SECTION 221117 - GRAY-WATER PIPING

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

1. GENERAL
	* + 1. RELATED DOCUMENTS

Retain or delete this article in all Sections of Project Manual.

* + - * 1. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
			1. SUMMARY
				1. Section Includes:

Under-building-slab and aboveground gray-water pipes, tubes, and fittings inside buildings.

Encasement for piping.

* + - 1. SUBMITTALS
				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 submitted and tabbed (for combined submittals).

Do not ask for manufacturer's specifications, material safety data sheets, installation instructions, and similar items that may conflict with specification requirements or needlessly involve Architect in Contractor's means and methods of construction.

* + - * 1. Product Data: For each type of product.

Pipes, tubes, fittings, and specialties for each type of piping.

Joining materials.

Encasement for piping.

Transition fittings.

Dielectric fittings.

Sustainable Design Submittals:

* + - * 1. Coordination Drawings: Piping layout, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
				2. Field quality-control reports.
1. PRODUCTS

Manufacturers and products listed in SpecAgent and MasterWorks Paragraph Builder are neither recommended nor endorsed by the AIA or Deltek. Before inserting names, verify that manufacturers and products listed there comply with requirements retained or revised in descriptions and are both available and suitable for the intended applications.

* + - 1. PERFORMANCE REQUIREMENTS

Revise pressure ratings in this article to suit Project. Gray-water piping may require higher rating if used in high-rise buildings.

* + - * 1. Water Piping Minimum Working Pressure: [**50 psig**] [**80 psig**] [**100 psig**] <**Insert value**> unless otherwise indicated.
			1. COPPER TUBE AND FITTINGS

Tube in "Hard Copper Tube" paragraph below is available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

* + - * 1. Hard Copper Tube: [ASTM B 88, Type L] [and] [ASTM B 88, Type M] water tube, drawn temper.

Tube in "Soft Copper Tube" paragraph below is available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

* + - * 1. Soft Copper Tube: [ASTM B 88, Type K] [and] [ASTM B 88, Type L] water tube, annealed temper.

Fittings in "Cast-Copper, Solder-Joint Fittings" paragraph below are available in NPS 1/4 to NPS 12 (DN 8 to DN 300).

* + - * 1. Cast-Copper, Solder-Joint Fittings: ASME B16.18 “Cast Copper Alloy Solder Joint Pressure Fittings”.

Fittings in "Wrought-Copper, Solder-Joint Fittings" paragraph below are available in NPS 1/4 to NPS 8 (DN 8 to DN 200).

* + - * 1. Wrought-Copper, Solder-Joint Fittings: ASME B16.22 “Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings”,.

Flanges in "Bronze Flanges" paragraph below are available in NPS 1/2 to NPS 12 (DN 15 to DN 300).

* + - * 1. Bronze Flanges: ASME B16.24 “Cast Copper Alloy Pipe Flanges, Flanged Fittings, and Valves: Classes 150, 300, 600, 900, 1500 and 2500”, Class 150, with solder-joint ends.

Unions in "Copper Unions" paragraph below are available in NPS 1/4 to NPS 4 (DN 8 to DN 100).

* + - * 1. Copper Unions:

MSS SP-123 “Non-Ferrous Threaded and Solder-Joint Unions for Use with Copper Water Tube”.

Cast-copper-alloy, hexagonal-stock body.

Ball-and-socket, metal-to-metal seating surfaces.

Solder-joint or threaded ends.

Fittings in "Copper Pressure-Seal-Joint Fittings" paragraph below are available in NPS 1/2 to NPS 4 (DN 15 to DN 100).

* + - * 1. Copper Pressure-Seal-Joint Fittings:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=12124) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Elkhart Products Corporation; a part of Aalberts Integrated Piping Systems](http://www.specagent.com/Lookup?uid=123457123084).

FNW; Ferguson Enterprises, Inc.

[NIBCO INC](http://www.specagent.com/Lookup?uid=123457123085).

Viega

Or equal.

