metering equipment.
17. Product Data: For continuous metering equipment for energy consumption.
18. Product Data for EQ Credit "Acoustic Performance": Documentation indicating that systems and equipment comply.
19. Product Data for Credit IEQ 1, "Outdoor Air Delivery Monitoring": Documentation indicating that systems, equipment, and controls comply.
20. Product Data for Credit IEQ 6.2, "Controllability of Systems - Thermal Comfort": Documentation indicating that systems, equipment, and controls comply.
21. Product Data for EQ Credit "Thermal Comfort": Documentation indicating that systems, equipment, and controls comply.
22. Product Data for Credit IEQ 7.1, "Thermal Comfort - Design": Documentation indicating that systems, equipment, and controls comply.

C. Shop Drawings: For VRF HVAC systems.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
4. Include diagrams and details of refrigerant piping and tubing showing installation requirements for manufacturer-furnished divided flow fittings.
5. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: For fully and partially exposed indoor units with factory finishes viewable by occupants.

1. Include a Sample for each unique finish with unit identification, detailed description of application, and cross-referenced floor plans showing locations.

E. Delegated-Design Submittals:

1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.
2. Include design calculations with corresponding diagram of refrigerant piping and tubing sizing for each system installed.
3. Include design calculations with corresponding floor plans indicating that refrigerant concentration limits are within allowable limits of ASHRAE 15 and governing codes.
4. Include calculations showing that system travel distance for refrigerant piping and controls cabling are within horizontal and vertical travel distances set by manufacturer. Provide a comparison table for each system installed.

1.6 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, elevations, sections, and details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Suspended ceiling components.
2. Structural floors, roofs and associated members to which equipment, piping, cables, and conduit will be attached.
3. Size and location of initial access modules for acoustical tile.
4. Wall-mounted controllers located in finished space showing relationship to light switches, fire-alarm devices, and other installed devices.
5. Size and location of access doors and panels installed behind walls and inaccessible ceilings for products installed behind walls and requiring access.
6. Items penetrating finished ceiling including the following:

    a. Luminaires.
    b. Air outlets and inlets.
    c. Speakers.
    d. Sprinklers.
    e. Service access panels.

B. Qualification Data:

1. For Installer: Certificate from VRF HVAC system manufacturer certifying that Installer has successfully completed prerequisite training administered by manufacturer for proper installation of systems, including but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.

    a. Retain copies of Installer certificates on-site and make available on request.

2. For VRF HVAC system manufacturer.
3. For VRF HVAC system provider.

C. Seismic Qualification Data: Certificates, for equipment, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

D. Product Test Reports: Where tests are required, for each product, for tests performed by a qualified testing agency.

E. Source quality-control reports.

F. Field quality-control reports.

G. Sample Warranties: For manufacturer's warranties.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For VRF HVAC systems to include in emergency, operation, and maintenance manuals. Service and installation manuals must be readily available on the manufacturer’s website without entering a username and password.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.
2. Program Software Backup: On CD or DVD, USB media, or approved cloud storage platform, complete with data files.
3. Device address list.
4. Printout of software application and graphic screens.

1.8 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Filters:

    a. One set(s) for each unit with replaceable filters.
    b. One set(s) for each unit type and unique size of washable filters.

2. Indoor Units: One for each unique size and type installed.
3. Controllers for Indoor Units: One for each unique controller type installed.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Nationally recognized manufacturer of VRF HVAC systems and products.
2. Shipped VRF HVAC systems with similar requirements to those indicated for a continuous period of five years within time of bid.
3. VRF HVAC systems and products that have been successfully tested and in use on at least three completed projects.
4. Having complete published catalog literature, installation, and operation and maintenance manuals for all products intended for use.
5. Having full-time in-house employees for the following:

    a. Product research and development.
    b. Product and application engineering.
    c. Product manufacturing, testing, and quality control.
    d. Technical support for system installation training, startup, commissioning, and troubleshooting of installations.
    e. Owner training.

B. Factory-Authorized Service Representative Qualifications:

1. Authorized representative of, and trained by, VRF HVAC system manufacturer.
2. In-place facility located within driving distance of Project.
3. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
4. Demonstrated past experience on five projects of similar complexity, scope, and value.

    a. Each person assigned to Project shall have demonstrated past experience.

5. Staffing resources of competent and experienced full-time employees that are assigned to execute work according to schedule.
6. Service and maintenance staff assigned to support Project during warranty period.
7. Product parts inventory to support ongoing system operation for a period of not less than five years after Substantial Completion.
8. VRF HVAC system manufacturer's backing to take over execution of Work if necessary to comply with requirements indicated. Include Project-specific written letter, signed by manufacturer's corporate officer, if requested.

C. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.

1. Each employee shall be certified by manufacturer for proper installation of systems, including, but not limited to, equipment, piping, controls, and accessories indicated and furnished for installation.
2. Installer certification shall be valid and current for duration of Project.
3. The installing contractor shall have attended VRF HVAC system manufacturer's installation training prior to installing the system.
4. Retain copies of Installer certificates on-site and make available on request.
5. Each person assigned to Project shall have demonstrated past experience.

    a. Demonstrated past experience with products being installed for period within three consecutive years before time of bid.
    b. Demonstrated past experience on five projects of similar complexity, scope, and value.

6. Installers shall have staffing resources of competent, trained, and experienced full-time employees that are assigned to execute work according to schedule.

D. Mockups: Build mockups to set quality standards for materials and execution.

1. Build mockups to show a finished installation for each of the following applications:

    a. For each different indoor unit type with exposed surfaces viewable by occupants.

2. Mockups shall be operational.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

E. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility.

1.10 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in a clean and dry place.

B. Comply with manufacturer's written rigging and installation instructions for unloading and moving to final installed location.

C. Handle products carefully to prevent damage, breaking, denting, and scoring. Do not install damaged products.

D. Protect products from weather, dirt, dust, water, construction debris, and physical damage.

1. Retain factory-applied coverings on equipment to protect finishes during construction and remove just prior to operating unit.
2. Cover unit openings before installation to prevent dirt and dust from entering inside of units. If required to remover coverings during unit installation, reapply coverings over openings after unit installation and remove just prior to operating unit.

E. Replace installed products damaged during construction.

1.11 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace equipment and components that fail(s) in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Faulty operation.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period:

a. For Compressor: Five year(s) from date of Substantial Completion.
b. For Parts, Including Controls: Five year(s) from date of Substantial Completion.
c. For Labor: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Samsung HVAC; DVM S VRF HR, split system heat recovery for simultaneous cooling and heating, DVM S VRF HP, split system heat pump, or a comparable product by one of the following:

1. Carrier Corporation; a unit of United Technologies Corp.
2. Daikin AC (Americas), Inc.
3. Fujitec America, Inc.
4. LG Electronics.
5. Mitsubishi Electric & Electronics USA, Inc.
6. Trane Company (The).

B. Heat Recovery Model Nomenclature:

1. Outdoor Unit: Samsung model AM****X*R/AA.
2. Indoor Unit: Samsung model AM****N**CH**.
3. Control System: Samsung model DVM S NASA Control Network Solution.

C. Heat Pump Model Nomenclature:

1. Outdoor Unit: Samsung model AM****XV**H/AA.
2. Indoor Unit: Samsung model AM****N**CH**.
3. Control System: Samsung model DVM S NASA Control Network Solution.

D. Source Limitations: Obtain products from single source from single manufacturer including, but not limited to, the following:

1. Indoor and outdoor units, including accessories.
2. Controls and software.
3. MCUs.
4. EEVs.
5. Refrigerant isolation valves.
6. Specialty refrigerant pipe fittings.

2.2 SYSTEM DESCRIPTION

A. Direct-expansion (DX) VRF HVAC system(s) with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, [**MCUs,**]outdoor unit(s), piping, controls, and electrical power to make complete operating system(s) complying with requirements indicated.

1. Three-pipe system design.
2. System(s) operation, air-conditioning, heat pump, or heat recovery as indicated on Drawings.
3. Each system with one refrigerant circuit shared by all indoor units connected to system.

B. 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.

C. AHRI Compliance: System and equipment performance certified according to AHRI 1230.

D. ASHRAE Compliance:

1. ASHRAE 15: For safety code for mechanical refrigeration.
2. ASHRAE 62.1: For indoor air quality.
3. ASHRAE 135: For control network protocol with remote communication.
4. ASHRAE/IES 90.1 Compliance: For system and component energy efficiency.

E. UL Compliance: Comply with UL 1995.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional specialist, as defined in Section 014000 "Quality Requirements," to design complete and operational VRF HVAC system(s) complying with requirements indicated.

1. Provide system refrigerant calculations.

a. Refrigerant concentration limits shall be within allowable limits of ASHRAE 15 and governing codes.
b. Indicate compliance with manufacturer's maximum vertical and horizontal travel distances. Prepare a comparison table for each system showing calculated distances compared to manufacturer's maximum allowed distances.

2. Include a mechanical ventilation system and gas detection system as required to comply with ASHRAE 15 and governing codes.
3. System Refrigerant Piping and Tubing:

a. Arrangement: Arrange piping to interconnect indoor units and outdoor unit(s) in compliance with manufacturer requirements and requirements indicated.
b. Routing: Conceal piping above ceilings and behind walls to maximum extent possible.
c. Sizing: Size piping system, using a software program acceptable to manufacturer, to provide performance requirements indicated. Consider requirements to accommodate future change requirements.

4. System Controls:

a. Network arrangement.
b. Network interface with other building systems.
c. Product selection.
d. Sizing.

B. Service Access:

1. Provide and document service access requirements.

2. Locate equipment, system isolation valves, and other system components that require service and inspection in easily accessible locations. Avoid locations that are difficult to access if possible.
3. Where serviceable components are installed behind walls and above inaccessible ceilings, provide finished assembly with access doors or panels to gain access. Properly size the openings to allow for service, removal, and replacement.
4. If less than full and unrestricted access is provided, locate components within an 18-inch reach of the finished assembly.
5. Where ladder access is required to service elevated components, provide an installation that provides for sufficient access within ladder manufacturer's written instructions for use.
6. Comply with OSHA regulations.

C. System Design and Installation Requirements:

1. Design and install systems indicated according to manufacturer's recommendations and written instructions.
2. Where manufacturer's requirements differ from requirements indicated, contact Architect for direction. The most stringent requirements should apply unless otherwise directed in writing by Architect.

D. Isolation of Equipment: Provide isolation valves to isolate each MCU**,** indoor unit and outdoor unit for service, removal, and replacement without interrupting system operation.

E. System Capacity Ratio: The sum of connected capacity of all indoor units shall be within the following range of outdoor-unit rated capacity:

1. Not less than 60 percent.
2. Not more than 130 percent.
3. Range acceptable to manufacturer.

F. System Turndown: Stable operation down to 10 percent of outdoor-unit capacity.

G. System Auto Refrigerant Charge: Each system shall have an automatic refrigerant charge function to ensure the proper amount of refrigerant is installed in system.

H. Outdoor Conditions:

1. Suitable for outdoor ambient conditions encountered.

    a. Design equipment and supports to withstand wind loads of governing code and ASCE/SEI 7.
    b. Provide corrosion-resistant coating for components and supports where located in coastal or industrial climates that are known to be harmful to materials and finishes.

2. Maximum System Operating Outdoor Temperature: See Drawings.
3. Minimum System Operating Outdoor Temperature: See Drawings.

I. Sound Performance: Sound levels generated by operating HVAC equipment shall be within requirements indicated.

1. Indoor: Within design guidelines of "2015 ASHRAE HANDBOOK- HVAC Applications."
2. Outdoor Unit – Heat Recovery: Outdoor air-source heat recovery units (individual modules) shall have a sound rating no higher than 64 dBA. The outdoor heat recovery system shall have optional night quite modes to reduce unit sound in evenings reducing fan and/or compressor sound (4 level settings).
3. Outdoor Unit – Heat Pump: Outdoor air-source heat pump units (individual modules) shall have a sound rating no higher than 64 dBA.

J. Thermal Movements: Allow for controlled thermal movements from ambient, surface, and system temperature changes.

K. Capacities and Characteristics: As indicated on Drawings.

2.4 RECESSED, CEILING-MOUNTED (360 CASSETTE) INDOOR UNIT

A. Basis-of-Design Product: Samsung HVAC; Recessed indoor unit, ceiling-mounted cassette, 360 degree air distribution pattern, for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM0**KN4DCH/AA, with ceiling grille model PC4N**MAN.

B. Nominal Capacity Range:

1. Cooling: 9000 to 48,000 Btu/h (2.64 to 14.1 kW).
2. Heating: 10,000 to 54,000 Btu/h (2.93 to 15.8 kW).

C. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and control board with field connections.

D. Cabinet:

1. Material: Galvanized steel frame with high impact plastic chassis and fascia, UL 94 V-0 flammability rating.
2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
4. Outside Air Intake: Knockout panel for outside ventilation air. Requires outside air ventilation kit.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins coated with hydrophilic paint on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
4. Internal Tubing: Copper tubing with brazed joints.
5. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
6. Field Piping Connections: Manufacturer's standard.
7. Factory Charge: Dehydrated air or nitrogen.
8. Testing: Factory pressure tested and verified to be without leaks.

9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted condensate pump with check valve, with a maximum vertical lift of 29 inches (737 mm).
3. Condensate Float Switch: Disable unit operation in the event of condensate overflow.
4. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Direct-drive turbo fan arrangement driven by a single motor statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three or more speed settings with a speed range of least 50 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Access: Included with fascia panel, to accommodate filter replacement without the need for tools.
2. Media: Washable, electrostatic filter.

I. Air Outlet Assembly: Fascia panel mounted in bottom of unit cabinet, square with circular air outlet for installation in finished ceilings. Color: Black or white.

1. Discharge Pattern Adjustment: Fixed or auto-swing direction, 10 to 60 degree angle, with wireless, touch, or premium wired controller.
2. Independent Discharge Pattern: Independent air distribution control with wireless or premium wired controller (10 to 60 degree control range in three directions).
3. Internal Booster Fan: Three internal booster fans create an area of low pressure outside the air outlet opening causing the air to change direction.
4. Return-Air Inlet: Manufacturer's standard grille in bottom of fascia panel.

J. Unit Accessories:

1. Outdoor Air Ventilation Kit: Field-installed on outside air connection with booster fan, 12 V dc relay, and controls to introduce outside ventilation air to the indoor unit.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

K. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.

3. EEPROM: Removable EEPROM stores system programming information, unit name, serial number, and other data.
4. Factory-Installed Controller: Configurable digital control.
5. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation mode, manual operation mode, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
6. Wireless Controller: Infrared receiver and LED indicator lights on fascia panel for wireless controller use.
7. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
8. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB, requires an accessory PCB.
9. Communication: Network communication with other indoor units and outdoor unit(s).
10. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
11. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.5 EXPOSED, WALL-MOUNTED INDOOR UNIT

A. Basis-of-Design Product: Samsung HVAC; Exposed, wall-mounted, indoor unit, for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM0***NQDCH/AA.

B. Nominal Capacity Range:

1. Cooling: 7500 to 31,700 Btu/h (2.2 to 9.3 kW).
2. Heating: 8500 to 33,400 Btu/h (2.5 to 9.8 kW).

C. Description: Factory-assembled complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

D. Cabinet:

1. Material: High impact plastic chassis, UL 94 V-0 flammability rating.
2. Mounting: Galvanized steel mounting plate to secure unit to wall.
3. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins coated with hydrophilic paint on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
4. Internal Tubing: Copper tubing with brazed joints.
5. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
6. Field Piping Connections: Multi-direction refrigerant piping connections can be routed in four directions.
7. Factory Charge: Dehydrated air or nitrogen.
8. Testing: Factory pressure tested and verified to be without leaks.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection. Multi-direction drain can be routed in four directions.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Direct-drive cross-flow fan arrangement driven by a single motor statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three or more speed settings with a speed range of least 50 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Washable Media: Manufacturer's standard filter with supplemental and anti-odor filters.

I. Grille Assembly: Manual adjustable guide vane to change the airflow direction from side-to-side (left-to-right). Motorized air sweep louver provides automatic change in airflow by directing the air up and down for uniform distribution.

J. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

K. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.
3. EEPROM: EEPROM on PCB stores all system data, programming information, unit name, serial number, and other data.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, room occupancy control, auto operation mode, manual operation mode, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
5. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
6. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB.
7. Wireless Controller: Infrared receiver and LED indicator lights for wireless controller use.
8. Communication: Network communication with other indoor units and outdoor unit(s).
9. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
10. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.6 UNDER CEILING/WALL INDOOR UNIT

A. Basis-of-Design Product: Samsung HVAC; Exposed, indoor unit, for ceiling mounting or wall mounting near floor, and for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM0**FNCDCH/AA.

B. Nominal Capacity Range:
1. Cooling: 18,000 and 24,000 Btu/h (5.28 and 7.03 kW).
2. Heating: 20,000 and 27,000 Btu/h (5.86 and 7.91 kW).

C. Description: Factory-assembled and tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

D. Cabinet:

1. Material: White, high impact plastic chassis, UL 94 V-0 flammability rating.
2. Mounting: Galvanized steel mounting plate to secure unit to wall (wall-mounted applications only).
3. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins coated with hydrophilic paint on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Internal Tubing: Copper tubing with brazed joints.
4. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
5. Field Piping Connections: Multi-direction refrigerant piping connections can be routed in four directions.
6. Factory Charge: Dehydrated air or nitrogen.
7. Testing: Factory pressure tested and verified to be without leaks.
8. Expansion Valve: External expansion valve required.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection. Multi-direction drain can be routed in four directions.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Direct-drive Sirocco fan arrangement driven by a single motor statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three speed settings with a speed range of least 50 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Media: Washable, permanent filter.

I. Grille Assembly: Automatic air sweep louver provides automatic change in airflow by directing the air up and down for uniform distribution.

J. Unit Accessories:

1. External Expansion Valve: Electronic modulating type with linear or proportional characteristics.
2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

K. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.
3. EEPROM: Removable EEPROM on PCB stores all system data, programming information, unit name, serial number, and other data.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation model, manual operation model, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
5. Wireless Controller: Infrared receiver and LED indicator lights for wireless controller use.
6. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
7. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB.
8. Communication: Network communication with other indoor units and outdoor unit(s).
9. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
10. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.7 UNDER CEILING INDOOR UNIT

A. Basis-of-Design Product: Samsung HVAC; Exposed, indoor unit, for ceiling mounting, and for use with DVM S and DVM S Eco HR, MCU, or HP systems, Big Ceiling model AM0**JNCDCH/AA.

B. Nominal Capacity Range:

1. Cooling: 36,000 and 48,000 Btu/h (5.28 and 7.03 kW).
2. Heating: 40,000 and 54,000 Btu/h (5.86 and 7.91 kW).

C. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

D. Cabinet:

1. Material: Galvanized steel frame with high impact plastic chassis and fascia, UL 94 V-0 flammability rating. White finish.
2. Mounting: Galvanized steel mounting plate to secure unit to wall (wall-mounted applications only).
3. Internal Access: Removable panels on one side of unit for field access to internal components for inspection, cleaning, service, and replacement.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins coated with hydrophilic paint on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Internal Tubing: Copper tubing with brazed joints.
4. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
5. Field Piping Connections: Multi-direction refrigerant piping connections can be routed in four directions.
6. Factory Charge: Dehydrated air or nitrogen.
7. Testing: Factory pressure tested and verified to be without leaks.
8. Expansion Valve: External expansion valve required.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection. Multi-direction drain can be routed in four directions.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Multiple Sirocco fans arrangement direct-driven by a single motor statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three speed settings with a speed range of least 50 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.

2. Media: Washable, permanent filter.

I. Grille Assembly: Automatic air sweep louver provides automatic change in airflow by directing the air up and down for uniform distribution and extended air throw.

J. Unit Accessories:

1. External Expansion Valve: Electronic modulating type with linear or proportional characteristics.
2. Condensate Pump: Integral reservoir and control with electrical power connection through unit power.

K. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.
3. EEPROM: Removable EEPROM on PCB stores all system data, programming information, unit name, serial number, and other data.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation model, manual operation model, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
5. Wireless Controller: Infrared receiver and LED indicator lights for wireless controller use.
6. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
7. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB.
8. Communication: Network communication with other indoor units and outdoor unit(s).
9. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
10. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.8 RECESSED, 4-WAY CEILING CASSETTE INDOOR UNIT

A. Basis-of-Design Product: Samsung HVAC; Recessed indoor unit, ceiling-mounted cassette, 4-way air distribution pattern, for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM0**FN4DCH/AA, with ceiling grille model PC4NUSKFN.

B. Nominal Capacity Range:

1. Cooling: 9000 to 48,000 Btu/h (2.64 to 14.1 kW).
2. Heating: 10,000 to 54,000 Btu/h (2.93 to 15.8 kW).

C. Description: Factory-assembled[**and -tested**] complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and control board with field connections.

D. Cabinet:

1. Material: Galvanized steel frame with high impact plastic chassis and fascia, UL 94 V-0 flammability rating.
2. Mounting: Manufacturer-designed provisions for field installation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
5. Outside Air Intake: Knockout panel for outside ventilation air. Requires outside air ventilation kit.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins coated with hydrophilic paint on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
4. Internal Tubing: Copper tubing with brazed joints.
5. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
6. Field Piping Connections: Manufacturer's standard.
7. Factory Charge: Dehydrated air or nitrogen.
8. Testing: Factory pressure tested and verified to be without leaks.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted condensate pump with check valve, with a maximum vertical lift of 29 inches (737 mm).
3. Condensate Float Switch: Disable unit operation in the event of condensate overflow.
4. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Direct-drive turbo fan arrangement driven by a single motor statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.

4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three or more speed settings with a speed range of least 50 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Access: Included with fascia panel, to accommodate filter replacement without the need for tools.

I. Air Outlet Assembly: Grille mounted in bottom of unit cabinet, square with 4 outlet vanes.

1. Discharge Pattern Adjustment: Automatically air outlet vanes swing up and down for uniform air distribution.
2. Independent Discharge Pattern: Independent air distribution control with wireless or premium wired controller (32 to 65 degree control range each direction).
3. Return-Air Inlet: Manufacturer's standard grille in bottom of fascia panel.

J. Unit Accessories:

1. Outdoor Air Ventilation Kit: Field-installed on outside air connection with booster fan, 12 V dc relay, and controls to introduce outside ventilation air to the indoor unit.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

K. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.
3. EEPROM: Removable EEPROM on PCB stores all system data, programming information, unit name, serial number, and other data.
4. Factory-Installed Controller: Configurable digital control.
5. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation model, manual operation model, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
6. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
7. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB.
8. Wireless Controller: Infrared receiver and LED indicator lights on fascia panel for wireless controller use.
9. Communication: Network communication with other indoor units and outdoor unit(s).
10. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
11. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.

2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.9 MINI 4-WAY CEILING CASSETTE, INDOOR UNIT

A. Basis-of-Design Product: Samsung HVAC; Recessed indoor unit, ceiling-mounted mini cassette, 4-way air distribution pattern, for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM0***NNDCH/AA, with ceiling grille model PC4NUSKFN.

B. Nominal Capacity Range:

1. Cooling: 5000 to 20,000 Btu/h (1.47 to 5.86 kW).
2. Heating: 6000 to 23,000 Btu/h (1.76 to 6.74 kW).

C. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and control board with field connections.

D. Cabinet:

1. Material: Galvanized steel frame with high impact plastic chassis and fascia, UL 94 V-0 flammability rating, designed for installation in acoustical tile modular ceilings, 24 by 24 inches (610 by 610 mm).
2. Mounting: Manufacturer-designed provisions for field installation.
3. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
4. Outside Air Intake: Knockout panel for outside ventilation air. Requires outside air ventilation kit.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins coated with hydrophilic paint on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
4. Internal Tubing: Copper tubing with brazed joints.
5. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
6. Field Piping Connections: Manufacturer's standard.
7. Factory Charge: Dehydrated air or nitrogen.
8. Testing: Factory pressure tested and verified to be without leaks.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted condensate pump with check valve, with a maximum vertical lift of 29 inches (737 mm).
3. Condensate Float Switch: Disable unit operation in the event of condensate overflow.
4. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Direct-drive turbo fan arrangement driven by a single motor statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three speed settings with a speed range of least 50 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Access: Included with fascia panel, to accommodate filter replacement without the need for tools.
2. Media: Washable, permanent filter.

I. Air Outlet Assembly: Grille mounted in bottom of unit cabinet, square with 4 outlet vanes.

1. Discharge Pattern Adjustment: Automatically air outlet vanes swing up and down for uniform air distribution.
2. Independent Discharge Pattern: Independent air distribution control with wireless or premium wired controller (32 to 65 degree control range each direction).
3. Return-Air Inlet: Manufacturer's standard grille in bottom of fascia panel.

J. Unit Accessories:

1. Outdoor Air Ventilation Kit: Field-installed on outside air connection with booster fan, 12 V dc relay, and controls to introduce outside ventilation air to the indoor unit.
2. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

K. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.
3. EEPROM: Removable EEPROM on PCB stores all system data, programming information, unit name, serial number, and other data.
4. Factory-Installed Controller: Configurable digital control.
5. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation model, manual operation model, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
6. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.

7. Room Occupancy Control: Motion detector to enable and disable the unit with time delay settings, requires an accessory PCB.
8. Wireless Controller: Infrared receiver and LED indicator lights on fascia panel for wireless controller use.
9. Communication: Network communication with other indoor units and outdoor unit(s).
10. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
11. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.10 RECESSED, SLIM 1-WAY CEILING CASSETTE, INDOOR UNIT

A. Basis-of-Design Product: Samsung HVAC; Recessed, indoor unit, for ceiling mounting, and for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM0**FN1DCH/AA, with ceiling grille PC1NUSMAN or PC1NUPMAN.

B. Nominal Capacity Range:

1. Cooling: 7500 to 12,000 Btu/h (2.2 to 3.52 kW).
2. Heating: 8500 to 13,500 Btu/h (2.5 to 3.96 kW).

C. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

D. Cabinet:

1. Material: High impact plastic chassis, UL 94 V-0 flammability rating.
2. Mounting: Recessed suspension hangers bolts.
3. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
4. Internal Access: Removable panels of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins coated with hydrophilic paint on copper tubing.
2. Coil Tubes: Copper with internal grooves.

3. Internal Tubing: Copper tubing with brazed joints.
4. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
5. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
6. Field Piping Connections: Manufacturer's standard.
7. Factory Charge: Dehydrated air or nitrogen.
8. Testing: Factory pressure tested and verified to be without leaks.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted condensate pump with check valve, with a maximum vertical lift of 29 inches (737 mm).
3. Condensate Float Switch: Disable unit operation in the event of condensate overflow.
4. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Direct-drive Sirocco fan arrangement driven by a single motor statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three speed settings with a speed range of least 50 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Access: Front, to accommodate filter replacement without the need for tools.
2. Media: Washable, permanent filter.

I. Grille Assembly: Automatic air sweep louver provides automatic change in airflow by directing the air up and down for uniform distribution.

J. Unit Accessories:

1. External Expansion Valve: Electronic modulating type with linear or proportional characteristics.

K. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.
3. EEPROM: Removable EEPROM on PCB stores all system data, programming information, unit name, serial number, and other data.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation model, manual operation model, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.

5. Wireless Controller: Infrared receiver and LED indicator lights for wireless controller use.
6. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
7. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB.
8. Communication: Network communication with other indoor units and outdoor unit(s).
9. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
10. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

L. Unit Electrical:

1. Enclosure: Manufacturer's standard, and suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch, complying with NFPA 70.
4. Control Transformer: Manufacturer's standard, field installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.

2.11 CONCEALED, CEILING-MOUNTED, DUCTED INDOOR UNIT (MSP DUCT)

A. Basis-of-Design Product: Samsung HVAC; Concealed, indoor fan-coil unit, horizontal discharge, for above ceiling mounting, and for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM***MNMDCH/AA.

B. Nominal Capacity and Static Pressure Range:

1. Cooling: 7500 to 18,000 Btu/h (2.2 to 5.27 kW).
2. Heating: 8500 to 20,000 Btu/h (2.5 to 5.86 kW).
3. External Static Pressure: 0 to 0.6 in. wg (0 to 149 Pa).

C. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

D. Cabinet:

1. Material: Galvanized steel.
2. Insulation: Manufacturer's standard internal insulation, complying with ASHRAE 62.1, to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement from three sides.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
4. Internal Tubing: Copper tubing with brazed joints.
5. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
6. Field Piping Connections: Manufacturer's standard.
7. Factory Charge: Dehydrated air or nitrogen.
8. Testing: Factory pressure tested and verified to be without leaks.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted condensate pump with check valve, with a maximum vertical lift of 29 inches (737 mm).
3. Condensate Float Switch: Disable unit operation in the event of condensate overflow.
4. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Two Sirocco fans direct-driven by a single motor, statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three speed settings with a speed range of least 50 percent.
6. Static Pressure Scanning: The indoor unit shall have static pressure scanning for simple setup and optimized comfort settings for the occupant.
7. Smart Tuning: The indoor unit shall have smart-tuning function that can provide optimized comfort by allowing the occupant to offset the fan airflow curve with a wired remote controller to increase or decrease airflow.
8. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Return Air Filter: Manufacturer's standard included on return air inlet.
2. Return Air Filter Box Accessory: Side access, for angle filter orientation, to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.

I. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

J. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.

3. EEPROM: Removable EEPROM on PCB stores all system data, programming information, unit name, serial number, and other data.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation model, manual operation model, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
5. Factory-Installed Sensors: Discharge air temperature.
6. Remote Controller: Fan speed adjustable with accessory remote controller, or service software, according to external static pressure.
7. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
8. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB.
9. Communication: Network communication with other indoor units and outdoor unit(s).
10. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
11. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

K. Unit Electrical:

1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways.

2.12 CONCEALED, CEILING-MOUNTED, DUCTED INDOOR UNIT (HSP DUCT 24K – 54K)

A. Basis-of-Design Product: Samsung HVAC; Concealed, indoor fan-coil unit, horizontal discharge, for above ceiling mounting, and for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM****NHDCH/AA.

B. Nominal Capacity and Static Pressure Range:

1. Cooling: 24,000 to 54,000 Btu/h (7.03 to 15.8 kW).
2. Heating: 27,000 to 61,400 Btu/h (7.91 to 18.0 kW).
3. External Static Pressure: 0.12 to 0.8 in. wg (29.8 to 199 Pa)

C. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

D. Cabinet:

1. Material: Galvanized steel.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.

3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement from three sides.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
4. Internal Tubing: Copper tubing with brazed joints.
5. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
6. Field Piping Connections: Manufacturer's standard.
7. Factory Charge: Dehydrated air or nitrogen.
8. Testing: Factory pressure tested and verified to be without leaks.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Unit-mounted condensate pump with check valve, with a maximum vertical lift of 29 inches (737 mm).
3. Condensate Float Switch: Disable unit operation in the event of condensate overflow.
4. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Three Sirocco fans direct-driven by a single motor, statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three speed settings with a speed range of least 50 percent.
6. Static Pressure Scanning: The indoor unit shall have static pressure scanning for simple setup and optimized comfort settings for the occupant.
7. Smart Tuning: The indoor unit shall have smart-tuning function that can provide optimized comfort by allowing the occupant to offset the fan airflow curve with a wired remote controller to increase or decrease airflow.
8. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Return Air Filter: Manufacturer's standard included on return air inlet.
2. Return Air Filter Box Accessory: Side access, for angle filter orientation, to accommodate field installation without removing ductwork and to accommodate filter replacement without need for tools.

I. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.

J. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.
3. EEPROM: Removable EEPROM on PCB stores all system data, programming information, unit name, serial number, and other data.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation model, manual operation model, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
5. Factory-Installed Sensors: Discharge air temperature.
6. Remote Controller: Fan speed adjustable with accessory remote controller, or service software, according to external static pressure.
7. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
8. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB.
9. Communication: Network communication with other indoor units and outdoor unit(s).
10. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
11. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

K. Unit Electrical:

1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways.

2.13 CONCEALED, CEILING-MOUNTED, SLIM, DUCTED INDOOR UNIT

A. Basis-of-Design Product: Samsung HVAC; Concealed, indoor fan-coil unit, horizontal discharge, for above ceiling mounting, and for use with DVM S and DVM S Eco HR, MCU, or HP systems, model AM0**FNLDCH/AA.

B. Nominal Capacity and Static Pressure Range:

1. Cooling: 7500 to 48,000 Btu/h (2.2 to 14.1 kW).
2. Heating: 8500 to 54,000 Btu/h (2.5 to 15.8 kW).
3. External Static Pressure: 0 to 0.16 in. wg (0 to 39.8 Pa)

C. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.

D. Cabinet:

1. Material: Galvanized steel.
2. Insulation: Manufacturer's standard internal insulation to provide thermal resistance and prevent condensation.
3. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork. Return air inlet convertible from back or bottom with removal and replacement of conversion plate.
4. Mounting: Manufacturer-designed provisions for field installation.
5. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.

E. DX Coil Assembly:

1. Construction: Nonferrous construction, slit fins on copper tubing.
2. Coil Tubes: Copper with internal grooves.
3. Expansion Valve: Electronic modulating type with linear or proportional characteristics.
4. Internal Tubing: Copper tubing with brazed joints.
5. Internal Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
6. Field Piping Connections: Manufacturer's standard.
7. Factory Charge: Dehydrated air or nitrogen.
8. Testing: Factory pressure tested and verified to be without leaks.
9. Refrigerant Piping: Insulate both refrigerant lines to the indoor unit.

F. Drain Assembly:

1. Pan: Non-ferrous material, with bottom sloped to low point drain connection.
2. Condensate Removal: Gravity.

    a. If a floor drain is not available at unit, provide unit with field-installed condensate pump accessory.

3. Field Piping Connection: Non-ferrous material.

G. Fan and Motor Assembly:

1. Fan: Two or three Sirocco fans direct-driven by a single motor, statically and dynamically balanced.
2. Construction: Fabricated from non-ferrous components.
3. Motor: Brushless dc or electronically commutated with permanently lubricated bearings.
4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
5. Speed Settings and Control: Three speed settings with a speed range of least 50 percent.
6. Vibration Control: Integral isolation to dampen vibration transmission.

H. Filter Assembly:

1. Return Air Filter: Manufacturer's standard included on return air inlet.

I. Unit Accessories:

1. Remote Room Temperature Sensor Kit: Wall-mounted, hardwired room temperature sensor kit for use in rooms that do not have room temperature measurement.
2. Condensate Pump: Accessory condensate pump with check valve, with a maximum vertical lift of 29 inches (737 mm) is available with condensate float switch to disable the unit in the event of condensate overflow.

J. Unit Controls:

1. Control System: Indoor unit integrates with SAMSUNG NASA Control Network Solution.
2. Enclosure: Manufacturer's standard, and suitable for indoor locations.
3. EEPROM: EEPROM on PCB stores all system data, programming information, unit name, and other data.
4. Features and Functions: Self-diagnostics, time delay, auto-restart, auto operation model, manual operation model, filter service notification, power consumption display, drain assembly high water level safety shutdown and notification.
5. Factory-Installed Sensors: Discharge air temperature.
6. Supplemental Heat: External heater control programming capability for supplemental heat via external contact control module, requires an accessory PCB.
7. Room Occupancy Control: External contact control module for unoccupied room control functions, requires an accessory PCB.
8. Communication: Network communication with other indoor units and outdoor unit(s).
9. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
10. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

K. Unit Electrical:

1. Enclosure: Metal, suitable for indoor locations.
2. Field Connection: Single point connection to power entire unit and integral controls, 208/230 V, single phase, 60 hertz.
3. Disconnecting Means: Circuit breaker or switch.
4. Control Transformer: Manufacturer's standard, factory installed.
5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways.

2.14 ELECTRONIC EXPANSION VALVE KITS FOR SINGLE-ZONE HEAT PUMP SYSTEMS AND HEAT RECOVERY SYSTEMS

A. Basis-of-Design Product: Samsung HVAC; model MEV EEV electronic expansion valve kits.

B. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.

1. EEV kit shall be completely factory assembled, piped and wired. Each unit shall be run tested at the factory. This unit shall be mounted indoors. The EEV kit selection is based on the capacity of the connected unit.

C. Cabinet:

1. Galvanized-steel construction to UL 94.
2. Mounting: Manufacturer-designed provisions for indoor field installation.

D. Drain Pan: Provide integral drain pan, with bottom sloped to a low point drain connection, and provide appropriate drain termination at installation.

E. Refrigeration Assemblies and Specialties:

1. Specially designed by manufacturer for single zone heat pump or heat recovery systems, to install in-line on the liquid line for a single indoor unit.

F. Unit Controls:

1. Circuit Board: Interfaces to the DVM S NASA Control Network Solution and performs all functions necessary for operation.
2. Features and Functions: Self-diagnostics, fuse protection.
3. Communication: Network communication with indoor units and outdoor unit(s).
4. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
5. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

G. Unit Electrical:

1. Field Connection: The single zone EEV is powered and controlled directly from the indoor unit that it is metering refrigerant to via included wire harness.
2. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.

H. Unit Piping:

1. Unit Tubing: Copper tubing with brazed joints.
2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
3. Field Piping Connections: Manufacturer's standard.
4. Piping Length: The length of pipe between an EEV kit and a single indoor unit cannot exceed 7 feet (2.13 m) (pipe length).
5. Factory Charge: Dehydrated air or nitrogen.
6. Testing: Factory pressure tested and verified to be without leaks.

2.15 SYSTEM CONTROLS

A. Basis-of-Design Product: Samsung HVAC; DVM S NASA Control Network Solution.

B. General Requirements:

1. The Samsung DVM S NASA Control Network Solution consists of remote controllers, system controllers, centralized controllers, and/or integrated web based interface communicating over a high-speed communication bus. The Samsung DVM S NASA Control Network Solution shall support operation monitoring, scheduling, error monitor, power distribution, personal browsers, tenant billing, online maintenance support, and integration with Building Management Systems (BMS) using either LonWorks or BACnet interfaces
2. Network: Indoor units and outdoor units shall include integral controls and connect through a manufacturer-selected control network.
3. Network Communication Protocol: Open control communication between interconnected units.
4. Integration with Building Automation System: ASHRAE 135, BACnet IP and certified by BACnet Testing Lab (BTL), including the following:

    a. Ethernet connection via RJ-45 connectors and port with transmission at 100 Mbps or higher.
    b. Integration devices shall be connected to local uninterruptible power supply unit(s) to provide at least 5 minutes of battery backup operation after a power loss.

5. Operator Interface:

    a. Operators shall interface with system and unit controls through the following:

        1) Operator interfaces integral to controllers.
        2) Owner-furnished PC connected to central controller(s).
        3) Web interface through web browser software.
        4) Integration with Building Automation System.

    b. Users shall be capable of interface with controllers for indoor units control to extent privileges are enabled. Control features available to users shall include the following:

        1) On/off control.
        2) Temperature set-point adjustment.

C. VRF HVAC System Operator Software for PC:

1. Software offered by VRF HVAC system manufacturer shall provide system operators with ability to monitor and control VRF HVAC system(s) from a single dedicated Owner-furnished PC.
2. Software shall provide operator with a graphic user interface to allow monitoring and control of multiple central controllers from a single device location through point-and-click mouse exchange.
3. Plan views shall show building plans with location of indoor units and identification superimposed on plans.
4. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.

5. Schedules operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Schedules daily, weekly, and annual events.
6. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
7. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
8. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
9. Supports Imperial and Metric Temperature Units: Fahrenheit and Celsius.
10. Displays service notifications and error codes.
11. Monitors and displays up to 3000 item error history and 10000 item operation history for regular reporting and further archiving.
12. Monitors and displays cumulative operating time of indoor units.
13. Able to disable and enable operation of individual controllers for indoor units.
14. Information displayed on individual controllers shall also be available for display.
15. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.

D. Central Controllers:

1. Centralized control for all indoor and outdoor units from a single central controller location.

    a. Include multiple interconnected controllers as required.

2. Controls operation mode of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units. Operation modes available through central controller shall match those operation modes of controllers for indoor units.
3. Schedule operation of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.

    a. Sets schedule for daily, weekly, and annual events.
    b. Schedule options available through central controller shall at least include the schedule options of controllers for indoor units.

4. Changes operating set points of indoor units as individual units, by selected groups of indoor units, or as collection of all indoor units.
5. Optimized start feature to start indoor units before scheduled time to reach temperature set-point at scheduled time based on operating history.
6. Night setback feature to operate indoor units at energy-conserving heating and cooling temperature set-points during unoccupied periods.
7. Service diagnostics tool.
8. Able to disable and enable operation of individual controllers for indoor units.
9. Information displayed on individual controllers shall also be available for display through central controller.
10. Information displayed for outdoor units, including refrigerant high and low pressures percent capacity.
11. Multiple RJ-45 ports for direct connection to a local PC and an Ethernet network switch.
12. Operator interface through a backlit, high-resolution color display touch panel and web accessible through standard web browser software.

E. Wired Controllers for Indoor Units:

1. Single controller capable of controlling multiple indoor units as group.
2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
3. Multiple Language: English or French and Spanish.
4. Temperature Units: Fahrenheit and Celsius.
5. On/Off: Turns indoor unit on or off.
6. Hold: Hold operation settings until hold is released.
7. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
8. Temperature Display: 1-degree increments.
9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments.
10. Relative Humidity Display: 1 percent increments.
11. Relative Humidity Set-Point: Adjustable in 1 percent increments between <**Insert relative humidity range**>.
12. Fan Speed Setting: Select between available options furnished with the unit.
13. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
14. Seven-day programmable operating schedule with up to [**five**] [**eight**] <**Insert number**> events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
15. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
16. Occupancy detection.
17. Service Notification Display: "Filter" <**Insert notifications**>.
18. Service Run Tests: Limit use by service personnel to troubleshoot operation.
19. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
20. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
21. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
22. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.
23. <**Insert features and functions**>.

F. Wireless Controllers for Indoor Units:

1. Wireless Communication:

    a. Controller communicates to remote-mounted receiver that is wired to indoor unit(s).

        1) Include receivers with wireless controllers as required to complete installation.
        2) Low-voltage power required for receivers shall be powered through non-polar connections to indoor unit.

    b. One wireless controller shall be capable of communicating with one or multiple receivers to control one or multiple indoor units as a group.

2. Controller Battery Life: [**Three**] <**Insert number**> years.
3. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.

4. Multiple Language: [**English**] [**or**] [**French**] [**Spanish**] <**Insert language**>.
5. Temperature Units: [**Fahrenheit**] [**or**] [**Celsius**] [**Fahrenheit and Celsius**].
6. On/Off: Turns indoor unit on or off.
7. Hold: Hold operation settings until hold is released.
8. Operation Mode: Cool, Heat, Auto, Dehumidification, Fan Only, and Setback.
9. Temperature Display: 1-degree increments.
10. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments between <**Insert temperature range**>.
11. Relative Humidity Display: 1 percent increments.
12. Relative Humidity Set-Point: Adjustable in 1 percent increments between <**Insert relative humidity range**>.
13. Fan Speed Setting: Select between available options furnished with the unit.
14. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit.
15. Seven-day programmable operating schedule with up to [**five**] [**eight**] <**Insert number**> events per day. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
16. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
17. Occupancy detection.
18. Service Notification Display: "Filter" <**Insert notifications**>.
19. Service Run Tests: Limit use by service personnel to troubleshoot operation.
20. Error Code Notification Display: Used by service personnel to troubleshoot abnormal operation and equipment failure.
21. User and Service Passwords: Capable of preventing adjustments by unauthorized users.
22. Setting stored in non-volatile memory to ensure that settings are not lost if power is lost. Battery for date and time only.
23. <**Insert features and functions**>.

2.16 SYSTEM REFRIGERANT AND OIL

A. Refrigerant:

1. As required by VRF HVAC system manufacturer for system to comply with performance requirements indicated.
2. ASHRAE 34, Class A1 refrigerant classification.
3. Refrigerant: A full charge of R-410A is included only for the condensing unit by VRF HVAC system manufacturer. Provide additional refrigerant based on diameters and lengths of system liquid refrigerant lines, and indoor equipment model and quantity.

B. Oil:

1. As required by VRF HVAC system manufacturer and to comply with performance requirements indicated.

2.17 SYSTEM CONDENSATE DRAIN PIPING

A. If more than one material is listed, material selection is Contractor's option.

B. Copper Tubing:

1. Drawn-Temper Tubing: According to **ASTM B 88, Type L** **(ASTM B 88M, Type B)** or Type DWV according to ASTM B 306.
2. Wrought-Copper Fittings: ASME B16.22.
3. Wrought-Copper Unions: ASME B16.22.
4. Solder Filler Metals: ASTM B 32, lead-free alloys, and water-flushable flux according to ASTM B 813.

C. CPVC plastic pipe according to ASTM F 441/F 441M, Schedule 40, with socket-type pipe fittings according to ASTM F 438 and solvent cement according to ASTM F 493.

D. PVC plastic pipe according to ASTM D 1785, Schedule 40, with socket-type pipe fittings according to ASTM D 2466 and solvent cement according to ASTM D 2564, primer according to ASTM F 656.

2.18 SYSTEM HYDRONIC PIPING

A. Comply with requirements in Section 232113 "Hydronic Piping" for system piping requirements.

2.19 SYSTEM REFRIGERANT PIPING

A. Comply with requirements in Section 232300 "Refrigerant Piping" for system piping requirements.

B. Refrigerant Piping:

1. Copper Tube: **ASTM B 280, Type ACR**.
2. Wrought-Copper Fittings: ASME B16.22.
3. Brazing Filler Metals: AWS A5.8/A5.8M.
4. Insulation: Insulate both heat pump refrigerant lines. Insulate all three refrigerant lines from heat recovery outdoor units to MCU.

C. Refrigerant Tubing Kits:

1. Factory-rolled and -bundled, soft-copper tubing with tubing termination fittings at each end.
2. Modular systems require outdoor refrigerant kits for module connections.
3. Standard one-piece length for connecting to indoor units.
4. Pre-insulated with flexible elastomeric insulation of thickness to comply with governing energy code and sufficient to eliminate condensation.

D. Divided-Flow Specialty Fittings: Where required by VRF HVAC system manufacturer for proper system operation, VRF HVAC system manufacturer shall furnish specialty fittings with identification and instructions for proper installation by Installer.

1. Y-Joint Fittings: Piping to multiple indoor units requires additional piping components. Use VRF HVAC system manufacturer's Y-joint fittings to branch the main refrigerant lines.

2. Tee Fittings: VRF HVAC system manufacturer's tee fittings must be used to connect outdoor units when multiple module systems are being installed (systems with more than one outdoor unit).

E. Refrigerant Isolation Ball Valves:

1. Description: Uni-body full port design, rated for maximum system temperature and pressure, and factory tested under pressure to ensure tight shutoff. Designed for valve operation without removing seal cap.
2. Seals: Compatible with system refrigerant and oil. Seal service life of at least 20 years.
3. Valve Connections: Flare or sweat depending on size.

2.20 METAL HANGERS AND SUPPORTS

A. Copper Tube Hangers:

1. Description: MSS SP-58, Types 1 through 58, copper-coated-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of **galvanized or copper-coated steel**.

B. Plastic Pipe Hangers:

1. Description: MSS SP-58, Types 1 through 58, galvanized-steel, factory-fabricated components.
2. Hanger Rods: Continuous-thread rod, nuts, and washer made of **galvanized steel**.

2.21 METAL FRAMING SYSTEMS

A. MFMA Manufacturer Metal Framing Systems:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. B-line, an Eaton business.
b. Flex-Strut Inc.
c. G-Strut.
d. Haydon Corporation.
e. Thomas & Betts Corporation; A Member of the ABB Group.
f. Unistrut; Part of Atkore International.
g. Wesanco, Inc.

2. Description: Shop- or field-fabricated, pipe-support assembly for supporting multiple parallel pipes.
3. Standard: MFMA-4.
4. Channels: Continuous slotted steel channel with inturned lips.
5. Channel Nuts: Formed or stamped steel nuts or other devices designed to fit into channel slot and, when tightened, prevent slipping along channel.

6. Hanger Rods: Continuous-thread rod, nuts, and washer made of galvanized steel for use indoors and of stainless steel for use outdoors.
7. Metallic Coating for Use Indoors: **hot-dip galvanized**.

2.22 FASTENER SYSTEMS

A. Powder-Actuated Fasteners: Threaded, zinc-coated steel stud, for use in hardened portland cement concrete with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

B. Mechanical-Expansion Anchors: Insert-wedge-type anchors, for use in hardened portland cement concrete; with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

1. Indoor Applications: **Zinc-coated** steel.
2. Outdoor Applications: Stainless steel.

2.23 PIPE STANDS

A. General Requirements for Pipe Stands: Shop- or field-fabricated assemblies made of manufactured corrosion-resistant components to support roof-mounted piping.

B. Compact Pipe Stand: One-piece plastic unit with integral-rod roller, pipe clamps, or V-shaped cradle to support pipe, for roof installation without membrane penetration.

C. Low-Type, Single-Pipe Stand: One-piece **stainless-steel** base unit with plastic roller, for roof installation without membrane penetration.

D. High-Type, Single-Pipe Stand:

1. Description: Assembly of base, vertical and horizontal members, and pipe support, for roof installation without membrane penetration.
2. Base: **Stainless steel**.
3. Vertical Members: Two or more cadmium-plated-steel or stainless-steel, continuous-thread rods.
4. Horizontal Member: Cadmium-plated-steel or stainless-steel rod with plastic or stainless-steel, roller-type pipe support.

E. High-Type, Multiple-Pipe Stand:

1. Description: Assembly of bases, vertical and horizontal members, and pipe supports, for roof installation without membrane penetration.
2. Bases: One or more; plastic.
3. Vertical Members: Two or more protective-coated-steel channels.
4. Horizontal Member: Protective-coated-steel channel.
5. Pipe Supports: Galvanized-steel, clevis-type pipe hangers.

F. Curb-Mounted-Type Pipe Stands: Shop- or field-fabricated pipe supports made from structural-steel shapes, continuous-thread rods, and rollers, for mounting on permanent stationary roof curb.

2.24 MISCELLANEOUS SUPPORT MATERIALS

A. Grout: ASTM C 1107, factory-mixed and -packaged, dry, hydraulic-cement, nonshrink and nonmetallic grout; suitable for interior and exterior applications.

1. Properties: Nonstaining, noncorrosive, and nongaseous.
2. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.

B. Structural Steel: ASTM A 36/A 36M, carbon-steel plates, shapes, and bars; galvanized.

C. Threaded Rods: Continuously threaded. Zinc-plated steel or galvanized steel for indoor applications and stainless steel for outdoor applications. Mating nuts and washers of similar material as rods.

2.25 PIPING AND TUBING INSULATION

A. Comply with requirements in Section 230719 "HVAC Piping Insulation" for system piping insulation requirements.

B. Condensate Drain Piping and Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
b. Indoors: **3/4 inch (19 mm)** thick.
c. Outdoors: **3/4 inch (19 mm)** thick.

2. Field-Applied Jacket:

a. Concealed: None required.
b. Indoors, Exposed to View: **None required.**
c. Outdoors, Exposed to View: **Aluminum, smooth, 0.020 inch (0.51 mm) thick**.

C. Refrigerant Tubing Insulation and Jacket Requirements:

1. Flexible Elastomeric Insulation:

a. Closed-cell, sponge- or expanded-rubber materials, complying with ASTM C 534, Type I for tubular materials.
b. Indoors: **1 inch (25 mm)** thick.
c. Outdoors: **1 inch (25 mm)** thick.

2. Field-Applied Jacket:

a. Concealed: None required.

b. Indoors, Exposed to View: **PVC, color selected by Architect, 20 mils (0.5 mm) thick**
c. Outdoors, Exposed to View: **Aluminum, smooth, 0.020 inch (0.51 mm) thick**.

D. Flexible Elastomeric Insulation Adhesive: Comply with MIL-A-24179A, Type II, Class I.

1. 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. 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."
3. 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." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
4. 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."
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." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

1. 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. 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."
3. 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." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
4. 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."
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." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

F. Metal Jacket Flashing Sealants:

1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F (Minus 40 to plus 121 deg C).
4. Color: Aluminum.
5. 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."
6. 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."
7. 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." Formaldehyde emissions shall not exceed 9 mcg/cu. m or 7 ppb, whichever is less.
8. 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."
9. 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." The building concentration of formaldehyde shall not exceed half of the indoor recommended exposure limit, or 33 mcg/cu. m, and that of acetaldehyde shall not exceed 9 mcg/cu. m.

2.26 SYSTEM CONTROL CABLE

A. Cable Rating: Listed and labeled for application according to NFPA 70.

1. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.

   a. Flame Travel Distance: 60 inches (1520 mm) or less.
   b. Peak Optical Smoke Density: 0.5 or less.
   c. Average Optical Smoke Density: 0.15 or less.

2. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.

3. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

B. Low-Voltage Control Cabling:

1. Paired Cable: NFPA 70, Type CMG.

    a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
    b. PVC insulation.
    c. Braided or foil shielded.
    d. PVC jacket.
    e. Flame Resistance: Comply with UL 1685.

2. Lead Content: Less than 300 parts per million.
3. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

    a. One pair, twisted, No. 16 AWG, stranded (19x29) or No. 18 AWG, stranded (19x30) tinned-copper conductors as required by VRF HVAC system manufacturer.
    b. PVC insulation.
    c. Braided or foil shielded.
    d. PVC jacket.
    e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
    f. Flame Resistance: Comply with NFPA 262.

4. Lead Content: Less than 300 parts per million.

C. TIA-485A Network Cabling:
1. Standard Cable: NFPA 70, Type CMG.

    a. Paired, **one pair** twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
    b. PVC insulation.
    c. Unshielded.
    d. PVC jacket.
    e. Flame Resistance: Comply with UL 1685.

2. Lead Content: Less than 300 parts per million.
3. Plenum-Rated Cable: NFPA 70, Type CMP.

    a. Paired, **one pair** No. 22 AWG, stranded (7x30) tinned-copper conductors.
    b. Fluorinated ethylene propylene insulation.
    c. Unshielded.
    d. Fluorinated ethylene propylene jacket.
    e. NFPA 262 includes the standard flame-resistance test criteria in common use for cables and conductors.
    f. Flame Resistance: NFPA 262.

4. Lead Content: Less than 300 parts per million.

D. Ethernet Network Cabling: TIA-568-C.2 Category **6** cable with connectors.

1. Description: Four-pair, balanced-twisted pair cable, certified to meet transmission characteristics of category cable indicated.
2. Conductors: 100-ohm, 23 AWG solid copper.
3. Lead Content: Less than 300 parts per million.
4. Shielding: **Shielded twisted pairs (FTP)**.
5. Cable Rating: By application.
6. Jacket: **Yellow** thermoplastic.

E. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for control wiring and cable raceways.

2.27 SOURCE QUALITY CONTROL

A. Factory Tests: Test and inspect factory-assembled equipment.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports for historical record. Submit reports only if requested.

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 products before installation. Reject products that are wet, moisture damaged, or mold damaged.

C. Examine roughing-in for piping and tubing to verify actual locations of connections before equipment installation.

D. Examine roughing-in for ductwork to verify actual locations of connections before equipment installation.

E. Examine roughing-in for wiring and conduit to verify actual locations of connections before equipment installation.

F. Examine walls, floors, roofs, and outdoor pads for suitable conditions where equipment will be installed.

G. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

H. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 EQUIPMENT INSTALLATION, GENERAL

A. Clearance:

1. Maintain manufacturer's recommended clearances for service and maintenance.
2. Maintain clearances required by governing code.

B. Loose Components: Install components, devices, and accessories furnished by manufacturer, with equipment, that are not factory mounted.

1. Loose components shall be installed by s**ystem Installer under supervision of manufacturer's service representative**.

C. Equipment Restraint Installation: Install equipment with seismic-restraint device. Comply with requirements for seismic-restraint devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

3.3 INSTALLATION OF INDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Unless otherwise required by VRF HVAC system manufacturer, support ceiling-mounted units from structure above using threaded rods; minimum rod size of 3/8 inch (10 mm).

C. Adjust supports of exposed and recessed units to draw units tight to adjoining surfaces.

D. Protect finished surfaces of ceilings, floors, and walls that come in direct contact with units. Refinish or replaced damaged areas after units are installed.

E. In rooms with ceilings, conceal piping and tubing, controls, and electrical power serving units above ceilings.

F. In rooms without ceiling, arrange piping and tubing, controls, and electrical power serving units to provide a neat and finished appearance.

G. Provide lateral bracing if needed to limit movement of suspended units to not more than **0.25 inch (13 mm).**

H. For floor- and wall-mounted units that are exposed, conceal piping and tubing, controls, and electrical power serving units within walls.

I. Floor-mounted units located in **mechanical** rooms.

J. Install floor-mounted units on support structure indicated on Drawings.

K. Install floor-mounted units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in **Section 033000 "Cast-in-Place Concrete."**

L. Attachment: Install hardware for proper attachment to supported equipment.

M. Grouting: Place grout under equipment supports and make bearing surface smooth.

3.4 INSTALLATION OF OUTDOOR UNITS

A. Install units to be level and plumb while providing a neat and finished appearance.

B. Install outdoor units on support structures indicated on Drawings.

C. Pad-Mounted Installations: Install outdoor units on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in **Section 033000 "Cast-in-Place Concrete."**

1. Attachment: Install anchor bolts to elevations required for proper attachment to supported equipment.
2. Grouting: Place grout under equipment supports and make bearing surface smooth.

D. Roof-Mounted Installations: Install outdoor units on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, stainless-steel fasteners.

3.5 GENERAL REQUIREMENTS FOR PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping and tubing systems. Install piping and tubing as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping and tubing in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping and tubing at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping and tubing above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping and tubing to permit valve servicing.

F. Install piping and tubing at indicated slopes.

G. Install piping and tubing free of sags.

H. Install fittings for changes in direction and branch connections.

I. Install piping and tubing to allow application of insulation.

J. Install groups of pipes and tubing parallel to each other, spaced to permit applying insulation with service access between insulated piping and tubing.

K. Install sleeves for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 230517 "Sleeves and Sleeve Seals for HVAC Piping."

L. Install escutcheons for piping and tubing penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 230518 "Escutcheons for HVAC Piping."

3.6 INSTALLATION OF SYSTEM CONDENSATE DRAIN PIPING

A. General Requirements for Drain Piping and Tubing:

1. Install a union in piping at each threaded unit connection.
2. Install an adjustable stainless-steel hose clamp with adjustable gear operator on unit hose connections. Tighten clamp to provide a leak-free installation.
3. If required for unit installation, provide a trap assembly in drain piping to prevent air circulated through unit from passing through drain piping. Comply with more stringent of the following:

    a. Details indicated on Drawings.
    b. Manufacturer's requirements.
    c. Governing codes.
    d. In the absence of requirements, comply with requirements of ASHRAE handbooks.

4. Extend drain piping from units with drain connections to drain receptors as indicated on Drawings. If not indicated on Drawings, terminate drain connection at nearest accessible location that is not exposed to view by occupants.
5. Provide each 90-degree change in direction with a Y- or T-fitting. Install a threaded plug connection in the dormant side of fitting or future use as a service cleanout.

B. Gravity Drains:

1. Slope piping from unit connection toward drain termination at a constant slope of not less than **one** percent.

C. Pumped Drains:

1. If unit condensate pump or lift mechanism is not included with an integral check valve, install a full-size check valve in each branch pipe near unit connection to prevent backflow into unit.

3.7 INSTALLATION OF HYDRONIC PIPING

A. Comply with requirements for hydronic pipe and tubing specified in Section 232113 "Hydronic Piping."

B. Comply with requirements for hydronic specialties specified in Section 232116 "Hydronic Piping Specialties."

C. Comply with requirements for ball valves specified in Section 230523.12 "Ball Valves for HVAC Piping."

D. Comply with requirements for butterfly valves specified in Section 230523.13 "Butterfly Valves for HVAC Piping."

E. Comply with requirements for check valves specified in Section 230523.14 "Check Valves for HVAC Piping."

F. Install continuous-thread hanger rods and **elastomeric** hangers of size required to support equipment weight.

1. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC." Fabricate brackets or supports as required.
2. Comply with requirements for hangers and supports specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

G. Where installing piping and tubing adjacent to equipment, allow space for service and maintenance.

3.8 INSTALLATION OF REFRIGERANT PIPING

A. Refrigerant Tubing Kits:

1. Unroll and straighten tubing to suit installation. Deviations in straightness of exposed tubing shall be unnoticeable to observer.
2. Support tubing using hangers and supports indicated at intervals not to exceed **5 feet (1.5 m)**. Minimum rod size, 1/4 inch (6.4 mm).
3. Prepare tubing ends and make mating connections to provide a pressure tight and leak-free installation.

B. Install refrigerant piping according to ASHRAE 15 and governing codes.

C. Select system components with pressure rating equal to or greater than system operating pressure.

D. Install piping as short and direct as possible, with a minimum number of joints and fittings.

E. Arrange piping to allow inspection and service of equipment. Install valves and specialties in accessible locations to allow for service and inspection. Install access doors or panels as specified in Section 083113 "Access Doors and Frames" if valves or equipment requiring maintenance is concealed behind finished surfaces.

F. Install refrigerant piping and tubing in protective conduit where installed belowground.

G. Install refrigerant piping and tubing in rigid or flexible conduit in locations where exposed to mechanical damage.

H. Unless otherwise required by VRF HVAC system manufacturer, slope refrigerant piping and tubing as follows:

1. Install horizontal hot-gas discharge piping and tubing with a uniform slope downward away from compressor.
2. Install horizontal suction lines with a uniform slope downward to compressor.
3. Install traps to entrain oil in vertical runs.
4. Liquid lines may be installed level.

I. When brazing, remove or protect components that could be damaged by heat.

J. Before installation, clean piping, tubing, and fittings to cleanliness level required by VRF HVAC system manufacturer.

K. Joint Construction:

1. Ream ends of tubes and remove burrs.
2. Remove scale, slag, dirt, and debris from inside and outside of tube and fittings before assembly.
3. Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

    a. Use Type BCuP (copper-phosphorus) alloy for joining copper fittings with copper tubing.
    b. Use Type BAg (cadmium-free silver) alloy for joining copper with bronze.

3.9 INSTALLATION OF METAL HANGERS AND SUPPORTS

A. Comply with requirements in Section 230548 "Vibration and Seismic Controls for HVAC" for seismic restraints.

B. Metal Pipe-Hanger Installation: Comply with MSS SP-69 and MSS SP-89. Install hangers, supports, clamps, and attachments as required to properly support piping from the building structure.

C. Metal Framing System Installation: Arrange for grouping of parallel runs of piping, and support together on field-assembled metal framing systems.

D. Comply with MFMA-103 for metal framing system selections and applications that are not specified.

E. Fastener System Installation:

1. Install powder-actuated fasteners, for use in lightweight concrete or concrete slabs less than 4 inches (100 mm) thick, in concrete after concrete is placed and completely cured. Use operators that are licensed by powder-actuated tool manufacturer. Install fasteners according to powder-actuated tool manufacturer's operating manual.
2. Install mechanical-expansion anchors in concrete after concrete is placed and completely cured. Install fasteners according to manufacturer's written instructions.
3. Use powder-actuated fasteners or mechanical-expansion anchors instead of building attachments where required in concrete construction.

F. Pipe Stand Installation:

1. Pipe Stand Types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stand and mount on permanent, stationary roof curb. See Section 077200 "Roof Accessories" for curbs.

G. Install hangers and supports complete with necessary attachments, inserts, bolts, rods, nuts, washers, and other accessories.

H. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

I. Install lateral bracing with pipe hangers and supports to prevent swaying.

J. Install building attachments within concrete slabs or attach to structural steel.

1. Install concrete inserts before concrete is placed; fasten inserts to forms and install reinforcing bars through openings at top of inserts.

K. Load Distribution: Install hangers and supports so that piping live and dead loads and stresses from movement will not be transmitted to connected equipment.

L. Pipe Slopes: Install hangers and supports to provide indicated pipe slopes and to not exceed maximum pipe deflections allowed by ASME B31.9 for building services piping.

M. Piping and Tubing Insulation:

1. Install MSS SP-58, Type 40, protective shields on cold piping with vapor barrier. Shields shall span an arc of 180 degrees.
2. Shield Dimensions for Pipe: Not less than the following:

a. NPS 1/4 to NPS 3-1/2 (DN 8 to DN 90): 12 inches (305 mm) long and 0.048 inch (1.22 mm) thick.

N. Horizontal-Piping Hangers and Supports: Install the following types:

1. Adjustable, Steel Clevis Hangers (MSS Type 1): For suspension of noninsulated or insulated, stationary pipes NPS 1/2 to NPS 30 (DN 15 to DN 750).
2. Pipe Hangers (MSS Type 5): For suspension of pipes NPS 1/2 to NPS 4 (DN 15 to DN 100), to allow off-center closure for hanger installation before pipe erection.
3. Clips (MSS Type 26): For support of insulated pipes not subject to expansion or contraction.
4. Multiple horizontal pipes located indoors may use metal framing systems with split clamp attachment for each pipe in lieu if individual clevis hangers.
5. Pipe stands for horizontal pipes located outdoors.
6. Provide copper-clad hangers and supports for hangers and supports in direct contact with copper pipe.
7. On plastic pipe, install pads or cushions on bearing surfaces to prevent hanger from scratching pipe.

O. Horizontal Piping Hanger Spacing and Rod Size: Install hangers for drawn-temper copper piping with the following maximum horizontal spacing and minimum rod sizes:

1. Sizes through NPS 3/4 (DN 20): Maximum span, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).
2. NPS 1 (DN 25): Maximum span, 6 feet (1.8 m); minimum rod size, 1/4 inch (6.4 mm).
3. NPS 1-1/4 (DN 32): Maximum span, 7 feet (2.1 m); minimum rod size, 3/8 inch (10 mm).
4. NPS 1-1/2 (DN 40): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
5. NPS 2 (DN 50): Maximum span, 8 feet (2.4 m); minimum rod size, 3/8 inch (10 mm).
6. NPS 2-1/2 (DN 65): Maximum span, 9 feet (2.7 m); minimum rod size, 3/8 inch (10 mm).
7. NPS 3 (DN 80) and Larger: Maximum span, 10 feet (3 m); minimum rod size, 3/8 inch (10 mm).

P. Plastic Pipe Hanger and Support Spacing:

1. Space hangers and supports according to pipe manufacturer's written instructions for service conditions.
2. Maximum spacing, 5 feet (1.5 m); minimum rod size, 1/4 inch (6.4 mm).

Q. Vertical-Piping Clamps: Install the following types:

1. Extension Pipe or Riser Clamps (MSS Type 8).
2. Carbon- or Alloy-Steel Riser Clamps (MSS Type 42): If longer ends are required for riser clamps.

R. Support vertical runs at roof, at each floor, and at midpoint intervals between floors, not to exceed **10 feet (3 m)**.

S. Comply with MSS SP-69 for pipe-hanger selections and applications that are not specified.

T. Use hangers, supports, and attachments with galvanized coatings unless otherwise indicated.

U. Hanger Adjustments: Adjust hangers to distribute loads equally on attachments and to achieve indicated slope of pipe.

V. Trim excess length of continuous-thread hanger and support rods to **1 inch (25 mm)**.

W. Hanger-Rod Attachments: Install the following types:

1. Steel Turnbuckles (MSS Type 13): For adjustment up to 6 inches (150 mm) for heavy loads.
2. Steel Clevises (MSS Type 14): For 120 to 450 deg F (49 to 232 deg C) piping installations.
3. Malleable-Iron Sockets (MSS Type 16): For attaching hanger rods to various types of building attachments.
4. Steel Weldless Eye Nuts (MSS Type 17): For 120 to 450 deg F (49 to 232 deg C) piping installations.

X. Building Attachments: Install the following types:

1. Steel or Malleable Concrete Inserts (MSS Type 18): For upper attachment to suspend pipe hangers from concrete ceiling.
2. Top-Beam C-Clamps (MSS Type 19): For use under roof installations with bar-joist construction, to attach to top flange of structural shape.
3. Side-Beam or Channel Clamps (MSS Type 20): For attaching to bottom flange of beams, channels, or angles.
4. Center-Beam Clamps (MSS Type 21): For attaching to center of bottom flange of beams.
5. Welded Beam Attachments (MSS Type 22): For attaching to bottom of beams if loads are considerable and rod sizes are large.
6. C-Clamps (MSS Type 23): For structural shapes.
7. Top-Beam Clamps (MSS Type 25): For top of beams if hanger rod is required tangent to flange edge.
8. Side-Beam Clamps (MSS Type 27): For bottom of steel I-beams.
9. Steel-Beam Clamps with Eye Nuts (MSS Type 28): For attaching to bottom of steel I-beams for heavy loads.
10. Linked-Steel Clamps with Eye Nuts (MSS Type 29): For attaching to bottom of steel I-beams for heavy loads, with link extensions.
11. Malleable-Beam Clamps with Extension Pieces (MSS Type 30): For attaching to structural steel.
12. Welded-Steel Brackets: For support of pipes from below or for suspending from above by using clip and rod. Use one of the following for indicated loads:

    a. Light (MSS Type 31): 750 lb (340 kg).
    b. Medium (MSS Type 32): 1500 lb (680 kg).

13. Side-Beam Brackets (MSS Type 34): For sides of steel or wooden beams.
14. Plate Lugs (MSS Type 57): For attaching to steel beams if flexibility at beam is required.
15. Horizontal Travelers (MSS Type 58): For supporting piping systems subject to linear horizontal movement where headroom is limited.

3.10 INSTALLATION OF PIPING AND TUBING INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated. Installation to maintain a continuous vapor barrier.

B. Insulation Installation on Pipe Fittings and Elbows:

1. Install mitered sections of pipe insulation.
2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Valves and Pipe Specialties:

1. Install preformed valve covers manufactured of same material as pipe insulation when available.

2. When preformed valve covers are unavailable, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
3. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Where PVC jackets are indicated, install with 1-inch (25-mm) overlap at longitudinal seams and end joints; for horizontal applications. Seal with manufacturer's recommended adhesive.

1. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

E. Where metal jackets are indicated, install with 2-inch (50-mm) overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches (300 mm) o.c. and at end joints.

3.11 INSTALLATION OF DUCT, ACCESSORIES, AND AIR OUTLETS

A. Where installing ductwork adjacent to equipment, allow space for service and maintenance.

B. Comply with requirements for metal ducts specified in Section 233113 "Metal Ducts."

C. Comply with requirements for nonmetal ducts specified in Section 233116 "Nonmetal Ducts."

D. Comply with requirements for air duct accessories specified in Section 233300 "Air Duct Accessories."

E. Comply with requirements for flexible ducts specified in Section 233346 "Flexible Ducts."

F. Comply with requirements for air diffusers specified in Section 233713.13 "Air Diffusers."

G. Comply with requirements for registers and grilles specified in Section 233713.23 "Registers and Grilles."

3.12 ELECTRICAL INSTALLATION

A. Comply with requirements indicated on Drawings and in applicable Division 26 Sections.

B. To extent electrical power is required for system equipment, components, and controls, and is not indicated on Drawings and addressed in the Specifications, the design for such electrical power shall be delegated to VRF HVAC system provider.

1. Delegated design of electrical power to equipment, components and controls, and associated installation shall be included at no additional cost to Owner.

C. Connect field electrical power source to each separate electrical device requiring field electrical power. Coordinate termination point and connection type with Installer.

D. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

E. Comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems" for grounding connections.

F. Install nameplate or acrylic label with self-adhesive back for each electrical connection indicating electrical equipment designation and circuit number feeding connection.

1. Nameplate shall be laminated phenolic layers of black with engraved white letters. Letters at least 1/2 inch (13 mm) high.
2. Locate nameplate or label where easily visible.

G. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or revised in this Section.

1. Outlet boxes shall be no smaller than 2 inches (50 mm) wide, 3 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.
2. Outlet boxes for cables shall be no smaller than 4 inches (102 mm) square by [**1-1/2 inches (38 mm)**] [**2-1/8 inches (53 mm)**] deep with extension ring sized to bring edge of ring to within 1/8 inch (3.1 mm) of the finished wall surface.
3. Flexible metal conduit shall not be used.

H. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.

I. Install manufactured conduit sweeps and long-radius elbows if possible.

J. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.

3.13 SOFTWARE

A. Cybersecurity:

1. Software:
   a. Coordinate security requirements with **IT department**.
   b. Ensure that latest stable software release is installed and properly operating.
   c. Disable or change default passwords to password using a combination of uppercase and lower letters, numbers, and symbols at least eight characters in length. Record passwords and turn over to party responsible for system operation and administration.

2. Hardware:
   a. Coordinate location and access requirements with **IT department**.
   b. Enable highest level of wireless encryption that is compatible with Owner's ICT network.
   c. Disable dual network connections.

3.14 INSTALLATION OF SYSTEM CONTROL CABLE

A. Comply with NECA 1.

B. Installation Method:

1. Install cables in raceways except as follows:

   a. Within equipment and associated control enclosures.
   b. In accessible ceiling spaces where open cable installation method may be used.
   c. In gypsum board partitions where cable may be enclosed within wall cavity.

2. Conceal raceway and cables except in unfinished spaces.

C. General Requirements for Cabling:

1. Comply with TIA-568-C Series of standards.
2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
3. Terminate all conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
4. Cables may not be spliced and shall be continuous from terminal to terminal. Do not splice cable.
5. Cables serving a common system may be grouped in a common raceway. Install control cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
6. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
9. Cold-Weather Installation: Bring cable to room temperature before dereeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles or access panels.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals.
15. Do not bend cables in a radius less than 10 times the cable OD.
16. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
17. Ground wire shall be copper, and grounding methods shall comply with IEEE C2. Demonstrate ground resistance.

D. Balanced Twisted-Pair Cable Installation:

1. Comply with TIA-568-C.2.

2. Do not untwist balanced twisted-pair cables more than 1/2 inch (13 mm) at the point of termination to maintain cable geometry.

E. Open-Cable Installation:

1. Suspend copper cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than **30 inches (760 mm)** apart.
2. Cable shall not be run through or on structural members or in contact with pipes, ducts, or other potentially damaging items. Do not run cables between structural members and corrugated panels.

F. Separation from EMI Sources: Comply with BICSI TDMM and TIA-569-D recommendations for separating unshielded cable from potential EMI sources including electrical power wiring and equipment.

3.15 FIRESTOPPING

A. Comply with requirements in Section 078413 "Penetration Firestopping."

B. Comply with TIA-569-D, Annex A, "Firestopping."

C. Comply with BICSI TDMM, "Firestopping" Chapter.

3.16 GROUNDING INSTALLATION

A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.

B. For low-voltage control cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.17 IDENTIFICATION

A. Identify system equipment, piping, tubing, and valves. Comply with requirements for identification specified in Section 230553 "Identification for HVAC Piping and Equipment."

B. Identify system electrical **and controls** components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify each control cable on each end and at each terminal with a number-coded identification tag. Each cable shall have a unique tag.

3.18 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage VRF HVAC system manufacturer's service representative to advise and assist installers; witness testing; and observe and inspect components, assemblies, and equipment installations, including controls and connections.

1. Field service shall be performed by **an employee or a factory-trained and -authorized service representative** of VRF HVAC system manufacturer whose primary job responsibilities are to provide direct technical support of its products.

    a. Additional factory-authorized representatives may assist with completion of certain activities only if supervised by manufacturer's employee. A factory-authorized representative shall not provide assistance without manufacturer's employee supervision.

2. Manufacturer shall provide on-site visits during the course of construction at installation milestones indicated. System Installer shall coordinate each visit in advance to give manufacturer sufficient notice to plan the visit.

    a. First Visit: Kick-off meeting.
    b. Second Visit: At approximately **50** percent completion of system(s).
    c. Final Visit: Final inspection before system startup.

3. Kick-off Meeting:

    a. Meeting shall include system Installer and other related trades with sole purpose of reviewing VRF HVAC system installation requirements and close coordination required to make a successful installation.
    b. Meeting shall be held at Project site and scheduled at a mutually agreed to time that occurs before the start of any part of system installation.
    c. Meeting shall cover the following as a minimum requirement:

        1) Review of latest issue of Contract Documents, Drawings, and Specifications, relevant to VRF HVAC systems.
        2) Manufacturer's installation requirements specific to systems being installed.
        3) Review of all relevant VRF HVAC system submittals, including delegated-design submittals.
        4) Required field activities related installation of VRF HVAC system.
        5) Project team communication protocol, contact information, and exchange of responsibilities for each party involved, including manufacturer, supplier, system Installer, and other related trades.

4. Site Visits: Activities for each site visit shall include the following:

    a. Meet with VRF HVAC system Installer to discuss field activities, issues, and suggested methods to result in a successful installation.
    b. Offer technical support to Installer and related trades as related to VRF system(s) being installed.
    c. Review progress of VRF HVAC system(s) installation for strict compliance with manufacturer's requirements.
    d. Advise and if necessary assist Installer with updating related refrigerant calculations and system documentation.
    e. Issue a report for each visit, documenting the visit.

        1) Report to include name and contact information of individual making the visit.
        2) Date(s) and time frames while on-site.

3) Names and contact information of people meeting with while on-site.
4) Clearly identify and list each separate issue that requires resolution. For each issue, provide a unique identification number, relevant importance, specific location or equipment identification, description of issue, recommended corrective action, and follow-up requirements needed. Include a digital photo for clarification if deemed to be beneficial.

5. Final Inspection before Startup:

a. Before inspection, Installer to provide written request to manufacturer stating the system is fully installed according manufacturer's requirements and ready for final inspection.
b. All system equipment and operating components shall be inspected. If components are inaccessible for inspection, they shall be made accessible before the final inspection can be completed.
c. Manufacturer shall provide a comprehensive inspection of all equipment and each operating component that comprise the complete system(s). Inspection shall follow a detailed checklist specific to each equipment and operating component.
d. Inspection reports for indoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Unit airflow direction within an acceptable range.
19) If applicable, fan external static pressure setting.
20) Filter type and condition acceptable.
21) Noise level within an acceptable range.
22) Refrigerant piping properly connected and insulated.
23) Condensate drain piping properly connected and insulated.
24) If applicable, ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

e. Inspection reports for outdoor units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Condensate removal acceptable.
13) Noise level within an acceptable range.
14) Refrigerant piping properly connected and insulated.
15) Condensate drain piping properly connected and insulated.
16) Remarks.

f. Inspection reports for indoor, dedicated outdoor air ventilation units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity settings and readings within an acceptable range.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Refrigerant piping properly connected and insulated.
22) Condensate drain piping properly connected and insulated.
23) Automatic dampers properly installed and operating.
24) Ductwork properly connected.
25) If applicable, external interlocks properly connected.
26) Remarks.

g. Inspection reports for energy recovery ventilators shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.

3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Humidity readings.
16) Condensate removal acceptable.
17) Fan settings and readings within an acceptable range.
18) Fan external static pressure setting.
19) Filter type and condition acceptable.
20) Noise level within an acceptable range.
21) Automatic dampers properly installed and operating.
22) Ductwork properly connected.
23) If applicable, external interlocks properly connected.
24) Remarks.

h. Inspection reports for hydronic units shall include, but not be limited to, the following:

1) Unit designation on Drawings.
2) Manufacturer model number.
3) Serial number.
4) Network address, if applicable.
5) Each equipment setting.
6) Mounting, supports, and restraints properly installed.
7) Proper service clearance provided.
8) Wiring and power connections correct.
9) Line-voltage reading(s) within acceptable range.
10) Wiring and controls connections correct.
11) Low-voltage reading(s) within an acceptable range.
12) Controller type and model controlling unit.
13) Controller location.
14) Temperature settings and readings within an acceptable range.
15) Condensate removal acceptable.
16) Noise level within an acceptable range.
17) Refrigerant piping properly connected and insulated.
18) Hydronic piping properly connected and insulated.
19) Proof of water flow checked for proper operation.
20) Condensate drain piping properly connected and insulated.
21) If applicable, external interlocks properly connected.
22) Remarks.

i. Installer shall provide manufacturer with the requested documentation and technical support during inspection.

j. Installer shall correct observed deficiencies found by the inspection.
k. Upon completing the on-site inspection, manufacturer shall provide a written report with complete documentation describing each inspection step, the result, and any corrective action required.
l. If corrective action is required by Installer that cannot be completed during the same visit, provide additional visits, as required, until deficiencies are resolved and systems are deemed ready for startup.
m. Final report shall indicate the system(s) inspected are installed according to manufacturer's requirements and are ready for startup.

B. Perform the following tests and inspections with the assistance of manufacturer's service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
3. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Refrigerant Tubing Positive Pressure Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing installation, pressurize tubing systems to a test pressure of not less than **1.5**times VRF HVAC system operating pressure, but not less than **600 psig (4137 kPa)**, using **dry nitrogen**.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of **24** hours. Allowance for pressure changes attributed to changes in ambient temperature are acceptable.
4. Prepare test report to record the following information for each test:

a. Name of person starting test, company name, phone number, and e-mail address.
b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
c. Detailed description of extent of tubing tested.
d. Date and time at start of test.
e. Test pressure at start of test.
f. Outdoor temperature at start of test.
g. Name of person ending test, company name, phone number, and e-mail address.
h. Date and time at end of test.
i. Test pressure at end of test.
j. Outdoor temperature at end of test.
k. Remarks:

5. Submit test reports for Project record.

D. Refrigerant Tubing Evacuation Testing:

1. Comply with more stringent of VRF HVAC system manufacturer's requirements and requirements indicated.
2. After completion of tubing positive-pressure testing, evacuate tubing systems to a pressure of **500** microns.
3. Successful testing shall maintain a test pressure for a continuous and uninterrupted period of **one** hour(s) with no change.
4. Prepare test report to record the following information for each test:

    a. Name of person starting test, company name, phone number, and e-mail address.
    b. Name of manufacturer's service representative witnessing test, company name, phone number, and e-mail address.
    c. Detailed description of extent of tubing tested.
    d. Date and time at start of test.
    e. Test pressure at start of test.
    f. Outdoor temperature at start of test.
    g. Name of person ending test, company name, phone number, and e-mail address.
    h. Date and time at end of test.
    i. Test pressure at end of test.
    j. Outdoor temperature at end of test.
    k. Remarks:

5. Submit test reports for Project record.
6. Upon successful completion of evacuation testing, system shall be charged with refrigerant.

E. System Refrigerant Charge:

1. Using information collected from the refrigerant tubing evacuation testing, system Installer shall consult variable refrigerant system manufacturer to determine the correct system refrigerant charge.
2. Installer shall charge system following VRF HVAC system manufacturer's written instructions.
3. System refrigerant charging shall be witnessed by system manufacturer's representative.
4. Total refrigerant charge shall be recorded and permanently displayed at the system's outdoor unit.

F. Products will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports.

3.19 STARTUP SERVICE

A. Engage a VRF HVAC system manufacturer's service representative to perform system(s) startup service.

1. Service representative shall be **a factory-trained and -authorized service representative** of VRF HVAC system manufacturer.
2. Complete startup service of each separate system.
3. Complete system startup service according to manufacturer's written instructions.

B. Startup checks shall include, but not be limited to, the following:

1. Check control communications of equipment and each operating component in system(s).
2. Check each indoor unit's response to demand for cooling and heating.
3. Check each indoor unit's response to changes in airflow settings.
4. Check each indoor unit and outdoor unit for proper condensate removal.
5. Check sound levels of each indoor **and outdoor** unit.

C. Installer shall accompany manufacturer's service representative during startup service and provide manufacturer's service representative with requested documentation and technical support during startup service.

1. Installer shall correct deficiencies found during startup service for reverification.

D. System Operation Report:

1. After completion of startup service, manufacturer shall issue a report for each separate system.
2. Report shall include complete documentation describing each startup check, the result, and any corrective action required.
3. Manufacturer shall electronically record not less than **two** hours of continuous operation of each system and submit with report for historical reference.

a. All available system operating parameters shall be included in the information submitted.

3.20 ADJUSTING

A. Adjust equipment and components to function smoothly, and lubricate as recommended by manufacturer.

B. Adjust initial temperature and humidity set points. Adjust initial airflow settings and discharge airflow patterns.

C. Set field-adjustable switches and circuit-breaker trip ranges according to VRF HVAC system manufacturer's written instructions, and as indicated.

D. Occupancy Adjustments: When requested within **12** months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to t**wo** visits to Project during other-than-normal occupancy hours for this purpose.

3.21 PROTECTION

A. Protect products from moisture and water damage. Remove and replace products that are wet, moisture damaged, or mold damaged.

B. Protect equipment from physical damage. Replace equipment with physical damage that cannot be repaired to new condition. Observable surface imperfections shall be grounds for removal and replacement.

C. Protect equipment from electrical damage. Replace equipment suffering electrical damage.

D. Cover and seal openings of equipment to keep inside of equipment clean. Do not remove covers until finish work is complete.

3.22 MAINTENANCE SERVICE

A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include **12** months' full maintenance by **skilled employees of system Installer who are manufacturer's authorized service representative**. Include **two** service visits for preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper equipment and system operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.23 SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for **two** years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within **two** years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least **30** days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

END OF SECTION 238129

SECTION 238239.19

WALL AND CEILING UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes wall and ceiling heaters with propeller fans and electric-resistance heating coils.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include rated capacities, operating characteristics, furnished specialties, and accessories.

B. Shop Drawings:

1. Include plans, elevations, sections, and details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include details of anchorages and attachments to structure and to supported equipment.
4. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
5. Wiring Diagrams: Power, signal, and control wiring.

1.3 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:

1. Berko; Marley Engineered Products.
2. Chromalox, Inc.
3. Indeeco.
4. Markel Products Company; TPI Corporation.
5. QMark; Marley Engineered Products.
6. Trane Inc.

2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. 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 CABINET

A. Front Panel: Stamped-steel louver or Extruded-aluminum bar grille, with removable panels fastened with tamperproof fasteners.

B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

C. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated, multispeed. Comply with requirements in Section 230513 "Common Motor Requirements for HVAC Equipment."

2.6 CONTROLS

A. Controls: Unit-mounted thermostat. Low-voltage relay with transformer kit.

B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install wall and ceiling unit heaters to comply with NFPA 90A.

B. Install wall and ceiling unit heaters level and plumb.

C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.

D. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."

E. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

END OF SECTION 238239.19

D. Electrical Engineer:
1. Stephen L. Hutchinson
2. AR0012633.
3. Responsible for Divisions 26,27 & 28

26 00 00	BASIC ELECTRICAL GENERAL REQUIREMENTS
26 05 19	LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES
26 05 20	MC CABLE
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS
26 05 33	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 09 23	LIGHTING CONTROL DEVICES
26 09 43	NETWORK LIGHTING CONTROLS
26 24 13	SWITCHBOARDS
26 24 16	PANELBOARDS
26 27 26	WIRING DEVICES
26 28 13	FUSES
26 28 16	ENCLOSED SWITCHES AND CIRCUIT BREAKERS
26 28 19	MOTOR AND CIRCUIT DISCONNECTS
26 32 13	ELECTRICAL GENERATING SYSTEM
26 36 00	TRANSFER SWITCHES
26 41 13	LIGHTNING PROTECTON SYSTEM
26 43 13	SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER CIRCUITS
26 51 00	LIGHTING FIXTURES AND LAMPS
26 52 00	EMERGENCY LIGHTING
27 10 00	STRUCTURED CABLING
27 15 00	COMMUNICATIONS HORIZONTAL CABLING
28 10 00	ACCESS CONTROL SYSTEM
28 31 00	DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM
28 52 34	PUBLIC SAFETY EMERGENCY COMMUNICATION SYSTEM

SECTION 26 00 00 - BASIC ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements described in Division 1 of these specifications, apply to the work specified in this section.

1.2 QUALITY ASSURANCE

A. Supervisory qualifications:

1. The electrical work on the project shall be under the direct supervision of a licensed journeyman.

B. Qualifications of installers:

1. For the actual fabrication, installation, and testing of the work of this section, use only thoroughly trained and experienced personnel who are completely familiar with the requirements of this work and with the installation recommendations of the manufacturers of the specified items.

2. In acceptance or rejection of installed electrical systems, no allowance will be made for lack of skill on the part of the installers.

1.3 DRAWINGS

A. The intent of the drawings and specifications is to obtain a complete and satisfactory installation. An attempt to separate and completely define the work of Division 26 has been made. Separate divisional drawings and specifications shall not relieve the electrical contractor from full compliance of the work of his trade indicated on any drawings or in any section of the specifications.

B. Architectural drawings take precedence over mechanical or electrical drawings with reference to building construction. Mechanical and electrical drawings are diagrammatic but shall be followed as closely as actual building construction and work of other trades permit.

C. Changes from drawings necessary to make the work of the electrical contractor conform to the building as constructed, or to fit work of other trades, or to comply with the rules of bodies having jurisdiction, shall be made by the electrical contractor at his own expense.

D. Field coordinate with other trades in ample time to build all chases and openings, set all sleeves, inserts and concealed materials and provide clearances that may be required.

E. The term "provide" used in this section of the specifications shall include all labor, materials and equipment necessary to install any item or system indicated on either plans or specifications, including items called for, implied or normally part of the equipment or system. The finished installation shall be complete and fully operational before final acceptance.

F. The architect or engineer reserves the right to make any reasonable changes (approximately six (6) feet) in the location of outlets, fixtures, switches, receptacles or equipment prior to the rough-in of such without any additional cost to the owner.

G. The electrical contractor is responsible for and shall pay for all access panels required in the architectural finishes or surfaces to provide access to junction boxes, strip heaters, ballasts or other devices provided and located by the electrical contractor. The access panel shall be installed by the trade constructing the base to which the access panel will be installed.

H. The electrical contractor is responsible for design, fabrication and erection of all supplementary structural framing required for attachment of hangers or other devices to support electrical equipment.

1. Framing members shall be designed for their actual loads, with allowable stresses set forth in AISC specifications and the AISC code, without excessive deflection and with consideration for rigidity under vibration. Supplementary framing including design loads, member size and location shall be clearly shown on the shop drawings.

2. No cutting or drilling of holes in structural members or precast concrete slabs will be permitted except where written permission has been obtained from the architect or structural engineer.

1.4 EXPLANATION TO BIDDERS

A. No oral explanations in regard to the meaning of drawings and specifications will be made and no oral instructions will be given before the award of the contract. Discrepancies, omissions or doubts as to the meaning of drawings and specifications should be communicated in writing to the engineer for interpretation. Bidders should act promptly and allow sufficient time for a reply to reach them before the submission of their bids. Any interpretation made will be in the form of an addendum to the specifications which will be forwarded to all bidders. Receipt of the addendum shall be acknowledged by the bidder on his bid form.

1.5 BID REQUIREMENTS

A. Before submitting his proposal, the bidder is required to visit the site of the proposed work and familiarize himself with the nature and extent of the work and any local conditions that may in any manner affect the work to be done or the equipment, materials and labor required. He is also required to carefully examine the plans and specifications and to inform himself thoroughly regarding any and all conditions and requirements that may in any manner affect the work to be performed under the contract. Ignorance on the part of the contractor will in no way relieve him of the obligations and responsibilities assumed under the contract.

B. In assembling his bid, the contractor, shall assemble a price based on these specifications and drawings, as shown, and with all materials and equipment exactly as specified. This figure shall be known as the "base bid". All prices must have this base bid clearly stated to be considered.

C. If asked, the contractors bidding on this project shall show evidence of having recently completed a similar job of like size and complexity. If the low bid contractor does not have sufficient financial resources, skilled labor, technical competence or experience, he shall not be awarded the contract.

1.6 SUBSTITUTIONS

A. Materials and equipment are specified by single or multiple manufacturers to indicate quality, material and type of construction desired. One or more manufacturer's products are shown on the drawings and have been used as a basis for design. It shall be the contractor's responsibility to ascertain that alternate manufacturer's products meet detailed specifications, and that size and arrangement of equipment is suitable for installation. The contractor may then bid the substituted products as a voluntary alternate with the price clearly indicated as an "add" or "deduct" from the base bid. All alternates are subject to approval by the engineer and by HUD. Any costs associated with substitutions shall be paid by the contractor requesting the substitution.

B. All requests for substitution shall clearly and specifically indicate any and all differences or omissions between the product specified as the basis of design and the product proposed for substitution. Differences shall include, but shall not be limited to the data as follows:

1. Principle of operation
2. Materials of construction or finishes
3. Thickness or gauge of materials
4. Weight of item
5. Deleted features or items
6. Added features or items
7. Changes in other contractor's work caused by the substitution

C. The contractor making the substitution shall assume responsibility and expense for any changes or damages to his or any other contractor's work caused by the substitution.

1.7 SUBMITTALS

A. Submit items for this division as follow:

1. Submit all Division 26 submittals at one time and in one integral group. Piece-by-piece submission of individual items will not be acceptable. The architect/engineer may check the contents of each submittal set upon initial delivery and if not complete as set forth herein, submittal sets may be returned to the contractor without review and may not be accepted until made complete.

2. Division 26 submittals must be delivered to the architect/engineer within thirty (30) days from official notice to proceed. Any delays arising directly or indirectly from deliverance of submittals after this time shall be the contractor's responsibility. Allow ten (10) working days from date of receipt for architect/engineer's review.

B. Submittal items shall be submitted on materials, apparatus and equipment as indicated under each section of this division and in compliance with the general conditions.

C. Shop drawings shall comply with Division 01 and shall include sufficient information to indicate compliance with specifications. Data shall include illustrations, catalog sheets, drawings, and certifications. Each sheet shall show the manufacturer's name or trademark.

D. At the time of each submission, the contractor shall call the architect/engineer's attention to any deviations from the contract documents and shall plainly mark the deviations on the submittals.

E. Manufacturer's names and catalog numbers: in some instances, specific references have been made to one or more manufacturers' names and catalog numbers. It should be noted that such use does not indicate that the material and equipment specified is necessarily an "off the shelf" item. Variances may be due to the requirement of a desired finish, material or other modification. The electrical contractor shall ascertain that such modifications are fully considered.

1.8 FAMILIARITY WITH LAWS AND CODES

A. The bidder is assumed to be familiar with all federal, state and local laws, ordinances, rules and regulations that in any manner affect the work. Ignorance on the part of the bidder will in no way relieve the bidder from responsibility to meet these requirements.

1.9 ORDINANCES AND REGULATIONS

A. All work shall conform to federal, state and local laws, ordinances or regulations governing the installation of the specified equipment. If the work as laid out, indicated or specified is contrary to or conflicts with local laws, ordinances or regulations, the contractor shall report these conflicts to the architect/engineer before submitting a bid. The architect/engineer will then issue instructions to clarify the conflict.

B. If the contractor fails to notify the architect/engineer of conflicts or omissions as noted above, all changes required to comply with local ordinances and regulations shall be made without additional expense to the owner.

1.10 PERMITS AND FEES

A. The electrical contractor shall obtain all necessary permits and inspections required for the electrical portion of the work and shall pay all charges incidental thereto.

B. The electrical contractor shall deliver to the architect/engineer all certificates of inspection issued by authorities having jurisdiction.

1.11 CODES AND INSPECTIONS

A. The installation shall comply with all laws applicable to the electrical installations which are enforced by the authority having jurisdiction. The latest adopted editions of the following codes shall apply to this project:

NFPA 30 Flammable and Combustible Liquids Code

NFPA 37	Standard for the Installation and use of Stationary Combustion Engines and Gas Turbines
NFPA 70	National Electrical Code
NFPA 72	National Fire Alarm Code
NFPA 80	Standard for Fire Doors and Fire Windows
NFPA 90A	Installation of Air Conditioning and Ventilating Systems
NFPA 96	Standard for Ventilation Control and Fire Prevention of Commercial Cooking Operations
NFPA 101	Life Safety Code
NFPA 110	Standard for Emergency and Standby Power Systems
NFPA 111	Standard on Stored Electrical Energy and Standby Power Systems
NFPA 780	Standard for the Installation of Lighting Protection Systems
ANSI A17.1	Elevator Code
ANSI A117.1	Handicap Accessibility Code
2010 FBC	Florida Building Code
ADA	Americans with Disability Act
FBC	Florida Building Code

B. In any specific case, where, different sections of any of the aforementioned codes or these plans and specifications specify different materials, methods of construction or other requirements, the most restrictive shall govern. In the case of any conflict between a general provision and a special provision, the special provision shall govern.

C. All materials shall be listed by the Underwriter's Laboratories, Incorporated, as conforming to its standards, where such a standard has been established for the particular type of material in question.

D. Where contract document requirements are in excess of code requirements and are permitted under the code, the contract documents shall govern.

1.12 SINGULAR AND PLURAL REFERENCES

A. Singular references in specifications shall not be construed as requiring one (1) device if multiple devices are indicated on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials required for work shall be new, of good quality, furnished, delivered, erected, connected and finished in every detail, selected and arranged to fit properly into building spaces.

B. Equipment shall be of type and capacity shown on equipment schedules on drawings and in specifications and shall be as manufactured by one of manufacturer’s designated approved equal accepted in advance by Project Architect/Engineer.

C. For ease of maintenance and parts replacement, use equipment from a single manufacturer to maximum extent possible.

D. Equipment, materials and components shall be new, standard current products of manufacturers regularly engaged in production of such equipment and shall be manufacturer's latest design conforming to specifications. Materials shall be accepted by code enforcing authorities. Materials used in fire rated construction and in electrical work shall be UL listed, with UL labels as specified.

E. Hardware and accessory fitting shall be U.S. Standard sizes designed, intended or appropriate for the use, and complimenting items with which they are used. Furnish with corrosion protection suitable for the atmosphere in which they are installed.

F. Ascertain before ordering equipment that equipment will fit assigned space without interference from other construction, i.e., check door clearances, ceiling heights, crane access and the like. Be responsible for expenses generated by substitution of equipment used as a basis for design. Maintain clearances as required by the NEC.

G. Since manufacturing methods vary, reasonable minor equipment variations are expected; however, performance and material requirements for the specified equipment are the minimum acceptable standards.

2.2 IDENTIFICATION OF ELECTRICAL SYSTEM ITEMS

A. Identify electrical equipment and conductors in accordance with following:

1. Distribution Equipment: Major components of distribution system such as circuit breakers, switches, switchboards and panelboards shall have nameplates with equipment identification, voltage and phase ratings and source of feed or circuit utilization. Equipment identification shall correspond to the designation on single line diagram. Panelboards shall have typed directories.

2. Starters, Disconnect Switches and Controls: Provide laminated phenolic nameplates with white letters on a black field secured with flush fastenings identifying equipment served.

3. Conductors: Color code wire and cable for feeders and branch circuits as follows unless otherwise required by local codes or electric utility company.

PHASE	208Y/120V	480Y/277V
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

B. Ground Fault Protected Devices:

1. Identify devices protected by ground fault interrupters.

2. Receptacles, not otherwise identified by manufacturer, shall have cover plates with words "Protected by GFI" and "Test Before Using" engraved thereon.

2.3 UNDERWRITERS' LABORATORIES LISTING AND LABELS

A. Where materials and equipment are available under continuing inspection and labeling of UL, provide such material and equipment.

B. Listing by Underwriters' Laboratories shall be evidenced by label or:

1. UL - Electrical Construction Materials List (Green Book)

2. UL - Electrical Appliance and Utilization Equipment List

3. UL - Building Materials List.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify/examine that the surfaces, substrates, and conditions are satisfactory to receive electrical general provisions, and are free from deviations/defects affecting quality of the work.

B. Notify Contractor in writing of conditions detrimental to proper/timely completion of the work.

C. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

D. Beginning of installation will be construed as acceptance of existing substrates, surfaces, and conditions.

3.2 EQUIPMENT INSTALLATION

A. Obtain services of manufacturer's representatives of major electrical equipment at job site during erection or construction of their equipment to insure proper installation. Failure to have such checks made by manufacturers shall place full responsibility for proper installation on Contractor who shall make any corrections or remedy defects at no additional cost to Owner.

B. Where necessary to meet space conditions bring equipment to its ultimate location in pieces or otherwise disassembled, then assemble it in place. Provide flanges, studs and the like for matching, alignment and field assembly.

C. Conduct field tests of equipment after assembly and during under direct supervision of manufacturer's representative. Upon satisfactory conclusion of field tests, manufacturer shall furnish, for each such apparatus or equipment, a written statement certifying that there has been no invalidation of any warranties, or guaranties, nor impairment of capacity or functioning of

apparatus or equipment. Field tests shall be in addition to all factory tests, shop tests and final tests and adjustments.

D. Avoid field assembly wherever possible by suitable scheduling of the general construction work.

1. Extra compensation will not be allowed for those cases where it is necessary to field assemble equipment or apparatus.

3.3 FABRICATION AND INSTALLATION

A. Workers: Use thoroughly trained and experienced workers, completely familiar with items to be installed and manufacturer's current recommended methods of installations.

B. Set equipment level, properly aligned and bolted together where in sections. Secure equipment and materials firmly in place. Screws, bolts, nuts, clamps, fittings or other fastening devices shall be made up tight.

C. Repair to a new condition, or replace materials damaged during delivery, storage or installation. Touch-up scratched or marred finishes on equipment to match original finish or completely refinish.

D. Factory paint or finish enclosures, panels, cabinets, relays, safety switches, fixtures and other exposed equipment or accessories except as indicated otherwise. Group mounted items shall be similar in finish and color.

E. Make connections for air conditioning and ventilating equipment and controls. Follow manufacturers recommendations and system requirements when no other information available.

F. Support electrical raceways, conduits and light fixtures from overhead structure, not from ducts, pipes, conduits or the like. Support piping and HVAC ducts from overhead structure, not from ducts, pipes, conduits or equipment.

G. In order to use same means of support for electrical and mechanical items, design combined support system and coordinate to safely support suspended items.

3.4 HOUSEKEEPING

A. Clean exposed surfaces raceways and equipment which have become covered with dirt, plaster or other material during handling and construction before such surfaces are prepared for painting or enclosed within building structure.

B. Keep raceway openings closed by means of plugs or caps to prevent entrance of foreign matter.

1. Cover fixtures, equipment and apparatus to protect them against dirt, water, chemical or mechanical damage both before and after installation.

2. Damaged fixtures, equipment or apparatus shall be restored to its original condition or replaced at no cost to Owner.

3.5 EXCAVATION AND BACKFILLING

A. Excavation, backfilling and compaction of trenches required for the installation of electrical services and to points of connection with exterior underground utilities outside of the building shall be performed as specified in Trenching, Backfilling and Compaction for Utilities - Refer to Division 31 sections.

3.6 SLEEVES BLOCKOUTS, CUTTING AND PATCHING, CORING AND DRILLING

A. Sleeves:

1. All conduits passing through concrete slabs shall be provided with sleeves.

2. All conduits passing through interior concrete or masonry walls and partitions shall be provided with sleeves.

3. Where pipe motion due to expansion and contraction will occur, sleeves shall be of sufficient diameter to permit free movement of pipe.

B. Cutting and Patching:

1. Cut and patch as needed for installation of electrical equipment. Perform finish patching according to specifications for each finish, by mechanics skilled in each type finish.

2. Install work so that no undue cutting and patching will be required in building construction. Do no cutting that may impair strength of building construction. Install work in various portions of building as construction progresses. Do not delay construction of building.

3. Cut and patch as needed for conduits where sleeves and inserts were not installed, or where incorrectly located.

4. Provide for cutting out holes in structural steel webs (number, size and location) by means of shop drawing submittal and review only as approved by Project Architect/Engineer. Reinforce holes as directed by Project Architect/Engineer.

C. Coring and Drilling:

1. If a sleeve is omitted, core drill to permit insertion of a pipe sleeve with sufficient clearance to permit grouting in place with specified backer rod and sealant space between the line and sleeve.

2. When core drilling or cutting duct holes in foundations, walls, beams, columns or structural slabs, determine the location of reinforcement and tendons before coring.

3. Holes, except for small screws, may not be drilled in beams or other structural members, without obtaining prior acceptance of Project Architect/Engineer.

3.7 WATERPROOFING AND ROOFING

A. Where electrical work penetrates building envelope, or any waterproofed construction, method of installation shall be performed in a manner to prevent transmission of water, heat, cold and drafts.

B. Follow details, including architectural, which establish types of waterproofing construction for each penetration condition.

C. Where a detail suitable to encountered condition is lacking, request instructions from Project Architect/Engineer.

D. Provide necessary sleeves, sealing and flashing required to make opening watertight

3.8 FINAL TESTING, ADJUSTMENTS AND ACCEPTANCE OF ELECTRICAL EQUIPMENT AND SYSTEMS

A. The date for the final acceptance test shall be sufficiently in advance of the contract completion date. To permit the execution of any adjustments and/or alterations which the final acceptance tests indicate as necessary for the proper functioning of all equipment. Any such modifications shall be completed within the number of days allotted for completion of the contract. Retests shall not relieve the contractor for this division of completion date responsibility.

B. Schedule testing and cleared through the General Contractor.

1. No testing of any kind shall be done or scheduled without clearance by General Contractor.

2. Furnish Project Architect/Engineer with name of person who will be in charge of testing, energizing and start-up.

C. Complete test and inspection records shall be made and incorporated into a report for each piece of equipment tested. Record readings taken. Submit electronic copies to Project Architect for review.

D. Notify the General Contractor in writing at least one week prior to test, establishing time that test is to be performed.

1. Perform tests in presence of Project Architect/Engineer.

E. Furnish necessary meters, instruments, temporary wiring and labor to perform required tests and adjustments of equipment and wiring including electrical equipment furnished by others, to determine proper polarity, phasing, freedom from grounds and shorts and operation of equipment. Measuring instruments shall be properly calibrated.

F. Demonstrate materials and manner of installation to be in accordance with the requirements of state and local public authorities, the utility company and NFPA.

G. Energize equipment following established procedures after certification by the Contractor that the installation is satisfactory.

H. Wiring:

1. Check system and equipment grounds for resistance using the Megger ground tester in accordance with manufacturer's instructions. Investigate circuits showing insulation resistance less than minimum values given in N.E.C. Correct weak points.

2. Overall resistance of the ground system shall be no greater than 15 ohms. Inspect grounding system to insure that above-ground cables and connections are suitably protected. Provide additional ground rod, if needed, to obtain the specified resistance.

3. Make ground resistance tests at test points designated by the Project Architect/Engineer. Ground resistance tests shall be in accordance with NEC at 15 ohms.

4. Correct or replace nominal current-carrying circuits which are defective or grounded. Correct other troubles encountered in these tests.

I. Breakers:

1. Set breakers so equipment will be in proper operating condition before being placed in service. Perform final operational tests to determine that wiring connections are correct.

J. Lighting:

1. Check lighting fixtures and receptacles for proper operation. At completion of work, clean fixtures and lenses and replace missing and burned out lamps.

2. In residential projects, provide keyless lamp holders and bulbs to all lighting outlets for future tenant luminaires, in order to comply with inspecting authority requirements.

K. Motors:

1. Make these tests on motors before start-up: Check motor nameplates for HP, speed, phase and voltage. Check bearings to see if they are filled with oil or grease. Lubricate. Check coupling alignment and shaft end-play.

2. Make these tests on motors during start-up:

a. Check shaft rotation before final connections are made. Check for bearing temperature and smooth operation.

b. Take a current reading at full load using a clamp-on ammeter. If ammeter is over the rated full load current, determine reason for the discrepancy and take corrective action.

3. After all connections are made, test motors and equipment for proper operation. Investigate cause of any motor operating above full load rating and remove cause, or report to manufacturer instead of increasing overload heater rating. Check rotation of motors.

4. Check overload elements in motor starters for suitability to the motor characteristics. Replace any overload element that does not conform to starter manufacturer's

recommendations based on actual nameplate current rating of the motor. Investigate the cause of any motor operating above full load rating and correct. Under no circumstances shall oversize overload relay trip rating be substituted.

L. Transformers: Megger winding insulation resistance, primary and secondary-to-ground and primary-to-secondary. Windings shall exhibit resistance in megohms equal to eight times the voltage rating of the winding in kV.

M. Control and Alarms: Check control and alarm circuits for proper operation. Test switchgear, switchboards, fire alarm system, as specified in each Section.

N. Service Voltage: Check service voltage at no-load and at full load on the distribution system. The objective shall be to maintain the equipment terminal voltage at less than 10% above nameplate rating at full system load. Then set transformer no-load taps so that at normal loading the average operating voltages at the terminals of all utilization equipment matches the nameplate voltage of that equipment as closely as possible.

O. Test all circuits, which under any circumstances can be paralleled, for proper phasing using hot phasing.

P. Acceptance: Observation of the operation of the electrical installation and equipment by the Project Architect/Engineer does not constitute acceptance of the Work. Acceptance will be made after the Contractor has adjusted his equipment, demonstrated that it meets the requirements of the Contract Document, and has furnished all the required certificates.

3.9 TOOLS AND SPARE PARTS

A. Use only tools designed for each operation. Keep tools in good condition. Do not use worn or broken tools. Wrench and vise teeth shall be sharp and clean to prevent damage to the materials. Screw drivers and wrenches shall be of the proper size to prevent damage to head or nuts.

B. Deliver special tools and spare parts provided with equipment to an authorized representative of the Owner. Obtain signed and dated receipts.

3.10 DEMONSTRATION

A. Demonstrate the essential features of the following mechanical and electrical systems upon completion of satisfactory testing:

1. Power System
2. Lighting System
3. Fire Alarm System
4. Emergency Generator

B. Hold the demonstrations in the presence of the Owner or his designated representatives and the Project Architect/Engineer to show functions, locations and relationships to the Drawings. Demonstrate how to "start-stop", reset, replace, and emergency procedures. Demonstrate one system at a time.

3.11 OPERATING INSTRUCTIONS

A. The electrical contractor shall provide the services of a competent operating engineer to supervise the operation of all equipment specified herein and to instruct the owner's operators during an eight (8) hour period. The operating instruction period shall be defined as straight time working hours and shall not include nights, weekends, or travel time to and/or from the project.

B. The architect/engineer shall be notified in writing at least five days before each operating instruction period begins. The contractor shall not commence any instruction period until the owner has issued his written acceptance of the starting time.

3.12 OPERATING AND MAINTENANCE BOOKS

A. The electrical contractor shall provide the owner, through the architect/engineer, with operating instructions and maintenance data books for all equipment and materials furnished under this division.

B. The electrical contractor shall submit four copies of operating and maintenance data books to the architect/engineer for review a minimum of four weeks before final inspection of the project. All data shall be assembled in a single completely indexed volume and shall identify the size, model, and features indicated for each item.

C. The following information shall be included where applicable:

1. Identifying name and mark number
2. Locations (where several similar items are used, provide a list)
3. Complete nameplate data
4. Certified record drawings and shop drawings
5. Parts lists
6. Wiring diagrams
7. Manufacturers' operating and maintenance instructions with all non-applicable information deleted

3.13 GUARANTEE AND SERVICE

A. In addition to the guarantee of equipment by the manufacturer of each piece of equipment specified herein, the electrical contractor shall also guarantee such equipment and shall be held for a period of one (1) year from final acceptance test for necessary adjustments and/or replacements of all defective equipment, materials and workmanship without expense to the owner.

B. The contractor shall furnish maintenance and service for one (1) year from final acceptance of the contract for all portions of the system. Such service for the one year period includes the following:

1. Necessary adjustment and/or replacement of all defective equipment and materials furnished.

C. Service and replacement of light bulbs shall be limited to thirty (30) days after final acceptance of the job.

1. Upon expiration of each of these limits noted herein, the maintenance, including labor and material costs, shall be at the owner's expense.

3.14 ACCEPTANCE

A. As a precedent to requesting a final inspection and release of retained monies, the electrical contractor shall:

1. Complete all work required under the electrical section of the specifications and drawings.

2. Submit electronic copies of final test data to the architect/engineer.

3. Furnish a complete set of "as built" reproducible tracings of the contractor's work to the architect/ engineer.

END OF SECTION

SECTION 26 05 19 – LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all materials and equipment and performing all labor and services necessary for the complete installation of the system of conductors for power and lighting service, including all related system and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. All conductors shall have 600 volt insulation and shall be copper of 98% conductivity. Compacted aluminum conductors are permitted where specifically listed on the drawings. Any cable not specifically labeled as an aluminum conductor shall be copper.

B. Conductors sizes specified are AWG up to No. 4/0 and circular mils above No. 4/0.

C. Conductor sizes 10 AWG and smaller shall be solid: conductors No. 8 AWG and larger shall be stranded.

D. Conductors No. 6 and smaller shall be NEC standard dual rated type "THWN," or "THHN" thermoplastic, approved for operation at 75^{o}c in dry and wet locations and 90^{o}c within electric discharge lighting equipment as permitted in NEC 410.68. Conductors No.4 and larger shall be NEC standard rated type "THWN," or “THHN” approved for operation at 75^{o}c in dry and wet locations.

E. Conductors used for underground construction in conduits may be type “THWN” or type “XHHW”.

F. All wire and cable shall be of the same name brand, and shall be in the original wrapping.

2.2 NON-METALLIC SHEATHED CABLE

A. Non-Metallic Sheathed Cable, type NM may be used for wiring within individual residential units containing a dedicated electrical panel where the construction of the building is type III, type IV or type V as allowed in National Electrical Code Article 334.10. Type NM cable is not

to be used anywhere else in the facility unless specifically authorized by the engineer and the owner.

2.3 TYPE MC CABLE

See section 26 05 20

PART 3 - EXECUTION

3.1 SIZE

A. Minimum size conductors installed shall be No. 12 AWG for all applications except where specifically noted otherwise for special system circuits.

3.2 COLOR CODING

A. All lighting and receptacle branch circuit conductors shall be color coded. Feeder cables and service entrance conductors shall be color coded by use of colored plastic tape applied within 6" of each conductor end or shall have insulation of the color required for proper phasing. All color coding shall be with the same color being used with its respective phase or bus through the entire job as follows:

PHASE	208Y/120V	480Y/277V
A	Black	Brown
B	Red	Orange
C	Blue	Yellow
Neutral	White	Gray
Ground	Green	Green

3.3 WIRE INSTALLATION

A. No wires or cables shall be pulled into the conduit until the conduit system is complete and plastering is applied and dried. This does not refer to a white finish coat of plaster which may be applied after the wires are pulled in.

3.4 NM CABLE INSTALLATION

A. Type NM cable shall be concealed within walls, floors or ceilings that provide a thermal barrier of material that has a 15-minute finish rating as identified in U.L. listings of fire-rated assemblies.

3.5 NEUTRALS

A. All wiring for lighting and receptacle branch circuits shall be run as single-phase, two-wire with a dedicated neutral conductor. Sharing of neutrals for multi-wire branch circuits is not acceptable.

3.6 SPLICES AND JOINTS

A. Conductors shall be continuous from outlet to outlet and from outlet to junction box or pull box. All splices and joints shall be carefully and securely made to be mechanically and electrically solid with solderless pressure connectors and insulated with Scotch 33 tape and friction tape, if insulation is not provided in pressure type connector used. Where connection is made to any terminals of more than 30 amperes capacity and where conductors larger than No. 10 are connected to any terminal, CU/AL terminal lugs shall be bolted to the conductors. Where multiple connections are made to the same terminal, individual lugs for each conductor shall be used.

1. All conductors shall be properly terminated in accordance with torque requirements specified in the National Electrical Code.

2. Aluminum conductors shall be treated with an oxide inhibiting agent immediately prior to termination and torqueing of the connection.

3.7 SLACK

A. All wire and cables for power, lighting, control and signal shall be continuous from origin to destination with proper splices as specified. At the end of these wires and cables only sufficient slack shall be left as may be required for making proper connections. There shall be no unnecessary slack.

3.8 CONNECTION TO WIRING DEVICES

A. Where conductors are to be connected directly to the devices without the use of lugs, such as occurs at side connections of lighting switches and plug receptacles, the conductors shall be formed into suitable loops to fit around the terminal screws.

1.2 CONNECTION TO METALLIC SURFACES

A. Where wires and cables are connected to metallic surfaces, the coated surfaces of the metal shall be polished before installing the mechanical connectors. The lacquer coating of conduits shall be removed where ground clamps are to be installed.

1.3 CONNECTION AT OUTLETS

A. The conductors terminating at each wired outlet shall be left not less than six (6) inches long at their outlet fitting to facilitate the installation of devices or fixtures. Where more than one pair of conductors enters an outlet, the several pairs of conductors shall be neatly spliced and made mechanically and electrically secure to conductors which shall be not less than six (6) inches long within the outlet.

1.4 WIRING FOR LIGHTS

A. Branch circuit wiring which supplies more than one fixture through the wireway of other fixtures shall be approved for use at 90°c.

1.5 WIRING TO LIGHT SWITCHES

A. Wall switch outlets shall be wired to provide control of outlets indicated. All connections to single pole switches shall be made so that the off operation of the switch opens the ungrounded leg.

1.6 LABELING

A. Each wire in a pull box, junction box or equipment wire chamber shall be labeled with the proper panel letter and circuit number identification, and where two or more wires are spliced, each shall be labeled. Labels shall be printed numbers and letters on suitable plastic tape. Wires and cables shall be identified by suitable Brady adhesive label tapes.

END OF SECTION

SECTION 26 05 20 – TYPE MC CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Branch Circuits: Type MC Cable for use as branch circuits.

B. General Applications: Type MC Cable may be used in the following general applications based on the National Electrical Code (NEC):

1. For general purpose branch circuits
2. For applications requiring grounding paths
3. For applications requiring isolated grounding
4. Exposed or concealed
5. In cable tray where identified for such use
6. In dry locations and embedded in plaster or against other masonry

1.2 SUBMITTALS

A. Product Data: Submit manufacturer’s product data that materials comply with specified requirements and are suitable for intended application.

B. Installation Instructions: Manufacturer’s installation instructions shall be included in submittal. Industry guides may supplement the manufacturer’s instructions.

C. Manufacturer: Type MC Cables and wire shall be supplied from a single manufacturer.

1.3 REQUIREMENTS

A. MC Cable: Type MC Cable shall meet the following:

1. UL 1569 Standard for Metal-Clad Cables
2. UL Standard 83 for Thermoplastic-Insulated Wires and Cables or UL Standard 44 for Thermoset-Insulated Wires and Cables
3. UL Standard 1479 Standard for Fire Tests of Through-Penetration Firestops.
4. UL Classified 1, 2, and 3 Hour Through-Penetration Firestop Systems.

B. MC Cable Fittings: Type MC Cable connectors shall comply with UL 514B Standard for Conduit, Tubing, and Cable Fittings.

C. National Electrical Code: Type MC Cable shall meet the following NEC requirements.

1. NEC Articles 230, 250, 300, 330

2. NEC Class I Div. 2, Class II Div. 2, & Class III Div. 1 Hazardous Locations.

D. Federal Specification: Type MC Cable shall meet Federal Specification A-A59544.

E. Flame Test: Type MC Cable shall pass IEEE 1202 (70,000 BTU/hr) Vertical Cable Tray Flame Test.

PART 2 - PRODUCTS

2.1 PRODUCT

A. Interlocked Armor Ground Type MC Cable

2.2 MANUFACTURERS

A. Southwire Company

B. Senator Wire and Cable

C. AFC Cable Systems

2.3 TYPE MC CABLE CONSTRUCTION

A. Circuit Conductors

1. Conductors: Soft-drawn solid copper conductors shall be permitted for 12 and 10 AWG conductor sizes. Stranded copper conductors shall be class B stranded or equivalent.

2. Insulation: The conductors shall be constructed with THHN insulation rated for 90°C dry and rated for 600 volts.

B. Equipment Grounding Conductors

1. Insulated Copper Conductor: A green insulated grounding conductor shall be cabled with copper circuit conductors and located under the nonmetallic tape covering.

C. Cable Assembly

1. All insulated circuit conductors and any insulated grounding conductors shall be cabled together and contained under an overall nonmetallic tape covering.

D. Metal-Clad Sheath / Armor Assembly

1. Interlocked Armor: The interlocking metal tape armor shall be aluminum.

2. Aluminum interlocking metal tape shall be formed and helically wrapped around the cable assembly such that the interlocked armor is in intimate contact throughout the entire cable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Neat and Workmanlike Installation: MC Cable shall be installed parallel or perpendicular to walls. No diagonal runs shall be permitted. Additional supports shall be used when the cable is exposed.

B. Manufacturer's Instructions: Type MC Cable shall be installed per the manufacturers written installation instructions. Industry guides may supplement the manufacturer's instructions.

C. Manufacturer: Type MC Cables for circuits shall be supplied from a single manufacturer.

D. Securing and Supporting: Type MC Cable shall be secured and supported at intervals not exceeding six feet unless otherwise permitted in the National Electrical Code.

E. Minimum Bending Radius: Bends in Type MC Cable shall be made so that the cable will not be damaged. The radius of the curve of the inner edge of any bend should not be less than seven times the cable diameter.

F. Firestop Systems: Type MC Cable shall be installed per the cable manufacturer's Through-Penetration Firestop Systems listing by Underwriter Laboratory.

3.2 CONTINUITY OF METAL RACEWAYS, CABLE ARMOR AND ENCLOSURES

A. General: Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electric conductor and shall be connected to all boxes, fittings, and cabinets or enclosures so as to provide an effective ground fault current path per Section 250.4 of the NEC.

B. Circuits Under 250 Volts: Type MC Cable shall be terminated per manufacturer's written installation instructions

3.3 SPECIFIC USES

A. Type MC Cable may be used in the following applications:

1. For general purpose branch circuits.

2. Environmental air-handling spaces per 2017 NEC 300.22(B)/(C)

3. Places of assembly per NEC 518.4 and theaters per NEC 520.

4. Under raised floors for information technology equipment conductors and cables per NEC 645.5(E)

3.4 USES NOT PERMITTED

A. Type MC Cable should not be used in wet locations, either direct burial, in underground conduit, or overhead.

3.5 AMPACITY

A. The ampacity of Type MC Cable shall be determined in accordance with Article 310.15 of the National Electrical Code. The installation should not exceed the ratings of the terminations and equipment.

END OF SECTION

SECTION 26 05 26 – GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all materials and equipment and performing all labor and services necessary to insure that the electrical service and electrical systems conform with the requirements of article 250 of the NEC and as specified hereinafter.

PART 2 - PRODUCTS

2.1 PRODUCT

A. The products specified in Section 26 05 19 apply to the work specified in this section.

2.2 GROUND RODS

A. Ground rods shall be a minimum of 5/8" x 10'-0" copper-clad ground rods.

2.3 GROUND CLAMPS

A. Ground clamps shall be UL approved for the application.

PART 3 - EXECUTION

3.1 EQUIPMENT TO BE GROUNDED

A. The following systems and/or equipment shall be grounded in accordance with the rules of the National Electrical Code, the local code, and as hereinafter specified.

1. Building power system including all available grounding electrodes as listed in National Electrical Code Article 250.52.

2. Raceway and conduit systems

3. Lighting fixtures

4. Noncurrent carrying metal parts of all motors, panels and other electrically operated equipment.

5. Telephone system

6. Data System

7. Fire alarm system

8. Above ground gas piping system upstream from the equipment shutoff valve.

9. Above ground metal piping systems.

3.2 SERVICE EQUIPMENT

A. The service equipment shall be bonded ahead of the main water service meter and grounded to installed ground rods using bare copper wire in steel conduit. The wire shall be sized in accordance with Article 250.66 of the National Electrical Code. Copper-clad ground rods shall be driven to a depth sufficient to provide a grounding electrode of 15 ohms maximum resistance to ground. If the resistance is greater than 15 ohms, additional ground rods shall be installed and bonded to the first electrode.

3.3 MADE ELECTRODES

A. Made electrodes shall consist of copper-clad ground rods. The rods shall be installed such that at least 8'-0" of length is in contact with the soil. The upper end of the electrode shall be flush with or below ground level unless the above ground end and the grounding wire attachment are protected against physical damage.

3.4 BONDING

A. All metal conduits entering the building service panel and all metal feeder conduits to panels shall be bonded together and to the system ground using metal grounding bushings and copper conductors terminated on the ground bus of the distribution equipment. Metallic conduit systems shall be electrically continuous throughout.

3.5 NEUTRAL

A. The system neutral conductor shall be identified throughout and shall be grounded at the building service only.

3.6 EQUIPMENT GROUND WIRE

A. An equipment grounding wire sized as per NEC Article 250.122 shall be installed inside all conduit, and shall be bare or have green insulation.

3.7 ACCESSIBILITY

A. All grounding electrode connections shall be accessible for periodic inspection and testing.

3.8 CONNECTIONS

A. Connections to ground rods and underground or concealed reinforcing rods shall be made with exothermic welds similar to Cad-Weld systems. Connections to above ground electrodes shall be made with UL listed grounding clamps.

3.9 ISOLATED GROUNDS

A. Isolated ground systems shall have a separate ground wire installed in the conduit which is run to the building service ground with no other interconnections between normal ground and isolated ground. Isolated ground wires shall be sized in accordance with the equipment served and shall be identified by a colored stripe on the green insulation.

END OF SECTION

SECTION 26 05 33 – RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all materials and equipment and performing all labor and services necessary for the complete installation of the system of conduits for power and lighting service, including all related system and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 BUSHINGS, LOCKNUTS AND CONNECTORS

A. Where rigid conduit enters a box of any description, the conduit shall be secured to the box with a locknut on the outside and a similar nut and bushings on the inside.

B. Where electric metallic tubing enters such boxes the connection between the connector and the box shall be made tight by an approved manner both on the inside and the outside of the box.

C. Conduit terminations at the boxes shall be provided with bushings. Bushings for conductors through #8 AWG shall be galvanized, non-insulating type; for #6 AWG and larger conductors, bushings shall be insulated and selected for the size conduit involved.

D. Conductors in vertical runs must be supported if the vertical rise exceeds values in table 300.19(A) of the NEC. Provide properly sized support bushing at the top of the vertical raceway. Intermediate supports shall be provided as necessary to limit supported conductor length to not exceed values specified in table 300.19(A) of the NEC.

2.2 CONDUIT

A. All conduit installed in concrete floor slabs shall be underwriter's approved hot dipped rigid galvanized steel conduit or schedule 40 PVC conduit.

B. All conduit installed underground shall be schedule 40 rigid polyvinyl chloride (PVC) or hot dipped rigid galvanized steel conduit coated with an asphaltum paint approved by the architect.

C. All conduit installed exposed in exterior areas above finished grade shall be underwriter's approved rigid hot dipped galvanized steel unless otherwise noted on the drawings. Conduit installed exposed in interior areas above finished floor shall be Underwriter's approved hot

dipped rigid galvanized steel or electrical metallic tubing unless otherwise noted on the drawings.

D. All conduit installed in or above ceilings or stud partitions shall be rigid galvanized steel conduit or electrical metallic tubing.

E. PVC schedule 40 conduit shall not be used above grade anywhere on the project unless otherwise noted on the drawings. PVC conduit may not be used within the building.

F. Electrical metallic tubing: all electrical metallic tubing shall be galvanized and conform to all pertinent requirements of the national electrical code.

G. All flexible metallic conduit installed in wet or damp locations shall be liquid-tight (PVC extruded cover) and all installations in dry locations shall be flexible steel conduit (no cover), unless specifically noted otherwise.

H. PVC conduit: all polyvinyl chloride conduit shall be heavy-wall schedule 40 or schedule 80 where noted on drawings, with factory made bends, couplings, and fittings.

I. Connectors and couplings: for electrical metallic tubing, compression, tap-on or set screw type fittings shall be used. For rigid steel conduit, threaded couplings and locknuts and bushings shall be used. For PVC, PVC couplings and fittings shall be used. Where PVC underground conduit connects to steel conduit, suitable threaded conduit adapter fittings shall be used. For flexible conduit, liquid-tight fittings shall be used with liquid-tight flexible conduit and compression fittings shall be used with flexible steel conduit.

2.3 FLOOR BOXES

A. Floor boxes shall be cast metal with threaded conduit entrance, and shall have means for adjusting floor plate to finish floor level. All floor boxes shall be waterproof and flush with the finished floor.

B. Service fittings shall be flush brass finish fittings with appropriate carpet flange or trim plate for hard floor as required as manufactured by Wiremold or Hubbell.

2.4 JUNCTION AND PULL BOXES

A. Junction and pull boxes one hundred (100) cubic inches in volume or smaller shall be standard outlet boxes. Those one hundred fifty (150) cubic inches or larger shall be constructed as specified for cabinet construction and shall be furnished with covers. Boxes shall be coated inside and out to prevent corrosion.

B. Boxes shall be sized in accordance with the requirements of the national electrical code, and junction boxes not used for service entrance duty shall not be smaller than four (4) inches square and one and one-half (1-1/2) inches in depth with covers accessible at all times. Boxes on concealed conduit shall be set with covers flush with the finished plaster line unless otherwise shown.

2.5 OUTLET BOXES

A. At each outlet shown, furnish and install a box of suitable size and construction to serve the purpose properly. Furnish and install plaster rings where required in connection with adjacent plaster finish where these occur. In unfinished masonry walls, furnish and install handy boxes of such size as to permit their being completely covered by the device plate. Boxes for metal conduit systems and for MC cable shall be galvanized steel. All unused knockouts in boxes shall be filled or capped before plates or devices are installed. Boxes for type NM cable installation may be non-metallic boxes per Article 314.3 of the National Electrical Code. Installation of boxes shall not diminish the fire ratings of any walls. The contractor shall provide UL listed fire rated protection for any boxes compromising the fire integrity of a rated wall.

B. Ceiling outlets shall be four (4) inch octagonal boxes of the appropriate depth and furnished with three-eighths (3/8) inch fixture studs fastened through from back of boxes. For plaster surfaces, furnish and install plaster rings and ears.

C. At each switch or receptacle outlet shown, provide an approved switch box or handy box of the number of gangs indicated.

D. Outlet boxes for all exposed work shall be of the cast type.

E. Stamped steel outlet boxes shall be manufactured by Appleton Electric Company, Raco Manufacturing Company or Steel City Electric Company.

F. Cast metal outlet boxes shall be manufactured by Appleton Electric Company, Crouse-Hinds Company, or Killark Electric Manufacturing Company.

G. Above Class I locations, underground wiring shall be installed in threaded rigid metal conduit. All these conduits shall be sealed within ten feet of the conduit emergence from below grade. Provide seal at the panelboard and at the load itself.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify the electrical installation may be made in complete accordance with all pertinent codes and regulations and the original design.

3.2 DISCREPANCIES

A. In the event of discrepancy, immediately notify the architect/engineer.

B. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION

A. Coordinate the installation of electrical items with the work schedules of other trades to prevent unnecessary delays in the total work.

3.4 INSTALLATION OF RACEWAYS AND FITTINGS

A. Conduit shall be of the sizes required to accommodate the number of conductors in accordance with the National Electrical Code, or as noted on the drawings. The sizes shown on the plans may be increased if desired to facilitate the pulling of conductors. The minimum conduit size shall be one half inch (1/2").

B. All conduits shall be concealed unless otherwise shown on the drawings. Concealed conduit run above the ceiling shall be supported independent of ceiling construction. Where a ceiling of the lay-in type is used, the conduit must be installed high enough to permit removal of ceiling panels.

C. Exposed conduit shall be run parallel with or at right angles to the building walls and supported from the walls or ceilings with straps or clamps secured with wood screws for wood construction, machine screws for metal construction, and expansion anchors with bolts for masonry or concrete slab construction. All exposed conduit runs shall be subject to approval.

D. Underground conduit shall be laid at a minimum depth below grade of 36 inches, unless specifically noted otherwise.

E. Conduit shall be continuous from outlet to outlet and from outlet to cabinet, junction or pull box. Conduits shall enter and be secured to all boxes in such a manner that each system shall be electrically continuous from point of service to all outlets.

F. Approved Appleton, Crouse-Hinds, or O.Z. Manufacturing Company expansion fittings shall be installed in all rigid conduit and E.M.T. runs, where such conduit runs extend across expansion joints in the building.

G. No conduit shall be trapped except where shown on the drawings.

H. Conduit connection to a box which has no threaded hub for its reception shall be double lock-nutted with locknuts designed to bite into the metal. Provide an insulated bushing at each end of each conduit run. Use insulated bushings with separate locknuts on all conduit entering a panel cabinet. All conduits entering outlet boxes shall be provided with either insulated throat connectors or separate locknuts and insulated bushings. Bushings must be installed before any wire is pulled in.

I. At rigid steel couplings, conduits shall be threaded so that they meet in the coupling. Right and left couplings shall not be used; conduit couplings of the Erickson type shall be used at locations requiring such joints.

J. All threaded joints shall be made up with joint compound applied to the male threads only.

K. Conduit shall be secured in place and protected to prevent damage to work during construction. The ends of all conduit runs shall be plugged to avoid filling with plaster, etc. All conduit shall be blown out and/or swabbed clear of water and trash prior to pulling wire.

L. Flexible conduit shall be used only where indicated on the drawings, or where specified otherwise.

M. Conduit connections from outlet boxes, junction boxes, conduit, switch boxes, or motor controller to rotating or vibrating machinery or equipment shall be made with flexible conduit which shall be as short as possible with a maximum length of thirty-six (36) inches.

N. Conduit connections from outlet boxes to recessed lighting fixtures shall be made with 3/8" flexible conduit which shall have a maximum length of 72 inches, unless otherwise noted.

O. PVC conduit installed underground shall be encased in concrete with a minimum thickness of six inches on all sides of the conduit in high traffic areas such as driveways, roads and other areas as indicated on the drawings.

P. Where underground PVC conduit turns up to run above grade, the elbow and all conduit from the elbow up shall be rigid galvanized steel unless otherwise noted on the drawings. Where the PVC conduit is encased in concrete, the transition to steel conduit shall be made within the concrete casing.

Q. All telephone conduit routed to the telephone terminal wood backboard shall be terminated with an end bushing within six (6) inches of the edge of the backboard.

R. All conduits penetrating a fire or smoke wall shall be sealed with Dow Corning silicone RTV foam #3-6548 to preserve the rating of the fire wall.

3.5 INSTALLATION OF JUNCTION AND PULL BOXES

A. Junction boxes and pull boxes made of code gauge steel shall be furnished and installed where such boxes may be necessary to facilitate the pulling or splicing of cables. Boxes must be made accessible. Conduits shall enter these boxes through tight fitting clearance holes. Where required, suitable supports shall be provided in all pull boxes to support feeders passing through the boxes so that feeder conductors will not remain unsupported for a distance greater than three (3) feet.

B. Junction boxes shall have only the holes necessary to accommodate the conduits at point of installation. All boxes shall have suitable provisions to secure covers.

C. Junction boxes shall be securely attached to the building construction, using wood screws for wood construction, bolts for metal construction, and expansion anchors with bolts for masonry or concrete construction. Boxes flush mounted in tile or masonry construction shall be secured in place with cement mortar. Boxes flush mounted in ceiling shall be supported from building structure in dependent of the ceiling construction.

D. Junction boxes installed in rated walls shall be covered on five sides with appropriate putty pads to maintain the rating of the wall.

3.6 INSTALLATION OF OUTLET BOXES

A. Boxes shall have only the holes necessary to accommodate the conduits at point of installation. All boxes shall have suitable provisions to secure covers.

B. Boxes shall be securely attached to the building construction, using wood screws for wood construction, bolts for metal construction, and expansion anchors with bolts for masonry or concrete construction. Boxes flush mounted in tile or masonry construction shall be secured in place with cement mortar. Boxes flush mounted in ceiling shall be supported from building structure independent of the ceiling construction.

C. All outlet boxes shall be flush mounted within the wall regardless of wall construction, unless they are specifically shown as being used with exposed conduit.

D. The edge of all outlet boxes shall be flush with the surface in which they are recessed. The contractor shall be attentive to boxes set in masonry walls. The devices that fit into the outlet boxes shall be screwed tight before the cover plates are installed. The cover plates shall not be used as a means of tightening the devices in place.

E. Flush mounted outlet boxes in all exposed masonry walls shall be masonry boxes or shall be four (4) inch square boxes with square cornered tile covers. The boxes or box covers shall have square edges and shall have the device holes inside the box.

F. Extra deep type concrete boxes shall be used in concrete walls and slabs to permit entering and leaving of conduits and to avoid steel reinforcing rods.

G. Wall switch outlets shown at door locations shall be installed on the lock side of the door, four (4) inches from the jamb, unless otherwise indicated on the drawings. Door swings shall be verified from architectural drawings.

H. Outlet boxes for telephone and data shall be 4-11/16 inches square and shall have raised covers with rectangular opening in center.

I. Outlets shall be located approximately as shown on the plans. Exact mounting heights for all outlets shall be determined at the building site and shall be verified by the contractor from architectural drawings which indicate casework and other architectural conditions. Outlets shall be located so as not to split the top of wainscot, backsplashes, or to be obstructed by equipment of any type indicated or specified. Where outlets are shown on the drawings as being adjacent and different mounting heights are specified for each, they shall be mounted one directly over the other, on the centerline of the group or on the centerline of the room.

J. Where outlets are installed in waterproofed walls or columns, a 6" x 6" x 3" deep wood box shall be placed in the forms before the concrete is poured. This box is to be removed before the waterproofing is applied. The contractor shall then waterproof the wall and the opening after which the outlet shall be installed. Grout around the box. Boxes to be set carefully so the cover plates will be flush.

K. Outlet boxes in conduit work which is exposed to the weather, and for vapor-tight lighting fixtures and devices shall be cast corrosion resistant type with threaded conduit hubs to accommodate the conduit size entering.

L. Outlets for the attachment of lighting fixtures shall be provided with fixture studs securely anchored to the boxes. Where outlet boxes are used to support lighting fixtures, the outlet boxes shall be firmly anchored to the structural members of the building.

END OF SECTION

SECTION 26 09 23 – LIGHTING CONTROL DEVICES

GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

B. The contractor shall coordinate all of the work in this section with all trades covered in the other sections of the specifications to provide a complete and operable system.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The extent of the lighting control system work is indicated by the drawings and by the requirements of this section. It is defined to include, but is not limited to, occupancy sensors, power packs and auxiliary relays. System installation includes the installation of occupancy sensors, power packs and auxiliary relays in accordance with manufacturer's installation instructions.

1.4 QUALITY ASSURANCE

A. Component Testing: All electronic component board assemblies are to be factory tested and burned in prior to installation.

B. System Support: Factory fax/telephone/email support shall be available free of charge during normal business hours.

C. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

D. NEC Compliance: Comply with applicable portions of the NEC.

E. UL Compliance: UL Listed in compliance with applicable UL Safety Standard.

F. FCC Emissions: All assemblies are to be in compliance with FCC Part 15, Class B.

1.5 WARRANTY

A. Manufacturer shall warrant specified equipment to be free from defects in materials and workmanship for at least 5 years from the date of manufacture.

1.6 SUBSTITUTIONS

A. If equipment from another manufacturer is submitted for approval, identification of any and all exceptions to the specifications must be provided with a detailed explanation of each exception.

PRODUCTS

2.1 PRODUCT

A. The products specified in Section 26 09 23 apply to the work specified in this section.

2.2 PASSIVE INFRARED/ULTRASONIC (DUAL TECHNOLOGY) WALL SWITCH OCCUPANCY SENSOR

A. Sensor shall recess into standard single gang wall switch box.

B. Sensor shall meet NEC grounding requirements, providing a green grounding wire with ring terminal and thread-forming screw.

C. Sensor shall have one line lead (black) and one load lead (red) for connection to lighting circuit.

D. Sensor shall be rated 120VAC and 277VAC input at line frequency of 60 hertz.

E. Sensor shall be rated for electronic and magnetic ballasts, incandescent and motor loads.

	Load Rating @ 120V	Load Rating @ 277V
Ballast	1000VA	1800VA
Incandescent	1000W	
Motor	1/4hp	

F. Sensor shall employ a mechanical relay to stop current flow to load when sensor is inactive (off).

G. Sensor shall employ a dual element PIR sensor having highest sensitivity to infrared with wavelength of 9.8 microns to detect human occupancy.

H. Sensor shall have major motion coverage up to 1000 square feet and minor motion coverage up to 300 square feet.

I. Sensor shall employ a multi-segmented lens having a 180 degree coverage pattern.

J. Coverage pattern and sensitivity shall be verified in accordance with NEMA WD-7 Guide for Occupancy Sensors.

K. Sensor shall have a bypass and time delay adjustment located behind a removable cover. A tool is required to remove cover, activate sensor bypass or adjust time delay.

L. Sensor shall have time delay adjustment ranging from 15 seconds to 30 minutes.

M. Sensor shall include mounting hardware, decorator wall plate cover and screws to mount cover. Wall plate cover color shall match the sensor.

2.3 CEILING MOUNTED DUAL TECHNOLOGY OCCUPANCY SENSORS

A. Sensor shall employ a Power Pack to supply power to sensor.

B. Sensor shall employ power pack or auxiliary relay to switch class 1 lighting loads and control switching of lighting loads.

C. Sensor shall have sensitivity, mode and time delay adjustments located behind a snap-on cover which is accessible when sensor is fully installed and mounted, and does not require the sensor to be moved or removed to make adjustments.

D. Sensor shall have a sensitivity adjustment ranging from 60 to 100%.

E. Sensor shall have a set of normally opened and normally closed contacts, called an isolated form c relay, rated no less than 1A@24VDC, allowing the sensor to interface with building automation systems (BAS), HVAC, security, lighting control and other control systems.

F. Sensor shall detect occupancy using passive infrared (PIR) and ultrasonic technology and employ a lens with 360 degree coverage pattern covering up to 1000 sq. ft

G. Sensor shall have a mode selector switch and have 2 operating modes; automatic and manual. In the manual mode, sensor remains activated and will not turn off (for service and maintenance use only).

2.4 POWER PACK & AUXILIARY RELAY

A. Power pack and auxiliary relay shall be rated for 120VAC and 277VAC loads at line frequency of 60Hz.

B. Power pack shall have an input voltage selector switch to select 120VAC or 277VAC input.

C. Power pack and auxiliary relay shall have separate threaded ½ in. chase nipples for class 1 and class 2 wiring, allowing both power pack and auxiliary relay to be mounted in or out of a standard 4 in. x 4 in. junction box, and providing separation of class 1 and class 2 wiring. Power pack and auxiliary relay may be mounted between two junction boxes, allowing both class 1 and class 2 wiring to be enclosed in conduit as may be required by code.

D. Power pack and auxiliary relay shall incorporate one relay rated no less than 20A at either 120 or 277VAC 60Hz.

E. Power pack and Auxiliary relay shall have a 24VDC control input to allow class 2 sensors to turn on lighting connected to power pack or auxiliary relay.

EXECUTION

3.1 GENERAL

A. Provide the quantity of occupancy sensors required for complete and proper volumetric coverage to completely cover the controlled areas. Contractor shall verify room coverage and ceiling heights with manufacturer and provide the quantity of occupancy sensors as required. Rooms shall have one hundred (100) percent volumetric coverage of small motion detection to completely cover the controlled areas to accommodate all occupancy habits of single or multiple occupants at any location within the room(s). The locations and quantities of sensors shown on the drawings are diagrammatic and indicate only rooms that are to be provided with sensors. Proper judgment must be exercised in executing the work so as to ensure the best

possible installation in the available space and to overcome local difficulties due to space limitations or interference of structural or architectural components. Provide sensors to provide complete and proper volumetric coverage.

B. Power Packs shall be located in accessible ceiling spaces.

C. Exact locations of Power Pack boxes shall be based on observing good installation practice and shall be consistent throughout the project. Power Packs shall be located in accessible ceiling spaces above or near wall mounted override switches. Attention shall be paid to all aspects of installation to ensure that there is the minimum aesthetic impact of the hardware on the appearance of the affected rooms. All control unit hardware shall be completely contained within a suitable NEMA-type enclosure, with no exposed wire other than low voltage Class 2 wiring.

3.2 INSTALLATION

A. The Electrical Contractor, as part of the work of this section, shall coordinate, receive, mount, connect, and place into operation all equipment. The Electrical Contractor shall furnish all conduit, wire, connectors, hardware, and other incidental items necessary for properly functioning lighting control and occupancy sensors as described herein and shown on the plans. The Electrical Contractor shall maintain performance criteria stated by manufacturer without defects, damage, or failure

1. Compliance: Contractor shall comply with manufacturer’s product data, including shop drawings, technical bulletins, product catalog installation instructions, and product carton instructions for installation.

2. All occupancy sensors and Power Packs shall be of the same manufacturer throughout unless otherwise noted.

3. Install occupancy sensors in areas shown, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.

4. Install occupancy sensors and switches only in electrical boxes that are clean, free from excess building materials, debris, and similar matter.

5. Install occupancy sensors plumb and aligned in the plane of the ceiling where they are installed.

6. Refer to Architectural drawing, elevations, etc. for exact location of wall switches where indicated on the Architectural plans. Coordinate location of all wall switches with other specialty items and millwork and avoid conflicts. Coordinate with all trades to avoid conflicts during construction.

7. Circuit Power Packs ahead of local control switches - source – Power Pack – local toggle switch(s) – load.

8. Low voltage cabling installed from Power Pack to sensor(s) and from sensor to sensor shall be supported every 5 feet at a minimum height of 3 feet above grid/ceiling but no closer than six inches below deck. Support system shall be ceiling wire attached to structure and

clipped to ceiling support grid using Caddy drop wire securing clip #EC311. Cabling is hung plumb to devices.

3.3 TESTING AND ADJUSTMENT

A. At the time of installation the contractor shall test and adjust each sensor for proper detection of motion appropriate to room usage. The contractor shall follow the testing and adjustment procedures as written in the manufacturer's installation instructions for each sensor model.

B. Prior to testing and adjusting, verify with Owner/Architect the initial settings for each type of area based on its intended function and use.

C. Verify with Owner all adjustable functions of each type of occupancy sensor prior to installation.
Set all adjustable functions of each type of occupancy sensor as directed by Owner. Initial settings unless directed by Owner / Architect:

Ceiling Sensors:
1. Auto-On = On
2. Lighting Sweep = Off
3. Ultrasonic Self-Adjust = On
4. Infrared Self-Adjust = On
5. BAS Interface = On
6. Zero Time Delay = Off
7. Manual Override = Off
8. Range = Adjust relative to room size or as directed by Owner
9. Delay = 30 minutes
10. Frequency = 32 kHz

D. Before energizing, check for continuity of circuits, short circuits, and grounding connections. After energizing, check devices to demonstrate proper operation.

E. Operate each wall switch with circuit energized and verify proper operation.

F. Adjust sensor to de-energize lighting after 30 minutes of inactivity.

G. At the time of checkout and testing, the owner's representative shall be thoroughly instructed in the proper operation of the system.

3.4 PROTECTION

A. Contractor shall protect installed product and finished surfaces from damage during all phases of installation including preparation, testing, and cleanup

END OF SECTION

SECTION 26 09 43 – NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section. Contractor shall coordinate all of the work in this section with all of the trades covered in other sections for the specification to provide a complete and operable system.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. All labor, materials, appliances, tools, equipment, facilities, transportation and services necessary for and incidental to performing all operations in connecting with furnishing, delivery and installation of the work of this Section.

1.4 DESCRIPTION OF WORK

A. Furnish and install a complete system for the control of lighting and other equipment as indicated on the plans, detailed in the manufacturer submittal and as further defined herein. Contractor is solely responsible to verify quantity, installation locations and wiring requirements for this project. Specific manufacture’s catalog numbers, when listed in this section are for reference only. It is the responsibility of the contractor to verify with lighting control manufacturer all catalog information and specific product acceptability.

B. The system shall include but not be limited by the following list: Pre-wired, microprocessor controlled relay or dimming panels with latching relays controlled via switches, photocells, occupancy sensors, Time based control, building automation systems, thermostats, and other control devices.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualification: Product shall be manufactured by manufacturer listed below. Manufacturer of network lighting controls with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system. Any product other than one made by manufacturer listed below must be pre-approved a minimum of ten days before bid time.

1. Lighting Control & Design
2. Crestron
3. Lutron
4. Greengate

5. WattStopper

B. Source Requirements: Provide Network Lighting Controls through a single source from a single manufacturer.

C. Lighting Control Panels

1. Panels shall be UL 916 listed. LCP's controlling emergency circuits shall be ETL listed to UL 924. Panels shall be listed to comply with CSA C22.2#205. Emergency source circuits controlled in normal operation by a relay panel shall fully comply with NEC 700-9(b). Electrical contractor is responsible for verifying compliance

D. Electrical Components, Devices, and Accessories:

1. All Devices: UL Listed and labeled per NFPA 70

2. Control Wiring: shall be in accordance with the NEC requirements for class 2 remote control systems, Article 725 and manufacturer specifications.

1.6 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of modular dimming controls system the fail in materials or workmanship within the specified warranty period following substantial completion.

1. Warranty Period: 3 years.

B. Manufacturer's Extended Support Service: Extended telephone support: Unlimited period.

1.7 SYSTEM DESCRIPTION

A. The lighting control system is a networked system that communicates via communication wire. The system must be able to communicate with digital centralized relay panels, small distributed relay panels, fully distributed fixture level control by relays or dimmers, digital switches, photocells, occupancy sensors, building management control, and other system interfaces. The intent is to centralize all lighting control into one system. Lighting control systems shall have the capability to be remotely controlled via the internet or building wide Ethernet LAN.

B. System software shall provide real time status of each relay, each zone, and each group.

C. Lighting control system shall be able to be monitored by and take commands from a remote PC. At any time, should the remote PC go off-line all system programming uploaded to the lighting control system shall continue to operate as intended.

D. System shall be capable of warning of an impending off sweep by flashing lights Off/On once or twice by relay or by zone prior to the lights being turned off. The warning interval times between

flash and the final lights off signal shall be definable for each zone. Occupants shall be able to override any scheduled Off sweep using local controls.

E. System Components: System includes, but is not limited to, the following addressable components:

1. Keypad controls
2. Touch panel controls
3. Window treatment controls
4. Remote occupancy sensors
5. Room-combining partition sensor
6. Lighting load shedding
7. Timed room lighting
8. Daylight compensating lighting controls
9. Audio visual equipment controls
10. Interface to facility-wide room management
11. Interface to building automation system interface

PART 2 - PRODUCTS

2.1 SYSTEM CHARACTERISTICS

A. Web-accessible, network-connected programmable lighting control system that receives digital or analog signals from addressable input devices, assembles signals at central signal processor, and distributes operating signals to addressable control devices that effect a change in state.

1. Electronic power switching modules and relays process signals and effect circuit on-off switching, emergency switching, and 0–10V dimming where indicated. Emergency switching overrides preset state and puts each circuit to the programmed emergency condition. Buttons on the module provide manual disconnect and manual circuit testing.

2.2 NETWORK LIGHTING CONTROL PANELS

A. All relay panels shall be in a NEMA 1 rated enclosure with screw cover or hinged locking door. Other NEMA rated types optional.

B. A barrier shall separate the high voltage and low voltage compartments of the panel and separate 120V and 277V. A barrier shall also separate normal from emergency circuits.

C. Control electronics shall be capable of driving 8 to 42 relays, control any individual or group of relays, provide individual relay overrides, provide a master override for each panel, store all

programming in non-volatile memory, after power is restored return system to the correct state for time of day, provide programmable dual blink warn timers for each relay or zone of relays, and be able to control Normally Open Latching or Normally Closed Latching Relays.

D. All system components shall connect and be controlled via control wire, 4 twisted pair cable with connectors, providing real time two-way communication with each system component.

E. Feed-Through Network Lighting Control Panels:

1. Branch Circuit Protection: Pass through type utilizing separate branch circuit protection indicated on Drawings.

2. Switching Relay Types: Standard modular high inrush, lifetime rated minimum 1,000,000 on/off cycles, with air gap off protection.

3. Cabinet Capacity: As required for circuits indicated.

2.3 CENTRAL SIGNAL PROCESSOR

A. A control processor shall control and program the entire lighting control system and supply all time functions and accept modem (RS232) inputs

B. Shall be capable of a minimum of 32 schedules. Each schedule shall consist of one set of on/off times per day for each day of the week and for each of two holidays lists. Scheduling shall apply to any individual relay or group of relays.

C. Shall be capable of controlling a minimum of 127 addresses on a single bus and be capable of interfacing digitally with other buses using manufacturer supplied interface cards.

D. Control Processor: Network connected dual bus programmable control processor for low voltage controls, devices, and subsystems through multiple control interfaces. SNMP support, with built-in firewall, NAT, and router. 4-wire bus providing 24 VDC power to network devices, with two independent sensing inputs. In separate enclosure.

2.4 SYSTEM ACCESSORIES

A. All switches shall be digital and communicate via control wire. Contact closure style switches, shall not be acceptable.

B. Digital low voltage switch shall be a device that sits on the lighting control system bus. Digital switch shall connect to the system bus using the same cable and connection method required for relay panels.

C. Keypad shall be configurable in multiple button combinations.

D. Remote Keypad Controls: Remote keypad with auto-adjusting backlight illuminating replaceable, engraveable programmable buttons in number indicated, with white LED indicators, configured to fit in standard single-gang box.

1. Color: As selected from manufacturer's full range of colors.

2.5 CONDUCTORS AND CABLING

A. UTP Cable: 100-ohm, UTP. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:

1. Communications Control Cable, Plenum Rated: 22 AWG data pair, stranded bare copper and 18 AWG power pair, stranded bare copper, Type CMP, complying with NFPA 262.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation, examine work area to verify measurements, and that commencing installation complies with manufacturer's requirements.

3.2 INSTALLATION

A. Comply with requirements of Division 26 Sections "Common Work Results for Electrical."

B. Do not install network power controls until space is enclosed, HVAC systems are running, and overhead and wet work in space are complete.

C. Install network power switching controls in accordance with manufacturer's instructions.

D. Grounding: Provide electrical grounding in accordance with NFPA 70.

E. Provide typewritten panelboard schedule in pocket provided in panel doors.

F. Any damage done to electronic components due to failure to protect them shall be the sole responsibility of the installing contractor.

G. Do not mix low voltage and high voltage conductors in the same conduit. No exceptions.

3.3 SOFTWARE

A. Install and program software to meet the Owner's requirements. Provide current licenses, and backup copies of the software for the Owner's records.

3.4 SYSTEM STARTUP

A. Provide manufacturer's system startup and adjustment. EC shall contact control manufacturer at least 7 days before turnover of project. EC shall be available during factory commissioning.

B. Switch each load on and off with manual line test feature of the power switching module before installing processors.

C. Perform operational testing to verify compliance with Specifications. Adjust as required.

D. Provide a factory technician for on-site training of the owners' representatives and maintenance personnel. Coordinate timing with General Contractor.

3.5 ADJUSTING

A. Within 12 months of the date of Substantial Completion, provide onsite service to adjust the system to account for actual occupied conditions.

3.6 CLOSEOUT ACTIVITIES

A. Demonstration: Schedule demonstration with Owner. Factory authorized service representative to instruct owner's staff to adjust, operate and maintain network power switching systems; and provide instruction using the system software.

B. Training: Train Owner's personnel to operate, maintain, and program network power switching systems. Allow for a minimum of trips to the jobsite to provide additional training as needed.

C. Furnish set of approved submittals, and record drawings of actual installation for Owner's personnel in attendance at training session.

3.7 SUBMITTALS

A. Shop Drawings

1. Submit dimensioned drawings of lighting control system and accessories including, but not necessarily limited to, relay panels, switches, photocells, occupancy sensors, and other interfaces. Shop drawings shall indicate exact location of each device or a RFI to confirm location. Plans are diagrammatical. EC to verify all lighting control material requirements from approved shop drawings.

B. Product Data

1. Submit for approval manufacturer's data on the specific lighting control system and components.

C. One Line Diagram.

D. Submit a one-line diagram of the system configuration indicating the type, size and number of conductors between each. Submittals showing typical riser diagram are not acceptable.

END OF SECTION

SECTION 262413 – SWITCHBOARDS

PART 1 GENERAL

1.01 GENERAL PROVISIONS

The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work of this section.

1.02 REFERENCE

. Refer to Section 260000 for supplementary general conditions.

1.03 SCOPE

The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the installation of the main switchboard, including all related systems and accessories as shown by the drawings, and hereinafter specified. The electrical service shall be 120/208 volts, three phase, four wire, wye connected with grounded neutral as shown on the drawings. The service entrance shall comply with the requirements of the NEC and the local utility company.

PART 2 PRODUCTS

2.01 SWITCHBOARDS

The switchboards sections shall be of the dead front type, completely metal enclosed, self-supporting structure independent of wall supports of the required number of vertical sections bolted together to form one rigid switchboard 91.5" high incorporating switching and protective devices of the number, rating and type noted herein or shown of the drawings with the necessary inter- connections, instrumentation and control wiring. Switchboard construction shall be of the universal frame type using die-formed, bolted members. The sides, top and rear shall be covered with removable screw-on plates. Front plates shall be sectionalized and removable. All plates shall be fabricated from code gauge steel. Ventilation openings shall be provided where required. The switchboard shall meet all National Electrical Code requirements for service equipment.

1. The bus shall be tin-plated copper or tin-plated aluminum of sufficient size to qualify for UL label and adequately braced/supported to withstand mechanical forces exerted during short circuit conditions when directly connected to a power source having the indicated short circuit current. All connections shall be tightly bolted.

2. Small wiring, necessary fuse blocks and terminal blocks within the switchboard shall be furnished when required. All groups of control wires leaving the switchboard shall be provided with terminal blocks with suitable numbering strips. All hardware used on conductors shall have a high tensile strength and an anti-corrosive zinc plating.

3. A ground bus and lug shall be furnished firmly secured to each vertical section structure and shall extend the entire length of the switchboard.

4. The switchboard section shall be provided with adequate lifting means and shall be capable of being rolled or moved into installation position and bolted directly to the floor without the use of floor sills.

5. A-B-C type bus arrangement, left-to-right, top-to-bottom, and front-to-rear, as viewed from the front, shall be used throughout.

6. Adequate conduit space shall be provided to meet NEC requirements.

7. Each switching and protective device shall be provided with visible means of on-off identification. All terminals shall be of the anti-turn solderless type suitable for copper or aluminum cable of sizes indicated.

8. All exterior and interior steel surfaces of the switchboard shall be properly cleaned prior to the application of baked on gray ANSI-16 enamel. A rust-inhibiting phosphatized coating shall be applied as part of the cleaning operation.

9. The switchboard section shall be a minimum of 20 inches deep all sections of the switchboard shall align so that the back of the complete structure may be placed flush against a wall. Service sections shall be side as well as front accessible.

10. The internal components (switching and protective devices etc.) Shall be removable from the front and shall be panel mounted with the necessary device line and load connections front accessible.

11. The main or horizontal bus shall be braced for short- circuit stresses of 65,000 RMS amperes unless noted otherwise on the drawings. When interconnecting horizontal bus is installed between vertical sections, no portion of the horizontal bus shall extend within 8 inches of the bottom or within 8 inches of the front, inside any vertical panel section of the switchboard structure.

12. Vertical sections shall be completely factory assembled, wired and tested before delivery, and shall conform to UL listing requirements and National Electrical Code standards. Individual vertical sections shall be designed for bolting together at the installation site with the only electrical connection being the main bus splice plates.

13. Switchboards shall be manufactured by Square D, General Electric, Cutler-Hammer, Eaton, or Siemens.

14. Due to size limitations in the main electrical room it shall be the contractor's responsibility to provide equipment dimensionally equal to the equipment specified.

2.02 MAIN CIRCUIT BREAKER

The main circuit breaker shall be individually mounted in the switchboard and shall be rated at 65,000 AIC unless noted otherwise on the drawings. Refer to the drawings for ampere ratings of the switchboard.

2.03 BRANCH DEVICES

The branch devices shall be suitable for use in the switchboard as described for the sizes as shown on the drawings.

1. Branch circuit breakers are to be totally front accessible and front connectable. They shall be mounted in the switchboard to permit installation, maintenance and testing without reaching over any line side bussing. The branch circuit breakers / connectors to the distribution panel bussing shall be of a 'blow-on' design such that the connections grip the bus bars firmly under heavy fault current conditions. Removal of the branch circuit breakers shall be by the disconnection of the load side cable terminations only. Branch circuit breakers shall be rated for 65,000 AIC or as noted on the plans.

2.04 RATINGS

The distribution system shall be a fully rated system. Series rated systems are not acceptable for use on this project.

2.05 COORDINATION

The electrical distribution system is required to be a fully coordinated system. All modifications to equipment submitted by the contractor to provide a fully coordinated system shall be made by the contractor at no additional cost. All equipment submittal reviews are subject to approval of the system coordination study without exception.

PART 3 EXECUTION

3.01 INSTALLATION

The switchboard section shall be secured to the concrete floor or to a 4" high concrete pad, as indicated on the drawings with expansion anchors and bolts.

3.02 LABELING

Provide a black finish, white core bakelite nameplate for each switch in the switchboard section. Nameplates shall be installed in a suitable location and fastened with sheet metal screws. Nameplates shall comply with the details shown on the drawings and the labeling shall match the designations listed on the drawings.

END OF SECTION

SECTION 26 24 16 – PANELBOARDS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the panelboards including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 PANELBOARDS

A. Panelboards shall be of the dead-front type incorporating switching and protective devices of the number, rating and type specified herein or shown on the drawings. Panelboards shall have general purpose enclosures and shall be suitable for flush or surface mounting as indicated. All panelboards shall be rated for the intended voltage and shall be in accordance with the Underwriters' Laboratories, Inc. "Standard for Panelboards" and "Standard for Cabinets and Boxes" and shall be so labeled where procedures exist. Where panelboards are to be used as service entrance equipment, they shall be so labeled. Panelboards shall also comply with NEMA standard for panelboards, National Electrical Code and Federal Specification 115A (Power Distribution Panels) where applicable.

2.2 INTERIORS

A. All interiors shall be completely factory assembled with switching and protective devices, wire connectors, etc. All wire connectors, except screw terminals, shall be of the anti-turn solderless type and all shall be suitable for copper or aluminum wire of the sizes indicated on the drawings.

B. Interiors shall be so designed that switching and protective devices can be replaced without disturbing adjacent units and without removing the main bus connectors and shall be so designed that circuits may be changed without machining, drilling or tapping.

C. Bus bars for the mains shall be of tin plated copper or tin plated aluminum, sized in accordance with Underwriters' Laboratories standards. Unless otherwise noted, full size insulated neutral and ground bus bars shall be included. Bus bar taps for panels with single pole branches shall be arranged for sequence phasing of the branch circuit devices. Bussing shall be braced throughout to conform to industry standard practice governing short circuit stresses in panelboards. Bracing

shall be equivalent to, or compatible with, the rated interrupting capacity of the smallest overcurrent device in that panelboard. All panel boards shall be fully rated. Series rating of panels is not acceptable.

D. Phase bussing shall be full height without reduction. Cross connectors shall be tin plated copper or tin plated aluminum.

E. Insulated neutral bussing shall have a suitable lug for each outgoing feeder requiring a neutral connection or shall utilize set screws to bond the neutral wire to the neutral bus through holes drilled in the neutral bar. A neutral bus utilizing flat head screws to hold the neutral wires will be acceptable provided that ring type crimp on connectors are used on the conductors that are to be connected to the neutral bus. A ground bus, identical to the neutral bus, shall be provided and bolted to the interior.

F. All molded case main circuit breakers shall be vertically mounted. All vertically mounted molded case circuit breakers shall be mounted so the handle is up for "on" and down for "off", when viewed from the normal standing position.

G. Spaces for future installation of molded case circuit breakers on the job site may be permitted if so required, to utilize the manufacturer's standard panelboard design. The spaces shall be complete with all bus and bus connectors such that future breakers can be installed without adding or changing bus on the main bus. Bus connectors connected to the energized main bus shall be rigidly anchored at the other end with insulating bus supports or dummy breakers or spare breakers.

2.3 BOXES

A. Boxes shall be made from unpainted galvanized code gauge steel having multiple knockouts except where noted. Boxes shall be of sufficient size to provide a minimum gutter space of four (4) inches on all sides, and to have a minimum width of twenty (20) inches unless noted otherwise. Where feeder cables supplying the mains of a panel are carried through its box to supply other electrical equipment, the box shall be so sized as to include this wiring space. This wiring space shall be in addition to the minimum gutter space specified above and the limiting width may be increased accordingly.

B. At least four (4) interior mounting studs shall be provided.

C. Box identification number shall be on box.

2.4 TRIMS

A. Hinged doors covering all switching device handles shall be included in all panel trims, and shall not uncover any live parts in making switching device handles accessible. Doors shall have semi flush type cylinder lock and catch, except that doors over forty eight (48) inches in height shall have a vault handle and 3 point catch complete with lock, arranged to fasten door at top, bottom and center. Door hinges shall be concealed. All locks shall be keyed alike. A directory frame and typewritten directory card with all spares marked in pencil and having a transparent plastic cover shall be furnished on the inside face of each door.

B. The trims shall be fabricated from code gauge sheet steel.

C. All exterior and interior steel surfaces of the panelboard trim shall be properly cleaned and finished with grey ANSI 61 paint over a rust inhibiting phosphatized coating.

D. Trims shall have the same width and height as the box. Trims shall be mountable by a screwdriver without the need for special tools.

E. Shop drawings for the panels shall show that all of the aforementioned requirements have been incorporated into each panel. Panels shall be as manufactured by General Electric Company, Square D Company, Cutler-Hammer or Siemens. The branch circuit breaker arrangement in each respective panel shall be as indicated in the panel schedules on the drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Panelboards shall be securely attached to building construction, using wood screws for wood construction, bolts for metal construction, and expansion anchors with bolts or Tapcon anchors for masonry or concrete construction.

B. Install panels so that breaker number 1 is the top left breaker. Panel interiors shall not be installed where breaker number 1 is the bottom right breaker.

C. In panels that contain multi-layered neutral bus install neutrals beginning with the back neutral bus row and work forward. Do not make up neutrals on front neutral bus row unless all other rows are full.

D. Label breaker mounting space with manufacturer-provided number labels.

END OF SECTION

SECTION 26 27 26 – WIRING DEVICES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the wiring devices including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 WALL SWITCHES

A. Switches shall be totally enclosed, rated at 120/277 volts, WHITE plastic handles, of the quiet type, back and side wired full rated at 15 amperes as follows, unless otherwise noted:

Switch	P & S	Leviton	Hubbell
Single pole	CSB15AC1	CS115	CSB115
Double pole	CSB15AC2	CS215	CSB215
Three way	CSB15AC3	CS315	CSB315
Four-way	CSB15AC4	CS415	CSB415
Keyed-switches	PS15AC1XL	M1201-XL	HBL1201L
3-way keyed switches	PS15AC3XL	M1203-XL	HBL1203L

2.2 RECEPTACLES

A. Single and duplex receptacles shall be 15 ampere (provide with 20 ampere rating when installed on a dedicated circuit), 125 volts, back and side wired, with grounded pole, of WHITE plastic color as follows:

Receptacle	P & S	Leviton	Hubbell
Duplex	CR15	BR15	CRF15
Single	5251	5015	HBL5261
GFI	15971	GFNT1	GFRST1

Outdoor GFI/WR	1597TRWR	GFWR1	GFWRST15
Controlled	5262CH	TBR15-S1	BR15C1
Tamper Resistant	TR5252	TBR15	CR15

2.3 SPECIAL PURPOSE RECEPTACLES

A. Special-purpose receptacles shall be of similar grade specification as single or duplex receptacles and shall be as described in the legend of symbols and notes for electrical systems on the drawings.

2.4 DEVICE PLATES

A. Provide device plates for each and every outlet box requiring same, and of the type required for the service and device involved; furnish in gangs as necessary. Plates and screws shall be the product of the same manufacturer. Finish of the plates shall be WHITE unbreakable nylon unless otherwise noted.

2.5 CAPS

A. Where necessary, receptacles shall be furnished with a matching cap.

2.6 STORAGE

A. Prior to installation the wiring devices shall be stored on the job site in the original labeled cartons. The devices shall be installed in the outlets as soon as possible after the wire is installed. The devices shall then be temporarily covered using the device packaging material, until finishing and painting operations are completed. Devices and device plates that are stained or paint splashed shall be replaced. A cleaned device or device plate will not be accepted.

2.7 TIME SWITCHES

A. Furnish and install, where shown, time switches of the astronomical twenty-four hour, seven day type, capable of being set for different on-off times each day of the week, to an operating accuracy of plus or minus 15 minutes of the desired time and with day omitting device. All time switches shall be of the electronic type. Mechanical time switches are not acceptable.

B. Time switch contacts shall be capable of switching 40 amperes per pole continuously at rated voltage as indicated and shall have poles and switching arrangement as indicated on the drawings.

C. Separate manual on and off buttons shall enable operation manually without disturbing automatic settings.

D. Enclosure shall be NEMA 1 for indoor use and NEMA 3R for outdoor use. NEMA 1 enclosure shall have combination 1/2"-3/4" knock-outs on bottom and both sides. Provision shall be made for positive padlocking and/or sealing.

E. Terminals shall be capable of receiving up to #8 AWG wire.

F. Time switches shall be as manufactured by Tork, Intermatic, or other approved manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Wall switches shall be installed in the vertical position unless otherwise specified or indicated on the drawings.

3.2 3-WAY AND 4-WAY SWITCHES

A. Vertically operated switches shall be "on" in the upper position, except for 3-way and 4-way switches. If operated horizontally, they shall be "on" in the left position.

3.3 MULTIPLE SWITCHES

A. Where more than one switch is shown at one outlet, they shall be installed under one plate in an order appropriate to the location of the outlets controlled, unless otherwise indicated on drawings.

END OF SECTION

SECTION 26 28 13 – FUSES

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the fuses including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 FUSES

A. Fuses shall be as manufactured by Bussman, Gould-Shawmut or Littelfuse and shall be dual-element and current limiting as specified on the drawings.

2.2 SPARES

A. For each such fuse installed, this contractor shall furnish to the owner at the completion of the work a fuse cabinet with three (3) spare fuses of each type used.

PART 3 - EXECUTION

3.1 MOTOR CIRCUIT FUSES

A. Motor circuit fuses shall be dual element, time delay type rated between 125 and 150 percent of nameplate rating. UL Class K5 type FRN as required.

3.2 PANELBOARD FEEDER FUSES

A. Where required panelboard feeders at 120 volts ac to ground shall be fused as follows:

30 to 100 amperes	type FRN-UL Class K5
110 to 600 amperes	type LPN-UL Class K5

3.3 MAIN SWITCH FUSES

A. Main switches and circuits exceeding 600 amperes capacity shall be fused with type KRP-C Hi-cap current limiting fuses, UL class l. The exact type shall be as recommended by the manufacturer considering interrupting and coordination requirements.

END OF SECTION

SECTION 26 28 16 – ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the circuit breakers including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 BREAKERS

A. All branch circuit breakers shall be UL labeled and shall be thermal and magnetic, molded case type, quick-make and quick-break both on manual and on automatic operation and shall be bolted to the panel bus. Breakers shall be the over-the-center toggle operating type, with the handle going to a position between "on" and "off" to indicate automatic tripping. All multi-pole breakers shall be internal common trip.

2.2 RATINGS

A. The breakers to be furnished shall, in each instance, be determined by the specifications, the ampacity and poles as scheduled or as indicated, and by the minimum UL labeled RMS symmetrical amperes interrupting capacity at circuit voltage as indicated by the schedules, but in no case less than 10,000 RMS symmetrical amperes. NEMA ratings are not acceptable in lieu of UL ratings. Breakers shall be labeled as required by the NEC.

PART 3 - EXECUTION

3.1 MOUNTING

A. All molded case main circuit breakers shall be vertically mounted. All vertically mounted molded case circuit breakers shall be mounted so the handle is up for "on" and down for "off," when viewed from the normal standing position.

END OF SECTION

SECTION 26 28 19 – MOTOR AND CIRCUIT DISCONNECTS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the motor and circuit disconnects including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 MOTOR DISCONNECTS

A. All motor disconnect switches shall be rated, at a minimum, for the voltage of the equipment they are disconnecting, in NEMA-1 (indoor) or rain-tight NEMA-3R (outdoor) enclosures unless noted otherwise. Switches shall be fusible or non-fusible as indicated on the drawings in ratings as required for the equipment served. Disconnect switches shall be of the general duty type as manufactured by General Electric Company, Square D Company, Cutler-Hammer or Siemens..

2.2 SAFETY SWITCHES

A. Any and all fused or unfused safety switches which may be required shall be furnished and installed under this section of the work; no switches of any kind or type will be provided under other sections of the specifications. Switches shall be provided with quick-make, quick-break mechanisms and shall be general duty type and of the appropriate ampere rating. Those employed for motors and their feeders shall be horsepower rated switches. Switches for outdoor installation shall be provided with weather-tight cabinets. Those utilized for service entrance duty shall bear the UL label of approval for such service.

PART 3 - EXECUTION

3.1 MOUNTING

A. Where required, motor and circuit disconnects shall be securely attached to the building construction, using wood screws for wood construction, bolts for metal construction, and expansion anchors with bolts for masonry or concrete construction.

3.2 MOUNTING TO EQUIPMENT

A. Motor circuit disconnects furnished and installed by the electrical contractor shall not be mounted to mechanical equipment unless otherwise noted. The motor and circuit disconnects shall be supported by the building structure or by independent supports

END OF SECTION

SECTION 26 32 13 – ELECTRICAL GENERATING SYSTEM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the installation of the electric generating system, including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 SYSTEM

A. Provide an emergency electric generating system consisting of:

1. Diesel fuel electric plant, complete.
2. Automatic remote control system.
3. Plant exerciser
4. Accessories and services as specified.

2.2 HEATERS

A. Provide a diesel engine driven electric generating plant complete with jacket heater, battery heater and ready for satisfactory operation. The jacket water heater and battery heater shall automatically disconnect when the generator is running. Both heaters shall be thermostatically controlled to maintain temperature at $90^{o.}$

2.3 TESTS

A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three separate tests: design prototype tests, final production tests, and site tests.

1. Design prototype tests: components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and pre-production models,

which will not be sold, shall have been used for the tests. Prototype test programs shall include the requirements of NFPA 110 and the following:

a. Maximum power (KW)
b. Maximum motor starting (KVA) at 35% instantaneous voltage dip
c. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40
d. Governor speed regulation under steady-state and transient conditions
e. Voltage regulation and generator transient response
f. Fuel consumption at 1/4, 1/2, 3/4, and full load
g. Harmonic analysis, voltage waveform deviation, and telephone influence factor
h. Three-phase short circuit tests
i. Alternator cooling air flow
j. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses
k. Endurance testing

2. Final production tests: each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:

a. Single-step load pickup
b. Transient and steady--state governing
c. Safety shutdown device testing
d. Voltage regulation
e. Rated power
f. Maximum power
g. Upon request, arrangements to either witness this test will be made, or a certified test record will be sent prior to shipment

2.4 HISTORY OF MANUFACTURER

A. The plant shall be the product of a manufacturer that has been regularly engaged in the production of such equipment for at least ten years with a history of similar sized installations in satisfactory operation for ten years.

2.5 SERVICE

A. The plant manufacturer shall have service facilities with parts in stock and trained service personnel and shall furnish complete service within twenty-four hours after request.

2.6 CURRENT PRODUCTION

A. The entire generating plant shall be comprised of materials which are of standard manufacture and which shall be in current production.

2.7 INSTALLATION MECHANICS

A. Installation shall be by qualified mechanics regularly employed in installing and servicing electric generator units. Installation procedures shall be in accordance with the standard recommendations of the manufacturer.

2.8 ACCEPTABLE MANUFACTURERS

A. The plant shall be as manufactured by Kohler, Generac, Caterpillar or Cummins-Onan suitable for operation on diesel fuel.

2.9 UNIT PERFORMANCE

A. Within ten seconds after loss of the normal power source, the system shall be capable of transfer of emergency load to the generating set and supplying full current demands within plus or minus two percent frequency stability. This requirements shall apply from a "cold" start.

2.10 MAINTENANCE MANUALS

A. Provide one paper and one electronic copy of maintenance manuals to the owner which shall cover the entire system specified in this section, and shall contain the following:

1. Copy of approved shop drawings
2. Copy of manufacturer's factory test
3. Copy of test results after installation
4. Copy of operating and maintenance instructions
5. Copy of parts list

2.11 APPLICABLE DOCUMENTS

A. The installation shall conform to all applicable local codes and with the latest adopted addition of the following National Fire Protection Association Codes, standards, recommended practices and manuals:

1. NFPA 37 Stationary Combustible Engines and Gas Turbines.
2. NFPA-110 Emergency & Standby Power Systems.

2.12 MATERIALS

A. Engine

1. The engine shall be diesel fuel powered, four cycle. It shall have four (4) or six (6) cylinders, with an operating speed of 1800 rpm. Intake and exhaust valves shall be heat resisting alloy steel. Full pressure lubrication shall be supplied by a gear oil pump. Engine shall have replaceable oil filters, lube oil cooler, engine instruments shall be oil pressure gage, water temperature gauge, charge rate ammeter.
2. The rated net horsepower of the engine at the generator synchronous speed, with all accessories attached shall not be less than that required to produce the KW specified on the drawings at stand-by rating, unless otherwise noted.

