SECTION 230503 - PIPES AND TUBES FOR HVAC PIPING AND EQUIPMENT

This Section includes pipe materials and fittings normally encountered in HVAC piping systems and common to more than one section in this Division.

This section is intended to be used as standalone section to specify pipe materials and fittings for entire Division. When this section is used, suggest deleting piping specifications in individual piping system specification sections and reference this Section.

Refrigerant piping is contained in SpecText Section 232300. Piping for site utilities may be included in applicable site utility sections or included in this section. Piping for underground services such as hot water, chilled water, steam, steam condensate, and fuel oil are included in SpecText Section 336100, Section 336300 and Section 335213.

Manufacturers found in SpecAgent for this Section were identified as representative and not as an endorsement for meeting requirements of this Specification.

This Section includes performance, proprietary, and descriptive specifications. Edit to avoid conflicting requirements.

This Section may include term "Architect/Engineer." "Architect" is used in AIA contract documents; "Engineer" is used in EJCDC contract documents. Retain appropriate term.

See Drawing Coordination Checklist and Evaluations for information needed to coordinate this Specification Section with Drawings.

1. GENERAL
   * + 1. SUMMARY
          1. Section Includes: Pipe and pipe fittings for the following systems:

Pool condenser water piping.

Heating water piping.

Glycol piping.

Chilled water piping.

Condenser water piping.

Radiant heating piping.

Equipment drains and over flows.

Engine exhaust.

Low pressure steam piping.

Low pressure steam condensate piping.

Medium and high pressure steam piping.

Medium and high pressure steam condensate piping.

Fuel oil piping.

Fuel oil protector piping.

Fuel oil piping underground containment system.

Natural gas piping.

LPG gas piping.

Unions and flanges.

Underground pipe markers.

Bedding and cover materials.

* + - * 1. Related Sections:

Use the following reference when firestopping is specified in Division 07.

Section 078400 - Firestopping: Product requirements for firestopping for placement by this section.

Section 083113 - Access Doors and Frames: Product requirements for access doors for placement by this section.

Section 099000 - Painting and Coating: Product and execution requirements for painting specified by this section.

Section 230516 - Expansion Fittings and Loops for HVAC Piping Piping Expansion Compensation: Product requirements for piping expansion compensation devices for placement by this section.

Section 230523 - General-Duty Valves for HVAC Piping: Product requirements for valves for placement by this section.

Retain choice in the following paragraph when firestopping is specified in this Division.

Section 230529 - Hangers and Supports for HVAC Piping and Equipment: Product requirements for pipe hangers and supports [**and firestopping**] for placement by this section.

Section 230548 - Vibration and Seismic Controls for HVAC Piping and Equipment: Product requirements for vibration isolation for placement by this section.

Section 230700 - HVAC Insulation: Product requirements for piping insulation for placement by this section.

Section 232116 - Hydronic Piping Specialties: Product requirements for hydronic piping specialties for placement by this section.

Section 232216 - Steam and Condensate Piping Specialties: Product requirements for steam and condensate piping specialties for placement by this section.

Section 310516 - Aggregates for Earthwork: Aggregate for backfill in trenches.

Section 312316 - Excavation: Product and execution requirements for excavation and backfill required by this section.

Section 312316.13 - Trenching: Execution requirements for trenching for underground piping systems.

Section 312323 - Fill: Execution requirements for backfilling required by this section.

Edit the following paragraphs to include appropriate site utility piping sections when site piping is specified in those sections. Delete the piping materials in the appropriate PART 2 listings.

Section 335100 - Natural-Gas Distribution: Product and execution requirements for site natural gas distribution systems.

Section 335213 - Fuel-Oil Distribution: Product and execution requirements for factory insulated piping for use with oil distribution systems in underground applications.

Section 336100 - Hydronic Energy Distribution: Factory insulated piping for use with hydronic distribution systems in below ground applications.

Section 336300 - Steam Energy Distribution: Factory insulated piping for use with steam distribution systems in below ground applications.

* + - 1. REFERENCES

List reference standards included within text of this section. Edit the following for Project conditions.

* + - * 1. American Society of Mechanical Engineers:

ASME B16.3 - Malleable Iron Threaded Fittings.

ASME B16.4 - Gray Iron Threaded Fittings.

ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings.

ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

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

ASME B31.1 - Power Piping.

ASME B31.9 - Building Services Piping.

ASME B36.10M - Welded and Seamless Wrought Steel Pipe.

ASME Section IX - Boiler and Pressure Vessel Code - Welding and Brazing Qualifications.

* + - * 1. ASTM International:

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

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

ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.

ASTM A536 - Standard Specification for Ductile Iron Castings.

ASTM B32 - Standard Specification for Solder Metal.

ASTM B68 - Standard Specification for Seamless Copper Tube, Bright Annealed.

ASTM B75 - Standard Specification for Seamless Copper Tube.

ASTM B88 - Standard Specification for Seamless Copper Water Tube.

ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service.

ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications.

ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.

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

ASTM D2241 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter.

ASTM D2310 - Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

ASTM D2464 - Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

ASTM D2466 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.

ASTM D2467 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

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

ASTM D2661 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings.

ASTM D2751 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.

ASTM D2846/D2846M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems.

ASTM D2855 - Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.

ASTM D2996 - Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

ASTM F437 - Standard Specification for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

ASTM F438 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.