Fittings for NPS 2 and Smaller: Wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

Fittings for NPS 2-1/2 to NPS 4: Cast-bronze or wrought-copper fitting with EPDM-rubber, O-ring seal in each end.

Fittings and couplings in "Appurtenances for Grooved-End Copper Tubing" paragraph below are available in NPS 2 to NPS 8 (DN 50 to DN 200).

* + - * 1. Appurtenances for Grooved-End Copper Tubing:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=12129) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Anvil International/Smith-Cooper International; Tailwind Capital, LLC](http://www.specagent.com/Lookup?uid=123457123094).

[Shurjoint; a part of Aalberts Integrated piping Systems](http://www.specagent.com/Lookup?uid=123457123095).

[Victaulic Company](http://www.specagent.com/Lookup?uid=123457123096).

Or equal.

Bronze Fittings for Grooved-End, Copper Tubing: ASTM B 75 “Standard Specification for Seamless Copper Tube” copper tube or ASTM B 584 “Standard Specification for Copper Alloy Sand Castings for General Applications” bronze castings.

AWWA C606 does not cover couplings in "Mechanical Couplings for Grooved-End Copper Tubing" subparagraph below. At least three listed manufacturers make this type of coupling with dimensions for copper tube and fittings.

Mechanical Couplings for Grooved-End Copper Tubing:

Copper-tube dimensions and design similar to AWWA C606 “Standard for Grooved and Shouldered Joints”.

Ferrous housing sections.

EPDM-rubber gaskets suitable for hot and cold water.

Bolts and nuts.

Minimum Pressure Rating: 300 psig.

Tube and fittings in two paragraphs below are available in NPS 1-1/4 to NPS 8 (DN 32 to DN 200).

* + - * 1. Copper DWV Tube: ASTM B 306 “Standard Specification for Copper Drainage Tube”, drainage tube, drawn temper.
				2. Copper Drainage Fittings: ASME B16.23 “Cast Copper Alloy Solder Joint Drainage Fittings: DWV”, cast copper or ASME B16.29 “Wrought Copper and Wrought Copper Alloy Solder-Joint Drainage Fittings- DMV”, wrought copper, solder-joint fittings.
			1. PVC WATER PIPE AND FITTINGS

Pipe in this article is available in NPS 1/8 to NPS 24 (DN 6 to DN 600).

* + - * 1. PVC Water Pipe: ASTM D 1785 “Standard Specification for Poly(Vinyl Chloride) Plastic Pipe, Schedules 40, 80, and 120”, [**Schedule 40**] [**and**] [**Schedule 80**] [**purple in color**].

Fittings in "PVC Water Socket Fittings" paragraph below are available in NPS 1/8 to NPS 12 (DN 6 to DN 300).

* + - * 1. PVC Water Socket Fittings: [ASTM D 2466 for Schedule 40] [and] [ASTM D 2467 for Schedule 80] [purple in color].

Fittings in "PVC Water Schedule 80 Threaded Fittings" paragraph below are available in NPS 1/8 to NPS 6 (DN 6 to DN 150).

* + - * 1. PVC Water Schedule 80 Threaded Fittings: ASTM D 2464 “Standard Specification for Threaded Poly(Vinyl Chloride) Plastic Pipe Fittings, Schedule 80”.
			1. PP PIPE AND FITTINGS

Pipe in this article is available in NPS 1/2 to NPS 10 (DN 15 to DN 250).

* + - * 1. PP Water Pipe: ASTM F 2389 “Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems”, [**SDR 7.4**] [**and**] [**SDR 11**] [**purple in color**].

Fittings in "PP Water Socket Fittings" paragraph below are available in NPS 1/2 to NPS 10 (DN 15 to DN 250).

* + - * 1. PP Water Socket Fittings: ASTM F 2389 “Standard Specification for Pressure-rated Polypropylene (PP) Piping Systems “[, purple in color].
			1. PIPING JOINING MATERIALS
				1. Pipe-Flange Gasket Materials:

AWWA C110/A21.10 “Standard for Ductile-Iron and Gray-Iron Fittings”, rubber, flat face, 1/8 inch thick or ASME B16.21 “Nonmetallic Flat Gaskets for Pipe Flanges”, nonmetallic and asbestos free unless otherwise indicated.

