SECTION 221100 - FACILITY WATER DISTRIBUTION

This Section includes domestic water piping systems with pipe, valves, piping specialties, pumps, and other components.

Coordinate location of piping, valves, and hangers and supports with other sections in this Division. When Section 220529, Section 220503, and Section 220523 are used consider deleting duplicate requirements and referencing appropriate sections.

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:

Domestic water piping, buried beyond 5 feet of building.

Domestic water piping, within 5 feet of building.

Domestic water piping, above grade.

Unions and flanges.

Valves.

Pipe hangers and supports.

Pressure gages.

Pressure gage taps.

Thermometers.

Flow control valves.

Water pressure reducing valves.

Relief valves.

Strainers.

Hose bibs.

Hydrants.

Recessed valve box.

Backflow preventers.

Water hammer arrestors.

Thermostatic mixing valves.

Pressure balanced mixing valves.

Diaphragm-type compression tanks.

Water softeners.

System lubricated circulators.

In-line circulator pumps.

Close-coupled pumps.

Base-mounted pumps.

In-line circulator pumps.

Pressure booster systems.

Underground pipe markers.

Bedding and cover materials.

* + - * 1. Related Sections:

Section 033000 - Cast-In-Place Concrete: Execution requirements for placement of concrete house keeping pads specified by this section.

Use the following reference when firestopping is specified another section.

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.

Use the following when pipe materials are specified in one location in this Division.

Section 220513 - Common Motor Requirements for Plumbing Equipment: Product requirements for motors for placement by this section.

Section 220516 - Expansion Fittings and Loops for Plumbing Piping: Execution requirements for pipe expansion devices for placement by this section.

Use the following when valves are specified in one location in this Division.

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 is 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 isolators for placement by this section.

Section 220553 - Identification for Plumbing Piping and Equipment: Product requirements for pipe identification and valve tags for placement by this section.

Section 220700 - Plumbing Insulation: Product and execution requirements for pipe insulation.

* + - 1. REFERENCES

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

* + - * 1. American National Standards Institute:

ANSI Z21.22 - Relief Valves for Hot Water Supply Systems.

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

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

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

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

ASME B31.9 - Building Services Piping.

ASME B40.1 - Gauges - Pressure Indicating Dial Type - Elastic Element.

ASME Section VIII - Boiler and Pressure Vessel Code - Pressure Vessels.

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

* + - * 1. American Society of Sanitary Engineering:

ASSE 1010 - Performance Requirements for Water Hammer Arresters.

ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers.

ASSE 1012 - Performance Requirements for Backflow Preventer with Intermediate Atmospheric Vent.

ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.

ASSE 1019 - Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type.

ASSE 5013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers (RP) and Reduced Pressure Fire Protection Principle Backflow Preventers (RFP).

ASSE 5015 - Performance Requirements for Testing Double Check Backflow Prevention Assemblies (DC) and Double Check Fire Protection Backflow Prevention Assemblies (RPDF).

* + - * 1. ASTM International:

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

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 B88 - Standard Specification for Seamless Copper Water Tube.

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

ASTM D1785 - Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 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 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 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 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 D 3311 - Standard Specification for Drain, Waste, and Vent (Dwv) Plastic Fittings Patterns.

ASTM E1 - Standard Specification for ASTM Thermometers.

ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers.

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

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

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

ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.

ASTM F891 - Standard Specification for Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core.

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.

* + - * 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 C651 - Disinfecting Water Mains.

AWWA C700 - Cold-Water Meters - Displacement Type, Bronze Main Case.

AWWA C701 - Cold-Water Meters - Turbine Type, for Customer Service.

AWWA C702 - Cold-Water Meters - Compound Type.

AWWA C706 - Direct-Reading, Remote-Registration Systems for Cold-Water Meters.

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.

AWWA M6 - Water Meters - Selection, Installation, Testing, and Maintenance.

* + - * 1. Manufacturers Standardization Society of the Valve and Fittings Industry:

MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.

MSS SP 67 - Butterfly Valves.

MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

MSS SP 70 - Cast Iron Gate Valves, Flanged and Threaded Ends.

MSS SP 71 - Cast Iron Swing Check Valves, Flanged and Threaded Ends.

MSS SP 78 - Cast Iron Plug Valves, Flanged and Threaded Ends.

MSS SP 80 - Bronze Gate, Globe, Angle and Check Valves.

MSS SP 85 - Cast Iron Globe & Angle Valves, Flanged and Threaded.

MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

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

* + - * 1. National Electrical Manufacturers Association:

NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum).

* + - * 1. Plumbing and Drainage Institute:

PDI WH201 - Water Hammer Arrester Standard.

* + - * 1. Underwriters Laboratories Inc.:

UL 393 - Indicating Pressure Gauges for Fire-Protection Service.

UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service.

* + - 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. Product Data:

Piping: Submit data on pipe materials, fittings, and accessories. Submit manufacturer's catalog information.

Valves: Submit manufacturers catalog information with valve data and ratings for each service.

Hangers and Supports: Submit manufacturers catalog information including load capacity.

Domestic Water Specialties: Submit manufacturers catalog information, component sizes, rough-in requirements, service sizes, and finishes.

Pumps: Submit pump type, capacity, certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

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

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

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

* + - * 1. Manufacturer's Installation Instructions: Submit installation instructions for pumps, valves and accessories.
				2. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
			1. CLOSEOUT SUBMITTALS
				1. Project Record Documents: Record actual locations of valves and equipment.
				2. Operation and Maintenance Data: Submit spare parts list, exploded assembly views and recommended maintenance intervals.
			2. QUALITY ASSURANCE
				1. For drinking water service, provide valves complying with NSF 61.

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

* + - * 1. Maintain one copy of each document on site.
			1. QUALIFICATIONS
				1. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years [**documented**] experience [**and with service facilities within 100 miles of Project**] [**and with service facilities within <\_\_\_\_\_\_\_\_> miles of Project**].
				2. Installer: Company specializing in performing Work of this section with minimum three years [**documented**] experience [**approved by manufacturer**].
			2. PRE-INSTALLATION MEETINGS
				1. Section 013000 - Administrative Requirements: Pre-installation meeting.
				2. Convene minimum [**one**] <**\_\_\_\_\_\_\_\_**> week prior to commencing Work of this Section.
			3. DELIVERY, STORAGE, AND HANDLING
				1. Accept valves and equipment on site in shipping containers with labeling in place. Inspect for damage.
				2. Provide temporary protective coating on cast iron and steel valves.
				3. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
				4. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the Work, and isolating parts of completed system.
			4. ENVIRONMENTAL REQUIREMENTS
				1. Do not install underground piping when bedding is wet or frozen.
			5. FIELD MEASUREMENTS
				1. Verify field measurements prior to fabrication.
			6. WARRANTY

This Article extends warranty period beyond one year. Extended warranties increase construction costs and Owner enforcement responsibilities. Specify warranties with caution.