ASTM F439 - Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

ASTM F441/F441M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

ASTM F493 - Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.

ASTM F876 - Standard Specification for Crosslinked Polyethylene (PEX) Tubing.

ASTM F877 - Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot-and Cold-Water Distribution Systems.

ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications.

* + - * 1. American Welding Society:

AWS A5.8 - Specification for Filler Metals for Brazing and Braze Welding.

AWS D1.1 - Structural Welding Code - Steel.

* + - * 1. American Water Works Association:

AWWA C105 - American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems.

AWWA C110 - American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids.

AWWA C111 - American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

AWWA C151 - American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water.

* + - * 1. National Fire Protection Association:

NFPA 30 - Flammable and Combustible Liquids Code.

NFPA 31 - Standard for the Installation of Oil-Burning Equipment.

NFPA 54 - National Fuel Gas Code.

NFPA 58 - Liquefied Petroleum Gas Code.

* + - 1. SUBMITTALS

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        2. Manufacturer’s installation instructions shall be provided along with product data.
        3. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
        4. Section 013300 - Submittal Procedures: Submittal procedures.
        5. Shop Drawings: Indicate layout of piping systems, including equipment, critical dimensions, and sizes.
        6. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

USE PARAGRAPH BELOW WITH EPD REQUIREMENT WHEN PROJECT ESTIMATE IS $1M OR MORE.

* + - * 1. Submit an Environmental Product Declaration (EPD) from the manufacturer for steel pipe within this specification section, if available. A statement of the contractor’s good faith effort to obtain the EPD shall be provided if not available.

Manufacturer-provided EPDs must be Product Specific Type III (Third-Party Reviewed), in adherence with ISO 14025 *Environmental labels and declarations*, ISO 14044 *Environmental management – Life cycle assessment*, and ISO 21930 *Core rules for environmental product declarations of construction products and services.*

Include the following paragraph when Contractor is responsible for pipe sizing.

* + - * 1. Design Data: Indicate pipe sizes.
        2. Welders' Certificate: Include welders' certification of compliance with [**ASME Section IX.**] [**AWS D1.1.**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**>
        3. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
        4. Manufacturer’s installation instructions shall be provided along with product data.
        5. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
      1. QUALITY ASSURANCE
         1. Perform Work in accordance with [**ASME B31.1**] [**ASME B31.9**] code for installation of piping systems and ASME Section IX “Welding and Brazing Qualifications” for welding materials and procedures.
      2. QUALIFICATIONS
         1. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum [**three**] <**\_\_\_\_\_\_\_\_**> years [**documented**] experience.
         2. Installer: Company specializing in performing work of this section [**with minimum <\_\_\_\_\_\_\_\_> years [documented] experience**] [**approved by manufacturer**].
      3. PRE-INSTALLATION MEETINGS
         1. Section 013000 - Administrative Requirements: Pre-installation meeting.
         2. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> week prior to commencing work of this section.
      4. DELIVERY, STORAGE, AND HANDLING
         1. Requirements for transporting, handling, storing, and protecting products.
         2. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
         3. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
      5. ENVIRONMENTAL REQUIREMENTS
         1. Product Requirements: Environmental conditions affecting products on site.
         2. Do not install underground piping when bedding is wet or frozen.
      6. FIELD MEASUREMENTS
         1. Verify field measurements prior to fabrication.
      7. COORDINATION
         1. Section 013000 - Administrative Requirements: Requirements for coordination.
         2. Coordinate installation of buried piping with trenching.

1. PRODUCTS
   * + 1. POOL CONDENSER WATER PIPING
          1. CPVC Pipe: ASTM F441/F441M “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80”, Schedule 40 or Schedule 80, chlorinated polyvinyl chloride (CPVC) material.

Fittings: [**ASTM F438, CPVC, Schedule 40, socket type.**] [**ASTM F439, CPVC, Schedule 80, socket type.**] [**ASTM F437, CPVC, Schedule 80, threaded.**]

Joints: ASTM D2846/D2846M “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems”, solvent weld with ASTM F493 “Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings” solvent cement.

* + - 1. HEATING WATER [**AND GLYCOL**] PIPING, BURIED
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and over,**] black [**with AWWA C105 polyethylene jacket, or double layer, half-lapped 10 mil polyethylene tape**].

Fittings: ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, forged steel welding type [**with double layer, half-lapped 10 mil polyethylene tape**].

Joints: Welded.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] annealed.

Fittings: ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings”, wrought copper.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - 1. HEATING WATER [**AND GLYCOL**] PIPING, ABOVE GROUND
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and larger,**] black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings”, malleable iron or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, forged steel welding type.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - * 1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and larger,**] black, [**cut**] [**rolled**] grooved ends.

Fittings: [**ASTM A395/A395M and ASTM A536 ductile iron,**] [**or**] [**ASTM A234/A234M carbon steel,**] grooved ends.

Joints: Grooved mechanical couplings meeting ASTM F1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”.

Housing Clamps: ASTM A395/A395M “Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures” and ASTM A536 “Standard Specification for Ductile Iron Castings” ductile iron, [**enamel coated**] [**hot dipped galvanized**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>, compatible with steel piping sizes, [**rigid**] [**or**] [**flexible**] type.

Gasket: Elastomer composition for operating temperature range from [**-30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**>degrees F.

Accessories: [**Steel**] [**Stainless steel**] bolts, nuts, and washers.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] [**M,**] drawn.

Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings”, cast brass, or ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings” solder wrought copper.

The following is proprietary fitting method; delete or edit for Project conditions.

Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**M,**] [**L,**] [**K,**] drawn, rolled grooved ends.

Fittings: [**ASME B16.18 cast copper alloy,**] [**or**] [**ASME B16.22 wrought copper and bronze,**] [**or**] [**ASTM B584 bronze sand castings,**] grooved ends.

Joints: Grooved mechanical couplings meeting ASTM F1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”.

Housing Clamps: ASTM A395/A395M “Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures” and ASTM A536 “Standard Specification for Ductile Iron Castings” ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.

Gasket: Elastomer composition for operating temperature range from [**-30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

Accessories: [**Steel**] [**Stainless steel**] bolts, nuts, and washers.

* + - 1. CHILLED WATER PIPING, BURIED
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and over,**] black [**with AWWA C105 polyethylene jacket, or double layer, half-lapped 10 mil polyethylene tape**].

Fittings: ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” forged steel welding type [**with double layer, half-lapped 10 mil polyethylene tape**].

Joints: Welded.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K**] [**L**] annealed.

Fittings: ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings”, wrought copper.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - * 1. Ductile Iron Pipe: AWWA C151 “American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water”.

Fittings: AWWA C110 “American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in.. (75 mm through 1200 mm), for Water and Other Liquids”, ductile iron, standard thickness.

Joints: AWWA C111 “American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings”, rubber gasket with 3/4 inch diameter rods.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40, [**and Schedule 80 for sizes 8 inch and larger,**] or ASTM D2241 “Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter”, SDR 21 or 26, polyvinyl chloride (PVC) material.

Fittings: [**ASTM D2466, Schedule 40, PVC**] [**ASTM D2467, Schedule 80, PVC**] [**ASTM D2464 PVC, threaded**].

Joints: ASTM D2855 “Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems” solvent cement.

* + - * 1. Fiberglass Pipe: ASTM D2310 “Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe”, glass fiber reinforced thermosetting resin material.

Fittings: Fiberglass reinforced epoxy.

Joints: [**Hub-and-spigot with rubber gasket.**] [**Non-threaded, union or flanged coupling.**]

* + - 1. CHILLED WATER PIPING, ABOVE GROUND
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and larger,**] black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings”, malleable iron or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, forged steel welding type.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - * 1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” Schedule 40, black, [**cut**] [**rolled**] grooved ends.

Fittings: [**ASTM A395/A395M and ASTM A536 ductile iron,**] [**or**] [**ASTM A234/A234M carbon steel,**] grooved ends.

Joints: Grooved mechanical couplings meeting ASTM F1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”.

Housing Clamps: ASTM A395/A395M “Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures” and ASTM A536 “Standard Specification for Ductile Iron Castings” ductile iron, [**enamel coated**] [**hot dipped galvanized**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>, compatible with steel piping sizes, [**rigid**] [**or**] [**flexible**] type.

Gasket: Elastomer composition for operating temperature range from [**-30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

Accessories: [**Steel**] [**Stainless steel**] bolts, nuts, and washers.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] [**M,**] drawn.

Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings”, cast brass, or ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings”, solder wrought copper.

The following is proprietary fitting method; delete or edit for Project conditions.

Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**M,**] [**L,**] [**K,**] drawn, rolled grooved ends.

Fittings: [**ASME B16.18 cast copper alloy,**] [**or**] [**ASME B16.22 wrought copper and bronze,**] [**or**] [**ASTM B584 bronze sand castings,**] grooved ends.

Joints: Grooved mechanical couplings meeting ASTM F1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”.

Housing Clamps: ASTM A395/A395M “Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures” and ASTM A536 “Standard Specification for Ductile Iron Castings” ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.

Gasket: Elastomer composition for operating temperature range from [**-30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

Accessories: [**Steel**] [**Stainless steel**] bolts, nuts, and washers.

Plastics generally are not approved for use in fire rated assemblies or through fire separations or may require approved fire stops. Confirm use for this application.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40, [**and Schedule 80 for sizes 8 inch and larger,**] or ASTM D2241 “Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter”, SDR 21 or 26, polyvinyl chloride (PVC) material.

Fittings: [**ASTM D2466, Schedule 40, PVC**] [**ASTM D2467, Schedule 80, PVC**] [**ASTM D2464 PVC, threaded**].

Joints: ASTM D2855 “Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems” solvent cement.

* + - * 1. FRP Pipe: ASTM D2310 “Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe”, glass fiber reinforced thermosetting resin material.

Fittings: Fiberglass reinforced epoxy.

Joints: [**Hub-and-spigot with rubber gasket.**] [**Non-threaded, union or flanged coupling.**]

* + - 1. CONDENSER WATER PIPING, BURIED
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and larger,**] black [**with AWWA C105 polyethylene jacket, or double layer, half-lapped 10 mil polyethylene tape**].

Fittings: ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” forged steel welding type [**with double layer, half-lapped 10 mil polyethylene tape**].

Joints: Welded.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] annealed.

Fittings: ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings”, wrought copper.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - * 1. Ductile Iron Pipe: AWWA C151 “American National Standard for Ductile-Iron Pipe, Centrifugally Cast, for Water”.

Fittings: AWWA C110 “American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids”, ductile iron, standard thickness.

