

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Mechanically joined piping system requirements.
- B. Carbon steel grooved piping system.
- C. Copper grooved piping system.
- D. Stainless steel grooved piping system.
- E. Copper press-fit piping system.

1.02 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.

1.03 SUBMITTALS

- A. Submit in accordance with conditions of Contract and Division 01 submittal procedures.
- A. Reference Division 23 Section, "Basic Piping Materials and Methods" for additional submittal requirements.
- B. Shop Drawings:
 - 1. Indicate grooved-joint couplings and fittings on drawings and product submittals, and specifically identify with the applicable style or series designation.
 - 2. If an assembly of flexible couplings are used for seismic vibration, thermal expansion, or noise and vibration reduction, submit shop drawings indicating location of assembly, including anchors and guides. Include movement analysis of the assembly, and performance data of the assembly.
- C. Reports as specified in Part 3 of this Section.

1.04 QUALITY ASSURANCE

- B. Comply with Division 23 Section, "Basic Piping Materials and Methods."
- A. Single Source Responsibility: All components of each mechanically joined piping system used shall be of one manufacturer and conform to local code approval.

- B. Grooving and Joining Tools: Approved by the mechanically joined piping system manufacturer for use with their system and furnished by one manufacturer, though not necessarily the same as the grooved component manufacturer.
- C. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this Section, with minimum three years of documented experience and ISO 9001 certification.
 - 1. Date stamp all castings used for coupling housings, fittings, etc. for quality assurance and traceability.
- D. Installer Qualifications:
 - 1. Company specializing in performing work of the type specified in this Section, with minimum three years of documented experience.
 - 2. Certified by the mechanically joined manufacturer on the proper use of mechanically joining tools and installation of mechanically joined piping products.
- E. Pipe, fittings, and specialties shall be manufactured in plants located in the United States or certified to meet the specified ASTM, ASME, and ANSI standards.

1.05 DELIVERY, STORAGE, AND HANDLING

- C. Comply with Division 23 Section “Basic Piping Materials and Methods.”

PART 2 - PRODUCTS

2.01 MECHANICALLY JOINED PIPING SYSTEM REQUIREMENTS

- D. Antifreeze and Water Treatment:
 - 1. Refer to Division 23 Section “HVAC Water Treatment” for antifreeze and water treatment products.
- A. Pipe Materials:
 - 1. Refer to the specific product sections in Part 2 for the acceptable pipe materials.
- B. Fittings:
 - 1. General: Fittings shall be of wall thickness, pressure rating, and material compatible with adjoining pipe as listed and approved by the manufacturer’s current literature for the piping system used.
 - 2. Reference Division 23 Section “Basic Piping Materials and Methods” for additional fittings.
 - 3. Grooved:
 - a) All grooved joints shall be full-flow type and conform to AWWA C606 and ASTM F1476.

- 1) Victaulic Advanced Groove System (AGS) pipe ends are an acceptable alternate.
 - b) Body Materials:
 - 1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12 or ASTM A395 Grade 65-45-15.
 - 2) Wrought Steel: Comply with ASTM A234, Grade WPB, 0.375 inch wall.
 - 3) Carbon Steel: Comply with ASTM A53, Grade B or ASTM SA352, Grade LCC.
 - 4) Wrought copper: Comply with ASTM B75 Alloy C12200 or ASTM B152 Alloy C1100.
 - 5) Bronze Sand Cast: Comply with ASTM B16.18 and B584 ally UNS C89836.
 - 6) Stainless Steel: Type 304 or 316, conforming to ASTM A240, A312, A351, A403, A743, or A744, Grade CF8M.
 - c) Coating: Suitable enamel, epoxy, or hot-dipped galvanized according to ASTM A153 to match system requirements.
4. Strapless Outlet Fittings:
- a) Pipe Strapless Outlets: 1/2 inch or 3/4 inch NPT outlet for use on 4 inch and larger pipe sizes, rated for 300 psig.
 - 1) Housing: Ductile iron housing conforming to ASTM A536, Grade 65-45-12, painted black.
 - 2) Collar: Hot rolled steel collar conforming to ASTM A569, zinc electroplated to ASTM B633.
 - 3) Bushing: Brass conforming to UNS C37700.
 - 4) Seat/Liner Gasket: Same as Grooved Joint Gasket requirements specified under article "Joining Materials."
5. Test Caps: Ductile iron cap according to ASTM A536, Grade 65-45-12, suitable for use on metallic IPS pipe with integral NPT ball valve, maximum test pressure of 250 psi and maximum test temperature of 110 degrees F. Victaulic T-60 test cap or approved equal.
6. Press-Fit:
- a) Press-fit fittings shall include self-contained O-ring seals in the end connections.
 - b) Body Materials:
 - 1) Stainless Steel: Type 304 or Type 316, conforming to ASTM A240, A312, A351, A743, or A744, Grade CF8M.
 - 2) Wrought Copper: Comply with ASTM B75 Allow C12200 or ASTM B152 Alloy C1100.
 - 3) Cast Copper: Comply with ASTM B584 Alloy C87600 or C84400.
 - c) End Connections:

