SECTION 232533 - HVAC MAKEUP-WATER FILTRATION EQUIPMENT

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 the following HVAC water-filtration equipment:

HVAC makeup-water softeners.

RO equipment for HVAC makeup water.

Multimedia filters.

Self-cleaning strainers.

Bag- or cartridge-type filters.

Centrifugal separators.

Water-softener chemicals.

* + - * 1. Related Requirements:

Retain subparagraphs below to cross-reference requirements Contractor might expect to find in this Section but are specified in other Sections.

Section 232513 "Water Treatment for Closed-Loop Hydronic Systems" for hydronic water-treatment equipment.

Section 232516 "Water Treatment for Open-Loop Hydronic Systems" for hydronic heating and cooling water-treatment equipment.

Section 232519 "Water Treatment for Steam System Feedwater" for water treatment of steam system feedwater.

Section 232523 "Water Treatment for Humidification Steam System Feedwater" for water treatment equipment of humidification steam system feedwater.

* + - 1. DEFINITIONS

Retain terms that remain after this Section has been edited for a project.

* + - * 1. RO: Reverse osmosis.
				2. TSS: Total suspended solids include both organic and inorganic solids that are suspended in the water. These solids may include silt, plankton, and industrial wastes.
			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).
				4. Product Data: Include rated capacities, operating characteristics, and furnished specialties and accessories for the following products:

Water softeners.

RO units.

Multimedia filters.

Self-cleaning strainers.

Bag- or cartridge-type filters.

Centrifugal separators.

* + - * 1. Shop Drawings: Softeners and filtration equipment, maintenance space required, and piping connections to HVAC systems.

Include plans, elevations, sections, and attachment details.

Include diagrams for power, signal, and control wiring.

Retain "Seismic Qualification Certificates" paragraph below if required by seismic criteria applicable to Project. Coordinate with Section 230548 "Vibration and Seismic Controls for HVAC Piping and Equipment." See ASCE/SEI 7 for certification requirements for equipment and components.

* + - * 1. Seismic Qualification Certificates: For [**water softeners**] [**RO equipment**] [**water-filtration units**] and components, from manufacturer.

Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

* + - * 1. Water-Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.

Retain "Field quality-control reports" paragraph below if Contractor is responsible for field quality-control testing and inspecting.

* + - * 1. Field quality-control reports.
				2. Water Analysis: Illustrate water quality available at Project site.
			1. CLOSEOUT SUBMITTALS
				1. Operation and Maintenance Data: For sensors, injection pumps, [**water softeners,**] [**RO equipment,**] [**water-filtration units,**] and controllers to include in emergency, operation, and maintenance manuals.
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. HVAC MAKEUP-WATER SOFTENER
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3M.

CSI Water Treatment Systems.

Culligan International Company.

Approved equivalent.

* + - * 1. Description: Twin mineral tanks and one brine tank, factory mounted on skid.
				2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Retain first paragraph below for projects in seismic areas; if retaining, also retain "Seismic Qualification Certificates" paragraph in "Informational Submittals" Article.

* + - * 1. Fabricate supports and attachments to tanks with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure, as recommended in writing by manufacturer.
				2. Mineral Tanks:

Retain first subparagraph below to require FRP tanks to be ASME labeled; delete for non-code construction. Steel tanks are available but seldom used [Fabricate and label steel filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.]

Fabricate and label fiber-reinforced plastic (FRP) filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, if indicated.

First option in "Pressure Rating" subparagraph below is usual minimum pressure rating; use higher rating if required.

Pressure Rating: [**100 psig**] [**125 psig**] [**150 psig**] <**Insert value**> minimum.

Wetted Components: Suitable for water temperatures from [**40 to at least 100 deg F**] <**Insert range**>.

Freeboard: 50 percent, minimum, for backwash expansion above the normal resin bed level.

Support Legs or Skirt: Constructed of structural steel, welded or bonded to tank before testing and labeling.

Upper Distribution System: Single-point type, fabricated from lead-free brass valve body, pipe and fittings.

Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, nonclogging polyethylene strainers; arranged for even-flow distribution through resin bed.

