SECTION 225100 - SWIMMING POOL PLUMBING SYSTEMS

TIPS:

To view non-printing Editor's Notes that provide guidance for editing, click on MasterWorks/Single‑File Formatting/Toggle/Editor's Notes.

To read detailed research, technical information about products and materials, and coordination checklists, click on MasterWorks/Supporting Information.

Content Requests:

This Section includes piping and equipment for swimming pools.

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:

Pool water piping.

Pool condenser water piping.

Unions and flanges.

Valves.

Pipe hangers and supports.

Pumps.

Pool fittings and equipment.

Filters.

Surge tanks.

Pool water treatment.

Water heaters.

Heating boiler.

Shell and tube heat exchanger.

* + - * 1. Related Sections:

Section 033000 - Cast-in-Place Concrete: Execution requirements for concrete housekeeping pads specified by this Section.

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

Section 07841300 - 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 0991143 and/or 0991234000 - Painting and Coating: Product and execution requirements for painting specified by this Section.

Section 131100 - Swimming Pools: Product and execution requirements for swimming pool construction.

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

Section 220503 - Pipes and Tubes for Plumbing Piping and Equipment: Product and installation requirements for piping materials applying to various system types.

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

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

Section 231123 - Facility Natural-Gas Piping: Product requirements for connections to gas water heaters for placement by this Section.

Section 232113 - Hydronic Piping: Product and execution requirements for hydronic piping connected to equipment specified in this Section.

Section 232116 - Hydronic Piping Specialties: Product and execution requirements for hydronic piping specialties used by swimming pool systems.

Section 232123 - Hydronic Pumps: Product and execution requirements for pumps used with systems specified in this Section.

Section 232213 - Steam and Condensate Heating Piping: Product and execution requirements for steam supply and steam condensate return piping connected to equipment specified in this Section.

Section 232216 - Steam and Condensate Piping Specialties: Product and execution requirements for steam supply and steam condensate piping specialties connected to equipment specified in this Section.

Section 260503 - Equipment Wiring Connections: Execution requirements for electric connections to equipment specified by this Section.

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

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

Section 312316.13 - Trenching: Execution requirements for trenching required by this Section.

Section 312323 - Fill: Requirements for backfill to be placed by this Section.

* + - 1. REFERENCES

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

* + - * 1. American Society of Heating, Refrigerating and Air-Conditioning Engineers:

ASHRAE 90.1 - Energy Standard for Buildings Except Low-Rise Residential Buildings.

ASHRAE 146 - Method of Testing for Rating Pool Heaters.

* + - * 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 B31.9 - Building Services Piping.

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

* + - * 1. ASTM International:

ASTM A36/A36M - Standard Specification for Carbon Structural Steel.

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

ASTM A536 - Standard Specification for Ductile Iron Castings.

ASTM B32 - Standard Specification for Solder Metal.

ASTM B88 - Standard Specification for Seamless Copper Water Tube.

ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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. Hydronics Institute:

H.I. Heating Boiler Standard - Testing and Rating Standard for Heating Boilers.

* + - * 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 80 - Bronze Gate, Globe, Angle and Check Valves.

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. Underwriters Laboratories Inc.:

UL 1081 - Swimming Pool Pumps, Filters, and Chlorinators.

UL 1261 - Electric Water Heaters for Pools and Tubs.

* + - 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 specified and tabbed (for combined submittals).

Only request submittals needed to verify compliance with Project requirements.

* + - * 1. Section 013300 - Submittal Procedures: Submittal procedures.
				2. Shop Drawings: Indicate detailed assembly of components of each system or sub-system.
				3. Product Data:

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

Valves: Submit manufacturer's catalog information with valve data and ratings for each service.

Hangers and Supports: Submit manufacturer's catalog information including load capacity.

Pool Specialties: Submit manufacturer's 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.

Water Heaters: Submit capacity, dimension drawings indicating components and connections to other equipment and piping, performance data, and utility connections.

Heat Exchanger: Submit capacity, dimensions, size of trappings, and performance data.

Filters: Submit manufacturer's catalog information, capacity, component sizes, rough-in requirements, dimensions of tanks, tank lining methods, anchors, attachments, lifting points, and drains.

Chemical Treatment: Submit for each system component manufacturer's catalog information, capacity, component sizes, rough-in requirements.

* + - * 1. Manufacturer's Installation Instructions: Submit details, components assembly, and start-up procedures.
				2. Manufacturer's Certificate: Certify products meet or exceed specified requirements.
				3. Submittals for this section are subject to the re-evaluation fee identified in Article 4 of the General Conditions.
				4. Manufacturer’s installation instructions shall be provided along with product data.
				5. Submittals shall be provided in the order in which they are specified and tabbed (for combined submittals).
			1. CLOSEOUT SUBMITTALS
				1. Section 0177000 - Execution and Closeout RequirementsProcedures: Closeout procedures.
				2. Project Record Documents: Record actual locations of controlling devices and under-floor and buried piping.
				3. Operation and Maintenance Data: Submit replacement part numbers and availability, and service depot location and telephone number.
			2. QUALITY ASSURANCE

Include one of the following paragraphs based on type of equipment used for pool heating in PART 2.

* + - * 1. Pool Heater Performance Requirements: Thermal Efficiency Rating not less than prescribed by ASHRAE 90.1 (Energy Standard for Buildings Except Low-Rise Residential Buildings) when tested according to ASHRAE 146 (Method of Testing for Rating Pool Heaters).

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

* + - * 1. Boiler Performance Requirements: Conform to minimum efficiency prescribed by ASHRAE 90.1 (Energy Standard for Buildings Except Low-Rise Residential Buildings) when tested according to H.I. Heating Boiler Standard (Testing and Rating Standard for Heating Boilers).
				2. Perform Work according to [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.