B. Alternator

1. The alternator shall be salient-pole, brushless, 12-lead reconnectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewered stator for smooth voltage waveform. The insulation shall meet the NEMA standard (MG1-22.40 and 16.40) for Class H and be insulated with epoxy varnish to be fungus resistant per mil 1-24092. Temperature rise of the rotor and stator shall be limited to NEMA Class F ratings. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within +/-2% at any constant load from 0% to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range, stability and volts-per-hertz operations; and be protected from the environment by conformal coating.

2. Upon 1-step application of any load up to 100% of the rated load at 0.8 power factor, the voltage dip shall not exceed 20% and shall recover to +/-2% of rated voltage within 1 second.

3. The generator shall be capable of sustaining at least 300% of rated current for at least 10 seconds under a 3-phase symmetrical short by inherent design or by the addition of an optional current boost system.

4. The generator, having a single maintenance free bearing, shall be directly connected to the flywheel housing with a semi-fixable coupling between the rotor and the flywheel.

C. Provide flexible seamless exhaust tubing between engine and exhaust pipe. Exhaust piping shall extend to a point outside of the building or housing and up terminating in a rain cap. Avoid dumping exhaust products on architectural finishes.

D. Provide silencer complete with companion flanges, if required. Silencer shall be sized according to the silencer manufacturer's recommendations for the engine used. Silencer shall be mounted as close to the engine as possible and so that its weight is not supported by the engine. Silencer shall be critical grade silencing. The silencer shall be insulated with the same insulation as exhaust piping.

E. Provide weatherproof, sound dampening housing with 140 mile per hour wind rating and debris impact rating.

F. Instruments and Controls

1. The plant mounted control panel shall be vibration isolated on the alternator frame. Connection of conduit panel shall be made with flexible conduit. It shall contain the following instruments and controls and indication in accordance with NFPA 110:

    a. AC ammeter (dual range indicates current each phase).
    b. AC voltmeter
    c. Console mounted rheostat for voltage adjustment
    d. High/low meter scale indicator
    e. Frequency meter (pointer type)
    f. Voltmeter/ammeter phase selector with an off position

g. Three pole in-line main circuit breaker, size as drawings indicate. This circuit breaker shall be shunt trip or under-voltage trip and shall open simultaneously with any automatic shutdown of the engine.
h. Remote emergency stop - see drawing for exact location of stop station.
i. Overcrank shutdown
j. Low water temp <70°f
k. High engine temp. shutdown
l. Low lube oil pressure shutdown
m. Over speed shutdown
n. EPS supplying load
o. Control switch not in auto. Position
p. Battery charger malfunctioning
q. Low voltage in battery
r. Lamp test function

2. The remote annunciator shall be located as shown on the plans. This annunciator shall be flush mounted, powered by the generator starting batteries, have indicating lights and audible signals for each function specified above.

G. Crank-Start System

1. The set shall be equipped with an electric starting motor with solenoid and either bendix or overrunning clutch drive. The motor voltage and capacity shall be as recommended by the engine manufacturer. Provide lead-acid storage batteries, rack mounted on the set, complete with connecting cables. Batteries shall be sized to provide for three consecutive full starts without recharging.

2. Furnish and install a battery charger to automatically maintain the starting batteries at full charge. The charger shall be automatic two rate type with high and trickle rates. The charger shall be equipped with an ammeter showing the charging rate and circuit protection. The charger shall be designed so that it will not be damaged during the engine cranking. Contractor shall supply 120 volt ac power to the battery charger.

2.13 FUEL SYSTEM

A. Provide a base mounted diesel fuel tank sized as noted on the drawings. The tank shall incorporate spill containment features and shall be of double wall construction.

B. The tank shall be an integral part of the generator assembly and shall be detailed in the shop drawing submittal showing all features and low fuel level sensor setting.

2.14 COOLING SYSTEM

A. The engine shall be cooled by engine mounted radiator. The radiator shall be sized to maintain safe operating temperatures at 100of ambient. The engine shall be equipped with thermostat and jacket water pump.

2.15 AIR SUPPLY/EXHAUST SYSTEM

A. An air cleaner and silencer shall be furnished, located and mounted as recommended by the engine manufacturer. A drip-proof crank case breather tube may terminate in the air cleaner intake.

2.16 AUTOMATIC TRANSFER SWITCHES

A. The automatic transfer switch shall be heavy duty, 3 pole, contactor type. The unit shall be fully rated, to protect all types of loads, inductive and resistive, from loss of continuity of power. The unit shall automatically afford complete protection and shall be rated as shown on the drawings. The unit shall automatically transfer its load circuit to emergency power supply upon failure of its normal supply, the unit shall automatically retransfer its load to the normal supply. The switch shall utilize heavy duty contactors that shall be electrically operated and mechanically held in both the normal and emergency position. The switch shall be electrically and mechanically interlocked so that a neutral position is not possible, nor shall it be possible for load circuits to be connected to normal and emergency sources simultaneously. Voltage sensing relays shall be provided to monitor each phase of the normal supply. A drop in voltage in any phase below the pre-determined drop-out value of the relay shall initiate load transfer. The relays shall initiate retransfer of the load to the normal supply as soon as the voltage is restored in all phases beyond the predetermined pickup value of the relay. Voltage sensing relays shall be of the magnetic type with fixed drop-out and pickup values.

The unit shall obtain its operating current from the source to which the load is being transferred. All accessories and equipment shall be front accessible for ease of maintenance or removal. Accessories shall be provided according to the following specifications:

1. Time delay normal to emergency, adjustable 0.2 seconds, to 60 seconds, pneumatic, set at 3 seconds

2. Time delay on engine starting, adjustable 0.2 seconds to 60 seconds, pneumatic, set at 2 seconds.

3. Time delay on restoration to normal, adjustable 0.2 seconds to 30 minutes, pneumatic, set at 15 minutes.

4. Engine cool-off timer, adjustable 0 to 30 minutes pneumatic, set at 15 minutes.

5. Test switch, for test operation of the emergency power supply and transfer switch.

6. Engine start contacts.

7. Frequency relay for emergency source, prevents transfer from normal to emergency source until the generator has reached its operating frequency.

8. Pilot lights to indicate switch position.

9. Four-position selector switch. Provide for switch positions of "off", "test", "auto", and "engine start". In the "off" position, the control and generator pick-up relays are de-energized and the engine start circuit is opened. The switch will not operate nor will the engine start on power failure. The "test" position simulates power failure. Engine starting is initiated and the switch transfers when emergency voltage appears. The "auto" position will return the transfer switch to normal and shut down the engine. This position sets the transfer switch for automatic transfer on failure of normal voltage. The "engine start" position retains the transfer switch at normal while the engine starting circuit is completed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide spring vibration isolators between the concrete pad and generator mounting base. They shall be the type recommended by the plant manufacturer. Vibration isolator data shall be included in shop drawings.

B. Exhaust pipes shall not be installed closer than 9 inches to combustible materials. Pitch exhaust pipes downward, and install a condensate trap and drain valve at a point where the rise occurs. Avoid sharp bends.

3.2 TESTS

A. After completion of the installation the authorized dealer and/or manufacturer of the set shall inspect and test the unit and its performance. A two-hour on-site installation test shall be conducted in accordance with NFPA 110-5-13.2.3. This shall then be followed by a two-hour full load test in accordance with NFPA 110-5-13.2.5. The building load can serve as part or all of the load, supplemented by a load bank of sufficient size to provide a load equal to 100 percent of the nameplate KW rating of the EPSS. All test results shall be presented at the 100% inspection, test results shall be type written on a standard form indicting all required information.

3.3 SUBMITTAL DATA

A. Shop drawings

1. Shop drawings shall include complete data on the set including cross-referenced interconnection points with starter panel and transfer switch.

2. Submit short circuit decrement curve and control panel mounted circuit breaker time/current curve. This must be submitted with the generator shop drawings, the package will not be reviewed if this information is missing.

B. Maintenance manuals

1. Guarantee

a. In addition to the one year warranty specified elsewhere, the generator set shall be covered by a written guarantee made out to the owner by the manufacturer of the set. This guarantee shall cover defects in workmanship and materials of the generating set for a period of five years or 1,500 hours of operation, whichever occurs first. Time to start from date of acceptance.

END OF SECTION

SECTION 26 36 00 – TRANSFER SWITCHES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Automatic transfer switch including necessary accessories indicated on drawings and specified in this section.

1.2 SUBMITTALS

A. Submit detailed shop drawings for review.

B. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the transfer switches including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 AUTOMATIC TRANSFER SWITCH:

A. The current rating shall be as shown on the Drawings. Control voltage shall be 120 volts. The transfer switch shall be suitable for operation at a maximum line voltage of 600 volts and be in accordance with the requirements of Underwriters' Laboratories, Inc., Standard UL-1008.

B. Automatic Transfer Switch shall be manufactured by or equivalent of ASCO, Kohler, Onan, or Zenith.

2.2 THE COMPLETE AUTOMATIC TRANSFER SWITCH:

A. Shall be designed and tested by manufacturer. It shall include necessary relays, associated wiring and component parts, together with electrically and mechanically interlocked switch and shall provide the following functions:

1. Upon power line outage, automatically start generating set, and when set comes up to voltage, disconnect load circuits from main line and transfer them to standby set output.

2. Upon normal power line return transfer load back to line and stop set.

3. Rating of transfer switch shall be sufficient to handle capacity of loads being transferred and the ampere interrupting capacity to match normal side feeder available short circuit rating.

4. Automatic transfer switch shall be mechanically held, electrically operated type rated for continuous duty in an unventilated sheet metal enclosure. The switch shall be double throw having electrically operated normal-emergency positions inherently interlocked

mechanically and with main contacts mechanically attached to a common shaft. A manual operator shall be provided.

5. All main contacts shall be silver alloy wiping-action type. They shall be protected by arcing contacts. Main contacts shall transfer in 1/15th of a second or less. All switch and relay contacts, coils, springs, and control elements shall be removable from the front of the transfer switch without removal of the switch panels from the enclosure and without disconnection of drive linkages or power conductors. Sensing and control relays shall be continuous duty industrial control type with minimum contact rating of 10 amperes.

6. Undervoltage Protection: Solid state voltage sensitive devices shall be provided to monitor normal power source and signal emergency power to start and assume load, on a partial loss of power on any and all phases or where feedback voltages exist. These shall have calibrated dial adjustments and be temperature compensated for a maximum deviation of $\pm$ 2 volts, from -25 degrees F. to +175 degrees F.

7. Battery Charger: Load transfer control shall include a SCR design, fused, battery charger to automatically charge and maintain starting battery of emergency set. It shall have a maximum charge rate of 2 amp at 24 volts (nominal) and automatically taper to trickle charge. It shall have a manually set timer to provide an equalize charge for periods up to 12 hours.

8. Time Delay to Start Emergency Power: A time delay, adjustable from l.5 seconds, shall be provided to prevent emergency power from needless starting and stopping during periods of momentary voltage fluctuations from normal power source.

9. Time Delay to Pick-Up Load: A time delay, adjustable from 5 seconds to 50 seconds, shall be provided to prevent emergency power from accepting load until emergency power operates unloaded for a predetermined period of time.

10. Time Delay to Retransfer Load: After normal power has returned to service, a time delay adjustable from one minute to thirty minutes shall be provided to delay re transferring load to normal power for purpose of (l) overriding initial voltage fluctuations of returning normal power and (2) providing a predetermined minimum period of operating time for emergency power. If emergency set should fail during delay period, time delay shall be bypassed and load instantly retransferred to normal power.

11. Time Delay to Stop Emergency Power: After load has been retransferred to normal power, a time Delay, adjustable from one minute to 30 minutes, shall be provided to allow engine to cool by permitting emergency set to operate unloaded for a predetermined period of time before shut down.

12. Automatic Exerciser: Means shall be provided to automatically start and run emergency generating set for a set period of time for purpose of testing or exercising complete engine, alternator and load transfer control. After completion of set period of time for testing and exercising, emergency source shall be automatically shut down. Such periods for testing or exercising shall be adjustable in multiples of 15 minutes per period with period repeated on any combination of days over a cycle of 7 days before recycling. During period of testing or exercising, emergency power shall assume load.

13. Test Switch: Provide to simulate a normal source failure.

14. Provide for Remote Control Operation from the Fire Control Station (FCS) where required.

15. Disconnect Device: Provide means to electrically disconnect control section from transfer switch to permit safe access for maintenance or service of control, during periods of normal operation.

16. The Switch shall have fully rated neutral transfer contacts driven by the main contact shaft which momentarily interconnect the neutrals of the two sources during the transfer/retransfer operations. The neutrals shall remain interconnected until the source contacts close on the source to which the load is being transferred.

17. Normal and Emergency Lamps: Colored indicating lights shall be provided on the enclosure door and labeled to indicate transfer switch position: Green - normal source; Red - emergency.

18. Provide two auxiliary contacts, one to close and the other to open when normal source fails.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cabinet shall be installed rigidly and securely attached to building construction and shall not depend upon conduits for support.

B. Automatic transfer switch shall be installed and connected in accordance with the manufacturers recommendations.

C. Provide all necessary signal wiring to start / stop the stand-by generator unit

END OF SECTION

SECTION 26 41 13 – LIGHTNING PROTECTION SYSTEM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 05 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all materials and equipment and performing all labor necessary for the complete installation of the lightning protection system, including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. The system shall consist of air terminals mounted on the top of the building to adhesive base plates connected with copper cable. The cable shall extend to down conductors. The down conductors shall be installed in concealed conduit extended to ground rods. The building steel may also be utilized in the lightning protection system.

B. Lightning protection equipment shall be as manufactured by Harger, Independent Protection Company, Thompson Protection, or equal.

C. Air terminals: Shall be aluminum of the size as indicated on the plans or as required under the master “installation requirements”.

D. Conductors: Shall be aluminum, Class 1, and shall be sized appropriately.

E. Ground rods shall be 5/8" diameter x 10'-0" long, copperclad, minimum.

F. Miscellaneous items: Provide all miscellaneous items such as connectors, all purpose clamps, splices, fasteners, loops, pipe clamps, standing seam clamps, three-way clamps, cross run clamps, and adhesives as required to make the system complete in every respect.

G. The complete system shall comply with the latest edition of Underwriters’ Laboratories, Inc. Bulletin No. 96A, “Installation Requirements for Lightning Protection”, and with NFPA 780, “Standard for the Installation of Lightning Protection Systems.”

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.

B. Verify the electrical installation may be made in complete accordance with all pertinent codes and regulations and the original design.

3.2 DISCREPANCIES

A. In the event of discrepancy, immediately notify the architect/engineer.

B. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.3 PREPARATION

A. Coordinate the installation of electrical items with the work schedules of other trades to prevent unnecessary delays in the total work.

3.4 INSTALLATION

A. Common grounding: Provide a common ground between the lightning protection system, the electrical service and as noted on the plans. All grounding mediums shall be bonded together.

B. The contractor shall submit complete shop drawings showing the design of the system prepared by a licensed lightning protection contractor for review and approval by the engineer.

C. Resistance to ground: Resistance to ground shall not exceed 25 ohms at each ground rod. Each ground rod shall be tested by the contractor with the results recorded and turned over to the architect/engineer. At a minimum, there shall be two ground rods per down lead. See plans for locations. If, after the first two ground rods are installed and tested, and the required resistance has not been obtained, additional rods shall be installed. All tests shall be observed by the architect/engineer.

D. Cable to cable and cable to ground rod connections shall be made by heavy duty cadweld or exothermic weld connections.

E. Metallic bodies

1. Metal bodies located within six (6) feet of a lightning conductor shall be connected to the lightning conductor system. Metal bodies of inductance shall be inter-connected even though they are over six (6) feet from a lightning conductor if they are within six (6) feet of a metal body already connected.

2. Soil vent pipes within six (6) feet of the main conductor shall be connected thereto with a main-size conductor or its equivalent.

F. Radius of bends: No bend of a conductor shall form an angle of less than 90 degrees, nor shall have a radius of bend less than 8 inches.

G. Location of ground rods: Ground rods shall be installed at least three (3) feet away from building foundation walls.

H. After completion of the lightning protection system, the contractor shall have the system inspected per the requirements of UL 96A and NFPA 780. After all "Letter of Findings" have been corrected and completed, the contractor shall then apply for a UL Lightning Protection Inspection Certificate. A copy of the application for the final certificate or the certificate shall be presented to the architect / engineer prior to the final AHCA inspection.

END OF SECTION

SECTION 26 43 13 – SURGE PROTECTION FOR LOW-VOLTAGE ELECTRICAL POWER

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

B. This section describes the materials and installation requirements for surge protection devices (SPD)for the protection of all AC electrical circuits from the effects of lightning induced currents, substation-switching transients and internally generated transients resulting from inductive and/or capacitive load switching.

C. The specified system shall be designed, manufactured, tested, and installed in compliance with the latest edition of the following standards and publications:

1. American National Standards Institute and Institute of Electrical and Electronic Engineers(ANSI/IEEE C62.1, C62.41, and C62.45 including the 8x20 and the 10x1000 testing

2. Underwriter’s Laboratories (UL 1449 and UL 1283)

3. Federal Information Processing Standards Publication 94 (FIPS PUB 94)

4. National Electrical Manufacturer Association (NEMA)

5. National Fire Protection Association (NFPA 20, 70, 75, and 78)

6. NEC 285.6

D. The system shall be UL listed as a complete system under UL 1449 (latest edition) standard for surge protection devices (SPD) and the rating shall be permanently affixed to the SPD.

1.2 RELATED WORK SPECIFIED ELSEWHERE:

A. General electrical requirements
B. Raceway, boxes and fittings
C. Wire and cable
D. Low voltage motor control
E. Variable frequency drives
F. Grounding
G. Lightning protection system
H. Interrupting rating coordination

1.3 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.4 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the surge protection devices including all related systems and accessories as shown by the drawings and hereinafter specified.

1.5 SUBMITTALS

A. Submit shop drawings, product data and manufacturer's installation instructions.

B. The surge suppression submittals shall also include:

1. Dimensional drawing of each suppressor type indicating mounting arrangements.

2. Category C3 (20kv, 10ka) test results.

3. Documentation of specified system’s UL 1449 clamping voltage ratings.

4. 10 x 1000 testing documentation

5. If requested a sample of each type of surge suppressor type shall be submitted to be used for testing and evaluation.

PART 2 - PRODUCTS

2.1 SERVICE ENTRANCE

A. Suppressor shall be listed in accordance with UL 1449, standard for safety, surge protection device and UL 1283, electromagnetic interference filters.

B. Suppressor shall be tested with the Category C3 high exposure waveform (20kv, 10ka 8/20u sec. Waveform) per ANSI/IEEE C62.41 - 1991.

C. For 3 phase, 4-wire plus ground configurations, suppressor shall provide suppression elements between each phase conductor and the system neutral and each phase conductor and the system ground as well as neutral to ground for a total of seven suppression modes.

D. Suppressor manufacturer shall provide certified test data confirming a "fail-short" failure mode.

E. Visible indication of proper suppressor connection and operation shall be provided. The indicator lights shall indicate which phase as well as which module is fully operable. There shall be an indicator that confirms a ground connection is intact to the SPD device.

F. The mounting position of the suppressor shall permit a short lead length between the suppressor and the point of connection. The lead length shall be kept as short as possible.

G. Suppressor shall meet or exceed the following criteria:

1. Maximum single impulse current rating: 200,000 amperes per phase (8/20usec. waveform).

Note: if the suppressor utilizes internal fuses, the maximum single impulse current cannot exceed the rating of the fuse, unless pre-approved by the specifying engineer.

2. Pulse life rating: category c (8/20usec. waveform): 1,000 occurrences with no clamping drift.

3. Maximum clamping voltage will be listed for a 3ka, 8/20usec. waveform. The clamping voltage must not exceed the following:

Voltage	L-N	N-G	L-G
120/208	400	400	400
480	800	800	800
240	400	400	400

4. The Category C3 clamping voltage ANSI/IEEE C.62.41-1991 (20kv-1.2/25ous.10ka-8/20us.) shall not exceed the following:

Voltage	L-N	N-G	L-G
120/208	675	675	675
480	1250	1250	1250
240	675	675	675

H. Suppressor shall have turn-on and turn-off times of less than one nanosecond.

I. Suppressor shall be of solid-state components and shall operate bi-directional.

J. The SPD shall be constructed using surge current modules (MOV based). The status of each module shall be monitored on the front of the SPD enclosure as well redundantly inside the enclosure (for the purpose of identifying a possible defective indicator light)

K. Terminals shall be provided for all of the necessary power and ground connections. Each terminal shall accommodate wire sizes of #14 to #1 AWG.

L. The SPD shall be equipped with an audible alarm that will actuate when any one of the surge current modules has failed. An alarm on/off switch shall be provided to silence the alarm and an alarm push-to-test switch shall be provided to test the alarm. Both switches and audible alarm shall be located on the front cover of the SPD enclosure.

M. Suppressor shall incorporate copper bus bars for the surge current path. Small round wiring or plug-in connections are not acceptable. Surge current diversion modules shall use two bolt-on connections to the copper bus bars for reliable low impedance connections.

N. Internal mounting of the SPD in switchgear is not acceptable.

O. The suppressor will have a warranty guarantee for a period of ten years.

P. Suppressor shall be by PQ Protection, Advanced Protection Technologies, or Surge Suppression Incorporated.

2.2 TERMINAL STRIP HARD-WIRED (120 VAC) SUPPRESSOR

A. Suppressor shall be listed in accordance with UL 1449, Standard for Safety, Surge Protection Devices.

B. Visible indication of proper suppressor connection and operation shall be provided.

C. The suppressor shall be internally fused, in such a manner that the power is not interrupted.

D. Suppressor shall consist of a three stage hybrid design: first stage mov, second stage air-core indicator, third stage silicon avalanche diode or mov.

E. Suppressor shall provide three suppression modes: line to neutral, line to ground, and neutral to ground.

F. Suppressor shall provide a maximum single impulse current rating of 25,000 amperes (8/20usec. waveform) per mode.

G. Suppressor shall provide a pulse life rating of 3,000 amperes (8/20usec. waveform) every thirty (30) seconds for 200 occurrences.

H. Suppressor's maximum clamping voltage when subjected to ANSI/IEEE C62.41-1980, Cat. B (6kv-1.1/50usec., 3ka-8/20usec.) shall not exceed 350 volts peak.

I. Suppressor shall be by PQ Protection, Advanced Protection Technologies, Surge Suppression Incorporated.

J. The suppressor will have a warranty guarantee for a period of five years.

PART 3 - EXECUTION

3.1 SERVICE ENTRANCE- HIGH PEAK CURRENT AND REDUNDANT PROTECTION

A. Install one primary suppressor at each utility service entrance to the facility, according to manufacturer's recommendations.

B. Suppressor shall be installed on the load side of the service entrance as close as practical. Connect to a dedicated 60Amp, 3 pole breaker for servicing means.

C. Conductors between suppressor and point of attachment shall be kept as short and straight as possible.

D. Suppressor's ground shall be bonded to the service entrance ground.

3.2 ELECTRONIC EQUIPMENT AC POWER SUPPLY:

A. Install each hard-wired branch circuit surge suppressor between each equipment item and its power supply conductors as follows:

1. Fire alarm master panel
2. Intercom master
3. Building management system master

4. Security system master
5. TV head

B. Install suppressor according to manufacturer's recommendations.

C. Suppressor shall be by PQ Protection, Advanced Protection Technologies, or Surge Suppression Incorporated.

3.3 ELECTRONIC EQUIPMENT

A. Install one on each circuit conductor where entering and/or leaving a building for the following systems:

1. Fire alarm system
2. Intercom system
3. Building management system
4. Security system
5. CATV

B. Suppressor shall be by PQ Protection, Advanced Protection Technologies, or Surge Suppression Incorporated.

END OF SECTION

SECTION 26 51 00 – LIGHTING FIXTURES AND LAMPS

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to Section 26 00 00 for supplementary general conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the lighting fixtures and lamping, including all related systems and accessories as shown by the drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 FIXTURE SCHEDULE

A. Lighting fixtures shall be as specified in the lighting fixture schedule on the drawings and as specified herein.

2.2 SUBSTITUTION

A. The lighting fixture manufacturers and catalog numbers specified in the fixture schedule on the drawings may not be substituted without authorization from the engineer.

2.3 CEILING TYPES

A. The contractor shall be responsible for confirming all ceiling types before ordering lighting fixtures shipped to the job.

2.4 TESTING

A. Each lighting fixture shall have been tested and certified for proper operation by the fixture manufacturer for the type ceiling and mounting on or in which it is installed.

B. All fixtures shall bear the UL or ETL label

2.5 LAMP MANUFACTURERS

A. Lamps shall be as manufactured by General Electric Company, Phillips or Sylvania.

PART 3 - EXECUTION

3.1 FIXTURE INSTALLATION

A. Lighting fixtures shall be installed as specified in the lighting fixture schedule on the drawings and as specified herein.

B. Lighting fixtures shall be supported from the building structure and independently of the grid ceiling. The contractor shall coordinate this requirement with the ceiling trades.

C. Fixtures shall be supported in a manner that will insure the fixture weight being equally distributed from each support and the fixture remaining in a level position.

D. Each ceiling anchor or support for fixtures shall be tested with a weight of not less than 50 pounds or three times the weight of the installed fixtures, whichever is greater. Testing shall be done in the presence of the architect's representative on the job.

3.2 SPLICES

A. No wiring splice or tap shall be located within an arm, stem, etc., used for support of lighting fixture. Wire shall be continuous from splice in outlet box of the building wiring system to lamp socket, or to driver terminals in luminaires.

3.3 LAMP INSTALLATION

A. Lamps installed in lighting fixtures shall be as specified in the fixture schedule on the drawings and as specified herein. All lamps shall be operating at the time of final inspection.

3.4 RATED CEILINGS

A. All recessed fixtures scheduled to be installed in a rated ceiling assembly shall be protected by a UL listed “tenting” assembly that will maintain the integrity of the rated ceiling assembly and allow for proper operation of the light fixture without unnecessary interruptions caused by thermal disconnecting means.

END OF SECTION

SECTION 26 52 00 – EMERGENCY LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Luminaires and Accessories

B. Exit Signs

C. Emergency Lighting Fixtures with battery back-up power

1.2 RELATED SECTIONS

A. Section 26 05 33.16 Boxes

B. Section 26 51 10 Luminaires

1.3 REFERENCES

A. ANSI C78.379— American National Standard for Electric Lamps—Classification of the Beam Patterns of Reflector Lamps.

B. ANSI/NFPA 70—National Electrical Code

C. ANSI/NFPA 101—Life Safety Code

D. NEMA WD 6—Wiring Devices-Dimensional Requirements

1.4 SUBMITTALS

A. Submit under provisions of Division 01.

B. Shop Drawings: Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide dimensions, ratings, and performance data.

D. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.

E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.5 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Division 01.

B. Accurately record actual locations of each luminaire.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Division 01.

B. Maintenance Data: Include replacement parts list.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three (3) years' experience.

1.8 EXTRA MATERIALS

A. Furnish under provisions of Division 01.

B. Provide one (1) replacement lamp for each type lamp installed.

C. Provide two (2) of each battery type provided.

PART 2 - PRODUCTS

2.1 LUMINAIRES

A. Furnish products as specified on drawings.

B. Substitutions: Under provisions of Division 01.

C. Install ballasts, lamps, and specified accessories at factory.

2.2 EXIT LIGHTS

A. Exit lighting fixtures shall be “LED” type with “self-diagnostic testing” capability.

B. Emergency lighting fixtures shall be “LED” type with “self-diagnostic testing” capability.

C. Area of Rescue/Refuge fixtures shall be “LED” type with “self-diagnostic testing” capability.

2.3 LAMPS

A. LED

B. Reflector Lamp Beam Patterns: ANSI C78.379

2.4 ACCEPTABLE MANUFACTURER

A. Dual-lite

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrate and supporting grids for luminaires.

B. Examine each luminaire to determine suitability for lamps specified.

3.2 INSTALLATION

A. Emergency lighting fixtures with battery back-up power shall be provided independent of the general lighting fixtures and not “Inverter” type ballast. Fixtures shall be wall or ceiling-mounted a maximum of 12' above finished floor. Emergency lighting fixtures shall have self-diagnostic capability.

B. Install in accordance with manufacturer’s instructions.

C. Install exit signs using pendants supported from swivel hangers. Provide pendant length required to suspend luminaire at indicated height.

D. Install surface mounted battery type emergency lights and exit signs plumb and adjust to align with building lines and with each other. Secure to prohibit movement.

E. Install exit signs and emergency lights using fire stopping materials to meet regulatory requirements for fire rating.

F. Install wall mounted emergency lights and exit signs at height as indicated on Drawings.

G. Install accessories furnished with each emergency light and exit sign.

H. Connect emergency lighting units and exit signs to local unswitched lighting branch circuits provided under Section 26 05 33.16, Boxes, using flexible conduit as indicated.

I. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaire.

J. Bond products and metal accessories to branch circuit equipment grounding conductor.

K. Ceiling mounted exit signs shall be connected to an outlet box located within 6'-0" of the fixture with flexible ½" conduit.

3.3 FIELD QUALITY CONTROL

A. Operate each luminaire after installation and connection. Inspect for proper connection and operation.

3.4 ADJUSTING

A. Adjust work under provisions of Division 01.

B. Aim and adjust luminaires as directed.

C. Adjust exit sign directional arrows as indicated.

D. Replace luminaires that have failed lamps at Substantial Completion.

3.5 CLEANING

A. Clean work under provisions of Division 01

B. Clean electrical parts to remove conductive and deleterious materials.

C. Remove dirt and debris from enclosure.

D. Clean photometric control surfaces as recommended by manufacturer.

E. Clean finishes and touch up damage.

3.6 DEMONSTRATION

A. Provide systems demonstration under provisions of Division 01.

B. Provide minimum of two hours demonstration of luminaire operation.

C. Light bulb replacement guarantee shall be limited to 60 days after the date of Substantial Completion. The Electrical Contractor shall, at the end of this period, inspect the work and replace all burned out or defective light bulbs.

END OF SECTION

SECTION 27-10-00 – STRUCTURED CABLING

PART 1 - GENERAL

1.01 Section Includes

A. Fiber Optic Cabling (Multi-Mode OM3)
B. Horizontal Copper Cabling (CAT 6)
C. Racks, Frames, Cabinets
D. Voice Grade Copper Cabling
E. IP Paging Cabling (Pre-Cabling for devices, installation by Division 27)
F. Surveillance Cabling (Pre-Cabling for devices in new construction, installation by others)
G. Audio Microphone and Speaker Cabling (Pre-Cabling for device installation by Division 27)
H. Cabling Connectors
I. Data Jack System
J. Equipment Mounting and Interconnecting Devices
K. System Testing

1.02 Related Sections

A.	Section 26 05 10	Basic Electrical Requirements
B.	Section 26 05 29	Supporting Devices
C.	Section 26 05 33.13	Conduit and Raceways
D.	Section 26 05 45	Pre-Fabricated Ground Pull Boxes

1.03 Scope of Work

A. Contractor shall be responsible for providing a complete, functional data communications system, whether ancillary devices/components are included in this specification or not. The Contractor shall provide equipment for 20% growth on patch panels and punch down locations.

B. The cabling plant shall consist of a Main Distribution Frame (MDF) and multiple Intermediate Distribution Frames (IDFs), as shown on the drawings. All conduit and cable interconnecting the MDF to the IDFs shall be a part of this scope. Intent is to install a 10 GIG fiber optic compliant system (IEEE Std 802.3ae). All network cabling shall be Category 6 rated with a 25-year manufacturer's performance warranty. This Installing Contractor shall be required to be Belden (or pre-approved equal) certified.

C. Owner intends to install a VOIP system to run on the 50/125 µm, laser optimized fiber optic site cable and Category 6 horizontal cable. This system is implied when referencing data.

D. The installation shall include cable (fiber optic and twisted-pair copper), connectors (fiber optic and twisted-pair copper), jumpers (fiber optic and twisted-pair copper), patch panels (fiber optic and twisted-pair copper), wire management, telecommunications outlets, and racks or cabinets, and Owner designated LAN equipment, as required.

E. In addition to material and equipment, Contractor shall provide labor and any incidental material required for installation. All fiber strands shall be terminated with connectors and landed on the fiber interconnect equipment. All copper station cables shall be terminated on patch panels (IDF end) and data communications outlets (work station end). Upon completion of installation, Contractor shall test all fiber and copper cable and record the test results, as specified herein.

F. The work performed under this specification shall be of good quality and performed in a professional manner. In this context, "good quality" means the work shall meet industry technical standards and quality of appearance. The Owner/Engineer reserves the right to reject all or a portion of the work performed, either on technical or aesthetic grounds.

G. Install/terminate fiber and multi-pair UTP cable from the MDF to every IDF in the building. These runs shall all be in a star configuration. These backbone cables shall all be dedicated direct links between the MDF and the IDF. Provide rack mount fiber and copper panels in all closets and mount all equipment on a rack, wall, or cabinet, as required by this specification or the drawings.

H. Conduit, ground pull boxes, and cabling (to include pre-cabling for intrusion and access system) to be provided by this Contractor. Coordinate all requirements with other trades prior to submitting shop drawings.

I. This Contractor shall coordinate with utility providers. This shall include setting meeting dates with the providers and resolving the scope and timing of work to be done by each party. Telephone utility demarcation points shall be established and clear prior to submittal of shop drawings.

J. This Contractor shall provide to the Contractor (at least three months ahead of Substantial Completion) AutoCAD drawings with jack numbers reflecting the FISH room numbers as outlined in this specification. Before the Contractor can install any equipment, this Contractor shall have all cabling terminated and PASS tested for use by the Contractor at least two months ahead of Substantial Completion.

K. Testing of the various systems shall be provided by this Contractor, as stipulated herein.

1.04 General

A. It is the responsibility of the Contractor to verify ALL aspects of the installation. The guidelines used shall include the TIA/EIA 568C.0, C.1, C.2, C.3, TIA/EIA 569-C, TIA/EIA 606-B. As well as, IEEE 802.3ab specification for Gigabit Ethernet over UTP (1000 Base-T), IEEE 802.3ae specification for 10 Gbit/s Ethernet over fiber, and IEEE 802.3z specification for 1000BASE-X Gbit/s Ethernet over Fiber-Optic at 1 Gbit/s.

B. It is the intent that all TIA/EIA and IEEE standards adopted at the time of bid opening shall be met.

C. Contractor shall provide Category 6 cabling system.

D. The structured cabling infrastructure is to include all equipment, materials, and labor required to provide, install, and test a complete system, as described herein.

1.05 Applicable Standards (latest version)

A.	TIA/EIA-568-C.0	Generic Telecommunications Cabling for Customer Premises.
B.	TIA/EIA-568-C.1	Commercial Building Telecommunications Cabling Systems Standard.
C.	TIA/EIA-568-C.2	Balanced Twisted Pair Telecommunications Cabling Systems Standard.
D.	TIA/EIA-568-C.3	Optical Fiber Telecommunications Cabling Systems Standard.
E.	TIA/EIA-569-C	Telecommunications Pathways and Spaces.
F.	TIA/EIA-598-C	Optical Fiber Cable Color Coding.
G.	IEEE 802.3ab	Specification for Gigabit Ethernet over UTP cable.
H.	IEEE 802.3ae	Specification for 10 Gbit/s Ethernet over fiber optic cable.

I. IEEE 802.3z	Specification for Gigabit Ethernet over fiber optic cable.
J. ANSI/TIA-1152	Requirements for Field Test Instruments.
K. ANSI/TIA-606-B	Administration Standard for Commercial Telecommunications Infrastructure.
L. ANSI J-STD-607-A	Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
M. TIA-758-B	Customer-Owned Outside Plant Telecommunications Infrastructure Standard.
N. ASTM D 4566-08e1	Standard Test Methods for Electrical Performance Properties of Insulations and Jackets for Telecommunications Wire and Cable.
O. IEC 60603 Part 7	Connectors for frequencies below 3 MHz for use with printed boards – Part 7: Detail specification for connectors, 8-way, including fixed and free connectors with common mating features, with assessed quality.
P. NEC	National Electrical Code.
Q. BICSI	Building Industry Consulting Service International

1.06 Contractor Qualifications

A. The installing communications contractor shall be able to submit proof that they meet the following qualifications upon request from the Engineer.

1) PERFORMANCE HISTORY: Contractor must have successfully performed at least three projects of similar scope and size, within two years of the date of this bid, in the local area. Proof of performance shall be in the form of reference sheets which shall include a brief description of the project, the beginning and ending contract price, the project foreman or superintendent's name, and the name, address, and telephone number of a project contact. The Superintendent proposed for the project shall have been responsible for at least two of these projects under the employment of this Contractor.

2) FIBER OPTICS EXPERIENCE: Contractor must be able to prove to the satisfaction of the Owner/Engineer that it has significant experience in the installation of fiber optics cable systems and communication systems. Installation must include installation of fiber optics cable, fiber termination, a knowledge of interconnect equipment, and a thorough knowledge of testing procedures.

3) TIME IN BUSINESS: Contractor must have been in business, under the current name, and in the business of installing telecommunications systems, continuously, for a period of at least three years, prior to the date of this bid. Essential installation personnel shall include at least one foreman and two journey level installers or technicians. By submitting the names of these personnel, Contractor is committing them to the execution of the project outlined in this specification.

4) REQUIRED LICENSE: The Contractor shall possess, at a minimum, a State of Florida Low Voltage License.

5) RCDD ON STAFF: The Contractor shall have a (BICSI) Registered Communication Distribution Designer on staff.

6) OFFICE LOCATION: The Contractor shall maintain a permanent office within 75 miles of the project site.

1.07 Definitions

A. COMMUNICATIONS EQUIPMENT ROOM (CER) OR MAIN CROSS-CONNECT (MC or MDF or MXC): The MDF is the location, within a building or complex of buildings, where the entire telecommunications system originates. It includes the physical location, enclosure, wire and cable management hardware, termination hardware, distribution hardware, and equipment racks. EIA/TIA-569 refers to the room housing the MDF as the "Equipment Room." The MDF should be located either in proximity to or co-located with the telephone utility demarcation point. A clear working space of 30 inches in front of and behind the equipment racks is required.

B. COMMUNICATIONS CLOSET (CC) OR INTERMEDIATE CROSS CONNECT (IC or IDF or IXC): The IDF is the location in a building where a transition between the backbone or vertical riser system and the horizontal distribution system occurs. It includes the physical location, enclosure, wire and cable management hardware, termination hardware, distribution hardware, and equipment racks. Each IDF in the building shall be such that the station cable route distance to the furthest workstation is within 90 meters. If an IDF is co-located with a power distribution room, observe minimum clearances from power distribution equipment (10 feet) and enclose the cable in metal conduit, and mount the patch panels in a cabinet. A clear working space of 30 inches in front and behind the equipment racks is required.

C. Walls supporting "wall mount" equipment shall be covered with factory-finished, 3/4" fire-treated plywood from 4" above the finished floor to the ceiling shall be provided as manufactured by Pathway Spaces, Inc. Backboard Kits or pre-approved equal. Refer to drawings for colors and locations. The MC and CC floors must be sealed from the concrete by means of epoxy paint or linoleum as per spec.

E. Provide means to provide and install.

F. For purposes of this specification: All cabling shall be Category 6. Category 5, 5E, or 5E+ shall not be accepted.

1.08 Owner Provided LAN Electronics

A) Electronics shall be provided and installed by the Owner. It is necessary for this ~~Integrator~~ Contractor to become familiar with the location, space requirements, and specific mounting requirements of the electronics. All requirements and information shall be known before building out the MDF or IDFs.

1.09 Pre-Bid Substitutions

A. Under provisions of Division 01 and Section 26 05 10.

B. Submit any requests for substitutions or deviations prior to bid opening. Only those requests that are complete and approved by the Engineer in written addendum form shall be accepted.

1.10 Shop Drawing Submittals

A. The Contractor shall submit per Division 01. The submission shall consist of five major sections with each section separated with insertable index tabs.

1) The first section shall be the "Index" which shall include the project title and address, and name of the firm. The contents of each section shall be listed on the index.

2) The second section shall include a copy of the Contractor's valid State license, and a list of instrumentation to be used for system testing. Include copy of RCDD certificate.

3) The third section shall contain the product specifications. Product submittal shall include a cover page listing manufacturer, part number and description of each product to be provided. Also include in this section original specification data sheets for each product or computer printouts from .PDF files for each product. Photocopies of catalog pages shall not be accepted.

4) The fourth section shall contain samples of proposed cable markers and labeling.

5) The fifth section shall contain a scaled, complete, detailed MDF and IDF layout with rack elevations, scaled floor plans with equipment locations shown, and a layout of any wall mounted backloads. Within this section, the color of the backboards shall be identified. One, 4'x8' board shall be ordered red for fire related devices; two, 4'x8' boards shall be ordered green for security related devices and the rest shall be colored gray for telephone and data. The color scheme shall be approved prior to ordering. These shall follow the District Standard for equipment placement within the rack.

6) Attach: Include disk copy and three hard copies of an AutoCAD drawing showing the jack numbering at each jack location and the patch panel jack numbering per room with FISH room numbers.

B. The Contractor shall provide the shop drawing submittals within 60 days of receipt of contract. No work shall begin, nor equipment be ordered without an Engineer-accepted shop drawing submittal.

1.11 Function and Operation

A. The intended function of the data communications cable system is to transmit data signals from a central location to individual data outlet locations. Upon completion of the work outlined in this specification, the system shall be capable of supporting Gigabit Ethernet data signals per IEEE 802.3ab, IEEE 802.3z, IEEE 802.3ae, and 1.2 Gb/s ATM. Fiber optic cable shall be laser or Vertical Cavity Surface Emitting Laser (VCSEL) optimized.

B. The maximum multi-mode backbone distance shall be based on LAN equipment transmission wavelengths of:

1) @ 850nm - 550 meters for VCSEL optimized multi-mode OM3 (50/125µm) fiber or OM4.
2) @ 1310nm – 600 meters for VCSEL optimized multi-mode OM3 (50/125µm) fiber or OM4.

C. Performance verification and documentation shall be as specified herein. Distances beyond the above will be run with Single mode.

PART 2 – PRODUCTS

2.01 Fiber Optic Cabling

A. It is the intent that the inter-building fiber optic cabling, installed on this project, accommodates the data, fire alarm, and surveillance systems. Fibers dedicated to these systems shall be labeled as to their use.

B. All OSP fiber cable that is run 50 feet or more inside a building shall be installed in no less than two inch GRC, above ceiling from entry point to termination point.

C. Outside Plant Fiber – Multi-Mode

1) Provide for inter-building backbones: loose tube, gel filled, moisture proof, outside plant, multi-strand, multi-mode fiber optic cable. Provide 50/125µm and in quantities indicated on drawing interconnect diagram (regardless of part number). Multimode fiber strands shall be optimized for (VCSEL) or Vertical Cavity Surface Emitting Laser based systems. Fiber strands shall exceeded TIA/EIA 568-C.3 and IEEE802.3z specifications. All fiber shall be installed with pull strings for future use. All Inter-closet backbone connections shall be 24 strands (12 pairs). All Closet to portable connections shall be 6 strands (3 pairs) unless otherwise stated in drawings for number of fibers per cable.

2) Approved Manufacturers:

a) Mohawk: M9E500T product series with AdvanceLite fiber optic cable.

b) Berk-Tek: OPD product series with GIGAlite10-FB fiber optic cable (OPDD12B024FB3010/F5).

D. Indoor Plant Fiber – Multi-Mode

1) Provide for intra-building backbones: tight buffer, plenum rated, multi-strand fiber cable. Provide 50/125µm in quantities indicated on drawing interconnect diagram (regardless of part number). Multimode fiber strands shall be optimized for (VCSEL), or, Vertical Cavity Surface Emitting Laser based systems. Fiber strands shall exceeded TIA/EIA 568-C.3 and IEEE802.3z specifications. All fiber shall be installed with pull strings for future use. All Inter-closet backbone connections shall be 24 strands (12 pairs). All Closet to portable connections shall be 6 strands (3 pairs) unless otherwise stated in drawings for number of fibers per cable.

2) Approved Manufacturers:

a) Mohawk: M9E611 product series with AdvanceLite fiber optic cable.
b) Berk-Tek: PDP product series with GIGAlite10-FB fiber optic cable (PDP024FB3010/F5).

2.02 Fiber Optic Cabling Connectors

A. Provide fiber optic connectors at each end of installed, outside plant fibers. Tip material shall be zirconia ceramic and pre-radiused. Each installed connector shall not exceed –0.5 dB @ 1,300 nm of insertion loss per mated assembly. Provide connector protectors at each connection point to prevent accidental damage to connectors (dust covers).

1) Terminate fiber on 568SC connectors appropriate to fiber type, in quantities indicated on drawings.

a) Approved Manufacturers:

(1) Hubbell: 2CLICK Series
(2) 3M: Crimplok

B. Protect all 250 µm fibers with cable end kit and fan out tubing kit or breakout jacketing kit.

Approved Manufacturers:

(1) Mohawk: AX10110x Series.
(2) Berk-Tek: #10033xxx Series.

2.03 Fiber Optic Cable Interconnect Devices

A. Fiber Optic Interconnect Cabinets (Rack-Mounted)

1) Rack mounted fiber interconnect cabinets shall be constructed of 16 gauge cold rolled steel protecting fiber terminations on all sides. Cabinets shall install in a 19" data rack with standard EIA hole spacing.

2) Patching and termination compartments shall be separated by a steel panel supporting the fiber couplers.

3) Patching compartment shall be accessible through a front mount door (swing down to open).

4) Provide fiber adapter panels preloaded with duplex 568SC type couplers for fiber cross connects. Cover empty slots with blank adapter panels, if applicable.

5) Cabinets shall be equipped with fiber storage management.

6) Approved Manufacturers:

a) Hubbell: #FCR350SP36R.
b) Ortronics: OR-615MMC-36P-00

B. Fiber Optic Interconnect Cabinets (Surface Mounted)

1) Provide surface mounted, fiber interconnect cabinets. Cabinets shall be constructed of 16 gauge cold rolled steel to protect fiber terminations on all sides.

2) Patching and termination compartments shall be separated by a steel panel supporting the fiber couplers.

3) Patching and splicing compartment shall be accessible through a front mount steel door with flush lock.

4) Provide 6-pack fiber adapter panels preloaded with duplex 568SC type couplers for fiber cross connects. Cover empty slots with blank adapter panels, if applicable.

5) Mount box on 2' high x 4' wide x ¾" thick, AC-grade, plywood painted on all six sides with two coats of flame retardant paint, as manufactured by Pathway & Spaces, Inc. Backboard Kits or pre-approved equal.

6) Approved Manufacturers:

a) Hubbell: #FTU2SP.

b) Ortronics: OR-615SMFC-LX-12P.

2.04 Equipment Racks

A. Free standing racks shall be height, as specified, and provided with EIA 19" mounting. Securely

mount to floor (on an isolation pad and utilize non-conductive washers) and provide ladder rack with required front and rear clearances. Racks shall be constructed of extruded aluminum or cold rolled steel with standard EIA hole pattern on front and rear. Finish shall be anodized black. Provide rack with the following accessories/features:

1) Connect separate, solid, #4 AWG, insulated, grounding wire between the ground bus and the building's grounding system.

2) For four post racks/open equipment frames, provide two, equipment shelves per frame, per Owner's requirements (depth of provided frame – secured at four corners).

3) Provide rack/frame with mounting hardware and all accessories required to complete installation of the rack. Provide support for each rack, as required, and backer board, as indicated on drawings and as manufactured by Pathway & Spaces, Inc. Backboard Kits or pre-approved equal.

4) Provide cable management system for rack. Per rack, provide vertical cable channel guide (both sides) and necessary horizontal cable guide panels (split ring), as necessary, to handle all terminated cables and as per drawings and these specifications (see patch panel requirements). Provide Velcro tie wraps for cable management within racks. Nylon tie wraps shall not be used within racks.

5) Provide cable management system for rack. Per rack, provide vertical management rings at front and rear holes at twelve inch spacing – both sides or provide vertical channels, provide horizontal cable managers (three per frame). Provide Velcro tie wraps for cable management within rack. Nylon tie wraps or electrical or adhesive tapes shall not be used within frame.

6) Provide one per rack: Rack mounted, twelve position power strip with circuit breaker, surge suppression, and 15 feet cordage whip. Coordinate electrical service requirements with Division 26 Contractor.

7) Approved Manufacturers

   a) Relay Rack (quantities as indicated on drawings)

      (1) Hubbell: #CR1973.
      (2) Great Lakes: #GLRR-1984BA with 1984-VCM.
      (3) Pre-Approved Equal.

   b) Four Post Rack/Open Equipment Frame

      (1) Hubbell: #SF841929.
      (2) Great Lakes: #4PM6.
      (3) Pre-Approved Equal.

   c) Swing Gate Wall Rack

      (1) Hubbell: #HPWWMR36D.
      (2) Great Lakes: #GL36SR.

(3) Pre-Approved Equal.

2.05 Voice Grade Copper Cabling

A. Interbuilding - Twisted Pair

1) Between buildings, twisted pair cable shall be 24 AWG solid conductors and manufactured expressly for telephone use. The individual pairs must be color coded to Bell System/telephone industry standards. Inter-building cable shall be filled, for the purpose of water intrusion prevention and composed of aluminum/steel sheath. Reference drawings for pair count.

a) Acceptable Manufacturers:

(1) Mohawk
(2) Avaya

2) Cable shall be sized and installed according to the drawings for twisted pair.

3) Cables shall transition from outside (filled) cable to the “tails” of the protection units with properly equipped and installed splice closure units in quantities necessary to terminate all cable (Porta Systems Series 24 Building Entrance Terminals – 110 Terminations or pre-approved equivalent).

4) Terminate, as indicated on drawings.

5) The telephone service surge protector module block must be connected with a No. 6 AWG or larger solid copper insulted wire to the single point ground on the plywood backboard. The length of this wire shall be kept as short as possible and not have any sharp bends.

6) The interbuilding cable surge protector building entrance terminals must be connected with a No. 6 AWG solid copper insulated ground wire to the grounding terminal bar inside the far end building main service entrance equipment enclosure.

7) Provide Porta Systems - Delta Protector Heat Coil or equivalent 5 pin protector module for the interbuilding cable. A module must be installed on all interbuilding cable runs and must be sufficient in quantity to protect all pairs installed (230 volt for voice and 75 volt for data – quantities as required).

B. Interbuilding Cable Labeling

1) All interbuilding cabling shall be terminated on the 5 pin protector blocks, then connected to patch panels. All protector blocks must be labeled as to the building to which the cable runs. It shall not be permissible to split a protector block between two buildings.

2) Each patch panel shall be labeled with the Building Number and Room Number, as labeled on the drawing, to which the interbuilding cable runs. There shall be a one-to-one relationship for each jack in the panels at both ends.

C. Intrabuilding - Twisted Pair

1) Twisted pair cable shall be riser-rated, tight buffer, 24 AWG solid conductors and manufactured

expressly for telephone use. The individual pairs must be color coded to Bell System/telephone industry standards.

a) Acceptable Manufacturers:

(1) Mohawk
(2) Avaya

2) Cable shall be sized and installed according to the drawings for twisted pair.

2.06 UTP Horizontal Cabling

A. Provide plenum-rated, Category 6 compliant, unshielded twisted pair (UTP) copper cable, blue. Cable shall contain insulated primaries enclosed in a thermoplastic outer jacket.

B. The Contractor shall inspect all cable prior to installation to verify that it is identified properly on the reel identification label, that it is of proper gauge, containing the correct number of pairs, etc. Damaged cable or any other components failing to meet specifications shall not be used in the installation.

C. Provide three feet of “s” coiled cable above ceiling at each outlet location.

D. Provide plenum-rated only where required by building code. Non Plenum spaces may use standard riser cabling. Unshielded twisted pair (UTP) copper cable. Cable shall contain insulated primaries enclosed in a thermoplastic outer jacket. Coordinate final color of cable with Owner prior to installation.

1) Category 6 compliant
a. Acceptable Manufacturers:
(1) Mohawk: 6-LAN M58291 For Riser cabling
(2) Mohawk: 6-LAN M58287 For Plenum cabling

(3) Berk-Tek: LANmark-10032455 for Riser Cabling
(4) Berk-Tek: LANmark-10036226 for Plenum Cabling

2.07 Data Jack System (TIA/EIA T568A Wiring Configuration)

A. Recessed Mount—Provide faceplate and specified number of eight position eight conductor connectors in a four port configuration. The jacks shall individually snap-in to faceplate. Data outlet shall provide compliance with TIA-568C.0, C.1, C.2, and TIA-606-B specifications. Termination of all jacks shall be 110-type insulation displacement connectors (IDC), T568A pin/pair assignment and shall utilize printed circuit board technology.

B. Provide a communications outlet outside of the Cafeteria Manager's office for the connection of an overhead speaker. The outlet needs to be located in such a way as to allow a speaker ~~chime or bell~~ to be connected to it and for the sound to be heard by Food Service staff.

C. For wall mount telephone locations, provide stainless steel wall plate with lugs for flush mounting of modular jack or with jack installed.

Acceptable Manufacturers:

1) Hubbell: #P630S1G.

2) Ortronics: GigaMo Series #OR-854045212.

D. Jacks shall meet Category 6 component specifications per TIA 568C.2 as verified by ETL.

Acceptable Manufacturers:

1) Hubbell: NEXTSPEED HXJ6OW with IFP14OW (faceplate)–Office White.
2) Ortronics: Clarity6 TracJack OR-TJ600 with OR-40300546 (faceplate)–Fog White and any necessary blanks.

2.08 Labeling

A. Each cable shall be permanently labeled at both ends with the Communications Closet Room Number, Patch Panel Number, and Patch Panel Port Number. All network system components shall be labeled, including rooms, racks, cabinets, patch panels, individual ports in each patch panel, communications outlets, etc. The system identification administration shall meet the requirements of EIA/TIA 606.

B. Each termination point shall have a recessed designation strip with clear plastic cover for jack identification. Lettering shall be typed – not handwritten. The associated termination shall be permanently labeled according to the following scheme (as labeled on the drawing):

Room Number-Position in Room Clockwise from Main Door

For example, the third jack from the door in Room 01-101 would be labeled:

01-101-3

C. Each patch panel shall be labeled sequentially left to right, top to bottom with the room number and port letter, such that the ports can be located easily on the panel.

D. All fibers in each fiber optic cable shall be identified at each end on the interconnect cabinet with permanent plastic labels. Fiber cabinets shall be identified with the building number and corresponding fiber number for the far end of the cables.

D. Labeling Notes

1) Labels shall be made using a device which produces typewritten print (Brother P-Touch tape marking system is acceptable).

2) Allow more characters if needed (i.e., BB-RRRR).

E. Labeling Copper

1) Communications Outlet Labeling

Each jack on the Communications Outlet shall be labeled at the faceplate using the following format to indicate its location on the patch panel:

Format:

BB-RRR

port port
port port

P##-P##-P##-P##

Top Label

BB ..... Building number where the communications closet servicing that jack is located.

RRR..... Room number where the communications closet servicing
that jack is located.

Bottom Label

P ..... Patch Panel ID (A, B, C, D, etc.)

##..... Patch Panel port number (01-48, etc.)

Label indicates jacks left to right, top to bottom, separated by a dash.

Example

12-103 .....
Building number of the
communications closet 12
Room number of the
communications closet 103

port port.....Jacks on this
port port .....communications outlet … A47,A48,B01,B02

2) Patch Panel Labeling
Each patch panel shall be labeled using the following format:

Format:

port	port	port	port
BB-RRR	BB-RRR	BB-RRR	BB-RRR

BB ..... Building number the jack is serving.

RRR..... Room number the jack is serving.

Label shall be placed just below or above the jack.

Example

port	port	port	port
12-103	12-103	12-103	12-103

Building number the jacks are serving.....12
Room number the jacks are serving.....103

3) Cable Labeling

Each cable shall be labeled at both ends- at the patch panel and at the communication outlet.

a) Format at the patch panel end:
BB-RRR
BB ..... Building number the jack is serving.
RRR ..... Room number the jack is serving.
Label shall be attached to the cable within six inches of the cable's termination point
Example
12-103
Building number the jack is serving……..12
Room number the jack is serving……103

b) Format for the communications outlet end
BB-RRR
BB ..... Building number where the communications closet servicing that jack is Located.
RRR……..Room number of communications closet.
Label shall be attached to the cable within six inches of the cable's termination point.

Example

12-103
Building number where the CC servicing
That the jack is located…….12
Room number of the communications closet…… 103

F. Fiber Labeling

1) Fiber Patch Panel Labeling

Each Fiber Patch Panel (at both the CER and CC ends) shall be labeled using the following format:

Format:

BB-RRR

BB ..... Building number the jack is serving.
RRR..... Room number the jack is servicing.
Label shall be attached to the cabinet.

Example

12-103

Building number the fiber is serving 12

Room number the fiber is serving.....103

2) Cable labeling

Each cable shall be labeled at both ends using the following format.

Format:

BB-RRR

BB ..... Building number the fiber is serving. RRR.....

Room number the fiber is serving.

Label shall be attached to the cable within six inches of the cable's termination point.

Example

12-103

Building number the jack is serving 12

Room number the jack is serving.....103

2.09 Building Cable Routing System

A. J-Hooks

1) From cable tray to stubbed up outlet conduits, building shall be supplied cables through Category 6 compliant J-hook system located in the ceiling space. The J-hooks shall be of adequate size to accommodate all cable specified herein plus 50%. Acceptable Manufacturer: B-Line

2) J-hook system shall be no closer than 18 inches from sources of electromagnetic interference such as fluorescent light fixtures or shall be shielded from such interference by tray sections designed for that purpose.

3) All efforts shall be made to keep transitions smooth and continuous to prevent excessive bending and turning of cables.

4) Cabling shall be supported to the building structure at a maximum of 4-foot intervals with J-hooks. Cabling shall not be supported from the ceiling, ductwork, conduits, piping, or any other non-structural building member.

B. Cable Trays

1) As indicated on drawings, provide snake tray system. Manufacturer’s Part No. No. CM 201-425-D-8. Size to accommodate all cable specified herein plus 50%.

2) Do not locate closer than 18" from all sources of electromagnetic interference such as fluorescent light fixtures.

3) All efforts shall be made to keep transitions smooth and continuous to prevent excessive bending and turning of cables.

2.10 Patch Panels (TIA/EIA 568A Wiring Configuration)

A. Provide 48 port, loaded, UTP patch panels (rack mount) per TIA 568C.2 as verified by ETL. Panels shall have 110 IDC type to eight position eight conductor connectors with no exposed PC boards. Jacks shall be manufactured with printed circuit board (PCB) and have T568A pin/pair assignment

(unless otherwise noted on the drawings). Patch panels shall be provided with individual port and patch panel labeling identification areas and shall be labeled consistent with the data jack system labeling outlined in this specification.

B. Provide quantity to accommodate number of outlets indicated on drawings.

C. Provide rear cable management and horizontal cable management guide either as an integral part of the patch panel or provide as a separate piece and station support bars. Each 48 port patch panel is to have a dedicated horizontal cable guide located adjacent to the patch panel in the rack or as indicated on drawings.

D. The building and room number in which the patch panel resides shall be prominently displayed.

E. Patch panels shall be alphabetically labeled from top to bottom, left to right, beginning with the letter A and proceeding through the alphabet. Each port of each patch panel must be numbered and labeled with the originating jack identification using building, room, and jack designation.

F. Voice designated patch panels may be provided with 24-ports for between building voice cables per these specifications.

G. Category 6 compliant acceptable manufacturers:

1) Hubbell: NextSpeed P6E48UE
2) Ortronics: Clarity6 OR-PSD66U48

2.11 Voice—110 PATCH PANELS

A. Provide Category 6, component level, UTP modular patch panels (rack mount). Panels shall be 110 IDC type connectors to eight position eight conductor connectors with no exposed PC boards. For voice application, terminate two pair per port. Jacks shall be manufactured with printed circuit board (PCB) or lead frame technology. Patch panels shall be provided with individual port and patch panel labeling identification areas and shall be labeled consistent with the data jack system labeling outlined in this specification.

B. Provide quantity to accommodate number of outlets indicated on drawings.

C. Provide rear cable management and horizontal cable management guide either as an integral part of the patch panel or provide as a separate piece and station support bars. Each patch panel is to have a dedicated horizontal cable guide located adjacent to the patch panel in the rack, or as indicated on the drawings.

D. The building and room number in which the patch panel resides shall be prominently displayed.

E. Patch panels shall be alphabetically labeled from top to bottom, left to right, beginning with the letter A and proceeding through the alphabet. Each port of each patch panel must be numbered and labeled with the originating jack identification using building, room, and jack designation.

F. Acceptable Manufacturers:

1) Hubbell.

2) Ortronics.

2.12 Fiber Jumpers and Patch Cords

A. Fiber Jumpers

Install fiber jumpers, provided by others, with LAN electronics.

B. Category 6 Patch Cords (Data)

1) Provide bootless, Category 6 compliant cords (with an RJ-45 8P8Cjack on each end). Confirm final colors with Engineer/Owner prior to ordering. Cords shall be delivered to the school no later than two months prior to Substantial Completion for installation and testing by this Contractor.

a) One patch cord shall be provided for each end of each Category 6 link (i.e., two per link), quantity as indicated on drawings, plus 10% spares. Provide blue cords (data) in the following lengths:

- Line Cords .....50% - 10 feet and 50% - 15 feet.
- Patch Cords.....50% - 1 foot, 20% - 3 feet, and 20% - 5 feet. 10% 7 feet.

Provide 30% blue spare cords in equivalent quantities as above

b) Category 6 Compliant Acceptable Manufacturers:

(1) Hubbell: NextSpeed Series (PCX6Bxx).
(2) Ortronics: Clarity6 Series (OR-MC60x-x6)

c) Color of patch cords are as follows in the quantities specified above for each category:
Data- Blue
Wireless Access Points – Yellow
Voice – Orange
Speakers – Purple
Cameras – Green
Fire- Red

2.13 Zone Paging Cable

A. This Contractor shall furnish and install zoned loudspeaker paging system cable. The paging system speakers/amplifier/control headend shall be provided and installed by Division 27 51 13 Unified Communications System (UCS).

B. The loudspeaker paging system shall be designed to provide a primarily one-way broadcast message system and provide for a classroom panic button to activate a page (at a pre-determined location(s)) upon an emergency.

C. Within the building (in classrooms and as noted on drawings), provide Category 6 cabling as specified in this section and indicated on drawings. Provide 10 foot coil of cable at each speaker location shown on drawings and at MDF/IDF prior to termination. The cabling shall be homerun from each speaker location to the appropriate Communications Closet or IDF and terminated on patch panels. Speakers are intended to be installed by the Division 27 51 13 Unified

Communication System (UCS) Contractor. The Division 27 Contractor shall cross-connect to LAN equipment (fiber optic cable between buildings) and integrate VOIP and IP Paging systems.

D. Corridors and common areas shall have analog speakers and are intended to be one building zone (provide home run cable from speaker to MDF/IDF, then gang). Exterior of building shall have analog speakers and are intended to be one building zone (provide home run cable from speaker to MDF/IDF, then gang). All analog zones shall have zone controllers and be integrated with IP Paging system. Speakers are intended to be installed by the Division 27 51 13 Unified Communications system Contractor.

E. For exterior flush mounted speakers (to be analog), provide a 4” x 4” recessed box without plaster ring and with extension box. Provide an AR adapter ring for any Atlas VTF-152UCN paging horns. For surface mounted VT-152UCN paging horn provide an SEN back box.

F. For corridors/common areas with hard ceilings (plaster), cut in and install backbox, run cable in conduit back to accessible area (Atlas Sound Model 96-8 or pre-approved equal) . For tile ceiling, install a 2’x2’ speaker that is on the approved Bid 15-803-094. Backbox shall accept any 8" loudspeaker.

G. The paging system shall be utilized for emergency announcements and must be designed to accommodate all applicable fire and safety codes. All components must meet UL, CSA, and FCC requirements.

2.14 Surveillance System Cabling

A. This Contractor shall furnish and install Surveillance (CCTV) system cable. The devices and headend shall be provided by others. Route cable in designated cable tray or J-hooks, as necessary.

B. This Contractor shall terminate cables at MDF or IDFs in patch panel as designated on drawings. Leave a 10-foot cable coil at the MDF/IDF end. Leave an above ceiling coil in the room that would reach to the furthest corner plus five feet. All exterior boxes and raceways shall be provided by Division 26 contractor.

C. On the wall, adjacent to the door in the SRO’s office, provide a four square junction box (at 18" AFF) with a blank faceplate and a 1" conduit to above ceiling. Situate adjacent to a duplex power receptacle.

D. In Administration area, provide a coaxial cable (with adjacent power receptacle), from a location (typically, behind the reception desk at 80" AFF) that visitors can observe the surveillance images. Cable shall be run back to the MDF/IDF’s (whichever is closest) security rack. This connection is intended for a monitor (provided by others).

E. For the devices noted on the drawings, provide the following wire types:

1) Camera—Building-to-Building cable: Multi-Mode fiber optic cable. Cable counts included within fiber specified in this Section and depicted on drawings.

2) Camera—Building to Pole cable: Outside Plant, CCTV RG-6/u coaxial cable (18 AWG, solid copper center conductor with foam polyethylene, dielectric 75 ohm impedance, 95% bare copper braided shield).

3) Fixed Camera cable within building, Siamese type configuration with separation web:

a) Power: One, 18 AWG, power wire.

b) Video: CCTV RG-6/u coaxial plenum cable (18 AWG, solid copper center conductor with foam FEP, dielectric 75 ohm impedance, 95% bare copper braided shield).

c) Homerun from each camera to the local IDF/MDF.

4) PTZ Camera cable within building: Siamese type configuration with separation web:

a) Power/Data: Two pair, 18 AWG, power wires.

b) Video: CCTV RG-6/u coaxial plenum cable (18 AWG, solid copper center conductor with foam FEP, dielectric 75 ohm impedance, 95% bare copper braided shield).

c) Homerun from each camera to the local IDF/MDF.

2.15 Audio Microphone cabling (Public Address Systems)

A. Provide single twisted pair, shielded cable with 20 GA stranded conductors and 22 GA drain wire.

B. Acceptable Manufacturers:

1. West Penn 25292.

2. Belden 9154.

2.16 Audio Speakers Cabling (Public Address Systems)

A. Provide 12 GA, two conductor, stranded, unshielded speaker cable.

B. Acceptable Manufacturers:

1. West Penn.

2. Belden.

2.17 Miscellaneous Equipment

A. As per the needs of the installation, miscellaneous equipment shall be required at the Contractor's expense. It is the Contractor's responsibility to identify and bid all miscellaneous equipment necessary to provide a complete and properly functioning system.

B. All backboards shall be ¾" AC Grade plywood painted on all sides with flame retardant paint as manufactured by Pathway Spaces, Inc. Backboard Kits or approved equal. Reference drawings and these specifications for color coding.

PART 3 - EXECUTION

3.01 General

A. Contractor shall follow established guidelines for installation and termination of all cabling and equipment; as established in EIA/TIA 568C.0, C.1, C.2, C.3, EIA/TIA-569; BISCI Telecommunications Distribution Methods Manual; and the National Electrical Code (NEC).

B. Work shall be of professional quality and shall not detract from the aesthetic qualities of the facility. Contractor shall ensure that the site is clean of construction debris prior to leaving the site unsupervised at the end of every work day.

C. This Contractor shall provide to the Division 27 51 13 Unified Communications Systems (UCS) (at least three months prior to Substantial Completion) two complete copies of the systems floor plan drawings documenting the room FISH numbers and the assigned jack numbers. These drawings are to be utilized for designating telephone locations and obtaining the appropriate telephone service to the site.

3.02 Cabling

A. All cabling shall be installed in conduit only between buildings and within walls, as shown on the drawings and per the Industry Standards as outlined in the BICSI Telecommunications Distribution Methods Manual, EIA/TIA 568C.0, C.1, C.2, C.3, EIA/TIA 569, and the following:

1) Care should be taken to insure the integrity of the installed cable. Use wide sweep elbows at all right angles.

2) Fire Penetrations: Fire stop penetrations through fire rated or smoke walls I.A.W., UL Standards, and EIA/TIA 569.

3) Tension: Cable shall be free from tension at both ends, as well as over the length of each run. Pulling tensions shall not exceed manufacturer’s published data.

4) Grounding: Ground shields I.A.W. applicable standards.

5) One pull string shall be left in the ceiling, secured in the same manner as the station cabling, subsequent to installation running from the MDF to each classroom.

6) Cables shall be terminated in order, lowest room number first, station A first, and ports 1-4 in order.

7) Three feet of slack, when within operating limits, shall be neatly coiled in the ceiling directly above the drop for each communication outlet.

8) All fibers shall be installed with pull strings for future use.

9) All cables shall be dressed and permanently labeled at each end using approved labels to ensure a neat and organized appearance.

3.03 Excavation

A. Provide excavation, backfill, and compaction in conformance with industry standards.

B. Provide dewatering as required to insure proper installation of duct bank or underground pathways.

C. Jack and bore under existing concrete slab, sidewalks, etc. shall be preferred for underground routing of pathways. Ensure safe re-routing of facility occupants during procedures or perform procedure after occupancy hours of the facility. However, if cutting of existing concrete slab, sidewalks, etc. is deemed to be required, the cutting shall be from joint to joint (control or expansion). Final surface finish shall match surrounding conditions.

D. Do not cut roots larger than ½" in diameter.

E. Hand trenching is required. Contractor to ensure that there are no open trenches prior to leaving the site unsupervised at the end of every work day.

F. Perform required trenching and backfilling associated with the Work under this Division.

G. Provide all materials necessary and as required by OSHA to protect personnel working in trenches.

3.04 Penetrations

A. Fire penetrations: Fire stop all fire or smoke wall penetrations I.A.W. published UL standards. It is this Contractor's responsibility to identify fire walls.

B. Masonry penetrations: Masonry penetrations to install materials shall be saw-cut for square or irregular penetrations, masonry drilled for round penetrations 1" diameter or less, or core drilled for round penetrations larger than 1" diameter. Under no circumstances shall masonry penetrations be chipped or hammered.

C. Provide necessary sleeves and chases where conduits pass through walls. Wall sleeves shall be installed above ceiling and be supported on both sides of the wall with strut and beam clamps. Ream and bush both sides of sleeves.

D. Conduit penetrations entering a building from the exterior, perpendicular to the wall, shall be sealed with UV resistant silicone and shall be water tight.

E. Conduit entering the building shall be sealed with approved duct seal to prevent intrusion of gas, water, or pests from outside the building.

F. Any openings created by or for this Contractor and left unused shall also be sealed as part of this work.

G. Drip loops shall be provided for all exterior connections.

3.05 Concrete Work

This Contractor shall be responsible to replace concrete pads, supports, piers, bases, foundations, and encasements damaged from the installation of the Work under this Division.

3.06 Painting of Damaged Areas

Raceways, conduit supports, hangers, and surface raceway, where exposed, shall be painted to match mounting surface or surrounding surfaces. Panels and equipment with damaged painted surfaces shall be refinished to previous conditions.

3.07 Fiber Testing (to be submitted at Substantial Completion)

A. TESTING: Contractor shall test each fiber strand and each pair of each twisted-pair copper cable. The Owner/Engineer reserves the right to have a representative present during all or a portion of the testing. A testing schedule shall be planned and agreed upon beforehand.

1) FIBER-OPTIC BACKBONE CABLE: Each fiber in every backbone cable run shall be tested with an optical light source and power meter as manufactured by Noyes Fiber Systems or HP/Agilent Technologies. Each multimode fiber shall be tested at both 850 and 1300nm. Maximum fiber strand attenuation shall be determined using the following link attenuation equation:

2) Maximum link attenuation = Connector attenuation + Cable attenuation + Splice attenuation

3) Maximum attenuation per component:

a) Connector attenuation 0.75dB/1 mated connector pair
b) Cable attenuation 3.5dB/km @ 850nm and 1.5dB/km @ 1300nm
c) Splice attenuation 0.3dB/splice

4) Contractor shall calculate the acceptance values for each fiber strand based on the above criteria. The fiber certification report shall be submitted listing the power loss budget dB value, the measured dB loss, and the dB margin of each measured fiber strand to the acceptance values per test limit: TIA Backbone Fiber Standard 568B.

B. Backbone lengths shall be verified with an OTDR or Light Source/Power Meter with length based standard testing as manufactured by Noyes Fiber Systems, Agilent, or pre-approved equal. Per this specification, maximum distance shall not exceed 500 meters to support LAN equipment operating at 850 nm and 1,000 meters to support LAN equipment operating at 1300 nm. Optical power meter and OTDR results shall be in the form of tester report print outs, hand written results will not be accepted. Photocopies of test results will not be accepted, only original signed print outs will be accepted. These results shall be submitted to the Engineer.

1) Fiber backbone test results shall include:

a) Wavelength
b) Fiber Type
c) Cable Length
d) dB Loss
e) Power Loss Budget for measured cable length
f) Loss Margin
g) Continuity
h) Attenuation Specification
i) Bandwidth Specification
j) Fiber and Cable Number
k) Measurement Direction
l) Reference Set-up
m) Test Equipment Model and Serial #’s
n) Test Date
o) Operator (Crew Members)

3.08 Horizontal Copper Testing (to be submitted prior to Substantial Completion)

A. TESTING: Contractor shall test each horizontal, twisted-pair, copper channel. The Owner/Engineer reserves the right to have a representative present during all or a portion of the testing. A testing schedule shall be planned and agreed upon beforehand.

1) HORIZONTAL UTP CABLE: Each horizontal cable run shall be tested for all frequencies from 1 MHz to 550 MHz. The test shall be a channel configuration which includes the patch cord, patch panel, UTP cable, workstation jack, and workstation cord. The cable tester shall be set for channel parameters before testing. Each Category 6 cable shall be tested using a Level III tester compliant with TIA specifications for testing of Category 6 configurations with the latest software upgrade available at time of bid. Tester shall be consistent with the manufacturer's requirements for hardware and software for a certified system and shall be based on compliance with TIA requirements. No tester shall be approved without meeting these requirements. Prior to testing UTP runs, the tester shall be calibrated per manufacturer's guidelines. Contractor to submit documentation of calibration upon request. The correct cable NVP shall be entered into tester to assure proper length and attenuation readings. Category 6 test results shall be in the form of tester software print outs. Photocopies shall not be accepted, only original signed reports shall be accepted. Test results shall be furnished to the Engineer.

2) Category 6 UTP cable testing shall include:

a) Cable Length

b) Wire Map

c) Insertion Loss

(1) Cable
(2) Connecting Hardware
(3) Channel

d) Pair-to-Pair Near End Cross Talk (NEXT) Loss

(1) Cable
(2) Connecting Hardware
(3) Work Area, Equipment, and Patch Cord
(4) Channel

e) Power Sum NEXT Loss

(1) Cable
(2) Channel

f) Pair-to-Pair Equal Level Far End Cross Talk (ELFEXT)

(1) Cable
(2) Channel

g) Connecting Hardware Pair-to-Pair FEXT loss

h) Power Sum ELFEXT

(1) Cable
(2) Channel

i) Return Loss

(1) Horizontal Cable
(2) Connecting Hardware
(3) Work Area, Equipment, and Patch Cord
(4) Channel

j) Propagation Delay

(1) Cable
(2) Channel

k) Propagation Delay Skew

(1) Cable
(2) Channel

l) LCL (Longitudinal Conversion loss)

(1) Cable (in both directions)
(2) Connecting Hardware

3. MULTI-PAIR UTP BACKBONE CABLE: Each pair shall be tested from termination block in MDF to termination block in IDF for continuity.

3.09 Documentation

A. Contractor shall provide documentation to include test results and as-built drawings. Drawings shall be developed in CAD (i.e., AutoCAD 2014 or higher). The following documents shall be provided to the Engineer:

1) Each MDF and IDF shall contain a copy of that building's as-built drawing affixed to an adjacent wall or located in an interior pouch for quick reference. Revised rack and equipment cabinet elevations shall be provided including serial numbers of all installed equipment.

2) Three sets of black line, as-built drawing sets.

3) Provide CD-ROM reflecting all the work with actual device and equipment locations. Drawings to be submitted in .dwg or .dxf format and pdf format.

B. Provide the testing results database on CD-ROM for the completed job (i.e., fiber and copper). The CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.
1) Additionally, provide one hard copy of the fiber optic cabling test results and one hard copy of UTP cabling results. These results shall be submitted to the Engineer prior to the Contractor calling for substantial completion inspection.

2) Provide each communications room with its own notebook containing the corresponding test reports for both the fiber and copper cabling. Each notebook shall have a clear front pocket and be labeled with that communications room’s designation.

C. Provide a bill of materials of all installed equipment and wiring, rack, and backboard equipment

layouts showing placement of support equipment, and model and serial numbers of all installed equipment.

3.10 Acceptance

A. Acceptance of the Data Communications System, by the Owner, shall be based on receiving the following:

1) Copy of all test results.

All fiber segments and all workstation data cables must meet the criteria established in section above. The Contractor is responsible for additional fiber strands and UTP cable to be installed if any show defective during testing.

2) Copy of as-built drawings shall contain the following.

a) Changes and/or deviations from the construction (bid) prints.
b) All communication outlet addresses and locations.
c) Horizontal cable routing.
d) Backbone cable routing.

3) Copy of Manufacturer's 25 year Cabling Plant Performance Warranty.

3.11 Project Completion

Upon completion of the work of this Section, thoroughly clean all exposed portions of the installation, removing all traces of soil, labels, grease, oil, or other foreign material, and using only the type cleaner recommended by the manufacturer of the item being cleaned. Cover all exposed cabling and termination devices.

3.12 Training

Provide a minimum of two site personnel with training on the network cabling system for up to two hours on site. Training shall cover the location labeling scheme, documentation structure and contents, documentation orientation, and system reconfiguration (i.e., reassignment of Communication Outlet function via patching). Training shall take place at time of Substantial Completion before building is occupied by Owner.

3.13 Warranty

The Contractor shall and does hereby warrant all materials and equipment furnished under this scope of work to be free from defects and function or operate satisfactorily for a period of one year from Substantial Completion of this project.

END OF SECTION

SECTION 27 15 00 – COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to section 26 00 00 for electrical engineer's additional conditions.

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all materials and equipment and performing all labor and services necessary for the complete installation of the UTP wiring system including all related systems and accessories as shown by the drawings and herein after specified.

PART 2 - PRODUCTS

2.1 EQUIPMENT

A. Enhanced Category 6 UTP cable as manufactured by Superior/Essex: Cobra or Berk-Tek: LANmark-350.

B. Enhanced Category 6 UTP cable shall be 24 AWG, 4 pair, and plenum rated. All conductors shall be insulated with FEP. UTP cable box shall be a REEL-PAK to avoid kinking of cable during installation. UTP cable shall be capable of 1000 MBPS operation (1000Base-T) per IEEE802.3ab specifications. Cable jacket shall be blue in color. Cable must meet NFPA 262-1985 and UL910 Standards.

C. UTP cables shall be used only for intrabuilding wiring unless specifically noted otherwise on the plans.

D. When enhanced horizontal UTP cables are placed above suspended ceilings, a network of cable trays and J hooks shall be required to support the communication cables in these spaces. Cable tray shall be placed from the communication equipment room to the telecommunication rooms. Cable tray shall also be installed to support the main horizontal cable distribution path. Horizontal cables routed from the cable tray to the workstation areas shall be supported by J hooks. The J hook supports shall be situated no greater than 40” to 60” apart.

E. Cable tray shall be as manufactured by Snake Tray #CM201-425-D-8.

F. UTP cable connections shall be made via 110 type to modular patch panels rated for 4 pair termination. Patch panels shall be ETL verified to Category 6 component specification per ANSI/TIA/EIA 568-B.

G. UTP patch panels and communication outlets shall be as manufactured by Hubbell Premise Wiring, SpeedGain series or Ortronics Clarity series.

The following equipment shall be used:

1. Modular to 110 patch panels T568-B wiring 19" rack mount

   24 ports Hubbell #P5E24UE #OR PHD5E6U24

   48 ports Hubbell #P5E48UE #OR PHD5E6U48

   96 ports Hubbell #P5E96UE #OR PHD5E6U96

   Coordinate port colors with owner. Each port shall be identified with a room number/outlet number label.

2. Equipment racks and cabinets:

   a. Communication cabinets shall be wall mount steel protective enclosures for mounting 19" wide EIA standard equipment. The cabinets shall provide a swing frame to allow easy access for wiring installation and maintenance. The cabinet door shall be lockable. Cabinets shall be as follows:

      2 ft. Height Great Lakes Cabinet #GL24WM Black
      4 ft. Height Great Lakes Cabinet #GL48WM Black

   b. Relay racks for mounting 19" wide EIA standard equipment shall be 84" high, black in color and bolted to floor. Relay racks shall be as follows:

      Hubbell Premise Wiring #HPW84RR19
      Ortronics #604004600

   c. Ladder rack shall be 12” wide, black in color. Constructed of 16 Ga. tubular steel, weight capacity of 45 lbs/foot. Rung spacing shall be 9.5” and stringer dimensions shall be 0.375” w x 1.5” h.

      Provide all accessories for the proper installation of ladder rack system in telecommunication rooms.

      Hubbell Premise Wiring #HLS0612B

   d. Cable Management: Vertical management channels shall be provided on each side of the rack. Vertical channels shall be 6” wide and provide separate channels for the horizontal UTP cables and the patch cords. Cable channels shall be provided with a cover, color to be black. The horizontal management panels shall consist of 3.5” high, 19” rack mount panel with 7 steel management rings. Horizontal panel shall provide a hinged front cover to conceal patch cords.

      Hubbell Premise Wiring (Vertical) # VC76
      Hubbell Premise Wiring (Horizontal) # HC219CE3N

3. Communication outlets shall consist of one (1) 4 port single gang plate with (2) T568-B wired enhanced category 5 modular jacks, unless noted. When the communications outlet requires more than 2 ports, contractor shall provide a 4 or 6-Port single gang plate. Provide blanks for all unused ports. Jacks shall be ETL verified to Category 6 component specification per ANSI/TIA/EIA 568-B. Faceplate shall provide clear labeling windows and be white in color. Communications outlets shall be as manufactured by Hubbell Premise Wiring, SpeedGain series or Ortronics.

   Faceplate Hubbell # NSP12W Legrand # WP3402

   a. Standard communication outlets shall contain 2 RJ45 ports for data, voice, video and auxiliary use.

      Modular jack Hubbell # HJU6 Legrand # HJU6 Series

   b. For surface mount applications provide a deep surfaced mount outlet box as manufactured by Hubbell Premise Wiring or Ortronics.

      Hubbell Premise Wiring #MT678DB
      Ortronics #OR40300185

   c. Provide dust covers for all jacks.
   d. Each patch panel shall be labeled using the following format:

      Format:

X	x	x	x
BB-RRR	BB-RRR	BB-RRR	BB-RRR

      BB=building number the jack is serving.
      RRR=room number the jack is serving.
      Label shall be placed just below the jack.

      Example:

X	X	X	X
12-103	12-103	12-103	12-103

      Building number the jacks are serving = 12
      Room number the jacks are serving=103

   e. Each jack on the communications outlet shall be labeled at the faceplate using the following format:

      Format:
      BB-RRR
      X X
      X X
      P##-P##-P##-P##

Top label
BB=building number where the communications closet servicing that jack is located.
RRR=room number where the communications closet servicing that jack is located.

Bottom label
P=patch panel id (A,B,C,D, etc)
##=patch panel port number (01-96, etc.)
Label indicates jacks left to right, top to bottom, separated by a dash.

Example:
12-103 building number of the communications closet = 12
X Xroom number of the communications closet =103
X Xjacks on this communications outlet = A47, A48, B01, B02
A47-A48-B01-B02

f. All labels shall be made using a device which produces typewritten print. Handwritten labels will not be accepted.

g. Each cable shall be labeled at both ends - at the patch panel and at the communications outlet.

1) Format at the patch panel end:
BB-RRR
BB=building number the jack is serving.
RRR=room number the jack is serving.
Label shall be attached to the cable within six inches of the cable's termination point.

Example:

12-103 building number the jack is serving = 12
room number the jack is serving = 103

2) Format at the communications outlet end:
BB-RRR
BB=building number where the communications closet servicing that jack is located.
RRR=room number of communications closet.
Label shall be attached to the cable within six inches of the cable's termination point.

Example:
12-103 building number where the cc servicing that jack is located = 12
12-104 Room number of the communications closet = 103

h. The contractor shall provide enhanced category 6 patch cords for each jack in the installation. Patch cords and communication outlets shall be by the same manufacturer. Approved manufacturers are Hubbell Premise Wiring, SpeedGain series or Ortronics, Clarity.

i. The contractor shall provide fifty percent (50%) of the patch cables in three (3) foot in lengths and fifty percent (50%) in six (6) foot lengths or such lengths as to present a neat appearance depending on the installation.

PART 3 - PART III EXECUTION

3.1 INSTALLATION

A. Each enhanced category 6 cable shall be tested using a ETL verified level III tester compliant with ANSI/TIA/EIA 568-B specifications for testing of enhanced category 6 cabling. Tester shall be as manufactured by Agilent/HP (Wirescope 350), approval of other testers shall be based on 100% compliance with ANSI/TIA/EIA 568B testing requirements. Prior to testing UTP runs, the tester shall be calibrated per manufacturer guidelines. The correct cable NVP shall be entered into tester prior to testing to assure proper length and attenuation readings. Test path shall include workstation cord, communications outlet, UTP horizontal cabling, patch panel and patch cord. The tester shall be configured for channel link testing parameters. During channel link testing the patch cords and work station cords shall be the same as those provided by the contractor per this specification. Each channel link test shall include one patch cord and one workstation cord. The results of each test shall be recorded on a standard form showing location, date of test, results of test and identification of person performing the test. A PDF copy of the test results shall be furnished to the engineer for distribution to the LAN team. Enhanced category 6 UTP cable testing shall include:

1. Cable length
2. Wire Map
3. Attenuation
4. NEXT
5. Power Sum NEXT
6. ELFEXT
7. Power Sum ELFEXT
8. Return Loss
9. Delay
10. Delay Skew

B. Contractor shall provide cable route diagrams in the as-built drawings. Drawings shall indicate:

1. End points
2. Cable routing
3. Patch panel ports
4. Cable length

C. Maximum distance for Gigabit Ethernet wiring with UTP cable shall be 295 feet in accordance with ANSI/TIA/EIA-568B and IEEE 802.3ab standards.

D. Maximum pulling tension per 4 pair enhanced category 6 cable shall not exceed 25lbs.

E. Maximum bend radius for 4 pair enhanced category 6 cable is 4 times the outer diameter.

F. Maximum distance between UTP data rated cable supports shall be located on 48” to 60” centers for bundles of 16 four pair cable or less. Where larger quantities of cables are bunched together in the ceiling at a congested area, such as close to the telecommunication closet, Snake Tray shall be installed to carry the additional weight per TIA/EIA-569 standard.

G. All cables shall be permanently labeled identifying the origination point and termination point. Labels shall be at each end of cable and at any intermediate junction boxes where cable is accessible. Labeling shall be detailed on as-built cable drawings.

End of Section

SECTION 28-10-00 – ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. Provide a TCP/IP Access Control System. The intent is for this Contractor to provide the devices, connections, testing, programming, documentation, etc. for a working system (including any missing or defective cabling).

B. The security access system shall have the following:

1) Regulate access through specific doors
2) Credential cards and readers
3) Monitoring of field-installed devices
4) Reporting

1.03 RELATED SECTIONS

A.	Section 08 71 00	Door Hardware
B.	Section 26 05 19	Building Wire and Cable
C.	Section 26 05 33.16	Boxes
D.	Section 26 05 53	Electrical Identification
E.	Section 27 10 00	Structured Cabling
F.	Section 28 30 00	Intrusion Detection System

1.04 DEFINITIONS

A. Central Station: A PC with software designated as the main controlling PC of the security access system. Where this term is presented with initial capital letters, this definition applies.

B. ACU: Access Control Unit

C. Controller: An intelligent peripheral control unit that uses a computer for controlling its operation. Where this term is presented with an initial capital letter, this definition applies.

D. Credential: Data assigned to an entity and used to identify that entity.

E. GFI: Ground fault interrupter.

F. Identifier: A credential card, keypad personal identification number or code, biometric characteristic, or other unique identification entered as data into the entry-control database for the purpose of identifying an individual. Where this term is presented with an initial capital letter, this definition applies.

G. I/O: Input/Output

H. LAN: Local area network

I. WAN: Wide area network

J. LED: Light-emitting diode

K. RF: Radio frequency

L. ROM: Read-only memory. ROM data are maintained through losses of power.

M. TCP/IP: Transport control protocol/Internet protocol incorporated into Microsoft Windows.

N. UPS: Uninterruptible power supply.

O. WAN: Wide area network

P. Wiegand: Patented magnetic principle that uses specially treated wires embedded in the credential card.

1.05 SYSTEM DESCRIPTION

A. Intent is for the Access Control System to be IP based. Existing System Software: Paxton, Net2.

1) Multi-user multi-tasking to allow for independent activities and for monitoring to occur simultaneously at different workstations.

2) Graphical user interface to show pull-down menus and a menu tree format.

3) Password-protected operator login and access.

B. Network, connecting the system, shall be via a dedicated VLAN on Owner’s network.

1.06 QUALIFICATION AND QUALITY ASSURANCE

A. Manufacturer: Manufacturer's authorized representative, trained and approved for installation of units required for this Project, with at least five years documented experience. Installing and servicing office to be located within a 50 mile radius of Pinellas County. Pinellas County Schools Approved Vendors Only! See Pinellas County Schools Rep for vendor to be used.

B. Installer: Company specializing in access control systems with five years’ experience, certified by Florida State Licensing Board as an access control system installing contractor and maintain installation, service, and technical staff within 50 miles of Pinellas County. Contractor shall provide evidence of qualifications upon request.
Pinellas County Schools Approved Vendors Only! See Pinellas County Schools Rep for vendor to be used.

C. Installer shall employ workers trained and approved by manufacturer. Cable installer shall have on staff a registered communication distribution designer certified by Building Industry Consulting Service International.

D. The Contractor shall be prepared to offer a service contract for the maintenance of the system after the warranty period.

E. Certifications

1) Paxton Integrator (demonstrates competency and experience on the Paxton software and hardware) Paxton Net 2 Essential and Net 2 Advanced Certificates required.

2) Paxton Certified Staff - minimum of three within 50 miles of Pinellas County. Paxton Net 2 Essential and Net 2 Advanced Certificates required

F. 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.

G. Comply with NFPA 70, "National Electrical Code."

H. Comply with SIA DC-03 and SIA DC-07.

1.07 PERFORMANCE REQUIREMENTS

A. Existing security access system has a single database for access-control and credential-creation functions.

B. Distributed Processing: System shall be a fully distributed processing system so that information including time, date, valid codes, access levels, and similar data is downloaded to Controllers so that each Controller makes access-control decisions for that Location. Intermediate Controllers for access control shall not be used. If communications to Central Station are lost, all Controllers shall automatically buffer event transactions until communications are restored, at which time buffered events shall be uploaded to the Central Station.

C. System Network Requirements

1) Interconnect system components and provide automatic communication of status changes, commands, field-initiated interrupts, and other communications required for proper system operation.

2) Communication shall not require operator initiation or response and shall return to normal after partial or total network interruption such as power loss or transient upset.

3) System shall automatically annunciate communication failures to the operator and identify the communication link that has experienced a partial or total failure.

D. Existing Central Station shall provide operator interface, interaction, display, control, and dynamic and real-time monitoring. Existing Central Station shall control system networks to interconnect all system components, including workstations and field-installed Controllers.

E. Field equipment shall include Controllers, sensors, and controls. Controllers shall serve as an interface between the Central Station and sensors and controls. Data exchange between the Central Station and the Controllers shall include down-line transmission of commands, software, and databases to Controllers. The up-line data exchange from the Controller to the Central Station shall include status data such as alarms, status reports, and entry-control records. Controllers are classified as alarm-annunciation or entry-control type.

F. System Response to Alarms: Alarms shall be annunciated at the Central Station within one second of the alarm occurring at a Controller or device controlled by a local Controller, and within 100 ms if the alarm occurs at the Central Station. Alarm and status changes shall be displayed within 100 ms after receipt of data by the Central Station. All graphics shall be displayed, including graphics-

generated map displays, on the console monitor within five seconds of alarm receipt at the security console.

G. False Alarm Reduction: The design of Central Station and Controllers shall contain features to reduce false alarms. Equipment and software shall comply with SIA CP-01.

H. Error Detection: A cyclic code error detection method shall be used between Controllers and the Central Station, which shall detect single- and double-bit errors, burst errors of eight bits or less, and at least 99 percent of all other multi-bit and burst error conditions. Interactive or product error detection codes alone will not be acceptable. A message shall be in error if one bit is received incorrectly. System shall retransmit messages with detected errors. A two-digit decimal number shall be operator assignable to each communication link representing the number of retransmission attempts. When the number of consecutive retransmission attempts equals the assigned quantity, the Central Station shall print a communication failure alarm message. System shall monitor the frequency of data transmission failure for display and logging.

I. Data Line Supervision: System shall initiate an alarm in response to opening, closing, shorting, or grounding of data transmission lines.

J. Door Hardware Interface: Coordinate with Division 08 Section that specifies door hardware required to be monitored or controlled by the security access system. The Controllers in this Section shall have electrical characteristics that match the signal and power requirements of door hardware. Integrate door hardware specified in Division 08 Section to function with the controls and PC-based software and hardware in this Section.

1.08 SUBMITTALS (submit three copies of the requested data)

A. Shop Drawings

1) Product Data: For each type of product indicated (include dual reed door contacts and local alarm device when door is propped open). Include operating characteristics, furnished specialties, and accessories. Reference each product to a location on Drawings. Test and evaluation data presented in Product Data shall comply with SIA BIO-01.

2) Location and elevations of equipment to be mounted.

3) Door Rough-In (indicated door hardware): For each door, provide a raceway rough-in drawing detailing the means and methods to provide access control and power cabling. This includes cabling within door frame and door.

3) Battery calculations for Controllers and door locks.

4) Copy of contractor license and RCDD certificate.

B. Project planning documents as specified in Part 3.

C. Operation and Maintenance Data

1) Manufacturer's specification sheets, operating specifications, design guides, user's guides for software and hardware, and PDF files on CD-ROM or USB drive of the hard-copy submittal.

2) System installation and setup guides, with data forms to plan and record options and setup decisions.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Controllers

1) Store in temperature- and humidity-controlled environment in original manufacturer's sealed containers. Maintain ambient temperature between 50 and 85 deg F and not more than 80% relative humidity, noncondensing.

2) Open each container; verify contents against packing list, and file copy of packing list, complete with container identification for inclusion in operation and maintenance data.

3) Mark packing list with designations that have been assigned to materials and equipment for recording in the system labeling schedules that are generated by cable and asset management system specified in Part 2.

4) Save original manufacturer's containers and packing materials and deliver as directed under provisions covering extra materials.

1.10 PROJECT CONDITIONS

A. Pre-Construction Inspection and Deficiency List: This Contractor shall inspect doors prior to starting construction. Any deficiencies that would affect the access control system installation shall be brought to the Owner’s attention. It would be the Owner’s decision whether to correct these items independent of this Contractor or to add the scope of work to this Contract.

B. Environmental Conditions: System shall be capable of withstanding the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1) Interior, Controlled Environment: System components, except central-station control unit, installed in temperature-controlled interior environments shall be rated for continuous operation in ambient conditions of 36 to 122 deg F dry bulb and 20 to 90 percent relative humidity, noncondensing. NEMA 250, Type 1 enclosure.

2) Exterior Environment: System components installed in locations exposed to weather shall be rated for continuous operation in ambient conditions of minus 30 to plus 122 deg F dry bulb and 20 to 90 percent relative humidity, condensing. Rate for continuous operation where exposed to rain as specified in NEMA 250, winds up to 85 mph. NEMA 250, Type 3R enclosures.

PART 2 – PRODUCTS

2.01 APPLICATION SOFTWARE – SECURITY ACCESS SYSTEM

A. Paxton Access, IP Access Control System

Headend PC/Software (Net2), Enrollment Center, and Access Cards are existing.

B. Controller Software

1) Controllers shall operate as an autonomous intelligent processing unit. Controllers shall make decisions about access control, alarm monitoring, linking functions, and door locking schedules for its operation, independent of other system components. Controllers shall be part of a fully distributed processing control network. The portion of the database associated with a Controller and consisting of parameters, constraints, and the latest value or status of points connected to that Controller, shall be maintained in the Controller.

2) The following functions shall be fully implemented and operational within each Controller:

   a) Monitoring inputs.
   b) Controlling outputs.
   c) Automatically reporting alarms to the Central Station.
   d) Reporting of sensor and output status to Central Station on request.
   e) Maintaining real time, automatically updated by the Central Station at least once a day.
   f) Communicating with the Central Station.
   g) Executing Controller resident programs.
   h) Diagnosing.
   i) Downloading and uploading data to and from the Central Station.

3) Controller Operations at a Location

   a) Connect to communications loop via Category cable and the Owner's LAN/WAN equipment. Globally operating I/O linking and anti-passback functions between Controllers within the same Location without central-station or workstation intervention. Linking and anti-passback shall remain fully functional within the same location even when the Central Station or workstations are off-line.

   b) In the event of communications failure between the Central Station and a Location, there shall be no degradation in operations at the Controllers at that Location.

   c) Buffered events shall be handled in a first-in first-out mode of operation.

4) Individual Controller Operation

   a) Controllers shall transmit alarms, status changes, and other data to the Central Station when communications circuits are operable. If communications are not available, Controllers shall function in a stand-alone mode and operational data, including the status and alarm data normally transmitted to the Central Station, shall be stored for later transmission to the Central Station. Buffer capacity for the latest 99,999 transactions shall be provided at each Controller.

   b) Card-reader ports of a Controller shall be custom configurable for different card-reader formats. Multiple reader or keypad formats may be used simultaneously at different Controllers or within the same Controller.

   c) Controllers shall provide a response to card-readers or keypad entries in less than 0.25 seconds, regardless of system size.

   d) Controllers that are reset, or powered up from a non-powered state, shall automatically request a parameter download and reboot to its proper working state. This shall happen without any operator intervention.

   e) Initial Startup: When Controllers are brought on-line, database parameters shall be automatically downloaded to them. After initial download is completed, only database changes shall be downloaded to each Controller.

   f) Failure Mode: On failure for any reason, Controllers shall perform an orderly shutdown and force Controller outputs to a predetermined failure mode state, consistent with the failure modes shown and the associated control device.

g) Startup after Power Failure: After power is restored, startup software shall initiate self-test diagnostic routines, after which Controllers shall resume normal operation.

h) Startup after Controller Failure: On failure, if the database and application software are no longer resident, Controllers shall not restart, but shall remain in the failure mode until repaired. If database and application programs are resident, Controllers shall immediately resume operation. If not, software shall be restored automatically from the Central Station.

C. Controller-to-Controller Communications

Controller-to-Controller Communications: Via Owner's LAN/WAN. This Contractor to establish communication with input from Owner for port allocation.

D. Database Downloads

1) All data transmissions from PC to a Location, and between Controllers at a Location, shall include a complete database checksum to check the integrity of the transmission. If the data checksum does not match, a full data download shall be automatically retransmitted.

2) If a Controller is reset for any reason, it shall automatically request and receive a database download from the PC. The download shall restore data stored at the Controller to their normal working state and shall take place with no operator intervention.

2.02 SURGE AND TAMPER PROTECTION

A. Surge Protection: Protect components from voltage surges originating external to equipment housing and entering through power, communication, signal, control, or sensing leads. Include surge protection for external wiring of each conductor-entry connection to components.

1) Minimum Protection for Power Connections 120 V and More: Auxiliary panel suppressors complying with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits."

2) Minimum Protection for Communication, Signal, Control, and Low-Voltage Power Connections: Comply with requirements in Division 26 Section "Transient-Voltage Suppression for Low-Voltage Electrical Power Circuits" as recommended by manufacturer for type of line being protected.

B. Tamper Protection: Tamper switches on enclosures, control units, pull boxes, junction boxes, cabinets, and other system components shall initiate a tamper-alarm signal when unit is opened or partially disassembled. Control-station control-unit alarm display shall identify tamper alarms and indicate locations.

2.03 TCP/IP CONTROLLER

A. Provide intelligent, TCP/IP peripheral control unit, complying with UL 294, which stores time, date, valid codes, access levels, and similar data downloaded from the Central Station or workstation for controlling its operation.

B. Controller Battery Backup: Sealed Lead Acid, sized to provide run time during a power outage of 1 hour with a minimum of 7Ah capacity, complying with UL 924. Contractor to ensure Owner's network switch (connected to access control system) shall be on an Owner-provided UPS that is connected to an emergency power circuit within the closet.

C. Provide power supply for controller/panel. Locate control in closets. Provide plug-in transformer for closets with single panels. Provide power supply for closets with multiple panels (Acceptable Manufacturer: Altronix ALTV244 or sized as required by number of panels).

D. The Controller shall automatically restore communication within 10 seconds after an interruption with the field device network with DC line supervision on each of its alarm inputs.

Inputs: Monitor dry contacts for changes of state that reflect alarm conditions. Provide at least eight alarm inputs, which are suitable for wiring as normally open or normally closed contacts for alarm conditions.

E. Provide local entry-control functions including communications with access-control devices such as card readers, door strikes, and door operators.

1) Operate as a stand-alone portal with the Controller using the downloaded database during periods of communication loss between the Controller and the field-device network.

2) Accept information generated by the entry-control devices; automatically process this information to determine valid identification of the individual present at the portal:

a) On authentication of the credentials or information presented, check privileges of the identified individual, allowing only those actions granted as privileges.

b) Privileges shall include, but not be limited to, time of day control, day of week control, group control, and visitor escort control.

3) Maintain a date-, time-, and Location-stamped record of each transaction. A transaction is defined as any successful or unsuccessful attempt to gain access through a controlled portal by the presentation of credentials or other identifying information.

F. Inputs

1) Data from entry-control devices.

2) Database downloads and updates from the Central Station that include enrollment and privilege information.

G. Outputs

1) Indicate success or failure of attempts to use entry-control devices and make comparisons of presented information with stored identification information.

2) Grant or deny entry by sending control signals to portal-control devices.

3) Maintain a date, time, and location stamped record of each transaction and transmit transaction records to the Central Station.

4) Door Prop Alarm: If a portal is held open for longer than 20 seconds (adjustable), alarm shall sound. Provide Recessed dual reed (position/status) door contacts with alarm hardware and associated cabling in jamb, opposite hinge location separate from the Intrusion System contact.

5) With power supplies sufficient to power at voltage and frequency required for field devices and portal-control devices.

6) Data Line Problems: For periods of loss of communications with Central Station or when data transmission is degraded and generating continuous checksum errors, the Controller shall continue to control entry by accepting identifying information, making authentication decisions, checking privileges, and controlling portal-control devices.

H. Intent is to use Owner's LAN switches. The Installer shall notify Owner as to number of ports required and coordinate as to which ports are to be utilized prior to connection.

I. Acceptable Manufacturer: Paxton Access Net2 Plus, Single Door Controller (682-610-US). Reference drawings for locations and quantities of access doors and closets. Any equipment deviations or configuration modifications shall be pre-approved prior to bid.

2.04 MULTI-TECHNOLOGY, ENCODED PROXIMITY CARD READER

A. Encoded proximity card reader shall be Weigand output with passive detection that shall use a swept-frequency, RF field generator to read the resonant frequencies of tuned circuits laminated into compatible credential cards. The resonant frequencies read shall constitute a unique identification code number.

B. Card reader shall respond to passage requests by generating a signal that is sent to the Controller.

C. Card reader shall be powered from its associated Controller, including its standby power source.

D. Mounting types shall be suitable for outdoors installation.

E. Provide with LED visual indicator (i.e., red, green, amber) and audio feedback representing status and activity information, easily discernible for the audibly or visually impaired

F. Acceptable Manufacturer: HID Plus Mini Mullion Reader, Model# 6005BGB00. Substitutions must be pre-approved by Owner representative.

2.05 DOOR HARDWARE INTERFACE (Refer to Architect's Door Hardware)

A. Electric Door Strikes: Power and signal shall be from the Controller. Electric strike kit, power supply, etc. Electric strike kit shall be HES 9400 or 8000 series locks unless otherwise stated by district representative. Refer to "Division 08, Access Door Hardware." To verify function of electric strike with door hardware.

B. Acceptable manufacturer for Latch Retraction: SDC LR100VDK. Substitutions must be pre-approved by Owner Representative.

C. Delayed Egress

In addition to the DynaLock 3101 and power supply described in 3.02 G, the following devices are required. The Von Duprin 050271-00 exit switch is the only acceptable request to exit switch. The Securitron PZ1 is preferred for an interior annunciator and ADI OE-1GANGDRSR for the exterior annunciator. The magnetic locks are different for the interior and the exterior. The preferred interior mag is the SDC Part # 1581 and for the exterior the Schlage Part# SFX 7410. Any substitutions must be pre-approved by Owner Representative.

2.06 CABLES

A. This Contractor shall provide cabling per manufacturer's recommendations for a working system. All access control system cabling shall be plenum rated and consistent with Owner's standards. All

network cabling shall match Division 27 10 00 Structured cabling specifications or pre-approved equal.

Part 3 – EXECUTION

3.01 EXAMINATION

A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting installation.

B. Examine roughing-in for LAN and control cable conduit systems to Controllers, card readers, and other cable-connected devices to verify actual locations of conduit and back boxes before device installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF ACCESS CONTROL SYSTEM

A. Install access control system as indicated, in accordance with equipment manufacturer's written instructions.

B. Contractor shall provide all equipment required for the installation of the access control system. To include Electric Strikes.

C. Contractor shall install all equipment, conduit, wire, terminal strips and related equipment. All wiring shall be closed to verify continuity. The Main Control Panels shall be installed in either an IDF or MDF room and have an electrical system grounding connection and LAN/WAN connection.

D. Provide concealed conduit from door jambs to above finished ceilings. Wiring to terminal cabinets and other device locations shall be run, without conduit, in ceiling spaces. All wiring shall be in accordance with N.E.C.

E. One to Four Net2 Controllers at one location with strikes or latch retraction:
Use a single 12V 7Ah battery in each panel

F. Five to Nine Net2 Controllers at one location with strikes:
Mount Altronix 2PX2 Trove on wall using all six mounting points
If on drywall use a minimum of 3/16” toggle bolts
If on masonry wall use a minimum of 3/16” masonry screw
If on wood use a minimum of #8 screws
Battery backup will be Two 12V 18Ah NB#2 batteries in parallel
Power supply will be Altronix AL1012ULXB
Power distribution will be Altronix PD16W
The controller and associated strike will be wired to the same single fuse

G. Delayed Egress configurations:
Use Net2 panel and DynaLock 3101 wired as 24VDC
Power supply shall be Altronix AL600ULX and capable of powering 2 Net2 panels and 2 3101 panels

3.03 FIRESTOPPING

A. All penetrations of rated walls, floors, or ceilings, shall be through a metallic conduit sleeve fire stopped with a UL listed firestopping product. See project drawings for penetration details.

B. Penetrations of non-rated masonry walls shall have a conduit sleeve.

3.04 PREPARATION

A. Comply with recommendations in SIA CP-01.

B. Comply with EIA/TIA-606, "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings."

C. Obtain detailed Project planning forms from manufacturer of access-control system; develop custom forms to suit Project. Fill in all data available from Project plans and specifications and publish as Project planning documents for review and approval.

1) For each Location, record setup of Controller features and access requirements.
2) Propose start and stop times for time zones and holidays and match up access levels for doors.
3) Set up groups, facility codes, linking, and list inputs and outputs for each Controller.
4) Assign action message names and compose messages.
5) Set up alarms. Establish interlocks between alarms and intruder detection.
6) Complete system diagnostics and operation verification.
7) Prepare a specific plan for system testing, startup, and demonstration.
8) Develop acceptance test concept and, on approval, develop specifics of the test.

3.05 COMPLETION AND TESTING

A. Furnish to the Owner, a written report which certify that all initiating devices have been tested and which indicate the result of the inspection. Additionally, furnish to the Owner, three sets of Operation and Maintenance manuals with parts list and other information necessary for the proper operation and maintenance on the system, as installed. Include three copies of complete troubleshooting and repair manuals. Provide Owner with a CD-ROM copy (AutoCAD 2014 or later) and two printed copies as-built drawings indicating location of conduit, junction boxes and zoning of each individual device.

B. Upon completion of installation, system shall be completely checked-out and tested by a factory-authorized representative, to determine that the system was tested and installed in accordance with the manufacturer's instructions and all applicable codes. Results of the check out and testing shall be reported in writing to the Architect/Engineer. The written report shall precede or accompany the Contractor's request for acceptance inspection for work under this Section. This representative shall prepare an inspection report for the Owner and instruct the Owner's personnel in the operation of the system.

C. Provide eight effort-hours of on-site training for two people on the operation, maintenance, troubleshooting, and repair of the system at the Contractor's expense. Training shall be certified by the manufacturer and be at different times for each person. Transportation, room and board, where needed, shall be the responsibility of the trainer. Furnish Engineer with a list of attendees.

D. The Contractor, at no cost to the Owner, shall immediately replace all equipment, devices, and/or work found to be defective.

E. Before testing the access control system transmission from the project site to the central control station, coordinate with the Owner’s Project Representative. Personnel shall be available to verify a successful and trouble-free transmission signal.

F. Site Test:

1) Check and test installation for shorts, ground, and circuit continuity.
2) Cables: Test free from opens, grounds, or crosses (shorts) between conductors.
3) Walk-test system for proper function and operation. Ensure proper zoning of devices.
4) Test all functions on access control panels for proper functions and operations.
5) Verify signals are properly received by the District.
6) Check for proper standby battery backup in access control panels and remote power supplies.
7) Verify remote power supplies are UL listed.
8) Inspect and test cabinet tampers on access control cabinets.
9) Verify raceway cover is properly color-coded.

3.06 CABLING

A. Comply with NECA 1, "Good Workmanship in Electrical Contracting."

B. Wiring Method: Install wiring in raceway and cable tray. Use NRTL-listed plenum cable in environmental air spaces, including plenum ceilings. Conceal raceway and wiring except in unfinished spaces.

C. Install cables without damaging conductors, shield, or jacket.

D. Boxes and enclosures containing security system components or cabling, and which are easily accessible to employees or to the public, shall be provided with a lock. Boxes above ceiling level in occupied areas of the building shall not be considered to be accessible. Junction boxes and small device enclosures below ceiling level and easily accessible to employees or the public shall be covered with a suitable cover plate and secured with tamperproof screws.

3.07 CABLE APPLICATION

A. Comply with EIA/TIA-569, "Commercial Building Standard for Telecommunications Pathways and Spaces."

B. Do not exceed cabling recommended lengths.

C. Cable application requirements are minimum requirements and shall be exceeded if recommended or required by manufacturer of system hardware.

D. Card Readers

1) Install number of conductor pairs recommended by manufacturer for the functions specified.

2) For greater distances, install "extender" or "repeater" modules recommended by manufacturer of the Controller.

3) Install minimum No. 18 AWG shielded cable to readers that draw 50 mA or more.

3.08 GROUNDING

A. Comply with Division 26 Section "Grounding and Bonding for Electrical Systems."

B. Comply with IEEE 1100, "Power and Grounding Sensitive Electronic Equipment."

C. Ground cable shields, drain conductors, and equipment to eliminate shock hazard and to minimize ground loops, common-mode returns, noise pickup, cross talk, and other impairments.

D. Signal Ground:

1) Terminal: Locate in each equipment room and wiring closet; isolate from power system and equipment grounding.

2) Bus: Mount on wall of main equipment room with standoff insulators.

3) Backbone Cable: Extend from signal ground bus to signal ground terminal in each equipment room and wiring closet.

3.09 IDENTIFICATION

A. In addition to requirements in this Article, comply with applicable requirements in Division 26 Section "Identification for Electrical Systems" and with TIA/EIA-606.

B. Using cable and asset management software specified in Part 2, develop Cable Administration Drawings for system identification, testing, and management. Use unique, alphanumeric designation for each cable, and label cable and jacks, connectors, and terminals to which it connects with same designation. Use logical and systematic designations for facility's architectural arrangement.

C. Label each terminal strip and screw terminal in each cabinet, rack, or panel.

1) All wiring conductors connected to terminal strips shall be individually numbered, and each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with the name and number of the particular device as shown.

2) Each wire connected to building-mounted devices is not required to be numbered at the device if the color of the wire is consistent with the associated wire connected and numbered within the panel or cabinet.

D. At completion, cable and asset management software shall reflect as-built conditions.

3.10 FIELD QUALTIY 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. Remove and replace malfunctioning devices and circuits and retest as specified above.

3.11 PROTECTION

A. Maintain strict security during the installation of equipment and software.

3.12 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain security access system.

B. Develop separate training modules for the following:

1) Computer system administration personnel to manage and repair the LAN and databases and to update and maintain software.
2) Operators who prepare and input credentials to man the control station and workstations and to enroll personnel.

3.13 PROJECT RECORD DRAWINGS

A. Submit documents under the provisions of Division 1.

B. Include location of end-of-line devices.

3.14 WARRANTY

A. Submit data under provisions of Division 1.

B. Include letter from authorized manufacturer representative's (addressed to the District) stating that the system is operational and in compliance with warranty requirements. Include five copies of full manufacturer’s published warranty for parts and components to be provided.

C. Provide warranty response information inside alarm system control panel.

D. Warranty shall allow the District to repair vandalized areas without voiding the total system warranty.

E. The system shall be warranted with the electric components covered for a period of one year full maintenance (parts, wiring, and labor) provided by Contractor or Manufacturer’s Authorized Representative. The remaining elements including wiring and zone controls shall be warranted for a period of two years from the date of acceptance by the Owner against defective materials, design, workmanship, and improper adjustment. Any defective materials shall be replaced at no expense (parts or labor) to the Owner providing they do not show abuse. The representative must be able to respond to warranty calls within 12 hours of notice, whether oral or written.

F. This Contractor shall assist in and install software updates on the Owner’s system throughout the warranty period (software and labor to install are to be included within this bid), if needed.

END OF SECTION

SECTION 28 31 00 – DIGITAL, ADDRESSABLE FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 GENERAL PROVISIONS

A. The general provisions of the contract, including general and supplementary conditions and general requirements, apply to the work specified in this section.

1.2 REFERENCE

A. Refer to section 26 00 00 for supplementary general conditions

1.3 SCOPE

A. The work included under this section of these specifications consists of furnishing all material and equipment and performing all labor and services necessary for the complete installation of the fire alarm system as shown on the drawings and hereinafter specified.

B. The usage of trade names and model numbers herein is for the purpose of establishing required levels of performance and quality. It shall be the responsibility of the contractor to fully substantiate, to the satisfaction of the architect/ engineer, that any proposed substitute products are the same as or better than those specified.

PART 2 - PRODUCTS

2.1 GENERAL

A. The contractor shall furnish, install and place in operating condition an electronically operated, closed circuit fire alarm system as described herein and shown on the plans. All units of the alarm system shall be listed by Underwriter's Laboratories for fire alarm use and the control panel shall bear the UL label. The system shall be installed in accordance with requirements of the National Electrical Code and in compliance with applicable provisions of Standards #72 published by the National Fire Protection Association.

B. The system shall be a non-coded fire alarm system, class B, with remote annunciation. Silent Knight fire alarm equipment has been used as the standard for design. Other acceptable manufacturers are Simplex, Honeywell and Notifier.

C. Flow alarm switches and control valve supervision (tamper) switches, if required, will be provided by the sprinkler contractor and wired to the fire alarm system by the electrical contractor. All switches to be UL listed.

D. Smoke dampers, if required, will be furnished and installed by the heating, ventilating and air conditioning contractor. The electrical contractor shall provide power circuits, wiring and remote mounted relays to activate the dampers upon detection of fire or fire potential as described on the plans. Any required connection to exhaust fans or air handling units shall be performed by the electrical contractor through relays controlled by the fire alarm control panel. Smoke dampers shall be powered by the same panel and circuit as their respective HVAC equipment. When equipment is running, dampers shall be normally open; when equipment is off, dampers shall be normally closed.

2.2 OPERATION

A. Actuation of any automatic initiation device such as smoke detectors, heat detectors, flow switch etc. Shall automatically initiate the following:

1. Sound all alarm horns.

2. Flash all visual fire indicators.

3. Release magnetic door holders.

4. Shut down all air handling units and exhaust fans throughout the facility.

5. Cause a red LED, identifying the active zone, to flash on the actuated zone module at the control panel.

6. Indicate the active zone on the building annunciator.

7. Shut all smoke dampers in ducts associated with the air handling units and exhaust fans which are shut down.

8. Activate the remote station connection module and transmit the alarm signal to a remote location (required leased phone line and any charges for connection to the remote receiving equipment shall be the responsibility of the building owner).

B. Activation of any manual initiating device (such as a pull station) shall automatically initiate the following:

1. Sound all alarm horns.

2. Flash all visual fire indicators.

3. Release magnetic door holders.

4. Cause the LCD display to identifying the active zone at the control panel.

5. Indicate the active zone on the building annunciator.

6. Activate the remote station connection module and transmit the alarm signal to a remote location (required leased phone line any charges for connection to the remote receiving equipment shall be the responsibility of the building owner).

C. Operation of the "alarm silence" switch shall be indicated by illumination of the "alarm silenced" display and an audible trouble signal.

D. Power failures, opens grounds, or any disarrangement of the system wiring or components shall be indicated by a visual and audible trouble signal. The audible trouble signal may be silenced but the trouble LED shall remain lit until the system has been returned to normal operating condition.

2.3 EQUIPMENT

A. Provide a Silent Knight fire alarm control panel/annunciator composed of but not limited to the following modules and components.

B. The alarm control module shall be provided which allows an alarm from one zone to be silenced but allows subsequent alarms from other zones to resound the alarm. The control module shall provide monitoring of all status changes within the system, system reset, signal silence, system trouble LED, alarm silenced LED, common system alarm LED, AC power on LED, alarm silenced LED, trouble silence and lamp test.

C. The central processing modules shall utilize analog communication techniques to integrate and control addressable devices. "T" taps along the analog cable are permitted in Class B configuration, since supervision is accomplished by polling each addressable device. The module shall be able to support a variety of addressable devices including: addressable photoelectric smoke detectors, addressable ionization smoke detectors, addressable duct detectors, addressable manual fire stations and addressable zone terminal. The central processing module shall poll devices three times before it will report an abnormal condition. Once the condition is reported the LCD display shall annunciate the devices alphanumeric identification and the type of condition (alarm, trouble or supervisory). If multiple alarms are present the device display shall scroll and the appropriate condition type will illuminate on each scroll. If the operator requires additional information, the cabinet door can be opened and the off-normal display can be activated. To activate the off-normal display, the operator pushes the test/display button. The off-normal display will then scroll in ascending order and provide the operator with detailed information for each point (alarm, trouble, test, communication, and disable and system ground fault. The sounder on the common control module will sound with any abnormal condition. The central processing module communicates with the common control module through the inter-module data cable. Communication is two way, alarm and trouble information is passed from the CPU to the common control module and system reset and alarm silence is passed from the common control module to the central processor module. The central processor module also has the ability to communicate with other system modules.

D. Communication: Field programming is possible by accessing the programming mode and selecting the proper sequence of push-buttons (passcode).

E. The control module is used for output control for signaling devices & for AHU shut-down.

F. The monitor module is used for monitoring dry contact devices such as sprinkler flow and tamper switches. Each module has an individual analog address for FACP communication.

G. Power supply units furnished shall each be capable of supplying regulated 24/12 volts dc (for circuitry), regulated 28.2 volts dc (to float the sealed backup battery pack). And unregulated 24 volts dc, rated at 10 amps, full load (for the signal circuits).

H. Control panel mounted batteries shall be furnished which are sufficient to provide power for the entire system, upon loss of normal 120 VAC power, for a period of twenty-four (24) hours with ten (10) minutes of alarm indication at the end of that period.

I. Furnish non-coded, single action stations as shown on the plans. Stations shall be red in color, and fabricated of high impact Lexan. The stations shall provide mechanical indications of operation until reset with the proper key.

J. Provide multi-tone devices with eight tone selectable output integral mounting plates as shown on the plans. Each unit shall be equipped with xenon strobe with an output of 15/75 candella-seconds and the word "fire" hot stamped in red on the vandal resistant polycarbonate lens. Each multi-tone device shall be constructed of high impact thermoplastic, finished in red, and have a minimum output rating of 96 dba at 10'.

K. Addressable Zone Module. This module is a Class B alarm receiving circuit that accommodates normally open contact devices. It also provides the interface for 2-wire 24vdc smoke detectors, manual fire alarm boxes, heat detectors, waterflow detectors and other fire alarm initiating devices. One or several such alarm initiating devices may be connected on the zone loop wires. It is recommended that no more than 20 smoke detectors be tied on any single module, and it is recommended that waterflow devices be separated from other alarm initiating devices. The module shall have a field selectable address which will allow the CPU to distinguish it from other addressable devices. A yellow LED shall be provided to indicate status changes. The module shall mount to a surface or semi-flush box. The box shall be a standard 4 11/16" square electrical box and a 4 11/16" square box extension ring. The zone loop wiring from the module to the initiating device shall be supervised by an end of line resistor installed at the last device on the loop.

L. Provide electromagnetic, wall mounted or floor mounted door holders/releases as indicated on the plans. The door holders/releases shall hold fire and smoke barrier doors open until released by manual or automatic fire alarm initiation. The device shall operate on 24vdc. The doors shall be able to be opened or closed manually at any time and must shut automatically in the event of a power failure. The holding power of the electromagnet shall be approximately thirty-five (35) pounds (15kg).

M. Digital alarm communicator transmitter: The digital alarm communicator transmitter/FACP shall be the Silent Knight #5204/5205. The DACT shall have the capability to supervise two telephone lines, seize the phone line and send the alarm signal on one or both lines without the addition of additional equipment. It shall sound a local trouble signal if the telephone service is interrupted for longer than 45 seconds and it shall transmit a signal indicating the loss of phone line service to the central station over the remaining phone line.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide all equipment, wiring, conduit and outlet boxes required for the erection of a complete and operating system in accordance with applicable local, state and national codes, the manufacturer's recommendations, these plans and specifications. Wiring shall be in accordance with the requirements of NFPA-70 Article 760 and NFPA Pamphlet #72 and be in a completely separate conduit system. Color code shall be used throughout.

B. The manufacturer's authorized representative shall provide supervision of final system panel connections, perform a complete functional test of the system and submit a written report to the contractor attending to the proper operation of the system.

C. All components, parts and assemblies supplied by the manufacturer shall be guaranteed against defects in materials and workmanship for a period of 12 months commencing upon start up and beneficial use, at which time the system is protecting property or occupants provided such

defects are not caused by misuse, abuse, neglect, unauthorized tampering or modification or acts of god. Warranty services shall be provided by a qualified factory trained representative of the equipment manufacturer during normal working hours, Monday thru Friday, excluding holidays. The representative shall be based in a fully staffed branch office located within a reasonable distance (50 miles) from the job site with an adequate supply of repair parts. The manufacturer shall not be liable for consequential damages. The manufacturer's statement of warranty shall be included in the submittals.

D. Upon satisfactory completion of system tests, the manufacturer's representative shall present for the owner's consideration a proposal to provide semi-annual inspection and tests of the system.

E. Upon completion of the installation, the electrical contractor shall provide to the architect, with a copy to the manufacturer's representative, a signed written statement attesting that all system equipment was installed in accordance with these specifications and in accordance with wiring diagrams, instructions and directions provided to the contractor by the manufacturer.

END OF SECTION

SECTION 28 52 34 – PUBLIC SAFETY EMERGENCY COMMUNICATION SYSTEM

PART 1 GENERAL

1.1 SUMMARY

A. System Devices.

B. Cabling.

C. Equipment Mounting.

D. System Testing.

1.2 RELATED DOCUMENTS

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

B. Related Sections

1. Division 28 Section “Fire Alarm and Smoke Detection System with Voice Evacuation.”

2. Division 28 Section “Common Work Results for Electronic Safety and Security” for project scope of work, contractor qualifications, definitions, substitutions, warranty, etc.

3. Division 26 Section “Raceway and Boxes for Electrical Systems.”

1.3 DEFINITIONS

A. DAS, Distributed Antenna System. B.

BDA, Bi-Directional Antenna.

C. Contractor, Integrator/Installer.

D. The system, “Public Safety Emergency Communication System” shall mean the same as Two-Way Radio Communication Enhancement System,” shall mean the same as “Public Safety Radio System,” and shall mean the same as “Emergency Responder Radio Coverage System.”

1.4 SCOPE OF WORK

A. Provide a “turn-key” Public Safety Communication System (i.e., Two-Way Radio Communications Enhancement System) for Public Safety 700 MHz and 800 MHz bands. System shall comply with NFPA 72, Chapter 24; NFPA 1221, and IFC 510 standards system. This specification is meant to provide the functional requirements of the system to be installed. Building is intended to be integrated with the fire alarm system for supervisory monitoring per NFPA.

B. Furnished equipment and components shall be of manufacturer's latest model.

C. Contractor shall be responsible for providing complete, functional systems, whether ancillary devices/components are included in this specification or not.

D. DAS/BDA system shall consist of one master fiber main unit with fiber connected DAS remote booster units.

E. DAS/BDA master to remote DAS booster units shall utilize single mode fiber to communicate back to master DAS/BDA.

F. System shall be monitored by the Fire Alarm Panel for antenna malfunction, signal booster failure, low battery capacity, loss of AC power, and failure of the battery charger.

1.5 CONTRACTOR QUALIFICATIONS

A. RELEVANT EXPERIENCE: Contractor must be able to prove, to the satisfaction of the Engineer, that they have significant experience in the installation of public safety communications systems in the local area. "Experienced" shall mean that the Contractor has personnel that have been trained and certified in the installation of similar systems in the local area and, upon request, shall provide evidence of same. Installation must include installation, termination, a knowledge of interconnect equipment, and a thorough knowledge of testing procedures.

B. TIME IN BUSINESS: Contractor must have been in business, under the current name and in the business of installing communications systems, continuously, for a period of at least three years prior to the date of this bid.

C. REQUIRED CERTIFICATION: The Contractor shall possess, at a minimum, a State of Florida low voltage and fire alarm licenses.

D. OFFICE LOCATION: The Contractor shall maintain a permanent office within 75 miles of the project site.

1.6 PRE-BID SUBSTITUTION REQUESTS AND SUBMITTALS

A. Per Division 28 Section, "Common Work Results for Electronic Safety and Security."

1.7 SUBMITTALS

A. Refer to Specification Section, "Basic Electronic Safety and Security Requirements.

B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Dimensioned Outline Drawings of the mounting of equipment for the system: Locate and describe mounting and anchorage provisions.

2. Provide dB calculations to establish signal requirements at indoor panel antennas. Indicate any modifications required to obtain specified coverage.

3. Provide exterior, dB signal strength at Yagi outdoor antenna.

1.8 PROJECT SITE CONDITIONS

A. Coordinate installation of outdoor antenna for access to the roof or exterior side wall so that the bracket and related fasteners are watertight.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Basis of Design—Honeywell/Notifier

B. Pre-approved Substitute—RSI

C. Other Substitutes—Submit a written substitution request, prior to bid, to the Engineer.

2.2 PUBLIC SAFETY COMMUNICATION SYSTEM

A. This Public Safety Communication System is intended to provide reliable, two-way radio coverage for first responders operating inside of building(s). The two-way radio communications enhancement system is intended to help ensure the safety of building occupants and first responders by extending the coverage of the public safety communications system to the interior areas of the building through the use of BDAs and a network of indoor antennas strategically located to provide reliable public safety radio system coverage throughout the interior of the building(s).

B. This Contractor shall pre-qualify this installation by the manufacturer's representative or an authorized distributor. This effort shall include a site survey and design document review of antenna placement to ensure appropriate signal coverage for the building(s). Based on the site survey, this Contractor shall provide the quantity of equipment for adequate building coverage. IB wave design may be required.estimated quantities and locations).

1. Amplifier: Provide 80 dB, wide band, bi-directional amplifier in NEMA 4 rated amplifier housing (signal boosters shall be a Class 8; FCC-type accepted and must operate in accordance with FCC rules). Amplifier shall provide remote monitoring system with Ethernet port, integrated 7-pin alarm, UPS port for external battery backup, energy-saving operation to allow bands to remain dormant when not in use, automatic gain control, A/C 110V or D/C 16-24V power option, and independently adjustable frequency attenuation for uplink and downlink (reduce gain in -1 dBm increments). Locate amplifiers as indicated on drawings. Acceptable Manufacturer: Notifier-Enterprise Fiber BDA/DAS Master with Enterprise Fiber DAS Remote; quantities as indicated on drawings.

a. Building shall be identified by a sign (located on or near the Fire Alarm Control Panel) stating: "This building is equipped with an Emergency Responder Radio Coverage System." The fire protection and related equipment shall be identified by a red sign with minimum one-inch high, white letters.

2. Annunciator: Provide annunciator system, with FORM-C relay outputs, to main fire alarm system. The system shall accept relay signaling indicating the following alarms: loss of AC power, amplifier problems, antenna problems, battery capacity below 30%, battery charger fail, communications faults, and summary system alarm. Acceptable Manufacturer: Notifier Remote/External Annunciator. Provide with required contacts, bias-T, and 50 ohm terminator in required quantities.

3. Battery Back-Up: Provide battery backup with at least 12 hours of 100% system operation capacity and arranged in accordance with NFPA 1221 10.6.10. Provide enclosure and batteries compliant with system. Model: Notifier BBU.

4. Outdoor Antenna: Provide outdoor, Yagi directional antenna, quantities and locations as indicated on the drawings. Antenna shall have a two-foot, BDA-400 cable pigtail. Provide Commscope AL4RPV-50 cable to signal boosters. Provide mast pole (two inch RGC) with weatherhead for mounting antenna (shall meet requirements of Florida Building Code and ANSI/TIA-222-G). The shield of the coaxial cable shall be suitably connected to the building's electrical ground system at the base of the antenna mast and at a coaxial lightning protector. Mount per manufacturer's recommendations. Acceptable Manufacturer: Honeywell BDA-YDA763869-14-1.

5. Indoor Antennas: Provide indoor, omni-directional antennas, quantities and locations as indicated on the drawings. The maximum radio signal propagation delay introduced by the in-building coverage solution shall not exceed eight microseconds. Acceptable Manufacturer: Honeywell BDA- OIA-698869-3-1. quantities as required, for connection between devices. Cable between the amplifier and each antenna shall be homerun in rigid conduit. For runs greater than distance allowed by BDA-400 series, provide BDA-600 series coaxial cable with connector for minimizing signal loss.

D. Additional Items

1. Provide necessary adapters and splitters (BDA-PSx-L2), directional couplers (BDA-DCxx-L2), and lightning surge protectors (BDA-P8AX09-6G-N/FF) with dedicated ground rod and #8 ground cable or heavier.

2. At antenna, allow length for drip loop and weatherproof all connectors (i.e., foam tape, vinyl tape, and UV protective liquid sealer over outer tape).

   a. Per the manufacturer's installation requirements: Provide, from the roof-mounted antenna, a 75 foot low loss cable into the building; then, connect a lightning surge suppressor; then, provide a two foot cable to the amplifier. From the amplifier, provide cable (in conduit) and connectors/tappers to the in-building antennas. Locate each in-building antenna on the ceiling, face down, in the locations specified on the design.

3. Provide dedicated circuit (home run) from an emergency power source for all active components. Provide NEMA twist-lock electrical plug and receptacle set to connect the active components of the DAS to the AC power.

E. Installation shall maintain minimum required separation distance between the inside and outside antennas.

2.3 PRE- AND POST-TESTING, DESIGN, AND INSTALLATION

A. This Contractor shall pre-qualify this installation with the manufacturer's representative or an authorized distributor. The pre-qualify field signal testing shall be submitted with signal strength test in compliance with regulations for approval prior to system devices and equipment installation. If deemed necessary to install the system, this effort shall include a site survey and design document review of antenna placement to ensure appropriate signal coverage for the building(s). Based on the site survey, this Contractor shall design and provide the quantity of equipment for adequate building coverage. IB wave design may be required.

1. Contractor shall not test until all permanent doors and windows are installed.

2. Pre- and post- testing and installation shall be completed by a FCC license holder and supervised by a Contractor-provided, licensed, Florida Professional Engineer (i.e., Engineer-of-Record).

3. Testing results shall be recorded and shall be certified by the Engineer-of- Record. Results shall be submitted to the Owner/AHJ, per requirements.

A. This Contractor shall provide an annual service contract quote, to the Owner, for the system specified in this section. The quote shall be broken down annually for a five year period and contain a description of services to be provided along with hourly rates by category.

1. The Contractor shall be a qualified firm having the knowledge of RF installation with training and experience with two-way, enhanced, radio communication systems to insure that the originally-installed system is still in compliance, to conduct annual preventive maintenance, and to assist with annual testing. Documentation of training and experience may be requested.

B. Annual testing of two-way radio communications enhancement systems shall be performed in accordance with the requirements of NFPA 72-2013 (or most current version).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions. This effort shall require a "soft install" to verify adequate coverage before permanently mounting the equipment.

3.2 TESTING

A. Once construction is complete and prior to occupancy, this Contractor shall submit all test documentation and a signed statement from the manufacturer or manufacturer's representative of radio coverage compliance stating that the Public Safety radio system coverage reliability within the occupancy was tested in accordance with the provisions set forth in NFPA 72-2013 14.4.12 (1-36 and A14.4.12, and meets the requirements set forth in NFPA 72-2013 24.5.2.2, 24.5.2.3.

1. Statement of Radio Coverage Compliance shall include the following:

   a. Project Name, Project Address, Test Date and Time.

   b. Certifying Statement: "The occupancy identified above was tested for the County's 700/800 public safety radio systems radio RF coverage levels. To the best of my knowledge, information, and belief; the radio RF coverage levels for this occupancy meet or exceed those required."

   c. Signature of Manufacturer or Manufacturer's Representative.

system for the first time. The two-way radio communication enhancement system shall not be activated for optimization and testing without prior Owner approval. The Owner's staff may, at their sole discretion, require that an initial desense test be conducted prior to initial activation to ensure that no harmful interference occurs to the Owner's radio system. This Contractor shall conduct system activation and optimization efforts.

1. System Isolation: Once the system is deployed and before turning up the active components, this Contractor shall verify that the isolation between the donor and the in-door antenna systems is at least 15 dB greater than the gain of the DAS.

2. Downlink Signal Strength Measurements: Provide a minimum RF signal level of -95 dBm and 3.4 Delivered Audio Quality throughout the entire facility. With the purpose of accounting for the signal fading, two readings of signal strength should be taken per tile within intervals of 20 seconds each. The first, 20 second reading shall be performed to determine the maximum peak hold of the test channel. The second reading shall be performed to determine the Two-Way Radio Communications Enhancement System's requirement of minimum peak hold of the test channel. Then, the average of both readings per tile should be calculated.

3. Uplink: Calculations of the link budget may be used to estimate the necessary gain in the uplink to produce a signal strength of -95 dBm at the donor site. However, as a rule of thumb it is advisable to set up the uplink gain of the DAS at values ranging between 10-20 dB less than the downlink gain, depending on the distance to the donor site. It is advisable that the test procedures be conducted considering the size of the building and the classification of the area under test (general structure or critical area).

C. Defining the test locations as per the size of the building or as recommended by the manufacturer.

1. For small buildings, define five tests locations: one at each corner and one in the center of the building. No "Fail" conditions should be allowed. Therefore 100% of the floor area shall show -95 dBm or better signal strength.

2. For medium buildings, test along the core and at each corner of the building and; then, at a maximum of 25 foot intervals in-between the previously defined points whenever possible, in a grid pattern, at each floor.

3. For large buildings, test along the core and at each corner of the building and; then, at a maximum of 50 foot intervals in-between the previously defined points whenever possible, in a grid pattern, at each floor.

4. For medium and large buildings, 95% and 99% of the readings should show -

95 dBm or better for General Structure and Critical Areas, respectively per floor.

5. In all cases, the signal strength measurements should be reflected on a building floor plan to show "Before and After" measurements.

D. The Contractor shall coordinate scheduling of system testing with the fire alarm contractor at the site. Testing shall include this System's Contractor's staff, the fire alarm contractor's staff, and the Owner's AHJ.

E. The test participants shall conduct NFPA72-2013 compliant coverage testing and supervisory notification/alarm panel testing on the scheduled date.

F. This Contractor shall submit the test documentation for Owner review and comments. Owner shall sign off to the Fire Marshal.

3.3 DEMONSTRATION

A. The Contractor shall demonstrate system performance. System demonstration shall be scheduled at the convenience of the Owner's personnel and after the Contractor has submitted all test results and with no less than 48 hours' notice. The test shall be performed in the presence of the Owner/Engineer. The Contractor shall furnish all instrumentation and personnel for the demonstration.

3.4 SYSTEM DOCUMENTATION

A. Post the statement of radio coverage compliance at the fire alarm control panel. An additional copy shall be submitted to the Owner's representative.

B. Provide three hard copies and a CD-ROM or USB drive in AutoCAD 2018 or higher (dwg and pdf) of system as-built drawings to include the following information:

1. Block diagram and riser diagram of the entire system.

2. Exact routing of installed cabling.

C. Provide two sets of operating instructions and maintenance manuals (include troubleshooting procedures).

3.5 WARRANTY

A. Refer to Specification Section Common Work Results for Electronic Safety and Security.

END OF SECTION

SECTION 311000
SITE CLEARING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Remove surface debris, impacting site improvements.

B. Clear site of plant life and grass, as required to allow for site improvement.

C. Remove trees and shrubs, as directed by Site Engineer, Landscape Architect, Owner and authority having jurisdiction.

D. Coordinate with Site Engineers instructions and bring any conflicts to the attention of Site Engineer and Architect.

1.02 REGULATORY REQUIREMENTS

A. Conform to applicable codes for disposal of debris, erosion and environmental requirements, protection of remaining vegetation, etc.

B. Coordinate clearing work with utility companies.

PART 2 PRODUCTS

2.01 MATERIALS

A. Herbicide: comply with all applicable codes, laws and ordinances if used for vegetation control.

PART 3 EXECUTION

3.01 PREPARATION

A. Bidders expected to examine site and determine character of the materials to be encountered.

B. Verify existing plant life and features designated to remain are tagged or identified.

3.02 PROTECTION

A. Protect utilities that remain, from damage.

B. Protect trees, plant growth, and features designated to remain as final landscaping.

C. Protect bench marks and any designated existing structures from damage or displacement.

D. Contractor shall take every precaution and temporary measures necessary to prevent damage from erosion of freshly graded areas, any settlement or washing occurring prior to acceptance of work shall be repaired and grades re-established to required elevations and slopes at no additional cost to the Owner. This applies to damage to the newly graded areas within site limits, offsite related utility construction and damage to adjacent properties by eroded material.

3.03 CLEARING

A. Clear areas required for access to site and execution of Work.

3.04 REMOVAL

A. Remove debris, rock, and extracted plant life from site.

B. Any existing rubbish, trash and junk shall be removed and the site left clear of such material.

C. All abandoned utilities within site area encountered during site grading shall be completely removed to a point 10 feet beyond new building lines. Ends of abandoned utilities shall be capped or plugged as approved by utility companies or authority having jurisdiction. All utilities requiring shutting off or cutting off at mains shall be accomplished per the utilities company requirements. Contractor shall coordinate this removal with local utility companies. Care shall be exercised when clearing areas where existing utilities to remain in service are located so no damage to existing utilities occurs.

D. Remove and dispose of all stumps, all matted roots and all roots in all construction areas.

E. Area within 5 feet beyond building limits and parking lot area shall be stripped at two inches minimum to remove all soil contain vegetated material. This material shall be disposed of as waste.

F. When possible, topsoil shall be excavated to a depth of 4 inches, and carefully removed to storage piles. Topsoil, when stored, shall be kept separate from other excavated materials and shall be free of roots, stones, and other undesirable material.

END OF SECTION 311000

SECTION 312000

EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs on grade.
2. Excavating and backfilling for buildings and structures.
3. Drainage course for slabs on grade.
4. Subbase course for concrete walks and pavements.
5. Subbase and base course for asphalt paving.

1.2 DEFINITIONS

A. Backfill: soil material used to fill an excavation.

1. Initial Backfill: backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
2. Final Backfill: backfill placed over initial backfill to fill a trench.

B. Base Course: course placed between subbase course and hot mix asphalt paving.

C. Bedding Course: course placed over excavated subgrade in a trench before laying pipe.

D. Borrow Soil: satisfactory soil imported from off-site for use as fill or backfill.

E. Drainage Course: course supporting slab on grade that minimizes upward capillary flow of pore water.

F. Excavation: removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Architect. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be without additional compensation.

G. Fill: soil materials used to raise existing grades.

H. Structures: buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

I. Subbase Course: course placed between subgrade and base course for hot mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot mix asphalt walk.

J. Subgrade: surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

K. Utilities: on-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.3 PROJECT CONDITIONS

A. Existing Utilities: do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Architect and then only after arranging to provide temporary utility services according to requirements indicated.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Satisfactory Soils: ASTM D2487 Soil Classification Groups GW, GP, GM, SW, SP, and SM or a combination of these groups; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.

C. Unsatisfactory Soils: soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487 or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2% of optimum moisture content at time of compaction.

D. Subbase Material: naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90% passing a 1½ inch sieve and not more than 12% passing No. 200 sieve.

E. Base Course: naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95% passing a 1½ inch (37.5-mm) sieve and not more than 8% passing No. 200 sieve.

F. Engineered Fill: naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90% passing a 1½ inch (37.5 mm) sieve and not more than 12% passing No. 200 sieve.

G. Bedding Course: naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100% passing a 1 inch (25.4 mm) sieve and not more than 8% passing No. 200 sieve.

H. Drainage Course: narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D448; coarse-aggregate grading Size 57; with 100% passing a 1½ inch (37.5 mm) sieve and 0% to 5% passing No. 8 sieve.

2.2 ACCESSORIES

A. Warning Tape: acid resistant and alkali resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface per Division 2 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, per Division 2 Section "Site Clearing," during earthwork operations.

3.2 EXCAVATION

A. Unclassified Excavation: excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in Contract Sum or Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

3.3 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of +/- 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, installing services and other construction, and inspections.

1. Excavations for Footings and Foundations: do not disturb excavation bottom. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.4 EXCAVATION FOR WALKS AND PAVEMENTS

A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.5 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated. Note: clearance as indicated.

C. Trench Bottoms: excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material, 4 inches deeper elsewhere, to allow for bedding course.

3.6 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Architect, without additional compensation.

3.7 UNAUTHORIZED EXCAVATION

A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28 calendar day compressive strength of 2500 psi, may be used when approved by Architect.

1. Fill unauthorized excavations under other construction or utility pipe as directed by Architect.

3.8 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.9 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete per Division 3 Section 033000 "Cast in Place Concrete."

D. Provide 4 inch thick, concrete base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in 4 inches minimum of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of subbase material, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches (300 mm) below finished grade, except 6 inches (150 mm) below subgrade under pavements and slabs.

3.10 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers under required elevations as follows:

1. Grass and planted areas, use satisfactory soil material.
2. Walks and pavements, use satisfactory soil material.
3. Steps and ramps, use engineered fill.
4. Building slabs, use engineered fill.

3.11 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2% of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2% and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95%.
2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92%.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 85%.
4. Utility trenches, compact each layer of initial and final backfill soil material at 85%.

3.13 GRADING

A. General: uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: +/- 1 inch.
2. Walks: +/- 1 inch.
3. Pavements: +/- ½ inch.

C. Grading inside Building Lines: finish subgrade to a tolerance of ½ inch when tested with a 10 foot straightedge.

3.14 SUBBASE AND BASE COURSES

A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Shape subbase and base course to required crown elevations and cross-slope grades.
2. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95% of maximum dry unit weight according to ASTM D698.

3.15 DRAINAGE COURSE

A. Place drainage course on subgrades free of mud, frost, snow, or ice.

B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
2. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95% of maximum dry unit weight according to ASTM D698.

3.16 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification & approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Architect.

D. Testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2922, and ASTM D2937, as applicable.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.17 PROTECTION

A. Protecting Graded Areas: protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.18 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 313116

TERMITE CONTROL

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. Soil treatment.

1.3 PREINSTALLATION MEETINGS

A. Pre-installation Conference: conduct conference at Project site.

1.4 ACTION SUBMITTALS

A. Product Data: each product type, include:

1. Construction details, material descriptions, dimensions of individual components, and profiles for termite control products.
2. EPA-Registered Label for termiticide products.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: qualified Installer.

B. Product Certificates: each type of termite control product.

C. Soil Treatment Application Report: after termiticide application completed, submit report for Owner's records including:

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.

D. Bait-Station System Installation Report: after bait-station system installation completed, submit report for Owner's records including:

1. Location of areas and sites conducive to termite feeding and activity.
2. Plan drawing showing number and locations of bait stations.
3. Dated report for each monitoring and inspection occurrence, indicating level of termite activity, procedure, and treatment applied before time of Substantial Completion.
4. Termiticide brand name and manufacturer.
5. Quantities of termiticide used.
6. Schedule of inspections for one year from date of Substantial Completion.

E. Sample Warranties: special warranties.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: licensed specialist who according to regulations of authorities having jurisdiction to apply termite control treatment and products where Project is located and who employs workers trained and approved by manufacturer to install manufacturer products.

1.7 FIELD CONDITIONS

A. Soil Treatment:

1. Environmental Limitations: ensure penetration does not treat water saturated or frozen soil.

2. Do not treat soil while precipitation is occurring.

3. Comply with EPA-Registered Label requirements and authorities having jurisdiction.
4. Related Work: coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

1.8 WARRANTY

A. Soil Treatment Special Warranty: manufacturer standard form, signed by Applicator and Contractor, certifying 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 at no cost to Owner.

1. Warranty Period: 5-years from Substantial Completion date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: obtain termite control products from single source and single manufacturer.

2.2 SOIL TREATMENT

A. Termiticide: EPA-Registered termiticide acceptable to authorities having jurisdiction, in an aqueous solution formulated to prevent termite infestation.

1. Manufacturers: subject to compliance with requirements, provide products by:

a. BASF Corporation.
b. Bayer Environmental Science.
c. Ensystex, Inc.
d. Syngenta.

2. Service Life of Treatment: soil treatment termiticide that is effective for five years minimum against infestation of subterranean termites.

2.3 EXAMINATION

A. Examine substrates, areas, and conditions, with Applicator present, complying with moisture content requirements of soil per termiticide label, earthwork interfaces, slab/foundation work, landscaping, utility installation, and other conditions affecting termite control performance.

B. Proceed with application only after unsatisfactory conditions have been corrected.

2.4 PREPARATION

A. General: prepare work areas according to authorities having jurisdiction requirements and per manufacturer written instructions before beginning application/installation of termite control treatment(s). Remove extraneous sources of wood cellulose and other edible materials, (wood debris, tree stumps, 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/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, according to requirements of authorities having jurisdiction.

2.5 APPLYING SOIL TREATMENT

A. Application: mix soil treatment termiticide solution to uniform consistency. Apply treatment at product's EPA-Registered Label volume and rate for maximum specified concentration of termiticide so a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction.

1. Slabs-on-Grade: underground - 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: soil adjacent to and along 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.
3. Crawlspaces: soil under and adjacent to foundations. Treat adjacent areas, including around entrance platform, porches, and equipment bases. Apply overall treatment only where attached concrete platform and porches are on fill or ground.
4. Masonry: treat voids.
5. Penetrations: expansion joints, control joints, and areas where slabs and below-grade walls will be penetrated.

B. Post warning signs in areas of application.

C. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

2.6 PROTECTION

A. After application avoid treated soil disturbance. Keep off treated areas until completely dry.

B. Protect termiticide solution dispersed in treated soils and fills from being diluted by exposure to water spillage or weather until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.

2.7 MAINTENANCE SERVICE

A. Maintenance Service: beginning at Substantial Completion, maintenance service shall include 12 months full maintenance by skilled employees of termite-control-treatment Installer. Include quarterly maintenance as required for proper performance according to the product's EPA-Registered Label and manufacturer's written instructions. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

B. Continuing Maintenance Proposal: provide from termite-control-treatment Installer to Owner, in the form of a standard yearly maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

END OF SECTION 313116

SECTION 323119 - DECORATIVE METAL FENCES AND GATES

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. Decorative aluminum fences.
2. Swing gates.

B. Related Requirements:
1. Section 281500 "Access Control Hardware Devices" for access control devices installed at gates and provided as part of a security system.
2. Division 26 Sections for electrical service and connections for system disconnect switches and powered devices including, but not limited to, motor operators, controls, and limit switches.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For fencing and gates.

1. Include plans, elevations, sections, gate locations, post spacing, and mounting attachment details, and grounding details.
2. Wiring Diagrams: Include diagrams for power, signal, and control wiring.

C. Samples: For each fence material and for each color specified.

1. Provide Samples 12 inches (300 mm) in length for linear materials.

1.4 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.

1. Include 10-foot (3-m) length of fence complying with requirements.
2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Wind Loading:

1. Fence Height: 0 to 15 feet (0 to 4.57 m).
2. Wind Exposure Category: Per Structural Drawings.
3. Design Wind Speed: Per Structural Drawings.
4. Design Wind Pressure: Per Structural Drawings.

B. Lightning-Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

2.2 DECORATIVE ALUMINUM FENCES

A. Decorative Aluminum Fences: Fences made from aluminum extrusions.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

a. Alumi-Guard; Barrette Outdoor Living, Inc.
b. Elite Fence Products, Inc.
c. Ideal Aluminum Products.
d. Royal Aluminum and Steel, Inc.
e. Superior Aluminum Products, Inc.

B. Posts: Square extruded tubes.

1. Line Posts: 2-1/2 by 2-1/2 inches (64 by 64 mm) with 0.100-inch (2.54-mm) wall thickness.
2. End and Corner Posts: 2-1/2 by 2-1/2 inches (64 by 64 mm) with 0.100-inch (2.54-mm) wall thickness.
3. Swing Gate Posts: 3 by 3 inches (76 by 76 mm) with 0.125-inch (3.18-mm) wall thickness.

C. Post Caps: Aluminum castings that project at least 1/4 inch (6 mm) beyond posts.

D. Rails: Extruded-aluminum channels, 1-1/4 by 1-1/4 inches (32 by 32 mm), with 0.078-inch- (1.98-mm-) thick sidewalls and 0.062-inch- (1.57-mm-) thick top.

E. Pickets: Extruded-aluminum tubes, 3/4 inch (19 mm) square, with 0.050-inch (1.27-mm) wall thickness.

1. Extend pickets beyond top rail as indicated and press flat and trim to produce spear point shape.
2. Picket Spacing: 4 inches (101.6 mm) clear, maximum.

F. Fasteners: Manufacturer's standard concealed fastening system.

G. Fabrication: Assemble fences into sections by welding pickets to rails.

1. Fabricate sections with clips welded to rails for field fastening to posts.
2. Drill clips for fasteners before finishing.

H. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

I. Finish: Baked enamel or powder coating.

2.3 SWING GATES

A. Gate Configuration: As indicated.

B. Gate Frame Height: 72 inches (1830 mm).

C. Gate Opening Width: As indicated.

D. Aluminum Frames and Bracing: Fabricate members from square extruded-aluminum tubes 2-1/2 by 2-1/2 inches (64 by 64 mm) with 0.125-inch (3.18-mm) wall thickness.

E. Frame Corner Construction: Welded.

F. Additional Rails: Provide as indicated, complying with requirements for fence rails.

G. Infill: Comply with requirements for adjacent fence.

H. Picket Size, Configuration, and Spacing: Comply with requirements for adjacent fence.

I. Spring Hinges: BHMA A156.17, Grade 1, suitable for exterior use.

1. Function: 320 - Gate spring pivot hinge. Adjustable tension.
2. Material: Malleable iron; galvanized.

J. Hinges: BHMA A156.1, Grade 1, suitable for exterior use.

1. Function: 39 - Full surface, triple weight, antifriction bearing.
2. Material: Wrought steel, forged steel, cast steel, or malleable iron; galvanized.

K. Electric Strikes: BHMA A156.31, Grade 1, of configuration required for use with lock specified, fail-safe, and suitable for exterior use.

1. Mounting Plate: Configuration necessary for mounting electric strikes. Fabricate from 1/8-inch- (3.2-mm-) thick, aluminum plate.
2. Mounting: Mortise into post.

L. Exit Hardware: BHMA A156.3, Grade 1, Type 1 (rim exit device), with push pad actuating bar, suitable for exterior use.

1. Function: 08 - Entrance by lever. Key locks or unlocks lever.
2. Mounting Channel: Bent-plate channel formed from 1/8-inch- (3.2-mm-) thick, aluminum plate. Channel spans gate frame. Exit device is mounted on channel web, recessed between flanges, with flanges extending 1/8 inch (3.2 mm) beyond push pad surface.

M. Finish exposed welds to comply with NOMMA Guideline 1, Finish #2 - completely sanded joint, some undercutting and pinholes okay.

N. Galvanizing: For items other than hardware that are indicated to be galvanized, hot-dip galvanize to comply with ASTM A123/A123M. For hardware items, hot-dip galvanize to comply with ASTM A153/A153M.

O. Metallic-Coated-Steel Finish: High-performance coating.

P. Steel Finish: High-performance coating.

Q. Aluminum Finish: Baked enamel or powder coating.

2.4 ALUMINUM

A. Aluminum, General: Provide alloys and tempers with not less than the strength and durability properties of alloy and temper designated in paragraphs below for each aluminum form required.

B. Extrusions: ASTM B221 (ASTM B221M), Alloy 6063-T5.

C. Tubing: ASTM B429/B429M, Alloy 6063-T6.

D. Plate and Sheet: ASTM B209 (ASTM B209M), Alloy 6061-T6.

E. Die and Hand Forgings: ASTM B247 (ASTM B247M), Alloy 6061-T6.

F. Castings: ASTM B26/B26M, Alloy A356.0-T6.

2.5 MISCELLANEOUS MATERIALS

A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.

1. For aluminum, provide type and alloy as recommended by producer of metal to be welded and as required for strength and compatibility in fabricated items.

B. Concrete: Normal-weight, air-entrained, ready-mix concrete complying with requirements in Section 033000 "Cast-in-Place Concrete" with a minimum 28-day compressive strength of 3000 psi (20 MPa), 3-inch (75-mm) slump, and 1-inch (25-mm) maximum aggregate size or dry, packaged, normal-weight concrete mix complying with ASTM C387/C387M mixed with potable water according to manufacturer's written instructions.

C. Nonshrink Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M and specifically recommended by manufacturer for exterior applications.

2.6 GROUNDING MATERIALS

A. Comply with requirements of Section 260526 "Grounding and Bonding for Electrical Systems." and at a minimum as defined below.

B. Grounding Conductors: Size as indicated on Drawings. Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-5/8 inch (41 mm) wide and 1/16 inch (1.6 mm) thick, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Grounding Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic-welded type.
2. Grounding Rods: Copper-clad steel.

a. Size: 5/8 by 96 inches (16 by 2440 mm).

2.7 ALUMINUM FINISHES

A. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 2 mils (0.05 mm). Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.

1. Color and Gloss: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, construction layout, and other conditions affecting performance of the Work.

B. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

1. Construction layout and field engineering are specified in Section 017300 "Execution."

3.3 DECORATIVE FENCE INSTALLATION

A. Install fences according to manufacturer's written instructions.

B. Post Excavation: Drill or hand-excavate holes for posts in firm, undisturbed soil. Excavate holes to a diameter of not less than 4 times post size and a depth of not less than 24 inches (600 mm) plus 3 inches (75 mm) for each foot (300 mm) or fraction of a foot (300 mm) that fence height exceeds 4 feet (1.2 m).

C. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts and sleeves and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
    a. Concealed Concrete: Top 2 inches (51 mm) below gradeto allow covering with surface material. Slope top surface of concrete to drain water away from post.

3. Posts Set in Concrete: Extend post to within 6 inches (150 mm) of specified excavation depth, but not closer than 3 inches (75 mm) to bottom of concrete.
4. Posts Set into Concrete in Sleeves: Use galvanized-steel pipe sleeves with inside diameter at least 3/4 inch (20 mm) larger than outside diagonal dimension of post, preset and anchored into concrete for installing posts.

    a. Extend posts at least 5 inches (125 mm) into sleeve.
    b. After posts have been inserted in sleeves, fill annular space between post and sleeve with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions; shape and smooth to shed water. Finish and slope top surface of grout to drain water away from post.

5. Posts Set into Voids in Concrete: Form or core drill holes not less than 3/4 inch (20 mm) larger than outside diagonal dimension of post.

    a. Extend posts at least 5 inches (125 mm) into concrete.
    b. Clean holes of loose material, insert posts, and fill annular space between post and concrete with nonshrink grout, mixed and placed to comply with grout manufacturer's written instructions. Finish and slope top surface of grout to drain water away from post.
6. Space posts uniformly at 6 feet (1.83 m) o.c.

3.4 GATE INSTALLATION

A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.5 GROUNDING AND BONDING

A. Comply with Section 260526 "Grounding and Bonding for Electrical Systems." and at a minimum as defined below.

B. Fence Grounding: Install at maximum intervals of 1500 feet (450 m) except as follows:

1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 750 feet (225 m).

a. Gates and Other Fence Openings: Ground fence on each side of opening.

1) Bond metal gates to gate posts.
2) Bond across openings, with and without gates, except at openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury it at least 18 inches (460 mm) below finished grade.

C. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.

D. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2 unless otherwise indicated.

E. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

F. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.

G. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

H. Bonding to Lightning-Protection System: If fence terminates at lightning-protected building or structure, ground the fence and bond the fence grounding conductor to lightning-protection down conductor or lightning-protection grounding conductor, complying with NFPA 780.

3.6 FIELD QUALITY CONTROL

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

1. Grounding-Resistance Tests: Subject completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Architect promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
3. Report: Prepare test reports of grounding resistance at each test location certified by a testing agency. Include observations of weather and other phenomena that may affect test results.

3.7 ADJUSTING

A. Gates: Adjust gates to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.

3.8 DEMONSTRATION

A. Train Owner's personnel to adjust, operate, and maintain gates.

END OF SECTION 323119

SECTION 328400
PLANTING IRRIGATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, apply to this Section.

1.2 SCOPE:

A. Work covered under this section includes supplying and installing all materials and equipment required for a complete operational automatic irrigation system.

B. Information contained herein indicates materials types, quality of workmanship, and manner of protection, which shall be complied with in effecting the irrigation system.

C. Completion of work shall mean full and exact compliance and conformity with all the provisions of Contract Documents.

1.3 SUBMITTALS:

A. Provide manufacturer product data sheets for each specified item. Provide shop drawings for review/approval of all proposal installation providing 100% coverage meeting the specifications.

B. Samples specifically required for non-specified manufacturer products submitted as a substitution.

C. Product certificates shall be required by manufacturers for products not specifically named on plans or in specifications certifying that each product furnished meets this specification.

1.4 RELATED WORK:

A. Contractor shall fully acquaint themselves with related planting, paving, site, and utilities work described elsewhere in Contract Documents to preclude any misunderstandings and facilitate a trouble-free irrigation system.

B. Electrical service to controller shall be provided by electrical subcontractor and in compliance with NEC requirements.

1.5 QUALITY ASSURANCE:

A. Landscape irrigation system installation shall only be performed by a firm having five continuous years minimum full time experience with similar projects installing underground landscape irrigation systems. Crews shall be directed by a foreman thoroughly familiar with type of materials being installed and manufacturer's recommended installation methods.

B. Manufacturer Qualifications: employ only manufacturers with at least five continuous years of experience making the specified materials as a current catalog and regular production item.

1.6 FIELD MODIFICATIONS:

A. Slight modifications to reviewed shop drawings may be made only as necessary to meet field conditions and only as acceptable to Architect. Piping to be routed avoiding conflict with specimen plants and adjust as necessary to landscape construction.

B. Design Criteria: at any stage of the operations, the Architect shall have the right to reject any and all work and materials, which, in Architect's opinion, do not comply with requirements of Contract Documents. Such rejected work or material shall be immediately removed from site.

1.7 REQUIREMENTS OF REGULATORY AGENCIES:

A. Work shall comply with applicable codes, ordinances and regulations of the Florida Building Code sixth edition and authorities having jurisdiction. If re-use/grey water utilized as irrigation water source said water shall meet D.O.H. and D.E.P. water quality standards as well as other applicable F.A.C. rules pertaining to signage provision, hose connections, watering times and low trajectory nozzles use around public eating and drinking facilities. Irrigation system design shall allow for future connection to re-use/grey water system, all piping, nozzles and any other irrigation equipment shall be selected allowing for a future re-use/grey water supply.

1.8 AS-BUILT DRAWING/CLOSEOUT SUBMITTALS:

A. After completion of piping installation, Contractor shall furnish the Architect with a reproducible "AS-BUILT" drawing showing all sprinkler heads, valves, and pipelines to reasonable scale, and provide two dimensions minimum taken from fixed obvious objects to connection point, directional turns of all mainline piping, each automatic and manual control valve, and quick coupling valve. Plans shall be provided on or before date of work review for provisional acceptance.

1. Contractor shall furnish a drawing showing graphic representation of sprinkler zones and recommendations for controller time settings for each valve.

B. Instruction sheets and parts lists covering all operating equipment shall be bound into folders and furnished to Architect.

C. Backflow preventer test report (passing) shall be submitted to Owner.

1.9 UTILITIES:

A. Prior to excavation, verify in the field the location and depth of all new and existing utilities and other work that may be damaged by Contractor construction.

1.10 GUARANTEES:

A. Contractor shall furnish (in writing) warranties certifying the quality and workmanship of all materials and installation furnished in accordance with the Contract Documents, Project Manual's Division One and in accordance with the original manufacturer's warranties.

1. Contractor is responsible for the fulfillment of all manufacturers' warranties.

2. Contractor shall guarantee materials and workmanship for a period of one year from date of Substantial Completion by Owner or as stated in Project Manual's Division One whichever is greater.

B. Contractor is responsible for protection of the work until the date of Final Completion.

C. Contractor shall provide Owner with a written guarantee.

PART 2 – PRODUCTS

2.1 MATERIALS:

A. Materials and equipment shall be new and operate at the manufacturer's published capacities.

2.2 PIPE:

A. Comply with the following or as otherwise indicated on the plan: All PVC mainline pipe shall be CL 200 ASTM D-2241 or Schedule 40 ASTM D-1785, all PVC lateral pipe shall be CL 200 ASTM D-2241 or Schedule 40 ASTM D-1785 Polyvinyl Chloride, Type 1, NSF approved.

B. All crossings (sleeves) under paved areas shall be Schedule 40 PVC, ASTM D-1785.

C. For PVC plastic pipe, ASTM D-2466 socket fittings with ASTM A-2564 solvent cement.

2.3 CONTROLLER:

A. Contractor shall furnish Rain Bird ESP-LXME electric controller, Hunter I-Core.

1. Controller(s) shall be installed in area(s) approved by Owner.

2. All electrical connections are the Contractor's responsibility.

3. A typewritten plastic laminated legend shall be attached inside controller(s) door stating the areas covered by each remote control valve.

2.4 SPRINKLER HEADS:

A. Sprinkler heads shall be of the type shown or scheduled on the drawings. They shall be manufactured by Rainbird or Hunter.

2.5 RISERS AND SWING JOINTS:

A. Risers and swing joints shall be detailed on the drawings.

2.6 FLEX CONNECTIONS:

A. Connections shall be PVC flex pipe with glued fittings.

2.7 GATE VALVES:

A. Shall be all brass body.

2.8 REMOTE CONTROL VALVES:

A. Valves shall be manufactured by Rainbird or Hunter. Use Teflon tape only on threaded connections.

2.9 VALVE BOXES:

A. Valve boxes (bodies and covers) shall be Armor 11 inches by 17 inches rectangular box with purple reuse cover installed flush with finish grade.

2.10 CONTROL WIRING:

A. All wiring to automatic circuit valves shall be UF-14 (14 gauge) UL approved, direct burial wire of a different color than the black and white wires used on the 115 volt AC power.

B. Controller wiring to the valves shall be installed (where possible) in same trench as mainline. Where wires are not placed in trench with mainline install in schedule 40 PVC conduit, 18 inches minimum below grade.

C. All splices shall be made with King “one-step” connectors.

D. All wire shall be furnished in minimum 2,500' reels and spliced only at valve or tee locations.

2.11 BACKFLOW PREVENTER:

A. Backflow preventer installation shall comply with applicable regulatory agencies and shall be approved by applicable Water Management District and a passing test report shall be sent by Contractor to OCPS Maintenance.

2.12 SOLVENT CEMENT/SOLVENT & CLEANER:

A. Solvent Cement shall comply with ASTM A2546.

B. Solvent and cleaner: Uni-weld 1600.

PART 3 – EXECUTION

3.1 INSPECTION:

A. Contractor must examine areas and conditions under which landscape irrigation system is to be installed and (in writing) notify Architect of detrimental conditions proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 COORDINATION:

A. Crossings (sleeves) under paved areas (such as sidewalks, roadways and parking lots) as indicated, shall be installed by Contractor.

B. Crossings shall be installed prior to construction of paving.

C. Contractor shall be responsible for coordinating their work with all other parties involved with the project as well as coordinate the electrical power supply to Timing Device (controller) and tie-in into grounding system.

D. Contractor shall be responsible for full and complete coverage of all irrigated areas and shall make any necessary minor adjustments at no additional cost to Owner.

3.3 EXCAVATING AND TRENCHING:

A. Perform all excavations as required for the installation of the work under this section, including earth banks shoring to prevent cave-ins. Where major root systems of major existing trees are encountered, including roots 4 inches diameter minimum, tunnel to avoid cutting the roots.

B. Restore all surfaces, existing underground installations, damaged or cut as a result of the excavations to their original conditions.

C. Pipelines trenches shall be made of sufficient depth to provide minimum cover from finish grade as follows:

1. 18 inches minimum cover over main lines.
2. 18 inches minimum cover over control wires.
3. 12 inches minimum cover over lateral lines to heads.

D. Where possible, install pipe adjacent to curbs or paving minimizing plants and their roots interference.

E. Keep trenches free of obstruction and debris. Remove excess soil from site and leave grade as was prior to irrigation system installation.

F. Piping shall be routed around shrubs, trees and other permanent obstacles.

3.4 PIPE LINE ASSEMBLY:

A. Install plastic pipe as recommended by manufacturer providing for expansion and contraction. Cut plastic pipe square and remove burrs at cut ends prior to installation so smooth unobstructed flow will be obtained. Provide continuous support of pipe using an unobstructed even trench bottom free of debris.

B. Install remote control valves at locations no closer than 12 inches to weld edges, buildings, and walls. Plastic pipe fittings shall be solvent welded with solvents and methods as recommended by pipe manufacturer, except where screwed connections are required. Before applying solvent with a non-synthetic bristle brush pipe and fittings shall be thoroughly cleaned of dirt, dust, and moisture. Care should be taken not to use an excess amount of solvent, thereby causing a burr or obstruction to form on the inside of the pipe. Allow the joints to set at least 24 hours before

applying pressure on PVC pipe. Flush main and lateral piping on irrigation system to clean out all debris and sediment prior to the installation of heads and nozzles.

C. Sprinkler heads shall be installed so top is slightly above finish grade. If finish grade has not been established, set sprinkler head top 4 inches above grade then lowering sprinkler head when finish grade established and sod/mulch installed. Heads along curbs and walks shall be set flush to within 1/8 inch and 6 inches away from curb or walk. Heads and piping adjacent to buildings shall be 12 inches minimum off building's face. No water application shall be made within 12 inches of Building's exterior walls. Sprinkler heads adjacent to bus loop shall be located 48 inches from back of curb or as shown/noted on irrigation plan. Adjust heads having adjustment stem, for proper radius and throw for the area involved. Do not allow over-spray on buildings, walkways or on motor vehicles.

D. All control wires shall be installed in neat and orderly fashion underneath main and lateral pipes, if possible. 10 inch loops shall be provided at each valve where control wires are connected.

E. All piping and wiring passing under existing or future paving, construction, etc., shall be encased in sleeves as specified, extending 12 inches minimum beyond edges of paving base or construction.

F. Install warning tape directly above pressure piping, 12 inches below finish grade except under paving or slabs or where depth shall be 6 inches.

3.5 BACKFILLING AND COMPACTING:

A. After pressure testing complete and systems approved, or sections thereof, backfill excavations and trenches with clean soil, free of rubbish. Dress off all areas to finish grades. Repeat backfilling as required due to settlement.

B. Balance and adjust irrigation system components for efficient proper operation. This includes controller synchronization and individual controller stations, valves and sprinkler head adjustments. Do not allow over-spray on buildings, walkways, other paving or on automobiles.

3.6 RAIN SENSOR:

A. Install rain sensor on exposed surface that is unobstructed from rainfall. Install rain sensor control wiring in rigid conduit.

3.7 LABELS:

A. For reference, number each zone valve box on inside of valve box with a black waterproof marker. Numbers shall match the zone numbers on the drawings.

B. Number each zone valve control wire at the controller with a waterproof marker and tags. Numbers shall match the zone numbers on the drawings.

3.8 PRESSURE TESTING/SYSTEM DEMONSTRATION:

A. All piping, connectors and valves shall be hydrostatically pressure tested. The mainline test shall last for six hours minimum at 100 PSI. All leak areas and equipment to be replaced and system re-tested until no leaks are found. All testing shall be done before backfilling trenches.

B. As part of Close Out procedures, provide a complete demonstration to Owner's Authorized Representative addressing the operation of all irrigation system components.

C. Provide complete typewritten instructions for operation including recommended watering times, duration and preventative maintenance.

3.9 MAINTENANCE:

A. Maintain irrigation system until the date of Final Completion.

B. Maintenance shall include work, materials and replacements necessary to insure a complete properly operating system.

3.10 OWNERS RESPONSIBILITY FOR MAINTENANCE:

A. During guarantee period, maintaining system in working order shall be Owner's responsibility. The Owner shall perform necessary minor maintenance, keep grass from obstructing sprinkler heads and preventing vandalism/damage during landscape maintenance operation.

3.11 CLEAN-UP:

A. Upon completion and prior to inspection of the work, clear the site of debris, superfluous materials and equipment.

END OF SECTION 328400

APPENDIX ‘A’

FOOD SERVICE & LAUNDRY EQUIPMENT CUT SHEETS

A copy of the food service and laundry equipment cut sheets follows.

03/14/2025

MISE EN PLACE DESIGN

A Place for EverythingFood Service Design &Consulting

Project:
Oceancrest SN West
Melbourne
DD Equipment
Specifications

From:
Mise en Place Design
Marisa Mangani
8051 N. Tamiami Trail
Suite D5
Sarasota, FL 34243
941-321-7174

To:

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Submittal Sheet

03/14/2025

ITEM# K00 - MAIN KITCHEN

MAIN KITCHEN

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Submittal Sheet

03/14/2025

ITEM# K01 - AIR CURTAIN (1 EA REQ'D)

Berner CHD10-2072A

Commercial Series High Performance Air Curtain, 72" long, unheated, (2) 1/2 hp three speed motors, for door height up to 10-feet high, indoor mounting only, cULus, MADE IN USA

ACCESSORIES

Mfr	Qty	Model	Spec
Berner	1		Five year parts warranty (unheated units)
Berner	1	A	120v/60/1-ph
Berner	1	9503SD025-PR-A	Plunger/Roller Door Switch, NEMA 1, max. amp draw of 20 amps, 120-240v/1ph
Berner	1		For multiple manual doors on opening add for each additional roller
Berner	1		White aluminum housing, standard

COMMERCIAL HIGH PERFORMANCE 10
Ambient (Unheated) Air Curtain
Data Sheet

For Mounting Heights To 10' (environmental separation) and 8' (insect control)

STANDARD CONSTRUCTION
- 14" high x 15" deep
- 1/2 hp three speed motor(s)
- Factory installed fan speed switch
- White or black aluminum exterior cover (Optional: Custom Color or Stainless)
- Wall & Top Mounting
- Optional: Filter (washable)

Berner International Corporation certifies that the air curtains shown herein are licensed to bear the AMCA Seal. The ratings shown are based on tests and procedures performed in accordance with AMCA Publication 211 and comply with the requirements of the AMCA Certified Ratings Program. Rated data shown is for base (unheated) units. The AMCA Certified Ratings Seal applies to airflow rate, average outlet velocity, outlet velocity uniformity, velocity projection and power rating at free delivery only.

5 Year Limited Warranty | Made in USA | FDA RECOMMENDED | USDA COMPLIANCE

MODEL	Nozzle Width (in)	Max Vel. at Nozzle (fpm)	Avg. Outlet Vel. (fpm)	Air Volume (cfm)	Outlet Vel. Uniformity	Power Rating (kW)	Motor(s) @ hp	Net Wt. (lbs)
CHD10-1036A	36.00	3,284	2,062	1,804	73%	0.78	1 @ 1/2	50
CHD10-1042A	42.00	3,592	1,748	1,784	54%	0.74	1 @ 1/2	52
CHD10-1048A	48.00	3,614	1,515	1,768	62%	0.75	1 @ 1/2	53
CHD10-1060A	60.00	3,319	1,184	1,726	48%	0.73	1 @ 1/2	54
CHD10-2060A	60.00	3,711	1,801	2,626	74%	1.21	2 @ 1/2	70
CHD10-2072A	72.00	3,284	2,062	3,608	73%	1.56	2 @ 1/2	84
CHD10-2084A	87.00	3,592	1,687	3,568	54%	1.49	2 @ 1/2	104
CHD10-2096A	99.00	3,614	1,470	3,536	62%	1.49	2 @ 1/2	106
CHD10-3096A	99.00	3,284	1,841	4,430	73%	1.99	3 @ 1/2	120
CHD10-2108A	111.00	3,319	1,295	3,494	48%	1.48	2 @ 1/2	107
CHD10-3108A	111.00	3,284	2,006	5,412	73%	2.34	3 @ 1/2	150
CHD10-2120A	116.25	3,319	1,222	3,452	48%	1.47	2 @ 1/2	108
CHD10-3120A	116.25	3,284	1,908	5,392	54%	2.30	3 @ 1/2	152

NOTE: Operation at 50 Hz will generate approximately a 17% reduction in air performance.

See sheet EP-114 for amp draws/total load requirements.