Joints: AWWA C111 “American National Standard for Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings”, rubber gasket with 3/4 inch diameter rods.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40, [**and Schedule 80 for sizes 8 inch and larger,**] or ASTM D2241 “Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter”, SDR 21 or 26, polyvinyl chloride (PVC) material.

Fittings: [**ASTM D2466, Schedule 40, PVC**] [**ASTM D2467, Schedule 80, PVC**] [**ASTM D2464 PVC, threaded**].

Joints: ASTM D2855 “Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems” solvent cement.

* + - * 1. FRP Pipe: ASTM D2310 “Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe”, glass fiber reinforced thermosetting resin material.

Fittings: Fiberglass reinforced epoxy.

Joints: [**Hub-and-spigot with rubber gasket.**] [**Non-threaded, union or flanged coupling.**]

* + - 1. CONDENSER WATER PIPING, ABOVE GROUND
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and larger,**] [**black.**] [**galvanized.**]

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings”, [**galvanized**] malleable iron or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, [**galvanized**] forged steel welding type.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - * 1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” Schedule 40, [**black**] [**galvanized**], [**cut**] [**rolled**] grooved ends.

Fittings: [**ASTM A395/A395M and ASTM A536 ductile iron,**] [**or**] [**ASTM A234/A234M carbon steel,**] grooved ends.

Joints: Grooved mechanical couplings meeting ASTM F1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”.

Housing Clamps: ASTM A395/A395M “Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures” and ASTM A536 “Standard Specification for Ductile Iron Castings” ductile iron, [**enamel coated**] [**hot dipped galvanized**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>, compatible with steel piping sizes, [**rigid**] [**or**] [**flexible**] type.

Gasket: Elastomer composition for operating temperature range from [**-30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

Accessories: [**Steel**] [**Stainless steel**] bolts, nuts, and washers.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**M and DWV,**] [**M,**] [**L,**] drawn.

Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings”, cast brass, or ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings” solder wrought copper.

The following is proprietary fitting method; delete or edit for Project conditions.

Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**M,**] [**L,**] [**K,**] drawn, rolled grooved ends.

Fittings: [**ASME B16.18 cast copper alloy,**] [**or**] [**ASME B16.22 wrought copper and bronze,**] [**or**] [**ASTM B584 bronze sand castings,**] grooved ends.

Joints: Grooved mechanical couplings meeting ASTM F1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”.

Housing Clamps: ASTM A395/A395M “Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures” and ASTM A536 “Standard Specification for Ductile Iron Castings” ductile iron, enamel coated, compatible with copper tubing sizes, to engage and lock designed to permit some angular deflection, contraction, and expansion.

Gasket: Elastomer composition for operating temperature range from [**-30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

Accessories: [**Steel**] [**Stainless steel**] bolts, nuts, and washers.

Plastics generally are not approved for use in fire rated assemblies or through fire separations or may require approved fire stops. Confirm use for this application.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40, [**and Schedule 80 for sizes 8 inch and larger,**] or ASTM D2241 “Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter”, SDR 21 or 26, polyvinyl chloride (PVC) material.

Fittings: [**ASTM D2466, Schedule 40, PVC**] [**ASTM D2467, Schedule 80, PVC**] [**ASTM D2464 PVC, threaded**].

Joints: ASTM D2855 “Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems” solvent cement.

* + - * 1. FRP Pipe: ASTM D2310 “Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe”, glass fiber reinforced thermosetting resin material.

Fittings: Fiberglass reinforced epoxy.

Joints: [**Hub-and-spigot with rubber gasket.**] [**Non-threaded, union or flanged coupling.**]

* + - 1. RADIANT HEATING PIPING
         1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] annealed.

Fittings: ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings”, wrought copper.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - * 1. Polyethylene Pipe: ASTM F876 “Standard Specification for Crosslinked Polyethylene (PEX) Tubing” and ASTM F877 “Standard Specification for Crosslinked Polyethylene (PEX) Plastic Hot-and Cold-Water Distribution Systems”, cross-linked polyethylene, 100 psig operating pressure at 180 degrees F.

Fittings: Brass and copper.

Joints: Mechanical compression fittings.

* + - * 1. Composite Polyethylene Pipe: Aluminum tube laminated between two layers of [**high density**] [**cross-linked**] polyethylene, [**150**] [**125**] <**\_\_\_\_\_\_\_\_**> psig operating pressure at maximum [**140**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

Fittings: Brass flared compression.

Joints: Fittings adapt to copper tubing or copper tube fittings, threaded pipe and fittings, and copper compression fittings.

* + - * 1. Hose: Composite hose with nitrile liner, braided fiber reinforcing, neoprene cover, 150 psig operating pressure at 205 degrees F.

Fittings: Copper.

Joints: Nipple with stainless steel clamp.

* + - 1. EQUIPMENT DRAINS AND OVERFLOWS
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” Schedule 40, galvanized.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings”, malleable iron or ASME B16.4 “Gray Iron Threaded Fittings”, cast iron.

Joints: Threaded for pipe 2 inch and smaller; flanged for pipe 2-1/2 inches and larger.

* + - * 1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” Schedule 40, galvanized, [**cut**] [**rolled**] grooved ends.

Fittings: [**ASTM A395/A395M and ASTM A536 ductile iron,**] [**or**] [**ASTM A234/A234M carbon steel,**] grooved ends.

Joints: Grooved mechanical couplings meeting ASTM F1476 “Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications”.

