

**CRANE**

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CRANE WATER

730 COMMERCE DRIVE

VENICE, FL

34292 USA

# **35 gpm Water Purification System Operating and Maintenance Manual For**

**Customer: Crown Solutions Co. LLC**



BELCO WATER • CHICAGO HEATER • COCHRANE • ENVIRONMENTAL PRODUCTS • WESTINGHOUSE CONDENSERS

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## **SECTION 1 – INTRODUCTION**

### **1.1 PURPOSE OF THIS MANUAL**

This manual is intended to assist the installer and operator of the Crane Water Purification System to operate and maintain the system effectively. The focus of this manual is strictly on the Water Purification Equipment, and is not intended to address other customer-supplied equipment. Although this manual has been specially prepared for this unit, conditions may occur which are not specifically covered. If unusual conditions occur, it is recommended that you contact a Crane Water Field Service Representative prior to attempting any corrective measures that are not specifically outlined in this manual.

The information contained in this manual is intended for use by installers and/or operators of this equipment at their own discretion and risk. Since conditions of use are outside the control of the manufacturer, we cannot assume liability for results obtained or damages incurred through the application of the information presented. This information is not intended as a license to operate under or a recommendation to infringe upon any patent or copyright.

### **DESIGN OVERVIEW**

This Water Purification System is a skid-mounted 9 x 840 Reverse Osmosis system mounted on a single frame. The 9 x 840 Reverse Osmosis Water Treatment System was designed in accordance with membrane projections based on the customer's water requirements, specifications, and the feed water analysis. Final Permeate production is projected to be 35 gpm, with Conductivity of 1.79 mg/L TDS. Actual production rates will depend on the actual feed conditions at the installed location of the water purification system.

Basic components of the 9 x 840 Reverse Osmosis Skid include a sediment prefilter housing, a high-pressure pump, reverse osmosis pressure vessels, membranes, control valves. ORP, Conductivity, pH, Pressure, and Flow are monitored by sensors for display and logic decisions within the Microprocessor control system.

The Microprocessor Enclosure is mounted on the 9 x 840 skid frame. The Control Enclosure houses the Variable Frequency Drive (VFD) for the RO high-pressure pump motor, contactors, switches, and a DC power supply and the microprocessor controller with display. The enclosure is fan cooled. The display screen is located on the front panel of the Control Enclosure, with an Emergency Stop mushroom switch and the chemical dosing pumps HOA switches.

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This Water Treatment System is designed to process raw feed water from the customer-supplied source at a rate of 46 gpm and a minimum pressure of 40 psig. Feed water is dosed with both dechlorination and pH adjust solutions. The influent then enters the 5  $\mu$  (micron) filter housing before being pumped by the VFD-controlled RO high-pressure booster pump to the first array of the RO unit. The total recovery rate varies with water temperature and other site conditions.

The final Permeate flow of 35 gpm from the RO unit is fed to the customer's Permeate Storage Tank. The entire system will continue to run, producing Permeate until the customer's water tank level float switch reaches the "high" level.

Following is an outline of the components and conditions relating to this equipment order:

1. One (1) skid mounted 9 x 840 RO Unit with Microprocessor Controls Enclosure
2. One (1) Prefilter Housing with seven (7) 5 micron filter cartridges, installed on the RO skid
3. Fast Flush Feature (full flow of feed water bypassing the Concentrate Control valve) upon RO shut down.
4. One (1) Variable Frequency Drive (VFD) unit for control of the RO High Pressure Pump
5. One (1) Antiscalant Chemical Dosing Unit, installed off-skid from the RO frame
6. One (1) pH adjustment Dosing Unit, installed off-skid from the RO frame
7. Permeate divert feature is provided to divert permeate to drain when water quality is below the desired set point.

