SECTION 21 1313
WET-PIPE SPRINKLER SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install complete fire sprinkler system as specified in Contract Documents.
   2. Furnish and install Firestop Penetration Systems for plumbing systems penetrations as described in Contract Documents.

1.02 RELATED REQUIREMENTS

A. Section 01 7000: 'Closeout Submittals'.

B. Section 28 4600: 'Fire Detection and Alarm System' for fire detection and alarm annunciation panels including connection of tamper switches and pressure flow detectors to alarm system and furnishing and installing of low temperature switch.

C. Section 28 4600 Fire Detection and Alarm

D. Section 33 1416 Site Water Utility Distribution Piping : .

1.03 REFERENCE STANDARDS

A. ASME B1.20.1-2013 ‘Pipe Threads, General Purpose (Inch)’.

B. ASME B1.20.1M-2006 (R2011), ‘Pipe Threads, General Purpose (Metric)’.

C. ASME B16.1-2015, ‘Grey Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250’.

D. ASME B16.3-2011, 'Malleable Iron Threaded Fittings: Classes 150 and 300’.

E. ASME B16.4-2011, 'Gray Iron Threaded Fittings, Classes 125 and 250’.

F. ASME B16.5-2013, ‘Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard’.

G. AWWA C606-15, ‘Grooved and Shouldered Joints’.

H. AWA B2.1/B2.1M-2014, ‘Specification for Welding Procedure and Performance Qualification', (5th Edition).

I. ASTM A53/A53M-12, ‘Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless’.

J. ASTM A135/A135M-09 (2014), ‘Standard Specification for Electric-Resistance-Welded Steel Pipe’.

K. ASTM A234/A234M-17, ‘Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service’.

L. ASTM A395/A395M-99 (2014), ‘Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures’.

M. ASTM A536-84 (2014), ‘Standard Specification for Ductile Iron Castings’.

N. ASTM A795/A795M-13, ‘Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use’.

O. NFPA 13, 'Standard for the Installation of Sprinkler Systems' (2016 Edition or latest AHJ approved edition).

P. NFPA 24, 'Standard for the Installation of Private Fire Service Mains and their Appurtenances' (2016 Edition).

Q. NFPA 25, 'Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems' (2014 Edition).

R. NFPA 101, 'Life Safety Code' (2015 Edition).

S. UL Directory B, 'Fire Protection Equipment, Directory B' (2011).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of the fire riser with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Action Submittals:
   1. Shop Drawings:
      a. Size sprinkler system using NFPA 13 hydraulic calculation design method based on water supply evaluation performed at building site:
         1) On submittals, refer to sprinkler heads by sprinkler identification or model number published in appropriate agency listing or approval. Trade names and other abbreviated designations are not acceptable.
            (a) Grooved joint couplings and fittings shall be shown on drawings and product submittals and be specifically identified with applicable Victaulic styles or series numbers.
      b. Submittal Procedure:
         1) After award of Contract and before purchase of equipment, submit seven sets of shop drawings with specifications and hydraulic calculations, if pipe schedule method is not used, to Fire Sprinkler Consultant and two sets to local jurisdiction having authority for fire prevention for review.
         2) After integrating Fire Sprinkler Consultant's and local jurisdiction's comments into drawings, licensed certified fire protection engineer of record submitting fire sprinkler system design construction documents shall stamp, sign, and date each sheet of shop drawings and first page of specifications and calculations.
         3) Submit stamped documents to area office and local jurisdiction having authority for fire prevention for final approval.
         4) After final approval, submit four copies of approved stamped documents to Fire Sprinkler Consultant.
         5) Failure of system to meet requirements of authority having jurisdiction shall be corrected at no additional cost to Owner.

C. Informational Submittals:
   1. Certificates:
      a. Provide one (1) copy of completed NFPA 13 'Contractor's Material and Test Certification for Aboveground Piping' as specified in 'Field Quality Control' in Part 3 of this specification:
   2. Qualification Statement:
      a. Licensed fire protection engineer or fire protection system designer:
         1) Licensed for area of Project.
         2) Certified by NICET to level three minimum.
         3) Provide Qualification documentation if requested by Fire Sprinkler Consultant or Owner’s Representative.
      b. Installer:
         1) Provide Qualification documentation if requested by Fire Sprinkler Consultant or Owner’s Representative.

D. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Maintenance and instructions.

(a) List of system components used indicating name and model of each item.
(b) Manufacturer's maintenance instructions for each component installed in Project.
(c) Instructions shall include installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.

b. Warranty Documentation:
1) Include copies of required warranties.

c. Record Documentation:
1) Include copies of approved shop drawings.
2) Provide master index showing items included.
3) Provide name, address, and phone number of Architect, Fire Sprinkler Consultant, General Contractor, and Fire Protection subcontractor.
4) Provide operating instructions to include:
(a) General description of fire protection system.
(b) Step by step procedure to follow for shutting down system or putting system into operation.
5) Provide signed copy of NFPA 13 'Contractor's Material and Test Certification for Aboveground Piping'.

2. Instruction of Owner (as specified in Part 3 of this specification):
a. Provide Owner with latest version of NFPA 25.

E. Maintenance Materials Submittals:
1. Extra Stock Materials:
a. Six (6) spare sprinkler heads selected in representative proportion to quantity used in Project and in accordance with NFPA 13. Do not include Pendent and sidewall dry barrel sprinkler heads.
b. Provide spare heads in cabinet with sprinkler head wrench for each type of head used. After approval of cabinet and contents, mount cabinet in convenient location in Riser Room.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.06 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies:
1. Unless noted otherwise, system shall conform to:
a. NFPA 13 for Light & Ordinary Hazard Occupancies.
b. NFPA 24 for Service Mains and Their Appurtenances, Private.
c. NFPA 25, for ‘Inspection, Testing, and Maintenance.
d. NFPA 101, for Life Safety Code.
e. Requirements of local water department and local authority having jurisdiction for fire protection.
f. Underwriters Laboratories Publication, 'Fire Protection Equipment Directory' (Current Edition at time of Pre-Bid Meeting).
g. Comply with backflow prevention requirements and, if required, include device in hydraulic calculations.
h. Applicable rules, regulations, laws, and ordinances.

B. Qualifications:
1. Licensed fire protection engineer or fire protection system designer certified by NICET to level three minimum and engaged in design of fire protection systems. Engineer / designer shall:
a. Licensed for area of Project.
b. Minimum five (5) years experience in fire protection system installations.

c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
d. Be responsible for overseeing preparation of shop drawings, hydraulic calculations where applicable, and system installation.
e. Make complete inspection of installation.
f. Provide corrected record drawings to Owner with letter of acceptance.
g. Certify that installation is in accordance with Contract Documents.
h. Upon request, submit documentation.

2. Installer:
a. Licensed for area of Project.
b. Minimum five (5) years experience in fire protection system installations.
c. Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
d. Upon request, submit documentation.

C. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
1. Do not deliver system components until proper protection can be provided.
2. Accept valves on-site in shipping containers with labeling in place.
3. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage and Handling Requirements:
1. Protect all components from damage and corrosion.
2. Store items subject to moisture damage in dry, heated spaces.
3. Leave protective coverings and packaging in place until time of installation.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty:
1. Pipe Boot:
a. Provide thirty-five (35) year limited Product Warranty.

PART 2 PRODUCTS

2.01 SYSTEM

A. Manufacturers:
1. Manufacturers Contact List:
a. AGF Manufacturing, Inc , Malvern, PA 19355 www.agfmanufacturing.com
b. Croker Corp, Elmsford, NY www.croker.com.
c. Gruvlock by Anvil International, Portsmouth, NH www.anvilintl.com.
d. H O Trerice Company, Oak Park, MI www.hotco.com.
e. Kennedy Valve, Elmira, NY www.kennedyvalve.com.
f. Milwaukee Valve Co, New Berlin, WI www.milwaukeevalve.com.
g. Mueller Company, Decatur, IL www.muellerflo.com.
h. Nibco Inc, Elkhart, IN www.nibco.com.
i. Noble Company, Grand Haven MI www.noblecompany.com.
j. Notifier by Honeywell, Northford, CT www.notifier.com.
k. Potter Electric Signal Co, St Louis, MO www.pottersignal.com.
l. Potter-Roemer, Cerritos, CA www.potterroemer.com.

m. Prinzing, Milwaukee, WI www.prinzing.com.
n. Reliable Automatic Sprinkler Co, Mount Vernon, NY www.reliablesprinkler.com.
o. System Sensor, St Charles, IL www.systemsensor.com.
p. TYCO Fire & Building Products, Lansdale, PA www.tyco-fire.com.
q. Viega LLC 585 Interlocken Blvd Broomfield, CO 80021 https://www.viega.us/en/homepage.html
r. Victaulic Company of America, Easton, PA or Victaulic Company of Canada, Rexdale, ON www.victaulic.com.
s. Viking Corp, Hastings, MI www.vikingcorp.com.
t. Equal as approved by Architect before bidding. See Section 01 6200.

B. Description:
1. Automatic wet-pipe fire sprinkler system starting at flange in Fire Riser Room and extending throughout heated portions of building.
2. Dry sprinkler heads connected towet system over and into Vestibules.

C. Performance:
1. Design Criteria:
a. Area of Application and Corresponding Design Density:
1) Serving Area and Mechanical, Electrical, and Janitorial Areas:
(a) Ordinary Hazard Group 1.
(b) Design density = 0.15 gpm per sq ft over 1,500 sq ft (140 sq m).
2) Storage Areas:
(a) Ordinary Hazard Group 2.
(b) Design density = 0.20 gpm per sq ft over 1,500 sq ft (140 sq m).
3) All Other Areas:
(a) Light Hazard.
(b) Design density = 0.10 gpm per sq ft over 1,500 sq ft (140 sq m).
4) Increase remote areas by 30 percent where ceiling / roof is sloped more than 2 inches (50 mm) per ft.
5) Remote areas may be reduced within parameters indicated in NFPA 13 for use of quick response sprinklers throughout.
b. Maximum Coverage per Sprinkler Head:
1) Ordinary Hazard Areas: 130 sq ft (12.1 sq meters).
2) Attic Areas: 120 sq ft (11.2 sq meters).
3) Light Hazard Areas: 225 sq ft (20.1 sq meters).
c. Design Area shall be hydraulically most remote area in accordance with NFPA 13.
1) Provide a 10% safety allowance under adjusted water flow supply curve.
d. Maximum velocity of water flow within piping: 20 feet (6.1 m) per sec.

D. Components:
1. General: Use only domestically manufactured cast iron pipe fittings, valves, sprinkler heads, and other components.
a. Pipe of foreign manufacture that meets ASTM Standards is acceptable.
b. Ductile iron fittings of foreign manufacture are acceptable.
2. Pipe:
a. **Schedule 40** Welded Steel:
1) Exterior, Above Ground: Schedule 40 hot-dip galvanized welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
2) Interior, Above Ground: Schedule 40 black welded steel meeting requirements of ASTM A53/A53M, ASTM A135/A135M or ASTM A795/A795M.
3) Connections:
(a) 2 inches (50 mm) And Smaller: Screwed, flanged, or roll grooved coupling system.
(b) 2-1/2 inches (64 mm) And Larger: Flanged or roll grooved coupling system.

3. Fittings:
   a. Usage:
      1) 2 inches (50 mm) And Smaller: Welded, screwed, flanged, press, or roll grooved coupling system. For use with schedule 40 carbon steel pipe.
      2) 2-1/2 inches (64 mm) And Larger: Welded, flanged, or roll grooved coupling system.
   b. Types And Quality:
      1) Screwed:
         (a) Cast iron meeting requirements of ANSI B 16.4 or ductile iron meeting requirements of ANSI B 16.3 and ASTM A536, Grade 65-45-12.
         (b) Threaded fittings and pipe shall have threads cut to ANSI B1.20.1.
         (c) Do not extend pipe into fittings to reduce waterway.
         (d) Ream pipe after cutting to remove burrs and fins.
      2) Flanged: Steel meeting requirements of ANSI B16.5.
      3) Welded:
         (a) Carbon steel meeting requirements of ASTM A234/A234M.
         (b) Weld pipe using methods complying with AWS B2.1, level AR-3. Welding procedures and performance of welders shall comply with ASW B2.1, level AR3.
      4) Press
         (a) Approved Product
            (1) Viega MergPress for Black Iron 1/2 inch to 2 inch and/or current offerings.
      5) Roll Grooved Pipe Coupling System:
         (a) Ductile iron meeting requirements of ASTM A395/A395M and ASTM A536, and UL / CASA listed and FM approved.
         (b) Grooved products used on Project shall be from same manufacturer. Grooving tools shall be as recommended by manufacturer of grooved products.
         (c) Approved Products. See Section 01 6200:

	Grulvok	Tyco	Victaulic	Viking
Rigid Couplings	7401	772	Style 005	V-Z05
Flexible Couplings (*1)	7000	705	Style 75	V-7705
Flange Adaptors (*2)	7012	71	Style 744	V-7041
Grooved Coupling Gaskets (*3)	'E' EPDM	'E' EPDM	'E' EPDM (*4)	E-EPDM

            (1) Use in locations where vibration attenuation and stress relief are required.
            (2) Class 125 or 150.
            (3) Temperature rated 30 to 150 deg F (minus one to 65 deg C). NSF-61 certified.
            (4) Grade ‘A’
   c. Use of saddle or hole cut type mechanical tees is NOT APPROVED.
4. Valves:
   a. Air Venting Valves
      1) Design Criteria:
         (a) Shall be located near a high point in the system to allow air to be removed from that portion of the system.
         (b) Locate where most effective. Multiple locations, if needed are allowed.
         (c) Manual ball valve, minimum ½ inch, with hose connection and cap

b. Butterfly Valves:
   1) UL / CASA / FM approved.
   2) Indicating type.
   3) Approved Products.
      (a) Milwaukee:
         (1) Model BB-SC502 threaded ends with tamper switch one inch (25 mm) to 2 inches (50 mm).
         (2) Model BBV SC502 Grooved ends with tamper switch 2 inches (50 mm) to 2-1/2 inches (64 mm).
      (b) Nibco:
         (1) WD3510-4 Wafer type with valve tamper switch.
         (2) GD4765-8N Grooved type with valve tamper switch, 2-1/2 inches (64 mm) to 8 inch (200 mm).
      (c) Tyco (Grinnell):
         (1) Model TFP1515 wafer.
         (2) Model TFP1510 Grooved.
      (d) Victaulic: Series 705-W Grooved end type with internal supervisory switches.
      (e) Kennedy:
         (1) Model 01W wafer.
         (2) Model 01G grooved.

c. Gate Valves:
   1) UL / CASA / FM approved.
   2) Outside Screw and Yoke Type (O.S.&Y).
   3) Class 150 psi (1.03 MPa).
   4) Approved Products.
      (a) Nibco:
         (1) T-1040 with Threaded Ends 1/2 inch (12.7 mm) to 2 inches (50 mm).
         (2) F-637-31 Flanged Ends.
      (b) Mueller: R-2360-6 Flanged Ends.
      (c) Victaulic: Series 771 Grooved Ends.

d. Ball Valves:
   1) UL / CASA / FM approved.
   2) Valve tamper switch.
   3) Approved Products.
      (a) Milwaukee: BB-SCS02 with threaded ends.
      (b) Nibco:
         (1) KT-505 with threaded ends.
         (2) KG-505 with grooved ends.
      (c) Victaulic: Series 728 with grooved or threaded ends.

e. Swing Check Valves:
   1) 2 to 4 inch (50 to 100 mm), grooved ends, ductile iron, 300 psi (2.07 MPa).
      (a) Regrinding type.
      (b) Renewable disk.
      (c) Bronze Class 125 with threaded ends.
      (d) Approved Products.
         (1) Nibco: KT-403-W.
         (2) Tyco (Grinnell): CV-1F grooved ends.
         (3) Victaulic: 712.
         (4) Viking: G-1 grooved ends.
   2) 3 to 12 inch Horizontal Check:
      (a) Bolted bonnet.
      (b) Raised face flanges.

(c) Bronze mounted with ductile iron body.
(d) 125 lb Class A.
(e) Approved Products.
(1) Nibco: F-938-31.
(2) Mueller: A-2120-6.
(3) Viking: F-1 grooved and flanged.

f. Wafer Type Check Valves:
1) 4 to 8 inch (100 to 200 mm) cast iron body.
2) 175 psi minimum working pressure.
3) Rubber Seat.
4) Approved Products.
(a) Nibco: KW-900-W.
(b) Mueller: A-2102.
(c) Kennedy: Fig. 706.

g. Grooved-End Check Valves:
1) 2-1/2 to 12 inch (64 to 300 mm) ductile iron body.
2) 250 psi maximum working pressure.
3) Disc And Seat:
(a) 2-1/2 And 3 Inch (64 to 76 mm): Aluminum bronze disc with mounted elastomer seal and PPS (polyphenylene sulfide) coated seat.
(b) 4 Inch (100 mm) And Larger: Elastomer encapsulated ductile iron disc with welded in nickel seat.
4) Approved Products.
(a) Victaulic Series 717.
(b) Kennedy: Fig. 426.

h. Retard Chamber
1) Design Criteria:
(a) Self-draining.

i. Approved Products:
1) Reliable: E-1.
2) Victaulic: Series 752.
3) Viking: C-1.

j. Inspector's Test Valve:
1) Design Criteria:
(a) Bronze body with threaded or grooved ends.
(b) Combination sight glass / orifice.

k. Approved Products.
1) Reliable Model TD or TD with optional relief valve kit.
2) Tyco (Grinnell): Model F350.
3) Victaulic: Testmaster Alarm Test Module Style 720.
4) Viking 3011ASG [includes pressure relief] or Viking 3011SG.

l. Inspector's Test Valve:
1) Combination sight glass/orifice.
(a) Bronze top works.
(b) Approved Products.
(1) Reliable Model TD or TD with optional Refief valve kit.
(2) Tyco (Grinnell): Model F350.
(3) Victaulic: Testmaster II Alarm Test Module Style 720.
(4) Viking 3011ASG [includes pressure relief] or Viking 3011SG.

5. Sprinkler Heads:
a. Concealed Pendant:
1) Design Criteria:
(a) Adjustable cover.

(b) UL / CASA listed and approved.
(c) Concealed Cover Finish: White.
2) Acceptable Products:
(a) Wet Pendant, Flat Profile:
(1) Reliable: F4FR.
(2) Victaulic: Model 3802.
(3) Viking: Model VK462.
(4) Tyco (Grinnell): Model RF11.
(5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.
(b) Dry Pendant, Flat Profile:
(1) Tyco (Grinnell): DS-C.
(2) Victaulic: V3618.
(3) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

b. Dry Pendant
1) Flat Profile:
(a) Tyco (Grinnell): DS-C.
(b) Victaulic: V3618.
(c) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

c. Dry Flexible
1) Acceptable Product
2) Victaulic VICFLEX VS1

6. Horizontal Sidewall Sprinkler:
a. Design Criteria:
1) UL / CASA listed and approved.
2) Recess adjustable.
3) Where guards are required, use chrome plated sprinkler guards that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.

b. Acceptable Products:
1) Wet System:
(a) Reliable: F1FR.
(b) Tyco (Grinnell): Model TY-FRB.
(c) Victaulic: Model V2710.
(d) Viking: VK305.
(e) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

7. Attic Sprinklers, Upright:
a. Design Criteria:
1) UL / CASA listed and approved.
2) Approved for use in roof structures, combustible and non-combustible, with ceiling below.

b. Approved Products:
1) Tyco: BB, SD, or HIP.
2) Reliable DD56, DS56, GP56
3) Viking V-BB, V-SD, V-HIP, VK697

8. Pendant Sprinklers:
a. Design Criteria:
1) UL / CASA listed and approved.

2) Where guards or escutcheons are required, use chrome plated sprinkler guards and escutcheons that are listed, that are approved by Sprinkler Manufacturer for use with head, and that are supplied by Sprinkler Manufacturer.

b. Acceptable Products:
1) Reliable: F1FR.
2) Tyco: TY-FRB.
3) Victaulic: Model V2704.
4) Viking: VK302.
5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

9. Upright Sprinklers:
a. Design Criteria:
1) UL / CASA listed and approved.
b. Acceptable Products:
1) Reliable: F1FR.
2) Tyco: TY-FRB.
3) Victaulic: Models V2704.
4) Viking: VK300.
5) Equal as approved by Fire Sprinkler Consultant before bidding. See Section 01 6200.

10. Water Flow Alarm:
a. Electric Flow Alarm:
1) Design Criteria:
(a) UL / CASA listed and approved.
2) Approved Products:
(a) Bell Type:
(b) Potter Electric: Bell, PBA-AC, 6 inch (150 mm) diameter, 120VAC.
(c) System Sensor: Bell, SSV-120, 120VAC.
(d) Horne Strobe Type:
(e) Potter Electric: Horn Strobe, SASH-120, 120VAC.
(f) System Sensor: Horn Strobe, P2RHK-120, 120 VAC.
3) Mechanical Flow Alarm: Water Gong.
(a) Design Criteria:
(b) UL / CASA listed and approved.
(c) Approved Products:
(d) Reliable: C.
(e) System Sensor: SSV 120 or SSM 24 Series.
(f) Tyco: WMA-1.
(g) Victaulic: Series 760.
(h) Viking: F-2.

11. Concealed Spaces Sprinkler heads
a. Design Criteria:
1) UL / CASA listed and approved.
b. Acceptable Products:
1) Viking VK950
2) Other sprinklers listed in other sections can be used if it meets their listing.

12. Pressure Gauges:
a. Mechanical Water Pressure Gauges:
b. Design Criteria:
c. UL / CASA listed and approved.
d. 3-1/2 inch (89 mm) diameter dial.
e. 0 to 300 psi (0 to 2.07 MPa) in 5 psi (34.5 kPA) increments.
f. Approved Products:

1) Reliable: UA.
2) HO Trerice: 500.
3) Viking: 01124A.

13. Waterflow Detectors:
    a. Electrical Water Flow Switch:
        1) Design Criteria:
            (a) UL / CASA listed.
            (b) Switch activates with flow of 10 gpm (37.85 lpm) or more.
            (c) Two single pole double throw switches.
            (d) Automatic reset.
        2) Approved Products:
            (a) Potter-Roemer: Model 6201 thru 6208.
            (b) System Sensor: WFD20 thru WFD80.
            (c) Viking: VSR-F.
14. Tamper Switch
    a. Weather and Tamper Resistant Switch.
        1) Design Criteria:
            (a) UL / CASA listed.
            (b) Mount to monitor valve and not interfere with operation.
            (c) Shall operate in horizontal and vertical position.
        2) Approved Products.
            (a) Control Valves, Butterfly Valves, Post Indicator Valves:
                (1) Potter Electric: Model PCVS.
                (2) Notifier: Model PIBV2.
                (3) System Sensor: Model PIBV2.
            (b) O.S. & Y Valves:
                (1) Potter Electric: Model OSYSU.
                (2) System sensor: Model OSY2.
15. Electric Flow Alarm:
    a. Design Criteria:
        1) UL / CASA listed and approved.
    b. Approved Products:
        1) Include following paragraph for Bell.
        2) Potter Electric: Bell, PBA-AC, 6 inch (150 mm) diameter, 120VAC.
        3) System Sensor: Bell, SSV-120, 120VAC.
        4) Include following paragraph for Horn Strobe.
            (a) Potter Electric: Horn Strobe, SASH-120, 120VAC.
            (b) System Sensor: Horn Strobe, P2RHK-120, 120 VAC.
16. Mechanical Flow Alarm: Water Gong. - **ONLY USE if AHJ requires**
    a. Design Criteria:
        1) UL / CASA listed and approved.
    b. Approved Products:
        1) Reliable: C.
        2) System Sensor: SSV 120 or SSM 24 Series.
        3) Tyco: WMA-1.
        4) Victaulic: Series 760.
        5) Viking: F-2.
17. Automatic Drain Device:
    a. Design Criteria:
        1) Straight Design, 3/4 inch (19 mm).
    b. Approved Products:
        1) Nibco: Ball-Drip.
        2) Potter-Roemer: Figure 5982.

18. Fire Department Connection: Do not use bare brass due to theft issues
    a. Two-way Inlet with single clapper:
        1) Quality Standards: See Section 01 6000:
            (a) Round 'AUTO SPKR' identification plate, red enamel finish aluminum plate:
                (1) Croker: Fig 6766.
                (2) Potter-Roemer Fig. 5966.
        2) Approved Products.
            (a) Rough chrome plated:
                (1) Croker: 6405-RC.
                (2) Potter-Roemer: Fig. 5710-C.
            (b) Caps and Chains:
                (1) Croker: 6747 RC.
                (2) Potter-Roemer: 4625.
19. Indicating Post Valve:
    a. Design Criteria:
        1) As specified in Section 33 1416 Site Water Utility Distribution Piping
        2) Prefer exposed parts non-brass, for theft protection.
        3) Supervisory switch.
    b. Approved Products:
        1) As required by Authority Having Jurisdiction (AHJ).
20. Riser Manifold Assembly:
    a. Design Criteria:
        1) Groove x Groove Manifold Body.
        2) Water Flow Alarm Switch, VSC with Vane, UL / CASA listed and approved.
        3) 300 psi (2.07 MPa) Water Pressure Gauge.
        4) Test and Drain Valve with Manifold Drain Trim and 1/2 inch (12.7 mm) diameter test Orifice.
        5) Pressure Relief Valve, 175 psi (1.21 MPa), non-adjustable, pipe discharge to test Drain Valve.
        6) Approved Products:
            (a) Tyco: Model 513.
            (b) Victaulic: Style 747P.
            (c) Victaulic: Style 747.

2.02 ACCESSORIES

A. Manufacturers:
    1. Manufacturer Contact List:
        a. Anvil International, Portsmouth, NH www.anvilintl.com.
        b. Eaton, Highland, IL www.cooperbline.com.
        c. Unistrut Construction, Itasca, IL www.unistrutconstruction.com.
    2. Continuous Inserts:
        a. Quality Standard: See Section 01 6000.
            1) Unistrut Standard Duty P-3249 through P-3270.

B. Hangers, Rods, And Clamps:
    1. Design Criteria:
        a. Galvanized, unless specified otherwise, and UL/CASA listed and labeled for service intended.
        b. Hanger supports for sprinkler piping to conformance with NFPA 13.
    2. Quality Standard:
        a. Hangers and accessories shall be Anvil numbers specified or equals by B-Line by Eaton.
        b. Pipe Ring Hangers: Equal to Anvil Fig 69.
        c. Riser Clamps: Equal to Anvil Fig. 261.

C. Posted System Diagram:
   1. Provide single floor plan diagram showing wet pipe system elements.
   2. Include following information on diagram sheet:
      a. Step by step shut down procedure.
      b. Step by step system drainage procedure.
      c. Step by step start-up procedure.
      d. Step by step procedure for protection of system from freezing.
      e. Step by step procedure to follow in deactivating system for maintenance.
   3. Laminate diagram with plastic and mat or frame suitable for hanging near riser.

PART 3 EXECUTION

3.01 INSTALLERS

A. Approved Installers. See Section 01 4000:
   1. Approved Mechanical Subcontractors shall be pre-approved in accordance with Supplementary Conditions and included in Construction Documents by Addendum.

3.02 EXAMINATION

A. Drawings:
   1. Fire Protection Drawings show general arrangement of piping. Follow as closely as actual building construction and work of other trades will permit. Install system so it drains.
   2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Fire Protection Drawings.
   3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions and to enable system to drain.

3.03 INSTALLATION

A. Interface With Other Work: Provide inserts for attaching hangers in concrete floor construction at time floors are placed.

B. Connect system to flange provided under Section 33 1416: Site Water Utility Distribution Piping'. After installation of riser, fill annular space between pipe and slab with flexible mastic.

C. Install sprinkler systems in accordance with requirements of latest edition of NFPA 13 and as specified below:
   1. Provide maintenance access to equipment.
   2. Conceal sprinkler lines installed in occupied areas. In Mezzanine areas, route pipe to side or underneath Mezzanine walkway. Do not impede egress from Attic.
   3. Install to enable drainage of system.
      a. Install main drain from riser according to NFPA 13.
   4. Install piping system, except for dry heads, so it will not be exposed to freezing temperatures.
   5. Do not use dropped, damaged, or used sprinkler heads.
   6. Install tamper switches and flow detectors where located by Fire Sprinkler Consultant.
   7. Except for Siamese connection, install automatic ball drip device in lowest point of piping to fire department connection and drain to floor drain or to exterior of building.
   8. Brace and support system to meet seismic zone requirements for building site.
   9. Replacing anti-freeze fluid in existing systems only:
      a. Placard: Provide tag/placard on antifreeze system main valve that indicates manufacture type and brand of antifreeze solution, concentration by volume of antifreeze solution used, and volume of antifreeze solution used in system.

D. Install sprinkler systems in accordance with requirements of latest edition of NFPA 13 and as specified below:
   1. Provide maintenance access to equipment.

2. Conceal sprinkler lines installed in occupied areas. In Mezzanine areas, route pipe to side or underneath Mezzanine walkway. Do not impede egress from Mezzanine or Roof.
3. Install to enable drainage of system. Drain trapped piping in accordance with NFPA 13.
   a. Install main drain from riser.
4. Install piping system, except for dry heads, so it will not be exposed to freezing temperatures.
5. Do not use dropped, damaged, or used sprinkler heads.
6. Install tamper switches and flow detectors where located by Fire Sprinkler Consultant.
7. Install automatic ball drip device in lowest point of piping to fire department connection and drain to floor drain or to exterior of building.
8. Brace and support system to meet seismic zone requirements for building site.

E. Flush system at full design flow rate for minimum five minutes. Route water to outside of building. Protect landscaping and other exterior elements from damage during flow tests.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Field Tests:
   1. Pressure Test:
      a. Hydrostatically test system to 200 psi (1.38 MPa) minimum for two (2) hours as required by 'Contractor's Material And Testing certificate for Aboveground Piping':
         1) NFPA 13 (2010), Figure 24.1.
         2) NFPA 13 (2013), Figure 25.1.
         3) NFPA 13 (2016), Figure 25.1.
   2. Water Flow Test:
      a. Test to determine static and residual pressures and corresponding flow rate at point of connection to utility water main.
      b. Adjust water flow test data for seasonal fluctuations and future growth as recommended by Water Utility and AHJ.
      c. At point of connection to utility water main, combine inside and outside hose stream allowances.
      d. Flush system
   3. Check piping in relation to insulation envelope to be certain piping and auxiliary drains are properly enclosed inside building insulation envelope. Report unsatisfactory conditions to Fire Sprinkler Consultant.
   4. Check piping in relation to building’s thermal envelope to be certain piping is within insulation envelope and protected from freezing temperatures. Report unsatisfactory conditions to Fire Sprinkler Consultant.
   5. Tests shall be witnessed by Fire Sprinkler Consultant and representative of local jurisdiction over fire prevention.

3.05 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Instruction of Owner:
   1. Instruction Sessions:
      a. Instruct Owner's personnel in operation and maintenance of system utilizing ‘Operation And Maintenance Manual’ when so doing. Minimum instruction period shall be four (4) hours.
      b. Instruction sessions shall occur after Substantial Completion inspection when system is properly working and before final payment is made.
      c. Provide Owner with latest version of NFPA 25.

