

**SECTION 7
MECHANICAL EQUIPMENT**

7.01 Scope: The Contractor shall furnish all materials, labor and equipment necessary for complete installation of mechanical equipment as shown on the drawings and/or specified and the furnishing of the services of a competent factory representative to supervise and/or inspect the installation and initial operation of the equipment. The duration of the service to be furnished during the periods of installation and initial operation is estimated as specified below:

Article Number	Equipment	Days of Service
7.12	Packaged Filter System	12

- A. The Contractor shall furnish, install, test, adjust and paint in accurate, satisfactory, workmanlike manner, all machinery, equipment, apparatus, accessories, and fittings required for the completion of the work in accord with the drawings, specifications and equipment manufacturer.
- B. The Contractor shall furnish and install all materials including electric wiring, conduits, and controls not furnished by the equipment manufacturers. The Contractor's attention is directed to the General Requirements with reference to requirements for furnishing working drawings.
- C. The Contractor shall refer to electrical drawings for all voltage requirements for mechanical equipment.

7.02 Supervisory Services: The periods of installation and initial operation shall be assumed to occur on successive days, unless otherwise stated herein. If the Contractor fails to arrange his work so that all services may be performed on successive days, he will be required to furnish such services at a later date, at no additional expense to the Owner. Periods of service on more than one item furnished by the same manufacturer may run concurrently, if so reviewed and permitted by the Engineer. Manufacturers, who are required to furnish supervisory and/or inspection services, shall extend those services to include all equipment furnished by them for the Project, whether listed or no

7.03 Equipment Bids:

- A. Manufacturer: Any reference to an item of equipment or material by a specific manufacturer's trade name in these Specifications is intended merely as a standard. Even though named in the Specifications, equipment offered with smaller or lightweight mechanism or devices compared to that specified will not be approved for the project. Each bidder is required to state in his bid the name of at least one manufacturer or supplier named in these specifications for each major item of equipment and his bid price for that item as required in the Proposal. This requirement is to prevent rejection of the bid should a piece of substitute equipment be rejected. Other equipment shall be considered as specified in the "General Condition," if offered by the bidder under "Substitute Equipment," in the Proposal: provided, it is equal in functional design, mechanical and structural details, to the one specified.

If no named manufacturers are specified, the Contractor shall include the name of the manufacturer to be used in the Proposal.

- B. Substitute Equipment: Equipment offered under "Substitute Equipment" of the Proposal shall comply with requirements of these specifications. It shall be the responsibility of the Bidder to determine that equipment offered in the Proposal is in accordance with the specifications. Substitute equipment offered at a lower price by reason of smaller or lightweight members, inferior to or inefficient mechanism or devices will not be considered.
- C. Substitute Equipment Bid: The price for substitute equipment shall include the cost of all changes in the structure, mechanical, electrical work, and in other appurtenances for the accommodation of such equipment as determined by the Engineer, at the expense of the Contractor.
1. Information Required: It shall be the responsibility of the Bidder to ascertain that each manufacturer named in his Proposal has submitted to the Engineer at least two weeks in advance of the letting date complete information in regard to the equipment offered. For makes of equipment named in the specifications this may be a statement that the equipment offered is in strict accordance with the Engineer's specifications, listing any and all exceptions. To all substitute items of equipment, complete drawings, specifications, thickness and weights of principle parts shall be furnished to the Engineer two weeks prior to the letting date. A list of all substitute equipment which has been submitted in accordance with the above will be provided to all bidders one week prior to the receipt of bids.
- For makes of equipment with no named manufacturers, the manufacturer must either submit a statement that equipment is in strict accordance with the Specifications or list any exceptions.
2. Experience and Manufacturer: It is desired that only equipment which has undergone thorough development as provided by successful service in similar installations for at least two years shall be accepted for installation unless specified elsewhere in these Specifications. Manufacturers and/or equipment which does not meet the two year experience period will be considered if the manufacturer or supplier provides a bond or cash deposit which will guarantee replacement of the equipment or process in the event of failure or unsatisfactory service. The amount of bond or cash deposit shall be sufficient to cover all labor and equipment costs for replacement in addition to any costs incurred by the Owner because of failure or unsatisfactory service. The period of time for which the bond or cash deposit is required shall be two years.
- D. Standardization: To avoid a division of responsibility among several manufacturers for items of equipment having functions related to each other or to the same portion of the treatment process, and to avoid unnecessary duplication of replacement parts and service calls by the Owner, unless otherwise permitted herein, the equipment supplied under any numbered paragraph shall be the product of, or furnished and guaranteed by, one manufacturer.

7.04 Equipment Obtained from Equipment Manufacturer: The Contractor shall obtain all equipment specified, and that required for the safe operation and use of that equipment from the manufacturer or the equipment, unless excluded by provisions in this paragraph or specifications for the item.

