GVA-4000
Operation and Maintenance Manual

Table of Contents

1 Introduction

The purpose of this document is to offer instructions on how to operate and maintain the GVA-4000 Desalination system. Additionally, a parts list along with a vendor list will be provided.

2 Water Connections

2.1 Fresh Water Input Connection

The Fresh Water source will be connected to the Blue Ball Valve. The fresh water is used to flush the desalination system during Start-Up and Shut-Down.

2.1.1.1 Fresh Water Connection Photo

2.2 Brackish Water Input Connection

The Brackish Water source will be connected to the Red Ball Valve. The brackish water will be the source for the desalination system and will be used after the Start-Up Flush operation.

2.2.1.1 Brackish Water Connection Photo

2.3 Permeate Water Output Connection

The Permeate Water, fresh water, output is hose on the upper left side of the GVA-4000 next to the Blue PREMEATE OUTPUT label. This will be the source of the potable water to be distributed or stored for later use.

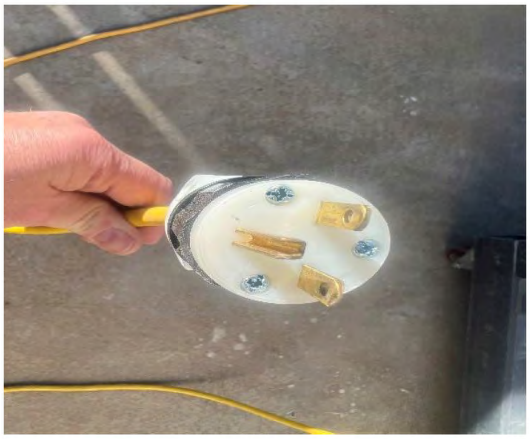
2.4 Concentrate Water Output Connection

The Concentrate Water, reject water, output is hose on the upper right side of the GVA-4000 next to the White CONCENTRATE OUTPUT label. This will be the reject water that will need to be discharged back to the ocean.

2.4.1.1 Permeate and Concentrate Output Connection Photo

3 Electric Connection

The GVA-4000 will need to be connected to 220-240 VAC, 60Hz, 20 Amp power source using the power connector on the attached power cable.



3.1.1.1 GVA-4000 Power Connector Photo

4 GVA-4000 Start-Up Operation

This section will describe how to start-up the GVA-4000 desalination system after the inlet, outlet and electrical connections have been made.

4.1.1.1 GVA-4000 Inlet and Outlet Water Connected

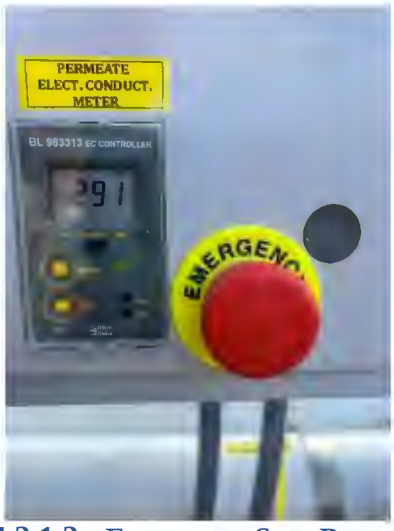
4.1.1.2 GVA-4000 Electrical Connected

4.2 Safety First

Insure that everyone that will be near the GVA-4000 are wearing safety glasses properly. The GVA-4000 will generate high pressure water and could be dangerous should a high pressure hose were to accidentally rupture.

4.2.1.1 Wear Safety Glasses

Should there be a water leak or other safety issue the GVA-4000 has an Emergency Stop button that will immediately turn of all electrical motors and components. Simply push in on the Emergency Button to stop all motors. Be sure to turn off the High Pressure Pump switch and the Booster Pump switch before resetting the Emergency Button switch by twisting the button in a clockwise manner.



4.2.1.2 Emergency Stop Button

4.3 Step 1: Select Fresh Water Inlet

Turn the Fresh Water Inlet Valve on and turn the Sea Water Inlet valve off shown in the photo below. This is done so that the desalination system will be flushed with fresh water during the initial start-up phase.

4.3.1.1 Fresh Water Inlet Valve On Photo

4.4 Step 2: Start Booster Pump

Turn on the Booster Pump which is the Black switch clockwise on the far left of the control panel.
The Green LED will light and the Red LED will light if the Pre-Filter Inlet Pressure is below 20 PSI. Monitor the Pre-Filter Inlet Pressure gauge which the furthest gauge to the right. That gauge should register approximately 40 PSI. If the gauge does register approximately 40 PSI and the RED LED is not light, proceed to Step 4, otherwise proceed to Step 3.

4.4.1.1 Pre-Filter Inlet Pressure Gauge Low Reading

4.4.1.2 Pre-Filter Inlet Pressure Gauge Operational Reading

4.5 Step 3: Purge Inlet Water

If the Pre-Filter Inlet Pressure is not approximately 40 PSI, it will be necessary to purge the air from the Booster Pump. While the Booster Pump is running, slightly open the Purge Valve and allow water to discharge for 30 second and close the Purge Valve then re-check to see if the Pre-Filter Inlet Pressure is around 40 PSI. You may need to repeat this process several times. Once the Pre-Filter Inlet Pressure is around 40 PSI, the RED LED will no longer be light.

4.5.1.1 Inlet Water Purge Valve

4.6 Step 4: Start High Pressure Pump

Before, starting the High Pressure Pump, the Inlet Vessel Pressure Control Valve is **not completely** closed which would be turned completely clockwise. It is best to have the Inlet Vessel Pressure Control Valve to be half open.

4.6.1.1 Inlet Vessel Pressure Control Valve

To start the High Pressure Pump, turn the Red Switch clockwise. The Inlet Vessel and the Concentrate Vessel Pressure Gauges should show around 300 PSI depending the position of Inlet Vessel Pressure Control Valve. If not adjust the Inlet Vessel Pressure Control Valve so the pressures are around 300 PSI but turning the valve clockwise to increase the pressures and counter-clockwise to reduce the pressures. You will note that the Pre-Filter and Post-Filter Pressure will be around 20 PSI. This is normal as long as the Post-Filter pressure remains above 15 PSI. Proceed to Step 5.

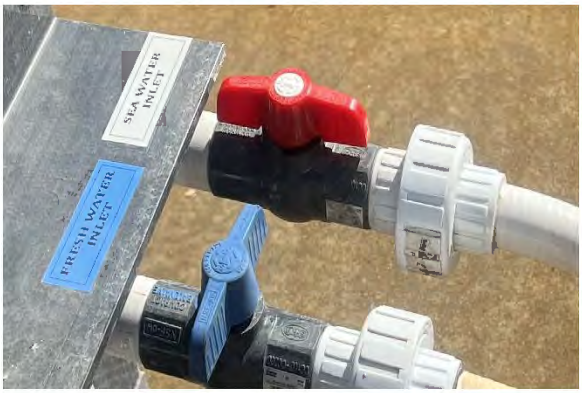
4.6.1.2 High Pressure Pump Concentrate Pressure Reading

4.7 Step 5: Switch Inlet from Fresh Water to Seawater Water

To switch to the Brackish Water source, turn on the Red Brackish Inlet valve so that both the Fresh Water Inlet Valve and the Seawater Water Valve are both on.

4.7.1.1 Fresh Water and Seawater Valves On

Wait about a minute then turn off the Fresh Water Valve. Proceed to Step 6.



4.7.1.2 Seawater Water Valve On and Fresh Water Valve Off

4.8 Step 6: Adjust Concentrate Discharge Pressure and Flow Rate

Adjust the Inlet Vessel Pressure Control Valve to increase the pressure on the Inlet Vessel Pressure Gauge to around 400-500 PSI for Brackish water which should give a Permeate Flow rate of around 2 Gallons per Minute (GPM). **Do not exceed** an Inlet Vessel or Concentrate Vessel Pressure of **550 PSI.**

4.8.1.1 Normal System Configuration for Brackish Water.

The GVA-4000 is now in the normal operation and will just need to be monitor occasionally during daily operation to insure the pressures and flow rates remain in the normal range. The normal Permeate Elect. Conduct operation range is usually between 1000 and 600 uS but can be as high as 2500 uS and still meet WHO drinking water standards.

4.8.1.2 Normal Permeate EC Operation Range

5 GVA-4000 Shut-Down Operation

This section will describe how to shut down the GVA-4000 desalination system after the system has been operating in normal run condition.

5.1 Step 1: Switch Inlet from Seawater Water to Fresh Water

To switch to the Fresh Water source, turn on the Blue Fresh Water Inlet valve so that both the Fresh Water Inlet Valve and the Seawater Water Valve are both on.

5.1.1.1 Fresh Water and Seawater Valves On

Wait about a minute then turn off the Seawater Water Valve. Proceed to Step 2.

5.1.1.2 Fresh Water Valve On and Sea Water Valve Off

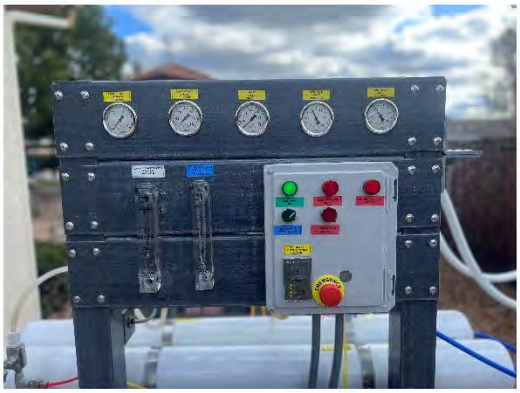
5.2 Step 2: Flush System with Fresh Water

Allow the system to continue to run connected to the fresh water. You will notice that the Concentrate Vessel Pressure and the Inlet Vessel Pressure will begin to decline. Continue to run the system till the two above mentioned pressure gauges reach around 300 PSI.

5.2.1.1 Flush Complete Gauge Readings

5.3 Step 3: Turn Off the High Pressure Pump

Turn off the High Pressure Pump by turning the Red High Pressure Pump Power Switch counter-clockwise to Off position.



5.3.1.1 High Pressure Pump Power Switch Off

5.4 Step 4: Turn Off the Booster Pump

Turn off the Booster Pump by turning the Black Booster Pump Power Switch counter-clockwise to Off position.

5.4.1.1 Booster Pump Power Switch Off

5.5 Step 5: Fresh Water Valve Off

Turn off the Fresh Water Valve. Both the Seawater and Fresh water valve should be off.

5.5.1.1 Fresh water and Sea water Inlet Valves Off

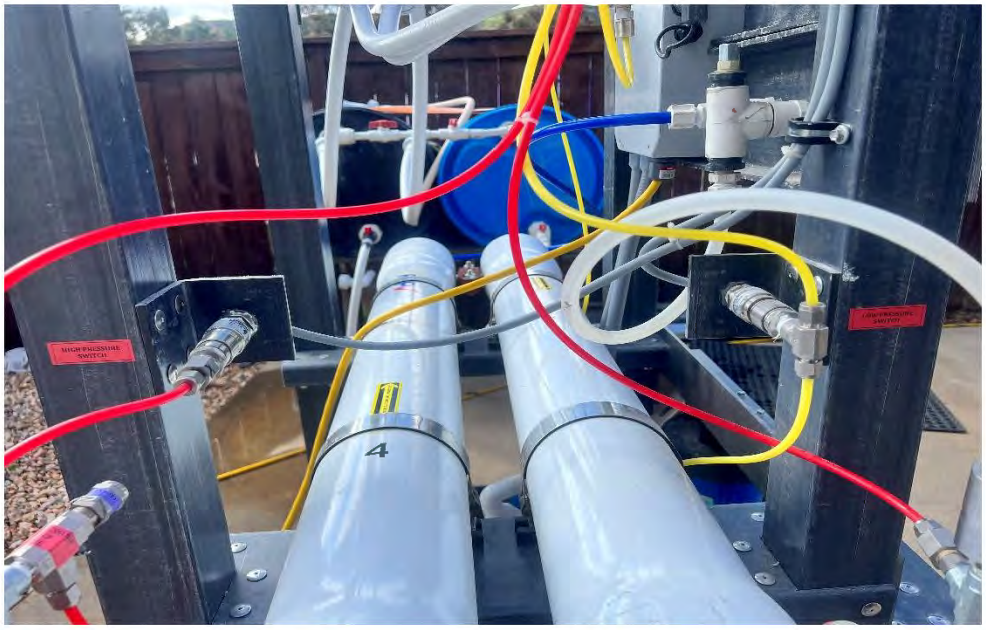
5.6 Adjust Concentrate Discharge Pressure Control Valve

Turn the Inlet Vessel Pressure Control Valve counter-clockwise a half a turn so that the Inlet Vessel Pressure is reduced for system start-up.

5.6.1.1 Inlet Vessel Pressure Control Valve

6 GVA-4000 Safety Features

The GVA-4000 has several electronic and mechanical safety feature that used to insure safe operation and provide a fail-safe shutdown should a non-safe operation is detected. The location for the high and low pressure safety devises are shown



6.1.1.1 GVA -4000 High and Low Pressure Device Location

6.2 GVA-4000 Inlet Low Pressure Sensor

This sensor detect the inlet pressure to the High Pressure Pump is at least 20 PSI. It is not 20 PSI or falls below 20 PSI power is removed from the High Pressure Pump for at least 1 minute.

6.2.1.1 High Pressure Pump Inlet Low Pressure Sensor

6.3 GVA-4000 High Pressure Sensor

This sensor detects the inlet to the membranes pressure from the High Pressure Pump is less than 600 PSI. It is 600 PSI or rises above 600 PSI power is removed from the High Pressure Pump for at least 1 minute.

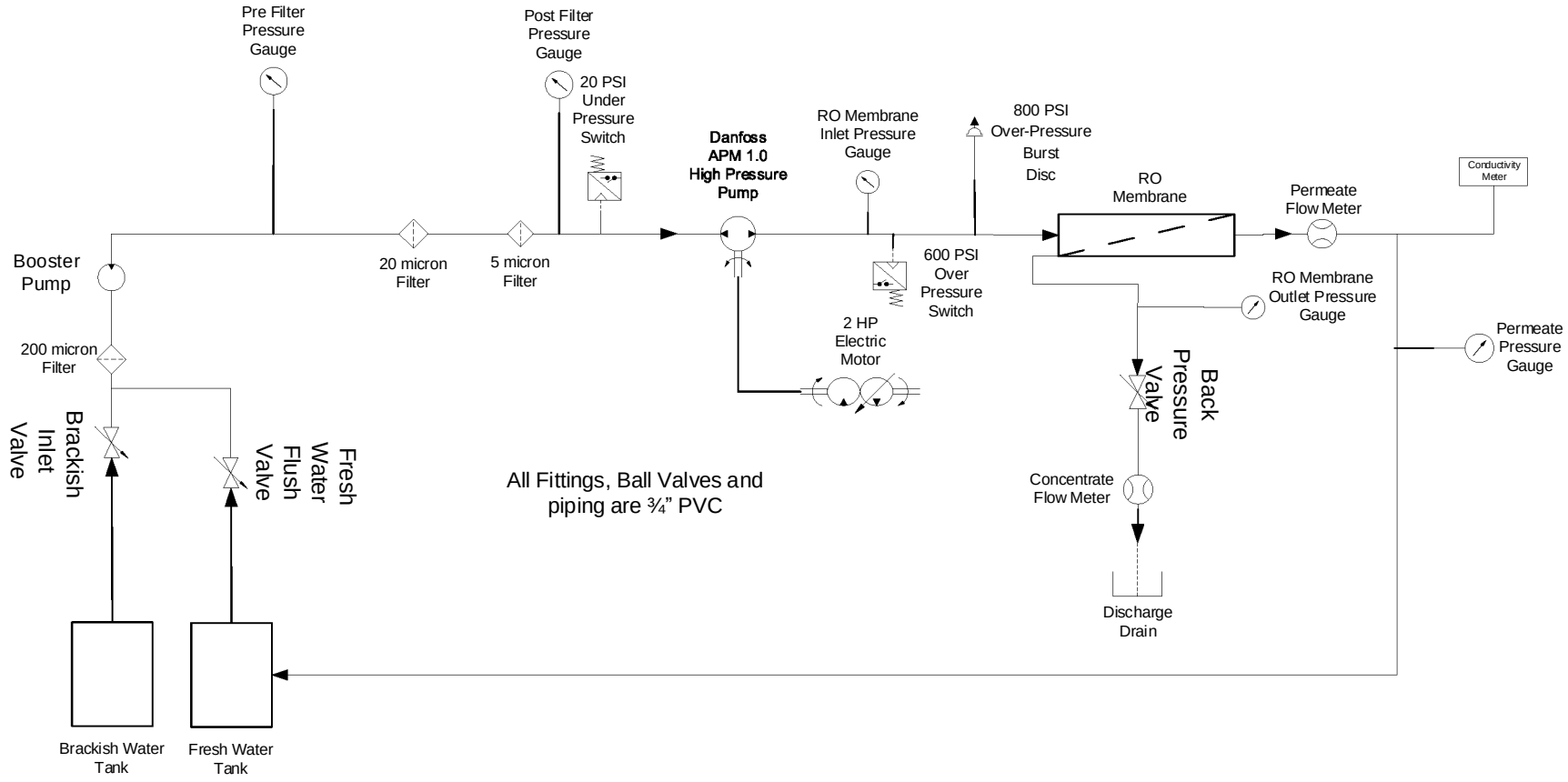
6.3.1.1 Membrane Inlet High Pressure Sensor

6.4 Emergency Shutdown Switch

This switch allows the operator to remove all power from the GVA-4000 due to a failure by depressing this switch. Once it is safe to re-start the GVA-4000, this switch may be reset by twisting the knob clockwise till the knob snap back out.

6.4.1.1 GVA-4000 Emergency Shutdown Switch

7 GVA-4000 Mechanical Block Diagram Discussion



7.1.1.1 GVA-4000 Mechanical Block Diagram

7.2 GVA-4000 Mechanical Block Diagram Explanation

The GVA-4000 has two water source inlets. A brackish water inlet which could be sourced by a brackish well which fills a brackish water tank. And, a fresh water inlet which is sourced by the fresh water storage tank.

There are two ¾" ball valves that allow for the selection of either of these two inlet sources. The inlet water is then filtered by a 200 micron cleanable filter for sand and large particulates.

The outlet of the 200 micron filter feed the inlet to the Booster Pump which insures that the supply pressure to the High Pressure Pump is maintained to a least 20 PSI.

The outlet of the Booster Pump is monitored by the Pre-Filter Pressure gauge and is fed through a 20 micron cartridge filter and 5 micron cartridge filter to further remove smaller particulates that could damage the High Pressure Pump.

The outlet of the 5 micron cartridge filter is monitored by the Post Filter Pressure gauge and the Under Pressure Switch that insures that the inlet pressure to the High Pressure Pump is at least 20 PSI. This is the main inlet feed to the High Pressure Pump.

The outlet of the High Pressure Pump is the main inlet feed for the RO membranes and is monitored by the RO Membrane Inlet Pressure gauge, 600 PSI Over-Pressure Switch, and the 800 PSI Over-Pressure Burst Disc.

The Reject Output of the RO membranes is fed to the Back Pressure Valve which controls the membrane inlet pressure and is monitored by the RO Membrane Outlet Pressure Gauge. The outlet of the Back Pressure Valve go to the Concentrate Flow Meter and is then discharge to an appropriate drain for disposal.

The Permeate Output of the RO Membranes is to a Permeate Flow Meter. This fresh water is then monitored for quality using a Conductivity Meter and the fresh water outlet pressure is monitored by the Permeate Pressure gauge.

7.3 GVA-4000 Mechanical Parts List

Miscellaneous Stainless Steel fittings such as Ts and elbows may be purchased thru Swagelok and miscellaneous plastic and PVC fittings as well as PVC tubing may be purchased thru US Plastic.