C. Training:
   1. Installer required to provide FM Training from latest version of NFPA 25 with checklist and brief explanation of following inspections:

a. Weekly Inspection.
b. Monthly Inspection.
c. Quarterly Inspection.
d. Semi-Annual Inspection.
e. Annual Inspection.

END OF SECTION

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SECTION 22 0501
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To:
   1. Common requirements and procedures for plumbing systems.
   2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
   3. Furnish and install sealants relating to installation of systems installed under this Division.

B. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, supports, and equipment for plumbing systems installed under other Sections.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Exterior concrete pads and bases for mechanical equipment.

B. Section 05 5000 - Metal Fabrications: Quality and requirements for welding.

C. Section 07 9200 - Joint Sealants: Elastomeric Joint Sealant: Quality at building exterior.

D. Sections 09 9113 - Exterior Painting: Painting of plumbing items requiring field painting.

E. Sections 09 9123 - Interior Painting: Painting of plumbing items requiring field painting.

F. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

G. Division 26: 'Electrical' for raceway and conduit, unless specified otherwise, and line voltage wiring.

H. Division 33: 'Utilities' for piped utilities.

I. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. FM (AG) - FM Approval Guide current edition.

C. ITS (DIR) - Directory of Listed Products Current Edition.

D. NEMA MG 1 - Motors and Generators 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of water and natural gas pipes with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.

1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
2) Include name, address, and phone number of each supplier.

b. Informational Submittals:
1) Design Submittals:
(a) See individual specification sections in Division 22 for Submittals required.
2) Qualification Statement:
(a) Plumbing Subcontractor:
(1) Provide Qualification documentation if requested by Architect or Owner.
(b) Installer:
(1) Provide Qualification documentation if requested by Architect or Owner.

B. Shop Drawings.

C. Certificate: Certify that products of this section meet or exceed specified requirements.

D. Delegated Design Data.

E. Test Reports.

F. Evaluation Service Reports: Show compliance with specified requirements.

G. Manufacturer's Instructions.

H. Source Quality Control Submittals.

I. Field Quality Control Submittals.

J. Manufacturer Reports.

K. Designer's Qualification Statement.

L. Manufacturer's Qualification Statement.

M. Installer's Qualification Statement.

N. Operation Data.

O. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

P. Project Record Documents: Record actual locations of utilities.

1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
1. Perform work in accordance with applicable provisions of Plumbing Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
3. Identification:
a. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

B. Qualifications: Requirements of Section 01 4000 - Quality Requirements apply, but not limited to the following:
1. Plumbing Subcontractor:
a. Company specializing in performing work of this section.
1) Minimum five (5) years experience in plumbing installations.

2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.

b. Upon request, submit documentation.

2. Installer:
   a. Licensed for area of Project.
   b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
   c. Upon request, submit documentation.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

D. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

E. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

F. Preconstruction Testing: Water.

G. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Accept valves on site in shipping containers with labeling in place.
   2. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage and Handling Requirements:
   1. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by Architect until installed.
   2. Store items subject to moisture damage in dry, heated spaces.

1.08 WARRANTY

A. Manufacturer Warranty:
   1. Provide certificates of warranty for each piece of equipment made out in favor of the Owner.

B. Special Warranty:
   1. Guarantee plumbing systems to be free from noise in operation that may develop from failure to construct system in accordance with Contract Documents.
   2. If plumbing sub-contractor with offices located more than 150 miles from Project site is used, provide service / warranty work agreement for warranty period with local plumbing sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

B. Pipe and Pipe Fittings:
   1. Weld-O-Let and Screw-O-Let fittings are acceptable.

C. Sleeves:
   1. General:
      a. Two sizes larger than bare pipe or insulation on insulated pipe.

2. In Concrete and Masonry:
   a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 gage galvanized sheet metal.

D. Valves:
1. Valves of same type shall be of same manufacturer.

PART 3 EXECUTION

3.01 INSTALLERS

A. Acceptable Installers:
1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

B. Substitution Limitations: Same as specified for products; see Section 01 6000 - Product Requirements.

3.02 INSTALLERS

A. Approved Installers. See Section 01 4000 - Quality Requirements:
1. Approved Plumbing Subcontractors shall be pre-approved in accordance with Supplementary Conditions and included in Construction Documents by Addendum.

3.03 EXAMINATION

A. Drawings:
1. Plumbing Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
2. Mechanical Drawings show general arrangement of piping, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
3. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over Plumbing Drawings.
4. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification of Conditions:
1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which plumbing work is dependent for efficiency and report work that requires correction.
2. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
3. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.
4. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.

3.04 PREPARATION

A. Changes Due to Equipment Selection:
1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.

2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
4. Be responsible for proper location of rough-in and connections provided under other Divisions.

3.05 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Interface With Other Work:
1. Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
2. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and confirm that they are properly installed.
3. Furnish inserts for attaching hangers that are to be cast in concrete floor construction to Division 03 at time floors are poured.

C. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

D. Locating Equipment:
1. Arrange pipes and equipment to permit ready access to valves, cocks, unions, traps, and to clear openings of doors and access panels.
2. Adjust locations of pipes, equipment, and fixtures to accommodate work to interferences anticipated and encountered.
3. Install plumbing work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe before fabrication.
   a. Right-Of-Way:
      1) Lines that pitch shall have right-of-way over those that do not pitch. For example, plumbing drains shall normally have right-of-way.
      2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
   b. Offsets, Transitions, and Changes in Direction:
      1) Make offsets, transitions, and changes in direction in pipes as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
      2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

E. Penetration Firestops:
1. Install Penetration Firestop System appropriate for penetration at plumbing systems penetrations through walls, ceilings, roofs, and top plates of walls.

F. Sealants:
1. Seal openings through building exterior caused by penetrations of elements of plumbing systems.
2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

G. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus:
1. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper installation of plumbing systems.

2. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings:
    a. Arrange so as to facilitate removal of tube bundles.
    b. Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
        1) Make connections of dissimilar metals with di-electric unions.
        2) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
    c. Do not use reducing bushings, bull head tees, close nipples, or running couplings. Street elbows are allowed only on potable water pipe 3/4 inch in diameter and smaller.
    d. Install piping systems so they may be easily drained.
    e. Install piping to insure noiseless circulation.
    f. Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.
    g. Do not install piping in shear walls.
    h. Cut piping accurately to measurements established at site. Remove burr and cutting slag from pipes.
    i. Work piping into place without springing or forcing.
    j. Make changes in direction with proper fittings.
3. Expansion of Thermoplastic Pipe:
    a. Provide for expansion in every 30 feet of straight run.
    b. Provide 12 inch offset below roof line in each vent line penetrating roof.
4. Expansion of PEX Pipe: Allow for expansion and contraction of PEX pipe as recommended by Pipe Manufacturer.

H. Sleeves:
1. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete slabs on grade.
2. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Seal sleeves with specified sealants. Follow Pipe Manufacturer's recommendations for PEX pipe penetrations through studs and floor slabs.
3. Sleeves through floors shall extend 1/4 inch (6 mm) above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
4. Sleeves through floors and foundation walls shall be watertight.

I. Escutcheons:
1. Provide spring clamp plates where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.

3.06 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
2. Surface finishes shall exactly match existing finishes of same materials.

3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Field Tests:
1. Perform tests on HVAC piping systems. Furnish devices required for testing purposes.

C. Non-Conforming Work:

1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
2. Repeat tests on new material, if requested.

3.08 CLEANING

A. Remove dirt, grease, and other foreign matter from each length of piping before installation:
   1. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
   2. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
   3. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

B. Clean exposed piping, equipment, and fixtures. Remove stickers from fixtures and adjust flush valves.

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.09 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Instruction of Owner:

D. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.

E. Instruct building maintenance personnel and Facility Manager in operation and maintenance of plumbing systems utilizing Operation And Maintenance Manual when so doing.

F. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.

G. Demonstrate proper operation of equipment to Owner's designated representative.

H. Demonstration: Demonstrate operation of system to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Conduct walking tour of project.
   3. Briefly describe function, operation, and maintenance of each component.

I. Training: Train Owner's personnel on operation and maintenance of system.
   1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
   2. Provide minimum of two hours of training.
   3. Instructor: Manufacturer's training personnel.
   4. Location: At project site.

3.10 PROTECTION

A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials. Protect plastic pipe from exposure to sunlight as appropriate.

END OF SECTION

SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 5000 - Metal Fabrications.

C. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

1.03 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

D. ASTM D635 - Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.

G. MFMA-4 - Metal Framing Standards Publication 2004.

H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

I. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:
   1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
   2. Coordinate the work with other trades to provide additional framing and materials required for installation.
   3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
   4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
   5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
   1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
   1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

D. Derating Calculations for Fiberglass Strut Channel Framing Systems: Indicate load ratings adjusted for applicable service conditions.

E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

F. Installer's Qualifications: Include evidence of compliance with specified requirements.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

D. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide required hardware to hang or support piping, equipment, or fixtures with related accessories as necessary to complete installation of plumbing work.

B. Provide hardware products listed, classified, and labeled as suitable for intended purpose.

C. Materials for Metal Fabricated Supports: Comply with Section 05 5000.
   1. Zinc-Plated Steel: Electroplated in accordance with ASTM B633 unless stated otherwise.
   2. Galvanized Steel: Hot-dip galvanized in accordance with ASTM A123/A123M or ASTM A153/A153M unless stated otherwise.

D. Corrosion Resistance: Use corrosion-resistant metal-based materials fully compatible with exposed piping materials and suitable for the environment where installed.

2.02 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:
   1. Comply with MSS SP-58.
   2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
   3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
   4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be

supported with a minimum safety factor of 1.25. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: Comply with Section 05 5000.

C. Metal Channel (Strut) Framing Systems:
1. Manufacturers:
    a. Anvil International: www.anvilintl.com.
    b. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
    c. Thomas & Betts Corporation: www.tnb.com/#sle.
    d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
    e. Substitutions: See Section 01 6000 - Product Requirements.
    f. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
3. Comply with MFMA-4.
4. Channel Material:
    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

D. Fiberglass Channel (Strut) Framing Systems: Factory-fabricated continuous-slot fiberglass channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
1. Manufacturers:
    a. Enduro Composites: www.endurocomposites.com/#sle.
    b. Substitutions: See Section 01 6000 - Product Requirements.
    c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Channel Material: Use polyester resin or vinyl ester resin.
3. Minimum Channel Dimensions: 1-5/8 inch width by 1 inch height.
4. Flammability: Fire retardant with NFPA 101, Class A flame spread index (maximum of 25) when tested in accordance with ASTM E84; self-extinguishing in accordance with ASTM D635.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.
1. Minimum Size, Unless Otherwise Indicated or Required:
    a. Equipment Supports: 1/2 inch diameter.
    b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
    c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
    d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

F. Thermal Insulated Pipe Supports:
1. Manufacturers:

a. KB Enterprises: www.snappitz.com/#sle.
b. Substitutions: See Section 01 6000 - Product Requirements.

2. General Construction and Requirements:
   a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
   d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
3. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Minimum Service Temperature: Minus 40 degrees F.
   c. Maximum Service Temperature: 180 degrees F.
   d. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
   e. Thickness: 60 mil.
   f. Connections: Brush on welding adhesive.
4. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

G. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
1. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
   b. Erico International Corporation, a brand of Pentair: www.erico.com/#sle.
   c. PHP Systems/Design: www.phpsd.com/#sle.
   d. Unistrut, a brand of Atkore International Inc: www.unistrut.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.
2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

H. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
   a. Hilti, Inc: www.us.hilti.com/#sle.
   b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
   c. Powers Fasteners, Inc: www.powers.com/#sle.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.
2. Manufacturers - Powder-Actuated Fastening Systems:
   a. Hilti, Inc: www.us.hilti.com/#sle.
   b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
   c. Powers Fasteners, Inc: www.powers.com/#sle.
   d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
   e. Substitutions: See Section 01 6000 - Product Requirements.
3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
6. Hollow Masonry: Use toggle bolts.
7. Hollow Stud Walls: Use toggle bolts.
8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
9. Sheet Metal: Use sheet metal screws.
10. Wood: Use wood screws.
11. Plastic and lead anchors are not permitted.
12. Powder-actuated fasteners are not permitted.
    a. Where approved by Architect.
    b. Use only threaded studs; do not use pins.
13. Hammer-driven anchors and fasteners are not permitted.
    a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
    b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
14. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
    d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
15. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Interface With Other Work:
   1. Furnish inserts for attaching hangers that are to be cast in concrete floor construction to Division 03 at time floors are poured.

B. Piping:
   1. Properly support piping and make adequate provisions for expansion, contraction, slope, and anchorage.
      a. Except for underground pipe, suspend piping from roof trusses or clamp to vertical walls using Unistrut and clamps. Do not hang pipe from other pipe, equipment, or ductwork. Laying of piping on any building element is not allowed.
      b. Supports For Horizontal Piping:
         1) Support metal piping at 96 inches (2 400 mm) on center maximum for pipe 1-1/4 inches (32 mm) or larger and 72 inches (1 800 mm) on center maximum for pipe 1-1/8 inch (29 mm) or less.
         2) Support thermoplastic pipe at 48 inches (1 200 mm) on center maximum.
         3) Support PEX pipe at 32 inches (800 mm) minimum on center.
         4) Provide support at each elbow. Install additional support as required.
      c. Supports for Vertical Piping:
         1) Place riser clamps at each floor or ceiling level.
         2) Securely support clamps by structural members, which in turn are supported directly from building structure.
         3) Provide clamps as necessary to brace pipe to wall.

d. Install supports from inserts cast into concrete floor system, including concrete joists and floor slabs. Where inserts cannot be used, provide expansion shields and support hangers from angles held in place by expansion bolts, never directly from expansion bolt itself. Provide calculations necessary to determine number of expansion bolts required to equal capacity of cast-in-place insert.
e. Attach Unistrut to structural steel roof supporting structure. Spacing and support as described above.
f. Insulate hangers for copper pipe from piping by means of at least two layers of Scotch 33 plastic tape.

2. Gas piping Identification:
   a. Apply paint identification for gas piping used with HVAC equipment as specified in Section 23 0553.

C. Install products in accordance with manufacturer's instructions.

D. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

E. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

F. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

G. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

H. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

I. Field-Welding (where approved by Architect): Comply with Section 05 5000.

J. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

K. Equipment Support and Attachment:
1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

L. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

M. Secure fasteners according to manufacturer's recommended torque settings.

N. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.02 REFERENCE STANDARDS

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

PART 2 PRODUCTS

2.01 PLUMBING COMPONENT IDENTIFICATION GUIDELINE

A. Pipe Markers: 3/4 inch diameter and higher.

2.02 NAMEPLATES

A. Description: Laminated piece with up to three lines of text.
   1. Letter Color: White.
   2. Letter Height: 3/16 inch.

2.03 STENCILS

A. Stencil Paint:
   1. One Coat Primer:
      a. 6-2 Quick Drying Latex Primer Sealer over fabric covers.
      b. 6-205 Metal Primer under dark color paint.
      c. 6-6 Metal Primer under light color paint.
   2. Finish Coats: Two coats 53 Line Acrylic Enamel.
   3. Performance Standard: Paints specified are from Pittsburgh Paint & Glass (PPG): www.pittsburghpaints.com.
   4. Acceptable Products. See Section 01 6200.
      a. Paint of equal quality from following Manufacturers may be submitted for Architect's approval before use. Maintain specified colors, shades, and contrasts.
         1) Benjamin Moore: www.benjaminmoore.com.
         2) ICI Dulux: www.dulux.com.
         3) Sherwin Williams: www.sherwin-williams.com.

2.04 PIPE MARKERS

A. Provide rigid vinyl or polyester, 360 degree wrap-around pipe makers.

B. Surface printed with UV ink and then thermoformed. Legend to include pipe contents and directional arrows.

C. Provide pipe markers as follows:

Pipe Use	Abbreviation
Domestic Hot Water	HW
Domestic Hot Water Recirculation	HW RECIRC
Domestic Cold Water	CW
Sanitary Vent	SV
Relief Vent	RV

D. Underground Flexible Marker: Bright-colored continuously printed ribbon tape, minimum 6 inches wide by 4 mil, 0.004 inch thick, manufactured for direct burial service.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.02 INSTALLATION

A. Labels:
   1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
      a. Water Heaters.
   2. Engrave following data from Equipment Schedules on Drawings onto labels:
      a. Equipment mark.
      b. Room(s) served.
      c. Panel and breaker from which unit is powered.

B. Pipe Markers:
   1. Wrap pipe marker around pipe with 0.5 inches minimum overlap. Use adhesive strip at overlap to adhere ends of marker together.
   2. Locate markers as follows:
      a. Adjacent to each item of equipment.
      b. At points of entry and exit where piping goes through wall.
      c. On each riser and junction.
      d. Every 25 feet maximum on long, continuous runs.

C. Painting:
   1. Only painted legends, directional arrows, and color bands are acceptable.
   2. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
      a. Adjacent to each item of equipment.
      b. At point of entry and exit where piping goes through wall.
      c. On each riser and junction.
      d. Every 25 feet on long continuous lines.
      e. Stenciled symbols shall be one inch high and black.

3.03 ATTACHMENTS

A. Schedules:
   1. Pipe identification Schedule:
      a. Apply stenciled symbols and color banding as follows. Extend color band 2 inches minimum beyond each side of stenciled symbols.

Pipe Use	Abbreviation	Band Color
Domestic Cold Water	CW	Light Blue
Domestic Hot Water	HW	Light Green
Recirculating Domestic Hot Water	HW RECIRC	Medium Green
Sanitary Vent	SV	Dark Gray
Relief Vent	RV	Light Gray

      b. Apply stenciled symbols as follows:

Pipe Use	Abbreviation	Direction of Flow
Domestic Cold Water	CW	**--->**
Domestic Hot Water	HW	**--->**
Domestic Recirc Water	HW Recirc	**--->**

END OF SECTION

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SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9113 - Exterior Painting: Painting insulation jacket.

C. Section 09 9123 - Interior Painting: Painting insulation jacket.

D. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GENERAL MANUFACTURERS LIST

A. Armacell: www.armaflex.com.

B. Childers Products Co: www.fosterproducts.com.

C. IMCOA: www.nomacokflex.com.

D. Johns-Manville: www.jm.com.

E. Knauf: www.knauffiberglass.com.

F. Manson: www.imanson.com.

G. Nomaco Inc: www.nomacokflex.com.

H. Owens-Corning: www.owenscorning.com.

I. Speedline Corp: www.speedlinepvc.com.

2.03 GENERAL INSULATION REQUIREMENTS

A. Materials:

1. Above Grade Metal Piping:

a. Insulation For Piping:

1) Snap-on glass fiber or melamine foam pipe insulation, or heavy density pipe insulation with factory vapor jacket.

2) Insulation Thickness:

Service Water Temperature		Pipe Sizes	
	Up to 1-1/4 Inches	1-1/2 to 2 Inches	Over 2 Inches
170 - 180 Deg F	One Inch	1-1/2 Inch	2 Inches

Service Water Temperature		Pipe Sizes	
	Up to 1-1/4 Inches	1-1/2 to 2 Inches	Over 2 Inches
140 - 160 Deg F	1/2 Inch	One Inch	1-1/2 Inches
45 - 130 Deg F	1/2 Inch	1/2 Inch	One Inch

3) Performance Standards: Fiberglas ASJ by Owens-Corning.
4) Acceptable Manufacturers:
   (a) Childers Products.
   (b) Knauf.
   (c) Manson.
   (d) Owens-Corning.
   (e) Johns-Manville.
   (f) Equal as approved by Architect before bidding. See Section 01 6200.

b. Fitting, Valve, And Accessory Covers:
1) PVC.
2) Performance Standard: Zeston by Johns-Manville.
3) Acceptable Manufacturers:
   (a) Knauf.
   (b) Speedline.
   (c) Johns-Manville.
   (d) Equal as approved by Architect before bidding. See Section 01 6200.

2. Below Grade Metal Piping:
a. Insulation:
1) 1/2 inch (13 mm) thick.
2) Acceptable Products.
   (a) SS Tubolit by Armacell.
   (b) ImcoLock by Imcoa.
   (c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
1) Acceptable Products.
   (a) Armacell 520.
   (b) Nomaco K-Flex R-373.

3. Pex Piping, Above And Below Grade:
a. Insulation:
1) 1/2 inch (13 mm) thick.
2) Acceptable Products.
   (a) SS Tubolit by Armacell.
   (b) ImcoLock by Imcoa.
   (c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
1) Acceptable Products.
   (a) Armacell 520.
   (b) Nomaco K-Flex R-373.

4. PP-R Piping, Above And Below Grade:
a. Insulation:
1) 1/2 inch (13 mm) thick.
2) Acceptable Products.
   (a) SS Tubolit by Armacell.
   (b) ImcoLock by Imcoa.
   (c) Nomalock or Therma-Cel by Nomaco.

b. Joint Sealant:
    1) Acceptable Products.
        (a) Armacell 520.
        (b) Nomaco K-Flex R-373.

5. PVC or ABS Piping, Above And Below Grade - Facility Storm Drain:
    a. Insulation:
        1) 1/2 inch (13 mm) thick.
        2) Acceptable Products.
            (a) SS Tubolit by Armacell.
            (b) ImcoLock by Imcoa.
            (c) Nomalock or Therma-Cel by Nomaco.
    b. Joint Sealant:
        1) Acceptable Products.
            (a) Armacell 520.
            (b) Nomaco K-Flex R-373.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Above Grade Piping:
1. Apply insulation to clean, dry piping with joints tightly butted.
2. Install insulation in manner to facilitate removal for repairs. Place sections or blocks so least possible damage to insulation will result from inspection or repairs of piping or equipment.
3. Piping up to 1-1/4 Inch Diameter:
    a. Adhere 'factory applied vapor barrier jacket lap' smoothly and securely at longitudinal laps with white vapor barrier adhesive.
    b. Adhere 3 inch wide self-sealing butt joint strips over end joints.
4. Piping 1-1/2 Inch Diameter And Larger:
    a. Use broken-joint construction in application of two-layer covering.
    b. Fill cracks and depressions with insulating cement mixed to thick plastic paste.
        1) Apply by hand in several layers to make up total specified thickness.
        2) Final layer shall have smooth uniform finish before application of covering.
5. Fittings, Valves, And Accessories:
    a. Do not apply insulation over flanged joints or victaulic couplings until piping has been brought up to operating temperature and flange bolts have been fully tightened. Insulate valves so wheel, stem, and packing nut are exposed.
    b. Insulate with same type and thickness of insulation as pipe, with ends of insulation tucked snugly into throat of fitting and edges adjacent to pipe insulation tufted and tucked in.
    c. Piping Up To 1-1/4 Inch Diameter:
        1) Cover insulation with one piece fitting cover secured by stapling or taping ends to adjacent pipe covering.
        2) Alternate Method:
            (a) Insulate fittings, valves, and accessories with one inch of insulating cement and vapor seal with two 1/8 inch wet coats of vapor barrier mastic reinforced with glass fabric extending 2 inches onto adjacent insulation.
    d. Piping 1-1/2 Inch To 2 Inches:
        1) Insulate with hydraulic setting insulating cement or equal, to thickness equal to adjoining pipe insulation.
        2) Apply final coat of fitting mastic over insulating cement.

e. Piping 2-1/2 Inches And Larger:
1) Insulate with segments of molded insulation securely wired in place and coated with skim coat of insulating cement.
2) Apply fitting mastic, fitting tape and finish with final coat of fitting mastic.

6. Pipe Hangers:
a. Do not allow pipes to come in contact with hangers.
b. Pipe Shield:
1) Provide schedule 40 PVC by 6 inches long at each clevis and/or Unistrut type hanger.
2) Provide 16 gage by 6 inches long galvanized shields at each pipe hanger to protect pipe insulation from crushing by clevis hanger.
3) Provide 22 gage by 6 inches long galvanized shield at each pipe hanger to protect insulation from crushing by Unistrut type hanger.
c. At Pipe Hangers:
1) Provide rigid calcium silicate insulation (100 psi compressive strength) at least 2 inches beyond shield.

7. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

B. Below Grade Piping:
1. Slip underground pipe insulation onto pipe and seal butt joints.
2. Where slip-on technique is not possible, slit insulation, apply to pipe, and seal seams and joints.

C. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 22 1005
PLUMBING PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Sanitary waste piping, buried within 5 feet of building.
B. Domestic water piping, buried within 5 feet of building.
C. Domestic water piping, above grade.
D. Natural gas piping, buried within 5 feet of building.
E. Natural gas piping, above grade.
F. Pipe flanges, unions, and couplings.
G. Pipe hangers and supports.
H. Ball valves.
I. Butterfly valves.
J. Pressure reducing valves.
K. Pressure relief valves.

1.02 SUMMARY

A. Includes But Not Limited To:
    1. Plumbing Piping:
        a. Perform excavating and backfilling required by work of this Section.
        b. Furnish and install potable water piping complete with necessary valves, connections, and accessories inside building and connect with outside utility lines 5 feet (1 50 m) from building perimeter as described in Contract Documents.
        c. Rough-in for and connect Food Preparation sinks.
    2. Facility Sanitary Sewers:
        a. Furnish and install soil, waste, and vent piping systems within building and connect with outside utility lines 5 feet (1.5 m) out from building where applicable.
        b. Perform excavation and backfill required by work of this Section.

1.03 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.
B. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.
C. Section 22 0553 - Identification for Plumbing Piping and Equipment.
D. Section 22 0719 - Plumbing Piping Insulation.
E. Section 22 1006 - Plumbing Piping Specialties
F. Section 23 5400 Furnaces
G. Section 31 2316 - Excavation and Trenching.
H. Section 31 2323 - Fill and Aggregate Base.

1.04 REFERENCE STANDARDS

A. ANSI LC 1/CSA 6.26 - Fuel Gas Piping Systems Using Corrugated Stainless Steel Tubing 2019.
B. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).
C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.
D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.
E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

F. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.

G. ASME B31.1 - Power Piping 2022.

H. ASME B31.9 - Building Services Piping 2020.

I. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.

J. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems 2020.

K. ASSE 1017 - Performance Requirements for Temperature Actuated Mixing Valves for Hot Water Distribution Systems 2009.

L. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2022).

M. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2022.

N. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.

O. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

P. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

Q. ASTM B32 - Standard Specification for Solder Metal 2020.

R. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.

S. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2022.

T. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.

U. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.

V. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.

W. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.

X. ASTM D2235 - Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings 2022.

Y. ASTM D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter 2022.

Z. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.

AA. ASTM D2609 - Standard Specification for Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe 2021.

BB. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.

CC. ASTM D2680 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly(Vinyl Chloride) (PVC) Composite Sewer Piping 2020.

DD. ASTM D2729 - Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.

EE. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.

FF. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.

GG. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

HH. ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing 2022a, with Editorial Revision.

II. ASTM F1960 - Standard Specification for Cold Expansion Fittings with PEX Reinforcing Rings for Use with Cross-linked Polyethylene (PEX) and Polyethylene of Raised Temperature (PE-RT) Tubing 2022.

JJ. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

KK. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.

LL. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.

MM. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).

NN. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.

OO. AWWA C606 - Grooved and Shouldered Joints 2015.

PP. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).

QQ. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2021.

RR. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications 2020.

SS. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.

TT. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.

UU. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

VV. MSS SP-67 - Butterfly Valves 2022.

WW. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

XX. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

YY. NSF 372 - Drinking Water System Components - Lead Content 2022.

ZZ. PPI TR-4 - PPI HSB Listing of Hydrostatic Design Basis (HDB), Hydrostatic Design Stress (HDS), Strength Design Basis (SDB), Pressure Design Basis (PDB) and Minimum Required Strength (MRS) Ratings for Thermoplastic Piping Materials or Pipe 2021.

AAA. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Qualifications:
   1. Manufacturer Qualifications:
      a. PP-R pipe and PP-RCT pipe:
         1) Certified by NSF International.
   2. Installers Qualifications:
      a. PP-R pipe and PP-RCT pipe:
         1) Certified by Manufacturer.
   3. Pre-Installation Conference:
      a. Participate in pre-installation conference as specified in Section 03 3111.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Manufacturer's Literature:
         1) PEX pipe and PEX pipe fittings.
         2) PP-R pipe and PP-R pipe fittings.
         3) PP-RCT pipe and PP-RCT pipe fittings.
   2. Samples:
      a. PEX pipe and fitting.
      b. PP-R pipe and fitting
      c. PP-RCT pipe and PP-RCT fitting

C. Informational Submittals:
   1. Test And Evaluation Reports:
      a. Written report of sterilization test.

D. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

E. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

F. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

G. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

H. Sustainable Design Documentation: For products meeting regulatory lead-content restrictions.

I. Project Record Documents: Record actual locations of valves.

J. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Valve Repacking Kits: One for each type and size of valve.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.09 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Plenum-Installed Acid Waste Piping: Flame-spread index equal or below 25 and smoke-spread index equal or below 50 according to ASTM E84 or UL 723 tests.

2.02 SANITARY WASTE PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.
   1. Fittings: Cast iron.
   2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. Cast Iron Pipe: CISPI 301, hubless.
   1. Fittings: Cast iron.
   2. Joints: CISPI 310, neoprene gasket and stainless steel clamp and shield assemblies.

C. ABS Pipe: ASTM F628.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

D. PVC Pipe: ASTM D2665 or ASTM D3034.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER AND CONDENSATE PIPING, ABOVE GRADE

A. ABS Pipe: ASTM F628.
   1. Fittings: ABS.
   2. Joints: Solvent welded with ASTM D2235 cement.

B. PVC Pipe: ASTM D2729.
   1. Fittings: PVC.
   2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn.
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.

B. Ductile Iron Pipe: AWWA C151/A21.51.
   1. Fittings: Ductile or gray iron, standard thickness.
   2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

C. PE Pipe: ASTM D2239.
   1. Fittings: ASTM D2609, PE.
   2. Joints: Mechanical with stainless steel clamp.

D. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. Manufacturers:
      a. Uponor, Inc; [_____]: www.uponorengineering.com/#sle.
      b. Substitutions: See Section 01 6000 - Product Requirements.
   2. PPI TR-4 Pressure Design Basis:
      a. 160 psig at maximum 73 degrees F.
      b. 100 psig at maximum 180 degrees F.
      c. 80 psig at maximum 200 degrees F.
      d. [____] psig at maximum [____] degrees F.
   3. Fittings: Brass and copper.
   4. Fittings: Brass and engineered polymer (EP) ASTM F1960.
   5. Joints: Mechanical compression fittings.
   6. Joints: ASTM F1960 cold-expansion fittings.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Pipe: ASTM B88 (ASTM B88M), Type K (A), Drawn (H).
   1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
   2. Joints: ASTM B32, alloy Sn95 solder.
   3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

B. Cross-Linked Polyethylene (PEX) Pipe: ASTM F876 or ASTM F877.
   1. PPI TR-4 Pressure Design Basis:
      a. 160 psig at maximum 73 degrees F.
      b. 100 psig at maximum 180 degrees F.
      c. 80 psig at maximum 200 degrees F.
   2. Fittings: Brass and copper.
   3. Fittings: Brass and engineered polymer (EP) ASTM F1960.
   4. Joints: Mechanical compression fittings.
   5. Joints: ASTM F1960 cold-expansion fittings.