- 1) Threaded: All threads shall conform to ASME B1.20.1.
- 2) Solder-Joint: Wrought-copper, ASME B16.18 or B16.22, streamlined pattern.
- 3) Flared Ends: Comply with ASME B16.26.

C. Joining Materials:

1. Reference Division 23 Section “Basic Piping Materials and Methods” for basic joining materials.
 1. Joining Tools: Approved by the mechanically joined piping system manufacturer for use with their system.
 2. Grooved Couplings: Multi-piece housing attached with bolts and nuts with pressure responsive elastomeric gasket, constructed of material specified under Article “Fittings” above and of the following styles.
 - a) Rigid Couplings: Designed with offsetting angle bolt pads to provide a rigid pipe joint to restrict axial or angular movement.
 - b) Flexible Couplings: Designed with flat bolt pads to provide a flexible pipe joint and accommodate a limited amount of linear and/or angular movement.
 - c) Reducing Couplings: Designed to include a direct pipe reduction on pipe run without additional components and includes steel washer to prevent telescoping of smaller pipe inside the larger pipe during a vertical system assembly.
 3. Coupling Bolts: Track-head type and constructed of the one of the following:
 - a) Type 304 or 316 stainless steel conforming to ASTM A193, Grade B8/B8M, Class 2 or ASTM F593 and F594, Group 2, Conditions CW.
 - b) Heat treated carbon steel conforming to ASTM A183 and A449, zinc electroplated to ASTM B633, with a minimum tensile strength of 110,000 psi.
 4. Nuts: Heavy-duty hexagonal type conforming to ASTM A563, Grade B or ASTM A194, Grade 8M.
 5. Washers: Flat type, plated carbon steel conforming to ASTM F436 or Type 304 or 316 stainless steel.
 6. Grooved-Joint Gaskets:
 - a) Molded synthetic rubber (EPDM compound) with central cavity and pressure responsive configuration, integral pipe stop, and complying with ASTM D2000, Grade 2CA615A25B24F17Z.
 - b) Gasket Grade: Type “E” for hydronic applications. Coordinate the appropriate gasket grade with the manufacturer for other applications.
 - c) Identification: Tagged with the appropriate color code to indicate the application.
 - d) Temperature operating range: -30 degrees F to +230 degrees F.

7. Flange Adapters:
 - a) Cast-Bronze Flanges: ASME B16.24, raised ground face, bolt holes spot faced.
 - b) Wrought Cast-Iron, Forged Steel, and Stainless Steel: ASME B16.5, including bolts, nuts, and gaskets of the following material group, end connection, and facing:
 - 1) Material Group: 1.1.
 - 2) Facings: Raised face.
 - c) Gaskets: ASME B16.21, non-metallic, asbestos free, 1/8 inch thick, full-face for cast-iron flanges and raised-face steel flanges, suitable for chemical, thermal, and dielectric conditions of piping system contents.
 - d) Flange bolts and nuts: ASME B18.2.1, hex head carbon steel according to ASTM A307, Grade B.
8. Pipe Transition Adapters:
 - a) Constructed of material, size, and end connection to join different pipe materials or joining methods.
 - b) Adapter shall be listed according to the manufacturer's literature for the application and joining methods.
 - c) Reference Division 23 Section "Basic Piping Materials and Methods" for dielectric fittings.
9. Press Couplings: Single-piece housing with self-contained O-ring seals in the end connections. O-ring seals shall comply with the following:
 - a) EPDM compound conforming to ASME B16.51.
 - b) Type "E" EPDM compound complying with ASTM D2000, Grade 2CA615A25B24F17Z.
 - c) Identification: Tagged with the appropriate color code to indicate the application.
 - d) Temperature operating range: -30 degrees F to +230 degrees F.