Unless otherwise stated in the specifications, the following type of materials shall not be considered to be a part of the equipment: Connecting piping and valves, railing set in the tank or structure, motor starters and wiring, steps and manholes installed separately from equipment, finish painting, etc.

7.05 Equipment Approval: Each manufacturer furnishing equipment shall submit the following in accordance with the General Requirements section of these Specifications:

- A. Certified drawings, guaranteed performance curves, wiring diagrams, specifications, and lists of electrical controls, including manufacturer's name and catalog number; furnish horsepower, normal full load maximum load ampere rating of each motor.
- B. Estimated weight of each unit
- C. Certified test curves for each pump with capacity of greater than 100 gpm prior to shipment
- D. List spare parts and tools furnished with equipment. Unless otherwise specified herein, tools shall be only such special tools required by the particular equipment.
- E. Complete installation and operation instructions and parts list

7.06 Mechanical Testing: After each unit has been installed and is ready for operation, it shall be operated continuously for a period of 24 hours. During that period, the equipment will be inspected for defects and weakness. Parts of the unit, which show a defect or weakness, or both, shall at once be removed and be replaced with new parts or be made good in a satisfactory manner, at no additional expense to the Owner.

- A. Continuous 24-hour test shall be made after all defects have been remedied, at no additional expense to the Owner.
- B. After installation and final testing, each equipment manufacturer furnishing supervision and/or inspection services shall make written certification to the Engineer and the Owner that the equipment and controls have been properly installed in accord with the drawings, specifications and manufacturer's requirements, and that the required operating and maintenance instructions have been furnished to the Engineer.

7.07 Piping for Equipment: The Contractor shall furnish completely dimensioned layouts for all piping, fittings, valves, specialties, and other equipment. Deviations from the dimensions shown on the drawings caused by equipment dimensions shall be taken into consideration by the Contractor and changes in piping, electrical conduit, and other similar items shall be done at no additional expense to the Owner.

- A. All piping and appurtenances shall be properly supported by a system of hangers, pipe stands, saddles, base ells, and concrete piers as required. Concrete insets, bolts, anchors, etc., shall be placed in the forms before placing concrete.

- 7.08 Shop Painting: All shop painting of equipment shall be as specified in "Painting" Section, unless otherwise specified.
- 7.09 Operation and Maintenance Manuals: Before the equipment is placed in service, operation and maintenance manuals for the equipment shall be delivered to the Engineer by the Contractor in accordance with the General Requirements section of these Specifications.
- 7.10 Guarantees: The Contractor shall guarantee the equipment to be free from defects in workmanship, design, and material for a period of one year after initial operation begins; the Contractor shall replace at no additional expense to the Owner, every defective part, and every part showing undue wear during that guarantee period. The date of initial operation shall be only after review by the Engineer and shall be furnished in writing to the Contractor.
- 7.11 Motors: Motors for operating mechanical equipment shall satisfy the latest requirements of the Institute of Electrical and Electronic Engineers, American National Standards Institute, and the National Electrical Manufacturer's Association. Motors shall be manufactured by Weg, Baldor, NIDEC or reviewed equivalent. All single and three-phase motors (except fan motors which may be of a reviewed manufacturer standard) shall be ball bearing, and have either sealed-in lubricant or be designed for external oil or grease lubrication. The equipment manufacturer shall supply motors having sufficient torque to start equipment under load and to accelerate the equipment smoothly and quickly to full speed without exceeding the motor nameplate ratings, including service factor. Motors shall have 1.15 service factor, except totally enclosed motors unless otherwise specified.
- A. Motors 25 horsepower and larger shall be equipped with embedded stator thermostats (normally closed) connected internally in series and brought out through motor junction box for connection to starter pilot relay 115V control circuit. Large motor protection will be covered under the paragraph applying to the individual motor.
 - B. Motors ½ horsepower and larger shall be 3-phase, 60 hertz, induction type and be designed for full voltage starting. Motors shall have either 40° C rise Class insulation or 60° C rise Class B insulation, be open drip-proof for indoor installation, be vertical splash-proof and drip-proof for outdoor installation or have 70° C Class B rating rise for totally enclosed, non-ventilated, outdoor, horizontal installation.
 - C. Motors smaller than ½- horsepower shall be single phase, induction, capacitor-run type, unless otherwise specified. Very small motors, and those for special purposes, may be shaded pole type; their use shall be subject to review by the Engineer.
- 7.12 Packaged Filter System: Contractor shall provide the iron and manganese removal packaged system; including, carbon steel pressure vessels, process piping, fittings, control valves, oxidation / filtration media, instruments and sample valves:
- A. Scope: This Specification shall govern the work necessary for furnishing and installing an oxidation / filtration system for treating drinking water. This system will be a packaged treatment system capable of reducing the incoming level of

manganese (Mn) below MCL of 0.05 mg/L, and Iron (Fe) below the MCL of 0.3 mg/L. The construction of the units shall provide for oxidation / filtration of raw water up to a flow rate as shown in the table 7.12 A. Contractor shall plumb and wire filter package in the field as required by manufacturer.