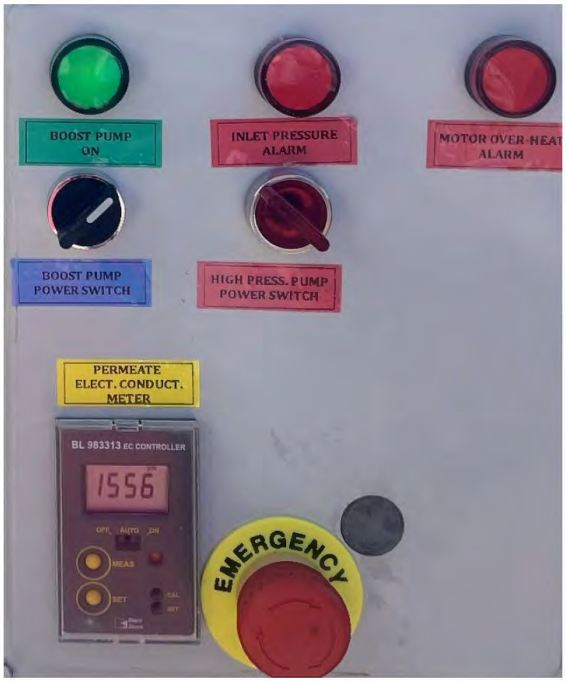
Component	Quantity	Part Number	Supplier	Location on GVA-4000
Fiberglass Membrane Housing	2	ROPV 4 X 40 1000 psi	Fresh Water Systems	Main Structure RO Membrane
Mounting Strap 4" Dia. Membrane Housing Pressure Vessel	4	47459	Wateranywhere	Main Structure RO Membrane
Mounting Saddle 4" Dia. Membrane Housing Pressure Vessel	4	45058	Wateranywhere	Main Structure RO Membrane
VICTAULIC STYLE 77 1" Flexible Coupling for Grooved End Pipe & Fittings	3	77	Ebay	Main Structure RO Membrane
Adapter – MC, FPT, 1 CNC Machined Part 316SS (See Appendix for Drawing)	1	1309629-RBP01	3A PROTOTYPE MANUFACTURING LIMITED Machined Part	Adapter between High Pressure Hose and Membrane Housing
Plug, M.CPLG .0.25 FPT CNC Machined Part 316SS (See Appendix for Drawing)	2	1309755-RAP01	3A PROTOTYPE MANUFACTURING LIMITED Machined Part	Adapter between 0.25 inch High Pressure Hoses and Membrane Housing
RO Membranes	2	TM710D	Toray	Main Structure RO Membrane
1-1/2" T Disc Filter -120 Mesh - 35 GPM	1	RKTD150	Amazon	200 Micron Filter
Booster Pump	1	HP75BN-4.75-10N36JT	DEPCO Pump Co	Booster Pump
Geekpure 10-Inch Whole House Water Filter Housing	1		Amazon	20 Micron Filter
Membrane Solutions 20 Micron Pleated Water Filter	1		Amazon	20 Micron Filter
Pentek 20" Big Blue Water Filter Housing	1		Amazon	5 Micron Filter
Membrane Solutions 5 Micron 2.5" OD x 20"	1		Amazon	5 Micron Filter
100 PSI Gauge	2	D83SS2502BA100	NISCO	Pre-Filter Pressure Gauge Post-Filter Pressure Gauge
Low Pressure Switch 8-60 PSI	1	MPS25-1C-D60A	Automation Direct	20 PSI Under Pressure Switch
SWRO High Pressure Pump	1	APP1.0	Danfoss	High Pressure Pump

2HP Electric Motor	1	G2099496	Zoro	High Pressure Pump
APP to 56TC Coupler	1	180U2416	Danfoss	High Pressure Pump
APP to 56TC Face Mount	1	180U2398	Danfoss	High Pressure Pump
High Pressure Hose	1	R2-SS43MPX12-SS43FJX12-36in	Hydraulic Hoses	High Pressure Pump
3/4 " JIC Malle x 1/2" NPTG	1	SS-2404-12-08	Discount Hydraulics	High Pressure Pump
1/2" BSPP Male x 1/2" NPTF Female	1	9035-08-08	Discount Hydraulics	High Pressure Pump
600 PSI Gauge	2	D83SS2502BA600	NISCO	RO Membrane Inlet and Outlet Pressure Gauges
Over Pressure Switch 100-1000 PSI	1	MPS25-1C-P1000A	Automation Direct	600 PSI Over Pressure Switch
Pressure Relief Valve	1	SS-4R3A	Swagelok	800 PSI Over-Pressure Burst Disc
Purple Spring Kit for R3A Series Proportional Relief Valve, 750 to 1500	1	177-R3A-K1-C	Swagelok	800 PSI Over-Pressure Burst Disc
1/4 in. NPT Female x Female (5mm Orifice) Needle Valve; Super Duplex S32760	1	ns2rp0508nfu-hw	Surplus Valve Fittings	Back Pressure Valve
Hydronix Panel Mount Flowmeter 0.5-5.0 GPM	2	PFM-055	Fresh Water Systems	Permeate and Concentrate Flow Meters
Mini Conductivity Controller (0 - 1999 uS/cm)	1	BL-983313-1	Hanna Instruments	Conductivity Meter
D80 Series Industrial Gauge, 1/4" NPT Center Back Mount, 15 psi	1	D83SS2502BA30/15	NISCO	Permeate Pressure Gauge
Hanna Conductivity Meter Probe	1	HI7634-00	Hanna Instruments	Conductivity Meter
3/8" ID x 1/2" OD x 1/16" Wall Blue LLDPE Tubing Working Pressure PSI 153	1	58514	US Plastic	Permeate Tubing
3/8" ID x 1/2" OD x 1/16" Wall White LLDPE Tubing Working Pressure PSI 153	1	58515	US Plastic	Reject Tubing
0.170" ID x 1/4" OD Yellow High Pressure Flexible Nylon 12 Tubing Working Pressure PSI 450, Burst Pressure PSI 1350	1	36154	US Plastic	Low Pressure Gauge tubing
0.170" ID x 1/4" OD Red High Pressure Flexible Nylon 12 Tubing Working Pressure PSI 450, Burst Pressure PSI 1350	1	36151	US Plastic	High Pressure Gauge tubing

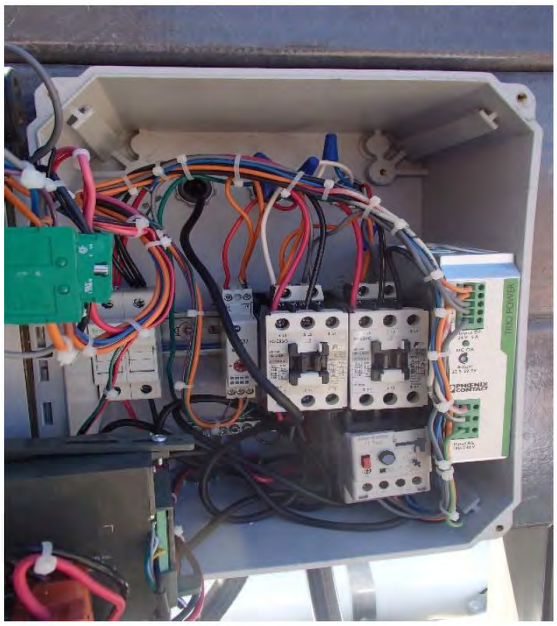
7.3.1.1 GVA-4000 Mechanical Block Diagram Parts List

8 GVA-4000 Electrical Control Block Diagram Discussion

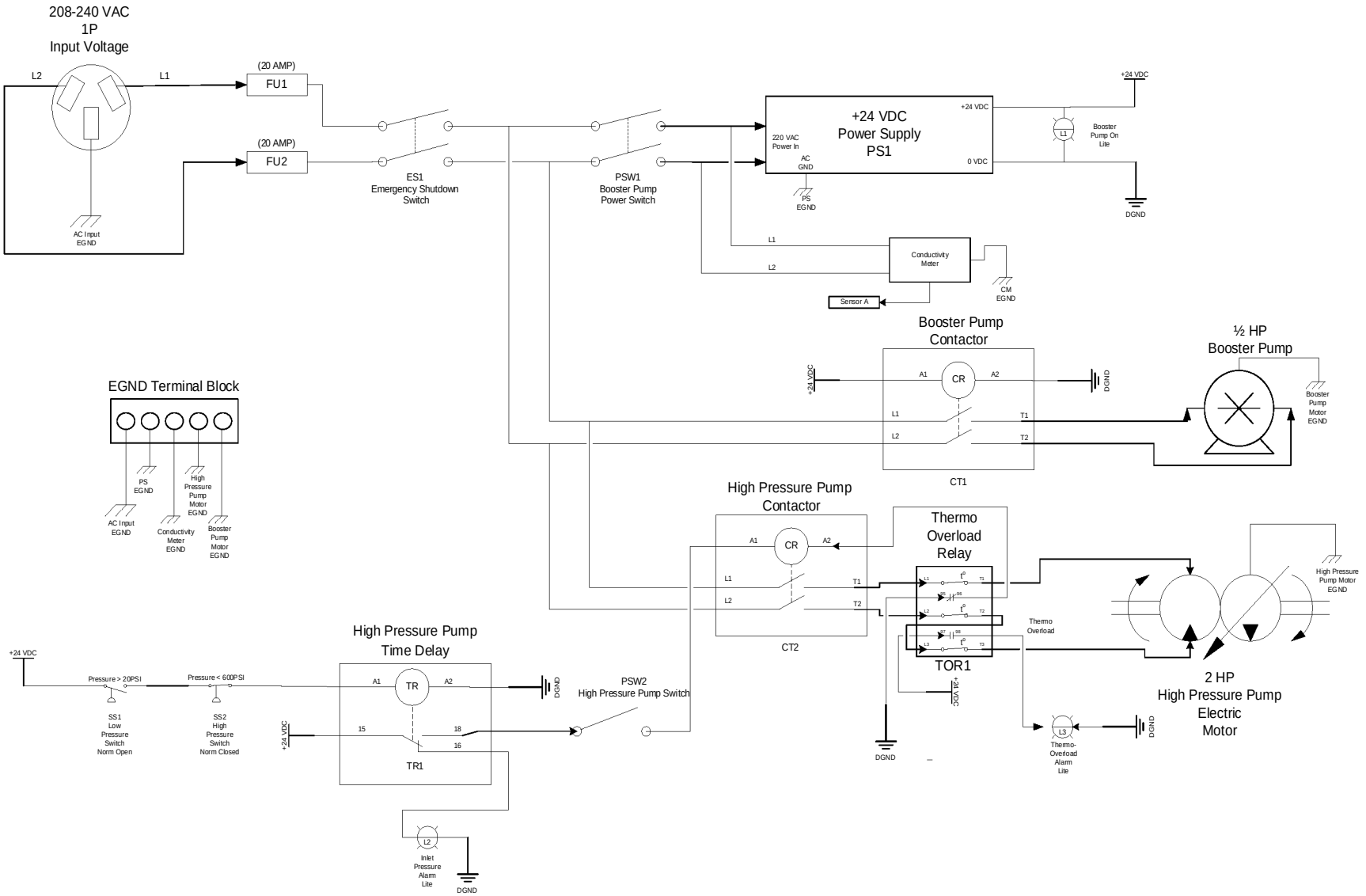
The GVA-4000 Electrical Control system consists of two power switch, fuse holder, two contactors, a power supply, timer, over-temperature switch, an emergency disconnect switch and an Electric Conductivity Meter.



8.1.1.1 GVA-4000 Electric Panel External View



8.1.1.2 GVA-4000 Internal View



8.1.1.3 GVA-4000 Electrical Control Block Diagram

8.2 GVA-4000 Electrical Control Block Diagram Explanation

Power is from a three prone 208-240 VAC single phase plug to a two 20 Amp Fuse Block. From the Fuse Block power is controlled by the Emergency Shutdown Switch (ES1) which allows for complete removal of power in an event of a failure. ES1 then applies power to the L1 and L2 for the Booster Pump Contactor (CT1) and the High Pressure Pump Contactor (CT2).

Additionally, power is supplied to the PSW1 Booster Pump Power Switch which is the Black Switch shown above in GVA-4000 Electric Panel External View. When PSW1 is turned on, this will energize the +24 VDC Power Supply (PS1) and the Conductivity Meter. By powering PS1, this will energize CT2 and will apply power to the Booster Pump. The Green Booster Pump On LED (L1) on the front panel will also be illuminated.

The 24 VDC output is fed to Inlet Low Pressure Switch (SS1) which is normally open. If the Booster Pump is providing fed water at a pressure above 20 PSI, SS1 will close otherwise it will remain open. After SS1, is the Membrane High Pressure Switch (SS2) which is normally closed. If the membrane inlet pressure is below 600 PSI, SS2 will remain closed otherwise it will open. If SS1 and SS2 are closed, +24 VDC is applied to the A1 input to the High Pressure Pump Time Delay (TR1). This will start a delay that is normally set for 3 minutes but can be adjusted to any interval. The purpose of this timer is to insure that the High Pressure Pump does not rapidly start and stop if the inlet pressure on SS1 bounces above and below 20 PSI. During this delay time the Red Inlet Pressure Alarm LED will be illuminated.

Once TR1 delay time has elapsed, +24 VDC is applied the High Pressure Pump Switch (PSW2). When PSW2 is turned on, this will energize the High Pressure Pump Contactor (CT2) and provide power thru the Thermo Overload Relay (TOR1). If the High Pressure Pump Electric Motor is not over-heating, power will be applied to it. If during operation the High Pressure Pump Electric does over-heat the TOR1 will open and remove power from the High Pressure Pump Electric Motor and Red Thermo-Overload Alarm LED will illuminate. If this happens, the operator should shutdown the GVA-4000 and diagnosis the cause for the over-heat condition.

8.3 GVA-4000 Electrical Control Parts List

Most of the electrical wiring is 12 AWG for AC power connection and 14 AWG for +24 VDC control wiring.

Component	Quantity	Part Number	Supplier	Location on GVA-4000
10X8X6 Enclosure	1	HW-100806CHSC	Ebay	Electrical Control Enclosure
USA 3-Prong Male AC Plug, UL Nema 6-15P 3 Pole Straight DIY Rewireable AC Plug, 15A 250V USA	1	Type B	Amazon	208-240 VAC 1P Plug
Mini Conductivity Controller (0-1999 µS/cm)	1	BL-983313-1	Hanna Instruments	Conductivity Meter
Hanna Conductivity Meter Probe	1	HI7634-00	Hanna Instruments	Conductivity Meter
Fuse Holder	2	LPHV0001Z	Digi Key	208-240 VAC Input
Emergency Stop Switch	1	A22E-M-02	Mouser Electronics	208-240 VAC Input
IEC contactor, 12A, (3) N.O. power poles, 24 VDC coil voltage	2	SC-E03PG-24VDC	Automation Direct	Booster Pump and High Pressure Pump contactors
208-240VAC- 24VDC Supply Mfr: Phoenix Contact	1	2866527	Mouser Electronics	+24 VDC Power Supply PS1
22 mm Switch Selector Black	1	2AS2-1	Allied Electronics	Booster Pump Power Switch
22 mm Switch Selector Red	1	2ASL4LB-1-024	Allied Electronics	High Pressure Pump Power Switch
22 mm Switch Selector Contact Block	4	S1	Allied Electronics	Power Switches
ProSense mechanical pressure switch 8 to 60 psig set point	1	MPS25-1C-D60A	Automation Direct	Low Pressure Switch (SS1)
ProSense mechanical pressure switch 100 to 1000 psig set point	1	MPS25-1C-P1000A	Automation Direct	High Pressure Switch (SS2)
AB Delay Timer	1	700-FEA3TU23	Ebay	High Pressure Pump Time Delay
GASHER 24V/20mA Energy Saving Indicator Light Mounting Hole Size 22mm Red 10 Pcs	2	JQ-073	Amazon	Inlet Pressure Alarm Lite Thermo-Overload Alarm Lite
GASHER 24V/20mA Energy Saving Indicator Light Mounting Hole Size 22mm Green 10 Pcs	1	JQ-070	Amazon	Boost Pump On Lite
ALLEN BRADLEY E1 PLUS OVERLOAD RELAY	1	193-EEBB	Ebay	Thermo-Overload Relay
Siemens Eclx Ground Bar Kit, 7 Terminal	1	ECLX069M	Amazon	EGND Terminal Block

8.3.1.1 GVA-4000 Electrical Control Block Diagram Parts List

9 GVA-4000 Routine Maintenance

9.1 200 Micron Inlet Filter

This filter should be cleaned daily at the end of the day by rinsing it with pressured fresh water and should last the life of the system if properly maintained. Unscrew the filter nut counterclockwise and loosen the nut holding the red filter element tight. Using a pressurized fresh water source, rinse the red filter element of any debris.

9.1.1.1 200 Micron Filter Location and Dis-Assembly

9.2 20 and 5 Micron Inlet Filters

These filters should be replaced if the pressure difference between the Pre-Filter Inlet Pressure and Post-Filter Inlet Pressure is 10 PSI or greater.

9.2.1.1 20 and 5 Micron Filters and Inlet Pressure Gauges

9.3 RO Membrane

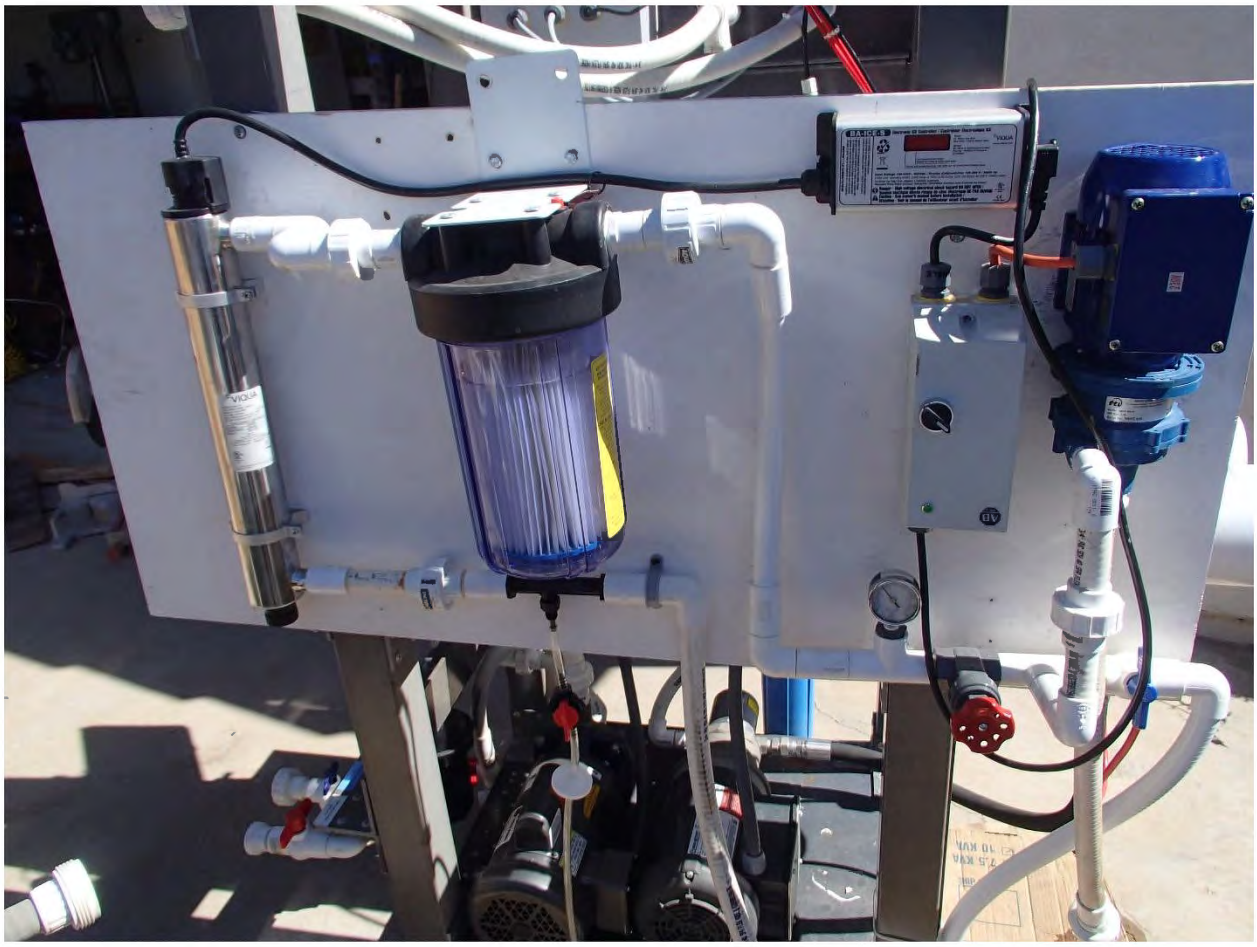
The RO Membranes should last 2-3 years if they are backflushed as recommended in the operation instructions when the GVA-4000 is started and before it is shut down with fresh water. If after several backflushing, there is a 300-400 pressure difference between the Inlet Vessel Pressure and the Concentrate Vessel Pressure. Additionally, you will notice a reduction in the amount of permeate water that is being produce at the normal pressure that you use for normal operations. You should record the daily pressures and the flow rates so as to have a record to see how the membranes are aging.

9.3.1.1 RO Membrane and Vessel Pressure Gauges

10 Self-Contained UV – Aeration System

10.1 Self-Contained UV – Aeration System Description

The GVA-4000 Desalination system is intended to be paired with a self-contained UV - Aeration System to insure that the permeate water in the fresh water storage tank remains safe and bacteria free. The UV – Aeration system is powered via a 220-240 power plug and is controlled by a power switch on the front control box.