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**] [**<\_\_\_\_\_\_\_\_> weeks**] prior to commencing Work of this Section.
			3. DELIVERY, STORAGE, AND HANDLING
				1. Section 016000 - Product Requirements: Product storage and handling requirements.
				2. Accept equipment on Site in shipping containers with labeling in place. Inspect for damage.
				3. Protect equipment from damage and elements by maintaining shipping packaging in place until installation. Maintain temporary inlet and outlet caps in place until installation.
			4. FIELD MEASUREMENTS
				1. Verify field measurements prior to fabrication.
			5. COORDINATION
				1. Section 013000 - Administrative Requirements: Coordination and project conditions.
				2. Coordinate Work with excavation, pool construction, pool deck construction, grounding, and bonding to allow proper placement and sequence of pool piping and equipment.
			6. WARRANTY

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

* + - * 1. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.
				2. Furnish [**five**] <**\_\_\_\_\_\_\_\_**>-year manufacturer warranty for pumps, water heaters, boilers, and heat exchangers.
			1. MAINTENANCE SERVICE
				1. Section 017000 - Execution and Closeout Requirements: Maintenance service.
				2. Furnish service and maintenance of [**water treatment systems**] <**\_\_\_\_\_\_\_\_**> for [**one year**] [**<\_\_\_\_\_\_\_\_> years**] from date of substantial completion.
				3. Examine [**system**] <**\_\_\_\_\_\_\_\_**> components [**weekly**] [**semi-monthly**] [**monthly**] [**bi-monthly**]. Clean, adjust, and lubricate equipment.
				4. Include systematic examination, adjustment, and lubrication of [**system**] <**\_\_\_\_\_\_\_\_**>, and controls checkout and adjustments. Repair or replace parts according to manufacturer's operating and maintenance data. Use parts produced by manufacturer of original equipment.
				5. Perform Work without removing [**system**] <**\_\_\_\_\_\_\_\_**> from service during building normal occupied hours.
				6. Provide emergency call back service [**at all hours**] [**during working hours**] for this maintenance period.
				7. Maintain locally, near Place of the Work, adequate stock of parts for replacement or emergency purposes. Have personnel available to ensure fulfillment of this maintenance service, without unreasonable loss of time.
				8. Perform maintenance Work using competent and qualified personnel under supervision [**and in direct employ**] of manufacturer or original installer.
				9. Do not assign or transfer maintenance service to agent or subcontractor without prior written consent of [**OwnerDirector’s Representative**] <**\_\_\_\_\_\_\_\_**>.
			2. MAINTENANCE MATERIALS
				1. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.
				2. Furnish [**one test kit**] [**two test kits**] [**<\_\_\_\_\_\_\_\_> test kits**] for manual testing:

Chlorine residual.

pH level.

Total alkalinity.

* + - 1. EXTRA MATERIALS
				1. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.
				2. Furnish [**two**] <**\_\_\_\_\_\_\_\_**> water treatment systems test probes, indicator bulbs, and surge fuses.
1. PRODUCTS
	* + 1. POOL WATER PIPING
				1. Copper Tubing: ASTM B88 (Standard Specification for Seamless Copper Water Tube) (ASTM B88M), Type [**K**] [**L**] [**M**], drawn.

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

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

Joints: [**ASTM B32, Alloy Grade Sb5 tin-antimony, or Alloy Grade Sn95 tin-silver 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) (ASTM B88M), 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)/A395M 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 ([**minus 34**] [**30**] <**\_\_\_\_\_\_\_\_**> degrees C) to [**230**] [**180**] <**\_\_\_\_\_\_\_\_**> degrees F ([**110**] [**82**] <**\_\_\_\_\_\_\_\_**> degrees C).

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

* + - * 1. CPVC Pipe: ASTM F441 (Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80)/F441M, 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)/D2846M, 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)/F441M, 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)/D2846M, 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 (50 mm) and Smaller:

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 (65 mm) and Larger:

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

PVC Piping: PVC flanges.

CPVC Piping: CPVC flanges.

Gaskets: 1/16-inch (1.6-mm) 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.

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

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

* + - * 1. Furnish materials according to [**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. [**GA-1**] 2 Inches (50 mm) and Smaller: MSS SP 80 (Bronze Gate, Globe, Angle and Check Valves), [**Class 125**] [**Class 150**] <**\_\_\_\_\_\_\_\_**>, bronze body, bronze trim, [**threaded**] [**union**] bonnet, [**nonrising**] [**rising**] stem, [**lock-shield stem**] [**handwheel**], inside screw [**with back-seating stem**], [**solid**] [**split**] wedge disc, [**alloy seat rings,**] [**solder**] [**or**] [**threaded**] ends.
				2. [**GA-2**] 2-1/2 Inches (65 mm) and Larger: MSS SP 70 (Cast Iron Gate Valves, Flanged and Threaded Ends), [**Class 125**] <**\_\_\_\_\_\_\_\_**>, cast-iron body, bronze trim, bolted bonnet, [**rising**] [**nonrising**] stem, handwheel, outside screw and yoke, solid wedge disc with bronze seat rings, flanged ends. Furnish chain-wheel operators for valves 6 inches (150 mm) and larger mounted over 8 feet (2400 mm) 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:

Conbroco (Apollo)

Milwaukee

Nibco

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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 (50 mm) and Smaller: MSS SP 110 (Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends), [**400 psi (2760 kPa) WOG**] [**600 psi (4140 kPa) WOG**] <**\_\_\_\_\_\_\_\_**>, [**one**] [**two**]-piece bronze body, chrome-plated brass ball, [**regular**] [**full**] port, teflon seats, blowout-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 (50 mm) 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, blowout-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 ball valve with PVC body and trim.

* + - * 1. [**BA-6**] 2 Inches (50 mm) and Smaller: 150 psi (1035 kPa) at 73 degrees F (55 degrees C) water temperature, maximum service temperature of 140 degrees F (60 degrees C), ASTM D1785 (Standard Specification for (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 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 (50 mm) and Smaller: 150 psi (1035 kPa) at 73 degrees F (55 degrees C) water temperature, maximum service temperature of 210 degrees F (100 degrees C), ASTM D1785 (Standard Specification for (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 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. 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

WattsATTS

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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.

* + - * 1. [**BF-1**] 2-1/2 Inches (65 mm) 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: Stainless steel.

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

Handle and Operator: [**10 position lever handle**] [**Infinite position lever handle with memory stop**] [**Handwheel and gear drive**] [**Furnish gear operators for valves 8 inches (200 mm) and larger, and chain-wheel operators for valves mounted over 8 feet (2400 mm) above floor**].

The following is butterfly valve with PVC body and trim.

* + - * 1. [**BF-2**] 2 Inches (50 mm) through 10 Inches (250 mm): 150 psi (1035 kPa) at 73 degrees F (55 degrees C) water temperature, maximum service temperature of 140 degrees F (60 degrees C), [**one**] [**two**]-piece body, ASTM D1785 (Standard Specification for (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 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 (50 mm) through 10 Inches (250 mm): 150 psi (1035 kPa) at 73 degrees F (55 degrees C) water temperature, maximum service temperature of 210 degrees F (100 degrees C), [**one**] [**two**]-piece body, ASTM D1785 (Standard Specification for (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 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 paragraph, 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.

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

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

Furnish materials according to [**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 type disc in water-oil-gas applications.

[**CK-1**] 2 Inches (50 mm) 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 (65 mm) 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.