Well	Flow Rate	Model
1-Forsyth	550 gpm	MOD 26-8460CS-2-AVT-DI
2-Homer	780 gpm	MOD 26-9660CS-2-AVT-DI
3-Industrial	830 gpm	MOD 26-9660CS-2-AVT-DI
4-Hammock	1440 gpm	MOD 26-13260CS-2-AVT-DI

B. General:

1. All system equipment shall be industry standard equipment, acceptable for use in potable drinking water applications
2. Each piece of equipment listed by make or model in the following sections is intended to establish the performance and quality standard of the desired device. It is not intended to exclude any piece of equipment that has the same performance as the example, provided that it meets the above criteria.
3. System shall be model as shown in the table below, as manufactured by AdEdge Water Technologies or reviewed equal.
4. Manufacturer shall notify Engineer at least two weeks prior to bidding any concerns with connecting piping and chemical feed systems etc. that may affect filter system function.

C. Quality Assurance:

1. Factory Acceptance Test:
 - a. The manufacturer shall certify piping hydrostatic pressure test passed:
 - 1) System hydrotest administered at maximum working pressure for a period of 60 minutes with no leaks observed
 - b. The manufacturer shall certify function test passed:
 - 1) Automatic system valves are in their correct positions during all cycles of operation.
 - 2) Instruments readings from flow sensors and pressure sensors have been verified against known control values.
 - 3) Automatic operations initiate on selected triggers.
 - 4) All required factory settings have been loaded onto the controllers.
 - c. System dimensions shall match submittal drawings.

2. Warranty: The equipment shall be warranted for a period of 12 months after start-up.

D. Functional Requirements:

1. Manufacturer's equipment shall consist of two 36" diameter carbon steel pressure vessels configured for parallel operation and designed to remove iron and manganese from the raw water using AdEdge AD26L filtration media.
2. System shall be a complete packaged treatment system with pre-assembled valve tee between vessels.
3. The vessels shall be of carbon steel construction with an internal ANSI/NSF 61 approved epoxy liner and shall be equipped with air vent and water drain valves
4. All piping and fittings shall be cement lined class 350 ductile iron.
5. Interconnecting piping between vessels and valve tree shall be provided by Supplier and installed by Contractor; Inlet, treated outlet, and backwash header shall be supplied and installed by Contractor.
6. The vessels shall be of carbon steel construction, with an internal ANSI/NSF 61 approved epoxy liner and shall be equipped with air vent and water drain valves.
7. The system shall perform automatic backwash operations using actuated butterfly valves seated on a valve harness and it shall consist of the following cycles: backwash and fast rinse. In addition, each vessel shall have the option to be placed into standby mode for servicing.
8. Automatic system operations shall be controlled by a PLC housed in a floor mounted NEMA 4X Control Panel enclosure. The operator will interface with the PLC through a panel-mounted touch-screen HMI.
9. Backwash shall be initiated based on time, flow throughput, or differential pressure across system inlet / outlet exceeding 10 psi.
10. Backwash water shall be treated water and shall enter the system back through the treated outlet tie point.
11. During backwash, the well pump shall be locked-out.
12. Fast rinse will use raw water. During fast rinse, well pump shall be on.
13. The system shall be supplied with a stainless steel hydraulic panel to monitor the system inlet and outlet for pressures and water sampling.
14. Chlorine (NaOCl) is required to be injected and mixed homogeneously upstream of the equipment. A minimum free chlorine residual of 0.5 mg/L must be maintained in the treated effluent of the IMTS.
15. Phosphate and fluoride are required to be injected downstream of the equipment post treatment.