* + - * 1. Controls: Automatic; factory mounted on mineral tanks and factory wired.

Adjustable duration of regeneration steps.

Push-button start and complete manual operation override.

Pointer on pilot-control valve shall indicate cycle of operation.

Means of manual operation of pilot-control valve if power fails.

Main Operating Valves: Industrial, automatic, multiport, diaphragm type with the following features:

Slow opening and closing, nonslam operation.

Diaphragm guiding on full perimeter from fully open to fully closed.

Isolated dissimilar metals within valve.

Self-adjusting, internal, automatic brine injector that draws brine and rinses at constant rate independent of pressure.

Float-operated brine valve to automatically measure the correct amount of brine to the softener and refill with fresh water.

Sampling cocks for soft water.

Flow Control: Automatic control of backwash and flush rates over variations in operating pressures that do not require field adjustments. Equip mineral tanks with automatic-reset-head water meter that electrically activates cycle controller to initiate regeneration at preset total in gallons and that automatically resets after regeneration to preset total in gallons for next service run. Include alternator to regenerate one mineral tank with the other in service.

* + - * 1. Brine Tank: Combination measuring and wet-salt storing system.

Tank and Cover Material: Fiberglass a minimum of 3/16 inch thick; or molded polyethylene a minimum of 3/8 inch thick.

Brine Valve: Float operated and plastic fitted for automatic control of brine withdrawn and freshwater refill.

Size: Large enough for at least four regenerations at full salting.

* + - * 1. Factory-Installed Accessories:

Piping, valves, tubing, and drains.

Sampling cocks.

Main-operating-valve position indicators.

Water meters.

* + - * 1. Water Test Kit: Include in wall-mounted enclosure for water softener.

If more than one water softener is required on Project, delete "Capacities and Characteristics" paragraph below and schedule water softeners on Drawings.

* + - * 1. Capacities and Characteristics:

Continuous Service Flow Rate: <**Insert gpm**> at 15-psig pressure loss.

Peak Service Flow Rate: <**Insert gpm**> at 25-psig pressure loss.

Water Consumption: <**Insert gal./day**>.

Water Demand: <**Insert number**> hours/day.

Electrical Characteristics:

Volts: <**Insert value**>.

Phase: <**Insert value**>.

Hertz: <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Interrupting Capacity: <**Insert amperage**>.

* + - 1. RO EQUIPMENT FOR HVAC MAKEUP WATER
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

3M.

CSI Water Treatment Systems.

Culligan International Company.

Approved equivalent.

* + - * 1. Description: Factory fabricated and tested with RO membrane elements in housings, high-pressure pumps and motors, controls, valves, and prefilter; mounted on skid.
				2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

Retain first paragraph below for projects in seismic areas; if retaining, also retain "Seismic Qualification Certificates" paragraph in "Informational Submittals" Article.

* + - * 1. Fabricate supports and attachments to tanks with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure as recommended in writing by manufacturer.
				2. Skid Assembly: Welded-steel frame coated with epoxy protective finish.

Modify details in "RO Membrane and Housing" paragraph below where necessary to specify the products selected as basis of design.

* + - * 1. RO Membrane and Housing:

Element: Thin-film composite with U-cup brine seal, with minimum 98 percent salt rejection based on 2000-ppm water supplied at 225 psig and 77 deg F.

Housing: ASTM A666, Type 304 stainless steel, with PVC end caps held in place with stainless-steel straps.

Modify details in "High-Pressure Pumps and Motors" paragraph below where necessary to specify the products selected as basis of design.

* + - * 1. High-Pressure Pumps and Motors:

Pump:

Vertical, multistage, centrifugal pump, operating at 3500 rpm, with ASTM A666, Type 304 stainless steel casing, shaft, impellers, and inlet and discharge casting.

Bearings shall be tungsten carbide and ceramic.

Cast-iron frame and flanged suction and discharge connections.

Motor characteristics, such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency, are specified in Section 230513 "Common Motor Requirements for HVAC Equipment." If different characteristics are required, add subparagraphs below to suit Project.