* + - * 1. Furnish [**five**] <**\_\_\_\_\_\_\_\_**> year manufacturer warranty for domestic water piping.
			1. EXTRA MATERIALS
				1. Furnish [**two**] <**\_\_\_\_\_\_\_\_**> packing kits for each size valve, [**two**] <**\_\_\_\_\_\_\_\_**> [**loose keys for outside hose bibs**] [**hose end vacuum breakers for hose bibs**] [**service kits**] for <**\_\_\_\_\_\_\_\_**> and [**two**] <**\_\_\_\_\_\_\_\_**> [**pump seals**] for each pump model.
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 (American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in, for Water and Other Liquids), [**ductile**] [**gray**] iron, standard thickness.

Joints: AWWA C111 (American National 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**].

* + - * 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 (Specification for Filler Metals for Brazing and 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 Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings), solvent weld with ASTM D2564 (Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems) solvent cement.

* + - * 1. PVC Pipe: AWWA C900 (Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution) Class [**100**] [**150**], polyvinyl chloride (PVC) material.

Fittings: AWWA C110 (American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in, for Water and Other Liquids), [**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.

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 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 (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters) 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 (PE) Plastic Pipe), Polyethylene.

Joints: Mechanical with stainless steel clamp.

* + - * 1. Fiberglass Pipe: AWWA C950 (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 (American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in. (75 mm through 1200 mm), for Water and Other Liquids), [**ductile**] [**gray**] iron, standard thickness.

Joints: AWWA C111 (American National 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**] [**Double layer, half lapped, <\_\_\_\_\_\_\_\_> mil polyethylene tape**].

* + - * 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 (Specification for Filler Metals for Brazing and 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 Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings), solvent weld with ASTM D2564 (Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems) solvent cement.

* + - * 1. PVC Pipe: AWWA C900 (Polyvinyl Chloride (PVC) Pressure Pipe, 4 in. through 12 in., for Water Distribution) Class [**100**] [**150**], polyvinyl chloride (PVC) material.

Fittings: AWWA C110 (American National Standard for Ductile-Iron and Grey-Iron Fittings, 3 in. through 48 in, for Water and Other Liquids), [**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.

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 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 (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameters) 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 (PE) 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

Some plumbing codes may require use of use 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 (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.

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, 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 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-Dipped, 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 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 (Vinyl Chloride) (CPVC) 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) (PVC) Plastic Pipe, Schedule 40, 80, and 120) [**Schedule 40**] [**Schedule 80**] or ASTM S2241 (Standard Specification for Polyethylene (PE) Plastic Pipe (SIDR-PR) 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 Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings), solvent weld with ASTM D2564 (Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems) solvent cement.

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.

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

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

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

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

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

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

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

* + - * 1. CPVC Pipe: ASTM F441 (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 (Vinyl Chloride) (CPVC) 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 (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings) solvent cement. Prime joints with a contrasting color.

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

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

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

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

Ferrous Piping: Class 150, 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, forged steel, slip-on flanges.

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

PVC Piping: PVC flanges.

CPVC Piping: CPVC flanges.

Gaskets: 1/16 inch thick preformed neoprene gaskets.

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

Valves included in this section are those applicable to piping system. Numbers used in Section 220523 have been retained for ease of cross referencing. Possibly renumber valves after editing section for project.

* + - 1. GATE VALVES

In this paragraph, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=7944&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:

Milwaukee

Nibco

Stockham

Approved equivalent.

\*\*\*\*\*\* [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.

The following two valves may be used in low pressure steam systems.

* + - * 1. [**GA-1**] 2 inches and Smaller: MSS SP 80 (Bronze Gate, Globe, Angle and Check Valves), [**Class 125**] [**Class 150**] <**\_\_\_\_\_\_\_\_**>, bronze body, bronze trim, [**threaded**] [**union**] bonnet, [**non-rising**] [**rising**] stem, [**lock-shield stem**] [**hand-wheel**], inside screw [**with back-seating stem**], [**solid**] [**split**] wedge disc, [**alloy seat rings,**] [**solder**] [**or**] [**threaded**] ends.
				2. [**GA-2**] 2-1/2 inches and Larger: MSS SP 70 (Cast Iron Gate Valves, Flanged and Threaded Ends), [**Class 125**] <**\_\_\_\_\_\_\_\_**>, cast iron body, bronze trim, bolted bonnet, [**rising**] [**non-rising**] stem, hand-wheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.
			1. GLOBE VALVES

In this Paragraph, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8006&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:

Johnson Controls

Milwaukee

Nibco

Approved equivalent.

\*\*\*\*\*\* [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.

Use Buna-N disc for water, oil, and gas services. Use teflon disc for steam services.

* + - * 1. [**GL-1**] 2 inches and Smaller: MSS SP 80 (Bronze Gate, Globe, Angle and Check Valves), [**Class 125**] [**Class 150**] <**\_\_\_\_\_\_\_\_**>, bronze body, bronze trim, [**threaded**] [**union**] bonnet, hand wheel, Buna-N composition disc, [**solder**] [**or**] [**threaded**] ends.
				2. [**GL-2**] 2-1/2 inches and Larger: MSS SP 85 (Cast Iron Globe & Angle Valves, Flanged and Threaded), [**Class 125**] <**\_\_\_\_\_\_\_\_**>, cast iron body, bronze trim, hand wheel, outside screw and yoke, flanged ends. Furnish chain-wheel operators for valves 6 inches and larger mounted over 8 feet above floor.
			1. BALL VALVES

In this Paragraph, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=7945&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:

Conbraco (Apollo)

Milwaukee

Nibco

Approved equivalent.

\*\*\*\*\*\* [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.

The following valve is economy type ball valve.

* + - * 1. [**BA-1**] 2 inches and Smaller: MSS SP 110 (Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends), [**400 psi WOG**] [**600 psi WOG**] <**\_\_\_\_\_\_\_\_**>, [**one**] [**two**] piece bronze body, chrome plated brass ball, [**regular**] [**full**] port, teflon seats, blow-out proof stem, [**solder**] [**or**] [**threaded**] ends [**with union**], [**lever handle**] [**wing or tee handle**] [**locking lever handle**] [**extended lever handle**] [**round handle**] [**oval handle**] [**with balancing stops**].
				2. [**BA-2**] 2 inches and Smaller: MSS SP 110 (Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends), [**Class 150**] <**\_\_\_\_\_\_\_\_**>, bronze, two piece body, [**chrome plated bronze**] [**type 316 stainless steel**] ball, [**regular**] [**full**] port, teflon seats, blow-out proof stem, [**solder**] [**or**] [**threaded**] ends [**with union**], [**lever handle**] [**wing or tee handle**] [**locking lever handle**] [**extended lever handle**] [**round handle**] [**oval handle**] [**with balancing stops**].

The following is three-piece repairable ball valve.