Housing Clamps: ASTM A395/A395M “Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures” and ASTM A536 “Standard Specification for Ductile Iron Castings” ductile iron, [**enamel coated**] [**hot dipped galvanized**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>, compatible with steel piping sizes, [**rigid**] [**or**] [**flexible**] type.

Gasket: Elastomer composition for operating temperature range from [**-30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

Accessories: [**Steel**] [**Stainless steel**] bolts, nuts, and washers.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**DWV,**] [**K,**] [**L,**] [**M,**] drawn.

Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings”, cast brass, or ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings” solder wrought copper.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: ASTM B32 “Standard Specification for Solder Metal”, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [**lead free**] solder.

Plastics generally are not approved for use in fire rated assemblies or through fire separations or may require approved fire stops. Confirm use for this application.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40, [**and Schedule 80 for sizes 8 inch and larger,**] or ASTM D2241 “Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter”, SDR 21 or 26, polyvinyl chloride (PVC) material.

Fittings: [**ASTM D2466, Schedule 40, PVC**] [**ASTM D2467, Schedule 80, PVC**] [**ASTM D2464 PVC, threaded**].

Joints: ASTM D2855 “Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems” solvent cement.

* + - * 1. ABS Pipe: ASTM D2680 or ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings”, Acrylonitrile-Butadiene-Styrene (ABS) material.

Fittings: ABS, ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings”.

Joints: ASTM D2235 “Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings”, solvent weld.

The following article may be used for flue and combustion air piping with certain types of boilers or water heaters.

* + - 1. FLUE AND COMBUSTION AIR PIPING
         1. PVC Pipe: ASTM D1785 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40, polyvinyl chloride (PVC) material.

Fittings: ASTM D2466 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40”, Schedule 40, PVC.

Joints: ASTM D2855 “Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems” solvent cement. Prime joints with a contrasting color.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 80, polyvinyl chloride (PVC) material.

Fittings: [**ASTM D2467, Schedule 80, PVC**] [**ASTM D2464 PVC, threaded**].

Joints: ASTM D2855 “Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems” solvent cement. Prime joints with a contrasting color.

* + - * 1. CPVC Pipe: ASTM F441/F441M “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80”, Schedule 40, chlorinated polyvinyl chloride (CPVC) material.

Fittings: ASTM F438 “Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40”, CPVC, Schedule 40, socket type.

Joints: ASTM D2846/D2846M “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems”, solvent weld with ASTM F493 “Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings” solvent cement. Prime joints with a contrasting color.

* + - * 1. CPVC Pipe: ASTM F441/F441M “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80”, Schedule 80, chlorinated polyvinyl chloride (CPVC) material.

Fittings: [**ASTM F439, CPVC, Schedule 80, socket type.**] [**ASTM F437, CPVC, Schedule 80, threaded.**]

Joints: ASTM D2846/D2846M “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems”, solvent weld with ASTM F493 “Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings” solvent cement. Prime joints with a contrasting color.

* + - * 1. ABS Pipe: ASTM D2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings”, Acrylonitrile-Butadiene-Styrene (ABS) material.

Fittings: ABS, ASTM D2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings”.

Joints: ASTM D2235 “Standard Specification for Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings”, solvent weld applied after cleaning.

* + - 1. ENGINE EXHAUST
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and larger,**] black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings”, malleable iron or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, forged steel welding type.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - 1. LOW PRESSURE STEAM PIPING, ABOVE GROUND (15 PSIG MAXIMUM)
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40, [**0.375 inch wall for sizes 12 inch and larger,**] black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings” malleable iron Class 125, or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” forged steel Class 125.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**M and DWV**] [**M**] [**L**], drawn.

Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings”, cast brass, or ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings” wrought copper.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - 1. LOW PRESSURE STEAM CONDENSATE PIPING, ABOVE GROUND
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 80, [**0.375 inch wall for sizes 12 inch and larger,**] black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings malleable iron Class 125, or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” forged steel Class 125.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type L, drawn.

Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings”, cast brass, or ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings” wrought copper.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - 1. MEDIUM AND HIGH PRESSURE STEAM PIPING, ABOVE GROUND - (150 PSIG MAXIMUM)
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 80, [**0.375 inch for sizes 16 inch and larger,**] black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings” malleable iron Class 250, or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” forged steel welding type, Class 300.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - 1. MEDIUM AND HIGH PRESSURE STEAM CONDENSATE PIPING, ABOVE GROUND
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 80, [**0.375 inch wall for sizes 12 inch and larger,**] black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings” malleable iron Class 250, or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” forged steel welding type, Class 300.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - 1. FUEL OIL PIPING - BURIED
         1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] [**M,**] [**drawn**] [**annealed**].

Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings” cast copper alloy or ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings” wrought copper or bronze.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] annealed.

Fittings: ASME B16.26 “Cast Copper Alloy Fittings for Flared Copper Tubes” cast bronze.

Joints: Flared.

* + - * 1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless”, Schedule 40 [**black**] [**galvanized**].

Fittings: ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, wrought carbon steel and alloy steel welding type.

Joints: [**ASME B31.1**] [**ASME B31.9**] welded.

Jacket: AWWA C105 “American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems” polyethylene or double layer, half-lapped 10 mil polyethylene tape.

