



DETAILED EQUIPMENT SPECIFICATION

HIGH PURITY LABORATORY WATER SYSTEM

Prepared for:

1.0 SCOPE

- 1.1 Provide as indicated a factory assembled, centralized high purity laboratory water system, including reverse osmosis and deionization, shipped for ease of installation and start up. The system shall be of an approved design as fabricated by a manufacturer regularly engaged in the production of water treatment equipment. All equipment and material shall be supplied per the specifications as intended for a complete and operational system.
- 1.2 Qualified manufacturers of water conditioning equipment shall be engaged in the manufacture of this type of equipment for a period of not less than (10) years. Acceptable manufacturers are Marlo Incorporated of Racine, Wisconsin or engineer's approval equal. www.marlo-inc.com

2.0 GENERAL DESCRIPTION

- 2.1 The system, in compliance with equipment specifications, is described as an integrated ultra pure, skid mounted, pre-piped, and pre-wired water system for Type 2 reagent grade lab water.

3.0 DESIGN DATA

3.1 DESIGN PARAMETERS

Daily Design System Usage ___ GPD (RO make-up rate)
Design System Flow ___ GPM at ___ psig (DI water distribution loop)
Daily Hours of Water Demand ___ Hours / Days of Week
Required System Inlet Water Pressure Range 50-80 PSIG
Operating Temperature Range 50-80°F
Electrical Requirements 460VAC, 3-phase, 60 Hz (single point connection)
Minimum Storage Tank Capacity ___ Gal.
Space Allowance (LxWxH) _____.

3.2 WATER ANALYSIS

[Inserted feed water analysis here]

3.3 DESIRED WATER QUALITY

CAP / NCCLS / ASTM Type 2 reagent grade water (or Engineer Specification)

4.0 REVERSE OSMOSIS (RO) PRE-TREATMENT EQUIPMENT

4.1 ACTIVATED CARBON FILTER

A single tank, activated carbon filter shall be provided for the removal of chlorine and organic matter for the prevention of RO membrane oxidation and fouling. Media tank to be constructed of fiberglass reinforced polyester (FRP) designed for 150 psig. A pre-piped internal backwash distributor and filtered water collector shall be provided. The filter media shall consist of a 12 x 40 mesh, coconut shell activated carbon. The automatic backwash cycle shall be performed by a top mounted, piston operated control valve with a pre-sized drain line flow control orifice. The backwash cycle is to be initiated by an electronic programmable timer. Automatically shuts down the R.O. when backwashing.

Basis of Design: Marlo Model ACE Series.

4.2 WATER SOFTENER

A twin alternating water softener properly sized for the inlet flow rate of the RO machine and incoming water hardness shall be provided to prevent the scaling of RO membrane elements. Resin tank to be constructed of fiberglass reinforced polyester (FRP) designed for 150 psig. A pre-piped internal backwash distributor and soft water collector shall be provided. Softening resin shall have an exchange capacity of 30,000 grains per cubic foot when regenerated with 15 lbs of salt. The brine tank shall be constructed of rotationally molded polyethylene with snug-fitting cover. A float operated, air-check brine valve shall be provided to automatically measure the correct amount of brine to the softener unit and re-fill with fresh water, and shall be equipped with safety overflow option.

The softener regeneration shall be performed by a top-mounted, piston operated control valve with pre-sized flow controls and brine injector. An attached water meter shall monitor the volume of water processed and automatically initiate softener regeneration. An electronic programmable timer shall display flow rate, batch remaining, etc. An alternator controller shall be provided to permit only one vessel in service at any time. The second tank is to be in either regeneration or stand-by mode at any time.

Basis of Design: Marlo Model MATC Series.

5.0 RO MACHINE EQUIPMENT DESCRIPTION

Basis of Design: Marlo MRO Series, Model MRO-

5.1 RO MEMBRANE ELEMENTS

The RO elements shall be thin-film composite (TFC) with an FRP or tape overwrap, anti-telescoping device and u-cup brine seal. The design salt rejection shall be 99% based on 2000-PPM water and 225 PSIG at 77 degrees F. RO machine models with output 2,500 GPD or less shall utilize 2.5" diameter membrane elements. RO machine models with output 2,500 GPD and greater shall utilize 4.0" diameter membrane elements.