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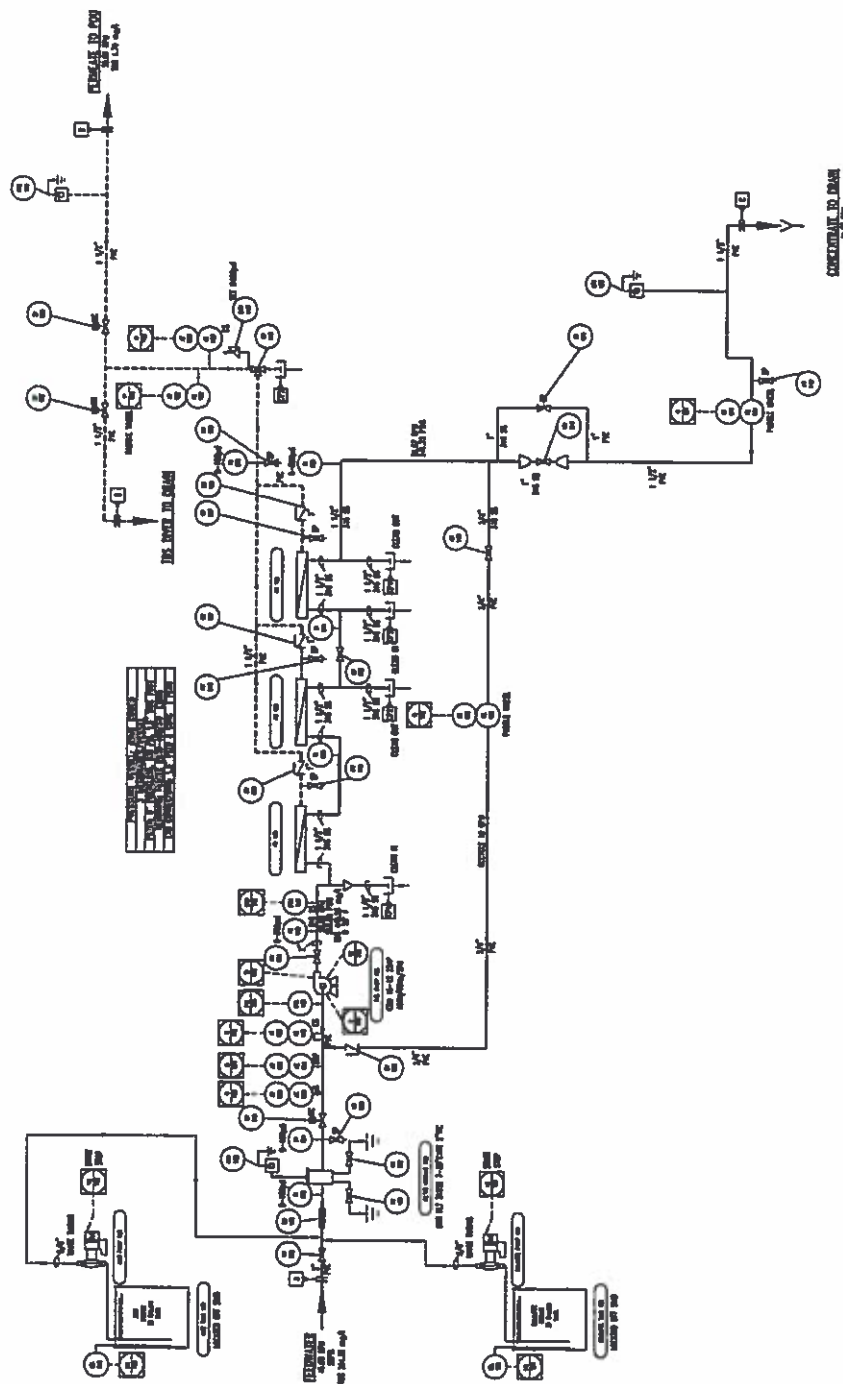


Figure 1-1 Reverse Osmosis Unit P & ID

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## 1.2 SYSTEMS DESCRIPTION

### 1.2.1 FEED WATER CHEMICAL DOSING

Dechlorination Dosing is used prior to this RO unit to remove chlorine from the feed water stream. Chlorine can permanently damage RO membranes. This dosing pump injects Sodium Bisulfite. The dosing pump is manually controlled. The Dechlorination dosing unit provides calculated injection of the chemical solution into the feed water flow stream at a constant rate, based on the chemical dosing projections. This dechlorination dosing unit is installed off-skid from the RO.

