SECTION 22 31 00
DOMESTIC WATER SOFTENERS

PART 1 – GENERAL

1.01 WORK INCLUDED

A. The work of this Section shall include, but is not limited to, the following:

1. Domestic water softeners
2. Chemicals
3. Water testing kits

1.02 RELATED DOCUMENTS

A. Section 22 05 01 – Plumbing General Provisions

B. Section 22 05 18 – Meters, Gauges and Thermometers for Plumbing

C. Section 22 11 00 – Domestic Water Systems

D. Section 22 11 10 – Plumbing Piping and Accessories

E. Section 26 05 19 – 600V Wire and Cable

F. Section 26 05 26 – Grounding System

1.03 REFERENCE STANDARDS

Published specifications standards, tests or recommended methods of trade, industry or governmental organizations apply to work in this Section where cited below:

A. ASME – American Society of Mechanical Engineers

1. ASME Standard for Boiler and Pressure Vessel Code – 2013

a. ASME BPVC – I through XII

B. ASTM – American Society for Testing and Materials

1. ASTM D859 – 2010: Standard Test Method for Silica in Water
2. ASTM D1067 – 2011: Standard Test Methods for Acidity or Alkalinity of Water
3. ASTM D1068 – 2010: Standard Test Methods for Iron in Water
4. ASTM D1126 – 2012: Standard Test Method for Hardness in Water
5. ASTM D1129 – 2013: Standard Terminology Relating to Water
6. ASTM D3370 – 2010: Standard Practices for Sampling Water from Closed Conduits

C. NFPA – National Fire Protection Association

1. NFPA 70 – National Electrical Code

D. NSF – National Sanitation Foundation

1. NSF/ANSI 61-2013: Drinking Water System Components – Health Effects

E. UL – Underwriters Laboratories Inc.

F. International Plumbing Code

G. Local Code and Code Amendments

1.04 QUALITY ASSURANCE

A. Comply with the applicable provisions and recommendations of the standards and codes listed in Paragraph 1.03 – Reference Standards, and the requirements of the listed related documents in Paragraph 1.02 – Related Documents.

B. Product Options: Drawings indicate size, profiles, and dimensional requirements of water softeners and are based on the specific system indicated. Refer to Division 01 Section "Product Requirements".

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to Authorities Having Jurisdiction, and marked for intended use.

D. ASME Compliance for Steel Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, where indicated.

E. ASME Compliance for FRP Tanks: Fabricate and label mineral tanks to comply with ASME Boiler and Pressure Vessel Code: Section X, where indicated.

1.05 SUBMITTALS

A. For each type of water softener, provide pressure and temperature classifications; piping connections locations and sizes; arrangement; dimensions; and required clearances. Include list indicating all required external connections.

B. Product Data: Submit manufacturer's latest certified published data on construction details, rated capacities, operating characteristics, pressure ratings, operating weights, **[controls and sequence for alternating operation,]** furnished specialties, water testing kits and accessories, and installation data **[including seismic restraints]**.

C. Submit shop drawings for all equipment provided under this Section, including plans, elevations, sections, details, and dimensions, accessories, required clearances, electrical requirements and wiring diagrams for power, signal, and control wiring specific to this project that clearly differentiate between manufacturer-installed and field-installed wiring and location and size of all required field connections.

D. Submit manufacturer's installation instructions, operation data, start-up instructions, maintenance data, parts list and controls specific to this project, accessories and maintenance data.

E. Submit ASME Pressure Vessel Form for each tank.

F. Submit Operational and Maintenance (O&M) manuals, including emergency operations instructions.

G. Submit Manufacturer Certificates: Signed by manufacturers certifying that water softeners comply with specified requirements.

H. Submit source water quality-control and pressure test reports.

I. Submit softener affluent quality-control test reports.

J. Submit warranty.

K. Submit Maintenance Service Agreement, prior to substantial completion.

L. Submit list of extra materials being provided.

1.06 ABBREVIATIONS

A. ABS: Acrylonitrile-butadiene-styrene plastic

B. FRP: Fiberglass-reinforced plastic

C. PE: Polyethylene plastic

D. PVC: Polyvinyl chloride plastic

1.07 COORDINATION

A. Coordinate size and location of concrete base. Concrete, reinforcement, and formwork requirements are specified in Division 03 and in Section 22 05 01 – Plumbing General Provisions.