Motor: NEMA-standard, C-faced, totally enclosed, fan-cooled motor supported on the pump-bearing frame. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

* + - * 1. Controls:

Microprocessor-based controller with digital display.

Interlock for remote start/stop control.

Membrane flush sequence when pumps shut down.

Run time indicator.

Low-pressure safety cutoff.

Panel-mounted gages as follows:

Product and concentrate.

Inlet, cartridge filter outlet, RO feed, RO concentrate, and RO product pressures.

Product conductivity monitor.

* + - * 1. Valves:

Stainless steel pump, concentrate, and recycle throttling valves rated for minimum 300 psig.

Automatic inlet shutoff valve, diaphragm type; solenoid actuated, normally closed, and constructed of glass-reinforced noryl thermoplastic.

PVC valves with EPDM seats and seals for isolation at inlet, and check and sample valves at product and concentrate. Provide sample valves at cartridge filter outlet, concentrate, and product outlet.

* + - * 1. Prefilter:

Housing: Polypropylene with built-in relief or vent valve.

Element: Spun-wound polypropylene.

* + - * 1. Inlet Water-Tempering Valve: Thermostatic water-tempering valve to maintain [**77 deg F**] <**Insert value**> inlet water temperature to RO unit.
				2. Activated Carbon Filter:

Media Tank: Fiberglass-reinforced polyester rated for minimum 150 psig with internal backwash distributor and filtered water collector.

Media: 12-by-40-mesh, bituminous coal-based activated carbon.

Backwash Valve: Piston-operated control valve with drain-line, flow-control orifice.

Backwash Control: Seven-day time clock.

* + - * 1. Atmospheric Storage Tank:

Tank: Polyethylene single piece with closed top and flat bottom with manway in top, 0.2-micron filter vent, inlet, discharge, and drain piping connections, and bulkhead fittings for level controls.

Control: Level switches start and stop RO unit. Low-level limit shall stop repressurization pumps, and signal an alarm.

* + - * 1. Repressurization Pumps:

Pumps: Two close-coupled, single-stage centrifugal pumps, with mechanical seals. Wetted components to be made of ASTM A666, Type 316 stainless steel.

Controls: NEMA 250, Type 4X pump control panel constructed of fiberglass to control pumps, one operating and one standby, with automatic alternator and fail-over control.

Motor characteristics, such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency, are specified in Section 230513 "Common Motor Requirements for HVAC Equipment." If different characteristics are required, add subparagraphs below to suit Project.

Motor: Open, drip-proof motor supported on the pump-bearing frame. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

* + - * 1. Water Test Kit: Include in wall-mounting cabinet for RO unit.

If more than one RO unit is required on Project, delete "Capacities and Characteristics" paragraph below and schedule RO units on Drawings.

* + - * 1. Capacities and Characteristics:

RO Product Flow Rate: <**Insert gpm**>.

Total Water-Flow Rate: <**Insert gpm**>.

Daily Water Consumption: <**Insert gal./day**>.

Water Demand: <**Insert number**> hours/day.

Storage Tank Size: <**Insert gal.**>.

RO Inlet Operating Temperature: [**77 deg F**] <**Insert value**>.

High-Pressure Pump:

Discharge Pressure: <**Insert psig**>.

Flow Rate: <**Insert gpm**>.

Horsepower: <**Insert value**>.

Motor Speed: [**3500**] <**Insert number**> rpm.

Repressure Pumps:

Discharge Pressure: <**Insert psig**>.

Flow Rate: <**Insert gpm**>.

Horsepower: <**Insert value**>.

Motor Speed: [**3500**] <**Insert number**> rpm.

Prefilter Design (at Total Water Flow Rate):

Filter Efficiency: [**98**] <**Insert number**> percent.

Particle Size: [**5**] <**Insert number**> microns and larger.

Clean Pressure Loss: [**2 psig**] <**Insert value**>.

Replacement Pressure Loss: [**6 psig**] <**Insert value**>.

Electrical Characteristics (Single-Point Connection):

Volts: <**Insert value**>.

Phase: <**Insert value**>.