D. General Duty Valves and Hydronic Specialties:

1. Acceptable manufacturers listed within this specification may have comparable products which comply with the product specifications referenced in the sections below. These products are acceptable provided they meet the specified requirements and are compatible with the piping system. Reference the Valve and Hydronic Specialties Schedule in Part 3 for examples of acceptable products and design intent. Refer to manufacturer's current literature for comparable products, sizes, pressure ratings, and connection methods compatible with the piping system. Products identified by model number are based on available size and pressure ranges from that manufacturer. Products offered by manufacturers with extended ranges are acceptable provided they meet the specified requirements.

2. Reference Division 23 Section “General Duty Valves for HVAC Piping” for general duty valve requirements.
 3. Reference Division 23 Section “Hydronic Specialties” for hydronic specialty requirements.
- E. Expansion Joints:
1. Reference Division 23 Section “Expansion Fittings and Loops for HVAC” for expansion joint requirements.
 2. Select expansion joint and support method in accordance with design conditions and performance data published in manufacturer’s literature using the following types:
 - a) Slip Type: Victaulic Style 150 Mover telescoping slip type or approved equal.
 - b) Standard Expansion Type: Style 155 expansion joint consisting of a series of flexible couplings joined in tandem or approved equal.

2.02 CARBON STEEL GROOVED PIPING SYSTEM

- A. Manufacturers:
1. ASC Engineered Solutions.
 2. Shurjoint Piping Products.
 3. Victaulic Company of America.
- B. Carbon Steel Pipe:
1. NPS 10 inch and Smaller: ASTM A53 or A106, Type E electric-resistance welded or Type S seamless, Grade B, Schedule 40, black steel, plain ends.

2.03 COPPER GROOVED PIPING SYSTEM

- A. Manufacturers:
1. ASC Engineered Solutions.
 2. Shurjoint Piping Products.
 3. Victaulic Company of America.
- B. Copper Tubing:
1. Copper Tube Size (CTS), ASTM B88 Type L, hard-drawn.

2.04 STAINLESS STEEL GROOVED PIPING SYSTEM

- A. Manufacturers:
1. ASC Engineered Solutions.
 2. Shurjoint Piping Products.
 3. Victaulic Company of America.
- B. Stainless Steel Pipe:

1. NPS 2 inch and Smaller: ASTM A312, Type 304 or 316, Schedule 10S, plain ends.
2. NPS 2-1/2 inch and larger: ASTM A312, Type 304 or 316, Schedule 10S, plain or beveled ends.

2.05 COPPER PRESS-FIT PIPING SYSTEM (CTS)

A. Manufacturers:

1. ASC Engineered Solutions “Gruvlok.”
2. Apollo “Xpress”.
3. Mueller Streamline PRS.
4. NIBCO, Inc., Press System.
5. Viega, ProPress.

B. Copper Tubing:

1. CTS 3/4 inch through 4 inch: ASTM B88 Type L, hard-drawn.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Install products in accordance with manufacturer’s instructions.
- B. Install piping to ASME B31.9 requirements.
- C. Reference Division 23 Section “Basic Piping Materials and Methods” for general piping installation requirements.
- D. Reference Division 23 Section “General Duty Valves for HVAC Piping” for general duty valve installation requirements.
- E. Reference Division 23 Section “Hydronic Specialties” for hydronic specialty installation requirements.

3.02 PIPE APPLICATION SCHEDULE

A. Heating Hot Water System:

1. Carbon Steel Grooved: 2 inch and larger.
2. Copper Grooved: 2 inch through 8 inch.
3. Stainless Steel Grooved: 2 inch and larger.
4. Copper Press-Fit: 3/4 inch through 4 inch.
5. Fitting Pressure Class: Minimum rating of 150 psig.

B. Chilled Water system

1. Carbon Steel Grooved: 2 inch and larger.
2. Copper Grooved: 2 inch through 8 inch.

3. Stainless Steel Grooved: 2 inch and larger.
 4. Copper Press-Fit: 3/4 inch through 4 inch.
 5. Fitting Pressure Class: Minimum rating of 150 psig.
- C. Use stainless steel couplings and fittings where design conditions require the use of non-ferrous piping materials for both interior and exterior piping surfaces.