2.06 NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASTM A234/A234M, wrought steel welding type.
   2. Joints: ASME B31.1, welded.
   3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

B. Copper Tube: Listed, ASTM B88 (ASTM B88M), Type K (A), annealed.
   1. Fittings: ASME B16.18 cast copper or ASME B16.22 wrought copper.
   2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.
   3. Mechanical Press Sealed Fittings: Double-pressed type and approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

C. Flexible Gas Piping:
   1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
   2. Fittings: Provided by piping system manufacturer.

2.07 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.
   1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
   2. Joints: Threaded or welded to ASME B31.1.

B. Flexible Gas Piping:
   1. Corrugated Stainless Steel Tubing: Comply with ANSI LC 1/CSA 6.26.
   2. Comply with ASTM E84.
   3. Fittings: Provided by piping system manufacturer.

C. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) or L (B) annealed.
   1. Fittings: ASME B16.26, cast bronze.
   2. Joints: Flared.

2.08 PIPE FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:
   1. Ferrous Pipe: Class 150 malleable iron threaded unions.
   2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes Over 1 inch:
   1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
   2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.
   1. Dimensions and Testing: In accordance with AWWA C606.
   2. Housing Material: Provide ASTM A47/A47M malleable iron, ductile iron, or galvanized.
   3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
   4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
   5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

2.09 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
   1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
      a. Cold and Hot Pipe Sizes 6 inch and Larger: Double hangers.
   3. Trapeze Hangers: Welded steel channel frames attached to structure.
   4. Vertical Pipe Support: Steel riser clamp.
   5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.
   6. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
      a. Bases: High-density polypropylene.
      b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
      c. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment and Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
      e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

B. Plumbing Piping - Drain, Waste, and Vent:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
   3. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.
   4. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.
   5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
   6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:
   1. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
   2. Hangers for Cold Pipe Sizes 2 inch and Over: Carbon steel, adjustable, clevis.
   3. Hangers for Hot Pipe Sizes 2 to 4 inch: Carbon steel, adjustable, clevis.
   4. Hangers for Hot Pipe Sizes 6 inch and Larger: Adjustable steel yoke, cast iron pipe roll, double hanger.
   5. Wall Support for Pipe Sizes Up to 3 inch: Cast iron hook.
   6. Wall Support for Pipe Sizes 4 inch and Larger: Welded steel bracket and wrought steel clamp.
   7. Wall Support for Hot Pipe Sizes 6 inch and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
   8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

9. Floor Support for Hot Pipe Sizes to 4 inch: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
10. Floor Support for Hot Pipe Sizes 6 inch and Larger: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
11. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:
1. Concrete Wedge Expansion Anchors: Comply with ICC-ES AC193.
2. Masonry Wedge Expansion Anchors: Comply with ICC-ES AC01.
3. Concrete Screw Type Anchors: Comply with ICC-ES AC193.
4. Masonry Screw Type Anchors: Comply with ICC-ES AC106.
5. Concrete Adhesive Type Anchors: Comply with ICC-ES AC308.
6. Other Types: As required.
7. Manufacturers:
   a. Powers Fasteners, Inc: www.powers.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.10 BALL VALVES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
2. Grinnell Products: www.grinnell.com/#sle.
3. Nibco, Inc: www.nibco.com/#sle.
4. Uponor, Inc: www.uponorengineering.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction, 4 inch and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.11 BUTTERFLY VALVES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
2. Crane Company: www.cranecpe.com/#sle.
3. Grinnell Products; B302: www.grinnell.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Construction 1-1/2 inch and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

C. Provide gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.

2.12 PRESSURE REDUCING VALVES

A. Manufacturers:
1. Amtrol Inc: www.amtrol.com/#sle.
2. Apollo Valves: www.apollovalves.com/#sle.
3. Cla-Val Company: www.cla-val.com/#sle.
4. Flomatic Valves: www.flomatic.com/#sle.
5. Watts Regulator Company: www.wattsregulator.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. 2 inch and Smaller:
1. ASSE 1003, bronze body, stainless steel, and thermoplastic internal parts, fabric reinforced diaphragm, strainer, threaded single union ends.
2. Pressure Reducing Pilot-Operator:
   a. Operating Range: 5 to 50 psi.

b. Connected into brass or bronze pilot piping and fittings.
c. Fixed flow restrictor, pressure gauges, and isolation valves.

C. 2 inch and Larger:
1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.
2. Pressure Reducing Pilot-Operator:
a. Operating Range: 5 to 50 psi.
b. Connected into brass or bronze pilot piping and fittings.
c. Fixed flow restrictor, strainer, pressure gauges, and isolation valves.

2.13 MIXING VALVES

A. Solid brass construction and CSA B125 certified.

B. Includes integral check valves and inlet screen. Features advanced paraffin-based actuation technology.

C. Flow of 5.7 GPM (21.58 LPM) with maximum 10 psi (69 kPA) pressure drop. Perform to minimum flow of 0.5 GPM (1.89 LPM) in accordance with ASSE 1070.

D. Set for 110 deg F (43 deg C) Service.

E. Match Construction Drawings for connection sizes.

F. Quality Standard: Powers LFLM495.
1. Acceptable Manufacturers: Acorn, Chicago Faucets, Leonard, Powers, Sloan, Symmons and Watts.

G. Font
1. Solid brass construction and CSA B125 certified.
2. Includes integral check valves and inlet screen. Features advanced paraffin-based actuation technology.
3. Flow of 11 GPM (41.58 LPM) with maximum 10 psi (69 kPA) pressure drop. Perform to minimum flow of 0.5 GPM (1.89 LPM) in accordance with ASSE 1017.
4. Set for 100 deg F (38 deg C) Font Service.
5. Match Construction Drawings for connection sizes.
6. Quality Standard: Watts LFMM431.
a. Acceptable Manufacturers: Acorn, Leonard, Powers, Sloan, Symmons, and Watts.

2.14 CIRCUIT BALANCING VALVES:

A. Valves 3/4 inch through 6 inches (19 mm through 150 mm):
1. Four function capability: Flow measurement, flow balancing with memory stop, positive shut off, and drain.
2. Provide provisions for connecting differential pressure meter. Each meter connection shall have shut off valves.
3. Include tamper proof and memory features.
4. Approved Products.
a. Armstrong: CBV.
b. Bell & Gosssett: Circuit Setter.
c. Taco: Accu-Flo.

2.15 PRESSURE RELIEF VALVES

A. ANSI Z21.22, AGA certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

2.16 STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com/#sle.
2. Green Country Filter Manufacturing: www.greencountryfilter.com/#sle.
3. WEAMCO: www.weamco.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

B. Domestic water use must meet NSF requirements

C. Size 2 inch and Smaller:
   1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
   2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

D. Size 1-1/2 inch to 4 inch:
   1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

E. Size 5 inch and Larger:
   1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Follow all manufacturers requirements.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. See Section 22 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
   1. See Section 22 0719.

H. Provide access where valves and fittings are not exposed.
   1. Coordinate size and location of access doors with Section 08 3100.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.

L. Excavate in accordance with Section 31 2316.

M. Backfill in accordance with Section 31 2323.

N. Install bell and spigot pipe with bell end upstream.

O. Install valves with stems upright or horizontal, not inverted. See Section 22 0523.

P. Install water piping to ASME B31.9.

Q. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

R. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

S. Pipe Hangers and Supports:

3.04 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

B. Water Piping: Slope at minimum of 1/32 inch per foot and arrange to drain at low points.

3.05 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.

B. Prior to starting work, verify system is complete, flushed, and clean.

C. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

D. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

E. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

F. Maintain disinfectant in system for 24 hours.

G. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

H. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

I. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.06 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved double check backflow preventer and water meter with by-pass valves, pressure reducing valve, and sand strainer. These may be located inside the building
   1. Provide sleeve in wall for service main and support at wall with reinforced concrete bridge. Calk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.
   2. Provide 18 gauge, 0.0478-inch galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.

3.07 SCHEDULES

A. Pipe Hanger Spacing:
   1. Metal Piping:
      a. Pipe Size: 1/2 inch to 1-1/4 inch:
         1) Maximum Hanger Spacing: 6.5 ft.
         2) Hanger Rod Diameter: 3/8 inches.
      b. Pipe Size: 1-1/2 inch to 2 inch:
         1) Maximum Hanger Spacing: 10 ft.
         2) Hanger Rod Diameter: 3/8 inch.
      c. Pipe Size: 2-1/2 inch to 3 inch:
         1) Maximum Hanger Spacing: 10 ft.

2) Hanger Rod Diameter: 1/2 inch.

d. Pipe Size: 4 inch to 6 inch:

2. Plastic Piping:

a. All Sizes:

1) Maximum Hanger Spacing: 6 ft.

2) Hanger Rod Diameter: 3/8 inch.

3.08 WARRANTY

A. 10 years factory-certified minimum for

1. PP-R pipe and fittings
2. PP-RCT pipe and PP-RCT fittings

END OF SECTION

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install miscellaneous potable water piping specialties as described in Contract Documents.
   2. Products furnished but not installed under this section as described in Contract Documents.

1.02 RELATED REQUIREMENTS

A. Section 22 0501 - Common Work Results for Plumbing.

B. Section 22 1005 - Plumbing Piping.

C. Section 22 3000 - Plumbing Equipment.

D. Section 22 4000 - Plumbing Fixtures.

1.03 REFERENCE STANDARDS

A. ASME A112.6.4 - Roof, Deck, and Balcony Drains 2022.

B. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers 2017.

C. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent 2021.

D. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Prevention Assemblies 2021.

E. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance 2011 (Reaffirmed 2016).

F. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

G. NSF 372 - Drinking Water System Components - Lead Content 2022.

H. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Certificates: Certify that grease interceptors meet or exceed specified requirements.

E. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

H. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, and water hammer arrestors.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements for additional provisions.
   2. Extra Loose Keys for Outside Hose Bibbs: One.
   3. Extra Hose End Vacuum Breakers for Hose Bibbs: One.
   4. Service Kits for: One.
   5. Containers of: One.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 GENERAL MANUFACTURERS

A. Ashcroft; www.ashcroftinc.com.

B. H O Trerice; www.hotco.com.

C. IPS Corporation; www.ipscorp.com.

D. Josam Co; www.josam.com.

E. Jay R. Smith Manufacturing Co; www.jrsmith.com.

F. Prier Products, Inc; www.prier.com.

G. Proset Systems Inc; www.prosetsystems.com.

H. Sioux Chief Manufacturing Co; www.siouxchief.com.

I. Sure Seal; www.thesureseal.com.

J. Wade (Division of Tyler Pipe); www.wadedrains.com.

K. Watts Drainage; www.watts.com.

L. Weiss Instruments, Inc; www.weissinstruments.com.

M. Woodford Manufacturing; www.woodfordmfg.com.

N. Zurn Cast Metals; www.zurn.com.

2.03 DRAINS

A. Floor Drain (FD-1):
   1. Approved types with deep seal trap and chrome plated strainer.
   2. Approved Products.
   3. Products:
      a. Josam: 30000-50-Z-5A.
      b. J. R. Smith: 2010-A.
      c. Mifab: F-1100-C.
      d. Sioux Chief: 832.
      e. Wade: 1100.
      f. Watts: FD-200-A.
      g. Zurn: Z-415.

2.04 CLEANOUTS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   2. Josam Company: www.josam.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Cleanouts at Exterior Surfaced Areas (CO-1):
   1. Round cast nickel bronze access frame and non-skid cover.

C. Cleanouts at Exterior Unsurfaced Areas (CO-2):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover.

D. Cleanouts at Interior Finished Floor Areas (CO-3):
   1. Lacquered cast iron body with anchor flange, reversible clamping collar, threaded top assembly, and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

E. Cleanouts at Interior Finished Wall Areas (CO-4):
   1. Line type with lacquered cast iron body and round epoxy coated gasketed cover, and round stainless steel access cover secured with machine screw.

F. Cleanouts at Interior Unfinished Accessible Areas (CO-5): Calked or threaded type. Provide bolted stack cleanouts on vertical rainwater leaders.

2.05 HOSE BIBBS

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   2. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.
   3. Watts Regulator Company: www.wattsregulator.com/#sle.
   4. Zurn Industries, LLC: www.zurn.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Interior Hose Bibbs:
   1. Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome-plated where exposed with handwheel, integral vacuum breaker in compliance with ASSE 1011.

C. Interior Mixing Type Hose Bibbs:
   1. Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, chrome plated where exposed with handwheels, and vacuum breaker in compliance with ASSE 1011

2.06 HYDRANTS

A. Manufacturers:
   1. Arrowhead Brass & Plumbing, LLC: www.arrowheadbrass.com/#sle.
   2. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   3. Murdock Manufacturing, Inc: www.murdockmfg.com/#sle.
   4. Zurn Industries, LLC: www.zurn.com/#sle.
   5. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Hydrants:
   1. ASSE 1019; freeze resistant, self-draining type with chrome plated wall plate hose thread spout, handwheel, and integral vacuum breaker. Locking. Minimum 12 inches - meet or exceed design conditions

2.07 BACKWATER VALVES

A. Manufacturers:
   1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   2. Savko Plastic Pipe & Fittings, Inc: www.savko.com/#sle.
   3. Zurn Industries, LLC: www.zurn.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Cast Iron Backwater Valves: ASME A112.6.4; lacquered cast iron body and cover, brass valve, extension sleeve, and access cover.

C. Plastic Backwater Valves: ABS body and valve, extension sleeve, and access cover.

2.08 BACKFLOW PREVENTERS

A. Manufacturers:
   1. Apollo Valves: www.apollovalves.com/#sle.
   2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.

3. Zurn Industries, LLC; 375XL: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Reduced Pressure Backflow Preventer Assembly:
1. ASSE 1013; cast bronze body and stainless steel springs; two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve that opens under back pressure in case of diaphragm failure, and non-threaded vent outlet.
2. Size: 2 inch assembly with threaded gate valves.

2.09 DOUBLE CHECK-VALVE ASSEMBLIES

A. Manufacturers:
1. Apollo Valves: www.apollovalves.com/#sle.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC; 350AST: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Double Check Valve Assembly:
1. ASSE 1012; cast bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
2. Size: 3/4 to 2 inch, NPS assembly with threaded full port ball valves.

2.10 WATER HAMMER ARRESTORS

A. Manufacturers:
1. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
2. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com/#sle.
3. Zurn Industries, LLC: www.zurn.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Water Hammer Arrestors:
1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.11 ACCESSORIES

A. Drain Accessories:
1. Condensate Receptor:
a. Approved Products.
b. Products:
1) Trap seal by Sureseal. Provide model number to match condensate receptor .
2) Trap guard by Proset Systems. Provide model number to match condensate Receptor
2. Floor Drains:
a. Approved Products.
b. Products:
1) Trap guard by Proset Systems. Provide model number to match floor drain.
2) Trap seal by Sureseal. Provide model number to match floor drain.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

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SECTION 22 3000
PLUMBING EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Water Heaters:
   1. Residential electric.

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install electric tank water heaters as described in Contract Documents.

1.03 RELATED REQUIREMENTS

A. Section 22 0501 - Common Work Results for Plumbing.

B. Section 22 1005 - Plumbing Piping.

1.04 REFERENCE STANDARDS

A. AHRI Directory of Certified Product Performance - Air-Conditioning, Heating, and Refrigeration Institute (AHRI) Current Edition.

B. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 174 - Standard for Household Electric Storage Tank Water Heaters Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data:
   1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.
   2. Indicate pump type, capacity, power requirements.
   3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.
   4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:
   1. Indicate dimensions, size of tappings, and performance data.
   2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Manufacturer's Instructions.

E. Project Record Documents: Record actual locations of components.

F. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Project Record Documents: Record actual locations of components.

I. Closeout Submittals:

1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
    a. Operations and Maintenance Data:
        1) Maintenance and operational instructions.
        2) Warranty Documentation:
            (a) Final, executed copy of Warranty.
        3) Record Documentation:
            (a) Manufacturers documentation:
            (b) Manufacturer's literature or cut sheet.

1.07 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
    1. Meet NSF International Standards for materials or products that come in contact with drinking water, drinking water treatment chemicals, or both for chemical contaminants and impurities that are indirectly imparted to drinking water from products, components, and materials used in drinking water systems.
    2. Seismic Anchoring System:
        a. Required for Seismic Design Category (SDC) C, D, E, or F or where authority having jurisdiction (AHJ) requires seismic protection use for water heater seismic anchoring systems.
        b. Seismic Design Category (SDC) shall be determined by Project Structural Engineer.
        c. Anchoring Components:
            1) Seismic and California certified/approved and labeled:
                (a) Straps/anchoring systems.
                (b) Fasteners.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

C. Certifications:
    1. Water Heaters: NSF approved.
    2. Electric Water Heaters: UL listed and labeled to UL 174.
    3. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

D. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

E. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

C. Provide Manufacture standard warranty from date of Substantial Completion covering both tank and component parts for leakage or other malfunction caused by defects in materials and/or workmanship.

D. Special Warranty:
    1. Three-year non-prorated warranty on water heaters of 20 gallon (76 liters) capacity and larger.

PART 2 PRODUCTS

2.01 WATER HEATERS

A. Manufacturers:

1. Manufacturer Contact List:
    a. ACT, Inc, Costa Mesa CA, (800) 200-1956
    b. American Water Heater Co; www.americanwaterheater.com.
    c. A. O. Smith Water Products Co; www.hotwater.com; (800) 265-8520 or (519) 271-5800.
    d. Enovative Group; www.enovativegroup.com.
    e. Bradford-White Corp; www.bradfordwhite.com.
    f. Heat Transfer Products; www.htproducts.com.
    g. Lochinvar; www.lochinvar.com.
    h. Rheem / Ruud Water Heater Div Rheem Manufacturing; www.rheem.com; (800) 268-6966 or (905) 527-9194.
    i. State Industries Inc; www.stateind.com.

PART 3 EXECUTION

4.01 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Install temperature-pressure relief valve on hot water heater and pipe discharge to directly above funnel of floor or condensate drain.

D. Anchor 20 gallon (76 liter) and larger water heaters to wall using anchoring straps and specified screws.

E. Water Heaters:
    1. Water heaters shall each have relief valve sized to match heat input and set to relieve at 120 psi (827 kPa).
    2. Install temperature-pressure relief valve on hot water heater and pipe discharge directly above funnel of floor condensate drain.
    3. Provide mixing valve at all water heater installations as specified in Section 22 1005.
    4. Connect to condensate drain following Section 22 1005
    5. Install hot water circulation pump and pump controls per manufacturer’s instructions:
        a. Coordinate with Contract Drawings for location of hard-wired motion sensors.
        b. Connect hard-wired motion sensors to pump control box.
        c. Verify correct operation of hard-wired motion sensors.
        d. Install manual activation button near pump.

4.02 ADJUSTING

A. Set discharge water temperature at 140 deg F (60 deg C). Final hot water temperature shall be 110 deg F (43 deg C) after thermostatic mixing valve. If no mixing valve set discharge temperature at 110 deg F (43 deg C).

END OF SECTION

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SECTION 22 4000
PLUMBING FIXTURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Wall hung urinals.

B. Lavatories.

C. Sinks.

D. Electric water cooler.

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install plumbing fixtures as described in Contract Documents.

1.03 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.04 DEFINITIONS

A. Maximum Performance (MaP): Toilet testing that rates toilet efficiency and flush performance by measuring number of grams of solid waste (soybean paste and toilet paper) that a toilet can flush and remove completely from fixture in single flush represented as a scale or score. 1000 grams is highest score possible (www.map-testing.com <http://www.map-testing.com>). All products must meet MaP 1000 score

1.05 REFERENCE STANDARDS

A. ASME A112.6.1M - Floor-Affixed Supports for Off-the-Floor Plumbing Fixtures for Public Use 1997 (Reaffirmed 2017).

B. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.

C. ASME A112.19.2 - Ceramic Plumbing Fixtures 2018, with Errata.

D. ASME A112.19.3 - Stainless Steel Plumbing Fixtures 2022.

E. ASME A112.19.4M - Porcelain Enameled Formed Steel Plumbing Fixtures 1994 (Reaffirmed 2009).

F. NSF 61 - Drinking Water System Components - Health Effects 2022, with Errata.

G. NSF 372 - Drinking Water System Components - Lead Content 2022.

H. UL (DIR) - Online Certifications Directory Current Edition.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Samples: Submit two lavatory supply fittings.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

G. Closeout Submittals:
   1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
      a. Operation and Maintenance Data:
         1) Sensor Operated operation and maintenance manuals.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Water Efficiency: EPA WaterSense label is required for all water closets, urinals, lavatory faucets, and showerheads.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

2.03 GENERAL MANUFACTURERS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. American Standard Brands; www.americanstandard-us.com.
      b. AMTC - Advanced Modern Technologies Corp; www.amtcorporation.com.
      c. Bemis Manufacturing Co; www.bemismfg.com.
      d. Beneke by Sanderson Plumbing Products; www.sppi.com.
      e. Church Seat Co; www.churchseats.com.
      f. Delany Flush Valves; www.delanyproduct.com.
      g. Delta Faucet Co; www.deltafaucet.coM; (519) 659-3626.
      h. Dearborn Brass; www.dearbornbrass.com.
      i. Gerber Plumbing Fixtures LLC; www.gerberonline.com.
      j. Josam Co; www.josam.com.
      k. Jay R. Smith Mfg. Co; www.jrsmith.com.
      l. Kohler Co Plumbing Div; www.us.kohler.com.
      m. McGuire Manufacturing Co; www.mcguiremfg.com.
      n. Mifab Manufacturing Inc; www.mifab.com.
      o. Moen Incorporated; www.moen.com.
      p. Olsonite Corp; www.olsonite.net; (519) 682-1240.
      q. Sloan Valve Co; www.sloanvalve.com.
      r. South Fork Manufacturing; (801) 953-3001; www.dirt-grabber.com.
      s. Toto U.S.A., Inc; www.totousa.com
      t. Wade Div Tyler Pipe; www.wadedrains.com.
      u. Watts Drainage; www.wattsdrainage.com.
      v. Zurn Industries, LLC; www.zurn.com; (905) 795-8844.

2.04 WALL HUNG URINALS

A. Manufacturers:
   1. Advanced Modern Technologies Corporation: www.amtcorporation.com/#sle.
   2. American Standard, Inc: www.americanstandard-us.com/#sle.
   3. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
   4. Kohler Company: www.kohler.com/#sle.

5. Sloan Valve Company: www.sloanvalve.com/#sle.
6. Toto USA: www.totousa.com/#sle.

B. Vitreous china, ASME A112.19.2, wall hung with side shields and concealed carrier.
1. Consumption Volume: 1.0 gal per flush, maximum.
2. Flush Style: Washout.
3. Flush Valve: Exposed (top spud).
4. Flush Operation: Sensor operated.
5. Trapway Outlet: Integral.
6. Removable stainless steel strainer.
7. Supply Size: 3/4 inch.
8. Outlet Size and Location: 2 inches, bottom side.
9. Approved Products.
   a. American Standard: Washbrook FloWise 6590.001.
   b. Gerber: Monitor 27-780 or 27-730.
   c. Kohler: Bardon K-4904-ET.
   d. Sloan: SU-1006-1.0.
   e. Toto: UT447E.

C. HEU (High-Efficiency Urinal) - Standard Fixture:
1. Water usage of 0.5 gallons (1.9 liters) per flush.
2. Approved Products.
   a. American Standard: Washbrook FloWise 6590.001.
   b. Gerber: Monitor 27-730.
   c. Kohler: Bardon K-4904-ET.
   d. Sloan SU-1009.
   e. Toto: UT447E.

D. Flush Valve Filter:
1. Required in following flush valves:
   a. Sloan.
   b. Zurn.
2. Approved Products.
   a. SFDG1 'Dirt Grabber' by South Fork Manufacturing.

E. Urinal Carriers:
1. Manufacturers:
   a. Jay R. Smith Manufacturing Company: www.jrsmith.com/#sle.
   b. JOSAM Company: www.josam.com/#sle.
   c. Zurn Industries, LLC; Z1221: www.zurn.com/#sle.
2. ASME A112.6.1M; cast iron and steel frame with tubular legs, lugs for floor and wall attachment, threaded fixture studs for fixture hanger, bearing studs.

2.05 LAVATORIES

A. Manufacturers:
1. American Standard, Inc: www.americanstandard-us.com/#sle.
2. DXV by American Standard, Inc: www.dxv.com/#sle.
3. Gerber Plumbing Fixtures LLC: www.gerberonline.com/#sle.
4. Kohler Company: www.kohler.com/#sle.
5. Zurn Industries, LLC: www.zurn.com/#sle.

B. Performance:
1. Design Criteria:
   a. Interior exposed pipe, valves, and fixture trim, including trim behind custom casework doors, shall be chrome plated.
   b. Faucets and other fixture fittings shall conform to requirements of ASME A112.18.1/CSA B125.1.

c. Floor Sinks (Sanitary) shall conform to requirements of ASME A112.6.7.
d. Lavatories shall conform to requirements of:
1) Enameled cast iron and enameled steel fixtures.
(a) ASME A112.19.1/CSA B45.2.
(b) CSA B45.2/ASME A112.19.1.
2) Stainless steel plumbing fixtures:
(a) ASME A112.19.3/CSA B45.4.
(b) CSA B45.4/ASME A112.19.3.

C. Components:
1. Lavatories And Fittings:
a. Standard and Handicap Accessible Counter Top Lavatories:
1) Size 20 by 17 inches (500 by 430 mm) nominal.
2) Approved Products.
(a) American Standard: Aqualyn 0476.028.
(b) Gerber: Luxoval 12-844.
(c) Kohler: Pennington K-2196-4N.
b. Standard and Handicap Accessible Self Supporting Lavatories:
1) Size: 20 by 18 inches (500 by 450 mm) nominal.
2) Approved Products.
(a) American Standard: Lucern 0355.012.
(b) Kohler: Greenwich K-2032.
c. Carrier / Support:
1) Approved Products.
2) Josam: 17100.
(a) Jay R. Smith: 0700.
(b) Mifab: MC-41.
(c) Wade: 520-M36.
d. Lavatory Fittings:
1) Faucet and Grid Strainer for Standard Sinks:
(a) Design Criteria:
(1) Meet NSF International Standards for Lead Free.
(b) Approved Products.
(1) American Standard: Monterrey Two-Handle Centerset Lavatory Faucet with Vandal-Resistant Wrist Blade handles and grid strainer drain 5502.170.
(2) Chicago: 802CP with 327XCP.
(3) Delta: 2529HDF.
(4) Gerber: C4-44-412.
(5) Kohler: K-7404-5A with K-7715 strainer.
(6) Moen: 8215 with 14750 grid strainer.
(7) Speakman: SC 3072.
(8) T & S: B-0890 with B-0899 Grid Strainer.
(9) Zurn: Z81104 with McGuire 155A Grid Strainer.
e. Faucet and Grid Strainer For Handicap Accessible Sinks:
1) Design Criteria:
(a) Meet NSF International Standards for Lead Free.
2) Approved Products.
(a) American Standard: Monterrey Two-Handle Centerset Lavatory Faucet with Vandal-Resistant Wrist Blade handles and grid strainer drain 5502.170.
(b) Chicago: 802-317CP with K7715 strainer.
(c) Delta: 2529HDF.
(d) Gerber: CO-44-412.

(e) Kohler: K-7404-5A with K-13885 strainer.
(f) Moen: 8215 with14750 grid strainer.
(g) Speakman: SC 3074.
(h) T & S: B-0890 with B-0899 Grid Strainer.
(i) Zurn: Z-81104 with McGuire 155A grid strainer.

f. Faucet and Drain:
1) Design Criteria:
(a) Meet NSF International Standards for Lead Free.
(b) Battery-operated automatic faucet
2) Accessories:
(a) Cast brass spout.
(b) Hard-wired automatic faucet.
(c) Cast brass spout with chrome finish.
(d) 4 inches (100 mm) cover plate.
(e) Single supply configuration.
(f) Solenoid valve.
(g) Control module and transformer.
(h) Hermetically sealed electronics.
(i) In-line filter.
3) Approved Product.
(a) Chicago: 116.306.21.1 with 4” CC E-tronic and 327A strainer.
(b) Delta: 591T0250 WITH 33T260 grid strainer.
(c) Gerber: 44-801-4 with 43-970 grid strainer.
(d) Moen: 8306 with McGuire 155A grid strainer.
(e) Speakman: S-8810 with S-3440 grid drain.
(f) Symmons: S6080-AC-G with grid strainer.
(g) Zurn: Z6913-CWB-SSH with grid strainer.

g. Flow Control Fitting:
1) Design Criteria:
(a) Meet NSF International Standards for Lead Free.
2) Accessories:
(a) Provide vandal-proof type in place of aerator. Flow shall be 0.5 gpm.
3) Approved Product.
(a) Omni L-200 Series by Chronomite Laboratories.

h. Supply pipes with stops:
1) Design Criteria:
(a) Meet NSF International Standards for Lead Free.
2) Accessories:
(a) Provide chrome plated quarter-turn brass ball valve, 12 inches (305 mm) long braided stainless steel riser, and chrome-plated steel flange.
3) Approved Products.
(a) McGuire: BV2165CC.
(b) Zurn: Z8804 LRQ-PC.

i. Trap:
1) Description:
(a) 17 gauge (1.4 mm) tube 'P' trap, chrome plated.
2) Design Criteria:
(a) Not required to meet NSF International Standards for Lead Free.
3) Approved Products.
(a) Dearborn.
(b) Engineered Brass Company (EBC).
(c) Keeney Manufacturing.
(d) McGuire.

(e) Zurn.

j. Safety Covers for Handicap Accessible Lavatories:
1) Description:
(a) Provide protection on water supply pipes and on trap.
2) Design Criteria:
(a) Not required to meet NSF International Standards for Lead Free.
3) Approved Products.
(a) Trapwrap by Brocar Products Inc.
(b) Pro Wrap by McGuire Products.
(c) Lav Guard 2 by TrueBro.
(d) Pro Extreme by Plumberex.

k. Stainless Steel Sinks and Fittings:
1) Design Criteria:
(a) Not required to meet NSF International Standards for Lead Free.
(b) Self-rimming, 18 gauge (1.2 mm) stainless steel, satin finish.

l. Double Compartment Sinks:
1) Design Criteria:
(a) Not required to meet NSF International Standards for Lead Free.
2) Approved Products.
(a) Elkay: LR 3319.
(b) Just: DL-1933-A-GR.
(c) Kindred: LBT 4408P-1.
(d) Elkay: LRAD 3319.
(e) Just: DL-ADA-1933-A-GR.
(f) Kindred: ALBD 4405P-1.

m. Single Compartment Sinks:
1) Design Criteria:
(a) Not required to meet NSF International Standards for Lead Free.
2) Approved Products.
(a) Elkay: LR 1918.
(b) Just: SL-2017-A-GR.
(c) Kindred: LBT 2709P-1.
(d) Elkay: LRAD 1918.
(e) Just: DL-ADA-2017-A-GR.
(f) Kindred: ALBS 270P-1.

n. Single Compartment Sink:
1) Description:
(a) Size: 22 by 19.5 inches (559 mm by 495 mm) nominal.
2) Design Criteria:
(a) Not required to meet NSF International Standards for Lead Free.
3) Approved Products.
(a) Elkay: LR-2219.
(b) Just: SL-1921-AG-R.
(c) Kindred: LBS 4008P-1.

o. Gooseneck Faucets for Compartment Sinks:
1) Design Criteria:
(a) Meet NSF International Standards for Lead Free.
2) Approved Products.
(a) Moen: 8227 (swivel).
(b) Speakman: SC-5724 (swivel).