Hertz: <**Insert value**>.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Interrupting Capacity: <**Insert amperage**>.

* + - 1. MULTIMEDIA FILTERS
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Aqua Pure Water Conditioning.

Diamond Water Systems, Inc.

Everfilt.

Approved equivalent.

* + - * 1. Description: Factory-fabricated and -tested, simplex, multimedia filter system, consisting of filter tank, media, strainer, circulating pump, piping, and controls for removing particles from water.

Filter Tank: Corrosion resistant with distribution system and media.

Retain first subparagraph below to require steel or stainless steel tanks to be ASME labeled; delete for non-code construction.

Fabricate and label steel filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

Retain first subparagraph below to require FRP tanks to be ASME labeled; delete for non-code construction.

Fabricate and label FRP filter tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, if indicated.

Pipe Connections NPS 2 and Smaller: Threaded in accordance with ASME B1.20.1.

Steel Tank Pipe Connections NPS 2-1/2 and Larger: Steel, Class 150 flanges in accordance with ASME B16.5 or grooved in accordance with AWWA C606.

FRP Tank Pipe Connections NPS 2-1/2 and Larger: Type A, integral; [**Designation E, 125-psig**] [**or**] [**Designation F, 150-psig**] pressure category flanges of grade same as tank material in accordance with ASTM D5421.

Motorized Valves: Flanged or grooved-end, ductile-iron butterfly type with [**EPDM**] <**Insert material**> valve seat and stem seal; with ASTM B148 aluminum bronze disc.

Strainer: Basket type mounted on pump suction.

Retain one of two "Piping" subparagraphs below.

Piping: ASTM A53; Type S, F, or E; Grade B; Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding, or ductile-iron fittings.

Piping: ASTM B88, Type L copper water tube, copper-alloy solder-joint fittings, and brazed, flanged, or grooved joints.

Safety Valves: Automatic pressure relief.

Circulating Pump: Overhung impeller, close coupled, single stage, end suction, centrifugal. Comply with UL 778 and with HI 1.1-1.2 and HI 1.3.

Casing: Radially split, cast iron.

Pressure Rating: [**125 psig**] [**150 psig**] minimum.

Impeller: ASTM B584 cast bronze; statically and dynamically balanced, closed, and keyed to shaft.

Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.

Seal: Mechanical.

Motor characteristics, such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency, are specified in Section 230513 "Common Motor Requirements for HVAC Equipment." If different characteristics are required, add subparagraphs below to suit Project.

Motor: Open, dripproof motor supported on the pump-bearing frame. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

Controls: Automatic control of circulating pump and tank backwash; factory wired for single electrical connection.

Panel: NEMA 250, [**Type 4**] <**Insert type**> enclosure with time clock and pressure gages.

Pump: Automatic and manual switching; manual switch position bypasses safeties and controls.

Backwash: Automatic; with time clock and differential pressure switch.

Backwash Valve: Tank mounted with valves interlocked to single actuator.

Retain option in "Support" subparagraph below for projects in seismic areas; if retaining, also retain "Seismic Qualification Certificates" paragraph in "Informational Submittals" Article.

Support: Skid mounting.[**Fabricate supports, base, and attachment to tank with reinforcement strong enough to resist filter movement during a seismic event, when filter base is anchored to building structure.**]

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

If more than one circulating multimedia filter is required on Project, delete "Capacities and Characteristics" paragraph below and schedule multimedia filters on Drawings.

* + - * 1. Capacities and Characteristics:

Filter Design:

Water Flow: <**Insert gpm**>.

Clean Pressure Loss: [**5 psig**] <**Insert value**>.

Maximum Media-Flow Rate: [**15 gpm/sq. ft.**] <**Insert value**>.

Filtration Efficiency: [**98**] <**Insert number**> percent.

Particle-Specific Gravity: [**1.8**] <**Insert number**>.

Particle Size: [**5**] [**10**] [**20**] [**45**] <**Insert number**> microns.

Filter Tank: With internal distribution piping.

Pressure Rating: <**Insert psig**>.

Diameter: <**Insert inches**>.

