ENGINEERING YOUR SUCCESS.

Parker Sea Recovery

Coral Sea

Owner's Manual

Parker Hannifin
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TABLE OF CONTENTS

SECTION 1

SYSTEM DESCRIPTION

SYSTEM DESCRIPTION:

CORAL SEA MODELS			
	GALLONS/DAY	**TONS/DAY**	**VOLTAGE**
Vertical	2800	10.5	460V/60Hz/3Ph or 380V/60Hz/3Ph
Vertical	3600	13.5	460V/60Hz/3Ph or 380V/60Hz/3Ph
Vertical	4200	16	460V/60Hz/3Ph or 380V/60Hz/3Ph
Vertical	5200	20	460V/60Hz/3Ph or 380V/60Hz/3Ph
Vertical	6200	23.5	460V/60Hz/3Ph or 380V/60Hz/3Ph
Vertical	6800	26	460V/60Hz/3Ph or 380V/60Hz/3Ph
Horizontal	2800	10.5	460V/60Hz/3Ph or 380V/60Hz/3Ph
Horizontal	3600	13.5	460V/60Hz/3Ph or 380V/60Hz/3Ph
Horizontal	4200	16	460V/60Hz/3Ph or 380V/60Hz/3Ph
Horizontal	5200	20	460V/60Hz/3Ph or 380V/60Hz/3Ph
Horizontal	6200	23.5	460V/60Hz/3Ph or 380V/60Hz/3Ph
Horizontal	6800	26	460V/60Hz/3Ph or 380V/60Hz/3Ph

SYSTEM SPECIFICATIONS:

HIGH REJECTION & HIGH YIELD MEMBRANE ELEMENTS:

Frame Configuration Single Length Membrane Element Vessels with Single Depth Membrane Rack

PERFORMANCE:

RATED PERFORMANCE / PRODUCT WATER PRODUCED:

+-15% at	820 PSI	77° F & 35,000 PPM TDS typical seawater
	56.6 bar	25° C & 35,000 PPM TDS typical seawater
	5516 kPa	25° C & 35,000 PPM TDS typical seawater
	57.7 Kg/cm2	25° C & 35,000 PPM TDS typical seawater

Model Number	Gallons/Day	Liters/Day
2800	2800	10,599
3600	3600	13,627
4200	4200	15,899
5200	5200	19,684
6200	6200	23,470
6800	6800	25,741

SALT REJECTION (CHLORIDE ION):

Per individual R.O. Membrane Element

Minimum 99.2%, Average 99.6%

PRODUCT WATER TEMPERATURE: Ambient to feed water temperature

SPECIFICATIONS:

SYSTEM FEED WATER:

FLOW:

	GALLONS PER MINUTE	LITERS PER MINUTE
ALL MODELS	15.6	59

SALINITY RANGE:

Seawater Systems up to 50,000 ppm TDS

TEMPERATURE RANGE: Max. 122° F (50° C), Min. 33° F (.5° C)

pH RANGE: 3-11 (typical seawater pH is 8)

REVERSE OSMOSIS MEMBRANE:

TYPE: Selected aromatic tri-polyamid, thin film composite, spiral wound, single pass reverse osmosis membrane element.

CHLORINE TOLERANCE: 0.1 PPM

SYSTEM PRESSURE:

Minimum:	15 psi	Maximum:	60 psi
	1 bar		4.1 bar
	103 kPa		414 kPa
	1 Kg/cm2		4.2 Kg/cm2

SYSTEM OPERATION:

Seawater	820 psi
	56.6 bar
	5516 kPa
	57.7 Kg/cm2

Brackish Varies w/PPM

DIMENSIONS & WEIGHT:

DIMENSIONS: REFER TO SECTION 9 DRAWING PULL-OUTS

WEIGHT:

MODEL	POUNDS	KILOGRAMS
ALL MODELS	425 -750	193 - 340

NOTE: System gross shipping weight add approximately 160 lbs. / 68 Kg

WATER CONNECTIONS:

Model	2800	3600	4200	5200	6200	6800
System Feed Water Inlet	¾ Inch Flange (American Standard)	¾ Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)
System Rinse/Cleaning Chemical Inlet	¾ Inch Flange (American Standard)	¾ Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)
Brine Discharge	¾ Inch Flange (American Standard)	¾ Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)
Rinse/Cleaning Chemical Return	¾ Inch Flange (American Standard)	¾ Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)	1 Inch Flange (American Standard)
Product	½ Inch Flange (American Standard)	½ Inch Flange (American Standard	¾ Inch Flange (American Standard)	¾ Inch Flange (American Standard)	¾ Inch Flange (American Standard)	¾ Inch Flange (American Standard)

ELECTRICAL:

CAUTION: The Parker Hannifin Reverse Osmosis Desalination System is designed to be as electrically efficient as possible. The High Pressure Pump's RPM's and Operating Pressure govern the amount of energy required by the High Pressure Pump's Electric Motor. In order to maintain a sufficient flow of feed water into the Reverse Osmosis Membrane Element, Parker Hannifin utilizes several different Driver/Driven pulley ratios. These different pulley ratios, in turn, create different power requirements.

The Parker Hannifin Systems utilize a three phase, mono Cycle (Hz) Electric Motor of either 50 or 60 Hz. When operating on 50 Hz, the electric motor turns slower than a motor used in a 60 Hz operation. However, the High Pressure pump must be driven at a predetermined RPM. For this reason, Parker Hannifin systems utilize different pulley ratios to drive the High Pressure Pump (Optional Pump). The High Pressure Pump maintains it's predetermined RPM when operating on the specified power source.

Therefore, do not attempt to operate the Parker Hannifin system from a power source that creates 50 Hz if you have a 60 Hz System. Likewise, do not attempt to operate the Parker Hannifin system from a source that creates a 60 Hz if you have a 50 Hz System.

If the Parker Hannifin system is set up for 50 Hz and operated at 60 Hz, the motor will turn too fast and require excessive power. This over stresses and overheats the motor. If the Parker Hannifin system is set up for 60 Hz but operated at 50 Hz, R.O. Membrane Element fouling may occur. This is because the motor turns too slowly and drives the High Pressure pump slower than the required predetermined speed thus subjecting the R.O. Membrane Element to high recovery (percentage ratio of feed to product).

CHEMICAL SAFETY & FIRST AID

Parker Hannifin SRC SC Storage Chemical

WARNING! CONTAINS SODIUM METABISULFITE. HARMFUL IF SWALLOWED, AVOID BREATHING DUST & FUMES. CAUSES IRRITATION TO EYES & MUCOUS MEMBRANES. DO NOT TAKE INTERNALLY. KEEP AWAY FROM FOOD.

FIRST AID: IF SWALLOWED, CALL A PHYSICIAN, GIVE TAP WATER & INDUCE VOMITING. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH WATER FOR 15 MINUTES & GET IMMEDIATE MEDICAL ATTENTION. THOROUGHLY WASH AFFECTED SKIN AFTER HANDLING PRODUCT.

MEDICAL PERSONNEL FAMILIAR WITH:
Parker Hannifin's "SRC SC", SYSTEM & MEMBRANE STORAGE CHEMICAL,
are available 24 HOURS A DAY, 7 DAYS A WEEK,
U.S.A. TOLL FREE MEDICAL EMERGENCY NUMBER 1-800-228-5635.

FOR INDUSTRIAL USE ONLY.

Use with adequate ventilation. Prevent breathing dust & prevent contact with eyes. Thoroughly was contacted parts after handling. Do not allow powder to become wetted with small amounts of water. Adding small amounts of water to powder may liberate irritating sulfur dioxide gas. Add powder to specified amount of water only. Do not mix with other chemicals or cleaners. If spilled, sweep up as much as possible then flush with water to drain.

KEEP OUT OF REACH OF CHILDREN.

Parker Hannifin SRC MCC-1 Membrane Cleaning Chemical

WARNING! CONTAINS SODIUM METASILICATE. HARMFUL IF SWALLOWED. MAY CAUSE BURNS. AVOID CONTACT WITH EYES. AVOID PROLONGED CONTACT WITH SKIN. DO NOT TAKE INTERNALLY. KEEP AWAY FROM FOOD.

FIRST AID: IF SWALLOWED, CALL A PHYSICIAN, DO NOT INDUCE VOMITTING, GIVE ONE GLASS OF TAP WATER OR MILK. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH WATER FOR 15 MINUTES & GET IMMEDIATE MEDICAL ATTENTION. THOROUGHLY WASH AFFECTED SKIN AFTER HANDLING PRODUCT. CONTACT A PHYSICIAN IF IRRITATION PERSISTS.

MEDICAL PERSONNEL FAMILIAR WITH:
Parker Hannifin's "SRC MCC1", R.O. MEMBRANE ELEMENT ALKALINE DETERGENT CLEANING CHEMICAL
are available 24 HOURS A DAY, 7 DAYS A WEEK,
U.S.A. TOLL FREE MEDICAL EMERGENCY NUMBER 1-800-228-5635.

FOR INDUSTRIAL USE ONLY.

Use with adequate ventilation. Prevent breathing dust & prevent contact with eyes. Thoroughly wash contacted parts after handling. Do not allow powder to become wetted with small amounts of water. Add powder to specified amount of water only. Do not mix with other chemicals or cleaners. If spilled, sweep up as much as possible then flush with water to drain.

KEEP OUT OF REACH OF CHILDREN.

Parker Hannifin SRC MCC-2 Membrane Cleaning Chemical

WARNING! CONTAINS SULFAMIC ACID. CAUSES BURNS, EYE & SKIN IRRITATION. HARMFUL IF SWALLOWED. AVOID BREATHING DUST. DO NOT TAKE INTERNALLY. KEEP AWAY FROM FOOD.

FIRST AID: IF SWALLOWED, CALL A PHYSICIAN, DO NOT INDUCE VOMITTING, GIVE ONE GLASS OF TAP WATER OR MILK. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH WATER FOR 15 MINUTES & GET IMMEDIATE MEDICAL ATTENTION. THOROUGHLY WASH AFFECTED SKIN AFTER HANDLING PRODUCT. CONTACT A PHYSICIAN IF IRRITATION PERSISTS.

MEDICAL PERSONNEL FAMILIAR WITH:
Parker Hannifin's "SRC MCC2", R.O. MEMBRANE ELEMENT ACID CLEANING CHEMICAL
are available 24 HOURS A DAY, 7 DAYS A WEEK,
U.S.A. TOLL FREE MEDICAL EMERGENCY NUMBER 1-800-228-5635.

FOR INDUSTRIAL USE ONLY.

DO NOT MIX WITH CHLORINATED SOLUTIONS OR COMPOUNDS. Use with adequate ventilation. Prevent breathing dust & prevent contact with eyes. Thoroughly wash contacted parts after handling. Do not allow powder to become wetted with small amounts of water. Add powder to specified amount of water only. Do not mix with other chemicals or cleaners. If spilled, sweep up as much as possible then flush with water to drain.

KEEP OUT OF REACH OF CHILDREN.

Parker Hannifin SRC MCC-3 Membrane Cleaning Chemical

WARNING! CONTAINS SODIUM METABISULFITE. HARMFUL IF SWALLOWED. AVOID BREATHING DUST AND FUMES. CAUSES IRRITATION TO EYES AND MUCOUS MEMBRANES. DO NOT TAKE INTERNALLY. KEEP AWAY FROM FOOD.

FIRST AID: IF SWALLOWED, CALL A PHYSICIAN, GIVE TAP WATER AND INDUCE VOMITTING. IN CASE OF CONTACT IMMEDIATELY FLUSH EYES WITH WATER FOR 15 MINUTES & GET IMMEDIATE MEDICAL ATTENTION. THOROUGHLY WASH AFFECTED SKIN AFTER HANDLING PRODUCT. CONTACT A PHYSICIAN IF IRRITATION PERSISTS.

MEDICAL PERSONNEL FAMILIAR WITH:
Parker Hannifin's "SRC MCC3", R.O. MEMBRANE ELEMENT RUST REMOVER CLEANING CHEMICAL
are available 24 HOURS A DAY, 7 DAYS A WEEK,
U.S.A. TOLL FREE MEDICAL EMERGENCY NUMBER 1-800-228-5635.

FOR INDUSTRIAL USE ONLY.

Use with adequate ventilation. Prevent breathing dust & prevent contact with eyes. Thoroughly was contacted parts after handling. Do not allow powder to become wetted with small amounts of water. Adding small amounts of water to powder may liberate irritating sulfur dioxide gas. Add powder to specified amount of water only. Do not mix with other chemicals or cleaners. If spilled, sweep up as much as possible then flush with water to drain.

KEEP OUT OF REACH OF CHILDREN.

LIMITED WARRANTY

Parker Hannifin Corp. warrants that the Parker Hannifin Desalination System performs according to the specifications for a period of twelve (12) months and specifically listed components are warranted for up to 5 years from the date of shipment. Parker Hannifin, under no circumstances, is liable for damages arising out of or in any way connected with the failure of the system to perform as set forth herein. This limited warranty is in lieu of all other expressed or implied warranties, including those of merchantability and fitness for a particular purpose.

The warranty period is from the date of original shipment from Parker Hannifin's factory.

The following items are covered under warranty for the periods designated:

System and Accessories 1 (one) year

High Pressure Vessel 5 (five) years

HP Pump (Plunger) 5 (five) years (Optional)

HP Pump (Radial Axial) 1 (one) year

Repairs after warranty 3 (three) months

The following items are considered normal user maintenance and are not covered under warranty:

1. Sea Strainer Element
2. Cartridge Filter Elements
3. Sand & Graven in the MMF
4. Pump Packing Assemblies
5. Pump Seal Assemblies
6. Pump Valve Assemblies
7. Pump Crankcase Oil (Optional Pump)
8. Gauge Instrument Calibration
9. Fuses
10. Valve Seals and Packings
11. Exterior Corrosion

Installation of components not supplied by Parker Hannifin, are not covered by this or any limited warranty.

Improper installation, resulting in system failure or component failure or decline in performance is not covered by this or any limited warranty.

The Reverse Osmosis Membrane Element is warranted for a period of one year from the date of shipment of the membrane. Any misuse or improper operation or maintenance of the system that causes premature fouling of the Membrane Element is not warranted. The Reverse Osmosis Membrane Element is also guaranteed to be cleanable for a minimum of one year from the date of shipment, providing cleaning periods are adhered to and foulant is acid soluble metal hydroxides and calcium carbonates or alkaline soluble organic, inorganic substances and microbiological slimes. The Membrane Element is not warranted for iron fouling (rust), chemical or petroleum products attack, extreme temperatures (over 120 F/under 32 F), drying out or extreme pressures (over 1000 psi).

In the event of a defect, malfunction or failure, specifically covered by this warranty and during the warranty period, Parker Hannifin will repair or replace, at its option, the product or component therein, which upon examination by Parker Hannifin appears to be defective.

To obtain warranty service, the defective product or part must be returned to an authorized Parker Hannifin Factory Service Center (dealer) or direct to Parker Hannifin Corp. The end user must pay any transportation and labor expenses incurred in removing and returning the product to the service center or Parker Hannifin pending evaluation and warranty approval. Upon warranty approval, reasonable expenses will be reimbursed.

The limited warranty does not extend to any system or system component which has been subjected to alteration, misuse, neglect, accident, improper installation, inadequate or improper repair or maintenance or subject to use in violation of instructions furnished by Parker Hannifin, nor does the warranty extend to components on which the serial number has been removed, defaced or changed.

Parker Hannifin Corp. reserves the right to make changes or improvements in its product, during subsequent production, without incurring the obligation to install such changes or improvements on previously manufactured equipment.

The implied warranties, which the law imposes on the sale of this product, are expressly LIMITED in duration to the time period above. Parker Hannifin Corp. shall not be liable for damages, consequential or otherwise, resulting from the use and operation of this product, or from the breach of this LIMITED WARRANTY.

CAUTION: Use of non Parker Hannifin supplied parts and accessories, including but not limited to maintenance parts, pre-filter elements, cleaning and storage chemical, pump oil, spare parts, replacement parts, system components, installation components and/or system accessories, shall void all warranty expressed or implied.

Some of the damages that may not be covered by the warranty include:

a) Use of non-authorized or misuse of authorized chemicals for storage will void any warranty.

b) Rust fouling of the R.O. Membrane Element is not covered under warranty.

c) Damage to the System caused by a blocked brine discharge or product line will not be covered by warranty.

d) High temperature will cause up to 40% flux loss (loss of production) of the R.O. membrane element(s). This damage is irreversible to the R.O. membrane element and not covered by warranty.

e) Freezing temperatures will cause mechanical damage to the System and R.O. membrane element due to the expansion of water as it freezes. This damage is irreversible and not covered by any warranty.

f) Damage caused by excessive vibration will not be covered under warranty.

Parker Hannifin® TEMPERATURE EFFECT COMPARISON CHART

(At 820 psi & 35,000 ppm feedwater TDS conditions)

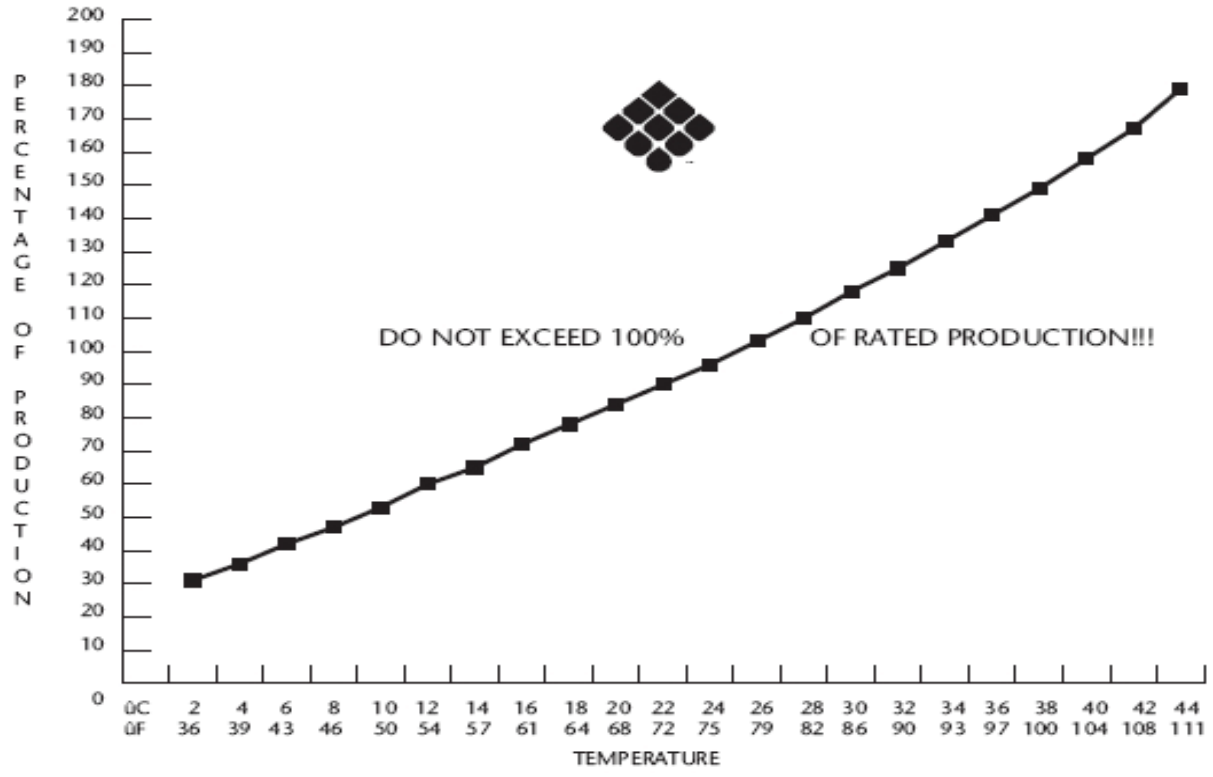
The Temperature Effect Chart on this page illustrates the loss or gain of productivity across the R.O. Membrane.

To determine what normal (in spec.) flow of the system is at 77º F (25º C), follow these directions:

1. Determine feed temperature.
2. Locate the corresponding temperature on the chart.
3. Follow the corresponding temperature in a vertical line up to the plotted production line.
4. From this temperature point at the production line, move left horizontally to the plotted productivity percent.
5. Calculate the system's present productivity in U.S. gallons per day by multiplying the gallon per hour product water flow meter reading by 24.
6. Divide the figure reached in step 5 above, present gallon per day productivity, by the plotted productivity percentage from step 4 above. The answer will be equivalent to the membranes present productivity at specification test parameters, 820 psi & 77º F (25º C).

Example:

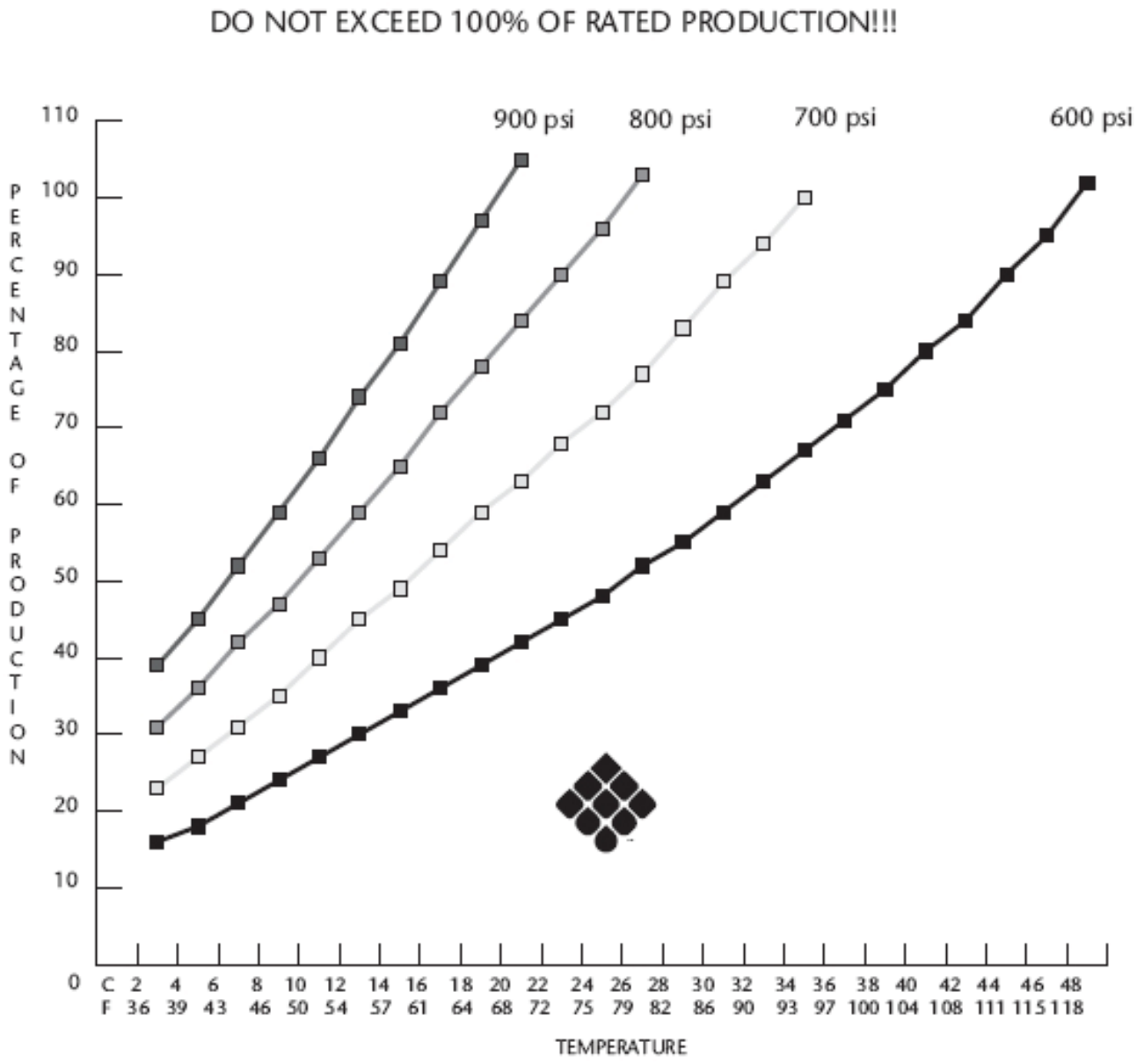
1. With the system operating at 820 psi (57 bar).
2. The present feed temperature is 61º F (16º C).
3. Plotted productivity is therefore 72% of normal.
4. The system is a 14,530 gallon per day model and it is presently producing 9,000 gallons per day.
5. 9,000 per day divided by .72 equals 12,500 gallons per day calculated productivity. The system is rated at 14,530 gallons per day ± 15% (12,350 to 16,709 gallons per day). Therefore the system is within specifications at 12,500 gallons per day actual productivity at 61º F (16º C), 820 psi (57 bar), and 35,000 ppm feed.



Parker Hannifin® TEMPERATURE EFFECT COMPARISON CHART

(Do not use this chart for brackish water systems & applications)

As the seawater temperature increases, the Parker Hannifin system pressure must be adjusted so that the system achieves no greater than 100% of rated product water flow. Product water flow greater than 100% of rated capacity causes premature fouling of the R.O. Membrane Element. This leads to more frequent required cleaning and voids all warranties of the SRC R.O. Membrane Elements.



SECTION 2

PRE-INSTALLATION NOTES

2 PRE-INSTALLATION NOTES

2.1 PRECAUTIONS

STORAGE PRIOR TO UNCRATING

1. Adhere to crate markings:
   - DO NOT store in direct sunlight;
   - DO NOT store above 103º F (39º C);
   - DO NOT freeze;
   - STORE ONLY on base with ARROWS UP.
   - KEEP THE R.O. MEMBRANE ELEMENT WET AT ALL TIMES.
2. If the R.O. System has been shipped new with Reverse Osmosis Membrane Elements installed, the System must be commissioned within 3 months. This is to avoid drying out or biological fouling of the R.O. Membranes.
3. Refer to Section 6 for further cautions of the R.O. Membrane Element.

UNCRATING:

1. Disassemble crate from system as follows: top first; sides second, third, fourth, and fifth.
2. Remove the System from the bottom of its shipping crate only when the system is in place ready for the final lift. Use caution in moving the System with a forklift after System is removed from the shipping crate. Place wood, cardboard or material onto the metal forks of the forklift.

CAUTION: Metal forks will damage the powder coating on the underside of the skid.

REVERSE OSMOSIS MEMBRANE ELEMENT SUSCEPTIBILITY TO CHEMICAL ATTACK

CAUTION: Do Not expose the System to intake Feed Water containing the following chemical:

Hydrogen peroxide	chloramines-T
Chlorine dioxide	chlorine
Bromine	phenolic disinfectants
chloramines	N-chlorioisocyanurates
hypochlorite	iodine
Bromide	petroleum products

Any chemical, not approved in writing by Sea Recovery.

USE OF NON-AUTHORIZED OR MISUSE OF AUTHORIZED CHEMICALS VOIDS SYSTEM WARRANTY

Do not connect any water line to the System that may contain any of the above chemicals. Example: Do not connect the inlet of the System to the ship's potable water system if the ships system contains chlorinated or brominated water. These chemicals destroy the copolymer components within the RO system. These oxidants and others also damage the RO Membrane Element. The Sea Recovery Optional Fresh Water Flush Accessory removes chlorine and bromine from the ship's potable water system.

DO NOT PERFORM INSTALLATION UNLESS:

1. The System Feed Water Sea Cock Valve is closed.
2. The System main electrical disconnect switch is switched "OFF", LOCKED, and TAGGED.
3. A Volt / Ohm Meter will be necessary.

WARNING: ELECTRICAL SHOCK HAZARD. The installation procedures expose the installer to High Voltage and electrical shock hazard. Only attempt installation if you are a qualified electrician and only if surrounding conditions are safe.

QUALIFICATIONS

Technicians must have technical knowledge and ability in the following fields:

a) Electrical, Electronic, Electric Motors & Circuits
b) Electromechanical & Mechanical Systems
c) Hydraulic and Liquid Pressure & Flow Systems
d) Piping and Plumbing Systems
e) Water Suction & Pressure Lines
f) Thru-Hull Fitting below & above water level

NECESSARY COMPONENTS SUPPLIED BY OWNER:

Refer to the P&ID and Interconnect Example on the following pages.

1. SHIP / VESSEL INSTALLATIONS:

a. Thru-Hull Fitting with Inlet Sea Cock Valve: The Thru-Hull Fitting must include a 1/4 turn Sea Cock Valve with either a ¾" MNPT connection (/3 systems) or a 1" MNPT connection (/4 systems) exposed for the supplied System Inlet Fitting. The entire fitting and valve assembly must be of corrosion resistant material such as Naval Bronze, PVC, CPVC, or Stainless Steel. Any ferrous material causes rust fouling of the Membrane Elements.

b. Power cable with the proper gauge rating for this system's power consumption.

c. An electrical power source capable of supplying the proper current at the proper AC Voltage, Cycles and Phase to the System.

d. Brine Thru-Hull Fitting for overboard dump (above water level) for the Brine Discharge Line from the system. This fitting must be minimum ¾" {1"} size with a ¾" {1"} MNPT nipple exposed for coupling with the supplied System Brine Discharge Connection. The brine discharge line should be located above water level to minimize pressure build up on the Brine Discharge Line. There should be no valves in the Brine Discharge Line. Damage occurs if the Brine Discharge is blocked by a closed valve during System operation.

e. Ship's Potable Water Storage Tank [62] with Product Water Storage Tank Connection: This fitting must be minimum ½" {3/4"} FNPT size for coupling with the System Product Water Fitting. The Product Water Line should terminate above water level. The Product Water Storage Tank must be vented to ensure no pressure build up during production.

CAUTION: There should be no valves in the Product Water Line. Damage to the System occurs if a valve is closed during System operation.

2. LAND INSTALLATIONS:

a. Feed Source for the R.O. System. The feed source may be from a deep well, shallow well, directly from the source, or other means. All necessary components required for Land Installations including screens, piping, valves, pumps, & gauges are available from Sea Recovery. Consult Sea Recovery's Application Engineers for assistance. The entire feed line, including well casings, must be of non-ferrous materials such as Naval Bronze, PVC, CPVC, or 316L Stainless Steel. Any ferrous material causes rust fouling of the R.O. Membrane Element.

   The feed source and line must be appropriately sized to prevent excessive friction losses. The proper feed flow and pressure required at the R.O. System varies depending upon the actual System configuration and installation. Consult Sea Recovery Application Engineers for assistance.

b. Power cable with the proper gauge rating for this system's power consumption.

c. An electrical power source capable of supplying the proper current at the proper AC Voltage, Cycles and Phase to the system.

d. Brine Discharge line back to the source or other suitable discharge location. For well applications do not discharge the brine back into the feed well. Do not install any valves in the Brine Discharge Line. A closed valve in the Brine Discharge line causes damage during system operation.

e. Potable Water Storage Tank [62] with Product Water Storage Tank Connection and product water line with associated piping and fittings. This line must be sized appropriately for the flow of Product Water over the horizontal run and vertical incline of the Product Water line to the Storage Tank/Cistern. The Product Water Storage system must be vented to ensure no pressure build up.

CAUTION: There should be no valves in the Product Water Line. Damage to the System occurs if a valve is closed during system operation.

2.1 SPECIAL CONSIDERATIONS

1. BONDING OF THE HIGH PRESSURE PUMP, FEED PUMP, and BOOSTER PUMP:

Vessel Installations. The High Pressure Pump, Feed Pump and Booster Pump may be isolated from the ships bonding system because of the protective coating applied to the pumps and their attached motor. As such, there may be no continuity between the pumps and the ships bonding system. The path of stray current from the electric motors may be through the Feedwater Line. This is especially true if the electric motor grounding wire is insufficient. If left unbonded, the pumps become sacrificial and corrosion by electrolysis takes effect and destroys the pump manifolds, chambers and impellers. Such destruction renders these pumps inoperable within just a few short months. The System Warranty does not cover damage resulting from electrolysis or improper or inadequate grounding.

Therefore, the pump manifolds and volutes should be individually and separately bonded to the ships Bonding System. The ships Bonding System is designed to provide the same electrical potential to all metal parts which come in contact with the ocean. This minimizes the potential for and effects of electrolysis.

CAUTION: Do not confuse the ships electrical ground with the ships Bonding System. These are two separate and distinct circuits, which have two separate and distinct functions. Using the ships electrical ground as a means to bond the pumps would enhance corrosion and rapidly destroy the pumps.

2. ELECTRICAL GROUNDING OF ALL PUMP MOTORS:

Whether for ship or land applications, the Electric Motors of all Pumps within the system must be properly electrically grounded. If left ungrounded, the Pump becomes the grounding device and is rapidly destroyed by electrolysis.

The Electric Motors must be individually and separately

electrically grounded to a proper electrical grounding source.

3. LENGTH OF CONNECTION LINES:

The System operates most efficiently with interconnect lines as short and straight as possible. As the distance of suction lines increase, the feed pressure decreases. As the distance of discharge lines increase, the greater the backpressure on those lines. Maximum allowable backpressure on the Brine Discharge line is 30 psi. Maximum allowable backpressure on the Product Water line is 20 psi.

NOTE: Restrictions in the Feed Line cause head loss and reduction of the Booster Pump Outlet Pressure. Ideal maximum output performance of the Booster Pump is important in order to maintain a proper pressure into the Pre-filtration Section. Feed Line restrictions reduce the pressure into the Pre-filters and may cause the System to shut down due to low-pressure output from the Booster Pump. Such Feed Line restrictions require expensive plumbing rework to correct the friction losses. This is considered an installation error, and any plumbing or installation correction is the owner's responsibility. Sea Recovery has no control over the system Feed Line installations and does not cover such difficulties arising from or attributed to the Feed Line installation.

4. SYSTEM FEED INLET

The FEED INLET (THRU-HULL FITTING ON SHIP INSTALLATIONS) must be in constant contact with the Feedwater. Any air suction leaks coming into the System Feed Line may cause the system to shut down due to low feed pressure. If the installation is aboard a vessel, care must be taken to plumb the Feed Line at the bottom of the Sea Chest. This ensures an uninterrupted supply of air free Feedwater. The Inlet Thru-Hull Fitting should be dedicated for only the R.O. System. Using a single Thru-Hull Fitting for several auxiliary Systems can cause air suction leaks from other Systems competing for the same feedwater.

5. THE R.O. MEMBRANE VESSEL ASSEMBLY

The RO Membrane Vessel Assembly must not be exposed to heat in excess of 103° F / 39.5 C. At temperatures above 103° F (39.5° C) the R.O. Membrane Elements experience irreversible flux loss (loss in production).

6. ACCESS FOR MAINTENANCE

GIVE SPECIAL CONSIDERATION TO ACCESS FOR MAINTENANCE of all components. Such access would include, but not limited to: Pre-filtration Element removal, High Pressure Pump oil changes, R.O. Membrane Element removal and Post Filtration Element removal.

7. THE CONTROLLER PANEL

Controller Panel contains System controls, which must be accessible for operation and viewing.

8. Locate the System in a well-ventilated area.

2.2 PIPING AND INTERCONNECT DIAGRAMS

The P&ID illustration foldout in Section 10. These illustrations may include Standard and Optional Accessory configurations.

Determine the Prefiltration and Post Filtration components that were supplied with the system being installed. Locate the appropriate diagram and interconnect the components as per the appropriate diagram.

Note: Symbol Used in this Section.

* Optional Accessory.

** Indicates items supplied by installer

† Indicates optional items used on Land Based Installations and/or where a Feed Pump is used.

2.3 RO MEMBRANE ELEMENT NOTES

CAUTION: Some systems are shipped WITHOUT the Reverse Osmosis Membrane Element. This is to accommodate Boat Builders that will install the System well in advance of commissioning the boat and the System.

DOES THIS SYSTEM HAVE R.O. MEMBRANE(S) INSTALLED OR NOT?

If not, is it your intention to install the R.O. membrane(s) at this time, or do you wish to install them at a later date when the boat is commissioned?

If the R.O. membrane elements are not installed and you wish to install them at this time contact Sea Recovery and supply us with your original Purchase Order Number, Sea Recovery's Invoice Number, and this System's Serial Number.

WARNING: IF THE REVERSE OSMOSIS MEMBRANE ELEMENT IS NOT TO BE INSTALLED AT THIS TIME ENSURE THAT YOU LEAVE A VISIBLE NOTE AT THE SYSTEM CONTROLLER AND AT THE FRONT OF THE CONTROL PANEL INFORMING THE END USER THAT: ***THE REVERSE OSMOSIS MEMBRANE ELEMENTS ARE NOT INSTALLED; TO CONTACT THE FACTORY FOR THE R.O. MEMBRANE ELEMENTS; AND DO NOT OPERATE THE SYSTEM WITHOUT THE R.O. MEMBRANE ELEMENTS INSTALLED.***

EXTENSIVE DAMAGE WILL OCCUR IF THE SYSTEM IS OPERATED WITHOUT THE R.O. MEMBRANE ELEMENTS INSTALLED.

DAMAGE TO THE SYSTEM CAUSED BY THE OPERATION OF THE SYSTEM WITHOUT R.O. MEMBRANE ELEMENTS INSTALLED IS: NOT COVERED BY THE SEA RECOVERY WARRANTY; IS THE LIABILITY OF THE INSTALLER IF THE INSTALLER DID NOT NOTIFY THE END USER; OR IS THE LIABILITY OF THE END USER IF THE INSTALLER NOTIFIED THE END USER THAT THE R.O. MEMBRANES WERE NOT INSTALLED AND TO NOT OPERATE THE SYSTEM WITHOUT THE R.O. MEMBRANE ELEMENTS INSTALLED.

Note: Symbol Used in this Section.

* Optional Accessory.

** Indicates items supplied by installer

† Indicates optional items used on Land Based Installations and/or where a Feed Pump is used.

2.4 COMPONENT DESCRIPTIONS

Components are installed in several modular skids forming a complete System. Refer to P&ID foldout in Section 10.

A. FEED SOURCE EXTERNAL TO THE SYSTEM:

This section of the System collects, filters and delivers the system feed water into the system. The feed source may be collected directly from the source or through a well, other natural filter bed or a ship's sea chest.

A beach well lateral or feed source screen pickup is the initial point at which the feed water enters the System line. A lateral will be used if the inlet will be from a beach well or other natural Media Filter. If the feed is taken directly from the source then the suction line can be fitted with a suction screen.

1. Feed source which will be direct from the ocean, river, well or other natural body of water, which is to be treated with the Sea Recovery Reverse Osmosis Desalination System.
2. The feed line check valve (or non return valve) is used in the suction line to ensure that the feed line remains full of feed water during shutdown periods.
3. The coarse strainer is a basket filter body with a cleanable fine mesh filter screen. Its design allows for quick bowl removal. The coarse strainer filters out large particulate matter. The fine element traps suspended particles that would otherwise enter and damage the feed water and/or booster pump. The result is lowered maintenance costs. The coarse strainer is designed for vacuum use and will not withstand pressure. The coarse strainer is not necessary if the feed source is from a well or other natural filter bed.

B. SUCTION LINE SUBSYSTEM:

This section of the System filters suspended solids from the feedwater of the system before it reaches the High Pressure Pump and R.O. Membrane Elements. The Feedwater may be collected directly from the source, from a well, or through a ship's Sea Chest / Inlet Thru Hull Fitting. The raw feed water is filtered to remove suspended solids larger than 5 Micron size (5/1,000,000 of a meter). The pre-filtration protects the R.O. Membrane Elements from fouling.

Always ensure that the Pre-Filtration Subsystem is clear and monitor it frequently.

1. Well water pump isolation valves allow for complete isolation and shut-off of the system feed water pump. These valves allow the pump to be removed for maintenance while maintaining the prime in the system feed water line.
2. The feed water pump supplies a positive pressure to the inlet of the System booster pump. A feed water pump may be required to deliver a positive pressure into the booster pump. Consult Sea Recovery's application engineering department for details if the supplied booster pump is unable to suck and deliver the proper flow and pressure into the System.
3. System feed water pump priming / well purging valve is used to prime the feed water pump as well as purge the beach well. Any new well must be purged for several days in order to clear it from fines and establish consistent flow.
4. System feed water pump isolation valves allow for complete isolation and shut-off of the System feed water pump. These valves allow the pump to be removed for maintenance while maintaining the prime in the system feed water line.
5. The booster pump skid inlet flange connection allows for connection of the feed line into the booster pump.
6. The 3-way ball valve at the booster pump inlet controls the feed source direction, which can either be normal operating feed water or storage chemical, cleaning chemicals or fresh water for rinsing.
7. Booster pump inlet pressure gauge (compound gauge) -30 to 60 psi (-2.1 to 4 bar) monitors feed water pressure or suction into the booster pump from the feed water source or feed water pump.
8. The booster pump supplies a positive pressure to the pre-filtration section and, in turn, to the high pressure pump. Positive pressure will provide longer life to the Media Filters and pre-filters, provide longer life to the high pressure pump and also decrease required maintenance and decrease associated maintenance

costs. Sea Recovery utilizes a high efficiency, marine quality pump which delivers approximately 40 psi (2.8 bar) into the Media Filter.

9. The booster pump outlet 3-way ball valve controls the direction of flow from the booster pump. Here the flow can be sent into the Media Filter for normal operation or to the R.O. membrane elements for cleaning purposes.
10. Flange connection, booster pump outlet to System at booster pump skid edge allows for connection of the booster pump skid outlet to the Hydrocylone inlet flange connection.
11. Hdrocyclone filter is an option that is recommended for systems that will be used in areas where the sea water is heavily laden with suspended solids.

    Seperation Range: 15-50 Microns

    Capacities: Up to 250 GPM

    Sizes: 3 in. (7.62 cm) and 6 in. (15.24 cm)
12. Flange connection, Hydrocyclone outlet allows for connection of the Prefilter inlet skid.

C. PREFILTRATION SUBSYSTEM:

This section of the system receives the raw feed water from the booster pump and filters any suspended solids down to a minimum 5 micron size (5/1,000,000 meter). Such controlled pre-filtration protects the SRC R.O. Membrane Element from undue fouling.

The pre-filtration subsystem must always be kept clean in order to allow the proper rate of System feed water to flow through it and into the high pressure pump. A partially or fully fouled pre-filtration subsystem will cause cavitation damage to the high pressure pump and will also permanently “foul” the R.O. membrane element.

Always ensure that the pre-filtration subsystem is clear, and monitor it frequently.

1. A 3-way directional control ball valve directs feed water flow into the Media Filter when in the normal position or allows backwash wastewater to exit the Media Filter when in the backwash position. In the “Down” position the valve is set to normal which allows feed water to enter the top of the Media Filter. In the “Up” position the valve is set to allow the backwash wastewater to exit the top of the Media Filter during the backwash maintenance operation.
2. Media Filter backwash flow control valve controls the velocity (volume) of feed water allowed to backwash the media bed. The velocity of water must be controlled. If the backwash water velocity is too great, the media may be forced out of the filter housing and be flushed to discharge. If the backwash water velocity is too low, the media will not be properly cleaned.
3. Media Filter backwash flow control meter measures the rate of the backwash water progress through the Media Filter. The flow meter is calibrated in gallon and liter per minute flow. This meter allows the operator to regulate the Media Filter backwash flow control valve to the required backwash velocity. Since the meter is clear, the operator will know when the filter bed is clean by observing the condition and clarity of the backwash water.
4. A low pressure gauges between the booster pump outlet and Media Filter inlet allows the operator to monitor the condition of the booster pump and Media Filter when correlated to pressure gauge.
5. Media Filters are two RFP (Reinforced Fiberglass Plastic) vessels, which contain a graduated Media Filter bed (sand and gravel). The media traps suspended solids, that are larger than 30 microns, and thus, provides protection and longer life to the pre-filter element. The Media Filter is backwashable, which minimizes maintenance costs.
6. Media Filter outlet / backwash inlet directional control 3-way ball valve, when used in conjunction with valve controls the direction of water flow out of or into the Media Filter. In the “DOWN” position, the valve is set to normal and allows filtered feed water to exit the bottom of the Media Filter. In the “UP” position, the valve is set to the backwash mode allowing feed water to reverse flow from the bottom of the media bed.
7. Media Filter drain valve allows draining of the Media Filter for maintenance.
8. 20 microns cartridge pre-filters, installed after the Media Filter, further filter the feed water to 20 microns. These primary cartridge pre-filters consist of RFP housings with a removable lid and specially treated cartridge filter elements. There are over 200 square feed of actual filter surface within the two primary pre-filter housings. These unique primary pre-filter elements efficiently filter suspended solids from the System feed water. It is essential that the pre-filter elements be changed on a regular basis, as they become fouled.
9. The cartridge pre-filter drain valve allows for draining of the cartridge filter canisters during pre-filter element changing and maintenance.
10. The small ball valve located on top of each of the cartridge pre-filter housing allow for air to be removed from the pre-filter housings. Air must be removed form the housings for safety reasons and to ensure full utilization of the cartridge pre-filter elements.
11. The low pressure gauges between the outlet of

the Media Filter and inlet of the primary 20 micron cartridge pre-filter allow for observation of the condition of the Media Filter when correlated to pressure gauge.

12. The 5 microns cartridge pre-filters, installed after the 20 micron cartridge pre-filters, accomplish final polishing filtration of the Systems feed water down to 5 microns. These secondary cartridge prefilters consist of RFP housings with a removable lid and specially treated cartridge filter elements. There are over 200 square feed of actual filter surface within the two secondary pre-filter housings. These unique secondary, or final polishing, pre-filter elements efficiently filter suspended solids from the System feed water for final protection of the R.O. membrane element. It is essential that the pre-filter elements be changed on a regular basis, as they become fouled.
13. The small ball valve located on top of each of the cartridge pre-filter housing allow for air to be removed from the pre-filter housings. Air must be removed form the housings for safety reasons and to ensure full utilization of the cartridge pre-filter elements.
14. The low pressure gauges between the outlet of the primary 20 micron cartridge pre-filters and the inlet of the secondary 5 micron cartridge pre-filter allow for observation of the condition of the primary 20 micron cartridge pre-filter elements when correlated to pressure gauge.
15. Low pressure protection switch will turn the System off automatically if feed water flow, through the pre-filtration section, drops below the requirements of the high pressure pump. Shutdown due to low pressure would indicate that the pre-filtration section requires maintenance such as Media Filter backwashing or cartridge pre-filter element changing. This low pressure protection switch protects the high pressure pump, the R.O. membrane element, and the booster pump from damage.
16. The low pressure gauge [38] between the outlet of the secondary 5 micron cartridge pre-filters and the inlet of the high pressure pump allow for observation of the condition of the secondary 5 micron cartridge pre-filter elements when correlated to pressure gauge.
17. Gallon/liter per minute feed water flow meter measures the rate of feed water progress through the pre-filtration section, into the high pressure pump and, in turn, into the R.O. membrane elements. The flow meter is calibrated in gallons, and liters per minute. This is one of the most important visual check points of the SRC System, and should be monitored on a regular basis.

    Proper interpretation of the GPM water flow meter readings, and movements, will allow the user to determine the need for maintenance or the occurrence of a malfunction in other components. The GPM feed water flow meter is, therefore, important to the proper operation of the System and must be monitored on a regular basis.

D. PRESSURIZATION SUBSYSTEM:

Proper pressure and proper flow across the SRC R.O. membrane element are two of the basic requirements for reverse osmosis. Both must be maintained at specified levels or the System simply will not function correctly. This is why it is important that the prefiltration subsystem be maintained to ensure that the high pressure subsystem receives a proper flow of feed water. The normal operating pressure of the SRC system is 700-850 psi (48.1-55.2 bar) for sea water use, or, 200 to 400 psi (13.8-27.6 bar) for brackish water use. The maximum pressure the System will develop is 975 psi (67.2 bar), because the high pressure switch supplied with the System automatically shuts the System off at 925 psi +/-50 psi (63.8 bar +/-3.5 bar).

Proper pressure into the System and flow across the SRC R.O. membrane is listed in the specification section of this manual. Over pressure will cause damage to the R.O. membrane element and under pressure results in low product water production as well as higher salinity content in the product water. Under flow of the feed water into the R.O. membrane element will cause rapid and premature fouling of the R.O. membrane element as a result of higher than normal recovery (percentage of recovered water to feed water).

Fluctuations in temperature of the feed water will affect System productivity.

1. Electric drive motor is an AC (alternating current) electric motor and may be ordered with varying NEMA, or industry, specifications to fit virtually any application or requirement. Consult Sea Recovery's Application Engineering Department for specific information on special drives.
2. High Pressure Pump (standard): The APP pumps are based on the axial piston principle and they are designed so that lubrication of the moving parts in the pumps is provided by the fluid itself. No oil lubrication is thus required.

   All parts included in the APP pumps are designed to provide long service life and minimum of service required.

   The pumps are fixed displacement pumps in which the flow is proportional to the number of revolutions of the input shaft and the pump displacement, regardless of any counter-pressure. .

3. High pressure pump (optional): This is a marine quality positive displacement ceramic plunger pump with stainless steel manifold.
4. The pressure relief valve (optional pump) works in conjunction with a over pressure switch to shut the System off should over pressure develop. If the System is over pressurized, the pressure relief valve will open and allow water pressure to build up at the pressure switch, which, in turn, opens to shut the System off.
5. The high pressure hose connects the outlet of the high pressure pump to the inlet of the pulsation dampener.
6. The pulsation dampener (optional pump) is of the in line design and has no repairable parts. The pulsation dampener is, therefore, maintenance free. The pulsation dampener assists the high pressure pump in delivering a smooth, pulsation free, supply of water to the R.O. membrane elements.
7. High pressure protection switch is a normally closed (N.C.) switch and set to open at 975 psi (67.2 bar). At 975 psi (67.2 bar), when the high pressure switch opens, the System will shut off for safety purposes.
8. The high pressure gauge located at the outlet of the high pressure pump and inlet of the first R.O. membrane element, is a visual indication of the pressure created by the high pressure pump and pressure within the R.O. membrane element assemblies. The high quality stainless steel gauge is glycerin oil filled for dampening, and provides an accurate, smooth reading.
9. The flow by-pass valve allows for the System to be started with minimal shock to the R.O. membrane elements. This valve should be opened at each start up of the System which allows a large portion of the feed water to by-pass the R.O. Membrane and discharge back to the feed water. This helps protect the membrane from the sudden thrust of water at each start up and, in turn, prolong the life of the R.O. membrane element.
10. Sea Recovery's R.O. membrane & vessel assemblies consists of an exclusive, and unique, high pressure, an corrosion resistant vessel, which houses two or three special spiral wound reverse osmosis membrane element. The R.O. membrane elements reject the salt ions present in the feed water, yet allow the potable H2O molecules to pass through the thin membrane surface. A sufficient flow of water across the membrane surface must be continually in progress in order for the correct percentage of salt rejection to occur. Only about 5 to 10% (sea water systems, per individual membrane element) of the system feed water becomes fresh product water. The remainder, becomes a concentrated brine solution which carries rejected salt ions away from the membrane element and back to the feed water source. The proper flow of water is also essential to minimize fouling of the R.O. membrane element. Reducing the flow of feed water, would cause the R.O. membrane element to recover a higher percentage of the feed water. Excessive recovery, would rapidly foul the membrane.
11. High pressure lines transfer pressurized seawater from the pulsation dampener to the first SRC R.O. membrane element vessel assembly, between R.O. membrane element vessel assemblies and from the last SRC R.O. membrane element vessel assembly to the back pressure regulator assembly. These lines are constructed of a special high grade stainless steel alloy.
12. The pressure by-pass valve must be open at each start up and during system storage or membrane cleaning cycles in order to relieve all pressure at the R.O. membrane element. The valve must be closed for normal operation.
13. The high pressure gauge located at the outlet of the R.O. membrane vessel assemblies and inlet of the back pressure regulator valve, is a visual indication of the differential pressure between the R.O. membrane vessel assemblies. Proper correlation of this pressure gauge to pressure gauge [46] will allow the operator to determine R.O. membrane element fouling and the necessity for cleaning of the R.O. membrane elements.
14. Back pressure regulator valve is of 316 Stainless Steel construction. By turning the valve handle clockwise, a smaller orifice is created and this results in pressure build up. By turning the valve handle clockwise and counter clockwise pressure is increased and decreased accordingly, which in turn increases and decreases System operating pressure and productivity of the R.O. membrane element(s).

E. BRINE DISCHARGE SUBSYSTEM:

This section of the System carries the Brine Discharge expelled from the R.O. Membrane Element back to the feed source.

1. The pressure gauge at the brine discharge line allows the operator to determine if there is any obstruction on the brine discharge line. This line must be kept free and clear of any blockages so that the brine water discharges with minimal pressure and restriction.
2. Brine discharge pressure switch is a normally closed switch and set at 70 psi (4.8 bar) when the brine disharge pressure exceeds 70 psi, the PLC will

shutdown the System.

3. Brine discharge line atmospheric check valve allows for natural drainage of the discharge line without creating a vacuum in the line.
4. Brine discharge outlet flange connection is the connection point for the brine discharge line back to the feed source.

F. PRODUCT WATER MONITORING SUBSYSTEM:

This section of the System gives a visual indication of the clarity and quantity of product water being produced. By correlating the quantity of product water produced to the System operating pressure, temperature and salinity of the system feed water the user can establish whether the SRC R.O. membrane element requires cleaning. This also allows the user to estimate the running time required to fill or refill the product water storage tank(s) or cistern(s).

Post filtration of the SRC System, is the final step in product water quality control. The type and quantity of post filtration required is dependent on the quality of the System feed water and desired quality or conditions of the product water. By the time the product water reaches the post filtration stage, the R.O. membrane element has removed most of the dissolved solids present in the feed water.

The Sea Recovery exclusive temperature compensated electronic subsystem has rejected any high salinity product water, so the water is potable from a salinity standpoint. The post filtration subsystem is designed to limit unpleasant odor, taste, and biological matter such as bacteria, virus, and other microorganisms which may have passed through the R.O. Membrane Element and would therefore be present in the product water. Optional post treatment and post filtration, such as pH adjustment, hardness adjustment, biological control and others may be added to the product water line if specific conditions are required by the owner.

1. Product water test taps located at each end of the R.O. membrane element pressure vessel assemblies allow the user to draw water samples from each of the individual R.O. membrane elements.
2. Product water manifold is designed to collect all product water produced by the R.O. Membrane Elements and routes the combined production on to the Product Water Flow Meter.
3. Product water line check valve is vented to the atmosphere for relief of vacuum during the condition of natural osmosis occurring as a result of power failure during normal pressurized operation, and, while the System is in operation, but not pressurized.
4. Potable product water line check valve prevents foreign chemical intrusion into the product water line from the product water storage tank or cistern.
5. Temperature compensated salinity probe is directly connected to the salinity controller, and sends a continuous signal to it. It electrically determines whether the salinity content of the product water is acceptable. This unique salinity probe compensates automatically for water temperature variations. A salinity probe must be temperature compensated in order to provide accurate readings, and protect the health of the individuals consuming the product water.
6. Gallon/Liter per minute product water flow meter has a flow-through design which allows it to measure the rate of product water progress from the membrane toward the product water storage tank. This flow meter is essential for plotting records of membrane performance for maintenance purposes.
7. Product water line pressure gauge registers the pressure on the product water line and assists the operator in diagnosing any line blockages. The product water line must be kept free and clear of any blockages.
8. Three-way diversion actuator valve is made of solid PVC and functions according to signals received from the salinity controller. After the controller has determined, from the temperature compensated salinity probe, that potable (drinkable) water is being produced, the controller energizes the valve to the “Potable” position. If the product water being produced is “Unpotable” then the controller energizes the valve to the “Unpotable” (discharge) position.
9. Potable product water outlet flange connection is provided at the skid edge for potable product routing into the booster pump skid edge where the post filtration components are located.
10. Potable product water outlet flange connection at the booster pump skid edge for inter connection of the System product water outlet and booster pumps post filtration section.
11. Hose wash down valve and connection is supplied to the System skid edge allowing the operator to utilize the product water being produced by the System for wash down and filling of the pretreatment or cleaning tanks.
12. Product water charcoal filter is designed to assist in the removal of unpleasant odors from the product water. A second charcoal filter may be added between the product water storage tank or cistern and the point of use. This would be desirable to remove impurities, sediment particles, or the taste of chlorine, all of which may be present in the product storage tank or cistern, due to sources other than the

SRC System.

13. Product water ultraviolet sterilizer destroys at least 99.9% of any virus, bacteria and other microorganisms which may pass through the SRC R.O. Membrane Element. The optional U.V. sterilizer, is highly recommended if the product water storage tank, or cistern, is not otherwise treated by a means such as chlorination. Use of the U.V. sterilizer is also recommended if the system feed inlet is near a polluted source such as a raw sewage outlet. However, such polluted sources should always be avoided.
14. Product water delivery pump (optional) flow control switch activates the optional product water delivery pump motor starter relay when potable product water production is in progress.
15. Product water delivery pump pushes the potable product water onward from the SRC R.O. System to the product water storage tank or cistern. This optional feature may or may not be necessary depending on the location of the product water storage tank, or cistern. Consult Sea Recovery's Application Engineering Department if the routing of the product water line will cause pressure build up on the product water line in excess of 20 psi (1.8 bar).
16. Potable product water outlet flange connection is provided at the booster pump skid edge for final potable product water collection.

G. CLEANING & RINSING SUBSYSTEM:

Consists of supplied valves and required tank or container for the cleaning, rinsing or storage of the R.O. System. The System should be rinsed, stored, and cleaned from time to time or as appropriate.

1. The flange connections at the booster pump skid edge, cleaning tank skid edge and Controller skid edge allow for interconnection of the cleaning tank.
2. Cleaning system drain valve used for draining the cleaning tank.
3. Cleaning solution tank holds the rinse water, R.O. membrane cleaning chemical or storage solution during the appropriate operation.
4. Cleaning system pressure gauges allow the operator to monitor the amount of R.O. membrane fouling and subsequent cleaning effectiveness. The greater the differential pressure observed at the onset of cleaning indicates a greater amount of R.O. membrane element fouling. The lower the differential pressure observed at the end of the cleaning indicates the success of the cleaning operation.

   Vic connectors allow for simple connection of cleaning chemical routing hoses into and out of the R.O. membrane vessel assemblies.

   Cleaning system flow restricter limits the flow or velocity of the cleaning chemical to an effective flow rate.

H. CHEMICAL PRE/POST TREATMENT SUBSYSTEM:

1. Chemical pretreatment tank (optional):

   PRETREATMENT: Flocculent, Antiscalant, Sequestriant, Sodium Bisulfite, Chlorine, Others

   POST TREATMENT: Chlorine, Bromine, pH neutralizing, Hardness adjustment, Others

Flocculent pretreatment System is used in cases of extreme turbidity of the feed water. If the feed water is taken directly from the feed source, it may be necessary to add chemical pretreatment to the System feed water prior to the Media Filter. Flocculent chemicals coagulate the suspended solids and assist the Media Filter in trapping them. If the System feed water is taken from a well, other natural filter bed, or if the feed source is extremely clear, it will not be necessary to add flocculent to the System feed line.

Antiscalant or Sequestriant chemical protects the R.O. membrane element from premature dissolved solids fouling. Such chemical pretreatment will only be required if the System is subjected to excessive recovery or if the feed water chemical make up indicates that fouling would occur. Normal sea water feed will not require antiscalant or sequestriant pretreatment.

If the feed water has been treated with chlorine then it must also be treated with sodium bisulfite in order to neutralize the chlorine as free chlorine will attack and damage the R.O. membrane element.

Post treatment chlorine or bromine may be desired if the product water will be stored in a cistern or tank for extended periods or if biological intrusion is likely from the cistern, tank or plumbing.

The product water from a R.O. System is aggressive and slightly acidic. The product water, if not treated, will attack metal piping systems. In order to neutralize the product water pH neutralizing and hardness adjustment chemicals are available.

2. Pump (optional), chemical metering

I. ELECTRONIC SUBSYSTEM:

This group of components includes the salinity controller, optional soft motor starters, and optional power disconnect switches. This subsystem measures water quality, controls the direction of product water flow, and, contains the central electrical connection point of the System. It also serves as the safeguard ensuring only potable product water is allowed to pass into the product water storage tank.

1. Salinity Controller is the central point of connection for all electrical lines in the System. The controller monitors the salt content of the product water (by means of the salinity probe), and signals the PVC three-way diversion actuator valve, when potable water is being produced. The PVC three-way diversion actuator valve, motors, U.V. sterilizer, and remote monitor are all directly connected to and governed by the Salinity Controller.

   Optional electrical equipment is also available such as soft motor starters and disconnect switches.

   Consult Sea Recovery's Application Engineering Department.

J. FRONT CONTROL PANEL

1. Pressure gauge - PI 1000 - 30 in. Hg to 70 psi (-1 to 4.8 bar) registers booster pump inlet vacuum suction or pressure.
2. Pressure gauge -PI 1001 0 to 160 psi (0 to 11 bar) registers booster pump outlet pressure, which is also inlet pressure to the Media Filter.

3. & 4. Pressure gauges -PI 1002 0 to 60 psi (0 to 11 bar) registers combined Media Filter outlet pressures as well as the 20 micron cartridge pre-filter inlet pressures.

5. & 6. Pressure gauges - PI 1003 0 to 160 psi (0 to 11) registers combined 20 micron cartridge pre-filter outlet pressures as well as the 5 micron cartridge pre-filter inlet pressures.

7. Pressure gauge - PI 1004 0 to 160 psi (0 to 11 bar) registers combined 5 micron cartridge pre-filter outlet pressure as well as the high pressure pump inlet pressure.
8. Pressure gauge - PI 1005 0-2000 psi (0-138 bar) registers outlet pressure from the high pressure pump as well as the inlet pressure to the R.O. membrane vessel assemblies.
9. Pressure gauge - PI 1006 0-2000 psi (0-138 bar) registers outlet pressure from the R.O. membrane vessel assemblies as well as the inlet pressure to the back pressure regulator.
10. Pressure gauge - PI 1007 0-160 psi (0-11 bar) registers the combined outlet pressure from the product water port of the R.O. membrane vessels (product water line pressure).
11. Pressure gauge - PI 1008 0-160 psi (0-11 bar) registers the pressure present in the brine discharge line.
12. Flow meter - FL 1001 10-80 gpm (37.8-302 lpm) measures the rate of the feed water progress through the System.
13. Flow meter - FL 1003 4-40 gpm (15.1-151 lpm) measures the combined rate of the backwash water through the Media Filters.

K. ELECTRICAL CONTROLLER PANEL

1. Contactor, High Pressure Pump Motor Starter is rated for a maximum of 10 horsepower.

SECTION 3

ELECTRICAL INFORMATION

3 ELECTRICAL INFORMATION

3.1 ELECTRICAL REQUIREMENTS & INFORMATION

Following are general electrical requirements and information for Coral Sea.

CAUTION: DO NOT PERFORM INSTALLATION UNLESS:

1. The System Feed Water Sea Cock Valve is closed.
2. The system main electrical disconnect switch is switched "OFF", LOCKED, and TAGGED.

WARNING: ELECTRICAL SHOCK HAZARD. A Volt / Ohm Meter will be necessary. The following installation procedures expose the installer to High Voltage and electrical shock hazard. Only attempt this if you are a qualified electrician and only if surrounding conditions are safe.

CAUTION: Always allow slack in electrical cables. Allow the cable to enter or leave from the strain relief in a straight manner for several inches to ensure proper connection, to relieve stress to the cable and fitting, and to allow ease of detachment and reattachment for maintenance or replacement. If electrical cables are pulled tight causing them to bend at the strain relief, they will pull out of the strain relief causing a dangerous electrical shock condition, the wire may break, and the strain relief will lose its water-tight integrity.

A. AMPERAGE NOTES

The Electric Motors within the Systems start in series with time delay between each motor starting after the Touch Screen "Start" Switch is pressed. First, the Booster Pump starts, then the main High Pressure Pump Electric Motor starts. Alternatively, the Booster Pump and High Pressure Pump may be started manually by accessing the manual operation mode from the Touch Screen.

During start up, the current of the Booster Pump Electric Motor surges to "Locked Rotor" amperage for a fraction of a second after which the current drops to normal running load. Then the High Pressure Pump Electric Motor starts and surges to "locked Rotor" amperage for a fraction of a second after which the current drops to normal running load.

Therefore, the maximum surge current equals the Booster Pump Electric Motor normal running amperage plus the High Pressure Pump Electric Motor starting amperage. Normal operational amperage equals the normal operating amperage of the Booster Pump Electric Motor plus the normal operating amperage of the High Pressure Pump Electric Motor.

B. POWER SOURCE REQUIREMENTS

Check line voltage and frequency to ensure that it agrees with system nameplate. Grounding and circuit protection should be done in accordance with National Electrical Code. See connection diagram on nameplate of motor or refer to the diagrams within this manual.

C. MOTOR ROTATION

Refer to Booster Pump and High Pressure Pump markings to determine proper rotation.

Three Phase Systems: Ensure proper rotation by jogging each motor from the manual operation mode.

3.2 RECOMMENDED CIRCUIT BREAKER SIZE

The recommended Circuit Breaker Size assumes that the R.O. System is equipped with up to three electric motors (Well Pump Motor, Booster Pump Motor, and High Pressure Pump Motor). If an optional Feed Pump is not used, the Circuit Breaker maybe resized appropriately to handle only two motors. Refer to System Specifications on Section 1 for details.

3.3 ELECTRICAL WIRING DIAGRAMS

WARNING: ELECTRICAL SHOCK HAZARD. A Volt/Ohm Meter will be necessary. The following installation procedures expose the installer to High Voltage and electrical shock hazard. Only attempt this if you are a qualified electrician and only if surrounding conditions are safe.

Note: Larger prints in Section 10 of this manual.

SECTION 4

INSTALLATION REQUIREMENTS

4 INSTALLATION REQUIREMENTS

LAND INSTALLATION NOTE: REFER TO SECTION 4.4 REGARDING FEED WATER INSTRUCTIONS FOR LAND INSTALLATIONS. REFER TO THE REST OF THIS SECTION FOR INSTALLATION.

All mounting surfaces must be flat in order to avoid warping of brackets and frames. Any damage caused by attaching the system or its components to an uneven surface is attributed to improper installation, is the liability of the installer, and is not covered by the Parker Hannifin warranty. Grind flat or use appropriate shims on uneven surfaces to ensure that mounting of the system components does not cause bending or warping.

Refer to the foldout illustrations at the back of this manual.

4.1 COMPONENTS SUPPLIED BY OWNER:

1 Suction piping of 1 inch inside diameter minimum. The suction line should include a 1/4 turn quick shut-off valve with a minimum 1" orifice and terminate with a 1 inch American standard national pipe thread nipple for connection of the supplied 1 inch female national pipe threaded flange fitting. The entire suction line, fitting and valve assembly must be of non-ferrous material. PVC, CPVC, Naval bronze or another noncorrosive material is correct. Any ferrous material will cause rust fouling of the SRC R.O. Membrane Element. Rust fouling of the R.O. Membrane Element may not be cleanable and may render the R.O. Membrane Element permanently damaged. Fouling of the R.O. Membrane Element by rust is not covered under warranty.

2. Brine discharge line sufficient to handle the system brine discharge along with unpotable product water discharge, and the media filter back flush waste water. The line and fitting must be minimum 1" size, with 1" piping up to the Parker Hannifin System and terminate with a 1 inch American standard national pipe thread nipple for connection of the supplied 1 inch female national pipe threaded flange fitting.

   Ferrous material should not be used as the brine discharge water is high in salt content and very corrosive. There should be no valving in this line. Damage to the system caused by a blocked brine discharge line will not be covered by warranty.

3. Product water storage tank connection: This fitting must be minimum 1" size, with 1" piping up to the Parker Hannifin System and terminate with a 1 inch American standard national pipe thread nipple for connection of the supplied 1 inch female national pipe threaded flange fitting.

   Ferrous material should not be used as the product water is very aggressive and slightly acidic. Product water will turn red or brown if ferrous material is used in the product water distribution line or storage tank.

   There should be no valving in this line. Damage to the system caused by a blocked product water line will not be covered by warranty.

4. Power cable with the proper gauge rating for this system's power consumption.

5. An electrical power source capable of supplying the proper current and voltage to the system.

4.2 FINAL LIFT OF THE SKID INTO PLACE

1. Attach lift ropes to the top portion of the frame four corner posts only. Use caution to protect the epoxy coating with soft material. DO NOT attach guidelines to, or handle the Parker Hannifin System by any of the piping, controls, or other components within the System. Lift each skid into place.

2. Set the skid onto wood blocks in order to suspend it above ground level while aligning mounting holes or studs.

3. Lift the skid and remove the wood blocks from the final resting place. Once the skid is in its exact place for installation gently set the skid down to rest and secure it.

4. Secure the each skid in place using Vibration Isolators as required.

4.3 INTERCONNECTING SKIDS

Refer to System Specifications regarding water line capacities and electrical power consumption.

A. INSTALLING FLANGE PLUMBING

install the interconnecting hose or pipe to skid flanges and fitting per Table 4-1 on Page 4-3.

B. INSTALLING COMPONENT PLUMBING

Install the component interconnecting tube per Table 4-2 on Page 4-3.

D. INSTALLING COMPONENT WIRNG

install Booster Pump and HP Pump wiring to control box

per system specification and wiring diagram in Section 3.

Install all other component wiring per system specification and wiring diagram.

E. INSTALLING MAIN POWER CABLE

install main power wiring per system specification and wiring diagram in Section 10.

IF SYSTEM COMMISSIONING AND OPERATION WILL BEGIN WITHIN 1 OR 2 DAYS THEN CONTINUE TO NEXT SECTION.

4.4 COMPONENT PREPARATION:

A. MEDIA FILTER

a. Remove the top entrance cover. The Filter Media used in the Media Filter consists of two grades of sand, which must be placed into the Media Filter from the bottom up as follows:

1) First add approximately 50 lbs (22 kg) of Fine Angular Gravel or Garnet 1/8 - 1/16 inches (3-1.5 mm). Fill to 1 - 3 inches (25 - 75 mm) above the bottom laterals.

2) Second add approximately 150 lbs (68 kg) of No. 20 grade Silica Sand.

b. Upon completion of the sand loading, wash off the top of the filter to remove all sand from the o-ring groove. Lubricate and replace the o-ring into its groove and mount the top entrance cover onto the top of the filter assembly.

c. Close the Media Filter Valve on the System. This forces the flow of feedwater from the Booster Pump through the Media Filter before it returns to the Pre-Filter Inlet.

Media Filter Connections:

NOTE: Media Filter Flange Connections are designed to mate directly to their corresponding flanges on the side of the System frame. If space limitations prevent this, connect the System Flanges to their corresponding Media Filter Flanges with flexible hose or pipe.

B. RO MEMBRANE

If the System was shipped without R.O. Membrane Elements installed, refer to Section 6 for installation details.

Do not install the Membrane Elements until the system is ready for commissioning. This ensures that the Membrane Elements do not dry out and become fouled.

If the system was shipped with Membrane Elements installed, refer to Section 6 for Storage and Cleaning instructions.

CAUTION: The Membrane and Vessel assembly is packaged with storage solution. Avoid skin and eye contact with this solution. In case of skin contact, rinse the skin thoroughly with water. In case of eye contact, flush repeatedly with water and notify a physician immediately. (THE STORAGE CHEMICAL IS WATER, SODIUM BISULFITE & PROPYLENE GLYCOL).

TABLE 4-1

Refer to the P&ID illustration at back of this manual. Use the recommended hose or piping as required to interconnect the System skids:

1 " Plumbing

Step	Run	Description
1.	From:	From Feed source
	To:	Booster Pump Feed Inlet
2.	From:	Booster Pump Feed Outlet
	To:	Cyclone Filter Inlet
3.	From:	Cyclone Filter Outlet
	To:	MMF Feed Inlet
4.	From:	MMF Feed Outlet
	To:	Pre-filter Inlet
5.	From:	MMF Brine Discharge
	To:	Brine Discharge Line
6.	From:	Pre-filter Oulet
	To:	HP Pump Inlet
7.	From:	HP Pump Outlet
	To:	Control Feed Inlet
8.	From:	Control Brine Discharge
	To:	Brine Discharge Line
9.	From:	Control Product Outlet
	To:	Post-filter Product Inlet
10.	From:	Post-filter Product Outlet
	To:	PH Nuetralizer Product Inlet
11.	From:	PH Nuetralizer Product Outlet
	To:	Storage Tank Product Inlet

TABEL 4-2

Refer to the P&ID illustration at the back of this manual. Use the recommended tube to interconnect the System components:

1/4" Plumbing

Step	Run	Description
1.	From:	Booster Pump Press. Pickup
	To:	BP Inlet Press. Guage
2.	From:	MMF Press. Pickup Tee
	To:	MMF Inlet Press. Gauge
3.	From:	MMF Press. Tee
	To:	Pre-filter Tee
4.	From:	Pre-filter Tee (4)
	To:	Pre-filter Press. Guage (4)

Notes:

1: Connection from Clean/Rinse water tank should terminate below the water level.

2: Connection to Clean/Rinse water tank should terminate above the water level.