Full-face or ring type unless otherwise indicated.

* + - * 1. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1 “Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws”, carbon steel unless otherwise indicated.
				2. Solder Filler Metals: ASTM B 32 “Standard Specification for Solder Metal”, lead-free alloys.
				3. Flux: ASTM B 813 “Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube”, water flushable.
				4. Brazing Filler Metals: AWS A5.8 “Filler Metals for Brazing & Braze Welding”, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated.
				5. Solvent Cements for Joining PVC Piping: ASTM D 2564 “Standard Specification for Solvent Cements for Poly (Vinyl Chloride) Plastic Piping Systems”. Include primer according to ASTM F 656 “Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) Plastic Pipe and Fittings”.
				6. Plastic, Pipe-Flange Gaskets, Bolts, and Nuts: Type and material recommended by piping system manufacturer unless otherwise indicated.
			1. TRANSITION FITTINGS
				1. General Requirements:

Same size as pipes to be joined.

Pressure rating at least equal to pipes to be joined.

End connections compatible with pipes to be joined.

* + - * 1. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.

Couplings in "Sleeve-Type Transition Coupling" paragraph below are available in NPS 1/2 to NPS 144 (DN 15 to DN 3600).

* + - * 1. Sleeve-Type Transition Coupling: AWWA C219 “Standard for Bolted, Sleeve-Type Couplings for Plain-End Pipe”.

[Manufacturers:](http://www.specagent.com/Lookup?ulid=12130) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Cascade Waterworks Mfg. Co](http://www.specagent.com/Lookup?uid=123457123098).

[Ford Meter Box Company, Inc. (The)](http://www.specagent.com/Lookup?uid=123457123099).

[JCM Industries, Inc](http://www.specagent.com/Lookup?uid=123457123101).

[Romac Industries, Inc](http://www.specagent.com/Lookup?uid=123457123102).

[Smith-Blair, Inc](http://www.specagent.com/Lookup?uid=123457123103).

[Viking Johnson](http://www.specagent.com/Lookup?uid=123457123104).

Or equal.

Fittings in "Plastic-to-Metal Transition Fittings" paragraph below are available in at least NPS 1/2 to NPS 2 (DN 15 to DN 50).

* + - * 1. Plastic-to-Metal Transition Fittings:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=12132) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Charlotte Pipe and Foundry Company](http://www.specagent.com/Lookup?uid=123457123072).

[Georg Fischer Harvel LLC](http://www.specagent.com/Lookup?uid=123457123073).

[Spears Manufacturing Company](http://www.specagent.com/Lookup?uid=123457123074).

Or equal.

Description:

PVC one-piece fitting with manufacturer's Schedule 80 equivalent dimensions.

One end with threaded brass insert and one solvent-cement-socket [or threaded] end.

Unions in "Plastic-to-Metal Transition Unions" paragraph below are available in NPS 1/2 to NPS 4 (DN 15 to DN 100).

* + - * 1. Plastic-to-Metal Transition Unions:

[Manufacturers:](http://www.specagent.com/Lookup?ulid=12133) Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

[Colonial Engineering, Inc](http://www.specagent.com/Lookup?uid=123457123106).

[NIBCO INC](http://www.specagent.com/Lookup?uid=123457123107).

[Spears Manufacturing Company](http://www.specagent.com/Lookup?uid=123457123108).

Or equal.

Description:

PVC four-part union.

Brass threaded end.

Solvent-cement-joint[**or threaded**] plastic end.

Rubber O-ring.

Union nut.

* + - 1. DIELECTRIC FITTINGS

Use of Dielectric unions are not recommended. Although they are good in theory, they have proven to be problematic in the field due to leakage problems, and improper gasket material section for each specific piping application. Use paragraph below for threaded or soldered piping as required.

* + - * 1. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.
				2. Valves: Bronze ball valve with end connections and pressure rating to match associated piping.

Unions in "Dielectric Unions" paragraph below are available in at least NPS 1/2 to NPS 2 (DN 15 to DN 50).