The dechlorination dosing unit consists of a dosing pump 101, and a dosing solution tank 101. A static mixer, SM-100, insures mixing of the sodium bisulfite for maximum dechlorination of the feed water flow (*See PID, Section 4 – Control and Section 5 – Operation for details*).

This RO unit also has a pH chemical dosing system for optimal membrane performance. A pH adjustment dosing unit is installed on the feed to the RO unit. The pH adjust dosing unit consists of chemical dosing pump 100, and solution tank 100. The acid dosing unit provides calculated injection of the chemical solution into the feed water flow stream at a constant rate, based on the chemical dosing projections. Consult the chemical dosing projections for the dosing unit (included at the end of this section) for details of the solution strengths and injection rates.

The dosing pump tank levels for both dosing units are monitored by the Control panel, and will fault and alarm when low, shutting down the dosing pumps (*See Section 4 – Control and Section 5 – Operation for details*).

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**Table 1-1 Major Dosing Unit Components**

P & ID, Part Number	Description	Qty	Remarks
Dosing Pumps -100 & 101/ DPO54P-1	Dosing Pump, 0.21 GPD 110V, 150 psi, PVDF	2	Pulsafeeder model LB02SA-KTC1-XXX
Dosing tanks – 100 & 101/ 23G21832PN7C00	35 Gallon 18"zx33" Chemical Solution storage tank	2	Polyethylene
DTLSASSMY01	Dosing Tank Level Switch assembly	2	Assembled components
SM-100/ STM02	2" Static Mixer, 6 elements	1	PVC

## 1.2.2 9 x 840 REVERSE OSMOSIS UNIT

Feed Water enters the RO skid through the manual skid isolation valve HV-100, and passes through the prefilter 100, removing suspended solids 5 micron and larger. The feed water inlet isolation solenoid valve SV-100 on the RO skid is opened by the microprocessor if low-solenoid pressure switch PSL100, prior to the high-pressure pump, sees the minimum pressure. If the minimum inlet pressure is not reached, the low-pressure switch will initiate a low-pressure alarm through the microprocessor, and the RO unit shuts down. When the pressure requirement is met, the feed water flows to the RO high-pressure boost pump 1, which applies hydrostatic pressure greater than the osmotic pressure, creating Permeate flow from the membranes. Permeate, or product water, flows from the RO unit to the Raw Water Storage Tank. The RO unit will continue to operate until the tank level switch in the Raw Water Storage Tank reaches the high level.

Controls for the RO unit include automatic fast flush, low-pressure shutdown, permeate divert and shutdown on high Permeate Storage Tank level.



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**Table 1-2 Major RO Unit Components**