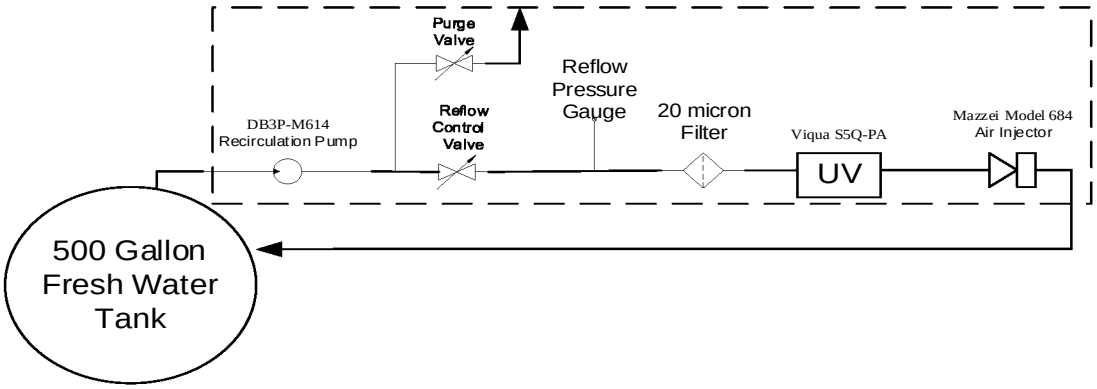


10.1.1.1 Self-Contained UV – Aeration System Picture

10.2 Self-Contained UV – Aeration System Start Up and Shut Down Procedures

1. Plug the 220-240 AC 1P plug into a 220-240 AC 1P power source
2. Turn on the power switch which is located on the control box.
3. For the initial startup it may be necessary to prime the pump by momentary opening and closing the blue purge valve.
4. The flow rate can be controlled thru the use of the Red throttle valve. The ideal flow rate is around 5 gallons per minute. This can be done easily with a 5 gallon bucket and a watch.
5. This system is designed for continuous operation. But should the system need to be shutdown for maintenance or repair, simply turn off the power switch.

10.4 Self-Contained UV – Aeration System Block Diagram Discussion



10.4.1.1 UV - Aeration System Block Diagram

This UV-Aeration System is designed and intended for continuous operation and assumes that there will always be water in the Fresh Water Tank. The 500 Gallon Fresh Water Tank should be slightly elevated above the UV-Aeration system to help prime the Recirculation Pump. The system is activated by a Power Switch on the front Control Box. Ideally, the feedwater for the system would come from the bottom of the 500 Gallon Fresh Water Tank and returned to the top of the Tank to provide for circulation of the stored water.

The UV-Aeration System is driven by the Recirculation Pump (RP) that feeds to valves. The purge valve is used initially to help prime the RP after which it should remain closes. The outlet of the Purge Valve (PV) should be directed to an outside drain for disposal. Once the RP is primed, the Reflow Valve (RV) should be opened and the Purge Valve closed. From the RV, the Permeate Water Flow (PWF) is monitored by the Reflow Pressure Gauge and is filtered by at 20 micron cartilage filter. After the 20 micron filter, the PWF is passed thru the UV unit to sterilize and then past an Air Injector to aerate. The PWF is then returned to the 500 Gallon Fresh Water Tank.

10.5 Self-Contained UV – Aeration System Parts List

Component	Quantity	Part Number	Supplier	Location on GVA-4000
Finish Thompson DB3P-M614 Pump	1	DB3P-M614	Neobits	Recirculation Pump
D80 Series Industrial Gauge, 1/4" NPT Center Back Mount, 15 psi	1	D83SS2502BA30/15	NISCO	Reflow Pressure Gauge
Geekpure 10 Inch Big Clear Water Filter Housing	1		Amazon	20 Micron Filter
Membrane Solutions 20 Micron Pleated Water Filter 10"x4.5"	1		Amazon	20 Micron Filter
UV Sterilization Unit	1	S5Q-PA/2 or comparable	Fresh Water Systems	UV
UV Lamp/Quartz Sleeve Combo Kit for S5Q-PA	1	S463-QL	Fresh Water Systems	UV
1/4" PVDF Venturi Injector	1		A2Z Ozone	Air Injector
In-Line Sanitary Filter for Aeration	1	41150	Northern Brewer	Air Injector

10.5.1.1 UV - Aeration System Block Diagram Parts List

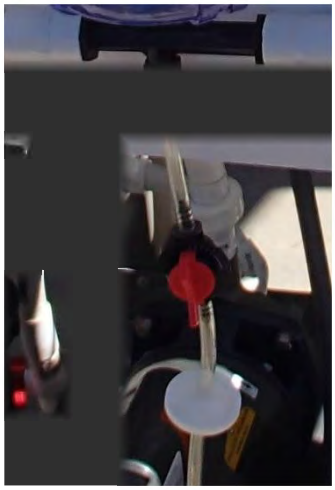
10.6 UV - Aeration System Routine Maintenance

10.6.1 20 Micron Filter

10.6.1.1 UV – Aeration 20 Micron Filter

This filter should be inspected daily to insure proper flow of the system. If the filter is clogged, it should be initially cleaned using pressurized fresh water. The filter should be replaced as needed.

10.6.2 Air Filter for Air Injector.



10.6.2.1 UV – Aeration Air Injector Air Filter

This filter should be inspected daily to insure proper air flow to the Air Injector. To test this filter, simply check for suction by placing your finger over the hose end that feeds the filter. If no noticeable suctions is felt the, the filter should be replaced.

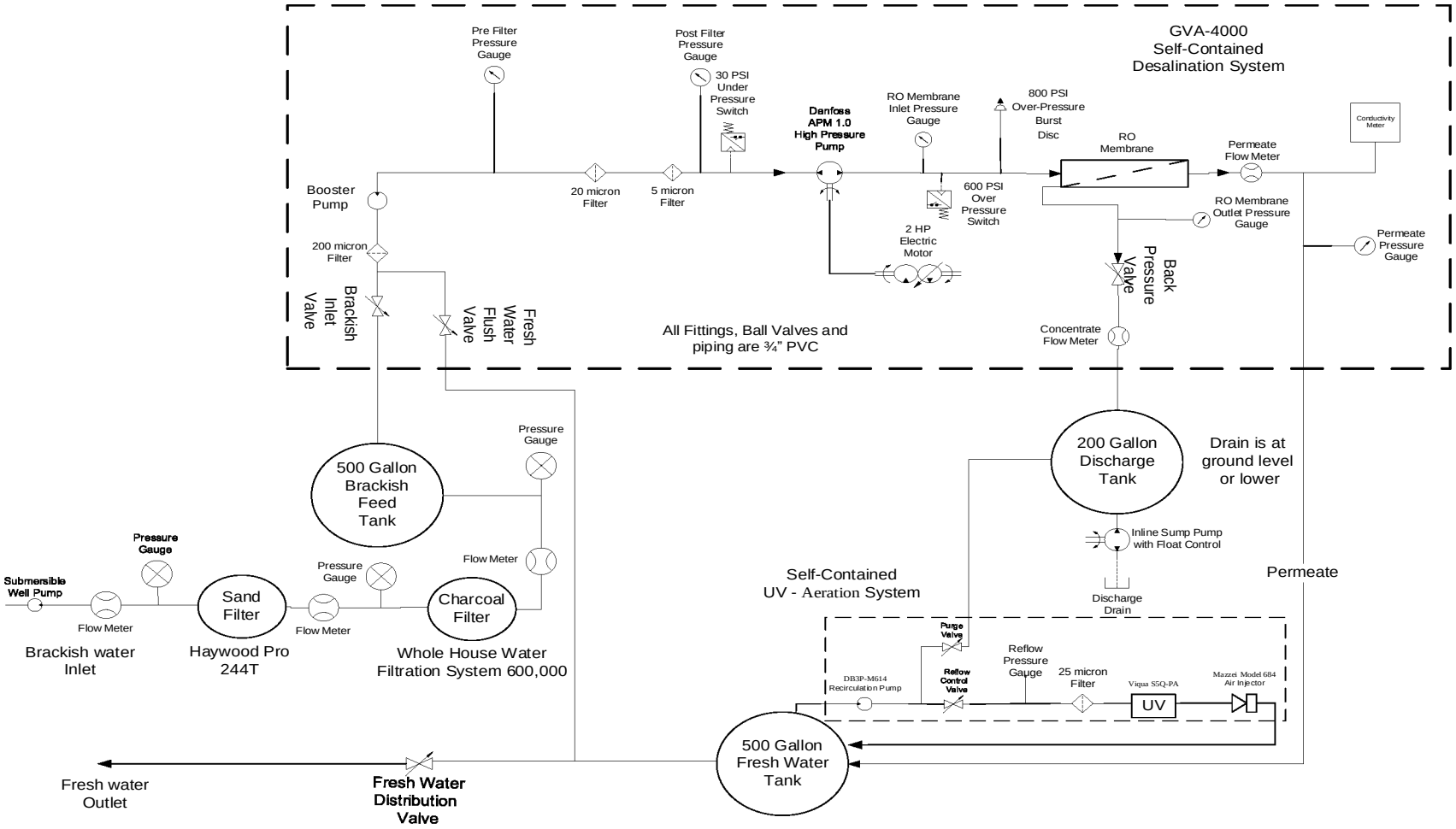
10.6.3 UV Bulb and Sleeve Replacement

10.6.3.1 UV Container, Sleeve, and Bulb

The UV sleeve, bulb and gaskets should be replaced on an annual basis to insure proper operation of the UV system.

11 Complete GVA-4000 System Configuration

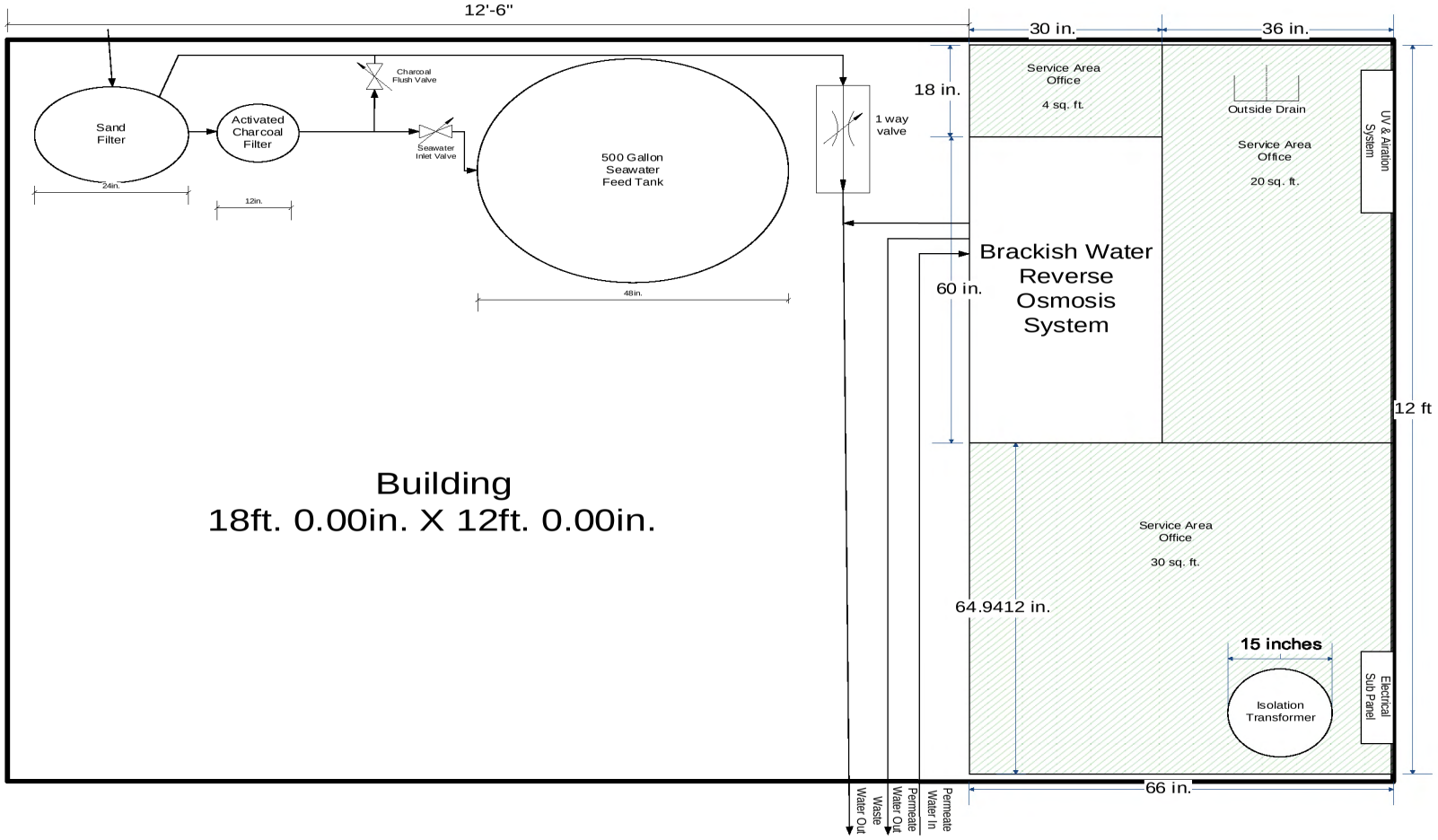
The diagram shown below shows the preferred input filtration, suggested brackish water storage, and fresh water storage.



11.1.1.1 Integrated GVA-4000 System Block Diagram

12 Suggested GVA-4000 Shelter Building Layout

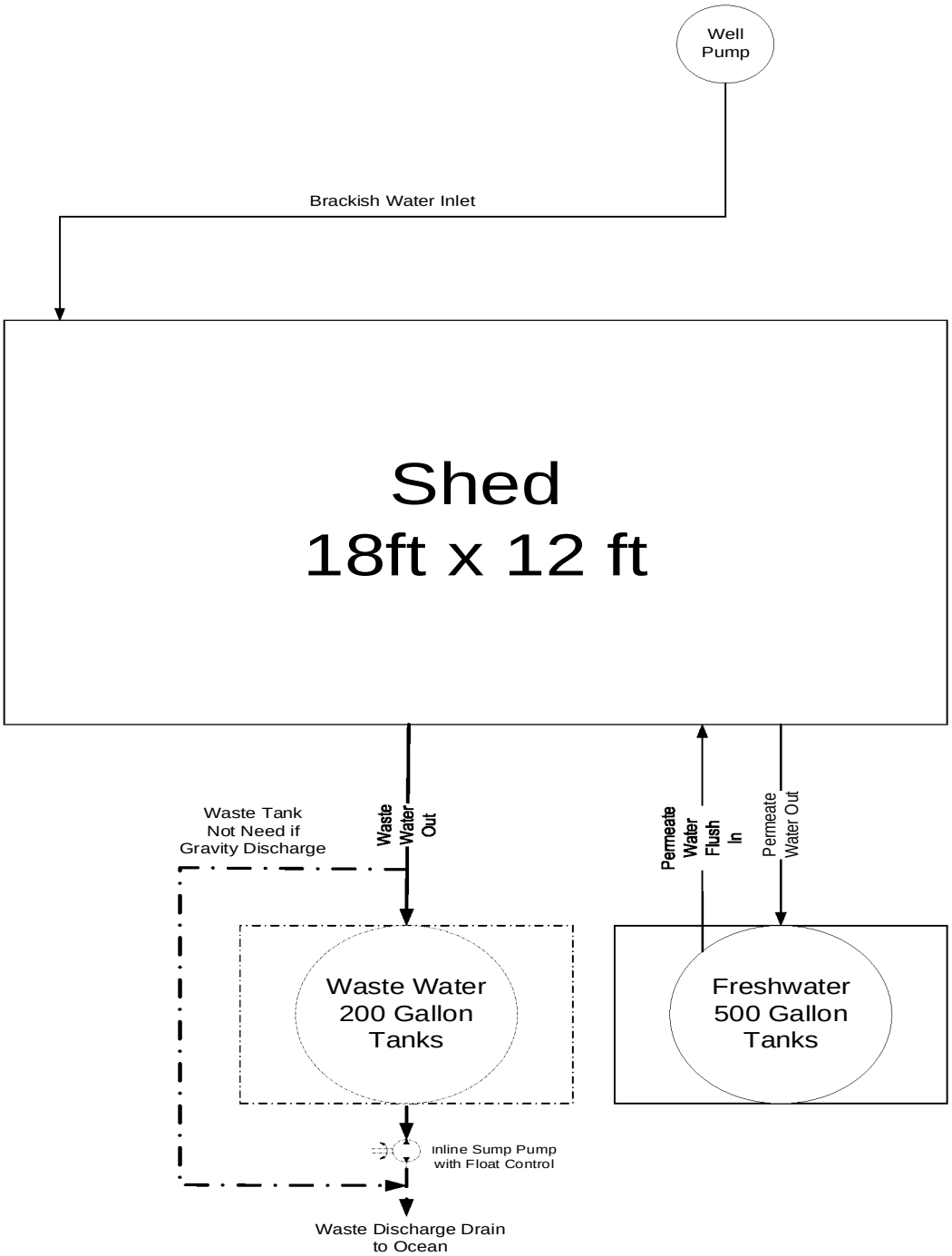
This is a suggested building size and configuration to allow for easy access to the GVA-4000 and UV – Aeration systems for repair and maintenance as well as to allow for storage of spare parts.



12.1.1.1 GVA-4000 and UV - Aeration Shelter Building Layout Diagram

13 Suggested GVA-4000 and UV – Aeration Site Map

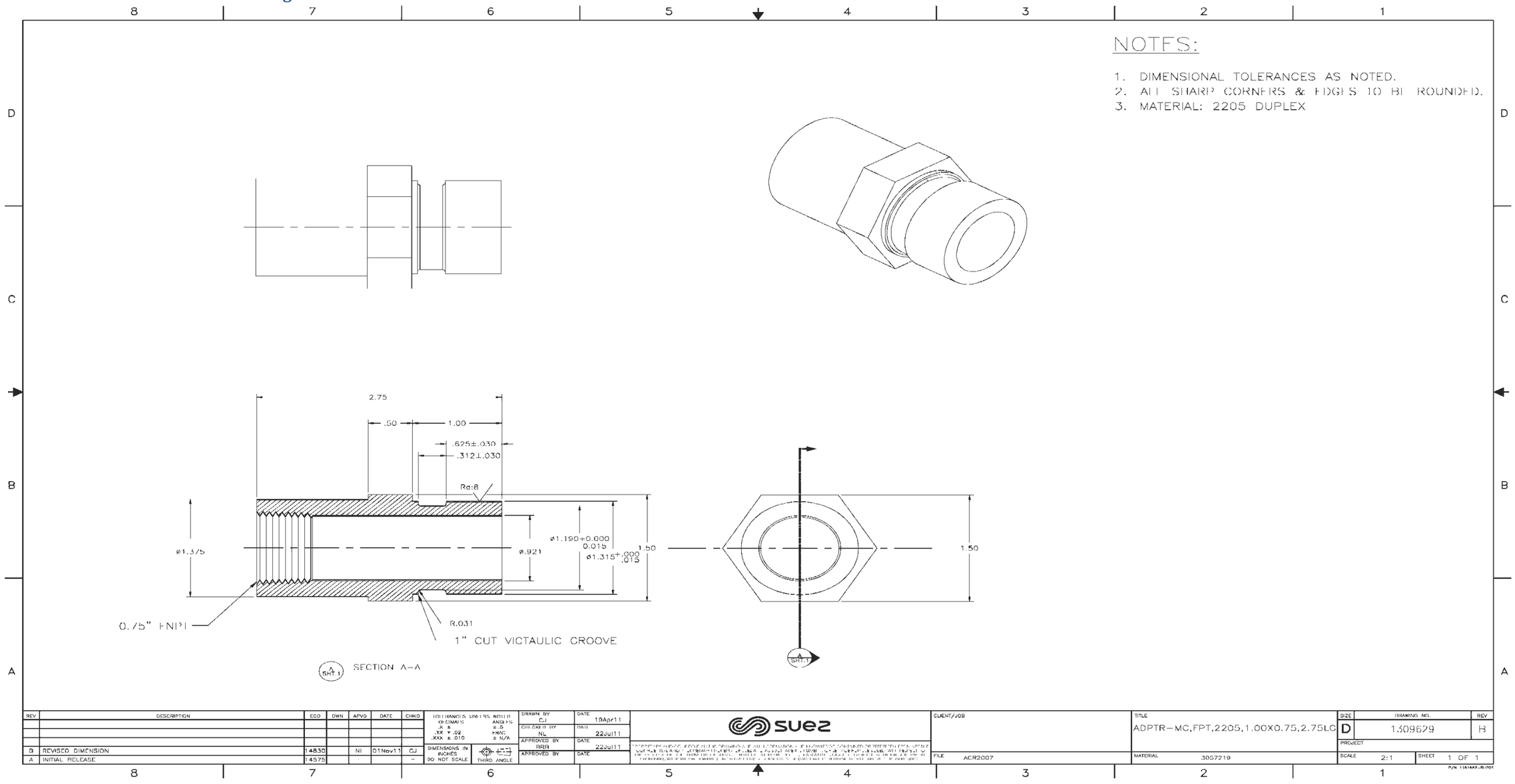
This layout show the suggest layout of the external tanks, inlets and outlets for the integrated GVA-4000 and UV – Aeration system.