VELOCITY PROJECTION: *Model CHD10-1036A*					
Distance from Nozzle (in)	40	80	120	160	200
Core Velocity (fpm)	1270	1100	1000	940	910
Uniformity (%)	92	91	91	88	86

MODEL NUMBER CONFIGURATION

CHD10-1 036 A A-R-SS

Series	# of Motors	Opening Width	Heat	Voltage	Opt. Switch	Cabinet Finish
CHD10	1, 2, 3	036" - 120"	A=Ambient	*A=120/1/60 B=208/1/60 J=240/1/60 Z=480/3/60 Q=600/3/60 V=220/1/50	Remote Switch	White *(leave blank)* BK=Black **Opt. Cabinet Finish** SS=Stainless Steel CC=Custom Color

*Suitable for 50hz

for Standard offering, leave options (Opt.) blank
make sure to specify Cabinet Finish if other than white

Sound level measured 10' (3m) from the unit in free field:

1 motor:	Low/Medium/High Speed:	64/65/66 dBA
2 motors 60":	Low/Medium/High Speed:	66/67/68 dBA
2 motors:	Low/Medium/High Speed:	67/68/69 dBA
3 motors:	Low/Medium/High Speed:	67/68/69 dBA

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www.berner.com Berner International 800.245.4455
111 Progress Ave. / New Castle / PA / 16101 / USA

DS-114D
November, 2017

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COMMERCIAL HIGH PERFORMANCE 10
Ambient (Unheated) Air Curtain
Electrical Performance Sheet

MODEL	120/1/60 (voltage code A) MOTOR AMP DRAW = 6.5 each			208/1/60 (voltage code B) MOTOR AMP DRAW = 3.5 each			240/1/60 (voltage code J) or 220/1/50 (voltage code V) MOTOR AMP DRAW = 3.5 each		
	# CKTS	AMPS PER CIRCUIT	BREAKER RATING PER CIRCUIT	# CKTS	AMPS PER CIRCUIT	BREAKER RATING PER CIRCUIT	# CKTS	AMPS PER CIRCUIT	BREAKER RATING PER CIRCUIT
CHD10-1036A CHD10-1042A CHD10-1048A CHD10-1060A	1	6.5	15	1	3.5	15	1	3.5	15
CHD10-2060A CHD10-2072A CHD10-2084A CHD10-2096A CHD10-2108A CHD10-2120A	1	13.0	20	1	7.0	15	1	7.0	15
CHD10-3096A CHD10-3108A CHD10-3120A	1	19.5	25	1	10.5	15	1	10.5	15

MODEL	480/3/60 (voltage code Z) MOTOR AMP DRAW = 1.4 each			600/3/60 (voltage code Q) MOTOR AMP DRAW = 1.0 each		
	# CKTS	AMPS PER CIRCUIT	BREAKER RATING PER CIRCUIT	# CKTS	AMPS PER CIRCUIT	BREAKER RATING PER CIRCUIT
CHD10-1036A CHD10-1042A CHD10-1048A CHD10-1060A	1	1.4	15	1	1.0	15
CHD10-2060A CHD10-2072A CHD10-2084A CHD10-2096A CHD10-2108A CHD10-2120A	1	2.8	15	1	2.0	15
CHD10-3096A CHD10-3108A CHD10-3120A	1	4.2	15	1	3.0	15

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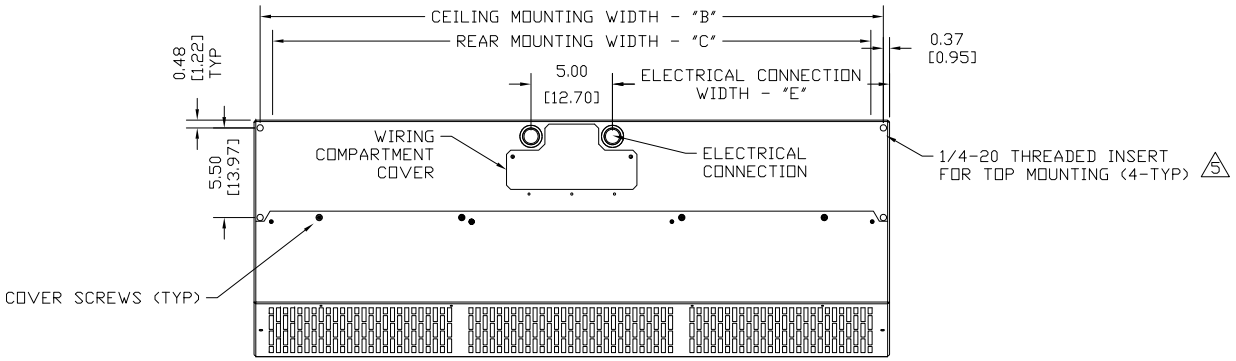
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EP-110
October, 2017

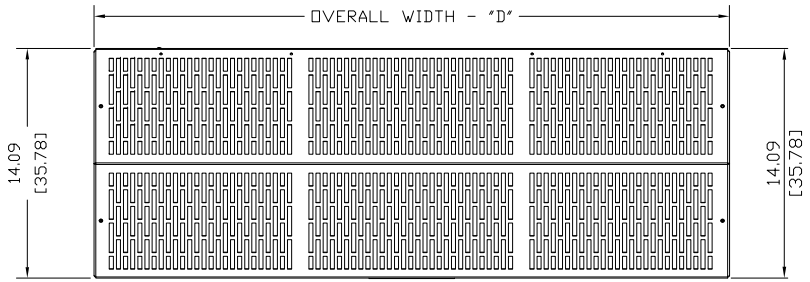
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CHD10
AMBIENT SYSTEM
(without Wall Mounting Plate)
(with Switches)

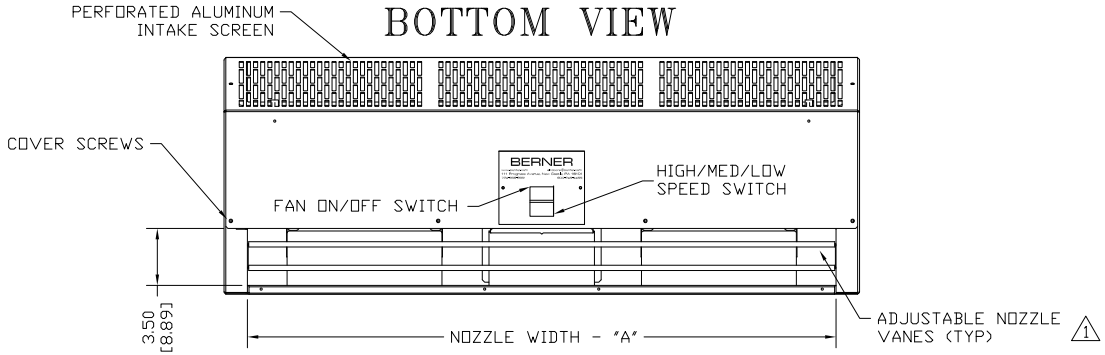
TOP VIEW



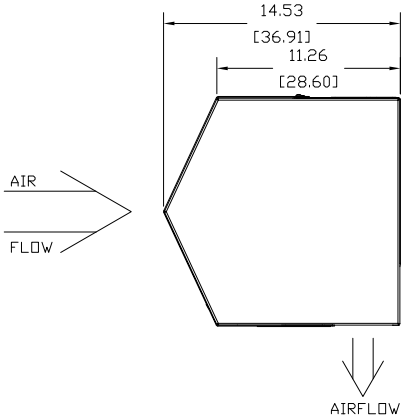
FRONT VIEW



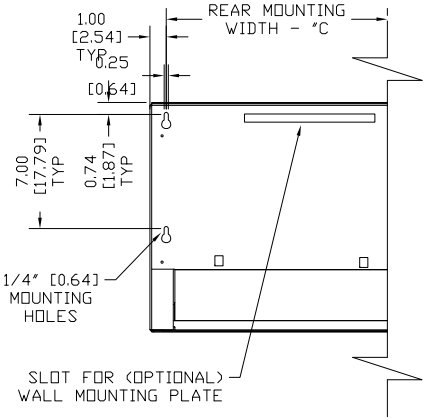
BOTTOM VIEW



END VIEW



REAR VIEW



MODEL 6	NOZZLE WIDTH "A"	CEILING MOUNTING WIDTH "B"	REAR MOUNTING WIDTH "C"	UNIT WIDTH "D"	ELECTRIC WIDTH "E"
CHD10-1036A	36.00 [91.44]	38.25 [97.16]	37.00 [93.98]	39.00 [99.06]	17.00 [43.18]
CHD10-1042A	42.00 [106.68]	44.25 [112.40]	43.00 [109.22]	45.00 [114.30]	20.00 [50.80]
CHD10-1048A	48.00 [121.92]	50.25 [127.64]	49.00 [124.46]	51.00 [129.54]	23.00 [58.42]
CHD10-1060A	60.00 [152.40]	62.25 [158.12]	61.00 [154.94]	63.00 [160.02]	29.00 [73.66]
CHD10-2060A	60.00 [152.40]	62.25 [158.12]	61.00 [154.94]	63.00 [160.02]	19.00 [48.26]
CHD10-2072A	72.00 [182.88]	74.25 [188.60]	73.00 [185.42]	75.00 [190.50]	17.00 [43.18]
CHD10-2084A	86.88 [220.66]	89.13 [226.38]	87.88 [223.22]	89.88 [228.28]	20.75 [52.71]
CHD10-2096A	98.88 [251.14]	101.13 [257.18]	99.88 [253.70]	101.88 [258.76]	23.75 [60.33]
CHD10-3096A	98.88 [251.14]	101.13 [257.18]	99.88 [253.70]	101.88 [258.76]	15.50 [39.37]
CHD10-2108A	110.88 [281.62]	113.13 [287.38]	111.88 [284.18]	113.88 [289.24]	26.75 [67.95]
CHD10-3108A	110.88 [281.62]	113.13 [287.38]	111.88 [284.18]	113.88 [289.24]	17.50 [44.45]
CHD10-2120A	116.25 [295.28]	118.50 [300.99]	117.25 [297.82]	119.25 [302.90]	28.06 [71.28]
CHD10-3120A	116.25 [295.28]	118.50 [300.99]	117.25 [297.82]	119.25 [302.90]	18.38 [46.67]

NOTES:

1. AIR CURTAIN MUST BE INSTALLED SO AIR STREAM IS NOT OBSTRUCTED WHEN DEFLECTED 20° TO EITHER SIDE OF ℄.
2. ELECTRICAL CONNECTIONS TO BE FLEXIBLE.
3. FIELD VERIFY DIMENSIONS.
4. ANCHORS TO SUPPORTING STRUCTURE BY OTHERS.
5. ADEQUACY OF SUPPORTING STRUCTURE IS TO BE VERIFIED BY A PROFESSIONAL STRUCTURAL ENGINEER.
6. LETTER "A" IN MODEL NUMBER DESIGNATES AMBIENT UNIT.
7. DIMENSIONS IN INCHES [CENTIMETERS].

PROJECT			
LOCATION			
ARCHITECT			
ENGINEER		REV.	B
DWG. NO.	CHD10-AMB-SWITCHES	TITLE: BERNER MODEL CHD10 AIR CURTAIN AMBIENT SYSTEM	
DATE	29JAN2020		
BY	S. BEIL		
REPLACES	17MAY2019	BERNER INTERNATIONAL CORP. NEW CASTLE,PA.	
BY	S. BEIL		

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Submittal Sheet

03/14/2025

ITEM# K02 - CAN RACK (1 EA REQ'D)

Advance Tabco CR10-162M

Can Rack, mobile design with casters, with sloped glides for automatic can retrieval, designed for #10 & #5 cans, aluminum construction, holds (162) #10 cans, or (216) #5 cans

ADVANCE TABCO
SMART FABRICATION™

ALUMINUM

CAN RACKS NSF

Full and Half Size

Item #: _____ Qty #: _____

Model #: _____

Project #: _____



CR10-162



CR10-162M

ALUMINUM TOP



POLY TOP



STAINLESS STEEL TOP



FEATURES:

Heavy duty welded construction.

Metal bullet feet on CR10-162 only.

4" Plate Casters with two Brakes. Standard on all Can Racks EXCEPT CR10-162 (See CR10-162M).

CONSTRUCTION:

Fully welded 1 1/4" square tubing ladder assembly.

MATERIAL:

Extruded aluminum angles.

Aluminum top .09 thickness.

MODEL #	Description	Can Capacity #10	Can Capacity #5
CR10-162	Full Can Rack	162	216
CR10-162M	Full Can Rack with Casters	162	216
CR10-72	Aluminum Top	72	96
CR10-54	Aluminum Top	54	72
CRPL10-72	Poly Top	72	96
CRPL10-54	Poly Top	54	72
CRSS10-72	S/S Top	72	96
CRSS10-54	S/S Top	54	72

ADVANCE TABCO
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Customer Service Available To Assist You 1-800-645-3166 8:30 am - 7:00 pm E.S.T.

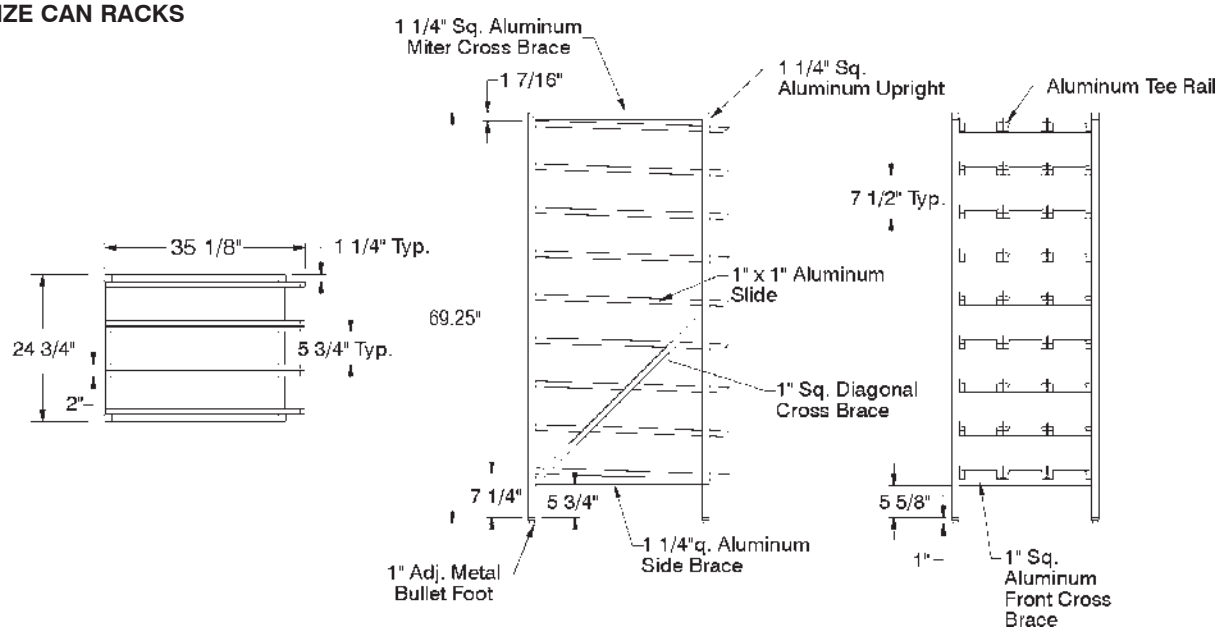
For Orders & Customer Service:
Email: customer@advancetabco.com or **Fax:** 631-242-6900

For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

DIMENSIONS and SPECIFICATIONS

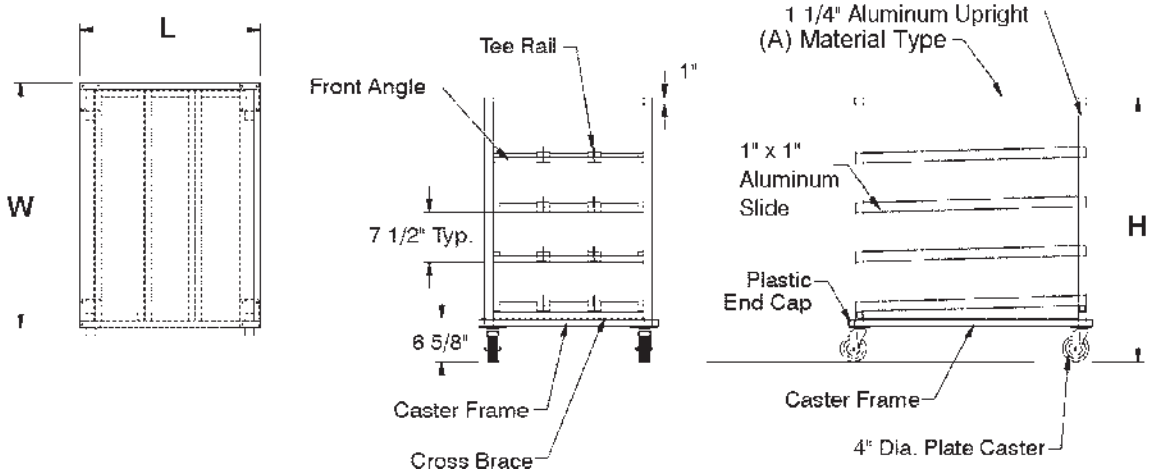
TOL ± .500" ALL DIMENSIONS ARE TYPICAL

FULL SIZE CAN RACKS



MODEL #	Description	Can Capacity #10	Can Capacity #5	Overall Size L x W x H	Approx. Weight
CR10-162	Full Can Rack	162	216	24 3/4" x 35 1/8" x 69 3/4"	65 lbs.
CR10-162M	Full Can Rack	162	216	24 3/4" x 35 1/8" x 69 3/4"	76 lbs.

HALF SIZE CAN RACKS



MODEL #	Rack Top Material (A)	Can Capacity #10	Can Capacity #5	Overall Size L x W x H	Approx. Weight
CR10-72	Aluminum Top	72	96	24 3/4" x 35 1/8" x 40 1/8"	59 lbs.
CR10-54	Aluminum Top	54	72	24 3/4" x 35 1/8" x 32 5/8"	54 lbs.
CRPL10-72	Poly Top	72	96	24 3/4" x 35 1/8" x 40 1/8"	79 lbs.
CRPL10-54	Poly Top	54	72	24 3/4" x 35 1/8' x 32 5/8"	74 lbs.
CRSS10-72	S/S Top	72	96	24 3/4" x 35 1/8" x 40 1/8"	63 lbs.
CRSS10-54	S/S Top	54	72	24 3/4" x 35 1/8" x 32 5/8"	55 lbs.

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

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Submittal Sheet

03/14/2025

ITEM# K03 - DRY STORAGE SHELVING (1 LT REQ'D)

Metro EPOXY

One lot dry storage shelving, 74" high, four tier, size and configure per plan layout.

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Submittal Sheet

03/14/2025

ITEM# K04 - WALK-IN COOLER (1 EA REQ'D)

American Panel CUSTOM

8'6" high, floorless, with white interior, two 48" LED light, inset door with 3rd hinge, IC Plus temperature monitoring system, heated vision window, 36" dtp kickplates on door, and 60" on exposed exterior, strip curtain, 25' extended probe, matching vertical and horizontal trim and closures to walls and ceiling.

EQPT REMARK: **REFER TO MFG SHOP DRAWINGS**

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Submittal Sheet

03/14/2025

ITEM# K05 - COOLER EVAPORATOR COIL (1 EA REQ'D)

American Panel

BOHN

EQPT REMARK: **REFER TO MFG SHOP DRAWINGS**

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K06 - COOLER CONDENSING UNIT (1 EA REQ'D)

American Panel

Preassembled remote medium temperature condensing unit with winter controls, UL listed 18" high stand and cover.

EQPT REMARK: **REFER TO MFG SHOP DRAWINGS**

BCH0015MCACZA0000 - SUBMITTAL

Project Name:		Project Location:	
Quote ID:		Item #:	1000
Submitted For:		Submitted On:	
Submitted By:		Submitted From:	
Identity #:		Tag:	

☐ For Record ☐ For Approval By:_____ Date:_____

General Product Information

Product Family:	BCH	Compressor Brand:	Copeland
Application:	Outdoor	Compressor Type:	Scroll
Temperature Range:	Medium Temp	Compressor Hp:	1.5
Voltage: (Volts/Ph/Hz)	208-230/3/60	Compressor Model:	ZS13KAE-TF5-118
Refrigerant Type:	R448A	Number of Compressor(s):	1
Piping:	Standard	Coil Type:	Microchannel

Technical Information

Performance Data

Ambient Temperature (°F)	Saturated Suction Temperature (°F)	Capacity (BTU/H)	Altitude (ft)	AWEF Value
95	25.0	13,890	0	7.6

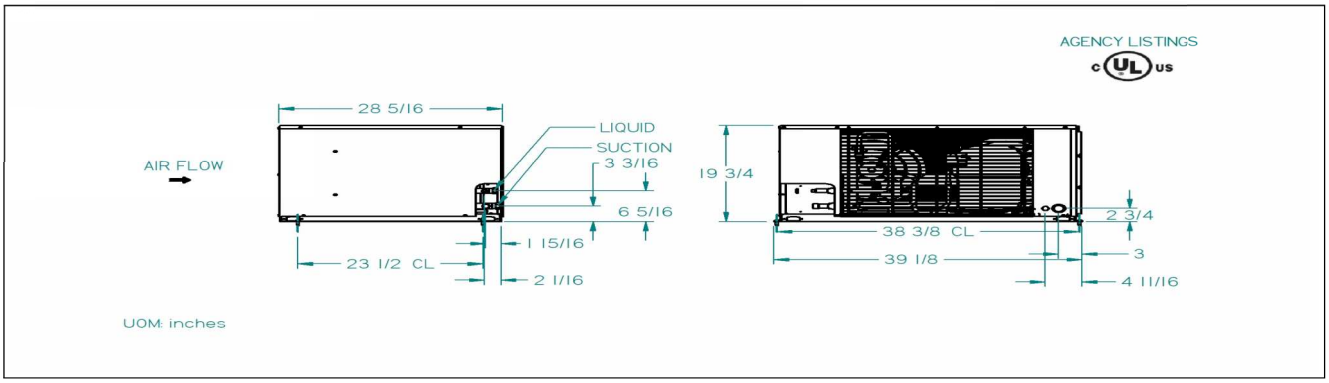
Electrical Data

Compressor(s)		Fan Motor(s)			Electric Ratings						
RLA	LRA	Quantity	Hp	FLA	Defrost Type	High or Low Amps?	Number of Contactors	MCA	MOPD	Evap.Fan Amps	Defrost Heater Amps
8.7	58	2	1/15	1	AIR DEFROST	NA		15	20	9	23

Unit Specifications

Connections (in.)		Receiver 90% Full (lbs)		Fan Blade(s) Diameter (in)	Sound Data (dB)	Approx. Net Weight (lbs)
Liquid Line	Suction	Standard	Over Sized			
0.5	0.875	14.0	20.0	14	63	221

Dimensional Drawing(s)



BCH0015MCACZA0000 - SUBMITTAL

Project Name:		*Project Location:*	
Quote ID:		*Item #:*	*1000*
Submitted For:		*Submitted On:*	
Submitted By:		*Submitted From:*	
Identity #:		*Tag:*	

Standard Features

CABINET AND CONSTRUCTION

- MICROCHANNEL COIL TECHNOLOGY STANDARD ON ALL UNITS
- PAINTED STEEL CABINETS FOR SUPERIOR STRENGTH AND CORROSION PROTECTION
- HEAVY DUTY, STEEL, 1-1/2 TALL BASE

SERVICEABILITY

- SUCTION SERVICE VALVES FOR HERMETIC AND SCROLL COMPRESSORS LOCATED OUTSIDE THE CABINET FOR QUICK INSTALLATIONS.
- RECEIVER WITH FUSIBLE PLUG, LIQUID SHUTOFF VALVE AND CHARGING PORT IS STANDARD
- LARGE ELECTRICAL PANEL FOR EASE OF ACCESS
- PREFABRICATED WIRING HARNESSES FOR TIGHT CRIMP CONNECTIONS AND CONSISTENT LABELING
- UNIT STAYS ON IF THE HOOD IS REMOVED FOR SERVICING
- SIGHT GLASS IS EASILY VIEWABLE

QUALITY

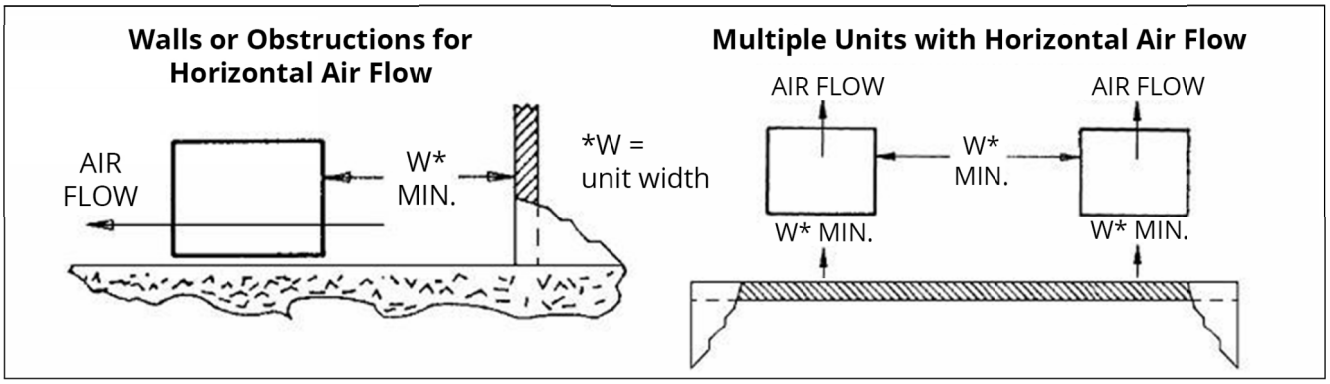
- ALL UNITS ARE COMPLETELY LEAK TESTED IN A HELIUM ENVIRONMENT, BUMP TESTED AND ALLOWED TO CYCLE OFF ON THE HIGH AND LOW PRESSURE CONTROL. EACH UNIT HAS A COPY OF THE RUN DATA SHIPPED INSIDE THE ELECTRICAL PANEL
- ELECTRICAL CIRCUITS ARE COMPLETELY CHECKED FOR CONTINUITY
- PIPING IS LAID OUT TO MINIMIZE STRESS AND VIBRATION AND IS PRE-BENT TO ELIMINATE LEAKS
- ENCAPSULATED, AUTO-RESET, HIGH AND LOW PRESSURE CONTROLS TO ELIMINATE LEAKS (ADJUSTABLE LOW PRESSURE CONTROL STANDARD)

Options

Mounted Options

- Brand Label - BOHN
- Coil Selection - MICROCHANNEL COIL
- Defrost Timer Options - NO TIMER
- Suction Line Options - SUCTION TUBE ONLY
- Cabinet Selection - Painted
- Pressure Options - ADJUSTABLE LOW - FIXED HIGH
- Phase Loss Monitor - NONE
- Snow Legs - NONE
- ETO ID - null
- Motor - PSC
- Receiver Options - STANDARD
- Liquid Line Options - FILTER DRIER AND SIGHT GLASS
- Discharge Line Options - HEAD PRESSURE VALVE 150#
- Fused Disconnect - NO FUSED DISCONNECT
- Crankcase Heater - CRANKCASE HEATER
- Pre Charged - NONE
- Hail Guard Factory Installed - NONE

Minimum Unit Clearances



BELU15BS6AMAB0300 - SUBMITTAL

Project Name:		Project Location:	
Quote ID:		Item #:	1000
Submitted For:		Submitted On:	
Submitted By:		Submitted From:	
Identity #:		Tag:	

☐ For Record ☑ For Approval By:_____ Date:_____

General Product Information

Product Family:	BEL	Motor type	2 SPEED EC
Defrost Type:	Air	Number of Fans:	2
Voltage: (Volts/Ph/Hz)	208-230/1/60	Fan HorsePower	1/20
Refrigerant Type:	R448A	Fins per Inch	6

Technical Information

Performance Data

Capacity			Air Flow				Altitude (ft)	AWEF Value	
TD (°F)	SST (°F)	Application Capacity* (BTU/H)	CFM	Fan Diameter (in.)	Air Throw (ft)			Cooler > 32	Freezer <= 32
					Standard	w/Collar			
10	25.0	14,500	1220	12			0	9	N/A

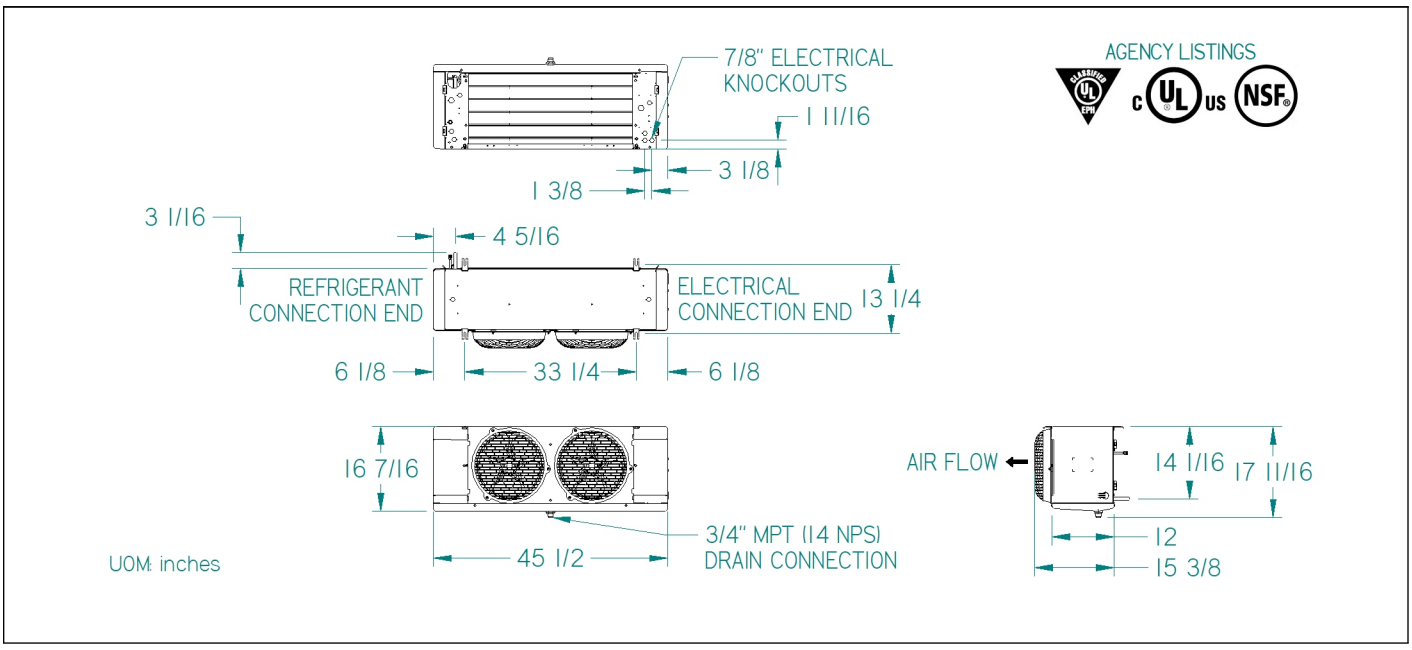
Electrical Data

Fan Motor(s)		Defrost Heater(s)		Drain Pan Heater(s)	
Watts	Amps	Watts	Amps	Watts	Amps
55	1				

Unit Specifications

Connections (in.)						Approx. Net Weight (lbs)
Coil Inlet	Suction	External Equalizer	Drain	Side Port	Hot Gas Drain Pan	
1/2	7/8	1/4	3/4			56

Dimensional Drawing(s)



BELU15BS6AMAB0300 - SUBMITTAL

Project Name:		*Project Location:*	
Quote ID:		*Item #:*	*1000*
Submitted For:		*Submitted On:*	
Submitted By:		*Submitted From:*	
Identity #:		*Tag:*	

Standard Features

EASE OF INSTALLATION SERVICE

- ALL ELECTRICAL COMPONENTS FACTORY WIRED TO TERMINAL BOARD AND IDENTIFIED, MAKING IT EASY TO FIELD WIRE THE UNIT

RELIABLE DURABLE

- HEAVY GAUGE GRAINED ALUMINUM CABINET CLEANS EASILY AND LOOKS ATTRACTIVE
- MOLDED FAN GUARD AND ACCESS PANELS ARE MADE OF STRONG, DURABLE, AND NSF AND UL SANITATION RATED PLASTIC MATERIAL
- SWEAT CONNECTIONS TO REDUCE POTENTIAL FOR LEAKS

PERFORMANCE

- EC MOTORS STANDARD ON ALL MODELS FOR IMPROVED UNIT EFFICIENCY

VERSATILE

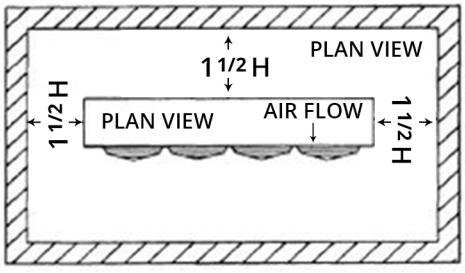
- LARGE DIAMETER DRAIN HOLE (3/4 " ID) IS LOCATED TOWARDS THE BACK OF THE UNIT
- MINIMAL HEIGHT OF THE LOW PROFILE SERIES MAKES IT IDEAL FOR LOW CEILING COOLERS
- CABINET DESIGN FEATURES HINGED, REMOVABLE FRONT ACCESS PANELS ON EACH SIDE FOR EASY ACCESS TO ELECTRICAL AND REFRIGERATION COMPONENTS
- LIQUID LINE SOLENOID WIRE HARNESS IS FACTORY-INSTALLED FOR QUICK INSTALLATION
- MOTORS PLUG INTO WIRING HARNESS FOR EASIER SERVICING
- HINGED, REMOVABLE DRAIN PAN FOR EASY AND SAFE ACCESS
- PRE-DRILLED HOLES ON THE BACK OF THE UNIT FOR ROOM THERMOSTAT
- QUICK REMOVAL FAN GUARD/MOTOR ASSEMBLY FOR EASY SERVICE OR REPLACEMENT OF AIR MOVER PARTS
- INTERNAL PANELS ARE ISOLATED FOR QUIET OPERATION
- INTERNALLY ENHANCED TUBING AND FIN DESIGN FOR HIGHER EFFICIENCY

Options

Mounted Options

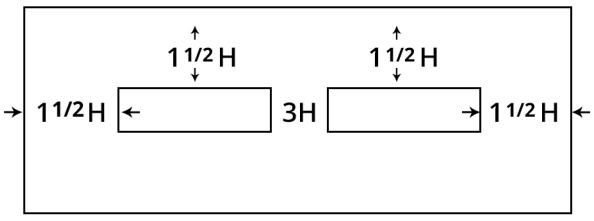
- Refrigerant Bundle - REFBUNDLE1
- Motor - 2 Speed EC
- Defrost Type - Air
- Fan Blade - Standard
- Cabinet Type - Stucco
- Controller Option - QRC
- Fin Material - Aluminum
- Customer Specified Valve Type - EEV
- Brand Label - BOHN
- Voltage - 208-230/1/60
- DTFD Option - None
- Fan Guard - Molded
- Drain Pan Type - Stucco
- Defrost Control - None
- Coil Mechanical Option - Beacon/QRC
- Valve Family - L

Minimum Unit Clearances



One Evaporator

NOTE:
H =Total Height evaporator coil surface.



Two Evaporators

** Capacities shown are Application Capacities reflecting nominal operation at 10°F TD. For models within the scope of the DOE AWEF (Annual Walk-in Energy Factor) standard, the Net Capacity is determined by the AHRI 1250 test method. DOE will publish this compliance data at www.regulations.doe.gov*

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K07 - WALK-IN COOLER SHELVING (1 LT REQ'D)

Metro EPOXY

One lot walk-in cooler shelving, 74" high, four tier, size and configure per plan layout.

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Submittal Sheet

03/14/2025

ITEM# K08 - BUN / SHEET PAN RACK (2 EA REQ'D)

Advance Tabco PR18-3W

Pan Rack, mobile, full height, end loading, 20-1/4"W x 26"D x 63-1/4"H, (18) 18" x 26" sheet pan capacity, slides on 3" centers, open sides, all-welded aluminum construction, 5" swivel casters, NSF

ALUMINUM

PAN RACKS NSF

All Welded Curved Top

Item #: _____ Qty #: _____

Model #: _____

Project #: _____



PR20-3W Shown
Front Load



PR20-3KWS Shown
Side Load

FEATURES:

Curved top design.

Heavy duty welded construction with 6 cross supports.

1" x 1 1/2" ribbed angles.

Front load pan rack holds 18" x 26" pans or 18" x 13" pans. Side load pan rack holds 18" x 26" pans.

Heavy duty 5" stem bolted swivel casters.

500 lb. capacity.

CONSTRUCTION:

Fully welded 1" square tubing ladder assembly.

Angles are 1" x 1 1/2" x 20" on front load pan rack and 1" x 1 1/2" x 17 3/4" on side load pan rack.

MATERIAL:

6063-T52 extruded aluminum angles, upright tubing, and support pieces.

Model #	Description	Pan Capacity	Shelf Spacing (A)	Overall Size L x W x H	Approx. Weight
PR10-3W	Front Load	10 Full Size or 20 Half Size	3"	20 1/4" x 26" x 38 1/2"	25 lbs.
PR10-6W	Front Load	10 Full Size or 20 Half Size	6"	20 1/4" x 26" x 69 1/4"	27 lbs.
PR12-5W	Front Load	12 Full Size or 24 Half Size	5"	20 1/4" x 26" x 69 1/4"	28 lbs.
PR15-4W	Front Load	15 Full Size or 30 Half Size	4"	20 1/4" x 26" x 69 1/4"	31 lbs.
PR18-3W	Front Load	18 Full Size or 36 Half Size	3"	20 1/4" x 26" x 63 1/4"	34 lbs.
PR20-3W	Front Load	20 Full Size or 40 Half Size	3"	20 1/4" x 26" x 69 1/4"	35 lbs.
PR30-2W	Front Load	30 Full Size or 60 Half Size	2"	20 1/4" x 26" x 69 1/4"	43 lbs.
PR10-6WS	Side Load	10 Full Size	6"	28 1/4" x 18" x 69 1/4"	26 lbs.
PR12-5WS	Side Load	12 Full Size	5"	28 1/4" x 18" x 69 1/4"	27 lbs.
PR15-4WS	Side Load	15 Full Size	4"	28 1/4" x 18" x 69 1/4"	30 lbs.
PR18-3WS	Side Load	18 Full Size	3"	28 1/4" x 18" x 63 1/4"	27 lbs.
PR20-3WS	Side Load	20 Full Size	3"	28 1/4" x 18" x 69 1/4"	34 lbs.

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Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

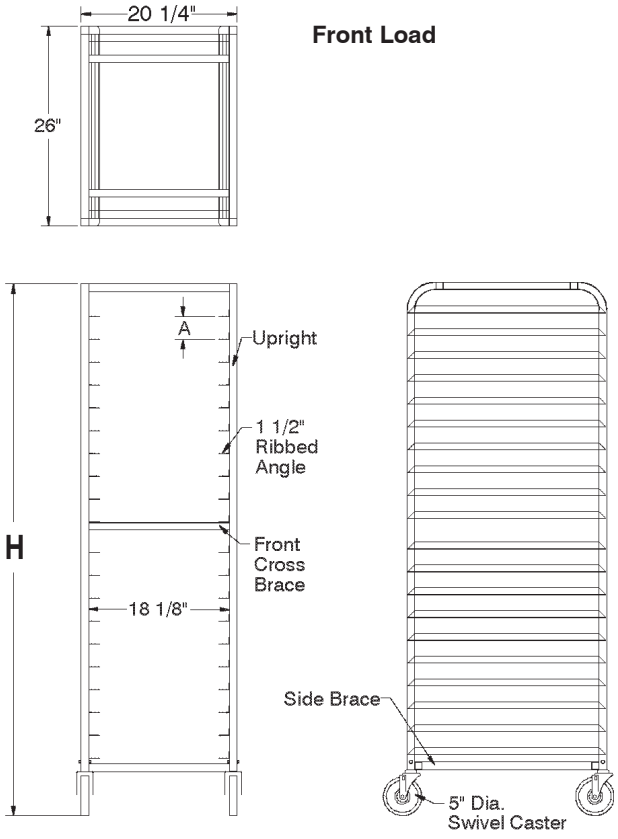
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DIMENSIONS and SPECIFICATIONS

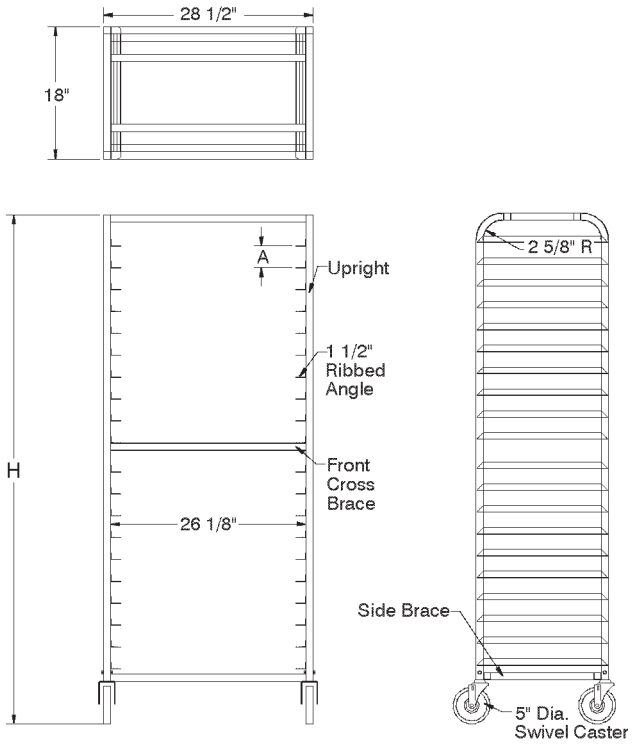
TOL ± .500”

ALL DIMENSIONS ARE TYPICAL

Front Load



Side Load



ADVANCE TABCO
SMART FABRICATION™

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

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Submittal Sheet

03/14/2025

ITEM# K09 - WALK-IN FREEZER (1 EA REQ'D)

American Panel CUSTOM

8'6" high, reinforced floor with interior ramp and dtp overlay, with white interior, one 48" LED light, heated vision window, IC Plus temperature monitoring system, extended probe, flush mounted door with 3rd hinge, 36" dtp kickplates on door, matching vertical and horizontal trim to ceiling and walls.

EQPT REMARK: **REFER TO MFG SHOP DRAWINGS**

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K10 - FREEZER EVAPORATOR COIL (1 EA REQ'D)

American Panel

BOHN

EQPT REMARK: **REFER TO MFG SHOP DRAWINGS**

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K11 - FREEZER CONDENSING UNIT (1 EA REQ'D)

American Panel

Preassembled remote low temperature condensing unit with winter controls, UL listed 18" high stand and cover.

EQPT REMARK: **REFER TO MFG SHOP DRAWINGS**

BCH0025LCACZA0000 -

SUBMITTAL

Project Name:		Project Location:	
Quote ID:		Item #:	1000
Submitted For:		Submitted On:	
Submitted By:		Submitted From:	
Identity #:		Tag:	

☐ For Record ☐ For Approval By:_____ Date:_____

General Product Information

Product Family:	BCH	Compressor Brand:	Copeland
Application:	Outdoor	Compressor Type:	Scroll
Temperature Range:	Low Temp	Compressor Hp:	2.5
Voltage: (Volts/Ph/Hz)	208-230/3/60	Compressor Model:	ZF08K4E-TF5-231
Refrigerant Type:	R448A	Number of Compressor(s):	1
Piping:	Standard	Coil Type:	Microchannel

Technical Information

Performance Data

Ambient Temperature (°F)	Saturated Suction Temperature (°F)	Capacity (BTU/H)	Altitude (ft)	AWEF Value
95	-10.0	10,440	0	3.12

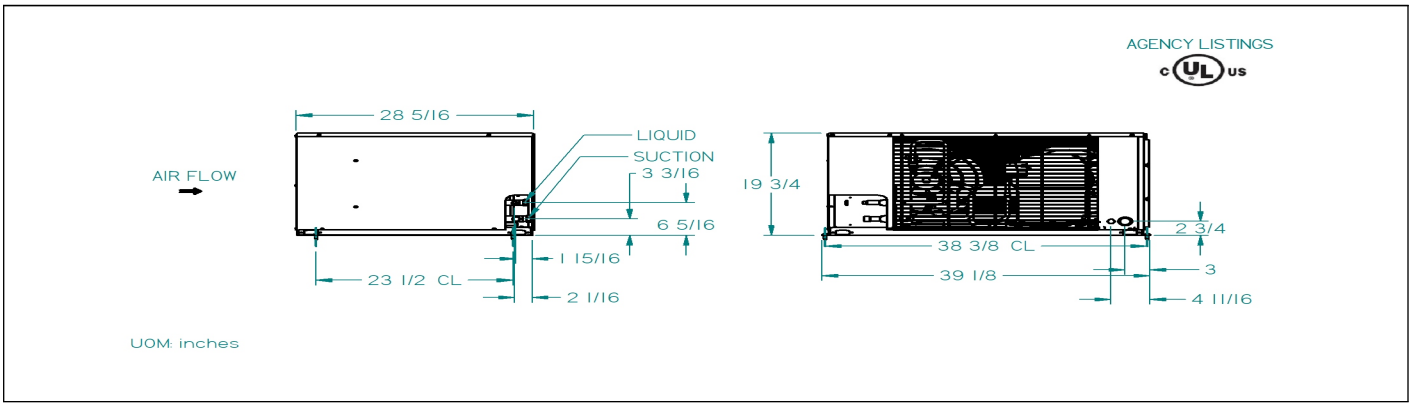
Electrical Data

Compressor(s)		Fan Motor(s)			Electric Ratings						
RLA	LRA	Quantity	Hp	FLA	Defrost Type	High or Low Amps?	Number of Contactors	MCA	MOPD	Evap.Fan Amps	Defrost Heater Amps
8.7	63	2	1/15	1	AIR DEFROST	NA		15	20	9	23

Unit Specifications

Connections (in.)		Receiver 90% Full (lbs)		Fan Blade(s) Diameter (in)	Sound Data (dB)	Approx. Net Weight (lbs)
Liquid Line	Suction	Standard	Over Sized			
0.5	0.875	14.0	20.0	14	64	230

Dimensional Drawing(s)



BCH0025LCACZA0000 -

SUBMITTAL

Project Name:		*Project Location:*	
Quote ID:		*Item #:*	*1000*
Submitted For:		*Submitted On:*	
Submitted By:		*Submitted From:*	
Identity #:		*Tag:*	

Standard Features

CABINET AND CONSTRUCTION

- MICROCHANNEL COIL TECHNOLOGY STANDARD ON ALL UNITS
- PAINTED STEEL CABINETS FOR SUPERIOR STRENGTH AND CORROSION PROTECTION
- HEAVY DUTY, STEEL, 1-1/2 TALL BASE

SERVICEABILITY

- SUCTION SERVICE VALVES FOR HERMETIC AND SCROLL COMPRESSORS LOCATED OUTSIDE THE CABINET FOR QUICK INSTALLATIONS.
- RECEIVER WITH FUSIBLE PLUG, LIQUID SHUTOFF VALVE AND CHARGING PORT IS STANDARD
- LARGE ELECTRICAL PANEL FOR EASE OF ACCESS
- PREFABRICATED WIRING HARNESSES FOR TIGHT CRIMP CONNECTIONS AND CONSISTENT LABELING
- UNIT STAYS ON IF THE HOOD IS REMOVED FOR SERVICING
- SIGHT GLASS IS EASILY VIEWABLE

QUALITY

- ALL UNITS ARE COMPLETELY LEAK TESTED IN A HELIUM ENVIRONMENT, BUMP TESTED AND ALLOWED TO CYCLE OFF ON THE HIGH AND LOW PRESSURE CONTROL. EACH UNIT HAS A COPY OF THE RUN DATA SHIPPED INSIDE THE ELECTRICAL PANEL
- ELECTRICAL CIRCUITS ARE COMPLETELY CHECKED FOR CONTINUITY
- PIPING IS LAID OUT TO MINIMIZE STRESS AND VIBRATION AND IS PRE-BENT TO ELIMINATE LEAKS
- ENCAPSULATED, AUTO-RESET, HIGH AND LOW PRESSURE CONTROLS TO ELIMINATE LEAKS (ADJUSTABLE LOW PRESSURE CONTROL STANDARD)

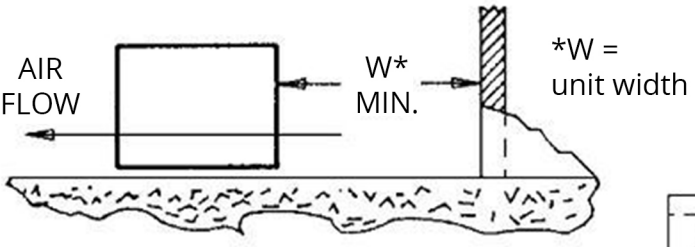
Options

Mounted Options

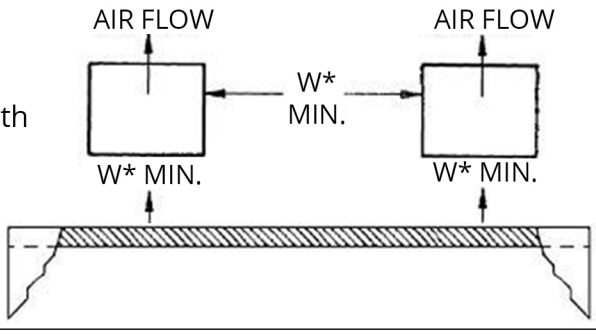
- Preferred Package Code - A0000 ~ STD Base
- Motor - PSC
- Receiver Options - STANDARD
- Liquid Line Options - FILTER DRIER AND SIGHT GLASS
- Discharge Line Options - HEAD PRESSURE VALVE 100#
- Fused Disconnect - NO FUSED DISCONNECT
- Crankcase Heater - CRANKCASE HEATER
- Pre Charged - NONE
- Hail Guard Factory Installed - NONE
- Brand Label - BOHN
- Coil Selection - MICROCHANNEL COIL
- Defrost Timer Options - NO TIMER
- Suction Line Options - SUCTION TUBE ONLY
- Cabinet Selection - Painted - OutDoor
- Pressure Options - ADJUSTABLE LOW - FIXED HIGH
- Phase Loss Monitor - NONE
- Snow Legs - NONE

Minimum Unit Clearances

Walls or Obstructions for Horizontal Air Flow



Multiple Units with Horizontal Air Flow



BEL0080BS6EEAB0300 - SUBMITTAL

Project Name:		Project Location:	
Quote ID:		Item #:	1000
Submitted For:		Submitted On:	
Submitted By:		Submitted From:	
Identity #:		Tag:	

☐ For Record ☐ For Approval By:_____ Date:_____

General Product Information

Product Family:	BEL	Motor type	EC
Defrost Type:	Electric	Number of Fans:	2
Voltage: (Volts/Ph/Hz)	208-230/1/60	Fan HorsePower	1/20
Refrigerant Type:	R448A	Fins per Inch	6

Technical Information

Performance Data

Capacity			Air Flow				Altitude (ft)	AWEF Value
TD (°F)	SST (°F)	Capacity (BTU/H)	CFM	Fan Diameter (ft)	Air Throw (ft) Standard	Air Throw (ft) w/Collar		
10	-20.0	8,150	1,371	12			0	4

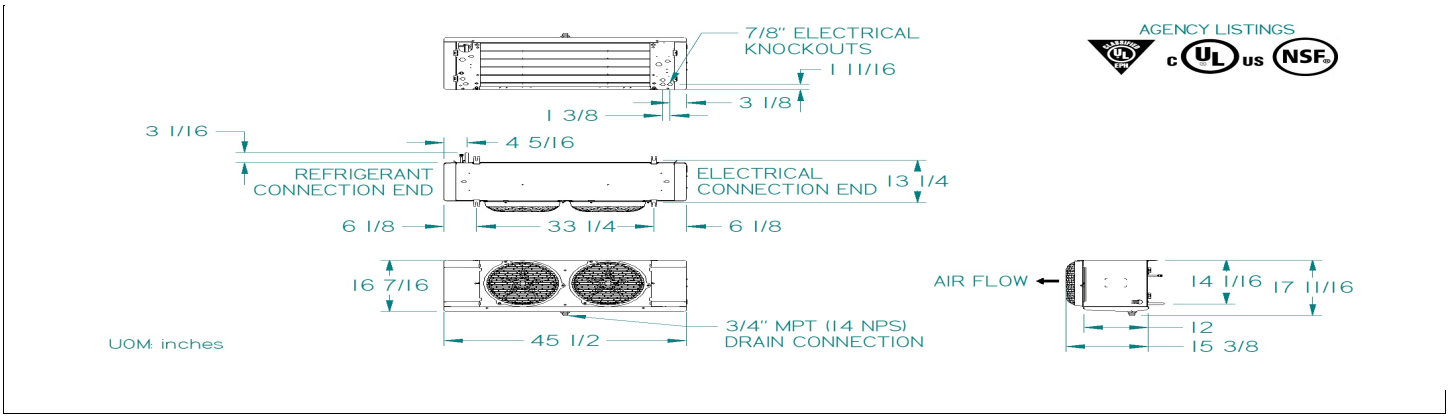
Electrical Data

Fan Motor(s)		Defrost Heater(s)		Drain Pan Heater(s)	
Watts	Amps	Watts	Amps	Watts	Amps
118	1	2,100	9.1		

Unit Specifications

Connections (in.)						Approx. Net Weight (lbs)
Coil Inlet	Suction	External Equalizer	Drain	Side Port	Hot Gas Drain Pan	
1/2	5/8	1/4	3/4			54

Dimensional Drawing(s)



BEL0080BS6EEAB0300 - SUBMITTAL

Project Name:		Project Location:	
Quote ID:		Item #:	1000
Submitted For:		Submitted On:	
Submitted By:		Submitted From:	
Identity #:		Tag:	

Standard Features

EASE OF INSTALLATION SERVICE

- ALL ELECTRICAL COMPONENTS FACTORY WIRED TO TERMINAL BOARD AND IDENTIFIED, MAKING IT EASY TO FIELD WIRE THE UNIT
- CABINET DESIGN FEATURES HINGED, REMOVABLE FRONT ACCESS PANELS ON EACH SIDE FOR EASY ACCESS TO ELECTRICAL AND REFRIGERATION COMPONENTS
- LIQUID LINE SOLENOID WIRE HARNESS IS FACTORY-INSTALLED FOR QUICK INSTALLATION
- MOTORS PLUG INTO WIRING HARNESS FOR EASIER SERVICING
- HINGED, REMOVABLE DRAIN PAN FOR EASY AND SAFE ACCESS
- PRE-DRILLED HOLES ON THE BACK OF THE UNIT FOR ROOM THERMOSTAT
- QUICK REMOVAL FAN GUARD/MOTOR ASSEMBLY FOR EASY SERVICE OR REPLACEMENT OF AIR MOVER PARTS

PERFORMANCE

- INTERNAL PANELS ARE ISOLATED FOR QUIET OPERATION
- INTERNALLY ENHANCED TUBING AND FIN DESIGN FOR HIGHER EFFICIENCY
- EC MOTORS STANDARD ON ALL MODELS FOR IMPROVED UNIT EFFICIENCY

RELIABLE DURABLE

- HEAVY GAUGE GRAINED ALUMINUM CABINET CLEANS EASILY AND LOOKS ATTRACTIVE
- MOLDED FAN GUARD AND ACCESS PANELS ARE MADE OF STRONG, DURABLE, AND NSF AND UL SANITATION RATED PLASTIC MATERIAL
- SWEAT CONNECTIONS TO REDUCE POTENTIAL FOR LEAKS

VERSATILE

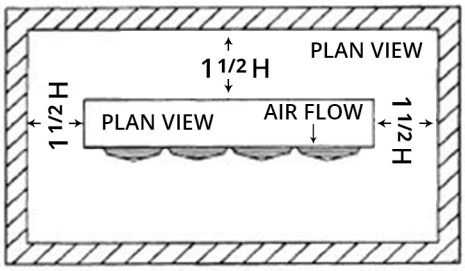
- LARGE DIAMETER DRAIN HOLE (3/4 " ID) IS LOCATED TOWARDS THE BACK OF THE UNIT
- MINIMAL HEIGHT OF THE LOW PROFILE SERIES MAKES IT IDEAL FOR LOW CEILING COOLERS

Options

Mounted Options

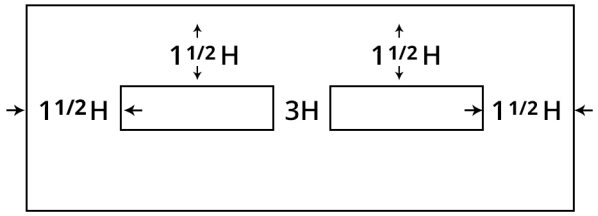
- Brand Label - BOHN
- Motor - Fixed Speed EC
- Voltage - 208-230/1/60
- Defrost Type - Electric
- Drain Pan Defrost Voltage - 208-230/1/60
- DTFD Option - None
- Fan Blade - Standard
- Fan Guard - Molded
- Cabinet Type - Stucco
- Drain Pan Type - Stucco
- Controller Option - QRC
- Defrost Control - None
- Fin Material - Aluminum
- Coil Mechanical Option - Beacon/QRC [E2V11 / L-1]
- Capacity Domain - null
- Capacity Domain - null
- Active Option - YES

Minimum Unit Clearances



One Evaporator

NOTE:
H =Total Height evaporator coil surface.



Two Evaporators

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K12 - WALK-IN FREEZER SHELVING (1 LT REQ'D)

Metro EPOXY

One lot walk-in freezer shelving, 74" high, four tier, size and configure per plan layout.

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K13 - DUNNAGE RACK (2 EA REQ'D)

Metro HP2248PD

Quick Ship - Metro Bow-Tie™ Dunnage Rack, 22" x 48" x 12"H, slotted, with separate polymer tie for joining racks, corrosion proof polymer construction, NSF

{9.09}

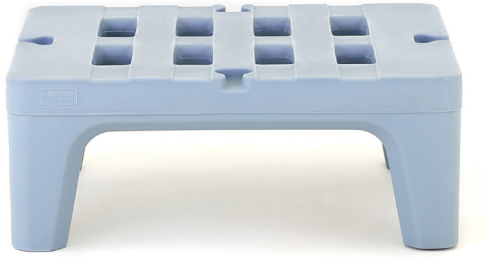
Polymer Bow-Tie™ Dunnage Racks

- **Easy-to-Clean:** Smooth rotomolded polymer offers snag-free surfaces and promotes easy cleaning.
- **Versatile:** Racks join together easily without tools in “end-to-end” and “back-to-back” configurations with the exclusive Bow-Tie™ feature.
- **Durable:** Rust and corrosion proof polymer construction.
- **Strong:** Heavy-duty construction gives racks the strength to hold up to 3,000 lbs. per unit.
- **Unique Design:** Racks have front-to-back slots for easier loading and unloading and superior air flow which promotes longer shelf life.
- **Packaged for Easy Shipping**
- **No Assembly Required**
- **NSF Listed**
- **Microban® Antimicrobial Product Protection*** ✓ Cart body has built-in *Microban® antimicrobial product protection to help fight the growth of stain and odor-causing bacteria, fungi, mold, and mildew to keep product cleaner between cleanings..

✓ Not sold in Canada.





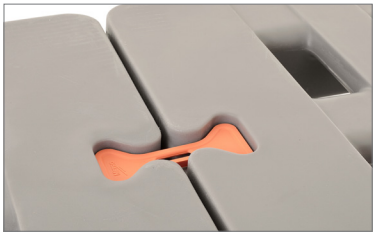


Microban® version

Racks joined with Bow-Tie® Polymer Tie
(1) Included with each rack.







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Microban® product protection does not by itself protect a user from food borne illness. Product must be routinely cleaned.

All Metro Catalog Sheets are available on our website: **metro.com**

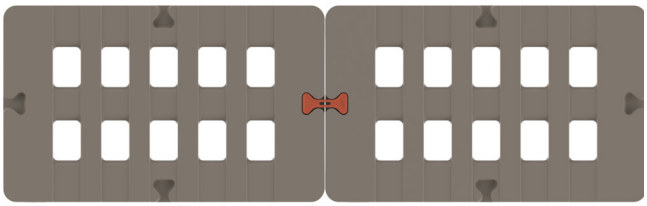
LO2-105A | 11/24

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Please confirm at time of order.
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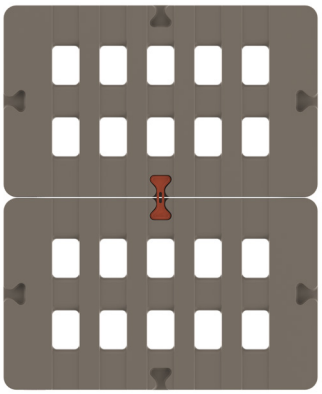
metro.com
North Washington Street, Wilkes-Barre, PA 18705
Product Information. U.S. and Canada: 1.800.992.1776
Outside U.S. and Canada: metro.com/contactus

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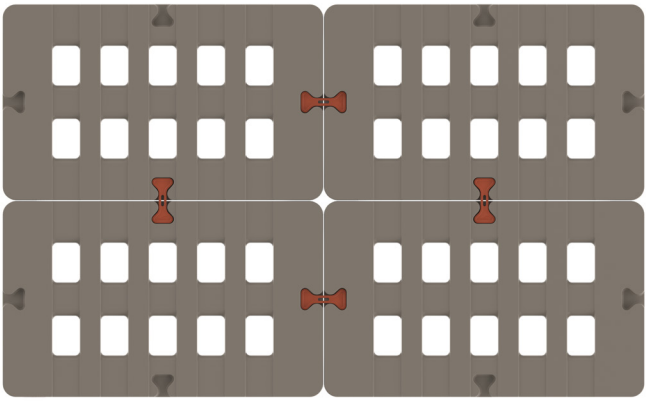
Polymer Bow-Tie™ Dunnage Racks



Racks joined in “end-to-end” configuration



Racks joined in “back-to-back” configuration



Racks joined in “end-to-end” and “back-to-back” configuration

Specifications

- Rotationally molded polyethylene construction
- Slotted top for air circulation
- Slots run front to back for easy loading and unloading
- All rack edges have generous radius to prevent product snagging or marking
- **Weight capacity:** 30" and 36" racks - 1,500 lbs. 48" and 60" racks - 3,000 lbs.
- Each rack provided with separate polymer tie for joining racks in “end-to-end” and “back-to-back” configurations. Rack has a recess centered each side of top surface to accept polymer tie.
- Joining system tie drops in and is removed from top without the use of tools.

Polymer Bow-Tie™ Dunnage Racks

Length (in.)	Length (mm)	Height (in.)	Height (mm)	Approx. Pkd. Wt. (lbs.)	Approx. Pkd. Wt. (kg)	Capacity (lbs.)	Capacity (kg)	Cat. No. Microban	Cat. No. Standard
30	760	12	305	24	10.8	1500	68	**HP2230PDMB**	**HP2230PD**
36	914	12	305	26	11.7	1500	68	**HP2236PDMB**	**HP2236PD**
48	1219	12	305	34	15.3	3000	136	**HP2248PDMB**	**HP2248PD**
60	1524	12	305	42	19	3000	136	**HP2260PDMB**	**HP2260PD**

✓ Microban models not sold in Canada.

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K14 - SPARE NO.

<Spare No.>

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Submittal Sheet

03/14/2025

ITEM# K15 - SPARE NO.

<Spare No.>

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K16 - CLEAN DISH/PAN SHELVING (1 LT REQ'D)

Metro EPOXY

One lot clean dish/pan shelving, 74" high, four tier, size and configure per plan layout

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design & Consulting

Submittal Sheet

03/14/2025

ITEM# K17 - THREE (3) COMPARTMENT SINK (1 EA REQ'D)

Advance Tabco 94-23-60-24RL

Regaline Sink, 3-compartment, with left & right-hand drainboards, 20" front-to-back x 20"W sink compartments, 14" deep, with 11"H backsplash, stainless steel legs with adjustable left-to-right and front cross rails, 24" drainboards, 1" adjustable bullet feet, 14 gauge 304 stainless steel, overall 28" F/B x 117" L/R, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Advance Tabco	3	K-15	Lever Waste Drain, twist handle operated with built in overflow, fits 3-1/2" drain opening, 2" NPT & 1-1/2" IPS outlet connections
Advance Tabco	3	K-4	Support Bracket, for lever waste drain handle, (1) support required for each lever drain
Advance Tabco	3	K-476	Punch hole for overflow drain, (1) punch required for each overflow drain, (please specify make & model of overflow used) (required for overflows unless using K-15)
Advance Tabco	2	K-454	Side splash, integral (welded), for NSF sinks & dish tables, height matches backsplash height (specify side)

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

REGALINE SINKS

Three Compartments - Two Drainboards

Item #: _____ Qty #: _____
Model #: _____
Project #: _____



93 & 9 SERIES
Adjustable Side
Cross-Bracing

YES! It's SeaMLess!

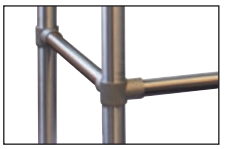
NSF



94 SERIES
Adjustable Side &
Front Cross-Bracing



93 & 9 Series Adjustable
Side Cross-Bracing



94 Series Adjustable
Side & Front Cross-Bracing



Recessed Bowl Surface
Accommodates Poly-Vance
Cutting Boards & Sink Covers

FEATURES:

Tile edge for ease of installation.

One piece **Deep Drawn** sink bowls with integral drainboards with splash.

All sink bowls have a large liberal 3" radius.

"94" Series is supplied with adjustable front and side cross braces featuring leg clamps.

"93" & "9" Series is supplied with adjustable side cross braces featuring leg clamps.

CONSTRUCTION:

All TIG welded.

Welded areas blended to match adjacent surfaces and to a satin finish.

MATERIALS:

Spec-Line (94 Series): 14 gauge type 304 stainless steel
11" High Splash.

Standard (93 Series): 16 gauge type 304 stainless steel
8" High Splash.

Super Saver (9 Series): 18 gauge type 304 stainless steel
8" High Splash.

LEGS:
- 1 5/8" diameter tubular stainless steel.
- Stainless steel gussets.
- Stainless Steel 1" adjustable bullet feet.

Bowl Size	O.A. Length	DRBD. Size	SPEC-LINE 94 Series Model #	WT.	STANDARD 93 Series Model #	WT.	SUPER SAVER 9 Series Model #	WT.	Cu. Ft.
			14 Ga. 304 S/S 14" Water Level		16 Ga. 304 S/S 12" Water Level		18 Ga. 304 S/S 12" Water Level		
16" x 20"	91"	18"	94-3-54-18RL	230 lbs.	93-3-54-18RL	189 lbs.	9-3-54-18RL	182 lbs.	49
	103"	24"	94-3-54-24RL	248 lbs.	93-3-54-24RL	197 lbs.	9-3-54-24RL	190 lbs.	55
	127"	36"*	94-3-54-36RL	275 lbs.	93-3-54-36RL	239 lbs.	9-3-54-36RL	208 lbs.	96
20" x 20"	103"	18"	94-23-60-18RL	248 lbs.	93-23-60-18RL	203 lbs.	9-23-60-18RL	198 lbs.	59
	115"	24"	94-23-60-24RL	276 lbs.	93-23-60-24RL	220 lbs.	9-23-60-24RL	195 lbs.	65
	139"	36"*	94-23-60-36RL	408 lbs.	93-23-60-36RL	387 lbs.	9-23-60-36RL	364 lbs.	89
24" x 24"	†127"	24"	94-43-72-24RL	390 lbs.	93-43-72-24RL	331 lbs.	9-43-72-24RL	318 lbs.	98
	†151"	36"*	94-43-72-36RL	448 lbs.	93-43-72-36RL	393 lbs.	9-43-72-36RL	345 lbs.	110
20" x 28"	103"	18"	94-83-60-18RL	358 lbs.	93-83-60-18RL	315 lbs.	9-83-60-18RL	277 lbs.	83
	115"	24"	94-83-60-24RL	394 lbs.	93-83-60-24RL	346 lbs.	9-83-60-24RL	305 lbs.	95
	139"	36"*	94-83-60-36RL	451 lbs.	93-83-60-36RL	398 lbs.	9-83-60-36RL	350 lbs.	109
			14" Water Level 18" Flood Level		12" Water Level 16" Flood Level		12" Water Level 16" Flood Level		

*** Regalines with 36" Drainboards are Supplied with Two Additional Legs (per drainboard) for Support.**
† Requires Two Faucets

Weights & Cubes Are Approximate

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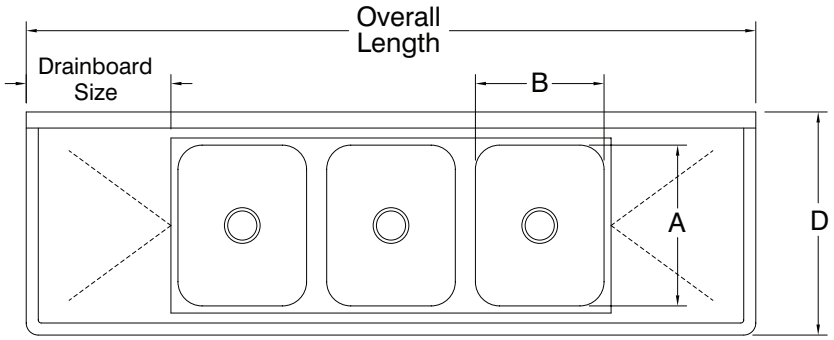
For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

REF-C

DIMENSIONS and SPECIFICATIONS

TOL Overall: ± .500”
Interior: ± .250”

ALL DIMENSIONS ARE TYPICAL



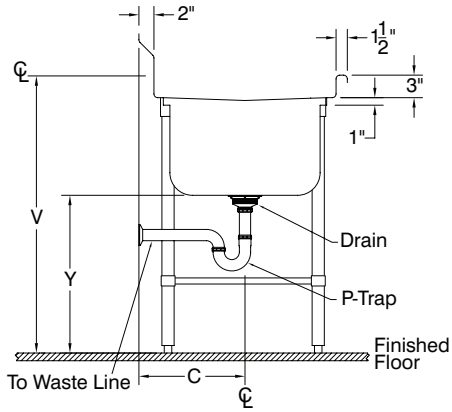
DESCRIPTION

BOWL SIZE	Overall Length	DRBD SIZE	Recommended Use	A	B	C	D	94 SERIES V	94 SERIES W	94 SERIES X	94 SERIES Y	94 SERIES Z	9 & 93 SERIES V	9 & 93 SERIES W	9 & 93 SERIES X	9 & 93 SERIES Y	9 & 93 SERIES Z
16”x20”	91” 103” 127”	18” 24” *36”	DISH SINKS	20”	16”	14 1/8”	28”	38”	11”	14”	19”	45”	38”	8”	12”	21”	42”
20”x20”	103” 115” 139”	18” 24” *36”	DISH & POT SINKS	20”	20”	14 1/8”	28”	38”	11”	14”	19”	45”	38”	8”	12”	21”	42”
18”x24”	97” 109” 133”	18” 24” *36”	POT & PAN SINKS	24”	18”	16 1/8”	32”	38”	11”	14”	19”	45”	38”	8”	12”	21”	42”
24”x24”	†127” †151”	24” *36”	POT SINKS	24”	24”	16 1/8”	32”	38”	11”	14”	19”	45”	38”	8”	12”	21”	42”
20”x28”	103” 115” 139”	18” 24” *36”	PAN SINKS	28”	20”	18 1/8”	36”	38”	11”	14”	19”	45”	38”	8”	12”	21”	42”

† Requires Two Faucets

*** Regalines with 36” Drainboards are Supplied with Two Additional Legs (per drainboard) for Support.**

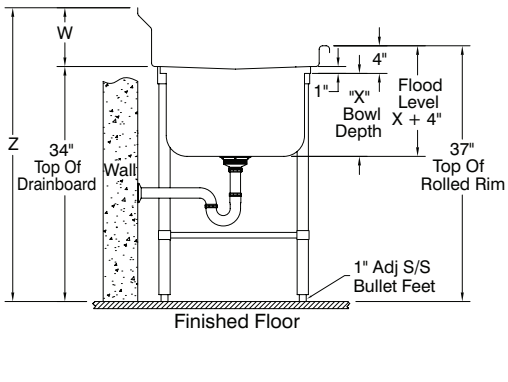
PLUMBING ROUGH-IN



MECHANICAL:

- Supply is 1/2” IPS hot & cold.
- Faucet holes on 8” centers.
- Faucets are not included **(see accessories)**.
- Waste drains are 1 1/2” IPS S/S basket type, located in center of sink bowl, and are included.

SECTION



ADVANCE TABCO
SMART FABRICATION™

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

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DTA-95



DTA-87



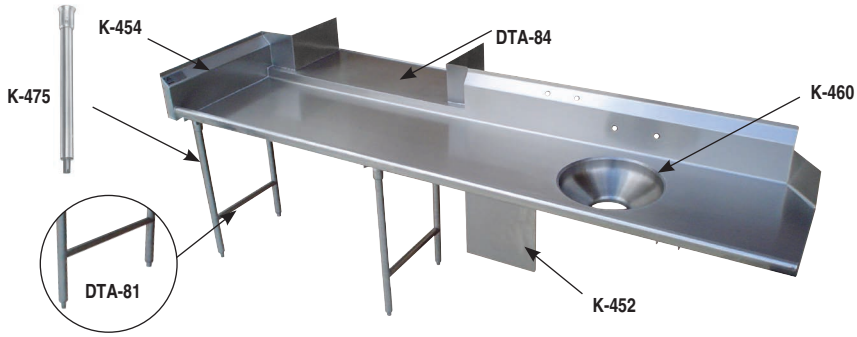
DTA-82



DTA-45

DISHTABLE MODS

Dishtable Modifications & Accessories



MODIFICATIONS

K-23	Welded Set-Up/Crated
K-24	Shell Crating
K-37	Anti-Siphon Vacuum Breaker Hole
K-57	Welded Field Joint (Welded In Field By Others)
K-76	Paint On Sound Deadening
K-77	Splash Cut-Out (Pipe Chase)
K-440	Waste Trough Installation Welded Into Table And Furnished With A 2" Deep Removable Basket
K-452	Control Bracket 8" x 12"
K-453	Control Bracket 14" x 16"
K-454	Side Splash
K-456	Scrap Block Installed (Includes Rubber Scrap Block)
K-460	Disposal Cone Welded Into Table And Furnished With 8" x 12" Control Bracket & Faucet Holes (Supplied By Others)
K-460A	Installation Of Disposal Cone With 14" x 16" Control Bracket, Faucet Holes (Cone Supplied By Others)
K-461	Disposal Collar Welded Into Sink Bowl And Furnished With 8" x 12" Control Bracket (Supplied By Others)
K-461A	Disposal Collar Welded Into Sink Bowl And Furnished With 14" x 16" Control Bracket (Supplied By Others)
K-472	Special Faucet Hole Location
K-495	Turn Down Backsplash (Incl. 2 Brackets. See K-397 For Addt'l Sets)
K-508A	Special Modification Charge
K-550	Stainless Steel Tubular Rack Storage
DTA-40	Drain Hole (For Sorting Table)
DTA-45	Scrap Trough Welded To Dump Sink - Min. Scrap Trough Length Is 3'. Max. Length Is 8'. For 20" x 20" x 8" Bowl Spec-Line Soil S30 Series Only. - Consult Factory For Trough Lengths Exceeding 8 Feet
DTA-46	Inside Mitered Corner
DTA-66	Provision For Dishlanding On Straight Soil Table (Min 4')
DTA-70	Install Booster Heater Brackets (Brackets By Others)
DTA-72	Provision For Side Loader
DTA-75	Provision For Limit Switch (Limit Switch By Others)
DTA-76	Move Prerinse Sink To Conform To Dishmachine Requirements. Please Specify Machine When Placing Order
DTA-78	Notch In Backsplash Return To Clear Handle Please Specify Machine When Placing Order
DTA-81	S/S Welded Leg Assembly with S/S Feet
DTA-82	15" x 20" x 8" Undercounter Dump Sink
DTA-84	Simple Pass-Thru (Specify Wall Thickness - Min. Length 36")
DTA-87	Pass-Thru Wall Frame (Specify Wall Thickness - Min. Length 36")
DTA-95	Install Scrapper Top
DTA-96	Install Trough Collector
DTA-99A	16" x 20" x 12" Sink Bowls
DTA-99B	20" x 20" x 12" Sink Bowls
DTA-99C	10" x 14" x 5" Dump Sink
DTA-99D	18" x 24" x 14" Sink
DTA-99E	24" x 24" x 14" Sink
DTA-106	Mirror Highlight To Dishtable Upgrade

ACCESSORIES

K-4	Lever Drain Bracket
K-5	Twist Handle Operated Drain
K-15	Twist Handle Operated Drain With Overflow
K-397	Wall Brackets (2 Each. Brackets Included With K-495)
K-455C	Stainless Steel Sink Cover 16" x 20"
K-455E	Stainless Steel Sink Cover 20" x 20"
K-457	Replacement Rubber Scrap Block (See K-456 For Install Cost)
K-475	Replacement S/S Leg With Stainless Steel Bullet Foot
K-478	Replacement Stainless Steel Bullet Foot
K-488	Flanged S/S Bullet Foot
K-550	Stainless Steel Tubular Rack Storage
K-610	Perforated Stainless Steel Sink Grid (Specify Bowl Size)
K-700D	12" High Removable Side Splash For Dishtables (Specify Model)
DTA-53	SPEC-LINE Heavy Duty Prerinse Faucet
DTA-51	Pre-Rinse Slide Bar for 18" x 24" Fab. Sink Bowls
DTA-52	Pre-Rinse Slide Bar for 24" x 24" Fab. Sink Bowls
DTA-55	Column Notch (Includes Splash)
DTA-56	Addt'l Length On 59" Side Of Corner Or Straight Tables
DTA-58	Pre-Rinse Basket w/ Slide Bar for 18" x 24" Fab. Sink Bowls
DTA-59	Pre-Rinse Basket w/ Slide Bar for 24" x 24" Fab. Sink Bowls
DTA-60	Prerinse Slide Bar for 20" x 20" Fab. Sink Bowls
DTA-62	Prerinse Basket For 20" x 20" Deep Drawn Bowls
DTA-63	Prerinse Slide Bar For 20" x 20" Deep Drawn Bowls
DTA-64	Prerinse Slide Bar For 16" x 20" Fab. Sink Bowls
DTA-65	Prerinse Slide Bar For 16" x 20" Deep Drawn Bowls
DTA-67	Stainless Steel Rear Cross-Bracing (Factory Installed Only)
DTA-69	Prerinse Basket For 16" x 20" Deep Drawn Bowls
DTA-100	Prerinse Basket with Slide Bar for 20" x 20" Fab. Sink Bowls
DTA-125	Prerinse Basket with Slide Bar for 16" x 20" Fab. Sink Bowls
DTA-125A	Perforated Basket for DTA-82 Dump Sink

ADDITIONAL DISHTABLE ACCESSORIES

For More Faucet Options & Faucet Specs,
See Faucet Specifications

⚠ WARNING:
Faucet(s) on this page may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info.,visit www.p65warnings.ca.gov.

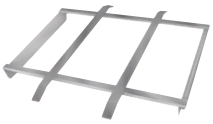
Prerinse Baskets with Welded Slide Bar For Fabricated Bowls

Model #	Fits Bowls	Wt.	Cu.
DTA-125	16" x 20" x 4"	9 lbs.	1
DTA-100	20" x 20" x 4"	12 lbs.	1
	Large Size Baskets		
DTA-58	18" x 24" x 4"	11 lbs.	1
DTA-59	24" x 24" x 4"	20 lbs.	1


DTA-100 Shown

Prerinse Slide Bars For Fabricated Bowls

Model #	Fits Bowls	Wt.	Cu.
DTA-64	16" x 20"	7 lbs.	1
DTA-60	20" x 20"	9 lbs.	1
	Large Size Prerinse Slide Bars		
DTA-51	18" x 24"	8 lbs.	1
DTA-52	24" x 24"	10 lbs.	1



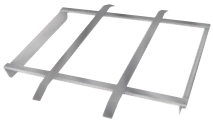
Prerinse Baskets with Welded Slide Bar For Deep Drawn Bowls

Model #	Fits Bowls	Wt.	Cu.
DTA-69	16" x 20" x 4"	9 lbs.	1
DTA-62	20" x 20" x 4"	12 lbs.	1


DTA-62 Shown

Prerinse Slide Bars for Deep Drawn Bowls

Model #	Fits Bowls	Wt.	Cu.
DTA-65	16" x 20"	7 lbs.	1
DTA-63	20" x 20"	9 lbs.	1



Splash Mounted Faucet EXTRA HEAVY DUTY

K-119
8" O.C.

16" Spout



Splash Mounted Faucet

K-101
8" O.C.

8" Spout



SPEC-LINE EXTRA HEAVY DUTY

Prerinse Faucet

DTA-53
8"O.C.

Wall Bracket Included

Splash Mounted

Interchangeable with T&S Brand Faucets
T&S Equivalent = B133-B



Prerinse Faucet

T&S

K-116
8"O.C.

Wall Bracket Included

Splash Mtd.



Add-A-Faucet for DTA-53 Prerinse Faucet K-117



Add-A-Faucet for K-116 Prerinse Faucet K-117-TS



Stainless Steel Sink Compartment Covers

K-455
16" x 20" Cover
or
20" x 20"
Specify Size



Lever Operated Drain

K-5


Twist Handle 2" IPS

Lever Drain Support Bracket

K-4



INDIVIDUAL Stainless Steel Legs with Stainless Steel Adjustable Bullet Feet

K-475



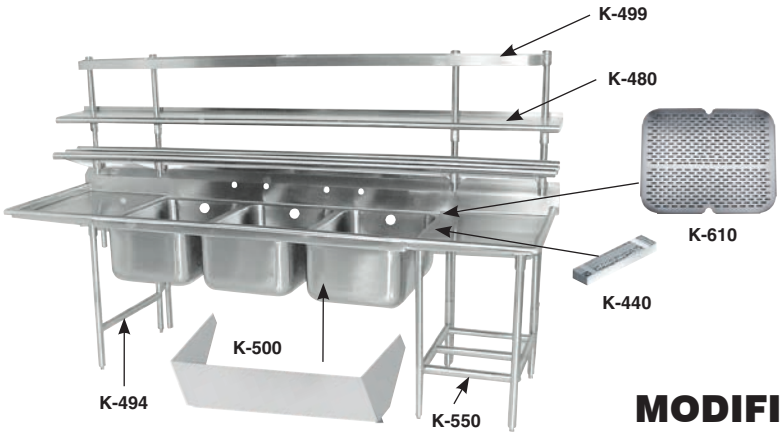
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SINK MODIFICATIONS & ACCESSORIES





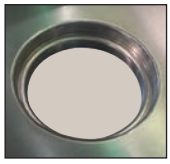
K-37 Anti-Siphon Vacuum Braker Holes



K-72 Leg-To-Wall Brace



K-460A Disposal Cone w/ Control Bracket & Faucet Holes



K-461A Install Collar w/ Control Bracket

MODIFICATIONS

K-4	Support Bracket for Lever Waste Drain Handle
K-23	Sink Legs Welded To Undershelf Or Left-To-Right Cross Rails, Shipped Set Up & Crated. (Top Is Not Welded To Legs)
K-23A	Sink Legs Welded To Leg Gussets Under Sink Top & To Undershelf Or Left-To-Right Cross Rails, Shipped Set Up & Crated
K-24	Shell Crating
K-37	Anti-Siphon Vacuum Breaker Holes
K-57	Welded field Joint *(Welded in field by others)*
K-76	Paint on Sound Deadening
K-77	Splash Cutout (Pipe Chase)
K-106	Mirror Highlite Edge for Sink
K-440	Waste Trough with 2" deep removable basket
K-447	High Backsplash up to 18"
K-448	High Backsplash up to 13"
K-450	Extra Drainboard
K-451	Drainboard Corner Turn
K-452	Control Bracket 8" x 12"
K-452S	Splash Mounted Control Bracket 8" x 12"
K-453	Control Bracket 14" x 16"
K-453S	Splash Mounted Control Bracket 14" x 16"
K-454	Sidesplash
K-456	Scrap Block Installed
K-460	Installation of Disposal Cone with 8" x 12" Control Bracket, Faucet Holes *(Cone supplied by others)*
K-460A	Installation of Disposal Cone with 14" x 16" Control Bracket, Faucet Holes *(Cone supplied by others)*

K-461	Install Collar with 8" x 12" control bracket *(Collar by others)*
K-461A	Install Collar with 14" x 16" control bracket *(Collar by others)*
K-470	Modify Bowl Depth
K-472	Faucet Hole Revision
K-473	Working Height Revision
K-476	Punch for Over Flow Holes *(Holes Only. N/C when ordering K-15)*
K-479	Undershelf Under Drainboard
K-480	Stainless Steel 12" Wide Shelf *(min. of 3 ft.)*
K-480A	Stainless Steel 15" Wide Shelf *(min. of 3 ft.)*
K-490	Provision for Pot Washer *(For "Wells-PW-106" only)*
K-491	Provision for Hatco Heater
K-495	Turn Down Backsplash *(Includes 2 Brackets. See K-397 Addt'l Sets)*
K-498	Tubular Overshelf 12" wide (Min. 3 Ft.)
K-499	Stainless Steel Pot Rack
K-500	Stainless Steel Apron to Cover Sink Bowls
K-500A	17" Stainless Steel Apron to Cover Sink Bowls and Support Lever Drain Handles
K-508	Special Sizing Charge (Larger size cut down to smaller size
K-508A	Special Modification Charge
K-510	Prepare Sink for Undercounter Dishwasher *(24" drainboard or larger)*
K-520	Poly Board/Stainless Steel Cover Holder
K-550	Stainless Steel Tubular Rack Storage
K-ROD	Weld Support Rods For Poly Sink Cover In Corners Of Sink Bowl

ACCESSORIES

K-30	Faucet Wall Mounting Bracket
K-72	Leg To Wall Brace
K-350	Residential Finish & Packaging
K-397	Wall Brackets for Sink *(Brackets Included with K-495)*
K-457	Replacement Rubber Scrap Block *(See K-456 for install cost)*
K-474	16 ga., '304' Series S/S Leg with S/S Foot
K-475	S/S Legs with S/S Foot
K-477	Replacement Leg Clamp For Adjustable Cross-Bracing
K-477C	Replacement Corner Leg Clamp For Adjustable Cross-Bracing
K-478	Stainless Steel Bullet Foot
K-488	Flanged S/S Bullet Foot
K-493	16 ga., '304' Series S/S Welded Leg Assembly with S/S Feet
K-494	S/S Welded Leg Assembly with S/S Feet
K-497	Galv. Welded Leg Assembly with Plastic Feet
K-497A	Galv. Individual Legs with Plastic Feet
K-496	Leg Assembly For Grease Interceptor w/ Adj. Cross-Bracing & S/S Feet *(For Grease Interceptors with 15" Ht. or less. Consult factory for larger Grease Interceptors)*
K-610	Perforated Stainless Steel Sink Grid *(Specify Bowl Size)*

SINK COVERS

Choose Model # & Add The Proper Letter In Place Of The Underscore (_).
Example: K-2A or FC-455H

	FOR DEEP DRAWN BOWLS		FOR FABRICATED BOWLS	
Bowl Size	**Poly Covers Model K-2_**	**S/S Covers Model K-455_**	**Poly Covers Model K-2_**	**S/S Covers Model FC-455_**
10" x 14"	A	A	AF	A
12" x 20"	I	I	IF	I
14" x 14"	H	H	HF	H
14" x 16"	B	B	BF	B
15" x 15"	Not Available	Not Available	MF	M
15" x 24"	Not Available	Not Available	UF	U
16" x 20"	C	C	CF	C
18" x 18"	Not Available	Not Available	JF	J
18" x 24"	D	D	DF	D
20" x 20"	E	E	EF	E
20" x 24"	Not Available	Not Available	PF	P
20" x 28"	G	G	GF	G
20" x 30"	Not Available	Not Available	SF	S
24" x 30"	Not Available	Not Available	TF	T
24" x 24"	F	F	FF	F
24" x 36"	Not Available	Not Available	RF	R
30" x 30"	Not Available	Not Available	VF	V

Custom Covers Available. Consult Factory.

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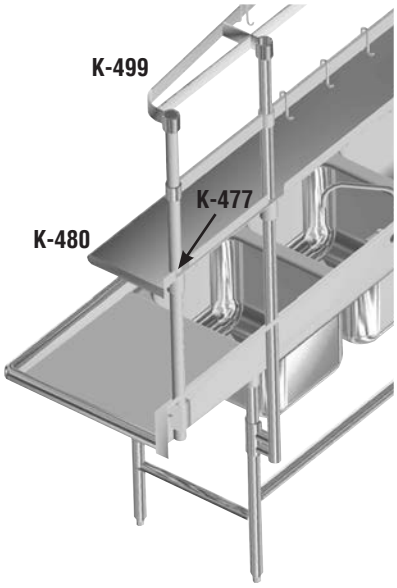
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POT RACK & TUBULAR OVERSHELF DETAILS AND SPECIFICATIONS

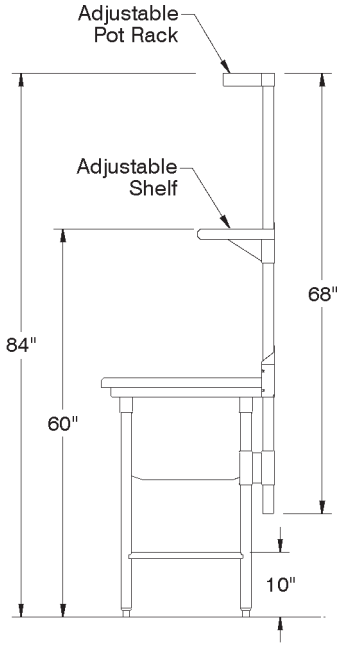
ADJUSTABLE POT RACK & SHELF



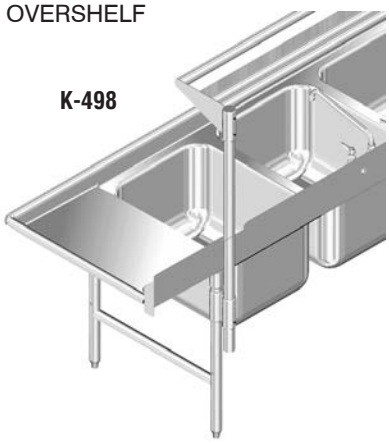
Item #: _____ Qty #: _____

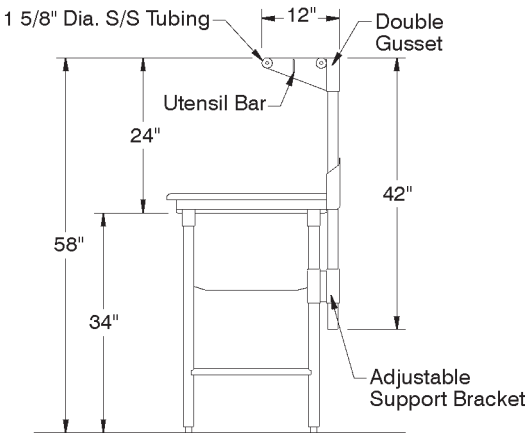
Model #: _____

Project #: _____

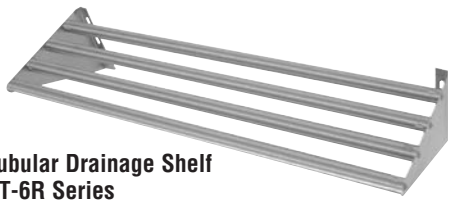


TUBULAR OVERSHELF





Model #	Description	Qty
K-477	Mounting Provision for Sink Mounted Pot Rack or Shelf	
K-480	12” Wide Stainless Steel Shelf	
K-498	Tubular Overshelf (min. 3 ft.)	
K-499	Stainless Steel Pot Rack	
DT-6R-36	3’ Tubular Wall Mounted Drainage Shelf	
DT-6R-48	4’ Tubular Wall Mounted Drainage Shelf	
DT-6R-60	5’ Tubular Wall Mounted Drainage Shelf	
DT-6R-72	6’ Tubular Wall Mounted Drainage Shelf	



Tubular Drainage Shelf
DT-6R Series

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Submittal Sheet

03/14/2025

ITEM# K17.1 - WALL / SPLASH MOUNT FAUCET (1 EA REQ'D)

Fisher 13270

Faucet, backsplash mount, 8" centers, 14" swing spout, lever handles with color coded indexes, 1/2" NPT male inlets, brass, CSA, ADA Compliant

ACCESSORIES

Mfr	Qty	Model	Spec
Fisher	1		4 year warranty against defects in materials or workmanship, standard
Fisher	2	2400-2103	Elbow, 1/2" F x 1/2" F, 90°, brass

APPLICATION:

PRODUCT NAME:

8" C/C BACKSPLASH FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

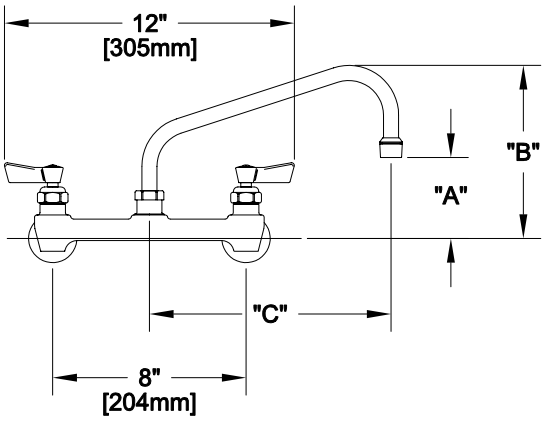
☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

- ☐ 13234 W/ 6" SWING SPOUT
- ☐ 13242 W/ 8" SWING SPOUT
- ☐ 13250 W/ 10" SWING SPOUT
- ☐ 13269 W/ 12" SWING SPOUT
- ☐ 13277 W/ 14" SWING SPOUT
- ☐ 13218 W/ 16" SWING SPOUT

OPTIONS OR MODIFICATIONS:

- ☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
- ☐ DJ SUB-ASSY (7-1/4" OR 13") CIRCLE LENGTH
- ☐ ELBOWS
- ☐ VANDAL RESISTANT KIT
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ OTHER _____



MODEL	DIM "A"	DIM "B"	DIM "C"
13234	2-1/4" [57mm]	5-7/8" [149mm]	6" [152mm]
13242	2-1/2" [64mm]	6-3/8" [162mm]	8" [204mm]
13250	3-1/8" [79mm]	6-7/8" [175mm]	10" [254mm]
13269	3-3/4" [95mm]	7-3/8" [187mm]	12" [305mm]
13277	4-3/8" [111mm]	8-1/4" [210mm]	14" [356mm]
13218	5" [127mm]	8-7/8" [225mm]	16" [406mm]

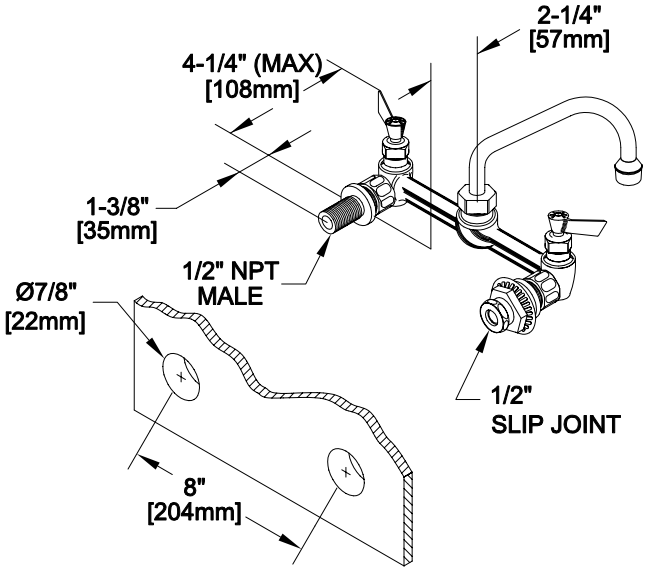
FEATURES

CONTROL VALVE
* 8" C/C BACKSPLASH MOUNT
* SWIVELLING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE: 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 5.0 LBS

ROUGH-IN:



ANSI/A112.18.1M

FISHER
FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 13234 REV. D

APPLICATION:

PRODUCT NAME:

1/2" ELBOW

JOB NAME:

☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

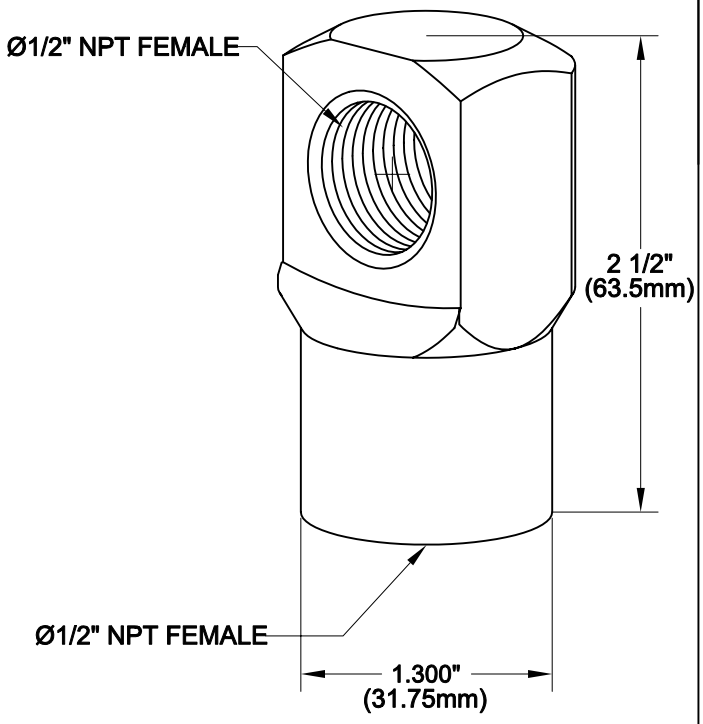
QUANTITY: | ITEM NO.

MODEL:

☐ 2400-2103 1/2" F X 1/2" F ELBOW

OPTIONS OR MODIFICATIONS:

☐ OTHER _____



FEATURES

* FITS ALL COMPETITOR'S COMMERCIAL FAUCETS
* 1/2" 90° ELBOW TO MAKE INSTALLATION EASIER WHEN YOU ARE LIMITED ON SPACE, BEHIND THE BACKSPLASH
* PREVENTS ANY CRIMPING OR OTHER DAMAGE TO SUPPLY LINES

SHIPPING WEIGHT
* 0.375 LBS

ANSI/A112.18.1M

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SPEC. 2400-2103 REV.A

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03/14/2025

ITEM# K18 - OVERSHELF (1 EA REQ'D)

Advance Tabco PS-12-108

Shelf with Pot Rack, wall-mounted, 108"W x 12"D, 18/430 stainless steel shelf, 2" x 1/4" stainless steel pot rack, includes: (9) plated double pot hooks (units 96" & longer have (3) support brackets), NSF

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STAINLESS STEEL

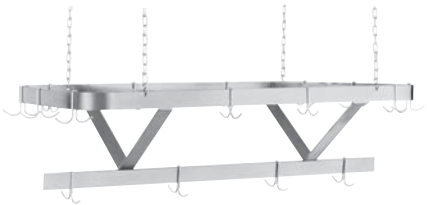
POT RACKS

Item #: _____ Qty #: _____

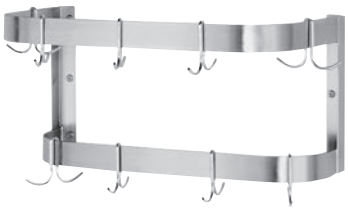
Model #: _____

Project #: _____

CEILING MOUNTED



WALL MOUNTED



SHELF w/ POT RACK



Ceiling Mounted

L	S/S	# of Hooks	Wt
36”	SC-36	12	42 lbs.
48”	SC-48	12	48 lbs.
60”	SC-60	18	54 lbs.
72”	SC-72	18	60 lbs.
84”	SC-84	18	66 lbs.
96”	SC-96	18	80 lbs.
108”	SC-108	18	86 lbs.
120”	SC-120	18	92 lbs.
132”	SC-132	18	98 lbs.
144”	SC-144	18	104 lbs.

Wall Mounted NSF

L	S/S	# of Hooks	Wt
24”	SW-24	12	18 lbs.
36”	SW-36	12	22 lbs.
48”	SW-48	12	26 lbs.
60”	SW-60	18	30 lbs.
72”	SW-72	18	34 lbs.
84”	SW-84	18	44 lbs.
96”	SW-96	18	48 lbs.
108”	SW-108	18	52 lbs.
120”	SW-120	18	56 lbs.
132”	SW-132	18	60 lbs.
144”	SW-144	18	64 lbs.

Shelf with Pot Rack NSF

L	12” Wide	Wt	15” Wide	Wt	18” Wide	Wt	# of Hooks
36”	PS-12-36	20 lbs.	PS-15-36	25 lbs.	PS-18-36	30 lbs.	6
48”	PS-12-48	30 lbs.	PS-15-48	35 lbs.	PS-18-48	40 lbs.	6
60”	PS-12-60	40 lbs.	PS-15-60	45 lbs.	PS-18-60	50 lbs.	9
72”	PS-12-72	50 lbs.	PS-15-72	55 lbs.	PS-18-72	60 lbs.	9
84”	PS-12-84	60 lbs.	PS-15-84	65 lbs.	PS-18-84	70 lbs.	9
96”	PS-12-96	70 lbs.	PS-15-96	75 lbs.	PS-18-96	80 lbs.	9
108”	PS-12-108	80 lbs.	PS-15-108	85 lbs.	PS-18-108	90 lbs.	9
120”	PS-12-120	90 lbs.	PS-15-120	95 lbs.	PS-18-120	100 lbs.	9
132”	PS-12-132	100 lbs.	PS-15-132	105 lbs.	PS-18-132	110 lbs.	9
144”	PS-12-144	110 lbs.	PS-15-144	115 lbs.	PS-18-144	120 lbs.	9

Units 8 ft. and larger are furnished with three (3) sets of supports brackets.

FEATURES: (Ceiling Mounted)

Ceiling suspension with chain hangers. Optional stainless steel Flat Bar in lieu of Chain available. Use **TA-98**.

MATERIAL:

Flat steel bar is 2” x 1/4”, stainless steel.

Pot hooks are plated.

24” long chain hangers are plated.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

FEATURES: (Wall Mounted)

Secured to wall by means of bolts through welded brackets. (Hardware not provided)

MATERIAL:

Flat steel bar is 2” x 1/4”, stainless steel.

Pot hooks are plated.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

FEATURES: (Shelf/Pot Rack)

A dual purpose unit for shelf and utensil storage.

Secured to wall by means of bolts through welded brackets. (Hardware not provided)

MATERIAL:

Flat stainless steel bar is 2” x 1/4”.
Pot hooks are plated.
Type “430” stainless steel shelf.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

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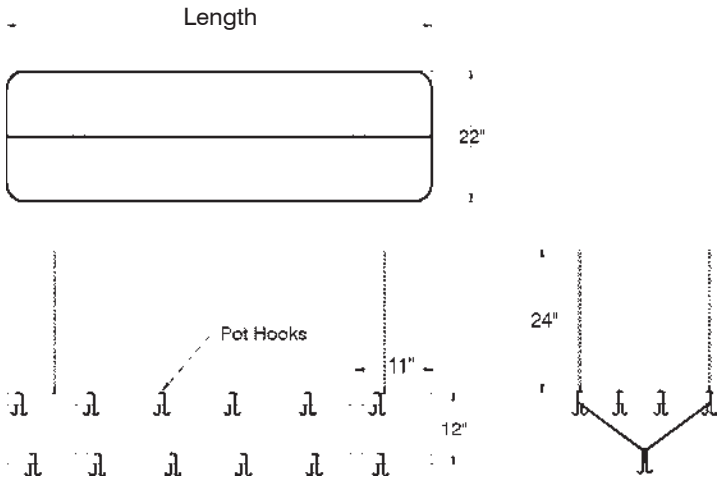
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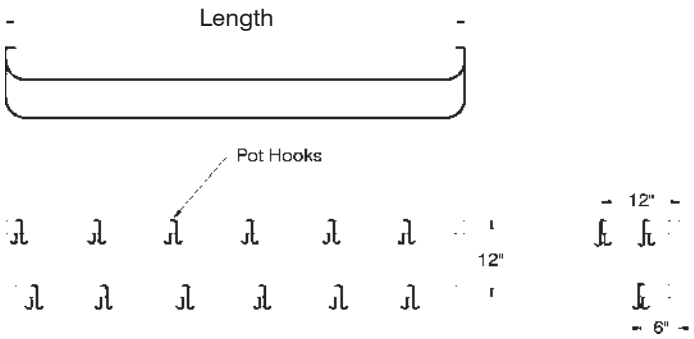
DETAILS and SPECIFICATIONS

TOL ± .500” ALL DIMENSIONS ARE TYPICAL

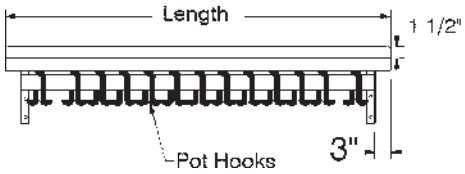
Ceiling Mounted



Wall Mounted



Shelf with Pot Rack



Width	A
12”	10 1/2”
15”	13 1/2”
18”	16 1/2”

Load Capacity = 20 lbs. per sq. ft.

(Evenly Distributed Weight)

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03/14/2025

ITEM# K19 - MOBILE TRASH CANS

By owner

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Submittal Sheet

03/14/2025

ITEM# K20 - WORK TABLE (1 EA REQ'D)

Custom CUSTOM

S/s work table with partial s/s undershelf, 20" x 20" s/s drawer and five inch rear splash.

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Submittal Sheet

03/14/2025

ITEM# K21 - INGREDIENT BIN (3 EA REQ'D)

Cambro IBS27148

Ingredient Bin, mobile, 27 gallon capacity, 1-pc seamless polyethylene bin, 2-pc sliding polycarbonate lid, scoop holder included (scoop sold separately), (4) 3" heavy duty casters (2 front swivel, 2 fixed), white with clear cover, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Cambro	3	SCP12CW135	Camwear® Scoop, 12 oz., polycarbonate, clear, NSF
Cambro	3	IBSH24148	Ingredient Bin Scoop Holder, 24 oz, white, for models IBS20148, IBS27148 and IBSF27

CAMBRO

Ingredient Bins

Slant Top

Models IBS20 – 21 gallon (81 L)
IBS27 – 27 gallon (102 L)
IBS37 – 37 gallon (140 L)

Item No. _____

Specifier Identification No. _____

Model No. _____

Quantity _____



IBS20



IBS27



IBS37

Scoops not Included

Features & Benefits

- Stores and transports a wide variety of dry ingredients such as flour, sugar, rice or grains. Perfect for restaurants, food manufacturers or commissaries.
- Available in 21, 27 and 37 gallon (81, 102, 140 L) capacity to meet standard industry requirements for storage and transportation of bulk foods.
- One-piece, seamless single-wall polyethylene bin construction is extremely durable. Won't rust or corrode. Liquids and dry foods will not stick or seep between seams.
- FDA accepted material. Meets all food contact requirements and eliminates need for liners.
- Smooth interior and exterior are easy to clean.
- Injection molded Camwear® polycarbonate lids are transparent, break resistant and offer quick and easy identification of contents. Slide-back feature means easy access.
- Working height permits storage under standard work tables.
- Heavy-duty 3" (7,6 cm) casters, 2 front swivel, 2 fixed.
- No assembly required.
- Available in White (148) only with Clear (135) cover.

Approvals

NSF

© Cambro Manufacturing Company 5801 Skylab Road, Huntington Beach, CA 92647-2056, U.S.A.
Telephone 714 848 1555 **Toll Free** 800 854 7631 **Customer Service Department** 800 833 3003

Ingredient Bins

Slant Top

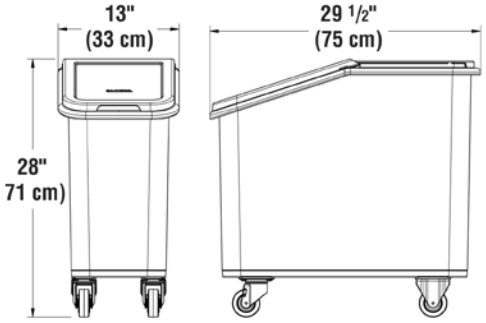
Models IBS20 – 21 gallon (81 L)
IBS27 – 27 gallon (102 L)
IBS37 – 37 gallon (140 L)

Item No. _____

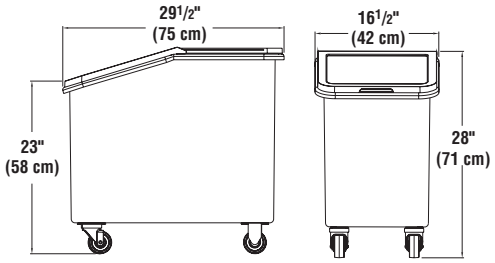
Specifier Identification No. _____

Model No. _____

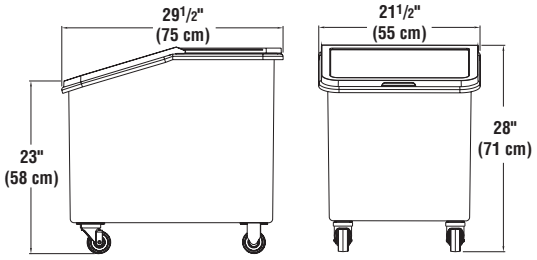
Quantity _____



IBS20



IBS27



IBS37

Specifications

Dimension Tolerance: +/- 1/4" (0,64 cm)

Code	Description	Volume Capacity	Load Capacity Sugar	Load Capacity Flour	Exterior Dimensions W x D x H	Case lbs./cube Kg/m³
Slant Top Ingredient Bin						
IBS20	21 gal. Ingredient Bin (81 L)	2.87 Cubic feet (0,081) Cubic meters	170 lbs. (77 kg.)	140 lbs. (63 kg.)	13" x 29 1/2" x 28" (33 x 75 x 71 cm)	28 (6,57) 13 (0,19)
IBS27	27 gal. Ingredient Bin (102 L)	3.98 Cubic feet (0,113) Cubic meters	226 lbs. (103 kg.)	150 lbs. (68 kg.)	16 1/2" x 29 1/2" x 28" (42 x 75 x 71 cm)	24 (7,50) 11 (0,22)
IBS37	37 gal. Ingredient Bin (140 L)	5.55 Cubic feet (0,157) Cubic meters	314 lbs. (142 kg.)	225 lbs. (102 kg.)	21 1/2" x 29 1/2" x 28" (55 x 75 x 71 cm)	28 (10,10) 13 (0,29)

Architect Specs

The Ingredient Bins shall be Cambro Model..., manufactured by Cambro Mfg. Co., Huntington Beach, CA 92648 U.S.A. Each unit shall be one piece, seamless, single-wall molded construction made of FDA Approved white polyethylene. Unit capacity shall range from 21 - 37 gallons (81 - 140 L) and/or 2.87 - 5.55 cu. ft. (0,081 - 0,157 cubic meters).

It shall have four each 3" (7,6 cm) casters with 1 1/4" (3,2 cm) wide tread, 2 front swivel and 2 fixed. It shall have an injection molded, transparent, slide-back polycarbonate lid. It shall not exceed 29" (73,6 cm) in height so that it can store under standard work tables. It shall be available in white only with a clear cover.

Approvals

NSF

CAMBRO

© Cambro Manufacturing Company 5801 Skylab Road, Huntington Beach, CA 92647-2056, U.S.A.
Telephone 714 848 1555 **Toll Free** 800 854 7631 **Customer Service Department** 800 833 3003

D041115 Ingredient Bin Slant Top CS

INGREDIENT BINS AND CAMWEAR® DRY SCOOPS



Ingredient Bins

- Store bulk dry ingredients such as flour and grain.
- Hygienic clear sliding lid reduces handling and allows for quick content identification.
- Bin made of FDA-accepted material so no liners are needed.
- Designed to fit under standard work tables.

3" Casters: 2 rear fixed, 2 front swivel.

Color: White (148).
Cover Color: Clear (135).

Scoops sold separately.

CA PROP 65 Lids Only


IBS20


IBS27


IBS37


IBSF27


IB32


IB36


IB44

CODE	DIMENSIONS W x L x H	LIQUID CAPACITY	LID TYPE	DRY CAPACITY (SUGAR)	DRY CAPACITY (FLOUR)
IBS20	13" x 29½" x 28"	21 gal.	Two Piece Sliding Lid	170 lbs.	140 lbs.
IBS27	16⁵⁄₁₆" x 29⅝" x 28"	27	Two Piece Sliding Lid	226	150
IBS37	21½" x 29½" x 28¼"	37	Two Piece Sliding Lid	314	225
IBSF27	13" x 30⅛" x 28½"	26.7	Two Piece Sliding Lid	216	150
IB32	22" x 24" x 23"	32	Single Flat Lid	215	160
IB36	15¼" x 29½" x 29"	34	Single Flat Lid	252	180
IB44	18½" x 29½" x 29"	42.5	Single Flat Lid	320	230

Case Pack: 1 **InStock Color:** White (148).

Camwear Dry Scoops

- Virtually unbreakable Camwear will not dent, chip or rust.
- Molded-in sure grip handle includes a hole for hanging.
- Ideal for use with Cambro Ice Caddies and Ingredient Bins.

Color: Clear (135).

CA PROP 65



CODE	APPROX. CAPACITY	CASE PACK
SCP6CW	6 oz.	12
SCP12CW	12	12
SCP24CW	24	12
SCP64CW	64	6

InStock Color: Clear (135).

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Submittal Sheet

03/14/2025

ITEM# K22 - SHELVING, WALL MOUNTED (1 EA REQ'D)

Advance Tabco WS-12-72-16

Shelf, wall-mounted, 72"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

WALL SHELVES

NSF



Item #: _____ Qty #: _____

Model #: _____

Project #: _____



FEATURES:

Brackets can be positioned to accommodate wall studs.

Furnished with a 1-5/8" Bullnose edge with a 1-1/2" turn-up edge at rear. Ends are turned down square.

MATERIAL:

16 Gauge Series - 304 stainless steel polished to a satin finish.

18 Gauge Series - 430 stainless steel polished to a satin finish.

CONSTRUCTION:

Secured to wall by means of bolts through support brackets.

Units 7 ft. and larger are furnished with 3 brackets.

	10" Wide			12" Wide			15" Wide			18" Wide			
L	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	Approx. Cu. Ft.
24"	WS-10-24-16	WS-10-24	8 lbs.	WS-12-24-16	WS-12-24	9 lbs.	WS-15-24-16	WS-15-24	11 lbs.	WS-18-24-16	WS-18-24	14 lbs.	3
30"	-	-	-	WS-12-30-16	WS-12-30	12 lbs.	-	-	-	-	-	-	4
36"	WS-10-36-16	WS-10-36	10 lbs.	WS-12-36-16	WS-12-36	12 lbs.	WS-15-36-16	WS-15-36	15 lbs.	WS-18-36-16	WS-18-36	21 lbs.	4
42"	-	-	-	WS-12-42-16	WS-12-42	14 lbs.	-	-	-	-	-	-	5
48"	WS-10-48-16	WS-10-48	12 lbs.	WS-12-48-16	WS-12-48	14 lbs.	WS-15-48-16	WS-15-48	18 lbs.	WS-18-48-16	WS-18-48	24 lbs.	5
60"	WS-10-60-16	WS-10-60	15 lbs.	WS-12-60-16	WS-12-60	17 lbs.	WS-15-60-16	WS-15-60	23 lbs.	WS-18-60-16	WS-18-60	28 lbs.	6
72"	WS-10-72-16	WS-10-72	17 lbs.	WS-12-72-16	WS-12-72	21 lbs.	WS-15-72-16	WS-15-72	28 lbs.	WS-18-72-16	WS-18-72	32 lbs.	7
84"	WS-10-84-16	WS-10-84	20 lbs.	WS-12-84-16	WS-12-84	25 lbs.	WS-15-84-16	WS-15-84	32 lbs.	WS-18-84-16	WS-18-84	36 lbs.	8
96"	WS-10-96-16	WS-10-96	23 lbs.	WS-12-96-16	WS-12-96	28 lbs.	WS-15-96-16	WS-15-96	36 lbs.	WS-18-96-16	WS-18-96	42 lbs.	10
108"	WS-10-108-16	WS-10-108	28 lbs.	WS-12-108-16	WS-12-108	32 lbs.	WS-15-108-16	WS-15-108	40 lbs.	WS-18-108-16	WS-18-108	48 lbs.	11
120"	WS-10-120-16	WS-10-120	32 lbs.	WS-12-120-16	WS-12-120	36 lbs.	WS-15-120-16	WS-15-120	44 lbs.	WS-18-120-16	WS-18-120	54 lbs.	12
132"	WS-10-132-16	WS-10-132	36 lbs.	WS-12-132-16	WS-12-132	42 lbs.	WS-15-132-16	WS-15-132	49 lbs.	WS-18-132-16	WS-18-132	60 lbs.	13
144"	WS-10-144-16	WS-10-144	40 lbs.	WS-12-144-16	WS-12-144	48 lbs.	WS-15-144-16	WS-15-144	55 lbs.	WS-18-144-16	WS-18-144	66 lbs.	14

ADVANCE TABCO
SMART FABRICATION™
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Customer Service Available To Assist You 1-800-645-3166 8:30 am - 7:00 pm E.S.T.

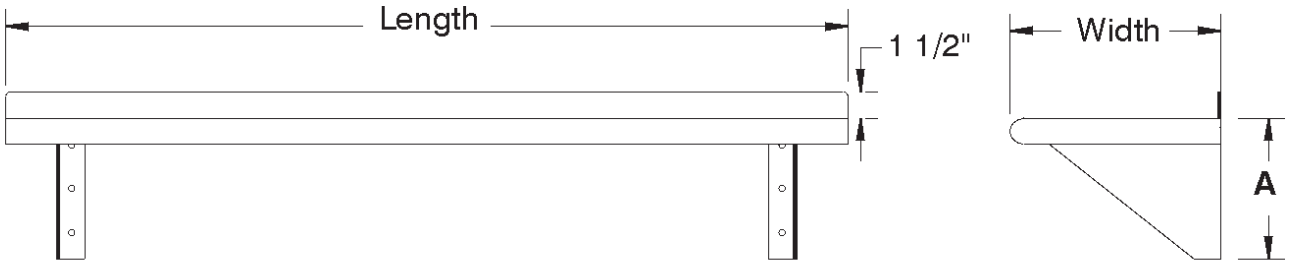
For Orders & Customer Service:
Email: customer@advancetabco.com or **Fax:** 631-242-6900

For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

REF-L

DETAILS and SPECIFICATIONS

TOL ± .500" ALL DIMENSIONS ARE TYPICAL

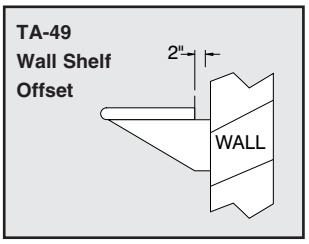


Width	A
10"	8 1/2"
12"	10 1/2"
15"	13 1/2"
18"	16 1/2"

Load Capacity = 20 lbs. per sq. ft.
(Evenly Distributed Weight)

Wall Shelf Options

PRT-1	Printer Shelf
TA-22A	Square Edge Shelf
TA-26	Welded Shelf Brackets
TA-49	Wall Shelf 2" Offset
TA-71	Heat Lamp Provision
TA-77	Check Minder
TA-77A	Concealer for Heat Lamp (Requires TA-77)
TA-99A	14 Ga. S/S 304 Upgrade for Overshelves
TA-100A	Bullnose Edge On All 4 Sides of Shelf
TA-102	6" Cantilever Shelf Offset





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Submittal Sheet

03/14/2025

ITEM# K23 - FOOD SLICER, ELECTRIC (1 EA REQ'D)

Globe (Middleby) G12

Food Slicer, manual, 12" diameter knife, extended chute and end weight accommodates 10-1/2"H product, pyramid-shaped end weight teeth & gripping teeth on underside of end weight, top mounted knife sharpener, belt-driven, ball bearing chute slide, attached knife ring guard, knife cover interlock, removable slice deflector, power indicator light, motor overload protection with manual reset, anodized aluminum construction, non-slip rubber feet, 1/2 HP, 115v/60/1-ph, 3.0 amps, cord, NEMA 5-15P, cETLus, ETL-Sanitation

ACCESSORIES

Mfr	Qty	Model	Spec
Globe (Middleby)	1		2 year parts & labor warranty

Project Name: _____ AIA#: _____

Model #: _____ Location: _____

SIS#: _____ Item #: _____ Quantity: _____

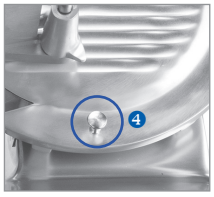
G-Series Medium Duty Manual Slicer

Enhanced features — improved slicing performance!

Chute and end weight now accommodate 10.5" tall product. Pyramid-shaped end weight teeth improve product gripping for optimal slice quality.







Model

❑ *G12 – 12" Diameter Knife*

Standard Features

- 12" hard chromed special alloy, hollow ground knife, longer lasting and easier to sharpen
- Extended rod, end weight and chute can accommodate product up to 10.5" in length (❶)
- Gripping teeth on underside of end weight for stability when slicing taller product *(inset ❷)*
- Pyramid-shaped end weight teeth improve product hold during slicing (❸)
- 0 to 9/16" slice thickness
- Powerful 1/2 HP knife motor
- Motor overload protection with manual reset
- Oversized positive traction grooved belt drive
- Knife cover interlock
- Knob makes installation and removal of knife cover easier *(inset ❹)*
- Top mounted all metal knife sharpener
- Removable easy-to-clean chute, slice deflector, and knife sharpener
- Anodized aluminum construction with seamless edges and radius corners
- Metal bottom base enclosure
- Permanently attached knife ring guard
- Moisture proof, easy-to-clean ON/OFF switch and knife hub
- Sealed splash zones for added sanitation and protection of electronics
- Ergonomically designed, dual purpose handle
- Easy movement with smooth stainless steel ball bearing chute slide
- 35° angled food chute
- No voltage release relay system
- Non-slip rubber feet

Optional items

- Large slicer cover
- Slaw tray
- Food fence
- Vegetable hopper
- Scale Mount

To select options, see complete list on back

Warranty

- *Two years parts and labor*

Intertek Intertek AQ AutoQuotes

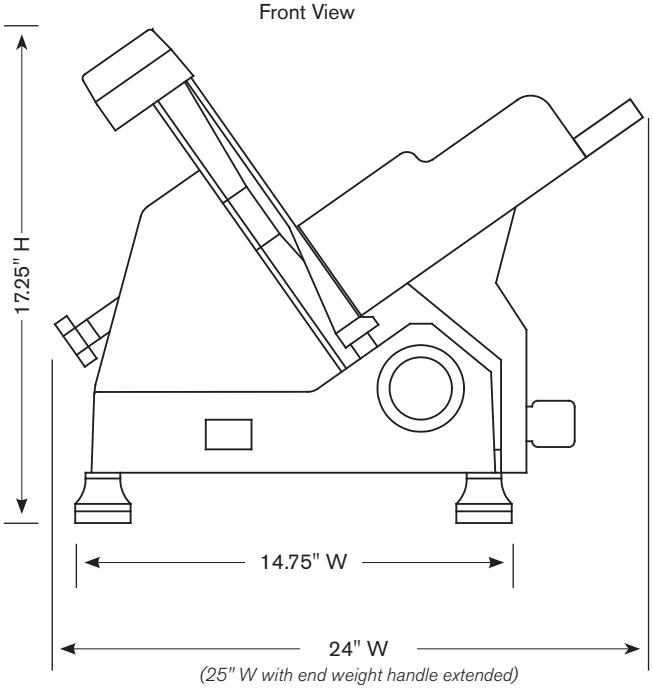
Approved by: _____ Date: _____

2153 Dryden Rd., Dayton, OH 45439 | 937-299-5493 | 800-347-5423 | Fax: 937-299-4147 | www.globefoodequip.com

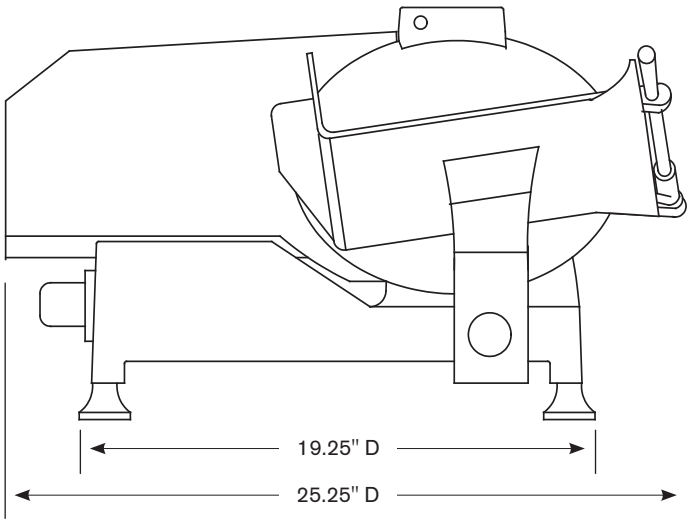
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Medium Duty Manual Slicer G12

Front View



Side View



SPECIFICATIONS

Model	Auto or Manual	Motor	Volts	Amps	Drive Type	Slicing Volume per Day	Cheese Slicing	Blade Diameter	Max Slice	Product Cutting Capacity W (Width)	D (Diameter)	L (Length)
G12	Manual	1/2 HP	115-60-1	3	Belt	4 Hours	0 100% Time	12" (30.48 cm)	9/16" (1.43 cm)	10" (25.4 cm)	8.25" (21 cm)	10.5" (26 cm)

Cord & Plug: Attached 6 foot flexible 3-wire cord with molded plug fits a grounded receptacle. NEMA 5-15

DIMENSIONS | SHIPPING INFORMATION

Reinforced carton for shipping. The weight and dimensions of this reinforced carton are included below and may vary from shipment to shipment.
Freight class 85

Model	Overall Dimensions	Net Wt	Shipping Dimensions	Ship Wt
G12	25" w x 25.25" d x 17.25" h (64 cm x 64 cm x 44 cm)	54 lbs (25 kg)	26" w x 22" d x 20" h (66 cm x 56 cm x 51 cm)	61 lbs (28 kg)

Manual slicer with 12" diameter hard chromed special alloy, hollow ground knife with stain resistant heavy-gauge anodized aluminum finish. Unit has 1/2 HP fan cooled motor with overload protection, manual reset, permanently lubricated ball bearings and positive traction grooved drive belt. Slicer has top mounted, removable, dual action knife sharpener with two stones, and removable food chute, slice deflector and knife cover. On/Off switch and electric wiring are moisture proof, with sealed splash zones. Slicer is NSF and ETL listed. Two-year parts and labor warranty.

OPTIONAL ITEMS:

- ❑ **SC-LARGE** Large slicer cover
- ❑ **SLAWTRAY** Slaw tray
- ❑ **300014** Vegetable hopper
- ❑ **M500A** Food fence (11" d x 1-1/8" h)
- ❑ **SCALE MOUNT-G** Mount for Globe 10 lb. scale

Available only at time of purchase.

2153 Dryden Rd., Dayton, OH 45439 | 937-299-5493 | 800-347-5423 | Fax: 937-299-4147 | www.globefoodequip.com

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Submittal Sheet

03/14/2025

ITEM# K24 - HAND SINK (4 EA REQ'D)

Advance Tabco 7-PS-50

Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, with heavy duty splash mounted gooseneck faucet, lever drain with overflow, P-trap, wall bracket, NSF, cCSAus

ACCESSORIES

Mfr	Qty	Model	Spec
Advance Tabco	4	K-316-LU	Wrist Handles

STAINLESS STEEL

STANDARD HAND SINKS

Conforms To NSF 61/9 Lead Free Requirements

SPLASH MOUNTED FAUCETS



7-PS-60

Wrist Handles



7-PS-68



7-PS-50



7-PS-54

DECK MOUNTED FAUCET



7-PS-67



7-PS-20



7-PS-20-NF
Faucet omitted

SINGLE HOLE PUNCH
Faucet omitted



7-PS-71

DOUBLE HOLE PUNCH
Faucet omitted



7-PS-70

LARGE SINK BOWLS

Features Large Size Sink Bowl 16” x 20” x 8”



7-PS-45

Features Large Size Sink Bowl 16” x 14” x 8”



7-PS-49

Item #: _____ **Qty #:** _____

Model #: _____

Project #: _____

FEATURES:

One piece **Deep Drawn** sink bowl design.

Sink bowl size is 10” x 14” x 5”.

7-PS-45 sink bowl size is 16” x 20” x 8”.

7-PS-49 sink bowl size is 16” x 14” x 8”.

All sink bowls have a large liberal radii with a minimum dimension of 2” and are rectangular in design for increased capacity.

Stainless steel 3 1/2” basket drain with 1-1/2” IPS.

Additional Features:

7-PS-20	K-22 4” O.C. deck mounted centerset faucet.
7-PS-20-NF	Deck mounted faucet omitted. Two 4” O.C. holes.
7-PS-45	K-59 4” O.C. splash mounted faucet and 2 Stainless Steel Support Brackets. (Hardware Included).
7-PS-49	K-59 4” O.C. splash mounted faucet and 2 Stainless Steel Support Brackets. (Hardware Included).
7-PS-50	K-59 4” O.C. splash mounted gooseneck faucet. Lever operated drain and built-in overflow with plastic overflow tube and spring clamps. 1-1/2” P-Trap.
7-PS-54	K-59 4” O.C. splash mounted gooseneck faucet. 1-1/2” P-Trap.
7-PS-60	K-59 4” O.C. splash mounted gooseneck faucet.
7-PS-67	K-59 4” O.C. splash mounted gooseneck faucet and lever operated drain.
7-PS-68	K-59 4” O.C. splash mounted gooseneck faucet with Wrist Handles.
7-PS-70	Splash mounted faucet omitted. Two 4” O.C. holes.
7-PS-71	Splash mounted faucet omitted. Single center hole.

CONSTRUCTION:

All TIG welded.

Welded areas blended to match adjacent surfaces and to a satin finish.

Die formed Countertop Edge with a No-Drip offset.

One sheet of stainless steel - No Seams.

MATERIAL:

Heavy gauge type 304 series stainless steel.

Wall mounting bracket is Galvanized and of offset design.

All fittings are brass / chrome plated unless otherwise indicated.

MECHANICAL:

Faucet supply is 1/2” IPS male thread hot and cold.

Faucet Flow Rate: 1.0 GPM/3.8 LPM aerator. 60 PSI.

⚠ WARNING:

Equipment that includes a faucet may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info.,visit www.p65warnings.ca.gov.

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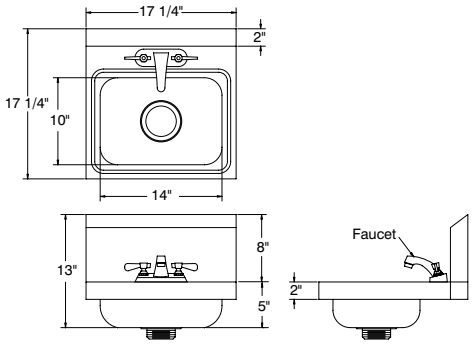
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REF-B

DIMENSIONS and SPECIFICATIONS

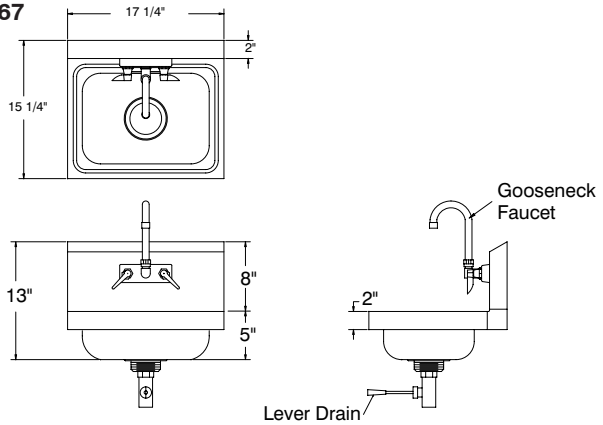
TOL Overall: ± .500" Interior: ± .250" **FITTINGS SUPPLIED AS SHOWN** **ALL DIMENSIONS ARE TYPICAL**

7-PS-20



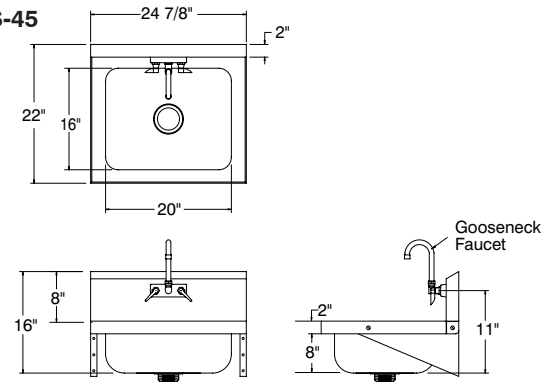
15 lbs.

7-PS-67



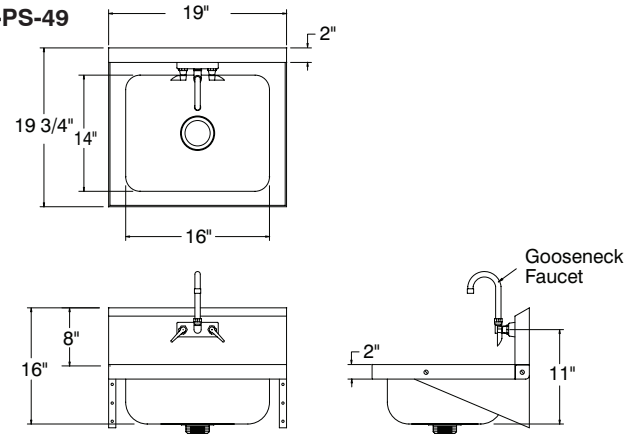
15 lbs.

7-PS-45



31 lbs.

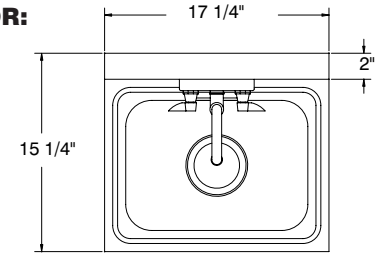
7-PS-49



31 lbs.

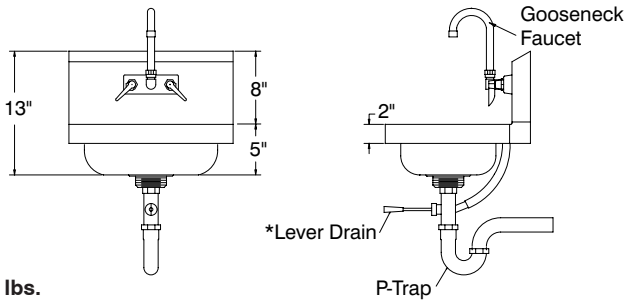
TOP VIEW FOR:

7-PS-50
7-PS-54
7-PS-60
7-PS-68
7-PS-70



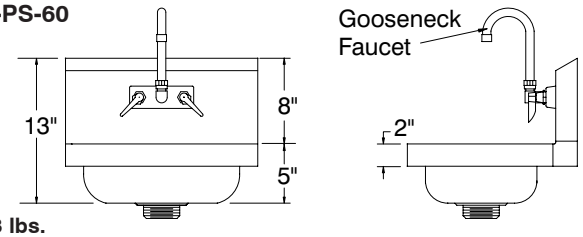
Sink Bowl 10" x 14" x 5"

7-PS-50 & 7-PS-54*
NOTE: *7-PS-54 Hand Sink <u>Excludes</u> Lever Drain and Overflow



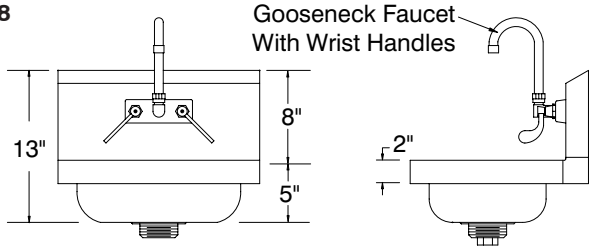
15 lbs.

7-PS-60



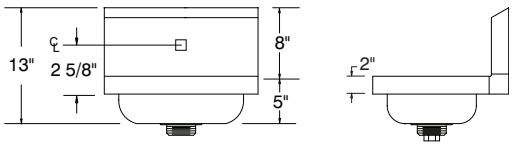
13 lbs.

7-PS-68

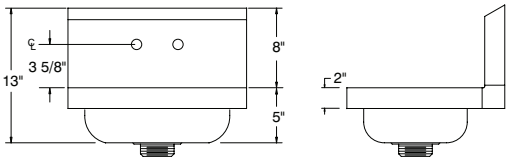


13 lbs.

7-PS-71



7-PS-70



12 lbs.

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FAUCET PARTS & ACCESSORIES

Faucet Repair Kit
For K-22, K-59, K-123, K-125, K-126, K-206 & K-316 Faucets
Includes 2 Cartridges and Handles
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-00A (Set of 2)



Faucet Repair Kit
For K-1, K-11, K-50, K-51, K-52, K-53, K-56, K-124, K-101, K-160, K-208 & K-240 Faucets
Includes 2 Cartridges and Handles
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-00B (Set of 2)





K-02 Filler Faucet Repair Kit
For K-54 & K-54A Faucets
*Can Only Be Used On Faucets Purchased From 2016 - 2019. For Older Faucets, See Below.



K-02A Filler Faucet Repair Kit
For K-54 & K-54A Faucets
*Can Only Be Used On Faucets Purchased Before January 2016 or After 2019.



Service Faucet Vacuum Breaker Repair Kit
For K-240 Faucet
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-03

Pedal/Knee Valve Replacement Parts

Replacement Bonnet for Pedal/Knee Valve
For K-103, K-104, 7-PS-32 & 7-PS-39
K-01



Replacement Check Valves
For K-103, K-104, 7-PS-32 & 7-PS-39
K-19



Thermostatic Mixing Valve
For K-103, K-104, 7-PS-32 & 7-PS-39
K-425



Mixing Valve & Retainer
For K-103, K-104, 7-PS-32 & 7-PS-39
K-19A



Faucet Options & Accessories

Hands-Free Wand





K-400

Low Flow Aerator



.5 GPM
K-08

Wrist Handles (Pair)



*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-316-LU

Wrist Handles (Pair)
For Heavy Duty 8" O.C. Faucets



K-416-LU

Splash Mount Faucet Mounting Kit
K-1, K-11, K-101, K-105, K-112, K-119 & K-211



K-06

Faucet Wall Mounting Bracket
8" O.C.



K-30

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Submittal Sheet

03/14/2025

ITEM# K25 - PREP TABLE (1 EA REQ'D)

Fabricated CUSTOM

S/s prep table with 20" x 20" x 14" deep prep sink with lever waste, s/s undershelf and five inch rear and right side splash.

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Submittal Sheet

03/14/2025

ITEM# K25.1 - DECK MOUNT FAUCET (1 EA REQ'D)

Fisher 33130

Faucet, deck mount, 8" centers, 12" swing spout, lever handles with color coded indexes, 1/2" male inlets, brass, ADA Compliant

ACCESSORIES

Mfr	Qty	Model	Spec
Fisher	1		4 year warranty against defects in materials or workmanship

APPLICATION:

PRODUCT NAME:

8" C/C DECK FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

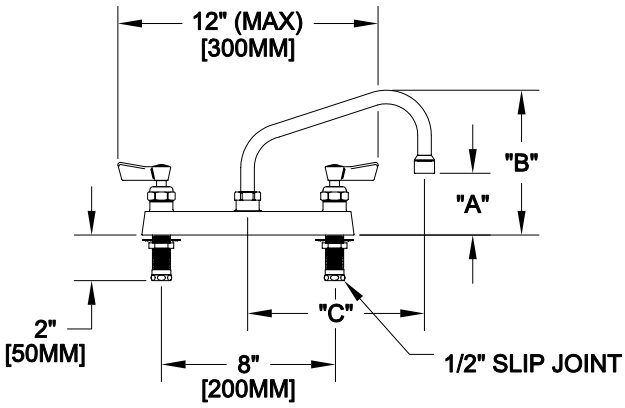
☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

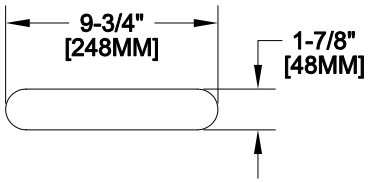
- ☐ 3310 WITH 6" SWING SPOUT
- ☐ 3311 WITH 8" SWING SPOUT
- ☐ 3312 WITH 10" SWING SPOUT
- ☐ 3313 WITH 12" SWING SPOUT
- ☐ 3314 WITH 14" SWING SPOUT
- ☐ 1627 WITH 16" SWING SPOUT

OPTIONS OR MODIFICATIONS:

- ☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
- ☐ DJ SUB-ASSY (7-1/4" OR 13") CIRCLE LENGTH
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ VANDAL RESISTANT KIT
- ☐ OTHER _____

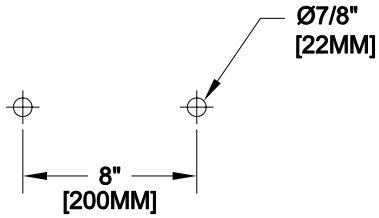


FOOTPRINT:



MODEL	DIM "A"	DIM "B"	DIM "C"
3310	2-3/8" [60MM]	6" [150MM]	6" [150MM]
3311	2-5/8" [66MM]	6-1/2" [165MM]	8" [200MM]
3312	3-1/4" [83MM]	7" [177MM]	10" [250MM]
3313	3-3/4" [98MM]	7-1/2" [188MM]	12" [300MM]
3314	4-5/8" [115MM]	8-3/8" [212MM]	14" [350MM]
1627	5-1/8" [131MM]	9" [228MM]	16" [400MM]

ROUGH-IN:



FEATURES

* 8" C/C DECK MOUNT
* SWIVELLING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT

SYSTEM LIMITS

* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE: 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT

* 5.5 LBS

ANSI/A112.18.1M

FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3310 REV. B

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Submittal Sheet

03/14/2025

ITEM# K26 - CAN OPENER (1 EA REQ'D)

Edlund S-11

Can Opener, manual, 16" bar length, dishwasher safe, rust proof, stainless steel, with cast stainless steel base, NSF certified

ACCESSORIES

Mfr	Qty	Model	Spec
Edlund	1		5 year limited warranty

S-11 NSF Manual Can Openers

For the very highest standard in food safety and sanitation, the S-11 manual can opener has over 17 years of success in foodservice worldwide utilizing proprietary can opening technology. The patented S-11 has successfully opened nearly one billion cans without a single complaint – giving it a stainless reputation. Add in the industry's longest warranty and you've got an opener that's a cut above any other.



- 5-year warranty
- NSF Certified
- Dishwasher safe
- Made in U.S.A.
- Rustproof stainless steel construction
- Parts remove easily for replacement
- Tamper proof model also available
- Available with screw down base or clamp on model
- Standard size or with long bar for taller cans
- Patented

Open up to a higher standard in food safety.



Dishwasher Safe

Toss in the dishwasher for easy cleaning. The industry's first all-stainless can opener, the S-11 resists rust and stays looking new, no matter how many times it's washed.



Fewer Parts

The S-11's advanced design means fewer parts than most other openers, and its patented Quick Change Mechanism makes knife and gear replacement fast and easy.



Quick Change Mechanism

Makes gear replacement fast and easy.



S-11 with clamp base

Tamper proof S-11 opener with tamper proof base



ST-93 Rustproof can opener cleaning tool



A tamper proof version of the S-11 is now available equipped with locking hardware.



SPECIFICATIONS:

MODEL #	DESCRIPTION	PRODUCT CODE	CASE CUBE FT^3/M^3	CASE WEIGHT LBS./KGS
S-11	Stainless Steel Can Opener With cast stainless steel base	15000	3.3/0.1	30/13.6
S-11 L	With long bar for cans up to 17″ high (50cm)	15300	3.3/0.1	30/13.6
S-11 E	Comes complete with ST-93 cleaning tool and extra knife and gear	15400	3.3/0.1	31/14.1
S-11 C	Clamping Base Model Now available with clamp instead of screws Secures to underside of table	15020	3.3/0.1	30/13.6
S-11 CL	Clamping Base Model With long bar for cans up to 17″ high (50cm)	15320	3.3/0.1	30/13.6
S-11 CE	Clamping Base Model complete with ST-93 cleaning tool and extra knife and gear	15420	3.3/0.1	32/14.5
S-11 WB	Without Base	15200	3.3/0.1	21/9.5
S-11 TP	Tamper Proof Opener With tamper proof base	15080	3.3/0.1	30/13.6
ST-93	Rustproof can opener cleaning tool	38500		.5/.2

Note: S-11 Series standard length bar is 16″ (40.6 cm) long. Extra long bar is 22″ (55.9) cm) long.

EDLUND ISO 9001:2000 CERTIFIED NSF

Edlund We're in your kitchen.™

Edlund Company, Inc., 159 Industrial Parkway, Burlington, VT 05401 800-772-2126 www.edlundco.com

WARRANTY INFORMATION: THE EDLUND COMPANY WARRANTS THESE PRODUCTS TO BE FREE FROM DEFECTS IN MATERIAL AND WORKMANSHIP FOR A PERIOD OF ONE YEAR FROM DATE OF PURCHASE. THE COMPANY'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIRING OR REPLACING WITHOUT CHARGE ANY PART OR PARTS FOUND TO BE DEFECTIVE UNDER NORMAL USE. IT IS THE RESPONSIBILITY OF THE PURCHASER TO RETURN THE ENTIRE UNIT TO THE FACTORY, TRANSPORTATION CHARGES PREPAID. THIS WARRANTY DOES NOT COVER PARTS THAT MUST BE REPLACED UNDER NORMAL USE, INCLUDING KNIVES AND DRIVE GEARS ON CAN OPENERS. NO OTHER WARRANTY, WRITTEN OR VERBAL, IS AUTHORIZED BY THE COMPANY. WARRANTY INFORMATION OUTSIDE THE UNITED STATES MAY VARY, CONSULT YOUR DISTRIBUTOR.

12/07 ED01-4021

NSF Manual Can Openers



S-11 Made in U.S.A.

S-11 MANUAL CAN OPENERS WITH 5 YEAR WARRANTY!

The most sanitary can opener in the world! Rustproof, NSF Certified and dishwasher safe. All stainless steel. Parts remove easily for replacement.

Model Number	Description	Product Code	Case Cube Ft3/M3	Master Case	Case Weight lbs./kgs
S-11	Stainless Steel Can Opener (NSF Certified) With cast stainless steel base	15000	3.3/0.1	3	30/13.6
S-11L	With long bar for cans up to 17" high (50 cm)	15300	3.3/0.1	3	30/13.6
S-11E	**"Extra Value"** comes complete with ST-93 cleaning tool and 1 extra knife and gear	15400	3.3/0.1	3	31/14.1
S-11C	Clamping Base Model (NSF Certified) Now available with clamp instead of screws. Secures to underside of table	15020	3.3/0.1	3	30/13.6
S-11CL	With long bar for cans up to 17" high (50 cm)	15320	3.3/0.1	3	30/13.6
S-11CE	**"Extra Value"** – Clamping Base Model complete with ST-93 cleaning tool and extra knife and gear.	15420	3.3/0.1	3	32/14.5
S-11WB	Without Base	15200	3.3/0.1	3	21/9.5
S-11TP	Tamper resistant opener with tamper proof base	15080	3.3/0.1	3	30/13.6

Note: S-11 has standard bar length of 16" (40.6 cm) long. Extra long bar is 22" (55.9 cm) long.

U SERIES MANUAL CAN OPENERS

Edlund now offers the Universal Series Manual Can Openers. These can openers offer substantial improvements over our popular #1® and #2® models. The U-12 includes many of the same design features as our S-11 standard openers, with quick change gear, stainless steel shaft and pull pin for easy blade replacement. The base design features a replaceable insert for a tighter fit and easier slide action. Other base options are also available. NSF Certified.

Model Number	Description	Product Code	Case Cube Ft3/M3	Master Case	Case Weight lbs./kgs
U-12	Quick change NSF can opener with standard length bar and new plated base	14100	3.3/0.1	3	21/9.5
U-12WB	NSF Opener without base	14000	3.3/0.1	3	21/9.5
U-12S	NSF Opener with stainless steel base	14200	3.3/0.1	3	21/9.5
U-12C	NSF Opener with cast stainless steel clamp base	14010	3.3/0.1	3	22/9.9
U-12L	NSF Opener with long bar and plated steel base	14500	3.3/0.1	3	22/9.9
U-12SL	NSF Opener with long bar and stainless steel base	14600	3.3/0.1	3	22/9.9
U-12CL	NSF Opener with long bar and cast stainless steel clamp base	14300	3.3/0.1	3	23/10.4

Note: U-12 Series standard bar length is 16" (40.6 cm) long. Extra long bar is 22" (55.9 cm) long.



U-12 Made in U.S.A.



SG-2 Made in U.S.A.

SG-2 NSF STANLESS MANUAL CAN OPENERS WITH 2 YEAR WARRANTY!

For operators who only require a lighter duty manual can opener but want full stainless steel protection, Edlund introduces the SG-2 Model. The flagship of our popular G-2 Series Openers, this new model is all stainless steel, dishwasher safe, and features our patented quick change knife and gear system, and comes with a full two year warranty. A great opener for a Global Marketplace.

Model Number	Description	Product Code	Case Cube Ft3/M3	Master Case	Case Weight lbs./kgs
SG-2	NSF Stainless Opener with standard bar and stainless base	13100	3.3/0.1	3	18/8.1
SG-2C	NSF Stainless Opener with stainless clamp base	13200	3.3/0.1	3	20/9
SG-2L	NSF Stainless Opener with long bar and stainless base	13300	3.3/0.1	3	20/9
SG-2CL	NSF Stainless Opener with long bar and stainless clamp base	13400	3.3/0.1	3	22/9.8

Note: SG-2 Series standard bar length is 16" (40.6 cm) long. Extra long bar is 22" (55.9 cm) long.

Edlund blades are reversible for longer life and available through your dealer.

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Submittal Sheet

03/14/2025

ITEM# K27 - SHELVING, WALL MOUNTED (1 EA REQ'D)

Advance Tabco WS-12-36-16

Shelf, wall-mounted, 36"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

WALL SHELVES

NSF



Item #: _____ Qty #: _____

Model #: _____

Project #: _____



FEATURES:

Brackets can be positioned to accommodate wall studs.

Furnished with a 1-5/8" Bullnose edge with a 1-1/2" turn-up edge at rear. Ends are turned down square.

MATERIAL:

16 Gauge Series - 304 stainless steel polished to a satin finish.

18 Gauge Series - 430 stainless steel polished to a satin finish.

CONSTRUCTION:

Secured to wall by means of bolts through support brackets.

Units 7 ft. and larger are furnished with 3 brackets.

	10" Wide			12" Wide			15" Wide			18" Wide			
L	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	Approx. Cu. Ft.
24"	WS-10-24-16	WS-10-24	8 lbs.	WS-12-24-16	WS-12-24	9 lbs.	WS-15-24-16	WS-15-24	11 lbs.	WS-18-24-16	WS-18-24	14 lbs.	3
30"	-	-	-	WS-12-30-16	WS-12-30	12 lbs.	-	-	-	-	-	-	4
36"	WS-10-36-16	WS-10-36	10 lbs.	WS-12-36-16	WS-12-36	12 lbs.	WS-15-36-16	WS-15-36	15 lbs.	WS-18-36-16	WS-18-36	21 lbs.	4
42"	-	-	-	WS-12-42-16	WS-12-42	14 lbs.	-	-	-	-	-	-	5
48"	WS-10-48-16	WS-10-48	12 lbs.	WS-12-48-16	WS-12-48	14 lbs.	WS-15-48-16	WS-15-48	18 lbs.	WS-18-48-16	WS-18-48	24 lbs.	5
60"	WS-10-60-16	WS-10-60	15 lbs.	WS-12-60-16	WS-12-60	17 lbs.	WS-15-60-16	WS-15-60	23 lbs.	WS-18-60-16	WS-18-60	28 lbs.	6
72"	WS-10-72-16	WS-10-72	17 lbs.	WS-12-72-16	WS-12-72	21 lbs.	WS-15-72-16	WS-15-72	28 lbs.	WS-18-72-16	WS-18-72	32 lbs.	7
84"	WS-10-84-16	WS-10-84	20 lbs.	WS-12-84-16	WS-12-84	25 lbs.	WS-15-84-16	WS-15-84	32 lbs.	WS-18-84-16	WS-18-84	36 lbs.	8
96"	WS-10-96-16	WS-10-96	23 lbs.	WS-12-96-16	WS-12-96	28 lbs.	WS-15-96-16	WS-15-96	36 lbs.	WS-18-96-16	WS-18-96	42 lbs.	10
108"	WS-10-108-16	WS-10-108	28 lbs.	WS-12-108-16	WS-12-108	32 lbs.	WS-15-108-16	WS-15-108	40 lbs.	WS-18-108-16	WS-18-108	48 lbs.	11
120"	WS-10-120-16	WS-10-120	32 lbs.	WS-12-120-16	WS-12-120	36 lbs.	WS-15-120-16	WS-15-120	44 lbs.	WS-18-120-16	WS-18-120	54 lbs.	12
132"	WS-10-132-16	WS-10-132	36 lbs.	WS-12-132-16	WS-12-132	42 lbs.	WS-15-132-16	WS-15-132	49 lbs.	WS-18-132-16	WS-18-132	60 lbs.	13
144"	WS-10-144-16	WS-10-144	40 lbs.	WS-12-144-16	WS-12-144	48 lbs.	WS-15-144-16	WS-15-144	55 lbs.	WS-18-144-16	WS-18-144	66 lbs.	14

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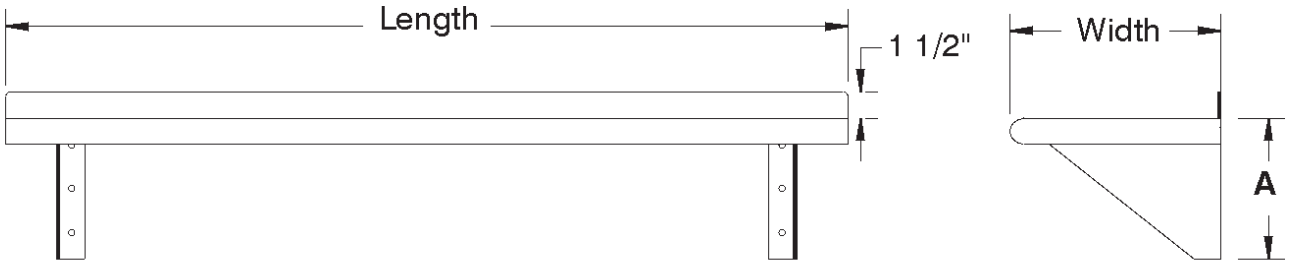
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REF-L

DETAILS and SPECIFICATIONS

TOL ± .500" ALL DIMENSIONS ARE TYPICAL

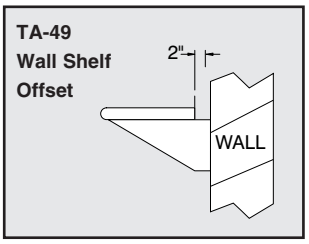


Width	A
10"	8 1/2"
12"	10 1/2"
15"	13 1/2"
18"	16 1/2"

Load Capacity = 20 lbs. per sq. ft.
(Evenly Distributed Weight)

Wall Shelf Options

PRT-1	Printer Shelf
TA-22A	Square Edge Shelf
TA-26	Welded Shelf Brackets
TA-49	Wall Shelf 2" Offset
TA-71	Heat Lamp Provision
TA-77	Check Minder
TA-77A	Concealer for Heat Lamp (Requires TA-77)
TA-99A	14 Ga. S/S 304 Upgrade for Overshelves
TA-100A	Bullnose Edge On All 4 Sides of Shelf
TA-102	6" Cantilever Shelf Offset





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Submittal Sheet

03/14/2025

ITEM# K28 - POT RACK (1 EA REQ'D)

Advance Tabco SW-48

Pot Rack, wall-mounted, double bar design, 48"W x 12"D, constructed of 1/4" x 2" stainless steel, includes: (12) plated double pot hooks, NSF

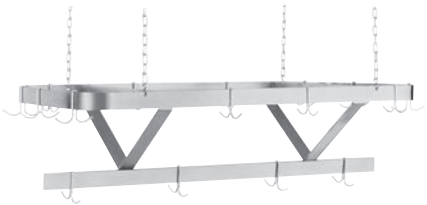
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STAINLESS STEEL

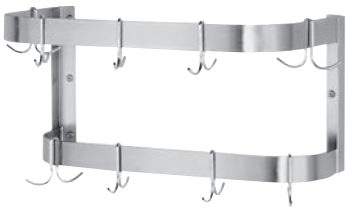
POT RACKS

Item #: _____ Qty #: _____
Model #: _____
Project #: _____

CEILING MOUNTED



WALL MOUNTED



SHELF w/ POT RACK



Ceiling Mounted

L	S/S	# of Hooks	Wt
36”	SC-36	12	42 lbs.
48”	SC-48	12	48 lbs.
60”	SC-60	18	54 lbs.
72”	SC-72	18	60 lbs.
84”	SC-84	18	66 lbs.
96”	SC-96	18	80 lbs.
108”	SC-108	18	86 lbs.
120”	SC-120	18	92 lbs.
132”	SC-132	18	98 lbs.
144”	SC-144	18	104 lbs.

Wall Mounted NSF

L	S/S	# of Hooks	Wt
24”	SW-24	12	18 lbs.
36”	SW-36	12	22 lbs.
48”	SW-48	12	26 lbs.
60”	SW-60	18	30 lbs.
72”	SW-72	18	34 lbs.
84”	SW-84	18	44 lbs.
96”	SW-96	18	48 lbs.
108”	SW-108	18	52 lbs.
120”	SW-120	18	56 lbs.
132”	SW-132	18	60 lbs.
144”	SW-144	18	64 lbs.

Shelf with Pot Rack NSF

L	12” Wide	Wt	15” Wide	Wt	18” Wide	Wt	# of Hooks
36”	PS-12-36	20 lbs.	PS-15-36	25 lbs.	PS-18-36	30 lbs.	6
48”	PS-12-48	30 lbs.	PS-15-48	35 lbs.	PS-18-48	40 lbs.	6
60”	PS-12-60	40 lbs.	PS-15-60	45 lbs.	PS-18-60	50 lbs.	9
72”	PS-12-72	50 lbs.	PS-15-72	55 lbs.	PS-18-72	60 lbs.	9
84”	PS-12-84	60 lbs.	PS-15-84	65 lbs.	PS-18-84	70 lbs.	9
96”	PS-12-96	70 lbs.	PS-15-96	75 lbs.	PS-18-96	80 lbs.	9
108”	PS-12-108	80 lbs.	PS-15-108	85 lbs.	PS-18-108	90 lbs.	9
120”	PS-12-120	90 lbs.	PS-15-120	95 lbs.	PS-18-120	100 lbs.	9
132”	PS-12-132	100 lbs.	PS-15-132	105 lbs.	PS-18-132	110 lbs.	9
144”	PS-12-144	110 lbs.	PS-15-144	115 lbs.	PS-18-144	120 lbs.	9

Units 8 ft. and larger are furnished with three (3) sets of supports brackets.

FEATURES: (Ceiling Mounted)

Ceiling suspension with chain hangers. Optional stainless steel Flat Bar in lieu of Chain available. Use **TA-98**.

MATERIAL:

Flat steel bar is 2” x 1/4”, stainless steel.

Pot hooks are plated.

24” long chain hangers are plated.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

FEATURES: (Wall Mounted)

Secured to wall by means of bolts through welded brackets. (Hardware not provided)

MATERIAL:

Flat steel bar is 2” x 1/4”, stainless steel.

Pot hooks are plated.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

FEATURES: (Shelf/Pot Rack)

A dual purpose unit for shelf and utensil storage.

Secured to wall by means of bolts through welded brackets. (Hardware not provided)

MATERIAL:

Flat stainless steel bar is 2” x 1/4”.
Pot hooks are plated.
Type “430” stainless steel shelf.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

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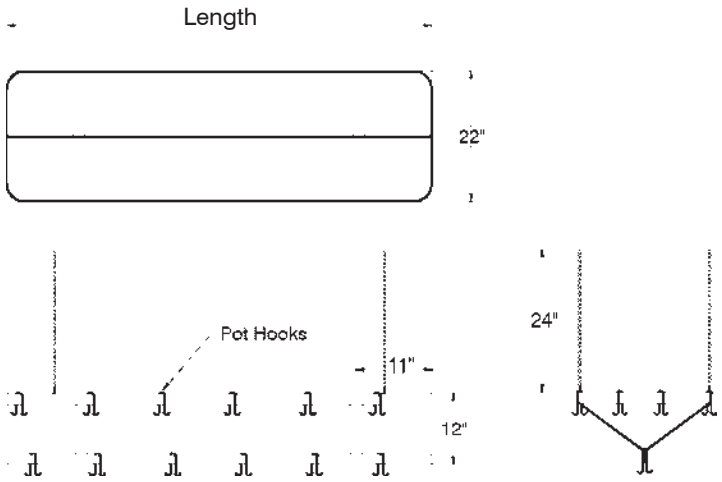
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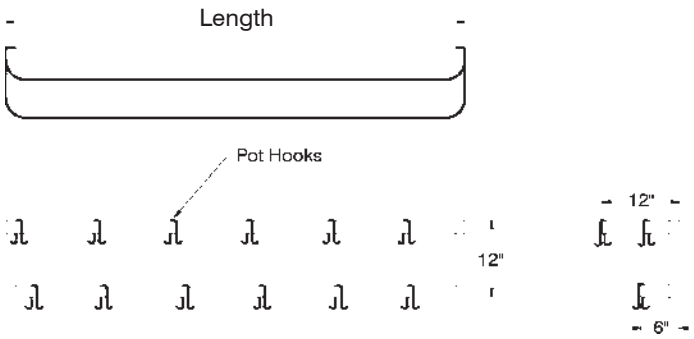
DETAILS and SPECIFICATIONS

TOL ± .500” ALL DIMENSIONS ARE TYPICAL

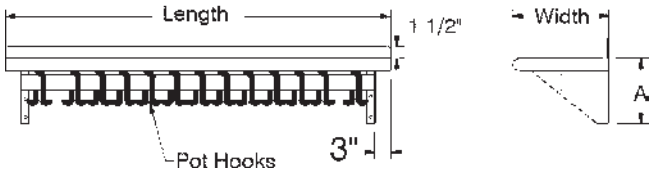
Ceiling Mounted



Wall Mounted



Shelf with Pot Rack



Width	A
12”	10 1/2”
15”	13 1/2”
18”	16 1/2”

Load Capacity = 20 lbs. per sq. ft.

(Evenly Distributed Weight)

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

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MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K29 - PLANETARY MIXER (1 EA REQ'D)

Univex SRM20+

Food Mixer, countertop, 20 quart capacity, variable speed drive, includes removable SwingRing safety guard, stainless steel bowl, batter beater, wire whip, dough hook, and bowl scraper, 1/2 hp, cETLus, NSF, Made in USA

ACCESSORIES

Mfr	Qty	Model	Spec
Univex	1		Two-year, on-site parts & labor warranty, see model "WARRANTY SHEET" for details
Univex	1		115v/60/1-ph, 10.6 amps, NEMA 5-15P, standard
Univex	1		Metallic silver

WE RAISE THE BAR. WE SET THE STANDARD.

Project _____ Item Number _____ Quantity _____

SRM20+ Mixer

Countertop Mixer

Univex Corporation



*Shown with optional PTO

20 Quart (qt.) Countertop Mixer

MADE IN THE USA

Model:

- SRM20+: 20 qt. COUNTERTOP MIXER (WITH OR WITHOUT PTO HUB)

Features:

- 1/2 hp capacitor start motor
- Variable Speed Drive: 4 fixed speeds or any speed in-between
- Change speeds without having to stop the mixer
- Two-piece, stainless steel, dishwasher safe safety guard
- Heavy-duty stainless steel bowl
- Interlock switches protect operator from injury if safety guard is open or bowl is lowered
- Hardened alloy gears in transmission
- Durable NSF approved hybrid epoxy/ polyester powder coat finish

Standard Accessories:

- 20 qt. stainless steel bowl
- Dough hook
- Batter beater
- Wire whip
- Ingredient chute
- Bowl scraper

Optional Accessories:

- 15 minute timer
- Heavy duty SS wire whip
- Sweet dough beater
- Splash ring
- 20 qt. pastry knife
- Four wing beater
- Cover

Optional Attachments:

- #12 Power Take Off (PTO) hub
- VS9 vegetable slicer with adjustable knife
- VS9H vegetable shredder with plate holder and 3/16" plate (additional plate size variations, grater plates, and julienne plate available)
- ALMFC12 meat and food grinder

Warranty:

- Two year, on-site parts and labor

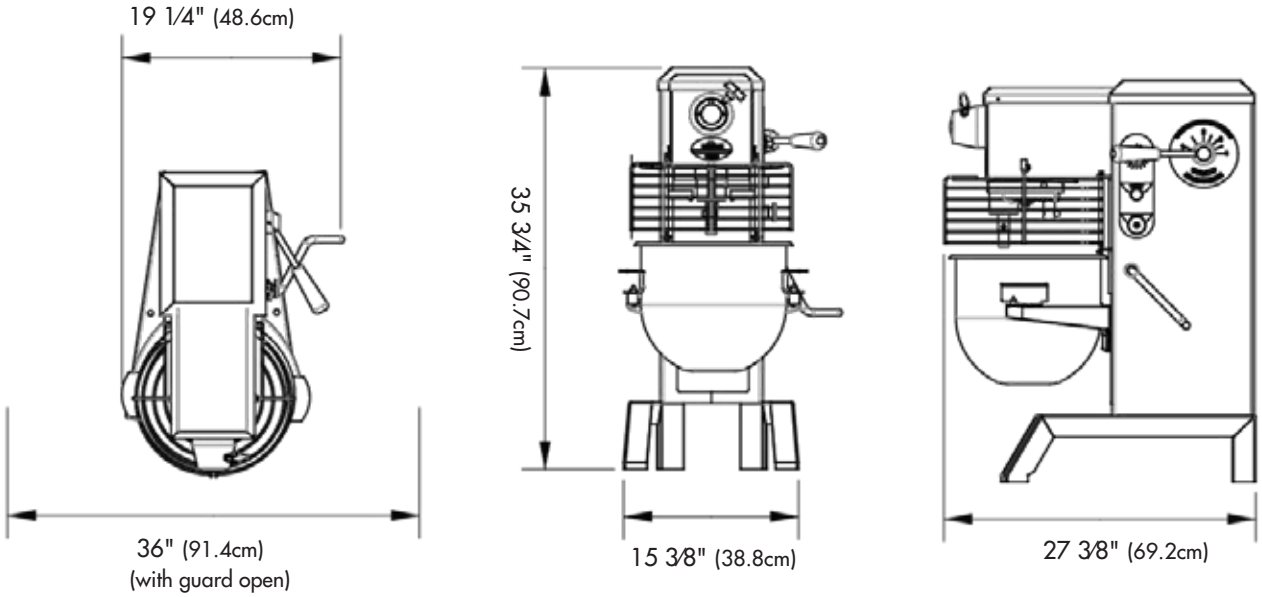
Univex Corporation
www.Univexcorp.com

3 Old Rockingham Rd
Salem, NH 03079
United States of America

TEL: (800)258-6358
INTL TEL: (603)893-6191
FAX: (800)356-5614
INTL FAX: (603)893-1249

WE RAISE THE BAR. WE SET THE STANDARD.

20 Quart Countertop Mixer SRM20+



*Shown with optional PTO and timer

Shipping Information		
Net Weight	**Shipping Weight**	**Overall Dimensions**
215 lbs. (97.5Kg)	254 lbs. (115.2Kg)	41" (104.1cm) H x 33" (83.8cm) W x 22" (55.9cm)
The weight and dimensions of the pallet are included in the weight and dimensions above.		

Electrical Information (60Hz)				
Attached 6 foot cord				
	Voltage	**Phase**	**AMPS**	**NEMA**
Standard	115	1	10.6	5-15P
Optional	208-240	1	4.8-5.3	6-15P

Mixer Speeds				
Speed	1	2	3	4
Beater Shaft (RPM)	135	260	435	528
PTO (RPM)	62	133	198	238

Bowl Capacity: 20 qts. (18.9 liters)

Motor: 1/2 hp capacitor start

Controls: Momentary contact stop & start buttons and contactor

Bowl Lift: Ergonomic hand operated crank, self locking in top and bottom position

Transmission: Featuring hardened alloy gearing and torque sensing variable speed pulleys

Power Take Off (PTO): #12 Hub

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Submittal Sheet

03/14/2025

ITEM# K30 - EQUIPMENT STAND, FOR MIXER / SLICER (1 EA REQ'D)

Advance Tabco MT-SS-302

Equipment Stand, 24"W x 30"D x 24"H, 14/304 stainless steel top, 18 gauge stainless steel adjustable undershelf & legs, adjustable stainless steel bullet feet, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Advance Tabco	1	TA-25ES	Casters, 5" diameter, set of 4 (2 with brakes) with stainless steel for 24" tall tables & mixer stands (capacity 200 lbs per caster)

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STAINLESS STEEL

MIXER TABLES

NSF



MX-SS-242 Shown
Mixer Not Included



MT-SS-242
Shown



AG-MT-242
Shown

Item #: _____ Qty #: _____
Model #: _____
Project #: _____

UTENSIL RACK & UNDERSHELF

	S/S Base	Galv. Base		
O.A. Size Wx L	Model	Model	Approx. Wt.	Approx. Cu. Ft.
24" x 24"	MX-SS-242	MX-GL-242	53 lbs.	3
30" x 24"	MX-SS-302	MX-GL-302	63 lbs.	3
30" x 30"	MX-SS-300	MX-GL-300	70 lbs.	4
30" x 36"	MX-SS-303	MX-GL-303	77 lbs.	4
36" x 36"	MX-SS-363	MX-GL-363	81 lbs.	5

WITH UNDERSHELF

	S/S Base	Galv. Base		
O.A. Size Wx L	Model	Model	Approx. Wt.	Approx. Cu. Ft.
24" x 24"	MT-SS-242	MT-GL-242	45 lbs.	3
30" x 24"	MT-SS-302	MT-GL-302	50 lbs.	3
30" x 30"	MT-SS-300	MT-GL-300	55 lbs.	4
30" x 36"	MT-SS-303	MT-GL-303	68 lbs.	4
36" x 36"	MT-SS-363	MT-GL-363	71 lbs.	5

BUDGET SERIES WITH UNDERSHELF

	S/S Base	Galv. Base		
O.A. Size Wx L	Model	Model	Approx. Wt.	Approx. Cu. Ft.
24" x 24"	SAG-MT-242	AG-MT-242	38 lbs.	3
30" x 24"	SAG-MT-302	AG-MT-302	41 lbs.	3
30" x 30"	SAG-MT-300	AG-MT-300	52 lbs.	4
30" x 36"	SAG-MT-303	AG-MT-303	58 lbs.	4
36" x 36"	SAG-MT-363	AG-MT-363	64 lbs.	5

FEATURES:

TOP is furnished with a 2" x 1" square die embossed NO-DRIP countertop offset edge with a 1/2" return on 4 sides.

Aluminum die cast "leg-to-shelf" clamp secures shelf to leg eliminating unsightly nuts and bolts. Undershelf is adjustable.

MATERIAL:

MX-SS & MT-SS SERIES - Stainless Steel Base

TOP is 14 gauge stainless steel type "304" series with galvanized understructure.

UNDERSHELF is 18 gauge stainless steel.

LEGS are 1 5/8" diameter tubular stainless steel with stainless steel bullet feet & gussets.

UTENSIL RACK on MX-SS Series is 1 5/8" dia. stainless steel tubing with stainless steel hooks.

MX-GL & MT-GL Series - Galvanized Steel Base

TOP is 14 gauge stainless steel type "304" series with galvanized understructure.

UNDERSHELF is galvanized steel.

LEGS are 1 5/8" diameter, tubular galvanized steel. Gussets are galvanized steel with 1" adjustable plastic bullet feet.

UTENSIL RACK on MX-SS Series is 1 5/8" diameter galvanized steel tubing with stainless steel hooks.

SAG-MT & AG-MT Budget Series

TOP is heavy gauge stainless steel type "430" series with galvanized understructure.

SAG-MT Series UNDERSHELF is 18 gauge stainless steel.
AG-MT Series UNDERSHELF is galvanized steel.

SAG-MT Series LEGS are 1 5/8" diameter, tubular stainless steel. Gussets are stainless steel. 1" adjustable stainless steel bullet feet.

AG-MT Series LEGS are 1 5/8" diameter, tubular galvanized steel. Gussets are galvanized steel. 1" adjustable plastic bullet feet.

CONSTRUCTION:

All TIG welded. Exposed weld areas polished to match adjacent surface.

Entire Top is mechanically polished to a satin finish and is sound deadened. Countertop edge polished to a MIRROR FINISH.

Roll formed embossed galvanized hat channels are secured to top by means of structural adhesive and weld studs.

Gussets welded to support hat channels.