* + - * 1. [**BA-3**] 2 inches and Smaller: MSS SP 110 (Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends), [**Class 150**] <**\_\_\_\_\_\_\_\_**>, bronze, three piece body, [**chrome plated bronze**] [**type 316 stainless steel**] ball, [**regular**] [**full**] port, teflon seats, blow-out proof stem, [**solder**] [**or**] [**threaded**] ends, [**lever handle**] [**wing or tee handle**] [**locking lever handle**] [**extended lever handle**] [**round handle**] [**oval handle**] [**with balancing stops**].

The following is ball valve with PVC body and trim.

* + - * 1. [**BA-6**] 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F ASTM D1785 (Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120) PVC body and ball, double lever handle, [**EPDM**] [**fluorocarbon**] seals, teflon seats, [**regular**] [**full**] port, [**single**] [**double**] union type with [**socket**] [**threaded**] ends.

The following is ball valve with CPVC body and trim.

* + - * 1. [**BA-7**] 2 inches and Smaller: 150 psi at 73 degrees F water temperature, maximum service temperature: 210 degrees F, ASTM D1785 (Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120) CPVC body and ball, double lever handle, [**EPDM**] [**fluorocarbon**] seals, teflon seats, [**regular**] [**full**] port, [**single**] [**double**] union type with [**socket**] [**threaded**] ends.
			1. PLUG VALVES

In this Paragraph, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=7946&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:

Flowserve Co.

Henry Pratt Company

Emerson Electric Co.

Approved equivalent.

\*\*\*\*\*\* [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. [**PL-1**] 2 inches and Smaller: MSS SP 78 (Cast Iron Plug Valves, Flanged and Threaded Ends), [**Class 150**] [**Class 300**], [**semi-steel**] <**\_\_\_\_\_\_\_\_**> construction, [**round**] [**square**] [**rectangular**] port, [**full pipe area**] [**regular opening**], pressure lubricated, teflon packing, threaded ends. Furnish one plug valve wrench for every ten plug-valves with minimum of one wrench.
				2. [**PL-2**] 2-1/2 inches and Larger: MSS SP 78 (Cast Iron Plug Valves, Flanged and Threaded Ends), [**Class 150**] [**Class 300**], [**semi-steel**] <**\_\_\_\_\_\_\_\_**> construction, [**round**] [**square**] [**rectangular**] port, [**full pipe area**] [**regular opening**], pressure lubricated, teflon packing, flanged ends. Furnish [**wrench-operated**] [**worm gear-operated**].
			1. BUTTERFLY VALVES

In this Paragraph, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=7947&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:

Milwaukee

Nibco

WATTS

Approved equivalent.

\*\*\*\*\*\* [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.

Use stainless steel disc for swimming pool applications. Use Buna-N (Nitrile rubber) seats in compressed air applications.

* + - * 1. [**BF-1**] 2-1/2 inches and Larger: MSS SP 67 (Butterfly Valves), [**Class 150**] [**Class 200**] [**Class 250**] <**\_\_\_\_\_\_\_\_**>.

Body: Cast or ductile iron, [**wafer**] [**lug**] [**or**] [**grooved**] ends, stainless steel stem, extended neck.

Disc: [**Nickel-plated ductile iron**] [**Aluminum bronze**] [**Elastomer coated ductile iron**] [**Chrome plated ductile iron**] [**or**] [**stainless steel**].

Seat: Resilient replaceable [**EPDM**] [**Buna N**] [**neoprene Viton**].

Handle and Operator: [**10 position lever handle.**] [**Infinite position lever handle with memory stop.**] [**Hand-wheel and gear drive.**] [**Furnish gear operators for valves 8 inches and larger, and chain-wheel operators for valves mounted over 8 feet above floor.**]

The following is butterfly valve with PVC body and trim.

* + - * 1. [**BF-2**] 2 inches through 10 inches: 150 psi at 73 degrees F water temperature, maximum service temperature: 140 degrees F, [**one**] [**two**] piece body, ASTM D1785 (Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120) PVC, lug type flange facing, disc encapsulated with EPDM, stainless steel shaft, locking lever handle.

The following is butterfly valve with CPVC body and trim.

* + - * 1. [**BF-3**] 2 inches through 10 inches: 150 psi at 73 degrees F water temperature, maximum service temperature 210 degrees F, [**one**] [**two**] piece body, ASTM D1785 (Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedule 40, 80, and 120) CPVC, lug type flange facing, disc encapsulated with EPDM, stainless steel shaft, locking lever handle.
			1. CHECK VALVES
				1. Horizontal Swing Check Valves:

In this Subparagraph, list manufacturers acceptable for this Project.

[Manufacturers](http://www.specagent.com/LookUp/?ulid=8008&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:

Milwaukee

Nibco

Stockham

Approved equivalent.

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

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.

[**CK-1**] 2 inches and Smaller: MSS SP 80 (Bronze Gate, Globe, Angle and Check Valves), [**Class 150**] <**\_\_\_\_\_\_\_\_**>, bronze body and cap, bronze seat, Buna-N disc, [**solder**] [**or**] [**threaded**] ends.

[**CK-2**] 2-1/2 inches and Larger: MSS SP 71 (Cast Iron Swing Check Valves, Flanged and Threaded Ends), [**Class 125**] <**\_\_\_\_\_\_\_\_**>, cast iron body, bolted cap, bronze or cast iron disc, [**renewable disc seal and seat,**] flanged ends.

* + - * 1. Spring Loaded Check Valves:

In this Paragraph, list manufacturers acceptable for this Project.

[Manufacturers](http://www.specagent.com/LookUp/?ulid=8007&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:

Milwaukee

Nibco

Stockham

Approved equivalent.

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

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.

[**CK-6**] 2 inches and Smaller: MSS SP 80 (Bronze Gate, Globe, Angle and Check Valves), [**Class 250**] <**\_\_\_\_\_\_\_\_**>, bronze body, in-line spring lift check, silent closing, Buna-N disc, integral seat, [**solder**] [**or**] [**threaded**] ends.

[**CK-7**] 2-1/2 inches and Larger: MSS SP 71 (Cast Iron Swing Check Valves, Flanged and Threaded Ends), [**Class 125**] <**\_\_\_\_\_\_\_\_**>, [**wafer**] [**globe**] style, cast iron body, bronze seat, center guided bronze disc, stainless steel spring and screws, flanged ends.

* + - 1. PIPE HANGERS AND SUPPORTS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=7949&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:

L B & A, Inc.

Metraflex Co.

Panther Industries

Approved equivalent.

