SECTION 221000 - PLUMBING PIPING

This Section includes pipe materials and fittings normally encountered in plumbing 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.

Piping for site utilities may be included in applicable site utilities sections or included in this Section.

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:

Domestic water piping[**, beyond 5 feet of building**] [**, within 5 feet of building**].

Sanitary sewer piping[**, beyond 5 feet of building**] [**, within 5 feet of building**].

Chemical resistant sewer piping.

Storm water piping[**, beyond 5 feet of building**] [**, within 5 feet of building**].

Pool water piping.

Equipment drains and over flows.

Compressed air piping.

Medical 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 078413 – Penetration 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 099114 and/or 099123 - Painting and Coating: Product and execution requirements for painting specified by this section.

Section 220516 - Expansion Fittings and Loops for Plumbing Piping: Product requirements for piping expansion compensation devices for placement by this section.

Section 220523 - General-Duty Valves for Plumbing Piping: Product requirements for valves for placement by this section.

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

Section 220529 - Hangers and Supports for Plumbing Piping and Equipment: Product requirements for pipe hangers and supports [**and firestopping**] for placement by this section.

Section 220548 - Vibration and Seismic Controls for Plumbing Piping and Equipment: Product requirements for vibration isolation for placement by this section.

Section 220700 - Plumbing Insulation: Product requirements for piping insulation for placement by this section.

Section 226113 - Medical Gas and Vacuum Systems: Product requirements for medical gas systems for placement by this section.

* + - 1. REFERENCES

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

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

ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings.

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 B16.23 - Cast Copper Alloy Solder Joint Drainage Fittings (DWV).

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

ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

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 A47 - Standard Specification for Ferritic Malleable Iron Castings.

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

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

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

ASTM A395 - 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 B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes.

ASTM B43 - Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

ASTM B75 - Standard Specification for Seamless Copper Tube.

ASTM B88 - Standard Specification for Seamless Copper Water Tube.

ASTM B251 - Standard Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.

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

ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes.

ASTM B306 - Standard Specification for Copper Drainage Tube (DWV).

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

ASTM C14 - Standard Specification for Concrete Sewer, Storm Drain, and Culvert Pipe.

ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.

ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.

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

ASTM C1053 - Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent (DWV) 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 D2239 - Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters.

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

ASTM D2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter.

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 D2513 - Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.

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

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

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

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

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

ASTM D2683 - Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing.

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

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

ASTM D2846 - 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 D2997 - Standard Specification for Centrifugally Cast Fiberglass (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.

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

ASTM D3035 - Standard Specification for Polyethylene (PE) Plastic Pipe (DR-PR) Based on Controlled Outside Diameter.

ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.

ASTM D3262 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

ASTM D3517 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe.

ASTM D3754 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.

ASTM D3840 - Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Fittings for Nonpressure Applications.

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 F442/F442M - Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR).

ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

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

ASTM F628 - Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core.

ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.

ASTM F1281 - Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe.

ASTM F1282 - Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe.

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 C104 - American National Standard for Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.

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.

AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution.

AWWA C901 - Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service.

AWWA C950 - Fiberglass Pressure Pipe.

* + - * 1. Cast Iron Soil Pipe Institute:

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

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

* + - * 1. National Fire Protection Association:

NFPA 99 - Standard for Health Care Facilities.

* + - 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. [**Submit shop drawings sealed by registered professional Director’s Representative.**]
				6. Product Data: Submit data on pipe materials and fittings. Submit manufacturers catalog information.

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

* + - * 1. Design Data: Indicate pipe sizes. Indicate pipe sizing methods. Indicate calculations used. [**Submit sizing methods sealed by registered professional Director’s Representative.**] [**Submit calculations sealed by registered professional Director’s Representative.**]
				2. Welders' Certificate: Include welders' certification of compliance with [**ASME Section IX**] [**AWS D1.1**] <**\_\_\_\_\_\_\_\_**>.
			1. QUALITY ASSURANCE
				1. Perform Work in accordance with ASME B31.9 “Building Services Piping” code for installation of piping systems and ASME Section IX for welding materials and procedures.

Include the following paragraph only when cost of acquiring specified standards is justified.

* + - * 1. Maintain [**one copy**] [**<\_\_\_\_\_\_\_\_> copies**] of [**each**] document on site.
			1. 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.

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

* + - * 1. Installer: Company specializing in performing work of this Section and approved by manufacturer.
				2. Design [**piping systems**] [**pipe hangers and supports**] <**\_\_\_\_\_\_\_\_**> under direct supervision of Professional Director’s Representative experienced in design of this Work and licensed [**at Project location**] [**in State of <\_\_\_\_\_\_\_\_>**].
			1. PRE-INSTALLATION MEETINGS
				1. Section 013000 - Administrative Requirements: Pre-installation meeting.
				2. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> week prior to commencing Work of this Section.
			2. DELIVERY, STORAGE, AND HANDLING
				1. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.
				2. Protect piping from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
			3. ENVIRONMENTAL REQUIREMENTS
				1. Do not install underground piping when bedding is wet or frozen.
			4. FIELD MEASUREMENTS
				1. Verify field measurements prior to fabrication.
			5. COORDINATION
				1. Section 013000 - Administrative Requirements: Requirements for coordination.
				2. Coordinate installation of buried piping with trenching.
1. PRODUCTS
	* + 1. DOMESTIC WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

This Article contains piping that may be specified in site utility sections. Coordinate with site utility sections to avoid duplication.

* + - * 1. Ductile Iron Pipe: AWWA [**C151**] [**C104**] <**\_\_\_\_\_\_\_\_**>.

Fittings: AWWA C110 “Standard for Ductile-Iron and Gray-Iron Fittings”, [**ductile**] [**gray**] iron, standard thickness.

Joints: AWWA C111 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, rubber gasket with rods.

Jackets: [**AWWA C105 polyethylene jacket**] [**Double layer, half lapped, [10] <\_\_\_\_\_\_\_\_> mil polyethylene tape**].

Copper tubing Types indicate wall thickness. Type K has greatest wall thickness.

* + - * 1. Copper Tubing: [**ASTM B88**], Type [**K,**] [**L,**] annealed.