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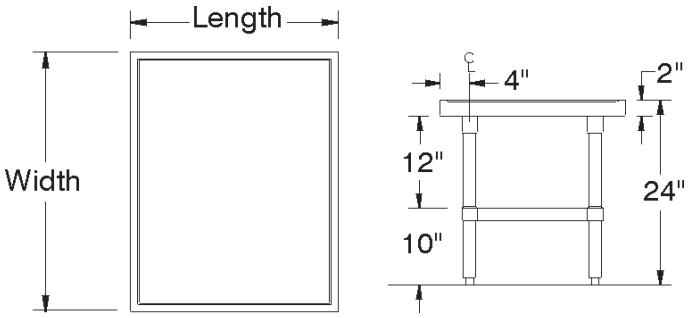
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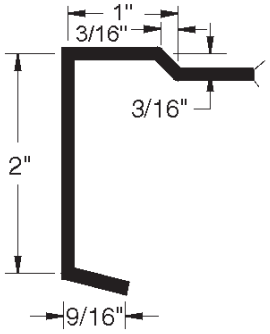
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DETAILS and SPECIFICATIONS

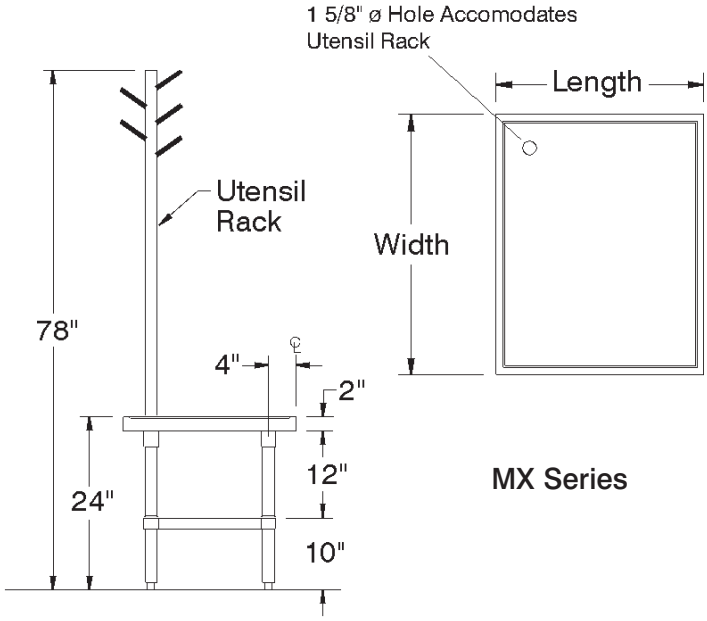
TOL ± .500" ALL DIMENSIONS ARE TYPICAL



MT, SAG & AG Series



Countertop Edge Detail



MX Series

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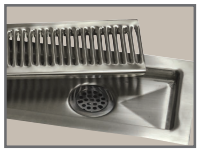
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TABLE MODIFICATIONS & ACCESSORIES

TOP MODIFICATIONS



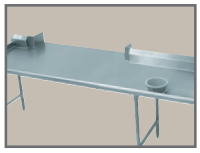
TA-56
5" NSF Partition



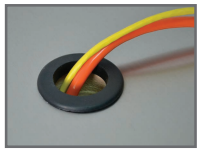
TA-523
Drop-In Urn Trough



CDR-5
Condiment Holder



TA-84
Pass-Thru



TA-108
Grommet For Cords

QTY.		
____	CDR-5	Condiment Holder (Accommodates 5 Bins)
____	TA-1	Notch Backsplash For Roll Up Door w/ Pass-Thru
____	TA-3	Stainless Steel Hat Channel & Gusset Upgrade
____	TA-7	10" Partial Splash
____	TA-8	Column Notch in Rear Splash (Includes Splash)
____	TA-10	5" Partial Splash
____	TA-12	Countertop Edge
____	TA-22	Square Edge Table
____	TA-28	Cut-Out For Cold Well. Incudes Louvered Doors
____	TA-29	16 Ga. 304 Rear Splash Capping Strip w/Adhesive Backing
____	TA-30	1-1/2" Side Splash
____	TA-30A	1-1/2" Turn Up For Table Tops
____	TA-31	5" Side Splash
____	TA-32	10" Side Splash
____	TA-34	Top Cut-Out
____	TA-34A	Top Cut-Out for Undermount Well
____	TA-35	Splash Cut-Out
____	TA-41	Poly-Vance 5/8" Cutting Board
____	TA-56	5" NSF Partition
____	TA-56A	18" NSF Partition
____	TA-57	Prepare Welded Field Joint (Welded in field by others)
____	TA-57A	Bolted Field Joint (Bolted in field by others)
____	TA-57B	Hairline Field Joint
____	TA-58	Stepdown to 24" Working Height
____	TA-64	Urn Trough (Factory installation only)
____	TA-75	Mitered Edge
____	TA-76	Paint on Sound Deadening
____	TA-79	Flour Trough (Factory installation only)
____	TA-82	Scrap Chute (6" dia. opening)
____	TA-84	Simple Pass-Thru
____	TA-87	Enclosed Rear Splash
____	TA-91	Poly Retaining Clips Includes TA-22 (S/S top table)

QTY.		
____	TA-93	Wall Brackets (Includes 2. For 5" & 10 1/2" splash only)
____	TA-96A	Can Opener Provision for Openers with Bolt-on Base (Customer to provide location)
____	TA-96B	Can Opener Surface Mount Provision with 4" S/S Tube for Openers w/o Base (Customer to provide location)
____	TA-96C	Can Opener Spacer Plate Provision for Use on Tables With Countertop Edge & Can Opener Base (Customer to provide location)
____	TA-100	Bull Nose All Sides of Worktable
____	TA-101	Rear Tray Lock
____	TA-106	Mirror HI-LITE Edge
____	TA-107	Vacuum Breaker Holes on Tables (Includes Backsplash with 2" Return)
____	TA-108	2" Hole with Grommet for Appliance Cord
____	TA-112	Hubble Outlet
____	TA-113	Notch Top for Buyout Unit
____	TA-130	Cutlery Dispenser Holder (Undercounter Mounted)
____	TA-135	Plate Shelf (Undercounter Mounted)
____	TA-366A	Heavy duty Understructure Top
____	TA-502	Install Advnace Tabco Hot Food Unit In Work Table Top (Requires TA-34 Top Cut-Out & TA-27 Control Panel. Does not include wiring. Consult factory)
____	TA-521	Drop-In urn Trough 1'
____	TA-522	Drop-In urn Trough 2'
____	TA-523	Drop-In urn Trough 3'
____	TA-524	Drop-In urn Trough 4'
____	TA-525	Drop-In urn Trough 5'
____	TA-526	Drop-In urn Trough 6'
____	TA-527	Drop-In urn Trough 7'
____	TA-528	Drop-In urn Trough 8'
____	TA-529	Drop-In urn Trough 9'
____	TA-550	Install Customer Supplied Buyout Items (Does not include wiring. Consult factory)
____	TA-551	Installation of Hot Food Wells. (Requires TA-34 Top Cut-Out & TA-27 Control Panel. Does not include wiring. Consult factory)

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TABLE MODIFICATIONS & ACCESSORIES

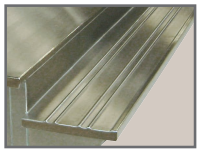
BASE MODIFICATIONS



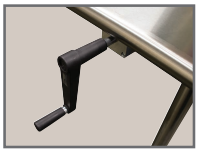
TA-39
Louvered Hinged Doors



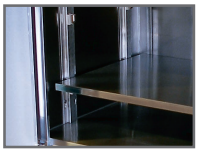
TA-73
Drop-Down Tray Slide



TA-74
Solid Tray Slide



TA-900
ADJ. Height Tables



TA-116
Adj. Mid-Shelf

QTY.		
____	TA-4	Removable Access Panel
____	TA-4A	Luvered Panel
____	TA-5	Curb Mounting Provision
____	TA-15	Provision for Built In Drawer Warmer
____	TA-23	Welded Set-Up Table/Crating
____	TA-24	Shell Crating
____	TA-27	Control Panel (Must add TA-34A or TA-34B)
____	TA-36A	Sliding/Hinge Stainless Steel Doors
____	TA-36B	1/2 Height Stainless Steel Hinge Doors
____	TA-36C	Hinged door with Trash Flap
____	TA-37	Stainless Enclosed Base
____	TA-39	24" Louvered Hinged Doors
____	TA-40	Remove Undershelf in Cabinet Base For Slide in Buyout
____	TA-42	Interior Partition (2.5"x30")
____	TA-43	Filler Panel (3"x30" with Flanged Feet)
____	TA-44	K.D. Aluminum Pan Rack Slides (6 slides. Table min. lgth. 30")
____	TA-45	K.D. Aluminum Glass Rack Slides (3 slides. Table min. lgth. 3 feet)
____	TA-46	Door Locks

QTY.		
____	TA-48	12"x12" Cut-Out in Back Panel/Undershelf for Plumbing
____	TA-54	Removable Kick Plate
____	TA-55	Remove Back Panel (on Enclosed Base)
____	TA-63	Removable Shelving (In addition to standard shelf & table width)
____	TA-70	S/S Tubular Tray Divider (12" sections)
____	TA-73	Tubular Tray Slide w/Dropdown (Stationary Tray Slide Available. Factory installation only)
____	TA-74	Solid Tray Slide
____	TA-92	12" Apron (in front of sink)
____	TA-92A	17" Stainless Steel Apron to Cover Sink Bowls and Support Lever Drain Handles
____	TA-116	Adjustable Enclosed Base Cabinet Mid Shelf- Add to Price of Enclosed Base Table with Fixed Mid Shelf **(M)**. Shelves Over 36" In Length Require Multiple Sections With Center Partition. For Partial Shelves Add To Price Of Shelf.
____	TA-130	Cutlery Dispenser Holder (Undercounter Mounted)
____	TA-135	Plate Shelf (Undercounter Mounted)
____	TA-205	Connect Cafeteria Items (Per Joint Between 2 Tables. Requires Casters)
____	TA-900	Upgrade Table To be Height Adjustable In Field (Up to 6" Only. Unit Ships Set Up)

ELECTRICAL & DATA PORT OUTLETS



TA-62
Duplex Outlet



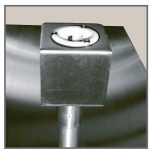
TA-62A
GFI Duplex Outlet



TA-62D
GFI Doghouse Outlet



TA-62F
Empty Junction Box



TA-112
Hubble Outlet

QTY.		
____	TA-62	Standard Duplex Electrical Outlet & Cover Plate (Under Flat Top). NEMA 5-15R
____	TA-62A	GFI Duplex Outlet & Cover Plate in a VKS Splash. NEMA 5-20R
____	TA-62C	GFI Duplex Outlet & Cover Plate Below Shelf Top. NEMA 5-20R
____	TA-62D	GFI Duplex Outlet & Cover Plate in a Doghouse. NEMA 5-20R

QTY.		
____	TA-62E	Upgrade Outlet to a NEMA 6-20R or Equiv.
____	TA-62F	Junction Box (empty) Below Table Top. Includes 1 Gang Size, Stainless Steel Face Plate
____	TA-112	Hubble Outlet
____	TA-622	CAT-5 Data Port Outlet. Cable Not Included

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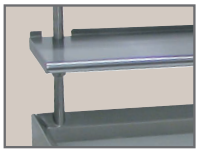
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TABLE MODIFICATIONS & ACCESSORIES

OVERSHELF & POT RACK MODIFICATIONS



TA-9A
1"Turn Up



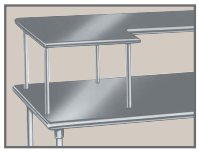
TA-22A
Square Edge



TA-71
Heat Lamp Mounting Provision



TA-100A
Bull Nose



TA-102
24" x 24" Extension

QTY.		
____	TA-9A	Partial 1" Turn-Up for all Table Mt. Shelves
____	TA-22A	Square Edge on Overshelf
____	TA-26-10	Welded Wall Shelf Brackets for 10" Wide Shelf
____	TA-26-12	Welded Wall Shelf Brackets for 12" Wide Shelf
____	TA-26-15	Welded Wall Shelf Brackets for 15" Wide Shelf
____	TA-26-18	Welded Wall Shelf Brackets for 18" Wide Shelf
____	TA-47	Shelf Mounting Bracket for Existing Table
____	TA-49	Wall Shelf 2" Offset
____	TA-60	Special Sizing Charge for Shelves (Must Order Larger Unit to be Cut Down to Smaller Size)
____	TA-71	Heat Lamp Mounting Provision
____	TA-71A	Heat Lamp Remote Control Bracket
____	TA-78	Additional Lin. Ft. Past 12' For Table Mt. Shelf (For ODS, OTS, TS, DS & WS Shelving only)
____	TA-77	Check Minder Shelf Provision (Factory install only)
____	TA-83	Spice Bins

QTY.		
____	TA-84A	Knife Rack for Rolled Rim Tables
____	TA-84B	Knife Rack for Poly Top Tables
____	TA-84C	Knife Rack for Square Edge Tables
____	TA-86	Stainless Steel Pot Hooks
____	TA-89	Double Sided Plated Pot Hooks (Package of 4)
____	TA-89A	Single Sided Plated Pot Hooks (Package of 4)
____	TA-98	Stainless Steel Flat Bar in lieu of Chain
____	TA-99	16 Ga. S/S 304 Upgrade for Wall & Over Shelves
____	TA-100A	Bull Nose All Sides of Shelf
____	TA-100R	Bull Nose Three Sides of Shelf w/ Rear Turn Up
____	TA-102	24" x 24" Extension for Microwave or Computer Shelf (Add to OTS and ODS Shelves. See page 65)
____	TA-103	24" Wide PT Shelf (36" Min Length. Mid mount only. PT Series Shelf, See Pg. 73. Add to 18" Wide Shelf)
____	TA-104	Additional Length Over 12' (Add to 18" Shelf. (PA & CU Shelving Only. Max. Length is 14' as Single Piece)

UNDERSHELF MODIFICATIONS

QTY.		
____	TA-9	1-1/2" Turn-Up for Undershelves
____	TA-17	Upgrade Undershelf to a Marine Edge (Must add TA-23)
____	TA-48	12"x12" Cut-Out in Back Panel or Undershelf for Plumbing

QTY.		
____	TA-94	Upgrade 16 Ga. 304 S/S Undershelf
____	TA-94A	Upgrade 14 Ga. 304 S/S Undershelf
____	TA-366	Reinforced Understructure For Undershelves

SIZE MODIFICATIONS

QTY.		
____	TA-33	Special Working Height
____	TA-59	36" Wide Equipment Stand
____	TA-6	Extra Length for Standard Tables Over 12' (Tables Over 14' Require Field Joint TA-57)
____	TA-61	Special Sizing Charge (Larger Unit Cut Down to Smaller Size)
____	TA-61A	Special Modification Charge

QTY.		
____	TA-65	Enclosed Base Units Over 12' (Open Base Table)
____	TA-66	Enclosed Base Units Over 12' (Sliding Door Units)
____	TA-67	Enclosed Base Units Over 12' (Hinged Door Units)
____	TA-105	Modify Enclosed Base Table w/ Drawers to 24" Width
____	TA-110	Modify Enclosed Base Table w/ Drawers to 36" Width

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Customer Service Available To Assist You 1-800-645-3166 8:30 am - 8:00 pm E.S.T.

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For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

TABLE MODIFICATIONS & ACCESSORIES

LEG MODIFICATIONS

QTY.		
____	TA-16	1 Galvanized Leg with Plastic Bullet Foot (34 1/2" Total Length)
____	TA-16-4	4 Galvanized Legs with Plastic Bullet Feet (34 1/2" Total Length)
____	TA-16-6	6 Galvanized Legs with Plastic Bullet Feet (34 1/2" Total Length)
____	TA-19	Stainless Steel Flanged Bullet Foot For Work Table
____	TA-19L	S/S Bolt-on Leg w/ Flanged Foot For Enclosed Base Table
____	TA-20	1 Stainless Steel Leg with S/S Bullet Foot (34 1/2" Total Length)
____	TA-20-4	4 Stainless Steel Leg with S/S Bullet Feet (34 1/2" Total Length)

QTY.		
____	TA-20-6	6 Stainless Steel Leg with S/S Bullet Feet (34 1/2" Total Length)
____	TA-20L	Replacement Bolt-on Leg For Enclosed Base Table
____	TA-21	Stainless Steel Bullet Foot
____	TA-68	Relocate Rear Cross Rail To Center (for Open Base Tables Only)
____	TA-72	Leg to Wall Brace (Set per table)
____	TA-95	Upgrade 16 Ga. 304 S/S Legs Only

WORK TABLE CASTERS



Standard Casters

Maintains the Standard 35-1/2" Working Height

200 lbs. Load Capacity Per Caster

When Used w/ Stainless Steel Legs

TA-25S-4 **Set of 4** (Two with Brakes)
TA-25S-6 **Set of 6** (Two with Brakes)

When Used w/ Galvanized Legs

TA-25G-4 **Set of 4** (Two with Brakes)
TA-25G-6 **Set of 6** (Two with Brakes)

Replacement Casters

For Work Tables

TA-25 **Set of 4** (Two with Brakes)

TA-25A **Set of 6** (Two with Brakes)

200 lbs. Load Capacity Per Caster



Optional Standard Caster Upgrades:

TA-25B Set For brakes on all wheels (Standard Casters) - Add price to the following models: TA-25, TA-25A, TA-25S-4, TA-25S-6, TA-25G-4, TA-25G-6

TA-25C Per Caster Upgrade Standard Caster with Heavy Duty Urethane Wheels (Per Caster)

EQUIPMENT STAND CASTERS



Standard Casters

5" Urethane Wheels.
Maintains the Standard 24" Working Height

200 lbs. Load Capacity Per Caster

w/ Stainless Steel Legs

TA-25ES **Set of 4** (Two with Brakes)

w/ Galvanized Legs

TA-25EG **Set of 4** (Two with Brakes)



HEAVY DUTY Casters

5" Urethane Wheels

400 lbs. Load Capacity Per Caster

TA-255 Super Heavy Duty Set of 4 (Two with Brakes)

TA-256 Super Heavy Duty Set of 6 (Two with Brakes)

Enclosed Base Table Casters

Easy Bolt-On Style



TA-255P **Set of 4** (Two with Brakes)
TA-255AP **Set of 6** (Two with Brakes)

300 lbs. Load Capacity Per Caster

For brakes on all wheels (Enclosed Base Casters) - Add price to models: TA-255P or TA-255AP

TA-255PB

Optional Equipment Stand Caster Upgrade:

TA-255B For brakes on all wheels (Equipment Casters) - Add price to any of the following models: TA-255, TA-256, TA-25ES, TA-25EG

Contact Our SMART FABRICATION™ Department for more information at 800-645-3166 or email in your specifications to smartfab@advancetabco.com

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ITEM# K31 - CABINET, ENCLOSED, BUN / FOOD PAN (1 EA REQ'D)

Cambro 1826DTC401

Camcart®, double cavity for trays & sheet pans, 33-1/4"W x 21-1/2"D x 63-3/4"H, (24) tray support rails on 1-15/16" centers, polyethylene, foam insulation, molded-in handle, (4) 6" casters (2 fixed, 2 swivel, 1 with brake), slate blue

CAMBRO® INSULATED TRANSPORT 1826DTC AND 1826DBC

Redesigned and Ready for Work

New!



CAMBRO MADE IN USA

StoreSafe StaySafe®

- Durable insulated storage and transport for sheet pans and food boxes.
- Double cavity design.
- Improved ergonomics for easy transport.

CAMBRO®
TRUSTED FOR GENERATIONS™

www.cambro.com

Cambro® Insulated Transport 1826DTC and 1826DBC

The Cambro® 1826DBC and 1826DTC have been long time stalwarts of our insulated transport product category. With continuous product improvement being a part of our culture, we have re-imagined these classic carts with a modern design, upgraded hardware and close attention to ergonomics.



1826DBC for Cambro® Food Boxes

FOOD BOXES CODE*	CAPACITY
18263CW	10 per cart
18266CW	6
18269CW	4

*Cambro® Food Boxes available in both clear Camwear® and white Poly.



1826DTC for sheet pans

Capacity:
24/ea 1826 sheet pans/trays.



Robust, stainless steel hinges prevent door sag and improper seal.



Increased door thickness to eliminate warpage and improve insulation.



Vertical molded-in handles for easy maneuvering at any height.



Casters: 6" x 1¼" 2/EA swivel (1 with brake, 1 without brake) 2/EA rigid.

CODE	DIMENSIONS W x D x H	UNIT WEIGHT	CASE LBS. (CUBE)
1826DBC	21½" x 33¼" x 64"	112.5 lbs.	129 (27.74)
1826DTC	21½" x 33¼" x 64"	115.5	132 (27.74)
1826DBCSP**	21½" x 33¼" x 64 5/16"	140.5	157 (27.74)
1826DTCSP**	21½" x 33¼" x 64 5/16"	143.5	160 (27.74)

Case Pack: 1 **Color:** Black (110), Slate Blue (401), Dark Brown (131), Charcoal Gray (615). Shipping weight excludes pallet/box.
**SP models come equipped with a security package.

For more information about Cambro products visit www.cambro.com or contact your Distributor, Cambro Sales Representative or the Cambro Customer Service Department.

CAMBRO TRUSTED FOR GENERATIONS™

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INSULATED FOOD SERVERS (NON-ELECTRIC)

Camcarts®

- Use to hold hot or cold bulk food stored on trays/sheet pans or food boxes.
- Durable polyethylene and thick foam insulation retain safe food temperatures.
- Sturdy plastic, rust-proof latches are secured into molded-in mounting plates.
- Molded-in handle on the back for easy maneuvering.







Colors: Slate Blue (401), Coffee Beige (157), Dark Brown (131), Charcoal Gray (615).

6" Casters: 2 fixed, 2 swivel, 1 with brake.

Note: Cool metal sheet pans to 250°F before placing onto tray supports.

Venting plug is covered by US Patent D 553,717 S.

Only 1826DBC and 1826DBCSP are NSF Listed.

1826DTC Double Cavity Cart for Trays and Sheet Pans

Capacity: 24 tray support rails on 1 15/16" centers (12 per cavity). Holds up to 24 each 18" x 26" trays or sheet pans.

1826DBC Double Cavity Cart for Food Storage Boxes

Capacity: 26 support rails on 1¾" centers (13 per cavity). Holds 18" x 26" Food Storage Boxes.

Camcart with Security Package (SP)

Specially designed for high security applications, with tamper-resistant hardware: metal hinges with non-removeable pins, metal latches with welded bails, lockable hasp and chassis plate.







CASTER IMPACT PLATES
Impact plates add metal reinforcement to hold casters in place even when dropped.

CODE	DESCRIPTION	EXTERIOR DIMENSIONS W x D* x H	INTERIOR DIMENSIONS W x D x H
1826DTC	For trays & sheet pans	21½" x 33¼" x 63¾"	16½ x 26½" x 25 7/16"
1826DBC	For food storage boxes	21½" x 33¼" x 63¾"	16½ x 26½" x 25 7/16"
Camcarts with Security Package			
1826DTCSP	For trays & sheet pans	21½" x 33¼" x 63¾"	16½ x 26½" x 25 7/16"
1826DBCSP	For food storage boxes	21½" x 33¼" x 63¾"	16½ x 26½" x 25 7/16"

Case Pack: 1 *Exterior Depth measurement includes handle.

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ITEM# K32 - SPARE NO.

<Spare No.>

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ITEM# K33 - REACH-IN REFRIGERATOR (1 EA REQ'D)

Continental Refrigerator 1RN

Refrigerator, reach-in, one-section, 20 cu. ft., self-contained refrigeration, stainless steel front, aluminum interior & ends, standard depth, full-height solid door, cylinder lock, electronic control with digital display, hi-low alarm, electric condensate evaporator, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF, ENERGY STAR®

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	1		Standard warranty: 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	1		115v/60/1-ph, 5.2 amps, cord, NEMA 5-15P
Continental Refrigerator	1		Door hinged on right, standard
Continental Refrigerator	1		5" Casters, standard

REACH-IN REFRIGERATOR

Model: 1RN

Natural Refrigerant R-290 Model

1-Section Reach-In Refrigerator

ENERGY STAR® Qualified Commercial Refrigerator

1RN - Stainless steel front, aluminum end panels and interior
1RNSA - Stainless steel exterior, aluminum interior
1RNSS - Stainless steel exterior and interior
Designed to maintain NSF-7 temperatures in 100°F ambient.



Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**

Standard Model Features

REFRIGERATION SYSTEM

- Self contained, performance rated refrigeration system
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Automatic, electric condensate evaporator

CABINET ARCHITECTURE

- 3” non-CFC polyurethane foam insulation
- Smooth, polished chrome workflow door handle
- Cam action, lift off hinges
- Self-closing door
- Magnetic snap in Santoprene™ door gasket
- Cylinder lock in door
- Heavy duty, epoxy coated steel shelves
- 5” casters

MODEL FEATURES

- LED interior lighting
- Electronic control, off-cycle defrost
- Rehinging of door (in the field)

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Options and Accessories

(upcharge and lead times may apply)

Stainless steel case back	Shallow depth (consult factory)
Additional epoxy coated steel shelves	Hinged glass door (consult factory)
Chrome or stainless steel shelves	Half doors
Heavy duty pilaster strips	Pass-Thru (consult factory)
Wine rack	**Correctional Facility Options**
Adjustable legs	• One way security screws
Custom laminates	• Locking hasp (lock not included)
Pan slide assemblies	• Stainless steel mesh cover
Expansion valve	• Coverless hinges
Special electrical requirements (consult factory)	

Consult factory for other model configurations, options and accessories.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	20 (566 cu l)
Width, Overall (inches)	26 (660 mm)
Depth, Overall (inches) (including handle)	35 3/8 (899 mm)
Depth (inches) (less door)	32 (813 mm)
Depth (inches) (door open 90°)	55 1/2 (1410 mm)
Clear Door Width (inches)	19 3/8 (492 mm)
Clear Door Height (inches)	58 5/8 (1489 mm)
Height, Overall (inches) (including 5" casters)	82 1/4 (2089 mm)
Number of Doors	1
Number of Shelves	3
Shelf Area (square feet)	20.4 (1.9 sq m)
Tray Slide Capacity (2" centers)	24

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4+
Capacity (BTU per hour)*	1940

ELECTRICAL DATA

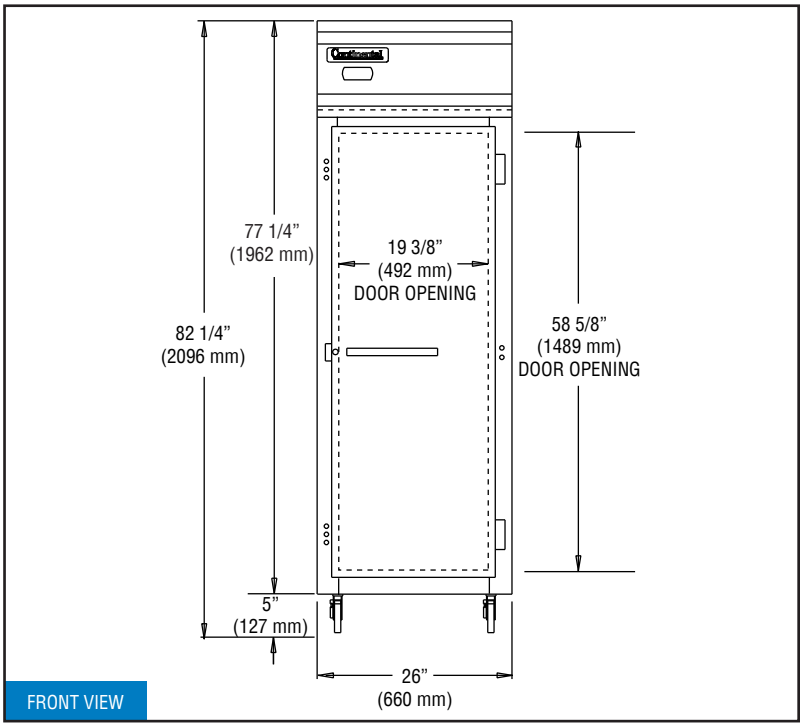
Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	5.9 (3.9)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

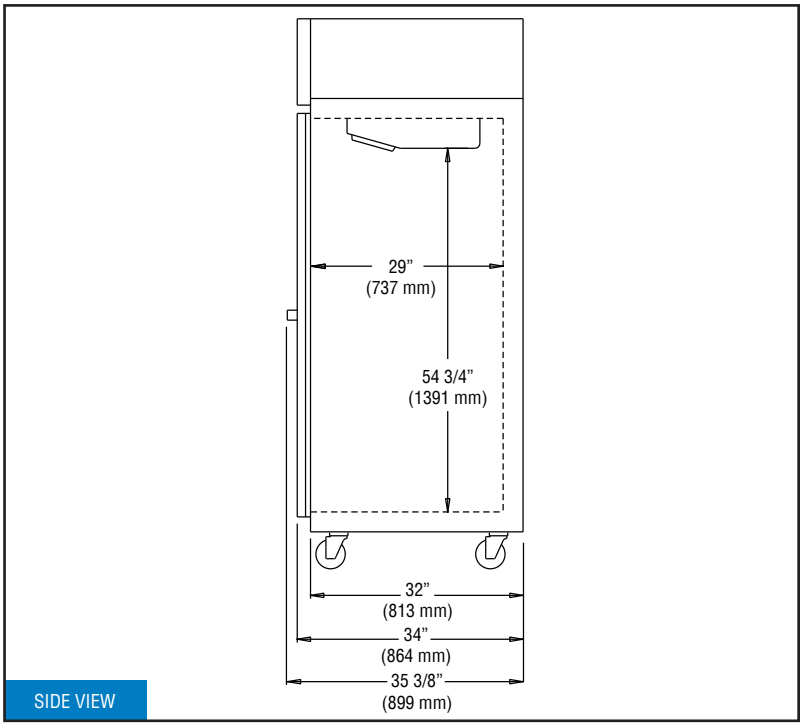
Height - Crated (inches)	85 1/2 (2172 mm)
Width - Crated (inches)	31 5/8 (803 mm)
Depth - Crated (inches)	42 (1067 mm)
Volume - Crated (cubic feet)	65 (1841 cu l)
Weight Std - Crated (pounds)	275 (124 kg)
Weight SS - Crated (pounds)	330 (149 kg)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.

Model Plan Views



FRONT VIEW



SIDE VIEW

IMPORTANT NOTE: If the cabinet is located directly against a wall and/or under a low ceiling, a minimum clearance of 12" is required on top and 3" on sides and rear.

Continental Refrigerator
Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

PROUDLY DESIGNED & ASSEMBLED IN THE U.S.A.



Equipped with one NEMA-5-15P Plug (varies by country)

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REVISED: 1/29/24

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ITEM# K34 - PREP TABLE (1 EA REQ'D)

Custom CUSTOM

S/s prep table with two 20" x 20" x 14" deep prep sinks with lever waste, s/s undershelf and five inch rear and right side splash.

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ITEM# K34.1 - DECK MOUNT FAUCET (1 EA REQ'D)

Fisher 33130

Faucet, deck mount, 8" centers, 12" swing spout, lever handles with color coded indexes, 1/2" male inlets, brass, ADA Compliant

ACCESSORIES

Mfr	Qty	Model	Spec
Fisher	1		4 year warranty against defects in materials or workmanship

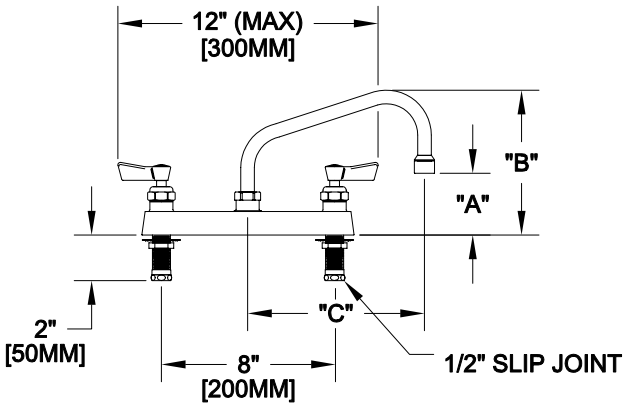
APPLICATION:

PRODUCT NAME:

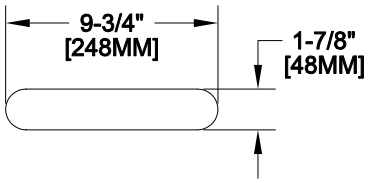
8" C/C DECK FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

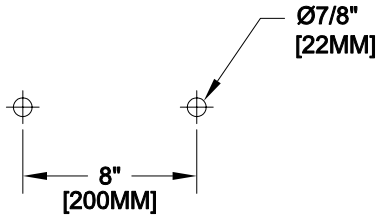


FOOTPRINT:



MODEL	DIM "A"	DIM "B"	DIM "C"
3310	2-3/8" [60MM]	6" [150MM]	6" [150MM]
3311	2-5/8" [66MM]	6-1/2" [165MM]	8" [200MM]
3312	3-1/4" [83MM]	7" [177MM]	10" [250MM]
3313	3-3/4" [98MM]	7-1/2" [188MM]	12" [300MM]
3314	4-5/8" [115MM]	8-3/8" [212MM]	14" [350MM]
1627	5-1/8" [131MM]	9" [228MM]	16" [400MM]

ROUGH-IN:



ANSI/A112.18.1M

SPECIAL CONFIGURATION
☐ _____ CHECK BASE MODEL AND OPTIONS

MODEL:
- ☐ 3310 WITH 6" SWING SPOUT
- ☐ 3311 WITH 8" SWING SPOUT
- ☐ 3312 WITH 10" SWING SPOUT
- ☐ 3313 WITH 12" SWING SPOUT
- ☐ 3314 WITH 14" SWING SPOUT
- ☐ 1627 WITH 16" SWING SPOUT

OPTIONS OR MODIFICATIONS:
- ☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
- ☐ DJ SUB-ASSY (7-1/4" OR 13") CIRCLE LENGTH
- ☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
- ☐ VANDAL RESISTANT KIT
- ☐ OTHER _____

FEATURES

* 8" C/C DECK MOUNT
* SWIVELLING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE: 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 5.5 LBS

SPEC. 3310 REV. B

FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

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ITEM# K35 - SHELVING, WALL MOUNTED (1 EA REQ'D)

Advance Tabco WS-12-48-16

Shelf, wall-mounted, 48"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

WALL SHELVES

NSF



Item #: _____ Qty #: _____

Model #: _____

Project #: _____



FEATURES:

Brackets can be positioned to accommodate wall studs.

Furnished with a 1-5/8" Bullnose edge with a 1-1/2" turn-up edge at rear. Ends are turned down square.

MATERIAL:

16 Gauge Series - 304 stainless steel polished to a satin finish.

18 Gauge Series - 430 stainless steel polished to a satin finish.

CONSTRUCTION:

Secured to wall by means of bolts through support brackets.

Units 7 ft. and larger are furnished with 3 brackets.

	10" Wide			12" Wide			15" Wide			18" Wide			
L	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	Approx. Cu. Ft.
24"	WS-10-24-16	WS-10-24	8 lbs.	WS-12-24-16	WS-12-24	9 lbs.	WS-15-24-16	WS-15-24	11 lbs.	WS-18-24-16	WS-18-24	14 lbs.	3
30"	-	-	-	WS-12-30-16	WS-12-30	12 lbs.	-	-	-	-	-	-	4
36"	WS-10-36-16	WS-10-36	10 lbs.	WS-12-36-16	WS-12-36	12 lbs.	WS-15-36-16	WS-15-36	15 lbs.	WS-18-36-16	WS-18-36	21 lbs.	4
42"	-	-	-	WS-12-42-16	WS-12-42	14 lbs.	-	-	-	-	-	-	5
48"	WS-10-48-16	WS-10-48	12 lbs.	WS-12-48-16	WS-12-48	14 lbs.	WS-15-48-16	WS-15-48	18 lbs.	WS-18-48-16	WS-18-48	24 lbs.	5
60"	WS-10-60-16	WS-10-60	15 lbs.	WS-12-60-16	WS-12-60	17 lbs.	WS-15-60-16	WS-15-60	23 lbs.	WS-18-60-16	WS-18-60	28 lbs.	6
72"	WS-10-72-16	WS-10-72	17 lbs.	WS-12-72-16	WS-12-72	21 lbs.	WS-15-72-16	WS-15-72	28 lbs.	WS-18-72-16	WS-18-72	32 lbs.	7
84"	WS-10-84-16	WS-10-84	20 lbs.	WS-12-84-16	WS-12-84	25 lbs.	WS-15-84-16	WS-15-84	32 lbs.	WS-18-84-16	WS-18-84	36 lbs.	8
96"	WS-10-96-16	WS-10-96	23 lbs.	WS-12-96-16	WS-12-96	28 lbs.	WS-15-96-16	WS-15-96	36 lbs.	WS-18-96-16	WS-18-96	42 lbs.	10
108"	WS-10-108-16	WS-10-108	28 lbs.	WS-12-108-16	WS-12-108	32 lbs.	WS-15-108-16	WS-15-108	40 lbs.	WS-18-108-16	WS-18-108	48 lbs.	11
120"	WS-10-120-16	WS-10-120	32 lbs.	WS-12-120-16	WS-12-120	36 lbs.	WS-15-120-16	WS-15-120	44 lbs.	WS-18-120-16	WS-18-120	54 lbs.	12
132"	WS-10-132-16	WS-10-132	36 lbs.	WS-12-132-16	WS-12-132	42 lbs.	WS-15-132-16	WS-15-132	49 lbs.	WS-18-132-16	WS-18-132	60 lbs.	13
144"	WS-10-144-16	WS-10-144	40 lbs.	WS-12-144-16	WS-12-144	48 lbs.	WS-15-144-16	WS-15-144	55 lbs.	WS-18-144-16	WS-18-144	66 lbs.	14

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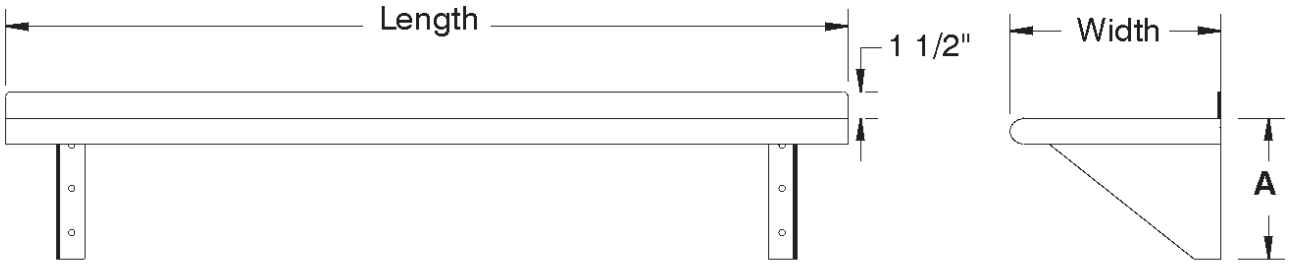
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DETAILS and SPECIFICATIONS

TOL ± .500" ALL DIMENSIONS ARE TYPICAL

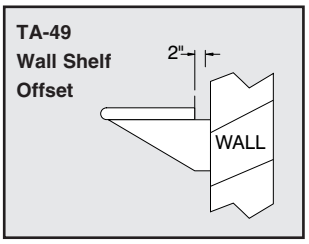


Width	A
10"	8 1/2"
12"	10 1/2"
15"	13 1/2"
18"	16 1/2"

Load Capacity = 20 lbs. per sq. ft.
(Evenly Distributed Weight)

Wall Shelf Options

PRT-1	Printer Shelf
TA-22A	Square Edge Shelf
TA-26	Welded Shelf Brackets
TA-49	Wall Shelf 2" Offset
TA-71	Heat Lamp Provision
TA-77	Check Minder
TA-77A	Concealer for Heat Lamp (Requires TA-77)
TA-99A	14 Ga. S/S 304 Upgrade for Overshelves
TA-100A	Bullnose Edge On All 4 Sides of Shelf
TA-102	6" Cantilever Shelf Offset





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ITEM# K36 - POT RACK (1 EA REQ'D)

Advance Tabco SW-48

Pot Rack, wall-mounted, double bar design, 48"W x 12"D, constructed of 1/4" x 2" stainless steel, includes: (12) plated double pot hooks, NSF

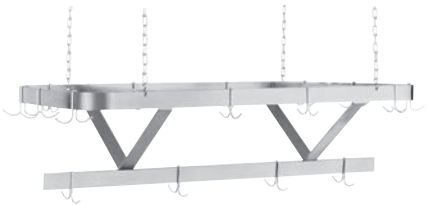
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STAINLESS STEEL

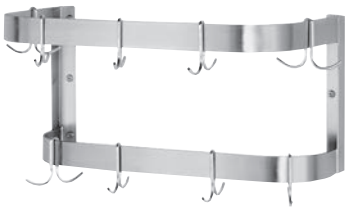
POT RACKS

Item #: _____ Qty #: _____
Model #: _____
Project #: _____

CEILING MOUNTED



WALL MOUNTED



SHELF w/ POT RACK



Ceiling Mounted

L	S/S	# of Hooks	Wt
36”	SC-36	12	42 lbs.
48”	SC-48	12	48 lbs.
60”	SC-60	18	54 lbs.
72”	SC-72	18	60 lbs.
84”	SC-84	18	66 lbs.
96”	SC-96	18	80 lbs.
108”	SC-108	18	86 lbs.
120”	SC-120	18	92 lbs.
132”	SC-132	18	98 lbs.
144”	SC-144	18	104 lbs.

Wall Mounted NSF

L	S/S	# of Hooks	Wt
24”	SW-24	12	18 lbs.
36”	SW-36	12	22 lbs.
48”	SW-48	12	26 lbs.
60”	SW-60	18	30 lbs.
72”	SW-72	18	34 lbs.
84”	SW-84	18	44 lbs.
96”	SW-96	18	48 lbs.
108”	SW-108	18	52 lbs.
120”	SW-120	18	56 lbs.
132”	SW-132	18	60 lbs.
144”	SW-144	18	64 lbs.

Shelf with Pot Rack NSF

L	12” Wide	Wt	15” Wide	Wt	18” Wide	Wt	# of Hooks
36”	PS-12-36	20 lbs.	PS-15-36	25 lbs.	PS-18-36	30 lbs.	6
48”	PS-12-48	30 lbs.	PS-15-48	35 lbs.	PS-18-48	40 lbs.	6
60”	PS-12-60	40 lbs.	PS-15-60	45 lbs.	PS-18-60	50 lbs.	9
72”	PS-12-72	50 lbs.	PS-15-72	55 lbs.	PS-18-72	60 lbs.	9
84”	PS-12-84	60 lbs.	PS-15-84	65 lbs.	PS-18-84	70 lbs.	9
96”	PS-12-96	70 lbs.	PS-15-96	75 lbs.	PS-18-96	80 lbs.	9
108”	PS-12-108	80 lbs.	PS-15-108	85 lbs.	PS-18-108	90 lbs.	9
120”	PS-12-120	90 lbs.	PS-15-120	95 lbs.	PS-18-120	100 lbs.	9
132”	PS-12-132	100 lbs.	PS-15-132	105 lbs.	PS-18-132	110 lbs.	9
144”	PS-12-144	110 lbs.	PS-15-144	115 lbs.	PS-18-144	120 lbs.	9

Units 8 ft. and larger are furnished with three (3) sets of supports brackets.

FEATURES: (Ceiling Mounted)

Ceiling suspension with chain hangers. Optional stainless steel Flat Bar in lieu of Chain available. Use **TA-98**.

MATERIAL:

Flat steel bar is 2” x 1/4”, stainless steel.

Pot hooks are plated.

24” long chain hangers are plated.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

FEATURES: (Wall Mounted)

Secured to wall by means of bolts through welded brackets. (Hardware not provided)

MATERIAL:

Flat steel bar is 2” x 1/4”, stainless steel.

Pot hooks are plated.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

FEATURES: (Shelf/Pot Rack)

A dual purpose unit for shelf and utensil storage.

Secured to wall by means of bolts through welded brackets. (Hardware not provided)

MATERIAL:

Flat stainless steel bar is 2” x 1/4”.
Pot hooks are plated.
Type “430” stainless steel shelf.

CONSTRUCTION:

All welded stainless steel units are blended to a satin finish.

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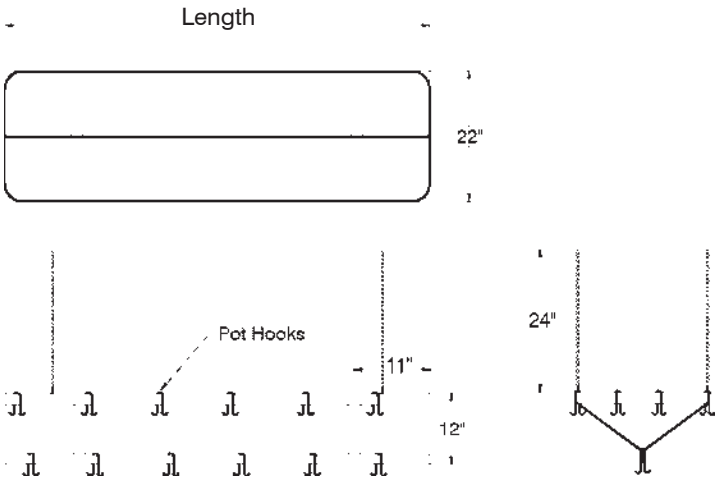
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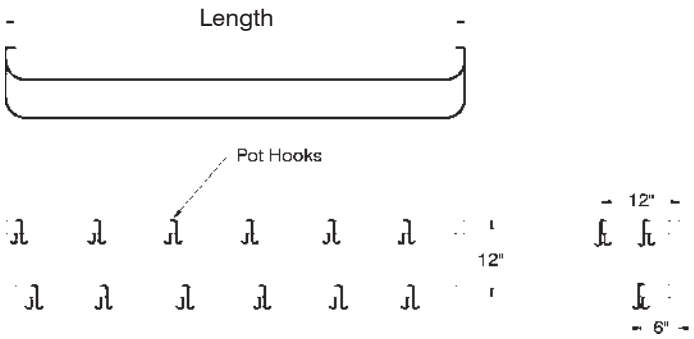
DETAILS and SPECIFICATIONS

TOL ± .500” ALL DIMENSIONS ARE TYPICAL

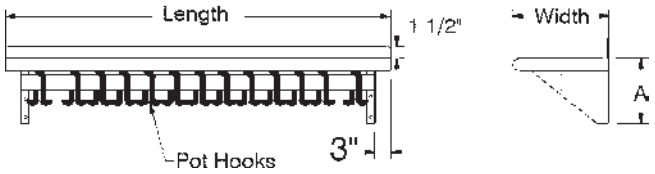
Ceiling Mounted



Wall Mounted



Shelf with Pot Rack



Width	A
12”	10 1/2”
15”	13 1/2”
18”	16 1/2”

Load Capacity = 20 lbs. per sq. ft.

(Evenly Distributed Weight)

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

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03/14/2025

ITEM# K37 - SLIM JIM TRASH CAN

By Owner

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03/14/2025

ITEM# K38 - SPARE NO.

<Spare No.>

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ITEM# K39 - SPARE NO.

<Spare No.>

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ITEM# K40 - EXHAUST HOOD (1 EA REQ'D)

Captive-Aire PROJECT NO

S/S Exhaust Hood with Make-Up Air, 21' 6" long O.A., 24" high, consisting of the following components to be provided by the F.S.E.C. and installed by the Mechanical Contractor:

-Stainless Steel Captrate Solo Filter(s)
-Two hood sections
-Recessed round LED lights
-Grease cup
-Exhaust Riser
-Field wrapper (left, front and right sides, as necessary)
-Utility cabinet located on left side of hood section as shown on plans.
-Prewired electrical package factory installed in utility cabinet for Exhaust fan(s), Supply Fan(s), Audible alarm, Exhaust on in Fire Condition and Lights out in Fire Condition. LCD Interface, (INCLUDES SPARE WIRING TERMINAL(S) FOR FIELD WIRING TO BUILDING FIRE PANEL AND ELECTRIC EQUIPMENT OFF IN FIRE CONDITION)
-Pre-piped TANK Fire Suppression System
-PSP supply plenum
-Left vertical end panel
-Right vertical end panel
-3" rear standoff
- Exhaust fan(s) and curb(s)
-Supply unit with 8 ton dual circuit modular packaged cooling with heat pump

NOTE: Hood permit, hanging hood, hood installation, all ductwork, setting fans and curbs, patching, all electrical field wiring, start-up & balance, gas or electric shutdown for fire hook-up shall be the responsibility of the Mechanical Contractor.

NOTE: Please refer to the Captive-Aire hood detail drawing(s) in the Food Service Equipment set of plans for further details.

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ITEM# K41 - FIRE PROTECTION (1 EA REQ'D)

Captive-Aire FIRE SYSTEM

Tank fire system with detection, gas valve, permit, installation, certification and one test.

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03/14/2025

ITEM# K42 - WALL PANELS (1 EA REQ'D)

Captive-Aire CUSTOM

S/s wall panels from under hood to top of cove base, to extend 18" past either side of hood to ceiling.

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03/14/2025

ITEM# K43 - TILTING SKILLET BRAISING PAN, ELECTRIC (1 EA REQ'D)

Groen BPM-15EC

Braising Pan, electric, 15-gallon capacity, 8" deep pan, 35" pan height, IPX6 water rated electronic Classic controls, manual tilt, standard etch marks, faucet bracket, round tubular open leg base, stainless steel construction, bullet feet, cUL, UL, IPX6, NSF, Made in USA

ACCESSORIES

Mfr	Qty	Model	Spec
Groen	1		(1) year parts & labor, (10) year pan warranty, standard
Groen	1		208v/60/3-ph, 7.7kW, 22.0 amps, std.
Groen	1	Z091869	Faucet, single pantry, with swing spout

BRAISING PANS

TILTING SKILLET ELECTRIC MODELS BPM-E

Braising pan shall be a Groen electric heated manual tilting BPM Series (specify 15, 30 or 40 gallon, Classic (C), Advanced (A) or Cook2Temp™ (C2T) controls) model 8" (15E) or 10" (30E, 40E) deep pan body with 3" radius corners, 5/8" thick stainless steel clad cooking surface mounted on open leg stand with height-adjustable bullet feet. CookTemp models also come with a probe.

Certifications:

PROJECT NAME:	
LOCATION:	
ITEM NO:	
QTY:	
MODEL NO:	
AIA NO:	
SIS NO:	
CSI SECTION:	11400



BPM-15EA Model shown

AVAILABLE MODELS:

CLASSIC CONTROLS:
- ☐ BPM-15EC (15 GALLON)
- ☐ BPM-30EC (30 GALLON)
- ☐ BPM-40EC (40 GALLON)

ADVANCED CONTROLS:
- ☐ BPM-15EA (15 GALLON)
- ☐ BPM-30EA (30 GALLON)
- ☐ BPM-40EA (40 GALLON)

COOK2TEMP CONTROLS:
- ☐ BPM-15EC2T (15 GALLON)
- ☐ BPM-30EC2T (30 GALLON)
- ☐ BPM-40EC2T (40 GALLON)

CONSTRUCTION: The pan body shall be of type 304 stainless steel, solid one-piece welded heavy-duty construction, with 8" (15E) or 10" (30E, 40E) pan depth. All exposed surfaces shall be stainless steel. The cooking surface is a heavy 5/8" thick stainless steel clad plate fitted with flat bar electric heating elements, ensuring efficient heat transfer over the entire cooking surface. The heavy plate prevents warping or distortion. Controls and tilt mechanism are mounted in a stainless steel water resistant IPX6-rated housing, on right side of the pan body. Braising pan shall come standard with mounting bracket for either right-side, left-side or right-rear faucet mounting. Graduated fill-level marks in both gallons and liters are standard.

FINISH: Interior of braising pan shall be polished to a 100 emery grit finish on C/A models, 180 emergy grit on C2T models. Exterior of braising pan shall have a #3 finish, ensuring maximum ease in cleaning and maintaining appearance.

SANITATION & NSF LISTING: Braising pan shall be designed and constructed to be NSF-listed, meeting all known health department and sanitation codes. True open leg tubular stand design and 3" radius pan interior make cleaning easier.

UL LISTING: Braising pan shall be UL- and cUL- listed.

MANUAL TILT: The braising pan shall have a smooth-action, quick-tilting body with manual crank and worm-and-gear tilt mechanism, which provides precise control during pouring of pan contents. Pan body shall tilt to vertical in 24 turns and past vertical to assist in cleaning.

CONTROLS: All controls to be located in a right-front mounted water resistant (IPX6 rated) enclosure: **Classic -C Models** include: Power ON-OFF switch with indicator light, temperature control knob with 175 to 400°F (79 to 204°C) range increments and HEAT(ing) indicator light; **Advanced -A Models** include: Same control features as Classic models with the addition of temperature and time set knob (175 to 400°F/79 to 204°C range), LED display of set temperature or cook time, buttons for reset of Low Temp and High Temp presets, MANUAL mode button for knob-setting of pan temperature, and TIMER-set button with indicator light; **Cook2Temp -C2T Models** include: Same control features as Classic and Advanced models with the addition of Auto C2T and Manual C2T buttons with core probe connection port, MANUAL mode button for knob-setting of pan temperature for manual cooking and manual C2T cooking.

PERFORMANCE/FEATURES: Braising pan shall be equipped with controls that allow operation at 7-degree angle to facilitate griddling. Braising pan shall be thermostatically-controlled for automatic shut-off when desired temperature is reached and automatic power ON when temperature falls below desired setting. Braising pan to have high limit thermostat as safety feature.

INSTALLATION: One electrical connection required. Specify 208, 240 or 480 Volt electrical service. All units ship three-phase, and are field convertible to single-phase operation.

OPTIONS/ACCESSORIES:
- ☐ Single pantry water faucet
- ☐ Double pantry water faucet
- ☐ Single or double pantry faucet with spray hose assembly (48" or 60")
- ☐ 2" tangent drawoff (option must be ordered with unit)
- ☐ Strainer for tangent drawoff valve
- ☐ Pouring lip strainer
- ☐ Flanged feet
- ☐ Caster kit w/restraint cable
- ☐ Steamer pan carrier (on 30 and 40 gallon models only)
- ☐ Steamer pan inserts
- ☐ Replacement core probe (on C2T models only)

ADDITIONAL RESOURCES:

Request A Quote

Sales Tools

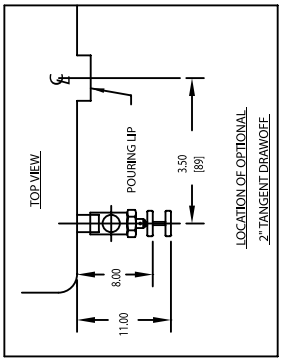
Find A Rep

Braising Pans
175750 RevH
08/23

groen

BPM-15E

ELECTRICAL RTEQUIREMENTS				
REQ'D VOLTAGE	BPM-15E PHASE	AMPS	Kw	
208	1	37	7.7	
	3	22		
240	1	32	7.7	
	3	19		
440	3	9	6.4	
480	3	10	7.6	

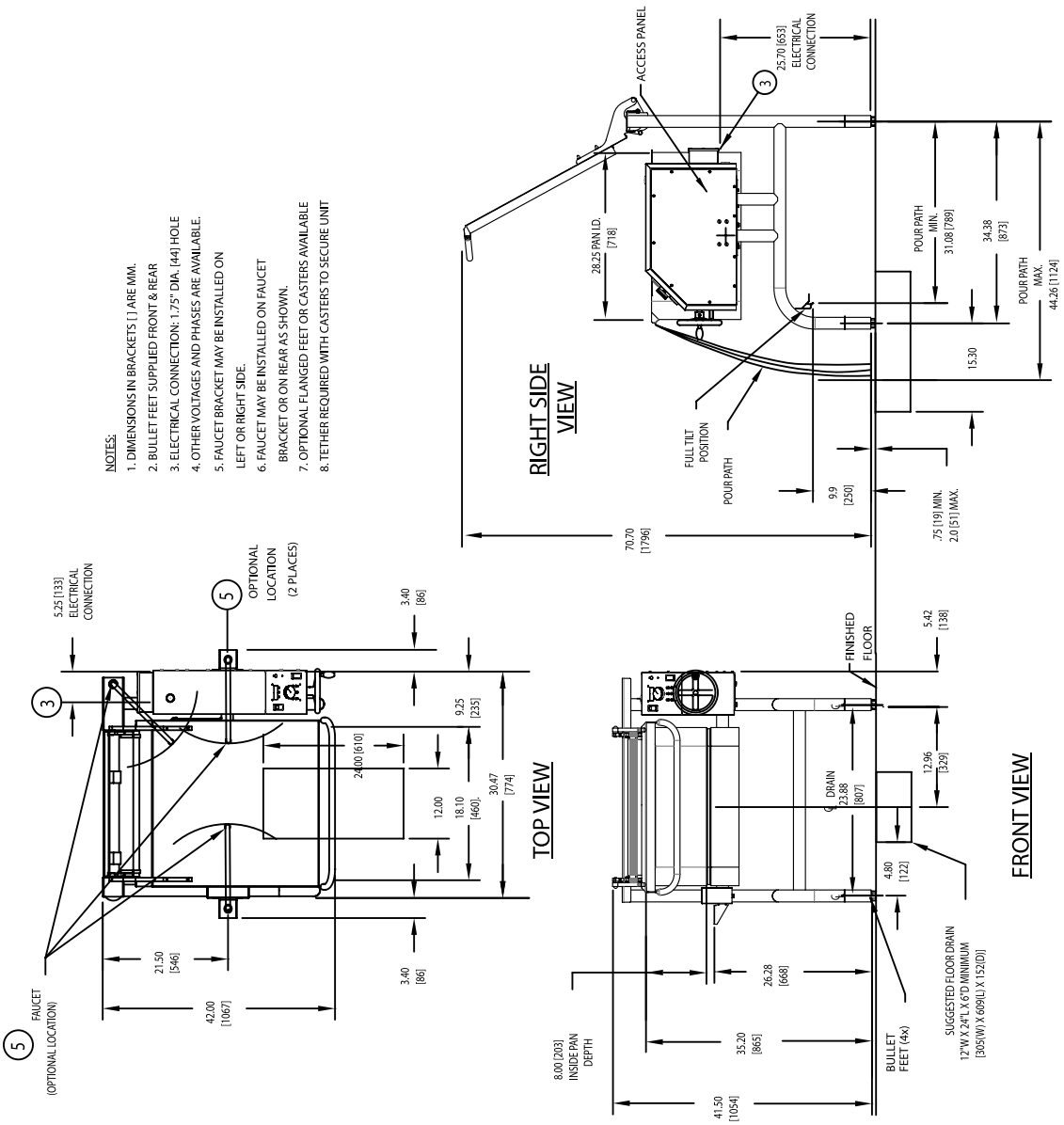



CLASSIC CONTROL


ADVANCED CONTROL


COOK2TEMP CONTROL

NOTES:
1. DIMENSIONS IN BRACKETS [ ] ARE MM.
2. BULLET FEET SUPPLIED FRONT & REAR
3. ELECTRICAL CONNECTION: 1.75" DIA. [44] HOLE
4. OTHER VOLTAGES AND PHASES ARE AVAILABLE.
5. FAUCET BRACKET MAY BE INSTALLED ON LEFT OR RIGHT SIDE.
6. FAUCET MAY BE INSTALLED ON FAUCET BRACKET OR ON REAR AS SHOWN.
7. OPTIONAL FLANGED FEET OR CASTERS AVAILABLE
8. TETHER REQUIRED WITH CASTERS TO SECURE UNIT

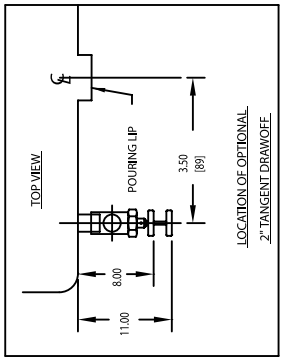


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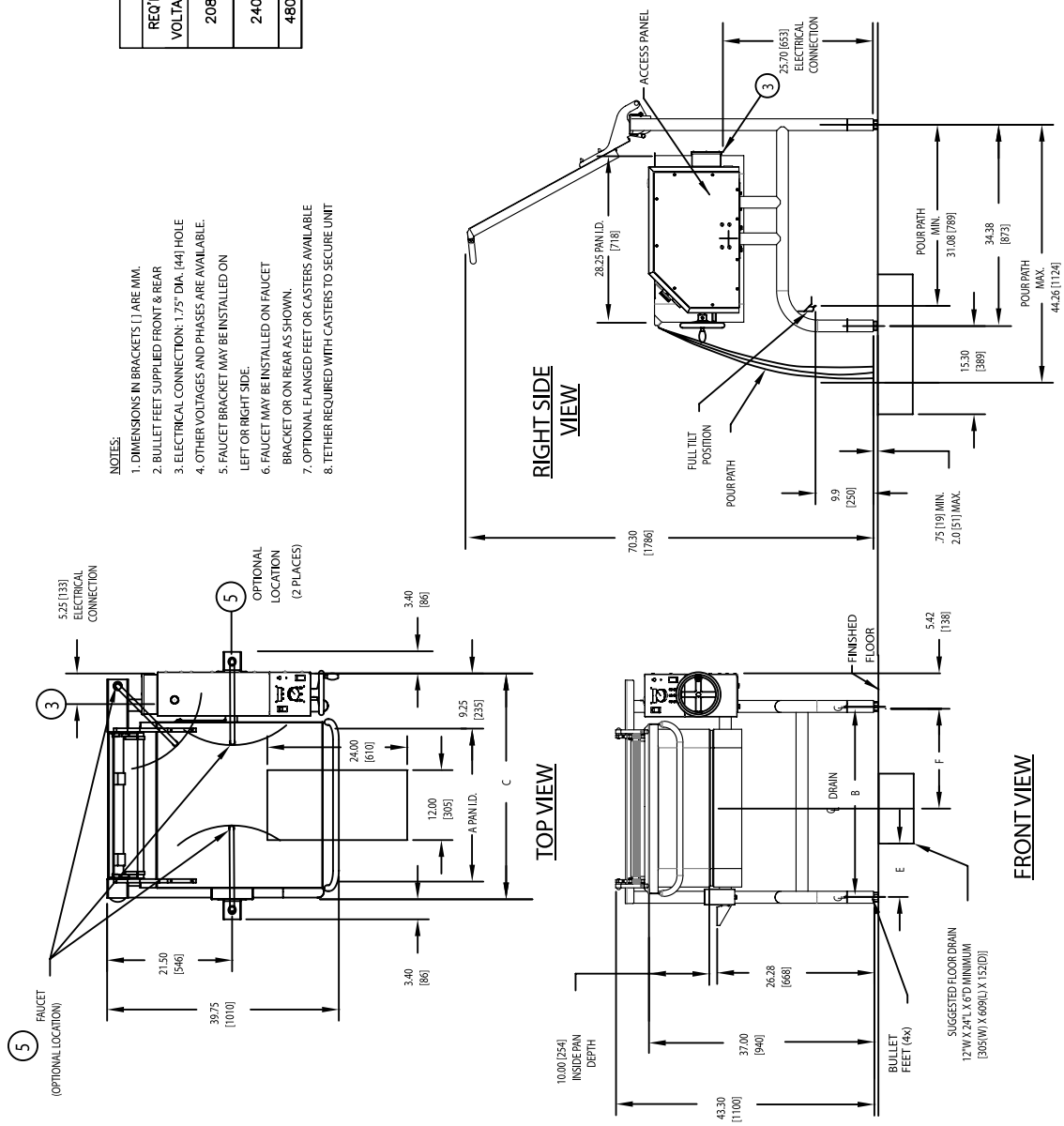
BPM-30/40E

ELECTRICAL RTEQUIREMENTS								
REQ'D VOLTAGE	BPM-30E				BPM-40E			
	PHASE	AMPS	Kw		AMPS	PHASE	Kw	
208	1	56	11.5		74	1	15.3	
	3	32			43	3		
240	1	48	11.5		64	1	15.3	
	3	28			37	3		
480	3	14	11.5		19	3	15.3	

TABLE OF DIMENSIONS				
MODEL	BPM-30E		BPM-40E	
DIMS.	INCH	MM	INCH	MM
A	26.25	667	35.75	908
B	32.00	813	41.50	1054
C	38.50	984	48.00	1226
D	8.75	222	13.50	343
E	8.90	225	13.60	346
F	17.10	435	21.90	556



NOTES:
1. DIMENSIONS IN BRACKETS [ ] ARE MM.
2. BULLET FEET SUPPLIED FRONT & REAR
3. ELECTRICAL CONNECTION: 1.75" DIA. [44] HOLE
4. OTHER VOLTAGES AND PHASES ARE AVAILABLE.
5. FAUCET BRACKET MAY BE INSTALLED ON LEFT OR RIGHT SIDE.
6. FAUCET MAY BE INSTALLED ON FAUCET BRACKET OR ON REAR AS SHOWN.
7. OPTIONAL FLANGED FEET OR CASTERS AVAILABLE
8. TETHER REQUIRED WITH CASTERS TO SECURE UNIT




CLASSIC CONTROL


ADVANCED CONTROL


COOK2TEMP CONTROL

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Information known to be correct at time of creation. Please reference our website for the most updated product information and specifications.

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Submittal Sheet

03/14/2025

ITEM# K44 - FLOOR TROUGH (1 EA REQ'D)

Advance Tabco FTG-1230

Floor Trough, 30"W x 12"D x 4" deep, 14 gauge 304 stainless steel, includes stainless steel subway grating constructed from 3/16" x 1" bars, removable stainless steel strainer basket, 4" O.D. waste pipe 3"L, pitched towards waste, NSF

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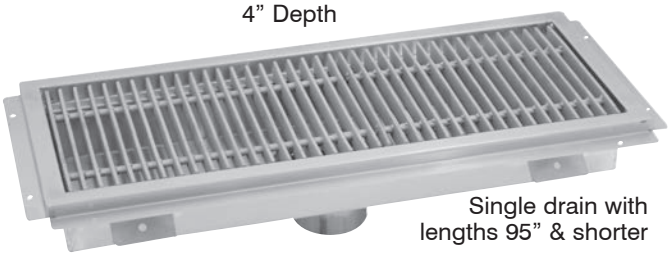
STAINLESS STEEL

FLOOR TROUGHS, DRAINS & FLOOR DRAINS

Item #: _____ Qty #: _____
Model #: _____
Project #: _____

12” Floor Troughs

4” Depth



Single drain with lengths 95” & shorter



Double drains with lengths 96” & longer

7.5” Floor Water Troughs

4” Depth





Cut-Out View of Anti-Splash

FT-1
Optional Anti-Splash Guard
(Per ft. Factory installed)

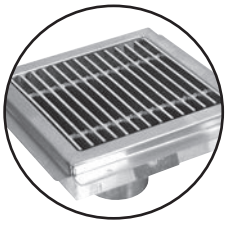


FT-2
Stainless Steel Strainer Basket
with Handle (Included with all Floor Troughs, Water Receptacles & Floor Drains)

12” Floor Drain

4” Depth





FD-1
Optional Stainless Steel Grate for Floor Drains

OPTIONAL ACCESSORIES

Model #	Description	Qty
FT-1	Anti-Splash Guard (Per Ft.)	
FT-2	FT-2 Replacement Strainer Basket	
FT-3	FT-3 Modify Trough Depth (2 ”- 6” Deep. Per Ft.)	
FT-4	FT-4 Modify Drain Hole Outlet Size (Allow 2” to 8” Dia.)	
FT-1	FT-5 Grate Upgrade to A.D.A. Compliant (7/16 Gap. Per Ft.)	
FD-1	FD-1 Floor Drain Stainless Steel Grate	

FEATURES:

Waste receptacle will accommodate up to a 4” waste pipe.
Includes 4” O.D. - 3” Long Plumbing Sleeve.
Removable perforated stainless steel strainer basket with handle provided.
Pitched towards waste.
Gratings Available:
FTG Series: Stainless Steel “Subway Style” grating from 3/16” x 1” solid “304” stainless steel bar. (Not included with Floor Drains. Use Model FD-1). Grating is spaced 9/16” (Inside clearance) between bars.
FFTG Series: Fiberglass “Subway Style” Grating from 5/8” x 1” Non-Slip Medium Grit Polyester Resin (SPF). Grating is spaced 7/8” (Inside clearance) between bars.
Troughs 96” or larger in length made with two (2) drains.
Custom sizes available. Consult factory.

CONSTRUCTION:

All TIG welded.
All external corners welded and polished to a satin finish.

MECHANICAL:

Creased design to ensure proper drainage.
Perimeter flange mounts directly to sub floor.
3/4” vertical step designed to accommodate floor tile installation.

MATERIAL:

14 gauge “304” type stainless steel polished stainless steel grating.
Fiberglass grating: Gray fiberglass composite. Light weight, skid and corrosion resistant.

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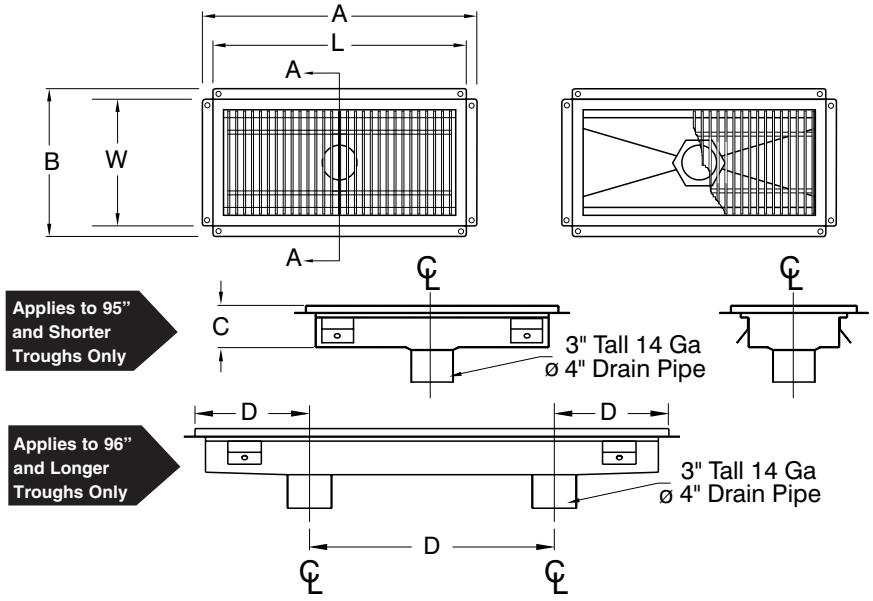
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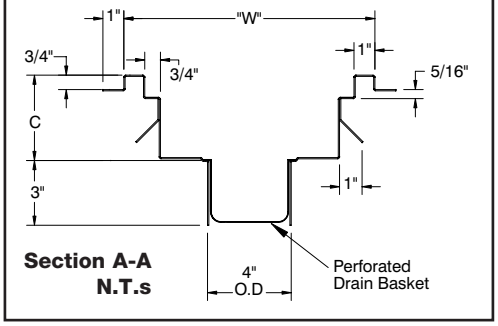
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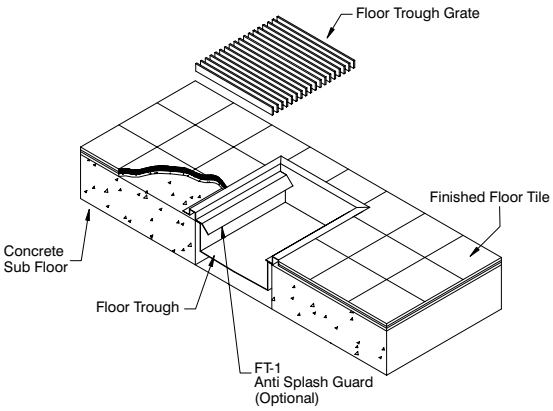
DIMENSIONS and SPECIFICATIONS

ALL DIMENSIONS ARE TYPICAL TOL ± .500”



PLUMBING ROUGH-IN





12”, 18” & 24” WIDE FLOOR TROUGHS

Stainless Steel Grating	Wt.	Fiberglass Grating	Wt.	L	W	A	B	C	D
FTG-1224	46 lbs.	FFTG-1224	34 lbs.	24”	12”	26”	14”	4”	-
FTG-1230	56 lbs.	FFTG-1230	37 lbs.	30”	12”	32”	14”	4”	-
FTG-1236	66 lbs.	FFTG-1236	40 lbs.	36”	12”	38”	14”	4”	-
FTG-1242	76 lbs.	FFTG-1242	43 lbs.	42”	12”	44”	14”	4”	-
FTG-1248	86 lbs.	FFTG-1248	46 lbs.	48”	12”	50”	14”	4”	-
FTG-1254	96 lbs.	FFTG-1254	49 lbs.	54”	12”	56”	14”	4”	-
FTG-1260	106 lbs.	FFTG-1260	52 lbs.	60”	12”	62”	14”	4”	-
FTG-1272	116 lbs.	FFTG-1272	55 lbs.	72”	12”	74”	14”	4”	-
FTG-1284	126 lbs.	FFTG-1284	81 lbs.	84”	12”	86”	14”	4”	-
FTG-1296*	146 lbs.	FFTG-1296	90 lbs.	96”	12”	98”	14”	4”	32”
FTG-12108*	166 lbs.	FFTG-12108	99 lbs.	108”	12”	110”	14”	4”	36”
FTG-12120*	180 lbs.	FFTG-12120	108 lbs.	120”	12”	122”	14”	4”	40”
FTG-1824	62 lbs.	FFTG-1824	43 lbs.	24”	18”	26”	20”	4”	-
FTG-1830	74 lbs.	FFTG-1830	47 lbs.	30”	18”	32”	20”	4”	-
FTG-1836	86 lbs.	FFTG-1836	54 lbs.	36”	18”	38”	20”	4”	-
FTG-1842	98 lbs.	FFTG-1842	61 lbs.	42”	18”	44”	20”	4”	-
FTG-1848	110 lbs.	FFTG-1848	69 lbs.	48”	18”	50”	20”	4”	-
FTG-1854	122 lbs.	FFTG-1854	76 lbs.	54”	18”	56”	20”	4”	-
FTG-1860	134 lbs.	FFTG-1860	83 lbs.	60”	18”	62”	20”	4”	-
FTG-1872	146 lbs.	FFTG-1872	90 lbs.	72”	18”	74”	20”	4”	-
FTG-1884	165 lbs.	FFTG-1884	111 lbs.	84”	18”	86”	20”	4”	-
FTG-1896*	187 lbs.	FFTG-1896	125 lbs.	96”	18”	98”	20”	4”	32”
FTG-18108*	208 lbs.	FFTG-18108	138 lbs.	108”	18”	110”	20”	4”	36”
FTG-18120*	229 lbs.	FFTG-18120	150 lbs.	120”	18”	122”	20”	4”	40”
FTG-2424	69 lbs.	FFTG-2424	52 lbs.	24”	24”	26”	26”	4”	-
FTG-2430	81 lbs.	FFTG-2430	59 lbs.	30”	24”	32”	26”	4”	-
FTG-2436	104 lbs.	FFTG-2436	68 lbs.	36”	24”	38”	26”	4”	-
FTG-2442	118 lbs.	FFTG-2442	75 lbs.	42”	24”	44”	26”	4”	-
FTG-2448	131 lbs.	FFTG-2448	83 lbs.	48”	24”	50”	26”	4”	-
FTG-2454	145 lbs.	FFTG-2454	95 lbs.	54”	24”	56”	26”	4”	-
FTG-2460	162 lbs.	FFTG-2460	102 lbs.	60”	24”	62”	26”	4”	-
FTG-2472	195 lbs.	FFTG-2472	119 lbs.	72”	24”	74”	26”	4”	-
FTG-2484	218 lbs.	FFTG-2484	137 lbs.	84”	24”	86”	26”	4”	-
FTG-2496*	243 lbs.	FFTG-2496	153 lbs.	96”	24”	98”	26”	4”	32”
FTG-24108*	274 lbs.	FFTG-24108	168 lbs.	108”	24”	110”	26”	4”	36”
FTG-24120*	310 lbs.	FFTG-24120	188 lbs.	120”	24”	122”	26”	4”	40”

***Troughs 96” or larger in length made with two (2) drains.**

7.5” WIDE FLOOR TROUGHS (4” Depth)

Model #	Length	Width	A	B	C	Wt.
FTG-724	24”	7.5”	26”	9.5”	4”	44 lbs.
FTG-730	30”	7.5”	32”	9.5”	4”	45 lbs.
FTG-736	36”	7.5”	38”	9.5”	4”	63 lbs.
FTG-748	48”	7.5”	50”	9.5”	4”	82 lbs.
FTG-760	60”	7.5”	62”	9.5”	4”	101 lbs.
FTG-772	72”	7.5”	74”	9.5”	4”	110 lbs.
FTG-784	84”	7.5”	86”	9.5”	4”	119 lbs.
FTG-796	96”	7.5”	98”	9.5”	4”	138 lbs.
FTG-7108	108”	7.5”	110”	9.5”	4”	157 lbs.
FTG-7120	120	7.5”	122”	9.5”	4”	170 lbs.

12” WIDE FLOOR WATER RECEPTACLES (2” Depth)

Model #	Length	Width	A	B	C	Wt.
FRG-24	24”	12”	26”	14”	2”	44 lbs.
FRG-736	36”	12”	38”	14”	2”	63 lbs.
FRG-748	48”	12”	50”	14”	2”	82 lbs.

12” WIDE FLOOR DRAIN (4” Depth)

Model #	Length	Width	A	B	C	Wt.
FDR-1212	12”	12”	14”	14”	4”	26 lbs.

CUSTOM SIZES AVAILABLE!

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.
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A Place for EverythingFood Service Design & Consulting

Submittal Sheet

03/14/2025

ITEM# K45 - CONVECTION OVEN, GAS (1 EA REQ'D)

Vulcan VC44GD

Convection Oven, gas, double-deck, standard depth, solid state controls, electronic spark igniters, 60 minute timer, (5) nickel plated racks per oven, stainless steel front, top, sides & 8"H legs, stainless steel doors with windows, (2) 50,000 BTU, NSF, CSA Star, CSA Flame, ENERGY STAR®

ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		Gas type to be specified
Vulcan	1		(2) 120v/60/1-ph, 15.4 amps total, (2) cords with plugs
Vulcan	1		Gas manifold piping included and stacking kit
Vulcan	1		Casters, set of (4)

Project _____

AIA # _____ SIS # _____

Item # _____ Quantity _____ C.S.I. Section 114000

VC44G SERIES

Double Deck Gas Convection Ovens



SELL SHEET

Model VC44GD
Shown on optional casters

MODELS

- ❑ **VC44GD** Solid state temperature controls adjust from 150° to 500°F. 60 minute timer with audible alarm.
- ❑ **VC44GC** Computer controls with digital time and temperature readouts. 99-hour timer with audible alarm. Roast and Hold cycle. One hundred programmable menu selections. Shelf I.D. programming.

Double deck ovens are supplied as separate units with a stacking kit.

STANDARD FEATURES

- Stainless steel front, sides, top and legs
- Independently operated stainless steel doors with double pane windows
- 50,000 BTU/hr. burner per section, 100,000 BTU/hr. total
- Electronic spark igniters
- ½ H.P. two speed oven blower-motor. 120/60/1 with 6' cord and plug; 7.7 amps per section; 15.4 amps total draw
- Oven cool switch for rapid cool down
- Porcelain enamel on steel oven interior
- Five nickel plated grab-and-go oven racks with eleven rack positions per section (10 total racks)
- ¾" rear gas connection with combination gas pressure regulator and safety solenoid system
- One year limited parts and labor warranty

SPECIFIER STATEMENT

Double section gas convection oven, Vulcan Model No. (VC44GD) (VC44GC). Stainless steel front, sides, top and legs. Independently operated stainless steel doors with double pane windows. Non-sag insulation applied to the top, rear, sides, bottom and doors. Porcelain enamel on steel oven interiors measures 29"w x 22⅛"d x 20"h. Two interior oven lights per section. Five nickel plated oven racks per section measure 28¼" x 20½". Eleven position nickel plated rack guides with positive rack stops. One 50,000 BTU/hr. burner per section. 100,000 total BTU/hr. Electronic spark igniters. Furnished with a two speed ½ H.P. oven blower-motor per section. Oven cool switch for rapid cool down. 120 volt, 60 Hz, 1 ph power supply required. 6' cord and plug. 7.7 amps total draw per section.

Exterior Dimensions:
40¼" W x 40" D (includes motor & door handles)
40¼" W x 37¾" D (includes motor only)
70" H on 8" legs

CSA design certified. NSF listed.

Specify type of gas when ordering.
Specify altitude when above 2,000 FT.

OPTIONS

- ❑ Kosher friendly control package
- ❑ Complete prison package
  - ❑ Security screws only
- ❑ 208V or 240V, 60 Hz, 1 ph, two speed, ½ H.P. blower motor; 208V, 4.2 amps; 240V, 3.6 amps
- ❑ Casters
- ❑ Simultaneous chain driven doors
- ❑ Control panel mounted on left side of oven
- ❑ Stainless steel rear enclosure
- ❑ Second year extended limited parts and labor warranty

ACCESSORIES (PACKAGED AND SOLD SEPARATELY)

- ❑ Extra oven rack(s)
- ❑ Rack hanger(s)
- ❑ Stainless steel drip pan
- ❑ Flexible gas hose with quick disconnect and restraining device; consult price book for available sizes
- ❑ Down draft flue diverter for direct vent connection

Approved by_____ Date_____ Approved by_____ Date_____

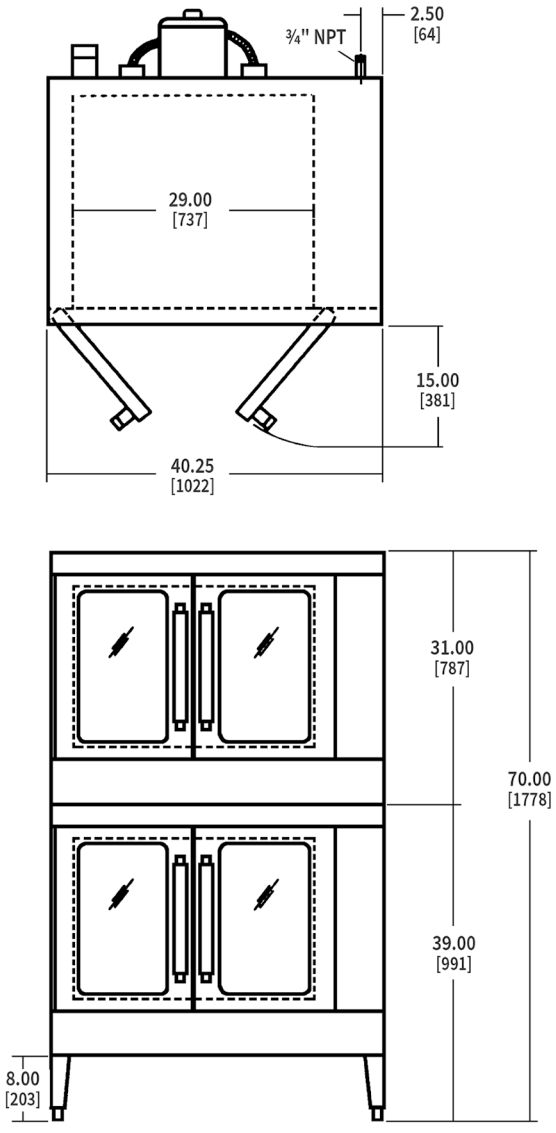
VC44G SERIES
Double Deck Gas Convection Ovens

INSTALLATION INSTRUCTIONS

1. A combination gas pressure regulator and safety solenoid valve system is included in this unit. Natural gas is 5.0" W.C., Propane gas is 10.0" W.C.
2. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by visiting the National Fire Protection Association website at https://www.nfpa.org/. Refer to NFPA No. 96.
3. These units are manufactured for installation in accordance with ANSZ223.1A (latest edition), National Fuel Gas Code. Information may be obtained from The American Gas Association website at https://www.aga.org/.
4. Clearances:

	Combustible	Non-combustible
Rear	0"	0"
Right Side	2"	0"
Left Side	1"	0"

5. This appliance is manufactured for commercial installation only and is not intended for home use.
6. The installation location should not experience temperatures below -20°C (-4°F).

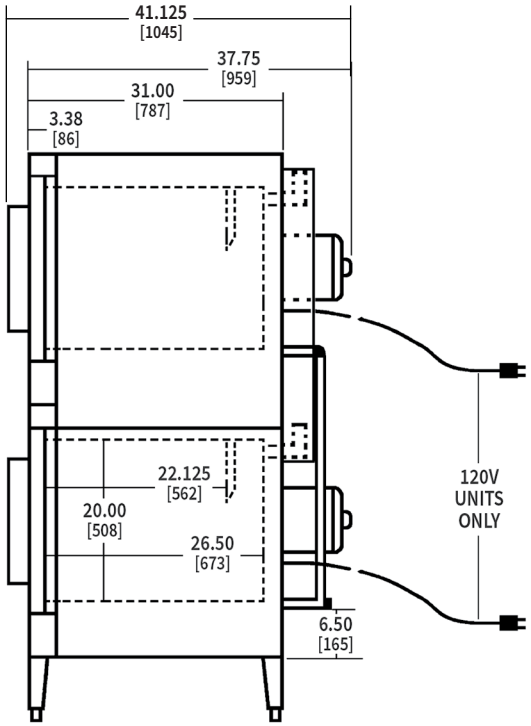


CAD and/or Revit Files Available

INSTALLATION MANUAL

40¼" W x 41⅛" D (includes motor & door handles)
40¼" W x 37¾" D (includes motor only)
70" H on 8" legs

Oven interior: 29" W x 22⅛" D x 20" H



Model	Width	Depth w/handles	Height	Per Oven BTU/hr.	Total BTU/hr.	Electrical	Weight
VC44G	40¼"	41⅛"	70"	50,000	100,000	120/60/1	820 lbs (372 KG) without skids/packaging 928 lbs (422 KG) with skids/packaging

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K45.1 - BLUE HOSE GAS CONNECTOR KIT (1 KT REQ'D)

Dormont 1675KITS48

Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) Swivel MAX®, (1) full port valve, (1) elbow, coiled restraining cable with hardware, 167,000 BTU/hr minimum flow capacity, limited lifetime warranty

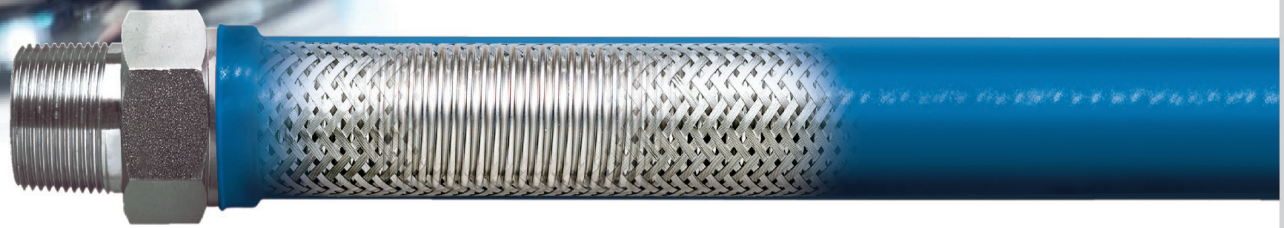
Item #K45.1
1675KITS48
Dormont
Page: 122
Oceancrest SN West Melbourne



Foodservice Moveable Equipment Installation Products

The Dormont Blue Hose™ is the heart of the Safety System, specifically engineered for caster-mounted commercial cooking equipment. The Blue Hose includes an antimicrobial protective PVC coating, and our Stress Guard® technology that makes the hose easier to install and dramatically reduces stress on the hose ends.

The fuel gas codes require the use of an ANSI Z21.69/CSA 6.16 moveable gas connector with all appliances that may or may not utilize casters and, under normal use, are moved on a regular basis for service, positioning or area cleanliness.



STRESS GUARD TECHNOLOGY
Rotation technology reduces stress on both ends of the hose

Stainless Steel Construction
Heavy-duty, flexible, corrugated 304 stainless steel tubing

Stainless Steel Braid
Tight-weave braid prevents corrugations from stretching as equipment is moved

Antimicrobial PVC Coating
Inhibits growth of bacteria, mold and mildew on the gas connector





A Watts Water Technologies Company USA: 6015 Enterprise Drive, Export, PA 15632 • 1-800-DORMONT • Dormont.com

The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. It is a complete system of connection products designed with the safety of your kitchen, the food you serve, your employees, and your business in mind.

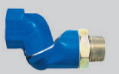
The Safety System includes the famous Dormont Blue Hose and our exclusive safety-based fittings - the SnapFast quick-disconnect, the Safety Quik quick-disconnect valve, and the Swivel MAX. Safe, unique, and affordable, the Dormont Safety System provides peace of mind for the gas connections in your commercial kitchen.



Safety Quik
- Prevents user from turning on gas while appliance is disconnected
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SnapFast
- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SwivelMAX
- Reduces stress on connector
- Increases kitchen aisle space by allowing connector to be positioned closer to the wall



Restraining Cable
- Prevents transmission of strain to connector
- Provided 1' shorter than the gas connector



Safety-Set
Always on the mark
- Ensures cooking equipment is always positioned in design-specified location
- Fast installation with choice of adhesive foam tape or thumbscrews

S-BUYGUIDE-Front.indd 1
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Dormont® Moveable Commercial Equipment Kits

KIT SOLUTIONS	50 = ½" ID 75 = ¾" ID 100 = 1" ID 125 = 1-¼" ID PART NUMBER	BTU/hr Minimum Flow Capacity*	THE BLUE HOSE™	SnapFast® QUICK-DISCONNECT	Swivel MAX® 1st SWIVEL	Swivel MAX® 2nd SWIVEL	Safety Quik® VALVE	RESTRAINING CABLE
Standard Kit (KIT)[1] The Dormont Blue Hose™ SnapFast Quick-Disconnect Restraining Cable	1650KIT36	77K	√	√				√
	1650KIT48	68K	√	√				√
	1650KIT60	60K	√	√				√
	1675KIT36	218K	√	√				√
	1675KIT48	180K	√	√				√
	1675KIT60	158K	√	√				√
	16100KIT36	379K	√	√				√
	16100KIT48	334K	√	√				√
	16100KIT60	294K	√	√				√
Single Swivel MAX Kit (KITS)[2] The Dormont Blue Hose™ SnapFast Quick-Disconnect One Swivel MAX Swivel Restraining Cable	1650KITS36	72K	√	√	√			√
	1650KITS48	63K	√	√	√			√
	1650KITS60	56K	√	√	√			√
	1675KITS36	203K	√	√	√			√
	1675KITS48	167K	√	√	√			√
	1675KITS60	147K	√	√	√			√
	16100KITS36	353K	√	√	√			√
	16100KITS48	310K	√	√	√			√
	16100KITS60	274K	√	√	√			√
Double Swivel MAX Kit (KIT2S)[3] The Dormont Blue Hose™ SnapFast Quick-Disconnect Two Swivel MAX Swivels Restraining Cable	1650KIT2S36	69K	√	√	√	√		√
	1650KIT2S48	60K	√	√	√	√		√
	1650KIT2S60	54K	√	√	√	√		√
	1675KIT2S36	193K	√	√	√	√		√
	1675KIT2S48	160K	√	√	√	√		√
	1675KIT2S60	140K	√	√	√	√		√
	16100KIT2S36	336K	√	√	√	√		√
	16100KIT2S48	295K	√	√	√	√		√
	16100KIT2S60	261K	√	√	√	√		√
Safety Quik Kit (KITCF)[4] The Dormont Blue Hose™ Safety Quik Quick-Disconnect Restraining Cable	1650KITCF36	77K	√				√	√
	1650KITCF48	68K	√				√	√
	1650KITCF60	60K	√				√	√
	1675KITCF36	218K	√				√	√
	1675KITCF48	180K	√				√	√
	1675KITCF60	158K	√				√	√
	16100KITCF36	379K	√				√	√
	16100KITCF48	334K	√				√	√
	16100KITCF60	294K	√				√	√
Safety Quik Single Swivel MAX Kit (KitCFS)[5]	1650KITCFS36	72K	√		√		√	√
	1650KITCFS48	63K	√		√		√	√
	1650KITCFS60	56K	√		√		√	√
	1675KITCFS36	203K	√		√		√	√
	1675KITCFS48	161K	√		√		√	√
	1675KITCFS60	147K	√		√		√	√
	16100KITCFS36	353K	√		√		√	√
	16100KITCFS48	310K	√		√		√	√
	16100KITCFS60	274K	√		√		√	√

[1] Includes Full Port Gas Valve and (2) 90° Street Elbows
[2] Includes Full Port Gas Valve and (1) 90° Street Elbow
[3] Includes Full Port Gas Valve
[4] Includes (2) 90° Street Elbows
[5] Includes (1) 90° Street Elbow

Indicates most commonly stocked item

*BTU/hr Minimum Flow Capacity (0.64 Sp.Gr., 1000 BTU/ft^3 Natural Gas at 0.5" wc pressure drop)

ADDITIONAL CONFIGURATIONS ARE AVAILABLE IN OUR CATALOG.

Add PS to the end of any part number to include the Safety-Set® wheel placement system

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

S-D-BUYGUIDE 1538

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MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K46, K47 - RANGE, 36", 6 OPEN BURNERS (1 EA REQ'D)

Vulcan 36S-6BN-QS-PLATINUM

(Quick Ship) Endurance™ Restaurant Range, natural gas, 36", (6) 30,000 BTU burners, lift-off burner heads, standard oven, stainless steel front, sides, backriser, & lift-off high shelf, fully MIG welded chassis, 6" adjustable legs, 215,000 BTU, CSA, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		Gas type to be specified
Vulcan	1	36RB-N	Salamander Broiler, natural gas, 36" wide, 50,000 BTU heavy duty burner, dual control, (6) grid positions, removable pan, stainless steel front, top & sides, 3/4" gas connection & pressure regulator
Vulcan	1	CONNECT-CHALL	Inter-plumbing gas connection kit (requires rear gas connection on range), for connecting 36RB/36IRB to Endurance or Challenger Series ranges
Vulcan	1	RSHELF-XL36	Reinforced highshelf, for 36" medium duty ranges (shipped in separate carton)

VULCAN

Project _____

AIA # _____ SIS # _____

Item # _____ Quantity _____ C.S.I. Section 114000

ENDURANCE™ GAS RESTAURANT RANGE

6 Open Burners / 36" Wide Gas Range



SELL SHEET

Model 36C-6BN
Shown on optional casters

SPECIFIER STATEMENT

36" wide gas restaurant range, Vulcan Model No. 36S-6BN. Fully MIG welded aluminized steel frame for added durability. Stainless steel front, sides, backriser, highshelf and 6" adjustable legs. Extra deep crumb tray with welded corners. Six 30,000 BTU/hr. open top burners with lift-off burner heads. Energy saving flashtube open burner ignition system (one pilot for every two burners) shrouded for reliability. Heavy duty cast grates, easy lift-off 12" x 12½" in the front and 12" x 14½" in the back to better accommodate stock pots or large pans. Grates have a built in aeration bowl for greater efficiency. Burner knobs are cool to the touch, high temperature material. One oven: 35,000 BTU/hr. standard bakers depth oven with porcelain oven bottom and door panel, measures 27"d x 26⅜"w x 14"h. Oven thermostat adjusts from 250°F to 500°F with a low setting. Oven is supplied with two racks, two rack guide sets, and four rack positions. Oven door is heavy duty with an integrated door hinge/spring mechanism requiring no adjustment. ¾" rear gas connection and pressure regulator. Total input 215,000 BTU/hr.

Exterior Dimensions:
34"d x 36"w x 58"h on 6" adjustable legs

MODELS

- ❑ **36S-6BN** 1 Standard Oven / Natural Gas
- ❑ **36S-6BP** 1 Standard Oven / Propane
- ❑ **36C-6BN** 1 Convection Oven / Natural Gas
- ❑ **36C-6BP** 1 Convection Oven / Propane

STANDARD FEATURES

- Fully MIG welded frame
- Stainless steel front, sides, backriser, lift-off high shelf
- 6" stainless steel adjustable legs
- Six open top burners, each burner is 30,000 BTU/hr. with lift-off burner heads
- Shrouded flash tube pilot system (one pilot per two burners)
- Heavy duty cast grates, easy lift-off 12" x 12½" in front and 12" x 14½" in the rear
- Extra deep pull out crumb tray with welded corners
- 35,000 BTU/hr. baker's depth standard oven cavity; full size sheet pans fit side-to-side or front-to-back
- Oven thermostat adjusts from 250°F to 500°F
- Two oven racks and four rack positions
- 35,000 BTU/hr. convection oven in place of standard oven, 24"d x 26⅜"w x 13⅞"h (115v - 1 phase blower motor 4 amp, 6' cord and plug); full size sheet pans only fit side-to-side in convection oven; convection oven motor requires field attachment
- One year limited parts and labor warranty

ACCESSORIES (PACKAGED AND SOLD SEPARATELY)

- ❑ Extra oven rack with rack guides
- ❑ Casters (set of four)
- ❑ Leveling casters (set of four)
- ❑ Flanged feet (set of four)
- ❑ 10" stainless steel stub back
- ❑ Reinforced high shelf for mounting salamander broiler

OPTIONS (FACTORY INSTALLED)

- ❑ Flame Safety device with manual spark ignition for all open top burners, thermostatic griddles and oven pilots
- ❑ Hot tops

ENDURANCE GAS RESTAURANT RANGE – 6 Open Burners / 36" Wide Gas Range

Approved by_____ Date_____ Approved by_____ Date_____

ENDURANCE™ GAS RESTAURANT RANGE

6 Open Burners / 36" Wide Gas Range

INSTALLATION INSTRUCTIONS

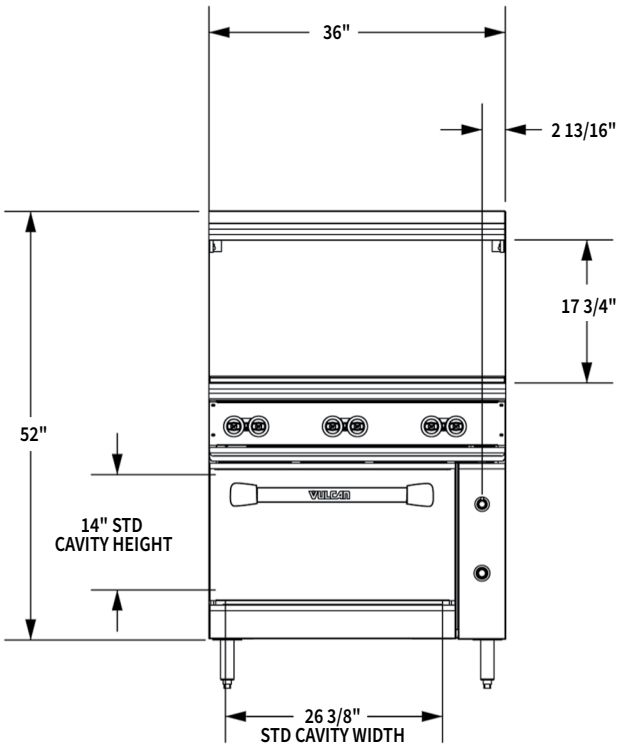
INSTALLATION MANUAL

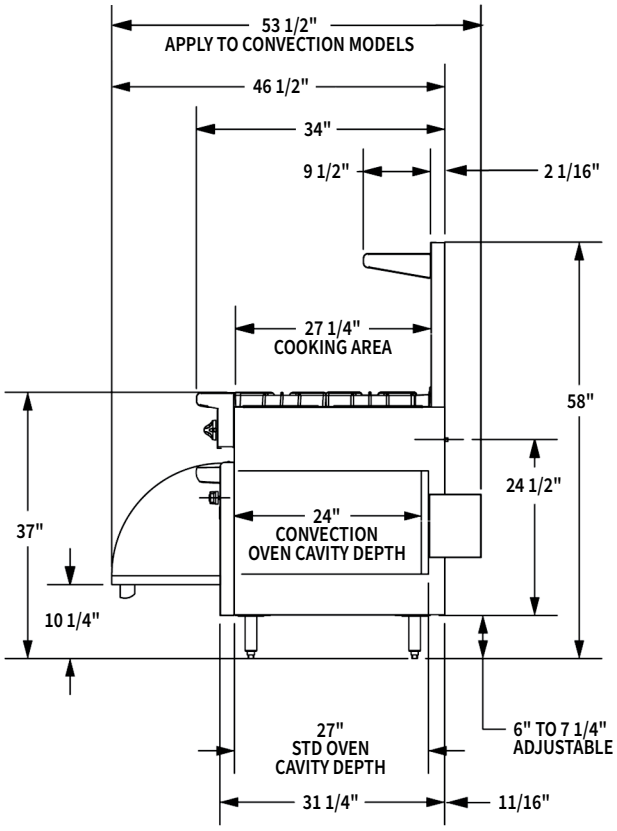
1. A pressure regulator sized for this unit is included. Natural gas 5.0" W.C., propane gas 10.0" W.C.
2. Gas line connecting to range must be ¾" or larger. If flexible connectors are used, the inside diameter must be ¾" or larger.
3. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by visiting the National Fire Protection Association website at https://www.nfpa.org/. Refer to NFPA No. 96.
4. These units are manufactured for installation in accordance with ANSZ223.1A (latest edition), National Fuel Gas Code. Information may be obtained from The American Gas Association website at https://www.aga.org/.
5. Clearances

	Rear	Sides
Combustible	6"	10"
Standard Oven Non-Combustible	0"	0"
Convection Oven Non-Combustible	Min. 4"	0"

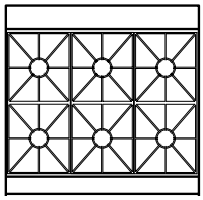
6. For proper combustion, install equipment on adjustable legs or casters provided with unit.
7. This appliance is manufactured for commercial installation only and is not intended for home use.

SPECIFY TYPE OF GAS WHEN ORDERING.
SPECIFY ALTITUDE WHEN ABOVE 2,000 FEET.





CAD and/or Revit Files Available

Top Configuration	Model	Description	Total Input BTU / Hr.	Shipping Weight Lbs. / KG
	**36S-6BN**	1 Standard Oven / 6 Burners / Natural Gas	215,000	520 / 236
	36S-6BP	1 Standard Oven / 6 Burners / Propane	215,000	520 / 236
	36C-6BN	1 Convection Oven / 6 Burners / Natural Gas	215,000	580 / 263
	36C-6BP	1 Convection Oven / 6 Burners / Propane	215,000	580 / 263

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

Item # _____ C.S.I. Section 11420

RANGES

36RB
36" HEAVY DUTY GAS SALAMANDER BROILER



Model 36RB

☐ **36RB-N** Natural Gas
☐ **36RB-P** Propane Gas

NOTE: 36RB may be used in conjunction with appropriate reinforced range back riser, wall mounted with optional brackets or counter mounted with optional 4" legs.

STANDARD FEATURES

- Stainless steel front, top and sides.
- Dual heat controls for zone cooking.
- Six 8,300 BTU cast iron burners with stainless steel radiants. 50,000 BTU/hr. total input.
- Standing pilot ignition system.
- Cool-to-the-touch knob on lever provides positive positioning of the broiler carriage (6 positions).
- Heavy-duty chrome plated grid (27½"w x 13"d).
- Removable full width spillage pan.
- ¾" top gas connection and gas pressure regulator.
- One year parts and labor warranty.

OPTIONS

☐ Set of wall mount brackets.
☐ Set of 4" legs with adjustable feet.
☐ Stainless steel reinforced back riser for range mounting.
☐ Range inter-plumb kit.
☐ Stainless steel back panel.

SPECIFICATIONS

Gas salamander broiler, Vulcan Model No. 36RB. Stainless steel front, top and sides. Six 8,300 BTU/hr. cast iron burners with stainless steel radiants; 50,000 BTU/hr. total input. Dual heat controls with improved temperature control (250°F-800°F at rack). Pilot ignition system. Cool-to-the-touch knob on lever provides positive positioning of the broiling carriage. Heavy-duty chrome plated broiling grid measures 27½"w x 13"d. Removable full width spillage pan. ¾" top gas connection and gas pressure regulator.

Exterior Dimensions:
36"w x 19"d x 17⅝"h.

CSA design certified. NSF listed.

SPECIFY TYPE OF GAS WHEN ORDERING.
SPECIFY ALTITUDE WHEN ABOVE 3,999 FT.

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

RANGES

36RB
36" HEAVY DUTY GAS SALAMANDER BROILER

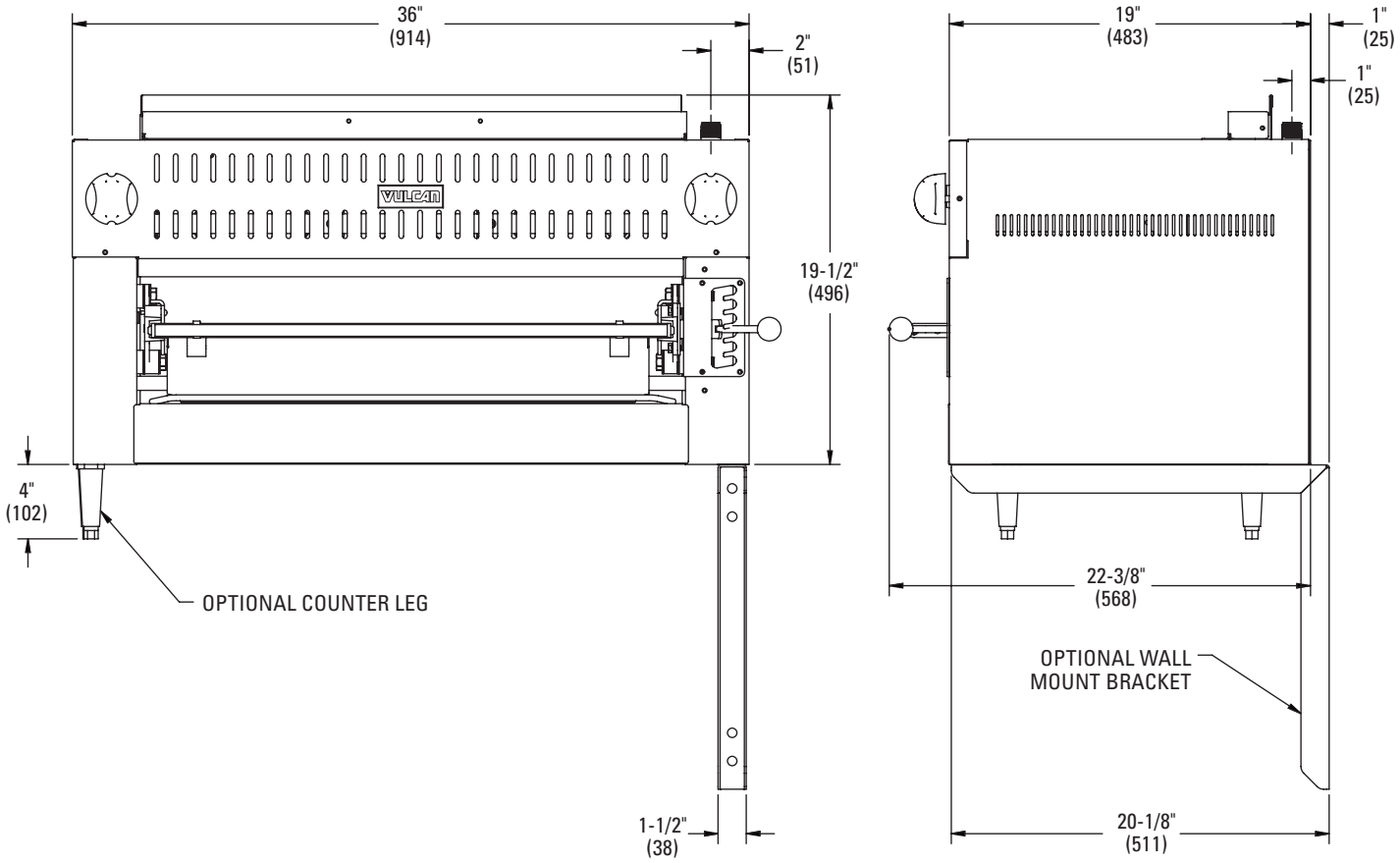
INSTALLATION REQUIREMENTS:

1. A gas pressure regulator sized for this unit is included. Natural gas 5" W.C., Propane gas 10" W.C.
2. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02169. When writing refer to NFPA No. 96.
3. These units are manufactured for installation in accordance with National Fuel Gas Code, ANSI-Z223.1/NFPA #54 (latest edition). Copies may be obtained from The American Gas Association, Accredited Standards Committee Z223 @ 400N. Capital St. NW, Washington, DC 20001, or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

   NOTE: In the Commonwealth of Massachusetts
   All gas appliances vented through a ventilation hood or exhaust system equipped with a damper or with a power means of exhaust shall comply with 248 CMR.
4. Clearances:

	Combustible	Non-Combustible
Rear	0"	0"
Sides	6"	0"
Bottom	10"	4"

5. This appliance is manufactured for commercial installation only and is not intended for home use.



GAS CONNECTION: ¾" (19 mm)

MODEL	INPUT BTU/hr.	WIDTH	DEPTH	HEIGHT	APPROX. SHIP. WT.
36RB	50,000	36" (914 mm)	19" (483 mm)	See Drawing	180 lbs./82 kg

Mounting of salamander requires purchase of correct reinforced riser or reinforced shelf

VULCAN
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P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K46.1 - BLUE HOSE GAS CONNECTOR KIT (1 KT REQ'D)

Dormont 16100KITS48

Dormont Blue Hose™ Moveable Gas Connector Kit, 1" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) Snap Fast™ QD, (1) Swivel MAX®, (1) full port valve, (1) elbow, coiled restraining cable with hardware, 310,000 BTU/hr minimum flow capacity, limited lifetime warranty

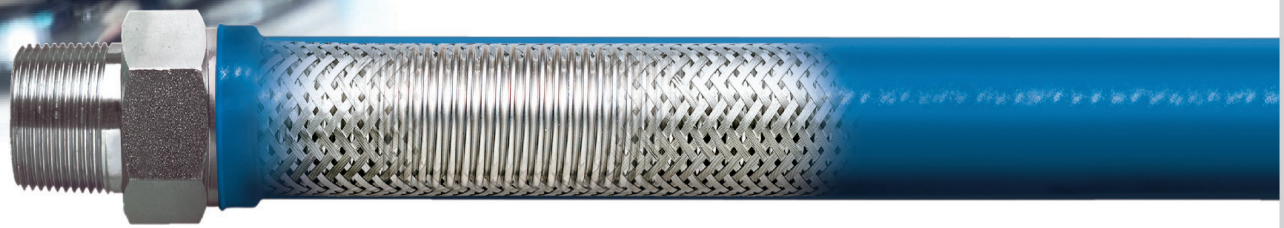
Item #K46.1
16100KITS48
Dormont
Page: 130
Oceancrest SN West Melbourne



Foodservice Moveable Equipment Installation Products

The Dormont Blue Hose™ is the heart of the Safety System, specifically engineered for caster-mounted commercial cooking equipment. The Blue Hose includes an antimicrobial protective PVC coating, and our Stress Guard® technology that makes the hose easier to install and dramatically reduces stress on the hose ends.

The fuel gas codes require the use of an ANSI Z21.69/CSA 6.16 moveable gas connector with all appliances that may or may not utilize casters and, under normal use, are moved on a regular basis for service, positioning or area cleanliness.



STRESS GUARD TECHNOLOGY
Rotation technology reduces stress on both ends of the hose

Stainless Steel Construction
Heavy-duty, flexible, corrugated 304 stainless steel tubing

Stainless Steel Braid
Tight-weave braid prevents corrugations from stretching as equipment is moved

Antimicrobial PVC Coating
Inhibits growth of bacteria, mold and mildew on the gas connector





A Watts Water Technologies Company USA: 6015 Enterprise Drive, Export, PA 15632 • 1-800-DORMONT • Dormont.com

The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. It is a complete system of connection products designed with the safety of your kitchen, the food you serve, your employees, and your business in mind.

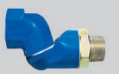
The Safety System includes the famous Dormont Blue Hose and our exclusive safety-based fittings - the SnapFast quick-disconnect, the Safety Quik quick-disconnect valve, and the Swivel MAX. Safe, unique, and affordable, the Dormont Safety System provides peace of mind for the gas connections in your commercial kitchen.



Safety Quik
- Prevents user from turning on gas while appliance is disconnected
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SnapFast
- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SwivelMAX
- Reduces stress on connector
- Increases kitchen aisle space by allowing connector to be positioned closer to the wall



Restraining Cable
- Prevents transmission of strain to connector
- Provided 1' shorter than the gas connector



Safety-Set
- Ensures cooking equipment is always positioned in design-specified location
- Fast installation with choice of adhesive foam tape or thumbscrews

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Dormont® Moveable Commercial Equipment Kits

KIT SOLUTIONS	50 = ½" ID 75 = ¾" ID 100 = 1" ID 125 = 1-¼" ID PART NUMBER	BTU/hr Minimum Flow Capacity*	THE BLUE HOSE™	SnapFast® QUICK-DISCONNECT	Swivel MAX® 1st SWIVEL	Swivel MAX® 2nd SWIVEL	Safety Quik® VALVE	RESTRAINING CABLE
Standard Kit (KIT)[1] The Dormont Blue Hose™ SnapFast Quick-Disconnect Restraining Cable	1650KIT36	77K	√	√				√
	1650KIT48	68K	√	√				√
	1650KIT60	60K	√	√				√
	1675KIT36	218K	√	√				√
	1675KIT48	180K	√	√				√
	1675KIT60	158K	√	√				√
	16100KIT36	379K	√	√				√
	16100KIT48	334K	√	√				√
	16100KIT60	294K	√	√				√
Single Swivel MAX Kit (KITS)[2] The Dormont Blue Hose™ SnapFast Quick-Disconnect One Swivel MAX Swivel Restraining Cable	1650KITS36	72K	√	√	√			√
	1650KITS48	63K	√	√	√			√
	1650KITS60	56K	√	√	√			√
	1675KITS36	203K	√	√	√			√
	1675KITS48	167K	√	√	√			√
	1675KITS60	147K	√	√	√			√
	16100KITS36	353K	√	√	√			√
	16100KITS48	310K	√	√	√			√
	16100KITS60	274K	√	√	√			√
Double Swivel MAX Kit (KIT2S)[3] The Dormont Blue Hose™ SnapFast Quick-Disconnect Two Swivel MAX Swivels Restraining Cable	1650KIT2S36	69K	√	√	√	√		√
	1650KIT2S48	60K	√	√	√	√		√
	1650KIT2S60	54K	√	√	√	√		√
	1675KIT2S36	193K	√	√	√	√		√
	1675KIT2S48	160K	√	√	√	√		√
	1675KIT2S60	140K	√	√	√	√		√
	16100KIT2S36	336K	√	√	√	√		√
	16100KIT2S48	295K	√	√	√	√		√
	16100KIT2S60	261K	√	√	√	√		√
Safety Quik Kit (KITCF)[4] The Dormont Blue Hose™ Safety Quik Quick-Disconnect Restraining Cable	1650KITCF36	77K	√				√	√
	1650KITCF48	68K	√				√	√
	1650KITCF60	60K	√				√	√
	1675KITCF36	218K	√				√	√
	1675KITCF48	180K	√				√	√
	1675KITCF60	158K	√				√	√
	16100KITCF36	379K	√				√	√
	16100KITCF48	334K	√				√	√
	16100KITCF60	294K	√				√	√
Safety Quik Single Swivel MAX Kit (KitCFS)[5]	1650KITCFS36	72K	√		√		√	√
	1650KITCFS48	63K	√		√		√	√
	1650KITCFS60	56K	√		√		√	√
	1675KITCFS36	203K	√		√		√	√
	1675KITCFS48	161K	√		√		√	√
	1675KITCFS60	147K	√		√		√	√
	16100KITCFS36	353K	√		√		√	√
	16100KITCFS48	310K	√		√		√	√
	16100KITCFS60	274K	√		√		√	√

[1] Includes Full Port Gas Valve and (2) 90° Street Elbows
[2] Includes Full Port Gas Valve and (1) 90° Street Elbow
[3] Includes Full Port Gas Valve
[4] Includes (2) 90° Street Elbows
[5] Includes (1) 90° Street Elbow

Indicates most commonly stocked item

*BTU/hr Minimum Flow Capacity (0.64 Sp.Gr., 1000 BTU/ft^3 Natural Gas at 0.5" wc pressure drop)

ADDITIONAL CONFIGURATIONS ARE AVAILABLE IN OUR CATALOG.

Add PS to the end of any part number to include the Safety-Set® wheel placement system

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

S-D-BUYGUIDE 1538

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MISE EN PLACE DESIGN
A Place for EverythingFood Service Design & Consulting

Submittal Sheet

03/14/2025

ITEM# K48 - CONVECTION STEAMER, COUNTERTOP (1 EA REQ'D)

Vulcan C24EA3-PLUS-QS-PLATINUM

Convection Steamer, countertop, electric, 1 compartment, 24" wide, (3) 12" x 20" x 2-1/2" pans capacity, high output stainless steel steam generator with Timed Smart Drain & PowerFlush, staged water fill, professional controls with 60-minute timer, buzzer & constant steam feature, cook/ready lights & power switch, split water lines, stainless steel interior & exterior, leveling feet, UL EPH Classified, cULus

ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		208v/60/3-ph, 27.0 amps, 8.5kW
Vulcan	1	CORDPLG3PAN3P	CORD & plug set (rated to 208-240v/3-ph - 40.0 amps), CABLE 8/4 90C UL SO, SEO, SOW OR SEOW, 7'7": ANGLED PLUG HBL8462C NEMA 15-60P
Vulcan	1	SMF600-SYSTEM	SCALEBLOCKER™ Water Treatment, field installed by others at jobsite
Vulcan	1		2nd year limited water related parts only & labor warranty
Vulcan	1	STAND 34YSGL	Stand, 24" wide x 34" high, includes (1) set of pan slides, for counter top steamers
Vulcan	1	CTOPHTESHIELD	Heat Shield, 3/5 pan steamer
Vulcan	3	HOSEWTR 3/4BBV	Flex stainless steel water hose 72", 3/4" female GHT (2 per unit required for gas & electric, 3 with filter system, 1 per unit for direct steam)

VULCAN

Project _____

AIA # _____ SIS # _____

Item # _____ Quantity _____ C.S.I. Section 114000

C24EA PLUS SERIES

Electric Counter Convection Steamer



Model C24EA5

SELL SHEET

ANSI/NSF Standard #4

c UL us LISTED

SPECIFIER STATEMENT

Single compartment electric convection steamer. Professional Controls with 60-minute timer, buzzer and constant steam feature, cook/ready lights and power switch. High output stainless steel generator with SmartDrain and Powerflush along with 2-speed staged water fill for superior heat-up and steam quality. Stainless steel exterior and cooking compartment with coved interior corners. Heavy duty door and door latch mechanism with door gasket guard. Shipped for 208/60-50/3 electrical service. Can be field converted to 208/60-50/1, 240/60-50/3 and 240/60-50/1. Split water line connection. 1½" NPT drain connection.

Exterior Dimensions:

3 pan: 24"w x 33"d x 19½"h

5 pan: 24"w x 33"d x 26"h

UL Listed. Classified by UL to NSF Standard #4.

MODELS

- ❑ **C24EA3** 3 pan capacity
- ❑ **C24EA5** 5 pan capacity

STANDARD FEATURES

- High output stainless steel steam generator
- Shipped for 208/60-50/3 electrical service; can be field converted to 208/60-50/1 and 240/60-50/3 and 240/60-50/1
- Smart Drain System (timed drain) with PowerFlush
- Professional controls with 60-minute timer, buzzer and constant steam feature, cook/ready lights and power switch
- Illuminated power switch with cook and ready lights
- Cord strain relief
- Stainless steel exterior and cooking compartment with coved interior corners
- Heavy duty door and door latch mechanisms with gasket guard
- Split water line connection; 1½" NPT drain connection
- One year limited parts and labor warranty

OPTIONS

❑ Second year extended limited parts and labor warranty contract

ACCESSORIES (PACKAGED AND SOLD SEPARATELY)

❑ CB15K Carbon Block filtration

❑ SMF600 ScaleBlocker® water treatment system, includes second year warranty

❑ Steamer Security Package, includes controls protected by lockable cover, perforated flue cover, security fasteners & tack-welds

❑ 4" adjustable counter legs

❑ Open leg 24"w stand with shelf and 1 set of adjustable pan slides
- ❑ 28"h
- ❑ 34"h
- ❑ 6" locking casters

❑ Stacking kit for two units with hardware, counter mount or on 15" and 28" stands

Note: Only a single 3 or 5 pan steamer or two 3 pan steamers can be stacked on a 28"h stand. Single 3 or 5 pan steamers only on a 34"h stand. Any combination of two steamers can be stacked on a 15" stand.
- ❑ 15" open leg stand
- ❑ 6" locking casters

❑ Cord and plug set, 208-240v/1ph (rated to 45 amps) 72": ANGLED PLUG HBL9462C NEMA 14-60 (CORDPLG-3PAN1P)

❑ Cord and plug set, 208-240v/3ph (rated to 40 amps) 72": ANGLED PLUG HBL8462C NEMA 15-60 (CORDPLG-3PAN3P).

❑ Cord and plug set, 208-240v/3ph (rated to 55 amps) 72": ANGLED PLUG HBL8462C NEMA 15-60 (CORDPLG-5PAN3P)

❑ Cord and plug set, 480v/3ph (rated to 30 amps) 72": STRAIGHT PLUG HBL2731 NEMA L16-30 (CORDPLG-5PAN480)

❑ Flex stainless steel water connection 72" ¾" female NSHT on both ends, 2 required and 3 with filter system, Qty. ____

C24EA PLUS SERIES – Electric Counter Convection Steamer

Approved by_____ Date_____ Approved by_____ Date_____

C24EA PLUS SERIES
Electric Counter Convection Steamer

SERVICE CONNECTIONS

ELECTRICAL CONNECTIONS: Field Wire Electrical Connection 1¼" (32 mm) K.O. service entrance.

DRAIN: 1½" IPS piped to open drain. No solid connections. 60" length before open air gap opening and not more than two bends or elbows. **Note:** Stacked units must have independent drains, do not connect together.

GENERATOR WATER SUPPLY: ¾" (19 mm) male NSHT to generator, flow rate 4 gpm @ minimum 20 to maximum 60 psi. (138-414 kPa) treated water.

CONDENSING WATER SUPPLY: ¾" (19 mm) male NSHT to condenser, flow rate 4 gpm @ minimum 20 to maximum 60 psi. (138-414 kPa) untreated water.

WATER QUALITY STATEMENT

The fact that a water supply is potable is no guarantee that it is suitable for steam generation. Your water supply must be within these general guidelines:

SUPPLY PRESSURE	20 - 60 psig
HARDNESS*	less than 3 grains
SILICA	less than 13 ppm
TOTAL CHLORINE	less than 0.1 ppm
pH RANGE	7-8
UN-DISSOLVED SOLIDS	less than 5 microns

* 17.1 ppm = 1 grain of hardness

Other factors affecting steam generation are iron content, amount of chloridation and dissolved gases. Water supplies vary from state to state and from locations within a state. Therefore it is necessary that the local water treatment specialist be consulted before the installation of any steam generating equipment.

NOTES

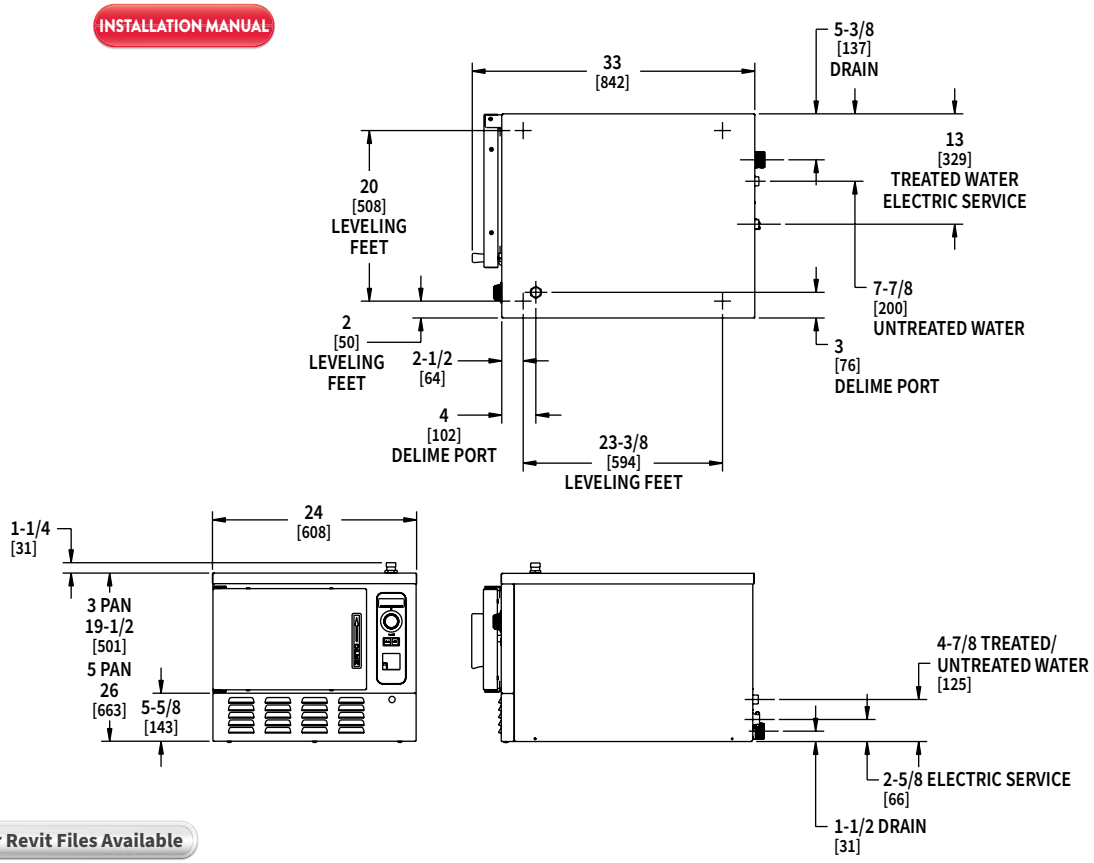
- Dimensions which locate the above connections have a tolerance of + or - 3" (+ or - 75mm).
- Installation of backflow preventer's, vacuum breakers and other specific code requirements is the responsibility of the owner and installer. It is the responsibility of the owner and installer to comply with local codes.
- Do not use plastic drains.
- This appliance is manufactured for commercial installation only and is not intended for home use.

Pan Capacity				
Model	**1"**	**2½"**	**4"**	**6"**
C24EA3	6	3	2	1
C24EA5	10	5	3	2

Model	PH	208V		240V	
		KW	Amp	KW	Amp
C24EA3	1	8.5	41	8.5	36
	3	8.5	27	8.5	21
C24EA5	1	15	72	15	63
	3	15	48	15	36

NOTE: 208 volt, 3 phase is an unbalance load, and amp listed is the max on any leg. Refer to the I/O manual for further details.

INSTALLATION MANUAL



CAD and/or Revit Files Available

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

Project _____

AIA # _____ SIS # _____

Item # _____ Quantity _____ C.S.I. Section 114000

SCALEBLOCKER™
Water Filter System



Model SMF600

System tested and certified by NSF International

- ANSI/NSF Standard 53–Health Claims
  - Cysts Reduction: Cryptosporidium, Giardia, Entamoeba
  - Turbidity Reduction
- ANSI/NSF Standard 42–Aesthetic Claims
  - Chlorine Reduction, Class I
  - Taste and Odor Reduction

SPECIFIER STATEMENT

Water filter system, Vulcan Model No. SMF_____. Single quick connect cartridge design. Patented technology reduces lime scale, chlorine, and chloramines without chemicals or additives. Reduces the need of frequent deliming. Modular mounting bracket and head assembly with ¼ turn quick connect cartridge. Shutoff valve and connection for treated water for generator and untreated for cold water condensate. Filter water test port with shut off valve. Incoming water parameters are 40-125 PSI, 45-100°F, PH 6-9, alkalinity 80-100 PPM, chlorine/chloramines 0-4 PPM. chlorides 0-30 PPM, hardness 0-300 PPM (0 to 17.5 grains). Water connections are ¾" NPTM with ¾" Male GHT.

Exterior Dimensions:
SMF600: 15½"w x 9½"d x 18½"h
SMF620: 15½"w x 9½"d x 29½"h

NSF tested and certified.
Not to exceed 120°F.

MODELS

- ❑ **SMF600** Water filter system
- ❑ **SMF620** Water filter system

STANDARD FEATURES

- Single cartridge design
- ¼ turn cartridge quick disconnect and connect for easy changes, no wrench required
- Category 3 recyclable cartridge
- Nano crystal scale reduction reduces the need for deliming
- Hollow carbon for chlorine/chloramines removal
- Modular mounting bracket and head assembly
- Quick connect inlet and outlet assemblies for reversing flow or adding optional pre-filter
- Shut off valve and pressure gauge standard
- Connections are ¾-inch NPTF with ¾-inch Male GHT adaptors installed (male garden hose thread)
- Filtered water test valve
- Unfiltered water connection for cold water condensate with cap if not used
- Free filter maintenance reminders when system is registered with Vulcan
- Treats water up to 300 PPM (17.5 grains), hardness
- Removes up to 4 PPM chlorine/chloramines

ACCESSORIES (PACKAGED AND SOLD SEPARATELY)

- ❑ Preventive maintenance kit
- ❑ Stainless steel flex water connection hose 72", ¾" Female GHT, (garden hose thread), each end.

SCALEBLOCKER™ – Water Filter System

Approved by_____ Date_____ Approved by_____ Date_____

VULCAN

SCALEBLOCKER™
Water Filter System

NOTES

1. Dimensions which locate the below connections have a tolerance of + or - 3" (+ or - 77mm).

SMF600

Service Flow	0-2 GPM
Service Life	7,500 Gal
Inlet / Outlet	¾" NPTF inlet and ¾" Male GHT (¾" NPTF adapter) outlet
Inlet Min / Max Pressure	40-125 PSIG
Min / Max Temperature	45-100F (7-37C)
Weight, Operating	21 Lbs. (9.5 kg)

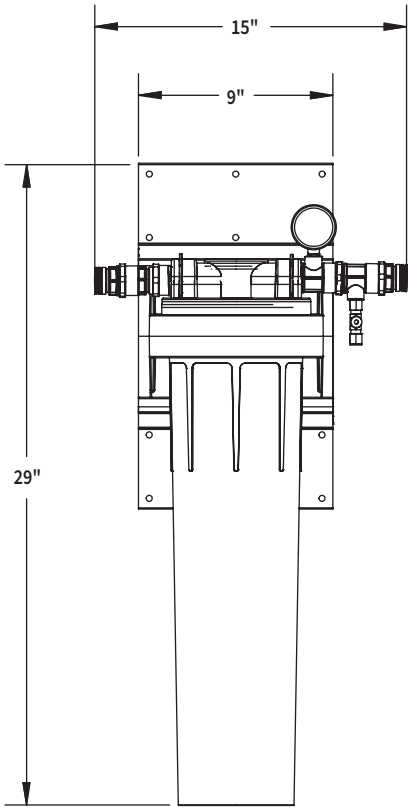
SMF620

Service Flow	0-4 GPM
Service Life	12,000 Gal
Inlet / Outlet	¾" NPTF inlet and ¾" Male GHT (¾" NPTF adapter) outlet
Inlet Min / Max Pressure	40-125 PSIG
Min / Max Temperature	45-100F (7-37C)
Weight, Operating	32 Lbs. (15.5 kg)

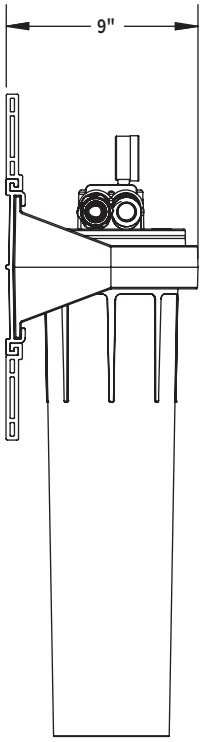
2. Installation of backflow preventers, vacuum breakers, other code requirements and local code compliance is the responsibility of the owner and installer.
3. Filter clearance needed for access:
   Front 13"
   Bottom 4"
4. This appliance is manufactured for commercial installation only and not intended for home use.

WATER QUALITY STATEMENT:

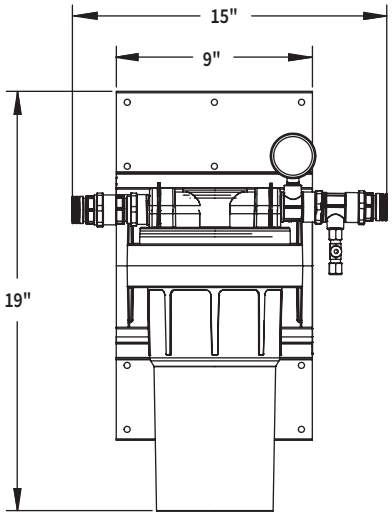
Water from ScaleBlocker™ System should only be connected to the boiler / generator feed and not the condenser connection of the steamer. Systems are not to be used where water is microbiologically unsafe or with water of unknown quality without adequate disinfections before and after use. Connecting to a municipal water supply complies with this requirement.



SMF620-SYSTEM



TYPICAL SIDE VIEW



SMF600-SYSTEM

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

Item # _____ C.S.I. Section 11420

S T E A M

STANDS
FOR COUNTER STEAMERS



Model STAND_28XSGL

- ☐ **STAND_28XSGL** 28" high
- ☐ **STAND_34XSGL** 34" high

STANDARD FEATURES

- Stainless steel frame and removable pan slides.
- Slides accept 12" x 20" food pans or 18" x 26" sheet pans.
- Flanged feet for use with C24EA3, C24EA5, C24EO3 and C24EO5 Steamers.
- One year limited parts and labor warranty.

ACCESSORIES (Packaged & Sold Separately)

- ☐ Additional universal pan slides (S/PAN_SLIDES). Qty. ____.
- ☐ Pull out shelf assembly (not available with VPX Series Steamers).
- ☐ Casters.

SPECIFICATIONS

Counter steamer equipment stand. Stainless steel frame and removable pan slides. Slides accept 12" x 20" food pans or 18" x 26" sheet pans. Flanged feet.

Exterior Dimensions:
24"w x 27 7/16"d x (28") (34") overall height.

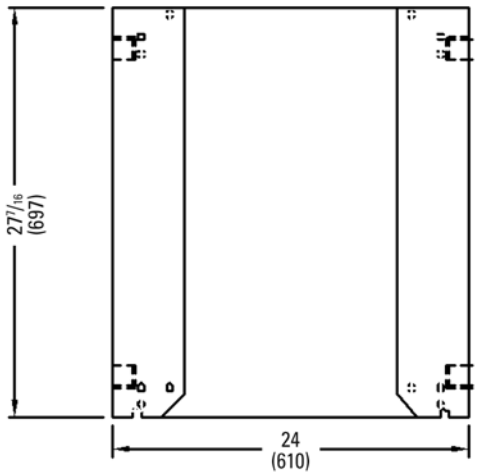
NSF listed.

a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

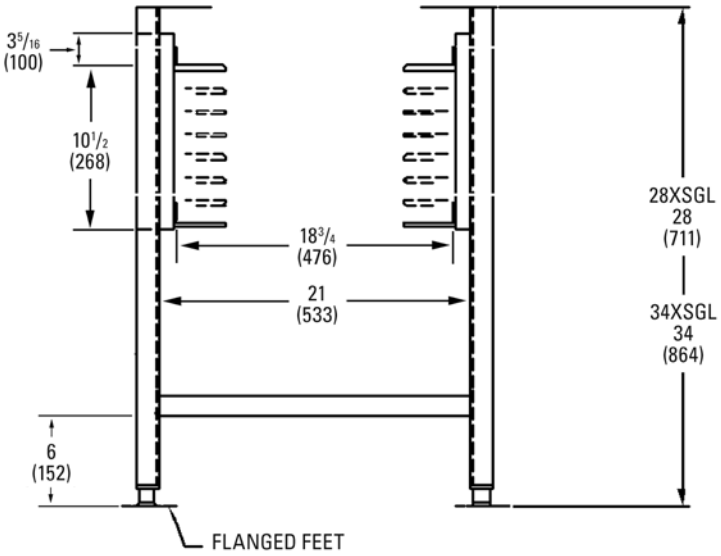
S T E A M

VULCAN

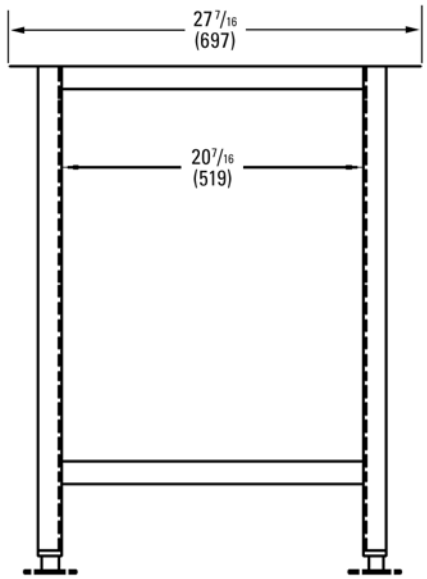
STANDS
FOR COUNTER STEAMERS



TOP VIEW



FRONT VIEW



SIDE VIEW

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K49 - CHARBROILER, GAS, COUNTERTOP (1 EA REQ'D)

Vulcan VACB25

Achiever Charbroiler, countertop, 25-1/8", (4) 17,000 BTU cast iron burners, infinite heat control valves, fully welded chassis, (1) drip tray, stainless steel front, sides & top trim, backsplash & grease trough, 4" adjustable legs, 68,000 BTU, CSA, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		Gas type to be specified
Vulcan	1	SPLASH6-CB25	Splashguard, 6" add-on, sides & back

Item # _____ C.S.I. Section 11420

GRIDDLES & BROILERS

VACB SERIES
HEAVY DUTY COUNTER MODEL GAS CHARBROILER



Model VACB36

- ☐ **VACB25** 25⅛" wide
- ☐ **VACB36** 36" wide
- ☐ **VACB47** 46⅞" wide
- ☐ **VACB60** 62⅛" wide
- ☐ **VACB72** 72½" wide

STANDARD FEATURES

- All welded chassis with stainless steel sides, control panel, top trim, backsplash and grease trough
- Heavy duty cast iron char-radiants
- 5¼" wide cast iron diamond grates
- One 17,000 BTU/hr burner for each broiler grate
- Easy lighting standing pilot ignition system
- One high range infinite heat control valve for each burner. Valve adjustment marks engraved into front panel for easy set-up.
- Heat deflector tray system reflects heat upwards creating a “Cool Zone” in the grease drawer and facilitates easier cleaning.
- 4" adjustable legs
- ¾" rear gas connection and gas pressure regulator
- Supercharger burner dividers minimize heat transfer to enhance multi-zone cooking capability
- One year limited parts and labor warranty

SPECIFICATIONS

Low profile, high volume gas charbroiler, Vulcan-Hart Model No. _____. All welded chassis with stainless steel front, sides, top trim and grease trough. Heavy cast iron char-radiants. 5¼" wide cast iron diamond grates. Supercharger burner dividers. One 17,000 BTU/hr. burner for each broiling grate. Underburner deflector system reflects heat upwards. Standing pilot ignition system. One high range infinite heat control valve for each burner. 4" adjustable legs. ¾" rear gas connection and gas pressure regulator.

Exterior dimensions:
_____" wide x 31" deep x 12" working height

CSA design certified. NSF Certified.

SPECIFY TYPE OF GAS WHEN ORDERING.
SPECIFY ALTITUDE WHEN ABOVE 3,999 FT.

ACCESSORIES

- ☐ 6" legs.
- ☐ 10⅝" deep plate rail.
- ☐ Condiment rail.
- ☐ Cutting board.
- ☐ 6" back and side splash kit.
- ☐ 12¾" overshelf.
- ☐ Straight and waffle pattern cast iron grates.
- ☐ Welded steel round rod grate.
- ☐ Fajita plate warmer.
- ☐ 10½" wide griddle plate inserts.
- ☐ Stainless steel stand with undershelf and casters.

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

GRIDDLES & BROILERS

VACB SERIES
HEAVY DUTY COUNTER MODEL GAS CHARBROILER

INSTALLATION REQUIREMENTS:

1. A gas pressure regulator supplied with the unit must be installed:
   Natural Gas 5.0" (127 mm) W.C.
   Propane Gas 10.0" (254 mm) W.C.
2. An adequate ventilation system is required for commercial cooking equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269. When writing refer to NFPA No. 96.
3. These units are manufactured for installation in accordance with National Fuel Gas Code, ANSI-Z223.1/NFPA #54 (latest edition). Copies may be obtained from The American Gas Association, Accredited Standards Committee Z223 @ 400 N. Capital St. NW, Washington, DC 20001, or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

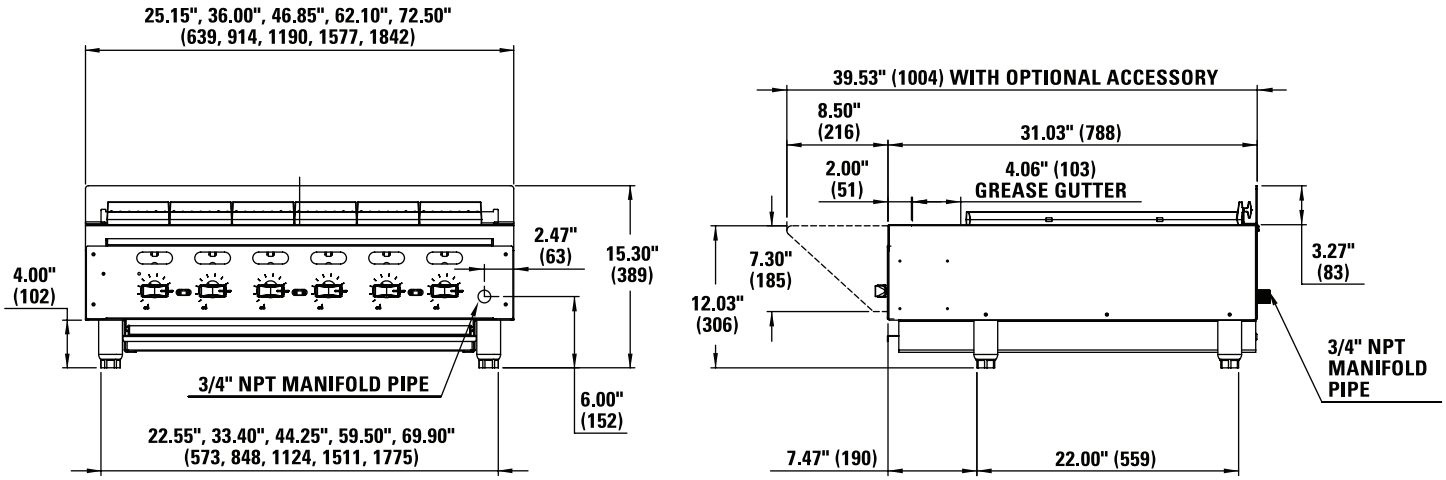
NOTE: In The Commonwealth of Massachusetts
All gas appliances vented through a ventilation hood or exhaust system equipped with a damper or with a power means of exhaust shall comply with 248 CMR.

4. CLEARANCES

	Non-Combustible
Rear	3"
Sides	0"

All models require a 4" bottom clearance from a non-combustible counter and must be installed with minimum 4" legs.

5. This appliance is manufactured for commercial installation only and is not intended for home use.



MODEL	WIDTH	DEPTH	OVERALL HEIGHT	WORKING HEIGHT*	BROILING AREA
VACB25	25.15" (639)	31" (788)	15.30" (389)	12" (306)	21.50" (546) x 22.31" (567)
VACB36	36.00" (914)				32.25" (819) x 22.31" (567)
VACB47	46.85" (1190)				43.00" (1092) x 22.31" (567)
VACB60	62.10" (1577)				57.00" (1448) x 22.31" (567)
VACB72	72.50" (1842)				68.75" (1746) x 22.31" (567)

*These are nominal dimensions and can vary by +1.75" with adjustable legs. Dimensions in "( )" are in millimeters.

MODEL	# BURNERS	# DRIP TRAYS	TOTAL BTU/HR NATURAL GAS	TOTAL BTU/HR LP GAS	APPROX SHIP WT (LB/KG)
VACB25	4	1	68,000	64,000	290/131
VACB36	6	1	102,000	96,000	370/167
VACB47	8	2	136,000	128,000	450/203
VACB60	11	2	187,000	176,000	500/225
VACB72	13	2	221,000	208,000	580/263

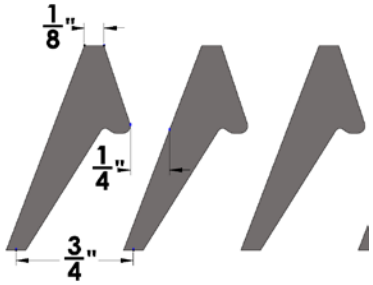
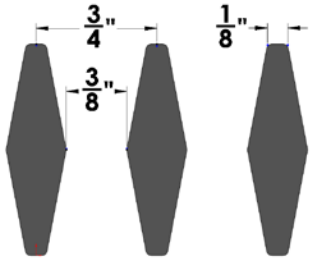
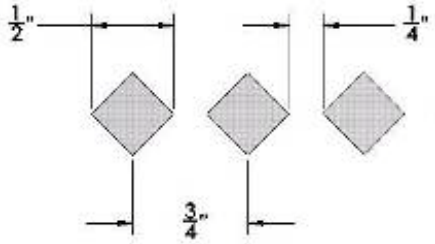
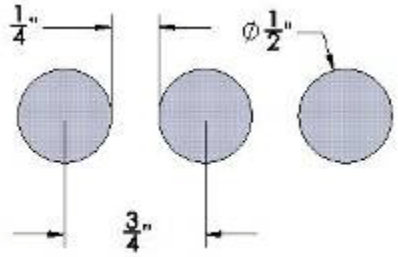
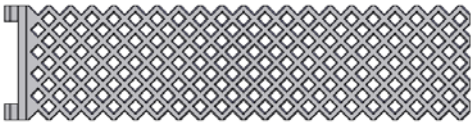
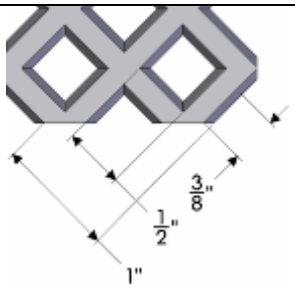
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NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

VULCAN
DONE TO PERFECTION.

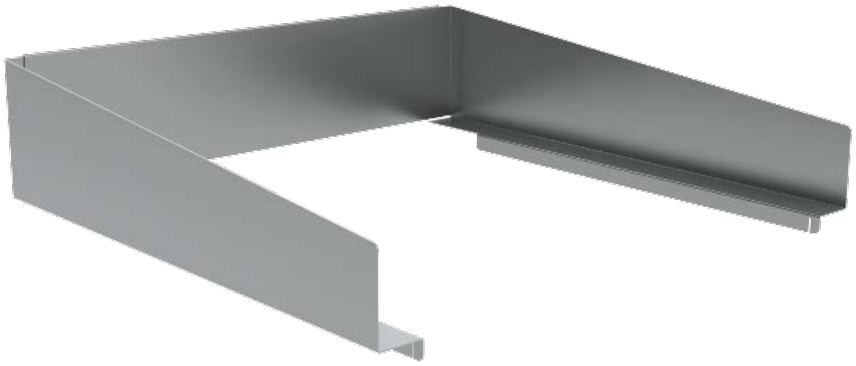
WOLF
No worries.

VCCB & SCB CHARBROILER ACCESSORIES

DESCRIPTION	GRATE PICTURE	PROFILE
SERVICE PART: 710424 **CAST IRON SLANTED GRATE** **STANDARD ON ALL UNITS**		
ACCESSORY CODE: GRATE-CDIA7 **CAST IRON DIAMOND GRATE**		
ACCESSORY CODE: GRATE-SSDIA7 **CARBON STEEL DIAMOND FABRICATED GRATE**		
ACCESSORY CODE: GRATE-RROD7 **CARBON STEEL 1/2” ROUND ROD GRATE**		
ACCESSORY CODE: GRATE-WAFFLE **CAST IRON WAFFLE GRATE**		

F-38323 (10-11)

VCCB & SCB CHARBROILER ACCESSORIES



ACCESSORY CODE:
SPLASH6-CBxx

STAINLESS STEEL SPLASH KIT.
“xx” REPRESENTS UNIT SIZE



ACCESSORY CODE:
PLTRAIL-VCCBxx

STAINLESS STEEL PLATE RAIL
“xx” REPRESENTS UNIT SIZE

F-38323 (10-11)

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K49.1 - BLUE HOSE GAS CONNECTOR KIT (1 KT REQ'D)

Dormont 1675KITS48

Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) Swivel MAX®, (1) full port valve, (1) elbow, coiled restraining cable with hardware, 167,000 BTU/hr minimum flow capacity, limited lifetime warranty

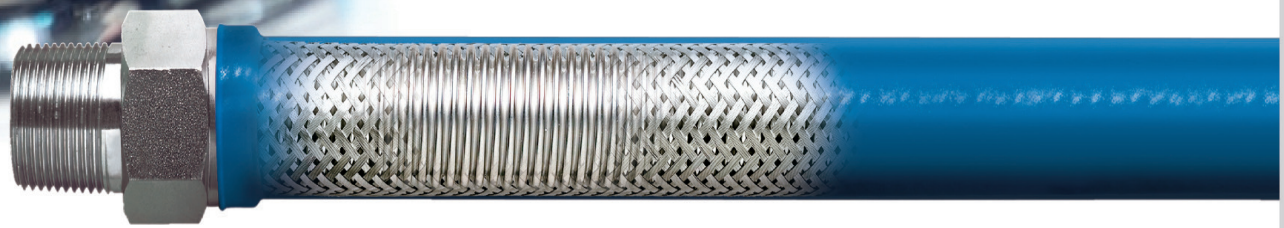
Item #K49.1
1675KITS48
Dormont
Page: 145
Oceancrest SN West Melbourne



Foodservice Moveable Equipment Installation Products

The Dormont Blue Hose™ is the heart of the Safety System, specifically engineered for caster-mounted commercial cooking equipment. The Blue Hose includes an antimicrobial protective PVC coating, and our Stress Guard® technology that makes the hose easier to install and dramatically reduces stress on the hose ends.

The fuel gas codes require the use of an ANSI Z21.69/CSA 6.16 moveable gas connector with all appliances that may or may not utilize casters and, under normal use, are moved on a regular basis for service, positioning or area cleanliness.



STRESS GUARD TECHNOLOGY
Rotation technology reduces stress on both ends of the hose

Stainless Steel Construction
Heavy-duty, flexible, corrugated 304 stainless steel tubing

Stainless Steel Braid
Tight-weave braid prevents corrugations from stretching as equipment is moved

Antimicrobial PVC Coating
Inhibits growth of bacteria, mold and mildew on the gas connector





A Watts Water Technologies Company USA: 6015 Enterprise Drive, Export, PA 15632 • 1-800-DORMONT • Dormont.com

The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. It is a complete system of connection products designed with the safety of your kitchen, the food you serve, your employees, and your business in mind.

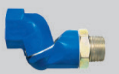
The Safety System includes the famous Dormont Blue Hose and our exclusive safety-based fittings - the SnapFast quick-disconnect, the Safety Quik quick-disconnect valve, and the Swivel MAX. Safe, unique, and affordable, the Dormont Safety System provides peace of mind for the gas connections in your commercial kitchen.



Safety Quik
- Prevents user from turning on gas while appliance is disconnected
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SnapFast
- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SwivelMAX
- Reduces stress on connector
- Increases kitchen aisle space by allowing connector to be positioned closer to the wall



Restraining Cable
- Prevents transmission of strain to connector
- Provided 1' shorter than the gas connector



Safety-Set
Always on the mark
- Ensures cooking equipment is always positioned in design-specified location
- Fast installation with choice of adhesive foam tape or thumbscrews

S-BUYGUIDE-Front.indd 1
11/6/15 11:07 AM

Dormont® Moveable Commercial Equipment Kits

KIT SOLUTIONS	50 = ½" ID 75 = ¾" ID 100 = 1" ID 125 = 1-¼" ID PART NUMBER	BTU/hr Minimum Flow Capacity*	THE BLUE HOSE™	SnapFast® QUICK-DISCONNECT	Swivel MAX® 1st SWIVEL	Swivel MAX® 2nd SWIVEL	Safety Quik® VALVE	RESTRAINING CABLE
Standard Kit (KIT)[1] The Dormont Blue Hose™ SnapFast Quick-Disconnect Restraining Cable	1650KIT36	77K	√	√				√
	1650KIT48	68K	√	√				√
	1650KIT60	60K	√	√				√
	1675KIT36	218K	√	√				√
	1675KIT48	180K	√	√				√
	1675KIT60	158K	√	√				√
	16100KIT36	379K	√	√				√
	16100KIT48	334K	√	√				√
	16100KIT60	294K	√	√				√
Single Swivel MAX Kit (KITS)[2] The Dormont Blue Hose™ SnapFast Quick-Disconnect One Swivel MAX Swivel Restraining Cable	1650KITS36	72K	√	√	√			√
	1650KITS48	63K	√	√	√			√
	1650KITS60	56K	√	√	√			√
	1675KITS36	203K	√	√	√			√
	1675KITS48	167K	√	√	√			√
	1675KITS60	147K	√	√	√			√
	16100KITS36	353K	√	√	√			√
	16100KITS48	310K	√	√	√			√
	16100KITS60	274K	√	√	√			√
Double Swivel MAX Kit (KIT2S)[3] The Dormont Blue Hose™ SnapFast Quick-Disconnect Two Swivel MAX Swivels Restraining Cable	1650KIT2S36	69K	√	√	√	√		√
	1650KIT2S48	60K	√	√	√	√		√
	1650KIT2S60	54K	√	√	√	√		√
	1675KIT2S36	193K	√	√	√	√		√
	1675KIT2S48	160K	√	√	√	√		√
	1675KIT2S60	140K	√	√	√	√		√
	16100KIT2S36	336K	√	√	√	√		√
	16100KIT2S48	295K	√	√	√	√		√
	16100KIT2S60	261K	√	√	√	√		√
Safety Quik Kit (KITCF)[4] The Dormont Blue Hose™ Safety Quik Quick-Disconnect Restraining Cable	1650KITCF36	77K	√				√	√
	1650KITCF48	68K	√				√	√
	1650KITCF60	60K	√				√	√
	1675KITCF36	218K	√				√	√
	1675KITCF48	180K	√				√	√
	1675KITCF60	158K	√				√	√
	16100KITCF36	379K	√				√	√
	16100KITCF48	334K	√				√	√
	16100KITCF60	294K	√				√	√
Safety Quik Single Swivel MAX Kit (KitCFS)[5]	1650KITCFS36	72K	√		√		√	√
	1650KITCFS48	63K	√		√		√	√
	1650KITCFS60	56K	√		√		√	√
	1675KITCFS36	203K	√		√		√	√
	1675KITCFS48	161K	√		√		√	√
	1675KITCFS60	147K	√		√		√	√
	16100KITCFS36	353K	√		√		√	√
	16100KITCFS48	310K	√		√		√	√
	16100KITCFS60	274K	√		√		√	√

[1] Includes Full Port Gas Valve and (2) 90° Street Elbows
[2] Includes Full Port Gas Valve and (1) 90° Street Elbow
[3] Includes Full Port Gas Valve
[4] Includes (2) 90° Street Elbows
[5] Includes (1) 90° Street Elbow

Indicates most commonly stocked item

*BTU/hr Minimum Flow Capacity (0.64 Sp.Gr., 1000 BTU/ft^3 Natural Gas at 0.5" wc pressure drop)

ADDITIONAL CONFIGURATIONS ARE AVAILABLE IN OUR CATALOG.

Add PS to the end of any part number to include the Safety-Set® wheel placement system

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

S-D-BUYGUIDE 1538

© Dormont 2015

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K50 - GRIDDLE, GAS, COUNTERTOP (1 EA REQ'D)

Vulcan MSA24

Heavy Duty Griddle, countertop, gas, 24" W x 24" D cooking surface, 1" thick polished steel griddle plate, embedded mechanical snap action thermostat every 12", millivolt pilot safety, manual ignition, low profile, stainless steel front, sides, front grease trough, 4" back & tapered side splashes, 4" adjustable legs, 54,000 BTU, CSA Star, CSA Flame, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		Gas type to be specified

Project _____

AIA # _____ SIS # _____

Item # _____ Quantity _____ C.S.I. Section 114000

MSA SERIES
Heavy Duty Gas Griddles



Model MSA48

SELL SHEET

SPECIFIER STATEMENT

Low profile heavy duty gas griddle, Vulcan Model No._____. Stainless steel front, sides and front top ledge. Fully welded stainless and aluminized steel body frame. 11" low profile cooking height on 4" legs. 1" thick polished steel griddle plate with 12 gauge, 4" stainless steel back and tapered side splashes. Grease chute is fully welded to stop grease migration. One 27,000 BTU/hr. "U" shaped aluminized steel burner and mechanical snap action thermostat for each 12" of griddle width. Chrome thermostat knob guards. Temperature adjusts from 200° to 550°F. One pilot safety for every two burners. 3½" wide stainless steel grease trough. ¾" rear gas connection and gas pressure regulator.

Exterior Dimensions:
_____"w x 33" d x 15½" h on 4" legs.

CSA design certified. NSF listed.

SPECIFY TYPE OF GAS WHEN ORDERING
SPECIFY ALTITUDE WHEN ABOVE 2,000 FT.

GRIDDLE MODELS

- ❑ **MSA24- [ ]:** 24" w x 24" d
- ❑ **MSA36- [ ]:** 36" w x 24" d
- ❑ **MSA48- [ ]:** 48" w x 24" d
- ❑ **MSA60- [ ]:** 60" w x 24" d
- ❑ **MSA72- [ ]:** 72" w x 24" d

PLATE OPTIONS

- ❑ **101:** 1" Steel plate
- ❑ **201:** 30"d Steel plate
- ❑ **105:** 1" Hexavalent Chrome Plated
- ❑ **CO1:** ¾" Rapid Recovery™ Composite
  Note: 72" composite is not available.

Example: MSA36-201 is 36" Griddle with 30" deep steel plate
MSA48-CO1 is 48" Griddle with Rapid Recovery™ composite

STANDARD FEATURES

- Stainless steel front, sides and front top ledge with "Cool Bullnose" design
- Fully welded stainless and aluminized steel chassis frame
- 11" low profile cooking height on 4" adjustable legs
- 1" thick polished steel griddle plate with 12 gage, 4" stainless steel back and tapered side splashes
- Spatula wide 3½" grease gutter and chute is fully welded for easier cleaning and to stop grease migration
- One 27,000 BTU/hr. "U" shaped aluminized steel burner for every 12" of griddle width
- One embedded snap action thermostat per burner with temperature adjust from 200°F to 550°F on Steel or Chrome plate; temperature adjusts from 200°F to 450°F on Rapid Recovery™ plate
- Large 6 quart stainless steel grease drawer (2 drawers on 60" and 72" models)
- Heavy duty chromed thermostat knob guards
- One pilot safety valve for every two burners; safety will completely shut off gas to pilot and burners if pilot extinguishes
- Manual ignition
- Bottom heat shields
- ¾" rear gas connection and gas pressure regulator
- One year limited parts and labor warranty

OPTIONS

- ❑ Chrome plate (w/palmetto brush, scraper & blade)
- ❑ 30" Depth Steel Plate
- ❑ Rapid Recovery™ Plate
- ❑ Rear grease trough
- ❑ Under-device plumbing
- ❑ 10" Back splash
- ❑ Piezo ignition system (no ext. flame source required)
- ❑ Factory installed frame for clamshell accessory

ACCESSORIES *(see last page)*

MSA SERIES – Heavy Duty Gas Griddles

Approved by_____ Date_____ Approved by_____ Date_____

MSA SERIES
Heavy Duty Gas Griddles

INSTALLATION INSTRUCTIONS

INSTALLATION MANUAL

1. A gas pressure regulator supplied with the unit must be installed;

   Natural Gas 4.0" (102 mm) W.C.
   Propane Gas 10.0" (254 mm) W.C.

2. All models require a 6" (152 mm) clearance at both sides and rear adjacent to combustible and 0" from non-combustible constructions. All models require a 4" (102mm) bottom clearance and must be installed with minimum 4" legs.

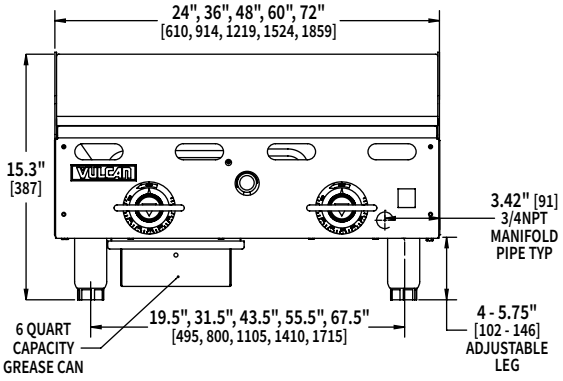
3. These units are manufactured for installation in accordance with ANSI/NFPA-70, National Electrical code.

   An adequate ventilation system is required for Commercial Cooking Equipment (NFPA No. 96). Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02169.

4. These units are manufactured for installation in accordance with National Fuel Gas Code, ANSI-Z223.1/NFPA #54 (latest edition). Copies may be obtained from The American Gas Association, Accredited Standards Committee Z223 @ 400 N. Capital St. NW, Washington, DC 20001, or the Secretary Standards Council, NFPA, 1 Batterymarch Park, Quincy, MA 02169-7471.

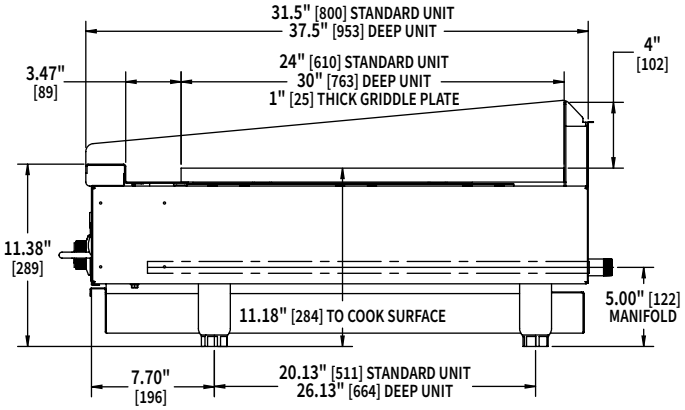
   NOTE: In The Commonwealth of Massachusetts
   All gas appliances vented through ventilation hood or exhaust system equipped with a damper or with a power means of exhaust shall comply with 248 CMR.

5. This appliance is manufactured for commercial installation only and is not intended for home use.

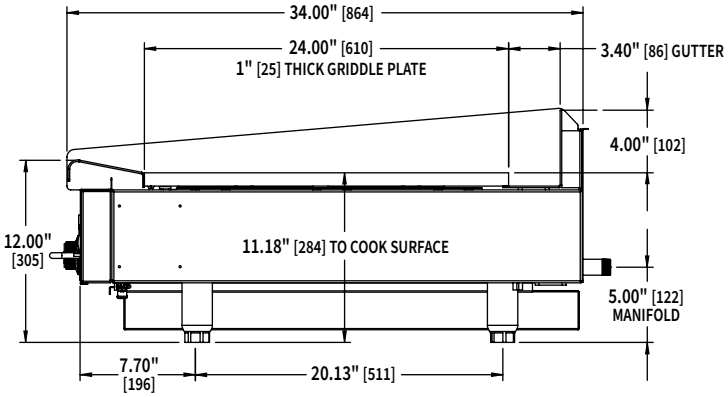


Front View

NOTES:
1. ADJUSTABLE LEGS ARE 2" IN DIAMETER.
   LEGS ARE RECESSED 1¼" FROM EACH SIDE.



Front Grease Trough - Side View



Rear Grease Trough - Side View

CAD and/or Revit Files Available

Model	Width	Depth	Overall Height*	Working Height*	Number of Burners	Total BTU/Hr.	Number of Drawers	Approximate Shipping Weight
MSA24	24"	31½"	15¼"	11⅛"	2	54,000	1	285 lbs./129 kg.
MSA36	36"	31½"	15¼"	11⅛"	3	81,000	1	400 lbs./181 kg.
MSA48	48"	31½"	15¼"	11⅛"	4	108,000	1	480 lbs./218 kg.
MSA60	60"	31½"	15¼"	11⅛"	5	135,000	2	650 lbs./295 kg.
MSA72	72"	31½"	15¼"	11⅛"	6	162,000	2	790 lbs./358 kg.

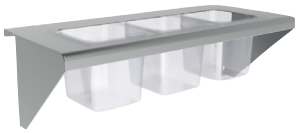
*These are nominal dimensions and can vary by +1.75" with adjustable legs.

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

VULCAN

MSA SERIES
Heavy Duty Gas Griddles

ACCESSORIES (packaged and sold separately)

	DESCRIPTION	ITEM #	FOR
	**PLATE RAIL** Stainless steel plate rail, 10⅝" depth *Note: Standard plate rail accessories are incompatible with rear grease trough griddles*	❑ **PLTRAIL-24** ❑ **PLTRAIL-36** ❑ **PLTRAIL-48** ❑ **PLTRAIL-60** ❑ **PLTRAIL-72**	MSA24 MSA36 MSA48 MSA60 MSA72
	**CONDIMENT RAIL** Stainless steel condiment rail, 10⅝" depth. Pans not included. *Note: Condiment rail accessories are incompatible with rear grease trough griddles*	❑ **CONRAIL-24** ❑ **CONRAIL-36** ❑ **CONRAIL-48** ❑ **CONRAIL-60** ❑ **CONRAIL-72**	MSA24 MSA36 MSA48 MSA60 MSA72
	**CUTTING BOARD** Stainless steel cutting board with Sani-Tuff®, 10⅝" depth *Note: Cutting board accessories are incompatible with rear grease trough griddles*	❑ **CUTBD-24** ❑ **CUTBD-36** ❑ **CUTBD-48** ❑ **CUTBD-60** ❑ **CUTBD-72**	MSA24 MSA36 MSA48 MSA60 MSA72
	**LEGS** 6" stainless steel legs	❑ **LEGS-GRD6**	All MSA
	**HOSE** ¾" x 4' long gas flex hose and quick disconnect	❑ **3/4QD-HOSE-4**	All MSA
	**BANKING STRIP** Griddle Banking Strip	❑ **BANKING-STRIP**	All MSA
	**EQUIPMENT STAND** Universal equipment stand 24"H, ½" marine edge, undershelf, stainless steel, 5" casters	❑ **STAND/C-24** ❑ **STAND/C-36** ❑ **STAND/C-48** ❑ **STAND/C-60** ❑ **STAND/C-72**	MSA24 MSA36 MSA48 MSA60 MSA72
	INTEGRATED STAND Equipment stand integrated into griddle unit (37" working height)	❑ **ISTAND/C-24** ❑ **ISTAND/C-36** ❑ **ISTAND/C-48** ❑ **ISTAND/C-60** ❑ **ISTAND/C-72**	MSA24 MSA36 MSA48 MSA60 MSA72

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K50.1 - BLUE HOSE GAS CONNECTOR KIT (1 KT REQ'D)

Dormont 1675KITS48

Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) Swivel MAX®, (1) full port valve, (1) elbow, coiled restraining cable with hardware, 167,000 BTU/hr minimum flow capacity, limited lifetime warranty

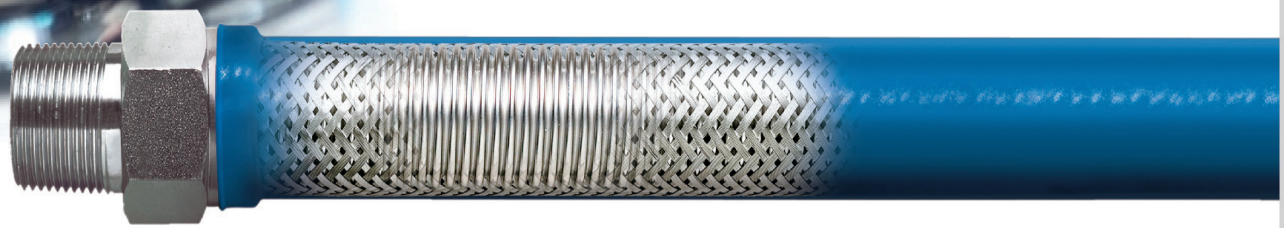
Item #K50.1
1675KITS48
Dormont
Page: 152
Oceancrest SN West Melbourne



Foodservice Moveable Equipment Installation Products

The Dormont Blue Hose™ is the heart of the Safety System, specifically engineered for caster-mounted commercial cooking equipment. The Blue Hose includes an antimicrobial protective PVC coating, and our Stress Guard® technology that makes the hose easier to install and dramatically reduces stress on the hose ends.

The fuel gas codes require the use of an ANSI Z21.69/CSA 6.16 moveable gas connector with all appliances that may or may not utilize casters and, under normal use, are moved on a regular basis for service, positioning or area cleanliness.



STRESS GUARD TECHNOLOGY

Rotation technology reduces stress on both ends of the hose

Stainless Steel Construction
Heavy-duty, flexible, corrugated 304 stainless steel tubing

Stainless Steel Braid
Tight-weave braid prevents corrugations from stretching as equipment is moved

Antimicrobial PVC Coating
Inhibits growth of bacteria, mold and mildew on the gas connector





A Watts Water Technologies Company USA: 6015 Enterprise Drive, Export, PA 15632 • 1-800-DORMONT • Dormont.com

The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. It is a complete system of connection products designed with the safety of your kitchen, the food you serve, your employees, and your business in mind.

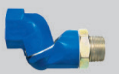
The Safety System includes the famous Dormont Blue Hose and our exclusive safety-based fittings - the SnapFast quick-disconnect, the Safety Quik quick-disconnect valve, and the Swivel MAX. Safe, unique, and affordable, the Dormont Safety System provides peace of mind for the gas connections in your commercial kitchen.



Safety Quik
- Prevents user from turning on gas while appliance is disconnected
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SnapFast
- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SwivelMAX
- Reduces stress on connector
- Increases kitchen aisle space by allowing connector to be positioned closer to the wall



Restraining Cable
- Prevents transmission of strain to connector
- Provided 1' shorter than the gas connector



Safety-Set
Always on the mark
- Ensures cooking equipment is always positioned in design-specified location
- Fast installation with choice of adhesive foam tape or thumbscrews

S-BUYGUIDE-Front.indd 1
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Dormont® Moveable Commercial Equipment Kits

KIT SOLUTIONS	50 = ½" ID 75 = ¾" ID 100 = 1" ID 125 = 1-¼" ID PART NUMBER	BTU/hr Minimum Flow Capacity*	THE BLUE HOSE™	SnapFast® QUICK-DISCONNECT	Swivel MAX® 1st SWIVEL	Swivel MAX® 2nd SWIVEL	Safety Quik® VALVE	RESTRAINING CABLE
Standard Kit (KIT)[1] The Dormont Blue Hose™ SnapFast Quick-Disconnect Restraining Cable	1650KIT36	77K	√	√				√
	1650KIT48	68K	√	√				√
	1650KIT60	60K	√	√				√
	1675KIT36	218K	√	√				√
	1675KIT48	180K	√	√				√
	1675KIT60	158K	√	√				√
	16100KIT36	379K	√	√				√
	16100KIT48	334K	√	√				√
	16100KIT60	294K	√	√				√
Single Swivel MAX Kit (KITS)[2] The Dormont Blue Hose™ SnapFast Quick-Disconnect One Swivel MAX Swivel Restraining Cable	1650KITS36	72K	√	√	√			√
	1650KITS48	63K	√	√	√			√
	1650KITS60	56K	√	√	√			√
	1675KITS36	203K	√	√	√			√
	1675KITS48	167K	√	√	√			√
	1675KITS60	147K	√	√	√			√
	16100KITS36	353K	√	√	√			√
	16100KITS48	310K	√	√	√			√
	16100KITS60	274K	√	√	√			√
Double Swivel MAX Kit (KIT2S)[3] The Dormont Blue Hose™ SnapFast Quick-Disconnect Two Swivel MAX Swivels Restraining Cable	1650KIT2S36	69K	√	√	√	√		√
	1650KIT2S48	60K	√	√	√	√		√
	1650KIT2S60	54K	√	√	√	√		√
	1675KIT2S36	193K	√	√	√	√		√
	1675KIT2S48	160K	√	√	√	√		√
	1675KIT2S60	140K	√	√	√	√		√
	16100KIT2S36	336K	√	√	√	√		√
	16100KIT2S48	295K	√	√	√	√		√
	16100KIT2S60	261K	√	√	√	√		√
Safety Quik Kit (KITCF)[4] The Dormont Blue Hose™ Safety Quik Quick-Disconnect Restraining Cable	1650KITCF36	77K	√				√	√
	1650KITCF48	68K	√				√	√
	1650KITCF60	60K	√				√	√
	1675KITCF36	218K	√				√	√
	1675KITCF48	180K	√				√	√
	1675KITCF60	158K	√				√	√
	16100KITCF36	379K	√				√	√
	16100KITCF48	334K	√				√	√
	16100KITCF60	294K	√				√	√
Safety Quik Single Swivel MAX Kit (KitCFS)[5]	1650KITCFS36	72K	√		√		√	√
	1650KITCFS48	63K	√		√		√	√
	1650KITCFS60	56K	√		√		√	√
	1675KITCFS36	203K	√		√		√	√
	1675KITCFS48	161K	√		√		√	√
	1675KITCFS60	147K	√		√		√	√
	16100KITCFS36	353K	√		√		√	√
	16100KITCFS48	310K	√		√		√	√
	16100KITCFS60	274K	√		√		√	√

[1] Includes Full Port Gas Valve and (2) 90° Street Elbows
[2] Includes Full Port Gas Valve and (1) 90° Street Elbow
[3] Includes Full Port Gas Valve
[4] Includes (2) 90° Street Elbows
[5] Includes (1) 90° Street Elbow

Indicates most commonly stocked item

*BTU/hr Minimum Flow Capacity (0.64 Sp.Gr., 1000 BTU/ft^3 Natural Gas at 0.5" wc pressure drop)

ADDITIONAL CONFIGURATIONS ARE AVAILABLE IN OUR CATALOG.

Add PS to the end of any part number to include the Safety-Set® wheel placement system

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

S-D-BUYGUIDE 1538

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Submittal Sheet

03/14/2025

ITEM# K51 - EQUIPMENT STAND, REFRIGERATED BASE (1 EA REQ'D)

Continental Refrigerator D48GN

Refrigerator Griddle Stand, one-section, (2) drawers, accommodates (2) 12" x 20" x 6", stainless steel top with drip guard marine edge, stainless steel exterior & interior, electronic control with digital display, hi-low alarm, high/low temperature alarm, self-contained refrigeration, R290 hydrocarbon refrigerant, 1/5 HP, 10' cord, cETLus, NSF, ENERGY STAR®

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	1		Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	1		115v/60/1-ph, 2.5 amps, cord, NEMA 5-15P, standard
Continental Refrigerator	1		Condensing unit on the right, standard
Continental Refrigerator	1		Casters, 3" diameter, 4"H overall, standard
Continental Refrigerator	1		Stainless steel top extension, 3"
Continental Refrigerator	1		right side

GRIDDLE STAND REFRIGERATOR

Model: D48GN

Natural Refrigerant R-290 Model

48” Griddle Stand Refrigerator

ENERGY STAR® Qualified Commercial Refrigerator

Stainless steel exterior and interior, reinforced stainless steel work top with drip guard marine edge and stainless steel case back.

Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**



Options and Accessories

(upcharge and lead times may apply)

Flat top in lieu of marine edge	Integral heat shield top
16 gauge stainless steel top (flat or marine)	Cylinder locks
Top extensions (flat or marine edge)	Doors in lieu of drawers
Condensing unit on left (standard on right)	Special electrical requirements (consult factory)

Consult factory for other model configurations, options and accessories.

Standard Model Features

REFRIGERATION SYSTEM

- Performance rated refrigeration system
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Automatic, hot gas condensate evaporator
- Non-corrosive, plasticized fin evaporator coil
- Easily serviceable, front slide outcondensing unit

CABINET ARCHITECTURE

- High density, non-CFC polyurethane foamed-in-place insulation
- Easy glide, fully extendable drawers designed to hold 6” deep pans side-by-side
- Smooth, polished chrome drawer handles
- One-piece, snap in magnetic Santoprene™ drawer gaskets
- Heavy duty drawer track with built in drawer safety clips
- Drawers designed to hold 250 lb. capacity
- (2) drawer pan divider bars*
- 4” casters on support plates

* Pans supplied by others

MODEL FEATURES

- Electronic control, off-cycle defrost
- Front breathing

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	9.0 (255 cu l)
Width, Overall (inches)	48 (1219 mm)
Depth, Overall (inches) (including handles)	35 (897 mm)
Height, Overall (inches) (including 4" casters)	26 (670 mm)
Number of Drawers	2

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/5
Capacity (BTU per hour)*	1620

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	2.5 (1.9)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

Weight (pounds)	450 (204 kg)
Height - Crated (inches)	30 (762 mm)
Width - Crated (inches)	64 (1626 mm)
Depth - Crated (inches)	39 (991 mm)

DRAWER PAN DIVIDERS (supplied with model)

CM2-0764	2 (one per drawer)

See drawer pan configurations on right (**pans not supplied**). For other drawer pan configurations, consult factory.

TOP WEIGHT CAPACITY

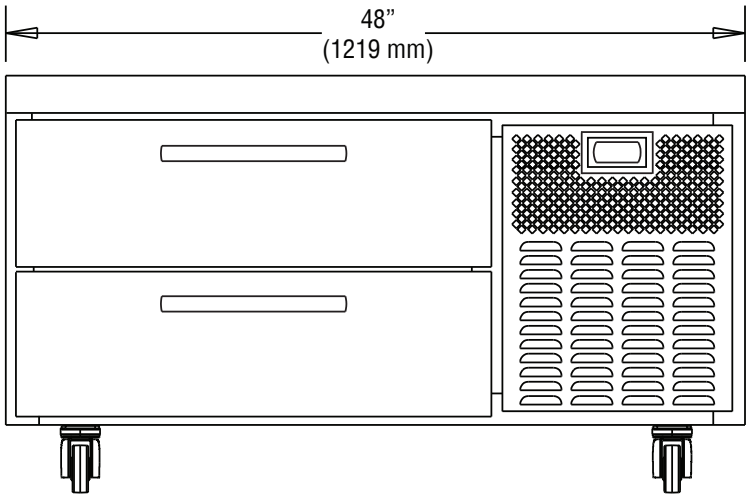
Max. Top Weight Capacity (pounds)	775 (352 kg)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.

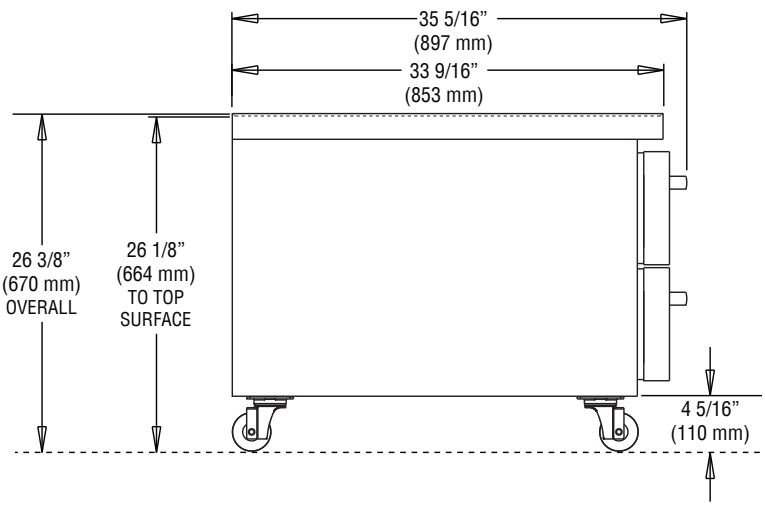


Equipped with one NEMA-5-15P Plug (varies by country)

Model Plan Views

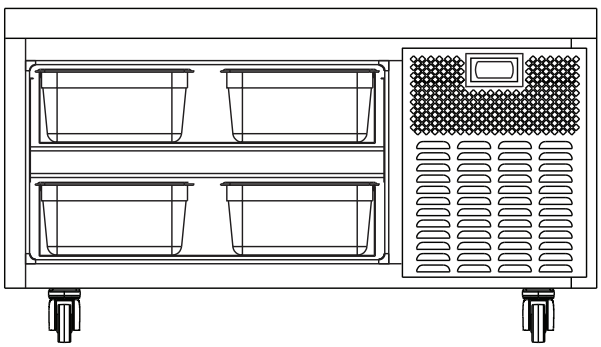


FRONT VIEW



SIDE VIEW

Shown with (4) 12 x 20 x 6 pans (**not supplied**).