13.1.1.1 GVA-4000 and UV - Aeration Site Diagram

14 Appendix

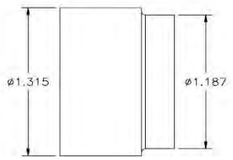
14.1 GVA-4000 Mechanical Drawings for CNC Machined Parts

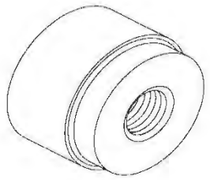


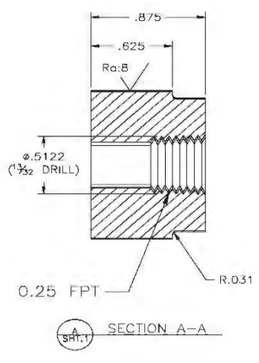
14.1.1.1 Mechanical Drawing for Adapter -MC, FPT, 1

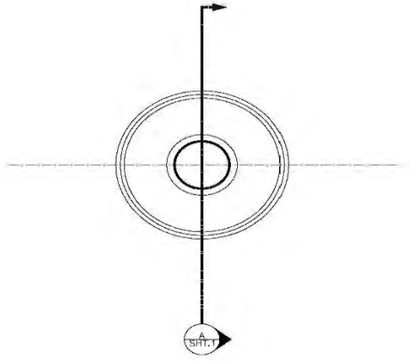
NOTES:

1. DIMENSIONAL TOLERANCES AS NOTED.
2. ALL SHARP CORNERS & EDGES TO BE ROUNDED.
3. MATERIAL: 2205 DUPLEX









REV	DESCRIPTION	ECO	DWN	APVD	DATE	CHKD
A	INITIAL RELEASE	14575	–	–	–	–

TOLERANCES UNLESS NOTED
DECIMALS ANGLES
.X ± ± .5
.XX ± .02 FRAC
.XXX ± .010 ± N/A
DIMENSIONS IN INCHES
DO NOT SCALE
THIRD ANGLE

DRAWN BY	AK
DATE	11May11
CHECKED BY	NL
DATE	25Jul11
APPROVED BY	BRB
DATE	25Jul11
APPROVED BY	
DATE	

SUEZ

CLIENT/JOB

TITLE: PLUG,M.CPLG, 2205, W/ 0.25 FPT

FILE: ACR2007

MATERIAL: 3058492

SIZE	DRAWING NO.	REV
D	1309755	A

PROJECT

SCALE: 2:1 SHEET: 1 OF 1

P/N 1161662-19491

14.1.1.2 Mechanical Drawing for Plug, M.CPLG 0.25 FPT

14.2 MPS25 Series Mechanical Pressure Switch Specification

The ProSense MPS25 series mechanical pressure switches are designed for the toughest applications where conventional pressure switch designs often don't measure up. These cost effective switches, depending on the pressure range, have either an all welded 316 stainless steel sealed diaphragm actuator design or a direct acting 316 stainless steel piston design with a Buna-N O-ring. The rugged 316 stainless steel enclosure provides uncompromising protection and long life in difficult environments. The robust design is resistant to vibration and shock, and provides reliable operation over a wide operating temperature range. Pressure ranges from vacuum to 7500 psig are available along with a ¼ inch NPT male threaded process connection and a precision snap-acting SPDT, 3 Amp, mechanically operated switch output. Choose from either an integral 6-foot (1.5m) cable with ½ inch NPT male conduit connection or a DIN 175301-803C L-connector.

Applications

- Process control & automation
- Pump & compressors
- Hydraulic systems
- Pneumatic systems
- Engine monitoring
- Presses
- Machine tools

#E320431

** UL only applies to the MPS25 series units with integral cable*

Features

- Compact size
- 316 stainless steel enclosure
- All stainless welded diaphragm or stainless piston and Buna-N O-ring
- Pressure ranges from -15 psig vacuum to 7500 psig
- Tamper resistant field adjustment
- *Integral 6-foot cable with 1/2 inch NPT male conduit connection or DIN form C electrical connections
- 1/4 inch NPT male process connection
- Wide operating temperature range
- Precision snap-acting SPDT, 3 Amp mechanically operated switch
- UL*, CSA, CE and RoHS compliant
- 3-year warranty

MPS25 Series Mechanical Pressure Switches

Part Number	Description	Actuator Type	Electrical Connection	Pcs/ Pkg	Wt(lb)	Price
MPS25-1C-DV15A	Pressure switch, -15 psig vacuum to 15 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output	316 stainless steel welded diaphragm	1/2" NPT male conduit connection, integral 6-foot/1.5 meter, 4 conductor cable with 18AWG leads	1	0.9	$129.00
MPS25-1C-D30A	Pressure switch, 6 to 30 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.9	$129.00
MPS25-1C-D60A	Pressure switch, 8 to 60 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.9	$129.00
MPS25-1C-D100A	Pressure switch, 10 to 100 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.9	$129.00
MPS25-1C-P200A	Pressure switch, 40 to 200 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output	316 stainless steel piston with Buna-N O-ring		1	0.9	$130.00
MPS25-1C-P500A	Pressure switch, 50 to 500 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.9	$129.00
MPS25-1C-P1000A	Pressure switch, 100 to 1000 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.9	$129.00
MPS25-1C-P2000A	Pressure switch, 200 to 2000 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.9	$129.00
MPS25-1C-P5000A	Pressure switch, 500 to 5000 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.9	$129.00
MPS25-1C-P7500A	Pressure switch, 750 to 7500 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.9	$129.00
MPS25-1C-DV15D	Pressure switch, -15 psig vacuum to 15 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output	316 stainless steel welded diaphragm	DIN 175301-803C L-Connector (8mm)	1	0.5	$121.00
MPS25-1C-D30D	Pressure switch, 6 to 30 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.5	$121.00
MPS25-1C-D60D	Pressure switch, 8 to 60 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.5	$121.00
MPS25-1C-D100D	Pressure switch, 10 to 100 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.5	$121.00
MPS25-1C-P200D	Pressure switch, 40 to 200 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output	316 stainless steel piston with Buna-N O-ring		1	0.5	$121.00
MPS25-1C-P500D	Pressure switch, 50 to 500 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.5	$121.00
MPS25-1C-P1000D	Pressure switch, 100 to 1000 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.5	$121.00
MPS25-1C-P2000D	Pressure switch, 200 to 2000 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.5	$121.00
MPS25-1C-P5000D	Pressure switch, 500 to 5000 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.5	$121.00
MPS25-1C-P7500D	Pressure switch, 750 to 7500 psig setpoint range, 1/4" NPT male port, 3A SPDT switch output			1	0.5	$121.00

ProSense MPS25 Series General Specifications	
Setpoint	Field adjustable (factory default 50% of full scale)
Setpoint Repeatability	±2% of range above 100 psig and ±5% for 100 psig and below (Additional setpoint shift of ±2% of range per 40°F from initial setpoint set at 70°F typical)
Vibration	Passed ML-STD-202G
Shock	75G's 10 milliseconds 3-axis
Piston Actuator	Stainless steel with Buna-N O-ring, 200 to 7500 psig
Mechanical Life Piston Design	> 1,000,000 operations typical
Diaphragm Actuator	316L SS, up to 100 psig
Mechanical Life Diaphragm Design	> 400,000 operations typical
Enclosure Material	316L SS
Enclosure Rating	NEMA 6, IP 67
Pressure Connection	1/4" NPT Male
Electrical Output	SPDT 3A @ 125 VAC / 2A @ 30VDC resistive
Electrical Termination	1/2" NPT Male conduit connection or Micro DIN 175301-803C with mating connector
Agency Approvals	UL (#E320431) cable version only, CSA, CE, RoHS

MPS25 Series Mechanical Pressure Switch Performance Characteristics

Part Number	*Setpoint Adjustability*			*Setpoint Repeatability*			*Deadband**		
	psig	*bar, kg/cm2*	*kPa*	*psig*	*bar, kg/cm2*	*kPa*	*psig*	*bar, kg/cm2*	*kPa*
MPS25-1C-DV15x	-15/15	-1/1	-100/100	±1.5	±0.1	±10	1-5	0.07-0.35	7-35
MPS25-1C-D30x	6-30	0.4-2	4-200	±1.5	±0.1	±10	1-5	0.07-0.35	7-35
MPS25-1C-D60x	8-60	0.6-4	60-400	±3	±0.2	±20	2-10	0.14-0.70	14-70
MPS25-1C-D100x	10-100	0.7-7	70-700	±5	±0.35	±35	3-15	0.2-1.0	20-100
MPS25-1C-P200x	40-200	2.8-14	280-1400	±4	±0.28	±28	3-30	0.2-2.0	20-200
MPS25-1C-P500x	50-500	3.5-35	350-3500	±10	±0.70	±70	20-100	1.4-7.0	140-700
MPS25-1C-P1000x	100-1000	7-70	700-7000	±20	±1.40	±140	25-150	1.7-10	170-1000
MPS25-1C-P2000x	200-2000	14-140	1400-14000	±40	±2.8	±280	30-300	2-20	200-2000
MPS25-1C-P5000x	500-5000	35-350	3500-35000	±100	±7.0	±700	75-750	5-50	500-5000
MPS25-1C-P7500x	750-7500	50-500	5000-50000	±150	±10.0	±1000	110-1100	7.5-75	750-7500

** Due to the mechanical design of the MPS25 switch, the actual deadband will vary from one switch to another but will be within the specified deadband range. Generally, the expected deadband for a setpoint at the lower end of the range will trend towards the lower end for the deadband range. The deadband for a setpoint at the upper end of the range will trend towards the upper end for the deadband range.*

Material & Temperature

Ranges	*Wetted Material*	*Temperature Range*
Up to 100#	SS	-40-100°C (-40-212°F)
200#	SS, BUNA	-28-100°C (-18.4-212°F)
500# to 7500#	SS, BUNA	-40-100°C (-40-212°F)

Proof Pressure

Ranges (listed in psig)	*psig*	*bar, kg/cm2*	*kPa*
Up to 100#	1000	70	7000
200#	2000	140	14000
500 to 2000#	8000	500	55000
5000 to 75000#	15000	1000	100000

Burst Pressure

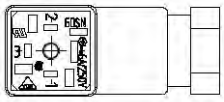
Ranges (listed in psig)	*psig*	*bar, kg/cm2*	*kPa*
Up to 100#	>9500	>655	>65500
200#	>10000	>700	>70000
500 to 2000#	>30000	>2100	>210000
5000 to 7500#	>50000	>3500	>350000

Electrical Connections

1/2" NPT male conduit connector with 6-foot (1.5m) integral cable

Wire Color / Function	
Wire Color	*Function*
Red	Normally Closed
White	Common
Blue	Normally Open
Green	Ground

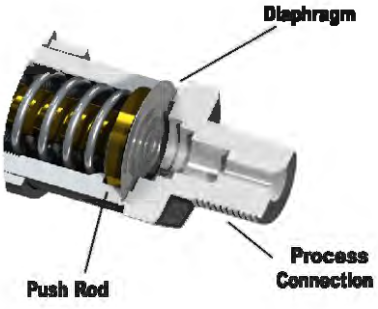
DIN 175301-803C L-Connector



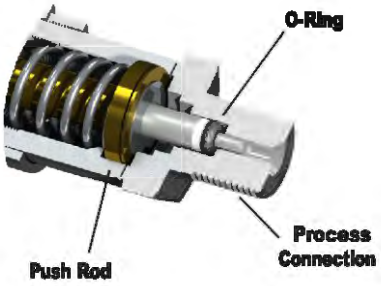
1 – COMMON
2 – NORMALLY CLOSED
3 – NORMALLY OPEN
4 – GROUND

Actuator Design

The MPS25 series actuator responds to changes in pressure and operates the internal micro switch in response to these changes. The actuator is normally exposed to the process media and must be chemically compatible with it. The MPS25 series is available with a welded stainless steel diaphragm (no O-ring) in pressure ranges up to 100 psig. A stainless steel piston with Buna-N O-ring is available for pressure ranges from 200 to 7500 psig.



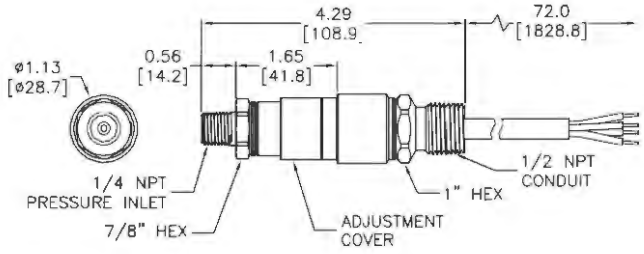
Diaphragm Actuator Type
Up to 100 psig



Piston Actuator Type
200 to 7500 psig

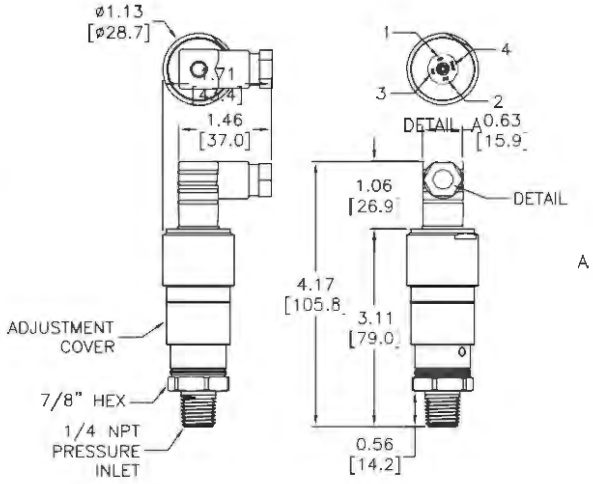
Dimensions

inches [mm]



MPS25 Cable Units

See our website www.AutomationDirect.com for complete Engineering drawings.



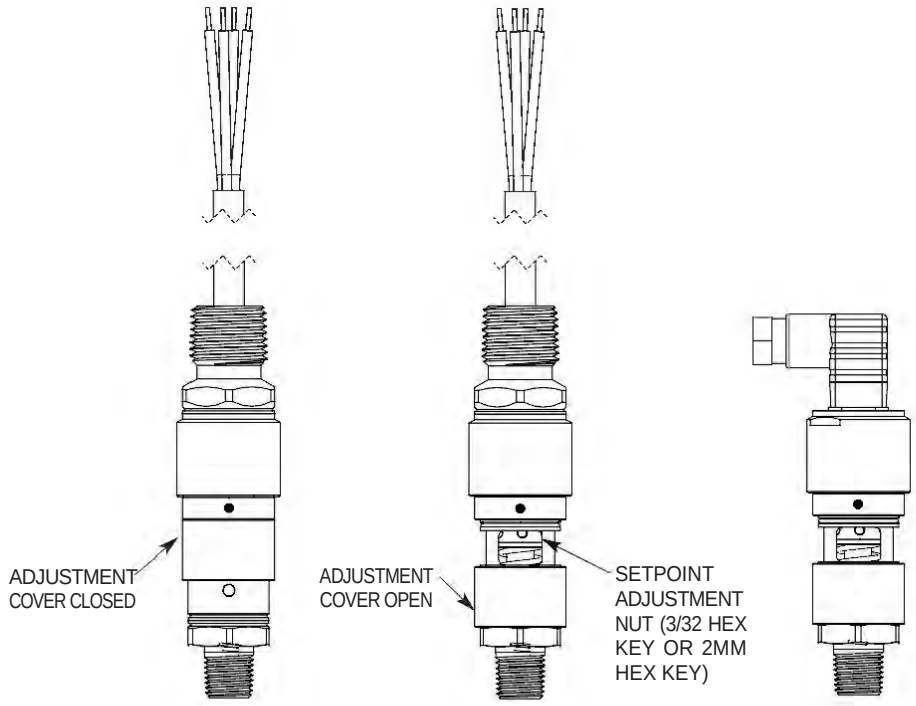
MPS25 DIN Connector Units

DIN Connector Specifications	
Number of contacts	3 + PE
Cable glands	PG 7
Conductor size max.	0.75 mm² / 18AWG
Type of termination	Screw
Suitable cables	4.5 mm to 6mm
Standard DIN	EN 175 301-803-C

Field Adjustable Setpoint

The MPS25 series switches have a field adjustable setpoint. To adjust the setpoint, follow the instructions in the diagram. The pressure switch operates as follows:

The Normally Open contact will close when the pressure is raised from 0 psig to the setpoint. The reset point is then measured from the setpoint, reducing the pressure until the Normally Open contact opens.



SLIDE COVER DOWN TO ACCESS SETPOINT ADJUSTMENT SLIDE COVER UP TO CLOSE AND SEAL ADJUSTMENT

ROTATE LEFT ⟵ TO INCREASE SETPOINT
ROTATE RIGHT ⟶ TO DECREASE SETPOINT
Ø 0.095″ OR SMALLER TOOL REQUIRED TO ROTATE NU

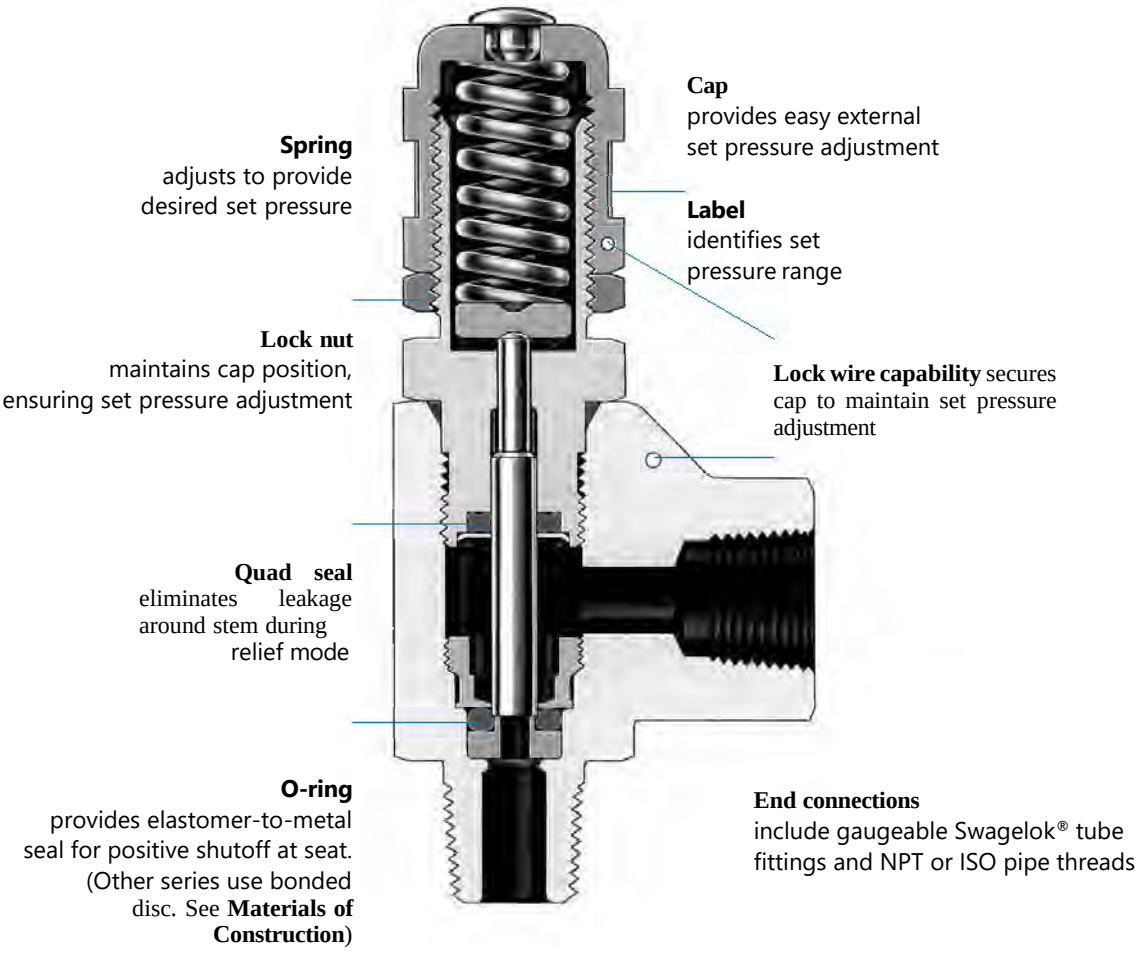
14.2 SS-4R3A Stainless Steel High Pressure Relief Valve Specification

14.2.1.1 SS-4R3A and Purple 750-1500 PSIG Spring Set

Proportional Relief Valves

R Series

- Liquid or gas service
- Set pressures from 10 to 6000 psig (0.7 to 413 bar)
- 1/4 and 1/2 in. and 6 to 12 mm end connections



R3A series valve shown.