3.03 PREPARATION

- A. Remove scale and dirt on inside and outside before assembly.
- B. Verify pipe and tube ends are free from indentations, projections, and roll marks in the area from tube end to groove from proper gasket sealing.
- C. Prepare piping connections to equipment using jointing system specified.
- D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.04 PIPING INSTALLATIONS

- A. Hydronic piping installations shall be installed subject to Division 23 Section “Hydronic Piping” in addition to those requirements specified in this Section.

3.05 PIPE HANGERS AND SUPPORTS APPLICATION

- A. Comply with the requirements of Division 23 Section “Hangers and Supports for HVAC Piping and Equipment.”

3.06 PIPE JOINT CONSTRUCTION

- A. Reference Division 23 Section “Basic Piping Materials and Methods” for basic pipe joint construction.
- B. Where more than one pipe material is specified, provide joining fittings or pipe transition adapters with appropriate dielectric isolation that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
- C. Grooved Joints:
 1. Ream, debur, and clean tube ends and verify they are free from indentations, projections and roll marks in the area from tube end to groove for proper gasket sealing.
 2. Roll and cut groove ends in accordance to manufacturer’s current listed standards and according to AWWA C606. Use rolls sets designed and intended for use on the appropriate pipe material when grooving pipe.
 - a) Victaulic Advanced Groove System (AGS) pipe ends are an acceptable alternate. If Victaulic AGS grooved system is used, all

couplings, adapters, fittings, and valves shall be compatible with AGS grooved ends.

- b) Do not use cut groove ends in copper tubing, roll groove only.
 - c) Do not use cut groove ends in stainless steel pipe, roll groove only.
3. Verify tolerances of and maintain grooving tool components for duration of grooving processes. Replace grooving tool components that are found out of tolerance with new as required.
 4. Flaring of CTS tube ends to IPS dimensions or to accommodate alternate sized couplings is not allowed.
 5. Verify the gasket style and elastomeric material (grade) is suitable for the intended service as specified and in combination with any system chemical additives.
 6. Reference latest published manufacturer's product data for additional pressure ratings and application information.
 7. Reference the latest published of manufacturer's field installation instructions or other included installation instruction prior to attempting assembly.
 8. Install gaskets with lubricant suitable for all piping services. Lubricant shall be by one manufacturer.

D. Press-Fit Joints:

1. Install press piping system in accordance with manufacturer's recommendations.
2. Ream, debur, and clean tube ends and verify they are free from indentations, projections, burrs and foreign matter.
3. Install permanent inspection mark on tube.
4. Clean tube and fittings of all dirt and oil. Verify O-ring is in place and free of oil, grease or dirt.
5. Push pipe or tube into fittings with twisting action to all the way to the fitting stop or shoulder.
6. Mark tube with permanent marker to indicate proper tube insertion depth.
7. Verify press tool has correct size jaw set for tube size used.
8. Complete one tool cycle with empty jaw to calibrate tool for each time new jaw is inserted into tool.
9. Squeeze jaw arms to open tool jaws and place jaws around the contour of the fitting. Verify tool is perpendicular to the fitting and depress tool switch.
10. Squeeze jaw open to remove the tool and observe witness mark.
11. Verify crimped fitting connection for misalignment of the copper tube, misalignment of the tool or improper insertion of the tube. If any of these conditions are found cut out the joint and provide a new joint.
12. Maintain minimum distance between joints per the manufacturer's published installation instructions.

E. Stainless Steel to Copper Systems:

1. Stainless steel 4 inch and smaller to copper 2 inches and smaller:
 - a) Stainless steel reducing tee with 2 inch grooved side outlet.