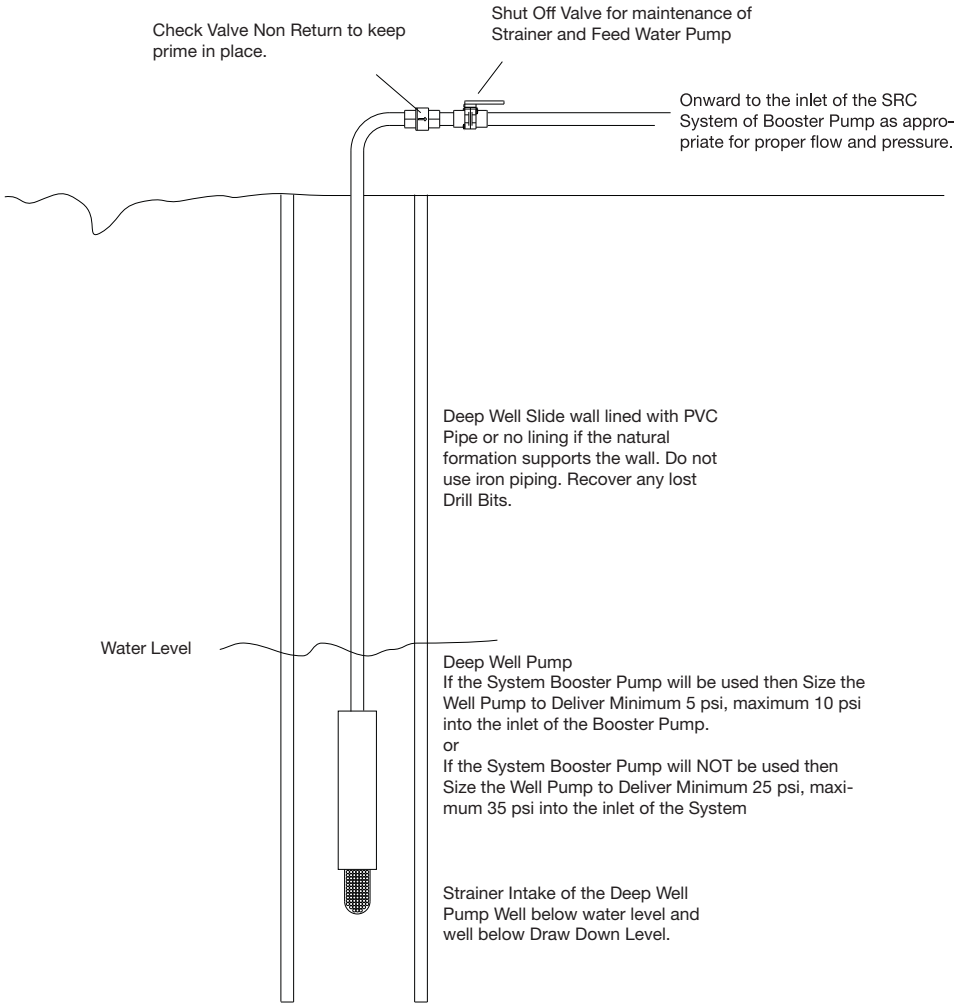
3: The Brine Discharge connection should terminate above water level.

4.5 LAND FEED WATER PICK-UP

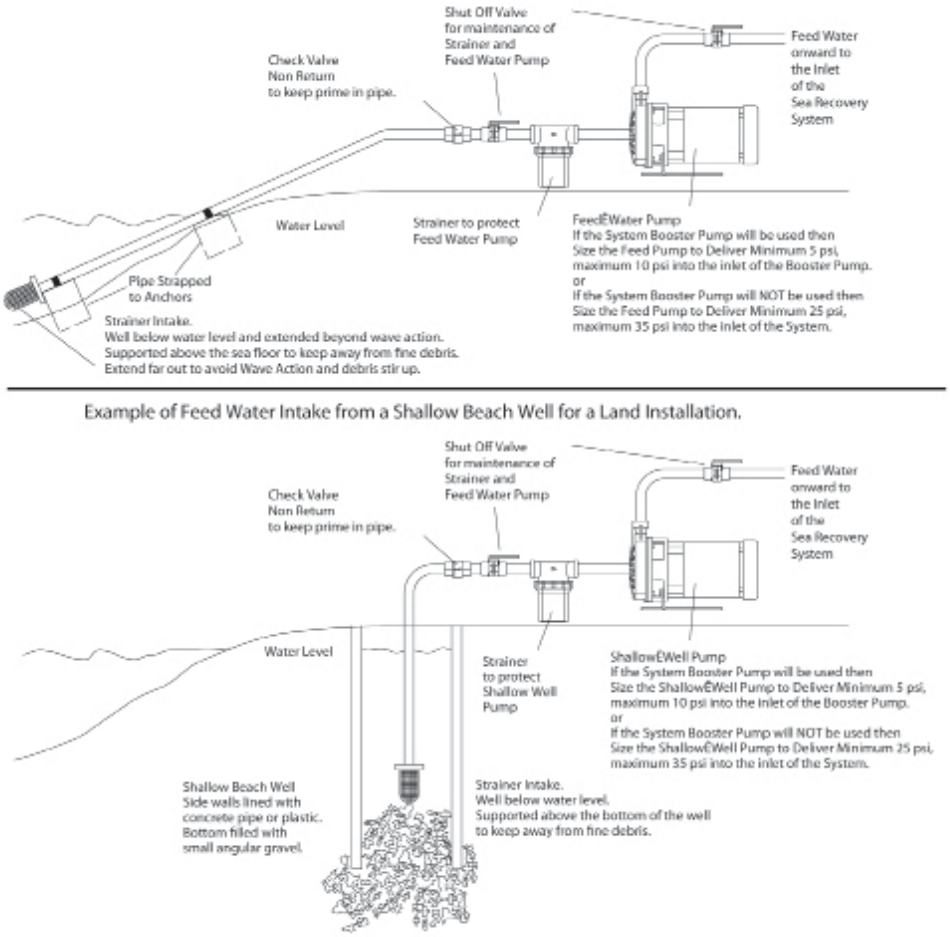
LAND INSTALLATION FEED WATER PICK-UP INFORMATION

Refer to the following illustrations.

Example of Feed Water Intake from a Deep Well for a Land Installation



Example of Water intake from a Feed Source



Example of Feed Water Intake from a Shallow Beach Well for a Land Installation.

4.6 UV STERILIZER INSTALLATION

If applicable, the UV Sterilizer is normally installed when the System is shipped; otherwise, install the UV Sterilizer Assembly per System P&ID and Wiring diagram.

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SECTION 5

OPERATIONS MANUAL

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Coral Sea Control System

Operations Manual

(Base System)

PLC Firmware Version: 4.01
HMI Firmware Version: 4.01

Project: Parker Sea Recovery Coral Sea		Doc: 1010016	Version: 01c
Document Name: Control System Operations Manual		Author: AGE	Page: Page 1 of 129

Document Revision:

Version	Author	Date	Effected Pages	Description
01a	AGE	04-08-2011	All	Initial Draft
01b	AGE	04-27-2011	29, 79-81	System Size Correction, Correction to Transducer Label, Message Item Numbering Modification
01c	AGE	05-04-2015	All	Company Logo Revision

Abbreviations:

LPS: Low Pressure Switch
HPS: High Pressure Switch
PT: Pressure Transducer
FT: Flow Transducer
PI: Pressure Indicator
Analog CH: Variable PLC Input, ranging from 4-20mA
mA: Milli-Ampers (1.0^{E-03})
PSRC: Parker Sea Recovery Corporation
FWF: Fresh Water Flush
Modbus: High level communications protocol for industrial networks

Definitions:

Modbus: A high-level protocol for industrial networks developed in 1979 by Modicon (now Schneider Automation Inc.). Providing services at layer 7 of the OSI model, it defines a request/response message structure for a client/server environment. Modbus runs over various data links including its own Modbus+ token passing network and serial links such as RS-232 and RS-485.

It is widely used with TCP/IP over Ethernet. Individual device networks connected to Modbus+ or serial links hook into Ethernet via gateways for transport over an IP network or the Internet. Modbus is governed by the Modbus-IDA Organization, a merger of the Modbus Organization and IDA Group in 2003. For more information, visit www.modbus.org.

Table of Contents:

1. System Settings prior to attempting operation:

Refer to the system P&ID and ensure the following items are in the correct position:

Coral Sea Standard System Equipment:

MV-1001	Feed water selection valve	Normal position (Tab Down)
PI-1000	Booster Pump Feed Pressure Indicator	Minimum 11 PSI-A
BP-1000	Booster Pump	Not relevant
MV-1002	Media filter by-pass valve	Position Per System Spec

Note:

For Systems with a Media Filter This valve must be placed in correct position to ensure flow is directed through media filter assembly.

For systems without media filter this valve must be placed in 'By-pass' position

Optional Media Filter System Equipment:

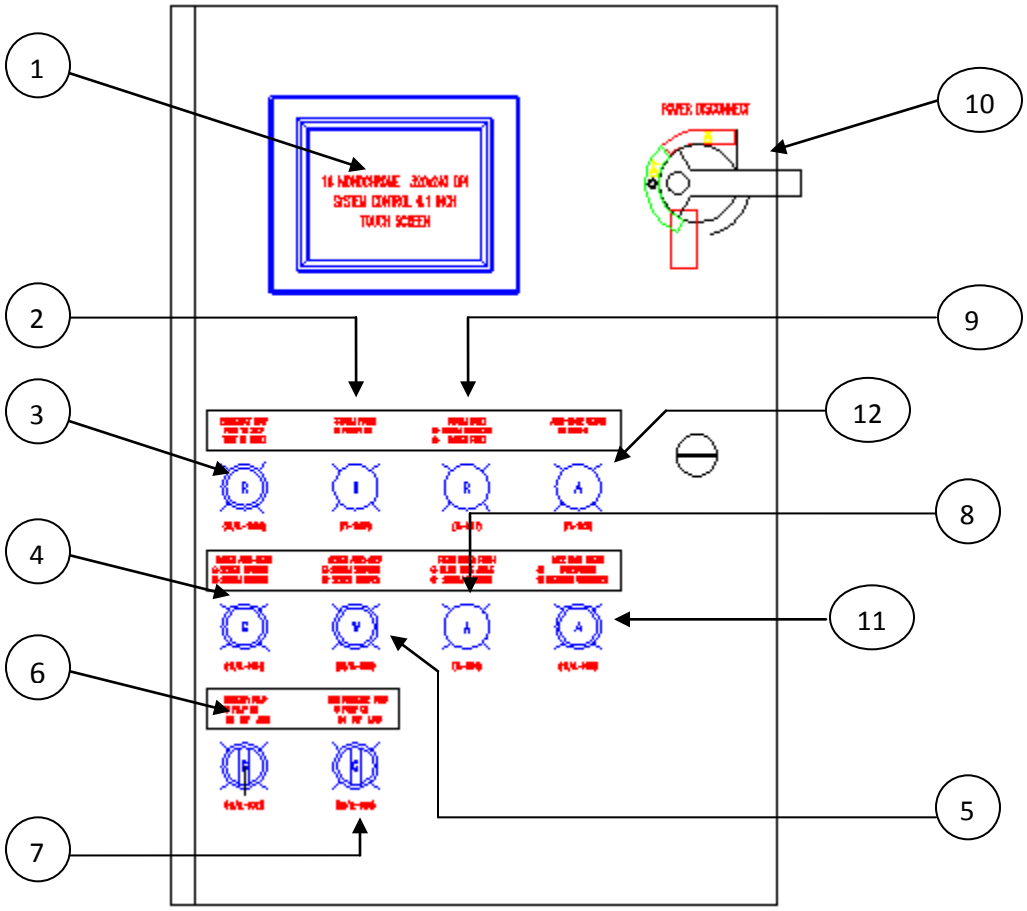
PI-1001	Media filter assembly inlet pressure gauge	Not relevant
MV-1003	Media filter inlet valve	Normal position (Tab Right)
MV-1004	Media filter outlet valve	Normal position (Tab Left)
F-101A	Media filter assembly	Loaded with media
PI-1002	Media filter/Booster Pump outlet pressure gauge	Not relevant
MV-1005	Media filter rinse valve	Normal position (Tab Down)
CV-1002	Media System Check Valve	Not relevant

Continuation of Coral Sea Standard System Equipment:

CV-1000	Feed System check Valve	Not relevant
FIL-1000	20u Cartridge filter assembly	Not relevant
PI-1003	20u Outlet 5u Inlet pressure gauge	Not relevant
FIL-1001	5u Cartridge filter assembly	Not relevant
MV-1007	Cartridge System Drain Valve	Closed Position
PI-1004	High pressure pump inlet pressure gauge	>20 PSI : < 75 PSI
PSL-1001	High pressure pump inlet pressure switch	Not relevant
PT-1004	High pressure pump inlet pressure transmitter	Not relevant
HPP-1001	High pressure pump	Not relevant
CV-1007	High pressure pump bypass check valve	Not relevant
CV-1008	High pressure pump output check valve	Not relevant
PI-1005	High pressure pump outlet pressure gauge	<950 PSI
PSH-1001	High pressure pump outlet pressure switch	Not relevant
PT-1005	High pressure pump outlet pressure transmitter	Not relevant

NV-1002	Back pressure regulator	Fully Open
FT-1001	Brine water flow meter	Not relevant
MV-1010	Brine water selection valve	Normal Position (Tab Up)
FT-1002	Product water flow meter	Not relevant
TDS-1001	Salinity probe	Not relevant
DV-1008	Product water diversion valve	Fully Closed
CV-1005	Fresh water flush inlet check valve	Not relevant
FIL-1006	Fresh water flush carbon filter	Not relevant
MV-1006	Fresh water flush control valve	Fully Closed

2. The Control Panel



Item Number	Item Description
1	Touch Screen Interface
2	System Main Power Indicator
3	Emergency Stop Button
4	System Auto-Start Button
5	System Auto-Stop Button
6	Booster Pump Control Operator
7	High Pressure Pump Control Operator
8	Fresh Water Flush Indicator
9	System Fault Indicator
10	Main Power Disconnect
11	Media Filter Backwash Button/Indicator
12	Media Filter Rinse Indicator

The new Coral Sea control system incorporates the very latest in powerful control system technology as well as highly intelligent programming. At the core of the control system is the all new 32 bit Programmable Logic Controller (PLC); this device provides constant supervision of your water maker. Should any problem arise during operation this intelligent hardware will first analyze if this fault could possibly damage the water maker, if so it classifies this error as 'critical' and shuts the unit down to prevent damage. However, if the controller deems the current problem as 'non critical' the water maker is allowed to continue operating; meanwhile the control system will alert operators that service is required by beeping and displaying a warning notification on the system touch screen; the controller will continue to monitor the situation closely and if the current problem should become 'critical' the control system will take action to prevent damage and shut the water maker down. The reason for the shutdown will be displayed on the system touch screen.

The new Coral Sea controller has also been designed to ensure maximum water maker productivity; the system contains multiple programs to allow for operation even in 'critical' fault situations, ensuring that whenever possible your water maker can produce the water essential for survival. Please see "emergency operations" section for further details.

This manual has been written to help walk you through the various features offered by the installed control system. During fault situations your water maker control system produces messages to help point you to the problem; contained within this manual is a list of trouble shooting tips based on these messages; each tip will detail the likely possibilities which resulted in the call for the associated fault message.

The new Coral Sea control system also comes with an available Modbus interface. This Modbus interface can be used to create an open communications interface between locally hosted control systems and the Coral Sea water maker. Via the Modbus interface it is possible to monitor all control system inputs and outputs; it is also possible to monitor data normally displayed on the control system touch screen including alarm information, performance information, system pressure information and salinity information.

For further information on the Modbus interface, please refer to the Coral Sea Modbus Specification documentation.

3. Initial System Checks/Commissioning.

The new Coral Sea control system comes loaded with a special utility tool designed to aid in the initial system checks and commissioning of the system. This utility can be accessed in the following manner.

Please note it is not possible to enter commissioning mode while the water maker is operating. Trying to enter commissioning mode while the unit is running will simply not be permitted, and the commissioning screens shown in this section will fail to appear as stated in this document.

Stop system operation before attempting to enter commissioning mode.

3.1 Entering Commissioning Mode

From the Main Splash screen press the arrow in the lower right corner.

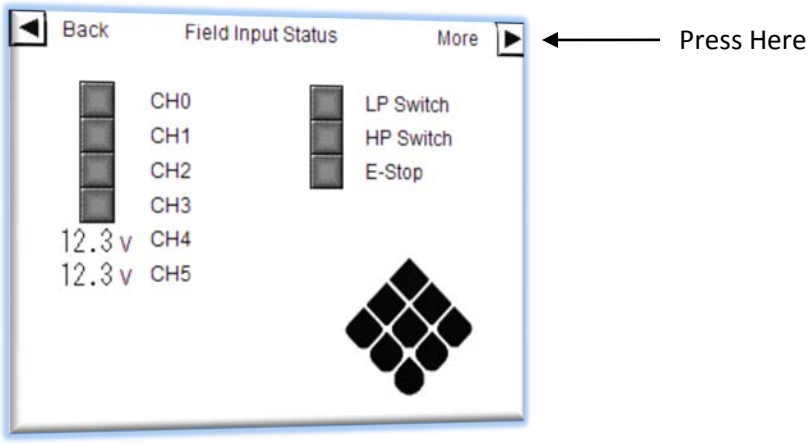
Press Here

This will take you to one of two main menu screens. Once again press the arrow in the lower right corner.

Press Here

This will take you to the second of the two main menu screens. Press on the shown area to access the hidden commissioning mode screens.

If the unit was not running pressing the illustrated area will switch the controller into commissioning mode. This is confirmed by the system menu being replaced with the first of four diagnostic screens. The first screen as shown below details all of the inputs currently being received by the controller. This screen can be used to check for proper external sensor functionality. A grey indicator as seen extensively below signifies that an input is not present, when the indicator is illuminated this implies the input is present and as expected (healthy).

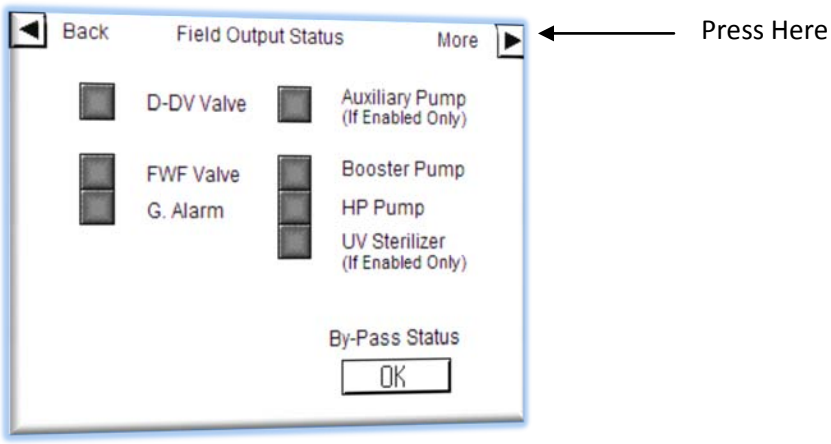


Key:

CH0: Analog CH0 (PT-1004). Illuminates if the input is enabled and the connected sensor is healthy
CH1: Analog CH1 (PT-1005). Illuminates if the input is enabled and the connected sensor is healthy
CH2: Analog CH2 (PT-1006). Illuminates if the input is enabled and the connected sensor is healthy
CH3: Analog CH3 (TDS-1001). Illuminates if the input is enabled and the connected sensor is healthy
CH4: Displays the current voltage being received from the brine flow sensor, start the system in manual mode while in commissioning mode to watch the voltage readings from this sensor to confirm if the sensor is functioning correctly. The sensor has a 4 to 20 GPM span over 0 to 10V hence an 8GPM flow would result in approximately a 4.8 to 5.0v reading, and a 16 GPM flow would result in a near 8.5 to 9.0v reading.
CH5: Displays the current voltage being received from the Product flow sensor, start the system in manual mode while in commissioning mode to watch the voltage readings from this sensor to confirm if the sensor is functioning correctly. The sensor has a 0 to 5 GPM span over 0 to 10V hence a 2.5GPM flow would result in approximately a 4.8 to 5.0v reading, and a 4.2 GPM flow would result in a near 8.5 to 9.0v reading.
LP Switch: Low Pressure Switch, Illuminates when the switch contact closes
HP Switch: High Pressure Switch, Illuminates when the switch contact closes
E-Stop: E-Stop Active, Illuminates whenever an E-Stop condition is present (inc. remotely)

Press on the 'More' button at the top right corner of the screen.

This will take you to the second of four commissioning screens. The second screen as shown below details all of the outputs currently being powered by the controller. This screen can be used to check for proper external equipment functionality. A grey indicator as seen extensively below signifies that an output is currently turned off, when the indicator is illuminated this implies the output is powered and the connected external device should be active.



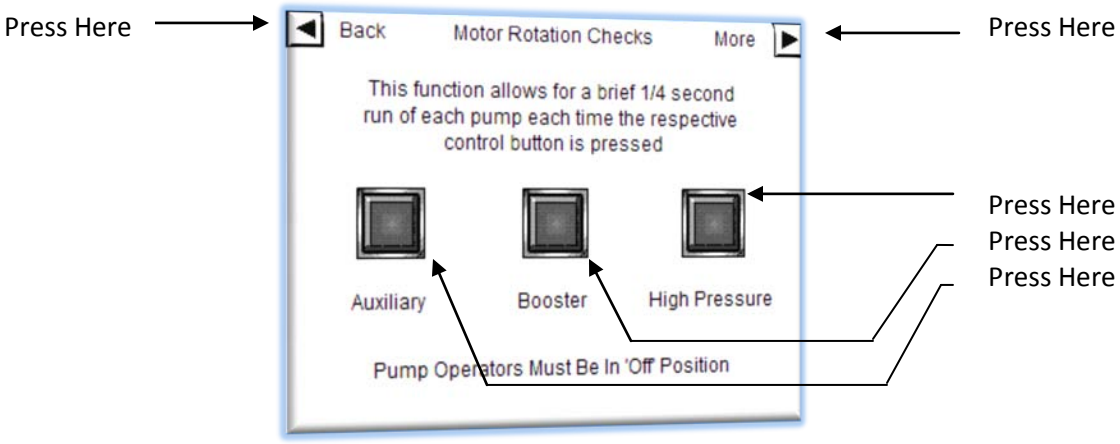
Key:

D-DV Valve: Product Diversion Valve, Illuminates if the controller is requesting the valve to open
FWF Valve: Fresh Water Flush Valve, Illuminates if the controller is requesting the valve to open
G. Alarm: General Alarm, Illuminates if the controller is reporting a fault condition
Auxiliary Pump: Feed or Product Pump, Illuminates if the controller is requesting pump operation
Booster Pump: Booster Pump, Illuminates if the controller is requesting pump operation
HP Pump: High Pressure Pump, Illuminates if the controller is requesting pump operation
UV Sterilizer: UV Sterilizer, Illuminates if the controller is requesting sterilizer operation

By-Pass Status: Signifies if the user has willingly overridden the sensors past their limited 200 hour duration and in doing so accepted responsibility for voiding the factory warranty.

Press on the 'More' button at the top right corner of the screen.

This will take you to the third of four commissioning screens. This screen can be used to jog all connected pumps. Each time the jog button is pressed, the pump is energized for ¼ of a second. For a pump to jog successfully, the pump must be enabled, and the pump operator must be in the 'Off' position.



3.2 Motor and Pump Rotation Checks

Step 1.

Once at the motor jog screen press the auxiliary pump button to jog the external pump. If the button will not activate this is because the auxiliary pump option is not enabled, therefore skip this step. If the button does activate and the pump spins in the correct direction proceed to the next step. However, if the pump spins in the incorrect direction switch the main power disconnect on the auxiliary pump control panel door to the 'Off' position, using a screw driver release the lock on the control panel door to the auxiliary pump and open the control panel door. Locate the external pump contactor (DCP-100). Turn the switch at the top of the contactor to the 'Off' position. Loosen the screw clamps holding the field L2 and L3 wires in the contactor output terminals, swap the wires over and re-secure them in the contactor output terminals, turn the switch at the top of the device back to the 'On' position, close and lock the enclosure door, and switch the main disconnect back to the 'On' position. Navigate back to the commissioning screens and finally to the motor jog screen if the screen has moved away, jog the pump once again to ensure correct rotation.

Extremely High Outgoing Voltage Present!
Always ensure incoming power to the unit has been disconnected and locked off before proceeding with altering outgoing power connections. Failure to do so could result in injury or death.

Step 2.

Once correct rotation of the auxiliary pump has been obtained (if fitted), press the booster pump jog button, check to see if the booster pump spins in the correct direction, if it does proceed to step three, if the booster pump does not spin in the correction direction shutdown main incoming power to the unit and switch the main power disconnect on the control panel to the 'Off' position, using a screw driver release the lock on the main control panel door and open the panel door. Locate the main incoming power disconnect switch DS-100. Loosen the screw clamps holding the incoming power L2 and L3 wires into the disconnect switch input terminals, swap the wires over and re-secure them into the disconnect switch input terminals, close and lock the enclosure door. Switch main incoming power back on and rotate the main disconnect switch back to the 'On' position. Navigate back to the commissioning screens and finally to the motor jog screen, jog the booster pump once again to ensure correct rotation.

Extremely High Incoming Voltage Present!
Always ensure incoming power to the unit has been disconnected and locked off before proceeding with altering incoming power connections. Failure to do so could result in injury or death.

Extremely High Outgoing Voltage Present!
Always ensure incoming power to the unit has been disconnected and locked off before proceeding with altering outgoing power connections. Failure to do so could result in injury or death.

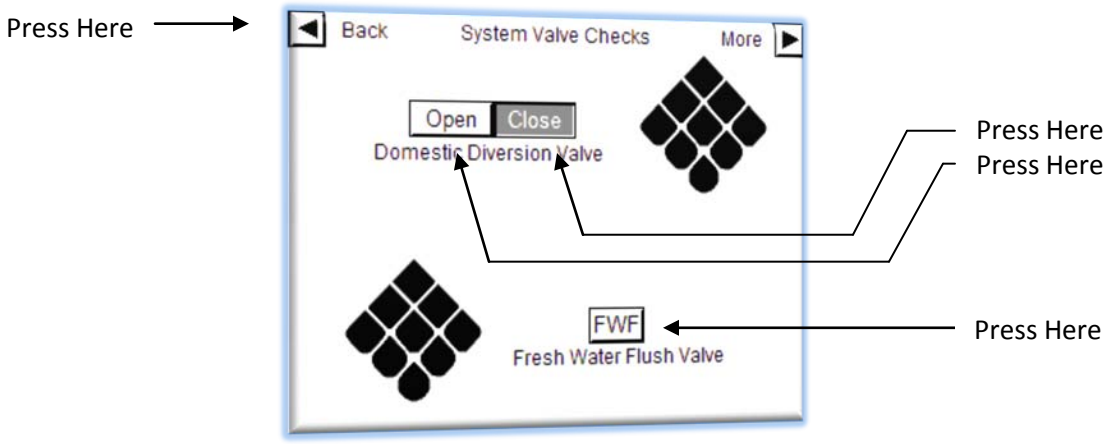
Step 3.

As correct rotation of both booster and High pressure pump are checked and confirmed during the FAT test there is no need to check rotation of the High pressure pump. However, it is still recommended as a final check that you still do so. Press the High Pressure pump jog button and confirm correct rotation of the pump.

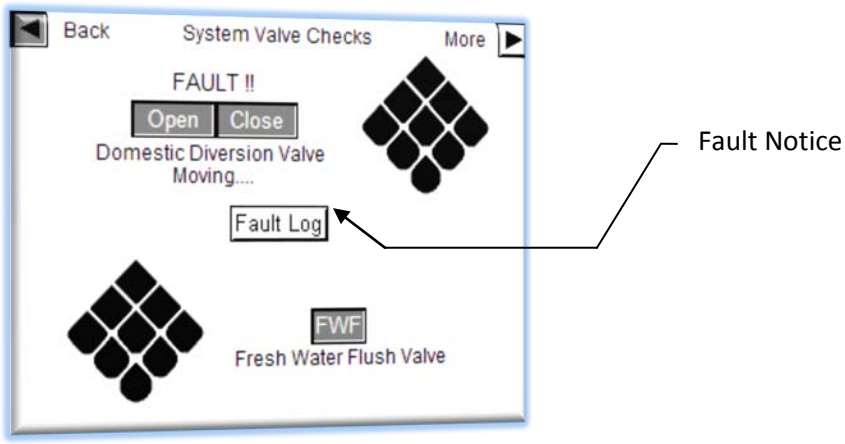
Once these tests have been completed and correct rotation of all connected pumps has been confirmed exit commissioning mode by pressing the arrow in the top left corner four times. This will return you to the main operations menu.

3.3 Valve Operation Checks

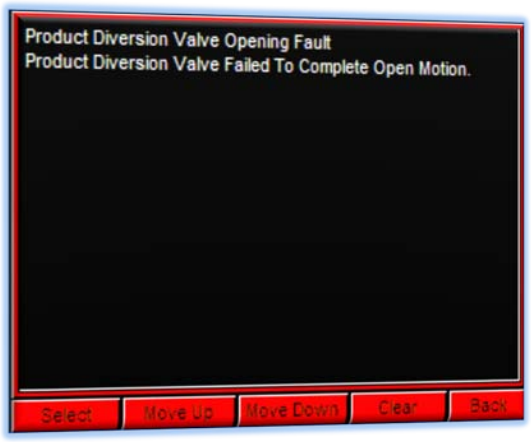
hile viewing the 'Motor Rotation Checks' Screen press on the 'More' button at the top right corner of the screen. This will take you to the fourth of four commissioning screens. This screen can be used to manually drive all of the automatic valves currently connected to the control system. To activate a valve simply press on the action you require. If the tested valve indicates a fault condition, the 'Fault Log' button will appear which will allow you to view what fault has been detected.



If the tested valve indicates a fault condition, the 'Fault Log' button will appear which will allow you to view what fault has been detected.

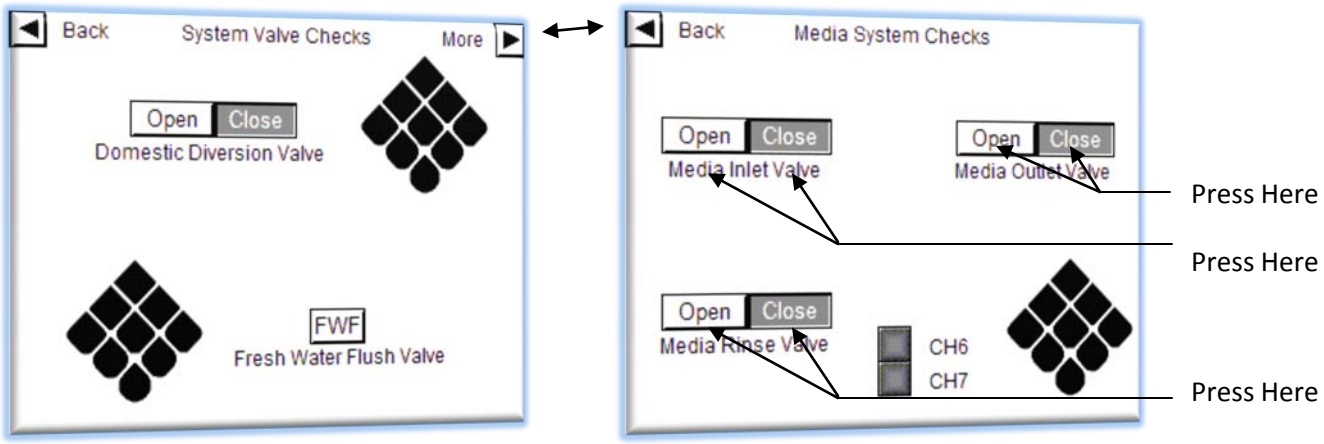


Press the 'Fault Log' button to be taken to the fault message center screen as detailed on the next page



Pressing ‘Select’ will highlight the first alarm item.
Pressing ‘Move Up’ will scroll up through the alarm list
Pressing ‘Move Down’ will scroll down through the alarm list
Pressing ‘Clear’ will clear the listed alarm notifications and return you to the previous screen.
Pressing ‘Back’ will exit the alarm list. Please note the ‘Back’ button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press ‘Accept’ to exit this screen.

If your system is equipped with an automatic media filter additional 'Media System Checks' screens will be available to you, this is indicated by the 'More' indicator and arrow in the upper right hand corner of the primary 'System Valve Checks' Screen, if no such indicator is visible, the automatic media filter option is not included in your system configuration, if this indicator is visible press on the arrow in the upper right hand corner of the 'System Valve Checks' screen to access these additional screens, as shown below:



This 'Media System Checks' Screen also provides information regarding the health of the analog channels associated with this system feature:

Key:

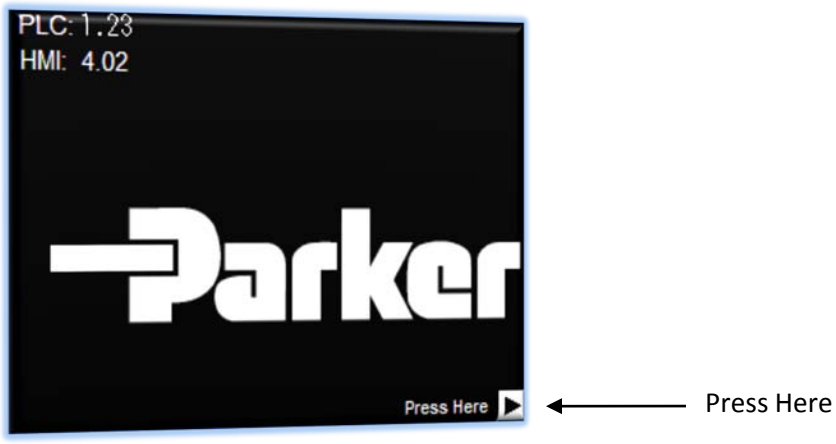
CH6: Analog CH4 (PT-1001). Illuminates if the input is enabled and the connected sensor is healthy
CH7: Analog CH5 (PT-1002). Illuminates if the input is enabled and the connected sensor is healthy

4. Editing System Set-points.

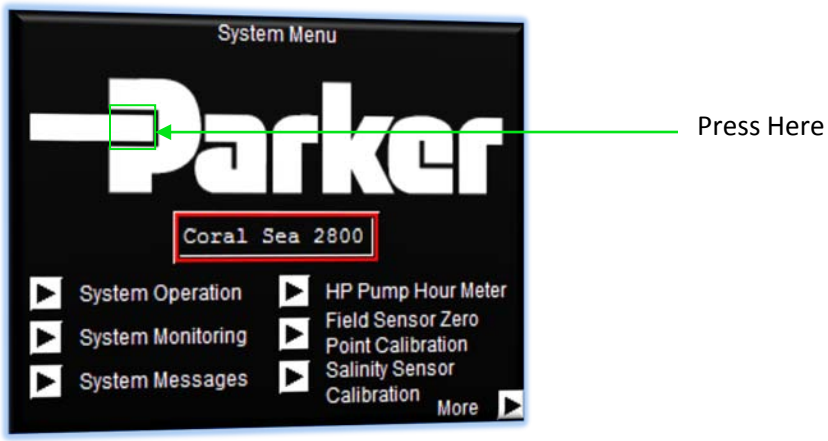
The new Coral Sea control system comes pre-loaded with typical alarm level set points, system shutdown values, etc. However, these set-points can be accessed and changed should the need arise. It should be noted that changing these configurations is not recommended unless prior authorization has been granted by Parker Sea Recovery Engineering group. Hence access to the system set-point editing mode has been restricted with a password. To gain access to these features, please contact Parker Sea Recovery to obtain the required password.

4.1 Entering Set-point Editing Mode

From the Main Splash screen press the arrow in the lower right corner.



This will take you to the first of two main menu screens. Press on the shown area to access the hidden system set-point editing mode screens.



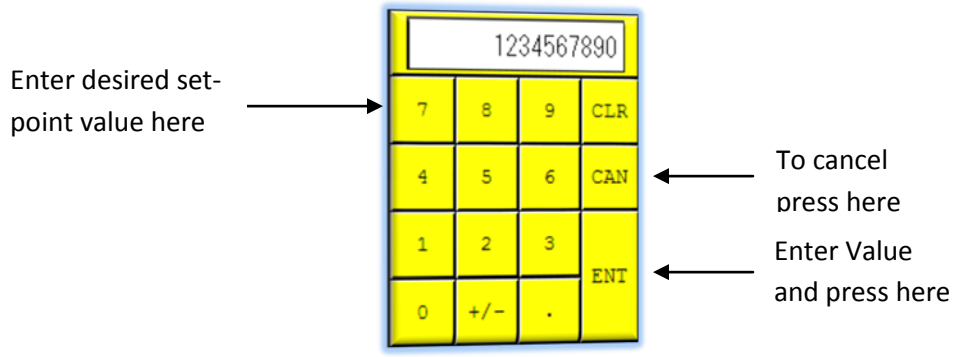
Once this area has been pressed the password entry dialogue box will appear. Enter the password given to you by Parker Sea Recovery, and press the 'ENT' key. To cancel this operation press the 'CAN' key as shown below:

Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Entering the correct password will bring you to the following screen.

From this screen it is possible to change the following system set-points:

To change a value press on the currently entered value, a number entry pop up screen will be displayed. Enter the newly required set-point and press the 'ENT' button to complete entry, to cancel the request press the 'CAN' button as illustrated below:



4.2 Minimum FWF Pressure (PSI):

This value determines the alarm level associated with Fresh Water Flushing faults. In order for the fresh water flush system to operate correctly there must be sufficient pressure in the system to ensure the high pressure pump bypass check valve opens. If there is not sufficient pressure to allow this, the control system will raise an alarm to notify the operator that Fresh Water Flushing is not taking place as designed.

Typical values entered here are 30 PSI

4.3 Fresh Water Flush Time (Seconds):

The value entered here (in seconds) determines how long the fresh water system will operate for once active pumps have been stopped by pressing the 'Auto-Stop' button. Once the allotted time has expired the fresh water flush system will enter a dormant mode for 7 days before repeating the flushing cycle.

Typical values entered here are 600 Seconds in all applications

4.4 Minimum HP Pump Inlet Pressure (PSI):

This value determines at what minimum inlet pressure the system will shut down and indicate a High Pressure pump inlet pressure low fault. In order for the Danfoss high pressure pump to operate correctly there must always be a minimum inlet pressure of 20 PSI at the inlet of the pump, pressure below this limit cause the pump to cavitate, if the control system is connected to a CAT pump this value can be much lower.

Typical values entered here are 20 PSI in Danfoss pump applications
Typical values entered here are 10 PSI in CAT pump applications

4.5 Maximum HP Pump Inlet Pressure (PSI):

This value determines at what maximum inlet pressure the system will shut down and indicate a High Pressure pump inlet pressure high fault. In order for the Danfoss high pressure pump to operate correctly there cannot be a pressure greater than 75 PSI at the inlet of the pump, pressure above this limit causes the pump to shear off the piston shoes as it initially begins to rotate. This type of damage is not covered by warranty should these settings report being changed by the user, if the control system is connected to a CAT pump this value should remain at 75 PSI.

Typical values entered here are 75 PSI in all pump applications

4.6 System Minimum Operating Pressure (PSI):

This value determines at what minimum outlet pressure the system will allow the high pressure pump to operate for extended periods of time. Operation below the inputted value triggers an alarm, and after 10 minutes a total system shutdown. Setting this value too low can severely damage the high pressure pump, as there is not enough internal pressure to lift the piston shoes off the pump back plate. This causes rapid wear of the piston shoes and eventual failure of the pump. This type of damage is not covered by warranty should these settings report being changed by the user, if the control system is connected to a CAT pump this value can be reduced

Typical values entered here are 350 PSI in Danfoss pump applications
Typical values entered here are 100 PSI in CAT pump applications

4.7 System Maximum Operating Pressure (PSI):

This value determines at what maximum outlet pressure the system will allow the high pressure pump to operate. Operation above the inputted value triggers an instant shutdown of the system. Setting this value too high can severely damage the high pressure pump motor, as there is not enough available horsepower to drive the high pressure pump beyond these limits. This causes rapid overheating of the high pressure pump electric motor, and eventual failure of the motor. This type of damage is not covered by warranty should these settings report being changed by the user, if the control system is connected to a CAT pump this value should remain the same.

Typical values entered here are 975 PSI in all pump applications

4.8 Maximum Membrane Health DP (PSI): (if PT-1005 fitted only)

This value determines at what maximum differential pressure the system will allow the membrane chain to operate. Detection of pressures above the number inputted here will result in performance warnings (See Performance Warning Messages), stating an excessive membrane pressure differential. This will not cause a system shutdown, but it is advisable upon seeing these warning messages to perform a chemical cleaning of the system to remove scaling.

Typical values entered here are 45 PSI in all applications

4.9 Maximum High Pressure Pump Hours:

The value here determines at what number of operational hours the water maker will call for high pressure pump servicing. Once the entered number of hours is exceeded the system will raise a performance warning (See Performance Warning Messages), stating the high pressure pump is due for servicing. Operation over these hours is allowed, but is not recommended.

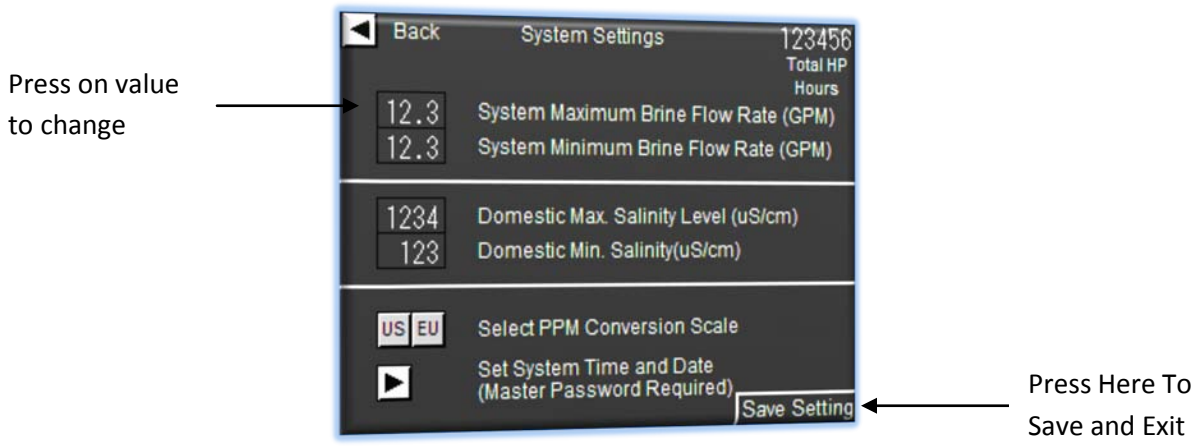
Typical values entered here are 8000 Hrs in Danfoss pump applications
Typical values entered here are 2000 Hrs in CAT pump applications

4.10 Low Pressure Valve Actuation Time:

The value entered here (in seconds) determines how long the control system will wait for movement of an automated low pressure valve to complete. If the correct feedback from the valve has not been received before this time expires, the system will either generate a performance warning, or shutdown the unit and generate a fault warning, the action taken depends on what operational state the water maker was in at the time of failure.

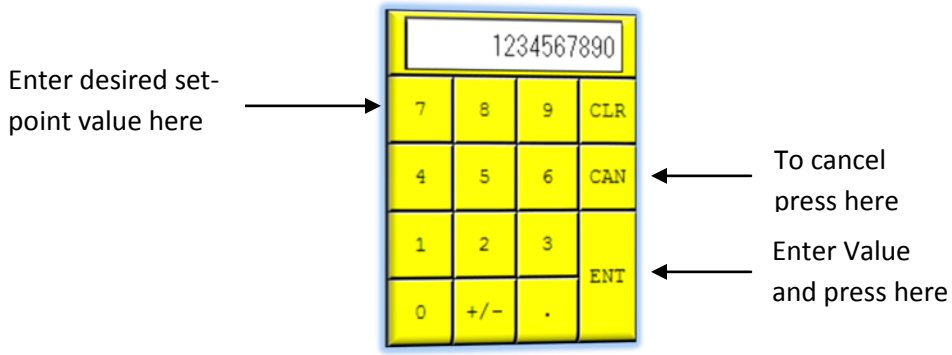
Typical values entered here are 15 Seconds in all applications

Pressing the arrow in the top right hand corner of the screen will bring you to the following screen:



Again from this screen it is possible to change the following system set-points:

To change a value press on the currently entered value, a number entry pop up screen will be displayed. Enter the newly required set-point and press the 'ENT' button to complete entry, to cancel the request press the 'CAN' button as illustrated on the next page:



4.11 System Minimum Brine Flow Rate (GPM):

This value determines at what brine flow rate the control system will alert you that the system is experiencing difficulty. During normal operation the control system would expect to see approximately 8 to 16 GPM for all pump applications when the system is not in fresh water production mode. If the control system sees flow drop below the value stated here it will not shutdown the water maker but it will indicate the problem by flashing the brine system flow rate bar on the pressure and system flow monitors page, it will also raise a 'System Performance Monitor' alarm indicating the detected problem. If system flow drops below the value specified here it could indicate a high pressure pump failure is imminent.

Typical values entered here are 5 GPM for 2600 and 3600 systems
Typical values entered here are 12 GPM for 4200 systems and above

4.12 System Maximum Brine Flow Rate (GPM):

This value determines at what brine flow rate the control system will alert you that the system is experiencing difficulty. During normal operation the control system would expect to see approximately 8 to 16 GPM for all pump applications when the system is not in fresh water production mode. If the control system sees flow rise above the value stated here it will not immediately shutdown the water maker but it will indicate the problem by flashing the brine system flow rate bar on the pressure and system flow monitors page, it will also raise a performance warning (See Performance Warning Messages) indicating the detected problem. If system flow continues to exceed the value specified here for 2 minutes the control system will shutdown the water maker. High flow rates can be an indication of a breached line/significant leak, therefore after 2 minutes action is taken to protect the integrity of the location in which the water maker is housed.

Typical values entered here are 10 GPM for 2600 and 3600 systems
Typical values entered here are 18 GPM for 4200 systems and above

4.13 Domestic Max. Salinity Level (uS/cm):

This value stated in uS/cm determines at what product water conductivity level the system will activate the diversion valve and UV sterilizer (if fitted). Once the product water measured conductivity drops below the number inputted here, the water maker deems the water as acceptable.

Typical values entered here are 1200 uS/cm in all applications

4.14 Domestic Min. Salinity Level (uS/cm):

This setting allows you to determine what minimum salinity level from the salinity probe will be accepted. Domestic systems cannot produce product water with salinity lower than the value entered here, therefore any readings below this value causes the water maker control system to reject the salinity probe input under the suspicion that the salinity probe has been removed from the system pipe work and is currently sitting in air.

Typical values entered here are 100 in domestic water applications

4.15 PPM Conversion Factor:

Europe and the US use different scaling factors when converting uS/cm in to PPM. Within the US a scaling factor of approximately 0.5 is used, within Europe a factor of 0.67 is used. Press on the conversion factor you desire, once set the selected conversion factor button will remain depressed. Changing this scaling factor results in a different bar and numbering system on the product water salinity monitoring page when 'PPM' is selected as the preferred viewing unit.

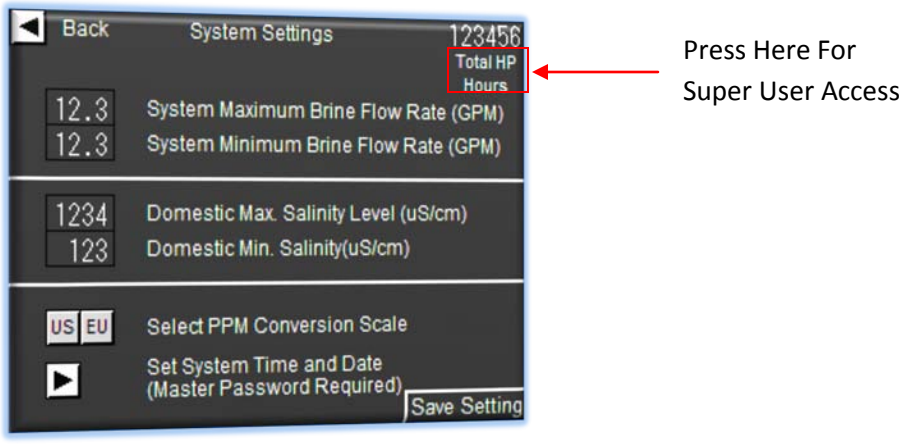
4.16 System Time and Date:

This will allow you to change the time and date stored within the touch screen. To access this high level editing screen a password is required. Contact Parker Sea Recovery for further details

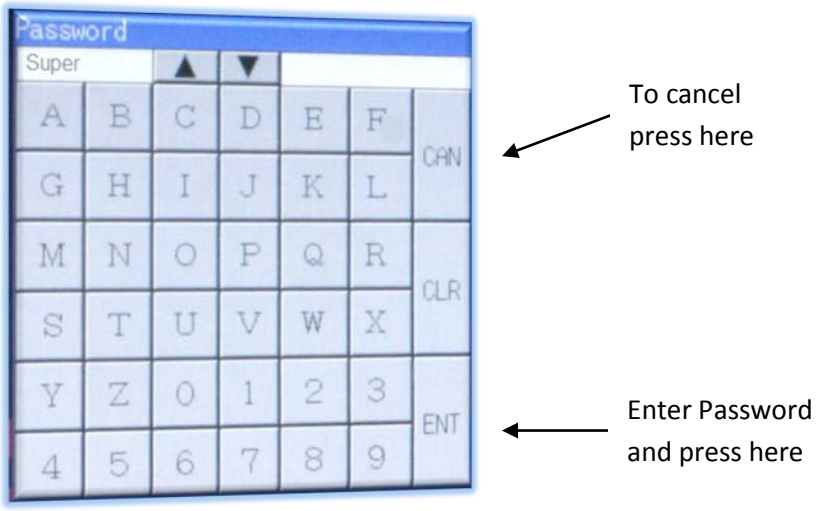
To exit the system settings screens you must press the "Save Settings' button located in the lower right hand corner of the second settings screen, even if you have not applied any changes to the system settings, this button must be pressed to exit the settings screen. Failure to do so will result in an automatic save after 60 seconds of inactivity.

This completes the usual system settings that need to be applied out in the field, all other settings have been loaded into your water maker at the Sea Recovery Fabrication factory. However, in the cases where the system has received a capacity upgrade in the field or other odd scenarios where access to these Fabrication settings would need to be allowed, that can be done in the following manor:

From the Second System settings screen as shown below, press on the hidden activation area:

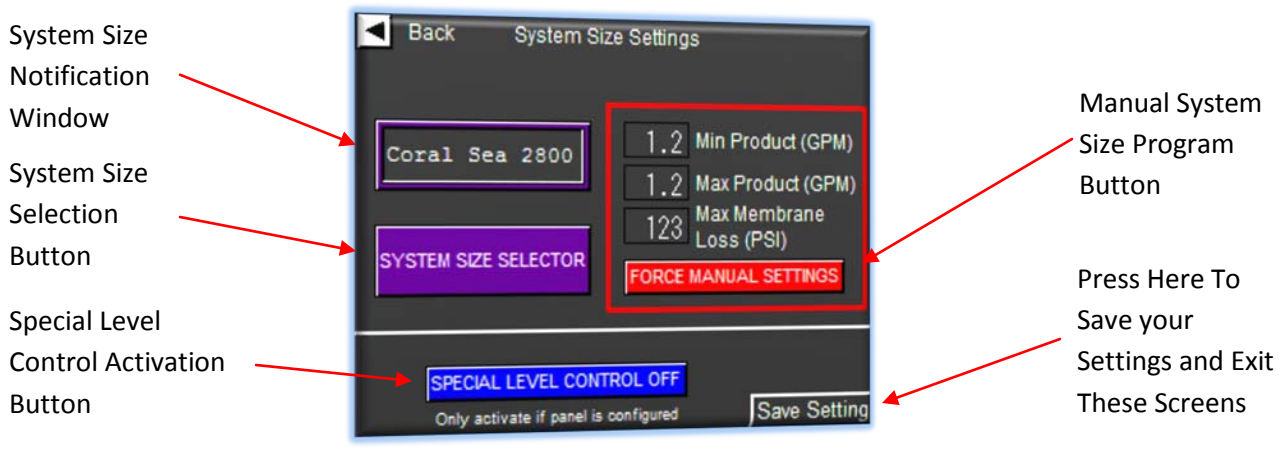


Pressing on the area shown will prompt the controller to ask you for the super user access password via the illustrated dialogue box. This password must be obtained from Parker Sea Recovery. Enter the password given to you by Parker Sea Recovery, and press the 'ENT' key. To cancel this operation press the 'CAN' key as shown below:



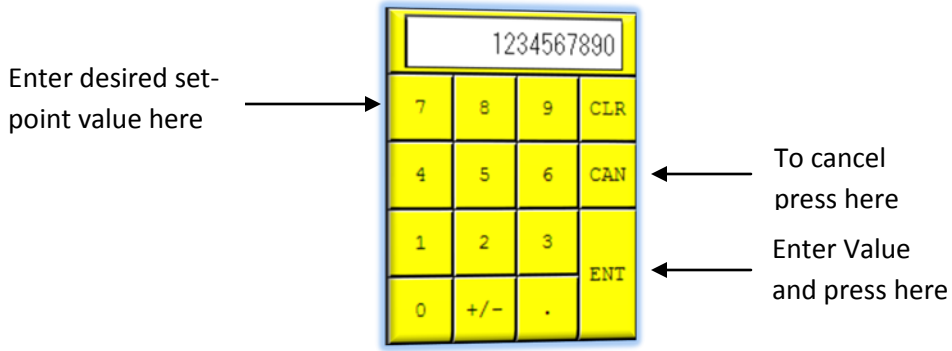
Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Entering the correct password will bring you to the following screen.



From this special screen it is possible to change the system size settings and to enabled manual override of those size settings for harsh environments, it is also possible to enable special level control functions if your water maker is equipped with such hardware.

To change a value press on the currently entered value, a number entry pop up screen will be displayed. Enter the newly required set-point and press the 'ENT' button to complete entry, to cancel the request press the 'CAN' button as illustrated below:



4.17 System Size Selector

Pressing this button causes the control system scroll through the available system recovery sizes within Coral Sea product line, each time the button is pressed the system will increment to the next available size as listed here: 2800, 3600, 4200, 5200, 6200 & 6800. Once the maximum system size has been reached pressing the system size selection button again will cause the system to return the beginning of the list.

4.18 Special Level Control

Some control systems are specially requested with tank full and tank empty level control abilities, if your control system has been built to accommodate these special functions, you may enable and disable this function by pressing this button. AS you press the button the text within the button will change to reflect the current state of the feature.

4.19 Min Product (GPM)

* Please note: *

Entering data into this field is only permitted if the user has selected 'Force Manual Settings', confirmation that this mode is enabled is given by the 'System Size Notification Window'. Once manual settings are enabled the text within the window will change from a standard system production size to 'MANUAL MODE'. To enter manual mode, press the 'Manual System Production Variable Settings' button.

This value determines what minimum permeate flow rates the controller should expect to see during normal operation, if the controller sees permeate flow rates drop below this level consistently for 60 seconds it will alert you by raising a performance warning (See Performance Warning Messages) indicating the detected problem, the water maker will not shut down and will continue to function at these lower permeate flow rates. However attempts should be made to discover why permeate flow rates have fallen.

Normal values are automatically entered here as system sizes are adjusted using the 'System Size Selector' button. However in manual mode any value can be entered here.

4.20 Max Product (GPM)

* Please note: *

Entering data into this field is only permitted if the user has selected 'Force Manual Settings', confirmation that this mode is enabled is given by the 'System Size Notification Window'. Once manual settings are enabled the text within the window will change from a standard system production size to 'MANUAL MODE'. To enter manual mode, press the 'Manual System Production Variable Settings' button.

This value determines what maximum permeate flow rates the controller should expect to see during normal operation, if the controller sees permeate flow rates rise above this level consistently for 60 seconds it will alert you by raising a performance warning (See Performance Warning Messages) indicating the detected problem, the water maker will not shut down and will continue to function at these higher permeate flow rates. However attempts should be made to discover why permeate flow rates have risen, and corrections performed to bring them back to within normal levels before membrane damage occurs.

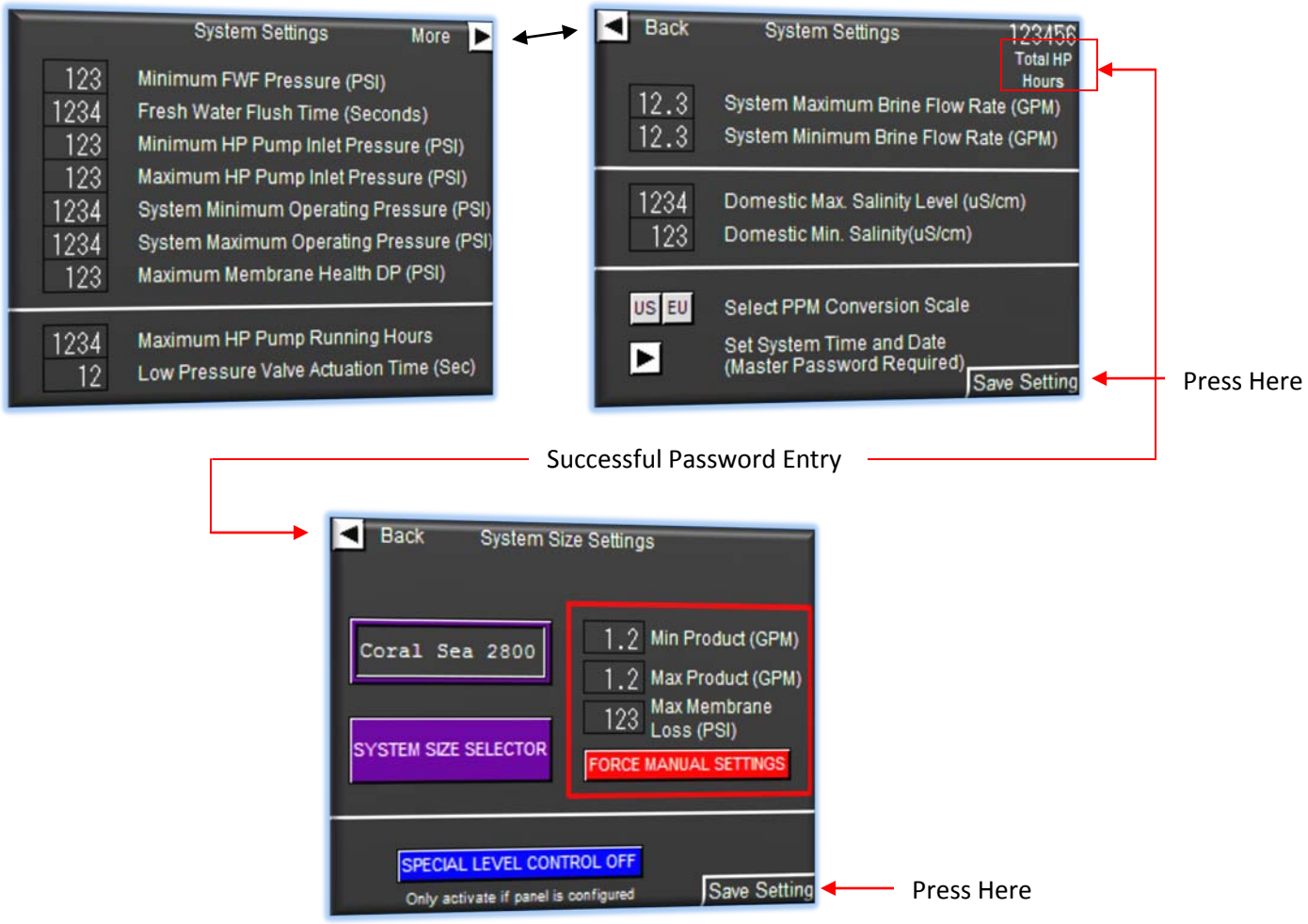
Normal values are automatically entered here as system sizes are adjusted using the 'System Size Selector' button. However in manual mode any value can be entered here.

4.21 Max Membrane Loss (PSI)

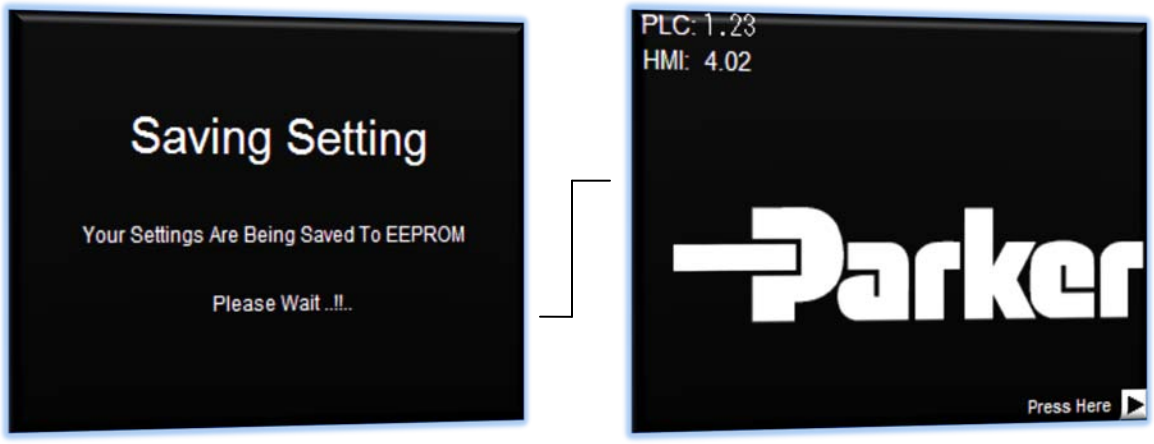
This value determines the calculated pressure differential allowable for the connected/configured membrane rack. This number should not be tampered with unless absolutely required. This number is only valid once the system commissioning engineer has successfully set up the 'Maximum Membrane Health DP (PSI)' (4.10) entry field. This number is used by the system to calculate the current membrane fouling state and drive the indication graphic in the 'Monitors' section.

4.22 Saving System Set-point Data Changes

Once you have completed your system changes you must save your data before being allowed to exit the system set-point editing screens. To save your changes navigate to the second or third set-point editing screen and press the 'Save Setting' button as illustrated on the next page:



If you do not save your settings by pressing the button as shown, the system will automatically save your settings if it monitors that you have not touched the touch screen for 60 seconds, in either case when system settings are being saved the following screen will be shown briefly. Once the saving procedure has been completed, the controller will return to the main splash screen as illustrated on the next page:



Once the system has returned to the main splash screen, set-point data saving is complete and set point editing mode is canceled.

5. Normal Operation

5.1 Overview

The new Coral Sea control system has two possible methods of operation; these are manual mode and automatic mode. In manual mode the controller requires that the operator activate the pumps by turning the relative pump operator switches to the 'Pump On' position. If the user attempts to operate a pump when it is determined by the control system as unsafe to do so, the controller will raise a performance warning (See Performance Warning Messages) detailing the specific reason why the requested pump cannot be started, it will also flash the appropriate pump control switch which is being prevented from operating. The operator must correct the situation before attempting to run the pump again. To request further attempts to run the pump simply turn the relative pump operator switch to the 'Off' position, then back to the 'Pump On' position. If the problem has been rectified the pump will start, if problems still persist further performance warning messages will be raised.

Once successful start up of all connected and enabled pumps has been completed by the operator, the control system will attempt to automatically activate the connected system valves. If the connected valves cannot be successfully activated the control system will raise performance warning messages (See Performance Warning Messages), but will continue to hold the system in an operational state. In the event of these types of failures manual actuation of the valves will be required.

5.2 Starting the System Manually

The Coral Sea has a variety of different pump configuration options available; therefore this manual start up procedure will cover all available options. If your system does not have a discussed option installed simply ignore the relative descriptions.

Before attempting a manual start up procedure it is important to check that all valves are in the correct position as previously identified in the section titled, "System settings prior to attempting operation".

Ensure that the main circuit breaker located in the top right corner of the control panel is in the 'ON' position and that the 'Power On' Indicator on the front of the control panel is illuminated.

Ensure that the E-Stop button is not pressed in. If the E-stop button is illuminated, the button is pressed in, release it by turning the mushroom in a clockwise direction.

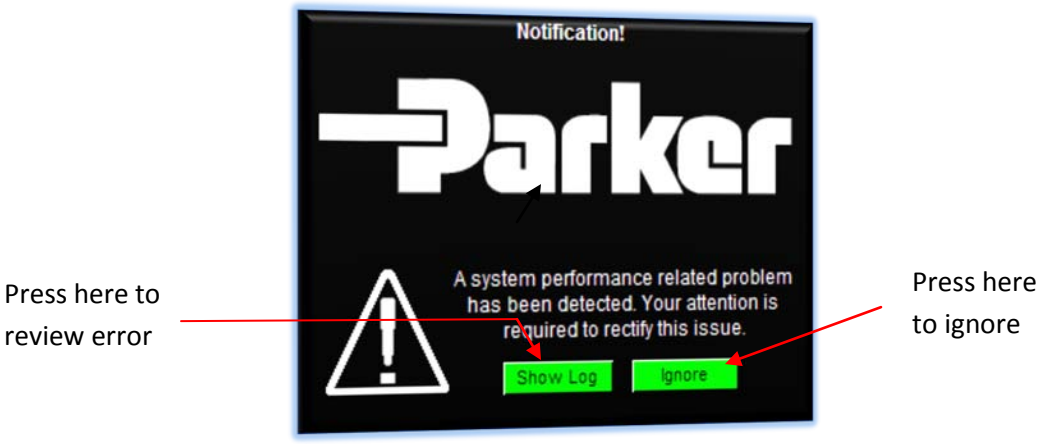
Ensure no alarms or faults are currently being indicated. If the alarm light is illuminated or flashing an alarm or performance warning is present, accept or clear these alarms before attempting to proceed.

5.3 Auxiliary Feed Pump Activation: (If installed)

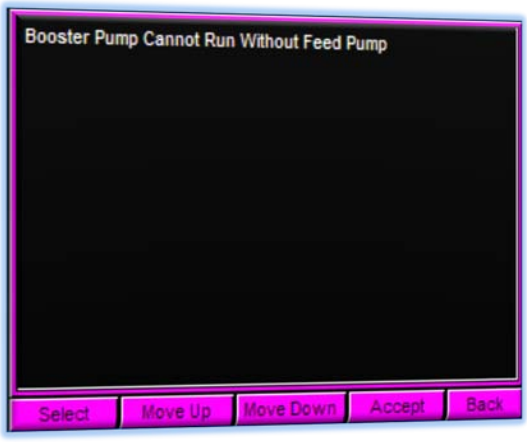
Turn the 'Aux. Pump' operator switch to the 'Pump On' position on the remote pump control panel. The white stop light on the main control panel door as well as the 'Aux. Pump' operator switch indicator on the remote pump control panel will illuminate. To stop the pump either turn the 'Aux. Pump' operator back to the 'Off' position, or press the system 'Auto-Stop' button.

5.4 Booster Pump Activation:

Turn the 'Booster Pump' operator switch to the 'Pump On' position. If the optional feed pump is fitted and running the 'Booster Pump' operator switch indicator will illuminate. If the optional feed pump is fitted but not running the control system will raise a performance warning.



Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:



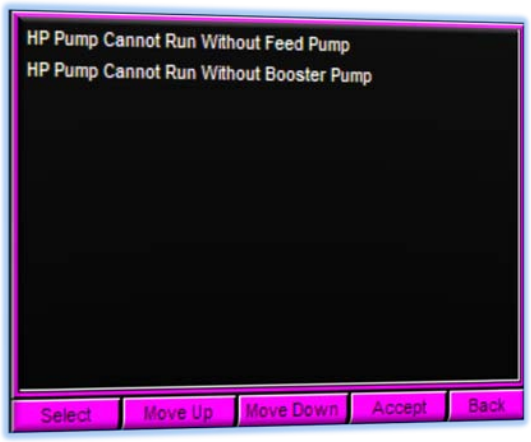
Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

The operator must correct the situation before attempting to continue or restart the pump. To stop the pump either turn the 'Booster Pump' operator back to the 'Off' position, or press the system 'Auto-Stop' button to stop all pumps simultaneously.

5.5 High Pressure Pump Activation:

Turn the 'High Pressure Pump' operator switch to the 'Pump On' position. If the optional feed pump is fitted and running and the 'Booster Pump' is currently running, and no system faults are present, the 'High Pressure Pump' operator switch indicator will illuminate. If there are any problems preventing the high pressure pump from operating the control system will raise a performance warning detailing the problem.

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown on the next page:



Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

The operator must correct the situation before attempting to continue or restart the pump. To stop the pump either turn the 'High Pressure Pump' operator back to the 'Off' position, or press the system 'Auto-Stop' button to stop all pumps simultaneously.

5.6 Auxiliary Product Pump Activation: (If installed)

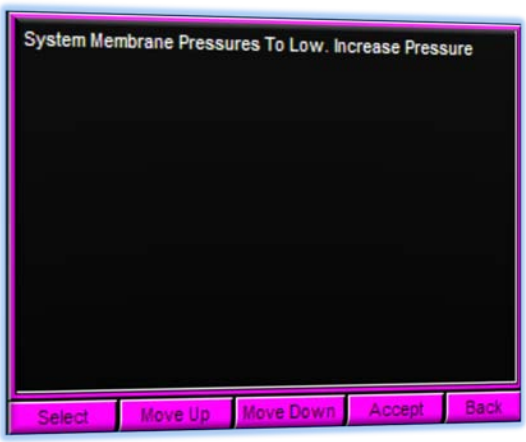
Turn the 'Aux. Pump' operator switch on the remote pump control panel to the 'Pump On' position. The pump operator indicator will not illuminate and the pump will not run until potable water has been detected and successful activation of the product diversion valve has been completed. To stop the pump either turn the 'Aux. Pump' operator back to the 'Off' position, or press the system 'Auto-Stop' button to stop all pumps simultaneously.

5.7 Automatic/Manual Activation of System Valves

Once the operator has successfully started all connected and enabled pumps the control system will examine the health of the system salinity sensor, if the salinity sensor reports an unhealthy state refer to the section labeled (Manual Salinity Control Operation), if the sensor reports a healthy state the control system will begin to monitor membrane pressures. If the system detects pressure are below the

recommended minimum required to product potable water the control system will raise a performance warning message detailing the problem.

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:

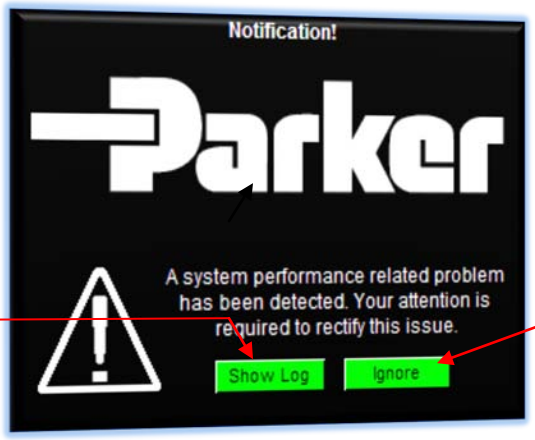


Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

The system will continue to run for a limited time (max 10 minutes), but during this limited time it will not be able to progress any further. The operator must manually increase system pressure by turning the 'System Pressure Regulator' in a clockwise direction. If the operator fails to increase system pressure

to acceptable levels within the time allowed. The control system will automatically shutdown the water maker to prevent damage and wasted electricity. If the operator does manually increase the pressure to acceptable levels as requested the controller will begin to monitor product water salinity levels. Once acceptable salinity levels are detected the controller will activate the UV Sterilizer for 30 seconds (if fitted), if the UV sterilizer is not fitted the controller will skip this step. Once the UV Sterilizer has completed its warm up cycle, or if the controller has skipped this step, it will then attempt to activate the product water diversion valve. If the valve fails to activate properly the control system will raise a performance warning message detailing the problem.

Press here to review error



Press here to ignore

Pressing ‘Ignore’ clears the performance warning; pressing ‘Show Log’ will open the performance warning log window where details concerning the detected problem are given as shown below:

Pressing ‘Select’ will highlight the first alarm item.
Pressing ‘Move Up’ will scroll up through the alarm list
Pressing ‘Move Down’ will scroll down through the alarm list
Pressing ‘Accept’ will clear the listed alarm notifications.

Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

The system will continue to run but will not be able to progress any further. The operator must manually actuate the product diversion valve (See Manual Actuation of System Valves). Once the operator has manually actuated the product diversion valve the controller will activate the product water pump (if enabled) and continue to monitor product water salinity levels. If the salinity levels become unacceptable the controller will attempt the close the diversion valve. If the valve fails to activate properly the control system will raise a performance warning message detailing the problem.

Press here to review error

Press here to ignore

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:

Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list

Pressing ‘Accept’ will clear the listed alarm notifications.
Pressing ‘Back’ will exit the alarm list. Please note the ‘Back’ button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press ‘Accept’ to exit this screen.

The operator must now manually close the product diversion valve as soon as possible to prevent contamination of the potable water supply.

5.8 Manual Salinity Control Operation:

When operating in manual mode, the control system monitors the health of the salinity sensor, if the salinity sensor reports as unhealthy it is still possible to operate the system, however monitoring of the salinity levels will not be available, therefore the operator is required to monitor the salinity levels of the product water manually via the sample ports and using a hand held salinity meter.

In the event that the salinity sensor has failed the control system will present you with the following screen immediately after successful high pressure pump start up.

From this screen you can monitor all available system pressures, flows and salinity readings if they become available, you can also control system valves directly from this screen. In this mode the control system will not continue to carry out any functions automatically, it is now in a fully manual mode. The operator must keep checking the quality of the product water via the sample ports using a handheld salinity meter, once the operator is satisfied that the water is of good quality, they may activate the UV system (if fitted) by pressing the control button located next to it. As they do so, the Domestic Water Diversion Valve control button will change state and display 'WAIT!" in this state activation of the diversion valve is not allowed until the UV system has completed it warm up cycle (approx. 30 seconds). Once this warm up cycle is completed the button will change state to report the domestic diversion valves current position, at this time the operator can activate the valve by pressing on the button. The system will now attempt to open the product diversion valve. If the valve fails to activate properly the control system will raise a performance warning message detailing the problem as shown on the next page:

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:

Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

Pressing 'Accept' returns you to the manual control screen.