1.08 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of water softener that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures of mineral and brine tanks.
b. Faulty operation of controls.
c. Deterioration of metals, metal finishes, and other materials beyond normal use.
d. Attrition loss of resin exceeding 3 percent per year.
e. Mineral washed out of system during service run or backwashing period.
f. Effluent turbidity greater and color darker than incoming water.
g. Fouling of under-drain system, gravel, and resin, with turbidity or by dirt, rust, or scale from softener equipment or soft water, while operating according to manufacturer's written operating instructions.

2. Domestic Water Softener, Warranty Period: From date of Substantial Completion.

a. Mineral Tanks: 10 years.
b. Brine Tanks: 5 years.

c. Controls: 5 years.
d. Under-drain Systems: 5 years.

1.09 MAINTENANCE SERVICE

A. Submit four (4) copies of manufacturer's "Agreement for Continued Service and Maintenance", before substantial completion, for Owner's acceptance. Offer terms and conditions for furnishing chemicals and providing continued testing and servicing to include replacing materials and equipment. Include one-year term of agreement with option for one-year renewal.

1.10 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Salt for Brine Tanks: Prior to substantial completion, furnish same form as and at least four times original load, but not less than 500 pounds. Deliver on pallets according to the following:

a. Food-Grade Pellet Salt: In 80-pound packages.

2. Store salt on raised platform where directed by Owner. Do not store in contact with concrete floor.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide products by one of the manufacturers specified.

1. Lakeside Water Treatment, Inc. Model No. LWT 3000-4
2. Phoenix Water Conditioning systems
3. Marlo Incorporated
4. Alamo Water Treatment, now part of Watts Water Technologies, Inc.
5. Ecodyne Water Treatment, LLC
6. Culligan International Company

2.02 DOMESTIC WATER SOFTENERS

A. Description: Factory-assembled, pressure-type water softener.

1. Comply with NSF 61, "Drinking Water System Components – Health Effects".

2. Configuration: [Two Unit, with one mineral tank and one brine tank] [Three Unit, with two mineral tanks and one brine tank] [Four Unit, with three mineral tanks and one brine tank].

3. Mineral Tanks: Coated steel; pressure-vessel quality.

a. Construction: Fabricated and stamped to comply with ASME Boiler and

Pressure Vessel Code: Section VIII, “Pressure Vessels”.

b. Pressure Rating: 150 psig.
c. Wetted Components: Suitable for water temperatures from 40 to 120 degrees F.
d. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
e. Support Legs or Skirt: Constructed of structural steel, welded to tank before testing and labeling.
f. Upper Distribution System: Single, point type, fabricated from galvanized steel to be skid-mounted complete with inter-connecting pipe and fittings.
g. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, non-clogging **[plastic]** strainers; arranged for even flow distribution through resin bed.
h. Liner: PE, ABS, or other approved equivalent material suitable for potable water.

4. Mineral Tanks: Steel, electric welded; pressure-vessel quality.

a. [Fabricate supports and attachments to tank with reinforcement strong enough to resist tank movement during seismic event when tank supports are anchored to building structure.]
b. Construction: Fabricated and stamped to comply with ASME Boiler and Pressure Vessel Code: Section VIII, “Pressure Vessels”.
c. Pressure Rating: 150 psig.
d. Wetted Components: Suitable for water temperatures from 40 to 120 degrees F.
e. Freeboard: 50 percent minimum for backwash expansion above normal resin bed level.
f. Hand-holes: 4 inches round or 4 by 6 inches elliptical, in top head and lower sidewall of tanks 30 inches and smaller in diameter.
g. Manhole: 11 by 15 inches in top head of tanks larger than 30 inches in diameter.
h. Support Legs or Skirt: Constructed of structural steel, welded to tank before testing and labeling.
i. Finish: Exterior of tank spray painted with rust-resistant prime coat, 3-mil dry film thickness. Interior sandblasted and lined with epoxy-polyamide coating, 10-mil dry film thickness.
j. Upper Distribution System: Single, point type, fabricated from galvanized steel to be skid-mounted complete with inter-connecting pipe and fittings.
k. Lower Distribution System: Hub and radial-arm or header-lateral type; fabricated from PVC pipe and fittings with individual, fine-slotted, non-clogging **[PE]** strainers; arranged for even flow distribution through resin bed.
l. Liner: PE, ABS, or other approved equivalent material suitable for potable water.