- b) Stainless steel rigid coupling, dielectric waterway adapter and CTS rigid coupling.
 - c) Contractors Option (in lieu of above) - 2 inch rigid CTS adapter coupling, 2 inch grooved X copper plain adapter (size as required).
 - 2. Stainless steel 6 inch and larger to copper 2 inches and smaller:
 - a) Stainless steel tee and welded pipet with 2 inch welded outlet.
 - b) 2 inch schedule 40 stainless steel short nipple with grooved and plain ends. Weld nipple to pipet.
 - c) Stainless steel rigid coupling, dielectric waterway adapter and CTS rigid coupling.
 - d) Contractors Option (in lieu of above) - Stainless steel reducing tee with 2 inch grooved side outlet, 2 inch rigid CTS adapter coupling, 2 inch grooved X copper plain adapter (size as required).
 - 3. Stainless steel 6 inch and larger to copper 2-1/2 inches to 4 inches:
 - a) Stainless steel tee or reducing tee with grooved side outlet:
 - b) Stainless steel rigid coupling, dielectric waterway adapter and CTS rigid coupling.
 - c) Contractors Option (in lieu of above):
 - 1) Rigid CTS adapter coupling, grooved X copper plain adapter (size as required).
 - 2) Grooved X stainless steel flange adapter nipple (X = size as required), bronze flange and dielectric flange kit.
 - 4. Stainless steel to copper 6 inches to 8 inches:
 - a) Stainless steel tee or reducing tee with grooved side outlet.
 - b) Stainless steel rigid coupling.
 - c) Grooved X stainless steel flange adapter nipple (X = size as required).
 - d) Bronze flange and dielectric flange kit.
- F. Dielectric Isolation Requirements: Refer to Division 23 Section “Basic Piping Materials and Methods” for dielectric fittings and their installation requirements. Provide dielectric flanges, flange kits, or dielectric transition couplings for the following joint types:
- 1. Flange Adapters to Iron, Ductile Iron or Steel Body Valves or Fittings (Except Butterfly Valves): Provide full face gaskets between flanges and adapter flanges. At each bolt, provide steel washers, thermoplastic washers and bolt isolation sleeves or thermoplastic combination washers and bolt sleeves on valve and adapter flanges.
 - 2. Flange Adapters to Butterfly Valves in Series with Iron, Ductile Iron or Steel Body Valves or Fittings: At each bolt, provide stainless steel washers, thermoplastic washers and bolt isolation sleeves or thermoplastic combination washers and bolt sleeves on adapter flange. Provide stainless steel bolts on butterfly valve flange.

3. Flange Adapters to Butterfly Valves in Copper Tubing: Install flat washers at each bolt on adapter flange. Provide full face gasket only for butterfly valves without integral liner acting as a gasket.
4. Dielectric Transition Couplings: Provide dielectric transition coupling when connecting copper pipe to butterfly valves. Provide dielectric transition coupling when connecting grooved IPS pipe to CTS pipe.

G. Couplings:

1. Install rigid couplings unless noted otherwise.
2. Install flexible couplings at locations required to accommodate expansion and/or vibration isolation.
 - a) Install flexible couplings at pumps.
 - b) Install flexible couplings at expansion joints.
 - c) Install three flexible couplings at mechanical equipment connections for noise and vibration reduction in lieu of flexible connectors if preferred.
3. Install reducing couplings at reductions in pipe size.
4. Install boltless security couplings where noted on the plans.
5. Install press couplings in conjunction with the appropriate press piping system.

H. Flange Adapters:

1. Install flange adapter washers when flange adapters are used against the following surfaces:
 - a) Rubber.
 - b) Adapting to ANSI/AWWA cast flanges.
 - c) Rubber faced lug valves.
 - d) Serrated flanged surfaces.
2. Do not install flange adapters for applications that incorporate tie rods for anchoring or on standard grooved-end fittings within 90 degrees of each other.

I. Miscellaneous Connections:

1. Install test caps for temporary use during piping system testing activities. Test caps shall not be permanently installed in the piping system.
2. Test caps may be reused within the maximum test pressure and provided the product remains undamaged. Inspect and verify the suitability for service of all test caps prior to installation and use.
3. Connect test caps to piping system with Victaulic Style 107N or equivalent rigid coupling.
4. Test cap may be used for filling, testing, or draining purposes by connecting to the NPT outlet of the integral ball valve.
5. Install blind flanges with separate means to fill, test, or drain system for testing if test caps are not available from manufacturer.

3.07 VALVE AND HYDRONIC SPECIALTIES SCHEDULE

- A. Reference Division 23 Section “General Duty Valves for HVAC Piping” for general duty valve applications.
- B. Valve and Hydronic Specialties Schedule: The following schedule references Victaulic model numbers as examples of acceptable products and design intent.