\*\*\*\*\*\* [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. Plumbing Piping: Conform to [**ASME B31.9**] [**ASTM F708**] [**MSS SP 58**] [**MSS SP 69**] [**MSS SP 89**].
				2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: [**Malleable iron**] [**Carbon steel**], adjustable swivel, split ring.
				3. Hangers for Cold Pipe Sizes 2 inches and Larger: Carbon steel, adjustable, clevis.
				4. Hangers for Hot Pipe, Sizes 2 to 4 inches: Carbon steel, adjustable, clevis.
				5. Hangers for Hot Pipe, Sizes 6 inches and Larger: Adjustable steel yoke, cast iron pipe roll and double hanger.
				6. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.
				7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 inches and Larger: Steel channels with welded supports or spacers and hanger rods, cast iron roll.
				8. Wall Support for Pipe Sizes 3 inches and Smaller: Cast iron hooks.
				9. Wall Support for Pipe Sizes 4 inches and Larger: Welded steel bracket and wrought steel clamps.
				10. Wall Support for Hot Pipe Sizes 6 inches and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast iron pipe roll.
				11. Vertical Support: Steel riser clamp.
				12. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
				13. Floor Support for Hot Pipe Sizes 4 inches and Smaller: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
				14. Floor Support for Hot Pipe Sizes 6 inches and Larger: Adjustable cast iron pipe roll and stand, steel screws, and concrete pier or steel support.
				15. Copper Pipe Support: Carbon steel ring, adjustable, copper plate.
			1. PRESSURE GAGES

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8026&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:

Ametek, U.S. Gauge Div.

Ashcroft Dresser Industries Instrument Div.

Marsh Instrument Co., Unit of General Signal

Weiss Instruments, Inc.

WIKA Instruments Corp.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Gage: ASME B40.1 (Gauges - Pressure Indicating Dial Type - Elastic Element), [**UL 393**] [**UL 404**] with bourdon tube, rotary brass movement, brass socket, front calibration adjustment, black scale on white background.

Case: [**Steel**] [**Cast aluminum**] [**Fiberglass reinforced polypropylene**] [**Stainless steel**] [**ABS**].

Bourdon Tube: [**Brass**] [**Phosphor bronze**] [**Type 316 stainless steel**].

Dial Size: [**2 inch**] [**2-1/2 inch**] [**3-1/2 inch**] [**4 inch**] [**4-1/2 inch**] [**6 inch**] [**8-1/2 inch**] diameter.

Mid-Scale Accuracy: [**One**] [**two**] [**1/2**] <**\_\_\_\_\_\_\_\_**> percent.

Scale: [**Psi**] [**kPa**] [**Both psi and kPa**].

* + - 1. PRESSURE GAGE TAPS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8027&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:

Ametek, U.S. Gauge Div.

Ashcroft Dresser Industries Instrument Div.

Marsh Instrument Co., Unit of General Signal

Weiss Instruments, Inc.

WIKA Instruments Corp

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Needle Valve: [**Brass**] [**Steel**] [**Stainless Steel**], 1/4 inch NPT for minimum 300 psi.
				2. Ball Valve: [**Brass**] [**Stainless Steel**], [**1/8 inch NPT**] [**1/4 inch NPT**] for 250 psi.
				3. Pulsation Damper: Pressure snubber, brass with 1/4 inch NPT connections.
			1. STEM TYPE THERMOMETERS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8032&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:

Trerice (H.O.) Co.

Weiss Instruments, Inc.

Weksler Instruments Corp.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Thermometer: ASTM E1 (Standard Specification for ASTM Thermometers), red appearing mercury, lens front tube, cast aluminum case with enamel finish.

Size: [**7-inch**] [**9 inch**] [**12 inch**] scale.

Window: Clear [**glass**] [**Lexan**].

Stem: Brass, 3/4 inch NPT, [**3-1/2 inch**] [**<\_\_\_\_\_\_\_\_> inch**] long.

Accuracy: [**ASTM E77**] 2 percent.

Calibration: [**Degrees F**] [**Degrees C**] [**Both degrees F and degrees C**].

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

* + - * 1. Thermometer: ASTM E1 (Standard Specification for ASTM Thermometers), adjustable angle, red appearing mercury, lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device.

Size: [**7 inch**] [**9 inch**] [**12 inch**] scale.

Window: Clear [**glass**] [**Lexan**].

Stem: Brass, 3/4 inch NPT, [**3-1/2 inch**] [**<\_\_\_\_\_\_\_\_> inch**] long.

Accuracy: [**ASTM E77**] 2 percent.

Calibration: [**Degrees F**] [**Degrees C**] [**Both degrees F and degrees C**].

* + - 1. FLOW CONTROL VALVES

In this Paragraph, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8022&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:

Cameron International Corporation

Crane Holdings, Inc

Fisher-Emerson

Flowserve Corp.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Construction: [**Class 125**] [**Class 150**] <**\_\_\_\_\_\_\_\_**>, Brass or bronze body with union on inlet [**and outlet**], temperature and pressure test plug on inlet [**and outlet**] [**, combination blow-down or back-flush drain**].
				2. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure [**5 psi**] [**<\_\_\_\_\_\_\_\_> psi**].
			1. WATER PRESSURE REDUCING VALVES

Some codes require use of Water Pressure Reducing Valves when water pressure within building exceeds 80 psi.

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8025&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:

Bell & Gossett

Watts Co.

Zurn Industries

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. 2 inches and Smaller: MSS SP 80 (Bronze Gate, Globe, Angle and Check Valves), bronze body, stainless steel and thermoplastic internal parts, fabric reinforced diaphragm, strainer, [**threaded**] [**and single union**] [**double union**] ends.
				2. 2 inches and Larger: MSS SP 85 (Cast Iron Globe & Angle Valves, Flanged and Threaded), cast iron body, bronze fitted, elastomeric diaphragm and seat disc, flanged.
			1. RELIEF VALVES

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8021&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:

MAXPRO Technologies

SSP Fittings Corp.

The Lee Company

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Pressure Relief:

ANSI Z21.22 (Relief Valves for Hot Water Supply Systems) certified, bronze body, teflon seat, steel stem and springs, automatic, direct pressure actuated.

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

Bronze body, Teflon seat, steel stem and springs, automatic, direct pressure actuated at maximum 60 psi, UL listed for fuel oil, capacities ASME certified and labeled.

* + - * 1. Temperature and Pressure Relief:

ANSI Z21.22 (Relief Valves for Hot Water Supply Systems) certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME certified and labeled.

* + - 1. STRAINERS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8023&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:

Dayton

Mueller

Hayward Flow Control

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. 2 inch and Smaller: [**Threaded brass body for 175 psi CWP**] [**Class 150, threaded bronze body 300 psi CWP**], Y pattern with 1/32 inch stainless steel perforated screen.
				2. 1-1/2 inch to 4 inch: Class 125, flanged iron body, Y pattern with 1/16-inch stainless steel perforated screen.
				3. 5 inch and Larger: Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.
			1. HOSE BIBS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8024&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:

Arrowhead

EZ-Flo

Matco-Norca

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Interior: Bronze or brass with integral mounting flange, replaceable hexagonal disc, hose thread spout, [**chrome plated where exposed**] with [**hand wheel**] [**lock shield and removable key**], [**integral**] vacuum breaker in conformance with ASSE 1011 (Performance Requirements for Hose Connection Vacuum Breakers).
				2. Interior Mixing: Bronze or brass, wall mounted, double service faucet with hose thread spout, integral stops, [**chrome plated where exposed**] with hand wheels, and vacuum breaker in conformance with ASSE 1011 (Performance Requirements for Hose Connection Vacuum Breakers).
			1. POSITIVE DISPLACEMENT METERS (LIQUID)

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8020&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:

Badger Co.