* + - * 1. Dielectric Unions:

Standard: ASSE 1079.

Revise pressure rating and temperature in "Pressure Rating" subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**125 psig** minimum at **180 deg F**] [**150 psig**] [**250 psig**] <Insert value>.

End Connections: Solder-joint copper alloy and threaded ferrous.

Flanges in "Dielectric Flanges" paragraph below are available in at least NPS 1-1/2 to NPS 4 (DN 40 to DN 100).

* + - * 1. Dielectric Flanges:

Standard: ASSE 1079.

Factory-fabricated, bolted, companion-flange assembly.

Revise pressure rating in "Pressure Rating" subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [**125 psig** minimum at **180 deg F**] [**150 psig**] [**175 psig**] [**300 psig**] <Insert value>.

End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

Flanges in "Dielectric-Flange Insulating Kits" paragraph below are available in at least NPS 1/2 to NPS 48 (DN 15 to DN 1200).

* + - * 1. Dielectric-Flange Insulating Kits: Consisting of dielectric sleeves and washers, and dielectric gasket.

Standard: ANSI Class 150.

Nonconducting materials for field assembly of companion flanges.

Revise pressure rating in "Pressure Rating" subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating: [150 psig] <Insert value>.

Temperature Rating: [250 deg f] <Insert value>.

Gasket: Full faced Neoprene.

Bolt Sleeves: Mylar.

Washers: Double Phenolic washers.

Nipples in "Dielectric Nipples" paragraph below are available in at least NPS 1/2 to NPS 4 (DN 15 to DN 100).

* + - * 1. Dielectric Nipples: Nipples with inert non-corrosive thermoplastic linings are not acceptable.

Standard: IAPMO PS 66.

Electroplated steel nipple complying with ASTM F1545.

Revise pressure rating and temperature in "Pressure Rating and Temperature" subparagraph below to suit Project, or insert other options for specific applications.

Pressure Rating and Temperature: [300 psig at 225 deg F] <Insert values>.

End Connections: Male threaded or grooved.

1. EXECUTION
	* + 1. EXAMINATION

Retain this article only if it supplements Division 01 requirements and includes provisions that apply specifically to individual Sections.

* + - * 1. Examine areas and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
				2. Examine roughing-in for gray-water piping to verify actual locations of piping connections before [**equipment**] [**fixture**] installation.
				3. Examine walls, floors, roofs, and <**Insert description**> for suitable conditions where gray-water piping will be installed.
				4. Proceed with installation only after unsatisfactory conditions have been corrected.
			1. PIPING INSTALLATION

Coordinate piping installations and specialty arrangements with Drawings. If Drawings are explicit enough, these requirements may be reduced or omitted.

* + - * 1. Drawing plans, schematics, and diagrams indicate general location and arrangement of gray-water water piping. Indicated locations and arrangements are used to size pipe and calculate friction loss, expansion, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.
				2. Install copper tubing under building slab according to CDA's "Copper Tube Handbook."
				3. Install underground ductile iron tube in PE encasement according to ASTM A 674 “Standard Practice for Polyethylene Encasement for Ductile Iron Pipe” or AWWA C105/A21.5 “Standard for Polyethylene Encasement for Ductile-Iron Pipe Systems”.
				4. Install seismic restraints on piping. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
				5. Install piping concealed from view and protected from physical contact by building occupants unless otherwise indicated and except in equipment rooms and service areas.
				6. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.
				7. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal, and coordinate with other services occupying that space.
				8. Install piping to permit valve servicing.
				9. Install nipples, unions, special fittings, and valves with pressure ratings the same as or higher than the system pressure rating used in applications below unless otherwise indicated.
				10. Install piping free of sags and bends.
				11. Install fittings for changes in direction and branch connections.
				12. Install unions in copper tubing at final connection to each piece of equipment, machine, and specialty.
				13. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
				14. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."
				15. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."
				16. Install pressure gages on suction and discharge piping for each plumbing pump and packaged booster pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
				17. Install shutoff valve, hose-end drain valve, strainer, pressure gage, and test tee with valve inside the building at each gray-water water-service entrance. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping" and with requirements for drain valves and strainers in Section 221119 "Domestic Water Piping Specialties."
				18. Install shutoff valve immediately upstream of each dielectric fitting.
				19. Install gray-water water piping level [with 0.25 percent slope downward toward drain] [without pitch] and plumb.