Features

High-Pressure Valves

- Service up to 6000 psig (413 bar)
- Multiple springs for a selection of set pressure ranges
- Valves available factory-set to a specified set pressure
- 1/4 in. and 6 and 8 mm end connections—R3A series
- 1/2 in. and 12 mm end connections—R4 series

Low-Pressure Valves

- Service up to 300 psig (20.6 bar)
- One spring for the full set pressure range
- Valves available factory-set to a specified set pressure
- 1/4 in. and 6 and 8 mm end connections—RL3 series
- 1/2 in. and 12 mm end connections—RL4 series

Applications

R series relief valves are proportional relief valves that open gradually as the pressure increases. Consequently, they do not have a capacity rating at a given pressure rise (accumulation), and they are not certified to ASME or any other codes.

Some system applications require relief valves to meet specific safety codes. The system designer and user must determine when such codes apply and whether these relief valves conform to them.

Swagelok proportional relief valves should never be used as ASME Boiler and Pressure Vessel Code safety relief devices.

Swagelok proportional relief valves are not "Safety Accessories" as defined in the Pressure Equipment Directive 2014/68/EU.

Operation

R series relief valves OPEN when system pressure reaches the set pressure and CLOSE when system pressure falls below the set pressure.

- High-pressure R3A and R4 series—select and install the spring that covers the required set pressure; apply the matching label to the cap.
- Low-pressure RL3 and RL4 series—the spring is already installed.

For valves not actuated for a period of time, initial relief pressure may be higher than the set pressure.

Pressure-Temperature Ratings

Series	R3A					R4				RL3 and RL4			
Inlet Working Pressure①	6000 psig (413 bar); up to 8000 psig (551 bar) during relief					6000 psig (413 bar)				300 psig (20.6 bar)			
Outlet Working Pressure①	1500 psig (103 bar)					2500 psig (172 bar)				225 psig (15.5 bar)			
Set Pressure	50 to 6000 psig (3.4 to 413 bar)					50 to 1500 psig (3.4 to 103 bar)				10 to 225 psig (0.7 to 15.5 bar)			
Seal Material	Fluoro-carbon FKM	Buna N	Neo-prene	Ethylene pro-pylene	Perfluoro-carbon FFKM	Fluoro-carbon FKM	Buna N	Neo-prene	Ethylene pro-pylene	Fluoro-carbon FKM	Buna N	Neo-prene	Ethylene pro-pylene
Temperature, °F (°C)	Maximum Set Pressure, psig (bar)												
–40 (–40)			—									—	
–30 (–34)		—									—		
–10 (–23)	—		6000 (413)	—	—	—	—	—	—	—		225 (15.5)	225 (15.5)
0 (–17)		6000 (413)									225 (15.5)		
10 (–12)										225 (15.5)			
25 (–4)	6000 (413)			6000 (413)	2500 (172)	1500 (103)	1500 (103)	1500 (103)	1500 (103)				
30 (–1)													
40 (4)					6000 (413)								
50 (10)													
70 (20)													
150 (65)	5580 (384)	5580 (384)	5580 (384)	5580 (384)	3000 (207)								
200 (93)	5160 (355)	5160 (355)	5160 (355)	5160 (355)	1500 (103)								
250 (121)	4910 (338)	4910 (338)	4910 (338)	4910 (338)	—								
275 (135)	—	—	4660 (321)	—				—	—				
300 (148)										—			

① Outlet pressure should not exceed inlet pressure.

Set Pressure and Resealing Pressure

- Set pressure is the upstream pressure at which the first indication of flow occurs. Set pressure of each valve **after initial relief** is repeatable within
  - ± 3.0 psig (0.20 bar) or ± 5 % (whichever is greater) of the initial set pressure at 60 to 80°F (15 to 26°C)
  - ± 6.0 psig (0.40 bar) or ± 20 % (whichever is greater) of the initial set pressure below 60°F (15°C) and above 80°F (26°C).
- Resealing pressure is the upstream pressure at which there is no indication of flow. Resealing pressure is always lower than set pressure.

Testing

Every R series proportional relief valve is tested for set and resealing performance.

Series	Test Set Pressure psig (bar)	Minimum Resealing Pressure as a Percentage of Set Pressure, %
RL3, RL4	10 to 20 (0.7 to 1.3)	50
	175 to 225 (12.0 to 15.5)	91
R3A, R4	100 to 200 (6.8 to 13.7)	50
	850 to 1000 (58.5 to 68.9)	84

Back Pressure

High-Pressure Valves (R3A and R4 Series)

The effect of system back pressure is minimized by the design of these high-pressure valves.

Low-Pressure Valves (RL3 and RL4 Series)

System back pressure increases the set pressure of the valve. To compensate, multiply the back pressure by 0.8 and subtract the result from the desired set pressure. Use the result to pre-set the valve while back pressure is equal to atmospheric pressure.

Example:

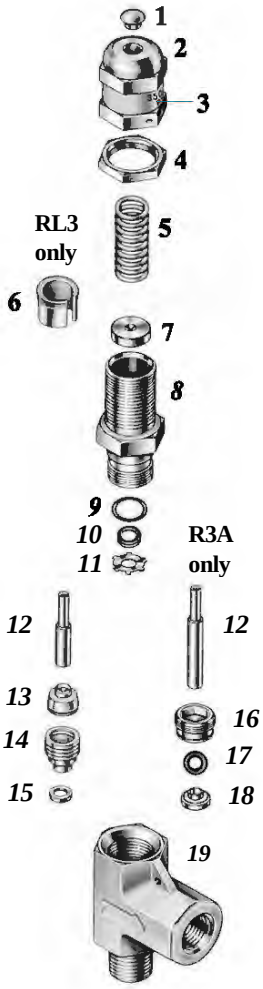
Desired set pressure is 120 psig. System back pressure is 40 psig.

Step 1. Multiply back pressure by 0.8.
40 psig × 0.8 = 32 psig.

Step 2. Subtract result from desired set pressure.
120 psig – 32 psig = 88 psig.

Step 3. Pre-set proportional relief valve to 88 psig.

RL3 and R3A

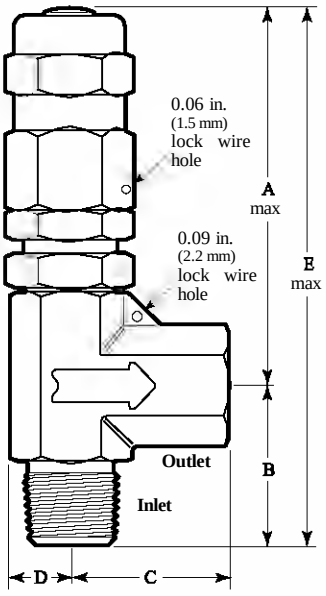


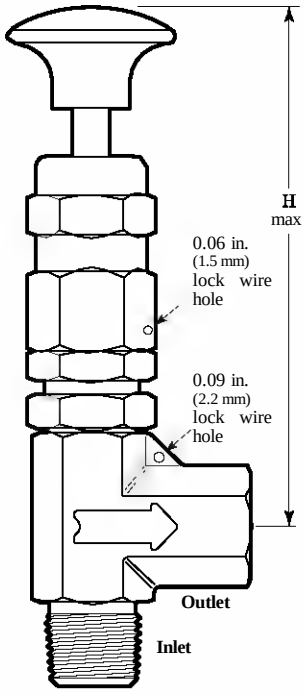
RL4 and R4

Component		Material Grade/ASTM Specification
1	Plug	302 SS/ASTM 240
2	Cap	316 SS/A479
3	Label	Polyester
4	Lock nut	RL3, R3A—powdered metal 300 series SS/B783; RL4, R4—316 SS/A276
5	Spring	S17700 SS/AMS 5678
6	Sleeve	304 SS/A240
7	Spring support	RL3, R3A—powdered metal 300 series SS/B783; RL4, R4—316 SS/A276
8	*Bonnet*	*316 SS/A479*
9	*O-ring*	*Fluorocarbon FKM*
10	*Quad seal*	*PTFE-coated fluorocarbon FKM*
11	*Retainer*	*RL3, R3A—316 SS/A666; RL4, R4—316 SS/A479*
12	*Stem*	*316 SS/A479*
12a	*Bonded stem*	*Fluorocarbon FKM-bonded① 316 SS/A479*
13	*Bonded disc*	
14	*Seat*	*316 SS/A479*
15	*Gasket*	*PTFE-coated 316 SS/A240*
16	*Seat retainer*	*316 SS/A479*
17	*O-ring*	*Fluorocarbon FKM*
18	*Insert*	*316 SS/A479*
19	*Body*	*316 SS/A182*
	Lubricants	*Molybdenum disulfide-based dry film and paste; silicone-based*

Dimensions

Dimensions are for reference only and are subject to change.





Valve with Manual Override Handle

Low-Pressure Valves (RL3 and RL4 Series)

End Connections		Ordering Number	Dimensions, in. (mm)					
Inlet/Outlet	Size		A	B	C	D	E	
RL3 series: 0.19 in. (4.8 mm) fully open orifice								
Swagelok tube fittings	1/4 in.	SS-RL3S4	2.70 (68.6)	1.44 (36.6)	1.60 (40.6)	0.43 (10.9)	4.14 (105)	
	6 mm	SS-RL3S6MM						
	8 mm	SS-RL3S8MM						
Male NPT/ Swagelok tube fitting	1/4 in.	SS-RL3M4-S4		1.19 (30.2)	1.60 (40.6)		3.89 (98.8)	4 (1
Male NPT/ female NPT	1/4 in.	SS-RL3M4-F4		1.19 (30.2)	1.17 (29.7)		3.89 (98.8)	
Male ISO/ female ISO①	1/4 in.	SS-RL3M4F4-RT		1.19 (30.2)	1.17 (29.7)		3.89 (98.8)	
RL4 series: 0.25 in. (6.4 mm) fully open orifice								
Swagelok tube fittings	1/2 in.	SS-RL4S8	4.09 (104)	1.83 (46.5)		0.50 (12.7)	5.92 (150)	
	12 mm	SS-RL4S12MM						
Male NPT/ Swagelok tube fitting	1/2 in.	SS-RL4M8S8		1.43 (36.3)	1.83 (46.5)		5.52 (140)	5 (1
Male NPT/ female NPT	1/2 in.	SS-RL4M8F8		1.43 (36.3)	1.43 (36.3)		5.52 (140)	

High-Pressure Valves (R3A and R4 Series)

End Connections		Ordering Number	Dimensions, in. (mm)					
Inlet/Outlet	Size		A	B	C	D	E	
R3A series: 0.14 in. (3.6 mm) fully open orifice								
Swagelok tube fittings	1/4 in.	SS-4R3A	2.70 (68.6)	1.44 (36.6)	1.60 (40.6)	0.43 (10.9)	4.14 (105)	
	6 mm	SS-6R3A-MM						
	8 mm	SS-8R3A-MM						
Male NPT/ Swagelok tube fitting	1/4 in.	SS-4R3A1		1.19 (30.2)	1.60 (40.6)		3.89 (98.8)	4 (1
Male NPT/ female NPT	1/4 in.	SS-4R3A5		1.19 (30.2)	1.17 (29.7)		3.89 (98.8)	
Male ISO/ female ISO①	1/4 in.	SS-4R3A5-RT		1.19 (30.2)	1.17 (29.7)		3.89 (98.8)	
R4 series: 0.25 in. (6.4 mm) fully open orifice								
Swagelok tube fittings	1/2 in.	SS-R4S8	4.09 (104)	1.83 (46.5)		0.50 (12.7)	5.92 (150)	
	12 mm	SS-R4S12MM						
Male NPT/ Swagelok tube fitting	1/2 in.	SS-R4M8S8		1.43 (36.3)	1.83 (46.5)		5.52 (140)	5 (1
Male NPT/ female NPT	1/2 in.	SS-R4M8F8		1.43 (36.3)	1.43 (36.3)		5.52 (140)	

Dimensions shown with Swagelok tube fitting nuts finger-tight.

① See specifications ISO 7/1, BS EN 10226-1, DIN-2999, and JIS B0203.

Ordering Information

Low-Pressure Valves (RL3 and RL4 Series)

Valve contains spring; set pressure must be adjusted. Select a valve ordering number.

Factory-Set Valves

RL3 and RL4 series valves are available with springs factory-set to a specified set pressure. Valves are set, tested, locked, and tagged with the set pressure; certificates of test are included.

To order, add **-SET** to the valve ordering number and specify the desired set pressure.

Example: SS-RL3S4**-SET**

Replacement Spring Kits

Spring kits include spring and installation instructions. Select a spring kit ordering number.

Options and Accessories

Seal Materials Fluorocarbon FKM is the standard seal material. Buna N, ethylene propylene, and neoprene and perfluorocarbon FFKM are available.

Quad seal elastomers are PTFE-coated.

To order a *valve* with an optional seal material, add a valve seal material designator to the valve ordering number.

Seal Material	Designator	
	Valves	Seal Kits
Buna N	-BU	BN①
Ethylene propylene	-EP	EP
Neoprene	-NE	NE
Perfluorocarbon FFKM②	-KZ	KZ
Fluorocarbon FKM	—	VI

①

②

Examples: SS-4R3A**-BU**
SS-RL3S4**-BU**

Series	Spring Kit Ordering Number	Set Pressure Range psig (bar)
RL3	177-13K-RL3	10 to 225 (0.7 to 15.5)
RL4	177-13K-RL4	

High-Pressure Valves (R3A and R4 Series)

Valve does not contain spring. Select a valve ordering number and a spring kit ordering number.

Spring Kits

Spring kits include spring, label, 302 SS lock wire with seal, spring support, and installation instructions.

Select a spring kit basic ordering number and add the spring designator for the desired set pressure range.

Examples: **177-R3A-K1-F**
177-13K-R4-C

Set Pressure Range psig (bar)	Spring Designator	Spring Color
R3A series spring kit: basic ordering number 177-R3A-K1-		
50 to 350 (3.4 to 24.1)	A	Blue
350 to 750 (24.1 to 51.7)	B	Yellow
750 to 1500 (51.7 to 103)	C	Purple
1500 to 2250 (103 to 155)	D	Orange
2250 to 3000 (155 to 206)	E	Brown
3000 to 4000 (206 to 275)	F	White
4000 to 5000 (275 to 344)	G	Red
5000 to 6000 (344 to 413)	H	Green
R4 series spring kit: basic ordering number 177-13K-R4-		
50 to 350 (3.4 to 24.1)	A	Blue
350 to 750 (24.1 to 51.7)	B	Yellow
750 to 1500 (51.7 to 103)	C	Purple

Factory-Set Valves

R3A and R4 series valves are available with springs factory-set to a specified set pressure. Valves are set, tested, locked, and tagged with the set pressure; certificates of test are included.

To order, add **-SET** and a spring designator whose range includes the desired set pressure to the valve ordering number; specify the desired set pressure.

Example: SS-4R3A-**SETB**

To order a *replacement seal kit,* insert a seal kit material designator as a prefix (R3A series) or suffix (all others) to the seal kit basic ordering number.

Examples: **BU**-R3A-K2
SS-3K-RL3-**BN**

RL3 Series	R3A Series	RL4 Series	R4 Series
Seal kit basic ordering number			
SS-3K-RL3-	-R3A-K2	SS-3K-RL4-	SS-3K-R4-
Seal kit contents			
O-ring, quad seal, bonded disc, retainer, instructions	O-rings (2), quad seal, retainer, instructions	O-ring, quad seal, bonded disc, retainer, instructions	O-ring, quad seal, bonded stem, instructions

Special Cleaning and Packaging (SC-11)

To order R series relief valves processed in accordance with Swagelok *Special Cleaning and Packaging (SC-11)* (MS-06-63) to ensure compliance with product cleanliness requirements stated in ASTM G93 Level C, add **-SC11** to the valve ordering number.

Example: SS-RL3S4-**SC11**

Oxygen Service Hazards

For more information about hazards and risks of oxygen- enriched systems, see the Swagelok *Oxygen System Safety* technical report (MS-06-13), page 1184

Manual Override Handles

A manual override handle opens the valve without changing the set pressure.

For use with:

- RL3 and RL4 series— standard spring
- R3A series—A, B, and C springs only
- R4 series—A spring only. Handle diameter is 1.50 in. (38.1 mm). Maximum overall height of valve with handle in closed position:
- 5.16 in. (131 mm) for R3A and RL3 series
- 6.78 in. (172 mm) for R4 and RL4 series

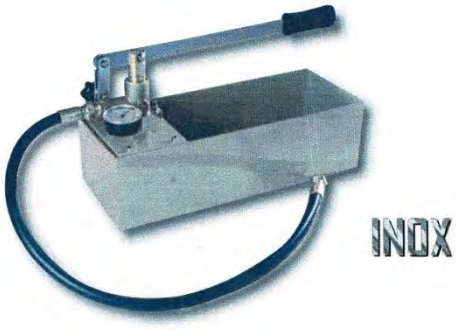
14.3 Test and Calibration Pump for Pressure Relief Valve

OPERATING INSTRUCTIONS
MANUAL DE INSTRUCCIONES
MANUEL D'INSTRUCTIONS

WHEELER REX

TESTING PUMP / BOMBA DE COMPROBACIÓN / POMPE D'EPREUVE

ENGLISH



SAFETY INSTRUCTIONS

Attention! Be careful.

1. The pressure created could lead to serious injury.
2. Respect general safety instructions, use protective footwear and eyewear.
3. Check that pressure hoses are free from obstruction and damage. If necessary, replace only with original spare parts.
4. Check inlet filter before performing any testing operation.
5. If you don't use the pump for a long time, and/or in low temperature countries, put a small amount of anti-freeze solution inside the pump. This will extend the gasket working life.
6. The pump is made for transplant works, repairs and water installations. The liquids that can be used should have maximum1.5mPas viscosity and use water solutions between 7 and 12 pH.

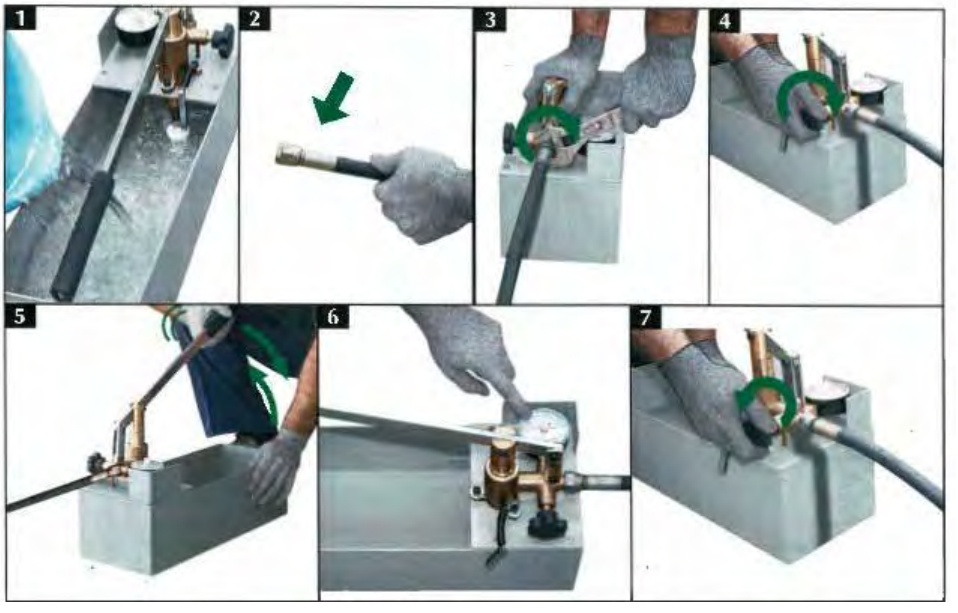
TECHNICAL CHARACTERISTICS

Capacity	12 l/min
Pressure	COD. 60011 ___60 bar = 860 Psi
	COD. 60012 ___100 bar = 1440 Psi
Hose connection	1/2"
Weight	8 Kgs.

WORKING INSTRUCTIONS

Check that all components are fine and correctly in place.