* + - * 1. FRP: ASTM D2310 “Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe” and ASTM D2996 “Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe”, UL listed filament wound glass fiber reinforced epoxy pipe with integral epoxy liner and exterior coating.

Fittings: Compression molded, filament wound, fiberglass-reinforced epoxy.

Joints: Tapered bell and spigot adhesive bonded.

* + - 1. FUEL OIL PIPING - ABOVE GROUND
         1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] [**M,**] drawn.

Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings” cast copper alloy or ASME B16.22 “Wrought Copper and Copper Alloy Solder Joint Pressure Fittings” wrought copper and bronze.

ASTM B32 permits up to 0.1 percent lead content in solders not classified as containing lead.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, [lead free] solder**] [**AWS A5.8 Classification BCuP-3 or BCuP-4 silver braze.**]

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K,**] [**L,**] annealed.

Fittings: ASME B16.26 “Cast Copper Alloy Fittings for Flared Copper Tubes” cast bronze.

Joints: Flared.

* + - * 1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” or ASME B36.10M “Welded and Seamless Wrought Steel Pipe” Schedule 40 black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings”, malleable iron, or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” wrought carbon steel and alloy steel welding type.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - * 1. FRP: ASTM D2310 “Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe” and ASTM D2996 “Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe”, UL listed filament wound glass fiber reinforced epoxy pipe with integral epoxy liner and exterior coating.

Fittings: Compression molded, filament wound, fiberglass-reinforced epoxy.

Joints: Tapered bell and spigot adhesive bonded.

* + - 1. FUEL OIL PROTECTOR PIPING
         1. PVC Pipe: ASTM D1785 “Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40 or ASTM D2241 “Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter”, SDR 21 or 26, polyvinyl chloride (PVC) material.

Fittings: [**ASTM D2466, Schedule 40, PVC**] [**ASTM D2467, Schedule 80, PVC**] [**ASTM D2464 PVC, threaded**].

Joints: ASTM D2855 “Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems” solvent cement.

* + - 1. FUEL OIL PIPING UNDERGROUND CONTAINMENT SYSTEM

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

OPW, A Dover Company

Ronvanco Piping Systems

Approved equivalent.

* + - * 1. Substitutions: [**Section 016000 - Product Requirements**] [**Not permitted**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers' products specified above.

* + - * 1. FRP: ASTM D2310 “Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe” and ASTM D2996 “Standard Specification for Filament-Wound Fiberglass (Glass-Fiber-Reinforced Thermosetting Resin) Pipe”, UL listed filament wound glass fiber reinforced epoxy pipe with integral epoxy liner and exterior coating.

Fittings: Two piece, compression molded, filament wound glass fiber-reinforced epoxy.

Joints: Mechanical.

* + - 1. NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” Schedule 40 black.

Fittings: ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service” forged steel welding type.

Joints: ASME B31.9 “Building Services Piping”, welded.

Jacket: AWWA C105 “American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems” polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

* + - 1. NATURAL GAS PIPING, ABOVE GRADE
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” Schedule 40 black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings”, malleable iron, or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service forged steel welding type.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - * 1. Copper Tubing: [**ASTM B88 “**Standard Specification for Seamless Copper Water Tube”**, Type [K] or [L]**] [**ASTM B68 or ASTM B75**] [**ASTM B280, drawn**].

Fittings: ASME B16.26 “Cast Copper Alloy Fittings for Flared Copper Tubes” cast bronze, compression type.

Joints: Flared.

* + - 1. LPG GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” Schedule 40 black.

Fittings: ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service”, forged steel welding type.

Joints: ASME B31.9 “Building Services Piping”, welded.

Jacket: AWWA C105 “American National Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems” polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

* + - 1. LPG GAS PIPING, ABOVE GRADE
         1. Steel Pipe: ASTM A53/A53M “Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless” Schedule 40 black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings”, malleable iron, or ASTM A234/A234M “Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service forged steel welding type.

Joints: Threaded for pipe 2 inch and smaller; welded for pipe 2-1/2 inches and larger.

* + - * 1. Copper Tubing: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type [**K**] [**L**] annealed.

Fittings: ASME B16.26 “Cast Copper Alloy Fittings for Flared Copper Tubes”, cast bronze, compression type.

Joints: Flared.

* + - 1. UNIONS AND FLANGES
         1. Unions for Pipe 2 inches and Smaller:

Ferrous Piping: Class [**150**] [**250**] [**300**], malleable iron, threaded.

Copper Piping: Class 150, bronze unions with [**soldered**] [**brazed joints**].

Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

PVC Piping: PVC.

CPVC Piping: CPVC.

* + - * 1. Flanges for Pipe 2-1/2 inches and Larger:

Ferrous Piping: Class [**150**] [**250**] [**300**], forged steel, slip-on flanges.

Copper Piping: Class 150, slip-on bronze flanges.

PVC Piping: PVC flanges.

CPVC Piping: CPVC flanges.

Gaskets: 1/16 inch thick preformed neoprene gaskets.

* + - * 1. PVC Pipe Materials: For connections to equipment and valves with threaded connections, furnish solvent-weld socket to screwed joint adapters and unions, or ASTM D2464 “Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80”, Schedule 80, threaded, PVC pipe.
      1. UNDERGROUND PIPE MARKERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers:](http://www.specagent.com/Lookup?ulid=9748) Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:

Craftsmark Identification Systems

Seton Identification Products

W.H. Brady Products

Or equal.