5.2 RO ELEMENT HOUSINGS

The RO element housings shall be constructed of fiberglass reinforced plastic (FRP) with PVC end caps. Stainless steel clamps hold the end caps in place. Each housing assembly is complete with one set of O-rings and O-ring lubricant.

5.3 HIGH PRESSURE PUMP AND MOTOR

RO Models 2500 GPD and smaller

The RO feed pump shall be a positive displacement type constructed of 304 stainless steel casing, shaft, impellers, inlet and discharge castings. All pump bearings shall be tungsten carbide and ceramic. The pump shall have a cast iron frame with suction/discharge connections. A NEMA standard C-faced ODP motor shall be mounted to an adapter supported on the pump-bearing frame. The motor shall be rated for 3500 RPM, 120 VAC, 1-Phase, 60 Hz power supply.

RO Models 2500 GPD and greater

The RO feed pump shall be a vertical mounted, multi-stage centrifugal pump. Wetted components shall be constructed of 316 stainless steel with flanged suction / discharge connections. Motors shall be TEFC and rated for 3500 RPM, 460 VAC, 3-Phase, 60 Hz power supply.

5.4 ELECTRICAL CONTROL SYSTEM

The control panel shall contain an illuminated selector switch indicating power OFF/ON, status/alarm lights, pre-wired motor starter (if applicable), power disconnect switch, control relays, and terminal blocks factory assembled and tested. Enclosure shall be NEMA 4X rated and constructed of FRP. A pressure switch shall be provided to shut down the RO pump in a low pressure condition. A pretreatment interlock indicator and control shall be provided to prevent RO operation when pretreatment equipment (such as the activated carbon filter) is off-line in the backwash or regeneration mode.

5.5 INSTRUMENTATION

Two (2) panel-mounted flowmeters, one product and one concentrate, shall be included. Panel-mounted pressure gauges for inlet, cartridge filter outlet, RO feed, and RO concentrate shall be 316 stainless steel and liquid filled. A panel-mounted conductivity monitor shall be provided to measure the RO product quality (in microsiemens/cm). The monitor shall have a digital display, alarm relays, and automatic temperature compensation. The conductivity probe shall be mounted in the RO product outlet line and pre-wired to the conductivity monitor.

5.6 VALVES

The concentrate throttle valve and recycle throttle valve shall be an in-line needle style, constructed of stainless steel and rated over 300 PSIG. The automatic inlet shutoff valve shall be a diaphragm type, solenoid actuated, normally closed, and constructed of brass or Noryl thermoplastic. The inlet isolation valve, product and concentrate check valves and sample valves shall be PVC with EPDM seats and seals. There shall be a sample valve for cartridge filter outlet, concentrate and product lines.

5.7 SEDIMENT PRE-FILTER

A cartridge filter housing shall be provided in the RO machine inlet line and constructed of polypropylene and include a built-in pressure relief or vent valve. The filter element shall be constructed of spun-wound polypropylene and rated at 5-micron nominal and 20" in length. Furnish 4 spare filter elements.

5.8 SKID AND FRAME ASSEMBLY

The entire RO machine shall be built on a skid and frame constructed of structural carbon steel and completely electrically welded. The entire surface shall be finish painted with a "Safety Blue" self-priming, high solids epoxy overcoat.

5.9 PIPING

All low pressure piping (80 psig or less) shall be constructed of Sch 80 PVC. RO product tubing from each membrane housing shall be reinforced PVC. All control and pressure gauge tubing shall be constructed of polyethylene.

All high pressure piping (80 psig and higher) shall utilize threaded and compression pressure fittings and shall be constructed of stainless steel or brass. High pressure control and pressure gauge tubing shall be constructed of high pressure nylon, or reinforced polyethylene.

5.10 ATMOSPHERIC STORAGE TANK

The RO product water storage tank shall be constructed of linear polyethylene in one piece, seamless construction and closed-top, conical bottom configuration. The tank shall have an 8" top opening for convenient access. PVC bulkhead fittings shall be installed for high / low-level switches, RO product inlet, RO product discharge, high purity water return, and drain. A 0.2-micron tank vent filter shall be installed in the top head of the tank. A pressure relief valve (PRV) constructed of polypropylene shall be installed in the high purity water distribution return line at the top of the storage tank and furnished with a 0-30psi stainless steel pressure gauge.

5.11 STORAGE TANK LEVEL CONTROL

An adjustable float switch assembly shall be provided for the product storage tank. Switches shall signal start and stop to the RO unit. A secondary adjustable float switch shall be provided for low tank level, and shall signal the shut-off of the repressurization pump.