E. Service Conditions:

1. The system shall be designed and constructed for installation indoors or outdoors and for continuous operation with the following service conditions based on the following parameters:
 - a. Service Loading Rate: 7.0-8.0 gpm / ft² of media area
 - b. Media Bed Depth of 36" to 40" plus underbedding media
 - c. Vessel Configuration: Parallel
 - d. Electrical Requirements: 120 volts, single phase, 60 Hz
 - e. Ambient Air Temperature: 20° F to 110° F
 - f. Design Pressure: 60 pounds per square inch (psi)
2. Representative water chemistry data for the well that operate at the site is as follows:

<i>Table 7.12 E-2</i>				
	Well 1 Forsyth	Well 2 Homer	Well 3 Industrial	Well 4 Hammock
pH:	7.1	7.1	7.3	7.3
Hardness:	165 mg/L as CaCO ₃	166 mg/L as CaCO ₃	-	-
Alkalinity:	182 mg/L as CaCO ₃	179 mg/L as CaCO ₃	-	-
Iron:	0.127 mg/L	0.04 mg/L	0.26 mg/L	0.22 mg/L
Manganese:	0.097 mg/L	0.06 mg/L	0.11 mg/L	0.08 mg/L
Nitrate:	ND	ND	ND	ND
Chloride:	ND	ND	ND	ND

- F. Minimum Performance Requirements: Under the service conditions set forth in Paragraph 2.03, the IMTS shall consistently reduce iron to below 0.3 mg/L as Fe and manganese to below 0.05 mg/L as Mn in the final effluent

G. Vessels:

1. Carbon Steel Vessels:
 - a. Shell and Heads Acceptable Material:
 - 1) Carbon Steel SA-516 Gr. 70
 - 2) Carbon Steel SA-414 Gr. G
 - 3) Carbon Steel SA-455
 - b. Acceptable Head Types: Flanged and dished heads
 - c. Sideshell Height: 60"

- d. Exterior Coat:
- 1) Surface Preparation: SPIO Near White Metal Blast (Immersion)
 - 2) Film Thickness: 5 to 8 mils DFT
 - 3) Acceptable Product: Carboline Carboquick 200, Safety Blue Color
- e. Inner Liner:
- 1) Surface Preparation: SSPC-SP-5 Full White Blast
 - 2) Film Thickness: 10 to 16 mils DFT
 - 3) Acceptable Product: Carboline Carbogaurd 891 VOC Epoxy, Certified to ANSI/NSF 61
- f. Lifting Lugs: Minimum of 2 on vessels
- g. Connections:
- 1) Process Inlet and Outlet: Threaded couplings, flanged spools or double-drilled pad flanges
 - 2) Air Vent: Minimum 2" NPT half coupling located on top head
 - 3) Media Loading: 14" x 18" elliptical manway on top head
 - 4) Accessing Tank Internals: 14" x 18" elliptical manway on sideshell
- h. Vessel Internals:
- 1) Inlet distributor:
 - Type: Splash Plute
 - 2) Outlet Collector:
 - Type: Hub and slotted laterals w/ 0.010" slots
 - Material: 304 Stainless Steel
 - 3) Internal clips shall be provided, whenever required, to support the weight of vessel internals at the discretion of the manufacturer.
- i. Leg Requirements: BEAM legs with individual foot pads and anchor holes
- j. Maximum Working Pressure (MWP): 150 psi
- k. Maximum Operating Temperature: 120° F
- l. ASME-Code Certification: NON-Code
- H. Media: The media bed depth shall be 36" deep.
1. Oxidation / Filtration Media:
 - a. Iron and Manganese Reduction Media: The media shall be loaded with sufficient freeboard to allow for bed expansion during backwash.

- b. Type: AD26LManganese Dioxide-Coated Silica
 - c. Granular, well graded, attrition-resistant mineral
 - d. 14 x 40 mesh, 108 pound/cubic feet
 - e. ANSI/NSF 61 certified for drinking water
 - f. Material shall be discarded as a solid waste in an RCRA subtitle D (non-hazardous) landfill at the end of its life.
2. Underbedding: Garnet 1.19-2.38 mm (120-151 pounds/cubic feet)

I. Automatic System Valves:

- 1. Process Valves: Process valves shall be installed on valve tree between vessels suitable for the control of all automatic system operations required by the system and meet the following parameters:
 - a. Type: Lug-style butterfly valves; NSF 61 certified
 - b. Materials: Cast iron body, EPDM seat, 316 stainless steel stem, Nylon-11-coated ductile iron disc
 - c. Operation: 175 psi maximum pressure
 - d. Process Mounting: ANSI class 125/150 flanges
 - e. Actuator Mounting: ISO 5211-compliant
 - f. Manufacturer: Bray S31 or Engineer reviewed equal
- 2. Electric Open/Close Valve Actuators: RCEL electric actuators shall be installed on electrically-actuated process control valves with 2", 3" and 4" nominal pipe size and meet the following parameters:
 - a. Type: Quarter-turn worm gear drive
 - b. Materials: Aluminum alloy enclosure
 - c. Operation: 110/230VAC 50/60Hz power
 - d. Range: 90°± 5° travel angle with travel stop adjustment
 - e. Limit Switches: Two limit switches
 - f. Position: Color-coded dome visual indicator
 - g. Manual Operation: L-wrench (6mm hexagon)
 - h. Anti-Condensation: One space heater
 - i. Enclosure: NEMA 4, 4X and 6 and IP68
 - j. Valve Mounting: ISO 5211-compliant
 - k. Manufacturer: RCEL 005L or Engineer reviewed equal

J. 6" and 8" Electric Open/Close Valve Actuators:

- 1. General: RCEL actuators shall be installed on electrically-actuated process control valves with 6" and 8" nominal pipe size.