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

Joints: Compression connection or Brazed, AWS A5.8 “Filler Metals for Brazing & Braze Welding” BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

* + - * 1. PVC Pipe: [**ASTM D1785, Schedule [40] [80]**] [**ASTM D2241, [SDR-26 for 160 psig pressure rating] [SDR-41 for 100 psig pressure rating] [SDR-21 for 200 psig pressure rating]**], 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 the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. PVC Pipe: AWWA C900 “Standard for Polyvinyl Chloride Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in., for Water Transmission and Distribution” Class [**100**] [**150**], polyvinyl chloride (PVC) material.

Fittings: AWWA C110 “Standard for Ductile-Iron and Gray-Iron Fittings”, [**ductile**] [**gray**] iron, standard thickness.

Joints: ASTM D3139 “Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals” compression gasket ring.

ASTM D3035 piping is available in 10 different wall thicknesses ranging from DR 32.5, thinnest, to DR 7, thickest with pressure ratings from 160 psi (1.10 MPa) to 840 psi (5.79 MPa). Coordinate wall thickness and pressure rating with intended service conditions.

* + - * 1. Polyethylene Pipe: [**AWWA C901**] [**ASTM D3035, DR <\_\_\_\_\_\_\_\_> for <\_\_\_\_\_\_\_\_> psi pressure rating**]:

Fittings: AWWA C901 “Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service”, molded [**or fabricated**].

Joints: [**Compression**] [**Butt fusion**].

* + - * 1. Copper Tubing: ASTM B42 “Standard Specification for Seamless Copper Pipe, Standard Sizes”, [**Temper O61 annealed**] [**Temper H80 hard 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.

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 B42 “Standard Specification for Seamless Copper Pipe, Standard Sizes”, Temper O61 annealed.

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

Joints: Flared.

ASTM D2239 includes six SIDR wall thicknesses ranging from SIDR 19 to SIDR 5.3. SIDR 19 most closely matches Schedule 40 pipe.

* + - * 1. Polyethylene Pipe: ASTM D2239 “Standard Specification for Polyethylene Plastic Pipe Based on Controlled Inside Diameter” SIDR 19, or ASTM D2447 “Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter” Schedule 40.

Fittings: ASTM D2609 “Standard Specification for Plastic Insert Fittings for Polyethylene Plastic Pipe”, Polyethylene.

Joints: Mechanical with stainless steel clamp.

* + - * 1. Fiberglass Pipe: AWWA C950 “Standard for Fiberglass Pressure Pipe”.

Polyethylene/aluminum composition tubing (aluminum tube laminated to interior and exterior layers of polyethylene) is available in 1/2 inch, 3/4 inch, and 1 inch sizes. Pipe material is suitable for buried applications, and has low flame spread (suitable for commercial buildings).

* + - * 1. Polyethylene/Aluminum Composition Tubing: ASTM F1281 “Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe” or ASTM F1282 “Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe”.

Fittings and Joints: Brass compression type.

* + - 1. DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING
				1. Ductile Iron Pipe: AWWA [**C151**] [**C104**] <**\_\_\_\_\_\_\_\_**>.

Fittings: AWWA C110 “Standard for Ductile-Iron and Gray-Iron Fittings”, [**ductile**] [**gray**] iron, standard thickness.

Joints: AWWA C111 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, rubber gasket with rods.

Jackets: [**AWWA C105 polyethylene jacket**] [**Double layer, half lapped, [10] <\_\_\_\_\_\_\_\_> mil polyethylene tape**].

Copper tubing Types indicate wall thickness. Type K has greatest wall thickness.

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

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

Joints: Compression connection or Brazed, AWS A5.8 “Filler Metals for Brazing & Braze Welding” BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

* + - * 1. PVC Pipe: [**ASTM D1785, Schedule 40**] [**ASTM D1785, Schedule 80**] [**ASTM D2241, SDR-26 for 160 psig pressure rating**] [**ASTM D2241, SDR-41 for 100 psig pressure rating**] [**ASTM D2241, SDR-21 for 200 psig pressure rating**], 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 the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. PVC Pipe: AWWA C900 “Standard for Polyvinyl Chloride Pressure Pipe and Fabricated Fittings, 4 in. Through 12 in., for Water Transmission and Distribution” Class [**100**] [**150**], polyvinyl chloride (PVC) material.

Fittings: AWWA C110 “Standard for Ductile-Iron and Gray-Iron Fittings”, [**ductile**] [**gray**] iron, standard thickness.

Joints: ASTM D3139 “Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals” compression gasket ring.

ASTM D3035 piping is available in 10 different wall thicknesses ranging from DR 32.5, thinnest, to DR 7, thickest with pressure ratings from 160 psi (1.10 MPa) to 840 psi (5.79 MPa). Coordinate wall thickness and pressure rating with intended service conditions.

* + - * 1. Polyethylene Pipe: [**AWWA C901**] [**ASTM D3035, DR <\_\_\_\_\_\_\_\_> for <\_\_\_\_\_\_\_\_> psi pressure rating**]:

Fittings: AWWA C901 “Polyethylene (PE) Pressure Pipe and Tubing, 1/2 in. through 3 in., for Water Service”, molded [**or fabricated**].

Joints: [**Compression**] [**Butt fusion**].

* + - * 1. Copper Tubing: ASTM B42 “Standard Specification for Seamless Copper Pipe, Standard Sizes”, [**Temper H80 hard drawn**] [**Temper O61 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 and bronze.

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver, solder**] [**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 B42 “Standard Specification for Seamless Copper Pipe, Standard Sizes”, Temper O61 annealed.

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

Joints: Flared.

ASTM D2239 includes six SIDR wall thicknesses ranging from SIDR 19 to SIDR 5.3. SIDR 19 most closely matches Schedule 40 pipe.

* + - * 1. Polyethylene Pipe: ASTM D2239 “Standard Specification for Polyethylene Plastic Pipe Based on Controlled Inside Diameter” SIDR 19, or ASTM D2447 “Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter” Schedule 40.

Fittings: ASTM D2609 “Standard Specification for Plastic Insert Fittings for Polyethylene Plastic Pipe”, Polyethylene.

Joints: Mechanical with stainless steel clamps.

Polyethylene/aluminum composition tubing (aluminum tube laminated to interior and exterior layers of polyethylene) is available in 1/2 inch , 3/4 inch, and 1 inch sizes. Pipe material is suitable for buried applications, and has low flame spread (suitable for commercial buildings).

* + - * 1. Polyethylene/Aluminum Composition Tubing: ASTM F1281 “Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe” or ASTM F1282 “Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe”.

Fittings and Joints: Brass compression type.