DRAWER PAN CONFIGURATION

Continental Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

PROUDLY DESIGNED & ASSEMBLED IN THE U.S.A.

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REVISED: 2/8/24

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K51.1 - WHEEL PLACEMENT (1 ST REQ'D)

Dormont PS

(PS) Dormont Safety-Set, equipment placement system for all caster-mounted equipment, allows precise, consistent equipment placement under the fire suppression and ventilation systems, satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3), includes two (2) units and hardware pack

Safety-Set™

Always on the mark™

Positioning System for Foodservice Equipment



How important is safety?

Every commercial kitchen is designed to meet specific codes and standards to ensure the highest level of safety. One area of code that is receiving stricter enforcement by inspectors is cooking equipment placement in relation to the fire suppression and ventilation systems.

CODE ALERT ***NFPA Codes 17A (5.6.4) and 96 (12.1.2.3) require that a means be present to ensure cooking equipment is always positioned in its design specified location in relation to the fire suppression and ventilation systems during cooking operations.***

Correct equipment placement allows the fire safety systems to effectively protect the kitchen and its staff in the event of a fire.

How important is consistent equipment placement?

Caster-mounted equipment such as warming carts can be placed anywhere in a commercial kitchen, but often it is difficult to keep the equipment in the same location consistently. With each use, equipment in a line can shift positions leading to inefficient use of available space and additional time requirements to reorganize the line.

If safety and consistent equipment placement are priorities in your kitchen, an equipment placement system is the solution for you.

Safety-Set™ by Dormont is the newest advancement in placement systems delivering maximum functionality to ensure your equipment is **always on the mark™!** Designed for use with all commercial kitchen caster-mounted equipment, Safety-Set allows equipment to be consistently returned to its desired or design specified location after every cleaning or maintenance.







Benefits:

- Can be used with all caster-mounted equipment
- Open floor design allows all casters to rest level on the floor to ensure even cooking
- Satisfies NFPA codes 17A (5.6.4) and 96 (12.1.2.3)
- Fast, easy installation with choice of adhesive foam tape or thumb screw hardware pack (both included)

Recommended Applications:

- Gas & Electric Cooking Equipment
- Holding & Warming Carts
- Food Transportation Carts
- Salad Bars
- Mobile Refrigerators & Freezers
- Banquet Carts

NSF



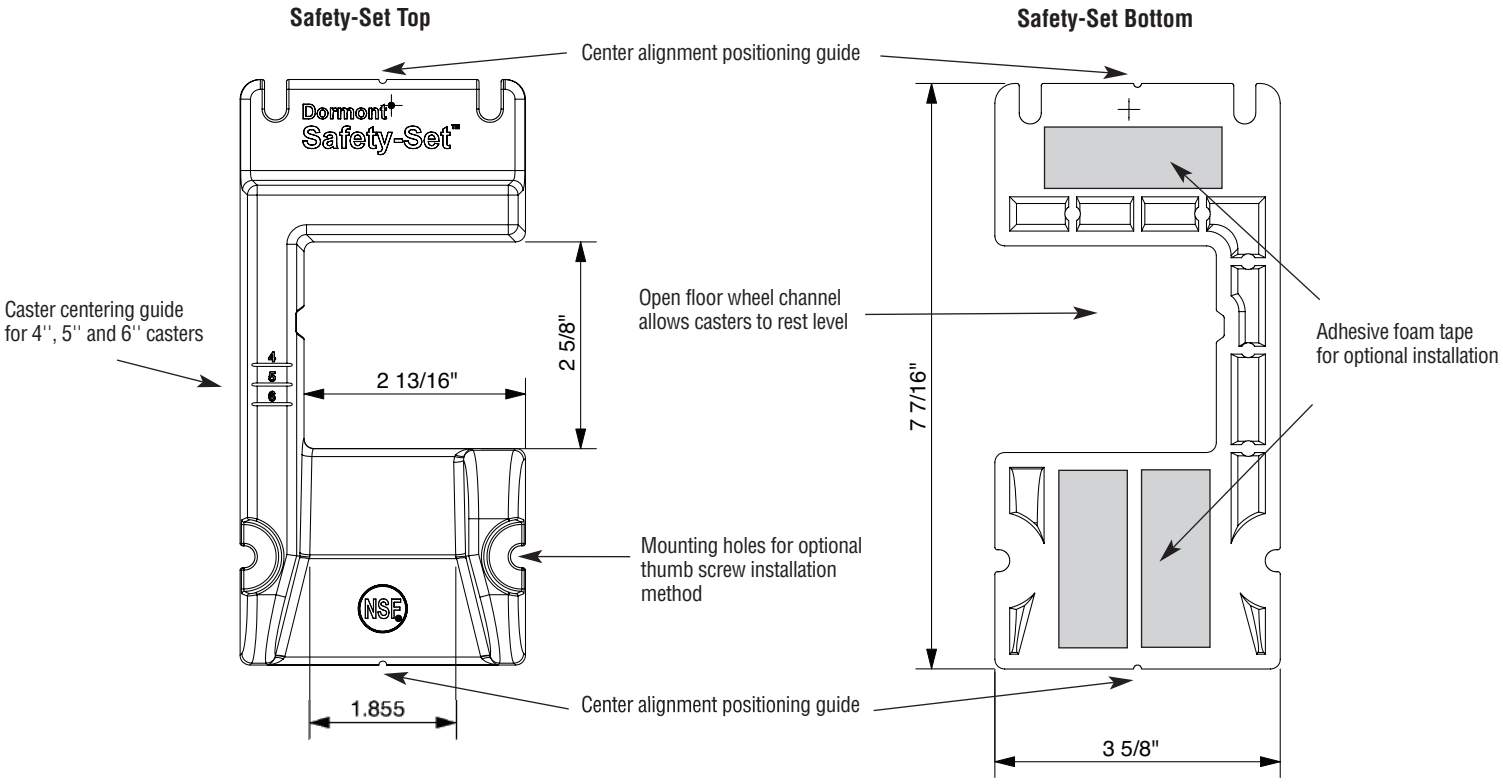
*Next Day Shipping Available!**

*Additional fees and terms may apply. Orders must be received before 12 pm est for next day delivery. Dormont reserves the right to limit quantities.

1-800-DORMONT • www.dormont.com Dormont®

Safety-Set

Precise, Consistent Equipment Placement After Every Cleaning





Two installation methods to choose from!

Each Safety-Set system includes both the adhesive foam tape and the thumb screw hardware pack for your convenience.



Thumb Screw Hardware Pack



Adhesive Foam Tape

Features:

- Compatible with 4'', 5'' and 6'' casters
- Ideal for new and existing applications
- Certified to NSF/ANSI Standard 169-Special Purpose Food Equipment & Devices
- Composed of a flame retardant PC/ABS injection molded blend
- Able to withstand 1,000 lbs. of crush force



PART OF THE

Dormont Safety System

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K52 - GAS FLOOR FRYER (1 EA REQ'D)

Vulcan 1GR45M-QS

Fryer, gas, 15-1/2" W, free-standing, 45-50 lbs. capacity, millivolt thermostat controls, twin baskets, stainless steel cabinet & fry tank, adjustable casters (2 swivel locking & 2 non-locking), 120,000 BTU, CSA Star, CSA Flame, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		10 year limited tank warranty
Vulcan	1		Gas type to be specified

Project _____

AIA # _____ SIS # _____

Item # _____ Quantity _____ C.S.I. Section 114000

1GR45 SERIES
FREE STANDING GAS FRYER



Model 1GR45M

SPECIFICATIONS

45 - 50 lbs. capacity free standing gas fryer, Vulcan Model No. 1GR45M Stainless steel cabinet. Set of four 6" adjustable casters (2 locking). Stainless steel fry tank with four heat exchanger tubes and a “V” shaped cold zone. 1¼" full port ball type drain valve. Twin fry baskets with plastic coated handles. 120,000 BTU/hr. input. Millivolt (M) control system. Tank brush, stainless steel crumb scoop and clean-out rod.

Overall Dimensions:
15½"W x 30¼"D x 47 ⅛"H. Working height 36¼".

CSA design certified. NSF listed

SPECIFY TYPE OF GAS WHEN ORDERING
- ❑ Natural Gas
- ❑ Propane Gas

SPECIFY ALTITUDE
- ❑ Natural Gas for above 2000 ft
- ❑ Propane Gas for above 3500 ft

MODELS

- ❑ **1GR45M:** Behind the door millivolt thermostat control adjusts from 200° to 400°F.

STANDARD FEATURES

- Stainless steel fry tank, 45 - 50 lb. capacity
- 1¼" full port ball type drain valve
- Stainless steel cabinet
- Set of four 6" adjustable casters (2 locking)
- Twin fry baskets with plastic coated handles
- 120,000 BTU/hr. input
- Four heat exchanger tubes positioned for easy cleaning
- Hi-limit shut-off
- Combination gas shut-off valve and pilot safety system
- Tank brush, stainless steel crumb scoop and clean-out rod
- Ten year limited tank warranty
- One year limited parts and labor warranty

ACCESSORIES

- ❑ **COVER-TANK:** Stainless steel tank cover – doubles as a work surface top
- ❑ **CONNECT-KITVUL:** Connecting Kit(s) – Connects two fryers together (brackets, grease strip and hardware included)
- ❑ **VBASKET-SINGLE:** Single large basket – 13"W x 13¼"D x 6"H
- ❑ **BASKETS-TWINRD:** Set of twin baskets – 6½"W x 12¾"D x 6"H
- ❑ **3/4QD-HOSE-4:** ¾" x 4" Flexible gas hose with quick disconnect
- ❑ **VSPGARD-G/E:** 10" high stainless steel removable splash guard
- ❑ **FRYMATE-VX15:** add-on frymate warming station
- ❑ **CRUMB-SCREEN:** Crumb Screen mesh with handles
- ❑ **VULLEGS-PLTMNT:** Adjustable legs 6", set of 4

OPTIONS

- ❑ Second year extended limited parts and labor warranty.

GR SERIES FREE STANDING GAS FRYER - 1GR45

Approved by_____ Date_____ Approved by_____ Date_____

1GR45 SERIES
FREE STANDING GAS FRYER

INSTALLATION INSTRUCTIONS

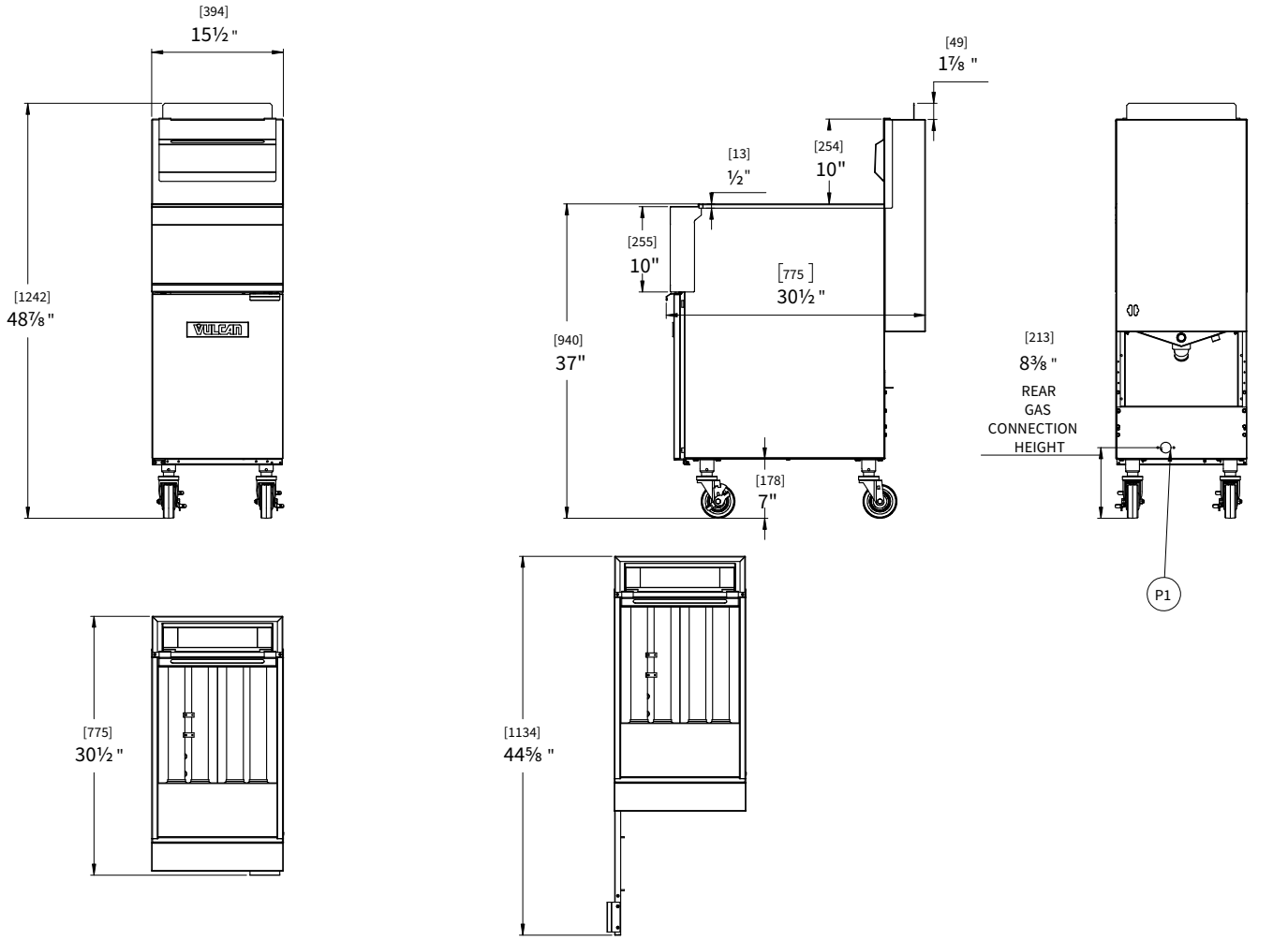
1. A combination valve with pressure regulator is provided with this unit.
   - Natural Gas
     Operating pressure – 4.0" W.C.
     Recommended supply pressure 7-9" W.C.
     Not to exceed 14" W.C. (1/2 PSI)
   - Propane Gas
     Operating pressure – 10.0" W.C.
     Recommended supply pressure 11-12" W.C.
     Not to exceed 14" W.C. (1/2 PSI)
2. An adequate ventilation system is required for Commercial Cooking Equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269. When writing refer to NFPA No. 96.
3. All models require a 6" (152 mm) clearance at both sides and rear adjacent to combustible construction.
4. All models require a 16" (407 mm) minimum clearance to adjacent open top burner units.
5. This appliance is manufactured for commercial installation only and is not intended for home use.

SERVICE CONNECTIONS:

(P1) ½" (13 mm) ID and ¾" (19 mm) OD rear gas connection.

(E1) NEMA 5-15P 120 Volt cord & plug supplied with fryers.

NOTE: In line with its policy to continually improve its product, Vulcan reserves the right to change materials and specifications without notice.



MODEL	Width	Depth	Overall Height	Working Height	Tank Size	BTU/hr.	Fry Comp. Capacity	Approx. Shipping Weight
1GR45	15½"	30¼"	47⅛"	36 ¼"	14" x 14"	120,000	45 - 50 lbs.	215 lbs.

This appliance is manufactured for commercial use only and is not intended for home use.

As continued product improvement is a policy of Vulcan, specifications are subject to change without notice.

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K52.1 - BLUE HOSE GAS CONNECTOR KIT (1 KT REQ'D)

Dormont 1675KITS48PS

Dormont Blue Hose™ Moveable Gas Connector Kit, 3/4" inside dia., 48" long, covered with stainless steel braid, coated with blue antimicrobial PVC, (1) SnapFast® QD, (1) Swivel MAX®, (1) full port valve, (1) elbow, (1) pair Safety Set® with hardware mounting options, limited lifetime warranty

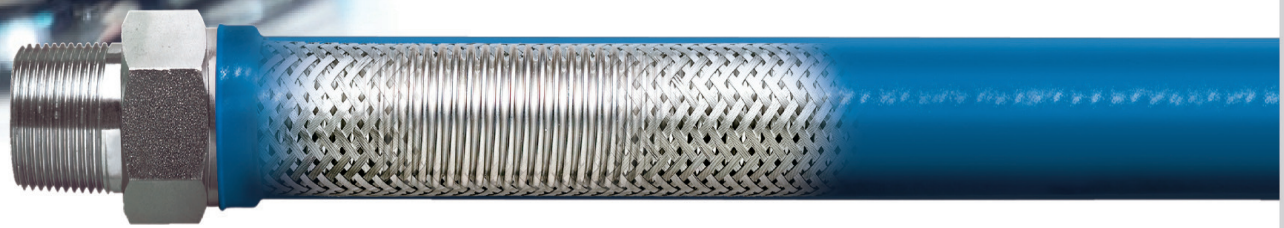
Item #K52.1
1675KITS48PS
Dormont
Page: 164
Oceancrest SN West Melbourne



Foodservice Moveable Equipment Installation Products

The Dormont Blue Hose™ is the heart of the Safety System, specifically engineered for caster-mounted commercial cooking equipment. The Blue Hose includes an antimicrobial protective PVC coating, and our Stress Guard® technology that makes the hose easier to install and dramatically reduces stress on the hose ends.

The fuel gas codes require the use of an ANSI Z21.69/CSA 6.16 moveable gas connector with all appliances that may or may not utilize casters and, under normal use, are moved on a regular basis for service, positioning or area cleanliness.



STRESS GUARD TECHNOLOGY
Rotation technology reduces stress on both ends of the hose

Stainless Steel Construction
Heavy-duty, flexible, corrugated 304 stainless steel tubing

Stainless Steel Braid
Tight-weave braid prevents corrugations from stretching as equipment is moved

Antimicrobial PVC Coating
Inhibits growth of bacteria, mold and mildew on the gas connector





A Watts Water Technologies Company USA: 6015 Enterprise Drive, Export, PA 15632 • 1-800-DORMONT • Dormont.com

The Dormont Safety System™ is the first and only complete gas equipment connection system specifically engineered for the commercial kitchen. It is a complete system of connection products designed with the safety of your kitchen, the food you serve, your employees, and your business in mind.

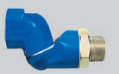
The Safety System includes the famous Dormont Blue Hose and our exclusive safety-based fittings - the SnapFast quick-disconnect, the Safety Quik quick-disconnect valve, and the Swivel MAX. Safe, unique, and affordable, the Dormont Safety System provides peace of mind for the gas connections in your commercial kitchen.



Safety Quik
- Prevents user from turning on gas while appliance is disconnected
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SnapFast
- One-handed quick-disconnect fitting
- Thermal shut-off when internal temperature exceeds 350°F (177°C)



SwivelMAX
- Reduces stress on connector
- Increases kitchen aisle space by allowing connector to be positioned closer to the wall



Restraining Cable
- Prevents transmission of strain to connector
- Provided 1' shorter than the gas connector



Safety-Set
Always on the mark
- Ensures cooking equipment is always positioned in design-specified location
- Fast installation with choice of adhesive foam tape or thumbscrews

S-BUYGUIDE-Front.indd 1
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Dormont® Moveable Commercial Equipment Kits

KIT SOLUTIONS	50 = ½" ID 75 = ¾" ID 100 = 1" ID 125 = 1-¼" ID PART NUMBER	BTU/hr Minimum Flow Capacity*	THE BLUE HOSE™	SnapFast® QUICK-DISCONNECT	Swivel MAX® 1st SWIVEL	Swivel MAX® 2nd SWIVEL	Safety Quik® VALVE	RESTRAINING CABLE
Standard Kit (KIT)[1] The Dormont Blue Hose™ SnapFast Quick-Disconnect Restraining Cable	1650KIT36	77K	√	√				√
	1650KIT48	68K	√	√				√
	1650KIT60	60K	√	√				√
	1675KIT36	218K	√	√				√
	1675KIT48	180K	√	√				√
	1675KIT60	158K	√	√				√
	16100KIT36	379K	√	√				√
	16100KIT48	334K	√	√				√
	16100KIT60	294K	√	√				√
Single Swivel MAX Kit (KITS)[2] The Dormont Blue Hose™ SnapFast Quick-Disconnect One Swivel MAX Swivel Restraining Cable	1650KITS36	72K	√	√	√			√
	1650KITS48	63K	√	√	√			√
	1650KITS60	56K	√	√	√			√
	1675KITS36	203K	√	√	√			√
	1675KITS48	167K	√	√	√			√
	1675KITS60	147K	√	√	√			√
	16100KITS36	353K	√	√	√			√
	16100KITS48	310K	√	√	√			√
	16100KITS60	274K	√	√	√			√
Double Swivel MAX Kit (KIT2S)[3] The Dormont Blue Hose™ SnapFast Quick-Disconnect Two Swivel MAX Swivels Restraining Cable	1650KIT2S36	69K	√	√	√	√		√
	1650KIT2S48	60K	√	√	√	√		√
	1650KIT2S60	54K	√	√	√	√		√
	1675KIT2S36	193K	√	√	√	√		√
	1675KIT2S48	160K	√	√	√	√		√
	1675KIT2S60	140K	√	√	√	√		√
	16100KIT2S36	336K	√	√	√	√		√
	16100KIT2S48	295K	√	√	√	√		√
	16100KIT2S60	261K	√	√	√	√		√
Safety Quik Kit (KITCF)[4] The Dormont Blue Hose™ Safety Quik Quick-Disconnect Restraining Cable	1650KITCF36	77K	√				√	√
	1650KITCF48	68K	√				√	√
	1650KITCF60	60K	√				√	√
	1675KITCF36	218K	√				√	√
	1675KITCF48	180K	√				√	√
	1675KITCF60	158K	√				√	√
	16100KITCF36	379K	√				√	√
	16100KITCF48	334K	√				√	√
	16100KITCF60	294K	√				√	√
Safety Quik Single Swivel MAX Kit (KitCFS)[5]	1650KITCFS36	72K	√		√		√	√
	1650KITCFS48	63K	√		√		√	√
	1650KITCFS60	56K	√		√		√	√
	1675KITCFS36	203K	√		√		√	√
	1675KITCFS48	161K	√		√		√	√
	1675KITCFS60	147K	√		√		√	√
	16100KITCFS36	353K	√		√		√	√
	16100KITCFS48	310K	√		√		√	√
	16100KITCFS60	274K	√		√		√	√

[1] Includes Full Port Gas Valve and (2) 90° Street Elbows
[2] Includes Full Port Gas Valve and (1) 90° Street Elbow
[3] Includes Full Port Gas Valve
[4] Includes (2) 90° Street Elbows
[5] Includes (1) 90° Street Elbow

Indicates most commonly stocked item

*BTU/hr Minimum Flow Capacity (0.64 Sp.Gr., 1000 BTU/ft^3 Natural Gas at 0.5" wc pressure drop)

ADDITIONAL CONFIGURATIONS ARE AVAILABLE IN OUR CATALOG.

Add PS to the end of any part number to include the Safety-Set® wheel placement system

We guarantee our commercial gas connectors for the life of the original appliance to which it is connected.

S-D-BUYGUIDE 1538

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Submittal Sheet

03/14/2025

ITEM# K53 - FRYMATE HOLDING STATION (1 EA REQ'D)

Vulcan FRYMATE VX15

Frymate™ Holding Station, free standing or add-on unit, 15-1/2" wide, 30-1/8" depth, stainless steel cabinet base, stainless steel top drain section with removable grease collector, set of 4 casters (2 locking), connecting strip & hardware

ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1	FOOD-WARMER	ThermoGlo™ Food Warmer, 120v

Item # _____ C.S.I. Section 11420

F R Y E R S

FRYMATE™
VX15 & VX21S



Frymate VX15
shown with optional ThermoGlo™ Food Warmer

STANDARD FEATURES

- Stainless steel cabinet
- Set of 4 adjustable casters (2 locking)
- Stainless steel sloped drain top with removable grease collector
- One year limited parts and labor warranty

ACCESSORIES (Packaged & Sold Separately)

☐ Tank cover (works as solid top work surface)
- **COVER-TANK:** FRYMATEVX15
- **COVER-TANK85:** FRYMATE VX21S

☐ Food Warmer with 2 year warranty

COMPATIBILITY

☐ **FRYMATEVX15:** All 35, 45 and 65 lb. fryers

☐ **FRYMATEVX21S:** All 85 lb. fryers

SPECIFICATIONS

Free standing or "Add-On" Frymate™, Vulcan-Hart Models: FRYMATE-VX15 and VX21S. These "Add-On" accessory Frymates can be securely attached to any gas or electric free-standing fryer or KleenScreen *PLUS*® fryer battery. "Add-On" a Frymate to the left or right side of a fryer, or both sides. 18 gauge steel body with stainless steel cabinet. Set of 4 casters (2 locking). Stainless steel sloped drain top with removable grease collector to allow for easy removal of food products, clean up and is dishwasher safe. Easy access storage area behind door. Grease strips, brackets, and hardware standard with every Frymate.

Overall Dimensions:

FRYMATEVX15 = 15½"w x 30⅛"d x 36¼"h working height.

FRYMATEVX21S = 21"w x 34⅜"d x 36¼"h working height.

NSF listed.

VULCAN
a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

F R Y E R S

FRYMATE™
VX15 & VX21S

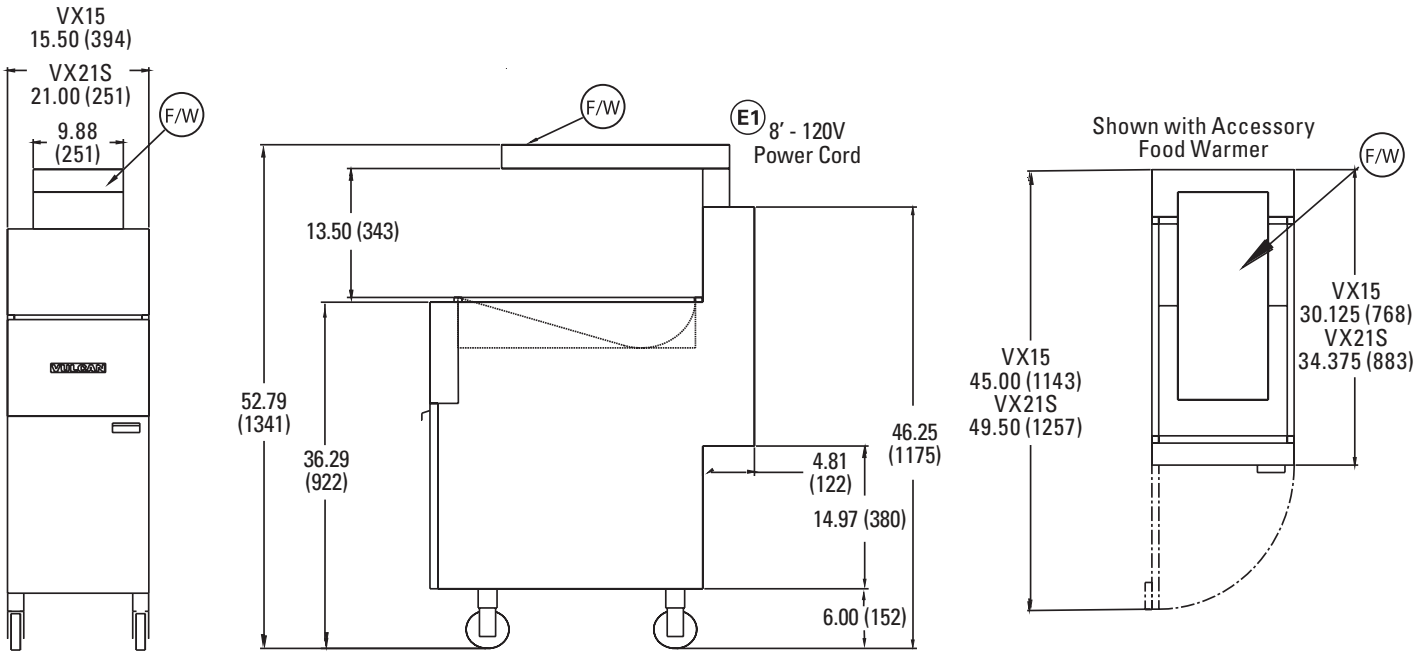
INSTALLATION INSTRUCTIONS

1. An adequate ventilation system is required for Commercial Cooking Equipment. Information may be obtained by writing to the National Fire Protection Association, Batterymarch Park, Quincy, MA 02269. When writing refer to NFPA No. 96.
2. This appliance is manufactured for commercial installation only and is not intended for home use.

SERVICE CONNECTIONS:

(E1) 8', 120 volt power cord supplied on optional food warmer. NEMA 5-15P, 120/60/1, 9 amps electrical connection, 48¼" from floor.

NOTE: In line with its policy to continually improve its product, Vulcan reserves the right to change materials and specifications without notice.



Model	Width	Depth	Overall Height	Working Height	Tank Size	BTU/HR	Fry Comp. Capacity	Approx. Shipping Weight
FRYMATEVX15	15.50"	30.125"	46.25"	36.25"	N/A	N/A	N/A	122 lbs. (55 kg)
FRYMATEVX21S	21.00"	34.375"	46.25"	36.25"	N/A	N/A	N/A	173 lbs. (78 kg)

This appliance is manufactured for commercial use only and is not intended for home use.

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P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

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Submittal Sheet

03/14/2025

ITEM# K54 - SPARE NO.

<Spare No.>

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Submittal Sheet

03/14/2025

ITEM# K55 - SPARE NO.

<Spare No.>

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Submittal Sheet

03/14/2025

ITEM# K56 - REACH-IN DUAL TEMP CABINET (1 EA REQ'D)

Continental Refrigerator 1RFNHD

Refrigerator/Freezer, reach-in, one-section, 10 cu ft. refrigerator/10 cu. ft. freezer, self-contained refrigeration, stainless steel front, aluminum interior & ends, standard depth, (2) half-height solid self-closing doors, cylinder locks, electronic control with digital display, freezer can be adjusted to operate as low as -10°F, hi-low alarm, (4) epoxy-coated steel shelves, electric condensate evaporator, R290 Hydrocarbon refrigerant, dual 1/5 & 1/3 HP, cETLus, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	1		Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	1		115v/60/1-ph, 2.5 amps, cord & plug (refrigerator), standard
Continental Refrigerator	1		115v/60/1-ph, 5.7 amps, cord & plug (freezer), standard
Continental Refrigerator	1		Door hinged on left
Continental Refrigerator	1		5" Casters, standard

DUAL TEMP REFRIGERATOR/FREEZER

Model: 1RFNHD

Natural Refrigerant R-290 Model

1-Section Dual Temp Over/Under Reach-In Refrigerator/Freezer (0°F)

1RFNHD - Stainless steel front, aluminum end panels and interior
1RFNSAHD - Stainless steel exterior, aluminum interior
1RFNSSHD - Stainless steel exterior and interior



Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**

Standard Model Features

REFRIGERATION SYSTEM

- Separate, self contained, performance rated refrigeration systems
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Automatic, electric condensate evaporator

Freezer section: standard operating temperature is 0 to -5°F and can be adjusted to operate as low as -10°F in a 90°F ambient.

CABINET ARCHITECTURE

- 3” non-CFC polyurethane foam insulation
- Smooth, polished chrome workflow door handles
- Cam action, lift off hinges
- Self-closing doors
- Magnetic snap in Santoprene™ door gaskets
- Cylinder lock in each door
- Heavy duty, epoxy coated steel shelves
- 5” casters

MODEL FEATURES

- LED interior lighting
- Electronic controllers with digital display & hi-low alarm
- Off-cycle defrost (refrigerator section)
- Automatic electric defrost (freezer section)

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Options and Accessories

(upcharge and lead times may apply)

Stainless steel case back	Rehinging of doors (consult factory)
Additional epoxy coated steel shelves	Special electrical req. (consult factory)
Chrome or stainless steel shelves	**Correctional Facility Options**
Custom laminates	• One way security screws
Pan slide assemblies	• Locking hasp (lock not included)
Wine rack	• Stainless steel mesh cover
Adjustable Legs	• Coverless hinges
Heavy Duty Pilaster Strips	

Consult factory for other model configurations, options and accessories.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	10/10 (283/283 cu l)
Width, Overall (inches)	26 (660 mm)
Depth, Overall (inches) (including handles)	35 ⅜ (899 mm)
Depth (inches) (less doors)	32 (813 mm)
Depth (inches) (doors open 90°)	55 ½ (1410 mm)
Clear Door Width (inches)	19 ⅜ (492 mm)
Clear Half Door Height (inches)	27 ½ (699 mm)
Height, Overall (inches) (including 5" casters)	82 ¼ (2089 mm)
Number of Doors	2
Number of Shelves	4
Shelf Area (square feet)	20.4 (1.9 sq m)
Tray Slide Capacity (per half section)	11

REFRIGERANT DATA

Condensing Unit Size (H.P.)	⅕, ⅓
Capacity (BTU per hour)*	1940 / 1590

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3 / 3
Total Amps (International)	2.7 (2.9) / 5.9 (3.1)
Defrost Amps (International)	3.9 (2.2)
(2) 10 ft. Cord/Plug [attach.] (International)	Yes (No)

SHIPPING DATA

Height - Crated (inches)	85 ½ (2172 mm)
Width - Crated (inches)	31 ⅝ (803 mm)
Depth - Crated (inches)	42 (1067 mm)
Volume - Crated (cubic feet)	65 (1841 cu l)
Weight Std - Crated (pounds)	420 (191 kg)
Weight SS - Crated (pounds)	480 (218 kg)

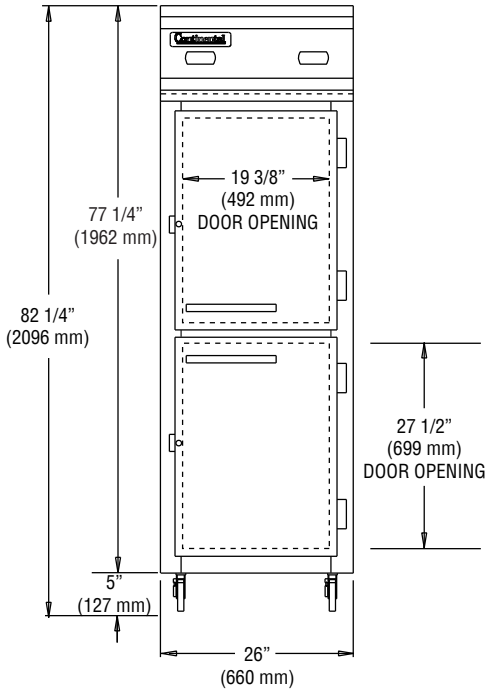
* Rating @ +25°F evaporator, 90°F ambient (refrigerator)
* Rating @ -15°F evaporator, 90°F ambient (freezer)

Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.

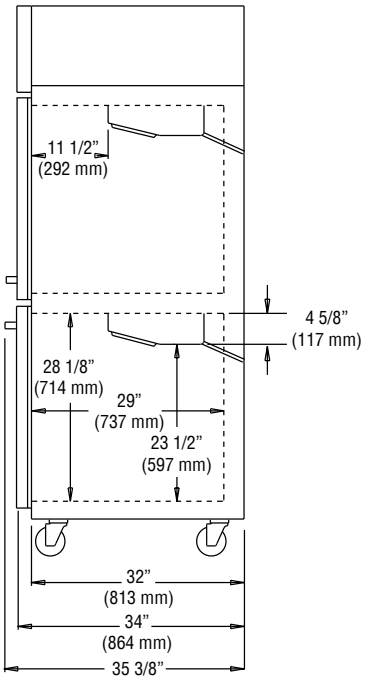


Equipped with two NEMA-5-15P Plugs (varies by country)

Model Plan Views



FRONT VIEW



SIDE VIEW

IMPORTANT NOTE: If the cabinet is located directly against a wall and/or under a low ceiling, a minimum clearance of 12" is required on top and 3" on sides and rear.

Continental Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

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REVISED: 1/5/2024

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K57 - MOBILE PLATE AND DISH DISPENSER (1 EA REQ'D)

Dinex DXPSBH2P

Colossus Heated Plate Dispenser, mobile, convection, (2) self-leveling adjustable cylinders, accommodates (75) 10-1/4" dia. china plates per silo, adjustable digital thermostat, thermostatic controls maintain plates at 180°F, 75 - 90 minute heating time, (2) soft-close hinged lids, fully insulated top & sides, stainless steel dispenser mechanisms with adjustable springs, push handle, heavy duty 304 stainless steel exterior, enclosed base, corner bumpers, (4) 5" swivel plate casters (2 with brakes), dual voltage, operates at 208v/60/1-ph, 3200 watts (15 amps),, cord, NEMA 6-20P

DINEX®

JOB _____ ITEM # _____

COLOSSUS PLATE AND WAX BASE HEATER AND DISPENSER

Compliant with NSF/ANSI Standard 2



DXPSBH2P

Item Numbers
DXPSBH2P
DXPSBH3P
DXPSBH2WB
DXPSBH3WB
DXPSBH2PWB

Application

Dinex Colossus Plate and Wax Base Heaters and Dispensers are heat retentive devices used in tray make up systems. An adjustable digital thermostat makes the unit compatible for low and high heat applications.

Standard Features

- Heavy-duty 304 high nickel 18-8 stainless steel construction
- 5" swivel plate casters
- Corner bumpers standard
- 3200 watts of converted forced air heat for faster heat up (thermostatically controlled)
- Field adjustable digital thermostat
- Gasketless lid seal design to maintain heat
- Self-leveling, field adjustable spring dispensing design allows easy access to bases and plates
- Two and three silo configurations
- Soft-close hinges

Construction

- The exterior is constructed of 304 high nickel 18-8 stainless steel and the frame is constructed of 18-gauge. The side and front panels are constructed of 18-gauge. The back panel is constructed of 18-gauge and the base is constructed of 14-gauge. Two (2) and three (3) silo models are available. Each tube holds approximately 45 plates or 60 bases.
- The fully insulated lids are constructed from 20-gauge stainless steel with a gasketless design.
- 5" polyurethane non-marking swivel casters (2 with brakes) are standard.
- The heating system is a forced air convection design that circulates thermostatically controlled super heated air evenly through the fully insulated cabinet. The dual voltage unit is designed to draw 3200 watts at 240 volts with 13.5 Amps and 3000 watts at 208 volts with 14.5 Amps. (4800 watts for 3 silo version)

Control System

Thermostatic controls to maintain plates at 180°F and bases at 300°F. The heating system recirculates the hot air horizontally to ensure rapid and efficient heating of the plates or bases. Full heating of the plates or bases is accomplished in 75 to 90 minutes.

Initial heat-up of a fully loaded is approximately 2 hours or less with reheat cycles to be 1-1/2 hours depending on wax base design.

Warranty

One year parts and labor.

We do not accept returns on any Dinex equipment or Dinex custom products. Please contact your local Dinex rep to ensure order accuracy prior to ordering.

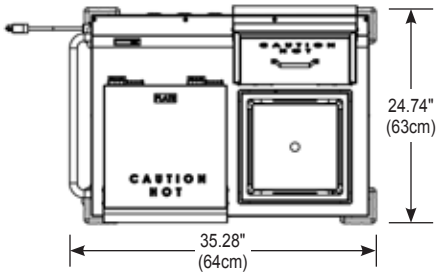
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4711 E. Hefner Road
Oklahoma City, OK 73131
800.654.8210 | 405.475.5600
www.dinex.com

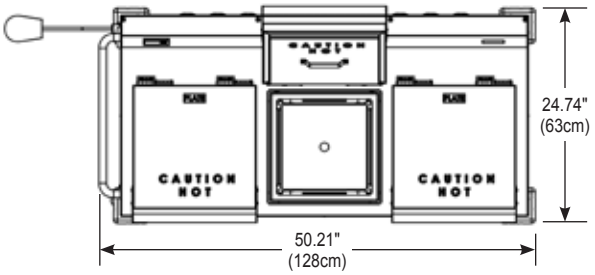
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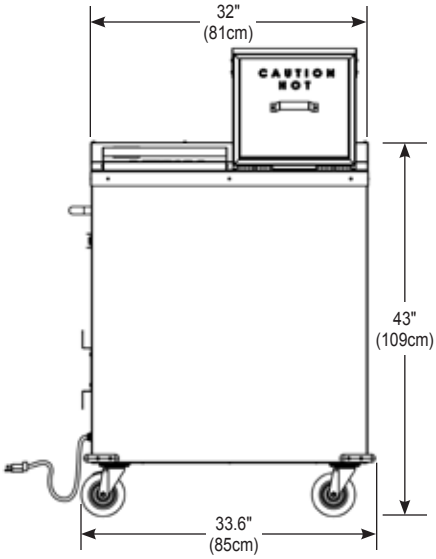
COLOSSUS PLATE AND WAX BASE HEATER AND DISPENSER



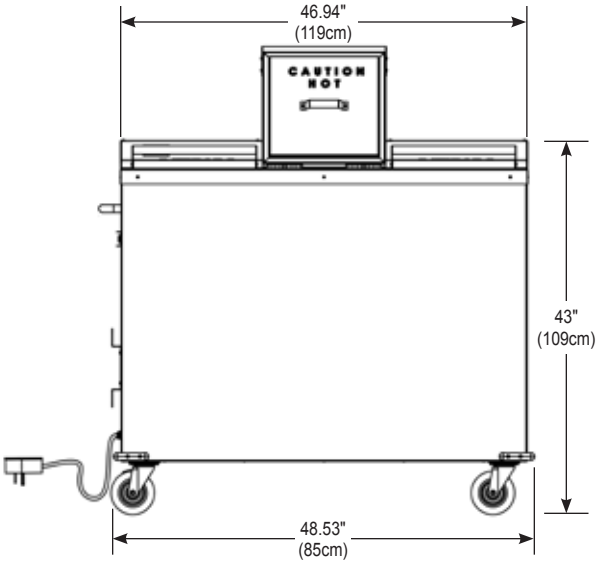
Nema 6-20P







DXPSBH2



DXPSBH3

Items and Dimensions

ITEM NUMBER	OVERALL WIDTH	OVERALL DEPTH	OVERALL HEIGHT*	NO. OF TUBES	APPROX. CAPACITY EA TUBE / TOTAL	WATTS	AMPAGE 208V	AMPAGE 240V	SHIP WEIGHT	SHIP CUBE
DXPSBH2P	35.28" (64cm)	24.75" (63cm)	43" (109cm)	2	75 / 150	3200	15.3	13.3	300 lbs (136kg)	22.40
DXPSBH3P	50.21" (128cm)	24.75" (63cm)	43" (109cm)	3	75 / 135	4800	23	20	425 lbs (193kg)	31.11
DXPSBH2WB	35.28" (64cm)	24.75" (63cm)	43" (109cm)	2	60 / 120	3200	15.3	13.3	300 lbs (136kg)	22.40
DXPSBH3WB	50.21" (128cm)	24.75" (63cm)	43" (109cm)	3	75 / 225	4800	23	20	425 lbs (193kg)	31.11
DXPSBH2PWB	35.28" (64cm)	24.75" (63cm)	43" (109cm)	3	75P / 60WB / 105	3200	15.3	13.3	300 lbs (136kg)	21.77

* Height includes casters

Please confirm that you have the most current specification sheet by visiting www.dinex.com.

It is Dinex's policy to offer equipment which is design certified by companies that have been accredited at the federal level by the Occupational Safety and Health Agency (OSHA) and ANSI as a national recognized testing laboratory. These companies include CSA International, Underwriters Laboratories, Edison Testing Laboratories and National Sanitation Foundation. However, a continuing program of product improvement makes it necessary to submit new models to the agencies as they are developed. Consequently, all models may not bear the appropriate labels at all times.

Dinex reserves the right to change specifications and product design without notice. Such revisions do not entitle the buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment.

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DINEX
4711 E. Hefner Road
Oklahoma City, OK 73131
800.654.8210 | 405.475.5600
www.dinex.com

Rev 06/2020

Colossus Plate & Base Heater



Hot Plates. Hot Food.

The Colossus Heated Plate Dispenser is designed for heating china plates to 180°F and wax bases at 300°F in less than two hours. It's ideal for heating plates and bases to maintain hot food temperatures during delivery in conjunction with the Dinex Induction Heating System.



Benefits



Convection

Quick plate and base heating with even temperatures



Temperature Control

Clear temperature read-out for better temperature control



Self Leveling

Field adjustable spring dispensing design allows easy access to bases and plates



Durability

Stainless steel exterior and corner bumpers

DINEX



Prod No	Description	Dimensions W x D x H*	Approx. Capacity Ea Tube / Total	Pack
Colossus Plate & Base Heaters				
DXPSBH2P	2 Silo Heater for 10.25" Plates, Stainless Steel	35.28" x 24.75" x 43"	75 / 150	1 ea
DXPSBH3P	3 Silo Heater for 10.25" Plates, Stainless Steel	50.21" x 24.75" x 43"	75 / 135	1 ea
DXPSBH2WB	2 Silo Heater for Wax Bases, Stainless Steel	35.28" x 24.75" x 43"	60 / 120	1 ea
DXPSBH3WB	3 Silo Heater for Wax Bases, Stainless Steel	50.21" x 24.75" x 43"	75 / 225	1 ea
DXPSBH2PWB	2 Silo Heater for 10.25" Plates and Wax Bases, Stainless Steel	35.28" x 24.75" x 43"	75P / 60WB / 105	1 ea

*Height includes casters

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03/14/2025

ITEM# K58 - WORK TABLE (1 EA REQ'D)

Fabricated CUSTOM

18" wide x 38"work table with undershelf and flanged feet.

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Submittal Sheet

03/14/2025

ITEM# K59 - HOT FOOD SERVING COUNTER / TABLE (1 EA REQ'D)

Dinex DXP5HF

DineXpress™ Hot Food Unit, electric, 74"L x 36"H, (5) wells with 1000w element with thermostatically controlled each, mobile, modular design with interlocking mechanism, 14 gauge stainless steel top, 20 gauge stainless steel front & end panels, 18 gauge stainless steel bottom shelf, manifold drains standard, 5" swivel plate casters (2 with brakes), 5kW, NSF, UL

ACCESSORIES

Mfr	Qty	Model	Spec
Dinex	1		1 year warranty parts and labor from date of purchase
Dinex	1		208v/60/1-ph, 24.0 amps, 5000 watts, NEMA 6-30P
Dinex	1	DXPIND5	Manifold drains to master valve
Dinex	1	DXPAUTOFILL	Automatic water fill
Dinex	1	DXPSCB5	Cutting Board for DineXpress™ system, 8", for (5) openings - 74"W, stainless

DINEX®

JOB _____ ITEM # _____

DINEXPRESS HOT FOOD COUNTERS

Compliant with NSF/ANSI Standard 2



DXP3HF shown with optional 3-bar tray slide and formica finish

Item Numbers
DXP2HF
DXP3HF
DXP4HF
DXP5HF
DXP6HF

The versatile modular design of the DineXpress Serving System Hot Food Counters allows you to customize your cafeteria or a buffet line-up. Hot Food Counters are compatible and will interlock with other DineXpress units. This design allows the units to be disconnected for cleaning under the serving line. With DineXpress you choose only the options and accessories that you want and need for your line-up.

Dinex's equipment has the advantage of Food Safe technology and certification. This ensures that your food is kept out of the danger zone. Food spoilage occurs mainly because of rapidly accelerated bacteriological activity within the 40°F-140°F danger zone.

With Food Safe technology hot food stays above 140°F longer and cold food is kept below 40°F. Both are key factors in HACCP compliance and the fight against foodborne pathogens.

Standard Features

- 14-gauge stainless steel top with 1-1/2" turndown on all sides
- Top secured by four recessed bolts for easy access
- 14-gauge stainless steel legs fastened to
- 18-gauge stainless steel bottom shelf, open control side
- Open control side for additional storage capacity
- 20-gauge stainless steel end and front panels are attached to legs
- 20-gauge stainless steel bottom-mounted wells, 6-1/2" deep with coved corners
- 2" insulation on sides and between wells, 1-1/2" on bottom, 1" on the ends and 1/4" fiber frax all around
- 1000 watt tubular heating element for each well is individually and thermostatically controlled
- Wells can be run wet or dry
- 5" diameter swivel plate casters, 2 with brakes
- Interlocking mechanism is provided to interlock with other DineXpress units.
- Drain valve exits operator's left side as standard. Drain valve is 3/4" FPT.
- Common drains and manifolds

Dimensions

- DXP2HF – 36"H x 28"D x 32"L
- DXP3HF – 36"H x 28"D x 46"L
- DXP4HF – 36"H x 28"D x 60"L
- DXP5HF – 36"H x 28"D x 74"L
- DXP6HF – 36"H x 28"D x 88"L
- 36" height on all standard units
- 30" height is available on Petite Elite 500 units
- 28" width
- 32" to 88" length in 14" increments

Electrical

- Two, three and four well units are available, 120 volts
- All units available in 208 or 240 volt, single-phase standard
- Eight foot electrical cord and plug
- Some options or accessories may not be available with certain voltages

Common Options

- Pizzazz powder coating in lieu of stainless steel
- Tray slides
- Protector guards
- Hinged or sliding doors
- See reverse side for additional options

Warranty

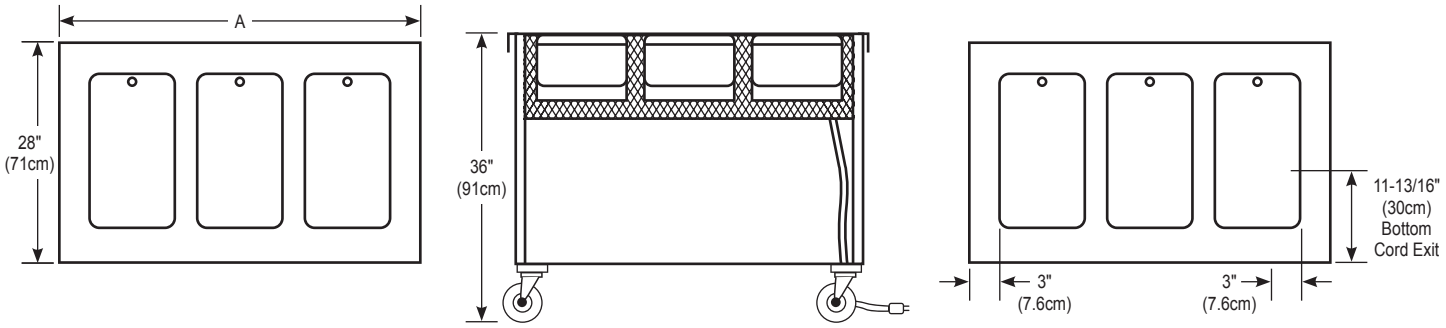
One year parts and labor.

We do not accept returns on any Dinex equipment or Dinex custom products. Please contact your local Dinex rep to ensure order accuracy prior to ordering.

DINEX®
4711 E. Hefner Road
Oklahoma City, OK 73131
800.654.8210 | 405.475.5600
www.dinex.com

Rev 11/19

DINEXPRESS HOT FOOD COUNTERS



Items and Dimensions

						AMPS			NEMA CAP NUMBER			
ITEM NUMBER	NO. OF WELLS	LENGTH (A)	WIDTH	HEIGHT	WATTS	120V	208V	240V	120V	208V	240V	SHIP WEIGHT (LBS)
DXP2HF	2	32" (81cm)	28" (71cm)	36" (91cm)	2000	16.7	9.6	8.3	5-30P	6-15P	6-15P	300
DXP3HF	3	46" (117cm)	28" (71cm)	36" (91cm)	3000	25.0	14.4	12.5	5-50P	6-20P	6-20P	310
DXP4HF	4	60" (152cm)	28" (71cm)	36" (91cm)	4000	33.3	19.2	16.7	5-50P	6-30P	6-30P	335
DXP5HF	5	74" (188cm)	28" (71cm)	36" (91cm)	5000	N/A	24.0	20.8	N/A	6-30P	6-30P	375
DXP6HF	6	88" (224cm)	28" (71cm)	36" (91cm)	6000	N/A	28.8	25.0	N/A	6-50P	6-50P	400

Spacing between wells is 2". Floor clearance of unit is 6-1/4". Clearance height of open under storage is 17-3/4". Open under storage widths are 22-3/16", 36-3/16",50-3/16", 64-3/16" and 78-3/16".

Dimension Additions For Options

- Add 23-3/4" to height for buffet protector guard
- Add 14" to height for cafeteria protector guard
- Add 22-3/4" to height for double display shelf
- Add 8" to width for cutting board
- Add 12-3/4" to width for solid ribbed tray slide
- Add 12-1/2" to width for 3-bar tray slide

Note: Line-up drawing required when ordering false front, cashier stand or interconnected units.

ITEM NO	DESCRIPTION
DXPPPC	PIZZAZZ POWDER COATING
DXPSCB	8" stainless steel cutting board, flush with top
DXPMCB	8" maple cutting board, flush with top
DXPSRTS	Solid 3-ribbed tray slide, 16-gauge stainless steel
DXP3BTS	3-bar tray slide
DXPMBS	18" maple end bread shelf; left, right - flush with top
DXPSBS	18" stainless steel end bread shelf; left, right - flush with top
DXPHD	Hinged doors with solid bottom
DXPSD	Sliding doors with solid bottom
DXPCPG	Cafeteria protector guard (no heat or lights)
DXPCPGL	Cafeteria protector guard with incandescent lights
DXPCPGFL	Cafeteria protector guard with fluorescent lights
DXPCEG	Cafeteria end guards, right or left
DXPINT	Intermediate shelf
DXPFPB	Full perimeter bumper

ITEM NO	DESCRIPTION
DXPBPG1	Buffet single side protector guard (no heat or lights)
DXPBPG1IL	Buffet single side protector guard with incandescent lights
DXPBPG1FL	Buffet single side protector guard with fluorescentlights
DXPBEG	Buffet end guards, right or left
DXPBDD	Buffet double display two-sided protector guard
DXPBPGC	Classic protector guards
DXPCPGC	Cafeteria Style Classic Single protector guard
DXPBPG1C	Buffet Style Classic Single Sided protector guard
DXPSCPGC	Cafeteria Style Classic Single protector guards
DXPSSL	Legs in lieu of casters
DXPDOUT	Duplex outlet (120V, 15 AMP)
DXPFRMA	Formica laminate finish
DXPFLP	Filler Strips
DXPFF	Fill Faucet
DXPSKR	Skirting

Please confirm that you have the most current specification sheet by visiting www.dinex.com.

It is Dinex's policy to offer equipment which is design certified by companies that have been accredited at the federal level by the Occupational Safety and Health Agency (OSHA) and ANSI as a national recognized testing laboratory. These companies include CSA International, Underwriters Laboratories, Edison Testing Laboratories and National Sanitation Foundation. However, a continuing program of product improvement makes it necessary to submit new models to the agencies as they are developed. Consequently, all models may not bear the appropriate labels at all times.

Dinex reserves the right to change specifications and product design without notice. Such revisions do not entitle the buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment.

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03/14/2025

ITEM# K60 - WORK TABLE (1 EA REQ'D)

Fabricated CUSTOM

24" wide x 36"work table with undershelf and flanged feet.

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Submittal Sheet

03/14/2025

ITEM# K61 - TRAY ASSEMBLY COUNTER (1 EA REQ'D)

Custom CUSTOM

S/s tray assembly counter, 18" wide with double undershelf and flanged feet

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Submittal Sheet

03/14/2025

ITEM# K62 - DOUBLE OVERSHELF (1 EA REQ'D)

Fabricated CUSTOM

18" wide double overshelf, with microwave provision, mounted to items K60 and K58, with heat lamp, item K63 mounted under top shelf.

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Submittal Sheet

03/14/2025

ITEM# K63 - HEAT LAMP (1 EA REQ'D)

Hatco GRA-60

Glo-Ray® Infrared Strip Heater, 60" W, standard wattage, tubular metal heater rod, single heater rod housing, aluminum construction, 1050 watts, NSF, CE, cULus, Made in USA

ACCESSORIES

Mfr	Qty	Model	Spec
Hatco	1		120v/60/1-ph
Hatco	1	BLT TOG-1	(1) Built-in toggle control (remote recommended) (available at time of purchase only)
Hatco	1	STANDARD	Clear Anodized Aluminum housing, finish, standard (available at time of purchase only)

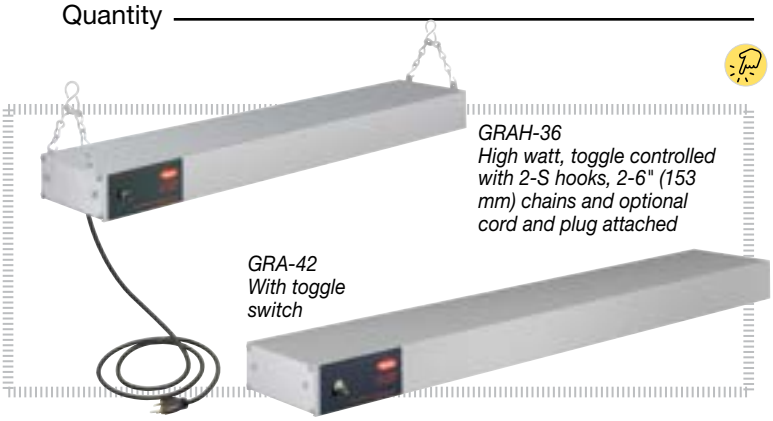
Project _____

Item # _____

Quantity _____

Glo-Ray® Aluminum Infrared Strip Heaters

Models: GRA-18, -24, -30, -36, -42, -48, -54, -60, -66, -72, -84, -96, -108, -120, -132, -144
GRAH-18, -24, -30, -36, -42, -48, -54, -60, -66, -72, -84, -96, -108, -120, -132, -144



Safely hold the temperature of your product without drying out or further cooking food with Hatco's Glo-Ray® Infrared Aluminum Strip Heaters. The end result is hot, fresh food that's ready-to-serve. The continuous aluminum housing and heavy-duty mountings ensure the durability and quality of Hatco products.

Standard features

- Prefocused heat pattern covers the entire holding surface
- Consistent holding temperatures with no "cold spots"
- Sturdy extruded aluminum housings that do not sag, in widths from 18" to 144" (457 to 3658 mm)
- Standard and high watt models available
- Reflector does not blacken, maintaining a consistent heat pattern
- Protective wire guards under heating element
- Insulation minimizes heat loss
- Factory assembled with mounting tabs, ready to install quickly and easily
- All units single phase only
- Additional reflector styles and lower wattage elements also available, please consult factory for more information

Options (available at time of purchase only)

6" (152 mm) Housing - *Designer* Color or Gloss Finish (clear Anodized Standard)⊗▪
☐Warm Red ☐Black ☐Gray Granite ☐White Granite
☐Navy Blue ☐Hunter Green ☐Antique Copper ☐Radiant Red
☐Glossy Gray ☐Bold Black ☐Gleaming Gold ☐Brilliant Blue

☐Indicator Light (not available as Built-In with Tandem Element option)

Power Leads - Extended beyond standard 3' (914 mm), conduit on 120V, 208V, 240V models only (must specify lead length)
☐1'-5' (305-1525 mm) ☐6'-10' (1829-3048 mm)
☐11'-15' (3352-4572 mm) ☐16'-20' (4877-6096 mm)

Sneeze Guard ☐9.375" (238 mm) - One side ☐9.375" (238 mm) - Two sides ☐14" (356 mm) - One side ☐14" (356 mm) - Two sides

☐No Control

Infinite Control (remote enclosure recommended) – consult factory if element rating exceeds 12.2 amps
☐Built-in (max. of 12.2 amps) (remote installation recommended)
☐Remote Infinite Switch (max. 12.2 amps)

Remote Control Enclosure (RMB) – *Designer* Color or Gloss Finish (clear Anodized Standard)⊗▪
☐Warm Red ☐Black ☐Gray Granite ☐White Granite
☐Navy Blue ☐Hunter Green ☐Antique Copper ☐Radiant Red
☐Glossy Gray ☐Bold Black ☐Gleaming Gold ☐Brilliant Blue

☐Adjustable Tubular Stands 10"-14" (254-356 mm) - Permanent, for hardwired installation

Non-Adjustable Tubular Stands (match housing color) choose clearance below
☐10" (254 mm) ☐12" (305 mm) ☐14" (356 mm) ☐16" (406 mm)

C-Leg Stands - Portable, for cord & plug installation
☐Standard Watt - 10" (254) clearance - for models up to 72" (1829 mm) wide
☐High Watt - 13.5" (343 mm) clearance - for models up to 72" (1829 mm) wide

T-Leg Stands - for models up to 72" (1829 mm) wide, specify clearance - Portable, for cord & plug installation
☐10" (254 mm) (Standard Watt) ☐13.5" (343 mm) ☐16" (406 mm) ☐18" (457 mm)

☐Attached 6' (1829 mm) Cord & Plug Set on 120V models up to 72" (1829 mm) wide require Standard Chain Mount Kit (two S hooks with two 6" (153 mm) lengths of chain) or add optional C-leg stands, or T-leg stands (see specific model for plug configuration)

☐Two S hooks with two 6" (153 mm) lengths of chain - Stationary, for cord & plug installation

☐Attached 6' (1829 mm) Cord & Plug Set on Export models up to 96" (2438 mm) wide

Accessories

Adjustable Angle Brackets (with clearance above unit)
☐1"-2" (25-51 mm) ☐7" (178 mm) - GRA models only

☐Chain Suspension

⊗ Non-standard colors are non-returnable

NOTE: Install Remote Box outside Heat Zone or damage will occur.

▪ **IFS anti-microbial coatings use naturally-occurring, environmentally sustainable, silver ions to help inhibit the growth of microbes on the powder coated surface. See www.hatcocorp.com/antimicrobial-paint for more information.**

For operation, location and safety information, please refer to the Installation and Operating Manual.

MADE IN THE USA

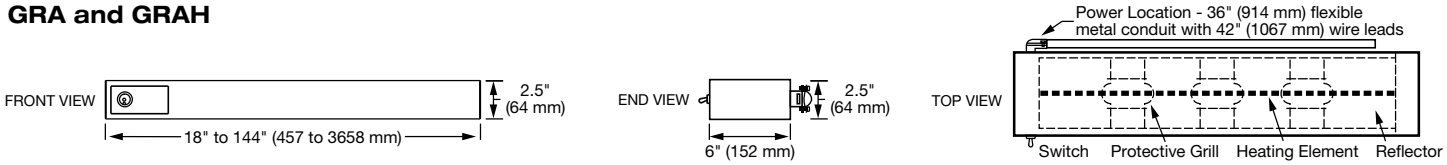
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Glo-Ray® Aluminum Infrared Strip Heaters

Models: GRA-18, -24, -30, -36, -42, -48, -54, -60, -66, -72, -84, -96, -108, -120, -132, -144
GRAH-18, -24, -30, -36, -42, -48, -54, -60, -66, -72, -84, -96, -108, -120, -132, -144

GRA and GRAH



SPECIFICATIONS

Glo-Ray® Aluminum Infrared Strip Heaters
Phase: All Single Phase
Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical information for International models

Standard Watt					High Watt					Both Models	
Model	Volts	Watt	Amps	Approx. Ship Weight●	Model	Volts	Watt	Amps	Approx. Ship Weight●	Plug (Optional)	Width x Depth x Height
GRA-18	120	250	2.1	7 lbs. (4 kg.)	GRAH-18	120	350	2.9	7 lbs. (4 kg.)	NEMA 5-15P	18" x 6" x 2.5" (457 x 153 x 64 mm)
	208		1.2			208		1.7		–	
	240		1.0			240		1.5			
	–	–	–			100	350	3.5		–	
	200	231	1.2			200	324	1.6			
	220	250	1.1			220	350	1.6		CEE 7-7 Schuko BS-1363	
	240		1.0			240		1.5			
	220-230 (CE)‡	250-273	1.1-1.2			220-230 (CE)‡	350-383	1.6-1.7			
	230-240 (CE)‡	230-250	1.0-1.0			230-240 (CE)‡	321-350	1.4-1.5			
GRA-24	120	350	2.9	7 lbs. (4 kg.)	GRAH-24	120	500	4.2	8 lbs. (4 kg.)	NEMA 5-15P	24" x 6" x 2.5" (610 x 153 x 64 mm)
	208		1.7			208		2.4		–	
	240		1.5			240		2.1			
	–	–	–			100	500	5.0		–	
	200	324	1.6			200	462	2.3			
	220	350	1.6			220	500	2.3		CEE 7-7 Schuko BS-1363	
	240		1.5			240		2.3			
	220-230 (CE)‡	350-383	1.6-1.7			220-230 (CE)‡	500-547	2.3-2.4			
	230-240 (CE)‡	321-350	1.4-1.5			230-240 (CE)‡	459-500	2.0-2.1			
GRA-30	120	450	3.8	8 lbs. (4 kg.)	GRAH-30	120	660	5.5	8 lbs. (4 kg.)	NEMA 5-15P	30" x 6" x 2.5" (762 x 153 x 64 mm)
	208		2.2			208		3.2		–	
	240		1.9			240		2.8			
	–	–	–			100	660	6.6		–	
	200	416	2.1			200	610	3.1			
	220	450	2.1			220	660	3.0		CEE 7-7 Schuko BS-1363	
	240		1.9			240		2.8			
	220-230 (CE)‡	450-492	2.1-2.2			220-230 (CE)‡	660-721	3.0-3.1			
	230-240 (CE)‡	413-450	1.8-1.9			230-240 (CE)‡	606-660	2.6-2.8			
GRA-36	120	575	4.8	9 lbs. (5 kg.)	GRAH-36	120	800	6.7	9 lbs. (5 kg.)	NEMA 5-15P	36" x 6" x 2.5" (914 x 153 x 64 mm)
	208		2.8			208		3.8		–	
	240		2.4			240		3.3			
	–	–	–			100	800	8.0		–	
	200	532	2.7			200	740	3.7			
	220	575	2.6			220	800	3.6		CEE 7-7 Schuko BS-1363	
	240		2.4			240		3.3			
	220-230 (CE)‡	575-629	2.6-2.7			220-230 (CE)‡	800-874	3.6-3.8			
	230-240 (CE)‡	528-575	2.3-2.4			230-240 (CE)‡	735-800	3.2-3.3			
GRA-42	120	675	5.6	10 lbs. (5 kg.)	GRAH-42	120	950	7.9	11 lbs. (5 kg.)	NEMA 5-15P	42" x 6" x 2.5" (1067 x 153 x 64 mm)
	208		3.2			208		4.6		–	
	240		2.8			240		4.0			
	–	–	–			100	950	9.5		–	
	200	624	3.1			200	878	4.4			
	220	675	3.1			220	950	4.3		CEE 7-7 Schuko BS-1363	
	240		2.8			240		4.0			
	220-230 (CE)‡	675-738	3.1-3.2			220-230 (CE)‡	950-1038	4.3-4.5			
	230-240 (CE)‡	620-675	2.7-2.8			230-240 (CE)‡	873-950	3.8-4.0			
GRA-48	120	800	6.7	11 lbs. (5 kg.)	GRAH-48	120	1100	9.2	11 lbs. (5 kg.)	NEMA 5-15P	48" x 6" x 2.5" (1219 x 153 x 64 mm)
	208		3.8			208		5.3		–	
	240		3.3			240		4.6			
	–	–	–			100	1100	11.0		–	
	200	740	3.7			200	1017	5.1			
	220	800	3.6			220	1100	5.0		CEE 7-7 Schuko BS-1363	
	240		3.3			240		4.6			
	220-230 (CE)‡	800-874	3.6-3.8			220-230 (CE)‡	1100-1202	5.0-5.2			
	230-240 (CE)‡	735-800	3.2-3.3			230-240 (CE)‡	1010-1100	4.4-4.6			

● Shipping weight includes packaging and does not include RMB.
‡ CE approved units for 220–230V utilize a 220V heating system; 230–240V CE units utilize a 240V heating system.

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Glo-Ray® Aluminum Infrared Strip Heaters

Models: GRA-18, -24, -30, -36, -42, -48, -54, -60, -66, -72, -84, -96, -108, -120, -132, -144
GRAH-18, -24, -30, -36, -42, -48, -54, -60, -66, -72, -84, -96, -108, -120, -132, -144

SPECIFICATIONS
Glo-Ray® Aluminum Infrared Strip Heaters

Phase: All Single Phase
Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical information for International models

Standard Watt					High Watt					Both Models	
Model	Volts	Watt	Amps	Approx. Ship Weight●	Model	Volts	Watt	Amps	Approx. Ship Weight●	Plug (Optional)	Width x Depth x Height
GRA-54	120	925	7.7	13 lbs. (6 kg.)	GRAH-54	120	1250	10.4	13 lbs. (6 kg.)	NEMA 5-15P	54" x 6" x 2.5" (1372 x 153 x 64 mm)
	208		4.4			208		6.0		–	
	240		3.9			240		5.2			
	200	855	4.3			200	1156	5.8		–	
	220	925	4.2			220	1250	5.7		CEE 7-7 Schuko BS-1363	
	240		3.9			240		5.2			
	220-230 (CE)‡	925-1011	4.2-4.4			220-230 (CE)‡	1250-1366	5.7-5.9			
	230-240 (CE)‡	850-925	3.7-3.9			230-240 (CE)‡	1148-1250	5.0-5.2			
GRA-60	120	1050	8.8	14 lbs. (7 kg.)	GRAH-60	120	1400	11.7	14 lbs. (7 kg.)	NEMA 5-15P	60" x 6" x 2.5" (1524 x 153 x 64 mm)
	208		5.0			208		6.7		–	
	240		4.4			240		5.8			
	200	971	4.9			200	1295	6.5		–	
	220	1050	4.8			220	1400	6.4		CEE 7-7 Schuko BS-1363	
	240		4.4			240		5.8			
	220-230 (CE)‡	1050-1148	4.8-5.0			220-230 (CE)‡	1400-1530	6.4-6.7			
	230-240 (CE)‡	964-1050	4.2-4.4			230-240 (CE)‡	1286-1400	5.6-5.8			
GRA-66	120	1160	9.7	16 lbs. (8 kg.)	GRAH-66	120 ↜	1560	13.0	16 lbs. (8 kg.)	NEMA 5-15P♣	66" x 6" x 2.5" (1676 x 153 x 64 mm)
	208		5.6			208		7.5		–	
	240		4.8			240		6.5			
	200	1073	5.4			200	1442	7.2		–	
	220	1160	5.3			220	1560	7.1		CEE 7-7 Schuko BS-1363	
	240		4.8			240		6.5			
	220-230 (CE)‡	1160-1268	5.3-5.5			220-230 (CE)‡	1560-1705	7.1-7.4			
	230-240 (CE)‡	1066-1160	4.6-4.8			230-240 (CE)‡	1433-1560	6.2-6.5			
GRA-72	120	1275	10.6	17 lbs. (8 kg.)	GRAH-72	120 ↜	1725	14.4	17 lbs. (8 kg.)	NEMA 5-15P♣	72" x 6" x 2.5" (1829 x 153 x 64 mm)
	208		6.1			208		8.3		–	
	240		5.3			240		7.2			
	200	1179	5.9			200	1595	8.0		–	
	220	1275	5.8			220	1725	7.8		CEE 7-7 Schuko BS-1363	
	240		5.3			240		7.2			
	220-230 (CE)‡	1275-1394	5.8-6.1			220-230 (CE)‡⊙	1725-1885	7.8-8.2			
	230-240 (CE)‡	1171-1275	5.1-5.3			230-240 (CE)‡⊙	1584-1725	6.9-7.2			
GRA-84	120 ↜	1500	12.5	19 lbs. (9 kg.)	GRAH-84	120 ↜	2050	17.1	19 lbs. (9 kg.)	–	84" x 6" x 2.5" (2134 x 153 x 64 mm)
	208		7.2			208		9.9			
	240		6.3			240		8.5			
	200	1387	6.9			200	1895	9.5		–	
	220-230 (CE)‡	1500-1640	6.8-7.1			220-230 (CE)‡⊙	2050-2241	9.3-9.7		CEE 7-7 Schuko BS-1363	
	230-240 (CE)‡	1377-1500	6.0-6.3			230-240 (CE)‡⊙	1883-2050	8.2-8.5			
GRA-96	120 ↜	1725	14.4	21 lbs. (10 kg.)	GRAH-96	120 ↜	2400	20.0	21 lbs. (10 kg.)	–	96" x 6" x 2.5" (2438 x 153 x 64 mm)
	208		8.3			208		11.5			
	240		7.2			240		10.0			
	200	1595	8.0			200	2219	11.1		–	
	220-230 (CE)‡	1725-1885	7.8-8.2			220-230 (CE)‡⊙	2400-2623	10.9-11.4		CEE 7-7 Schuko BS-1363	
	230-240 (CE)‡	1584-1725	6.9-7.2			230-240 (CE)‡⊙	2204-2400	9.6-10.0			
GRA-108✖⚯	120	1850	15.4	24 lbs. (11 kg.)	GRAH-108✖⚯	120	2500	20.8	23 lbs. (11 kg.)	–	108" x 6" x 2.5" (2743 x 153 x 64 mm)
	208		8.9			208		12.0			
	240		7.7			240		10.4			
	220	1850	8.4			220	2500	11.4			
	240		7.7			240		10.4			
GRA-120✖⚯	120	2100	17.5	26 lbs. (12 kg.)	GRAH-120✖⚯	120	2800	22.5	26 lbs. (12 kg.)	–	120" x 6" x 2.5" (3048 x 153 x 64 mm)
	208		10.1			208		13.5			
	240		8.8			240		11.7			
	220	2100	9.5			220	2800	12.7			
	240		8.8			240		11.7			

● Shipping weight includes packaging and does not include RMB.
‡ CE approved units for 220–230V utilize a 220V heating system; 230–240V CE units utilize a 240V heating system.
↜ 120V models with infinite switch require tandem (end-to-end) elements, consult factory for applications.
⚯ Glo-Ray models 108"–144" (2743-3048 mm) wide and 120V models of GRAH-84 and GRAH-96 contain tandem (end-to-end) elements that may be individually controlled.
✖ Not available with CE Mark.
♣ GRAH-66 and GRAH-72 require NEMA 5-20P cord for Canada.
⊙ Available with RMB or remote switch only.

Glo-Ray® Aluminum Infrared Strip Heaters

Models: GRA-18, -24, -30, -36, -42, -48, -54, -60, -66, -72, -84, -96, -108, -120, -132, -144
GRAH-18, -24, -30, -36, -42, -48, -54, -60, -66, -72, -84, -96, -108, -120, -132, -144

SPECIFICATIONS

Glo-Ray® Aluminum Infrared Strip Heaters
Phase: All Single Phase
Amps: Amps on all models can vary based on configuration – please consult factory.

The shaded areas contain electrical information for International models

Standard Watt					High Watt					Both Models	
Model	Volts	Watt	Amps	Approx. Ship Weight▲	Model	Volts	Watt	Amps	Approx. Ship Weight▲	Plug (Optional)	Width x Depth x Height
GRA-132✖○○	120	2320	19.3	30 lbs. (14 kg.)	GRAH-132✖○○	120	3120	26.0	31 lbs. (14 kg.)	–	132" x 6" x 2.5" (3353 x 153 x 64 mm)
	208		11.2			208		15.0			
	240		9.7			240		13.0			
	220	2320	10.5			220	3120	14.2			
	240	2320	9.7			240	3120	13.0			
GRA-144✖○○	120	2550	21.3	33 lbs. (15 kg.)	GRAH-144✖○○	120	3450	28.8	48 lbs. (22 kg.)	–	144" x 6" x 2.5" (3658 x 153 x 64 mm)
	208		12.3			208		16.6			
	240		10.6			240		14.4			
	220	2550	11.6			220	3450	15.7			
	240	2550	10.6			240	3450	14.4			

▲ Shipping weight includes packaging and does not include RMB.
○○ Glo-Ray models 108"–144" (2743-3048 mm) wide and 120V models of GRAH-84 and GRAH-96 contain tandem (end-to-end) elements that may be individually controlled.
✖ Not available with CE Mark.

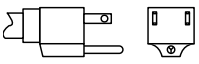
TOGGLE SWITCH
Toggle Switch: Max. 15 amps. Location: Chef's left side standard, other options available.

INFINITE SWITCH
Max. 12.2 amps

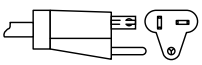
LEADS
36" (914 mm) flexible metal conduit with 42" (1067) wire leads.
USA/Canada: 3' (914 mm) conduit with leads – server's right.
Export/Euro: 6" (152 mm) leads – server's right.

PLUG CONFIGURATIONS
Please refer to electrical specification chart.

NEMA 5-15P



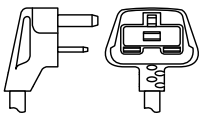
NEMA 5-20P



CEE 7-7 Schuko



BS-1363



RECOMMENDED MOUNTING HEIGHTS
(Refer to the Installation section of the Manual on the Hatco website)
Standard Watt: 8"-11" (203-279 mm) **High Watt:** 11"-14" (279-356 mm)

MINIMUM CLEARANCES
Combustibles
Below overshelf:1" (25 mm) clearance.
Unit to surface below: High watt, 13.5" (343 mm) or Standard watt - 10" (254 mm).
Unit to wall: 3" (76 mm).

Non-Combustibles
Hardwired with Built-In Switches:
Must be installed in a pass through area.
Below overshelf: 1" (25 mm) clearance.
Unit to surface below:
High watt with infinite control or indicator light - 10" (254 mm).
High watt with On/Off toggle switch - 8" (203 mm).

Corded Units with Built-In Switches:
Must be installed in a pass through area.
Below overshelf: 3" (76 mm) clearance.
Unit to surface below: High watt: 11" (279 mm) or Standard watt: 10" (254 mm).

Hardwired Units with Remote Switches:
May be installed against a non-combustible back wall and flush to an overshelf.
Unit to surface below: 8" (203 mm).
Setback from the front of an overshelf: Maximum 10" (254 mm).

REMOTE CONTROL ENCLOSURES
RMB series uses one Control Box per Strip Heater - If RMB2 series is used, multiple warmers can be controlled from one box (U.S., Canada only). CE models require any remote switches be contained in a Remote Control Enclosure.

Click here to download the RMB Choose Remote Box Excel Spreadsheet
or follow this file path: www.hatcocorp.com > Resources > Choose Remote Box

Model	Width	Maximum Infinite/Toggle Switches	
		U.S., Canada, Export U.S. Dollar	Euro
RMB-3	6" (150 mm)	1 infinite or 2 toggle	1 infinite or 2 toggle
RMB-7	9.375" (239 mm)	2 infinite or 4 toggle	2 infinite or 3 toggle
RMB-14	14.375" (366 mm)	4 infinite or 6 toggle	4 infinite or 4 toggle
RMB-16	16.375" (417 mm)	4 infinite with 1 toggle	–
RMB-20	20.375" (518 mm)	4 infinite with 3 toggle	–
RMB2-1R	11" (279 mm)	1 toggle, 1 infinite, 1 relay, 1 indicator light	–
RMB2-2R	14" (356 mm)	1 toggle, 1 infinite, 2 relays, 1 indicator light	–

PRODUCT SPECS
Infrared Foodwarmers
The Infrared Foodwarmer shall be a Glo-Ray®, manufactured by the Hatco Corporation, Milwaukee, WI 53234 U.S.A.

The Strip Heater shall be a Glo-Ray model ... , rated at ... watts, ... volts, single phase and be ... inches (millimeters) in overall width. The Glo-Ray shall consist of an aluminum housing and include as standard equipment four stainless steel shelf mounting tabs and an on-off switch may be optionally installed remotely or to either the front or rear of the unit. The infrared heating element shall be tubular metal sheathed. The foodwarmer shall be factory assembled ready for electrical installation. Options and accessories shall include adjustable or non-adjustable tubular stand, C-leg stand, T-leg stand, angle brackets, suspension chain and fittings, sneeze guard, cord and plug set, indicator light, and infinite control – remote or built-in. The Housing and RMB shall have Optional *Designer* Color or Gloss Finish anti-microbial paint.

Warranty consists of 24/7 parts and service assistance (U.S. and Canada only).

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K64 - MICROWAVE OVEN (1 EA REQ'D)

ACP RCS10DSE

Amana® Commercial Microwave Oven, 1.2 cu. ft. capacity, 1000 watts, medium volume, 10-min. dial timer, (4) power levels, non-removable air filter, side hinged door with tempered glass, accommodates 14" plate, stainless steel exterior & interior, 120v/60/1-ph, 13.0 amps, 15 MCA, 1550 watts (total), NEMA 5-15P, cETLus, ETL-Sanitation

ACCESSORIES

Mfr	Qty	Model	Spec
ACP	1		3-year limited warranty (1 year full)

Amana® Commercial

Project #:_____

Item #:_____

AIA File #:

Specification #:

Medium Volume

Amana Commercial Microwave Model RCS10DSE



Model RCS10DSE shown

Medium Volume
This category of microwave is ideal for...

Applications:
- Coffee shops
- Ethnic restaurants
- Concessions
- Dessert stations

All ACP, Inc. commercial ovens are backed by our Culinary Center. Call us with any question regarding food preparation, menu development and cooking times. 866-426-2621.

Culinary Center ACP

Power Output

- 1000 watts of power.
- Four power levels.

Easy to Use

- User friendly ten minute dial timer lights up for at-a-glance monitoring.
- Timer automatically resets to zero if door is opened during heating. User option allows manual reset to zero.
- See-through door and lighted interior for monitoring without opening the door.
- 1.2 cubic ft. (34 liter) capacity accommodates a 14" (356 mm) platter, prepackaged foods and single servings.
- Stackable to save valuable counter space.

Easy to Maintain

- Stainless steel exterior and interior for easy cleaning and a commercial look.
- Constructed to withstand the foodservice environment.
- Non-removable air filter protects oven components.
- Backed by the ACP, Inc. 24/7 ComServ Support Center, 866-426-2621.
- ETL Listed.

C ETL LISTED US Intertek

ETL SANITATION LISTED Intertek

Part No. 20154733
Updated 6/17/16
Original Instructions

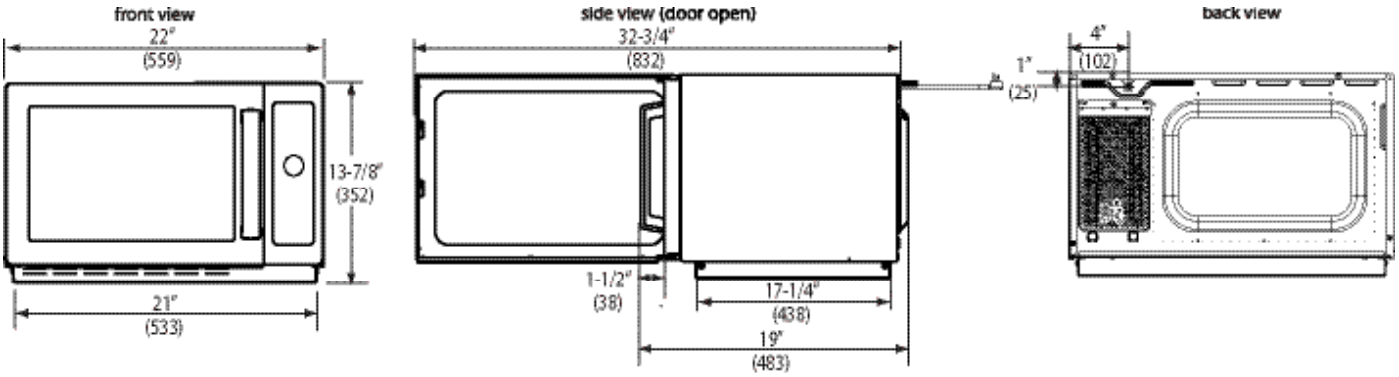
ACP INC.

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Cedar Rapids, Iowa 52404

225 49th Ave Dr. SW Cedar Rapids, IA 52404 | 800-233-2366 | 319-368-8120 | Fax: 319-368-8198 | www.acpsolutions.com

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Amana Commercial Microwave Model RCS10DSE | Medium Volume



Installation Clearances - Top: 2" (51), Sides: 1" (25), Back: None

Drawings available from KCL CADlog - techs@kclcad.com

Specification #:

Specifications			
Model	RCS10DSE	UPC Code 728028129465	
Configuration	Countertop		
Control System	Dial		
Max. Cooking Time	10:00		
Power Levels	4		
Time Entry Option	Yes		
Microwave Distribution	Rotating antenna, top		
Magnetron	1		
Stackable	Yes		
Stage Cooking	1		
Interior Light	Yes		
Door Handle	Grab & Go		
Signal	End of cycle		
Exterior Dimensions	H 13 ⅞" (352)	W 22" (559)	D*19" (483)
Cavity Dimensions	H 8 ½" (216)	W 14 ½" (368)	D 15" (381)
Door Depth	32 ¾" (832), 90°+ door open		
Usable Cavity Space	1.2 cubic ft. (34 liter)		
Exterior Finish	Stainless steel		
Interior Finish	Stainless steel		
Power Consumption	1550 W, 13 A		
Power Output**	1000 W** Microwave		
Power Source	120V, 60 Hz, 15 A single phase		
Plug Configuration / Cord	NEMA 5-15	5 ft. (1.5m)	
Frequency	2450 MHz		
Product Weight	41 lbs. (19 kg.)		
Ship weight (approx.)	47 lbs. (21 kg.)		
Shipping Carton Size	H 16 ⅝" (422)	W 25 ³⁄₁₆" (640)	D 19 ¾" (502)
UPS Shippable	Yes		

Specifications

Commercial microwave shall have a user-friendly 10 minute dial timer with illuminated digits and an end of cycle audible signal. Timer shall automatically reset if the door is opened during heating with user option to manually reset to zero. There shall be a four power level and cooking stage. Microwave output shall be 1000 watts distributed by one magnetron with a rotating top antenna to provide superior even heating throughout the cavity. Durable door shall have a tempered glass window and a grab and go handle with a 90°+ opening for easy access. An interior light shall facilitate monitoring without opening the door. The large 1.2 cubic ft. (34 liter) cavity shall accommodate a 14" (356 mm) platter. Interior ceramic shelf shall be sealed and recessed on oven bottom to reduce plate-to-shelf edge impact. Oven shall have a stainless steel exterior and interior and be stackable to save counter and shelf space. The air filter shall be permanently affixed to the front of the oven. Microwave oven shall comply with standards set by the U.S Department of Health and Human Services, UL923 for safety and NSF4 for sanitation.

Intertek Intertek

Warranty

Warranty Certificate for this product can be found on the ACP, Inc. website at:

www.acpsolutions.com/warranty

Service

All products are backed by the ACP, Inc. 24/7 ComServ

er.

ComServ Commercial Service 866-426-2621

AIA File #:

Measurements in ( ) are millimeters
* Includes handle
** IEC 60705 Tested

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Cedar Rapids, Iowa 52404

225 49th Ave. Dr. SW Cedar Rapids, IA 52404 U.S.A. | 800-233-2366 | 319-368-8120 | Fax: 319-368-8198 | www.acpsolutions.com

RCS Series
RESTAURANT LINE

RCS10TS - 1000 Watts, Touch pad control
RCS10DSE - 1000 Watts, Dial control

FEATURES AND BENEFITS

- 1000 watts of cooking power
  - Quick heating for consistent results
- 1.2 cubic ft. (34 L) oven capacity
  - Accommodates a 14" (356 mm) platter
- Motor driven top antenna
  - Reliable distribution of energy for consistent heating results
- Non-removable front air filter
  - Cools componentry, extends life of oven

TOUCH CONTROL MODELS

- 100 programmable menu items, 4 cooking stages, 5 power levels
- Braille touch pads
- Versatile program options
- One-touch cooking

DIAL CONTROL MODELS

- 10:00 light up dial timer
- 4 power levels
- Automatic reset to zero when cooking cycle is interrupted (manual reset available as user option)





Reliable, long lasting Grab 'n Go handle with no moving parts

Available with touch pad or dial controls

IDEAL APPLICATIONS

- Server stations
- Convenience stores
- Coffee shops
- Concessions
- Breakrooms

Fabricated and Assembled in the USA

BOOST HEATS AND RE-THERMS IN SECONDS!

- Breakfast sandwich reheats in 1:00
- Stage cooking perfectly prepares instant oatmeal in 1:30

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K65 - CONVEYOR TOASTER (1 EA REQ'D)

Vollrath CT2-120350

Conveyor Toaster, horizontal conveyor, all bread types, (350) slices per hour, 1-3/8"H opening, 10-1/2"W belt (2 slice), variable speed control, power saver mode, quartz heaters, stainless steel & aluminized steel construction, 1" adjustable legs, 120v/60/1-ph, 1.6kW, 13.3 amps, cord with NEMA 5-15P, NSF, cULus, Made in USA (model JT1) (Refer to vollrathfoodservice.com for full warranty policy)

ACCESSORIES

Mfr	Qty	Model	Spec
Vollrath	1		2 years parts & 1 year labor warranty

Outperform every day.™

Project:

Item Number:

Quantity:

CONVEYOR TOASTERS - 250-350 SLICES PER HOUR* (MODELS JT1, JT1H)



CT2-120350



CT2H-120250

ITEMS

Item No.	Model No.	Description
CT2-120350	JT1	350 Slices Per Hour*
CT2H-120250	JT1H	250 Slices Per Hour*, High Clearance

FEATURES

- Stainless steel and aluminized steel construction.
- Variable speed control allows for real-time adjustments.
- 10½" (26.7 cm) 2-slice wide conveyor is larger than industry standard for better toasting results.
- Forced convection toasting promotes uniform results and energy efficiency.
- Energy efficient, fast reacting, quartz heaters.
- High-quality, insulated wires help prevent against dry rotting and cracking.
- High-temperature thermoplastic terminal blocks with stainless steel clamping provides superior connections; designed for ease of serviceability.
- Maintenance-free drive system; stainless steel drive chain does not require lubrication.
- Standby mode saves up to 75 percent energy during slow periods when unit is not in use and allows machine to quickly return to full power.
- Adjustable legs.
- 4½ ft. (1.4 m) cord with plug.
- Made in the USA.

DESCRIPTION

Vollrath's 250-350 slice per hour, 120V conveyor toasters feature easy to use conveyor control to perfectly toast a variety of bread products - from sliced bread to buns and bagels. These toasters are well suited for lower volume applications such as self-serve breakfast buffets and to replace pop-up toasters.

WARRANTY

- Warrantied parts: The warranty period is 2 year parts, 1 year labor.
- Heater tubes: The warranty period is 1 year, including labor when performed at an authorized service center. Heater tube glass damage is not covered by this warranty.
- For full warranty details, please refer to www.Vollrath.com.

CLEARANCE AND ENVIRONMENT REQUIREMENTS

- Do not place on surfaces or near walls, partitions or kitchen furniture unless they are made of non-combustible material or clad with non-combustible heat-insulating material. Toasters must not be used near or below curtains and other combustible materials.
- Maximum ambient temperature: 104° F (40 ° C).

AGENCY LISTINGS

c UL us LISTED NSF

** Slices per hour is based on maximum conveyor speed. Conveyor speed determines toasting time and affects color and texture of the toast. Results may vary based upon type of bread, color and texture preference.*

Due to continued product improvement, please consult www.vollrath.com for current product specifications.

Approvals	Date

Outperform every day.™

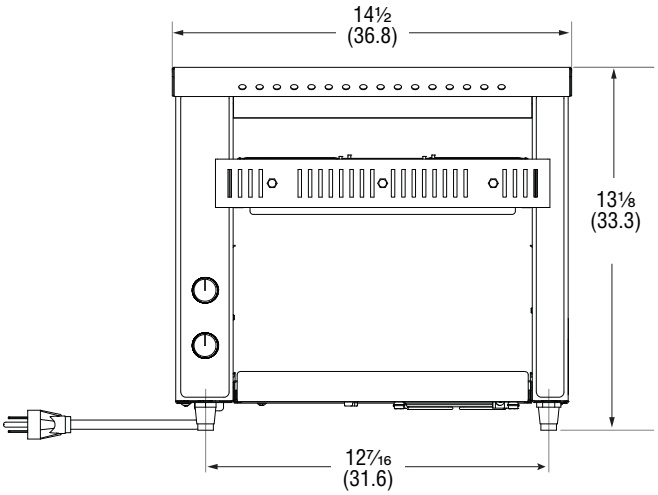
The Vollrath Company, L.L.C.
1236 North 18th Street
Sheboygan, WI 53081-3201 U.S.A.
Main Tel: 800.624.2051 or 920.457.4851
Main Fax: 800.752.5620 or 920.459.6573
Customer Service: 800.628.0830
Canada Customer Service: 800.695.8560

Technical Services
techservicereps@vollrathco.com
Toasters: 1-800-309-2250
All Other Products: 800.628.0832

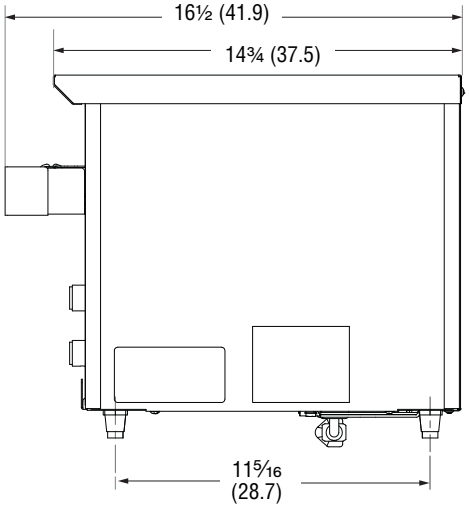
CONVEYOR TOASTERS - 250-350 SLICES PER HOUR* (MODELS JT1, JT1H)

DIMENSIONS (Shown in inches (cm))

CT2-120350

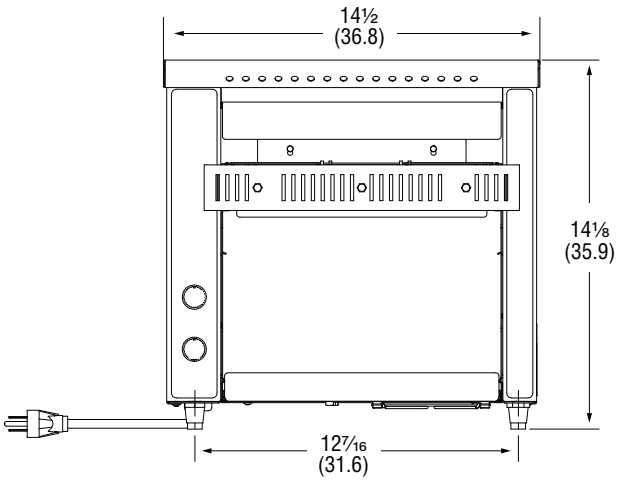


Front View

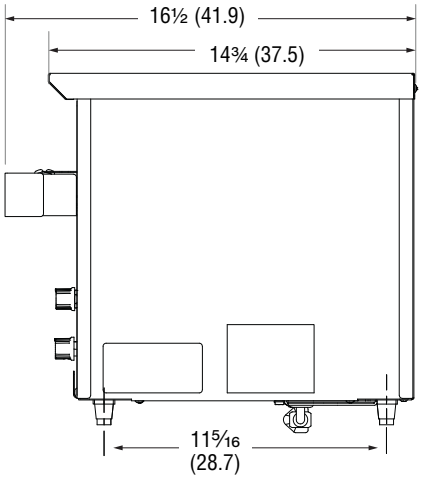


Side View

CT2H-120250



Front View



Side View

SPECIFICATIONS

Item No.	Model	Slices or Bun Halves per Hour* (Up To)	Product Opening In (CM)	Voltage	Watts	Amps	Hz	Weight LB (KG)	Plug
CT2-120350	JT1	350	1⅜ (3.2)	120	1600	13.3	60	35 (15.9)	NEMA 5-15P
CT2H-120250	JT1H	250	1-2⅛ (2.5-7.6)						

Receptacle

120V



NEMA 5-15R

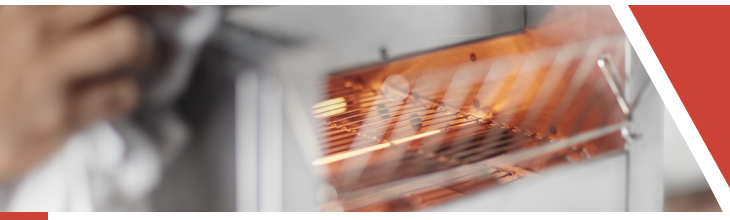
** Slices per hour is based on maximum conveyor speed. Conveyor speed determines toasting time and affects color and texture of the toast. Results may vary based upon type of bread, color and texture preference.*

VOLLRATH®
Outperform every day.™
www.vollrath.com

The Vollrath Company, L.L.C.
1236 North 18th Street
Sheboygan, WI 53081-3201 U.S.A.
Main Tel: 800.624.2051 or 920.457.4851
Main Fax: 800.752.5620 or 920.459.6573
Customer Service: 800.628.0830
Canada Customer Service: 800.695.8560

Technical Services
techservicereps@vollrathco.com
Toasters: 1-800-309-2250
All Other Products: 800.628.0832

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Printed in USA



CONVEYOR TOASTERS

OVERALL CONVEYOR TOASTER FEATURES AND BENEFITS:

- Forced convection toasting promotes uniform results and energy efficiency
- Most models have energy-efficient, fast-reacting quartz heaters
- Standby mode saves up to 75 percent energy during slow periods when unit is not in use and allows unit to quickly return to full power
- Variable speed control to achieve desired color
- Maintenance-free drive system; stainless steel drive chain does not require lubrication

NEW Conveyor Toasters (JT1 & JT1H)

- Speed control only
- 2-slice, 10½" wide conveyor belt
- For low-volume and self-serve applications or when replacing pop-ups

USMADE OF US & GLOBAL MATERIALS

NSF C UL US LISTED

2 TWO YEAR WARRANTY



JT1

ITEM #	FOOD PRODUCT TYPE	PRODUCT OPENING HEIGHT IN (CM)	VOLTAGE	OUTPUT	INTENDED OPERATION TYPE	ONE-SIDED TOASTING OPTION
JT1						
CT2-120350	Standard breads	1½" (3.8)	120	Up to 350 slices or bun halves per hour	Low-volume and self-serve applications or when replacing pop-up toasters	–
JT1H						
CT2H-120250	Standard breads, specialty breads, buns & bagels	2 ½" (6.4)	120	Up to 250 slices or bun halves per hour	Low-volume and self-serve applications or when replacing pop-up toasters	–

International models available - visit vollrath.com/toasters

NEW Conveyor Toasters (JT1B & JT1BH)

- Speed control only
- One-sided toasting option – toggle between full heat and one-sided top-heat toasting only for bagels or buns
- 2-slice, 10½" side conveyor belt
- For low-volume and self-serve applications or when replacing pop-ups

NSF C UL US LISTED USMADE OF US & GLOBAL MATERIALS 2 TWO YEAR WARRANTY



JT1BH

ITEM #	FOOD PRODUCT TYPE	PRODUCT OPENING HEIGHT IN (CM)	VOLTAGE	OUTPUT	INTENDED OPERATION TYPE	ONE-SIDED TOASTING OPTION
JT1B						
CT2B-120500	Standard breads, buns & bagels	1½" (3.8)	120	Up to 500 slices or bun halves per hour	Self-serve or mid-size-volume applications, one-sided toasting option	✓
JT1BH						
CT2BH-120400	Standard breads, specialty breads, buns & bagels	1½"-3" (3.8-7.6), adjustable	120	Up to 400 slices or bun halves per hour	Self-serve or mid-size-volume applications, one-sided toasting option	✓

International models available - visit vollrath.com/toasters

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Submittal Sheet

03/14/2025

ITEM# K66 - MOBILE BASE DISPENSER (1 EA REQ'D)

Dinex DXPSBH2WB

Colossus Wax Base Heater/Dispenser, mobile, convection, (2) self-leveling adjustable cylinders, accommodates (60) 9" wax bases per silo, adjustable digital thermostat, thermostatic controls maintain plates at 180°F and bases at 300°F, 75 - 90 minute heating time, (2) soft-close hinged lids, fully insulated top & sides, stainless steel dispenser mechanisms with adjustable springs, push handle, heavy duty 304 stainless steel exterior, enclosed base, corner bumpers, (4) 5" swivel plate casters (2 with brakes), dual voltage, operates at 208v/60/1-ph, 3200 watts (15 amps), or 240v/60/1-ph, 3000 watts (13.3 amps), cord, NEMA 6-20P

DINEX®

JOB _____ ITEM # _____

COLOSSUS PLATE AND WAX BASE HEATER AND DISPENSER

Compliant with NSF/ANSI Standard 2



DXPSBH2P

Item Numbers
DXPSBH2P
DXPSBH3P
DXPSBH2WB
DXPSBH3WB
DXPSBH2PWB

Application

Dinex Colossus Plate and Wax Base Heaters and Dispensers are heat retentive devices used in tray make up systems. An adjustable digital thermostat makes the unit compatible for low and high heat applications.

Standard Features

- Heavy-duty 304 high nickel 18-8 stainless steel construction
- 5" swivel plate casters
- Corner bumpers standard
- 3200 watts of converted forced air heat for faster heat up (thermostatically controlled)
- Field adjustable digital thermostat
- Gasketless lid seal design to maintain heat
- Self-leveling, field adjustable spring dispensing design allows easy access to bases and plates
- Two and three silo configurations
- Soft-close hinges

Construction

- The exterior is constructed of 304 high nickel 18-8 stainless steel and the frame is constructed of 18-gauge. The side and front panels are constructed of 18-gauge. The back panel is constructed of 18-gauge and the base is constructed of 14-gauge. Two (2) and three (3) silo models are available. Each tube holds approximately 45 plates or 60 bases.
- The fully insulated lids are constructed from 20-gauge stainless steel with a gasketless design.
- 5" polyurethane non-marking swivel casters (2 with brakes) are standard.
- The heating system is a forced air convection design that circulates thermostatically controlled super heated air evenly through the fully insulated cabinet. The dual voltage unit is designed to draw 3200 watts at 240 volts with 13.5 Amps and 3000 watts at 208 volts with 14.5 Amps. (4800 watts for 3 silo version)

Control System

Thermostatic controls to maintain plates at 180°F and bases at 300°F. The heating system recirculates the hot air horizontally to ensure rapid and efficient heating of the plates or bases. Full heating of the plates or bases is accomplished in 75 to 90 minutes.

Initial heat-up of a fully loaded is approximately 2 hours or less with reheat cycles to be 1-1/2 hours depending on wax base design.

Warranty

One year parts and labor.

We do not accept returns on any Dinex equipment or Dinex custom products. Please contact your local Dinex rep to ensure order accuracy prior to ordering.

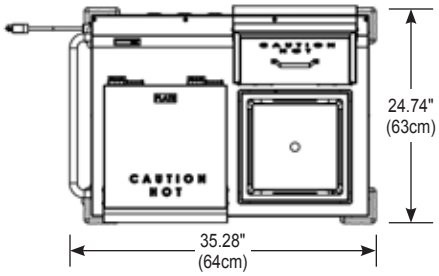
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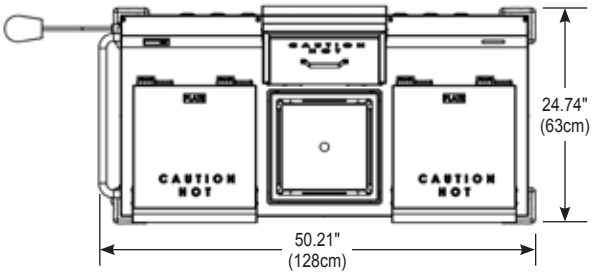
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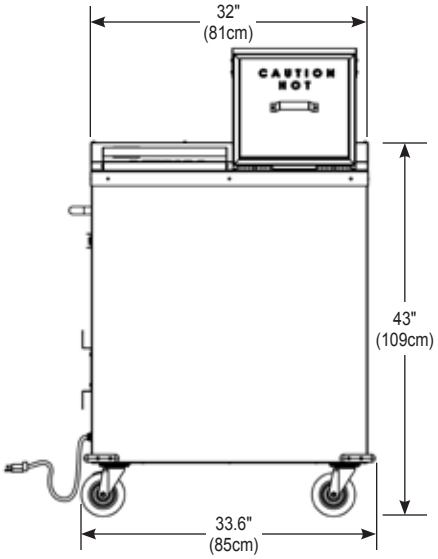
COLOSSUS PLATE AND WAX BASE HEATER AND DISPENSER



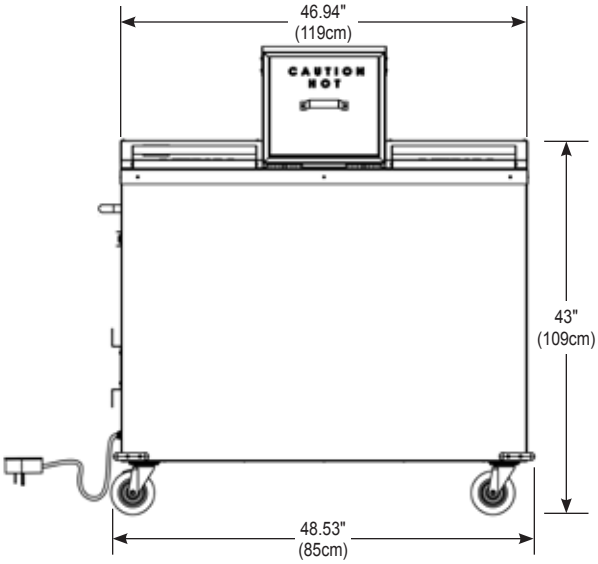
Nema 6-20P







DXPSBH2



DXPSBH3

Items and Dimensions

ITEM NUMBER	OVERALL WIDTH	OVERALL DEPTH	OVERALL HEIGHT*	NO. OF TUBES	APPROX. CAPACITY EA TUBE / TOTAL	WATTS	AMPAGE 208V	AMPAGE 240V	SHIP WEIGHT	SHIP CUBE
DXPSBH2P	35.28" (64cm)	24.75" (63cm)	43" (109cm)	2	75 / 150	3200	15.3	13.3	300 lbs (136kg)	22.40
DXPSBH3P	50.21" (128cm)	24.75" (63cm)	43" (109cm)	3	75 / 135	4800	23	20	425 lbs (193kg)	31.11
DXPSBH2WB	35.28" (64cm)	24.75" (63cm)	43" (109cm)	2	60 / 120	3200	15.3	13.3	300 lbs (136kg)	22.40
DXPSBH3WB	50.21" (128cm)	24.75" (63cm)	43" (109cm)	3	75 / 225	4800	23	20	425 lbs (193kg)	31.11
DXPSBH2PWB	35.28" (64cm)	24.75" (63cm)	43" (109cm)	3	75P / 60WB / 105	3200	15.3	13.3	300 lbs (136kg)	21.77

* Height includes casters

Please confirm that you have the most current specification sheet by visiting www.dinex.com.

It is Dinex's policy to offer equipment which is design certified by companies that have been accredited at the federal level by the Occupational Safety and Health Agency (OSHA) and ANSI as a national recognized testing laboratory. These companies include CSA International, Underwriters Laboratories, Edison Testing Laboratories and National Sanitation Foundation. However, a continuing program of product improvement makes it necessary to submit new models to the agencies as they are developed. Consequently, all models may not bear the appropriate labels at all times.

Dinex reserves the right to change specifications and product design without notice. Such revisions do not entitle the buyer to corresponding changes, improvements, additions or replacements for previously purchased equipment.

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Rev 06/2020

Colossus Plate & Base Heater



Hot Plates. Hot Food.

The Colossus Heated Plate Dispenser is designed for heating china plates to 180°F and wax bases at 300°F in less than two hours. It's ideal for heating plates and bases to maintain hot food temperatures during delivery in conjunction with the Dinex Induction Heating System.



Benefits



Convection

Quick plate and base heating with even temperatures



Temperature Control

Clear temperature read-out for better temperature control



Self Leveling

Field adjustable spring dispensing design allows easy access to bases and plates



Durability

Stainless steel exterior and corner bumpers

DINEX



Prod No	Description	Dimensions W x D x H*	Approx. Capacity Ea Tube / Total	Pack
Colossus Plate & Base Heaters				
DXPSBH2P	2 Silo Heater for 10.25" Plates, Stainless Steel	35.28" x 24.75" x 43"	75 / 150	1 ea
DXPSBH3P	3 Silo Heater for 10.25" Plates, Stainless Steel	50.21" x 24.75" x 43"	75 / 135	1 ea
DXPSBH2WB	2 Silo Heater for Wax Bases, Stainless Steel	35.28" x 24.75" x 43"	60 / 120	1 ea
DXPSBH3WB	3 Silo Heater for Wax Bases, Stainless Steel	50.21" x 24.75" x 43"	75 / 225	1 ea
DXPSBH2PWB	2 Silo Heater for 10.25" Plates and Wax Bases, Stainless Steel	35.28" x 24.75" x 43"	75P / 60WB / 105	1 ea

*Height includes casters

For more information visit www.carlislefsp.com/dispensers-and-heaters/convection-plate-heaters

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Submittal Sheet

03/14/2025

ITEM# K67-K69 - SPARE NO.

<Spare No.>

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Submittal Sheet

03/14/2025

ITEM# K70 - FLATWARE & TRAY CART (1 EA REQ'D)

Dinex DXPIDTS1C1418

Tray & Silverware Dispenser, open tubular frame, mobile design, 9-cylinder silverware holder, cantilever single stack 14" x 18" tray size, 150 capacity, self-elevating tray platform, stainless steel construction, (4) 5"HD non- marking swivel casters (2 with brakes) & bumpers, CSA (IDTS1C/1418)

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DINING EXCELLENCE

JOB _____ ITEM # _____

CANTILEVER STYLE TRAY & SILVER DISPENSERS



Item Numbers

- ❑ DXIDTS1C1418
- ❑ DXIDTS1C1520
- ❑ DXIDTS1C1622

Application
This self-leveling cantilever style tray and silver dispenser is offered in one model, the single stack.

This self-leveling cantilever style tray and silver dispenser can be found on tray lines, in the front or back-of-the-house, or any place your needs require.

Construction
The lifting mechanism is equipped with a full complement of stainless steel extension springs that can be easily disconnected to adjust the lifting rate. A removable stainless steel carrier arm provides bottom support for trays being dispensed.

The base is fabricated of stainless steel and reinforced with heavy gauge hat channels. It has four 5" heavy-duty non-marking swivel casters (2 with brakes) are securely mounted to the base and a non-marking bumper is attached at each corner.

The pylon is fabricated of stainless steel, welded to the base and lifted with a stainless steel tubular push handle.

The top mounted silverware holder is fabricated from stainless steel with a No. 4 finish and includes plastic silverware cylinders.

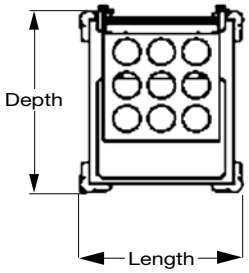
Standard Features
- Stainless steel construction including stainless steel extension springs for long lasting dependable service.
- Patented self-leveling mechanism lifts out for easy cleaning.
- Field adjustable to accommodate different weights.
- Corner bumpers
- Plastic silverware cylinders
- 2-locking casters

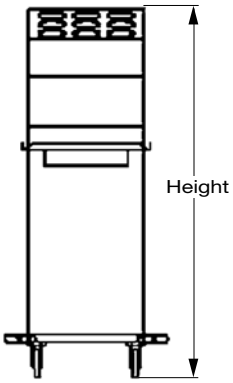
Warranty
One year parts and labor.

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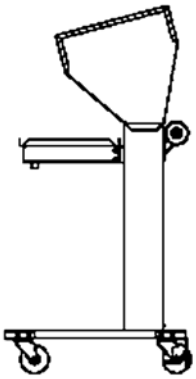
044-REV 01/10

CANTILEVER STYLE TRAY & SILVER DISPENSERS





Front View



Side View

Items and Dimensions

ITEM NUMBER	MODEL NUMBER	LENGTH	DEPTH	HEIGHT	NUMBER OF CYLINDERS	MAXIMUM TRAY SIZE	SHIP WEIGHT	SHIP CUBE
DXIDTS1C1418	IDTS1C/1418	23.50" (59.7cm)	26.25" (66.7cm)	54.15" (137.5cm)	9	14.625" x 18.375" (37.1cm x 46.7cm)	178 lb. (80.7kg)	14.9
DXIDTS1C1520	IDTS1C/1520	23.50" (59.7cm)	26.25" (66.7cm)	54.15" (137.5cm)	9	15.625" x 20.375" (39.7cm x 51.8cm)	178 lb. (80.7kg)	14.9
DXIDTS1C1622	IDTS1C/1622	23.50" (59.7cm)	31.25" (79.4cm)	54.15" (137.5cm)	9	16.625" x 22.375" (42.2cm x 56.8cm)	178 lb. (80.7kg)	14.9

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044-REV 01/10



DXIDTS1S1418

Tray & Silverware Dispensers

- **Save space in the kitchen**
- Combination tray and silverware dispensers are offered in a single stack model with six or eight silverware holders, or double stack with eight or ten silverware holders
- Each style can accommodate several different tray types
- Cantilever style available in single stack configuration with eight or ten silverware holders
- Solid shelf style available in both single and double stack configurations with six, eight, or ten silverware holders
- NSF Listed



DXIDTS1C1520

Prod No	Description	Max Tray Size	L x D x H	Pack
Single Stack Cantilever Style Tray & Silverware Dispensers - 9 Cylinder - 150 Tray Capacity				
DXIDTS1C1321 Δ	Cantilever Style	13" x 21" / 33 x 53.3 cm	22.75" x 29.5" x 55" / 57.8 x 74.9 x 139.7 cm	1 ea
DXIDTS1C1418 Δ	Cantilever Style	14" x 18" / 35.6 x 45.7 cm	22.75" x 29.5" x 55" / 57.8 x 74.9 x 139.7 cm	1 ea
DXIDTS1C1520 Δ	Cantilever Style	15" x 20" / 38.1 x 50.8 cm	22.75" x 29.5" x 55" / 57.8 x 74.9 x 139.7 cm	1 ea
DXIDTS1C1622 Δ	Cantilever Style	16" x 22" / 40.6 x 55.9 cm	22.75" x 30.88" x 55" / 57.8 x 78.4 x 139.7 cm	1 ea
Single Stack Shelf Style Tray & Silverware Dispensers - 8 Cylinder - 150 Tray Capacity				
DXIDTS1S1418 Δ	Shelf Style	14.75" x 18.75" / 37.5 x 47.6 cm	22.75" x 28.75" x 53.25" / 57.8 x 73 x 135.3 cm	1 ea
DXIDTS1S1520 Δ	Shelf Style	15.75" x 20.75" / 40 x 52.7 cm	22.75" x 28.75" x 53.25" / 57.8 x 73 x 135.3 cm	1 ea
DXIDTS1S1622 Δ	Shelf Style	16.75" x 22.38" / 42.5 x 56.8 cm	22.75" x 28.75" x 53.25" / 57.8 x 73 x 135.3 cm	1 ea
Double Stack Shelf Style Tray & Silverware Dispensers - 16 Cylinder - 300 Tray Capacity				
DXIDTS2S1418 Δ	Shelf Style	14.75" x 18.75" / 37.5 x 47.6 cm	44.75" x 28.75" x 53.25" / 113.7 x 73 x 135.3 cm	1 ea
DXIDTS2S1520 Δ	Shelf Style	15.75" x 20.75" / 40 x 52.7 cm	44.75" x 28.75" x 53.25" / 113.7 x 73 x 135.3 cm	1 ea
DXIDTS2S1622 Δ	Shelf Style	16.75" x 22.38" / 42.5 x 56.8 cm	44.75" x 28.75" x 53.25" / 113.7 x 73 x 135.3 cm	1 ea

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Submittal Sheet

03/14/2025

ITEM# K71 - BASE STORAGE/DRYING CART (1 EA REQ'D)

Dinex DX1173X50

TMP® Drying & Storage Cart, holds 50 domes or 100 bases/underliners or Quicktemp® bases, 1" stainless steel tubing frame, 5" casters (2 with brakes) (1173/X50)

ACCESSORIES

Mfr	Qty	Model	Spec
Dinex	1		1 year parts & labor warranty

DINEX®
DINING EXCELLENCE

JOB _____ ITEM # _____

DRYING AND STORAGE CARTS

Item Numbers
- ❑ DX1173X50
- ❑ DX1173X80
- ❑ DX1173X100

Cradle Inserts
- ❑ DX1173XC10



Item Numbers: DX1173X50 & DX1173X100



Item Number: DX1173XC10

Application
The Drying and Storage Carts come fully assembled and ready to use. The frame is constructed of 1" tubular stainless steel for light weight and maximum strength. Cradle supports are 14 gauge welded and polished stainless steel. Cradles are uncoated stainless steel, and will not chip, split or corrode.

Construction
Frame: 16-gauge stainless steel upright frame, 1" diameter

Cradle Support: 14-gauge stainless steel angle bars and 1" stainless steel center supports to hold removable cradle inserts (shipped with cart)

Casters: Four-5" swivel casters: Two have locking brakes

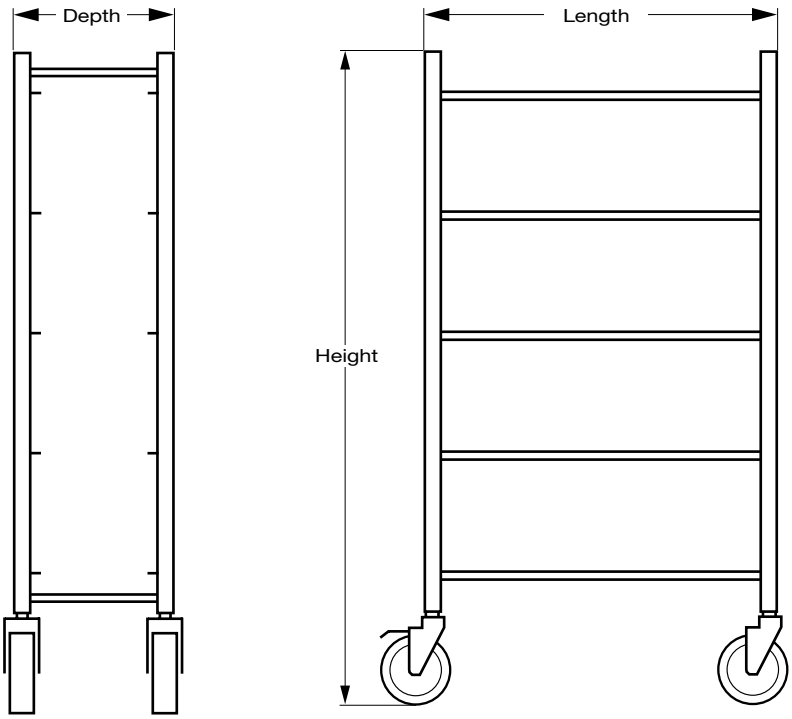
Features
- Industrial-strength swivel-stem casters provide easy maneuverability. Locking wheels on 2 casters will secure cart in place.
- Carts feature a unique cradle design for easy loading, efficient drying and storage.
- Cradles are removable for easier ware washing in dish machine.
- Dry and store combinations for domes, insul-bases and underliners on the same cart for convenient storage, transport and tray make-up.
- Three sizes are available to meet your space requirements and storage needs.

Warranty
One year parts and labor.

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TMP-011-REV 10/09

DRYING AND STORAGE CARTS

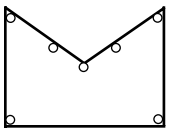


Items and Dimensions

ITEM NUMBER	MODEL NUMBER	LENGTH	DEPTH	HEIGHT	WITH CRADLE	SHIP WEIGHT	SHIP CUBE	CRADLE SPACING	SHELF SPACING	NUMBER OF CRADLES	DOMES/ UNDERLINERS PER CRADLE	TOTAL CAP. DOMES/ UNDERLINERS
DX1173X50	1173/X50	19.5” (50cm)	20.25” (51cm)	73” (185cm)	79” (201cm)	115 lb. (52.2kg)	19.2	3.5” (9cm)	13” (33cm)	5	10/20	50/100
DX1173X80	1173/x80	40” (102cm)	20.25” (51cm)	59” (150cm)	65” (165cm)	125 lb. (56.8kg)	29.9	3.5” (9cm)	13” (33cm)	8	10/20	80/160
DX1173X100	1173/x100	40” (102cm)	20.25” (51cm)	73” (185cm)	19” (201cm)	145 lb. (65.8kg)	36.3	3.5” (9cm)	13” (33cm)	10	10/20	100/200

Cradle Insert

Item Number	Model Number	Length	Depth	Height
DX1173XC10	1173/XC10	18”	17.5”	10.5”


Front View


Side View

Stainless steel cradle insert 14-guage (uncoated) stainless steel

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TMP-011-REV 10/09

RACKS

Drying & Storage Racks

- Versatile mobile racks for domes and bases **accommodate every foodservice need**
- Drying and Storage Racks keep your trayline and dishwashing area organized and operating at peak efficiency
- The stainless steel cradles are removable for easy cleaning in the dishwasher
- Induction Base Drying Racks are designed to efficiently dry, store and transport your Induction Bases
- DX1173XC10 Drying Cradle Insert is an easy carry cradle, made entirely of stainless steel; holds domes and bases securely for easier washing, drying and storage
- Some units are NSF Listed, see product chart for details
- Locking casters allow for safe and easy staging of your trayline
- The tray drying rack allows for ample ventilation for drying and storage of trays



DX1173X50



DX1173X100



DXIBDRS90



DX10053



DX1173XC10



DXIDTDR3

Prod No	Description	L x D x H	Pack
Stainless Steel Storage Racks For 9" Domes & Underliners			
DX1173X50 Δ	Holds 50 domes or 100 bases/underliners	19.5" x 20.25" x 73" / 49.5 x 51.4 x 185.4 cm	1 ea
DX1173X80 Δ	Holds 80 domes or 160 bases/underliners	40" x 20.25" x 59" / 101.5 x 51.4 x 149.8 cm	1 ea
DX1173X100 Δ	Holds 100 domes or 200 bases/underliners	40" x 20.25" x 73" / 101.5 x 51.4 x 185.4 cm	1 ea
DX1173XC10	Replacement Drying Cradle Insert for DX1173 Series	18" x 17.5" x 10.5" / 45.7 x 44.4 x 26.7 cm	1 ea
Storage Racks For Induction Bases			
DXIBDRS90 Δ	Holds 90 Induction Bases	20.5" x 22" x 78" / 52.1 x 55.9 x 198.1 cm	1 ea
DXIBDRS180 Δ	Holds 180 Induction Bases	40" x 22" x 78" / 101.6 x 55.9 x 198.1 cm	1 ea
DXIBDRS270 Δ	Holds 270 Induction Bases	59.5" x 22" x 78" / 151.1 x 55.9 x 198.1 cm	1 ea
DX10251DT	Replacement Wire Cradle (18 bases per cradle)	17.75" x 18" x 6" / 45.1 x 45.7 x 15.2 cm	1 ea
Stainless Steel Storage Racks For 9" Domes & Underliners			
DXIRDSD950 Δ	Holds 50 domes or 100 bases/underliners	22.5" x 22" 78" / 57.1 x 55.8 x 198.1 cm	1 ea
DXIRDSD9100 Δ	Holds 100 domes or 200 bases/underliners	44" x 22" x 78" / 111.7 x 55.8 x 198.1 cm	1 ea
DXIRDSD9150 Δ	Holds 150 domes or 300 bases/underliners	65.5" x 22" 78" / 166.2 x 55.8 x 198.1 cm	1 ea
DX10053	Washrack & Cradle for 9" Domes (fits D950, D9100, D9150)	19" x 18.25" x 7.5" / 48.7 x 46.36 x 19 cm	2 ea
Flat Tray Drying Racks			
DXIDTDR3	Drying rack for 14"x 18" & 15"x 20" flat trays (approx 120 trays)	63.75" x 28" x 74.5" / 161.8 x 71.1 x 189.2cm	1 ea

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Submittal Sheet

03/14/2025

ITEM# K72 - DOME STORAGE/DRYING CART (2 EA REQ'D)

Dinex DX1173X80

TMP® Drying & Storage Cart, holds 80 domes or 160 bases/underliners or Quicktemp® bases, 1" stainless steel tubing frame, 5" casters (2 with brakes) (1173/X80)

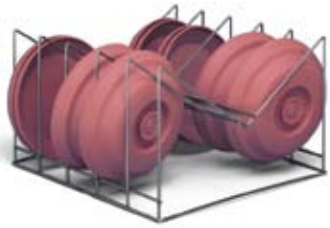
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DINING EXCELLENCE

JOB _____ ITEM # _____

DRYING AND STORAGE CARTS



Item Numbers: DX1173X50 & DX1173X100



Item Number: DX1173XC10

Item Numbers
- ❑ DX1173X50
- ❑ DX1173X80
- ❑ DX1173X100

Cradle Inserts
- ❑ DX1173XC10

Application
The Drying and Storage Carts come fully assembled and ready to use. The frame is constructed of 1" tubular stainless steel for light weight and maximum strength. Cradle supports are 14 gauge welded and polished stainless steel. Cradles are uncoated stainless steel, and will not chip, split or corrode.

Construction
Frame: 16-gauge stainless steel upright frame, 1" diameter

Cradle Support: 14-gauge stainless steel angle bars and 1" stainless steel center supports to hold removable cradle inserts (shipped with cart)

Casters: Four-5" swivel casters: Two have locking brakes

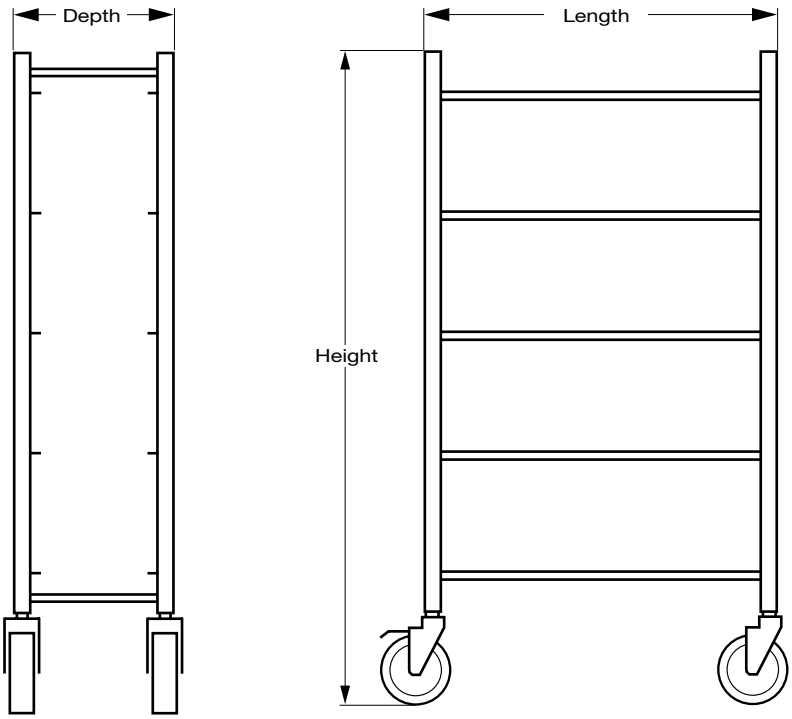
Features
- Industrial-strength swivel-stem casters provide easy maneuverability. Locking wheels on 2 casters will secure cart in place.
- Carts feature a unique cradle design for easy loading, efficient drying and storage.
- Cradles are removable for easier ware washing in dish machine.
- Dry and store combinations for domes, insul-bases and underliners on the same cart for convenient storage, transport and tray make-up.
- Three sizes are available to meet your space requirements and storage needs.

Warranty
One year parts and labor.

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DRYING AND STORAGE CARTS

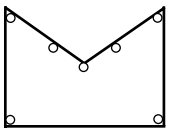


Items and Dimensions

ITEM NUMBER	MODEL NUMBER	LENGTH	DEPTH	HEIGHT	WITH CRADLE	SHIP WEIGHT	SHIP CUBE	CRADLE SPACING	SHELF SPACING	NUMBER OF CRADLES	DOMES/ UNDERLINERS PER CRADLE	TOTAL CAP. DOMES/ UNDERLINERS
DX1173X50	1173/X50	19.5” (50cm)	20.25” (51cm)	73” (185cm)	79” (201cm)	115 lb. (52.2kg)	19.2	3.5” (9cm)	13” (33cm)	5	10/20	50/100
DX1173X80	1173/x80	40” (102cm)	20.25” (51cm)	59” (150cm)	65” (165cm)	125 lb. (56.8kg)	29.9	3.5” (9cm)	13” (33cm)	8	10/20	80/160
DX1173X100	1173/x100	40” (102cm)	20.25” (51cm)	73” (185cm)	19” (201cm)	145 lb. (65.8kg)	36.3	3.5” (9cm)	13” (33cm)	10	10/20	100/200

Cradle Insert

Item Number	Model Number	Length	Depth	Height
DX1173XC10	1173/XC10	18”	17.5”	10.5”


Front View


Side View

Stainless steel cradle insert 14-guage (uncoated) stainless steel

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RACKS

Drying & Storage Racks

- Versatile mobile racks for domes and bases **accommodate every foodservice need**
- Drying and Storage Racks keep your trayline and dishwashing area organized and operating at peak efficiency
- The stainless steel cradles are removable for easy cleaning in the dishwasher
- Induction Base Drying Racks are designed to efficiently dry, store and transport your Induction Bases
- DX1173XC10 Drying Cradle Insert is an easy carry cradle, made entirely of stainless steel; holds domes and bases securely for easier washing, drying and storage
- Some units are NSF Listed, see product chart for details
- Locking casters allow for safe and easy staging of your trayline
- The tray drying rack allows for ample ventilation for drying and storage of trays



DX1173X50



DX1173X100



DXIBDRS90



DX10053



DX1173XC10



DXIDTDR3

Prod No	Description	L x D x H	Pack
Stainless Steel Storage Racks For 9" Domes & Underliners			
DX1173X50 Δ	Holds 50 domes or 100 bases/underliners	19.5" x 20.25" x 73" / 49.5 x 51.4 x 185.4 cm	1 ea
DX1173X80 Δ	Holds 80 domes or 160 bases/underliners	40" x 20.25" x 59" / 101.5 x 51.4 x 149.8 cm	1 ea
DX1173X100 Δ	Holds 100 domes or 200 bases/underliners	40" x 20.25" x 73" / 101.5 x 51.4 x 185.4 cm	1 ea
DX1173XC10	Replacement Drying Cradle Insert for DX1173 Series	18" x 17.5" x 10.5" / 45.7 x 44.4 x 26.7 cm	1 ea
Storage Racks For Induction Bases			
DXIBDRS90 Δ	Holds 90 Induction Bases	20.5" x 22" x 78" / 52.1 x 55.9 x 198.1 cm	1 ea
DXIBDRS180 Δ	Holds 180 Induction Bases	40" x 22" x 78" / 101.6 x 55.9 x 198.1 cm	1 ea
DXIBDRS270 Δ	Holds 270 Induction Bases	59.5" x 22" x 78" / 151.1 x 55.9 x 198.1 cm	1 ea
DX10251DT	Replacement Wire Cradle (18 bases per cradle)	17.75" x 18" x 6" / 45.1 x 45.7 x 15.2 cm	1 ea
Stainless Steel Storage Racks For 9" Domes & Underliners			
DXIRDSD950 Δ	Holds 50 domes or 100 bases/underliners	22.5" x 22" 78" / 57.1 x 55.8 x 198.1 cm	1 ea
DXIRDSD9100 Δ	Holds 100 domes or 200 bases/underliners	44" x 22" x 78" / 111.7 x 55.8 x 198.1 cm	1 ea
DXIRDSD9150 Δ	Holds 150 domes or 300 bases/underliners	65.5" x 22" 78" / 166.2 x 55.8 x 198.1 cm	1 ea
DX10053	Washrack & Cradle for 9" Domes (fits D950, D9100, D9150)	19" x 18.25" x 7.5" / 48.7 x 46.36 x 19 cm	2 ea
Flat Tray Drying Racks			
DXIDTDR3	Drying rack for 14"x 18" & 15"x 20" flat trays (approx 120 trays)	63.75" x 28" x 74.5" / 161.8 x 71.1 x 189.2cm	1 ea

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Submittal Sheet

03/14/2025

ITEM# K73 - AIR CURTAIN REFRIGERATOR (1 EA REQ'D)

Dinex DXPACR15L

ACR Air Curtain Refrigerator, one-section, horizontal and vertical air flow, bottom mount self-contained refrigeration, accommodates: (15) 18" x 26" or (30) 14" x 18" trays, stainless steel tray slides, LED display, 270° swing left hinged insulated stainless steel door with reverse feature, rear mounted tubular push handle with donut bumper, non-marking corner bumpers, (4) 5" casters with brakes, stainless steel, 1/2 HP, 120v/60/1-ph, 16 amps, NEMA-5-20P, Made in USA

ACCESSORIES

Mfr	Qty	Model	Spec
Dinex	1		1 year parts & labor warranty

DINEX®

JOB _____ ITEM # _____

AIR CURTAIN REFRIGERATOR ACR SERIES

Compliant with NSF/ANSI Standard 2



DXPACR15R

Item Numbers
DXPACR15R
DXPACR15L

Mobile Or Stationary
The Dinex model ACR15 air curtain refrigerated cabinet offers refrigerated storage and service for a variety of foods. The fully self- contained refrigeration system provides a cold air curtain which allows for extended operation with the front door open while maintaining food temperature and safety for up to two hours. Bulk foods, in pans or on trays, are conveniently stored on the provided removable tray slides.

Liner
The cabinet liner is constructed of stainless steel, welded together and sealed to prevent leakage. It is fitted at the bottom with a drain, leading to a hot gas condensate evaporator with electric backup mounted in the refrigeration compartment.

Exterior
The exterior is constructed of all welded stainless steel. Stainless steel ventilation louvers are mounted on all four sides of the refrigeration compartment. The front louver is removable for service. The cabinet is fully insulated. Stainless steel grip handles are mounted on the rear of the cabinet.

Door
The front door is double panel, constructed of all welded stainless steel and fully insulated. It is mounted to the cabinet with heavy duty stainless steel hinges which allow the door to swing 270º. The door has a full perimeter gasket and a heavy duty pull handle. A heavy duty edge mounted door latch is provided.

Tray Slides
The provided fifteen pairs of tray slides are mounted on two lift-off frames, one for each side. The frames may be easily removed for cleaning. The slides are mounted on 3" centers and incorporate a no-tip feature. The capacity is (15) 18" x 26" sheet pans or (30) 14" x 18" trays.

Refrigeration System
Re-circulating air is chilled as it passes through an evaporator/blower unit. The air then passes through ductwork designed to ensure full coverage of the food and to provide the efficient front air curtain. Cooling of the air is provided by a 1/2 H.P., 120V, single phase, fan cooled condensing unit mounted at the bottom of the cabinet. A microprocessor control monitors the entire system. It includes an LED display which is mounted on the front of the unit. Total amperage, including the condensate evaporator, is 16.0 Amps. The 10' long supply cord is fitted with a NEMA 5-20P plug. The cord exits from the rear of the cabinet and a cord hook is provided. The coolant is environmentally safe type R-404A.

Casters
The unit is mounted on four 5" diameter, heavy duty, swivel casters. Includes a set of 4 corner bumpers.

Performance
Pull down time from 80ºF ambient to 41ºF inside the cabinet in 30 minutes or less. The air screen technology will maintain the food at 41ºF with the door open for up to two hours.

Warranty
One year parts and labor.

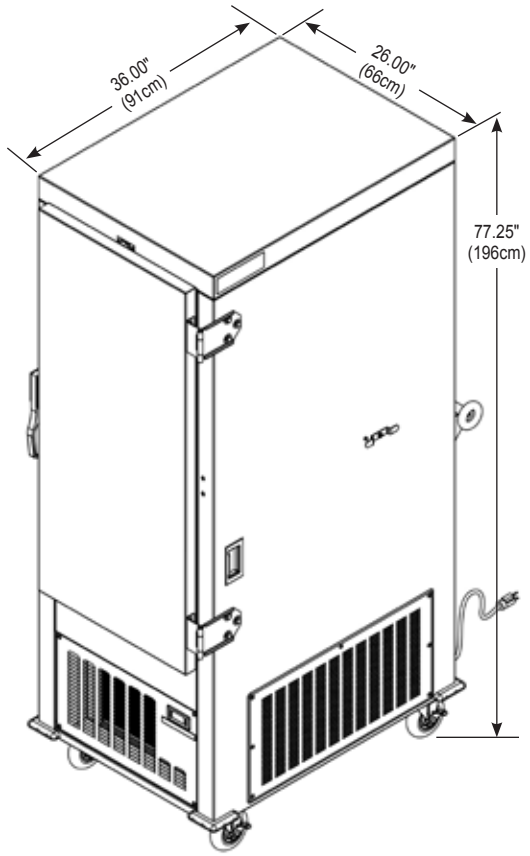
Options
Mechanical refrigeration compressor extended warranty

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Rev 06/2020

AIR CURTAIN REFRIGERATOR ACR SERIES





Nema 5-20P

Items and Dimensions

ITEM NUMBER	DOOR HINGE	OVERALL WIDTH	OVERALL DEPTH	OVERALL HEIGHT*	NEMA PLUG	SHIP WEIGHT	SHIP CUBE
DXPACR15R	Right Mount	26" (66cm)	36" (91cm)	77.25" (196cm)	5-20P	525 lbs (238kg)	10.33
DXPACR15L	Left Mount	26" (66cm)	36" (91cm)	77.25" (196cm)	5-20P	525 lbs (238kg)	10.33

* Height includes casters

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It is Dinex's policy to offer equipment which is design certified by companies that have been accredited at the federal level by the Occupational Safety and Health Agency (OSHA) and ANSI as a national recognized testing laboratory. These companies include CSA International, Underwriters Laboratories, Edison Testing Laboratories and National Sanitation Foundation. However, a continuing program of product improvement makes it necessary to submit new models to the agencies as they are developed. Consequently, all models may not bear the appropriate labels at all times.

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Submittal Sheet

03/14/2025

ITEM# K74 - MEAL TRAY DELIVERY CART (8 EA REQ'D)

Dinex DXPICT12

TQ Economy Tray Delivery Cart, (1) door, 1-compartment, 42-3/4"H, enclosed, (12) tray capacity, designed to hold multiple tray sizes (14" x 18", 15" x 20", & Dinex room service trays), fixed tray slides with 5-1/4" spacing, two trays per slide, optional push handle, fixed panels, magnetic door catch, drop latch, (4) 5" plate-type casters, 2 swivel with brakes, 2 fixed without brakes, stainless steel construction, CSA, Made In USA (ICT/12)

ACCESSORIES

Mfr	Qty	Model	Spec
Dinex	8	DXPICTTR1	Top Rail, 1 sided, for TQ Economy Carts (ICT/TR1)
Dinex	8	DXPICTPH	Push Handle, for TQ Economy Tray Delivery Carts (ICT/PH)
Dinex	8	DXPICTDRAIN	Drain Assembly for TQ Economy Carts (ICT/DRAIN)

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JOB _____ ITEM # _____

TQ ECONOMY CART – ENCLOSED

Accommodates 14" x 18" and 15" x 20" Trays and Dinex Room Service Tray DXRST152003

Compliant with NSF/ANSI Standard 2



DXPICT10

Item Numbers
DXPICT10
DXPIPCT12

Pass-Thru Model
DXPICTPT10
DXPICTPT12

Application

The TQ Economy Cart is designed for transporting trays in units desiring to provide “Room Service" or “Late tray" style meals. The all stainless steel cart features fixed tray slides with 5.25" spacing. This cart will accommodate 14"x 18" and 15" x 20" trays and Dinex Room Service Tray DXRST152003, 2 trays per slide.

Construction

Dinex TQ Economy Carts are fabricated with 1" square tubing frame with welded 18-gauge pre-formed side panels/tray slides. The top, bottom and single panel door shall be 18-gauge, stainless steel. Door has recessed door pull with a transport latch. The door has a 270° door swing with magnets to keep the door in an opened position.

Casters

Four 5" diameter plate-type, 2 fixed, 2 swivel with brakes.

Standard Features

- All stainless steel
- Pull type door handle
- Transport latch with magnets
- Small footprint
- Accommodates both 14" x 18" & 15" x 20" trays
- Plate-type 5" casters, 2 with brakes

Options

- Corner bumpers
- 1, 2, 3, or 4-sided top rails
- Wrap-around bumpers

Warranty

One year parts and labor.

* Wrap around bumper option adds 2" (5cm) to the overall width and depth

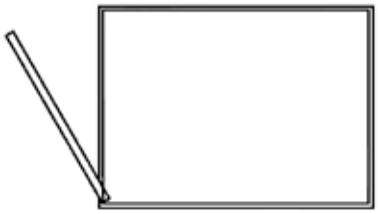
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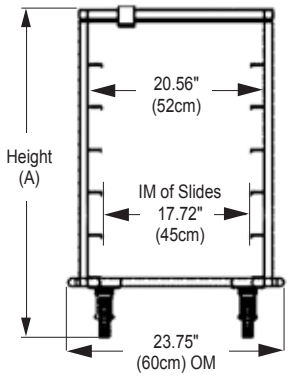
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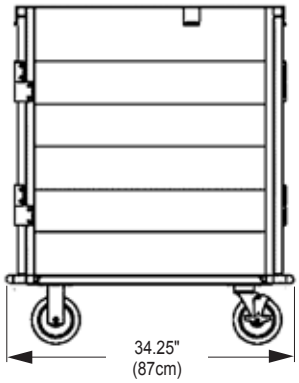
136P – Rev 10/2020

TQ ECONOMY CART – ENCLOSED

Accommodates 14" x 18" and 15" x 20" Trays and Dinex Room Service Tray DXRST152003







Items and Dimensions

ITEM NUMBER	WIDTH*	DEPTH*	HEIGHT	TRAY SPACING	TRAY CAPACITY	CART WEIGHT	SHIP WEIGHT	SHIP CUBE
DXPICT10 DXPICTPT10	23.75" (60cm)	34.25" (87cm)	37.1" (94cm)	5.625"	10	137 lbs (62kg) 149 lbs (68kg)	215 lbs (98kg) 220 lbs (100kg)	19.7
DXPICT12 DXPICTPT12	23.75" (60cm)	34.25" (87cm)	42.68" (108cm)	5.625"	12	141 lbs (64kg) 153 lbs (69kg)	235 lbs (107kg) 240 lbs (109kg)	22.4

* Wrap around bumper option adds 2" (5cm) to the overall width and depth

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TQ Economy Tray Delivery Carts

Prod No	Description	Capacity	L x D x H	Pack
1 Tray, 1 Door Version				
TRAY SIZES: 14" x 18", 13" x 21", 15" x 20" and Dinex Room Service Tray				
DXICT6S Δ	Room Service Cart, Enclosed	6	19.25" x 24.5" x 42.63" / 48.9 x 62.2 x 108.3 cm	1 ea
DXICT7S Δ	Room Service Cart, Enclosed	7	19.25" x 24.5" x 48.25" / 48.9 x 62.2 x 122.5 cm	1 ea
DXICT8S Δ	Room Service Cart, Enclosed	8	19.25" x 24.5" x 53.88" / 48.9 x 62.2 x 136.8 cm	1 ea
DXICT10S Δ	Room Service Cart, Enclosed	10	19.25" x 24.5" x 65.13" / 48.9 x 62.2 x 165.4 cm	1 ea
1 Tray, 1 Side Door Version				
TRAY SIZES: 14" x 18", 15" x 20", Tray Spacing 4.75" and 3-Sided Top Rail is Standard				
DXICT1T1DS9CC Δ	Room Service Cart, Enclosed with Side Door	9	21.72 x 23.75 x 52.98" / 55.2 x 60.3 x 134.6 cm	1 ea
2 Tray, 1 Door Version				
TRAY SIZES: 14" x 18", 15" x 20" and Dinex Room Service Tray				
DXICT10 Δ	Tray Cart, Enclosed	10	23.75" x 34.25" x 37.13" / 60.3 x 87 x 94.3 cm	1 ea
DXICTPT10 Δ	Tray Cart, Enclosed, Pass Thru	10	23.75" x 34.25" x 37.13" / 60.3 x 87 x 94.3 cm	1 ea
DXICT12 Δ	Tray Cart, Enclosed	12	23.75" x 34.25" x 42.75" / 60.3 x 87 x 108.6 cm	1 ea
DXICTPT12 Δ	Tray Cart, Enclosed, Pass Thru	12	23.75" x 34.25" x 42.75" / 60.3 x 87 x 108.6 cm	1 ea
DXICT16 Δ	Tray Cart, Enclosed	16	23.75" x 34.25" x 54" / 60.3 x 87.0 x 137.2 cm	1 ea
DXICTPT16 Δ	Tray Cart, Enclosed, Pass Thru	16	23.75" x 34.25" x 54" / 60.3 x 87.0 x 137.2 cm	1 ea
DXICT20 Δ	Tray Cart, Enclosed	20	23.75" x 34.25" x 65.25" / 60.3 x 87.0 x 165.7 cm	1 ea
DXICTPT20 Δ	Tray Cart, Enclosed, Pass Thru	20	23.75" x 34.25" x 65.25" / 60.3 x 87.0 x 165.7 cm	1 ea
DXICT24 Δ	Tray Cart, Enclosed	24	23.75" x 34.25" x 76.5" / 60.3 x 87.0 x 194.3 cm	1 ea
DXICTPT24 Δ	Tray Cart, Enclosed, Pass Thru	24	23.75" x 34.25" x 76.5" / 60.3 x 87.0 x 194.3 cm	1 ea
2 Tray, 2 Door Version				
TRAY SIZES: 14" x 18", 15" x 20" and Dinex Room Service Tray				
DXICT202D Δ	Tray Cart, Enclosed, 2 door	20	46.34" x 34.22" x 37.15" / 117.7 x 86.9 x 94.4 cm	1 ea
DXICTPT202D Δ	Tray Cart, Enclosed, 2 door, Pass Thru	20	46.34" x 34.22" x 37.15" / 117.7 x 86.9 x 94.4 cm	1 ea
DXICT242D Δ	Tray Cart, Enclosed, 2 door	24	46.34" x 34.22" x 42.75" / 117.7 x 86.9 x 108.7 cm	1 ea
DXICTPT242D Δ	Tray Cart, Enclosed, 2 door, Pass Thru	24	46.34" x 34.22" x 42.75" / 117.7 x 86.9 x 108.7 cm	1 ea
DXICT282D Δ	Tray Cart, Enclosed, 2 door	28	46.34" x 34.22" x 48.4" / 117.7 x 86.9 x 122.9 cm	1 ea
DXICTPT282D Δ	Tray Cart, Enclosed, 2 door, Pass Thru	28	46.34" x 34.22" x 48.4" / 117.7 x 86.9 x 122.9 cm	1 ea
DXICT322D Δ	Tray Cart, Enclosed, 2 door	32	46.34" x 34.22" x 54.03" / 117.7 x 86.9 x 137.2 cm	1 ea
DXICTPT322D Δ	Tray Cart, Enclosed, 2 door, Pass Thru	32	46.34" x 34.22" x 54.03" / 117.7 x 86.9 x 137.2 cm	1 ea

TQ Economy Tray Cart Options

Prod No	Description	Capacity
Top Rails		
DXICTTR1	Top Rail, One Side for TQ Economy Carts	For 10 to 16 capacity carts
DXICTTR2	Top Rail, Two Sides for TQ Economy Carts	For 10 to 16 capacity carts
DXICTTR3	Top Rail, Three Sides for TQ Economy Carts	For 10 to 16 capacity carts
DXICTTR4	Top Rail, Four Side for TQ Economy Carts	For 10 to 16 capacity carts
DXICT2DTR3	Top Rail, Three Sides for TQ Economy Carts	For 20 to 32 capacity carts
DXICT3DTR4	Top Rail, Four Sides for TQ Economy Carts	For 20 to 32 capacity carts
Accessories		
DXICTWB	Wrap-Around Bumpers for TQ Economy Carts	—
DXICTCB	Corner bumpers for TQ Economy Carts	—
DXICTCC	Carafe Caddy for TQ Economy Carts	For all capacity carts
DXICTDRAIN	Drain Assembly for TQ Economy Carts - One Per Door	—
DXICTPH	Push Hhandle for TQ Economy Carts	For 16, 20 and 24 capacity carts
DXICTTOW	Tow Hitch for TQ Economy Carts	—
Caster Upgrade Packages		
DXICTCAST6	6" Caster Upgrade for ICT Carts	—
DXICTCAST8	8" Caster Upgrade for ICT Carts	—
DXICTCAST54S	5" (4) Swivel Casters (2) with Brakes	—
DXICTCAST64S	6" (4) Swivel Casters (2) with Brakes	—
DXICTCAST84P	8" Pneumatic Caster (2) Fixed Casters (2) Swivel with Brake	—

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Submittal Sheet

03/14/2025

ITEM# K75 - SANDWICH / SALAD PREPARATION REFRIGERATOR (1 EA REQ'D)

Continental Refrigerator SW36N10

Sandwich Unit, 36"W, 10.3 cu ft capacity, two-section, (10) 1/6 size x 4" deep pans with 12" cutting board, (2) field rehingeable doors, stainless steel top, front & end panels, aluminum back & interior, rear mounted self-contained refrigeration, automatic hot gas condensate evaporator, R290 hydrocarbon refrigerant, 1/5 hp, cETLus, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	1		Standard warranty: 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	1		115v/60/1-ph, 2.46 amps, cord, NEMA 5-15P
Continental Refrigerator	1		Left Door hinged on left & right door hinged on right
Continental Refrigerator	1		Casters, 5"

SANDWICH UNIT REFRIGERATOR

Model: SW36N10

Natural Refrigerant R-290 Model

36” Standard Top Sandwich Unit Refrigerator with Solid Door - 10 Pans

Stainless steel front, top and end panels, aluminum back and interior.

Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**



Standard Model Features

REFRIGERATION SYSTEM

- Performance rated refrigeration system
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Unique air flow distribution allows pan product to maintain 33° - 41°F
- Automatic, hot gas condensate evaporator
- Non-corrosive, plasticized fin evaporator coil
- Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

- 2” non-CFC polyurethane foam insulation
- Smooth, polished chrome door handles
- Spring loaded, self closing doors
- Magnetic snap in Santoprene™ door gaskets
- Heavy duty, Additional steel shelves
- 12” deep, full length nylon cutting board
- Insulated lid
- Completely enclosed, vented and removable case back
- 5” casters

MODEL FEATURES

- Electronic control, off-cycle defrost
- (10) 1/6 size recessed pans, 4” deep
- Removable interior tub below pans
- Field rehingeable doors

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Options and Accessories

(upcharge and lead times may apply)

Stainless steel interior	Flat lid
Stainless steel back	Vision panel lid
Additional epoxy coated steel shelves	Door locks
Stainless steel shelves	Front breathing
Overshelves (single or double)	Rear mounted cutting board
Adjustable legs	Composite cutting board
Optional caster sizes	Crumb catcher
	Modified pan opening

Consult factory for other model configurations, options and accessories.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	10.3 (292 cu l)
1/6 Size Pans (4" deep)	10
Width, Overall (inches)	36 (914 mm)
Depth, Overall (inches) (including handles & bumpers)	32 3/16 (818 mm)
Depth, Cutting Board (inches)	12 (305 mm)
Height, Overall (inches) (including 5" casters)	42 1/4 (1073 mm)
Shelf Area (square feet)	4.6 (0.4 sq m)
Number of Shelves	2
Number of Doors	2
Interior Depth (inches)	19 3/8 (492 mm)
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	32 (813 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/5
Capacity (BTU per hour)*	1625

* Rating @ +25°F evaporator, 90°F ambient

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	2.46 (1.85)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

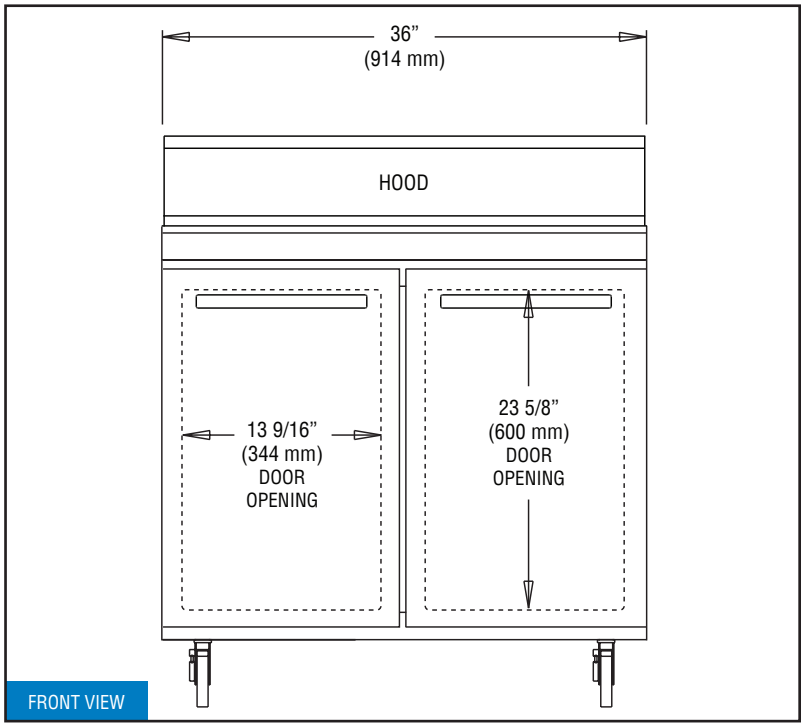
Weight (pounds)	254 (115 kg)
Height - Crated (inches)	43 1/4 (1099 mm)
Width - Crated (inches)	44 (1118 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.

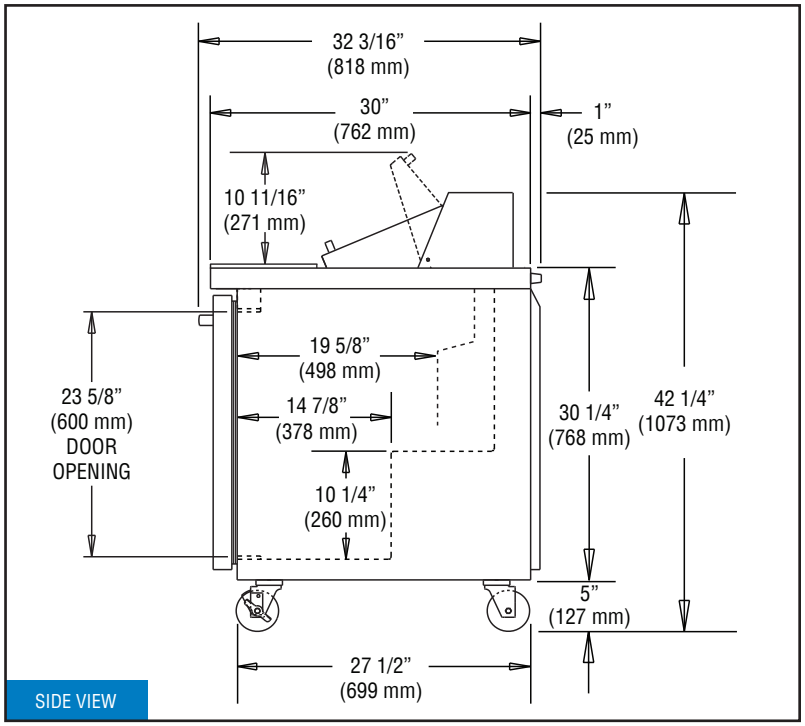


Equipped with one NEMA-5-15P Plug (varies by country)

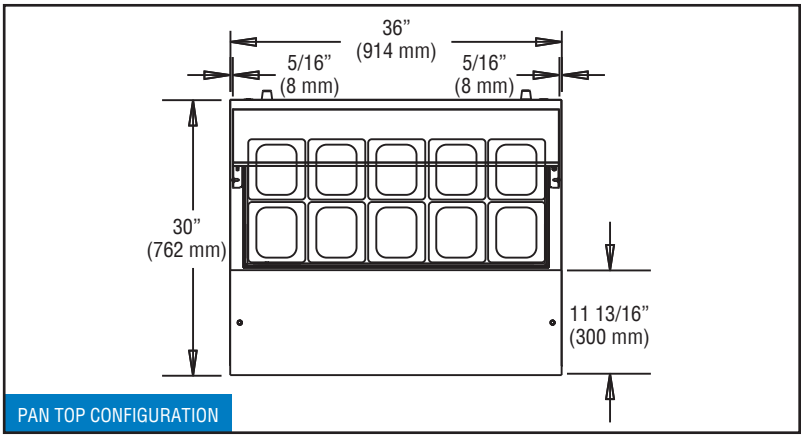
Model Plan Views



FRONT VIEW



SIDE VIEW



PAN TOP CONFIGURATION

Continental Refrigerator
Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

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A Division of National Refrigeration & Air Conditioning Products, Inc.

REVISED: 3/12/24

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K76 - WORK TABLE (1 EA REQ'D)

Fabricated CUSTOM

S/s work table with s/s undershelf, 20" x 20" s/s drawer, and five inch rear splash.

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Submittal Sheet

03/14/2025

ITEM# K77 - BLIXER (1 EA REQ'D)

Robot Coupe BLIXER10

Blixer® Commercial Blender/Mixer, vertical, 11.5 liter capacity, stainless steel bowl with handle, (3) blade adjustable stainless steel Blixer® assembly, pulse switch, two speed 1800 & 3600 RPM, 11.0 amps, 4-1/2 HP, 208-240v/60/3-ph, NEMA L15-20P, cETLus, ETL-Sanitation

BLIXER®

robot coupe

Blixer® 10

D	
Number of 7 oz. portions :	10 to 33 portions
Quantity processed per operation	4 to 14 lbs



A SALES FEATURES

Blixer 10 is designed to prepare texture-modified meals with either raw and cooked ingredients in a minimum of time.

B TECHNICAL FEATURES

Blixer 10. 3-phase. Power 4.5 HP. 2 speeds. Pulse function. 10 L stainless-steel bowl with 2 handles. Bowl-base blade assembly with 3 detachable fine serrated blades included. Scraper arm and lid wiper included. 10 to 33 portions (7 oz.) and more.

Select your options at the back page, F part.

C TECHNICAL DATA

Output power	4.5 HP
Electrical data	208-240V/60/3
Speeds	1800 and 3600 rpm
Dimensions (WxDxH)	12 7/16" x 21 1/2" x 26 3/4" - Cube: 10.74
Rate of recyclability	95%
Net weight	117 lbs
Nema #	L15-20P
Reference	BLIXER 10 - 208-240V/60/3

E PRODUCT FEATURES / BENEFITS

MOTOR BASE

- **Direct drive induction motor (no belt)** for intensive use.
- Power 4.5 HP.
- Stainless steel motor shaft.
- Flat, easy-clean motor base.
- IP65 control panel with flush buttons.
- Magnetic safety and motor brake.
- **2 speeds : 1800 and 3600 rpm**
- Pulse function for a better cut precision.

CUTTER FUNCTION

- 11.5 L stainless-steel bowl with 2 handles for a better grip.
- Central bowl locking system for easy assembly.
- Bowl-base blade assembly with 3 fine serrated blades to ensure a perfectly uniform consistency, even when processing small quantity.
- Transparent lid to enable user to monitor processing.
- Opening in centre of lid for adding liquid or dry ingredients during processing.
- **Transparent lid with bowl scraper** to improve the end-product consistency and **with a lid wiper** to enable user to monitor processing.
- **Opening in center of lid** for adding liquid or dry ingredients during processing.

INCLUDED ACCESSORIES

- Stainless steel fine serrated blade assembly (3 blades)
- Scraper arm and lid wiper

STANDARDS
ETL electrical and sanitation Listed/ cETL (Canada)

ETL LISTED 9900098 Conforms to UL NSF/ANSI Std 763 Std 8 Certified to CAN/CSA Std C22.2 No.195

Robot Coupe USA, Inc.
264 South Perkins - Ridgeland, MS 39157
PH: 601-898-8411 - Toll free: 800-824-1646 - Fax: 601-898-9134
info@robotcoupeusa.com

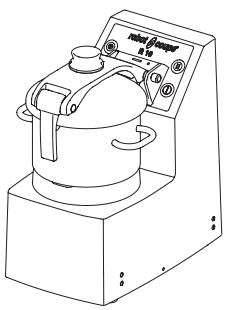
Blixer® 10

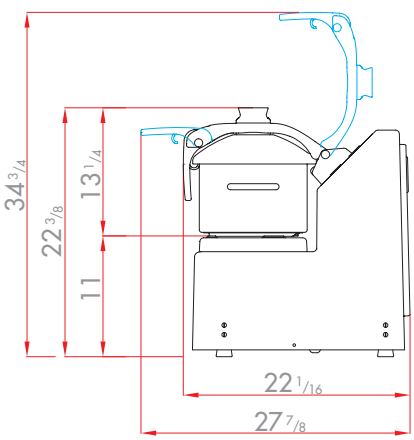
F OPTIONAL ATTACHMENTS

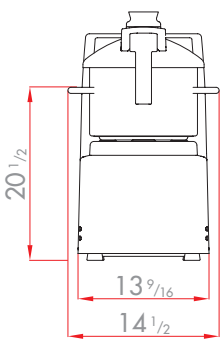
- 3 Blade Fine Serrated Edge Stainless Steel Adjustable Blade Assembly - Ref. 27378
- Lid Assembly with seal - Ref. 59319
- Complete Bowl Assembly - Ref. 59265

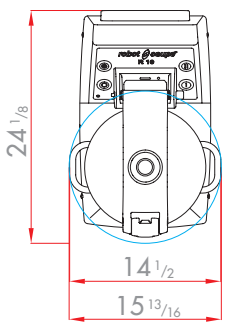
G ELECTRICAL DATA

208-240V/60/3 – delivered with cord and plug.









FLOOR-STANDING BLIXER®





	Blixer® 8	Blixer® 10
Induction motor	✓	✓
Power	3 HP	4.5 HP
Voltage	3-Phase 208 - 240 V	3-Phase 208 - 240 V
Speed	1800 - 3600 rpm	1800 - 3600 rpm
Pulse	✓	✓
Motor support	Composite	Composite
Bowl	8 L stainless steel bowl	11.5 L stainless steel bowl
Watertight lid	✓	✓
Blixer® arm	✓	✓
Blade	2 adjustable stainless steel fine serrated "S" blade - **Included**	3 adjustable stainless steel fine serrated "S" blades - **Included**
Number of 200 g portions	5 - 28	10 - 33

Choose your model:

Blixer® 8	$
BLIXER8 - 208-240V/60/3	

Blixer® 10	$
BLIXER10 - 208-240V/60/3	

Minimum Branch Circuit Protection Required : 20 AMP

Choose your options:

	Blixer® 8		Blixer® 10	
Options	**Ref.**	**$**	**Ref.**	**$**
Stainless steel bowl assembly	59264		59265	
2 Blade Fine Serrated Stainless Steel Adjustable Blade Assembly	27377		-	-
3 Blade Fine Serrated Stainless Steel Adjustable Blade Assembly	-	-	27378	
Lid Assembly with seal	59319		59319	

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Submittal Sheet

03/14/2025

ITEM# K78 - SHELVING, WALL MOUNTED (1 EA REQ'D)

Advance Tabco WS-12-84-16

Shelf, wall-mounted, 84"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF (units 84" & longer have (3) support brackets)

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

WALL SHELVES

NSF



Item #: _____ Qty #: _____

Model #: _____

Project #: _____



FEATURES:

Brackets can be positioned to accommodate wall studs.

Furnished with a 1-5/8" Bullnose edge with a 1-1/2" turn-up edge at rear. Ends are turned down square.

MATERIAL:

16 Gauge Series - 304 stainless steel polished to a satin finish.

18 Gauge Series - 430 stainless steel polished to a satin finish.

CONSTRUCTION:

Secured to wall by means of bolts through support brackets.

Units 7 ft. and larger are furnished with 3 brackets.

	10" Wide			12" Wide			15" Wide			18" Wide			
L	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	Approx. Cu. Ft.
24"	WS-10-24-16	WS-10-24	8 lbs.	WS-12-24-16	WS-12-24	9 lbs.	WS-15-24-16	WS-15-24	11 lbs.	WS-18-24-16	WS-18-24	14 lbs.	3
30"	-	-	-	WS-12-30-16	WS-12-30	12 lbs.	-	-	-	-	-	-	4
36"	WS-10-36-16	WS-10-36	10 lbs.	WS-12-36-16	WS-12-36	12 lbs.	WS-15-36-16	WS-15-36	15 lbs.	WS-18-36-16	WS-18-36	21 lbs.	4
42"	-	-	-	WS-12-42-16	WS-12-42	14 lbs.	-	-	-	-	-	-	5
48"	WS-10-48-16	WS-10-48	12 lbs.	WS-12-48-16	WS-12-48	14 lbs.	WS-15-48-16	WS-15-48	18 lbs.	WS-18-48-16	WS-18-48	24 lbs.	5
60"	WS-10-60-16	WS-10-60	15 lbs.	WS-12-60-16	WS-12-60	17 lbs.	WS-15-60-16	WS-15-60	23 lbs.	WS-18-60-16	WS-18-60	28 lbs.	6
72"	WS-10-72-16	WS-10-72	17 lbs.	WS-12-72-16	WS-12-72	21 lbs.	WS-15-72-16	WS-15-72	28 lbs.	WS-18-72-16	WS-18-72	32 lbs.	7
84"	WS-10-84-16	WS-10-84	20 lbs.	WS-12-84-16	WS-12-84	25 lbs.	WS-15-84-16	WS-15-84	32 lbs.	WS-18-84-16	WS-18-84	36 lbs.	8
96"	WS-10-96-16	WS-10-96	23 lbs.	WS-12-96-16	WS-12-96	28 lbs.	WS-15-96-16	WS-15-96	36 lbs.	WS-18-96-16	WS-18-96	42 lbs.	10
108"	WS-10-108-16	WS-10-108	28 lbs.	WS-12-108-16	WS-12-108	32 lbs.	WS-15-108-16	WS-15-108	40 lbs.	WS-18-108-16	WS-18-108	48 lbs.	11
120"	WS-10-120-16	WS-10-120	32 lbs.	WS-12-120-16	WS-12-120	36 lbs.	WS-15-120-16	WS-15-120	44 lbs.	WS-18-120-16	WS-18-120	54 lbs.	12
132"	WS-10-132-16	WS-10-132	36 lbs.	WS-12-132-16	WS-12-132	42 lbs.	WS-15-132-16	WS-15-132	49 lbs.	WS-18-132-16	WS-18-132	60 lbs.	13
144"	WS-10-144-16	WS-10-144	40 lbs.	WS-12-144-16	WS-12-144	48 lbs.	WS-15-144-16	WS-15-144	55 lbs.	WS-18-144-16	WS-18-144	66 lbs.	14

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Customer Service Available To Assist You 1-800-645-3166 8:30 am - 7:00 pm E.S.T.

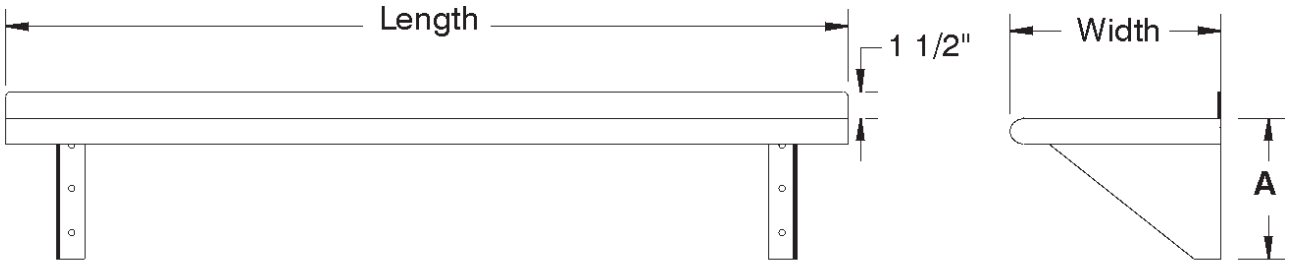
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Email: customer@advancetabco.com or **Fax:** 631-242-6900

For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

REF-L

DETAILS and SPECIFICATIONS

TOL ± .500" ALL DIMENSIONS ARE TYPICAL

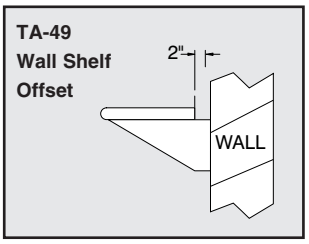


Width	A
10"	8 1/2"
12"	10 1/2"
15"	13 1/2"
18"	16 1/2"

Load Capacity = 20 lbs. per sq. ft.
(Evenly Distributed Weight)

Wall Shelf Options

PRT-1	Printer Shelf
TA-22A	Square Edge Shelf
TA-26	Welded Shelf Brackets
TA-49	Wall Shelf 2" Offset
TA-71	Heat Lamp Provision
TA-77	Check Minder
TA-77A	Concealer for Heat Lamp (Requires TA-77)
TA-99A	14 Ga. S/S 304 Upgrade for Overshelves
TA-100A	Bullnose Edge On All 4 Sides of Shelf
TA-102	6" Cantilever Shelf Offset





ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.
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Submittal Sheet

03/14/2025

ITEM# K79 - HEATED HOLDING/TRANSPORT INSTITUTIONAL CABINET (1 EA REQ'D)

Vulcan VBP15ES

Holding/Transport Cabinet, Institutional Series, mobile, capacity (15) 18" x 26" x 1" or (30) 12" x 20" x 2-1/2" pans, includes (10) pair of adjustable tray slides 1-1/2" OC, forced air blower, side mounted push handles, recessed control panel, electronic control with digital display, ambient to 190° F, 20 gauge stainless steel interior & exterior, cULus, UL EPH Classified

ACCESSORIES

Mfr	Qty	Model	Spec
Vulcan	1		10 year warranty on heating elements
Vulcan	1		120v/60/1-ph, 1500 watts, 12.5 amps, cord with NEMA 5-15P, standard
Vulcan	1		Field reversible doors
Vulcan	1		Stainless steel dutch doors
Vulcan	1		5" Casters, set of (4)

Item # _____ C.S.I. Section 11420

HEATED HOLDING

VBP SERIES
HOLDING & TRANSPORT CABINETS



Model VBP15

UL Listed. UL Listed to Canadian safety standards.
Classified by UL to NSF Standard #4.

SPECIFICATIONS

Vulcan Model No. VBP heated holding and transport cabinets. Blower motor for gentle and even temperature distribution. Complete with 5" heavy duty casters (2 swivel with brakes and 2 rigid) (VBP5 has 3" casters). Simple knob actuated electronic control with digital display for holding at temperatures up to 190°F. Adjustable racking will hold 18" x 26" or 12" x 20" pans or a combination of both on 1½" centers. Lip-load racking will hold 18" x 26" pans on 1½" centers. Shelving will hold a variety of pan sizes. Complete with universal tray slides adjustable on 1½" centers. Cabinet interior and exterior are both constructed out of 20 gauge stainless steel. Recessed side-mounted handles, magnetic action door latch, and full insulation; 1½" in side walls and 2" in top. Integrated steel frame for maximum strength. Field reversible doors. Complete with rear mounted cord and plug: NEMA 5-15 for 120 volts and NEMA 6-15 for 208-240 volts. One year limited parts and labor warranty. After the first year, 10-year parts warranty on the heating elements.

Units with adjustable racking:

- ☐ **VBP5** (see reverse for capacities)
- ☐ **VBP7** (see reverse for capacities)
- ☐ **VBP13** (see reverse for capacities)
- ☐ **VBP15** (see reverse for capacities)
- ☐ **VBP18** (see reverse for capacities)

Units with lip-load racking:

- ☐ **VBP7LL** (Fifteen 18" x 26" x 1" sheet pans)
- ☐ **VBP15LL** (Thirty 18" x 26" x 1" sheet pans)

Units with shelves:

- ☐ **VBP7SL** (Three Shelves)
- ☐ **VBP15SL** (Six Shelves)

STANDARD FEATURES

- ■ Holding Capacity:
  - 18" x 26" sheet pans.
  - 12" x 20" pans, or a combination of both on 1½" centers.
  - Other pan sizes on shelves.
- ■ Simple knob actuated electronic control with digital display for holding at temperatures of up to 190°F.
- ■ Blower motor for gentle and even temperature distribution.
- ■ Dutch doors (VBP15 and VBP18).
- ■ 5" heavy duty casters (2 swivel with brakes and 2 rigid) (3" on VBP5).
- ■ Recessed side mounted handles.
- ■ Universal tray slides adjustable on 1½" centers. VBP15 & VBP13 ship with 10 pairs of tray slides. VBP7 & VBP5 ships with 5 pairs, VBP18 ships with 15 pairs.
- ■ Interior and the exterior are both constructed out of 20 gauge stainless steel.
- ■ Fully insulated with 1½" in side walls and 2" in top.
- ■ Integrated steel frame for maximum strength.
- ■ Magnetic action door latch.
- ■ Field reversible doors.
- ■ Rear mounted cord.
- ■ Complete with cord and plug: NEMA 5-15 for 120 volts and NEMA 6-15 for 208-240 volts.
- ■ One year limited parts and labor warranty. After the first year, 10-year parts warranty on the heating elements.

OPTIONS

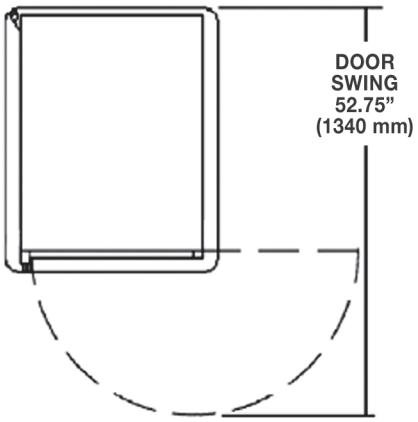
- ☐ 208/240 volt
- ☐ Humidity pan
- ☐ Full perimeter bumper
- ☐ Glass Dutch doors (VBP7 and VBP15 only)
- ☐ Wire shelves to sit on tray slides
- ☐ Additional tray slides
- ☐ Mechanical control

a division of ITW Food Equipment Group LLC
P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

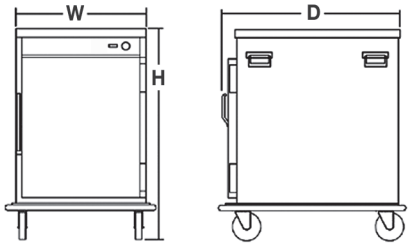
HEATED HOLDING

VBP SERIES
HOLDING & TRANSPORT CABINETS

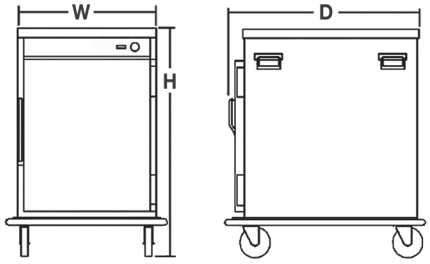
Drawings shown with optional bumper



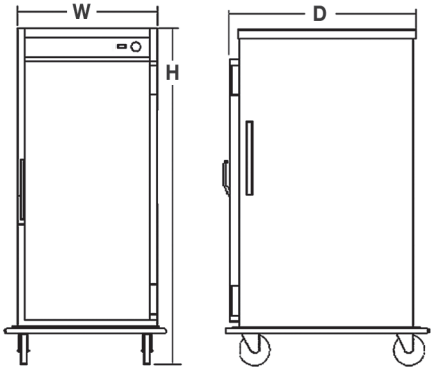
All Models Top View



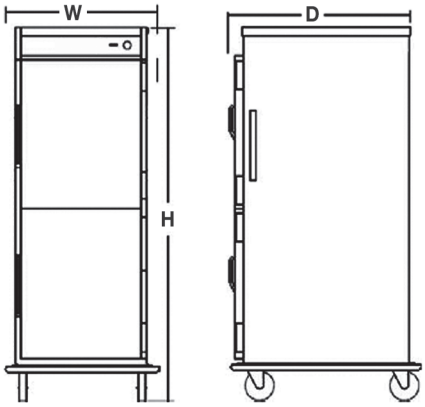
VBP5 Front & Side Views



VBP7 Front & Side Views



VBP13 Front & Side Views



VBP15 & VBP18 Front & Side Views

MODEL	DIMENSIONS	CAPACITY		ELECTRICAL			SHIPPING WEIGHTS	
	EXTERIOR	12" x 20" x 2½" PANS	18" x 26" SHEET PANS	VOLTS	WATTS	AMPS	LBS	KG
VBP5	27¼" W x 33" D x 30½" H	10	5	120	1,500	12.5	173	79
VBP7	27¼" W x 33" D x 39" H	14	7	120	1,500	12.5	198	90
VBP7LL	27¼" W x 33" D x 39" H	NA	15	120	1,500	12.5	198	90
VBP7SL	27¼" W x 33" D x 39" H	Unit comes with 3 shelves		120	1,500	12.5	198	90
VBP13	27¼" W x 33" D x 59¾" H	26	13	120	1,500	12.5	270	123
VBP15	27¼" W x 33" D x 65¼" H	30	15	120	1,500	12.5	297	135
VBP15LL	27¼" W x 33" D x 65¼" H	NA	30	120	1,500	12.5	297	135
VBP15SL	27¼" W x 33" D x 65¼" H	Unit comes with 6 shelves		120	1,500	12.5	297	135
VBP18	27¼" W x 33" D x 73½" H	36	18	120	1,500	12.5	337	153

*per compartment
Optional bumper adds 3¼" to the width and 1⅝" to the depth.