* + - * 1. Substitutions: [**Section 016000 - Product Requirements**] [**Not permitted**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Edit the following descriptive specifications to identify project requirements and to eliminate conflicts with manufacturers' products specified above.

* + - * 1. Plastic Ribbon Tape: Bright colored, continuously printed, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

Consider the following paragraph for non-metallic pipe.

* + - * 1. Trace Wire: Magnetic detectable conductor, [**clear**] [**brightly colored**] plastic covering, imprinted with "[**Domestic Water Service**] [**Sewer Service**] <**\_\_\_\_\_\_\_\_**>" in large letters.
      1. BEDDING AND COVER MATERIALS

Select bedding and cover material type for Project conditions. When more than one type is required, edit the following paragraph. Caution: Utilize material "Type" coding from Section 310516 in this section for uniformity of reference.

* + - * 1. Bedding: Fill Type [**A1**] [**A2**] [**A3**] [**A4**] as specified in Section [**310516**] <**\_\_\_\_\_\_\_\_**>.
        2. Cover: Fill Type [**A1**] [**A2**] [**A3**] [**A4**], as specified in Section [**310516**] <**\_\_\_\_\_\_\_\_**>.
        3. Soil Backfill from Above Pipe to Finish Grade: Soil Type [**S1**] [**S2**], as specified in Section [**310516**] <**\_\_\_\_\_\_\_\_**>. [**Subsoil with no rocks over 6 inches in diameter, frozen earth or foreign matter.**]

1. EXECUTION
   * + 1. EXAMINATION
          1. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.
          2. Verify excavations are to required grade, dry, and not over-excavated.
          3. Verify trenches are ready to receive piping.
       2. PREPARATION
          1. Ream pipe and tube ends. Remove burrs. [**Bevel plain end ferrous pipe.**]
          2. Remove scale and dirt on inside and outside before assembly.
          3. Prepare piping connections to equipment with flanges or unions.
          4. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.
       3. INSTALLATION - BURIED PIPING SYSTEMS

Retain one of the following reference standards based on piping system applicable to project. Coordinate with Utility service provider requirements.

* + - * 1. Install natural gas piping in accordance with NFPA 54 “National Fuel Gas Code”, and utility service provider requirements for underground piping and all above ground piping up to utility service connection including natural gas meter and pressure reducing valve.
        2. Install LPG piping in accordance with NFPA 58 “Liquefied Petroleum Gas Code”.
        3. Install fuel oil piping in accordance with NFPA 30 “Flammable and Combustible Liquids Code”.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Verify connection [**to existing piping system**] <**\_\_\_\_\_\_\_\_**> size, location, and invert are as indicated on Drawings.
        2. Establish elevations of buried piping with not less than <**\_\_\_\_\_\_\_\_**> ft of cover.
        3. Establish minimum separation of <**\_\_\_\_\_\_\_\_**> from [**other services**] [**sanitary sewer piping**] <**\_\_\_\_\_\_\_\_**> piping in accordance with <**\_\_\_\_\_\_\_\_**> code.

Edit the following based on piping material used.

* + - * 1. Excavate pipe trench in accordance with Section [**312316.13**] <**\_\_\_\_\_\_\_\_**>.
        2. Install pipe to elevation [**as indicated on Drawings**] <**\_\_\_\_\_\_\_\_**>.
        3. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding [**4**] <**\_\_\_\_\_\_\_\_**> inches [**compacted**] [**loose**] depth; [**compact to [95] <\_\_\_\_\_\_\_\_> percent maximum density**].
        4. Install pipe on prepared bedding.
        5. Route pipe in straight line.
        6. When installing piping in PVC protector pipe install both carrier pipe and PVC pipe using long sweep elbows.
        7. Install pipe to allow for expansion and contraction without stressing pipe or joints.
        8. Install [**shutoff**] [**and**] [**drain**] valves at locations indicated on Drawings in accordance with [**this Section**] [**Section [230523] <\_\_\_\_\_\_\_\_>**].
        9. Install plastic ribbon tape continuous [**over top of pipe.**] [**buried [6] <\_\_\_\_\_\_\_\_> inches below finish grade,**] above pipe line; coordinate with Section [**312323**] [**312316.13**]. Refer to Section 230553.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

Use the following paragraph for non-metallic pipe.

* + - * 1. Install trace wire continuous [**over top of pipe.**] [**buried [6] <\_\_\_\_\_\_\_\_> inches below finish grade,**] above pipe line; coordinate with Section [**312323**] [**312316.13**]. Refer to Section 230553.
        2. Pipe Cover and Backfilling:

Backfill trench in accordance with Section [**312323.**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.**>

Maintain optimum moisture content of fill material to attain required compaction density.

After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in [**4**] [**6**] inches compacted layers to [**6**] [**12**] inches minimum cover over top of jacket. Compact to [**95**] <**\_\_\_\_\_\_\_\_**> percent maximum density.

Evenly and continuously backfill remaining trench depth in uniform layers with backfill material.

Do not use wheeled or tracked vehicles for tamping.

Use the following article for requirements common to more than one piping system.