Retain first paragraph below if piping is required to withstand seismic design loads.

* + - * 1. Install pressure gages on suction and discharge piping for each plumbing pump. Comply with requirements for pressure gages in Section 220519 "Meters and Gages for Plumbing Piping."
				2. Comply with requirements for pipe hangers and supports specified in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."
			1. WATER PIPE JOINT CONNECTIONS
				1. Ream ends of pipes and tubes and remove burrs.
				2. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
				3. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1 “Pipe Threads, General Purpose, Inch”. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

Apply appropriate tape or thread compound to external pipe threads.

Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.

* + - * 1. Brazed Joints for Copper Tubing: Comply with CDA's "Copper Tube Handbook," "Brazed Joints" chapter.
				2. Soldered Joints for Copper Tubing: Apply ASTM B 813 “Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube”, water-flushable flux to end of tube. Join copper tube and fittings according to ASTM B 828 “Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings” or CDA's "Copper Tube Handbook."
				3. Pressure-Sealed Joints for Copper Tubing: Join copper tube and pressure-seal fittings with tools recommended by fitting manufacturer.
				4. Joint Construction for Grooved-End Copper Tubing: Make joints according to AWWA C606 “Standard for Grooved and Shouldered Joints”. Roll groove ends of tubes. Lubricate and install gasket over ends of tubes or tube and fitting. Install coupling housing sections over gasket with keys seated in tubing grooves. Install and tighten housing bolts.
				5. Flanged Joints: Select appropriate asbestos-free, nonmetallic gasket material in size, type, and thickness suitable for gray-water water service. Join flanges with gasket and bolts according to ASME B31.9 “Building Services Piping”.
				6. Joint Construction for Solvent-Cemented Plastic Piping: Clean and dry joining surfaces. Join pipe and fittings according to the following:

Comply with ASTM F 402 “Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings” for safe-handling practice of cleaners, primers, and solvent cements. Apply primer.

PVC Piping: Join according to ASTM D 2855 “Standard Practice for the Two-Step Method of Joining Poly(Vinyl Chloride) or Chlorinated Poly(Vinyl Chloride) Pipe and Pipe Components with Tapered Sockets”.

* + - * 1. Joints for Dissimilar-Material Piping: Make joints using adapters compatible with materials of both piping systems.
			1. TRANSITION FITTING INSTALLATION
				1. Install transition couplings at joints of dissimilar piping.
				2. Transition Couplings:

Install transition couplings at joints of piping with small differences in ODs.

In Drainage Piping: [**Unshielded**] [**Shielded**], nonpressure transition couplings.

In Aboveground Force Main Piping: Fitting-type transition couplings.

In Underground Force Main Piping:

NPS 1-1/2 and Smaller: Fitting-type transition couplings.

NPS 2 and Larger: Pressure transition couplings.

* + - * 1. Transition Fittings in Aboveground Gray-Water Piping NPS 2 and Smaller: Plastic-to-metal transition [fittings] [or] [unions].
			1. INSTALLATION OF DIELECTRIC FITTINGS
				1. General Requirements: Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

Joining Dissimilar Threaded Piping: Make up connection with a threaded coupling or with companion flanges.

Joining Dissimilar Non-Threaded Piping: Make up connection with adapters recommended by the manufacturers of the piping to be joined.

Joining Galvanized Steel Pipe and Copper Tubing: Make up connection with a dielectric connector.

* + - * 1. Dielectric Fittings for [2 inches] <Insert pipe size> and Smaller: Use dielectric [couplings] [couplings or nipples] [nipples] [unions].
				2. Dielectric Fittings for [2-1/2 inch to 4 inch] <Insert pipe size range>: Use dielectric [flanges] [flange kits] [nipples].
				3. Dielectric Fittings for [5 inch] <Insert pipe size> and Larger: Use dielectric flange kits.
			1. VALVE INSTALLATION

Retain this article if valves are required.