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P.O. Box 696 ■ Louisville, KY 40201 ■ Toll-free: 1-800-814-2028 ■ Local: 502-778-2791 ■ Quote & Order Fax: 1-800-444-0602

NOTE: In line with its policy to continually improve its products, Vulcan reserves the right to change materials and specifications without notice.

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K80 - SPARE NO.

<Spare No.>

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K81 - SPARE NO.

<Spare No.>

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K82 - ICE MAKER, CUBE-STYLE (1 EA REQ'D)

Hoshizaki KM-660MAJ

Ice Maker, Cube-Style, 22"W, air-cooled, self-contained condenser, production capacity up to 650 lb/24 hours at 70°/50° (560 lb AHRI certified at 90°/70°), stainless steel finish, crescent cube Style, R-404A refrigerant, 115v/60/1-ph, 15.2 amps, NSF, UL

ACCESSORIES

Mfr	Qty	Model	Spec
Hoshizaki	1		Warranty: 3-Year parts & labor on entire machine
Hoshizaki	1		Warranty: 5-Year parts & labor on evaporator
Hoshizaki	1		Warranty: 5-Year parts on compressor & air-cooled condenser
Hoshizaki	1	H9320-51	Water Filtration System, single configuration, 18.4" H (manifold & cartridge)
Hoshizaki	1		Warranty: 1-Year on entire water filtration system & replaceable elements, standard

KM-350/520/660M_J(Z)

KM-350/520/660M_J(Z)
12/19/24
Item # 13260

SLIM-LINE MODULAR CRESCENT CUBER

Item #: _____

Project: _____

Qty: _____

AIA#: _____

W x D x H
22" x 27 3/8" x 28"

KM EDGE X ICE MACHINE SERIES

Air-Cooled
KM-350MAJ ★
KM-520MAJ ★
KM-660MAJ
Air-cooled model shown on optional bin: B-300

Water-Cooled
KM-350MWJ
KM-520MWJ
KM-660MWJ

Remote Air-Cooled
KM-520MRJZ ★
KM-660MRJZ ★

★ ENERGY STAR



Features

- **Individual crescent cube**
- **Factory-installed ultrasonic bin control can be adjusted on site**
- **Simple, one-hour cleaning process** CLEANASSIST

- Durable construction with fewer parts
- Self-diagnostic programming automatically adjusts to changing conditions
- Snap fit parts for easy cleaning
- Stainless steel double-sided evaporator
- CycleSaver™ design
- EverCheck™ alert system
- Removable air filters (air-cooled model only)
- R-404A Refrigerant

Available on Bins/Dispensers:

B-250SF	B-500/SF	B-800SF	B-1150SS	DB-130H
B-300SF	B-700SF	B-900SF	B-1300SS	DB-200H
				DM-200B

Top kit may be required. See Bin Spec Sheets.

Warranty:
3 Year Parts & Labor on entire machine 5 Year Parts & Labor on evaporator
5 Year Parts on Compressor; air-cooled condenser coil
Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.
Shipping: (LxWxH) 33.5" x 25.88" X 34.6" Volume: 17.36ft³

FACTORY WARRANTY: Parts & Labor 3 YR Ice Maker, 5 YR Evaporator; Parts 5 YR Compressor

Condenser	Model	ICE PRODUCTION Air / Water Temp Lbs. per 24 hours 70°/ 50°F	ICE PRODUCTION 90°/ 70°F	WATER USAGE Potable Gal. per 100 lbs. 90°/ 70°F	WATER USAGE Condenser Gal. per 100 lbs. 90°/ 70°F	ELECTRICAL kWh Used per 100 lbs. 90°/ 70°F	ELECTRICAL Min. Circuit/ Max. Fuse Size	ELECTRICAL Amperage	ELECTRICAL Voltage	Circuit Wires (including ground)	Heat Rejection BTU/hr.	Refrigerant Charge Amount	Net / Ship Weight (lbs.)
Air	KM-350MAJ ★	489	393	14.5	N/A	5.42	15A	9.05A	115V/60/1	3	5,700	1 lb. 3.4 oz.	125 / 175
Water	KM-350MWJ	414	383	15.5	109	4.90	15A	7.5A	115V/60/1	3	6,600	11.6 oz.	126 / 175
Air	KM-520MAJ ★	533	450	15.0	N/A	5.25	20A	10.6A	115V/60/1	3	6,600	1 lb. 10.8 oz.	145 / 175
Water	KM-520MWJ	474	444	14.8	75	4.65	20A	8.45A	115V/60/1	3	6,300	12.7 oz.	127 / 175
Remote	KM-520MRJZ ★	547	495	13.6	N/A	4.80	20A	12.05A	115V/60/1	3	6,200	2 lb. 4.7 oz. 4 lb. 2.7 oz.†	145 / 175
Air	KM-660MAJ	650	560	14.8	N/A	5.3	20A	15.2A	115V/60/1	3	8,000	1 lb. 9.8 oz.	150 / 180
Water	KM-660MWJ	647	630	16.1	152	4.28	20A	12.35A	115V/60/1	3	8,900	15.2 oz.	130 / 180
Remote	KM-660MRJZ ★	642	570	15.0	N/A	5.25	20A	16.1A	115V/60/1	3	8,100	2 lb. 4.7 oz. 4 lb. 2.7 oz.†	150 / 180

† (with condenser)

Power cord not included. Must be hard-wired at site.

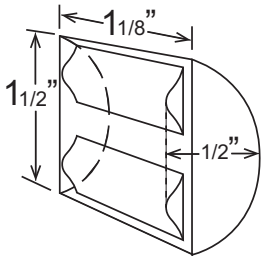
Hoshizaki reserves the right to change specifications without notice.

KM-350/520/660M_J(Z)
12/19/24
Item # 13260

KM-350/520/660M_J(Z)

SLIM-LINE MODULAR CRESCENT CUBER

KM*Edge*™ Cube Dimensions*



† approximate size in inches, image not to scale

Operating Limits

- Ambient Temp Range 45 - 100°F
- Water Temp Range 45 - 90°F
- Water Pressure 10 - 113 PSIG
- Voltage Range 104 - 127V
- If GFCI is required, a GFCI breaker MUST be used in lie of GFCI receptacle

Service

- Panels easily removed and all components accessible for service.
- Removable/cleanable air filters. (Air-cooled model only)
- Allow 6" (15 cm) clearance at rear, sides, and top for proper air circulation and ease of maintenance/service.

Plumbing

- Icemaker water supply line: minimum 1/4" nominal ID copper water tubing or equivalent
- Icemaker drain line: minimum 3/4" nominal ID hard pipe or equivalent

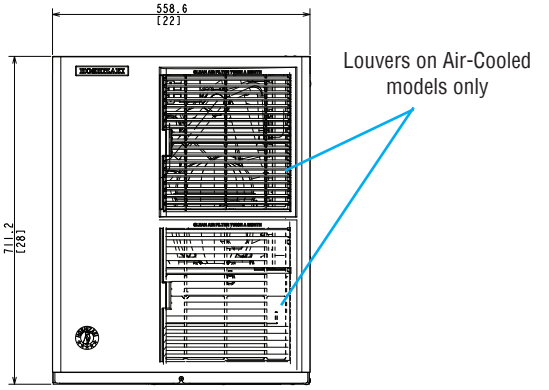
Water-Cooled Model (Lines Must Be Independent of Icemaker)

- Condenser water supply line: minimum 1/4" nominal ID copper water tubing or equivalent
- Condenser drain/return line: minimum 1/4" nominal ID hard pipe (open drain system) or copper water tubing (closed loop system) or equivalent

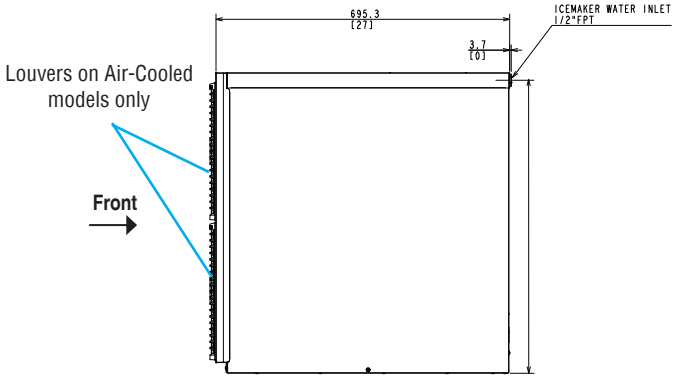
Water Filter

Please refer to water filter specification sheet for recommendations.

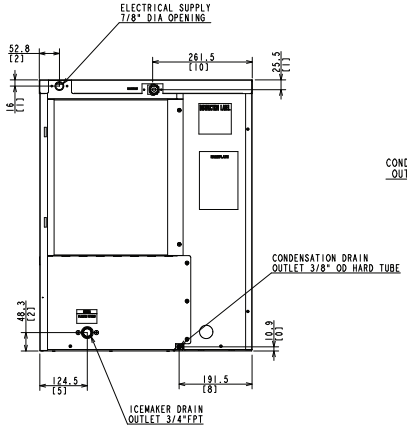
FRONT VIEW



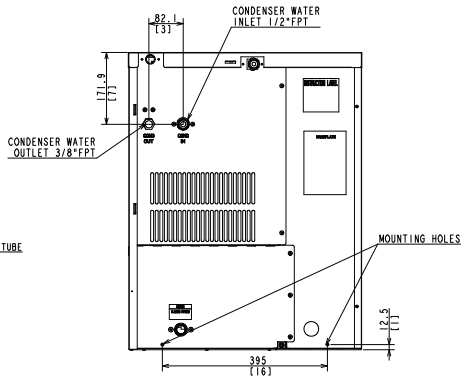
SIDE VIEW



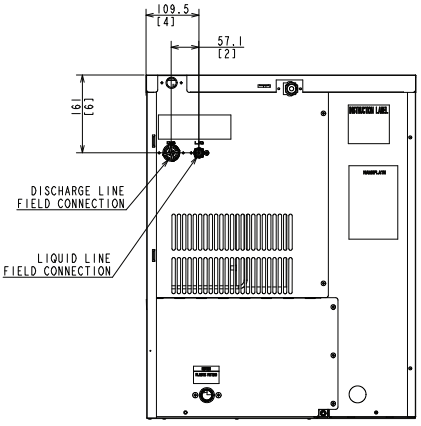
REAR VIEW



AIR-COOLED

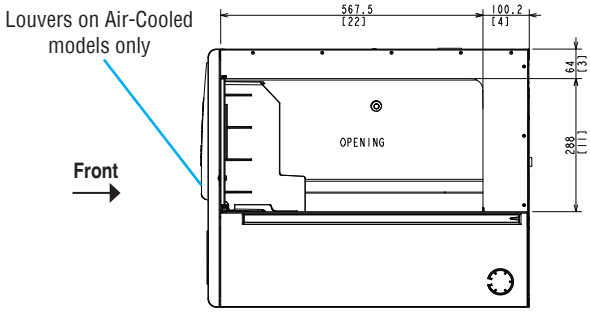


WATER-COOLED



REMOTE AIR-COOLED

BOTTOM VIEW

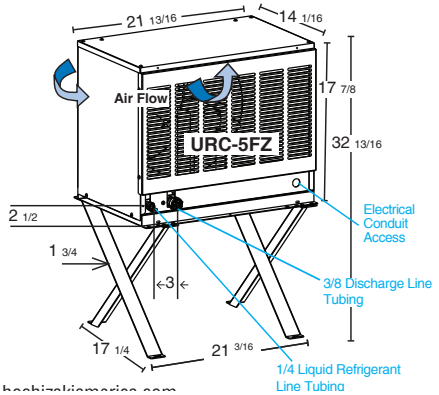


URC-5FZ Remote Condenser (Sold Separately)

(W x D x H) 21 13/16 x 14 1/16 x 32 13/16

For Use with KM-520MRJZ and KM-660MRJZ

Brazed Line Sets
(Sold Separately)
25' HS-5587
35' HS-5588



WATER FILTERS

FILTRATION SYSTEMS

WATER FILTERS
02/13/22
Item # 13076

Item #: _____

Project: _____

Qty: _____

AIA#: _____

H9320 FILTER
Single, Double, Triple



H9320-51

Single Configuration
18.4" H*



H9320-52

Double Configuration
19.11" H*



H9320-53

Triple Configuration
19.15" H*

*height includes manifold and cartridge

HOSHIZAKI H9320 FILTER

Available in single, double and triple configurations. Rated NSF Class 1, STD 42, for taste, odor and chlorine reduction and for mechanical filtration (95.6% removal of particles one (1) micron and larger in size.)

- Keep ice makers functioning at full capacity
- 97.3% average reduction of chlorine from incoming water supply, eliminating tastes and odors of the ice
- Filters are rated as one (1) micron nominal producing crystal clear ice
- Decrease machine maintenance by reducing lime scale build-up

Model	Filter	Max Flow Rate	Working Pressure	Temperature	Capacity
H9320-51	4HC-H	2 gpm	10-125 psi	35-100°F	21,000 gal
H9320-52	4HC-H	4 gpm	10-125 psi	35-100°F	42,000 gal
H9320-53	4HC-H	6 gpm	10-125 psi	35-100°F	63,000 gal

Plumbing

Inlet/Outlet Connections: Single: (2) 3/8" FNPT
Double & Triple: (1) 3/4" MNPT / (1) 3/4" FNPT

The H9320 Filters and their respective cartridges have been tested and listed by NSF only for the functions listed above. Check for compliance with state and local laws and regulations. Do not use where the water is microbiologically unsafe, or with waters of unknown quality without adequate disinfection before or after the unit. The H9320 filter can be used with water that may contain filterable cysts.

The H9320 System is tested and certified by NSF International against NSF/ANSI Standard 42 for the reduction of:
Std. No. 42 - Aesthetic effects

Aesthetic Effects
Bacteriostatic Effects
Chemical Reduction
Chlorine

Mechanical Filtration
Nominal Particulate Class 1
Taste & Odor

E-10 PREFILTER
(9795-80)

E-20 PREFILTER
(9795-90)



E-10 PREFILTER
(9795-80)
Recommended for single configuraton



E-20 PREFILTER
(9795-90)
Recommended for twin and triple configuraton

E-10 and E-20 Prefilters can be used for ice. Everpure prefilters are designed to increase the life of Hoshizaki 4HC-H water filters in areas with an unusual amount of dirt in the water. With a 10 micron (nominal) rating, the economical Everpure prefilter traps much of the dirt which contributes to scale buildup in ice makers, and clogs the delicate orifices of other water-using equiment.

When you install an Everpure prefilter, the Hoshizaki 4HC-H water filters can concentrate on what they do best: remove particles one (1) micron nominal and larger in size.

Replacement Cartridges:
E-10 Prefilters: 12 pack (9534-12)
40 pack (9534-40)

E-20 Prefilters: 6 pack (9534-26)
20 pack (9534-20)

Warranty:
One Year replaceable elements*
One Year the entire system
* Warranty applies to material defects in materials & workmanship only.

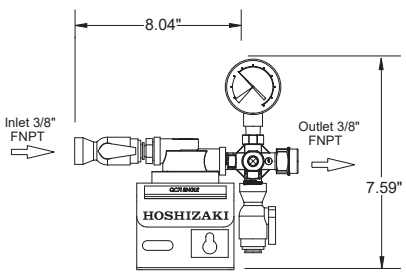
Hoshizaki reserves the right to change specifications without notice.

WATER FILTERS

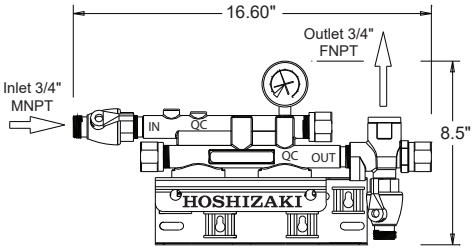
FILTRATION SYSTEMS

Model Number	Description Flow Rate (Gal. per min.)	Undercounter KMs	KM Cubers	IM Cubers	Cubelets & Flakers	DCM/DBs
H9320-51	Single (2 GPM)	AM-50 KM-81 KM-116 KM-161 KM-231 KM-301	KM-350, 520, 660 KML-325, 500, 700 KMD-410, 460, 530 KMS-830 DKM-500	IM-200,500 IM-50BAA-LM	All Models	All Models
H9320-52	Twin 2 x (2 GPM)	N/A	KM-901, 1100 KMD-860 KMS-822, 1122, 1402	IM-50BAA-Q	N/A	N/A
H9320-53	Triple 3 x (2 GPM)	N/A	KM-1301, 1340, 1601, 1900, 2200, 2600 KMH-2100 KMS-2000	N/A	N/A	N/A
H9655-11	Replacement Cartridge (1) One each	Recommended water filter configurations based on average ice machine usage and regular filter replacement. If your operation has challenging water conditions or higher usage, then it may be necessary to use an additional filter or prefilter.				

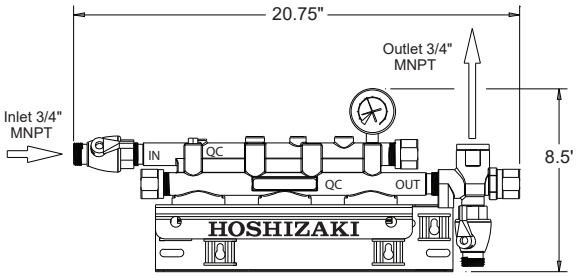
Single



Twin



Triple



MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K83 - ICE BIN FOR ICE MACHINES (1 EA REQ'D)

Hoshizaki B-500SF

Ice Bin, 30"W, top-hinged front-opening door, 500-lb ice storage capacity, for top-mounted ice maker, stainless steel exterior, painted legs included, protected with H-GUARD Plus Antimicrobial Agent, ETL, ETL-Sanitation

ACCESSORIES

Mfr	Qty	Model	Spec
Hoshizaki	1		Warranty: 3-Year parts & labor for bin

SF Bins

ICE STORAGE BIN SERIES

Item #: _____

Project: _____

Qty: _____

AIA#: _____

SF - Stainless Steel Finish



B-250SF | B-300SF BD-300SF | B-500SF BD-500SF



B-700SF | B-800SF | B-900SF

Features

- **Polyethylene bin liner for sanitary storage**
- **Sturdy construction for side-by-side or stacked ice machine installation**

- Ice storage capacity from 250 lbs. up to 900 lbs.
- Both surfaces are designed for easy cleaning
- Long lasting attractive appearance
- Foamed-in-place polyurethane insulation, in all bin walls and bottom, provides dependable ice storage

SF - Stainless Steel Finish

BD Bins

- Fit 24" - 24 1/2" deep ice machine without top kit extension

Warranty:

2 Year Parts & Labor (Production prior to January 2012)
3 Year Parts & Labor (Production January 2012 and after)
Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.

Model Number	Exterior Dimensions W x D x H*	Interior Dimensions W x D x H	Application Storage Capacity†	Cubic Volume	Shipping Dimensions L x W x H	Shipping Weight (lbs.)
B-250SF	30" x 32.3" x 33.4"	27" x 27.7" x 23.7"	250 lbs.	10.30 ft³	35" x 32" x 32"	—
B-300SF	22" x 32.3" x 46"	19" x 27.7" x 37.6"	300 lbs.	11.51 ft³	35" x 24" x 45"	125
BD-300SF	22" x 32.3" x 46"	19" x 27.7" x 37.6"	300 lbs.	11.51 ft³	35" x 24" x 45"	130
B-500SF	30" x 32.3" x 46"	27" x 27.7" x 37.6"	500 lbs.	16.33 ft³	35" x 32" x 45"	140
BD-500SF	30" x 32.3" x 46"	27" x 27.7" x 37.6"	500 lbs.	16.33 ft³	35" x 32" x 45"	140
B-700SF	44" x 32.3" x 46"	41" x 27.7" x 37.6"	700 lbs.	24.77 ft³	46" x 35" x 45"	175
B-800SF	48" x 32.3" x 46"	45" x 27.7" x 37.6"	800 lbs.	26.90 ft³	50.25" x 35" x 45"	185
B-900SF	52" x 32.3" x 46"	49" x 27.7" x 37.6"	900 lbs.	29.59 ft³	54.5" x 35" x 45"	195

*Height includes 6" legs
† Capacity based on volume x 30 lb/ft³ average density of ice.

Hoshizaki reserves the right to change specifications without notice.

SF Bins

ICE STORAGE BIN SERIES

Ice Machine Model Application

	22" Width KM-350M KM-520M KM-660M F-450M F-801M F-1002M	22" Width KMD-410M† KMS-822M FD-650M-C† FD-1002M-C	30" Width KM-901M KM-1340M KM-1601M KML Series KMD-355/505M KMD-705M F-1501M F-2001	30" Width KMD-460M‡ KMD-530M‡ KMD-860M‡ KMS-1402M* KMS-2000M*	44" Width 2 KM-350M 2 KM-520M 2 KM-660M IM-500S 2 F-450M 2 F-801M 2 F-1002M	44" Width 2 KMD-410M 2 FD-650M-C 2 FD-1002M-C	48" Width KM-1301S KM-1400S KM-1601S KM-1900S KM-2200S KM-2600S
Bins B-300SF DB-130H	—	NEED HS-2153 HS-5424 *(KMD-410 on B-300 only)*	N/A	N/A	N/A	N/A	N/A
Bins B-250SF B-500SF	NEED HS-2033	NEED HS-2033 & HS-2129	—	NEED HS-2129	N/A	N/A	N/A
Bins B-700SF	NEED HS-2035	NEED HS-2035 & HS-2130	NEED HS-2034	NEED HS-2130 & HS-2034	—	NEED HS-2130 *(KMD-410 does not apply)*	N/A
Bins B-800SF	NEED HS-2035 & HS-2032	NEED HS-2035, HS-2032 & HS-2131	NEED HS-2034 & HS-2032	NEED HS-2131, HS-2034 & 2032	NEED HS-2032	NEED HS-2032 & HS-2131	—
Bins B-900SF	NEED HS-2035 & HS-2033	NEED HS-2035, HS-2033 & HS-2132	NEED HS-2035	NEED HS-2132 & HS-2035	NEED HS-2033	NEED HS-2033 & HS-2132	NEED HS-2032
Bins DB-200H DM-200B	NEED HS-2036 *(KM units only)*	N/A	— *(KML Series only)* NEED HS-2148 *(KMD Series on DB-200H only)*	N/A	N/A	N/A	N/A

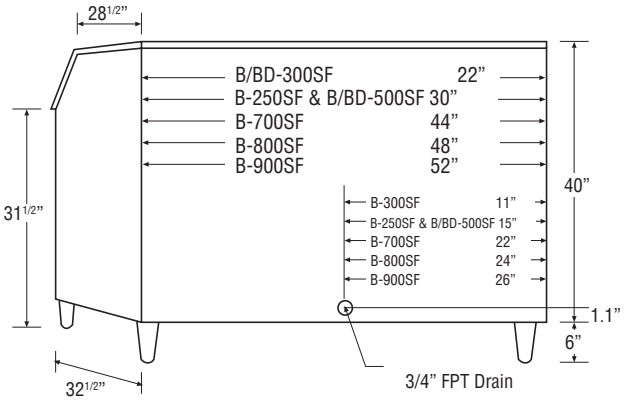
— No top kit necesary | N/A Combination of ice maker and bin is not possible

BD Bins fit 24" - 24 1/2" deep ice machine without Top Kit extension.
† **BD-300SF:** KMD-410M, KMS-822M, FD-650M-C, FD-1002M-C
‡ **BD-500SF:** KMD-460M, KMD-530M, KMD-860M, KMD-355, KMD-505M, KMD-705M

Top Kits:
HS-2032 - 4" ABS Top Kit
HS-2033 - 8" ABS Top Kit
HS-2034 - 14" ABS Top Kit
HS-2035 - 22" ABS Top Kit
HS-2036 - (2) 4" ABS Top Kits
HS-2066 - Seismic Kit for SD 500 Stands
HS-2071 - Anchored Leg Kit SD 500 Stands
HS-2111 - 11.3" x 26.2" Stainless Cover/Separator
HS-2148 - 30" x 3.1" Stainless Cover
HS-2153 - KMD-410 on B-300 bin
HS-2160 - 2 KM-901M

B-250SF





Ice Drop Area



B Bins



BD Bins



Bin Flanged Legs:
B/BD-300SF



Bin Legs:
B-250SF, B/BD-500SF
B-700SF, B-800SF
B-900SF

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K84 - FLOOR TROUGH (1 EA REQ'D)

Advance Tabco FTG-1230

Floor Trough, 30"W x 12"D x 4" deep, 14 gauge 304 stainless steel, includes stainless steel subway grating constructed from 3/16" x 1" bars, removable stainless steel strainer basket, 4" O.D. waste pipe 3"L, pitched towards waste, NSF

STAINLESS STEEL

FLOOR TROUGHS, DRAINS & FLOOR DRAINS

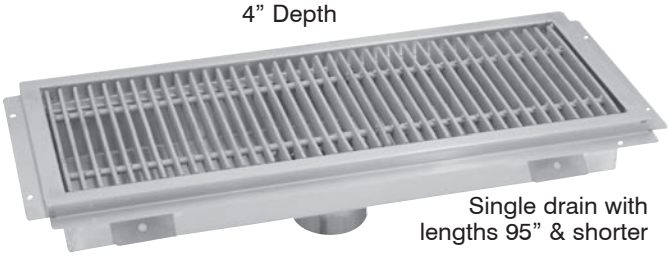
Item #: _____ Qty #: _____

Model #: _____

Project #: _____

12” Floor Troughs

4” Depth



Single drain with lengths 95” & shorter



Double drains with lengths 96” & longer

7.5” Floor Water Troughs

4” Depth





Cut-Out View of Anti-Splash

FT-1
Optional Anti-Splash Guard
(Per ft. Factory installed)

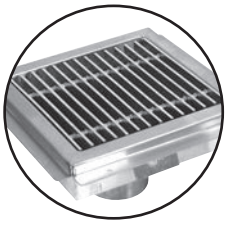


FT-2
Stainless Steel Strainer Basket
with Handle (Included with all Floor Troughs, Water Receptacles & Floor Drains)

12” Floor Drain

4” Depth





FD-1
Optional Stainless Steel Grate for Floor Drains

OPTIONAL ACCESSORIES

Model #	Description	Qty
FT-1	Anti-Splash Guard (Per Ft.)	
FT-2	FT-2 Replacement Strainer Basket	
FT-3	FT-3 Modify Trough Depth (2 ”- 6” Deep. Per Ft.)	
FT-4	FT-4 Modify Drain Hole Outlet Size (Allow 2” to 8” Dia.)	
FT-1	FT-5 Grate Upgrade to A.D.A. Compliant (7/16 Gap. Per Ft.)	
FD-1	FD-1 Floor Drain Stainless Steel Grate	

FEATURES:

Waste receptacle will accommodate up to a 4” waste pipe.

Includes 4” O.D. - 3” Long Plumbing Sleeve.

Removable perforated stainless steel strainer basket with handle provided.

Pitched towards waste.

Gratings Available:

FTG Series: Stainless Steel “Subway Style” grating from 3/16” x 1” solid “304” stainless steel bar. (Not included with Floor Drains. Use Model FD-1). Grating is spaced 9/16” (Inside clearance) between bars.

FFTG Series: Fiberglass “Subway Style” Grating from 5/8” x 1” Non-Slip Medium Grit Polyester Resin (SPF). Grating is spaced 7/8” (Inside clearance) between bars.

Troughs 96” or larger in length made with two (2) drains.

Custom sizes available. Consult factory.

CONSTRUCTION:

All TIG welded.

All external corners welded and polished to a satin finish.

MECHANICAL:

Creased design to ensure proper drainage.

Perimeter flange mounts directly to sub floor.

3/4” vertical step designed to accommodate floor tile installation.

MATERIAL:

14 gauge “304” type stainless steel polished stainless steel grating.

Fiberglass grating: Gray fiberglass composite. Light weight, skid and corrosion resistant.

ADVANCE TABCO SMART FABRICATION™
www.advancetabco.com

Customer Service Available To Assist You 1-800-645-3166 8:30 am - 8:00 pm E.S.T.

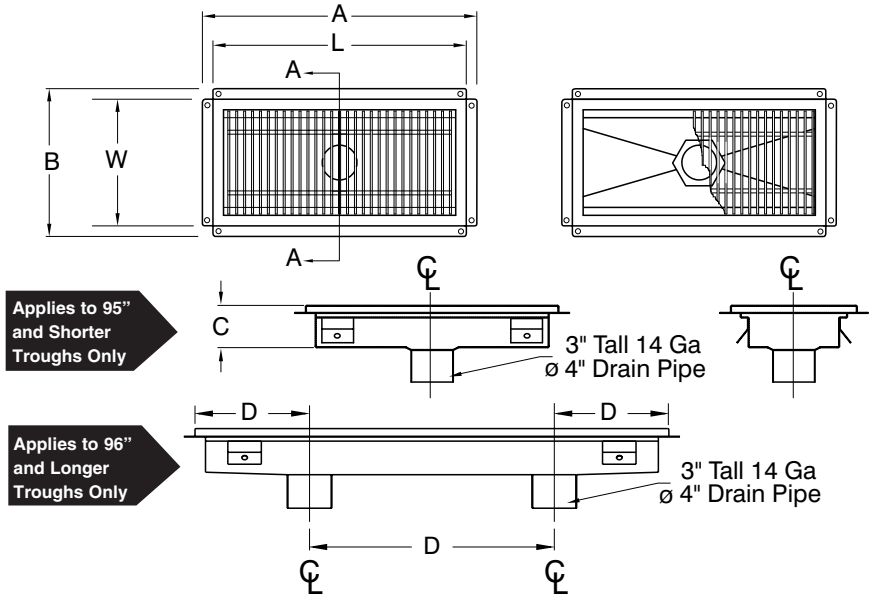
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Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

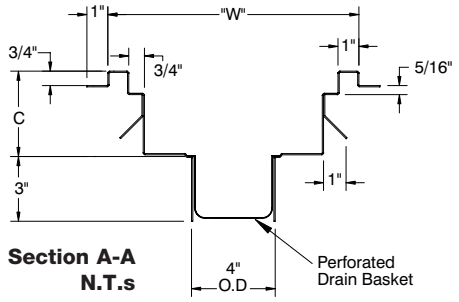
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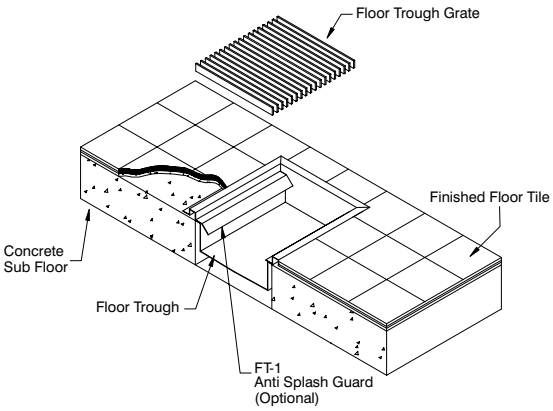
DIMENSIONS and SPECIFICATIONS

ALL DIMENSIONS ARE TYPICAL TOL ± .500”



PLUMBING ROUGH-IN





12”, 18” & 24” WIDE FLOOR TROUGHS

Stainless Steel Grating	Wt.	Fiberglass Grating	Wt.	L	W	A	B	C	D
FTG-1224	46 lbs.	FFTG-1224	34 lbs.	24”	12”	26”	14”	4”	-
FTG-1230	56 lbs.	FFTG-1230	37 lbs.	30”	12”	32”	14”	4”	-
FTG-1236	66 lbs.	FFTG-1236	40 lbs.	36”	12”	38”	14”	4”	-
FTG-1242	76 lbs.	FFTG-1242	43 lbs.	42”	12”	44”	14”	4”	-
FTG-1248	86 lbs.	FFTG-1248	46 lbs.	48”	12”	50”	14”	4”	-
FTG-1254	96 lbs.	FFTG-1254	49 lbs.	54”	12”	56”	14”	4”	-
FTG-1260	106 lbs.	FFTG-1260	52 lbs.	60”	12”	62”	14”	4”	-
FTG-1272	116 lbs.	FFTG-1272	55 lbs.	72”	12”	74”	14”	4”	-
FTG-1284	126 lbs.	FFTG-1284	81 lbs.	84”	12”	86”	14”	4”	-
FTG-1296*	146 lbs.	FFTG-1296	90 lbs.	96”	12”	98”	14”	4”	32”
FTG-12108*	166 lbs.	FFTG-12108	99 lbs.	108”	12”	110”	14”	4”	36”
FTG-12120*	180 lbs.	FFTG-12120	108 lbs.	120”	12”	122”	14”	4”	40”
FTG-1824	62 lbs.	FFTG-1824	43 lbs.	24”	18”	26”	20”	4”	-
FTG-1830	74 lbs.	FFTG-1830	47 lbs.	30”	18”	32”	20”	4”	-
FTG-1836	86 lbs.	FFTG-1836	54 lbs.	36”	18”	38”	20”	4”	-
FTG-1842	98 lbs.	FFTG-1842	61 lbs.	42”	18”	44”	20”	4”	-
FTG-1848	110 lbs.	FFTG-1848	69 lbs.	48”	18”	50”	20”	4”	-
FTG-1854	122 lbs.	FFTG-1854	76 lbs.	54”	18”	56”	20”	4”	-
FTG-1860	134 lbs.	FFTG-1860	83 lbs.	60”	18”	62”	20”	4”	-
FTG-1872	146 lbs.	FFTG-1872	90 lbs.	72”	18”	74”	20”	4”	-
FTG-1884	165 lbs.	FFTG-1884	111 lbs.	84”	18”	86”	20”	4”	-
FTG-1896*	187 lbs.	FFTG-1896	125 lbs.	96”	18”	98”	20”	4”	32”
FTG-18108*	208 lbs.	FFTG-18108	138 lbs.	108”	18”	110”	20”	4”	36”
FTG-18120*	229 lbs.	FFTG-18120	150 lbs.	120”	18”	122”	20”	4”	40”
FTG-2424	69 lbs.	FFTG-2424	52 lbs.	24”	24”	26”	26”	4”	-
FTG-2430	81 lbs.	FFTG-2430	59 lbs.	30”	24”	32”	26”	4”	-
FTG-2436	104 lbs.	FFTG-2436	68 lbs.	36”	24”	38”	26”	4”	-
FTG-2442	118 lbs.	FFTG-2442	75 lbs.	42”	24”	44”	26”	4”	-
FTG-2448	131 lbs.	FFTG-2448	83 lbs.	48”	24”	50”	26”	4”	-
FTG-2454	145 lbs.	FFTG-2454	95 lbs.	54”	24”	56”	26”	4”	-
FTG-2460	162 lbs.	FFTG-2460	102 lbs.	60”	24”	62”	26”	4”	-
FTG-2472	195 lbs.	FFTG-2472	119 lbs.	72”	24”	74”	26”	4”	-
FTG-2484	218 lbs.	FFTG-2484	137 lbs.	84”	24”	86”	26”	4”	-
FTG-2496*	243 lbs.	FFTG-2496	153 lbs.	96”	24”	98”	26”	4”	32”
FTG-24108*	274 lbs.	FFTG-24108	168 lbs.	108”	24”	110”	26”	4”	36”
FTG-24120*	310 lbs.	FFTG-24120	188 lbs.	120”	24”	122”	26”	4”	40”

***Troughs 96” or larger in length made with two (2) drains.**

7.5” WIDE FLOOR TROUGHS (4” Depth)

Model #	Length	Width	A	B	C	Wt.
FTG-724	24”	7.5”	26”	9.5”	4”	44 lbs.
FTG-730	30”	7.5”	32”	9.5”	4”	45 lbs.
FTG-736	36”	7.5”	38”	9.5”	4”	63 lbs.
FTG-748	48”	7.5”	50”	9.5”	4”	82 lbs.
FTG-760	60”	7.5”	62”	9.5”	4”	101 lbs.
FTG-772	72”	7.5”	74”	9.5”	4”	110 lbs.
FTG-784	84”	7.5”	86”	9.5”	4”	119 lbs.
FTG-796	96”	7.5”	98”	9.5”	4”	138 lbs.
FTG-7108	108”	7.5”	110”	9.5”	4”	157 lbs.
FTG-7120	120	7.5”	122”	9.5”	4”	170 lbs.

12” WIDE FLOOR WATER RECEPTACLES (2” Depth)

Model #	Length	Width	A	B	C	Wt.
FRG-24	24”	12”	26”	14”	2”	44 lbs.
FRG-736	36”	12”	38”	14”	2”	63 lbs.
FRG-748	48”	12”	50”	14”	2”	82 lbs.

12” WIDE FLOOR DRAIN (4” Depth)

Model #	Length	Width	A	B	C	Wt.
FDR-1212	12”	12”	14”	14”	4”	26 lbs.

CUSTOM SIZES AVAILABLE!

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.
© ADVANCE TABCO, FEBRUARY 2025

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K85 - BEVERAGE TABLE (1 EA REQ'D)

Custom CUSTOM BEVERAGE TABLE

S/s beverage table with partial s/s undershelf, five inch rear splash.

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K86 - TEA BREWER

By Vendor

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K87 - COFFEE BREWER

By Vendor

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K88 - JUICE DISPENSER

By Vendor

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K89 - ICE & WATER DISPENSER (1 EA REQ'D)

Hoshizaki DCM-271BAH-OS

Opti-Serve Ice Maker/Water Dispenser, Cubelet-Style, air-cooled, self-contained condenser, production capacity up to 257 lb/24 hours at 70°/50° (196 lb AHRI certified at 90°/70°), 10 lb built-in storage capacity, counter model, touchless LED sensor, 10-1/4" cup clearance, protected with H-GUARD Plus Antimicrobial Agent, R-404A refrigerant, 4" legs, 115v/60/1-ph, 8.5 amps, cord & NEMA 5-15P, NSF, UL, ADA Compliant

ACCESSORIES

Mfr	Qty	Model	Spec
Hoshizaki	1		Warranty: 3-Year parts & labor on entire machine
Hoshizaki	1		Warranty: 5-Year parts on compressor, air-cooled condenser
Hoshizaki	1	LP-4 LEG	Leg Package, (4) x 4" stainless steel legs
Hoshizaki	1	H9320-51	Water Filtration System, single configuration, 18.4" H (manifold & cartridge)
Hoshizaki	1		Warranty: 1-Year on entire water filtration system & replaceable elements

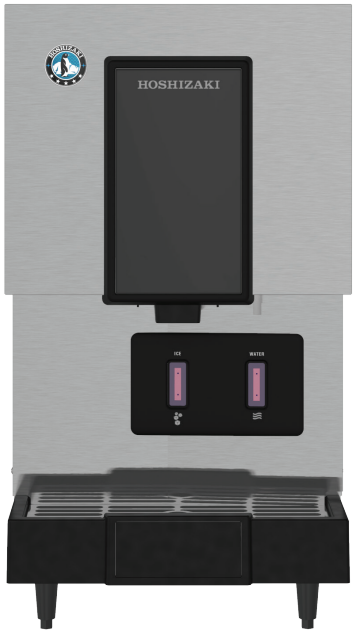
DCM-271BAH-OS

DCM-271BAH-OS
07/02/24
Item # 13574

OPTI-SERVE SERIES
CUBELET ICE MACHINE AND WATER DISPENSER

W x D x H
16 5/8" x 24 1/4" x 31 3/4" *
*including 4" legs

OptiServe
TOUCHLESS ICE & WATER





Hands-free sensor designed for use with opaque containers. Not intended for outdoor use - avoid placement in direct sunlight.

Item #: _____
Project: _____
Qty: _____
AIA#: _____

Features

- **Opti-Serve touchless ice and water**
- **10 1/4" cup clearance**
- **Quieter operation**
- **ADA Compliant**

- Attractive modern design
- Easy to chew, Cubelet ice
- Up to 257 lbs. of ice production per 24 hours
- Built-in storage capacity of 0.3ft³/10 lbs.*
- Durable stainless steel drain pan grate
- Easy-cleaning removable spout
- 2-second flush cycle every hour
- Advanced CleanCycle24™ design
- 6 ft. cord with a NEMA 5-15 plug
- R-404A Refrigerant

ADVANCED CleanCycle

Warranty:
3 Year Parts & Labor on entire machine.
5 Year Parts on Compressor; air-cooled condenser coil.
Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.
*Rated in accordance with AHRI Standard 820(I-P). Capacity based on 100% of total volume x 30 lb/ft³ average density of ice.

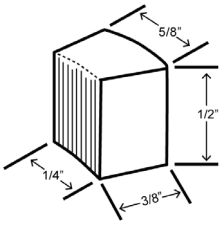
Shipping: (LxWxH) 20.88" x 30.63" X 36.25" Volume: 13.42ft³

FACTORY WARRANTY
Parts & Labor 3 YR Entire Machine
Parts 5 YR Compressor

		ICE PRODUCTION		WATER USAGE		ELECTRICAL						
Condenser	Model	Air / Water Temp Lbs. per 24 hours 70°/ 50°F	90°/ 70°F	Potable Gal. per 100 lbs. 90°/ 70°F	Condenser Gal. per 100 lbs. 90°/ 70°F	kWh Used per 100 lbs. 90°/ 70°F	Min. Circuit/ Max. Fuse Size	Amperage	Voltage	Heat Rejection BTU/hr.	Refrigerant Charge Amount	Net / Ship Weight (lbs.)
Air-Cooled	DCM-271BAH-OS	257	196	12.0	N/A	6.9	15A	8.5A	115V/60/1	3,300	14.8 oz	136 / 154

Power cord included..

Cubelet Dimensions*



* approximate size in inches, image not to scale

Operating Limits

- Ambient Temp Range 45 - 100°F
- Water Temp Range 45 - 90°F
- Water Pressure 10 - 113 PSIG
- Voltage Range 104 - 127V
- If GFCI is required, a GFCI breaker MUST be used in lieu of GFCI receptacle

Service

- Allow 6" (15cm) clearance at rear and sides for proper air circulation and ease of maintenace and/ or service should they be required. Allow 24" (61 cm) clearance at top to allow for removal of auger.

Not intended for outdoor use - avoid placement in direct sunlight.

Plumbing

- Icemaker Water Supply Line: Minimum 1/4" Nominal ID Copper Water Tubing or Equivalent
- Icemaker Drain Line: Minimum 3/4" Nominal ID Hard Pipe or Equivalent
- 3/4" MPT drain

Water Filter

Please refer to water filter specification sheet for recommendations.

Hoshizaki reserves the right to change specifications without notice.

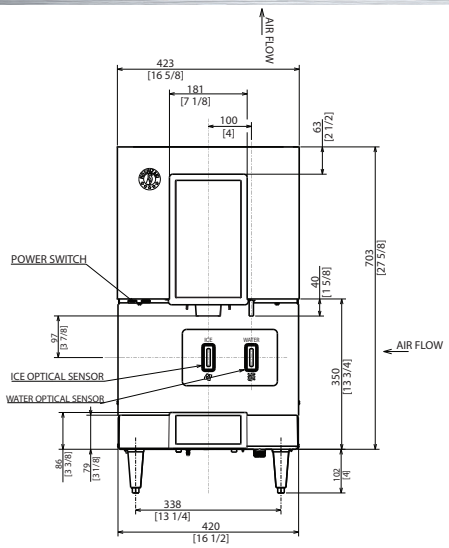
DCM-271BAH-OS

DCM-271BAH-OS
07/02/24
Item # 13574

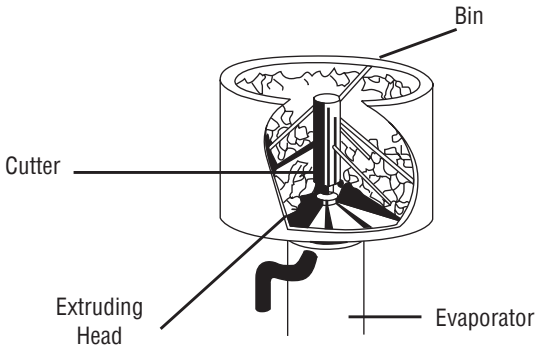
OPTI-SERVE SERIES
CUBELET ICE MACHINE AND WATER DISPENSER

inch
[mm]

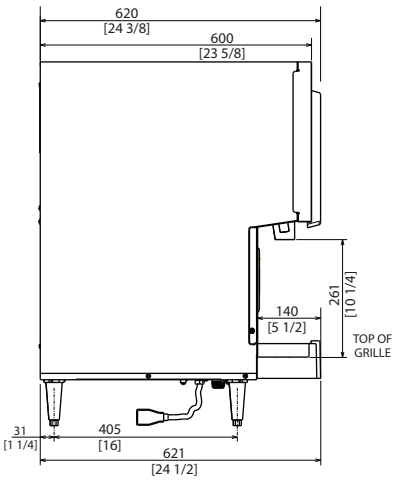
FRONT VIEW

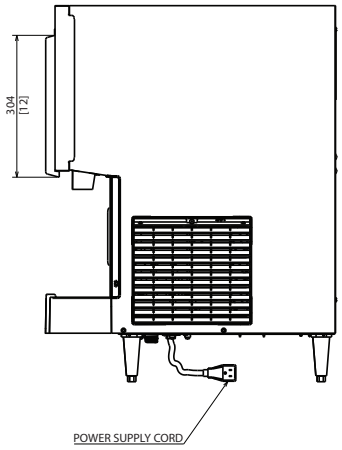


AIR-COOLED



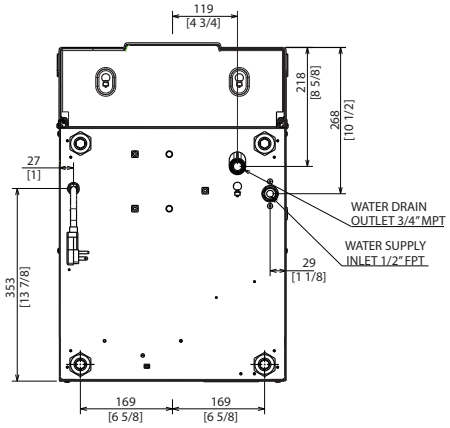
SIDE VIEW



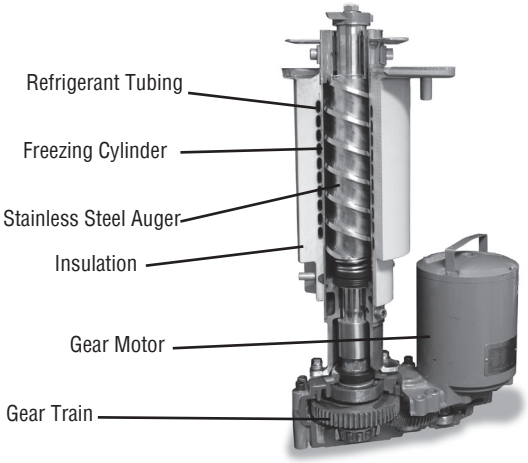


AIR-COOLED

BOTTOM VIEW



AIR-COOLED



EVAPORATOR

NOTE: DCM-271BAH-OS is made to pair with SD-271 stand. Placing a DCM-271BAH-OS on SD-270 stand will require a new drain hole to be cut.

Caster & Leg Accessories

Casters and Legs used on Hoshizaki Equipment

Item #: _____

Project: _____

Qty: _____

AIA#: _____

Casters

HS-3546/HS-3547



HS-5035



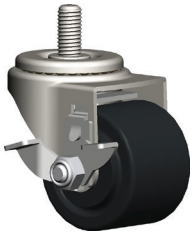
HS-5036 without brakes



HS-5036 with brakes



HS-5320/HS-5321



Accessory Number	Description	For use with	Weighted Capacity per caster
HS-3546	4” caster with 5/8”-11 thread, Set of 4 (2 with brakes)	Used on Steelheart Uprights, all models. C___S-xxx from aux code E-8 to H-5	400 lbs.
HS-3547	4” caster with 5/8”-11 thread, Set of 6 (3 with brakes)		
HS-5035	4” caster 1/2”-13 thread, Set of 4 (2 with brakes)	Undercounters	175 lbs.
HS-5036	6” caster 1/2”-13 thread, Set of 4 (2 with brakes)	Worktop, Sandwich Prep	350 lbs.
HS-5037	2” caster 1/2”-13 thread, Set of 4 (2 with brakes)	LP Undercounter models	220 lbs.
HS-5320	3-3/8” caster, 1/2”-13 thread, Set of 4 (2 with brakes)	Pizza Prep Tables for ADA Compliant dimensions	300 lbs.
HS-5321	3-3/8” caster, 1/2”-13 thread, Set of 6 (3 with brakes)		

Hoshizaki reserves the right to change specifications without notice.

Caster & Leg Accessories

Casters and Legs used on Hoshizaki Equipment

Item #: _____

Project: _____

Qty: _____

AIA#: _____

Legs

DM LEGS



LP-4 LEG



LP-6P-LEG



LP-6 Flange Leg



LP-6 LEG



Accessory Name/Number	Kit Number	Part Number	Description	Stud Length	For use with	Weighted Capacity per leg
	HS-2071, HS-2072, HS-2073	4A2091-01	Stainless, height 6", 5/8-11, 4pk	3/4" thread	DCM-300, DCM-500, SD Stands	2000 lbs.
DM LEGS			Black, height 4", 3/8-16, 1/2 4pk	5/8" thread	DM-200B	2000 lbs.
		4A2145-01	Black epoxy, height 4", 3/8-11, 4pk	5/8" thread	DCM-271BAH(-OS)	1000 lbs.
LP-6P LEG		4A2525-01	Black, height 6", 5/8-11, 4pk	3/4" thread	B-250, B-500, BD-500 B-700, B-800, B-900 KM-81, KM-116, KM-161, KM-231, KM-301 DB-200H, F-330(-C), F-300, F-500, IM-200	2000 lbs.
LP-6 FLANGE LEG		4A2526-01	Black epoxy, height 6", 5/8-11, 4pk	3/4" thread	SD-200, SD-271, SD-500, SD-750, B-300, BD-300, DB-130H, DKM-500	2000 lbs.
		4A2966-01	Stainless, height 6", 3/8-16, 4pk	3/4" thread	PR46A(-D2, D4)	500 lbs.
LP-6 LEG		4A0930-01	Stainless, height 6", 5/8-11, 2pk	3/4" thread		2000 lbs.
		4A0930-02	Stainless, height 6", 5/8-11, 2pk	3/4" thread		2000 lbs.
		4A0930-03	Stainless, height 6", 5/8-11, 2pk	1/2" thread		2000 lbs.
	HS-3585	4A0930-04	Stainless, height 6", 5/8-11, 4pk	3/4" thread		2000 lbs.
		4A0930-05	Stainless, height 6", 1/2-13, 4pk	3/4" thread		2000 lbs.

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WATER FILTERS

FILTRATION SYSTEMS

Item #: _____

Project: _____

Qty: _____

AIA#: _____

H9320 FILTER
Single, Double, Triple



H9320-51

Single Configuration
18.4" H*



H9320-52

Double Configuration
19.11" H*



H9320-53

Triple Configuration
19.15" H*

*height includes manifold and cartridge

HOSHIZAKI H9320 FILTER

Available in single, double and triple configurations. Rated NSF Class 1, STD 42, for taste, odor and chlorine reduction and for mechanical filtration (95.6% removal of particles one (1) micron and larger in size.)

- Keep ice makers functioning at full capacity
- 97.3% average reduction of chlorine from incoming water supply, eliminating tastes and odors of the ice
- Filters are rated as one (1) micron nominal producing crystal clear ice
- Decrease machine maintenance by reducing lime scale build-up

Model	Filter	Max Flow Rate	Working Pressure	Temperature	Capacity
H9320-51	4HC-H	2 gpm	10-125 psi	35-100°F	21,000 gal
H9320-52	4HC-H	4 gpm	10-125 psi	35-100°F	42,000 gal
H9320-53	4HC-H	6 gpm	10-125 psi	35-100°F	63,000 gal

Plumbing

Inlet/Outlet Connections: Single: (2) 3/8" FNPT
Double & Triple: (1) 3/4" MNPT / (1) 3/4" FNPT

The H9320 Filters and their respective cartridges have been tested and listed by NSF only for the functions listed above. Check for compliance with state and local laws and regulations. Do not use where the water is microbiologically unsafe, or with waters of unknown quality without adequate disinfection before or after the unit. The H9320 filter can be used with water that may contain filterable cysts.

The H9320 System is tested and certified by NSF International against NSF/ANSI Standard 42 for the reduction of:
Std. No. 42 - Aesthetic effects

Aesthetic Effects
Bacteriostatic Effects
Chemical Reduction
Chlorine

Mechanical Filtration
Nominal Particulate Class 1
Taste & Odor

E-10 PREFILTER
(9795-80)

E-20 PREFILTER
(9795-90)



E-10 PREFILTER
(9795-80)
Recommended for single configuraton



E-20 PREFILTER
(9795-90)
Recommended for twin and triple configuraton

E-10 and E-20 Prefilters can be used for ice. Everpure prefilters are designed to increase the life of Hoshizaki 4HC-H water filters in areas with an unusual amount of dirt in the water. With a 10 micron (nominal) rating, the economical Everpure prefilter traps much of the dirt which contributes to scale buildup in ice makers, and clogs the delicate orifices of other water-using equiment.

When you install an Everpure prefilter, the Hoshizaki 4HC-H water filters can concentrate on what they do best: remove particles one (1) micron nominal and larger in size.

Replacement Cartridges:
E-10 Prefilters: 12 pack (9534-12)
40 pack (9534-40)

E-20 Prefilters: 6 pack (9534-26)
20 pack (9534-20)

Warranty:

One Year replaceable elements*
One Year the entire system
* Warranty applies to material defects in materials & workmanship only.

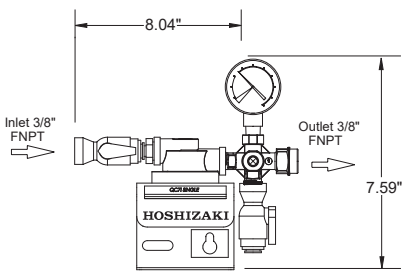
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WATER FILTERS

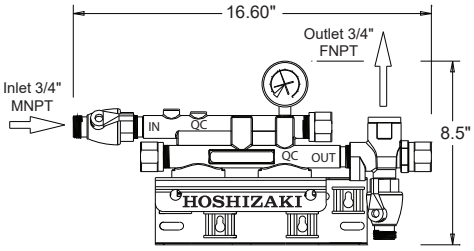
FILTRATION SYSTEMS

Model Number	Description Flow Rate (Gal. per min.)	Undercounter KMs	KM Cubers	IM Cubers	Cubelets & Flakers	DCM/DBs
H9320-51	Single (2 GPM)	AM-50 KM-81 KM-116 KM-161 KM-231 KM-301	KM-350, 520, 660 KML-325, 500, 700 KMD-410, 460, 530 KMS-830 DKM-500	IM-200,500 IM-50BAA-LM	All Models	All Models
H9320-52	Twin 2 x (2 GPM)	N/A	KM-901, 1100 KMD-860 KMS-822, 1122, 1402	IM-50BAA-Q	N/A	N/A
H9320-53	Triple 3 x (2 GPM)	N/A	KM-1301, 1340, 1601, 1900, 2200, 2600 KMH-2100 KMS-2000	N/A	N/A	N/A
H9655-11	Replacement Cartridge (1) One each	Recommended water filter configurations based on average ice machine usage and regular filter replacement. If your operation has challenging water conditions or higher usage, then it may be necessary to use an additional filter or prefilter.				

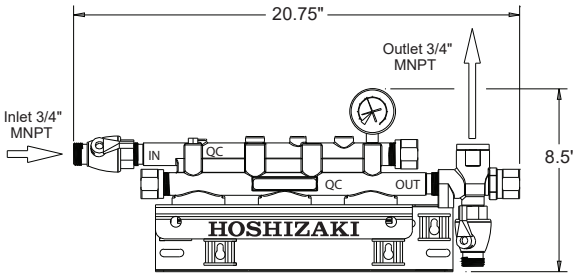
Single



Twin



Triple



MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K90 - RACK DOLLY (2 EA REQ'D)

Cambro CD2020401

Camdolly®, 22-1/2"L x 22-1/2"W x 8-1/4"H (exterior dimensions), without handle, polyethylene construction, (4) 3" heavy duty swivel casters, load capacity 300 lbs., slate blue, NSF

CAMBRO

Item No. _____

Specifier Identification No. _____

Model No. _____

Quantity _____

Camdollies®

For Dish Racks

Without Handle
Model CD2020, CDR2020
With Handle
Models CD2020H, CD2020HB, CDR2020H

StoreSafe

Features & Benefits

- Make any job easier by smoothly transporting stacks of full size 20" x 20" (50 cm x 50 cm) dish racks with these rugged and reliable Camdollies. The CDR2020 and CDR2020H models will transport side by side stacks of half size dish racks also.
- Load capacity:
  Model CD2020 - 300 lbs. (136 Kg.)
  Model CDR2020 - 350 lbs. (159 Kg.)
  Models CD2020H, CDR2020H, CD2020HB - 350 lbs. (159 Kg.)
- Material design:
  Models CD2020, CD2020H, CD2020HB - One piece seamless, double-wall, high-density polyethylene construction is extremely durable. Won't rust or corrode. Foamed-in-place polyurethane core adds greater structural strength and reduces noise. Molded in handle on Model CD2020H and CD2020HB is extra sturdy and will not break or bend. Provides controlled handling and maneuvering over the roughest terrain.
  Models CDR2020 and CDR2020H - Injection molded high-density polypropylene offers exceptional performance with improved affordability. Will handle the demands of any foodservice operation. Won't rust or corrode. Weighs 40% less than the CD2020 for improved ease of handling and carrying when empty. A powder coated handle on the CDR2020H offers easy maneuvering.
- Simple to clean - all can be wiped down or steam cleaned.
- Casters:
  Models CD2020, CD2020H - Four each 3" (7,6 cm) heavy-duty, swivel casters, no brake. Bolted into molded-in steel plates.
  Model CD2020HB - Two each rear 10" (25,4 cm) Easy Wheels and 2 each 5" (12,7 cm) swivel casters, 1 w/ brake. Bolted into molded-in steel plates.
  Models CDR2020, CDR2020H - Four each 4" (10 cm) swivel casters, no brake.
- No assembly required for models CD2020, CD2020H and CD2020HB. Minimal assembly required for CDR2020 and CDR2020H.
- Colors:
  Models CD2020, CD2020H and CD2020HB available in 5 colors.
  Models CDR2020 andCDR2020H available in Soft Gray (151) only.



For Camracks™



CD2020



CD2020H



CD2020HB

10" (25,4 cm) Easy Wheels



CDR2020H



CDR2020

Approvals

NSF **CD2020, CD2020H, CD2020HB only.**

CAMBRO MANUFACTURING COMPANY
http://www.cambro.com
© 2008 Cambro Manufacturing Company 5801 Skylab Road, Huntington Beach, California 92647-2056-U.S.A.
Telephone (1)714 848 1555 **Toll Free** 800 854 7631 **Customer Service** 800 833 3003
LIT FCST-0102-06

Camdollies®

For Dish Racks

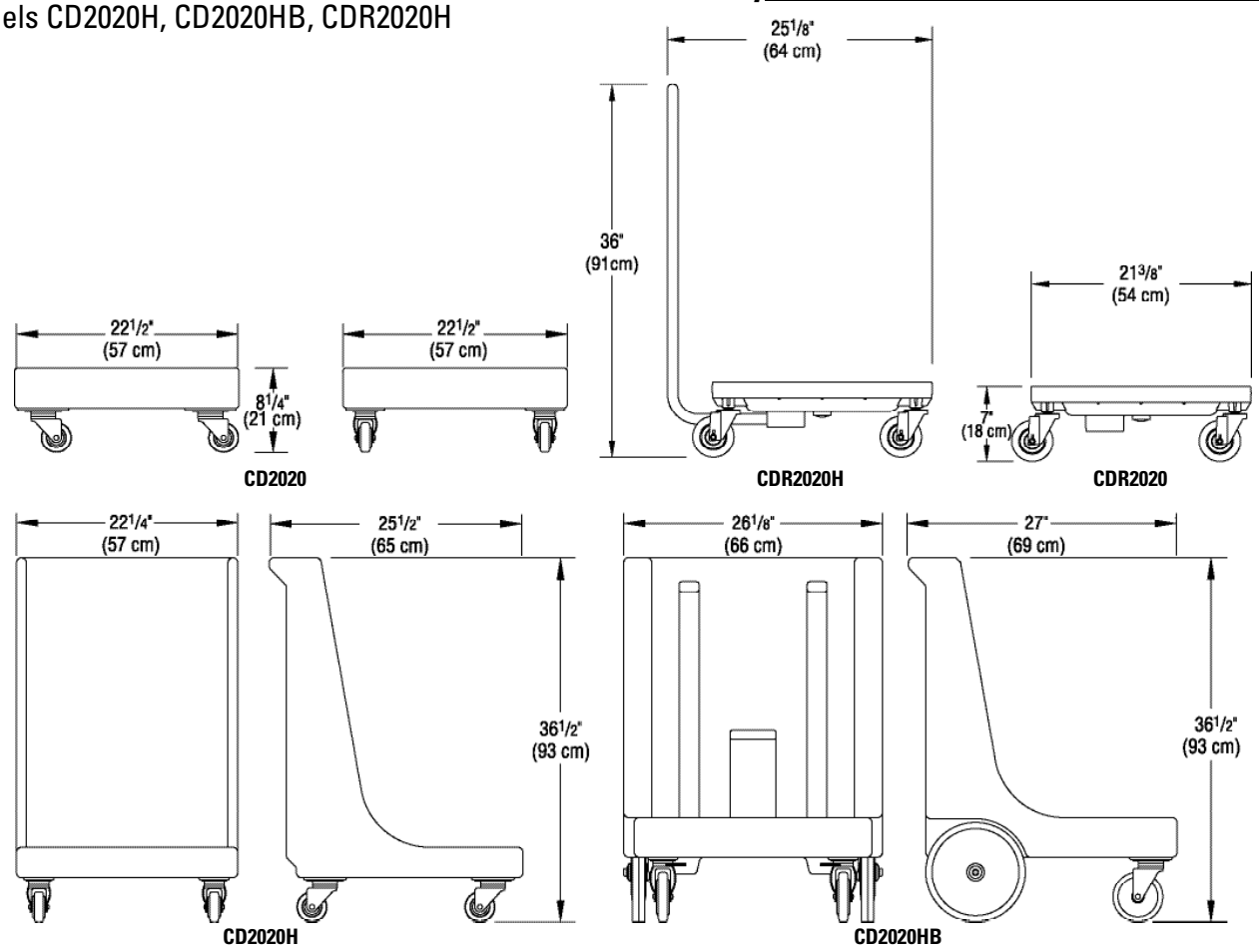
Without Handle
Model CD2020, CDR2020
With Handle
Models CD2020H, CD2020HB, CDR2020H

Item No. _____

Specifier Identification No. _____

Model No. _____

Quantity _____



Specifications

Dimension Tolerance: +/- 1/4" (0,64 cm)

Code	Description	Load Capacity	Interior Dimensions W x L	Exterior Dimensions L x W x H	Case lbs./cube Kg/m³
Without Handle					
CD2020	Camdolly	300 lbs (136 Kg)	20 1/16" x 20 1/16" (51 x 51 cm)	22 1/2" x 22 1/2" x 8 1/4" (57 x 57 x 21 cm)	19 (2.14) 9 (0,06)
CDR2020	Camdolly	350 lbs (159 Kg)	20 7/8" x 20 7/8" (53 x 53 cm)	21 3/8" x 21 3/8" x 7" (54 x 54 x 18 cm)	11 3/4 (1.14) 5,3 (0,03)
With Handle					
CD2020H	Camdolly	350 lbs (159 Kg)	20 1/4" x 20 1/4" (52 x 52 cm)	25 1/2" x 22 1/4" x 36 1/2" (65 x 57 x 93 cm)	32 1/4 (11.45) 15 (0,32)
CDR2020H	Camdolly	350 lbs (159 Kg)	20 7/8" x 20 7/8" (53 x 53 cm)	25 1/8" x 21 3/8" x 36" (64 x 54 x 91 cm)	21 1/2 (3.25) 9,7 (0,1)
CD2020HB	Camdolly	350 lbs (159 Kg)	20 1/2" x 20 5/8" (52 x 52 cm)	27" x 26 1/8" x 36 1/2" (69 x 66 x 93 cm)	46 (15.89) 21 (0,44)

Architect Specs

The dish rack transport cart shall be a Camdolly, Cambro Model.....manufactured by Cambro Mfg. Co., Huntington Beach, CA 92648 U.S.A. Models CD2020, CD2020H and CD2020HB shall be constructed of single-molded, seamless, double wall, high-density polyethylene and thick foam injected polyurethane. Models CDR2020 and CDR2020H shall be constructed of injection molded polypropylene. It shall be available with a load capacity of either 300 or 350 lbs. (136 or 159 Kg). It shall be available with a molded-in handle or a chrome handle. Models CD2020, CD2020H and CD2020HB shall be available with 4 each 5" (12,7 cm) swivel casters, no brake, or with 2 each 10" (25,4 cm) Easy Wheels and 2 each 5" (12,7 cm) swivel casters, 1 w/ brake. Casters shall be bolted into molded-in metal plates. Models CDR2020 and CDR2020H shall be available with 4 each 4" (10 cm) swivel casters, no brake. Models CDR2020 and CDR2020H shall be available in 1 color and shall require minimal assembly. Models CD2020, CD2020H and CD2020HB shall be available in 5 colors and require no assembly.

Standard Colors (CD2020, CD2020H, CD2020HB)

❑ Coffee Beige (157) ❑ Dark Brown (131) ❑ Black (110)
❑ Slate Blue (401) ❑ Gray (180)

Standard Colors (CDR2020, CDR2020H)

❑ Soft Gray (151)

Approvals

NSF **CD2020, CD2020H, CD2020HB only.**

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http://www.cambro.com

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Telephone (1)714 848 1555 **Toll Free** 800 854 7631 **Customer Service** 800 833 3003 Printed in USA

CAMDOLLIES® FOR INSULATED BEVERAGE SERVERS AND CARRIERS

Without Handles



CD100

EXTERNAL DIM. W x D x H:
19⅝" x 28⅝" x 10½"

INTERIOR DIM. W x D:
17³⁄₁₆" x 26⅜"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: 250LCD, 350LCD, 500LCD, UC250, UC500, 100MPCHL, 100MPC, 300MPC, UPC300, UPC100, UPCS140, UPCS160, UPCS180, UPCSS160



CD160

EXTERNAL DIM. W x D x H:
16⁷⁄₁₆" x 24½" x 10⅜"

INTERIOR DIM. W x D:
14¼" x 22¼"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: UPCS140, UPCS160, UPCS180, UPCSS160, UPC140, UPC160, UPC180



CD300

EXTERNAL DIM. W x D x H:
25½" x 19¼" x 10½"

INTERIOR DIM. W x D:
16⅞" x 23⁵⁄₁₆"

CAPACITY: 350 lbs.

CASTER TYPE: A

FITS: 1000LCD, UC1000, 300MPC, 1318MTC, UPC300, 1318CC, UPCS140, UPCS160, UPCS180, UPCSS160



CD400

EXTERNAL DIM. W x D x H:
21⁵⁄₁₆" x 28⅛" x 9"

INTERIOR DIM. W x D:
18½" x 25⁹⁄₁₆"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: UPCS400, UPC400



CDC300

EXTERNAL DIM. W x D x H:
17⁵⁄₁₆" x 24⅞" x 7⁵⁄₁₆"

INTERIOR DIM. W x D:
17⅛" x 24⅝"

CAPACITY: 300 lbs.

CASTER TYPE: D

FITS: EPP400, EPP300, UPC300, EPP180SW, EPP160SW



CDC400

EXTERNAL DIM. W x D x H:
18¹⁵⁄₃₂" x 25¼" x 6⅞"

INTERIOR DIM. W x D:
18½" x 25"

CAPACITY: 300 lbs.

CASTER TYPE: D

FITS: UPC400, EPP180XLTSW



CD1420

EXTERNAL DIM. W x D x H:
16¼" x 21¾" x 8⁵⁄₁₆"

INTERIOR DIM. W x D:
13⅜" x 19⁵⁄₁₆"

CAPACITY: 350 lbs.

CASTER TYPE: B

FITS: 100LCD



CD2020

EXTERNAL DIM. W x D x H:
22½" x 22½" x 8¼"

INTERIOR DIM. W x D:
20⅛" x 20⅛"

CAPACITY: 300 lbs.

CASTER TYPE: B

FITS: 250LCD, 350LCD, 500LCD, 1000LCD, UC1000



CD2028

EXTERNAL DIM. W x D x H:
21⅞" x 30¼" x 8¼"

INTERIOR DIM. W x D:
19½" x 27⅞"

CAPACITY: 350 lbs.

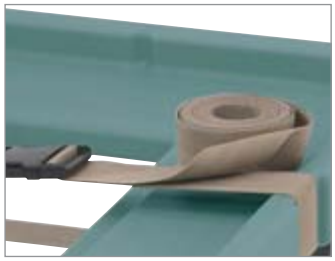
CASTER TYPE: B

FITS: 100MPC, UPC100, 300MPC, UPC300, UPC400

Camdolly® Colors:
Coffee Beige (157), Dark Brown (131), Black (110), Slate Blue (401).
CDC300 and CDC400 Color: Red (358).
CD400 InStock Colors:
Black (110), Dark Brown (131).

Caster Type:
(A) 5" Casters, 2 fixed, 2 swivel, 1 with brake.
(B) 3" Casters, 4 swivel, no brakes.
(C) 10" Rear Big Wheels, 2 front 5" swivel casters, 1 with brake.
(D) 4" Casters, 4 swivel 2 with brake.

Optional Accessories



400STP (STRAP)

DIMENSION: 150" Long

UTHSTP (STRAP)

DIMENSION: 200" long



1826HAR (LIFTING HARNESS)

DIMENSION: 142" long

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Submittal Sheet

03/14/2025

ITEM# K91-K93 - SPARE NO.

<Spare No.>

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A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K94 - SOILED DISHTABLE (1 EA REQ'D)

Fabricated CUSTOM

S/s soiled dish table, "L"-shaped with 42" deep flat drop-off area, rolled edge, 20" x 20" x 8" deep scrap sink with disposer provision, ten inch rear splash, s/s legs and cross rails

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Submittal Sheet

03/14/2025

ITEM# K94.1 - PRE-RINSE FAUCET ASSEMBLY (1 EA REQ'D)

Fisher 21100

Pre-Rinse Assembly, single-deck dual control valve, with spring action flexible gooseneck, 21" riser, 36" hose, wall bracket & Ultra-Spray™/PLUS spray valve (1.15 gallons per minute @ 60 PSI)

APPLICATION:

PRODUCT NAME:
PRE-RINSE SPRING STYLE
SINGLE DECK DUAL CONTROL

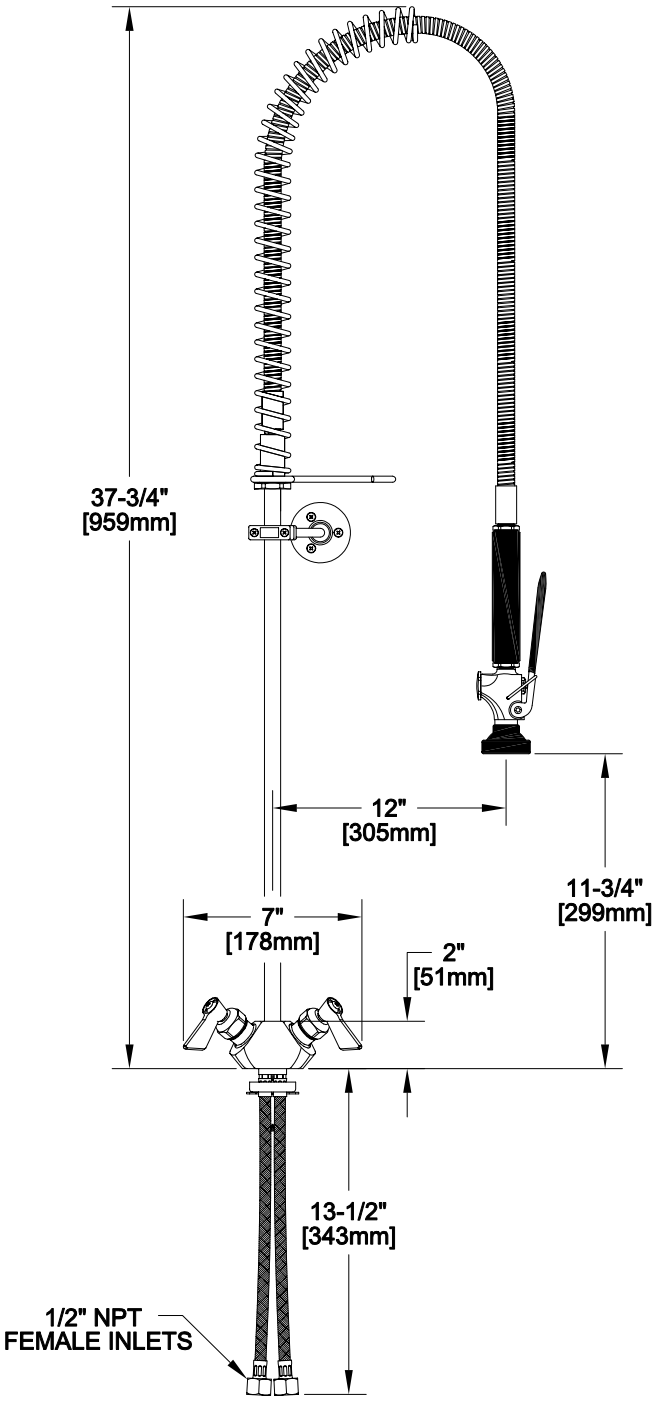
JOB NAME:

SPECIAL CONFIGURATION
☐ _____ CHECK BASE MODEL AND OPTIONS

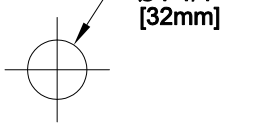
QUANTITY: | ITEM NO.

MODEL:
☐ 2110 ULTRA SPRAY VALVE, NO WALL BRACKET
☐ 2110-WB ULTRA SPRAY VALVE, WALL BRACKET

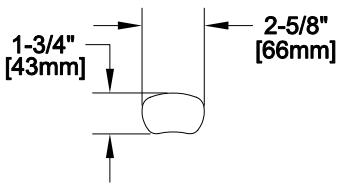
OPTIONS OR MODIFICATIONS:
☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH
☐ ADD-ON FAUCET (6", 8", 10", 12", 14", 16") CIRCLE
☐ IN-LINE DUAL CHECK VALVE
☐ BRUSH
☐ VANDAL RESISTANT KIT
☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE
☐ OTHER _____



ROUGH-IN:



FOOTPRINT:



FEATURES

CONTROL VALVE
* SINGLE DECK DUAL CONTROL
* INTERNAL SPRING LOADED CHECK VALVES
* SWIVELLING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* STAINLESS STEEL BRAIDED INLET HOSES

HOSE
* 36" LENGTH
* STAINLESS STEEL END FITTINGS
* STAINLESS STEEL EXTERNAL JACKET
* 3 PLY FIBER REINFORCED INTERNAL RUBBER HOSE
* REPAIRABLE IN FIELD WITH SIMPLE TOOLS

ULTRA SPRAY VALVE
* LOWEST ENERGY USER - 1.15 GPM @ 60 PSI
* CLEANS FASTER - TEST PROVEN
* ENGINEERED TO LAST - NO 'O' RINGS TO LEAK
* INTERCHANGEABLE - FITS ALL BRANDS

WALL BRACKET
* ADJUSTS FROM 2" TO 12"

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE: 200 PSI MAX. STATIC

SHIPPING WEIGHT
* 12.0 LBS

EPAct 2005 Compliant ANSI/A112.18.1M

FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 2110 REV. G

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Submittal Sheet

03/14/2025

ITEM# K95 - DOUBLE SIDED RACK SHELF (1 EA REQ'D)

Fabricated CUSTOM

S/s double-sided rack shelf with weep holes and vertical rack storage on top, mount to soiled dishtable.

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03/14/2025

ITEM# K96 - MOBILE TRASH CANS

By Vendor

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Submittal Sheet

03/14/2025

ITEM# K97 - DISPOSER (1 EA REQ'D)

InSinkErator SS-200-7-AS101

SS-200™ Complete Disposer Package, sink mount system, 6-5/8" diameter inlet, with #7 collar adaptor for sink installation, 2 HP motor, stainless steel construction, includes syphon breaker, (2) solenoid valves, (2) flow control valves, removable splash baffle, stainless steel sink stopper, programmable AquaSaver® Control Center AS-101 with water-saving technology, automatic water saving function, auto reversing, timed run, post flush, adjustable leg kit

ACCESSORIES

Mfr	Qty	Model	Spec
InSinkErator	1		(3) years parts & labor warranty
InSinkErator	1		Standard height disposer body
InSinkErator	1		208v/60/3-ph, 3.6 amps
InSinkErator	1	SYPHON STD	Syphon breaker standard, 1/2" (11477)

PROJECT: _____ **ITEM NO.:** _____

SS SERIES FOOD WASTE DISPOSERS

Food waste disposers are a hygienic and environmentally sustainable way to manage pre- and post-consumer scraps in a foodservice establishment. The SS Series disposers are ideal for heavy-duty applications such as restaurants, schools and universities, healthcare facilities and hospitals, and government facilities.

1 YEAR ON-SITE PARTS & LABOR WARRANTY

PRODUCT FEATURES & SPECIFICATIONS

SS-SERIES

- Whether you serve 25 or 2,500 people, there is an InSinkErator disposer that's designed for your operation. From the small-capacity SS-100™ model to our large-capacity SS-1000™ workhorse, InSinkErator disposers deliver superior performance, quiet operation, maximum energy efficiency, and reliable service.

SYSTEM OVERVIEW

- Stainless steel and chrome-plated finish
- Corrosion-resistant, stainless steel grind chamber
- Heavy-duty induction motor with built-in thermal overload protection
- Enclosure provides protection against outside moisture with controlled power air flow to cool motor
- Extremely durable shredding elements
- Double-tapered Timken roller bearings provide a shock-absorbing cushion
- Triple lip seal protects motor from water damage
- Secondary spring-loaded oil seal provides double protection against water and loss of grease

CLEANING

- Disposers are easy to clean and maintain
- Wipe down exterior surfaces with a wet cloth
- Use warm soapy water on the splashguard



Commercial Disposer Sizing Chart

To determine the proper size disposer, use this recommended sizing chart. Sizing recommendations are given in general terms; actual capacities vary depending on the volume and type of food waste.

Volume Processed / Application	Light Majority Fruits & Vegetables	Medium 50/50 Mixture	Heavy Majority Meats & Seafood
High Buffet/Cafeteria Government	SS-300	SS-300/ SS-500	SS-500	SS-500/ SS-1000	SS-500/ SS-1000
Medium Full Service Restaurant	SS-200	SS-300	SS-300/ SS-500	SS-500	SS-500/ SS-1000
Low Limited Service Restaurant/Café/ Fast Casual	SS-100	SS-200	SS-300	SS-300/ SS-500	SS-1000
	SS-100	SS-100	SS-200	SS-300	SS-300/ SS-500

2,500 MEALS

100 MEALS

Food Waste Composition

A complete collection of our product drawings is available for download at the **InSinkErator Revit/CAD** Library, which can be found at www.insinkerator.com/foodservice. Product information is also accessible on ***The KCL CADalog***. More information is available from KCL at www.kclcad.com.

1250 International Drive
Mount Pleasant, WI 53177
TEL: 800-845-8345

www.insinkerator.com/foodservice

c UL us LISTED

ISO 9001 QUALITY SYSTEMS CERTIFIED

WHAT'S INCLUDED

- Base disposer: 1 mounting gasket
- Disposer packages: 1 mounting/bowl assembly, 1 electrical control, 1 syphon breaker, 1 solenoid valve, and 1 flow control valve (the standard flow control valve will be sent with the unit unless the optional valve is specified)

MODEL & HORSEPOWER/ELECTRICAL REQUIREMENTS (CHOOSE ONE)

Small Capacity Disposers



☐ **SS-100** 1 HP	☐ 115/208-230V, 60 Hz, 1 Ph, 11.6/5.1/5.7 amps, **cULus** ☐ 208-230/460V, 60 Hz, 3 Ph, 2.0/2.4/1.2 amps, **cULus**	☐ 120/208-240V, 60 Hz, 1 Ph, 11.6/5.1/5.7 amps, **NOM** ☐ 100/200-230V, 50/60 Hz, 1 Ph, 10.4/5.2/5.4 amps
Water Usage:	☐ 5 GPM (18.9 LPM) standard water flow	☐ 3 GPM (11.4 LPM) reduced water flow (optional)

Medium Capacity Disposer



☐ **SS-200** 2 HP	☐ 115/208-230V, 60 Hz, 1 Ph, 17.4/7.7/8.7 amps, **cULus** ☐ 208-230/460V, 60 Hz, 3 Ph, 3.6/4.4/2.2 amps, **cULus** ☐ 115/208-230V, 60 Hz, 1 Ph, 17.4/7.7/8.7 amps, **cULus**, **short body**	☐ 208-230/460V, 60 Hz, 3 Ph, 3.6/4.4/2.2 amps, **cULus**, **short body** ☐ 208-240/460V, 60 Hz, 3 Ph, 3 Ph, 3.6/4.4/2.2 amps, **NOM** ☐ 380V, 50/60 Hz, 3 Ph, 2.3 amps
Water Usage:	☐ 7 GPM (26.5 LPM) standard water flow	☐ 5 GPM (18.9 LPM) reduced water flow (optional)

Large Capacity Disposers



☐ **SS-300** 3 HP	☐ 208-230/460V, 60 Hz, 3 Ph, 6.0/7.4/3.7 amps, **CUL** ☐ 208-230/460V, 60 Hz, 3 Ph, 6.0/7.4/3.7 amps, **CUL**, **short body** ☐ 208-230/460V, 60 Hz, 3 Ph, 7.0/8.6/3.7 amps, **NOM**	☐ 415V, 50 Hz, 3 Ph, 4.9 amps ☐ 220V, 50 Hz, 3 Ph, 7.2 amps ☐ 380V, 50/60 Hz, 3 Ph, 4.1 amps
Water Usage:	☐ 8 GPM (30.3 LPM) standard water flow	☐ 7 GPM (26.5 LPM) reduced water flow (optional)
☐ **SS-500** 5 HP	☐ 208-230/460V, 60 Hz, 3 Ph, 8.6/8.8/4.4 amps, **CUL** ☐ 208-230/460V, 60 Hz, 3 Ph, 8.6/8.8/4.4 amps, **CUL**, **short body** ☐ 230/460V, 50 Hz, 3 Ph, 9.0/4.5 amps	☐ 415V, 50 Hz, 3 Ph, 6.0 amps ☐ 380V, 50 Hz, 3 Ph, 8.9 amps
Water Usage:	☐ 8 GPM (30.3 LPM) standard water flow	☐ 7 GPM (26.5 LPM) reduced water flow (optional)
☐ **SS-1000** 10 HP	☐ 208-230/460V, 60 Hz, 3 Ph, 11.0/13.0/6.5 amps, **CUL** ☐ 208-230/460V, 60 Hz, 3 Ph, 11.0/13.0/6.5 amps, **CUL**, **short body**	
Water Usage:	☐ 10 GPM (37.9 LPM) standard water flow	

DISPOSER MOUNTING ASSEMBLIES (CHOOSE ONE)

Sink Collar Mounts



☐ **#5 Sink Flange Kit**
for 3-1/2"–4" (88.9 mm–101.6 mm) sink opening (support legs are recommended)

#5 adaptors only available on small and medium capacity disposers.



☐ **#6 Collar Adaptor Kit**
for welding into trough, for 6-5/8" (168.3 mm) opening, includes splash baffle



☐ **#7 Collar Adaptor Kit**
for welding into sink, for 6-5/8" (168.3 mm) opening, includes splash baffle and stopper

Sink Bowl Mounts

Bowl Size

- ☐ 12" (304.8 mm) with one adjustable water nozzle
- ☐ 15" (381.0 mm) with one adjustable water nozzle
- ☐ 18" (457.2 mm) with two adjustable water nozzles

Kit Type



☐ **Type A Sink Bowl Assembly**
- bowl
- water nozzle(s)
- bowl cover
- splash baffle



☐ **Type B Sink Bowl Assembly**
- bowl
- water nozzle(s)
- silver guard
- splash baffle

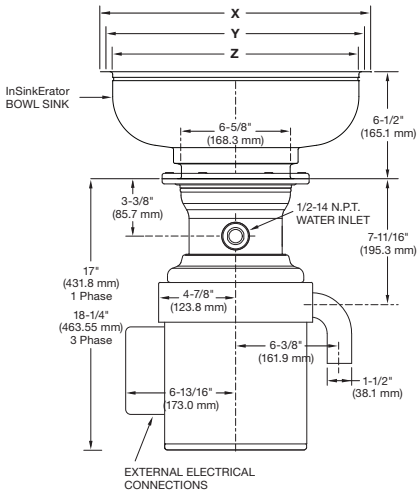
ELECTRICAL CONTROLS (CHOOSE ONE)

☐ **AS-101 Control Center** AquaSaver®	☐ **CC-101 Control Center**	☐ **CC-202 Control Center**	☐ **Manual Reverse Switch**	☐ **Manual Switch**
				
• Automatically changes direction • Stainless-steel housing • Automatic shut-off with power loss • Line disconnect • Programmable post-flush • Timed run • Automatically regulates water flow to grind load	• Automatically changes direction • Stainless-steel housing • Automatic shut-off with power loss • Line disconnect • Programmable post-flush • Timed run	• Automatically changes direction • Stainless-steel housing • Automatic shut-off with power loss	• Manually changes direction • Stainless-steel housing • Automatic shut-off with power loss	• Single direction • Polycarbonate housing • Automatic shut-off with power loss

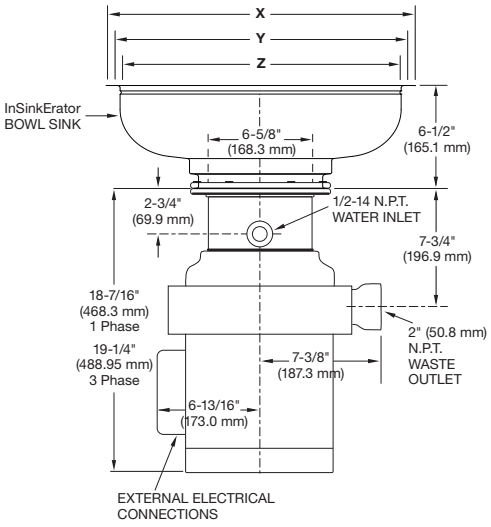
DISPOSER DIMENSIONS

Standard models shown. A short body model is available on medium and large capacity disposers. Short body models reduce overall height by 1" (25.4 mm) on medium capacity disposers and by 3" (76.2 mm) on large capacity disposers.

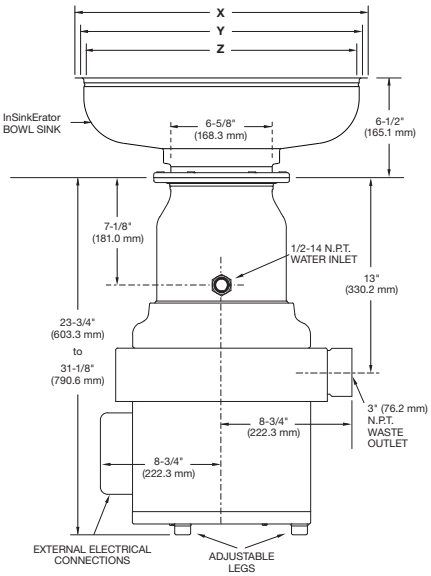
Small Capacity



Medium Capacity



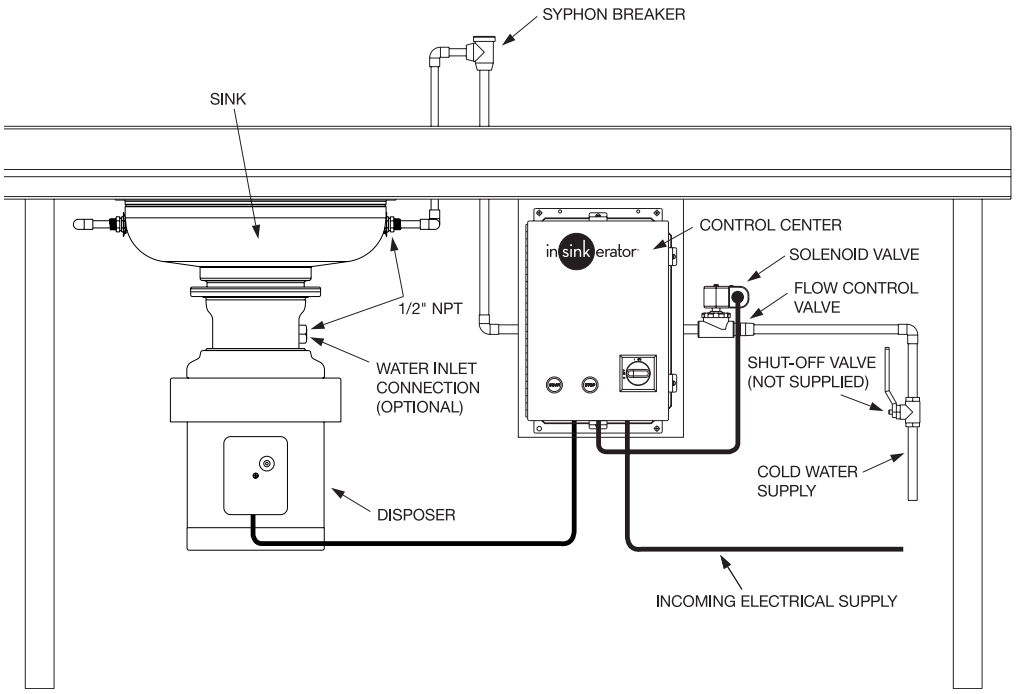
Large Capacity



If mounting directly to a sink, use dimension chart below for adaptor height in place of InSinkErator bowl sink height.
IMPORTANT: #5 adaptors only available on small and medium capacity disposers.

Bowl Mounts	Flange O.D. **X**	Work Table Hole **Y**	Flange I.D. **Z**	**Height**
12" (304.8 mm)	13-1/2" (342.9 mm)	12-1/4" (311.2 mm)	12" (304.8 mm)	6-1/2" (165.1 mm)
15" (381 mm)	16-1/2" (419.1 mm)	15-1/4" (387.4 mm)	15" (381.0 mm)	6-1/2" (165.1 mm)
18" (457.2 mm)	19-1/2" (495.3 mm)	18-1/4" (463.6 mm)	18" (457.2 mm)	6-1/2" (165.1 mm)
Collar Mounts	**X**	**Y**	**Z**	**Height**
#5	Fits Standard Sink Opening: 3-1/2" – 4" (88.9 mm – 101.6 mm)			2-3/4" (69.9 mm)
#6	7-13/16" (198.4 mm)	6-7/8" (174.6 mm)	6-5/8" (168.3 mm)	1-3/16" (30.2 mm)
#7	9-1/8" (231.8 mm)	7-7/8" (200.0 mm)	7-5/8" (193.7 mm)	2-1/16" (52.4 mm)

TYPICAL INSTALLATION - BOWL



REPLACING A COMPETITIVE DISPOSER

- Refer to the Mounting Adaptor Guide or Video for adaptors that fit competitor sink bowls or cones.
- Have sink bowl/cone type with appropriate dimensions available when contacting Customer Service with questions or to place an order.

SAMPLE SPECIFICATION

InSinkErator Food Waste Disposer. Food waste grinding system with _____ HP disposer, _____ control panel. _____ Volts, _____ Hz, _____ Phase operation. _____ disposer mount. Syphon breaker with 1/2" NPT connections; flow control valve; (1) 24V water solenoid.

PROJECT INFORMATION

Item Number: _____

Quantity: _____

Manufacturer: InSinkErator

Model Number: _____

Electrical Requirements: _____volts _____phase

Project: _____

Address: _____

City/State/Zip: _____

Contact: _____

Phone: _____

Dealer: _____

City/State/Zip: _____

Contact: _____

Phone: _____

Installer: _____

Contact: _____

Phone: _____

Consultant: _____

Contact: _____

Phone: _____

PROJECT: _____ **ITEM NO.:** _____

ACCESSORIES



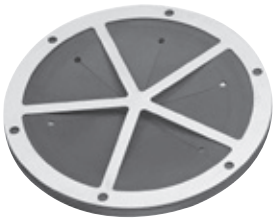
ADJUSTABLE SUPPORT LEGS

- Recommended for all disposer installations & mountings
- Sold in sets of two legs
- Two support legs can be added to small disposer orders
- Two support legs included with Medium disposers, but not installed
- Three support legs are included and installed on Large disposers.
- P/N 11757C



FLANGE FOOT

- Provides secure floor mounting option for commercial disposers
- Use anywhere extra stability or security is a concern
- Flange foot is sold individually and includes one set screw
- Order two feet for medium size units and three feet for large units
- P/N 14394



THROAT GUARD

- Throat Guard mounts at the throat opening of the disposer
- Keeps hands safely away from disposer grind chamber
- Cannot be removed while disposer is installed on sink or trough
- Fits any disposer with a standard $6\frac{5}{8}$" throat opening
- Includes gasket and mounting bolts
- P/N 13620



TAMPER-PROOF CONTROL PANEL SCREWS

- Replaces standard closure screws on disposer control panels
- Eliminates unauthorized entry into control panel for safety and security
- For use with CC-101, CC-202, AS-101, WX-101 and PR-101 disposer control panels
- Includes four control panel replacement screws and matching wrench
- P/N 13946



MAGNETIC SILVER SAVER

- Mounts to any trough system
- To order, specify part# 13983
- One Trough Magnetic Silver Saver approximately 18 inches from disposer hole is recommended. Additional magnets along length of trough are optional.

Our products appear on ***The KCL CADalog***
More information is available from
Kochman Consultants, Ltd. at www.kclcad.com.

1250 International Dr.
Mount Pleasant, WI 53177
TEL: 800-845-8345

www.insinkerator.com/foodservice

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Submittal Sheet

03/14/2025

ITEM# K98 - DISHWASHER, CONVEYOR TYPE (1 EA REQ'D)

American Dish ADC-44 HIGH L-R

Dishwasher, conveyor type, left to right feed, high temp/dual sanitizer, (244) racks/hour @ .49 gallon per rack, 3 HP wash pump, auto-fill, drain pump filter, top mounted controls, dual rinsing system, stainless steel motor panels, stainless steel construction, electric tank heat, (must specify voltage) 208v or 240v, 60a/3ph - recommended optional booster - 70 degree rise J-27 (see options), ENERGY STAR®

ACCESSORIES

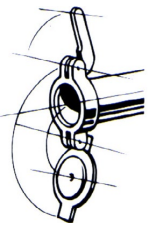
Mfr	Qty	Model	Spec
American Dish	1		208-240v/60/3-ph, 60.0 amps

ADC-44 Conveyor by ADS

HIGH or LOW temp the choice is yours...

*A High Capacity **ENERGY SAVING**, self-purging stage conveyor...*

- *244* ***Racks per Hour***
- ***Operates ONLY when Racks are Inserted***
- *Unrivaled* ***cleaning ability***
- *Dual* ***rinsing system***
- *User Friendley* ***conveyor***
- ***Uses as little as .49 gallons per load***



- *flips open, snaps shut*
- *quick fast clearing of spray arms*
- *shortens the cleaning process & eliminates down time*

Captive end caps



Water Curtain Rinseability

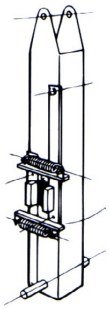
- *activates prior to final rinse*
- *initiates the rinsing process and acts as a shield*

Dual - Fail Safe Heater Control

- *precise water control mechanism*
- *only allows heaters to operate when tank is full*
- *unaffected by heavy soil, water action, strong chemicals and lime build up*

Fail - Safe Conveyor System

- *slip clutch design - stops rack movement*
- *once removed operation easily resumes*
- *eliminates damaged racks*



Drain Pump Filter



- *2 stage PUMP STRAINER*
- *eliminates wash pump obstructions and clogged jets*
- *funtions as drains stopper*

ENERGY STAR

Quality & Reliability... As tempting as it may be, a Conveyor cannot be built just to perform... It must be built to Survive.

At American Dish Service, Quality People, Designs, and Products have been the foundations of our organization for over *45 years*.

www.americandish.com

American Dish Service
Manufacturers of Ware Washing Equipment

900 Blake Street Edwardsville, KS 66111-3820 Toll Free (800) 922-2178 Phone (913) 422-3700 Fax (913) 422-6630

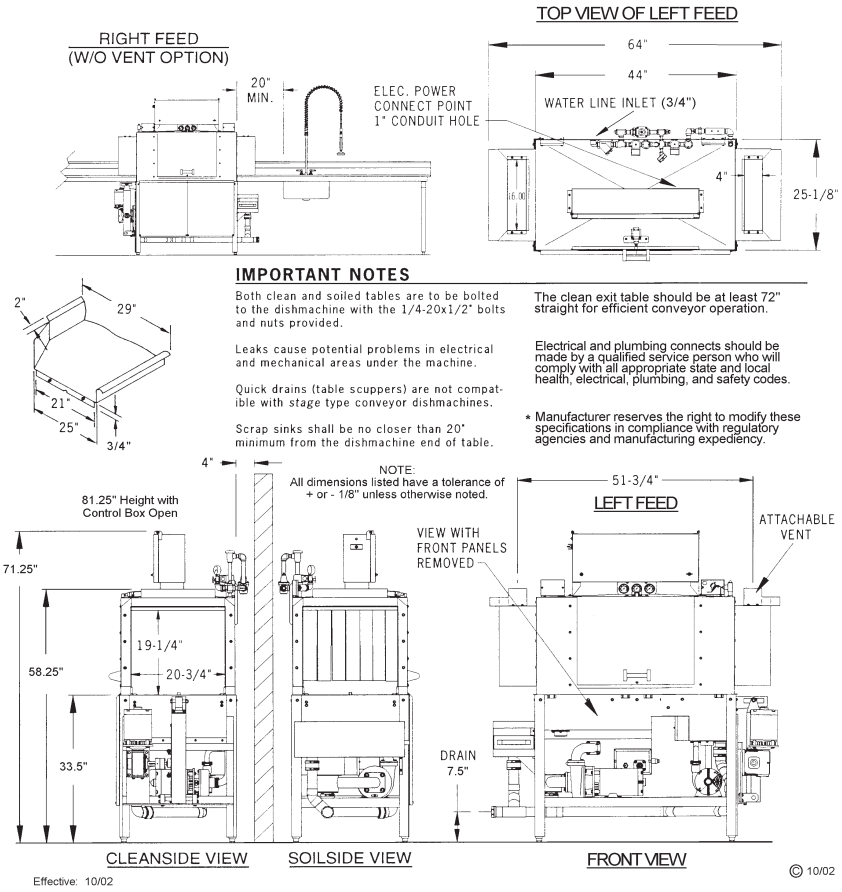
ADC-44 Conveyor

All these features are Standard on the ADC-44. While other manufacturers may offer these same features as Add-Ons"... at American Dish our machines are COMPLETE & READY TO RUN.



- Auto Fill
- Energy Saving Stage Washer
- No Circuit Boards
- Rack Saving Conveyor Drive
- 360 Sq. in. of Washing Action
- High Capacity Heaters
- Wide Opening Access Doors with Safety Interlock
- Skirted Motor Compartment
- Heavy Stainless Steel Const.
- No Operator Controls
- Low Water Consumption
- Quiet Operation
- 244 Racks per Hour
- Auto Cut-Off
- Self-Purging
- 11 Gallon Wash Tank
- 3 HP Wash Pump
- Dual Rinsing System

ENERGY STAR



American Dish Service
Manufacturers of Ware Washing Equipment
WWW.AMERICANDISH.COM
U.S. REGISTERED PATENTS

Model ADC-44 Specifications

ADC-44	FAMILY MODELS (left or right feed) ADC-44 HOT TEMP	ADC-44 CHEMICAL
NSF RATED CAPACITY	244 rack/hr	244 rack/hr
CONVEYOR SPEED	6.8 ft/min or 2.07 meters	6.8 ft/min or 2.07 meters
WATER CONSUMPTION	.49 gal/rack or 1.8 liters	.49 gal/rack or 1.8 liters
TOTAL GAL. PER HR.	120 gph or 454.2 liters	120 gph or 454.2 liters
FINAL RINSE TEMP (20 psi)	180° F/82.2 C	120° F/48.8 C
SANITIZER	180° WATER	50ppm CHLORINE

ELECTRICAL POWER SUPPLY . . . 208/240V, 3PH, 60 AMP, 60 HZ
3 Phase installation requires 6 gauge wires, a suitable ground, and a clean circuit.
1 PH, 50/60 AMP, 60 HZ
1 Phase installation requires one(1) 50 Amp service using 8 gauge wires with a 10 gauge neutral wire, and one(1) 60 Amp service using 6 gauge wires and a suitable ground, both on clean circuits.

MOTOR RATINGS . . . . . 3HP WASH, 1/3HP RINSE 1/3HP CONVEYOR
HEATER RATINGS . . . . . 12KW WASH, 2.25KW RINSE
RACK SIZE . . . . . STANDARD 19.75" x 19.75" or 50.2 x 50.2 cm
ACCESS DOOR CLEARANCE . . . . . 15" x 24.5" 38.1 x 62.2 cm
RACK CLEARANCE (Through machine) . . . . . 19.25" x 20.75" 48.9 x 52.7 cm
WATER INLET . . . . . (3/4") F.P.T.
DRAIN SIZE . . . . . (2") F.P.T.
HEIGHT (with door open) . . . . . 73.75" 187.3 cm
(81.25" or 206.3 cm with control box cover open)
WIDTH (Overall) . . . . . 64" 162.5 cm
WIDTH, TABLE TO TABLE . . . . . 44" 111.7 cm
DEPTH . . . . . 30" 76.2 cm
SHIPPING WEIGHT STD/BoBooster . . . . . 760 Lbs./856 Lbs. 203.2 cm/205.7 cm
SHIPPING DIMENSIONS(STD) 72" L x 36" W x 80" H 182.9 cm x 91.4 cm x 203.2 cm
SHIPPING DIMENSIONS(BoB) 72" L x 36" W x 81" H 182.9 cm x 91.4 cm x 207.7 cm

ADS has built a strong history based on Customer Service, Quality and Reliability. A Commitment to Excellence is the driving force behind American Dish Service.

WARNING: Cancer and Reproductive Harm - www.P65Warnings.ca.gov

900 Blake Street Edwardsville, KS 66111-3820 Toll Free (800) 922-2178 Phone (913) 422-3700 Fax (913) 422-6630

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K99 - PANTLEG DUCT (1 EA REQ'D)

Custom CUSTOM

S/s all welded and watertight pantleg duct to extend 6" above ceiling, with trim rings.
See detail in food service set

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K100 - DISH FAN (1 EA REQ'D)

Captive DU50HFA

800 CFM dish fan and roof curb

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Submittal Sheet

03/14/2025

ITEM# K101 - BOOSTER HEATER, ELECTRIC (1 EA REQ'D)

Hubbell J1627

Booster Heater, electric, 27.0 kW, 16-gallon storage capacity, ASME stamped stainless steel tank with CFC/HCFC free closed cell foam insulation, electronic display controller with low water cut-off & leak detection, stainless steel exterior, pressure reducing valve with by-pass, T&P gauge, T&P relief valve, adjustable plastic legs, UL, cUL, ASME, UL EPH (ANSI/NSF 5)

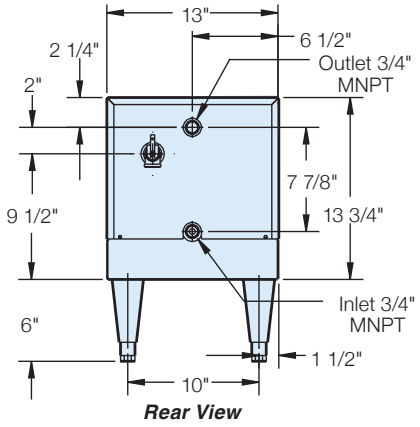
ACCESSORIES

Mfr	Qty	Model	Spec
Hubbell	1	J1627R	208v/60/3-ph, 75.0 amps

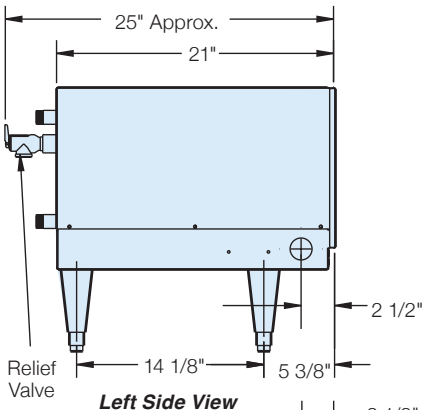
Model J6 - (1 to 18kW) Dimensions



Shipping Weight: 95 lbs.

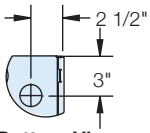


Rear View



Left Side View

Knockouts: Left Side And Bottom
3/4" X 1" X 1-1/4"

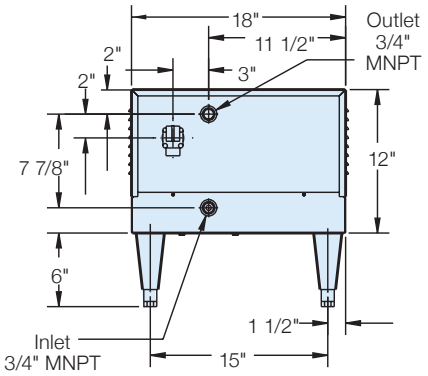


Bottom View

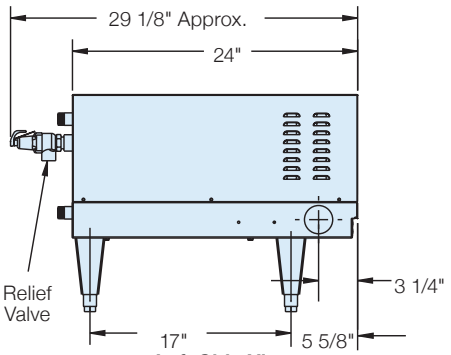
Model J6 - (24 to 58.5kW) Dimensions



Shipping Weight: 110 lbs.

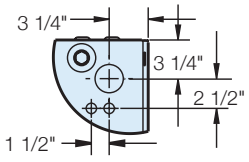


Rear View



Left Side View

Knockouts: Left Side - (1) 1-1/2" X 2"
Bottom - (2) 1/2" and (1) 1-1/2" x 2"

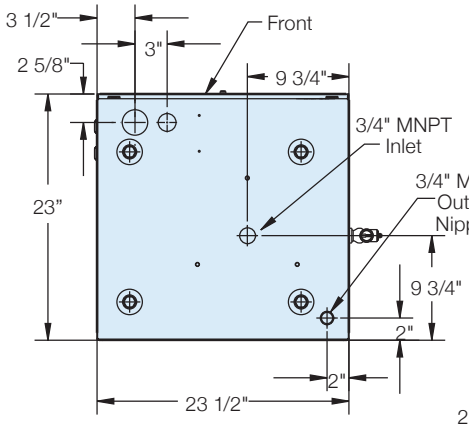


Bottom View

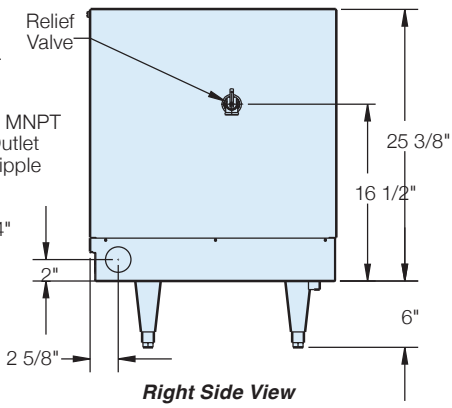
Model J16 - (1 to 58.5kW) Dimensions



Shipping Weight: 160 lbs.



Bottom View



Right Side View

Knockouts: Left Side - 1-1/2" X 2"
Bottom - 1-1/2" X 2" and 3/4" X 1" X 1-1/4"

J6 and J16 Wiring Chart

kW	Volt	Ph	Unit Amp Draw	Branch Amp Draw	Phase-Phase Resistance (Ohms)	Min. Feed Breaker or Fuse Size	Internal Power Wire Size	Element Jumper Wire Size	Copper Power Feed Wire Size	Conduit Size	Diagram
1	120	1	8.3	8.3	14.4	15	12	N/A	14	½"	1(NT)
1.5	120	1	12.5	12.5	9.6	20	12	N/A	14	½"	1(NT)
2	120	1	16.7	16.7	7.2	25	12	N/A	12	½"	1(NT)
3	120	1	25.0	25.0	4.8	35	12	12	10	½"	1(NT)
4	208	1	19.2	19.2	10.8	25	12	N/A	10	½"	1(NT)
	240	1	16.7	16.7	14.4	25	12	N/A	12	½"	1(NT)
	380	1	10.7	10.7	36.1	15	12	N/A	12	½"	1(WT)
	480	1	8.3	8.3	57.6	15	12	N/A	14	½"	1(WT)
5	208	1	24.0	24.0	8.7	30	12	N/A	10	½"	1(NT)
	240	1	20.8	20.8	11.5	30	12	N/A	10	½"	1(NT)
	380	1	13.2	13.2	28.9	20	12	N/A	12	½"	1(WT)
	480	1	10.4	10.4	46.1	15	12	N/A	14	½"	1(WT)
6	208	1	28.8	28.8	7.2	40	12	12	8	½"	4
	208	3	16.7	16.7	14.4	25	12	12	10	½"	10(NT)
	240	1	25.0	25.0	9.6	35	12	12	8	½"	4
	240	3	14.4	14.4	19.2	20	12	12	12	½"	10(NT)
	380	3	8.6	8.6	48.1	15	12	12	14	½"	10(WT)
	480	3	7.2	7.2	76.8	10	12	12	14	½"	10(WT)
	600	3	6.0	6.0	114.8	10	12	12	14	½"	14
7	208	1	32.5	32.5	6.4	45	12	12	8	½"	4
	208	3	18.7	18.7	12.4	25	12	12	10	½"	10(NT)
	240	1	30.5	30.5	8.2	40	12	12	8	½"	4
	240	3	17.6	17.6	16.5	25	12	12	10	½"	10(NT)
	380	3	10.0	10.0	41.3	15	12	12	12	½"	10(WT)
	480	3	8.4	8.4	65.8	15	12	12	14	½"	10(WT)
	600	3	6.8	6.8	102.0	10	12	12	14	½"	14
9	208	1	43.3	43.3	4.8	55	10	12	6	¾"	4
	208	3	25.0	25.0	9.6	35	10	12	8	½"	10(NT)
	240	1	37.5	37.5	6.4	50	10	12	8	½"	4
	240	3	21.7	21.7	12.8	30	10	12	10	½"	10(NT)
	380	3	14.3	14.3	32.1	20	12	12	12	½"	10(WT)
	480	3	10.8	10.8	51.2	15	12	12	14	½"	10(WT)
	600	3	9.1	9.1	76.5	15	12	12	14	½"	14
10.5	208	1	48.8	48.8	4.3	65	8	10	6	¾"	4
	208	3	29.1	29.1	8.2	40	12	12	8	½"	10(NT)
	240	1	43.8	43.8	5.5	55	10	12	6	¾"	4
	240	3	25.3	25.3	11.0	35	12	12	8	½"	10(NT)
	380	3	17.1	17.1	27.5	25	12	12	10	½"	10(WT)
	480	3	12.6	12.6	43.9	20	12	12	12	½"	10(WT)
	600	3	10.2	10.2	68.1	15	12	12	14	½"	14
12	208	1	57.7	57.7	3.6	75	8	10	4	1"	4
	208	3	33.3	33.3	7.2	45	12	12	8	½"	10(NT)
	240	1	50.0	50.0	4.8	65	8	10	6	¾"	4
	240	3	28.9	28.9	9.6	40	12	12	8	½"	10(NT)
	380	3	18.6	18.6	24.1	25	12	12	10	½"	10(WT)
	480	3	14.4	14.4	38.4	20	12	12	12	½"	10(WT)
	600	3	11.3	11.3	61.2	15	12	12	14	½"	14
13.5	208	1	64.9	64.9	3.2	85	8	10	4	1"	4
	208	3	37.5	37.5	6.4	50	10	12	8	½"	10(NT)
	240	1	56.3	56.3	4.3	75	8	10	4	1"	4
	240	3	32.5	32.5	8.5	45	12	12	8	½"	10(NT)
	380	3	21.4	21.4	21.4	30	12	12	10	½"	10(WT)
	480	3	16.2	16.2	34.1	25	12	12	12	½"	10(WT)
	600	3	13.6	13.6	51.0	20	12	12	12	½"	14

J6 and J16 Wiring Chart (cont.)

kW	Volt	Ph	Unit Amp Draw	Branch Amp Draw	Phase-Phase Resistance (Ohms)	Min. Feed Breaker or Fuse Size	Internal Power Wire Size	Element Jumper Wire Size	Copper Power Feed Wire Size	Conduit Size	Diagram
15	208	1	72.1	72.1	2.9	95	6	8	3	1"	4 (DB)
	208	3	41.6	41.6	5.8	55	10	12	6	¾"	10(NT)
	240	1	62.5	62.5	3.8	80	8	10	4	1"	4
	240	3	36.1	36.1	7.7	50	10	12	8	½"	10(NT)
	380	3	22.9	22.9	19.3	30	12	12	8	½"	10(WT)
	480	3	18.0	18.0	30.7	25	12	12	10	½"	10(WT)
	600	3	14.7	14.7	47.1	20	12	12	12	½"	14
18	208	1	86.5	86.5	2.4	110	6	8	2	1"	4 (DB)
	208	3	50.0	50.0	4.8	65	8	10	6	¾"	10(NT)
	240	1	75.0	75.0	3.2	95	6	8	3	1"	4 (DB)
	240	3	43.3	43.3	6.4	55	10	12	6	¾"	10(NT)
	380	3	27.9	27.9	16.0	35	12	12	8	½"	10(WT)
	480	3	21.7	21.7	25.6	30	12	12	10	½"	10(WT)
	600	3	18.1	18.1	38.3	25	12	12	12	½"	14
24	208	1	115.4	38.5	1.8	145	10	12	1/0	1¼"	3A
	208	3	66.6	66.6	3.6	85	8	10	4	1"	13(NT)
	240	1	100.0	33.3	2.4	130	12	12	1	1¼"	3A
	240	3	57.7	57.7	4.8	75	8	10	4	1"	13(NT)
	380	3	37.1	37.1	12.0	50	10	12	6	¾"	13(WT)
	480	3	28.9	28.9	19.2	40	12	12	8	½"	13(WT)
	600	3	22.6	22.6	30.6	30	12	12	10	½"	15
27	208	1	130.0	43.3	1.6	165	10	12	2/0	1½"	6A
	208	3	74.9	37.5	3.2	95	10	12	3	1"	12(NCB)
	240	1	112.5	37.5	2.1	145	10	12	1/0	1¼"	3A
	240	3	65.0	65.0	4.3	85	8	10	4	1"	13(NT)
	380	3	42.9	42.9	10.7	55	10	12	6	¾"	13(WT)
	480	3	32.5	32.5	17.1	45	12	12	8	½"	13(WT)
	600	3	27.2	27.2	25.5	35	12	12	8	½"	15
30	208	1	144.2	48.1	1.4	185	8	10	3/0	1½"	6A
	208	3	83.3	41.6	2.9	105	10	12	2	1"	12(NCB)
	240	1	125.0	41.7	1.9	160	10	12	2/0	1½"	6A
	240	3	72.2	36.1	3.8	95	10	12	3	1"	12(NCB)
	380	3	45.7	45.7	9.6	60	10	12	4	1"	13(WT)
	480	3	36.1	36.1	15.4	50	10	12	8	½"	13(WT)
	600	3	29.4	29.4	23.6	40	12	12	8	½"	15
36	208	1	173.1	57.7	1.2	220	8	10	4/0	2"	6A
	208	3	99.9	50.0	2.4	125	8	10	1	1¼"	12(NCB)
	240	1	150.0	50.0	1.6	190	8	10	3/0	1½"	6A
	240	3	86.6	43.3	3.2	110	10	12	2	1"	12(NCB)
	380	3	55.7	55.7	8.0	70	8	10	3	1"	13(WT)
	480	3	43.3	43.3	12.8	55	10	12	6	¾"	13(WT)
	600	3	36.2	36.2	19.1	50	10	12	8	½"	15
39	208	1	187.5	62.5	1.1	235	8	10	250	2"	6A
	208	3	108.3	54.1	2.2	140	8	10	1/0	1¼"	12(NCB)
	240	1	162.5	54.2	1.5	205	8	10	4/0	1½"	6A
	240	3	93.8	46.9	3.0	120	10	12	1	1"	12(NCB)
	380	3	60.8	60.8	7.4	80	8	10	3	1"	13(WT)
	480	3	46.9	46.9	11.8	60	8	10	6	¾"	13(WT)
	600	3	36.2	36.2	19.1	50	10	12	8	¾"	15

J6 and J16 Wiring Chart (cont.)

kW	Volt	Ph	Unit Amp Draw	Branch Amp Draw	Phase-Phase Resistance (Ohms)	Min. Feed Breaker or Fuse Size	Internal Power Wire Size	Element Jumper Wire Size	Copper Power Feed Wire Size	Conduit Size	Diagram
40.5	208	1	195.0	65.0	1.1	245	8	10	250	2"	6A
	208	3	112.6	56.3	2.1	145	8	10	1/0	1¼"	12(NCB)
	240	1	168.8	56.3	1.4	215	8	10	250	1½"	6A
	240	3	97.4	48.7	2.8	125	10	12	1	1"	12(NCB)
	380	3	60.8	60.8	7.1	80	8	10	3	1"	13(WT)
	480	3	48.7	48.7	11.4	65	8	10	4	¾"	13(WT)
	600	3	36.2	36.2	19.1	50	10	12	8	¾"	15
45	208	3	119.1	59.5	1.9	150	8	10	2/0	1¼"	12(NCB)
	240	1	187.5	62.5	1.3	235	8	10	250	2"	6A
	240	3	108.3	54.1	2.6	140	8	10	1/0	1¼"	12(NCB)
	380	3	68.6	34.3	6.4	90	12	12	2	1"	12(WT)
	480	3	54.1	54.1	10.2	70	8	10	4	¾"	13(WT)
	600	3	42.2	42.2	16.4	55	10	12	6	¾"	15
54	208	3	149.9	74.9	1.6	190	6	8	3/0	1½"	12
	240	3	129.9	65.0	2.1	165	8	10	2/0	1½"	12
	380	3	80.0	40.0	5.3	100	10	12	1	1"	12(WT)
	480	3	65.0	65.0	8.5	85	8	10	4	1"	13(WT)
	600	3	54.3	54.3	12.8	70	8	10	4	1"	15
58.5	208	3	159.9	79.9	1.5	200	6	8	4/0	1½"	12
	240	3	140.7	70.4	2.0	180	6	8	2/0	1½"	12
	380	3	91.4	45.7	4.9	115	10	12	1	1"	12(WT)
	480	3	70.4	35.2	7.9	90	12	12	3	1"	12(WT)
	600	3	54.3	54.3	12.3	70	8	10	4	1"	15
	208	3	178.6	59.5	1.4	225	8	10	4/0	1½"	17
	600	3	63.4	63.4	10.9	80	8	10	4	¾"	18

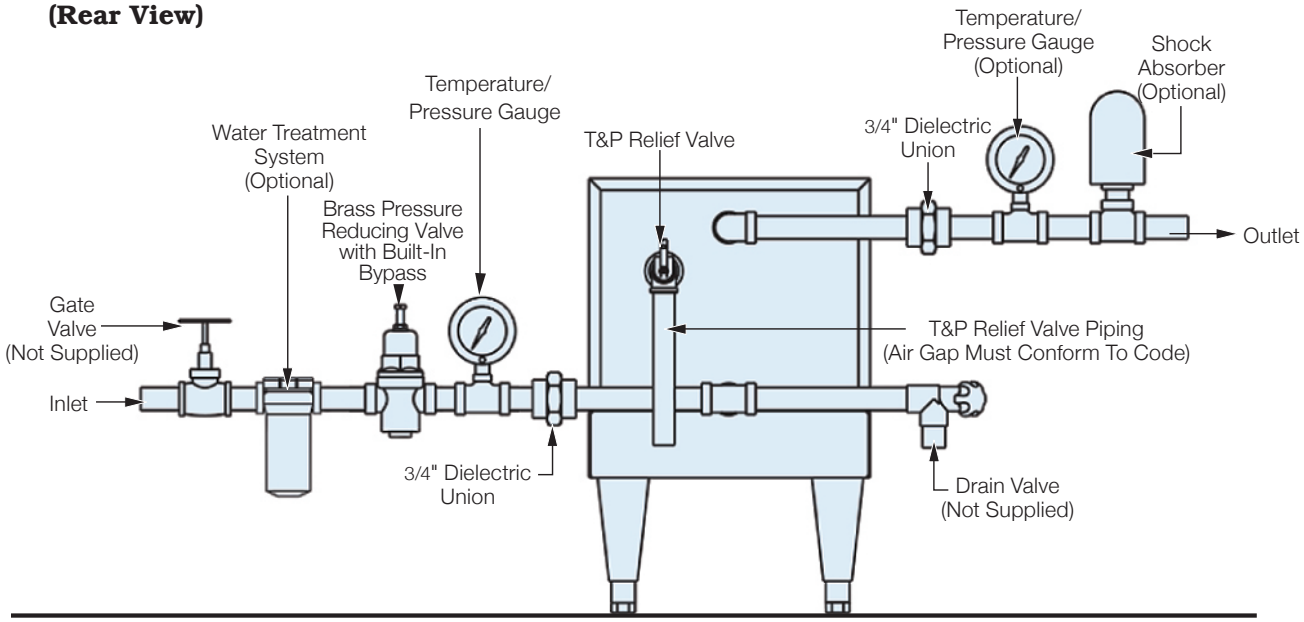
J6 and J16 Wiring Chart Notes:

1. Power feed wire sizing is based on using 75°C Cu THHN wire with feeder branch protection rated at 125%.
2. Internal wire sizing is based on using 200°C SEW-2 or PTFE wiring in a raceway with an ambient temperature up to 60°C.
3. For information on 277V, 415V, or 440V models reference the supplied drawing or contact the factory.
4. Normal phase-to-phase resistance tolerance is ±5%.
5. 380, 480, and 600-volt phase-to-phase resistance values are shown with the transformer disconnected.
6. For 575V models, multiply the kW rating of the 600V model by a de-rating factor of 0.92 to get the actual rating for 575V.
7. For models manufactured prior to June 24, 2005, that utilize wiring diagrams 3, 5, 6, 7(NT), 7(WT), or 11 please contact the factory for wiring diagrams.

Typical Installation Diagrams

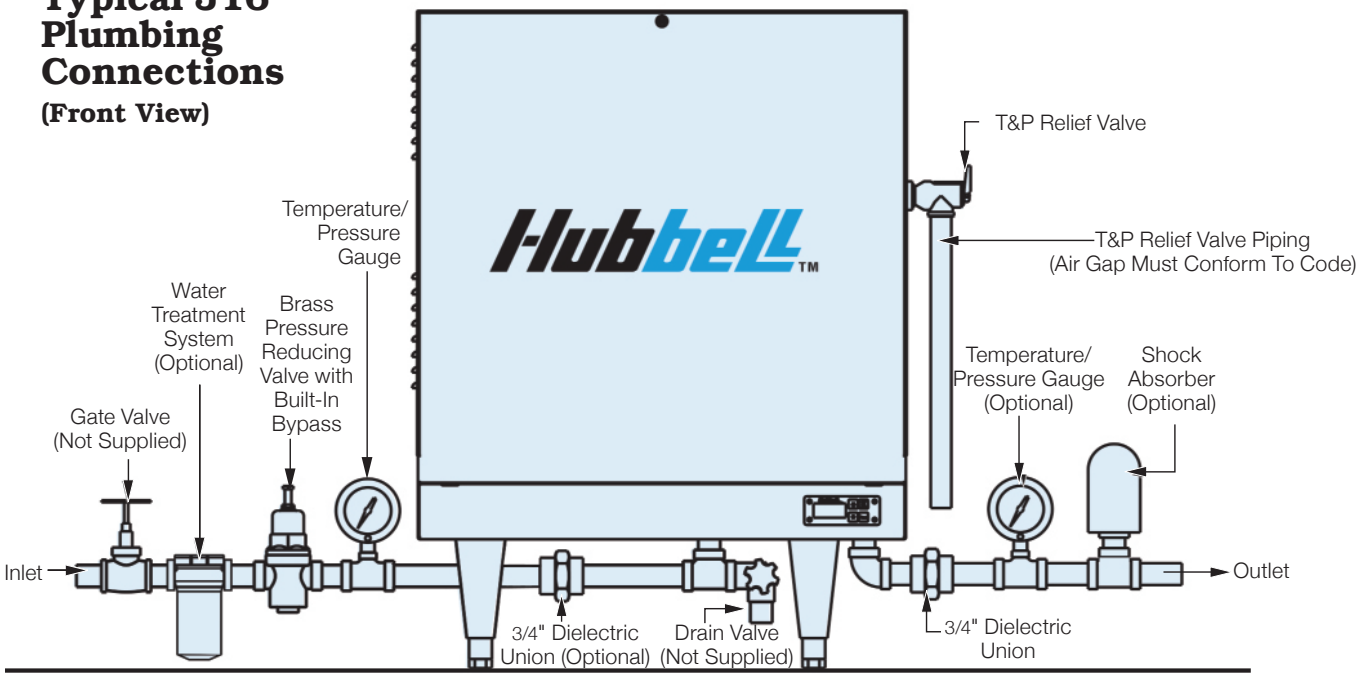
Typical J6 Plumbing Connections

(Rear View)



Typical J16 Plumbing Connections

(Front View)



Plumbing Notes:

1. Dielectric unions as supplied must be installed in the inlet and outlet piping to prevent electrolysis.
2. No check valve may be installed in the supply line to the booster.
3. All shut off valves must be gate or ball valves - not globe valves.
4. The brass pressure reducing valve with built-in bypass is adjustable from 25 to 75 psi.
5. To minimize heat loss and maximize efficiency, hot water piping should be insulated.

Recovery Ratings 1-58.5 kW								
KW Rating	Recovery Rate in GPH at °F Temperature Rise (ΔT)							
	20° ΔT	30° ΔT	40° ΔT	60° ΔT	70° ΔT	80° ΔT	110° ΔT	140° ΔT
1	20	14	10	7	6	5	4	3
1.5	31	20	15	10	9	8	6	4
2	41	27	20	14	12	10	7	6
3	61	41	31	20	18	15	11	9
4	82	55	41	27	23	20	15	12
5	102	68	51	34	29	26	19	15
6	123	82	61	41	35	31	22	18
7	143	96	72	48	41	36	26	20
9	184	123	92	61	53	46	33	26
10.5	215	143	107	72	61	54	39	31
12	246	164	123	82	70	61	45	35
13.5	276	184	138	92	79	69	50	39
15	307	205	154	102	88	77	56	44
18	368	246	184	123	105	92	67	53
24	491	328	246	164	140	123	89	70
27	553	368	276	184	158	138	100	79
30	614	409	307	205	175	154	112	88
36	737	491	368	246	211	184	134	105
39	798	532	399	266	228	200	145	114
40.5	829	553	415	276	237	207	151	118
45	921	614	461	307	263	230	167	132
54	1105	737	553	368	316	276	201	158
58.5	1198	798	599	399	342	299	218	171

Recovery Ratings 64-88 kW								
64	1310	873	655	437	374	328	238	187
68	1392	928	696	464	398	348	253	199
81	1658	1105	829	553	474	415	301	237
86	1761	1174	880	587	503	440	320	252
88	1802	1201	901	601	515	450	328	257

Formulas To Solve For:

Recovery

GPH x _____ °F ΔT x 0.00244 = KW

KW x 410 ÷ GPH = _____ °F ΔT

KW x 410 ÷ _____ °F ΔT = GPH

Note: 1 KW will heat 4.1 GPH at a 100°F ΔT

Electrical

$\frac{KW \times 1000}{Volts} \div 1.73 = Amps\ 3\ Phase$

$\frac{KW \times 1000}{Volts} = Amps\ 1\ Phase$

Metric Conversion

Liters x 0.2641 = Gallons
Gallons x 3.79 = Liters
Gallons x 0.003785 = m^3
m^3 x 264.2 = Gallons
1°F ΔT = 1.8°F ΔT

°F = (°C x 1.8) + 32
°C = (°F - 32) x 0.556
psi x 0.06896 = Bar
Bar x 14.5 = psi
psi x 6.86 = kPa

kPa x 0.1456 = psi
Lbs x 0.4536 = Kg
Kg x 2.2 = Lbs
Watts/Sq.Cm. x 6.4 = Watts/Sq.In.
Watts/Sq.In. x 0.155 = Watts/Sq.Cm.

Voltage De-Rating Factors

Rated Voltage	Applied Voltage	KW De-Rating Factor
600	575	92%
600	550	84%
480	460	92%
480	440	84%
240	230	92%
240	220	84%

When the actual supply voltage (applied voltage) is different than the booster design voltage (rate voltage) the resulting KW output will be affected. Please see the chart for typical voltage de-rating factors, or use the following formula:

$\frac{Applied\ Votage^2}{Rated\ Voltage^2} \times Rated\ KW = KW\ output\ at\ applied\ voltage$

J Model Standard Accessories

J6 and J16 Boosters

- √ T&P Relief Valve
- √ Brass pressure reducing valve with built-in bypass
- √ (4) NSF approved plastic legs
- √ (1) Combination temperature and pressure gauge
- √ (2) Dielectric Unions

- √
- √

- √
- √

Note: Any and all optional accessories for a Hubbell booster heater must be called out in the written specifications. A model number in and of itself does not reflect any optional accessoties selected.

Optional Accessories

☐ **1. Slide Brackets:** Available for the J6 model only, these brackets allow for mounting the booster heater under a counter. See slide bracket diagram for details.

☐ **2. Shock Absorber:** Reduce the harmful pressures resulting from quick closing dishwasher solenoid valves by installing a shock absorber between the booster and the dishwasher.

☐ **3. Tamper Resistant Package:** For prison and other secure facilities a tamper resistant package is available with all hardware tamper resistant type. Includes standard plastic legs unless otherwise specified.

☐ **4. Protective Cover:** Keep your Hubbell booster free from dirt, debris, chemicals and excessive water with this removable form fitted protective cover. Velcro fasteners make it easily installed and simple to remove when service is required. Clear window allows visibility of Hubbell booster digital display.

☐ **5. Alternate Legs:** Please specify type: Nickel plated die cast, stainless steel, stainless steel with flanged base for floor mounting.

☐ **6. 24 Volt Heater Interlock Adapter:** An optional plug adapter that interlocks the heater via a 24-Volt signal through the J1 connector on the control board (standard on the J3).

☐ **7. Water Treatment System:** Provide superior mineral scale prevention and corrosion control by feeding a special blend of scale control compounds into the hot water stream before the booster. The in-line system to include a clear cartridge housing to allow an operator to view the cartridge and determine when it needs replacement without the need to open the system.

☐ **8. Alternative Voltages:** Hubbell booster heaters are available in alternate voltages including 380, 415, 440 and 575 volt. Please contact factory for kW selection.

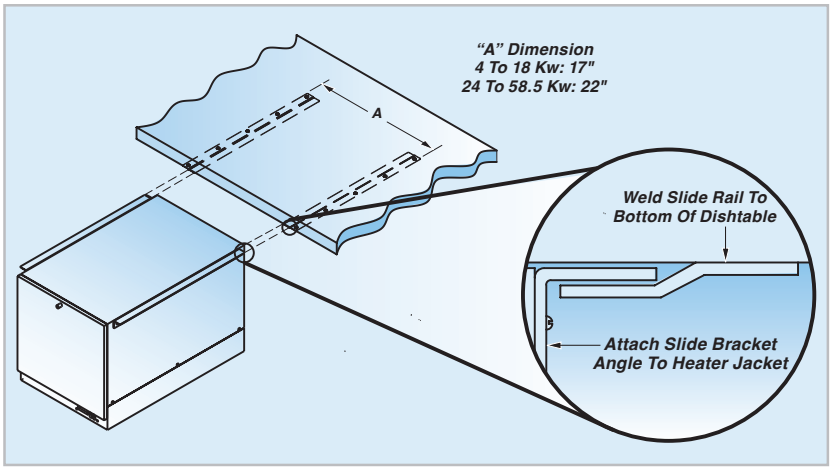
☐ **9. Low Temperature Interlock:** This device is built into the booster and monitors water temperature and will trip an SPDT relay when water temperature drops below a set point (150 - 180°F) thereby preventing final rinse from activating.

☐ **10. Remote Alarm Adapter:** This device installs into the Hubbell controller and provides remote alarm capability to indicate a reset fault condition. Common/N.O./N.C. rated 220 VDC, 250 VAC, 2 amp max.

☐ **11. Remote Control Panel:** This device allows you to install the booster in one location and have complete control of it (on/off, temperature adjustment, reset and temperature indication) from another location (200 feet maximum). Remote control panel is 5" x 2" x 3" and NEMA 4 rated.

Note: None of the listed optional accessories are available with J4 models.

J6 Slide Bracket Detail



Water Quality Requirements

Recommended water hardness is 4 to 6 grains of hardness per gallon (GPG). Water hardness above 6 GPG should be treated by a water conditioner (water softener or in-line treatment). Water hardness below 4 GPG also requires treatment to reduce potential corrosion. Excessive GPG will result in higher operating and maintenance costs and will reduce product longevity.

Chlorides must not exceed 50 parts per million (ppm). Excessive chlorides will result in metallic corrosion and will reduce product longevity.

Water treatment has been shown to reduce costs associated with deliming the booster as well as reducing metallic corrosion. Product failure caused by these conditions is not covered under warranty. See warranty for complete details.

Booster Sizing for a Low Temp Dishmachine

Chemical low-temp dishwashers are most effective when supplied with 140°F hot water. This water temperature may not be available due to an undersized primary water heater or local safety code. Hubbell J model boosters can operate as a pre-heater for chemical low-temp dishwashers to provide an adequate supply of 140°F hot water for proper operation. For temperatures other than the factory setting of 185°F, simply set the digital display to your desired temperature.

To properly size a Hubbell booster heater for low temp use:

1. Determine the required temperature rise; the difference in temperature between your supply water temperature to your booster and your desired hot water temperature out of the booster.
2. Determine the water usage gallons per hour (GPH) by consulting the dishwasher data plate, literature or NSF listing.
3. Select the appropriate kW based on 1 and 2 above using either the formula below or the Recovery Rating Chart on page 4.

Booster Sizing Formula

Required Variables:

A. Water usage in GPH _____

B. Supply water temp in °F _____

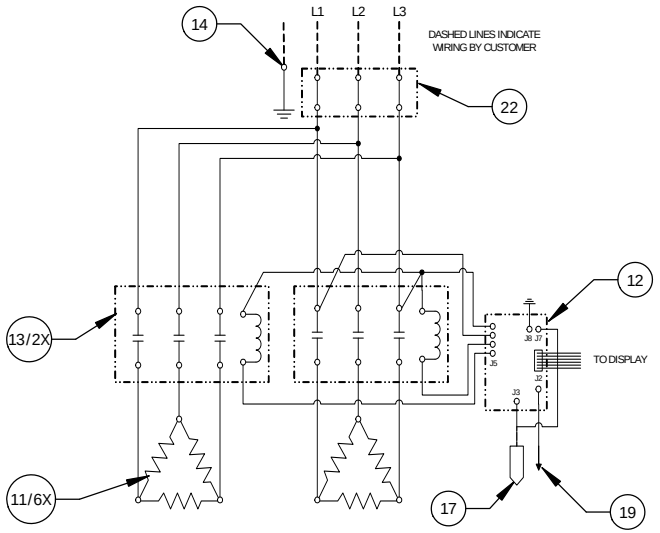
C. Desired water temp in °F _____

D. Calculate the ΔT (temp rise) by subtracting **C** - **B** in °F _____

Formula to Determine KW:

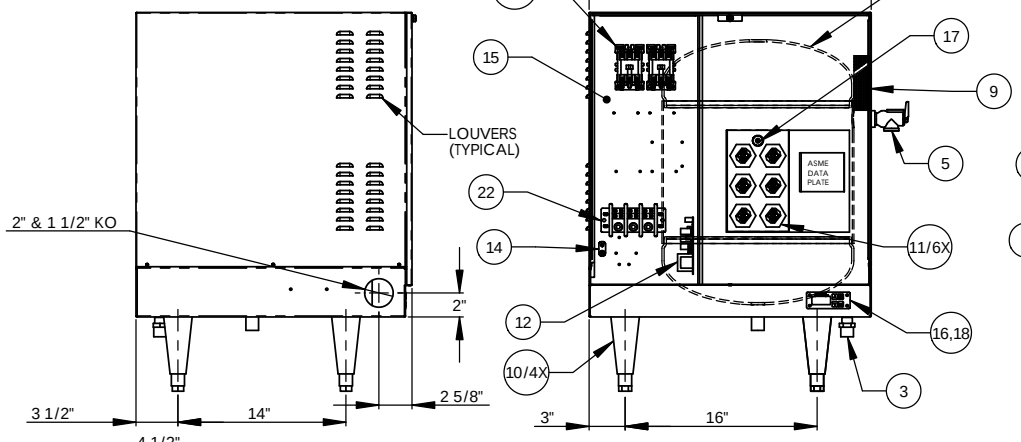
_____ GPH x _____ °F ΔT x 0.00244 = _____ KW

27kW - 208V - 3Ø - 74.9A

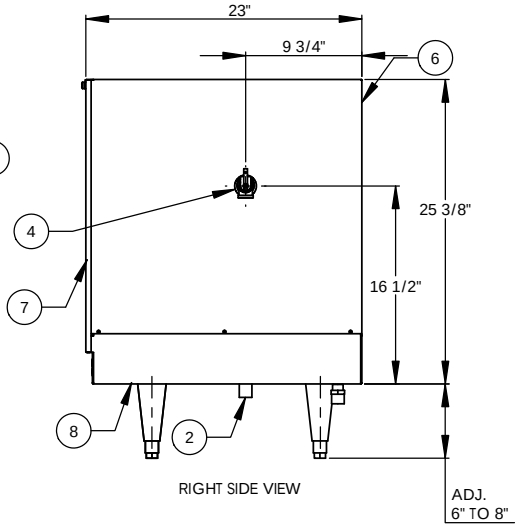


ITEM NO.	QTY.	PART NO.	MATERIAL	DESCRIPTION
1	1	J16-3 TANK	304L S/S	16 GALLON VESSEL ASSEMBLY
2	1	J16 INLET	304 S/S	3/4" MNPT INLET
3	1	J16 OUTLET	COPPER	3/4" MNPT OUTLET
4	1		304L S/S	3/4" FNPT FOR RELIEF VALVE
5	1	100XL .75 150LB	BRONZE	RELIEF VALVE SET AT 150PSI, 210°F
6	1	J16 JACKET	304 S/S	TOP COVER ASSEMBLY
7	1	J16 FRONT COVER	304 S/S	FRONT COVER ASSEMBLY
8	1	J16 BASE	304 S/S	BASE ASSEMBLY
9	1		FOAM	INSULATION
10	4	61649NOBN5T4	PLASTIC	ADJUSTABLE LEGS
11	6	C1315-17	BRASS PLUG & COPPER SHEATH	HEATING ELEMENT - 1-7/8" HEX 6000W @ 240V/4500W @ 208V
12	1	T1000	VARIOUS	CONTROL MODULE
13	2	C25DNF340B	VARIOUS	MAGNETIC CONTACTOR 50A (RESISTIVE) - 240V
14	1	KA4C	COPPER	GROUND LUG
15	1	J16CONTROL PLATE	GALVANEEL	ELECTRICAL MOUNTING PANEL
16	1	TD1000	VARIOUS	DIGITAL DISPLAY MODULE
17	1	P65	VARIOUS	PROBE ASSEMBLY
18	1	OVERLAY J MODEL	LEXAN	OVERLAY FOR DISPLAY MODULE
19	1		VARIOUS	LEAK DETECTION SENSOR
20	1	TTD405	VARIOUS	T&P GAUGE 30-240°F/0-200PSI
21	1	N45BU	BRONZE	PRESS REDUCING VALVE 25-75 PSI
22	1	16220-3	VARIOUS	POWER DISTRIBUTION BLOCK 175A, 3-POLE, 1 PRIM., 4 SEC.

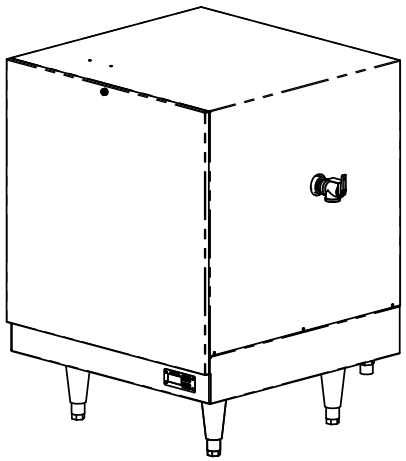
REVISIONS				
ZONE	REV.	DESCRIPTION	DATE	APPROVED
	-	-	--	---

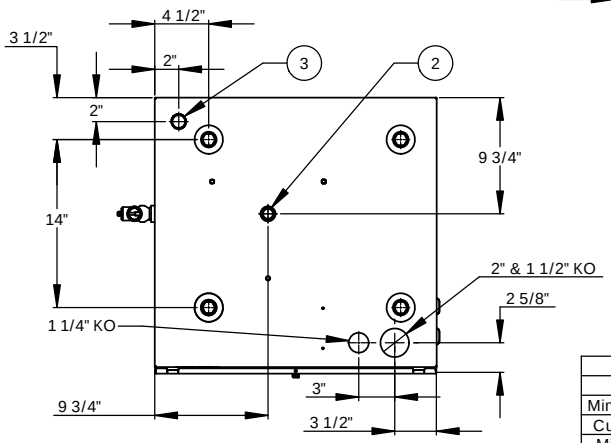


FRONT VIEW
(WITH COVER REMOVED)



RIGHT SIDE VIEW





BOTTOM VIEW

INSTALLATION REQUIREMENTS	
AMP Draw	74.9
Min. Breaker/Fuse Size	95 AMP
Cu Power Feed Wire	#3 AWG THHN
Min. Power Conduit	1"
Wiring Diagram	12 (NCB)

ELECTRICAL NOTES:
1. POWER FEED WIRE SIZING IS BASED ON 75°C Cu THHN WIRE WITH FEEDER BRANCH PROTECTION AT 125%.
2. REFERENCE INSTALLATION, OPERATION, AND MAINTENANCE MANUAL FOR COMPLETE INSTALLATION INSTRUCTIONS.

NOTES:
1. TANK IS DESIGNED, FABRICATED, AND STAMPED IAW ASME SECTION VIII CODE, LATEST ADDENDA.
2. TANK IS DESIGNED FOR 150PSI AND PRESSURE TESTED AT 225PSI.
3. PROBE ASSEMBLY (Pc. No. 17) PROVIDES TEMPERATURE CONTROL, HI-LIMIT, AND LOW WATER SENSING.
4. UNIT IS UL, CUL, AND UL EPH LISTED.
5. PIECE NOS. 5, 10, 20, & 21 ARE SHIPPED LOOSE.
6. CONTROL CIRCUIT WIRE TO BE #18 TEFZEL 750 (200°C), POWER CIRCUIT WIRE TO BE #10 TEFZEL 750 (200°C). ELEMENT JUMPER WIRE TO BE #12 TEFZEL 750 (200°C).
7. PHASE TO PHASE RESISTANCE: 3.2 OHMS
8. APPROXIMATE WEIGHT:
   DRY: 131 LBS.
   WET: 264 LBS.

PROPRIETARY AND CONFIDENTIAL
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DIMENSIONS ARE IN INCHES
TOLERANCES:
(UNLESS OTHERWISE SPECIFIED)
FRACTIONAL ±⅛
ANGULAR: MACH ±½° BEND ±1°
TWO PLACE DECIMAL ±0.01
THREE PLACE DECIMAL ±0.005

	DATE	NAME
DRAWN	2/26/03	PRD
CHECKED	2/26/03	WENIII
ENG APPR.	2/26/03	PRD
MFG APPR.	2/26/03	CHD

Hubbell™ Stratford, CT 06615 (203) 378-2659
The Electric Heater Company

Customer:

Description: J MODEL BOOSTER HEATER
J1627R- 16 GALLON
27kW - 208V - 3Ø

SIZE	DWG. NO.	REV
C	J1627R	-

SCALE: 1:8 | FSCM: 19857 | SHEET 1 OF 1

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K102 - CLEAN DISH TABLE (1 EA REQ'D)

Custom CUSTOM

S/s clean dish table. "L" shaped, with s/s rollers, s/s legs and cross rails, ten inch rear splash.

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# K103 - DISHTABLE SORTING SHELF (1 EA REQ'D)

Advance Tabco DT-6R-13

Sorting Shelf, wall mounted, traditional design, 62"W, accommodates (3) full size dish racks, solid end brackets, stainless steel, NSF

DISHTABLE SORTING SHELVES

Item #: _____ Qty #: _____
Model #: _____
Project #: _____



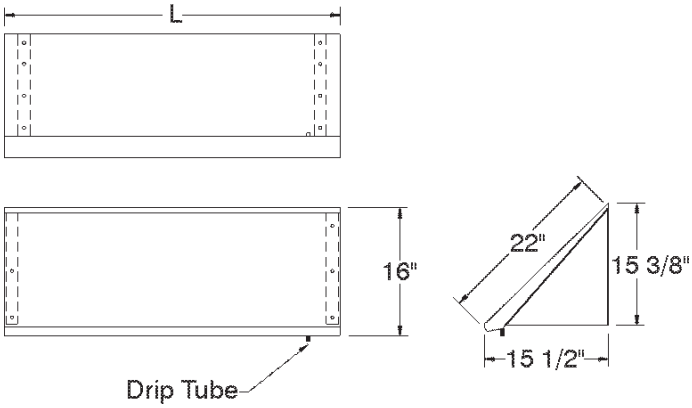
TRADITIONAL DESIGN

FEATURES:
A solid die formed wall mounted rack shelf with solid end brackets.

CONSTRUCTION:
TIG-welded with exposed areas blended to a satin finish.

MATERIAL:
Brackets are 16 gauge type 300 series stainless steel.

Shelf is 16 gauge type 300 series stainless steel.



MODEL #	# of Racks	L	Wt
DT-6R-11	1	22”	20 lbs.
DT-6R-12	2	42”	30 lbs.
DT-6R-13	3	62”	40 lbs.
DT-6R-14	4	82”	50 lbs.



KD TUBULAR DESIGN

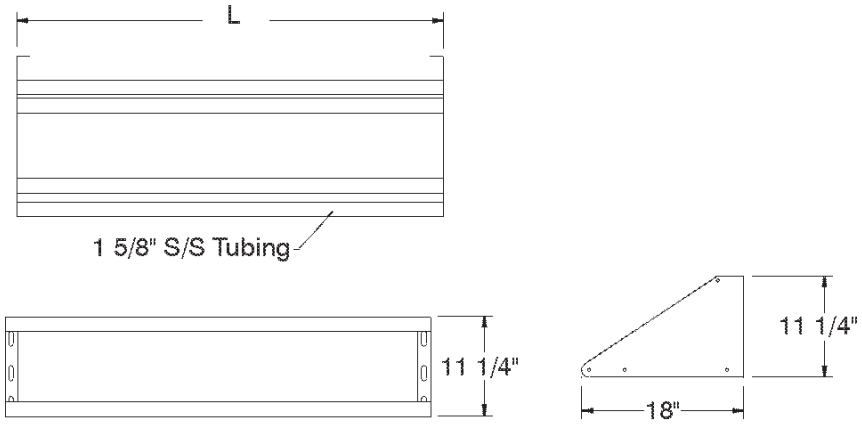
FEATURES:
A dual purpose open tubular design wall mounted rack shelf with solid end brackets bolted in field. Unit completely knock down.

CONSTRUCTION:
No welds. Unit is supplied with assembly hardware.

MATERIAL:
Brackets are 16 gauge type 300 series stainless steel.

Tubing is 1 5/8” diameter stainless steel 18 gauge tubing.

Stainless steel bolts (included).



MODEL #	# of Racks	L	Wt
DT-6R-21	1	22”	15 lbs.
DT-6R-22	2	42”	23 lbs.
DT-6R-23	3	62”	30 lbs.
DT-6R-24	4	82”	38 lbs.

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Submittal Sheet

03/14/2025

ITEM# K104 - RACK DOLLY (2 EA REQ'D)

Cambro CD2020401

Camdolly®, 22-1/2"L x 22-1/2"W x 8-1/4"H (exterior dimensions), without handle, polyethylene construction, (4) 3" heavy duty swivel casters, load capacity 300 lbs., slate blue, NSF

CAMBRO

Item No. _____

Specifier Identification No. _____

Model No. _____

Quantity _____

Camdollies®

For Dish Racks

Without Handle
Model CD2020, CDR2020
With Handle
Models CD2020H, CD2020HB, CDR2020H

StoreSafe

Features & Benefits

- Make any job easier by smoothly transporting stacks of full size 20" x 20" (50 cm x 50 cm) dish racks with these rugged and reliable Camdollies. The CDR2020 and CDR2020H models will transport side by side stacks of half size dish racks also.
- Load capacity:
  Model CD2020 - 300 lbs. (136 Kg.)
  Model CDR2020 - 350 lbs. (159 Kg.)
  Models CD2020H, CDR2020H, CD2020HB - 350 lbs. (159 Kg.)
- Material design:
  Models CD2020, CD2020H, CD2020HB - One piece seamless, double-wall, high-density polyethylene construction is extremely durable. Won't rust or corrode. Foamed-in-place polyurethane core adds greater structural strength and reduces noise. Molded in handle on Model CD2020H and CD2020HB is extra sturdy and will not break or bend. Provides controlled handling and maneuvering over the roughest terrain.
  Models CDR2020 and CDR2020H - Injection molded high-density polypropylene offers exceptional performance with improved affordability. Will handle the demands of any foodservice operation. Won't rust or corrode. Weighs 40% less than the CD2020 for improved ease of handling and carrying when empty. A powder coated handle on the CDR2020H offers easy maneuvering.
- Simple to clean - all can be wiped down or steam cleaned.
- Casters:
  Models CD2020, CD2020H - Four each 3" (7,6 cm) heavy-duty, swivel casters, no brake. Bolted into molded-in steel plates.
  Model CD2020HB - Two each rear 10" (25,4 cm) Easy Wheels and 2 each 5" (12,7 cm) swivel casters, 1 w/ brake. Bolted into molded-in steel plates.
  Models CDR2020, CDR2020H - Four each 4" (10 cm) swivel casters, no brake.
- No assembly required for models CD2020, CD2020H and CD2020HB. Minimal assembly required for CDR2020 and CDR2020H.
- Colors:
  Models CD2020, CD2020H and CD2020HB available in 5 colors.
  Models CDR2020 andCDR2020H available in Soft Gray (151) only.



For Camracks™



CD2020



CD2020H



CD2020HB

10" (25,4 cm) Easy Wheels



CDR2020H



CDR2020

Approvals

NSF **CD2020, CD2020H, CD2020HB only.**

CAMBRO MANUFACTURING COMPANY
http://www.cambro.com
© 2008 Cambro Manufacturing Company 5801 Skylab Road, Huntington Beach, California 92647-2056-U.S.A.
Telephone (1)714 848 1555 **Toll Free** 800 854 7631 **Customer Service** 800 833 3003
LIT FCST-0102-06

Camdollies®

For Dish Racks

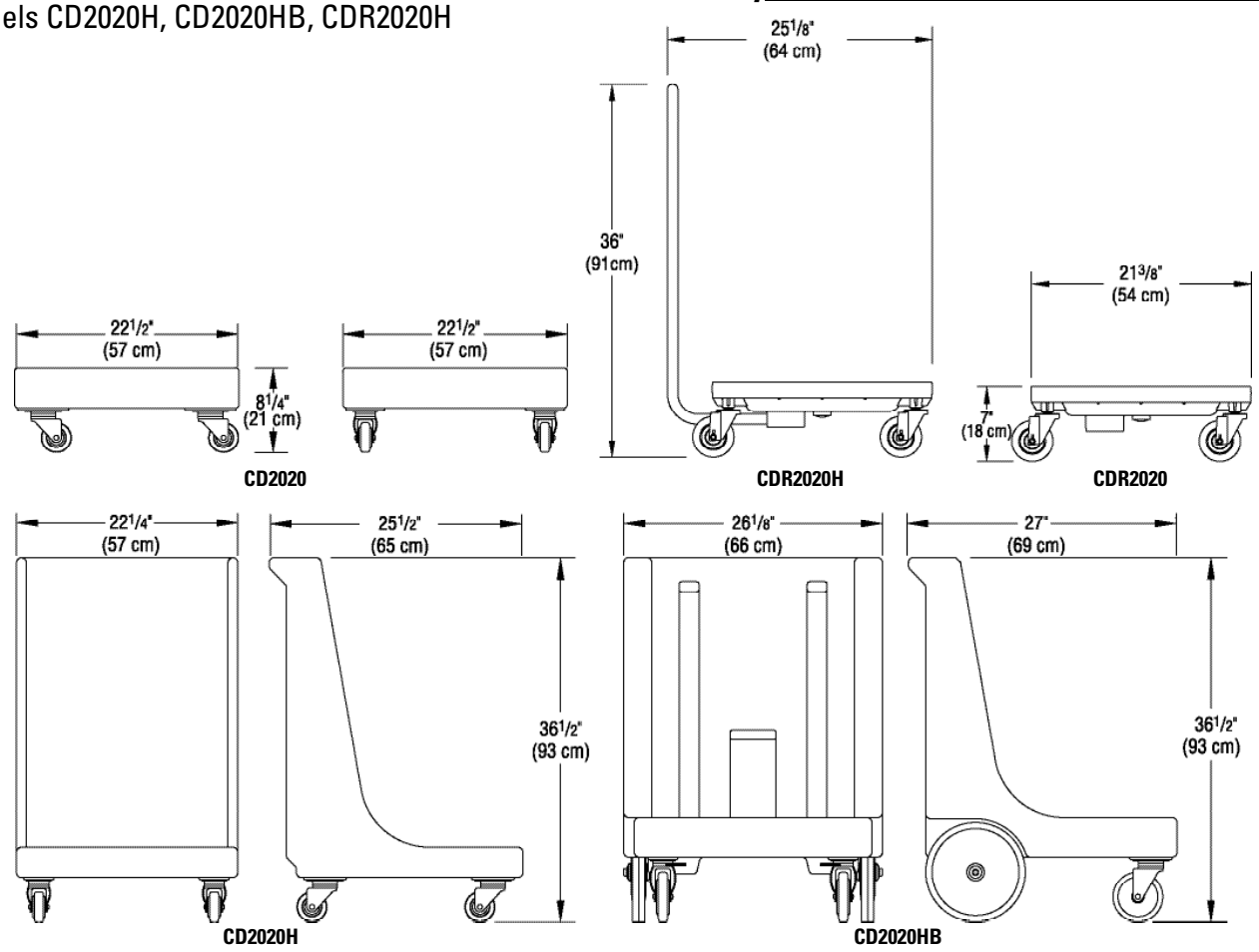
Without Handle
Model CD2020, CDR2020
With Handle
Models CD2020H, CD2020HB, CDR2020H

Item No. _____

Specifier Identification No. _____

Model No. _____

Quantity _____



Specifications

Dimension Tolerance: +/- 1/4" (0,64 cm)

Code	Description	Load Capacity	Interior Dimensions W x L	Exterior Dimensions L x W x H	Case lbs./cube Kg/m³
Without Handle					
CD2020	Camdolly	300 lbs (136 Kg)	20 1/16" x 20 1/16" (51 x 51 cm)	22 1/2" x 22 1/2" x 8 1/4" (57 x 57 x 21 cm)	19 (2.14) 9 (0,06)
CDR2020	Camdolly	350 lbs (159 Kg)	20 7/8" x 20 7/8" (53 x 53 cm)	21 3/8" x 21 3/8" x 7" (54 x 54 x 18 cm)	11 3/4 (1.14) 5,3 (0,03)
With Handle					
CD2020H	Camdolly	350 lbs (159 Kg)	20 1/4" x 20 1/4" (52 x 52 cm)	25 1/2" x 22 1/4" x 36 1/2" (65 x 57 x 93 cm)	32 1/4 (11.45) 15 (0,32)
CDR2020H	Camdolly	350 lbs (159 Kg)	20 7/8" x 20 7/8" (53 x 53 cm)	25 1/8" x 21 3/8" x 36" (64 x 54 x 91 cm)	21 1/2 (3.25) 9,7 (0,1)
CD2020HB	Camdolly	350 lbs (159 Kg)	20 1/2" x 20 5/8" (52 x 52 cm)	27" x 26 1/8" x 36 1/2" (69 x 66 x 93 cm)	46 (15.89) 21 (0,44)

Architect Specs

The dish rack transport cart shall be a Camdolly, Cambro Model.....manufactured by Cambro Mfg. Co., Huntington Beach, CA 92648 U.S.A. Models CD2020, CD2020H and CD2020HB shall be constructed of single-molded, seamless, double wall, high-density polyethylene and thick foam injected polyurethane. Models CDR2020 and CDR2020H shall be constructed of injection molded polypropylene. It shall be available with a load capacity of either 300 or 350 lbs. (136 or 159 Kg). It shall be available with a molded-in handle or a chrome handle. Models CD2020, CD2020H and CD2020HB shall be available with 4 each 5" (12,7 cm) swivel casters, no brake, or with 2 each 10" (25,4 cm) Easy Wheels and 2 each 5" (12,7 cm) swivel casters, 1 w/ brake. Casters shall be bolted into molded-in metal plates. Models CDR2020 and CDR2020H shall be available with 4 each 4" (10 cm) swivel casters, no brake. Models CDR2020 and CDR2020H shall be available in 1 color and shall require minimal assembly. Models CD2020, CD2020H and CD2020HB shall be available in 5 colors and require no assembly.

Standard Colors (CD2020, CD2020H, CD2020HB)

❑ Coffee Beige (157) ❑ Dark Brown (131) ❑ Black (110)
❑ Slate Blue (401) ❑ Gray (180)

Standard Colors (CDR2020, CDR2020H)

❑ Soft Gray (151)

Approvals

NSF **CD2020, CD2020H, CD2020HB only.**

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CAMDOLLIES® FOR INSULATED BEVERAGE SERVERS AND CARRIERS

Without Handles



CD100

EXTERNAL DIM. W x D x H:
19⅝" x 28⅝" x 10½"

INTERIOR DIM. W x D:
17³⁄₁₆" x 26⅜"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: 250LCD, 350LCD, 500LCD, UC250, UC500, 100MPCHL, 100MPC, 300MPC, UPC300, UPC100, UPCS140, UPCS160, UPCS180, UPCSS160



CD160

EXTERNAL DIM. W x D x H:
16⁷⁄₁₆" x 24½" x 10⅜"

INTERIOR DIM. W x D:
14¼" x 22¼"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: UPCS140, UPCS160, UPCS180, UPCSS160, UPC140, UPC160, UPC180



CD300

EXTERNAL DIM. W x D x H:
25½" x 19¼" x 10½"

INTERIOR DIM. W x D:
16⅞" x 23⁵⁄₁₆"

CAPACITY: 350 lbs.

CASTER TYPE: A

FITS: 1000LCD, UC1000, 300MPC, 1318MTC, UPC300, 1318CC, UPCS140, UPCS160, UPCS180, UPCSS160



CD400

EXTERNAL DIM. W x D x H:
21⁵⁄₁₆" x 28⅛" x 9"

INTERIOR DIM. W x D:
18½" x 25⁹⁄₁₆"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: UPCS400, UPC400



CDC300

EXTERNAL DIM. W x D x H:
17⁵⁄₁₆" x 24⅞" x 7⁵⁄₁₆"

INTERIOR DIM. W x D:
17⁵⁄₁₆" x 24⅝"

CAPACITY: 300 lbs.

CASTER TYPE: D

FITS: EPP400, EPP300, UPC300, EPP180SW, EPP160SW



CDC400

EXTERNAL DIM. W x D x H:
18¹⁵⁄₃₂" x 25¼" x 6⅞"

INTERIOR DIM. W x D:
18½" x 25"

CAPACITY: 300 lbs.

CASTER TYPE: D

FITS: UPC400, EPP180XLTSW



CD1420

EXTERNAL DIM. W x D x H:
16¼" x 21¾" x 8⁵⁄₁₆"

INTERIOR DIM. W x D:
13⅜" x 19⁵⁄₁₆"

CAPACITY: 350 lbs.

CASTER TYPE: B

FITS: 100LCD



CD2020

EXTERNAL DIM. W x D x H:
22½" x 22½" x 8¼"

INTERIOR DIM. W x D:
20⅛" x 20⅛"

CAPACITY: 300 lbs.

CASTER TYPE: B

FITS: 250LCD, 350LCD, 500LCD, 1000LCD, UC1000



CD2028

EXTERNAL DIM. W x D x H:
21⅞" x 30¼" x 8¼"

INTERIOR DIM. W x D:
19½" x 27⅞"

CAPACITY: 350 lbs.

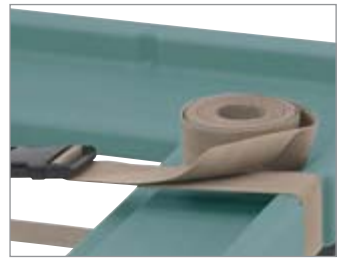
CASTER TYPE: B

FITS: 100MPC, UPC100, 300MPC, UPC300, UPC400

Camdolly® Colors:
Coffee Beige (157), Dark Brown (131), Black (110), Slate Blue (401).
CDC300 and CDC400 Color: Red (358).
CD400 InStock Colors:
Black (110), Dark Brown (131).

Caster Type:
(A) 5" Casters, 2 fixed, 2 swivel, 1 with brake.
(B) 3" Casters, 4 swivel, no brakes.
(C) 10" Rear Big Wheels, 2 front 5" swivel casters, 1 with brake.
(D) 4" Casters, 4 swivel 2 with brake.

Optional Accessories



400STP (STRAP)

DIMENSION: 150" Long

UTHSTP (STRAP)

DIMENSION: 200" long



1826HAR (LIFTING HARNESS)

DIMENSION: 142" long

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Submittal Sheet

03/14/2025

ITEM# K105 - HAND SINK (1 EA REQ'D)

Advance Tabco 7-PS-50

Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, with heavy duty splash mounted gooseneck faucet, lever drain with overflow, P-trap, wall bracket, NSF, cCSAus

ACCESSORIES

Mfr	Qty	Model	Spec
Advance Tabco	1	K-316-LU	Wrist Handles

STAINLESS STEEL

STANDARD HAND SINKS

Conforms To NSF 61/9 Lead Free Requirements

ADVANCE TABCO
SMART FABRICATION™

SPLASH MOUNTED FAUCETS



7-PS-60



7-PS-68



7-PS-50



7-PS-54



7-PS-67

DECK MOUNTED FAUCET



7-PS-20



7-PS-20-NF
Faucet omitted

SINGLE HOLE PUNCH
Faucet omitted



7-PS-71

DOUBLE HOLE PUNCH
Faucet omitted



7-PS-70

LARGE SINK BOWLS

Features Large Size Sink Bowl 16” x 20” x 8”



7-PS-45

Features Large Size Sink Bowl 16” x 14” x 8”



7-PS-49

Item #: _____ **Qty #:** _____

Model #: _____

Project #: _____

FEATURES:

One piece **Deep Drawn** sink bowl design.

Sink bowl size is 10” x 14” x 5”.

7-PS-45 sink bowl size is 16” x 20” x 8”.

7-PS-49 sink bowl size is 16” x 14” x 8”.

All sink bowls have a large liberal radii with a minimum dimension of 2” and are rectangular in design for increased capacity.

Stainless steel 3 1/2” basket drain with 1-1/2” IPS.

Additional Features:

7-PS-20	K-22 4” O.C. deck mounted centerset faucet.
7-PS-20-NF	Deck mounted faucet omitted. Two 4” O.C. holes.
7-PS-45	K-59 4” O.C. splash mounted faucet and 2 Stainless Steel Support Brackets. (Hardware Included).
7-PS-49	K-59 4” O.C. splash mounted faucet and 2 Stainless Steel Support Brackets. (Hardware Included).
7-PS-50	K-59 4” O.C. splash mounted gooseneck faucet. Lever operated drain and built-in overflow with plastic overflow tube and spring clamps. 1-1/2” P-Trap.
7-PS-54	K-59 4” O.C. splash mounted gooseneck faucet. 1-1/2” P-Trap.
7-PS-60	K-59 4” O.C. splash mounted gooseneck faucet.
7-PS-67	K-59 4” O.C. splash mounted gooseneck faucet and lever operated drain.
7-PS-68	K-59 4” O.C. splash mounted gooseneck faucet with Wrist Handles.
7-PS-70	Splash mounted faucet omitted. Two 4” O.C. holes.
7-PS-71	Splash mounted faucet omitted. Single center hole.

CONSTRUCTION:

All TIG welded.

Welded areas blended to match adjacent surfaces and to a satin finish.

Die formed Countertop Edge with a No-Drip offset.

One sheet of stainless steel - No Seams.

MATERIAL:

Heavy gauge type 304 series stainless steel.

Wall mounting bracket is Galvanized and of offset design.

All fittings are brass / chrome plated unless otherwise indicated.

MECHANICAL:

Faucet supply is 1/2” IPS male thread hot and cold.

Faucet Flow Rate: 1.0 GPM/3.8 LPM aerator. 60 PSI.

⚠ WARNING:

Equipment that includes a faucet may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info.,visit www.p65warnings.ca.gov.

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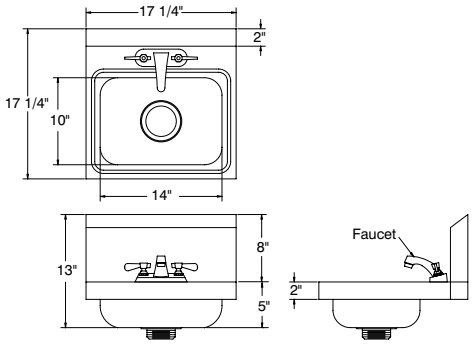
For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or Fax: 631-586-2933

REF-B

DIMENSIONS and SPECIFICATIONS

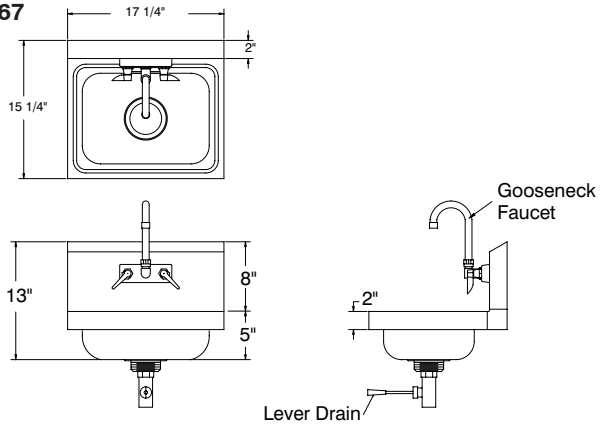
TOL Overall: ± .500" Interior: ± .250" **FITTINGS SUPPLIED AS SHOWN** **ALL DIMENSIONS ARE TYPICAL**

7-PS-20



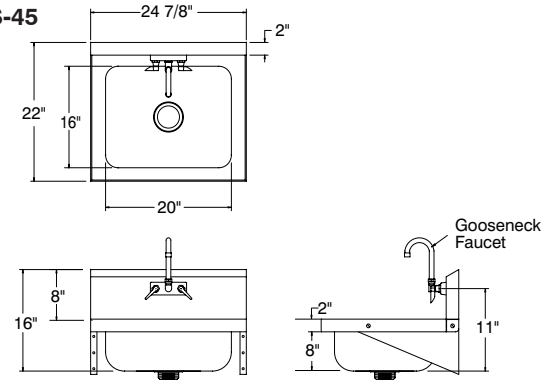
15 lbs.

7-PS-67



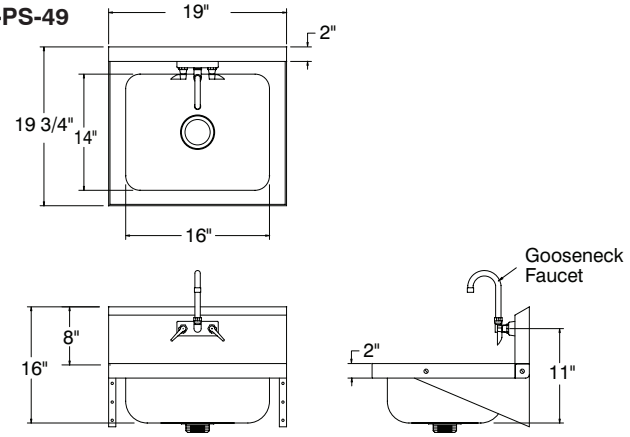
15 lbs.

7-PS-45



31 lbs.

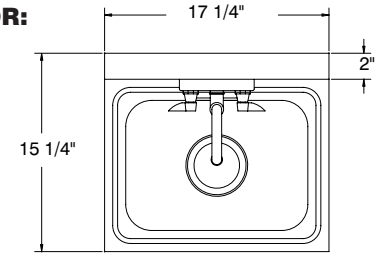
7-PS-49



31 lbs.

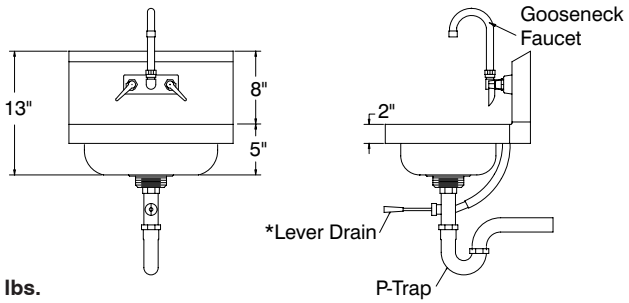
TOP VIEW FOR:

7-PS-50
7-PS-54
7-PS-60
7-PS-68
7-PS-70



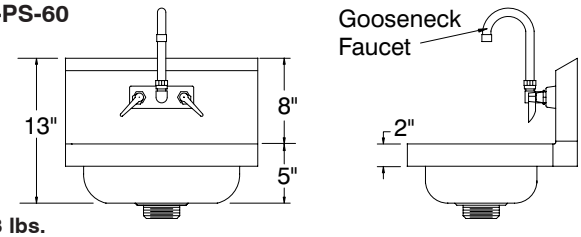
Sink Bowl 10" x 14" x 5"

7-PS-50 & 7-PS-54*
NOTE: *7-PS-54 Hand Sink <u>Excludes</u> Lever Drain and Overflow



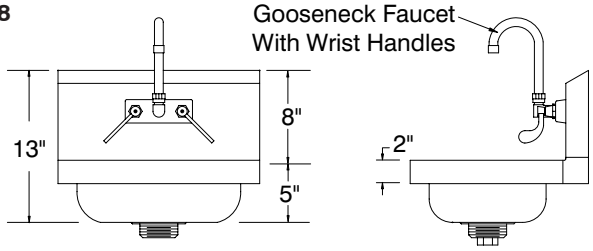
15 lbs.

7-PS-60



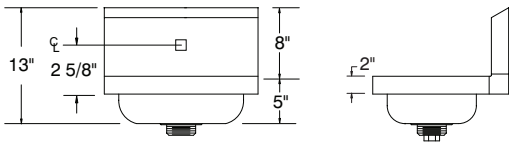
13 lbs.

7-PS-68

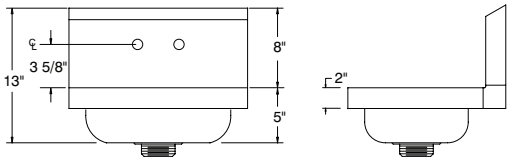


13 lbs.

7-PS-71



7-PS-70



12 lbs.

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FAUCET PARTS & ACCESSORIES

Faucet Repair Kit
For K-22, K-59, K-123, K-125, K-126, K-206 & K-316 Faucets
Includes 2 Cartridges and Handles
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-00A (Set of 2)



Faucet Repair Kit
For K-1, K-11, K-50, K-51, K-52, K-53, K-56, K-124, K-101, K-160, K-208 & K-240 Faucets
Includes 2 Cartridges and Handles
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-00B (Set of 2)





K-02 Filler Faucet Repair Kit
For K-54 & K-54A Faucets
*Can Only Be Used On Faucets Purchased From 2016 - 2019. For Older Faucets, See Below.



K-02A Filler Faucet Repair Kit
For K-54 & K-54A Faucets
*Can Only Be Used On Faucets Purchased Before January 2016 or After 2019.



Service Faucet Vacuum Breaker Repair Kit
For K-240 Faucet
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-03

Pedal/Knee Valve Replacement Parts

Replacement Bonnet for Pedal/Knee Valve
For K-103, K-104, 7-PS-32 & 7-PS-39
K-01



Replacement Check Valves
For K-103, K-104, 7-PS-32 & 7-PS-39
K-19



Thermostatic Mixing Valve
For K-103, K-104, 7-PS-32 & 7-PS-39
K-425



Mixing Valve & Retainer
For K-103, K-104, 7-PS-32 & 7-PS-39
K-19A



Faucet Options & Accessories

Hands-Free Wand





K-400

Low Flow Aerator



.5 GPM
K-08

Wrist Handles (Pair)



*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-316-LU

Wrist Handles (Pair)
For Heavy Duty 8" O.C. Faucets



K-416-LU

Splash Mount Faucet Mounting Kit
K-1, K-11, K-101, K-105, K-112, K-119 & K-211
K-06



Faucet Wall Mounting Bracket
8" O.C.
K-30



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Submittal Sheet

03/14/2025

ITEM# K106 - EYE WASH STATION (1 EA REQ'D)

T&S Brass EW-7360B-TMV

Eyewash System, wall mount, thermostatic mixing valve, chrome-plated brass ball valve, 1/2" NPT, 1-1/4" outlet

T&S BRASS AND BRONZE WORKS, INC.
2 Saddleback Cove / P.O. Box 1088
Travelers Rest, SC 29690

Travelers Rest, SC: 800-476-4103 • Simi Valley, CA: 800-423-0150 • Fax: 864-834-3518 • www.tsbrass.com

Model No.
EW-7360B-TMV
Item No.