5. Controls: Automatic, to control backwash and flush rates over wide variations in operating pressures, and shall not require field adjustments.

a. Progressive Demand Initiated Flow:
1) The electrical system shall consist of one main control panel. Each unit also has its own flow sensor. The flow sensors shall be field-wired to the main

control panel.

2) The main control panel shall have an operator interface, three-position selector switch and fault alarm mounted on the control-panel door.

3) The control power three-position selector switch shall be in the “Auto” mode for normal operation. In the “Manual” position, the outputs from the programmable controller shall be turned off. In the “Off” position, power to the electrical system shall be turned off. To “Manually” operate the stagers, the selector switch must be placed in the “Manual” position.

4) The operator interface shall be used to access data registers in the programmable controller. The flow rate and gallons remaining in each unit’s thru-put batch shall be displayed. The system flow rate and total gallons passed through the system shall be displayed. Regeneration shall be started, advanced or reset by using the operator interface.

5) The system shall be pre-programmed at the factory. **[The only field change(s) that may be required is an adjustment to a regeneration step time, thru-put gallonage or flow rate, at which the second and third unit are put on stream. Such changes shall be made by using the operator interface.]**

6) System shall provide flow totalizing instrumentation to display instantaneous total flow through the softener system, as well as store and display, on demand, the peak flow through the system for the preceding 24-hour period, resettable.

6. System Operation:

   a. On systems with multiple units, the system shall be programmed to have one unit in service at all times. If the flow through the system increases beyond the setpoint for a pre-determined amount of time, a second unit shall be automatically placed in service. If the flow continues to rise, a third unit shall also be placed in service. The second or third unit shall be placed or removed from service, depending on the flow rates.

   b. In “Auto” operation, when the unit in service exhausts on thru-put gallonage, it shall be removed from service and placed in regeneration automatically. The unit that was in stand-by shall then be placed in service. The unit that was placed in regeneration shall automatically advance through each step of regeneration. After completion of regeneration, the unit shall return to stand-by mode.

   c. In “Semi-Auto” operation, when the unit in service exhausts on thru-put gallonage, the fault alarm shall be initiated. The alarm shall be silenced by depressing an alarm silence key. The operator must then start a regeneration by depressing the start regeneration key of the exhausted unit. The unit that was in stand-by shall then be placed in service. The unit that was placed in regeneration shall automatically advance through each step of regeneration. After completion of regeneration, the unit shall return to stand-by mode. The mode of operation may be changed by using the operator interface.

   d. A manual regeneration of any unit may be started, as long as another unit is not in regeneration, by depressing the appropriate start regeneration key.

7. Brine Tank: Combination measuring- and wet-salt storing system.

   a. Tank and Cover Material: Fiberglass, 3/16-inch thick; or molded PE, ⅜-inch thick.

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

c. Size: 78 inches diameter by 60 inches high.

8. Factory-Installed Accessories:

a. Piping, valves, tubing, and drains.
b. Sampling cocks.
c. Main-operating-valve position indicators.
d. **[Water meters]**.

B. Capacity and Characteristics:

1. Service: Hot water
2. Water Analysis:

a. Hardness: 25 grains per gallon
b. Iron: 0
c. Dissolved Solids: 407.0 ppm
d. Chlorine: 0.5 ppm
e. Inlet Water Pressure: 50 psig
f. Water Temperature: 60 degrees F

3. Continuous Service Flow Rate: 100 gpm
4. Peak Service Flow Rate: 140 gpm
5. Water Meter Size: Refer to the Drawings
6. Manifold Pipe Size: Refer to the Drawings
7. Backwash to Drain, Pipe Size: 15 gpm, 2 inch
8. Water Consumption: [_____] gallons per day
9. Water Demand: [_____] hours per day
10. Number of Mineral Tanks: Two
11. Mineral Quantity, Each Tank: [_____] cubic feet
12. Mineral Exchange Capacity: [_____] grains per cubic foot per 15 pounds of salt
13. Electrical Characteristics:

a. Volts: 120
b. Phases: 1
c. Hertz: 60
d. Full-Load Amperes: 3
e. Minimum Circuit Ampacity: 15
f. Maximum Overcurrent Protection: 15

14. Salt Capacity: [_____] pounds

2.03 CHEMICALS

A. 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.

1. Exchange Capacity: 30,000 grains per cubic foot of calcium carbonate of resin when regenerated with 15 pounds of salt.

B. Salt for Brine Tanks: High-purity sodium chloride, free of dirt and foreign material. Rock and granulated forms are not acceptable.