Inlet and Outlet Size: <**Insert NPS**>.

Blowdown Piping Outlet Size: <**Insert NPS**>.

Filter Media: <**Insert material**>.

Start Backwash Pressure Loss: [**13 psig**] <**Insert value**>.

Backwash Period: [**10**] <**Insert number**> minutes.

Circulating Pump:

Capacity: <**Insert gpm**>.

Total Dynamic Head: <**Insert feet**>.

Motor Speed: <**Insert number**> rpm.

Inlet Size: <**Insert NPS**>.

Outlet Size: <**Insert NPS**>.

Pump Motor Size and Electrical Characteristics:

Horsepower: <**Insert value**>.

Volts: [**120**] [**208**] [**240**] [**277**] [**480**] <**Insert number**> V.

Phase: [**Single**] [**Three**].

Hertz: [**60**] <**Insert number**> Hz.

Unit Electrical Characteristics:

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Interrupting Capacity: <**Insert amperage**>.

* + - 1. SELF-CLEANING STRAINERS
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Everfilt.

Hayward Flow Control.

Approved equivalent.

* + - * 1. Description: Factory-fabricated and -tested, ASTM A126, Class B, cast-iron or steel, self-cleaning strainer system of tank, strainer, backwash arm or cleaning spiral, drive and motor, piping, and controls for removing particles from water.

Fabricate and label ASTM A126, Class B, cast-iron or steel strainer tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

Pipe Connections:

NPS 2 and Smaller: Threaded in accordance with ASME B1.20.1.

NPS 2-1/2 and Larger: Steel, Class 150 flanges in accordance with ASME B16.5 or grooved according to AWWA C606.

* + - * 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
				2. Motorized Valves: Flanged or grooved-end, ductile-iron angle type with [**EPDM**] <**Insert material**> valve seat and stem seal; with ASTM B148 aluminum bronze disc.
				3. Strainer: Stainless steel.
				4. Piping: ASTM A53; Type S, F, or E; Grade B; Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding, or ductile-iron fittings.
				5. Safety Valves: Automatic pressure relief.

Hydraulic drive on some units makes motorized drive unnecessary.

* + - * 1. Backwash Arm Drive:

Drive Casing: Cast iron.

Worm Gears: Immersed in oil.

Motor characteristics, such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency, are specified in Section 230513 "Common Motor Requirements for HVAC Equipment." If different characteristics are required, add subparagraphs below to suit Project.

Motor: Open, dripproof motor supported on the strainer-bearing frame. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

* + - * 1. Controls: Automatic control of backwash; factory wired for single electrical connection.

Panel: NEMA 250, [**Type 4**] <**Insert type**> enclosure with time clock and pressure gages.

Backwash Arm Drive: Automatic and manual switching; manual switch position bypasses safeties and controls.

Backwash: Automatic; with time clock and differential pressure switch.

Backwash Valve: Electric actuator.

Retain option in "Support" paragraph below for projects in seismic areas; if retaining, also retain "Seismic Qualification Certificates" paragraph in "Informational Submittals" Article.

* + - * 1. Support: Skid mounting.[**Fabricate supports, base, and attachment to tank with reinforcement strong enough to resist strainer movement during a seismic event, when strainer base is anchored to building structure.**]

If more than one strainer is required on Project, delete "Capacities and Characteristics" paragraph below and schedule strainers on Drawings.

* + - * 1. Capacities and Characteristics:

Strainer Design:

Water Flow: <**Insert gpm**>.

Clean Pressure Loss: [**5 psig**] <**Insert value**>.

Strainer Mesh: [**40**] [**60**] [**80**] <**Insert number**>.

Strainer Tank: With internal distribution piping.

Material: [**Cast iron**] [**Steel**] <**Insert material**>.

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

Inlet and Outlet Size: <**Insert NPS**>.

Backwash Piping Outlet Size: <**Insert NPS**>.

Start Backwash: [**10 psig**] <**Insert value**>.

Backwash Period: [**5**] <**Insert number**> minutes.

Hydraulic drive on some units makes motorized drive unnecessary.