2. Faucets for Standard Double and Single Compartment Sinks:
a. Design Criteria:
1) Meet NSF International Standards for Lead Free.

b. Approved Products.
    1) American Standard: Heritage/Amarilis Two-Handle Bottom-Mount Kitchen Faucet with Swivel spout 7270.
    2) Chicago: 1888CP.
    3) Delta: 27C2243-S5.
    4) Gerber: CO-44-002.
    5) Kohler: K-7761-K with handles K-16012-5.
    6) Zurn Commercial Brass: Z-831J3.

3. Gooseneck Faucets for Compartment Serving Area Sinks:
4. Design Criteria:
    a. Meet NSF International Standards for Lead Free.
5. Approved Products.
    a. Moen: 8227. (swivel).
    b. Speakman: SC-5724. (swivel).
6. Faucets for Sacrament Preparation Room Sink:
    a. Design Criteria:
        1) Meet NSF International Standards for Lead Free.
    b. Approved Products.
        1) American Standard: Gooseneck Swivel Spout 7100.241H.
        2) Chicago: 350-ABCP.
        3) Delta: 27C643-R4.
        4) Gerber: C4-44-701.
        5) Kohler: K-7895-C.
        6) Moen: 8103.
        7) Speakman: SC-7112.
        8) T & S: 0305-01.
        9) Zurn: Z-825B1FC.
7. Faucets for Serving Area Sinks:
    a. Design Criteria:
        1) Meet NSF International Standards for Lead Free.
    b. Approved Products.
        1) Moen: 8227. (swivel).
        2) Speakman: SC-5724. (swivel).
8. Supply pipes with stops:
    a. Design Criteria:
        1) Meet NSF International Standards for Lead Free.
    b. Accessories:
        1) Provide chrome plated quarter-turn brass ball valve, 12 inches (300 mm) long braided stainless steel riser, and chrome-plated steel flange.
    c. Approved Products.
        1) McGuire: BV2165CC.
        2) Zurn: Z8804 LRQ-PC.
9. Flow Control Fitting:
    a. Design Criteria:
        1) Meet NSF International Standards for Lead Free.
    b. Accessories:
        1) Provide vandal-proof type in place of aerator. Flow shall be 1.5 gpm.
    c. Approved Product.
        1) Omni A-200 Series by Chronomite Laboratories.
10. Waste For Standard Stainless Steel Sinks:
    a. Design Criteria:
        1) Not required to meet NSF International Standards for Lead Free.
    b. Approved Products.

1) Elkay: LK-99.
2) Kindred: 1130.
3) Kohler: K8801.
4) McGuire: 151.
5) Zurn Z-8740-PC.

11. Trap:
    a. Description:
        1) 17 gauge (1.4 mm) tube 'P' trap, chrome plated.
    b. Design Criteria:
        1) Not required to meet NSF International Standards for Lead Free.
    c. Approved Products.
        1) Dearborn.
        2) Engineered Brass Company (EBC).
        3) Keeney Manufacturing.
        4) McGuire: MCT150075NCZN.
        5) Zurn.
12. Miscellaneous Sinks And Fittings:
    a. Service Sink:
        1) Description:
            (a) Floor Type, enameled cast iron, 28 inches (711 mm) square with vinyl coated rim guard or 24 inches (610 mm) square with Stainless Steel rim guard.
        2) Design Criteria:
            (a) Not required to meet NSF International Standards for Lead Free.
        3) Approved Products.
            (a) American Standard: Florwell Enameled Cast Iron 7741.000 with vinyl rim guard 7745.811.
            (b) CECO: 871.
            (c) Kohler: Whitby K-6710.
            (d) Zurn: 5850.
        4) Service Sink Fittings:
            (a) Design Criteria:
                (1) Not required to meet NSF International Standards for Lead Free.
            (b) Supply:
                (1) Mounting height of 42 inches (1 050 mm).
                (2) Provide 48 inch (1 200 mm) hose and clamp unless spout is threaded.
            (c) Approved Products.
                (1) American Standard: Exposed Yoke Wall-Mount Utility Faucet with top brace 8344.112 with threaded spout.
                (2) Chicago: 897 CP.
                (3) Delta: 28T9 with 28T911 hose and bracket.
                (4) Gerber: C4-44-654.
                (5) Kohler: K-8928.
                (6) Moen: 8124.
                (7) Speakman: SC-5812.
                (8) T&S: B-0665-BSTP.
                (9) Zurn: Z-843M1.
        5) Drain and Strainer:
            (a) Approved Products.
                (1) American Standard: Grid strainer 7721.038.
                (2) Kohler: K-9146, 3 inch IPS.
                (3) Trap: Cast iron, PVC, or ABS to match piping.

2.06 SINKS

A. Manufacturers:
   1. American Standard, Inc: www.americanstandard-us.com/#sle.
   2. Kohler Company: www.kohler.com/#sle.
   3. Meganite, Inc: www.meganite.com/#sle.
   4. Relang International, LLC; DURASEIN: www.duraseinusa.com/#sle.

2.07 SERVICE SINKS

A. Description:
   1. One piece, precast terrazzo made of black and white marble chips in gray Portland cement.

B. Design Criteria:
   1. Not required to meet NSF International Standards for Lead Free.
   2. Terrazzo construction without dropped-down curb and stainless steel cap.
   3. Color: Grey.

C. Components:
   1. Service Basin:
      a. Neo-corner service basin with plain curbs with galvanized bond flange.
      b. Terrazzo surface ground and polished with all air holes or pits grouted and excess removed.
      c. Shoulders not less than 12 inch (305 mm) high outside and 10 inch (254 mm) inside at lowest wall. Shoulder width not less than 2 inches (50.8 mm) on all sides.
      d. Stainless steel cast drain body integrally and provides for caulked lead connection not less than 1 inch (25 mm) deep to 3 inch (76 mm) pipe.
      e. Integral stainless steel drain assembly and strainer plate.
      f. Wall Guards (protect walls adjacent to service sink):
         1) Process Area Custodial Room: Two 36 inch (915 mm) wide by 12 inch (305 mm) high heavy gauge stainless steel wall guard panels required at each sink: Model MSG3624.
      g. Public Area Custodial Room: Two 32 inch (813 mm) wide by 12 inch (305 mm) high heavy gauge stainless steel wall guard panels required at each sink: Model MSG3232.
      h. Family Services Module: Two 24 inch (610 mm) wide by 12 inch (305 mm) high heavy gauge stainless steel wall guard panels required at each sink: Model MSG2424.
      i. Removable Stainless Steel Strainer Plate (at each sink): Model 1453BB.

2.08 HANDICAP ACCESSIBLE BI-LEVEL COOLER

A. Design Criteria:
   1. Vandal proof operating bar on front and both sides.
   2. 8 GPH (30.3 LPH) water at 50 deg F (10 deg C) water cooled from 80°F (26.7°C) inlet water and 90°F (32.2°C) ambient per ASHRAE testing.
   3. 115-120 V, 60 Hz, single phase.
   4. Flexible bubbler.
   5. Build-In strainer.
   6. Meets state and federal requirements for both children or adults as defined by the Americans with Disabilities Act.

B. Approved Products.
   1. Elkay: Model EZSTL8LC.
   2. Halsey Taylor: Model HAC8FSBL-Q-ADA.
   3. Murdock Manufacturing: Model A172408B-UBL.
   4. Oasis: Model PG8ACSL.

C. Standard Bi-Level Cooler:
   1. Design Criteria:

a. 14 GPH (53 LPH) water at 50 deg F (10 deg C) water cooled from 80°F (26.7°C) inlet water and 90°F (32.2°C) ambient per ASHRAE testing.
b. 115 V, 60 Hz, single phase.
c. Flexible bubbler.

2. Acceptable Products:
a. Halsey Taylor: WM14A-BL.
b. Equal as approved by Architect before use. See Section 01 6200.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome-plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended to hold fixture in place.

F. Install each fixture with separate vent line. Do not circuit vent.

G. Ensure provisions are made for proper support of fixtures and that rough-in piping is accurately set and protected from movement and damage.
1. Seal wall-mounted fixtures around edges to wall with sealant specified in Section 07 9213 'Elastomeric Joint Sealants'.
2. Attach wall-hung fixtures to carriers.
3. Support fixture hanger or arm free of finished wall.

H. Adjust flush valves for proper flow.

I. Provide each individual fixture supply with accessible chrome-plated stop valve with hand wheel.

J. Self-Supporting Lavatories: Install using carriers. Support carrier free of finished wall.

K. Install Safety Covers on all under sink / lavatories with exposed water supply pipes and traps.

L. Install Handicap Accessible Lavatories as per ADA height mounting requirements.

M. Urinals: Install with accessible stop or control valve in each branch supply line.

N. Mounting:
1. Urinals:
a. Standard: 24 inches (610 mm) from floor to bottom lip.
b. Handicap Accessible: 17 inches (432 mm) maximum from floor to bottom lip.

O. Water Closets:
1. Floor or Wall Fixtures:
a. Make fixture connections with approved brand of cast iron flange, soldered or caulked securely to waste pipe. Make joints between fixtures and flanges tight with approved

fixture setting compound or gaskets. Caulk between fixtures with sealant specified in Section 07 9213. Point edges.

P. Flush Valve Filters:
   1. Install in Sloan and Zurn only flush valves.
   2. Install after water lines have been flushed out, but before turning water into flush valve.

Q. Service Sink:
   1. Follow Manufacture's written instructions including but not limited to the following:
      a. Install and level terrazzo service basin on 1/2 inch (12.7 mm) layer of mortar.
      b. Install wall guard panels over galvanized flange of service sink and over FRP panels on both walls.
      c. Apply sealant between flanges and wall guard and edges of wall guard.

R. Drinking Foutains and Water Cooler:
   1. Mounting:
      a. General:
         1) Coordinate location of fountain with location and height of electrical outlet to ensure concealment of outlet by fountain.
         2) Anchor bottom of fountain to wall.
         3) Install 3/8 inch (9.5 mm) IPS union connection and Chicago No. 441 stop to building supply line.
         4) Install 1-1/4 inch (32 mm) IPS slip cast brass 'P' trap. Install trap so it is concealed.
      b. Accessible Drinking Fountains:
         1) Spout outlets of wheelchair accessible drinking fountains shall be 36 inches (915 mm) maximum above floor.
         2) Spout outlets of drinking fountains for standing persons shall be 38 inches (965 mm) and 43 inches (1090 mm) maximum above floor.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

B. Polish chrome finish at completion of Project.

C. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION

END OF DIVISION

SECTION 23 0501
COMMON WORK RESULTS FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. Includes But Not Limited To:
   1. Common requirements and procedures for HVAC systems.
   2. Responsibility for proper operation of electrically powered equipment furnished under this Division.
   3. Interface with Testing And Balancing Agency.
   4. Furnish and install sealants relating to installation of systems installed under this Division.
   5. Furnish and install Firestop Penetration Systems for HVAC system penetrations as described in Contract Documents.
   6. Furnish and install sound, vibration, and seismic control elements.

B. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, and equipment for mechanical systems installed under other Sections.

C. Related Requirements:
   1. Section 03 3000 - Cast-in-Place Concrete for exterior concrete pads and bases for mechanical equipment.

D. Products Furnished But Not Installed Under This Section:
   1. Sleeves, inserts, supports, and equipment for mechanical systems installed under other Sections.
   2. Section 05 5000 - Metal Fabrications for quality and requirements for welding.
   3. Section 07 8400 - Firestopping for quality of Penetration Firestop Systems to be used on Project and submittal requirements.
   4. Section 07 9200 - Joint Sealants for quality of sealants used at building exterior.
   5. Section 07 9200 - Joint Sealants for quality of acoustical sealants.
   6. Section 09 9113 - Exterior Painting: Painting of mechanical items requiring field painting.
   7. Section 09 9123 - Interior Painting: Painting of plumbing items requiring field painting.
   8. Section 26 2913 - Enclosed Controllers for magnetic starters and thermal protective devices (heaters) not factory mounted integral part of mechanical equipment.
   9. Division 26: Raceway and conduit, unless specified otherwise, line voltage wiring, outlets, and disconnect switches.
   10. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.
   11. Sections Under 33 5000 Heading: Fuel Distribution Utilities.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Exterior concrete pads and bases for mechanical equipment.

B. Section 05 5000 - Metal Fabrications: Quality and requirements for welding.

C. Section 07 8400 - Firestopping: Quality of penetration firestop systems to be used on Project and submittal requirements.

D. Section 07 9200 - Joint Sealants: Elastomeric Joint Sealant: Quality at building exterior.

E. Section 09 9113 - Exterior Painting: Painting of mechanical items requiring field painting.

F. Section 09 9123 - Interior Painting: Painting of plumbing items requiring field painting.

G. Section 22 1005 Plumbing Piping [for condensate piping]

H. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

I. Division 26: 'Electrical' for raceway and conduit, unless specified otherwise, and line voltage wiring.

J. Division 33: 'Utilities' for piped utilities.

K. Slots and openings through floors, walls, ceilings, and roofs provided under other Divisions in their respective materials.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. FM (AG) - FM Approval Guide current edition.

C. ITS (DIR) - Directory of Listed Products Current Edition.

D. NEMA MG 1 - Motors and Generators 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of mechanical items with size, location and installation of service utilities.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Manufacturer's catalog data for each manufactured item.
         1) Provide section in submittal for each type of item of equipment. Include Manufacturer's catalog data of each manufactured item and enough information to show compliance with Contract Document requirements. Literature shall show capacities and size of equipment used and be marked indicating each specific item with applicable data underlined.
         2) Include name, address, and phone number of each supplier.
      b. Informational Submittals:
         1) Design Submittals:
            (a) See individual Specification Sections in Division 23 for Submittals required.
         2) Qualification Statement:
            (a) HVAC Subcontractor:
               (1) Provide Qualification documentation if requested by Architect or Owner.
            (b) Installer:
               (1) Provide Qualification documentation if requested by Architect or Owner.

C. Shop Drawings:
   1. Schematic control diagrams for each separate fan system, heating system, control panel, etc. Each diagram shall show locations of all control and operational components and devices. Mark correct operating settings for each control device on these diagrams.
   2. Diagram for electrical control system showing wiring of related electrical control items such as firestats, fuses, interlocks, electrical switches, and relays. Include drawings showing electrical power requirements and connection locations.
   3. Drawing of each temperature control panel identifying components in panels and their function

4. Other shop drawings required by Division 23 trade Sections.

D. Certificate: Certify that products of this section meet or exceed specified requirements.

E. Delegated Design Data.

F. Test Reports.

G. Evaluation Service Reports: Show compliance with specified requirements.

H. Manufacturer's Instructions.

I. Source Quality Control Submittals.

J. Field Quality Control Submittals.

K. Manufacturer Reports.

L. Designer's Qualification Statement.

M. Manufacturer's Qualification Statement.

N. Installer's Qualification Statement.

O. Operation Data.

P. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

Q. Project Record Documents: Record actual locations of mechanical installations.

1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Perform work in accordance with applicable provisions of Mechanical Codes applicable to Project. Provide materials and labor necessary to comply with rules, regulations, and ordinances.
   2. In case of differences between building codes, laws, local ordinances, utility company regulations, and Contract Documents, the most stringent shall govern. Notify Architect in writing of such differences before performing work affected by such differences.
   3. Identification:
      a. Motor and equipment name plates as well as applicable UL and AGA labels shall be in place when Project is turned over to Owner.

B. Qualifications: Requirements of Section 01 4000 - Quality Requirements apply, but not limited to the following:
   1. Mechanical Subcontractor:
      a. Company specializing in performing work of this section.
         1) Minimum five (5) years experience in HVAC installations.
         2) Minimum five (5) satisfactorily completed installations in past three (3) years of projects similar in size, scope, and complexity required for this project before bidding.
      b. Upon request, submit documentation.
   2. Installer:
      a. Licensed for area of Project.
      b. Designate one (1) individual as project foremen who shall be on site at all times during installation and experienced with installation procedures required for this project.
      c. Upon request, submit documentation.

C. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with at least three years of documented experience.

E. Fabricator Qualifications.

F. Supplier Qualifications.

G. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

H. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

I. Preconstruction Testing.

J. Copies of Documents at Project Site: Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Acceptance Requirements:
   1. Accept valves on site in shipping containers with labeling in place.
   2. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

B. Storage and Handling Requirements:
   1. In addition to requirements specified in Division 01, stored material shall be readily accessible for inspection by Architect until installed.
   2. Store items subject to moisture damage in dry, heated spaces.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty:
   1. Provide certificates of warranty for each piece of equipment made out in favor of the Owner.

C. Special Warranty:
   1. Guarantee mechanical systems to be free from noise and vibration in operation that may develop from failure to construct system in accordance with Contract Documents.
   2. If mechanical sub-contractor with offices located more than 150 miles from Project site is used, provide service / warranty work agreement for warranty period with local mechanical sub-contractor approved by Architect. Include copy of service / warranty agreement in warranty section of Operation And Maintenance Manual.

PART 2 PRODUCTS

2.01 COMPONENTS

A. Components shall bear Manufacturer's name and trade name. Equipment and materials of same general type shall be of same make throughout work to provide uniform appearance, operation, and maintenance.

B. Pipe and Pipe Fittings:
   1. Weld-O-Let and Screw-O-Let fittings are acceptable.

C. Sleeves:
   1. General:
      a. Two sizes larger than bare pipe or insulation on insulated pipe.
   2. In Concrete and Masonry:
      a. Standard weight galvanized iron pipe, Schedule 40 PVC, or 14 gage galvanized sheet metal.

D. Valves:
   1. Valves of same type shall be of same manufacturer.

PART 3 EXECUTION

3.01 INSTALLERS

A. Acceptable Installers:
   1. Meet Quality Assurance Installer Qualifications as specified in Part 1 of this specification.

B. Substitution Limitations: Same as specified for products; see Section 01 6000 - Product Requirements.

3.02 INSTALLERS

A. Approved Installers. See Section 01 4000 - Quality Requirements:
   1. Approved Mechanical Subcontractors shall be pre-approved in accordance with Supplementary Conditions and included in Construction Documents by Addendum.

3.03 EXAMINATION

A. Drawings:
   1. HVAC Drawings show general arrangement of piping, ductwork, equipment, etc. Follow as closely as actual building construction and work of other trades will permit.
   2. Consider Architectural and Structural Drawings part of this work insofar as these drawings furnish information relating to design and construction of building. These drawings take precedence over HVAC Drawings.
   3. Because of small scale of Drawings, it is not possible to indicate all offsets, fittings, and accessories that may be required. Investigate structural and finish conditions affecting this work and arrange work accordingly, providing such fittings, valves, and accessories required to meet conditions.

B. Verification of Conditions:
   1. Examine premises to understand conditions that may affect performance of work of this Division before submitting proposals for this work. Examine adjoining work on which mechanical work is dependent for efficiency and report work that requires correction.
   2. No subsequent allowance for time or money will be considered for any consequence related to failure to examine site conditions.
   3. Ensure that items to be furnished fit space available. Make necessary field measurements to ascertain space requirements including those for connections and furnish and install equipment of size and shape so final installation shall suit true intent and meaning of Contract Documents. If approval is received by Addendum or Change Order to use other than originally specified items, be responsible for specified capacities and for ensuring that items to be furnished will fit space available.
   4. Check that slots and openings provided under other Divisions through floors, walls, ceilings, and roofs are properly located. Perform cutting and patching caused by neglecting to coordinate with Divisions providing slots and openings at no additional cost to Owner.

3.04 PREPARATION

A. Changes Due to Equipment Selection:
   1. Where equipment specified or otherwise approved requires different arrangement or connections from that shown in Contract Documents, submit drawings showing proposed installations.
   2. If proposed changes are approved, install equipment to operate properly and in harmony with intent of Contract Documents. Make incidental changes in piping, ductwork, supports, installation, wiring, heaters, panelboards, and as otherwise necessary.
   3. Provide additional motors, valves, controllers, fittings, and other equipment required for proper operation of systems resulting from selection of equipment.
   4. Be responsible for proper location of rough-in and connections provided under other Divisions.

3.05 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Interface With Other Work:
   1. Furnish sleeves, inserts, supports, and equipment that are to be installed by others in sufficient time to be incorporated into construction as work proceeds. Locate these items and see they are properly installed.

2. Electrical: Furnish exact location of electrical connections and complete information on motor controls to installer of electrical system.
    a. Testing And Balancing:
        1) Put HVAC systems into full operation and continue their operation during each working day of testing and balancing.
        2) Make changes in pulleys, belts, fan speeds, and dampers or add dampers as required for correct balance as recommended by Testing And Balancing Agency and at no additional cost to Owner.

C. Cut carefully to minimize necessity for repairs to previously installed or existing work. Do not cut beams, columns, or trusses.

D. Locating Equipment:
1. Arrange pipes, ducts, and equipment to permit ready access to valves, cocks, unions, traps, filters, starters, motors, control components, and to clear openings of doors and access panels.
2. Adjust locations of pipes, ducts, switches, panels, and equipment to accommodate work to interferences anticipated and encountered.
3. Install HVAC work to permit removal of equipment and parts of equipment requiring periodic replacement or maintenance without damage to or interference with other parts of equipment or structure.
4. Determine exact route and location of each pipe and duct before fabrication.
    a. Right-Of-Way:
        1) Lines that pitch shall have right-of-way over those that do not pitch. For example, steam, steam condensate, and drains shall normally have right-of-way.
        2) Lines whose elevations cannot be changed shall have right-of-way over lines whose elevations can be changed.
    b. Offsets, Transitions, and Changes in Direction:
        1) Make offsets, transitions, and changes in direction in pipes and ducts as required to maintain proper head room and pitch of sloping lines whether or not indicated on Drawings.
        2) Furnish and install all traps, air vents, sanitary vents, and devices as required to effect these offsets, transitions, and changes in direction.

E. Piping:
1. Furnish and install complete system of piping, valved as indicated or as necessary to completely control entire apparatus.
    a. Pipe drawings are diagrammatic and indicate general location and connections. Piping may have to be offset, lowered, or raised as required or directed at site. This does not relieve this Division from responsibility for proper erection of systems of piping in every respect.
    b. Arrange piping to not interfere with removal of other equipment, ducts, or devices, or block access to doors, windows, or access openings.
        1) Arrange so as to facilitate removal of tube bundles.
        2) Provide accessible flanges or ground joint unions, as applicable for type of piping specified, at connections to equipment and on bypasses.
            (a) Make connections of dissimilar metals with di-electric unions.
            (b) Install valves and unions ahead of traps and strainers. Provide unions on both sides of traps.
        3) Do not use reducing bushings, street elbows, bull head tees, close nipples, or running couplings.
        4) Install piping systems so they may be easily drained. Provide drain valves at low points and manual air vents at high points in hot water heating and cooling water piping.
        5) Install piping to insure noiseless circulation.

6) Place valves and specialties to permit easy operation and access. Valves shall be regulated, packed, and glands adjusted at completion of work before final acceptance.

c. Do not install piping in shear walls.

2. Properly make adequate provisions for expansion, contraction, slope, and anchorage.
   a. Cut piping accurately for fabrication to measurements established at site. Remove burr and cutting slag from pipes.
   b. Work piping into place without springing or forcing. Make piping connections to pumps and other equipment without strain at piping connection. Remove bolts in flanged connections or disconnect piping to demonstrate that piping has been so connected, if requested.
   c. Make changes in direction with proper fittings.
   d. Expansion of Thermoplastic Pipe:
      1) Provide for expansion in every 30 feet of straight run.
      2) Provide 12 inch offset below roof line in each vent line penetrating roof.
3. Provide sleeves around pipes passing through concrete or masonry floors, walls, partitions, or structural members. Do not place sleeves around soil, waste, vent, or roof drain lines passing through concrete floors on grade. Seal sleeves with specified sealants.
   a. Sleeves through floors shall extend 1/4 inch above floor finish in mechanical equipment rooms above basement floor. In other rooms, sleeves shall be flush with floor.
   b. Sleeves through floors and foundation walls shall be watertight.
4. Provide spring clamp plates (escutcheons) where pipes run through walls, floors, or ceilings and are exposed in finished locations of building. Plates shall be chrome plated heavy brass of plain pattern and shall be set tight on pipe and to building surface.
5. Remove dirt, grease, and other foreign matter from each length of piping before installation.
   a. After each section of piping used for movement of water or steam is installed, flush with clean water, except where specified otherwise.
   b. Arrange temporary flushing connections for each section of piping and arrange for flushing total piping system.
   c. Provide temporary cross connections and water supply for flushing and drainage and remove after completion of work.

F. Penetration Firestops:
   1. Install Penetration Firestop System appropriate for penetration at mechanical systems penetrations through walls, ceilings, roofs, and top plates of walls.

G. Sealants:
   1. Seal openings through building exterior caused by penetrations of elements of HVAC systems.
   2. Furnish and install acoustical sealant to seal penetrations through acoustically insulated walls and ceilings.

3.06 REPAIR / RESTORATION

A. Each Section of this Division shall bear expense of cutting, patching, repairing, and replacing of work of other Sections required because of its fault, error, tardiness, or because of damage done by it:
   1. Patch and repair walls, floors, ceilings, and roofs with materials of same quality and appearance as adjacent surfaces unless otherwise shown.
   2. Surface finishes shall exactly match existing finishes of same materials.

3.07 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Field Tests:

1. Perform tests on mechanical piping systems. Furnish devices required for testing purposes.

C. Non-Conforming Work:
1. Replace material or workmanship proven defective with sound material at no additional cost to Owner.
2. Repeat tests on new material, if requested.

3.08 SYSTEM START-UP

A. Off-Season Start-up:
1. If Substantial Completion inspection occurs during heating season, schedule spring start-up of cooling systems. If inspection occurs during cooling season, schedule autumn start-up for heating systems.
2. Notify Owner seven days minimum before scheduled start-up.
3. Time will be allowed to completely service, test, check, and off-season start systems. During allowed time, train Owner's representatives in operation and maintenance of system.
4. At end of off-season start-up, furnish Owner with letter confirming that above work has been satisfactorily completed.

B. Preparations that are to be completed before start up and operation include, but are not limited to, following:
1. Dry out electric motors and other equipment to develop and properly maintain constant insulation resistance.
2. Make adjustments to insure that:
a. Equipment alignments and clearances are adjusted to allowable tolerances.
b. Nuts and bolts and other types of anchors and fasteners are properly and securely fastened.
c. Packed, gasketed, and other types of joints are properly made up and are tight and free from leakage.
d. Miscellaneous alignings, tightenings, and adjustings are completed so systems are tight and free from leakage and equipment performs as intended.
3. Motors and accessories are completely operable.
4. Inspect and test electrical circuitry, connections, and voltages to be properly connected and free from shorts.
5. Adjust drives for proper alignment and tension.
6. Make certain filters in equipment for moving air are new and of specified type.
7. Properly lubricate and run-in bearings in accordance with Manufacturer's directions and recommendations.

3.09 CLEANING

A. Clean exposed piping, ductwork, and equipment.

B. No more than one week before Final Inspection, flush out bearings and clean other lubricated surfaces with flushing oil. Provide best quality and grade of lubricant specified by Equipment Manufacturer.

C. Replace filters in equipment for moving air with new filters of specified type no more than one week before Final Inspection.

D. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.10 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.
1. Include following in Operations And Maintenance Manual specified in Section 01 7800:
a. Operations and Maintenance Data (Modify and add to requirements of Section 01 7800):

2. At beginning of HVAC section of Operations And Maintenance Manual, provide master index showing items included.
3. Provide name, address, and phone number of Architect, Architect's Mechanical Engineer, General Contractor, and HVAC, Sheet Metal, Refrigeration, and Temperature Control subcontractors.
4. Identify maintenance instructions by using same equipment identification used in Contract Drawings. Maintenance instructions shall include:
5. List of HVAC equipment used indicating name, model, serial number, and nameplate data of each item together with number and name associated with each system item.
6. Manufacturer's maintenance instructions for each piece of HVAC equipment installed in Project. Instructions shall include name of vendor, installation instructions, parts numbers and lists, operation instructions of equipment, and maintenance and lubrication instructions.
7. Summary list of mechanical equipment requiring lubrication showing name of equipment, location, and type and frequency of lubrication.
8. Manual for Honeywell thermostat used and published by Honeywell.
9. Provide operating instructions to include:
    a. General description of each HVAC system.
    b. Step by step procedure to follow in putting each piece of HVAC equipment into operation.
    c. Provide diagrams for electrical control system showing wiring of items such as smoke detectors, fuses, interlocks, electrical switches, and relays.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Instruction of Owner:

D. Instruct building maintenance personnel and Stake Physical Facilities Representative in operation and maintenance of mechanical systems utilizing Operation And Maintenance Manual when so doing.

E. Instruct building maintenance personnel and Facility Manager in operation and maintenance of mechanical systems utilizing Operation And Maintenance Manual when so doing.

F. Conduct instruction period after Substantial Completion inspection when systems are properly working and before final payment is made.

G. Demonstrate proper operation of equipment to Owner's designated representative.

H. Demonstration: Demonstrate operation of system to Owner's personnel.
1. Use operation and maintenance data as reference during demonstration.
2. Conduct walking tour of project.
3. Briefly describe function, operation, and maintenance of each component.

I. Training: Train Owner's personnel on operation and maintenance of system.
1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Manufacturer's training personnel.
4. Location: At project site.

J. Warranty Documentation:

K. Include copies of warranties required in individual Sections of Division 23.

L. Manufacturers documentation:

M. Record Documentation:

N. Copies of approved shop drawings

3.11 PROTECTION

A. A. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system. Cap or plug open ends of pipes and equipment to keep dirt and other foreign materials out of system. Do not use plugs of rags, wool, cotton waste, or similar materials.

B. Do not operate pieces of equipment used for moving supply air without proper air filters installed properly in system. Install temporary filters or coverings on all return grills.

END OF SECTION

SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration-isolated equipment support bases.

1.02 INCLUDES BUT NOT LIMITED TO

A. Quality of and requirements for anchorage and seismic restraint systems and vibration isolation systems for HVAC piping and equipment.

1.03 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 03 3053: Miscellaneous Exterior Cast-In-Place Concrete.

C. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

D. Furnishing and installing of seismic restraint and vibration isolation systems is by installer of equipment requiring such systems. Manufacturers of equipment specified for seismic restraint shall provide product data needed for calculation of seismic restraint needs. This information shall include, but not be limited to, equipment dimensions, dimensioned anchor points, operating weight, and center of gravity dimension.

1.04 DEFINITIONS

A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

C. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

1.05 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement 2022.

E. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.

F. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

G. VISCMA 101 - Seismic Restraint Specification Guidelines for Mechanical, Electrical, and Plumbing Systems; 2015.

H. VISCMA 102 - Vibration Isolation Specification Guidelines for Mechanical, Electrical, and Plumbing Systems; 2012.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.