The operator must manually actuate the product diversion valve in order to continue (See Manual Actuation of System Valves). Once the valve has been manually actuated, the system will report as 'producing water in manual mode'. Manual control of the product pump is now available (if fitted).The operator must continuously check product water salinity levels to ensure good product water. If high salinity levels are measured again press the diversion valve control button to close the valve. Once this

button is pressed the control system will attempt to close the product diversion valve. If the valve fails to activate properly the control system will raise a performance warning message detailing the problem.

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:

Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

Pressing 'Accept' returns you to the manual control screen.

The operator must manually actuate the product diversion valve as soon as possible to prevent contamination of the potable water supply. (See Manual Actuation of System Valves).

6. Manual Shutdown

To stop the system at any point within manual mode operation simply press the 'Auto-Stop' button, all pumps will stop simultaneously and all activated valves will be requested to return to their home positions. If any valve fails to activate properly the control system will raise performance warning messages or system fault messages detailing the problem(s). Once all pumps have successfully stopped the control system will activate the fresh water flush (if fitted).

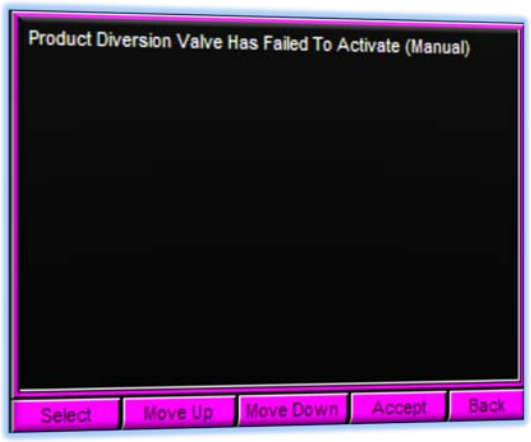
To perform a phased stop of the system in manual mode, individually turn off running pumps. To prevent fault screens from being displayed, it is advisable to shut the pumps down in the reverse order in which they were started.

Turn off the product pump (if fitted), turn off the high pressure pump, when doing so the control system will attempt to return the domestic product water diversion valve to its home position. If this valve fails to activate properly the control system will raise a performance warning message detailing the problem.

Press here to review error

Press here to ignore

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown on the next page:



Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

The system will continue to run in this state, the operator should manually actuate the failed valve (See Manual Actuation of Valves). Once valves have been manually placed in the correct position turn the booster pump off, then turn off the feed pump (if fitted). When the system is shut down manually in this manner fresh water flushing will not take place.

7. Automatic Start up Operation

Automatic start up operation is a new feature added to the Coral Sea Series of products. It allows for virtually hands free start up of the system and all associated equipment. This automatic start up operation can also be carried out remotely via the Modbus communications link (if installed).

Before attempting automatic start up, it is important to check that all valves are in the correct position as previously identified in the section titled, “System settings prior to attempting operation”.

Ensure that the main circuit breaker located in the top right corner of the control panel is in the ‘ON’ position and that the ‘Power On’ Indicator on the front of the control panel is illuminated.

Ensure that the E-Stop button is not pressed in. If the E-stop button is illuminated, the button is pressed in, release it by turning the mushroom in a clockwise direction.

Ensure no alarms or faults are currently being indicated. If the alarm light is illuminated or flashing an alarm or performance warning is present, accept or clear these alarms before attempting to proceed.

To initiate an automatic start up of the system simply press the ‘Auto-Start’ button on the control panel door or navigate to the ‘System Operation’ screen (See Menu Navigation). Once the screen has been accessed press the ‘Start’ button.

Immediately after the ‘Auto-Start’ button is pressed, the green indicator light embedded in the button will begin to flash rapidly, at this moment the system is performing system pre-checks, if a problem is detected the system will abort the automatic start-up routine and display a system fault notification screen detailing the problem (See System Critical Error Messages), as shown on the next page:

Press here to review fault

Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown below:

Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Clear' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Clear' to exit this screen.

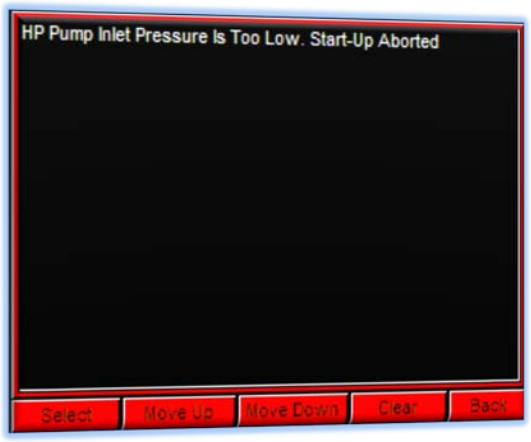
The operator must correct the detected problem before re-attempting automatic operation.

If no pre-check errors are detected the control system will begin a 10 second count-down. During the count-down the system will beep intermittently and display a warning screen as shown on the next page:

Once the 10 second count-down has been completed the control system will activate the auxiliary feed pump (if fitted), once the auxiliary feed pump has successfully run for 10 seconds, or if the auxiliary feed pump is not fitted the control system will start the booster pump. The control system now performs system pressure checks before continuing. If system pressures fail to reach expected levels the system will abort the automatic operation routine. All running pumps will be shutdown and the controller will display a system fault notification screen detailing the problem (See System Critical Error Messages), as shown below:

Press here to review fault

Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown on the next page:



Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Clear' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Clear' to exit this screen.

The operator must correct the detected problem before re-attempting automatic operation.

If pre-filtration pressures reach expected levels the control system will begin to monitor high pressure pump inlet and outlet pressures, if inlet pressures drop below pre-set limits the automatic operation routine is aborted. All running pumps are shutdown and the controller will display a system fault notification screen detailing the problem (See System Critical Error Messages), as shown below:

Press here to review fault

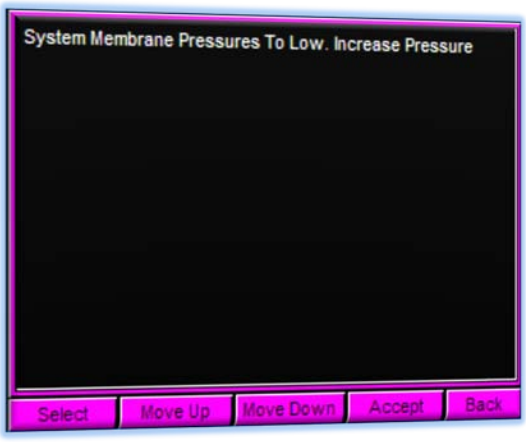
Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown below:

Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Clear' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Clear' to exit this screen.

The operator must correct the detected problem before re-attempting automatic operation.

If inlet pressure remains at acceptable levels the system will monitor the high pressure pumps outlet pressure. If after 60 seconds of operation the outlet pressure of the pump is too low the control system will display a performance warning message detailing the problem.

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:

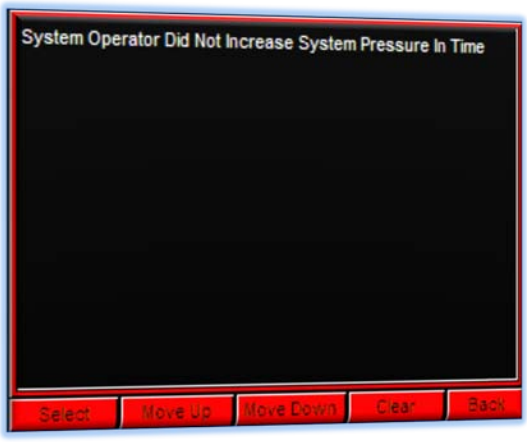


Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

The system will continue to operate in this state for a further 10 minutes. If the system pressure has not been raised above minimum levels within this time the automatic operation routine will be aborted. All running pumps are shutdown, and the controller will display a system fault notification screen detailing the problem (See System Critical Error Messages), as shown below:

Press here to review fault

Pressing ‘Show Log’ will open the system fault log window where details concerning the detected fault are given as shown below:



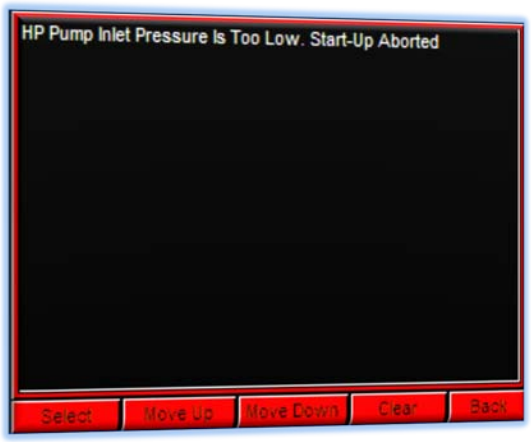
Pressing ‘Select’ will highlight the first alarm item.
Pressing ‘Move Up’ will scroll up through the alarm list
Pressing ‘Move Down’ will scroll down through the alarm list
Pressing ‘Clear’ will clear the listed alarm notifications.
Pressing ‘Back’ will exit the alarm list. Please note the ‘Back’ button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press ‘Clear’ to exit this screen.

The operator must increase pressure within the specified time in order to avoid this system fault. High pressure pump outlet pressure monitoring is provided to protect the high pressure pumps internal moving parts. If the high pressure pump is operated at too lower a pressure there is not enough internal pressure to effectively lubricate the pumps moving surfaces, this will result in rapid wear of the pump piston shoes and other essential moving parts, also while running the unit at such low pressures it is not possible to produce potable water and therefore a waste of facility electricity.

If high pressure pump outlet pressures are deemed above minimum and below maximum the system will begin monitoring product water salinity levels. If at any point high pressure pump outlet or inlet pressures stray beyond acceptable levels the automatic operation routine will be aborted. All running pumps are shutdown, and the controller will display a system fault notification screen detailing the problem (See System Critical Error Messages), as shown on the next page:

Press here to review fault

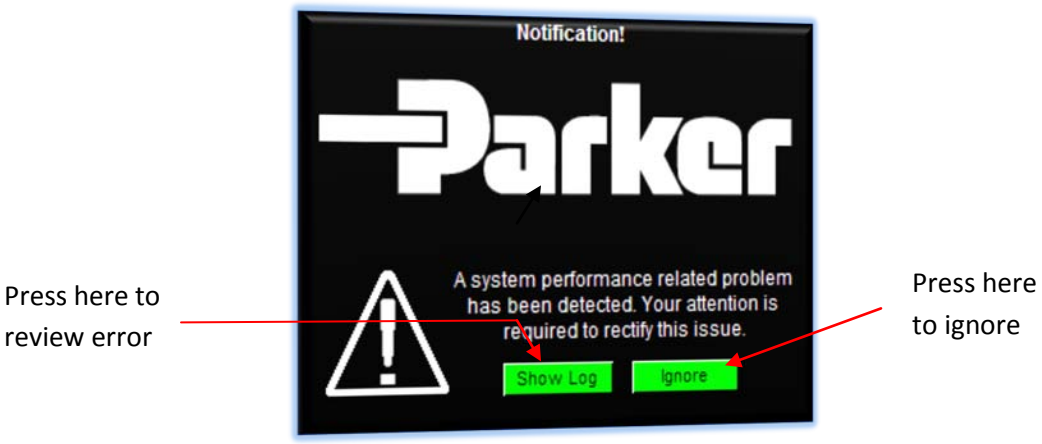
Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown below:



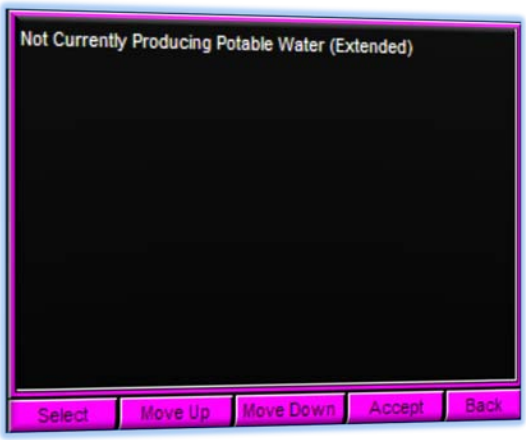
Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Clear' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Clear' to exit this screen.

The operator must correct the detected problem before re-attempting automatic operation.

If all systems are reporting healthy and within expected limits, the system will continue monitoring product water salinity levels. If acceptable salinity levels are not detected within 10 minutes of operation the control system will display a performance warning message detailing the problem, as shown below:



Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:



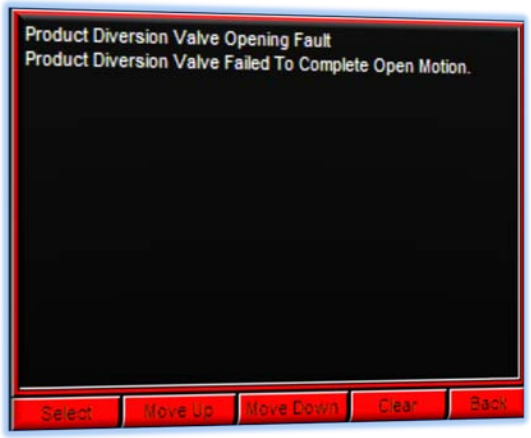
Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

The system will continue to operate in this state continuously or until shutdown by the operator or a fault is detected.

Once acceptable salinity levels have been detected and appear stable. On systems with UV Sterilizers (if fitted), the control system will activate the UV Sterilizer warm up routine. Once the UV Sterilizer has completed the warm up cycle, or if a UV Sterilizer is not fitted to the system, the control system will attempt to activate the diversion valve. If the valve fails to activate correctly the automatic operation routine will be aborted. All running pumps are shutdown, all activated valves are requested to return to their home position, and the controller will display a system fault notification screen detailing the problem (See System Critical Error Messages), as shown below:

Press here to review fault

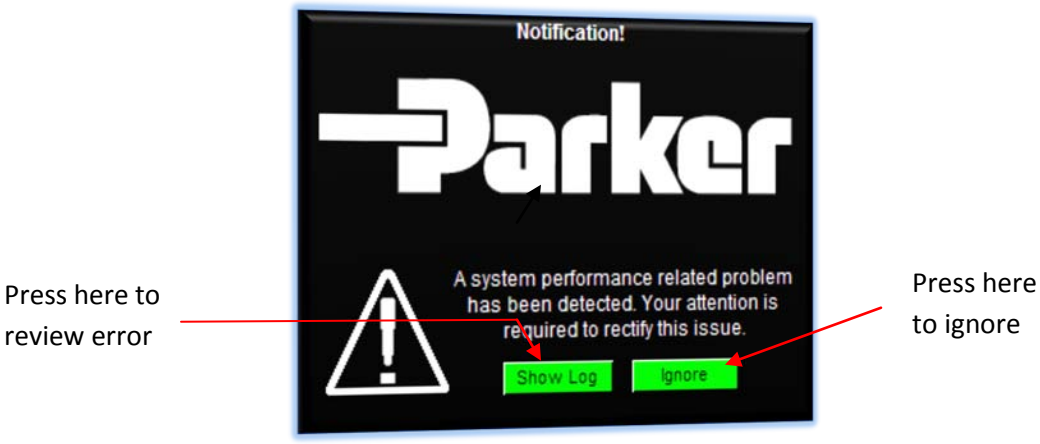
Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown below:



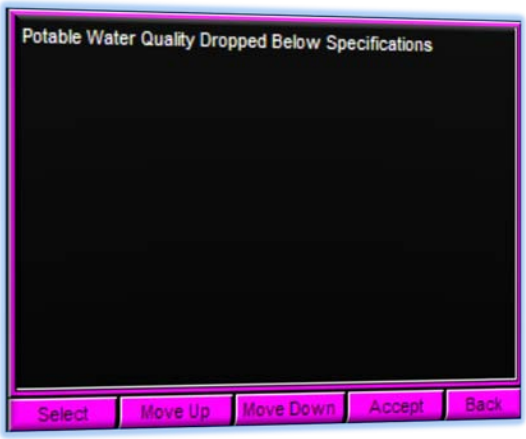
Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Clear' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Clear' to exit this screen.

The operator must correct the detected problem before re-attempting automatic operation.

If the product diversion valve activates successfully the control system will activate the product auxiliary pump (if fitted). At this point the unit is classified as fully operational. If product water salinity levels stray beyond acceptable limits the control system will raise a performance warning detailing the problem.



Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:

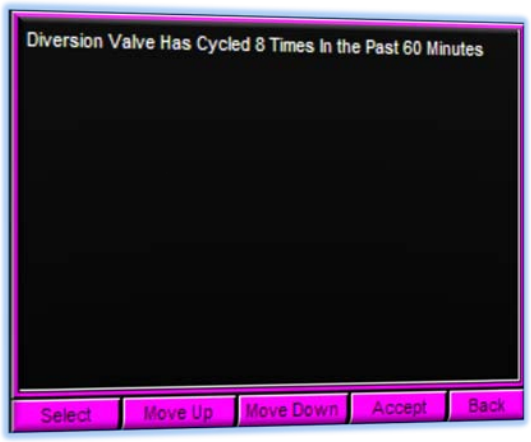


Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

It will also de-activate the product diversion valve, deactivate the product auxiliary pump, and place the UV Sterilizer system into a shutdown routine (if fitted). If acceptable salinity levels are detected once again, the control system will activate the UV Sterilizer warm up routine (if fitted), and when appropriate re-activate the product water diversion valve. The system will remain in this cycle until shutdown by the operator or until a system fault is detected.

If the product diversion valve cycles 8 times within a 60 minute period, the control system will issue a performance warning message detailing the problem; it is advisable to check system settings at this time to ensure optimum performance. This type of message is usually generated when system pressures are insufficient to generate acceptable potable water given the quality of the current feed water.

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown on the next page:



Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

The system will continue to operate in this state continuously or until shutdown by the operator, or a fault is detected.

8. Automatic Shut down Operation:

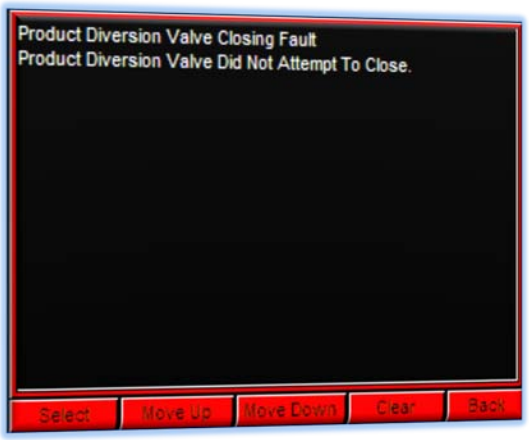
At any time in the automatic start up process the system can be shut down by pressing the 'Auto-Stop' button, pressing this button results in a controlled shutdown of the system. This controlled shut down can take up to 45 seconds to complete depending on where the system was in its automatic start up routine at the time the 'Auto-Stop' button was pressed.

Once pressed the 'Auto-Stop' button will begin to flash. This response is to inform you a system shutdown is now in progress. Once the system shut down is completed the 'System Auto Stop' light will remain steadily illuminated.

If a system fault is detected during shutdown the controller will display a system fault notification screen detailing the problem (See System Critical Error Messages), as shown below:

Press here to review fault

Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown below:



Pressing ‘Select’ will highlight the first alarm item.
Pressing ‘Move Up’ will scroll up through the alarm list
Pressing ‘Move Down’ will scroll down through the alarm list
Pressing ‘Clear’ will clear the listed alarm notifications.
Pressing ‘Back’ will exit the alarm list. Please note the ‘Back’ button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press ‘Clear’ to exit this screen.

The operator must correct the detected problem before re-attempting automatic operation.

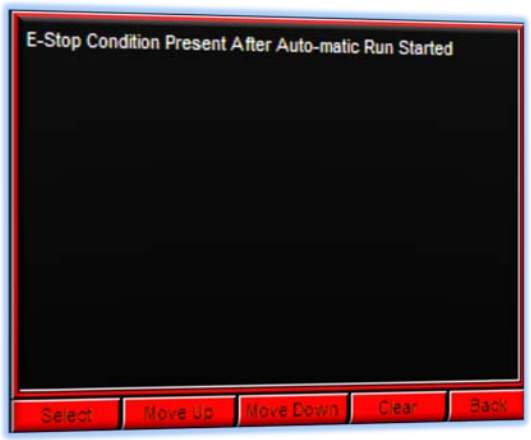
9. Emergency Shutdown Operation:

To shut down the system in an emergency press the E-Stop button, pressing this button cause all rotating equipment to cease immediately. It will also cause the 'Auto-Stop' button to flash. This flashing indicator is signaling to you what will happen when you release the E-Stop button. Once the E-Stop is released the system will move any activated valves to their home position (if applicable), the 'Auto-Stop' button will remain steadily illuminated once this action is completed.

The controller will also display a system fault notification screen detailing that the E-Stop button was activated during operation (See System Critical Error Messages), as shown below:

Press here to review fault

Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown below:



Pressing ‘Select’ will highlight the first alarm item.
Pressing ‘Move Up’ will scroll up through the alarm list
Pressing ‘Move Down’ will scroll down through the alarm list
Pressing ‘Clear’ will clear the listed alarm notifications.
Pressing ‘Back’ will exit the alarm list. Please note the ‘Back’ button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press ‘Clear’ to exit this screen.

The operator must release the E-Stop button and accept this warning before re-attempting automatic operation.

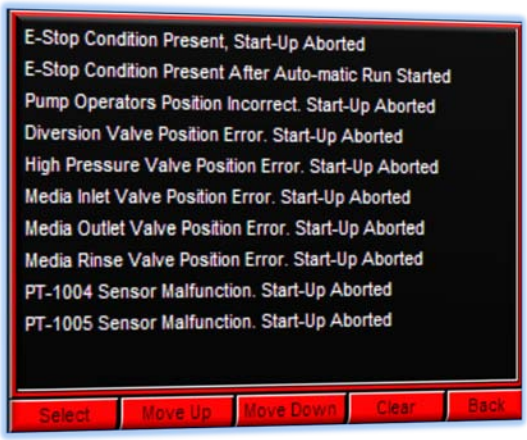
10. System Critical Error Messages

The Coral Sea control system contains three message centers, all of which are intended to provide as much information to the operator as possible. The main of the three message centers is the critical error message center.

During operation if a system failure occurs which could result in the unsafe operation of the water maker, the fault is deemed as a 'Critical Error'. These types or faults cause an immediate shutdown of the water maker and all associated equipment. The critical error message center is the information window used by the operator to examine system faults of this nature. Typically when these faults occur they are preceded by a 'System Warning' screen as shown below:

Press here to review fault

Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown below:



Pressing ‘Select’ will highlight the first alarm item.
Pressing ‘Move Up’ will scroll up through the alarm list
Pressing ‘Move Down’ will scroll down through the alarm list
Pressing ‘Clear’ will clear the listed alarm notifications.
Pressing ‘Back’ will exit the alarm list. Please note the ‘Back’ button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press ‘Clear’ to exit this screen.

When a system fault is detected the system fault light remains steadily illuminated, and the general alarm contact also changes state until the fault is cleared by the operator, this can be done by pressing the clear button on the touch screen or by pressing and holding the ‘Auto-Stop’ button for 2 seconds.

10.1 System fault codes and possible causes

Number	Fault Displayed	Possible Causes
1	E-Stop Condition Present, Start-Up Aborted	The E-Stop button was pressed in when an automatic start was requested. Release the E-stop button by turning it in a clockwise direction before continuing
2	E-Stop Condition Present After Automatic Run Started	Once the system was running the E-Stop button was pressed. Release the E-Stop button by turning it in a clockwise direction before continuing
3	Pump Operators Position Incorrect. Start-Up Aborted	All enabled pump operator switches must be placed into the 'Auto' position. If these switches are not in the 'Auto' position, auto starting will be prohibited.
4	Diversion Valve Position Error. Start-Up Aborted	The product diversion valve is not currently in the correct position (closed) for starting. Check that the valve is switched to auto and that the current position is correct.
5	Reserved	Reserved For Future Use
6	Media Inlet Valve Position Error. Start-Up Aborted **	The media filter inlet valve is not currently in the correct position (closed) for starting. Check that the valve is switched to auto and that the current position is correct
7	Media Outlet Valve Position Error. Start-Up Aborted **	The media filter outlet valve is not currently in the correct position (closed) for starting. Check that the valve is switched to auto and that the current position is correct
8	Media Rinse Valve Position Error. Start-Up Aborted **	The media filter rinse valve is not currently in the correct position (closed) for starting. Check that the valve is switched to auto and that the current position is correct
9	PT-1004 Sensor Malfunction. Start-Up Aborted	Pressure transducer PT-1004 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing

10	PT-1005 Sensor Malfunction. Start-Up Aborted	Pressure transducer PT-1005 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
11	PT-1006 Sensor Malfunction. Start-Up Aborted **	Pressure transducer PT-1006 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
12	TDS-1001 Sensor Malfunction. Start-Up Aborted	Salinity transmitter TDS-100 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
13	FT-1001 Sensor Malfunction. Start-Up Aborted	Flow transducer FT-1001 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
14	FT-1002 Sensor Malfunction. Start-Up Aborted	Flow transducer FT-1002 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
15	PT-1001 Sensor Malfunction. Start-Up Aborted **	Pressure transducer PT-1001 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
16	PT-1002 Sensor Malfunction. Start-Up Aborted **	Pressure transducer PT-1002 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
17	PT-1003 Sensor Malfunction. Start-Up Aborted **	Pressure transducer PT-1003 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
18	PT-1007 Sensor Malfunction. Start-Up Aborted **	Pressure transducer PT-1007 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing

19	PT-1000 Sensor Malfunction. Start-Up Aborted **	Pressure transducer PT-1000 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
20	PT-1008 Sensor Malfunction. Start-Up Aborted **	Pressure transducer PT-1008 is reporting a fault. Check the system messaging area for help diagnosing the type of failure detected, and rectify before continuing
21	HP Pump Outlet Pressure Too High. Start-Up Aborted	The outlet pressure of the high pressure pump was driven too high; this caused the control system to shutdown the unit. Run the system at pressures below maximum (975 PSI)
22	HP Sensor Overridden When HP Switch Detected Fault	The system was operating in emergency mode (PT-1005 By-passed) when the high pressure switch detected an over pressure situation. Check system pressures and ensure they are below maximum.
23	High Pressure Sensor Override Time Limit Reached	The system was operating in emergency mode (PT-1005 By-passed) for the maximum allowable time (100hrs). Replace the by-passed sensor before continuing, or contact PSRC for further help.
24	Membrane Outlet Pressure Too High. Start-Up Aborted	The outlet pressure of the membrane chain was driven too high; this caused the control system to shutdown the unit. Run the system at pressures below maximum (975 PSI)
25	Feed Pump Did Not Respond To Auto run Command	Auto-start attempted to start the feed pump but for some reason the pump did not start, check system contactors and overloads for fault indication
26	Booster Pump Did Not Respond To Auto run Command	Auto-start attempted to start the booster pump but for some reason the pump did not start, check system contactors and overloads for fault indication
27	HP Pump Inlet Pressure Too Low. Start-Up Aborted	Auto-start could not start the high pressure pump because inlet pressures to the pump did not reach required values. Check the system filtration chain for clogged filters, backwash the sand filter if required

28	HP Pump Inlet Pressure Too High. Start-Up Aborted	Auto-start could not start the high pressure pump because inlet pressures to the pump exceeded specifications. Check feed line pressure regulation equipment and ensure inlet pressure to the system is not exceeding specified maximums (10 PSI)
29	Low Pressure Sensor Override Time Limit Reached	The system was operating in emergency mode (PT-1004 By-passed) for the maximum allowable time (100hrs). Replace the by-passed sensor before continuing, or contact PSRC for further help.
30	LP Sensor Overridden When LP Switch Detected Fault	The system was operating in emergency mode (PT-1004 By-passed) when the low pressure switch detected an under pressure situation. Check filtration system for blockages, and backwash the sand filter if required.
31	HP Pump Did Not Respond To Auto run Command	Auto-start attempted to start the high pressure pump but for some reason the pump did not start, check system contactors and fuses for fault indication
32	Operator Did Not Increase System Pressure Within Time	Auto-start energized all connected pumps, but the system operator did not increase system operating pressure to above minimum within allowable time. Re-start unit and increase system pressures to within normal operating specifications
33	TDS-1001 Commissioning Error. Start-Up Aborted	Auto-start cannot start and control the system because the salinity sensor is reporting as disabled. This has been caused by a configuration error. Contact PSRC for assistance
34	Booster Pump Outlet Pressure Below Minimum Set-Point**	The system was attempting to backwash and rinse the media filter when it detected the output of the booster pump drop below minimum allowable set-points, this condition triggered a shutdown of the unit
35	Backwash Fault Media Inlet Valve Position Inappropriate**	The system was attempting to backwash and rinse the media filter when a position feedback failure of the media inlet valve was detected, the failure in position feedback has triggered a shutdown.
36	Backwash Fault Media Outlet Valve Position Inappropriate**	The system was attempting to backwash and rinse the media filter when a position feedback failure of the media outlet valve was detected, the failure in position feedback has triggered a shutdown.

37	Backwash Fault Media Rinse Valve Position Inappropriate**	The system was attempting to backwash and rinse the media filter when a position feedback failure of the media inlet valve was detected, the failure in position feedback has triggered a shutdown
38	E-Stop Condition During Backwash, Sequence Aborted**	The system was attempting to backwash and rinse the media filter when the system operator pressed the E-stop. This action triggered a full abort of the media backwash cycle and shutdown the unit.
39	System Brine Flow Exceeded Maximum Set-Point	The system has detected brine flows in excess of 130% of normal values. To protect the integrity of the location in which the water maker is installed the controller shutdown the water maker for fear of a large scale leak.
40	High Pressure Pump Inlet Pressure Too Low (Manual)	The system was operating in manual mode when the inlet pressure to the high pressure pump dropped below minimum levels. Check filtration chain for blockages and back wash media filter if required
41	High Pressure Pump Inlet Pressure Too High (Manual)	The system was operating in manual mode when inlet pressures to the high pressure pump exceeded specifications. Check feed line pressure regulation equipment and ensure inlet pressure to the system is not exceeding specified maximums (10 PSI)
42	High Pressure Pump Outlet Pressure Too High (Manual)	The outlet pressure of the high pressure pump was driven too high; this caused the control system to shutdown the unit. Run the system at pressures below maximum (975 PSI)
43	High Pressure Pump Inlet Low Pressure Switch Fault	The system was operating in manual mode when inlet pressures to the high pressure pump dropped below minimum specifications and detected via the low pressure switch. Check filtration chain for blockages and back wash the media filter if required
44	High Pressure Pump Outlet High Pressure Switch Fault	The system was operating in manual mode when outlet pressures of the high pressure pump exceeded specifications and detected via the high pressure switch. Run the system at pressures below maximum (975 PSI)

45	Manual Start Failed. Low Pressure Sensor Fault Detected	The operator attempted to run the system in manual mode but during the start-up procedure the control system detected a fault with the low pressure sensor (PT-1004) and the manual run was aborted to protect the system from damage. Enter the system status message center for further details of the fault. Rectify the fault or override the sensor before continuing.
46	Manual Start Failed. High Pressure Sensor Fault Detected	The operator attempted to run the system in manual mode but during the start-up procedure the control system detected a fault with the high pressure sensor (PT-1005) and the manual run was aborted to protect the system from damage. Enter the system status message center for further details of the fault. Rectify the fault or override the sensor before continuing.
47	Domestic Diversion Valve Position Feedback Lost	The control system has lost all position feedback from the product diversion valve. Check valve wiring for breaks or snags, check 5 x 20mm fuses within the control panel for failures (indicated by red light)
48	Domestic Diversion Valve Did Not Attempt To Open	The control system commanded the product diversion valve to open but the valve did not respond to the command at all. Check that the valve is switch to 'Auto' and that all power wiring is free from breaks or snags. Check 5 x 20mm fuses within the control panel for failures (indicated by red light)
49	Domestic Diversion Valve Failed To Complete Open Motion	The control system commanded the product diversion valve to open. The valve responded to the command but failed to open fully in the time allowed. Probable cause of failure is either power loss to the valve, or a worn and failing actuator. Check 5 x 20 mm fuses within control panel for failures (indicated by red light)
50	Domestic Diversion Valve Opening Fault	This fault indicator is usually raised along with either a failure to respond to open command fault, or an open command motion failed to complete.
51	Domestic Diversion Valve Closing Fault	This fault indicator is usually raised along with either a failure to respond to close command fault, or a close command motion failed to complete.

52	Domestic Diversion Valve Did Not Attempt To Close	The control system commanded the product diversion valve to close but the valve did not respond to the command at all. Check that the valve is switch to 'Auto' and that all power wiring is free from breaks or snags. Check 5 x 20mm fuses within the control panel for failures (indicated by red light)
53	Domestic Diversion Valve Failed To Complete Close Motion	The control system commanded the product diversion valve to close. The valve responded to the command but failed to close completely in the time allowed. Probable cause of failure is either power loss to the valve, or a worn and failing actuator. Check 5 x 20 mm fuses within control panel for failures (indicated by red light)
54	Media Filter Inlet Valve Position Feedback Lost**	The control system has lost all position feedback from the media filter inlet valve. Check valve wiring for breaks or snags, check 5 x 20mm fuses within the control panel for failures (indicated by red light)
55	Media Filter Inlet Valve Did Not Attempt To Open**	The control system commanded the media filter inlet valve to open but the valve did not respond to the command at all. Check that the valve is switch to 'Auto' and that all power wiring is free from breaks or snags. Check 5 x 20mm fuses within the control panel for failures (indicated by red light)
56	Media Filter Inlet Valve Failed To Complete Open Motion**	The control system commanded the media filter inlet valve to open. The valve responded to the command but failed to open fully in the time allowed. Probable cause of failure is either power loss to the valve, or a worn and failing actuator. Check 5 x 20 mm fuses within control panel for failures (indicated by red light)
57	Media Filter Inlet Valve Opening Fault**	This fault indicator is usually raised along with either a failure to respond to open command fault, or an open command motion failed to complete.
58	Media Filter Inlet Valve Closing Fault**	This fault indicator is usually raised along with either a failure to respond to close command fault, or a close command motion failed to complete.

59	Media Filter Inlet Valve Did Not Attempt To Close**	The control system commanded the media filter inlet valve to close but the valve did not respond to the command at all. Check that the valve is switch to 'Auto' and that all power wiring is free from breaks or snags. Check 5 x 20mm fuses within the control panel for failures (indicated by red light)
60	Media Filter Inlet Valve Failed To Complete Close Motion**	The control system commanded the media filter inlet valve to close. The valve responded to the command but failed to close completely in the time allowed. Probable cause of failure is either power loss to the valve, or a worn and failing actuator. Check 5 x 20 mm fuses within control panel for failures (indicated by red light)
61	Media Filter Outlet Valve Position Feedback Lost**	The control system has lost all position feedback from the media filter outlet valve. Check valve wiring for breaks or snags, check 5 x 20mm fuses within the control panel for failures (indicated by red light)
62	Media Filter Outlet Valve Did Not Attempt To Open**	The control system commanded the media filter outlet valve to open but the valve did not respond to the command at all. Check that the valve is switch to 'Auto' and that all power wiring is free from breaks or snags. Check 5 x 20mm fuses within the control panel for failures (indicated by red light)
63	Media Filter Outlet Valve Failed To Complete Open Motion**	The control system commanded the media filter outlet valve to open. The valve responded to the command but failed to open fully in the time allowed. Probable cause of failure is either power loss to the valve, or a worn and failing actuator. Check 5 x 20 mm fuses within control panel for failures (indicated by red light)
64	Media Filter Outlet Valve Opening Fault**	This fault indicator is usually raised along with either a failure to respond to open command fault, or an open command motion failed to complete.
65	Media Filter Outlet Valve Closing Fault**	This fault indicator is usually raised along with either a failure to respond to close command fault, or a close command motion failed to complete.

66	Media Filter Outlet Valve Did Not Attempt To Close**	The control system commanded the media filter outlet valve to close but the valve did not respond to the command at all. Check that the valve is switch to 'Auto' and that all power wiring is free from breaks or snags. Check 5 x 20mm fuses within the control panel for failures (indicated by red light)
67	Media Filter Outlet Valve Failed To Complete Close Motion**	The control system commanded the media filter outlet valve to close. The valve responded to the command but failed to close completely in the time allowed. Probable cause of failure is either power loss to the valve, or a worn and failing actuator. Check 5 x 20 mm fuses within control panel for failures (indicated by red light)
68	Media Filter Rinse Valve Position Feedback Lost**	The control system has lost all position feedback from the media filter inlet rinse. Check valve wiring for breaks or snags, check 5 x 20mm fuses within the control panel for failures (indicated by red light)
69	Media Filter Rinse Valve Did Not Attempt To Open**	The control system commanded the media filter rinse valve to open but the valve did not respond to the command at all. Check that the valve is switch to 'Auto' and that all power wiring is free from breaks or snags. Check 5 x 20mm fuses within the control panel for failures (indicated by red light)
70	Media Filter Rinse Valve Failed To Complete Open Motion**	The control system commanded the media filter rinse valve to open. The valve responded to the command but failed to open fully in the time allowed. Probable cause of failure is either power loss to the valve, or a worn and failing actuator. Check 5 x 20 mm fuses within control panel for failures (indicated by red light)
71	Media Filter Rinse Valve Opening Fault**	This fault indicator is usually raised along with either a failure to respond to open command fault, or an open command motion failed to complete.
72	Media Filter Rinse Valve Closing Fault**	This fault indicator is usually raised along with either a failure to respond to close command fault, or a close command motion failed to complete.

73	Media Filter Rinse Valve Did Not Attempt To Close**	The control system commanded the media filter rinse valve to close but the valve did not respond to the command at all. Check that the valve is switch to 'Auto' and that all power wiring is free from breaks or snags. Check 5 x 20mm fuses within the control panel for failures (indicated by red light)
74	Media Filter Rinse Valve Failed To Complete Close Motion**	The control system commanded the media filter rinse valve to close. The valve responded to the command but failed to close completely in the time allowed. Probable cause of failure is either power loss to the valve, or a worn and failing actuator. Check 5 x 20 mm fuses within control panel for failures (indicated by red light)

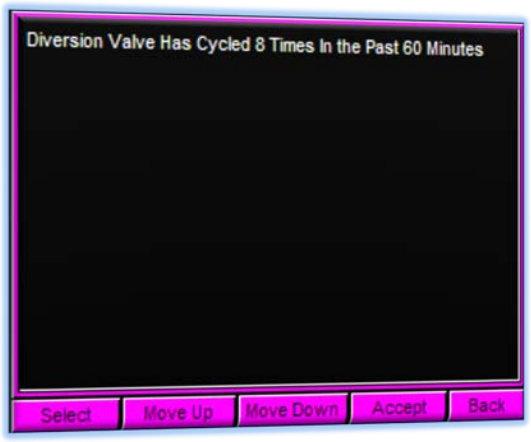
** = Indicates optional components

11. System Performance Messages

The Coral Sea control system contains three message centers, all of which are intended to provide as much information to the operator as possible. The most commonly displayed of the three message centers is the performance message center.

During operation, if a system fault which results in the water maker not operating at peak efficiency is detected, the fault is deemed as a 'Non Critical Error'. These types of faults do not require an immediate shutdown of the water maker. While safe to do so the water maker will continue to run and prompt the operator that attention is required by logging the fault in the performance message center. The performance message center is the information window used by the operator to examine system faults of this nature. Typically when these faults occur they are preceded by a 'Performance Warning' screen as shown below:

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown on the next page:



Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

When a system performance fault is detected the system fault indicator will blink at 0.5 second intervals, the general alarm contact will not change state in these situations. The system fault indicator will continue to blink until the fault is accepted by the operator; this can be done by pressing the 'Accept' button in the performance message center or by pressing 'Ignore' in the preceding performance warning screen. Once a fault has been accepted the system fault indicator will stop blinking, but a log of the fault is kept within the performance message center. This list of potential problems can be viewed at any time by manually navigating back to the performance message center (See Menu Navigation)

11.1 System performance notifications and possible causes

Number	Message Displayed	Possible Causes
1	Booster Pump Cannot Run Without Feed Pump	The operator is attempting to manually run the booster pump but has neglected to start the enabled auxiliary feed pump first. Switch off the booster, and start the auxiliary feed pump before continuing
2	HP Pump Cannot Run Without Feed Pump	The operator is attempting to manually run the high pressure pump but has neglected to start the enabled auxiliary feed pump first. Switch off the high pressure pump, and start the auxiliary feed pump before continuing
3	HP Pump Cannot Run Without Booster Pump	The operator is attempting to manually run the high pressure pump but has neglected to start the booster pump first. Switch off the high pressure pump, and start the booster pump before continuing
4	HP Pump Cannot Run Inlet Pressure is too Low	The operator is attempting to manually run the high pressure pump, but inlet pressure to the pump is too low. Check the filtration chain, and backwash the media filter if required
5	HP Pump Cannot Run Inlet Pressure is too High	The operator is attempting to manually run the high pressure pump, but inlet pressure to the pump is too high. Check feed line pressure regulation equipment and ensure inlet pressure to the system is not exceeding specified maximums (10 PSI)
6	HP Pump Cannot Run Pump Outlet Pressure is too High	The operator is attempting to manually run the high pressure pump, but the outlet pressure of the pump is currently too high. Relieve pressure in the system by adjusting the back pressure regulator setting
7	HP Pump Cannot Run Membrane Outlet Pressure is too High	The operator is attempting to manually run the high pressure pump, but the outlet pressure of the membrane chain is currently too high. Relieve pressure in the system by adjusting the back pressure regulator setting
8	Pumps Cannot Be Operated When E-Stop Button Activated	The operator is attempting to run a pump, but the E-Stop system has been activated. Check all E-Stop buttons and release any currently pressed in by turning in a clockwise direction

9	Sensor PT-1004 In By-pass Mode	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1004 pressure sensor. The system can only operate in this state for a limited time. Consult PSRC for additional information
10	Sensor PT-1005 In By-pass Mode	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1005 pressure sensor. The system can only operate in this state for a limited time. Consult PSRC for additional information
11	Sensor PT-1006 In By-pass Mode**	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1006 pressure sensor.
12	Sensor TDS-1001 In By-pass Mode (Manual Mode Active)	The operator has entered the emergency override screen and activated the emergency by-pass of the TDS-1001 salinity transmitter. Operation of the unit is still possible. However operation of the product diversion valve will need to be carried out manually.
13	Sensor FT-1001 In By-pass Mode	The operator has entered the emergency override screen and activated the emergency by-pass of the FT-1001 flow sensor.
14	Sensor FT-1002 In By-pass Mode	The operator has entered the emergency override screen and activated the emergency by-pass of the FT-1002 flow sensor.
15	Sensor PT-1001 In By-pass Mode**	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1001 pressure sensor.
16	Sensor PT-1002 In By-pass Mode**	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1002 pressure sensor.

17	Sensor PT-1003 In By-pass Mode**	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1003 pressure sensor.
18	Sensor PT-1007 In By-pass Mode**	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1007 pressure sensor.
20	Sensor PT-1000 In By-pass Mode**	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1000 pressure sensor.
21	Sensor PT-1008 In By-pass Mode**	The operator has entered the emergency override screen and activated the emergency by-pass of the PT-1008 pressure sensor.
22	PT-1005 In Bypass Mode, Emergency Mode Active	The operator has activated the emergency by-pass of pressure sensor PT-1005, and is now operating the system. Operation is allowed to continue until the maximum preset time has elapsed (100hrs). Contact PSRC for additional information
23	PT-1004 In Bypass Mode, Emergency Mode Active	The operator has activated the emergency by-pass of pressure sensor PT-1004, and is now operating the system. Operation is allowed to continue until the maximum preset time has elapsed (100hrs). Contact PSRC for additional information
24	System Membrane Pressure Below Min Specifications	The operator is running the system in automatic mode, but has failed to increase system operating pressures to normal levels. The currently pressure is too low for continuous operation; failure to increase pressure will result in an automatic shutdown.
25	Not Currently Producing Potable Water (Extended)	The system is running in automatic mode, but has not been able to product potable water within the normal time frames. Check system pressure settings

26	Potable Water Quality Dropped Below Specifications	The system is running in automatic mode and was producing potable water, but for some unknown reason the water quality of the product water deteriorated and is no longer acceptable. Check system pressure settings
27	Diversion Valve Has Cycled 8 Times In the Past 60 Minutes	The system is running in automatic mode and was producing potable water, but for some unknown reason the water quality of the product water fluctuated between potable and non potable 8 times within the last 60 minutes. Check system pressure settings
28	High Pressure Pump Requires Servicing	The high pressure pump has run for more than 8000 hrs and now requires servicing
29	Reserved	Reserved For Future Use
30	Domestic Diversion Valve Has Failed To Activate (Man)	The operator is running the system manually, and automatic activation of the product diversion valve failed to complete successfully. To continue the operator must actuate the valve manually
31	Insufficient Fresh Water Flush Inlet Pressure**	Fresh water flush mode is currently active but insufficient pressure is detected at the fresh water flush inlet.
32	System Operator Has Placed LP Switch In By-pass Mode	The operator has entered the emergency override screen and activated the emergency by-pass of the low pressure switch.
33	System Operator Has Placed HP Switch In By-pass Mode	The operator has entered the emergency override screen and activated the emergency by-pass of the high pressure switch.
34	Operation Not Possible Max. Emergency Hours Reached	The system has been running in emergency override mode for the maximum allowable time. The damaged sensor must be replaced to continue.

35	Membrane Differential Pressure Exceeds Specifications**	The differential pressure across the membrane chain has exceeded specifications. Chemical cleaning is required to remove scaling. If this does not solve the problem, membrane replacement may be required.
36	Domestic Salinity Probe Reads as 'In Air', Values Not Trusted	The salinity probe is reporting values only seen when the probe element is not submerged in water. This can happen when the system has been dormant for extended periods of time. In these eventualities running the system in manual salinity control mode is possible. Once the probe senses water this mode will be turned off. On the next automatic start up automatic mode will be used.
37	Domestic Diversion Valve In Open Position. Please Close	The operator ran the system in manual mode during the last run, and for some reason was forced to operate the product diversion valve manually. However, when the operator shut the system down they did not return the product diversion valve to the closed position. The valve must be manually turned to the closed position before you can continue
38	Multi-Media Filter Differential Pressure Exceeds Limits**	The system has detected the differential pressure across the media filter has exceeded specified set-points; the filter should be backwashed soon.
39	Automatic Media Filter Function Has been Disabled**	The system has detected a problem with sensors required for the operation of the automatic multimedia function, therefore until these sensors have been repaired, this function has been disabled
40	System Brine Flow Rate Is Unusually High. Possible Leak	The system has detected that brine flow rates are in excess of 130% of normal. This has triggered an alarm due to the fact that it could indicate a large scale leak within the system
41	System Brine Flow Rate Is Low. Possible HP Pump Wear	The system has detected that brine flow rates are below 70% of normal; this could indicate massive High Pressure pump wear.

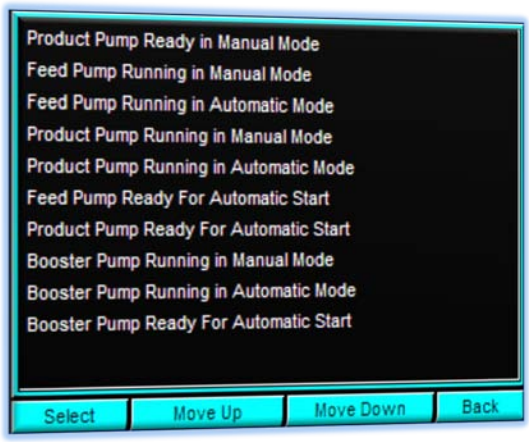
** = Indicates optional components

12. System Status Messages

The Coral Sea control system contains three message centers, all of which are intended to provide as much information to the operator as possible. The most commonly used of the three message centers is usually the system status message center.

During operation, anytime the water maker senses a change in external input, or if the water maker makes a decision to operate any part of the water maker a message detailing what is currently happening will be displayed in the system status message center. The system status message center is the information window used by the operator to examine any internal messages generated by the water maker.

To access this messaging screen navigate to the system message selection menu (See Menu Navigation) and press the arrow alongside the 'System Status Messages' text. Doing so will present you with the following screen:

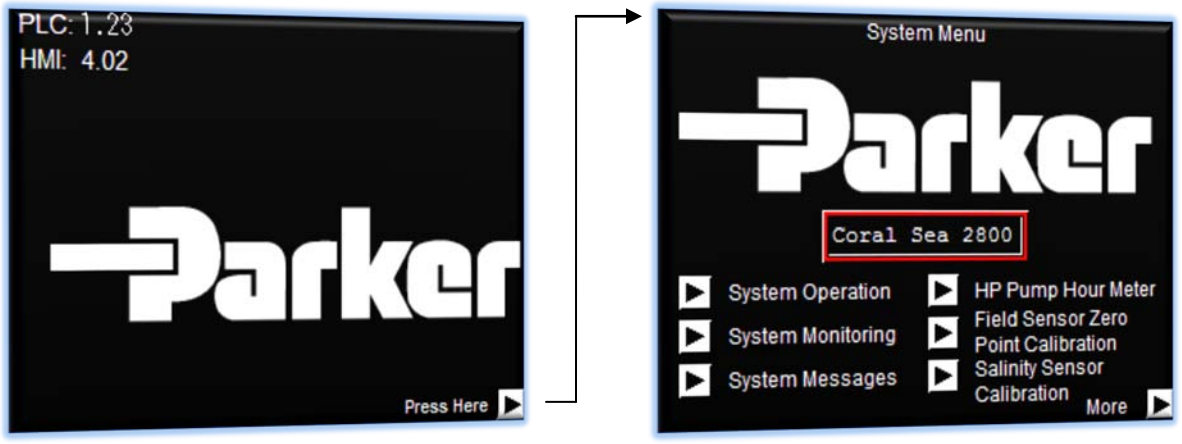


Pressing 'Select' will highlight the first message item.
Pressing 'Move Up' will scroll up through the message list
Pressing 'Move Down' will scroll down through the message list
Pressing 'Back' will return you to the system message selection menu.

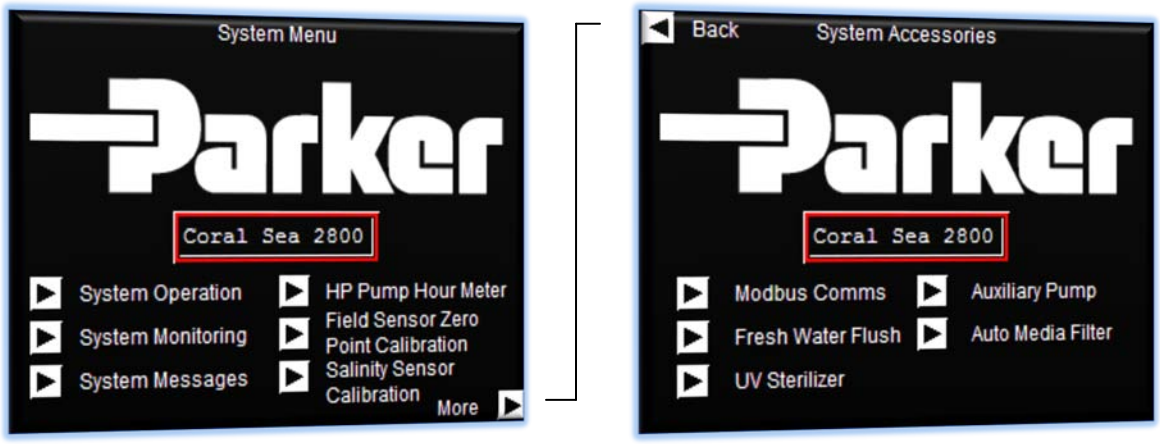
When a system status message is displayed, the system fault indicator will not illuminate and the general alarm contact will not change state.

13. Menu Navigation

The new Coral Sea control system has many user interface menus and screens, all of which are designed to present as much information to the operator as possible. Navigating these screens is quite simple and begins when moving from the home screen by pressing the arrow in the lower right corner of the screen. Once you press this arrow the screen will change to the first of two main operation menus as shown below:



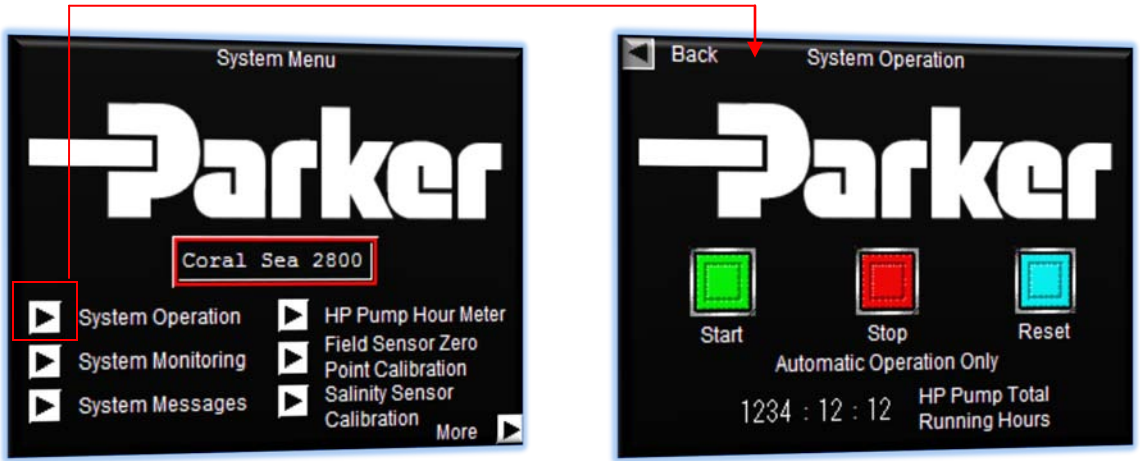
Accessing the second main menu can be achieved by pressing the arrow in the lower right hand corner of the first main menu screen as shown below:



Pressing the arrow in the top left hand corner of the second menu screen will return you to the first menu screen.

13.1 Accessing the 'System Operation' Screen:

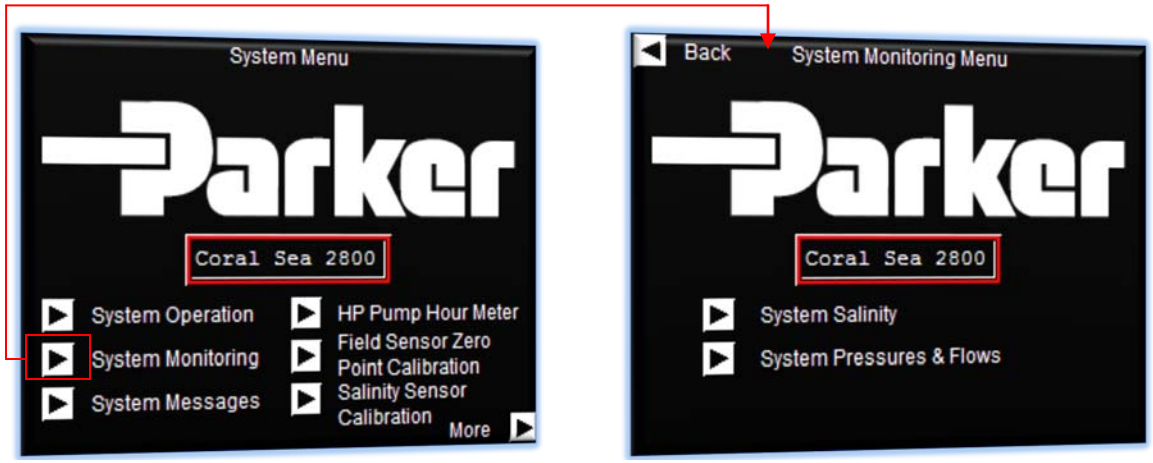
From the first menu screen, system functions and secondary menu systems can be accessed. To enter the system operation screen press on the arrow next to the text 'System Operation' as shown below:



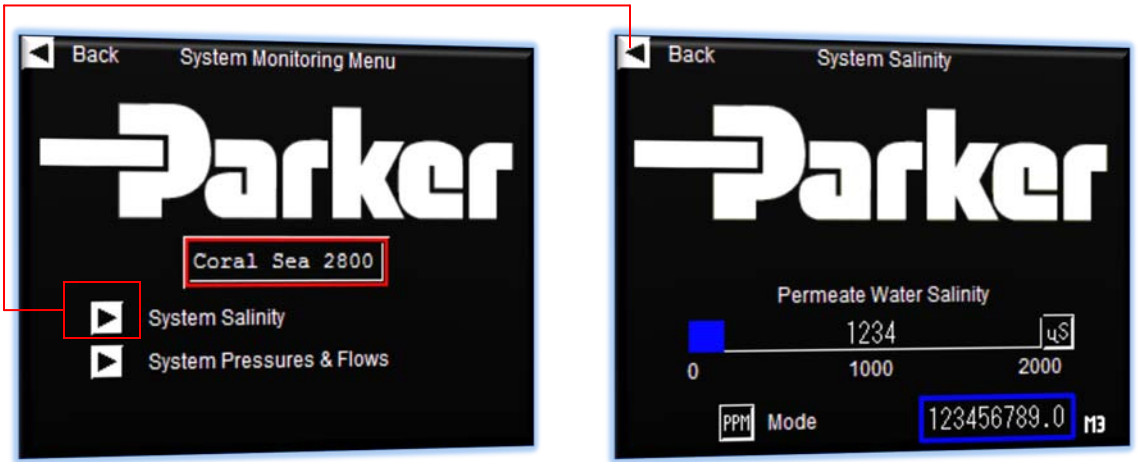
Pressing the arrow in the top left hand corner of the system operation screen will return you to the first menu screen.

13.2 Accessing Product Salinity Level Screens:

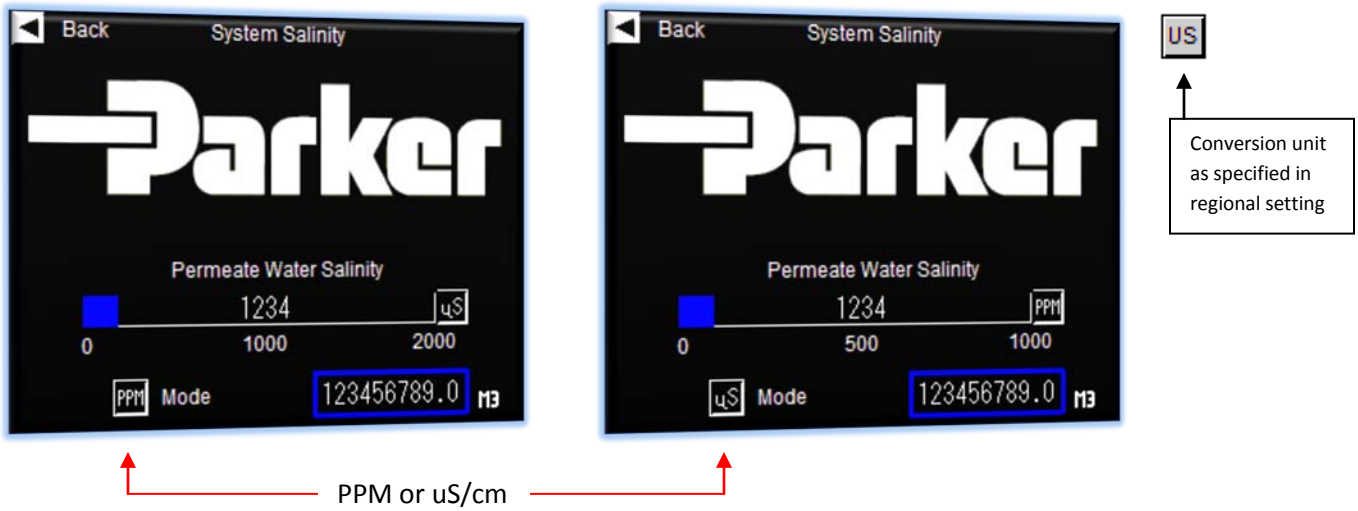
To view product water salinity readings, access the 'System Monitoring' screen. This is done in the following manner; from the first menu screen press on the arrow next to the text 'System Monitoring' as shown below:



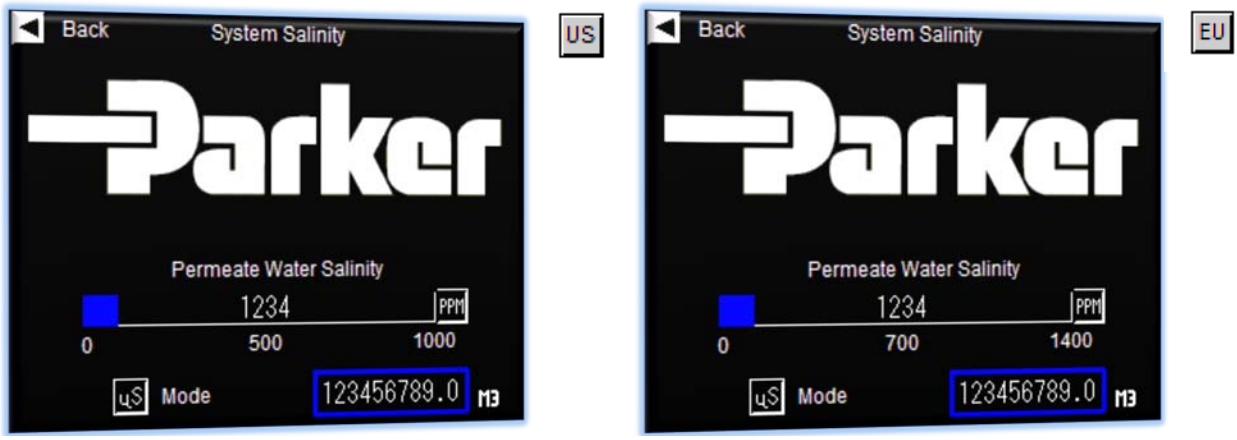
This will display the 'System Monitoring Menu' Screen, from this screen you can access various machine monitors including the product water salinity monitor. Accessing the salinity monitor requires one further step. Press on the arrow next to the' System Salinity' text as detailed on the next page:



The current product water salinity readings are displayed. By default the system will display product water salinity in uS/cm. This can be changed to PPM if the user prefers this measuring system. To change from uS/cm to PPM press the 'PPM' button in the lower section of the salinity monitoring screen. As you press the 'PPM' button it will change to 'uS', to return to uS/cm display press the 'uS' button and vice versa as shown below:



As you press the 'PPM' button the type of display you see will differ depending on what the regional settings are within the water maker (US/EU) as shown on the next page:

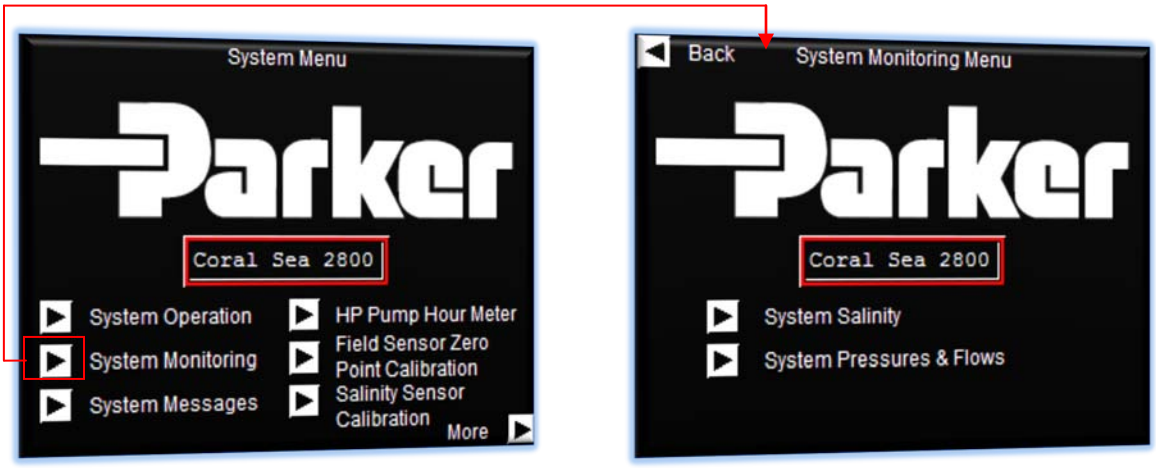


US Region Settings EU Regional Settings

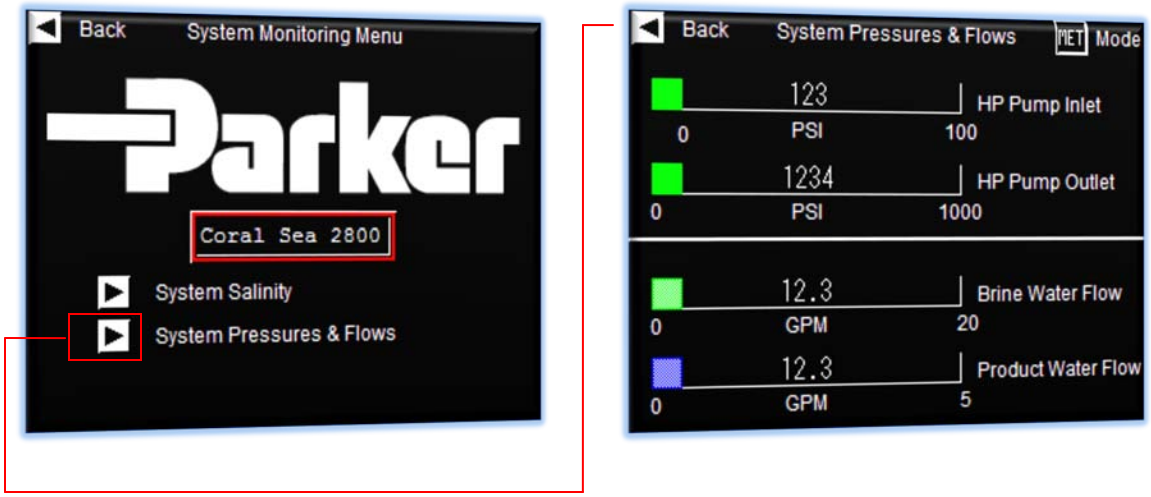
When switching between uS/cm and PPM the system will remember the last chosen unit of display and will automatically return to it when you next access the product salinity monitoring feature.

13.3 Accessing System Pressure and Flow Screens:

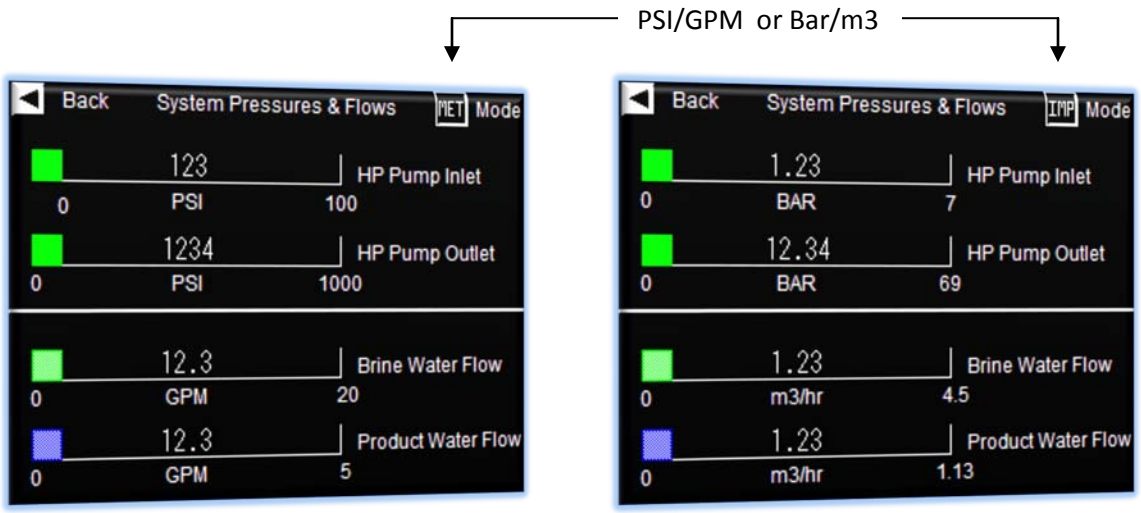
To view system pressures and flows, access the 'System Monitoring' screen. This is done in the following manner; from the first menu screen press on the arrow next to the text 'System Monitoring' as shown below:



The 'System Monitoring Menu' Screen is displayed. To navigate to the pressure and flow readings screen press the arrow next to the 'System Pressures & Flows' text. Pressing this arrow will take you to the pressure monitoring screen as shown on the next page:



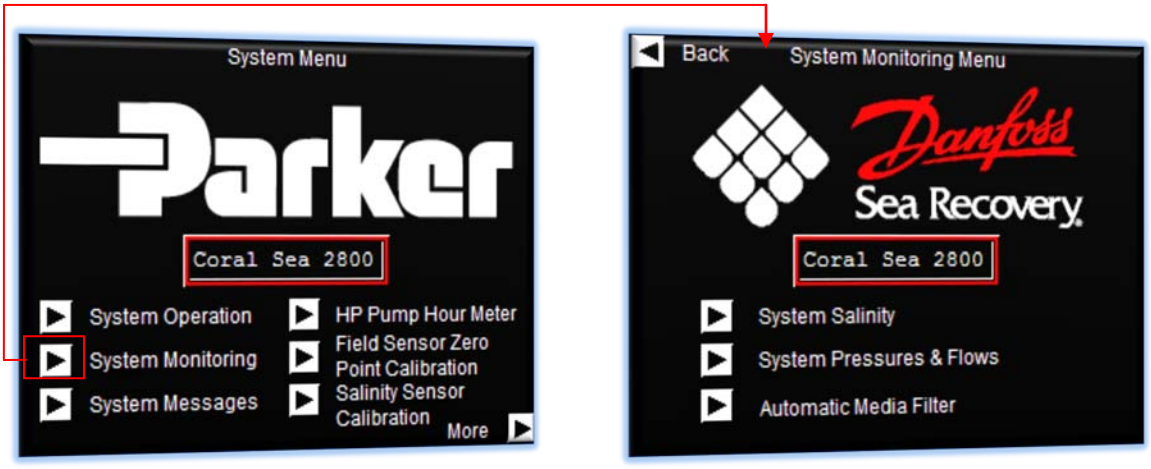
By default the system will display system pressures in PSI and flows in GPM. This can be changed to pressures in Bar and flows in m3/hr if the user prefers this measuring system. To change from PSI/GPM to Bar/m3 press the 'MET' button in the upper right section of the pressure monitoring screen. As you press the 'MET' button it will change to 'IMP', to return to PSI/GPM display press the 'IMP' button and vice versa as shown below:



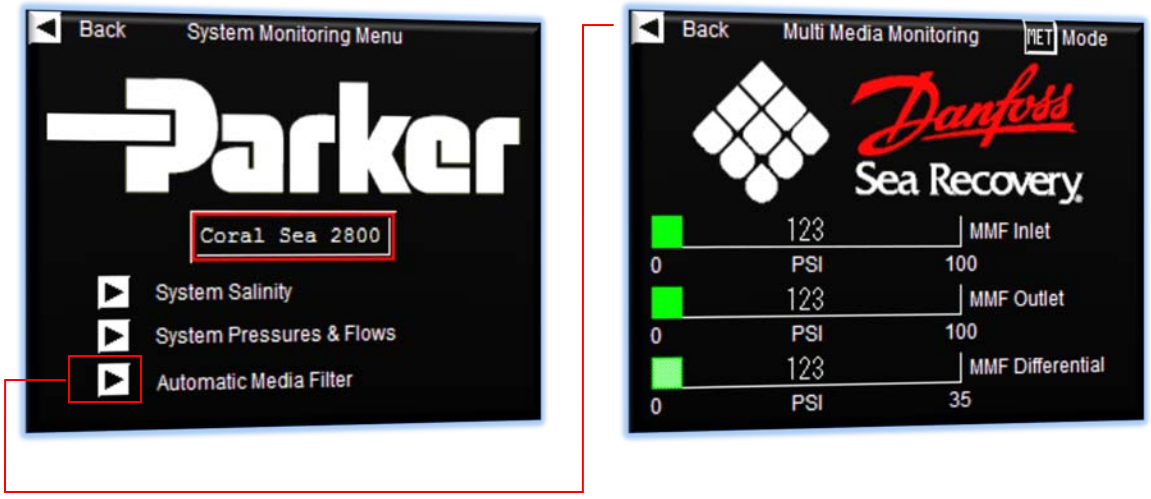
When switching between PSI/GPM and Bar/m3 the system will remember the last chosen unit of display and will automatically return to it when you next access the system pressures and flows display feature.