* + - 1. INSTALLATION - ABOVE GROUND PIPING
         1. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
         2. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
         3. Group piping whenever practical at common elevations.
         4. Sleeve pipe passing through partitions, walls and floors. Refer to Section 230529.
         5. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 230516.
         6. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 230700.
         7. Provide access where valves and fittings are not accessible. [**Coordinate size and location of access doors with Section 083113.**]
         8. Install non-conducting dielectric connections wherever jointing dissimilar metals.
         9. Establish invert elevations, slopes for drainage to [**1/4**] [**1/8**] <**\_\_\_\_\_\_\_\_**> inch per foot minimum. Maintain gradients.
         10. Slope piping and arrange systems to drain at low points.
         11. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
         12. Install piping penetrating roofed areas to maintain integrity of roof assembly.
         13. Install valves in accordance with Section 230523.
         14. Install hydronic piping specialties in accordance with Section 232116.
         15. Install steam and condensate piping specialties in accordance with Section 232216.
         16. Insulate piping. Refer to Section 230700.
         17. Install pipe identification in accordance with Section 230553.

The following articles are for use with specific piping systems. Insert additional requirements as applicable. Installation requirements can be in accordance with referenced standards. Appropriate system piping section can be referenced and installation requirements can be specified in that section.

* + - 1. INSTALLATION - HEATING AND COOLING PIPING SYSTEMS
         1. [**Install [glycol,] [condenser water,] and [engine exhaust] piping in accordance with ASME B31.9.**]
         2. [**Install [heating water] [and] [chilled water] piping in accordance with [ASME B31.1] [ASME B31.9].**]
         3. [**Install [steam supply] [and] [steam condensate return] piping in accordance with [ASME B31.1] [ASME B31.9]**].

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. [**Install [glycol,] [condenser water,] [engine exhaust] [heating water] [chilled water] [steam supply] [and] [steam condensate return] piping systems in accordance with Section [232113] <\_\_\_\_\_\_\_\_>.**]

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - 1. INSTALLATION - ABOVEGROUND FUEL OIL PIPING
         1. Install fuel oil piping in accordance with NFPA 31 “Standard for the Installation of Oil-Burning Equipment”.
         2. Install fuel oil piping in accordance with Section [**231113**] <**\_\_\_\_\_\_\_\_**>.
         3. Provide non-conducting dielectric connections wherever jointing dissimilar metals. Install in accordance with NACE RP-01-69.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Install Work in accordance with [**[State] [Municipality] of <\_\_\_\_\_\_\_\_> [Highways] [Public Work's] standards.**]
      1. INSTALLATION - GAS PIPING SYSTEMS
         1. Install natural gas piping in accordance with NFPA 54 “National Fuel Gas Code”.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Install LPG piping in accordance with NFPA 58 “Liquefied Petroleum Gas Code”.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Install [**natural gas**] [**LPG**] piping systems in accordance with Section [**231123**] <**\_\_\_\_\_\_\_\_**>.
        2. Provide support for utility meters in accordance with requirements of utility company.
        3. Install vent piping from gas pressure reducing valves to outdoors and terminate in weatherproof hood.
        4. Install gas pressure regulator vent full size opening on regulator and [**terminate outdoors**] [**as indicated on Drawings**].
      1. FIELD QUALITY CONTROL
         1. Section [**014000 - Quality Requirements**] [**017000 - Execution and Closeout Requirements**]: Field inspecting, testing, adjusting, and balancing.
         2. Test [**heating water piping system**] [**glycol piping system**] [**chilled water piping system**] [**condenser water piping system**] in accordance with [**ASME B31.9**] [**ASME B31.1**].
         3. Test [**low pressure steam supply piping**] [**low pressure steam condensate piping**] [**medium and high pressure steam supply piping**] [**medium and high pressure steam condensate piping**] in accordance with [**ASME B31.9**] [**ASME B31.1**].
         4. Test [**heating water piping system**] [**glycol piping system**] [**chilled water piping system**] [**condenser water piping system**] in accordance with [**ASME B31.9**] [**ASME B31.1**].
         5. Test [**low pressure steam supply piping**] [**low pressure steam condensate piping**] [**medium and high pressure steam supply piping**] [**medium and high pressure steam condensate piping**] in accordance with [**ASME B31.9**] [**ASME B31.1**].
         6. Pressure test natural gas piping in accordance with NFPA 54 “National Fuel Gas Code”.

\*\*\*\*\*\* [OR] \*\*\*\*\*\*

* + - * 1. Pressure test LPG piping in accordance with NFPA 58 “Liquefied Petroleum Gas Code”.
        2. Pressure test [**fuel oil**] <**\_\_\_\_\_\_\_\_**> piping in accordance with NFPA 31 “Standard for the Installation of Oil-Burning Equipment”.
      1. CLEANING
         1. Execution and Closeout Requirements: Requirements for cleaning.
         2. After completion, fill, clean, and treat [**heating water piping system**] [**glycol piping system**] [**chilled water piping system**] [**condenser water piping system**]. Refer to Section [**232500**] <**\_\_\_\_\_\_\_\_**>.
         3. After completion, clean, and treat [**low pressure steam supply piping**] [**low pressure steam condensate piping**] [**medium and high pressure steam supply piping**] [**medium and high pressure steam condensate piping**]. Refer to Section [**232500**] <**\_\_\_\_\_\_\_\_**>.
         4. After completion, clean, and treat [**low pressure steam supply piping**] [**low pressure steam condensate piping**] [**medium and high pressure steam supply piping**] [**medium and high pressure steam condensate piping**]. Refer to Section [**232500**] <**\_\_\_\_\_\_\_\_**>.

END OF SECTION 230503