Drive Motor Size and Electrical Characteristics:

Horsepower: <**Insert value**>.

Volts: [**120**] [**208**] [**240**] [**277**] [**480**] <**Insert number**> V.

Phase: [**Single**] [**Three**].

Hertz: [**60**] <**Insert number**> Hz.

Unit Electrical Characteristics:

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Interrupting Capacity: <**Insert amperage**>.

* + - 1. [**BAG**] [**CARTRIDGE**]-TYPE FILTERS
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Filter Specialists, Inc.

Hayward Flow Control.

PEP Filters, Inc.

Approved equivalent.

* + - * 1. Description: [**Floor-mounted housing**] [**Housing**] with filter [**bags**] [**cartridges**] for removing particles from water.

Housing: Corrosion resistant; designed to separate inlet from outlet and to direct inlet through [**bag**] [**cartridge**]-type water filter; with [**bag support and**]base, feet, or skirt.

Pipe Connections NPS 2 and Smaller: Threaded in accordance with ASME B1.20.1.

Steel Housing Pipe Connections NPS 2-1/2 and Larger: Steel, Class 150 flanges in accordance with ASME B16.5 or grooved in accordance with AWWA C606.

Plastic Housing Pipe Connections NPS 2-1/2 and Larger: 150-psig plastic flanges.

[**Bag**] [**Cartridge**]: Replaceable; of shape to fit housing.

If more than one bag- or cartridge-type filter is required on Project, delete "Capacities and Characteristics" paragraph below and schedule bag- or cartridge-type filters on Drawings.

* + - * 1. Capacities and Characteristics:

Filter Design:

Water-Flow Rate: <**Insert gpm**>.

Filtration Efficiency: [**98**] <**Insert number**> percent.

Particle Size: [**10**] [**20**] <**Insert number**> microns and larger.

Clean Pressure Loss: [**2 psig**] <**Insert value**>.

Pressure Loss at Replacement: [**6 psig**] <**Insert value**>.

Housing:

Material: [**Carbon steel**] [**Plastic**].

Pressure Rating: <**Insert psig**>.

Seal Material: [**Nitrile rubber**] <**Insert material**>.

Diameter: <**Insert inches**>.

Height or Length: <**Insert inches**>.

Inlet and Outlet Size: <**Insert NPS**>.

Drain Size: [**Not applicable**] <**Insert NPS**>.

Bag Support Basket Material: [**Stainless steel**] <**Insert material**>.

[**Bag**] [**Cartridge**]:

Number Required: <**Insert number**>.

Nominal Diameter: <**Insert inches**>.

Nominal Length: <**Insert inches**>.

Media Material: [**Cotton**] [**Polyester**] [**Polypropylene**] <**Insert material**>.

* + - 1. CENTRIFUGAL SEPARATORS
				1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

Culligan International Company.

LAKOS; a Lindsay Company.

PEP Filters, Inc.

Approved equivalent.

* + - * 1. Description: Simplex separator housing, with baffles and chambers for removing particles from water by centrifugal action and gravity.
				2. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
				3. Housing: With manufacturer's proprietary system of baffles and chambers.

Construction: Fabricate and label steel separator housing to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.

Inlet: Designed with tangential entry to produce centrifugal flow of feedwater.

Vortex Chamber: Designed for downward vortex flow and gravity separation of particles.

Collection Chamber: Designed to hold separated particles.

Outlet: Near top of unit.

Purge: At bottom of collection chamber.

Pipe Connections NPS 2 and Smaller: Threaded in accordance with ASME B1.20.1.

Pipe Connections NPS 2-1/2 and Larger: Steel, Class 150 flanges in accordance with ASME B16.5 or grooved in accordance with AWWA C606. Provide stainless steel flanges if tank is stainless steel.

* + - * 1. Motorized Purge Valve: Gate or plug pattern valve.

Motorized Valves: Butterfly-type, flanged or grooved-end, ductile-iron body, with [**EPDM**] <**Insert material**> valve seat and stem seal; with ASTM B148 aluminum bronze disc.

* + - * 1. Strainer: Stainless steel basket type mounted on pump suction.