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

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

Furnish materials according to [**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 (50 mm) 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 (65 mm) 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:

McMaster-Carr

Metraflex Co.

Panther Industries

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Conform to [**ASME B31.9**] [**ASTM F708**] [**MSS SP58**] [**MSS SP69**] [**MSS SP89**].
				2. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches (13 to 38 mm): [**Malleable iron**] [**Carbon steel**], adjustable swivel, split ring.
				3. Hangers for Cold Pipe Sizes 2 Inches (50 mm) and Larger: Carbon steel, adjustable, clevis.
				4. Hangers for Hot Pipe Sizes 2 to 4 Inches (50 to 100 mm): Carbon steel, adjustable, clevis.
				5. Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Larger: Adjustable steel yoke, cast-iron roll, double hanger.
				6. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
				7. Multiple or Trapeze Hangers for Hot Pipe Sizes 6 Inches (150 mm) and Larger: Steel channels with welded spacers and hanger rods, cast-iron roll.
				8. Wall Support for Pipe Sizes 3 Inches (76 mm) and Smaller: Cast-iron hooks.
				9. Wall Support for Pipe Sizes 4 Inches (100 mm) and Larger: Welded steel bracket and wrought steel clamp.
				10. Wall Support for Hot Pipe Sizes 6 Inches (150 mm) and Larger: Welded steel bracket and wrought steel clamp with adjustable steel yoke and cast-iron 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 (100 mm) 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 (150 mm) and Larger: Adjustable cast-iron roll and stand, steel screws, and concrete pier or steel support.
				15. Copper Pipe Support: Copper-plated, carbon steel ring.

The following pumps are typically used for residential and small commercial pool applications, and for hot tubs.

* + - 1. POOL FILTER PUMPS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8092&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:

Hayward

TruSonik

XtremepowerUS

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Type: [**UL 1081,**] Horizontal shaft, single stage, direct connected, with motor, oil lubricated, with casing, integral hair and lint strainer, renewable wear ring, impeller, mechanical seal.
				2. Casing: [**Bronze**] [**Glass reinforced plastic resin**], self-primary, double volute rated for 125 psi (860 kPa) working pressure, with pipe flanges.
				3. Impeller: [**Bronze**] [**Fiberglass filled plastic resin**], closed [**with casing wear rings**].
				4. Shaft: Alloy steel with integral thrust collar and stainless-steel sleeve.
				5. Seal: Carbon rotating against stationary ceramic seat.
				6. Strainer: Hair and lint basket built into casing with 12:1 ratio of free area to pipe inlet area, removable [**Lexan**] cover.
				7. Pump Motors: Operate at 3500 rpm unless otherwise indicated. Refer to Section 210513.

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

* + - * 1. Performance:

Flow capacity: <**\_\_\_\_\_\_\_\_**> gpm (<**\_\_\_\_\_\_\_\_**> L/s).

Head: <**\_\_\_\_\_\_\_\_**> feet (<**\_\_\_\_\_\_\_\_**> kPa).

* + - * 1. Electrical Characteristics:

<**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW).

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

* + - 1. WHIRLPOOL JET PUMPS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8093&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

Allied Innovations

Aqua Flo

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Type: [**UL 1081,**] Horizontal shaft, single stage, direct connected, with motor, oil lubricated, with casing, integral hair and lint strainer, renewable wear ring, impeller, mechanical seal.
				2. Casing: [**Bronze**] [**Glass reinforced plastic resin**], self-primary, double volute rated for 125 psi (860 kPa) working pressure, with pipe flanges.
				3. Impeller: [**Bronze**] [**Fiberglass filled plastic resin**], closed [**with casing wear rings**].
				4. Shaft: Alloy steel with integral thrust collar and stainless-steel sleeve.
				5. Seal: Carbon rotating against stationary ceramic seat.
				6. Strainer: Hair and lint basket built into casing with 12:1 ratio of free area to pipe inlet area, removable [**Lexan**] cover.
				7. Pump Motors: Operate at 3500 rpm unless otherwise indicated. Refer to Section 210513.

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

* + - * 1. Performance:

Flow Capacity: <**\_\_\_\_\_\_\_\_**> gpm (<**\_\_\_\_\_\_\_\_**> L/s).

Head: <**\_\_\_\_\_\_\_\_**> feet (<**\_\_\_\_\_\_\_\_**> kPa).

* + - * 1. Electrical Characteristics:

<**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW).

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

The following pumps are general duty pumps typically used in large commercial and institutional installations.

* + - 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:

Bell & Gossett Domestic Pump

Berkeley

Goulds

Mepco

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Type: Horizontal shaft, single stage, single or double suction, direct connected, radial or horizontally split casing, for 125 psi (860 kPa) maximum working pressure.
				2. Casing: [**Cast iron**] [**Bronze**] [**Stainless steel**], with suction and discharge gage ports, [**renewable bronze casing wearing rings,**] seal flush connections, drain plug, flanged suction and discharge.
				3. Impellers: [**Bronze**] [**Stainless steel**], fully enclosed, keyed to motor shaft extension.
				4. Shaft: Stainless steel.
				5. Seals: Carbon rotating against stationary ceramic seat, 225 degrees F (107 degrees C) 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: <**\_\_\_\_\_\_\_\_**> gpm <**\_\_\_\_\_\_\_\_**> (<**\_\_\_\_\_\_\_\_**> L/s).

Head: <**\_\_\_\_\_\_\_\_**> feet (<**\_\_\_\_\_\_\_\_**> kPa).

* + - * 1. Electrical Characteristics:

<**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW).

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

* + - 1. POOL FITTINGS AND EQUIPMENT

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8094&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:

Controlomatic

Hayward

Waterco

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Main Drain: ABS body, [**9-by-9**] <**\_\_\_\_\_\_\_\_**>-by-<**\_\_\_\_\_\_\_\_**>-inch ([**225-by-225**] <**\_\_\_\_\_\_\_\_**>-by-<**\_\_\_\_\_\_\_\_**>-mm) square frame and grate, [**44**] <**\_\_\_\_\_\_\_\_**> sq. in. ([**284**] <**\_\_\_\_\_\_\_\_**> sq. cm) open area, PVC outlet coupling, [**2**] <**\_\_\_\_\_\_\_\_**>**-**inch ([**50**] <**\_\_\_\_\_\_\_\_**>**-**mm) bottom connections with plugs.

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

* + - * 1. Main Drain: Cast-iron body, 12-by-12-inch (300-by-300-mm) chrome bronze square frame and grate, 55 sq. in. (355 sq. cm) open area, side outlet, 2-inch (50-mm) bottom connection with plug.