Dayton

Neptune

Approved equivalent.

\*\*\*\*\*\* [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. [**AWWA C700**] [**AWWA C701**] [**AWWA C702**], positive displacement disc type suitable for fluid with bronze case and cast iron [**frost-proof, breakaway**] bottom cap, hermetically sealed register [**, remote reading to AWWA C706**].
				2. Meter: Brass body turbine meter with magnetic drive register.

Service: [**Cold water, 122 degrees F**] [**Hot water, 200 degrees F**].

Nominal Flow: <**\_\_\_\_\_\_\_\_**> gpm.

Pressure Drop at Nominal Flow: <**\_\_\_\_\_\_\_\_**> psi.

Maximum Flow: <**\_\_\_\_\_\_\_\_**> gpm.

Maximum Operating Pressure: <**\_\_\_\_\_\_\_\_**> psi.

Accuracy: [**1-1/2**] <**\_\_\_\_\_\_\_\_**> percent.

Maximum Counter Reading: [**10 million**] [**100 million**] gallons.

Pipe Size: [**1/2 inch**] [**3/4 inch**] [**<\_\_\_\_\_\_\_\_> inch**].

* + - 1. HYDRANTS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8016&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:

Josam Co.

Watts Regulator Co.

Zurn by Hydromechanics Div., Zurn Industries, Inc.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Wall Hydrant: ASSE 1019 (Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type); non-freeze, self-draining type with [**chrome plated**] [**polished bronze**] [**wall plate**] [**lockable recessed box**] hose thread spout, [**hand wheel**] [**locks shield and removable key**], and [**integral**] vacuum breaker.
				2. Floor Hydrant: ASSE 1019 (Performance Requirements for Vacuum Breaker Wall Hydrants, Freeze Resistant, Automatic Draining Type); [**chrome plated**] [**polished bronze**] lockable recessed box, hose thread spout, lock shield and removable key, and vacuum breaker.
			1. RECESSED VALVE BOX

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8017&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:

Acudor

Mifab

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Washing Machine: Plastic preformed rough-in box with brass [**long shank valves with wheel handles**] [**valves with single lever handle**], socket for 2 inch waste, slip in finishing cover.
				2. Refrigerator: Plastic preformed rough-in box with brass valves with wheel handle slip in finishing cover.
			1. BACKFLOW PREVENTERS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8015&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:

Conbraco Industries, Inc.

Febco

Watts Regulator Co.

Wilkins Regulator Div., Zurn Industries, Inc.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

Other types of back flow preventers are available. Specific requirements, particularly regarding use of reduced pressure back flow type, depends on local code requirements.

* + - * 1. Reduced Pressure Backflow Preventers:

Comply with ASSE 1013 (Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers).

Bronze body, with bronze internal parts and stainless steel springs.

Two independently operating, spring loaded check valves; diaphragm type differential pressure relief valve located between check valves; third check valve opening under back pressure in case of diaphragm failure; non-threaded vent outlet; assembled with two gate valves, strainer, and four test cocks.

* + - * 1. Double Check Valve Assemblies: Comply with ASSE 1015 or AWWA C510; Bronze body with corrosion resistant internal parts and stainless steel springs; two independently operating check valves with intermediate atmospheric vent.
			1. WATER HAMMER ARRESTORS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8014&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:

Amtrol, Inc.

Josam Co.

Smith by Jay R. Smith Mfg. Co. Div., Smith Industries, Inc.

Watts Regulator Co.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. ASSE 1010 (Performance Requirements for Water Hammer Arresters); [**stainless steel**] [**copper**] construction, [**bellows**] [**piston**] type sized in accordance with PDI WH-201.
				2. Pre-charged suitable for operation in temperature range [**-100 to 300 degrees F**] [**34 to 250 degrees F**] and maximum [**250 psi**] [**150 psi**] working pressure.
			1. THERMOSTATIC MIXING VALVES

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8009&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:

Heat-Timer

Lawler Manufacturing Co., Inc

Leonard Valve Co.

Symmons Industries, Inc.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment. Conform to ASSE 1070 to temper water to maximum 110 degrees F.
				2. Capacity: <**\_\_\_\_\_\_\_\_**> gpm at [**45 psi**] [**<\_\_\_\_\_\_\_\_>psi**] differential.
				3. Accessories:

Check valve on inlets.

Volume control shut-off valve on outlet.

Stem thermometer on outlet.

Strainer stop checks on inlets.

* + - * 1. Cabinet: 16 gage [**prime coated**] [**enameled**] [**stainless**] steel, for [**recessed**] [**surface**] mounting with keyed lock.
			1. PRESSURE BALANCED MIXING VALVES

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8010&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:

American Standard

Moen, Inc.

Watts Co.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Valve: Chrome plated cast brass body, stainless steel cylinder and integral temperature adjustment.
				2. Capacity: <**\_\_\_\_\_\_\_\_**> gpm at [**45 psi**] [**<\_\_\_\_\_\_\_\_> psi**] differential.
				3. Accessories:

Volume control shut-off valve on outlet.

Stem thermometer on outlet.

Strainer stop checks on inlets.

* + - * 1. Cabinet: 16 gage [**prime coated**] [**enameled**] [**stainless**] steel, for [**recessed**] [**surface**] mounting with keyed lock.
			1. DIAPHRAGM-TYPE COMPRESSION TANKS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8011&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:

Bell & Gossett Domestic Pump

Burcam

Dayton

Taco

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Construction: Welded steel, tested and stamped in accordance with ASME Section VIII (Boiler and Pressure Vessel Code - Pressure Vessels); supplied with National Board Form U-1, rated for working pressure of 125 psig, with flexible [**EPDM**] diaphragm sealed into tank, and steel legs or saddles.
				2. Accessories: Pressure gage and air-charging fitting, tank drain; pre-charge to [**12 psig**] [**<\_\_\_\_\_\_\_\_> psig**].
				3. Size: <**\_\_\_\_\_\_\_\_**> inches diameter, <**\_\_\_\_\_\_\_\_**> inches overall length, <**\_\_\_\_\_\_\_\_**> gal capacity.
			1. WATER SOFTENERS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8013&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:

Nancrede Engineering Co.

Reynolds Culligan

JMCC Water Filters

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Performance:

Softening Capacity: <**\_\_\_\_\_\_\_\_**> grains.