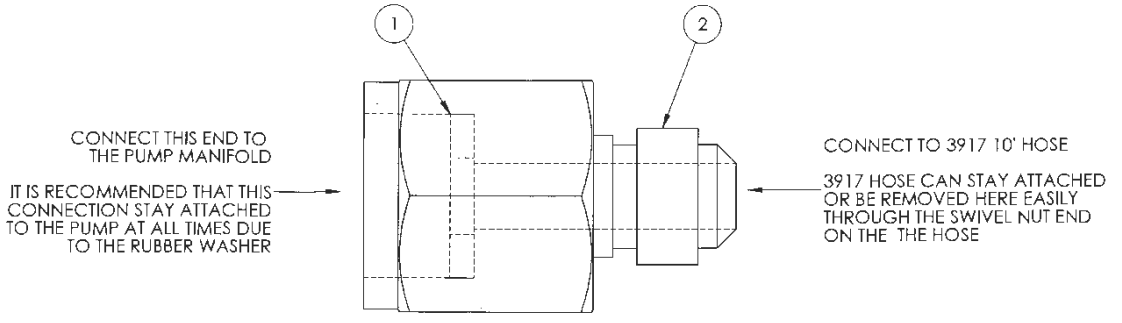
1. Fill the tank with clean water. The filter must be always correctly placed.
2. Connect the hose to the installation to be checked.
3. Connnect the hose to the pump, getting sure that there is no leakage.
4. Close up the valve.
5. Pump up until reach the pressure test.
6. Leave the pump with required pressure during testing time.
7. Open up the valve allowing water ways.



SOLUTION TO THE POSSIBLE PROBLEM OF LOSS OF PRESSURE OR IMPROPERLY PUMPING OF THE TESTING PUMPS

When the testing pump shows an effect of loss of pressure or improperly pumping, because it is hard or it does not pump water, the main reason used to be that the outlet valve is blocked by impurities of water as lime, cement, dust or other sustances.

ASSEMBLE THE HOSE ADAPTER TO THE PUMP MANIFOLD PRIOR TO USE



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	277326	RUBBER WASHER	1
2	277327	MJICF x F-FLAT FACED BSPP ADAPTER	1

It is possible to solve this trouble following next steps:

1. Disassemble the set of the outlet valve using a 5 mm Allen. This "set of the outlet valve" has four pieces:

   - Ref.- 81144 - Grooved stud
   - Ref.- 81163 - Spring
   - Ref.- 81155 - O-ring gasket
   - Ref.- 81158 - Plug

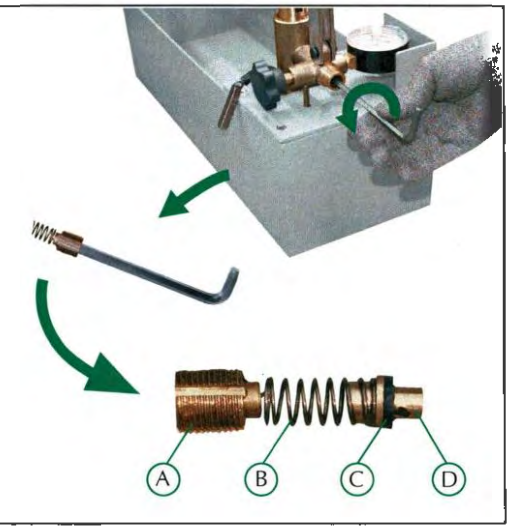
2. Check that these four pieces are in good conditions and clean any dirtiness they could have (probably this dirtiness blocked the outlet valve).

3. Clean the place of the outlet valve using a cylindrical brush or using compressed-air.

4. Assemble back the four pieces in the same way screwing them on without forcing the spring, it means, do not screw on to the end. If the spring is forced, the flow of water will be blocked by it. A correct adjust could be tested pumping water.
   For adjusting the set of the outlet valve, it could be screwing on until feel the spring power (do not continue screwing on) and then loosen one or two turns.

5. Pump water to check the correct adjustment of the outlet valve.
   a) If the handle is too hard, loosen the outlet valve using a 5 mm Allen a little bit.
   b) If the valve loses pressure, screw on a little bit this valve using a 5 mm Allen.

81144	Grooved stud	A
81163	Spring	B
81155	O-ring gasket	C
81158	Plug	D



4

NOTES

IMPORTANT!

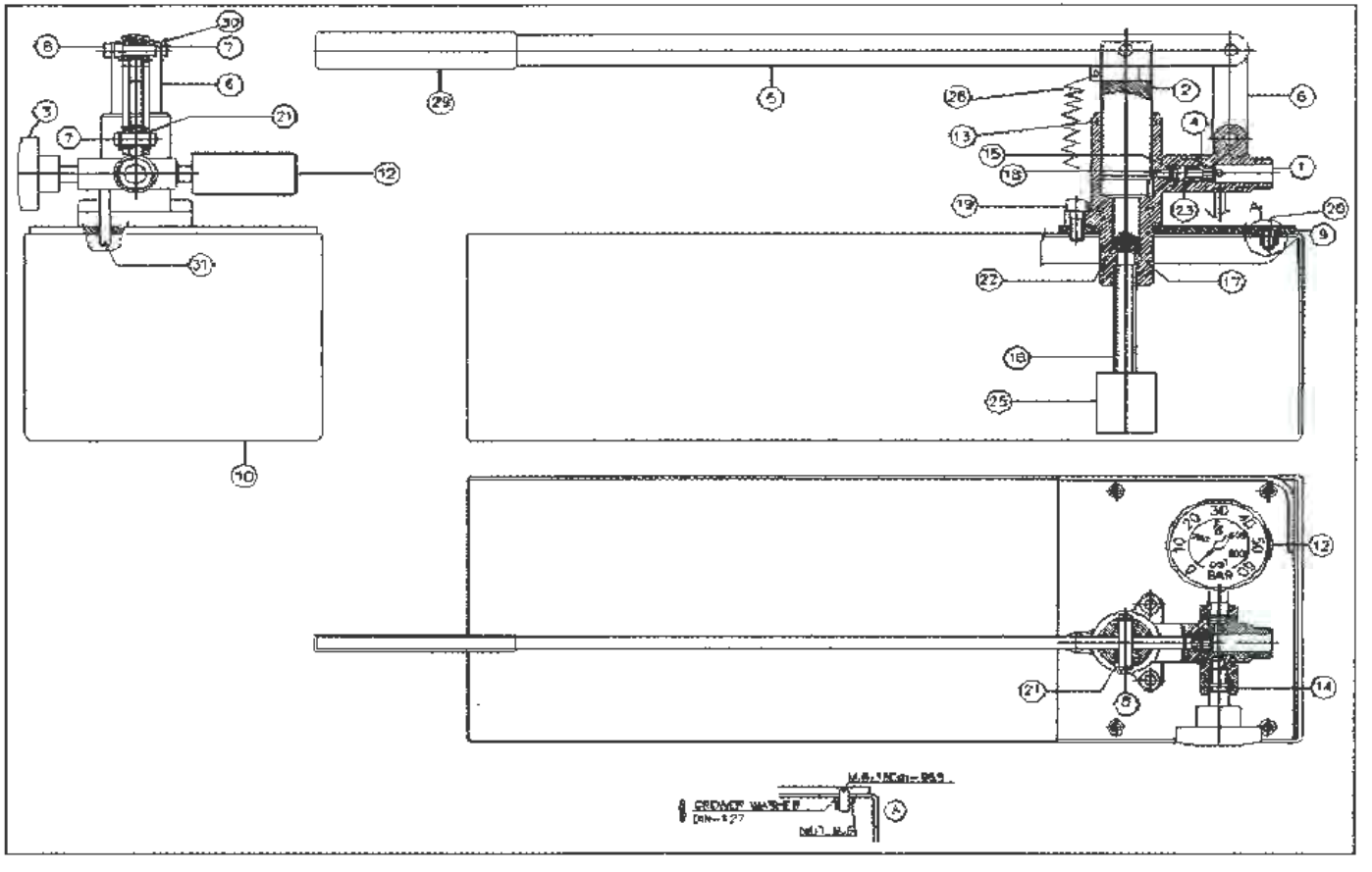
The maker will not take responsibility for damage or malfunction as a result of the Testing Pump being incorrectly used or, applied for a purpose for which it was not intended.

For ordering spare parts, please refer to the Spare Parts Drawing and note the needed number.

GUARANTEE

The maker guarantees to the machine owner 12 months against any manifacture defect.
This guaranteee do not cover the parts wich are consumables.

Note: to apply the guarantee its necesary to send the "GUARANTEE CERTIFICATE" duly filled within one week after purchased the machine to the maker.



Item No	Code	Description	Quantity Reqd	
25	80072	Filter	1	
1	81141	Valve Body	1	
2	81142	Piston	1	
3	81143	Returning Knob	1	
4	81144	Stud	1	
5	81145	Bar	1	
6	81146	Joint	2	
7	81147	Pin	2	
8	81148	Pin	1	
9	81149	Valve Setting Plate	1	
10	81150	Horizontal Tank	1	
11	81151	Hose	1	
12	29949	Monometer 60 bar	1	
12	81169	Monometer 100 bar	1	
13	81153	O-Ring	1	
14	81154	O-Ring	1	
15	81155	O-Ring	1	
16	81156	Aspiration Tube	1	
17	81157	Ball	1	
18	81158	Plug	1	
19	81159	Screw	3	
20	81160	Screw	4	
30	81177	Pin	3	
22	81162	Aspiration O-Ring	1	
23	81163	Spring Outway	1	
27	81165	Vertical Tank	1	
28	81166	Aspiration TubeVertical	1	
29	81167	Foam Handle	1	
26	81168	Transport Spring	1	
	81164	O-Rings Set	1	
	81140	Valve Set	1	
	81139	Hose	1	
	81138	O-Ring for hose	1	
31	81178	Returning Tube	1	
* 32	277326	Rubber Washer	1	B
* 33	277327	MJIC F x F-Flat Faced BSPP Adapter	1	B
* 34	3917	10' Hose, 3000psi	1	A
* Not Shown			6/27/2018	Rev B

COD.	Nº	DENOMINACIÓN	DESCRIPTION	DESCRIPTION	CANT / QTY / QTÉ
80072	25	FILTRO	FILTER	FILTRE	1
81141	1	CUERPO VÁLVULA	VALVE BODY	CORPS DE VALVE	1
81142	2	PISTÓN	PISTON	PISTON	1
81143	3	MANDO DE RETORNO	RETURNING KNOB	COMMANDE DE RETOUR	1
81144	4	ESPÁRRAGO VÁLVULA DE SALIDA	STUD	GOUPILLE	1
81145	5	PALANCA	BAR	LEVIER	1
81146	6	ARTICULACIÓN	JOINT	ARTICULATION	2
81147	7	PASADOR TIRANTE BRAZO	PIN	CLAVETTE	2
81148	8	PASADOR TIRANTE-ÉMBOLO	PIN	CLAVETTE	1
80401	9	TAPA APOYO VÁLVULA	VALVE SETTING PLATE	SUPPORT DE VALVE	1
80302	10	TANQUE HORIZONTAL DE ACERO INOXIDABLE	STAINLESS STEEL HORIZONTAL TANK	CUVE HORIZONTALE ACIER INOXYDABLE	1
29949	12	MANÓMETRO 60 BAR	MANOMETER 60 BAR	MANOMÈTRE 60 BARS	1
81153	13	JUNTA TÓRICA Ø30 X 3 (ÉMBOLO)	O-RING Ø30 X 3 PISTON	JOINT TORIQUE Ø30 X 3 PISTON	1
81154	14	JUNTA TÓRICA Ø7,3 X 2,4 (RETORNO)	O-RING Ø7,3 X 2,4 RETURNING	JOINT TORIQUE Ø7,3 X 2,4 RETOUR	1
81155	15	JUNTA TÓRICA Ø5,4 X 1,5 (SALIDA)	O-RING Ø5,4 X 1,5 OUT WAY	JOINT TORIQUE Ø5,4 X 1,5 SORTIE	1
81156	16	TUBO ASPIRACIÓN	ASPIRATION TUBE	TUBE D'ASPIRATION	1
81157	17	BOLA ASPIRACIÓN Ø14	BALL Ø14	BOULE Ø14	1
81158	18	TAPÓN VÁLVULA SALIDA	OUTLET VALVE PLUG	BOUCHON DE SORTIE DE VALVE	1
81159	19	TORNILLO FIJO VÁLVULA M8X20 DIN 912	SCREW M8X20 DIN 912	VIS M8X20 DIN 912	3
81160	20	TORNILLO PLACA M6 X15 DIN 7991	SCREW M6X15 DIN 7991	SCREW M6X15 DIN 7991	4
81177	30	PASADOR Ø3X15 DIN-94	PIN Ø3X15 DIN-94	PIN Ø3X15 DIN-94	3
81162	22	JUNTA TORICA Ø12X3 (ASPIRACIÓN)	ASPIRATION O RING Ø12 X 3	JOINT TORIQUE Ø12 X 3	1
81163	23	MUELLE VÁLVULA SALIDA	OUTLET VALVE SPRING	RESSORT DE SORTIE DE VALVE	1
81167	25	AGARRADERO GOMA ESPUMA	FOAM HANDLE	MANCHON	1
81168	26	MUELLE-CHAVETA TRANSPORTE	TRANSPORT SPRING	TRANSPORT SPRING	1
29950		KIT DE JUNTAS	O-RINGS SET	JEU DE JOINTS TORIQUES	1
81140		CONJUNTO VÁLVULA	VALVE SET	ENSEMBLE DE VALVE	1
3917		MANGUERA (ASIENTO PLANO Y CÓNICO)	HOSE (FLAT SEAT AND CONIC SEAT)	TUBE (BASE PLATE ET CONIQUE)	1
81138		JUNTA TÓRICA PARA MANGUERA (ASIENTO PLANO)	O-RING FOR HOSE WITH FLAT AND CONIC SEAT	JOINT TORIQUE POUR TUBE (BASE PLANE)	1
81178	31	TUBO DE RETORNO	RETURNING TUBE	RETOUR	1
81189		CONJUNTO VÁLVULA DE SALIDA	OUTLET VALVE SET	ENSEMBLE DE SORTIE DE VALVE	1

WHEELER REX

GUARANTEE CERTIFICATE
CERTIFICADO DE GARANTIA
CERTIFICAT DE GARANTIE

ITEM / ARTICULO / ARTICLE: .....

SERIE N° / N° DE SERIE / N° SERIE: .....

DISTRIBUTOR / DISTRIBUIDOR / DISTRIBUTEUR: .....

COUNTRY / PAIS / PAYS: .....TEL.:.....

FECHA DE VENTA / SALE DATE / DATE VENTE:.....

NOMBRE DEL COMPRADOR / BUYER NAME / NOM DE L'ACHETEUR:.....

BUYER TEL. / TEL. COMPRADOR / TEL. DE L'ACHETEUR:.....

WHEELER REX GUARANTEES TO THE BUYER OF THIS MACHINE THE TOTAL WARRANTY (DURING 12 MONTHS), OF THE PIECES WITH MANUFACTURING FAULTS. THIS GUARANTEE DOES NOT COVER THOSE PIECES WORN OUT DUE TO A NORMAL USE. IN ORDER TO OBTAIN THE VALIDITY OF THIS WARRANTY, IT IS ABSOLUTELY NECESSARY TO FULFILL THIS DOCUMENT AND RESEND IT TO WHEELER REX WITHIN 7 DAYS FROM SALE DATE.

WHEELER REX GARANTIZA AL COMPRADOR DE ESTA MAQUINA LA GARANTIA TOTAL (DURANTE 12 MESES), DE LAS PIEZAS CON DEFECTOS DE FABRICACION. ESTA GARANTIA NO CUBRE AQUELLAS PIEZAS QUE POR SU USO NORMAL TIENEN UN DESGASTE. PARA OBTENER LA VALIDEZ DE LA GARANTIA, ES ABSOLUTAMENTE IMPRESCINDIBLE QUE COMPLETE Y REMITA ESTE DOCUMENTO A WHEELER REX, DENTRO DE LOS SIETE DIAS A PARTIR DE LA FECHA DE COMPRA

WHEELER REX GARANTIE A L'ACHETEUR DE CETTE MACHINE LA GARANTIE TOTALE (PENDANT 12 MOIS) DES PIECES AVEC DEFAUTS DE FABRICATION. CETTE GARANTIE NE COUVRE PAS LES PIECES QUI PAR UN USAGE NORMAL, SOIENT DETERIOREES. POUR OBTENIR LA VALIDITE DE LA GARANTIE, IL EST ABSOLUMENT IMPERATIF COMPLETER ET ENVOYER CE DOCUMENT WHEELER REX, DANS UN DELAI DE 7 JOURS A PARTIR DE LA DATE D'ACHAT

STAMP / SELLO / CACHET

COPY FOR WHEELER REX / EJEMPLAR PARA WHEELER REX / EXEMPLAIRE POUR WHEELER REX

WHEELER REX

GUARANTEE CERTIFICATE
CERTIFICADO DE GARANTIA
CERTIFICAT DE GARANTIE

ITEM / ARTICULO / ARTICLE: .....

SERIE N° / N° DE SERIE / N° SERIE: .....

DISTRIBUTOR / DISTRIBUIDOR / DISTRIBUTEUR: .....

COUNTRY / PAIS / PAYS: .....TEL.:.....

FECHA DE VENTA / SALE DATE / DATE VENTE:.....

NOMBRE DEL COMPRADOR / BUYER NAME / NOM DE L'ACHETEUR:.....

BUYER TEL. / TEL. COMPRADOR / TEL. DE L'ACHETEUR:.....

WHEELER REX GUARANTEES TO THE BUYER OF THIS MACHINE THE TOTAL WARRANTY (DURING 12 MONTHS), OF THE PIECES WITH MANUFACTURING FAULTS. THIS GUARANTEE DOES NOT COVER THOSE PIECES WORN OUT DUE TO A NORMAL USE. IN ORDER TO OBTAIN THE VALIDITY OF THIS WARRANTY, IT IS ABSOLUTELY NECESSARY TO FULFILL THIS DOCUMENT AND RESEND IT TO WHEELER REX WITHIN 7 DAYS FROM SALE DATE.

WHEELER REX GARANTIZA AL COMPRADOR DE ESTA MAQUINA LA GARANTIA TOTAL (DURANTE 12 MESES), DE LAS PIEZAS CON DEFECTOS DE FABRICACION. ESTA GARANTIA NO CUBRE AQUELLAS PIEZAS QUE POR SU USO NORMAL TIENEN UN DESGASTE. PARA OBTENER LA VALIDEZ DE LA GARANTIA, ES ABSOLUTAMENTE IMPRESCINDIBLE QUE COMPLETE Y REMITA ESTE DOCUMENTO A WHEELER REX, DENTRO DE LOS SIETE DIAS A PARTIR DE LA FECHA DE COMPRA

WHEELER REX GARANTIE A L'ACHETEUR DE CETTE MACHINE LA GARANTIE TOTALE (PENDANT 12 MOIS) DES PIECES AVEC DEFAUTS DE FABRICATION. CETTE GARANTIE NE COUVRE PAS LES PIECES QUI PAR UN USAGE NORMAL, SOIENT DETERIOREES. POUR OBTENIR LA VALIDITE DE LA GARANTIE, IL EST ABSOLUMENT IMPERATIF COMPLETER ET ENVOYER CE DOCUMENT WHEELER REX, DANS UN DELAI DE 7 JOURS A PARTIR DE LA DATE D'ACHAT

STAMP / SELLO / CACHET

COPY FOR THE CUSTOMER / EJEMPLAR PARA EL CLIENTE / EXEMPLAIRE POUR LE CLIENT

14.4 Danfoss APP High Pressure Pump Specifications

1. Introduction

This data sheet is valid for APP pumps both non ATEX and ATEX certified. ATEX certified pumps are indicated by Ex in the type designation - example APP 0.6 Ex.

The Danfoss range of APP high-pressure pumps is designed according to EN 809 for use in RO applications with low viscosity and corrosive fluids such as:
- Sea water
- Brackish water
- Waste water (APP W)

Danfoss APP pumps are positive displacement pumps with axial pistons that move a fixed amount of water in each cycle. Flow is proportional to the number of input shaft revolutions (rpm). Unlike centrifugal pumps, they produce the same flow at a given speed no matter what the discharge pressure.

Below sectional drawing is an example of an APP pump. The sectional drawing for the specific pump sizes are to be found in the pump instruction.