Retain one of two "Piping" paragraphs below.

* + - * 1. Piping: ASTM A53; Type S, F, or E; Grade B; Schedule 40 black steel, with flanged, grooved, or threaded joints and malleable, steel welding or ductile-iron fittings.
				2. Piping: ASTM B88, Type L copper water tube, copper-alloy solder-joint fittings, and brazed, flanged, or grooved joints.
				3. Circulating Pump: Overhung impeller, close coupled, single stage, end suction, centrifugal. Comply with UL 778 and with HI 1.1-1.2 and HI 1.3.

Casing: Radially split, cast iron.

Pressure Rating: [**125 psig**] [**150 psig**] minimum.

Impeller: ASTM B584 cast bronze; statically and dynamically balanced, closed, and keyed to shaft.

Shaft and Shaft Sleeve: Steel shaft, with copper-alloy shaft sleeve.

Seal: Mechanical.

Motor characteristics, such as NEMA designation, temperature rating, service factor, enclosure type, and efficiency, are specified in Section 230513 "Common Motor Requirements for HVAC Equipment." If different characteristics are required, add subparagraphs below to suit Project.

Motor: Open, dripproof motor supported on the pump-bearing frame. General requirements for motors are specified in Section 230513 "Common Motor Requirements for HVAC Equipment."

* + - * 1. Controls: Automatic control of circulating pump and separator purge; factory wired for single electrical connection.

Panel: NEMA 250, [**Type 4**] <**Insert type**> enclosure.

Pump: Automatic and manual switching; manual switch position bypasses safeties and controls.

Separator Purge: Automatic and manual.

TSS Controller Interlock: Open separator purge valve with bleed-off control.

Retain option in "Support" paragraph below for projects in seismic areas; if retaining, also retain "Seismic Qualification Certificates" paragraph in "Informational Submittals" Article.

* + - * 1. Support: Skid mounting.[**Fabricate supports, base, and attachment to separator housing with reinforcement strong enough to resist separator movement during a seismic event, when separator base is anchored to building structure.**]

If more than one separator is required on Project, delete "Capacities and Characteristics" paragraph below and schedule separators on Drawings.

* + - * 1. Capacities and Characteristics:

Separator Design:

Water-Flow Rate: <**Insert gpm**>.

Pressure Loss: [**5 psig**] <**Insert value**>.

Separator Efficiency: [**98**] <**Insert number**> percent.

Particle-Specific Gravity: [**1.8**] <**Insert number**>.

Particle Size: [**5**] [**10**] [**20**] [**45**] <**Insert number**> microns.

Housing:

Material: [**Steel**] [**Stainless steel**] [**Plastic**] [**Fiberglass**] <**Insert material**>.

Pressure Rating: <**Insert psig**>.

Diameter: <**Insert inches**>.

Height: <**Insert inches**>.

Inlet and Outlet Size: <**Insert NPS**>.

Purge Size: <**Insert NPS**>.

Retain "Circulating Pump" subparagraph below only if separator is circulating type.

Circulating Pump:

Capacity: <**Insert gpm**>.

Total Dynamic Head: <**Insert feet**>.

Motor Speed: <**Insert number**> rpm.

Inlet Size: <**Insert NPS**>.

Outlet Size: <**Insert NPS**>.

Pump Motor Size and Electrical Characteristics:

Horsepower: <**Insert value**>.

Volts: [**120**] [**208**] [**240**] [**277**] [**480**] <**Insert number**> V.

Phase: [**Single**] [**Three**].

Hertz: [**60**] <**Insert number**> Hz.

Full-Load Amperes: <**Insert value**>.

Minimum Circuit Ampacity: <**Insert value**>.

Maximum Overcurrent Protection: <**Insert amperage**>.

Interrupting Capacity: <**Insert amperage**>.

* + - 1. WATER-SOFTENER CHEMICALS
				1. Mineral: High-capacity, sulfonated-polystyrene ion-exchange resin that is stable over entire pH range with good resistance to bead fracture from attrition or shock. Resin exchange capacity shall be a minimum 30,000 grains/cu. ft. of calcium carbonate of resin when regenerated with 15 lb of salt.
				2. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are unacceptable.
1. EXECUTION
	* + 1. WATER ANALYSIS

Delete this article if water analysis has been or will be performed by Director’s Representative.