2. Specifications:
 - a. Type: Quarter-turn double reduction worm and wheel
 - b. Motor: Single phase squirrel cage capacitor run induction motor
 - c. Materials: Aluminum die-cast enclosure
 - d. Operation: 110/220VAC 50/60Hz power
 - e. Range: $90^{\circ} \pm 10^{\circ}$ travel angle with travel stop adjustment
 - f. Limit Switches: Two limit switches
 - g. Position: Mechanical visual indicator
 - h. Manual Operation: Handwheel override
 - i. Anti-Condensation: One space heater
 - j. Enclosure: NEMA 4, 4X and 6 and IP68
 - k. Valve Mounting: ISO 5211-compliant
 - l. Manufacturer: RCEL 005L or Engineer reviewed equal

K. Manual System Valves:

1. Throttling Valves: Throttling valves shall be installed to provide manual flow control on the common backwash water outlet and meet the following parameters:
 - a. Type: Globe Valve
 - b. Materials: Cast Iron body and bonnet
 - c. Operation: Manual, outside screw and yoke, 200 psi CWP
 - d. Mounting: ANSI class 125/150 flanges
 - e. Manufacturer: Sharpe, Apollo, or Engineer-reviewed equal
2. Air Release Valves: Air release valves shall be installed on each vessel's vent piping and meet the following parameters:
 - a. Type: Combination Air/Vacuum Valve
 - b. Materials: PVC
 - c. Size: 1"
 - d. Working Pressure: 3 – 250 psi
 - e. Working Temperature: 140F Max
 - f. Manufacturer: ARI D-040 or Engineer reviewed equal

L. System Instrumentation:

1. Flow Sensors: Flow sensors shall be installed on each vessel's inlet and meet the following parameters:
 - a. Type: Electromagnetic Flow Sensor

- b. Materials:
 - 1) Sensor Body: Compact aluminum coated
 - 2) O-Rings: EPDM
 - 3) Electronics Housing: Cast powder-coated aluminum
 - 4) Electrodes: 1.443/316L
 - c. Accuracy: $\pm 0.5\%$ of full scale
 - d. Output: Square wave, opto-isolated
 - e. Range: 0.2-20 ft/sec
 - f. Manufacturer: Endress+Hauser Promag W400
or Engineer-reviewed equal
2. Pressure Sensors: Pressure sensors shall be installed on inlet and outlet of each vessel for measuring differential pressure and total system pressure and meet the following parameters:
- a. Type: Electronic pressure sensor, IP 65 enclosure
 - b. Materials: 316 stainless steel housing and 303 stainless steel wetted parts
 - c. Accuracy: $< \pm 0.35\%$ of span (best fit straight line)
 - d. Output: 4-20 mA analog output
 - e. Pressure Range: 0-150 psi
 - f. Manufacturer: Endress+Hauser Promag, PMP21, PMP 51
or Engineer reviewed equal
3. Pressure Gauges: Pressure gauges shall be installed on each vessel's inlet and outlet. Gauges shall meet the following parameters:
- a. Type: Glycerin-filled 2½" dial, ¼" NPT connection
 - b. Materials: Brass or 316 stainless internals; 304 stainless steel case
 - c. Accuracy: $\pm 2.5\%$ of full scale
 - d. Output: Local reading only
 - e. Pressure Range: 0 to 100 psi
 - f. Manufacturer: WIKA or Engineer reviewed equal
4. Sample Ports: PVC ball valves shall be installed on each vessel's inlet and outlet, and on the system backwash outlet.
- a. PVC ball valve shall meet the following parameters:
 - 1) Type: PVC ball valves, ¼", rugged unibody construction
 - 2) Material: PVC body conforming to ASTM D1784, EPDM O-rings