The following frames and grates are used in larger pools where drain is cast into pool.

* + - * 1. Square Frames and Grates: ABS, [**9-by-0**] [**12-by-12**] [**18-by-18**]-inch ([**225-by-225**] [**300-by-300**] [**450-by-450**]-mm) frame and grates, [**44**] [**78**] [**176**] sq. in ([**284**] [**503**] [**1135**] sq. cm).

The following two drain types are typically used in small packaged pools and hot tubs.

* + - * 1. Round Frames and Grates: ABS, white color with stainless-steel securing screws, 8-inch (200-mm) nominal diameter, 13 sq. in. (84 sq. cm) open area.
				2. Anti-Vortex Drain: ABS, white color with stainless-steel securing screws, 8-inch (200-mm) nominal diameter, 7 sq. in. (45 sq. cm) open area, with [**frame for concrete pool**] [**mounting lock-nut and gasket for fiberglass pool**].
				3. Suction Drain: Bronze frame, chrome-plated grille, nominal 4-by-10 inch (100 x 250 mm) size, 25 sq. in. (161 sq. cm) open area, for maximum 105 gpm (400 L/min) flow at 1.5 ft/s (0.46 m/s) velocity.
				4. Wall and Floor Inlets: White cycolac, nominal 4-inch (100-mm) diameter, with internal spinner valve disc.
				5. Gutter Drain: White cycolac, nominal 2.75-by-4.5 inch (70-by-114 mm) size, 4 sq. in. (26 sq. cm) open area.
				6. Ball Inlets: [**ABS**] [**Chrome-plated cast bronze**] body and ball with stainless-steel screws, with 1-1/2-inch (40-mm) water inlet [**, 1/2-inch (13-mm) air connection**], 30 gpm (2.6 L/s) nominal flow rate.
				7. Skimmers: NSF approved, ABS molded body, with 10-inch (250-mm) diameter cover, 8-inch (200-mm) wide hinged weir with automatic level adjustment of 4.5 inches (140 mm), thermoplastic strainer with 160 cu. in. (2600 cu. cm) capacity, 55 gpm (3.3 L/s) flow rating.
				8. Hair and Lint Strainer: ABS molded body with basket with 12:1 ratio of free area to pipe inlet area, removable [**Lexan**] cover.
			1. RESIDENTIAL FILTERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8095&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:

Honeywell International

3M

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Assembly: [**UL 1081,**] pressure sand type consisting of filter unit, multi-position valve with backwash indicator, circulating pump with built-in hair and lint strainer, and pump-to-filter hose connection.
				2. Tank: One-piece shell of fiberglass-reinforced vinyl ester resin with separate top flange designed for maximum working pressure of 50 psi (345 kPa), with minimum bursting pressure of 300 psi (2070 kPa), and hydrostatic tested to 75 psi (518 kPa), mounted on fiberglass-reinforced plastic base.
				3. Internal Distribution System: Fabricated of thermoplastic extrusions and moldings with basket type upper distributor and under-drain consisting of slotted moldings extending radially from central standpipe.
				4. Multi-Position Valve: Construct of corrosion-resistant and corrosion-proof materials with control handle registering six positions; Filter, Backwash, Whirlpool, Drain, Test, Rinse and Winterize.
				5. Filter Medium: Hard, durable grains of rounded or sub-angular silica sand, maximum 1 percent flat or micaceous particles, effective size of 0.17 inch (0.44 mm) and uniformity coefficient of 1.35.
			1. COMMERCIAL FILTERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8096&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:

General Electric Co.

Honeywell International

3M

Approved equivalent

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

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

* + - * 1. Furnish materials according to [**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. Assembly: [**UL 1081,**] pressure sand-and-gravel type consisting of filter tank(s), face piping with butterfly valves, and gage panel.
				2. Filter Tank: Fabricate from ASTM A36 (Standard Specification for Carbon Structural Steel)/A36M steel plate to ASME Section VIII (Boiler and Pressure Vessel Code - Pressure Vessels) suitable for working pressure of <**\_\_\_\_\_\_\_\_**> psi (<**\_\_\_\_\_\_\_\_**> kPa), and hydrostatic test pressure of <**\_\_\_\_\_\_\_\_**> psi (<**\_\_\_\_\_\_\_\_**> kPa). Furnish 11-by-15-inch (280-by-380-mm) manhole in top head and leveling jacks. Equip with 3/4-inch (20-mm) automatic air vent and tubing for connection to manual air vent on gage panel. Paint externally with primer, and epoxy coat internally.
				3. Influent Distribution System: Schedule 80 PVC pipe consisting of head and laterals with orifices directed upwards, designed for maximum 8 fps (2.44 m/s) velocity of water in laterals at rated filter capacity.
				4. Under-Drain System: Schedule 80 PVC pipe, consisting of header and laterals with orifices pointed downwards, designed for maximum 10 fps (3.05 m/s) velocity of water in laterals at rated filter capacity. Space laterals and orifices to allow uniform water flow through filter bed during filter and backwash operations.
				5. Face Piping: Class 125 cast-iron flanged pipe fittings and Schedule 40 flange-connected steel pipe designed for maximum 10 fps (3.05 m/s) velocity of water at rated filter capacity, incorporating line size butterfly valves. Furnish sight glass at waste connection.
				6. Gage Panel: Mount on tank and furnish with 4-inch (100-mm) diameter influent and effluent pressure gages connected by tubing to nipples on tank nozzles; with NSF stainless-steel name plate.
				7. Furnish concrete fill in bottom of tank to within one inch (25 mm) of underside of effluent header.
				8. Filter Support Media: Clean, hard rounded gravel with minimum average specific gravity of 2.5, free from shale, mica, clay, sandstone, loam, and other impurities. Screen to sizes specified with maximum 2 percent by weight of thin, flat, or elongated pieces. Filter support media consisting of four grades of gravel laid in level layers, each 4 inches (100 mm) deep as follows:

Coarse gravel 3/4 inch to 1-1/2 inches (20 to 38 mm).

Medium gravel 1/2 to 3/4 inch (13 to 20 mm).

Fine gravel 1/8 to 1/4 inch (3 to 6 mm).

Buckwheat gravel 1/16 to 1/8 inch (1.5 to 3 mm).

* + - * 1. Filter Sand: Hard, durable grains of rounded or sub-angular silica sand, free from clay, loam, dirt and organic matter, maximum 1 percent by weight flat or micaceous particles, effective size of 0.17 inch (0.44 mm) and uniformity coefficient of 1.35. Place upon filter support media in level bed minimum 20 inches (510 mm) deep.
				2. Performance:

Flow Rate: <**\_\_\_\_\_\_\_\_**> gpm (<**\_\_\_\_\_\_\_\_**> L/s).

