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## DETAILED EQUIPMENT SPECIFICATION

### MRO-2.5 SERIES REVERSE OSMOSIS SYSTEMS

#### 1.0 SCOPE

- 1.1 Provide as indicated a factory assembled reverse osmosis (RO) system 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, Inc. or engineer's approval equal.

#### 2.0 GENERAL DESCRIPTION

- 2.1 The system, in compliance with equipment specifications, is described as an \_\_\_\_\_
- 2.2 The system specifications are based on Marlo Model MRO-\_\_\_\_\_

#### 3.0 DESIGN DATA

##### 3.1 DESIGN PARAMETERS

Design System Flow \_\_\_\_\_ GPM (RO make-up rate)  
Design System Flow \_\_\_\_\_ GPM (Distribution)  
Daily Water Usage \_\_\_\_\_ Gallons / Day  
Daily Hours of Water Demand \_\_\_\_\_ Hours / Day  
Operating Temperature Range \_\_\_\_\_ °F  
Operating Pressure Range (System) \_\_\_\_\_ PSIG  
Electrical Requirements \_\_\_\_\_  
System Dimensions (LxWxH) \_\_\_\_\_  
Desired Storage Capacity \_\_\_\_\_ Gal. (Atmospheric Tank)  
Desired Storage Capacity \_\_\_\_\_ Gal. (Pressure Tank)

##### 3.2 WATER ANALYSIS

**(insert accurate feed water quality report here)**

##### 3.3 DESIRED WATER QUALITY

**(insert final water quality parameters here)**

## **4.0 EQUIPMENT DESCRIPTION**

### **4.1 RO MEMBRANE ELEMENTS**

The RO elements shall be thin-film composite (TFC), 2.5" diameter with a tape overwrap, anti-telescoping device and u-cup brine seal. Membrane length shall vary from 14", 21", or 40" depending on RO machine model. The design salt rejection shall be 98% based on 2000-PPM water and 225 PSIG at 77 degrees F.

### **4.2 RO ELEMENT HOUSINGS**

The RO element housings shall be constructed of PVC 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.

### **4.3 HIGH PRESSURE PUMP AND MOTOR**

The pump shall be a positive-displacement rotary vane type constructed of brass. It shall be rated between 80-330 GPH at a 225 psig discharge pressure depending on RO machine model. The pump shall have 3/8" threaded suction/discharge connections. A NEMA standard C-faced ODP motor shall be directly clamped to the pump. The motor shall be rated for a 120 VAC, single-phase, 60 Hz. power supply. Motor horsepower shall range between 0.33 to 0.75 Hp depending on RO machine model.

### **4.4 ELECTRICAL CONTROL SYSTEM**

The control panel shall contain an illuminated selector switch indicating power OFF/ON, status/alarm lights, motor starter, 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 inlet water 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.

### **4.5 INSTRUMENTATION**

Two (2) panel-mounted flowmeters, one product and one concentrate reject, shall be included. The pressure gauge for membrane system pressure shall be 316 stainless steel and liquid filled.

### **4.6 VALVES**

The concentrate reject throttle valve and recycle throttle valve shall be an in-line needle style, constructed of brass and rated over 300 PSIG. The automatic inlet shutoff valve shall be a solenoid type, normally closed, and constructed of brass.

### **4.7 CARTRIDGE PRE-FILTER**

A cartridge filter housing shall be provided in the inlet line and constructed of polypropylene and include a built-in pressure relief valve. The filter element shall be constructed of spun-wound polypropylene and rated at 5-micron nominal.

### **4.8 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 sand-blasted and finish painted with a "Safety Blue" self-priming, high solids epoxy overcoat.

### **4.9 PIPING**

All low pressure lines (75 psig or less) shall be constructed of Sch 80 PVC pipe and fittings. RO product and concentrate reject lines from each membrane housing shall be reinforced PVC tubing. All high pressure lines (75 psig and higher) shall be constructed of brass pipe and fittings. Threaded and compression type high pressure fittings are acceptable. A union disconnect fitting shall be provided for easy pump removal without complete disassembly of the high pressure piping lines.