2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Seismic Controls:
   a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
   b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:
1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.07 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Action Submittals:
1. Product Data:
   a. Restraint system and anchorage method to be used for each piece of equipment.
   b. Seismic restraints and calculations for all flexible mounted equipment.
   c. Vibration isolators and flexible couplings.
   d. Clearly outlined procedures for installing and adjusting isolators, seismic bracing anchors, and snubbers.
2. Shop Drawings:
   a. Show size, hanger length, and location of seismic restraints for piping and ductwork.
   b. Show details for each isolator and seismic brace with snubbers proposed for specified equipment.
   c. Show details for proposed structural steel frames and rails and for anchors to be used in conjunction with isolation of equipment.
   d. Show locations of piping and ductwork restraints on installation and fabrication floor plans (not bid set of documents of floor plans), noting size and type of restraint to be used.
   e. Show details of supports, hangers, anchorage, and bracing for isolated equipment as designed or proposed by professional engineer employed by Restraint Manufacturer and qualified with seismic experience in bracing for mechanical equipment. Shop drawings submitted for seismic bracing and anchors shall bear engineer's signed professional seal.
   f. Include anchor bolt calculations, signed and stamped by registered engineer, showing adequacy of bolt sizing and type.
      1) Calculations shall include anchor embedment, minimum edge distance and minimum center distance.
      2) Design lateral forces shall be distributed in proportion to mass distribution of equipment.
      3) Furnish calculations for anchors on restraint devices, cable, isolators, and on rigidly mounted equipment.

C. Certification for seismically qualified equipment; identify basis for certification.

D. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Evidence of qualifications for seismic controls designer.

G. Evidence of qualifications for manufacturer.

H. Manufacturer’s detailed field testing and inspection procedures.

I. Field quality control test reports.

1.08 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.
   1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.09 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 ASSEMBLIES

A. Manufacturers:
   1. Acceptable Manufacturers:
      a. Amber / Booth Company, Houston, TX www.amberbooth.com.
      b. Mason Industries Inc, Hauppauge, NY www.mason-ind.com.
      c. Vibration Mountings and Control Inc, Bloomington, NJ (201) 838-1780.
      d. Equal as approved by Architect before bidding. See Section 01 6200.

B. Performance:
   1. Design Criteria:
      a. Isolation And Seismic Equipment:
         1) Piping: Restrain piping in accordance with ANSI/SMACNA 001 Seismic Restraint Manual, Chapter 4, Figures 4.11 to 4.19.
         2) Equipment with Fixed Anchor or Support:
            (a) Restraint designed according to ASCE/SEI 7-10, Chapter 13, 'Seismic Design Requirements For Nonstructural Components'.
            (b) Horizontal force factor for elements of structures:
            (c) In addition, vertical force restraint requirement shall be computed at 1/2 value of horizontal forces.
            (d) Restrain equipment not anchored directly to floors by cable system designed and furnished by Restraint Manufacturer.
         3) Ductwork: Restrain ductwork in accordance with ANSI/SMACNA 001 Seismic Restraint Manual, Chapter 4, Figures 4.2 to 4.10 as appropriate.
      b. Vibration Isolation Requirements:
         1) Isolate equipment from structure by means of resilient vibration and noise isolators.
         2) Unless otherwise noted, isolate HVAC equipment one horsepower and over from structure by means of resilient vibration and noise isolators in accordance with ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms'.
         3) Design and install isolation equipment, hangers, connections, and other isolating devices to prevent transmission of vibration to structure from equipment and associated piping and ductwork.

4) For floor-mounted equipment, use recommendations with ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms'.
5) For roofs and floors constructed with open web joints, thin long span slabs, wooden construction and unusual light weight construction, evaluate equipment weighing more than 300 pounds to determine additional deflection of structure caused by equipment weight. Isolator deflection shall be 15 times additional deflection or deflection shown in ASHRAE 'Handbook - HVAC Applications', Chapter 48, Table 1, 'Design Guidelines for HVAC-Related Background Sound in Rooms', whichever is greater.
6) Under-Equipment Spring Isolators:
   (a) Equal to Mason SSLFH earthquake motion restrained spring mounts with freestanding stable steel springs, leveling bolts, corrosion resistant finish, motion limiting design, uplift restraining bolts, and 1/4 inch (6 mm) ribbed neoprene noise stop pad.
   (b) Isolators shall accept force in any direction up to 1.0 g without failure, and shall limit movement to 3/4 inch (19 mm) in any direction.
   (c) Springs shall have 50 percent overload capacity.
   (d) Size as required to achieve specified static deflection.
   (e) Outer diameter of spring proper shall not be less than 0.8 of spring height when in loaded position.
7) Overhead Support Spring And Rubber Hangers:
   (a) Combination spring and neoprene hangers.
   (b) Hanger bracket shall have 500 percent overload capability and shall allow up to 15 degree hanger rod misalignment without short-circuiting.
   (c) Springs shall have 50 percent overload capacity.
   (d) Provide seismic bracing as required.
8) Isolate piping and ductwork in mechanical equipment room and piping and ductwork three supports away or 50 feet (15 meters) from other mechanical equipment, whichever is greater, from structure by means of vibration and noise isolators.
   (a) Isolate suspended piping with combination spring and fiberglass hangers in supporting rods.
   (b) Support floor-mounted piping directly on spring mounts.
9) Isolate vertical pipe risers from structure using vibration and noise isolating expansion hangers having minimum rated deflection of four times anticipated pipe movement. Enclose in housing for fail-safe equipment.
10) Incorporate flexible connectors in piping adjacent to reciprocating equipment.
11) Incorporate flexible connections in ductwork adjacent to air-moving units.
12) Elastomeric Isolator: Neoprene or high quality synthetic rubber with anti-ozone and anti-oxidant additives.
13) Nuts, Bolts, And Washers: Electroplated zinc.
14) Isolators Exposed To Weather: Cadmium plated and neoprene coated springs.

c. Seismic Requirements:
1) Mechanical equipment, piping, and ductwork shall be braced, snubbed, or supported to withstand seismic disturbances and remain operational.
2) Seismic restraint equipment and resilient isolation devices shall be designed and furnished by single Manufacturer.

C. Finishes:
1. Clean and paint steel components. Thoroughly clean structural steel bases of welding slag and prime with zinc-chromate or metal etching primer. Etch and paint hot dipped galvanized steel components.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Field-Welding (where approved by Architect): Comply with Section 05 5000.

E. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Isolation Equipment:
   1. Mount vibration isolated equipment on rigid steel frames or concrete bases unless Equipment Manufacturer certifies direct attachment capability.
   2. Install snubbers with factory set clearances.
   3. Piping:
      a. Protect isolated and non-isolated piping 2-1/2 inches (64 mm) inside diameter and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motions.
      b. Locations shall be as scheduled and include, but not be limited to:
         1) At drops to equipment and at flexible connections.
         2) At 45 degree or greater changes in direction of pipe.
         3) At horizontal runs of pipe 30 feet (9.15 m) maximum on center spacing.
         4) Gas piping shall have additional restraints as scheduled.
   4. Ductwork:
      a. Protect isolated and non-isolated rectangular ductwork 4 feet square (0.372 sq m) in cross-sectional area and larger in all planes by restraints to accommodate thermal movement as well as restrain seismic motion.
      b. Locations shall be determined by Seismic Restraint Manufacturer and include, but not be limited to:
         1) Horizontal runs of ductwork 30 feet (9.15 m) maximum on center spacing.
         2) 45 degree or greater changes in direction of ductwork.
         3) Each end of duct runs and drops of equipment.
         4) Each flexible connection.

G. Vibration Isolation: Install piping and ductwork to prevent transmission of noise and vibration into structure.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Provide manufacturer representative or authorized technician services to assist with inspection and testing of vibration isolation systems and seismic controls. Submit a detailed copy of manufacturer recommended inspection, testing, and field report procedures.

D. Vibration Isolation Systems:
   1. Verify isolator static deflections.
   2. Verify required clearance beneath vibration-isolated equipment support bases.
   3. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

E. Seismic Controls:
   1. Verify snubbing element air gaps.

F. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

G. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.04 ATTACHMENTS

A. Statement of special inspections.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Adhesive-backed duct markers.

D. Stencils.

E. Pipe markers.

F. Ceiling tacks.

1.02 SUMMARY

A. Products Furnished But not Installed Under This Section:
   1. Identification of HVAC piping and equipment as described in Contract Documents including:
      a. Paint identification for gas piping used in HVAC equipment.
      b. Stencils and band colors for gas piping used in HVAC equipment.

B. Related Requirements:
   1. Section 09 9124: ‘Interior Painted Metal’ for providing field painting of identification of piping used with HVAC equipment.
   2. Section 22 0529: 'Hangers And Supports For Plumbing’ for field installation of pipe stencils and band colors for identification for piping used with HVAC equipment.

1.03 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.04 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Automatic Controls: Tags. Key to control schematic.

C. Control Panels: Nameplates.

D. Dampers: Ceiling tacks, where located above lay-in ceiling.

E. Ductwork: Nameplates.

F. Heat Transfer Equipment: Nameplates.

G. Instrumentation: Tags.

H. Major Control Components: Nameplates.

I. Piping: Tags.

J. Relays: Tags.

K. Small-sized Equipment: Tags.

L. Thermostats: Nameplates.

M. Valves: Tags and ceiling tacks where located above lay-in ceiling.

N. Water Treatment Devices: Nameplates.

2.02 ABBREVIATIONS FOR PIPE STENCILS AND EQUIPMENT IDENTIFICATION AND BAND COLORS FOR PIPE IDENTIFICATION

A. Apply stenciled symbols and continuous painting as follows:
   1. Mechanical Mezzanine and Exposed on Roof:

Pipe Type	Pipe Color
Gas	Yellow

2.03 NAMEPLATES

A. Manufacturers:
   1. Advanced Graphic Engraving, LLC: www.advancedgraphicengraving.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. Seton Identification Products, a Tricor Direct Company: www.seton.com/#sle.

B. Letter Color: White.

C. Letter Height: 1/4 inch.

D. Background Color: Black.

E. Plastic: Comply with ASTM D709.

2.04 TAGS

A. Manufacturers:
   1. Advanced Graphic Engraving: www.advancedgraphicengraving.com/#sle.
   2. Brady Corporation: www.bradycorp.com/#sle.
   3. Brimar Industries, Inc: www.pipemarker.com/#sle.
   4. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   5. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.05 ADHESIVE-BACKED DUCT MARKERS

A. Manufacturers:
   1. Brimar Industries, Inc: www.pipemarker.com/#sle.
   2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.

B. Material: High gloss acrylic adhesive-backed vinyl film 0.0032 inch; printed with UV and chemical resistant inks.

C. Style: Individual Label.

D. Color: Yellow/Black.

2.06 STENCILS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   3. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Stencils: With clean cut symbols and letters of following size:
   1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
   2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
   3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.
   4. 8 to 10 inch Outside Diameter of Insulation or Pipe: 24 inch long color field, 2-1/2 inch high letters.
   5. Over 10 inch Outside Diameter of Insulation or Pipe: 32 inch long color field, 3-1/2 inch high letters.
   6. Ductwork and Equipment: 2-1/2 inch high letters.

2.07 PIPE MARKERS

A. Manufacturers:
   1. Brady Corporation: www.bradycorp.com/#sle.
   2. Brimar Industries, Inc: www.pipemarker.com/#sle.
   3. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   4. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
   5. MIFAB, Inc: www.mifab.com/#sle.
   6. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

D. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

E. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

2.08 CEILING TACKS

A. Manufacturers:
   1. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: Steel with 3/4 inch diameter color coded head.

PART 3 EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

H. Labels:
   1. Identify following items with specified labels fastened to equipment with screws (unless noted otherwise):
      a. Thermostats and control panels in mechanical spaces (attach label to wall directly above or below thermostats).
      b. Furnaces.
      c. Condensing units.
      d. Duct furnaces.
      e. Accessible exhaust fans.
   2. Engrave following data from Equipment Schedules on Drawings onto labels:
      a. Equipment mark.
      b. Area served.
      c. Thermostat zone number, when different from equipment mark.
      d. Panel and breaker from which unit is powered.

I. Pipe Markers:
   1. Wrap pipe marker around pipe with 1/2 inch (12.7 mm) minimum overlap. Use adhesive strip at overlap to adhere ends of marker together.
   2. Locate markers as follows:
      a. Adjacent to each item of equipment.
      b. At points of entry and exit where piping goes through wall.
      c. On each riser and junction.
      d. Every 25 feet (7.620 m) maximum on long, continuous runs.

J. Painting:
   1. New Surfaces:
      a. Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
      b. Existing Surfaces:
         1) Remove deteriorated existing paint down to sound substrate by scraping and sanding. Feather edges of existing paint by sanding to be smooth with adjacent surfaces. Spot prime bare metal surfaces immediately.
         2) Remove rust spots by sanding and immediately spot prime. If all traces of rust cannot be removed, apply rust blocker recommended by Paint Manufacturer before applying full primer coat.
         3) Clean existing sound painted surfaces as well as scraped and sanded existing painted surfaces as recommended by Paint Manufacturer.
         4) Apply prime coat over entire surface to be painted.
         5) Lightly sand entire surface.
         6) Clean surface as recommended by Paint Manufacturer.
         7) Apply finish coats.
   2. Leave equipment in like-new appearance.
   3. Only painted legends, directional arrows, and color bands are acceptable.
   4. Locate identifying legends, directional arrows, and color bands at following points on exposed piping of each piping system:
      a. Adjacent to each item of equipment.

b. At point of entry and exit where piping goes through wall.
c. On each riser and junction.
d. Every 25 feet (7.620 m) on long continuous lines.
e. Stenciled symbols shall be one inch (25 mm) high and black.

END OF SECTION

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SECTION 23 0713
DUCT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install thermal wrap duct insulation as described in Contract Documents.

1.03 RELATED REQUIREMENTS

1.04 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

C. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Samples: Submit two samples of any representative size illustrating each insulation type.

D. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of experience and approved by manufacturer.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.08 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

B. Manufacturers contact list

2.02 THERMAL WRAP DUCT INSULATION

A. 1-1/2 inch (38 mm) or 3 inch (76 mm) thick fiberglass with factory-laminated, reinforced aluminum foil scrim kraft facing and density of 0.75 lb / per cu ft (12 kg / per cu m).

B. Thermal Conductivity: 0.27 BTU in/HR SF deg F at 75 deg F (24 deg C) maximum.

C. Acceptable Products:
   1. Type 75 standard duct insulation by Certainteed St Gobain.
   2. Microlite FSK by Johns-Manville.
   3. Duct Wrap FSK by Knauf Fiber Glass.
   4. Alley Wrap FSK by Manson Insulation Inc.
   5. FRK by Owens-Corning.
   6. Equal as approved by Architect before bidding. See Section 01 6200.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive:
   1. For indoor applications:
      a. Provide adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

PART 3 EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:
   1. Provide insulation with vapor barrier jackets.
   2. Finish with tape and vapor barrier jacket.
   3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
   4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:
   1. Provide with or without standard vapor barrier jacket.
   2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

F. Exterior Applications: Provide insulation with vapor barrier jacket. Cover with outdoor jacket finished.

G. External Duct Insulation Application:
   1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
   2. Secure insulation without vapor barrier with staples, tape, or wires.
   3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
   4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
   5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

H. Duct and Plenum Liner Application:
   1. Adhere insulation with adhesive for 90 percent coverage.
   2. Secure insulation with mechanical liner fasteners. Refer to SMACNA (DCS) for spacing.
   3. Seal and smooth joints. Seal and coat transverse joints.
   4. Seal liner surface penetrations with adhesive.
   5. Duct dimensions indicated are net inside dimensions required for airflow. Increase duct size to allow for insulation thickness.

END OF SECTION

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install insulation on above ground refrigerant piping and fittings as described in Contract Documents.
   2. Furnish and install insulation for hot water heating and return piping system as described in Contract Documents.
   3. Furnish and install insulation for steam and condensate piping system as described in Contract Documents.

1.03 RELATED REQUIREMENTS

A. Section 23 0501 - Common Work Results for HVAC.

B. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.04 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2019).

C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement 2007 (Reapproved 2019).

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022a.

F. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2022.

G. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

I. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022a.

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Samples: Submit two samples of any representative size illustrating each insulation type.

D. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum five years of experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

B. Storage And Handling Requirements:
   1. Keep materials and work dry and free from damage.
   2. Replace wet or damaged materials at no additional cost to Owner.

1.08 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GENERAL MANUFACTURERS

A. Manufacturers:
   1. Manufacturer Contact List:
      a. Armacell; www.armaflex.com.
      b. Childers Products Co; www.fosterproducts.com.
      c. Foster Products Corp; www.fosterproducts.com.
      d. Johns-Manville; www.jm.com.
      e. Knauf; www.knauffiberglass.com.
      f. Manson; www.isolationmanson.com.
      g. Nitron Industries; www.nitronindustries.com.
      h. Owens-Corning; www.owenscorning.com; (416) 733-1600.
      i. Ramco; www.ramco.com.
      j. Nomac; www.nomaco.com.
      k. Speedline Corp; www.speedlinepvc.com.

B. Materials:
   1. Refrigeration Piping System:
      a. Thickness:
         1) Pipe Size, Outside Diameter — Insulation Thickness
            (a) One inch and smaller — 1/2 Inch
            (b) 1-1/8 to 2 inch — 3/4 Inch
         2) One inch sheet for fittings as recommended by Manufacturer.
         3) Approved Products. See Section 01 6200:
            (a) AP Armaflex 25/50 by Armacell.
            (b) Nitrolite by Nitron Industries. White only for exterior.
            (c) Nomaco K-Flex.
      b. Thickness:
         1) Pipe Size, Outside Diameter — Insulation Thickness
            (a) 25 mm and smaller — 13 mm
            (b) 29 to 50 mm — 19 mm
         2) 25 mm sheet for fittings as recommended by Manufacturer.
         3) Approved Products. See Section 01 6200:
            (a) AP Armaflex 25/50 by Armacell.

(b) Nitrolite by Nitron Industries. White only for exterior.
(c) Nomaco K-Flex.

c. Joint Sealer:
1) For indoor applications:
2) Provide adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
3) Approved Products. See Section 01 6200:
(a) Armacell 520 by Armacell.
(b) Namaco K-Flex R-373.
4) Insulation Tape:
(a) Approved Products. See Section 01 6200:
(1) Armaflex AP Insul Tape by Armacell.
(2) FT182 Tape by Nitron Industries.
(3) Elastomeric Foamtape by Nomac K-Flex.
5) Exterior Finish:
(a) For application to non-white, exterior insulation.
(b) Approved Products. See Section 01 6200:
(1) WB Armaflex Finish by Armacell.
(2) R-374 Protective Coating by Nomaco K-Flex.

PART 3 EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 PREPARATION

A. Before application of insulating materials, brush clean surfaces to be insulated and make free from rust, scale, grease, dirt, moisture, and any other deleterious materials.

B. Use drop cloths over equipment and structure to prevent adhesives and other materials spotting the work.

3.03 INSTALLATION

A. Refrigeration System Piping System:
1. General:
a. Install insulation in snug contact with pipe.
1) Insulate flexible pipe connectors.
2) Insulate thermal expansion valves with insulating tape.
3) Insulate fittings with sheet insulation and as recommended by Manufacturer.
b. Slip insulation on tubing before tubing sections and fittings are assembled keeping slitting of insulation to a minimum.
c. Do not install insulation on lines through clamp assembly of pipe support. Butt insulation up against sides of clamp assembly.
d. Stagger joints on layered insulation. Seal joints in insulation.
e. Install insulation exposed outside building so 'slit' joint seams are placed on bottom of pipe.
f. Paint exterior exposed, non-white insulation with two coats of specified exterior finish.
2. System Requirements:
a. Condensing Units: Install insulation on above ground refrigerant suction piping and fittings, including thermal bulb, from thermal expansion valve.
b. Split System Heat Pump Units: Install insulation on above ground refrigerant liquid and suction piping and fittings.

B. Install in accordance with manufacturer's instructions.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

E. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:
   1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure-sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
   2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

3.04 FIELD QUALITY CONTROL

A. Non-Conforming Work:
   1. Method of installing insulation shall be subject to approval of Architect. Sloppy or unworkmanlike installations are not acceptable.

3.05 CLEANING

A. Leave premises thoroughly clean and free from insulating debris.

3.06 PROTECTION

A. Protect insulation wherever leak from valve stem or other source might drip on insulated surface, with aluminum cover or shield rolled up at edges and sufficiently large in area and of shape that dripping will not splash on surrounding insulation.

END OF SECTION

SECTION 23 0923.01
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.01 SUMMARY

A. Included But Not Limited To:
   1. Furnish and install automatic temperature control system as described in Contract Documents.
   2. Honeywell LCBS Connect based systems
   3. Furnish and install conductors and make connections to control devices, motors, and associated equipment.
   4. Assist in air test and balance procedure.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

B. Section 23 0501 - Common Work Results for HVAC.

C. Section 23 3300 - Air Duct Accessories: Furnishing and installing of temperature control dampers.

D. Division 26:
   1. Furnishing and installing of raceway, conduit, and junction boxes, including pull wires, for temperature control system except as noted above.
   2. Power wiring to magnetic starters, disconnect switches, and motors.
   3. Motor starters and disconnect switches, unless integral with packaged equipment.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Installer to provide product literature or cut sheets for all products specified in Project.
      b. Installer to provide questions of control equipment locations to Mechanical Engineer prior to installation.

C. Informational Submittals:
   1. Certificates:
      a. Installer must provide ‘Certificate of Sponsorship’ signed from Approved Distributor with bid confirming Installer sponsorship.

D. Closeout Submittals:
   1. Include following in Operations and Maintenance Manual specified in Section 01 7800:
      a. Operations and Maintenance Data:
         1) Provide Operations and Maintenance Manual as specified in Section 23 0501.
      b. Record Documentation:
         1) Installer's 'Certificate of Sponsorship'.

E. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

F. Installer's Qualification Statement. Complete and submit signed "Certificate of Sponsorship" LCBS

G. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.
   1. Revise shop drawings to reflect actual installation and operating sequences.
   2. Include submittals data in final "Record Documents" form.

H. Operation and Maintenance Data:
   1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
   2. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

I. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owners name and registered with manufacturer. Include copies in Operations and Maintenance Manual.

1.06 QUALITY ASSURANCE

A. Qualifications: Requirements of Section 01 4301 applies, but is not limited to the following:
   1. Installer:
      a. Before bidding, obtain sponsorship from a local, Approved Distributor specified under PART 2 PRODUCTS of this specification. Initial requirements for sponsorship are:
         1) Receive LCBS Connect product training from Approved Distributor.
         2) Installer to provide Distributor sponsorship by submitting ‘Certificate of Sponsorship’ as Informational Submittal with bid. Certificate available as Attachment in this Specification.

B. Perform work in accordance with NFPA 70.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer Contract List:
   1. Air Products & Controls Ltd; www.ap-c.com.
   2. Fire-Lite Alarms; www.firelite.com.
   3. Honeywell Inc; www.honeywell.com.
      a. Primary Contact: Chris Brinkerhoff, (801) 550-3344, chris.brinkerhoff@honeywell.com.
   4. ICCA Firex; www.icca.invensys.com.
   5. Insul_Guard:
      a. Primary Contact: Dan Craner, (801) 518-3733; insul_guard@comcast.net.
   6. System Sensor; www.systemsensor.com.
   7. Substitutions: See Section 01 6000 - Product Requirements.

B. Distributors: Obtain LCBS Connect control devices, RP panels, sensors, actuators and other control equipment from following Sponsoring Approved Distributors. See Section 01 4301:
      a. Idaho:
         1) MI Controls: (503) 233-5501; dave@micontrols.com; Dave Innocenti.

2) Building Controls and Solutions LLC: (801) 214-3316; Dan.Craner@building-controls.com; Dan Craner.

b. Utah:
1) Control Equipment Co: (800) 452-1457.
2) Building Controls and Solutions LLC: (801) 214-3316; Dan.Craner@building-controls.com; Dan Craner.

c. Wyoming:
1) Building Controls and Solutions LLC: (801) 214-3316; Dan.Craner@building-controls.com; Dan Craner.
2) CD Jones: (303) 501-0411; Mbisbee@cdjones.com; Mark Bisbee.

C. Performance:
1. Design Criteria:
a. Honeywell LCBS Connect control system with cloud based gateway:
1) General Requirements:
(a) Controls multistage equipment, dehumidification and ventilation with 2 wire connection to controller interface location in occupied space.
(b) Adjustable backlight to controller interface module from 15 percent-100 percent after 30 seconds of setting adjustments.
(c) System controllers can be programmed from the interface module or from the cloud service.
(d) LCBS Connect controller utilizes echelon communication network with the controller located near the mechanical equipment and the system interface located in the occupied space.
(e) System shall control outdoor ventilation air based upon system occupancy of electric / electronic actuation of dampers.
(f) CO2 sensors will open ventilation dampers only when CO2 exceeds 800 ppm with ppm monitored by cloud service.
(g) LCBS Connect devices access via internet Chrome browser via gateway.
(h) Wired room temperature sensors may be added as specified.
2) System Requirements:
(a) Up to 3 Heat/2 Cool Heat Pumps; Up to 3 Heat/2 Cool Conventional Systems.
(b) Tri-Lingual display (Selectable for English, Spanish, or French).
(c) 18 to 30 Vac.
(d) 50 Hz; 60 Hz.
(e) System switch to include Auto changeover for Heat-Cool.
(f) 7-Day Programming.
(g) 365-Day Event Scheduling.
(h) Display Security Lockout options.
(i) Minimum/ Maximum Temperature Range Stops.
(j) Configurable over-ride option.
(k) Remote Access via internet.
(l) Dehumidification setting range 40 to 80 percent RH.

b. Honeywell TrueZone panel enabled device(s):
1) General Requirements: Zone Panel:
(a) Work in conjunction with LCBS Connect.
(b) Control multiple zones on single fan coil unit (gas fired furnace with air conditioning or air handling unit with heat pump).
(c) Keypad programming and checkout.
(d) Work with conventional, heat pump or dual fuel applications.
(e) Push wire terminals.
(f) Add-a-zone panel expandable.
2) Dampers:

(a) Bypass damper installs in any orientation at any angle.
(b) Bypass damper provides constant pressure relief regardless of blower speed.
(c) Bypass damper provides visual damper percentage open.
(d) Zone damper powered by 24VAC circuit from zone panel.
(e) Zone damper adjustable range stops for consistent bleed setting.
(f) Zone damper LED indicator lights (red closed, green open/ 3 wire applications).
(g) Zone damper terminals have push terminals.

D. Components:
1. Controller, Wall Module:
a. Controller and Display Kit:
1) Approved Product.
(a) Part Number Honeywell YCRL6438SR1000 consisting of following:
(1) Unitary Controller: Honeywell CRL6438SR1000
(2) Wall Module: Honeywell TS120
(b) Wall Cover Plate: Honeywell 50002883-001.
(c) Discharge Air / Return Air Sensors: Honeywell C7041B2005 20k ohms.
(d) Outdoor Air Sensor: Honeywell C7041F2006.
(e) Indoor Air Sensor:
(1) Sylk bus network; Honeywell TR40.
(f) Averaging sensor:
(1) Sylk bus network; Honeywell TR40.
b. Internet Gateway Module(s): One (1) module per thirty (30) controllers.
1) Approved Product.
(a) LCBS Connect Gateway Module: Honeywell LGW1000.
2. Zone Panel and Components:
a. Zone Panel: Honeywell TrueZone HZ322.
b. Zone Panel: Honeywell TrueZone HZ432.
c. Zone Expansion Controller X4, where required: Honeywell TAZ-4.
d. Zone Panel Transformer: AT175F1023.
e. Zone Discharge Air Temperature Sensor: Honeywell C7735A1000.
f. Zone Damper(s): Honeywell ARD (damper size) TZ round damper.
g. Zone Damper(s): Honeywell ZD (damper size) TZ rectangular damper.
h. Zone Bypass Damper: Honeywell CPRD (damper size).
3. Sealant Compound:
a. Description:
1) Non hardening waterproof, vapor proof, self-adhesive for hot or cold application for sealing conduit openings against drafts, dust, moisture and noise.
b. Approved Product.
1) Duct Seal Compound No. DS-130 by Gardner Bender; www.gardnerbender.com.
2) Thumb-Tite Sealing Compound No. 4216-92 by Nu-Calgon; www.nucalgon.com.
4. Guard for Cultural Center Sensors:
a. Match color of sensor.
b. Approved Product.
1) MSI-244 controller guard with integral wood base by Zimmerman Technologies.
2) WMG 1 controller guard by Insul_Guard.
5. Duct Smoke Detectors:
a. Duct mounted smoke detector in systems with airflow greater than 2000 CFM.
b. Intelligent low flow photoelectric duct smoke detector with flash scan.
c. Approved Product.
1) System Sensor Model D4120.

6. Transformer:
   a. 120 / 24 V, 50VA Honeywell AT150F.
   b. 120 / 24 V, 75VA Honeywell AT175F.
7. Damper Actuators:
   a. Electric type equipped for Class I wiring.
   b. Shall not consume power during Unoccupied cycle or use chemicals or expandable media.
   c. Have built in spring return.
   d. Approved Product.
      1) Honeywell MS8105A1030/U.
      2) Honeywell MS8105A1130 with end switch.
8. Conductors:
   a. Color-coded and No. 16 and No. 12 AWG Type TWN, TFN, or THHN, stranded.
   b. Controller Cable: 12, 8, or 4 conductor, 18AWG solid copper wire, insulated with high-density polyethylene. Conductors parallel enclosed in brown PVC jacket (22 AWG cable not allowed).
   c. Echelon Network Ebus Communicating Cable:
      1) Class Two Quality Standard. See Section 01 6200:
         (a) CAT 4, 22 gauge (0.025 in) (0.645 mm), twisted pair, non-plenum and non-shielded cable.
9. Local Relay (RP) Panels For Chapel And Cultural Center Systems:
   a. 16-ga (1.59 mm) screw cover, painted sheet metal. Box with cover and knockouts, pre-wired terminal strips, relay, and transformer.
   b. Provide Labels with Distributor contact information on each panel.
   c. Approved Products.
      1) Standard: LDS Model RP-6.
10. CO2 Return Air Sensor:
    a. Duct mount with display.
    b. Approved Product.
       1) Honeywell: C7232B1006.
11. CO2 Room Air Sensor:
    a. Wall Mount CO2 Sensor without display.
       1) Description: Stand-alone carbon dioxide (CO2) and temperature sensor for use in determining ventilation necessity with HVAC controllers.
    b. Approved Product.
       1) Honeywell C7262A1016/U.
12. Control for Electric Wall Heater:
    a. Electric Heater Control: CEO
       1) Combination Equipment and Thermal Overload Switch Panel:
       2) CEO panel must be provided by approved panel builder. See Section 01 6200 for definitions of Categories:
          (a) Switching Relay: Part Number Functional Devices: Relay RIB2401B 20 amp rating.
          (b) Disconnect Heater Overload: FMS-TAX5, 2-Pole 1 HP starter switch.

E. Operation Sequences:
   1. Programmable controller shall control Unoccupied and Occupied status of fan system based on adjustable seven-day program. Fan shall run continuously in Occupied Mode and cycle in Unoccupied Mode.
   2. Adjustable heating and cooling set points shall control space temperature by activating either heating or cooling equipment. Programmable controller provides automatic change over between heating and cooling.