1. Shaft sealing
2. Port flange
3. Bleeding plug
4. Retainer plate
5. Piston/shoe
6. Valve plate
7. Swash plate
8. Cylinder barrel
9. Springs
10. Port plate
11. Flushing valve (not available on APP 5.1-10.2)
12. Housing
13. Tail stock screws
14. Drain plug

2. Benefits

- Zero risk of lubricant contamination:
  - Oil lubricants are replaced with the pumped medium, water, so there is no contamination risk from the pump.
- Low maintenance costs:
  - Efficient design and all-stainless steel construction ensure exceptionally long life. When Danfoss specifications are met, service intervals of 8,000 hours can be expected. Service is easy, and can be carried out on-site due to the simple design and few parts.
- Low energy costs:
  - The highly efficient axial piston design provides the lowest energy consumption of any comparable pump on the market.
- Easy installation:
  - The most compact and lightest design available.
  - The pump can be installed vertically and horizontally.
  - No pulsation dampeners necessary due to extremely low pressure pulsation.
  - Powered directly by electric motors or combustion engines (with special coupling).
  - All pumps except APP(W) 5.1 - 10.2 are supplied with an integrated flushing valve that allows the fluid to flow from inlet to the outlet, when the pump is not running.
- High reliability:
  - All parts are made of high corrosion resistant materials e.g. Duplex (EN1.4462/ UNS S31803/SAF 2205) and Super Duplex (EN1.4410/UNS S32750/ SAF 2207) stainless steel and carbon reinforced PEEK.
- Certified quality:
  - Pump available as ATEX certified: category 2, zone 1 or category 3, zone 3. For other certifications, please see data sheets for APP S (all super duplex) and APP S 674 (API).
  - Positive Material Identification (PMI) report available on request.
  - ISO 9001, ISO 14001.

3. Application examples

Danfoss APP pumps are built into a broad range of RO desalination plants around the world:

- Containerized solutions for hotels, resorts and residences on islands and in coastal regions
- Mobile systems for humanitarian and military organizations
- Onboard systems for ships and yachts
- Offshore platforms for the oil and gas industry
- Municipal and regional waterworks

4 Technical data

4.1 APP 0.6-1.0

Pump size		APP 0.6	APP 0.8	APP 1.0
Code number APP		180B3048	180B3037	180B3049
Code number APP ATEX[4]		180B3148	180B3137	180B3149
Geometric displacement	cm^3/rev.	4.07	5.08	6.30
	in^3/rev.	0.25	0.31	0.38
Pressure				
Max. outlet [1] pressure continuous	barg	80	80	80
	psig	1160	1160	1160
Min. outlet [1] pressure	barg	20	20	20
	psig	290	290	290
Inlet pressure [2] continuous	barg	0.5 - 5	0.5 - 5	0.5 - 5
	psig	7.3 - 72.5	7.3 - 72.5	7.3 - 72.5
Max. inlet pressure peak	barg	10	10	10
	psig	145	145	145
Speed				
Min. speed continuous	rpm	700	700	700
Max. speed [2] continuous	rpm	3450	3450	3450
Typical flow - Flow curves available in item 5				
1000 rpm at max. pressure	m^3/h	0.22	0.29	0.36
1500 rpm at max. pressure	m^3/h	0.34	0.43	0.54
1200 rpm at max. pressure	gpm	1.18	1.52	1.90
1800 rpm at max. pressure	gpm	1.78	2.28	2.84
Technical specifications				
Media [3] temperature	°C	2 - 50	2 - 50	2 - 50
	°F	36 - 122	36 - 122	36 - 122
Ambient temperature	°C	0-50	0-50	0-50
	°F	32 - 122	32 - 122	32 - 122
Weight (dry)	kg	5.2	5.2	5.2
		11.5	11.5	11.5
Sound pressure level, LPA 1m[5]	dB(A)	74	74	74
Footprint with IEC motor[6]	m^2	0.1	0.1	0.14
	$foot^2$	1.08	1.08	1.51
Typical motor size				
Max. speed at max. pressure	kW	2.2	3.0	4.0
3000 rpm at max. pressure	HP	3	5	5
Torque at max. outlet pressure	Nm	5.8	7.2	8.9
	lbf-ft	4.2	5.3	6.6

[1] For lower and higher pressure, please contact Danfoss.
[2] For speeds above 3000 rpm the pump must be boosted at a pressure of 2-5 barg (29-72.5 psig).
[3] Dependent on the NaCl concentration - see chapter 8.
[4] Category 2, Zone 1 or Category 3, Zone 2.
[5] A-weighted sound pressure level at 1 m from the pump unit surfaces (reference box) acc. to EN ISO 20361 section 6.2. The noise measurements are performed acc. to EN ISO 3744:2010 on a motor-pump unit at max. pressure and speed.
[6] Max. area covered with recommended motor configuration (excl. of space to service pump)

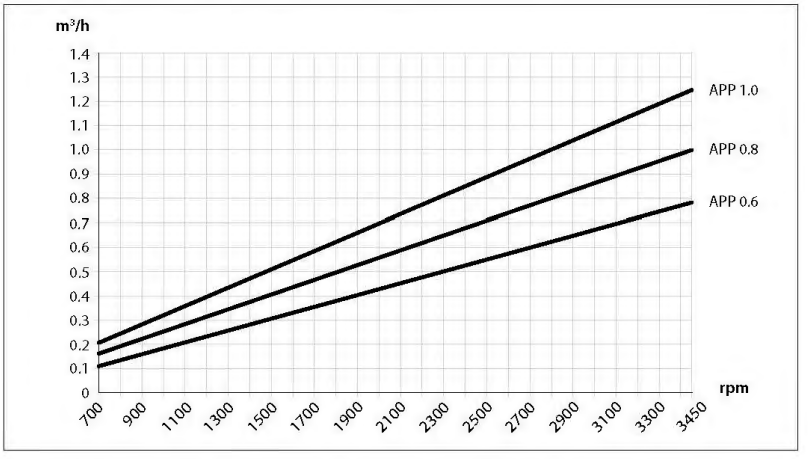
5. Flow at different rpm

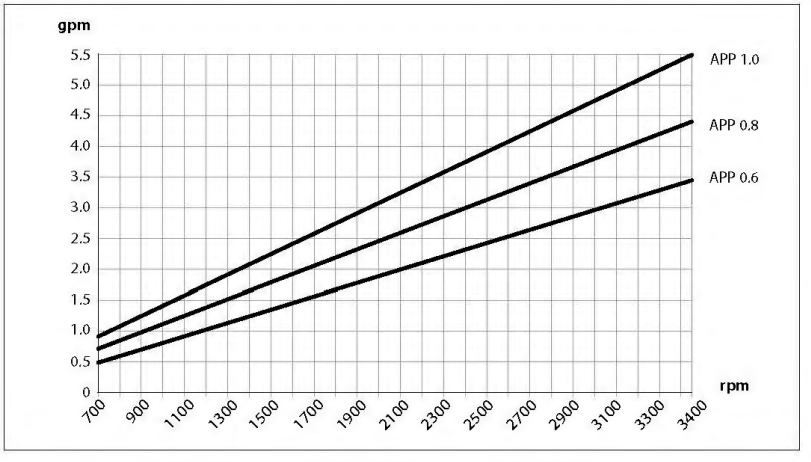
If the flow required and the rotation speed (rpm) of the pump is known, it is easy to select the pump fitting the application best by using the diagrams below.

Furthermore, these diagrams shows that the flow can be changed by changing the rotation speed of the pump. The flow/rpm ratio is constant, and the "required" flow can be obtained by changing the rotation speed to a corresponding value. Thus, the required rpm can be determined as:

$$\text{Required rpm} = \frac{\text{Required flow x Rated rpm}}{\text{Rated flow}}$$

5.1 APP 0.6-1.0 flow curves measured at 80 barg (1160 psig)

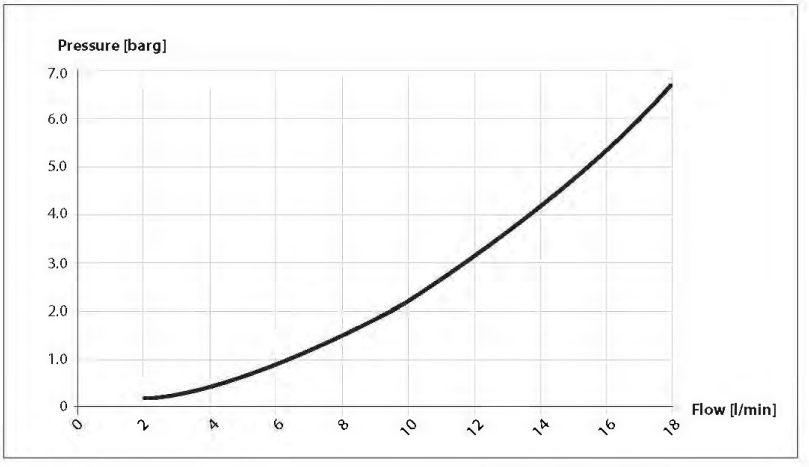




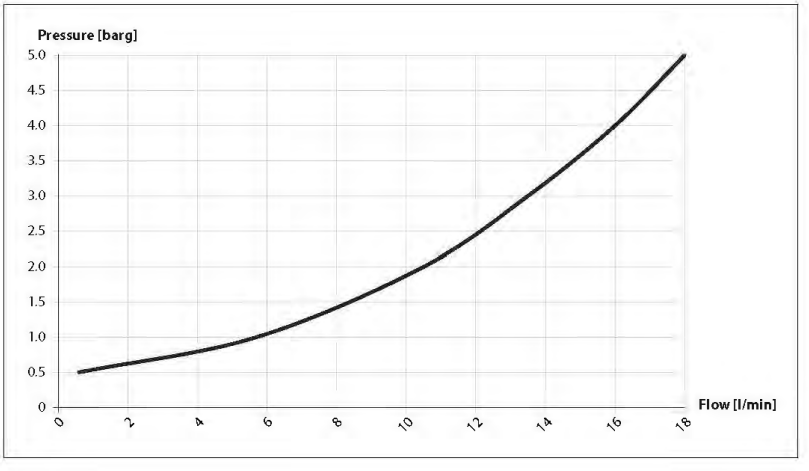
6 Flushing valve curves

All pumps except APP (W) 5.1 - 10.2 are supplied with an integrated flushing valve that allows the fluid to flow from inlet to the outlet, when the pump is not running.

6.1 APP 0.6–1.0 integrated flushing valve



6.2 APP 1.5–3.5 integrated flushing valve



7. Motor requirements

The power requirements can be determined using one of the following guiding equations:

$$\text{Required power} = \frac{\text{l/min x barg}}{\text{Calc. factor}} \text{ [kW] or } \frac{\text{16.7 x m}^3\text{/h x barg}}{\text{Calc. factor}} \text{ [kW] or } \frac{\text{0.26 x gpm x psig}}{\text{Calc. factor}}$$

1 hp	=	0.75 kW
1 gpm	=	3.79 l/min
1 m^3/h	=	4.40 gpm
1 kW	=	1.34 hp
1 l/min	=	0.26 gpm
1 gpm	=	0.23 m^3/h

7.1 Calculation factor for APP 0.6-1.0

Name	rpm	Calculation factor
APP 0.6	3450	496
APP 0.8	3450	509
APP 1.0	3450	512

7.2 Calculation factor for APP 1.5-3.5

Name	rpm	Calculation factor
APP 1.5	3450	519
APP 1.8	3450	524
APP 2.2	3450	532
APP 2.5	3000	535
APP 3.0	3450	532
APP 3.5	3000	530

7.3 Calculation factor for APP (W) 5.1-10.2

Name	rpm	Calculation factor
APP (W) 5.1	1800	506
APP (W) 6.5	1800	514
APP (W) 7.2	1800	518
APP (W) 8.2	1800	523
APP (W) 10.2	1800	528

7.4 Calculation factor for APP 11-13

Name	rpm	Calculation factor
APP 11	1200	513
APP 11	1500	502
APP 13	1200	516
APP 13	1500	505

7.5 Calculation factor for APP 16-22

Name	rpm	Calculation factor
APP 16	1200	540
APP 16	1500	533
APP 17	1200	541
APP 17	1500	536
APP 19	1200	537
APP 19	1500	531
APP 22	1200	540
APP 22	1500	535

7.6 Calculation factor for APP 21-43

Name	rpm	Calculation factor
APP 21	1200	543
APP 21	1500	531
APP 24	1200	547
APP 24	1500	537
APP 26	1200	543
APP 26	1500	534
APP 30	1200	545
APP 30	1500	540
APP 38	1500	541
APP 43	1700	537

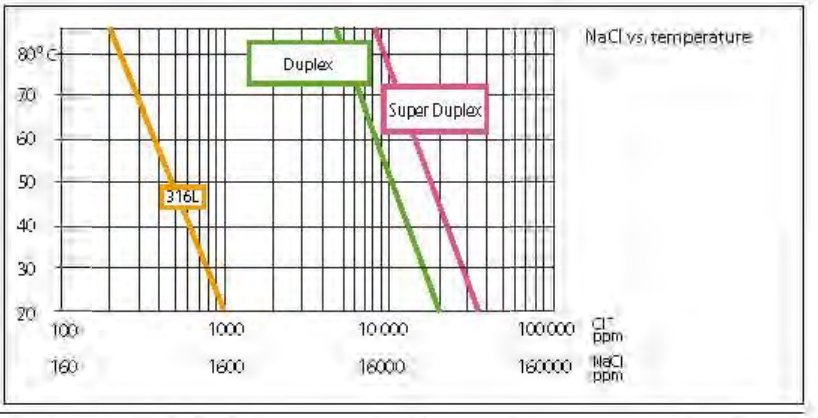
8. Temperature and corrosion

8.1 Temperature

Fluid temperature: Min. +2°C to max. +50°C (Min. +35.6°F to max. +122°F)
Ambient temperature: Min. +2°C to max. +50°C (Min. +35.6°F to max. +122°F)

In case of lower operating temperatures, please contact Danfoss High Pressure Pumps operation

stop in order to minimize the risk of crevice corrosion.
The chart below illustrates the corrosive resistance of different types of stainless steel related to NaCl concentration and temperature.
The APP water pump is made of Duplex and Super Duplex.
If the water pump is operated above the Duplex line, always flush water pump with fresh water at operation stop in order to minimize the risk of crevice corrosion.

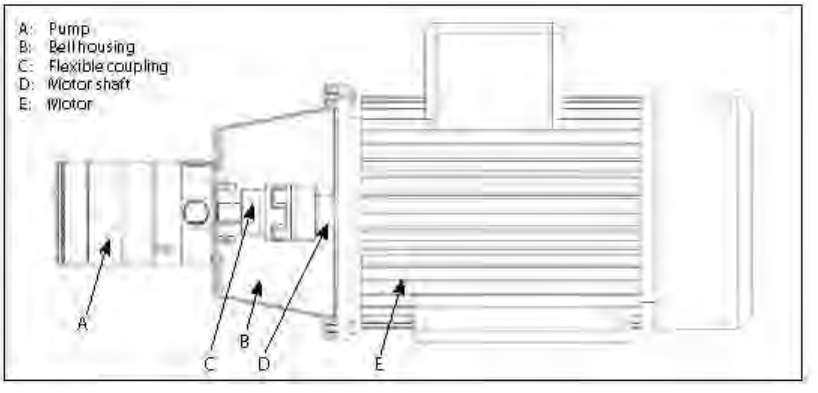


9. Installation

See example below on how to mount the pump and connect it to an electric motor or combustion engine (special coupling).

If alternative mounting is required, please contact your Danfoss sales representative for further information.

Note: Do not add any axial or radial loads to the pump shaft.



9.1 Filtration

Proper filtration is crucial for the performance. maintenance and warranty of your pump.

Protect your pump, and the application in which it is installed, and by always ensuring that all filtration specifications are met, and by always changing filter cartridges according to schedule.

Since water has very low vicosity, Danfoss APP pumps have been designed with very narrow clearances in order to control internal leakage rates and improve component performance.

To minimize wear on the pump, it is therefore essential to filter inlet water properly.

The main filter must have a filtration efficiency of 99.98% at 10 µm. We strongly recommend that you always use precision depth filter cartridges rated 10µm abs. $ß_{10}$≥5000.

Please note that we do not recommend bag filters or string-wound filter cartridges, which typically have only 50% filtration efficiency. This means that out of the 100,000 particles that enter such filters, 50,000 particles pass right through; compare this to precision depth filters that are 99.98% efficient, and only allow 20 of the same 100,000 particles to pass through.

For more information on the importance of proper filtration, including explanation of filtration principles, definitions and guidance on how to select the right filter for your pump, please consult our Filtration information and specifications (Danfoss document number 521B1009).

Noise

Since the pump unit is typical mounted on a frame or bell housing the overall noise level can only be determined for a complete system. To minimize vibrations and noise throughout the system, it is therefore very important to mount the pump unit correctly on a frame with anti-vibration-dampeners, and to use flexible hoses rather than metal pipes where possible.

The noise level is influenced by:

- **Pump speed:**
  High rpm generates more fluid/structure borne pulsations/vibrations than low rpm, because of higher frequency.
- **Discharge pressure:**
  High pressure generates more noise than low pressure.
- **Pump mounting:**
  Rigid mounting generates more noise than flexible mounting, because of structure-borne vibrations. Be sure to use dampers when mounting.
- **Connections to pump:**
  Pipes connected directly to the pump make more noise than flexible hoses, because of structure-borne vibrations.
- **Variable frequency drives (VFD):**
  Motors regulated by VFDs can produce more noise if the VFD does not have the right settings.

9.2 RO system with direct supply:

Inlet line:

a) Dimension the inlet line to obtain minimum pressure loss (large flow, minimum pipe length, minimum number of bends/connections, and fittings with low or no pressure losses). If relevant, please consult "Parallel coupled pumps and iSaves" (180R93549

Inlet filter:

b) Install an inlet filter (1) in front of the APP pump (2). Please consult section 9.1, "Filtration" for guidance on how to select the right filter. Thoroughly clean pipes and flush system prior to start-up.

Low pressure relief valve:

c) Install a low pressure relief valve (9) in order to avoid system or pump damage in case the pump stops momentarily or is spinning backwards.

Monitoring pressure switch:

d) Install a monitoring pressure switch (3) between the filter (1) and the pump inlet. Set the minimum inlet pressure according to specifications described in item 4 about technical data. If the inlet pressure is lower than the minimum pressure set, the monitoring pressure switch must prevent the pump from starting or from running.

Hoses:

e) Use flexible hoses (4) to minimize vibrations and noise. Please consult the Danfoss Hoses and hose fittings data sheet (521B0909) for guidance.

Inlet pressure:

f) In order to eliminate the risk of cavitation and other pump damage, pump inlet pressure must always be maintained according to specifications described in item 4 about technical data.

Flushing valve:

g) For easy system filling and flushing, an integrated flushing valve (6) is in the APP pump (except APP (W) 5.1-10.2).

Non-return valve:

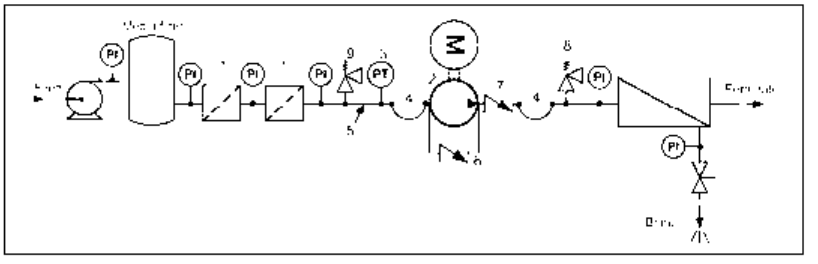
h) A non-return valve (7) in outlet can be installed in order to avoid backspin of the pump. The volume of water in the membrane vessel works as an accumulator and will send flow backwards in case of the pump stops momentarily.

High pressure safety or relief valve:

i) As the Danfoss APP pump begins to create pressure and flow immediately after start-up and regardless of any counter pressure, a safey or pressure relief valve (8) should be installed after the non-return valve to prevent system damage and to avoid high pressure peaks.