### **4.10 DELUXE UPGRADE PACKAGE (OPTIONAL)**

The deluxe upgrade package will convert the brass feed pump to an all 304 stainless steel constructed pump for extra durability and longer service life. It will also include a panel-mounted conductivity monitor

shall be provided to measure the RO product quality (in microsiemens/cm). The monitor shall have a digital display and automatic temperature compensation. The conductivity probe shall be mounted in the RO product outlet line and pre-wired to the conductivity monitor.

#### 4.11 INSTRUCTIONS

A set of two (2) 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, and calibration documents shall also be included. A recommended "on-hand" spare parts list shall be provided.

#### 4.12 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.

#### 4.13 FIELD-SERVICE

On-site startup or service shall be made available from the factory or the local manufacturers representative. Technical service phone support and spare parts must also be available from the manufacturers factory. Rates and prices to be clearly stated in the operation and maintenance manuals.

### 5.0 OPTIONAL EQUIPMENT (RO PRE-TREATMENT)

#### 5.1 MULTI-MEDIA FILTER

A single multi-media filter properly sized for the inlet flow rate of the RO machine shall be provided for suspended solids removal down to the order of 10-20 micron. 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 top layer of anthracite, middle layer of silica sand, and bottom layer of multi-grade garnet. The filter media shall be provided separately in one (1) cubic foot bags and installed at the job-site. 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 to be initiated by an adjustable seven (7) day electro-mechanical calendar timeclock. Basis of Design: Marlo MID Series

#### 5.2 ACTIVATED CARBON FILTER

A single activated carbon filter properly sized for the inlet flow rate of the RO machine shall be provided for the removal of chlorine and prevention of RO membrane damage. 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, bituminous coal based activated carbon. The filter media shall be provided in one (1) cubic foot bags and installed at the job-site. 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 to be initiated by an adjustable seven (7) day electro-mechanical calendar timeclock. Basis of Design: Marlo ACA Series

#### 5.3 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.

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 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 MAT Series

#### 5.4 INLET WATER TEMPERING VALVE

A thermostatic water tempering valve shall be provided to increase the RO inlet water temperature to 75-77°F and improve machine performance. The valve shall include a bronze body, swivel action check stops, removable cartridge/strainer, stainless steel internal piston, temperature regulator dial, hot/cold water inlet shutoff valves, and outlet bimetal thermometer. Basis of Design: Symmons Series #5

#### 5.5 SDI APPARATUS

A Silt Density Index (SDI) apparatus shall be provided to measure the degree of suspended solids feeding the RO membranes. It consists of a pressure regulator, pressure gauge, filter holder, 600 mL beaker, sample valve, tubing and 0.45 micron filter papers.

#### 5.6 WATER TEST KIT

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

### 6.0 OPTIONAL EQUIPMENT (RO POST-TREATMENT)

#### 6.1 ATMOSPHERIC STORAGE TANK

The free-standing RO product water storage tank shall be constructed of linear polyethylene in one piece, seamless construction and closed-top, flat bottom design. The tank shall have a top manway for convenient access. PVC bulkhead fittings shall be installed for high / low-level switches, RO permeate inlet, RO permeate discharge, and drain. A 0.2-micron tank vent filter shall be installed at the top head of the tank.

#### 6.2 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.

#### 6.3 RO WATER RE-PRESSURIZATION PUMPS

One (1) close coupled, single-stage centrifugal pump suitable for the distribution of RO water shall be provided. Wetted components shall be constructed of 316 stainless steel with NPT suction / discharge connections. Motors shall be ODP and rated for 3500 RPM, 120 VAC, single-phase, 60 Hz power supply (460 VAC, 3-phase, 60 Hz for motors 1 Hp and higher). Basis of Design: G&L NPE Series

#### 6.4 PRESSURIZED STORAGE SYSTEM

An FRP hydropneumatic pressure tank with an internal rubber air-cell shall be provided to maintain water pressure in the RO water point-of-use line. The system can be either installed as a direct feed from the RO machine or in conjunction with an atmospheric tank and repressurization pump. As water is consumed and the pressure in the tank decreases, the repressurization or RO pump shall start via a pressure switch installed at the tank inlet and refills the pressure tank. Available in nominal volume capacities of 20, 30, 40, and 80 gallons. Not recommended for RO continuous recirculating distribution lines.

### 7.0 SKID MOUNTED SYSTEM OPTION

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 are to be constructed of Sch 80 PVC. 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.