

SECTION 22 67 19.16
REVERSE-OSMOSIS WATER EQUIPMENT (DEDUCT ALTERNATE #1)

PART 1 - GENERAL

1.1 DESCRIPTION

Complete industrial-type packaged reverse osmosis (RO) water treatment system producing high purity water by removal of dissolved minerals, bacteria, particles and organic impurities. Designed for continuous automatic operation. The system shall include pre-filter, product storage tank and all devices necessary for fully operational system. RO system operation will be controlled by the water level in the product storage tank.

1.2 RELATED WORK

- A. Systems for service other than boiler plant make-up water, Section 22 05 11, COMMON WORK RESULTS FOR PLUMBING.

1.3 QUALITY ASSURANCE

Manufacturer shall have been engaged in the manufacture of reverse osmosis systems as a primary product for at least ten years. The ten year requirement supersedes any conflicting requirement in other parts of the project specification.

1.4 SUBMITTALS

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Manufacturer's Literature and Data:
1. Catalog cuts, complete description and specifications of all equipment and accessories
 2. Accessories including filters, product storage tank, pressure gages and test kit.
 3. Performance data including normal and maximum flow and pressure drop. Certification that required performance will be achieved.
 4. Piping.
- C. Complete detailed layout, setting, arrangement, and installation drawings including. Drawings shall also show all parts of the apparatus including relative positions, dimensions, and sizes and general arrangement of connecting piping.

1.5 PROJECT CONDITIONS

- A. Influent Water Analysis: *Data obtained from the 2011 Supplement for Calendar Year 2010 Annual Water Quality Report for the Buffalo Water Authority (Operated by Veolia Water). Coordinate actual water conditions on site with COTR.

Maximum Silt Density Index (SDI) Rating	(Not identified within report)
Turbidity, NTU	0.05 (average)
Maximum Free Chlorine and/or Chloramine	0.73 ppm (average)
Color:	(Not identified within report)
Maximum pH (continuous)	8.1
Minimum pH (continuous)	7.5

Confirm the analysis with current samples and tests.

- B. Design Parameters:

As schedule or noted on plan and schedule drawings.

1.6 APPLICABLE PUBLICATIONS:

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society of Mechanical Engineers (ASME):
B40.100-2005.....Pressure Gages and Gage Attachments
- C. ASTM International (ASTM):
A269-07.....Seamless and Welded Austenitic Stainless Steel
Tubing for General Service.
D1785-06.....Poly (Vinyl Chloride) (PVC) Plastic Pipe,
Schedules 40, 80, and 120.
- D. American Water Works Association (AWWA):
B300-04.....Hypochlorites
B301-04.....Liquid Chlorine
C651-05.....Disinfecting Water Mains
- E. National Electrical Manufacturers Association (NEMA):
ICS-6-1993(R2001, R2006) Industrial Control and Systems: Enclosures
- F. National Fire Protection Association (NFPA):
70-07.....National Electrical Code.
- G. Department of Health and Human Services, Food and Drug Administration (FDA):
CFR 21, Chapter 1, Part 175.300, Resinous and Polymeric Coatings

PART 2 - PRODUCTS

2.1 REVERSE OSMOSIS SYSTEM

- A. Packaged automatic reverse osmosis system mounted on steel frame, designed for project conditions. Equipment arranged on the frame to allow easy access for operating, maintenance and repair.
- B. Performance Requirements:
 - 1. Membrane reject ratio: 98% minimum. TDS of product is 2% maximum of input TDS.
 - 2. Capture rate: 70% minimum. Maximum amount of water to drain 30% of input.
- C. RO Membrane Elements:

Thin-film composite with FRP over-wrap, anti-telescoping device, u-cup brine seal. The design salt rejection shall be 98% based on 2000 ppm water at 225 psig at 77 degrees F.
- D. RO Element Housings:

PVC 225 psi rated membrane pressure vessels with glass filled PP end caps held in place with acetal snap-in retainer clips. Each housing assembly complete with one set of O-rings and O-ring lubricant.
- E. High Pressure Pumps and Motors:

Vertical multistage high efficiency centrifugal type with Type 304 stainless steel casing, shaft, impellers. Tungsten carbide and ceramic shaft seals. Stainless steel frame with FNPT piping connections.
- F. Manual Valves:
 - 1. Concentrate Throttle Valve, Recycle Throttle Valve: needle style, incorporated into concentrate and recycle rotometers rated for 250 psi minimum.
 - 2. Product Check Valves: PVC with EPDM seats and seals.
- G. Automatic Valves:
 - 1. Automatic Inlet Shut Off Valve: Solenoid type, diaphragm actuated, normally closed, constructed of glass-filled Noryl thermoplastic.
 - 2. Automatic Membrane Flush Valve: Provide for purging the membranes with fresh water upon machine shut down.
- H. Plumbing:
 - 1. Low Pressure Feed, Reject and Recycle Plumbing (75 psi and under): Reinforced PVC hose and PE tubing.
 - 2. RO Product Tubing From Each Membrane Housing: PE tubing.
 - 3. Low Pressure Control and Pressure Gage Tubing: PE tubing.
 - 4. High Pressure Reject and Recycle Piping (above 75 psi): 300 psi

reinforced hose and 250 psi rate nylon tubing.