1. Carbon Steel Grooved Piping System:

<u>Valve or Specialty Type</u>	<u>Model/Series Number</u>
Iron Ball Valve	726
Iron Butterfly Valve	761
Iron Swing Check	712
Iron Lift Check	716
Iron Venturi Check	779
Balancing Valve	785 through 789
Coil Kits	799 or 79V
T-Strainer	730
Y-Strainer	732
Suction Diffuser	731

2. Copper Grooved Piping System:

<u>Valve or Specialty Type</u>	<u>Model/Series Number</u>
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3. Brass Butterfly Valve 608NStainless Steel Grooved Piping System:

<u>Valve or Specialty Type</u>	<u>Model/Series Number</u>
Stainless Steel Ball Valve	726S
Stainless Steel Butterfly Valve	461N
Stainless Steel Swing Check	416 or 712S P569

4. Copper Press-Fit Piping System:

<u>Valve or Specialty Type</u>	<u>Model/Series Number</u>
Bronze Ball Valve	*Nibco PC585-70-66
Bronze Gate Valve	*Nibco PF111
Bronze Globe Valve	*Nibco PF211
Bronze Swing Check	*Nibco PF413 or PF480

3.08 HYDRONIC SPECIALTIES INSTALLATION

- A. Reference Division 23 Section “Hydronic Piping Specialties” for product requirements.
- B. Strainers:
 - 1. Provide copper press to connect X screwed NPT adapters for 2 inches and smaller.
 - 2. Provide press to connect adapter flanges for 2-1/2 inches to 4 inches.
 - 3. Provide copper grooved adapter flanges for 2-1/2 inches to 8 inches.

3.09 EXPANSION JOINT INSTALLATION

- A. Provide expansion joints where indicated. Expansion joints and their installation requirements are specified in Division 23 Section “Expansion Fittings and Loops for HVAC Piping”.
 - 1. Provide with copper press to connect ends or copper press to connect X screwed NPT adapters for 2 inches and smaller.
 - 2. Provide with copper press to connect ends or press to connect adapter flanges for 2-1/2 inches to 4 inches.
 - 3. Provide copper grooved adapter flanges for 2-1/2 inches to 8 inches.
- B. As a contractor’s option and where field conditions allow, provide expansion joints consisting of an assembly of flexible couplings: Fabricated from a combination of couplings and nipples with rolled groove short type “K” or “L” copper tube nipples and flexible CTS couplings. Install with removable ties to hold joint compressed or expanded during piping fabrication. Provide the same gaskets as specified above for rigid couplings. Provide expansion joints of an assembly of flexible couplings with displacement identical expansion joints as indicated.

3.010 EQUIPMENT CONNECTIONS

- A. Grooved flexible style couplings may be used at equipment connections where specified for vibration isolation control only.
- B. Press to connect joints shall not be provided for equipment connections. Provide flanges, unions, di-electric unions or waterway fittings. Flanges, unions, di-electric unions and waterway fittings are specified in Division 23 Section “Basic Piping Materials and Methods.”

3.011 FIELD QUALITY CONTROL

- A. Reference Division 23 Section “Hydronic Piping” for field quality control requirements in addition to those specified herein.
- B. The following procedures are paraphrased from the ASME B31.9, code for pressure piping, building services piping.
- C. The mechanically joined piping system manufacturer’s factory trained representative shall provide on-site training for contractor’s field personnel in the use of grooving tools and installation of grooved joint products.
- D. Installing contractor shall schedule training session at project site for all workers that will be installing or handling the grooved piping system. Submit certification letter along with list of attendees to Engineer of Record within 30-days of mobilization. Include copy of certification letter with closeout documents.

- E. Grooved piping supplier shall provide certification training to Contractor without cost and without additional cost to Owner.
- F. Provide testing procedures as defined in Division 23 Section “Hydronic Piping” and as specified in grooved mechanical piping manufacturer’s installation instructions.
- G. The grooved coupling manufacturer’s factory trained representative shall periodically visit the jobsite and review the installation to verify that the contractor is following best recommended practices in grooved product installation.
- H. Installing contractor shall visually inspect couplings and repair or replace any misaligned couplings and couplings with gaps prior to calling for substantial completion review as defined in Division 23 Section “Common Work Results for HVAC.”

3.012 ADJUSTING AND CLEANING

- A. Reference Division 23 Section “Hydronic Piping” for adjusting and cleaning procedures.

3.013 STARTUP

- A. Reference Division 23 Section “Hydronic Piping” for startup procedures.

END OF SECTION