1. Form: Processed, food-grade salt pellets.

2.04 WATER TESTING SETS

A. Description: Manufacturer's standard water-hardness testing apparatus, a one-year supply of testing chemicals, testing procedure instructions, and a one-year supply of log sheets. Include metal cabinet suitable for wall mounting.

2.05 SOURCE QUALITY CONTROL

A. Hydrostatically test mineral tanks before shipment to minimum of 1.5 times pressure rating.

B. Prepare and submit test reports.

PART 3 – EXECUTION

3.01 CONCRETE PADS

A. Provide concrete pads as per specification Section 22 05 01 – Plumbing General Provisions for all domestic water softeners.

3.02 WATER SOFTENER INSTALLATION

A. Install domestic water softener equipment on concrete pads, level and plumb. Maintain manufacturer's recommended clearances. Arrange units so controls and devices that require servicing are accessible. **[Seismically restrain and]** anchor mineral and brine tanks and floor-mounted accessories to structure.

B. Install tanks **[in "L" shaped arrangement with brine tank in the middle, arranged for easy salt front loading] [as indicated on the Drawings]**. The Contractor shall provide all **[90-degree ells and]** interconnecting piping to hook up tanks **[and brine maker]** per the manufacturer's requirements.

C. Install brine lines and fittings provided by equipment manufacturer but not specified to be factory installed.

D. Prepare mineral-tank distribution system and underbed for minerals and place specified mineral into mineral tanks.

E. Install metal cabinets for water testing sets mounted on wall, unless otherwise indicated, and near water softeners as indicated on the Drawings.

3.03 CONNECTIONS

A. Piping installation requirements are specified in Section 22 11 10 – Plumbing Piping and Accessories. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Install piping adjacent to equipment with unions to allow for service and maintenance.

C. Make piping connections between water-softener-unit headers and dissimilar-metal water piping with dielectric fittings. Dielectric fittings are specified in Section 22 11 10 – Plumbing Piping and Accessories.

D. Install shut-off valves on domestic water inlet and water softener outlet piping of each mineral tank, and on inlet and outlet headers.

1. General-duty valves are specified in Section 22 11 00 – Domestic Water Systems.
2. Exception: Water softeners with factory-installed shut-off valves at locations indicated.

E. Install pressure gauges on domestic water inlet and water softener outlet piping of each mineral tank. Pressure gauges are specified in Section 22 05 19 – Meters, Gauges and Thermometers for Plumbing.

1. Exception: Water softeners with factory-installed pressure gauges at locations indicated.

F. Install valved bypass water piping around water softeners.

1. General-duty valves are specified in Section 22 11 00 – Domestic Water Systems.
2. Water piping is specified in Section 22 11 10 – Plumbing Piping and Accessories.

G. Install gravity drains as indirect wastes to spill into floor drains or sinks.

H. Install backwash discharge line to a vertical standpipe drain with an air gap fitting. Provide a separate standpipe drain for each backwash line.

I. Ground equipment according to Section 26 05 26 – Grounding and Bonding for Electrical Systems.

J. Connect wiring according to Section 26 05 19 – Low-Voltage Electrical Power Conductors and Cables.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust field-assembled components and equipment installation, including connections. Submit report results in writing.

B. Perform the following field tests and inspections and prepare and submit test reports:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
2. Operational Test: After electrical circuitry has been energized, start units to confirm proper unit operation.
3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

C. Remove and replace malfunctioning water softeners that do not pass tests and inspections and retest as specified above.

3.05 START-UP SERVICE

A. Engage a factory-authorized service representative to perform start-up service.

1. Complete installation and start-up checks according to manufacturer's written instructions.

B. Add water to brine tanks and fill with salt.

1. Domestic Water Softeners: Food-grade salt pellets.

C. Sample water softener effluent after start-up and at three consecutive seven-day intervals (total of four samples), prepare and submit certified test reports for required water performance characteristics. Comply with the following:

1. ASTM D859, Standard Test Method for Silica in Water
2. ASTM D1067, Standard Test Methods for Acidity or Alkalinity of Water
3. ASTM D1068, Standard Test Methods for Iron in Water
4. ASTM D1126, Standard Test Method for Hardness in Water
5. ASTM D1129, Standard Terminology Relating to Water
6. ASTM D3370, Standard Practices for Sampling Water from Closed Conduits

3.06 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain water softeners. Refer to Section 22 05 01 – Plumbing General Provisions, for training and O&M documentation requirements.

END OF SECTION 22 31 00