5.12 WATER TEST KIT

A comprehensive water quality testing kit shall be provided to field-measure total water hardness, total iron, free chlorine, and pH.

5.13 INSTRUCTIONS

A set of three (3) complete Installation, Operation and Maintenance manuals shall be provided in three-ring binder form. As-built general arrangement, process and instrument, and electrical drawings shall be included. All component data, manuals, calibration documents shall also be included. A recommended "on-hand" spare parts list shall be provided.

5.14 WARRANTY

The manufacturer shall provide an 18-month materials and workmanship warranty from the date of equipment shipment. Membrane element warranty is per the selected RO element manufacturer standard warranty.

6.0 RO POST-TREATMENT EQUIPMENT

6.1 RO WATER RE-PRESSURIZATION PUMPS

Two (2) vertical mounted, multi-stage centrifugal pumps suitable for the distribution of RO / ultra pure water shall be provided. One pump is designed as a dedicated piped and wired spare. Wetted components shall be constructed of 316 stainless steel with flanged suction / discharge connections. Motors shall be TEFC and rated for 3500 RPM, 460 VAC, 3-phase, 60 Hz power supply. A NEMA-4X pump control panel constructed of fiberglass shall be provided with prewired motor starters, pump selector switch, pump run lights, low tank level alarm light, hand/off /auto switches, and pump run hour meters.

Basis of Design: Grundfos CRN Series

6.2 MIXED-BED DEIONIZATION POLISHING BOTTLES (SERVICE EXCHANGE TYPE)

Furnish four (4) non-regenerable, service exchange type deionization vessels. Each vessel shall be constructed of FRP and filled with mixed-bed ion exchange resin sized for the laboratory water distribution flow. Vessels to be oriented in a series configuration with two (2) vessels serving as the primary service and two (2) vessels serving as the polisher. Vessels are to be provided with quick-disconnect hose couplings. At resin exhaustion, the primary vessels are removed and the replaced with the polishing vessels and the fresh tanks are placed in the polishing position. A dual-channel resistivity monitor shall be provided to indicate water purity after the primary vessels and after the polishing vessels. An alarm output shall be provided for out-of-range water purity indicating the need for a vessel change-out. Vessel change-outs with fresh resin are to be performed by the owner's independently contracted service company.

6.3 ULTRAVIOLET LIGHT

An ultraviolet water disinfection light shall be provided for the effective destruction of bacteria on DI quality water. The lamp wavelength shall be 254 nm with a 9,000 hour life. The pressure vessel shall be 316L stainless steel electropolished and passivated. The UV lamp shall be housed in a heavy-duty quartz jacket. A NEMA-3R electrical control cabinet shall include an elapsed run time indicator. The ON/OFF control shall be wired through the pump control panel and a lamp out warning and intensity indicator shall be a part of the electronics. Basis of Design: Viqua UVMax Series.

6.4 POST-FILTER HOUSING

Designed to trap sub-micron contaminants down stream of the UV light. Filter housings shall be constructed of 316L stainless steel. The filter element shall be polyether sulphone and rated at 0.2 micron absolute with a 222 style end-configuration, silicone "O" rings and "spear" top.

7.0 SKID MOUNTED SYSTEM PACKAGE

The RO machine, pre-treatment equipment, and post-treatment equipment (excluding the RO water storage tank) shall be provided completely mounted on a common skid and frame assembly constructed of welded

structural carbon steel. All interconnecting piping and manual isolation/bypass valves between equipment shall be provided. Piping and valves prior to the RO water storage tank are to be constructed of Sch 80 PVC. Piping and valves for the distribution and post-treatment equipment after the RO water storage tank are to be constructed of butt fusion welded high purity polypropylene. The complete system shall be factory tested prior to shipping.

- 7.1 Electrical control panels and all interconnecting wiring are to be provided in a watertight flexible conduit. A single point electrical connection for three-phase and single-phase power shall be required.
- 7.2 Master Control Panel (MCP) – Main control panel NEMA-4X with non-metallic enclosure on the skid shall consist of a completely factory wired system including transformer, motor starters, fused disconnect switch, alarm status lights for ultraviolet sterilizer, low and high water level lights, water purity digital readout for primary/polished DI vessels, and low water quality alarm.

- END OF SECTION-