3. Controller provides optional override by allowing timed override of program by pushing override on controller touch screen. This shall activate controller to Occupied Mode and system shall control to Occupied set point.
4. Minimum outdoor ventilation air damper, spring return type, shall open in controller Occupied Mode and remain closed in Unoccupied Mode.
5. Systems with CO2 sensor to control minimum, spring return type, outdoor ventilation air damper:
   a. Damper shall open in controller Occupied Mode only when CO2 sensor setpoint of 800 ppm is reached. Damper shall close if CO2 level drops below about 700 ppm.
   b. Damper shall remain closed in controller Unoccupied Mode.
6. Systems with Energy Recovery Ventilator (ERV):
   a. ERV shall activate in controller Occupied Mode and remain inactive in Unoccupied Mode.
   b. Systems with CO2 sensor to control outdoor ventilation air damper, ERV in controller shall activate ONLY when TWO conditions are present:
      1) Controller is in Occupied Mode.
      2) CO2 sensor setpoint of 800 ppm is reached.

PART 3 EXECUTION

3.01 INSTALLERS

A. Approved HVAC Sub-Contractors shall be pre-approved and included in Construction Documents by Addendum.

3.02 INSTALLATION

A. Interface With Other Work:
   1. Calibrate room controllers as required during air test and balance. Insulate sensor J-box with fiberglass insulation; expandable/ foam insulation is NOT acceptable.
   2. Install sealant compound, non hardening waterproof, vapor proof, self-adhesive for hot or cold application for sealing conduit openings against drafts, dust, moisture and noise.
   3. Instruct air test and balance personnel in proper use and setting of control system components.
   4. Install low voltage electrical wiring in accordance with Division 26 of these Specifications.

B. Echelon Communication: Ebus
   1. Ebus cable needs to be installed at least 12 inches (300 mm) from lighting, motors, or low voltage switching cables

C. Zone Panel:
   1. Zone panel shall be mounted by mechanical equipment with associated LCBS module in close proximity but mounted 24 inches (610 mm) apart.
   2. Zone panel shall be mounted at eye level and accessible for visual inspection.
   3. Install discharge air sensor 6 feet (1.80 m) downstream from a/c coil.
   4. Install OA sensor in fresh air duct.
   5. TOD relay for fresh air damper which is not part of zone panel shall be mounted in close proximity to panel and clearly labeled such.
   6. Zone panel shall be programmed for appropriate amount of zones and control.
   7. Zone dampers shall use three (3) wires for LED damper display.
   8. Power for zone transformer shall come from mechanical equipment for service switch disconnect.
   9. Zone and bypass dampers shall have actuation component positioned such as for visual damper position inspection.
   10. Set minimum zone damper position to 30 percent or setting number 3.

D. Control for Electric Wall Heater.

1. Install according to local code the electric heater RIB with overload disconnect into electric heater unit.
2. Commission controller to be seen by gateway and webpage.

E. Safety Controls: Interlock duct smoke detectors to keep heating, cooling, and system fan from operating when detector is energized.

F. Safety Controls:
1. Interlock main return air duct smoke detectors to keep heating, cooling, and system fan from operating when detector is energized. Interlock smoke detector for combination fire / smoke dampers so fire / smoke damper closes on detection of smoke.
2. Interlock gas valves with cooling compressors and supply air fan.
3. Gas valves shall obtain their electrical control power from same circuit as supply fan motor.
4. Check high limit thermostats furnished with heating equipment for correct operation. Gas valves shall close when duct temperature exceeds high limit setting. Perform this work immediately after wiring burner controls.
5. Wire bonnet thermostatic switches to dissipate all heat in combustion chambers.
6. Fresh air dampers shall close on fan shut-down, power failure, open fan motor disconnect switch, and when thermostat is in Unoccupied Mode.
7. Gas burner safety controls furnished with furnace units shall be incorporated in control circuits for all modes of operation.
8. Control twinned furnace systems, where two furnaces serve common supply and return plenums, as one unit with twinning kit. Motors shall start and stop together and gas valves operate together.

G. Mount damper actuators and actuator linkages external of airflow. Make certain dampers operate freely without binding or with actuator housing moving.

H. Paste copy of record control wiring diagram on back of relay panel door cover for each multiple furnace system.

3.03 FIELD QUALITY CONTROL

A. Field Tests:
1. Calibrate, adjust, and set controls for proper operation, operate systems, and be prepared to prove operation of any part of control system. This work is to be completed before pre-substantial completion inspection.
2. Test each individual heating, cooling, and damper control for proper operation using control system.

3.04 SYSTEM STARTUP

A. For systems with LCBS Controller.
1. Contractor is responsible for a fully functioning control system accessible via internet web browser. Contractor is responsible to coordinate Network start up with assistance from local IT technician. Local IT technician shall provide available ports on network switch for LCBS gateway.
2. Contractor is responsible configuring all controllers with proper zone names, zone scheduling, proper Church conference / holiday scheduling, all to be coordinated with local FM manager. Set proper clock setting including day/month/year.
3. Set Heating / Cooling to proper stages
4. Set heat cycle rates to 9 cph and cooling to 4 cph.
5. Set DO1 relay to “Occupancy”.
6. Set System switch operation to “Automatic” changeover.
7. Set fan switch operation to “ON”.
8. Set minimum UnOcc start time for all days. No days shall be scheduled Unconfigured.
9. Set Occupied start times to match meeting start times; provided by local FM manager.
10. Place all zone over-ride durations to one (1) hour except for Bishop and Stake area which shall be set to two (2) hours.

11. Set Occupied default heating setpoints to 70 degrees, cooling setpoints to 74 degrees.
12. Set Unoccupied default heating setpoint to 60 degrees, cooling setpoints to 90 degrees. Moist/Humid areas set unoccupied cooling at 80F
13. Set each zone to applicable Holiday scheduling for General & Stake Conferences.
14. EWH- Set EWH SET heating 50F (10C) minimum
    a. Set Unoccupied Setpoint
        1) Electric wall heater should always run in Unoccupied setting.

B. For systems with TrueZONE Zone Panel:
1. Contractor responsible for fully functioning zoning system connected to LCBS controller system.
2. Contractor responsible to configuring of zone panel.
3. Contractor responsible to coordinate Network start up with assistance from air balancer.

3.05 ADJUSTING

A. LCBS controller configuration settings; the following are configuration guidelines for consistent installations:

1.	Temperature Units:	Fahrenheit/ Celsius
2.	Equipment Type:	Conventional/heat pump
	a. Stages of Heat	1,2
	b. Stages of Cool	1,2
	c. Fan operation in heat mode	Enable Fan w/ Heat
3.	Equipment Options:	
	a. Leave at Default	
	b. Heating Cycles per Hour	6-9 cph
	c. Cooling Cycles per Hour	3-4 cph

4. Recovery:
    a. Leave at Default.
5. Economizer / DLC:
    a. Configure as required by control equipment.
6. Sensor Selection:
    a. Set according to averaging sensors.
    b. Set to multi sensor “Smart” when averaging.
    c. Set Occupancy Sensor to “Disable”.
7. Terminal Assignment:
    a. Set according to equipment.
    b. Set Terminal DO1 to Occupancy to control fresh air damper based upon scheduled occupancy or over-ride.
8. Dehumidification:
    a. Leave at default.
    b. See Accessory Loops.
9. Miscellaneous:
    a. Leave at default.
10. Sensor setting:
    a. Leave at default.
    b. Set as Required
11. Accessory Loops - Set as required:
    a. Hot water valve
    b. Dehumidification
    c. Other.
12. Configure Zone Name (display on Home Screen).
13. Set Password to ABCD.
14. Set Occupied Setpoint.
15. Set Unoccupied Setpoint

16. Set Schedule.
17. MENU/ Holiday-Event Scheduler / Custom Events/ Create new event:
    a. Mountain Time Zone:
        1) First Sunday in April: Unoccupied all zones for all day / every year.
        2) First Sunday in April: Unoccupied all zones for all day / every year.
        3) First Sunday in October: Unoccupied all zones for all day / every year.
        4) First Sunday in October: Unoccupied all zones for all day / every year.

B. Zone Panel Configuration:
1. Configuration:
    a. Conventional or Heat Pump
    b. Cooling Stages: (match equipment)
    c. Heat Stages: (match equipment)
    d. RF Enabled: (NO)
    e. Zones Installed: (match number of zones)
    f. Heat Staging Control: (percent Zones)
2. Advanced Configuration:
    a. Heat Fan Control (HVAC)
    b. Purge Time: (2 minutes)
    c. Fan in Purge: (HVAC)
    d. Purge Dampers: (Unchanged)
    e. Changeover Delay: (15 minutes)
    f. DA temperature Sensor: (Yes)
    g. DA temperature High Limit: (140 degree)
    h. DA Low Limit: (35 degree)
    i. DAT MSTG Inhibit : (Yes)
    j. MSTG OT Lockout: (No)
3. Save Changes.

3.06 CLOSEOUT ACTIVITIES

A. Instruction of Owner:
1. Include as part of training required in Section 23 0501, following training:
    a. Training shall be by personnel of installing company and utilize operator’s manuals and as-built documentation.
    b. Provide training in (2) two sessions including LCBS Connect sight & smart Apps for up to six (6) hours total:
    c. First session will occur between system completion and Substantial Completion.
    d. Second session will occur within forty-five (45) days of Substantial Completion when agreed upon by Owner.
    e. Training shall include sequence of operation review, selection of displays, modification of schedules and setpoints, troubleshooting of sensors, etc, as follows:
        1) Control System Overview:
            (a) Show access to system through both individual controllers and Internet browser and how network works. Scheduling building at minimum for Stake and General Conference, special events.
        2) Controller Programming from Keypad: Instructions on developing setpoints and schedules and adjusting local zone temperatures.
        3) Web Internet training with local Facilities Manager during two (2) sessions.
            (a) Review all features accessible from the ‘Settings’ tab including Alarm points, user access, scheduling and humidity setpoints (where applied).

3.07 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.08 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

3.09 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of energy management and control systems for one years from Date of Substantial Completion.

C. Provide two complete inspections, one in each season, to inspect, calibrate, and adjust controls as required, and submit written reports.

D. Provide complete service of systems, including call backs. Make minimum of two complete normal inspections of approximately two hours duration in addition to normal service calls to inspect, calibrate, and adjust controls, and submit written reports.

E. ATTACHMENTS [CERTIFICATE OF SPONSORSHIP, LCBS]

CERTIFICATE OF SPONSORSHIP

Electric and Electronic Control System for HVAC Installer

PROJECT INFORMATION (To be filled out by Installer - available from project specification):

Project Name: _____

Project Number: _____

Project Address: _____

INSTALLER INFORMATION (To be filled out by Installer):

Installer Name: _____

Installer Firm: _____

Installer Address: _____

I acknowledge and confirm the above listed Installer has received training and exhibit LCBS/Commercial System skills and is qualified to install the automation control system as specified for Project identified above. Our company will stand behind the Installer meeting the legal specified performance requirements.

Sponsoring Approved Honeywell Distributor Name: _____

Signature: _____ Printed Signature: _____

Date: _____

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SECTION 23 1123
FACILITY NATURAL-GAS PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Perform excavation and backfill required for work of this Section.
   2. Furnish and install gas piping and fittings within building and from building to meter including connection to meter as described in Contract Documents.

1.03 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 23 0501 Common HVAC Requirements

C. Section 23 0533- Identification For HVAC Piping and Equipment

D. Section 23 0516 - Expansion Fittings and Loops for HVAC Piping.

E. Section 33 5216 - Gas Hydrocarbon Piping.

1.04 REFERENCE STANDARDS

A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.

B. ASME B31.9 - Building Services Piping 2020.

C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welders' Certificates: Submit certification of welders' compliance with ASME BPVC-IX.

D. Shop Drawings: For non-penetrating rooftop supports, submit detailed layout developed for this project, with design calculations for loadings and spacings.

E. Sustainable Design Documentation: For soldered copper joints, submit installer's certification that the specified installation method and materials were used.

F. Project Record Documents: Record actual locations of valves.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 6000 - Product Requirements, for additional provisions.
   2. Valve Repacking Kits: One for each type and size of valve.

1.06 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 GENERAL MANUFACTURERS:

A. Manufacturer Contact List:
   1. BrassCraft; www.brasscraft.com.
   2. Cimberio Valve Co Inc; www.cimberio.com.
   3. ConBraCo Industries, Inc; www.conbraco.com;(416) 293-8111.
   4. Dormont Manufacturing Company; www.dormont.com.
   5. Jenkins-NH-Canada; www.jenkins-nh-canada.com.
   6. Jomar International; www.jomar.com.
   7. California Valves (formally KOSO) by Pacific Seismic Products Inc; Distributed by Strand Earthquake Consultants www.strandearthquake.net.
   8. Viega LLC; www.viega.com.
   9. Watts Regulator Co; www.wattsreg.com; (888) 208-8927.

2.02 MATERIALS:

A. Above-Ground Pipe:
   1. Black carbon steel, butt welded, Schedule 40 pipe meeting requirements of A53/A53M.

B. Above-Ground Pipe Fittings:
   1. Welded forged steel fittings meeting requirements of ASTM A234/A234M.
   2. Standard weight malleable iron screwed.
   3. Viega MegaPressG fittings.

C. Below-Ground Pipe And Fittings: Polyethylene pipe and fittings meeting requirements of ASTM D2513 with No. 14 coated copper trace wire.

D. Valves:
   1. 125 psi (862 kPa) bronze body ball valve, UL listed.
   2. Approved Products.
      a. CIM 102.1 by Cimbrio Valve.
      b. Apollo Series 80-100 by ConBraCo.
      c. 'Red Cap' R602 by Jenkins NH Canada.
      d. Model T-204 by Jomar International.
      e. Model B-6000-UL by Watts Regulator.

E. Cocks:
   1. Gauge Cocks: Conbraco Series 50-56 bronze gauge cock.

F. Flexible Connector:
   1. Type 304 stainless steel corrugated tube coated for corrosion protection.
   2. Approved Products.
      a. Dormont Supr-Safe.
      b. BrassCraft Procoat.

G. Seismic Valves:
   1. Natural gas seismic shut-off valves.

a. Rate at maximum 20 psi (138 kPA) pressure with positive seating from minus 40 deg F to plus 150 deg F (minus 40 deg C to plus 66 deg C) for exterior mounting near gas meter.
b. UL listed valve, factory set for IBC Seismic Design Category D, E, or F.
c. Size to be determined by total cu ft (0.028 cu m) per hour gas flow requirement of building and following conditions: 0.1 inch (2.54 mm) water column maximum allowable pressure-drop through valve with available pressure of 4 oz (113 grams).
d. Approved Product.
    1) California Seismic Gas Shutoff Valve (formally KOSO):
        (a) Horizontal installation: Model 314F or 315F.
        (b) Vertical installation with bottom inlet: Model VB314F or VB315F.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.
    1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
    2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
    3. Trapeze Hangers: Welded steel channel frames attached to structure.
    4. Vertical Pipe Support: Steel riser clamp.
    5. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
        a. Bases: High density polypropylene.
        b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
        c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
        d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
        e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
        f. Manufacturers:
            1) PHP Systems/Design: www.phpsd.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Steel pipe installed through air plenums, in walls:
    1. Pipes 2-1/2 inches (64 mm) and larger shall have welded fittings and joints.
    2. Other steel pipe may have screwed or welded fittings.
    3. Viega MegaPressG:
        a. Install MegaPressG fittings according to Manufacture’s recommendations and with Manufacture’s recommended tools.

B. Lay underground pipe in accordance with Manufacturer's recommendations and local gas utility company regulations and specifications.
    1. Provide 24 inch (610 mm) minimum steel pipe between vertical rise of riser and end of polyethylene line if anode-less riser is not used. Use plastic-to-steel transition or

compression fitting between end of polyethylene line and steel meter riser. Provide cathodic protection for steel riser or use anode-less riser.
2. Place tracer wire along side of polyethylene pipe from meter to point where pipe rises inside building.
3. Place 4 inches (100 mm) of sand around gas line buried underground.
4. Do not install gas piping under building floor slabs-on-grade.

C. After gas meter, valves, seismic valve and etc, gas piping should rise inside outside wall and not be visible to public.

D. On lines serving gas-fired equipment, install gas cocks adjacent to equipment outside of equipment cabinet and easily accessible.

E. Install 6 inch (150 mm) long minimum dirt leg, with pipe cap, on vertical gas drop serving each gas-fired equipment unit.

F. Use fittings for changes of direction in pipe and for branch runouts.

G. Visible gas piping inside building shall be painted yellow and labeled.

H. Install seismic valve in 24 inch (610 mm) long pipe section anchored to building wall at each end.

I. Install in accordance with manufacturer's instructions.

J. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

K. Route piping in an orderly manner and maintain gradient. Route parallel and perpendicular to walls.

L. Install piping to maintain headroom, conserve space, and not interfere with use of space.

M. Group piping whenever practical at common elevations.

N. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 23 0516.

O. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

P. Provide access where valves and fittings are not exposed.
1. Coordinate size and location of access doors with Section 08 3100.

Q. Establish elevations of buried piping outside the building to ensure not less than [_____] ft of cover.

R. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

S. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

T. Provide support for utility meters in accordance with requirements of utility companies.

U. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

V. Install valves with stems upright or horizontal, not inverted.

W. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

X. Sleeve pipes passing through partitions, walls and floors.

Y. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

6. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
7. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

3.04 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 5216. Gas service distribution piping to have initial minimum pressure of 2 PSI. Pressure will be reduced to 0.5 PSI at each fixture.

3.05 FIELD QUALITY CONTROL

A. Field tests:
1. Subject all portions of gas piping system, in sections or in entirety, to air pressure of 75 psig (0.52 MPa) and prove airtight for four (4) hours.
2. Disconnect equipment not suitable for 75 psig (0.52 MPa) pressure from piping system during test period.

END OF SECTION

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SECTION 23 2300
REFRIGERANT PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators. [Sight Glass]

D. Valves.

E. Strainers.

F. Check valves.

G. Pressure regulators.

H. Pressure relief valves.

I. Filter-driers.

J. Solenoid valves.

K. Receivers.

L. Flexible connections.

1.02 SUMMARY

A. Includes But Not Limited To:

1. Furnish and install piping and specialties for refrigeration systems as described in Contract Documents.

1.03 DEFINITIONS:

A. Refrigerant: Absorbs heat by a change of state (evaporation) from liquid to a gas, and releases heat by a change of state (condenses) from gas back to a liquid.

B. Vibration Isolation: Vibration reduction in which an isolation system is placed between the source of unwanted vibration and an item which needs to be shielded from the vibration.

1.04 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 09 9123 - Interior Painting.

C. Section 23 0716 - HVAC Equipment Insulation.

D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.05 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers 2005.

B. AHRI 710 (I-P) - Performance Rating of Liquid-Line Driers 2009.

C. AHRI 711 (SI) - Performance Rating of Liquid-Line Driers 2009.

D. AHRI 730 (I-P) - Flow Capacity Rating of Suction Line Filters and Suction Line Filter Driers 2013 (Reapproved 2014).

E. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.

F. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants 2019.

G. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

H. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators 2021.

I. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

J. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2020.

K. ASME B31.9 - Building Services Piping 2020.

L. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

M. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

O. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

P. UL 429 - Electrically Operated Valves Current Edition, Including All Revisions.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturer's catalogue information. Provide manufacturer's catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Design Data: Submit design data indicating pipe sizing. Indicate load-carrying capacity of trapeze, multiple pipe, and riser support hangers.

E. Test Reports: Indicate results of leak test, acid test.

F. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

G. Submit welders certification of compliance with ASME BPVC-IX.

H. Designer's qualification statement.

I. Installer's qualification statement.

J. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

K. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.07 QUALITY ASSURANCE

A. Designer Qualifications: Design piping system under direct supervision of a Professional Engineer experienced in design of this type of work.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 PRODUCTS

2.01 SYSTEM DESCRIPTION

A. Filter-Driers:
   1. Use a filter-drier immediately ahead of liquid-line controls, such as thermostatic expansion valves, solenoid valves, and moisture indicators.

2.02 REGULATORY REQUIREMENTS

A. Comply with ASME B31.9 for installation of piping system.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

C. Welders Certification: In accordance with ASME BPVC-IX.

D. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

2.03 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn.
   1. Fittings: ASME B16.22 wrought copper.
   2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.

B. Pipe Supports and Anchors:
   1. Provide hangers and supports that comply with MSS SP-58.
      a. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
   2. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Malleable iron adjustable swivel, split ring.
   3. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
   4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
   5. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
   6. Vertical Support: Steel riser clamp.
   7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.
   8. Hanger Rods: Mild steel threaded both ends, threaded one end, or continuous threaded.
   9. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.
   10. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
      a. Bases: High density, UV tolerant, polypropylene or reinforced PVC.
      b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
      c. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
      d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.
      e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.
      f. Manufacturers:
         1) PHP Systems/Design: www.phpsd.com/#sle.

2.04 REFRIGERANT

A. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50.

B. Refrigerant: R-134a, tetrafluoroethane as defined in ASHRAE Std 34.

2.05 MOISTURE AND LIQUID INDICATORS

A. Manufacturers:
   1. Henry Technologies: www.henrytech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Indicators: Single port type, UL listed, with copper or brass body, flared or soldered ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum temperature of 200 degrees F and maximum working pressure of 500 psi.

2.06 VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Henry Technologies: www.henrytech.com/#sle.
   3. Flomatic Valves: www.flomatic.com/#sle.

B. Diaphragm Packless Valves:
   1. UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, soldered or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

C. Packed Angle Valves:
   1. Forged brass or nickel plated forged steel, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, soldered or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

D. Ball Valves:
   1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

E. Service Valves:
   1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or soldered ends, for maximum pressure of 500 psi.

2.07 STRAINERS

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Straight Line or Angle Line Type:
   1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

C. Straight Line, Noncleanable Type:
   1. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of standard psi.

2.08 CHECK VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.
   4. Substitutions: See Section 01 6000 - Product Requirements.

B. Globe Type:
   1. Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum temperature of 300 degrees F and maximum working pressure of 425 psi.

C. Straight Through Type:
   1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.09 PRESSURE REGULATORS

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

2.10 PRESSURE RELIEF VALVES

A. Manufacturers:
   1. Hansen Technologies Corporation: www.hantech.com/#sle.
   2. Henry Technologies: www.henrytech.com/#sle.
   3. Sherwood Valve/Harsco Corporation: www.sherwoodvalve.com/#sle.

B. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi.

2.11 FILTER-DRIERS

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Performance:
   1. Flow Capacity - Liquid Line: ton, minimum, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).
   2. Flow Capacity - Suction Line: ton, minimum, rated in accordance with AHRI 730 (I-P).
   3. Water Capacity: As indicated in schedule, rated in accordance with AHRI 710 (I-P) (AHRI 711 (SI)).
   4. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
   5. Design Working Pressure: 350 psi, minimum.

C. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

D. Construction: UL listed.
   1. Replaceable Core Type: Steel shell with removable cap.
   2. Sealed Type: Copper shell.
   3. Connections: As specified for applicable pipe type.

2.12 SOLENOID VALVES

A. Manufacturers:
   1. Flow Controls Division of Emerson Electric: www.emersonflowcontrols.com/#sle.
   2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
   3. Sporlan, a Division of Parker Hannifin: www.parker.com/#sle.

B. Valve: AHRI 760 I-P, pilot operated, copper, brass or steel body and internal parts, synthetic seat, stainless steel stem and plunger assembly (permitting manual operation in case of coil failure), integral strainer, with flared, soldered, or threaded ends; for maximum working pressure of 500 psi.

C. Coil Assembly: UL 429 UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light.

2.13 RECEIVERS

A. Manufacturers:

1. Henry Technologies: www.henrytech.com/#sle.
2. Parker Hannifin/Refrigeration and Air Conditioning: www.parker.com/#sle.
3. Sherwood Valve/Harsco Corporation: www.sherwoodvalve.com/#sle.

B. Internal Diameter 6 inch and Smaller:
1. AHRI 495, UL listed, steel, brazed; 400 psi maximum pressure rating, with tappings for inlet, outlet, and pressure relief valve.

C. Internal Diameter Over 6 inch:
1. AHRI 495, welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; 400 psi with tappings for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

2.14 FLEXIBLE CONNECTORS

A. Manufacturers:
1. Circuit Hydraulics, Ltd: www.circuit-hydraulics.co.uk/#sle.
2. Flexicraft Industries: www.flexicraft.com/#sle.
3. Penflex: www.penflex.com/#sle.

B. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure of 500 psi.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain-end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and avoid interference with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Pipe Hangers and Supports:
1. Install in accordance with ASME B31.5.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping or isolate from other metals

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.

J. Flood piping system with nitrogen when brazing.

K. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

L. Prepare unfinished pipe, fittings, supports, and accessories for finish painting. See Section 09 9123.

M. Insulate piping and equipment.

N. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

O. Provide replaceable cartridge filter-driers, with isolation valves and valved bypass.

P. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

Q. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

R. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

S. Fully charge completed system with refrigerant after testing.

T. Provide electrical connection to solenoid valves. See Section 26 0583.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test and repair piping until no leakage.

D. Field Tests:
   1. Make evacuation and leak tests in presence of Architect's Engineer after completing refrigeration piping systems. Positive pressure test will not suffice for procedure outlined below.
      a. Draw vacuum on each entire system with two stage vacuum pump. Draw vacuum to 300 microns using micron vacuum gauge capable of reading from atmosphere to 10 microns. Do not use cooling compressor to evacuate system nor operate it while system is under high vacuum.
      b. Break vacuum with nitrogen and re-establish vacuum test. Vacuum shall hold for 30 minutes at 300 microns without vacuum pump running.
      c. Conduct tests at 70 deg F (21 deg C) ambient temperature minimum.
      d. Do not run systems until above tests have been made and systems started up as specified. Inform Owner's Representative of status of systems at time of final inspection and schedule start-up and testing if prevented by outdoor conditions before this time.
      e. After testing, fully charge system with refrigerant and conduct test with Halide Leak Detector.
      f. Recover all refrigerant in accordance with applicable codes. Do not allow any refrigerant to escape to atmosphere.

3.04 NON-CONFORMING WORK:

A. If it is observed that refrigerant lines are being or have been brazed without proper circulation of nitrogen through lines, all refrigerant lines installed up to that point in time shall be removed and replaced at no additional cost to Owner.

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 RELATED REQUIREMENTS

A. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC Section 01 4546 Duct Testing, Adjusting, and Balance

B. Section 23 0713 - Duct Insulation: External insulation and duct liner.

C. Section 23 3300 - Air Duct Accessories.

D. Section 23 3700 - Air Outlets and Inlets: Fabric air distribution devices.

1.03 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors current edition, including all revisions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.05 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide UL Class 1 ductwork, fittings, hangers, supports, and appurtenances in accordance with NFPA 90A and SMACNA (DCS) guidelines unless stated otherwise.

B. Provide metal duct unless otherwise indicated. Fibrous glass duct can be substituted at the Contractor's option.

C. Acoustical Treatment: Provide sound-absorbing liners and sectional silencers for metal-based ducts in compliance with Section 23 3319.

D. Duct Shape and Material in accordance with Allowed Static Pressure Range:

E. Duct Sealing and Leakage in accordance with Static Pressure Class:

F. Duct Fabrication Requirements:

1. Duct and Fitting Fabrication and Support: SMACNA (DCS) including specifics for continuously welded round and oval duct fittings.
2. Use reinforced and sealed sheet-metal materials at recommended gauges for indicated operating pressures or pressure class.

3. Construct tees, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide airfoil turning vanes of perforated metal with glass fiber insulation.
4. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.
5. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
6. Provide turning vanes of perforated metal with glass fiber insulation when an acoustical lining is required.
7. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted black on exterior side; seal to louver frame and duct.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.
   1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
   2. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
   3. Manufacturers and Products: Approved
      a. Carlisle HVAC Products; Hardcast Iron-Grip 601 Water Based Duct Sealant: www.carlislehvac.com/#sle.
      b. Duct Butter or ButterTak by Cain Manufacturing Co Inc, Pelham, AL www.cainmfg.com.
      c. DP 1010, DP 1030 or DP 1015 by Design Polymerics, Fountain Valley, CA www.designpoly.com.
      d. PROseal, FIBERseal, EVERseal, or EZ-seal by Ductmate Industries, Inc., Charleroi, PA www.ductmate.com.
      e. SAS by Duro Dyne, Bay Shore, NY or Duro Dyne Canada, Lachine, QB www.durodyne.com.
      f. Iron Grip 601 by Hardcast Inc, Wylie, TX www.hardcast.com.
      g. MTS100 or MTS 200 by Hercules Mighty Tough, Denver CO, www.herculesindustries.com.
      h. 15-325 by Miracle / Kingco, Div ITW TACC, Rockland, MA www.taccint.com.
      i. 44-39 by Mon-Eco Industries Inc, East Brunswick, NJ www.mon-ecoindustries.com.
      j. Airseal Zero by Polymer Adhesive Sealant Systems Inc, Weatherford, TX www.polymeradhesives.com.
      k. Airseal #22 Water Base Duct Sealer by Polymer Adhesive Sealant Systems Inc, Weatherford, TX
      l. www.polymeradhesives.com

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated in contract documents.

B. Provide duct material, gauges, reinforcing, and sealing for operating pressures indicated.

C. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

D. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

2.04 METAL DUCTS

A. Material Requirements:
   1. Galvanized Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Flexible Ducts: 2 layer black polymer film supported by helically wound spring steel wire.
   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
   2. Pressure Rating: 4 inches WG positive and 0.5 inches WG negative.
   3. Maximum Velocity: 4000 fpm.
   4. Temperature Range: Minus 20 degrees F to 175 degrees F.
   5. Manufacturers:
      a. JP Lamborn Co., Fresno CA www.jplflex.com.
      b. Flexmaster USA Inc, Houston, TX www.flexmasterusa.com or Flexmaster Canada Ltd, Richmond Hill, ON (905) 731-9411.
      c. Thermaflex by Flexible Technologies, Abbeville, SC or Mississauga, ON www.thermaflex.net.
   6. Products
      a. PR-25 by JP Lamborn.
      b. Flex-Vent KP by Thermaflex by Flexible Technologies.
      c. Type 1B Insulated by Flexmaster

C. Cinch/Draw Bands: Nylon, 3/8 inch (9.5 mm) removable and reusable type
   1. Listed and labeled in accordance with Standard UL 181B and labeled ‘UL 181 B-C’.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. During construction, provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering the ductwork system.

C. Flexible Ducts: Connect to metal ducts with draw bands.
   1. Install duct in fully extended condition free of sags and kinks, using 72 inch (1 800 mm) maximum lengths.
   2. Make duct connections by coating exterior of duct collar for 3 inches (75 mm) with duct sealer and securing duct in place over sheet metal collar with specified draw/cinch bands.