Total Effective Area: <**\_\_\_\_\_\_\_\_**> sq. ft (<**\_\_\_\_\_\_\_\_**> sq. m).

Filtering Capacity: <**\_\_\_\_\_\_\_\_**> gpm per sq. ft (<**\_\_\_\_\_\_\_\_**> L/s/sq. m) of filter area.

* + - 1. COMMERCIAL VACUUM FILTERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8097&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:

Compressed Air Systems, Inc.

Schenck Process

Filpro Corp

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Filter Assembly:

Total Filter Area: <**\_\_\_\_\_\_\_\_**> sq. ft (<**\_\_\_\_\_\_\_\_**> sq. m).

Filter Rate: <**\_\_\_\_\_\_\_\_**> gpm (<**\_\_\_\_\_\_\_\_**> L/min).

Flow Rate: <**\_\_\_\_\_\_\_\_**> gpm/sq. ft (<**\_\_\_\_\_\_\_\_**> m/min) of filter area.

Filtering Capacity: <**\_\_\_\_\_\_\_\_**> gal. (<**\_\_\_\_\_\_\_\_**> L) in <**\_\_\_\_\_\_\_\_**> hours.

* + - * 1. Filtering Unit: Vacuum type utilizing principle of filtering through cake of diatomaceous earth, where filtration operation is concluded on suction side of pump.
				2. Filter Tank: [**0.188 inch (5 mm) thick steel internally lined with white plastic lining 0.01 inch (0.025 mm) thick, and painted on exterior with primer.**] [**11 gage (2.8 mm) Type 304 stainless steel.**] Continuously welded joints. Braced externally around perimeter. Slope floor towards drain nozzle. Support floor with flat bars spaced as required. Flange external connection larger than 2 inches (50 mm). Internal connections for manifold stainless steel. [**Furnish full-length catwalk.**]
				3. Baffle: Coated steel or stainless steel, secured to sidewall of tank.
				4. Filter Element: Rectangular bottom drain filter element consisting of filter chamber connected to bottom discharge outlet, both fitted with filter cover. Fabricated filter chamber of high impact styrene, vacuum formed in two identical halves butted and joined over entire contact area.
				5. Filter Element Cover: Woven monofilament linear polyethylene, sewn on two sides with Dacron thread with Velcro type closure for on-Site installation maintenance or replacement.
				6. Element Hold-Down: Coated steel or stainless steel with corrugated PVC foam spacer, stainless-steel fasteners.
				7. Collection Tube: Schedule 80 PVC pipe, machined and drilled to accept element assembly. Finish one end of tube to mate effluent tank internal nozzle and seal opposite end. Secure element collection tube to bottom of tank with stainless-steel clamp assembly.
			1. SURGE TANKS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8098&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:

Flexicraft Industries

Surface Combustion, Inc

Tanks Direct

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Tank: Reinforced fiber glass for 50 psi (345 kPa) working pressure with cover and gasket, fittings, and taps for accessories:

Diameter: <**\_\_\_\_\_\_\_\_**> inches (<**\_\_\_\_\_\_\_\_**> mm).

Height: <**\_\_\_\_\_\_\_\_**> inches (<**\_\_\_\_\_\_\_\_**> mm).

Volume: <**\_\_\_\_\_\_\_\_**> gal (<**\_\_\_\_\_\_\_\_**> L).

* + - * 1. Float Valve: PVC flange body with wafer type disc on stainless-steel shaft and two stainless-steel float rods and polyethylene floats. Disc 20 percent open with float up and full open with float down.
				2. Remote Control Valve: Diaphragm type hydraulically operated with [**threaded**] [**flanged**] connections, and float actuated, multi-port, two position pilot valve.
			1. POOL WATER TREATMENT (SALT SOLUTION)

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8099&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:

Olin Corporation

Occidental Petroleum Corporation

Westlake Corp.

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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 Requirement: Suitable for <**\_\_\_\_\_\_\_\_**> bathers per day, maximum <**\_\_\_\_\_\_\_\_**> bathers per hour density.
				2. Package: System using electrolytic process to produce biocide of hypochlorous acid HOCl, and nascent oxygen from mild salt solution (4000 ppm sodium chloride). Components include:

Electrolysis cells.

Main power assembly.

Master console containing controls and operation indicating lights.

Water sampling system with probes for pH and HOCl residual.

pH dosing unit.

* + - * 1. Operation: Continuously monitor pool water and generate HOCl and oxygen to maintain chlorine residual of 1.5 ppm. Maintain pH of 7.4 by feeding dilute muriatic acid.
			1. POOL WATER TREATMENT (CHLORINE INJECTION)

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8100&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:

Olin Corporation

Occidental Petroleum Corporation

Westlake Corp.

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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 Requirement: [**UL 1081,**] injection rate [**0.2-4**] [**0.5-10**] [**1.0-20**] [**2.5-50**] [**5-100**] pounds per day ([**0.09-1.8**] [**0.23-4.5**] [**0.45-9.1**] [**1.13-22.7**] [**2.27-45.4**] kg per day).
				2. Regulator: Continuously monitor pH and chlorine levels and control chemical feed pumps. Maintain pH of 7.5 and free chlorine residual of 0.9 ppm. Mount regulator in surface mounted general purpose enclosure of fiberglass construction and incorporate:

On-off switch.

Green light to indicate regulator is energized.

Toggle switches for chemical feed pumps, with off, manual, and automatic positions.

Relays for direct switching of pump motors.

Yellow lights to indicate pump operation.

Red lights for abnormal conditions.

Interlock to prevent chlorine feed when pH is abnormal.

3-inch (80-mm) meters for continuous display of pH and chlorine levels.

Calibration controls for pH and chlorine.

* + - * 1. Sensors: Electrode with coaxial cable for attachment to regulator.
				2. Flow Switch: Shuts down controller on no flow through sampling line.
				3. Gas Chlorinator: Vacuum-operated chlorinator, comprising cylinder unit, control unit, and injector.

Cylinder Unit with [**one cylinder**] [**two cylinders**] [**<\_\_\_\_\_\_\_\_> cylinders**] incorporating combined pressure reducing and shut-off valve and chlorine supply indicator.

Control Unit containing injection meter, V-notch orifice, differential regulating valve, pressure relief valve, and chlorine supply indicator.

Connect injector directly into piping.

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

* + - * 1. Liquid Chlorinator: System consisting of two tanks with injector pumps to feed liquid chlorine (bleach) and muriatic acid.