Service Flow: <**\_\_\_\_\_\_\_\_**> gpm.

Electrical Characteristics:

<**\_\_\_\_\_\_\_\_**> hp <**\_\_\_\_\_\_\_\_**> rated load amperes.

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz, <**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

* + - * 1. Softener Tank: Glass fiber reinforced plastic tank.
				2. <**\_\_\_\_\_\_\_\_**> x <**\_\_\_\_\_\_\_\_**> x <**\_\_\_\_\_\_\_\_**> inches overall size, resin capacity <**\_\_\_\_\_\_\_\_**> cu ft..
				3. Brine Tank: Glass fiber reinforced plastic tank, <**\_\_\_\_\_\_\_\_**> x <**\_\_\_\_\_\_\_\_**> x <**\_\_\_\_\_\_\_\_**>inches overall size, salt capacity <**\_\_\_\_\_\_\_\_**>lb.
				4. Control: [**Brass**] [**Reinforced plastic**] [**control valve cycled to regenerate from one to twelve day period**] [**Reinforced plastic control valve cycled to regenerate after adjustable metered quantity of water flow**].
			1. SYSTEM LUBRICATED CIRCULATORS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8031&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:

Armstrong

Bell & Gossett

Approved equivalent.

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

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

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

* + - * 1. Type: Horizontal shaft, single stage, direct connected with multiple speed wet rotor motor for in-line mounting, for 140 psig maximum working pressure, 230 degrees F maximum water temperature.
				2. Casing: [**Bronze**] <**\_\_\_\_\_\_\_\_**> with flanged pump connections.
				3. Impeller, Shaft, Rotor: Stainless Steel.
				4. Bearings: Metal Impregnated carbon (graphite) and ceramic.
				5. Motor: Impedance protected, [**multiple**] [**single**] [**two**] [**three**] speed [**, with external speed selector**].

Use the following paragraph for one or more identical pumps. Use pump schedule when specifying pumps with different criteria.

* + - * 1. Performance:

Flow Capacity: <**\_\_\_\_\_\_\_\_**> gal/min.

Head: <**\_\_\_\_\_\_\_\_**> feet.

Select one or more of the following subparagraphs appropriate to equipment requirements.

* + - * 1. Electrical Characteristics: In accordance with Section 260503 and the following:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

[**115**] [**230**] [**460**] <**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

* + - 1. IN-LINE CIRCULATOR PUMPS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8030&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:

Amtrol, Inc.

Armstrong Pumps, Inc.

Bell & Gossett Div., ITT Fluid Technology Corp.

Taco, Inc.

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. Casing: Bronze rated for 125 psig working pressure [**with stainless steel rotor assembly**].
				2. Impeller: Bronze.
				3. Shaft: Alloy steel with integral thrust collar and two, oil lubricated bronze sleeve bearings.
				4. Seal: Carbon rotating against stationary ceramic seat.
				5. Drive: Flexible coupling.

Use the following paragraph for one or more identical pumps. Use pump schedule when specifying pumps with different criteria.

* + - * 1. Performance:

Flow: <**\_\_\_\_\_\_\_\_**> gpm, at <**\_\_\_\_\_\_\_\_**> feet of head.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics: In accordance with Section 260503 and the following:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

Motors: In accordance with Section 210513.

* + - 1. CLOSE COUPLED PUMPS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8029&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:

Amtrol, Inc.

Bell & Gossett Div., ITT Fluid Technology Corp.

Taco, Inc.

Weil Pump Co.

Approved equivalent.

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

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

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

* + - * 1. Type: Horizontal shaft, single stage, close coupled, radial split casing, for [**125 psig**] [**175 psig**] [**250 psig**] maximum working pressure.
				2. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
				3. Impeller: Bronze, fully enclosed, keyed to motor shaft extension.
				4. Shaft: Stainless steel.

Select one of the following paragraphs for seal type desired. When more than one is required for different pumps, indicate type on pump schedule. Use Viton fittings for high temperature applications. Packing gland seals are restricted to approximately 100 psig maximum suction head pressure.

* + - * 1. Seal: Carbon rotating against stationary ceramic seat, [**225**] [**212**] <**\_\_\_\_\_\_\_\_**> degrees F maximum continuous operating temperature.

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

* + - * 1. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.

Use the following paragraph for one or more identical pumps. Use pump schedule when specifying pumps with different criteria.

* + - * 1. Performance:

Flow Capacity: <**\_\_\_\_\_\_\_\_**> gal/min.

Head: <**\_\_\_\_\_\_\_\_**> feet head.

Select one or more of the following subparagraphs appropriate to equipment requirements.

* + - * 1. Electrical Characteristics: In accordance with the following:

[**<\_\_\_\_\_\_\_\_>hp**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

Motors: In accordance with Section 210513. [**1750 rpm unless specified otherwise.**]

Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.

* + - 1. BASE MOUNTED PUMPS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8028&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:

Amtrol, Inc.

Bell & Gossett., ITT Fluid Technology Corp.

Taco, Inc.

Approved equivalent.

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

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

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

* + - * 1. Type: Horizontal shaft, single stage, direct connected, radial [**or horizontal**] split casing, for [**125 psig**] [**175 psig**] [**250 psig**] maximum working pressure.
				2. Casing: Cast iron, with suction and discharge gage ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.
				3. Impeller: Bronze, fully enclosed, keyed to shaft.
				4. Bearings: [**Oil**] [**Grease**] [**Permanently**] lubricated roller or ball bearings.
				5. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

Use the following paragraph for one or more identical pumps. Use pump schedule when specifying pumps with different criteria.

* + - * 1. Performance:

Flow Capacity: <**\_\_\_\_\_\_\_\_**> gal/min.

Head: <**\_\_\_\_\_\_\_\_**> feet head.

Select one or more of the following subparagraphs appropriate to equipment requirements.

* + - * 1. Electrical Characteristics: In accordance with Section 260503 and the following:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

Motors: In accordance with Section 210513. [**1750 rpm unless specified otherwise.**]

Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box.

* + - 1. PRESSURE BOOSTER SYSTEMS

In this Article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8012&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:

Amtrol

Dayton Pumps

Stark USA

Approved equivalent.

\*\*\*\*\*\* [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 specified above.

* + - * 1. System: Packaged with [**two**] [**three**] [**four**] pumps, factory assembled, tested, and adjusted; shipped to site as integral unit; consisting of pumps, valves, and galvanized piping, with control panel assembled on fabricated steel base with structural steel framework.
				2. Controls and Instruments: Locate in NEMA 250 (Enclosures for Electrical Equipment (1000 Volts Maximum)) Type 1, general-purpose enclosure with main disconnecting switch interlocked with door.

Furnish for each motor, fused circuit, magnetic starter with three overloads, control circuit transformer with fuse protection and selector switch for each pump.