- 3) Operation: 150 psi @ 70° F; lever handle for 90° turn operation
 - 4) Manufacturer: Asahi or Engineer reviewed equal
- M. System Control: The manufacturer shall provide a master control panel which shall house the logic controller, HMI, power supply, relays, terminal blocks and other ancillary components for proper operation of the system. The panel shall be mounted on the skid and pre-wired and pre-programmed. All wiring to field devices shall be terminated at a numbered terminal strip mounted directly in the panel.
- N. Master Panel Controls:
- 1. Main Disconnect Switch: Power to ALL components
 - 2. ON/OFF Power Switch: Power to PLC, HMI
 - 3. System Alarm Light: RED
- O. Enclosure:
- 1. General: The master control panel components shall be housed in a skid-mounted enclosure. The panel shall face the front of the skid, or as required by site conditions, and shall be positioned to avoid interference with other system components.
 - 2. Specification:
 - a. Type: Wall Mounted Enclosure
 - b. Rating: NEMA 4X
 - c. Materials: 304 stainless steel
 - d. Panel Door: Fitted with quarter-turn latches; no door window
 - e. Manufacturer: Hoffman or Engineer-reviewed equal
- P. Logic Controller:
- 1. General: A programmable logic controller (PLC) shall control all automatic operations of the treatment system, and shall provide external communication ports. PLC shall be fully programmed, staged and debugged at the manufacturer's facility.
 - 2. Specification:
 - a. Type: Programmable logic controller
 - b. I/O Capabilities: Digital and analog inputs / outputs
 - c. Communication: Serial RS243C/RS485, RJ-45 10/100 Mbps
 - d. Ethernet Protocols: EtherNet/IP, Modbus TCP/IP
 - e. Internal Clock: Embedded real time clock
 - f. Configuration: Embedded LCD display for user configuration
 - g. Memory: Non-volatile battery-backed RAM

- h. Programming: RSLogix 500 using ladder logic
- i. Manufacturer: Allen Bradley Compact Logix

Q. HMI Interface:

1. General: A human machine interface (HMI) shall provide the operator a touch-screen interface to view current states of the general system parameters and operational settings.
2. Alarms: The HMI shall also display system alarms and provide an alarm log. The following alarms are required as a minimum:
 - a. High Service Flow
 - b. High and Low Backwash Flow
 - c. High System Differential Pressure
 - d. Individual Vessel Breaker Failure
3. Specification:
 - a. Type: Color TFT LCD touch screen with 64K colors
 - b. Size: 10" nominal (10.4" diagonal)
 - c. Resolution: 640 x 480 pixels
 - d. Backlight: 50,000 hour lifetime, user replaceable
 - e. Communication: USB, Serial RS232/422/485, RJ-45 10/100 Mbps
 - f. Ethernet Protocols: EtherNet/IP, Modbus TCP/IP
 - g. Remote Access: Web-server available through RJ-45 port
 - h. Enclosure: NEMA4/4X, IP65
 - i. Manufacturer: Automation Direct C-More 10"

R. Mechanical Components:

1. Piping, Fittings and Flanges: Cement Lined Ductile Iron
2. Anchor Bolts, Nuts and Washers: Type 316 stainless steel

S. Installation:

1. The manufacturer shall provide a detailed pre-installation checklist and system commissioning plan (SCP) as a communication tool for proper installation, and shall work closely with the Contractor to ensure the system is installed in accordance with the manufacturer's recommendations.
2. Installation of the equipment and related appurtenances shall be performed by the Contractor and shall be in accordance with the Engineer's Drawings and with the manufacturer's shop drawings, instructions and recommendations. Conflicts of information shall be called to the attention of the Engineer.

3. The Contractor shall secure the equipment to the building's concrete foundation with appropriate anchor bolts, in accordance with the Engineer's and manufacturer's recommendations. The equipment shall be accurately leveled on the ground surface.
4. The Contractor shall provide all external piping tying to the manufacturer's equipment. The Contractor shall provide pipe supports for external piping so as to impose minimal loads and stresses on the manufacturer's equipment.
5. The Contractor shall provide all field wiring, including electrical power supply and controls, to the manufacturer's equipment. The field wiring shall be completed and terminated at the manufacturer's equipment control panel prior to start-up. The manufacturer shall provide the Contractor with a field wiring diagram identifying wire numbers or terminal block where control wiring from field devices must be landed on the manufacturer's equipment control panel.
6. The equipment will **NOT** come pre-loaded with media and underbedding. Media loading shall occur onsite during start-up by the Contractor under the supervision of the manufacturer. ***DO NOT*** load media prior to start-up unless directed by the manufacturer and only while following the manufacturer's guidelines. The equipment will ship on a flat-bed trailer for offloading by Contractor using forklift or crane. Media will ship in 50 pound bags loaded onto pallets for offloading by Contractor using forklift.