* + - 1. DOMESTIC WATER PIPING, ABOVE GRADE

Copper tubing Types indicate wall thickness. Type K has greatest wall thickness; Type M the least wall thickness.

Some plumbing codes may require use of ASTM B88 , Type K or Type L pipe for water service applications and water distribution systems, but may not allow use of Type M.

* + - * 1. Copper Tubing: ASTM B88, Type [**M,**] [**L,**] [**K,**] 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 [**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 “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 [**minus 30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**>degrees F.

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

Galvanized steel piping is not approved in many jurisdictions for domestic hot water piping.

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

Fittings: [**ASTM A395 and ASTM A536 ductile iron,**] [**or**] [**ASTM A234 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 “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-dip galvanized**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>, compatible with steel piping sizes, [**rigid**] [**or**] [**flexible**] type.

Gasket: Elastomer composition for operating temperature range from [**minus 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. Confirm use for this application and acceptance by authorities having jurisdiction.

* + - * 1. CPVC Pipe: ASTM D2846 “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems”, ASTM F441 “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80”, or ASTM F442 “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR-PR)”, chlorinated polyvinyl chloride (CPVC) material.

Fittings: ASTM D2846 “Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Hot- and Cold-Water Distribution Systems”, 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”, or ASTM F441“Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80”, CPVC.

Joints: ASTM D2846 “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 Plastic Pipe and Fittings” solvent cement.

Confirm use of PVC for this application and acceptance by authorities having jurisdiction.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly(Vinyl Chloride) Plastic Pipe, Schedules 40, 80, and 120” [**Schedule 40**] [**Schedule 80**] or ASTM D2241 “Standard Specification for Polyethylene Plastic Pipe Based on Controlled Inside Diameter” SDR-26 for not less than 150 psi pressure rating, 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 the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

Polyethylene/aluminum composition tubing (aluminum tube laminated to interior and exterior layers of polyethylene) is available in 1/2 inch, 3/4 inch, and 1 inch sizes. Pipe material is suitable for buried applications, and has low flame spread (suitable for commercial buildings).

* + - * 1. Polyethylene/Aluminum Composition Tubing: ASTM F1281 “Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe” or ASTM F1282 “Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe”.

Fittings and Joints: Brass compression type.

* + - 1. SANITARY SEWER PIPING, BURIED BEYOND 5 FEET OF BUILDING

This Article contains piping that may be specified in site utility sections. Coordinate with site utility sections to avoid duplication.

Cast or ductile iron pipe is normally used for durability, longevity, resistance to corrosion, acids, gases, and resistance to induced subsoil loads. It is available in 5- and 10-foot lengths and with diameters ranging from 2 to 15 inches. Pipe ends are usually bell and spigot but can be specified with plain end for mechanical clamp and gasket joint.

* + - * 1. Cast Iron Soil Pipe: ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”, [**extra heavy**] [**service**] weight, [**bell and spigot**] [**plain**] ends.

Fittings: Cast iron, ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”.

Joints: ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber gasket joint devices.

Pressure classes define pipe wall thickness depending on pipe size. Available pressure classes include 150, 200, 250, 300, and 350. Insert pressure class required for project conditions. Smaller pipe sizes are not available in lesser pressure classes.

* + - * 1. Ductile Iron Pipe: AWWA C150 or AWWA C151, [**<\_\_\_\_\_\_\_\_> minimum pressure class,**] [**50 minimum special class**] [**52 minimum special class**] [**54 minimum special class**], [**bell and spigot**] [**plain**] ends.

Fittings: AWWA C110 “Standard for Ductile-Iron and Gray-Iron Fittings”, [**ductile**] [**gray**] iron, standard thickness.

Joints: AWWA C111 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, rubber gasket joint devices.

Concrete pipe, un-reinforced, is normally used in non-pressure applications and where subsoil backfill will not induce loads causing pipe fracture. Sizes range from 4 to 36 inches. Class 1, 2, and 3 designations refer to pipe strength. Absorption of moisture may be a concern in using this pipe material.

* + - * 1. Concrete Pipe: ASTM C14 “Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe” Class [**1**] [**2**] [**3**]; un-reinforced, [**bell and spigot**] [**plain**] <**\_\_\_\_\_\_\_\_**> ends.

Fittings: Concrete pipe, ASTM C14 “Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe”.

Joints: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber compression gasket.

Reinforced concrete pipe is normally used for larger diameter applications, for low pressure applications, or where subsoil pressure requires greater pipe strength than un-reinforced concrete type. Sizes range from 12 to 108 inches depending on Class and Wall type. Absorption of moisture may be a concern in using this pipe material.

* + - * 1. Reinforced Concrete Pipe: ASTM C76 “Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe”, Class [**I**] [**II**] [**III**] [**IV**] [**V**] with Wall Type [**A**] [**B**] [**C**]; [**mesh**] [**bar**] reinforcement, [**bell and spigot**] <**\_\_\_\_\_\_\_\_**> ends.

Fittings: Reinforced concrete.

Joints: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber compression gasket.

Plastic pipe is normally used for acidic or corrosive waste sewer systems, ease of jointing, reasonably flexible in moving subsoils, and is relatively impervious to moisture infiltration or exfiltration. ABS pipe is described in ASTM D2751. PVC pipe is covered in ASTM D2729, and ASTM D3034; each offering various qualities and characteristics.

* + - * 1. ABS Pipe: ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings”, SDR [**23.5**] [**35**] [**42**], Acrylonitrile-Butadiene-Styrene (ABS) material, bell and spigot style solvent sealed ends.

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.

* + - * 1. ABS Pipe: ASTM F628 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core”, Acrylonitrile-Butadiene-Styrene (ABS) material.

Fittings: ABS.

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

* + - * 1. ABS Pipe: ASTM D2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene 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 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.

* + - * 1. PVC Pipe: ASTM D2729 “Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings”, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.

Fittings: PVC, ASTM D2729 “Standard Specification for Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. PVC Pipe: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings” SDR [**35**] <**\_\_\_\_\_\_\_\_**>, polyvinyl chloride (PVC) material.

Fittings: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”, PVC.

Joints: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric gaskets.

Use the following plastic pipe, up to 12 inches diameter.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly(Vinyl Chloride) Plastic Pipe, Schedules 40, 80, and 120”, Schedule [**40**] [**80**] [**120**], polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.

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

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” Solvent cement.

* + - * 1. PVC Pipe: ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”, polyvinyl chloride (PVC) material.