D. Duct sizes indicated are precise inside dimensions. For lined ducts, maintain sizes inside lining.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

END OF SECTION

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SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Duct access doors.
B. Duct test holes.
C. Flexible duct connectors.
D. Volume control dampers.
E. Low leakage (Class 1A) control dampers.
F. Miscellaneous products:
G. Acoustical Liner System
    1. Fasteners
H. Flexible Equipment Connections
I. Dampers and Damper Accessories
    1. Duct opening closure film.
    2. Concealed Ceiling Damper Regulators
    3. Dampers
        a. Bypass dampers
        b. Motorized Outside Air Dampers
        c. Motorized Zone Dampers
        d. Volume Dampers
J. Air Turns
K. Branch Tap for Flexible Ductwork

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.
B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.
C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

1.03 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURES

A. AGM Industries, Brockton, MA www.agmind.com.
B. Air Balance Inc, Holland, OH www.airbalance.com.
C. Air Filters Inc, Baltimore, MD www.afinc.com.
D. Air-Rite Manufacturing, Bountiful, UT (801) 295-2529.
E. American Warming & Ventilating, Holland, OH www.american-warming.com.
F. Arrow United Industries, Wyalusing, PA www.arrowunited.com.
G. Cain Manufacturing Company Inc, Pelham, AL www.cainmfg.com.
H. C & S Air Products, Fort Worth, TX www.csairproducts.com.
I. CertainTeed Corp, Valley Forge, PA www.certainteed.com.
J. Cesco Products, Florence, KY www.cescoproducts.com.

K. Daniel Manufacturing, Ogden, UT (801) 622-5924.
L. Design Polymerics, Fountain Valley, CA www.designpoly.com.
M. Ductmate Industries Inc, East Charleroi, PA www.ductmate.com.
N. Duro Dyne, Bay Shore, NY www.durodyne.com.
O. Dyn Air Inc. Lachine, QB www.dynair.ca
P. Elgen Manufacturing Company, Inc. East Rutherford, NJ www.elgenmfg.com
Q. Flexmaster USA Inc, Houston, TX www.flexmasterusa.com.
R. Greenheck Corp, Schofield, WI www.greenheck.com.
S. Gripnail Corp, East Providence, RI www.gripnail.com.
T. Hardcast Inc, Wylie, TX www.hardcast.com.
U. Hercules Industries, Denver, CO, www.herculesindustries.com.
V. Honeywell Inc, Minneapolis, MN www.honeywell.com.
W. Industrial Acoustics Co, Bronx, NY www.industrialacoustics.com.
X. Johns-Manville, Denver, CO www.jm.com.
Y. Kees Inc, Elkhart Lake, WI www.kees.com.
Z. Knauf Fiber Glass, Shelbyville, IN www.knauffiberglass.com.
AA. Manson Insulation Inc, Brossard, QB www.isolationmanson.com.
BB. Metco Inc, Salt Lake City, UT (801) 467-1572 www.metcospiral.com.
CC. Miracle / Kingco, Rockland, MA www.taccint.com.
DD. Mon-Eco Industries Inc, East Brunswick, NJ www.mon-ecoindustries.com.
EE. Nailor Industries Inc, Houston, TX www.nailor.com.
FF. Owens Corning, Toledo, OH www.owenscorning.com.
GG. Polymer Adhesive Sealant Systems Inc, Irving, TX www.polymeradhesives.com.
HH. Pottorff Company, Fort Worth, TX www.pottorff.com.
II. Ruskin Manufacturing, Kansas City, MO www.ruskin.com.
JJ. Sheet Metal Connectors Inc, Minneapolis, MN www.smconnectors.com.
KK. Tamco, Stittsville, ON www.tamco.ca.
LL. Techno Adhesive, Cincinnati, OH www.technoadhesives.com.
MM. Titus, Richardson, TX (972) 699-1030. www.titus-hvac.com
NN. McGill AirSeal, Columbus, OH www.mcgillairseal.com.
OO. United Enertech Corp, Chattanooga, TN www.unitedenertech.com.
PP. Utemp Inc, Salt Lake City, UT (801) 978-9265.
QQ. Ventfabrics Inc, Chicago, IL www.ventfabrics.com.
RR. Ward Industries, Grand Rapids MI www.wardind.com.
SS. Young Regulator Co, Cleveland, OH www.youngregulator.com

2.02 ACOUSTICAL LINER SYSTEM:

A. Duct Liner:
1. One inch (25 mm) thick, 1-1/2 lb (0.68 kg) density fiberglass conforming to requirements of ASTM C1071. Liner will not support microbial growth when tested in accordance with ASTM C1338.
2. Approved Products.
a. ToughGard by CertainTeed.

b. Duct Liner E-M by Knauf Fiber Glass.
c. Akousti-Liner by Manson Insulation.
d. Quiet R by Owens Corning.
e. Linacoustic RC by Johns-Manville.

B. Adhesive:
1. For indoor applications:
a. Provide adhesive that has a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
2. Approved Water-Based Products.
a. Cain: Hydrotak.
b. Design Polymerics: DP2501 or DP2502 (CMCL-2501).
c. Duro Dyne: WSA.
d. Elgen: A-410-WB.
e. Hardcast: Coil-Tack.
f. Hercules: Mighty Tough Adhesives MTA500 or MTA600.
g. Miracle / Kingco: PF-101.
h. Mon-Eco: 22-67 or 22-76.
i. Polymer Adhesive: Glasstack #35.
j. Techno Adhesive: 133.
k. McGill AirSeal: Uni-tack.
3. Approved Solvent-Based (non-flammable) Products.
a. Cain: Safetak.
b. Duro Dyne: FPG.
c. Hardcast: Glas-Grip 648-NFSE.
d. Miracle / Kingco: PF-91.
e. Mon-Eco: 22-24.
f. Polymer Adhesive: Q-Tack.
g. Techno Adhesive: 'Non-Flam' 106.
4. Approved Solvent-Based (flammable) Products.
a. Cain: HV200.
b. Duro Dyne: MPG.
c. Hardcast: Glas-Grip 636-SE.
d. Miracle / Kingco: PF-96.
e. Mon-Eco: 22-22.
f. Polymer Adhesive: R-Tack.
g. Techno Adhesive: 'Flammable' 106.

C. Fasteners:
1. Adhesively secured fasteners not allowed.

D. Approved Products.
1. AGM Industries: 'DynaPoint' Series RP-9 pin.
2. Cain.
3. Duro Dyne.
4. Gripnail: May be used if each nail is installed by 'Grip Nail Air Hammer' or by 'Automatic Fastener Equipment' in accordance with Manufacturer's recommendations.

2.03 BACKDRAFT DAMPERS

A. Backdraft Dampers: Factory-fabricated.
1. Backdraft blades shall be nonmetallic neoprene coated fiberglass type.
2. Stop shall be galvanized steel screen or expanded metal, 1/2 inch (13 mm) mesh.
3. Frame shall be galvanized steel or extruded aluminum alloy.
4. Approved Products.
a. Air-Rite: Model BDD-3.

b. American Warming: BD-15.
c. C & S: BD30.
d. Pottorff: BD-51.
e. Ruskin: NMS2.
f. Utemp: BFEA.

2.04 LOCKING QUADRANT DAMPER REGULATORS:

A. Approved Products. See Section 01 6200 for definitions of Categories:
1. Duro Dyne: KS-385.
2. Dyn Air: QPS-385.
3. Elgen: EQR-4.
4. Ventfabrics: Ventline 555.
5. Young: No. 1.

2.05 CONCEALED CEILING DAMPER REGULATORS:

A. Approved Products.
1. Cain.
2. Duro Dyne.
3. Elgen.
4. Metco Inc.
5. Ventfabrics: 666 Ventlok.
6. Young: 301.

2.06 VOLUME DAMPERS:

A. Rectangular Duct:
1. Factory-manufactured 16 ga (1.6 mm) galvanized steel, single blade and opposed blade type with 3/8 inch (9.5 mm) axles and end bearings. Blade width 8 inches (200 mm) maximum. Blades shall have 1/8 inch (3 mm) clearance all around.
2. Damper shall operate within acoustical duct liner.
3. Provide channel spacer equal to thickness of duct liner.
4. Dampers above removable ceiling and in Mechanical Rooms shall have locking quadrant on bottom or side of duct. Otherwise, furnish with concealed ceiling damper regulator and cover plate.
5. Approved Products.
a. Air-Rite: Model CD-2.
b. American Warming: VC-2-AA.
c. Arrow: OBDAF-207.
d. C & S: AC40.
e. Cesco: AGO.
f. Daniel: CD-OB.
g. Greenheck: VCD-20.
h. Nailor: 1810 or 1820.
i. Pottorff: CD-42.
j. Ruskin: MD-35.
k. United Enertech: MD-115.
l. Utemp: CD-OB.

B. Round Duct:
1. Factory-manufactured 20 ga (1.0 mm) galvanized steel, single blade with 3/8 inch (9.5 mm) axles and end bearings.
2. For use in outside air ducts.
3. Approved Products.
a. Air Balance: Model AC-22.
b. Air-Rite: Model CD-8.
c. American Warming: V-22.

d. Arrow: Type-70.
e. C & S: AC21R.
f. Cesco: MGG.
g. Nailor: 1890.
h. Pottorff: CD-21R.
i. Ruskin: MDRS-25.
j. United Enertech: RD.

2.07 MOTORIZED OUTSIDE AIR DAMPERS

A. General:
1. Low leakage type. AMCA certified.
2. Make provision for damper actuators and actuator linkages to be mounted external of air flow.

B. Rectangular Ducts:
1. Damper Blades:
a. Steel or aluminum airfoil type with mechanically locked blade seals, 8 inch (200 mm) blade width maximum measured perpendicular to axis of damper.
2. Jamb seals shall be flexible metal compression type.
3. Opposed or single blade type.
4. Approved Products.
a. Air Balance: AC 526.
b. American Warming: AC526.
c. Arrow: AFD-20.
d. C & S: AC50.
e. Cesco: AGO3.
f. Nailor: 2020.
g. Pottorff: CD-52.
h. Ruskin: CD-60.
i. Tamco: Series 1000.
j. United Enertech: CD-150 or CD-160.

C. Round Ducts:
1. Damper Blades:
a. Steel with mechanically locked blade seals.
b. Blade seals shall be neoprene or polyethylene.
2. Single blade type.
3. Approved Products.
a. Air Balance: AC 25.
b. American Warming: VC25.
c. Arrow: Type 70 or 75.
d. C & S: AC25R.
e. Cesco: AGG.
f. Nailor: 1090.
g. Pottorff: CD-25R.
h. Ruskin: CD25.
i. Tamco: Square-to-Round Series 1000.
j. United Enertech: RI.

2.08 MOTORIZED ZONE DAMPERS: (FOR USE WITH SPECIFIED ZONING PANEL):

A. Approved Product.
1. Honeywell Dampers (round) ARD(size)TZ.
2. Honeywell Dampers (rectangular) ZD(size x size)TZ.
3. Honeywell Dampers (retrofit) RR(5 inch to 8 inch)TZ.

2.09 BYPASS DAMPER:

A. Approved Product.
   1. Honeywell CPRD (size) from 8 inch to 14 inch.

2.10 BACKDRAFT DAMPERS:

A. Backdraft blades shall be nonmetallic neoprene coated fiberglass type.

B. Stop shall be galvanized steel screen or expanded metal, 1/2 inch (13 mm) mesh.

C. Frame shall be galvanized steel or extruded aluminum alloy.

D. Approved Products.
   1. Air-Rite: Model BDD-3.
   2. American Warming: BD-15.
   3. C & S: BD30.
   4. Pottorff: BD-51.
   5. Ruskin: NMS2.
   6. Utemp: BFEA.

2.11 AIR TURNS:

A. Single thickness vanes. Double thickness vanes not acceptable.

B. 4-1/2 inch (115 mm) wide vane rail. Junior vane rail not acceptable.

2.12 BRANCH TAP FOR FLEXIBLE DUCTWORK:

A. Factory-manufactured rectangular-to-round 45 degree leading tap fabricated of 24 ga (0.635 mm) zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A653, with G-90 coating.

B. One inch wide mounting flange with die formed corner clips, pre-punched mounting holes, and adhesive coated gasket.

C. Manual Volume Damper:
   1. Single blade, 22 ga (0.79 mm) minimum
   2. 3/8 inch (9.5 mm) minimum square rod with brass damper bearings at each end.
   3. Heavy-duty locking quadrant on 1-1/2 inch (38 mm) high stand-off mounting bracket attached to side of round duct.

D. Approved Products.
   1. ST-1HD by Air-Rite:
   2. Nylon damper bearings approved for Air-Rite.
   3. STO by Flexmaster.
   4. HET by Sheet Metal Connectors

2.13 DUCT ACCESS DOORS

A. General:
   1. Factory built insulated access door with hinges and sash locks, as necessary. Construction shall be galvanized sheet metal, 24 ga (0.635 mm) minimum.
   2. Fire and smoke damper access doors shall have minimum clear opening of 12 inches (300 mm) square or larger as shown on Drawings.

B. Rectangular Ducts:
   1. Approved Products.
      a. Air Balance: Fire/Seal FSA 100.
      b. Air-Rite: Model HAD-2.
      c. Cesco: HDD.
      d. Elgen: TAB Type / Hinge and Cam.
      e. Flexmaster: Spin Door.
      f. Kees: ADH-D.
      g. Nailor: 08SH.
      h. Pottorff: 60-HAD.

i. Ruskin: ADH-24.
j. United Enertech: L-95.

C. Round Ducts:
1. Approved Products.
a. Ductmate: 'Sandwich' Access Door.
b. Elgen: Sandwich Access Door.
c. Kees: ADL-R.
d. Nailor: 0809.
e. Pottorff: RAD.
f. Ruskin: ADR.
g. Ward: DSA.

2.14 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.15 FLEXIBLE EQUIPMENT DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.
1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz/sq yd.
a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gauge, 0.0239 inch thick galvanized steel.

C. Approved Products
1. Cain: N-100.
2. Duro Dyne: MFN.
3. Dyn Air: CPN with G-90 galvanized off-set seam.
4. Elgen: ZLN / SDN.
5. Ventfabrics: Ventglas.
6. Ductmate: ProFlex.

2.16 MISCELLANEOUS PRODUCTS

A. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.
1. Thickness: 2 mils, minimum
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.
5. Manufacturers:

B. Duct Hangers:
1. One inch (25 mm) by 18 ga (1.27 mm) galvanized steel straps or steel rods as shown on Drawings, and spaced not more than 96 inches (2 400 mm) apart. Do not use wire hangers
2. Attaching screws at trusses shall be 2 inch (50 mm) No. 10 round head wood screws. Nails not allowed.

PART 3 EXECUTION

3.01 INSTALLATION

A. Furnish and install acoustic lining in following types of rectangular ducts unless noted otherwise on Contract Documents:
1. Supply air.
2. Return air.
3. Mixed air.

4. Transfer air.
5. Relief air.
6. Exhaust air.
7. Elbows, fittings, and diffuser drops greater than 12 inches (300 mm) in length.

B. Do not install acoustic lining in round ducts.

C. Flexible Connections: Install flexible inlet and outlet duct connections to each furnace.

D. Access Doors In Ducts:

E. Install at each manual outside air damper and at each motorized damper. Locate doors within 6 inches (150 mm) of installed dampers.

F. Install within 6 inches (150 mm) of fire dampers and in Mechanical Room if possible. Install on side of duct that allows easiest access to damper.

G. Dampers And Damper Accessories:

H. Install concealed ceiling damper regulators.

I. Paint cover plates to match ceiling tile.

J. Do not install damper regulators for dampers located directly above removable ceilings or in Mechanical Rooms.

K. Provide each take-off with an adjustable volume damper to balance that branch.

L. Anchor dampers securely to duct.

M. Install dampers in main ducts within insulation.

N. Dampers in branch ducts shall fit against sheet metal walls, bottom and top of duct, and be securely fastened. Cut duct liner to allow damper to fit against sheet metal.

O. Where concealed ceiling damper regulators are installed, provide cover plate.

P. Install motorized dampers.

Q. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). See Section 23 3100 for duct construction and pressure class.

R. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

S. Provide duct test holes where indicated and required for testing and balancing purposes.

T. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

U. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

V. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum two duct widths from duct take-off.

W. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cabinet exhaust fans.

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install exhaust fans as described in Contract Documents.

1.03 RELATED REQUIREMENTS

A. Section 23 3100 HVAC DUCTS and Casings

B. Section 23 0548 - Vibration and Seismic Controls for HVAC.

C. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

1.04 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.

B. AMCA 99 - Standards Handbook 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

G. UL 705 - Power Ventilators Current Edition, Including All Revisions.

1.05 FIELD CONDITIONS

A. Request Owner permission to use permanent ventilator(s) for ventilation during construction.

PART 2 PRODUCTS

2.01 POWER VENTILATORS - GENERAL

A. Manufacturers:
   1. Acme Engineering & Manufacturing Corp, Muskogee, OK www.acmefan.com.
   2. Broan-Nu Tone LLC, Harford, WI www.broan.com.
   3. Carnes Co., Verona, MI www.carnes.com.
   4. Loren Cook Co., Springfield, MO www.lorencook.com.
   5. Soler & Palau (S&P USA Ventilation Systems, LLC), Jacksonville FL www.solerpalau-usa.com.

B. Static and Dynamically Balanced: Comply with AMCA 204.

C. Performance Ratings: Comply with AMCA 210, bearing certified rating seal.

D. Sound Ratings: Comply with AMCA 301, tested to AMCA 300, bearing certified sound ratings seal.

E. Fabrication: Comply with AMCA 99.

F. UL Compliance: UL 705, listed, labeled, designed, manufactured, and tested.

G. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 CABINET EXHAUST FANS

A. Manufacturers:

B. Ceiling Mounted Exhaust Fans:

1. Acoustically insulated housings. Sound level rating of 5.0 sones maximum for CFM and static pressure listed on Contract Drawings.
2. Include chatterproof integral back-draft damper with no metal-to-metal contact.
3. True centrifugal wheels.
4. Entire fan, motor, and wheel assembly shall be easily removable without disturbing housing.
5. Suitably ground motors and mount on rubber-in shear vibration isolators.
6. Provide wall or roof cap, as required.
7. Acceptable Products
   a. Acme: VQ.
   b. Broan: LoSone.
   c. Carnes: VCD.
   d. Cook: Gemini.
   e. Soler & Palau: FF.

C. Grille: Molded white plastic.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Hung Cabinet Fans:
1. Install fans with resilient mountings and flexible electrical leads. Refer to Section 23 0548.
2. Install flexible connections between fan and ductwork; see Section 23 3300. Ensure metal bands of connectors are parallel with minimum 1 inch flex between ductwork and fan while running.

C. Install backdraft dampers on all outside outlets.

D. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans.

END OF SECTION

SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Registers/grilles:

B. Fabric air distribution devices.

C. Louvers:

D. Vents

E. Louvered penthouses.

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install diffusers, registers, and grilles connected to ductwork as described in Contract Documents.
   2. Furnish and install louvers connected to ductwork as described in Contract Documents.

1.03 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Painting of ducts visible behind outlets and inlets.

B. Section 23. 3100 HVAC ducts and casings.

1.04 REFERENCE STANDARDS

A. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating 2012 (Reapproved 2015).

B. ASHRAE Std 70 - Method of Testing the Performance of Air Outlets and Air Inlets 2006 (Reaffirmed 2021).

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

D. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

E. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems 2021.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual 2012.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

H. UL 2518 - Standard for Safety Air Dispersion Systems Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

C. Samples: Submit two of each required air outlet and inlet type.

D. Project Record Documents: Record actual locations of air outlets and inlets.

1.06 QUALITY ASSURANCE

A. Test and rate air outlet and inlet performance in accordance with ASHRAE Std 70.

B. Test and rate louver performance in accordance with AMCA 500-L.

C. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carnes, a division of Carnes Company Inc: www.carnes.com/#sle.

B. Krueger-HVAC: www.krueger-hvac.com/#sle.

C. Metalaire, a brand of Metal Industries Inc: www.metalaire.com/#sle.

D. Price Industries: www.price-hvac.com/#sle.

E. Titus, a brand of Air Distribution Technologies: www.titus-hvac.com/#sle.

F. Tuttle and Bailey: www.tuttleandbailey.com/#sle.

2.02 CEILING DIFFUSSERS

A. Finish: Off-white baked enamel.

B. Approved Products
1. Carnes: SKSA.
2. J & J: R-1400.
3. Krueger: SH.
4. Metal*Aire: 5500S.
5. Nailor: 65OOB.
6. Price: SMD-6.
7. Titus: TDC-6.
8. Tuttle & Bailey: M.

2.03 CEILING EXHAUST AND RETURN REGISTERS/GRILLES

A. Finish: Off-white baked enamel.

B. 1/2 inch (12.7 mm) spacing.

C. See Contract Documents for location of filter grilles.

D. Approved Products
1. Carnes: RSLA.
2. J & J: S90H.
3. Krueger: S85H.
4. Metal*Aire: SRH.
5. Nailor: 6155H.
6. Price: 535.
7. Titus: 355RL or 355 RS.
8. Tuttle & Bailey: T75D.

2.04 WALL SUPPLY REGISTERS/GRILLES

A. Color: Off-white baked enamel.

B. Approved Products
1. Krueger: 5815.
2. Metal*Aire: 42C.
3. Nailor: 51RCD.
4. Price: RCG-DVS.
5. Titus: 1707.
6. Tuttle & Bailey: AVF.

2.05 HIGH SIDE WALL RETURN GRIELLES

A. Finish: Off-white baked enamel.

B. Approved Products
1. Metal*Aire: 41C.
2. Krueger: 5810.
3. Nailor: 51RC.
4. Price: RCG.

5. Titus: 1700.
6. Tuttle & Bailey: AVF.

2.06 SIDEWALL SUPPLY REGISTERS/GRILLES

A. Finish: Off-white baked enamel.

B. Removable core.

C. Double deflection.

D. Set sidewall supply register blades at 15 degrees upward deflection

E. Approved Products
1. Krueger: 5815.
2. Metal*Aire: 42C.
3. Nailor: 51RCD.
4. Price: RCG-DVS.
5. Titus: 1707.
6. Tuttle & Bailey: AVF.

2.07 LOW SIDEWALL RETURN GRILLS

A. Finish: Off-white baked enamel.

B. 38 or 45 degree deflection.

C. Approved Products
1. Carnes: RSHA.
2. J & J: S-590.
3. Krueger: S480H.
4. Metal*Aire: HD-RH.
5. Nailor: 6145H-HD.
6. Price: 91.
7. Titus: 33RL or 33RS.
8. Tuttle & Bailey: T115D.

2.08 SOFFIT GRILLES:

A. Finish: Baked enamel. Match soffit color.

B. Aluminum with aluminum mesh insect screen.

C. Approved Products
1. Carnes: RAAA.
2. J & J: ALS95H.
3. Krueger: S585H.
4. Metal*Aire: RHE.
5. Nailor: 5155-IS.
6. Price: 635.
7. Titus: 355FL.
8. Tuttle & Bailey: A75D.

2.09 FLOOR / TOE SPACE RETURN GRILLES:

A. Finish: Clear anodized.

B. Approved Products
1. Carnes: CCJB (with mitered corners welded on face and sanded).
2. J & J: 2500 with Frame 10.
3. Krueger: 1500F.
4. Metal*Aire: 2000F.
5. Nailor: 49-240-FN-MM.
6. Price: LBPH-25B.
7. Titus: CT-540.

8. Tuttle & Bailey: 4000 CO.

2.10 FABRIC AIR DISTRIBUTION DEVICES

A. General Requirements:
   1. Diffuser material to comply with ASTM E84, UL 723, UL 2518, NFPA 90A, and NFPA 90B.
   2. Air Dispersion Method:
   3. Hanger Supports:

2.11 LOUVERS

A. Manufacturers:
   1. Airolite Co, Marietta, OH www.airolite.com.
   2. Air-Rite Manufacturing, Bountiful, UT www.air-ritemfg.com.
   3. American Warming & Ventilating, Holland, OH www.awv.com.
   4. Arrow United Industries, Wyalusing, PA www.arrowunited.com.
   5. Carnes Co, Verona, WI www.carnes.com or Energy Technology Products LTD, Edmonton, AB (780) 468-1110.
   6. Industrial Louvers Inc, Delano, MN www.industriallouvers.com or DKG Construction, LTD., Waterdown, ON 289-895-9729.
   7. Pottorff, Fort Worth, TX www.pottorff.com.
   8. Ruskin Manufacturing, Kansas City. MO www.ruskin.com.
   9. United Enertech Corporation, Chattanooga, TN www.unitedenertech.com.
   10. Vent Products Co Inc, Chicago, IL www.ventprod.com.
   11. SF435 by Western Ventilation Products Ltd, Calgary, AB www.westvent.com.
   12. Wonder Metals Corp, Redding, CA www.wondermetals.com.

B. General:
   1. Extruded aluminum, with blades welded or screwed into frames.
   2. Frames shall have mitered corners.
   3. Louvers shall be recessed, flanged, stationary, or removable as noted on Contract Documents.

C. Finish:
   1. Polyvinyledene Fluoride (PVF_2) Resin-base finish (Kynar 500 or Hylar 5000) containing 70 percent minimum PVF_2 in resin portion of formula. Thermo-cured two coat system consisting of corrosion inhibiting epoxy primer and top coat factory applied over properly pre-treated metal.
   2. Color as selected by Architect from Manufacturer's standard colors.

D. Louvers Connected To Ductwork:
   1. 1/2 inch (13 mm) mesh 16 ga (1.59 mm) aluminum bird screen.
   2. Approved Products
      a. K638 by Airolite.
      b. LE-1 by Air-Rite Manufacturing.
      c. LE48 by American Warming & Ventilating.
      d. EA-405 by Arrow United Industries.
      e. FKDA by Carnes.
      f. 455-XP by Industrial Louvers.
      g. EFK-445 by Pottorff.
      h. ELF81S30 by Ruskin.
      i. EL-4 by United Enertech.
      j. 2740-31 by Vent Products.
      k. EX by Wonder Metals.

E. Architectural Louvers:
   1. Aluminum bug screen.
   2. T608 by Airolite.
   3. LE57 by American Warming & Ventilating.

4. EFJ-245 by Pottorff.
5. EL-2 by United Enertech.
6. Equals by Arrow United Industries, Carnes, or Industrial Louvers as approved by Architect before installation.
7. Anchor securely into openings.
8. Where louvers touch masonry or dissimilar metals, protect with heavy coat of asphaltum paint.

2.12 LOUVERED PENTHOUSES

A. Type: All welded assembly with 4 inch deep louvers, mitered corners, sheet aluminum roof, with factory prime coat finish.

B. Color: To be selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Comply with SMACNA (ASMM) for flashing/counter-flashing of roof penetrations and supports for roof curbs and roof mounted equipment.

C. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

D. Install diffusers to ductwork with air tight connection.

E. Anchor all items securely

F. Louvers
1. Anchor securely into openings.
2. Where louvers touch masonry or dissimilar metals, protect with heavy coat of asphaltum paint.

G. Provide balancing dampers on duct take-off to diffusers and grilles and registers, despite whether dampers are specified as part of diffuser, or grille and register assembly.

H. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

I. Set sidewall supply register blades at 15 degrees upward deflection

END OF SECTION

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SECTION 23 4000
HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Disposable panel filters.

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install filters used in mechanical equipment.

1.03 RELATED REQUIREMENTS

1.04 REFERENCE STANDARDS

A. AHRI 851 (SI) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013.

B. UL 900 - Standard for Air Filter Units Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

1.06 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.01 FILTER MANUFACTURERS

2.02 PERFORMANCE REQUIREMENTS

A. Comply with the rating requirements in AHRI 851 (SI).

2.03 GENERAL FILTER REQUIREMENTS

A. Furnace Filters: One inch (25 mm) thick throw-away type as recommended by Furnace Manufacturer. MERV 4 minimum.

B. Energy Recovery Units:
   1. Two inch (50 mm) thick pleated throw-away type as recommended by Energy Recovery Unit Manufacturer with ANSI/ASHRAE 52.2 MERV rating of 6 or higher.

2.04 DISPOSABLE PANEL FILTERS

A. Media: UL 900 Class 2, fiber blanket, factory sprayed with flameproof, non-drip, non-volatile adhesive.
   1. Nominal Size: 24 by 24 inches.
   2. Thickness: 1 inch.

B. Performance Rating:
   1. Face Velocity: 500 fpm.
   2. Initial Resistance: 0.15 in-wc.
   3. Recommended Final Resistance: 0.50 in-wc.
   4. MERV 4 minimum

PART 3 EXECUTION

3.01 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Provide ample access for filter removal

C. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

E. **FIELD QUALITY CONTROL**

1. Inspection: At date of Substantial Completion, air filters shall be new, clean, and approved by Owner's representative.

END OF SECTION

SECTION 23 4114
SIDE-ACCESS HOUSING AND FILTERS

PART 1 GENERAL

1.01 INCLUDES BUT NOT LIMITED TO

A. Furnish and install housings with filters in specified ductwork as described in Contract Documents.

1.02 RELATED REQUIREMENTS

A. Section 01 5000 - Temporary Facilities and Controls: Filters for temporary heating and ventilating.

B. Section 23 0501 - Common Work Results for HVAC.

C. Section 23 3100 - HVAC Ducts and Casings.

1.03 REFERENCE STANDARDS

A. AHRI 851 (SI) - Performance Rating of Commercial and Industrial Air Filter Equipment 2013.

B. ASHRAE 52.1 - Gravimetric and Dust-Spot Procedures for Testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter; 1992.

C. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size 2017, with Addendum (2022).

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process 2022.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing 2017.

G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material) 2019.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

I. UL 900 - Standard for Air Filter Units Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Informational Submittals:
   1. Manufacturer Reports: Substantiating test reports on leakage from Manufacturer.

C. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, and connection requirements.

D. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and connection requirements.

E. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

F. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

PART 2 PRODUCTS

2.01 FILTER MANUFACTURERS

A. The Camfil Group: www.camfilfarr.com/#sle.

B. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.

2.02 PERFORMANCE REQUIREMENTS

A. Comply with the rating requirements in AHRI 851 (SI).

B. Performance:
   1. Design Criteria:
      a. Leakage:
         1) At rated airflow, upstream to downstream of filter, holding frame and slide mechanism shall be less than one percent at 3 inch (76 mm) w.g. differential.
         2) Into housing frame ambient atmosphere at rated airflow shall be less than 0.5 percent at 3 inch (76 mm) w.g. negative.

C. Components:
   1. Filters:
      a. Pre-Filters:
         1) 2 inch (50 mm) medium efficiency, pleated, disposable type with non-woven cotton fabric media, media support grid, and enclosing frame.
         2) Capable of being installed or removed without disturbing seal on final filter.
      b. Final Filters: Media shall be synthetic microfiber, laminated to reinforcing backing to form lofted filter blanket with average efficiency of between 90 and 95 percent in accordance with ASHRAE Test Standard (52.1-92) and listed by UL as Class (2)(1).
      c. Approved Products:
         1) 3P Glide/Pack with 2 inch (50 mm) thick 30/30 pre-filters and 12 inch (300 mm) thick Camfil Riga Flo P95 final filter by Camfil Farr.
   2. Pressure Gauge:
      a. Magnehelic differential pressure gage capable of indicating minimum of 1-1/2 inches (38 mm) static pressure.
      b. Quality Standard: Dwyer 2000 Series.
   3. Insulation:
      a. Housing and access doors shall be double wall with insulation between walls.
      b. Insulation shall be thermal, acoustical glass fiber, one inch (25 mm) thick with thermal conductivity of 0.25 to 0.30 K and bond strength of 20 PSF, based on S-08B modified. It shall withstand 250 deg F (121 deg C), meet hazard standards of NFPA 90A, and be tested in accordance with ASTM E84. Flame spread rating shall be 25 with a maximum smoke development of 50.