T. Start-Up Services and Testing:

1. The Contractor shall be responsible to ensure that all chemicals required for start-up are available.
2. Media loading shall be performed by the Contractor under the manufacturer's supervision. The Contractor shall ensure that all required scaffolding and/or ladders are available on-site to perform media loading.
3. The media possesses a chlorine demand which must be satisfied before performing backwash. The chlorine demand of the media is satisfied by activating the media with a solution of 500 mg/L of available chlorine and allowing it to soak before flushing. Activation of the media shall be performed by the manufacturer during the start-up using sodium hypochlorite which shall be provided by the Contractor. The Contractor shall coordinate with the manufacturer on the amounts of the sodium hypochlorite required for activating the media.
4. Start-up of the manufacturer's equipment is expected to generate backwash wastewater and forward-flow waste water during the start-up process. The Contractor shall be responsible for ensuring the site is prepared to manage this waste volume.
5. The manufacturer's field services shall be retained for a period of not less than three 8-hour days for start-up and commissioning made in one trip. The manufacturer's representative shall perform the following services:

- a. Inspect the completed installation to ensure conformance and consistency with specifications and approved shop drawings
- b. Approve media loading and perform initial media flush (backwash)
- c. Test, calibrate and adjust all system components to ensure proper operation
- d. Load the media and perform initial media flush
- e. Instruct Owner's personnel in the operation and maintenance of the treatment system and conduct a training seminar at the site
- f. Perform field-tests to demonstrate contaminant removal compliance

7.13 Backwash Holding System:

A. Scope

1. The Supplier shall furnish the following components of the Equipment:
 - a. Backwash Holding Tanks with Fittings and Stands
2. The Supplier shall be responsible for:
 - a. Size all equipment to be supplied per this specification
 - b. Prepare submittals documents with shop drawings
 - c. Fabricate / Procure the Equipment
 - d. Provide Backwash Tank
 - e. Deliver the equipment to the project job site
3. The Contractor shall be responsible for:
 - a. Interface with engineer during the submittals review process.
 - b. Receive, offload, and store all Equipment delivered by the Supplier.
 - c. Preparation of the groundwork and construction of the foundation for the installation of the Backwash Holding Tank.
 - d. Install all Equipment delivered by the Supplier.
 - e. Supply and install interconnecting piping, fittings and valves between the Supplier's Equipment and other site equipment.
 - f. Supply and install the overflow piping on the Backwash Holding Tank.
 - g. Supply and install isolation valves as shown on the Contract Drawings.
 - h. Make water available for the Backwash Holding Tank erection crew to perform hydrostatic testing after tank erection is completed.

- i. Perform disinfection of the tank and provide water sample for bacteriological testing to a state-certified lab.
- j. Provide internal piping and supports for the sludge outlet line from the center sump to the sludge outlet nozzle on the Backwash Holding Tank

B. Functional Requirements:

- 1. The Backwash Holding Tank shall be a flat-bottom tank.
- 2. The Backwash Holding Tank shall be of sufficient capacity to hold a nominal volume of 125% of the projected Backwash Volume from at least one vessel's backwash. Nominal volume is calculated as the total volume of the tank from the bottom of the tank to the invert of the overflow.
- 3. The Backwash Holding Tank shall also be of sufficient capacity to hold at least 110% of the projected Backwash Volume from at least one vessel's backwash in the working volume of the holding tank. Working volume is calculated as the volume between the invert of the overflow and the outlet.

C. Service Conditions : The following service conditions apply:

Well	Projected Backwash Volume:		Design Treatment Flow	Nominal Volume
	Gallons per Vessel:	Gallons from Treatment System:		
Forsyth	6,550 gal	13,100 gal	550 gpm	10,500 gal
Homer	8,550 gal	17,100 gal	780 gpm	12,500 gal
Industrial	8,550 gal	17,100 gal	830 gpm	10,500 gal
Hammock	8,550 gal	17,100 gal	830 gpm	12,500 gal

- 1. Expected Backwash Outlet on Treatment System: 6" diameter
- 2. Settling Time: 2-3 hours
- 3. Treatment System Expected Inlet Pressure: TBD (60 psi Assumed in Design Phase)

D. Backwash Holding Tank:

- 1. Storage Tank
 - a. Design: Upright, cylindrical, flat-bottom, single wall tank, molded in one-piece seamless construction by the rotational molding process.
 - b. Storage Content: Temporary storage of non-hazardous backwash water.
 - c. Standards: ASTM D1998
 - d. Materials: HDLPE (High Density Linear Polyethylene)
 - e. Minimum Specific Gravity: 1.5
 - f. Nominal Volume: See table above