Fittings: PVC, ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. Copper Tube: [**ASTM B75**] [**ASTM B88**] [**ASTM B251**] Type [**K**] [**L**] annealed.

Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast bronze, or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV”, 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.

* + - 1. SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

Cast or ductile iron pipe is normally used for durability, longevity, resistance to corrosion, acids, gases, and resistance to induced subsoil loads. It is available in 5- and 10-foot lengths and with diameters ranging from 2 to 15 inches. Pipe ends are usually bell and spigot but can be specified with plain end for mechanical clamp and gasket joint.

* + - * 1. Cast Iron Soil Pipe: ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”, [**extra heavy**] [**service**] weight, [**bell and spigot**] [**plain**] ends.

Fittings: Cast iron, ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”.

Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings” neoprene gaskets or lead and oakum.

Cast Iron Pipe: CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”, hub-less.1. Fittings: Cast iron, CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”.Joints: CISPI 310 “Specification for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications” neoprene gasket and stainless steel clamp and shield assemblies.

Pressure classes define pipe wall thickness depending on pipe size. Available pressure classes include 150, 200, 250, 300, and 350. Insert pressure class required for project conditions. Smaller pipe sizes are not available in lesser pressure classes.

* + - * 1. Ductile Iron Pipe: AWWA C150 or AWWA C151 “Standard for Ductile-Iron Pipe, Centrifugally Cast”, [**<\_\_\_\_\_\_\_\_> minimum pressure class,**] [**50 minimum special class**] [**52 minimum special class**] [**54 minimum special class**], [**bell and spigot**] [**plain**] ends.

Fittings: AWWA C110 “Standard for Ductile-Iron and Gray-Iron Fittings”, [**ductile**] [**gray**] iron, standard thickness.

Joints: AWWA C111 “Standard for Rubber-Gasket Joints for Ductile-iron Pressure Pipe and Fittings”, rubber gasket joint devices.

Concrete pipe, un-reinforced, is normally used in non-pressure applications and where subsoil backfill will not induce loads causing pipe fracture. Sizes range from 4 to 36 inches. Class 1, 2, and 3 designations refer to pipe strength. Absorption of moisture may be a concern in using this pipe material.

* + - * 1. Concrete Pipe: ASTM C14 “Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe”, Class [**1**] [**2**] [**3**]; un-reinforced, [**bell and spigot**] [**plain**] <**\_\_\_\_\_\_\_\_**> ends.

Fittings: Concrete pipe, ASTM C14 “Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe”.

Joints: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber compression gasket.

Reinforced concrete pipe is normally used for larger diameter applications, for low pressure applications, or where subsoil pressure requires greater pipe strength than un-reinforced concrete type. Sizes range from 12 to 108 inches depending on Class and Wall type. Absorption of moisture may be a concern in using this pipe material.

* + - * 1. Reinforced Concrete Pipe: ASTM C76 “Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe”, Class [**I**] [**II**] [**III**] [**IV**] [**V**] with Wall Type [**A**] [**B**] [**C**]; [**mesh**] [**bar**] reinforcement, [**bell and spigot**] <**\_\_\_\_\_\_\_\_**> ends.

Fittings: Reinforced concrete.

Joints: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber compression gasket.

Plastic pipe is normally used for acidic or corrosive waste sewer systems, ease of jointing, reasonably flexible in moving subsoils, and is relatively impervious to moisture infiltration or exfiltration. ABS pipe is described in ASTM D2751. PVC pipe is covered in ASTM D2729, and ASTM D3034; each offering various qualities and characteristics.

* + - * 1. ABS Pipe: ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings”, SDR [**23.5**] [**35**] [**42**], Acrylonitrile-Butadiene-Styrene (ABS) material, bell and spigot style solvent sealed ends.

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.

* + - * 1. ABS Pipe: ASTM F628, Acrylonitrile-Butadiene-Styrene (ABS) material.

Fittings: ABS.

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

* + - * 1. ABS Pipe: ASTM D2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene 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 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.

* + - * 1. PVC Pipe: ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings”, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.

Fittings: PVC, ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. PVC Pipe: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings” SDR [**35**] <**\_\_\_\_\_\_\_\_**>, polyvinyl chloride (PVC) material.

Fittings: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”, PVC.

Joints: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric gaskets.

Use the following plastic pipe, up to 12 inches diameter.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly(Vinyl Chloride) Plastic Pipe, Schedules 40, 80, and 120”, Schedule [**40**] [**80**] [**120**], polyvinyl chloride (PVC) material, bell and spigot style solvent sealed joint ends.

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

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” Solvent cement.

Copper tubing Type designations apply only to tubing furnished under ASTM B88. Types indicate wall thickness. Type K has greatest wall thickness; Type M the least wall thickness.

* + - * 1. Copper Tube: [**ASTM B306, DWV**] [**ASTM B75**] [**ASTM B88**] [**ASTM B251**] Type [**K**] [**L**] [**M**].

Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast bronze, or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV” 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.

* + - * 1. Plastic Pipe: ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”, polyvinyl chloride (PVC) material.

Fittings: PVC, ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. Fiberglass Pipe: ASTM D3262 “Standard Specification for "Fiberglass" Sewer Pipe”, glass fiber reinforced thermosetting resin material.

Fittings: ASTM D3840 “Standard Specification for "Fiberglass" Pipe Fittings for Nonpressure Applications”.

Joints: Epoxy.

* + - * 1. Fiberglass Pipe: ASTM D3754 “Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe”, ASTM D3517 “Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe”, ASTM D2996 “Standard Specification for Filament-Wound "Fiberglass" Pipe” and ASTM D2997 “Standard Specification for Centrifugally Cast "Fiberglass" Pipe”, glass fiber reinforced thermosetting resin material.

Fittings: Custom laminated fiberglass.

Joints: Epoxy.

* + - 1. SANITARY SEWER PIPING, ABOVE GRADE
				1. Cast Iron Pipe: ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”, service weight.

Fittings: Cast iron, ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”.

Joints: ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber gasket joint devices or lead and oakum.

* + - * 1. Cast Iron Pipe: CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”, hub-less, service weight.

Fittings: Cast iron, CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”.

Joints: CISPI 310 “Specification for Use in Connection With Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications", neoprene gaskets and stainless steel clamp-and-shield assemblies.

Copper tubing Type designations apply only to tubing furnished under [ASTM B88] Types indicate wall thickness. Type K has greatest wall thickness; Type M the least wall thickness.