* + - * 1. Perform an analysis of supply water to determine quality of water available at Project site.
			1. INSTALLATION
				1. Equipment Mounting:

Retain first subparagraph below to require equipment to be installed on cast-in-place concrete equipment bases.

Install [**water-softener**] [**water-filtration**] equipment on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."

Retain one of two subparagraphs below. Retain first for projects in seismic areas; retain second for projects not in seismic areas. Indicate vibration isolation and seismic-control device type and minimum deflection in supported equipment schedule on Drawings.

Comply with requirements for vibration isolation and seismic control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."

* + - 1. WATER-SOFTENER INSTALLATION
				1. Install water-softener equipment on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units, so controls and devices that require servicing are accessible. Anchor mineral and brine tanks and floor-mounting accessories to substrate.
				2. Install brine lines and fittings furnished by equipment manufacturer but not factory installed.
				3. Prepare mineral-tank distribution system and underbed for minerals, and place specified mineral into mineral tanks.
				4. Install water-testing sets on wall adjacent to water softeners.
			2. RO UNIT INSTALLATION
				1. Install RO unit and storage tank on concrete bases, level and plumb. Maintain manufacturer's recommended clearances. Arrange units, so controls and devices that require servicing are accessible. Anchor RO unit and storage tank with pumps to substrate.
				2. Install interconnecting piping and controls furnished by equipment manufacturer but not factory installed.
				3. Install water-testing sets on wall adjacent to RO unit.
			3. PIPING CONNECTIONS

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

* + - * 1. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
				2. Where installing piping adjacent to equipment, allow space for service and maintenance.
				3. Make piping connections between HVAC [**water-softener**] [**water-filtration**] equipment and dissimilar-metal piping with dielectric fittings. Comply with requirements in Section 232113 "Hydronic Piping."
				4. Install shutoff valves on HVAC [**water-softener**] [**water-filtration**] equipment inlet and outlet. Metal general-duty valves are specified in Section 230523.11 "Globe Valves for HVAC Piping," Section 230523.12 "Ball Valves for HVAC Piping," Section 230523.13 "Butterfly Valves for HVAC Piping," and Section 230523.15 "Gate Valves for HVAC Piping."
				5. Comply with requirements in Section 221119 "Domestic Water Piping Specialties" for backflow preventers required in makeup-water connections to potable-water systems.
				6. Confirm applicable electrical requirements in electrical Sections for connecting electrical equipment.
			1. ELECTRICAL CONNECTIONS
				1. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
			2. FIELD QUALITY CONTROL

Retain "Manufacturer's Field Service" paragraph below to require a Company Service Advisor to perform tests and inspections.

* + - * 1. Manufacturer's Field Service: Engage a Company Service Advisor to test and inspect components, assemblies, and equipment installations, including connections.

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

* + - * 1. Perform the following tests and inspections[**with the assistance of a Company Service Advisor**]:

Inspect field-assembled components and equipment installation, including piping and electrical connections.

Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.

Place HVAC [**water-softener**] [**water-filtration**] system into operation, and calibrate controls during the preliminary phase of HVAC systems' startup procedures.

Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.

Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

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

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 test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.

Repair leaks and defects with new materials and retest piping until no leaks exist.

* + - * 1. Equipment will be considered defective if it does not pass tests and inspections.
				2. Prepare test and inspection reports.
			1. MAINTENANCE SERVICE

Verify with Director’s Representative that maintenance service is required for Project.

* + - * 1. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above, to inhibit corrosion, scale formation, and biological growth for equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:

Periodic field service and consultation.

Customer report charts and log sheets.

Laboratory technical analysis.

Analyses and reports of all chemical items concerning safety and compliance with government regulations.

* + - 1. DEMONSTRATION
				1. [**Engage a Company Service Advisor to train**] [**Train**] Director’s Representative's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment.

END OF SECTION 232533