Furnish low limit pressure switch, low pressure alarm indicator, running indicator, current sensing devices, minimum run timers, manual alternation, and suction and discharge pressure gages.

* + - * 1. Lead Pump: Operate continuously with lag [**pump**] [**pumps**] operating on system demand. When lead pump fails to operate, start next pump in sequence automatically.
				2. Time Delay Relay: Prevent lag [**pump**] [**pumps**] short cycling on fluctuating demands.
				3. Thermal Bleed Circuit with Solenoid Valve: Prevent overheating during low demand.
				4. Low Pressure Control: Stop pump operation when incoming water pressure drops to atmospheric.
				5. Pump Switch: Permit manual or automatic operation.

When system discharge pressure-reducing valve is specified, then check valves on each pump discharge are required.

* + - * 1. Valves: [**Each pump outlet**] [**System discharge**] combination pressure reducing and check valve to maintain constant system pressure. Furnish gate or butterfly valves on suction and discharge of each pump. [**Furnish check valve on each pump discharge.**]
				2. Time Clock for Automatic Day-Night Changeover:

Day cycle: Operate system continuously with pressure to fixtures maintained by pressure reducing valves.

Night Cycle: Operate [**pump**] [**pumps**] intermittently on pressure switch located near pressure tank operating pump for pre-determined adjustable time period.

* + - * 1. Performance:

Flow: <**\_\_\_\_\_\_\_\_**>gpm, at <**\_\_\_\_\_\_\_\_**> feet of head.

Motors: <**\_\_\_\_\_\_\_\_**> hp.

* + - * 1. Electrical Characteristics and Components:

Select one or more of the following subparagraphs appropriate to equipment requirements.

Electrical Characteristics: In accordance the following:

[**<\_\_\_\_\_\_\_\_>hp.**] [**<\_\_\_\_\_\_\_\_> rated load amperes.**]

<**\_\_\_\_\_\_\_\_**> volts, [**single**] [**three**] phase, 60 Hz.

<**\_\_\_\_\_\_\_\_**> amperes maximum [**fuse size**] [**circuit breaker size**] [**overcurrent protection**].

<**\_\_\_\_\_\_\_\_**> minimum circuit ampacity.

<**\_\_\_\_\_\_\_\_**> percent minimum power factor at rated load.

Motors: In accordance with Section 210513.

Disconnect Switch: Factory mount disconnect switch in [**control panel**] [**on equipment**].

* + - 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

Approved equivalent.

\*\*\*\*\*\* [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 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**] <**\_\_\_\_\_\_\_\_**>" in large letters.
1. EXECUTION
	* + 1. EXAMINATION
				1. Section 013000 - Administrative Requirements: Coordination and project conditions.
				2. Verify excavations are to required grade, dry, and not over-excavated.
			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. INSTALLATION - METERS
				1. Install positive displacement meters in accordance with AWWA M6 (Water Meters - Selection, Installation, Testing, and Maintenance), with isolating valves on inlet and outlet. [**Provide full line size bypass with globe valve for liquid service meters.**]

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - THERMOMETERS AND GAGES
				1. Install one pressure gage for each pump, locate taps before strainers and on suction and discharge of pump; pipe to gage.
				2. Install gage taps in piping.
				3. Install pressure gages with pulsation dampers. Provide [**needle valve**] [**or**] [**ball valve**] to isolate each gage.
				4. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inches for installation of thermometer sockets. Allow clearance from insulation.
				5. Provide instruments with scale ranges selected according to service with largest appropriate scale.
				6. Install gages and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.
				7. Adjust gages and thermometers to final angle, clean windows and lenses, and calibrate to zero.

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

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

Provide inserts for placement in concrete forms.

Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inches and larger.

Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut [**above**] [**flush with top of**] [**recessed into and grouted flush with**] slab.

* + - * 1. Pipe Hangers and Supports:

Install in accordance with [**ASME B31.9**] [**ASTM F708**] [**and**] [**MSS SP 89**].

Support horizontal piping as schedule.

Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

Place hangers within 12 inches of each horizontal elbow.

Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

Support vertical piping at every [**other**] floor. Support riser piping independently of connected horizontal piping.

Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

Provide [**copper plated hangers and supports for copper piping**] [**sheet lead packing between hanger or support and piping**].

Manufactured hangers are normally supplied in black steel.

Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 210548.

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

* + - * 1. Install hangers and supports in accordance with Section 220529.
			1. INSTALLATION - BURIED PIPING SYSTEMS
				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. Remove scale and dirt on inside of piping before assembly.
				2. Install pipe to elevation [**as indicated on Drawings**] <**\_\_\_\_\_\_\_\_**>.
				3. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding [**4**] <**\_\_\_\_\_\_\_\_**> inches [**compacted**] [**loose**] depth; [**compact to [95] <\_\_\_\_\_\_\_\_> percent maximum density**].
				4. Install pipe on prepared bedding.
				5. Route pipe in straight line.
				6. Install pipe to allow for expansion and contraction without stressing pipe or joints.
				7. Install [**shutoff**] [**and**] [**drain**] valves at locations indicated on Drawings in accordance with [**this Section**] [**Section [220523] <\_\_\_\_\_\_\_\_>**].
				8. 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.
			1. INSTALLATION - ABOVE GROUND PIPING
				1. Install non-conducting dielectric connections wherever jointing dissimilar metals.
				2. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
				3. Install piping to maintain headroom without interfering with use of space or taking more space than necessary.
				4. Group piping whenever practical at common elevations.
				5. Slope piping and arrange systems to drain at low points.
				6. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 210516.
				7. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 220700.
				8. Provide access where valves and fittings are not accessible. [**Coordinate size and location of access doors with Section 083113.**]
				9. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
				10. Provide support for utility meters in accordance with requirements of utility companies.
				11. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 099114 and/or 099123.
				12. Install domestic water piping in accordance with ASME B31.9 (Building Services Piping).
				13. Sleeve pipes passing through partitions, walls and floors. Refer to Section 220529.
				14. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section [**078413**] [**220529**] <**\_\_\_\_\_\_\_\_**>.
				15. Install unions downstream of valves and at equipment or apparatus connections.

It is not requirement of valves that stems be upright or horizontal, but one of good practice and installation quality.

* + - * 1. Install valves with stems upright or horizontal, not inverted.
				2. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

In the following two paragraphs, each valve type is suitable for application and may be specified without exclusions.

* + - * 1. Install [**gate**] [**ball**] [**or**] [**butterfly**] valves for shut-off and to isolate equipment, part of systems, or vertical risers.
				2. Install [**globe**] [**ball**] [**or**] [**butterfly**] valves for throttling, bypass, or manual flow control services.
				3. Provide lug end butterfly valves adjacent to equipment when functioning to isolate equipment.
				4. Provide spring loaded check valves on discharge of water pumps.
				5. Provide flow controls in water circulating systems [**as indicated on Drawings**] <**\_\_\_\_\_\_\_\_**>.