* + - * 1. Copper Tube: [**ASTM B306, DWV**] [**ASTM B75**] [**ASTM B88**] [**ASTM B251**] Type [**K**] [**L**] [**M**].

Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast bronze, or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV”, 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.

* + - * 1. Copper Pipe: [**ASTM B42 Temper O61 annealed**] [**ASTM B42 Temper H80 hard drawn**] [**ASTM B302**].

Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast bronze, or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV” wrought copper.

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

* + - * 1. Aluminum DWV Pipe: CAN 3-B281.

Fittings: Cast iron, ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”.

Joints: [**ASTM C564**] [**CISPI 310**], thermoplastic rubber coupling and stainless steel clamps.

* + - * 1. Brass Pipe: ASTM B43 “Standard Specification for Seamless Red Brass Pipe, Standard Sizes”, chrome plated.

Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast bronze, chrome plated.

Joints: Mechanical compression.

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

Fittings: Cast iron, [**ASME B16.1, flanges and fittings;**] [**ASME B16.4, threaded fittings**].

Fittings: Malleable iron, [**ASME B16.3, threaded type**] ASTM A47 “Standard Specification for Ferritic Malleable Iron Castings”.

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

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

Fittings: [**ASTM A395 and ASTM A536 ductile iron,**] [**or**] [**ASTM A234 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 “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-dip galvanized**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>, compatible with steel piping sizes, [**rigid**] [**or**] [**flexible**] type.

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

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

Plastics may not be approved in all situations. ABS has flame spread rating exceeding 25 and is not suitable in fire rated or non-combustible construction. PVC has flame spread less than 25 and with suitable fire stopping is generally approved for use in fire rated assemblies or through fire separations. Confirm use for this application and acceptance by authorities having jurisdiction.

* + - * 1. ABS Pipe: ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings” or ASTM F628 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe With a Cellular Core”, Schedule 40, DWV, 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.

* + - * 1. ABS Pipe: ASTM D2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene Schedule 40 Plastic Drain, Waste, and Vent Pipe and Fittings” or ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings”, Acrylonitrile-Butadiene-Styrene (ABS) material.

Fittings: ABS, ASTM D2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene 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.

* + - * 1. PVC Pipe: ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings”, polyvinyl chloride (PVC) material.

Fittings: ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings”, PVC.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. PVC Pipe: ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”, polyvinyl chloride (PVC) material.

Fittings: ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”, PVC.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly(Vinyl Chloride) Plastic Pipe, Schedules 40, 80, and 120 [**Schedule [40] [80]**] or ASTM D2241 “Standard Specification for Polyethylene Plastic Pipe Based on Controlled Inside Diameter” SDR-26 for not less than 150 psi pressure rating, 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 the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” Solvent cement.

* + - * 1. Fiberglass Pipe: ASTM D3262 “Standard Specification for "Fiberglass" Sewer Pipe”, glass fiber reinforced thermosetting resin material.

Fittings: ASTM D3840 “Standard Specification for "Fiberglass" Pipe Fittings for Non-pressure Applications”, glass fiber reinforced thermosetting resin.

Joints: Epoxy.

* + - * 1. Fiberglass Pipe: ASTM D3754 “Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe”, ASTM D3517 “Standard Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pressure Pipe, ASTM D2996 “Standard Specification for Filament-Wound "Fiberglass" Pipe” and ASTM D2997 “Standard Specification for Centrifugally Cast "Fiberglass" Pipe”, glass fiber reinforced thermosetting resin material.

Fittings: Custom laminated Fiberglass.

Joints: Epoxy.

* + - 1. CHEMICAL RESISTANT SEWER PIPING
				1. Cast Iron Pipe: CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”, hubless, service weight.

Fittings: Cast iron, CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”.

Joints: CISPI 310 “Specification for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”, neoprene gaskets and stainless steel clamp-and-shield assemblies.

* + - * 1. ABS Pipe: ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings” or ASTM F628 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Schedule 40 Plastic Drain, Waste, and Vent Pipe with a Cellular Core”, 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.

* + - * 1. PVC Pipe: ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings” or ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings, polyvinyl chloride (PVC) material.

Fittings: PVC, ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings” or ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. Glass Pipe: ASTM C1053 “Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent Applications”, borosilicate glass material.

Fittings: ASTM C1053 “Standard Specification for Borosilicate Glass Pipe and Fittings for Drain, Waste, and Vent Applications”, borosilicate glass.

Joints: Stainless steel compression couplings with tetra-fluoroethylene seal ring.

* + - * 1. [**PP**] [**PPFR**] Pipe: Polypropylene [**, flame retardant**].

Fittings: Polypropylene.

Joints: Electrical resistance fusion.

* + - 1. STORM WATER PIPING, BURIED BEYOND 5 FEET OF BUILDING

This article contains piping that may be specified in site utility sections. Coordinate with site utility sections to avoid duplication.

Cast iron soil pipe is normally used for durability, longevity, resistance to corrosion, acids, gases, and resistance to induced subsoil loads. It is available in 5- and 10-foot lengths and with diameters ranging from 2 to 15 inches . Pipe ends are usually bell and spigot but can be specified with plain end for mechanical clamp and gasket joint.

* + - * 1. Cast Iron Pipe: ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”, [**extra heavy**] [**service**] type, [**bell and spigot**] [**plain**] ends.

Fittings: Cast iron, ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”.

Joints: ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber gasket joint devices or lead and oakum.

Concrete pipe, unreinforced, is normally used in non-pressure applications and where subsoil backfill will not induce loads causing pipe fracture. Sizes range from 4 to 36 inches. Class 1, 2, and 3 designations refer to pipe strength. Absorption of moisture may be a concern in using this pipe material.

* + - * 1. Concrete Pipe: ASTM C14 “Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe”, Class [**1**] [**2**] [**3**]; unreinforced, [**bell and spigot**] [**plain**] <**\_\_\_\_\_\_\_\_**> ends.

Fittings: Concrete.

Joints: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber compression gasket joint.

Reinforced concrete pipe is normally used for larger diameter applications, for low pressure applications, or where subsoil pressure requires greater pipe strength than unreinforced concrete type. Sizes range from 12 to 108 inches depending on Class and Wall type. Absorption of moisture may be a concern in using this pipe material.