P & ID Tag #, Part Number	Description	Qty	Remarks
Pump-100/ CRN15-12	High-pressure pump, Grundfos, 25 hp, 230-460 v/60 hz/3 phase, 2" flange (300 # class)	1	316 SS
HV-100/ UBV12	2" PVC Feed water inlet isolation valve	1	ASAHI 5090A020
Filter housing -100/ SFH730	Prefilter housing, uses seven 30" cartridges, ½" drain ports & ¼" drain ports	1	316 SS
PFC25	30" L x 2.75' Pleated 5 micron cartridge	7	WB-931-5
SV-100/ GCV200BM	Feedwater inlet 2" solenoid valve, 150 # class, 120 v/60 hz operator w/ override	1	316 SS
PV1 thru PV3/ ASI05-ASME	Pressure Vessel, 300 psi, 3 membrane length, " sideport	3	Fiberglass
Membranes/ ETB85	Membrane element, 9,10500 gpd, brackish water, 8" x 40"	9	Filmtec BW30-400/34i
XV-104/ MBV01SW	Concentrate fast flush, 1" Motorized ball valve, 1000 # class, socket weld, 120v/60 hz operator	1	316 SS w/ Apollo actuator
PSL100/ E1H-H90	Low pressure switch, 3.5-90 psi, Buna-N diaphragm	1	Low pressure protection
PSH100/ E1H-H250	High Pressure switch, 11-250 psi, Buna-N diaphragm	1	High pressure protection
HV-111/ VGS20- Korea	Concentrate Control globe valve, 1" valve, 800 lb class	1	316 SS
DGO 58/ PI 102, 104 & 105	0-300 psi liquid filled 4" dia pressure gage	3	316 SS
DGO57/ PI100, 101, 103 & 106	0-100 psi liquid filled 4" dia pressure gage	4	316 SS
ARV 102/ PRV36	Pressure relief valve, ss, ¾" MNPT x 1 ½" FNPT	1	ASME code valve 100 psi set pressure
SV102/ GCV150B-N/O	Permeate TDS divert to drain solenoid valve	1	300 psi
SV103/ GCV150B	Permeate to point of use water solenoid valve	1	300 psi



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HV110/ TWBV150-SPEARSH	Permeate 3-way valve for cleaning return & POU	1	
SP103,SP105,SP106, SP107,SP109 & SP112/ SPV01	Sample port valves 1/4" ball valve	1	PVC
HV104/ JFL32-Italy	HP Pump throttle vavle, 2" SS Ball valve 3 pc SW	1	
HV108/ JFL31-Italy	Arrray isolation valve, 1 1/2" SS Ball valve 3 pc SW	1	
HV112/ JFL49-Korea	Concentrate recycle vavle, 3/4" ss globe valve sw, 800#	1	

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## GLOSSARY OF TERMS

The following terms are commonly used when discussing RO units and related equipment.

**ALKALINITY**- the measurement of a solution's acid neutralizing ability.

**ANION** – A negatively charged ion; in water treatment also a factor in conductivity or resistivity. As an example, Strong Base Anion Exchange Resin may be used for the removal of negative ions, or "anions" in a water treatment process.

**ARRAY** – An arrangement of process equipment in a parallel and/or series configuration.

**BASICITY** - the power/measurement of an acid to react with bases, dependent on the number of replaceable hydrogen atoms of the acid

**BIRM** – Birm, for the removal of dissolved ferrous iron, is a trademarked name owned by Clack Corporation. Birm is an acronym for "Backwashable Iron Removal Media" composed of a granular manganese-coated aluminum silicate. With Birm as a catalyst, iron particles are formed when oxygen and ferrous iron compounds dissolved in the water form chemical bonds and precipitate out as "rust" or solid iron particles. This precipitate is rinsed to drain during backwash / rinse cycles.

**BRINE** - (1) Reject - normally, the waste stream from reverse osmosis which contains most of the dissolved solids from the feed in a concentrated form.  
(2) Water or solution containing high volume or concentration of salt

**CATION** – A positively charged ion; in water treatment also a factor of conductivity or resistivity of water. As an example, Strong Acid Cation Exchange Resin may be used for the removal of positive ions, or "cations" in a water treatment process.

**CHLORINE** - Symbol Cl; atomic weight 35.43; atomic number 17; valence 1, 3, 5, or 7. Chlorine is often used in water treatment as a disinfectant. Chlorine is also used in conjunction with Greensand Plus filter media as a pre-oxidizer. It may be used as a gas or as a hypochlorite (OCl-) compound. Chlorine in the air is toxic at concentrations over 0.1 ppm.

**COMPACTION** - Tightening of a membrane structure due to compressive stress of operating pressure. Compaction results in reduced productivity.