This Space for Architect/Engineer Approval

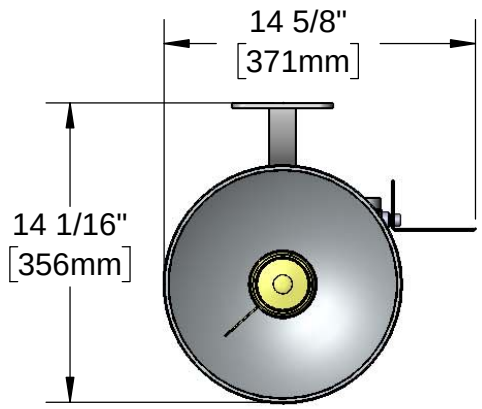
Job Name_____Date_____

Model Specified_____ Quantity_____

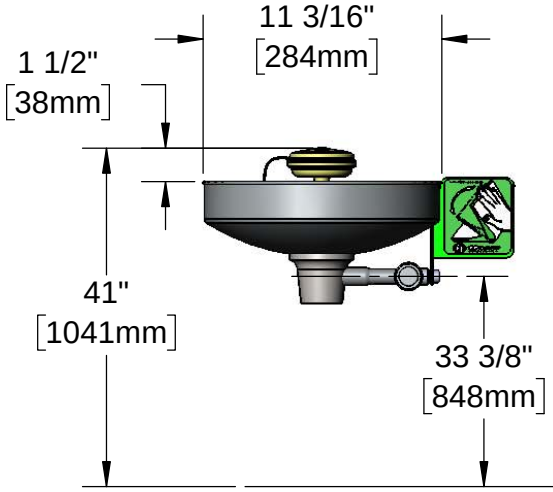
Customer/Wholesaler_____

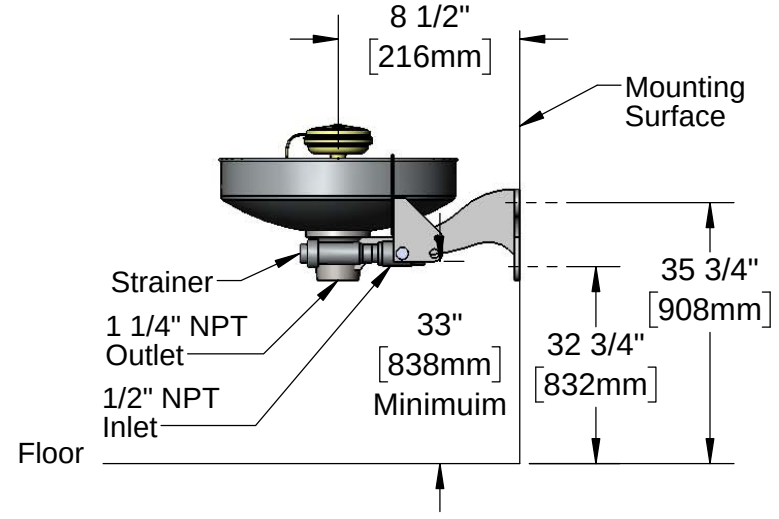
Contractor_____

Architect/Engineer_____

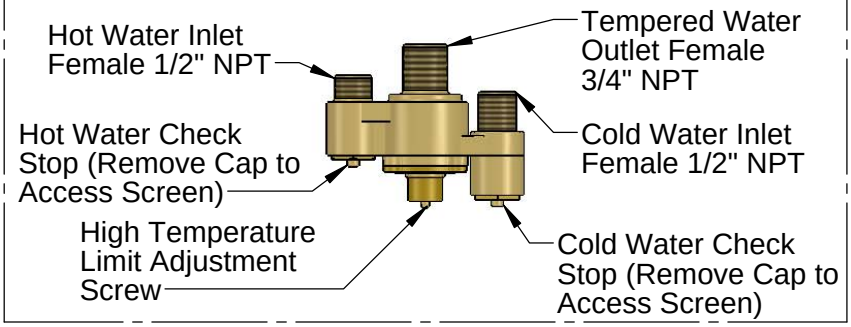








EW-9201EF
Thermostatic Mixing Valve (Included)



Note:
1. ANSI Standard Z358.1 Specifies Eyewash Nozzles to be 33" [838mm] to 45" [1143mm] Above the Floor

2. These Dimensions are for Reference

Product Specifications:
Wall Mount Eye/Face Wash with Chrome Plated Brass Stay Open Ball Valve, 1/2" NPT Inlet and 1 1/4" NPT Waste Outlet

Product Compliance:
ANSI Z358.1 (Latest Revision)
NSF 61 Exempt (Non-Potable)
ASSE 1071 (TMV)

Drawn: JBC	Checked: JRM	Approved: JHB	Date: 04/06/17	Scale: 1:9	Sheet: 1 of 1

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Submittal Sheet

03/14/2025

ITEM# K107 - DRYING RACK UNIT (1 EA REQ'D)

Metro MAX4-PR48VX3

MetroMax® 4 Mobile Drying Rack Unit, 48"W x 24"D x 68"H, 4-tier, for bulk drying & trays/cutting boards/sheet pans, includes: (3) open shelf frames, (1) shelf, (4) 63" mobile posts, (2) drop-ins, (1) cutting board/tray drying rack, (4) polymer swivel casters (2 with brakes), built in Microban® antimicrobial product protection, NSF

{9.32}

MetroMax® 4 Drying Racks

MetroMax 4 Drying Racks combine the corrosion protection and strength of MetroMax 4 with the convenience of a drying rack unit that efficiently sorts and holds pots, pans and trays while they dry to prevent wet nesting.

Three Tier Tray Rack:
36" (914mm) and 48" (1219mm) lengths. Each consists of (3) MetroMax 4 shelf frames, (4) 63" (1600mm) mobile posts, (4) corrosion resistant polymer horn casters (two swivel, two brake), (3) tray racks,

Four Tier Bulk Drying and Tray Rack:
36" (914mm) and 48" (1219mm) lengths. Each consists of (3) MetroMax 4 shelf frames, (1) MetroMax 4 shelf, (4) 63" (1600mm) mobile posts, (4) corrosion resistant polymer horn casters (two swivel, two brake), (2) stainless steel drop-in racks, (1) tray rack.

Four Tier Tray and Steam Pan Rack:
36" (914mm) and 48" (1219mm) lengths. Each consists of (4) MetroMax 4 shelf frames, (4) 63" (1600mm) mobile posts, (4) corrosion resistant polymer horn casters (two swivel, two brake), (2) tray racks, (2) steam pan racks.

Key Benefits

- **Promotes food safety** by preventing wet nesting, where two wet/damp items are nested together preventing proper airflow.
- **Superior air circulation:** Fast drying of trays, cutting boards, pans, lids, pots and all sink items.
- **"Hold strong" slots:** Tray and Pan Racks have tall slots to assure trays, cutting boards, steam pans, and other tall items don't tip over while being loaded/unloaded and during use.
- **Wobble Free, Worry Free mobility:** Sturdy carts are easy to maneuver with swivel polymer casters.
- **Easy to Clean:** Shelf mats have built-in Microban antimicrobial product protection. It keeps the product "cleaner between cleanings".
- **NSF Listed**



MAX4-PR48VX2



MAX4-PR48VX3



MAX4-PR48VX4

PROTECTION THAT LIVES ON MICROBAN

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NSF

All Metro Catalog Sheets are available on our website: **metro.com**

LO2-231 | 11/24

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metro.com
North Washington Street, Wilkes-Barre, PA 18705
Product Information. U.S. and Canada: 1.800.992.1776
Outside U.S. and Canada: metro.com/contactus

{9.32} MetroMax® 4 Drying Racks

Specifications - Shelving Units, Drop-Ins, Tray Racks, Pan Racks

- **Longitudinal Beams & Posts:** Pultrusions - continuous glass fibers and thermo set resin composite.
- **End Beams, Adjustable Foot & Socket:** Injection molded polyester thermoplastic resin with glass reinforcement.
- **Drop In Rack:** Electro-Polished Type 304 Stainless Steel
- **Cutting Board/Tray Drying Rack:** Corrosion resistant taupe epoxy coated steel and rigid PVC (non phtalate) extrusions.
- **Shelf Mats:** Polypropylene. Mats contain Microban antimicrobial product protection.
- **Load Capacity:** 200 lbs. (91kg) per drop-in rack, tray rack, or pan rack.
- **Stationary Load Capacity:** 2000lbs. (907kg)
- **Mobile Load Capacity:** 750 lbs. (340kg) per unit
- **Polymer Casters:** 2 swivel, 2 swivel with brakes. Corrosion-resistant, polymer horn, stainless steel axle and hardware. 5" (127mm) diameter.



MAX4-PR36VX2



MAX4-PR36VX3



MAX4-PR36VX4

Dimensions

MetroMax 4 Mobile Drying Rack Units

Three Tray Racks (three tier unit)

Model No.	Nominal Width (in.)	Nominal Width (mm)	Nominal Length (in.)	Nominal Length (mm)	Nominal Height (in.)	Nominal Height (mm)	Approx. Pkd. Wt. (lbs.)	Approx. Pkd. Wt. (kg)
MAX4-PR36VX2	24	610	36	914	68	1702	72.7	33.0
MAX4-PR48VX2	24	610	48	1219	68	1702	86.9	39.4

Two SS Drop-ins, One Tray Rack, One Bulk Shelf (4-tier)

Model No.	Nominal Width (in.)	Nominal Width (mm)	Nominal Length (in.)	Nominal Length (mm)	Nominal Height (in.)	Nominal Height (mm)	Approx. Pkd. Wt. (lbs.)	Approx. Pkd. Wt. (kg)
MAX4-PR36VX3	24	610	36	914	68	1702	65.0	29.5
MAX4-PR48VX3	24	610	48	1219	68	1702	76.8	34.8

Two Tray Racks and Two Pan Racks (4-tier)

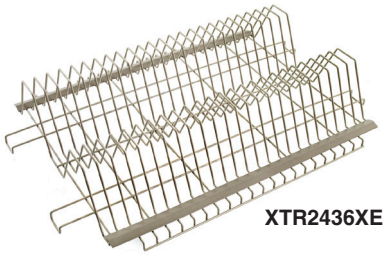
Model No.	Nominal Width (in.)	Nominal Width (mm)	Nominal Length (in.)	Nominal Length (mm)	Nominal Height (in.)	Nominal Height (mm)	Approx. Pkd. Wt. (lbs.)	Approx. Pkd. Wt. (kg)
MAX4-PR36VX4	24	610	36	914	68	1702	80.6	36.5
MAX4-PR48VX4	24	610	48	1219	68	1702	95.3	43.2

Note: For the actual dimensions for mobile units, add 2" (51mm) to the nominal dimension to account for the bumpers.

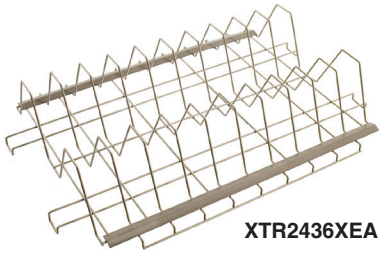
{9.32} MetroMax® 4 Drying Racks



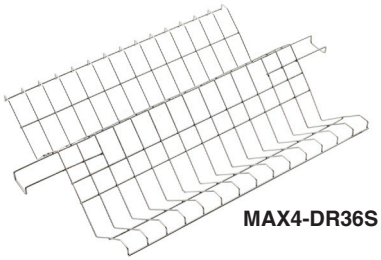
Tip: Convert a MetroMax 4 shelf to an open frame by removing the shelf mat sections.



XTR2436XE



XTR2436XEA



MAX4-DR36S



Important: Drip Tray must mount to a MetroMax i 24x36" (610x914mm) Frame. Steam Pan not included.

Cutting Board & Tray Drying Rack Accessories

- Mount to MetroMax 4 open shelf frames (no shelf mats), open grid and solid MetroMax i shelves, MetroMax i open shelf frames, MetroMax Q shelves, Super Erecta Pro, and Super Erecta.
- 1 1/8" (28mm) or 3" (76mm) slot spacing available.
- Polymer glide strips provide an impact resistant surface for long life.

Model No.	Fits Shelf or Frame (in.)	(mm)	Upright Spacing (in.)	(mm)	Upright Height (in.)	(mm)	Tray Capacity	Approx. Pkd. Wt. (lbs.)	(kg)
XTR2436XE	24x36	610x914	1 1/8	28	6	150	24	14.7	6.7
XTR2448XE	24x48	610x1219	1 1/8	28	6	150	34	19.8	9.0
XTR2460XE	24x60	610x1524	1 1/8	28	6	150	43	25.4	11.5
XTR2436XEA	24x36	610x914	3	76	6	150	10	9.9	4.5
XTR2448XEA	24x48	610x1219	3	76	6	150	14	12.9	5.8
XTR2460XEA	24x60	610x1524	3	76	6	150	17	16.4	7.4

Type 304 Stainless Drop-In Racks (for MetroMax 4 only)

- Drop-ins (models "MAX4-") require a four-sided MetroMax 4 frame.
- A drop-in rack can be added to a standard MetroMax 4 shelf by removing the shelf mats and using the shelf frame.

Model No.	Fits Shelf (in.)	(mm)	Height (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)
MAX4-DR36S	24x36	610x914	33 7/8	860		
MAX4-DR48S	24x48	610x1219	45 7/8	1165		

MetroMax 4 open shelf frames

- Open shelf frames accomodate the drop-ins, tray racks, and pan racks.
- Bag of 4 wedges included.
- A standard MetroMax 4 may be converted to a frame by removing all shelf mat sections.

Model No.	Fits Shelf or Frame (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)
MAX4-4F2436	24x36	610x914	6.9	3.1
MAX4-4F2448	24x48	610x1219	8.6	3.9

Drip Tray - for a MetroMax i frame or shelf.

- Patent pending water collection accessory is compatible with MetroMax i.
- Consult Spec Sheet 9.32b to learn how to integrate this accessory and its related MetroMax i shelf or shelf frame to a MetroMax 4 unit.

{9.32}

MetroMax® 4 Drying Racks

Sorting Pegs

6" Tall *(152mm)* **Sorting Pegs**

- Installs to any open grid polymer Metro shelf
- Pack of 8 Pegs
- Can be used to manage steam pans 4" (102mm) and deeper
- Material: Mineral reinforced polypropylene
- Model No. **X6PEG-8PK**

X6PEG-8PK

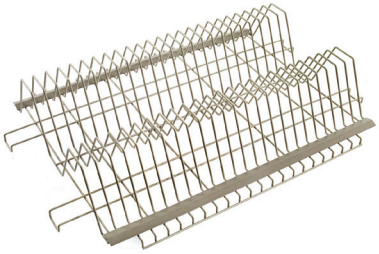


X8

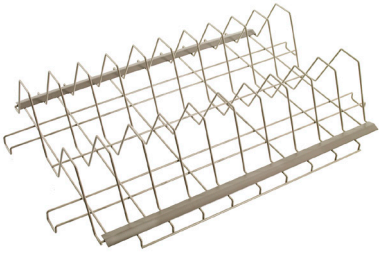


Drying Option.

Tray and pan drying wire racks are compatible with any Super Erecta, Super Erecta Pro, or Super Adjustable Super Erecta Shelf.



XTR2436XE



XTR2436XEA



XTR2436XE Shown on a Smartwall unit atop of Super Erecta Shelving in Metroseal Gray.

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Submittal Sheet

03/14/2025

ITEM# K108 - CLEAN DISH/PAN SHELVING (1 LT REQ'D)

Metro EPOXY

One lot clean dish/pan shelving, 74" high, four tier, size and configure per plan layout

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Submittal Sheet

03/14/2025

ITEM# K109 - CART, UTILITY (1 EA REQ'D)

Cambro SC225131

Service Cart Pro, 31-1/4"L x 18"W x 34"H, small, (3) ribbed shelves, open sides, 390 lbs. total weight capacity (130 lbs. per shelf), (2) 3" rigid and (2) 3" swivel casters with brake, one piece molded body, polyethylene, dark brown, NSF

CAMBRO

Project _____

Item No. _____

Model No. _____

Quantity _____

Service Cart PRO

Size: Small, Open Sides

Models SC225, SC225S

Features & Benefits

- Sturdy, strong and durable, these carts are made of one-piece polyethylene construction.
- Versatile for a variety back of house or front of house applications.
- Total weight capacity is 390 lbs. (176,9 kg) or 130 lbs. (59 kg.) per shelf.
- Three durable shelves feature raised ridges to protect surface against heat. Shelf surfaces are lightly textured (top only), stain resistant and easy to clean. NOTE: Best to cool metal pans to 250°F (121°C) before placing on cart.
- Raised 1½" (3,8 cm) marine rail around top shelf helps to prevent items from slipping off.
- Open available flat space on top shelf for products is 23⅝" L x 14" D (60 x 35,6 cm).
- Vertical open space between each shelf is 10⅞" (27,6 cm).
- Middle and bottom shelves have a ¾" (2 cm) raised edge on one side to help keep items in place.
- Two molded-in ergonomic handles on each end of the cart are recessed, flush to the body, to save space.
- Four heavy-duty, non-marking 3" x 1¼" (7,6 x 3,2 cm) plate casters:
  Model SC225 - 2 rigid, 2 swivel with brake
  Model SC225S - 4 swivel, all with brake
- Optional accessories include an 8 gallon (30,3 L) and 2½ gallon (9,5 L) Quick Connect Bin that securely slide and lock down onto molded-in dovetails positioned safely below the handles.
- Available in three colors: Black (110), Dark Brown (131), Charcoal Gray (615).
- No assembly required.

Service Cart PRO and Quick Connect Bins are covered by US Patents D882,203 S, D883,755 S, and D885,003 S.



SC225



SC225
Shown with optional Quick Connect Bins



2.5 Gallon (9,5 L)
Small Quick Connect Bin



8 Gallon (30,3 L)
Large Quick Connect Bin

Approvals

NSF

Information and specifications are subject to change without notice. Please confirm at time of order.

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Service Cart PRO

Project _____

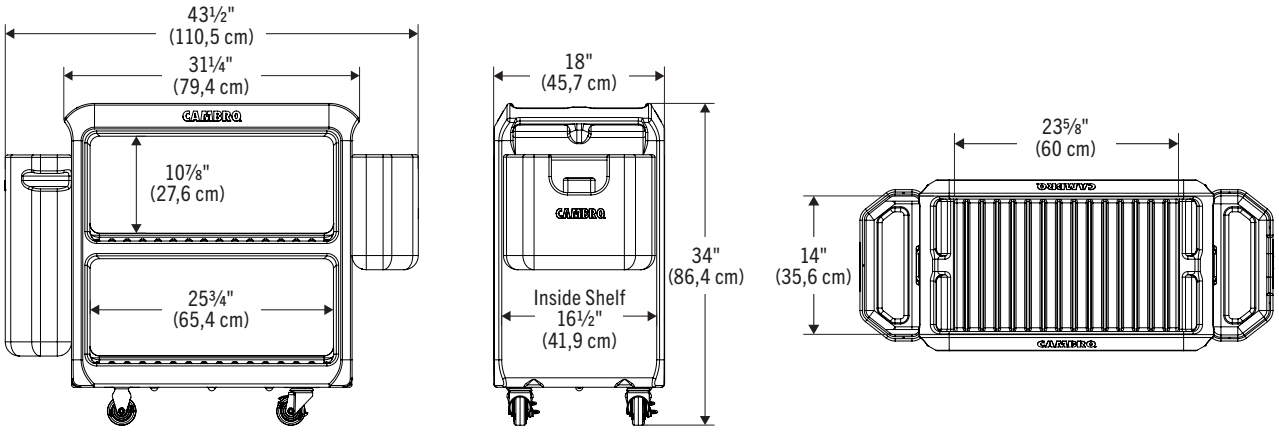
Item No. _____

Model No. _____

Quantity _____

Size: Small, Open Sides

Models SC225, SC225S



Specifications

Dimension Tolerance: +/- ¼" (0,64 cm)

CODE	CASTERS	INTERIOR SHELF DIMENSIONS L x D x H	CART DIMENSIONS L x D x H	UNIT WEIGHT LBS. (KG)
SC225	2 Rigid, 2 Swivel with Brake	25¾" x 16½" x 10⅞" (65,4 x 41,9 x 27,6 cm)	31¼" x 18" x 34" (79,4 x 45,7 x 86,4 cm)	36 lbs. (16,3 kg)
SC225S	4 Swivel, All with Brake	25¾" x 16½" x 10⅞" (65,4 x 41,9 x 27,6 cm)	31¼" x 18" x 34" (79,4 x 45,7 x 86,4 cm)	37.76 lbs. (17,1 kg)

Optional Accessories

2.5 Gal. (9,5 L) Small Quick Connect Bin ❑ QCSB

8 Gal. (30,3 L) Large Quick Connect Bin ❑ QCTB

Standard Service Cart Pro Colors

❑ Black (110)

❑ Dark Brown (131)

❑ Charcoal Gray (615)

Quick Connect Bin Color

❑ Black (110)

Architect Specs

The small size Service Cart PRO shall be Cambro model SC225, SC225S. It shall be constructed of one-piece polyethylene with molded-in, recessed handles on each end of the cart. It shall be able to transport up to 600 lbs. (272 kg). It shall have three solid shelves. Each shelf shall have raised ridges to protect surface against heat. Top shelf only will be textured and will have a 1½" (3,8 cm) raised marine rail all around to help keep contents in place. Middle and bottom shelves shall have ¾" (2 cm) raised edge on one side. Space opening between the shelves shall be 10⅞" (27,6 cm). It shall have four each 3" x ¼" (7,6 x 3,2 cm) non-marking plate casters: 2 rigid and 2 swivel with brake or 4 swivel all with brake. It shall have molded in dovetails below the handles to attach optional Quick Connect Bins (small 2½ gallon/9,5 L) and large 8 gallon/30,3 L) both in Black (110). The Service Cart Pro shall require no assembly and shall be available in Black (110), Dark Brown (131) and Charcoal Gray (615). It shall be NSF listed.

Approvals

NSF

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SCPL3

D022406

SERVICE CARTS

- All-purpose versatile, durable and dependable workhorses.
- Ideal for use on the receiving dock or setting up and bussing tables.
- Made of one-piece, polyethylene with molded-in handles and shelves.
- Choose from models with open or enclosed sides.

Colors: Black (110), Slate Blue (401), Dark Brown (131), Coffee Beige (157), Granite Gray (191).

BC225, BC2254S, BC11TC and BC1115SH can be shipped by parcel carrier.



Open Carts



BC225
CASTER DIA./TYPE: 3", 2 fixed, 2 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 28" x 16" x 32¼"
SHELF DIMENSIONS L x D x H: 21¾" x 15½" x 11¼"
LOAD CAPACITY: 350 lbs.
Case Pack: 1



BC2254S
CASTER DIA./TYPE: 3", 4 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 28" x 16" x 32¼"
SHELF DIMENSIONS L x D x H: 21¾" x 15½" x 11¼"
LOAD CAPACITY: 350 lbs.
Case Pack: 1



BC230
CASTER DIA./TYPE: 5", 2 fixed, 2 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 33¼" x 20" x 34⅝"
SHELF DIMENSIONS L x D x H: 27" x 19½" x 11¼"
LOAD CAPACITY: 500 lbs.
Case Pack: 1



BC2304S
CASTER DIA./TYPE: 5", 4 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 33¼" x 20" x 34⅝"
SHELF DIMENSIONS L x D x H: 27" x 19½" x 11¼"
LOAD CAPACITY: 500 lbs.
Case Pack: 1

Enclosed Carts



BC235
CASTER DIA./TYPE: 5", 2 fixed, 2 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 37¼" x 21½" x 34⅝"
SHELF DIMENSIONS L x D x H: 31½" x 20⅜" x 11⅜"
LOAD CAPACITY: 500 lbs.
Case Pack: 1



BC2354S
CASTER DIA./TYPE: 5", 4 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 37¼" x 21½" x 34⅝"
SHELF DIMENSIONS L x D x H: 31½" x 20⅜" x 11⅜"
LOAD CAPACITY: 500 lbs.
Case Pack: 1



BC330
CASTER DIA./TYPE: 5", 2 fixed, 2 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 33⅛" x 20" x 34⅝"
SHELF DIMENSIONS L x D x H: 27" x 18½" x 11¼"
LOAD CAPACITY: 500 lbs.
Case Pack: 1



BC3304S
CASTER DIA./TYPE: 5", 4 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 33⅛" x 20" x 34⅝"
SHELF DIMENSIONS L x D x H: 27" x 18½" x 11¼"
LOAD CAPACITY: 500 lbs.
Case Pack: 1

Optional Accessories

CODE	BC11TC*	BC1115SH*
DESCRIPTION	11 gal. trash container	1.75 gal. silverware holder
DIMENSIONS W x D x H	13¾" x 8⅛" x 21⅛"	14½" x 6" x 5⅜"

Case Pack: 1 *BC11TC & BC1115SH will not fit KD Service or Utility Carts. BC11TC & BC1115SH are available in Black (110) and Dark Brown (131).



BC11TC



BC1115SH

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03/14/2025

ITEM# K110 - SPARE NO.

<Spare No.>

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Submittal Sheet

03/14/2025

ITEM# K111 - SPARE NO.

<Spare No.>

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Submittal Sheet

03/14/2025

ITEM# K112 - MOP SINK (1 EA REQ'D)

Advance Tabco 9-OP-20

Mop Sink, floor mounted, 25"W x 21"D x 10"H (overall), 20"W x 16" front-to-back x 6" deep (bowl size), free flow drain with 2" IPS outlet, stainless steel construction, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Advance Tabco	1	K-240	Service Sink Faucet, wall mount, heavy duty, 8" OC, 6-1/2" spout, with hose thread & pail hook, vacuum breaker spout, wall braced, chrome-plated brass
Advance Tabco	1	K-06	Splash Mount Faucet Mounting Kit, for K-1, K-11, K-101, K-105, K-112, K-119 & K-211 faucets

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

FABRICATED FLOOR MOP SINKS

Item #: _____ Qty #: _____
Model #: _____
Project #: _____



Standard Mop Sink
9-OP-20 Shown



Drop Front Mop Sink
9-OP-40DF Shown

FEATURES:

Floor mounted unit eliminates the need of lifting heavy containers.

Tile edge furnished on the rear.

Bowls rectangular in design for increased capacity.

K-16 Free Flow Drain is included with each mop sink.

-DF models feature a notched out front which allows for ease of emptying mop bucket)

CONSTRUCTION:

All TIG welded.

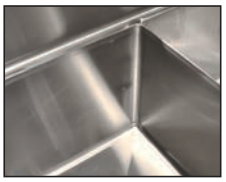
Welded areas blended to match adjacent surfaces and to a satin finish.

MATERIAL:

16 Gauge type "304" series stainless steel sink bowl & Apron.



Notched Out Front Allows Ease of Emptying Mop Bucket



Fabricated Bowls are Welded Together at the Seams

	Model #	Bowl Size (A x B x C)	O.A. Dimension (W x L x H)	Drain Distance (E)	Drain Distance (F)	Approx. Wt.	Approx. Cu.
STANDARD	9-OP-18	15" x 15" x 10"	18" x 18" x 14"	9"	9"	30 lbs.	4
	9-OP-20	16" x 20" x 6"	21" x 25" x 10"	10-1/2"	12-1/2"	33 lbs.	4
	9-OP-28	20" x 28" x 6"	25" x 33" x 10"	12-1/2"	16-1/2"	47 lbs.	7
	9-OP-40	16" x 20" x 12"	21" x 25" x 16"	10-1/2"	12-1/2"	45 lbs.	6
	9-OP-48	20" x 28" x 12"	25" x 33" x 16"	12-1/2"	16-1/2"	62 lbs.	9
LARGE BOWL	9-OP-44	24" x 24" x 12"	29" x 29" x 16"	12-1/2"	16-1/2"	70 lbs.	9
	9-OP-33	24" x 36" x 12"	29" x 41" x 16"	12-1/2"	20 1/2"	73 lbs.	9
	9-OP-34	24" x 48" x 12"	29" x 53" x 16"	12-1/2"	20 1/2"	76 lbs.	9
DROP FRONT	9-OP-40DF	16" x 20" x 12"	18-1/2" x 25" x 16"	10-1/2"	12-1/2"	85 lbs.	9
	9-OP-48DF	20" x 28" x 12"	22-1/2" x 33" x 16"	12-1/2"	16-1/2"	110 lbs.	15

MOP SINK ACCESSORIES

16" High Side & Back Splashes for 9-OP Series Mop Sinks

Splashes on All 3 Sides

Model #	Fits Units:	Model #	Fits Units:
K-298	9-OP-20 9-OP-40	K-298D	9-OP-40DF
K-299	9-OP-28 9-OP-48	K-299D	9-OP-48DF
K-300	9-OP-44	-	-

Splash on Left or Right & Back

Model #	Fits Units:	Model #	Fits Units:
K-288LorR	9-OP-20 9-OP-40	K-288LorRD	9-OP-40DF
K-290LorR	9-OP-28 9-OP-48	K-290LorRD	9-OP-48DF
K-291LorR	9-OP-44	-	-

Height Above Finished Floor (A.F.F.)
9-OP-20/9-OP-28 = 26" High 9-OP-40/9-OP-40DF/9-OP-44/9-OP-48/ 9-OP-48DF = 32" High



Left & Right Splashes Shown

K-16 Replacement drain for floor mop sinks
K-240 Service Faucet*
K-242 23" wide mop hanger
K-243 Stainless steel mop drainage tray
K-244 Hose and hanger
K-245 8" x 24" utility shelf
K-246 8" x 36" utility shelf

*Does not meet Federal Lead Free Standards as it is not intended for potable water.



K-243



K-240



K-245



K-242



K-16



K-244

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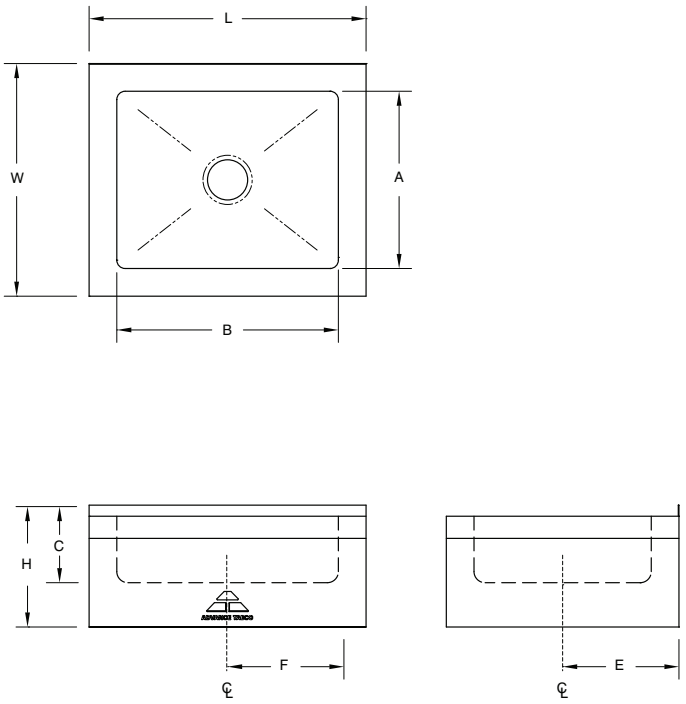
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DIMENSIONS and SPECIFICATIONS

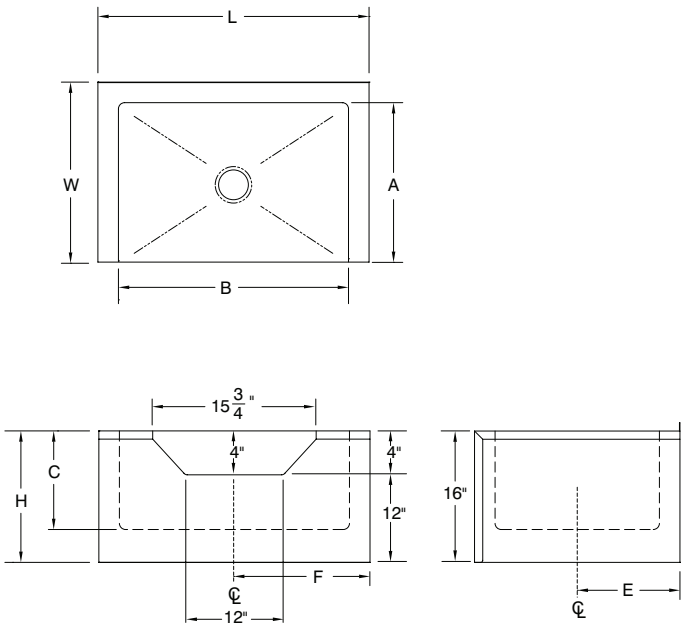
TOL Overall: ± .500”
Interior: ± .250”

ALL DIMENSIONS ARE TYPICAL

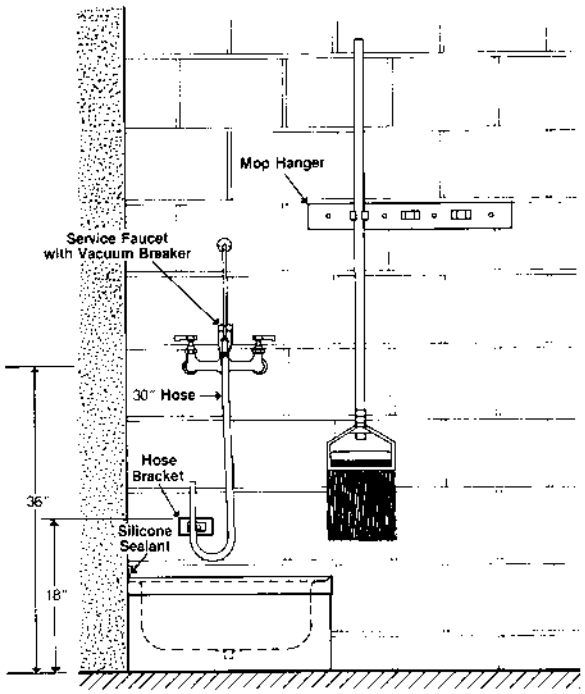
STANDARD MOP SINK



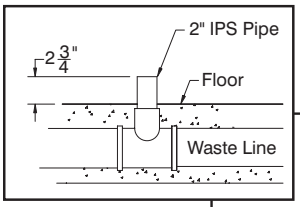
DROP FRONT MOP SINK

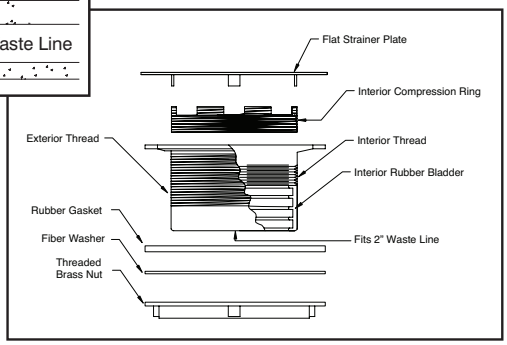


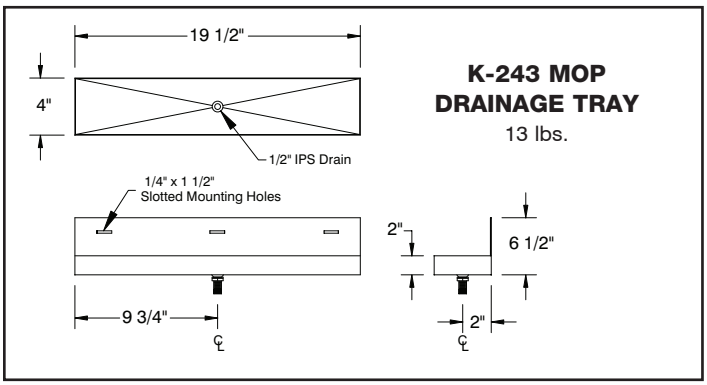
SUGGESTED INSTALLATION



MOP SINK DRAIN ASSEMBLY





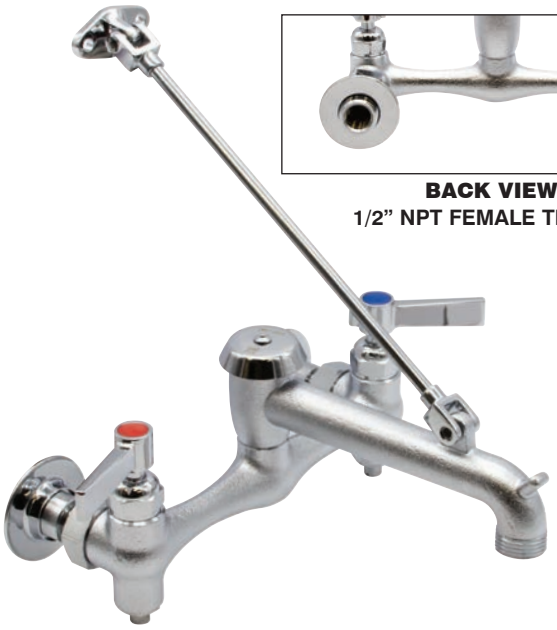


K-243 MOP DRAINAGE TRAY
13 lbs.

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

© ADVANCE TABCO, JULY 2024

K-240
SERVICE FAUCET FOR MOP SINKS



BACK VIEW
1/2" NPT FEMALE THREAD

Item #: _____ Qty #: _____
Model #: _____
Project #: _____

FEATURES:

8" O.C. water supply.
Quarter turn wedge style handles with colored hot & cold Indexes.
9.6 GPM/36.3 LPM.
Wall support bracket & pail hook.
Vacuum breaker. Built-in stops.
Garden hose outlet.

MATERIAL:

Brass chrome plated body & spout.
Chrome plated handles.



Click This Link To View Assembly Sheet

Options & Accessories

Replacement Vacuum Breaker Repair Kit For K-240



K-03

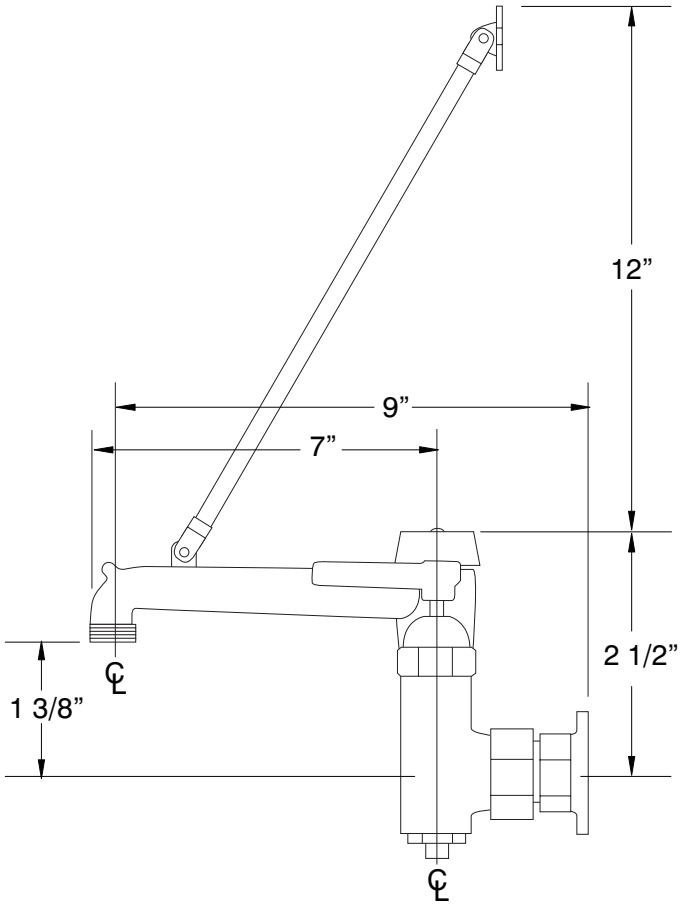
Faucet Repair Kit*
K-00B (Set of 2)
Includes 2 Cartridges and 2 Handles With Red & Blue Indexes



*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.

⚠ WARNING:
Faucet(s) on this page may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info.,visit www.p65warnings.ca.gov.

DIMENSIONS and SPECIFICATIONS



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REF-G

FAUCET PARTS & ACCESSORIES

Faucet Repair Kit
For K-22, K-59, K-123, K-125, K-126, K-206 & K-316 Faucets
Includes 2 Cartridges and Handles
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-00A (Set of 2)



Faucet Repair Kit
For K-1, K-11, K-50, K-51, K-52, K-53, K-56, K-124, K-101, K-160, K-208 & K-240 Faucets
Includes 2 Cartridges and Handles
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-00B (Set of 2)





K-02 Filler Faucet Repair Kit
For K-54 & K-54A Faucets
*Can Only Be Used On Faucets Purchased From 2016 - 2019. For Older Faucets, See Below.



K-02A Filler Faucet Repair Kit
For K-54 & K-54A Faucets
*Can Only Be Used On Faucets Purchased Before January 2016 or After 2019.



Service Faucet Vacuum Breaker Repair Kit
For K-240 Faucet
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-03

Pedal/Knee Valve Replacement Parts

Replacement Bonnet for Pedal/Knee Valve
For K-103, K-104, 7-PS-32 & 7-PS-39
K-01



Replacement Check Valves
For K-103, K-104, 7-PS-32 & 7-PS-39
K-19



Thermostatic Mixing Valve
For K-103, K-104, 7-PS-32 & 7-PS-39
K-425



Mixing Valve & Retainer
For K-103, K-104, 7-PS-32 & 7-PS-39
K-19A



Faucet Options & Accessories

Hands-Free Wand



K-400



Low Flow Aerator



.5 GPM
K-08

Wrist Handles (Pair)



*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-316-LU

Wrist Handles (Pair)
For Heavy Duty 8" O.C. Faucets



K-416-LU

Splash Mount Faucet Mounting Kit
K-1, K-11, K-101, K-105, K-112, K-119 & K-211
K-06



Faucet Wall Mounting Bracket
8" O.C.
K-30



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MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# K113 - WIRE SHELVING (5 EA REQ'D)

Metro 1836NK3

Quick Ship - Super Erecta® Shelf, wire, 36"W x 18"D, Metroseal™ Green epoxy-coated corrosion-resistant finish with Microban® antimicrobial protection, plastic split sleeves are included in each carton, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Metro	4	74PK3	Quick Ship - Super Erecta® SiteSelect™ Post, 74-1/2"H, adjustable leveling bolt, posts are grooved at 1" increments & numbered at 2" increments, double grooved every 8", Metroseal 3 Green epoxy coated corrosion-resistant finish with Microban® antimicrobial protection

METRO®

We put space to work.

Item # _____

Job _____

Super Erecta® Shelf
Wire Shelving

NSF

- **Unique Design:** The open wire design of these shelves minimizes dust accumulation and allows free circulation of air, greater visibility of stored items and greater light penetration.
- **Durable Construction:** Super Erecta shelves and posts are constructed of heavy-gauge carbon steel or Type 304 stainless steel.
- **Choice of Finishes:** Super Erecta Brite™ and chrome-plated for dry storage; Metroseal™ Epoxy (green or gray), and Type 304 stainless steel for corrosive environments; and attractive epoxy color options for merchandising applications.
- **Metroseal:** Proprietary rust-resistant finish is a durable epoxy coating over a protective zinc substrate. Metroseal contains Microban® antimicrobial product protection which continuously fights the growth of bacteria, mold, and mildew that cause stains and odors. 12-year limited warranty against rust and corrosion.
- **Versatile:** Super Erecta® Shelf wire shelving can adapt to your changing needs. By using various accessories, hundreds of shelving configurations become possible.
- **Fast, Secure Assembly:** SiteSelect® Posts have a double groove visual guide feature every 8" (203mm), circular grooves at 1" (25mm) increments, and are numbered at 2" (50mm) intervals. A patented, tapered split sleeve snaps together around each post. Tapered openings in the shelf corners slide over the tapered split sleeves providing a positive lock. Shelf is assembled in minutes without the use of any special tools.
- **Adjustability:** Shelves can be adjusted at 1" (25mm) intervals along the entire length of the post.
- **Shelf Ribs:** Run front to back, allowing you to slide items on and off shelves smoothly.
- **Shelf Accessibility:** Shelves can be loaded/unloaded easily from all sides This open construction allows maximum use of storage cube.
- **Adjustable Feet:** Bolt levelers compensate for surface irregularities.

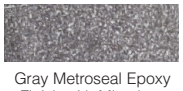
Note: Stainless stationary posts are equipped with stainless steel leveling feet.



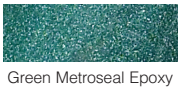
Super Erecta Chrome Wire



Super Erecta with Metroseal



Gray Metroseal Epoxy Finish with Microban



Green Metroseal Epoxy Finish with Microban

InterMetro Industries Corporation
North Washington Street, Wilkes-Barre, PA 18705
Product Information. U.S. and Canada: 1.800.992.1776
Outside U.S. and Canada: www.metro.com/contactus

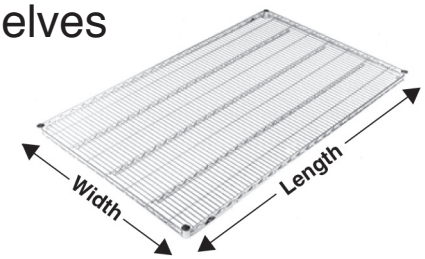
L02-006e
Printed in U.S.A. 6/20

Information and specifications are subject to change without notice. Please confirm at time of order.

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Super Erecta® Shelf Wire Shelving

Wire Shelves







Aluminum Split Sleeve

- See spec sheet 10.14 for epoxy color options.
- Plastic split sleeves are included with each shelf Replacements are available: Cat. No. **9985** (bag of 4)
- Aluminum split sleeves are recommended for abusive mobile applications. Sleeves with stainless C-rings must be used for cart wash applications (exceeding 200°F/93°C) and for all autoclave applications.
  Cat. No. **9986Z** (bag of 4 with zinc C-rings)
  Cat. No. **9986S** (bag of 4 with stainless steel C-rings)
- Weight capacity (evenly distributed) per shelf
  800 lbs. (363kg) for lengths of 18" to 48" (457 to 1219mm)
  600 lbs. (272kg) for lengths of 54" (1370mm) or longer
- Weight capacity (evenly distributed) per unit.
  Stationary shelving units have a maximum load capacity (evenly distributed) of 2,000 lbs. (907kg). Mobile units have a maximum capacity of three times the caster load rating up to but not exceeding 1,000 lbs. (453kg) total. Consult the Metro catalog for caster load ratings.

Cat. No. Super Erecta Brite	Cat. No. Chrome	Cat. No. Metroseal Green (K3) with Microban	Cat. No. Metroseal Gray (K4) with Microban	Cat. No. Stainless	Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)
1424BR	**1424NC**	**1424NK3**	**1424NK4**	**1424NS**	14x24	355x610	5.3	2.4
1430BR	**1430NC**	**1430NK3**	**1430NK4**	**1430NS**	14x30	355x760	6.3	2.8
1436BR	**1436NC**	**1436NK3**	**1436NK4**	**1436NS**	14x36	355x914	7.5	3.4
1442BR	**1442NC**	**1442NK3**	**1442NK4**	**1442NS**	14x42	355x1066	8.3	3.8
1448BR	**1448NC**	**1448NK3**	**1448NK4**	**1448NS**	14x48	355x1219	9.4	4.3
1460BR	**1460NC**	**1460NK3**	**1460NK4**	**1460NS**	14x60	355x1524	11.8	5.4
1472BR	**1472NC**	**1472NK3**	**1472NK4**	**1472NS**	14x72	355x1829	14.4	6.5
-	**1818NC**	**1818NK3**	**1818NK4**	**-**	18x18	457x457	5.3	2.4
1824BR	**1824NC**	**1824NK3**	**1824NK4**	**1824NS**	18x24	457x610	6.1	2.7
1830BR	**1830NC**	**1830NK3**	**1830NK4**	**1830NS**	18x30	457x760	7.1	3.2
1836BR	**1836NC**	**1836NK3**	**1836NK4**	**1836NS**	18x36	457x914	8.2	3.7
1842BR	**1842NC**	**1842NK3**	**1842NK4**	**1842NS**	18x42	457x1066	9.3	4.2
1848BR	**1848NC**	**1848NK3**	**1848NK4**	**1848NS**	18x48	457x1219	10.7	4.9
1854BR	**1854NC**	**1854NK3**	**1854NK4**	**1854NS**	18x54	457x1370	11.9	5.4
1860BR	**1860NC**	**1860NK3**	**1860NK4**	**1860NS**	18x60	457x1524	13.4	6.1
1872BR	**1872NC**	**1872NK3**	**1872NK4**	**1872NS**	18x72	457x1829	14.6	6.6
2124BR	**2124NC**	**2124NK3**	**2124NK4**	**2124NS**	21x24	530x610	10.1	4.6
2130BR	**2130NC**	**2130NK3**	**2130NK4**	**2130NS**	21x30	530x760	10.5	4.8
2136BR	**2136NC**	**2136NK3**	**2136NK4**	**2136NS**	21x36	530x914	10.7	4.9
2142BR	**2142NC**	**2142NK3**	**2142NK4**	**2142NS**	21x42	530x1066	11.5	5.2
2148BR	**2148NC**	**2148NK3**	**2148NK4**	**2148NS**	21x48	530x1219	11.9	5.4
2154BR	**2154NC**	**2154NK3**	**2154NK4**	**2154NS**	21x54	530x1370	12.9	5.8
2160BR	**2160NC**	**2160NK3**	**2160NK4**	**2160NS**	21x60	530x1524	13.4	6.1
2172BR	**2172NC**	**2172NK3**	**2172NK4**	**2172NS**	21x72	530x1829	14.4	6.5
2424BR	**2424NC**	**2424NK3**	**2424NK4**	**2424NS**	24x24	610x610	6.5	3.0
2430BR	**2430NC**	**2430NK3**	**2430NK4**	**2430NS**	24x30	610x760	8.3	3.8
2436BR	**2436NC**	**2436NK3**	**2436NK4**	**2436NS**	24x36	610x914	10.1	4.6
2442BR	**2442NC**	**2442NK3**	**2442NK4**	**2442NS**	24x42	610x1066	11.9	5.4
2448BR	**2448NC**	**2448NK3**	**2448NK4**	**2448NS**	24x48	610x1219	14.2	6.4
2454BR	**2454NC**	**2454NK3**	**2454NK4**	**2454NS**	24x54	610x1370	16.1	7.3
2460BR	**2460NC**	**2460NK3**	**2460NK4**	**2460NS**	24x60	610x1524	18.0	8.2
2472BR	**2472NC**	**2472NK3**	**2472NK4**	**2472NS**	24x72	610x1829	21.4	9.7

Note: The actual length of the shelves is 1/8" (3.2mm) shorter than the nominal dimension shown. The actual depth of the shelves is 1/8" (3.2mm) greater than the nominal dimension shown.

Note: The following restrictions apply to shelving units that utilize 14" (355mm) wide shelves:
Free-standing units: Units taller than 63" (1600mm) must be properly fastened to the floor or wall using Metro foot plates or wall brackets.
Mobile units: maximum allowable post height is 54" (1370mm).

Super Erecta® Shelf Wire Shelving

SiteSelect® Posts

Stationary Posts - Equipped with a leveling bolt to account for uneven floors.

- Height includes leveling bolt (completely tightened) and post cap. Leveling bolt can be adjusted 0.5" (13mm).
- Foot plates may be ordered separately and installed in place of leveling foot.
- Replacement leveling bolts: Zinc Cat. No. **RPF04-004**, Stainless Steel Cat. No. **RPF04-004C**
- Replacement post cap for standard posts: Black Cat. No. **RPC06-035**

Cat. No. Chrome	Cat. No. Metroseal Green (K3) with Microban	Cat. No.. Metroseal Gray (K4) with Microban	Cat. No. Stainless Steel	Actual Height (in.)	Actual Height (mm)	Approx Pkd. Wt. (lbs.)	Approx Pkd. Wt. (kg)
7P	**7PK3**	**7PK4**	**-**	7.375	187	0.5	0.3
13P	**13PK3**	**13PK4**	**13PS**	14.375	365	1	0.5
27P	**27PK3**	**27PK4**	**27PS**	28.375	720	1.75	0.75
33P	**33PK3**	**33PK4**	**33PS**	34.375	873	2	0.9
54P	**54PK3**	**54PK4**	**54PS**	54.4375	1382	3	1.4
63P	**63PK3**	**63PK4**	**63PS**	62.4375	1585	3.5	1.6
74P	**74PK3**	**74PK4**	**74PS**	74.5	1892	4	1.8
86P	**86PK3**	**86PK4**	**86PS**	86.5	2197	5	2.3
***96P**	**-**	**-**	**-**	96.5	2450	5.5	2.5

*96P should not be used on units less than 24" (610mm) deep. Consult Metro Engineering for alternate recommendations.



SiteSelect Posts feature double grooves every 8" (203mm) to aid assembly.



Stationary Post



Post for Stem Caster

Special Length Posts

Cut posts are available. Consult your Metro representative for more information.

Mobile Posts (For use with Stem Casters)

- Height includes post cap.

Cat. No. Chrome	Cat. No. Metroseal Green (K3) with Microban	Cat. No. Metroseal Gray (K4) with Microban	Cat. No. Stainless Steel	Actual Height (in.)	Actual Height (mm)	Approx. Pkd. Wt. (lbs.)	Approx. Pkd. Wt. (kg)
13UP	**13UPK3**	**13UPK4**	**13UPS**	13.75	349	1	0.5
27UP	**27UPK3**	**27UPK4**	**27UPS**	27.75	704	1.75	0.75
33UP	**33UPK3**	**33UPK4**	**33UPS**	33.75	857	2	0.9
54UP	**54UPK3**	**54UPK4**	**54UPS**	53.8125	1366	3	1.4
63UP	**63UPK3**	**63UPK4**	**63UPS**	61.8125	1570	3.5	1.6
-	**70UPK3**	**70UPK4**	**-**	69.75	1771	3.75	1.7
74UP	**74UPK3**	**74UPK4**	**74UPS**	73.875	1876	4	1.8
86UP	**86UPK3**	**86UPK4**	**86UPS**	85.875	2181	4.5	2.0

Staked Posts (For use with Truck Dollies)

- Each post connects to the truck dolly through the stem receptacle. The stem receptacle is staked into the bottom of the post to ensure a durable connection in abusive mobile applications. Each includes a leveling/connecting bolt.

Cat. No. Chrome	Cat. No. Stainless Steel	Actual Height (in.)	Actual Height (mm)	Approx. Pkd. Wt. (lbs.)	Approx. Pkd. Wt. (kg)
54P-STKD	**54PS-STKD**	54.4375	1382	3	1.4
63P-STKD	**63PS-STKD**	62.4375	1585	3.5	1.6
74P-STKD	**74PS-STKD**	74.5	1892	4	1.8



Staked Post

Swaged Posts (For use with Stem Casters in Cart Wash Applications)

- Each post has an aluminum cap swaged into the top of the post.

Cat. No. Stainless Steel	Actual Height (in.)	Actual Height (mm)	Approx. Pkd. Wt. (lbs.)	Approx. Pkd. Wt. (kg)
33UPS-SW	33.75	857	2	.9
54UPS-SW	53.8125	1366	3	1.4
63UPS-SW	61.8125	1570	3.5	1.6



Swaged Post

Job _____

Super Erecta Shelf®
Wire Shelving

We put space to work.

Super Wide Shelving



- **High-density Storage:** Super Wide shelves have a greater storage area for holding large quantities of supplies, especially large, bulky objects, providing maximum storage in minimum space.
- **Load Capacity (evenly distributed) per shelf:**

  Depths: 30" and 36" (760 and 914mm)

  800 lbs. (363kg) for lengths 48" (1219mm) or shorter.

  600 lbs. (272kg) for lengths 54" (1370mm) or longer.

Cat. No. Chrome	Cat. No. Metroseal Green (K3) with Microban	Cat. No.. Metroseal Gray (K4) with Microban	Cat. No. Stainless Steel	Nominal Width/Length (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)
3036NC	**3036NK3**	**3036NK4**	**3036NS**	30x36	760x914	14.2	6.4
3048NC	**3048NK3**	**3048NK4**	**3048NS**	30x48	760x1219	17.7	8.0
3060NC	**3060NK3**	**3060NK4**	**3060NS**	30x60	760x1524	20.2	9.2
3072NC	**3072NK3**	**3072NK4**	**3072NS**	30x72	760x1829	22.7	10.3
3636NC	**3636NK3**	**-**	**3636NS**	36x36	910x914	16.7	7.6
3648NC	**3648NK3**	**-**	**3648NS**	36x48	910x1219	21.6	9.8
3660NC	**3660NK3**	**-**	**3660NS**	36x60	910x1524	26.4	12.0
3672NC	**3672NK3**	**-**	**3672NS**	36x72	910x1829	31.6	14.3

Note: The actual length of the shelves is 1/8" (3.2mm) shorter than the nominal dimension shown. The actual depth of the shelves is 1/8" (3.2mm) greater than the nominal dimension shown.

Foot Plates



- Use to bolt units to the floor, or when a broader, more stable foot is desired. Foot plates also help to protect floors by distributing the point load of the shelving unit across a larger contact point.
- Foot plates (completely tightened) add .125" (3mm) to the specified heights of each stationary post on the table.

  Zinc Cat. No. **9993Z**

  Stainless Steel Cat. No. **9993S**

"S" Hook



- Used to add on shelving units with only two posts required. Order two per shelf level.

  Cat. No. **9995Z**

We put space to work.

Item # _____

Job _____

Super Erecta Pro®

Durable and Cleanable. The original — reinnovated.

Corrosion resistant shelving constructed of removable polymer open grid shelf mats over a wire shelf frame. Shelf frames and posts have Metroseal epoxy coating over an electroplated substrate. Shelves with polymer mats offer a 15 year limited warranty against corrosion, while posts offer a 12 year warranty against corrosion. Microban® antimicrobial product protection is built into the frames, shelf mats, and posts. Shelf has a rigid four-sided frame with center truss(es). Robust corner provides complete 360° capture of the split sleeves and post for added stability. Stationary units have maximum capacity of 2,000 lbs. (907kg) evenly distributed. Mobile units (with stem casters) offer a maximum total unit load of 900 lbs. (408kg). Units assemble easily — shelves mount on split sleeves along grooved, numbered posts and adjust on 1" (25mm) increments.

- **Prolonged durability:** Polymer shelf mats are corrosion proof and impact resistant. They will not chip, rust, or corrode.
- **Easy to clean:** Removable polymer shelf mats can easily be lifted off the shelf frames for cleaning in sinks or wash/dish machines.
- **Strong and robust:** Steel corners, side and center supports assure a sturdy and stable weight bearing surface.

  Weight capacities for evenly distributed loads:
  800 lbs. (363kg) per shelf for lengths of 24" to 48" (610 to 1220mm)
  600 lbs. (275kg) per shelf for lengths of 54" (1370mm) or longer
  2,000 lbs. (907kg) maximum per stationary unit.
- **Interchangeable:** Super Erecta Pro shelves are compatible on the same shelving units with other Super Erecta shelving options: Super Erecta wire, Super Adjustable Super Erecta, Solid Super Erecta shelves, Dunnage shelves, Cantilever shelves. Super Erecta Pro shelves can be used with Post-Type Wall Mounts, Direct Wall Mounts, SmartWall Wall Mounts, Security Units, Top Track, and qwikTRAK systems.
- **Microban Product Protection:** Microban antimicrobial product protection is built into the shelf mats and the Metroseal 3 epoxy coating to protect the product from bacteria, mold, mildew, and fungus that cause odors and product degradation. Microban protection keeps the product "cleaner between cleanings".
- **Efficient use of storage space:** Shelves can be adjusted at 1" (25mm) increments along the post to maximize the use of available vertical storage space.
- **Open Grid Shelf Mats:** Open grid shelves promote air circulation and light penetration.
- **Fast, Easy Assembly:** Super Erecta Pro units assemble easily in minutes, without tools. SiteSelect posts have numbered grooves and feature unique double grooves every 8" (203mm) to help position the shelves.
- **Warranty against rust and corrosion:** Shelves with polymer shelf mats – 15 years. Posts – 12 years. Shelf mats are constructed of polypropylene and will never rust.





For stem casters, see catalog sheet #11.20



*MICROBAN® and the MICROBAN® symbol are registered trademarks of the Microban Products Company, Huntersville, NC.

PROTECTION THAT LIVES ON MICROBAN NSF SUPPORTS GOOD HACCP PROCESSES

All Metro Catalog Sheets are available on our website: **www.metro.com**

InterMetro Industries Corporation
North Washington Street, Wilkes-Barre, PA 18705
Product Information. U.S. and Canada: 1.800.992.1776
Outside U.S. and Canada: www.metro.com/contactus

L02-184
Printed in U.S.A. Rev. 9/21

Information and specifications are subject to change without notice. Please confirm at time of order.

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Job _____

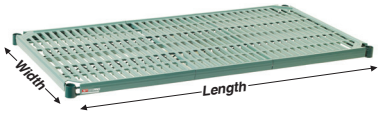
Super Erecta Pro® Shelves

We put space to work.

Standard Shelves

- Part number includes shelf with removable polymer shelf mats and one bag of split sleeves

Nominal Width/Length (in.)	(mm)	Approx Pkd. Wt. (lbs.)	(kg)	Model No. SE Pro Metroseal 3
14x24	355x610	4.5	2.0	**PR1424NK3**
14x30	355x760	6.3	2.9	**PR1430NK3**
14x36	355x914	8.0	3.6	**PR1436NK3**
14x42	355x1060	10.0	4.5	**PR1442NK3**
14x48	355x1219	11.9	5.4	**PR1448NK3**
14x60	355x1524	14.9	6.8	**PR1460NK3**
14x72	355x1829	18.3	8.3	**PR1472NK3**
18x24	457x610	6.0	2.7	**PR1824NK3**
18x30	457x760	7.8	3.5	**PR1830NK3**
18x36	457x914	9.5	4.2	**PR1836NK3**
18x42	457x1060	11.3	5.0	**PR1842NK3**
18x48	457x1219	13.0	5.8	**PR1848NK3**
18x54	457x1372	14.8	6.6	**PR1854NK3**
18x60	457x1524	16.5	7.4	**PR1860NK3**
18x72	457x1829	19.8	8.8	**PR1872NK3**
21x24	530x610	8.0	3.6	**PR2124NK3**
21x30	530x760	9.5	4.2	**PR2130NK3**
21x36	530x914	11.3	5.0	**PR2136NK3**
21x42	530x1060	12.5	5.6	**PR2142NK3**
21x48	530x1219	14.3	6.4	**PR2148NK3**
21x54	530x1372	16.5	7.4	**PR2154NK3**
21x60	530x1524	18.3	8.1	**PR2160NK3**
21x72	530x1829	21.5	9.6	**PR2172NK3**
24x24	610x610	9.5	4.2	**PR2424NK3**
24x30	610x760	11.3	5.0	**PR2430NK3**
24x36	610x914	13.0	5.8	**PR2436NK3**
24x42	610x1060	14.0	6.3	**PR2442NK3**
24x48	610x1219	15.5	6.9	**PR2448NK3**
24x54	610x1372	18.3	8.1	**PR2454NK3**
24x60	610x1524	20.0	8.9	**PR2460NK3**
24x72	610x1829	23.3	10.4	**PR2472NK3**



Actual Dimensions: Width: Add 1/4" (6mm) to nominal size. Length: Subtract 1/4" (6mm) from nominal size.

Note: Polymer Shelf mats are designed to fit Super Erecta Pro shelves and cannot be retrofitted to Super Erecta wire shelves.

Replacement Split Sleeves
Model No. 9985 (Bag of four sets.)

Specifications

- **Shelf frames:** Carbon steel with Metroseal 3 epoxy coating.
- **Polymer Shelf mats:** polypropylene.
- **Microban antimicrobial product protection** is built into the polymer shelf mats and Metroseal 3 epoxy coating.
- **NSF listed for all environments.**
- **Continuous Temperature:** Super Erecta Pro Shelves can be used continuously within a range of -20/120° F (-29/49° C). For cleaning only, the unloaded product or shelf mats may be intermittently exposed to temperatures up to 200° F (93° C).

NOTE: Not suitable for cart wash applications.

SHELVING HEIGHT GUIDELINES

Shelf Depth	14" (356mm)	18" (457mm)	21" (533mm)	24" (610mm)
Maxium Post Height Allowable	▼	▼	▼	▼
Stationary	63" (1600mm)	86" (2184mm)	86" (2184mm)	96" (2438mm)
Mobile	54" (1372mm)	74" (1880mm)	74" (1880mm)	86" (2184mm)

Note: 14" deep stationary shelving taller than 63" must be fastened to the floor or wall. For stationary units with foot plates or wall brackets properly attached to the floor or wall, the maximum allowable height is 96" (2438mm). See spec sheet 10.81 for options.

SiteSelect Posts

Stationary post height includes leveling bolt.

STATIONARY

Actual Height (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Model No. Metroseal 3	Model No. Stainless
14 1/2	370	1.0	0.5	**13PK3**	**13PS**
34 1/2	875	2.0	0.9	**33PK3**	**33PS**
54 9/16	1385	3.0	1.4	**54PK3**	**54PS**
62 9/16	1590	3.5	1.6	**63PK3**	**63PS**
—	—	—	—	—	—
74 5/8	1895	4.0	1.8	**74PK3**	**74PS**
86 5/8	2200	5.0	2.3	**86PK3**	**86PS**

MOBILE (For use with stem casters)

Actual Height (in.)	(mm)	Approx. Pkd. Wt. (lbs.)	(kg)	Model No. Metroseal 3	Model No. Stainless
13 3/4	349	1.0	0.5	**13UPK3**	**13UPS**
33 3/4	857	2.0	0.9	**33UPK3**	**33UPS**
53 13/16	1366	3.0	1.4	**54UPK3**	**54UPS**
61 13/16	1570	3.5	1.6	**63UPK3**	**63UPS**
69 3/4	1772	3.8	1.7	**70UPK3**	—
73 7/8	1876	4.0	1.8	**74UPK3**	**74UPS**
85 7/8	2181	5.0	2.3	**86UPK3**	**86UPS**

NOTE: Special length posts are available. Consult your Metro representative.

"S" Hook: Used to "add on" one or multiple Super Erecta Pro shelving units while eliminating the cost of two posts per unit. Can be used to join units end-to-end, back-to-back, at right angles, etc. Two "S" hooks are required for each shelf.
Model No. Q9995Z

Notes about "add-on" units.

- Add-on (Adjacent) units must be configured entirely of one style of shelf. (Example: Adjacent unit may be configured entirely of Super Erecta Pro OR entirely of Super Erecta Wire/Super Adjustable shelves.)
- To connect an adjacent Super Erecta or Super Adjustable Super Erecta wire shelving unit to a Super Erecta Pro unit using S-hooks, the adjacent unit must use S-hook model number Q9995Z.
- A mixed shelving unit having a combination of Super Erecta Pro, Super Erecta wire, and Super Adjustable cannot be connected to another unit with "S" Hooks.



Super Erecta Pro® Shelves

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# E01 - EMERGENCY STORAGE SHELVING (1 LT REQ'D)

Metro EPOXY

One lot emergency storage shelving, 74" high, four tier, size and configure per plan layout.

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Submittal Sheet

03/14/2025

ITEM# B00 - BISTRO

Bistro

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# E02 - COMMERCIAL WASHER (2 EA REQ'D)

Electrolux Professional EED-665

65 pound, hard mount commercial washer

Electrolux PROFESSIONAL

200G HARD-MOUNT WASHER
EXTRA DRY EXTRACTION



REDUCE COSTS, INCREASE PRODUCTIVITY, AND EXTEND LINEN LIFE.

With true spin technology, industry-best water savings, and ultimate programmability, our 200 G-force washer is the most advanced machine in its class.

INNOVATIVE TECHNOLOGY

Our Power Balance extraction technology offers speed in more than a name.

200 G-FORCE

High extraction speed leads to shorter dry times and lower energy costs for your laundry operation.

POWER BALANCE

Our smart accelerometer keeps your washer balanced and maintains ultra-fast extraction – consistently.

Don't wash efficiency down the drain. Reduce costs – automatically.

AUTOMATIC SAVINGS

AS weighs each load of laundry and introduces the precise volume of water needed for the perfect wash – cutting water bills by up to 50%.

EFFICIENT DOSING

Reduce chemical costs by over 30%. Our dosing technology weighs each load and adds the optimum volume of soap and other chemicals to achieve the best wash results.

Optimize your on-premises laundry operation.

COMPASS PRO

With a dual-language display and 48 programable wash options, Compass Pro allows laundry operations to optimize their laundry room and eliminate user error.

ERGONOMIC DESIGN

Electrolux Professional washers are certified to international standards of ergonomics, making your laundry room a healthier and more productive workplace.

EED-200G-OPL

	EED-620	EED-625	EED-630	EED-645	EED-665	EED-685
DRY WEIGHT CAPACITY (LB/KG)	20 | 9	25 | 11	30 | 14	45 | 20	65 | 29	85 | 39
WIDTH (IN/MM)	26 | 660	28 3/8 | 720	28 3/8 | 720	29 1/2 | 750	32 11/16 | 830	35 13/16 | 910
DEPTH (IN/MM)	28 9/16 | 725	27 9/16 | 700	31 1/8 | 790	36 | 915	40 9/16 | 1030	43 7/8 | 1115
HEIGHT (IN/MM)	44 11/16 | 1135	48 1/16 | 1220	48 1/16 | 1220	52 15/16 | 1345	56 5/16 | 1430	57 11/16 | 1465
HEIGHT TO BOTTOM OF DOOR (IN/MM)	14 3/16 | 360	14 9/16 | 370	14 9/16 | 370	17 5/16 | 440	18 1/2 | 470	19 7/8 | 505
DOOR OPENING DIAMETER (IN/MM)	12 3/16 | 310	14 3/8 | 365	14 3/8 | 365	15 9/16 | 395	17 1/8 | 435	17 1/8 | 435
CYLINDER VOLUME (FT3/L)	3 | 85	3.7 | 105	4.6 | 130	6.4 | 180	8.8 | 250	11.7 | 330
DRAIN OUTLET DIAMETER (IN/MM)	3 | 75	3 | 75	3 | 75	3 | 75	3 | 75	3 | 75
HEIGHT TO CENTERLINE OF DRAIN (IN/MM)	4 1/8 | 105	4 1/8 | 105	4 1/8 | 105	4 1/8 | 105	4 1/8 | 105	4 1/8 | 105
EXTRACTION (G-FORCE)	200G	200G	200G	200G	200G	200G
DYNAMIC LOAD (LB/KN)	380+/-840 1.7+/-3.8	420+/-980 1.9+/-4.4	510+/-1200 2.3+/-5.4	670+/-1500 3.0+/-6.7	860+/-1850 3.8+/-8.3	950+/-2210 4.3+/-9.9
DYNAMIC FREQUENCY (HZ)	13.8	12.9	12.9	12.4	11.7	11.2
NOISE LEVEL (DBA)	<70	<70	<70	<70	<70	<72
CRATED WIDTH (IN/MM)	27 3/16 | 690	29 1/2 | 750	29 1/2 | 750	30 11/16 | 780	33 7/8 | 860	37 | 940
CRATED DEPTH (IN/MM)	32 11/16 | 830	35 1/16 | 890	37 3/8 | 950	39 3/16 | 995	43 11/16 | 1110	47 1/16 | 1195
CRATED HEIGHT (IN/MM)	48 | 1219	53 1/8 | 1350	53 1/8 | 1350	56 7/16 | 1434	61 1/4 | 1556	62 7/16 | 1586
CRATED WEIGHT (LB/KG)	276 | 126	364 | 166	432 | 169	522 | 238	615 | 280	717 | 326
ELECTRICAL REQUIREMENTS (STANDARD)						
STANDARD VOLTAGES (V/Hz/Ø)			120 or 208 - 240 | 60 | 1			
POWER (KW) **/ CKT BREAKER** (A) **120V**	0.5 / 15	0.6 / 15	0.6 / 15	0.8 / 15	1.2 / 15	1.4 / 15
POWER (KW) **/ CKT BREAKER** (A) **240V**	0.4 / 15	0.5 / 15	0.4 / 15	0.7 / 15	1.1 / 15	1.3 / 15
WATER INFORMATION						
INLET FITTINGS (* = 3 INLETS)	3/4 | DN20	3/4 | DN20	3/4 | DN20	3/4* | DN20*	3/4* | DN20*	3/4* | DN20*
FLOW (GPM/LPM @ 45 PSI) (EACH INLET)	5 | 20	5 | 20	5 | 20	5 | 20	16 | 60	16 | 60
RECOMMENDED WATER PRESSURE (PSI/KPA)	30-90 200-600	30-90 200-600	30-90 200-600	30-90 200-600	30-90 200-600	30-90 200-600
MODIFIED ENERGY FACTOR	2.1	2.2	2.2	2.3	2.0	2.0
WATER FACTOR (GAL PER CYCLE/DRUM VOLUME)	4.0	4.4	3.9	4.0	4.0	4.0

WASH FEATURES

STANDARD WASH PROGRAMS	33	33	33	33	33	33
CUSTOM WASH PROGRAMS	15	15	15	15	15	15
AVAILABLE LANGUAGES	3	3	3	3	3	3
TOP MOUNTED SOAP BOX AND REAR CHEMICAL INJECTION PORTS	•	•	•	•	•	•
NUMBER OF DETERGENT SIGNALS	5	5	5	5	5	5

Electrolux PROFESSIONAL AUTHORIZED PARTNER

• STANDARD

○ OPTIONAL

LaundryLux
800-645-2204 • LAUNDRYLUX.COM
461 DOUGHTY BOULEVARD, INWOOD, NEW YORK 11096-0338
SALES: 516-371-4400 · F 516-371-4204 · sales@laundrylux.com
PARTS: 516-371-2000 · F 516-371-4029 · parts@laundrylux.com
TECH: 516-371-0700 · F 516-371-4029 · techcare@laundrylux.com

20230531

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# B01 - PASS-THRU REFRIGERATOR (1 EA REQ'D)

Continental Refrigerator D1RNPT

Designer Line Refrigerator, pass-thru, one-section, self-contained refrigeration, aluminum exterior & interior, stainless steel front, standard depth cabinet, full-height solid doors, cylinder locks, electronic control with digital display, hi-low alarm, 6" stainless steel legs, R290 hydrocarbon refrigerant, 1/4 HP, ENERGY STAR®

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	1		Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	1		115v/60/1-ph, 5.2 amps, cord, NEMA 5-15P, standard
Continental Refrigerator	1		Door hinged on right, standard (control side)
Continental Refrigerator	1		Door hinged on left (rear)
Continental Refrigerator	1	50205-4	Casters, swivel, with brakes (4" diameter rubber tires) set of 4 (5" height)

DESIGNER LINE REFRIGERATOR

Model: D1RNPT

Natural Refrigerant R-290 Model

Designer Line

1-Section Pass-Thru Refrigerator

ENERGY STAR® Qualified Commercial Refrigerator

D1RNPT - Stainless steel front, aluminum end panels and interior
D1RNSAPT - Stainless steel exterior, aluminum interior
D1RNSSPT - Stainless steel exterior and interior



Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**

Standard Model Features

REFRIGERATION SYSTEM

- Self contained, performance rated "plug" refrigeration system
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Refrigeration system is readily accessible on top of cabinet, separate from the "food zone"
- Automatic, hot gas condensate evaporator
- Expansion valve system

CABINET ARCHITECTURE

- 3" non-CFC polyurethane foam insulation
- Smooth, polished chrome workflow door handles
- Cam action, lift off hinges
- Self-closing doors
- Magnetic snap-in Santoprene™ door gaskets
- Cylinder lock in each door
- Heavy duty pilaster strips
- Heavy duty, epoxy coated steel shelves
- Adjustable 6" stainless steel legs

MODEL FEATURES

- LED interior lighting
- Electronic control, off cycle defrost
- Top and side air distribution ducts
- Cabinet upper side panels and refrigeration "plug" system can be removed and reinstalled at job site

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Options and Accessories

(upcharge and lead times may apply)

Additional epoxy coated steel shelves	**Correctional Facility Options**
Chrome or stainless steel shelves	• One way security screws
Wine racks	• Locking hasp (lock not included)
Caster options	• Stainless steel mesh cover
Pan slide assemblies	• Coverless hinges
Custom laminates	Special electrical requirements (consult factory)
Glass door(s) (consult factory)	Re-hinging of doors (consult factory)

Consult factory for other model configurations, options and accessories.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	21 (595 cu l)
Width, Overall (inches)	26 (660 mm)
Depth, Overall (inches) (including handles)	38 ¾ (984 mm)
Depth (inches) (less doors)	32 (813 mm)
Depth (inches) (doors open 90°)	79 (2007 mm)
Clear Door Width (inches)	19 ⅜ (492 mm)
Clear Door Height (inches)	58 ⅝ (1489 mm)
Height, Overall (inches) (including 6" legs)	83 ¼ (2115 mm)
Number of Doors	2
Number of Shelves	3
Shelf Area (square feet)	20.4 (1.9 sq m)
Tray Slide Capacity (2" centers)	24

REFRIGERANT DATA

Condensing Unit Size (H.P.)	¼
Capacity (BTU per hour)*	1940

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	5.5 (3.9)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

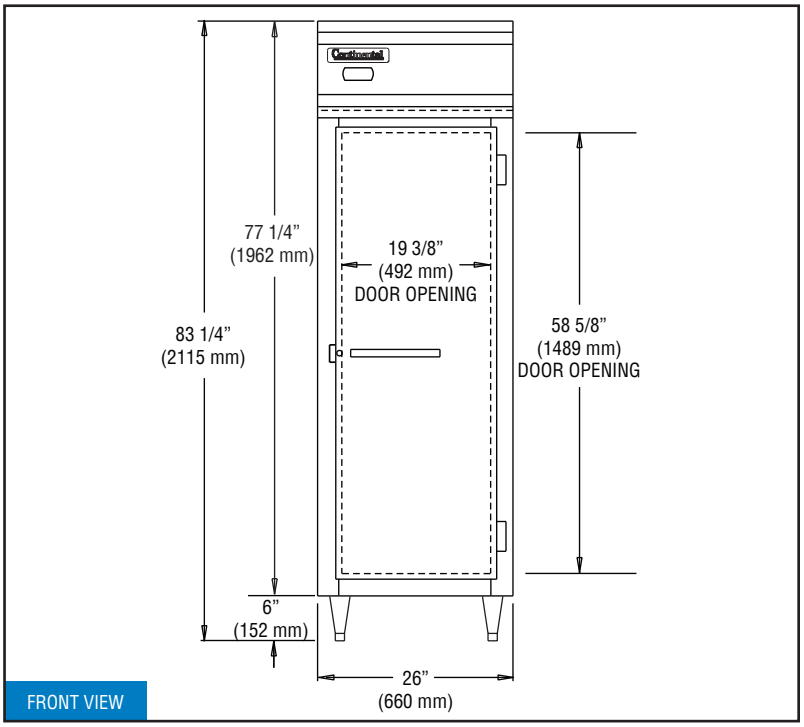
Height - Crated (inches)	85 ½ (2172 mm)
Width - Crated (inches)	31 ⅝ (803 mm)
Depth - Crated (inches)	42 (1067 mm)
Volume - Crated (cubic feet)	65 (1841 cu l)
Weight Std - Crated (pounds)	340 (155 kg)
Weight SS - Crated (pounds)	405 (184 kg)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.

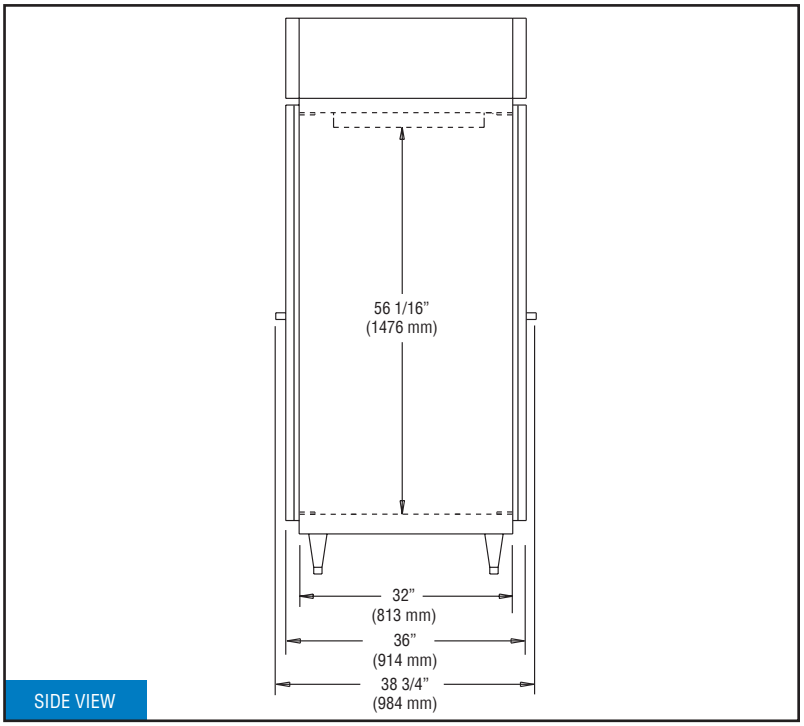


Equipped with one NEMA-5-15P Plug
(varies by country)

Model Plan Views



FRONT VIEW



SIDE VIEW

IMPORTANT NOTE: If the cabinet is located under a low ceiling, a minimum clearance of 12" is required on top and 3" on sides.

Continental Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

PROUDLY DESIGNED & ASSEMBLED IN THE U.S.A.

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REVISED: 6/27/24

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Submittal Sheet

03/14/2025

ITEM# E03 - COMMERCIAL WASHER (1 EA REQ'D)

FUTURE FUTURE

65 pound, hard mount commercial washer

Electrolux PROFESSIONAL

200G HARD-MOUNT WASHER
EXTRA DRY EXTRACTION



REDUCE COSTS, INCREASE PRODUCTIVITY, AND EXTEND LINEN LIFE.

With true spin technology, industry-best water savings, and ultimate programmability, our 200 G-force washer is the most advanced machine in its class.

INNOVATIVE TECHNOLOGY

Our Power Balance extraction technology offers speed in more than a name.

200 G-FORCE

High extraction speed leads to shorter dry times and lower energy costs for your laundry operation.

POWER BALANCE

Our smart accelerometer keeps your washer balanced and maintains ultra-fast extraction – consistently.

Don't wash efficiency down the drain. Reduce costs – automatically.

AUTOMATIC SAVINGS

AS weighs each load of laundry and introduces the precise volume of water needed for the perfect wash – cutting water bills by up to 50%.

EFFICIENT DOSING

Reduce chemical costs by over 30%. Our dosing technology weighs each load and adds the optimum volume of soap and other chemicals to achieve the best wash results.

Optimize your on-premises laundry operation.

COMPASS PRO

With a dual-language display and 48 programable wash options, Compass Pro allows laundry operations to optimize their laundry room and eliminate user error.

ERGONOMIC DESIGN

Electrolux Professional washers are certified to international standards of ergonomics, making your laundry room a healthier and more productive workplace.

EED-200G-OPL

	EED-620	EED-625	EED-630	EED-645	EED-665	EED-685
DRY WEIGHT CAPACITY (LB/KG)	20 | 9	25 | 11	30 | 14	45 | 20	65 | 29	85 | 39
WIDTH (IN/MM)	26 | 660	28 3/8 | 720	28 3/8 | 720	29 1/2 | 750	32 11/16 | 830	35 13/16 | 910
DEPTH (IN/MM)	28 9/16 | 725	27 9/16 | 700	31 1/8 | 790	36 | 915	40 9/16 | 1030	43 7/8 | 1115
HEIGHT (IN/MM)	44 11/16 | 1135	48 1/16 | 1220	48 1/16 | 1220	52 15/16 | 1345	56 5/16 | 1430	57 11/16 | 1465
HEIGHT TO BOTTOM OF DOOR (IN/MM)	14 3/16 | 360	14 9/16 | 370	14 9/16 | 370	17 5/16 | 440	18 1/2 | 470	19 7/8 | 505
DOOR OPENING DIAMETER (IN/MM)	12 3/16 | 310	14 3/8 | 365	14 3/8 | 365	15 9/16 | 395	17 1/8 | 435	17 1/8 | 435
CYLINDER VOLUME (FT3/L)	3 | 85	3.7 | 105	4.6 | 130	6.4 | 180	8.8 | 250	11.7 | 330
DRAIN OUTLET DIAMETER (IN/MM)	3 | 75	3 | 75	3 | 75	3 | 75	3 | 75	3 | 75
HEIGHT TO CENTERLINE OF DRAIN (IN/MM)	4 1/8 | 105	4 1/8 | 105	4 1/8 | 105	4 1/8 | 105	4 1/8 | 105	4 1/8 | 105
EXTRACTION (G-FORCE)	200G	200G	200G	200G	200G	200G
DYNAMIC LOAD (LB/KN)	380+/-840 1.7+/-3.8	420+/-980 1.9+/-4.4	510+/-1200 2.3+/-5.4	670+/-1500 3.0+/-6.7	860+/-1850 3.8+/-8.3	950+/-2210 4.3+/-9.9
DYNAMIC FREQUENCY (HZ)	13.8	12.9	12.9	12.4	11.7	11.2
NOISE LEVEL (DBA)	<70	<70	<70	<70	<70	<72
CRATED WIDTH (IN/MM)	27 3/16 | 690	29 1/2 | 750	29 1/2 | 750	30 11/16 | 780	33 7/8 | 860	37 | 940
CRATED DEPTH (IN/MM)	32 11/16 | 830	35 1/16 | 890	37 3/8 | 950	39 3/16 | 995	43 11/16 | 1110	47 1/16 | 1195
CRATED HEIGHT (IN/MM)	48 | 1219	53 1/8 | 1350	53 1/8 | 1350	56 7/16 | 1434	61 1/4 | 1556	62 7/16 | 1586
CRATED WEIGHT (LB/KG)	276 | 126	364 | 166	432 | 169	522 | 238	615 | 280	717 | 326
ELECTRICAL REQUIREMENTS (STANDARD)						
STANDARD VOLTAGES (V/Hz/Ø)			120 or 208 - 240 | 60 | 1			
POWER (KW) **/ CKT BREAKER** (A) **120V**	0.5 / 15	0.6 / 15	0.6 / 15	0.8 / 15	1.2 / 15	1.4 / 15
POWER (KW) **/ CKT BREAKER** (A) **240V**	0.4 / 15	0.5 / 15	0.4 / 15	0.7 / 15	1.1 / 15	1.3 / 15
WATER INFORMATION						
INLET FITTINGS (* = 3 INLETS)	3/4 | DN20	3/4 | DN20	3/4 | DN20	3/4* | DN20*	3/4* | DN20*	3/4* | DN20*
FLOW (GPM/LPM @ 45 PSI) (EACH INLET)	5 | 20	5 | 20	5 | 20	5 | 20	16 | 60	16 | 60
RECOMMENDED WATER PRESSURE (PSI/KPA)	30-90 200-600	30-90 200-600	30-90 200-600	30-90 200-600	30-90 200-600	30-90 200-600
MODIFIED ENERGY FACTOR	2.1	2.2	2.2	2.3	2.0	2.0
WATER FACTOR (GAL PER CYCLE/DRUM VOLUME)	4.0	4.4	3.9	4.0	4.0	4.0

WASH FEATURES

STANDARD WASH PROGRAMS	33	33	33	33	33	33
CUSTOM WASH PROGRAMS	15	15	15	15	15	15
AVAILABLE LANGUAGES	3	3	3	3	3	3
TOP MOUNTED SOAP BOX AND REAR CHEMICAL INJECTION PORTS	•	•	•	•	•	•
NUMBER OF DETERGENT SIGNALS	5	5	5	5	5	5

Electrolux PROFESSIONAL AUTHORIZED PARTNER

• STANDARD

○ OPTIONAL

SCAN ME

LaundryLux
800-645-2204 • LAUNDRYLUX.COM
461 DOUGHTY BOULEVARD, INWOOD, NEW YORK 11096-0338
SALES: 516-371-4400 · F 516-371-4204 · sales@laundrylux.com
PARTS: 516-371-2000 · F 516-371-4029 · parts@laundrylux.com
TECH: 516-371-0700 · F 516-371-4029 · techcare@laundrylux.com

20230531

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Submittal Sheet

03/14/2025

ITEM# B02 - BEVERAGE TABLE (1 EA REQ'D)

Custom CUSTOM BEVERAGE TABLE

S/s beverage table with partial s/s undershelf, five inch rear splash.

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Submittal Sheet

03/14/2025

ITEM# E04 - DRAIN, FLOOR TROUGH (1 EA REQ'D)

H-M Company CUSTOM

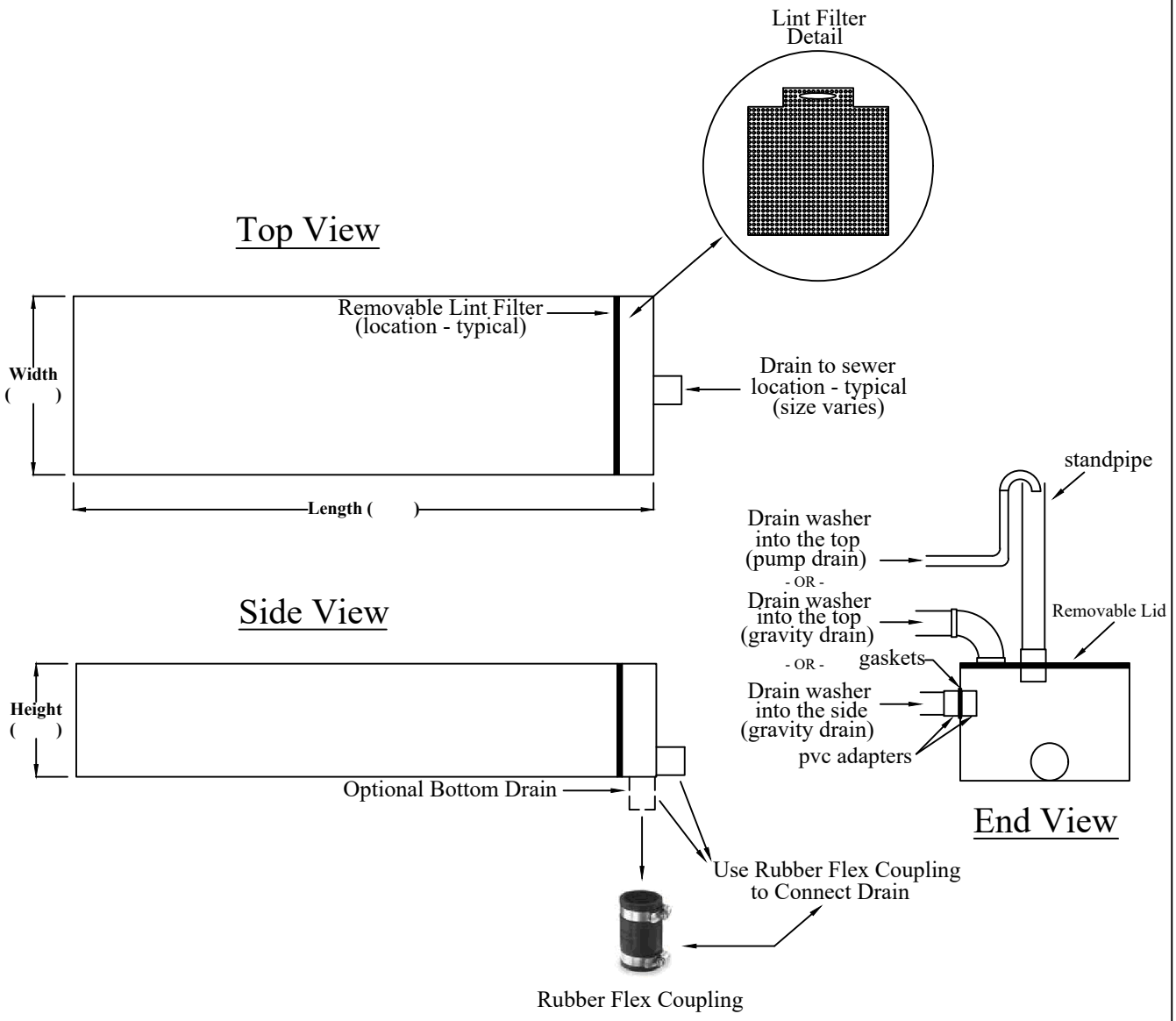
12" high x 18" wide x 15' long
With lint filter

Drain washers into top
Trough drain is 4" DW

H-M COMPANY
Since 1957
WWW.DRAINTROUGHS.COM
2305 GILBERT AVENUE
CINCINNATI, OHIO 45206
TELEPHONE: (513) 281-3832
FAX: (513) 281-0572
TELEPHONE: (800) 365-1900

SUBMITTAL SHEET

DRAIN TROUGH



ENGINEERING DATA

COMMERCIAL GRADE
BODY MATERIAL: 1/4" POLYPROPYLENE
LID MATERIAL: 3/8" POLYPROPYLENE
LINT FILTER MATERIAL: 1/4" PVC
LINT FILTER HOLES: 3/8"
CHEMICAL RESISTANT
MAXIMUM WATER TEMPERATURE: 190 DEGREES
LID ATTACHED WITH STAINLESS STEEL SCREWS
OPTIONAL SECOND FILTER CAN BE INSTALLED
CAN MANUFACTURE ANY SIZE NEEDED

UPC ®

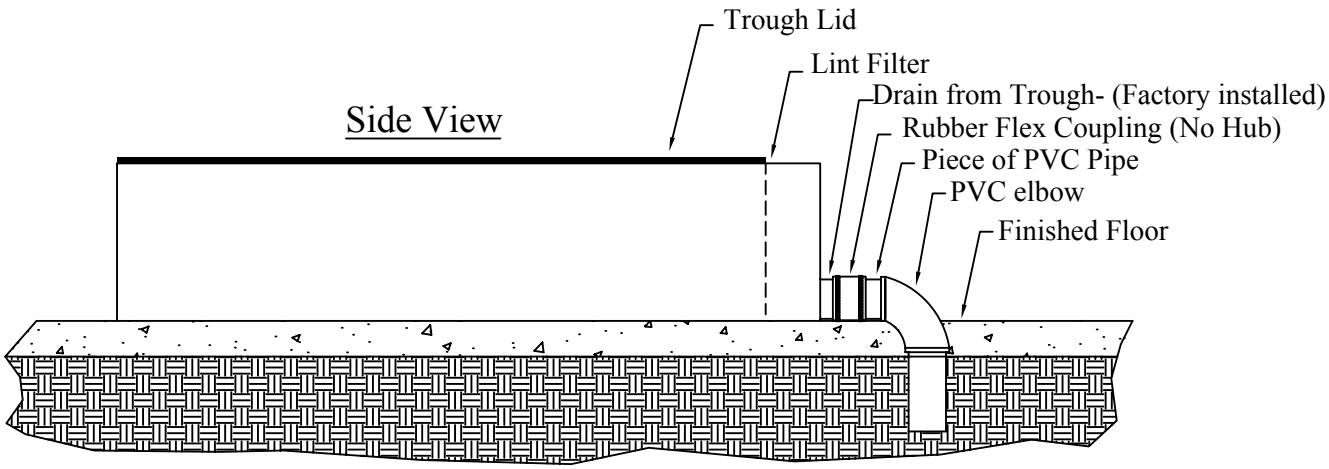
ANSI Accredited Program
PRODUCT CERTIFICATION
#0202

H-M COMPANY
Since 1957
www.draintroughs.com
2305 GILBERT AVENUE
CINCINNATI, OHIO 45206
TELEPHONE: (513) 281-3832
FAX: (513) 281-0572
TELEPHONE: (800) 365-1900

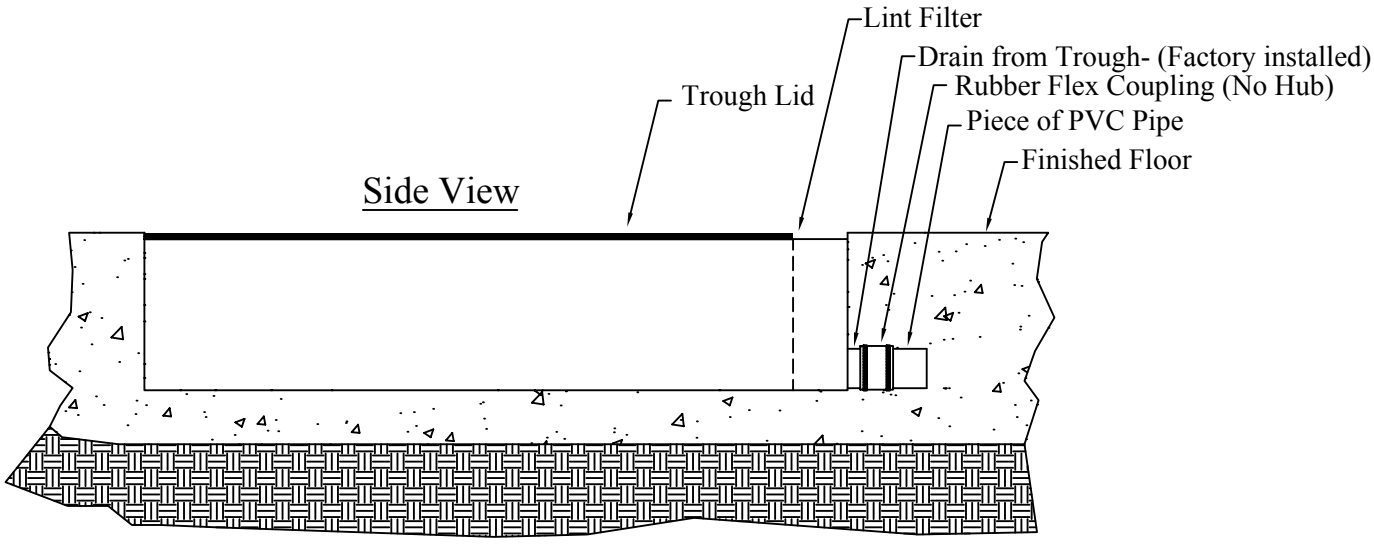
Installation Drawing

Drain Trough

Above Ground Installation



In Ground Installation



Notes

Trough is not a sealed unit and therefore requires a trap to be installed after the drain.

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03/14/2025

ITEM# B03 - BUILT-IN HANDSINK (1 EA REQ'D)

Custom CUSTOM

Five inch deep hand sink built into beverage counter

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Submittal Sheet

03/14/2025

ITEM# E05 - HAND SINK (1 EA REQ'D)

Advance Tabco 7-PS-90

Hand Sink, pedestal mounted base, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, heavy duty splash mounted faucet, pedal valves with easy access design, basket drain, wall bracket, NSF, cCSAus

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

HAND SINKS

PEDESTAL BASE

Conforms To NSF 61/9 Lead Free Requirements

Item #:_____ **Qty #:**_____

Model #:_____

Project #:_____



7-PS-90



7-PS-96



7-PS-99



7-PS-95



7-PS-18

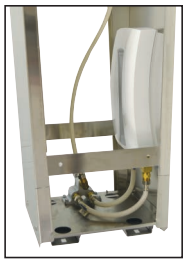
NOW AVAILABLE

Tankless Electric Heater

Only Needs Cold Water Supply

7-PS-92

Please See Tankless Heater Specification Sheet for Details



Keyhole Bracket for easier installation and greater stability.



FEATURES:

One piece **Deep Drawn** sink bowl design.

Sink bowl is 10" x 14" x 5"*.

(***7-PS-18** sink bowl is 14" x 16" x 6")

All sink bowls have a large liberal radii with a minimum dimension of 2" and are rectangular in design for increased capacity.

Keyhole wall mount bracket.

Stainless steel basket drain 1-1/2" IPS.

Flush-to-wall unit.

"Hands Free" splash mounted gooseneck faucet furnished with aerator.

Foot Pedal Valve for water operation.

Easy removable panel to access hidden plumbing.

Specific Features:

7-PS-95 towel dispenser with hinged towel box. Unit uses standard C-fold towels. Liquid Soap dispenser.

7-PS-96 includes two 7-3/4" high Side Splashes.

7-PS-99 towel dispenser & soap dispenser plus trash receptacle & cabinet storage.

CONSTRUCTION:

All TIG welded.

Welded areas blended to match adjacent surfaces and to a satin finish.

Die formed Countertop Edge with a No-Drip offset.

One sheet of stainless steel - No Seams.

MATERIAL:

Heavy gauge type 304 series stainless steel.

Wall mounting bracket is galvanized and of offset design.

All fittings are brass / chrome plated unless otherwise indicated.

MECHANICAL:

Single pedal mixing valve with 3/8" NPT Female. Built in check valve. Front operated temperature adjustment.

(Contractor on site must connect faucet to foot pedal operated valves.)

⚠ WARNING:

Equipment that includes a faucet may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info.,visit www.p65warnings.ca.gov.

ADVANCE TABCO
SMART FABRICATION™
www.advancetabco.com

Customer Service Available To Assist You 1-800-645-3166 8:30 am - 8:00 pm E.S.T.

For Orders & Customer Service:
Email: customer@advancetabco.com or Fax: 631-242-6900

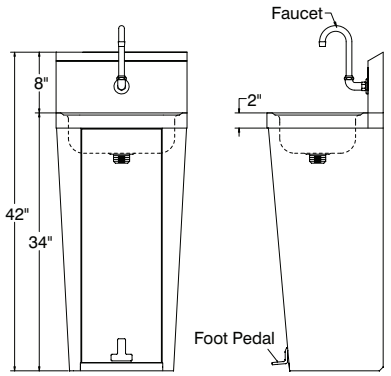
For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or Fax: 631-586-2933

REF-B

DIMENSIONS and SPECIFICATIONS

TOL Overall: ± .500" Interior: ± .250" **FITTINGS SUPPLIED AS SHOWN** **ALL DIMENSIONS ARE TYPICAL**

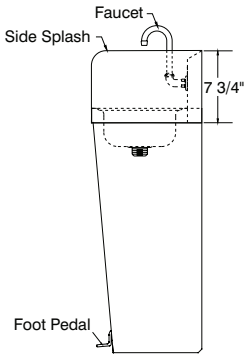
7-PS-90



Pedestal Base Front View
For 7-PS-90 & 7-PS-96

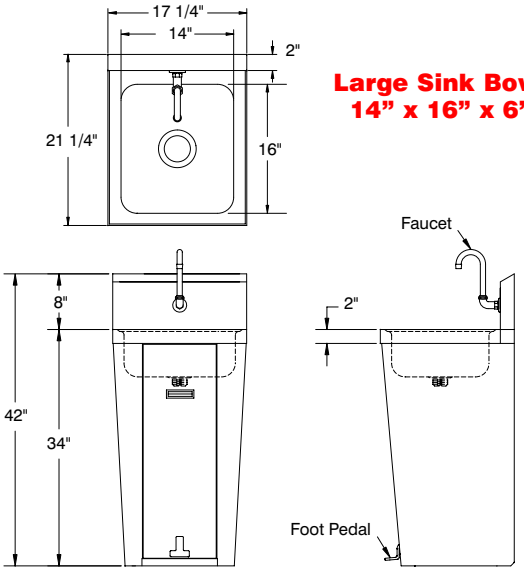
41 lbs.

7-PS-96



47 lbs.

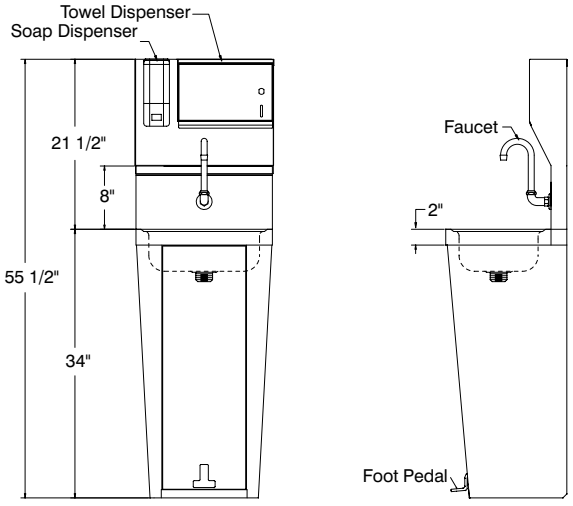
7-PS-18



Large Sink Bowl
14" x 16" x 6"

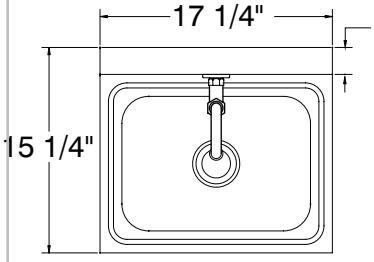
50 lbs.

7-PS-95

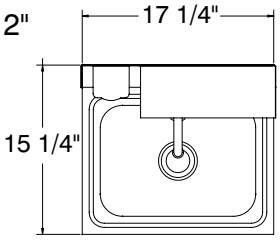


54 lbs.

TOP VIEW 7-PS-90 & 7-PS-96

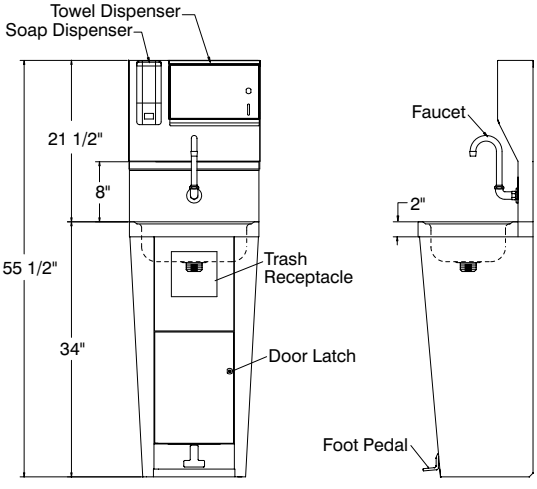


TOP VIEW 7-PS-95 & 7-PS-99



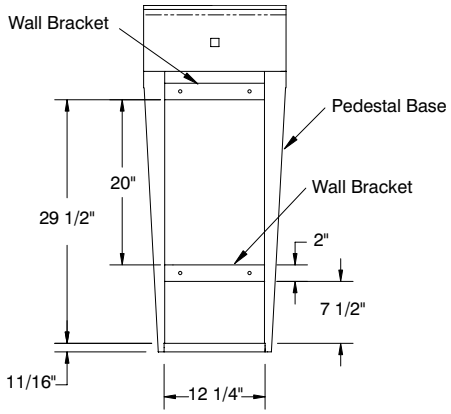
Sink Bowls 10" x 14" x 5"

7-PS-99



59 lbs.

REAR VIEW OF STANDARD PEDESTAL BASE UNITS



ADVANCE TABCO
SMART FABRICATION

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

© ADVANCE TABCO, AUGUST 2018

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Submittal Sheet

03/14/2025

ITEM# B03.1 - DECK MOUNT FAUCET (1 EA REQ'D)

Fisher 35150

Faucet, deck mount, 4" centers, 12" swivel gooseneck spout, lever handles with color coded indexes, 1/2" NPT male inlets, brass, ADA Compliant

ACCESSORIES

Mfr	Qty	Model	Spec
Fisher	1		4 year warranty against defects in materials or workmanship, standard

APPLICATION:

PRODUCT NAME:

4" C/C DECK FAUCET

JOB NAME:

QUANTITY: | ITEM NO.

☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

MODEL:

☐ 3515 W/ 12" SWIVEL GOOSENECK SPOUT

☐ 3525 W/ 6" SWIVEL GOOSENECK SPOUT

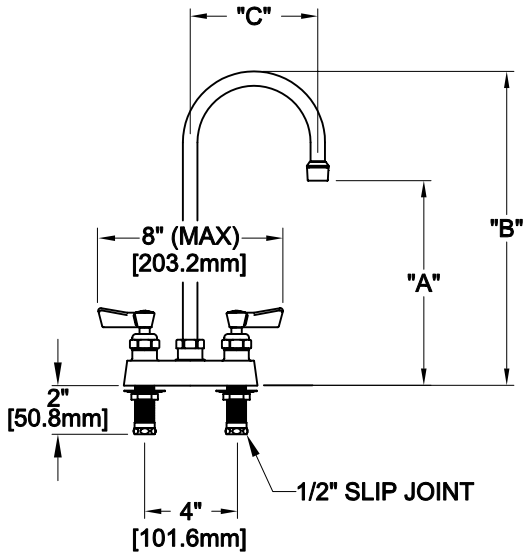
OPTIONS OR MODIFICATIONS:

☐ SUPPLY LINES (24" OR 36") CIRCLE LENGTH

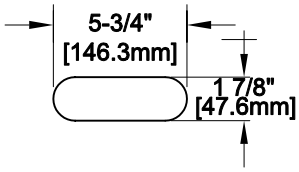
☐ VANDAL RESISTANT KIT

☐ HANDLES (CROSS OR WRIST) CIRCLE STYLE

☐ OTHER _____

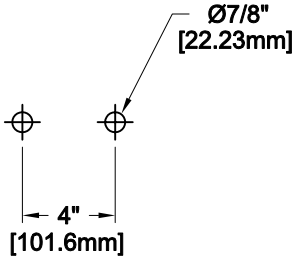


FOOTPRINT:



MODEL	DIM "A"	DIM "B"	DIM "C"
3515	8-1/2" [215.9mm]	12-1/2" [317.5mm]	5-1/2" [139.7mm]
3525	4-3/4" [120.7mm]	8-3/8" [212.7mm]	3-1/2" [88.90mm]

ROUGH-IN:



FEATURES:

* 4" C/C DECK MOUNT
* SWIVELING SEAT DISKS
* HOT SIDE STEM - RIGHT HAND
* COLD SIDE STEM - LEFT HAND
* STAINLESS STEEL SEATS
* STAINLESS STEEL SEAT SCREWS
* STAINLESS STEEL HANDLE SCREWS
* 1/2" SLIP JOINT KIT

SYSTEM LIMITS

* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE 200 PSI MAX. STATIC
* 2.20 GPM AT 80 PSI

SHIPPING WEIGHT
* 4.75 LBS

ANSI/A112.18.1M

FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3515 REV. D

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Submittal Sheet

03/14/2025

ITEM# E06 - SOILED LAUNDRY CARTS (5 EA REQ'D)

R&B Wire 416SOB

16 bu, antimicrobial soiled laundry cart

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03/14/2025

ITEM# B04 - SLIM JIM TRASH CAN

By Owner

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03/14/2025

ITEM# E07 - TWO-COMPARTMENT SINK (1 EA REQ'D)

BY GC SINKS

By Plumbing Contractor

EQPT REMARK: **BY GC - VERIFY ALL REQUIREMENTS**

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03/14/2025

ITEM# B05 - COFFEE BREWER

By Vendor

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03/14/2025

ITEM# E08 - SPARE NO.

<Spare No.>

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03/14/2025

ITEM# B06 - TEA BREWER

By Vendor

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03/14/2025

ITEM# E09 - COMMERCIAL DRYER (2 EA REQ'D)

Electrolux Professional DE-683

83 pound gas dryers

EQPT REMARK: **DUCT AND EXHAUST BY MECHANICAL CONTRACTOR**

OPL

Electrolux PROFESSIONAL

STACKED & SINGLE POCKET
HIGH-EFFICIENCY DRYERS



THE NEXT LEVEL IN DRYER TECHNOLOGY.

Reduce your energy consumption to an all-time low and provide superior linen care with the industry's most advanced commercial dryer.

INNOVATIVE TECHNOLOGY

Maximum Energy Savings

AUTOSTOP

Our smart sensor automatically lowers the temperature in the drum when garments are dry. This reduces energy consumption by 15% and eliminates the risk of overheating linens.

Faster, More Consistent Dry

REVERSE DRY

Advanced reversing cylinders prevent balling and wet spots. Our technology provides an even distribution of heat, dramatically reduces drying times, and cuts energy costs by 25%.

America's Easiest Control Panel

COMPASS PRO

With a dual-language display and exceptional programmability, Compass Pro allows laundry operations to optimize their laundry room and eliminate user error.

DE-OPL

OPL

	DE-635S	DE-650S	DE-635	DE-667	DE-683
CAPACITY (LB/KG)	2 x 35 I 2 x 16	2 x 50 I 2 x 22	35 I 16	67 I 30	83 I 37
WIDTH (IN/MM)	31 ⅛ I 790	34 ¼ I 870	28 ⅛ I 715	37 ¹³⁄₁₆ I 960	37 ¹³⁄₁₆ I 961
DEPTH (IN/MM)	43 ⅞ I 1115	52 ⁹⁄₁₆ I 1335	47 ⅝ I 1210	53 ¾ I 1365	61 ⅞ I 1560
HEIGHT (IN/MM)	76 ⅜ I 1940	82 ⅛ I 2085	66 ⁹⁄₁₆ I 1690	73 ⅛ I 1855	73 ⅛ I 1855
EXHAUST DUCT DIAMETER (IN/MM)	8 I 200	8 I 200	8 I 200	8 I 200	8 I 200
GAS (BTU/HR)	2 x 71,700	2 x 94,000	71,700	112,700	143,400
STANDARD VOLTAGES (V/Hz)	120 I 60				

PERFORMANCE

AUTOSTOP	•	•	•	•	•
AXIAL AIRFLOW	•	•	•	•	•
REVERSING CYLINDERS	•	•	•	•	•

DRYER FEATURES

COMPASS PRO	•	•	•	•	•
GALVANIZED STEEL DRUM	•	•	•	•	•
STANDARD DRYER PROGRAMS	33	33	33	33	33
CUSTOM DRYER PROGRAMS	15	15	15	15	15
AVAILABLE LANGUAGES	3	3	3	3	3

OPTIONS

o	STAINLESS STEEL FRONT PANEL	o	VOICE GUIDANCE
o	STAINLESS STEEL DRUM	o	RESIDUAL MOISTURE CONTROL

● STANDARD
o OPTIONAL

SCAN ME



TAKE YOUR LAUNDRY OPERATION TO THE NEXT LEVEL

Electrolux Professional washers and dryers are designed to work together as a complete laundry system

To achieve ultimate productivity and the greatest utility savings, pair these dryers with Electrolux Professional 450 G-force soft-mount washers.

Electrolux PROFESSIONAL
AUTHORIZED PARTNER

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PARTS: 516-371-2000 · F 516-371-4029 · parts@laundrylux.com
TECH: 516-371-0700 · F 516-371-4029 · techcare@laundrylux.com

20230113

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03/14/2025

ITEM# B07 - UNDERCOUNTER REFRIGERATOR (1 EA REQ'D)

Continental Refrigerator SW27N-U

Undercounter Refrigerator, 27"W, 7.4 cu ft capacity, one-section, (1) field rehingeable door, stainless steel front, top & end panels, aluminum interior, 1-3/8" diameter plate casters, front breathing, rear-mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/5 hp, cETLus, NSF, ENERGY STAR®

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	1		Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	1		115v/60/1-ph, 2.46 amps, cord, NEMA 5-15P, standard
Continental Refrigerator	1		Door hinged on left

UNDERCOUNTER REFRIGERATOR

Model: SW27N-U

Natural Refrigerant R-290 Model

27” Undercounter Refrigerator with Solid Door

ENERGY STAR® Qualified Commercial Refrigerator

Stainless steel front, top and end panels, aluminum back and interior.

Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**



Standard Model Features

REFRIGERATION SYSTEM

- Performance rated refrigeration system
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Automatic, hot gas condensate evaporator
- Non-corrosive, plasticized fin evaporator coil
- Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

- 2” non-CFC polyurethane foam insulation
- Smooth, polished chrome door handle
- Spring loaded, self closing door
- Magnetic snap in Santoprene™ door gasket
- Heavy duty, epoxy coated steel shelf
- Completely enclosed, vented and removable case back
- 1 3/8” diameter plate casters (factory installed)

MODEL FEATURES

- Field rehingeable door
- Electronic control, off cycle defrost
- 2” high, bottom mounted front breather air divider

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Options and Accessories

(upcharge and lead times may apply)

Stainless steel interior	Additional epoxy coated steel shelves
Stainless steel back	Stainless steel shelves
Stacking collar	Door locks
Drawers in lieu of doors (consult factory)**	Special electrical requirements (consult factory)

**Two tier: (1) 12 x 20 x 6 pan per drawer

Consult factory for other model configurations, options and accessories.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	7.4 (210 cu l)
Width, Overall (inches)	27 1/2 (699 mm)
Depth, Overall (inches) (including handle & bumpers)	32 3/16 (818 mm)
Height, Overall (inches) (including 1 3/8" plate casters)	31 13/16 (808 mm)
Shelf Area (square feet)	3.5 (0.3 sq m)
No. of Shelves	1
No. of Doors	1
Interior Depth (inches)	See Drawing
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	24 1/2 (622 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/5
Capacity (BTU per hour)*	1625

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	2.5 (2.2)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

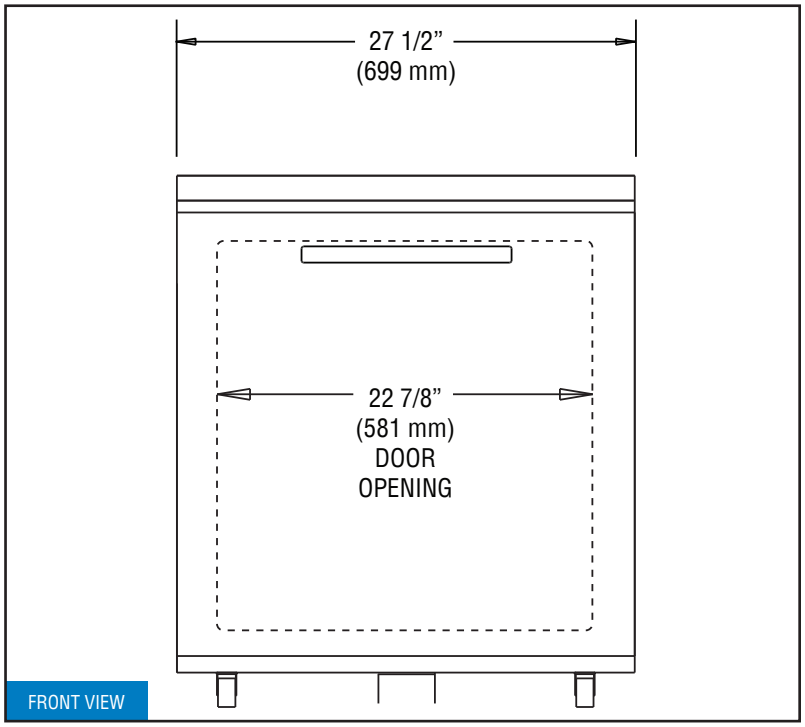
Weight (pounds)	200 (91 kg)
Height - Crated (inches)	43 1/4 (1099 mm)
Width - Crated (inches)	35 1/2 (902 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

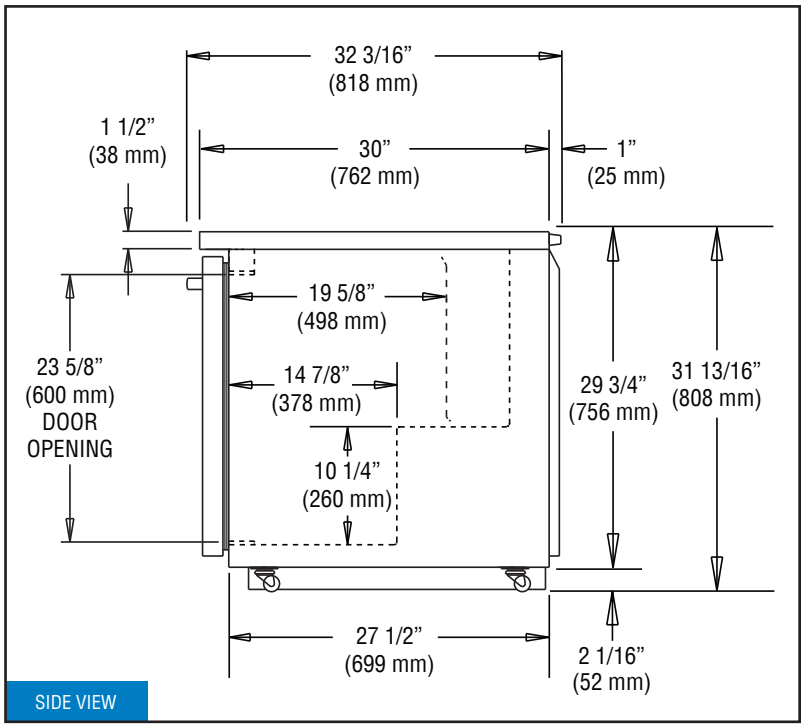
* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Model Plan Views





NOTE: For proper operation, the area under and in front of the cabinet **must** not be obstructed in any way.

Continental Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

Intertek

PROUDLY DESIGNED & ASSEMBLED IN THE U.S.A.

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A Division of National Refrigeration & Air Conditioning Products, Inc.

REVISED: 4/3/24

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# E10 - COMMERCIAL DRYER (1 EA REQ'D)

FUTURE FUTURE

83 pound gas dryer

EQPT REMARK: **DUCT AND EXHAUST BY MECHANICAL CONTRACTOR**

Electrolux PROFESSIONAL

STACKED & SINGLE POCKET HIGH-EFFICIENCY DRYERS



THE NEXT LEVEL IN DRYER TECHNOLOGY.

Reduce your energy consumption to an all-time low and provide superior linen care with the industry's most advanced commercial dryer.

INNOVATIVE TECHNOLOGY

Maximum Energy Savings

AUTOSTOP

Our smart sensor automatically lowers the temperature in the drum when garments are dry. This reduces energy consumption by 15% and eliminates the risk of overheating linens.

Faster, More Consistent Dry

REVERSE DRY

Advanced reversing cylinders prevent balling and wet spots. Our technology provides an even distribution of heat, dramatically reduces drying times, and cuts energy costs by 25%.

America's Easiest Control Panel

COMPASS PRO

With a dual-language display and exceptional programmability, Compass Pro allows laundry operations to optimize their laundry room and eliminate user error.

DE-OPL

	DE-635S	DE-650S	DE-635	DE-667	DE-683
CAPACITY (LB/KG)	2 x 35 | 2 x 16	2 x 50 | 2 x 22	35 | 16	67 | 30	83 | 37
WIDTH (IN/MM)	31 ⅛ | 790	34 ¼ | 870	28 ⅛ | 715	37 ¹³⁄₁₆ | 960	37 ¹³⁄₁₆ | 961
DEPTH (IN/MM)	43 ⅞ | 1115	52 ⁹⁄₁₆ | 1335	47 ⅝ | 1210	53 ¾ | 1365	61 ⅞ | 1560
HEIGHT (IN/MM)	76 ⅜ | 1940	82 ⅛ | 2085	66 ⁹⁄₁₆ | 1690	73 ⅛ | 1855	73 ⅛ | 1855
EXHAUST DUCT DIAMETER (IN/MM)	8 | 200	8 | 200	8 | 200	8 | 200	8 | 200
GAS (BTU/HR)	2 x 71,700	2 x 94,000	71,700	112,700	143,400
STANDARD VOLTAGES (V/Hz)			120 | 60		

PERFORMANCE

AUTOSTOP	•	•	•	•	•
AXIAL AIRFLOW	•	•	•	•	•
REVERSING CYLINDERS	•	•	•	•	•

DRYER FEATURES

COMPASS PRO	•	•	•	•	•
GALVANIZED STEEL DRUM	•	•	•	•	•
STANDARD DRYER PROGRAMS	33	33	33	33	33
CUSTOM DRYER PROGRAMS	15	15	15	15	15
AVAILABLE LANGUAGES	3	3	3	3	3

OPTIONS

o	STAINLESS STEEL FRONT PANEL	o	VOICE GUIDANCE
o	STAINLESS STEEL DRUM	o	RESIDUAL MOISTURE CONTROL

● STANDARD
o OPTIONAL



TAKE YOUR LAUNDRY OPERATION TO THE NEXT LEVEL

Electrolux Professional washers and dryers are designed to work together as a complete laundry system

To achieve ultimate productivity and the greatest utility savings, pair these dryers with Electrolux Professional 450 G-force soft-mount washers.

Electrolux PROFESSIONAL
AUTHORIZED PARTNER

Laundrylux
800-645-2204 • LAUNDRYLUX.COM

461 DOUGHTY BOULEVARD, INWOOD, NEW YORK 11096-0338
SALES: 516-371-4400 · F 516-371-4204 · sales@laundrylux.com
PARTS: 516-371-2000 · F 516-371-4029 · parts@laundrylux.com
TECH: 516-371-0700 · F 516-371-4029 · techcare@laundrylux.com

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03/14/2025

ITEM# B08 - ESPRESSO CAPPUCCINO MACHINE (1 EA REQ'D)

Nuova Simonelli APPIA LIFE COMPACT VOL 110V

MAPPC19VOL02ND0002 Appia Life Espresso Machine, automatic, with volumetric dosing, 2 group compact, 7.5 liter boiler, 2 steam wands (Cool Touch), hot water nozzle, Black, 1.5kW, 110-125v/60/1-ph, 13 amps, NEMA 5-15P, UL, CSA, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Nuova Simonelli	1		2 year parts warranty on espresso equipment, standard

Nuova Distribution USA, LLC
6940 Salashan Parkway, Building A • Ferndale, WA 98248
www.nuovadistribution.com • (p) 360-366-2226 • (f) 360-366-4015

Appia Life Compact 2 Gr Vol 110v Spec Sheet

Water Requirements

- 3/8” dedicated cold water line with shut-off valve and compression fitting.
- Water hardness cannot exceed 3gpg or 50 ppm. If water hardness exceeds 3gpg a water softener must be installed.
- Minimum incoming water flow rate of 35 GPH and maximum line pressure of 70 PSI / 5 BAR.

Water Softening Equipment

1. Water Softener Capacity: Single - 4400 gpg
2. Water Softener Capacity: Double - 8800 gpg
3. Water Softener Capacity: Triple - 13200 gpg
4. Water Softener Capacity: Automatic - Programmable
5. Water Softener Capacity: Manual - 4400 gpg

Power Requirements

- Volts: 115 (voltage range of 110-125)
- Watts: 1500
- Amp draw: 13
- Receptacle: Nema 5-15


Nema 5-15

NSF / ANSI Std.4

The average water consumption of this machine is 4 gallons per day, which represents 128 drinks at 4oz per drink.

Water Softener/Maintenance Calculation

Cartridge Grain Capacity	÷	Water Hardness (grains per gallon)	=	Gallon Capacity of Cartridge	÷	Gallons of Water Used per Day	=	Days Until Cartridge Needs to be Replaced
_____	÷	_____	=	_____	÷	_____	=	_____

Shipping Dimensions & Weight

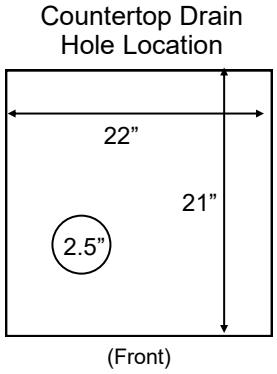
- Height: 32 inches
- Depth: 26 inches
- Width: 36 inches
- Weight: 145 pounds

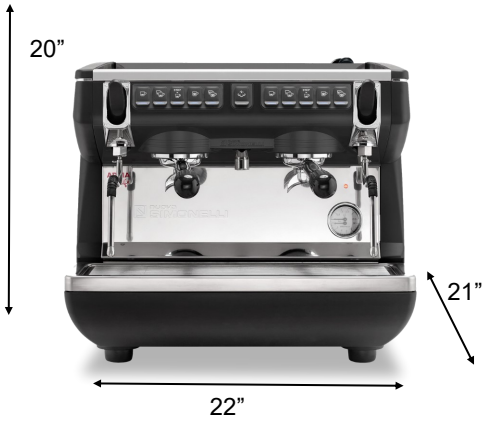
Counter Space Requirements

- Height: 20 inches
- Depth: 21 inches
- Width: 22 inches
- Weight: 130 pounds

Drain Requirements

- Open gravity drain of minimum 1.25 inch I.D., within 4 feet of the machine.





I, the customer, understand that these requirements must be in when the installer arrives. Failure to have the site ready will result in additional service and travel charges, and may cause further delays in installation.

Customer Name: _____ Signature: _____

Company Name: _____

Phone: _____ Fax: _____ Email: _____

Version 4.0

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ITEM# E11 - COUNTER W/ SINK (1 EA REQ'D)
BY GC MILLWORK
counters with storage
EQPT REMARK: **BY GC - VERIFY ALL REQUIREMENTS**

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03/14/2025

ITEM# B09 - SYRUP RACK

By owner

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03/14/2025

ITEM# E12 - MOBILE FOLDING TABLE (1 EA REQ'D)

Custom CUSTOM

S/s mobile table with s/s undershelf

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03/14/2025

ITEM# B10 - REFRIGERATED MERCHANDISER (1 EA REQ'D)

True Mfg. - General Foodservice GDM-23-HC~TSL01

Refrigerated Merchandiser, one-section, True standard look version 01, (4) shelves, (1) Low-E thermal glass hinged door, LED interior lights, powder coated steel exterior, white aluminum interior with stainless steel floor, R290 Hydrocarbon refrigerant, 1/3 HP, 115v/60/1-ph, 5.4 amps, NEMA 5-15P, cULus, UL EPH Classified, CE, Made in USA, ENERGY STAR®

ACCESSORIES

Mfr	Qty	Model	Spec
True Mfg. - General Foodservice	1		7 year compressor warranty, 7 years parts warranty, 7 year labor warranty, standard. Visit www.truemfg.com for specifics.
True Mfg. - General Foodservice	1		Self-contained refrigeration standard
True Mfg. - General Foodservice	1		Exterior: Black powder coated steel, standard
True Mfg. - General Foodservice	1		Interior: White aluminum, with white shelving, standard
True Mfg. - General Foodservice	1		Door hinged right standard
True Mfg. - General Foodservice	1		Illuminated sign decal: S-TS-02 "TRUE Stripe" graphic, standard
True Mfg. - General Foodservice	1		Castors, 2-1/2"

TRUE MANUFACTURING CO., INC.
U.S.A. FOODSERVICE DIVISION
2001 East Terra Lane • O'Fallon, Missouri 63366-4434 • (636)240-2400
Fax (636)272-2408 • Toll Free (800)325-6152 • Intl Fax# (001)636-272-7546
Parts Dept. (800)424-TRUE • Parts Dept. Fax# (636)272-9471 • www.truemfg.com

Project Name: _____ *AIA #*

Location: _____

Item #: _____ *Qty:* _____ *SIS #*

Model #: _____

Model:
GDM-23-HC~TSL01

Glass Door Merchandiser:
Swing Door Refrigerator with Hydrocarbon Refrigerant~True Standard Look Version 01



GDM-23-HC~TSL01

- The world's #1 manufacturer of glass door merchandisers.
- Factory engineered, self-contained, capillary tube system using environmentally friendly R290 hydro carbon refrigerant that has zero (0) ozone depletion potential (ODP), & three (3) global warming potential (GWP).
- Exterior - non-peel or chip black powder coated cold rolled steel; durable and permanent.
- Interior - attractive, NSF approved, white aluminum interior liner with stainless steel floor.
- Self closing door. Positive seal, torsion type closure system.
- LED interior lighting provides more even lighting throughout the cabinet. Safety shielded.
- "Low-E", double pane thermal insulated glass door assembly with extruded aluminum frame. The latest in energy efficient technology.
- Entire cabinet structure is foamed-in-place using a high density, polyurethane insulation that has zero ozone depletion potential (ODP) and zero global warming potential (GWP).

Bottom mounted units feature

- "No stoop" lower shelf to maximize product visibility.
- Storage on top of cabinet.
- Easily accessible condenser coil for cleaning.

Exterior Color Options



Standard Black Exterior



Optional White Exterior



Optional Stainless Exterior

ROUGH-IN DATA

Specifications subject to change without notice.
Chart dimensions rounded up to the nearest ⅛" (millimeters rounded up to next whole number).

Model	Doors	Shelves	Cabinet Dimensions (inches) (mm) W	D†	H	HP	Voltage	Amps	NEMA Config.	Cord Length (total ft.) (total m)	Crated Weight (lbs.) (kg)
GDM-23-HC~TSL01	1	4	27 686	29⅞ 759	78⅝ 1998	⅓ ⅓	115/60/1 230-240/50/1	5.4 2.4	5-15P ▲	9 2.74	355 161

† Depth does not include 1⅝" (42 mm) for door handles.

▲Plug type varies by country.

MADE WITH INNOVATION IN THE USA · 5 YEAR COMPRESSOR WARRANTY USA · ENERGY STAR · c UL us · CE · natural refrigerant.

9/18 Printed in U.S.A.

APPROVALS:

AVAILABLE AT:

Model:
GDM-23-HC~TSL01

Glass Door Merchandiser:
Swing Door Refrigerator with Hydrocarbon Refrigerant~True Standard Look Version 01

STANDARD FEATURES

DESIGN
- True's commitment to using the highest quality materials and oversized refrigeration systems provides the user with colder product temperatures, and lower utility costs in an attractive merchandiser that brilliantly displays packaged food and beverages.

REFRIGERATION SYSTEM
- Factory engineered, self-contained, capillary tube system using environmentally friendly R290 hydrocarbon refrigerant that has zero (0) ozone depletion potential (ODP), & three (3) global warming potential (GWP).
- High capacity, factory balanced refrigeration system that maintains cabinet temperatures of 33°F to 38°F (.5°C to 3.3°C) for the best in food preservation.
- State of the art, electronically commutated evaporator and condenser fan motors. ECM motors operate at higher peak efficiencies and move a more consistent volume of air which produces less heat, reduces energy consumption and provides greater motor reliability.
- Bottom mounted condensing unit positioned for easy maintenance. "No stoop" lower shelf maximizes visibility by raising merchandised product to higher level.

CABINET CONSTRUCTION
- Exterior - non-peel or chip black powder coated cold rolled steel; durable and permanent.
- Interior - attractive, NSF approved, white aluminum liner with stainless steel floor.
- Insulation - entire cabinet structure is foamed-in-place using a high density, polyurethane insulation that has zero ozone depletion potential (ODP) and zero global warming potential (GWP).
- Welded, heavy duty steel frame rail, black powder coated for corrosion protection.
- Frame rail fitted with leg levelers.
- Illuminated exterior sign panel. Variety of sign options available.

DOOR
- "Low-E", double pane thermal insulated glass door assemblies with extruded aluminum frame. The latest in energy efficient technology.
- Door fitted with 12" (305 mm) long extruded handle.
- Self closing door. Positive seal, torsion type closure system.
- Magnetic door gasket of one piece construction, removable without tools for ease of cleaning.

SHELVING
- Four (4) adjustable, heavy duty PVC coated wire shelves 22 9/16"L x 23 1/4"D (574 mm x 591 mm). Four (4) chrome plated shelf clips included per shelf.
- Shelf support pilasters made of same material as cabinet interior; shelves are adjustable on 1/2" (13 mm) increments.

LIGHTING
- LED interior lighting provides more even lighting throughout the cabinet. Safety shielded.

MODEL FEATURES
- Evaporator is epoxy coated to eliminate the potential of corrosion.
- See our website www.truemfg.com for latest color and sign offerings.
- Convenient clean-out drain built in cabinet floor.
- Listed under NSF/ANSI Standard 7 for the storage and/or display of packaged or bottled product.

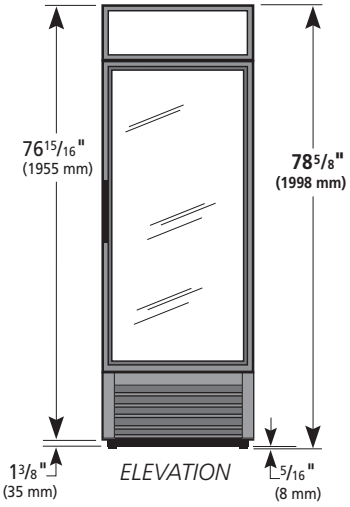
ELECTRICAL
- Unit completely pre-wired at factory and ready for final connection to a 115/60/1 phase, 15 amp dedicated outlet. Cord and plug set included.



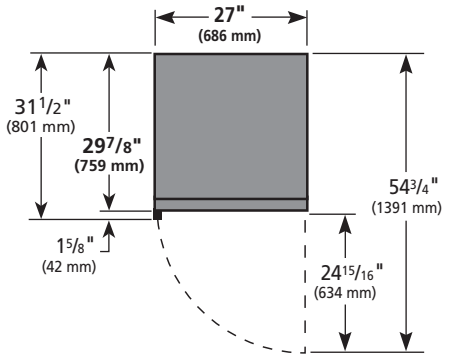
115/60/1
NEMA-5-15R

OPTIONAL FEATURES/ACCESSORIES
Upcharge and lead times may apply.
- ❑ 230 - 240V / 50 Hz.
- ❑ White exterior.
- ❑ Stainless steel exterior.
- ❑ Black aluminum interior liner with black shelving.
- ❑ Stainless steel interior liner.
- ❑ 6" (153 mm) standard legs.
- ❑ 6" (153 mm) seismic/flanged legs.
- ❑ 2 1/2" (64 mm) diameter castors.
- ❑ 4" (102 mm) diameter castors.
- ❑ Red wine thermostat.
- ❑ White wine thermostat.
- ❑ Chocolate thermostat.
- ❑ Barrel Locks – located in grill assembly (requires one per door)
- ❑ Wine racks.
- ❑ Sliding wine racks.
- ❑ Additional shelves.
- ❑ TrueFlex gravity feed organizers.
- ❑ Pricing strips.

PLAN VIEW



ELEVATION



PLAN VIEW

WARRANTY
Three year warranty on all parts and labor and an additional 2 year warranty on compressor. (U.S.A. only)

METRIC DIMENSIONS ROUNDED UP TO THE NEAREST WHOLE MILLIMETER

SPECIFICATIONS SUBJECT TO CHANGE WITHOUT NOTICE

Model	Elevation	Right	Plan	3D	Back
GDM-23-HC~TSL01					

TRUE MANUFACTURING CO., INC.
2001 East Terra Lane • O'Fallon, Missouri 63366-4434 • (636)240-2400 • Fax (636)272-2408 • Toll Free (800)325-6152 • Intl. Fax# (001)636-272-7546 • www.truemfg.com

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ITEM# E13 - CLEAN LAUNDRY SHELVING

By GC

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03/14/2025

ITEM# B11 - SPARE NO.

<Spare No.>

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ITEM# B12 - SPARE NO.

<Spare No.>

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ITEM# B13 - ISLAND COUNTER

Millwork, By GC

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03/14/2025

ITEM# B14 - DROP-IN SINK (1 EA REQ'D)

Advance Tabco DI-1-1515

Special Value Drop-In Sink, 1-compartment, 15"W x 15"D x 6" deep (overall), 12-1/4" wide x 10-1/4" front-to-back x 6" deep bowl, no drip self-rimmed edge, 20/304 stainless steel, with 4" on-center deck mounted gooseneck faucet, 3-1/2" basket drain with strainer, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Advance Tabco	1	K-316-LU	Wrist Handles Only, for splash or deck mount hand sink faucet (1 pair hot & cold 4" long blades), fits faucets supplied after November 2015 with hot & cold color rings that do not have exposed screw head

STAINLESS STEEL

DROP-IN SINKS
ONE COMPARTMENT
NO DRIP SELF-RIMMED EDGE



Item #: _____ Qty #: _____
Model #: _____
Project #: _____

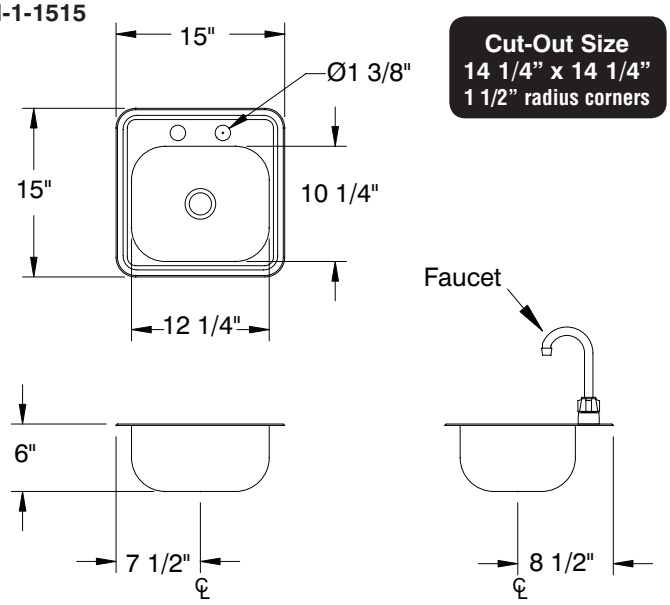
DIMENSIONS and SPECIFICATIONS

MODEL#	COMP	OVERALL LxW	BOWL SIZE LxW	DEPTH
DI-1-1515	1	15" x 15"	12-1/4" x 10-1/4"	6"

Length is Left to Right. Width is Front to Back

TOL ± .125" ALL DIMENSIONS ARE TYPICAL

DI-1-1515



Cut-Out Size
14 1/4" x 14 1/4"
1 1/2" radius corners

Approx. Wt. 11 lbs.

FEATURES:
One piece seamless **Deep Drawn** stainless steel bowl.
Self rimming design & bowl is sound deadened.
Raised, No Drip Self-Rim Edge. Mounting clips provided accommodates all thicknesses of counter.
K-52 faucet and drain

MATERIALS:
Stainless Steel Type 304, 20 Gauge.
Stainless Steel 3-1/2" Basket Drain.
Faucet is brass-nickel plated.

DESIGN:
Unit punched with 1-3/8" dia. faucet holes.

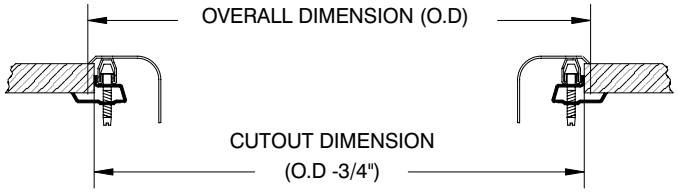
MECHANICAL:
Faucet supply is 1/2" IPS male thread.
Deck mounted faucet is furnished with aerator and 4" O.C.



STANDARD MOUNTING CLIPS
For countertops over 7/8" and up to 2" thick.
Replacement # K-28 (Per Sink)

Available Faucets & Accessories	Model #	Qty
Deck Mounted 3 1/2" Gooseneck. 4" O.C.	K-52	
Deck Mtd. X.H.D. 3 1/2" Gooseneck. 4" O.C.	K-62	
Mounting Clips (Bag of 4).	K-28	

TYPICAL INSTALLATION



Cut-Out Size = L to R x F to B

Standard Mounting Clips Fit Countertops Over 7/8" & Up To 2" Thick.

⚠ **WARNING:** Faucets on this page may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info.,visit www.p65warnings.ca.gov.

ADVANCE TABCO SMART FABRICATION™ www.advancetabco.com

Customer Service Available To Assist You 1-800-645-3166 8:30 am - 8:00 pm E.S.T.

For Orders & Customer Service:
Email: customer@advancetabco.com or **Fax:** 631-242-6900

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Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

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FAUCET PARTS & ACCESSORIES

Faucet Repair Kit
For K-22, K-59, K-123, K-125, K-126, K-206 & K-316 Faucets
Includes 2 Cartridges and Handles

*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.

K-00A (Set of 2)



Faucet Repair Kit
For K-1, K-11, K-50, K-51, K-52, K-53, K-56, K-124, K-101, K-160, K-208 & K-240 Faucets
Includes 2 Cartridges and Handles

*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.

K-00B (Set of 2)





K-02 Filler Faucet Repair Kit
For K-54 & K-54A Faucets

*Can Only Be Used On Faucets Purchased From 2016 - 2019. For Older Faucets, See Below.



K-02A Filler Faucet Repair Kit
For K-54 & K-54A Faucets

*Can Only Be Used On Faucets Purchased Before January 2016 or After 2019.



Service Faucet Vacuum Breaker Repair Kit
For K-240 Faucet

*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.

K-03

Pedal/Knee Valve Replacement Parts

Replacement Bonnet for Pedal/Knee Valve
For K-103, K-104, 7-PS-32 & 7-PS-39

K-01



Replacement Check Valves
For K-103, K-104, 7-PS-32 & 7-PS-39

K-19



Thermostatic Mixing Valve
For K-103, K-104, 7-PS-32 & 7-PS-39

K-425



Mixing Valve & Retainer
For K-103, K-104, 7-PS-32 & 7-PS-39

K-19A



Faucet Options & Accessories

Hands-Free Wand





K-400

Low Flow Aerator



.5 GPM

K-08

Wrist Handles (Pair)



*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.

K-316-LU

Wrist Handles (Pair)
For Heavy Duty 8" O.C. Faucets



K-416-LU

Splash Mount Faucet Mounting Kit
K-1, K-11, K-101, K-105, K-112, K-119 & K-211



K-06

Faucet Wall Mounting Bracket
8" O.C.



K-30

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www.advancetabco.com

Customer Service Available To Assist You 1-800-645-3166 8:30 am - 7:00 pm E.S.T.

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03/14/2025

ITEM# B15 - DROP-IN ICE BIN (1 EA REQ'D)

Advance Tabco D-24-IBL

Ice Bin, drop-in, 50-lb ice capacity, 21”W x 18”D x 14" deep overall (bin size 18"W x 13-5/8"D x 11" deep), removable stainless steel sliding cover, insulated, 1" diameter drain, NSF (cutout size 15-1/4" x 20-3/8")

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

Drop-In Ice Bins



D-24-IBL
Shown

Item #: _____ Qty #: _____
Model #: _____
Project #: _____

FEATURES:

11" deep ice bin.
Optional 7-Circuit cold plate sealed into the bottom.
Rubber thermal breaker reduces condensation.
Includes stainless steel sliding cover.

MECHANICAL:

1" IPS drain (non-cold plate models)
1/2" IPS drain (cold plate models)

MATERIAL:

Ice Bin: 20 gauge, 300 stainless steel
Jacket: 20 gauge galvanized steel
Cover: 20 gauge stainless steel
Ice Bin Insulation: Foam Insulation
Molding: Extruded black polyethylene thermal breaker marine edge

Model #	Dimension (L)	Dimension (B)	Cut Out Size W x L	Ice Capacity	Approx. Weight	Approx. Cu. Ft.
D-12-IBL	12"	6"	15 1/4" x 9 5/8"	23 lbs.	22 lbs.	3
D-24-IBL	21"	10 1/2"	15 1/4" x 20 3/8"	50 lbs.	39 lbs.	5
D-30-IBL	27"	13 1/2"	15 1/4" x 26 3/8"	62 lbs.	62 lbs.	8
D-36-IBL	33"	16 1/2"	15 1/4" x 32 3/8"	75 lbs.	67 lbs.	9

With 7-Circuit Cold Plate

D-24-IBL-7	21"	10 1/2"	15 1/4" x 20 3/8"	50 lbs.	84 lbs.	5
D-30-IBL-7	27"	13 1/2"	15 1/4" x 26 3/8"	62 lbs.	107 lbs.	8
D-36-IBL-7	33"	16 1/2"	15 1/4" x 32 3/8"	75 lbs.	113 lbs.	9

REPLACEMENT ICE BIN COVERS

Model #	For Use With:
D-12	D-12-IBL, D-24-WSIBL, D-24-WSIBL2, D-24-SIBL
D-24	D-24-IBL, D-24-IBL-7
D-24V	D-24-IBL, D-24-IBL-7 Units oriented with 18" dimension left-to-right
D-30	D-30-IBL, D-30-IBL-7
D-36	D-36-IBL, D-36-IBL-7



D-12
Shown

Cover designed to open front-to-rear, with 18" ice bin dimension front-to-rear.
(D-24-WSIBL2 opens left to right when installed with 21" front-to-rear)

ADVANCE TABCO
SMART FABRICATION™
www.advancetabco.com

Customer Service Available To Assist You 1-800-645-3166 8:30 am - 8:00 pm E.S.T.

For Orders & Customer Service:
Email: customer@advancetabco.com or **Fax:** 631-242-6900

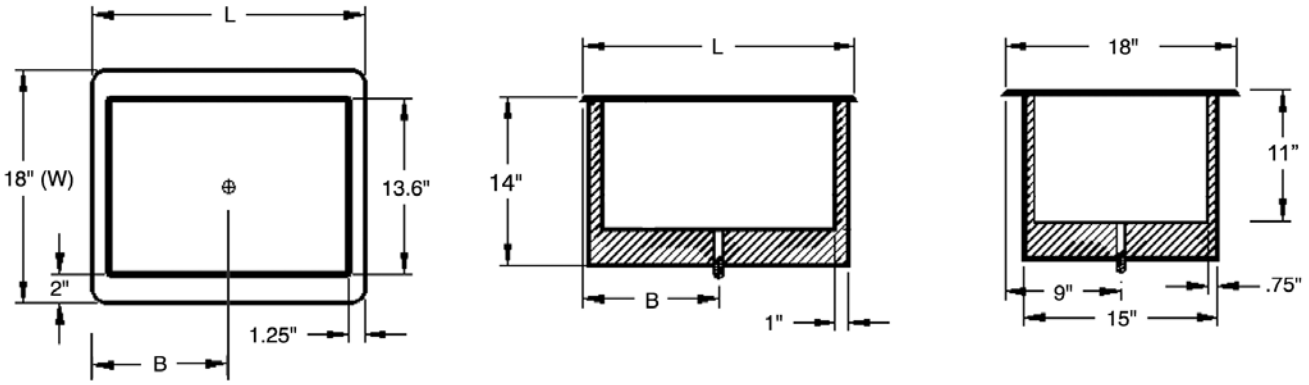
For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

REF-W

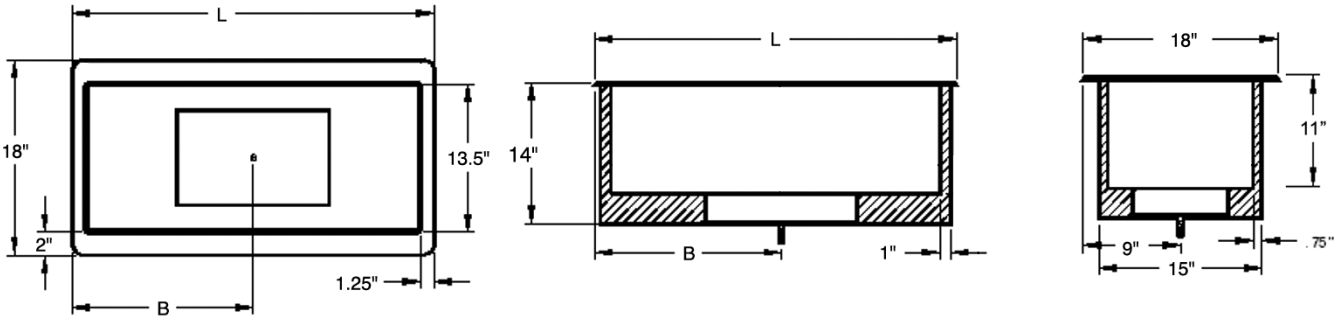
DIMENSIONS and SPECIFICATIONS

TOL Overall: ± .500” Interior: ± .250” ALL DIMENSIONS ARE TYPICAL

Non-Cold Plate Models



Cold Plate Models



ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.

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Submittal Sheet

03/14/2025

ITEM# B16 - BLENDER, BAR (2 EA REQ'D)

Vitamix 062824

Drink Machine Advance®, stackable 48 oz. (1.4 liter) clear BPA Free Tritan™ Advance® container, includes (6) pre-loaded programs, includes: Advance® blade assembly & lid, black base, 2.3 peak HP, 120v/50/60/1-ph, 11.5 amps, NEMA 5-15P, cULus, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Vitamix	2		3 years warranty on motor base parts & 1 year warranty on labor, standard
Vitamix	2	015578	Sound Reducing Centering Pad (for Drink Machine™ Advance®)

DRINK MACHINE ADVANCE®



Vitamix® COMMERCIAL

An Essential Tool for Maximizing Your Beverage Program

From smoothies to frozen cocktails, the Drink Machine Advance® is an essential tool for adding or expanding a blended beverage program in any bar, restaurant, or cafe.

Smart Product Design

- 6 optimized programs and automatic shut-off means you can turn it on, walk away, and achieve consistent results
- Pulse Control provides off-menu flexibility to fine tune recipes
- 48-ounce Advance® container creates faster, smoother pours resulting in time and cost savings along with improved customer experience
- ≈2.3 HP motor is designed to resist overheating when blending extra-thick ingredients, resulting in cooler operation and enhanced reliability during peak hours
- Sturdy controls provide improved grip

Una Herramienta Esencial para Maximizar su Programa de Bebidas

Desde smoothies hasta cocteles frozen, la Drink Machine Advance es una herramienta esencial para ampliar un programa de bebidas en cualquier bar, restaurante o cafetería.

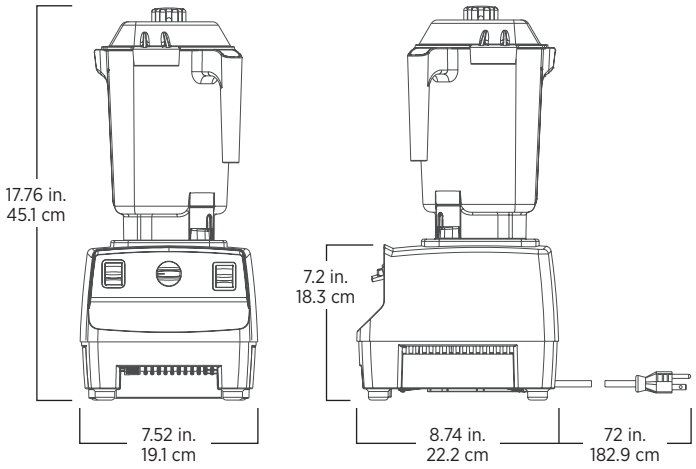
Diseño Inteligente del Producto

- Sus 6 programas optimizados y el apagado automático le permiten encender la licuadora, alejarse un momento y lograr resultados de calidad consistente
- Su control de pulsos brinda la flexibilidad para perfeccionar recetas fuera del menú
- El vaso Advance de 48 onzas mezcla, sirve rapida y fácilmente, lo que permite ahorrar tiempo y dinero mejorando así la experiencia del cliente
- Su motor de ≈2.3 HP está diseñado para resistir sobrecalentamientos cuando se mezclan ingredientes muy dificiles, logrando un funcionamiento más frío y mayor confiabilidad durante las horas de mayor demanda
- Sus robustos controles proporcionan un mejor agarre

vitamix.com/commercial

DRINK MACHINE ADVANCE®

062824 & 062825



Includes Drink Machine Advance® with 48-ounce high-impact, clear/stackable Advance® container, complete with Advance blade assembly and lid, and black or red base.

The Drink Machine Advance is backed by a three-year warranty on motor base parts and a one-year warranty on labor. For more complete warranty terms and conditions, please visit vitamix.com/commercial.

La Drink Machine Advance viene con un vaso Advance de alto impacto, transparente y apilable de 48 onzas y con un ensamble de cuchillas y tapa Advance, y una base de color negro o rojo.

La Drink Machine Advance está respaldada por una garantía de tres años en piezas de la base del motor y un año en mano de obra. Para conocer los términos y condiciones completos de la garantía, visite vitamix.com/commercial.

Product Specifications

Item Number	062824 Black	062825 Red
Motor	≈2.3 peak output horsepower motor	
Electrical	120 V, 50-60 Hz, 11.5 A	
Net Weight	11.53 lbs. *(13.54 lbs. with box)*	
Dimensions	17.76 x 7.52 x 8.74 in. *(HxWxD)*	

Also Available

62947	32 oz. Aerating container *(complete with aerating blade assembly, lid, and mini tamper)*		
15978	48 oz. Clear Advance container*		
58988	48 oz. Blue Advance container*	58990	48 oz. Orange Advance container*
58989	48 oz. Yellow Advance container*	58991	48 oz. Purple Advance container*

**Complete with Advance blade assembly and lid*

Especificaciones del Producto

Número de Artículo	062824 Negro	062825 Rojo
Motor	≈2.3 HP de potencia de salida máxima	
Especificaciones Eléctricas	120 V, 50-60 Hz, 11.5 A	
Peso Neto	11.53 lb *(13.54 lb con la caja)*	
Dimensiones	17.76 x 7.52 x 8.74 pulg *(Al x An x Pr)*	

También Disponible

62947	Vaso para aireación de 32 onzas *(viene con ensamble de disco para aireación, tapa y mini tamper)*		
15978	Vaso Advance transparente de 48 onzas*		
58988	Vaso Advance azul de 48 onzas*	58990	Vaso Advance anaranjado de 48 onzas*
58989	Vaso Advance amarillo de 48 onzas*	58991	Vaso Advance morado de 48 onzas*

**Incluye ensamble de cuchillas y tapa Advance*

Contact Information

U.S.A.

800.4DRINK4 or 800.437.4654

commercial@vitamix.com

Información de Contacto

Latin America

+1.440.782.2450

international@vitamix.com

vitamix.com/commercial

For more information, contact your local foodservice distributor.

Para más información, póngase en contacto con su distribuidor local de equipos para food service.

Vitamix COMMERCIAL

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03/14/2025

ITEM# B17 - REACH-IN UNDERCOUNTER FREEZER (1 EA REQ'D)

Continental Refrigerator SWF27N-U

Undercounter Freezer, 27"W, 7.4 cu ft capacity, one-section, (1) field rehingeable door, stainless steel front, top & end panels, aluminum interior, 1-3/8" diameter plate casters, front breathing, rear-mounted self-contained refrigeration, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	1		Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	1		115v/60/1-ph, 4.8 amps, cord, NEMA 5-15P, standard
Continental Refrigerator	1		Door hinged on left

UNDERCOUNTER FREEZER (0°F)

Model: SWF27N-U

Natural Refrigerant R-290 Model

27” Undercounter Freezer
with Solid Door

Stainless steel front, top and end panels, aluminum back and interior.

Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**



Standard Model Features

REFRIGERATION SYSTEM

- Performance rated refrigeration system
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Automatic, hot gas condensate evaporator
- Non-corrosive, plasticized fin evaporator coil
- Easily serviceable, back mounted compressor

CABINET ARCHITECTURE

- 2” non-CFC polyurethane foam insulation
- Smooth, polished chrome door handle
- Spring loaded, self closing door
- Magnetic snap in Santoprene™ door gasket
- Heavy duty, epoxy coated steel shelf
- Completely enclosed, vented and removable case back
- 1 3/8” diameter plate casters (factory installed)

MODEL FEATURES

- Field rehingeable door
- Electronic control, automatic electric defrost
- 2” high, bottom mounted front breather air divider

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Options and Accessories

(upcharge and lead times may apply)

Stainless steel interior	Additional epoxy coated steel shelves
Stainless steel back	Stainless steel shelves
Drawers in lieu of doors (consult factory)**	Door locks
	Special electrical requirements (consult factory)

**Two tier: (1) 12 x 20 x 6 pan per drawer

Consult factory for other model configurations, options and accessories.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	7.4 (210 cu l)
Width, Overall (inches)	27 1/2 (699 mm)
Depth, Overall (inches) (including handle & bumpers)	32 3/16 (818 mm)
Height, Overall (inches) (including 1 3/8" plate casters)	31 13/16 (808 mm)
Shelf Area (square feet)	3.5 (0.3 sq m)
Number of Shelves	1
Number of Doors	1
Interior Depth (inches)	See Drawing
Interior Height (inches)	26 1/4 (667 mm)
Interior Width (inches)	24 1/2 (622 mm)

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4
Capacity (BTU per hour)*	1572

ELECTRICAL DATA

Voltage (International)	115/60/1 (220/50/1)
Total Amps (International)	4.0 (2.8)
Defrost Amps (International)	4.8 (2.4)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

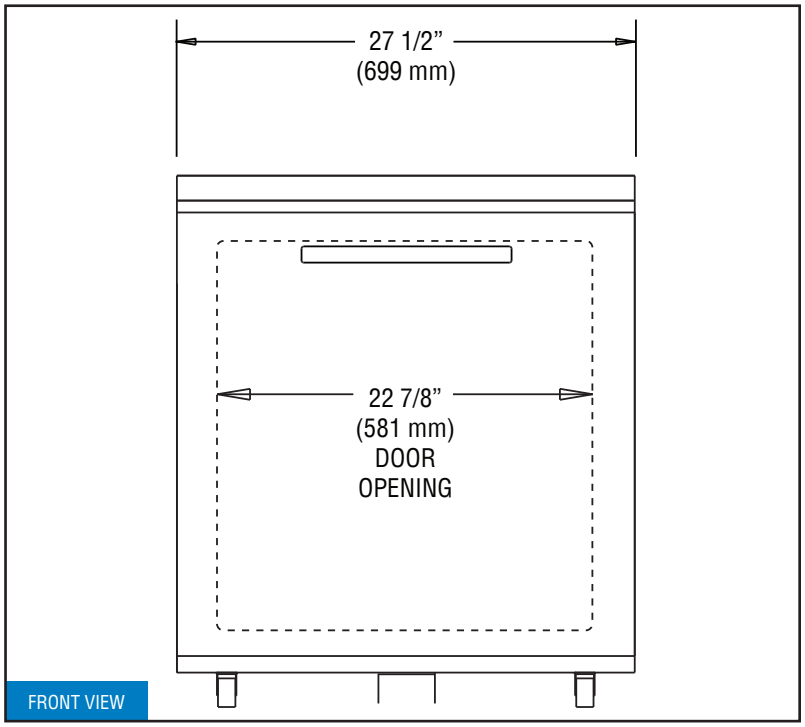
Weight (pounds)	200 (91 kg)
Height - Crated (inches)	43 1/4 (1099 mm)
Width - Crated (inches)	35 1/2 (902 mm)
Depth - Crated (inches)	37 1/4 (946 mm)

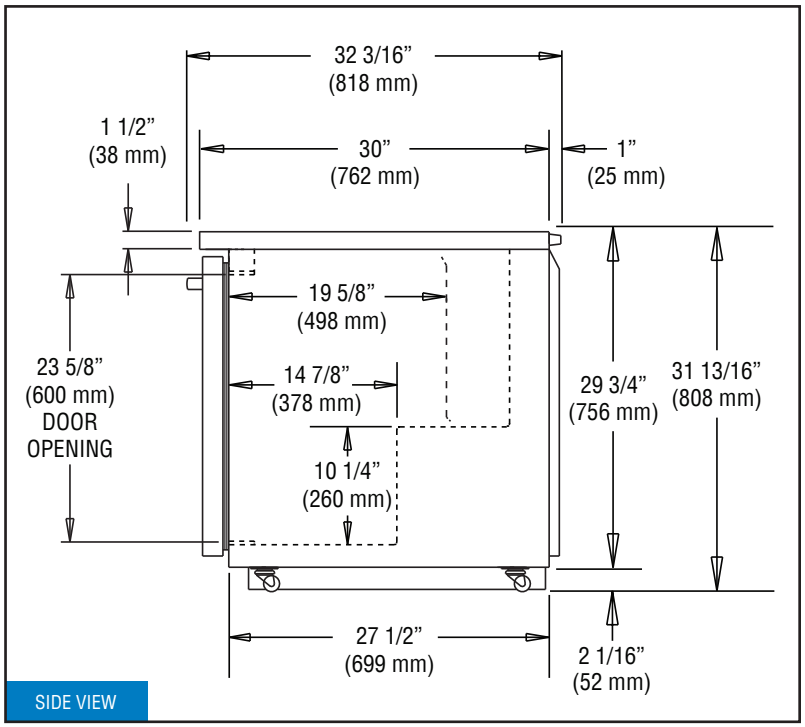
* Rating @ -15°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.



Equipped with one NEMA-5-15P Plug
(varies by country)

Model Plan Views





NOTE: For proper operation, the area under and in front of the cabinet **must** not be obstructed in any way.

Continental Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

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REVISED: 5/16/2022

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03/14/2025

ITEM# B18 - SPARE NO.

<Spare No.>

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03/14/2025

ITEM# B19 - SPARE NO.

<Spare No.>

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03/14/2025

ITEM# B20 - DISPLAY CASE, REFRIGERATED, SELF-SERVE (1 EA REQ'D)

Federal Industries LPRSS3

Specialty Display Low Profile Self-Serve Refrigerated Merchandiser, 36"W x 34"D x 46”H, self contained refrigeration with condensate evaporator, electronic temperature control, night curtain, 3500K LED lighting top & below shelf, (2) tiers of adjustable solid black metal shelves, stainless steel display deck & black interior, black trim, tempered glass ends, choice of laminate, thermometer, steel base construction, adjustable feet, R404, cULus, UL EPH Classified, Made In USA, DOE 2017 compliant

ACCESSORIES

Mfr	Qty	Model	Spec
Federal Industries	1		One year parts & labor warranty, standard
Federal Industries	1		Self-contained refrigeration standard
Federal Industries	1		120v/60/1-ph, 1/3 hp, 16.0 amps, cord & plug (NEMA 5-20P)
Federal Industries	1		Five year compressor warranty, standard (for self-contained units only)
Federal Industries	1		Laminate standard color - Black

FEDERAL INDUSTRIES
A Standex Company
215 Federal Avenue
Belleville, WI 53508-9201
Phone: 800-356-4206
Fax: 608-424-3234
Email: geninfo@federalind.com
Website: www.federalind.com

Project Name: _____
Item #: _____
Model #: _____ Qty: _____
Approval: _____

AIA#

SIS#

REFRIGERATED SELF-SERVE LOW PROFILE SPECIALTY MERCHANDISER

Maximize your display potential with Federal's low-profile, refrigerated self-serve merchandiser. Bring product to the customer for increased sales with the reduced labor of a self-serve display case.



Model LPRSS4 Shown

MODEL	DIMENSIONS (Includes End Panels)
□ **LPRSS3**	36 x 34 x 46 (in) 914 x 864 x 1168 (mm)
□ **LPRSS4**	48 x 34 x 46 (in) 1219 x 864 x 1168 (mm)
□ **LPRSS5**	60 x 34 x 46 (in) 1524 x 864 x 1168 (mm)
□ **LPRSS6**	72 x 34 x 46 (in) 1829 x 864 x 1168 (mm)

STANDARD FEATURES

Model Features

- Steel base construction with choice of six standard laminates on exterior. Other finishes optional
- Black trim
- Easily accessible light switch, power switch, and adjustable temperature control.
- Rear access to refrigeration system for quick and easy service
- Energy-saving night curtain
- Stainless steel display deck and black interior ends and back panel. Glass end panels.
- Adjustable Leg Levelers
- Cord and plug (Self-Contained only)
- Continuous line-ups are available for remote applications
- Insulated with high-density foam

Refrigeration

- On-Demand PTC condensate evaporator provided for a totally self-contained system standard on models LPRSS3 and LPRSS4.
- Condensate pump is standard on the LPRSS and LPRSS6 and remote cases.
- Electronic temperature controls maintain 38°-40°F.
- Easy clean, rustproof insulated evaporator coil compartment
- Starting January 1, 2025, R449a refrigerant will be replaced by R290
- Thermometer

Shelving

- Two tiers adjustable metal shelves

Lighting

- 3500K LED top light and shelf light
- DLC Certified, IP66 rated

Agency Approvals

- UL and UL Sanitation listed
- DOE 2017 Compliant

OPTIONAL ACCESSORIES

- □ Special Base Finish
- □ Casters: Recessed or Exposed
- □ Legs
- □ Remote Refrigeration (EEV Included) (Includes Condensate Pump)
- □ Solid Rear Sliding Access Doors
- □ Two-Tier Display Step in Lieu of Shelving
- □ Glass or Stainless Shelving in Lieu of Black Metal
- □ Flush End Panels for Counter Installations
- □ Joining Kit for Continuous Line-ups
- □ Reflective End Glass
- □ Stainless Steel Interior, including shelves
- □ Security Night Cover
- □ Front Non-Refrigerated Display Merchandiser
- □ Front or Rear Condensing unit air discharge
- □ Condensate Pump (optional for LPRSS3 & LPRSS4 Only)
- □ Condensate Evaporator Assembly (Field install, dedicated 120V, 15A Circuit Required) (optional for LPRSS5, LPRSS6 & remote cases only)

Made in America

DOE 2017 Energy Efficiency Compliant

ANSI/NSF 7

WARRANTY*
One year Parts and Labor
2nd thru 5th year part only service compressor
(U.S.A and Canada)

REVIT

Note: Information is subject to change at any time.
Visit www.federalind.com for the most current specs.

Revised 12/30/2024

AIA#

SIS#

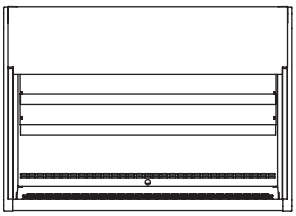
REFRIGERATED SELF-SERVE LOW PROFILE SPECIALTY MERCHANDISER

Product Specifications

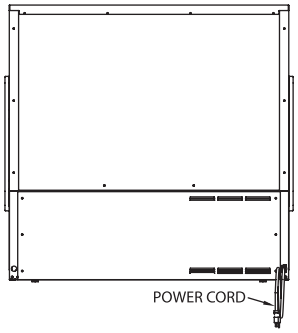
Intended Environment: Type I - Designed to operate in maximum ambient conditions of 75°F (24°C) and 55% relative humidity unless noted otherwise in system information below.		
Zone	**Intended Product To Be Displayed**	**Avg Prod Temp °F/°C**
All	Packaged Refrigerated Products	38°F / (3.3°C)

DIMENSION: xx"/(mm)

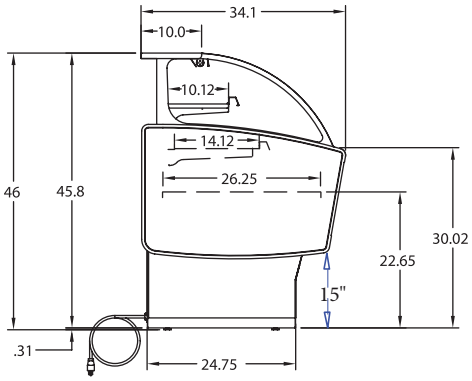
DIMENSION TOLERANCE +/- 0.25 (6.4)



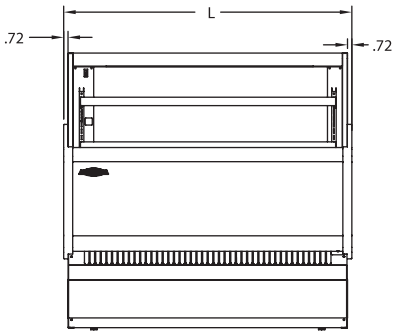
PLAN VIEW



REAR VIEW



END VIEW



FRONT VIEW

MODEL	DIMENSIONS				SHIPPING WHT		SELF CONTAINED Permanently Connected			OPTIONAL NEMA PLUG	SHELF AREA	*REMOTE	
	L	D	H	UNITS	LBS	KILO	VOLTAGE	AMPS	H.P.	CONFIG (SC)		VOLTAGE	AMPS
LPRSS3	36	34	46	in.	457	207	120/60/1	16 AMPS	1/3 HP	NEMA 5-20P	11	120/60/1	2 AMPS
	914	864	1168	mm.									
LPRSS4	48	34	46	in.	560	254	120/60/1	16 AMPS	1/3 HP	NEMA 5-20P	15	120/60/1	2 AMPS
	1219	864	1168	mm.									
LPRSS5	60	34	46	in.	650	295	208-240/60/1	9 AMPS	1/2 HP	NEMA 6-15P	19	120/60/1	3 AMPS
	1524	864	1168	mm.									
LPRSS6	72	34	46	in.	750	340	208-240/60/1	10 AMPS	3/4 HP	NEMA 6-15P	24	120/60/1	3 AMPS
	1829	864	1168	mm.									

- If a GFCI circuit is required, a GFCI Breaker Must be used instead of a GFCI recepticle.
- Case temperature will vary if the air curtain is disrupted.
- The rear of the unit needs to be 6" from wall.
- Refrigerated cases are designed to operate in a maximum of 75°F (24°C) ambient and 55% relative humidity.
- Due to continuing engineering improvements, specifications are subject to change without notice.

DOE 2017 Energy Efficiency Compliant

c UL us

ANSI/NSF 7

FEDERAL
The Signature of Quality

FEDERAL INDUSTRIES
A Standex Company
215 Federal Avenue, Belleville, Wisconsin 53508-9201

Phone: 800-356-4206
Fax: 608-424-3234
Email: Geninfo@Federalind.com
Website: Federalind.com

FEDERAL INDUSTRIES — REFRIGERATED & NON-REFRIGERATED BAKERY, HOT & COLD DELI DISPLAYS

FEDERAL

The Signature of Quality™

STANDARD COLOR LAMINATES



Special color laminates are available at additional cost and may affect delivery schedule.

Due to variations in the printing process, color may not be exact match. Please contact the factory for samples.

a Standex company

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ITEM# B21 - POS COUNTER

Millwork, By GC

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ITEM# B22 - POS

By owner

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ITEM# B23 - SLIM JIM TRASH CAN

BY Owner

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ITEM# B24 - DISPLAY CASE, DIPPING ICE CREAM (1 EA REQ'D)

Master-Bilt DD-26LCG

Ice Cream Dipping/Display Cabinet, low-glass, (4) 3 gallon can display, painted galvanized steel interior and exterior, 50" high stainless steel serving deck, curved glass view windows, LED interior lighting with switch, temperature range 5° to -5°F, 3/5 HP, 115v/60/1-ph, 5.9 amps, NEMA 5-15P, cULus, UL EPH Classified

ACCESSORIES

Mfr	Qty	Model	Spec
Master-Bilt	1		Pricing is valid for 60 days upon receipt of purchase order AND approved drawing (if applicable). Order must ship per our current standard lead time or pricing will be subject to change. All shipments will be FOB Hudson, WI or New Albany, MS.
Master-Bilt	1		2 year parts and labor warranty on cabinet, standard
Master-Bilt	1		5 year compressor part warranty, standard
Master-Bilt	1		White exterior finish, standard
Master-Bilt	1		White interior finish, standard
Master-Bilt	1	A394-11150	Frost Shield, for DD-26L/DD-26LCG
Master-Bilt	1	A394-20301	Can Holders, includes white can covers, fits DD-26/DD-26L/DD-26LCG
Master-Bilt	1		No dipper well required
Master-Bilt	1	44-00984	Can Covers, clear (each) for DD series
Master-Bilt	1	A390-11129	Lid Locking Kit, for all DD/DD-L/DD-LCG models (less locks, requires one kit per lid)

MASTER-BILT® Refrigeration Solutions

ITEM NO. _____
PROJECT _____
LOCATION _____
DATE _____ QTY. _____

DD-LCG SERIES

Low Curved Glass Ice Cream Dipping/Display Merchandisers

MODELS

- ❑ DD-26LCG
- ❑ DD-46LCG
- ❑ DD-66LCG
- ❑ DD-88LCG



DD-46LCG

c UL us

ANSI/NSF 7

FEATURES

CONSTRUCTION

- Rounded rear stainless steel heated top improves operator comfort
- Lower back rail provides improved operator ergonomics
- Frameless double pane tempered glass viewing window, with NSF51 approved powder coated top and bottom aluminum extruded trims, provides enhanced structural stability and appearance
- Tempered glass ends improve product visibility
- Energy efficient, long lasting LED lighting
- Independent on/off light switch
- Standard electronic controller increases reliability and saves energy by maintaining consistent product temperature
- 24 gauge painted textured interior and exterior
- Stainless steel top and attached superstructure
- Stainless steel serving deck
- Equipped with leveling legs to correct for unlevel flooring situations
- Drain with garden hose connector for ease of cleaning
- Heavy-duty epoxy-coated wire can support racks
- 3" thick walls and 2-1/2" floor with foamed-in-place “zero ODP” urethane insulation

LIDS

- Hinged, high-tensile, transparent acrylic dipping compartment lids with full length handle

REFRIGERATION

- Eco-friendly R290 refrigerant
- Cold wall evaporator
- Low maintenance condenser coil
- Condenser filter screen, removable without tools, for easy condenser coil cleaning resulting in peak efficiency and extended equipment life (DD-66LCG & DD-88LCG models). Screen should be cleaned every three months depending on operating environment.
- Rear air intake with rear and side discharge eliminates front grille and allows full front of cabinet for graphics
- Side compartment grille improves the air circulation and accessibility during servicing
- No minimum clearance required on cabinet sides but front, back and top must be left open for customer and operator access
- Temperature range: 5° to -5°F (-15° to -21°C)
- R-factor (insulation efficiency rating): 19.40

WARRANTY

- Standard limited two year parts and labor
- Additional three year coverage on compressor part

OPTIONS

- ❑ Removable can holders with white overnight can covers
- ❑ Dipper well
- ❑ Removable frost shields
- ❑ Leg kit
- ❑ Casters
- ❑ Lid locking kit (less locks, requires one kit per lid)

LOW CURVED GLASS ICE CREAM DIPPING/DISPLAY MERCHANDISERS

MASTER-BILT® Refrigeration Solutions

DD-LCG SERIES

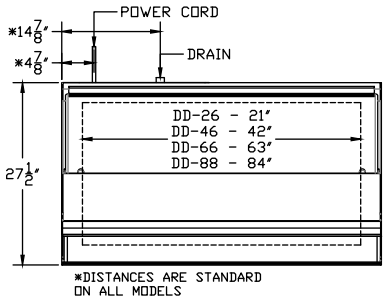
LOW CURVED GLASS ICE CREAM DIPPING/DISPLAY MERCHANDISERS

TECHNICAL SPECIFICATIONS

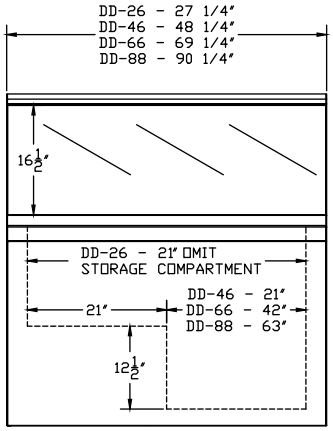
Model	DD-26LCG	DD-46LCG	DD-66LCG	DD-88LCG
Crated Height (in) (mm)	60 (1524)	60 (1524)	60 (1524)	60 (1524)
Crated Width (in) (mm)	45 (1143)	57 (1448)	80-1/2 (2045)	104 (2642)
Crated Depth (in) (mm)	40 (1016)	40 (1016)	40 (1016)	40 (1016)
Crated Weight (lbs/kg)	264 (120)	407 (184)	545 (248)	660 (300)
Interior Display Ht. (in) (mm)	20 (508)	20 (508)	20 (508)	20 (508)
Interior Storage Ht. (in) (mm)	*	12-1/2 (318)	12-1/2 (318)	12-1/2 (318)
Interior Display Width (in) (mm)	21 (533)	42 (1067)	63 (1600)	84 (2134)
Interior Storage Width (in) (mm)	*	21 (533)	42 (1067)	63 (1600)
Interior Depth (in) (mm)	21-1/2 (546)	21-1/2 (546)	21-1/2 (546)	21-1/2 (546)
Can Capacity display **	4	8	12	16
Can Capacity storage **	0	4	8	12
Overall Height (in) (mm)	50 (1270)	50 (1270)	50 (1270)	50 (1270)
Overall Width (in) (mm)	27-1/4 (692)	48-1/4 (1226)	69-1/4 (1759)	90-1/4 (2292)
Overall Depth (in) (mm)	27-1/2 (699)	27-1/2 (699)	27-1/2 (699)	27-1/2 (699)
Condensing Unit Size	3/5 HP	3/5 HP	5/6 HP	5/6 HP
Refrigerant	R290	R290	R290	R290
Electrical Characteristics	115/60/1	115/60/1	115/60/1	115/60/1
Maximum Fuse Size	15	15	15	15
Total Amp Draw	5.9	5.9	7.2	7.2

* Storage compartment not available on this model.