* + - * 1. Reinforced Concrete Pipe: ASTM C76 “Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe”, Class [**I**] [**II**] [**III**] [**IV**] [**V**] with Wall Type [**A**] [**B**] [**C**]; [**mesh**] [**bar**] reinforcement, [**bell and spigot**] <**\_\_\_\_\_\_\_\_**> ends.

Fittings: Reinforced concrete.

Joints: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber compression gasket.

Plastic pipe is normally used for acidic or corrosive waste sewer systems, ease of jointing, reasonably flexible in moving or expansive subsoils, and is relatively impervious to moisture infiltration or exfiltration. ABS pipe is described in ASTM D2751. PVC pipe is covered in ASTM D2729, and D3034; each offers various qualities and characteristics.

* + - * 1. ABS Pipe: ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings”, SDR [**23.5**] [**35**] [**42**], Acrylonitrile-Butadiene-Styrene (ABS) material, bell and spigot style solvent sealed ends.

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.

* + - * 1. PVC Pipe: ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings”, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.

Fittings: PVC, ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. Copper Tube: ASTM B306 “Standard Specification for Copper Drainage Tube” DWV.

Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast bronze, or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV” 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.

* + - * 1. PVC Pipe: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings” SDR [**35**] <**\_\_\_\_\_\_\_\_**>, polyvinyl chloride (PVC) material.

Fittings: ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”, PVC.

Joints: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric gaskets.

* + - * 1. PVC Pipe: ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings” or ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings” SDR 26, polyvinyl chloride (PVC) material.

Fittings: PVC, ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings” or ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems solvent cement.

* + - 1. STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

Cast iron soil pipe is normally used for durability, longevity, resistance to corrosion, acids, gases, and resistance to induced subsoil loads. It is available in 5- and 10-foot lengths and diameters ranging from 2 to 15 inches . Pipe ends are usually bell and spigot but can be specified with plain end for mechanical clamp and gasket joint.

* + - * 1. Cast Iron Pipe: ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings, [**extra heavy**] [**service**] weight, [**bell and spigot**] [**plain**] ends.

Fittings: Cast iron, ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings.

Joints: ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, rubber gasket joint devices or lead and oakum.

* + - * 1. Cast Iron Pipe: CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”, hubless, service weight.

Fittings: Cast iron, CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”.

Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

Concrete pipe, unreinforced, is normally used in non-pressure applications and where subsoil backfill will not induce loads causing pipe fracture. Sizes range from 4 to 36 inches . Class 1, 2, and 3 designations refer to pipe strength. Absorption of moisture may be a concern in using this pipe material.

* + - * 1. Concrete Pipe: ASTM C14 “Standard Specification for Nonreinforced Concrete Sewer, Storm Drain, and Culvert Pipe”, Class [**1**] [**2**] [**3**]; unreinforced, [**bell and spigot**] [**plain**] <**\_\_\_\_\_\_\_\_**> ends.

Fittings: Concrete.

Joints: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber compression gasket joint.

Reinforced concrete pipe is normally used for larger diameter applications, for low pressure applications, or where subsoil pressure requires greater pipe strength than unreinforced concrete type. Sizes range from 12 to 108 inches depending on Class and Wall type. Absorption of moisture may be a concern in using this pipe material.

* + - * 1. Reinforced Concrete Pipe: ASTM C76 “Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe”, Class [**I**] [**II**] [**III**] [**IV**] [**V**] with Wall Type [**A**] [**B**] [**C**]; [**mesh**] [**bar**] reinforcement, [**bell and spigot**] <**\_\_\_\_\_\_\_\_**> ends.

Fittings: Reinforced concrete.

Joints: ASTM C443 “Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets”, rubber compression gasket.

Plastic pipe is normally used for acidic or corrosive waste sewer systems, ease of jointing, reasonably flexible in moving or expansive subsoils, and is relatively impervious to moisture infiltration or exfiltration. ABS pipe is described in ASTM D2751. PVC pipe is covered in ASTM D2729, and D3034; each offers various qualities and characteristics.

* + - * 1. ABS Pipe: ASTM D2751 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings”, SDR [**23.5**] [**35**] [**42**], Acrylonitrile-Butadiene-Styrene (ABS) material, bell and spigot style solvent sealed ends.

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.

* + - * 1. PVC Pipe: ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings”, polyvinyl chloride (PVC) material, bell and spigot solvent sealed ends.

Fittings: PVC, ASTM D2729 “Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems solvent cement.

* + - * 1. Copper Tube: ASTM B306 “Standard Specification for Copper Drainage Tube”, DWV.

Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast bronze, or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV” 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.

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

Fittings: ABS.

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

* + - * 1. PVC Pipe: ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings” or ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings” SDR 26, polyvinyl chloride (PVC) material.

Fittings: PVC, ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings” or ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. PVC Pipe: ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”, ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”, or ASTM F679 “Standard Specification for Poly(Vinyl Chloride) Large-Diameter Plastic Gravity Sewer Pipe and Fittings”, polyvinyl chloride (PVC) material.

Fittings: PVC, ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings”, ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings, or ASTM F679 “Standard Specification for Poly(Vinyl Chloride) Large-Diameter Plastic Gravity Sewer Pipe and Fittings”.

Joints: ASTM F477 “Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe”, elastomeric gaskets.

* + - 1. STORM WATER PIPING, ABOVE GRADE
				1. Cast Iron Pipe: ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings” [**extra heavy**] [**service**] weight, [**bell and spigot**] [**plain**] ends.

Fittings: Cast iron, ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings”.

Joints: ASTM C564 “Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings”, neoprene gasket system or lead and oakum.

* + - * 1. Cast Iron Pipe: CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”, hubless, service weight.

Fittings: Cast iron, CISPI 301 “Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications”.

Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

* + - * 1. Copper Tube: ASTM B306 “Standard Specification for Copper Drainage Tube”, DWV.

Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast bronze, or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV” 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.

* + - * 1. Aluminum DWV Pipe: CAN-3 B281.

Fittings: Cast iron, ASTM A74 “Standard Specification for Cast Iron Soil Pipe and Fittings.

Joints: [**ASTM C564**] [**CISPI 310**], thermoplastic rubber coupling and stainless steel clamps.

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

Fittings: ABS.

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

* + - * 1. PVC Pipe: ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings” or ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings SDR 26, polyvinyl chloride (PVC) material.