Solution Metering Pump: Positive displacement, diaphragm pump with adjustable flow rate, thermoplastic construction, continuous-duty fully enclosed electric motor and drive, and [**built-in**] relief valve.

Solution Tanks: [**30**] [**50**] gal. ([**114**] [**189**] L) capacity, polyethylene, self-supporting, [**1**] [**5**] gal. ([**3.8**] [**19**] L) graduated markings; molded fiberglass cover with recess for mounting pump and liquid level switch [**, and direct reading scale**].

* + - 1. GAS FIRED WATER HEATER

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8101&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:

Bradford White.Corp.

Rheem Mfg. Co.; Rheem Water Heater Div.

Smith: A.O. Smith Water Products Co.

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Type: Automatic, natural gas-fired, vertical storage.

Include performance here when only one heater is specified. Delete and use schedule at end of Section for more than one unit.

* + - * 1. Performance:

Storage: <**\_\_\_\_\_\_\_\_**> gal. (<**\_\_\_\_\_\_\_\_**> L) capacity.

Input: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> kW).

Minimum Recovery Rate: <**\_\_\_\_\_\_\_\_**> gph (<**\_\_\_\_\_\_\_\_**> L/s) with 100 degrees F (38 degrees C) temperature rise.

Maximum Working Pressure: 150 psi (1000 kPa).

Consider copper lined tanks only when water conditions dictate their use.

* + - * 1. Tank: [**Glass-lined**] [**Copper-lined**] welded steel [**ASME labeled**]; multiple flue passages, 4-inch (100-mm) diameter inspection port, thermally insulated with minimum 2 inches (50 mm) of glass fiber, encased in corrosion-resistant steel jacket; baked-on enamel finish; floor shield and legs.
				2. Controls: Automatic water thermostat with temperature range adjustable from 10 to 180 degrees F (49 to 82 degrees C), gas pressure regulator, multi-ribbon or tubular burner, 100 percent safety shut-off pilot and thermocouple, flue baffle and draft hood.
			1. ELECTRIC WATER HEATERS

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8102&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:

Bradford White Corp.

Lochinvar Corp.

Rheen Mfg.; Rheem Water Heater Div.

Smith: A.O. Smith Water Products Co.

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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:

Storage: <**\_\_\_\_\_\_\_\_**> gal. (<**\_\_\_\_\_\_\_\_**> L) capacity.

Heating Element Size: <**\_\_\_\_\_\_\_\_**> kW.

Number of Heating Elements: <**\_\_\_\_\_\_\_\_**>.

Minimum Recovery Rate: <**\_\_\_\_\_\_\_\_**> gph (<**\_\_\_\_\_\_\_\_**> L/s) with 100 degrees F (56 degrees C) temperature rise.

Maximum Working Pressure: 150 psi (1000 kPa).

* + - * 1. Electrical Characteristics:

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

<**\_\_\_\_\_\_\_\_**> A maximum [**fuse size**] [**circuit breaker size**] [**over current protection**].

* + - * 1. Assembly: Tested according to UL 1261 (Electric Water Heaters for Pools and Tubs).
				2. Tank: [**Glass-lined**] [**Copper-lined**] welded steel; 4-inch (100-mm) diameter inspection port, thermally insulated with minimum 2 inches (50 mm) of glass fiber encased in corrosion-resistant steel jacket; baked-on enamel finish.
				3. Controls: Automatic immersion water thermostat; externally adjustable temperature range from 60 to 180 degrees F (16 to 82 degrees C), flanged or screw-in nichrome elements, high temperature limit thermostat.
				4. Accessories: Brass water connections and dip tube, drain valve, high-density magnesium anode, and ASME rated temperature and pressure relief valve.
			1. HEATING BOILER

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8103&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:

Adams Manufacturing Co.

Power Flame, Inc.

Webster Engineering & Manufacturing Co., Inc.

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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:

Gross input: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> W), at sea level.

Gross output: <**\_\_\_\_\_\_\_\_**> Btuh (<**\_\_\_\_\_\_\_\_**> W), at sea level.

* + - * 1. Type: Gas-fired water tube boiler, with copper finned tube heat exchanger, steel jacket with glass fiber insulation.

Gas burner, thermometer and pressure gauge, immersion thermostats for operating and high limit protection.

100 percent safety shut-off electric gas valve with transformer, electronic spark ignited safety pilot and pilot burner, gas pressure regulator, manual gas shut-off, low water cut off.

ASME rated temperature and pressure relief valve, automatic boiler fill and expansion tank, draft diverter.

* + - * 1. Pump:

Pump Capacity: <**\_\_\_\_\_\_\_\_**> gpm (<**\_\_\_\_\_\_\_\_**> L/s).

Type: All bronze, in-line circulation pump mounted [**on boiler**] [**between heater and storage tank**].

Electrical Characteristics:

<**\_\_\_\_\_\_\_\_**> hp (<**\_\_\_\_\_\_\_\_**> kW).

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

Control: Tank mounted immersion thermostat set at <**\_\_\_\_\_\_\_\_**> degrees F (<**\_\_\_\_\_\_\_\_**> degrees C).

* + - 1. SHELL AND TUBE TYPE HEAT EXCHANGER

In this article, list manufacturers acceptable for this Project.

* + - * 1. [Manufacturers](http://www.specagent.com/LookUp/?ulid=8104&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:

Enerquip LLC

Mason Manufacturing LLC

AGC Heat Transfer

Approved equivalent.

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

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

* + - * 1. Furnish materials according to [**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. Shell: [**Stainless steel**] [**Steel**] with [**threaded**] [**or**] [**flanged**] piping connections and necessary trappings, steel saddle and attaching U-bolts, designed for heating fluid in shell and heated fluid in tubes.
				2. Heads: Brass, with brass tube sheets, threaded or flanged for piping connections.
				3. Tubes: [**U-tube type with 3/4 inch (19 mm) OD minimum seamless copper tubes suitable for 125 psi (860 kPa) working pressure, with tube bundle removable for inspection and cleaning**] [**Stainless-steel coil**].
				4. Code: ASME Code for pressure vessels for service pressures, ASME "U" symbol stamped on heat exchanger.
				5. Accessories:

Wells for temperature regulator sensor [**and high limit sensor**] at water outlet.

ASME rated pressure and temperature relief valve on water outlet.

ASME rated pressure relief valves from tapping on heated waterside, set at 120 psi (820 kPa).

ASME rated pressure relief valve on [**water**] [**steam**] inlet on downstream side of control valve.

Thermometers and pressure gage taps in water inlet and outlets.