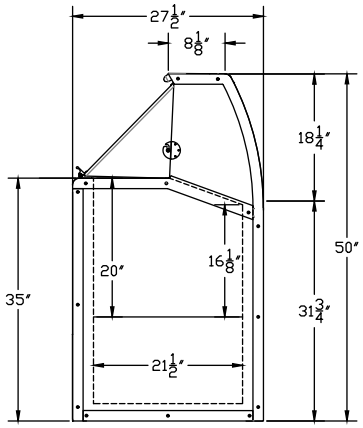
** Capacities in 9-1/2" diameter, 3 gallon tubs. Optional can holders accommodate tubs with a minimum inner diameter of 8-7/8" and a maximum outside diameter of 9-11/16". Measurements taken at the top edge opening where ice cream is dipped from.



PLAN VIEW



ELEVATION VIEW



SIDE VIEW

MASTER-BILT® Refrigeration Solutions

DD-LCG SERIES

LOW CURVED GLASS ICE CREAM DIPPING/DISPLAY MERCHANDISERS

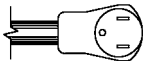
LISTINGS

c UL us

ANSI/NSF 7

HOOKUP

Via plug in, 10 foot long, flexible 3 wire 16/3 cord with molded plug. Drain hookup has standard garden hose connection.



NEMA 5-15P

BID SPECIFICATIONS

Item no. DD-_____LCG

Provide_____( ) Low Curved Glass Ice Cream Dipping/Display Merchandiser(s), Master-Bilt® model no. DD-_____LCG.

Cabinet will feature textured finish on interior and exterior.

Cabinet to be constructed of 24 gauge painted textured interior and exterior with a stainless steel top and attached superstructure as well as a stainless steel serving deck.

Cabinet to be provided with rounded rear stainless steel heated top and lower back rail for improved operator ergonomics. The viewing window will be constructed of frameless tempered glass with NSF51 approved powder coated top and bottom aluminum extruded trim.

Interior LED lighting controlled by an independent on/off switch. Cabinet to have rear air intake with rear and side discharge.

Hinged lids composed of high-tensile, transparent acrylic with full length handle.

Hanging frost shields with mounting screws offered as an option.

Refrigerant will be R290 and temperature range will be 5° to -5°F (-15° to -21°C).

Cabinet refrigeration system will contain a low maintenance condenser coil.

Cabinet to have standard limited two year parts and labor warranty with additional three year coverage on compressor part.

Cabinet to be UL and C-UL listed and UL EPH classified.

NOTE: Cabinet designed for optimum performance in air-conditioned area at 75°F ambient and 55% relative humidity.
All specifications within this publication subject to change without notice.

1505-3/24

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Submittal Sheet

03/14/2025

ITEM# B25 - DIPPER WELL (1 EA REQ'D)

Fisher 3041

Dipper Well Faucet and Sink, 6-7/8" diameter, 1-1/2" x 4" tailpiece, 40° - 140°F system limits, 200 psi maximum static pressure limit, stainless steel seat faucet, stainless steel pan with removable inner shell

APPLICATION:

PRODUCT NAME:
DIPPERWELL FAUCET & SINK ASSEMBLY

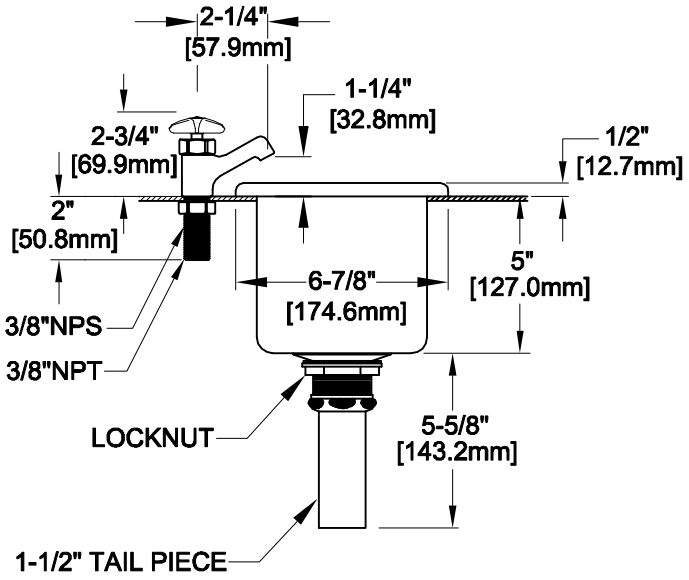
JOB NAME:

☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

QUANTITY: | ITEM NO.

MODEL:
☐ 3041

OPTIONS OR MODIFICATIONS:
☐ OTHER _____



FEATURES:

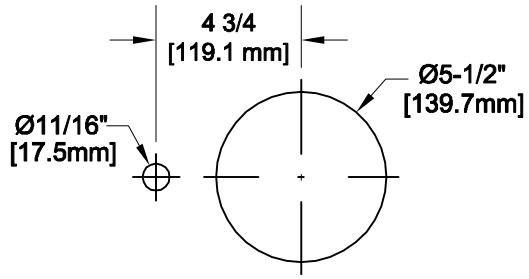
DIPPERWELL FAUCET
* STAINLESS STEEL SEAT

DIPPERWELL SINK
* STAINLESS STEEL PAN
* REMOVABLE INNER SHELL

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE 200 PSI MAX. STATIC

SHIPPING WEIGHT
* 3.5 LBS

ROUGH-IN:



ANSI/A112.18.1M

FISHER
FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3041 REV. D

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ITEM# SB00 - SNACK BARS

SNACK BARS

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# SB01 - REACH-IN REFRIGERATOR (2 EA REQ'D)

Continental Refrigerator 1RN

Refrigerator, reach-in, one-section, 20 cu. ft., self-contained refrigeration, stainless steel front, aluminum interior & ends, standard depth, full-height solid door, cylinder lock, electronic control with digital display, hi-low alarm, electric condensate evaporator, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF, ENERGY STAR®

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	2		Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	2		115v/60/1-ph, 5.2 amps, cord, NEMA 5-15P, standard
Continental Refrigerator	2		Door hinged on right, one hinged left
Continental Refrigerator	2		5" Casters, standard

REACH-IN REFRIGERATOR

Model: 1RN

Natural Refrigerant R-290 Model

1-Section Reach-In Refrigerator

ENERGY STAR® Qualified Commercial Refrigerator

1RN - Stainless steel front, aluminum end panels and interior
1RNSA - Stainless steel exterior, aluminum interior
1RNSS - Stainless steel exterior and interior
Designed to maintain NSF-7 temperatures in 100°F ambient.



Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**

Standard Model Features

REFRIGERATION SYSTEM

- Self contained, performance rated refrigeration system
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Automatic, electric condensate evaporator

CABINET ARCHITECTURE

- 3” non-CFC polyurethane foam insulation
- Smooth, polished chrome workflow door handle
- Cam action, lift off hinges
- Self-closing door
- Magnetic snap in Santoprene™ door gasket
- Cylinder lock in door
- Heavy duty, epoxy coated steel shelves
- 5” casters

MODEL FEATURES

- LED interior lighting
- Electronic control, off-cycle defrost
- Rehinging of door (in the field)

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Options and Accessories

(upcharge and lead times may apply)

Stainless steel case back	Shallow depth (consult factory)
Additional epoxy coated steel shelves	Hinged glass door (consult factory)
Chrome or stainless steel shelves	Half doors
Heavy duty pilaster strips	Pass-Thru (consult factory)
Wine rack	**Correctional Facility Options**
Adjustable legs	• One way security screws
Custom laminates	• Locking hasp (lock not included)
Pan slide assemblies	• Stainless steel mesh cover
Expansion valve	• Coverless hinges
Special electrical requirements (consult factory)	

Consult factory for other model configurations, options and accessories.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	20 (566 cu l)
Width, Overall (inches)	26 (660 mm)
Depth, Overall (inches) (including handle)	35 3/8 (899 mm)
Depth (inches) (less door)	32 (813 mm)
Depth (inches) (door open 90°)	55 1/2 (1410 mm)
Clear Door Width (inches)	19 3/8 (492 mm)
Clear Door Height (inches)	58 5/8 (1489 mm)
Height, Overall (inches) (including 5" casters)	82 1/4 (2089 mm)
Number of Doors	1
Number of Shelves	3
Shelf Area (square feet)	20.4 (1.9 sq m)
Tray Slide Capacity (2" centers)	24

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4+
Capacity (BTU per hour)*	1940

ELECTRICAL DATA

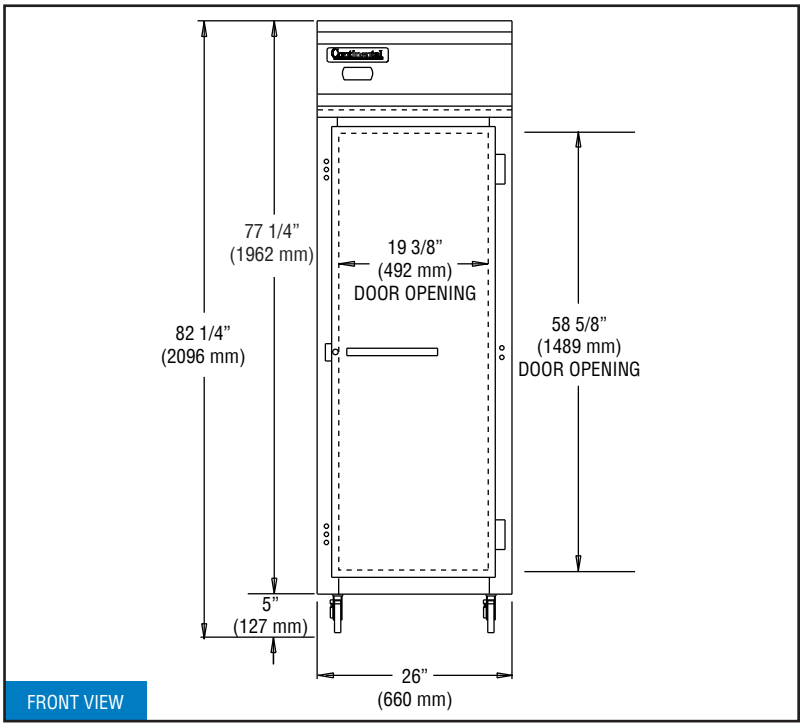
Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	5.9 (3.9)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

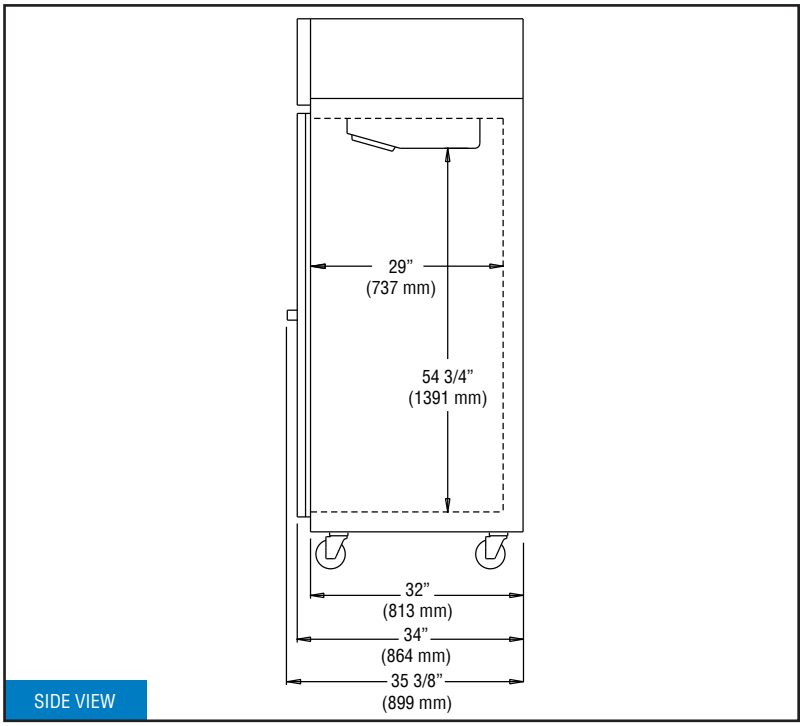
Height - Crated (inches)	85 1/2 (2172 mm)
Width - Crated (inches)	31 5/8 (803 mm)
Depth - Crated (inches)	42 (1067 mm)
Volume - Crated (cubic feet)	65 (1841 cu l)
Weight Std - Crated (pounds)	275 (124 kg)
Weight SS - Crated (pounds)	330 (149 kg)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.

Model Plan Views



FRONT VIEW



SIDE VIEW

IMPORTANT NOTE: If the cabinet is located directly against a wall and/or under a low ceiling, a minimum clearance of 12" is required on top and 3" on sides and rear.

Continental Refrigerator
Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

539 Dunksferry Road
Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

PROUDLY DESIGNED & ASSEMBLED IN THE U.S.A.



Equipped with one NEMA-5-15P Plug
(varies by country)

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REVISED: 1/29/24

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Submittal Sheet

03/14/2025

ITEM# SB02 - BACK COUNTERS

Qty: 2
Millwork, by GC

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Submittal Sheet

03/14/2025

ITEM# SB03 - COFFEE BREWER

Qty: 2
By Vendor

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Submittal Sheet

03/14/2025

ITEM# SB04 - HANDSINK/UTILITY SINK

Qty: 2
By GC

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Submittal Sheet

03/14/2025

ITEM# SB05 - JUICE DISPENSER

Qty: 2
By Vendor

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Submittal Sheet

03/14/2025

ITEM# SB06 - ICE & WATER DISPENSER (2 EA REQ'D)

Hoshizaki DCM-271BAH-OS

Opti-Serve Ice Maker/Water Dispenser, Cubelet-Style, air-cooled, self-contained condenser, production capacity up to 257 lb/24 hours at 70°/50° (196 lb AHRI certified at 90°/70°), 10 lb built-in storage capacity, counter model, touchless LED sensor, 10-1/4" cup clearance, protected with H-GUARD Plus Antimicrobial Agent, R-404A refrigerant, 4" legs, 115v/60/1-ph, 8.5 amps, cord & NEMA 5-15P, NSF, UL, ADA Compliant

ACCESSORIES

Mfr	Qty	Model	Spec
Hoshizaki	2		Warranty: 3-Year parts & labor on entire machine
Hoshizaki	2		Warranty: 5-Year parts on compressor, air-cooled condenser
Hoshizaki	2	LP-4 LEG	Leg Package, (4) x 4" stainless steel legs
Hoshizaki	2	H9320-51	Water Filtration System, single configuration, 18.4" H (manifold & cartridge)
Hoshizaki	2		Warranty: 1-Year on entire water filtration system & replaceable elements

DCM-271BAH-OS

DCM-271BAH-OS
07/02/24
Item # 13574

OPTI-SERVE SERIES
CUBELET ICE MACHINE AND WATER DISPENSER

Item #: _____

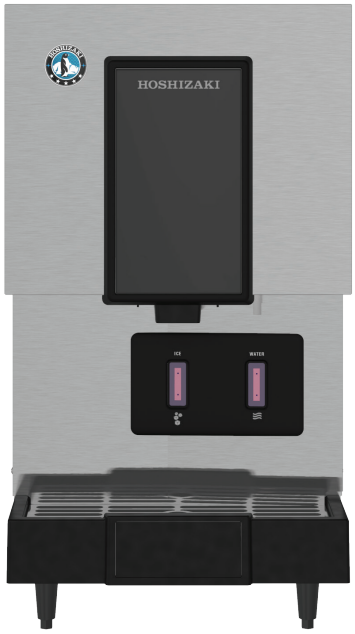
Project: _____

Qty: _____

AIA#: _____

W x D x H
16 5/8" x 24 1/4" x 31 3/4" *
*including 4" legs

OptiServe
TOUCHLESS ICE & WATER





Hands-free sensor designed for use with opaque containers. Not intended for outdoor use - avoid placement in direct sunlight.

Features

- **Opti-Serve touchless ice and water**
- **10 1/4" cup clearance**
- **Quieter operation**
- **ADA Compliant**

- Attractive modern design
- Easy to chew, Cubelet ice
- Up to 257 lbs. of ice production per 24 hours
- Built-in storage capacity of 0.3ft³/10 lbs.*
- Durable stainless steel drain pan grate
- Easy-cleaning removable spout
- 2-second flush cycle every hour
- Advanced CleanCycle24™ design
- 6 ft. cord with a NEMA 5-15 plug
- R-404A Refrigerant

ADVANCED CleanCycle

Warranty:
3 Year Parts & Labor on entire machine.
5 Year Parts on Compressor; air-cooled condenser coil.
Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.
*Rated in accordance with AHRI Standard 820(I-P). Capacity based on 100% of total volume x 30 lb/ft³ average density of ice.

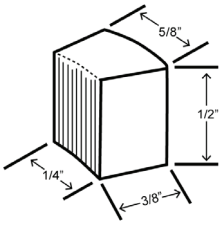
Shipping: (LxWxH) 20.88" x 30.63" X 36.25" Volume: 13.42ft³

FACTORY WARRANTY
Parts & Labor 3 YR Entire Machine
Parts 5 YR Compressor

		ICE PRODUCTION		WATER USAGE		ELECTRICAL						
Condenser	Model	Air / Water Temp Lbs. per 24 hours 70°/ 50°F	90°/ 70°F	Potable Gal. per 100 lbs. 90°/ 70°F	Condenser Gal. per 100 lbs. 90°/ 70°F	kWh Used per 100 lbs. 90°/ 70°F	Min. Circuit/ Max. Fuse Size	Amperage	Voltage	Heat Rejection BTU/hr.	Refrigerant Charge Amount	Net / Ship Weight (lbs.)
Air-Cooled	DCM-271BAH-OS	257	196	12.0	N/A	6.9	15A	8.5A	115V/60/1	3,300	14.8 oz	136 / 154

Power cord included..

Cubelet Dimensions*



* approximate size in inches, image not to scale

Operating Limits

- Ambient Temp Range 45 - 100°F
- Water Temp Range 45 - 90°F
- Water Pressure 10 - 113 PSIG
- Voltage Range 104 - 127V
- If GFCI is required, a GFCI breaker MUST be used in lieu of GFCI receptacle

Service

- Allow 6" (15cm) clearance at rear and sides for proper air circulation and ease of maintenace and/ or service should they be required. Allow 24" (61 cm) clearance at top to allow for removal of auger.

Not intended for outdoor use - avoid placement in direct sunlight.

Plumbing

- Icemaker Water Supply Line: Minimum 1/4" Nominal ID Copper Water Tubing or Equivalent
- Icemaker Drain Line: Minimum 3/4" Nominal ID Hard Pipe or Equivalent
- 3/4" MPT drain

Water Filter

Please refer to water filter specification sheet for recommendations.

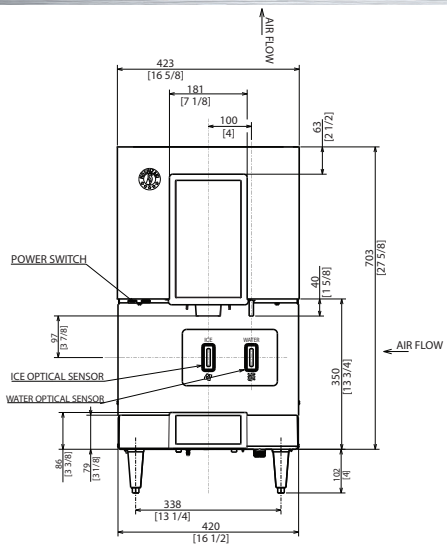
Hoshizaki reserves the right to change specifications without notice.

DCM-271BAH-OS

DCM-271BAH-OS
07/02/24
Item # 13574

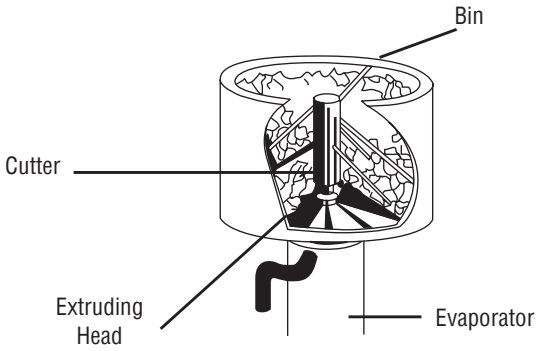
OPTI-SERVE SERIES
CUBELET ICE MACHINE AND WATER DISPENSER

FRONT VIEW

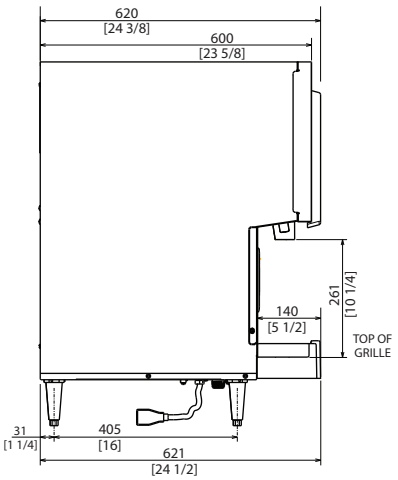


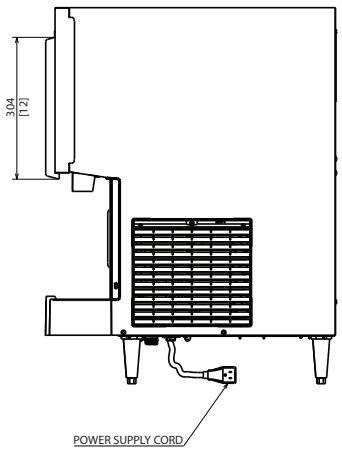
AIR-COOLED

inch
[mm]



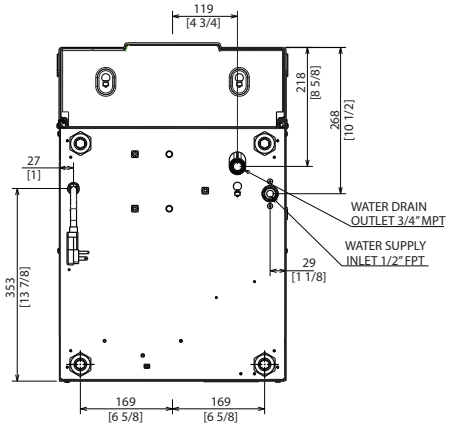
SIDE VIEW



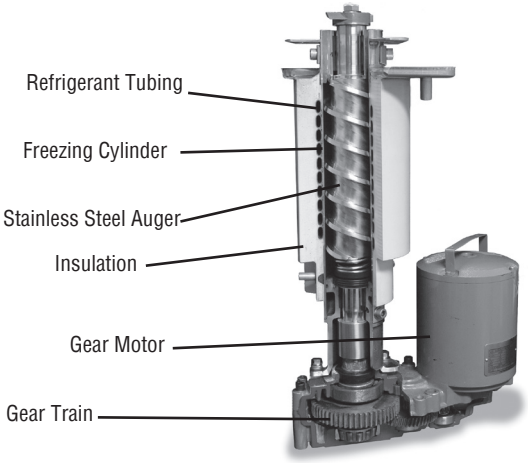


AIR-COOLED

BOTTOM VIEW



AIR-COOLED



EVAPORATOR

NOTE: DCM-271BAH-OS is made to pair with SD-271 stand. Placing a DCM-271BAH-OS on SD-270 stand will require a new drain hole to be cut.

Caster & Leg Accessories

Casters and Legs used on Hoshizaki Equipment

Item #: _____

Project: _____

Qty: _____

AIA#: _____

Casters

HS-3546/HS-3547



HS-5035



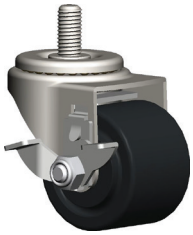
HS-5036 without brakes



HS-5036 with brakes



HS-5320/HS-5321



Accessory Number	Description	For use with	Weighted Capacity per caster
HS-3546	4” caster with 5/8”-11 thread, Set of 4 (2 with brakes)	Used on Steelheart Uprights, all models. C___S-xxx from aux code E-8 to H-5	400 lbs.
HS-3547	4” caster with 5/8”-11 thread, Set of 6 (3 with brakes)		
HS-5035	4” caster 1/2”-13 thread, Set of 4 (2 with brakes)	Undercounters	175 lbs.
HS-5036	6” caster 1/2”-13 thread, Set of 4 (2 with brakes)	Worktop, Sandwich Prep	350 lbs.
HS-5037	2” caster 1/2”-13 thread, Set of 4 (2 with brakes)	LP Undercounter models	220 lbs.
HS-5320	3-3/8” caster, 1/2”-13 thread, Set of 4 (2 with brakes)	Pizza Prep Tables for ADA Compliant dimensions	300 lbs.
HS-5321	3-3/8” caster, 1/2”-13 thread, Set of 6 (3 with brakes)		

Hoshizaki reserves the right to change specifications without notice.

Caster & Leg Accessories

Casters and Legs used on Hoshizaki Equipment

Item #: _____
Project: _____
Qty: _____
AIA#: _____

Legs

DM LEGS



LP-4 LEG



LP-6P-LEG



LP-6 Flange Leg



LP-6 LEG



Accessory Name/Number	Kit Number	Part Number	Description	Stud Length	For use with	Weighted Capacity per leg
	HS-2071, HS-2072, HS-2073	4A2091-01	Stainless, height 6", 5/8-11, 4pk	3/4" thread	DCM-300, DCM-500, SD Stands	2000 lbs.
DM LEGS			Black, height 4", 3/8-16, 1/2 4pk	5/8" thread	DM-200B	2000 lbs.
		4A2145-01	Black epoxy, height 4", 3/8-11, 4pk	5/8" thread	DCM-271BAH(-OS)	1000 lbs.
LP-6P LEG		4A2525-01	Black, height 6", 5/8-11, 4pk	3/4" thread	B-250, B-500, BD-500 B-700, B-800, B-900 KM-81, KM-116, KM-161, KM-231, KM-301 DB-200H, F-330(-C), F-300, F-500, IM-200	2000 lbs.
LP-6 FLANGE LEG		4A2526-01	Black epoxy, height 6", 5/8-11, 4pk	3/4" thread	SD-200, SD-271, SD-500, SD-750, B-300, BD-300, DB-130H, DKM-500	2000 lbs.
		4A2966-01	Stainless, height 6", 3/8-16, 4pk	3/4" thread	PR46A(-D2, D4)	500 lbs.
LP-6 LEG		4A0930-01	Stainless, height 6", 5/8-11, 2pk	3/4" thread		2000 lbs.
		4A0930-02	Stainless, height 6", 5/8-11, 2pk	3/4" thread		2000 lbs.
		4A0930-03	Stainless, height 6", 5/8-11, 2pk	1/2" thread		2000 lbs.
	HS-3585	4A0930-04	Stainless, height 6", 5/8-11, 4pk	3/4" thread		2000 lbs.
		4A0930-05	Stainless, height 6", 1/2-13, 4pk	3/4" thread		2000 lbs.

© HOSHIZAKI AMERICA, INC.

WATER FILTERS

FILTRATION SYSTEMS

Item #: _____

Project: _____

Qty: _____

AIA#: _____

H9320 FILTER
Single, Double, Triple



H9320-51

Single Configuration
18.4" H*



H9320-52

Double Configuration
19.11" H*



H9320-53

Triple Configuration
19.15" H*

*height includes manifold and cartridge

HOSHIZAKI H9320 FILTER

Available in single, double and triple configurations. Rated NSF Class 1, STD 42, for taste, odor and chlorine reduction and for mechanical filtration (95.6% removal of particles one (1) micron and larger in size.)

- Keep ice makers functioning at full capacity
- 97.3% average reduction of chlorine from incoming water supply, eliminating tastes and odors of the ice
- Filters are rated as one (1) micron nominal producing crystal clear ice
- Decrease machine maintenance by reducing lime scale build-up

Model	Filter	Max Flow Rate	Working Pressure	Temperature	Capacity
H9320-51	4HC-H	2 gpm	10-125 psi	35-100°F	21,000 gal
H9320-52	4HC-H	4 gpm	10-125 psi	35-100°F	42,000 gal
H9320-53	4HC-H	6 gpm	10-125 psi	35-100°F	63,000 gal

Plumbing

Inlet/Outlet Connections: Single: (2) 3/8" FNPT
Double & Triple: (1) 3/4" MNPT / (1) 3/4" FNPT

The H9320 Filters and their respective cartridges have been tested and listed by NSF only for the functions listed above. Check for compliance with state and local laws and regulations. Do not use where the water is microbiologically unsafe, or with waters of unknown quality without adequate disinfection before or after the unit. The H9320 filter can be used with water that may contain filterable cysts.

The H9320 System is tested and certified by NSF International against NSF/ANSI Standard 42 for the reduction of:
Std. No. 42 - Aesthetic effects

Aesthetic Effects
Bacteriostatic Effects
Chemical Reduction
Chlorine

Mechanical Filtration
Nominal Particulate Class 1
Taste & Odor

E-10 PREFILTER
(9795-80)

E-20 PREFILTER
(9795-90)



E-10 PREFILTER
(9795-80)
Recommended for single configuraton



E-20 PREFILTER
(9795-90)
Recommended for twin and triple configuraton

E-10 and E-20 Prefilters can be used for ice. Everpure prefilters are designed to increase the life of Hoshizaki 4HC-H water filters in areas with an unusual amount of dirt in the water. With a 10 micron (nominal) rating, the economical Everpure prefilter traps much of the dirt which contributes to scale buildup in ice makers, and clogs the delicate orifices of other water-using equiment.

When you install an Everpure prefilter, the Hoshizaki 4HC-H water filters can concentrate on what they do best: remove particles one (1) micron nominal and larger in size.

Replacement Cartridges:
E-10 Prefilters: 12 pack (9534-12)
40 pack (9534-40)

E-20 Prefilters: 6 pack (9534-26)
20 pack (9534-20)

Warranty:
One Year replaceable elements*
One Year the entire system
* Warranty applies to material defects in materials & workmanship only.

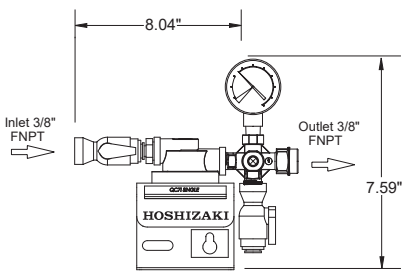
Hoshizaki reserves the right to change specifications without notice.

WATER FILTERS

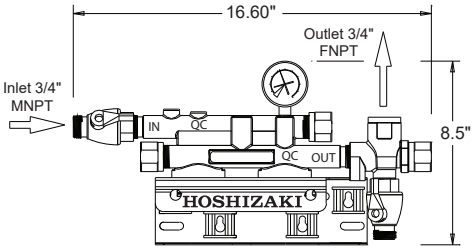
FILTRATION SYSTEMS

Model Number	Description Flow Rate (Gal. per min.)	Undercounter KMs	KM Cubers	IM Cubers	Cubelets & Flakers	DCM/DBs
H9320-51	Single (2 GPM)	AM-50 KM-81 KM-116 KM-161 KM-231 KM-301	KM-350, 520, 660 KML-325, 500, 700 KMD-410, 460, 530 KMS-830 DKM-500	IM-200,500 IM-50BAA-LM	All Models	All Models
H9320-52	Twin 2 x (2 GPM)	N/A	KM-901, 1100 KMD-860 KMS-822, 1122, 1402	IM-50BAA-Q	N/A	N/A
H9320-53	Triple 3 x (2 GPM)	N/A	KM-1301, 1340, 1601, 1900, 2200, 2600 KMH-2100 KMS-2000	N/A	N/A	N/A
H9655-11	Replacement Cartridge (1) One each	Recommended water filter configurations based on average ice machine usage and regular filter replacement. If your operation has challenging water conditions or higher usage, then it may be necessary to use an additional filter or prefilter.				

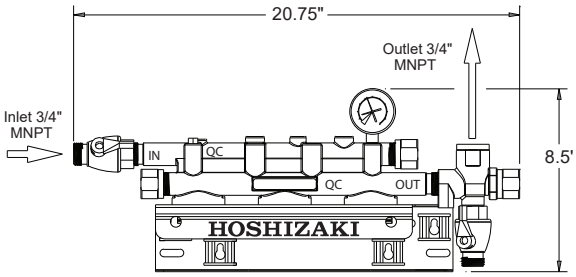
Single



Twin



Triple



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Submittal Sheet

03/14/2025

ITEM# SB07 - MICROWAVE OVEN (2 EA REQ'D)

ACP RCS10DSE

Amana® Commercial Microwave Oven, 1.2 cu. ft. capacity, 1000 watts, medium volume, 10-min. dial timer, (4) power levels, non-removable air filter, side hinged door with tempered glass, accommodates 14" plate, stainless steel exterior & interior, 120v/60/1-ph, 13.0 amps, 15 MCA, 1550 watts (total), NEMA 5-15P, cETLus, ETL-Sanitation

ACCESSORIES

Mfr	Qty	Model	Spec
ACP	2		3-year limited warranty (1 year full)

Amana® Commercial

Project #:_____

Item #:_____

AIA File #:

Specification #:

Medium Volume

Amana Commercial Microwave Model RCS10DSE



Model RCS10DSE shown

Medium Volume
This category of microwave is ideal for...

Applications:
- Coffee shops
- Ethnic restaurants
- Concessions
- Dessert stations

All ACP, Inc. commercial ovens are backed by our Culinary Center. Call us with any question regarding food preparation, menu development and cooking times. 866-426-2621.

Culinary Center ACP

Power Output

- 1000 watts of power.
- Four power levels.

Easy to Use

- User friendly ten minute dial timer lights up for at-a-glance monitoring.
- Timer automatically resets to zero if door is opened during heating. User option allows manual reset to zero.
- See-through door and lighted interior for monitoring without opening the door.
- 1.2 cubic ft. (34 liter) capacity accommodates a 14" (356 mm) platter, prepackaged foods and single servings.
- Stackable to save valuable counter space.

Easy to Maintain

- Stainless steel exterior and interior for easy cleaning and a commercial look.
- Constructed to withstand the foodservice environment.
- Non-removable air filter protects oven components.
- Backed by the ACP, Inc. 24/7 ComServ Support Center, 866-426-2621.
- ETL Listed.

C ETL LISTED US Intertek

ETL SANITATION LISTED Intertek

Part No. 20154733
Updated 6/17/16
Original Instructions

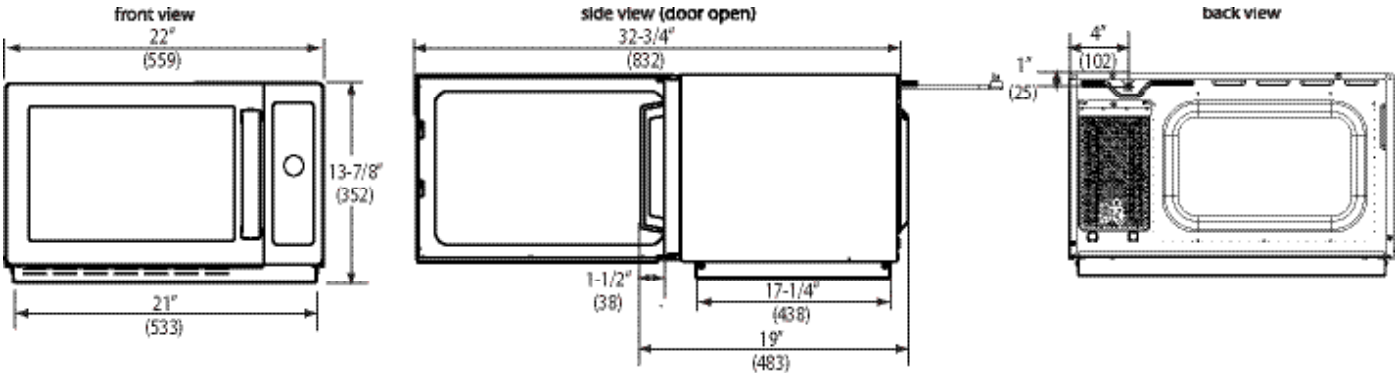
ACP INC.

© 2016 ACP, Inc.
Cedar Rapids, Iowa 52404

225 49th Ave Dr. SW Cedar Rapids, IA 52404 | 800-233-2366 | 319-368-8120 | Fax: 319-368-8198 | www.acpsolutions.com

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Amana Commercial Microwave Model RCS10DSE | Medium Volume



Installation Clearances - Top: 2" (51), Sides: 1" (25), Back: None

Drawings available from KCL CADlog - techs@kclcad.com

Specification #:

Specifications			
Model	RCS10DSE	UPC Code 728028129465	
Configuration	Countertop		
Control System	Dial		
Max. Cooking Time	10:00		
Power Levels	4		
Time Entry Option	Yes		
Microwave Distribution	Rotating antenna, top		
Magnetron	1		
Stackable	Yes		
Stage Cooking	1		
Interior Light	Yes		
Door Handle	Grab & Go		
Signal	End of cycle		
Exterior Dimensions	H 13 ⅞" (352)	W 22" (559)	D*19" (483)
Cavity Dimensions	H 8 ½" (216)	W 14 ½" (368)	D 15" (381)
Door Depth	32 ¾" (832), 90°+ door open		
Usable Cavity Space	1.2 cubic ft. (34 liter)		
Exterior Finish	Stainless steel		
Interior Finish	Stainless steel		
Power Consumption	1550 W, 13 A		
Power Output**	1000 W** Microwave		
Power Source	120V, 60 Hz, 15 A single phase		
Plug Configuration / Cord	NEMA 5-15	5 ft. (1.5m)	
Frequency	2450 MHz		
Product Weight	41 lbs. (19 kg.)		
Ship weight (approx.)	47 lbs. (21 kg.)		
Shipping Carton Size	H 16 ⅝" (422)	W 25 ³⁄₁₆" (640)	D 19 ¾" (502)
UPS Shippable	Yes		

Specifications

Commercial microwave shall have a user-friendly 10 minute dial timer with illuminated digits and an end of cycle audible signal. Timer shall automatically reset if the door is opened during heating with user option to manually reset to zero. There shall be a four power level and cooking stage. Microwave output shall be 1000 watts distributed by one magnetron with a rotating top antenna to provide superior even heating throughout the cavity. Durable door shall have a tempered glass window and a grab and go handle with a 90°+ opening for easy access. An interior light shall facilitate monitoring without opening the door. The large 1.2 cubic ft. (34 liter) cavity shall accommodate a 14" (356 mm) platter. Interior ceramic shelf shall be sealed and recessed on oven bottom to reduce plate-to-shelf edge impact. Oven shall have a stainless steel exterior and interior and be stackable to save counter and shelf space. The air filter shall be permanently affixed to the front of the oven. Microwave oven shall comply with standards set by the U.S Department of Health and Human Services, UL923 for safety and NSF4 for sanitation.

Intertek Intertek

Warranty

Warranty Certificate for this product can be found on the ACP, Inc. website at:

www.acpsolutions.com/warranty

Service

All products are backed by the ACP, Inc. 24/7 ComServ

er.

ComServ Commercial Service 866-426-2621

AIA File #:

Measurements in ( ) are millimeters
* Includes handle
** IEC 60705 Tested

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Cedar Rapids, Iowa 52404

225 49th Ave. Dr. SW Cedar Rapids, IA 52404 U.S.A. | 800-233-2366 | 319-368-8120 | Fax: 319-368-8198 | www.acpsolutions.com

RCS Series
RESTAURANT LINE

RCS10TS - 1000 Watts, Touch pad control
RCS10DSE - 1000 Watts, Dial control

FEATURES AND BENEFITS

- 1000 watts of cooking power
  - Quick heating for consistent results
- 1.2 cubic ft. (34 L) oven capacity
  - Accommodates a 14" (356 mm) platter
- Motor driven top antenna
  - Reliable distribution of energy for consistent heating results
- Non-removable front air filter
  - Cools componentry, extends life of oven

TOUCH CONTROL MODELS

- 100 programmable menu items, 4 cooking stages, 5 power levels
- Braille touch pads
- Versatile program options
- One-touch cooking

DIAL CONTROL MODELS

- 10:00 light up dial timer
- 4 power levels
- Automatic reset to zero when cooking cycle is interrupted (manual reset available as user option)





Reliable, long lasting Grab 'n Go handle with no moving parts

Available with touch pad or dial controls

IDEAL APPLICATIONS

- Server stations
- Convenience stores
- Coffee shops
- Concessions
- Breakrooms

Fabricated and Assembled in the USA

BOOST HEATS AND RE-THERMS IN SECONDS!

- Breakfast sandwich reheats in 1:00
- Stage cooking perfectly prepares instant oatmeal in 1:30

MISE EN PLACE DESIGN
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Submittal Sheet

03/14/2025

ITEM# SB08 - SLIM JIM TRASH CANS

By Owner

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Submittal Sheet

03/14/2025

ITEM# MC00 - MEMORY CARE

MEMORY CARE

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design & Consulting

Submittal Sheet

03/14/2025

ITEM# MC01 - MOP SINK (1 EA REQ'D)

Advance Tabco 9-OP-20-EC-X

Special Value Mop Sink, floor mounted, 25"W x 21"D x 10"H (overall), 20"W x 16" front-to-back x 6" deep (bowl size), free flow drain with 2" IPS outlet, stainless steel construction

ACCESSORIES

Mfr	Qty	Model	Spec
Advance Tabco	1	K-240-X	Service Sink Faucet, wall mount, heavy duty, 8" OC, 6-1/2" spout, with hose thread & pail hook, vacuum breaker spout, wall braced, chrome-plated brass
Advance Tabco	1	K-242	Mop Hanger, 23", accommodates (3)

ADVANCE TABCO
SMART FABRICATION™

SVU
SPECIAL VALUE UNITS

STAINLESS STEEL

ECONOMY FABRICATED FLOOR MOP SINKS

Item #: _____ Qty #: _____
Model #: _____
Project #: _____



FEATURES:

Floor mounted unit eliminates the need of lifting heavy containers.
Tile edge furnished on the rear.
Bowls rectangular in design for increased capacity.
K-16 Free Flow Drain is included with each mop sink.

CONSTRUCTION:

All TIG welded.
Welded areas blended to match adjacent surfaces and to a satin finish.

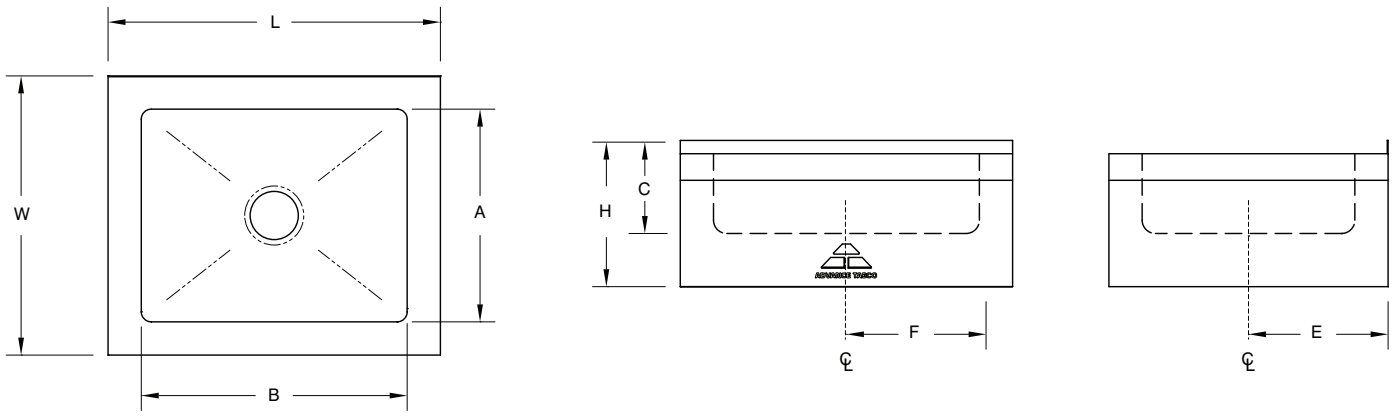
MATERIAL:

16 Gauge type "304" series stainless steel sink bowl.
18 Gauge type "304" series stainless steel sink apron.

Model #	Bowl Size (A x B x C)	O.A. Dimension (W x L x H)	Drain Distance (E)	Drain Distance (F)	Approx. Wt.	Approx. Cu.
9-OP-20-EC-X	16" x 20" x 6"	21" x 25" x 10"	10-1/2"	12-1/2"	33 lbs.	4
9-OP-40-EC-X	16" x 20" x 12"	21" x 25" x 16"	10-1/2"	12-1/2"	45 lbs.	4

DIMENSIONS and SPECIFICATIONS

TOL ± .500" ALL DIMENSIONS ARE TYPICAL



ADVANCE TABCO
SMART FABRICATION™
www.advancetabco.com

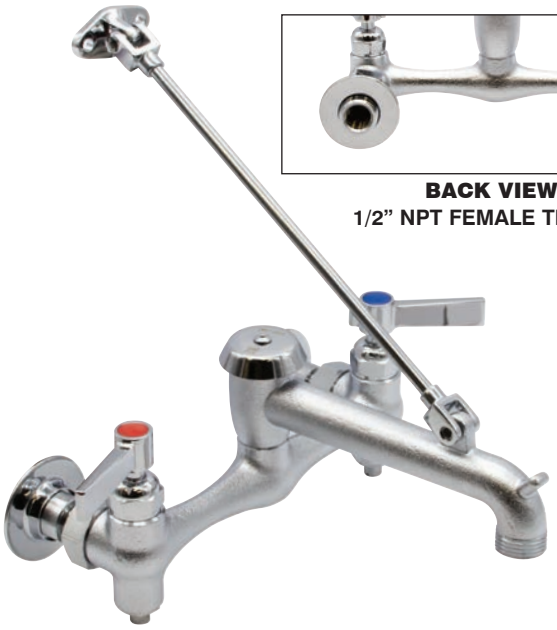
Customer Service Available To Assist You 1-800-645-3166 8:30 am - 7:00 pm E.S.T.

For Orders & Customer Service:
Email: customer@advancetabco.com or **Fax:** 631-242-6900

For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

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K-240
SERVICE FAUCET FOR MOP SINKS



BACK VIEW
1/2" NPT FEMALE THREAD

Item #: _____ Qty #: _____
Model #: _____
Project #: _____

FEATURES:

8" O.C. water supply.
Quarter turn wedge style handles with colored hot & cold Indexes.
9.6 GPM/36.3 LPM.
Wall support bracket & pail hook.
Vacuum breaker. Built-in stops.
Garden hose outlet.

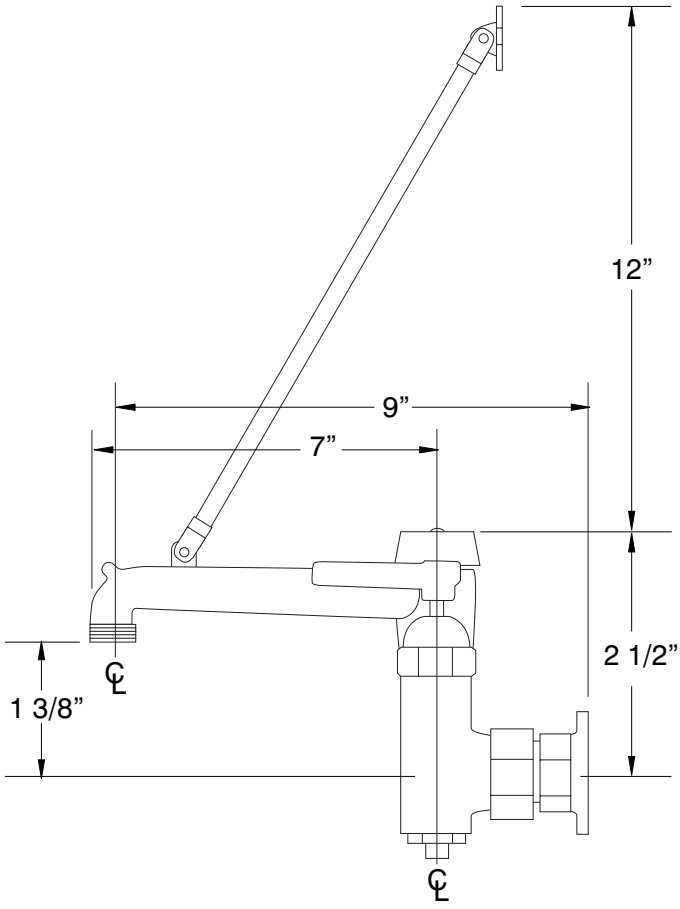
MATERIAL:

Brass chrome plated body & spout.
Chrome plated handles.



Click This Link To View Assembly Sheet

DIMENSIONS and SPECIFICATIONS



Options & Accessories



Replacement Vacuum Breaker Repair Kit For K-240

K-03



Faucet Repair Kit*
K-00B (Set of 2)
Includes 2 Cartridges and 2 Handles With Red & Blue Indexes

*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.

⚠ WARNING:

Faucet(s) on this page may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info.,visit www.p65warnings.ca.gov.

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REF-G

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

FABRICATED FLOOR MOP SINKS

Item #: _____ Qty #: _____
Model #: _____
Project #: _____



Standard Mop Sink
9-OP-20 Shown



Drop Front Mop Sink
9-OP-40DF Shown

FEATURES:

Floor mounted unit eliminates the need of lifting heavy containers.
Tile edge furnished on the rear.
Bowls rectangular in design for increased capacity.
K-16 3-1/2" Free Flow Drain. Connects to a 2" drain pipe.
-DF models feature a notched out front which allows for ease of emptying mop bucket).

CONSTRUCTION:

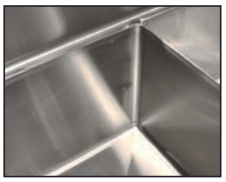
All TIG welded.
Welded areas blended to match adjacent surfaces and to a satin finish.

MATERIAL:

16 Gauge type "304" series stainless steel sink bowl & Apron.



Notched Out Front Allows Ease of Emptying Mop Bucket



Fabricated Bowls are Welded Together at the Seams

	Model #	Bowl Size (A x B x C)	O.A. Dimension (W x L x H)	Drain Distance (E)	Drain Distance (F)	Approx. Wt.	Approx. Cu.
STANDARD	9-OP-20	16" x 20" x 6"	21" x 25" x 10"	10-1/2"	12-1/2"	33 lbs.	4
	9-OP-28	20" x 28" x 6"	25" x 33" x 10"	12-1/2"	16-1/2"	47 lbs.	7
	9-OP-40	16" x 20" x 12"	21" x 25" x 16"	10-1/2"	12-1/2"	45 lbs.	6
	9-OP-48	20" x 28" x 12"	25" x 33" x 16"	12-1/2"	16-1/2"	62 lbs.	9
LARGE BOWL	9-OP-44	24" x 24" x 12"	29" x 29" x 16"	14-1/2"	14-1/2"	70 lbs.	9
DROP FRONT	9-OP-40DF	16" x 20" x 12"	18-1/2" x 25" x 16"	10-1/2"	12-1/2"	85 lbs.	9
	9-OP-48DF	20" x 28" x 12"	22-1/2" x 33" x 16"	12-1/2"	16-1/2"	110 lbs.	15

MOP SINK ACCESSORIES

16" High Side & Back Splashes for 9-OP Series Mop Sinks

Splashes on All 3 Sides

Model #	Fits Units:	Model #	Fits Units:
K-298	9-OP-20 9-OP-40	K-298D	9-OP-40DF
K-299	9-OP-28 9-OP-48	K-299D	9-OP-48DF
K-300	9-OP-44	-	-

Splash on Left or Right & Back

Model #	Fits Units:	Model #	Fits Units:
K-288LorR	9-OP-20 9-OP-40	K-288LDorRD	9-OP-40DF
K-290LorR	9-OP-28 9-OP-48	K-290LDorRD	9-OP-48DF
K-291LorR	9-OP-44	-	-

Height Above Finished Floor (A.F.F.)
9-OP-20/9-OP-28 = 26" High 9-OP-40/9-OP-40DF/9-OP-44/9-OP-48/ 9-OP-48DF = 32" High



Left & Right Splashes Shown

K-16 Replacement drain for floor mop sinks
K-240 Service Faucet*
K-242 23" wide mop hanger
K-243 Stainless steel mop drainage tray
K-244 Hose and hanger
K-245 8" x 24" utility shelf
K-246 8" x 36" utility shelf

*Does not meet Federal Lead Free Standards as it is not intended for potable water.



K-243



K-240



K-245



K-242



K-16



K-244

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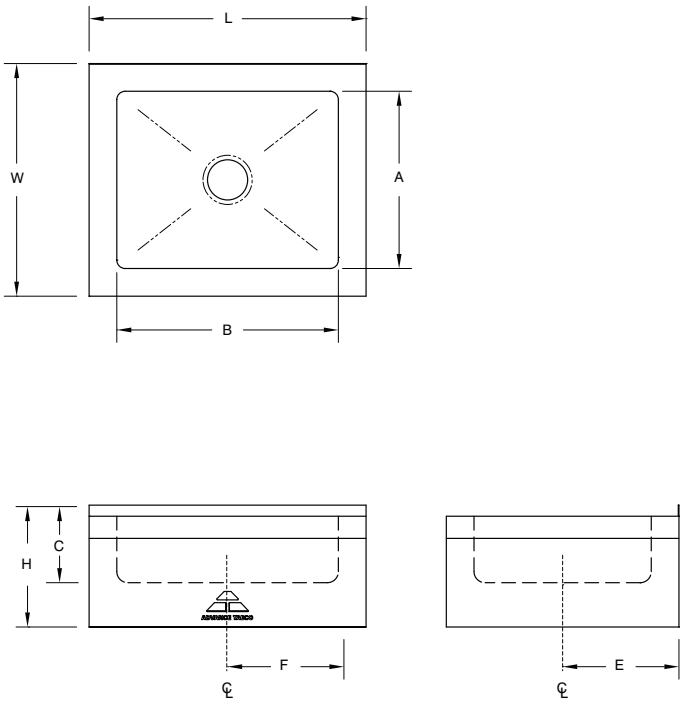
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DIMENSIONS and SPECIFICATIONS

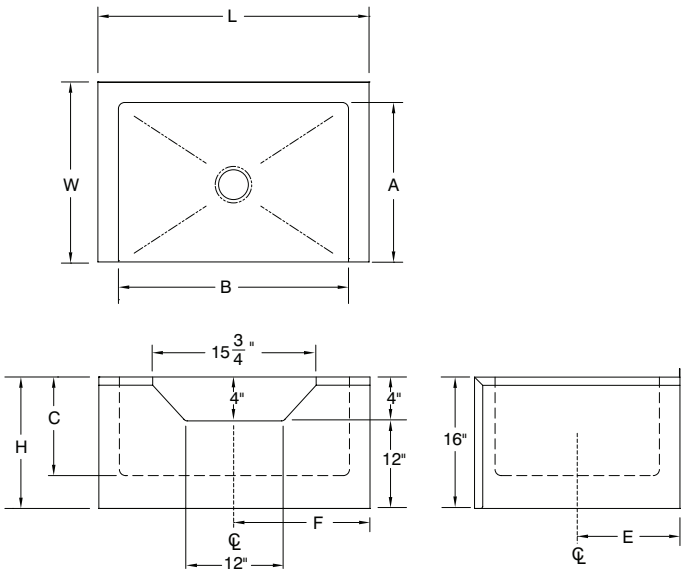
TOL Overall: ± .500”
Interior: ± .250”

ALL DIMENSIONS ARE TYPICAL

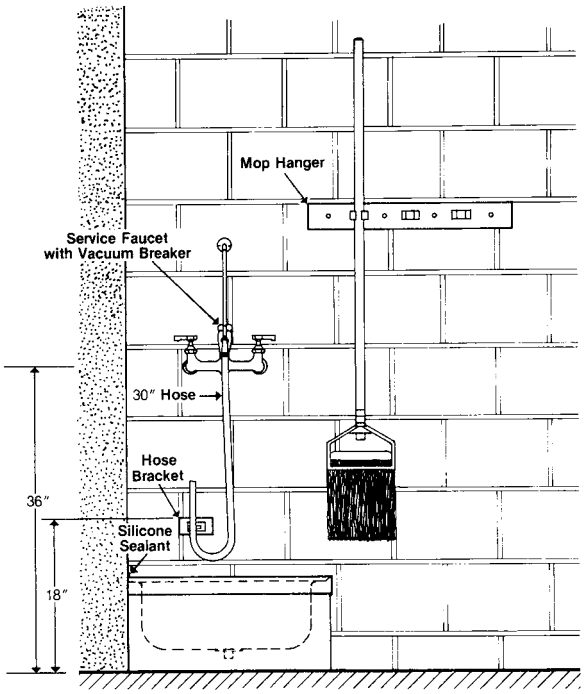
STANDARD MOP SINK



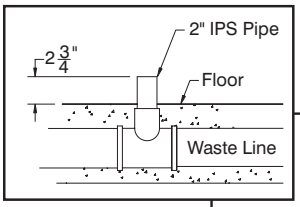
DROP FRONT MOP SINK

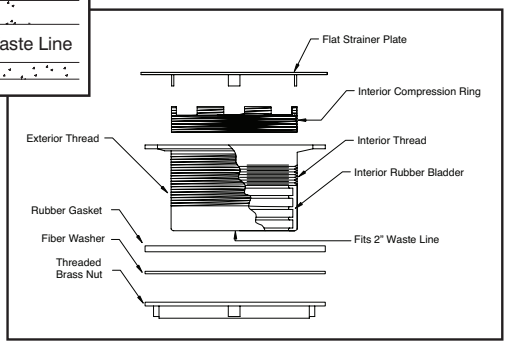


SUGGESTED INSTALLATION



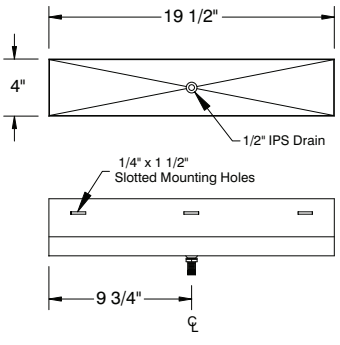
MOP SINK DRAIN ASSEMBLY

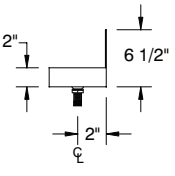




K-243 MOP DRAINAGE TRAY

13 lbs.





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Submittal Sheet

03/14/2025

ITEM# MC02 - SHELVING, WALL MOUNTED (1 EA REQ'D)

Advance Tabco WS-12-24-16

Shelf, wall-mounted, 24"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

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STAINLESS STEEL

WALL SHELVES

NSF



Item #: _____ Qty #: _____
Model #: _____
Project #: _____



FEATURES:

Brackets can be positioned to accommodate wall studs.

Furnished with a 1-5/8" Bullnose edge with a 1-1/2" turn-up edge at rear. Ends are turned down square.

MATERIAL:

16 Gauge Series - 304 stainless steel polished to a satin finish.

18 Gauge Series - 430 stainless steel polished to a satin finish.

CONSTRUCTION:

Secured to wall by means of bolts through support brackets.

Units 7 ft. and larger are furnished with 3 brackets.

	10" Wide			12" Wide			15" Wide			18" Wide			
L	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	Approx. Cu. Ft.
24"	WS-10-24-16	WS-10-24	8 lbs.	WS-12-24-16	WS-12-24	9 lbs.	WS-15-24-16	WS-15-24	11 lbs.	WS-18-24-16	WS-18-24	14 lbs.	3
30"	-	-	-	WS-12-30-16	WS-12-30	12 lbs.	-	-	-	-	-	-	4
36"	WS-10-36-16	WS-10-36	10 lbs.	WS-12-36-16	WS-12-36	12 lbs.	WS-15-36-16	WS-15-36	15 lbs.	WS-18-36-16	WS-18-36	21 lbs.	4
42"	-	-	-	WS-12-42-16	WS-12-42	14 lbs.	-	-	-	-	-	-	5
48"	WS-10-48-16	WS-10-48	12 lbs.	WS-12-48-16	WS-12-48	14 lbs.	WS-15-48-16	WS-15-48	18 lbs.	WS-18-48-16	WS-18-48	24 lbs.	5
60"	WS-10-60-16	WS-10-60	15 lbs.	WS-12-60-16	WS-12-60	17 lbs.	WS-15-60-16	WS-15-60	23 lbs.	WS-18-60-16	WS-18-60	28 lbs.	6
72"	WS-10-72-16	WS-10-72	17 lbs.	WS-12-72-16	WS-12-72	21 lbs.	WS-15-72-16	WS-15-72	28 lbs.	WS-18-72-16	WS-18-72	32 lbs.	7
84"	WS-10-84-16	WS-10-84	20 lbs.	WS-12-84-16	WS-12-84	25 lbs.	WS-15-84-16	WS-15-84	32 lbs.	WS-18-84-16	WS-18-84	36 lbs.	8
96"	WS-10-96-16	WS-10-96	23 lbs.	WS-12-96-16	WS-12-96	28 lbs.	WS-15-96-16	WS-15-96	36 lbs.	WS-18-96-16	WS-18-96	42 lbs.	10
108"	WS-10-108-16	WS-10-108	28 lbs.	WS-12-108-16	WS-12-108	32 lbs.	WS-15-108-16	WS-15-108	40 lbs.	WS-18-108-16	WS-18-108	48 lbs.	11
120"	WS-10-120-16	WS-10-120	32 lbs.	WS-12-120-16	WS-12-120	36 lbs.	WS-15-120-16	WS-15-120	44 lbs.	WS-18-120-16	WS-18-120	54 lbs.	12
132"	WS-10-132-16	WS-10-132	36 lbs.	WS-12-132-16	WS-12-132	42 lbs.	WS-15-132-16	WS-15-132	49 lbs.	WS-18-132-16	WS-18-132	60 lbs.	13
144"	WS-10-144-16	WS-10-144	40 lbs.	WS-12-144-16	WS-12-144	48 lbs.	WS-15-144-16	WS-15-144	55 lbs.	WS-18-144-16	WS-18-144	66 lbs.	14

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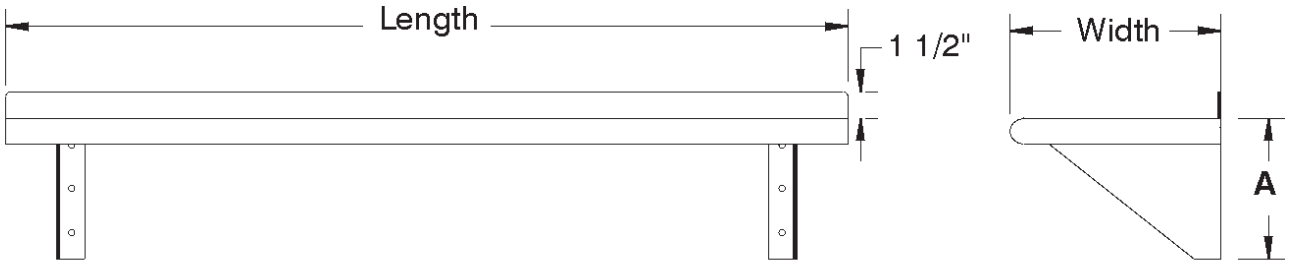
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DETAILS and SPECIFICATIONS

TOL ± .500" ALL DIMENSIONS ARE TYPICAL

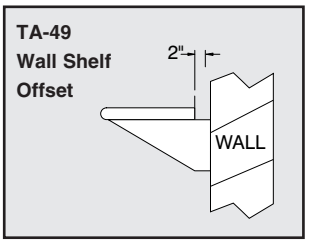


Width	A
10"	8 1/2"
12"	10 1/2"
15"	13 1/2"
18"	16 1/2"

Load Capacity = 20 lbs. per sq. ft.
(Evenly Distributed Weight)

Wall Shelf Options

PRT-1	Printer Shelf
TA-22A	Square Edge Shelf
TA-26	Welded Shelf Brackets
TA-49	Wall Shelf 2" Offset
TA-71	Heat Lamp Provision
TA-77	Check Minder
TA-77A	Concealer for Heat Lamp (Requires TA-77)
TA-99A	14 Ga. S/S 304 Upgrade for Overshelves
TA-100A	Bullnose Edge On All 4 Sides of Shelf
TA-102	6" Cantilever Shelf Offset





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Submittal Sheet

03/14/2025

ITEM# MC03 - HAND SINK (1 EA REQ'D)

Advance Tabco 7-PS-50

Hand Sink, wall mounted, 14" wide x 10" front-to-back x 5" deep bowl, 20 gauge 304 stainless steel, with heavy duty splash mounted gooseneck faucet, lever drain with overflow, P-trap, wall bracket, NSF, cCSAus

ACCESSORIES

Mfr	Qty	Model	Spec
Advance Tabco	1	K-316-LU	Wrist Handles

STAINLESS STEEL

STANDARD HAND SINKS

Conforms To NSF 61/9 Lead Free Requirements

ADVANCE TABCO
SMART FABRICATION™

SPLASH MOUNTED FAUCETS



7-PS-60



7-PS-68



7-PS-50



7-PS-54



7-PS-67

DECK MOUNTED FAUCET



7-PS-20



7-PS-20-NF
Faucet omitted

SINGLE HOLE PUNCH
Faucet omitted



7-PS-71

DOUBLE HOLE PUNCH
Faucet omitted



7-PS-70

LARGE SINK BOWLS

Features Large Size Sink Bowl 16” x 20” x 8”



7-PS-45

Features Large Size Sink Bowl 16” x 14” x 8”



7-PS-49

Item #: _____ **Qty #:** _____

Model #: _____

Project #: _____

FEATURES:

One piece **Deep Drawn** sink bowl design.

Sink bowl size is 10” x 14” x 5”.

7-PS-45 sink bowl size is 16” x 20” x 8”.

7-PS-49 sink bowl size is 16” x 14” x 8”.

All sink bowls have a large liberal radii with a minimum dimension of 2” and are rectangular in design for increased capacity.

Stainless steel 3 1/2” basket drain with 1-1/2” IPS.

Additional Features:

7-PS-20	K-22 4” O.C. deck mounted centerset faucet.
7-PS-20-NF	Deck mounted faucet omitted. Two 4” O.C. holes.
7-PS-45	K-59 4” O.C. splash mounted faucet and 2 Stainless Steel Support Brackets. (Hardware Included).
7-PS-49	K-59 4” O.C. splash mounted faucet and 2 Stainless Steel Support Brackets. (Hardware Included).
7-PS-50	K-59 4” O.C. splash mounted gooseneck faucet. Lever operated drain and built-in overflow with plastic overflow tube and spring clamps. 1-1/2” P-Trap.
7-PS-54	K-59 4” O.C. splash mounted gooseneck faucet. 1-1/2” P-Trap.
7-PS-60	K-59 4” O.C. splash mounted gooseneck faucet.
7-PS-67	K-59 4” O.C. splash mounted gooseneck faucet and lever operated drain.
7-PS-68	K-59 4” O.C. splash mounted gooseneck faucet with Wrist Handles.
7-PS-70	Splash mounted faucet omitted. Two 4” O.C. holes.
7-PS-71	Splash mounted faucet omitted. Single center hole.

CONSTRUCTION:

All TIG welded.

Welded areas blended to match adjacent surfaces and to a satin finish.

Die formed Countertop Edge with a No-Drip offset.

One sheet of stainless steel - No Seams.

MATERIAL:

Heavy gauge type 304 series stainless steel.

Wall mounting bracket is Galvanized and of offset design.

All fittings are brass / chrome plated unless otherwise indicated.

MECHANICAL:

Faucet supply is 1/2” IPS male thread hot and cold.

Faucet Flow Rate: 1.0 GPM/3.8 LPM aerator. 60 PSI.

⚠ WARNING:

Equipment that includes a faucet may expose you to chemicals, including lead, that are known to the State of California to cause cancer or birth defects or other reproductive harm. For more Info.,visit www.p65warnings.ca.gov.

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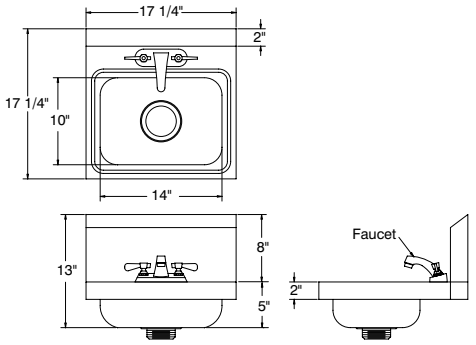
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REF-B

DIMENSIONS and SPECIFICATIONS

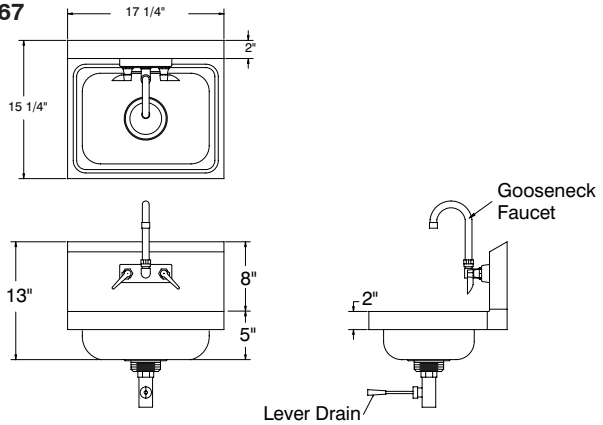
TOL Overall: ± .500" Interior: ± .250" **FITTINGS SUPPLIED AS SHOWN** **ALL DIMENSIONS ARE TYPICAL**

7-PS-20



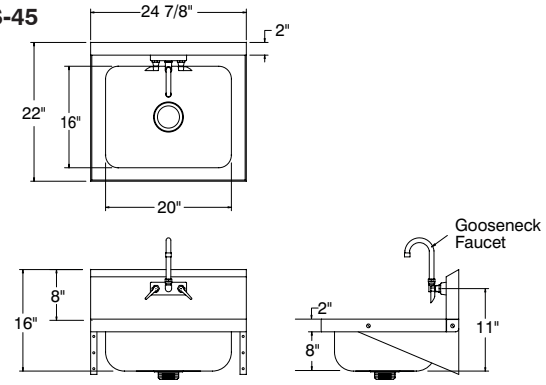
15 lbs.

7-PS-67



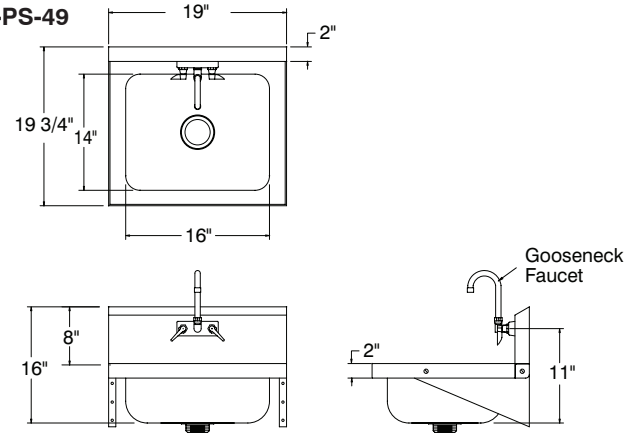
15 lbs.

7-PS-45



31 lbs.

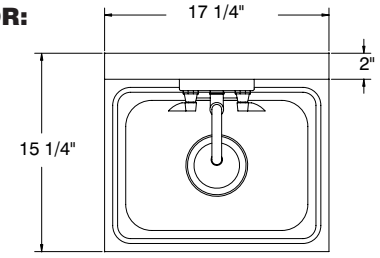
7-PS-49



31 lbs.

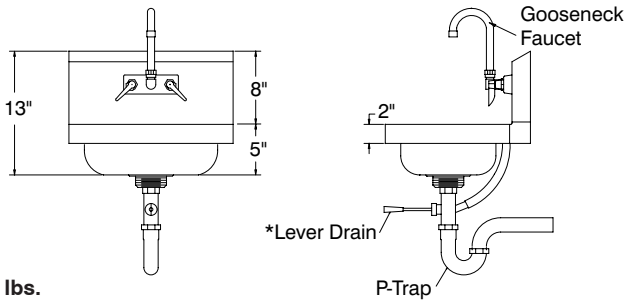
TOP VIEW FOR:

7-PS-50
7-PS-54
7-PS-60
7-PS-68
7-PS-70



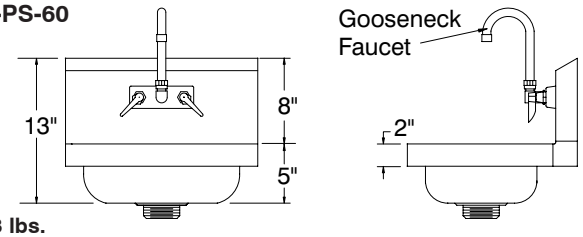
Sink Bowl 10" x 14" x 5"

7-PS-50 & 7-PS-54*
NOTE: *7-PS-54 Hand Sink <u>Excludes</u> Lever Drain and Overflow



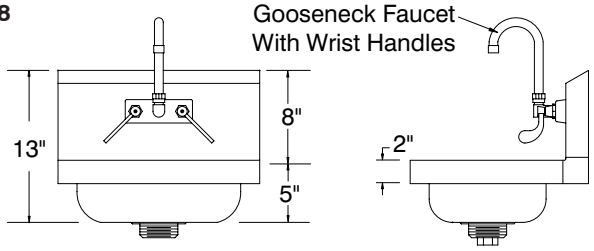
15 lbs.

7-PS-60



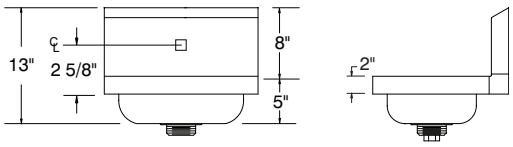
13 lbs.

7-PS-68

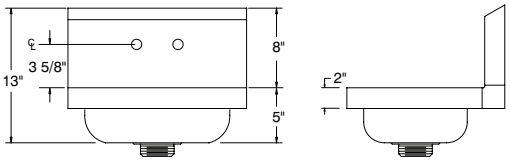


13 lbs.

7-PS-71



7-PS-70



12 lbs.

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FAUCET PARTS & ACCESSORIES

Faucet Repair Kit
For K-22, K-59, K-123, K-125, K-126, K-206 & K-316 Faucets
Includes 2 Cartridges and Handles
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-00A (Set of 2)



Faucet Repair Kit
For K-1, K-11, K-50, K-51, K-52, K-53, K-56, K-124, K-101, K-160, K-208 & K-240 Faucets
Includes 2 Cartridges and Handles
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-00B (Set of 2)





K-02 Filler Faucet Repair Kit
For K-54 & K-54A Faucets
*Can Only Be Used On Faucets Purchased From 2016 - 2019. For Older Faucets, See Below.



K-02A Filler Faucet Repair Kit
For K-54 & K-54A Faucets
*Can Only Be Used On Faucets Purchased Before January 2016 or After 2019.



Service Faucet Vacuum Breaker Repair Kit
For K-240 Faucet
*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-03

Pedal/Knee Valve Replacement Parts

Replacement Bonnet for Pedal/Knee Valve
For K-103, K-104, 7-PS-32 & 7-PS-39
K-01



Replacement Check Valves
For K-103, K-104, 7-PS-32 & 7-PS-39
K-19



Thermostatic Mixing Valve
For K-103, K-104, 7-PS-32 & 7-PS-39
K-425



Mixing Valve & Retainer
For K-103, K-104, 7-PS-32 & 7-PS-39
K-19A



Faucet Options & Accessories

Hands-Free Wand





K-400

Low Flow Aerator



.5 GPM
K-08

Wrist Handles (Pair)



*Can Only Be Used On Faucets Purchased After January 2016. For Older Faucets, Consult Customer Service.
K-316-LU

Wrist Handles (Pair)
For Heavy Duty 8" O.C. Faucets



K-416-LU

Splash Mount Faucet Mounting Kit
K-1, K-11, K-101, K-105, K-112, K-119 & K-211



K-06

Faucet Wall Mounting Bracket
8" O.C.



K-30

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Submittal Sheet

03/14/2025

ITEM# MC04 - REACH-IN REFRIGERATOR (1 EA REQ'D)

Continental Refrigerator 1RN

Refrigerator, reach-in, one-section, 20 cu. ft., self-contained refrigeration, stainless steel front, aluminum interior & ends, standard depth, full-height solid door, cylinder lock, electronic control with digital display, hi-low alarm, electric condensate evaporator, R290 Hydrocarbon refrigerant, 1/4 HP, cETLus, NSF, ENERGY STAR®

ACCESSORIES

Mfr	Qty	Model	Spec
Continental Refrigerator	1		Standard warranty (for the United States & Canada Only): 6 year parts and labor; additional 1 year compressor part
Continental Refrigerator	1		115v/60/1-ph, 5.2 amps, cord, NEMA 5-15P, standard
Continental Refrigerator	1		Door hinged on left
Continental Refrigerator	1		5" Casters, standard

REACH-IN REFRIGERATOR

Model: 1RN

Natural Refrigerant R-290 Model

1-Section Reach-In Refrigerator

ENERGY STAR® Qualified Commercial Refrigerator

1RN - Stainless steel front, aluminum end panels and interior
1RNSA - Stainless steel exterior, aluminum interior
1RNSS - Stainless steel exterior and interior
Designed to maintain NSF-7 temperatures in 100°F ambient.



Project Name:

Model Specified:

Location:

Item No: **Quantity:**

AIA #: **SIS #:**

Standard Model Features

REFRIGERATION SYSTEM

- Self contained, performance rated refrigeration system
- Natural, environmentally safe, high efficiency R-290 refrigerant[1]
- Automatic, electric condensate evaporator

CABINET ARCHITECTURE

- 3” non-CFC polyurethane foam insulation
- Smooth, polished chrome workflow door handle
- Cam action, lift off hinges
- Self-closing door
- Magnetic snap in Santoprene™ door gasket
- Cylinder lock in door
- Heavy duty, epoxy coated steel shelves
- 5” casters

MODEL FEATURES

- LED interior lighting
- Electronic control, off-cycle defrost
- Rehinging of door (in the field)

[1] R-290 refrigerant meets all federal and state regulatory requirements.

Options and Accessories

(upcharge and lead times may apply)

Stainless steel case back	Shallow depth (consult factory)
Additional epoxy coated steel shelves	Hinged glass door (consult factory)
Chrome or stainless steel shelves	Half doors
Heavy duty pilaster strips	Pass-Thru (consult factory)
Wine rack	**Correctional Facility Options**
Adjustable legs	• One way security screws
Custom laminates	• Locking hasp (lock not included)
Pan slide assemblies	• Stainless steel mesh cover
Expansion valve	• Coverless hinges
Special electrical requirements (consult factory)	

Consult factory for other model configurations, options and accessories.

Continental® Refrigerator

WARRANTY 6 Year Parts & Labor 7 Year Compressor

APPROVAL:

Model Specifications

DIMENSIONAL DATA

Net Capacity (cubic feet)	20 (566 cu l)
Width, Overall (inches)	26 (660 mm)
Depth, Overall (inches) (including handle)	35 3/8 (899 mm)
Depth (inches) (less door)	32 (813 mm)
Depth (inches) (door open 90°)	55 1/2 (1410 mm)
Clear Door Width (inches)	19 3/8 (492 mm)
Clear Door Height (inches)	58 5/8 (1489 mm)
Height, Overall (inches) (including 5" casters)	82 1/4 (2089 mm)
Number of Doors	1
Number of Shelves	3
Shelf Area (square feet)	20.4 (1.9 sq m)
Tray Slide Capacity (2" centers)	24

REFRIGERANT DATA

Condensing Unit Size (H.P.)	1/4+
Capacity (BTU per hour)*	1940

ELECTRICAL DATA

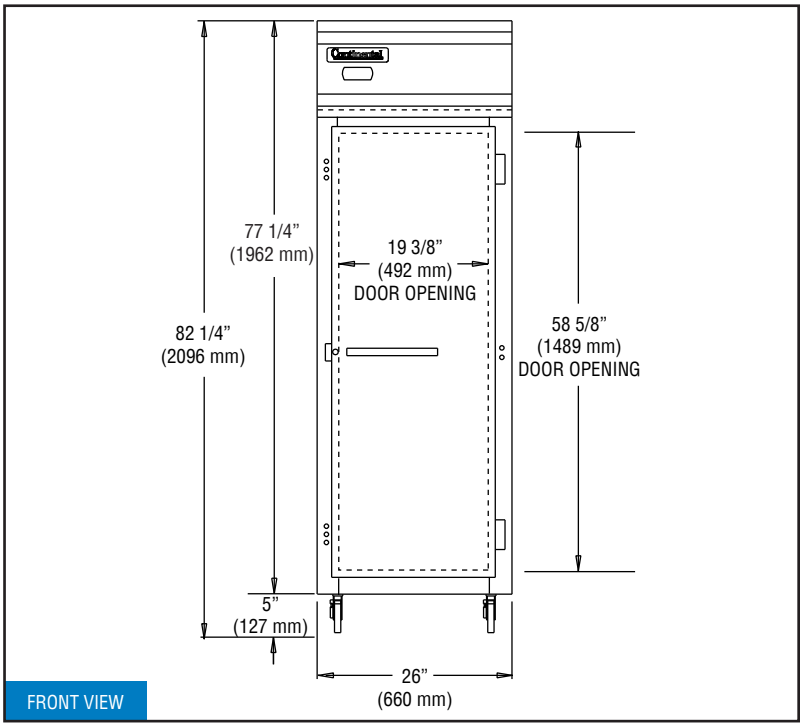
Voltage (International)	115/60/1 (220/50/1)
Feed Wires (including ground)	3
Total Amps (International)	5.9 (3.9)
10 ft. Cord/Plug [attached] (International)	Yes (No)

SHIPPING DATA

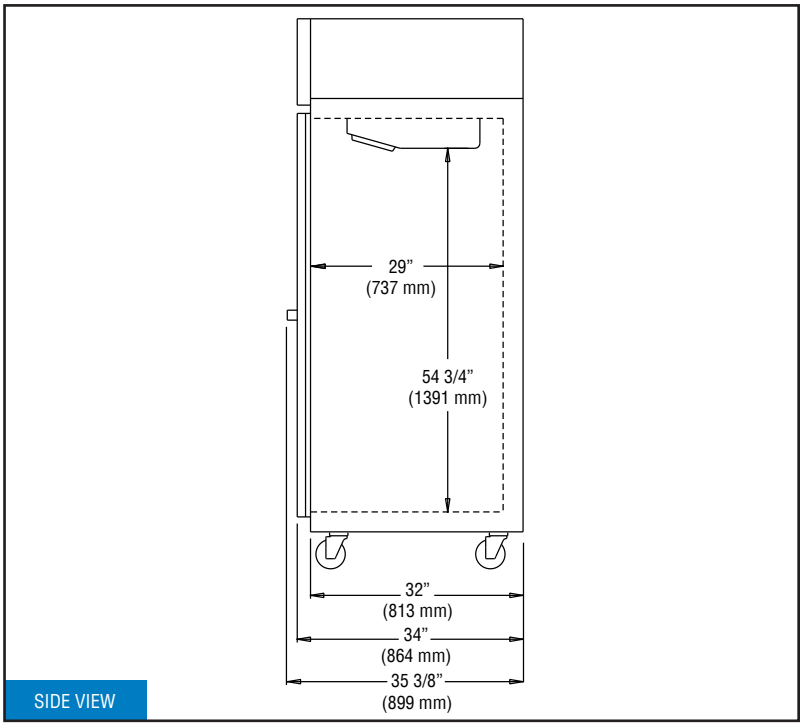
Height - Crated (inches)	85 1/2 (2172 mm)
Width - Crated (inches)	31 5/8 (803 mm)
Depth - Crated (inches)	42 (1067 mm)
Volume - Crated (cubic feet)	65 (1841 cu l)
Weight Std - Crated (pounds)	275 (124 kg)
Weight SS - Crated (pounds)	330 (149 kg)

* Rating @ +25°F evaporator, 90°F ambient
Figures in parentheses reflect metric equivalents rounded to the nearest whole unit.

Model Plan Views



FRONT VIEW



SIDE VIEW

IMPORTANT NOTE: If the cabinet is located directly against a wall and/or under a low ceiling, a minimum clearance of 12" is required on top and 3" on sides and rear.

Continental Refrigerator

Toll-Free: 800-523-7138
Phone: 215-244-1400
Fax: 215-244-9579

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Bensalem, PA 19020
www.continentalrefrigerator.com

Due to our continued efforts in developing innovative products, specifications subject to change without notice.

PROUDLY DESIGNED & ASSEMBLED IN THE U.S.A.

Equipped with one NEMA-5-15P Plug (varies by country)

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REVISED: 1/29/24

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Submittal Sheet

03/14/2025

ITEM# MC05 - BEVERAGE TABLE (1 EA REQ'D)

Fabricated CUSTOM BEVERAGE TABLE

S/s beverage table with partial s/s undershelf, five inch rear and right side splash.

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Submittal Sheet

03/14/2025

ITEM# MC06 - ICE & WATER DISPENSER (1 EA REQ'D)

Hoshizaki DCM-271BAH-OS

Opti-Serve Ice Maker/Water Dispenser, Cubelet-Style, air-cooled, self-contained condenser, production capacity up to 257 lb/24 hours at 70°/50° (196 lb AHRI certified at 90°/70°), 10 lb built-in storage capacity, counter model, touchless LED sensor, 10-1/4" cup clearance, protected with H-GUARD Plus Antimicrobial Agent, R-404A refrigerant, 4" legs, 115v/60/1-ph, 8.5 amps, cord & NEMA 5-15P, NSF, UL, ADA Compliant

ACCESSORIES

Mfr	Qty	Model	Spec
Hoshizaki	1		Warranty: 3-Year parts & labor on entire machine
Hoshizaki	1		Warranty: 5-Year parts on compressor, air-cooled condenser
Hoshizaki	1	LP-4 LEG	Leg Package, (4) x 4" stainless steel legs
Hoshizaki	1	H9320-51	Water Filtration System, single configuration, 18.4" H (manifold & cartridge)
Hoshizaki	1		Warranty: 1-Year on entire water filtration system & replaceable elements

DCM-271BAH-OS

DCM-271BAH-OS
07/02/24
Item # 13574

OPTI-SERVE SERIES
CUBELET ICE MACHINE AND WATER DISPENSER

Item #: _____

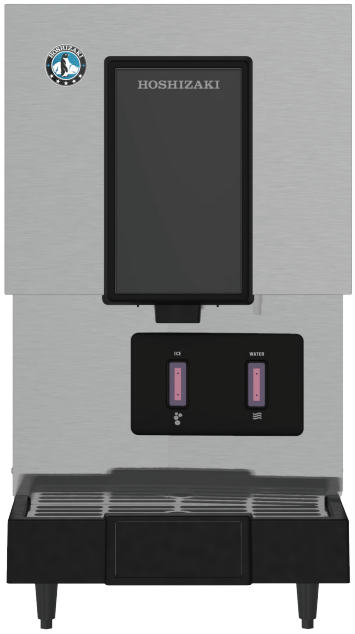
Project: _____

Qty: _____

AIA#: _____

W x D x H
16 5/8" x 24 1/4" x 31 3/4" *
*including 4" legs

OptiServe
TOUCHLESS ICE & WATER





Hands-free sensor designed for use with opaque containers. Not intended for outdoor use - avoid placement in direct sunlight.

Features

- **Opti-Serve touchless ice and water**
- **10 1/4" cup clearance**
- **Quieter operation**
- **ADA Compliant**

- Attractive modern design
- Easy to chew, Cubelet ice
- Up to 257 lbs. of ice production per 24 hours
- Built-in storage capacity of 0.3ft³/10 lbs.*
- Durable stainless steel drain pan grate
- Easy-cleaning removable spout
- 2-second flush cycle every hour
- Advanced CleanCycle24™ design
- 6 ft. cord with a NEMA 5-15 plug
- R-404A Refrigerant

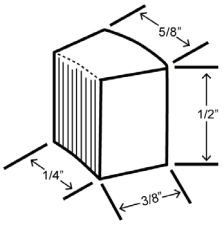
Warranty:
3 Year Parts & Labor on entire machine.
5 Year Parts on Compressor; air-cooled condenser coil.
Valid in United States, Canada, Puerto Rico and U.S. Territories. Contact factory for warranty in other countries.
*Rated in accordance with AHRI Standard 820(I-P). Capacity based on 100% of total volume x 30 lb/ft³ average density of ice.

Shipping: (LxWxH) 20.88" x 30.63" X 36.25" Volume: 13.42ft³

		ICE PRODUCTION		WATER USAGE		ELECTRICAL						
Condenser	Model	Air / Water Temp Lbs. per 24 hours 70°/ 50°F	90°/ 70°F	Potable Gal. per 100 lbs. 90°/ 70°F	Condenser Gal. per 100 lbs. 90°/ 70°F	kWh Used per 100 lbs. 90°/ 70°F	Min. Circuit/ Max. Fuse Size	Amperage	Voltage	Heat Rejection BTU/hr.	Refrigerant Charge Amount	Net / Ship Weight (lbs.)
Air-Cooled	DCM-271BAH-OS	257	196	12.0	N/A	6.9	15A	8.5A	115V/60/1	3,300	14.8 oz	136 / 154

Power cord included..

Cubelet Dimensions*



* approximate size in inches, image not to scale

Operating Limits

- Ambient Temp Range 45 - 100°F
- Water Temp Range 45 - 90°F
- Water Pressure 10 - 113 PSIG
- Voltage Range 104 - 127V
- If GFCI is required, a GFCI breaker MUST be used in lieu of GFCI receptacle

Service

- Allow 6" (15cm) clearance at rear and sides for proper air circulation and ease of maintenace and/ or service should they be required. Allow 24" (61 cm) clearance at top to allow for removal of auger.

Not intended for outdoor use - avoid placement in direct sunlight.

Plumbing

- Icemaker Water Supply Line: Minimum 1/4" Nominal ID Copper Water Tubing or Equivalent
- Icemaker Drain Line: Minimum 3/4" Nominal ID Hard Pipe or Equivalent
- 3/4" MPT drain

Water Filter

Please refer to water filter specification sheet for recommendations.

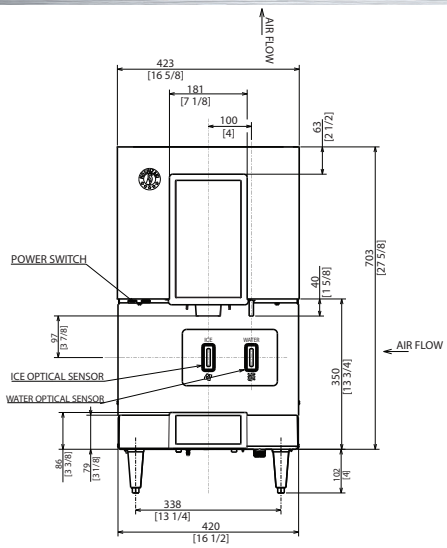
Hoshizaki reserves the right to change specifications without notice.

DCM-271BAH-OS

DCM-271BAH-OS
07/02/24
Item # 13574

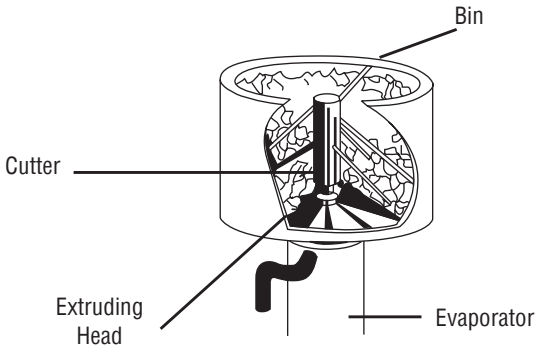
OPTI-SERVE SERIES
CUBELET ICE MACHINE AND WATER DISPENSER

FRONT VIEW

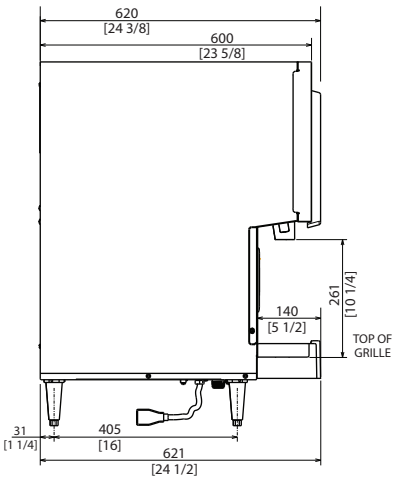


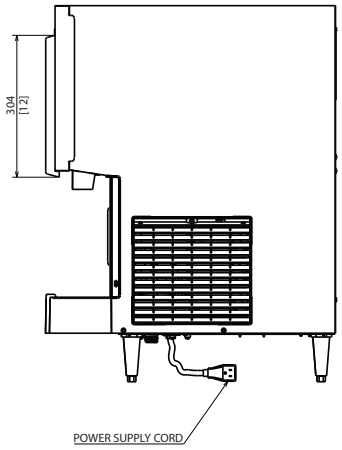
AIR-COOLED

inch
[mm]



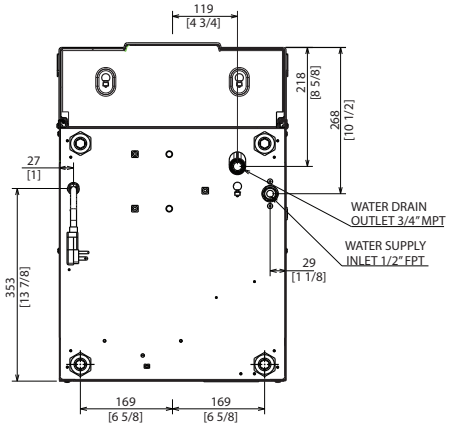
SIDE VIEW



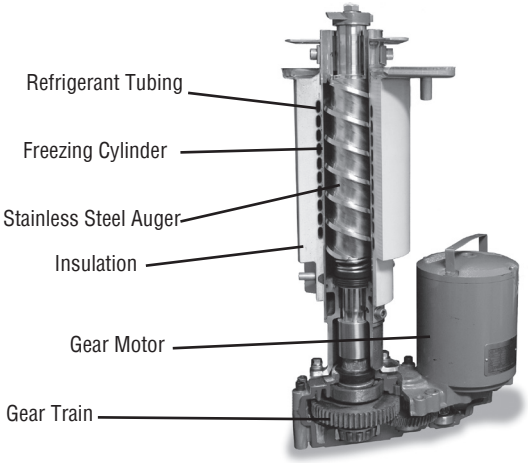


AIR-COOLED

BOTTOM VIEW



AIR-COOLED



EVAPORATOR

NOTE: DCM-271BAH-OS is made to pair with SD-271 stand. Placing a DCM-271BAH-OS on SD-270 stand will require a new drain hole to be cut.

Caster & Leg Accessories

Casters and Legs used on Hoshizaki Equipment

Item #: _____

Project: _____

Qty: _____

AIA#: _____

Casters

HS-3546/HS-3547



HS-5035



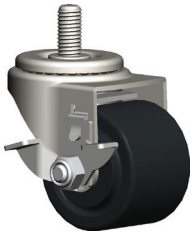
HS-5036 without brakes



HS-5036 with brakes



HS-5320/HS-5321



Accessory Number	Description	For use with	Weighted Capacity per caster
HS-3546	4” caster with 5/8”-11 thread, Set of 4 (2 with brakes)	Used on Steelheart Uprights, all models. C___S-xxx from aux code E-8 to H-5	400 lbs.
HS-3547	4” caster with 5/8”-11 thread, Set of 6 (3 with brakes)		
HS-5035	4” caster 1/2”-13 thread, Set of 4 (2 with brakes)	Undercounters	175 lbs.
HS-5036	6” caster 1/2”-13 thread, Set of 4 (2 with brakes)	Worktop, Sandwich Prep	350 lbs.
HS-5037	2” caster 1/2”-13 thread, Set of 4 (2 with brakes)	LP Undercounter models	220 lbs.
HS-5320	3-3/8” caster, 1/2”-13 thread, Set of 4 (2 with brakes)	Pizza Prep Tables for ADA Compliant dimensions	300 lbs.
HS-5321	3-3/8” caster, 1/2”-13 thread, Set of 6 (3 with brakes)		

Hoshizaki reserves the right to change specifications without notice.

Caster & Leg Accessories

Casters and Legs used on Hoshizaki Equipment

Item #: _____
Project: _____
Qty: _____
AIA#: _____

Legs

DM LEGS



LP-4 LEG



LP-6P-LEG



LP-6 Flange Leg



LP-6 LEG



Accessory Name/Number	Kit Number	Part Number	Description	Stud Length	For use with	Weighted Capacity per leg
	HS-2071, HS-2072, HS-2073	4A2091-01	Stainless, height 6”, 5/8-11, 4pk	3/4” thread	DCM-300, DCM-500, SD Stands	2000 lbs.
DM LEGS			Black, height 4”, 3/8-16, 1/2 4pk	5/8” thread	DM-200B	2000 lbs.
		4A2145-01	Black epoxy, height 4”, 3/8-11, 4pk	5/8” thread	DCM-271BAH(-OS)	1000 lbs.
LP-6P LEG		4A2525-01	Black, height 6”, 5/8-11, 4pk	3/4” thread	B-250, B-500, BD-500 B-700, B-800, B-900 KM-81, KM-116, KM-161, KM-231, KM-301 DB-200H, F-330(-C), F-300, F-500, IM-200	2000 lbs.
LP-6 FLANGE LEG		4A2526-01	Black epoxy, height 6”, 5/8-11, 4pk	3/4” thread	SD-200, SD-271, SD-500, SD-750, B-300, BD-300, DB-130H, DKM-500	2000 lbs.
		4A2966-01	Stainless, height 6”, 3/8-16, 4pk	3/4” thread	PR46A(-D2, D4)	500 lbs.
LP-6 LEG		4A0930-01	Stainless, height 6”, 5/8-11, 2pk	3/4” thread		2000 lbs.
		4A0930-02	Stainless, height 6”, 5/8-11, 2pk	3/4” thread		2000 lbs.
		4A0930-03	Stainless, height 6”, 5/8-11, 2pk	1/2” thread		2000 lbs.
	HS-3585	4A0930-04	Stainless, height 6”, 5/8-11, 4pk	3/4” thread		2000 lbs.
		4A0930-05	Stainless, height 6”, 1/2-13, 4pk	3/4” thread		2000 lbs.

© HOSHIZAKI AMERICA, INC.

WATER FILTERS

FILTRATION SYSTEMS

Item #: _____

Project: _____

Qty: _____

AIA#: _____

H9320 FILTER
Single, Double, Triple



H9320-51

Single Configuration
18.4" H*



H9320-52

Double Configuration
19.11" H*



H9320-53

Triple Configuration
19.15" H*

*height includes manifold and cartridge

HOSHIZAKI H9320 FILTER

Available in single, double and triple configurations. Rated NSF Class 1, STD 42, for taste, odor and chlorine reduction and for mechanical filtration (95.6% removal of particles one (1) micron and larger in size.)

- Keep ice makers functioning at full capacity
- 97.3% average reduction of chlorine from incoming water supply, eliminating tastes and odors of the ice
- Filters are rated as one (1) micron nominal producing crystal clear ice
- Decrease machine maintenance by reducing lime scale build-up

Model	Filter	Max Flow Rate	Working Pressure	Temperature	Capacity
H9320-51	4HC-H	2 gpm	10-125 psi	35-100°F	21,000 gal
H9320-52	4HC-H	4 gpm	10-125 psi	35-100°F	42,000 gal
H9320-53	4HC-H	6 gpm	10-125 psi	35-100°F	63,000 gal

Plumbing

Inlet/Outlet Connections: Single: (2) 3/8" FNPT
Double & Triple: (1) 3/4" MNPT / (1) 3/4" FNPT

The H9320 Filters and their respective cartridges have been tested and listed by NSF only for the functions listed above. Check for compliance with state and local laws and regulations. Do not use where the water is microbiologically unsafe, or with waters of unknown quality without adequate disinfection before or after the unit. The H9320 filter can be used with water that may contain filterable cysts.

The H9320 System is tested and certified by NSF International against NSF/ANSI Standard 42 for the reduction of:
Std. No. 42 - Aesthetic effects

Aesthetic Effects
Bacteriostatic Effects
Chemical Reduction
Chlorine

Mechanical Filtration
Nominal Particulate Class 1
Taste & Odor

E-10 PREFILTER
(9795-80)

E-20 PREFILTER
(9795-90)



E-10 PREFILTER
(9795-80)
Recommended for single configuraton



E-20 PREFILTER
(9795-90)
Recommended for twin and triple configuraton

E-10 and E-20 Prefilters can be used for ice. Everpure prefilters are designed to increase the life of Hoshizaki 4HC-H water filters in areas with an unusual amount of dirt in the water. With a 10 micron (nominal) rating, the economical Everpure prefilter traps much of the dirt which contributes to scale buildup in ice makers, and clogs the delicate orifices of other water-using equiment.

When you install an Everpure prefilter, the Hoshizaki 4HC-H water filters can concentrate on what they do best: remove particles one (1) micron nominal and larger in size.

Replacement Cartridges:
E-10 Prefilters: 12 pack (9534-12)
40 pack (9534-40)

E-20 Prefilters: 6 pack (9534-26)
20 pack (9534-20)

Warranty:
One Year replaceable elements*
One Year the entire system
* Warranty applies to material defects in materials & workmanship only.

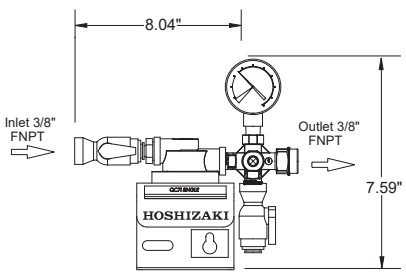
Hoshizaki reserves the right to change specifications without notice.

WATER FILTERS

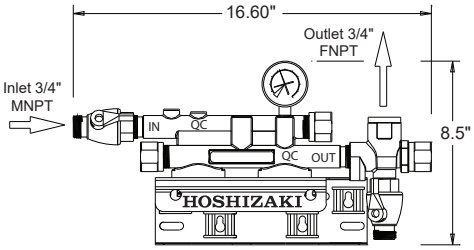
FILTRATION SYSTEMS

Model Number	Description Flow Rate (Gal. per min.)	Undercounter KMs	KM Cubers	IM Cubers	Cubelets & Flakers	DCM/DBs
H9320-51	Single (2 GPM)	AM-50 KM-81 KM-116 KM-161 KM-231 KM-301	KM-350, 520, 660 KML-325, 500, 700 KMD-410, 460, 530 KMS-830 DKM-500	IM-200,500 IM-50BAA-LM	All Models	All Models
H9320-52	Twin 2 x (2 GPM)	N/A	KM-901, 1100 KMD-860 KMS-822, 1122, 1402	IM-50BAA-Q	N/A	N/A
H9320-53	Triple 3 x (2 GPM)	N/A	KM-1301, 1340, 1601, 1900, 2200, 2600 KMH-2100 KMS-2000	N/A	N/A	N/A
H9655-11	Replacement Cartridge (1) One each	Recommended water filter configurations based on average ice machine usage and regular filter replacement. If your operation has challenging water conditions or higher usage, then it may be necessary to use an additional filter or prefilter.				

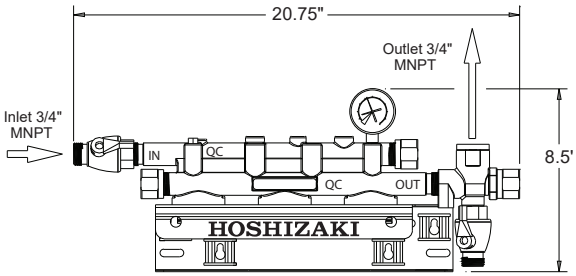
Single



Twin



Triple



MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# MC07 - JUICE DISPENSER

By vendor

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# MC08 - COFFEE BREWER

By vendor

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Submittal Sheet

03/14/2025

ITEM# MC09 - TEA BREWER

By vendor

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# MC10 - RACK DOLLY (1 EA REQ'D)

Cambro CD2020401

Camdolly®, 22-1/2"L x 22-1/2"W x 8-1/4"H (exterior dimensions), without handle, polyethylene construction, (4) 3" heavy duty swivel casters, load capacity 300 lbs., slate blue, NSF

CAMBRO

Item No. _____

Specifier Identification No. _____

Model No. _____

Quantity _____

Camdollies®

For Dish Racks

Without Handle
Model CD2020, CDR2020
With Handle
Models CD2020H, CD2020HB, CDR2020H

StoreSafe

Features & Benefits

- Make any job easier by smoothly transporting stacks of full size 20" x 20" (50 cm x 50 cm) dish racks with these rugged and reliable Camdollies. The CDR2020 and CDR2020H models will transport side by side stacks of half size dish racks also.
- Load capacity:
  Model CD2020 - 300 lbs. (136 Kg.)
  Model CDR2020 - 350 lbs. (159 Kg.)
  Models CD2020H, CDR2020H, CD2020HB - 350 lbs. (159 Kg.)
- Material design:
  Models CD2020, CD2020H, CD2020HB - One piece seamless, double-wall, high-density polyethylene construction is extremely durable. Won't rust or corrode. Foamed-in-place polyurethane core adds greater structural strength and reduces noise. Molded in handle on Model CD2020H and CD2020HB is extra sturdy and will not break or bend. Provides controlled handling and maneuvering over the roughest terrain.
  Models CDR2020 and CDR2020H - Injection molded high-density polypropylene offers exceptional performance with improved affordability. Will handle the demands of any foodservice operation. Won't rust or corrode. Weighs 40% less than the CD2020 for improved ease of handling and carrying when empty. A powder coated handle on the CDR2020H offers easy maneuvering.
- Simple to clean - all can be wiped down or steam cleaned.
- Casters:
  Models CD2020, CD2020H - Four each 3" (7,6 cm) heavy-duty, swivel casters, no brake. Bolted into molded-in steel plates.
  Model CD2020HB - Two each rear 10" (25,4 cm) Easy Wheels and 2 each 5" (12,7 cm) swivel casters, 1 w/ brake. Bolted into molded-in steel plates.
  Models CDR2020, CDR2020H - Four each 4" (10 cm) swivel casters, no brake.
- No assembly required for models CD2020, CD2020H and CD2020HB. Minimal assembly required for CDR2020 and CDR2020H.
- Colors:
  Models CD2020, CD2020H and CD2020HB available in 5 colors.
  Models CDR2020 andCDR2020H available in Soft Gray (151) only.



For Camracks™



CD2020



CD2020H



CD2020HB

10" (25,4 cm) Easy Wheels



CDR2020H



CDR2020

Approvals

NSF **CD2020, CD2020H, CD2020HB only.**

CAMBRO MANUFACTURING COMPANY
http://www.cambro.com
© 2008 Cambro Manufacturing Company 5801 Skylab Road, Huntington Beach, California 92647-2056-U.S.A.
Telephone (1)714 848 1555 **Toll Free** 800 854 7631 **Customer Service** 800 833 3003
LIT FCST-0102-06

Camdollies®

For Dish Racks

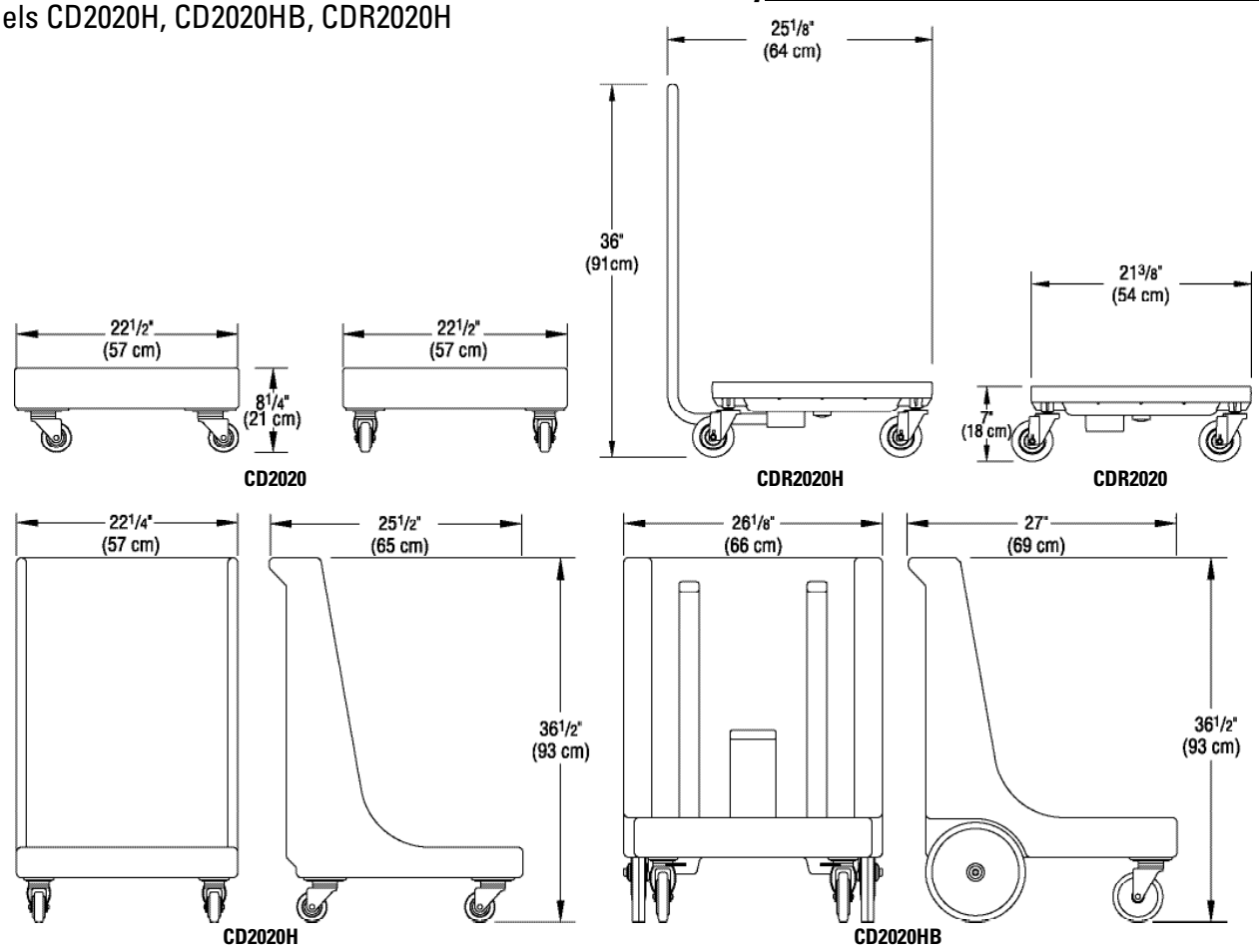
Without Handle
Model CD2020, CDR2020
With Handle
Models CD2020H, CD2020HB, CDR2020H

Item No. _____

Specifier Identification No. _____

Model No. _____

Quantity _____



Specifications

Dimension Tolerance: +/- ¼" (0,64 cm)

Code	Description	Load Capacity	Interior Dimensions W x L	Exterior Dimensions L x W x H	Case lbs./cube Kg/m³
Without Handle					
CD2020	Camdolly	300 lbs (136 Kg)	20 1/16" x 20 1/16" (51 x 51 cm)	22½" x 22½" x 8¼" (57 x 57 x 21 cm)	19 (2.14) 9 (0,06)
CDR2020	Camdolly	350 lbs (159 Kg)	20⅞" x 20⅞" (53 x 53 cm)	21⅜" x 21⅜" x 7" (54 x 54 x 18 cm)	11¾ (1.14) 5,3 (0,03)
With Handle					
CD2020H	Camdolly	350 lbs (159 Kg)	20¼" x 20¼" (52 x 52 cm)	25½" x 22¼" x 36½" (65 x 57 x 93 cm)	32¼ (11.45) 15 (0,32)
CDR2020H	Camdolly	350 lbs (159 Kg)	20⅞" x 20⅞" (53 x 53 cm)	25⅛" x 21⅜" x 36" (64 x 54 x 91 cm)	21½ (3.25) 9,7 (0,1)
CD2020HB	Camdolly	350 lbs (159 Kg)	20½" x 20⅝" (52 x 52 cm)	27" x 26⅛" x 36½" (69 x 66 x 93 cm)	46 (15.89) 21 (0,44)

Architect Specs

The dish rack transport cart shall be a Camdolly, Cambro Model.....manufactured by Cambro Mfg. Co., Huntington Beach, CA 92648 U.S.A. Models CD2020, CD2020H and CD2020HB shall be constructed of single-molded, seamless, double wall, high-density polyethylene and thick foam injected polyurethane. Models CDR2020 and CDR2020H shall be constructed of injection molded polypropylene. It shall be available with a load capacity of either 300 or 350 lbs. (136 or 159 Kg). It shall be available with a molded-in handle or a chrome handle. Models CD2020, CD2020H and CD2020HB shall be available with 4 each 5" (12,7 cm) swivel casters, no brake, or with 2 each 10" (25,4 cm) Easy Wheels and 2 each 5" (12,7 cm) swivel casters, 1 w/ brake. Casters shall be bolted into molded-in metal plates. Models CDR2020 and CDR2020H shall be available with 4 each 4" (10 cm) swivel casters, no brake. Models CDR2020 and CDR2020H shall be available in 1 color and shall require minimal assembly. Models CD2020, CD2020H and CD2020HB shall be available in 5 colors and require no assembly.

Standard Colors (CD2020, CD2020H, CD2020HB)

❑ Coffee Beige (157) ❑ Dark Brown (131) ❑ Black (110)
❑ Slate Blue (401) ❑ Gray (180)

Standard Colors (CDR2020, CDR2020H)

❑ Soft Gray (151)

Approvals

NSF **CD2020, CD2020H, CD2020HB only.**

CAMBRO MANUFACTURING COMPANY
http://www.cambro.com

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Telephone (1)714 848 1555 **Toll Free** 800 854 7631 **Customer Service** 800 833 3003 Printed in USA

CAMDOLLIES® FOR INSULATED BEVERAGE SERVERS AND CARRIERS

Without Handles



CD100

EXTERNAL DIM. W x D x H:
19⅝" x 28⅝" x 10½"

INTERIOR DIM. W x D:
17³⁄₁₆" x 26⅜"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: 250LCD, 350LCD, 500LCD, UC250, UC500, 100MPCHL, 100MPC, 300MPC, UPC300, UPC100, UPCS140, UPCS160, UPCS180, UPCSS160



CD160

EXTERNAL DIM. W x D x H:
16⁷⁄₁₆" x 24½" x 10⅜"

INTERIOR DIM. W x D:
14¼" x 22¼"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: UPCS140, UPCS160, UPCS180, UPCSS160, UPC140, UPC160, UPC180



CD300

EXTERNAL DIM. W x D x H:
25½" x 19¼" x 10½"

INTERIOR DIM. W x D:
16⅞" x 23⁹⁄₁₆"

CAPACITY: 350 lbs.

CASTER TYPE: A

FITS: 1000LCD, UC1000, 300MPC, 1318MTC, UPC300, 1318CC, UPCS140, UPCS160, UPCS180, UPCSS160



CD400

EXTERNAL DIM. W x D x H:
21⁹⁄₁₆" x 28⅛" x 9"

INTERIOR DIM. W x D:
18½" x 25⁹⁄₁₆"

CAPACITY: 300 lbs.

CASTER TYPE: A

FITS: UPCS400, UPC400



CDC300

EXTERNAL DIM. W x D x H:
17⁵⁄₁₆" x 24⅞" x 7⁵⁄₁₆"

INTERIOR DIM. W x D:
17⁹⁄₁₆" x 24⅝"

CAPACITY: 300 lbs.

CASTER TYPE: D

FITS: EPP400, EPP300, UPC300, EPP180SW, EPP160SW



CDC400

EXTERNAL DIM. W x D x H:
18¹⁵⁄₃₂" x 25¼" x 6⅞"

INTERIOR DIM. W x D:
18½" x 25"

CAPACITY: 300 lbs.

CASTER TYPE: D

FITS: UPC400, EPP180XLTSW



CD1420

EXTERNAL DIM. W x D x H:
16¼" x 21¾" x 8⁵⁄₁₆"

INTERIOR DIM. W x D:
13⅜" x 19⁵⁄₁₆"

CAPACITY: 350 lbs.

CASTER TYPE: B

FITS: 100LCD



CD2020

EXTERNAL DIM. W x D x H:
22½" x 22½" x 8¼"

INTERIOR DIM. W x D:
20⅛" x 20⅛"

CAPACITY: 300 lbs.

CASTER TYPE: B

FITS: 250LCD, 350LCD, 500LCD, 1000LCD, UC1000



CD2028

EXTERNAL DIM. W x D x H:
21⅞" x 30¼" x 8¼"

INTERIOR DIM. W x D:
19½" x 27⅞"

CAPACITY: 350 lbs.

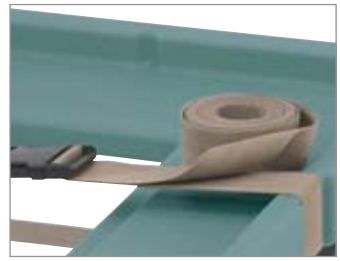
CASTER TYPE: B

FITS: 100MPC, UPC100, 300MPC, UPC300, UPC400

Camdolly® Colors:
Coffee Beige (157), Dark Brown (131), Black (110), Slate Blue (401).
CDC300 and CDC400 Color: Red (358).
CD400 InStock Colors:
Black (110), Dark Brown (131).

Caster Type:
(A) 5" Casters, 2 fixed, 2 swivel, 1 with brake.
(B) 3" Casters, 4 swivel, no brakes.
(C) 10" Rear Big Wheels, 2 front 5" swivel casters, 1 with brake.
(D) 4" Casters, 4 swivel 2 with brake.

Optional Accessories



400STP (STRAP)

DIMENSION: 150" Long

UTHSTP (STRAP)

DIMENSION: 200" long



1826HAR (LIFTING HARNESS)

DIMENSION: 142" long

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03/14/2025

ITEM# MC11 - SHELVING, WALL MOUNTED (1 EA REQ'D)

Advance Tabco WS-12-60-16

Shelf, wall-mounted, 60"W x 12"D, 1-5/8" bullnose front edge, 1-1/2"H rear up-turn, 16/304 satin finish stainless steel, NSF

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

WALL SHELVES

NSF



Item #: _____ Qty #: _____

Model #: _____

Project #: _____



FEATURES:

Brackets can be positioned to accommodate wall studs.

Furnished with a 1-5/8" Bullnose edge with a 1-1/2" turn-up edge at rear. Ends are turned down square.

MATERIAL:

16 Gauge Series - 304 stainless steel polished to a satin finish.

18 Gauge Series - 430 stainless steel polished to a satin finish.

CONSTRUCTION:

Secured to wall by means of bolts through support brackets.

Units 7 ft. and larger are furnished with 3 brackets.

	10" Wide			12" Wide			15" Wide			18" Wide			
L	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	16 Ga.	18 Ga.	Approx. Wt.	Approx. Cu. Ft.
24"	WS-10-24-16	WS-10-24	8 lbs.	WS-12-24-16	WS-12-24	9 lbs.	WS-15-24-16	WS-15-24	11 lbs.	WS-18-24-16	WS-18-24	14 lbs.	3
30"	-	-	-	WS-12-30-16	WS-12-30	12 lbs.	-	-	-	-	-	-	4
36"	WS-10-36-16	WS-10-36	10 lbs.	WS-12-36-16	WS-12-36	12 lbs.	WS-15-36-16	WS-15-36	15 lbs.	WS-18-36-16	WS-18-36	21 lbs.	4
42"	-	-	-	WS-12-42-16	WS-12-42	14 lbs.	-	-	-	-	-	-	5
48"	WS-10-48-16	WS-10-48	12 lbs.	WS-12-48-16	WS-12-48	14 lbs.	WS-15-48-16	WS-15-48	18 lbs.	WS-18-48-16	WS-18-48	24 lbs.	5
60"	WS-10-60-16	WS-10-60	15 lbs.	WS-12-60-16	WS-12-60	17 lbs.	WS-15-60-16	WS-15-60	23 lbs.	WS-18-60-16	WS-18-60	28 lbs.	6
72"	WS-10-72-16	WS-10-72	17 lbs.	WS-12-72-16	WS-12-72	21 lbs.	WS-15-72-16	WS-15-72	28 lbs.	WS-18-72-16	WS-18-72	32 lbs.	7
84"	WS-10-84-16	WS-10-84	20 lbs.	WS-12-84-16	WS-12-84	25 lbs.	WS-15-84-16	WS-15-84	32 lbs.	WS-18-84-16	WS-18-84	36 lbs.	8
96"	WS-10-96-16	WS-10-96	23 lbs.	WS-12-96-16	WS-12-96	28 lbs.	WS-15-96-16	WS-15-96	36 lbs.	WS-18-96-16	WS-18-96	42 lbs.	10
108"	WS-10-108-16	WS-10-108	28 lbs.	WS-12-108-16	WS-12-108	32 lbs.	WS-15-108-16	WS-15-108	40 lbs.	WS-18-108-16	WS-18-108	48 lbs.	11
120"	WS-10-120-16	WS-10-120	32 lbs.	WS-12-120-16	WS-12-120	36 lbs.	WS-15-120-16	WS-15-120	44 lbs.	WS-18-120-16	WS-18-120	54 lbs.	12
132"	WS-10-132-16	WS-10-132	36 lbs.	WS-12-132-16	WS-12-132	42 lbs.	WS-15-132-16	WS-15-132	49 lbs.	WS-18-132-16	WS-18-132	60 lbs.	13
144"	WS-10-144-16	WS-10-144	40 lbs.	WS-12-144-16	WS-12-144	48 lbs.	WS-15-144-16	WS-15-144	55 lbs.	WS-18-144-16	WS-18-144	66 lbs.	14

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SMART FABRICATION™
www.advancetabco.com

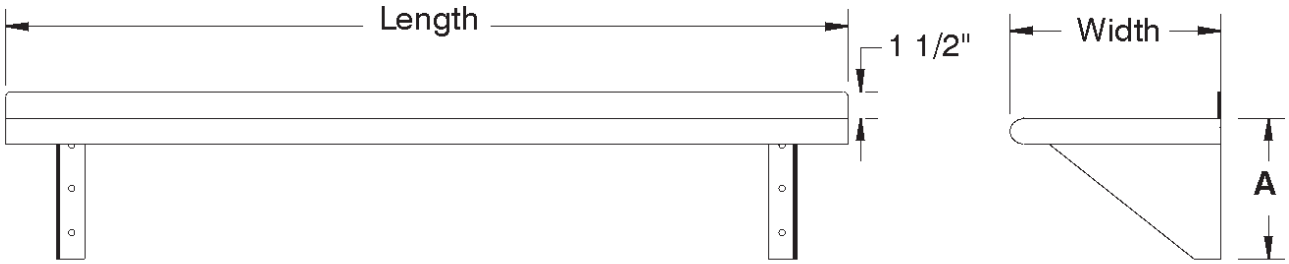
Customer Service Available To Assist You 1-800-645-3166 8:30 am - 7:00 pm E.S.T.

For Orders & Customer Service:
Email: customer@advancetabco.com or **Fax:** 631-242-6900

For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

DETAILS and SPECIFICATIONS

TOL ± .500" ALL DIMENSIONS ARE TYPICAL

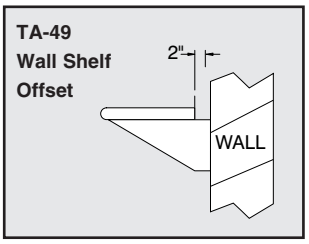


Width	A
10"	8 1/2"
12"	10 1/2"
15"	13 1/2"
18"	16 1/2"

Load Capacity = 20 lbs. per sq. ft.
(Evenly Distributed Weight)

Wall Shelf Options

PRT-1	Printer Shelf
TA-22A	Square Edge Shelf
TA-26	Welded Shelf Brackets
TA-49	Wall Shelf 2" Offset
TA-71	Heat Lamp Provision
TA-77	Check Minder
TA-77A	Concealer for Heat Lamp (Requires TA-77)
TA-99A	14 Ga. S/S 304 Upgrade for Overshelves
TA-100A	Bullnose Edge On All 4 Sides of Shelf
TA-102	6" Cantilever Shelf Offset





ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice.
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03/14/2025

ITEM# MC12 - SPARE NO.

<Spare No.>

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03/14/2025

ITEM# MC13 - SPARE NO.

<Spare No.>

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Submittal Sheet

03/14/2025

ITEM# MC14 - HOT FOOD SERVING COUNTER / TABLE (1 EA REQ'D)

Randell 3613-240

Hot Food Table, electric, 208/240V, 48" L, 30" D, 36" H, individual die-stamped (3) 12" x 20" top openings, sealed well with bottom element (used for wet operation), individual thermostatically controlled, stationary modular, open shelf base, stainless steel top & ends, full length 8" D NSF workboard & stainless steel 7" D plate shelf

ACCESSORIES

Mfr	Qty	Model	Spec
Randell	1		(1) year parts and labor warranty, standard
Randell	1		208v/60/1-ph, 2.6 kw, 12.48 amps, NEMA 6-20P, standard (3 x 865 watt elements)
Randell	1	HFFCTSGLL	Fill Faucet Left
Randell	1		6" Legs, standard
Randell	1	HFDST48	Overshelf, deck mount, single tier 48"

Certifications:

PROJECT NAME:	
LOCATION:	
ITEM NO:	
QTY:	
MODEL NO:	
AIA NO:	
SIS NO:	
CSI SECTION:	11400

HOT FOOD TABLES

ELECTRIC INDIVIDUAL SEALED WELL MODEL 3600

Electric operated, stainless steel open shelving base hot food table with 20 gauge stainless steel top, and individual die-stamped 12" x 20" top openings. Individual thermostatically controlled, electrically heated, sealed food wells designed for wet operation with wells provided with drains and manifold to a common gate valve. Unit prewired to junction box, power cord is supplied. 7" wide plate shelf and full length 8" deep cutting board. Unit on 6" high adjustable legs.



3613 shown with optional casters

SHORT FORM SPEC: Randell 3600 series hot food tables. Individually controlled, sealed element design includes thermostatically controlled food wells with on/off indicator light, mounted on front of 7" deep stainless steel plate shelf-removable for access to controls and heating elements. Top is one-piece stainless steel with 12"x20" raised perimeter die-formed food wells with sealed elements, standard with drains manifolded to common gate valve. Supplied with 8" wide, ½" thick full length cutting board and pre-wired 8' power cord with plug.

MODELS:

- ☐ 3612
- ☐ 3613
- ☐ 3614
- ☐ 3615

STANDARD FEATURES:

- Designed for wet operation
- Die stamped, raised sanitary rim pan openings in stainless steel top
- Stainless steel body construction - no assembly required.
- Thermostatic controls for precise food temperatures - one per well
- Drains manifolded to a common gate valve
- Stainless steel, full length plate shelf - 7" deep
- Stainless steel ends
- Full length, 8" deep cutting board
- Units take food pans directly, wet/dry operation
- Power cord
- 6" high adjustable legs
- Available for 120V, 208V, or 240 volt operation

UNIT TOP: Top to be one piece of die formed 20 gauge stainless steel with 1 5/8" square nosing. Top stamped with individual 12"x 20" die formed raised perimeter openings. Unit top fitted with compliment of 12"x 20"x 6 1/2" deep, electrically heated, sealed food wells, individual thermostatically controlled. Provided with 7" deep, removable 20 gauge stainless steel plate shelf, and 8" wide x 1/2" thick, full length NSF composition cutting board.

FOOD WELLS: 12"x 20" x 6 1/2" deep electrically heated, sealed food wells, individually and thermostatically controlled. Wells are designed for wet operation, provided with drains, and manifolded to a gate valve located on the left side of the unit.

CONTROLS: Unit comes standard with thermostatic controls and on/off indicator light. Controls mounted on front of 7" deep removable stainless steel plate shelf. Connections to heating elements are located outside of heated zone to avoid wiring deterioration. Individual food wells wired to common junction box. 8' power cord is supplied.

UNIT BASE: Bottom shelf to be stainless steel with channel bracing. Body ends to be stainless steel. Legs to be 6" high with adjustable bullet foot. Legs mounted to full length channel frame beneath body assembly.

ORIGIN OF MANUFACTURE: Designed and manufactured in the United States.

OPTIONS/ACCESSORIES:

- ☐ Counter Protectors
- ☐ Serving Shelves/Plexi Shields
- ☐ Overshelves
- ☐ Casters
- ☐ Roll Covers
- ☐ Adaptor Plates
- ☐ Manual Fill Faucet
- ☐ Stainless Steel Back
- ☐ Voltage Other than Standard On 3-5 Well Only

ADDITIONAL RESOURCES:

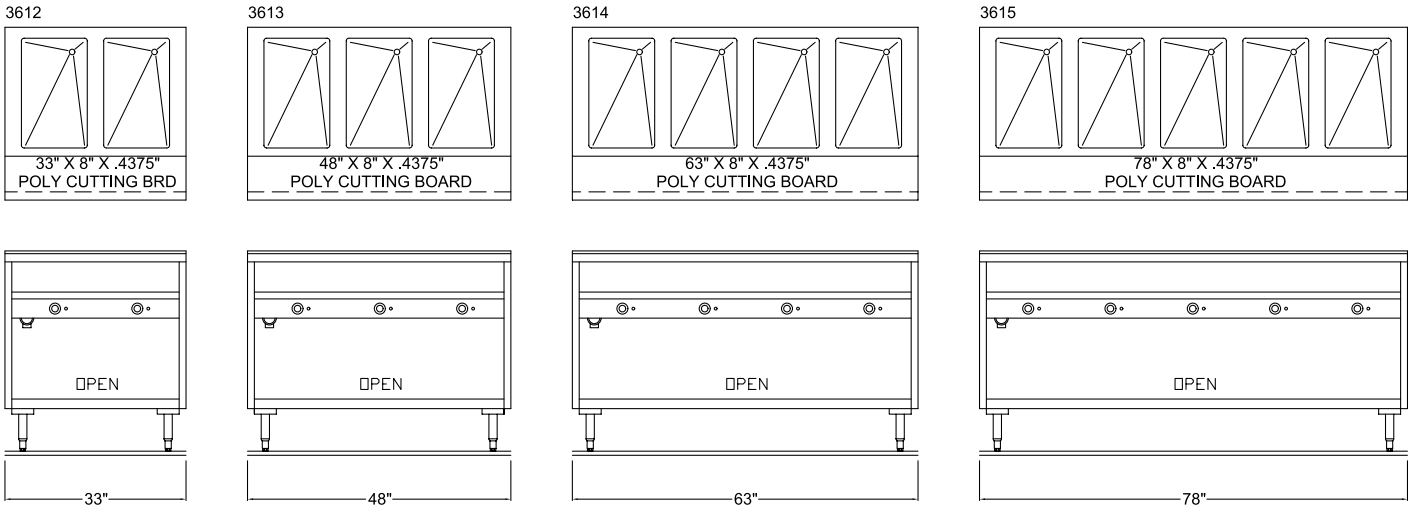
Request A Quote

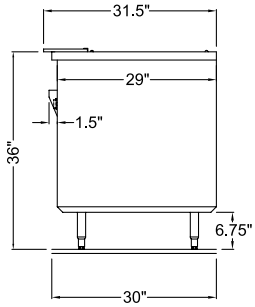
Sales Tools

Find A Rep

Serving Stations
PPSPEC0018 RevJ
08/21

randell 3600





6.75" IS STANDARD SETTING TO ACHIEVE A 36" WORK HEIGHT. LEGS HAVE AN ADJUSTABILITY FROM 6" - 7.25"

Model	L	D	H	No. of wells	No. of elements	Bottom Shelf Material	Sq. Ft.	120V-750Watt			208V-865Watt			240V-1150Watt			Ship Wt.
								KW	Amps	NEMA	KW	Amps	NEMA	KW	Amps	NEMA	
3612	33"	30"	36"	2	2	S.S.	5.5	1.50	12.50	5-20P	1.73	8.32	6-15P	2.30	9.58	6-15P	116
3613	48"	30"	36"	3	3	S.S.	8.1	2.25	18.75	5-30P	2.60	12.48	6-20P	3.45	14.38	6-20P	174
3614	63"	30"	36"	4	4	S.S.	10.7	3.00	25.00	5-50P	3.46	16.63	6-30P	4.60	19.17	6-30P	232
3615	78"	30"	36"	5	5	S.S.	13.3	3.75	31.25	5-50P	4.33	20.79	6-30P	5.75	23.96	6-30P	290

MADE IN USA

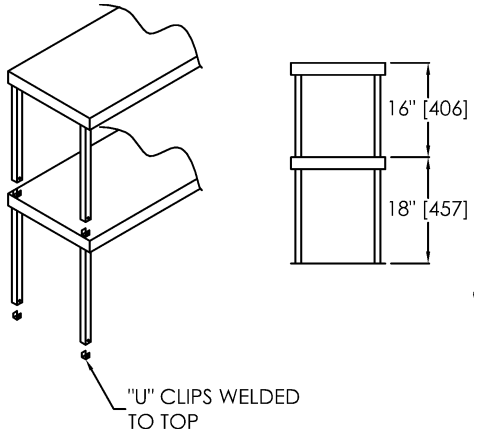
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Information known to be correct at time of creation. Please reference our website for the most updated product information and specifications.

RANDELL®

RanSpec Design Accessories - Overshelving

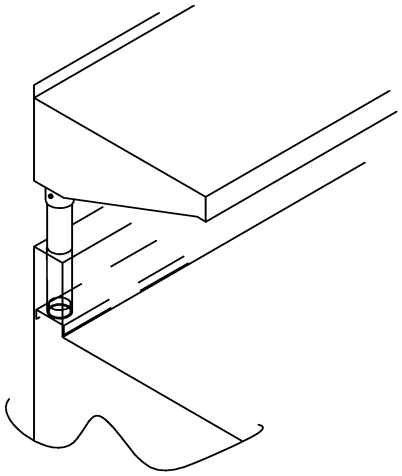
☐ Standard Deck-Mounted Overshelf

Constructed of die-formed 16 gauge stainless steel (14 gauge is optional). Supported with stainless tubular uprights.



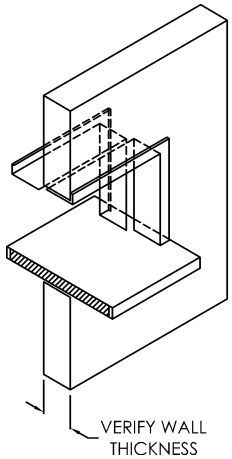
☐ Cantilevered Mounted Overshelf

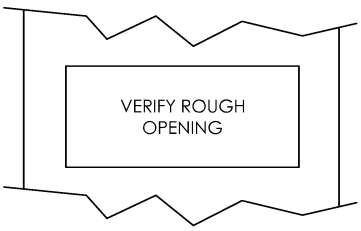
Constructed of die-formed 16 gauge stainless steel (14 gauge is optional). Supported with 1 5/8" stainless tubular uprights.



☐ Pass-thru Overshelf

Model # 11069 - Constructed of 16 gauge stainless steel with solid core shelf. Provided with two piece telescoping frame. 18" to 24" widths available on shelf. Frame adjusts for 4 1/2" to 10" wall thickness.





RANDELL®

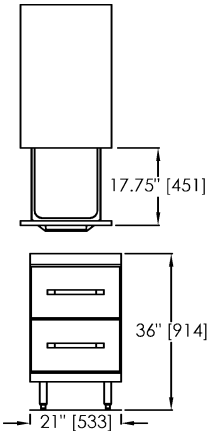
Design Accessories - Pull-Out Drawers

The Randell Patented Drawer Cartridge System!

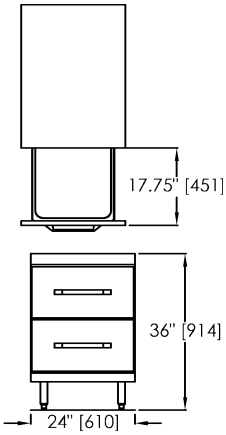
A fully welded, unitized drawer cartridge assembly with a quick release that allows the refrigerated drawers to be easily removed for cleaning.



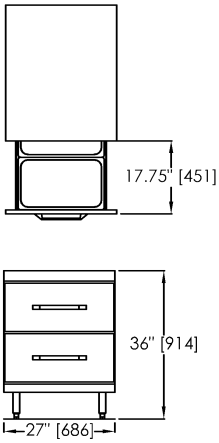
- Fully welded 14 gauge unitized Drawer Cartridge assembly.
- 14 gauge drawer tracks on 1 5/8" heavy duty stainless steel bearings.
- Heavy duty full extension tracks to accommodate 12" x 20" x 4" deep pans, two per drawer. Pans by others.
- Quick release allows drawers and liners to be removed without tools.
- Self-closing drawers with stainless steel drawer fronts & easy to grasp drawer handles.



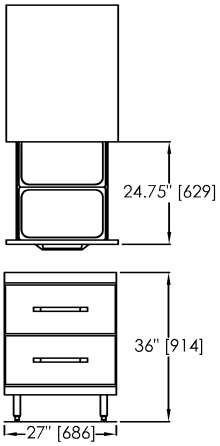
Model C11043-21
Fits standard 21" refrigerated sections. Available in 29" or 33" deep bases. 33" deep model supplied with (1) 12" x 20" x 6" dp. plastic pan per drawer.



Model C11043-24
Fits standard 24" refrigerated sections. Available in 29" or 33" deep bases. 33" deep model supplied with (1) 12" x 20" x 6" dp. plastic pan per drawer.

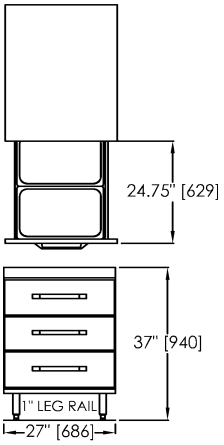


Model C11043-27
Increases standard 24" refrigerated section 3" to 27". - 29" or 33" deep bases.Supplied with (2) 12" x 20" x 6" dp. plastic pans per drawer.

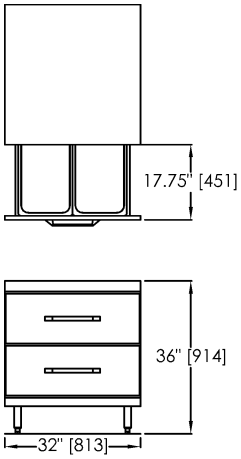


Model C11043-27E
Increases standard 24" refrigerated section 3" to 27" - **33" deep bases only.** Supplied with (2) 12" x 20" x 6" dp. plastic pans per drawer.

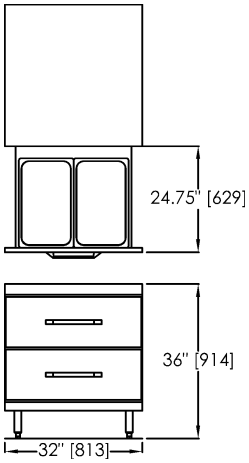
Note: 29" deep models supplied with grey ABS tub.



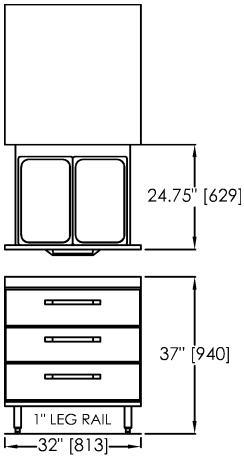
Model C11043-27TE
Increases standard 24" refrigerated section 3" to 27" - **33" deep bases only.** Supplied with (2) 12" x 20" x 4" dp. plastic pans per drawer.
Note:Unit body height is modified to accept (3) tiers of drawers.



Model C11043-32
Increases standard 24" refrigerated section 8" to 32" - 29" or 33" deep bases.Supplied with (2) 12" x 20" x 6" dp. plastic pans per drawer.



Model C11043-32E
Increases standard 24" refrigerated section 8" to 32" - 29" or 33" deep bases.Supplied with (2) 12" x 20" x 6" dp. plastic pans per drawer.



Model C11043-32TE
Increases standard 24" refrigerated section 8" to 32" - 29" or 33" deep bases. Supplied with (2) 12" x 20" x 4" dp. plastic pans per drawer.

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03/14/2025

ITEM# MC15 - WORK TABLE (1 EA REQ'D)

Fabricated CUSTOM

S/s work table with partial s/s undershelf and five inch rear splash.

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03/14/2025

ITEM# MC16 - MICROWAVE OVEN (1 EA REQ'D)

ACP RCS10DSE

Amana® Commercial Microwave Oven, 1.2 cu. ft. capacity, 1000 watts, medium volume, 10-min. dial timer, (4) power levels, non-removable air filter, side hinged door with tempered glass, accommodates 14" plate, stainless steel exterior & interior, 120v/60/1-ph, 13.0 amps, 15 MCA, 1550 watts (total), NEMA 5-15P, cETLus, ETL-Sanitation

ACCESSORIES

Mfr	Qty	Model	Spec
ACP	1		3-year limited warranty (1 year full)
Advance Tabco	1	MS-24-24	Microwave Shelf, wall-mounted, 24"W x 24"D, stainless steel, NSF

Amana® Commercial

Project #:_____

Item #:_____

AIA File #:

Specification #:

Medium Volume

Amana Commercial Microwave Model RCS10DSE



Model RCS10DSE shown

Medium Volume
This category of microwave is ideal for...

Applications:
- Coffee shops
- Ethnic restaurants
- Concessions
- Dessert stations

All ACP, Inc. commercial ovens are backed by our Culinary Center. Call us with any question regarding food preparation, menu development and cooking times. 866-426-2621.

Culinary Center ACP

Power Output

- 1000 watts of power.
- Four power levels.

Easy to Use

- User friendly ten minute dial timer lights up for at-a-glance monitoring.
- Timer automatically resets to zero if door is opened during heating. User option allows manual reset to zero.
- See-through door and lighted interior for monitoring without opening the door.
- 1.2 cubic ft. (34 liter) capacity accommodates a 14" (356 mm) platter, prepackaged foods and single servings.
- Stackable to save valuable counter space.

Easy to Maintain

- Stainless steel exterior and interior for easy cleaning and a commercial look.
- Constructed to withstand the foodservice environment.
- Non-removable air filter protects oven components.
- Backed by the ACP, Inc. 24/7 ComServ Support Center, 866-426-2621.
- ETL Listed.

C ETL LISTED US Intertek

ETL SANITATION LISTED Intertek

Part No. 20154733
Updated 6/17/16
Original Instructions

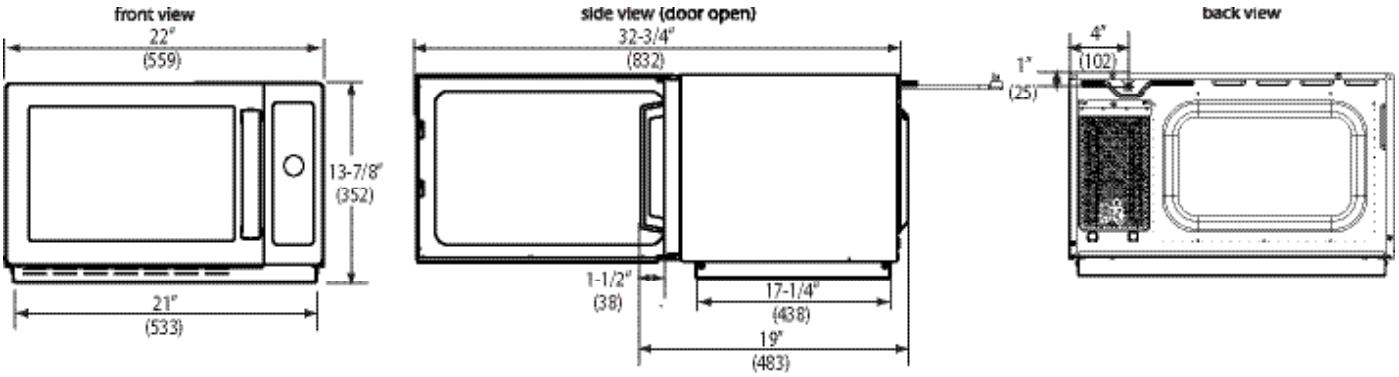
ACP INC.

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Cedar Rapids, Iowa 52404

225 49th Ave Dr. SW Cedar Rapids, IA 52404 | 800-233-2366 | 319-368-8120 | Fax: 319-368-8198 | www.acpsolutions.com

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Amana Commercial Microwave Model RCS10DSE | Medium Volume



Installation Clearances - Top: 2" (51), Sides: 1" (25), Back: None

Drawings available from KCL CADlog - techs@kclcad.com

Specification #:

Specifications			
Model	RCS10DSE	UPC Code 728028129465	
Configuration	Countertop		
Control System	Dial		
Max. Cooking Time	10:00		
Power Levels	4		
Time Entry Option	Yes		
Microwave Distribution	Rotating antenna, top		
Magnetron	1		
Stackable	Yes		
Stage Cooking	1		
Interior Light	Yes		
Door Handle	Grab & Go		
Signal	End of cycle		
Exterior Dimensions	H 13 ⅞" (352)	W 22" (559)	D*19" (483)
Cavity Dimensions	H 8 ½" (216)	W 14 ½" (368)	D 15" (381)
Door Depth	32 ¾" (832), 90°+ door open		
Usable Cavity Space	1.2 cubic ft. (34 liter)		
Exterior Finish	Stainless steel		
Interior Finish	Stainless steel		
Power Consumption	1550 W, 13 A		
Power Output**	1000 W** Microwave		
Power Source	120V, 60 Hz, 15 A single phase		
Plug Configuration / Cord	NEMA 5-15	5 ft. (1.5m)	
Frequency	2450 MHz		
Product Weight	41 lbs. (19 kg.)		
Ship weight (approx.)	47 lbs. (21 kg.)		
Shipping Carton Size	H 16 ⅝" (422)	W 25 ³⁄₁₆" (640)	D 19 ¾" (502)
UPS Shippable	Yes		

Specifications

Commercial microwave shall have a user-friendly 10 minute dial timer with illuminated digits and an end of cycle audible signal. Timer shall automatically reset if the door is opened during heating with user option to manually reset to zero. There shall be a four power level and cooking stage. Microwave output shall be 1000 watts distributed by one magnetron with a rotating top antenna to provide superior even heating throughout the cavity. Durable door shall have a tempered glass window and a grab and go handle with a 90°+ opening for easy access. An interior light shall facilitate monitoring without opening the door. The large 1.2 cubic ft. (34 liter) cavity shall accommodate a 14" (356 mm) platter. Interior ceramic shelf shall be sealed and recessed on oven bottom to reduce plate-to-shelf edge impact. Oven shall have a stainless steel exterior and interior and be stackable to save counter and shelf space. The air filter shall be permanently affixed to the front of the oven. Microwave oven shall comply with standards set by the U.S Department of Health and Human Services, UL923 for safety and NSF4 for sanitation.

Intertek Intertek

Warranty

Warranty Certificate for this product can be found on the ACP, Inc. website at:

www.acpsolutions.com/warranty

Service

All products are backed by the ACP, Inc. 24/7 ComServ

er.

ComServ Commercial Service 866-426-2621

AIA File #:

Measurements in ( ) are millimeters
* Includes handle
** IEC 60705 Tested

© 2016 ACP, Inc.
Cedar Rapids, Iowa 52404

225 49th Ave. Dr. SW Cedar Rapids, IA 52404 U.S.A. | 800-233-2366 | 319-368-8120 | Fax: 319-368-8198 | www.acpsolutions.com

RCS Series
RESTAURANT LINE

RCS10TS - 1000 Watts, Touch pad control
RCS10DSE - 1000 Watts, Dial control

FEATURES AND BENEFITS

- 1000 watts of cooking power
  - Quick heating for consistent results
- 1.2 cubic ft. (34 L) oven capacity
  - Accommodates a 14" (356 mm) platter
- Motor driven top antenna
  - Reliable distribution of energy for consistent heating results
- Non-removable front air filter
  - Cools componentry, extends life of oven

TOUCH CONTROL MODELS

- 100 programmable menu items, 4 cooking stages, 5 power levels
- Braille touch pads
- Versatile program options
- One-touch cooking

DIAL CONTROL MODELS

- 10:00 light up dial timer
- 4 power levels
- Automatic reset to zero when cooking cycle is interrupted (manual reset available as user option)



Reliable, long lasting Grab 'n Go handle with no moving parts

Available with touch pad or dial controls



IDEAL APPLICATIONS

- Server stations
- Convenience stores
- Coffee shops
- Concessions
- Breakrooms

Fabricated and Assembled in the USA

BOOST HEATS AND RE-THERMS IN SECONDS!

- Breakfast sandwich reheats in 1:00
- Stage cooking perfectly prepares instant oatmeal in 1:30

ADVANCE TABCO
SMART FABRICATION™

STAINLESS STEEL

MICROWAVE SHELVES

NSF

Item #: _____ Qty #: _____

Model #: _____

Project #: _____



Wall Mounted

Model #	Size W x L	Approx. Wt.	Approx. Cu. Ft.
MS-18-24	18" x 24"	27 lbs.	5
MS-20-30	20" x 30"	36 lbs.	5
MS-24-24	24" x 24"	32 lbs.	5
MS-24-36	24" x 36"	38 lbs.	7

CONSTRUCTION:

All TIG welded.

Exposed surfaces polished to a satin finish.

MATERIAL:

18 gauge stainless steel.

OPTIONAL TABLE MOUNTED UNITS:

Mounted on tubular supports and fastened to the top with expanding tubular connectors.

Please use OTS Series Shelving and add TA-102 for 24" x 24" extension for table mounted version.

FOR TABLE MOUNTED MICROWAVE SHELF:

Model #	W x L
MST-24-24	24" x 24"
MST-24-36	24" x 36"

MST Series





TA-102

TABLE MOUNTED SHELF WITH MICROWAVE EXTENTION

Use **OTS Shelving** and add **TA-102** for Microwave 24" x 24" extension. Specify Right or Left.

OPTIONAL:

2" Hole with Grommet For Appliance Cord

TA-108

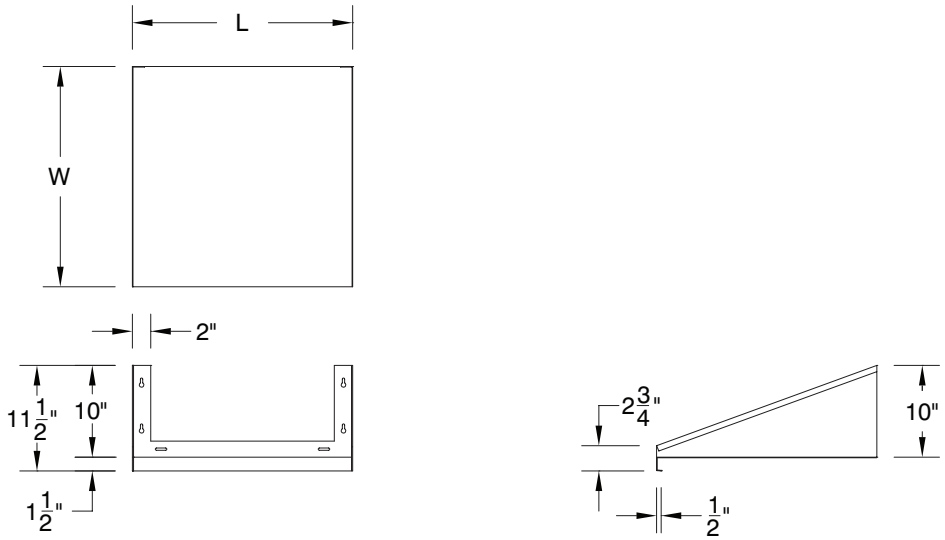


DETAILS and SPECIFICATIONS

TOL ± .500"

ALL DIMENSIONS ARE TYPICAL

WALL MOUNTED



ADVANCE TABCO
SMART FABRICATION™
www.advancetabco.com

Customer Service Available To Assist You 1-800-645-3166 8:30 am - 7:00 pm E.S.T.

For Orders & Customer Service:
Email: customer@advancetabco.com or **Fax:** 631-242-6900

For Smart Fabrication™ Quotes:
Email: smartfab@advancetabco.com or **Fax:** 631-586-2933

ADVANCE TABCO is constantly engaged in a program of improving our products. Therefore, we reserve the right to change specifications without prior notice. © ADVANCE TABCO, AUG. 2019 REF-L

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03/14/2025

ITEM# MC17 - SLIM JIM TRASH CAN

By owner

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03/14/2025

ITEM# MC18 - SPARE NO.

<Spare No.>

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03/14/2025

ITEM# MC19 - SPARE NO.

<Spare No.>

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ITEM# MC20 - ICE CREAM DIPPING CABINET (1 EA REQ'D)

Atlas Metal WDF-2

Ice Cream Freezer, drop-in type, with self-contained refrigeration, 4-1/2 cu.ft/100 lbs. capacity, stainless steel top & inner liner, galvanized outer liner, with hinged lids, on/off thermostat switch & pilot light

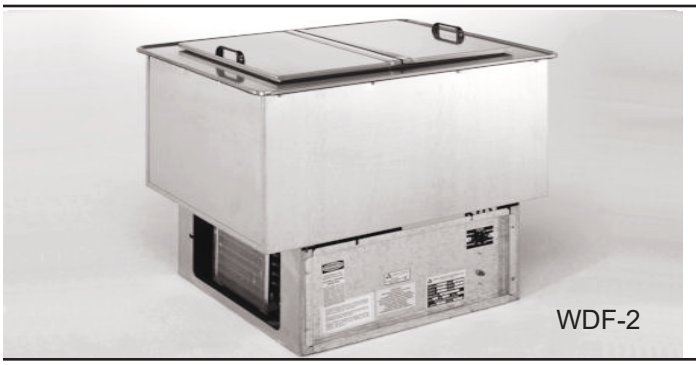
ACCESSORIES

Mfr	Qty	Model	Spec
Atlas Metal	1		5-year compressor warranty (net)
Atlas Metal	1		120v/60/1-ph, 1/4 HP, 6.2 amps, NEMA 5-15P, standard
Atlas Metal	1	LLD	Lid Locking Device
Atlas Metal	1	#2060-1	Condensate Evaporator
Atlas Metal	1	RS	Remote On/Off Switch, for counter mounting

ATLAS METAL
1135 N.W. 159th DRIVE, MIAMI, FLORIDA 33169
TEL 305.625.2451 TOLL FREE 800.762.7565 FAX 305.623.0475
WWW.ATLASFOODSERV.COM SALES@ATLASFOODSERV.COM

Project: _____
Item No.: _____
Quantity: _____

DROP-IN SERVING EQUIPMENT


WDF-2

ICE CREAM FREEZER

Refrigerated, Self-Contained

☐ **WDF-2**
☐ **WDF-3**

SPECIFICATIONS

TOP: Constructed of 18 gauge, type 304 stainless steel, die stamped with a raised perimeter bead. There shall be a solid vinyl gasket under the beaded edge to form a seal to the counter top, thus preventing seepage or marring the counter top.

LINER: The inner liner shall be 18 gauge, type 304 stainless steel, one piece construction, all welded, ground and polished to a uniform finish. All corners are coved with a minimum 1/4" radius on the horizontal edges and a minimum 3/4" radius on the vertical edges. The liner has copper tubing firmly soldered to the exterior sides and bottom. The unit is provided with an all stainless steel insulated, hinged, lift off lid, with plastic coated pulls.

INSULATION: The unit is fully insulated with high density polystyrene, 2-1/2" thick on all sides, and enclosed with a 22 gauge galvanized steel outer liner.

REFRIGERATION SYSTEM: The compressor housing shall be fabricated from 14 gauge galvanized and bolted to the base of the unit. A fully self-contained condensing unit is provided with a hermetically sealed compressor and a thermostat control. The system is fully charged with CFC free refrigerant and ready to operate.

NOTE: Proper ventilation must be provided in counter.

ELECTRICAL: The unit will be wired for 15 amps., 120 volt, single phase operation, with an on/off thermostat switch and pilot light. A 6' long, 3-wire cord and plug (NEMA 5-15P) will be provided.

Specifications subject to change without notice.

STANDARD FEATURES

- Fully insulated for maximum efficiency and energy savings
- Removable S/S hinged lid
- Factory applied gasket - makes installation a snap and seals units to the counter top, thus eliminating seepage
- Ideal for frozen dessert or use it as a mug or plate chiller
- 1-Year Parts & Labor Warranty
- NSF Certified and UL Listed

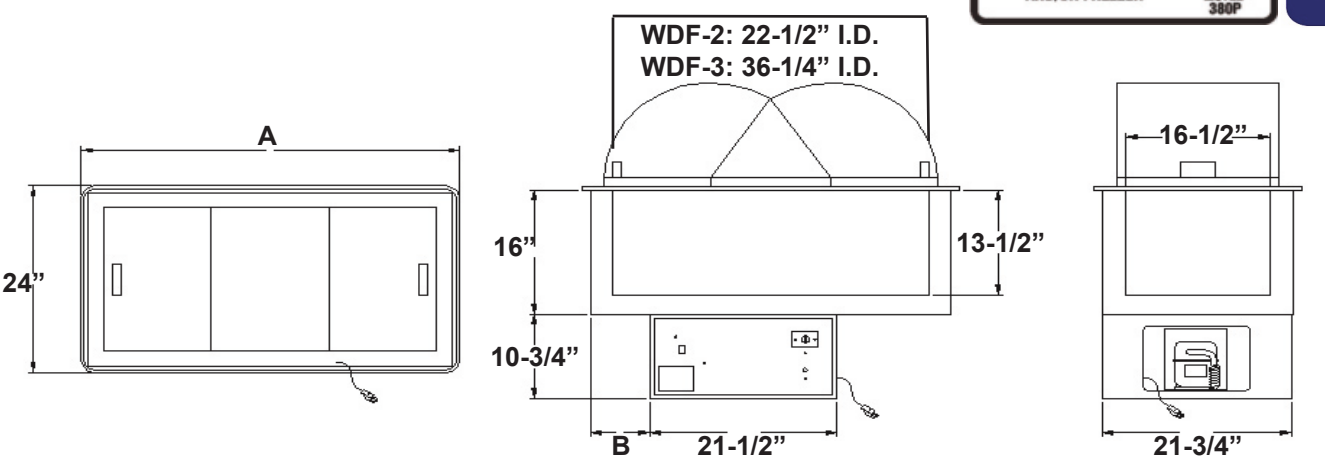
ACCESSORIES

- **5YW** - 5-Year Compressor Warranty
- Hinged Plexiglas Lid
- **LLD** - Lid Locking Device
- **2060-1** - Condensate Evaporator
- **RS** - Remote On/Off Switch for counter mounting
- ***220 Volt - 50 Cycle** Compressor

***Please see Operation & Installation Manual for ALL operation and maintenance details.**

*** Units with these accessories are not currently UL listed.**

DI-41



PLAN VIEW ELEVATION END VIEW

MODEL	INTERIOR DIMENSIONS	CUT-OUT REQUIRED	“A”	“B”	ELECTRICAL CHARACTERISTICS	CU. FT. CAPACITY	LBS. CAPACITY	SHIP WT. (LBS.)
WDF-2	16-1/2” X 22-1/2” X 13-1/2” *(41.9 X 57.1 X 34.2cm)*	22-1/4” X 28” *(56.5 X 71.1cm)*	29-3/4” *(75.5cm)*	3” *(7.6cm)*	6.2 amps. X 120V X 1/4HP	4.5	100 *(45.3kg)*	194 *(88kg)*
WDF-3	16-1/2” X 36-1/2” X 13-1/2” *(41.9 X 92.7 X 34.2cm)*	22-1/4” X 41-3/4” *(56.5 X 106cm)*	43-1/2” *(110.4cm)*	6-7/8” *(17.4cm)*	6.2 amps. X 120V X 1/4HP	7.8	150 *(68kg)*	232 *(105.2kg)*

REFRIGERATION CHART

MODEL	HP	REF.	OZ.	LOW PSIG.	HIGH PSIG.	BTU M10 90A	OPERATING TEMP
WDF-2	1/4	R513A	6	L(-10 IN-HG)	100	5260	-11 OFF TO 10.5 ON
WDF-3	1/4	R513A	7	L(-10 IN-HG)	100	5260	-11 OFF TO 10.5 ON

REMOTE REFRIGERATION MODEL	LESS COMP. SHIP WT. (LBS.)
WDFX-2	148 *(67.1kg)*
WDFX-3	178 *(80.7kg)*

NOTEWDFX REQUIRED A SOLENOID PACKAGE AND RS, REMOTE CONTROL PANEL

REFRIGERATED COLD PAN WITHOUT COMPRESSOR REQUIRED:

SOLENOID PACKAGE, LOOSE: **SOLENOID VALVE, SOLENOID COIL & COOPER FITTING**
SOLENOID PACKAGE, FACTORY INSTALLED: **SOLENOID BOX, SOLENOID VALVE, COIL & COOPER FITTING**

******ORDERS NOT FINAL UNTIL REFRIGERANT APPROVED******

COMPRESSORS FOR REMOTE INSTALLATIONS

2029-2M7 - 1/4 HP for WDFX-2 & 3

***** UNIT’S PERFORMANCE TESTED WITH LISTED REFRIGERANTS IN THE CHART ABOVE. PERFORMANCE MAY VARY WITH ALTERNATE REFRIGERANTS.*****

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03/14/2025

ITEM# MC21 - DIPPER WELL (1 EA REQ'D)

Fisher 3041

Dipper Well Faucet and Sink, 6-7/8" diameter, 1-1/2" x 4" tailpiece, 40° - 140°F system limits, 200 psi maximum static pressure limit, stainless steel seat faucet, stainless steel pan with removable inner shell

APPLICATION:

PRODUCT NAME:
DIPPERWELL FAUCET & SINK ASSEMBLY

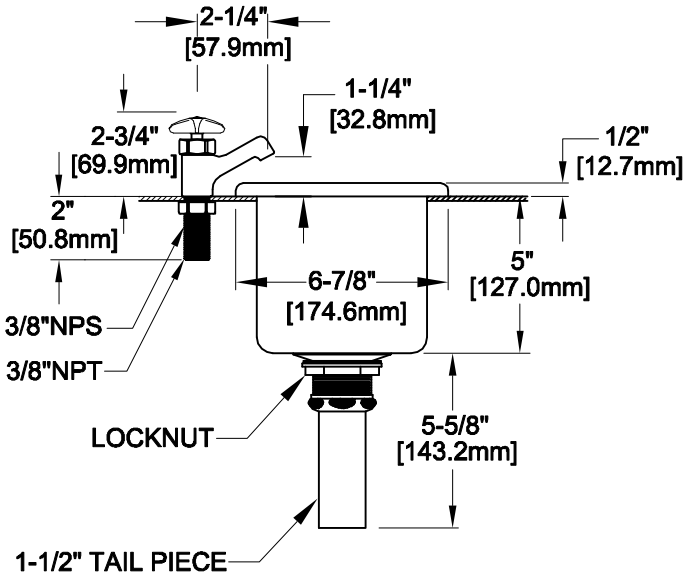
JOB NAME:

☐ _____ SPECIAL CONFIGURATION
CHECK BASE MODEL AND OPTIONS

QUANTITY: | ITEM NO.

MODEL:
☐ 3041

OPTIONS OR MODIFICATIONS:
☐ OTHER _____



FEATURES:

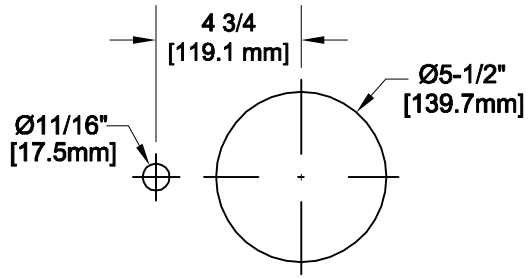
DIPPERWELL FAUCET
* STAINLESS STEEL SEAT

DIPPERWELL SINK
* STAINLESS STEEL PAN
* REMOVABLE INNER SHELL

SYSTEM LIMITS
* TEMP: 40°F MIN. TO 140°F MAX.
* PRESSURE 200 PSI MAX. STATIC

SHIPPING WEIGHT
* 3.5 LBS

ROUGH-IN:



ANSI/A112.18.1M

FISHER MANUFACTURING COMPANY
TOLL FREE: 800-421-6162 - FAX: 800-832-8238
information@fisher-mfg.com - www.fisher-mfg.com

SPEC. 3041 REV. D

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03/14/2025

ITEM# MC22 - HANDSINK/UTILITY SINK

By GC

MISE EN PLACE DESIGN
A Place for EverythingFood Service Design &Consulting

Submittal Sheet

03/14/2025

ITEM# MC23 - CART, UTILITY/BUSSING (1 EA REQ'D)

Cambro SC330110

Service Cart Pro, 37-1/2"L x 22"W x 37-1/4"H, medium, (3) ribbed shelves, one closed side, 600 lbs. total weight capacity (200 lbs. per shelf), (2) 6" rigid and (2) 6" swivel casters with brake, one piece molded body, polyethylene, black, NSF

CAMBRO

Service Cart PRO

Size: Medium

Models SC230, SC230S (open sides)
SC330, SC330S (1 closed side)

Project _____

Item No. _____

Model No. _____

Quantity _____

Features & Benefits

- Sturdy, strong and durable, these carts are made of one-piece polyethylene construction.
- Versatile for a variety back of house or front of house applications.
- Total weight capacity is 600 lbs. (272 kg) or 200 lbs. (90,7 kg) per shelf.
- Three durable shelves feature raised ridges to protect surface against heat. Shelf surfaces are lightly textured (top only), stain resistant and easy to clean. NOTE: Best to cool metal pans to 250°F (121°C) before placing on cart.
- Raised 1½" (3,8 cm) marine rail around top shelf helps to prevent items from slipping off.
- Open available flat space on top shelf for products is 28½" L x 18" D (72,4 x 45,7 cm).
- Vertical open space between each shelf is 10⅞" (27,6 cm).
- Middle and bottom shelves have a ¾" (2 cm) raised edge on one side to help keep items in place.
- Two molded-in ergonomic handles on each end of the cart are recessed, flush to the body, to save space.
- Four heavy-duty, non-marking 6 x 1½" (15 x 3,8 cm) plate casters:
  Model SC230, SC330 - 2 rigid, 2 swivel with brake
  Model SC230S, SC330S - 4 swivel, all with brake
- Optional accessories include an 8 gallon (30,3 L) and 2½ gallon (9,5 L) Quick Connect Bin that securely slide and lock down onto molded-in dovetails positioned safely below the handles.
- Available in three colors: Black (110), Dark Brown (131), Charcoal Gray (615).
- No assembly required.

Service Cart PRO and Quick Connect Bins are covered by US Patents D882,203 S, D883,755 S, and D885,003 S.



SC230



SC330
Shown with optional Quick Connect Bins



2.5 Gallon (9,5 L)
Small Quick Connect Bin



8 Gallon (30,3 L)
Large Quick Connect Bin

Approvals

NSF

Information and specifications are subject to change without notice. Please confirm at time of order.

CAMBRO U.S.A.
TEL: 1(714) 848-1555
FAX: 1(714) 230-4375
international@cambro.com

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CAMBRO
www.cambro.com

Service Cart PRO

Project _____

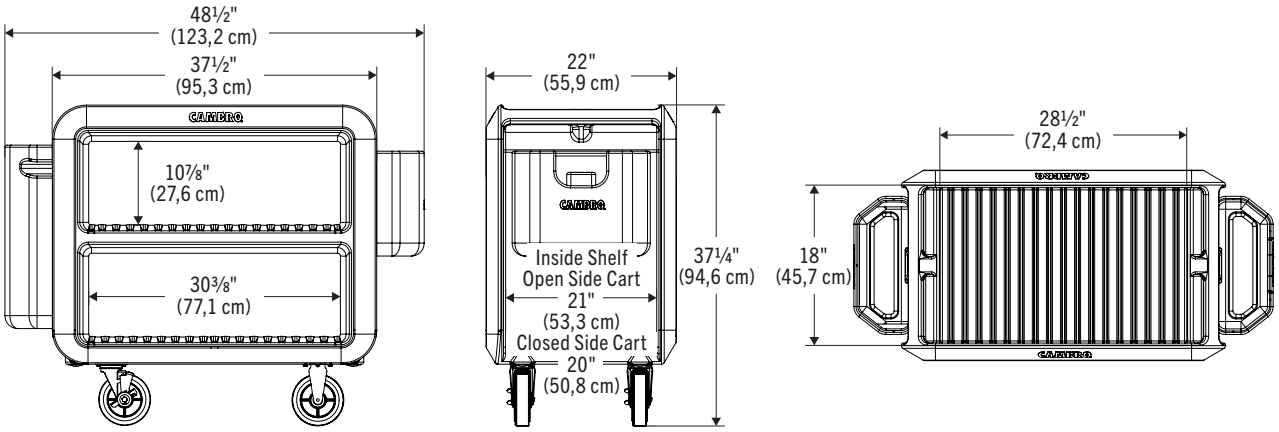
Item No. _____

Model No. _____

Quantity _____

Size: Medium

Models SC230, SC230S (open sides)
SC330, SC330S (1 closed side)



Specifications

Dimension Tolerance: +/- ¼" (0,64 cm)

CODE	CASTERS	INTERIOR SHELF DIMENSIONS L x D x H	CART DIMENSIONS L x D x H	UNIT WEIGHT LBS. (KG)
Open Sides				
SC230	2 Rigid, 2 Swivel with Brake	30⅜" x 21" x 10⅞" (77,1 x 53,3 x 27,6 cm)	37½" x 22" x 37¼" (95,3 x 55,9 x 94,6 cm)	52 lbs. (23,6 kg)
SC230S	4 Swivel, All with Brake	30⅜" x 21" x 10⅞" (77,1 x 53,3 x 27,6 cm)	37½" x 22" x 37¼" (95,3 x 55,9 x 94,6 cm)	53.78 lbs. (24,4 kg)
One Closed Side				
SC330	2 Rigid, 2 Swivel with Brake	30⅜" x 20" x 10⅞" (77,1 x 50,8 x 27,6 cm)	37½" x 22" x 37¼" (95,3 x 55,9 x 94,6 cm)	59 lbs. (26,7 kg)
SC330S	4 Swivel, All with Brake	30⅜" x 20" x 10⅞" (77,1 x 50,8 x 27,6 cm)	37½" x 22" x 37¼" (95,3 x 55,9 x 94,6 cm)	60.78 lbs. (27,6 kg)

Optional Accessories

2.5 Gal. (9,5 L) Small Quick Connect Bin ❑ QCSB
8 Gal. (30,3 L) Large Quick Connect Bin ❑ QCTB

Standard Service Cart Pro Colors

❑ Black (110)
❑ Dark Brown (131)
❑ Charcoal Gray (615)

Quick Connect Bin Color

❑ Black (110)

Architect Specs

The medium size Service Cart PRO shall be Cambro open sided model SC230, SC230S or model with 1 closed side SC330, SC330S. It shall be constructed of one-piece polyethylene with molded-in, recessed handles on each end of the cart. It shall be able to transport up to 600 lbs. (272 kg). It shall have three solid shelves. Each shelf shall have raised ridges to protect surface against heat. Top shelf only will be textured and will have a 1½" (3,8 cm) raised marine rail all around to help keep contents in place. Middle and bottom shelves shall have a ¾" (2 cm) raised edge on one side. Space opening between the shelves shall be 10⅞" (27,6 cm). It shall have four each 6" x 1½" (15 x 3,8 cm) non-marking plate casters: 2 rigid and 2 swivel with brake or 4 swivel all with brake. It shall have molded in dovetails below the handles to attach optional Quick Connect Bins (small 2½ gallon/9,5 L) and large 8 gallon/30,3 L) both in Black (110). The Service Cart Pro shall require no assembly and shall be available in Black (110), Dark Brown (131) and Charcoal Gray (615). It shall be NSF listed.

Approvals

NSF

Information and specifications are subject to change without notice. Please confirm at time of order.

CAMBRO
www.cambro.com

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SCPL2

D022406

SERVICE CARTS

- All-purpose versatile, durable and dependable workhorses.
- Ideal for use on the receiving dock or setting up and bussing tables.
- Made of one-piece, polyethylene with molded-in handles and shelves.
- Choose from models with open or enclosed sides.

Colors: Black (110), Slate Blue (401), Dark Brown (131), Coffee Beige (157), Granite Gray (191).

BC225, BC2254S, BC11TC and BC1115SH can be shipped by parcel carrier.



Open Carts



BC225
CASTER DIA./TYPE: 3", 2 fixed, 2 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 28" x 16" x 32¼"
SHELF DIMENSIONS L x D x H: 21¾" x 15½" x 11¼"
LOAD CAPACITY: 350 lbs.
Case Pack: 1



BC2254S
CASTER DIA./TYPE: 3", 4 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 28" x 16" x 32¼"
SHELF DIMENSIONS L x D x H: 21¾" x 15½" x 11¼"
LOAD CAPACITY: 350 lbs.
Case Pack: 1



BC230
CASTER DIA./TYPE: 5", 2 fixed, 2 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 33¼" x 20" x 34⅝"
SHELF DIMENSIONS L x D x H: 27" x 19½" x 11¼"
LOAD CAPACITY: 500 lbs.
Case Pack: 1



BC2304S
CASTER DIA./TYPE: 5", 4 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 33¼" x 20" x 34⅝"
SHELF DIMENSIONS L x D x H: 27" x 19½" x 11¼"
LOAD CAPACITY: 500 lbs.
Case Pack: 1

Enclosed Carts



BC235
CASTER DIA./TYPE: 5", 2 fixed, 2 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 37¼" x 21½" x 34⅝"
SHELF DIMENSIONS L x D x H: 31½" x 20⅜" x 11⅜"
LOAD CAPACITY: 500 lbs.
Case Pack: 1



BC2354S
CASTER DIA./TYPE: 5", 4 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 37¼" x 21½" x 34⅝"
SHELF DIMENSIONS L x D x H: 31½" x 20⅜" x 11⅜"
LOAD CAPACITY: 500 lbs.
Case Pack: 1



BC330
CASTER DIA./TYPE: 5", 2 fixed, 2 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 33⅛" x 20" x 34⅝"
SHELF DIMENSIONS L x D x H: 27" x 18½" x 11¼"
LOAD CAPACITY: 500 lbs.
Case Pack: 1



BC3304S
CASTER DIA./TYPE: 5", 4 swivel, 1 w/brake
OVERALL DIMENSIONS L x D x H: 33⅛" x 20" x 34⅝"
SHELF DIMENSIONS L x D x H: 27" x 18½" x 11¼"
LOAD CAPACITY: 500 lbs.
Case Pack: 1

Optional Accessories

CODE	BC11TC*	BC1115SH*
DESCRIPTION	11 gal. trash container	1.75 gal. silverware holder
DIMENSIONS W x D x H	13¾" x 8⅛" x 21⅛"	14½" x 6" x 5⅜"

Case Pack: 1 *BC11TC & BC1115SH will not fit KD Service or Utility Carts. BC11TC & BC1115SH are available in Black (110) and Dark Brown (131).



BC11TC



BC1115SH