Fittings: PVC, ASTM D2665 “Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings” or ASTM D3034 “Standard Specification for Type PSM Poly(Vinyl Chloride) Sewer Pipe and Fittings”.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - 1. POOL WATER PIPING

Copper tubing Types indicate wall thickness. Type K has greatest wall thickness; Type M the least wall thickness.

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

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

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. 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“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 [**minus 30**] [**86**] <**\_\_\_\_\_\_\_\_**> degrees F to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F.

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

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly(Vinyl Chloride) 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 the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

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

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

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - 1. POOL CONDENSER WATER PIPING
				1. CPVC Pipe: ASTM F441 “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 “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 Plastic Pipe and Fittings” solvent cement.

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

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings Classes 150 and 300”, malleable iron or ASME B16.4 “Gray Iron Threaded Fittings Classes 125 and 250”, cast iron.

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

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

Fittings: [**ASTM A395 and ASTM A536 ductile iron,**] [**or**] [**ASTM A234 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 “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-dip galvanized**] <**\_\_\_\_\_\_\_\_**>, compatible with steel piping sizes, [**rigid**] [**or**] [**flexible**] type.

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

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

Copper tubing Types indicate wall thickness. Type K has greatest wall thickness; Type M the least wall thickness.

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

* + - * 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.

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) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40, [**and Schedule 80 for sizes 8 inches and larger,**] or ASTM D2241 “Standard Specification for Polyethylene Plastic Pipe 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 the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

* + - * 1. ABS Pipe: ASTM D2680 “Standard Specification for Acrylonitrile-Butadiene-Styrene (ABS) and Poly (Vinyl Chloride) (PVC) Composite Sewer Piping” 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.

* + - 1. COMPRESSED AIR PIPING
				1. Steel Pipe: ASTM A53 “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless”, Schedule 40 black.

Fittings: ASME B16.3 “Malleable Iron Threaded Fittings Classes 150 and 300”, malleable iron, or ASTM A234 “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 “Standard Specification for Pipe, Steel, Black and Hot-Dipper, Zinc-Coated, Welded and Seamless Schedule 40, black, [**cut**] [**rolled**] grooved ends.

Fittings: [**ASTM A395 and ASTM A536 ductile iron,**] [**or**] [**ASTM A234 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 “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-dip galvanized**] <**\_\_\_\_\_\_\_\_**>, compatible with steel piping sizes, [**rigid**] [**or**] [**flexible**] type.

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

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

Copper tubing Types indicate wall thickness. Type K has greatest wall thickness; Type M the least wall thickness.

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

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

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.

Confirm use of polyethylene pipe.

* + - * 1. Polyethylene Pipe: ASTM D2513 “Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings”, SDR 11.5.

Fittings: ASTM D2683 “Standard Specification for Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing” or ASTM D2513 “Standard Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings” socket type.

Joints: Fusion welded.

Polyethylene/aluminum composition tubing (aluminum tube laminated to interior and exterior layers of polyethylene) is available in 1/2 inch, 3/4 inch , and 1 inch sizes, can be buried, and has low flame spread (suitable for commercial buildings).

* + - * 1. Polyethylene/Aluminum Composition Tubing: ASTM F1281 “Standard Specification for Crosslinked Polyethylene/Aluminum/Crosslinked Polyethylene (PEX-AL-PEX) Pressure Pipe” or ASTM F1282 “Standard Specification for Polyethylene/Aluminum/Polyethylene (PE-AL-PE) Composite Pressure Pipe”. Brass compression type fittings.
			1. MEDICAL GAS PIPING
				1. Factory Preparation: Wash inside of copper pipe and copper fitting with hot solution of sodium carbonate or trisodium phosphate mixed 1 lb to 3 gal of water; rinse with water, and blow dry with oil-free dry nitrogen or compressed air.
				2. Oxygen, Compressed Air, Nitrous Oxide, Nitrogen Systems, Aboveground:

Copper Tube: [**ASTM B88 “**Standard Specification for Seamless Copper Water Tube”**, Type K, drawn**] [**ASTM B280, drawn-Oxy**].

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.

Joints: AWS A5.8 “Filler Metals for Brazing & Braze Welding” Classification BCuP-3 or BCuP-4 silver braze.

* + - * 1. Oxygen, Compressed Air, Nitrous Oxide, Nitrogen Systems, Buried:

Copper Tube: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type K, 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.

Joints: AWS A5.8 “Filler Metals for Brazing & Braze Welding” Classification BCuP-3 or BCuP-4 silver braze.

* + - * 1. Vacuum and Anesthesia Gas Evacuation Systems, Aboveground:

Copper Tube: [**ASTM B88 “**Standard Specification for Seamless Copper Water Tube”**, Type L, drawn**] [**ASTM B280, drawn-Oxy**].

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.

Joints: AWS A5.8 “Filler Metals for Brazing & Braze Welding” Classification BCuP-3 or BCuP-4 silver braze [**or ASTM B32, Alloy Grade Sb5 tin-antimony solder**].

* + - * 1. Vacuum and Anesthesia Gas Evacuation Systems, Buried:

Copper Tube: ASTM B88 “Standard Specification for Seamless Copper Water Tube”, Type L and 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.

Joints: AWS A5.8 “Filler Metals for Brazing & Braze Welding” Classification BCuP-3 or BCuP-4 silver braze [**or ASTM B32, Alloy Grade Sb5 tin-antimony solder**].

* + - * 1. Oral Evacuation Systems:

PVC Pipe: ASTM D1785 “Standard Specification for Poly(Vinyl Chloride) Plastic Pipe, Schedules 40, 80, and 120”, PVC 1120 or 1220, and Schedule 40.

Fittings: ASTM D 2466 “Standard Specification for Threaded Poly(Vinyl Chloride) Plastic Pipe Fittings, Schedule 40”, PVC long radius or wye type.

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement.

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) Plastic Pipe, Schedules 40, 80, and 120”, Schedule 40, polyvinyl chloride (PVC) material.

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

Joints: ASTM D2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement. Prime joints with a contrasting color.

* + - * 1. PVC Pipe: ASTM D1785 “Standard Specification for Poly(Vinyl Chloride) 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 the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”, solvent weld with ASTM D2564 “Standard Specification for Solvent Cements for Poly(Vinyl Chloride) Plastic Piping Systems” solvent cement. Prime joints with a contrasting color.

* + - * 1. CPVC Pipe: ASTM F441 “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 “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 Plastic Pipe and Fittings” solvent cement. Prime joints with a contrasting color.