13.4 Accessing Automatic Multi-Media System Pressure Screens: (If Equipped)

To view the inlet and outlet pressures of your multi-media filter, access the 'System Monitoring' screen. This is done in the following manner; from the first menu screen press on the arrow next to the text 'System Monitoring' as shown below:

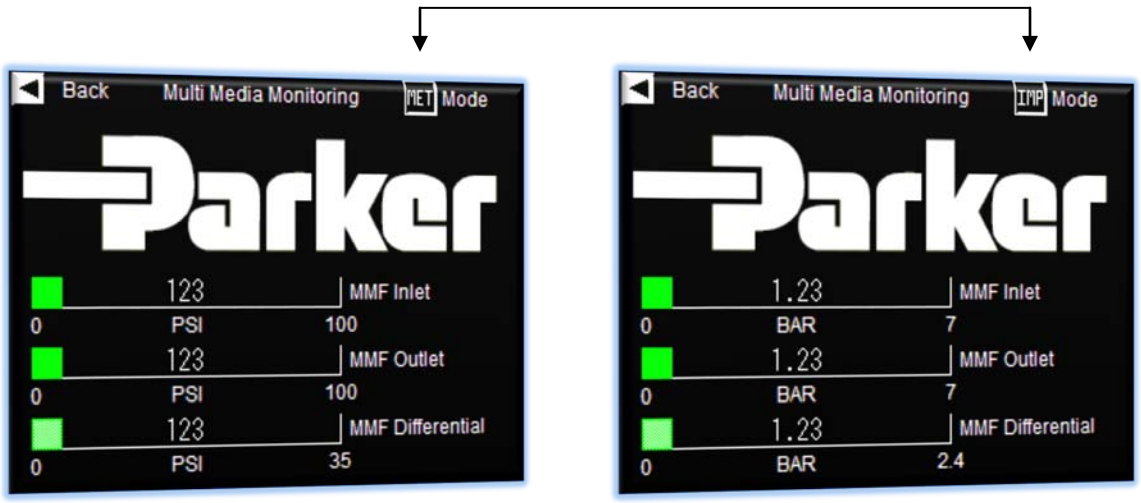


The 'System Monitoring Menu' Screen is displayed. To navigate to the multi-media pressure readings screen press the arrow next to the 'Automatic Media Filter' text. Pressing this arrow will take you to the pressure monitoring screen as shown on the next screen:



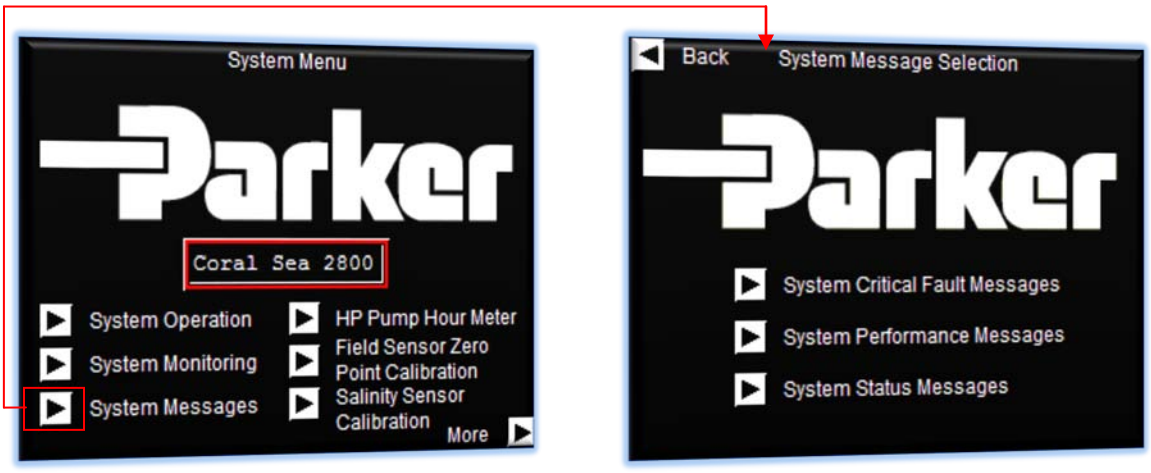
By default the system will display system pressures in PSI. This can be changed to Bar if the user prefers this measuring system. To change from PSI to Bar press the 'MET' button in the upper right section of

the pressure monitoring screen. As you press the 'MET' button it will change to 'IMP', to return to PSI display press the 'IMP' button and vice versa as shown below:



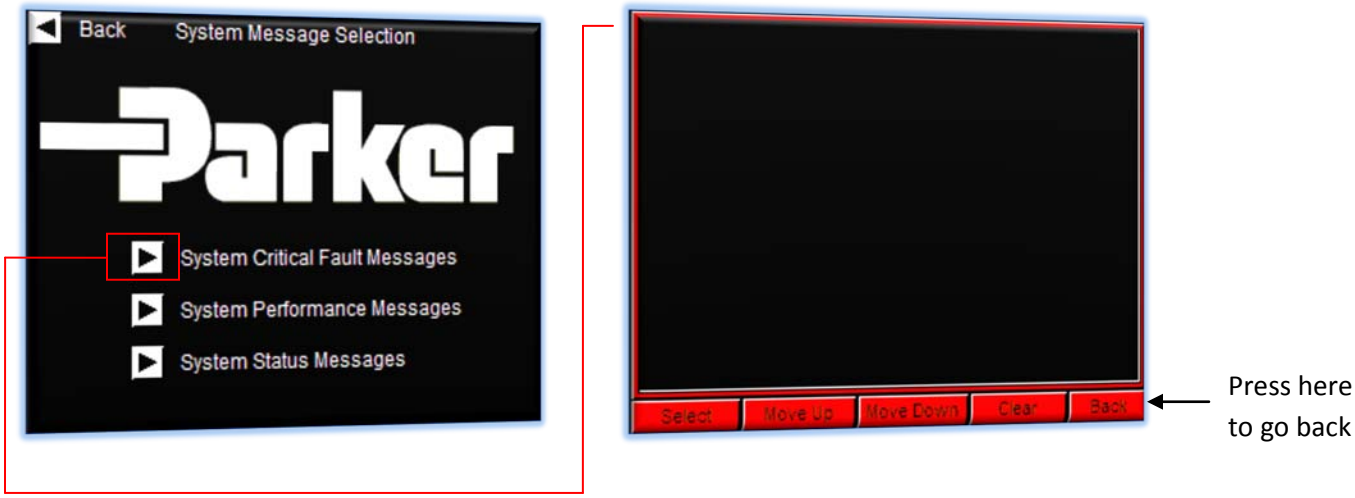
13.5 Accessing System Message Centers

To view system message centers, press on the arrow next to the text 'System Messages' as shown below:



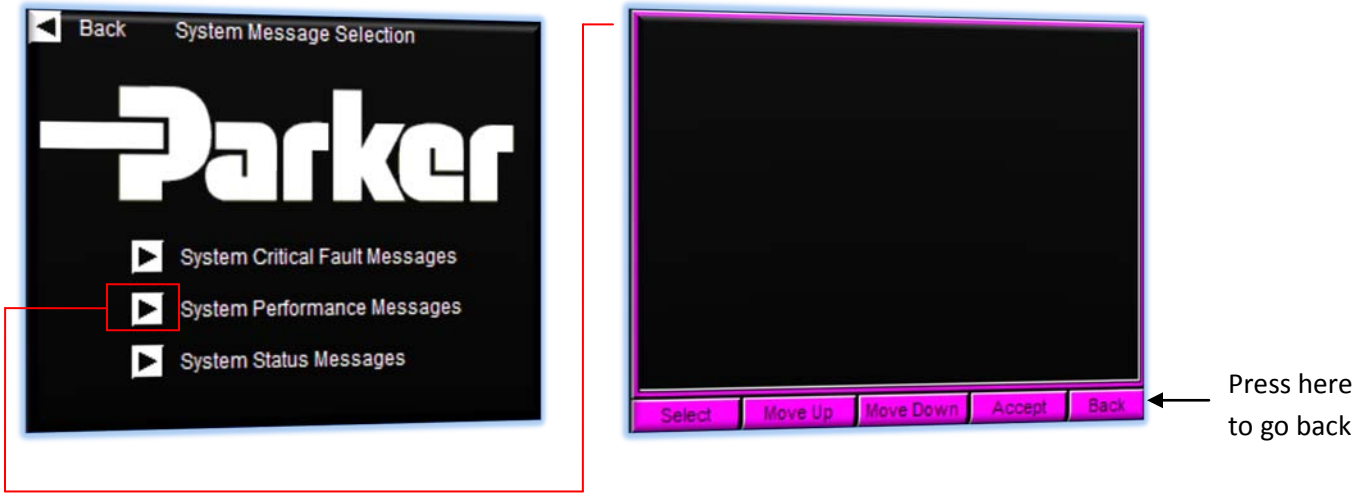
Pressing this button will lead you to the 'System Message Selection' Screen, from here you can access all three of the control system message centers.

To access the 'System Critical Fault' message center, press on the arrow next to the text 'System Critical Fault Messages', doing so will open the requested message center as shown below:



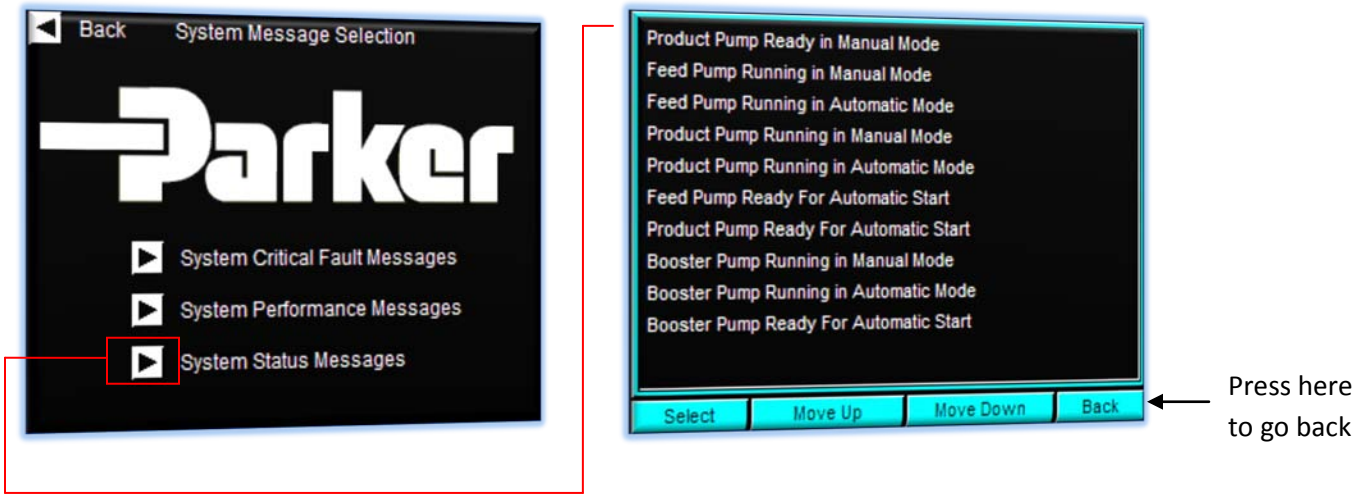
To return back to the menu screen press the back button

To access the 'System Performance' message center, press on the arrow next to the text 'System Performance Messages', doing so will open the requested message center as shown below:



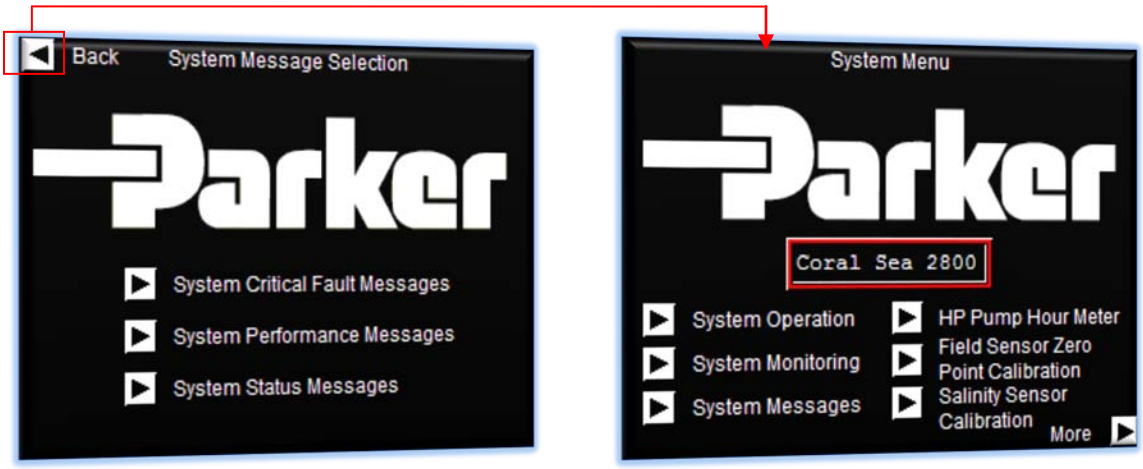
To return back to the menu screen press the back button

To access the 'System Status' message center, press on the arrow next to the text 'System Status Messages', doing so will open the requested message center as shown below:



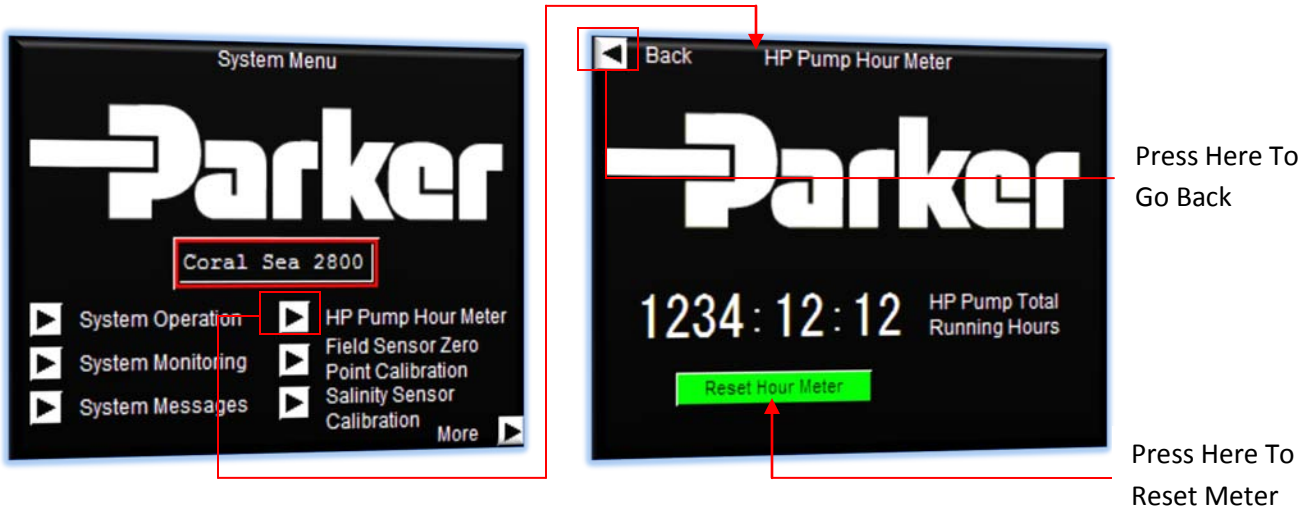
To return back to the menu screen press the back button

To return to the main menu screen press the arrow in the top left corner of the screen, pressing this button will return you to the main menu screen as shown below:



13.6 Accessing High Pressure Pump Hour Meter

To view the number of hours endured by the high pressure pump, press on the arrow next to the text 'HP Pump Hour Meter' as shown below:



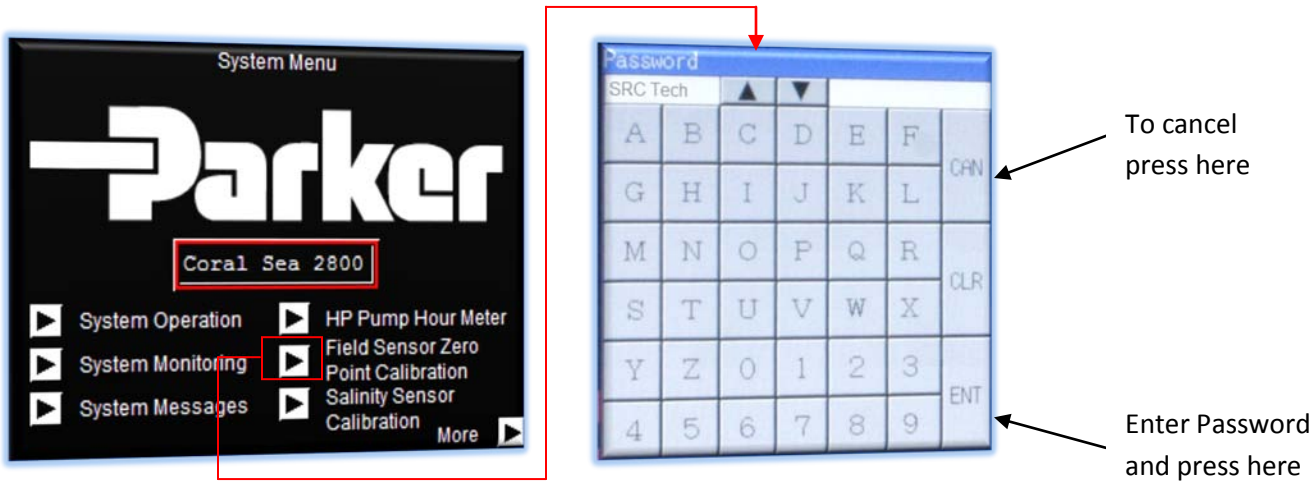
Pressing this button will lead you to 'HP Pump Hour Meter' screen as seen above:

From this 'HP Pump Hour Meter' screen it is possible to view the total amount of running hours endured by the high pressure pump. It is also possible to reset this number after servicing has been completed to prevent continuous system performance warning messages from being called during operation. Resetting of this accumulated hour meter can only be done once the counter has reached 8000hrs for Danfoss Pumps/2000hrs for CAT Pumps or over, until this time, the 'Reset' button is not active.

Pressing the arrow in the top left hand corner of the screen will return you to the 'System Menu' screen.

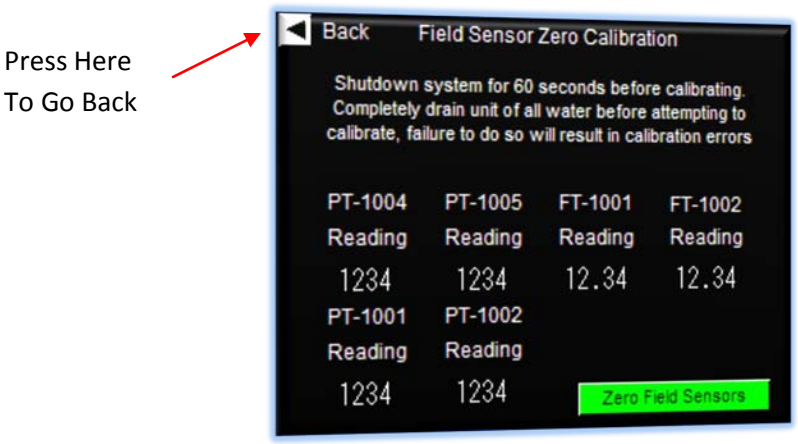
13.7 Accessing Field Sensor Zero Point Calibration Screens

To access the field sensor zero point calibration screen, press on the arrow next to the text 'Field Sensor Zero Point Calibration'. Pressing this button will bring you to the 'Password Required' screen as shown below:



Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Entering the correct password will bring you to the following screen.

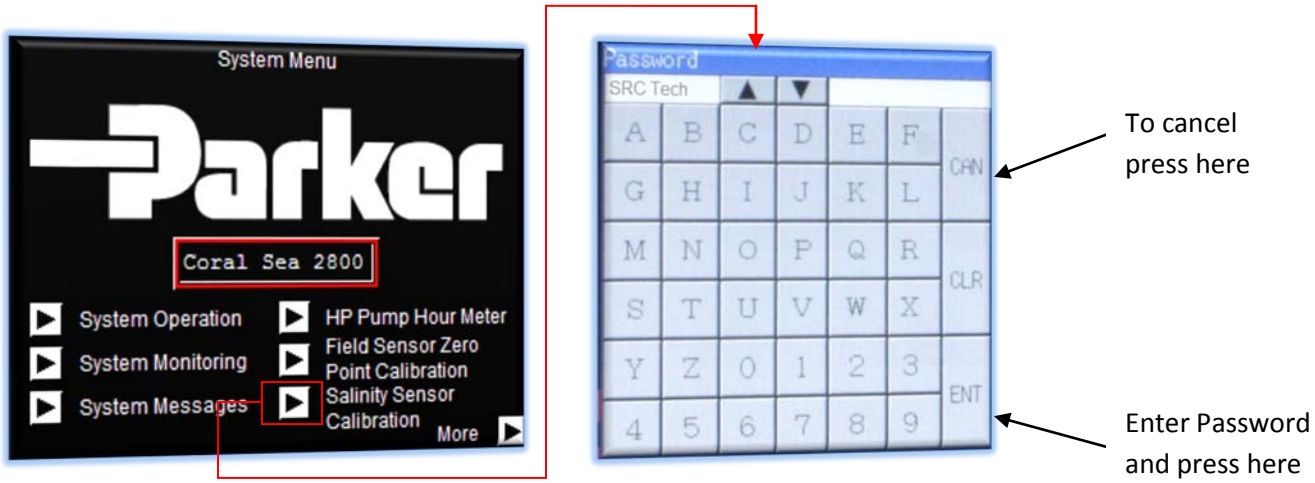


From this screen you can perform a zero-pressure calibration of the pressure sensor system. Please see the 'System Maintenance' section for further details.

Pressing the arrow in the top left had corner of the 'Pressure Sensor Zero' screen will return you to the 'System Menu' screen.

13.8 Accessing Salinity Sensor Calibration

To access the salinity sensor calibration screen, press on the arrow next to the text 'Salinity Sensor Calibration'. Pressing this button will bring you to the 'Password Required' screen as shown below:



Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Entering the correct password will bring you to the following screen.

From this screen you can perform a calibration of the salinity sensor system. Please see the 'System Maintenance' section for further details.

Pressing the arrow in the top left had corner of the 'Salinity Sensor Calibration' screen will return you to the 'System Menu' screen.

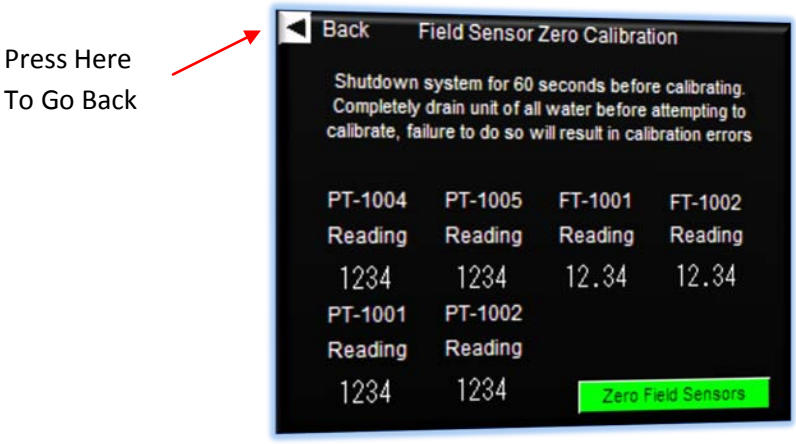
14. System Maintenance

14.1 Performing field sensor zero-point calibrations

To access the field sensor zero point calibration screen, press on the arrow next to the text 'Field Sensor Zero Point Calibration'. Pressing this button will bring you to the 'Password Required' screen as shown below:

Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Entering the correct password will bring you to the following screen.



From this screen it is possible to perform a zero-point calibration of all field sensors simultaneously.

Before performing zero point calibrations please perform the requested actions listed on the screen, these requests have been expanded here for further clarification.

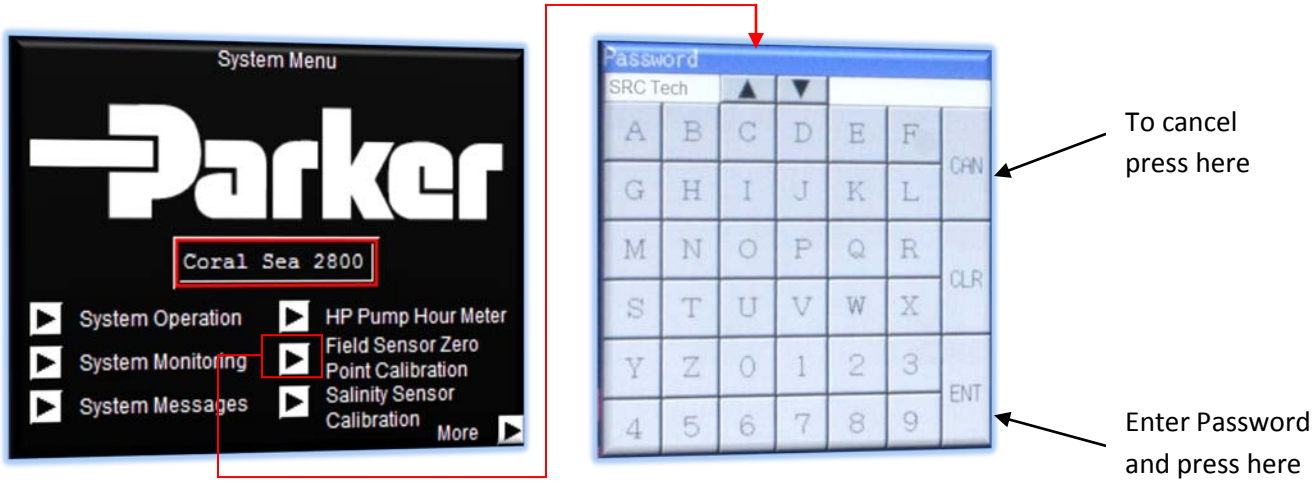
1. Shut the system down
2. Perform a complete system drain
3. Remove the power plug from the top of each pressure sensor.
4. Unscrew the pressure sensors from the manifold.
5. Re-secure the power plug to the top of each pressure sensor.
6. Do not attempt to remove the flow sensors from the pipe work.

Wait a brief moment to allow the control system to complete analog channel health tests, these tests will be automatically instigated once a sensor signal was lost due to the power plug being removed. Once all internal tests are complete you will see the current pressure readings of each connected pressure sensor and flow readings of each connected flow sensor on the display.

Press the ‘Zero Pressure Sensors’ button. The current readings displayed for each sensor will be zeroed out. If the button fails to respond to being pressed, or “Not Available” is displayed above the button there is an analog channel health issue preventing the system from calibrating. Back out of the ‘Field Sensor Zero Point Calibration’ screen and navigate to the ‘System Status Messages’ screen (See Menu Navigation) to obtain further information on the reported failure. Correct the problem and return to the ‘Field Sensor Zero Point Calibration’ screen once again to perform the sensor calibration.

14.2 Performing Salinity Sensor Calibration

To access the salinity sensor calibration screen, press on the arrow next to the text 'Salinity Sensor Calibration' screen. Pressing this button will bring you to the 'Password Required' screen as shown below:



Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

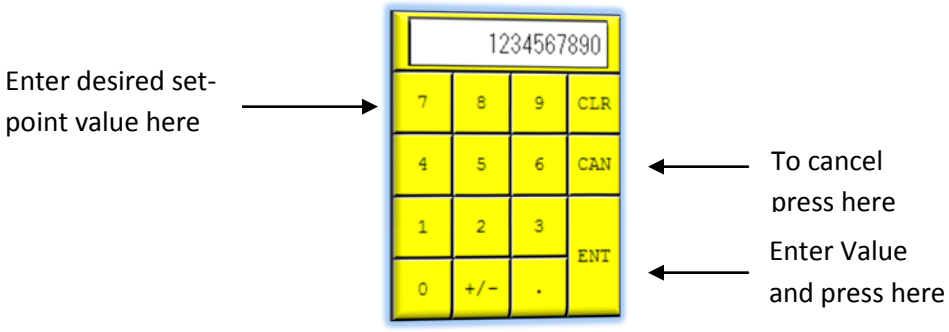
Entering the correct password will bring you to the following screen.

From this screen it is possible to perform a calibration of the salinity sensor system.

Before performing a calibration please perform the requested actions listed on the screen, these requests have been expanded here for further clarification.

1. Shut the system down
2. Isolate the clients permeate line pipe work (if applicable) and drain the product water line within the water maker frame.
3. Remove the salinity sensor from the water maker.
4. Place the salinity sensor probe into a bag of uS/cm testing solution.

If required change the value of the testing solution within the controller calibration software by pressing on the value currently entered, a number entry pop up screen will be displayed. Enter the newly required calibration solution value and press the 'ENT' button to complete entry, to cancel the request press the 'CAN' button as illustrated below:



Once the new value has been entered or if this step is not required, simply press the 'Calibrate Salinity Probe' button, the moment this button is pressed the displayed salinity reading will be automatically adjusted to reflect the same value as the testing solution.

5. Remove the salinity sensor probe from the bag of testing solution and re fit it into the water maker.
6. Open all product water valves on the clients pipe work (if required)

Salinity sensor calibration is now complete.

If the 'Calibrate Salinity Probe' button did not function or the current salinity reading was blank and the text above the display areas was missing, this indicates an analog channel health issue preventing the system from calibrating. Back out of the 'Salinity Sensor Calibration' screen and navigate to the 'System Status Messages' screen (See Menu Navigation) to obtain further information on the reported failure. Correct the problem and return to the 'Salinity Sensor Calibration' screen once again to perform the sensor calibration.

15. Emergency Operation

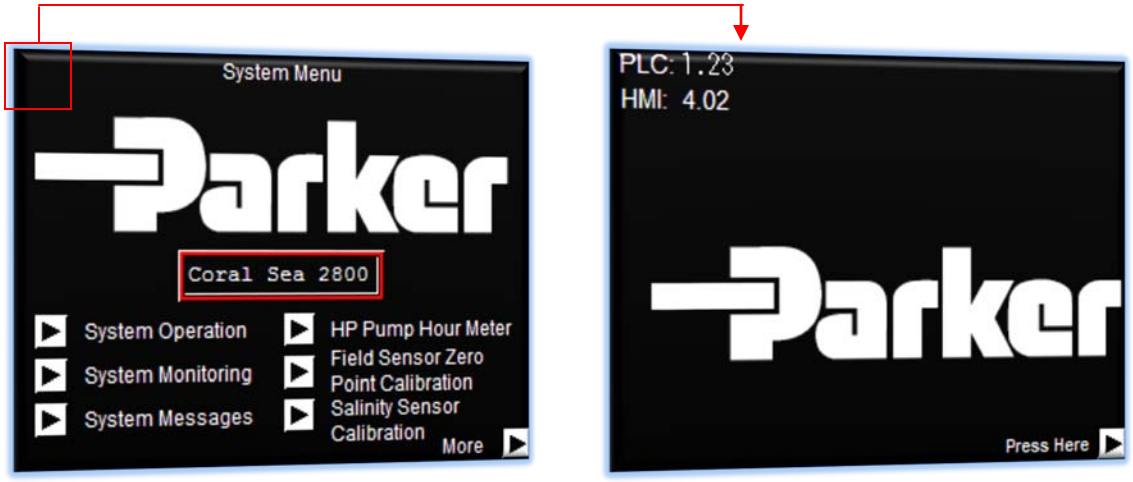
15.1 Accessing Emergency Override Menus:

One of the newer features of the Coral Sea control system is the ability to operate with damaged sensors. It is possible to override faulty/damaged sensors and still run the system in these emergencies to ensure potable water is still available.

Operation in emergency mode is only possible for brief periods of time; therefore it is vital that the required sensor is ordered as soon as possible to prevent water shortages.

Once emergency mode has completed its full operation cycle, it cannot be activated again. Each time the unit is started the control system will abort operation automatically and indicate to the operator that the maximum allowable time for emergency mode operation has been reached. Manual operation of the system is also inhibited.

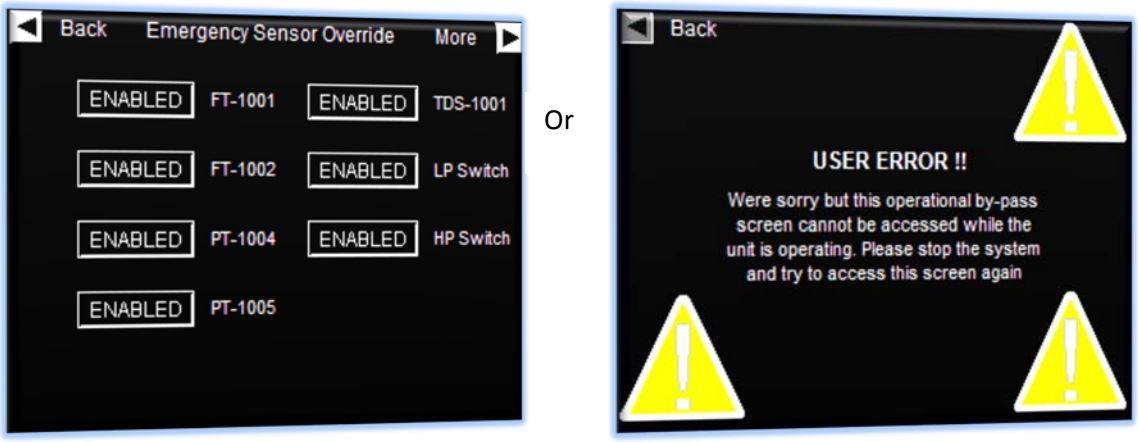
Accessing the emergency override system is a password restricted procedure. Passwords must be obtained from PSRC. To access the emergency override menu screen press in the top left hand corner of the first 'System Menu' screen, this will return you to the water maker home screen, as shown below:



From the home screen press on the indicated area to access the 'Emergency Sensor Override' menu as shown on the next page:

Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Entering the correct password will bring you to the following screen.

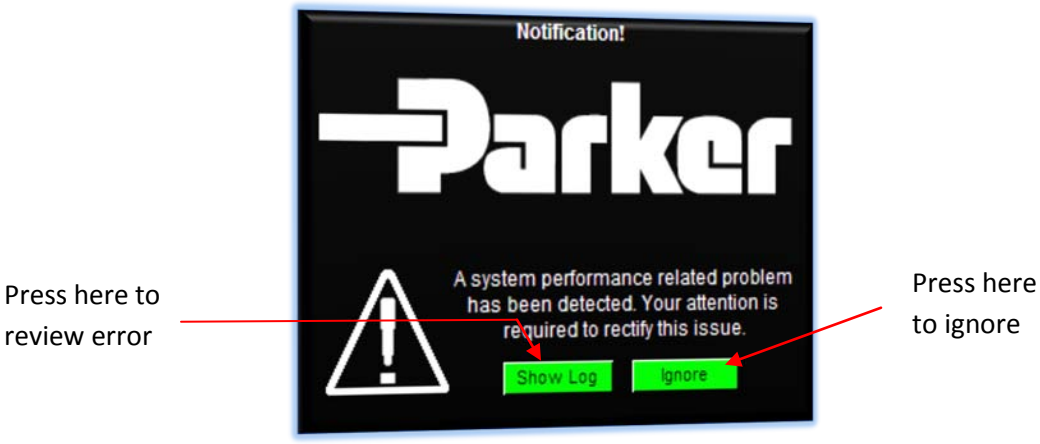


The illustrated 'User Error' screen will only appear if the system was in operation at the time you tired to access the emergency by-pass menu. Shutdown the system and try to access this feature again. If the system was off-line the 'Emergency Sensor Override' screen would have been displayed.

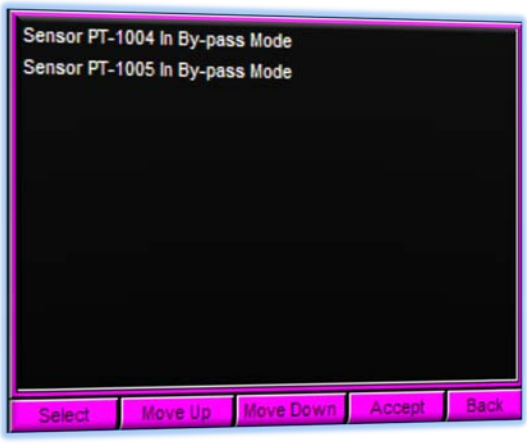
From the 'Emergency Sensor Override' screen it is possible to disable system sensors by pressing on the associated sensor button, as you press the button the buttons face changes to reflect the current operational state of the associated sensor.

It is not possible to disable both the low pressure sensor and the low pressure switch at the same time. If you attempt to do this, the button to the second device being disabled will become un-responsive.

Each time you disable a sensor the system fault light will begin to flash, this indicates that a 'System Performance Warning' has been raised. Once you exit the 'Emergency Sensor Override' screen the control system will provide you with a performance warning prompt so you can review new messages as shown below:



Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:

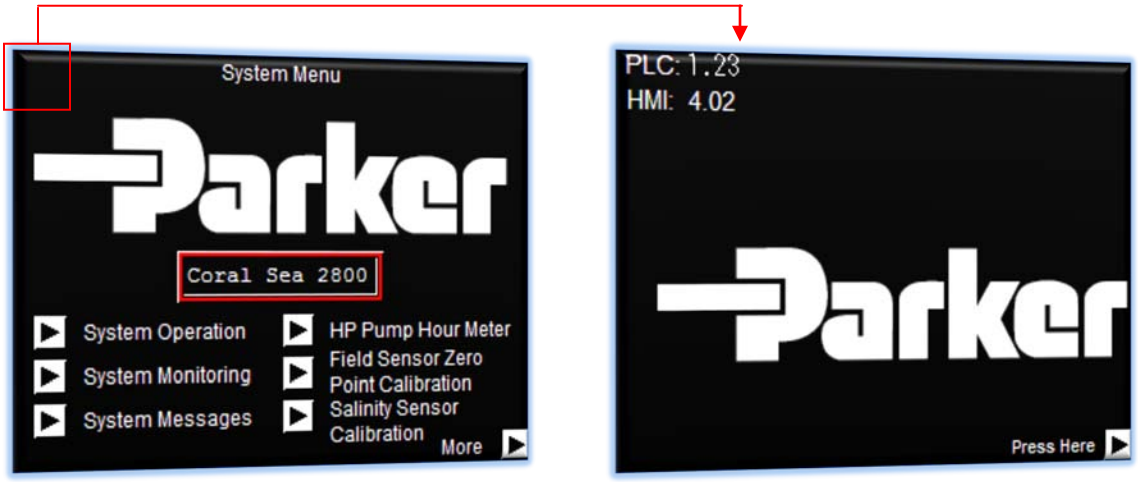


Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

Once 'Ignore' or 'Accept' has been pressed the system fault light will cease flashing, and remain off until new messages are raised.

15.2 Accessing Emergency Override Operation Time:

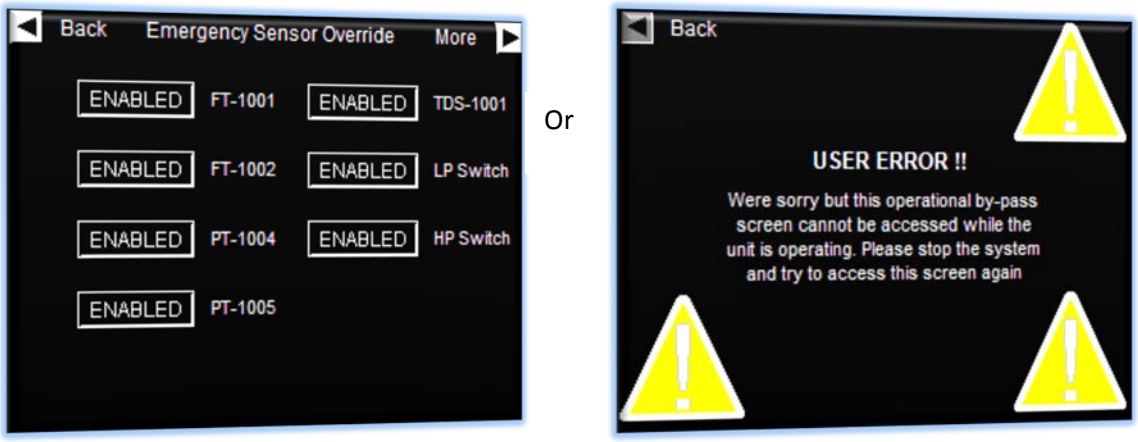
To view the total number of operational hours in emergency mode you must first access the 'Emergency Sensor Override' screen. Accessing the emergency override system is a password restricted procedure. Passwords must be obtained from PSRC. To access the emergency override menu screen press in the top left hand corner of the first 'System Menu' screen, this will return you to the water maker home screen, as shown below:



From the home screen press on the indicated area to access the 'Emergency Sensor Override' menu.

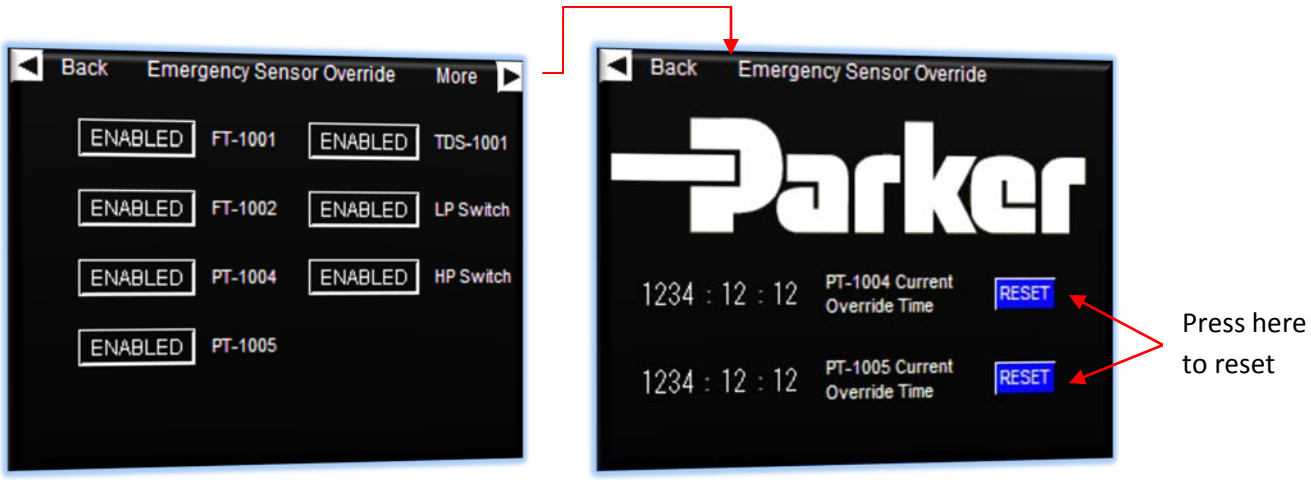
Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Entering the correct password will bring you to the following screen.



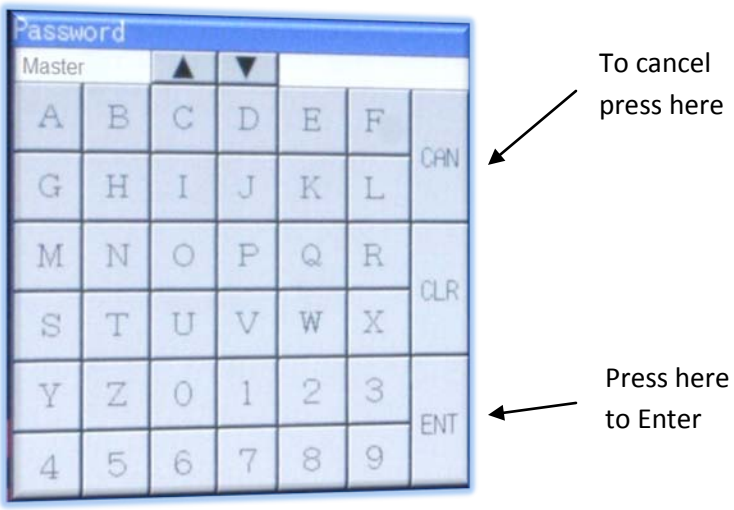
The illustrated 'User Error' screen will only appear if the system was in operation at the time you tired to access the emergency by-pass menu. Shutdown the system and try to access this feature again. If the system was off-line the 'Emergency Sensor Override' screen would have been displayed.

From the 'Emergency Sensor Override' screen press the arrow in the upper right hand corner of the screen. Pressing this area will change the display over to the current emergency operation timer display.



From this screen it is possible to view the total accumulated emergency operation hours. As these timers approach 100Hrs the system will shut down and further operation in any mode will not be permitted.

If the operator presses the 'Reset' button the emergency override time will not be cleared. Instead the control system will prompt for a secondary password as shown below:



In extreme emergencies it is possible to clear the timers and allow the system to run for a further 100 Hours, in these situations PSRC will void all equipment warranties.

Once the damaged sensor has been replaced with a new one, the control system will automatically detect this and clear the 'Emergency Override Operation' timer associated with the replaced part. The operator must manually remove the override to prevent further system shutdowns. Failure to do so will result in the system still operating in emergency sensor override mode, and faulting out after the 100 hour limit has been reached.

An easy way to remove sensor overrides is to simply cycle power to the water maker, each time power to the water maker is turned off and then back on again, any disabled sensors are automatically re-enabled.

16. Manual Actuation of System Valves.

Manual actuation of system valves maybe required in emergency situations. Actuating these valves can be carried out in the following manner:

16.1 Actuating the Product Diversion Valve

To manually actuate this valve the operator must first select manual mode on the value actuator body. This can be done by locating the small switch located beneath the valve actuator power and feedback plugs. Once this switch is located, switch it to the 'Manual' position. (See figure 1.1)

Figure 1.1

Once the switch has been set to the 'Manual' Position the valve can be actuated by turning the handle on top of the valve to the position required (See figure 1.2)

Figure 1.2

17. Fresh Water Flushing

Each time a running pump is stopped using the 'Auto-Stop' button the fresh water flush system will automatically be activated. Once all running pumps have been stopped the fresh water flush valve will open allowing fresh water into the system. The valve will remain open for 10 minutes to allow fresh water to completely fill the water maker pipe work and membrane vessels, during this time the fresh water flush indicator on the control panel door will remain steadily illuminated.

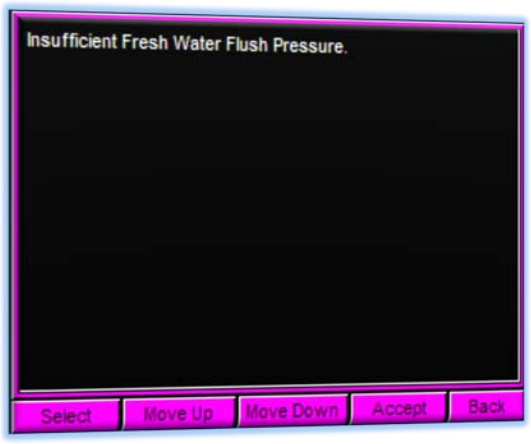
After the 10 minute fresh water flush cycle has ended, the valve will close and the fresh water flush indicator light on the panel door will extinguish. The control system will now enter 'Sleep Mode', while in this state the fresh water flush indicator light will illuminate for 1 second each hour. This brief flashing is indicating that the fresh water flush mode is still active but currently waiting for the next fresh water flush cycle to begin.

7 Days after the initial fresh water flush cycle completed, a secondary fresh water flush cycle will begin; the valve will re-open for 10 minutes allowing fresh water to flood the system once again. While the valve is open the fresh water flush indicator light on the panel door will remain steadily illuminated. After the 10 minute cycle has elapsed the control system will return to 'Sleep Mode'.

This cycle will continue indefinitely, unless a system pump is started by the operator, or the operator cancels the fresh water flush sequence by pressing and holding the "Auto-Stop' button for 2 seconds.

When the fresh water flush system is flushing; the control system examines the available fresh water pressure, if pressures are detected as being below the system set-point a performance warning notification is raised by the control system as shown below:

Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:

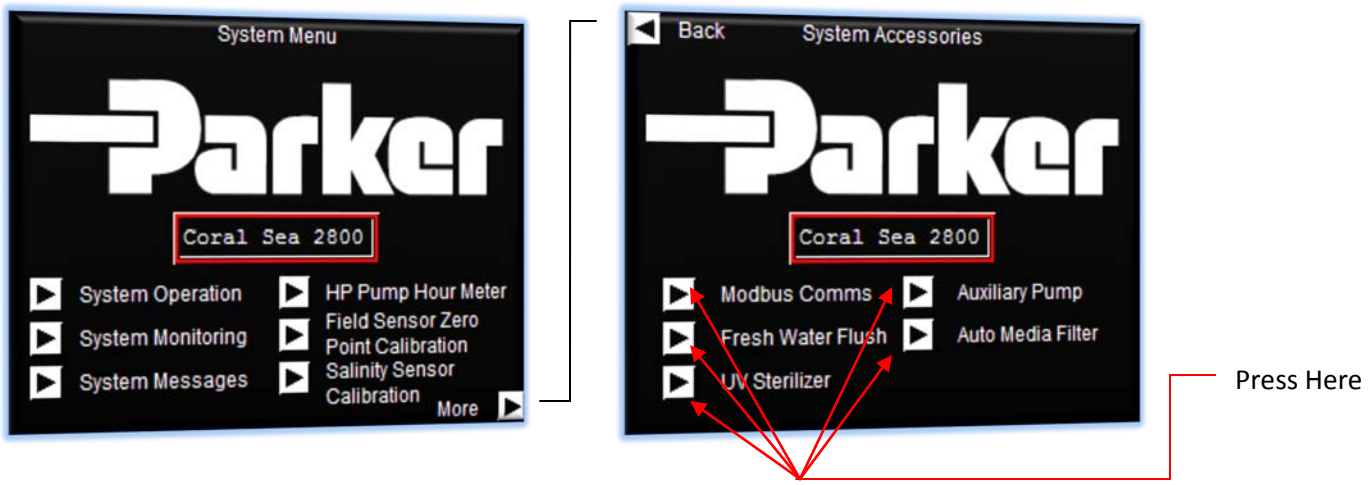


Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

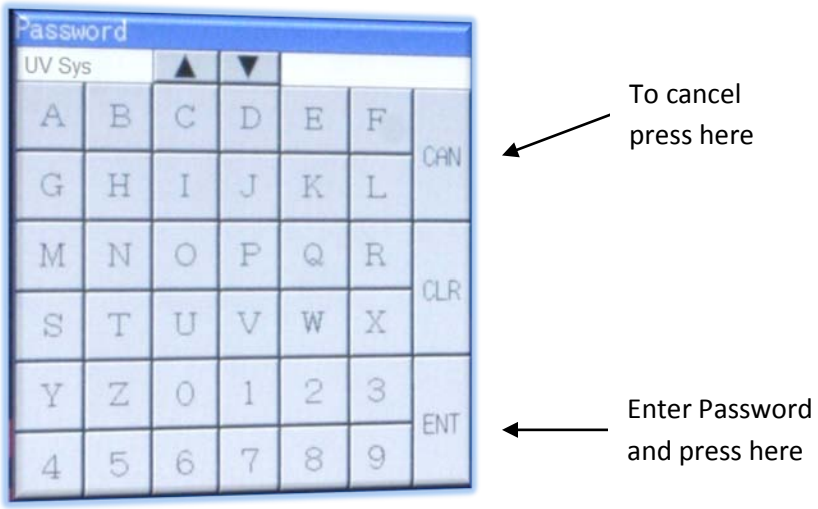
If fresh water pressure increases above the set-point, this warning screen will be canceled. The fresh water flush system will continue to operate while this warning is present.

18. Activating Accessories

To access the accessory activation screen, press on the arrow in the lower right corner of the 'System Menu' screen as shown below to access the 'System Accessories' screen:

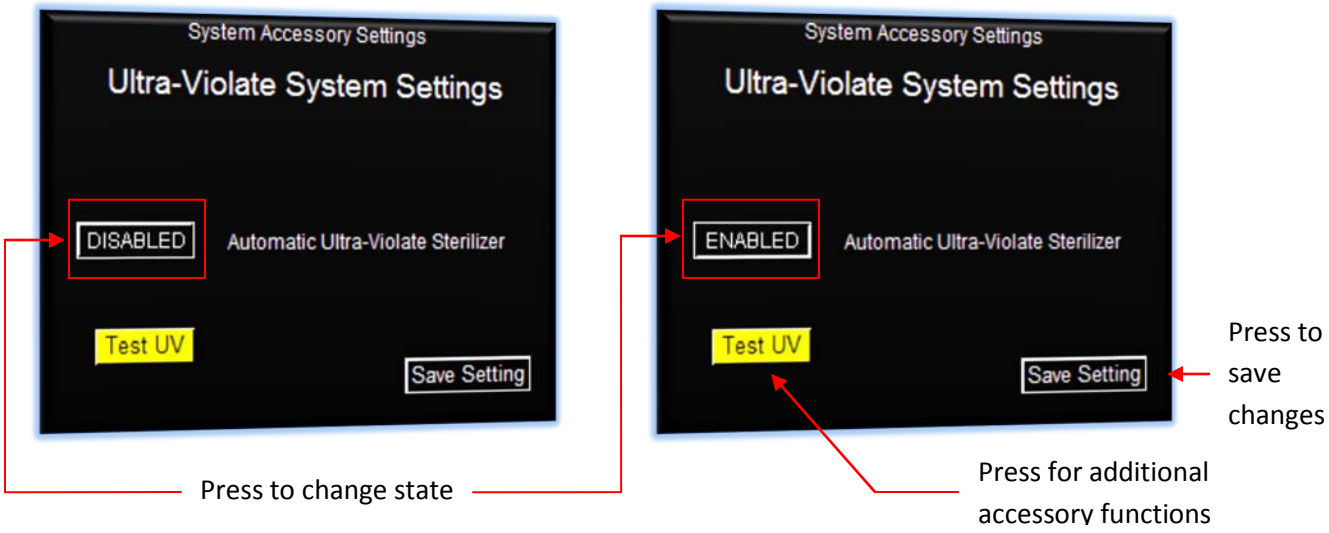


From this screen you can access all available system accessories, to switch on or off a system accessory press on the arrow next to the text describing your required accessory. Doing so will call up the accessory password request screen. If you do not have the password to your required accessory contact Parker Sea Recovery in order to obtain it (A surcharge for accessories may be applied if your unit was not originally purchased with the currently selected accessory)



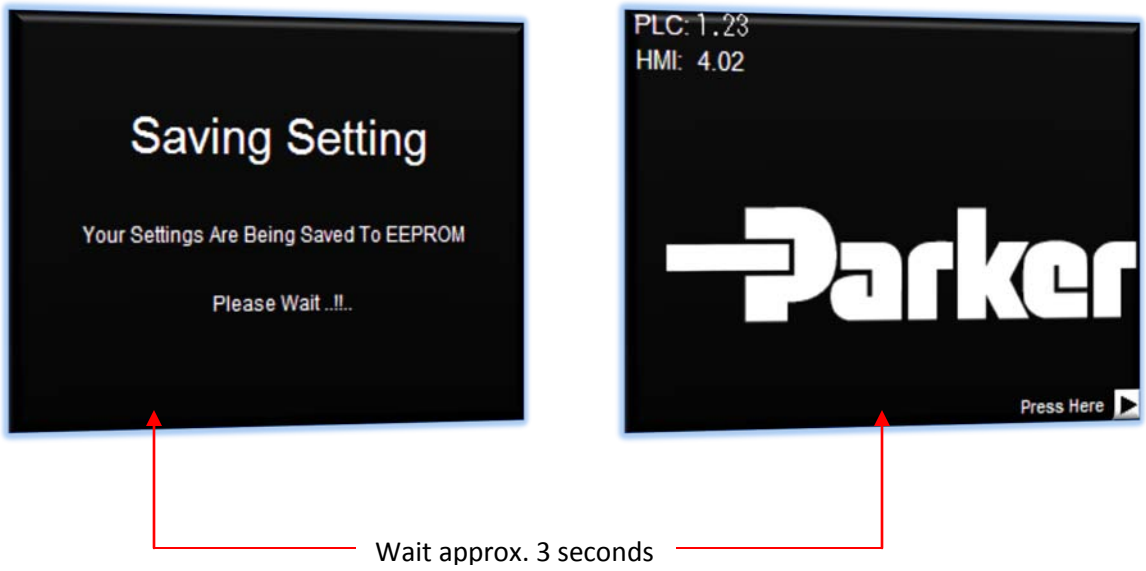
Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Once the correct password has been entered, the control system will pass you on to the accessory enable/disable screen, form this screen it is possible to activate or de-activate your selected accessory. The text within the control button reflects the accessories current state. To change the state press on the control button, as you do so the text within the control button will change to show the accessories new state as shown below:



Some accessory enable/disable control screens also offer additional abilities as seen here. These additional abilities relate directly to the functionality of accessory itself, as seen in this example you are given the option to test if the connected UV sterilizer system is actually functioning correctly or not by being given the ability to manually force the UV system into an 'ON' state. Please note however that these additional function buttons are only active once you have enabled the accessory. If you accidently leave the accessory in the 'ON' state, it will automatically be switched off when you exit this screen.

Once you have changed the accessory state to your requirements, press 'Save Setting To EEPROM ' button in the lower right corner of the screen to store these changes into system EEPROM. Once the 'Save Setting TO EEPROM' button has been pressed the system will advise you that these changes are being stored, once the store is complete the system will return to the main splash screen as shown on the next page:



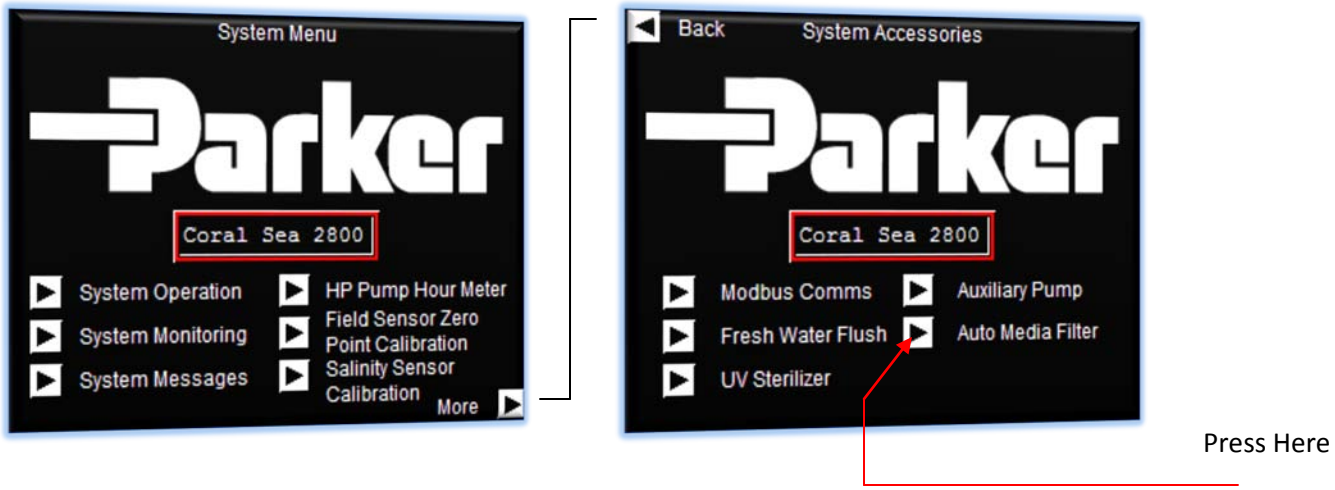
Your accessory state has been saved and the system is now ready for operation.

19. Automatic Multi-Media Filter Functions

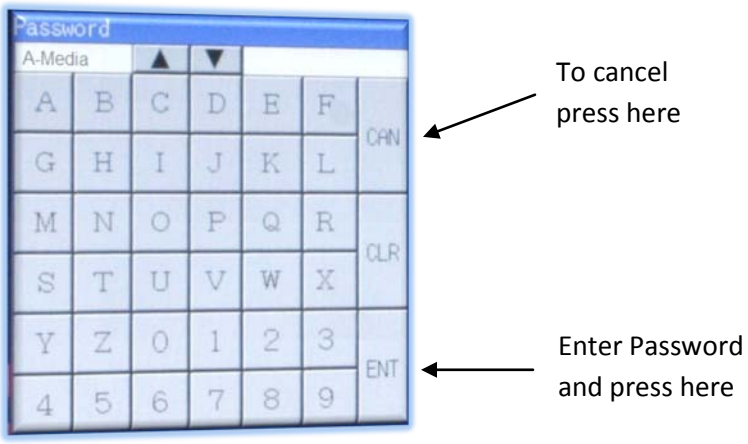
If your system is equipped with an automatic media filter you will be able to perform backwash and rinse cycles of your media filter at the press of a button, your control system will also perform these cleaning cycles automatically when needed.

19.1 Accessing Multi-Media Filter Options

To access the multi-media filter options screen, press on the arrow in the lower right corner of the 'System Menu' screen as shown below:



Press on the arrow next to the text 'Automatic Media Filter'. Doing so will call up the accessory password request screen. If you do not have the password to your required accessory contact Parker Sea Recovery in order to obtain it.



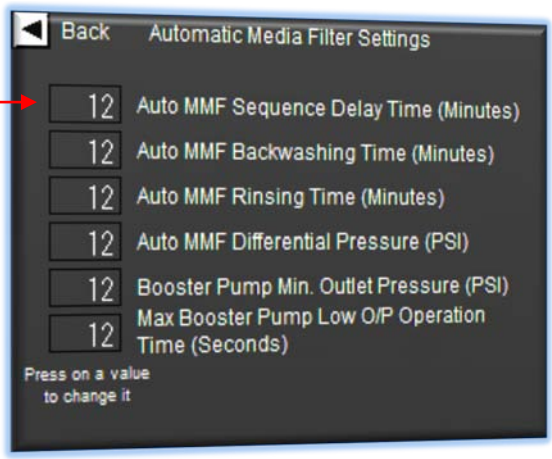
Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

Once the correct password has been entered, the control system will pass you on to the multi-media enable/disable screen, form this screen it is possible to enter into the multi-media system settings screens. To do this, simply press on the button labeled 'Multi-Media Filter Settings' as shown below:

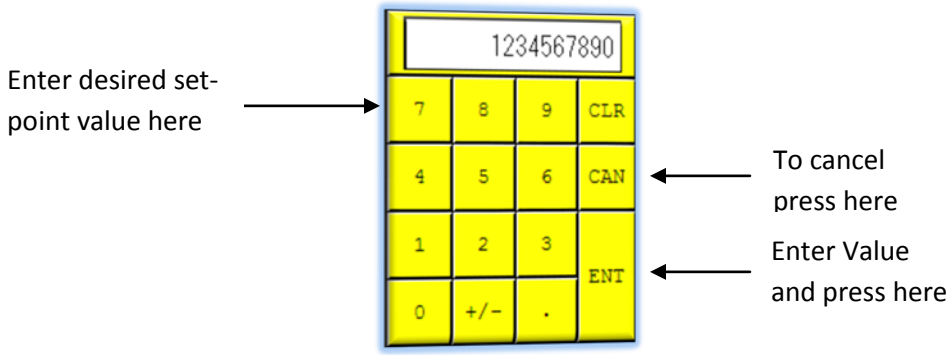
Press to change media settings

Pressing the indicated button will bring you to the following screen:

Press on value to change



To change a value press on the currently entered value, a number entry pop up screen will be displayed. Enter the newly required set-point and press the 'ENT' button to complete entry, to cancel the request press the 'CAN' button as illustrated on the next page:



From this screen it is possible to change the following system set-points:

19.2 Auto MMF Sequence Delay Time (Minutes):

This value stated in minutes determines how long the system will wait before initiating an automatic backwash cycle once the pre-determined differential pressure across the media filter housing has been detected. Once this time expires the controller will shutdown the water maker and prepare the system for an automatic backwash cycle.

Typical values entered here are 5 minutes in all applications

19.3 Auto MMF Backwashing Time (Minutes):

This value stated in minutes determines how long the system will backwash the multi-media filter for. Once this time has expired the controller will shutdown the water maker booster pump and prepare the system for rinsing.

Typical values entered here are 5 minutes in all applications

19.4 Auto MMF Rinsing Time (Minutes):

This value stated in minutes determines how long the system will rinse the multi-media filter for. Once this time has expired the controller will shutdown the water maker booster pump and prepare the system for normal operation.

Typical values entered here are 15 minutes in all applications

19.5 Auto MMF Differential Pressure (PSI):

This value stated in PSI determines at what differential pressure the controller will initiate an automatic backwashing of the multi-media filter assembly. Once the measured differential pressure reaches this set point the control system will initiate a shutdown timer (if operating in automatic mode) or display a performance warning (if operating in manual mode).

Typical values entered here are 25 PSI in all applications

19.6 Booster Pump Min. Outlet Pressure (PSI):

This value stated in PSI determines what the minimum allowable outlet pressure of the booster pump is, if the outlet pressure of the booster pump falls below this set point for a pre-determined period of time the control system will shutdown the pump to protect it from damage.

Typical values entered here are 15 PSI in all applications

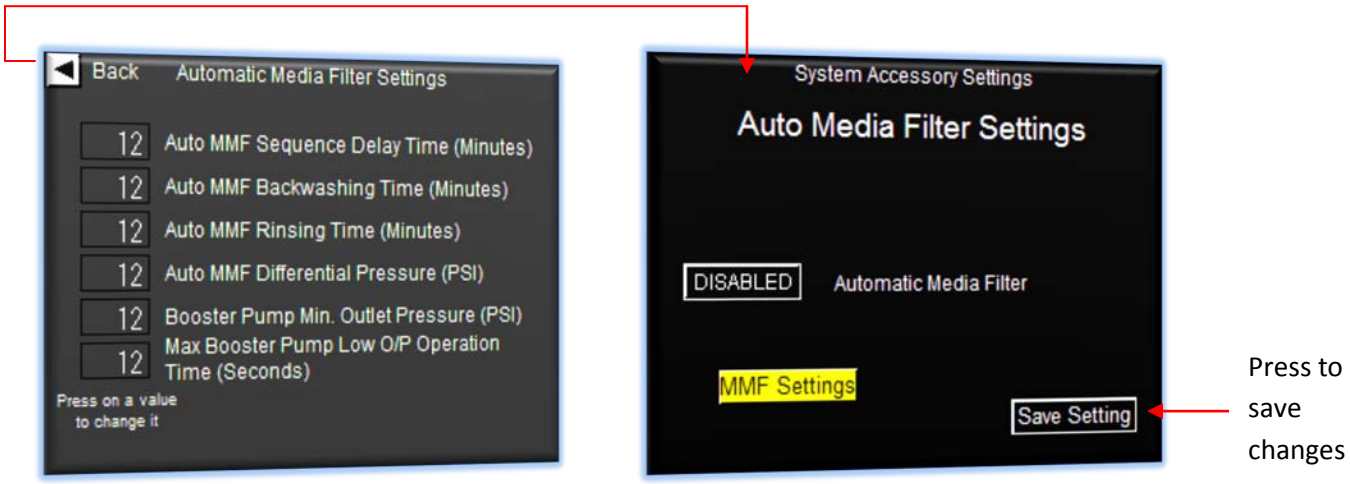
19.7 Booster Pump Low Output Operation Time (Seconds):

This value stated in seconds determines how long the booster pump is allowed to run with low output pressure before the system considers this a fault. If the booster pump output is below the pre-determined level for this entire amount of time the control system will shutdown the pump to protect it from damage.

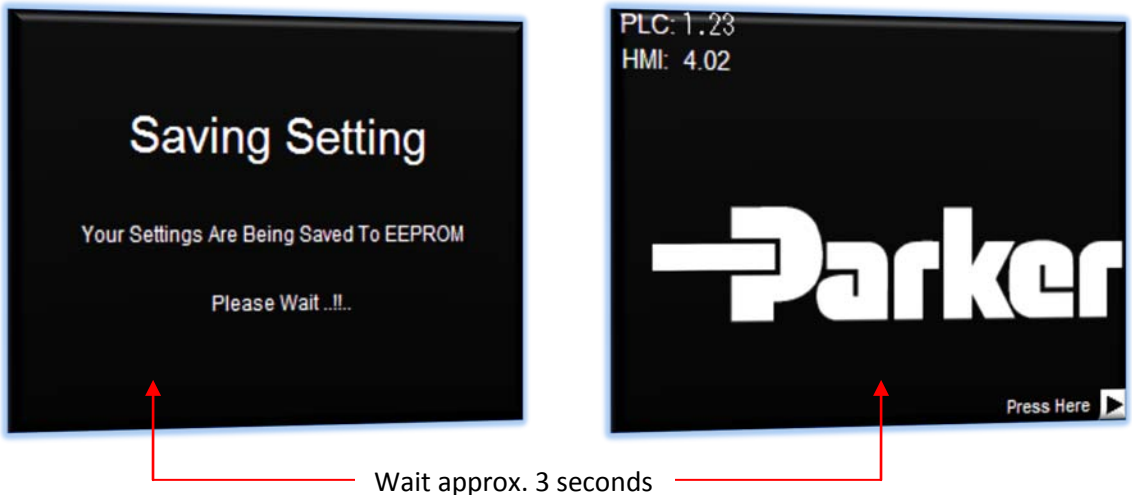
Typical values entered here are 30 seconds in all applications

19.8 Saving Multi-Media Filter Option Settings

Once you are finished inputting these settings press the arrow in the top left hand corner of the screen until you return to the screen as detailed below:



Once you have changed the multi-media system settings to your requirements, press 'Save Setting' button in the lower right corner of the screen to store these changes into system EEPROM. Once the 'Save Setting' button has been pressed the system will advise you that these changes are being stored, once the store is complete the system will return to the main splash screen as shown below:



Your multi-media system settings have now been saved and the system is now ready for operation.

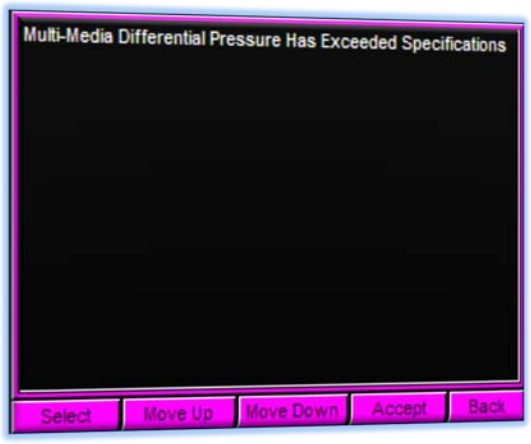
19.9 Activating the backwash cycle while operating the system in manual mode

The Coral Sea control system is fully capable of initiating multi-media backwash cycles automatically however this will only occur if the system is operating in fully automatic mode. If the system is operating in manual mode automatic backwashing of the multi-media filter assembly is disabled, instead the system will raise a performance warning notification indicating to the user that the detected multi-media filter differential pressure has exceeded specifications, as shown below:

Press here to review error

Press here to ignore

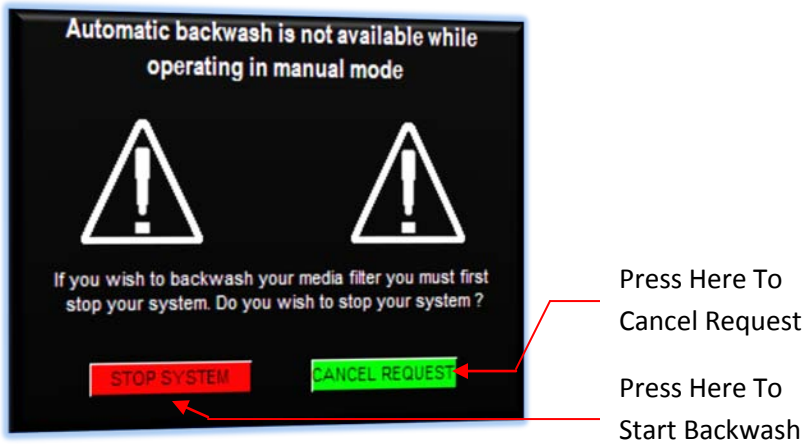
Pressing 'Ignore' clears the performance warning; pressing 'Show Log' will open the performance warning log window where details concerning the detected problem are given as shown below:



Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

Once the user has accepted this alarm the system will continue to function in manual mode and no further notifications will be given. Please note that ultimately a clogged multi-media filter will lead to a filtration chain failure, so although the system will continue to operate please bear in mind that it will not operate for too much longer before shutting down due to low feed system output pressure faults.

Once you have received the above indicated notification you can activate the multi-media sequence by pressing panel button #12 'Back Wash Status' (illustrated on page 7), once you press this button the controller touch screen will display the following screen:



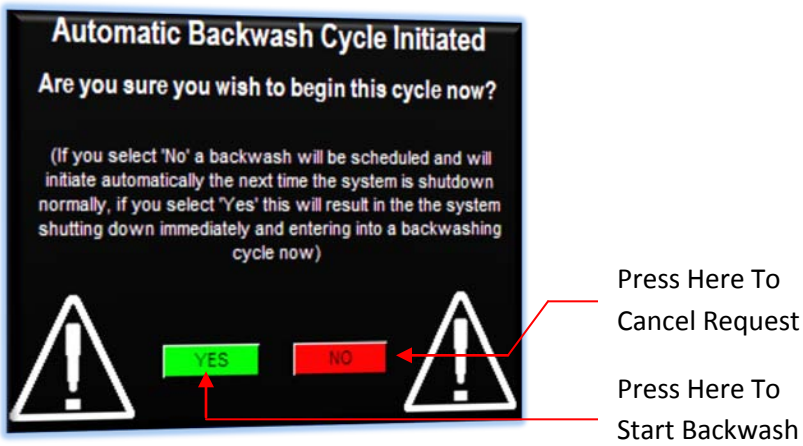
If you wish to cancel your request to initiate the backwashing cycle at this time press the 'Cancel Request' button or simply ignore this screen, after 60 seconds it will self cancel. If you wish to initiate the backwashing procedure press the 'Stop System' button on the touch screen or press panel button #12 'Back Wash Status' again.

Once you press either panel button #11 or the 'Stop System' button on the touch screen the system will enter the automatic backwashing sequence.

19.10 Activating the backwash cycle manually while operating the system in automatic mode

If your system is operating in automatic mode the control system will automatically initiate multi-media backwashing cycles when needed, however you can still initiate these backwash cycles manually if you choose to do so. Please note that if you manually initiate a backwash cycle during automatic operation the system will see this as a manual intervention; hence once the backwash cycle has been completed the system will remain shutdown and will not automatically re-start and re-enter production mode by itself.

To manually initiate a backwashing cycle during automatic mode press panel button #11 'Back Wash Status' (illustrated on page 7), once you press this button the controller touch screen will display the following screen:

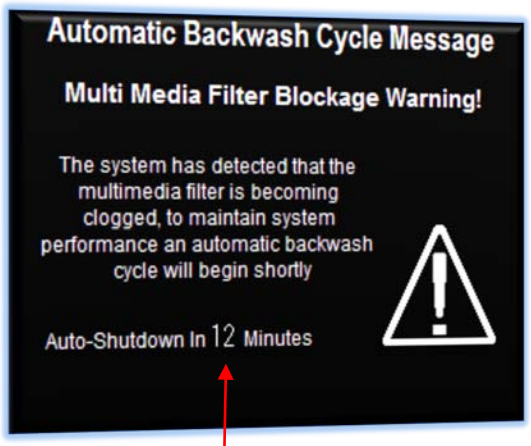


If you wish to cancel your request to initiate the backwashing cycle at this time press the 'No' button, doing so will cancel the above screen and automatically schedule a backwashing cycle for the next time the system is shutdown normally, if you do not wish to initiate a backwash or schedule a backwash for later simply ignore this screen, after 60 seconds it will self cancel. If you wish to initiate the backwashing procedure press the 'Yes' button on the touch screen or press panel button #11 'Back Wash Status' again.

Once you press either panel button #11 or the 'Yes' button on the touch screen the system will begin an automatic shutdown of the water maker and enter the automatic backwashing sequence.

19.11 Automatic activation of the backwash cycle

If your system is operating in automatic mode the control system will automatically initiate multi-media backwashing cycles when needed, when the control system initiates a backwashing cycle automatically its begins by shutting down the water maker, once the backwashing cycle has completed the control system will automatically re-start the water maker and place it back into production. The control system initiates an automatic backwashing cycle when it detects a high differential pressure across the multi-media filter assembly, before initiating the automatic shutdown procedure the control system will alert the system operator by displaying the following screen:



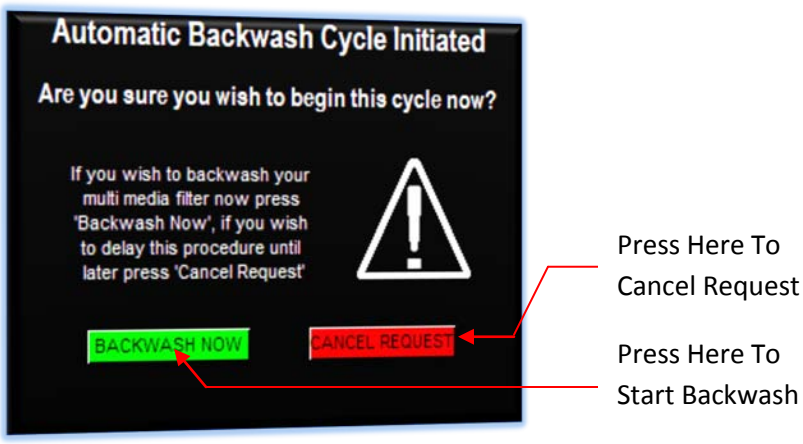
Delay time before backwash starts

Once the indicated time has elapsed the system will begin an automatic shutdown of the water maker and enter the automatic backwashing sequence. Once the backwashing sequence has completed the system will re-start and re-enter production mode automatically.

If you wish to skip the countdown time and initiate a backwash cycle manually press the panel button #11 'Back Wash Status' twice, pressing this button in this manner will abort the 5 minute count down and initiate the backwashing cycle immediately. Please note, as a manual intervention was detected the system will no longer automatically re-start and re-enter production mode, instead it will simply remain in shutdown mode once the backwashing cycle has completed.

19.12 Activating the backwash cycle manually while in standby mode

If your system is currently in standby mode you can initiate a backwash cycle by pressing panel button #11 'Back Wash Status' (illustrated on page 7), once you press this button the controller touch screen will display the following screen as shown on the next page:



If you wish to cancel your request to initiate the backwashing cycle at this time press the 'Cancel Request' button, doing so will cancel the above screen and return you to the previously displayed screen If you do not wish to initiate a backwash or cancel the request within 60 seconds this screen will self cancel. If you wish to initiate the backwashing procedure press the 'Backwash Now' button on the touch screen or press panel button #11 'Back Wash Status' again.

Once you press either panel button #11 or the 'Yes' button on the touch screen the system will begin an automatic backwashing sequence, once the sequence has completed the water maker will return to standby mode.

19.13 The automatic multi-media backwashing sequence

Once the automatic backwashing sequence begins the system will display the following screen:

While this screen is displayed the control system is preparing the water maker for backwashing, this means that if the water maker was operating when the request was initiated the system is being shutdown before the backwashing process starts. Once the system is ready for backwashing this screen will be replaced with the following screen as shown on the next page:

During the time this screen is displayed the water maker will beep, once the warning time has elapsed this screen will be replaced with the following screen as detailed on the next page:

The water maker is now backwashing the multi-media filter, this action will continue until the time has elapsed or unless a fault is detected. Once the back flushing timer has elapsed this screen will be replaced with the following screen:

The water maker is now preparing the system for rinsing the multi-media filter. Once the system is ready for rinsing this screen will be replaced with the screen shown on the next page:

During the time this screen is displayed the water maker will beep, once the warning time has elapsed this screen will be replaced with the following screen:

The water maker is now rinsing the multi-media filter, this action will continue until the time has elapsed or unless a fault is detected. Once the rinsing timer has elapsed this screen will be replaced with the following screen as detailed on the next page:

The water maker is now preparing the system for return to normal operation. Once the system is ready this screen will be replaced with the screen shown on the next page:

This screen will remain displayed for approximately 4 seconds, after this delay the system will return to the main menu. If your control system initiated the backwash cycle automatically, the system will now automatically re-start and re-enter production mode. If not, the unit will remain in a standby state.

After a manual backwashing cycle has been completed a 10 minute timer begins, if the unit is not operated during this time a fresh water flushing cycle is initiated. This cycle repeats every 7 days as described in the 'Fresh Water Flushing' section of this manual.

19.14 Aborting automatic backwashing cycles

During a backwashing cycle you can abort the cycle at any time by simply pressing panel button #5 'System Auto-Stop', once you press this button the system will stop al pumps and display the following screen:

The control system will now reset all valves and return the water maker to standby mode, once this has been completed the display will switch back to the main operation menu, as shown below:

19.15 Automatic multi-media faults

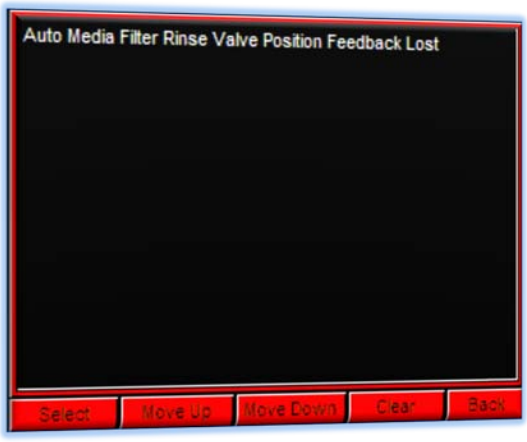
During multi-media backwashing sequences the control system constantly monitors all critical system elements for health, if a fault is detected the backwashing cycle is aborted, all pumps are de-activated the system resets all valves to their home position and returns the water maker to standby mode.

During the abort the system will display the following screens to notify the user which alarm caused the abort and shutdown:

This screen will be displayed as soon as a system fault is detected. Once the system reset has completed this screen switch to the fault warning screen as shown below:

Press here to review fault

Pressing ‘Show Log’ will open the system fault log window where details concerning the detected fault are given as shown below:



Pressing ‘Select’ will highlight the first alarm item.
Pressing ‘Move Up’ will scroll up through the alarm list
Pressing ‘Move Down’ will scroll down through the alarm list
Pressing ‘Clear’ will clear the listed alarm notifications.
Pressing ‘Back’ will exit the alarm list. Please note the ‘Back’ button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press ‘Clear’ to exit this screen.

The operator must correct the detected problem before re-attempting automatic backwashing operation.

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SECTION 6

R.O. MEMBRANE INSTALL & CARE

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Installation of RO elements

Prior to installation - preparations

1) Before directing any pre-treated feed water to elements, make sure piping system and pressure vessels are free of dust, oil, metal residues, organic deposits etc. This check should also be made when elements are reloaded or replaced.

2) Verify feed water quality matches system design values.

3) Flush system (without elements loaded) with pre-treated feed water for approx. 30 minutes.

4) Remove end plates from both ends of pressure vessel, check inside of the vessel and if necessary clean mechanically.


Instruction

If the inside of the pressure vessels are dirty, they should be cleaned. A soft mop or swab should be used, occasionally flushing with pre-treated water. Care must be taken not to scratch the inside surface of the vessels.

5) Install brine end adapter with O-rings into the permeate port of brine side end plate. Lubricate both parts using glycerin. Thrust ring should be used according to following note.

Note:

with “thrust ring”	without “thrust ring”
TM-series 8inch	others

Make sure “thrust ring” for absorption of axial thrust (this is a part of the pressure vessel) is installed for TM-series 8inch such that it will transmit axial forces from brine side element (this is the first element to be installed).

6) Optionally, permeate adapter with O-rings is inserted into the permeate port of brine side end plate at this stage. The risk of seal damage can, however, be minimized if this installation is done as last step, before re-fitting piping connections.

7) Attach brine side end plate onto the brine side of the vessel and install retaining ring set according to instruction manual of the pressure vessels.

To facilitate final control of element installation, it is useful to remove the head seal prior to insertion. Verification of full element insertion is easier this way, since the installed head seal usually provides for additional resistance upon removal of the end plate.

All required parts (except the vessel permeate adaptors) are shipped with each element package from Toray.
Permeate adaptors and thrust devices are typically supplied by the pressure vessel manufacturer.
When ordering pressure vessels, please specify type of RO element to be installed to ensure correct parts are provided by the vessel manufacturer.

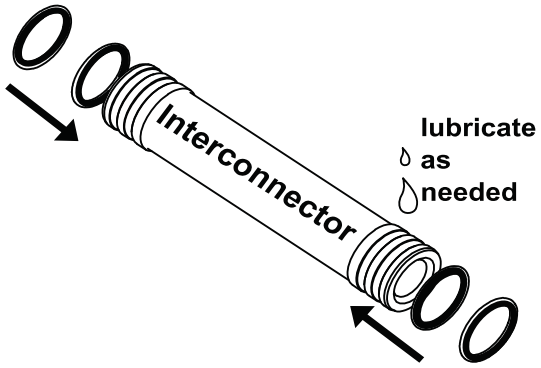
Unpack the elements.

1) Open element boxes, and remove RO elements and accessories. The accessories are separately packaged in small plastic bags inside the element box. Put empty boxes aside.

2) Prepare necessary parts as shown in the following table:

Parts	Required quantity
Brine seals	One per element
O-Rings	4 per element
Permeate port adaptor (open)	One per pressure vessel
Permeate plug adaptor (solid)	One per pressure vessel
Interconnectors	(qty. of elements) − (qty. of pressure vessels)

3) Assemble interconnectors with supplied O-rings carefully to avoid any scratches. Use glycerine as lubricant. Keep assembled interconnectors in a clean place until insertion into permeate tubes.



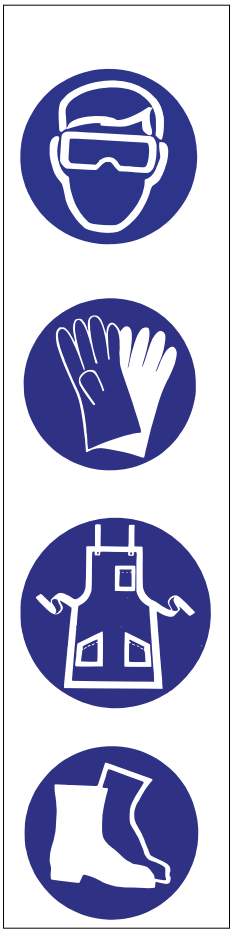
4) Safety considerations prior to opening of element packing bags:

Danger As shipped from Toray, new elements are packaged in approx. 0.5-1.0% sodium bisulfite solution, or sodium chloride solution with deoxidizer. Do not ingest these solutions. Solutions may be irritating to eyes and skin. Protection equipment is required. For details, see MSDS of sodium bisulfite solution.
The element shell is FRP (Fiber Reinforced Plastic). Beware of glass fiber strands and use correct safety equipment.

5) Cut open the element's shipping bag and prepare for insertion, following illustrations provided below.

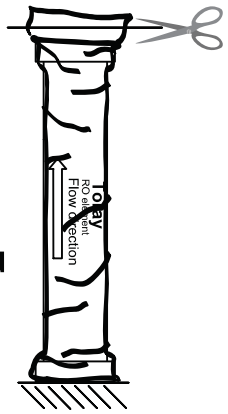
Toray elements come with a “flow direction arrow” laminated into the element shell. The arrow is simply provided to help ensure the brine seal is oriented in the right direction during installation. The arrow does not indicate a mandatory installation direction – the element can in fact be installed either way. The important point is the correct installation of the brine seal relative to direction of brine flow (see illustrations below)

Sample procedure



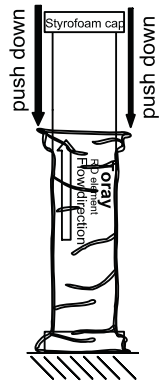
1.

Cut open the element's shipping bag at the top end

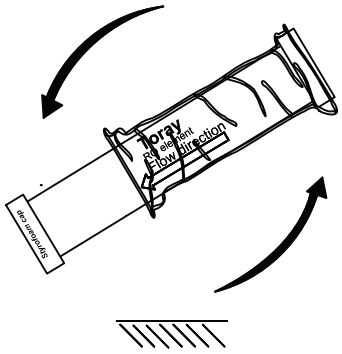


2.

Push down shipping bag. Leave upper styrofoam cap in place.

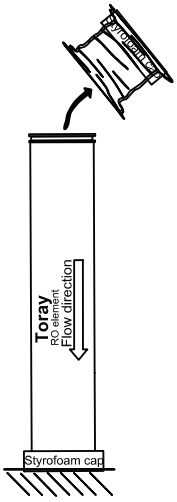


3.



Turn the element over. Element will stand on styrofoam cap now.

4.



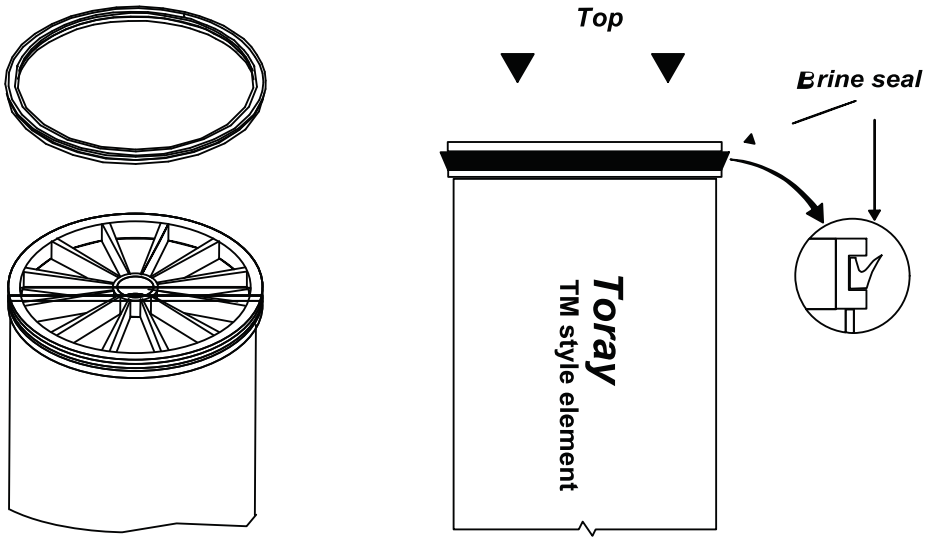
Remove top styrofoam cap, together with shipping bag.

The shipping bags are made of a special material which is a barrier to oxygen. This improves the useful lifetime of the preservation solution in the bag. If the bags are carefully and cleanly cut open at one end, some can be kept and re-used in case any RO elements need to be conserved or shipped.

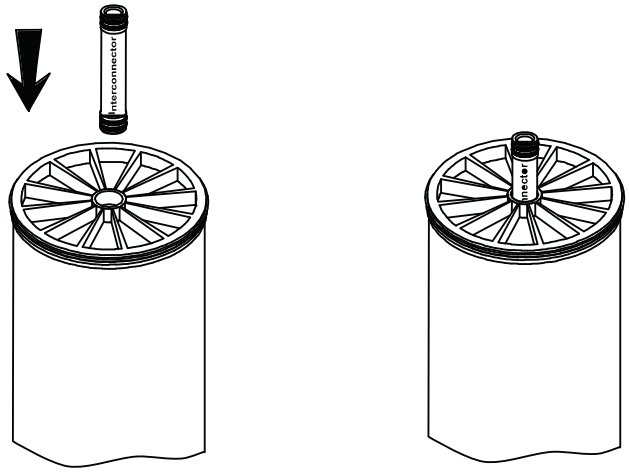
Assembly of element and accessories

1) Install brine seal:

Toray elements shipped from Toray Membrane USA will come with brine seal pre-installed, so this step can be omitted. Just check correct position of seal in this case. For other regions, follow subject illustration.



2) Install interconnector. Lubricate using glycerine as necessary.



Insertion of elements

Instruction

This is best done by a team of two persons.

Verify position and direction of the V-shaped brine seal as in illustration TMM-200.1.

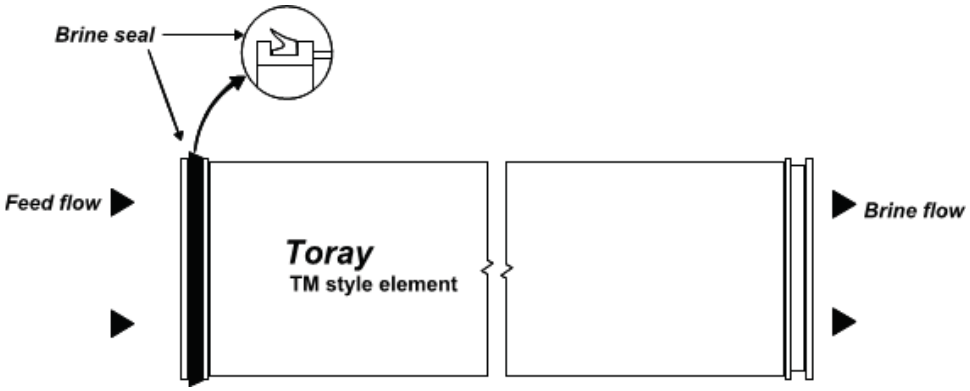


Illustration TMM-200.1: Orientation of brine seal

Caution

Only one brine seal per element is required. Do NOT install two. The brine seal is typically fitted at the feed end of the element.

If not already performed, open the RO pressure vessel's feed side

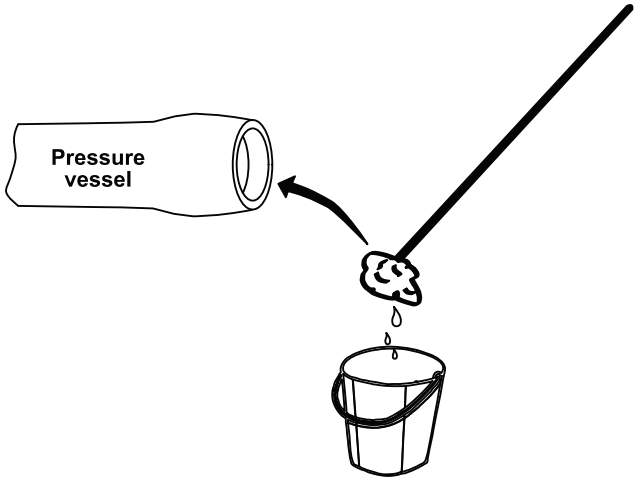
This procedure can be prepared by removing any head locking devices, prior to starting unpacking of elements, if site conditions allow this.

Lubricate the inside of RO pressure vessel with water and glycerine. This will

facilitate installation of elements (especially with longer pressure vessels containing multiple elements). Consider using approximately 100 ml of glycerine for each pressure vessel. If the viscosity of the glycerine is too high, dilute with clean water as needed for better lubrication.

Limit ingress of foreign matter, dust and dirt to vessels to a minimum by only opening/ closing one vessel at a time.

Use of a clean, soft mop or swab or similar tool will enable lubrication of the full length of the vessel. Take care not to scratch the inner surface of the pressure vessel.



After lubricating brine seals and vessel's inner surface with glycerine, insert element from feed side end into the pressure vessel. Approximately 2/3 of its length should be in the vessel, and 1/3 outside the vessel (see Illustration TMM-200.2), Insert element carefully and smoothly, especially the first element.

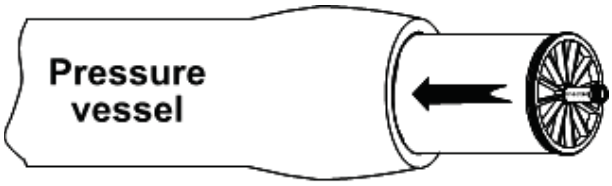


Illustration TMM-200.2: Insertion of first element

Attach brine seal to the second element as described for first element. Connect the two elements at the inter-connector, see Illustration TMM-200.3. The partly inserted element is best held in place by a helper. Now push both elements smoothly and firmly into vessel, keeping them in line to avoid damages to inter-connector or brine seal.

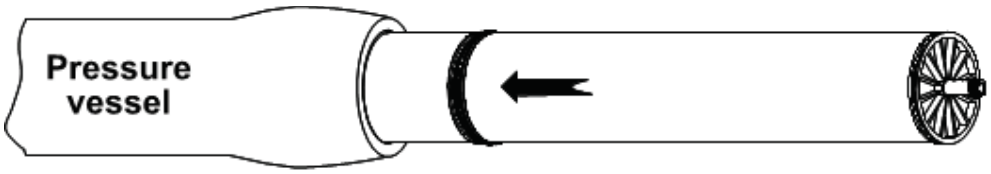


Illustration TMM-200.3: Insertion of following elements

Repeat procedure (see Illustration TMM-200.3). Insert elements one by one into the pressure vessel.

Insert the last element until only 1/3 of the element is outside the vessel

Locate and install correct brine end permeate adaptor (with O-rings) into the internal permeate port of the brine side end plate.

Note: if permeate is to be collected from the brine end of the vessel install the permeate port adaptor. If permeate is not to be collected at the brine end install the solid permeate plug adaptor.

Lubricate all O-rings with glycerine. (Note: this step can wait until just prior to end plate installation into the pressure vessel to minimize any risk of O-ring damage)

Locate and install Thrust ring into the brine side end of the pressure vessel (if provided)

Instruction

A Thrust Ring is typically necessary for 8 inch (and larger) diameter elements. It's purpose is to help absorb axial loads transmitted through the elements in the vessel during operation. It should not be omitted. Omission may result in the possibility of mechanical damage to the downstream elements.

Insert brine side end cap into the brine side of the vessel and install retaining ring set according to pressure vessel manufacturer's instructions

It can be useful to check for complete adaptor insertion into the downstream element and correct position of the brine side end plate relative to the retaining ring groove by first removing the end plate seal (located on the circumference of the end plate). This reduces the resistance to movement of the end plate. The end plate seal MUST be replaced prior to final installation of the end plate.

Push the last element home until the downstream element permeate adaptor tube is firmly connected, and brine side end plate is securely located against the retaining ring set

To prevent premature wear of permeate seal rings, the elements cannot be allowed to move in the axial direction. The permeate ports are typically supplied by the pressure vessel manufacturer. Shim rings are also typically available from the pressure vessel manufacturer to fill remaining gaps or tolerances (see Illustration TMM-200.4).

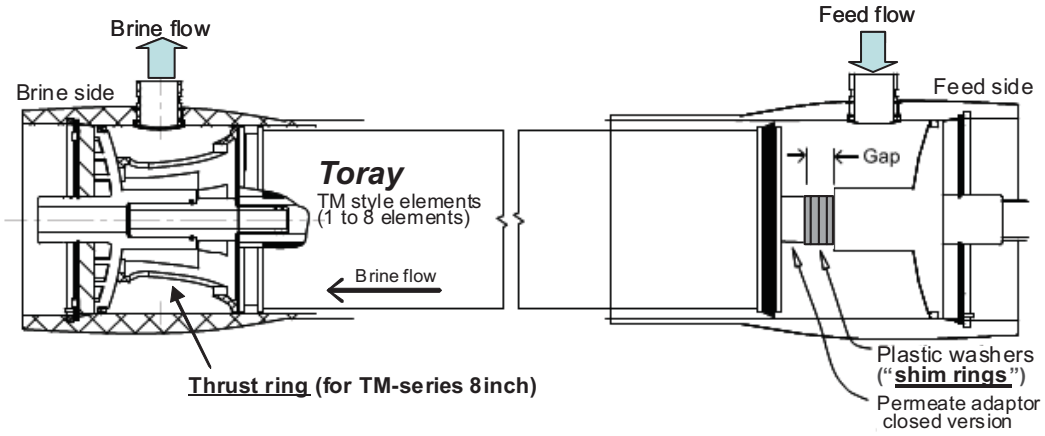


Illustration TMM-200.4: Applying shim rings

After installing all membranes, check distance "A" (see Illustration TMM-200.5). If distance "A" is bigger than the thickness of shim provided by the pressure vessel manufacturer, use the shim to fill the excess distance. Remained distance should be smaller than the thickness of shim. Shims must be positioned on the upstream end of the vessel.

The risk of mechanical disconnection of permeate adapters is especially high if the permeate header is connected to feed side of pressure vessel. The pressure vessel brine side is preferable over the feed side for installation of the permeate output connection to pipework.

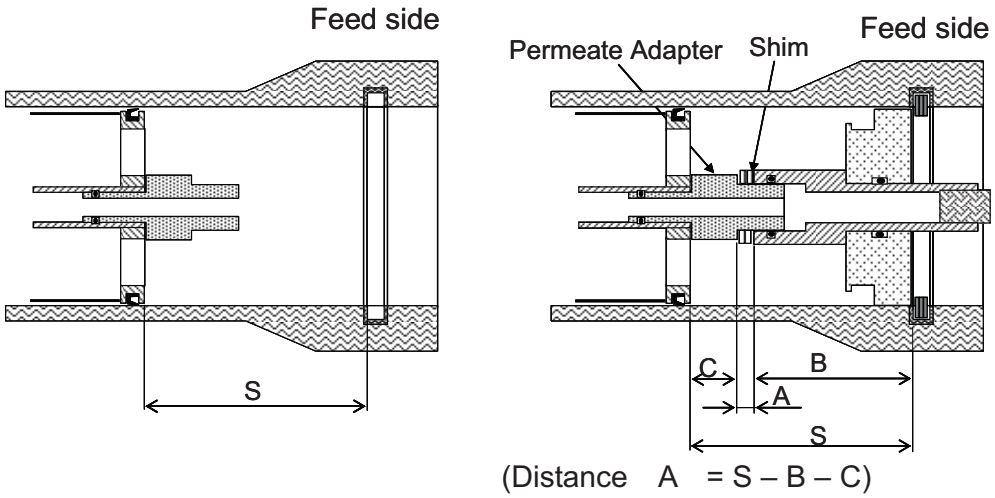


Illustration TMM-200.5: Shimming procedure

Permeate ports not used are best plugged with “closed” or “solid” type permeate adaptors (Permeate plugs) supplied by pressure vessel manufacturer. This provides the best protection against brine entering the permeate stream

Attach the feed side end plate of pressure vessel, and fit piping system to end plates. IMPORTANT: Make sure head seals for all pressure vessel end plates are installed at this time.

Element Removal

Elements may have to be removed from the pressure vessels. Some possible reasons are:

- Inspection
- Long term storage
- Shipment
- Replacement

The procedure to remove elements is as follows:

Caution

Before removing connection from the feed, brine and permeate piping ports on the pressure vessel, the remaining water in pressure vessel should be drained out to release the pressure inside.

1) Remove connection fittings from the feed, brine and permeate piping ports on the pressure vessel.

For side port and multiport pressure vessel configurations, removal of the permeate piping connections from the end plates is all that is required.

2) Remove the pressure vessel end plates from both the feed and concentrate ends of the pressure vessel.

3) Push the element stack into the vessel from the feed end of the pressure vessel. Push the element stack forward so the brine end element sticks out of the pressure vessel far enough for the operator to be able to grip the element and pull the reminder of the element out of the pressure vessel.

4) When removing the downstream element from the brine end of the pressure vessel, pull the element straight out. Do not apply any load up, down, or side to side on the interconnector that connects the element being removed to the upstream element(s) still remaining in the pressure vessel. Excessive load can damage the interconnector, product tube, brine seal, or interconnector O-rings.

5) Repeat procedures 3) and 4) to remove the remaining element(s) in the pressure vessel. A section of PVC pipe can be used to push the elements forward towards the brine end of the vessel for removal.

6) As elements are removed, take care to remove and retain all interconnectors and permeate end plate adapters. These parts may be reused. It is good engineering practice to replace all 0-ring seals with new ones prior to replacement.

If re-installation of elements is expected in the near future, it is recommended the elements are packed immediately into clean plastic bags, (see TMM-500: Storage).

For reloading elements, proceed according to TMM-200: Installation of RO elements.

For proper disposal of removed elements as industrial waste, please check local regulations and dispose accordingly.

Shutdown considerations for RO systems

1) When shutting down a RO system the system should be thoroughly flushed at low pressure with sufficient quality flushing water to displace all the brine from the pressure vessels. (see TMM-250 Flushing procedures)

   Acceptable water for flushing are: Pre-treated feed water (refer to table 240-1), or RO product water

   Water used for flushing should not contain any oxidants, Maintain the flush water solution pH between 3-8.5 at all times

Table 240-1: Suggested flushing water for various RO feed water treatment system

RO feed water type	Flushing water
Sea water	Pre-treated feed water
Brackish water	Pre-treated feed water
Waste water	RO product water
High pH Feed water, (such as 2nd pass high pH feed water)	• Pre-treated feed water without NaOH • 1st pass product water without NaOH

2) Ensure membrane elements are kept wet, properly sanitized, and protected from freezing at all times during the shut-down period.

3) Ensure guidelines for temperature and pH of the preservative solution are observed during shut-down period.

Take care that product back pressure never exceeds 0.05 MPa at any time. Product back pressure should be assessed on an individual stage basis.

Product backpressure is defined as product pressure minus feed resp. brine pressure.

Caution

If multiple RO trains are running in parallel, and one train is to be shut down, care should be taken to assure the train to be shut down is properly isolated from the common header piping using check valves or isolation valves. It is most important that pressure relief valves be present and installed on each individual train permeate line.

4) Membrane elements should not, under any circumstances, be exposed to chlorine or other chemical oxidants. Any such exposure may result in damage to the membrane, possibly resulting in irreversible increase in salt passage.

5) Extra care must be taken to avoid chlorine exposure

- When disinfecting piping or pretreatment equipment upstream of the membrane
- When preparing cleaning or storage solutions
- Care must be taken to ensure that no trace of chlorine is present in the feed water to the RO membrane elements.
- If residual chlorine is known to be present in the RO feed, it must be removed with sodium bisulfite (SBS) solution in stoichiometric excess , allowing sufficient contact time to accomplish complete dechlorination.

Short-Term Shut-down

Definition:

Short-term shut-down is for periods where an RO plant must remain out of operation for more than one day, but fewer than four days, with the RO elements remaining loaded in the vessels.

Prepare each RO train as follows:
Flush the RO section with flushing water, while simultaneously venting any air from the system feed piping.

1) When the pressure vessels are filled with flushing water, isolate the train by closing all isolation valves.

2) Repeat 1) and 2) above every 24 hours.

For detailed instructions of flushing procedures, see TMM-250: Flushing procedure.

Long-Term Shut-down

Definition:
Long-term shut-down is for periods where an RO plant must remain out of operation for more than four days with the RO elements remaining in the pressure vessels.

Prepare each RO train as follows:

Case.1) Flushing the RO system when sufficient flushing water is available.

Flush with flushing water for 0.5-1.0 hour at least every 2 days, while simultaneously venting any air from the system. When the pressure tubes are filled, close the valves.

For detailed instructions, see TMM-250 Flushing procedure

Case.2) Flushing the RO system when no flushing water source is available

a) Circulate permeate through the system. While circulating permeate through the system inject the RO system flush line with a 500 to 1000 mg/l (maximum) SBS solution. This solution will serve to inhibit biological growth during the shut down period. Circulate for 30 – 60 minutes.

b) Make sure the RO system is completely filled with the SBS solution . To prevent the solution from draining from the system take care to close all system isolation valves.

c) The pH of the preservative solution should never be allowed to drop below 3.0. The pH should be checked regularly. If the pH drops below 3.2, the preservative solution should be drained and replaced as soon as possible.

d) If pH measurement of preservation solution is not possible, repeat Steps a) and b) with fresh solution.
- Every thirty (30) days if the temperature is less than 80°F (27°C)
- Every fifteen (15) days if the temperature is equal to or greater than 80°F (27°C)

Notes: Any contact of the SBS solution with air (atmospheric oxygen) will oxidize SBS to sulfate, and the preservative solution pH will begin to drop. Care should be taken to keep the SBS preservative solution isolated from atmospheric oxygen. If the SBS is allowed to revert to sulfate the potential for biological activity will increase.

Flushing procedures

One simple procedure for removal of foulants is to flush the system with flushing water. Flushing scours the membrane surface by taking advantage of high velocity at low pressure. A large volume of flush water is required. This procedure can be an effective method for the removal of light organic fouling provided it is applied before significant performance decline has been observed.

General operating conditions for flushing are as follows:

Flushing water: Use pre-treated feed water (refer to table 250-1), or RO product water.

Flushing water should not contain any oxidants

Flushing water pH range should be maintained between 3-8.5.

Table 250-1: Flushing water to use for various RO feed water treatment systems

RO feed water type	Flushing water
Sea water	Pre-treated feed water
Brackish water	Pre-treated feed water
Waste water	RO product water
High pH Feed water, (such as 2nd pass high pH feed water)	• Pre-treated feed water without NaOH • 1st pass product water without NaOH

Pressure: Low pressure (0.1 – 0.2 MPa [15 - 30 psi])

Water flow rate: High flush water flow rate is best but do not exceed recommended vessel pressure drop.
Limit pressure drop to max 0.2 MPa [30 psi] per stage.

Maximum feed flow
rate per vessel

- 8.0 inch element: • 200 l/min (53gpm)
- 4.0 inch element • 50 l/min (13gpm)

Temperature: < 40°C (104°F)

Period: 0.5 - 1.0 hour

It is important to keep the permeate side isolation valve(s) open to keep the permeate back pressure to a minimum during the flushing procedure Feed/brine pressure should always be higher than permeate pressure to avoid any membrane damage.

Flush each stage (bank) separately.
Do not re-circulate flushing water.

Preservation procedures for RO elements

The objective is to store elements under clean conditions to maintain performance and to prevent bacteria growth.

After system shut-down, displace brine in the system with flushing water.

General conditions for preservation:

Flushing water: Use Pre-treated feed water (see Table 260-1), or RO product water.

Water for the flushing should not contain any oxidants

Flushing water pH range should be maintained between 3-8.5.

Table 260-1: Flushing water of various RO feed water treatment system

RO feed water type	Flushing water
Sea water	Pre-treated feed water
Brackish water	Pre-treated feed water
Waste water	RO product water
High pH Feed water (such as 2nd pass high pH feed water)	● Pre-treated Pass 1 feed water without NaOH ● 1st pass product water without NaOH

Caution

If potential for scaling and fouling exists, membranes must be flushed on shutdown according to TMM-250 Flushing procedures.

1) To maintain performance, elements must be wet at all times.

2) To prevent bacterial growth in the pressure vessels, sanitization procedures may be required - see TMM-400: Sanitization Methods

3) If elements are contaminated/fouled and extended shutdown is scheduled, it is recommended to perform chemical cleaning prior to preservation. This removes foulant from membranes and minimizes bacterial growth. Please review:

- TMM-300: General instructions and conditions for RO cleaning
- TMM-310: Guidelines for RO cleaning
- TMM-320: Instructions for chemical cleaning.

4) Allowable temperature range for preservation solutions 5° – 35°C (41 – 95°F)

5) Allowable pH range during preservation in the pressure vessel is 3 – 8.5

6) Make-up water for preservation solution must be free from residual chlorine or other oxidizing agents.

For preservation of elements, use sodium bisulfite solution. For details see section TMM-400: Sanitization Methods

General instructions and conditions for RO cleaning

The surface of an RO membrane is subject to fouling by suspended solids, colloids and precipitation. Pre-treatment of feed water prior to the RO process should be designed to avoid contamination/fouling of membrane surface as much as possible.
Operation at optimum conditions (permeate flow rate, pressure, recovery and pH-value) will result in less fouling of the membranes.
SDI15 is a measurement of particulates present in the feed water. With high SDI15 values (even in allowable range), membrane fouling due to particulates can cause performance decline in long-term operation.
Fouling can also be a consequence of large variations in raw water quality, or of errors in RO operation mode.
Fouling of the membrane surface will result in a performance decline, i.e. lower permeate flow rate and/or higher solute passage and/or increased differential pressure loss from feed side of a stage to the brine side.
Illustration 1 illustrates the effect of flux decrease due to fouling, and restoration of flux through cleaning. If the source of the foulant is not addressed and corrected, foulant removal will only bring temporary relief, as illustrated by the “saw tooth” pattern of the permeate flow in Illustration TMM-300.1.

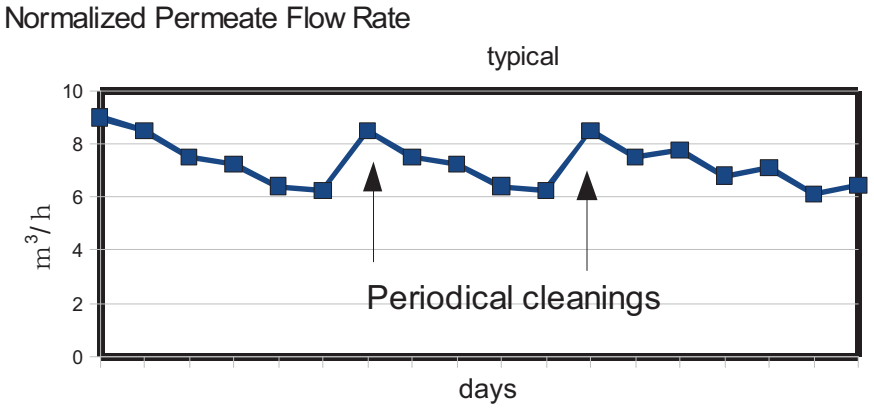


Illustration TMM-300.1: Effect of fouling on permeate flow rate

It should be noted that the best solution is typically to remove the foulant through improved pretreatment rather than subject the membranes to repeated cleanings.

Guidelines for RO cleaning

When to clean:

For best efficiency of cleaning procedure, elements must be cleaned before fouling has fully developed. If cleaning is postponed for too long, it will be difficult or impossible to completely remove foulants from the membrane surface and re-establish full performance.

Commence cleaning when

1. Normalized differential pressure increases more than 20%
OR
2. normalized permeate flow rate decreases by more than 10 %
OR
3. normalized salt passage increases by more than 20 %.

Weighing an element is an easy check for the occurrence of fouling. If the weight of the element is much higher than that of new element, fouling has occurred. Before weighing the element, stand it vertically on a perforated plate or drain for 60 minutes to allow drainage of fluids.

The approximate weight of new elements (drained condition) are:

- 4 inch diameter x 40 inch long: 4Kg,
- 8-inch diameter x 40 inch long (400ft2 membrane area): 15Kg
- 8-inch diameter x 40 inch long (440ft2 membrane area): 16 kg

Determination of foulant type

It is important to determine the type of foulants on the membrane surface before cleaning. The best approach for this is a chemical analysis of residues collected with a membrane filter during an SDI15 value determination for pretreated water.

In situations where chemical analysis is not available, it is often possible to classify foulants by color and consistency of residue on the membrane filter. A brownish color residue will typically indicate iron fouling. White or beige color typically indicates silica, loam, calcium scale, or biological fouling. Crystalline constitution is a feature of calcium scale or inorganic colloids. Bio-fouling or organic material will – besides the smell - often show slimy/sticky consistency.

Selection of cleaning procedure

Once contamination of the membrane surface has been identified, the correct cleaning procedure must be selected.

- If foulants are believed to be metal hydroxides, such as ferric hydroxide, or calcium scale, acidic cleaning procedures are promising, (see TMM-320: Instructions for chemical cleaning, TMM-330: Citric acid cleaning procedure).

- If foulant is believed to be organic or biological fouling, a cleaning procedure with detergents is recommended, (see TMM-320 Instructions for chemical cleaning, and TMM-340.Dodecyl Sodium Sulfate (DSS) Detergent Cleaning Procedure).

Evaluation of the effectiveness of cleaning

Descriptions of various cleaning procedures are given in TMM-320: Instructions for chemical cleaning. If the recommendations are followed, good results are generally obtained in many cases. Pressure drop across the modules should be reduced to initial value while permeate flow rate and solute rejection will be restored.

If performance is not sufficiently improved after cleaning, a different cleaning procedure may lead to a better result. Foulants will frequently adhere to membrane surface or remain in spacer material. Final removal may take several successive cleaning procedures. As foulants may be present as layers on the membrane surface, alternating citric acid and detergent (acid/ alkali) cleans are frequently more effective than repeated cleans with only one type of cleaner..

Instructions for chemical cleaning

General guidelines

Chemical maintenance cleanings are performed to remove contaminates from membrane surfaces by dissolving and/or separating through physical and chemical interaction with cleaning chemicals.

It is good practice to perform a system flush prior to initiating a chemical maintenance cleaning If the RO system is to be shut down for and extended time it is recommended that a chemical cleaning be performed prior to the introduction of any chemical preservatives After any chemical cleaning, it is recommended that the system be thoroughly flushed with either pre-treated raw water or permeate to insure removal of any residual cleaning chemicals dissolved or suspended solids from the RO system. See TMM Section 250 for flushing procedures.

CIP agents:	Generic cleaning chemicals are listed in Table 320-1
Make-up water:	Softened water or permeate, free of heavy metals, residual chlorine or other oxidizing agents.
Required quantity of CIP solution:	• 40 – 80 liters (11 - 22 gallons) per 8 - inch element (depending on the severity of the fouling) • 10 – 20 liters (3 - 6 gallons)per 4 - inch element (depending on the severity of the fouling)
CIP pressure:	Low pressure (0.1 – 0.2 MPa [15 – 30 psi])
CIP flow rate	
Recommended flow rate:	100 – 150 L/min ([25-40gpm], [6-9m^3/h]) per 8inch Vessel; 25 – 36 L/min ([6.5-10gpm], [1.5-2.2m^3/h]) per 4inch Vessel; The goal is to try and achieve the recommended cleaning flow rates above while keeping the cleaning solution pressure within the CIP pressure range of 15-30 psi.
Min. feed flow rate:	50 l/min (13.2 gallons/min) for each 8 - inch vessel 10 l/min (2.7gallons/min) for each 4 - inch vessel

SECTION 7

MAINTENANCE AND REPAIR

7 MAINTENANCE & REPAIR

From time to time, Parker Hannifin may make programming changes to the Control Logic.

Other production changes are tracked by Parker Hannifin through the System Serial Number.

Troubleshooting methods and results can vary depending on the operating conditions indicated on the SYSTEM control panels.

When ever requesting assistance from Parker Hannifin or one of Parker Hannifin's service dealers,

ALWAYS PROVIDE ALL INFORMATION AND OPERATION CONDITIONS DISPLAYED AT THE SYSTEM CONTROL PANELS.

SERIAL NUMBER: Helps us to determine the latest physical version and configuration of your system which is necessary to ensure that we provide you with the correct information or parts.

TYPE: Tells us the production capacity of your system which gives us a bench mark in diagnosing product water flow and pressure concerns.

TIME RUNNING: Assists us in diagnosing abnormalities that can occur at given operational time intervals such as required pump maintenance, or R.O. membrane element condition.

VERSION: Allows us to determine the specific sequential operation of the system based on the version of the programmed control logic.

AND Always provide us with the System Operating Voltage, Cycles, and Phase.

QUALIFICATIONS

Technicians must have technical knowledge and ability in the following fields:

a) Electrical, Electronic, Electric Motors & Circuits
b) Electromechanical & Mechanical Systems
c) Hydraulic and Liquid Pressure & Flow Systems
d) Piping and Plumbing Systems
e) Water Suction & Pressure Lines
f) Thru-Hull Fitting below & above water level

DO NOT PERFORM MAINTENANCE UNLESS:

1. The System Feed Water Sea Cock Valve is closed.
2. The system main electrical disconnect switch is switched "OFF", LOCKED, and TAGGED.
3. Section 10, Drawings Section is available.
4. Use of non SRC parts will cause damage to the System and void all Warranty. USE ONLY SRC SUPPLIED PARTS.

WARNING: ELECTRICAL SHOCK HAZARD. A Volt / Ohm Meter will be necessary. The following installation procedures expose the installer to High Voltage and electrical shock hazard. Only attempt this if you are a qualified electrician and only if surrounding conditions are safe.

REVERSE OSMOSIS MEMBRANE ELEMENT SUSCEPTIBILITY TO CHEMICAL ATTACK:

CAUTION: Do not expose the Parker Hannifin System to these chemicals:

Hydrogen peroxide	chloramines-T
Chlorine dioxide	chlorine
Bromine	phenolic disinfectants
chloramines	N-chlorioisocyanurates
hypochlorite	iodine
Bromide	petroleum products

or any other specific chemical not approved in writing by Parker Hannifin Corp. Use of non authorized or misuse of authorized chemicals voids warranty. Never use third party so called "Reverse Osmosis Chemicals" for storage or cleaning. Third Party chemicals will dissolve copolymer components within the Parker Hannifin System and will destroy the R.O. membrane element. Use of and subsequent damage caused by non Parker Hannifin Chemicals are the liability and responsibility of the operator and are not covered by the Parker Hannifin Warranty.

Do not connect any water line to the Parker Hannifin R.O. System that may contain any of the above listed chemicals. Examples: Do not connect the Parker Hannifin R.O. System to the ships potable product water tank if that tank has been treated with a Brominator as Bromine destroys the copolymer components within the system. Do not connect the Parker Hannifin R.O. System to any line that may contain chlorine or other oxidants as they destroy the R.O. membrane element.

If you use detergents to clean the internal wetted parts of the system ensure that they are rinsed thoroughly, wiped and dried prior to reassembly. After the components have been reassembled, product water can be used to remove any feed water residue from the exterior surfaces of the components.

USE OF NON-AUTHORIZED OR MISUSE OF AUTHORIZED CHEMICALS VOIDS SYSTEM WARRANTY.

7.1 50 HOURS CHECK

Approximately every 50 hours of use, the System should be inspected as part of a preventive maintenance program.

The following steps should be taken to ensure that potential problems are resolved prior to leading into major repairs. Any electro-mechanical pumping system requires similar preventive maintenance.

1. Mounting Hardware: Because the system is subject to vibrations transferred from the drive source, inspect all mounting hardware for tightness. Inspect all screws, brackets, nuts and bolts. Pay special attention to the mounting of the high-pressure pump and its electric motor as they are subject to more vibration than the rest of the system.
2. High-pressure Pump (optional): Regularly check the level of the crankcase oil. When the pump is horizontal, the oil level should be at the high level mark on the dipstick gauge. Over filling does not harm the pump. Use only Parker Hannifin SRC PO 2.5 high-pressure pump crankcase oil, which is available in 2.5 gallon containers.
3. Regularly clean any salt water or salt deposits off any part of the system by rinsing with a rag wetted with fresh water. Dry all parts, and as protection against the salt water environment, apply a thin coating of light oil such as WD-40 to the external metal parts.
4. Regularly check drive belt wear and tension (optional pump). The Tasman Sea Series Systems utilizes a "toothed" timing gear type belt. It does not require excessive tightening. Pay special attention to alignment, but do not over tighten the drive belt.
5. Check regularly for fluid leaks; either oil from the high-pressure pump (optional) or water from anywhere in the system. Do not arbitrarily tighten water fittings unless they are obviously loose or leaking. Do not over tighten the fittings. Be sure to tighten the black tube fittings by hand only, without tools. Use caution in tightening the gray PVC fittings.
6. Regularly check all tubing and high-pressure hoses for wear and friction against abrasive surfaces. Hoses should not be in contact with heated or abrasive surfaces.
7. Ensure that all high-pressure piping align properly to their respective mating pipe. Misalignment causes the Vic gasket, within the Vic fitting, to leak. Misalignment also causes wear and premature failure of the Vic fitting. Do not attempt to compress, align or bring piping together by using the Vic fitting as a "come along". The pipes must be aligned prior to installing the Vic gasket and fitting. Do not over tighten the Vic nuts and bolts..

7.2 OPERATOR MAINTENANCE INTERVALS

The frequency of required maintenance is dependent on the regularity of usage, the condition of the intake water (the location of use), the length of time the System is exposed to water, the total running time and, in some cases, the manner in which the System is installed.

Because of these factors, the Operator Maintenance Intervals are a guideline for recommended actions. The following maintenance timetable is an estimate of the time intervals at which maintenance may be required on various systems components. This is based upon factual data compiled from installations around the world. However, this schedule must be adjusted to each individual system depending upon the variables mentioned above. Refer to the Table on the opposite page.

7.3 SUCTION LINE EXTERNAL TO SYSTEM

Refer to P&ID illustration in Section 10.

1. Beach well and lateral assembly: In time the beach well may become fouled with suspended solids. Should this occur, the well must be relocated or recharged with fresh clean sand. If a deep well should develop iron bacteria the well must then be shock treated with a high dosage of chlorine.
2. PVC low-pressure ball and check valves: If a check valve allows water to leak or siphon back through the line, this would indicate that debris is lodged in the valve or that the seat or seal is worn or damaged and requires replacing. Clean the valve cavity of debris or replace the seal and seat as required.

   If a ball valve allows water to leak or bypass through the line, this would indicate that debris is lodged in the valve or that the seat or seal is worn or damaged and requires replacing. Clean the valve cavity of debris or replace the seal and seat as required.
3. Coarse strainer (not required if feed source is from a well) mesh screen cleaning or replacement:

   Remove the lid from the Coarse strainer by turning the lid counter clockwise. Take care to not damage the sealing gasket O-Ring attached to the lid. Clean the mesh screen, and ensure that the screen is intact. If the welded seam is ruptured or if the mesh screen remains plugged after cleaning, replace it with a new element. This strainer is a consumable, and is not a warranty replacement component.

   Wipe the O-Ring with a damp cloth. Lubricate it with Parker O-Ring lubricant. Seat the mesh screen

Maintenance Timetable:

COMPONENT	MAINTENANCE REQUIRED	TIME INTERVAL INTERMITTENT DUTY	TIME INTERVAL CONTINUOUS DUTY
Coarse Strainer	Inspect & Clean Screen & Housing	100 hours	weekly
Booster Pump	Replace Seals	3 months	2000 hrs
Multi Media Filter	Back wash & Rinse	200 hrs	weekly
Pre-filter	Replace element(s) & Clean housing	Low Pressure <6 psi (x BAR)	Low Pressure <6 psi (x BAR)
Flow Meters	Clean inside the clear face.	When dirty.	When dirty.
HP Pump Danfoss (opt)	Replace or refurbish	8000 hrs	8000 hrs
HP Pump Plunger (std)	Check internal components	500 hrs	500 hrs
R. O. Membrane	Clean Element	When normalized product flow or salt rejection decreases by 10%	When normalized product flow or salt rejection decreases by 10%
Salinity Probe	Clean Probes	Annually	Annually
Charcoal Filter	Replace Element	Monthly	Monthlys
UV Sterilizer	Replace lamp & quartz sleeve	6 months	2000 Hours

back into the bowl. Screw the lid on clockwise. Hand tighten only enough to seal water in and air out.

4. Feed water pump and booster pump (type A-10, B-15 or C-20): Replace the ceramic seal approximately every 2000 hours, or at the sign of leakage. The following procedures are to be followed.

Disassembly:

a) Loosen pump base bolts.

b) Loosen 8 volume bolts and slide pump away from volume. Volume may be left in piping.

c) Insert large screwdriver between vanes of impeller to hold the impeller and remove impeller lock screw from motor shaft.

d) Remove impeller from motor shaft. Two screw drivers 180 degrees apart or other suitable levers against bracket will help, or use gear puller. Do not bend impeller shrouds.

e) Pry carbon seal head from shaft sleeve. Again two screwdrivers as levers will help. Do not attempt to salvage the old carbon seal head.

f) Loosen four motor bolts and remove bracket from motor.

g) Remove seal seat from bracket. Do not attempt to salvage the old seal seat.

h) Inspect the stainless steel shaft sleeve. If scored, it should be replaced unless it can be polished to remove score marks.

i) Remove shaft sleeve if necessary. Heat sleeve to 200-212 degrees to loosen and then slip from shaft. Force of any type is not recommended.

Reassembly:

a) Clean motor shaft thoroughly. If solvents or liquids are used, dry thoroughly. Apply Loctite RC/609 to inside diameter of shaft sleeve. A vial of Loctite RC/609 is supplied with the repair kit or replacement sleeve.

b) Install shaft sleeve onto motor shaft, tapping into place to ensure it is sealed against motor shaft shoulder.

c) Thoroughly clean seal seat cavity in bracket.

d) Place small amount of vegetable oil on white ceramic seat cup and start it into seat cavity. Do not scratch seat surface.

e) Tap white ceramic seat into cavity using a smooth wood dowel, plastic rod or other soft material tool.

f) Install bracket onto motor using 4 bracket bolts. Tighten bolts evenly.

g) Place a small amount of vegetable oil on the rubber parts of black carbon seal head and slip black carbon seal with black carbon face toward white ceramic seat over stainless steel shaft sleeve. Turn black carbon seal head 1/4 turn while pushing towards white ceramic seat.

h) Push carbon seal head down shaft sleeve until carbon face touches stationary ceramic seat.

i) Install new sleeve gasket into shaft sleeve.

j) Install seal spring and retainer over shaft.

k) Install impeller onto motor shaft being careful to align key way of impeller with key way in motor shaft. Be careful seal spring retainer fits inside lip of impeller hub. Push impeller on until impeller bottoms out on shaft sleeve.

l) Install new impeller lock screw gasket into impeller lock screw. Install impeller lock screw into motor shaft and tighten.

m) Return pump to motor and install using new gasket and tighten 8 volume bolts evenly.

n) Jog the motor with the feed water pump switch (SW-1) to ensure free rotation.

5. Pretreatment tank: As the tank gets dirty, clean it with product water and a brush or cloth.

6. Pretreatment pump: The pretreatment pump may be repaired as per the instructions supplied with the pump.

7.4 LOW-PRESSURE PRE-FILTRATION SUBSYSTEM

1. Multi-Media Filter: As required perform multi media backwashing per Section 7.2

2. Flow Meters: Since the flow meter bodies are clear acrylic, light can penetrate them and support biological growth within. In order to gain access for cleaning of the flow meter body, first loosen the union locking rings then remove the body. To clean the flow meter body, pull a wetted soft cloth back and forth through it.

3. Cartridge pre-filter element replacement: The pre-filter elements must be replaced when plugged to the extent that the high-pressure pump is not receiving a positive head and the lowpressure switch is activating and stopping the system due to low feed water pressure to the highpressure pump. Determine if both the 25 and/or just the 5 micron pre-filter elements are fouled by reviewing the feed line pressure gauge readings. The pressure differential reading across these gauges will determine which or if both stages of the cartridge pre-filters are fouled and require replacement. Proceed as follows for the respective pre-filter element replacement. See Section onf Component Manuals.

4. Pressure gauges: The pressure gauges used in the Parker Hannifin R.O. system are non repairable.

   Replace the gauge should it loose calibration or develop a defect or malfunction.

5. Low-pressure switch: The low-pressure switch is normally open and will close on the rise at the factory set pressure of approximately 6-10 psi.

   Should the pressure setting drift from the factory set pressure the switch may be recalibrated.

a. Remove the calibration sealing cap located in the center top of the pressure switch canister to expose the calibration hole and calibration screw.

b. Insert a medium size flat blade screwdriver into the calibration hole. Adjust the calibration screw maximum 1/8 th turn (45 degrees) at a time clockwise to increase the set point or counter clockwise to decrease the set point as appropriate to adjust the switch.

c. Repeat this procedure as necessary to properly calibrate the switch.

7.5 PRESSURIZATION SUBSYSTEM

1. HP Pump (standard): Refer to Danfoss APP Pump instructions in Appendix A.

2. High-pressure pump (optional): Parker Hannifin Positive Displacement Split Manifold Plunger Pump (see below).

a. Servicing the valves:

1) Disassembly:

a) Remove the 6 M41 Hex Valve Plugs.

b) Using standard pliers, remove the valve retainer by grasping the top tab. The valve assembly should remain together. If the assembly separates, the parts will lift out without any tools.

c) Remove the O-Ring in the groove at the bottom of the valve chamber.

d) Inspect machined sealing surfaces on manifold. If pitting is present replace manifold.

2) Reassembly:

a) Examine the O-Rings and back-up rings on the seat and replace if cut or worn. Lubricate the O-Ring with silicone based O-Ring lubricant before installing the valve and seat.

b) Examine the surface of the valve seat for pitting, grooves or wear and replace if necessary.

c) Assemble valve retainer, spring, valve and seat by snapping together securely.

d) Lubricate outer O-Ring and back-up ring surface and walls of valve chamber with silicone based O-Ring lubricant and press valve assembly squarely into chamber.

e) Examine the O-Ring and back-up ring on the valve plug and replace if cut or worn.

   Lubricate new O-Ring and back-up ring with silicone based O-Ring lubricant before

   installing on plug to avoid damaging as they are worked over the plug threads.

f) Lubricate outer surface of O-Ring and back-up ring with silicone based O-Ring lubricant and slowly thread plug into chamber. Exercise caution to avoid extruding the back-up ring.

b. Removing discharge manifold:

1) Remove the 8 M16 x 110mm hex socket screws.

2) Tap the back side of the discharge manifold with a soft mallet and gradually work head from pump.

c. Removing the inlet manifold:

1) Remove the 8 M16 hex nut and M16 split lock washer.

2) Rotate crankshaft to separate inlet manifold from the crankcase. Tap the rear of the inlet manifold with a soft mallet and gradually work from pump.

NOTE: Exercise caution and keep manifold aligned with plungers to avoid damaging plungers as manifold is removed.

d. Servicing the packings:

1) Disassembly of High-pressure Seal:

a) Place the crankcase side of the inlet manifold down.

b) With reverse pliers, remove discharge valve spacer then lift packings and adapter assembly from chamber.

NOTE: If reverse pliers are not available, remove the exposed O-Ring and back-up ring from the discharge valve spacer. Insert screwdrivers on opposite sides of the O-Ring groove, partially pry the discharge valve spacers from the inlet manifold, then work out by hand.

c) Remove the male adapter, v-packings and female adapter by hand.

2) Reassembly of High-pressure Seal:

a) Insert the female adapter into the seal chamber.

b) Assemble both v-packings. Lubricate the outer surface of the packings with graphite based silicone lube, and insert into the seal chamber with the "v" side up.

c) Install the male adapter.

d) Examine the O-Ring and back-up ring on the discharge valve spacer and replace if cut or worn.

e) Lubricate outer surface with graphite based silicone lube and insert discharge valve spacer into seal chambers. Spacer with springs should be installed with springs towards the male adapter.

3) Disassembly of Low-pressure Seal:

a) Place the inlet manifold on blocks with crankcase side down.

b) If a press is not available, use the head of a 5/16" x 4" bolt head to drive the seals out.

NOTE: Reverse pliers may also be used to remove the seal.

c) Separate the stainless steel washer from the adapter.

d) Place the adapter on a block or packing case and drive out the low-pressure seal using a socket sized to fit.

4) Reassembly of Low-pressure Seal:

a) Examine the O-Ring on the adapter and replace it if it is cut or worn.

b) Lubricate inside of the adapter, insert new pre-greased lo-pressure seal into adapter with garter spring facing up and press squarely into position.

c) With crankcase side of the inlet manifold facing up, insert washer into seal chamber.

d) Lubricate inside of seal chamber and outer surface of adapter O-Ring.

e) Insert lo-pressure seal assembly with garter spring facing down and press squarely into position.

f) Servicing the plungers:

1) Disassembly:

a) Remove the seal retainers from the ceramic plungers.

b) Remove the inner collar from the front of the seal retainer.

c) Remove the used wick and install new wick.

NOTE: If replacing plungers, do not lubricate the new wick. Allow grease from new seal to lubricate plunger. If plunger is reused, saturate wick with 40 weight hydraulic oil before installing in seal retainer.

d) Replace collar in seal retainer.

e) Loosen plunger retainer 4-5 turns. Push plunger towards crankcase until plunger retainer pops out.

f) Unscrew and remove plunger retainer and gasket and remove ceramic plunger.

2) Reassembly:

a) Carefully examine each plunger for scoring or cracks and replace if worn.

NOTE: Ceramic plunger can only be installed one direction {Front to back}. Do not force onto rod.

b) Replace stainless steel gasket.

c) Examine gasket O-Ring and back-up ring on plunger retainer and replace if cut or worn. Lubricate O-Ring with silicone based O-Ring lubricant for ease of

installation and to avoid damaging O-Ring.

NOTE: Insert gasket first, then back-up ring and O-Ring.

d) Thread plunger retainer and stud assembly onto plunger rod. Exercise caution not to over torque.

e) Slip seal retainers over plungers. Insert smaller diameter first.

NOTE: Line up wicks with the oil holes in the crankcase and tabs on the oil pan.

f) Rotate shaft and line up two outside plungers.

g) Carefully replace inlet manifold onto plungers and press into crankcase. Keep manifold aligned to avoid damaging plungers.

h) Replace 4 hex socket screws and torque per chart.

i) Lubricate the plungers, the outer surface of the packing case, O-Rings and valve chamber walls with graphite based silicone lube.

j) Press O-Ring end of packing case into inlet manifold chambers.

k) Examine inlet port O-Ring at bottom of manifold and replace if cut or worn.

l) Lubricate outer surface of discharge valve spacer, O-Rings and valve chamber walls and carefully slip discharge manifold over discharge valve spacer.

m) Hand tighten the bottom center 2 hex socket screws first. Then hand tighten the remaining six hex socket screws. Follow sequence and torque per chart.

7	3	4	6
x	x	x	x
x	x	x	x
5	1	2	8

e. Servicing crankcase section:

1) While inlet manifold, plungers and seal retainers are removed, examine crankcase seals for wear.

2) Check oil level and for evidence of water in oil.

3) Rotate crankshaft by hand to feel for smooth bearing movement.

4) Examine crankshaft oil seal externally for drying, cracking or leaking.

5) Consult factory if crankcase service is required.

f. Torque chart:

Item	Thread Tool Size		Torque
Plunger Retainer #41	M 14	M 21	600 KG/CM 516 In.Lbs.
Inlet Manifold Hex nut #45	M 16	M 12	650 KG/CM 560 In.Lbs.
Discharge Manifold Hex Socket Screw #65	M 16	M 10	650 KG/CM 560 In.Lbs.
Valve Plug #63	M 70	M 70	1600 KG/CM 1376 In.Lbs.
Crankcase Cover Screw #16	M 10	M 17	250 KG/CM 217 In.Lbs.
Oil Seal Case	M 10	M 17	250 KG/CM

h. Lubrication:

Fill the crankcase with 10 quarts of oil to the high oil level mark on the oil dipstick as per specifications with SRC pump oil. ORIGINAL CRANKCASE OIL

MUST BE CHANGED AFTER THE INITIAL 50 HOURS OF OPERATION. Change oil every 2 weeks or at 500 hour intervals thereafter. GOOD LUBRICATION IS THE EASIEST, MOST EFFICIENT, AND LEAST EXPENSIVE PREVENTIVE MAINTENANCE. The pump crankcase holds 10 quarts of oil.

2. High-pressure pump motor: This is a ball bearing motor. No lubrication need be added before start up. The bearings have been lubricated at the factory.

a. Relubrication: The following interval is suggested as a guide. Relubricate the front and rear grease jerks every 4-6 months. Use 2-3 strokes of high quality ball bearing grease. Use Shell Dolium R Polyurea medium consistency grease.

CAUTION: Keep grease clean.

Lubricate motors at standstill. Remove and replace drain plugs at standstill. Do not mix petroleum grease and silicone grease in motor bearings.

3. Gear belt:

CAUTION: Switch the system disconnect switch to the "OFF" position, tag and lock for maintenance.

Note: The belt should be tight enough to allow lateral slip on the pulley of 1/8". When applying 8-16 lbs (3.6-7.3 kg) of downward force the belt should deflect 5/16 inch (8 mm). When adjusting the belt, the pump must be drawn away from the motor.

a. Remove the pulley guard.

b. Slacken the pump frame hold-down bolts completely on the pulley side of the pump.

c. Slacken the pump frame hold-down bolts slightly only enough to allow movement on the side opposite

the pulley. A degree of "drag" must be left between the pump and its frame to counteract the imbalance caused by the drag from the pulley belt.

d. Move the pump forward only enough to provide correct tension. Ensure that the motor pulley is still aligned correctly, square to the pump pulley.

e. Carefully tighten the hold down bolts.

f. Recheck pulley alignment and if proper, replace the pulley guard.

4. High-pressure pulsation dampener: The high-pressure pulsation dampener is of the in line type which has no moving or repairable parts.

7.6 POST FILTRATION SUBSYTEM

1. Salinity probe: The salinity probe will require cleaning approximately once a year.

a. To clean the probe, disconnect the three electrical salinity probe leads from the electrical controller taking care to note which color goes on which terminal.

b. Unscrew the probe from its tee housing (counter clockwise).

c. Using a soft bristle brush scrub the monel probes to remove any built up debris.

d. Reinstall the probe assembly into the tee housing and reconnect the electrical wires.

2. Charcoal Filter: A sulfurous smell (like rotten eggs) from the product water indicates that replacement of the activated charcoal is necessary. If no such smell develops beforehand, the charcoal should be replaced monthly. The charcoal filter elements are not cleanable. To replace the charcoal filter elements proceed as follows:

a. Unscrew the bowl from each of the charcoal filter housings (counter clockwise). Do not lose the lid O-Ring.

b. Remove the old charcoal elements and discard them.

c. Clean the lid O-Ring with a cloth and apply silicon based O-Ring lubricant.

d. Clean the bowl with a mild detergent and rinse it out thoroughly.

e. Insert a new charcoal filter element, SRC CFE/20, into each of the three charcoal filter bowls.

f. Place the lid O-Ring into the groove in the bowl.

g. Screw the bowl onto the lid clockwise, hand tight, and slightly snug by hand.

CAUTION: Do not over tighten the bowl onto the base. Over tightening will cause cracking of the lid or bowl and will make removal difficult.

3. Ultraviolet Sterilizer Assembly: Maintenance of the U.V. Sterilizer will consist of lamp replacement and quartz sleeve cleaning. Replace the lamp at the interval suggested on the Maintenance Timetable, or if the lamp fails to start, whichever comes first. The lamp becomes progressively weaker over time, so after six months of use, it may be ineffective though it still lights.

CAUTION: Make sure that system power is turned off before beginning sterilizer maintenance.

4. Product water delivery pump flow control switch: This switch is a normally open (N.O.) electrical switch and the electrical contacts of the switch close when there is product water flow in progress. The switch is set for a minimum of 1/2 gallon per minute flow. Upon closing, the switch sends a 24 VAC signal to a control relay, which in turn operates the pump contactor relay.

5. Product water delivery pump (type SC-100 SS): Replace the ceramic seal approximately every 2000 hours, or at the first sign of leakage.

CAUTION: Switch the system disconnect switch to the "OFF" position, lock and tag the switch for maintenance. Close the system shut-off valve.

A. Disassembly:

1. Remove 8 volume bolts from volume. Volume may be left in piping.

2. Remove pump assembly with motor if possible. Observe and make mental note of all parts prior to any further disassembly.

3. Remove impeller locking screw and washer from shaft.

4. Remove impeller from motor shaft by clamping down on shaft with a 6" pair of "C" clamp vise grips. Place "C" clamp vise grips through vented slots in bracket and clamp down on shaft. Take a heavy screw driver or file and wedge it between veins of impeller. Turn counter clockwise and unscrew impeller from shaft.

Note: If "C" clamp is not available and Allen wrench inserted in one of the pump shaft setscrews can be used to keep shaft from turning.

5. Remove spring and spring retainer of seal. Using two screwdrivers wedged in seal at 180 degrees pry off seal. Remove 4 motor bolts, remove base and slide bracket over shaft. Pry ceramic seat from seal cavity in bracket. Do not attempt to salvage seal or seat.

6. Thoroughly clean seal cavity in bracket and pump shaft with appropriate solvents or cleaners.

B. Reassembly:

1. If shaft was removed, install pump shaft onto motor shaft while aligning setscrews of pump shaft with key way of motor shaft. Ensure that all debris and burrs are removed from motor shaft. Also, ensure that slinger is aligned between the two setscrews of pump shaft.
2. Place bracket on firm surface with seat cavity (pump end) up. Place a small amount of vegetable oil on the seat cup or O-Ring of seat. Place seat in seat cavity with ceramic end up toward pump end. Be careful not to scratch sealing surface of seat with sharp objects or a leaking pump is the result. Gently tap seat into place with a wooden dowel or plastic rod (1-1/8 inch diameter) and to help insure seat is not damaged, use a cloth or clean rag over dowel or rod).
3. Place bracket on motor end, align base in place. Secure with 4 bolts.

Note: The longer 1 1/4 inch bolts are used with base.

4. Pull out pump shaft as far as it will go toward volume end and slightly snug one setscrew to hold shaft in place.
5. Lubricate pump shaft with a few drops of vegetable oil. Push seal in a rotating motion onto shaft evenly with carbon face toward ceramic seat. Be careful not to pull viton bellows from assembly. A tapered device placed over pump shaft threads (5/8" maximum O.D.) can simplify this operation.
6. Screw impeller onto shaft ensuring that the spring retainer of seal does not slip between the shoulder of the shaft and the impeller hub. Tighten impeller securely and reinstall impeller locking screw and washer. A screwdriver or flat file wedged between impeller vanes may be used as a tool.
7. Place gasket on bracket and install volume. Secure with 8 volume bolts and tighten bolts.
8. Set impeller by moving shaft toward motor approximately 0.010" - 0.015" (a screw driver against the shoulder can be used). Slightly tighten one setscrew of pump shaft to hold shaft in position. Rotate shaft by hand to ensure impeller clears volume. If impeller strikes volume, loosen setscrew and move shaft back further, repeat and check. When proper clearance between volume and impeller is achieved tighten setscrews on pump shaft securely.
9. Jog the motor by manually tripping the product water pump contactor to determine if rotation is free.

7.7 CLEANING STATION SUBSYSTEM

1. Solution tank: Clean the tank as required with product water and a cloth.

SECTION 8

COMPONENT USER MANUALS

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CORAL SEA

PRE-FILTER REPLACEMENT PROCEDURE

Document P/N B651970001
Revision A (Aug 1, 2011)

Sea Recovery Corp.
P.O. Box 5288
Carson, Ca 90745-5288
www.searecovery.com • sales@searecovery.com

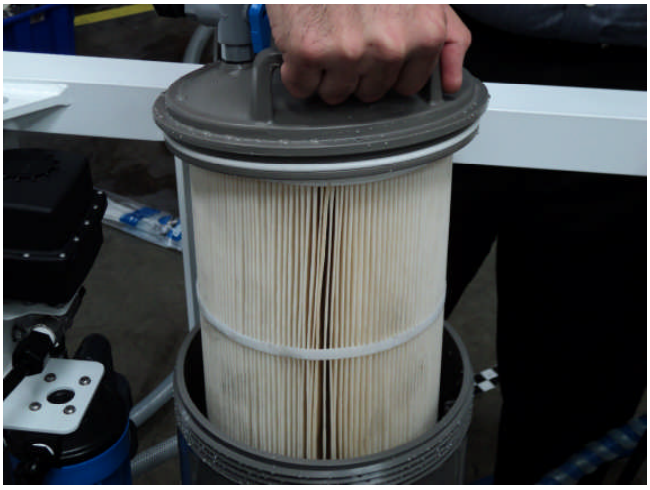
Main Control Box – Turn Booster Pump Off

Reduce Pressure Press Bleeder Valve Lever Down

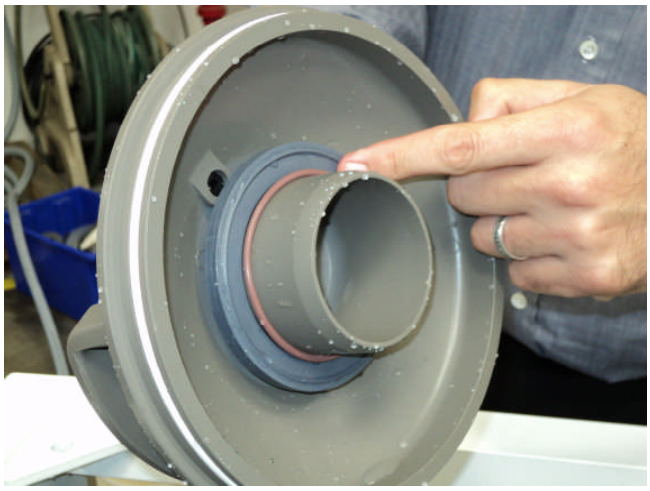
Open Discharge Valve to Drain Filter Housings

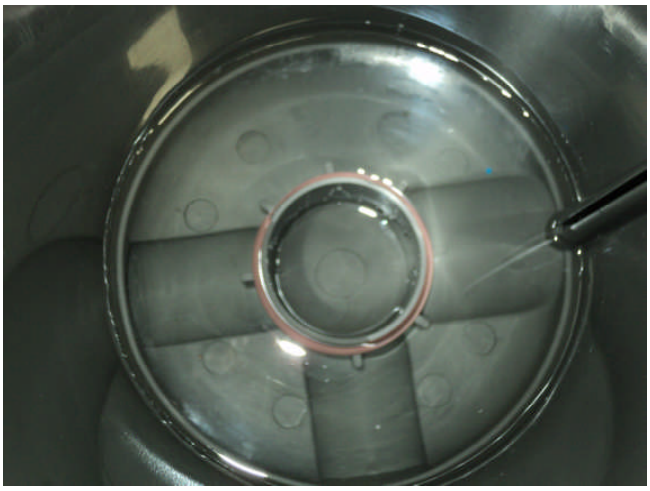
Remove Retainer Ring by Turning Counter-Clockwise

Pull up the Cover by the Handles Provided & Inspect the O-Ring Seal



Remove Filter Assembly from Housing





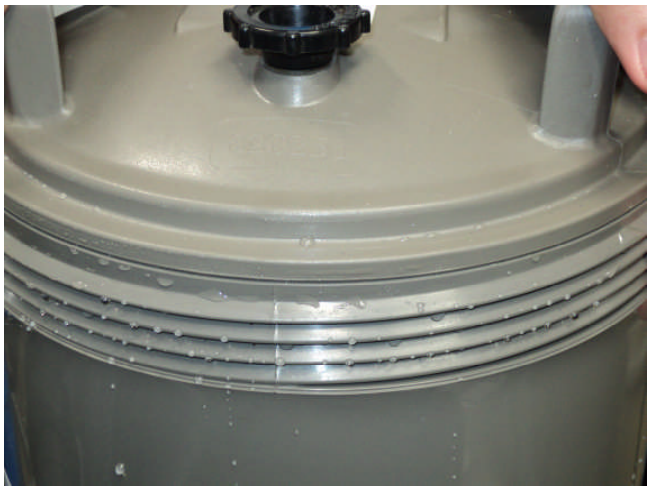
Inspect and Check for O-Ring Seals (Top & Bottom)

Wash & Rinse the Filter Housing

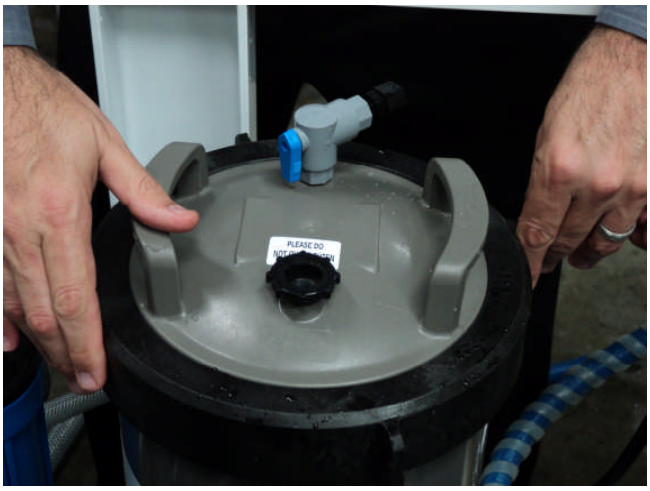
Install New Filter Cartridge Ensuring the Filter is Bottomed out on the Bottom O-Ring Seal

Place Cover Back on Filter Housing

Press Firmly Until Cover & Housing Make Contact



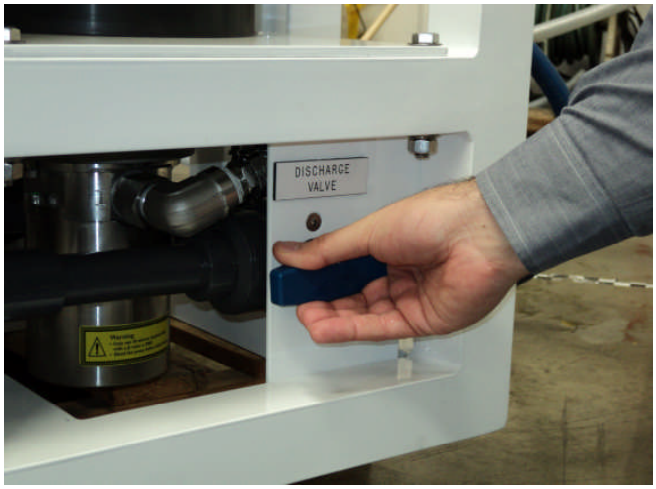
Correct Cover Installation



Place Retainer Ring Over Cover and Tighten Clockwise

Booster Pump Can now be Started Run for 5 Minutes to Flush Any Dirt

Close Bleeder Valve Lever by Pressing Up when A steady stream of Water Comes Out the Valve



Main Control Box – Turn Booster Pump Off Close Discharge Drain Valve

CORAL SEA

AUTOMATIC MULTIMEDIA VALVE

DESCRIPTIONS AND POSITIONING GUIDE

CORAL SEA

MULTIMEDIA

VALVE DESCRIPTION & POSITIONING GUIDE

Document P/N B651970040

Revision A (September 15th, 2013)

Sea Recovery Corp.

P.O. Box 5288

Carson, Ca 90745-5288

www.searecovery.com • sales@searecovery.com

Coral Sea

Automatic MultiMedia Valve

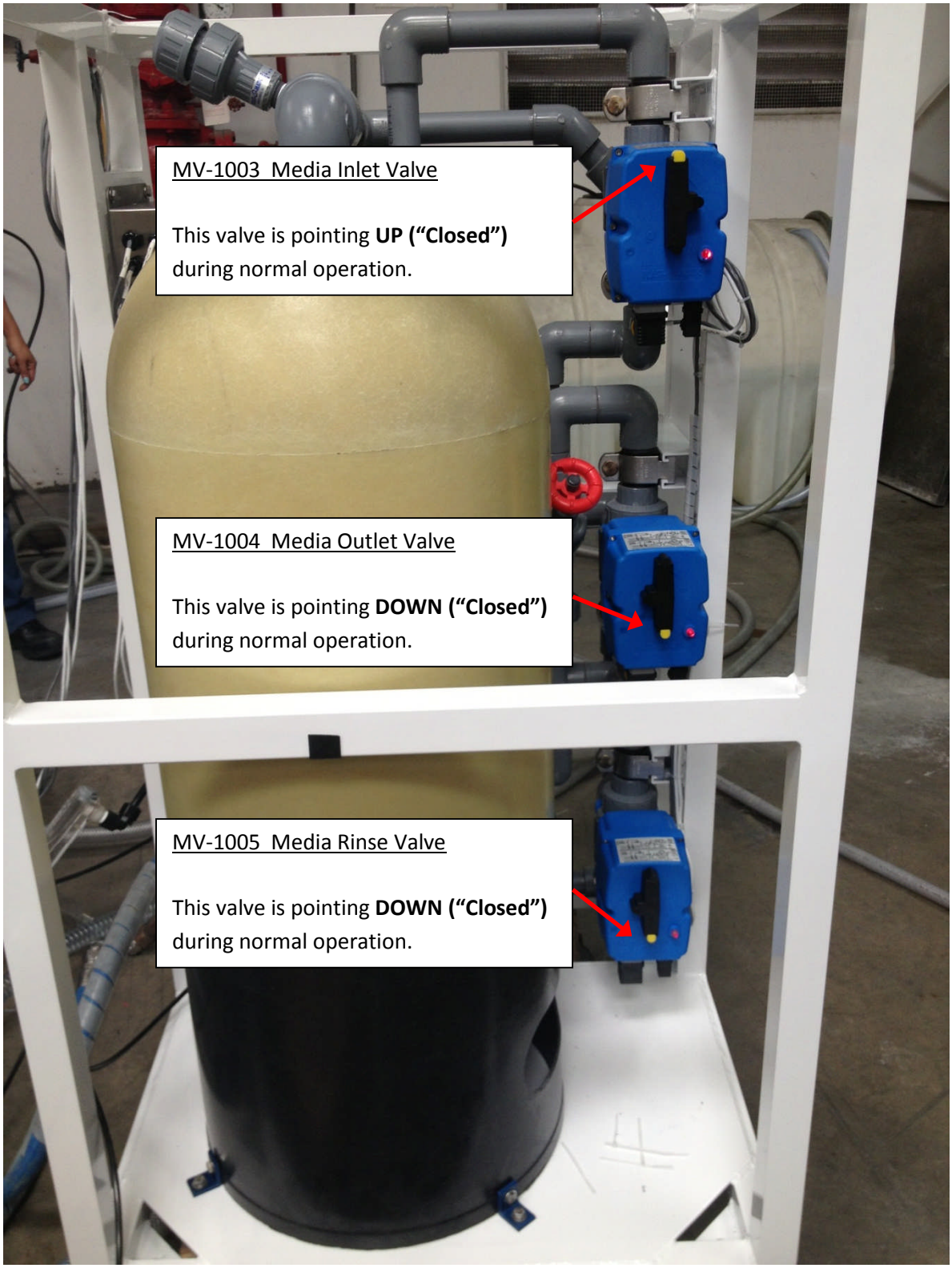
Position Guide

The Backwash operation is automatically controlled.

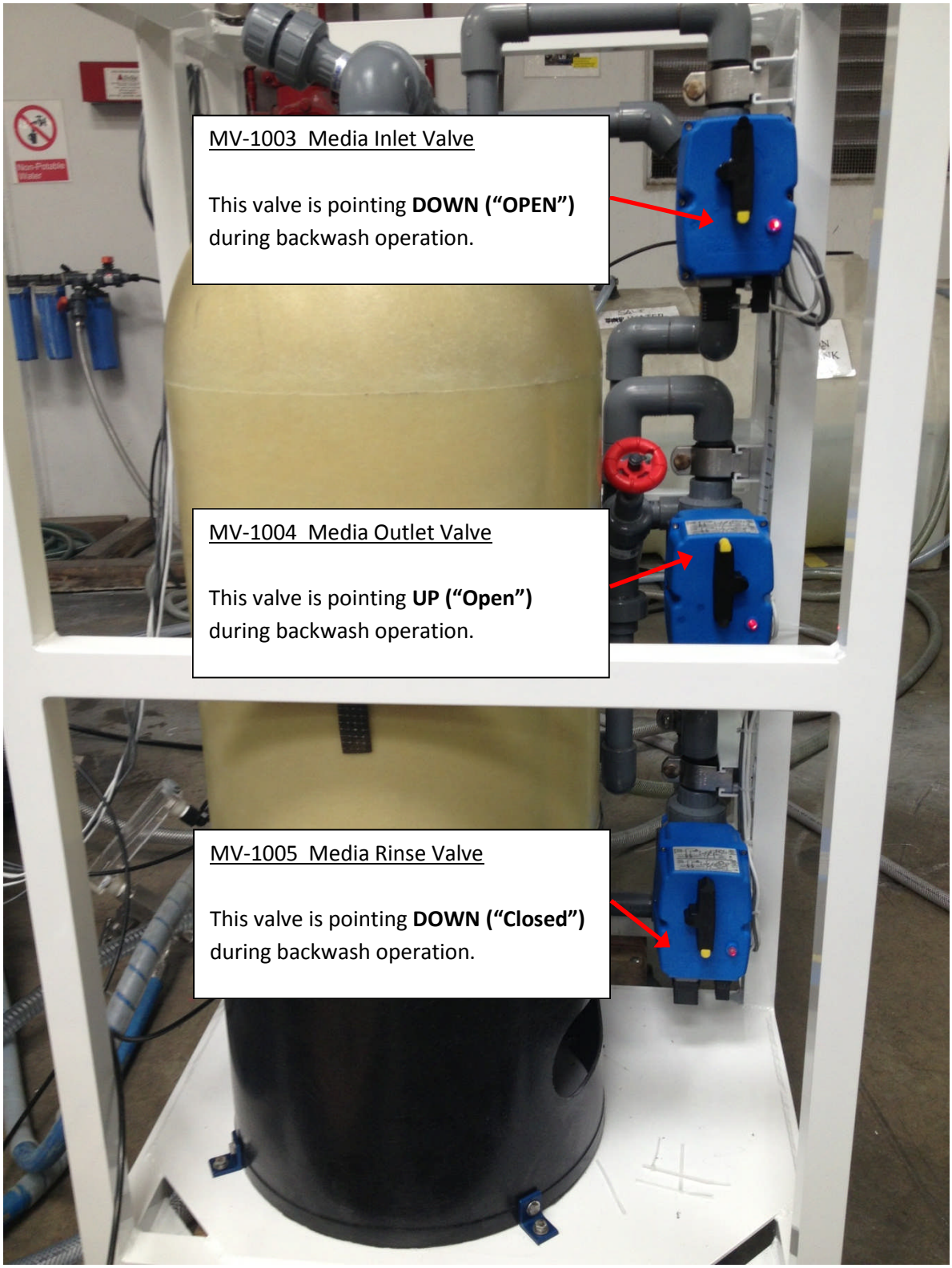
Use the Coral Sea electrical schematics to reference the proper wiring between the main control panel and the multimedia junction box.

Use this guide to reference and verify the correct directions of the MultiMedia Valves during installation and commissioning.

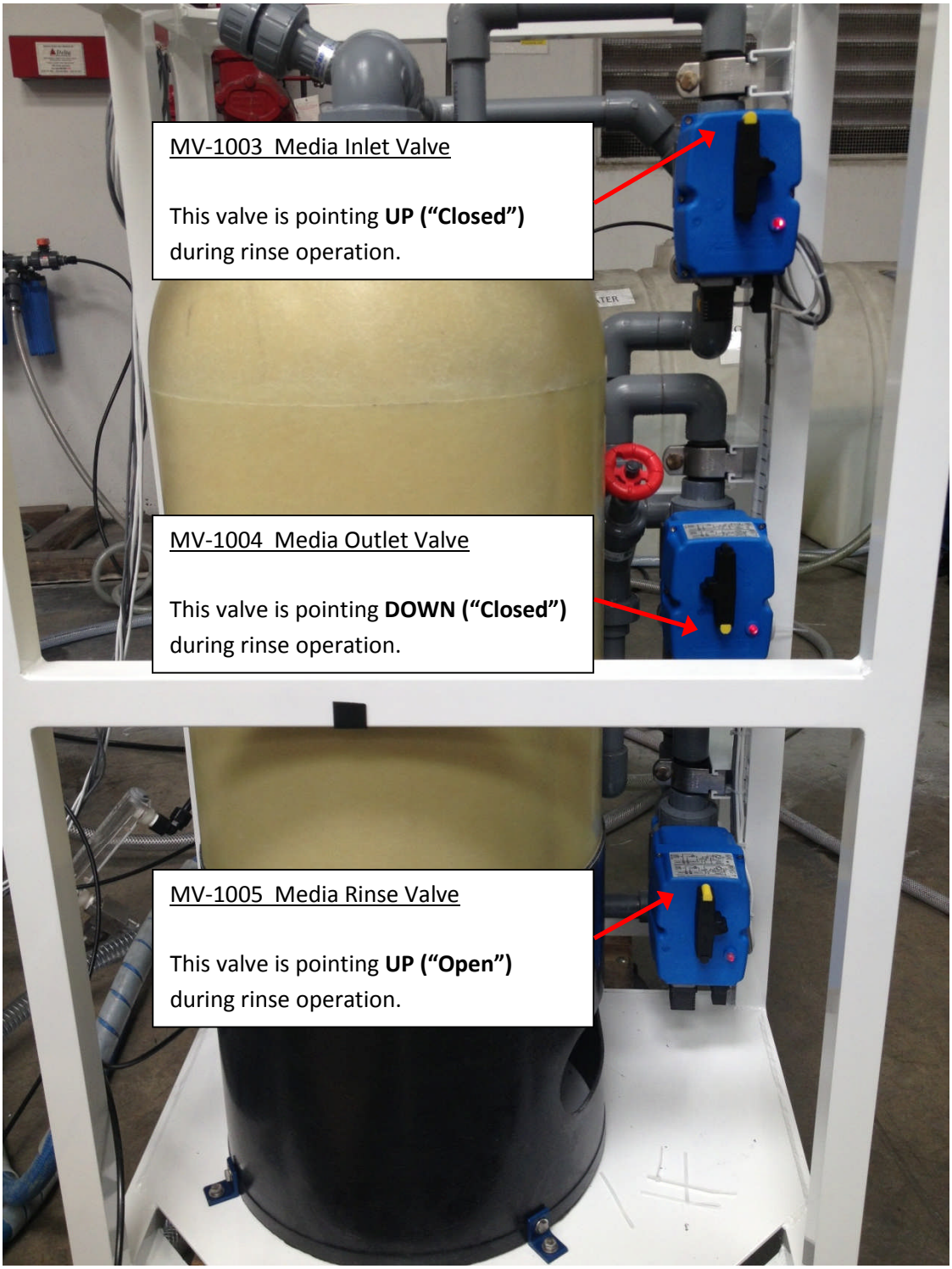
Normal Operation Positions / System Stopped Positions



Backwash Operation Positions



Rinse Operation Positions



SECTION 9

DRAWING PULL-OUTS

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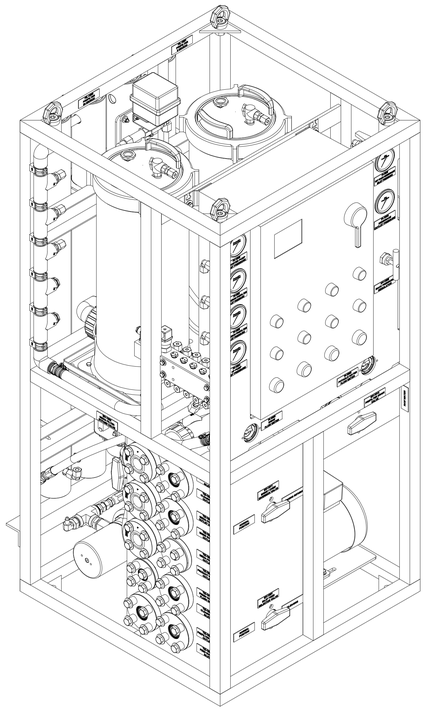
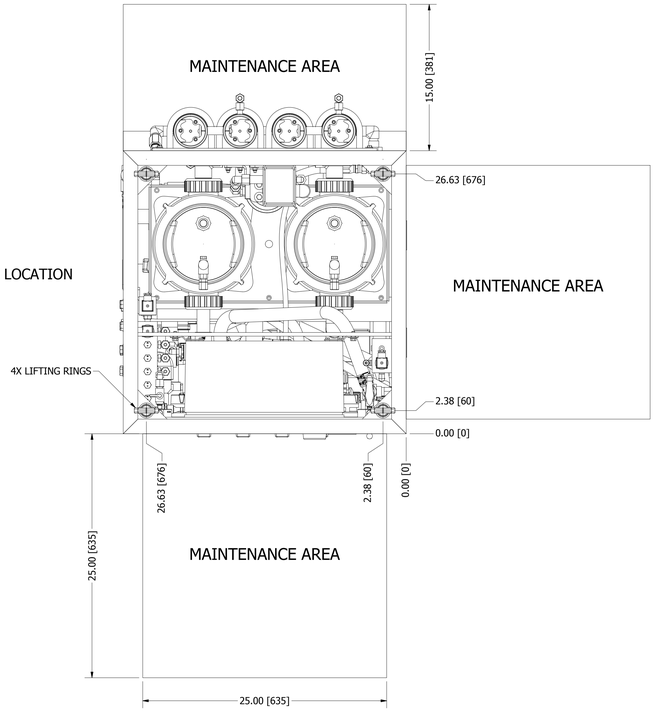
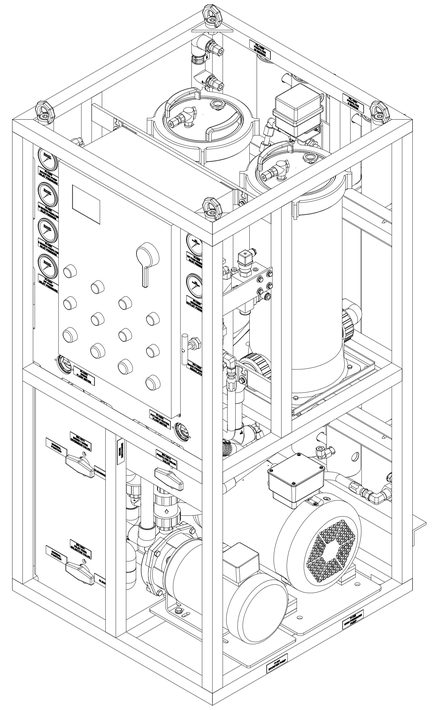
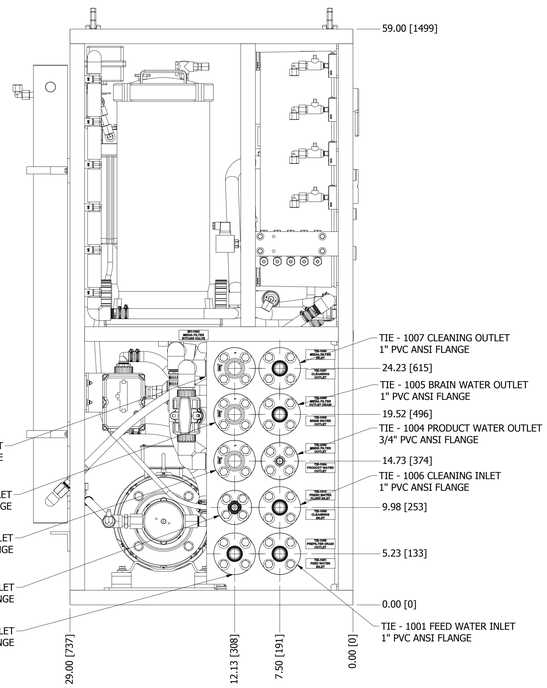
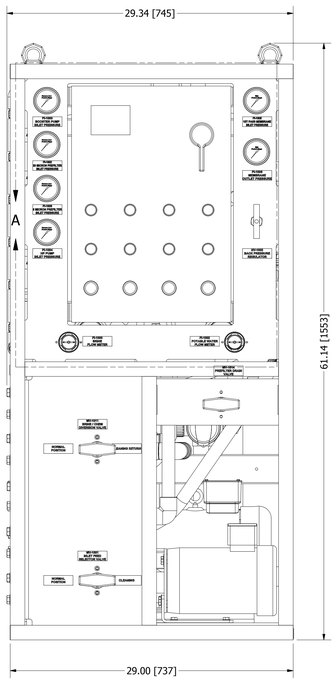
REVISION HISTORY					
REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY
A	09/26/2014	AS BUILT	RD	JB	CP
B	10/14/2014	CORE MODIFIED	RD	JB	CP
C	06/09/2015	AS BUILT	RD	JB	CP

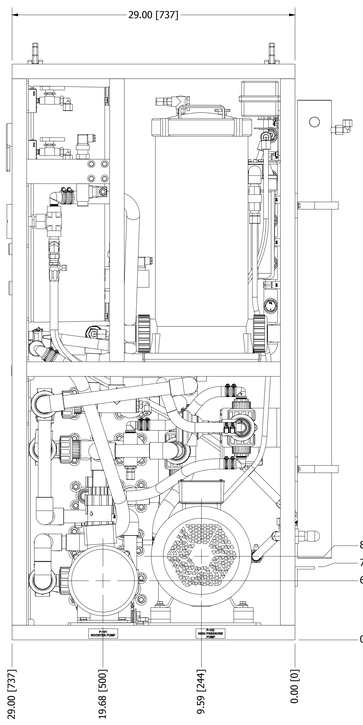


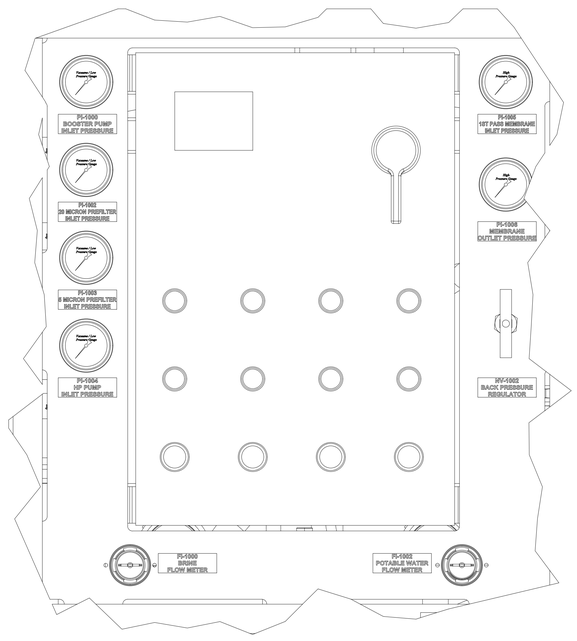




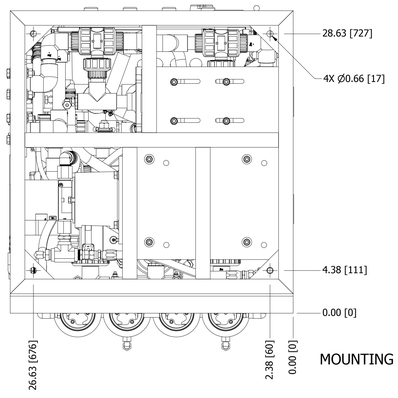








DETAIL A



MOUNTING HOLE LOCATION

DRAWING STATUS: PRODUCTION RELEASE

Parker Sea Recovery

Parker Water Purification
2630 El Presidio St
Carson, California, 90810 USA
Tel: 310-637-3400 Fax: 310-999-6262
www.parker.com

TOLERANCES:
UNLESS OTHERWISE NOTED.
ALL DIMENSIONS ARE IN INCHES (IN.) AND MILLIMETER (mm)

FRACTIONS	±1/16"	±1.5mm
.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

PROJECT: CORAL SEA (VERT)

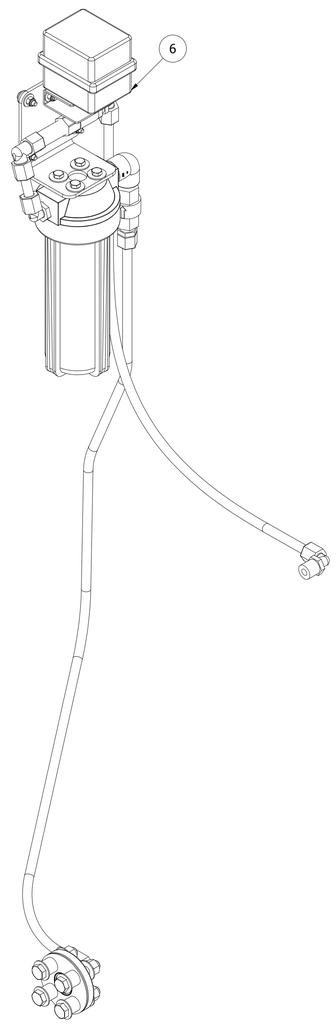
TITLE: CORAL SEA VERTICAL-3600,460V-60Hz-3PH,BASIC,PVC-ANSI,FWF

PREPARED BY:	RD	DATE:	07/18/2014	DWG NO.:	A550-13030200010201
CHECKED BY:	JB	DATE:	07/18/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/18/2014	WEIGHT:	824.265 lbmass

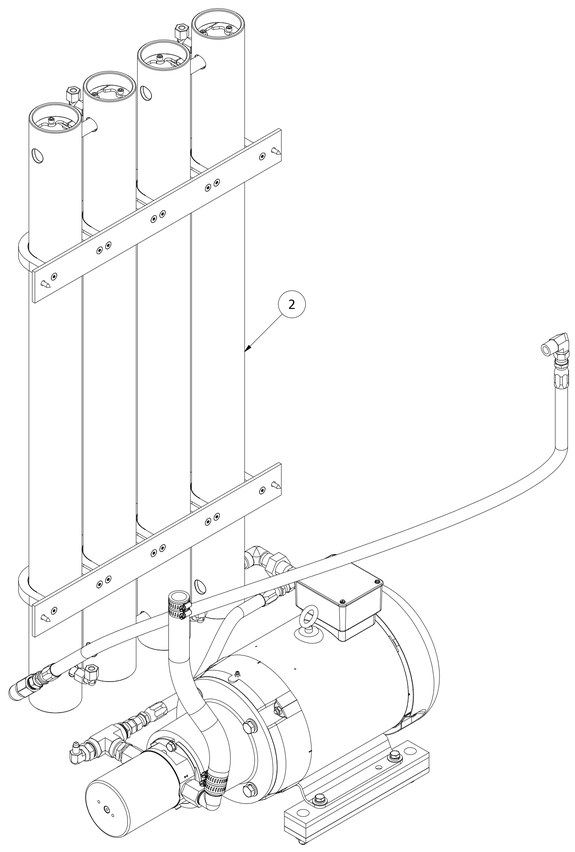
REV.: C

SHT 1 OF 2

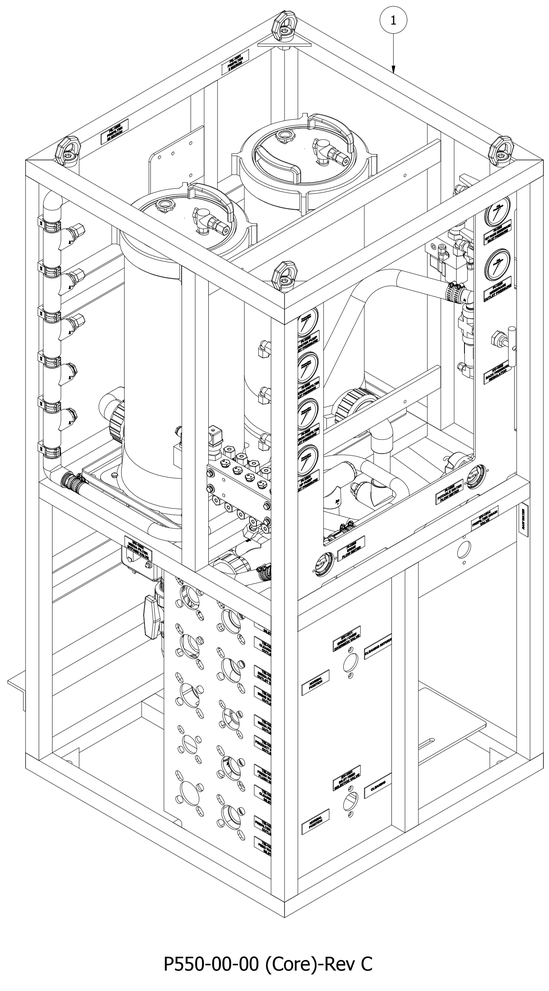
Z:\Water Purification\WR-086\WIP\Workspace\Workspace\A550 CORAL SEA SYSTEMS (VERT)\A550-CORAL SEA VERTICAL-3600,460V-60Hz-3PH,BASIC,PVC-ANSI,FWF Rev C.iam



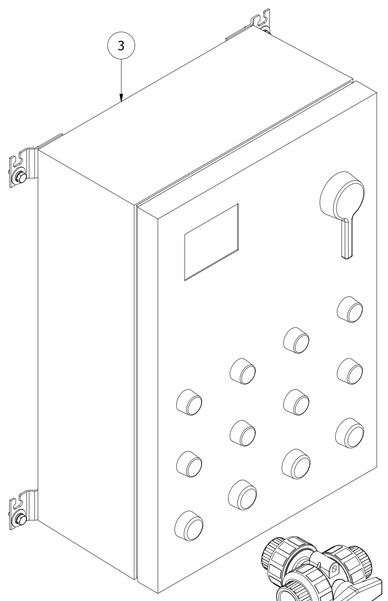
P550-06-02 (FWF - Yes)-Rev A

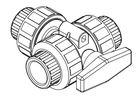


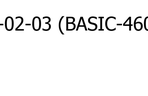
P550-01-13 (3600-460V,60Hz,3Ph)-Rev B



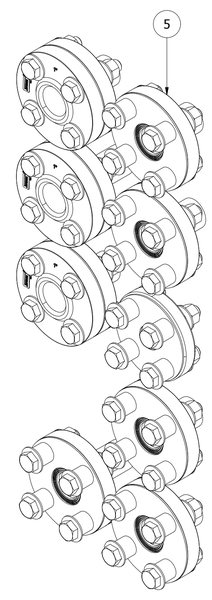
P550-00-00 (Core)-Rev C



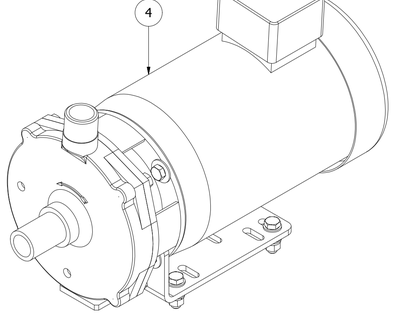




P550-02-03 (BASIC-460V,60Hz,3Ph)-Rev A



P550-05-01 (Flange - ANSI PVC)-Rev A



P550-03-04 (380-460V,50-60Hz,3Ph)-Rev A

BILL OF MATERIAL (B.O.M.)			
ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
1	1	CORAL SEA (Core)	P550-00-00
2	1	CORAL SEA (3600-460V,60Hz,3Ph)	P550-01-13
3	1	CORAL SEA (BASIC-460V,60Hz,3Ph)	P550-02-03
4	1	CORAL SEA (380-460V,50-60Hz,3Ph)	P550-03-04
5	1	CORAL SEA (Flange - ANSI PVC)	P550-05-01
6	1	CORAL SEA (FWF - Yes) (ANSI PVC)	P550-06-02

DRAWING STATUS: PRODUCTION RELEASE

Parker Sea Recovery
Parker Water Purification
2630 El Presidio St
Carson, California, 90810 USA
Tel: 310-637-3400 Fax: 310-999-6262
www.parker.com

TOLERANCES:
UNLESS OTHERWISE NOTED,
ALL DIMENSIONS ARE IN INCHES (IN.) AND MILLIMETER (mm)

FRACTIONS	±1/16"	±1.5mm
.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

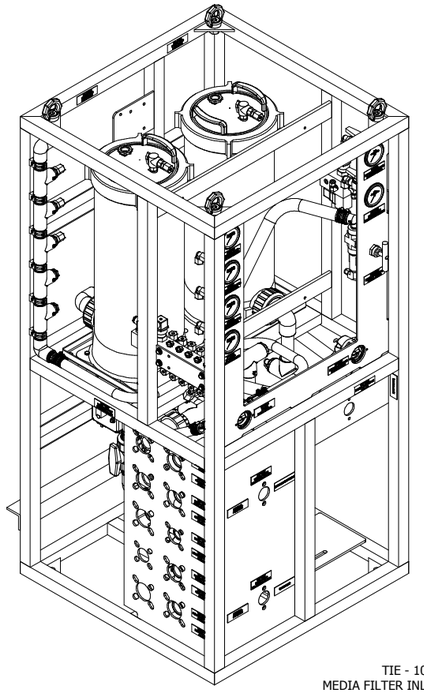
PROJECT: CORAL SEA (VERT)

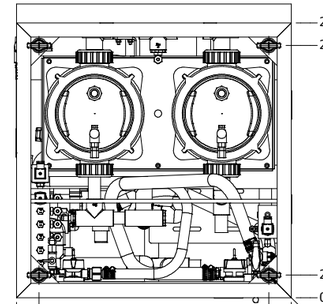
TITLE: CORAL SEA VERTICAL-3600,460V-60Hz-3PH,BASIC,PVC-ANSI,FWF

PREPARED BY:	RD	DATE:	07/18/2014	DWG NO.: A550-13030200010201	REV.: C
CHECKED BY:	JB	DATE:	07/18/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/18/2014	WEIGHT: 824.265 lbmass	SHT: 2 OF 2

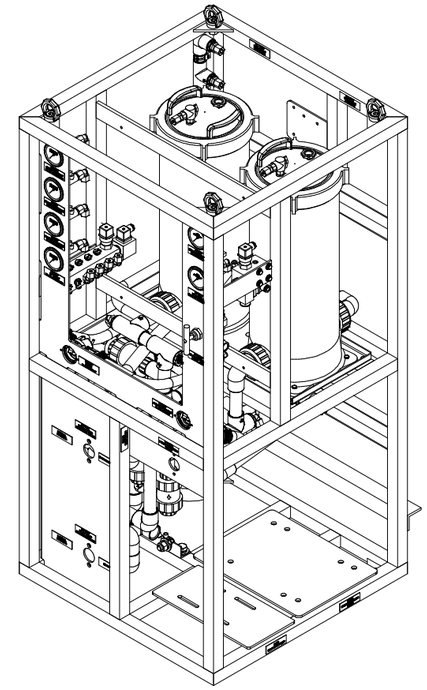
Z:\Water Purification\WR-066\WIP\Workspace\Workspace\A550 CORAL SEA SYSTEMS (VERT)\A550-CORAL SEA VERTICAL-3600,460V-60Hz-3PH,BASIC,PVC-ANSI,FWF-Rev C.iam

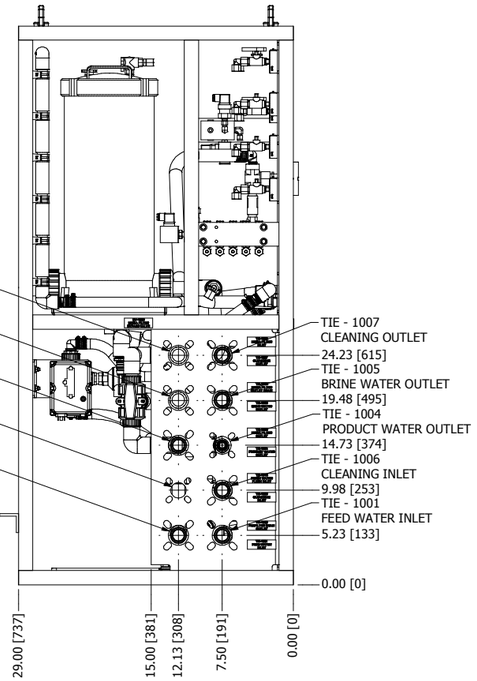
REVISION HISTORY					
REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY
A	09/23/2014	AS BUILT	RD	JB	CP
B	10/14/2014	HOSES CORRECTED	RD	JB	CP
C	06/09/2015	AS BUILT	RD	JB	CP

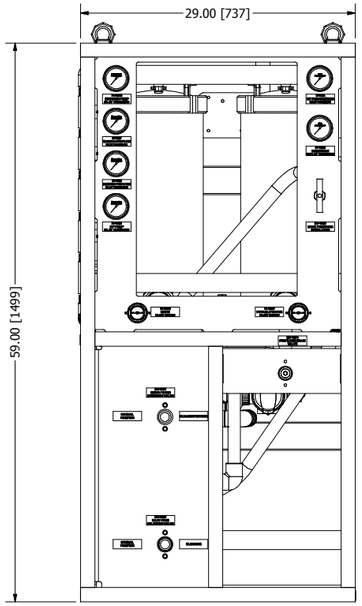


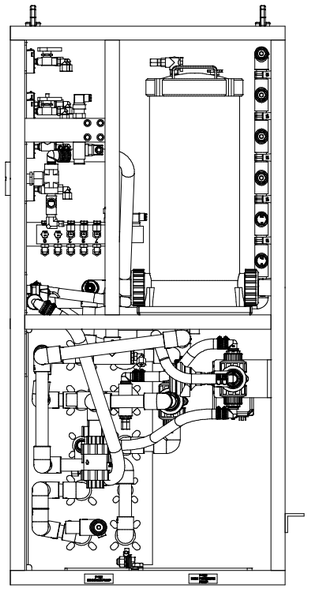


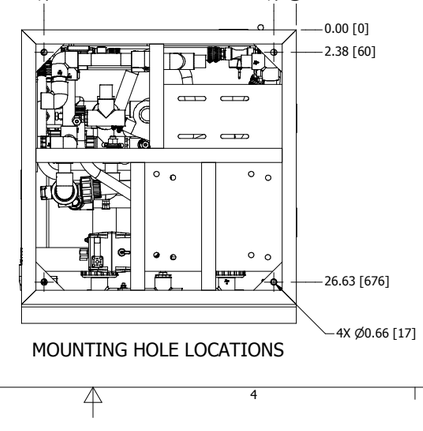
LIFTING RING LOCATIONS











MOUNTING HOLE LOCATIONS

DRAWING STATUS: PRODUCTION RELEASE

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.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

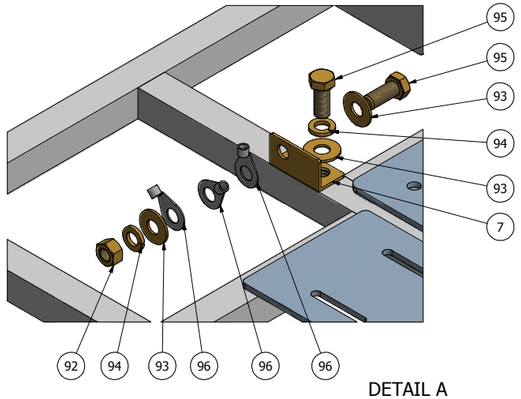
CUSTOMER:

PROJECT: CORAL SEA VERTICAL

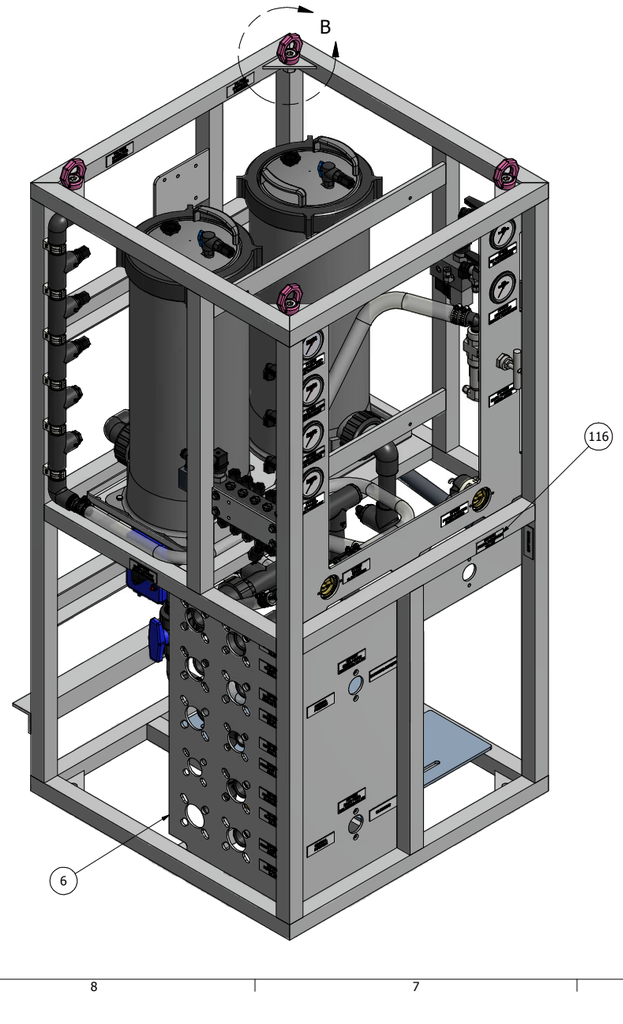
TITLE: CORAL SEA (Core)

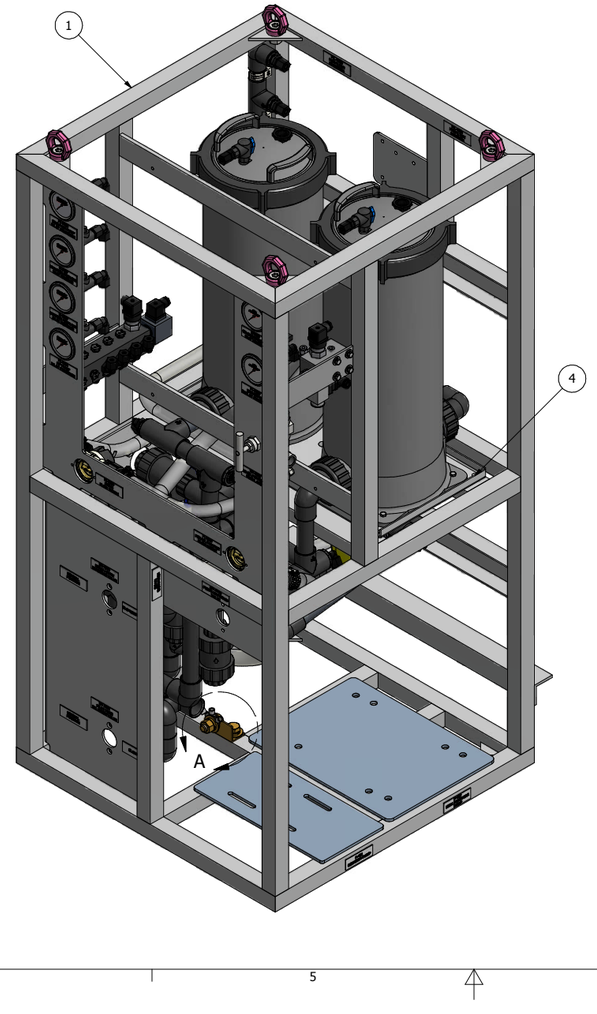
PREPARED BY:	RD	DATE:	7/7/2014	DWG NO.: P550-00-00	REV.: C
CHECKED BY:	JB	DATE:	7/7/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	7/7/2014	WEIGHT: N/A	SHT: 1 OF 7

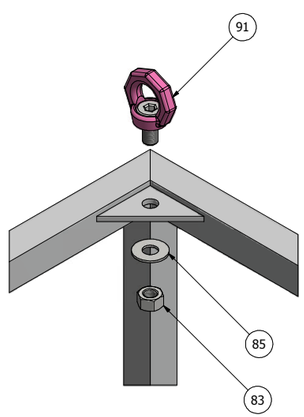
E:\Engineering\SRC\Commercial\Projects 2015\Inventor\1 JB Wkg Folder\Coral sea\Workspace\P550-00-00 (Core)-Rev C.iam



DETAIL A
SCALE 1 : 3







DETAIL B
SCALE 1 : 3

BILL OF MATERIAL (B.O.M.)			
ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
106	2	PIPE,PVC,S80,1.00x3.00L	0301099000
107	2	PIPE,PVC,S80,1.00x3.25L	0301099000
108	2	PIPE,PVC,S80,1.00x4.25L	0301099000
109	2	PIPE,PVC,S80,1.00x5.00L	0301099000
110	1	PIPE,PVC,S80,1.00x5.38L	0301099000
111	1	PIPE,PVC,S80,1.00x5.50L	0301099000
112	2	PIPE,PVC,S80,1.00x5.75L	0301099000
113	1	PIPE,PVC,S80,1.00x7.50L	0301099000
114	2	PIPE,PVC,S80,1.00x7.88L	0301099000
115	2	PIPE,PVC,S80,1.00x9.75L	0301099000
116	1	LABELS,CORAL SEA, A550	B588640010

BILL OF MATERIAL (B.O.M.)			
ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
62	3	PLUG SOC ,0.25 MT SS316L	0117340800
63	1	TEE ST .50 FT X .50 MT X .50 FT SS	0117492569
64	4	RB SR 1.00 SL x 0.25 FT	0170314083
65	4	ELBOW,PP,1/4 ODx1/4 FT	0204010869
66	16	ELBOW,PP,1/4 ODx1/4 MT	0204020869
67	1	ELBOW,PP,1/2 ODx1/2 MT	0204022569
68	3	FITTING,PP,1/4 ODx1/4 MT	0204090869
69	2	ELB90 .25 TUBE x .25 MT SS	0217020887
70	1	ELB90 .50 MPT X .25 TUBE SS	0217021087
71	12	NUT HEX .25-20 W-INSERT SS	061060045000
72	4	O-RING 233 ADAP FLOW METER	2614012453
73	1	HOSE,SPIRAL WIRE,CLEAR,0.75 x 41.00L	0328026600
74	1	HOSE,SPIRAL WIRE,CLEAR,0.75 x19.00L	0328026600
75	1	HOSE,SPIRAL WIRE,CLEAR,0.75 x 44.00L	0328026600
76	1	HOSE,SPIRAL WIRE,CLEAR,0.75 x12.00L	0328026600
77	1	HOSE,SPIRAL WIRE,CLEAR,1.00 x 30.00L	0328027600
78	1	HOSE,SPIRAL WIRE,CLEAR,1.00 x44.00L	0328027600
79	2	SUPPORT,PIPE,1.00	0501164400
80	6	SUPPORT,PIPE,0.75	0501164900
81	16	CLAMP,HOSE,SS,3/4"	05181434AA
82	8	CLAMP,HOSE,SS,1"	05181435AA
83	4	NUT,HEX,5/8-11,SS	061010077000
84	8	WASHER FLAT #10 SS	061080028000
85	4	WASHER,FLAT,5/8",SS	061080076000
86	16	WASHER,FLAT,OS,1/4",SS	061100043000
87	8	WASHER,LOCK,1/4",SS	061120043000
88	8	SCREW,HEX HEAD,.25-20x3/4",SS	061142145012
89	12	SCREW,HEX HEAD,.25-20x1",SS	061142145016
90	8	SC PHIL PAN A #10 X 1 SS	061170628016
91	4	RING,LIFTING,5/8"-11 w STAR KEY	06243157700LI
92	1	NUT,HEX,5/8-11,BRASS	066012177000
93	3	WASHER,FLAT,5/8",BRASS	066080076000
94	2	WASHER,LOCK,5/8",BRASS	066120076000
95	2	SCREW,HEX HEAD,.63-11x1.50,BRASS	0661421177024
96	3	LUG,5/8" BOLT,AL	067470076000
97	6	PIPE,PVC,S80,0.75 x 3.00L	0301096600
98	1	PIPE,PVC,S80,1.00x10.13L	0301099000
99	1	PIPE,PVC,S80,1.00x13.25L	0301099000
100	1	PIPE,PVC,S80,1.00x18.25L	0301099000
101	12	PIPE,PVC,S80,1.00x2.25L	0301099000
102	2	PIPE,PVC,S80,1.00x2.38L	0301099000
103	6	PIPE,PVC,S80,1.00x2.50L	0301099000
104	1	PIPE,PVC,S80,1.00x2.63L	0301099000
105	1	PIPE,PVC,S80,1.00x2.75L	0301099000

BILL OF MATERIAL (B.O.M.)			
ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
1	1	FRAME ASSY AL6061 3.00-4.00 C-S VERT	B586610010
2	3	NIPPLE 1.00 NPT x SL x 1.75 LG	0101394416
3	2	RING,SEALING,FILTER	0701100800
4	1	PANEL PREFILTER CORAL SEA HORIZONTAL	2020026103
5	1	BRACKET,VALVE,ACTUATOR	2020040407
6	1	PLATE,MTG,FLANGE,6061-T6,27.50x25.50x0.188TH	2020056318
7	1	BRACKET,GROUNDING,COMMERCIAL,BRASS	2021041000
8	1	MANIFOLD,XMTR,6 PORT w 2 SW,PRESS,LOW	5301650800
9	1	MANIFOLD,XMTR,2 PORT w 1 SW,PRESS,HIGH	5353650900
10	4	FITTING,PP,3/8 ODx1/2 MT	0204091969
11	2	FILTER HOUSING CPF OWS	07620302WA
12	1	ELEMENT,CPFE-AS,5 MICRON	0801064057
13	1	ELEMENT,CPFE-AS,20 MICRON	0801143557
14	1	GAUGE -30-0-70 CBM.NPT	10181532CC
15	3	GAUGE 0-160 CBM.NPT	10181533CC
16	2	GAUGE 0-2000 CBM.NPT	10181534CC
17	1	FLOWMETER,RFA,0-10VDC,RFA,4.0-20GPM	1121202100
18	1	FLOWMETER,ROTO,0-10VDC,RFA,0.5-5.0 GPM	1121532100
19	1	SWITCH,PRESS,LOW,6 PSI,DIN CONN	2301020758
20	1	TRANSDUCER,PRESSURE,LOW,0-300 PSI	2317100601
21	1	TRANSDUCER,PRESSURE,HIGH,0-2000 PSI	2317102001
22	1	SWITCH,PRESS,HIGH,900 PSI,DIN CONN	2321020558
23	1	SENSOR,CONDUCTIVITY,PP,SS316L,0.50-2.50 IN	31314212RH
24	2	CONNECTOR,PLUG,SWITCH,4 DIN	3131680100
25	1	ACTUATOR,VALVE,PLASTOMATIC	14010719RH
26	4	VALVE,CHECK,TU,PVC,1.00	1401271942
27	4	VALVE,BALL,.25 FT x MT	14015506AR-01
28	2	VALVE BALL .25 FTx MT	14015506AR-02
29	1	VALVE,BALL,3 HOLE,3W,VER,PVC,1.00 S	14018019RH
30	1	VALVE,BALL,3W,VER,PVC,1.00 SL	14018119RH
31	1	VALVE,REGULATOR,PRESSURE	1417018396
32	2	VALVE,SHUT OFF,SS,0.25 FPT x FPT	1417123987
33	1	ELB90 0.75 FPT x FPT	0101013783
34	1	ELB90 0.75 SL x FPT	0101043783
35	1	ELB90 1.00 SL x FPT	0101044483
36	1	ELB90 0.75 SL x SL	0101053783
37	31	ELB90 1.00 SL x SL	0101054483
38	1	ELB90 1.00 FPT x BARB	0101064483
39	1	ELB90 0.50 MPT x 1.00 BARB	0101072783
40	5	ELB90 0.75 MPT x BARB	0101073783
41	1	ELB90 1.00 MPT x BARB	0101074483
42	3	RB 0.75 MT x 0.25 FT	0101293483
43	1	RB 1.00 MT x 0.50 FT	0101294283
44	6	RB 0.75 SL x 0.50 FT	0101313683
45	1	RB 1.00 SL x 0.50 FT	0101314283
46	5	RB 1.00 SL x 0.75 FT	0101314383
47	1	RB 0.75 SL x 0.25 FT	0101323483
48	7	PLUG 0.25 MT	0101340883
49	2	PLUG 0.50 MT	0101342583
50	2	NIPPLE 0.25 NPT x CL	01013708CL
51	1	NIPPLE 0.50 NPT x CL	01013725CL
52	1	NIPPLE 0.75 NPT x CL	01013737CL
53	1	NIPPLE 1.00 NPT x SL x 3.50 LG	0101394435
54	2	TEE 0.75 FT x FT x FT	0101423783
55	5	TEE 0.75 SL x SL x SL	0101463783
56	7	TEE 1.00 SL x SL x SL	0101464483
57	1	ADAPTER 0.75 FPT x BARB	0101613783
58	1	ADAPTER 0.50 MPT x 1.00 BARB	0101652783
59	2	ADAPTER 0.75 MPT x BARB	0101653783
60	1	ADAPTER 1.00 MPT x BARB	0101654483
61	2	TEE,STREET,1.00 SL x SL x SPIG	0101AG4400

DRAWING STATUS: PRODUCTION RELEASE

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.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

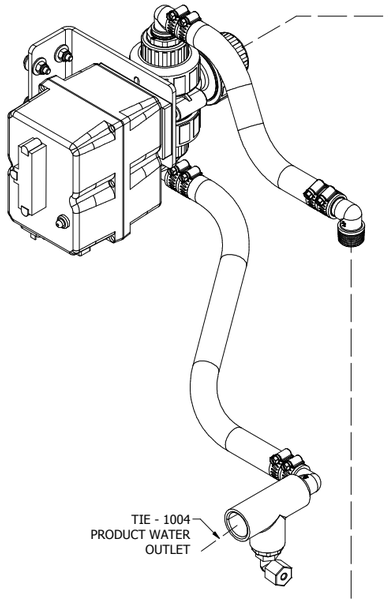
CUSTOMER:

PROJECT: CORAL SEA VERTICAL

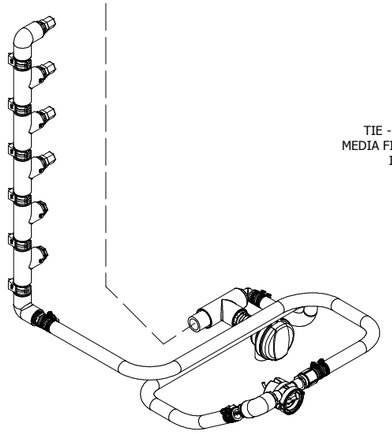
TITLE: CORAL SEA (Core)

PREPARED BY:	RD	DATE:	7/7/2014	DWG NO.: P550-00-00	REV.: C
CHECKED BY:	JB	DATE:	7/7/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	7/7/2014	WEIGHT: N/A	SHT: 2 OF 7

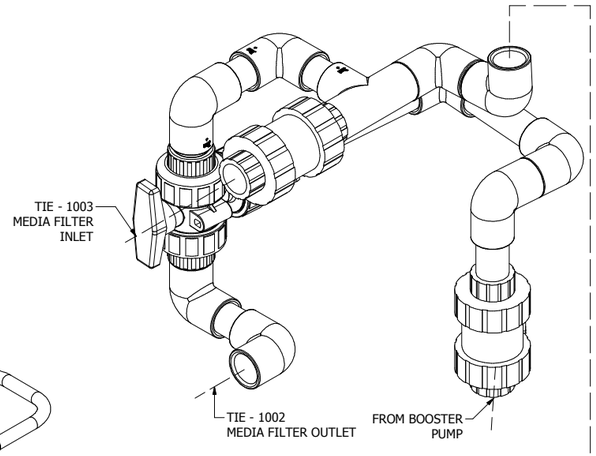
E:\Engineering\SRC\Commercial\Projects 2015\Inventor\1 JB Wkg Folder\Coral sea\Workspace\P550-00-00 (Core)-Rev C.iam



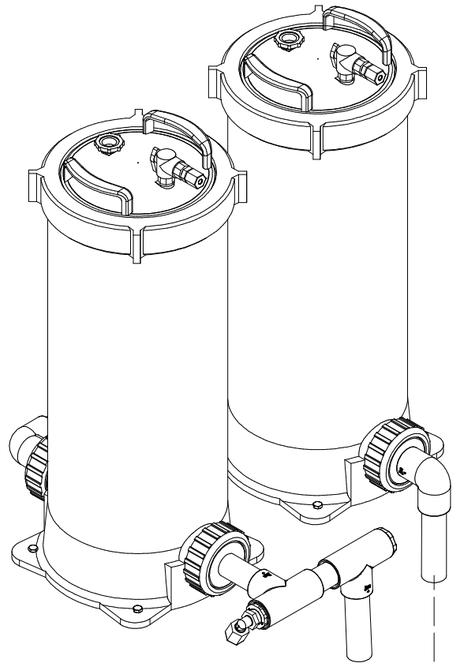
PRODUCT WATER FLOW METER PIPING



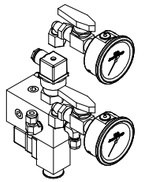
PRESSURE VESSEL ASSY

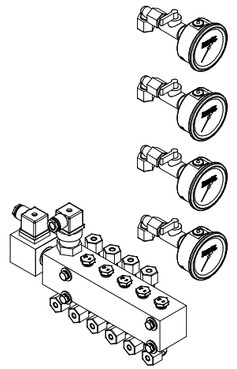


MEDIA FILTER PIPING

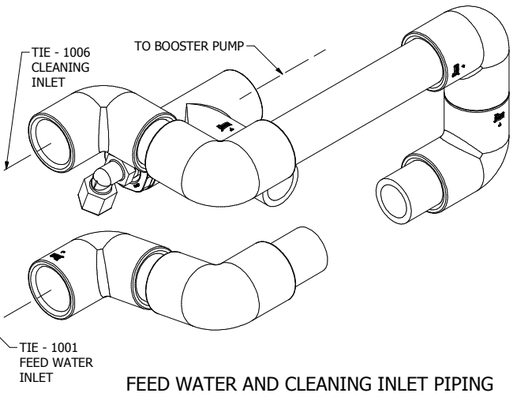


FILTER ASSY

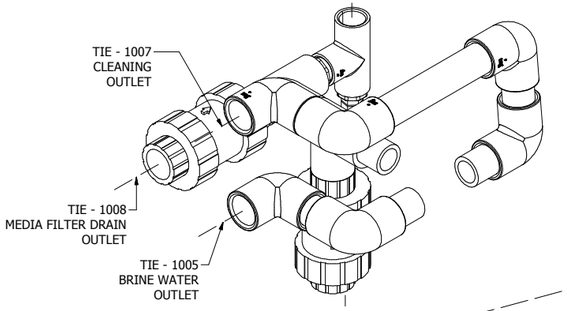




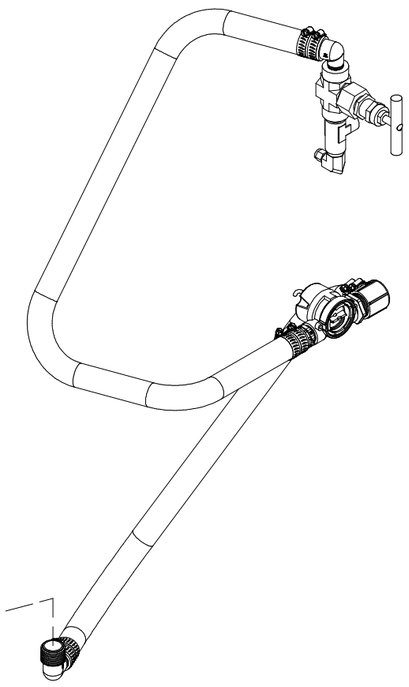
GAUGES AND MANIFOLDS



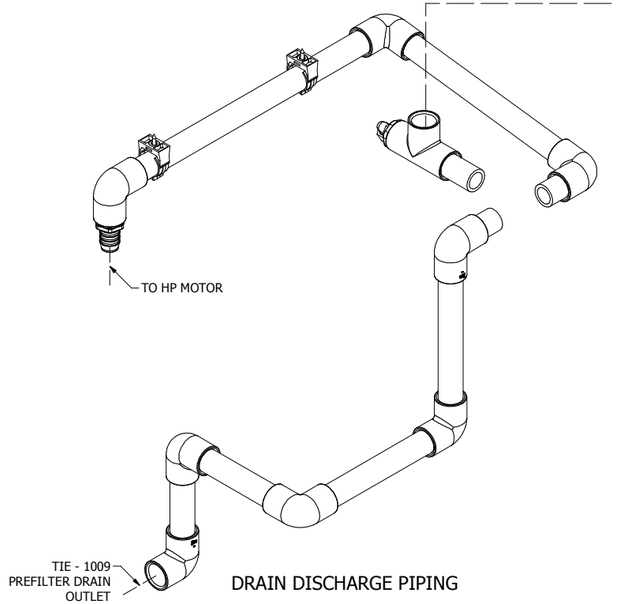
FEED WATER AND CLEANING INLET PIPING



BRINE DISCHARGE PIPING



BACK PRESSURE REGULATOR PIPING



DRAIN DISCHARGE PIPING

DRAWING STATUS: PRODUCTION RELEASE

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Parker Sea Recovery

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Tel: 310-637-3400 Fax: 310-999-6262
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TOLERANCES:
UNLESS OTHERWISE NOTED,
ALL DIMENSIONS ARE IN INCHES (IN.) AND MILLIMETER (mm)

FRACTIONS	±1/16"	±1.5mm
.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

PROJECT: CORAL SEA VERTICAL

TITLE: CORAL SEA (Core)

PREPARED BY:	RD	DATE: 7/7/2014	DWG NO.: P550-00-00	REV.: C
CHECKED BY:	JB	DATE: 7/7/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE: 7/7/2014	WEIGHT: N/A	SHT. 3 OF 7

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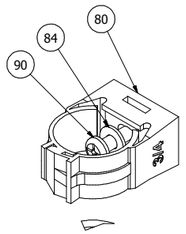
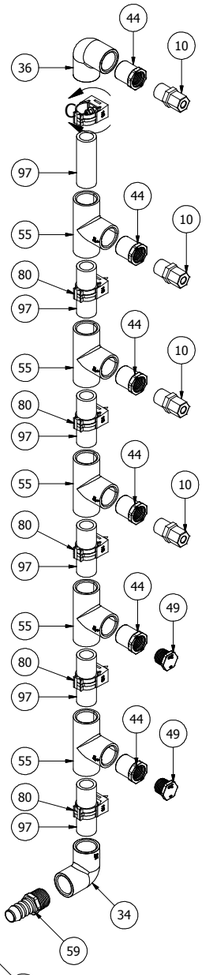
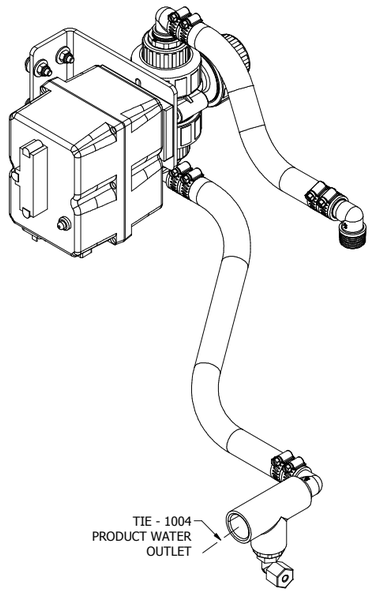
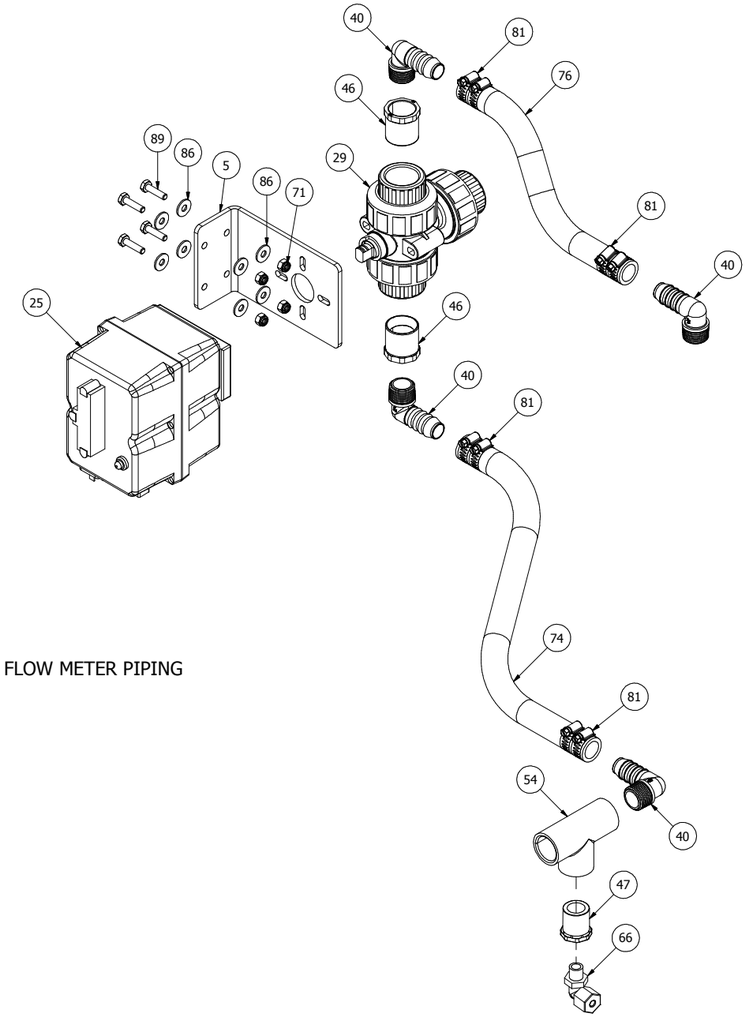


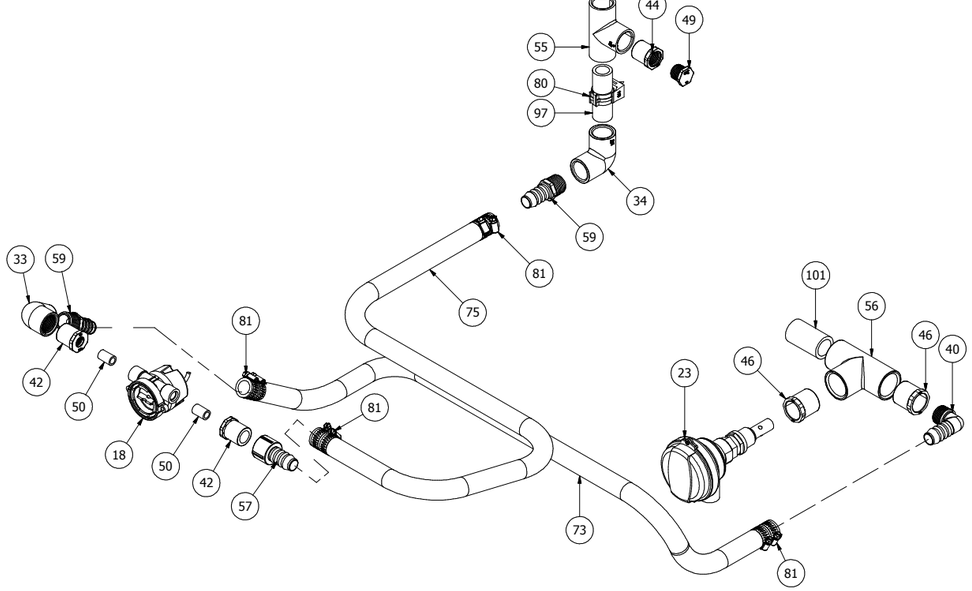
DETAIL C
SCALE 1 : 1

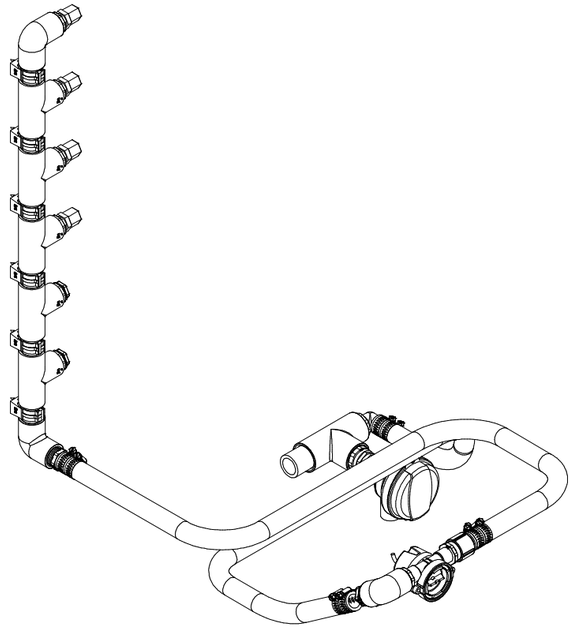






PRODUCT WATER FLOW METER PIPING





PRESSURE VESSEL ASSY

DRAWING STATUS:	PRODUCTION RELEASE		

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.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

PROJECT: CORAL SEA VERTICAL

TITLE: CORAL SEA (Core)

PREPARED BY:	RD	DATE:	7/7/2014	DWG NO.: P550-00-00	REV.: C
CHECKED BY:	JB	DATE:	7/7/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	7/7/2014	WEIGHT: N/A	SHT: 4 of 7

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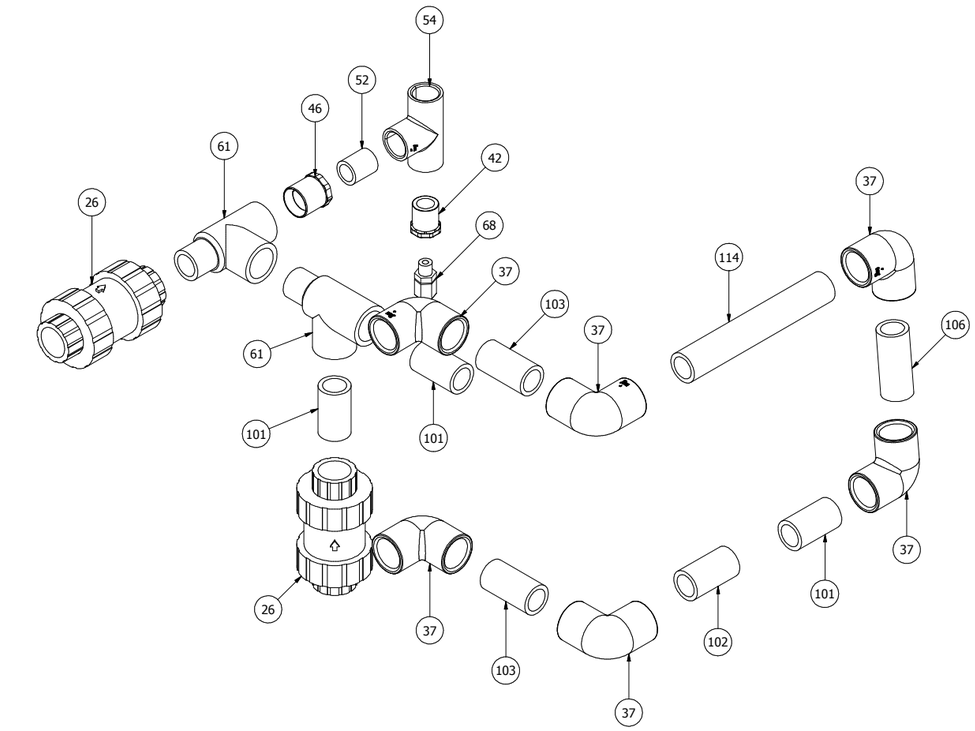
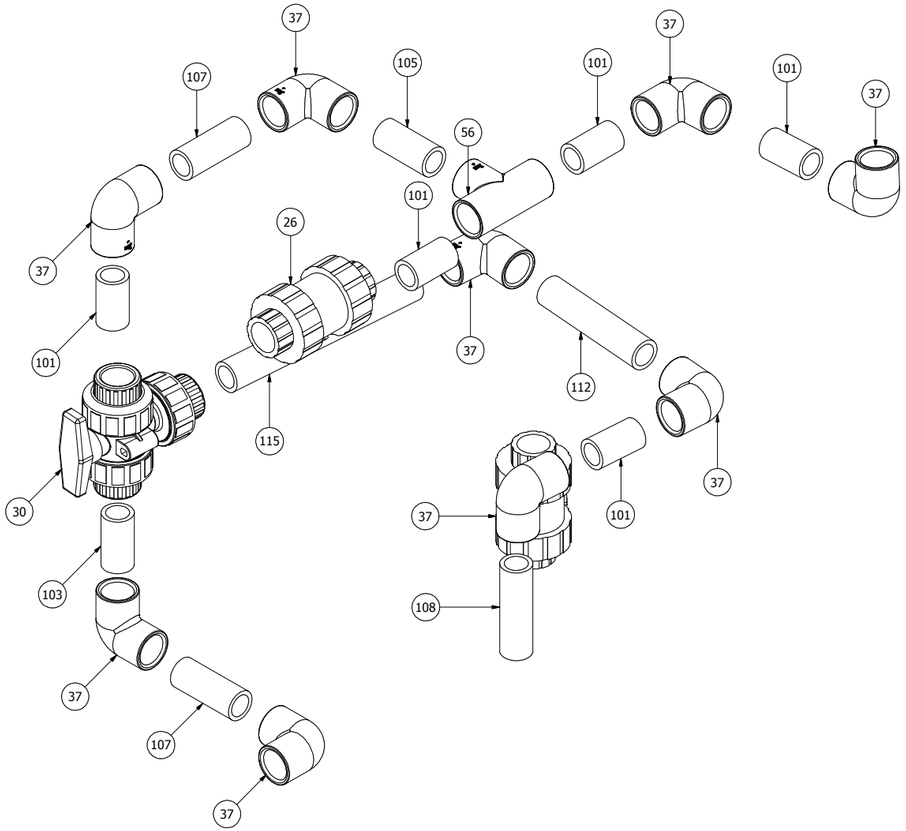
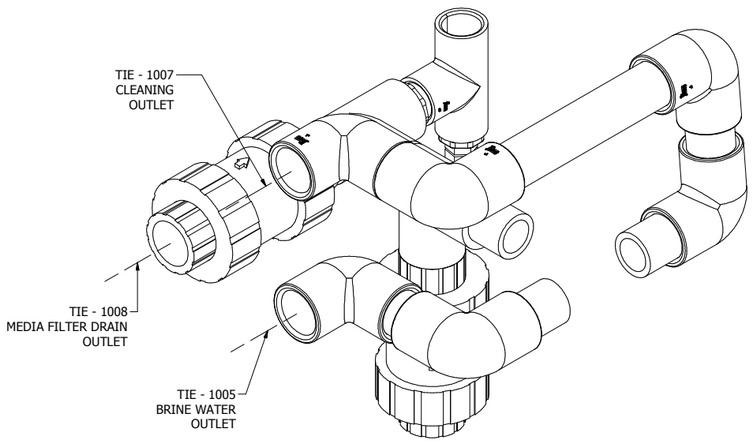
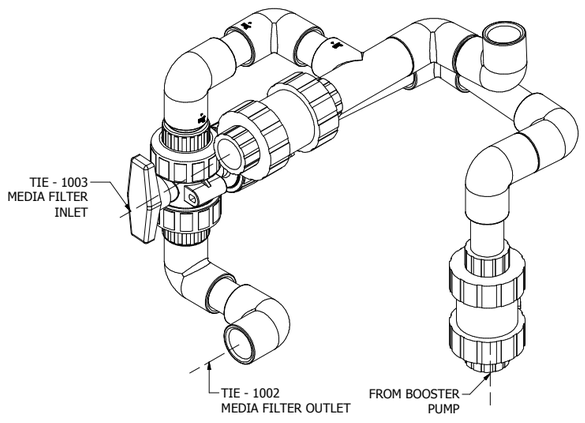






BRINE DISCHARGE PIPING



MEDIA FILTER PIPING

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.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

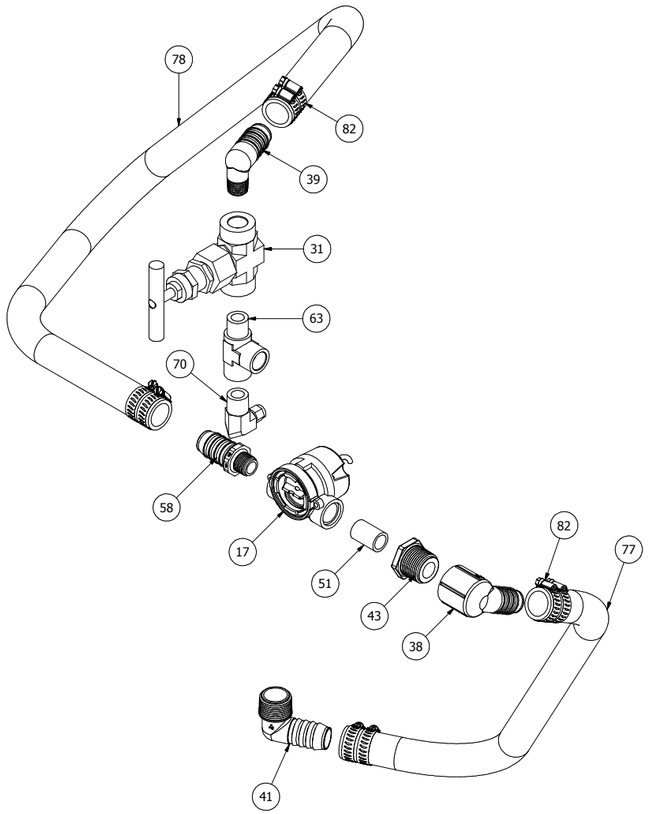
SCALE:

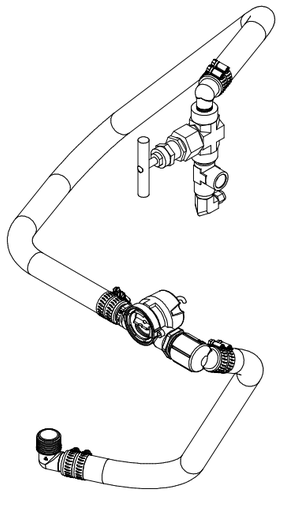
CUSTOMER:

PROJECT: CORAL SEA VERTICAL

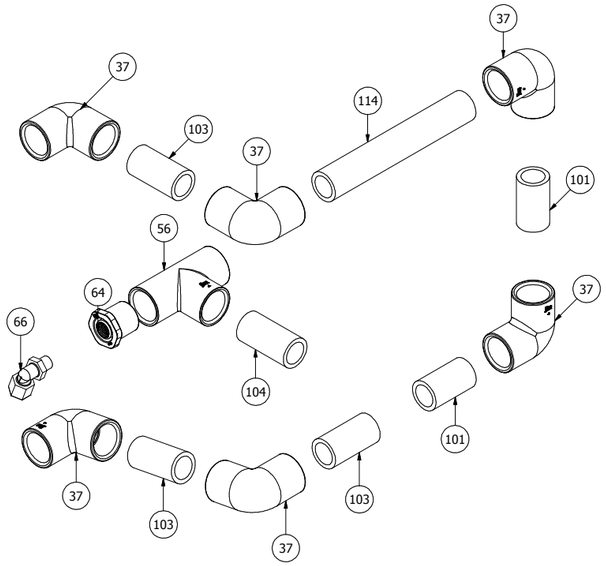
TITLE: CORAL SEA (Core)

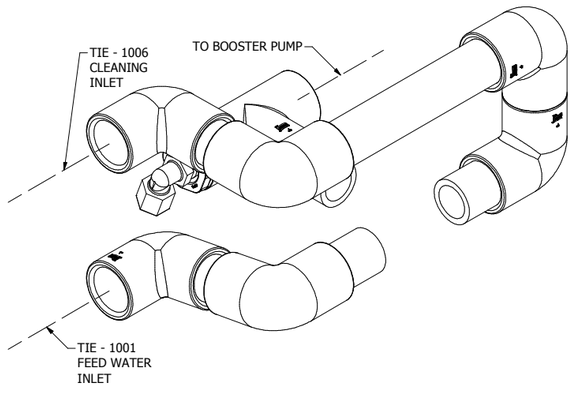
PREPARED BY:	RD	DATE:	7/7/2014	DWG NO.: P550-00-00	REV.: C
CHECKED BY:	JB	DATE:	7/7/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	7/7/2014	WEIGHT: N/A	SHT: 5 OF 7



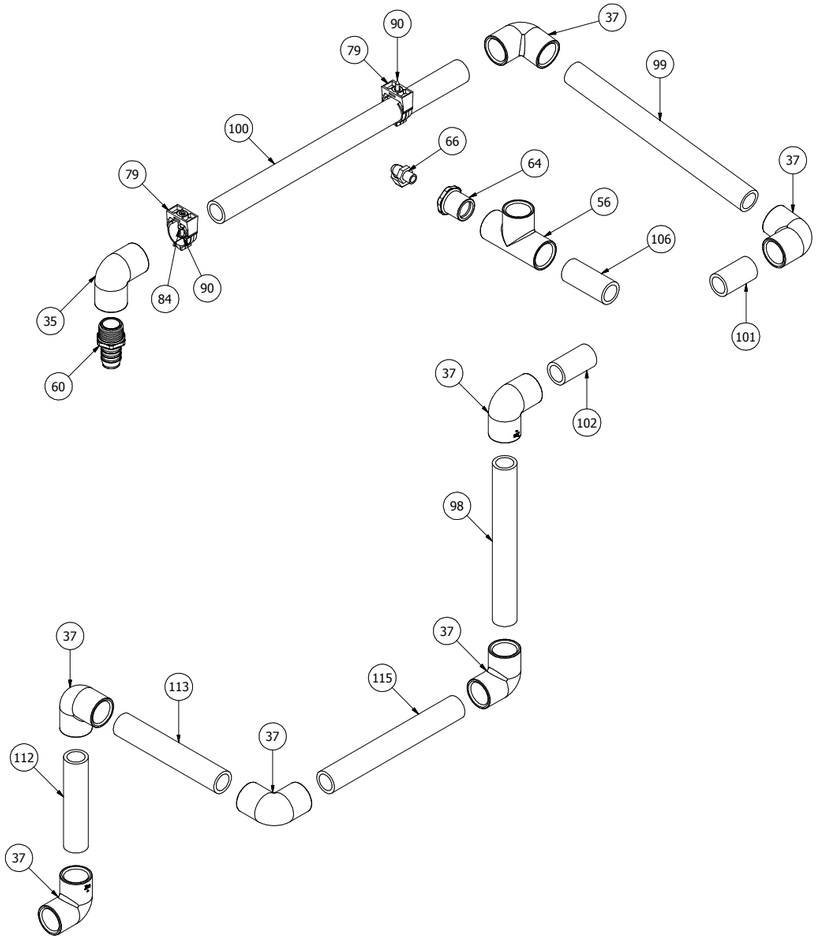


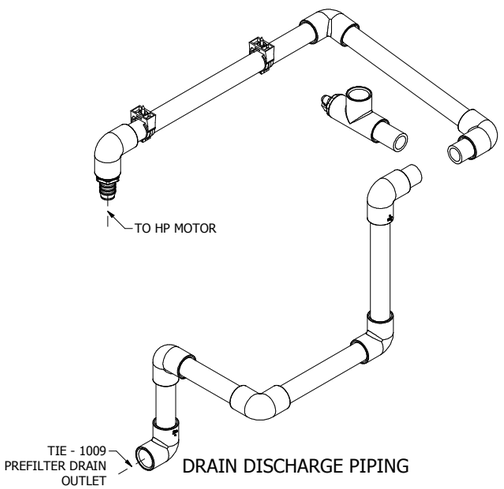
BACK PRESSURE REGULATOR PIPING





FEED WATER AND CLEANING INLET PIPING





DRAIN DISCHARGE PIPING

DRAWING STATUS: PRODUCTION RELEASE

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.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

PROJECT: CORAL SEA VERTICAL

TITLE: CORAL SEA (Core)

PREPARED BY:	RD	DATE:	7/7/2014	DWG NO.: P550-00-00	REV.: C
CHECKED BY:	JB	DATE:	7/7/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	7/7/2014	WEIGHT: N/A	SHT: 6 OF 7

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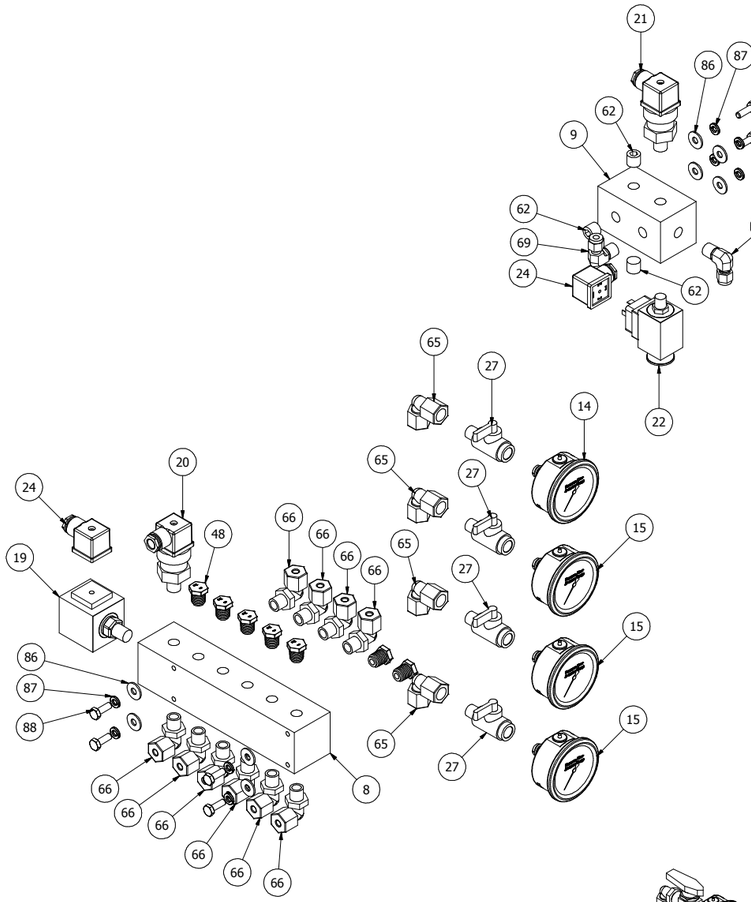
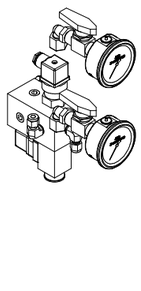
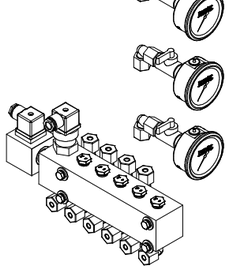
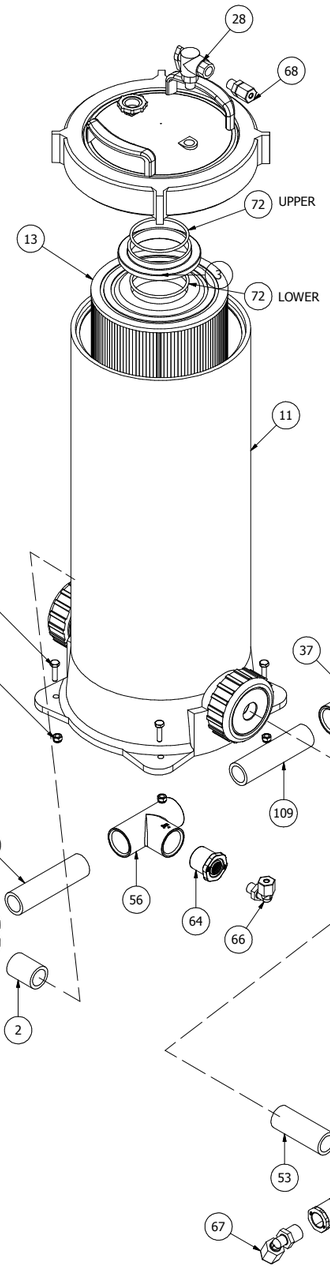
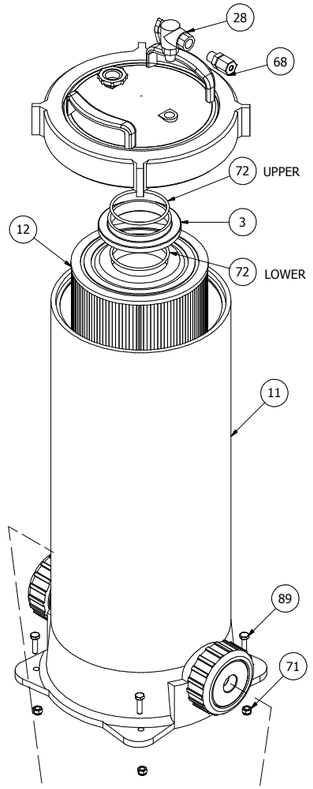


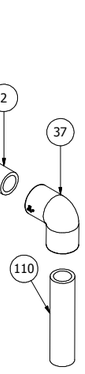


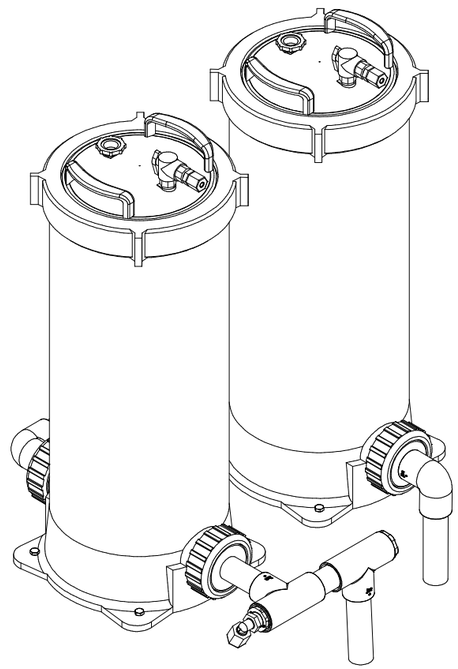


GAUGES AND MANIFOLDS









FILTER ASSY

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Parker Sea Recovery Parker Water Purification 2630 El Presidio St Carson, California, 90810 USA Tel: 310-637-3400 Fax: 310-999-6262 www.parker.com	**PROPRIETARY NOTICE:** This drawing includes confidential information of Parker Hannifin Corporation, which is provided for the sole purpose of permitting the recipient to evaluate the design or proposal submitted herewith. In consideration of receipt of this document, the recipient agrees to maintain such information in confidence and not reproduce or otherwise disclose the information to any person outside the group directly responsible for evaluation of its contents, except that there is no obligation to maintain the confidentiality of any information that becomes publicly known through no fault of recipient. By receiving and accepting this drawing the recipient agrees to the stated terms. **TOLERANCES:** **UNLESS OTHERWISE NOTED,** **ALL DIMENSIONS ARE IN INCHES (IN.) AND MILLIMETER (mm)** FRACTIONS ±1/16" ±1.5mm .X ±0.1" ±2.5mm .XX ±0.01 ±0.51mm .XXX ±0.005" ±0.127mm ANGLES ±1 DEG. SCALE:		
CUSTOMER:	PROJECT: CORAL SEA VERTICAL		
TITLE: CORAL SEA (Core)			
PREPARED BY: RD	DATE: 7/7/2014	DWG NO.: P550-00-00	REV.: C
CHECKED BY: JB	DATE: 7/7/2014	CUSTOMER P.O.	
APPROVED BY: CP	DATE: 7/7/2014	WEIGHT: N/A	SHT: 7 OF 7

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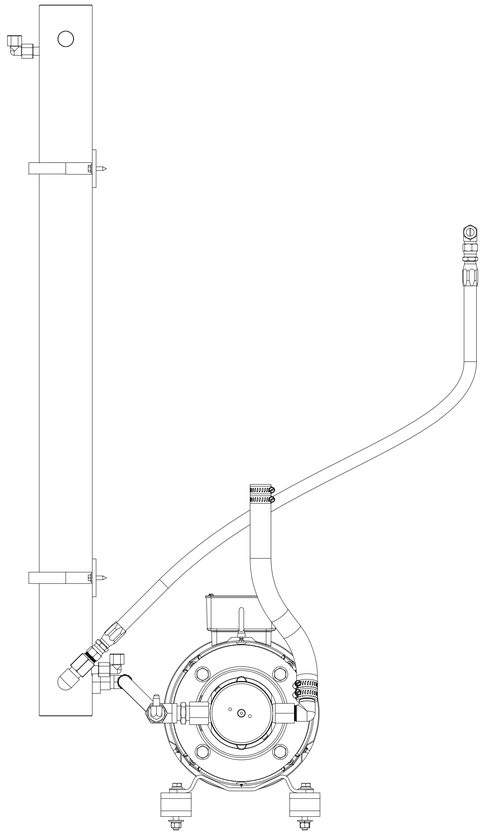
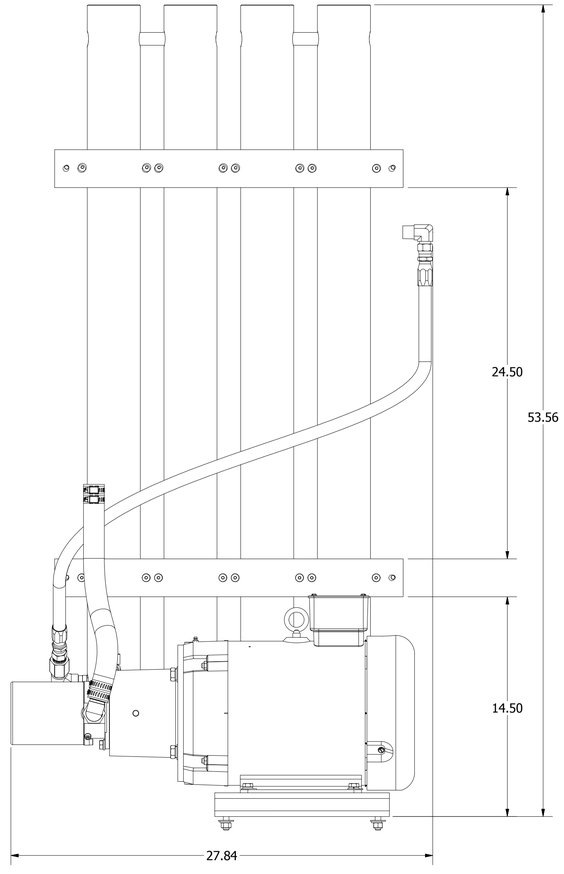
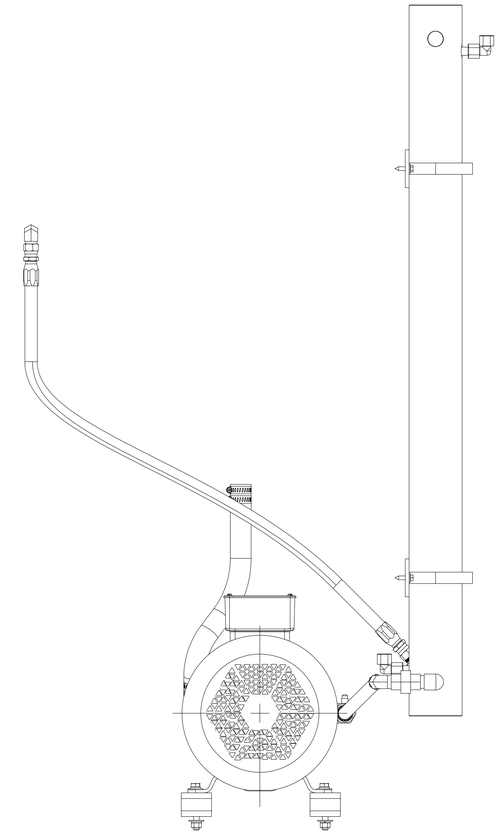
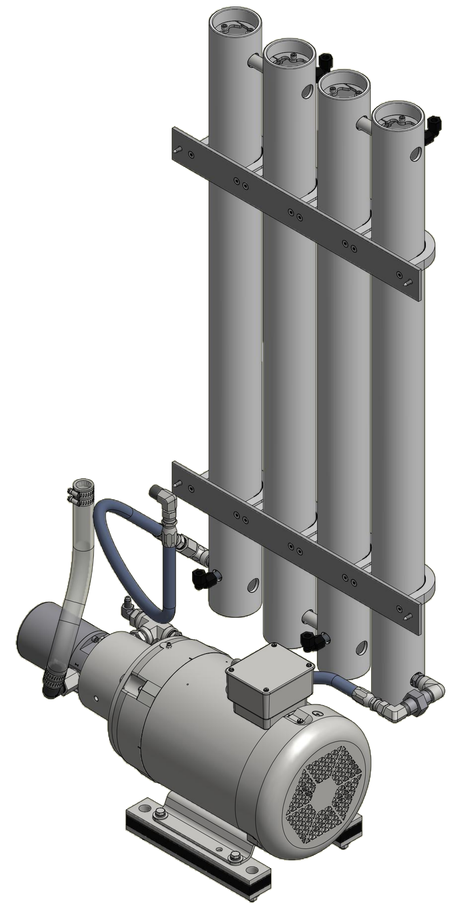
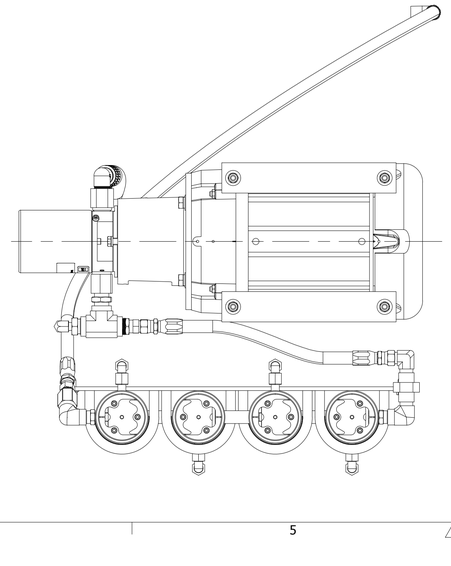
REVISION HISTORY					
REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY
A	09/24/2014	PRESSURE VESSELS ROUTING MODIFIED	RD	JB	CP
B	06/09/2015	AS BUILT	RD	JB	CP











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.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

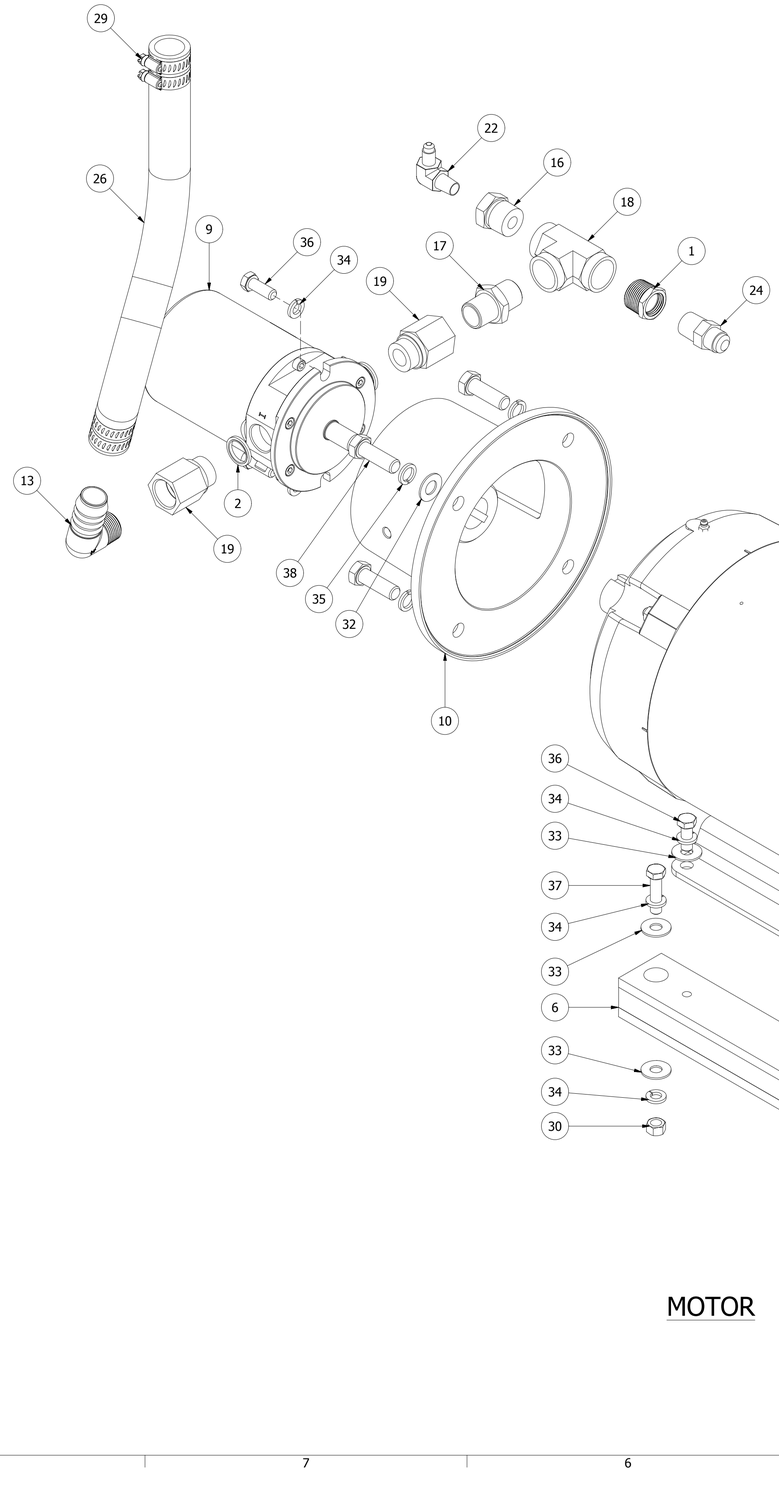
CUSTOMER:

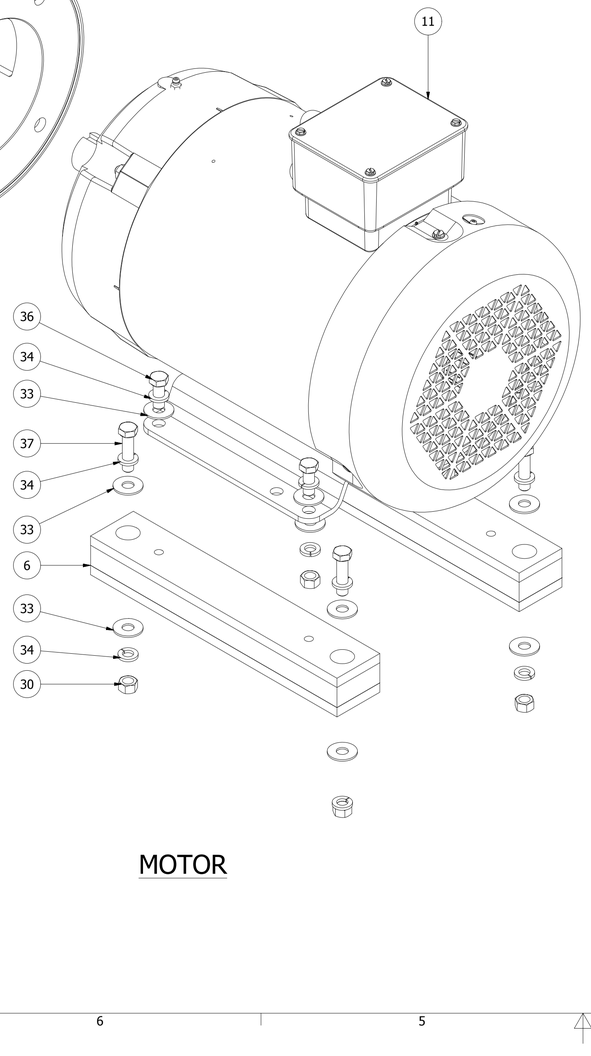
PROJECT: CORAL SEA

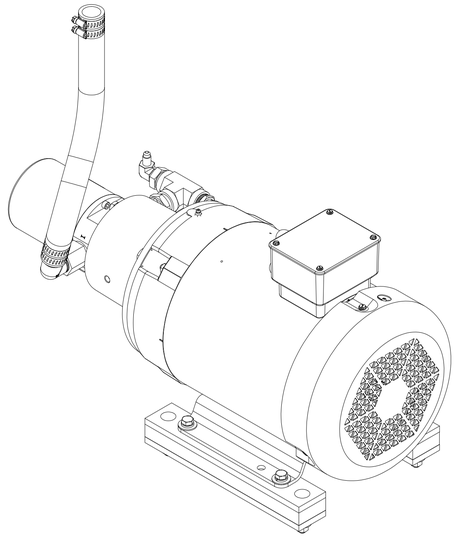
TITLE: CORAL SEA (3600-460V,60Hz,3Ph)

PREPARED BY:	RD	DATE:	07/17/2014	DWG NO.: P550-01-13	REV.: B
CHECKED BY:	JB	DATE:	07/17/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/17/2014	WEIGHT: 383.781 lbmass	SHT: 1 of 3

Z:\Water-Purification\WR-066\WIP\Workspace\Workspace\P550-01-13 (3600-460V,60Hz,3Ph)-Rev B.iam







MOTOR

BILL OF MATERIAL (B.O.M.)			
ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
1	1	RB 0.75 MT X 0.50 FT SS316L	0117293669
2	2	ADAP SEAL ORING 3-4BPS-ISO	2617102200
3	2	HP NIPPLE 0.25 MPT	0117410800
4	2	PLATE,SUPPORT,VESSEL,3 IN,23.00x2.50x0.25TH	0520052000
5	8	BRACKET,MVA U-CLAMP,3 IN	05202401GR
6	2	MOUNT,MOTOR,DAMPENER,VSM-215-B	21320703MI
7	3	INTERCONNECT MVA SS	2417430800
8	4	900 GPD MEM-VESSEL ASSY (SEAFARI)	B196900007
9	1	PUMP,DANFOSS,APP1 .5,6.6 GPM	12572406DS
10	1	BELL HSG &COUPLER,APP 1.5-3.5-213TC	12572413DS-1
11	1	MOTOR,10HP,460-60-3,7.5HP,380-50-3	1579274112
12	8	FELT ADHESIVE 0.125 X 0.75 STRIP	2615180100
13	1	ELB90 0.75 MPT x 1.00 BARB	0101074383
14	2	ELB90 ST 0.50 MPT x 0.50 FPT SS	0117232569
15	2	RB 0.50 MT x 0.25 FT SS	0117292387
16	1	RB 0.75 MT X 0.25 FT SS316L	0117293469
17	1	NIPPLE HEX .75 NPT X SH SS	01173837SH
18	1	TEE .75 FT X .75 FT X .75 FT SS	0117423769
19	2	ADAPTER .75-14 MBSP X .75 FPT	0117669200
20	1	UNION 0.50 FPT x FPT SS	0117672500
21	4	ELBOW,PP,3/8 ODx1/4 FT	0204011769
22	1	ELB90 -4 FLARE x 0.25 MT SS	1317020869
23	2	ELB90 -8 FLARE x 0.50 MT SS	1317022669
24	1	CONN -8 FLARE x .50 MPT SS	1317092600
25	4	FITTING,HOSE,-8 SWIVEL,SS	1317482369
26	1	HOSE,SPIRAL WIRE,CLEAR,1.00 x 16.00L	0328027600
27	1	HOSE,BLU,HP,-8 x 17.00L	2432180869
28	1	HOSE,BLU,HP,-8 x 47.00L	2432180869
29	4	CLAMP,HOSE,SS,1"	05181435AA
30	4	NUT,HEX,3/8-16,SS	061010057000
31	4	WASHER,FLAT,1/4",SS	061080043000
32	4	WASHER,FLAT,1/2",SS	061080066000
33	12	WASHER,FLAT,OS,3/8",SS	061100056000
34	14	WASHER,LOCK,3/8",SS	061120056000
35	4	WASHER,LOCK,1/2",SS	061120066000
36	6	SCREW,HEX HEAD,3/8-16x1",SS	061142157016
37	4	SCREW,HEX HEAD,3/8-16x1-1/2",SS	061142157024
38	4	SCREW,HEX HEAD,1/2-13x1 1/2",SS	061142167024
39	16	SC ALLEN FLAT .25-20 X .75 SS	061161845012
40	4	SCREX,HEX A,.25x1.00,SS	061172143016
41	1	FLARE-8 X 0.50 FT STRAIGHT SS	1317102669

DRAWING STATUS: PRODUCTION RELEASE

Parker Water Purification
2630 El Presidio St
Carson, California, 90810 USA
Tel: 310-637-3400 Fax: 310-999-6262
www.parker.com

TOLERANCES:
UNLESS OTHERWISE NOTED,
ALL DIMENSIONS ARE IN INCHES (IN.) AND MILLIMETER (mm)

FRACTIONS	±1/16"	±1.5mm
.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

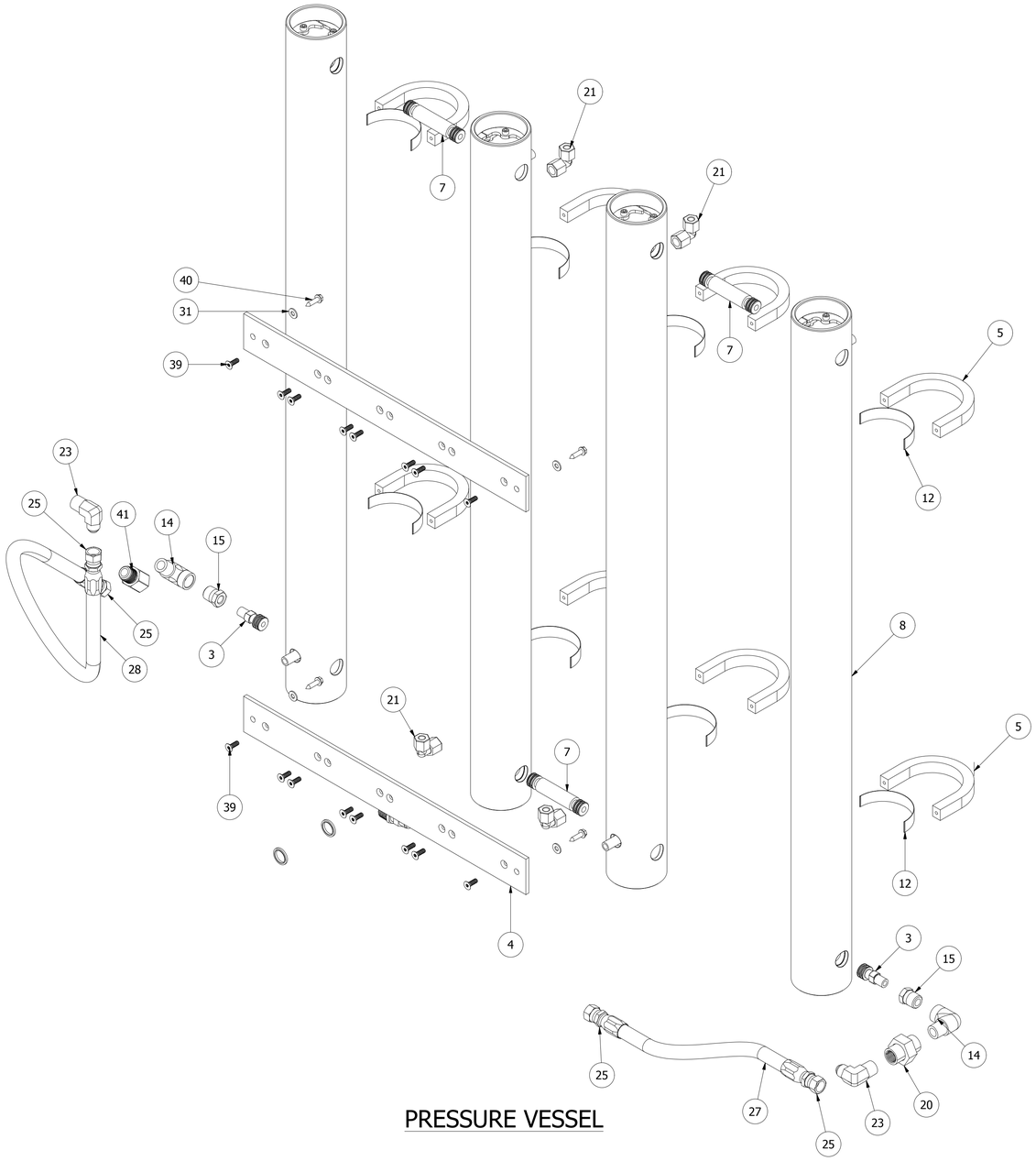
CUSTOMER:

PROJECT: CORAL SEA

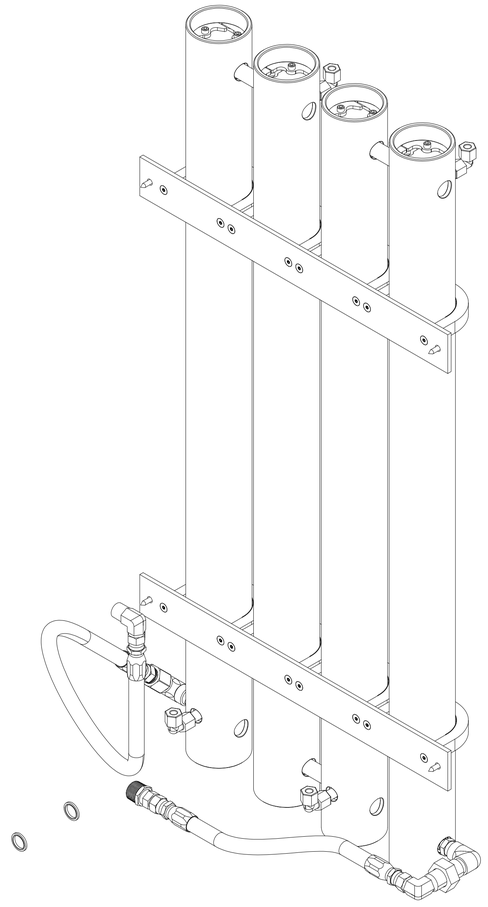
TITLE: CORAL SEA (3600-460V,60Hz,3Ph)

PREPARED BY:	RD	DATE:	07/17/2014	DWG NO.: P550-01-13	REV.: B
CHECKED BY:	JB	DATE:	07/17/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/17/2014	WEIGHT: 383.781 lbmass	SHT: 2 OF 3

Z:\Water-Purification\WR-066\WIP\Workspace\Workspace\P550-01-13 (3600-460V,60Hz,3Ph)-Rev B.iam



PRESSURE VESSEL



DRAWING STATUS:	PRODUCTION RELEASE

Parker Sea Recovery

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2630 El Presidio St
Carson, California, 90810 USA
Tel: 310-637-3400 Fax: 310-999-6262
www.parker.com

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.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

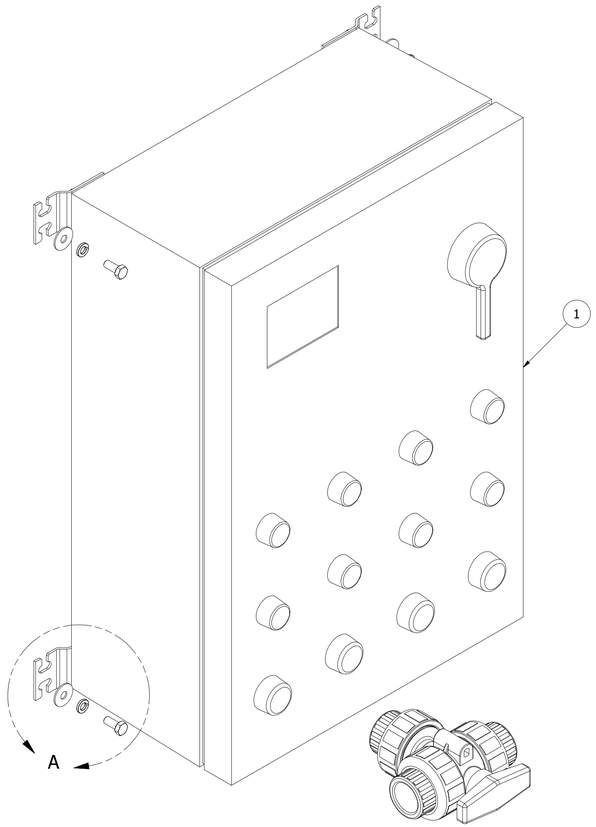
PROJECT: CORAL SEA

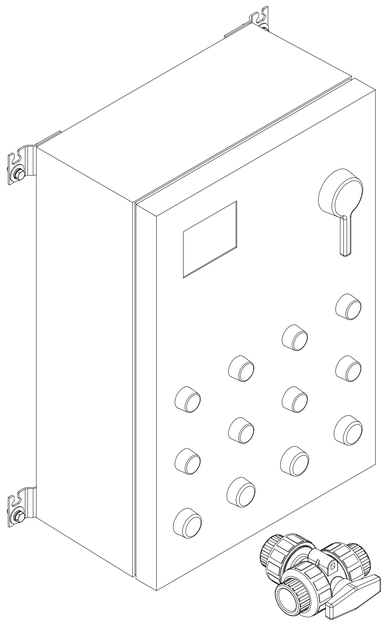
TITLE: CORAL SEA (3600-460V,60Hz,3Ph)

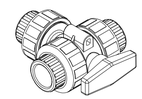
PREPARED BY:	RD	DATE:	07/17/2014	DWG NO.: P550-01-13	REV.: B
CHECKED BY:	JB	DATE:	07/17/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/17/2014	WEIGHT: 383.781 lbmass	SHT: 3 OF 3

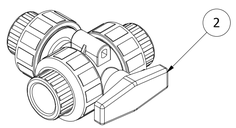
Z:\Water-Purification\WR-066\WIP\Workspace\Workspace\P550-01-13 (3600-460V,60Hz,3Ph)-Rev B.iam

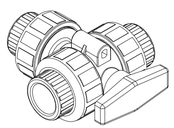
REVISION HISTORY					
REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY
A	06/09/2015	AS BUILT.	RD	JB	CP

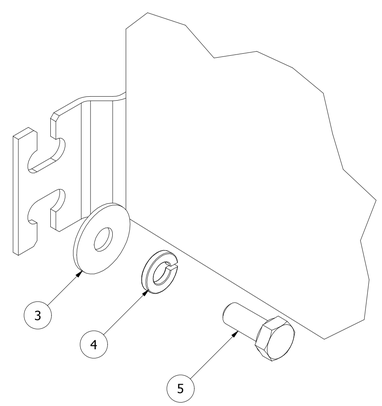












DETAIL A
SCALE 1 : 1

BILL OF MATERIAL (B.O.M.)			
ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
1	1	PANEL,CONTROL,24x16x9	B59564C001
2	3	VALVE,BALL,3W,VER,PVC,1.00 SL	14018119RH
3	4	WASHER,FLAT,OS,5/16",SS	061100049000
4	4	WASHER,LOCK,5-16 IN,SS	061120049000
5	4	SCREW,HEX HEAD,.31-18x0.75,SS	061142150012
6	1	KIT, ELECTRICAL, INTERCONNECT	P595640001

DRAWING STATUS: PRODUCTION RELEASE

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Tel: 310-637-3400 Fax: 310-999-6262
www.parker.com

TOLERANCES:
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.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

PROJECT: CORAL SEA

TITLE: CORAL SEA (BASIC-460V,60Hz,3Ph)

PREPARED BY:	RD	DATE:	07/04/2014	DWG NO.: P550-02-03	REV.: A
CHECKED BY:	JB	DATE:	07/04/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/04/2014	WEIGHT: 169.307 lbmass	SHT: 1 of 1

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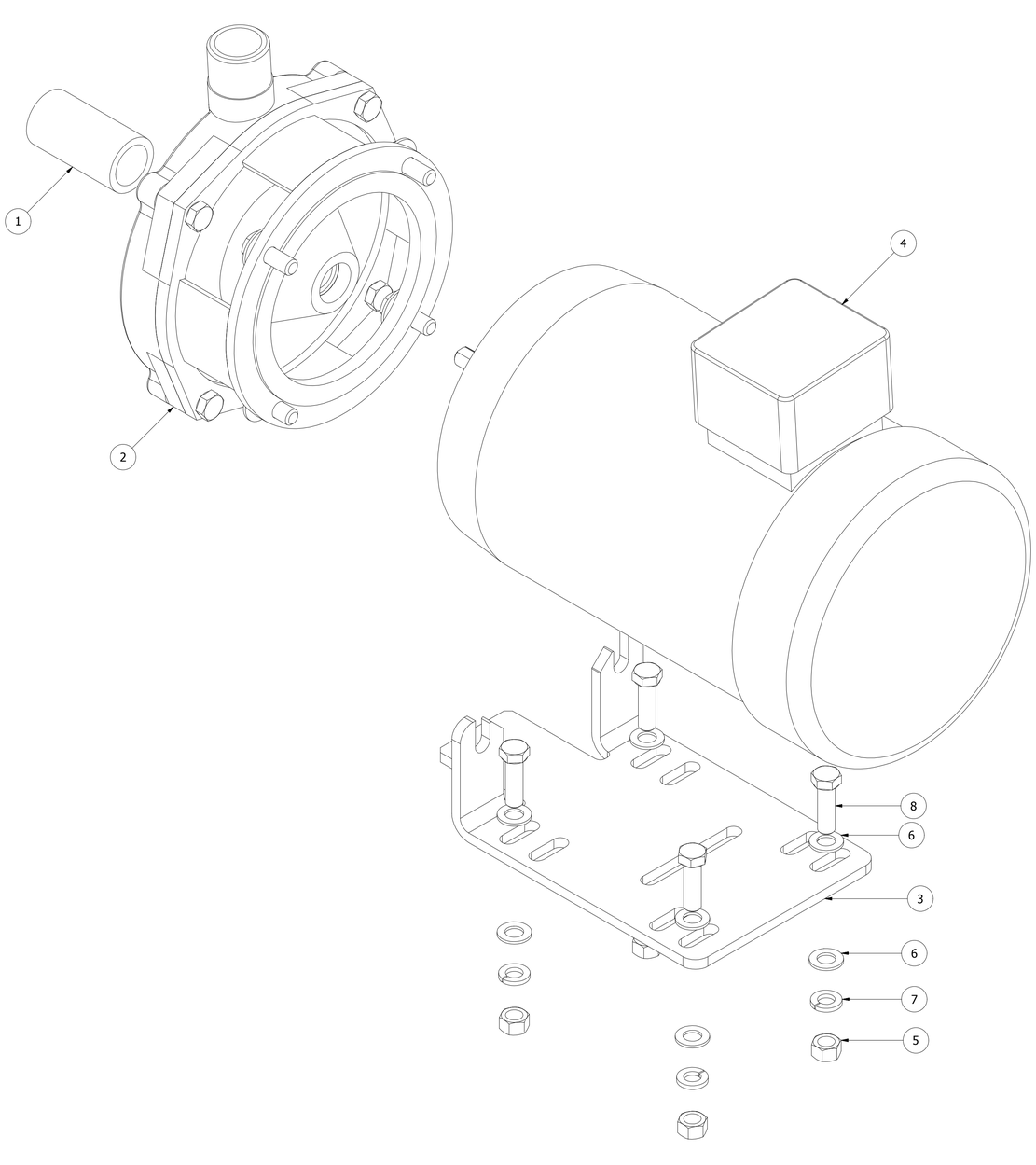
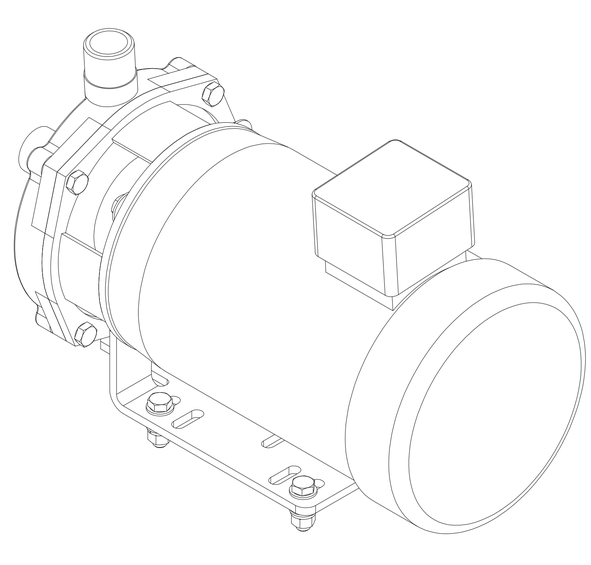
REVISION HISTORY					
REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY
A	09/25/2014	AS BUILT	RD	JB	CP





BILL OF MATERIAL (B.O.M.)			
ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
1	1	NIPPLE 1.00 NPT x SL x 2.50 LONG	0101394425
2	1	BOOSTER PUMP HEAD HP75 SS, 1.0 NPT	1217514773
3	1	BRACKET,MTG,PUMP,BOOSTER	1221514722-3
4	1	MOTOR,2HP,460-60-3,1.5HP,380-50-3	1544182210
5	4	NUT,HEX,3/8-16,SS	061010057000
6	8	WASHER,FLAT,3/8",SS	061080056000
7	4	WASHER,LOCK,3/8",SS	061120056000
8	4	SCREW,HEX HEAD,3/8-16x1-1/4",SS	061142157020

DRAWING STATUS: PRODUCTION RELEASE

Parker Sea Recovery

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2630 El Presidio St
Carson, California, 90810 USA
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www.parker.com

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.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

PROJECT: CORAL SEA

TITLE: CORAL SEA (380-460V,50-60Hz,3Ph)

PREPARED BY:	RD	DATE:	07/04/2014	DWG NO.: P550-03-04	REV.: A
CHECKED BY:	JB	DATE:	07/04/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/04/2014	WEIGHT: 31.274 lbmass	SHT: 1 of 1

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REVISION HISTORY					
REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY
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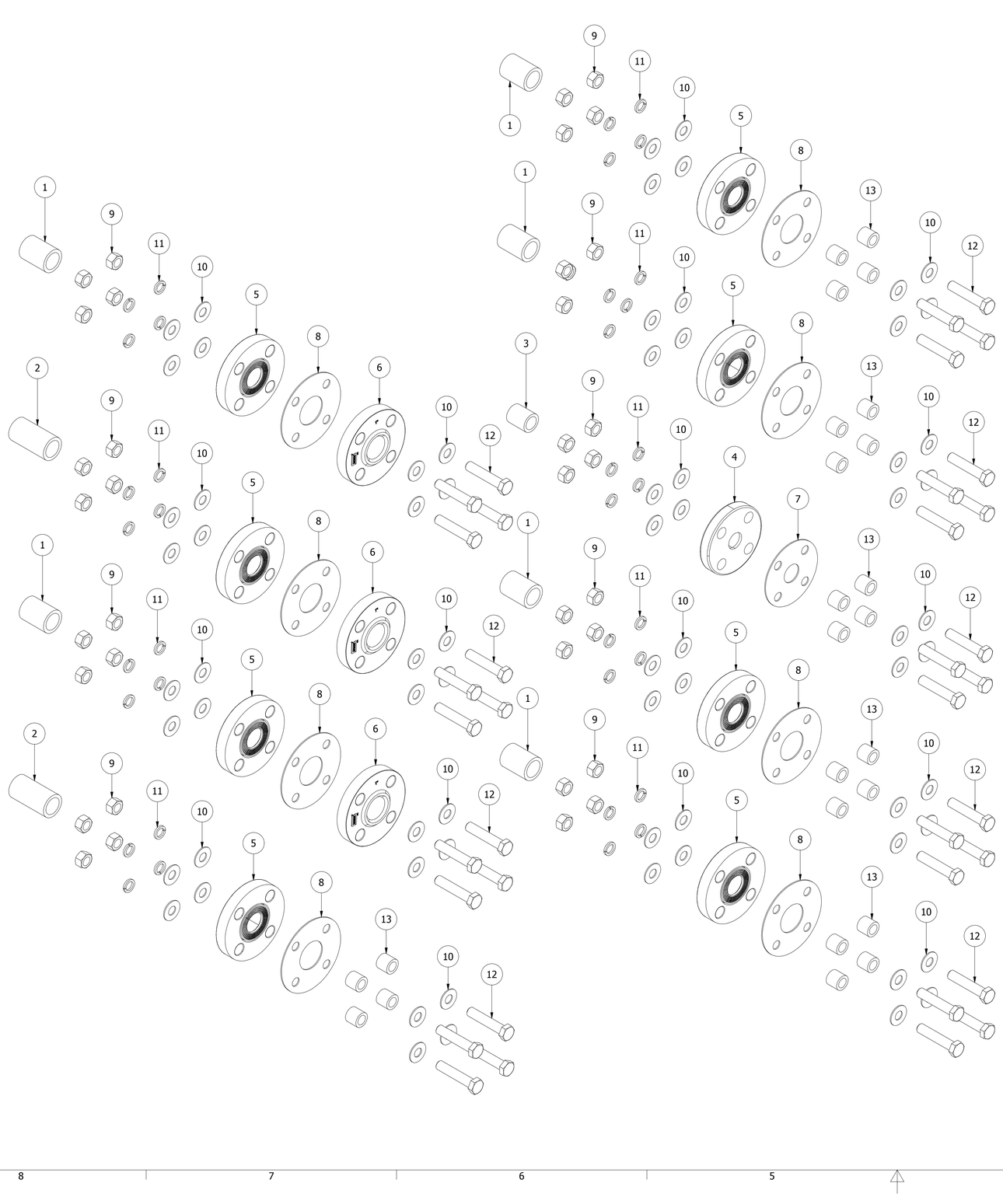

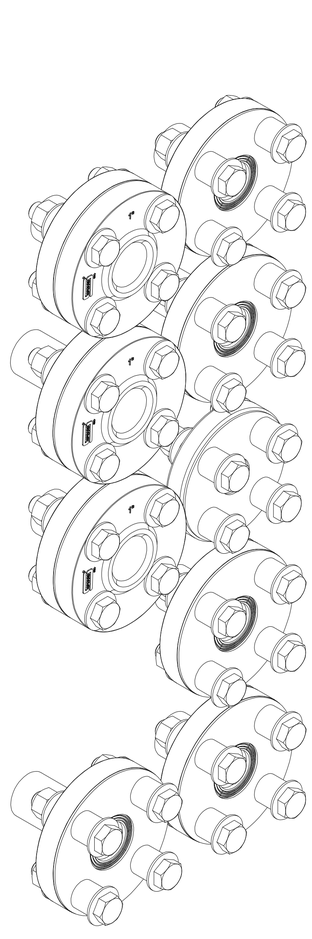

BILL OF MATERIAL (B.O.M.)

ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
1	6	NIPPLE 1.00 NPT x SL x 1.75 LG	0101394416
2	2	NIPPLE 1.00 NPT x SL x 2.50 LONG	0101394425
3	1	NIPPLE 0.75 NPT x CL	01013737CL
4	1	FLANGE 0.75 FPT	0101783783
5	8	FLANGE 1.00 FPT	0101784483
6	3	FLANGE 1.00 BLIND	0101804483
7	1	GASKET,FLANGE,EDPM,0.75	2635103700
8	8	GASKET,FLANGE,EPDM,1.00	2635104400
9	36	NUT,HEX,1/2-13,SS	0610100670000
10	72	WASHER,FLAT,OS,1/2",SS	061100660000
11	36	WASHER,LOCK,1/2",SS	061120660000
12	36	SCREW,HEX HEAD,1/2-13x2 1/2",SS	061142167040
13	24	PIPE,PVC,S80,.50x0.75L	0301098800

DRAWING STATUS: PRODUCTION RELEASE

Parker Water Purification
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Carson, California, 90810 USA
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www.parker.com

TOLERANCES:
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FRACTIONS	±1/16"	±1.5mm
.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

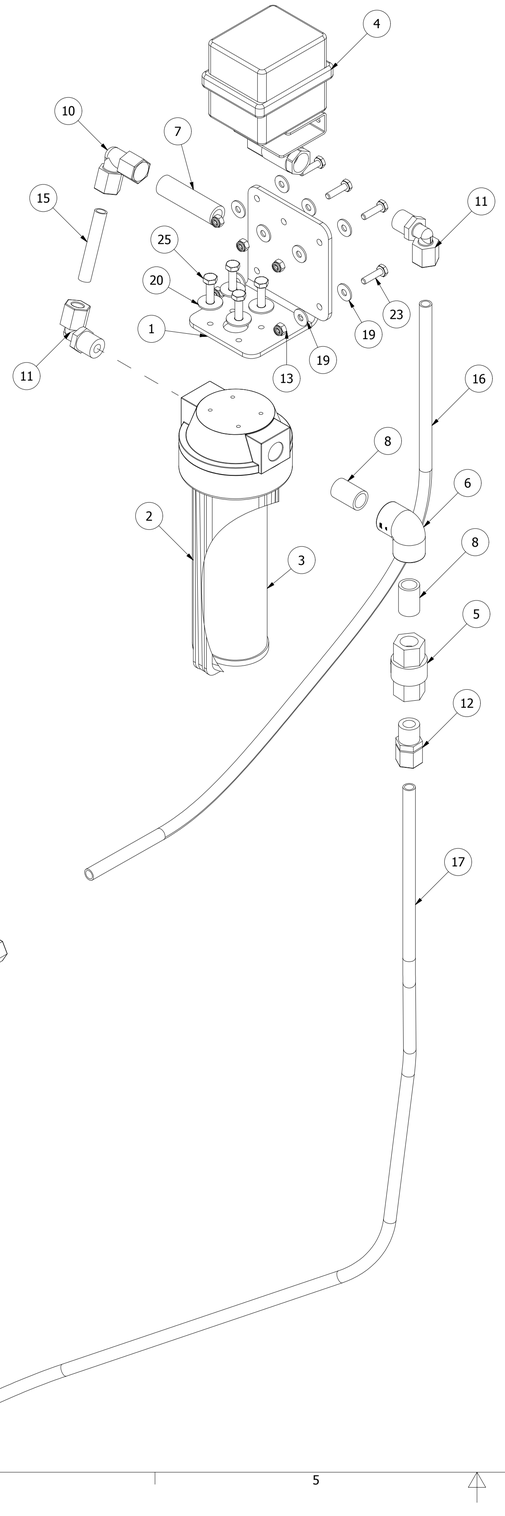
CUSTOMER:

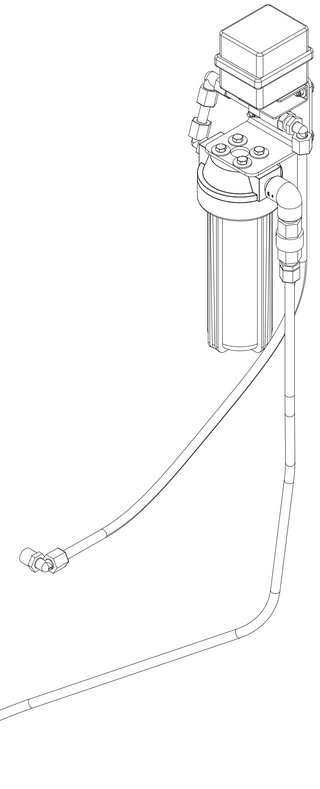
PROJECT: CORAL SEA

TITLE: CORAL SEA (Flange - ANSI PVC)

PREPARED BY:	RD	DATE:	07/07/2014	DWG NO.: P550-05-01	REV.: A
CHECKED BY:	JB	DATE:	07/08/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/08/2014	WEIGHT: 14.092 lbmass	SHT: 1 of 1

REVISION HISTORY					
REV	DATE	DESCRIPTION	DRAWN BY	CHECKED BY	APPROVED BY
A	06/10/2015	ADDED PART NO. 0803004773	RD	JB	CP





BILL OF MATERIAL (B.O.M.)			
ITEM NO	QTY.	DESCRIPTION	FILE/DWG. NAME
1	1	BRACKET,FWF,FILTER,CARBON - PR	2020040006
2	1	FILTER HOUSING .50 X 10	0713020873
3	1	CHARCOAL FILTER 10IN	0803004773
4	1	KZ VALVE FWF 0.50	1401105698
5	1	VALVE CHECK .50 FPT WITH VITO	14012117Ar
6	1	ELB90 0.50 FPT x FPT	0101012583
7	1	NIPPLE 0.50 NPT x 3.00	0101372530
8	2	NIPPLE 0.50 NPT x CL	01013725CL
9	1	FLANGE 0.50 FPT	0101782583
10	1	ELBOW,PP,1/2 ODx1/2 FT	0204012569
11	4	ELBOW,PP,1/2 ODx1/2 MT	0204022569
12	1	FITTING,PP,1/2 ODx1/2 MT	0204092569
13	5	NUT HEX .25-20 W-INSERT SS	061060045000
14	1	GASKET,FLANGE,EDPM,0.50	2635102000
15	1	TUBING,PARAFLEX,BLACK,0.50 x 3.00L	0312124269
16	1	TUBING,PARAFLEX,BLACK,0.50 x 33.00L	0312124269
17	1	TUBING,PARAFLEX,BLACK,0.50 x 47.00L	0312124269
18	4	NUT,HEX,1/2-13,SS	061010067000
19	10	WASHER,FLAT,OS,1/4",SS	061100043000
20	4	WASHER,FLAT,OS,5/16",SS	061100049000
21	8	WASHER,FLAT,OS,1/2",SS	061100066000
22	4	WASHER,LOCK,1/2",SS	061120066000
23	5	SCREW,HEX HEAD,.25-20x1",SS	061142145016
24	4	SCREW,HEX HEAD,1/2-13x2 1/2",SS	061142167040
25	4	SCREW,HEX A,.31x1.25,SS	061172149020
26	4	PIPE,PVC,S80,.50x0.75L	0301098800

DRAWING STATUS: PRODUCTION RELEASE

Parker Sea Recovery

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2630 El Presidio St
Carson, California, 90810 USA
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TOLERANCES:
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.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE:

CUSTOMER:

PROJECT: CORAL SEA

TITLE: CORAL SEA (FWF - Yes) (ANSI PVC)

PREPARED BY:	RD	DATE:	07/08/2014	DWG NO.: P550-06-02	REV.: A
CHECKED BY:	JB	DATE:	07/08/2014	CUSTOMER P.O.	
APPROVED BY:	CP	DATE:	07/08/2014	WEIGHT: 20.712 lbmass	SHT: 1 of 1

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DRAWING STATUS: RELEASED FOR PRODUCTION

Parker Water Purification
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.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

SCALE: NTS

CUSTOMER: STANDARD

PROJECT: STANDARD

TITLE:
CORAL SEA 6800 REVERSE OSMOSIS SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM

PREPARED BY:	RD	DATE:	6/5/15	DWG NO.: CS6800-A551-PID	RE
CHECKED BY:	JB	DATE:	6/5/15	CUSTOMER P.O.	–
	JB		6/5/15		

VALVES

- GATE (GA)
- GLOBE (GV)
- BALL (BV)
- NEEDLE (NV)
- CHECK (CK)
- SPRING LOADED CHECK (CK)
- BUTTERFLY (BF)
- DIAPHRAGM (DV)
- RELIEF AND/OR SAFETY (ARV)
- RUPTURE DISC (VB)
- 3-WAY
- 3-WAY SOLENOID
- 4-WAY SOLENOID
- 4-FUNCTION VALVE
- SAMPLE VALVE (SV)
- FOOT VALVE

N.O. – NORMALLY OPEN
N.C. – NORMALLY CLOSED

CONTROL VALVES/ACTUATORS

- PRESSURE REGULATOR VALVE WITH PRESSURE GAUGE
- MOTORIZED ACTUATOR
- MOTORIZED ACTUATOR WITH MANUAL OVERRIDE
- DOUBLE ACTING ACTUATOR
- DOUBLE ACTING ACTUATOR WITH LIMIT STOP
- DOUBLE ACTING ACTUATOR WITH SPRING TO CLOSE
- DOUBLE ACTING ACTUATOR WITH SPRING TO OPEN
- DOUBLE ACTING DIAPHRAGM ACTUATOR
- DOUBLE ACTING DIAPHRAGM ACTUATOR WITH HANDWHEEL
- DOUBLE ACTING DIAPHRAGM ACTUATOR WITH LIMIT STOP
- DOUBLE ACTING DIAPHRAGM ACTUATOR WITH SPRING TO CLOSE
- DOUBLE ACTING DIAPHRAGM ACTUATOR WITH SPRING TO OPEN
- SOLENOID VALVE
- AIR OPERATOR W/POSITIONER

EQUIPMENT SYMBOL

- MIXER OR AGITATOR (MX)
- INLINE STATIC MIXER
- HEATER (HE)
- INJECTION QUILL
- EDUCTOR/EJECTOR (ED)
- POSITIVE DISPLACEMENT PUMP W/MANUAL STROKE ADJUSTMENT (MP)
- POSITIVE DISPLACEMENT PUMP W/PNEUMATIC STROKE ADJUSTMENT (MP)
- POSITIVE DISPLACEMENT PUMP W/ELECTRIC STROKE ADJUSTMENT (MP)
- POSITIVE DISPLACEMENT AXIAL PISTON PUMP
- ROTARY COMPRESSER OR BLOWER
- AIR FILTER
- BLOWER OR FAN (BL OR FN)
- VACUUM PUMP (VP)
- DIAPHRAGM PUMP (DP)
- CENTRIFUGAL PUMP (P)
- HIGH PRESSURE PUMP (P)
- DESICCANT BREATHER
- VENT PIPE
- Y-STRAINER (YS)
- RUPTURE DISC
- DIAPHRAGM SEAL
- PULSATION DAMPENER (PD)
- CALIBRATION COLUMN (CC)
- RING DAMPENER

- RO/UF MODULE
- MEDIA FILTER
- CARTRIDGE FILTER (CF) HOUSING
- ROOF TANK (TK)
- ROOF TOP TANK (TK) CONE BOTTOM TANK (TK)
- OPEN TOP TANK (TK) WITH COVER
- ENERGY RECOVERY TURBINE (ERT)

MISCELLANEOUS SYMBOLS

- LINE 1 / LINE 2 / LINE 3 — LINE, EQUIPMENT OR PRODUCT REFERENCES INTO OR LEAVING DWG.
- TIE — TIE IN TO PIPING BY OTHERS
- 304 | CPVC — PIPING MATERIAL SPEC. BREAK

LIGHT COLOR LEGEND

(A) AMBER
(B) BLUE
(G) GREEN
(R) RED
(W) WHITE

SOLENOID VALVE OPERATION

3-WAY

4-WAY

FAIL OPEN TO PATHS A–C AND D–B

- A/S — AIR SUPPLY
- N/S — NITROGEN SUPPLY
- FG — FLOW SIGHT GLASS
- SG — SIGHTGLASS (ON VESSEL)
- LG — LEVEL GAUGE
- CONCENTRIC REDUCING
- ECCENTRIC REDUCING
- ENCLOSURE (CAP)
- FLANGE
- END CLOSURE (BLIND FLANGE)
- END CLOSURE (VIC PLUG)
- QUICK DISCONNECT
- UNION
- SANITARY CONNECTION
- FLOOR DRAIN OR SUMP

INSTRUMENT LINE SYMBOLS

- PNEUMATIC SIGNAL
- ELECTRICAL SIGNAL (ANALOG – 4–20mA OR 1–10 VDC)
- ELECTRICAL SIGNAL (DISCRETE)
- ELECTRICAL SIGNAL (FREQUENCY OR PULSE)
- ELECTRICAL POWER (VAC–SINGLE PHASE OR VDC)
- ELECTRICAL POWER (THREE PHASE)
- CAPILLARY TUBING (FILLED TUBING)
- CONNECTION TO PROCESS, OR INSTRUMENT SUPPLY

FLOW MEASUREMENT SYMBOLS

- FE — PADDLE WHEEL FLOW SENSOR
- FE — VORTEX SENSOR
- FE — SONIC FLOW SENSOR
- FI — INLINE FLOW INDICATOR (ROTAMETER)
- FC — FLOW CONTROL (RESTRICTOR)
- FE / M — MAGNETIC FLOW ELEMENT

INSTRUMENT SYMBOLS

- LOCALLY MOUNTED
- PANEL MOUNTED (MAIN OR REMOTE)
- PILOT LIGHT
- SHARED DISPLAY (CRT) AND/OR SHARED CONTROL

CONTROL SYMBOLS

- DI — DISCRETE INPUT TO PLC
- DO — DISCRETE OUTPUT FROM PLC
- AI — ANALOG INPUT TO PLC
- AO — ANALOG OUTPUT FROM PLC

NOTES:

1. THE DESCRIPTION OF AN ANALYTICAL VARIABLE FUNCTION (pH, SiO_2, O_3, ETC.) SHALL BE SHOWN OUTSIDE THE INSTRUMENT SYMBOL. EXAMPLE: AIC / pH
2. FOR A CONTROL STATION, SUBSTITUTE THE LETTER "K" FOR THE LETTER "C". EXAMPLE: PIK
3. ADD THE SUFFIX L (LOW), LL (LOW–LOW), H (HIGH), HH (HIGH–HIGH), HL (HIGH–LOW), AS REQUIRED. EXAMPLE: PSL, FAL
4. ADD THE SUFFIX L (CLOSED) OR H (OPEN) TO VALVE POSITION LIGHTS AS REQUIRED. EXAMPLE: ZLL (G) — INDICATES LIGHT COLOR (SEE LEGEND)
5. AUDIBLE/VISIBLE ALARMS SHALL HAVE AN "A" SUFFIX. VISIBLE ONLY ALARMS SHALL HAVE A "L" SUFFIX AND UTILIZE THE PILOT LIGHT SYMBOL. THE "A" OR "L" SHALL BE FOLLOWED BY THE APPROPRIATE SUFFIX AS SHOWN IN NOTE 3. EXAMPLE: FAL / FLL — AUDIBLE/ VISIBLE

INTERLOCKING FUNCTIONS

SPECIAL IDENTIFICATION

AP – ANALYZER TEST CONNECTION
D – DRAIN
FO – ORIFICE (RESTRICTION)
PP – PRESSURE TEST CONNECTION
PSE – RUPTURE DISC
PSV – PRESSURE/ VACUUM
SDI – SILT DENSITY INDEX TEST CONNECTION
SP – SAMPLE
TP – TEMPERATURE TEST CONNECTION
TW – THERMOWELL
YL – EQUIPMENT STATUS LIGHT
DC – DOUBLE CONTAINED

PIPING MATERIAL ABBREVIATIONS

C.I. – CAST IRON
CCPVC – CHLORINATED POLYVINYL CHLORIDE
C.S. – CARBON STEEL
D.I. – DUCTILE IRON
DSS – DUPLEX STAINLESS STEEL
EPSS – 316L STAINLESS STEEL (ELECTRO POLISHED)
ECPVC– ESLOCLEAN CPVC
FRP – FIBER RE–INFORCED PLASTIC
G.I. – GALVANIZED IRON
PFA – PERFLUOROALKKOXY
PP – POLYPROPYLENE
PPL – POLYPROPYLENE LINED CARBON STEEL
CPVC – POLYVINYL CHLORIDE
PVDF – POLYVINYLIDENE FLUORIDE
PVFB – PVDF BEADLESS & CREVICE FREE
PVFL – PVDF LINED
SGP – STEEL GALVANIZED
TFE – TEFLON
TFEL – TEFLON LINED (PTFE)
304 – 304 STAINLESS STEEL
304L – 304L STAINLESS STEEL
316 – 316 STAINLESS STEEL
316L – 316L STAINLESS STEEL

6. POWER/DISCONNECT SWITCH SHALL HAVE THE FOLLOWING SUFFIX. POWER DISCONNECT SWITCHS SHALL UTILIZE THE SUFFIX "DSW". POWER FROM THE MMC/BREAKER SHALL UTILIZE THE SUFFIX "J".

EXAMPLE:

DSW — DISCONNECT SWITCH
J — MCP BUCKET/ BREAKER

HAND SWITCH FUNCTIONS

HOA – HAND–OFF–AUTO
OCA – OPEN–CLOSE–AUTO
OO – OFF–ON
1,2 – DEVICE SELECT

EXAMPLES: HS HOA, HS 1,2

PUSHBUTTON (MOMENTARY CONTACT)
EXAMPLES: HMS

DRAWING STATUS: RELEASED FOR PRODUCTION

Parker Sea Recovery
Parker Water Purification
2630 El Presidio St
Carson, California, 90810 USA
Tel: 310-637-3400 Fax: 310-999-6262
www.parker.com

TOLERANCES:
UNLESS OTHERWISE NOTED,
ALL DIMENSIONS ARE IN INCHES (IN.) AND MILLIMETER (mi

FRACTIONS	±1/16"	±1.5mm
.X	±0.1"	±2.5mm
.XX	±0.01	±0.51mm
.XXX	±0.005"	±0.127mm
ANGLES	±1 DEG.	

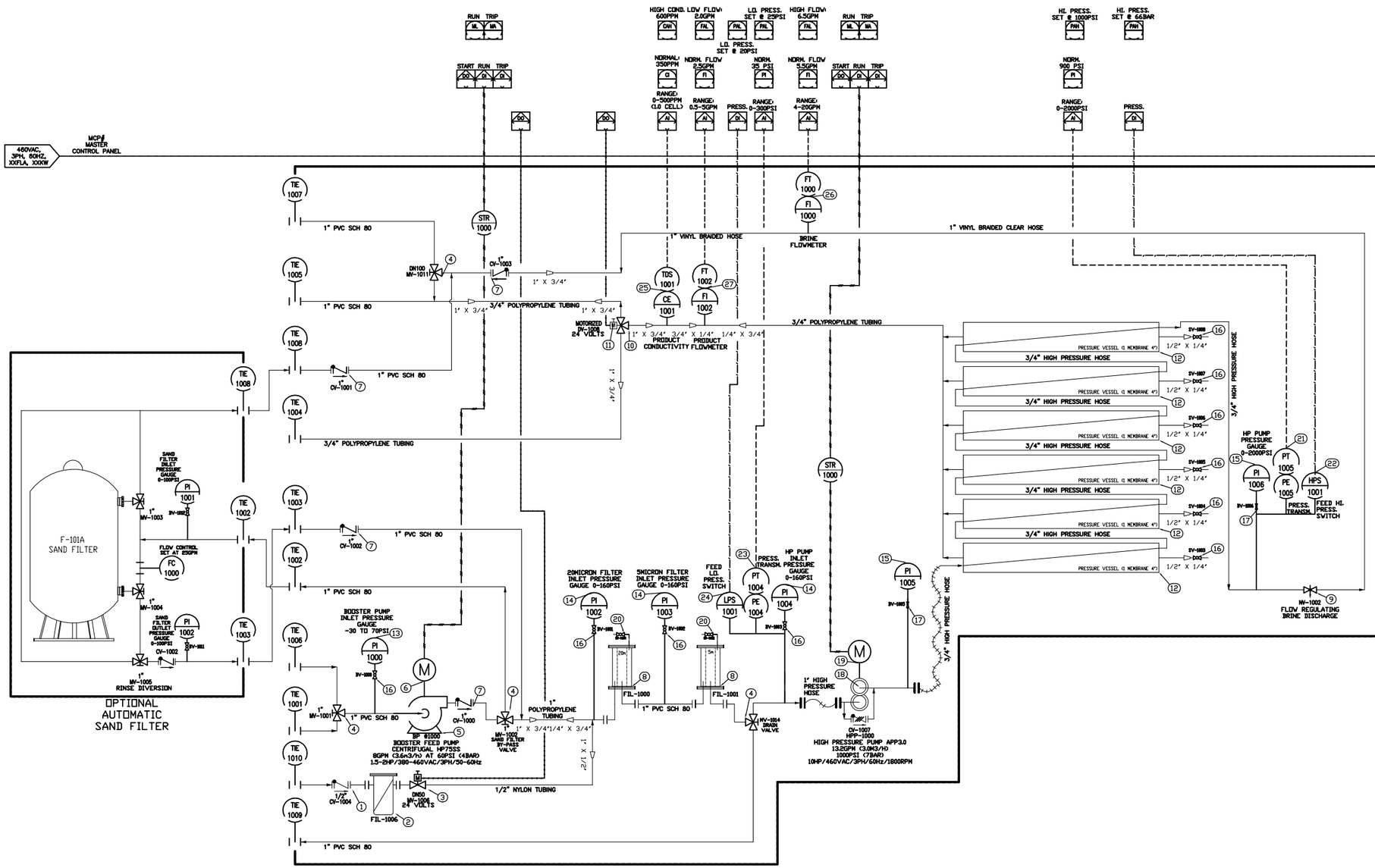
SCALE: NTS

CUSTOMER: STANDARD

PROJECT: STANDARD

TITLE: CORAL SEA 6800 REVERSE OSMOSIS SYSTEM
PROCESS AND INSTRUMENTATION DIAGRAM

PREPARED BY:	RD	DATE:	6/5/15	DWG NO.: CS6800-A551-PID	RE
CHECKED BY:	JB	DATE:	6/5/15	CUSTOMER P.O.	–
	JB		6/5/15		



TIE	DESCRIPTION	CONNECTION TYPE	MATERIAL
1001	INLET - SEA WATER FEED INLET TO BOOSTER PUMP	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1002	OUTLET - SEA WATER TO SAND FILTERS	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1003	INLET - SEA WATER FROM SAND FILTERS	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1004	OUTLET - PRODUCT WATER	3/4 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1005	OUTLET - BRINE DISCHARGE	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1006	INLET - CHEMICAL CLEANING	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1007	OUTLET - CHEMICAL CLEANING	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1008	INLET - SAND FILTER DRAIN	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1009	OUTLET - DRAIN	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80
1010	INLET - FRESH WATER FLUSH	1 INCH - ANSI FLANGE,150LBS	PVC, SCH.80

ITEM	QTY	PART NUMBER	DESCRIPTION
27	1	1121202100	FLOWMETER,RFA,0-10VDC,RFA,4.0-20GPM
26	1	1121532100	FLOWMETER,RDTD,0-10VDC,RFA,0.5-5.0 GPM
25	1	31314212RH	SENSOR,CONDUCTIVITY,PP,SS316L,GF #3-2850-52-41 (1.0 Cell)
24	1	2301020758	SWITCH,PRESS,LOW,6 PSI,DIN CONN
23	1	2317100601	TRANSDUCER,PRESSURE,LOW,0-300 PSI
22	1	2321020558	SWITCH,PRESS,HIGH,900 PSI,DIN CONN
21	1	2317102001	TRANSDUCER,PRESSURE,HIGH,0-2000 PSI
20	2	14015506AR-02	VALVE BALL .25 FTx MT
19	1	1579274122	MOTOR,10HP,460-60-3,7.5HP,380-50-3,BALDOR VM3711T WF3 J-BOX
18	1	12572408DS	PUMP,DANFOSS,APP3.0,13.2 GPM
17	2	1417123987	VALVE SHUT OFF SS 0.25 FPT x FPT
16	10	14015506AR-01	VALVE BALL .25 FT x MT
15	2	10181534CC	GAUGE 0-2000 CBM.NPT (TRIPLE)
14	3	10181533CC	GAUGE 0-160 CBM.NPT (TRIPLE)
13	1	10181532CC	GAUGE -30-0-70 CBM.NPT (TRIPLE)
12	6	24082426C1	VESSEL,PRESS,4 IN,MEM,SGL,1000EP,0.50 MPT
11	1	14010719RH	ACTUATOR,VALVE,PLASTOMATIC,2-
10	1	14018019RH	VALVE,BALL,3HOLE,3W,VER,PLASTOMATIC,PVC,1.00 SL
9	1	1417018396	VALVE PRESS REGULATOR-12
8	2	07620302WA	FILTER HOUSING CPF DWS
7	4	1401271942	VALVE CHECK TU HAYWARD PVC 1.00
6	1	1544182210	MOTOR,2HP,460-60-3,1.5HP,380-50-3,BALDOR JM3555 WF3 J-BOX
5	1	1217514773	BOOSTER PUMP HEAD HP75 SS, 1.0 NPT,A551
4	4	14018119RH	VALVE,BALL,3W,VER,PLASTOMATIC,PVC,1.00 SL
3	1	1401105698	KZ VALVE FWF 0.50
2	1	0713020873	FILTER HOUSING .50 X 10
1	1	14012117AR	VALVE CHECK .50 FPT WITH VITO

Parts List

DRAWING STATUS: RELEASED FOR PRODUCTION

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CHECKED BY:	JB	DATE:	6/5/15	CUSTOMER P.O.	-
	JB		6/5/15		

CORAL SEA CONTROL
SCHEMATIC 460vAC 60Hz
BASIC DESIGN

REV	ENGINEER	DESCRIPTION	DATED
A	JPD	Updated HMI size on layout, updated TB8/5 and TB8/6 on sheet 2, updated Brine Flow (FT-1000) and Product Flow (Ft-1002) info on sheet 5, updated wire line symbol for customer installed wiring	*
*	*	*	*
*	*	*	*

SEA RECOVERY
2630 EAST EL PRESIDIO ST.
CARSON
CALIFORNIA, 90810
U.S.A.
www.parker.com

DATE: 12/28/2011 02:45 PM	DRAWN BY: JPD	PROJECT ID: B59564C001	PROJECT: Coral Control System	DRAWING TITLE: Coral Sea (60Hz) Control Schematic Basic Installation	DRAWING NUMBER: Coral Sea Elec	SHEET: – OF –
DESCRIPTION: Coral Sea Drawing Set Basic	CHK APPR		CUSTOMER			

PANEL LAYOUT SYMBOLS

PILOT LIGHT
ACTION
COLOR
TAG NO

PUSHBUTTON, ILLUMINATED
ACTION
COLOR
TAG NO

HANDSWITCH, 3 POSITION, ILLUMINATED
HAND OFF AUTO
*COLOR *
TAG NO

HANDSWITCH, 2 POSITION, ILLUMINATED
OFF ON
*COLOR *
TAG NO

TAG NO
XX XX — SINGLE-TIER TERMINAL BLOCK XX

TAG NO — DOUBLE-TIER TERMINAL BLOCK
XX_1 XX_2 XX_2 XX_1

ABBREVIATIONS

- VFD – VARIABLE FREQUENCY DRIVE
- MS – MOTOR STARTER
- NO – NORMALLY OPEN
- NC – NORMALLY CLOSED
- C – COMMON
- LC – LIGHTING CONTACTOR
- HS – HANDSWITCH
- CB – CIRCUIT BREAKER
- F – FUSE
- LS(x) – LEVEL SWITCH (HIGH, LOW, LOW-LOW)
- LA(x) – LEVEL ALARM (LOW, LOW-LOW)
- PS(x) – PRESSURE SWITCH (LOW, LOW-LOW)
- FLS(x) – FLOW SWITCH
- PA(x) – PRESSURE ALARM (LOW, LOW-LOW)
- PDS(x) – PRESSURE DIFFERENTIAL SWITCH (HIGH)
- PDA(x) – PRESSURE DIFFERENTIAL ALARM (HIGH)
- PT – PRESSURE TRANSMITTER

POWER WIRING SYMBOLS

VFD-TAG NO
X.X Hp
CONTROL VIA MODBUS
SEE DWG PROJ MB FOR TERMINATIONS
ADDR 3
R1A R1B R1C R2A R2C S COM AI 1 +10 AI 2 U 1 U 2 U 3 U 4 +24
L1 L2 L3 PA PB U V W
VFD

YY-XXXXA
SAFETY RELAY
Y1 Y2 13 23 41
24VDC E-STOP SYSTEM
A1 A2 14 24 42
SAFETY RELAY

CB-TAG NO
XXA
WIRE IN 1 2 DB1 WIRE OUT
WIRE IN 3 4 L1 WIRE OUT
WIRE IN 5 6 L2 WIRE OUT
L3 WIRE OUT
CIRCUIT BREAKER

WIRE IN WIRE IN WIRE IN
HS-TAG NO
1 3 5
2 4 6
WIRE OUT WIRE OUT WIRE OUT
DISCONNECT

A2 A1
WIRE OUT 2 1 WIRE IN
WIRE OUT 4 3 WIRE IN
WIRE OUT 6 5 WIRE IN
WIRE OUT 22 21 WIRE IN
CONTACTOR

TAG NO
KVA
120V PRI
WIRE IN H4 H3 H2 H1 WIRE IN
X1 X2 X3 X4 12V SEC
WIRE OUT WIRE OUT
CONTROL TRANSFORMER

TAG NO
KVA
120V PRI
WIRE IN H4 H3 WIRE IN
X1 X2 12V SEC
WIRE OUT WIRE OUT
CONTROL TRANSFORMER

WIRING DIAGRAM SYMBOLS
POWER WIRING SYMBOLS

G T3 T2 T1 M TAG NO — MOTOR

TAG NO
WIRE IN H N WIRE OUT
WIRE IN + − WIRE OUT
DC POWER SUPPLY

TAG NO
WIRE IN L1 LINE L2 WIRE OUT
WIRE IN L1 LOAD L2 WIRE OUT
SURGE SUPPRESSOR

POWER RECEPTACLE
L N G
RECEPTACLE

TAG NO
WIRE IN H N WIRE OUT
FAN

CONTROL WIRING SYMBOLS

TAG NO
OFF ON
WIRE IN 1 2 WIRE OUT
HANDSWITCH, 2 POSITION

TAG NO
HAND OFF AUTO
H WIRE IN 1 2 H WIRE OUT
A WIRE IN 3 4 A WIRE OUT
HANDSWITCH, 3 POSITION

TAG NO
WIRE IN 1 2 WIRE OUT
PUSHBUTTON (N.O.)

TAG NO
WIRE IN 1 2 WIRE OUT
PUSHBUTTON (N.C.)

TAG-NO
E-STOP
1A 2A
1B 2B
E-STOP

LR-TAG NO
XXmh
3ø
A1 B1 C1
A2 B2 C2
E1
LINE REACTOR

WIRE-LINE SYMBOLS

SOLID LINE
PREWIRED BY SEA RECOVERY
INTERNAL TO PANEL

SOLID LINE
WIRED BY INSTALLER
EXTERNAL TO PANEL

LONG-DASHED LINE
WIRED BY SEA RECOVERY
EXTERNAL TO PANEL

BOLD SOLID LINE
PRE-INSTALLED BY SEA RECOVERY
TERMINAL BLOCK JUMPER COMB
OR BUS LINE

CONTROL WIRING SYMBOLS

YY-TAG NO
(+) CR (−)
CONTROL RELAY STYLE 1

YS-TAG NO
C WIRE IN C NO WIRE OUT
NO NC WIRE OUT
NC
CONTROL RELAY CONTACT STYLE 1

YY-TAG NO
A1 CR A2
CONTROL RELAY STYLE 2

C WIRE IN 11 14 NO WIRE OUT
NC WIRE OUT
12
CONTROL RELAY CONTACT STYLE 2

LSH-TAG NO
C WIRE IN C NO WIRE OUT
NO NC WIRE OUT
NC
LEVEL SWITCH, HIGH

PSL-TAG NO
C WIRE IN C NO WIRE OUT
NO
NC
PRESSURE SWITCH, LOW

PSLL-TAG NO
C WIRE IN C NO WIRE OUT
NO
NC
PRESSURE SWITCH, LOW, LOW

FSL-TAG NO
C WIRE IN C NO WIRE OUT
NO
FLOW SWITCH

PDSH-TAG NO
C WIRE IN C NO NO WIRE OUT
NC
HIGH DIFFERENTIAL PRESSURE SWITCH

\+ − xT TAG NO
TRANSMITTER

TAG NO
WIRE IN E1 M E2 WIRE OUT
MOTOR STARTER

TAG NO
WIRE IN A1 C A2 WIRE OUT
CONTACTOR

KV-TAG NO
WIRE IN H N WIRE OUT
SOLENOID

TAG NO
WIRE IN X1 COLOR X2 WIRE OUT
PILOT LIGHT

TAG NO
WIRE IN * WIRE OUT
* RATING
FUSE BLOCK

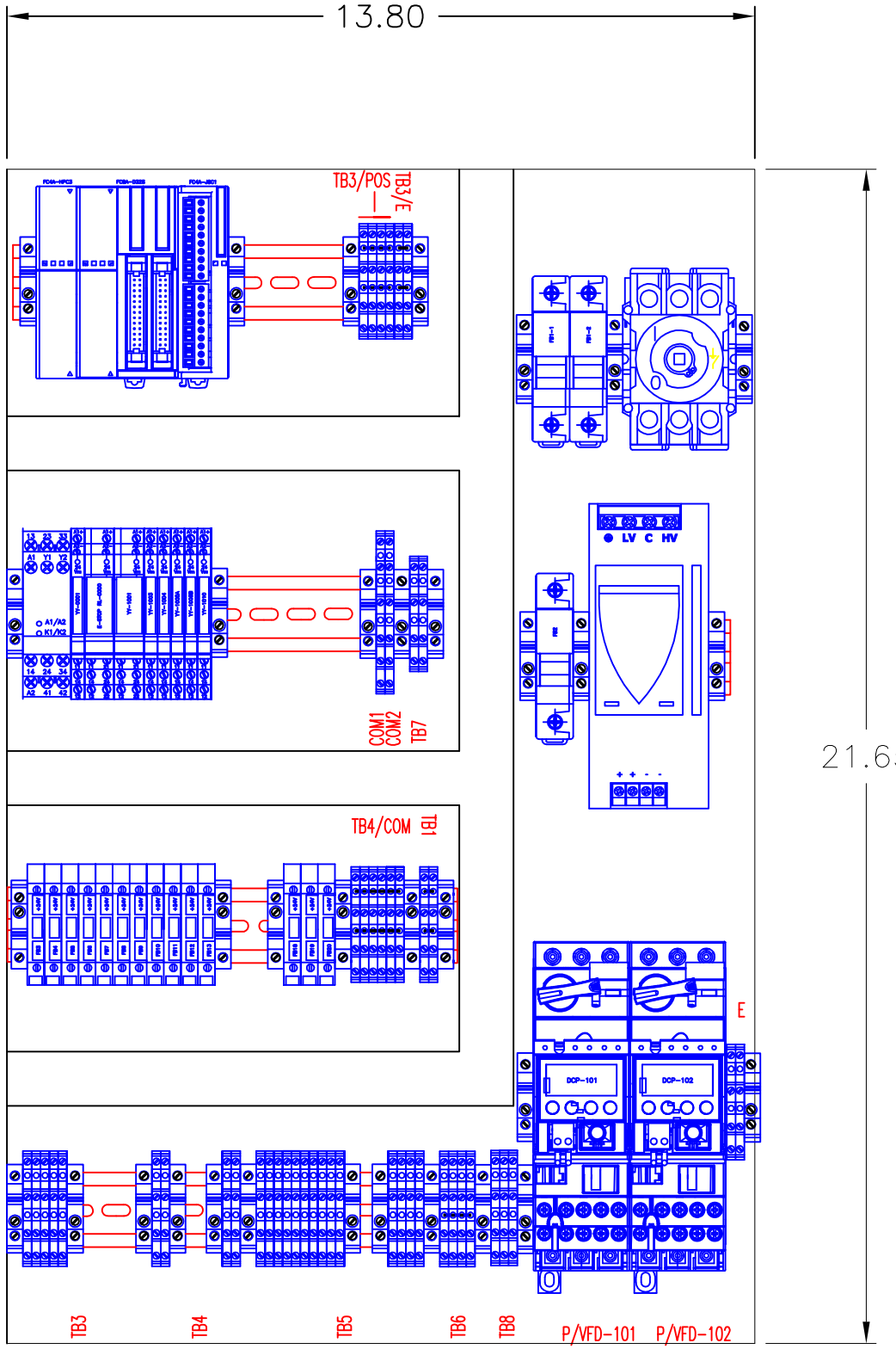
TAG NO
AMP AMP AMP
3 PHASE FUSE BLOCK

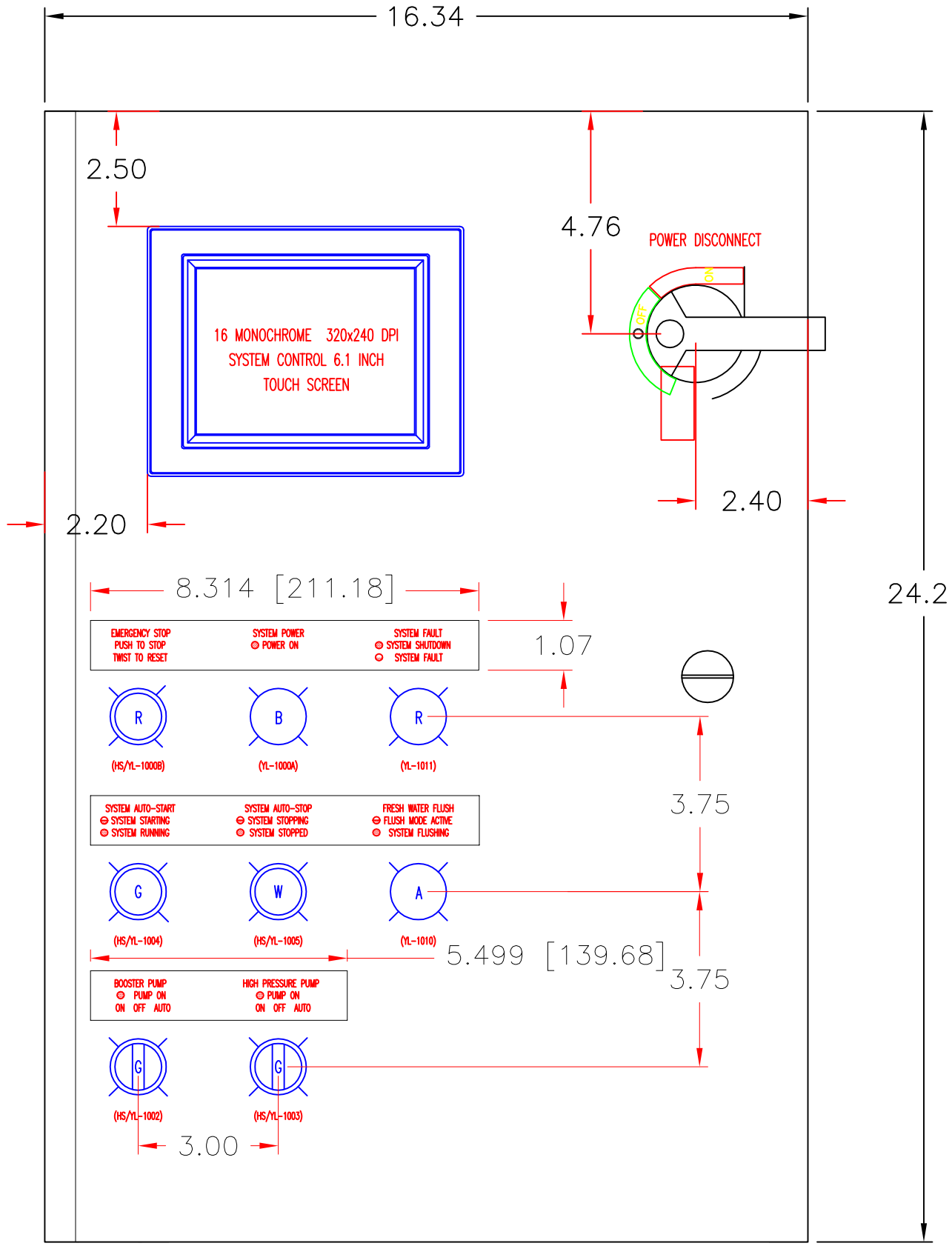
TB NO
WIRE IN * WIRE OUT
*TERMINAL NO.
TERMINAL BLOCK

Coral Sea Owner's Manual

SEA RECOVERY
2630 EAST EL PRESIDIO ST.
CARSON
CALIFORNIA, 90810
U.S.A.
www.parker.com

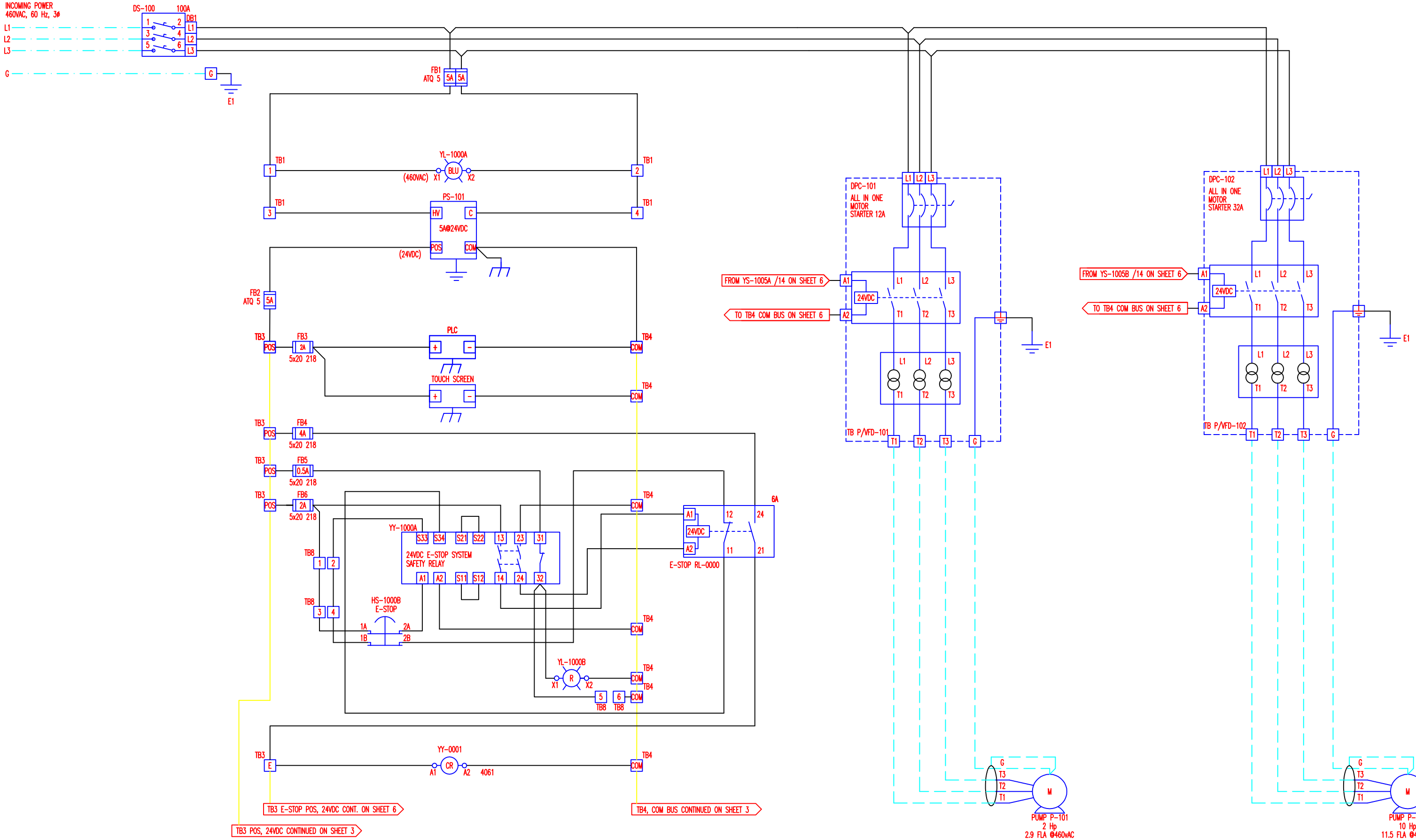
DATE	DRAWN BY	PROJECT ID	PROJECT	DRAWING TITLE	DRAWING NUMBER	SHEET
12/28/2011 02:45 PM	JPD	B59564C001	Coral Control System	Coral Sea (60Hz) Control Schematic Basic Installation	Coral Sea Elec	– OF –
DESCRIPTION: Coral Sea Drawing Set Basic	CHK APPR		CUSTOMER			





Coral Sea Owner's Manual

SEA RECOVERY 2630 EAST EL PRESIDIO ST. CARSON CALIFORNIA, 90810 U.S.A. www.parker.com	DATE 12/28/2011 02:45 PM	DRAWN BY JPD	PROJECT ID B59564C001	PROJECT Coral Control System	DRAWING TITLE Coral Sea (60Hz) Control Schematic Basic Installation	DRAWING NUMBER Coral Sea Elec
	DESCRIPTION Coral Sea Drawing Set Basic	CHK APPR		CUSTOMER		SHEET 1 OF 9



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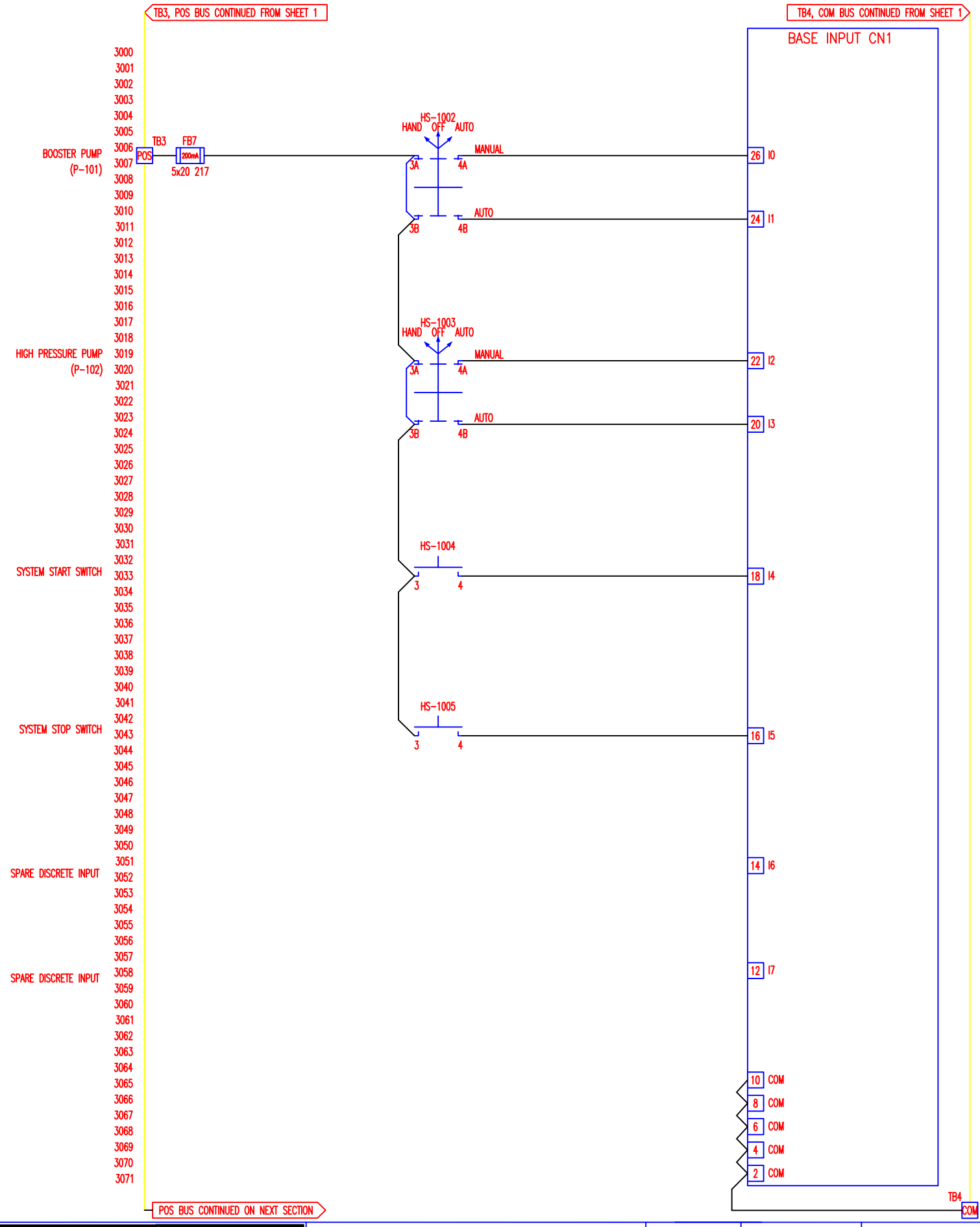
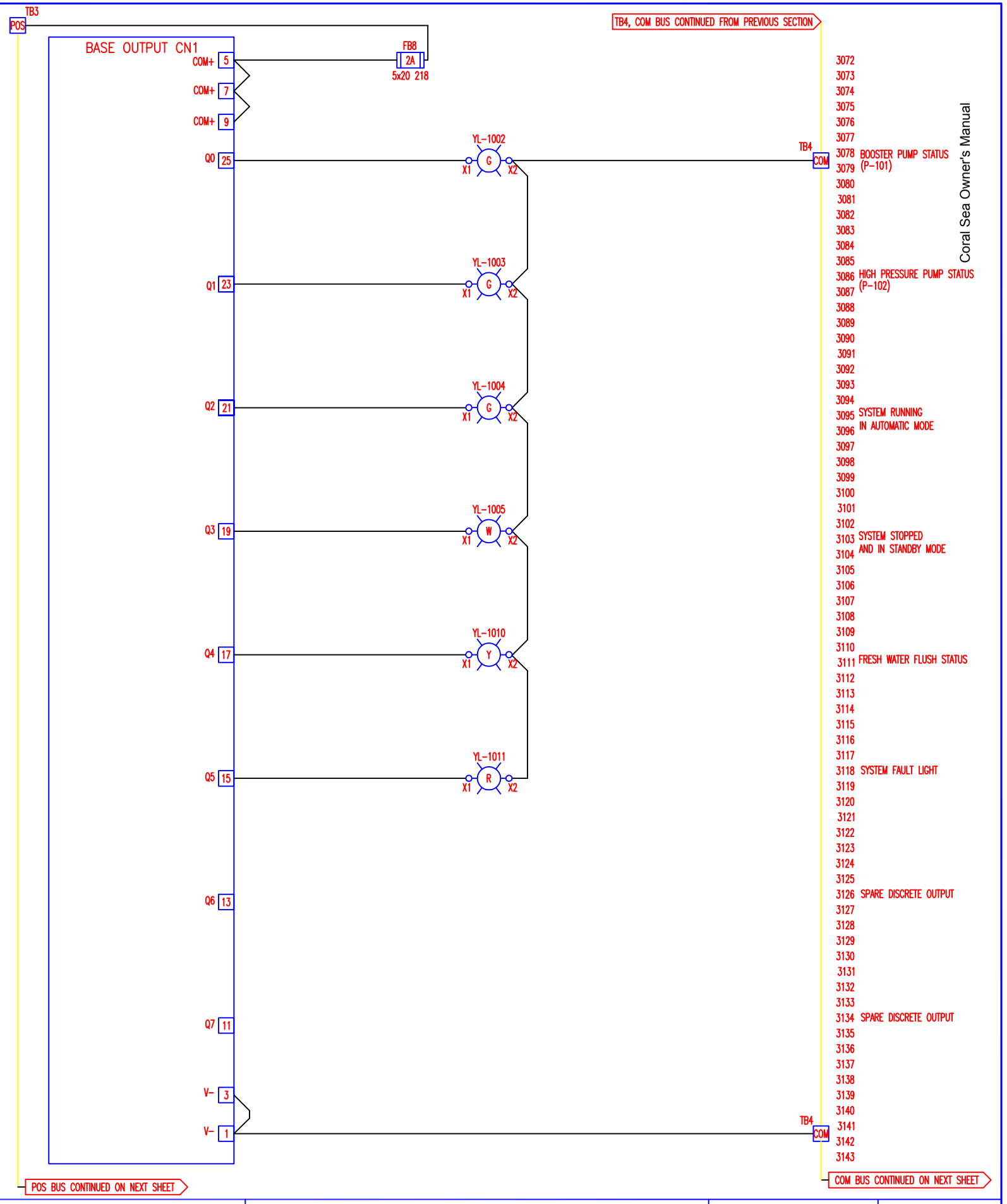
	DESCRIPTION Coral Sea Drawing Set Basic	CHK APPR		CUSTOMER		SHEET 2 OF 9

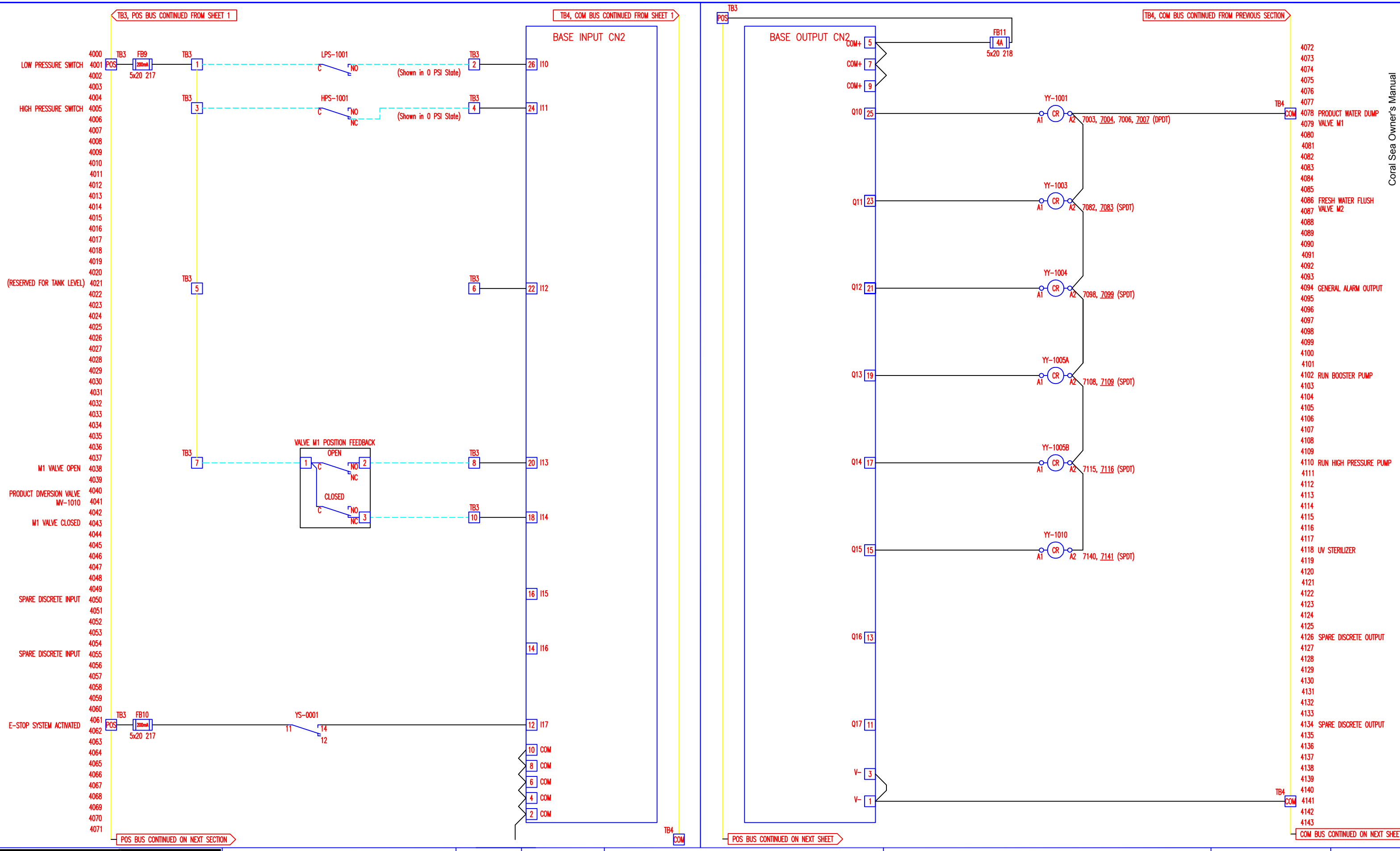




Coral Sea Owner's Manual

SEA RECOVERY
19610 SOUTH RANCHO WAY
RANCHO DOMINGUEZ
CALIFORNIA, 90220
U.S.A.
www.SeaRecovery.com

DATE 12/28/2011 02:45 PM	DRAWN BY JPD	PROJECT ID B59564C001	PROJECT Coral Control System	DRAWING TITLE Coral Sea (60Hz) Control Schematic Basic Installation	DRAWING NUMBER Coral Sea Elec	SHEET 3 OF 9
DESCRIPTION Coral Sea Drawing Set Basic	CHK APPR	CUSTOMER				



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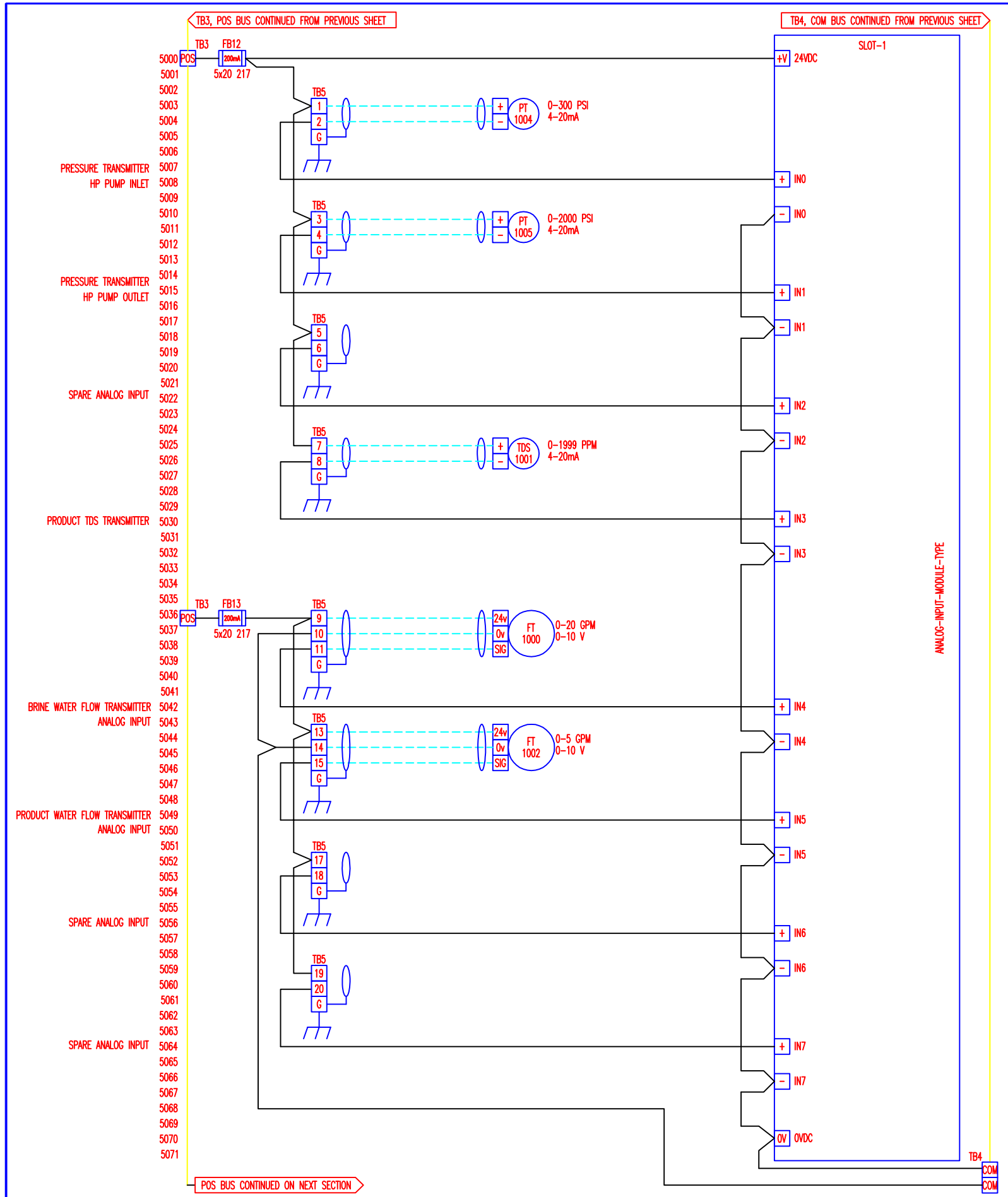
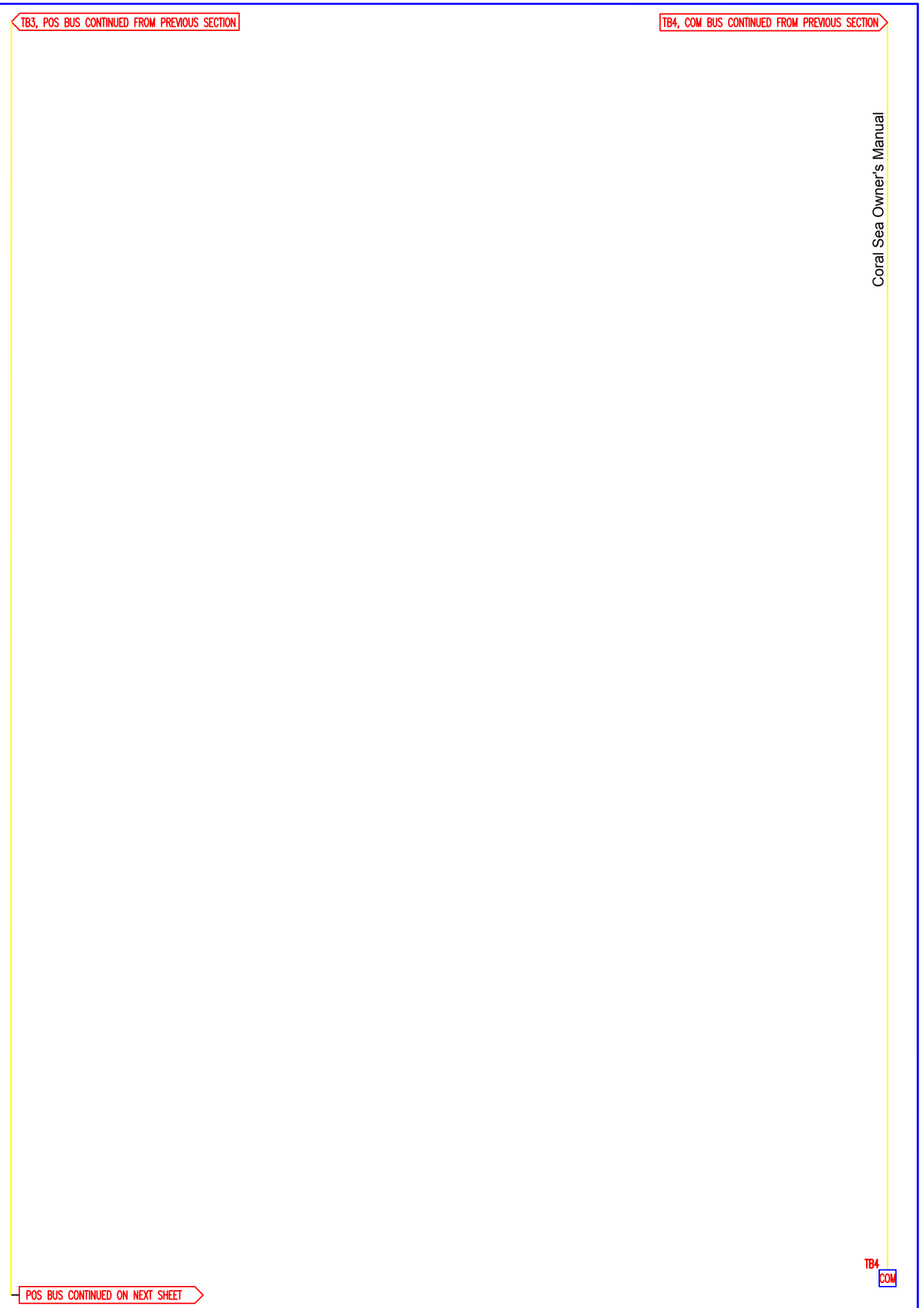
	DESCRIPTION Coral Sea Drawing Set Basic	CHK APPR		CUSTOMER			





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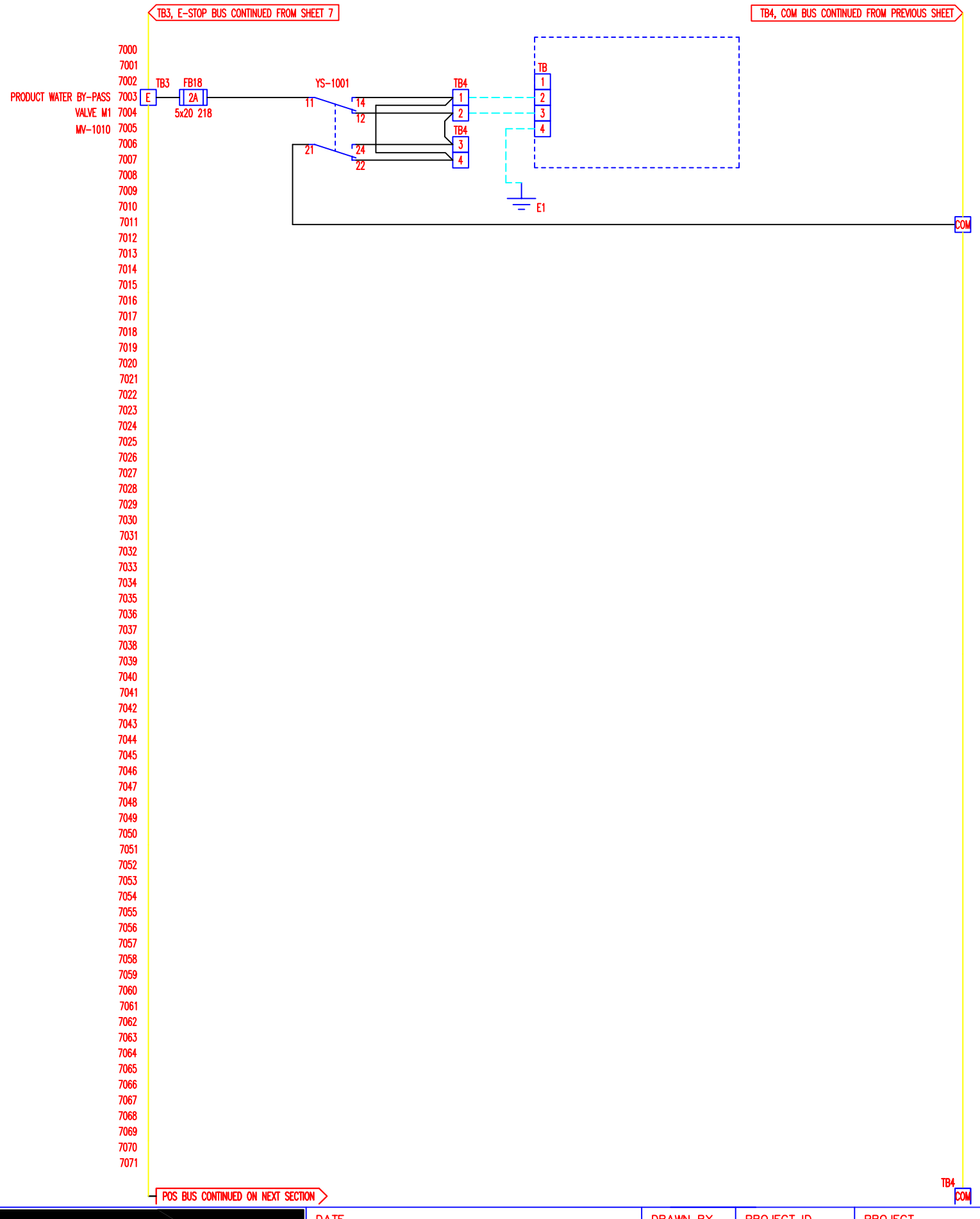
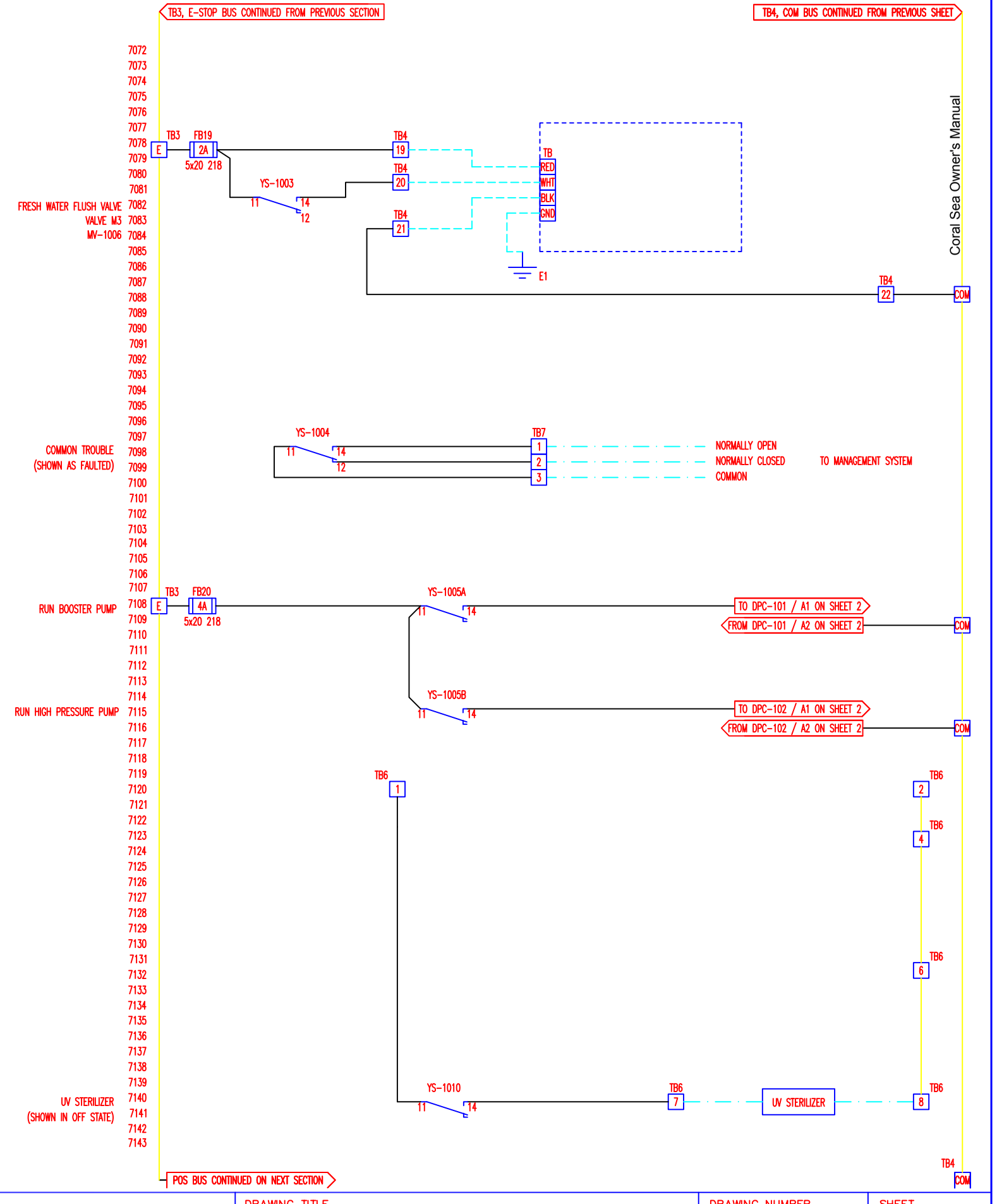
DESCRIPTION Coral Sea Drawing Set Basic	CHK		CUSTOMER		SHEET 5 OF 9
	APPR				





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12/28/2011 02:45 PM	JPD	B59564C001	Coral Control System	Coral Sea (60Hz) Control Schematic Basic Installation	Coral Sea Elec	6 OF 9
DESCRIPTION: Coral Sea Drawing Set Basic	CHK / APPR		CUSTOMER			

TB1

2	⊖	o	1	⊖	o	⊖	1		⊖	2
4	⊖	o	3	⊖	o	⊖	3		⊖	4

TB3

POS	⊖	o	POS	⊖	o	⊖	POS		⊖	POS
POS	⊖	o	POS	⊖	o	⊖	POS		⊖	POS
POS	⊖	o	POS	⊖	o	⊖	POS		⊖	POS
POS	⊖	o	POS	⊖	o	⊖	POS		⊖	POS
E	⊖	o	E	⊖	o	⊖	E		⊖	E
E	⊖	o	E	⊖	o	⊖	E		⊖	E

TB3

24VDC INPUT

2	⊖	o	1	⊖	o	⊖	1		⊖	2	(LPS-1001-C/TB3-1)
4	⊖	o	3	⊖	o	⊖	3		⊖	4	(LPS-1001-NO/TB3-2)
6	⊖	o	5	⊖	o	⊖	5		⊖	6	(HPS-1001-C/TB3-3)
8	⊖	o	7	⊖	o	⊖	7		⊖	8	(HPS-1001-NO/TB3-4)
10	⊖	o	9	⊖	o	⊖	9		⊖	10	(RESERVED FOR TANK LEVEL)
											(RESERVED FOR TANK LEVEL)
											(M1-1/TB3-7)
											(M1-2/TB3-8)
											(SPARE)
											(M1-3/TB3-10)

TB4

2	⊖	o	1	⊖	o	⊖	1		⊖	2
4	⊖	o	3	⊖	o	⊖	3		⊖	4

(M1-2/TB4-1)
(M1-3/TB4-2)
(NOT CONNECTED)
(NOT CONNECTED)

RESERVED

20	⊖	o	19	⊖	o	⊖	19		⊖	20	(M2-RED/TB4-17)
22	⊖	o	21	⊖	o	⊖	21		⊖	22	(M2-WHT/TB4-18)
											(M2-BLK/TB4-19)
											(NOT CONNECTED)

TB4

COM	⊖	o	COM	⊖	o	⊖	COM		⊖	COM
COM	⊖	o	COM	⊖	o	⊖	COM		⊖	COM
COM	⊖	o	COM	⊖	o	⊖	COM		⊖	COM
COM	⊖	o	COM	⊖	o	⊖	COM		⊖	COM
COM	⊖	o	COM	⊖	o	⊖	COM		⊖	COM
COM	⊖	o	COM	⊖	o	⊖	COM		⊖	COM

TB5

2	⊖	o	1	⊖	o	⊖	1		⊖	2	(PT-1001(+)/TB5-1)
4	⊖	o	3	⊖	o	⊖	3		⊖	4	(PT-1001(-)/TB5-2)
6	⊖	o	5	⊖	o	⊖	5		⊖	6	(PT-1002(+)/TB5-3)
8	⊖	o	7	⊖	o	⊖	7		⊖	8	(PT-1002(-)/TB5-4)
10	⊖	o	9	⊖	o	⊖	9		⊖	10	(SPARE)
12	⊖	o	11	⊖	o	⊖	11		⊖	12	(SPARE)
14	⊖	o	13	⊖	o	⊖	13		⊖	14	(TDS-1001(+)/TB5-7)
16	⊖	o	15	⊖	o	⊖	15		⊖	16	(TDS-1001(-)/TB5-8)
18	⊖	o	17	⊖	o	⊖	17		⊖	18	(FT-1000(+)/TB5-9)
20	⊖	o	19	⊖	o	⊖	19		⊖	20	(FT-1000(-)/TB5-10)
											(FT-1000(Sig)/TB5-11)
											(SPARE)
											(FT-1002(+)/TB5-13)
											(FT-1002(-)/TB5-14)
											(FT-1002(Sig)/TB5-15)
											(SPARE)
											(SPARE)
											(SPARE)
											(SPARE)
											(SPARE)
GND	⊖	o	GND	⊖	o	⊖	GND		⊖	GND	SHIELDS
GND	⊖	o	GND	⊖	o	⊖	GND		⊖	GND	SHIELDS
GND	⊖	o	GND	⊖	o	⊖	GND		⊖	GND	SHIELDS
GND	⊖	o	GND	⊖	o	⊖	GND		⊖	GND	

KEY

— · — · —	CUSTOMER INSTALLED WIRING
— — — —	SEA RECOVERY INSTALLED WIRING

SEA RECOVERY
2630 EAST EL PRESIDIO ST.
CARSON
CALIFORNIA, 90810
U.S.A.
www.parker.com

DATE	DRAWN BY	PROJECT ID	PROJECT	DRAWING TITLE	DRAWING NUMBER	SHEET
12/28/2011 02:45 PM	JPD	B59564C001	Coral Control System	Coral Sea (60Hz) Control Schematic Basic Installation	Coral Sea Elec	7 OF 9
DESCRIPTION: Coral Sea Drawing Set Basic	CHK APPR		CUSTOMER			

TB6

2	⊖	⊖	1	⊖	○	⊖	1		⊖	2
4	⊖	⊖	3	⊖	○	⊖	3		⊖	4
6	⊖	⊖	5	⊖	○	⊖	5		⊖	6
8	⊖	⊖	7	⊖	○	⊖	7		⊖	8

(L) INCOMING 120VAC@60HZ FUSED AT 5A
(N) INCOMING 120VAC@60HZ FUSED AT 5A
(SPARE)
(SPARE)
(SPARE)
(SPARE)
(L) 120VAC@60HZ SWITCHED/UV STERILIZER(L)
(N) 120VAC@60HZ UV STERILIZER(N)

TB7

2	⊖	○	1	⊖	○	⊖	1		⊖	2
4	⊖	○	3	⊖	○	⊖	3		⊖	4

(DRY CONTACT N.O./TB7-1) COMMON TROUBLE ALARM
(DRY CONTACT N.C./TB7-2) COMMON TROUBLE ALARM
(DRY CONTACT COM/TB7-3) COMMON TROUBLE ALARM

BLDG MGMT OR REMOTE ALARM PNL

OUR RELAY NORMALLY ENERGIZED
DE-ENERGIZED IS AN ALARM STATE

TB8

2	⊖	⊖	1	⊖	⊖	⊖	1		⊖	2
4	⊖	○	3	⊖	⊖	⊖	3		⊖	4
6	⊖	○	5	⊖	○	⊖	5		⊖	6

(REMOTE E-STOP CIRCUIT HS-1000B-1A/TB8-1)
(REMOTE E-STOP CIRCUIT HS-1000B-1B/TB8-2)
(REMOTE E-STOP CIRCUIT HS-1000B-2A/TB8-3)
(REMOTE E-STOP CIRCUIT HS-1000B-2B/TB8-4)
(REMOTE E-STOP CIRCUIT YL-1000B-X1/TB8-5)
(REMOTE E-STOP CIRCUIT YL-1000B-X2/TB8-6)

USAGE REQUIRES REMOVAL OF OVERRIDE JUMPERS

SEE E-STOP WIRING DIAGRAM SHEET 12 FOR MORE INFO

POWER IN

L1	⊖	○	⊖	L1
L2	⊖	○	⊖	L2
L3	⊖	○	⊖	L3
G	⊖	○	⊖	G

(INCOMING POWER / L1)
(INCOMING POWER / L2)
(INCOMING POWER / L3)
(INCOMING GOUND)

P/VFD-101

L1	⊖	○	⊖	L1
L2	⊖	○	⊖	L2
L3	⊖	○	⊖	L3
G	⊖	○	⊖	G

(VFD-101 / L1)
(VFD-101 / L2)
(VFD-101 / L3)
(VFD-101 / GROUND)

P/VFD-102

L1	⊖	○	⊖	L1
L2	⊖	○	⊖	L2
L3	⊖	○	⊖	L3
G	⊖	○	⊖	G

(VFD-102 / L1)
(VFD-102 / L2)
(VFD-102 / L3)
(VFD-102 / GROUND)

COM 1

TX	⊖	○	⊖	TX
RX	⊖	○	⊖	RX
SG	⊖	○	⊖	SG

(NULL MODEM CABLE)

(RX PORT ON MODBUS DEVICE)
(TX PORT ON MODBUS DEVICE)
(SIGNAL GROUND ON MODBUS DEVICE)

(IF RS232C REQUESTED)

COM 1

TX	⊖	○	⊖	CH1
RX	⊖	○	⊖	CH2
SG	⊖	○	⊖	SG

(CH1 PORT ON MODBUS DEVICE)
(CH2 PORT ON MODBUS DEVICE)
(SIGNAL GROUND ON MODBUS DEVICE)

(IF RS485/422 REQUESTED)

COM 2

TX	⊖	○	⊖	CH1
RX	⊖	○	⊖	CH2
SG	⊖	○	⊖	SG

(CH1 PORT ON MODBUS DEVICE)
(CH2 PORT ON MODBUS DEVICE)
(SIGNAL GROUND ON MODBUS DEVICE)

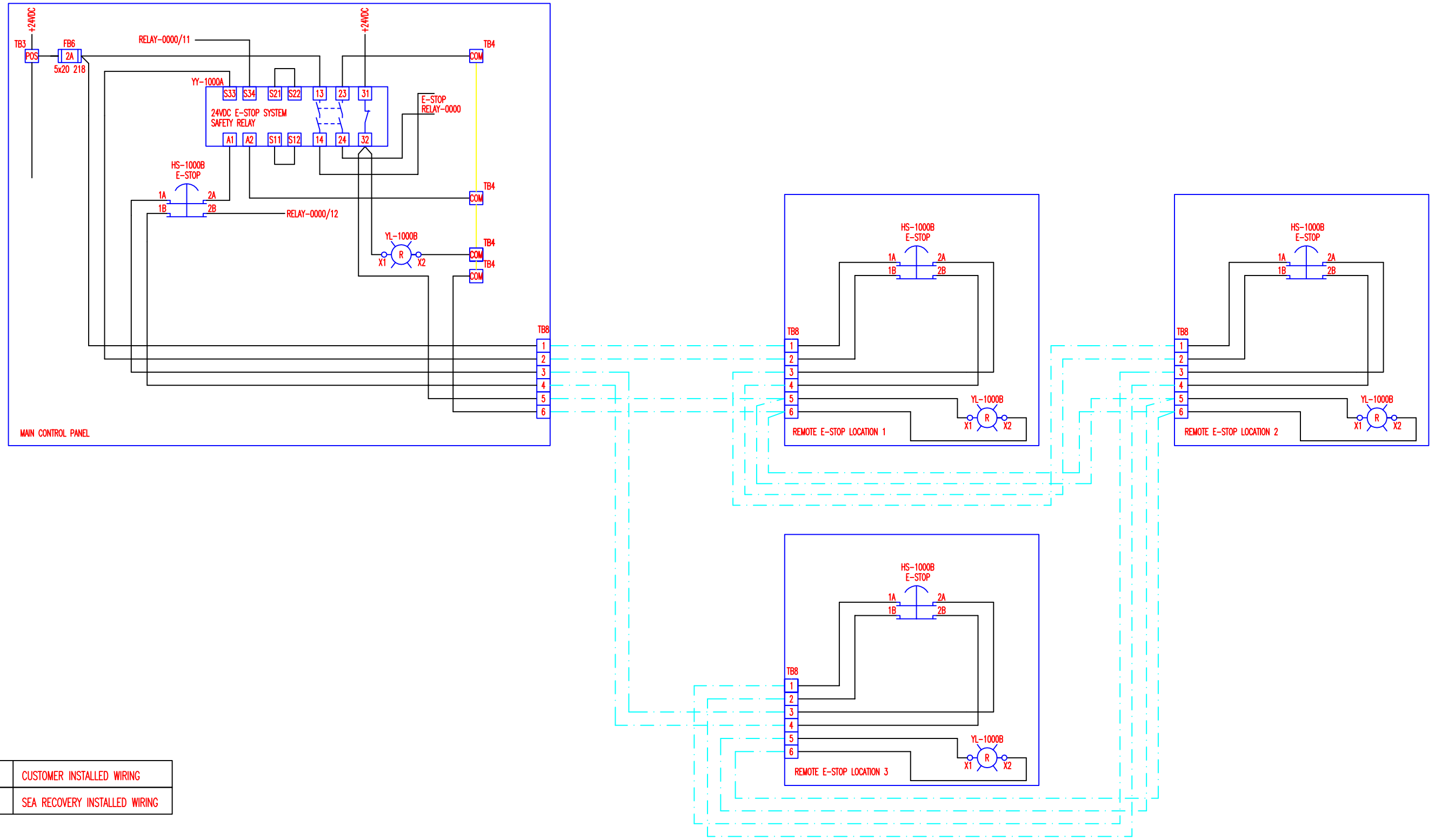
RS485 COMMUNICATIONS

KEY

— · — · —	CUSTOMER INSTALLED WIRING
— — — —	SEA RECOVERY INSTALLED WIRING

SEA RECOVERY
2630 EAST EL PRESIDIO ST.
CARSON
CALIFORNIA, 90810
U.S.A.
www.parker.com

DATE 12/28/2011 02:45 PM	DRAWN BY JPD	PROJECT ID B59564C001	PROJECT Coral Control System	DRAWING TITLE Coral Sea (60Hz) Control Schematic Basic Installation	DRAWING NUMBER Coral Sea Elec	SHEET 8 OF 9
DESCRIPTION Coral Sea Drawing Set Basic	CHK APPR		CUSTOMER			



KEY

— · — · —	CUSTOMER INSTALLED WIRING
— — — —	SEA RECOVERY INSTALLED WIRING

SEA RECOVERY 2630 EAST EL PRESIDIO ST. CARSON CALIFORNIA, 90810 U.S.A. www.parker.com	DATE 12/28/2011 02:45 PM	DRAWN BY JPD	PROJECT ID B59564C001	PROJECT Coral Control System	DRAWING TITLE Coral Sea (60Hz) Control Schematic Basic Installation	DRAWING NUMBER Coral Sea Elec	SHEET 9 OF 9
	DESCRIPTION Coral Sea Drawing Set Basic	CHK APPR		CUSTOMER			

SECTION 10

SPARE PARTS LIST

CORAL SEA

RECOMMENDED SPARE PARTS LIST

1 YEAR

Part Number	Description	QTY
0801063057	ELEMENT CPFE/AW 5 MIC >3/02	12
08020622KD	ELEMENT OWSE/AW >3/02	6
2625130172	SEAL/SEAT BOOSTER PUMP HP75	1
1732850546	DRIVE BELT 8MGT 1000021	1
0803004773	ELEMENT CHARCOAL 10"	6
B647800003	PUMP OIL 16 OZ.	1
B646800001	CLEANING KIT MCC 1 & 2	6
B645800003	STORAGE CHEMICAL	6
0803004906	ELEMENT CARBON BRIQUETTE 10"	1