Vacuum breaker and pressure gage tapping with pigtail siphon in shell.

1. EXECUTION
	* + 1. EXAMINATION
				1. Section 013000 - Administrative Requirements: Coordination and project conditions.
				2. Verify excavations, equipment supports and pipe hanger inserts.
			2. 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 (100 mm) 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 according to [**ASME B31.9**] [**ASTM F708**] [**and**] [**MSS SP 89**].

Support horizontal piping as schedule.

Install hangers to provide minimum 1/2 inch (15 mm) space between finished covering and adjacent work.

Place hangers within 12 inches (300 mm) of each horizontal elbow.

Use hangers with 1-1/2 inches (40 mm) 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. . [**Refer to Section 099000.**] 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 220548.

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

* + - * 1. Install hangers and supports according to 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 <**\_\_\_\_\_\_\_\_**> feet (<**\_\_\_\_\_\_\_\_**> m) of cover.

Edit the following based on piping material used.

* + - * 1. Remove scale and dirt on inside of piping before assembly.
				2. Excavate pipe trench according to Section [**312316**] [**312316.13**] <**\_\_\_\_\_\_\_\_**>.
				3. Place bedding material at trench bottom to provide uniform bedding for piping, level bedding materials in one continuous layer not exceeding [**4**] <**\_\_\_\_\_\_\_\_**> inches ([**100**] <**\_\_\_\_\_\_\_\_**> mm) [**compacted**] [**loose**] depth; [**compact to 95 percent maximum density**] [**compact to <\_\_\_\_\_\_\_\_> percent maximum density**].
				4. Install pipe on prepared bedding.
				5. Route pipe in straight line.
				6. Install piping specialties according to Section [**232116**] <**\_\_\_\_\_\_\_\_**>.
				7. Install pipe to allow for expansion and contraction without stressing pipe or joints.
				8. Install [**shutoff**] [**and**] [**drain**] valves at locations indicated on Drawings according to [**this Section**] [**Section 220523**] [**Section <\_\_\_\_\_\_\_\_>**].
				9. Install plastic ribbon tape continuous [**over top of pipe**] [**buried 6 inches (150 mm) below finish grade,**] [**buried <\_\_\_\_\_\_\_\_> inches (<\_\_\_\_\_\_\_\_> mm) below finish grade,**] above pipe line; coordinate with Section [**312323**] [**312316.13**] <**\_\_\_\_\_\_\_\_**>. Refer to Section [**220553**] <**\_\_\_\_\_\_\_\_**>.

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

Use the following paragraph for nonmetallic pipe.

* + - * 1. Install trace wire continuous [**over top of pipe**] [**buried 6 inches (150 mm) below finish grade,**] [**buried <\_\_\_\_\_\_\_\_> inches (<\_\_\_\_\_\_\_\_> mm) below finish grade,**] above pipe line; coordinate with Section [**312323**] [**312316.13**] <**\_\_\_\_\_\_\_\_**>. Refer to Section [**220553**] <**\_\_\_\_\_\_\_\_**>.
				2. Pipe Cover and Backfilling:

Backfill trench according to Section [**312323**] <**\_\_\_\_\_\_\_\_**>.

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

After hydrostatic test, evenly backfill entire trench width by hand placing backfill material and hand tamping in [**4**] [**6**] inches ([**100**] [**150**] mm) compacted layers to [**6**] [**12**] inches ([**150**] [**300**] mm) 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 according to [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - ABOVE GROUND PIPING SYSTEMS
				1. Install piping to conserve building space, not interfere with use of space and other work.
				2. Route piping in orderly manner, andmanner and maintain gradient.
				3. Group whenever practical at common elevations.
				4. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Provide access to valves and fittings.
				5. Pipe relief valve outlet and backwash to nearest floor drain.
				6. Install unions downstream of valves and at equipment or apparatus connections.
				7. Install piping according to ASME B31.9 (Building Services Piping).
				8. Sleeve pipe passing through partitions, wallswalls, and floors. Refer to Section 220529.
				9. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 220516.
				10. Provide access where valves and fittings are not accessible. [**Coordinate size and location of access doors with Section 083113.**]
				11. Slope piping and arrange systems to drain at low points.
				12. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
				13. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 0991143 and/or 0991234000.
				14. Install valves with stems upright or horizontal, not inverted.
				15. Insulate piping [**and equipment**]; refer to Section 220700.
				16. Sleeve pipes passing through partitions, wallswalls, and floors. Refer to Section 220529.
				17. Install firestopping at fire rated construction perimeters and openings containing penetrating sleeves and piping. Refer to Section [**07841300**] [**220529**] <**\_\_\_\_\_\_\_\_**>.

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

* + - * 1. Install Work according to [**State**] [**Municipality**] of <**\_\_\_\_\_\_\_\_**> [**Highways**] [**Public Work's**] standards.
			1. INSTALLATION - PUMPS
				1. Install pumps on concrete housekeeping pad minimum 3-1/2 inches (87 mm) high and 6 inches (150 mm) wider than equipment base on each side. Refer to Section 033000.
				2. Provide air cock and drain connection on horizontal pump casings.
				3. Provide line sized valve [**and strainer**] on suction and line sized soft seated check valve and isolation valve on discharge.
				4. Decrease from line size, with long radius reducing elbows or reducers. Support piping adjacent to pump independently of pump casings. Install supports under elbows on pump suction and discharge line sizes 4 inches (100 mm) and larger.
			2. INSTALLATION - FILTER TANKS
				1. Install filter tanks on concrete housekeeping pad minimum 3-1/2 inches (87 mm) high and 6 inches (150 mm) wider than equipment base on each side. Refer to Section 033000.
				2. Provide support for tanks independent of building structural framing members.
				3. Clean and flush tank [**prior to delivery to Site**] [**after installation**]. Seal until pipe connections are made.
			3. INSTALLATION - WATER HEATERS
				1. Install water heaters on concrete housekeeping pad minimum 3-1/2 inches (87 mm) high and 6 inches (150 mm) wider than equipment base on each side. Refer to Section 033000.
				2. Install water heaters according to [**AGA**] [**NSF**] [**NFPA**] [**UL**] requirements.
				3. Coordinate with plumbing piping and related [**fuel piping**] [**gas venting**] [**electrical**] work to achieve complete installation.
				4. Install [**natural**] [**propane**] gas piping according to Section [**231123**] <**\_\_\_\_\_\_\_\_**>.
			4. INSTALLATION - HEAT EXCHANGERS
				1. Install unit with clearance for tube bundle removal without disturbing other installed equipment or piping.
				2. Pipe relief valves and drains to nearest floor drain. [**Pitch shell for condensate drain to traps.**]

Use the following paragraph only for steam heated heat exchangers.