* + - * 1. General valve installation requirements are specified in the following Sections:

Section 220523.12, "Ball Valves for Plumbing Piping."

Section 220523.13, "Butterfly Valves for Plumbing Piping."

Section 220523.14, "Check Valves for Plumbing Piping."

Section 220523.15, "Gate Valves for Plumbing Piping."

* + - * 1. Shutoff Valves:

Install gate or full-port ball valve for piping NPS 2 and smaller.

Install gate valve for piping NPS 2-1/2 and larger.

* + - * 1. Check Valves: Install swing check valve, between pump and shutoff valve, on each sewage pump discharge.
			1. INSTALLATION OF HANGERS AND SUPPORTS

Retain first paragraph below if Project is in a seismic area.

* + - * 1. Comply with requirements for seismic-restraint devices in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment."
				2. Comply with requirements for pipe hanger, supports, and anchor devices in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment."

Vertical Piping: MSS Type 8 or 42, clamps.

Individual, Straight, Horizontal Piping Runs:

100 Feet and Less: MSS Type 1, adjustable, steel clevis hangers.

Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

Longer Than 100 Feet if Indicated: MSS Type 49, spring cushion rolls.

Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

Base of Vertical Piping: MSS Type 52, spring hangers.

1. Install hangers for copper tubing with maximum horizontal spacing and minimum rod diameters to comply with MSS-58 “Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation”, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
	* + - 1. Install vinyl-coated hangers for [PVC] [and] [PP] piping, with maximum horizontal spacing and minimum rod diameters, to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				2. Support horizontal piping within [12 inches] <Insert dimension> of each fitting and coupling.
				3. Support vertical runs of copper tubing to comply with MSS-58 “Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application and Installation”, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
				4. Support vertical runs of [PVC] [and] [PP] piping to comply with manufacturer's written instructions, locally enforced codes, and authorities having jurisdiction requirements, whichever are most stringent.
			1. IDENTIFICATION
				1. Identify system components. Comply with requirements for identification materials and installation in Section 220553 "Identification for Plumbing Piping and Equipment."
				2. Label pressure piping with system operating pressure.
				3. Label all non-potable water piping "NON-POTABLE, DO NOT DRINK."
			2. FIELD QUALITY CONTROL

Retain "Perform the following tests and inspections" paragraph below to require Contractor to perform tests and inspections.

* + - * 1. Perform the following tests and inspections:

Portions of testing and inspecting requirements in this article are taken from model plumbing codes. Verify that requirements are applicable to location of this Project.

Piping Inspections:

Do not enclose, cover, or put piping into operation until it has been inspected and approved by authorities having jurisdiction.

During installation, notify authorities having jurisdiction at least one day before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction:

Roughing-In Inspection: Arrange for inspection of piping before concealing or closing in after roughing in and before setting fixtures.

Final Inspection: Arrange for authorities having jurisdiction to observe tests specified in "Water Piping Tests" subparagraph and to ensure compliance with requirements.

Reinspection: If authorities having jurisdiction find that piping will not pass tests or inspections, make required corrections, and arrange for reinspection.

Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Water Piping Tests:

Fill gray-water piping. Check components to determine that they are not air bound and that piping is full of water.

Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with diagram of portion of piping tested.

Leave new, altered, extended, or replaced gray-water water piping uncovered and unconcealed until it has been tested and approved. Expose work that was covered or concealed before it was tested.

Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow it to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.

Repair leaks and defects with new materials, and retest piping or portion thereof until satisfactory results are obtained.

Prepare reports for tests and for corrective action required.

* + - * 1. Gray-water piping will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. ADJUSTING
				1. Perform the following adjustments before operation:

Close drain valves, hydrants, and hose bibbs.

Open shutoff valves to fully open position.

Open throttling valves to proper setting.

Adjust balancing valves in hot-water-circulation return piping to provide adequate flow.