D. Fabrication:
   1. Housings:
      a. Fabricate of not less than 16-ga (1.6 mm) zinc-coated lock-forming quality steel sheets meeting requirements of ASTM A653/A653M, with G-60 coating.
      b. Incorporate two access doors, extruded aluminum tracks, and individual holding frames for standard size, high efficiency, filter enclosing frame.
   2. Enclosing Frame: Fabricate of zinc-coated lock-forming quality steel, assembled so rigid and durable enclosure for filter pack is effected.

PART 3 EXECUTION

3.01 INSTALLATION

A. Brace and install housings so they will be free of vibration during operation. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Install filter gauge static pressure tips upstream and downstream of filters. Mount filter gauges on outside of filter housing or filter plenum, in accessible position. Adjust and level.

D. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

E. Provide filter gauges on filter banks, installed with separate static pressure tips upstream and downstream of filters.

END OF SECTION

SECTION 23 5400
FURNACES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Forced air furnaces.

B. Accessories

1.02 RELATED REQUIREMENTS

A. section 23 0923.01 direct-digital control system for HVAC

B. SUMMARY
   1. Includes But Not Limited To:
      a. Furnish and install horizontal/vertical gas-fired condensing furnaces as described in Contract Documents.

C. REFERENCE STANDARDS

D. ANSI Z21.47 - American National Standard for Gas-Fired Central Furnaces 2021.

E. ASHRAE Std 103 - Method of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers 2022.

F. NFPA 54 - National Fuel Gas Code 2021.

G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

I. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances 2019.

J. UL (DIR) - Online Certifications Directory Current Edition.

K. SUBMITTALS
   1. See Section 01 3000 - Administrative Requirements, for submittal procedures.
   2. Informational Submittals:
      a. Manufacturer Reports: Equipment check-out sheets.
   3. Special Procedure Submittals:
      a. Installer must register with Manufacturer before submitting Manufacturer Warranty:
         1) Installer to contact Owner's Representative (FM Group or Project Manager) for following MANDATORY information to be given to Manufacturer before Manufacturer will issue Manufacturer's 'Special LDS Warranty' included with Closing Submittal:
            (a) This must be given to Manufacturer:
               (1) Name of Owner (name of FM Group)
               (2) Mailing Address (FM office address)
               (3) Building Property ID.
               (4) Project site address
               (5) Model Number of each Unit.
               (6) Serial Number of each Unit.
               (7) Date of Installation / Startup.
   4. Closeout Submittals:
      a. Include following in Operations And Maintenance Manual specified in Section 01 7800:
         1) Warranty Documentation:
            (a) Final, executed copy of Manufacturer's 'Special LDS Warranty' including required Owner / Manufacturer mandatory information.
         2) Record Documentation:

(a) Manufacturers Documentation:
(1) Equipment checkout sheet: Complete and sign all items for each unit.

5. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.
6. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.
7. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.
8. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.
9. Warranty: Submit manufacturer’s warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
10. Project Record Documents: Record actual locations of components and connections.

L. QUALITY ASSURANCE
1. Regulatory Agency Sustainability Approvals:
a. ASHRAE Compliance:
1) Applicable requirements in with ANSI/ASHRAE 62.1, Section 5 - 'Systems and Equipment'
b. ASHRAE/ESNA Compliance:
1) Applicable requirements in ANSI/ASHRAE/IESNA 90.1, Section 6 - 'Heating, Ventilating, and Air-Conditioning'.
2. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

M. WARRANTY
1. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.
2. Provide fifteen (15) year minimum limited warranty of heat exchanger.
3. Provide five year manufacturer’s warranty for heat exchangers.
4. Provide five (5) year limited warranty on parts.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer Contact List:
1. Carrier Corporation:
a. Carrier National: Robert Lambert, 317-739-9379, robert.lambert@carrier.com ,
b. Carrier Utah: Bret Adams (Contractors HVAC Supply); (801) 224-1020 ext. 2527; bret.adams@chcsut.com.
2. Lennox Industries:
a. For pricing and information contact: Lennox National Account at 1-800-367-6285.
b. Lennox National Contact: Jeff.barrett@lennoxind.com 801-556-6114
3. York International [US Airconditioning]
a. Nick Filimoehala n.filimoehala@us-ac.com 801-463-5323

2.02 REGULATORY REQUIREMENTS

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

2.03 GAS FIRED FURNACES

A. Design Criteria:
1. Rated at 92 percent minimum AFUE (Annual Fuel Utilization Efficiency) calculated in accordance with DOE test procedures.

B. Annual Fuel Utilization Efficiency (AFUE): 0.95 ("condensing") in accordance with ASHRAE Std 103.

C. Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating element, controls, air filter, humidifier, and accessories; wired for single power connection with control transformer.
   1. Safety certified by CSA in accordance with ANSI Z21.47.
   2. Venting System: Direct.
   3. Combustion: Sealed.
   4. Air Flow Configuration: Downflow.
   5. Heating: Natural gas fired.
   6. Accessories:
      a. Air Piping [venting]
      b. Condensate drain.
      c. Filter Frame
      d. Vibration Isolators

D. Performance: Shown on drawings

E. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner. If not certified for combustible flooring, please provide additional steel base.

F. Primary Heat Exchanger:
   1. Material: Hot-rolled steel.
   2. Shape: Tubular type.

G. Secondary Heat Exchanger:
   1. Material: Aluminized steel.

H. Gas Burner:
   1. Atmospheric type with adjustable combustion air supply.
   2. Gas valve, two stage provides 100 percent safety gas shut-off; 24 volt combining pressure regulation, safety pilot, manual set (On-Off), pilot filtration, automatic electric valve.
   3. Electronic pilot ignition, with electric spark igniter.
   4. Combustion air damper with synchronous spring return damper motor.
   5. Non-corrosive combustion air blower with permanently lubricated motor.

I. Gas Burner Safety Controls:
   1. Thermocouple sensor: Prevents opening of gas valve until pilot flame is proven and stops gas flow on ignition failure.
   2. Flame rollout switch: Installed on burner box and prevents operation.
   3. Vent safety shutoff sensor: Temperature sensor installed on draft hood and prevents operation, manual reset.
   4. Limit Control: Fixed stop at maximum permissible setting, de-energizes burner on excessive bonnet temperature, automatic resets.

J. Supply Fan: Centrifugal type rubber mounted with direct drive with adjustable variable pitch motor pulley.

K. Motor:
   1. 1750 rpm single-speed, permanently lubricated, hinge mounted.

L. Air Filters: 1 inch thick urethane, washable type arranged for easy replacement.

M. Operating Controls:
   1. Room Thermostat: Cycles burner to maintain room temperature setting.
   2. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with adjustable timed off delay and fixed timed on delay, with manual switch for continuous fan operation. Provide continuous low speed fan operation.

N. Approved Products.
   1. Standard Furnaces
      a. Carrier: 59SC5A.

b. Lennox: ML195.
c. York: TG9S.

2. Two-Stage Heat with ECM motor:
a. Carrier: 59TN6.
b. Lennox: EL296V.
c. York: TM9V.

2.04 ACCESSORIES

A. Air Piping [venting]
1. Air Piping: Schedule 40 pipe and fittings meeting requirements of ASTM D1785, ASTM D2661, or ASTM D2665. Only solid core allowed.
2. Installation For Condensing Furnaces:
a. Run individual vent and individual combustion intake piping from each furnace to concentric roof termination kit provided by Furnace Manufacturer. Slope lines downward toward furnace.
b. Slope combustion chamber drain downward to funnel drain. Anchor to wall with wall clamps, allowing free movement through clamp for expansion.
c. Use concentric roof termination kit provided by Furnace Manufacturer. Install vent and combustion air intake piping at clearance and distances required by Furnace Manufacturer.
d. Attach factory-supplied neoprene coupling to combustion-air inlet connection and secure with clamp.
e. Ensure that factory-supplied perforated metal disc is installed in flexible coupling, unless its removal is required.
f. York Furnaces: Install air piping on side of furnace in horizontal or vertical installation.
3. Installation For Condensing Water Heaters:
a. Run individual vent and individual combustion intake piping from each water heater to roof termination as recommended by Water Heater Manufacturer. Concentric roof termination kit may be used if approved by and provided by Water Heater Manufacturer. Slope lines downward toward water heater.
b. Slope combustion chamber exhaust drain downward to floor drain.

B. Condensate drain.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and located correctly.

C. Verify that proper fuel supply is available for connection.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of authorities having jurisdiction.

B. Install in accordance with NFPA 90A.

C. Install gas fired furnaces in accordance with NFPA 54.

D. Provide vent connections in accordance with NFPA 211.

E. Pipe condensate to condensate receiver

F. Pipe drain from dehumidifier to nearest floor drain

G. Vibration Isolators:
1. Install vibration isolator on each hanger rod supporting horizontal furnace and under each corner of vertical furnace.

3.03 FIELD QUALITY CONTROL

A. Manufacturer Services:
   1. Furnace installer shall:
      a. Verify proper gas orifice size.
      b. Clock gas meter for rated input.
      c. Verify and set gas pressure at furnace.
      d. Check and measure temperature rise.
      e. Check safety controls for proper operation.
      f. Check combustion vent sizes and combustion air sizes.
   2. In addition, furnace installer shall start up, check out, and adjust furnaces using equipment check-out sheet provided by Manufacturer. Complete and sign all items on sheet and include copy in O and M binder/ electronic copy.

END OF SECTION

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SECTION 23 6313
AIR COOLED REFRIGERANT CONDENSERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Manufactured units.

B. Casing.

C. Condenser coils.

D. Fan requirements.

E. Compressors

F. Controls.

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install compressor units as described in contract documents.
   2. Furnish and install compressor units and roof mounted compressor unit curbs as described in Contract Documents.

1.03 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Equipment bases.

B. Section 23 0923.01 Direct-Digital Contorl System for HVAC

C. Section 23 2300 - Refrigerant Piping.

D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.04 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment 2023.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.

C. ASHRAE Std 20 - Methods of Laboratory Testing Remote Mechanical-Draft Air-Cooled Refrigerant Condensers 2019.

D. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

F. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical requirements, and wiring diagrams.

C. Shop Drawings: Indicate components, assembly, dimensions, weights and loading, required clearances, and location and size of field connections. Include schematic layouts showing condenser, refrigeration compressors, cooling coils, refrigerant piping and accessories required for complete system.

D. Manufacturer's Instructions: Submit manufacturer's complete installation instructions.

E. Operation and Maintenance Data: Include start-up instructions, maintenance instructions, parts lists, controls, and accessories.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer. Provide copy in O&M manual.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing the work of this section with minimum five years of experience.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's installation instruction for rigging, unloading and transporting units.

B. Protect units on site from physical damage. Protect coils.

PART 2 PRODUCTS

2.01 MANUFACTURERS:

A. Manufacturer Contact List:
   1. Air-Rite Manufacturing; www.air-ritemfg.com.
      a. Blair Halverson; (801) 295-2529.
   2. Carrier Corporation:
      a. Carrier National: Rob Lambert; (317) 739-9379. robert.lambert@carrier.com
      b. Carrier Utah: Bret Adams (Contractors HVAC Supply); (801) 224-1020 ext. 2527; bret.adams@chcsut.com.
   3. Lennox Industries:
      a. For pricing and information call Lennox National Account at (800) 367-6285.
      b. Lennox National Contact: Jeff Barrett Jeff.barrett@lennoxind.com 801-556-6114
   4. Trane, a brand of Ingersoll Rand; www.trane.com/#sle Contact: Jeff Bradford, jason.bradford@trane.com, 801-415-2046
   5. York International [US Airconditioning]:
      a. Nick Filimoehala n.filimoehala@us-ac.com 801-463-5323

2.02 PERFORMANCE REQUIREMENTS

A. Capacities: SEER rating as defined by AHRI shall be 13.0 or greater and meet code requirements.

B. Follow drawing schedule requirements

2.03 MANUFACTURED UNITS

A. Compressor units (5 tons or less)

B. Performance:
   1. Capacities: SEER rating as defined by AHRI shall be 13.0 or greater.

C. Provide packaged, factory assembled, pre-wired unit, suitable for outdoor use consisting of casing, condensing coil and fans, integral sub-cooling coil liquid accumulator.

D. Provide stamped louver coil guard for unit.

E. Construction and Ratings: In accordance with AHRI 210/240 and UL 207. Testing shall be in accordance with ASHRAE Std 20.

F. Performance Ratings: Energy Efficient Rating (EER)/Coefficient of Performance (COP) not less than prescribed by ASHRAE Std 90.1 I-P, in combination with compressor units.

G. Refrigerant: Use only refrigerants that have ozone depletion potential (ODP) of zero and global warming potential (GWP) of less than 50. Currently use R-410a Refrigerant

H. Each condenser unit shall have only one compressor.

I. Design with following features:

1. Externally mounted brass service valves with charging connections.
2. Crankcase heater.
3. Resilient rubber mounts.
4. Compressor motor-overload protection.
5. Single speed.

J. Approved Products
1. North Region:
   a. Carrier: 24ABB3.
   b. Lennox: 13ACXN.
   c. York: YCD.
2. Southeast Region:
   a. Carrier: 24ACC4.
   b. Lennox: 14ACX.
   c. York: YCE.
3. Southwest Region:
   a. Carrier: 24AAA5.
   b. Lennox: 14ACX.
   c. York: YCS.

2.04 CASING

A. House components in welded steel frame with steel panels with weather resistant, baked enamel finish.

B. Mount starters, disconnects, and controls in weatherproof panel provided with full opening access doors. Provide mechanical interlock to disconnect power when door is opened.

C. Provide removable access doors or panels with quick fasteners.

2.05 CONDENSER COILS

A. Coils: Aluminum fins mechanically bonded to seamless tubing. Provide sub-cooling circuits. Air test under water to 425 psig, and vacuum dehydrate. Seal with holding charge of nitrogen.

B. Configuration: Single refrigeration circuit with receiver.

C. Only one liquid line, one suction line, and one power connection shall be made to each compressor. Provide charging valves.

2.06 FAN REQUIREMENTS

A. Direct driven propeller type.

B. Fan motor shall be single or two speed, thermostatically controlled, permanently lubricated, and designed with permanent protection.

C. Motors shall be resiliently mounted.

D. Each fan shall have a safety guard.

E. Vertical discharge direct driven propeller type condenser fans with fan guard on discharge, equipped with roller or ball bearings with grease fittings extended to outside of casing.

F. Weatherproof motors suitable for outdoor use, single phase permanent split capacitor or with permanent lubricated ball bearings and built-in current and thermal overload protection; refer to Section 23 0513.

G. Compressors
1. Each condenser unit shall have only one compressor.
2. Design with following features:
   a. Externally mounted brass service valves with charging connections.
   b. Crankcase heater.
   c. Resilient rubber mounts.

d. Compressor motor-overload protection.
e. Single speed.

2.07 CONTROLS

A. Provide factory wired and mounted control panel, NEMA 250, containing fan motor starters, fan cycling thermostats, compressor interlock, and control transformer.

B. Provide controls to permit operation down to 0 degrees F ambient temperature.

C. Provide thermostat to cycle fan motors in response to outdoor ambient temperature.

D. Provide head pressure switch to cycle fan motors in response to refrigerant condensing pressure. Head pressure type low ambient kit.

E. Provide Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.

F. Factory wired and located in separate enclosure.

G. Following three paragraphs may not be factory installed and will therefore have to be field installed.
1. Safety devices:
2. High and low-pressure cutout.
3. Condenser fan motor-overload devices.
4. Anti-cycle timers to prevent units from starting up again for five minutes after any power interruption.
5. Head pressure type low ambient kit.

2.08 ACCESSORIES

A. Vibration Isolators:
1. 4 inches (100 mm) square by 3/4 inch (19 mm) thick minimum neoprene type vibration isolation pads.

B. Provide sight glass in liquid line as within 12 inches of coil. Refer to Section 23 2300.

C. Provide filter dryer. Refer to Section 23 2300.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide for connection to electrical service. See Section 26 0583.

C. Align condensers on concrete foundations. See Section 03 3000

D. Install sight glass in liquid line as within 12 inches of coil. Refer to Section 23 2300.

E. Install filter dryer. Refer to Section 23 2300.

F. Provide connection to refrigeration piping system. See Section 23 2300. Comply with ASHRAE Std 15.

G. General:
1. Coordinate with other trades affected by the Work of this section.

H. Compressor Units:
1. Set compressor units level on 'compressor unit curb' on vibration isolation pads located at each corner of unit.
2. Compressor unit to be anchored solidly to concrete slab.

I. Do not use capillary tube and piston type refrigerant metering devices

J. Provide cooling season start-up, winter season shut-down service, for first year of operation.

K. Shut-down system if initial start-up and testing takes place in winter and machines are to remain inoperative. Repeat start-up and testing operation at beginning of first cooling season.

3.02 FIELD QUALITY CONTROL

A. Manufacturer Services:
   1. Compressor units shall be started up, checked out, and adjusted by compressor unit Installer.
   2. Use equipment checkout sheet provided by Manufacturer:
      a. Complete and sign all items on sheet. Include copy in O&M Manual.

END OF SECTION

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SECTION 23 7223
PACKAGED AIR-TO-AIR ENERGY RECOVERY UNITS

PART 1 GENERAL

1.01 SECTION INCLUDES

1.02 SUMMARY

A. Includes But Not Limited To:
   1. Furnish and install air-to-air Energy Recovery Ventilation (Energy Recovery Ventilator) units as described in Contract Documents.

1.03 RELATED REQUIREMENTS

1.04 REFERENCE STANDARDS

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's installation instruction, product data, and engineering calculations.

C. Shop Drawings: Show design and assembly of energy recovery unit and installation and connection details.

D. Manufacturer's Qualification Statement.

E. Closeout Submittals: Submit manufacturer's operation and maintenance instructions.

1.06 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. ASHRAE Compliance:
      a. Applicable requirements in ANSI/ASHRAE 62.1, Section 5 - 'Systems and Equipment'.
      b. Capacity ratings for air-to-air energy recovery equipment shall comply with ANSI/ASHRAE 84, 'Method of Testing Air-to-Air Heat Exchangers'.

B. Manufacturer Qualifications:
   1. Firm regularly engaged in manufacturing energy recovery units.
   2. Products in satisfactory use in similar service for not less than five years.
   3. Manufactured and assembled in the United States of America.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in manufacturer's unopened packaging.

B. Store products to be installed indoors in dry, heated area.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Warranty ventilator to be free from defects in material and workmanship and of all parts for period of 1-1/2 years from date of Substantial Completion.

C. Warranty energy recovery wheel to be free from defects in material and workmanship for 3 years under circumstances of normal use.

D. Warranty motor to be free from defects in material and workmanship for 7 years under circumstances of normal use.

E. Warranty desiccant core to be free from defects in material and workmanship for 5 years under circumstances of normal use.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Energy Recovery Ventilators:

1. Greenheck Fan Corporation: www.greenheck.com/#sle.
2. RenewAire: www.renewaire.com/#sle.
3. S&P USA Ventilation System: www.solerpalau-usa.com/#sle.

2.02 ENERGY RECOVERY UNITS

A. Basis of Design Product:
   1. Basis of design for this Project is Energy Recovery Ventilation by RenewAire (model number(s) as shown on Contract Drawings).
   2. Approved Equivalent Product:
      a. Energy Recovery Module Model ECV by Greenheck.
      b. Total Recovery Model TRC by S&P USA Ventilation System.

B. Performance:
   1. Capacities:
      a. Element rated by Manufacturer using method described in ANSI/ASHRAE 84. Exceed 70 percent temperature efficiency.
      b. Applicable for range of ventilation up to 1100 CFM in each air stream without disposition of dust in elements.

C. Construction:
   1. Fixed plate element.
   2. 20 ga (0.95 mm) galvanized steel case with lapped corners.
   3. Leveling legs.
   4. Access door to blowers, energy transfer elements, and filters.
      a. Gasketed to provide air tight seal.
      b. Insulated with 1/4 inch (6.4 mm) Rubatex.
      c. Attached to unit using stainless steel fasteners.

D. Duct Openings: Four each 1/2 inch (12.7 mm) by 1/2 inch (12.7 mm) square duct collars suitable for connection to duct work.

E. Duct Openings: Four each 12 inch (305 mm) round duct collars suitable for connection to duct work.

F. Blowers:
   1. Forward curved blades directionally driven by open, drip-proof PSC motor rated for continuous duty.
   2. Motor: 2-3/4 horse power, 115 VAC, single phase, 60 hertz.
   3. Baked enamel finish.

G. 24 VAC control voltage.

2.03 ENERGY RECOVERY UNITS

A. Basis of Design Product:
   1. Basis of design for this Project is Energy Recovery Ventilation by RenewAire (model number(s) as shown on Contract Drawings).
   2. Approved Equivalent Product:
      a. Energy Recovery Module Model ECV or MiniCore by Greenheck.
      b. Total Recovery Model TRC by S&P USA Ventilation System.

B. Performance:
   1. Capacities:
      a. Element rated by Manufacturer using method described in ANSI/ASHRAE 84. Exceed 70 percent temperature efficiency.
      b. Applicable for range of ventilation up to 450 CFM in each air stream without disposition of dust in elements.

C. Construction:
   1. Fixed plate element.
   2. 20 ga (0.95 mm) galvanized steel case with lapped corners.

3. Foot Kit.
4. Access door to blowers, energy transfer elements, and filters.
    a. Gasketed to provide air tight seal.
    b. Insulated with 1 inch (25 mm), 4 lb (1.8 kg) density, fiberglass board insulation with foil/scrim face.
    c. Attached to unit using zinc plated fasteners.

D. Duct Openings: Four each 10 inch (255 mm) round duct collars suitable for connection to duct work.

E. Blowers:
1. Forward curved blades directionally driven by open, drip-proof PSC motor rated for continuous duty.
2. Motor: 0.6 horse power, 115 VAC, single phase, 60 hertz.

F. 24 VAC control voltage.

2.04 SOURCE QUALITY CONTROL

A. Tests:
1. Provide evidence of independent testing of core by Underwriters Laboratory (UL), verifying maximum flame spread index (FSI) of 25 and maximum smoke development index (SDI) of 50. Meet NFPA 90A and NFPA 90B requirements.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that structure is ready for installation of unit, that openings in deck for ductwork, if required, are correctly sized and located, and that mechanical and electrical utilities supplying unit are of correct capacities and are accessible.

3.02 INSTALLATION

A. Provide openings for suitable ductwork connection.

B. Install per manufacturers instructions.

C. Basis of Design Product - RenewAIre
1. Suspend Energy Recovery Units from structure

D. Approved Equivalent Product (Greenheck and S&P USA Ventilation System):
1. Suspend Energy Recovery Units from structure.
2. Coordinate with other Trades to ensure scheduled performance with Contract Drawings and specified performance is met and any installation changes required but not limited to following:
    a. Structural supports for units.
    b. Ductwork sizes and connection locations.
    c. Service clearances.
    d. Interference with existing or planned ductwork, piping, conduit, or wiring.
    e. Electric power requirements and wire-conduit and over-current protection sizes.
    f. Low voltage controls as shown on Contract Drawings.

E. Installer responsible for any additional costs incurred by other affected Trades and Consulting Engineer for work of this section.

3.03 SYSTEM STARTUP

A. Provide services of manufacturer's authorized representative to provide start up of unit.

3.04 CLEANING

A. Clean filters, air plenums, interior and exposed-to-view surfaces prior to Substantial Completion.

END OF SECTION

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SECTION 23 8216
AIR COILS

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 22 0719 - Plumbing Piping Insulation.

B. Section 23 0719 - HVAC Piping Insulation.

C. Section 23 2300 - Refrigerant Piping.

D. Section 23 3100 - HVAC Ducts and Casings: Installation of duct coils.

1.02 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addenda (2011).

B. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

1.03 DELIVERY, STORAGE, AND HANDLING

A. Protect coil fins from crushing and bending by leaving in shipping cases until installation, and by storing indoors.

B. Protect coils from entry of dirt and debris with pipe caps or plugs.

1.04 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Carrier Corporation:
   1. Carrier National: Bradley Brunner (270) 282-1241 Bradley.M.Brunner@Carrier.utc.com.
   2. Carrier Utah: Bret Adams (Contractors HVAC Supply) (801) 224-1020 ext. 2527 bret.adams@chcsut.com

B. Lennox Industries
   1. For pricing and information contact: Lennox National Account at 1-800-367-6285.
   2. Lennox National Contact: Jeff Barrett, Jeff.barrett@lennox.com, 801-556-6114

C. York International
   1. Nick Filimoehala n.filimoehala@us-ac.com 801-463-5323

2.02 REFRIGERANT COILS

A. Manufactured Units
   1. DX Coils:
      a. Cooling coil shall consist of heavy gauge steel cabinet with baked-on enamel finish to match air handler.
         1) Coil shall have aluminum fins bonded to seamless copper tubing.
         2) Comply with ANSI/AHRI Standard 210/240. Provide drain pans with connections at one end.
         3) Use thermal expansion valve with brazed joints In place of capillary tube metering device. Compression fittings not acceptable.
   2. Approved Products. :
      a. Horizontal:
         1) Carrier: CNPHP.
         2) Lennox: CH33.
         3) York: MC.
      b. Vertical:
         1) Carrier: CNPVP.

2) Lennox: CH34.
3) York: FC.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Install in ducts and casings in accordance with SMACNA (DCS).
   1. Support coil sections independent of piping on steel channel or double angle frames and secure to casings.
   2. Arrange supports to avoid piercing drain pans.
   3. Provide airtight seal between coil and duct or casing.
   4. Refer to Section 23 3100.

C. Protect coils to prevent damage to fins and flanges. Comb out bent fins.

D. Refrigerant Coils: Provide sight glass in liquid line within 12 inches of coil. Refer to Section 23 2300.

E. Insulate headers located outside air flow as specified for piping. Refer to Section 22 0719.

END OF SECTION

SECTION 23 8241
ELECTRIC UNIT HEATERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric unit heaters.

1.02 INCLUDES BUT NOT LIMITED TO

A. Furnish and install electric unit heaters as described in Contract Documents.

1.03 RELATED REQUIREMENTS

1.04 23 0923 DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

1.05 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils 2001, with Addenda (2011).

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:
   1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.
   2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.
   3. Indicate mechanical and electrical service locations and requirements.

D. Certificates: Certify that air coil capacities, pressure drops, and selection procedures meet or exceed specified requirements or coils are tested and rated in accordance with AHRI 410.

E. Manufacturer's Instructions: Indicate installation instructions and recommendations.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listings.

G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Regulatory Agency Sustainability Approvals:
   1. Unit heaters shall be UL listed and comply with NEC requirements.

PART 2 PRODUCTS

2.01 ELECTRIC UNIT HEATERS

A. Manufacturers:
   1. Brasch Manufacturing Co: www.brachmfg.com/#sle.
   2. INDEECO (Industrial Engineering and Equipment Company): www.indeeco.com/#sle.
   3. Substitutions: See Section 01 6200 for definitions of Categories.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Acceptable Heating Element Assemblies:
   1. Horizontal Projection Units:
      a. Steel fins copper brazed to steel sheath and epoxy sealed for moisture resistance.
      b. Nickel chromium resistance wire surrounded with magnesium oxide and sheathed in steel, spiral-finned tubes.
      c. High-mass, all steel tubular type, copper brazed, centrally located and installed in fixed element banks.
   2. Vertical Projection Units:

a. Finned tubular.
b. Nickel chromium resistance wire surrounded with magnesium oxide and sheathed in steel, spiral-finned tubes.
c. High-mass, all steel tubular type, copper brazed, centrally located and installed in fixed element banks.

D. Housing:
1. Horizontal Projection Units:
a. Construction materials to consist of heavy gage steel with galvanized, polyester powder coat, high gloss baked enamel finish.
b. Provide with threaded holes for threaded rod suspension or wall mounted.
c. Provisions for access to internal components for maintenance, adjustments, and repair.
2. Vertical Projection Units:
a. Construction materials to consist of heavy gage steel with polyester powder coat, high gloss baked enamel.
b. Provide with mounting support brackets or provisions for mounting from ceiling or structure above.
c. Provisions for access to internal components for maintenance, adjustments, and repair.

E. Air Inlets and Outlets:
1. Inlets: Provide stamped louvers, protective grilles with fan blade guard.
2. Outlets: Provide diffuser cones, directional louvers, radial diffusers.

F. Fan: Factory balanced, direct drive, axial type with fan guard.

G. Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.

H. Controls:
1. Disconnect.
2. 24-volt relay.
3. Control transformer.
4. 120-volt control.
5. Fan override to purge residual heat when de-energized.
6. Terminal block for remote control.

I. Electrical Characteristics:
1. 208 volts, single phase, 60 Hz.
2. Disconnect Switch: Factory mount disconnect switch.
3.

2.02 WALL HEATERS [TYPICAL IN FIRE RISER ROOM]

A. Manufacturers:
1. Berko, Marley Electric Co, Bennettsville. SC www.berkomeh.com.
2. QMark, Marley Electric Co, Bennettsville, SC www.qmarkmeh.com.
3. Raywall, Johnson, TN www.raywall.com.

B. Surface mounting.

C. Sheet metal casing.

D. Heating element shall be encased in steel finned casting and protected by thermal switch.

E. Fan motor shall be permanently lubricated and dust protected bearings.

F. Fan shall be vibration free.

G. Units shall be controlled automatically by external thermostat provided as specified in Section 23 0933 'Electric and Electronic Control System for HVAC'.

H. UL listed.

I. Open coil element or enclosed in steel casing.

J. Thermal cutout with indicator light and one time thermal fuse.

K. Finish: Baked-on enamel.

L. Design Standard. Q Mark QFG22281F (2.2KW) controller used with these plans can only handle 12.5 amps.

M. Surface mounting, include backbox (Catalog number GFRBB).

2.03 CEILING-MOUNTED HEATER. [OPTIONAL HEATER FOR COLD CLIMATES

A. Fan type for recess mounting on ceiling.

B. 20 ga (0.95 mm) minimum sheet metal casing.

C. Heating element shall be encased in steel finned casting and protected by thermal switch.

D. Fan motor shall be heavy duty enclosed and permanently lubricated.

E. 208 V, 3 phase, 60 Hz.

F. Fan shall be precision balanced and fan-motor assembly mounted to be vibration free.
   1. Units shall be controlled automatically by wall-mounted thermostat when heater is in 'ON' position.

G. Heater shall have built-in fan delay.

H. Finish: Baked-on enamel.

I. Quality Standard: FFCH-RE500 Series by Berko.

J. Approved Products Manufactures.
   1. Berko, Marley Electric Co, Bennettsville. SC www.berkomeh.com.
   2. QMark, Marley Electric Co, Bennettsville, SC www.qmarkmeh.com.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.02 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Do not damage equipment or finishes.

D. Unit Heaters:
   1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.
   2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

E. Cabinet Unit Heaters:
   1. Install as indicated.
   2. Coordinate to ensure correct recess size for recessed units.

3.03 CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

3.04 PROTECTION

A. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION