

Tasman Sea T-2

Operator's Manual



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PREFACE

PREFACE

Thank you for your purchase of a Danfoss Sea Recovery Tasman Sea Reverse Osmosis Desalination System. This manual contains instructions for the installation, operation, maintenance, and repair of the Danfoss Sea Recovery Desalination System. This information is provided to ensure extended life and safe operation of your Danfoss Sea Recovery system.

Please read this manual thoroughly before installation or operation, and keep it for future reference. A better understanding of the system ensures optimum performance and longer service life.

Danfoss Sea Recovery's Reverse Osmosis Desalination Systems are designed and engineered to function as a complete working unit. Generally speaking, the performance of each component within the System is dependent on the component prior to it and governs the performance of all components after it. Proper performance of the system is thus dependent upon proper operation of every single component within the system.

The intent of this manual is to allow the operator to become familiar with each component within the Danfoss Sea Recovery system. By understanding the function, importance, and normal operation of each component within each subsystem of the unit, the operator can readily diagnose minor problems, which if detected early are usually easily corrected. However, if left unattended, a problem in one component eventually affects the rest of the system and leads to further repairs.

The major documented causes of failures and problems are from the use of third party, non Danfoss Sea Recovery, parts, from improper installation, and from improper operation:

The use of third party, non Danfoss Sea Recovery, consumables, spares, and assemblies have, can, and will damage the Danfoss Sea Recovery system and/or specific components within the system. Do not use parts, non Danfoss Sea Recovery, components, consumables, or assemblies will void any and all warranty of the system and/or the effected component within the system.

Danfoss Sea Recovery maintains inventory for immediate shipment and our Service Dealers throughout the world maintain stock of Sea Recovery parts. Always insist on Danfoss Sea Recovery supplied parts for your system in order to avoid failures, eliminate problems, and maintain your Danfoss Sea Recovery Warranty.

Follow the Installation Instructions within this Owner's Manual.

COPYRIGHT

© COPYRIGHT NOTIFICATION

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The name "Sea Recovery®" is a U.S. Registered Trademark and belongs to Danfoss Corporation with all rights reserved.

The Sea Recovery® logo mark is a U.S. Registered Trademark and belongs to Danfoss Corporation with all rights reserved.

The trade name Tasman Sea is a Trade Mark of and belongs to Danfoss Corporation with all rights reserved.

All content included within this Owner's Manual, such as text, graphics, logos, and images, is the property of Danfoss Corporation and protected by U.S. and international copyright laws. The compilation (meaning the preparation, collection, arrangement, and assembly) of all content within this Owner's Manual is the exclusive property of Danfoss Corporation and protected by U.S. and international copyright laws. All software used in the design and manufacture of the Danfoss Sea Recovery Reverse Osmosis Desalination System is the property of Danfoss Corporation and protected by U.S. and international copyright laws. All computer and logic programming used in the design and manufacture of the Danfoss Sea Recovery Reverse Osmosis Desalination System the property of Danfoss Corporation and protected by U.S. and international copyright laws.

The content of this Owner's Manual and the software, and programming used in the design and manufacture of the Danfoss Sea Recovery Reverse Osmosis Desalination System is for the purpose of operation, maintaining, and repair of the Danfoss Sea Recovery Reverse Osmosis Desalination System. Any other use, including the reproduction, modification, distribution, transmission, republication, display, or performance, of the content within this Owner's Manual is strictly prohibited.

Terms and Conditions

Your use of this Owner's Manual acknowledges acceptance of the terms and conditions provided herewith and your agreement to comply with all applicable laws and regulations pertaining to the use of this Owner's Manual.

In addition, you agree not to use Sea Recovery's trademarked name or Sea Recovery's trademarked logo mark in any form or manner except with Danfoss Corporation's written permission. Danfoss Corporation holds all rights to its copyrights and trademarks, and to the material contained in this Owner's Manual. Any use of such requires the written permission from Danfoss Corporation.

APPROVALS

Danfoss Sea Recovery's Reverse Osmosis Desalination Systems are Type Accepted by the American Bureau of Shipping, ABS.



ABS

American Bureau of Shipping.

Safety, Service, Solutions

These three goals define the activities of ABS. They are the bedrock upon which the American Bureau of Shipping's commitment to set standards of excellence as one of the world's leading ship classification societies is founded.

From its inception in 1862, setting safety standards for the marine industry has been the core commitment of ABS. This is achieved through the establishment and application of technical standards, known as Rules, for the design, construction and operational maintenance of ships and other marine structures. Classification is a process that certifies adherence to these Rules. The core competencies of this worldwide network of ABS professionals lie in the fields of survey, engineering and auditing. Backing these field representatives is an unequivocal commitment to research and development.

The ABS Type Approval Program

The ABS Type Approval program has existed in some form since 1983. Today it is formalized in the Rules. Two basic processes and certificates establish the validity of a product and all other certificates that may be issued in the program. The format imitates the format of the European Marine Equipment Directive (MED).

- Satisfactory evaluation of a product to a set of Rules or standards is recorded in the issue of a "Product Design Assessment (PDA)" certificate. The process is the same as would be followed for an ABS Design Review Letter. It imitates the Module B category of the MED.
- Satisfactory evaluation of the manufacturing (Works) facility to confirm their ability to consistently manufacture the product in accordance with the PDA is recorded in the issue of a "Manufacturing Assessment (MA)" certificate. This was previously known in ABS as the MMEC program. This imitates the modules D and E of the MED.

The IACS Ad-Hoc Committee for the Certification of Materials and Components have consensus that Type Approval requires; 1) an evaluation of the product including prototype tests (if necessary), 2) a witness of the manufacture of the product (type test), and 3) an assessment of the manufacturer's ability to consistently manufacture the product in accordance with the approved specifications. There are a multitude of derivations of this process; following is an abbreviated outline of the basic certificates:

A Type Approved Product has satisfied the processes of:

1. An Engineer's evaluation of a design to determine conformance with specifications. The manufacturer should submit sufficient information to allow ABS to determine if the product meets specification. This results in a Product Design Assessment Certificate (PDA).
2. Witnessing manufacture and testing of a type of the product to determine compliance with the specification
3. A Surveyor's evaluation of the manufacturing arrangements to confirm that the product can be consistently produced in accordance with the specification. This results in the issue of a Manufacturing Assessment Certificate

Declaration Of Conformity



CONFORMITY DECLARATION

Manufacturer's Name: SFA RECOVERY CORP.

Manufacturer's Address: 19610 S. RANCHO WAY
RANCHO DOMINGUEZ, CA
90220 U.S.A.

Sea Recovery Corp. declares that the product:

Product Name: AQUA MATIC, AQUA WHISPER, AQUA
MINI, ULTRA WHISPER, AND HIGH SEA
SERIES OF REVERSE OSMOSIS
DESALINATION

Model Numbers: AQUA MATIC COMPACT, VERTICAL,
AND MODULAR, AQUA WHISPER
COMPACT, AND MODULAR, AQUA
MINI COMPACT, AND ULTRA WHISPER
COMPACT AND MODULAR, NORTH
SEA AND TASMAN SEA HORIZONTAL
AND CORAL SFA HORIZONTAL,
VERTICAL, AND MODULAR

Conforms to the following Standard(s): EN 55011A and EN 50082-1

SUPPLEMENTARY INFORMATION:

"The product complies with the requirements of the ECAC Directive 89/336/EEC."



Official Seal

CHRIS ROLLINS
VP Director of Quality Assurance, SRC
Manufacturer's Contact



Sea
Recovery
REVERSE OSMOSIS DESALINATION



ABS

CERTIFICATE NUMBER

95-HS122991C-PDA

ABS TECHNICAL OFFICE

Houston SED - Ship Systems

DATE

17 October 2006

CERTIFICATE OF Design Assessment

This is to Certify that a representative of this Bureau did, at the request of
Sea Recovery Corporation

assess design plans and data for the below listed product. This assessment is a representation by the Bureau as to the degree of compliance the design exhibits with applicable sections of the Rules. This assessment does not waive unit certification or classification procedures required by ABS Rules for products to be installed in ABS classed vessels or facilities. This certificate, by itself, does not reflect that the product is Type Approved. The scope and limitations of this assessment are detailed on the pages attached to this certificate. It will remain valid for five years from the date of issue or until the Rules or specifications used in the assessment are revised (whichever occurs first).

PRODUCT: Revenue Damages Reelmaster
MODEL: Tasman Sea Knots
ABS RULE: 2005 Steel Vessel Rules 1-1-4/7.7, 4-6-2/5.7
OTHER STANDARD: None;

AMERICAN BUREAU OF SHIPPING

Hans P. Lindler

Engineering Type Approval Coordinator

40294000X

NOTE: This certificate attests compliance with the rules of the ABS, by design and construction of the vessel, but does not guarantee or warrant the results of the design and construction. The certificate is issued to the shipowner, by design or construction. Any changes to the design or construction of the vessel, without the approval of the ABS, will void the certificate. The certificate is issued by the ABS and is not a guarantee of the vessel's safety.

78-02-00000
1-1-1000

LIMITED WARRANTY

Danfoss Sea Recovery Tasman Sea **LIMITED WARRANTY**

Danfoss Sea Recovery warrants that the Sea Recovery Desalination System performs according to specifications for a period of twelve (12) months from the date of shipment. Danfoss Sea Recovery's liability under this warranty is limited to repair or replacement of the Tasman Sea Desalination System at Danfoss Sea Recovery's discretion. Under no circumstances is Danfoss Sea Recovery liable for consequential 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.

Warranty Period starts from the date of original shipment by Danfoss Sea Recovery, or with proof of purchase from the date of sale to the original retail purchaser:

- | | |
|---|------------------|
| 1. System and accessories: | 1 (one) year |
| 2. Repairs made by Danfoss Sea Recovery after the original warranty period has expired: | 3 (three) months |

Normal reoccurring user maintenance listed below is not covered by this or any Danfoss Sea Recovery limited warranty:

- | | | |
|------------------------------|-------------------------------------|---------------------------|
| 1. Sea Strainer Element | 3. Fuses | 5. Instrument Calibration |
| 2. Cartridge Filter Elements | 4. Centrifugal Pump Seal Assemblies | |

This or any Danfoss Sea Recovery limited warranty does not cover installation components not supplied by Danfoss Sea Recovery.

Improper installation resulting in the Sea Recovery System or component failure or decline in performance is not covered by this or any Danfoss Sea Recovery limited warranty.

The Danfoss Sea Recovery Reverse Osmosis Membrane Element is guaranteed to be cleanable for a minimum of one year from date of shipment, providing cleaning periods are adhered to, and fouling is acid soluble metal hydroxides and calcium carbonates or alkaline soluble organic, inorganic substances and microbiological slimes. The Danfoss Sea Recovery R.O. Membrane Element is not guaranteed against iron fouling (rust), chemical or petroleum products attack, extreme temperatures (over 120° F/under 32° F), drying out, or extreme pressures (over 1000 psig).

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

To obtain warranty service, the defective product or part must be returned to an authorized Danfoss Sea Recovery Service Center or direct to Danfoss Sea Recovery. An updated listing of Danfoss Sea Recovery Factory Service Centers can be found on the Sea Recovery web site at <http://www.searecovery.com>. The purchaser must pay any transportation or labor expenses incurred in removing and returning the product to the service center or to Sea Recovery.

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 Danfoss Sea Recovery, nor does the warranty extend to components on which the serial number has been removed, defaced, or changed.

Danfoss Sea Recovery reserves the right to make changes or improvements in its product, during subsequent production, without incurring the obligation to incorporate 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. Danfoss Sea Recovery shall not be liable for damages, consequential or otherwise, resulting from the installation, use, and/or operation of this product or from the breach of this LIMITED WARRANTY.

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

Danfoss Sea Recovery Corporation
P.O. Box 5288
Carson, California 90745-5288 U.S.A.

Tel: 1-310-637-3400 • Fax: 1-310-637-3430
e-mail: srcsales@searecovery.com • Web: <http://www.searecovery.com>

SYSTEM IDENTIFICATION INFORMATION

Danfoss Sea Recovery®
Tasman Sea™
System Identification Information

INSTRUCTIONS: It is important that this form is completely filled in by the owner at the time of purchase of the Danfoss Sea Recovery Reverse Osmosis Desalinator. Retain this information in this Owner's Manual. This information will be requested by our Service Department and Parts Order Desk whenever contacting Danfoss Sea Recovery for technical assistance or by the Sales Department whenever ordering parts.

System Information: Tasman Sea Series

Model Number: T-2

Serial Number: _____

Operating Voltage:

Three Phase: ____ 208VAC; ____ 220 VAC; ____ 230VAC; ____ 380 VAC; ____ 415 VAC; or ____ 460 VAC
Cycles: ____ 50 Hz or ____ 60 Hz

Date Purchased: _____

Date Commissioned: _____ (First tested or operated)

Dealer Information (who was this system purchased from):

Dealer's Name: _____

Address: _____

City: _____ State: _____

Country: _____ Postal Code: _____

Telephone Number: _____

Dealer's Invoice Number: _____

Danfoss Sea Recovery Corporation
P.O. Box 5288
Carson, California 90745-5288 U.S.A.
Tel: 1-310-637-3400 • Fax: 1-310-637-3430
e-mail: srcsales@searecovery.com
Web: <http://www.searecovery.com>

Danfoss Sea Recovery®
Tasman Sea™
System Warranty Registration

INSTRUCTIONS: At the time of purchase of the Danfoss Sea Recovery Reverse Osmosis water maker, please complete the warranty information listed below. After completing this form, please make a copy, and mail it to the address provided at the bottom of this form.

System Information: Tasman Sea T-2

Serial Number: _____

Operating Voltage:

Three Phase: ____ 208VAC; ____ 220 VAC; ____ 230VAC; ____ 380 VAC; ____ 415 VAC; or ____ 460 VAC

Cycles: ____ 50 Hz or ____ 60 Hz

Date Purchased: _____

Date Commissioned: _____ (First tested or operated)

Dealer Information:

Dealer's Name: _____

Address: _____

City: _____ State: _____

Country: _____ Postal Code: _____

Dealer's Invoice Number: _____

Customer Information:

Customer's Name: _____

Address: _____

City: _____ State: _____

Country: _____ Postal Code: _____

Telephone Number: _____ E-Mail Address: _____

If Vessel Installation:

Boat's Manufacture: _____

Boat's Model: _____, Length: _____ Feet or _____ Meters.

Boat's Name: _____

If Land Installation:

Name of Commercial operation: _____

Location and address of Installation: _____

Mail a copy to:

Danfoss Sea Recovery Corporation

P.O. Box 5288

Carson, California 90745-5288 U.S.A.

Attention: Warranty Registration

Tel: 1-310-637-3400 • Fax: 1-310-637-3430

e-mail: srcsales@searecovery.com • Web: <http://www.searecovery.com>

Customer's comments: _____

Mail a copy to:
Danfoss Sea Recovery Corporation
P.O. Box 5288
Carson, California 90745-5288 U.S.A.
Attention: Warranty Registration

NOTICE: From time to time, Danfoss Sea Recovery may make programming changes to the Control Logic.

Other physical production changes may also be made from time to time and are tracked by Danfoss Sea Recovery through the System Serial Number.

Troubleshooting and repair methods and results can vary depending on the Control Logic version and System Serial Number

When requesting assistance from Danfoss Sea Recovery or one of Danfoss Sea Recovery's service dealers,

ALWAYS PROVIDE ALL INFORMATION LISTED BELOW:

SERIAL NUMBER helps us to determine the latest Control Logic version, as well as the latest physical version and configuration of your system which is necessary to ensure that we provide you with the correct information or parts.

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

ELAPSED OPERATING HOURS assists us in diagnosing abnormalities that can occur at given operational time intervals such as required pump maintenance, or R.O. Membrane Element condition.

OPTIONS INSTALLED tells us if you have installed and are utilizing any optional accessories that may be affecting the performance of the system.

Notes:

[illegible]

GENERAL SPECIFICATIONS

Danfoss Sea Recovery's Reverse Osmosis Desalination Systems comply with FCC § 15.105

United States Federal Communications Commission Compliance

FCC § 15.105

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Danfoss Sea Recovery's Reverse Osmosis Desalination Systems have been independently tested and determined to be in compliance with European CE (Conformité Européenne)



The CE Mark ('Trade Passport to Europe') is a visible declaration by the manufacturer (or his representative, importer, etc.) that the equipment which is marked complies with all the requirements of all the applicable directives. This mark allows manufacturers and exporters to circulate products freely within the 15 European Union (EU) members. Having ensured that the equipment does indeed meet all these requirements (including all the administrative requirements involved in being able to demonstrate compliance), the CE Mark may then be affixed and the product released.

The letters, "CE", indicate that the manufacturer has undertaken all assessment procedures required for the product. The CE mark indicates conformity to the legal requirements of the EU Directives.

The "CE" mark is now mandatory for regulated products sold in the European Union.

SPECIFICATIONS

PERFORMANCE:

PRODUCT WATER PRODUCED PER HOUR AND PER DAY OF OPERATION:

(+/-15% at 800 psig / 56 BAR, 77°F / 25°C & 35,000 PPM TDS Feed Water Salinity)

Model Number	per 1 hour of operation:		per 24 hours of operation:	
	U.S. Gallons	/ Liters	U.S. Gallons	/ Liters
SRC Tasman Sea T-2	666	2521	16000	60566

SALT REJECTION (CHLORIDE ION): 99.7%

PRODUCT WATER TEMPERATURE: Ambient to feed water temperature

SPECIFICATIONS:

SALINITY MONITORING: Automatic electronic monitoring. The salinity monitoring components of the system give a continuous readout in micromhos per cubic centimeter, are temperature compensated and of a fail-safe design.

SALINITY RANGE OF FEED WATER:

Seawater up to 50,000 PPM TDS (NaCl) (typical seawater salinity is 35,000 PPM)

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

SYSTEM FEED WATER:

Feed Water Flow Per Minute: 35 U.S. Gallons / 132 Liters

REVERSE OSMOSIS MEMBRANE:

TYPE: Specifically selected High Rejection / High Yield aromatic tri-polyamide, thin film composite, spiral wound, single pass reverse osmosis membrane element.

CHLORINE TOLERANCE: 0.1 PPM.

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

SYSTEM PRESSURE:

FEED WATER: Min 2 psi / 1.41 Kg/cm² / 137.9 kPa Max 10 psi / 4.22 Kg/cm² / 413.7 kPa

OPERATION: Seawater @ 35,000 PPM & 77° F / 25 C: Nominal 800 psi / / 56.25 Kg/cm² / 5516 kPa

EXTERNAL INSTALLATION WATER CONNECTIONS:

Pipe sizes to be supplied by the installer for connection of the Sea Recovery supplied components

Tasman Sea T-2

Feed Inlet:	38.1 mm (1 1/2) Inch Flange (American Standard)
Brine Discharge	38.1 mm (1 1/2) Inch Flange (American Standard)
Product	25.4 mm (1) Inch Flange (American Standard)

WEIGHT:

MODEL	Weight Lbs	Weight Kg
Tasman Sea T-2	2,200	1,000

Note: System gross shipping weight add approximately 400 Lbs/181 Kg

ELECTRICAL POWER REQUIREMENTS:

(H.P. = Horse Power; FLA = Full Load Amperes; LRA = Locked Rotor Amperes - Start Up)

HIGH PRESSURE PUMP ELECTRIC MOTOR THREE PHASE:

Hz	VAC	H.P.	FLA	LRA
25 horse power Catalog Number CM4103T				
60	230	25	58	373
60	460	25	29	208

BOOSTER PUMP & AUX WATER PUMP ELECTRIC MOTORS THREE PHASE:**2 HP PRODUCT PUMP**

Hz	VAC	FLA	LRA
60	230	5.4	35
60	460	2.7	17.5

3 HP BOOSTER PUMP

Hz	VAC	FLA	LRA
60	230	7.4	70
60	460	3.7	35

5 HP BOOSTER PUMP

Hz	VAC	FLA	LRA
60	230	12	90
60	460	6	47

RECOMMENDED THREE PHASE CIRCUIT BREAKER: The actual final system configuration may have a larger or different size Feed Water Pump and Booster Pump therefore size your Circuit Breaker accordingly. The below chart is an approximation assuming 3 horse power Feed Water & 3 horse power Booster Pumps.

**Operating Voltage Hz & Phase
Recommended Circuit Breaker Size**

Tasman Breaker Feed		
5 HP Booster	460	6
25 HP Danfoss	460	29
	Total	35
	NEC	1.75
	Feed Req	61.25

Tasman Breaker Feed		
5 HP Booster	230	12
25 HP Danfoss	230	58
	Total	70
	NEC	1.75
	Feed Req	122.5

POWER SOURCE REQUIREMENTS:

Tasman Sea Power Source Requirements					
Voltage	Freq	Min Freq	Max Freq	Min Volts	Max Volts
220	50	49	51	213	227
380	50	49	51	369	391
415	50	49	51	403	427
230	60	59	61	223	237
460	60	59	61	446	474

RECOMMENDED MAIN POWER WIRE SIZE TO Tasman Sea SYSTEM:

Tasman Feed Cable Size		
Voltage	Distance	Cable Req
230	10	8
230	25	6
230	50	4
460	10	12
460	25	12
460	50	10

NOTES: _____

[illegible]

GENERAL TERMS
AND
CONDITIONS OF SALE

GENERAL TERMS AND CONDITIONS OF SALE

These General Terms and Conditions of Sale ("Terms") apply to all deliveries of products and services ("Products") from Danfoss A/S or its Affiliates (each of which is referred to as "Danfoss") to any customer ("Customer"). In these Terms "Affiliate" shall mean an entity directly or indirectly controlled by Danfoss A/S whether by shares or voting rights. No terms and conditions other than the Terms shall be binding upon Danfoss and the Customer unless agreed in writing by both Danfoss and Customer. All terms and conditions contained in any prior communication which are different from or in addition to the Terms shall not be binding on Danfoss unless otherwise expressly agreed in writing by both Danfoss and Customer.

1. Confirmation of Order

Danfoss shall not be deemed to have accepted a purchase order until written, including electronic, confirmation of the order from Danfoss is received by Customer or Danfoss has received written, including electronic, timely and unconditional acceptance from Customer of Danfoss' quotation.

2. Terms of Delivery

The Products are delivered EXW from, at Danfoss' option, any of Danfoss' factories or places of business. Failing special instructions, Danfoss will dispatch the Products to Customer, at the risk and expense of Customer by a transport method chosen by Danfoss. EXW shall be interpreted in accordance with the version of Incoterms valid on the time of acceptance of the purchase order or quotation.

3. Delay

If Danfoss does not deliver at the agreed time, Customer is entitled to request delivery in writing and fix a final, reasonable, time limit for delivery. If delivery is not made within this time limit, the Customer is entitled to rescind the agreement of sale and claim compensation for its documented, direct loss. No further claims can be made by the Customer as a result of the delay.

4. Price Adjustments

Prices for Products are exclusive of VAT and/or other taxes or duties. Danfoss reserves the right to adjust accepted prices for non-delivered Products in the event of alterations in rates of exchange, variations in costs of materials, sub-suppliers' price increases, changes in wages, state requisitions or similar conditions over which Danfoss has no or limited control.

5. Packing

Disposable packing is included in the price and will not be credited if returned. Returnable packing is not included in the price, but will be credited if immediately returned in undamaged condition, at Customer's expense in accordance with Danfoss' instructions.

6. Terms of Payment

From due date, an interest rate of the lesser of 2 % per month or the highest rate allowable under applicable law will be payable.

7. Group Set-off

Danfoss and its Affiliates shall be entitled to set off own claims against the Customer, in the Customer's possible claims against any of said companies.

8. Product Information

Any information – irrespective of derivation from Danfoss or a Danfoss business contact – including but not limited to information on weight, dimensions, capacity or any other technical data in catalogues descriptions, advertisements, etc. shall be considered informative, and are only binding if and to the extent, explicit reference on this is made in order and/or order confirmation. Specific demands from the Customer are only binding if and to the extent they have been confirmed by Danfoss in writing.

9. Proprietary Information and Confidentiality

Any non-public information, including but not limited to, drawings, descriptions and any other technical documents which Danfoss has made or may make available to the Customer ("Technical Information") shall remain the property of Danfoss and shall be treated as confidential by Customer and its representatives and must not, without the written consent of Danfoss, be copied, reproduced, or transferred to third parties or be used for other purposes than those intended when the Confidential Information was made available. Confidential Information shall be returned upon Danfoss' request.

10. Alterations

Danfoss reserves the right to make alterations to Products which do not materially affect agreed specifications or the Products' form, fit or function, without notice.

11. Cost-free Repairs

Danfoss agrees to repair or replace, at the discretion of Danfoss, such Products that on Danfoss' examination are found to be defective at the time of delivery due to faulty manufacture, design and/or defective materials, provided the Customer makes a claim to Danfoss within 12 months from the date of delivery. If defects occur within the above mentioned period, the Product shall be forwarded to Danfoss according to prior agreement with Danfoss. A description of the reason for returning the Product shall be enclosed. Freight and insurance is paid by the Customer. Products returned shall be free of extraneous equipment. If Danfoss' examination shows that the Product is not faulty, the Product shall be returned to the Customer. Freight and insurance shall be paid by the Customer. If Danfoss ascertains that the Product is faulty, Danfoss shall send the repaired or a replacement Product to the Customer. Danfoss may choose the method of dispatch and pays freight and insurance. Products or product parts which have been replaced shall be the property of and retained by Danfoss.

ANY OTHER LIABILITIES ARE NOT ACCEPTED. WITHOUT LIMITING THE GENERALITY OF THE FOREGOING, UNLESS OTHERWISE EXPRESSLY SET FORTH HEREIN, THE PRODUCTS ARE SUPPLIED "AS IS", "WHERE IS" AND "WITH ALL FAULTS" AND DANFOSS MAKES NO WARRANTIES, EITHER EXPRESS OR IMPLIED AT LAW OR OTHERWISE (INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE).

12. Product Liability

Danfoss shall not be liable for any damage to real property or chattels caused by the Product after it has been delivered and whilst it is in the possession of the Customer. Nor shall Danfoss be liable for any damage to products manufactured by the Customer or to products of which the Customer's products form a part. If Danfoss incurs liability towards any third party for such damage as described in the preceding paragraph, the Customer shall indemnify, defend and hold Danfoss harmless. Customer shall indemnify and hold Danfoss harmless for all claims arising from damage resulting from the use or operation of the Products because of the improper repair, maintenance or operation of the Products by Customer, the failure of Customer to adequately train personnel in the operation of the Products, Customer's failure to comply with applicable laws or regulations or otherwise. If a claim for damage as described in this clause is lodged by a third party against either Danfoss or the Customer, the respondent party shall immediately inform the other party thereof in writing. The Customer shall be obliged to let itself be summoned to the court or arbitral tribunal examining claims for damages lodged against one of them on the basis of damage allegedly caused by the Product.

13. Secondary Damage

DANFOSS SHALL NOT BE HELD RESPONSIBLE FOR ANY SPECIAL, INDIRECT, CONSEQUENTIAL, PUNITIVE OR EXEMPLARY DAMAGE OR LOSS, WHICH MIGHT ARISE OUT OF ANY BREACH OF WARRANTY, FAULTY PRODUCTS, DELAY IN THE DELIVERY OF THE PRODUCTS, PRODUCT LIABILITY, RECALL OR OTHERWISE, IRRESPECTIVE OF THE CAUSE, INCLUDING BUT NOT LIMITED TO, LOSS OF PRODUCTION, LOSS OF PROFIT AND LOSS OF GOODWILL.

14. Mandatory liability

Nothing in these Terms (including but not limited to the exclusions and limitations in clause 11 to 13) shall operate so as to exclude or limit the liability of either party to the other for death or personal injury arising out of its negligence, fraudulent misrepresentation or for any other liability which cannot be excluded or limited by law.

15. Notice of Claims

Claims or complaints as to defects and/or delay in delivery of the Products or other claims shall be submitted in writing by Customer to Danfoss without undue delay.

16. Intellectual Property Rights

If the Product is delivered with embedded software, Customer obtains a non-exclusive, software license in form of a right of use to the software solely for the purposes set out in the applicable specification of the Product. Aside from this, Customer obtains no rights in form of license, patent, copyright, trademark or other proprietary right connected to the Products. Customer shall not obtain any rights to source codes to such software.

17. Restraint on Resale and Use for Certain Purposes

Danfoss products are produced for civilian use. Customer is not allowed to use or to resell the Products for purposes which have any connection to chemical, biological or nuclear weapons or for missiles which are capable of delivering such weapons. Customer is not allowed to sell the Products to persons, companies or any other kind of organization if Customer has knowledge of or suspects that said persons or entities are related to any kind of terrorist or narcotics activities. The Products may be subject to legal regulations and restrictions and may therefore be subject to restrictions in case of sale to countries/customers covered by export and import ban. These restrictions shall be observed in case of resale of the Products to such countries/customers. Customer is not allowed to resell the Products if there is doubt or suspicion that the Products can be used for the purposes mentioned in the preceding paragraph. If Customer receives knowledge of or suspects that the conditions in this clause have been violated, Customer shall immediately inform Danfoss.

18. Force Majeure

Danfoss is entitled to cancel orders or suspend delivery of Products and shall not be liable for any non-delivery, faulty or delayed delivery which partly or wholly is caused by circumstances beyond Danfoss' reasonable control, including, but not limited to, riots, civil unrest, war, terrorism, fire, insurrection, requisition, seizure, embargo or defects or delays in deliveries by sub-contractors, strikes, lockouts, slow downs, lack of transportation, scarcity of materials, sickness accidents in product testing, and insufficient supplies of energy. Any of Customer's contractual rights are suspended or become void in any such circumstances referred to in this clause. Customer is not entitled to any kind of damages or to make a claim whatsoever in case of cancellation or delayed delivery due to such circumstances.

19. Global Compact

Danfoss has joined the United Nations' Global Compact initiative which means that Danfoss has undertaken to live up to 10 principles on human rights, employees' rights, the environment and corruption. These principles are listed in "Danfoss Code of Conduct for Suppliers" to be seen on www.danfoss.com. Therefore Danfoss encourages the Customer to comply with these fundamental principles. For further information on Global Compact: <http://www.unglobalcompact.org>

20. Partial Invalidity

If one or more of the terms and conditions in these Terms or any part of a term is deemed invalid, unenforceable, illegal or inoperable, the validity, enforceability, legality or operability of all further terms and conditions shall not be affected or diminished thereby.

21. Disputes

Any dispute between the parties arising from or in connection with a purchase agreement governed by these Terms shall be settled pursuant to United States of America law including the United Nations' Convention for the International Sales of Goods (CISG), with the exception of the conflict of law provisions. Any dispute arising from or in connection with a purchase agreement governed by these Terms and which the parties themselves are unable to resolve shall be referred to and settled by arbitration under the Rules of Arbitration of the International Chamber of Commerce, Paris ("Rules") by one or more arbitrators appointed in accordance with said Rules. Each Party shall be entitled to seek appropriate injunction relief or any other temporary measures. The Parties may refer the enforcement of any arbitral award to any competent court. The seat of arbitration shall be Los Angeles California. English shall be the language to be used in the arbitration proceedings unless otherwise agreed between the parties. The arbitration proceedings and the arbitral award shall be confidential and involved persons on both sides are pledged to secrecy.

BASICS OF R.O (Reverse Osmosis)

INTRODUCTION:

Seawater is a combination of pure water, dissolved minerals, and suspended solids such as dirt, sand, and biological matter. The Coral Sea System uses three different stages to process the incoming seawater and produce Potable Drinking Water. The system constantly monitors the product water for quality and dumps water that is not suitable for drinking.

Pre-filtration:

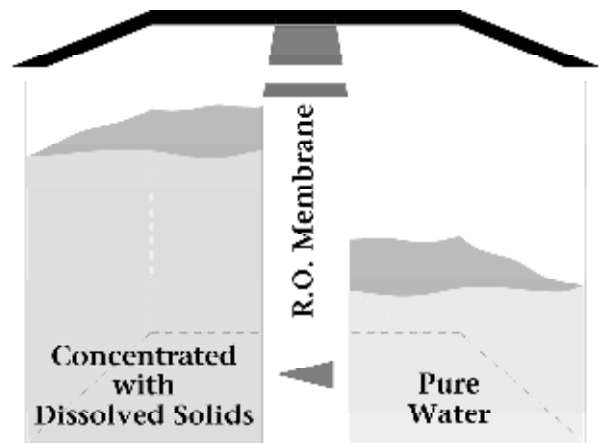
The First stage uses a centrifugal pump to collect the seawater and force it through barrier filters such as a Media Filter, Cartridge Filter, and Oil-Water separator. These barrier filters remove dirt, sand, biological matter, and any other solids suspended in the seawater down to 5 micron. This process protects the various components in the system, most notably the Reverse Osmosis Membrane.

Reverse Osmosis:

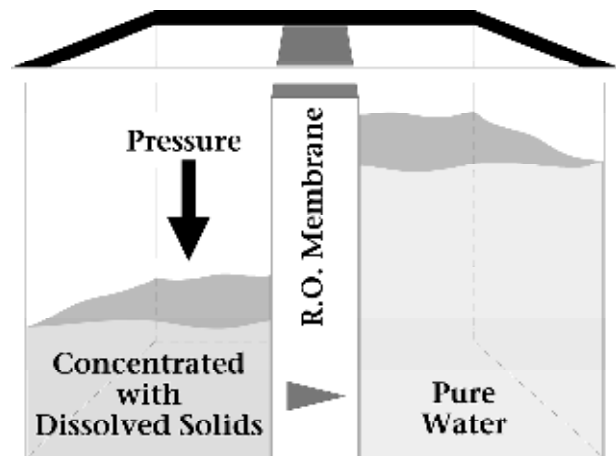
The Second Stage uses the principle of **Osmosis** to separate pure water from the salty seawater. Osmosis is a naturally occurring phenomenon. The above picture illustrates two solutions of differing dissolved solids concentrations separated by a **Semi-Permeable Membrane (R.O. Membrane)**. Due to osmosis, the two solutions try to equalize each other's concentrations of dissolved solids. Since dissolved solids are too large to pass through the R.O. Membrane, pure water diffuses through the membrane and flows from the solution with the lower concentration to the solution with the higher concentration.

Reverse Osmosis is a manmade process, which reverses the Osmosis process. By pressurizing the higher concentration solution (seawater) through a Semi-Permeable Membrane (R.O. Membrane) potable water is produced.

The Coral Sea uses a Stainless Steel Positive Displacement High Pressure Pump to increase the pressure of the water through the R.O. Membrane. A Backpressure Regulator controls the pressure that the High Pressure Pump achieves. A concentrated brine stream exits the R.O. Membrane and is measured by the Brine Flow meter before it is discharged.



Naturally Occurring Osmosis

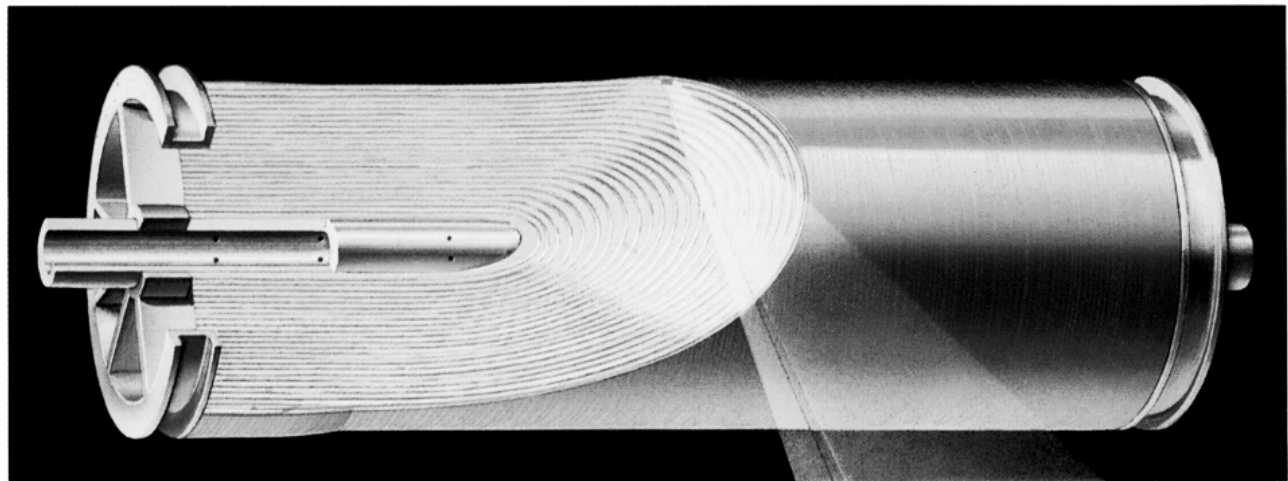


Manmade Reverse Osmosis

Post Filtration:

The Product Water flows out of the R.O. Membrane and passes into a Salinity/Temperature Probe, which adjusts automatically for temperature changes and displays the quality of the Product Water. Next, the Product Flow meter registers the amount of Product Water. The Product Water then proceeds to the 3-Way Diversion Valve. Here, potable water is diverted to the Charcoal Filter where gasses or odors present are absorbed and removed from the Product Water. Optional post filtration components may also include a pH Neutralizer and Ultraviolet Sterilizer.

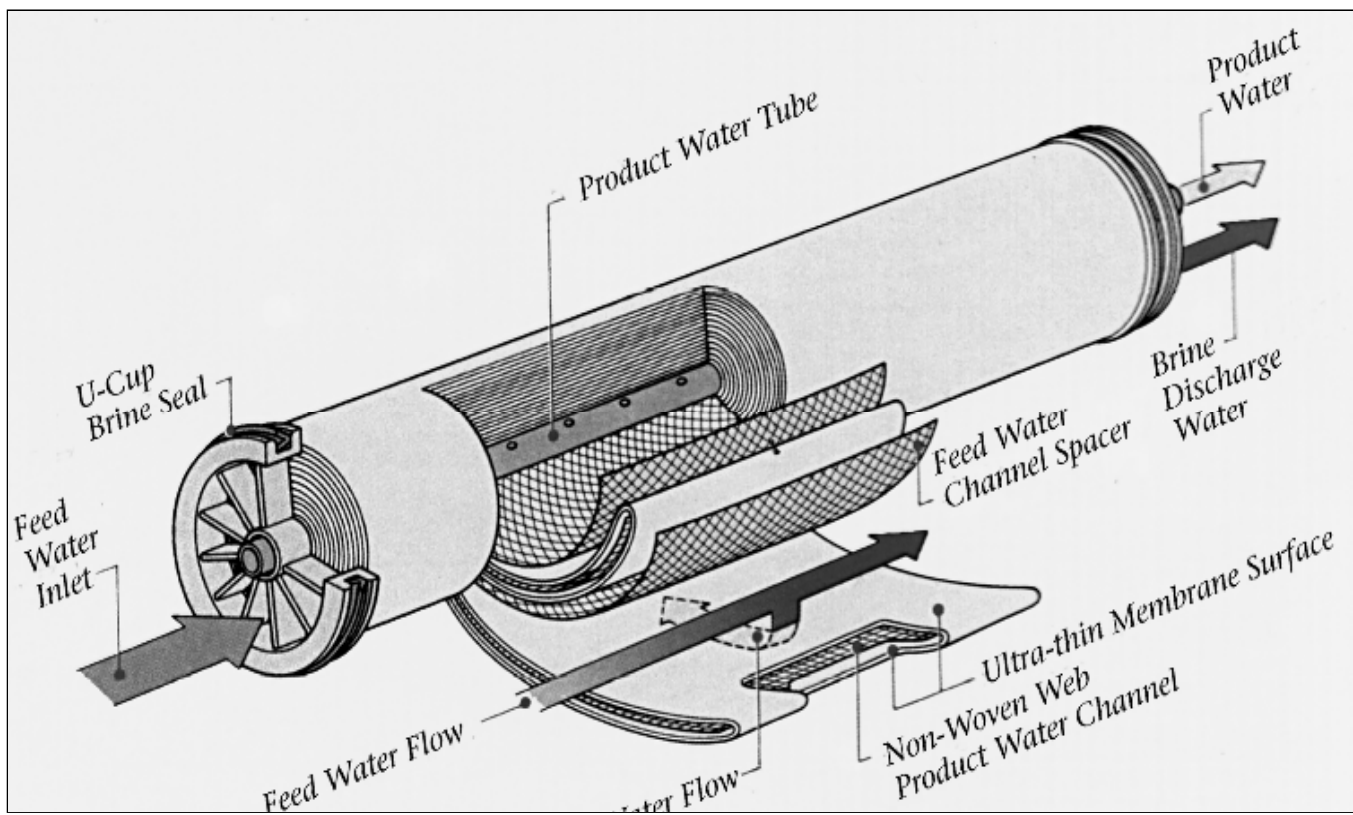
1. ANATOMY OF A REVERSE OSMOSIS MEMBRANE ELEMENT:



Ultra-thin membrane

Polysulfone layer

Non-woven web



2. PRINCIPLES OF REVERSE OSMOSIS:

A. OSMOSIS: Osmosis can be defined as the spontaneous passage of a liquid from a dilute to a more concentrated solution across an ideal semi permeable membrane which allows the passage of the solvent (water) but not the dissolved solids (solutes).

B. OSMOTIC PRESSURE: The transfer of the water from one side of the membrane to the other continues until the head (pressure) is large enough to prevent any net transfer of the solvent (water) to the more concentrated solution. At equilibrium, the quantity of water passing in either direction is equal, and the pressure is then defined as the Osmotic Pressure of the solution having that particular concentration of dissolved solids.

C. REVERSE OSMOSIS: As described above, water continues to flow from the pure water side of the membrane to the saline solution side until the pressure created by the high pressure pump on the saline solution side of the membrane equals the osmotic pressure. If the pressure of the saline solution is increased until it exceeds the osmotic pressure, water is forced to flow through the membrane from the solution containing the higher salt concentration into the solution with the lower salt concentration. The process is called Reverse Osmosis.

D. SPIRAL-WOUND MEMBRANE: The spiral-wound membrane consists of one or more membrane envelopes each formed by enclosing a channelized product water carrying material between two large flat membrane sheets. The membrane envelope is sealed on three edges with a special adhesive and attached with the adhesive to a small diameter pipe to form a cylinder 2, 4, 6, 8, or 12 inches in diameter and up to 40 inches in length. A polypropylene screen is used to form the feed water channel between the membrane envelopes. A wrap is applied to the membrane element to maintain the cylindrical configuration. The center tube is also the permeate (product water) collecting channel. Several elements may be connected in series within a single or multiple pressure vessel(s).

E. BOUNDARY LAYER CONCENTRATION

POLARIZATION: When water permeates through the membrane, nearly all the salt is left behind in the brine channel. In any dynamic hydraulic system the fluid adjacent to the wall of the vessel is moving relatively slowly. Even though the main body of the stream is turbulent, a thin film adjacent to the wall (membrane) is laminar. This thin film is called the boundary layer. When the dissolved salts, at the Boundary Layer become concentrated beyond permissible limits then these salts adhere to the membrane surface. This concentration of salts at the membrane surface is referred to as Concentration Polarization. Concentration Polarization is caused by excessive recovery (percentage of product water recovered from the feed water).

F. COMPACTION: Some densification of the membrane structure may take place while operating at elevated pressures, above 1000 psi. The change is known as compaction and is accompanied by a reduction in the water permeation rate.

G. WATER TEMPERATURE EFFECT The product water flow through the membrane is significantly affected by the water temperature. At any given pressure this flow increases with increasing water temperature and is reduced at lower temperatures.

H. PRESSURE: The operating pressure has a direct affect on product water quality and quantity. Both factors increase as the system pressure increases (within design limits). The system must be operated at the lowest pressure required to achieve the designed product water flow rate. This parameter also affects compaction, which proceeds at a faster rate at higher pressures as well as at higher temperatures.

I. BRINE VELOCITY: The brine flow over the membrane surface is very important to both product water quality and quantity. At low flows, concentration polarization occurs, causing the water quality to decline. In addition to inferior product water quality, low brine flows can increase the precipitation of sparingly soluble salts, which foul the membrane surface. If this occurs, the product water flux (production) declines.

NOTES:

CUSTOMER GENERAL REQUIREMENTS

CUSTOMER REQUIREMENTS

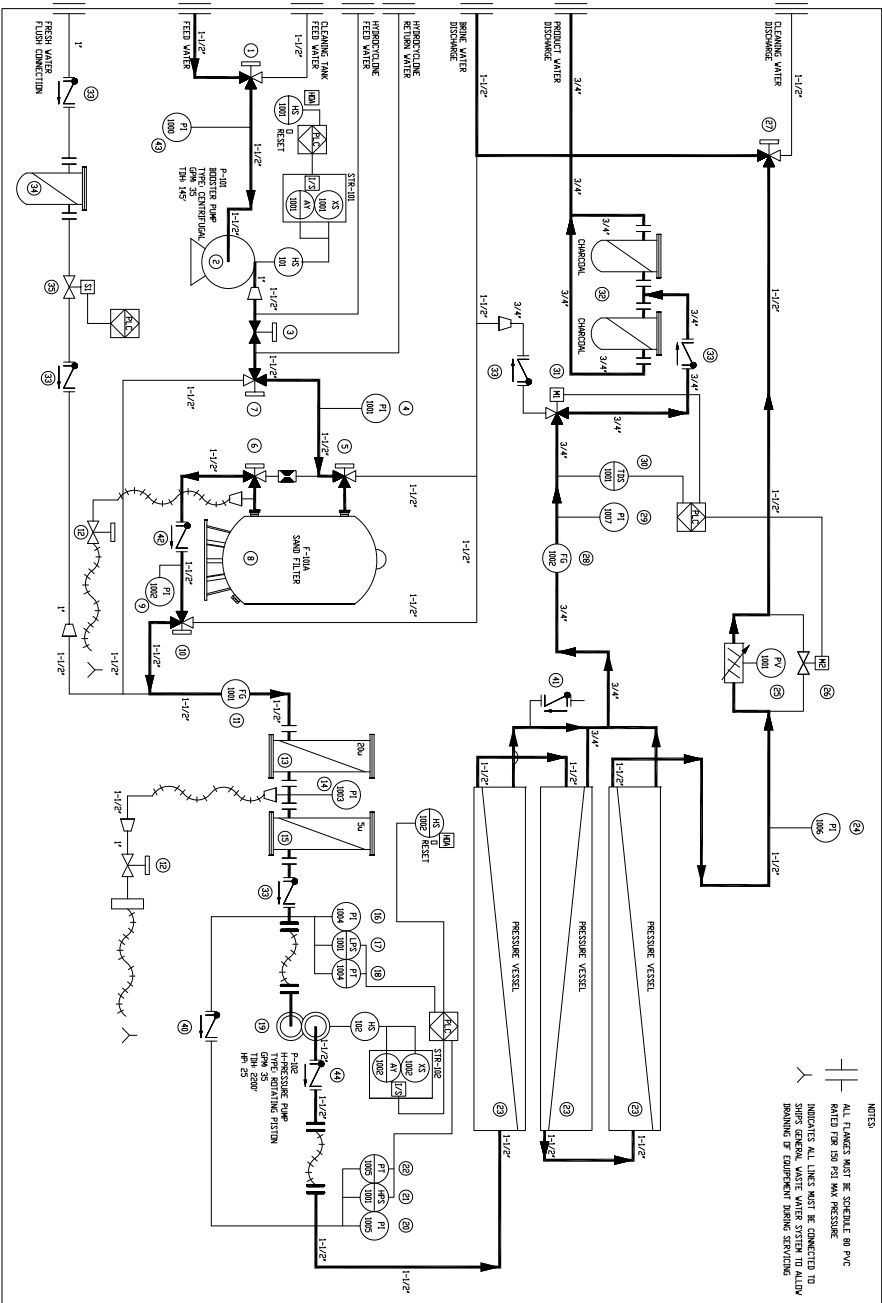
The Customer Shall Provide

- All foundations required.
- All floor drains and overboard discharge
- All labor, materials and tools necessary to unload, set, and erect the equipment, to install all corrosion resistant interconnecting piping between the system components (skids), to tighten piping that was loosened during shipping, and to place the equipment in operation.
- All sources of electrical power to each point of use, including any local and external disconnect devices required.
- All labor and material to install interconnecting control wiring and cabling.
- All piping, valves and fittings to bring the feed water to the system (made of corrosion-resistant material). All piping, valves and fittings to transfer the product water to the point of use and to discharge the wastewater.
- Electrical power supply including all interconnecting wiring, main three phase disconnect, wiring, conduit, to MCC and between all control panels.

P&ID

TASMAN SEA - P&ID

PT-Pressure Transducer
PI-Pressure Indicator
Mxx-Motorized Valve
FG-Flow Gauge
TDS-Salinity Meter
P-Pump
PLC-Programmable Logic Controller



NOTES:

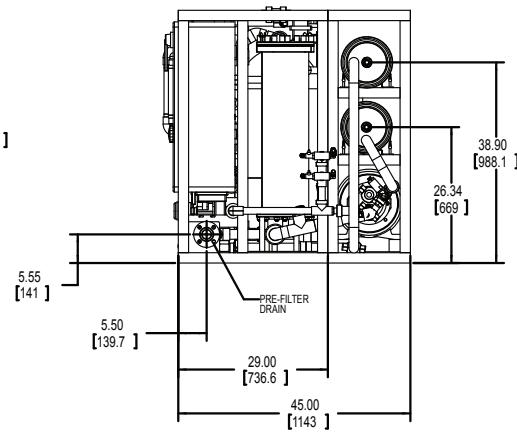
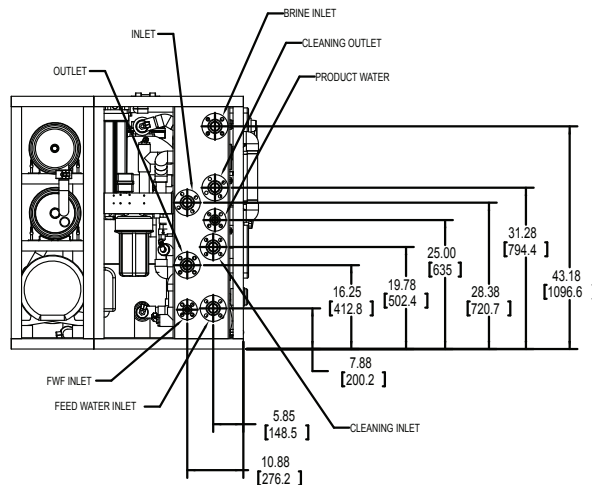
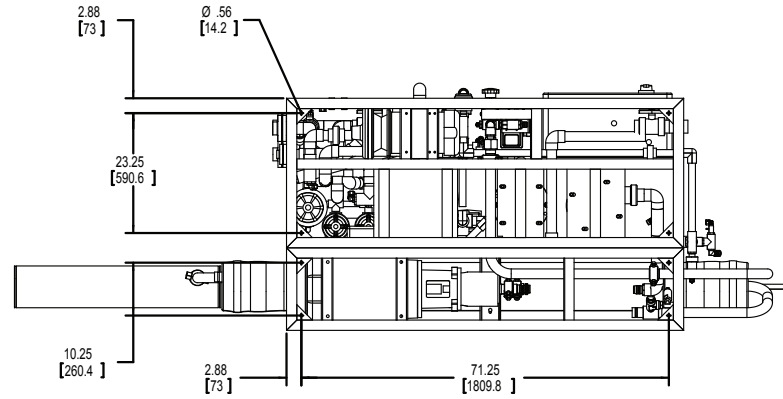
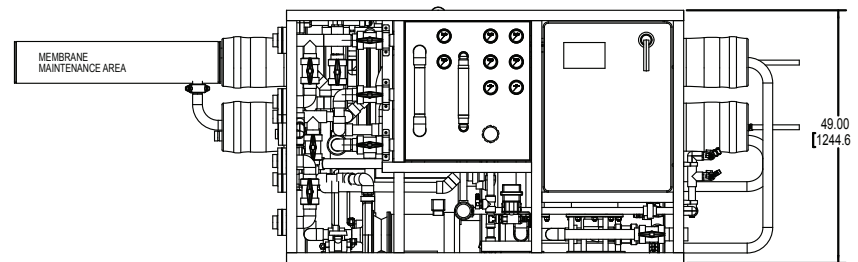
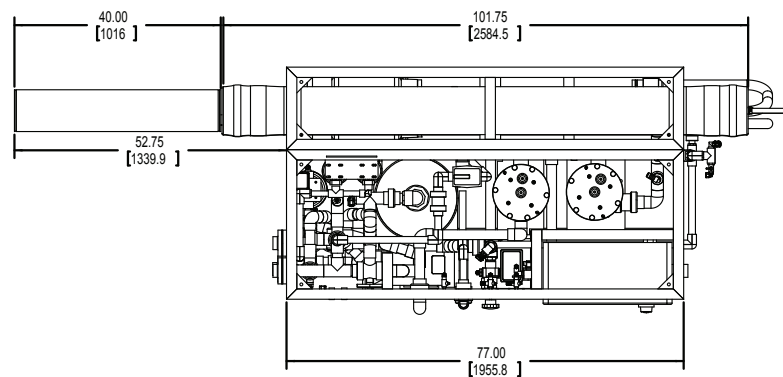
ALL FLANGES MUST BE SCHEDULE 80 PVC
RATED FOR 150 PSI MAX PRESSURE
INDICATES ALL LINES MUST BE CONNECTED TO
SHIP'S GENERAL WASTE WATER SYSTEM TO ALLOW
DRAINING OF EQUIPMENT DURING SERVICING

- KEY:
- 1 INLET FEED SELECTOR VALVE
 - 2 CLEAN/SEA WATER
 - 3 BOOSTER PUMP
 - 4 HYDROCYCLONE BY-PASS VALVE
 - 5 MEDIA FILTER INLET PRESSURE GAUGE
 - 6 MEDIA FILTER INLET VALVE VALVE
 - 7 MEDIA FILTER INLET VALVE VALVE
 - 8 MANUAL CIP MEDIA FILTER
 - 9 HYDROCYCLONE BY-PASS VALVE
 - 10 MEDIA FILTER INLET PRESSURE GAUGE
 - 11 MEDIA FILTER INLET VALVE VALVE
 - 12 FEED WATER FLOW GAUGE
 - 13 FILTRATION SYSTEM BRAIN VALVE
 - 14 200L/50L FILTER INLET/INLET
 - 15 PRESSURE GAUGE
 - 16 200L/50L FILTER INLET/INLET
 - 17 HIGH PRESSURE PUMP INLET
 - 18 HIGH PRESSURE PUMP INLET
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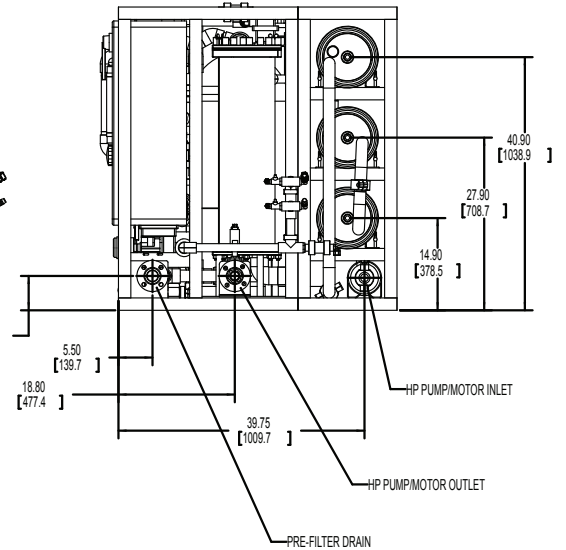
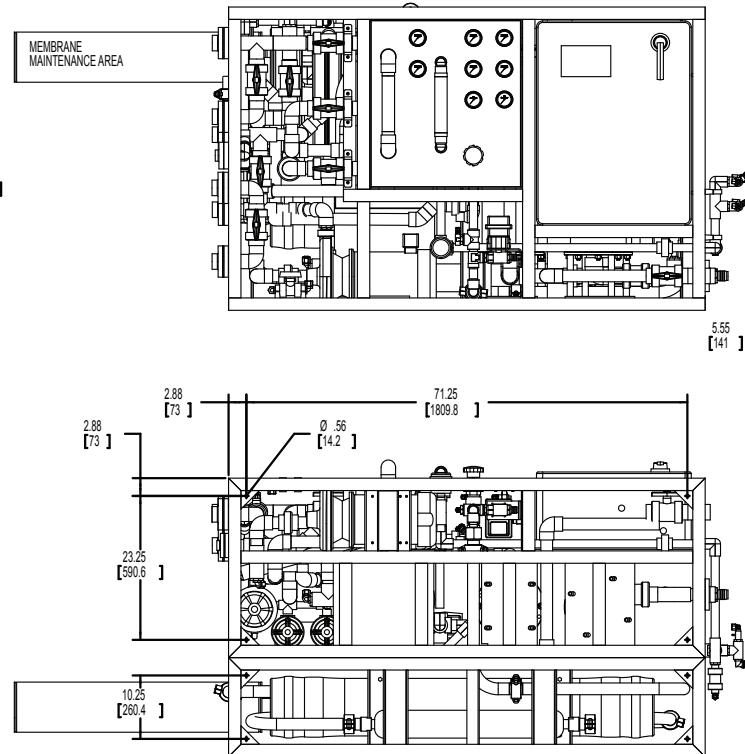
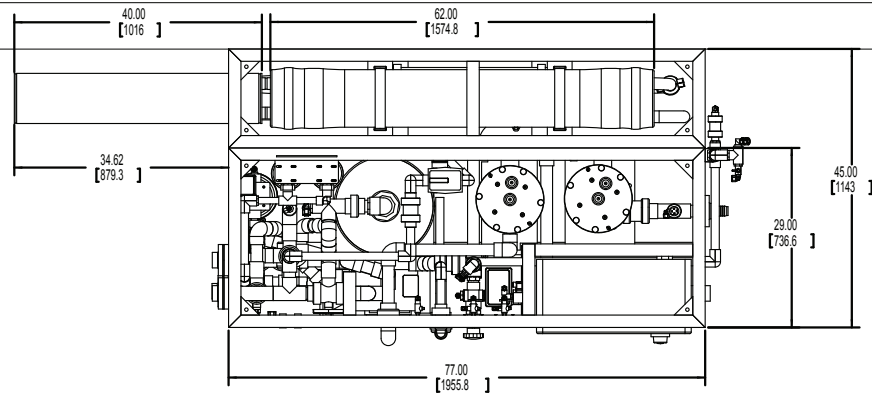
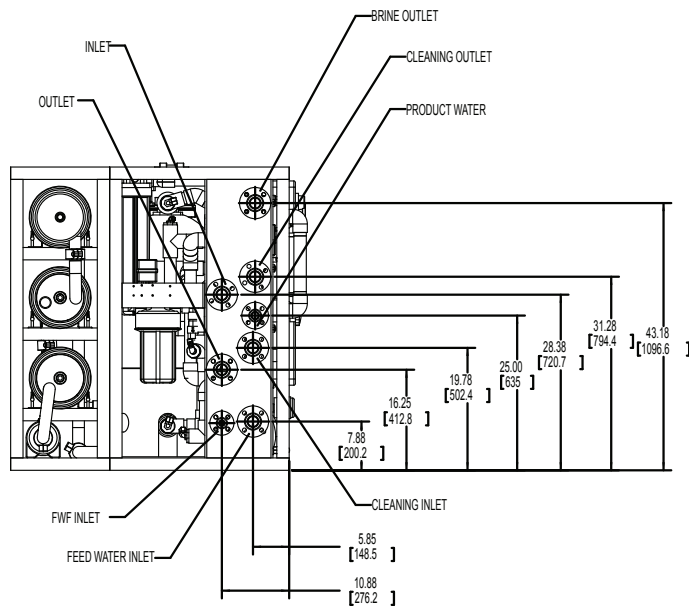
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BY	AS
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APPD	AS
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DESCRIPTION	2000L/50L FILTER INLET/INLET



MECHANICAL DRAWINGS



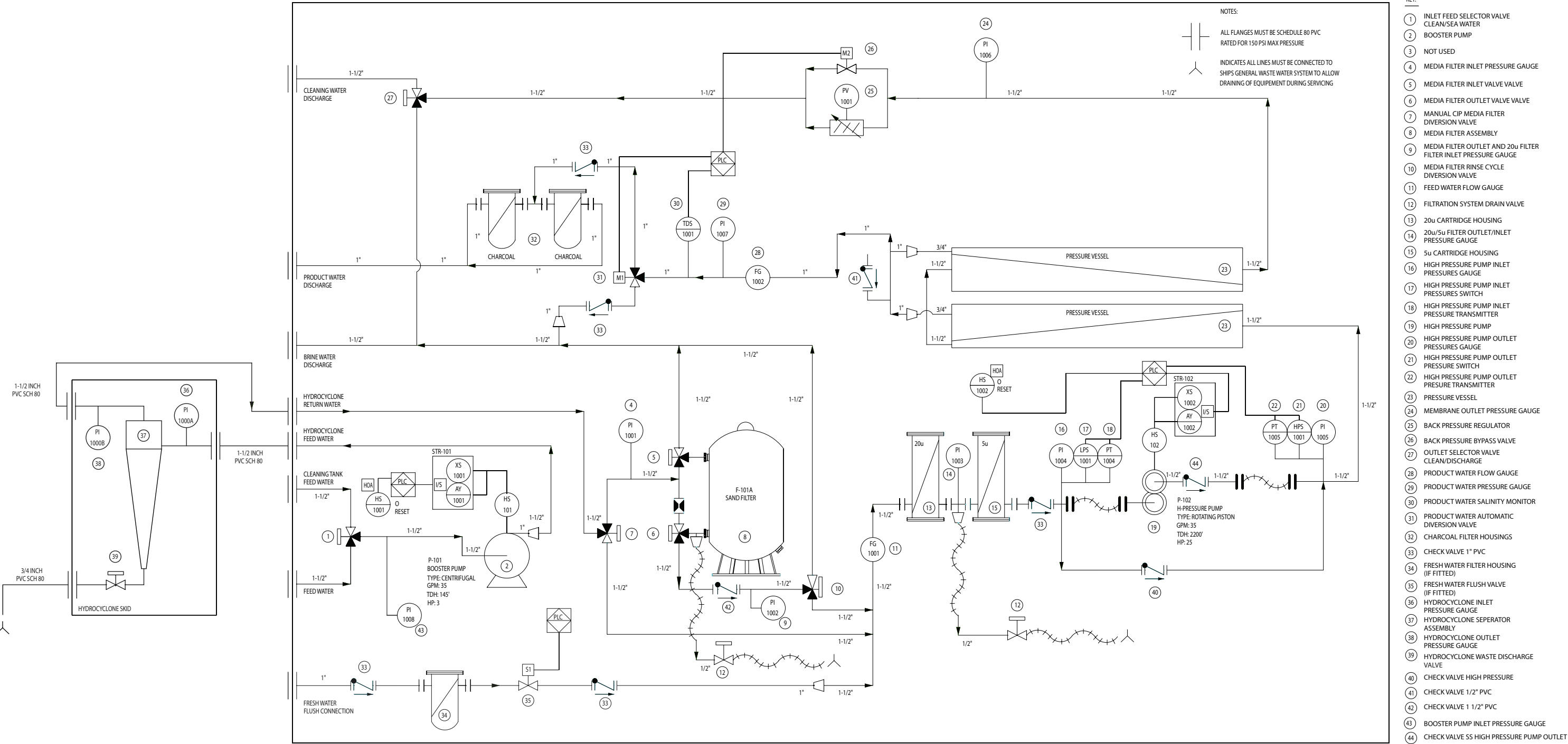
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REVISIONS		DRAWING INFORMATION		TASMAN SEA 60M3 (CAT VERSION)	
NO.	DESCRIPTION	DATE	BY	REV.	DESCRIPTION
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4	REVISED	2014-01-10	AS	4	REVISED
5	REVISED	2014-01-10	AS	5	REVISED
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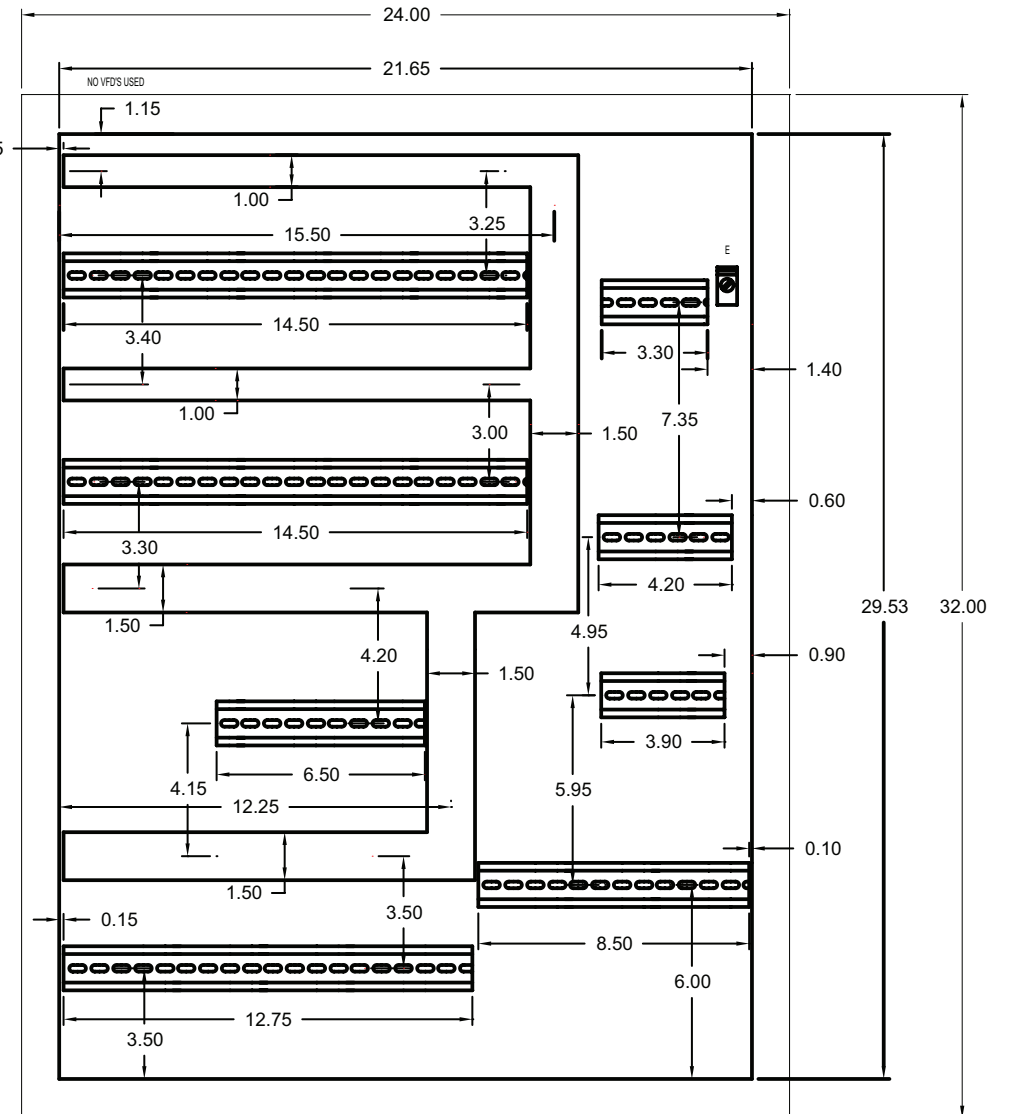
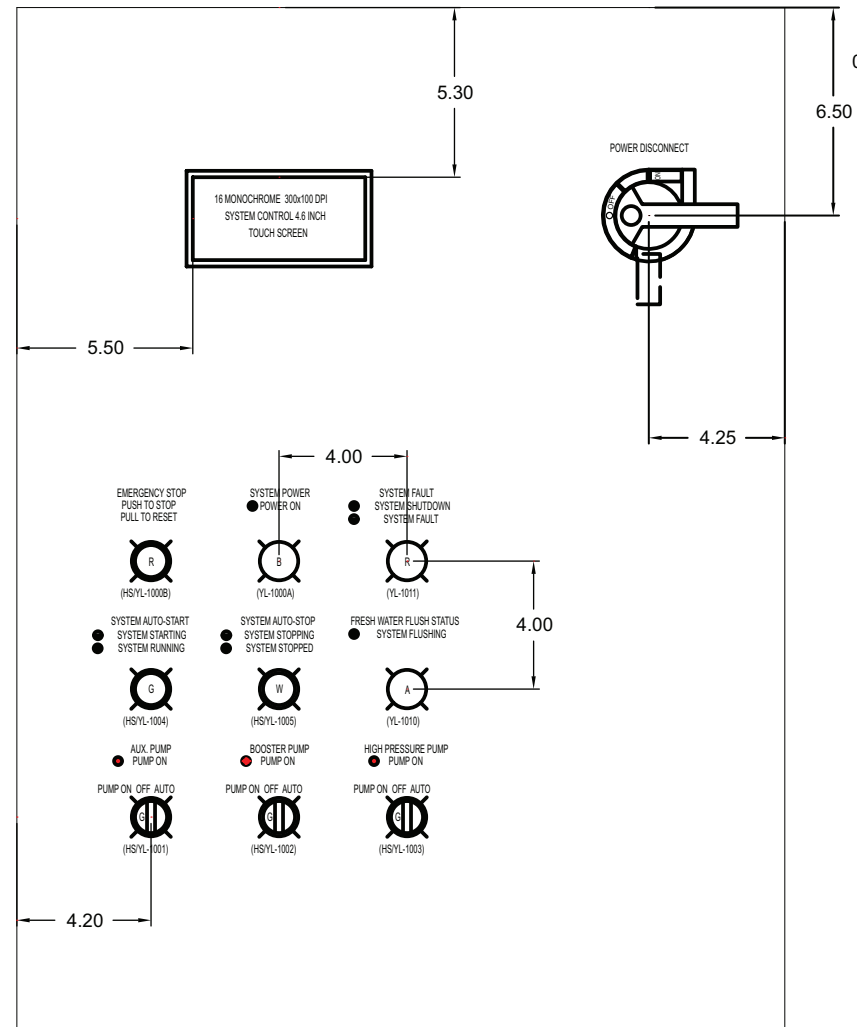
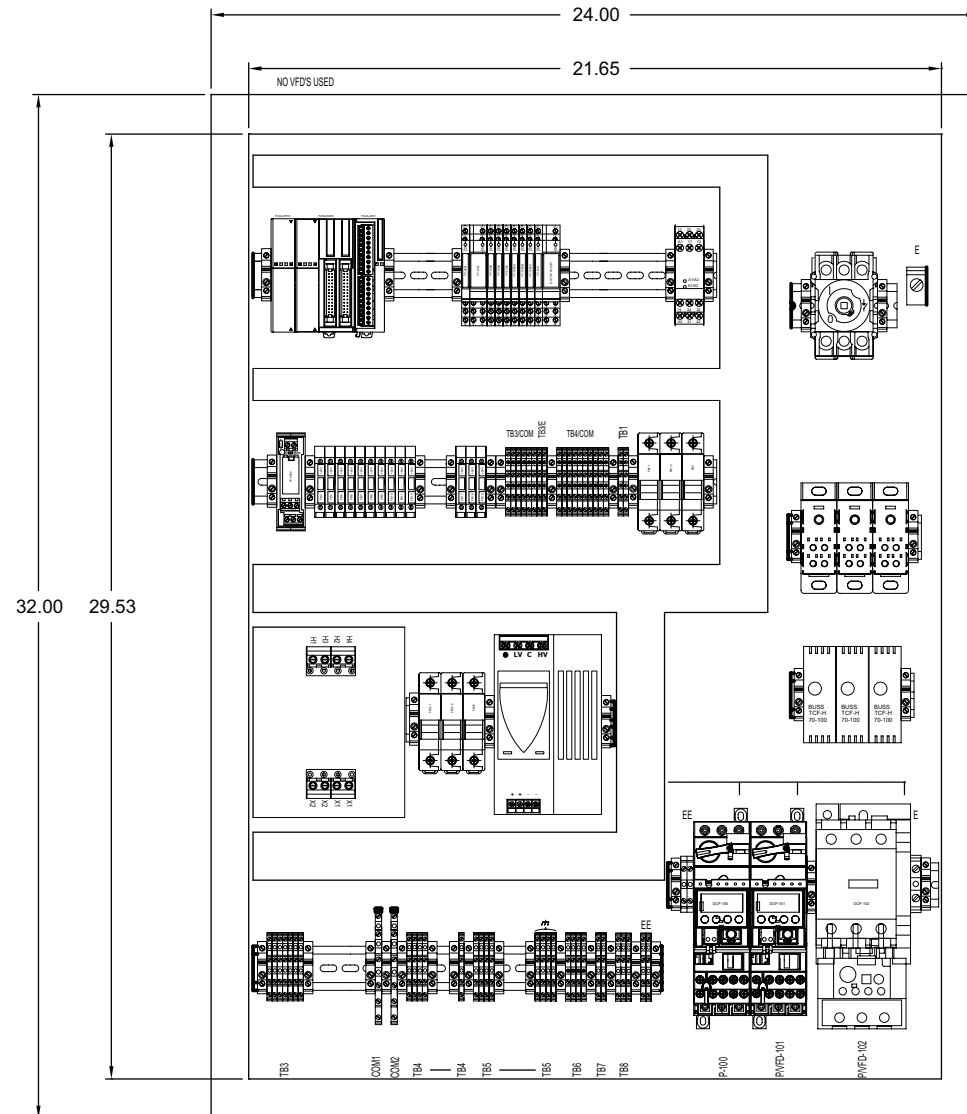
ELECTRICAL DRAWINGS

TASMAN SEA - P&ID

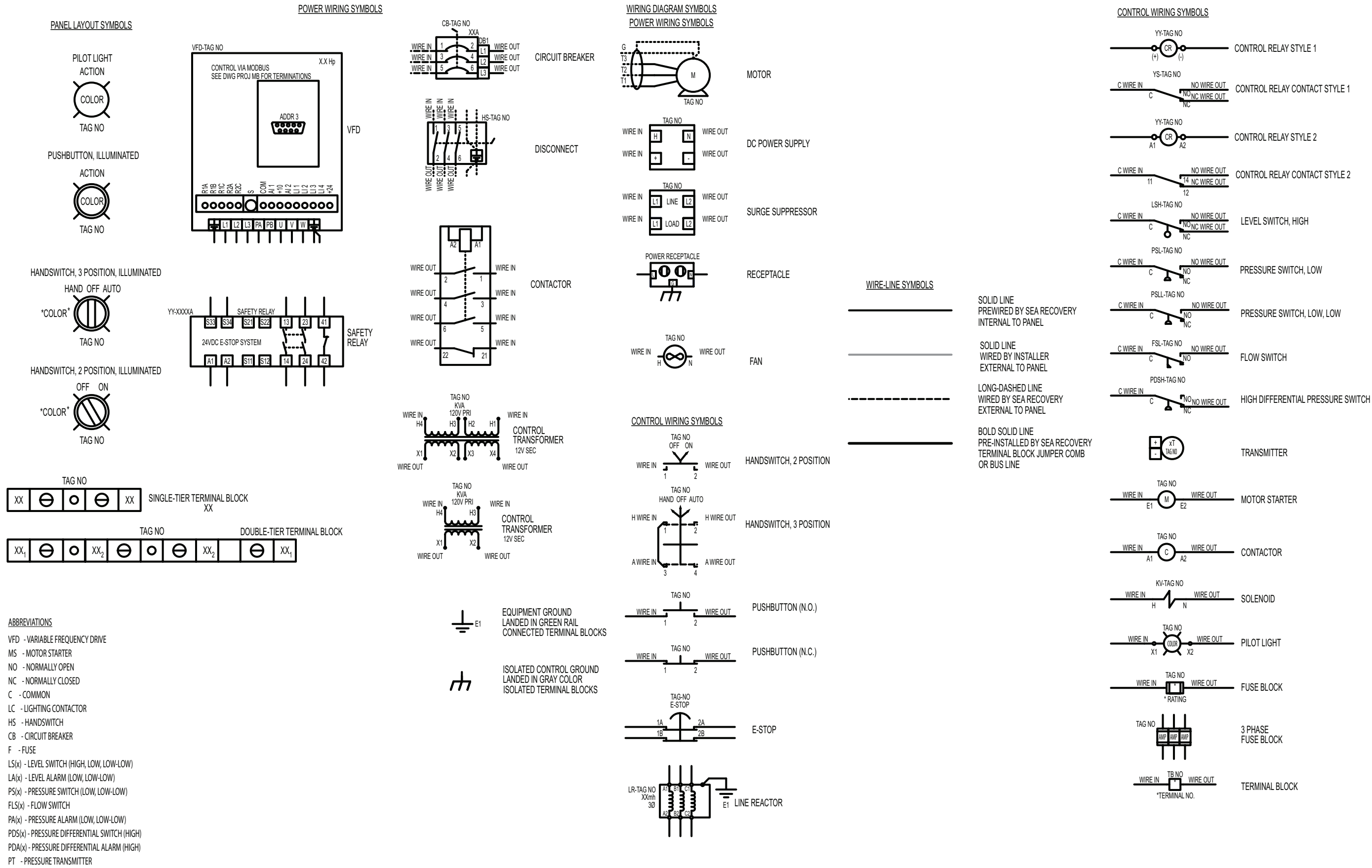


PT-Pressure Transducer
PI-Pressure Indicator
M-Meter
FG-Flow Gauge
TDS-TDS Meter
P-Pump
PLC-Program Logic Controller

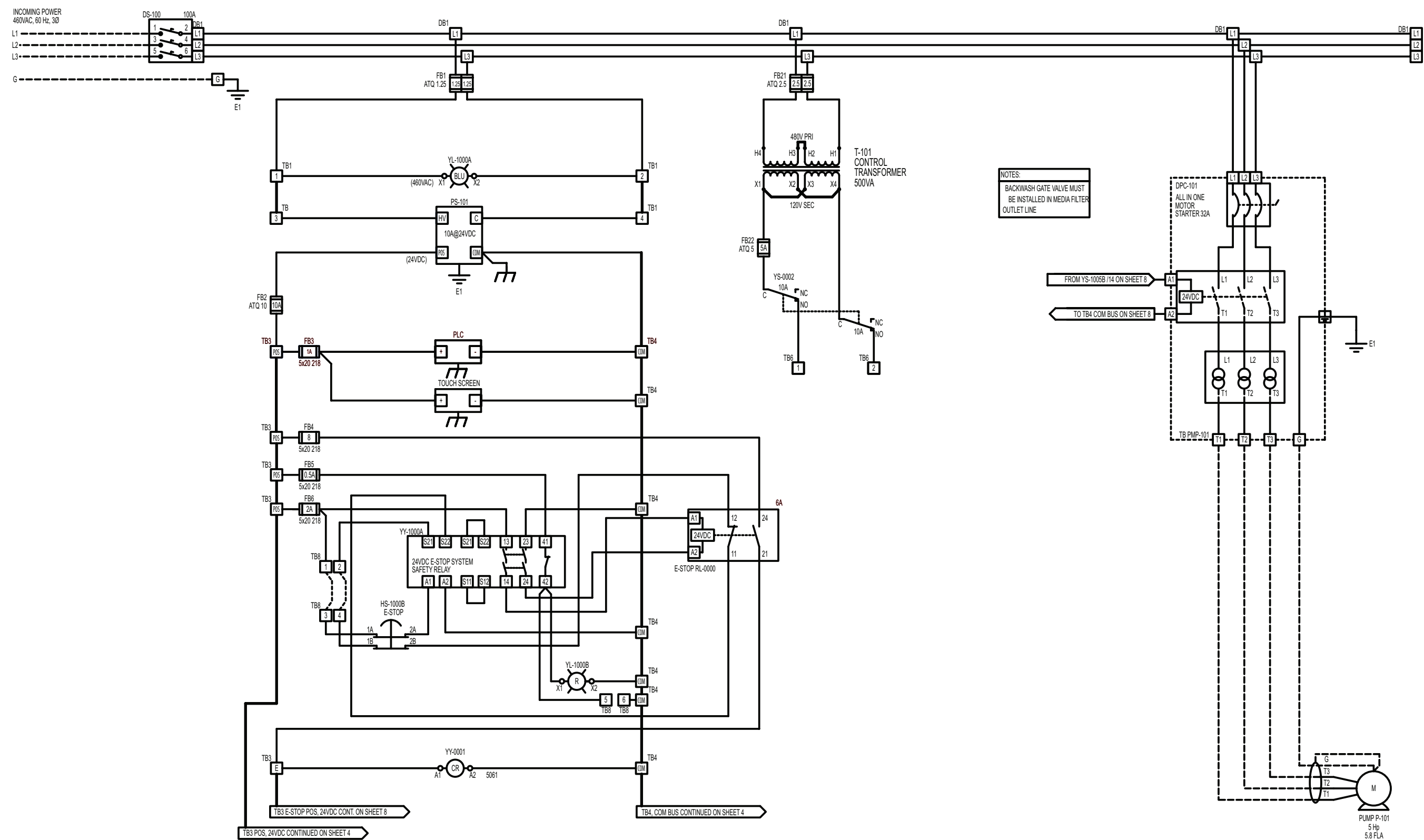
TASMAN SEA - CONTROL BOX



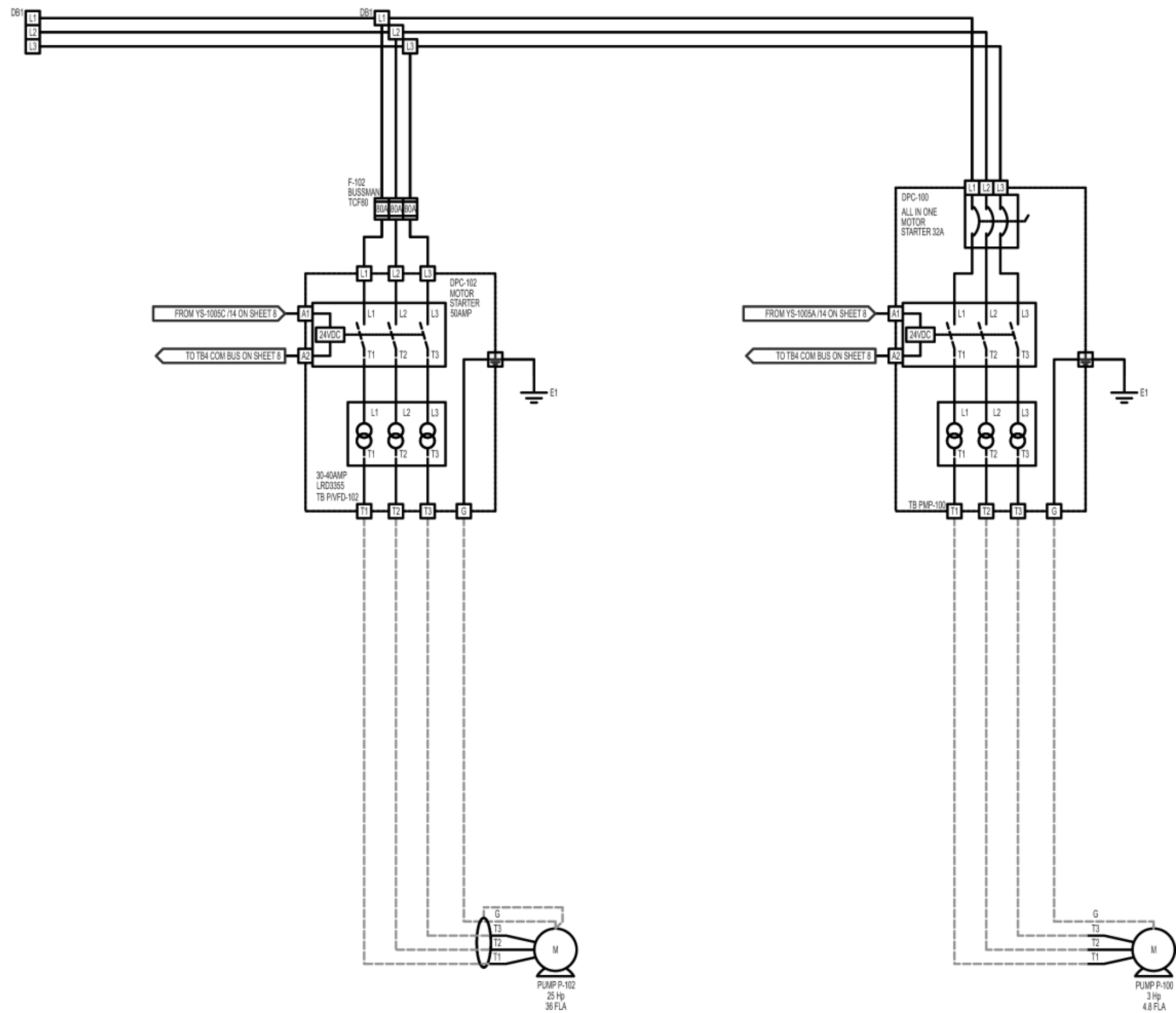
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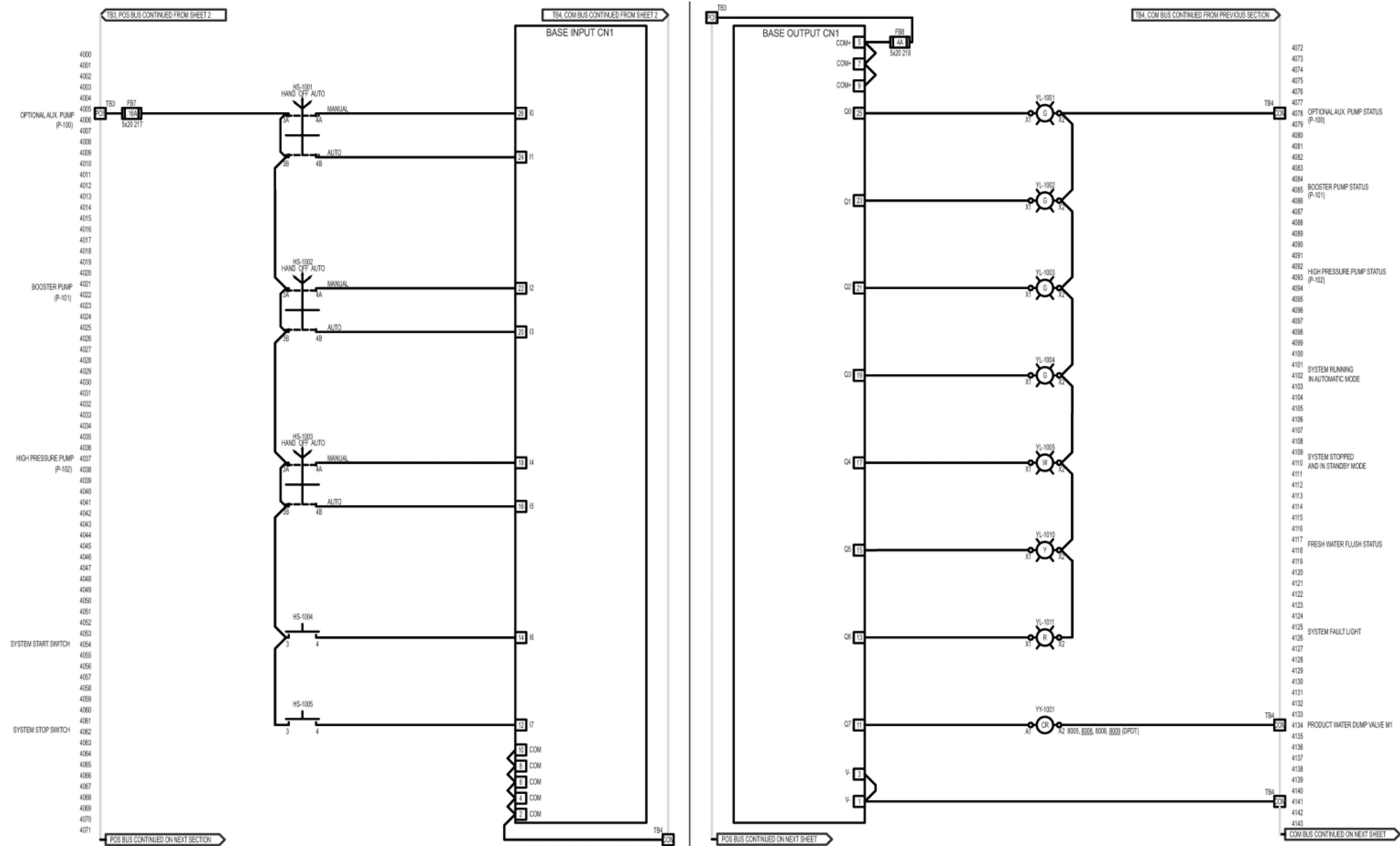
TASMAN SEA CONTROL BOX - POWER (1 of 2)



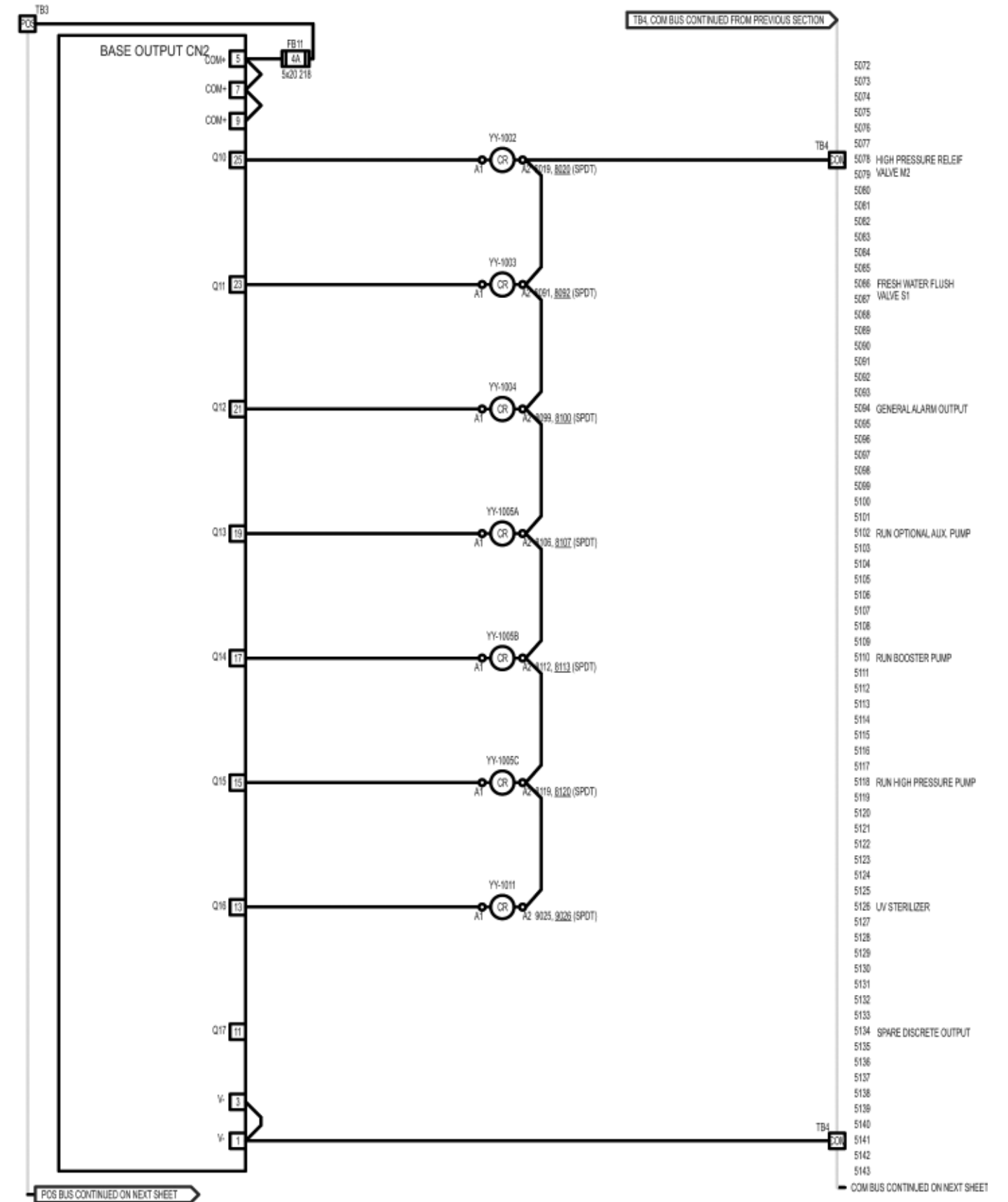
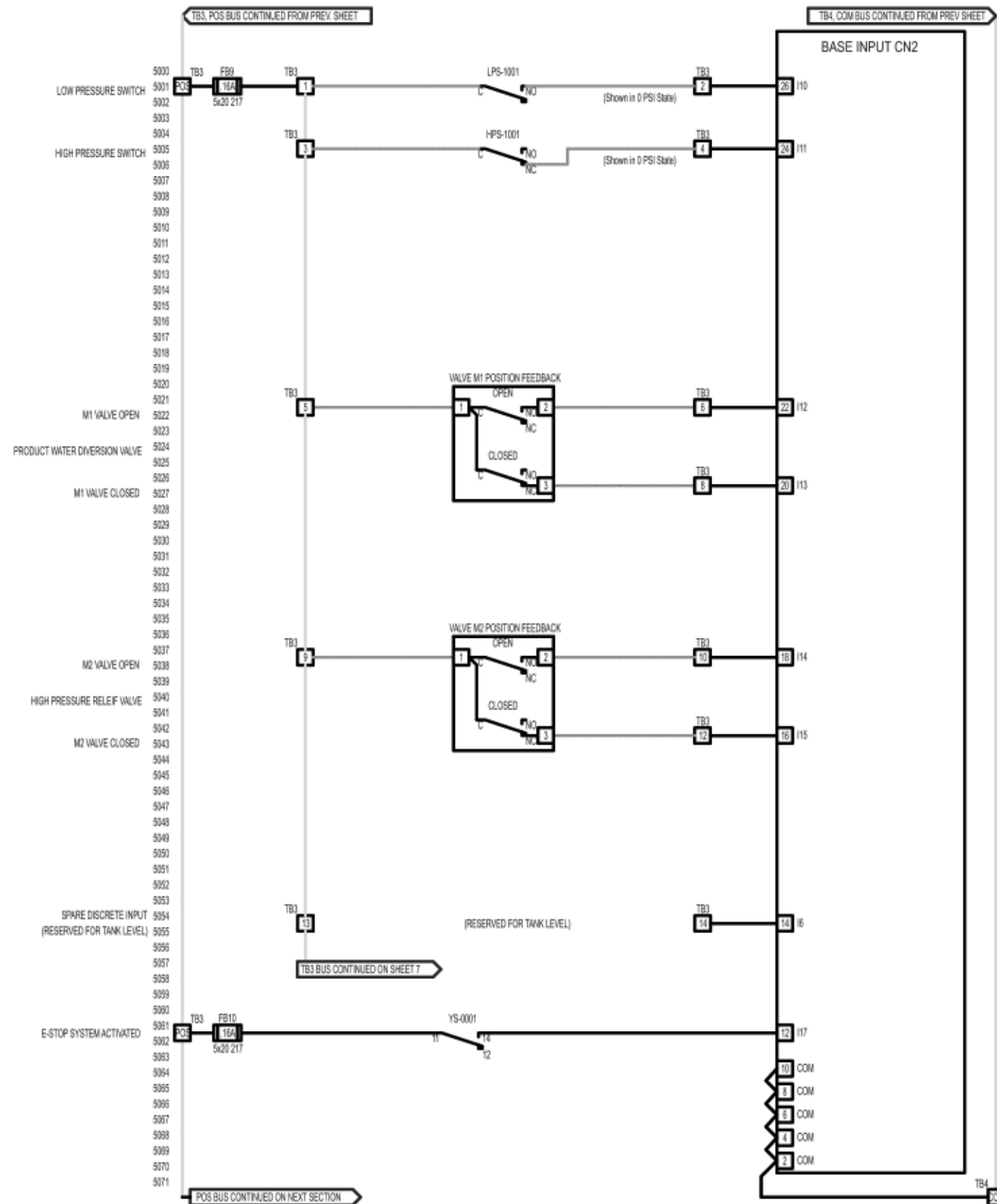
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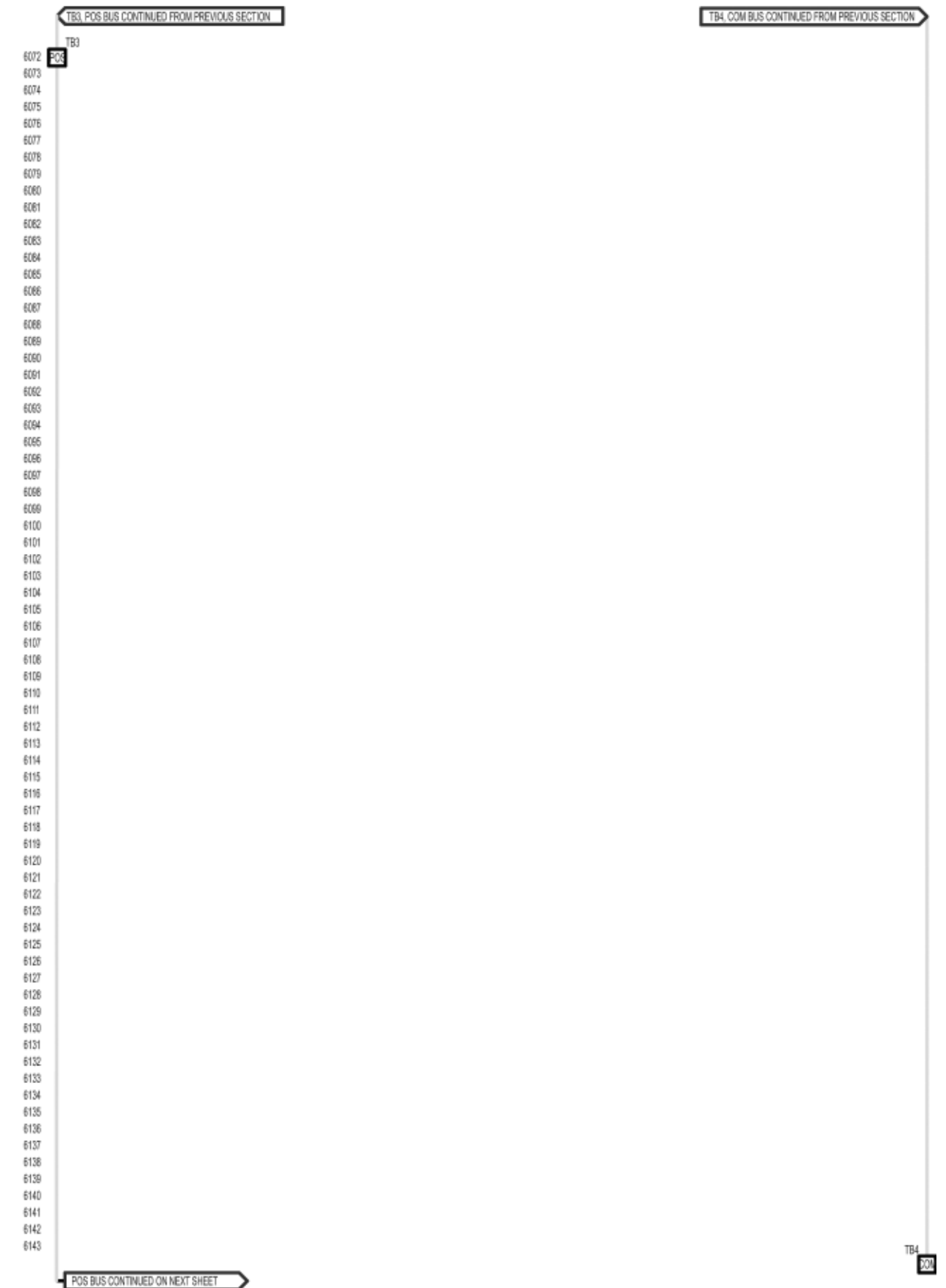
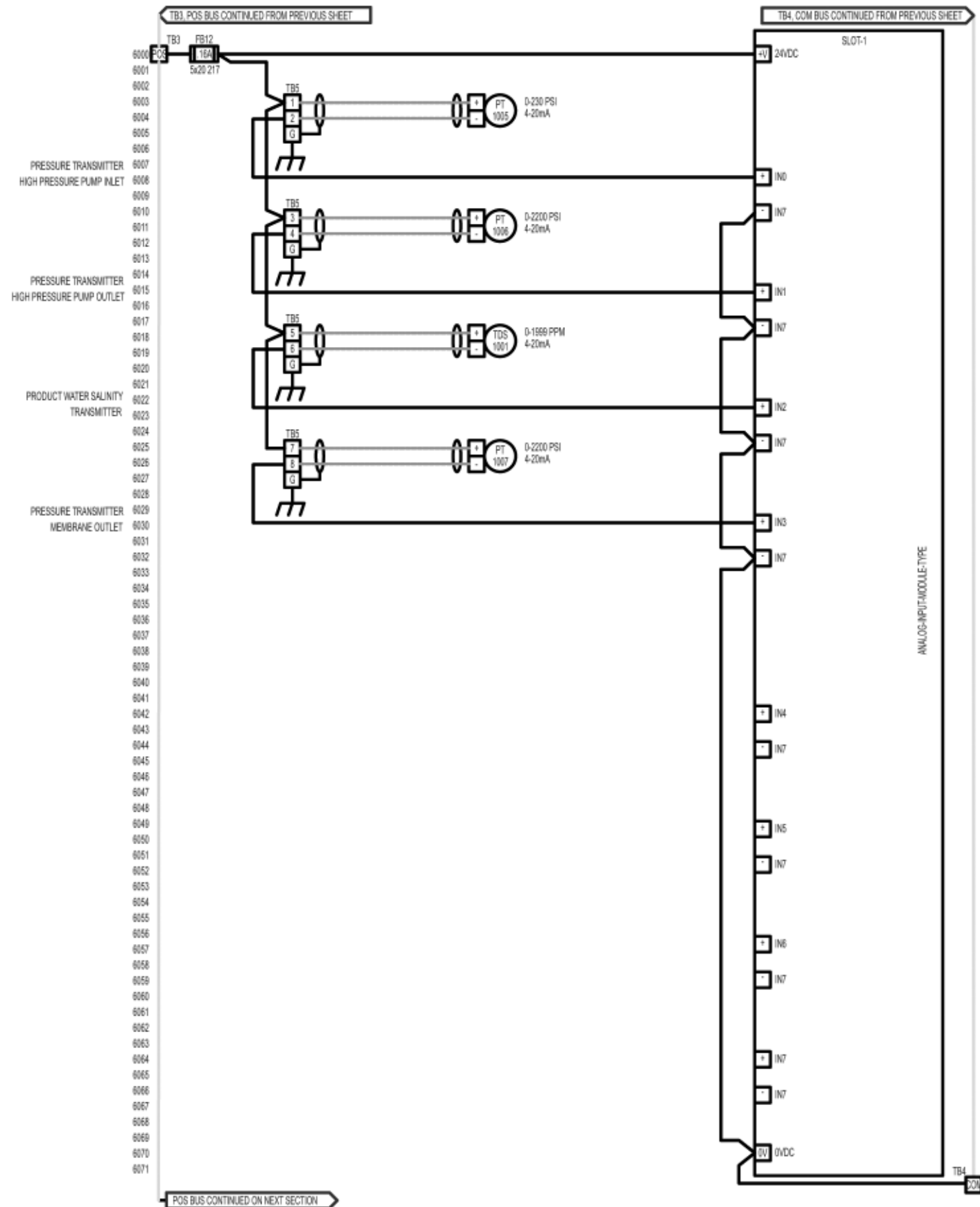
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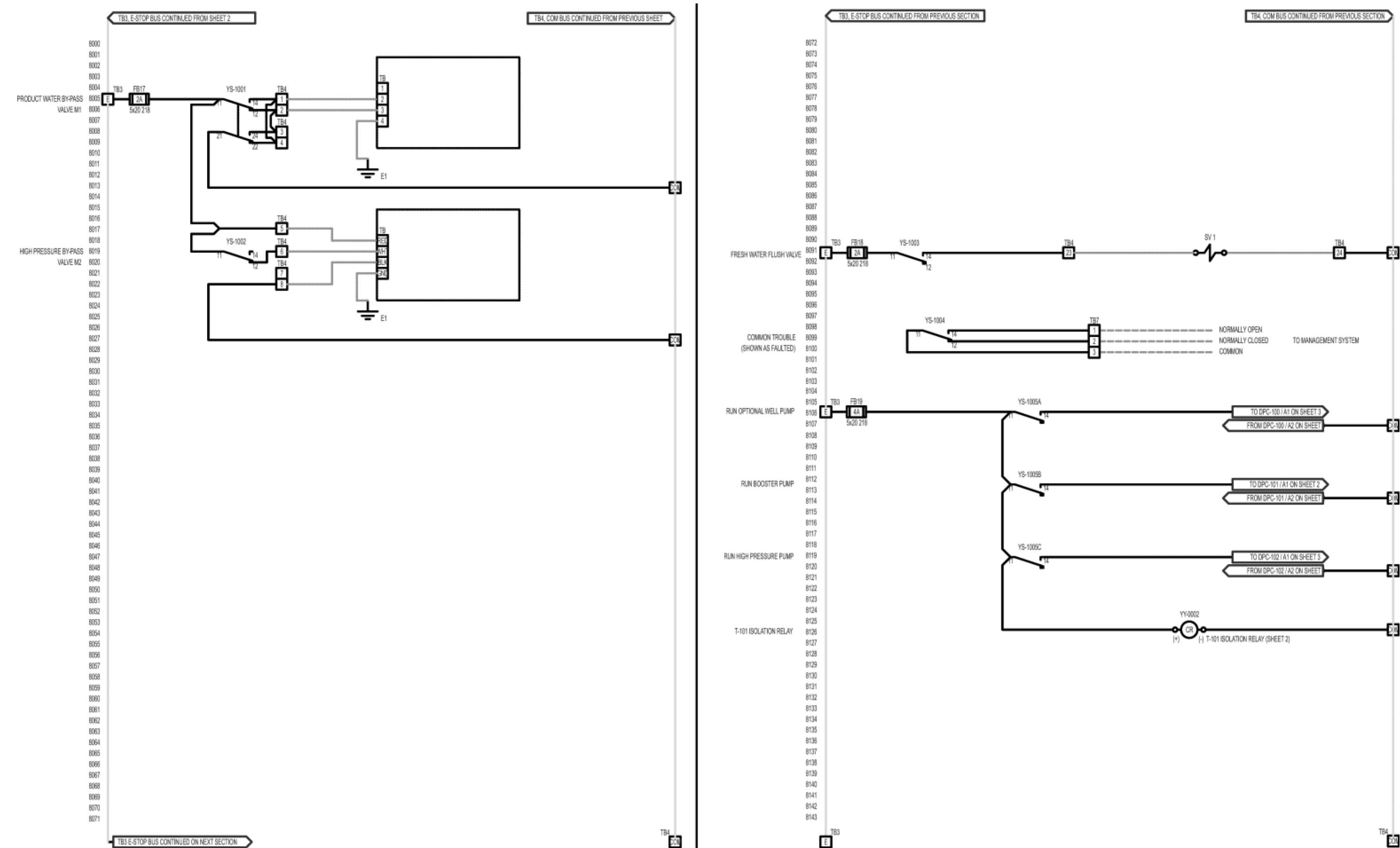
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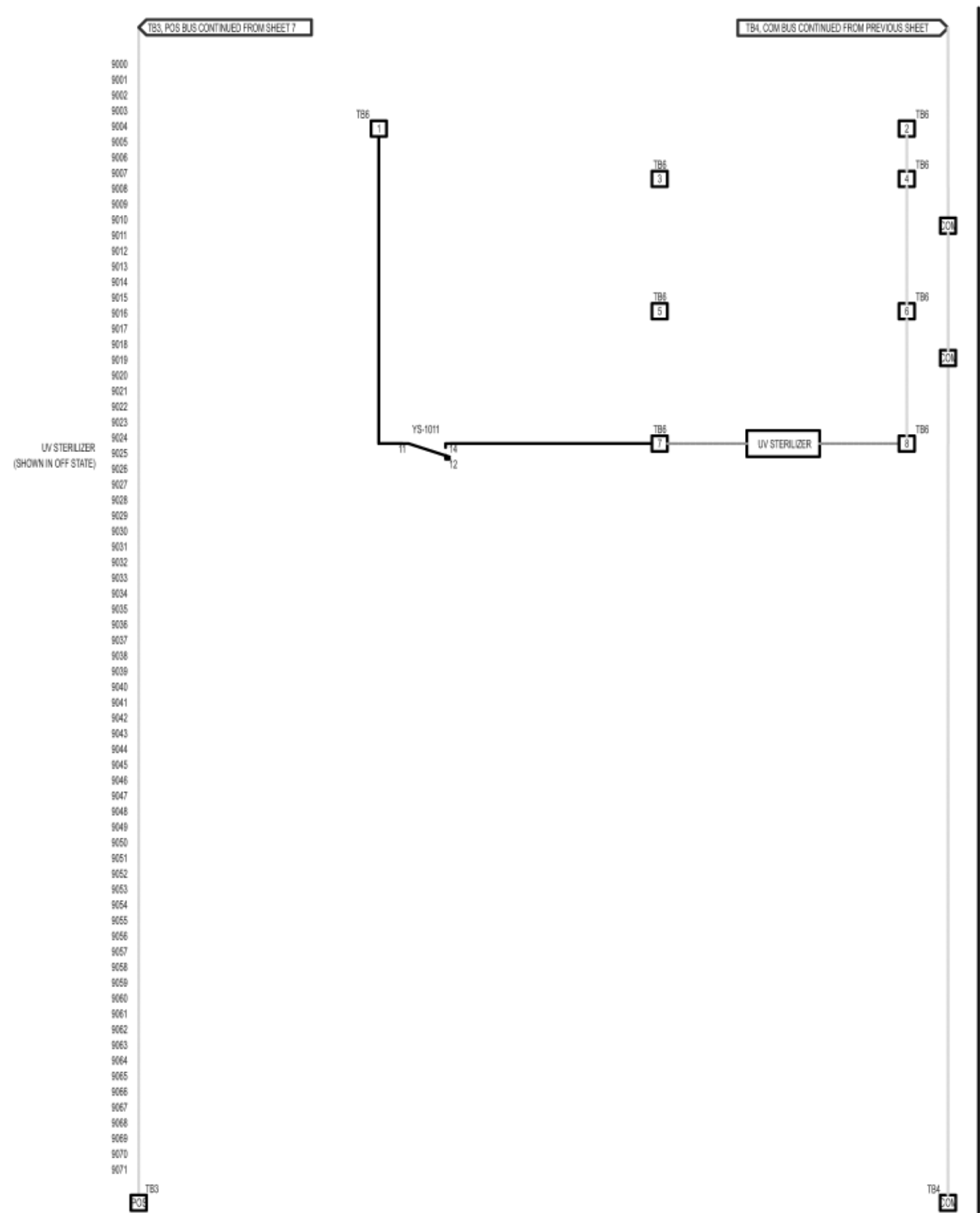


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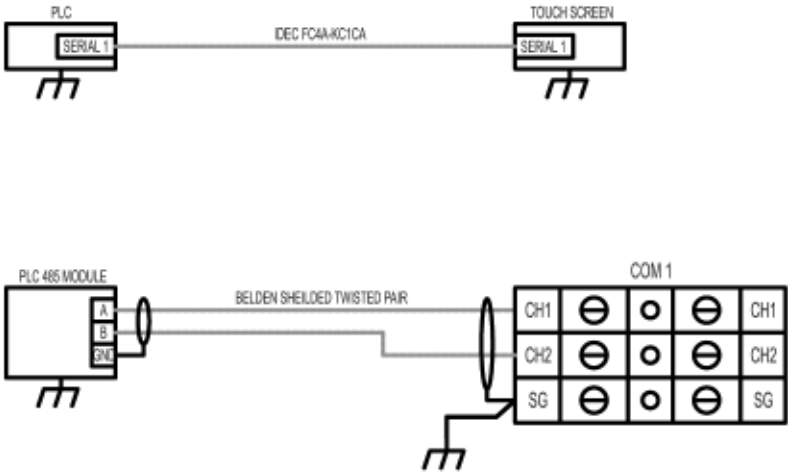


TASMAN SEA CONTROL BOX - CONTROL (4 of 4)

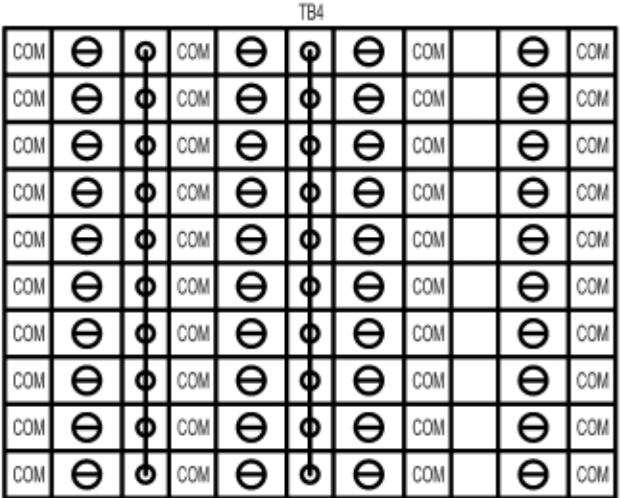
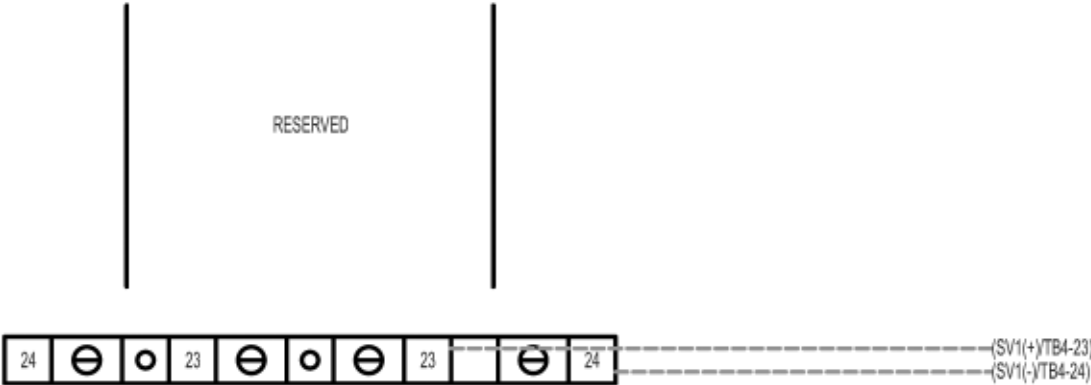
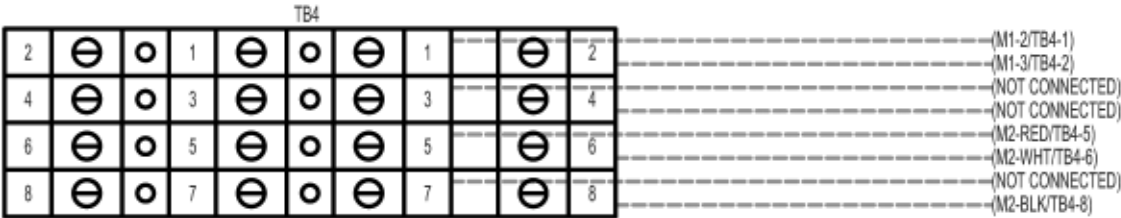
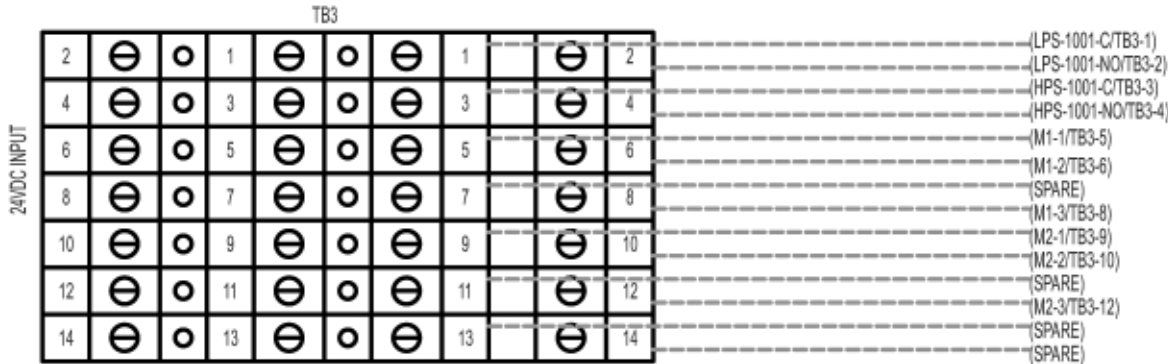
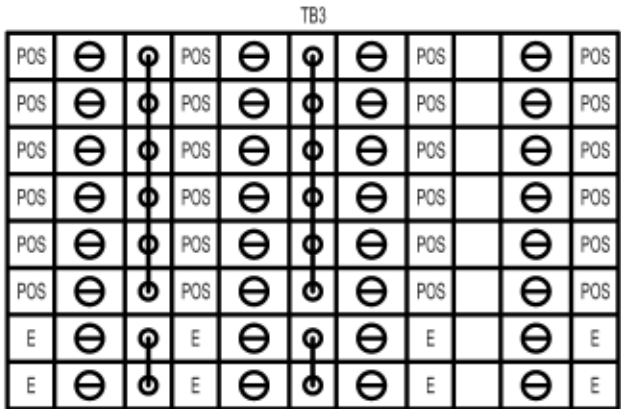
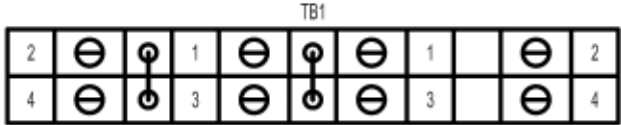




COMMUNICATIONS WIRING



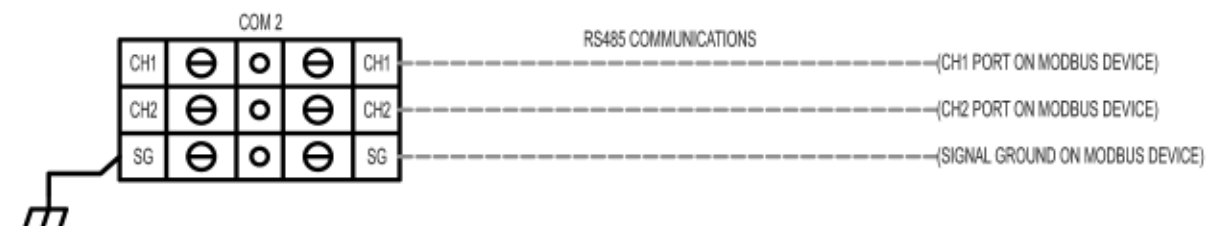
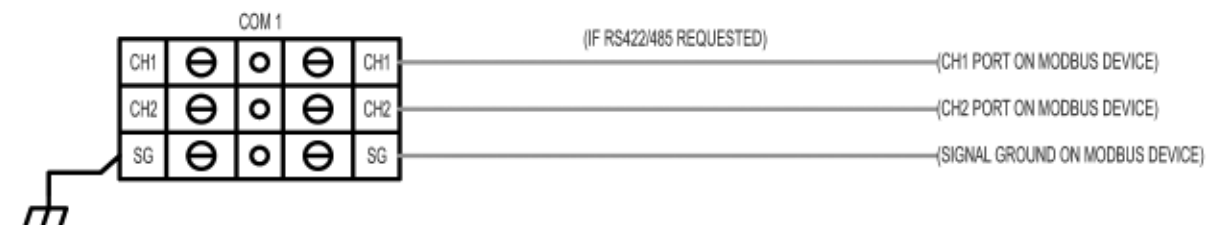
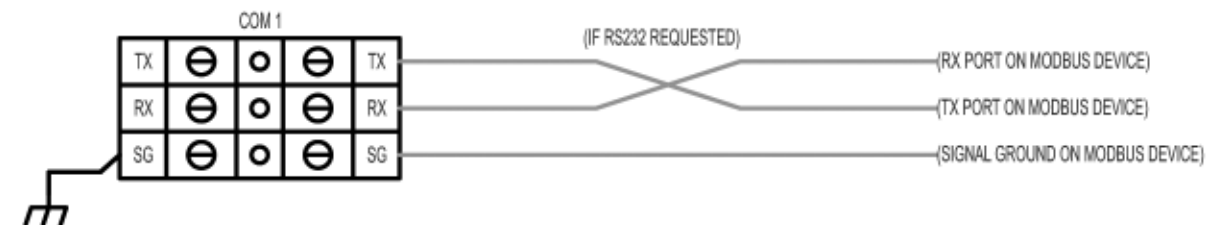
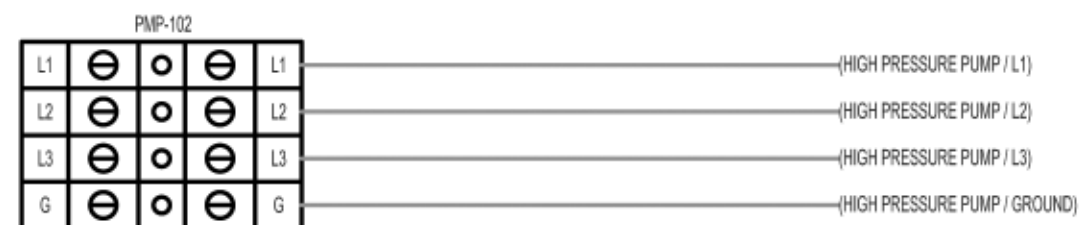
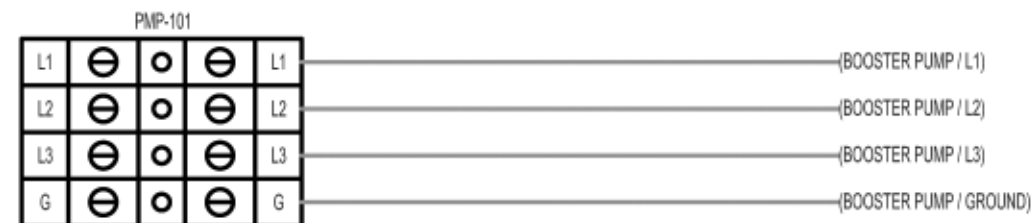
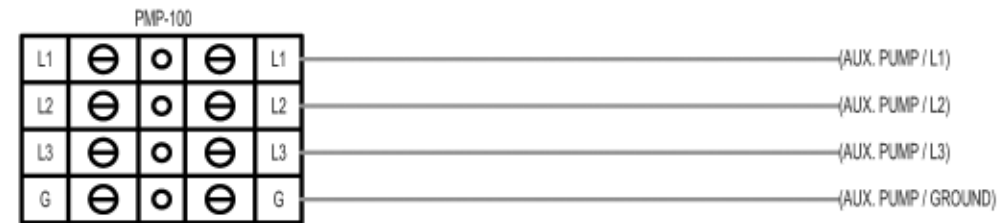
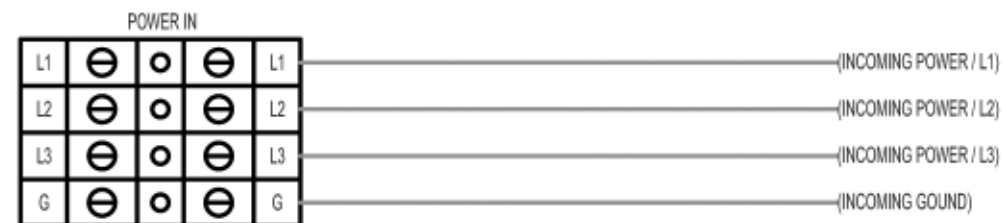
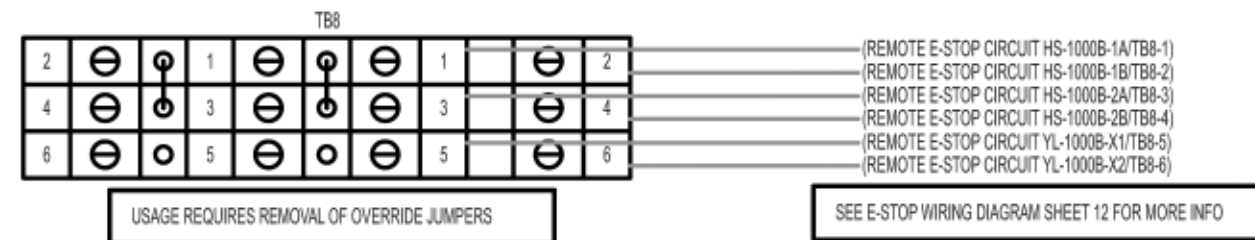
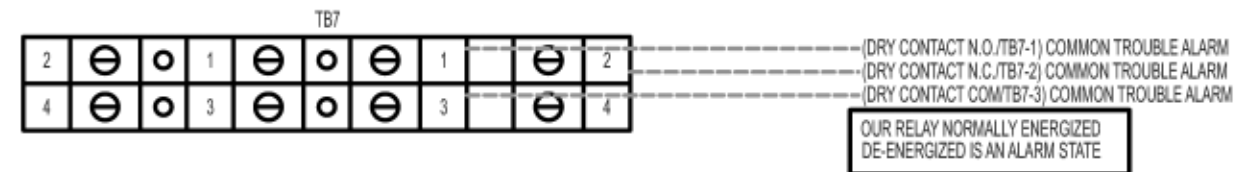
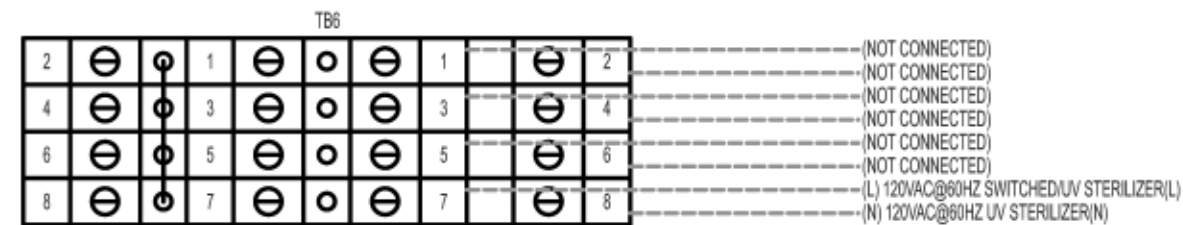
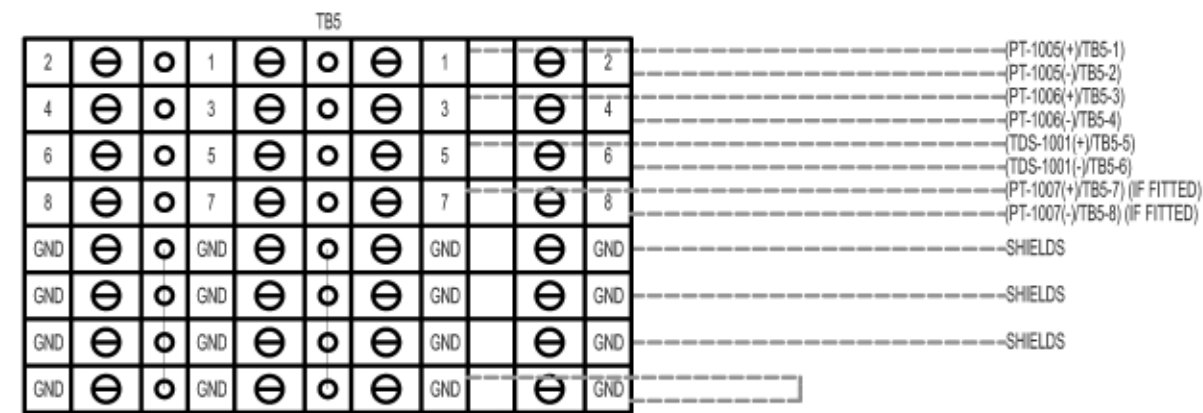
TASMAN SEA CONTROL BOX - TERMINATION (1 of 2)



KEY

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-----	SEA RECOVERY INSTALLED WIRING

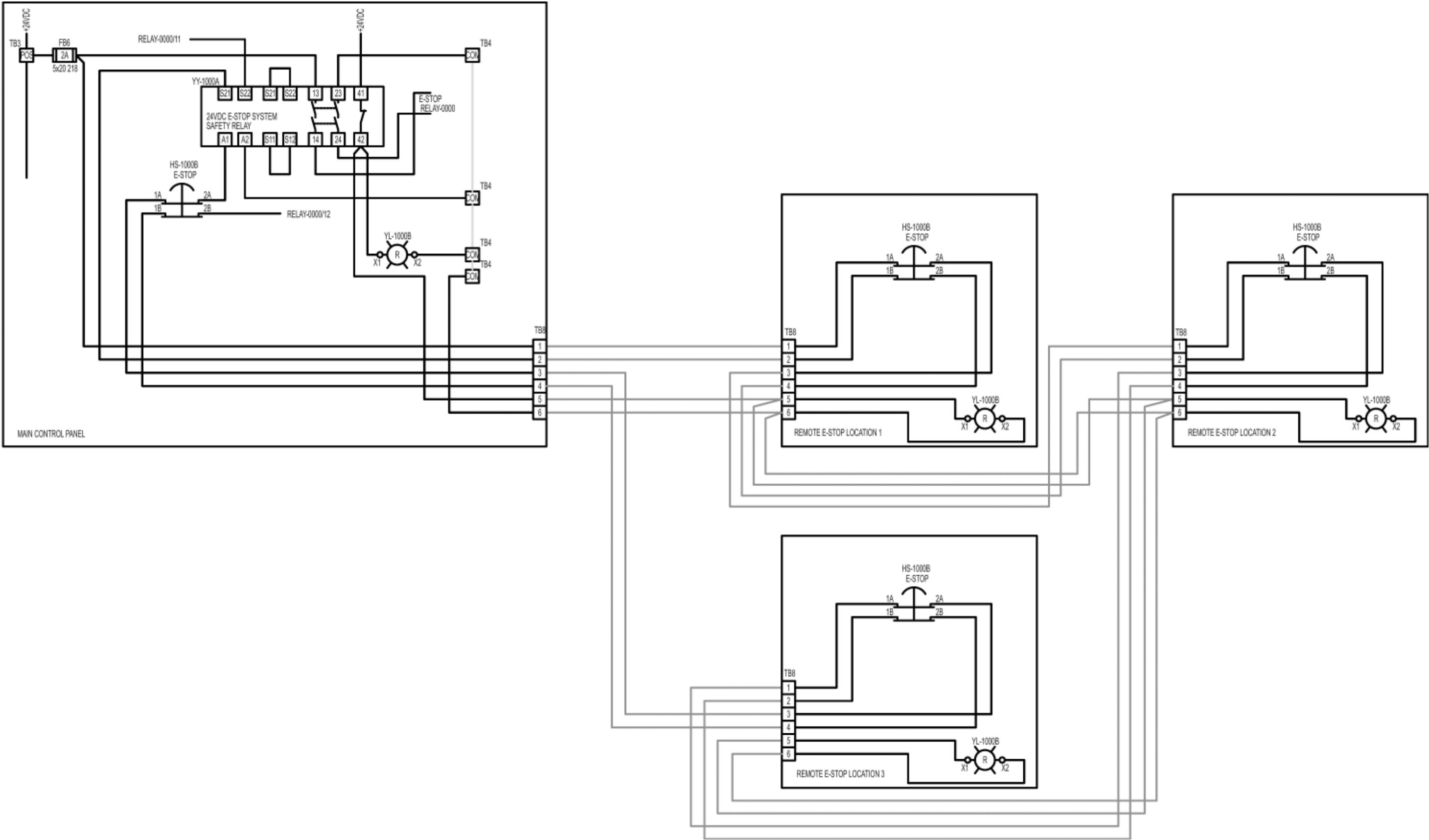
TASMAN SEA CONTROL BOX - TERMINATION (2 of 2)



KEY

—————	CUSTOMER INSTALLED WIRING
-----	SEA RECOVERY INSTALLED WIRING

TASMAN SEA CONTROL BOX - E-STOP



OPERATIONS MANUAL



P.O. Box 5288 • Carson, CA 90745-5288

Tasman Sea Control System

Operations Manual

(Base System)

PLC Firmware Version: 2.02

HMI Firmware Version: 1.21

Project: Danfoss Sea Recovery Tasman Sea	 <small>P.O. Box 5288 • Carson, CA 90745-5288</small>	Doc: 1010005	Version: 01b
Document Name: Control System Operations Manual		Author: AGE	Page: Page 1 of 92

Document Revision:

Version	Author	Date	Effected Pages	Description
01a	AGE	12-12-2009	All	Initial Draft
01b	AGE	12-28-2009	1,14,90-92	Software version revised to 2.02 and 1.21 respectively, additional commissioning features added, ability to activate accessories added.

Abbreviations:

LPS:	Low Pressure Switch
HPS:	High Pressure Switch
PT:	Pressure Transducer
FT:	Flow Transducer
Analog CH:	Variable PLC Input, ranging from 4-20mA
mA:	Milli-Amps (1.0×10^{-3})
DSRC:	Danfoss 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.

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1. System Settings prior to attempting operation:

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

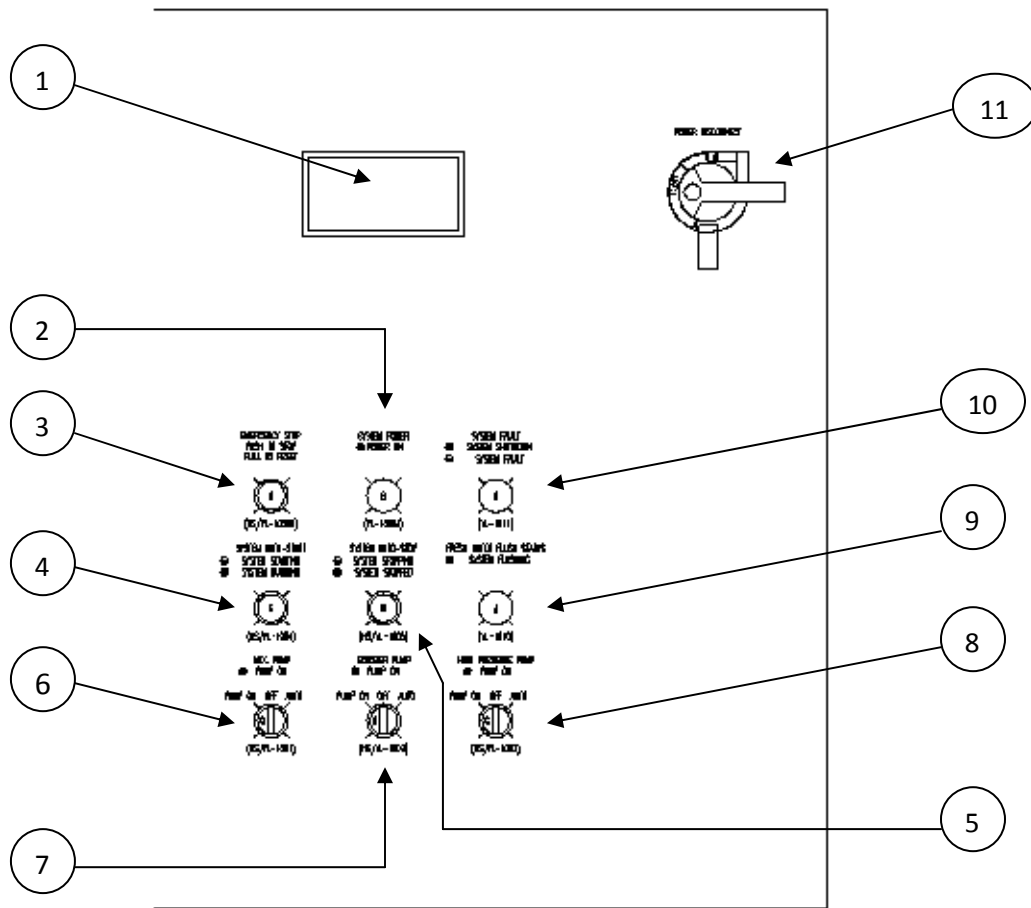
1.	Feed water selection valve	Normal position (Tab Down)
2.	Booster Pump	Not relevant
3.	Not Used	
4.	Media filter assembly inlet pressure gauge	Not relevant
5.	Media filter inlet valve	Normal position (Tab Right)
6.	Media filter outlet valve	Normal position (Tab Left)
7.	Media filter by-pass valve	Normal Position (Tab Right)
8.	Media filter assembly	Loaded with media
9.	Media filter outlet pressure gauge	Not relevant
10.	Media filter rinse valve	Normal position (Tab Down)
11.	Feed flow meter	Not relevant
12.	Cartridge and Media Filter Assembly drain valve	Closed position
13.	20u Cartridge filter assembly	Not relevant
14.	20u Outlet 5u Inlet pressure gauge	Not relevant
15.	5u Cartridge filter assembly	Not relevant
16.	High pressure pump inlet pressure gauge	>20 PSI : < 75 PSI
17.	High pressure pump inlet pressure switch	Not relevant
18.	High pressure pump inlet pressure transmitter	Not relevant
19.	High pressure pump	Not relevant
20.	High pressure pump outlet pressure gauge	Not relevant
21.	High pressure pump outlet pressure switch	Not relevant
22.	High pressure pump outlet pressure transmitter	Not relevant
23.	Pressure vessel	Not relevant
24.	Membrane outlet pressure gauge	<950 PSI
25.	Back pressure regulator	Fully Open
26.	High pressure by-pass valve	Fully Open
27.	Brine water selection valve	Normal Position (Tab Up)
28.	Product water flow meter	Not relevant
29.	Product water line pressure gauge	Not relevant
30.	Salinity probe	Not relevant
31.	Product water diversion valve	Fully Closed
32.	Charcoal filter assemblies	Not relevant
33.	Check valve 1" PVC	Not relevant
34.	Fresh water flush carbon filter	Not relevant
35.	Fresh water flush control valve	Fully Closed
36.	Hydro cyclone Inlet pressure gauge	Not relevant
37.	Hydro cyclone Assembly	Not relevant
38.	Hydro cyclone outlet pressure gauge	Not relevant
39.	Hydro cyclone drain valve	¼ open
40.	Check valve high pressure	Not relevant

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41.	Check valve ½" PVC	Not relevant
42.	Check valve 1-1/2" PVC	Not relevant
43.	Booster pump inlet pressure gauge	< 10 PSI
44.	Check valve SS high pressure pump outlet	Not relevant

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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	Auxiliary Pump Control Operator
7	Booster Pump Control Operator
8	High Pressure Pump Control Operator
9	Fresh Water Flush Indicator
10	System Fault Indicator
11	Main Power Disconnect

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The new Tasman 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 Tasman 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 Tasman 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 Tasman 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 Tasman Sea Modbus Specification documentation.

Project: Danfoss Sea Recovery Tasman Sea	 The logo for Danfoss Sea Recovery, featuring the word 'Danfoss' in a stylized red script font above the words 'Sea Recovery' in a black sans-serif font. Below this, in a smaller black font, is the text 'P.O. Box 40041, Auckland 1142, New Zealand'.	Doc: 1010005	Version: 01b
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3. Initial System Checks/Commissioning.

The new Tasman 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 manor.

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.

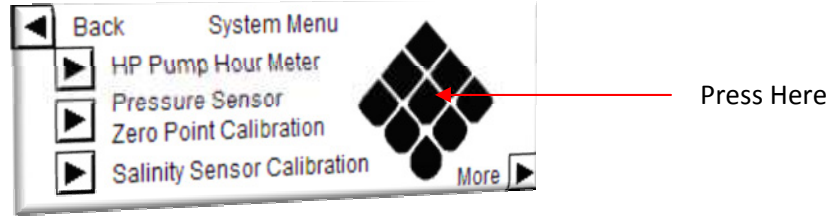


This will take you to one of two main menu screens. Once again press the arrow in the lower right corner.



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.

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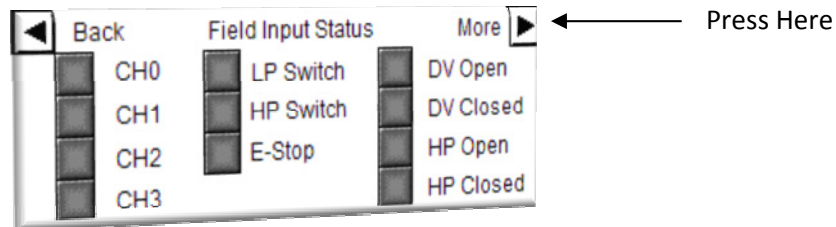


If the unit was not running pressing the illustrated area will switch the controller into commissioning mode. This is confirmed by the system menu being replaced with the first of four diagnostic screens. The first screen as shown below details all of the inputs currently being received by the controller. 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
- 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)
- DV Open: Product Diversion Valve, Illuminates when the valve actuator reports open position
- DV Closed: Product Diversion Valve, Illuminates when the valve actuator reports closed position
- HP Open: High Pressure Relief Valve, Illuminates when the valve actuator reports open position
- HP Closed: High Pressure Relief Valve, Illuminates when the valve actuator reports closed position

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



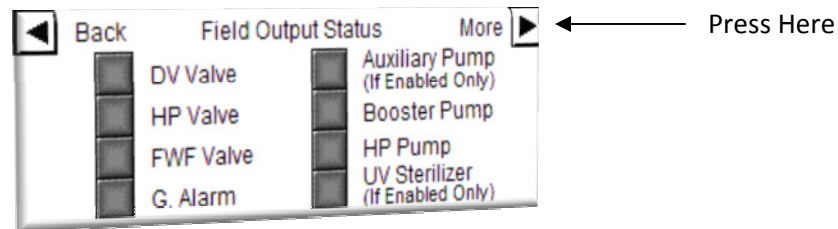
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This will take you to the second of four commissioning screens. The second screen as shown below details all of the outputs currently being powered by the controller. This screen can be used to check for proper external equipment functionality. A grey 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.

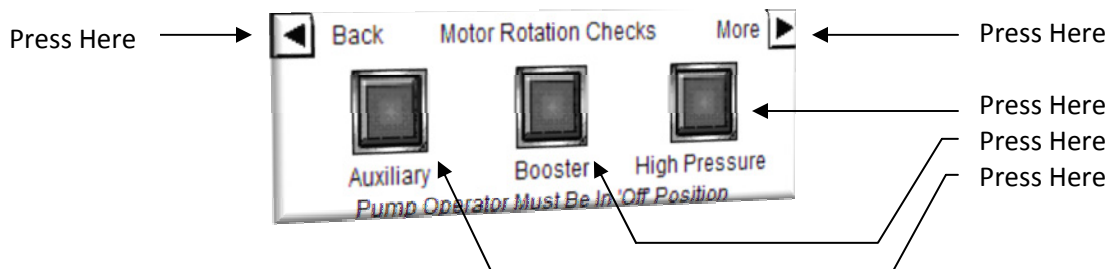
Key:

DV Valve: Product Diversion Valve, Illuminates if the controller is requesting the valve to open
 HP Valve: High Pressure Relief Valve, Illuminates if the controller is requesting the valve to close
 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

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.



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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, press the booster pump jog button, if the booster pump jogs in the correct direction switch the main power disconnect on the control panel door to the 'Off' position, using a screw driver release the lock on the control panel door 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, 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.

If the booster pump spins in the incorrect 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 control panel door and open the control 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 external 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.

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Step 2.

If the auxiliary pump spun in the correct direction, 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 control panel door and open the control 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. 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, 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 external pump and 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.

If there is no external pump fitted and the booster pump spun in the correct direction, proceed to step three.

Step 3.

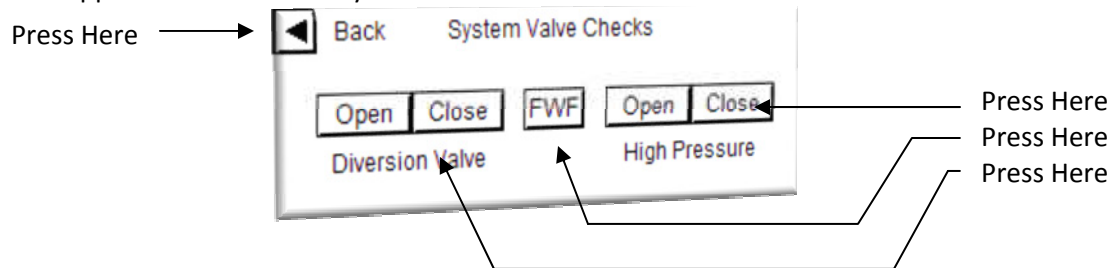
As correct rotation of both booster and High pressure pump are checked and confirmed during the FAT test there is no need to check rotation of the High pressure pump. However, it is still recommended as a final check that you still do so. Press the High Pressure pump jog button and confirm correct rotation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

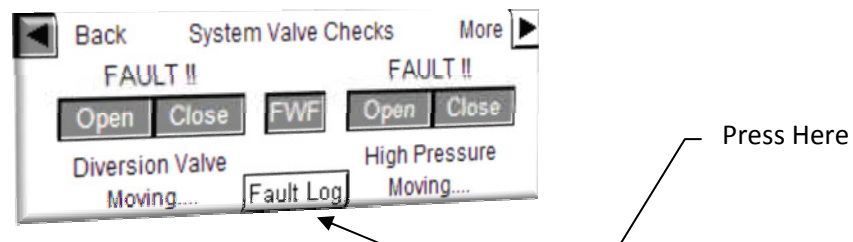
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3.3 Valve Operation Checks

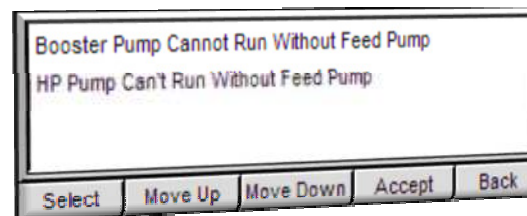
While viewing the 'Motor Rotation Checks' Screen press on the 'More' button at the top right corner of the screen. This will take you to the fourth of four commissioning screens. This screen can be used to manually drive all of the automatic valves currently connected to the control system. To activate 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



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 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.

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4. Editing System Set-points.

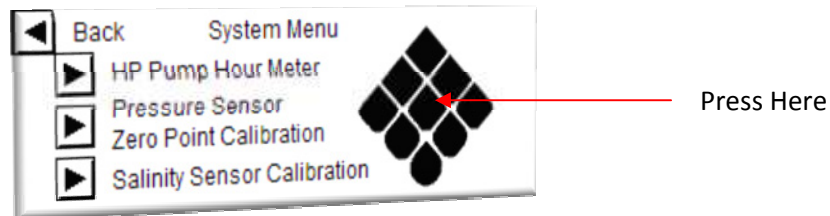
The new Tasman Sea control system comes pre-loaded with typical alarm level set points, system shutdown values, etc. However, these set-points can be accessed and changed should the need arise. It should be noted that changing these configurations is not recommended unless prior authorization has been granted by Danfoss 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 Danfoss 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.

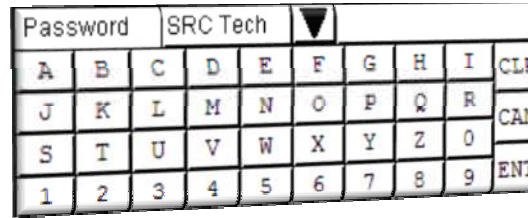


This will take you to the first of two main menu screens. Press on the shown area to access the hidden system set-point editing mode screens.



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

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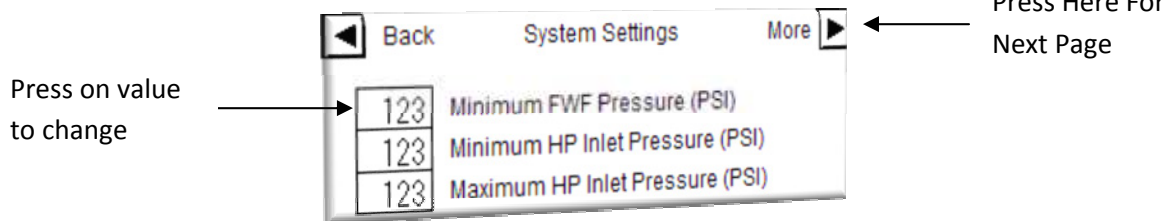


To cancel
press here

Enter Password
and press here

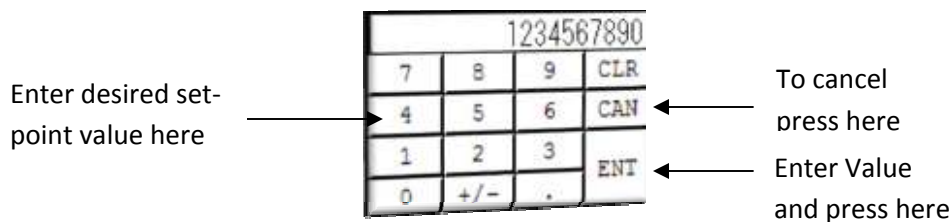
Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

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:



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4.2 Minimum FWF Pressure:

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 Minimum HP Pump Inlet Pressure:

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

4.4 Maximum HP Pump Inlet Pressure:

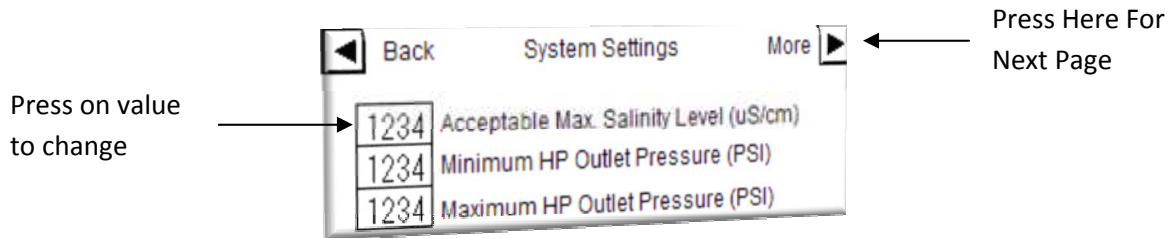
This value determines at what maximum inlet pressure the system will shut down and indicate a High Pressure pump inlet pressure high fault. In order for the Danfoss high pressure pump to operate correctly there cannot be a pressure greater than 75 PSI at the inlet of the pump, pressure above this limit 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

Press the arrow in the upper right hand corner of the screen to move into the next menu

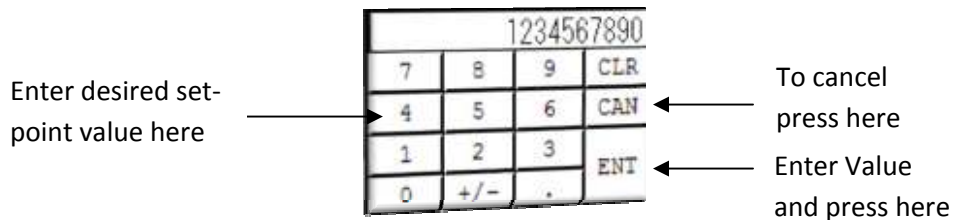
Project: Danfoss Sea Recovery Tasman Sea	 The logo for Danfoss Sea Recovery, featuring the word 'Danfoss' in a stylized red script font above the words 'Sea Recovery' in a black sans-serif font. Below this, in a smaller black font, is the text 'P.O. Box 1004-11, Victoria 3208 Australia'.	Doc: 1010005	Version: 01b
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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 below:



4.5 Acceptable Maximum Salinity Level:

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

4.6 Minimum HP Pump Outlet Pressure:

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

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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 325 PSI in Danfoss pump applications

Typical values entered here are 100 PSI in CAT pump applications

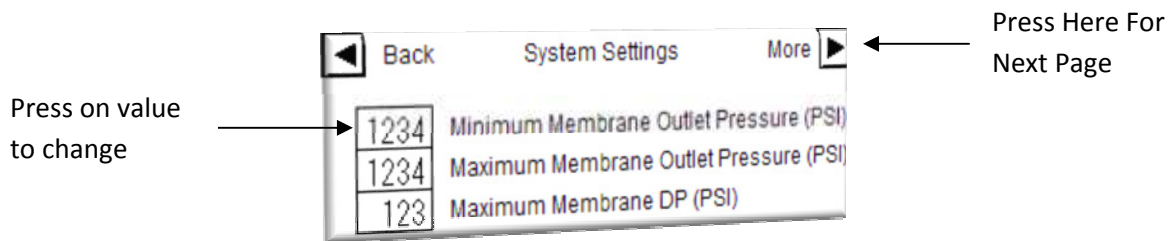
4.7 Maximum HP Pump Outlet Pressure:

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 950 PSI in all pump applications

Press the arrow in the upper right hand corner of the screen to move into the next menu

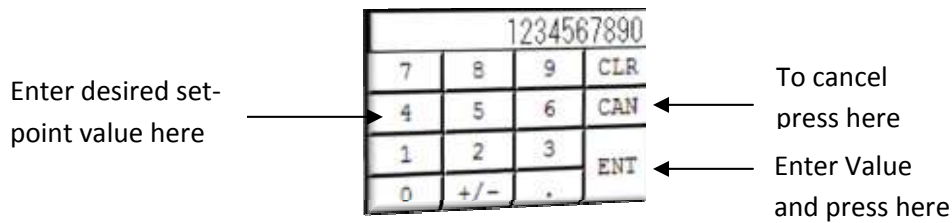
Pressing the arrow in the top right hand corner of the screen will bring you to the following screen:



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:

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4.8 Minimum Membrane Outlet Pressure: (if PT-1005 fitted only)

This value determines at what minimum outlet pressure the system will allow the membrane chain to operate for extended periods of time, this is mainly used as a backup of the minimum high pressure pump outlet pressure mentioned earlier, should for any reason the high pressure pump outlet pressure sensor report as unhealthy, the system will switch to this system parameter in order to provide protection of the high pressure pump. As before 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 325 PSI in Danfoss pump applications
Typical values entered here are 100 PSI in CAT pump applications

4.9 Maximum Membrane Outlet Pressure: (if PT-1005 fitted only)

This value determines at what maximum outlet pressure the system will allow the membrane chain to operate. Operation above the inputted value triggers an instant shutdown of the system, this is mainly used as a backup of the maximum high pressure pump outlet pressure mentioned earlier, should for any reason the high pressure pump outlet pressure sensor report as unhealthy, the system will switch to this system parameter in order to provide protection to the high pressure pump. 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 950 PSI in all pump applications

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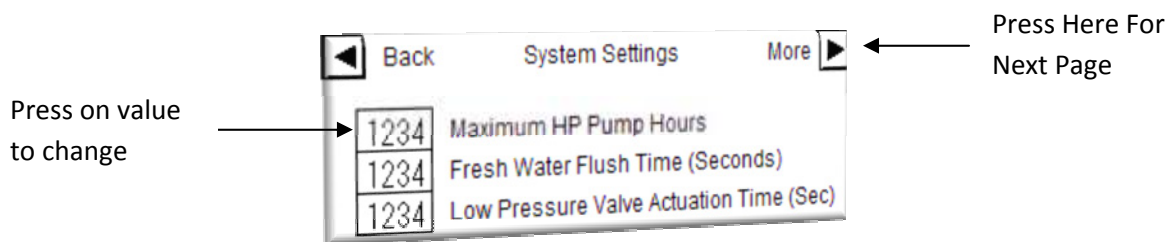
4.10 Maximum Membrane DT Pressure: (if PT-1005 fitted only)

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

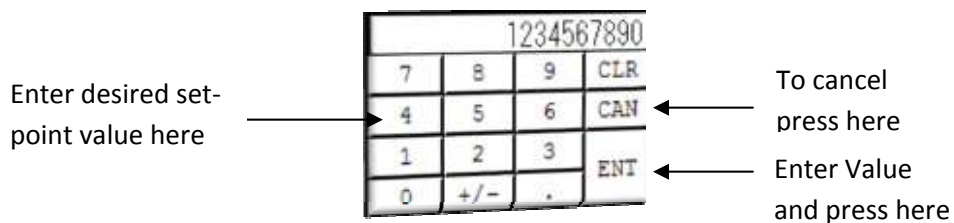
Press the arrow in the upper right hand corner of the screen to move into the next menu

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 below:



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4.11 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

4.12 Fresh Water Flush Time:

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

4.13 Low Pressure Valve Actuation Time:

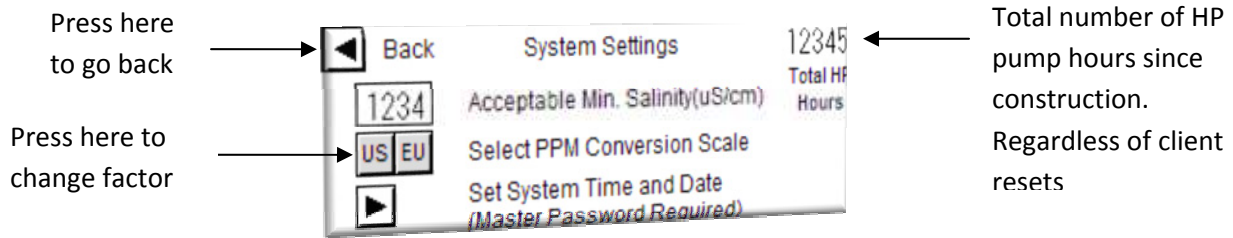
The value entered here (in seconds) determines how long the control system will wait for movement of an automated low pressure valve to complete. If the correct feedback from the valve has not been received before this time expires, the system will either generate a performance warning, or shutdown the 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 25 Seconds in all applications

Press the arrow in the upper right hand corner of the screen to move into the next menu

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



From this screen it is possible to change the following system conversion factors:

4.14 Acceptable Minimum Salinity Level

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 Danfoss Sea Recovery for further details.

To return to the main screen press the arrow in the top left hand corner of the display 5 times.

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5. Normal Operation

5.1 Overview

The new Tasman 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 Tasman 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.

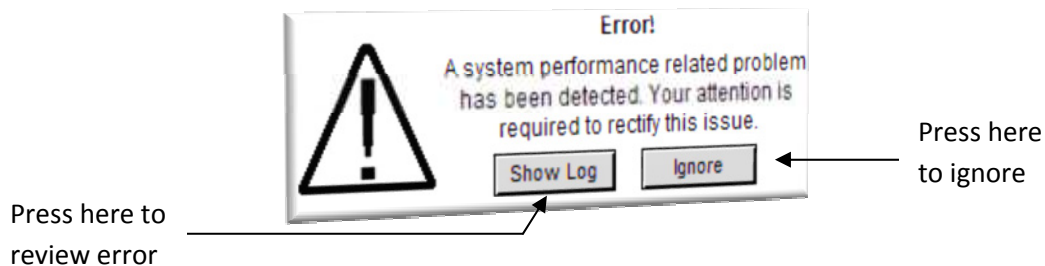
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5.3 Auxiliary Feed Pump Activation: (If installed)

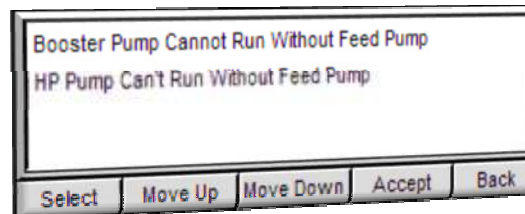
Turn the 'Aux. Pump' operator switch to the 'Pump On' position. The white stop light on the control panel door as well as the 'Aux. Pump' operator switch indicator will illuminate. To stop the pump either turn the 'Aux. Pump' operator back to the 'Off' position, or press the system 'Auto-Stop' button.

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.

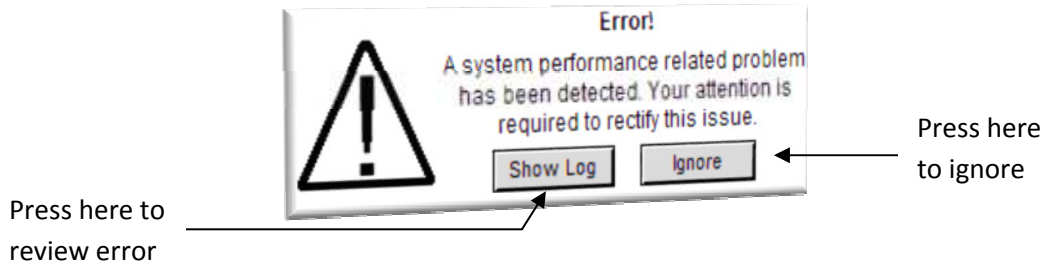
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

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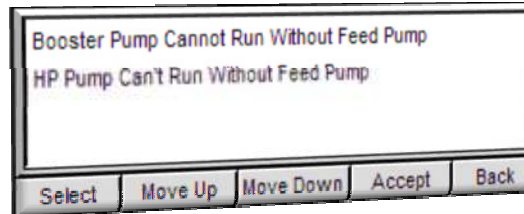
The operator must correct the situation before attempting to continue or restart the pump. To stop the pump either turn the 'Booster Pump' operator back to the 'Off' position, or press the system 'Auto-Stop' button to stop all pumps simultaneously.

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 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.

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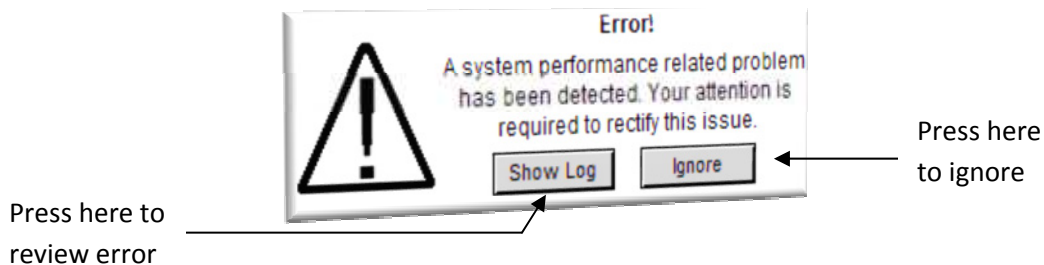
The operator must correct the situation before attempting to continue or restart the pump. To stop the pump either turn the 'High Pressure Pump' operator back to the 'Off' position, or press the system 'Auto-Stop' button to stop all pumps simultaneously.

5.6 Auxiliary Product Pump Activation: (If installed)

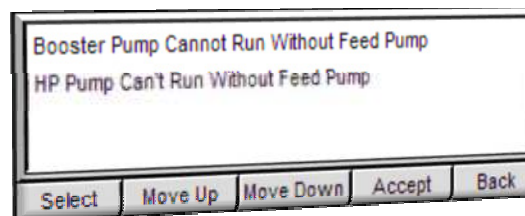
Turn the 'Aux. Pump' operator switch to the 'Pump On' position. The pump operator indicator will not illuminate and the pump will not run until potable water has been detected and successful activation of the product diversion valve has been completed. To stop the pump either turn the 'Aux. Pump' operator 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 attempt to close the high pressure by-pass valve, this action should take no more than a few seconds. 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:



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Pressing 'Select' will highlight the first alarm item.

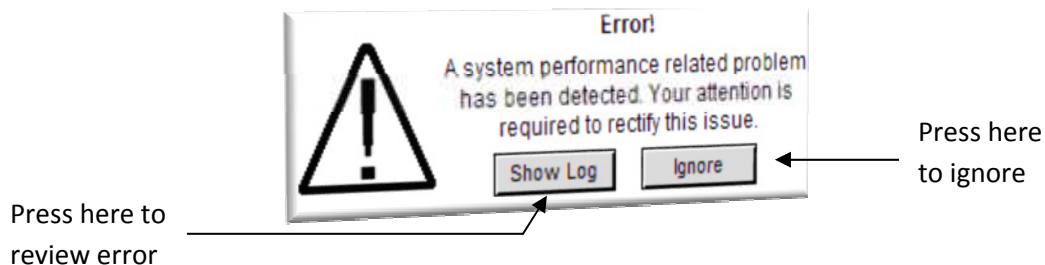
Pressing 'Move Up' will scroll up through the alarm list

Pressing 'Move Down' will scroll down through the alarm list

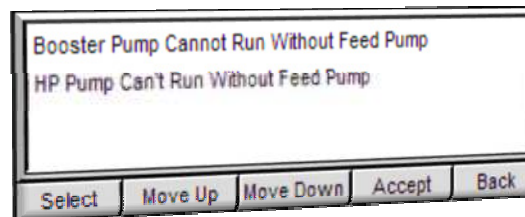
Pressing 'Accept' will clear the listed alarm notifications.

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 high pressure by-pass valve (See Manual Actuation of System Valves). Once the operator has manually actuated the high pressure by-pass valve 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.



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

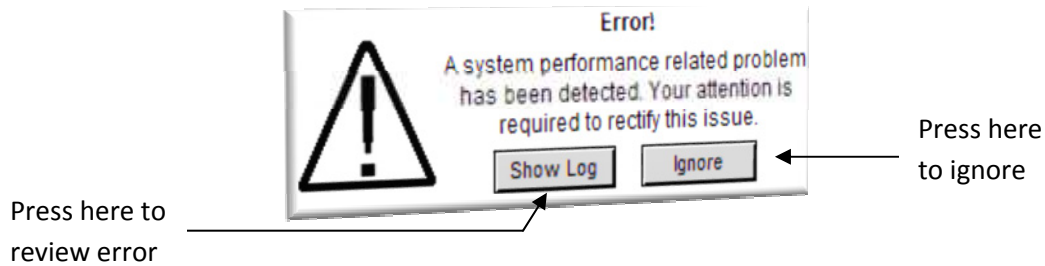
Pressing 'Move Down' will scroll down through the alarm list

Pressing 'Accept' will clear the listed alarm notifications.

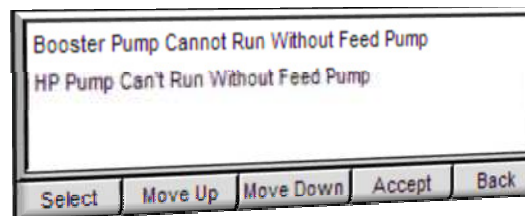
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

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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 to close the 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.

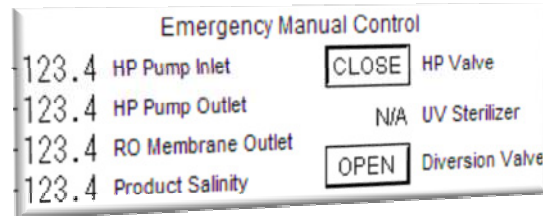
The operator must now manually close the product diversion valve as soon as possible to prevent contamination of the potable water supply.

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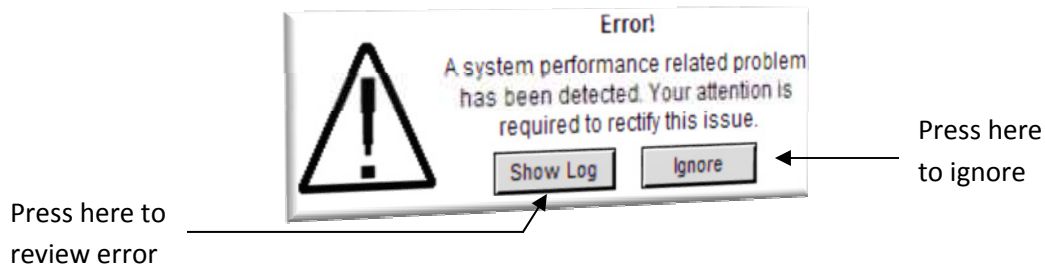
5.8 Manual Salinity Control Operation:

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.

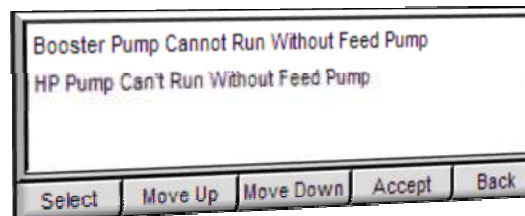
In the event that the salinity sensor has failed the control system will present you with the following screen immediately after successful high pressure pump start up.



From this screen you can monitor all available system pressures and salinity readings if they become available, you can also control system valves directly from this screen. As this screen was brought up by the control system, it automatically attempted to close the high pressure by-pass 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:



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Pressing 'Select' will highlight the first alarm item.

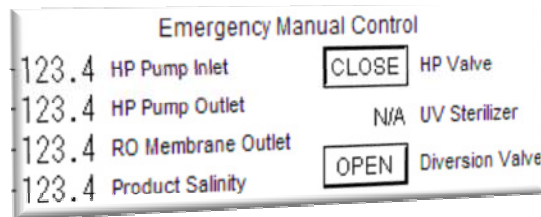
Pressing 'Move Up' will scroll up through the alarm list

Pressing 'Move Down' will scroll down through the alarm list

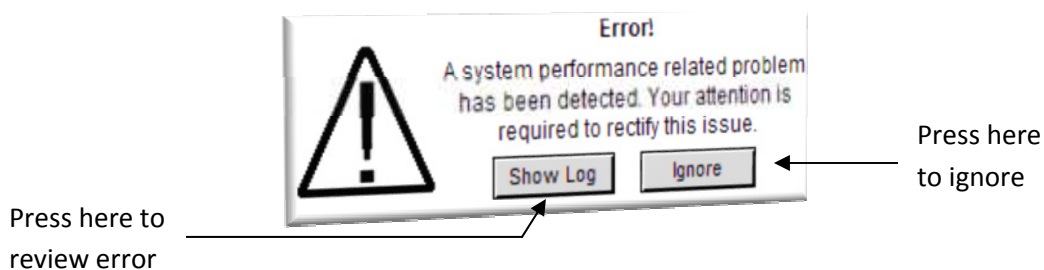
Pressing 'Accept' will clear the listed alarm notifications.

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.

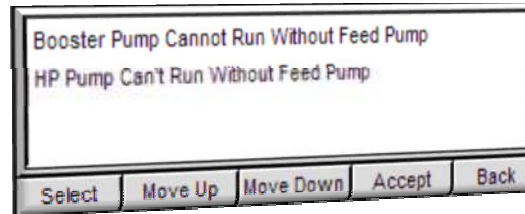


The operator must manually actuate the high pressure by-pass valve in order to continue (See Manual Actuation of System Valves). Once the valve has been manually actuated, the option to activate the UV Sterilizer (if fitted) becomes available; if the UV sterilizer is not fitted the option to control the product diversion valve becomes available. In systems with a UV Sterilizer, once acceptable salinity levels have been measured by the operator turn on the UV system by pressing the button, once you do so a 'Wait' instruction will appear next to the product diversion valve control; this indicator is present while the UV Sterilizer performs its warm up cycle. Once the UV sterilizer is ready this 'Wait' indicator changes into the option to control the product diversion valve, activate the product diversion valve by pressing the control button on the touch screen. 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.



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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.

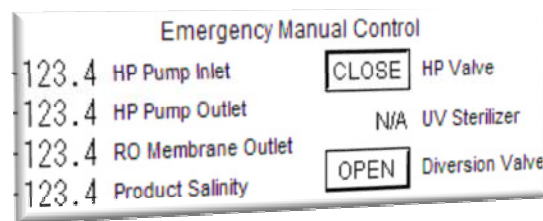
Pressing 'Move Up' will scroll up through the alarm list

Pressing 'Move Down' will scroll down through the alarm list

Pressing 'Accept' will clear the listed alarm notifications.

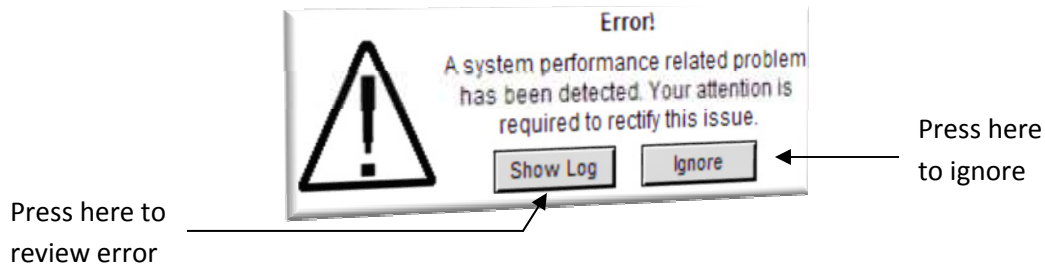
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

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

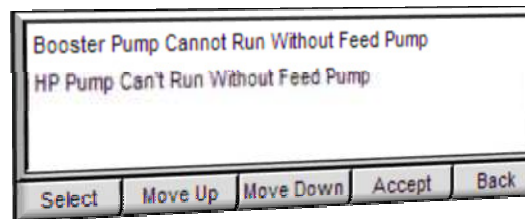


The operator must manually actuate the product diversion valve in order to continue (See Manual Actuation of System Valves). Once the valve has been manually actuated, the system will report as 'producing water in manual mode'. Manual control of the product pump is now available (if fitted). The operator 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.

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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).

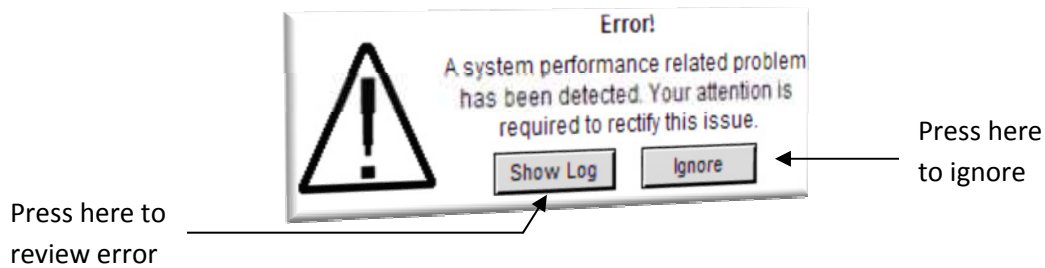
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6. Manual Shutdown

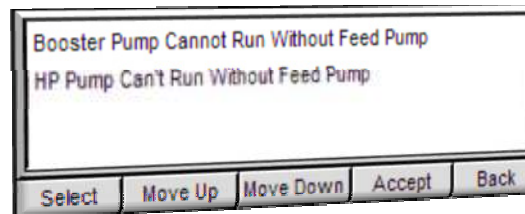
To stop the system at any point within manual mode operation simply press the 'Auto-Stop' button, all pumps will stop simultaneously and all activated valves will be requested to return to their home positions. If any valve fails to activate properly the control system will raise performance warning 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 high pressure by-pass and product diversion valves to their home position. If any 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.

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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.

Project: Danfoss Sea Recovery Tasman Sea	 The logo for Danfoss Sea Recovery, featuring the word 'Danfoss' in a red script font and 'Sea Recovery' in a black sans-serif font below it. At the bottom, in small text, it says 'P.O. Box 10000, Christchurch, New Zealand'.	Doc: 1010005	Version: 01b
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7. Automatic Start up Operation

Automatic start up operation is a new feature added to the Tasman 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.

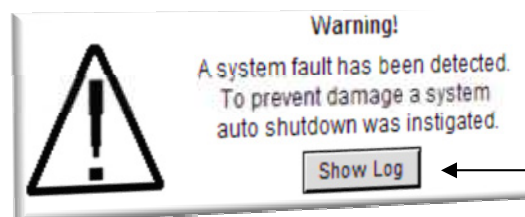
Ensure that the E-Stop button is not pressed in. If the E-stop button is illuminated, the button is pressed in, release it by turning the mushroom in a clockwise direction.

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.



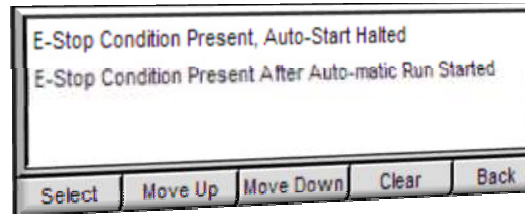
Immediately after the 'Auto-Start' button is pressed, the green indicator light embedded in the button will begin to flash rapidly, at this moment the system is performing system pre-checks, if a problem is detected the system will abort the automatic start-up routine and display a system fault notification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



Press here to review fault

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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

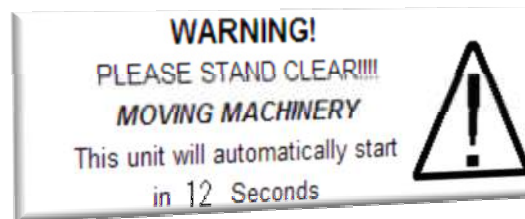
Pressing 'Move Down' will scroll down through the alarm list

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.

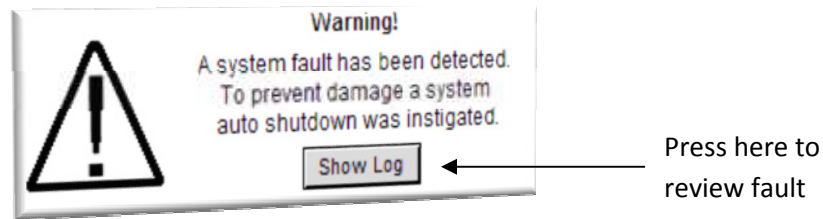
The operator must correct the detected problem before re-attempting automatic operation.

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 below:

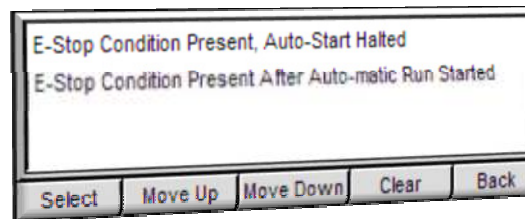


Once the 10 second count-down has been completed the control system will activate the auxiliary feed pump (if fitted), once the auxiliary feed pump has successfully run for 10 seconds, or if the auxiliary feed pump is not fitted the control system will start the booster pump. The control system now performs 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 on the next page:

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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

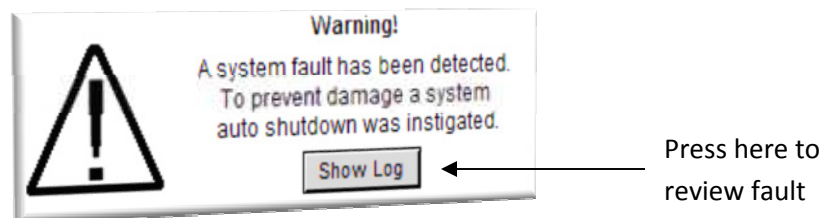
Pressing 'Move Down' will scroll down through the alarm list

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.

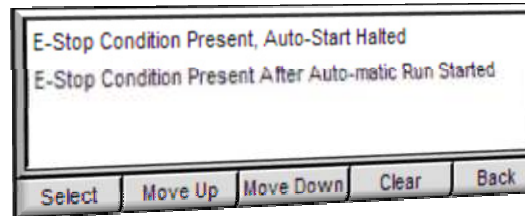
The operator must correct the detected problem before re-attempting automatic operation.

If pre-filtration pressures reach expected levels the control system will activate the high pressure pump. Once activated the control system will attempt to close the high pressure by-pass valve, if the valve fails to actuate correctly 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:



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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

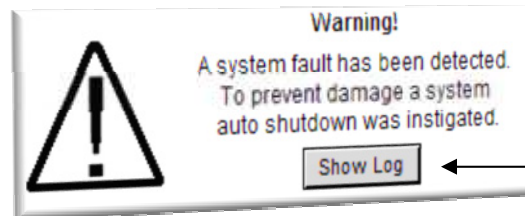
Pressing 'Move Down' will scroll down through the alarm list

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.

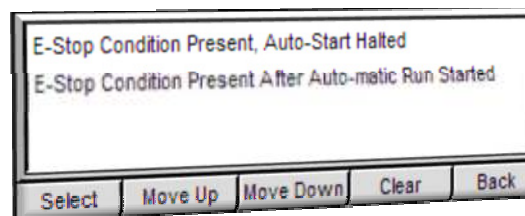
The operator must correct the detected problem before re-attempting automatic operation.

If the high pressure relief valve actuated as expected 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:



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Pressing 'Select' will highlight the first alarm item.

Pressing 'Move Up' will scroll up through the alarm list

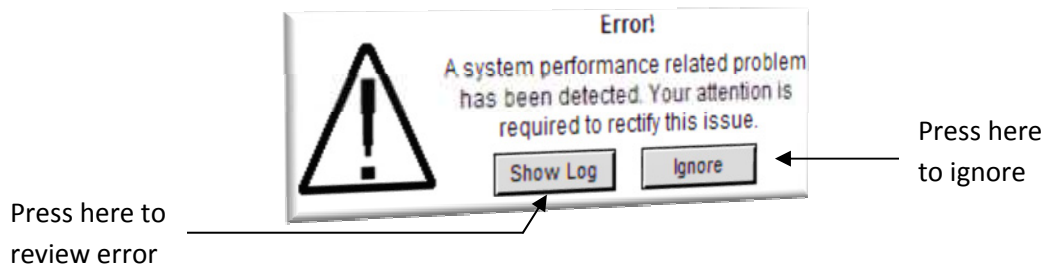
Pressing 'Move Down' will scroll down through the alarm list

Pressing 'Clear' will clear the listed alarm notifications.

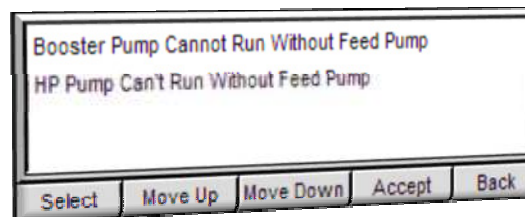
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Clear' to exit this screen.

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

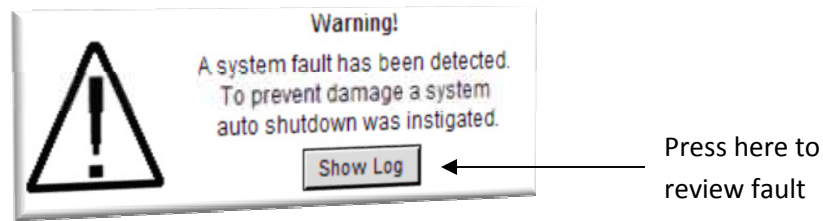
Pressing 'Accept' will clear the listed alarm notifications.

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.

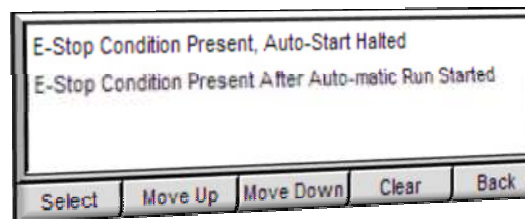
The system will continue to operate in this state for a further 10 minutes. If the system pressure has not been raised above minimum levels within this time the automatic operation routine will be aborted. All

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running pumps are shutdown, all activated valves will be 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:



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



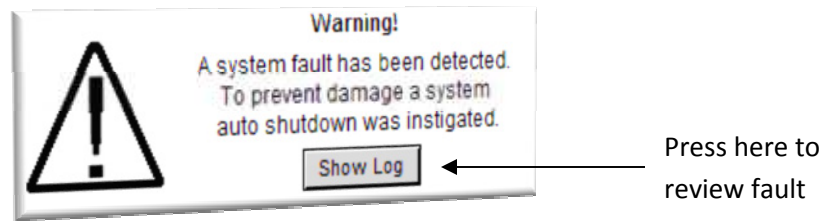
Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Clear' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button 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.

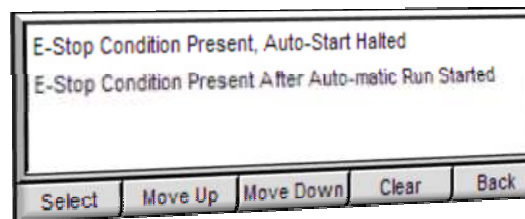
If high pressure pump outlet pressures are deemed above minimum and below maximum the system will begin monitoring product water salinity levels. If at any point high pressure pump outlet or inlet pressures stray beyond acceptable levels the automatic operation routine will be aborted. All running

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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:



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

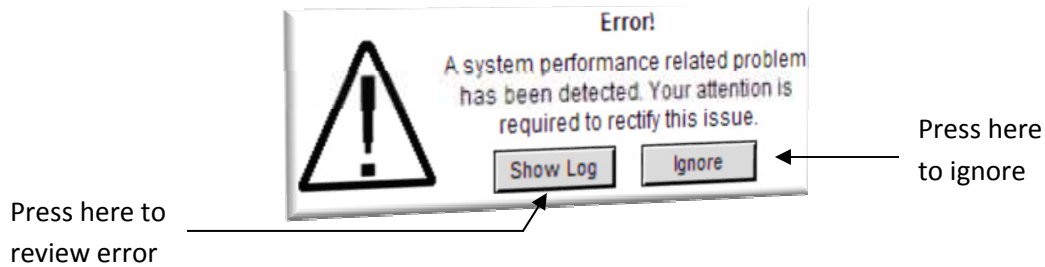


Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Clear' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button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

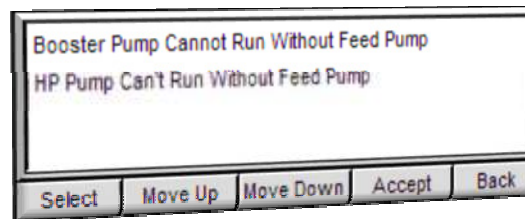
The operator must correct the detected problem before re-attempting automatic operation.

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 on the next page:

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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:

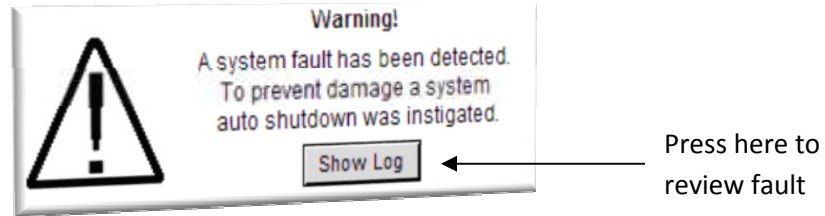


Pressing 'Select' will highlight the first alarm item.
Pressing 'Move Up' will scroll up through the alarm list
Pressing 'Move Down' will scroll down through the alarm list
Pressing 'Accept' will clear the listed alarm notifications.
Pressing 'Back' will exit the alarm list. Please note the 'Back' button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

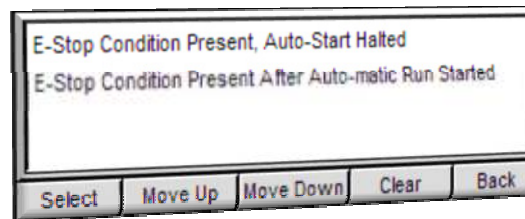
The system will continue to operate in this state continuously or until shutdown by the operator or a fault is detected.

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 on the next page:

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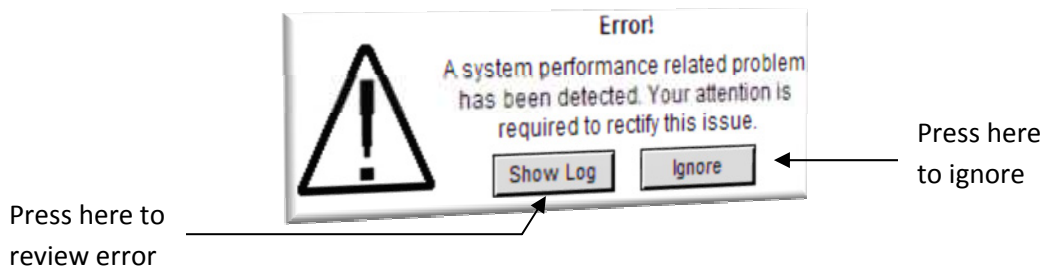
Pressing 'Show Log' will open the system fault log window where details concerning the detected fault are given as shown below:



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.

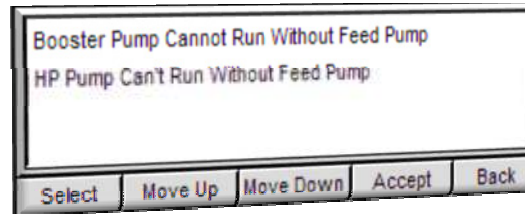
The operator must correct the detected problem before re-attempting automatic operation.

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.



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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

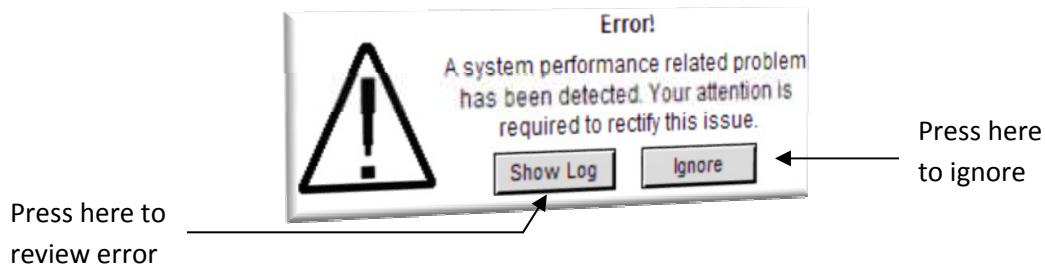
Pressing 'Move Down' will scroll down through the alarm list

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.

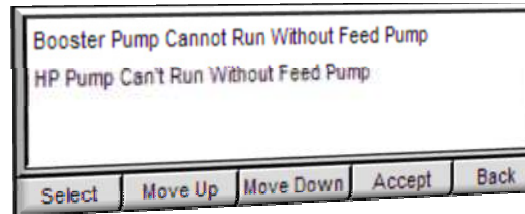
It will also de-activate the product diversion valve, deactivate the product auxiliary pump, and place the UV Sterilizer system into a shutdown routine (if fitted). If acceptable salinity levels are detected once again, the control system will activate the UV Sterilizer warm up routine (if fitted), and 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.



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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.

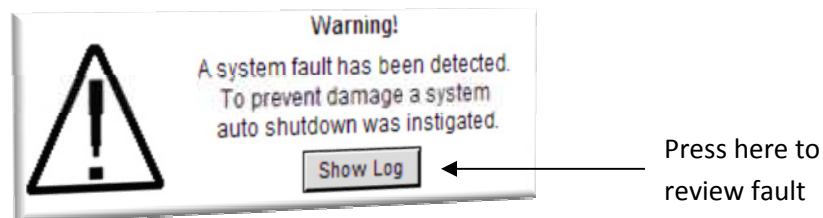
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8. Automatic Shut down Operation:

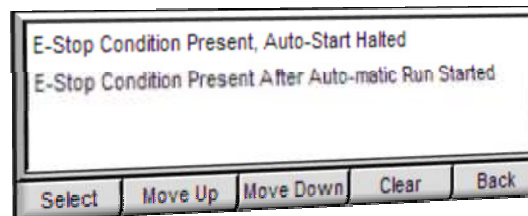
At any time in the automatic start up process the system can be shut down by pressing the 'Auto-Stop' button, pressing this button results in a controlled shutdown of the system. This controlled shut down can take up to 45 seconds to complete depending on where the system was in its automatic start up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



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.

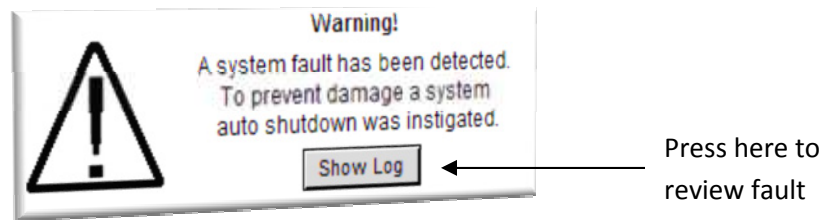
The operator must correct the detected problem before re-attempting automatic operation.

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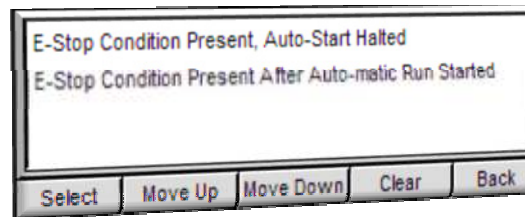
9. Emergency Shutdown Operation:

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:



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.

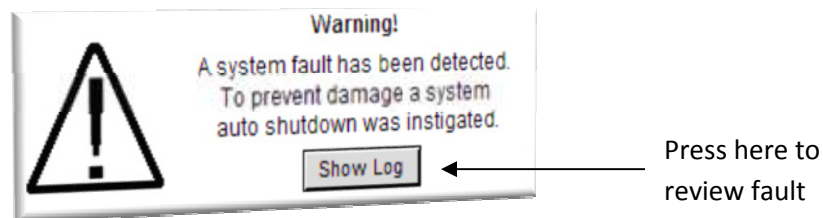
The operator must release the E-Stop button and accept this warning before re-attempting automatic operation.

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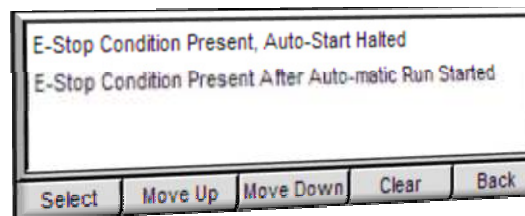
10. System Critical Error Messages

The Tasman 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 of 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:



You must press the 'Show Log' button to access 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.

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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	High Pressure Valve Position Error. Start-Up Aborted	The high pressure by-pass valve is not currently in the correct position (open) for starting. Check that the valve is switched to auto and that the current position is correct
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

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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	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
14	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
15	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
16	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
17	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
18	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

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19	Spare	Not Currently Used
20	Automatic BPR Fault. Start-Up Aborted**	The automatic back pressure regulator valve is reporting an error, check the system messaging area for further details, and rectify before continuing. (only on fully automatic models)
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 DSRC 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

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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 DSRC 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 DSRC for assistance
34	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
35	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)

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36	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)
37	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
38	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)
39	Product 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)
40	Product 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)
41	Product 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)
42	Product 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.

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43	Product 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.
44	Product 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)
45	Product 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)
46	High Pressure 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)
47	High Pressure 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)
48	High Pressure Valve Failed To Complete Close Motion	The control system commanded the product diversion valve to open. 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)
49	High Pressure Valve Closing Fault	This fault indicator is usually raised along with either a failure to respond to close command fault, or an open command motion failed to complete.

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50	High Pressure Valve Opening Fault	This fault indicator is usually raised along with either a failure to respond to open command fault, or a close command motion failed to complete.
51	High Pressure 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)
52	High Pressure 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 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)
53	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)
54	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)
55	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)
56	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.

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57	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.
58	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)
59	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)
60	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)
61	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)
62	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)
63	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.

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64	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.
65	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)
66	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)
67	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)
68	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)
69	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)
70	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.

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71	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.
72	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)
73	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)
74	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.
75	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.

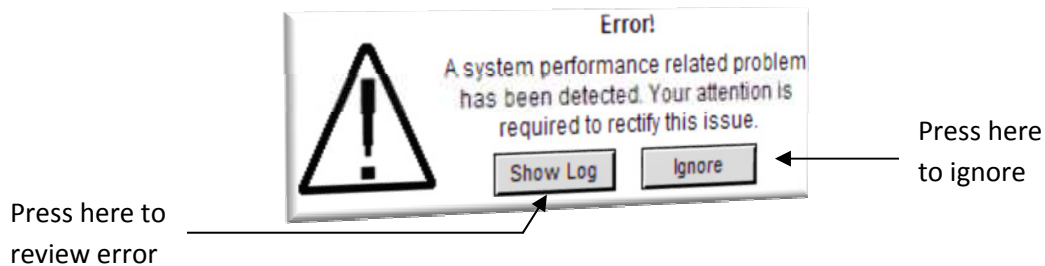
** = Indicates optional components

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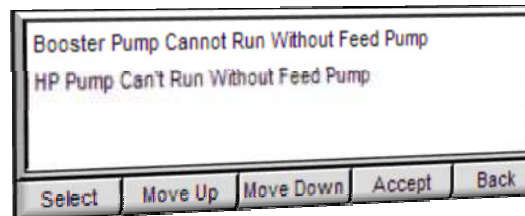
11. System Performance Messages

The Tasman 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 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.

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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

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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 DSRC 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 DSRC 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 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.
14	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.

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15	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.
16	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.
17	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 pressure sensor.
18	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 pressure sensor.
20	Reserved For Future Performance Warning Use	Reserved
25	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 DSRC for additional information
26	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 DSRC for additional information
27	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.

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28	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
29	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
30	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
31	High Pressure Pump Requires Servicing	The high pressure pump has run for more than 8000 hrs and now requires servicing
32	High Pressure Relief Valve Has Failed To Activate (Man)	The operator is running the system manually, and automatic activation of the high pressure relief valve failed to complete successfully. To continue the operator must actuate the valve manually
33	Product 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
36	Insufficient Fresh Water Flush Inlet Pressure**	Fresh water flush mode is currently active but insufficient pressure is detected at the fresh water flush inlet.
37	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.
38	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.

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39	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.
40	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.
41	Salinity Probe Reading as 'In Air', Values Can't Be 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.
42	Product 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

** = Indicates optional components

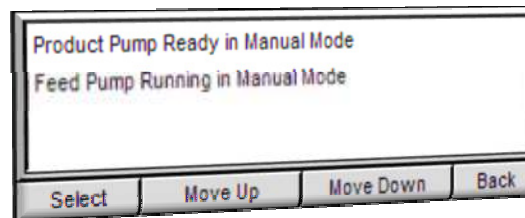
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12. System Status Messages

The Tasman 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:



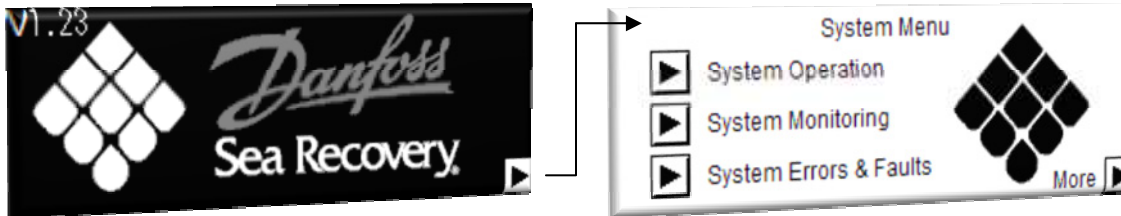
Pressing 'Select' will highlight the first message item.
Pressing 'Move Up' will scroll up through the message list
Pressing 'Move Down' will scroll down through the message list
Pressing 'Back' will return you to the system message selection menu.

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

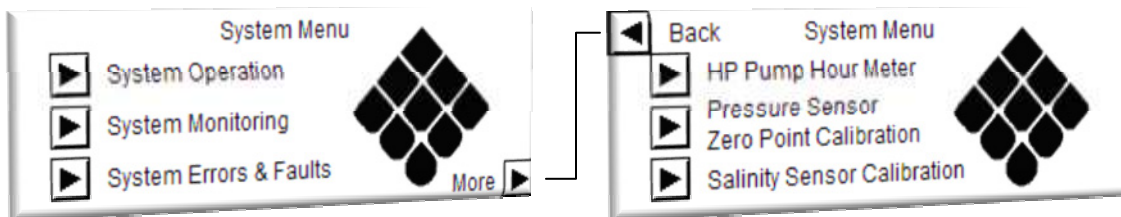
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13. Menu Navigation

The new Tasman 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.

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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:



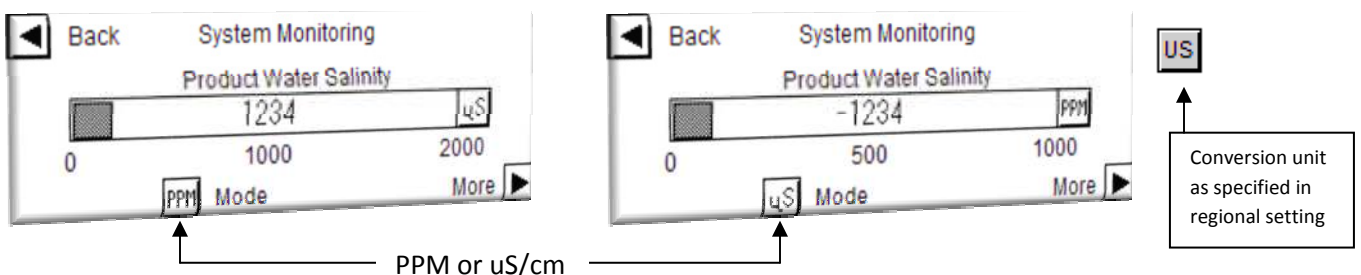
Pressing the arrow in the top left hand corner of the system operation screen will return you to the first menu screen.

13.2 Accessing Product Salinity Level Screens:

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

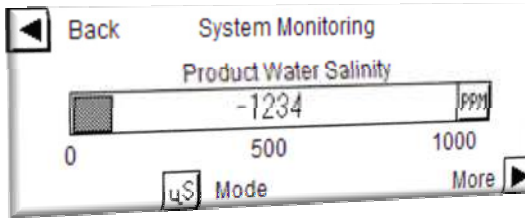


The current product water salinity readings are displayed. By default the system will display product water salinity in uS/cm. This can be changed to PPM if the user prefers this measuring system. To change from uS/cm to PPM press the 'PPM' button in the lower section of the salinity monitoring screen. 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:

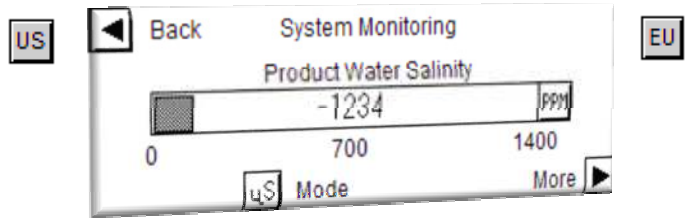


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As you press the 'PPM' button the type of display you see will differ depending on what the regional settings are within the water maker (US/EU) as shown below:



US Region Settings



EU Regional Settings

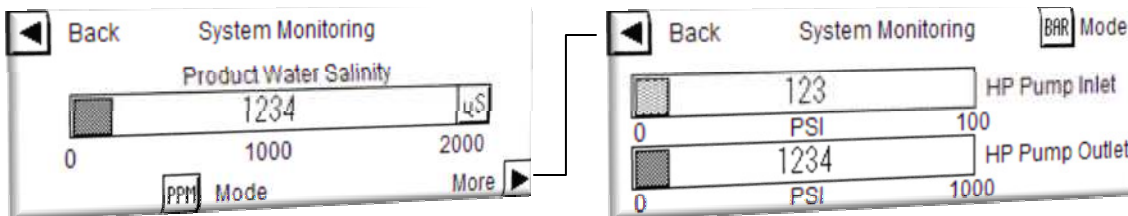
When switching between uS/cm and PPM the system will remember the last chosen unit of display and will automatically return to it when you next access the product salinity monitoring feature.

13.3 Accessing System Pressure Screens:

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

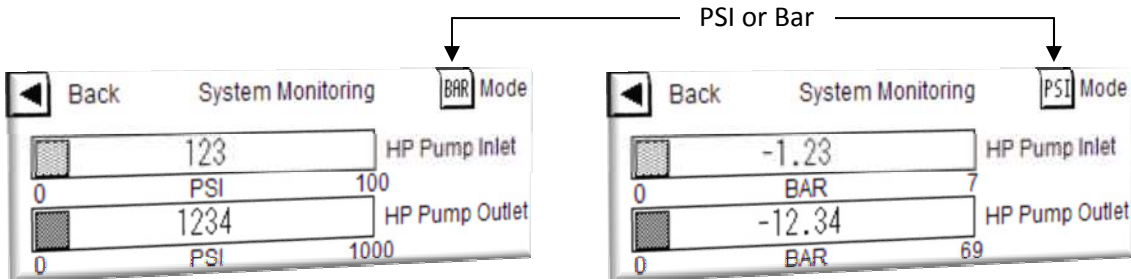


The current product water salinity readings are displayed. To navigate to the pressure readings screen press the arrow in the lower right hand corner of the salinity display screen. Pressing this arrow will take you to the pressure monitoring screen as shown below:

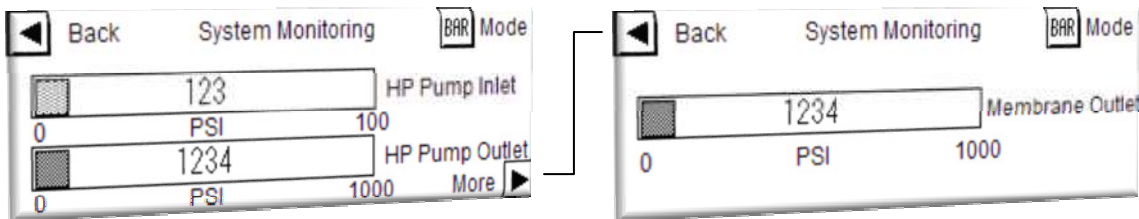


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By default the system will display system pressures in PSI. This can be changed to Bar if the user prefers this measuring system. To change from PSI to Bar press the 'Bar' button in the upper right section of the pressure monitoring screen. As you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



If additional pressure sensors are available for monitoring a 'More' button will be visible from the pressure monitoring screen, if this is visible additional system pressure displays are available, press on the arrow in the lower right hand corner of the system pressure display screen to access readings for the additional sensors as shown below:



Press on the arrow the upper left hand corner of the second system pressure display screen to return to the first system pressure display.

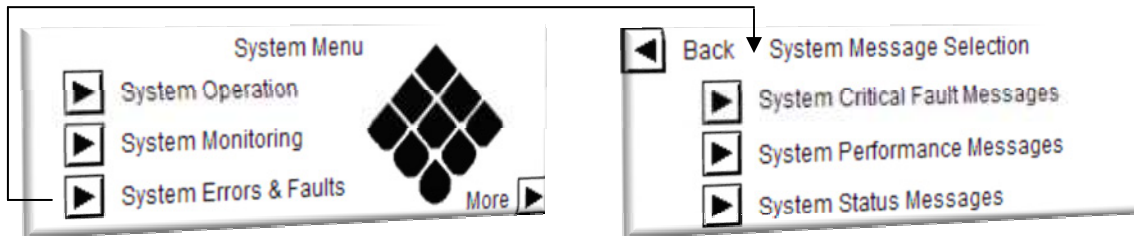
User preference for unit display is applied to these additional reading screens.

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

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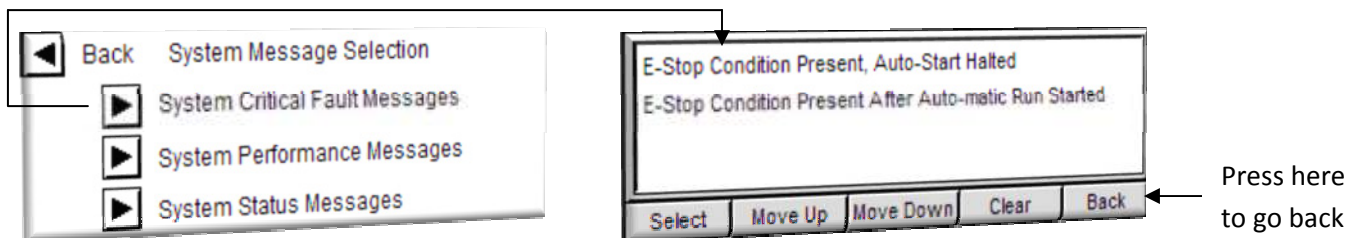
13.4 Accessing System Message Centers

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



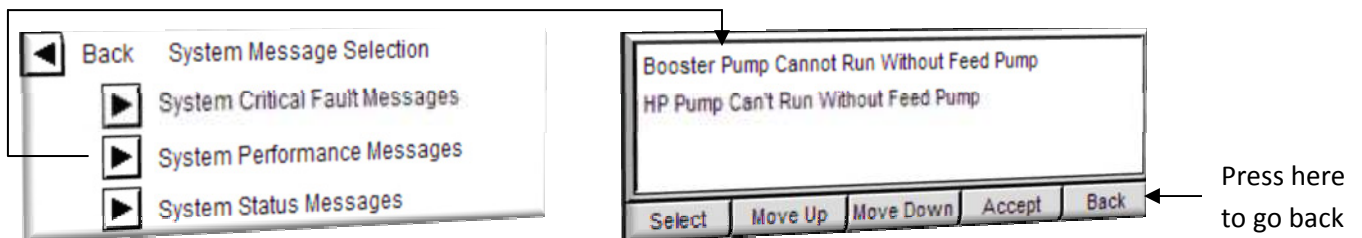
Pressing this button will lead you to the 'System Message Selection' Screen, from here you can access all three of the control system message centers.

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

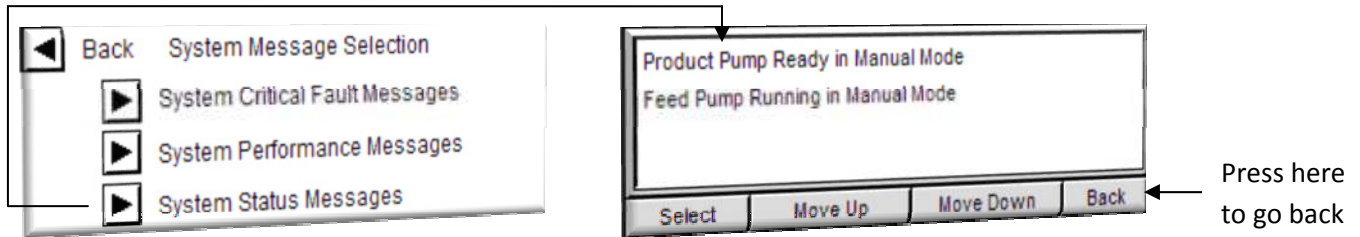
To access the 'System Performance' message center, press on the arrow next to the text 'System Performance Messages', doing so will open the requested message center as shown below:



To return back to the menu screen press the back button

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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:



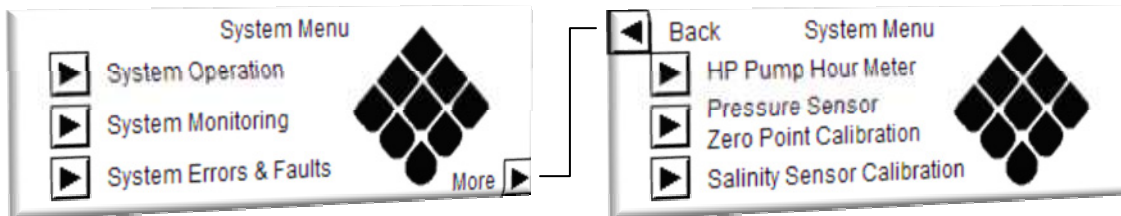
To return back to the menu screen press the back button

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:



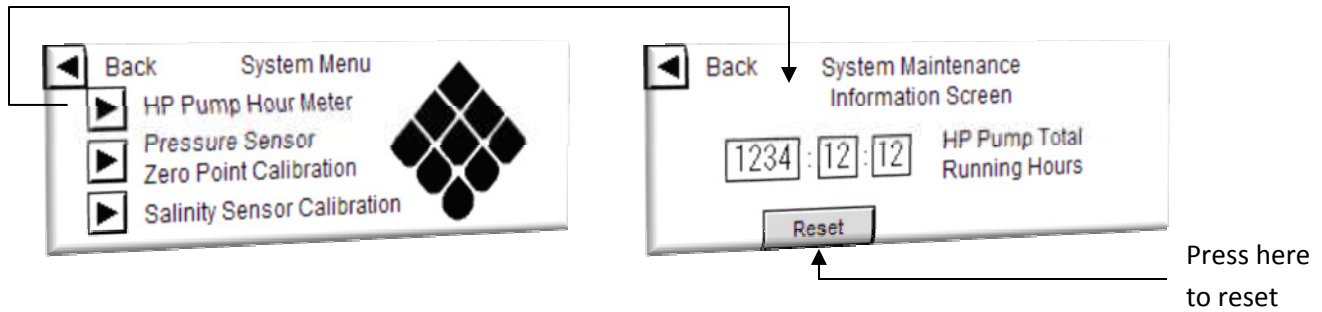
13.5 Accessing High Pressure Pump Hour Meter

To view the current amount of running hours endured by the high pressure pump, press on the arrow in the lower right corner of the 'System Menu' screen as shown below:



Pressing this button will lead you to the second 'System Menu' Screen; from here you can access the high pressure pump hour meter by pressing on the arrow next to the text 'HP Pump Hour Meter', doing this will bring you to the 'System Maintenance Information' screen as shown on the next page:

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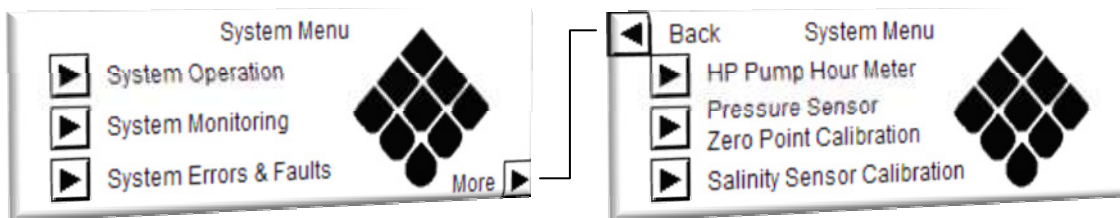


Pressing the arrow in the top left hand corner of the screen will return you to the second 'System Menu' screen.

From this 'System Maintenance Information' 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 or over, until this time, the 'Reset' button is not active.

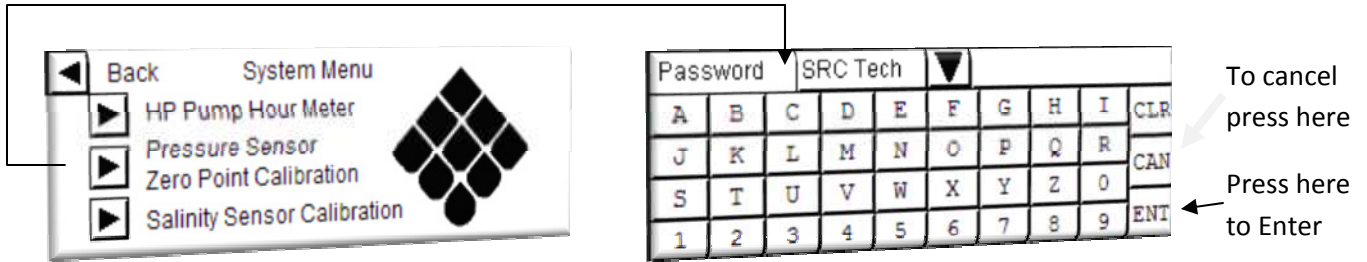
13.6 Accessing Pressure Sensor Calibration Screens

To access the pressure sensor calibration screen, press on the arrow in the lower right corner of the 'System Menu' screen as shown below:



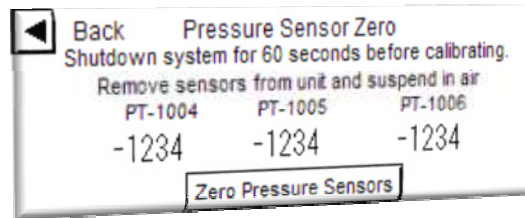
Pressing this button will lead you to the second 'System Menu' screen; from here you can access the pressure sensor calibration screen by pressing on the arrow next to the text 'Pressure Sensor Zero-Point Calibration', doing this will bring you to the 'Password Required' screen as shown on the next page:

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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.



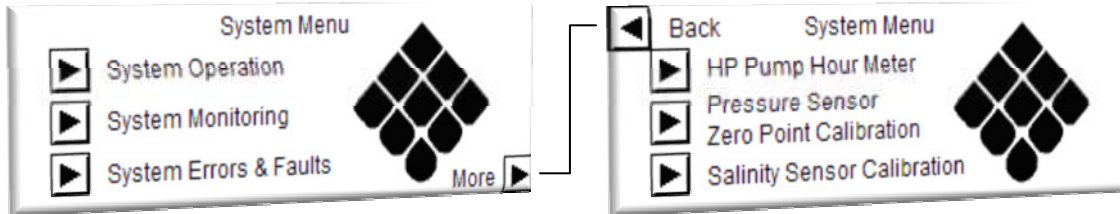
From this screen you can perform a zero-pressure calibration of the pressure sensor system. Please see the 'System Maintenance' section for further details.

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

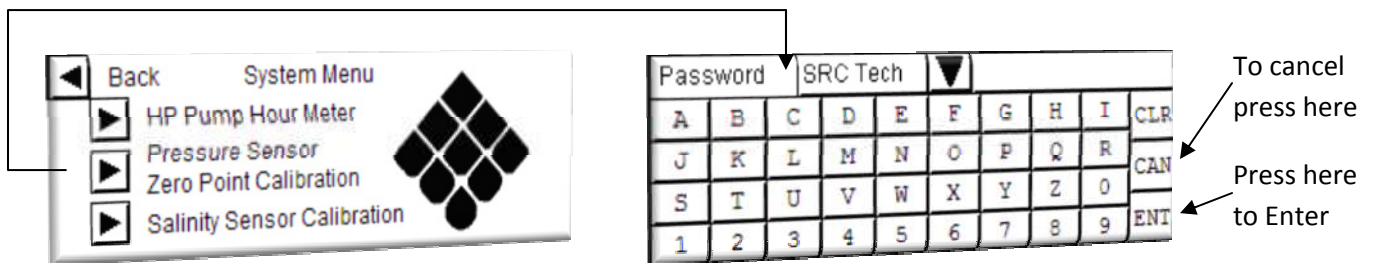
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13.7 Accessing Salinity Sensor Calibration

To access the salinity sensor calibration screen, press on the arrow in the lower right corner of the 'System Menu' screen as shown below:

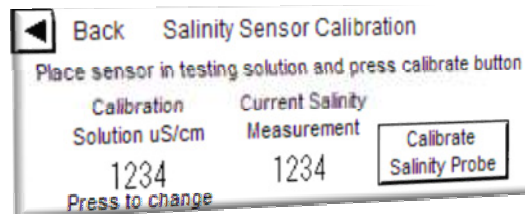


Pressing this button will lead you to the second 'System Menu' screen; from here you can access the salinity sensor calibration screen by pressing on the arrow next to the text 'Salinity Sensor Calibration', doing this will bring you to the 'Password Required' screen as shown on below:



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.

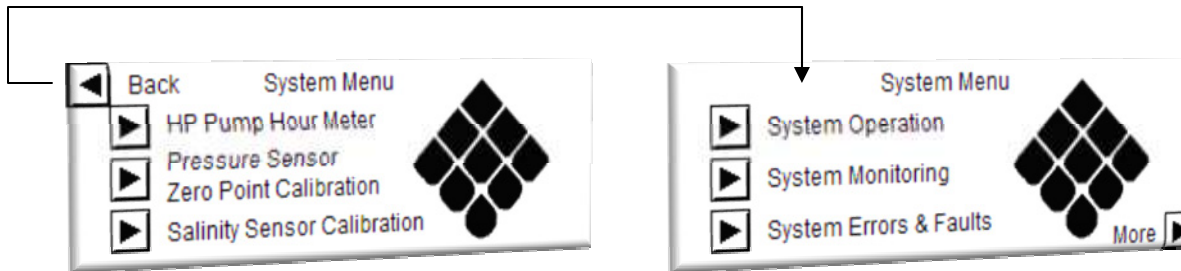


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From this screen you can perform a calibration of the salinity sensor system. Please see the 'System Maintenance' section for further details.

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

Pressing the arrow in the top left corner of the second 'System Menu' screen will return you to the first 'System Menu' screen as shown below:

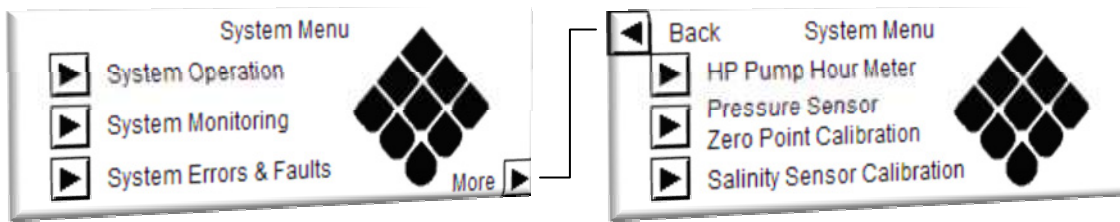


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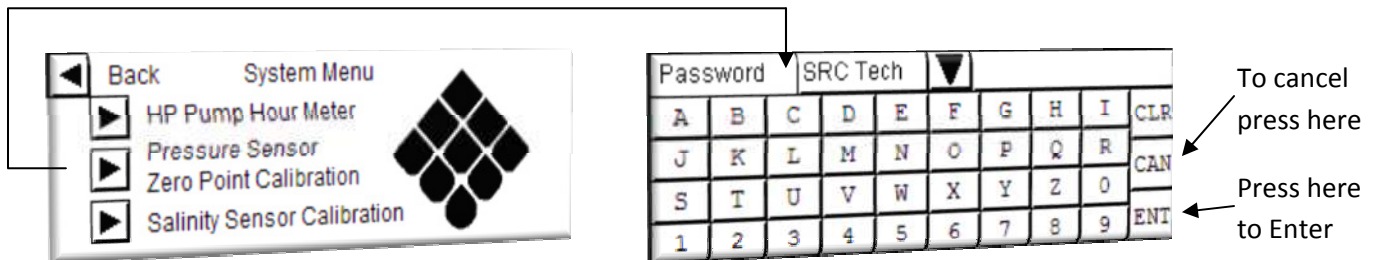
14. System Maintenance

14.1 Performing system pressure sensor zero-point calibrations

To access the pressure sensor calibration screen, press on the arrow in the lower right corner of the 'System Menu' screen as shown below:



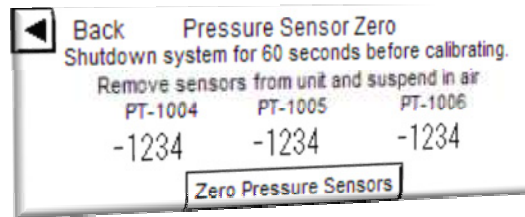
Pressing this button will lead you to the second 'System Menu' screen; from here you can access the pressure sensor calibration screen by pressing on the arrow next to the text 'Pressure Sensor Zero-Point Calibration', doing this will bring you to the 'Password Required' screen as shown below:



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.

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



From this screen it is possible to perform a zero-pressure calibration of the pressure sensor system.

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 sensor.
4. Unscrew the sensors from the manifold.
5. Re-secure the power plug to the top of each sensor.

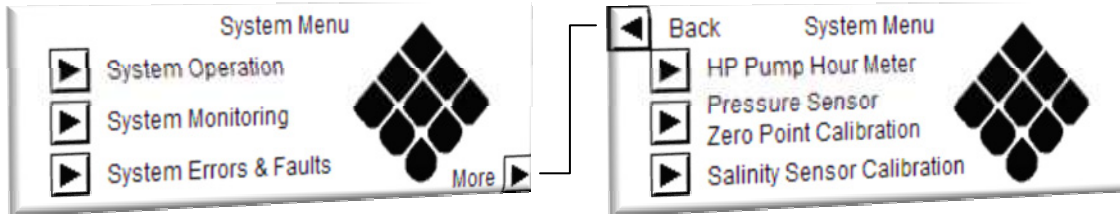
Wait a brief moment to allow the control system to complete analog channel health tests, these tests will be automatically instigated once a sensor signal was lost due to the power plug being removed. Once all internal tests are complete you will see the current pressure readings of each connected sensor 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 there is an analog channel health issue preventing the system from calibrating. Back out of the 'Pressure Sensor Zero' 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 'Pressure Sensor Zero' screen once again to perform the sensor calibration.

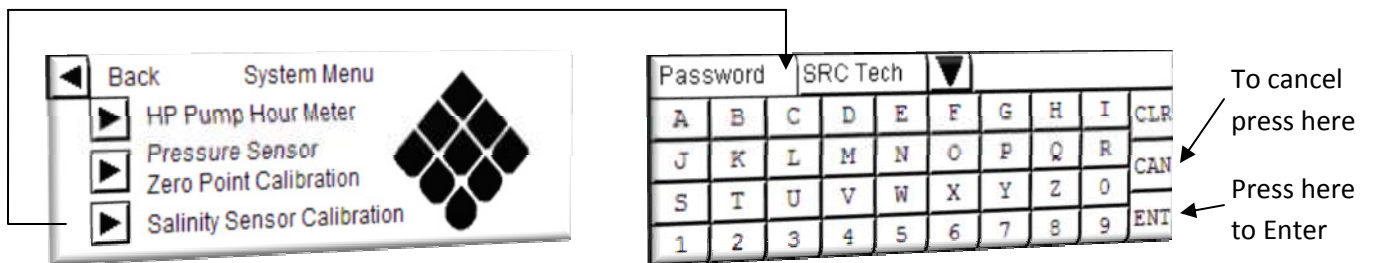
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14.2 Performing Salinity Sensor Calibration

To access the salinity sensor calibration screen, press on the arrow in the lower right corner of the 'System Menu' screen as shown below:

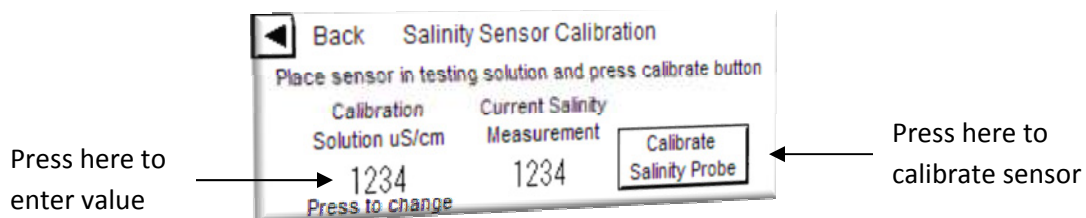


Pressing this button will lead you to the second 'System Menu' screen; from here you can access the pressure sensor calibration screen by pressing on the arrow next to the text 'Pressure Sensor Zero-Point Calibration', doing this will bring you to the 'Password Required' screen as shown below:



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.



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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:



5. 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.
6. Remove the salinity sensor probe from the bag of testing solution and re fit it into the water maker.
7. 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.

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15. Emergency Operation

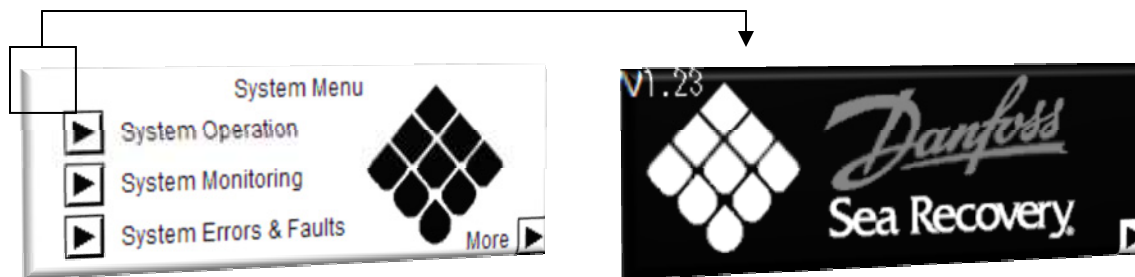
15.1 Accessing Emergency Override Menus:

One of the newer features of the Tasman 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.

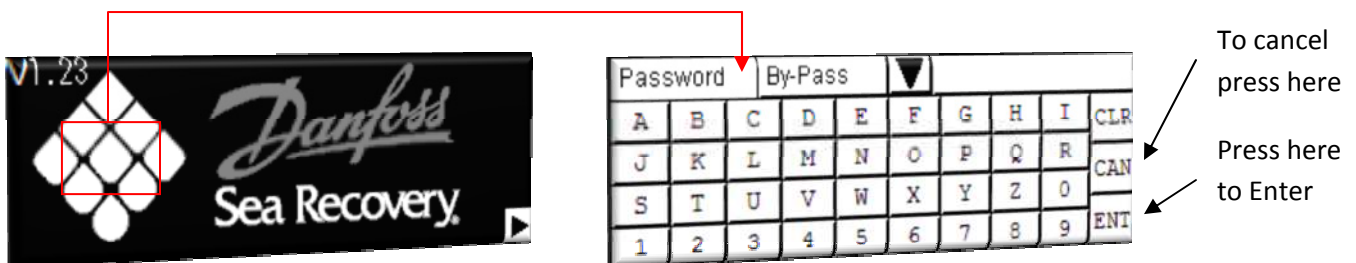
Operation in emergency mode is only possible for brief periods of time; therefore it is vital that the required sensor is ordered as soon as possible to prevent water shortages.

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 DSRC. 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:



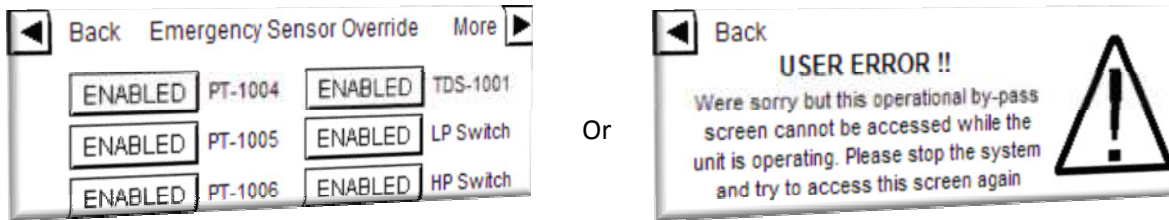
From the home screen press on the indicated area to access the 'Emergency Sensor Override' menu.



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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.

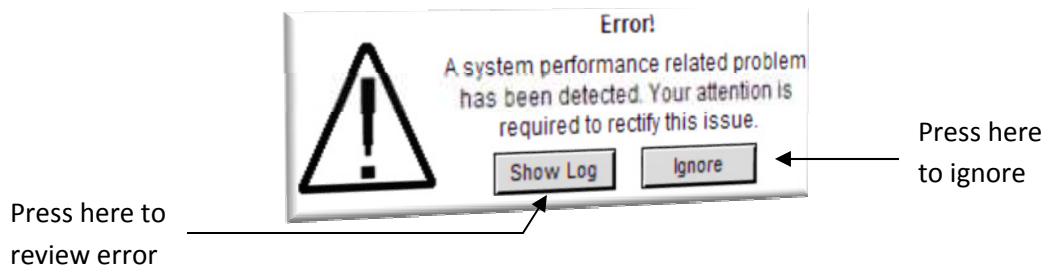


The illustrated 'User Error' screen will only appear if the system was in operation at the time you tried to access the emergency by-pass menu. Shutdown the system and try to access this feature again. If the system was off-line the 'Emergency Sensor Override' screen would have been displayed.

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.

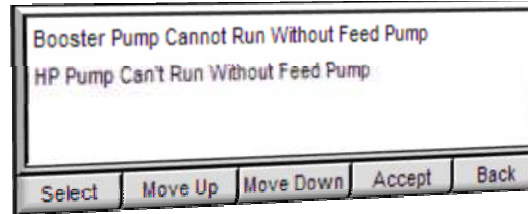
It is not possible to disable both the low pressure sensor and the low pressure switch at the same time. If you attempt to do this, the button to the second device being disabled will become un-responsive.

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 on the next page:

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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.

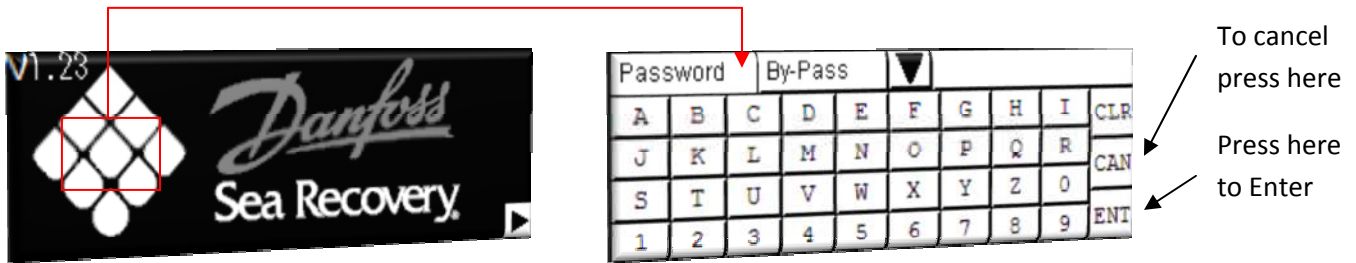
15.2 Accessing Emergency Override Operation Time:

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 DSRC. 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:



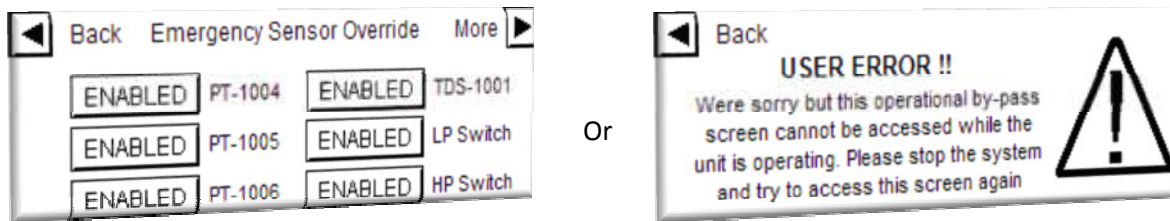
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From the home screen press on the indicated area to access the 'Emergency Sensor Override' menu.



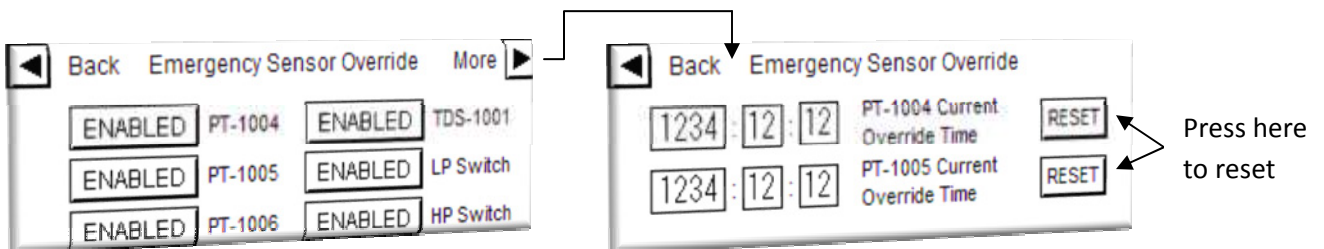
Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

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 tried 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.

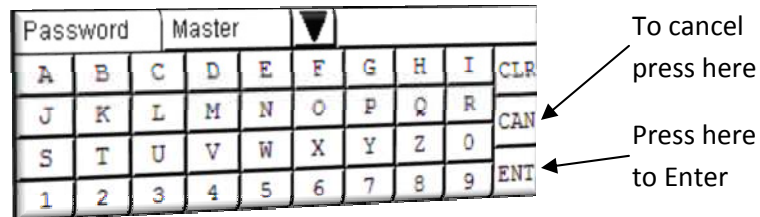
From the 'Emergency Sensor Override' screen press the arrow in the upper right hand corner of the screen. Pressing this area will change the display over to the current emergency operation timer display.



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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 DSRC 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.

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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 manor:

16.1 Actuating the High Pressure By-pass Valve

To manually actuate this valve the operator must first remove power from the valve actuator motor. This is done by locating the valve power plug hidden in the Tasman Sea electrical tray work located directly beneath the valve itself (See figure 1.1)



Figure 1.1

Once the power plug has been located separate the plug, by pressing on the button located on the top of the plug. Once pressed pull the plug a part (See figure 1.2)

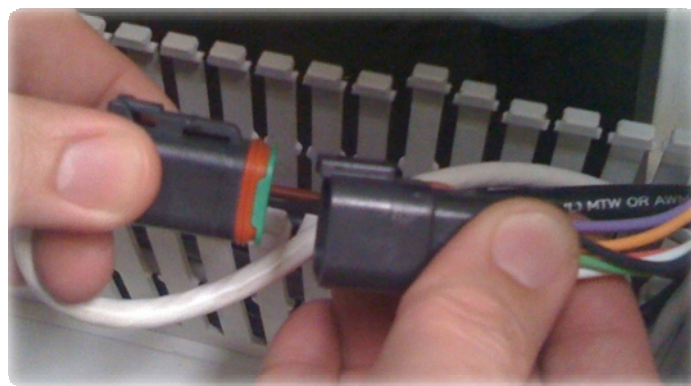


Figure 1.2

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You can now manually actuate the high pressure by-pass valve by moving the yellow handle into the position required (See figure 1.3)



Figure 1.3

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16.2 Actuating the Product Diversion Valve

To manually actuate this valve the operator must first select manual mode on the valve 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 2.1)



Figure 2.1

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 2.2)



Figure 2.2

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18. Fresh Water Flushing

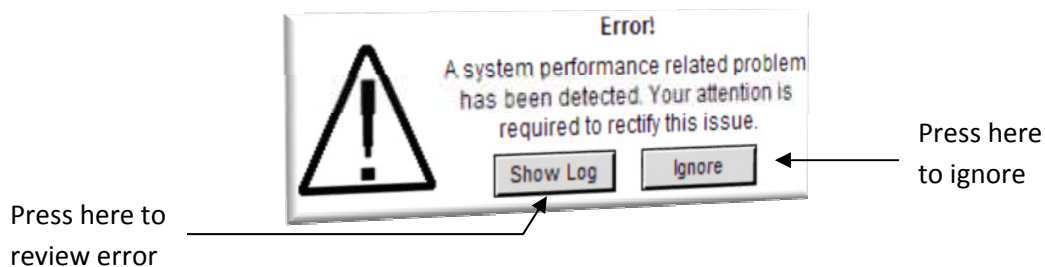
Each time a running pump is stopped using the 'Auto-Stop' button the fresh water flush system will automatically be activated. Once all running pumps have been stopped the fresh water flush valve will open allowing fresh water into the system. The valve will remain open for 10 minutes to allow fresh 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'.

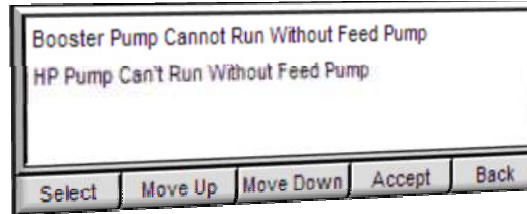
This cycle will continue indefinitely, unless a system pump is started by the operator, or the operator cancels the fresh water flush sequence by pressing and holding the "Auto-Stop' button for 2 seconds.

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 on the next page:

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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.

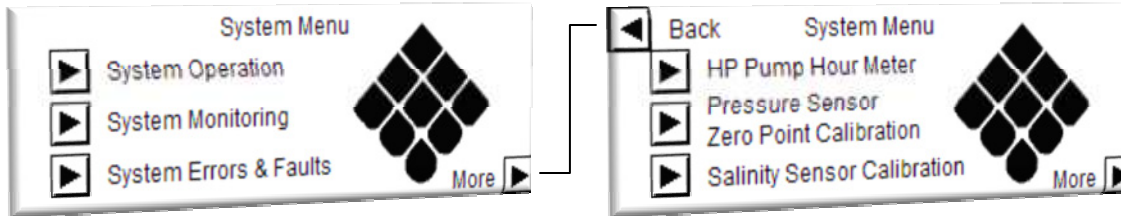
Pressing 'Back' will exit the alarm list. Please note the 'Back' button is only active if no faults or errors are currently displayed, if errors or faults are displayed, press 'Accept' to exit this screen.

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.

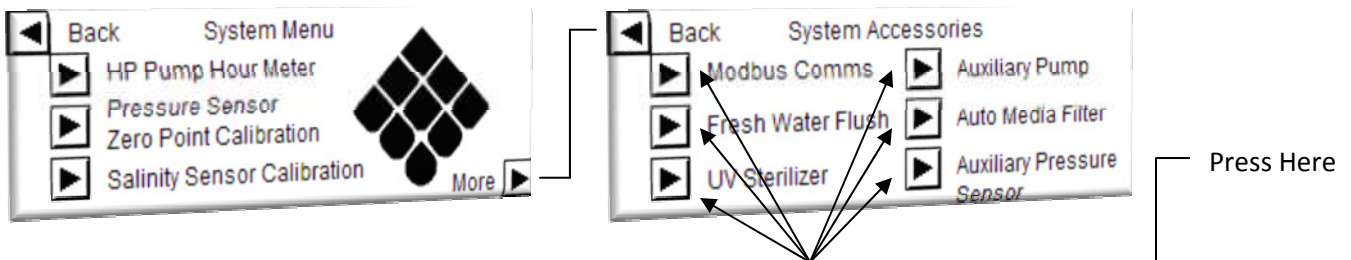
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19. Activating Accessories

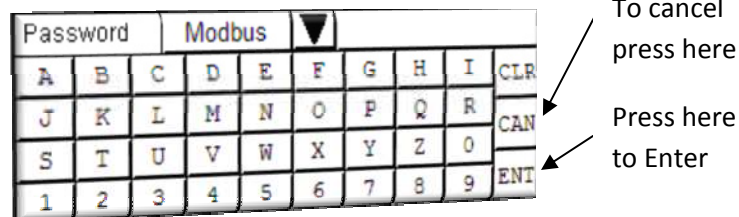
To access the accessory activation screen, press on the arrow in the lower right corner of the 'System Menu' screen as shown below:



This will bring you to the second 'System Menu' screen, press on the arrow in the lower right corner of this screen to access the 'System Accessories' screen



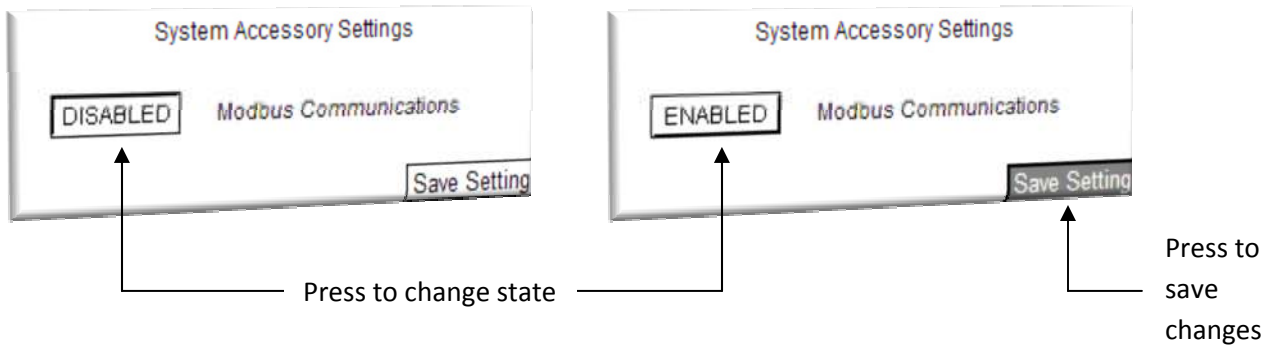
From this screen you can access all available system accessories, to switch on or off a system accessory press on the arrow next to the text describing your required accessory. Doing so will call up the accessory password request screen. If you do not have the password to your required accessory contact Danfoss 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)



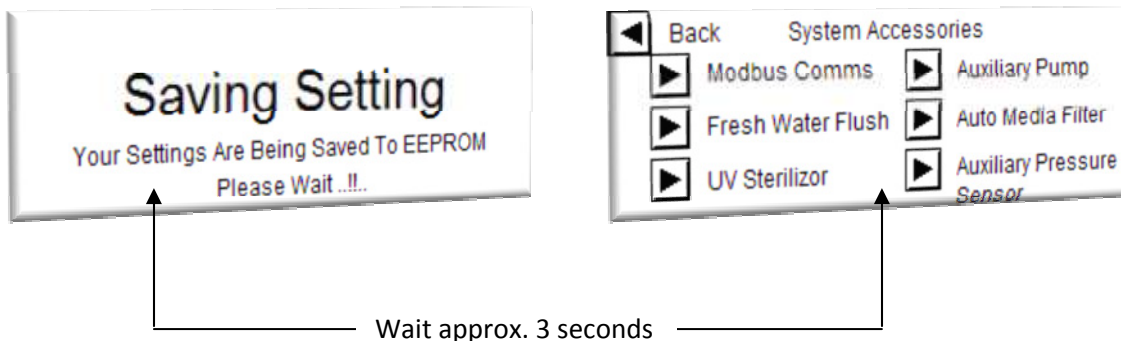
Entry of an incorrect password will result in the password prompt screen remaining visible. The password you have entered will be erased and the password screen will wait for you to attempt again. Press the 'CAN' key to cancel this request.

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Once the correct password has been entered, the control system you pass you on to the accessory enable/disable screen, from 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:



Once you have changed the accessory state 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 accessory menu as shown below:



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

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PRE-INSTALLATION
R.O. MEMBRANE CARE
&
SYSTEM INSTALLATION

[illegible]

1. SYSTEM STORAGE AND INSTALLATION PRECAUTIONS AND INFORMATION:

A. STORAGE PRIOR TO UNCRATING:

1. Adhere to crate markings:
 - **DO NOT** expose to or store in direct sunlight;
 - **DO NOT** expose to or store above 120 degrees F / 50 degrees C;
 - **DO NOT** expose to or store below 33° F / 1° C;
 - **DO NOT** freeze;
 - **DO NOT** store longer than 4 months without flushing with storage chemical;
 - **STORE ONLY** on base with ARROWS UP.
 - **KEEP THE R.O. MEMBRANE ELEMENT(S) WET AT ALL TIMES.**

B. REVERSE OSMOSIS MEMBRANE ELEMENT SUSCEPTIBILITY TO CHEMICAL ATTACK:

CAUTION: Do Not expose the Danfoss Sea Recovery System to intake Feed Water containing:

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

Any chemical, not approved in writing by Danfoss 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 listed chemicals. Example: Do not connect the inlet of the System to the ship's potable water system if the system contains chlorinated or brominated water. These chemicals destroy the copolymer components within the system. These oxidants and others also damage the R.O. Membrane Element. The Danfoss Sea Recovery Optional Fresh Water Flush Accessory removes chlorine and bromine from the ship's potable water system.

C. ARE YOU INSTALLATION COMPETENT?

Installing this Reverse Osmosis Desalination System will require understanding of:

- Thru-Hull under water fitting installation
- Thru-Hull above water fitting installation
- Electrical Circuits
- Electronic Circuits
- Electric Motors
- Hydraulic Systems and Pumps
- Liquid Pressures and Flows
- Electro Mechanical Systems
- Mechanical knowledge and skills
- Piping and Plumbing knowledge and skills

Do not attempt installation if you are not familiar with or are not proficient in the above fields of expertise.

D. CAUTION, DO NOT PERFORM INSTALLATION UNLESS:

1. The System Feed Water Inlet Valve is closed.
2. The system main electrical disconnect switch is switched **"OFF", LOCKED, & 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.

2. SPECIAL CONSIDERATIONS:

1. **BONDING OF THE HIGH PRESSURE PUMP, FEED PUMP AND BOOSTER PUMP:** Ship 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 motor may, therefore, be through the Feed Water Line. This may be particularly true if the electric motor grounding wire is insufficient. If left unbounded the pumps may become sacrificial and corrosion by electrolysis would then take effect which will destroy the pump manifolds, chambers and impellers. Such destruction can take effect and render these pumps inoperable within just a few short months. Destruction of these pumps by electrolysis and or improper or inadequate grounding of the electric motors will not be covered under the Danfoss Sea Recovery Warranty.

Therefore, the pump manifold 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 may not totally eliminate but rather it will minimize 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 would rapidly destroy the two pumps.

2. **ELECTRICAL GROUNDING OF ALL PUMP MOTORS:** Whether for ship or land applications, the electric motors of all pumps within the Danfoss Sea Recovery R.O. System must be properly electrically grounded. If left ungrounded the pump driven by the electric motors will become the grounding device and will rapidly be destroyed by electrolysis.

Therefore, the electric motors must be individually and separately electrically grounded to a proper electrical grounding source.

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 would rapidly destroy the two pumps.

3. **LENGTH OF CONNECTION LINES:** The system will operate 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 back pressure on those lines. Maximum allowable back pressure on the brine discharge line is 30 psi at 35 U.S. gallons (133 liters) per minute of water flow. Maximum allowable back pressure on the product water line is 30 psi at 15 U.S. gallons (57 liters) per minute of water flow.

NOTE: Restrictions within the system feed line which result in head loss into the Booster Pump will reduce the pumps output performance. Ideal maximum output performance of the Booster Pump is important in order to maintain a proper pressure into the Prefiltration Section. Loss of pressure caused by feed line restrictions may cause the System to be inoperative due to low pressure output from the Booster Pump. Such a line loss condition will require plumbing correction to over come the loss. This would be considered an installation obstacle and any plumbing or installation correction is the responsibility of the

owner. This would not be considered a warranty condition as Sea Recovery has no control over the System feed line installation.

4. SYSTEM FEED INLET (INLET THRU-HULL FITTING ON SHIP INSTALLATIONS) must be in constant contact with the feed water. Any air suction leaks coming into the system feed line may cause the system to shut down due to low feed pressure condition. If the installation is aboard a vessel care must be taken to plumb the feed line at the bottom of the Sea Chest so that the Danfoss Sea Recovery System receives an uninterrupted supply of air free feed water. The Inlet Thru-Hull Fitting should be dedicated for only the Danfoss Sea Recovery R.O. System.

Avoid using one Thru-Hull Fitting for several auxiliary systems. Typical cause of system failure and continual stopping is due to air suction leaks from other systems tied into a common Thru-Hull Fitting.

5. THE R.O. MEMBRANE VESSEL ASSEMBLY [34] must not be exposed to heat in excess of 122°F / 50°C. At temperatures above 122° F / 50°C the Reverse Osmosis Membrane Element can experience irreversible flux loss (loss in production).

INSTALLATION CAUTIONS:

6. Do not over tighten PVC fittings. If threaded pipe fittings leak after installation, remove the fitting, clean the mating threads, apply 3 to 4 wraps of Teflon tape to the male threads, apply liquid Teflon pipe sealer sparingly, and thread the parts back together. PVC fittings will crack if over tightened, snug with a wrench but do not over tighten.
7. All components that are under a vacuum condition when installation is in a ship should be installed below water level in a ship installation. This will aid the Booster Pump in priming.
8. Always allow hoses and tubes to enter and exit straight from the connection for a minimum of one inch prior to a bend. If stress is placed on the fitting due to a tight bend the fitting will leak and may break.
9. WARNING: Avoid skin and eye contact with the membrane packaging 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. R.O. Membrane Elements are stored in "sodium bisulfite".
10. NEVER mount any liquid holding component of the system above an electrical or electronic circuit or device. Extensive damage to the electrical or electronic device or circuit will result if water spills from the system during maintenance and or component failure.

CONNECTION LINE CAUTIONS:

11. All connection lines should be as short and straight as possible using minimum fittings.
Increased length causes line pressure loss in the Feed Water line.
Increased length causes excessive pressure build up in the Brine Discharge line.
Increased length causes excessive pressure build up in the Product Water line.
12. The connection lines must not be "kinked".
Kinks in the Feed Water line cause cavitation and continual System shut down.
Kinks in the Brine Discharge line cause excessive pressure build up and damage.
Kinks in the Product Water line cause excessive pressure build up and damage.

13. Avoid Vacuum conditions on all lines.

CAUTION: Excess Vacuum can be created within water lines to and from the System when the System is mounted in excess of 10 Feet above the Feed Water level. Vacuum can cause internal damage to the Multi Media Filter Liner, Cartridge Filters, High Pressure Pump, and R.O. Membrane Element. Further, excess vacuum can cause O-rings and seals to become displaced allowing air or water leaks.

If the System is mounted in excess of 10 Ft / 3 Meters above the feed water level inline vacuum breaker devices must be installed in the Feed Water Line, and Brine Discharge Line.

ACCESSIBILITY CAUTIONS:

14. This is a simple rule: Install the system and its supporting components in an accessible manner. The Tasman Sea system requires regular operator maintenance such as filter element changing. As with any Electro Mechanical system utilized in the Marine environment the Tasman Sea system will require repair from time to time. Hidden or out of reach items may become forgotten, not maintained, and cause damage to other system components. Danfoss Sea Recovery will refer any end user customer complaints regarding accessibility or installation problems back to the installer.

15. The System Control Panel must be accessible for operation and monitoring of the system.

ELECTRICAL POWER REQUIREMENTS:

16. Refer to the Specifications and to the specific electrical information provided in Preface of this Owner's Manual and ensure that the power source is sufficiently sized to provide the correct voltage and cycles during Start Up and Operation of the Danfoss Sea Recovery Tasman Sea Reverse Osmosis Desalination System.

3. DISTANCE BETWEEN COMPONENTS:

Ensure that all lines are sized appropriately so that there is no pressure loss at the Feed Water Line entering the System, and no excess pressure build up on the Brine Discharge Line, Multi Media Filter Waste Line, or Product Water Line exiting the system.

4. TOOLS REQUIRED FOR INSTALLATION:

Not all installations are typical, therefore, it is recommended to have a full set of Mechanic's and Electrician's tools available. No special system tools are required for installation. A separate TDS Meter, available from Danfoss Sea Recovery will assist in confirming system product water quality. A volt/ohm meter (VOM) is required for system installation and commissioning to ensure proper electrical power and connection.

5. COMPONENTS SUPPLIED BY INSTALLER OR OWNER:

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 a minimum 1 1/2" orifice, and a 1 1/2" MNPT nipple exposed for the system inlet fitting. The entire fitting and valve assembly must be of non-ferrous material. Naval Bronze, PVC, CPVC, Stainless Steel or another non-corrosive material is correct for the fitting. Any ferrous material will cause rust fouling of the Danfoss SRC R.O. Membrane Element.

- 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 Danfoss Sea Recovery 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 1 1/2" size with a 1 1/2" MNPT nipple exposed for coupling with the system Brine Discharge connection. It is preferred, but not absolutely necessary, that the brine discharge line terminate above water level to minimize pressure buildup on the line. There should be no valving in the Brine Discharge Line as damage to the system will occur if the Brine Discharge Line is blocked by a closed valve during system operation.
- e. Ship's Potable Water Storage Tank with Product Water Storage Tank Connection: This fitting must be minimum 1" FNPT size for coupling with the system product water fitting. It is preferred that the product water line terminate above water level. The product water line must be connected to a vented system to ensure no pressure build up during production. There should be no valving in the Product Water Line as damage to the system will occur if the Product Water Line is blocked by a closed valve during system operation.

2. LAND INSTALLATIONS:

- a. Feed Source for the Danfoss Sea Recovery R.O. System. The feed source may be from a deep well, shallow well, directly from the source, or other means. All necessary screens, piping, valving, pumps, gauges are available from Danfoss Sea Recovery as options. Consult Danfoss Sea Recovery Land Application Engineers for assistance. The entire feed line, including well casings, must be of non-ferrous material. Naval Bronze, PVC, CPVC, Stainless Steel or another non-corrosive material is correct for the fitting. Any ferrous material will cause rust fouling of the Danfoss SRC R.O. Membrane Element. The feed source and line must be appropriately sized so as to deliver the proper feed flow to the system at the proper pressure. The proper feed flow and pressure required at the Danfoss Sea Recovery R.O. System may vary depending upon the actual system configuration and installation. Consult Danfoss Sea Recovery Land 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 Danfoss Sea Recovery 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. There should be no valving in the Brine Discharge Line as damage to the system will occur if the Brine Discharge Line is blocked by a closed valve during system operation.
- e. Potable Water Storage Tank 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 line must be connected to a vented system to ensure no pressure build up during production. There should be no valving in the Product Water Line as damage to the system will occur if the Product Water Line is blocked by a closed valve during system operation.

6. UNCRATING:

1. Disassemble crate from system as follows:

first top;
second, third, fourth, fifth sides.
2. Remove the Danfoss Sea Recovery system from the bottom of it's shipping crate only when the system is in place ready for the final lift. Use caution in moving the system with a fork lift after system is removed from the shipping crate. Place wood, cardboard or material onto the metal forks of the fork lift. CAUTION: Metal forks will damage the epoxy coating on the underside of the skid.

7. FINAL LIFT OF THE DANFOSS SEA RECOVERY SYSTEM INTO PLACE:

1. Attach lift ropes to the top portion of the frame four corner eye bolts only. Use caution to protect the epoxy coating with soft material. DO NOT attach guide lines to, or handle the Danfoss Sea Recovery system by any of the system piping, controls, or other components within the system. Lift the Sea Recovery system into place.
2. Set the system onto wood blocks in order to suspend it above ground level while aligning mounting holes or studs.
3. Lift the system and remove the wood blocks from the final resting place. Once the system is in its exact place for installation gently set the system down to rest and secure it as appropriate for the application.

8. REVERSE OSMOSIS MEMBRANE ELEMENT NOTE:

CAUTION: Some systems are shipped WITHOUT the Reverse Osmosis Membrane Element. This is to accommodate, for example, Boat Builders that install the system well in advance of commissioning the boat and the Tasman Sea .

DOES THIS Danfoss Sea Recovery Tasman Sea 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 Reverse Osmosis Membrane Element has been installed, there will be a Reverse Osmosis Membrane Element Serial Number tag, illustrated below, attached to the High Pressure Vessel(s). Find this Serial Number tag to ensure that the R.O. Membrane Element(s) has been installed.

If the R.O. Membrane Element Serial Number tag is missing or

Sea Recovery

Rancho Dominguez, California 90220 U.S.A.
Tel: 1-310-637-3400 | Fax: 1-310-637-3430
Email: srsales@searecovery.com

SERIAL NO:
FLOW: -->
DATE:

087945021505
BRINE INLET END
October 15, 2005

does not contain a serial number and date then the R.O. Membrane(s) is (are) not installed. If the R.O. Membrane Element(s) is (are) are not installed and you wish to install them at this time contact Danfoss Sea Recovery and supply us with your original Purchase Order Number, Danfoss Sea Recovery's Invoice Number, and this Tasman Sea Serial Number.

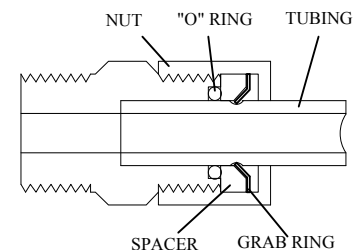
WARNING: IF THE REVERSE OSMOSIS MEMBRANE ELEMENT IS NOT TO BE INSTALLED AT THIS TIME ENSURE THAT YOU LEAVE A VISIBLE NOTE AT THE SYSTEM CONTROLLER AND AT THE FRONT OF THE CONTROL PANEL INFORMING THE END USER THAT: THE REVERSE OSMOSIS MEMBRANE ELEMENT(S) IS/ARE NOT INSTALLED; TO CONTACT THE FACTORY FOR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

EXTENSIVE DAMAGE WILL OCCUR IF THE TASMAN SEA SYSTEM IS OPERATED WITHOUT THE R.O. MEMBRANE ELEMENT(S) INSTALLED. DAMAGE TO THE SYSTEM CAUSED BY THE OPERATION OF THE SYSTEM WITHOUT R.O. MEMBRANE ELEMENT(S) 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. MEMBRANE(S) WERE NOT INSTALLED AND TO NOT OPERATE THE SYSTEM WITHOUT THE R.O. MEMBRANE ELEMENT(S) INSTALLED.

9. TUBING & HOSE NOTES AND CAUTIONS

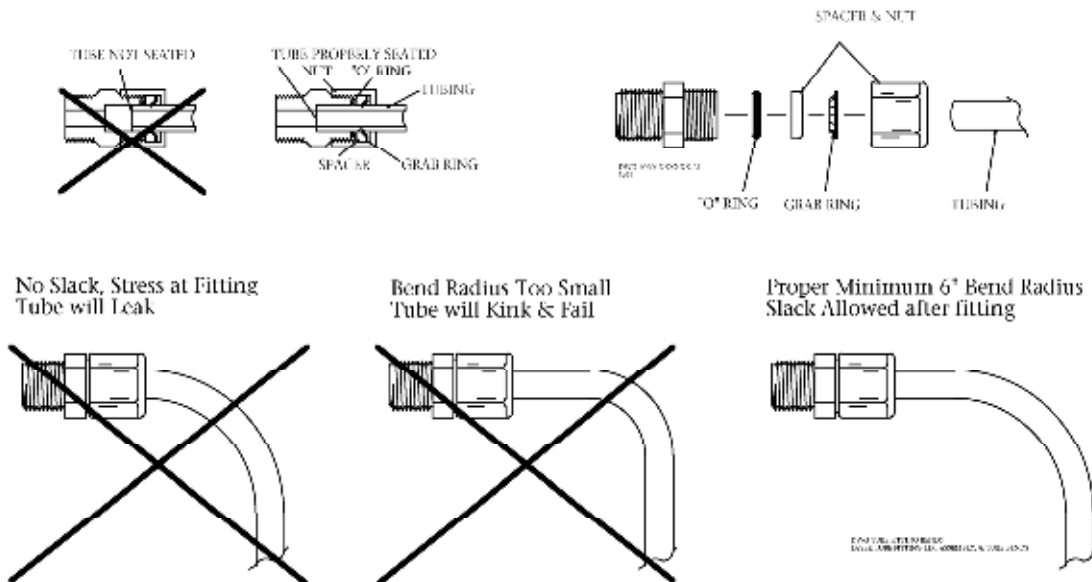
TUBE FITTING CONNECTIONS ASSEMBLY

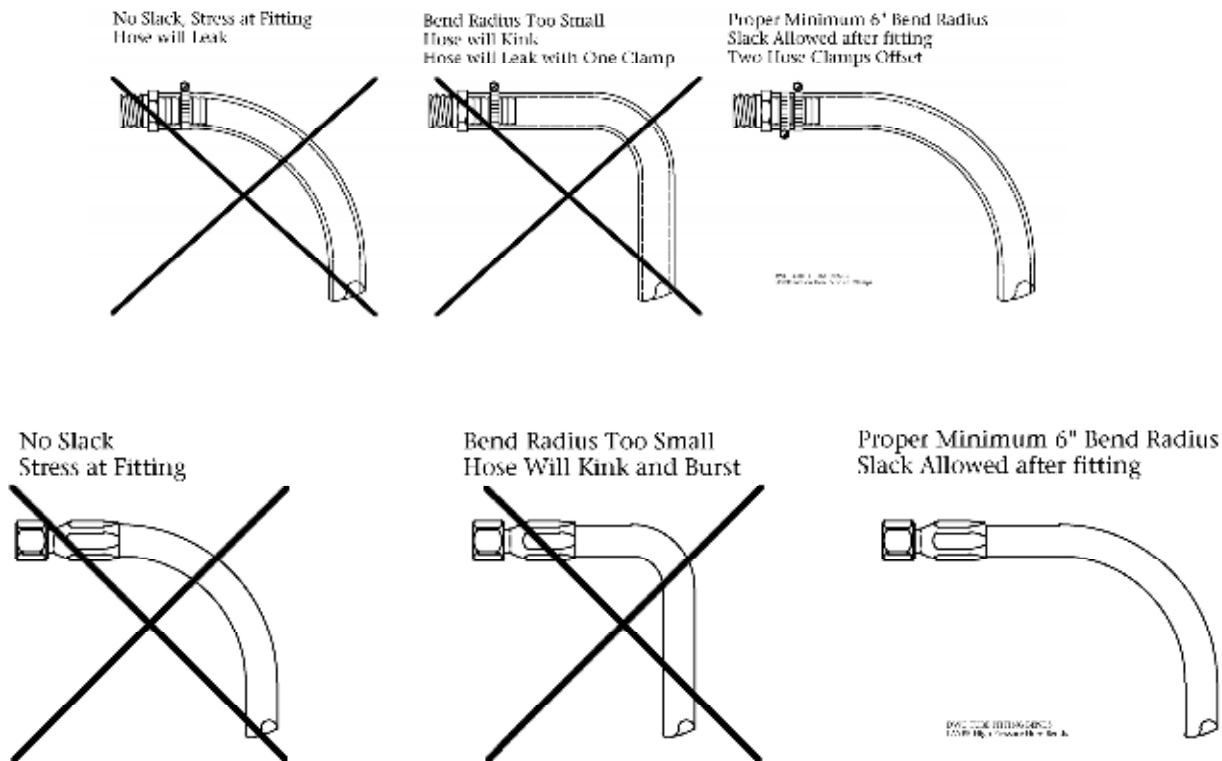
- Cut tube end square and clean.
- Loosen nut on fitting three turns.
- Insert tube into fitting until it bottoms.
- Loosen nut completely & remove tube with attached parts from body.
- Check to ensure that the O-Ring is seated onto the tube under the spacer (and not pinched into the body).
- Insert tube with attached parts into the body and tighten nut finger tight.



CAUTION: Refer to the following illustrations. Always allow slack in all tube and hose lines. Never cause the tube or hose to immediately bend from the fitting. Allow the line to enter or leave from the fitting in a straight manner for several inches to ensure proper connection, to relieve stress to the fitting and tube or hose, and to allow ease of detachment and reattachment during maintenance or repair.

If water lines are pulled tight causing them to bend at the fitting they will leak, allow air to enter, fail prematurely, and or break the fitting that they are attached to.





10. INSTALLATION PROCEDURES: External connections and mounting. Refer to System Specifications regarding water line capacities and electrical power consumption. Secure the Danfoss Sea Recovery system in place through the mounting holes provided in skid.

1. Mount and connect all feed water components external of the frame in line, as illustrated in the system piping and interconnect diagram in section 1, from the feed water source up to the Danfoss Sea Recovery System skid edge. Use a minimum feed water line of 1 1/2 inch - 38 mm for short and relatively straight runs. Consult Danfoss Sea Recovery Application Engineers for land installations or runs of extended lengths in excess of 10 feet and or if the system skid will be in excess of 3 feet above water level.
2. Mount and connect all product water components external of the frame in line, as illustrated in the system piping and interconnect diagram in section 1, from the Danfoss Sea Recovery System skid edge to the product water storage tank / cistern. Use a minimum product water delivery line of 1 inch - 25 mm for short and relatively straight runs. Consult Danfoss Sea Recovery Application Engineers for land installations or runs of extended lengths in excess of 100 feet and or if the system skid will be in excess of 40 feet below the product water storage tank / cistern.
3. Mount and connect the optional cleaning/storage/rinsing tank , as illustrated in the system piping and Inter-connect.
4. Connect the system feed water flange fitting to a minimum 1 1/2 inch / 38 mm feed - water line. The system requires, at skid edge, 36 U.S. gallons per minute / 136 liters per minute. Size the feed water line accordingly so that this flow of feed water arrives at the systems skid edge with minimal line loss. Line loss in the feed water line will adversely affect the performance of the booster pump. If feed water line loss results in poor performance of

the booster pump this will dictate the need to correct the feed water line plumbing and or increase the size of the booster pump. Such line loss resulting in poor booster pump performance is considered an installation obstacle and not a warranty issue. Install a vacuum break in this line if the piping drops more than 10 feet below the system, and if the System is more than 10 feet above water level.

5. Connect the system brine discharge flange fitting to a minimum diameter 1 1/2 inch / 38 mm discharge line. Maximum back pressure on the brine discharge line should be 30 psi. Install a vacuum break in this line if the discharge piping drops more than 10 feet below the system.
6. Connect the system product water flange fitting to a minimum 1 inch - 25 mm product water delivery line. Maximum back pressure on the product water line should be 30 psi.
7. Connect the system clean/store feed flange fitting to a minimum diameter 1 1/2 inch / 38 mm line.
8. Connect the system clean/store return flange fitting to a minimum diameter 1 1/2 inch / 38 mm line.

11. COMPONENT PREPARATION:

1. Media filter preparation: Remove the top entrance cover. The filter media used in the media filter consists of two grades of media which must be placed into the media filter from the bottom up as follows:

First Approx 100 lbs (45 kg) of Coarse Sand (Red Garnet).

Second Approx 200 lbs (90 kg) of No. 20 grade Silica Sand.

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.

2. CAUTION: The Danfoss Sea Recovery RO 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 SODIUM BISULFITE). If the Danfoss Sea Recovery system was shipped without the reverse osmosis membrane elements in place refer to section 9 for an exploded view of the assembly in order to install the elements.

12. ELECTRICAL CONNECTIONS: Refer to the Owner's Manual for all electrical wire routing and connection.

13. CAUTION: The Reverse Osmosis Membrane Element(s) must be kept wet else severe loss of production will occur.

Notes: _____

[illegible]

MAINTENANCE & REPAIR

Notes: _____

[illegible]

Maintenance and Repair Notes and Cautions

Maintenance and Repair will require understanding of:

- Electrical Circuits
- Electronic Circuits
- Electric Motors
- Hydraulic Systems
- Liquid Pressures and Flows
- Electro Mechanical Systems
- Mechanical knowledge and skills

Do not attempt maintenance and repair if you are not familiar with or are not proficient in the above fields of expertise.

USE CAUTION WHEN PERFORMING MAINTENANCE AND REPAIR.

DO NOT PERFORM MAINTENANCE UNLESS:

1. The System Feed Water Sea Cock Valve is closed.
2. The electrical power to the system is switched "**OFF**", **LOCKED**, and **TAGGED**.
3. "EXPLODED PARTS VIEWS" of this Owners Manual is available.

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

From time to time, Danfoss Sea Recovery may make programming changes to the Control Logic (CONTROL VER).

Other physical production changes may also be made from time to time and are tracked by Danfoss Sea Recovery through the System Serial Number.

Troubleshooting and repair methods and results can vary depending on the System Serial Number and the specific pre or post filtration options installed in the System.

When requesting assistance from Danfoss Sea Recovery or one of Danfoss Sea Recovery's service dealers, you must inform us of your specific System Model Number and Serial Number. This allows us to look up your particular System's test records and expedites our ability to assist you. If we are given a wrong model number or wrong serial number this will lead to frustration for you, wrong troubleshooting information from us, and failure to diagnose or correct the problem. Additionally, in order for us to expedite troubleshooting and assist you accurately, we must know all optional equipment installed in the System.

ALWAYS PROVIDE THE FOLLOWING INFORMATION:

SPECIFIC SYSTEM MODEL:

Tasman Sea T-2

OPERATING VOLTAGE CYCLES AND PHASE: _____ VAC, _____ HZ, _____ THREE PHASE

LIST OF INSTALLED OPTIONS:

Feed Water Pump [6]: _____ NO _____ YES

Feed Water Pump Type: _____ Centrifugal; _____ Self Priming; _____ Submersible

Hydro Cyclone Separator: _____ NO _____ YES

Vacuum Break Valve [9]: _____ NO _____ YES _____ Chemical

Vacuum Break Valve [40]: _____ NO _____ YES _____ Chemical

Pretreatment Chemical Injection: _____ NO _____ YES _____ Chemical

Pretreatment Chemical _____ NO _____ YES _____
Chemical

Post treatment Chemical Injection _____ NO _____ YES _____ Chemical

Ultra Violet Sterilizer Post Treatment: _____ NO _____ YES

Soft Motor Starter: _____ NO _____ YES

Fresh Water Flush: _____ NO _____ YES

MAINTENANCE & REPAIR

Are you mechanically inclined? Troubleshooting and subsequent correction or repair of the Tasman Sea will require understanding of:

Electrical Circuits	Electronic Circuits	Electric Motors
Hydraulic Systems	Liquid Pressures and Flows	Electro Mechanical Systems
Mechanical knowledge and skills		

Do not attempt troubleshooting and/or subsequent correction or repair if you are not familiar with, are not confident in performing, or are not proficient in the above fields of expertise.

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

CAUTION AVOID CHEMICAL ATTACK TO THE SYSTEM: Do not use for storage or cleaning and do not expose the Danfoss Sea Recovery R.O. System to:

hydrogen peroxide	chloramine	chloramine-T	N-chloroisocyanurates
chlorine dioxide	hypochlorite	chlorine	iodine
bromine	bromide	phenolic disinfectants	petroleum products

or any other specific chemical not approved in writing by Danfoss Sea Recovery 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 Danfoss Sea Recovery System and will destroy the R.O. Membrane Element. Use of and subsequent damage caused by non Danfoss Sea Recovery Chemicals are the liability and responsibility of the operator and are not covered by the Danfoss Sea Recovery Warranty.

Do not connect any water line to the Danfoss Sea Recovery R.O. System that may contain any of the above listed chemicals. Examples: Do not connect the Danfoss Sea Recovery R.O. System to the ships potable product water tank if that tank has been treated with a Brominator as Bromine destroys the co-polymer components within the system. Do not subject the Danfoss Sea Recovery R.O. Membrane(s) to any water source 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 the internal parts 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.

Weekly Quick Check: The following steps ensure that potential problems are resolved preventing major repairs:

1. Inspect all fasteners for tightness including brackets, screws, nuts, and bolts. Pay special attention to the High Pressure Pump and Electric Motor since they are subject to increased vibration.
2. Clean any salt water or salt deposits from the system with a wet rag.
3. Check for water leaks throughout the System and supporting water lines.
4. Check all tubing and high-pressure hoses for wear and abrasion against rough surfaces. The hoses must not contact heated or abrasive surfaces.

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 or operated. Because of these factors, it is virtually impossible to comprise an exact timetable for required maintenance. The following maintenance timetable is an estimate of the time intervals at which maintenance may be required on the various system components. This is based upon factual data compiled from Danfoss Sea Recovery installations around the world. However, this schedule must be adjusted to each individual system depending upon the variables listed.

[illegible]

WARNING: Components, spare parts, and consumables utilized within the Danfoss Sea Recovery System can be specific to Sea Recovery specifications and are not commercially available from other sources. Other Components utilized within the Danfoss Sea Recovery System are modified by Danfoss Sea Recovery for a specific purpose of compatibility and are not commercially available from other sources.

Many of these special components can appear to be similar to Danfoss Sea Recovery components. Extensive and expensive damage to the Danfoss Sea Recovery System WILL result if incompatible components are used in the Danfoss Sea Recovery System. Damage caused to the Danfoss Sea Recovery System as a result of third party components is the liability and responsibility of both the Marine Dealer that sold the component for use in the Danfoss Sea Recovery System as well as the Service Dealer or Owner/Operator that purchased and installed the third party component in the Danfoss Sea Recovery System and is not covered by the Sea Recovery Warranty.

Always insist on only Danfoss Sea Recovery supplied components, spares, and consumables.

- 1. Inlet Thru Hull Fitting:** Non Danfoss Sea Recovery component. Keep the Inlet Thru Hull Fitting free and clear of debris and marine growth. If the Inlet Thru Hull Fitting is clogged, this results in a low feed pressure condition, which causes the system to shut off.

Blockage at the Inlet Thru-Hull Fitting causes the System to shut off due to lack of Feed Water Flow. Unfortunately, since it is under water operators are reluctant to thoroughly inspect the Inlet Thru-Hull Fitting for problems. This can cause time consuming frustrations in attempting to gain feed water flow by trouble shooting other components in the System.

The Inlet Thru-Hull Fitting must be free and clear allowing the System to draw 36 U.S. Gallons Per Minute / 136 Liters Per Minute through it with minimal resistance. Any blockage at the Inlet Thru-Hull Fitting will cause low pressure and low flow problems at the System. This Inlet Thru-Hull Fitting must be a Forward Facing Scoop so that the System receives a positive flow of water as the boat is under way. It must be minimum 1 1/2" inside diameter. It must be installed in a position on the bottom of the Hull so as to allow free flowing Feed Water without air.

CAUTION: A flat profile, flush mount, inlet thru-hull fitting will cause a vacuum as the boat is under way, and this will cause loss of feed water flow and cavitation of the Booster Pump and High Pressure Pump resulting in continual system shut down due to low feed water flow and pressure. The resulting failure of the system to remain in operation is attributed to improper installation, is the liability of the installer, and is not covered by the Danfoss Sea Recovery warranty.

CAUTION: If the thru-hull fitting has been placed in a position on the underside of the hull that allows air to continually enter the thru-hull fitting, this will cause the system to continually shut down due to loss of feed water. The resulting failure of the system to remain in operation is attributed to improper installation, is the liability of the installer, and is not covered by the Danfoss Sea Recovery warranty.

CAUTION: The Danfoss Sea Recovery System must not be tied into another existing auxiliary water line already supplying another accessory on the boat. Using one Thru Hull fitting for other equipment will cause the Danfoss Sea Recovery System to draw air or cavitate leading to continual system shut down. The resulting failure of the system to remain in operation is attributed to improper installation, is the liability of the installer, and is not covered by the Danfoss Sea Recovery warranty.

CAUTION: If the Danfoss Sea Recovery System is connected to a Sea Chest or Stand Up Pipe, **do not plumb the Danfoss Sea Recovery System feed line to the "top" of the Sea Chest or Stand Up Pipe.** If plumbed into the top of these feed water arrangements, the Sea Recovery System will experience continual shut down due to air inducement into the system. The resulting failure of the system to remain in operation is attributed to improper installation, is the liability of the installer, and is not covered by the Danfoss Sea Recovery warranty. **Plumb the Danfoss Sea Recovery System to the "bottom" of such feed water arrangements to ensure a continual air free supply of feed water to the system.**

- 2. Sea Cock Valve:** Non Danfoss Sea Recovery component. The packing and connections of the Inlet Sea Cock Valve must be tight and must properly seal. Clean the valve cavity of debris or replace the seal and seat or the entire valve, as required. This section is under a vacuum condition while operating the system. Loose fittings or a worn seal will allow air to enter the Danfoss Sea Recovery system causing continual shut down due to subsequent low feed water pressure.

- 3. 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.
- 4. 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 by-pass 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.

- 5. 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. 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.

Wipe the "O" ring with a damp cloth. Lubricate it with Parker "O" ring lubricant. Seat the mesh screen back into the bowl. Screw the lid on clockwise. Hand tighten only enough to seal water in and air out.

- 6. 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

CAUTION: Switch the feed pump (or system) disconnect switch or circuit breaker to the "OFF" position, lock and tag the switch for maintenance. Close the system shut-off valve.

- a. Disassembly of feed water pump or booster pump
 - 1) Disconnect power source from motor at the motor electrical connection box.
 - 2) Disconnect electrical connections, tagging wires carefully to preserve correct rotation.
 - 3) Loosen pump base bolts.
 - 4) Loosen 8 volute bolts and slide pump away from volute. Volute may be left in piping.
 - 5) Insert large screw driver between vanes of impeller to hold the impeller and remove impeller lock screw from motor shaft.
 - 6) 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.
 - 7) Pry carbon seal head from shaft sleeve. Again two screw drivers as levers will help. Do not attempt to salvage the old carbon seal head.
 - 8) Loosen four motor bolts and remove bracket from motor.
 - 9) Remove seal seat from bracket. Do not attempt to salvage the old seal seat.
 - 10) Inspect the stainless steel shaft sleeve. If scored, it should be replaced unless it can be polished to remove score marks.
 - 11) 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.
- b. Re-assembly:
 - 1) 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.
 - 2) Install shaft sleeve onto motor shaft, tapping into place to ensure it is sealed against motor shaft shoulder.
 - 3) Thoroughly clean seal seat cavity in bracket.

- 4) Place small amount of vegetable oil on white ceramic seat cup and start it into seat cavity. Do not scratch seat surface.
- 5) Tap white ceramic seat into cavity using a smooth wood dowel, plastic rod or other soft material tool.
- 6) Install bracket onto motor using 4 bracket bolts. Tighten bolts evenly.
- 7) 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.
- 8) Push carbon seal head down shaft sleeve until carbon face touches stationary ceramic seat.
- 9) Install new sleeve gasket into shaft sleeve.
- 10) Install seal spring and retainer over shaft.
- 11) Install impeller onto motor shaft being careful to align keyway of impeller with keyway in motor shaft. Be careful seal spring retainer fits inside lip of impeller hub. Push impeller on until impeller bottoms out on shaft sleeve.
- 12) Install new impeller lock screw gasket into impeller lock screw. Install impeller lock screw into motor shaft and tighten.
- 13) Return pump and motor assembly to volute and install using new gasket and tighten 8 volute bolts evenly.
- 14) Reconnect electrical connections as tagged. Prime according to the new system start-up section "L" of this manual. Make sure that all air is removed from the system.
- 15) Jog the motor with the feed water pump switch SW-1 to determine if rotation is correct. If not, reconnect wiring to correct rotation.

7. Pre or post treatment tank : As the tank gets dirty, clean it with product water and a brush or cloth.

8. Pre or post treatment pump : The pretreatment pump may be repaired as per the instructions supplied with the pump.

9. Multi Media Filter back wash and rinse procedure: Follow this procedure when media fouling occurs during normal use and also after changing the media.

Primary Feed Water Pump Note: When there is a primary feed water pump installed, it may or may not have been supplied by Danfoss Sea Recovery and therefore may or may not be controlled by the Danfoss Sea Recovery system electrical controller. Where applicable, the instructions below clearly give directions for valve and switch positioning when using and when not using a primary feed water pump, for the purpose of backwashing the media filter, whether or not it was supplied by Danfoss Sea Recovery and or controlled by the Danfoss Sea Recovery electrical controller.

Booster Pump note: In some installations the booster pump will be used as a primary feed water booster pump if no other pressure source is present. In other installations the booster pump will be used as a secondary feed water booster pump to assist a primary feed water pump. In still other installations the booster pump will not be necessary if sufficient pressure is present from a primary feed water pump. Where applicable, the instructions below clearly give directions for valve and switch positioning when not using and when using the booster pump as a primary source or to assist in backwashing the media filter.

19. Ultraviolet Sterilizer Assembly: CAUTION: Make sure that system power is turned off before beginning sterilizer maintenance. 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.

20. CHEMICAL INJECTION PUMP

- a. The chemical injection pump has a flow range of .1 to 1 U.S. gallon per hour. All formulations are given with the assumption that the chemical injection pump will be set to the lowest setting of .1 U.S. gallons per hour. With a setting of .1 U.S. gallons per hour the chemical mixture in the chemical tank will last for one week (seven days). 16.8 U.S. gallons will be consumed from the chemical tank in seven days if the chemical injection pump is set for .1 U.S. gallons per hour (.1 U.S. gallon per hour X 24 hours X 7 days = 16.8 U.S. gallons).

21. CHEMICAL MIXTURE AND INJECTION RATIO

- a. General injection ratios:

The following ratios are general and listed for approximate reference. Each system will require specific chemical injection ratios if chemicals are used. The location of use, duty cycle, recovery ratio and quality of feed water will dictate the need for and ratio of pretreatment chemical injection. Post treatment chemical injection is generally limited to bacteria, virus and microorganism control. Individual desire, local guidelines and government standards may be followed to determine the ratio of post treatment chemical injection.

Pretreatment of feed water

floculant 5 to 10 ppm (parts per million)

sequestriant or antiscalant 5 to 8 ppm (parts per million)

Post treatment of product water

chlorine .2 to .5 ppm (parts per million)

- b. Mixing formula:

The following formulas are based on the assumption that a 20 U.S. gallon chemical tank will be used, the meantime between refill of the tank will be seven days based on a 24 hour per day continuous duty cycle, the chemical injection pump will be set for .1 U.S. gallons per hour flow and the chemical to be mixed is at 100% strength (not diluted). If the duty cycle of the Sea Recovery R.O. system will be 12 hours per day then the chemical tank will require refilling every two weeks; at 6 hours per day duty cycle the chemical tank will require refilling every four weeks; etc.

If the chemical is diluted, such as chlorine at a 33% strength, the amount to be mixed must be increased accordingly. In the case of a 33% strength chemical increase the amount to be mixed by 3 times; if the chemical is a 25% mixture then increase the amount to be mixed by 4 times; etc..

Note: The chemical mixing formula for pretreatment does not change from the SRC 15m3 to SRC 60m3 because the feed water remains constant into these three systems. However, the chemical mixing formula for post treatment does change because the product water flow is different between the various systems.

22. POST TREATMENT OF PRODUCT WATER and PRE TREATMENT OF FEED WATER:

1. POST TREATMENT OF PRODUCT WATER:

Chlorine .2 to .5 ppm (parts per million)

REFERENCE:

Formula = U.S. Gallons Per Day production x 365 days \approx 1,000,000 x PPM desired x 128 ounces per gallon \approx 52 weeks per year \approx percentage of concentration = amount of post treatment chemical to mix with 16.8 U.S. Gallons of product water to obtain a one week supply of post treatment chemical mixture.

DSRC T-2 system:

.2 ppm (1/5 ppm) ratio of chemical injection to product water

Weekly, or when chemical tank is empty

mix 3.4 ounce or 101 milliliters of 100% strength chem

or mix 10.2 ounces or 302 milliliters of 33% strength chem

with 16.8 gallons or 63.6 liters of product water

.5 ppm (1/2 ppm) ratio of chemical injection to product water

Weekly, or when chemical tank is empty

mix 8.5 ounces or 252 milliliters of 100% strength chem

or mix 25.5 ounces or 756 milliliters of 33% strength chem

with 16.8 gallons or 63.6 liters of product water

2. PRETREATMENT OF FEED WATER:

Based on 36 U.S. Gallons of feed water entering the system

CAUTION:

Excess Flocculant will by-pass the media filter and foul the R.O. Membrane Element.

Consult Sea Recovery Application Engineers for exact dosage.

Excess Antiscalant will foul the R.O. Membrane Element. Consult Sea Recovery Application Engineers for exact dosage.

REFERENCE:

This formula assumes feed water weight per U.S. Gallons at approximately 8.3 lbs per gallon and pretreatment chemical at approximately 10 lbs per gallon.

Formula = 36 U.S. Gallons Per Minute feed x 60 minutes per hour x 24 hours per day x 365 days per year x 8.3 lbs per gallon / 1,000,000 x PPM desired / 10 lbs per gallon pretreatment chemical weight x 128 ounces per gallon / 52 weeks per year = amount of pretreatment chemical to mix with 16.8 U.S. Gallons of product water to obtain a one week supply of pretreatment chemical mixture.

Flocculant dosage 4 to 10 ppm (parts per million)

Sequestriant or antiscalant dosage 2 to 8 ppm (parts per million)

2 ppm ratio of chemical injection to feed water. 32 U.S. Gallons per year will be required assuming continuous 24 hour per day operation

Weekly, or when chemical tank is empty

mix 77 ounces or 2288 milliliters of 100% strength chem

with 16.3 gallons or 61.7 liters of product water

4 ppm ratio of chemical injection to feed water. 52 U.S. Gallons per year will be required assuming continuous 24 hour per day operation

Weekly, or when chemical tank is empty

mix 155 ounces or 4575 milliliters of 100% strength chem
with 15.8 gallons or 59.8 liters of product water

6 ppm ratio of chemical injection to feed water. 104 U.S. Gallons per year
will be required assuming continuous 24 hour per day operation

Weekly, or when chemical tank is empty

mix 232 ounces or 6862 milliliters of 100% strength chem
with 14.8 gallons or 56 liters of product water

8 ppm ratio of chemical injection to feed water. 104 U.S. Gallons per year
will be required assuming continuous 24 hour per day operation

Weekly, or when chemical tank is empty

mix 309 ounces or 9150 milliliters of 100% strength chem
with 14.8 gallons or 56 liters of product water

10 ppm ratio of chemical injection to feed water. 130 U.S. Gallons per year
will be required assuming continuous 24 hour per day operation

Weekly, or when chemical tank is empty

mix 386 ounces or 11437 milliliters of 100% strength chem
with 14.3 gallons or 54.1 liters of product water

Fluid conversion formulas given for reference:

1 U.S. fluid ounce (oz)		=	30 milliliters
8 U.S. fluid ounces	=	1 U.S. cup	= 237 milliliters
16 U.S. fluid ounces	=	1 U.S. pint	= 473 milliliters
32 U.S. fluid ounces	=	1 U.S. quart	= 946 milliliters
128 U.S. fluid ounces	=	1 U.S. gallon	= 3785 milliliters
1 metric liter	=	100 centiliters	= 1000 milliliters
1 milliliter		=	.0338 U.S. fluid oz
1 centiliter		=	.338 U.S. fluid oz
1 metric liter		=	33.8 U.S. fluid oz

multiply		by		to get	divide	by		to get
ounces	X	29.5734	=	milliliters		≈29.5734		ounces
ounces	X	2.95734	=	centiliters		≈2.95734		ounces
ounces	X	.0295734	=	liters		≈.0295734		ounces
ounces	X	.0078125	=	gallons	≈	.0078125		ounces
gallons	X	128	=	ounces	≈	128		gallons
cups	X	16	=	gallons	≈	16		cups
quarts	X	4	=	gallons	≈	4		quarts
gallons	X	3.7854	=	liters		≈3.7854		gallons
liters	X	.26417	=	gallons	≈	.26417		liters

PUMP MAINTENANCE

Guideline on servicing the APP pumps (APP0.6-10.2)

Background

We have often been asked for information on typical wear phenomena and service intervals for the APP pumps.

This guideline provides information on when and how servicing is expected to be made. The recommendation is for guidance only and based on experience gained from operation even under extreme conditions.

Design/features

The APP pump design is characterized by:

- Long service lives with minimum of service.
- Being oil and grease-free, as all wear surfaces are lubricated / cooled by the pump medium (water).
- A rotating valve plate sliding against a stationary port-plate controlling the open/close functions for the water supply to the individual pistons. No check valves are thus required in the pump.
- Very small clearances creating the sealing between the moving parts which means that no movable sealing are required between the moving parts inside the pump.

The fine wear properties are achieved by means of a polymer sliding over a stainless steel surface. Between these surfaces a water film is generated – resulting in aquaplaning. If these sliding surfaces are damaged by wearing-down caused by, eg particles, cavitation or overload, the pump flow will be slightly reduced and in worst case, stainless steel will run against stainless steel. **This may cause a total breakdown of the pump – if service is not made in time.**

Danfoss guarantees minimum 8000 hours operation, however max. 18 months from date of sale, provided that the pump has been running according to the Danfoss specifications on pre-filtration, pressure and speed of rotation for the pump. The APP pump is made of super duplex / duplex materials. But in very salty waters and at high water temperatures, even super duplex can corrode. These corrosion particles may result in wear particles and consequently wear in the pump. **It is always recommended to flush the pump after system shutdowns.**

Recommendation

To prevent a total and disastrous breakdown, Danfoss recommends a pump inspection after max. 8000 hours - where worn parts will be changed, if any. **It is always recommended to change pistons and shaft sealing if the goal is to ensure another service free period.**

If the pistons are not changed, frequent inspection is recommended.

Please note that a poorer pre-filtration than 10 my absolute $\beta > 5000$ may reduce the service life depending on particle size and number.

The shaft sealing in APP5.1 – 10.2 is made of Hasteloy. At high TDS and high water temperature, the service life of the shaft sealing will be reduced. For these applications it is recommended to change the shaft sealing after approx. 4000 hours' operation.

Market experience shows that some systems equipped with the APP10.2 operating on water with high oxygen contents and high speed may cause increased cavitation in the pump. For these applications it is advised to make service checks already after 4000 hours. Under certain circumstances it will most likely be pistons requiring replacement.



Recommended service intervals for the APP pumps

This guideline provides information on the recommended service intervals. The recommendation is based upon good engineering practice and on experience gained from operation even under extreme conditions.

The recommendation is for guidance only.

Design/features

Danfoss APP pumps are designed for long operation and low maintenance and life cycle costs.

Danfoss guarantees 8,000 hours service free operation, however max. 18 months from date of production. After 8,000 operation hours it is recommended to inspect the pump and replace worn parts, if any.

If the Danfoss recommendations concerning system-design (see our data sheet) are not followed, the service life of the APP pumps might be affected.

The recommended service intervals on the different parts in the APP pumps appear from the table below:

Pos.	Qty.	Description	Material	Service interval
1	1	Housing, main bearing (Duplex, peek	No need for service
2	1	Mounting flange	Wetted part: duplex Dry part: AISI 316L	No wear part
3	1	Port flange	Duplex	No wear part
4	1	Swash plate	Super duplex	40,000 hours
5	5/7/9	Piston	Super duplex and PEEK	Recommended inspection on a yearly basis and evaluated acc. to App. 1
6	1	Valve plate	Super duplex	24.000 hours
7	1	Port plate	Super duplex and PEEK	24.000 hours
8	1	Cylinder barrel	Super duplex	40.000 hours
9	1	Retaining plate	Super duplex	24.000 hours
10	1	Retaining ball	Super duplex	40.000 hours
11	1	Retainer guide	Super duplex	40.000 hours
12	1/4	Spring	Duplex	40.000 hours
13	1	Spring guide	Duplex or Polypropylene	40.000 hours
14	1	Stop for shaft seal	Polypropylene	No wear part
15	1	Shaft seal	Hasteloy and NBR	It is good practice to change the seal after each dis-assembly of the pump
16	1	Flange for shaft seal	Super duplex	No wear part
17	5/7/9	Back-up ring	Teflon	24.000 hours
18		O-ring (overall)	NBR	24.000 hours
19		Screw (overall)	AISI 316	No wear part
20		Pin (overall)	AISI316 or duplex or PEEK	No wear part
21	1	Valve cone (flushing vavle)	Duplex or PEEK	40.000 hours
22	2	Bleeding screw	Duplex	No wear part
23	1	Parallel key	AISI302	40.000 hours

Appendix 1

Pistons:

The pistons are the heart of the pump regarding service.

If the pistons break down, the pump will suffer a breakdown.

In case of doubt - the pistons must be replaced.

The pictures below is ment as a guideline for evaluating the wear of the sliding surface.

Picture 1:



Cavitation of the piston shoes.
New inspection is required in 3000-4000 hours.

Picture 2:



Cavitation of the piston shoes.
All pistons must be replaced within the next 500-1000 hours.

Picture 3:



Cavitation of the piston shoes.
All pistons must be replaced within the next 100-200 hours.

Picture 4:



Cavitation of the piston shoes.
All pistons must be replaced immediately.

Picture 5:



Abrasive wear of the piston shoes.
All pistons must be replaced immediately.

This document covers the instructions for changing internal pump elements on the axial piston pumps APP5.1-10.2.

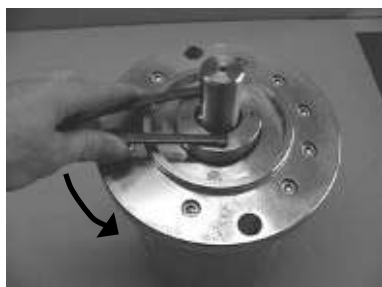
Note: It is essential that the pump is serviced in conditions of absolute cleanliness.

Tools needed:

- Shaft seal tool (code no. 180B4162)
- Service set shaft seal (code no. 180B4161)
- Screwdriver

To understand the pump design better, please see exploded view on last page.

1. Unscrew the seal-retaining ring counterclockwise and remove it.



2. Unscrew the 8 screws in the mounting flange.



3. Carefully remove the mounting flange from the housing.



4. Wet the shaft and shaft seal with clean (filtered) soap-water.
5. Carefully remove the shaft seal assembly using the shaft-seal extractor supplied, provided with the tool set. The extractor must fit underneath the shaft seal.



6. Remove the whole cylinder barrel and carefully place it on a suitable clean surface.



7. Remove the pistons, retaining plate, distance ring and retaining ball from the cylinder barrel.



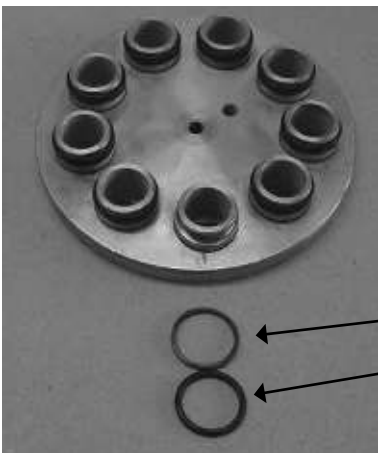
8. Carefully remove the valve plate assembly using a screwdriver.



9. Remove the O-rings and back-up rings from the valve plate.

10. Mount the new back-up rings on the new valve plate.

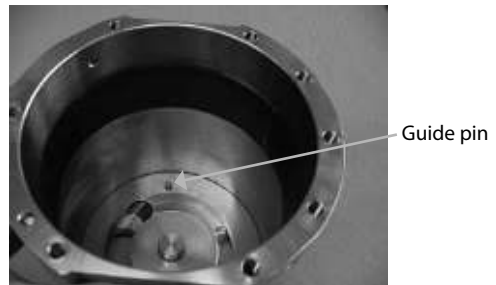
11. Mount the new O-rings.



12. Carefully press, by hand, the cylinder barrel onto the valve plate.



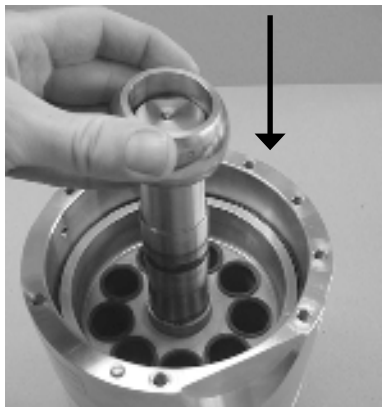
13. Position the port plate over the guide pin.
IMPORTANT: Make sure that the guide pin is located in the locating hole in the port plate.



14. Carefully slide the cylinder barrel into the housing.



15. Fit the retaining ball onto the shoulder of the shaft.



16. Carefully position all the pistons into the retaining ring.

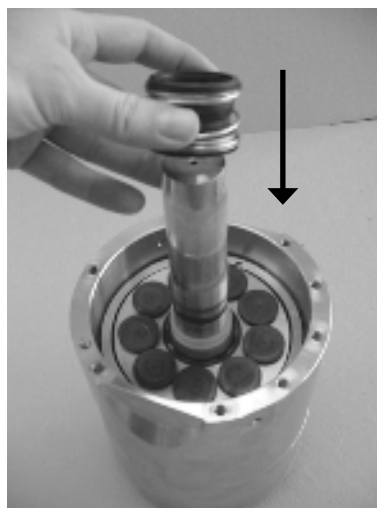
17. Position all the pistons, one in each piston bore, in the cylinder barrel. It may be necessary to tilt the retaining ring to allow the pistons to fit into the piston bores.



18. Position the new white spacer on top of the retaining ball.



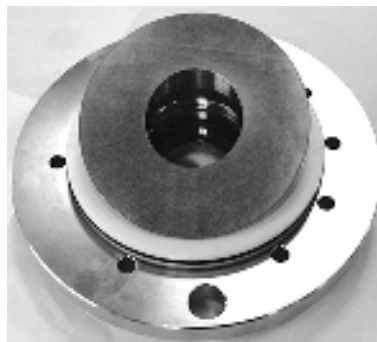
19. Mount the new shaft seal following the instructions in "Shaft Seal - APP 5.1 - 10.2" (521B0738).



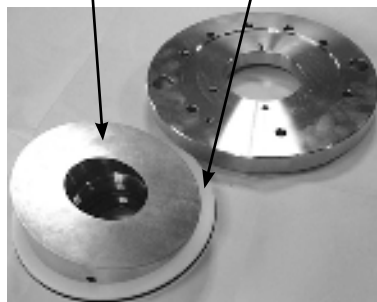
20. Unscrew the screw.



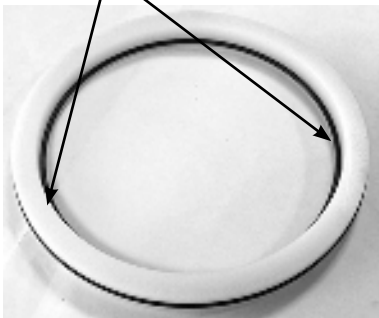
21. Turn the mounting flange upside down.



22. Remove the swash plate and the spacer.



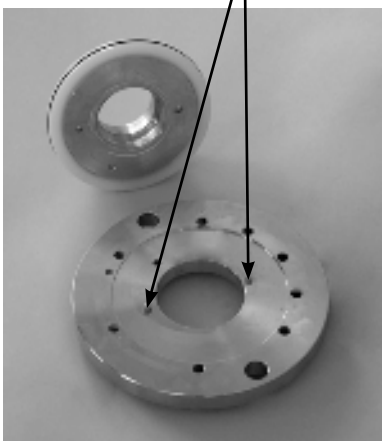
23. Replace the O-rings.



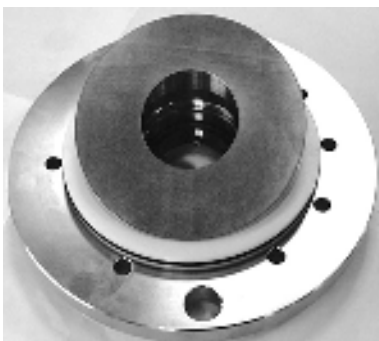
24. Mount the spacer on the swash plate.



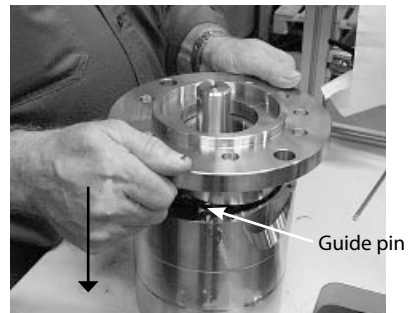
25. Position the swash plate on the mounting flange using the guide pins and fix it with the screw.



26. The mounting flange is now ready to be mounted on the housing.



27. Position the guide pin in the housing.



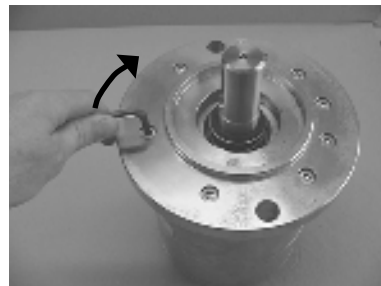
28. Position and carefully press, by hand, the combined flange and swash plate into the housing.

IMPORTANT: Ensure not to cut the O-ring.



29. Screw the 8 screws into the flange and the housing. Turn each screw 2 rounds at a time to ensure the flange is mounted as straight as possible. Tighten the screws to a torque of 30 ± 3 Nm.

To prevent seizing-up, lubricate the threads on the 8 screws with grease, screw them into the pump and tighten by hand. Use Molykote® D paste from Dow Corning or Klüber UH1 84-201 from Klüber lubrication.



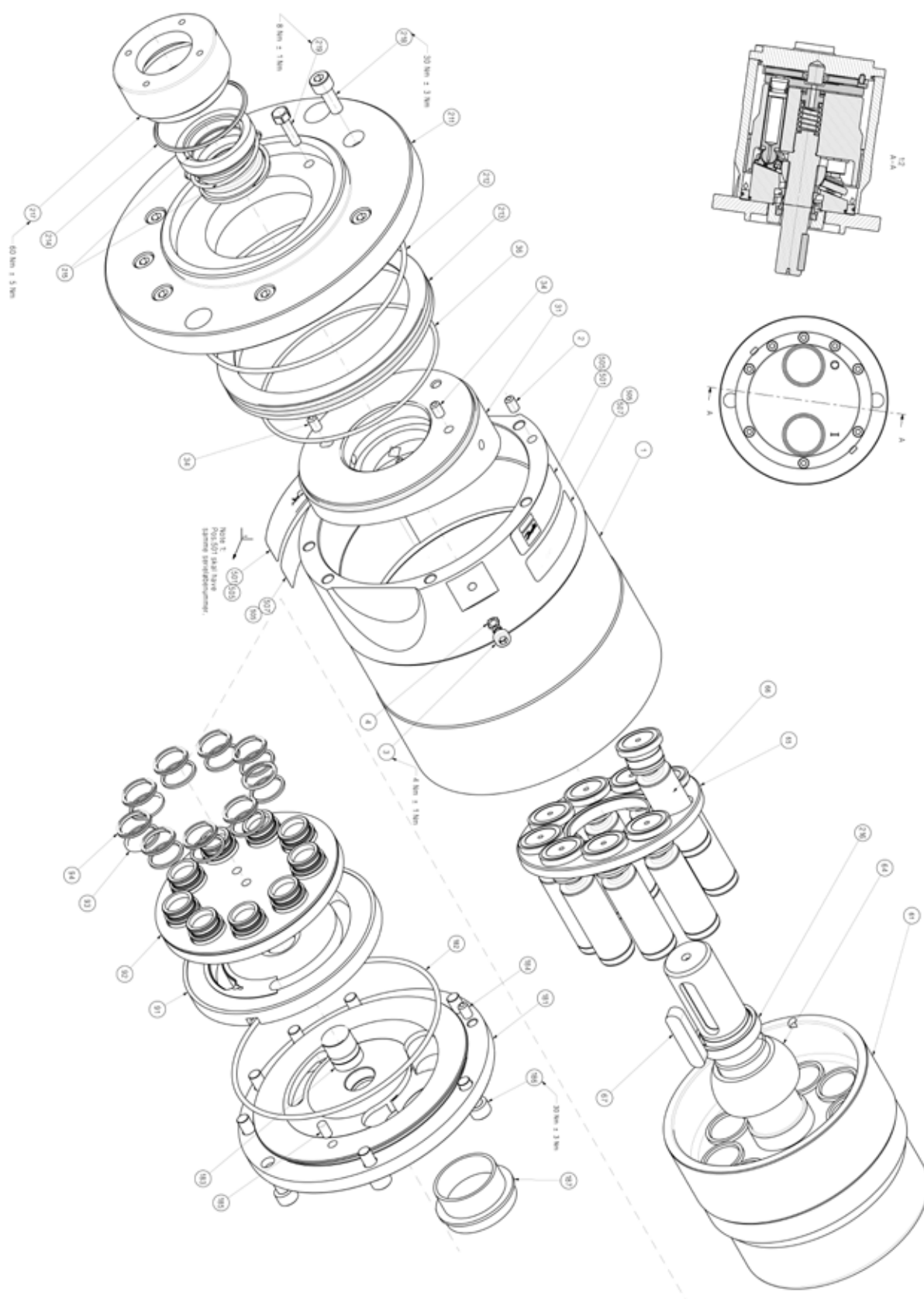
30. Mount the seal retainer ring. Tighten the ring with a torque of 30 ± 3 Nm.



Parts list for APP 5.1-10.2

18084133 - Swashplate set (APP10,2) 18084132 - Swashplate set (APP8,2) 18084131 - Swashplate set (APP7,2) 18084130 - Swashplate set (APP6,5) 18084129 - Swashplate set (APP5,1) 18084155 - Piston set (APP10,2) 18084154 - Piston set (APP5,1-8,2) 18084157 - Retainer set (APP10,2) 18084156 - Retainer set (APP5,1-8,2) 18084159 - Valve plate set (APP10,2) 18084158 - Valve plate set (APP5,1-8,2) 18084160 - Cylinder barrel (APP5,1-10,2) 18084161 - Sealset (APP5,1-10,2)	18084133 - Swashplate set (APP10,2) 18084132 - Swashplate set (APP8,2) 18084131 - Swashplate set (APP7,2) 18084130 - Swashplate set (APP6,5) 18084129 - Swashplate set (APP5,1) 18084155 - Piston set (APP10,2) 18084154 - Piston set (APP5,1-8,2) 18084157 - Retainer set (APP10,2) 18084156 - Retainer set (APP5,1-8,2) 18084159 - Valve plate set (APP10,2) 18084158 - Valve plate set (APP5,1-8,2) 18084160 - Cylinder barrel (APP5,1-10,2) 18084161 - Sealset (APP5,1-10,2)																
	Pos.	Qnt.	Designation	Material													
	1	1	Housing	Duplex													
	2	1	Pin (ø6*10)	AISI316	X												
	3	2	Bleed screw	Duplex	X												
	4	2	O-ring (ø4,5*1,5)	NBR	X												
	31	1	Swash plate 5,1	Super duplex										X			
	31	1	Swash plate 6,5	Super duplex											X		
	31	1	Swash plate 7,2	Super duplex												X	
	31	1	Swash plate 8,2	Super duplex													X
	31	1	Swash plate 10,2	Super duplex													X
	34	2	Pin (ø6*10)	AISI316	X									X	X	X	X
	36	1	O-ring (ø117*2,5)	NBR	X								X	X	X	X	X
	61	1	Cylinder barrel	Super duplex		X											
64	1	Retainer guide	Super duplex						X	X							
65	1	Retainer plate 5,1-8,2	Super duplex						X								
65	1	Retainer plate 10,2	Super duplex							X							
66	9	Piston 5,1-8,2	Super duplex								X						
66	9	Piston 10,0	Super duplex									X					
67	1	Key 10*8*45	AISI302	X													
91	1	Portplate 5,1-8,2	Super duplex/PEEK			X											
91	1	Portplate 10,2	Super duplex/PEEK				X										
92	1	Valve plate	Super duplex			X	X										
93	9	Backup ring	PEEK	X		X	X										
94	9	O-ring (ø18,3*2,4)	NBR	X		X	X										
181	1	Port flange	Super duplex														
182	1	O-ring (ø135*3)	NBR	X													
183	1	Guide pin	Super duplex														
184	1	Pin (ø6*10)	AISI316	X													
185	1	Pin (ø6*10)	PEEK	X													
186	8	Screw M8*20	AISI316	X													
187	2	Port connection/plug															
211	1	Flange	AISI316														
212	1	O-ring (ø135*3)	NBR	X							X	X	X	X	X	X	
213	1	Plate	PEHD 1000										X	X	X	X	
214	1	O-ring (ø58*2)	NBR	X													
215	1	Shaft seal	Hasteloy/NBR	X													
216	1	Stop bush	PEEK	X													
217	1	Bush	Super duplex														
218	8	Screw M8*20	AISI316	X							X	X	X	X	X	X	
219	1	Screw	AISI316	X									X	X	X	X	
		Instruction		X	X	X	X	X	X	X	X	X	X	X	X	X	

Exploded view



This user guide provides guidance on how to determine whether the parts of the APP5.1-10.2 are worn and should be replaced.

Seal retaining ring:

The seal retaining ring is not a wear part.

Swash plate:

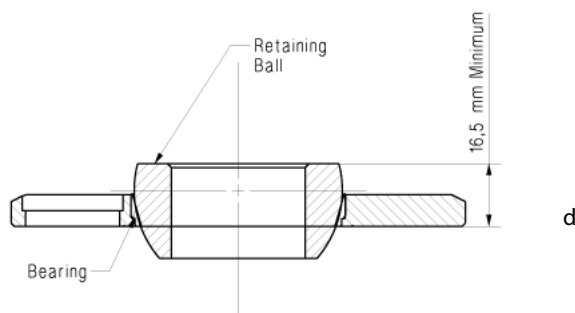
The swash plate is OK if the surface is smooth and no wear is visible and no scratches or grooves are felt. If not, change the swash plate according to instruction 521B0740.

Retaining Plate:

Slight wear felt on the sliding surface is acceptable (see picture). If the wear is worse, change the retaining plate according to instructions 521B0740. There must not be any level difference on the surface of the ring. The retainer ring must be absolute straight and not bend.



The bearing in the retaining plate is worn if the distance (d) is below 16.5 mm (0.65 inches). This corresponds to a wear of 1 mm (0.04 inches).



Retaining ball:

The retaining ball is OK if the sliding surface is smooth and no wear is visible and no scratches are felt. If the wear is worse, change the retaining ball according to instructions 521B0740.

Valve Plate:

Slight wear felt on the sliding surface is acceptable.

If mechanical and volumetric efficiencies are acceptable, the valve plate is OK.

If mechanical and volumetric efficiencies are not acceptable, change the valve plate according to instruction 521B0740.

Port Plate:

Slight wear felt on the sliding surface is acceptable.

If mechanical and volumetric efficiencies are acceptable, the port plate is OK.

If mechanical and volumetric efficiencies are not acceptable, change the valve plate according to instruction 521B0740.

Bearing surface inside pump housing:

The bearing is not a wear part.

The bearing is OK if the sliding surface is free of hard particles.

If the surface is rough, the pump will still work. However, the energy consumption might increase.

Outer surface of cylinder barrel:

The surface is OK if the sliding surface is free of hard particles and no elements stick out from the surface.

If the surface is rough, the pump will still work. However, the energy consumption might increase.

Piston bores:

Piston bores are not a replaceable part.

The surface of the bores in the cylinder barrel is OK if the sliding surface is free of hard particles.

If the surface is rough or has scratches or grooves, the pump will still work. However, the flow output might drop.

Pistons:

The pistons are the heart of the pump regarding service.

If the pistons break down, the pump will suffer a breakdown.

In case of doubt - the pistons must be replaced.

The pictures below is ment as a guideline for evaluating the wear of the sliding surface.

Picture 1:



Cavitation of the piston shoes.
New inspection is required in 3000-4000 hours.

Picture 2:



Cavitation of the piston shoes.
All pistons must be replaced within the next 500-1000 hours.

Picture 3:



Cavitation of the piston shoes.
All pistons must be replaced within the next 100-200 hours.

Picture 4:



Cavitation of the piston shoes.
All pistons must be replaced immediately.

Picture 5:



Abrasive wear of the piston shoes.
All pistons must be replaced immediately.

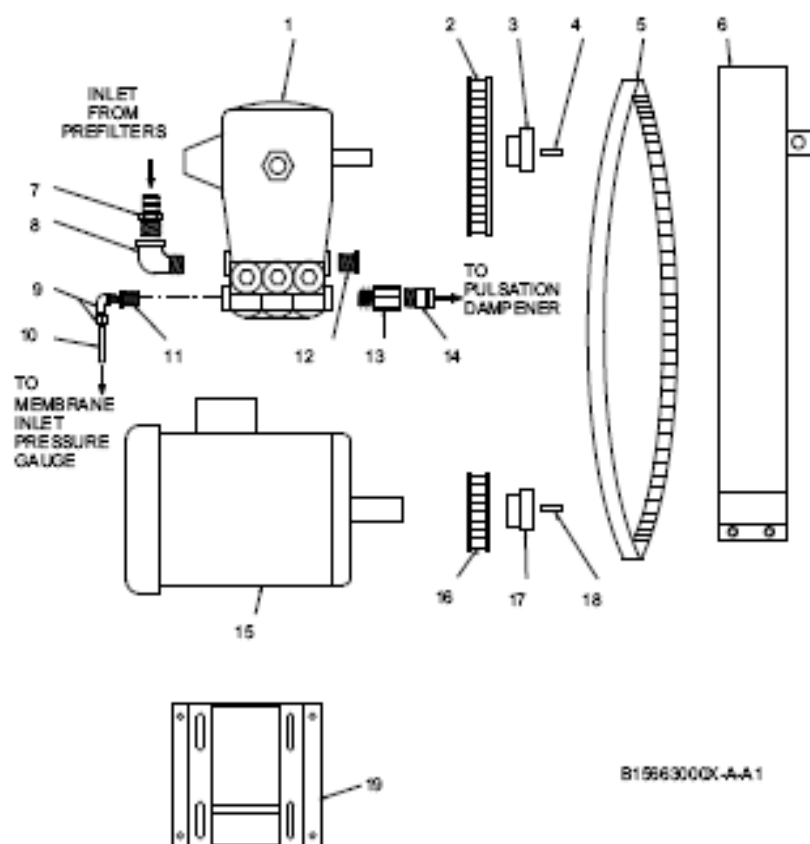
CAT PUMP MAINTENANCE

HIGH PRESSURE PUMP & MOTOR ASSEMBLY

WHEN ORDERING ASSEMBLY SPECIFY:

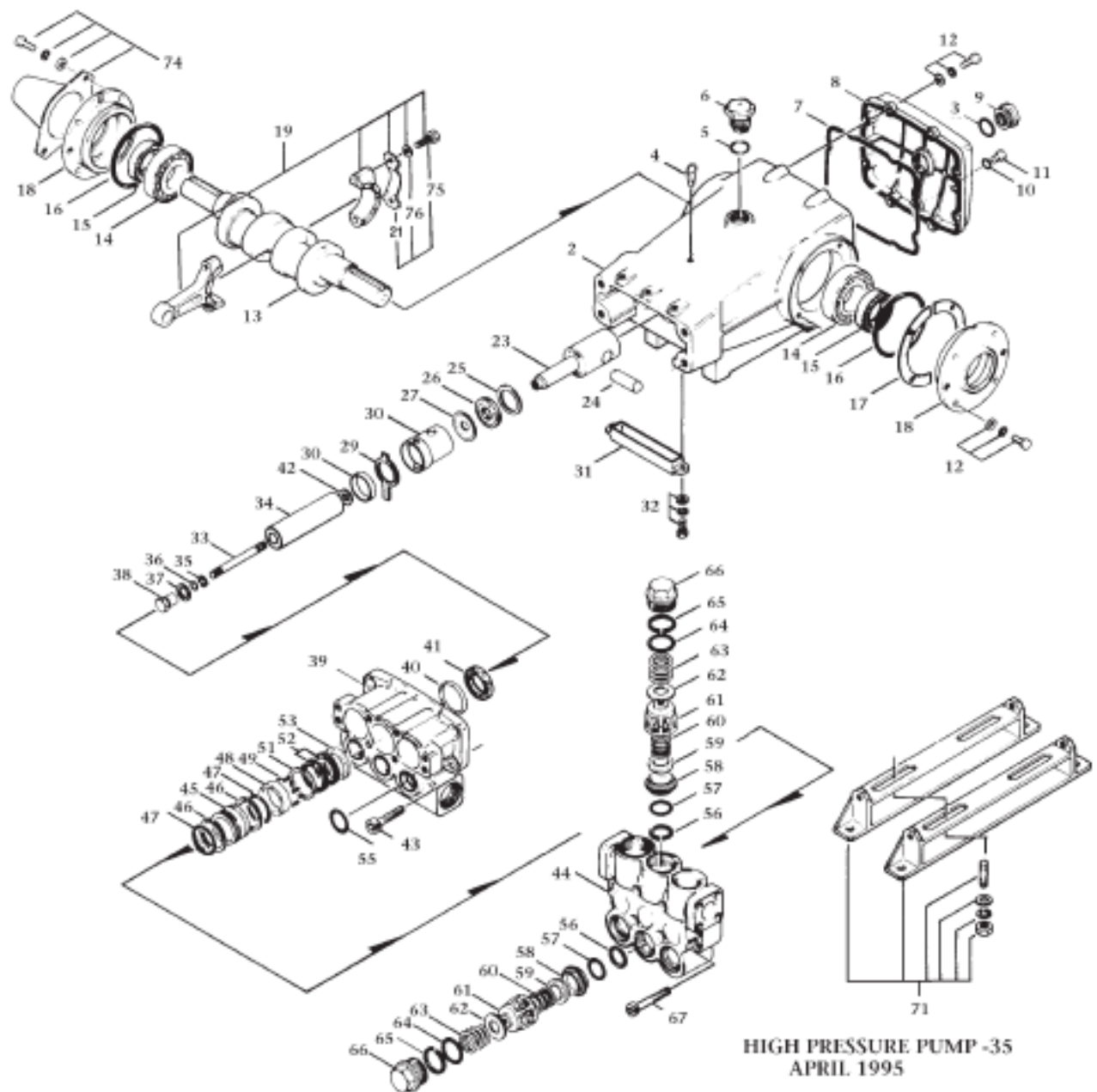
1. FULL SYSTEM MODEL NUMBER 2. OPERATING VOLTAGE, CYCLES & PHASE 3. SYSTEM SERIAL NUMBER

ITEM	QTY	DESCRIPTION	PART NUMBER
1	1	HIGH PRESSURE PUMP -35	1217172722
2	1	PULLY HP PUMP 50/60 Hz	1616741646
3	1	BUSHING, PULLY, HP PUMP 50/60 Hz	1616690792-35MM
4	1	KEY, HP PUMP PULLEY BUSHING	4416020700
5	1	DRIVE BELT -35	1732880746
6	1	PULLY GUARD	2020016902A
7	1	CONN MALE 1 1/2" MNPT X 1 1/2" BARB SS	01176559AA
8	1	ELB 90° STREET 1 1/2" NPT LOW PRESSURE	0117235900
9	1	ELB 90° 1/2" MNPT X 1/4" TUBE SS	0217021087
10	44 in	TUBE 1/4" OD SS	2417315300
11	1	RED BUSH 1" MNPT X 1/2" FNPT SS	0117294200
12	1	PIPE PLUG HEX HEAD 1 1/2" MNPT SS	01173459AE
13	1	ELB 90° -16 FLARE x 1" MPT	1317025169
14	1	MOTOR, 20 HP, 4 POLE, THREE PHASE 50 Hz	1585075111
		MOTOR, 20 HP, 4 POLE, THREE PHASE 60 Hz	1584075111
15.....	1	PULLY MOTOR 50 Hz	
		PULLY MOTOR 60 Hz	1616740146
16.....	1	BUSHING, PULLY MOTOR 50 ZHz	1616790546-158
		BUSHING, PULLY MOTOR 60 ZHz	1616790546-158
17.....	1	KEY, MOTOR PULLY BUSHING	4416020600
18.....	1	SLIDE PLATE MOTOR MOUNTING	1816011112



HIGH PRESSURE PUMP P/N 1217172722

ITEM	DESCRIPTION / MODEL NUMBER	PART NUMBER	QTY
2-74	HIGH PRESSURE PUMP 35 GPM	1222172722	1
2	CRANKCASE	1222172722 -2	1
3	"O" RING, OIL GAUGE	1222172722 -3	1
4	EYE BOLT	1222172722 -4	1
5	"O" RING OIL FILLER CAP BUNA-N	1222172722 -5	1
6	OIL FILLER CAP	1222172722 -6	1
7	"O" RING CRANKCASE COVER BUNA-N	1222172722 -7	1



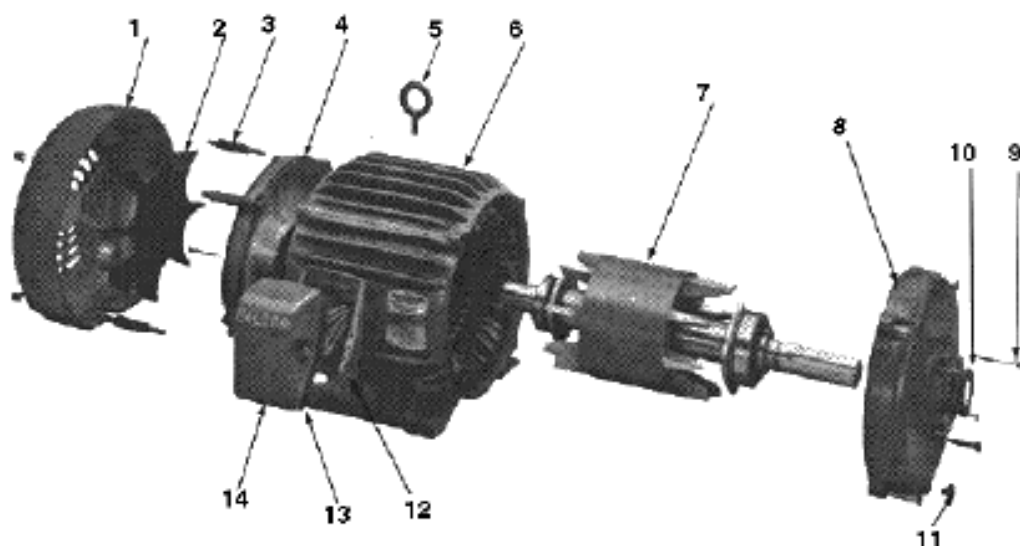
HIGH PRESSURE PUMP -35
APRIL 1995

HIGH PRESSURE PUMP PARTS LISTING CONTINUED

ITEM	DESCRIPTION / MODEL NUMBER	PART NUMBER	QTY
8	CRANKCASE COVER	1222172722 -8	1
9	OIL GAUGE	1222172722 -9	1
10	"O" RING DRAIN PLUG BUNA-N	1222172722 -10	1
11	DRAIN PLUG	1222172722 -11	
12	HEX HEAD SCREW (M8 x 25MM)	1222172722 -12	16
12	WASHER FLAT (M8)	1222172722 -12	16
12	WASHER SPLIT LOCK (M8)	1222172722 -12	16
13	CRANKSHAFT	1222172722 -13	1
14	BEARING	1222172722 -14	2
15	OIL SEAL	1222172722 -15	2
16	"O" RING BEARING CASE BUNA-N	1222172722 -16	2
17	1/2 CIRCLE SHIM, SEAL CASE	1222172722 -17	4
18	BEARING CASE	1222172722 -18	2
19	CONNECTING ROD	1222172722 -19	3
20	LOCKING WASHER	1222172722 -20	3
21	WASHER, LOCKING CONN ROD	1222172722 -21	6
23	PLUNGER ROD 316 STAINLESS STEEL	1222172722 -23	3
24	PLUNGER ROD PIN	1222172722 -24	3
25	WASHER, PLUNGER	1222172722 -25	3
26	OIL SEAL PLUNGER ROD BUNA-N	1222172722 -26	3
27	BARRIER SLINGER BUNA-N	1222172722 -27	3
29	WICK	1222172722 -29	3
30	SEAL RETAINER 2 PIECE	1222172722 -30	3
31	OIL PAN	1222172722 -31	1
32	HEX HEAD SCREW (M6 x 16MM)	1222172722 -32	2
32	WASHER FLAT (M6)	1222172722 -32	2
32	WASHER SPLIT LOCK (M6)	1222172722 -32	2
33	RETAINER STUD M10 x 122 MM 316 SS	1222172722 -33	3
34	CERAMIC PLUNGER	1222172722 -34	3
35	BACK-UP RING TEFLON	1222172722 -35	3
36	"O" RING PLUNGER RETAINER BUNA-N	1222172722 -36	3
37	GASKET 316 STAINLESS STEEL	1222172722 -37	3
38	PLUNGER RETAINER 316 STAINLESS STEEL	1222172722 -38	3
39	INLET MANIFOLD ALUMINUM BRONZE	1222172722 -39	1
40	SPACER	1222172722 -40	3
41	LOW PRESSURE SEAL 316 STAINLESS STEEL	1222172722 -41	3
42	KEY HOLE WASHER (M16)	1222172722 -42	3
43	HEX SOCKET SCREW (M14 x 40MM)	1222172722 -43	4
44	DISCHARGE MANIFOLD ALUMINUM BRONZE	1222172722 -44	1
45	CYLINDER 316 STAINLESS STEEL	1222172722 -45	3
46	BACK-UP RING TEFLON	1222172722 -46	6
47	"O" RING SPACER BUNA-N	1222172722 -47	6
48	V-PACKING SPACER WITH COIL SPRING 316 SS	1222172722 -48	3
49	COIL SPRING SPACER 316 STAINLESS STEEL	1222172722 -49	18
51	MALE ADAPTER ALUMINUM BRONZE	1222172722 -51	3
52	V-PACKING	1222172722 -52	6
53	FEMALE ADAPTER ALUMINUM BRONZE	1222172722 -53	3
55	"O" RING INLET MANIFOLD	1222172722 -55	3
56	BACK-UP RING	1222172722 -56	6
57	"O" RING VALVE SEAT BUNA-N	1222172722 -57	6
58	VALVE SEAT STEPPED 316 STAINLESS STEEL	1222172722 -58	6
59	VALVE 316 STAINLESS STEEL	1222172722 -59	6
60	VALVE SPRING 316 STAINLESS STEEL	1222172722 -60	6
61	VALVE SPRING RETAINER	1222172722 -61	6
62	WASHER, SPRING RETAINER	1222172722 -62	6
63	COIL SPRING (70KG), VALVE PLUG	1222172722 -63	6
64	"O" RING VALVE PLUG BUNA-N	1222172722 -64	6
65	BACK-UP RING VALVE TEFLON	1222172722 -65	6
66	VALVE PLUG ALUMINUM BRONZE	1222172722 -66	6
67	HEX SOCKET SCREW (M12 x 65MM)	1222172722 -67	8
71	MOUNTING RAIL ASSEMBLY SET	1222172722 -71	1
74	SHAFT PROTECTOR	1222172722 -74	1
75	SCREW HEX HEAD M10 X 55MM	1222172722 -75	6
76	WASHER M10	1222172722 -76	6

MOTOR, HIGH PRESSURE PUMP, 20 HP
 MOTOR, 20 HP, 4 POLE, THREE PHASE 50 Hz P/N 1585075111
 MOTOR, 20 HP, 4 POLE, THREE PHASE 60 Hz P/N 1584075111

ITEM	QTY	DESCRIPTION / MODEL NUMBER	PART NUMBER
		MOTOR, 20 HP, 4 POLE, THREE PHASE 50 Hz	1585075111
		MOTOR, 20 HP, 4 POLE, THREE PHASE 60 Hz	1584075111
1	1	FAN COVER	158X075111-1
2	1	COOLING FAN	158X075111-2
3	4	FAN COVER MOUNTING STUD	158X075111-3
4	1	FRONT END PLATE	158X075111-4
5	1	EYE BOLT	158X075111-5
6	1	WOUND STATOR ASSEMBLY	158X075111-6
7	1	ROTOR AND SHAFT ASSEMBLY	158X075111-7
8	1	PULLEY END PLATE	158X075111-8
9	2	RETAINER RING BOLT	158X075111-9
10	1	SLINGER	158X075111-10
11	1	AUTO DRAIN PLUG	158X075111-11
12	1	CONDUIT BOX	158X075111-12
13	1	CONDUIT BOX LID GASKET	158X075111-13
14	1	CONDUIT BOX LID	158X075111-14



SYSTEM TROUBLESHOOTING



P.O. Box 5288 • Carson, CA 90745-5288

Tasman Sea Control System

Trouble Shooting Manual

(Base System)

PLC Firmware Version: 2.02

HMI Firmware Version: 1.21

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1. FAULT TROUBLESHOOTING:

The Tasman Sea comes equipped with a highly intelligent control system. This system constantly performs health checks. If health checks show a component fault or pending system failure; the control system will shut the unit down to protect from damage. The reason for the shutdown is displayed on the system touch screen. To diagnose a problem refer to the tables listed in this document.

Next to each fault code is a list of reasons that could cause this fault code to be displayed. Investigate the reasons listed in order to locate and rectify the problem. If you are not able to locate the fault after researching the reasons given, call Danfoss Sea Recovery for further assistance.

When faulted the system generates specific fault codes, please refer to the table below for tips:

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	High Pressure Valve Position Error. Start-Up Aborted	The high pressure by-pass valve is not currently in the correct position (open) for starting. Check that the valve is switched to auto and that the current position is correct
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

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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	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
14	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
15	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

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16	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
17	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
18	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
19	Spare	Not Currently Used
20	Automatic BPR Fault. Start-Up Aborted **	The automatic back pressure regulator valve is reporting an error, check the system messaging area for further details, and rectify before continuing. (only on fully automatic models)
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 DSRC 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)

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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 DSRC 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 DSRC for assistance

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34	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
35	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)
36	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)
37	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
38	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)

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2. PERFORMANCE TROUBLESHOOTING:

The Tasman Sea control system also constantly monitors system performance. If performance checks detect a potential problem with the unit, the system will continue to function but will raise performance warnings. These faults do not result in a system shutdown, but should be address as soon as possible to help maintain optimal system performance. The reason for the warning is displayed on the system touch screen. To diagnose a problem refer to the tables listed in this document.

Next to each performance code is a list of reasons that could cause this code to be displayed. Investigate the reasons listed in order to locate and rectify the problem. If you are not able to locate the problem after researching the reasons given, call Danfoss Sea Recovery for further assistance.

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)

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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 DSRC 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 DSRC 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 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.

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14	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.
15	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.
16	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.
17	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 pressure sensor.
18	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 pressure sensor.
20	Reserved For Future Performance Warning Use	Reserved
25	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 DSRC for additional information
26	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 DSRC for additional information

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27	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.
28	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
29	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
30	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
31	High Pressure Pump Requires Servicing	The high pressure pump has run for more than 8000 hrs and now requires servicing
32	High Pressure Relief Valve Has Failed To Activate (Man)	The operator is running the system manually, and automatic activation of the high pressure relief valve failed to complete successfully. To continue the operator must actuate the valve manually
33	Product 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
36	Insufficient Fresh Water Flush Inlet Pressure**	Fresh water flush mode is currently active but insufficient pressure is detected at the fresh water flush inlet.

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37	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.
38	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.
39	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.
40	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.
41	Salinity Probe Reading as 'In Air', Values Can't Be 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.
42	Product 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

** = Indicates optional components

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3. AUXILIARY PUMP TROUBLESHOOTING

If the Auxiliary pump fails to operate, follow these steps to isolate the problem

1. Open the control panel door and manually override the disconnect switch to ensure the panel has power.



Extremely High Voltage Present!

Working on a live panel is sometimes necessary to help locate system faults. While working on a live panel extreme caution is needed.

Working on live panels should only be attempted by fully qualified personnel.

2. Turn the Auxiliary pump operator switch to the manual position.
3. Inspect the Auxiliary pump contactor (DCP-100) circuit protector switch. If this switch is currently in the 'off' (horizontal) position it confirms that a system overload resulted in the circuit breaker popping to protect the circuit. Reset the breaker by turning the switch to the 'on' (vertical) position and check Auxiliary pump function. If the pump still does not function, proceed with the next test.
4. Inspect the condition of relay YS-1005A, the small light on the relay should be illuminated when the Auxiliary pump operator switch is in the manual position. If it is, proceed to the next test, if not inspect the PLC, locate and inspect output indicator Q13, this output indicator should be illuminated. If it is, there is a wiring fault between the PLC and the Auxiliary pump contactor control relay (YS-1005A), trace out the wiring to identify the problem. If this output indicator is not illuminated there could possibly be a problem with the control system PLC, contact Danfoss Sea Recovery for further details.
5. Using a multi-meter test the voltage available across terminals A1 and A2 of the Auxiliary pump contactor (DCP-100). If 24vDC is detected when the Auxiliary pump operator is moved to the manual position proceed to the next test, if 24vDC is not detected, there is a wiring fault between the Auxiliary pump control relay (YS-1005A) and the Auxiliary pump contactor, trace out the wiring to identify the problem
6. Leave the Auxiliary pump operator in the manual position, using a multi-meter check the outgoing voltage from the Auxiliary pump contactor (DCP-100) terminals T1, T2 and T3. If the correct output voltage is detected, the problem lies within the Auxiliary pump power wiring, or within the motor itself. Re-assemble the panel, manually turn off the disconnect switch, close and lock the panel door. If the correct output voltage is not detected proceed with the next test.

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7. Using a multi-meter test the voltage available across the L1, L2 and L3 terminals of the Auxiliary pump contactor (DCP-100), if the correct voltage is detected the problem lies within the Auxiliary pump contactor itself, remove the contactor and replace with a new unit. If no voltage is detected proceed to the next test.
8. Using a multi-meter test the voltage available across terminals L1, L2 and L3 of DB-1, if the correct voltage is detected the problem lies within the cabling between DB-1 and the Feed pump contactor (DCP-100), trace out the wiring to identify the problem. If the correct voltage is not detected move on to the next test.
9. Using a multi-meter test the voltage available across terminals T1, T2 and T3 of the main disconnect switch (DS-100), if the correct voltage is detected the problem lies within the cabling between DS-100 and DB-1, trace out the wiring to identify the problem. If the correct voltage is not detected move on to the next test.
10. Once again verify incoming power to the panel. Using a multi-meter test the voltage available across terminals L1, L2 and L3 of DS-100 If the correct voltage is detected the problem lies within the main disconnect switch. Remove the switch and replace with a new unit. If the correct voltage is not detected investigate why the incoming power to the control system has failed.

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4. Booster Pump Trouble Shooting.

If the booster pump fails to operate, follow these steps to isolate the problem

1. Open the control panel door and manually override the disconnect switch to ensure the panel has power.



Extremely High Voltage Present!

Working on a live panel is sometimes necessary to help locate system faults.

While working on a live panel extreme caution is needed.

Working on live panels should only be attempted by fully qualified personnel.

2. Turn the booster pump operator switch to the manual position.
3. Inspect the booster pump contactor (DCP-101) circuit protector switch. If this switch is currently in the 'off' (horizontal) position it confirms that a system overload resulted in the circuit breaker popping to protect the circuit. Reset the breaker by turning the switch to the 'on' (vertical) position and check booster pump function. If the pump still does not function, proceed with the next test.
4. Inspect the condition of relay YS-1005A, the small light on the relay should be illuminated when the booster pump operator switch is in the manual position. If it is, proceed to the next test, if not inspect the PLC, locate and inspect output indicator Q14, this output indicator should be illuminated. If it is, there is a wiring fault between the PLC and the booster pump contactor control relay (YS-1005A), trace out the wiring to identify the problem. If this output indicator is not illuminated there could possibly be a problem with the control system PLC, contact Danfoss Sea Recovery for further details.
5. Using a multi-meter test the voltage available across terminals A1 and A2 of the booster pump contactor (DCP-101). If 24vDC is detected when the booster pump operator is moved to the manual position proceed to the next test, if 24vDC is not detected, there is a wiring fault between the booster pump control relay (YS-1005A) and the booster pump contactor, trace out the wiring to identify the problem
6. Leave the booster pump operator in the manual position, using a multi-meter check the outgoing voltage from the booster pump contactor (DCP-101) terminals T1, T2 and T3. If the correct output voltage is detected, the problem lies within the booster pump power wiring, or within the motor itself. Re-assemble the panel, manually turn off the disconnect switch, close and lock the panel door. If the correct output voltage is not detected proceed with the next test.

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7. Using a multi-meter test the voltage available across the L1, L2 and L3 terminals of the booster pump contactor (DCP-101), if the correct voltage is detected the problem lies within the booster pump contactor itself, remove the contactor and replace with a new unit. If no voltage is detected proceed to the next test.
8. Using a multi-meter test the voltage available across terminals L1, L2 and L3 of DB-1, if the correct voltage is detected the problem lies within the cabling between DB-1 and the booster pump contactor (DCP-101), trace out the wiring to identify the problem. If the correct voltage is not detected move on to the next test.
9. Using a multi-meter test the voltage available across terminals T1, T2 and T3 of the main disconnect switch (DS-100), if the correct voltage is detected the problem lies within the cabling between DS-100 and DB-1, trace out the wiring to identify the problem. If the correct voltage is not detected move on to the next test.
10. Once again verify incoming power to the panel. Using a multi-meter test the voltage available across terminals L1, L2 and L3 of DS-100 If the correct voltage is detected the problem lies within the main disconnect switch. Remove the switch and replace with a new unit. If the correct voltage is not detected investigate why the incoming power to the control system has failed.

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5. High Pressure Pump Trouble Shooting.

If the High Pressure pump fails to operate, follow these steps to isolate the problem

1. Open the control panel door and manually override the disconnect switch to ensure the panel has power.



Extremely High Voltage Present!

Working on a live panel is sometimes necessary to help locate system faults.

While working on a live panel extreme caution is needed.

Working on live panels should only be attempted by fully qualified personnel.

2. Turn the high pressure pump operator switch to the manual position.
3. Inspect the high pressure pump contactor (DCP-102) circuit protector fuses. If the fuse inspection windows have turned black it confirms that a system overload resulted in the circuit fuse popping to protect the circuit. Replace the blown fuses and check high pressure pump function. If the pump still does not function, proceed with the next test.
4. Inspect the condition of relay YS-1005C, the small light on the relay should be illuminated when the high pressure pump operator switch is in the manual position. If it is, proceed to the next test, if not inspect the PLC, locate and inspect output indicator Q15, this output indicator should be illuminated. If it is, there is a wiring fault between the PLC and the high pressure pump contactor control relay (YS-1005C), trace out the wiring to identify the problem. If this output indicator is not illuminated there could possibly be a problem with the control system PLC, contact Danfoss Sea Recovery for further details.
5. Using a multi-meter test the voltage available across terminals A1 and A2 of the high pressure pump contactor. If 24vDC is detected when the high pressure pump operator is moved to the manual position proceed to the next test, if 24vDC is not detected, there is a wiring fault between the high pressure pump control relay (YS-1005C) and the high pressure pump contactor, trace out the wiring to identify the problem
6. Leave the high pressure pump operator in the manual position, using a multi-meter check the outgoing voltage from the high pressure pump contactor (DCP-102) terminals T1, T2 and T3. If the correct output voltage is detected, the problem lies within the high pressure pump power wiring, or within the motor itself. Re-assemble the panel, manually turn off the disconnect switch, close and lock the panel door. If the correct output voltage is not detected proceed with the next test.

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7. Using a multi-meter test the voltage available across the L1, L2 and L3 terminals of the high pressure pump contactor (DCP-102), if the correct voltage is detected the problem lies within the high pressure pump contactor itself, remove the contactor and replace with a new unit. If no voltage is detected proceed to the next test.
8. Using a multi-meter test the voltage available across terminals L1, L2 and L3 of DB-1, if the correct voltage is detected the problem lies within the cabling between DB-1 and the high pressure pump contactor (DCP-102), trace out the wiring to identify the problem. If the correct voltage is not detected move on to the next test.
9. Using a multi-meter test the voltage available across terminals T1, T2 and T3 of the main disconnect switch (DS-100), if the correct voltage is detected the problem lies within the cabling between DS-100 and DB-1, trace out the wiring to identify the problem. If the correct voltage is not detected move on to the next test.
10. Once again verify incoming power to the panel. Using a multi-meter test the voltage available across terminals L1, L2 and L3 of DS-100 If the correct voltage is detected the problem lies within the main disconnect switch. Remove the switch and replace with a new unit. If the correct voltage is not detected investigate why the incoming power to the control system has failed.

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6. Motorized Valve Trouble Shooting.

If any motorized valve fails to operate. Refer to the control system display for an explanation of what fault occurred. Address each fault as indicated in the chart below:

1	Product 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)
2	Product 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)
3	Product 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)
4	Product 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.
5	Product 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.
6	Product 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)

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7	Product 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)
8	High Pressure 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)
9	High Pressure 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)
10	High Pressure Valve Failed To Complete Close Motion	The control system commanded the product diversion valve to open. 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)
11	High Pressure Valve Closing Fault	This fault indicator is usually raised along with either a failure to respond to close command fault, or an open command motion failed to complete.
12	High Pressure Valve Opening Fault	This fault indicator is usually raised along with either a failure to respond to open command fault, or a close command motion failed to complete.
13	High Pressure 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)

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14	High Pressure 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 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)
15	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)
16	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)
17	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)
18	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.
19	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.
20	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)

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21	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)
22	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)
23	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)
24	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)
25	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.
26	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.
27	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)

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28	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)
29	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)
30	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)
31	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)
32	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.
33	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.
34	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)

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35	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)
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** = Indicates optional components

If after checking all wiring and fusing as indicated in the tables above, it is safe to conclude the valve has failed, replace the valve.

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7. Ultra-violet Sterilizer Troubleshooting.

If the ultra-violet sterilizer fails to operate, follow these steps to isolate the problem.

1. Open the control panel door and manually override the disconnect switch to ensure the panel has power.



Extremely High Voltage Present!

Working on a live panel is sometimes necessary to help locate system faults. While working on a live panel extreme caution is needed. Working on live panels should only be attempted by fully qualified personnel.

2. Check the incoming and outgoing power fuses to the ultra-violet transformer (FB-21 & FB-22), if the indicator lights on the fuse carriers are illuminated this indicates the fuses have blown, replace the fuses and try operating the system again.
3. If the associated fuse carriers do not have the blown indicators illuminated, using a multi-meter measure the outgoing power from the panel to the ultra-violet sterilizer (TB6-1&2), if the correct voltage is measured the problem lies somewhere in the ultra-violet unit itself or the associated power wiring, manually turn off the disconnect switch, close and lock the panel door. If the correct output voltage is not detected proceed with the next test.
4. Using a multi-meter measure the output voltage of the ultra-violet control relay (YS-0002), if the correct voltage is measured the problem lies somewhere within the wiring from the control relay to the output terminals (TB6-1&2) of the panel, trace out the wiring to identify the problem. If the correct voltage is not measured, proceed to the next test.
5. Using a multi-meter measure the input voltage of the ultra-violet control relay (YS-0002), if the correct voltage is measured and the relay is energizing as required the problem lies within the control relay, replace the control relay with a new unit. If the correct voltage is not measured, proceed to the next test.
6. Using a multi-meter measure the output voltage of the ultra-violet transformer, if the correct voltage is measured the problem lies somewhere within the wiring from the transformer to the output terminals of the panel, re-check the health of FB-22 by removing the fuse and testing for conductivity, if the fuse tests as ok trace out the wiring to identify the problem. If the correct voltage is not measured, proceed to the next test.

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7. Using a multi-meter measure the input voltage to the ultra-violet sterilizer transformer, if the correct voltage is measured the problem lies within the transformer itself; replace the transformer with a new unit. If the correct voltage is not measured proceed to the next test.
8. Using a multi-meter measure the output voltage of FB21, if the correct voltage is measured the problem lies within the wiring between the fuse block and the ultra-violet transformer itself; trace out the wiring to identify the problem. If the correct voltage is not measured proceed to the next test.
9. Using a multi-meter measure the input voltage of FB21, if the correct voltage is measured the problem lies within the fuse carrier; re-check the health of FB-21 by removing the fuses and testing for conductivity, if the fuses test as ok, the problem lies within the fuse carrier. Replace the carrier with a new unit. If the correct voltage is not measured proceed to the next test.
10. Using a multi-meter test the voltage available across terminals L1 and L3 of DB-1, if the correct voltage is detected the problem lies within the cabling between DB-1 and FB-21; trace out the wiring to identify the problem. If the correct voltage is not detected move on to the next test.
11. Using a multi-meter test the voltage available across terminals T1 and T3 of the main disconnect switch (DS-100), if the correct voltage is detected the problem lies within the cabling between DS-100 and DB-1, trace out the wiring to identify the problem. If the correct voltage is not detected move on to the next test.
12. Once again verify incoming power to the panel. Using a multi-meter test the voltage available across terminals L1 and L3 of DS-100 If the correct voltage is detected the problem lies within the main disconnect switch. Remove the switch and replace with a new unit. If the correct voltage is not detected investigate why the incoming power to the control system has failed.

Project: Danfoss Sea Recovery Tasman Sea	 The logo for Danfoss Sea Recovery, featuring the word 'Danfoss' in a red script font and 'Sea Recovery' in a black sans-serif font below it. Below that, in smaller text, is 'P.O. Box 10000, Christchurch, New Zealand'.	Doc: 1010004	Version: 01a
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8. System Production Trouble Shooting

#	Symptom	Possible Causes	Test	Remedy
1	The System does not produce rated flow after Adjusting for Temperature and Salinity Effects.	1. Restriction in the Product outlet line/hose.	Ensure there are no blockages in product hoses or lines.	Straighten lines and hoses leading from the product outlet. Open all valves on product line completely.
		2. Error in calculating Salinity or Temperature Effects.	Higher salinity of Feedwater lowers production and requires increase in pressure. Lower temperature of Feedwater decreases production and requires an increase in Feedwater Pressure.	Refer again to "Salinity Effects" and "Temperature Effects" charts.
		3. Fouled Membrane	One or more Membranes have been: Stored Improperly for extended period of time Been exposed to temperatures in excess of 140° F / 60 C. Been pressurized past 1000 psi and become compacted. Allowed to dry out.	In tests 1 and 2, Membrane Cleaning is performed. This may not be completely effective in all situations. In tests 3 through 5, RO Membrane element must be replaced.
2	The System produces more than rated flow when pressure is lower than 420 psi in full salinity seawater.	1. Cracked RO Membrane Element(s).	Water Quality is extremely poor. Salinity of Product water is extremely high.	One or more Membranes needs replacement.
		2. Product Water O-ring on one or more of End Plug is damaged.	Water Quality Lamp is Red. Salinity of Product water is extremely high.	Replace damaged O-rings. <i>Use care during re-assembly.</i>
3	The System produces Poor Water Quality for Extended Period.	1. Product Salinity/Temperature Probe	Salinity Probe has debris on the probe causing the system to read poor water quality.	Clean the Salinity Probe with a soft-bristle toothbrush.
		2. Salinity Monitor out of calibration.	Test the actual Salinity of the product water with a portable TDS meter.	If the Salinity Monitor is found to need calibration, refer to Page I – 12 for instructions.
		3. Product O-rings	Check to see if Product Water O-rings are damaged. <i>These are the O-Rings that separate the brine from the product in the Membrane Vessel Assemblies.</i>	Replace O-rings if they are damaged.

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#	Symptom	Possible Causes	Test	Remedy
	The System produces Poor Water Quality for Extended Period. (Continued)	4. One or more Membrane Elements have a broken Product Tube.	The system not only produces bad water, but also meets or exceeds the rated flow at a lower than normal Pressure setting.	Replace RO Membrane element.
		5. Membranes are fouled, or have been attacked by chemicals.	The system produces the appropriate amount of product water, but the product water remains of poor quality.	Membrane is fouled and cleaning may restore performance. If not, membrane should be replaced. Refer to "Section J" for Membrane Cleaning and "Section K" for Membrane Replacement.
4	The Controller displays Good Water Quality but the water has a definite salt taste.	1. Blockage or pressure in excess of 55 psi is present in the Brine discharge line.	A blocked brine discharge line causes brine water to mix with product at the 3-Way Diversion Valve. Flow through the flow meter is normal.	Ensure that the Brine discharge line is free from kinks and that any valves installed in the brine discharge line are fully open.
		2. Salinity/Temperature Probe	Salinity/Temperature Probe has debris on the probe causing the system to read good water quality.	Clean the Salinity/Temperature Probe with a toothbrush.
5	Product Water leaks from the Product Tubing when the 3-Way Valve is activated.	1. Blockage or pressure in excess of 55 psi is present in the product outlet line from the system.	Is water flowing from the product outlet line in the ship fresh water storage tank?	Ensure that the Product line is free from kinks and that any valves installed in the product line are fully open.
		2. Clogged Charcoal Filter, Ultraviolet Sterilizer, or pH Neutralizer.	Leaks occur forward of the Post Filter Component, but not downstream.	Change the appropriate Charcoal or pH Neutralizing element. If the Ultraviolet Sterilizer is the source of the blockage, remove the cause of the blockage.
6	There is a Sulfurous smell (rotten eggs) in the product tank.	1. Dirty Pre-Filtration Element.	Dirty Pre-Filtration Elements allow biological matter to grow in a very amiable environment. When this biological matter decomposes sulfur gas is released as a byproduct.	Replace Pre-Filter element and/or Oil-Water Separator Element.
		2. Charcoal Filter	Charcoal filter has not been replaced in the recommended time interval.	Change Charcoal element.
		3. Product Tank	Product tank is dirty or has biological growth in it.	Clean and Chlorinate Product tank.
7	The UV sterilizer is flickering or does not light. (Do not look directly at the UV lamp)	1. UV lamp.	UV lamp has not been changed in the recommended period of time.	Replace the UV lamp.
		2. Voltage.	The UV ballast is very sensitive to voltage changes.	Ensure that the voltage supplied to the UV sterilizer is within 230 VAC \pm 10%.

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SYSTEM STORAGE
&
R.O. MEMBRANE ELEMENT
CLEANING

Notes: _____

[illegible]

DANFOSS SRC R.O. MEMBRANE ELEMENT CLEANING PROCEDURES

The membrane elements will require cleaning from time to time. Biological growth and salt accumulation will eventually make replacement necessary. The frequency of required cleaning is dependent on the rate of production loss and salt rejection loss caused by normal use. In order to properly assess performance changes, it is important that the initial flow and rejection readings be logged for comparison.

When determining the percentage of performance changes, feed water temperature and system pressure must be taken into consideration (Refer to the Temperature and Pressure Effects Chart in section "M") and compensate for those variables. After compensations, a 10% decline in productivity (GPM Flow) and/or a 10% increase in salt passage (indicated by the Salinity Controller LED Meter) will indicate that membrane cleaning may be necessary.

CAUTION: If the system is allowed to continue running after the described changes in productivity and/or salt rejection have occurred, the fouling membrane may rapidly degrade, becoming more difficult and eventually impossible to clean. As with any filtering device, early detection and correction of fouling will lead to prolonged life. Irreversible fouling brought about by user neglect will void all Danfoss SRC System Limited Warranty.

The cleaning compounds available from Danfoss Sea Recovery are designed to clean the R.O. membrane elements in a closed-loop configuration.

Danfoss Sea Recovery SRC MCC1 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 VOMITING, 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 Danfoss Sea Recovery "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 above 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
NET CONTENTS 1.5 POUNDS (.68 Kg)

Danfoss Sea Recovery SRC MCC2 Membrane Cleaning Chemical

DANGER: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 VOMITING, 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 Danfoss Sea Recovery "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 above 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
NET CONTENTS 1.5 POUNDS (.68 Kg)

SYSTEM STORAGE AND CLEANING

1. R.O. MEMBRANE ELEMENT HANDLING & SYSTEM STORAGE CAUTIONS:

- 1. TEMPERATURE:** Never store the R.O. Membrane Element or Membrane/Vessel Assembly in direct sunlight. Never expose the R.O. Membrane Element or Membrane/Vessel Assembly to storage temperatures above 120° F / 50 C or below 32° F / 0 C. High temperatures cause up to 40% loss of production from the R.O. membrane element. This damage is irreversible. Freezing temperatures cause mechanical damage to the system and irreversible damage to the R.O. membrane element.
- 2. DRYING OUT:** Never allow the R.O. membrane element to dry out, as 40% production loss occurs. This membrane damage may be irreversible. Some, but not all, production may be restored by saturating the R.O. Membrane Element in product water for several days and then operating the system using product water feed into the system for a continuous 48 hour period. The R.O. membrane element must remain wet at all times.
- 3. BIOLOGICAL FOULING:** Protect the R.O. membrane element from biological fouling. Production loss occurs if the element becomes fouled by biological slimes. Some, but not all, production may be restored after cleaning.

- 4. CHEMICAL FOULING:** Never expose the R.O. Membrane Element to chemicals other than those supplied by SRC. Use caution when operating the system in harbors that may be polluted with chemicals, oil, or fuel. Chemicals may damage the R.O. Membrane Element beyond repair.

WARNING: NEVER USE THIRD PARTY CHEMICALS, ONLY USE SEA RECOVERY SUPPLIED CHEMICALS. Third party chemicals are not compatible with various materials used in the Sea Recovery System. Copolymer parts within the Sea Recovery System will be dissolved by third party chemicals. Third party chemicals will destroy the Sea Recovery R.O. Membrane Element. Damage to the Sea Recovery System or components within the System resulting from non-compatible chemicals are the liability of the operator or maintenance personnel and are not covered by the Sea Recovery Warranty.

- 5. STORAGE:** The dark and moist interior of a membrane element is an excellent breeding ground for microorganisms. Simply operating the system does not protect the R.O. Membrane Element from production loss due to biological fouling. During short-term shutdowns, the system must be rinsed as explained in the following pages. During long-term shutdowns, the system must be rinsed as well as chemically treated as explained later in this chapter.
- 6. NEW SYSTEM STORAGE:** If the R.O. Membrane Element(s) is (are) installed in the System and if the System will not be installed and commissioned within 3 months from receipt refer to the procedures for either Short Term or Long Term storage within this Section.

CAUTION: Prior to Rinsing, Storing, Winterizing, or Cleaning of the System always first Back Wash then Rinse the Multi Media Filter as described below. Also, prior to Rinsing, Storing, or Cleaning of the System always replace all Prefiltration Cartridges with new cartridges.

Once-Through-Rinse operation with the Multi Media Filter in line and with the Multi Media Filter by-passed, and in a Closed Loop operation with the Multi Media Filter in line and with the Multi Media Filter by-passed.

A. SHORT-TERM SHUTDOWN:

If the Tasman Sea System is equipped with an automatic Fresh Water Flush option this manual Short Term Shutdown procedure is not required. If the Tasman Sea System is NOT equipped with an automatic Fresh Water Flush option then proceed as follows:

A short-term shutdown is defined as a period of time in which the system is not utilized for up to four weeks. An effective short-term protection for the system and R.O. membrane element is a Fresh Water Rinse of the entire system with fresh water (product water from the system). This prolongs the system life by minimizing electrolysis and retarding biological growth.

WARNING: WINTERIZING AND FREEZING TEMPERATURE STORAGE NOTE: If the system is exposed to freezing temperatures, perform a Manual Fresh Water Rinse as described below.

FRESH WATER RINSE PROCEDURE: Follow the directions below to rinse the system with fresh water or to Winterize the system against freezing temperatures. This procedure displaces the system feed water with fresh water and allows a short-term shutdown for up to four weeks, and adds propylene glycol if Winterizing. Fifty (50) gallons (190 liters) of fresh product or potable water is required for the fresh water rinse, and 10 gallons / 38 liters food grade glycerin (propylene glycol) is required for Winterizing.

1. Back Wash then Rinse the Multi Media Filter.
2. Replace all Pre-filtration Cartridges with new Cartridges.
3. Configure the system for a **"Once Through Rinse with multi media filter valved in line"**.
4. Fill the clean/store tank with 50 Gallons / 190 Liters of clean, fresh and un-chlorinated water (chlorine free and bromine free).
5. **WARNING: IF THE SYSTEM WILL BE EXPOSED TO FREEZING TEMPERATURES** add twenty percent (10 gallons / 38 liters) food grade glycerin (propylene glycol) to the fresh water in the clean/store tank. This prevents the water in the system from freezing.
6. Start the System by pressing the Start Switch.
7. Operation of the System will deplete the Fresh Water or Water and Propylene Glycol mixture in the Clean/Store Tank.
8. When the water or mixture in the Clean/Store Tank is depleted stop the System by pressing the Stop switch.
9. **FREEZING TEMPERATURE WARNING:** The Product Water Post Filtration Section of the System must be drained of all Product Water if the System will be exposed to freezing temperatures.
 - a. Charcoal Filter: Remove the Charcoal Filter bowls. Empty the water from the bowls. Replace the Charcoal Filter Elements with New Charcoal Filter Elements. Replace the bowls back onto the lids.
 - b. pH Neutralizing Filter: Remove all water from the pH Neutralizing Filter housing.
 - c. U.V. Sterilizer : Disconnect the product water line from the U.V. Sterilizer filter and drain the product water from it.

B. LONG TERM SHUTDOWN:

A Long Term or Prolonged Shutdown is a period in which the system goes un-used for longer than three months, depending on conditions. For this interval, the system should first be rinsed with fresh water then stored with system and Membrane Element Storage Chemical (SRC SC). This chemical inhibits bacterial growth while maintaining the high flux and salt rejection of the R.O. Membrane Element. The Long Term Shutdown procedure requires 100 gallons (379 liters) of potable water.

Items Required:

- 2 each Sea Recovery Storage Chemical SRC SC
- 20 Gallons / 75 liters of food grade glycerin (propylene glycol) if the System will be Winterized

Follow the directions below if the system will not be used for several months, or if the System is to be Winterized against freezing temperatures. This procedure displaces the system feed water with Storage Chemical or Storage Chemical and propylene glycol.

1. Back Wash then Rinse the Multi Media Filter.
2. Replace all Prefiltration Cartridges with new Cartridges.
3. Configure the system for a "Once Through Rinse with multi media filter valved in line".
4. Fill the clean/store tank with 50 Gallons / 190 Liters of clean, fresh and unchlorinated water (chlorine free and bromine free).
5. Start the System by pressing the Start Switch.
6. Operation of the System will deplete the Fresh Water or Water and Propylene Glycol mixture in the Clean/Store Tank.
7. When the water or mixture in the Clean/Store Tank is depleted stop the System by pressing the Stop switch.
8. Configure the system for a Closed Loop Recirculation with multi media filter valved in line.
9. Again, fill the clean/store tank with 50 Gallons / 190 Liters of clean, fresh and unchlorinated water (chlorine free and bromine free).
10. Dissolve one (1) SRC SC Storage Chemical (total 1.5 lbs) into a gallon of water. Add this solution to the 50 gallons of fresh water in the clean/store tank.
11. If the system will be exposed to freezing temperatures during the non operational storage period add 20 gallons / 75 liters of food grade glycerin propylene glycol to the clean/store tank
12. Start the System by pressing the Start Switch.
13. The storage chemical mixture is now re-circulating through the system and back into the clean/store tank. Allow this recirculation to continue for 10 minutes.
14. After 10 minutes of recirculation stop the system by pressing the stop switch.
15. Configure the system for a "Once Through Rinse with multi media filter valved in line".
16. Start the System by pressing the Start Switch.

17. Operation of the System will deplete the storage chemical mixture in the Clean/Store Tank.
18. When the storage chemical mixture in the Clean/Store Tank is depleted stop the System by pressing the Stop switch.
19. **FREEZING TEMPERATURE WARNING:** The Product Water Post Filtration Section of the System must be drained of all Product Water if the System will be exposed to freezing temperatures.
 - a. Charcoal Filter : Remove the Charcoal Filter bowls. Empty the water from the bowls. Replace the Charcoal Filter Elements with New Charcoal Filter Elements. Replace the bowls back onto the lids.
 - b. pH Neutralizing Filter: Remove all water from the pH Neutralizing Filter housing.
 - c. U.V. Sterilizer: Disconnect the product water line from the U.V. Sterilizer filter and drain the product water from it.

C. R.O. MEMBRANE ELEMENT CLEANING

Do not arbitrarily clean the R.O. Membrane in a NEW system. The R.O. Membrane Element(s) in a NEW system will not be fouled with any substance that is cleanable. Low production or high salinity of the Product water from a NEW system will be attributed to factors other than fouling. If a NEW system experiences low production this would indicate that there is a blockage in the Product Water Line, the feed water temperature is low, the feed water salinity is high, the operating pressure is low, the R.O. Membrane Element has dried out prior to use, the R.O. Membrane Element has been subjected to chemical fouling, suspended fouling such as silt or rust, or dissolved solids such as silica.

If a NEW System is experiencing low production due to R.O. Membrane drying out, the System should be operated for up to 48 hours **continuously** to clear and saturate the R.O. Membrane Element and product water channel.

Correlate and compensate operating pressure, feed water temperature, and feed water salinity as charted in the last section of this Owner's Manual. If a NEW system still experiences low production after 48 hours of **continual operation**, then contact the factory.

If a NEW System experiences poor quality Product Water, high in salinity, this would be attributed to a mechanical failure such as a broken or missing O-ring and will be accompanied with high production at low operating pressure. For problems with a NEW System refer to the Troubleshooting Section of this Owner's Manual.

The membrane element requires cleaning from time to time. Biological growth and salt accumulation eventually make replacement necessary. The frequency of required cleaning depends on the amount of production loss and salt rejection loss resulting from normal use. In order to properly assess performance changes, it is important to maintain daily log readings for comparison.

During performance comparisons, Feed Water Temp, Feed Water Salinity, and System Operating Pressure must be taken into consideration and compensated for. After compensations, a 10% decline in productivity (GPH Flow) and/or a 10% increase in salt passage indicate that the R.O. Membrane Element may require cleaning.

If production rate has dropped dramatically since the last time the system was used, this may be due to drying out of the R.O. Membrane Element and/or fouling during non use. If the system has not been used for several months and the production rate has dropped dramatically since the last time used, try operating the system for 48 or more continuous hours to saturate the Product Water Channel within the R.O. Membrane Element.

If production rate drops dramatically from one day to another, this may be due to chemical attack or suspended solids such as silt fouling which is not cleanable. Sewage chemicals or petroleum products cause irreparable damage to the R.O. Membrane Element. Suspended solids fouling resulting from silt, coral dust, iron (rust), river or inland waterway debris, or other small solid matter may not be cleanable. Heavy dissolved solids fouling from silica is not cleanable.

1. R.O. MEMBRANE ELEMENT CLEANING WATER AND CHEMICAL REQUIREMENTS:

- a. The process of rinsing and cleaning the R.O. Membrane Elements with just one cleaning compound requires 150 gallons / 568 liters of fresh non- chlorinated product water. If a second cleaning is performed using a different cleaning compound an additional 100 gallons / 379 liters will be required per additional cleaning.
- b. The Danfoss Sea Recovery Reverse Osmosis cleaning compounds are designed to clean in a closed loop configuration moderate fouling from the R.O. membrane element. If the R.O. Membrane Element is excessively fouled and in-field cleaning is not successful, the R.O. Membrane Element may be returned to Danfoss Sea Recovery or to one of Danfoss Sea Recovery's many Service Dealers for professional chemical cleaning. If your membrane requires professional cleaning, please contact Danfoss Sea Recovery for a Return Authorization Number, price quotation, and return instructions. Due to the complexity of and time involvement in professionally cleaning the R.O. Membrane Element it can be more cost effective to replace a heavily fouled R.O. Membrane Element. Always compare the cost of cleaning vs the cost of replacement in order to make the proper decision to clean or replace.
- c. **SRC MCC-1**, Membrane Cleaning Compound "# 1" is an alkaline cleaner designed to clean biological fouling and slight oil fouling from the R.O. Membrane Element. Biological fouling is usually the first cause of the R.O. Membrane Element fouling. The system is constantly exposed to seawater and biological growth which occurs from the first day forward. If exposed to seawater and left to sit, the R.O. Membrane Element may become fouled even with no actual system use. This fouling is minimized with fresh water rinsing whenever the system is not in use.
- d. **SRC MCC-2**, Membrane Cleaning Compound "# 2" is an acid cleaner designed to clean calcium carbonate and other mineral deposits from the R.O. Membrane Element. Mineral fouling is a slow process which takes place during use of the system. Therefore, if the system is more than one year old and has relatively few hours of use yet shows signs of R.O. Membrane Element fouling then that fouling is likely biological fouling. If the system has several thousand hours of use then there may be some mineral fouling combined with biological fouling.

WARNING: DO NOT MIX DIFFERENT CLEANING CHEMICALS TOGETHER. DO NOT USE DIFFERENT CLEANING CHEMICALS TOGETHER AT THE SAME TIME. MIX THE CLEANING CHEMICALS SEPARATELY AND USE THEM SEPARATELY. USE ONLY SEA RECOVERY SUPPLIED CHEMICALS. NEVER USE THIRD PARTY, NON SEA RECOVERY, CHEMICALS.

2. R.O. MEMBRANE ELEMENT CLEANING INSTRUCTIONS:

1. Back Wash then Rinse the Multi Media Filter.
2. Replace all Pre-filtration Cartridges with new Cartridges.
3. Configure the system for a "Once Through Rinse with multi media filter by-passed".
4. Fill the clean/store tank with 50 Gallons / 190 Liters of clean, fresh and un-chlorinated water (chlorine free and bromine free).
5. Start the System by pressing the Start Switch.
6. Operation of the System will deplete the Fresh Water in the Clean/Store Tank.
7. When the water in the Clean/Store Tank is depleted Stop the System by pressing the Stop switch.
8. Configure the system for a "Closed Loop with multi media filter by-passed".
9. Again, fill the clean/store tank with 50 Gallons / 190 Liters of clean, fresh and un-chlorinated water (chlorine free and bromine free).
10. Dissolve five each SRC MCC1 Alkaline Cleaner (total 7.5 lbs) into five gallons of water. Add this solution to the 50 gallons of fresh water in the clean/store tank.
11. Start the System by pressing the Start Switch.
12. The cleaning chemical mixture is now re-circulating through the R.O. Membrane Elements and back into the clean/store tank. Allow this recirculation to continue for 60 minutes.
13. After 60 minutes of recirculation stop the system by pressing the stop switch.
14. Configure the system for a "Once Through Rinse with multi media filter by-passed".
15. Start the System by pressing the Start Switch.
16. Operation of the System will deplete the storage chemical mixture in the Clean/Store Tank.
17. When the storage chemical mixture in the Clean/Store Tank is depleted Stop the System by pressing the Stop switch.
18. Configure the system for a "Closed Loop with multi media filter by-passed".
19. Again, fill the clean/store tank with 50 Gallons / 190 Liters of clean, fresh and un-chlorinated water (chlorine free and bromine free).
20. Start the System by pressing the Start Switch.
21. The rinse water is now re-circulating through the R.O. Membrane Elements and back into the clean/store tank. Allow this recirculation to continue for 20 minutes.
22. After 20 minutes of recirculation stop the system by pressing the stop switch.
23. Configure the system for a "Once Through Rinse with multi media filter by-passed".
24. Start the System by pressing the Start Switch.
25. Operation of the System will deplete the rinse water in the Clean/Store Tank.

26. When the rinse water in the Clean/Store Tank is depleted Stop the System by pressing the Stop switch.

If further cleaning is required repeat steps 3-33 above with a different Membrane Cleaning Chemical.

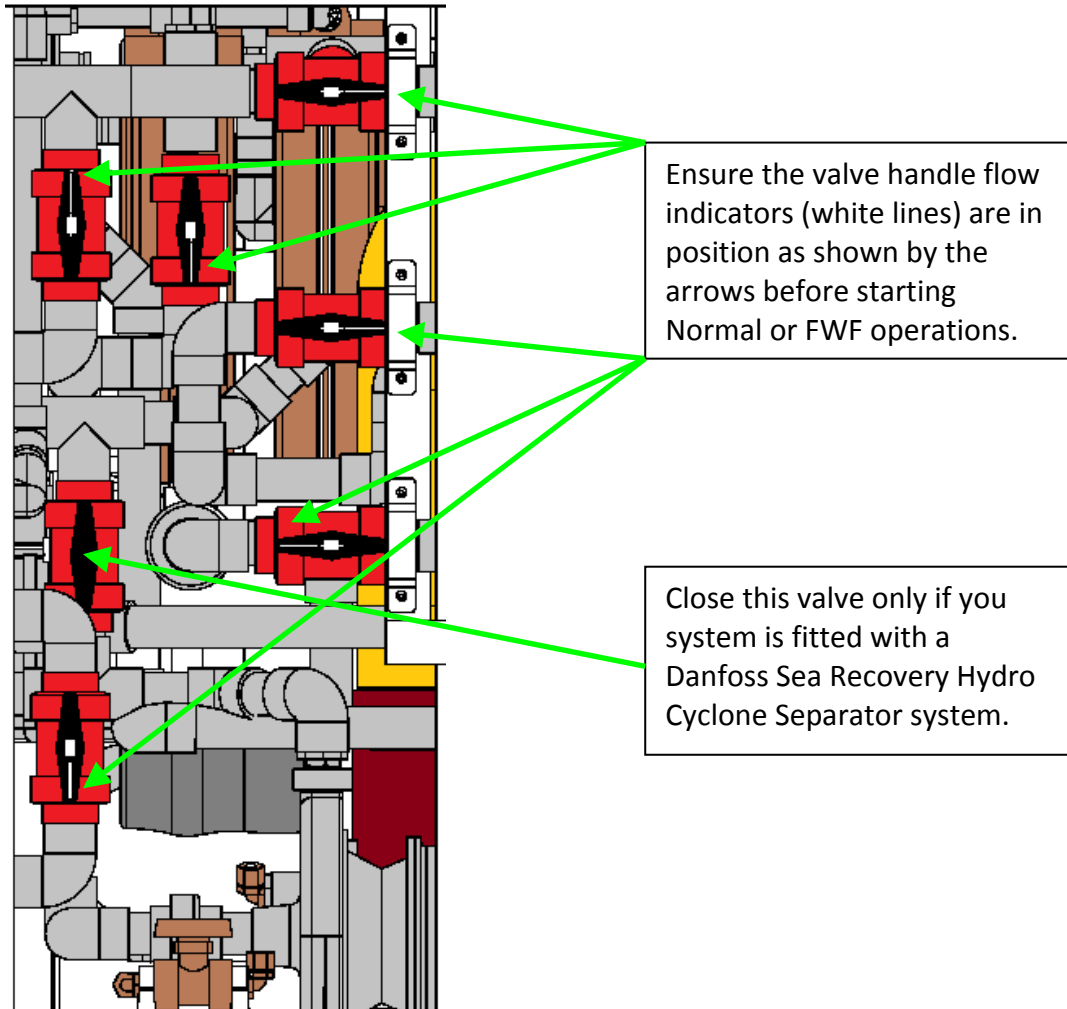
Notes: _____

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VALVE POSITIONING & FLOW
FOR:

NORMAL OPERATION/FWF
BACKWASH
RINSE
CLEAN
CHEMICAL CLEANING/RINSE

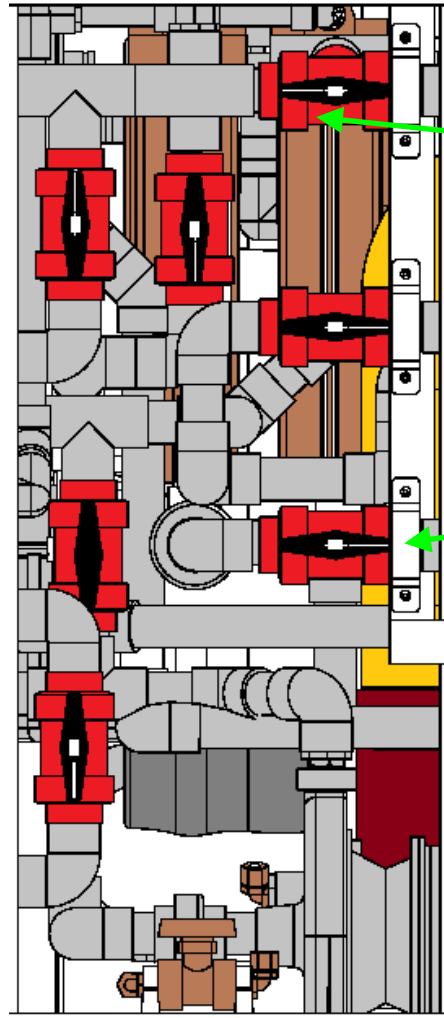
NORMAL OPERATION/FRESH WATER FLUSH



Once the valves have been placed in the positions indicated above, the system is ready for operation. Ensure all feed, brine and product valves external to the unit have been opened.

To control the system please refer to the control system operations manual.

BACKWASH OPERATION



Ensure the valve handle flow indicators (white lines) are in the normal operating position.
Change only the two (2) valve handle positions as shown by the arrows before starting Backwash operation.

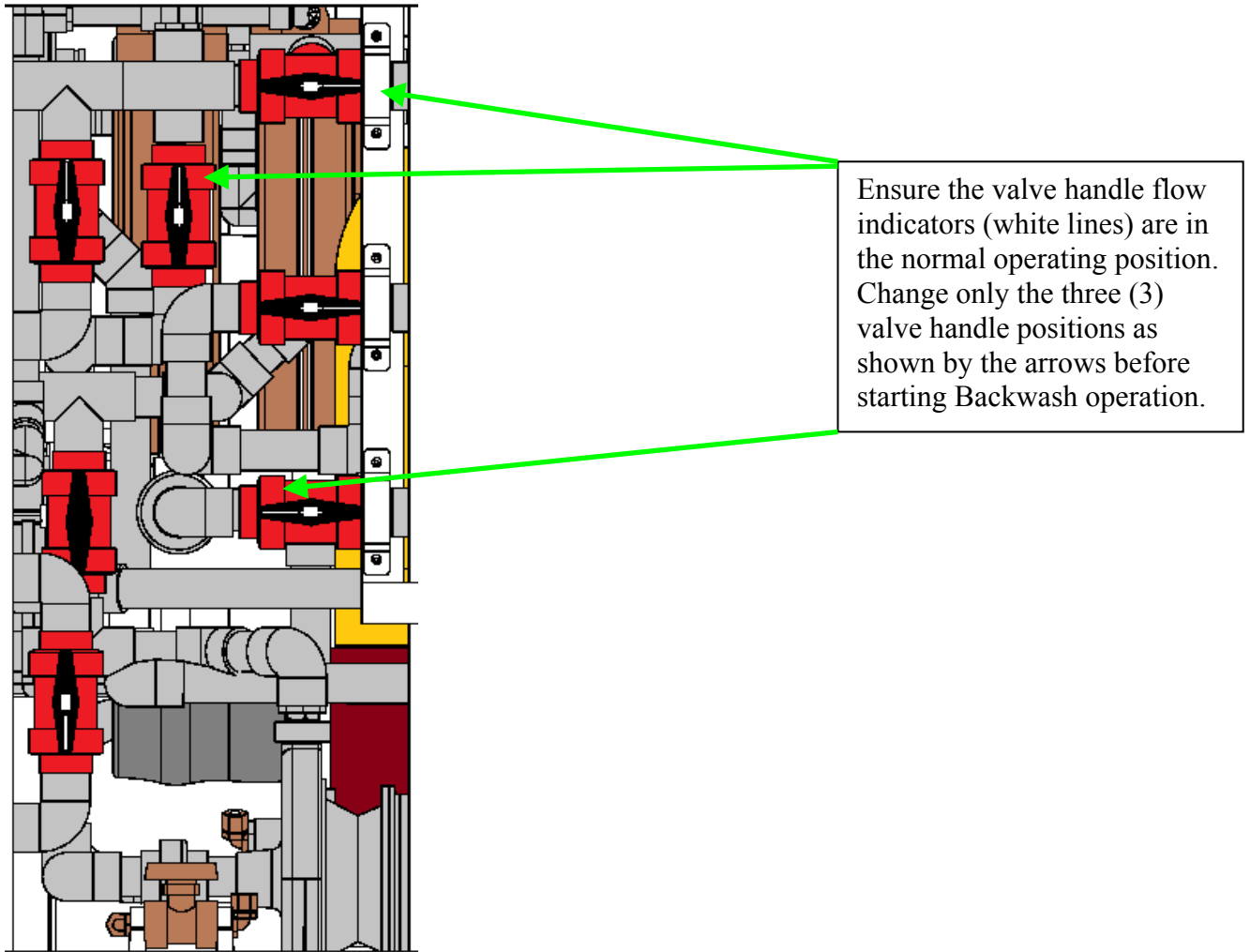
Once the two valves above have been placed in the correct position the system is ready for backwashing. To backwash the system follow the procedure listed below:

If your system is equipped with a Feed pump, turn the Aux. pump operator switch to the 'On' position. Turn the booster pump switch to the 'On' position.

Leave the system to run for approximately 5 minutes to complete the backwashing cycle. After this time turn the booster pump switch operator to the 'Off' position, turn the Aux. pump operator switch to the 'Off' position.

Backwashing is now complete.

RINSING OPERATION



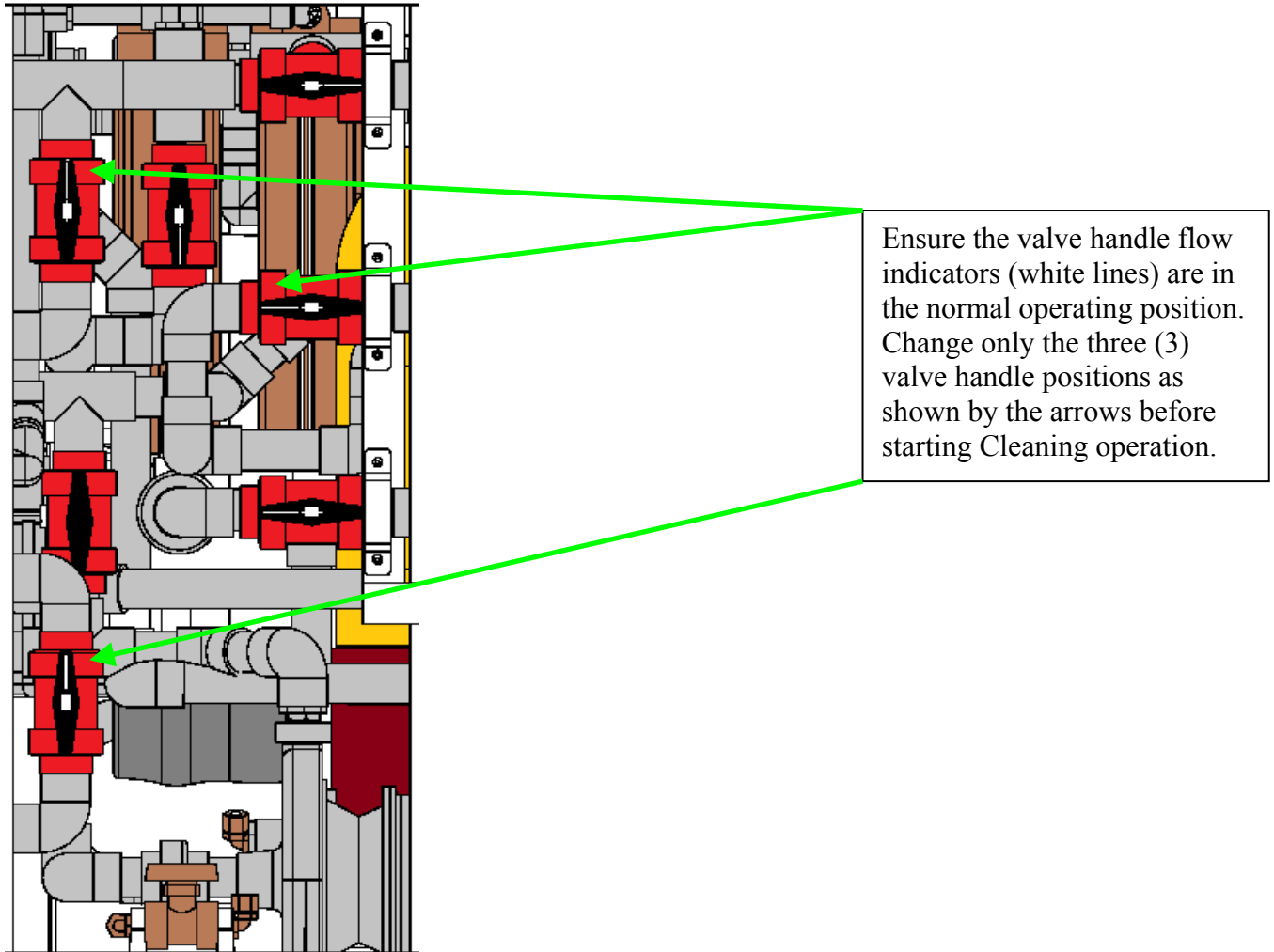
Once the three valves above have been placed in the correct position the system is ready for media rinsing. To rinse the system follow the procedure listed below:

If your system is equipped with a Feed pump, turn the Aux. pump operator switch to the 'On' position. Turn the booster pump switch to the 'On' position.

Leave the system to run for approximately 30 minutes to complete the rinsing cycle. After this time turn the booster pump switch operator to the 'Off' position, turn the Aux. pump operator switch to the 'Off' position.

Media rinsing is now complete.

CLEANING OPERATION



Close any external valves fitted within the feed water supply line.

Connect the cleaning/chemical storage tank to the Tasman Sea unit at the connection points provided.

Once the three valves above have been placed in the correct position the system is ready for cleaning/chemical treatment. To clean or chemically treat the system follow the procedure listed below:

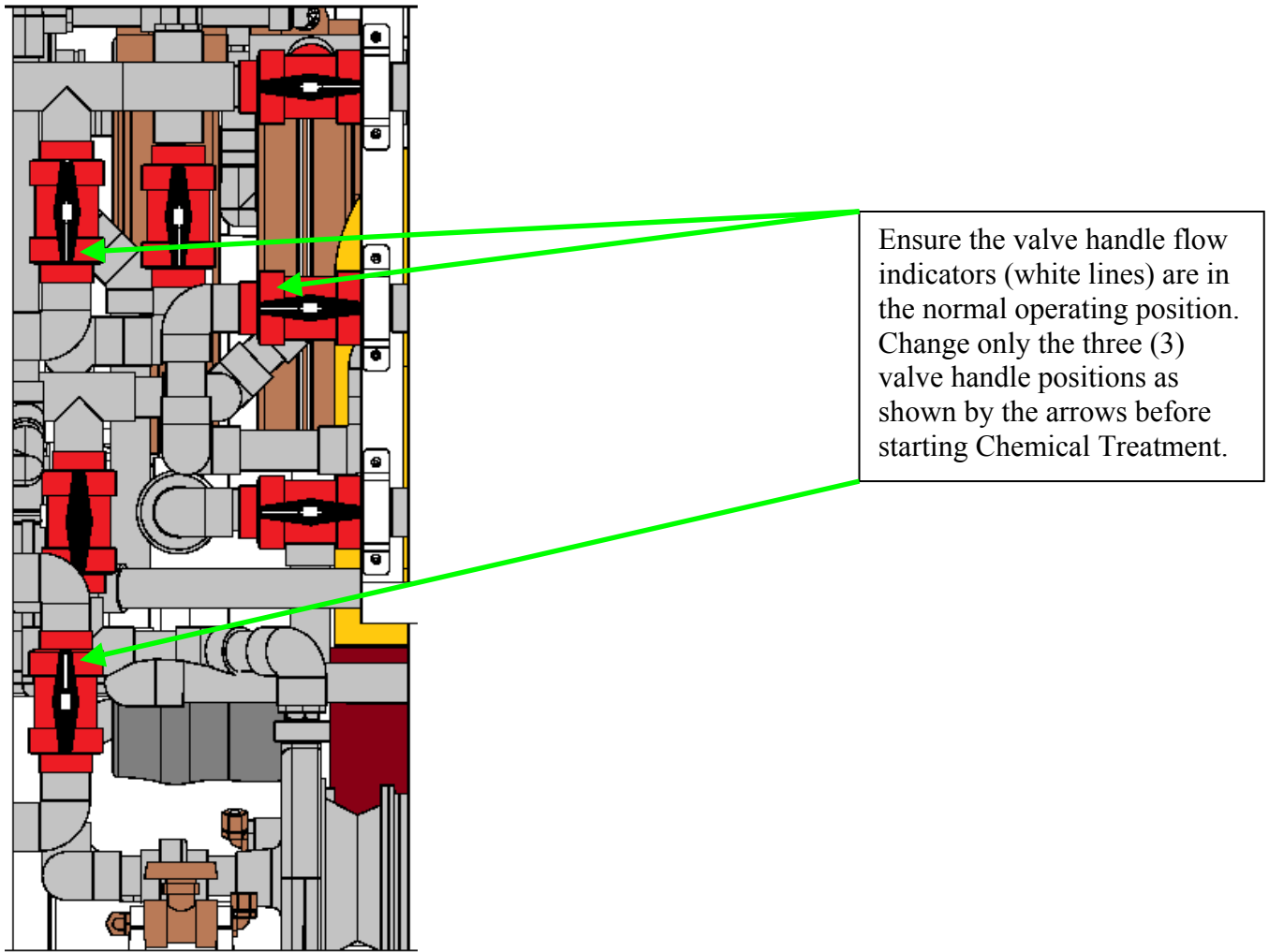
Fill the cleaning tank with non-chlorinated product water. The cleaning tank must contain enough water to fully rinse the system; typically this will require 100 gallons.

Turn the booster pump switch to the 'On' position.

Leave the system to run for approximately 30 minutes to complete the cleaning treatment cycle. After this time turn the booster pump switch operator to the 'Off' position.

Cleaning is now complete.

CHEMICAL TREATMENT OPERATION



Close any external valves fitted within the feed water supply line.

Connect the cleaning/chemical storage tank to the Tasman Sea unit at the connection points provided.

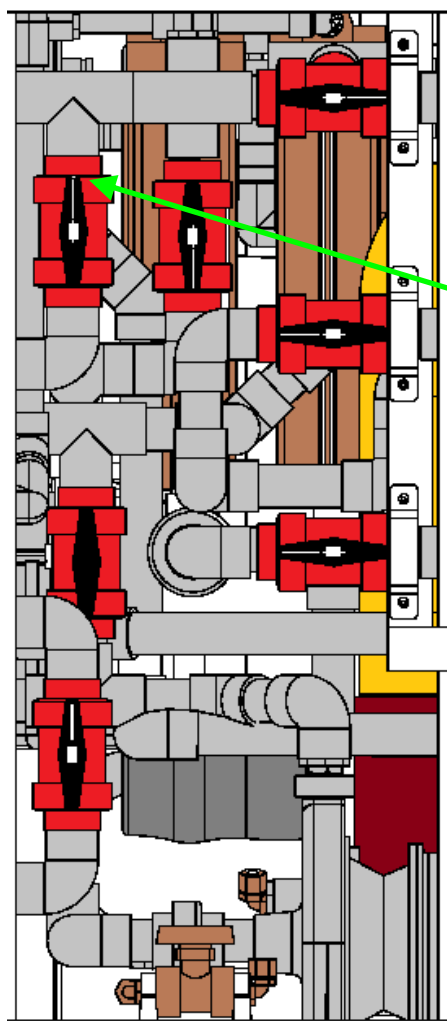
Once the three valves above have been placed in the correct position the system is ready for cleaning/chemical treatment. To clean or chemically treat the system follow the procedure listed below:

Pour 4 bottles of DSRC SC storage chemical solution into a small 2 to 5 gallon bucket. Add non-chlorinated water to the bucket and mix the solution thoroughly. Pour this mixed solution into the cleaning/chemical treatment tank, and fill the tank with approximately 100 gallons of non-chlorinated product water. If the system will be exposed to freezing temperatures add 10% (approximately 10 gallons) of food grade glycerin (propylene glycol) to the chemical treatment tank solution.

Turn the booster pump switch to the 'On' position.

Leave the system to run for approximately 30 minutes to complete the cleaning treatment cycle. After this time change the position of the discharge valve as shown in the picture on the next page, this change in position will allow the storage solution to be discharged overboard through the brine line.

VALVE POSITIONING



Ensure the valve handle flow indicators (white lines) are in the normal operating position. Change only the one (1) valve handle position as shown by the arrow.

Continue to operate the booster pump until all of the storage solution in the tank has been depleted from the cleaning/chemical tank then stop the booster pump by switching the booster pump operator switch to the 'Off' position.

The Danfoss Sea Recovery R.O system may now be left undisturbed for up to four months.

NOTE:

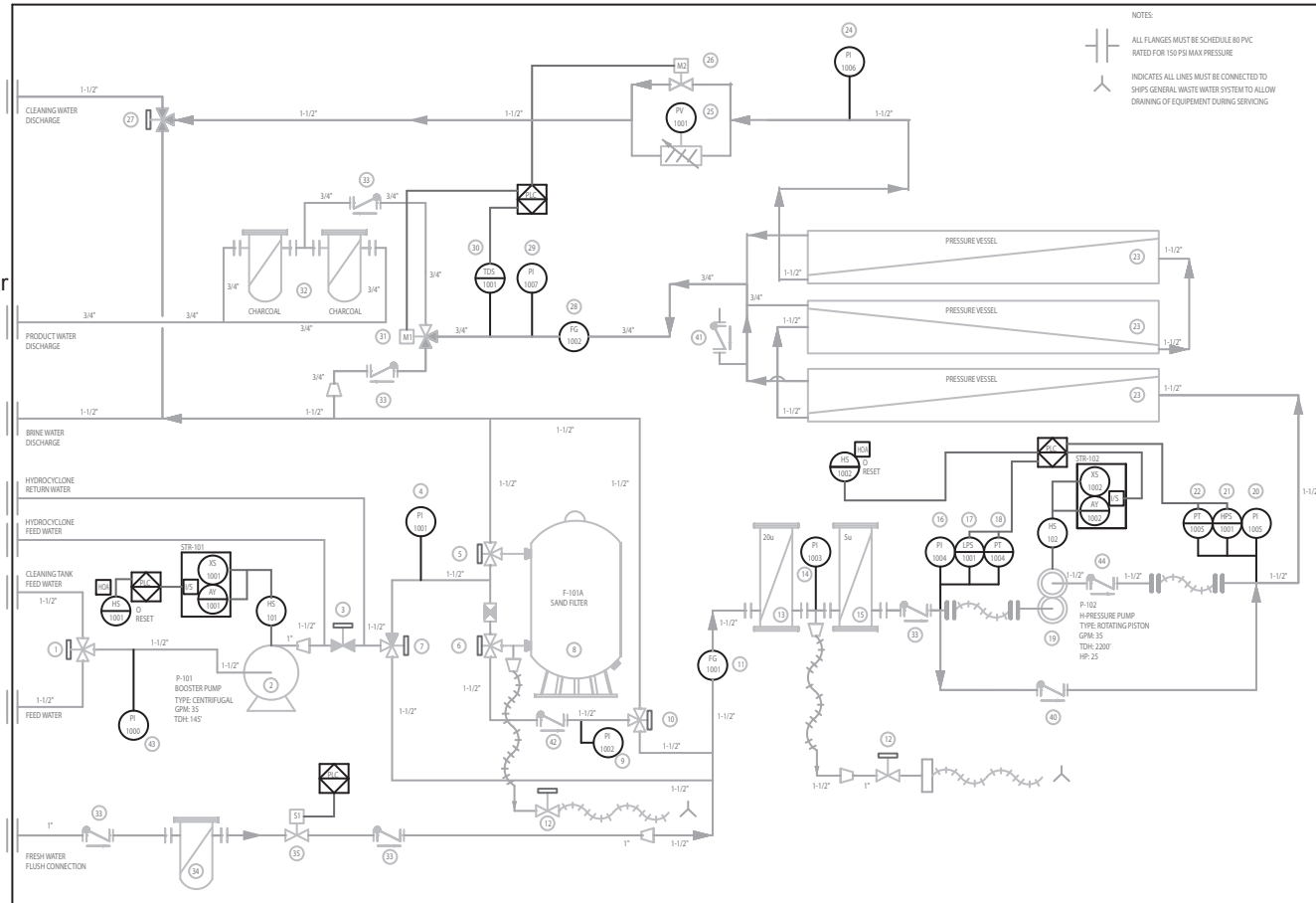
The normal storage chemical does not protect the R.O unit from freezing temperatures. For freezing conditions it is vital that the 10% propylene glycol solution be added to the chemical treatment solution.

Cleaning Treatment is now complete.

FRESH WATER FLUSH

TASMAN SEA - P&ID

PT-Pressure Transducer
PI- Pressure Indicator
Mxx-Motorized Valve
FG-Flow Gauge
TDS-Salinity Meter
P-Pump
PLC-Programmable Logic Controller



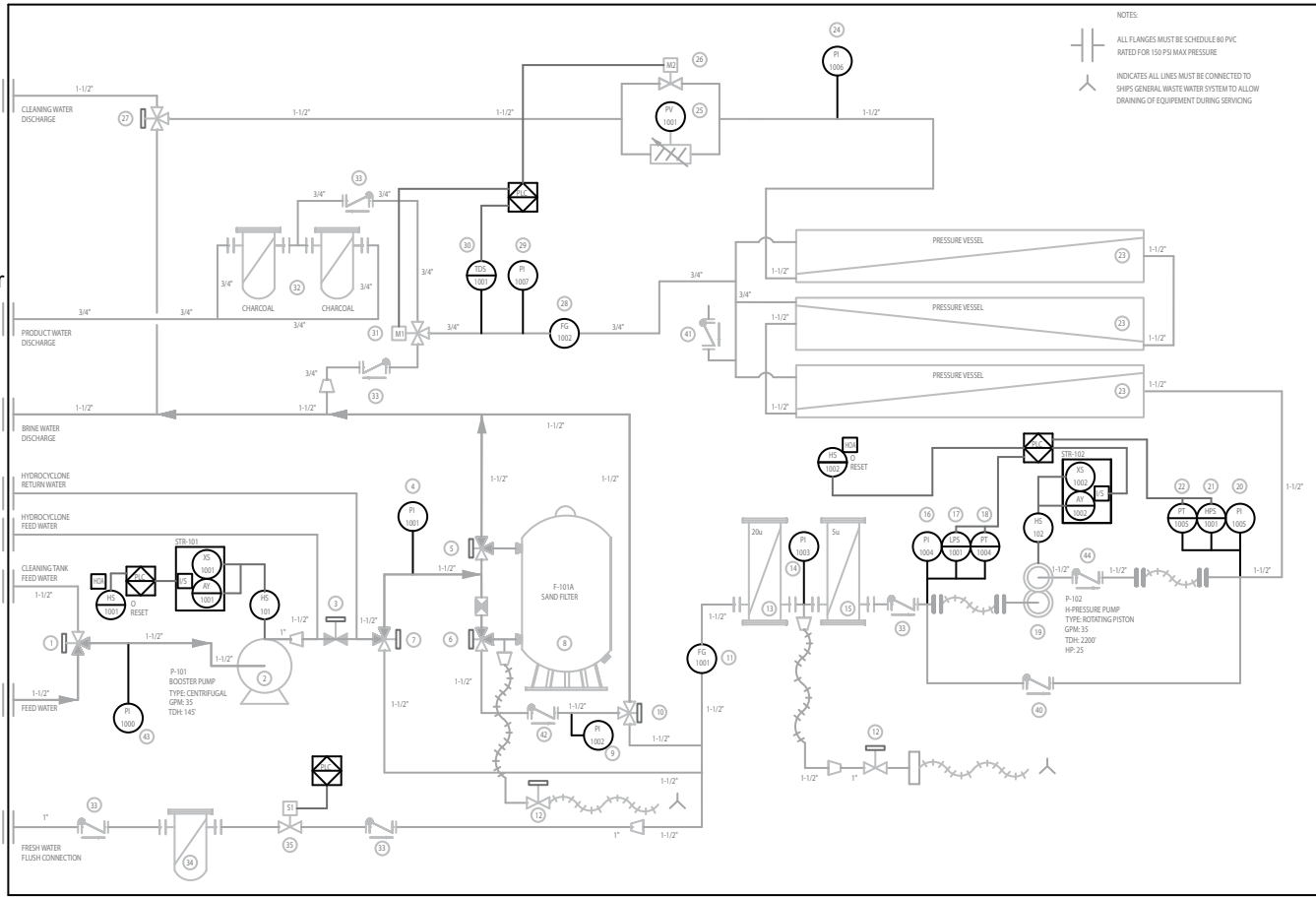
- 1 INLET FEED SELECTOR VALVE
CLEAN/SEA WATER
BOOSTER PUMP
- 2 HYDROCYCLONE BY-PASS VALVE
- 3 MEDIA FILTER INLET PRESSURE GAUGE
- 4 MEDIA FILTER INLET VALVE VALVE
- 5 MEDIA FILTER OUTLET VALVE VALVE
- 6 MANUAL CIP MEDIA FILTER
DIVERSION VALVE
- 7 MEDIA FILTER ASSEMBLY
- 8 MEDIA FILTER OUTLET AND 20w FILTER
FILTER INLET PRESSURE GAUGE
- 9 MEDIA FILTER RINSE CYCLE
DIVERSION VALVE
- 10 FEED WATER FLOW GAUGE
- 11 FILTRATION SYSTEM DRAIN VALVE
- 12 20w CARTRIDGE HOUSING
- 13 20w/50w FILTER OUTLET/INLET
PRESSURE GAUGE
- 14 50w CARTRIDGE HOUSING
- 15 HIGH PRESSURE PUMP INLET
PRESSURE GAUGE
- 16 HIGH PRESSURE PUMP INLET
PRESSURES SWITCH
- 17 HIGH PRESSURE PUMP INLET
PRESSURE TRANSMITTER
- 18 HIGH PRESSURE PUMP
- 19 HIGH PRESSURE PUMP OUTLET
PRESSURE GAUGE
- 20 HIGH PRESSURE PUMP OUTLET
PRESSURE SWITCH
- 21 HIGH PRESSURE PUMP OUTLET
PRESSURE TRANSMITTER
- 22 PRESSURE VESSEL
- 23 MEMBRANE OUTLET PRESSURE GAUGE
- 24 BACK PRESSURE REGULATOR
- 25 BACK PRESSURE BYPASS VALVE
- 26 OUTLET SELECTOR VALVE
CLEAN/DISCHARGE
- 27 PRODUCT WATER FLOW GAUGE
- 28 PRODUCT WATER PRESSURE GAUGE
- 29 PRODUCT WATER SALINITY MONITOR
- 30 PRODUCT WATER AUTOMATIC
DIVERSION VALVE
- 31 CHARCOAL FILTER HOUSINGS
- 32 CHECK VALVE
- 33 FRESH WATER FILTER HOUSING
(IF FITTED)
- 34 FRESH WATER FLUSH VALVE
(IF FITTED)
- 35 NOT USED
- 36 NOT USED
- 37 NOT USED
- 38 NOT USED
- 39 CHECK VALVE HIGH PRESSURE
- 40 CHECK VALVE 1/2" PVC
- 41 CHECK VALVE 1-1/2" PVC
- 42 BOOSTER PUMP INLET PRESSURE
GAUGE
- 43 CHECK VALVE SS HIGH PRESSURE
PUMP OUTLET

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BACKWASH

TASMAN SEA - P&ID

PT-Pressure Transducer
PI- Pressure Indicator
Mxx-Motorized Valve
FG-Flow Gauge
TDS-Salinity Meter
P-Pump
PLC-Programmable Logic Controller



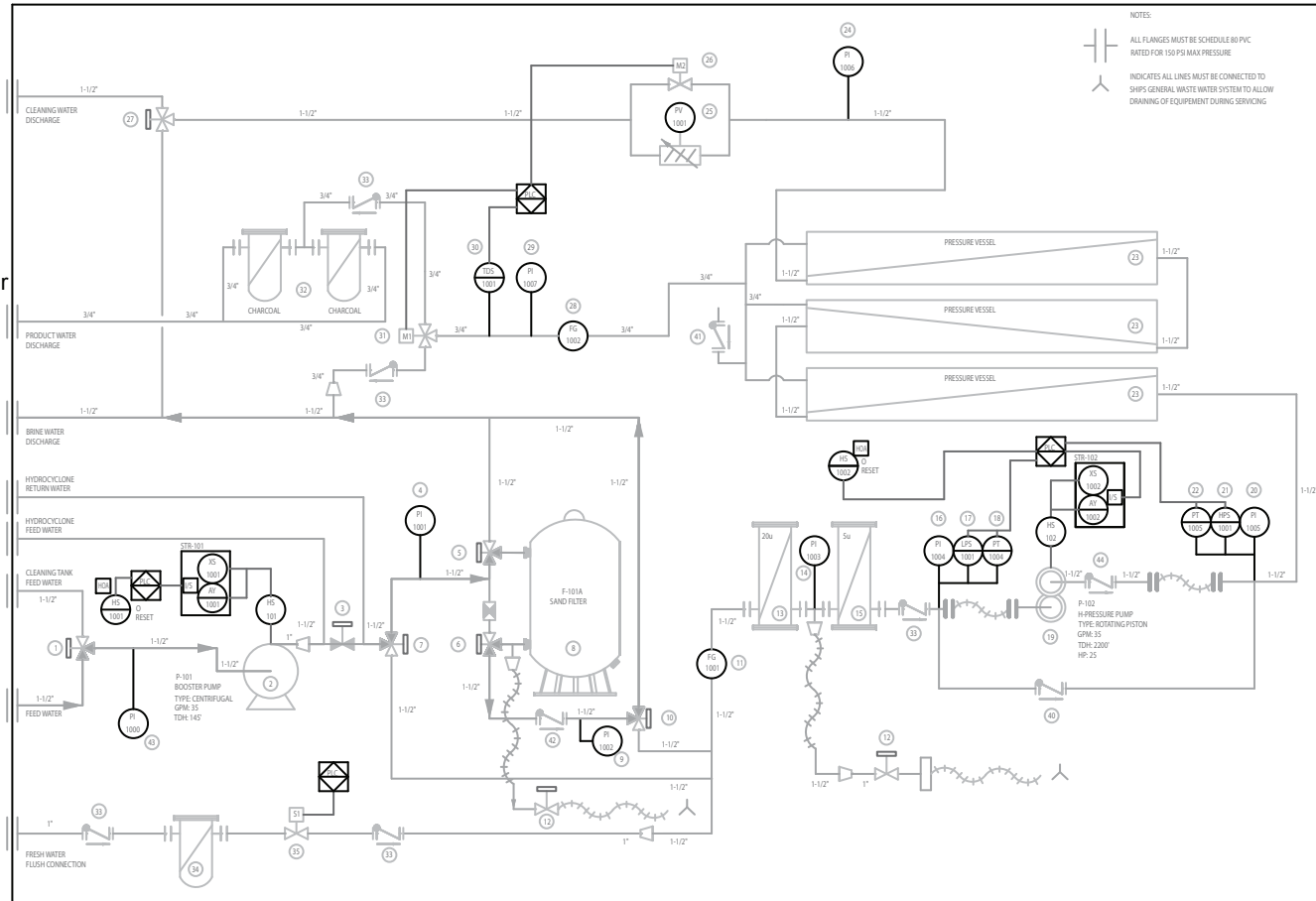
NOTES:
ALL FLANGES MUST BE SCHEDULE 80 PVC
RATED FOR 150 PSI MAX PRESSURE
INDICATES ALL LINES MUST BE CONNECTED TO
SHIP'S GENERAL WASTE WATER SYSTEM TO ALLOW
DRAINING OF EQUIPMENT DURING SERVICING

- KEY:
- ① INLET FEED SELECTOR VALVE
 - ② CLEAN/SEA WATER BOOSTER PUMP
 - ③ HYDROCYCLONE BY-PASS VALVE
 - ④ MEDIA FILTER INLET PRESSURE GAUGE
 - ⑤ MEDIA FILTER INLET VALVE VALVE
 - ⑥ MEDIA FILTER OUTLET VALVE VALVE
 - ⑦ MANUAL CIP MEDIA FILTER DIVERSION VALVE
 - ⑧ MEDIA FILTER ASSEMBLY
 - ⑨ MEDIA FILTER OUTLET AND 20μ FILTER FILTER INLET PRESSURE GAUGE
 - ⑩ MEDIA FILTER RINSE CYCLE DIVERSION VALVE
 - ⑪ FEED WATER FLOW GAUGE
 - ⑫ FILTRATION SYSTEM DRAIN VALVE
 - ⑬ 20μ CARTRIDGE HOUSING
 - ⑭ 20μ/5μ FILTER OUTLET/INLET PRESSURE GAUGE
 - ⑮ 5μ CARTRIDGE HOUSING
 - ⑯ HIGH PRESSURE PUMP INLET PRESSURES GAUGE
 - ⑰ HIGH PRESSURE PUMP INLET PRESSURES SWITCH
 - ⑱ HIGH PRESSURE PUMP INLET PRESSURE TRANSMITTER
 - ⑲ HIGH PRESSURE PUMP
 - ⑳ HIGH PRESSURE PUMP OUTLET PRESSURES GAUGE
 - ㉑ HIGH PRESSURE PUMP OUTLET PRESSURES SWITCH
 - ㉒ HIGH PRESSURE PUMP OUTLET PRESSURE TRANSMITTER
 - ㉓ PRESSURE VESSEL
 - ㉔ MEMBRANE OUTLET PRESSURE GAUGE
 - ㉕ BACK PRESSURE REGULATOR
 - ㉖ BACK PRESSURE BYPASS VALVE
 - ㉗ OUTLET SELECTOR VALVE
 - ㉘ CLEAN/DISCHARGE
 - ㉙ PRODUCT WATER FLOW GAUGE
 - ㉚ PRODUCT WATER PRESSURE GAUGE
 - ㉛ PRODUCT WATER SALINITY MONITOR
 - ㉜ PRODUCT WATER AUTOMATIC DIVERSION VALVE
 - ㉝ CHARCOAL FILTER HOUSINGS
 - ㉞ CHECK VALVE
 - ㉟ FRESH WATER FILTER HOUSING (IF FITTED)
 - ㊱ FRESH WATER FLUSH VALVE (IF FITTED)
 - ㊲ NOT USED
 - ㊳ NOT USED
 - ㊴ NOT USED
 - ㊵ CHECK VALVE HIGH PRESSURE
 - ㊶ CHECK VALVE 1/2" PVC
 - ㊷ CHECK VALVE 1-1/2" PVC
 - ㊸ BOOSTER PUMP INLET PRESSURE GAUGE
 - ㊹ CHECK VALVE SS HIGH PRESSURE PUMP OUTLET

RINSE MEDIA FILTER

TASMAN SEA - P&ID

PT-Pressure Transducer
PI- Pressure Indicator
Mxx-Motorized Valve
FG-Flow Gauge
TDS-Salinity Meter
P-Pump
PLC-Programmable Logic Controller



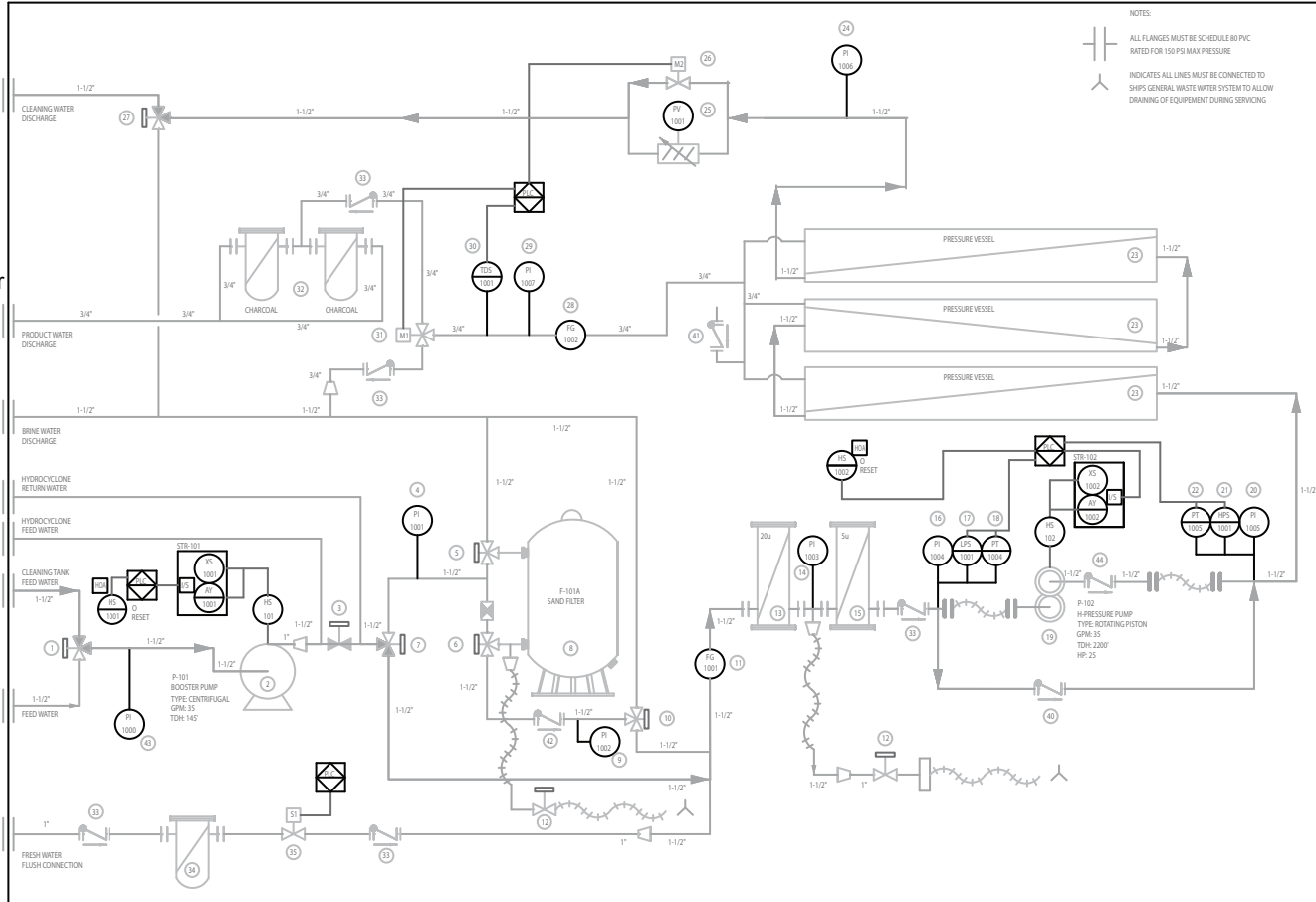
- KEY:
- INLET FEED SELECTOR VALVE
 - CLEAN/SEA WATER BOOSTER PUMP
 - HYDROCYCLONE BY-PASS VALVE
 - MEDIA FILTER INLET PRESSURE GAUGE
 - MEDIA FILTER INLET VALVE VALVE
 - MEDIA FILTER OUTLET VALVE VALVE
 - MANUAL CIP MEDIA FILTER DIVERSION VALVE
 - MEDIA FILTER ASSEMBLY
 - MEDIA FILTER OUTLET AND 20μ FILTER FILTER INLET PRESSURE GAUGE
 - MEDIA FILTER RINSE CYCLE DIVERSION VALVE
 - FEED WATER FLOW GAUGE
 - FILTRATION SYSTEM DRAIN VALVE
 - 20μ CARTRIDGE HOUSING
 - 20μ/5μ FILTER OUTLET/INLET PRESSURE GAUGE
 - 5μ CARTRIDGE HOUSING
 - HIGH PRESSURE PUMP INLET PRESSURES GAUGE
 - HIGH PRESSURE PUMP INLET PRESSURES SWITCH
 - HIGH PRESSURE PUMP INLET PRESSURE TRANSDUCER
 - HIGH PRESSURE PUMP
 - HIGH PRESSURE PUMP OUTLET PRESSURES GAUGE
 - HIGH PRESSURE PUMP OUTLET PRESSURES SWITCH
 - HIGH PRESSURE PUMP OUTLET PRESSURE TRANSDUCER
 - PRESSURE VESSEL
 - MEMBRANE OUTLET PRESSURE GAUGE
 - BACK PRESSURE REGULATOR
 - BACK PRESSURE BYPASS VALVE
 - OUTLET SELECTOR VALVE
 - CLEAN/DISCHARGE
 - PRODUCT WATER FLOW GAUGE
 - PRODUCT WATER PRESSURE GAUGE
 - PRODUCT WATER SALINITY MONITOR
 - PRODUCT WATER AUTOMATIC DIVERSION VALVE
 - CHARCOAL FILTER HOUSINGS
 - CHECK VALVE
 - FRESH WATER FILTER HOUSING (IF FITTED)
 - FRESH WATER FLUSH VALVE (IF FITTED)
 - NOT USED
 - NOT USED
 - NOT USED
 - CHECK VALVE HIGH PRESSURE
 - CHECK VALVE 1/2" PVC
 - CHECK VALVE 1-1/2" PVC
 - BOOSTER PUMP INLET PRESSURE GAUGE
 - CHECK VALVE SS HIGH PRESSURE PUMP OUTLET

TASMAN SEA P&ID		D		A		1 OF 1	
TASMAN SEA P&ID		D		A		1 OF 1	

Cleaning

TASMAN SEA - P&ID

PT-Pressure Transducer
PI- Pressure Indicator
Mxx-Motorized Valve
FG-Flow Gauge
TDS-Salinity Meter
P-Pump
PLC-Programmable Logic Controller



NOTES:

ALL FLANGES MUST BE SCHEDULE 80 PVC
RATED FOR 150 PSI MAX PRESSURE

INDICATES ALL LINES MUST BE CONNECTED TO
SHIP'S GENERAL WASTE WATER SYSTEM TO ALLOW
DRAINING OF EQUIPEMENT DURING SERVICING

KEY:

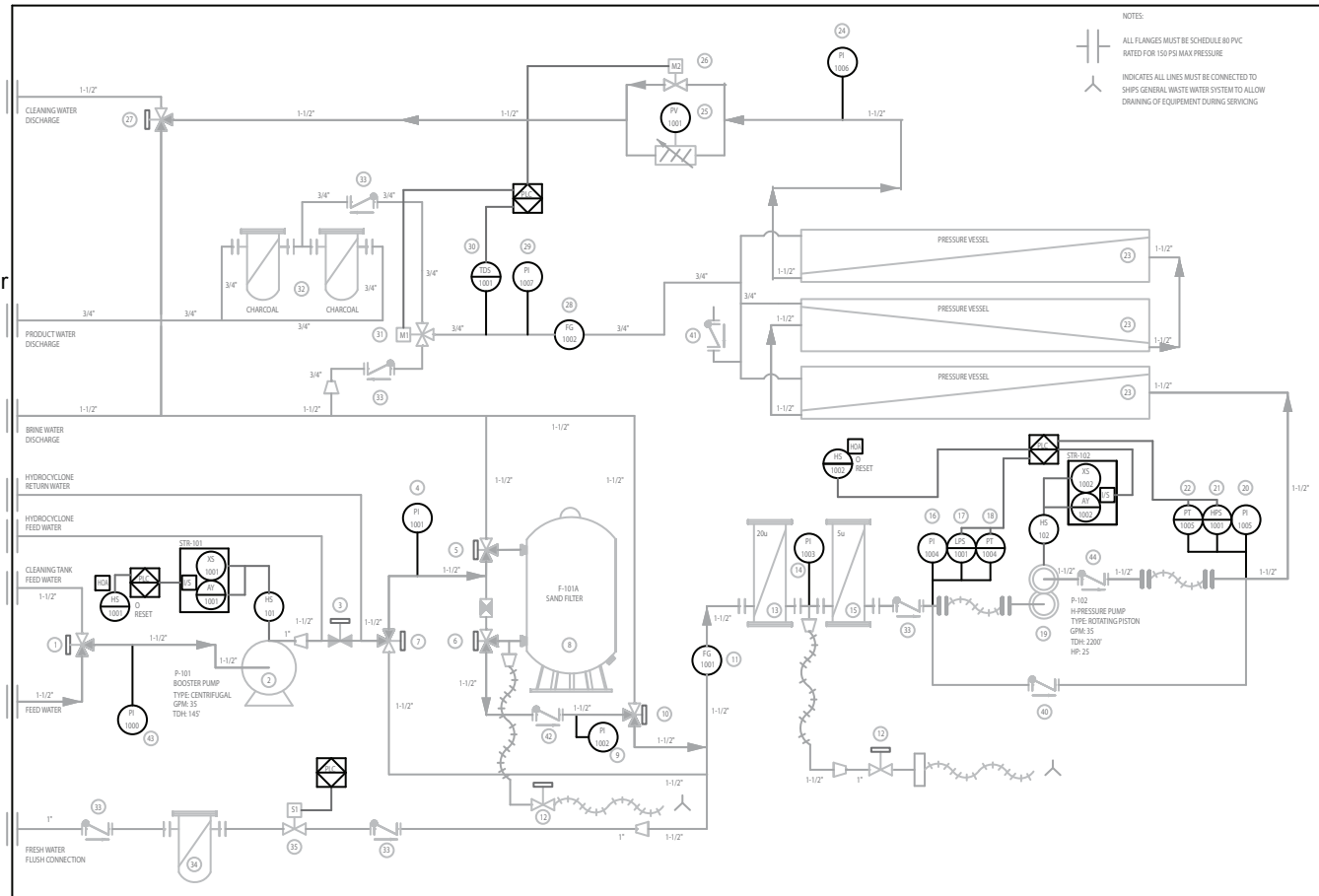
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DATE	APPROVAL			DATE	
SIGNATURE					
APPROVAL					

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DIMENSIONS ARE IN INCHES		
TOLERANCES	SUBPICK TASMAN SEA -P&ID	
JOG ± .01 XXX ± .005 ANGLES ± .1°		
D 1/2"	A 1/2"	TAC-BASIC 1/2"

TASMAN SEA - P&ID

PT-Pressure Transducer
PI- Pressure Indicator
Mxx-Motorized Valve
FG-Flow Gauge
TDS-Salinity Meter
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NOTES:

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DRAINING OF EQUIPEMENT DURING SERVICING

KEY:

DATE	APPROVED BY	DATE
SUPPLIER		
DESIGN		
APPROVAL		

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XXX ± .005
ANGLES: ± 1°

Danfoss
Sea Recovery

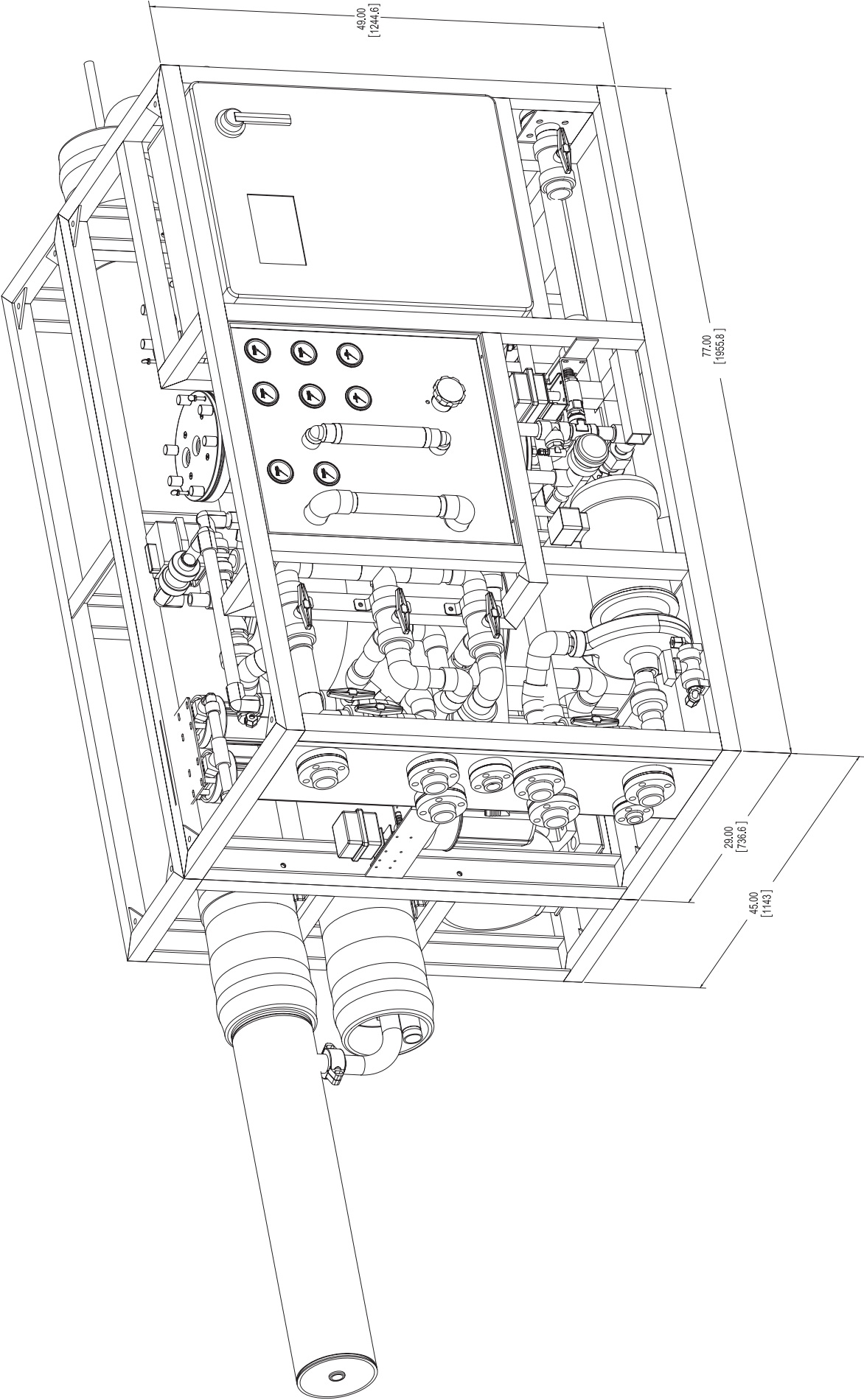
TASMAN SEA
P&ID

TAS-60-BASIC

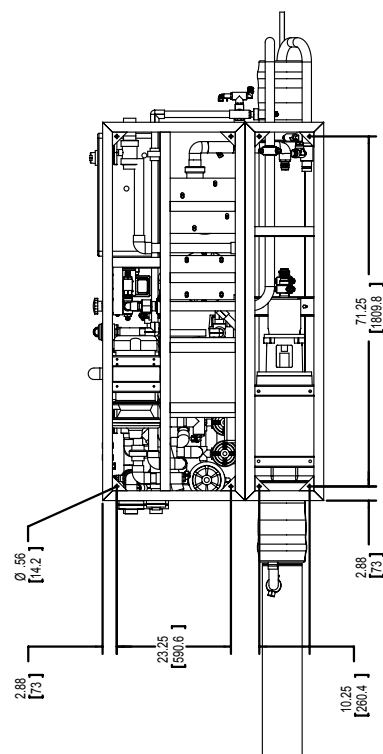
A

EXPLODED PARTS VIEW
&
PARTS LISTING

THE TASMAN SEA MAIN UNIT

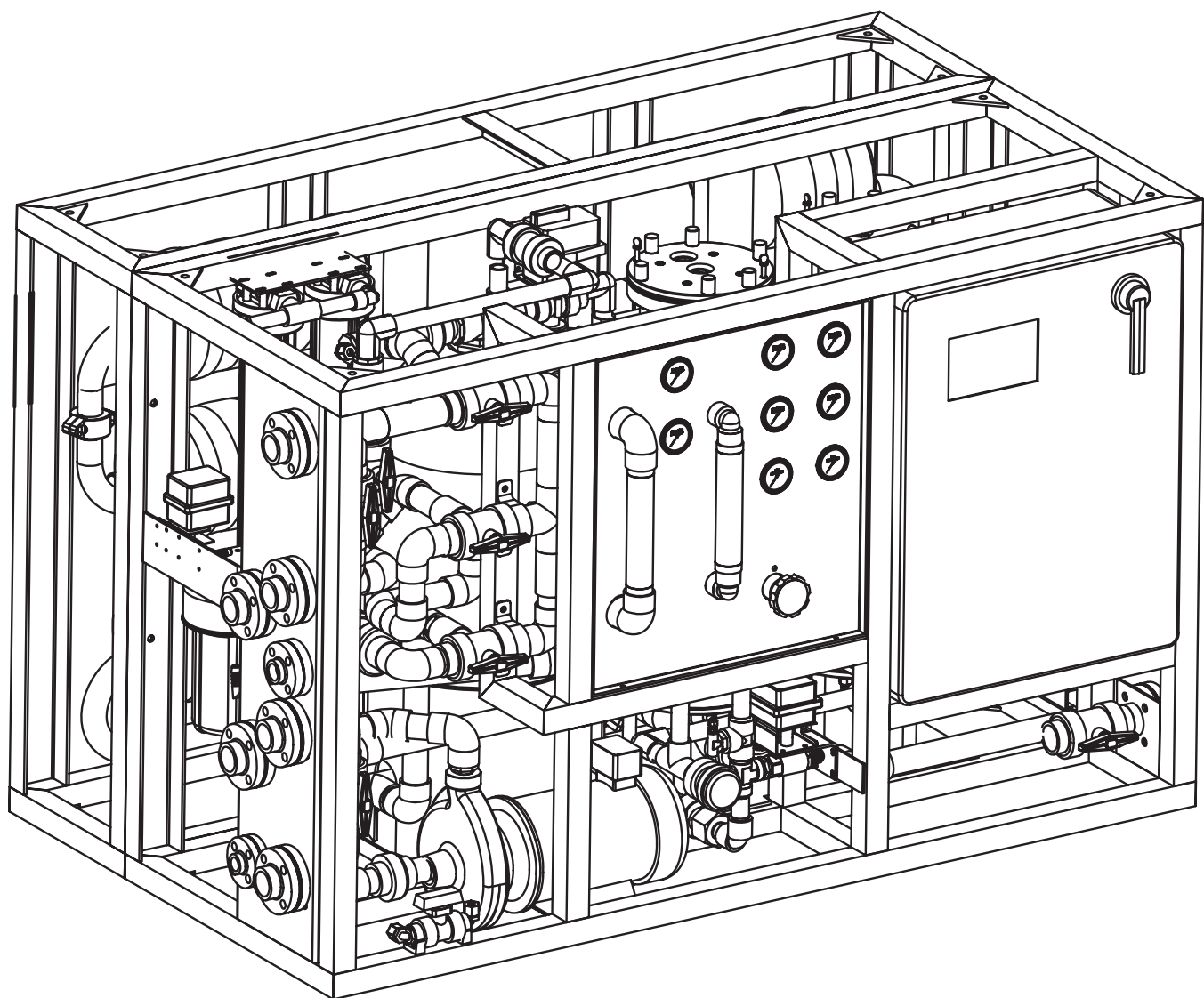


1. WEIGHT: DRY 1588KG IN DRY; 3148KG IN WET
2. CABLE GLAND: ALL GLANDS ARE ALONG THE BOTTOM OF THE CONTROL BOX THE ARE 18MM IN THE LOCATION SHOWN BELOW.

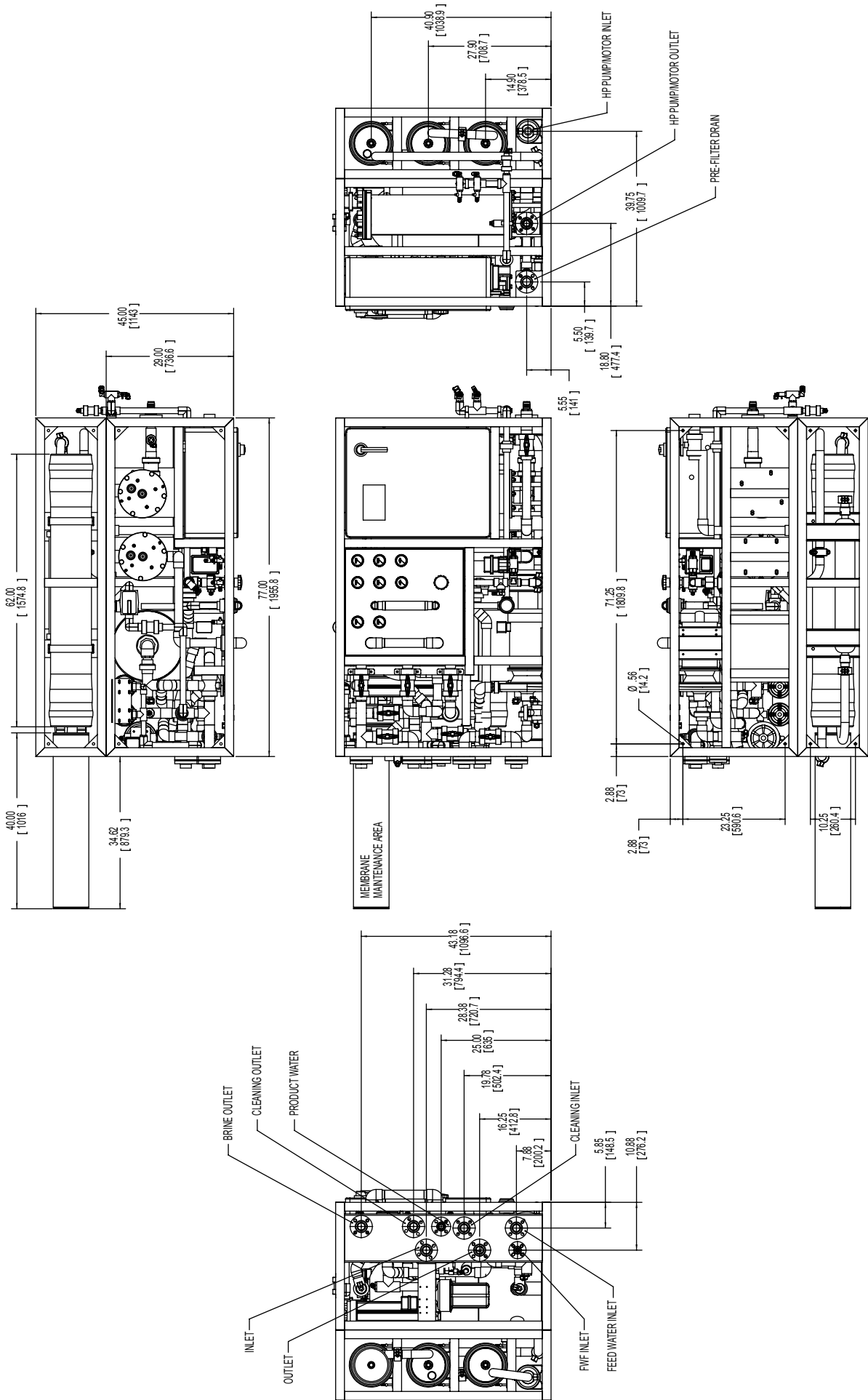


1. WHEN MAIN SKID AND MEMBRANE SKID ARE CONNECTED USE ONLY (4) OUTER HOLES ON THE FRAME TO MOUNT TO SHIP FLOOR, THE MIDDLE (4) MOUNTING HOLES ARE NOT NECESSARY.

THE TASMAN SEA MAIN UNIT WITH PLUNGER PUMP

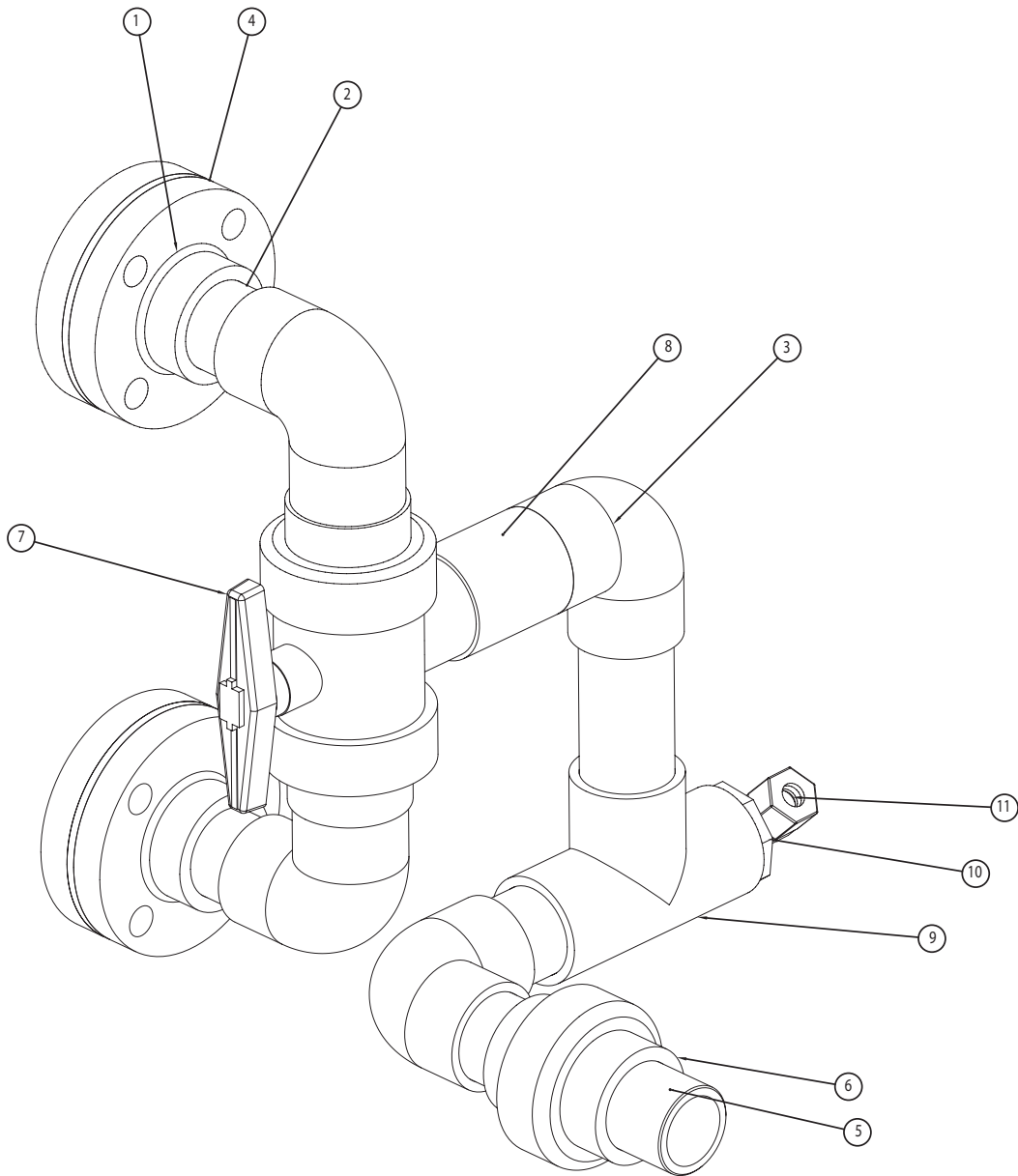


THE TASMAN SEA WITH PLUNGER PUMP - MAIN UNIT



FEED WATER INLET CLEAN VALVE ASSEMBLY

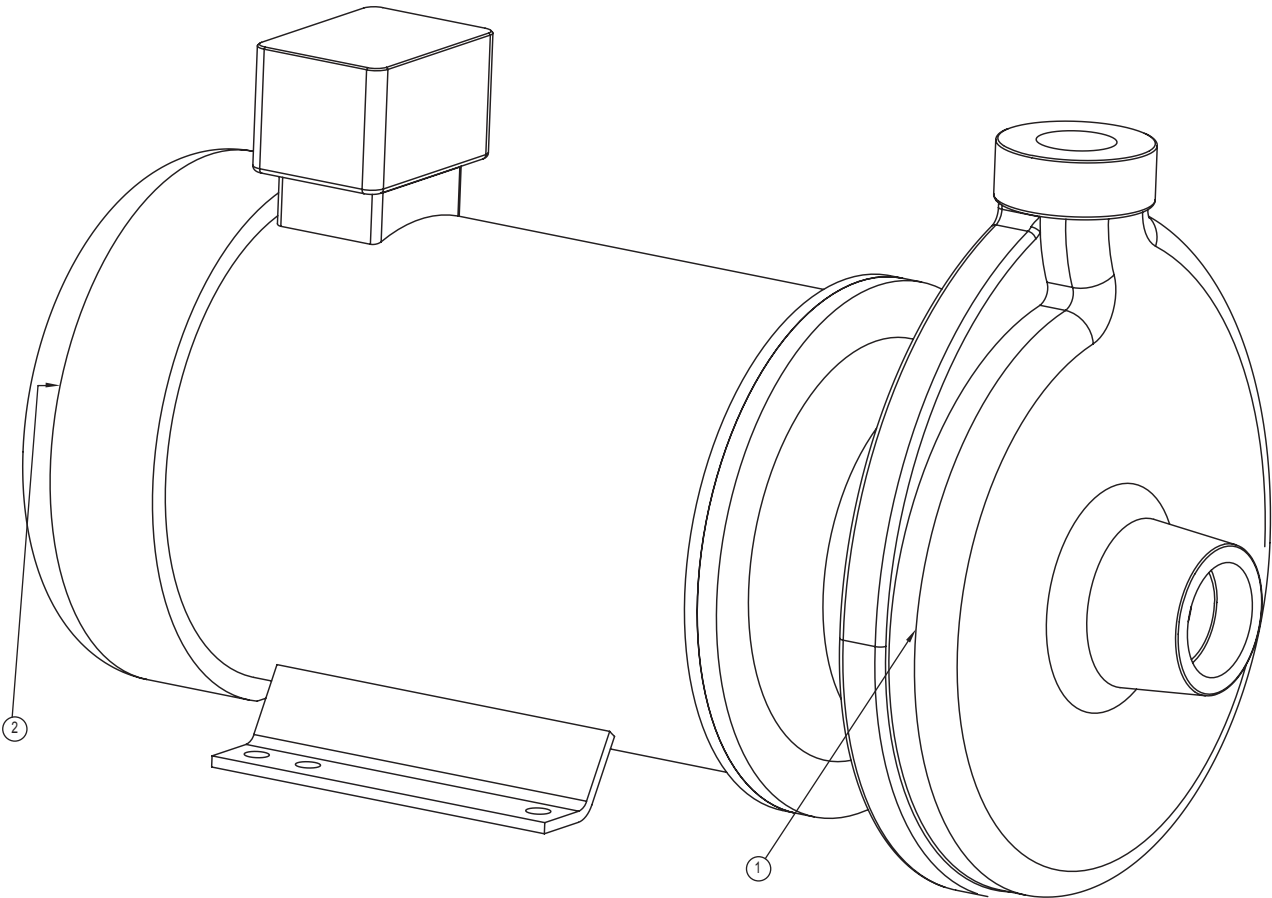
PART NUMBER: P010730001



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1		0101785983	FLANGE 1.50 FPT PVC	4
2		0301099200	PIPE PVC SCH 80 1.50 IN	A/R
3		0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	4
4		2635105900	GASKET FLANGE 1.5	2
5		01213759SH	NIPPLE 1.50 NPT X SHORT BRASS	1
6		0101685983	UNION 1.50 FNPT X 1.50 SL PVC	1
7	1	1401131942	3-WAY BALL VALVE 1.5 INCH	1
8		1401132342	CUPLINK FOR 1401132342 VALVE	1
9		0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	1
10		0101315583	RB 1.50 SL X .50 FNPT	1
11		0204022569	ELB90 PARKER	1

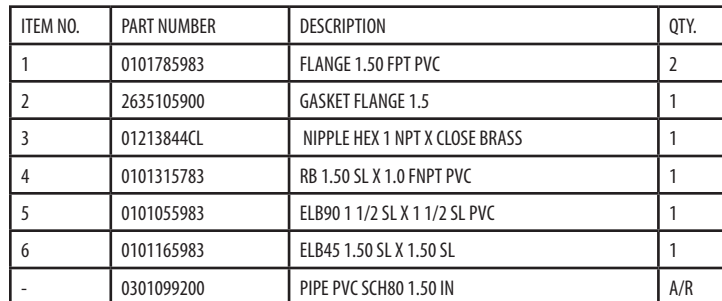
BOOSTER PUMP ASSEMBLY

PART NUMBER: B015730001
P&ID POSITION NO.: 2



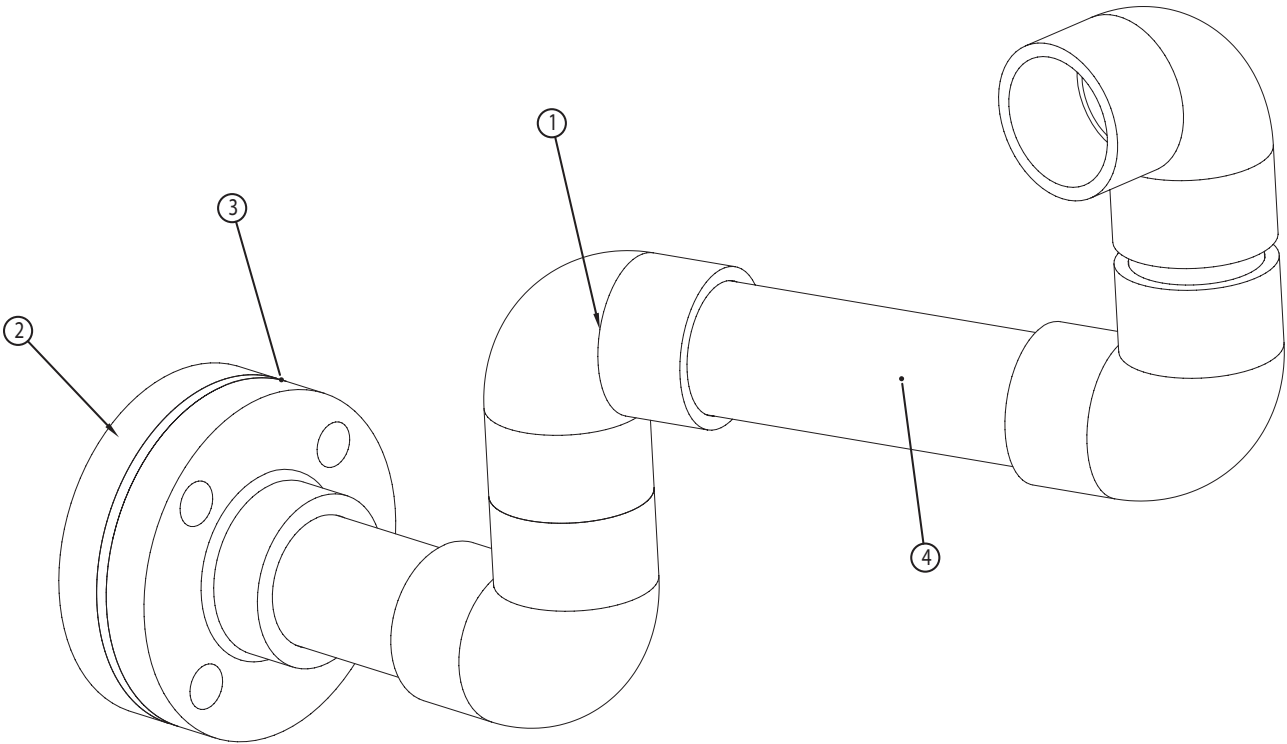
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	1217520772	BOOSTER PUMP PRICE PUMP JB100	1
2	1567304112	MOTOR 5 HP 3450 RPM 3PH 60 HZ	1

PART NUMBER: P017730002



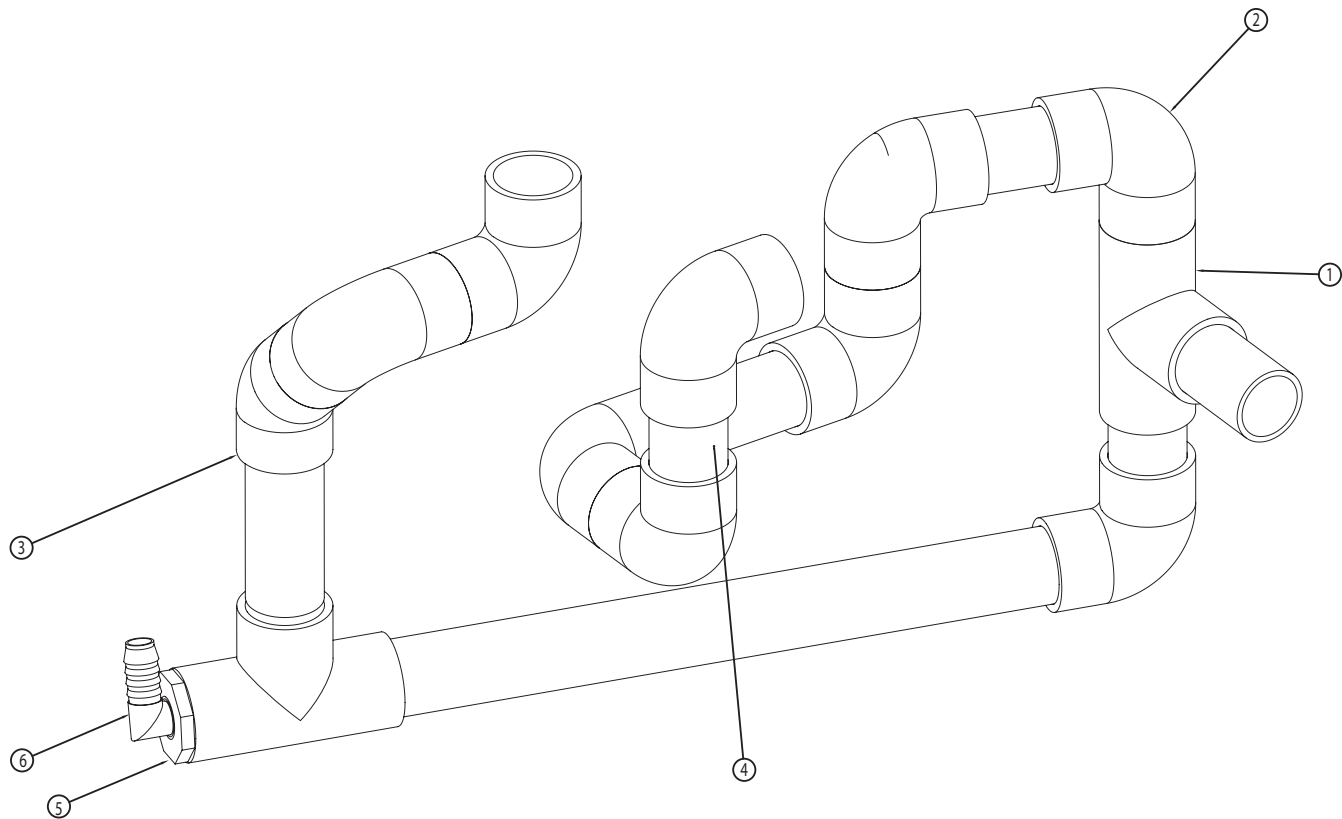
PIPING ASSY CLEANING INLET
PART NUMBER: P0101730003

Parts View



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	4
2	0101054483	FLANGE 1.50 FPT PVC	2
3	2635105900	GASKET FLANGE 1.5	1
4	0301099200	PIPE PVC SCH 80 1.5 IN	1

MEDIA FILTER TO FLOW METER
PART NUMBER: P066730001

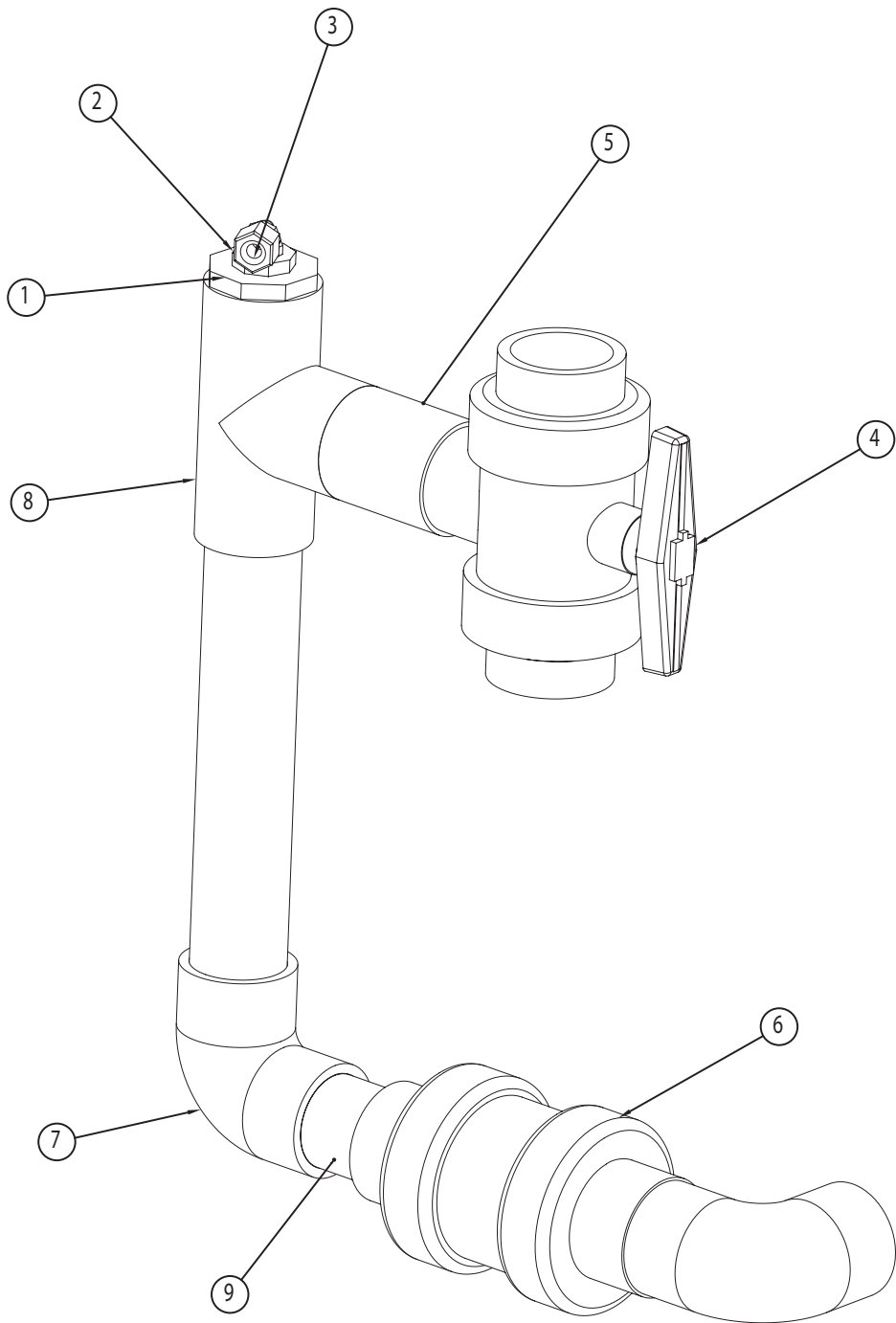


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	2
2	0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	9
3	0101165983	ELB45 1.50 SL X 1.50 SL	1
4	0301099200	PIPE PVC SCH 80 1.50 IN	A/R
5	0101315683	RB 1.50 SL X .75 FNPT PVC	1
6	0101073783	ELB90 .75 MNPT X .75 BARB NYLON	1

MULTI MEDIA FILTER CLEANING BYPASS ASSEMBLY

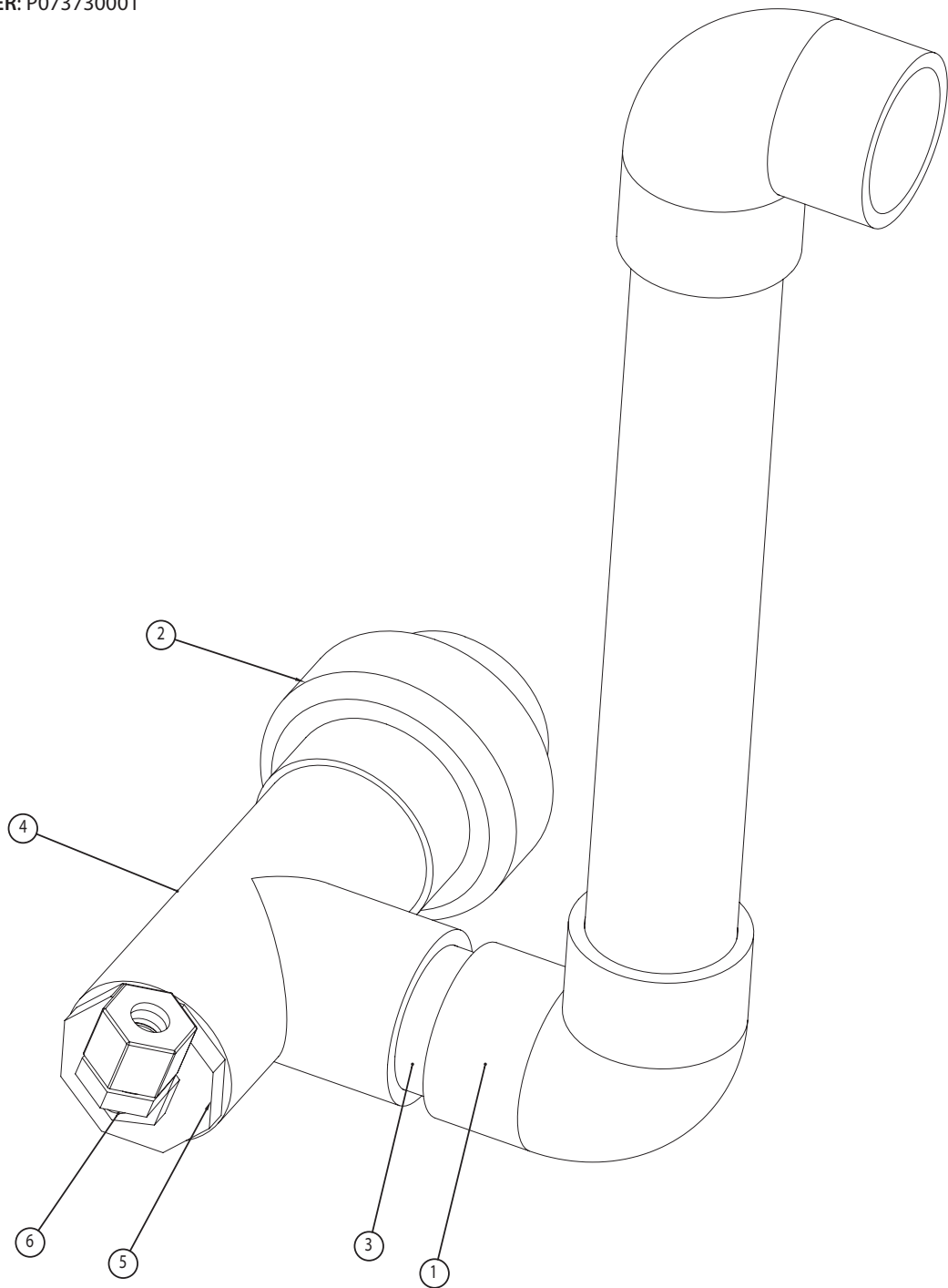
PART NUMBER: P072730001

Parts View



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1		0101315583	RB 1.50 SL X .50 FNPT	1
2		0101292383	RB 1/2 MT X 1/4 FT PVC	1
3		0204020869	Elb90 .25 TUBE X .25 MPT PLASTIC	1
4	10	1401131942	3-WAY BALL VALVE 1.5 INCH	1
5		1401132342	CUPLINK FOR 1401132342 VALVE	1
6	42	1401272442	TRU UNION CHECK VALVE 1.500 SL	1
7		0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	2
8		0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	1
9		0301099200	PIPE PVC SCH 80 1.50 IN	A/R

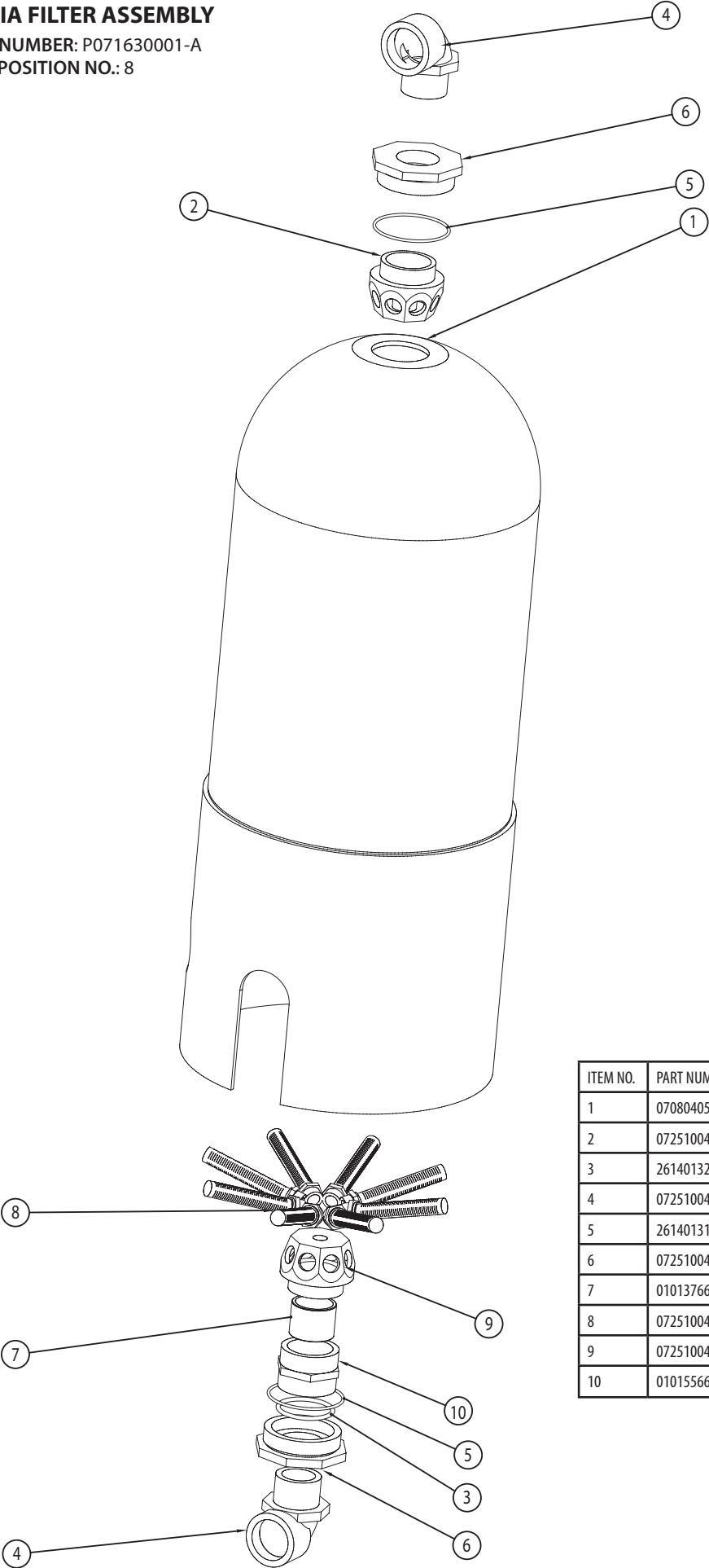
PIPE ASSEMBLY MEDIA FILTER OUTLET
PART NUMBER: P073730001



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	2
2	0101695983	UNION 1.50 SL X 1.50 SL PVC	1
3	0301099200	PIPE PVC SCH 80 1.50 IN	A/R
4	0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	1
5	0101315583	RB 1.50 SL X .75 FNPT PVC	1
6	0204022569	ELB90 PARKER	1

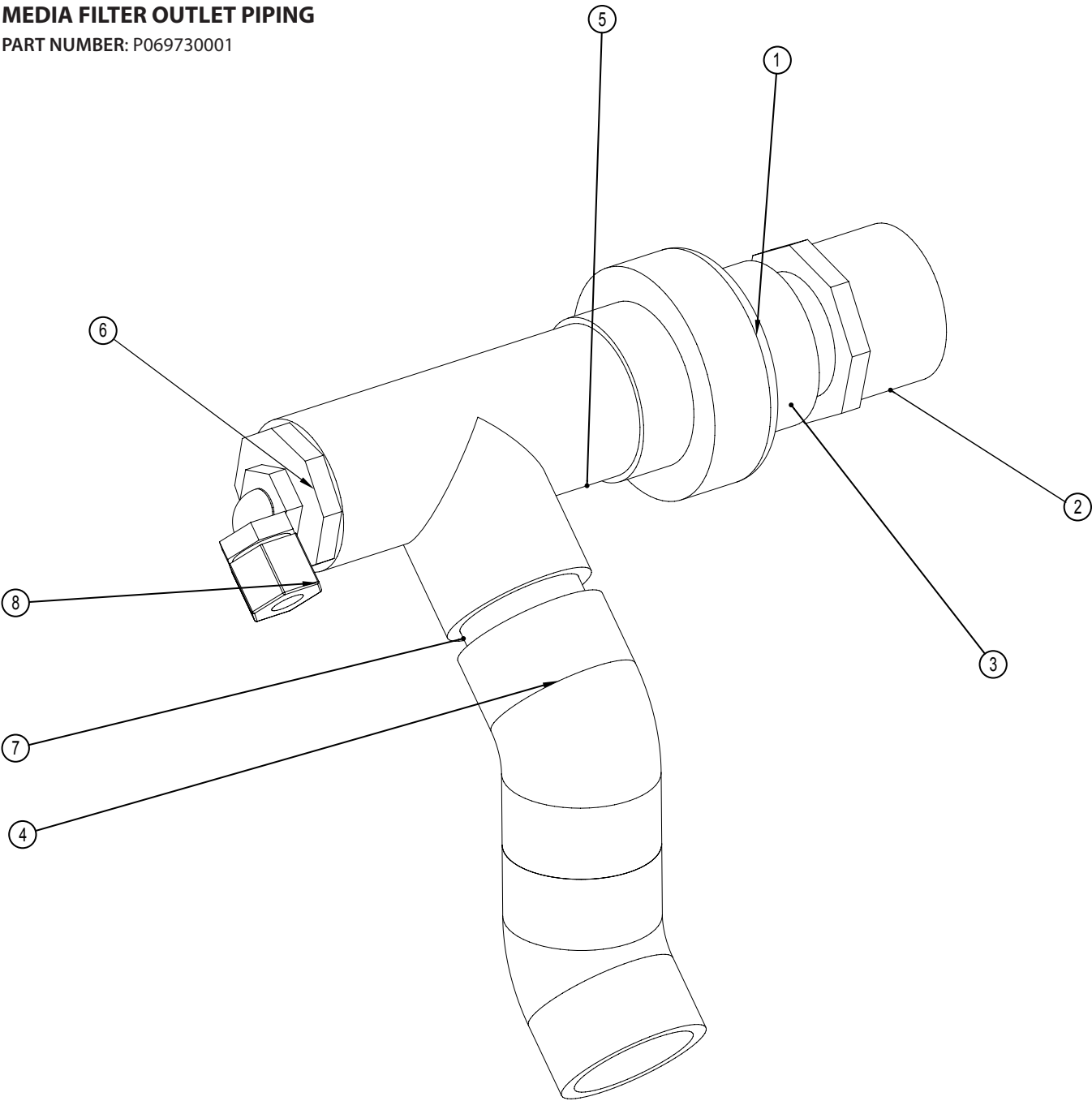
MEDIA FILTER ASSEMBLY

PART NUMBER: P071630001-A
P&ID POSITION NO.: 8



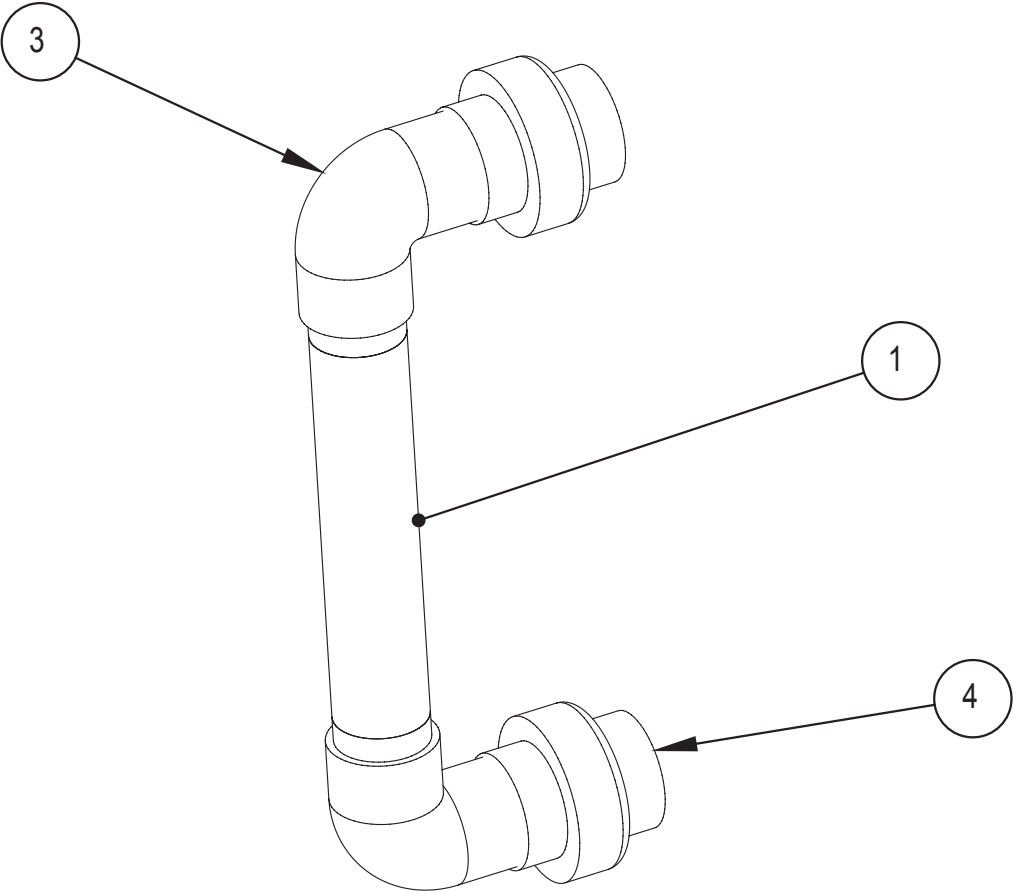
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0708040568	MEDIA FILTER HOUSING 1633 FRP	1
2	0725100400-04	TOP BAFFLE	1
3	2614013200	O-RING 334 ELBOW 2.0 MMF	2
4	0725100400-01	ELB90 2 MPT X SOC O-RING	2
5	2614013100	O-RING 240 BUTTRESS 4 X 2 MMF	2
6	0725100400-02	BUTTRESS 4 X 2	2
7	01013766CL	NIPPLE 2.00 NPT X CLOSE PVC	1
8	0725100400-06	LATERAL HUB BOTTOM	8
9	0725100400-05	MEDIA FILTER HUB BOTTOM	1
10	0101556683	COUP 2 FNPT X 2 FNPT PVC	1

MEDIA FILTER OUTLET PIPING
PART NUMBER: P069730001



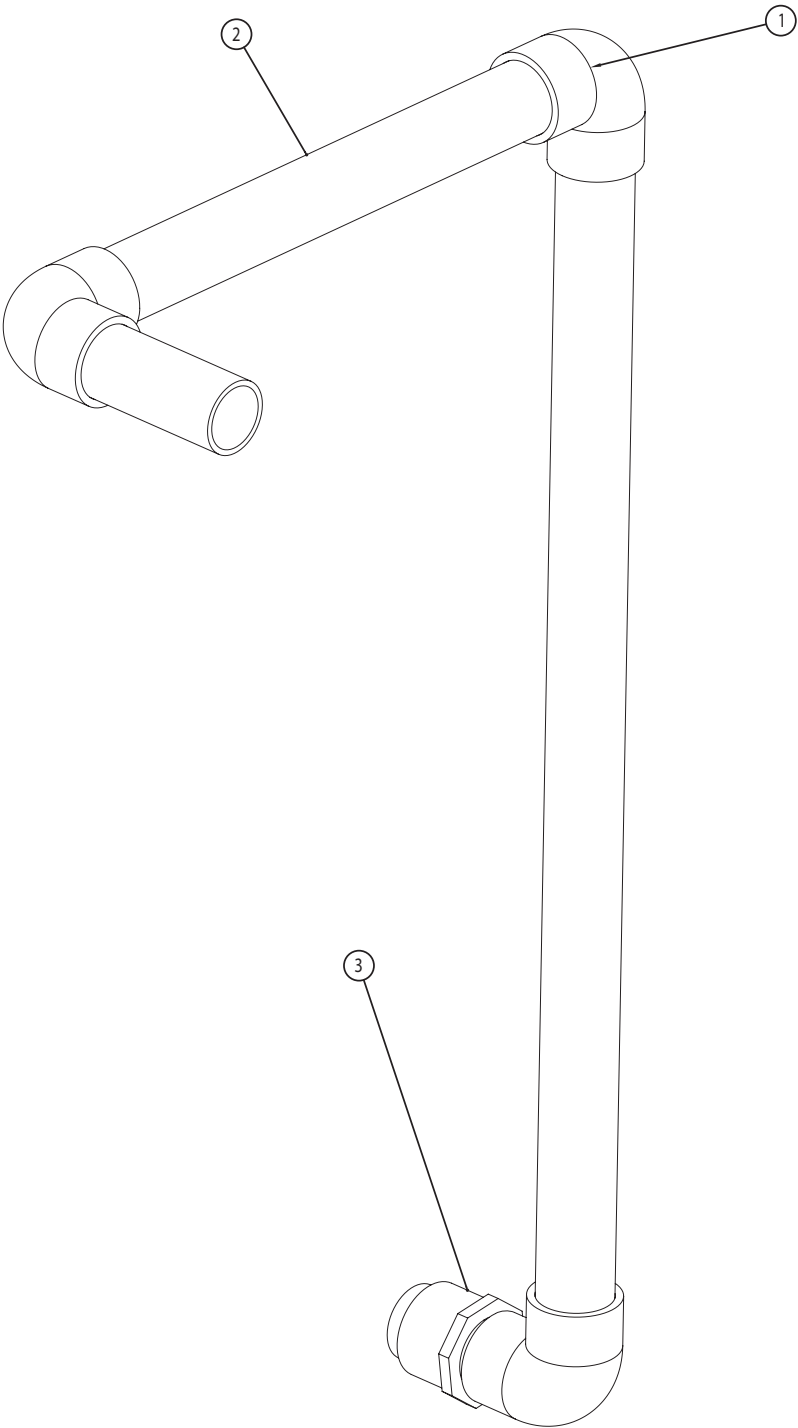
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101695983	UNION 1.50 SL X 1.50 SL PVC	1
2	0101326583	RB 2 SL X 1.50 SL PVC	1
3	0301099200	PIPE PVC SCH 80 1.50 IN	1
4	0101165983	ELB45 1.50 SL X 1.50 SL	2
5	0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	1
6	0101315583	RB 1.50 SL X .50 FNPT	1
7	0301099200	PIPE PVC SCH 80 1.50 IN x 3.88LG	1
8	0204022569	ELB90 .50 TUBE x .50 MPT	1

FEED WATER F/M SUB ASSEMBLY
PART NUMBER: P141630001-A



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1	11	1101321353	FLOW METER 40 GPM FEED	1
2		01013759CL	NIPPLE 1 1/2 NPT X CLOSE PVC	2
3		0101015983	ELB90 1 1/2 FNPT X 1 1/2 FNPT PVC	2
4		0101695983	UNION 1.50 SL X 1.50 SL PVC	2

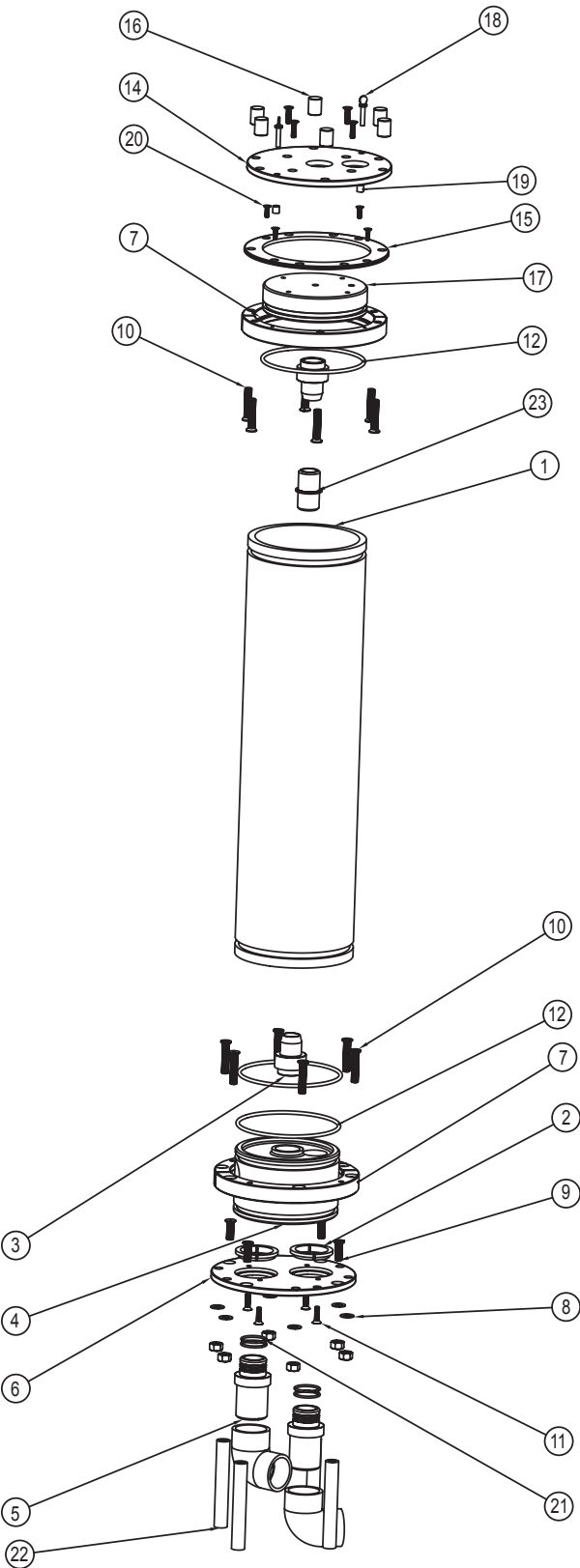
FLOW METER TO PREFILTER INLET FEED WATER
PART NUMBER: P141730002



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	3
2	0301099200	PIPE PVC SCH 80 1.50 IN	A/R
3	0101326583	RB 2 SL X 1.50 SL PVC	1

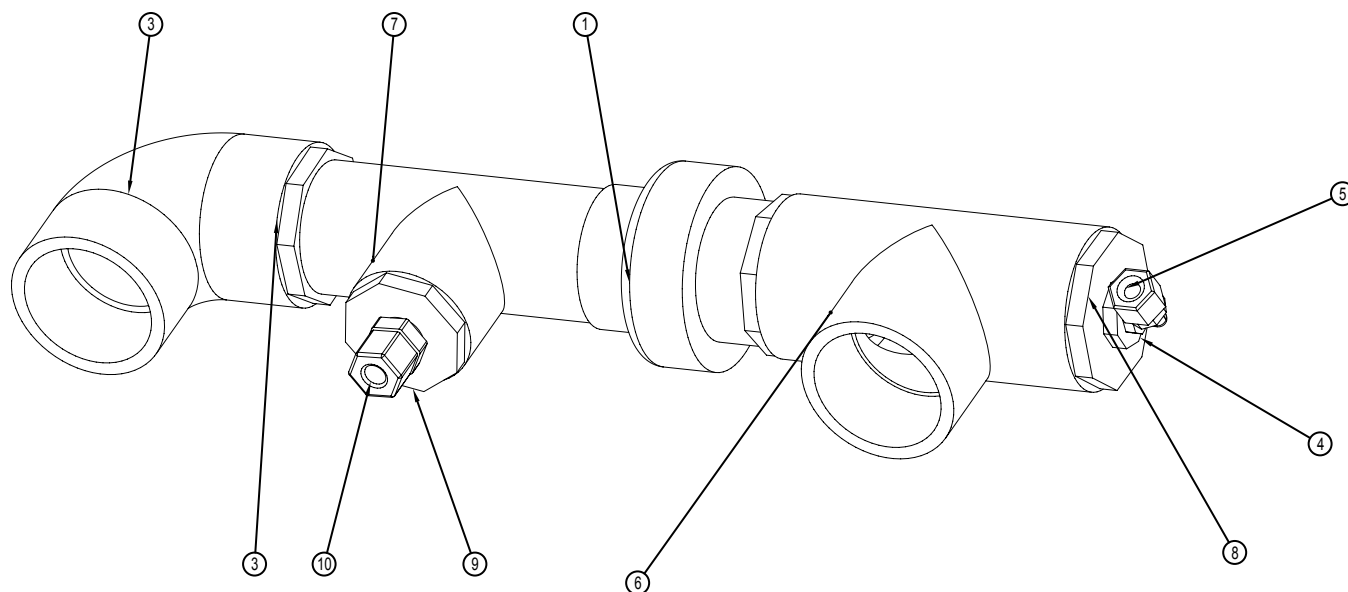
HOUSING CYCRONE PRE-FILTER ASSY

PART NUMBER: P1010630001-A
P&ID POSITION NO.: 13, 15



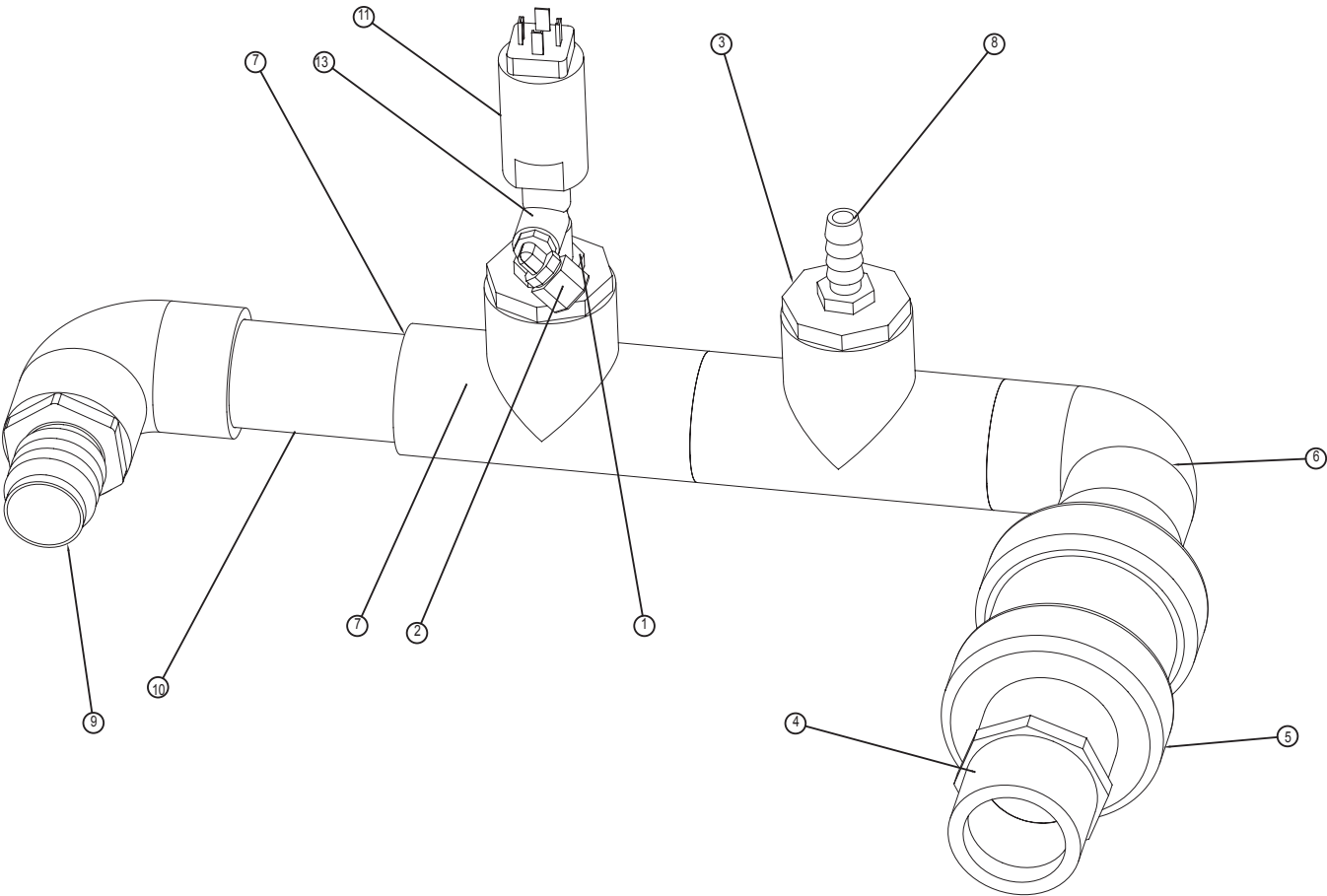
Item No.	Part Number	Description	Qty
1	07490302BD	HOUSING CYC CARTRIDGE LONG	1
2	0700100500-10	ANNULUS I-O PORT FRF FILTER	2
3	0700100500-06	ADAPTER CART TOP PLUG PVC FRP	2
4	0700100500-08	PLUG BOTTOM PVC FRP FILTER	1
5	0700100500-11	IO PORT 2 PVC FRP FILTER	2
6	0700100500-09	LID BOTTOM FRP FILTER HOUSING	1
7	0700100500-04	ANNULUS SPLIT	2
8	61100066000	WASHER FLAT OS 1/2"SS	6
9	61161767024	SCREW SLOT FLAT HEAD .50-13 X 1.5LG SS	4
10	61161767040	SC SLOT FLAT .50-13 X 2.5LG SS	12
11	H3061161850016	SC ALLEN FLAT 5/16-18 X 1 1/4 SS	8
12	2614011099	O-RING 442 CYC UP-LO PLUG	3
13	2614010999	O-RING 224 CYC PORT BUNA	4
14	0700100500-02	LID TOP FRP FILTER	1
15	0700100500-03	ANNULUS RETAINER	1
16	0700100500-01	KNOB KNURLED FRP FILTER REV OM	6
17	0700100500-05	PLUG TOP PVC FRP FILTER	1
18	61310050024	SC THUM .31-18 X 1.5 SHOLDR	2
19	61275067000	INSERT .31-18 X .50-13 SS	2
20	61161845014	SC ALLEN FLAT 1/4-20 X 7/8 SS	4
21	61060067000	NUT HEX .50-13 W/INSERT SS	6
22	0700100500-12	LEG,FRP FILTER _2	4
23	0700100500-07	ADAPTER DBL CART FRP	1

PART NUMBER: P101730001



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101695983	UNION 1.50 SL X 1.50 SL PVC	1
2	0101326583	RB 2 SL X 1.50 SL PVC	2
3	0101056683	ELB90 2 SL X 2 SL PVC	1
4	0101292383	RB 1/2 MT X 1/4 FT PVC	1
5	0204020869	ELb90 .25 TUBE X .25 MPT PLASTIC	1
6	0101466683	TEE 2.0 SL X 2.0 SL X 2.0 SL PVC	1
7	0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	1
8	0101316183	RB 2 SL X .50 FNPT PVC	1
9	0101315583	RB 1.50 SL X .50 FNPT	1
10	0204091969	CONN 3/8 TUBE X 1/2 MPT PLASTIC	1

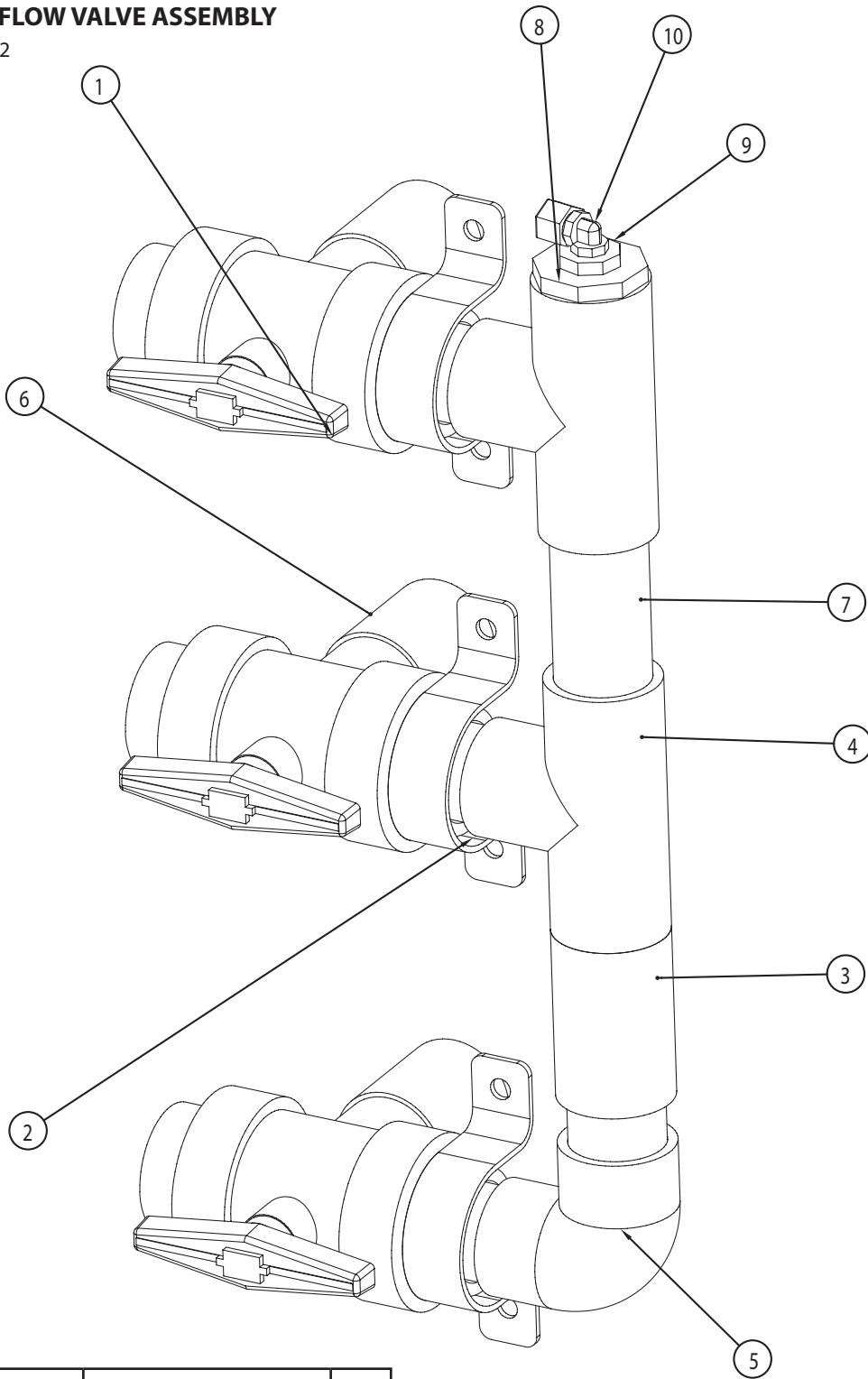
FEED WATER MANIFOLD FILTER - HPP
PART NUMBER: P143730001



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1		0101292383	UNION 1.50 SL X 1.50 SL PVC	1
2		0204020869	Elb90 .25 TUBE X .25 MPT PLASTIC	1
3		0101315583	RB 1.50 SL X .50 FNPT	2
4		0101326583	RB 2 SL X 1.50 SL PVC	1
5	42	1401272442	TRU UNION CHECK VALVE 1.500 SL	1
6		0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	2
7		0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	2
8		0101652583	ADAP .50 MNPT X .50 BARB PVC	1
9		0101655983	ADAP 1.50 MNPT X 1.50 BARB PVC	1
10		0301099200	PIPE PVC SCH 80 1.50 IN	A/R
11	18	2317100600	TRANSDUCER 0-300 PSI SS	1
12		01013708CL	NIPPLE 1/4 NPT X CLOSE PVC	2
13	12	0101420883	TEE .25 FNPT x .25 FNPT X .25 FNPT PVC	1

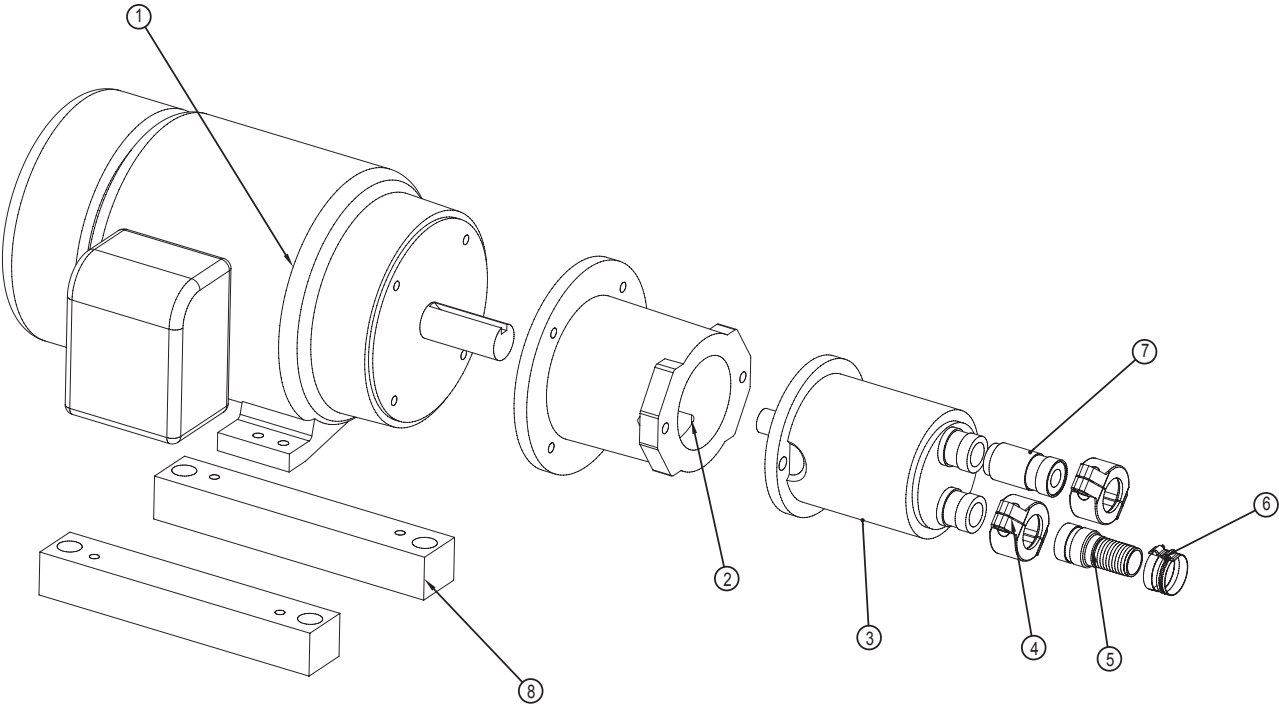
MULTI MEDIA FILTER FLOW VALVE ASSEMBLY

PART NUMBER: P066730002



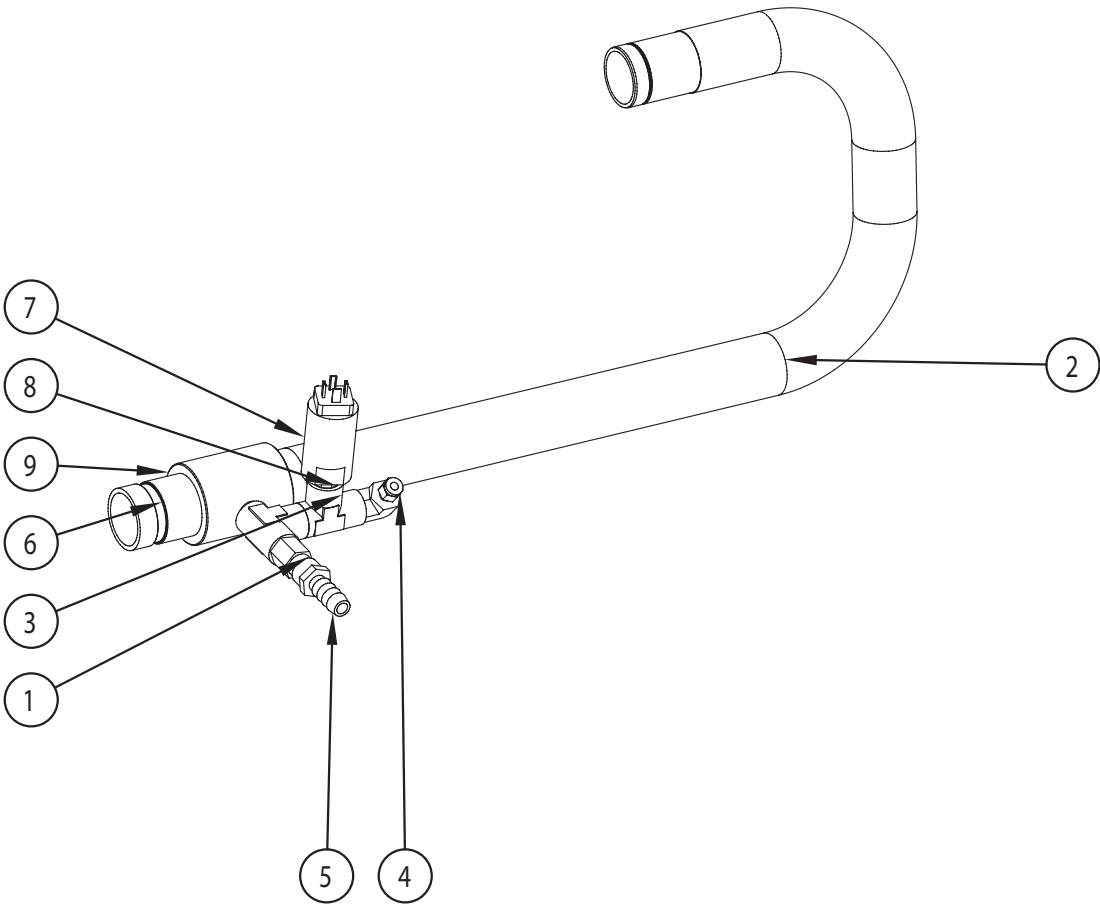
ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1	5,6,7	1401131942	3-WAY BALL VALVE 1.5 INCH	3
2		05160305AH	BRACKET U CLAMP MEM VESSEL 2 IN	3
3		0101575900	COUPLER ORIFICE PVC	1
4		0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	2
5		0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	1
6		1401132342	CUPLINK FOR 1401132342 VALVE	3
7		0301099200	PIPE PVC SCH 80 1.50 IN	A/R
8		0101315583	RB 1.50 SL X .50 FNPT	1
9		0101292383	RB 1/2 MT X 1/4 FT PVC	1
10		0204020869	ELB90 .25 TUBE X .25 MPT PLASTIC	1

HP PUMP/MOTOR APP 8.2 25HP 60HZ
PART NUMBER: B156730002



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1	46	1586285512	MOTOR 25HP 230-460-60HZ 3 PH	4
2		12572412DS-1	BELLOUSING AND COUPLER APP8.2/10.2	2
3	19	12572412DS	HPRA PUMP DANFOSS	1
4		0517170200	CLAMP VICTAULIC 1 1/2" SS	3
5		0117925900	ADAP 1.50 VIC X 1.50 BARB SS	1
6		05181437AA	HOSE CLAMP 1.50 SS	A/R
7	45	14172113DS	CHECK VALVE 1.5 - VIC SS	2
8		21320700MI	RUBBER MOUNT DAMPENING BAR	1

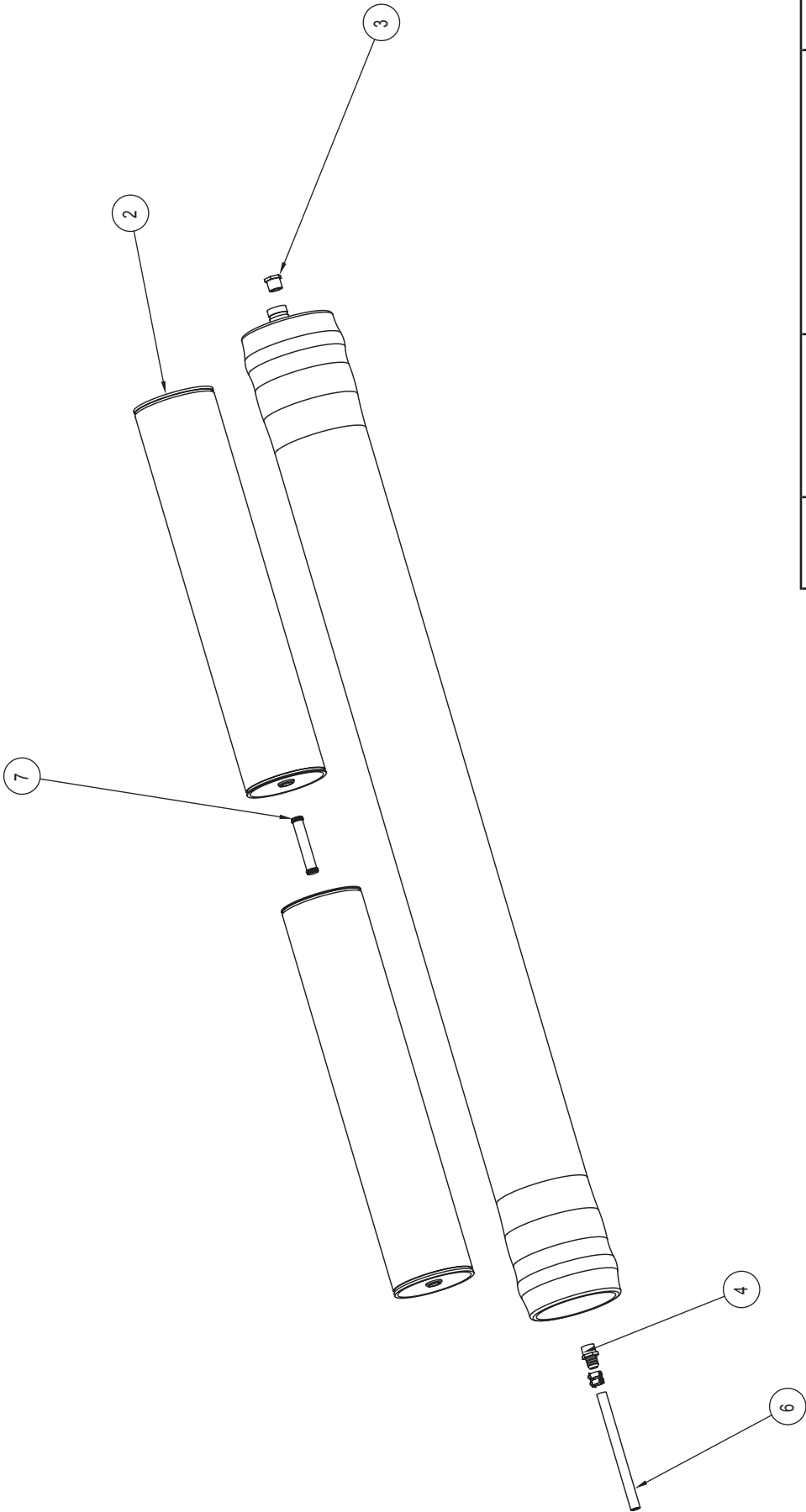
HPP- MEMBRANE INLET
PART NUMBER: P344730001



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1	40	1417211487	CHECK VALVE SWAGELock SS-8CPA2 3-50 PSI .500	1
2		0118895913	FITTING VIC-PRO 4IN 180d RAD MEM-PI	1
3		0117492569	TEE ST .50 FT X .50 MT X .50 FT SS	2
4		0217021087	ELB90 1/4 TUBE X 1/2 MPT SS	1
5		0101652583	ADAP .50 FNPT X .50 BARB PVC	1
6		0117875925	ADAPTER VIC-THREAD NIPPLE	1
7	22	2317102000	TRANSDUCER 0-2000 PSI SS .25	1
8		0117292319	RB .50 MT X .25 FT SS	1
9		01375954AE	COUP RED 1.50 npt X 1.50 npt SS	1

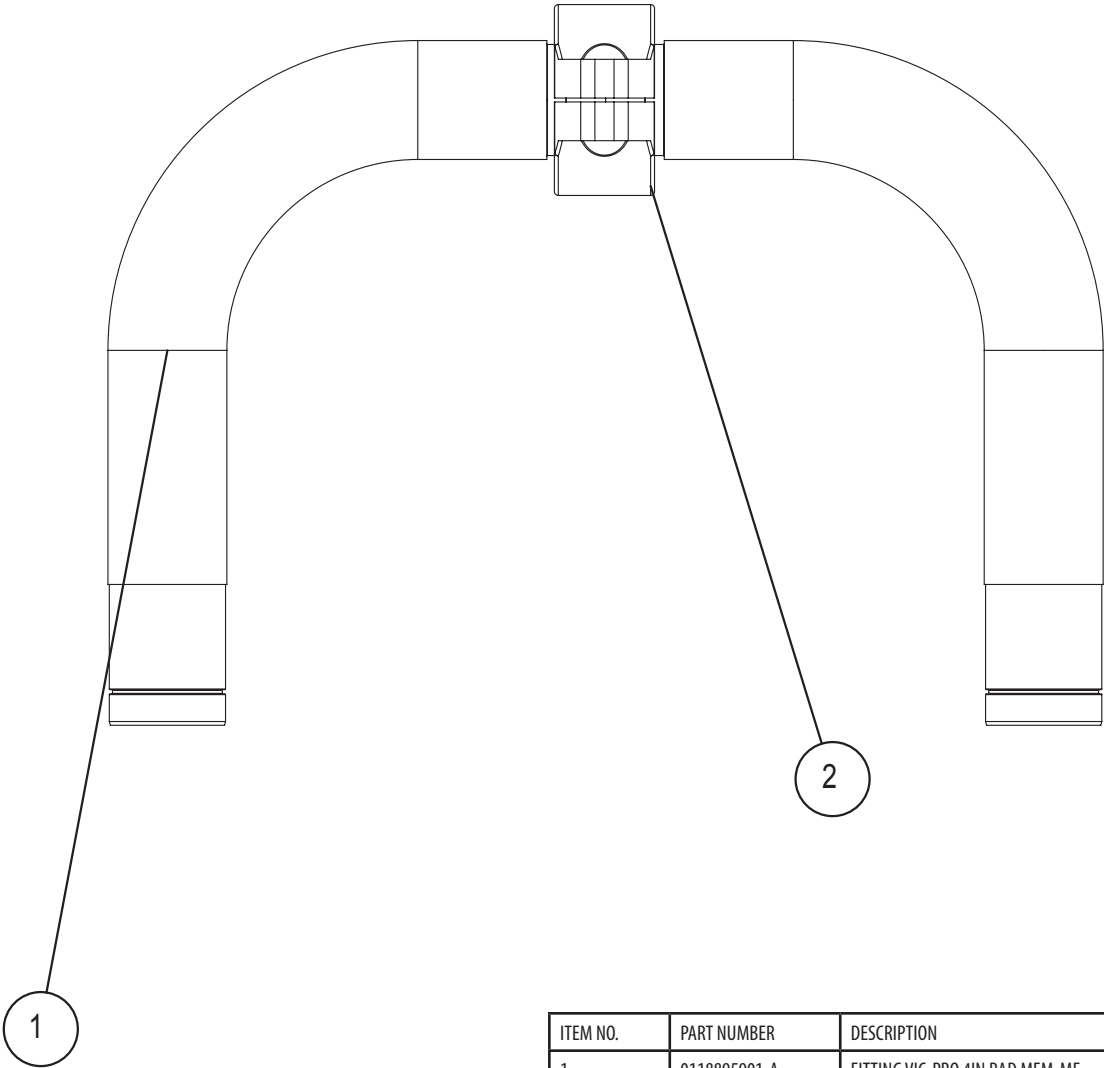
MEMBRANE VESSEL ASSY 8.0" DBL-HR

PART NUMBER: P201630002-A
P&ID POSITION NO.: 23



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	2408223102	VESSEL 8.00 DOUBLE W-END PLUG PT	1
2	2724033133	MEMBRANE 8 IN HR-HY W-SEAL	2
3	0101344483	PLUG 1.0 MPT PVC	1
4	0101654383	ADAP 1 MNPT X .750 BARB PVC	1
5	05181434AA	HOSE CLAMP .75 SS	2
6	0328066666	HOSE CLEAR BRAID .75 X 12.00 LG	1
7	2724033133-01	MEMBRANE INTERCONNECT	1

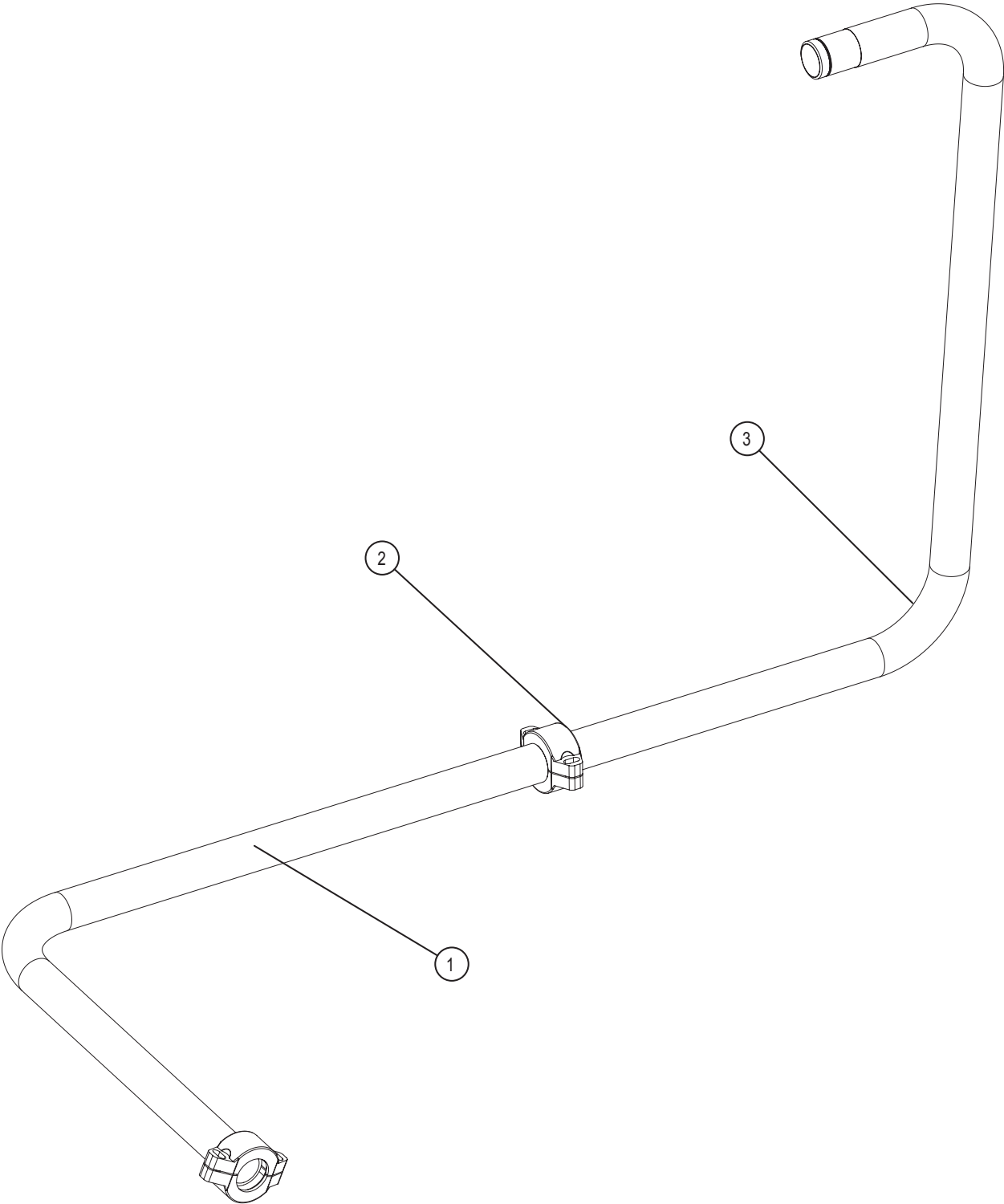
HIGH PRESSURE PIPE - MEMBRANE TO MEMBRANE
PART NUMBER: P347630003-A



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0118895901-A	FITTING VIC-PRO 4IN RAD MEM-ME	2
2	0517170200	CLAMP VICTAULIC 1 1/2" SS	1

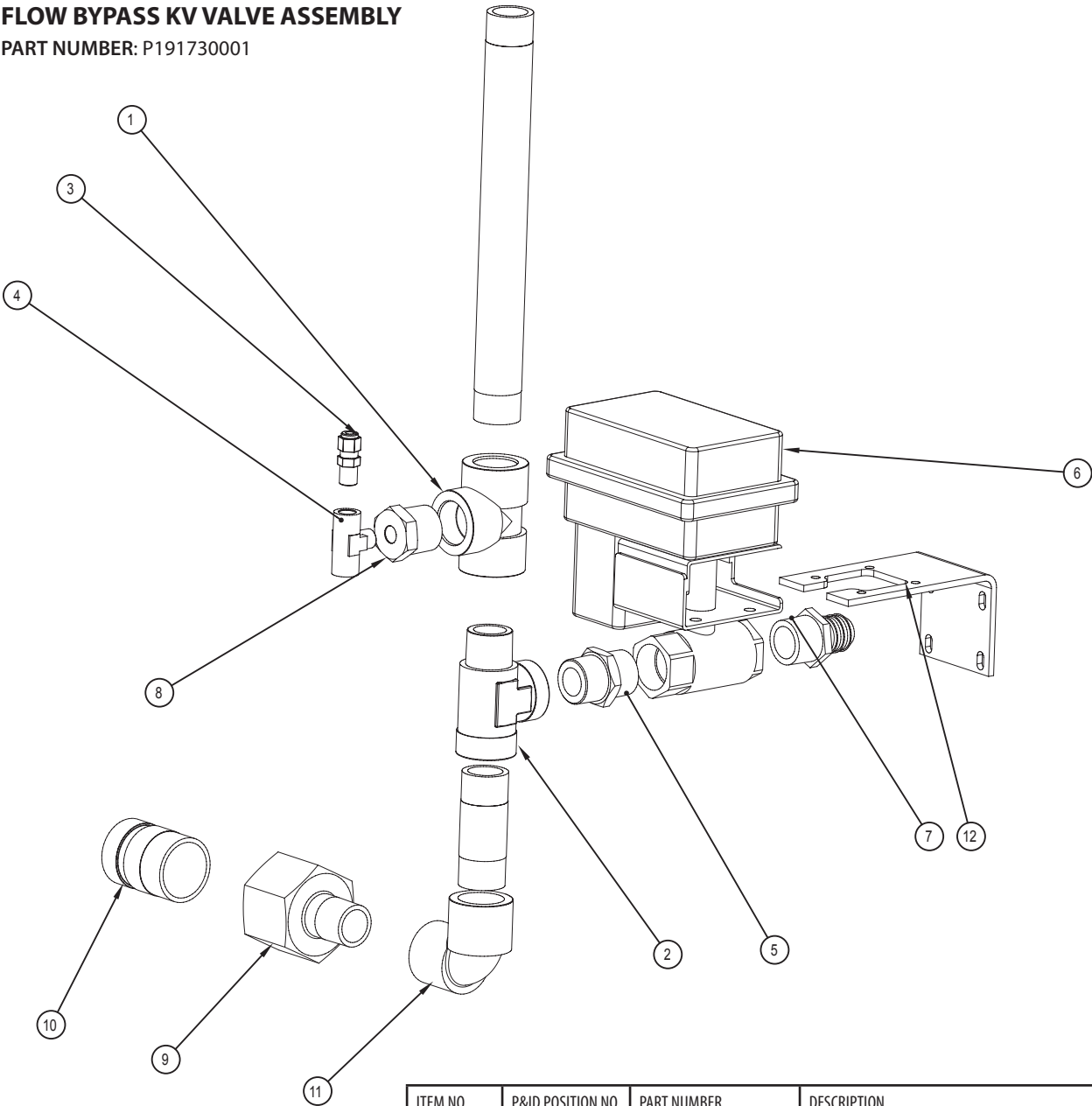
HP PIPE MVA-BPR
PART NUMBER: P460730001

Parts View



TEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0118895912	FITTING VIC-VIC 4 IN RAD PIPE TO BPR	1
2	0517170200	CLAMP VICTAULIC 1 1/2" SS	2
3	0118895911	FITTING VIC-PRO 4IN RAD MEM-PI	1

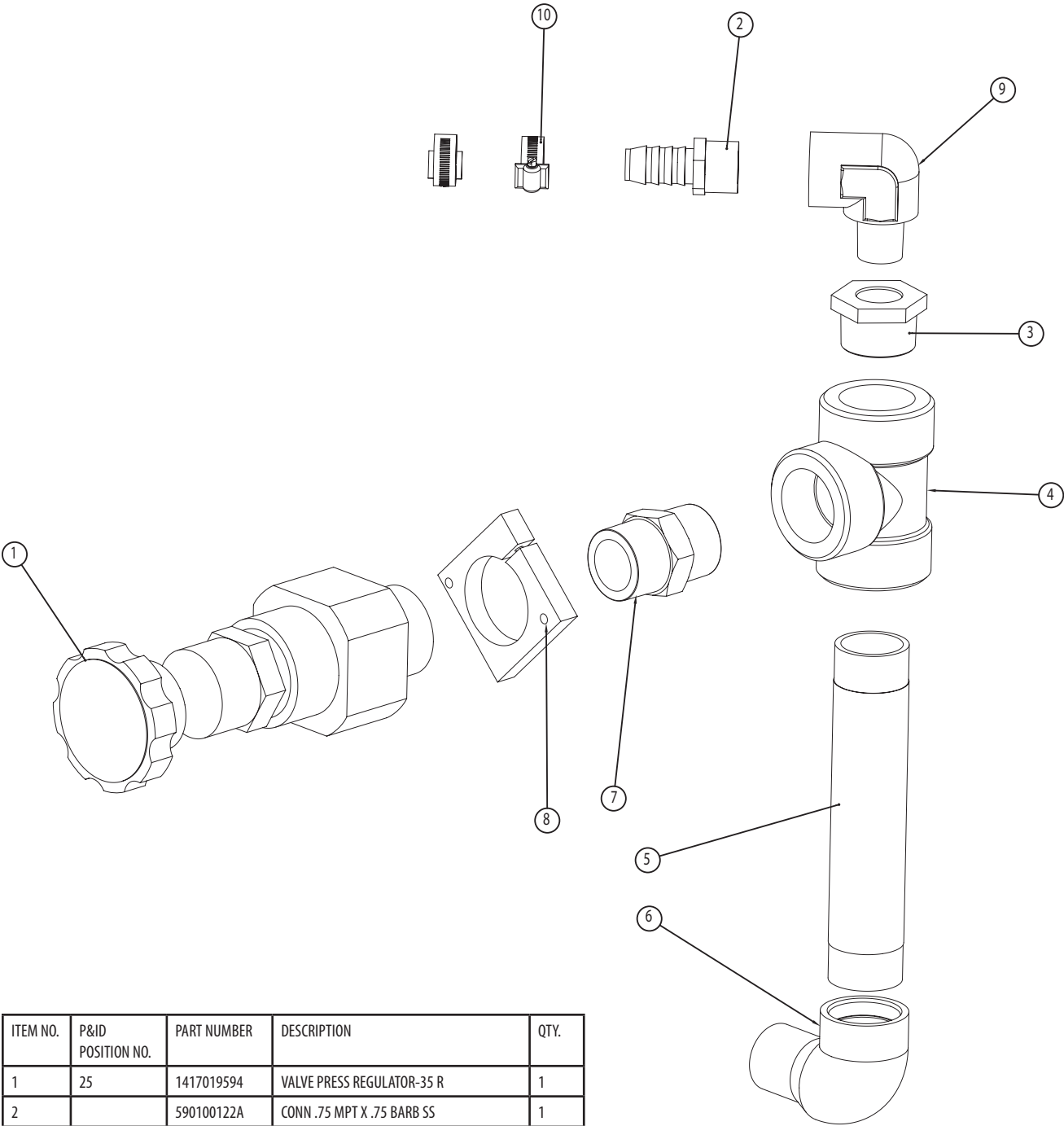
FLOW BYPASS KV VALVE ASSEMBLY
PART NUMBER: P191730001



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1		01174244AY	TEE 1 FNPT X 1 FNPT X 1 FNPT SS	1
2		01174944AY	TEE ST 1 FNPT X 1 MNPT X 1 FNPT SS	1
3		0217090887	CONN .25 Tube x .250 MNPT SS	1
4		0117520869	TEE BRANCH .25 FT X .25 MT X .25 FT SS	1
5		01173844CL	NIPPLE HEX 1 MNPT X CLOSE SS SCH160	1
6	28	1417018296	FLOW BYPASS VALVE	1
7		0101654383	ADAP 1 MNPT X .750 BARB PVC	1
8		0117294000	RB 1 MT X .25 FT SS	1
9		01378557AE	ADAP 1.50 FNPT X 1 MNPT SCH 160	1
10		0117875925	ADAPTER VIC NIPLE 1 1/2 X 2 1/2 DUPL	1
11		01170144AE	ELB90 1 FNPT X 1 FNPT SS 150	1
12		20200473008	BRACKET VALVE	1
13		0117375	NIPPLE 1.00 NPT X 3.312 SS	1
14		0117375	NIPPLE 1.00 NPT X 11.875 SS	1

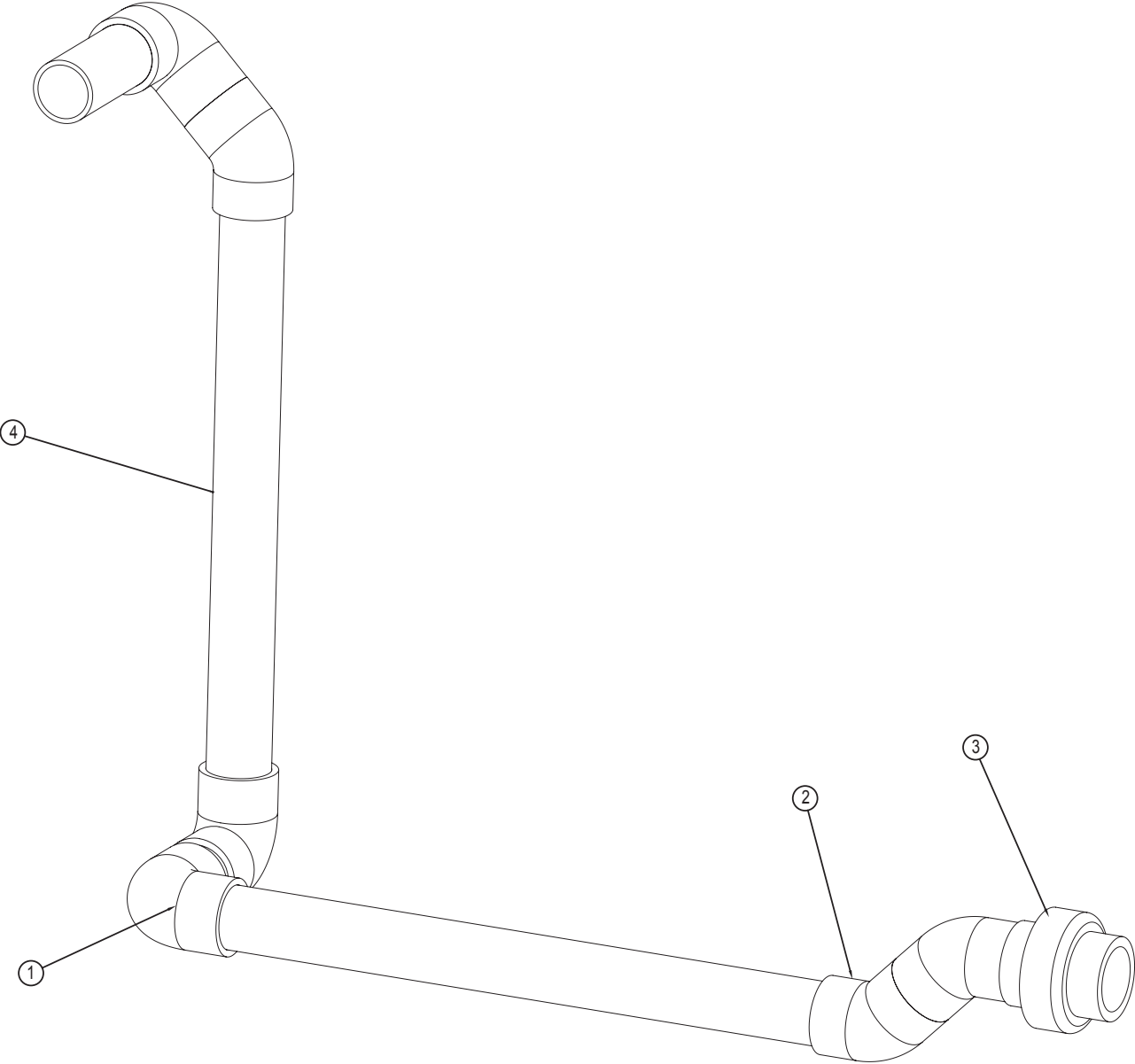
BACK PRESSURE REGULATOR ASSY

PART NUMBER: P476630001-A



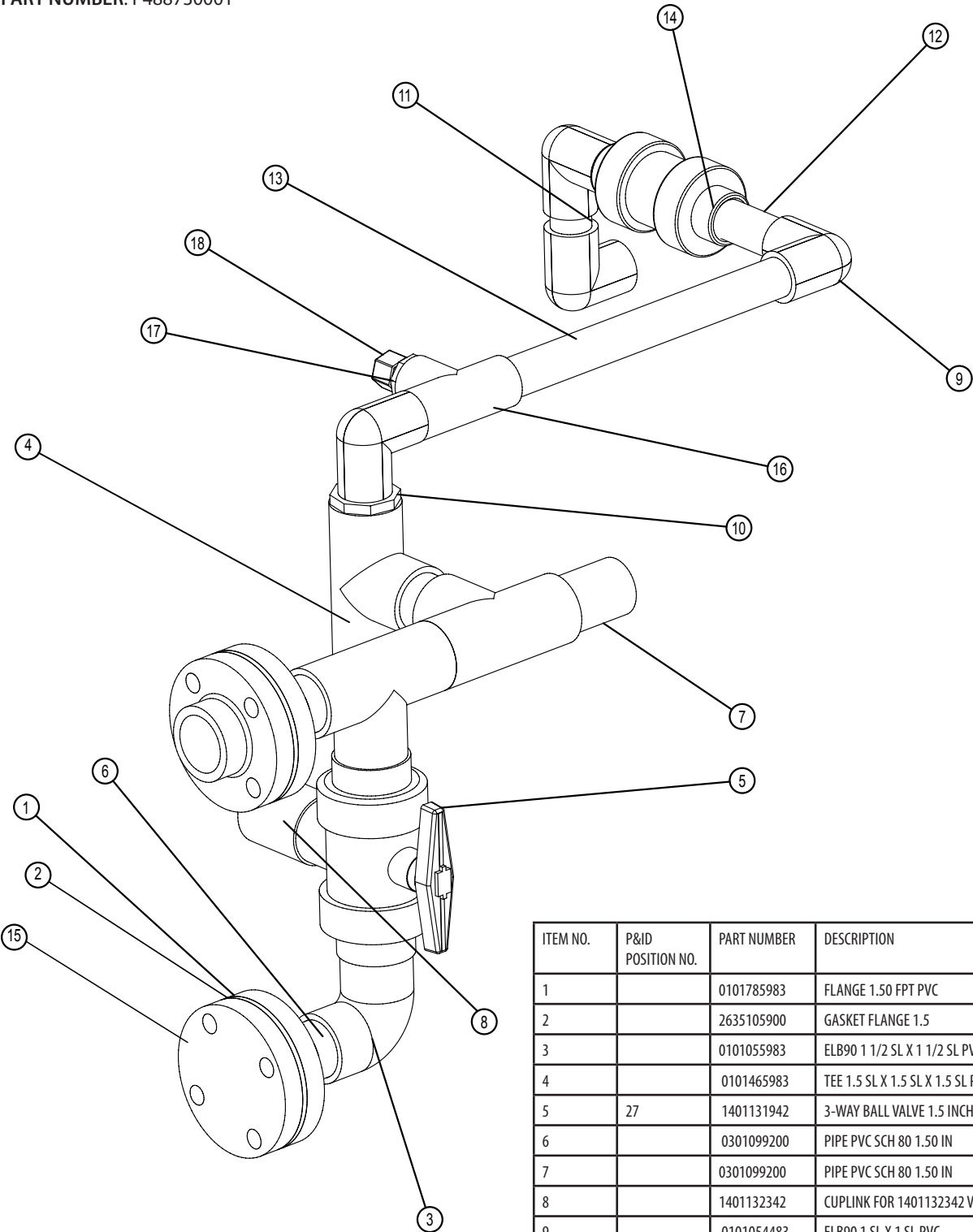
ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1	25	1417019594	VALVE PRESS REGULATOR-35 R	1
2		590100122A	CONN .75 MPT X .75 BARB SS	1
3		01172950AE	RB 1.25 MNPT X .75 FNPT SS	1
4		0117425200	TEE 1 1/4 FT X 1 1/4 FT X 1 1/4 FT SS	1
5		0117375249	NIPPLE 1.25 NPT X 7.25 SS MN	1
6		01172308AE	ELB90 ST 1.25 MNPT X 1.25 FNPT	1
7		01383852CL	NIPPLE HEX 1.25 MNPT SCH160 SS	1
8		0516122900	BRACKET REGULATING VALVE-35-65	1
9		0117233769	ELB90 ST .75 MPT X .75 FPT SS	1
10		05181434AA	HOSE CLAMP 3/4 SS	2

BRINE DISCHARGE FROM BPR
PART NUMBER: P480730001



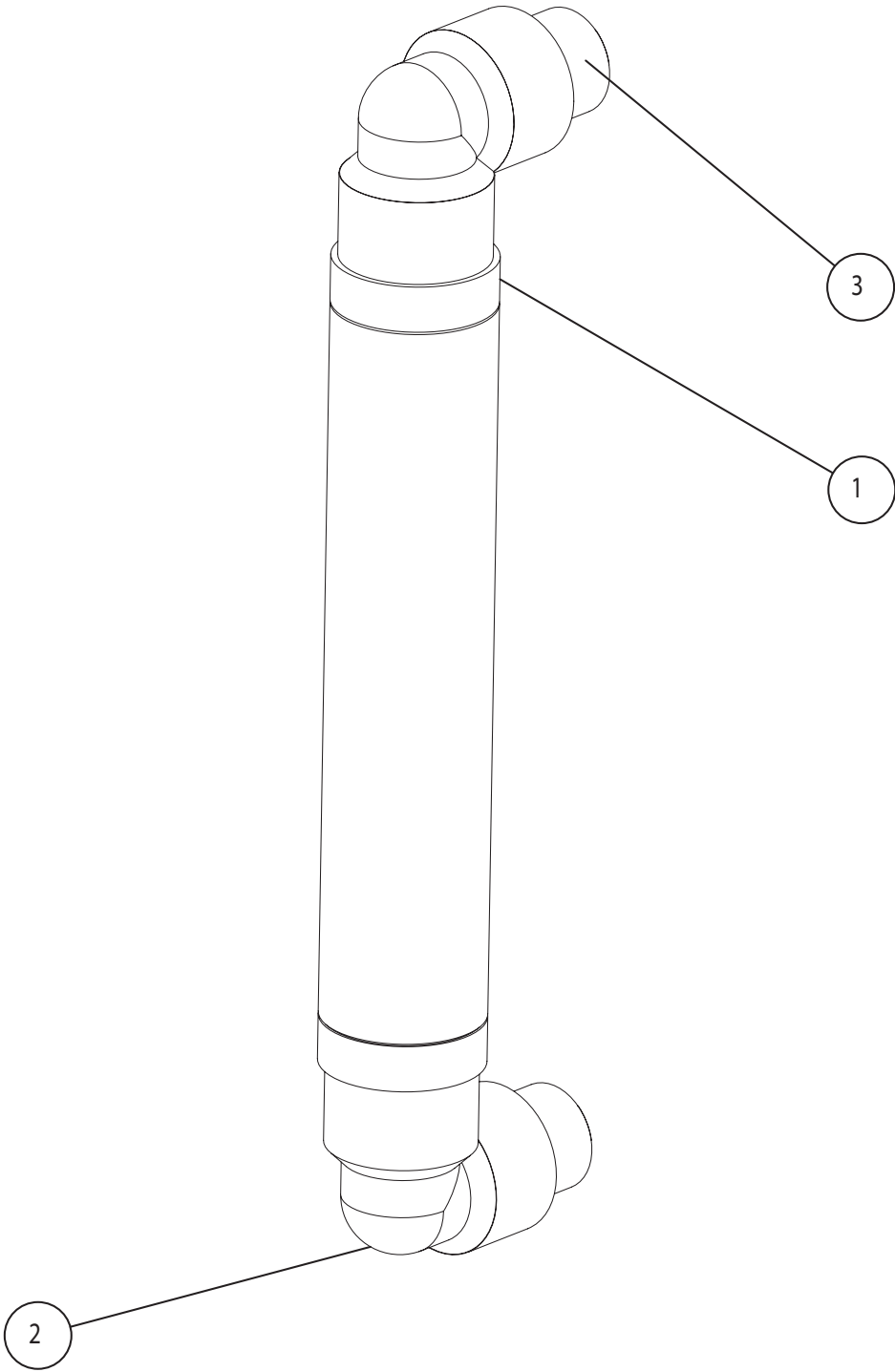
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	3
2	0101165983	ELB45 1.50 SL X 1.50 SL	3
3	0101695983	UNION 1.50 SL X 1.50 SL PVC	1
4	0301099200	PIPE PVC SCH 80 1.5 IN	A/R

BRINE DISCHARGE OUTLET
PART NUMBER: P488730001



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1		0101785983	FLANGE 1.50 FPT PVC	3
2		2635105900	GASKET FLANGE 1.5	2
3		0101055983	ELB90 1 1/2 SL X 1 1/2 SL PVC	1
4		0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	3
5	27	1401131942	3-WAY BALL VALVE 1.5 INCH	1
6		0301099200	PIPE PVC SCH 80 1.50 IN	3
7		0301099200	PIPE PVC SCH 80 1.50 IN	2
8		1401132342	CUPLINK FOR 1401132342 VALVE	1
9		0101054483	ELB90 1 SL X 1 SL PVC	4
10		0101325783	RB 1.50 SL X 1 SL PVC	1
11		0301099000	PIPE PVC SCH 80 1.0 IN	1
12		0301099000	PIPE PVC SCH 80 1.0 IN	1
13		0301099000	PIPE PVC SCH 80 1.0 IN	1
14	33	1401271942	VALVE CHECK TRU UNION 1.00 PVC	1
15		0101805983	FLANGE BLIND 1.5IN PVC	1
16		0101464483	TEE 1 SL X 1 SL X 1 SL PVC	1
17		0101314283	RB 1 SL x .50 FNPT PVC	1
18		0204092569	CONN 1/2 TUBE X 1/2 MNPT PLASTIC	1

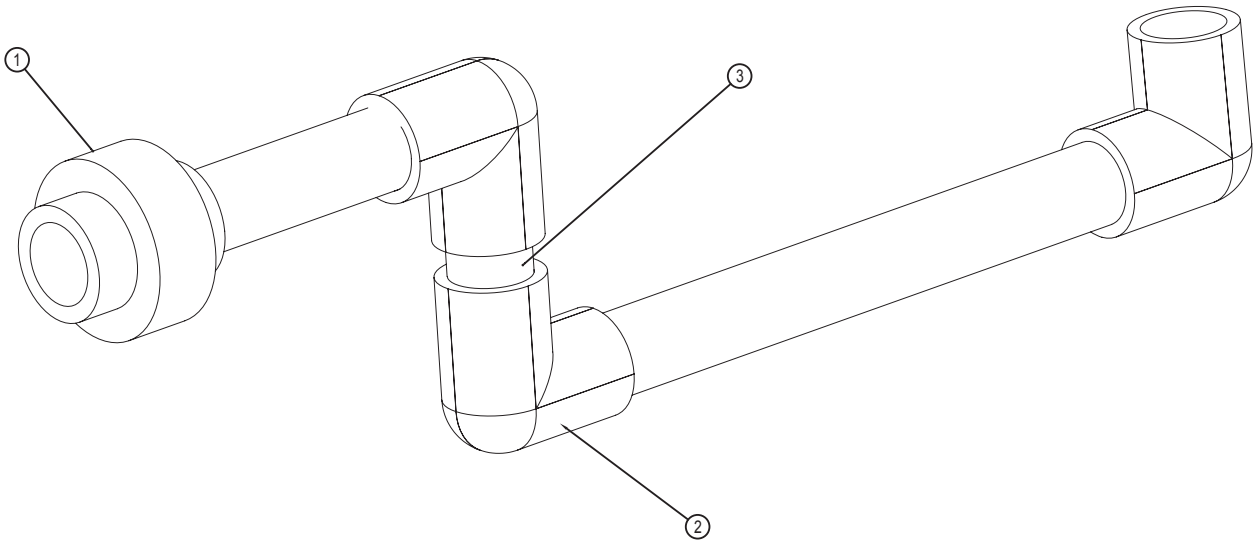
PRODUCT FLOW METER ASSEMBLY
PART NUMBER: P506730002



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1	28	1107646953	PRODUCT METER 15 GPM	1
2		0101014483	ELB90 1 FPT X 1 FPT PVC	2
3		01013744CL	NIPPLE 1 NPT X CLOSE PVC	2

F/M TO DIVERSION VALVE ASSEMBLY
PART NUMBER: P506730001

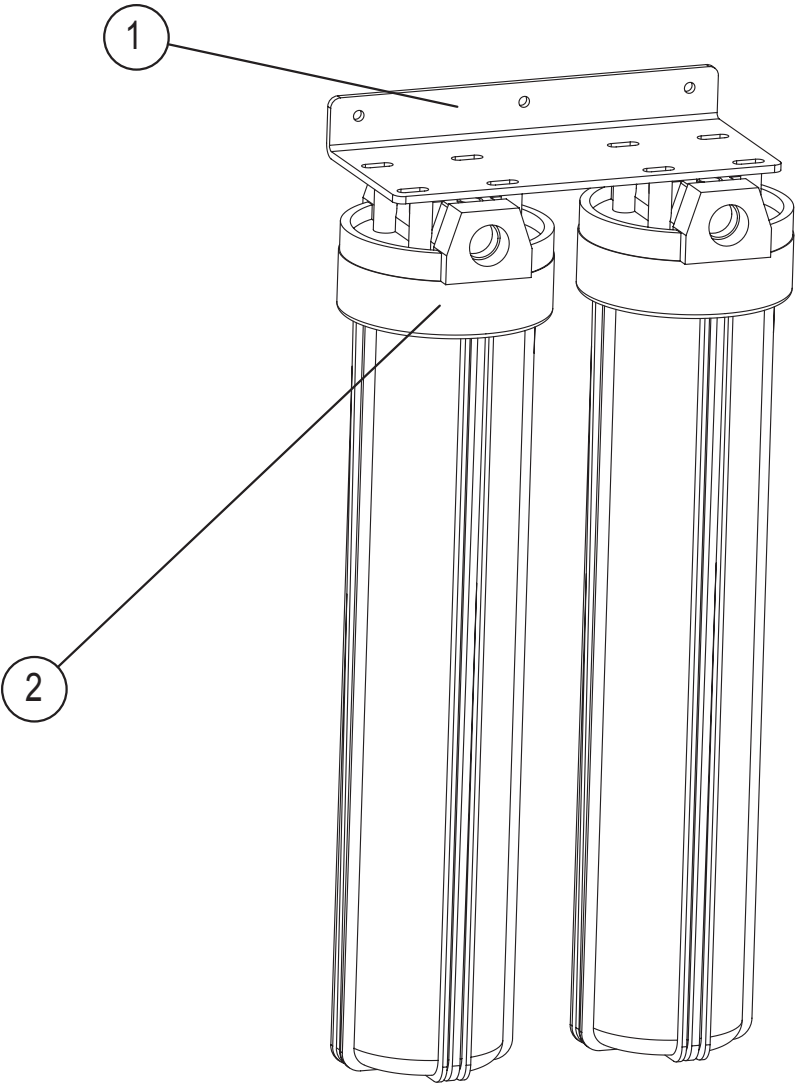
Parts View



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101684483	UNION 1 FPT X 1 SL PVC	1
2	0101054483	ELB90 1 SL X 1 SL PVC	3
3	0301099000	PIPE PVC SCH 80 1.0	1

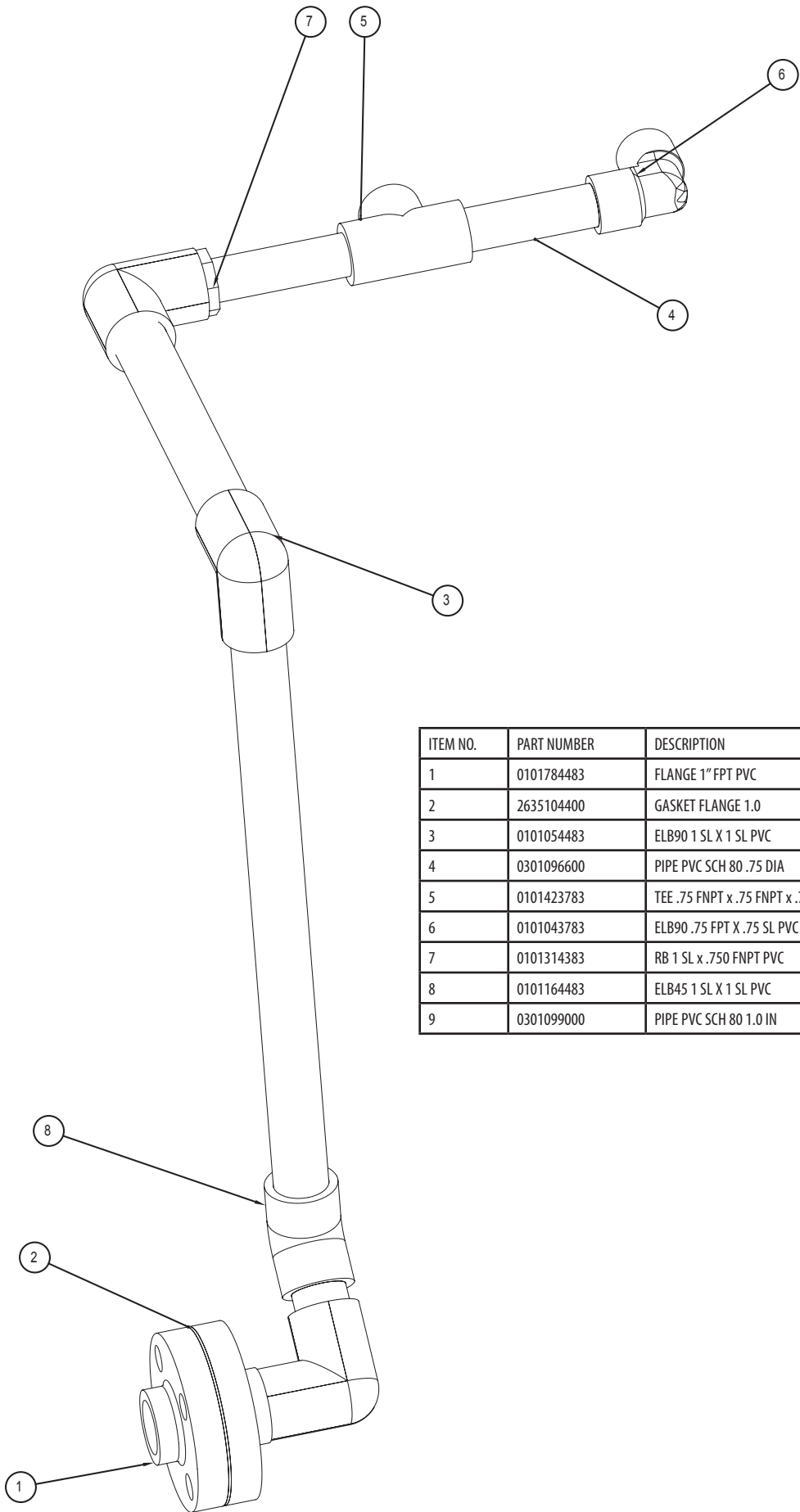
CHARCOAL FILTER ASSEMBLY

PART NUMBER: B521730001
P&ID POSITION NO.: 32



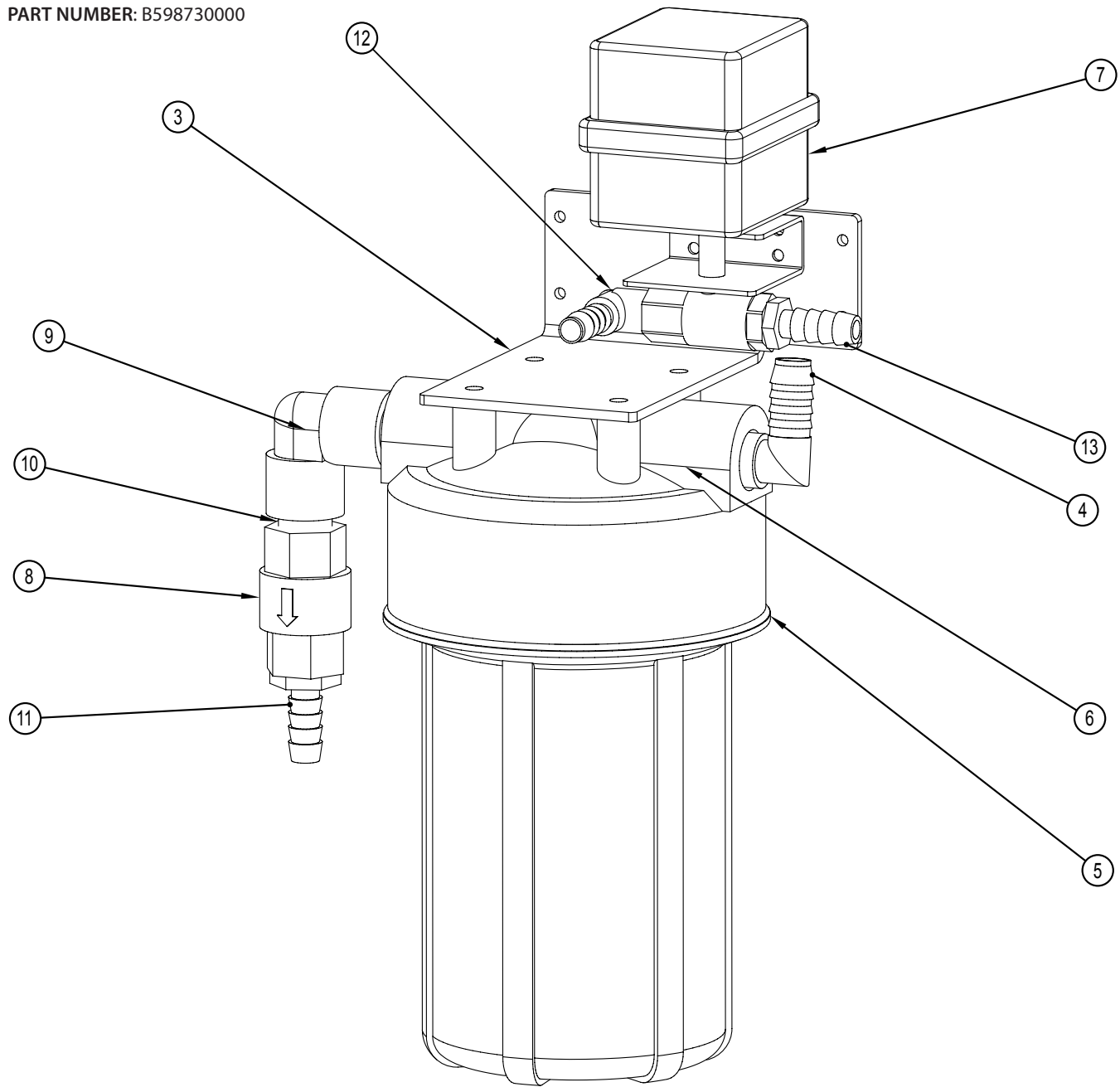
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	20200473017	BRACKET POST FILTER MOUNT	1
2	0713020273	FILTER HOUSING-LID O-RING .75 X 20.0	2

PRODUCT WATER OUTLET
PART NUMBER: P518730001



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	0101784483	FLANGE 1" FPT PVC	2
2	2635104400	GASKET FLANGE 1.0	1
3	0101054483	ELB90 1 SL X 1 SL PVC	3
4	0301096600	PIPE PVC SCH 80 .75 DIA	A/R
5	0101423783	TEE .75 FNPT x .75 FNPT x .75 FNPT PVC	1
6	0101043783	ELB90 .75 FPT X .75 SL PVC	1
7	0101314383	RB 1 SL x .750 FNPT PVC	1
8	0101164483	ELB45 1 SL X 1 SL PVC	1
9	0301099000	PIPE PVC SCH 80 1.0 IN	A/R

PART NUMBER: B598730000

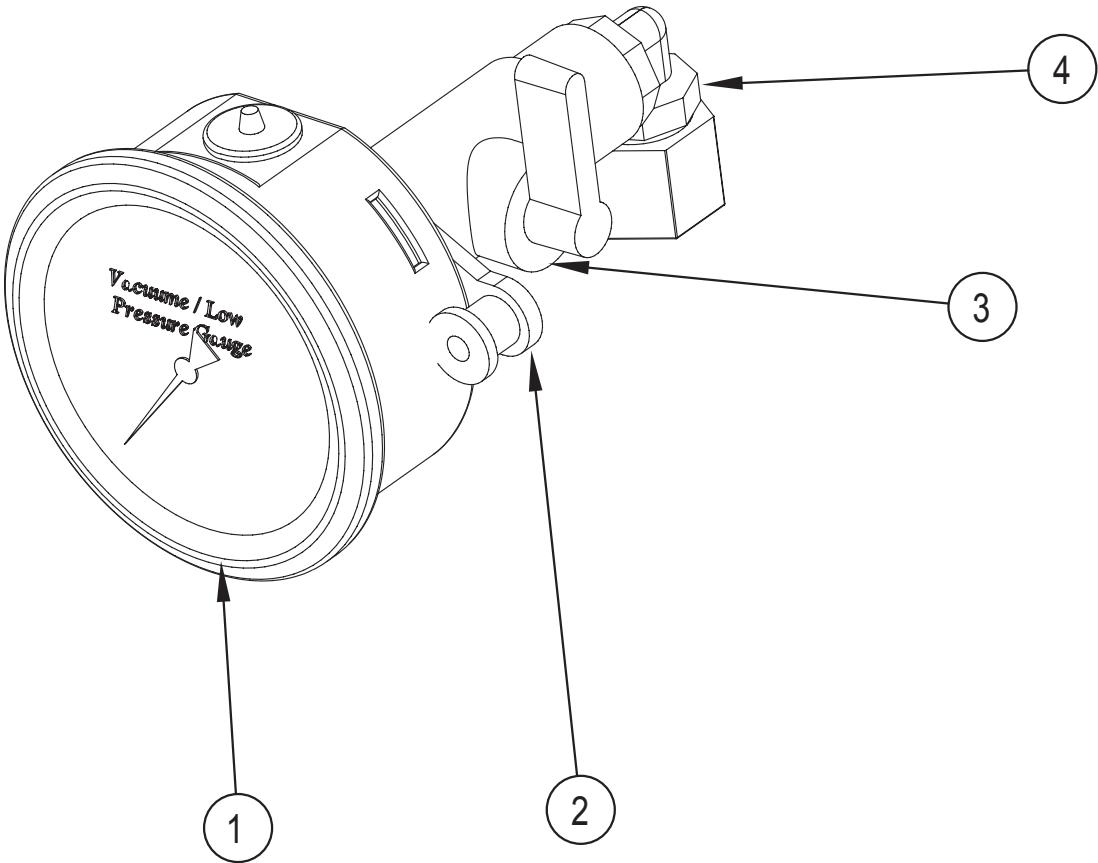


ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1		0803004906	ELEMENT CARBON BRIQUETTE 10.0	1
2		0713020606	FILTER O-RING	1
3		2020040003	BRACKET CARBON FILTER HSG FWF	1
4		0101073783	ELB90 .75 MNPT X .75 BARB PVC	1
5	34	0713020606	FILTER HOUSING BIG BLUE	1
6		0713020606	FILTER LID BIG BLUE	1
7	35	1417018296	FLOW VALVE	1
8		14012118AR	VALVE CHECK .75 FNPT WITH VITO	1
9		0101013783	ELB90 .75 FPT X .75 FPT PVC	1
10		01013737CL	NIPPLE .75 NPT X CLOSE PVC	2
11		0101653683	ADAP .75 MNPT X .50 BARB PVC	1
12		0101072583	ELB90 .50 MNPT X .50 BARB PVC	1
13		0101652583	ADAP .50 MNPT X .50 BARB PVC	1

LOW PRESSURE GAUGE ASSY

PART NUMBER: P011730002

P&ID POSITION NO.: 4, 9, 14, 16, 43

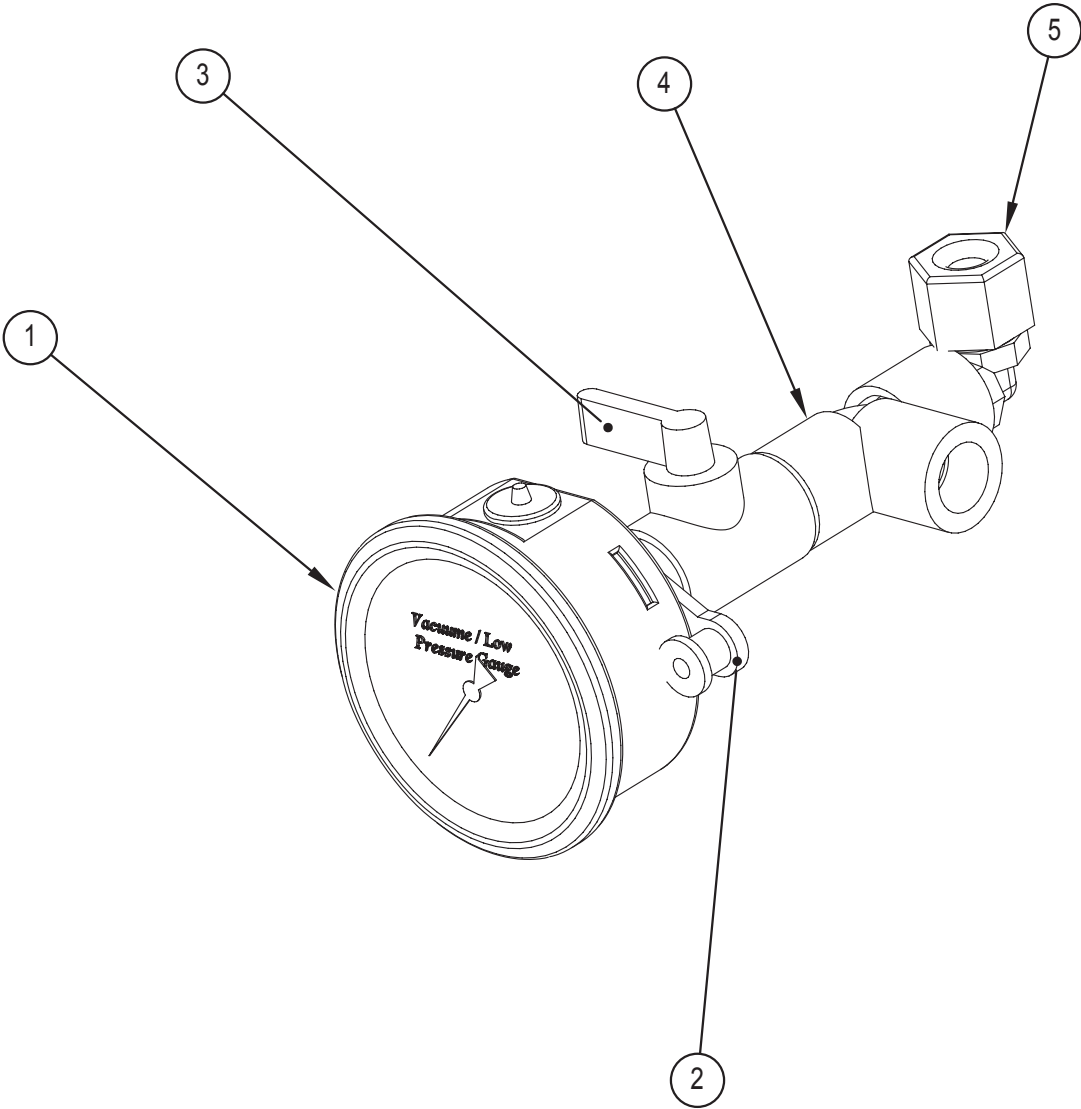


TEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	10181523CC	GAUGE 0-70 CBM.NPT	1
2	05180851CC -1	GAUGE BRACKET	1
3	14015506AR-01	VALVE BALL .25 IN FPT X	1
4	0204010869	ELB90 .25 TUBE x .25 FNPT PLASTIC	1

LOW PRESSURE GAUGE ASSEMBLY WITH SWITCH CONNECTION

PART NUMBER: P011730001

P&ID POSITION NO.: 18

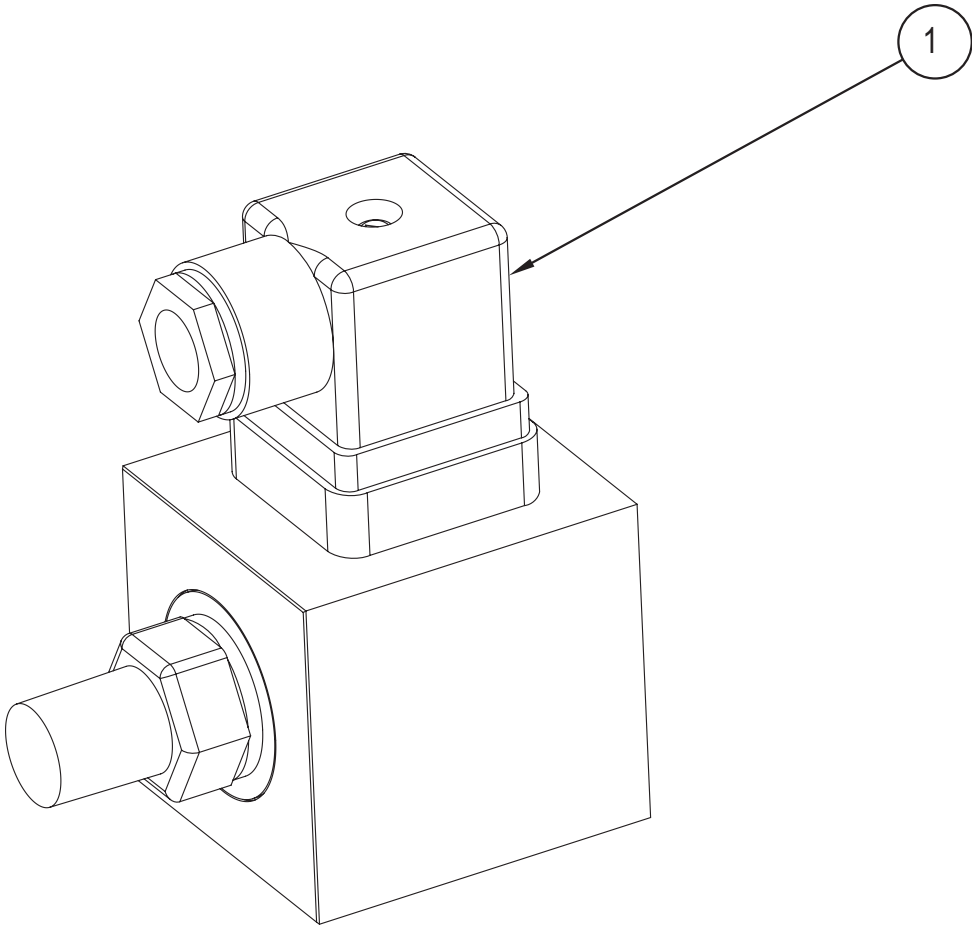


TEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	10181523CC	GAUGE 0-70 CBM.NPT	1
2	05180851CC-1	GAUGE BRACKET	1
3	14015506AR-01	VALVE BALL .25 IN FPT X	1
4	0117420869	TEE 1/4 FPT x 1/4 FPT x 1/4 FPT PVC	1
5	0204010869	ELB90 .25 TUBE x .25 FNPT PLASTIC	1

LOW PRESSURE SWITCH ASSEMBLY

PART NUMBER: P146630001-A

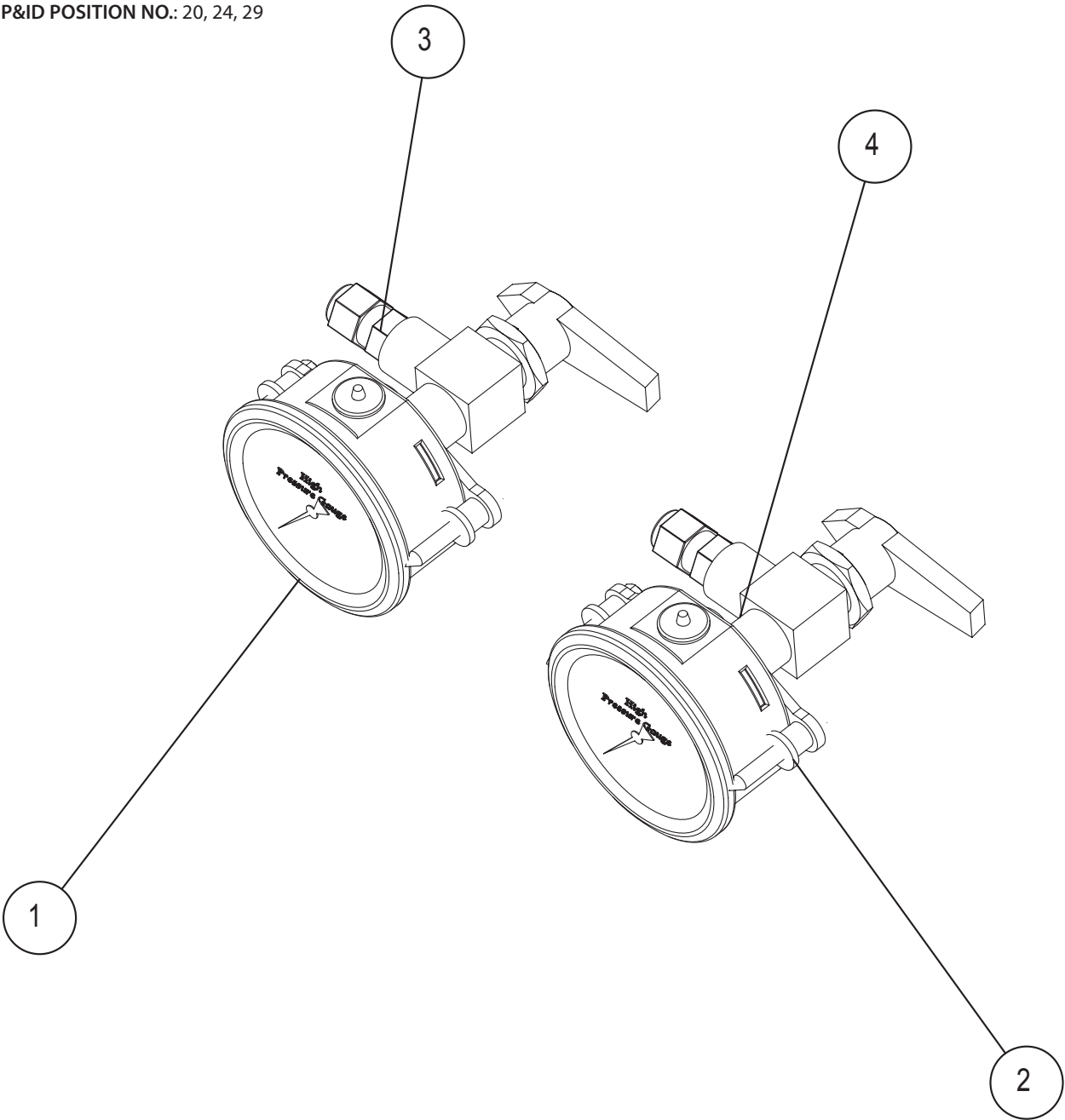
P&ID POSITION NO.: 17



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	2301020 758	SWITCH LOW PRES 6 PSI DIN CONN	1

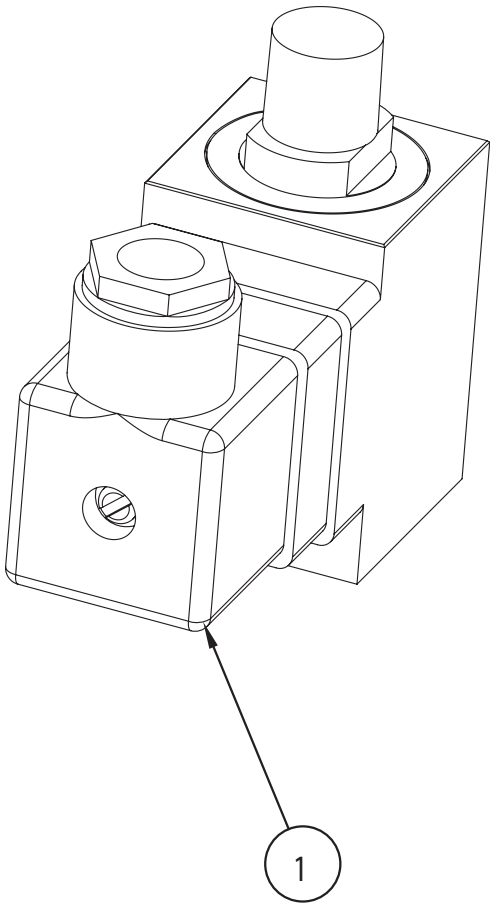
HIGH PRESSURE GAUGE

PART NUMBER: P171630001-A
P&ID POSITION NO.: 20, 24, 29



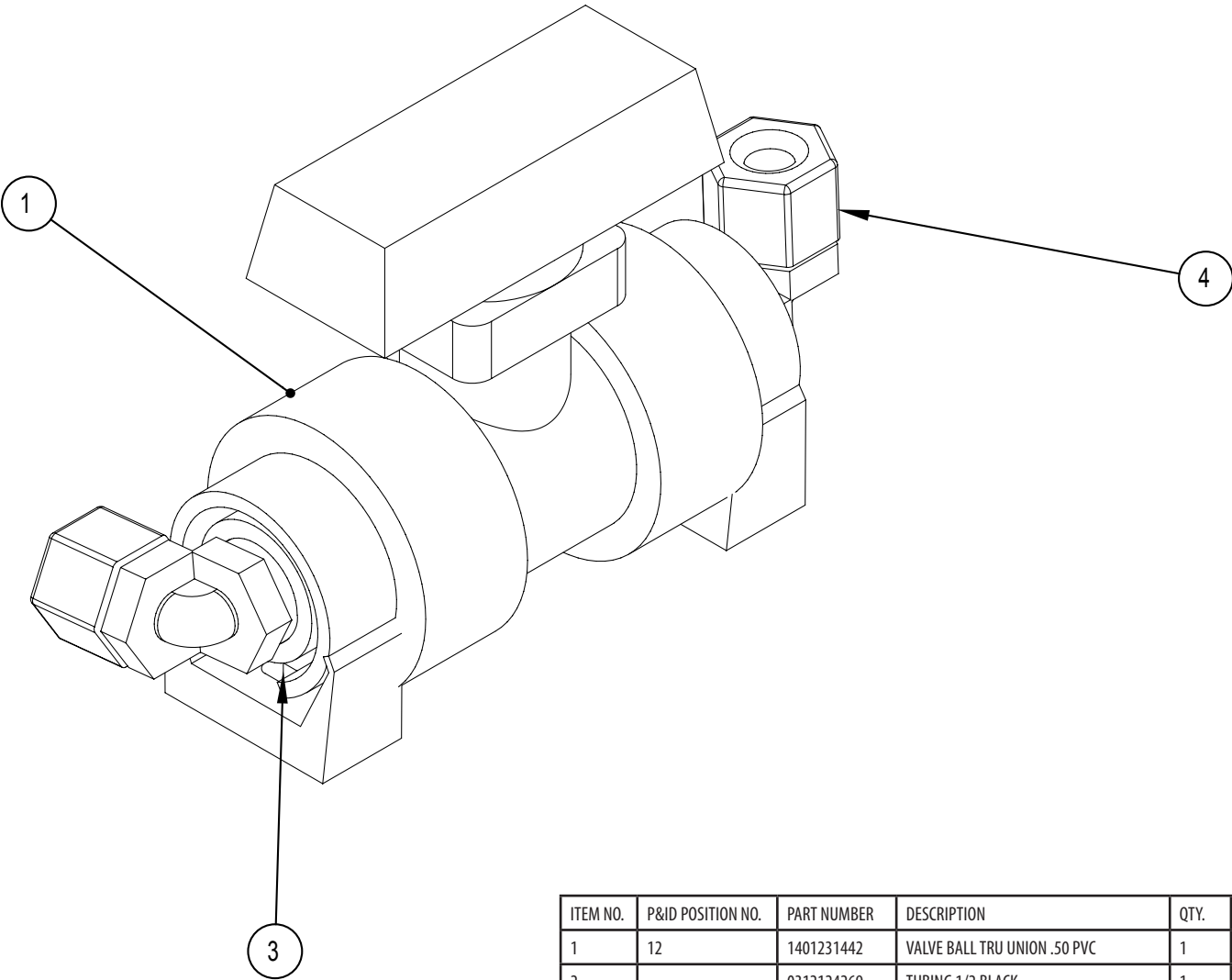
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	10181524CC	GAUGE 0-1400 CBM.NPT	2
2	05180851CC	GAUGE BRACKET CBM SS	2
3	0217090887	CONN .25 Tube x .250 MNPT SS	2
5	1417120196	VALVE BYPASS .250 SS AED	2

HIGH PRESSURE SWITCH
PART NUMBER: P176080001



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	2321020558	SWITCH HIGH PRES 900 PSI DIN C	1

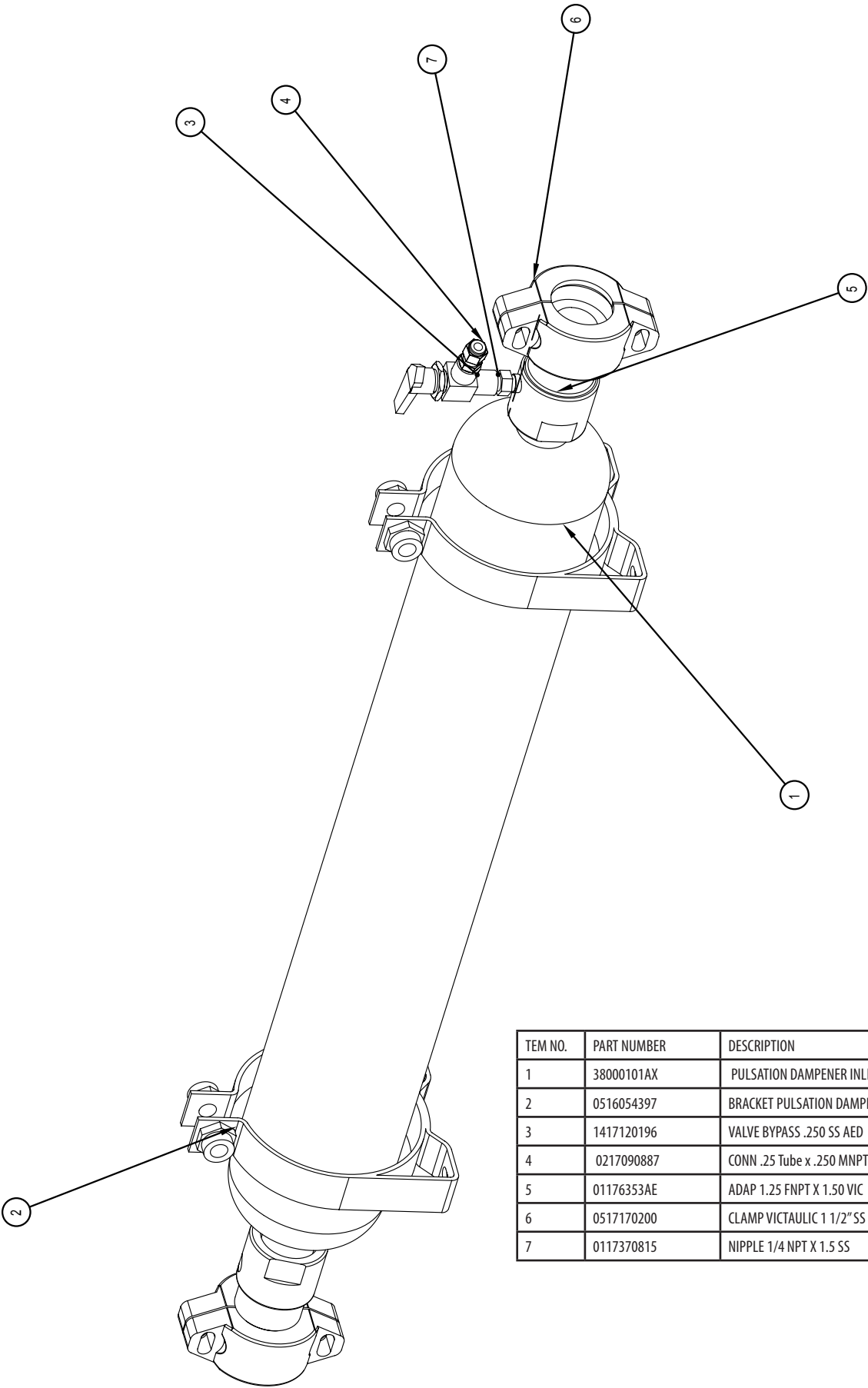
MMF DRAIN VALVE ASSY
PART NUMBER: P074730001



ITEM NO.	P&ID POSITION NO.	PART NUMBER	DESCRIPTION	QTY.
1	12	1401231442	VALVE BALL TRU UNION .50 PVC	1
2		0312124269	TUBING 1/2 BLACK	1
3		0501164400	PIPE SUPPORT 1"	2
4		0204021969	ELB90 3/8 TUBE X 1/2 MPT PLAST	2

PULSATION DAMPERNER INLINE
PART NUMBER: B159630001-A

Parts View

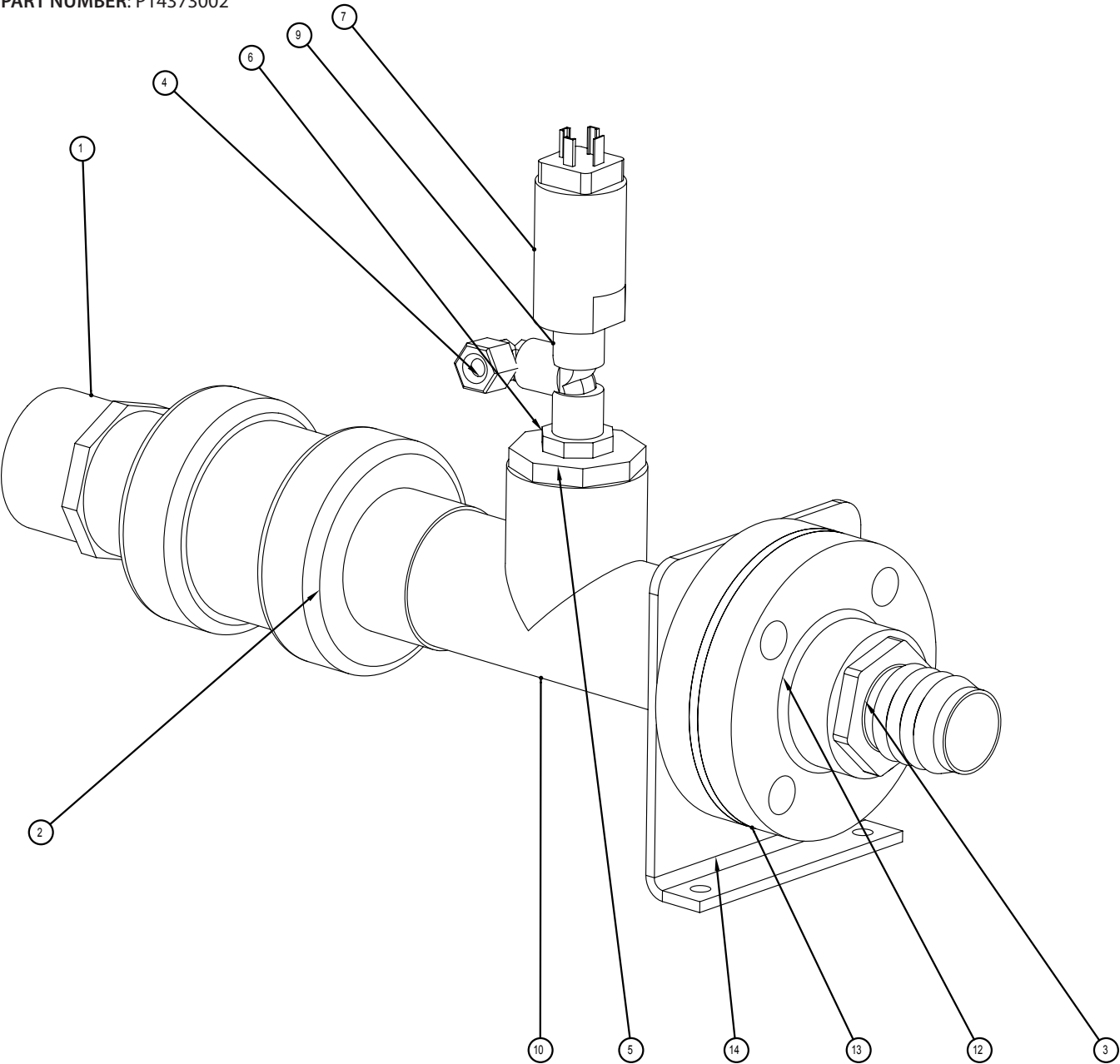


TEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	38000101AX	PULSATION DAMPENER INLINE 1.25	1
2	0516054397	BRACKET PULSATION DAMPENER	2
3	1417120196	VALVE BYPASS .250 SS AED	1
4	0217090887	CONN .25 Tube x .250 MNPT SS	1
5	01176353AE	ADAP 1.25 FNPT X 1.50 VIC	2
6	0517170200	CLAMP VICTAULIC 1 1/2" SS	2
7	0117370815	NIPPLE 1/4 NPT X 1.5 SS	1

CAT PUMP EXPLODED VIEWS

FEED WATER MANIFOLD FILTER - HPP

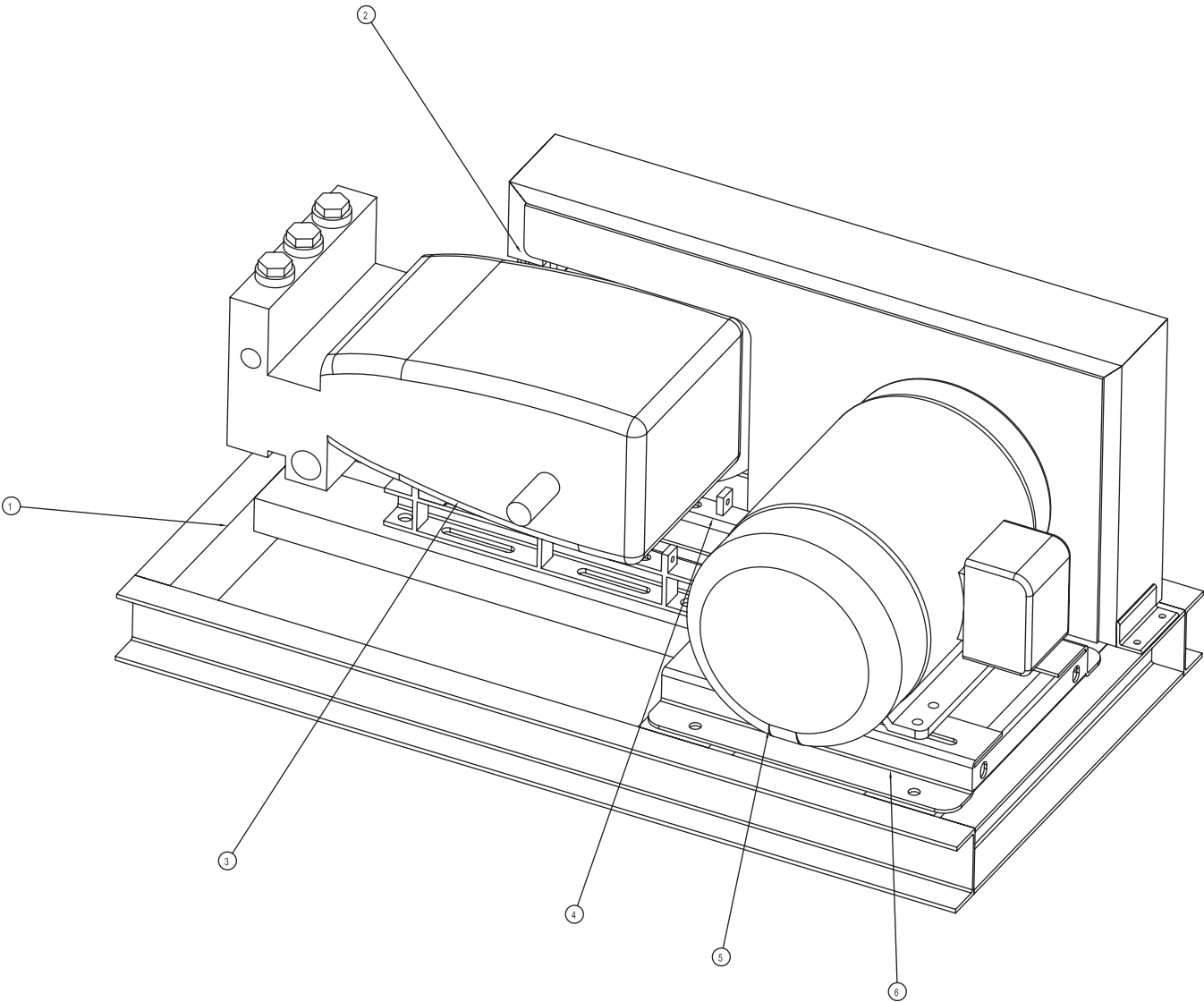
PART NUMBER: P14373002



Item No.	Part Number	Description	Qty
1	0101326583	RB 2 SL X 1.50 SL PVC	1
2	1401272442-01	TRU UNION CHECK VALVE 1.500 SL	1
3	0101655983	ADAP 1.50 MNPT X 1.50 BARB PVC	1
4	0204020869	Elb90 .25 TUBE X .25 MPT PLASTIC	1
5	0101315583	RB 1.50 SL X .50 FNPT	1
6	0101292383	RB 1/2 MT X 1/4 FT PVC	1
7	2317100600	TRANSDUCER 0-300 PSI SS	1
8	01013708CL	NIPPLE 1/4 NPT X CLOSE PVC	2
9	0101420883	TEE .25 FNPT x .25 FNPT X .25 FNPT PVC	1
10	0101465983	TEE 1.5 SL X 1.5 SL X 1.5 SL PVC	1
11	0301099200	PIPE PVC SCH 80 1.50 IN x 2.50LG	1
12	0101785983	FLANGE 1.50 FPT PVC	2
13	2635105900	GASKET FLANGE 1.5	1
14	20200479272	BRACKET 1.50 FLANGE (SINGLE)	1

PLUNGER PUMP MOTOR ASSY - TASMAN SEA
PART NUMBER: B156731001

Parts View



Item No.	Part Number	Description	Qty
1	2020037300	FRAME CAT PUMP/MOTOR MODULAR	1
2	2020017300	PULLEY GUARD TASMAN SEA MODULAR	1
3	1217172722	HP PUMP CAT 3531	1
4	1222172722-71	HP PUMP - 35 MOUNTING ASSY	2
5	1584075111	MOTOR 20HP 208-230-460-60 3PH	1
6	1816011112	MOTOR SLIDE PLATE B256T	1
7	1616741646	PULLEY HPP -35 50-60	1
8	1616690792-35MM	BUSHING HPP -35	1
9	1616790546-158	BUSHING MOTOR -35	1
10	1616740146	PULLEY MOTOR -35 60 HZ 20-30M3	1

CONSUMABLES

TASMAN SEA CONSUMABLES PARTS LISTING



Replacement filters

Whether for the pre-filtration stage or post treatment stage, the Sea Recovery R.O. Filter Elements are an essential part in proper system performance.



Membrane Element Storage Chemicals

These chemicals inhibit bacterial growth while maintaining the high flux and salt rejection of the R.O. Membrane Element.

Membrane Element Cleaning Compound #1 (SRC MCC-1) is an alkaline cleaner designed to clean biological fouling and slight oil fouling from the R.O. membrane element.

Membrane Element Cleaning Compound #2 (SRC MCC-2) is an acid cleaner designed to clean calcium carbonate and other mineral deposits from the R.O. membrane element.

Part No.	Description	Unit	1 Year Usage
0801141757	ELEMENT CPFE/AS 20 MIC PP	EA	36
0801061657	ELEMENT CPFE/AS 5 MIC PP	EA	36
0803004873	ELEMENT CHARCOAL 20"	EA	12
B655800006	SEAL KIT BOOSTER PUMP	EA	1
B646800001	MCC – CLEANING KIT MCC 1 & 2	EA	12
B645800003	STORAGE CHEMICAL	EA	12
B003730000	ELECTRONICS SPARE KIT LOW VOLTAGE	EA	1
B003730001	ELECTRONICS SPARE KIT HIGH VOLTAGE	EA	1
B665630001	O-RING KIT 15-60M3	EA	1
0803004906	ELEMENT CARBON BRIQUETE FWF	EA	4
B647800002	PUMP OIL	EA	4

CONVERSION CHARTS

NOTES: _____

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

MICRON / INCH / MESH

COMPARISON MEASUREMENTS

MICRON	INCH	INCH	MESH (opening)
1	.00003937	.0070	100
5	.00019685	.0075	90
10	.00039370	.0075	80
15	.00059055	.0078	70
20	.00078740	.0110	60
25	.00098425	.0130	50
30	.00118110	.0180	40
40	.00157480	.0260	30
50	.00196850	.0410	20
75	.00295275	.0850	10
100	.00393700	.1770	5
200	.00787400	.9370	1

TEMPERATURES CELSIUS vs FAHRENHEIT

CONVERSION CHART

F	C	F	C
0	-32	122	50
32	0	131	55
41	5	140	60
50	10	149	65
59	15	158	70
68	20	167	75
78	25	176	80
86	30	185	85
95	35	194	90
104	40	203	95
113	45	212	100

$$\text{CELSIUS} = 0.556 (F - 32)$$

$$\text{FAHRENHEIT} = (1.8 C) + 32$$

Sea Recovery TEMPERATURE EFFECT COMPARISON CHART

(At 820 psi & 35,000 ppm TDS NaCl feed water conditions)

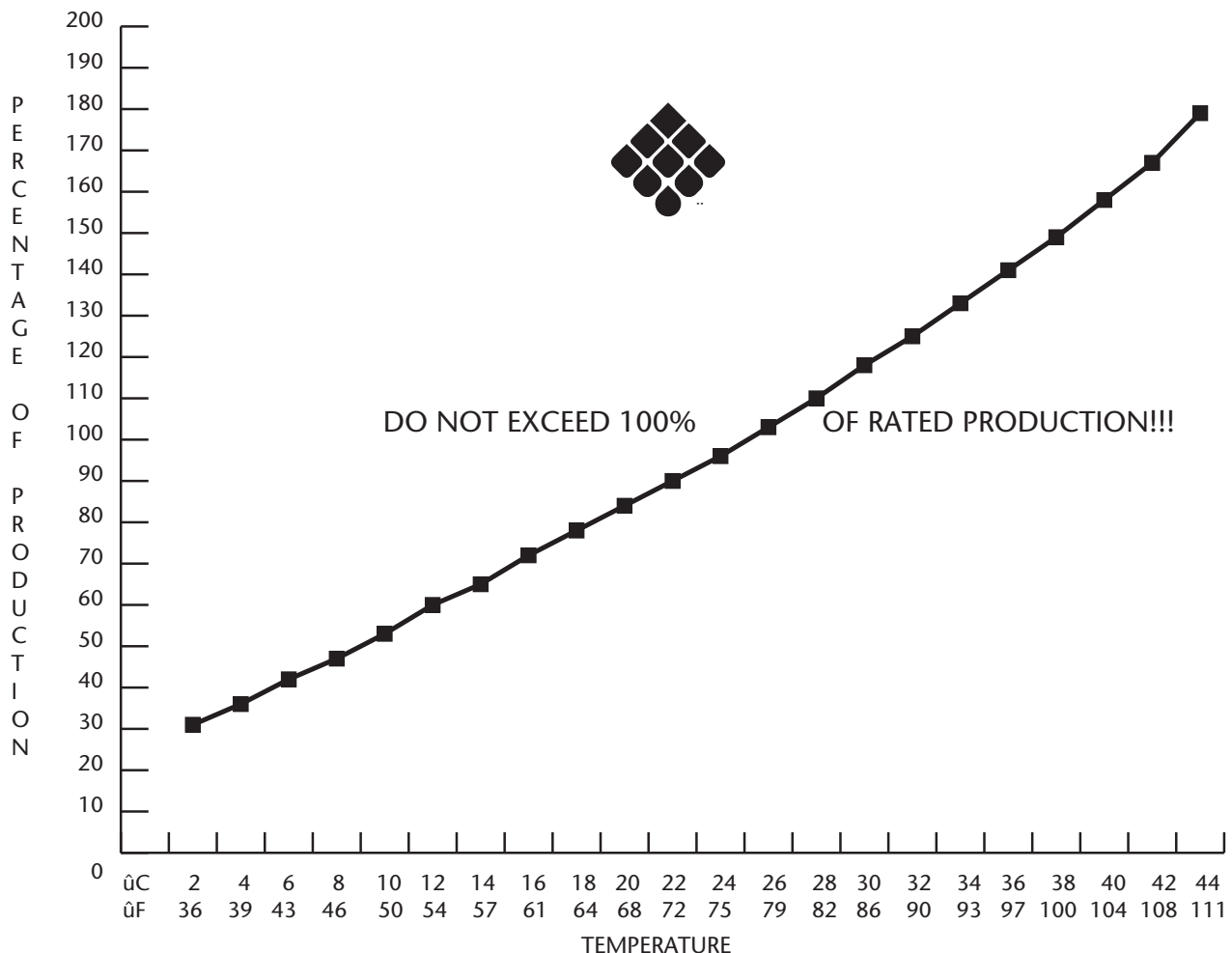
The Temperature Effect Chart on this page illustrates the loss or gain of productivity across the RO membrane.

To determine normal (in spec.) flow of the RO membrane at 77degrees F / 25degrees C follow these directions:

- 1) Determine feed source 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 & 77° F / 25° C.

Example:

- 1) With the system operating at 820 psi.
- 2) Present feed temperature is 61degrees F or 16degrees C.
- 3) Plotted productivity is therefore 72% of normal.
- 4) The system is a 900 gallon per day model and it is presently producing 630 gallons per day.
- 5) 630 gallons per day divided by .72 equals 875 gallons per day calculated productivity. The system is rated at 900 gallons per day $\pm 15\%$ (765 to 1035 gallons per day). Therefore, the system is within specifications at 630 gallons per day actual productivity at 61 degrees F/16 degrees C, 820 psi and 35,000 ppm feed.



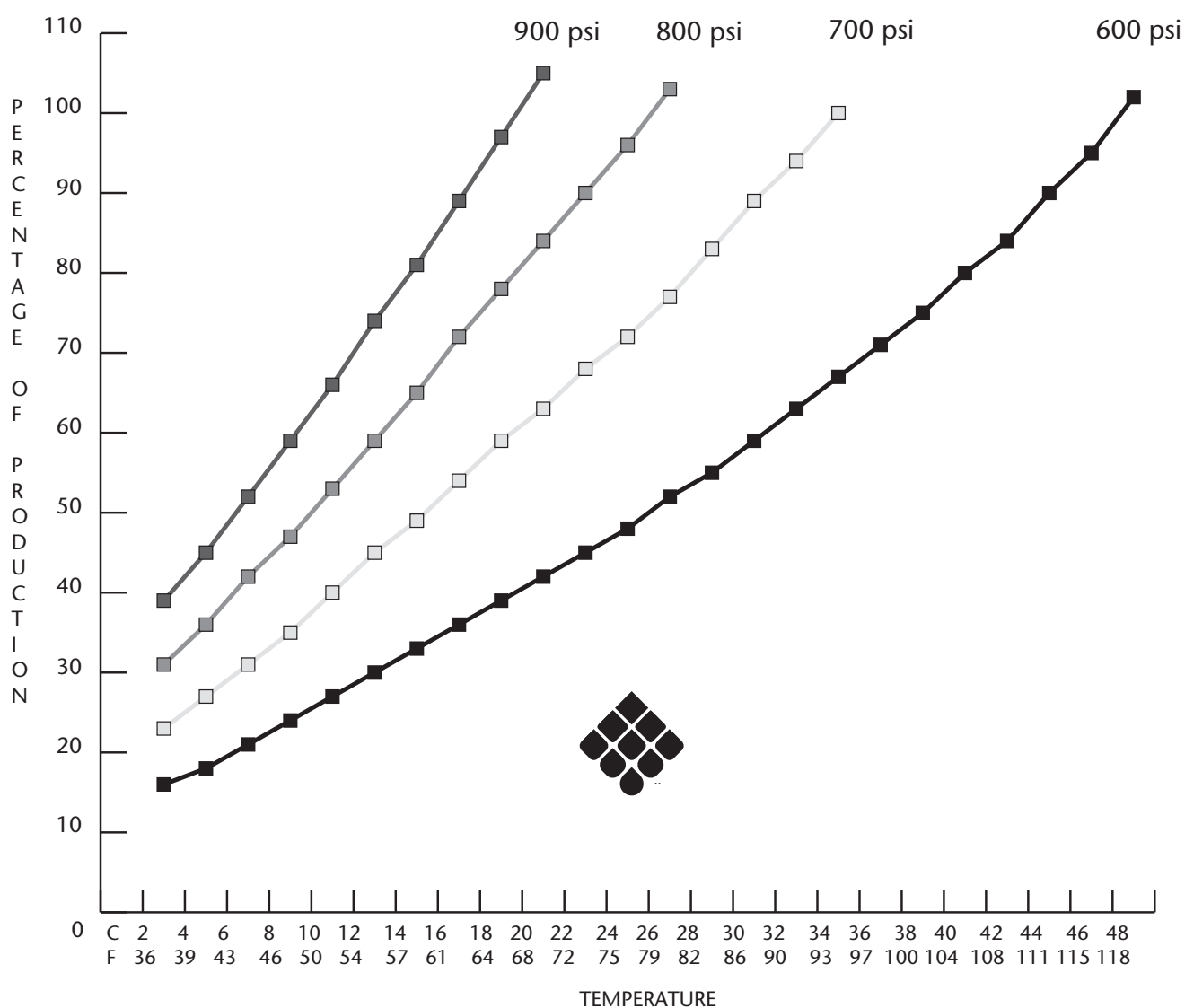
Sea Recovery

SEAWATER TEMPERATURE & PRESSURE EFFECTS CHART

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

As the seawater temperature increases, the Sea Recovery 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 product water flow will cause premature fouling of the SRC RO membrane element. This will lead to more frequently required cleaning and void all warranties of the SRC RO membrane element.

DO NOT EXCEED 100% OF RATED PRODUCTION!!!



WATER COMPARISON CHART

GALLONS / VOLUME / WEIGHT

U.S. GALLON	CUBIC FEET	CUBIC YARD	CUBIC METER	TON SHORT	TON METRIC
1	0.13	0.005	0.004	0.004	0.004
5	0.67	0.025	0.019	0.021	0.019
10	1.34	0.050	0.038	0.041	0.038
25	3.34	0.129	0.10	0.104	0.094
50	6.68	0.248	0.19	0.208	0.189
100	13.37	0.50	0.38	0.42	0.38
200	26.74	0.99	0.76	0.83	0.76
300	40.10	1.49	1.14	1.25	1.13
400	53.47	1.98	1.51	1.67	1.51
500	66.84	2.48	1.89	2.08	1.89
600	80.21	2.97	2.27	2.50	2.27
700	93.58	3.47	2.65	2.92	2.65
800	106.94	3.96	3.03	3.33	3.02
900	120.31	4.46	3.41	3.75	3.40
1,000	133.68	4.95	3.79	4.17	3.78
2,500	334.20	12.38	9.46	10.41	9.45
5,000	668.40	24.76	18.93	20.83	18.89
7,500	1002.60	37.13	28.39	31.24	28.34
10,000	1336.81	49.51	37.85	41.65	37.79
25,000	3342.00	123.80	94.60	104.10	94.50
50,000	6684.00	247.60	189.30	208.30	188.90
75,000	1006.00	371.30	283.90	312.40	283.40
100,000	13368.06	495.11	378.54	416.50	377.85

1 U.S. GALLON	=	231. CU. INCH
1 U.S. GALLON OF WATER	=	8.33 LBS.
1 SHORT TON	=	2000 LBS.
1 METRIC TON	=	2204.6 LBS.
1 CU. INCH OF WATER	=	0.0360 LBS.
1 CU. FOOT OF WATER	=	62.4 LBS.
1 IMPERIAL GALLON OF WATER	=	10.0 LBS.
1 GALLON	=	3.7854 LITERS
1 CUBIC METER	=	1000 LITERS
1 CUBIC METER	=	264 GALLONS

PPM CONVERSION CHART

SPECIFIC CONDUCTANCE IN MICROMHOS	SPECIFIC RESISTANCE IN OHMS	DISSOLVED SOLIDS P.P.M.	RESISTANCE*		P.P.M.
			MHOS	OHMS	
.0385	26,000,000	NONE	250.0	4,000	125
.0556	18,000,000	.02777	256.4	3,900	128
.0625	16,000,000	.03125	263.2	3,800	132
.0714	14,000,000	.03571	270.3	3,700	135
.0833	12,000,000	.04166	277.8	3,600	139
.1	10,000,000	.05	285.7	3,500	143
.125	8,000,000	.0625	294.1	3,400	147
.167	6,000,000	.08333	303.0	3,300	152
.2	5,000,000	.1	312.0	3,200	156
.25	4,000,000	.125	322.5	3,100	161
.5	2,000,000	.25	333.3	3,000	166
1	1,000,000	.5	344.8	2,900	172
2	500,000	1	357.0	2,800	179
4	250,000	2	370.4	2,700	185
6	166,666	3	384.6	2,600	192
8	125,000	4	400.0	2,500	200
10	100,000	5	416.6	2,400	208
12	83,333	6	434.8	2,300	217
14	71,428	7	454.5	2,200	227
16	62,500	8	476.2	2,100	238
18	55,555	9	500.0	2,000	250
20	50,000	10	526.3	1,900	263
22	45,454	11	555.5	1,800	278
24	41,666	12	588.2	1,700	294
26	38,461	13	625.0	1,600	312
28	35,714	14	666.6	1,500	333
30	33,333	15	714.2	1,400	357
40	25,000	20	769.2	1,300	384
50	20,000	25	833.3	1,200	416
60	16,666	30	909.0	1,000	500
70	14,286	35	1,000	1,000	500
80	12,500	40	1,111	900	555
100	10,000	50	1,250	800	625
120	8,333	60	1,428	700	714
140	7,142	70	1,666	600	833
160	6,250	80	2,000	500	1,000
180	5,555	90	2,500	400	1,250
200	5,000	100	3,333	300	1,667
			5,000	200	2,500
			10,000	100	5,000

*Approximate dissolved solids expressed as Calcium Carbonate (CaCO₃)

PRESSURE COMPARISON

psi	Kg/cm ²	"Hg Vacuum	bar	kPa	atmosphere
1	0.0704	2.036	0.0689	6.895	0.0681
14.22	1	28.96	0.981	98.07	0.968
0.4912	0.0345	1	0.0339	3.386	0.03342
14.504	1.02	29.53	1	100	0.987
0.14504	0.0102	0.295	0.01	1	0.00987
14.7	1.033	29.92	1.013	101.3	1

METRIC / U.S. CUSTOMARY UNIT EQUIVALENTS

multiply:		by:		to get or multiply:		by:		to get:
LINEAR								
inch	x	25.4	=	millimeters(mm)	x	0.03937	=	inch
feet	x	0.3048	=	meters(m)	x	3.281	=	feet
yard	x	0.9144	=	meters(m)	x	1.0936	=	yard
mile	x	1.6093	=	kilometers(km)	x	0.6214	=	mile
inch	x	2.54	=	centimeters(cm)	x	0.3937	=	inch
VOLUME								
fluid oz	x	29.57	=	milliliters (ml)	x	0.03381	=	fluid oz
U.S. quart	x	0.94635	=	liters(l)	x	1.0567	=	quarts
U.S. gallon	x	3.7854	=	liters(l)	x	0.2642	=	gallons
feet ³	x	28.317	=	liters	x	0.03531	=	feet ³
feet ³	x	0.02832	=	meters ³	x	35.315	=	feet ³
yard ³	x	0.7646	=	meters ³	x	1.3080	=	yard ³
MASS								
ounces	x	28.35	=	grams(g)	x	0.03527	=	ounces
pounds	x	0.4536	=	kilograms (kg)	x	2.2046	=	pounds
tons (2000lb)	x	907.18	=	kilograms (kg)	x	0.001102	=	tons
tons (2000lb)	x	0.90718	=	metric tons(t)	x	1.1023	=	tons

WIRE SIZE CROSS REFERENCE CHART:

American Wire Gauge			Metric Wire Gauge		Metric Wire
AWG	dia inch	sq. inch	dia mm	sq mm	Size mm ²
0000	0.4600	0.1661	11.6840	107.1649	100
000	0.4096	0.1317	10.4038	84.9683	85
00	0.3648	0.1045	9.2659	67.3980	65
0	0.3249	0.0829	8.2525	53.4609	50
1	0.2893	0.0657	7.3482	42.3871	40
2	0.2576	0.0521	6.5430	33.6069	32
3	0.2294	0.0413	5.8268	26.6516	32
4	0.2043	0.0328	5.1892	21.1385	19
6	0.1620	0.0206	4.1148	13.2913	13
8	0.1285	0.0130	3.2639	8.3626	8
10	0.1019	0.0082	2.5883	5.2588	5
12	0.0808	0.0051	2.0523	3.3064	3
14	0.0641	0.0032	1.6281	2.0809	2
16	0.0508	0.0020	1.2903	1.3070	1
18	0.0403	0.0013	1.0236	0.8225	.8
20	0.0320	0.0008	0.8128	0.5186	.5
22	0.0254	0.0005	0.6452	0.3267	.35

NOTES: _____

[illegible]