Manually adjust ball-type balancing valves in hot-water-circulation return piping to provide hot-water flow in each branch.

Adjust calibrated balancing valves to flows indicated.

Remove plugs used during testing of piping and for temporary sealing of piping during installation.

Remove and clean strainer screens. Close drain valves and replace drain plugs.

Remove filter cartridges from housings and verify that cartridges are as specified for application where used and are clean and ready for use.

Check plumbing specialties and verify proper settings, adjustments, and operation.

* + - 1. GRAY-WATER PIPING SCHEDULE
				1. Transition and special fittings with pressure ratings at least equal to piping rating may be used in applications below unless otherwise indicated.
				2. Flanges and unions may be used for aboveground piping joints unless otherwise indicated.

Retain "Fitting Option" paragraph below unless prohibited by authorities having jurisdiction.

* + - * 1. Fitting Option: Extruded-tee connections and brazed joints may be used on aboveground copper tubing.

This article is organized to first present the service and pipe size or size range; then to present optional piping materials and joining methods. Retain the sizes or size ranges applicable to Project; then retain the selected piping materials and joining methods.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Under-building-slab, gray-water piping, [3 inch] <Insert pipe size> and smaller, shall be[ one of] the following:

[Hard] [or] [soft] copper tube, [**ASTM B 88, Type K**] [**ASTM B 88, Type L**]; [wrought-copper, solder-joint fittings; and brazed] [copper pressure-seal fittings; and pressure-sealed] joints.

PVC, [**Schedule 40**] [**Schedule 80**]; socket fittings; and solvent-cemented joints.

PP, [**SDR 7.4**] [**SDR 11**] socket fittings; and fusion-welded joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Under-building-slab, gray-water piping, [4 inch] <Insert pipe size> and larger, shall be[ one of] the following:

PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground gray-water piping, [2 inch] <Insert pipe size> and smaller, shall be[ one of] the following:

Hard copper tube, [ASTM B 88, Type L] [ASTM B 88, Type M]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.

Hard copper tube, [ASTM B 88, Type L] [or] [ASTM B 88, Type M]; copper pressure-seal-joint fittings; and pressure-sealed joints.

Tubing in two subparagraphs below is available only in NPS 1 (DN 25) and smaller.

PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.

Retain " one of" option in first paragraph below to allow Contractor to select piping materials from those retained.

* + - * 1. Aboveground gray-water piping, [2-1/2 inch to 4 inch] <Insert pipe size range>, shall be[ one of] the following:

Hard copper tube, [ASTM B 88, Type L] [ASTM B 88, Type M]; [cast-] [or] [wrought-]copper, solder-joint fittings; and [brazed] [soldered] joints.

Hard copper tube, [ASTM B 88, Type L] [or] [ASTM B 88, Type M]; copper pressure-seal-joint fittings; and pressure-sealed joints.

Hard copper tube, [ASTM B 88, Type L] [or] [ASTM B 88, Type M]; grooved-joint, copper-tube appurtenances; and grooved joints.

PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.

PP, [SDR 7.4] [SDR 11] socket fittings; and fusion-welded joints.

* + - * 1. Aboveground gray-water piping, [5 inch] <Insert pipe size> and larger, shall be PVC, [Schedule 40] [Schedule 80]; socket fittings; and solvent-cemented joints.
			1. VALVE SCHEDULE
				1. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

Shutoff Duty: Use ball or gate valves for piping 2 inch and smaller. Use butterfly, ball, or gate valves with flanged ends for piping 2-1/2 inch and larger.

Throttling Duty: Use globe valves for piping 2 inch and smaller. Use butterfly or ball valves with flanged ends for piping 2-1/2 inch and larger.

Hot-Water Circulation Piping, Balancing Duty: [Calibrated] [Memory-stop] balancing valves.

Drain Duty: Hose-end drain valves.

* + - * 1. Use check valves to maintain correct direction of gray-water water flow to and from equipment.
				2. Iron grooved-end valves may be used with grooved-end piping.

END OF SECTION 221117