* + - * 1. Connect steam branch line from top of main. Pipe in flexible manner, pitched with steam flow, with pipe union connections. Provide steam pressure gage at exchanger inlet. Provide steam traps and valves [**as indicated on Drawings**]. Refer to Section 232216 for steam piping specialties. Refer to Section 232213 for steam piping materials.
			1. FIELD QUALITY CONTROL
				1. Section [**014000 - Quality Requirements**] [**017000 - Execution and Closeout Requirements**]: Field inspecting, testing, adjusting, and balancing.
				2. Test swimming pool piping systems according to [**ASME B31.9**] <**\_\_\_\_\_\_\_\_**>.

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

* + - * 1. Test swimming pool piping systems according to [**applicable code**] [**local authority having jurisdiction**] [**local department of health**] <**\_\_\_\_\_\_\_\_**>.
			1. SCHEDULES

Include schedule when more than one size and type of unit is required. Follow identification method used on Drawings, or include schedules on Drawings. No units of measurement are indicated; these may be added to schedule legend or included within each insert.

Consider the following examples when developing Project schedule.

* + - * 1. Valve Service:

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

Pool Water Piping: <**\_\_\_\_\_\_\_\_**>.

Pool Condenser Water Piping: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Surge Tanks:

ST-1:

Location: <**\_\_\_\_\_\_\_\_**>.

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

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

Diameter: <**\_\_\_\_\_\_\_\_**>.

Length: <**\_\_\_\_\_\_\_\_**>.

ST-2:

Location: <**\_\_\_\_\_\_\_\_**>.

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

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

Diameter: <**\_\_\_\_\_\_\_\_**>.

Length: <**\_\_\_\_\_\_\_\_**>.

* + - * 1. Pumps:

P-1:

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

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

Location: <**\_\_\_\_\_\_\_\_**>.

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

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

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

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

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

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

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

P-2:

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

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

Location: <**\_\_\_\_\_\_\_\_**>.

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

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

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

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

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

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

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

* + - * 1. Heat Exchangers:

HX-1:

Location: <**\_\_\_\_\_\_\_\_**>.

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

Heating Media: <**\_\_\_\_\_\_\_\_**>.

Diameter: <**\_\_\_\_\_\_\_\_**>.

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

Entering: <**\_\_\_\_\_\_\_\_**>.

Leaving: <**\_\_\_\_\_\_\_\_**>.

Flow Rate: <**\_\_\_\_\_\_\_\_**>.

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

Fouling Factor: <**\_\_\_\_\_\_\_\_**>.

Working Pressure: <**\_\_\_\_\_\_\_\_**>.

HX-2:

Location: <**\_\_\_\_\_\_\_\_**>.

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

Heating Media: <**\_\_\_\_\_\_\_\_**>.

Diameter: <**\_\_\_\_\_\_\_\_**>.

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

Entering: <**\_\_\_\_\_\_\_\_**>.

Leaving: <**\_\_\_\_\_\_\_\_**>.

Flow Rate: <**\_\_\_\_\_\_\_\_**>.

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

Fouling Factor: <**\_\_\_\_\_\_\_\_**>.

Working Pressure: <**\_\_\_\_\_\_\_\_**>.

Include schedule when pipe hanger spacing and size is not defined by code.

* + - * 1. Pipe Hanger Spacing:

Pipe Material: PVC and CPVC.

Pipe Size 1/2 inch (12 mm).

Maximum Hanger Spacing: 3 feet (0.9 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 3/4 inch (20 mm).

Maximum Hanger Spacing: 3 feet (0.9 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 1 inch (25 mm).

Maximum Hanger Spacing: 3 feet (0.9 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 1-1/4 inch (32 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 1-1/2 inch (32 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 2 inch (50 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 2-1/2 inch (65 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 1/2 inch (12 mm).

Pipe Size 3 inch (75 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 1/2 inch (12 mm).

Pipe Size 4 inch (100 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 5/8 inch (15 mm).

Pipe Size 5 inch (125 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 5/8 inch (15 mm).

Pipe Size 6 inch (150 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 3/4 inch (19 mm).

Pipe Size 8 inch (200 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 3/4 inch (19 mm).

Pipe Size 10 inch (250 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 7/8 inch (22 mm).

Pipe Size 12 inch (300 mm).

Maximum Hanger Spacing: 4 feet (1.2 m).

Hanger Rod Diameter: 7/8 inch (22 mm).

Pipe Material: Copper tube.

Pipe Size 1/2 inch (12 mm).

Maximum Hanger Spacing: 5 feet (1.5 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 3/4 inch (20 mm).

Maximum Hanger Spacing: 5 feet (1.5 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 1 inch (25 mm).

Maximum Hanger Spacing: 6 feet (1.8 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 1-1/4 inch (32 mm).

Maximum Hanger Spacing: 7 feet (2.1 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 1-1/2 inch (32 mm).

Maximum Hanger Spacing: 8 feet (2.4 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 2 inch (50 mm).

Maximum Hanger Spacing: 8 feet (2.4 m).

Hanger Rod Diameter: 3/8 inch (9 mm).

Pipe Size 2-1/2 inch (65 mm).

Maximum Hanger Spacing: 9 feet (2.7 m).

Hanger Rod Diameter: 1/2 inch (12 mm).

Pipe Size 3 inch (75 mm).

Maximum Hanger Spacing: 10 feet (3 m).

Hanger Rod Diameter: 1/2 inch (12 mm).

Pipe Size 4 inch (100 mm).

Maximum Hanger Spacing: 12 feet (3.7 m).

Hanger Rod Diameter: 5/8 inch (15 mm).

Pipe Size 5 inch (125 mm).

Maximum Hanger Spacing: 13 feet (4 m).

Hanger Rod Diameter: 5/8 inch (15 mm).

Pipe Size 6 inch (150 mm).

Maximum Hanger Spacing: 14 feet (4.3 m).

Hanger Rod Diameter: 3/4 inch (19 mm).

Pipe Size 8 inch (200 mm).

Maximum Hanger Spacing: 16 feet (4.9 m).

Hanger Rod Diameter: 3/4 inch (19 mm).

Pipe Size 10 inch (250 mm).

Maximum Hanger Spacing: 18 feet (5.5 m).

Hanger Rod Diameter: 7/8 inch (22 mm).

Pipe Size 12 inch (300 mm).

Maximum Hanger Spacing: 19 feet (5.8 m).

Hanger Rod Diameter: 7/8 inch (22 mm).

END OF SECTION 225100