* + - * 1. CPVC Pipe: ASTM F441/ “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 “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 Plastic Pipe and Fittings” solvent cement. Prime joints with a contrasting color.

* + - * 1. ABS Pipe: ASTM D2661 “Standard Specification for Acrylonitrile-Butadiene-Styrene 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 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. 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, 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=7943&mf=04&src=wd): Subject to compliance with requirements, 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 Company

Or equal.

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

* + - * 1. Furnish materials in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

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. 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.

* + - * 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. Install pipe to elevation [**as indicated on Drawings**] <**\_\_\_\_\_\_\_\_**>.
				2. 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**] [**compact to <\_\_\_\_\_\_\_\_> percent maximum density**].
				3. Install pipe on prepared bedding.
				4. Route pipe in straight line.
				5. Install pipe to allow for expansion and contraction without stressing pipe or joints.
				6. Install [**shutoff**] [**and**] [**drain**] valves at locations indicated on Drawings in accordance with [**this Section**] [**Section 220523**] [**Section <\_\_\_\_\_\_\_\_>**].
				7. Install plastic ribbon tape continuous [**over top of pipe.**] [**buried [6] <\_\_\_\_\_\_\_\_> inches below finish grade,**] above pipe line. Refer to Section 220553.

\*\*\*\*\*\* [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. Refer to Section 220553.
				2. Pipe Cover and Backfilling:

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.

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

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 220529.
				5. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.
				6. Provide access where valves and fittings are not accessible. [**Coordinate size and location of access doors with Section 083113.**]
				7. Install non-conducting dielectric connections wherever jointing dissimilar metals.
				8. Establish invert elevations, slopes for drainage to [**1/4**] [**1/8**] <**\_\_\_\_\_\_\_\_**> inch per foot minimum. Maintain gradients.
				9. Slope piping and arrange systems to drain at low points.
				10. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
				11. Install piping penetrating roofed areas to maintain integrity of roof assembly.
				12. Install valves in accordance with Section 220523.
				13. Install piping specialties in accordance with Section 232116.
				14. Insulate piping. Refer to Section 220700.
				15. Install pipe identification in accordance with Section 220553.

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 - DOMESTIC WATER PIPING SYSTEMS
				1. Install domestic water piping system in accordance with ASME B31.9.

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

* + - * 1. Install domestic water piping system in accordance with Section [**221100**] <**\_\_\_\_\_\_\_\_**>.

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - SANITARY WASTE AND VENT PIPING SYSTEMS
				1. Install sanitary waste and vent piping systems in accordance with ASME B31.9.

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

* + - * 1. Install sanitary waste and vent piping systems in accordance with [**local**] <**\_\_\_\_\_\_\_\_**> plumbing code.

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

* + - * 1. Install sanitary waste and vent piping systems in accordance with Section [**221300**] <**\_\_\_\_\_\_\_\_**>.
				2. Install bell and spigot pipe with bell end upstream.
				3. Support cast iron drainage piping at every joint.

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - STORM DRAINAGE PIPING SYSTEMS
				1. Install storm drainage piping systems piping in accordance with ASME B31.9.

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

* + - * 1. Install storm drainage piping systems in accordance with [**local**] <**\_\_\_\_\_\_\_\_**> plumbing code.

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

* + - * 1. Install storm drainage piping systems in accordance with Section [**221400**] <**\_\_\_\_\_\_\_\_**>.
				2. Install bell and spigot pipe with bell end upstream.
				3. Support cast iron drainage piping at every joint.

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - SWIMMING POOL PIPING SYSTEMS
				1. Install swimming pool piping systems in accordance with ASME B31.9.

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

* + - * 1. Install swimming pool piping systems in accordance with [**local**] [**State**] [**Department of Health requirements**] <**\_\_\_\_\_\_\_\_**>.

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

* + - * 1. Install swimming pool piping systems in accordance with Section [**225100**] <**\_\_\_\_\_\_\_\_**>.
				2. After completion, fill, clean, and treat systems. Refer to Section <**\_\_\_\_\_\_\_\_**>.

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - COMPRESSED AIR PIPING SYSTEMS
				1. Install compressed air piping systems piping in accordance with ASME B31.9.

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

* + - * 1. Install compressed air piping systems in accordance with Section [**221500**] <**\_\_\_\_\_\_\_\_**>.
				2. Install drip connections with valves at low points of piping system.
				3. Install take-off to outlets from top of main, with shut off valve after take-off. Slope take-off piping to outlets.
				4. Install compressed air couplings, female quick connectors, and pressure gages [**where outlets are indicated**] [**as indicated on Drawings**].
				5. Install tees instead of elbows at changes in direction of piping. Fit open end of each tee with plug.
				6. Cut pipe and tubing accurately and install without springing or forcing.
				7. Slope piping in direction of flow.
				8. Install strainers on inlet side of pressure reducing valves. Install pressure reducing valves with bypasses and isolation valves to allow maintenance without interruption of service.

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - MEDICAL GAS PIPING SYSTEMS
				1. Install medical gas piping systems in accordance with NFPA 99.

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. FIELD QUALITY CONTROL
				1. Test domestic water piping system in accordance with [**applicable code**] [**local authority having jurisdiction**] <**\_\_\_\_\_\_\_\_**>.
				2. Test sanitary waste and vent piping system in accordance with [**applicable code**] [**local authority having jurisdiction**] <**\_\_\_\_\_\_\_\_**>.
				3. Test storm drainage piping system in accordance with [**applicable code**] [**local authority having jurisdiction**] <**\_\_\_\_\_\_\_\_**>.
				4. Test swimming pool piping systems in accordance with [**ASME B31.9**] <**\_\_\_\_\_\_\_\_**>.

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

* + - * 1. Test swimming pool piping systems in accordance with [**applicable code**] [**local authority having jurisdiction**] [**local department of health**] <**\_\_\_\_\_\_\_\_**>.
				2. Test for Compressed Air Piping Leak Test: Prior to initial operation, clean and test compressed air piping in accordance with ASME B31.9 “Building Services Piping”.
				3. Test medical gas systems in accordance with [**NFPA 99**] [**Section 226013**] <**\_\_\_\_\_\_\_\_**>.
			1. CLEANING
				1. Clean and disinfect domestic water distribution system in accordance with Section [**221100**] <**\_\_\_\_\_\_\_\_**>.

END OF SECTION 221000