I. Controls:

1. Electronic PLC or microprocessor controller providing automatic control for all operating functions. Motor starter panel. All in FRP enclosures rated NEMA 4. All wiring factory-installed and tested. Comply with Section 26 05 21, LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES (600 VOLTS AND BELOW) and NFPA 70.
2. Autoflush indicator and control to flush RO concentrate at shut down or at predetermined intervals.
3. Warning Alarms: Low quality product and low feed pressure.
4. Automatic Shutdowns and Alarms: Low feed pressure, pretreatment lock out, storage tank full.
5. Status Indicators: Low feed pressure, low quality, pretreatment lockout, storage tank full.
6. Pump Motor Starter: Comply with Section 26 29 11, LOW-VOLTAGE MOTOR STARTERS.

J. Instrumentation and Displays:

1. All instrumentation readouts panel-mounted in enclosures rated NEMA 4. All factory wiring. Comply with NFPA 70.
2. Rotometer flow indicators for product, reject, recycle.
3. Pressure gages for inlet, cartridge filter outlet, RO feed and RO concentrate.
4. Conductivity indicator measuring product quality with digital displays, alarm relays and automatic temperature compensation.
5. Conductivity probe mounted in the RO product line.

K. Skid and Frame Assembly:

RO machine shall be built on a skid and frame constructed of welded structural carbon steel. The entire surface shall be sand-blasted and powder coated.

2.2 PRE-FILTER

- A. Single 2.5" by 20" long spun poly sediment filter sized for the RO machine inlet flow rate. Designed for suspended solids removal down to 10 microns.
- B. 20" PP filter housing with 3/4" FNPT inlet and outlet posts mounted within R.O. system frame.
- C. Replacement Filter Media: Provide cartridge for one complete replacement.

2.3 ACTIVATED CARBON FILTER

- A. Single filter sized for the RO machine inlet flow rate. Designed to remove chlorine and prevent RO membrane damage.
- B. Media Tank: FRP designed for 150 psi. Pre-piped internal backwash distributor and filtered water collector.
- C. Filter Media: 12 x 40 mesh bituminous coal-based activated carbon. Install media at job site.
- D. Backwash Cycle: Top-mounted, piston-operated control valve with pre-sized drain line flow control orifice. The cycle shall be initiated by and adjustable seven day electronic time clock.

2.4 RO WATER STORAGE TANK

- A. Free-standing, closed-top, flat-bottom, 100 gallon. Top access manway, PVC bulkhead, RO permeate inlet, RO permeate discharge and drain. Install 0.2 micron tank vent filter at the top head. Vented to atmosphere.
- B. Materials of Construction: Linear polyethylene in one piece.
- C. Tank Water Level Control: Adjustable float switch that signal starting and stopping RO pump.

2.5 PRESSURE GAGES

2-1/2 inches diameter, stainless steel case, rear connected. White dials, black hands, graduated from 0 to 0.7Mpa (0 to 100 psi) for prefilter inlet and prefilter outlet and 0-2 MPa (0-300 psi) for membrane inlet and membrane outlet with all gauges identity labeled.

2.6 WATER TESTING EQUIPMENT:

- A. Furnish water testing equipment in a portable cabinet specially made for the installed equipment. Include sufficient materials for 6 months of normal testing procedures.
- B. Silt Density Index (SDI) apparatus to measure degree of suspended solids feeding the RO membranes. Include pressure regulator, pressure gage, filter holder, 600 mL beaker, sample valve, tubing and 0.45 micron filter papers.
- C. Test kit to measure total water hardness, total iron, free chlorine, pH.

PART 3 - EXECUTION

3.1 REQUIRED TECHNICAL SERVICES:

Provide services of a qualified manufacturer's representative to check complete installation for conformance to manufacturer's recommendations, put system into service, make all adjustments required for full

conformance to design and specified requirements, and perform all demonstrations and tests.

3.2 FLUSHING AND DISINFECTING:

- A. Flush and disinfect new water lines and RO system and tank interiors in accordance with AWWA C651.
- B. Material:
 - 1. Liquid chlorine: AWWA B301.
 - 2. Hypochlorite: AWWA B300.

3.3 TESTS:

- A. Operating: Tests shall be run in presence of Contracting Officers Technical Representative (COTR) or Resident Engineer (RE).
- B. Procedure:
 - 1. Operate RO system at constant maximum required capacity for one hour after demineralized RO product water is produced. When necessary, waste product water to sewer to maintain above flow rate. Product water production shall begin when a sample shows that demineralization complies with requirements.
 - 2. Demonstrate all features of the control system including diagnostics and flow and cycle indications.

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