Several different products or materials are listed for each application. Select one or more for Project application. Verify products or materials selected comply with applicable codes.

* + - * 1. Install potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibs.
				2. Pipe relief from valves, back-flow preventers and drains to nearest floor drain.

Select testing procedure applicable to type of backflow preventers included in project.

* + - * 1. Test backflow preventers in accordance with ASSE [**5013**] [**5015**].
				2. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to [**lavatories**] [**sinks**] [**washing machine outlets**] <**\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**>.
				3. Install air chambers on hot and cold water supply piping to each fixture or group of fixtures (each washroom). Fabricate same size as supply pipe or 3/4 inch minimum, and minimum 18 inches long.

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

* + - * 1. Install Work in accordance with [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - PUMPS
				1. Provide pumps to operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
				2. Install long radius reducing elbows or reducers between pump and piping. Support piping adjacent to pump so no weight is carried on pump casings. For close coupled or base mounted pumps, install supports under elbows on pump suction and discharge line sizes 4 inches and over.
				3. Install pumps on vibration isolators. Refer to Section 210548.
				4. Install flexible connectors at or near [**pumps**] <**\_\_\_\_\_\_\_\_**> where piping configuration does not absorb vibration. Refer to Section 232116.
				5. Provide line sized shut-off valve and [**strainer**] [**pump suction fitting**] <**\_\_\_\_\_\_\_\_**> on pump suction, and line sized [**soft seat check valve, balancing valve, and shut-off valve**] [**combination pump discharge valve**] on pump discharge. Refer to Section 232116.
				6. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump so no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and larger.
				7. Provide air cock and drain connection on horizontal pump casings.
				8. Provide drains for bases and seals.
				9. Check, align, and certify alignment of base mounted pumps prior to start-up.
				10. Install [**close coupled and**] base mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 033000.
				11. Lubricate pumps before start-up.

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

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

Use back flow preventer and sand strainer where applicable. Select sleeve for through-wall or through-floor entry. The following paragraph makes Contractor responsible for service connection and meter installation. Clarify who is responsible for utility charges in Division 01.

* + - * 1. Provide new water service complete with approved [**reduced pressure**] [**double check**] [**back-flow preventer and**] water meter with by-pass valves [**pressure reducing valve,**] [**and strainer**].
				2. Provide sleeve in wall for service main and support at wall with reinforced-concrete bridge. Caulk enlarged sleeve and make watertight with pliable material. Anchor service main inside to concrete wall.

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

* + - * 1. Provide 18 gage galvanized sheet metal sleeve around service main to 6 inch above floor and 6 feet minimum below grade. Size for minimum of 2 inches of loose batt insulation stuffing.
			1. FIELD QUALITY CONTROL
				1. Test domestic water piping system in accordance with [**applicable code**] [**local authority having jurisdiction**] <**\_\_\_\_\_\_\_\_**>.
			2. CLEANING

Review this procedure for compliance with specific local code requirements. Prior to starting work, verify system is complete, flushed and clean.

* + - * 1. Verify pH of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).
				2. Inject disinfectant, free chlorine in liquid, powder and tablet or gas form, throughout system to obtain residual from 50 to 80 mg/L.
				3. Bleed water from outlets to obtain distribution and test for disinfectant residual at minimum 15 percent of outlets.
				4. Maintain disinfectant in system for 24 hours.
				5. When final disinfectant residual tests less than 25 mg/L, repeat treatment.
				6. Flush disinfectant from system until residual concentration is equal to incoming water or 1.0 mg/L.
				7. Take samples no sooner than 24 hours after flushing, from [**10**] [**5**] [**2**] percent of outlets and from water entry, and analyze in accordance with AWWA C651 (Disinfecting Water Mains).
			1. SCHEDULES

Include schedule when Project includes more than one size or type of equipment or when pipe hanger spacing and size is not defined by code. No units of measurement are indicated; add to schedule legend or include within each insert.

Consider the following examples when developing Project schedule.

* + - * 1. Valve Service:

In following Subparagraphs indicate whether service is "shutoff," "throttling," or "check."

Domestic Cold Water: <**\_\_\_\_\_\_\_\_**>.

Domestic Hot Water: <**\_\_\_\_\_\_\_\_**>.

Domestic Hot Water Recirculation: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Pumps:

P-1:

Manufacturer: <**\_\_\_\_\_\_\_\_**>.

Model No.: <**\_\_\_\_\_\_\_\_**>.

Service: <**\_\_\_\_\_\_\_\_**>.

Capacity: <**\_\_\_\_\_\_\_\_**>.

Head: <**\_\_\_\_\_\_\_\_**>.

Minimum Efficiency <**\_\_\_\_\_\_\_\_**>.

Seal Type: <**\_\_\_\_\_\_\_\_**>.

Motor Size: <**\_\_\_\_\_\_\_\_**>.

Motor Voltage/Phase <**\_\_\_\_\_\_\_\_**>/<**\_\_\_\_\_\_\_\_**>.

P-2:

Manufacturer: <**\_\_\_\_\_\_\_\_**>.

Model No.: <**\_\_\_\_\_\_\_\_**>.

Service: <**\_\_\_\_\_\_\_\_**>.

Capacity: <**\_\_\_\_\_\_\_\_**>.

Head: <**\_\_\_\_\_\_\_\_**>.

Minimum Efficiency <**\_\_\_\_\_\_\_\_**>.

Seal Type: <**\_\_\_\_\_\_\_\_**>.

Motor Size: <**\_\_\_\_\_\_\_\_**>.

Motor Voltage/Phase <**\_\_\_\_\_\_\_\_**>/<**\_\_\_\_\_\_\_\_**>.

Consider including following schedule if pipe hanger spacing and size are not defined by code.

* + - * 1. Pipe Hanger Spacing:

Pipe Material: Copper tube.

Size: 1-1/4 inches and smaller.

Maximum Hanger Spacing: 6 feet

1/2 inch

Pipe Material: Copper tube.

Size: 1-1/2 inches and larger.

Maximum Hanger Spacing: 10 feet

1/2 inch

Pipe Material: CPVC.

Size: 1 inch and smaller.

Maximum Hanger Spacing: 3 feet

1/2 inch

Pipe Material: CPVC.

Size: 1-1/4 inches and larger.

Maximum Hanger Spacing: 4 feet

1/2 inch

Pipe Material: Polybutylene.

Maximum Hanger Spacing: 2.7 feet

3/8 inch

Pipe Material: PVC.

Maximum Hanger Spacing: 4 feet

3/8 inch

Pipe Material: Steel.

Size: 3 inches and smaller.

Maximum Hanger Spacing: 12 feet

1/2 inch

Pipe Material: Steel.

Size: 4 inches and larger.

Maximum Hanger Spacing: 12 feet

5/8 inch

END OF SECTION 221100