- g. Tie-down / lifting lugs: Minimum of 4 integrally molded on top head
- h. Tank Color:
 - 1. Dark-colored resin for tanks to be installed exposed to sunlight
 - 2. Natural resin for tanks to be installed indoors away from sunlight
- i. Lateral Restraint System:
 - 1. Suggested on non-seismic indoor installations
 - 2. Minimum of four L-shaped anchor clips secured to a restraint band
 - 3. Anchor bolts to be provided by installing contractor
 - 4. Concrete pad shall be minimum 18-3/4" larger than tank diameter
- j. Seismic and Wind Restraint tie-down system:
 - 1. Required on seismic-prone areas and outdoors installations
 - 2. Designed for a minimum of 110 MPH wind loads, and seismic zone D seismic loads. Provide non-site-specific wet stamped calculations from Registered Professional Engineer.
 - 3. Seismic and wind design should always meet or exceed site-specific requirements as defined under the local building code.
 - 4. Restraint system shall include galvanized steel or stainless steel cables, cable clips, thimbles, and ASTM A36 anchor plates. Installation shall be performed per the recommendations set forth in the wet stamped calculations.
 - 5. Anchor bolts to be provided by installing contractor
 - 6. Concrete pad shall be minimum 24" larger than tank diameter
- k. Fittings and Tank Appurtenances Specifications
 - 1. Vent: U-Vent assembly shall be located on top head and sized to limit pressure or vacuum to a maximum of 1/2" of water column. Minimum size shall be at least one nominal pipe size larger than inlet and outlet fittings. On outdoor installations a fiberglass 17" x 17" mesh bug screen insert shall be installed on the U-vent.
 - 2. Overflow: Up-turned elbow inside tank
 - 3. Roof Access: 15" manway with threaded opening on top head
 - 4. Fittings located on the sidewall shall be PVC Bulkheads with EPDM gaskets on fittings 3" and smaller; they shall be PVC double-flanged bolted on fittings larger than 4" and larger.

5. Fittings located on the sidewall shall be located a minimum of 6" from the bottom and top of tank on sizes smaller than 3,000 gallons, and minimum of 9" from the bottom and top of tank on sizes 3,000 gallons or larger. The exception is if a Unitized Molded Outlet fitting is used as a drain on flat-bottom tanks.
 6. An 8" Fitting on the sidewall shall be located at 4 ft elevation for rinsing purposes.
 7. A 4" clean out fitting shall be located at 9" elevation with an internal siphon elbow.
 8. A 4" drain fitting shall be located at 2 ft elevation.
 9. Fitting gasket shall be at least 1-1/2" above or below the end of any knuckle radius on tanks smaller than 3,000 gallons, and 3" above or below the end of any knuckle radius on tanks 3,000 gallons or larger. In addition, fittings shall be installed away from flange lines and molded-in tank features such as gallon markers, logos, ribs, edges of tank flats, etc.
 10. Fittings must be located to avoid interference with tank tie-downs.
1. Manufacturer Qualifications and Workmanship:
 1. The tank manufacturer must have over 10 years of experience in the design and manufacture of rotationally molded chemical storage tanks using high density linear polyethylene.
 2. The finished tank shall be free, as commercially practical, of visual defects such as foreign inclusions, air bubbles, pinholes, pimples, crazing, cracking and delamination that will impair the serviceability of the tank.
 3. A factory test report shall be supplied with the tank showing:
 - a. Verification of wall thickness
 - b. Impact Test
 - c. Hydrostatic Test
 - d. Verification of Fitting Placement
 - e. Visual Inspection
 - f. Verification of Materials
 - m. Markings: The tank shall be marked to identify the product, date (month and year) of manufacture, capacity and serial number.
 - n. Manufacturer: Snyder Industries or equal.
 - o. Fittings and Tank Levels
 1. Backwash inlet shall be located on top head and sized same as backwash outlet on filter treatment system.

2. Overflow shall be located and sized at least the same pipe size as the expected backwash outlet on filter treatment system, and such that the head generated at the design treatment system flow is below the backwash inlet connection. The overflow shall be connected to a low pressure down-comer pipe that leads to drain with an air gap. The overflow piping shall be supplied and installed by the Contractor.
3. HHL (High High Level): registered minimum 1" below bottom of overflow connection.
4. Backwash Inhibit: The volume for backwash inhibit signal from HHL shall be at least 10% larger than the expected backwash volume from the largest single vessel in the filter treatment system.
5. Outlet shall be located minimum 6" above the top of the tank bottom.

E. Level Sensor:

1. Type: Electronic Pressure Sensor
2. Output: 4-20 mA
3. Electrical Connection: Plug M12, IP65/67 NEMA Type 4X Encl.
4. Sensor Range: 0 - 15 psi gauge
5. Reference Accuracy: Standard 0.5%
6. Manufacturer: Endress Hauser PTC31B

F. Backup Level Float:

1. Provide one sealed mercury float switch as a backup to the main level sensor to enunciate high tank level in the event of main level sensor failure.

7.14 Payment: No separate payment will be made for the work of this Section. The cost of the work, and all costs incidental thereto, shall be included in the amount bid in the proposal for the item to which the work pertains. Items herein not listed under Item No. 2 in the Proposal shall be included in the lump sum amount under Item No. 1 in the Proposal.