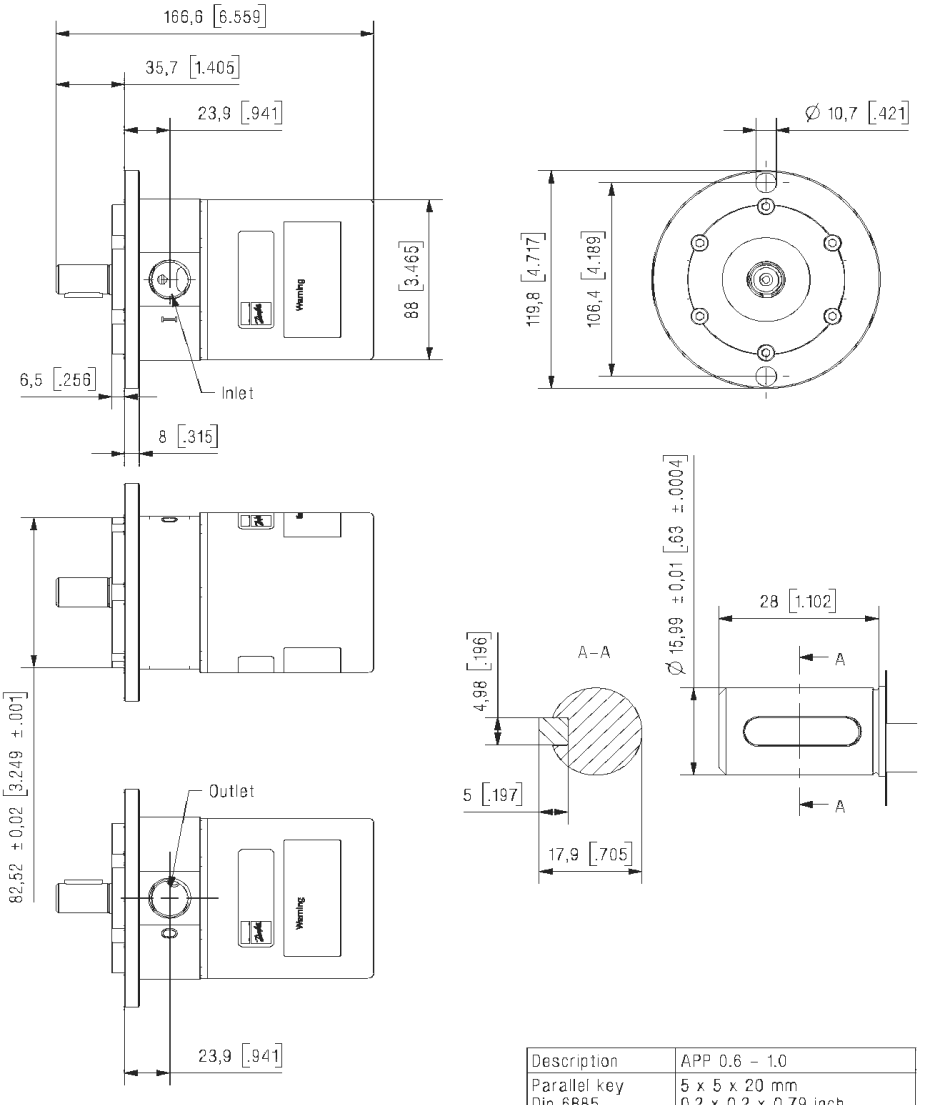
Note: If a non-return valve is mounted in the inlet line, a low-pressure relief valve is also required between the non-return valve and pump as protection against high-pressure peaks.

Preferred design - see section 9.2



10. Dimensions and connections

10.1 APP 0.6-1.0



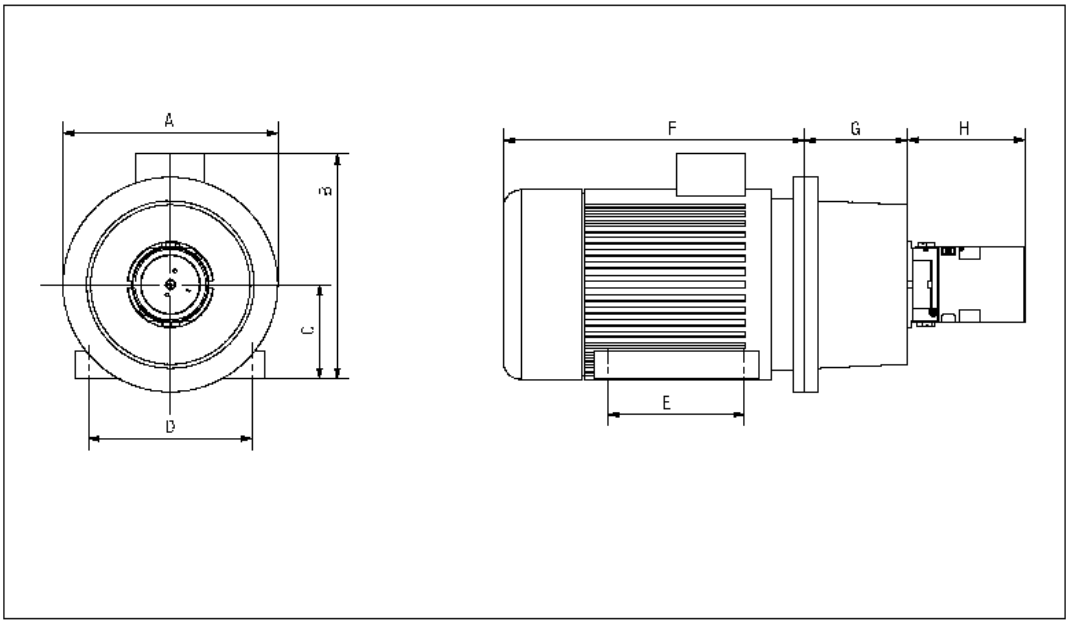
Dimensions without tolerances acc. To ISO 2768–1 designation C.

Description	APP 0.6 – 1.0
Parallel key Din 6885	5 x 5 x 20 mm 0.2 x 0.2 x 0.79 inch
Inlet	G 1/2"; depth 13 mm
Outlet	G 1/2"; depth 13 mm

11. Dimensions with motor unit

11.1 APP 0.6-3.5

The examples of assemblies with motor are only for IEC motors and couplings. Please make sure to check required motor power and dimensions when selecting size of pump and motor. For advice and calculation tool, please contact Danfoss.



Pump	A mm (inch)	B mm (inch)	C mm (inch)	D mm (inch)	E mm (inch)	F mm (inch)	G mm (inch)	H mm (inch)	IEC Electric motor
APP 0.6	200 (7.87)	245 (9.64)	90 (3.54)	140 (5.51)	100 (3.94)	265 (10.43)	100 (3.94)	131 (5.16)	1.5 kW, IEC 90S-2
APP 0.8	200 (7.87)	245 (9.64)	90 (3.54)	140 (5.51)	125 (4.92)	290 (11.42)	100 (3.94)	131 (5.16)	2.2 kW, IEC 90L-2
APP 1.0	250 (9.84)	260 (10.23)	100 (3.94)	160 (6.30)	140 (5.51)	325 (12.80)	120 (4.72)	131 (5.16)	3.0 kW, IEC 100L-2
APP 1.5	250 (9.84)	260 (10.23)	100 (3.94)	160 (6.30)	140 (5.51)	325 (12.80)	120 (4.72)	166 (6.54)	3.0 kW, IEC 100L-2
APP 1.8	250 (9.84)	290 (11.42)	112 (4.41)	190 (7.48)	140 (5.51)	340 (13.39)	120 (4.72)	166 (6.54)	4.0 kW, IEC 112M-2
APP 2.2	300 (11.81)	338 (13.31)	132 (5.20)	216 (8.50)	140 (5.51)	403 (15.87)	144 (5.67)	166 (6.54)	5.5 kW, IEC 132S1-2
APP 2.5	300 (11.81)	338 (13.31)	132 (5.20)	216 (8.50)	178 (7.01)	403 (15.87)	144 (5.67)	166 (6.54)	7.5 kW, IEC 132S2-2
APP 3.0	350 (13.78)	422 (17.40)	160 (6.30)	254 (10.0)	210 (8.27)	505 (19.88)	188 (7.40)	166 (6.54)	11 kW, IEC 160M1-2
APP 3.5	350 (13.78)	422 (17.40	160 (6.30)	254 (10.0)	210 (8.27)	505 (19.88)	188 (7.40)	166 (6.54)	11 kW, IEC 160M1-2

14.5 Toray TM710D RO Membrane Specification

'TORAY'
Innovation by Chemistry

Standard BWRO

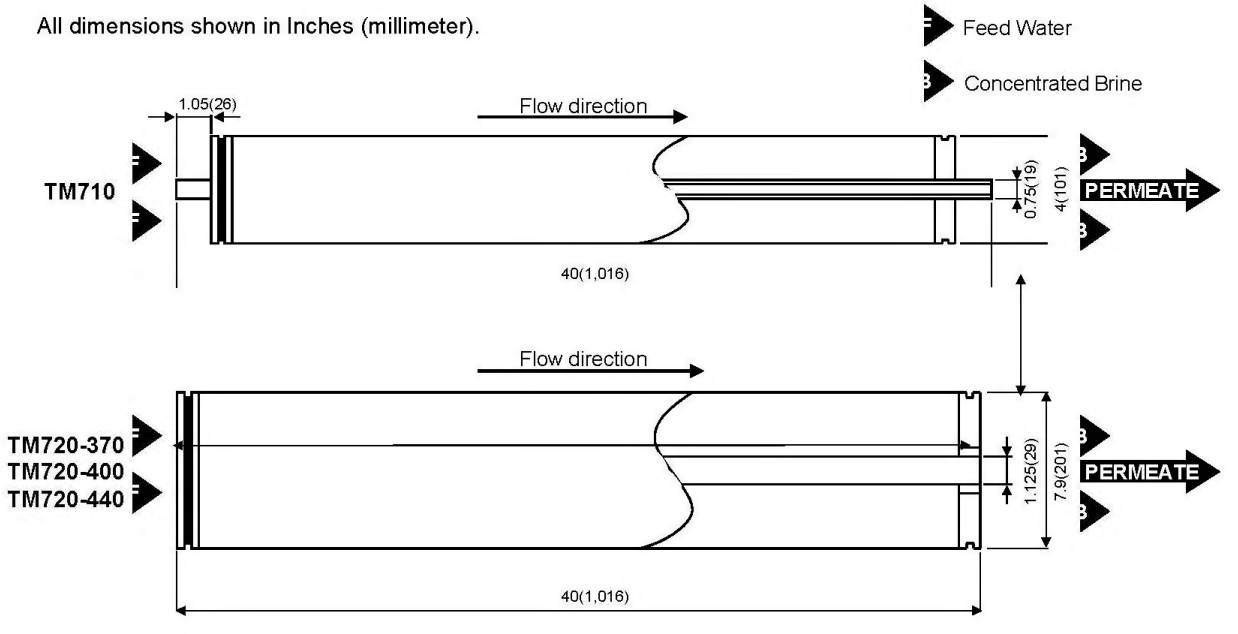
TM700

Type	Diameter Inch	Membrane Area ft²(m²)	Salt Rejection %	Product Flow Rate gpd(m³ / d)	Feed Spacer Thickness mil
TM710	4"	87(8)	99.7	2,400(9.1)	31
TM720-370	8"	370(34)	99.7	9,500(36.0)	31
TM720-400	8"	400(37)	99.7	10,200(38.6)	31
TM720-440	8"	440(41)	99.7	11,300(42.6)	28

1. Membrane Type		Cross Linked Fully Aromatic Polyamide Composite
2. Test Conditions	Feed Water Pressure Feed Water Temperature Feed Water Concentration Recovery Rate Feed Water pH	225 psi(1.55MPa) 77° F(25℃) 2,000 mg/l Nacl 15% 7
3. Minimum Salt Rejection		99.0%
4. Minimum Product Flow Rate		2,000gpd(7.6m³/d)(TM710) 7,500gpd(28.4m³/d)(TM720-370) 8,200gpd(31.0m³/d)(TM720-400) 9,000gpd(34.1m³/d)(TM720-440)

Dimensions

All dimensions shown in Inches (millimeter).



Operating Limits

Maximum Operating Pressure	600psi (4.1 MPa)
Maximum Feed Water Temperature	113° F (45℃)
Maximum Feed Water SDI_{15}	5
Feed Water Chlorine Concentration	Not Detectable
Feed Water pH Range, Continuous Operation	2-11
Feed Water pH Range, Chemical Cleaning	1-12
Maximum Pressure Drop per Element	15 psi (0.10 MPa)
Maximum Pressure Drop per Vessel	50 psi (0.34 MPa)

Operating Information

1. For the recommended design range, please consult the latest Toray technical bulletin, design guide lines, computer design program, and/ or call an application specialist. If the operating limits given in this Product Information Bulletin are not strictly followed, the Limited Warranty will be null and void.
2. All elements are wet tested, treated with a 1% by weight percent sodium bisulfite storage solution, and then vacuum packed in oxygen barrier bags, or treated with tested feed water solution, and then vacuum packed in oxygen barrier bags with deoxidant inside. To prevent biological growth during short term storage, shipment, or system shutdown, it is recommended that Toray elements be immersed in a protective solution containing 500 - 1,000 ppm of sodium bisulfite (food grade) dissolved in permeate.
3. The presence of free chlorine and other oxidizing agents under certain conditions, such as heavy metals which acts as oxidation catalyst in the feed water will cause unexpected oxidation of the membrane. It is strongly recommended to remove these oxidizing agents contained in feed water before operating RO system.
4. Permeate from the first hour of operation shall be discarded.
5. The customer is fully responsible for the effects of chemicals that are incompatible with the elements. Their use will void the element Limited Warranty.

Notice

1. Toray accepts no responsibility for results obtained by the application of this information or the safety or suitability of Toray's products, either alone or in combination with other products. Users are advised to make their own tests to determine the safety and suitability of each product combination for their own purposes.
2. All data may change without prior notice, due to technical modifications or production changes.

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Fax: +81 3 3245 4913
http:/ / www.toraywater.com

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Toray BlueStar Membrane Co., Ltd.

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JUL. 2014

14.6 Hanna Instruments BL983313-1 EC Indicator Specification

Instruction Manual

BL 983313-0
BL 983313-1

Panel-Mounted EC Indicators & Controllers

Black Stone

Dear Customer,

Thank you for choosing a Hanna product.

This manual will provide you with the necessary information for the correct operation of the meter. Please read it carefully before using the instrument.

If you need additional technical information, do not hesitate to e-mail us at **techserv@hannacan.com.**

These instruments are in compliance with the CE directives.

PRELIMINARY EXAMINATION

Remove the instrument from the packing material and examine it carefully. If any damage has occurred during shipment, immediately notify your Dealer or the nearest Hanna Customer Service Center.

Each meter is supplied with:

- Mounting brackets
- Instruction manual

Note: Conserve all packing material until the instrument has been observed to function correctly. Any defective item must be returned in its original packing.

SPECIFICATIONS

Range	0 to 1999 µS/cm
Resolution	1 µS/cm
Accuracy (@ 20°C/68°F)	±2% f.s.
Typical EMC Deviation	±2% f.s.
Probe	HI 7634-00 EC/TDS probe (not included)
Temp.Compensation	Automatic from 5 to 50°C (41 to 122°F); β=2%/°C
Calibration	Manual, through CAL trimmer
Dosing Contact	Maximum 2A (fuse protected), 250 Vac, 30 Vdc Contact close when measure > setpoint
Setpoint	Adjustable, from 0 to 1999 µS/cm
Overtime	Adjustable, typically from 5 to approx. 30 minutes
Power Consumption	10 VA
Installation Category	II
Power supply:	External (fuse protected)
BL983313-0	12 Vdc
BL983313-1	115/230 VAC ; 50/60Hz
Dimensions	83 x 53 x 99 mm (3.3x2.1x3.9")

CE DECLARATION OF CONFORMITY

HANNA instruments

CE

DECLARATION OF CONFORMITY

We

Hanna Instruments Italia Srl
viale delle Industrie, 12/A
35010 Ronchi di Villafranca - PD
ITALY

herewith certify that the EC and TDS controllers:

BL983313, BL983315, BL983317, BL983318, BL983319, BL983320, BL983321, BL983322, BL983324, BL983327, BL983329

have been tested and found to be in compliance with EMC Directive 89/336/EEC and Low Voltage Directive 73/23/EEC according to the following applicable normatives:

EN 50082-1: Electromagnetic Compatibility - Generic Immunity Standard
IEC 61000-4-2 Electrostatic Discharge
IEC 61000-4-3 RF Radiated
IEC 61000-4-4 Fast Transient

EN 50081-1: Electromagnetic Compatibility - Generic Emission Standard
EN 55022 Radiated, Class B

EN61010-1: Safety requirements for electrical equipment for measurement, control and laboratory use

Date of issue: 12.11.2003

A.Marullo - Technical Director
On behalf of
Hanna Instruments S.r.l.

WARRANTY

These instruments are warranted for two years against defects in workmanship and materials when used for their intended purpose and maintained according to instructions. Probes are warranted for six months. This warranty is limited to repair or replacement free of charge.

Damages due to accident, misuse, tampering or lack of prescribed maintenance are not covered. If service is required, contact the dealer from whom you purchased the instrument. If under warranty, report the model number, date of purchase, serial number and the nature of the failure. If the repair is not covered by the warranty, you will be notified of the charges incurred. If the instrument is to be returned to Hanna Instruments, first obtain a Returned Goods Authorization Number from the Customer Service department and then send it with shipment costs prepaid. When shipping any instrument, make sure it is properly packaged for complete protection.

Recommendations for Users

Before using these products, make sure that they are entirely suitable for the environment in which they are used. Operation of these instruments in residential areas could cause unacceptable interferences to radio and TV equipment. Any variation introduced by the user to the supplied equipment may degrade the instrument's EMC performance. To avoid electrical shock, do not use these instruments when voltages at the measurement surface exceed 24 Vac or 60 Vdc. To avoid damages or burns, do not perform any measurement in microwave ovens.

GENERAL DESCRIPTION

BL983313-0 and **BL983313-1** are conductivity indicators and controllers with a relay output designed for simplicity of use in a wide range of applications.

Connections and wiring to probe, power supply and contacts are made via the terminal blocks on the rear panel.

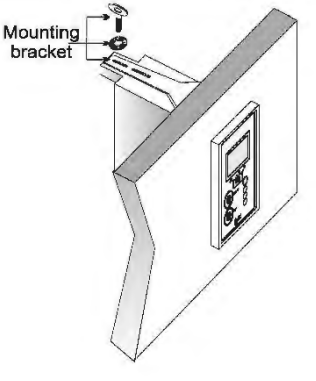
The probe is easy to clean and requires little maintenance.

Other features include: automatic temperature compensation of readings, single point calibration, overtime control system, multi-colour LED for indicating if the meter is in measurement/dosing/alarm condition, possibility to set (Off-Auto-On switch) dosing action mode.

Two models are available:

- **BL 983313-0** powered at 12 Vdc
- **BL 983313-1** powered at 115 or 230 Vac

ASSEMBLING VIEW

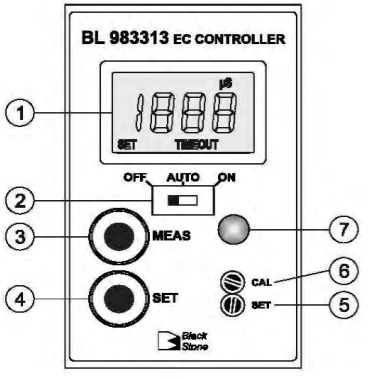


ACCESSORIES

HI 7634-00	EC/TDS probe
HI 70031P	1413 µS/cm calibration solution, 20 mL sachet (25 pcs)
HI 7031M	1413 µS/cm calibration solution, 230 mL
HI 7031L	1413 µS/cm calibration solution, 500 mL
HI 7061M	Probe cleaning solution, 230 mL bottle
HI 7061L	Probe cleaning solution, 500 mL bottle
HI 710005	12 Vdc power adapter, US plug
HI 710006	12 Vdc power adapter, European plug
HI 710012	12 Vdc power adapter, Australian plug
HI 710013	12 Vdc power adapter, South African plug
HI 710014	12 Vdc power adapter, UK plug
HI 731326	Calibration screwdriver (20 pcs)
HI 740146	Mounting brackets

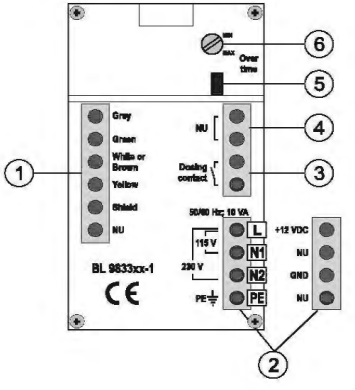
FUNCTIONAL DESCRIPTION

Front panel



1. Liquid Crystal Display
2. Switch for selecting dosing mode:
   - OFF = dosing disabled
   - Auto = automatic dosage, depending on setpoint value
   - ON = dosing always active
3. "MEAS" key to set the instrument to measurement mode
4. "SET" key to display and set the setpoint value
5. "SET" trimmer to adjust the setpoint value
6. "CAL" trimmer
7. 3-colour LED indicator:
   - Green = meter in measurement mode
   - Orange/Yellow = dosing in progress
   - Red, blinking = indicates an alarm condition

Rear panel



1. Connections for EC probe
2. Power supply terminal:
   - for BL983313-0 model: 12 Vdc adapter
   - for BL983313-1 model: 115 Vac or 230 Vac option
3. This contact acts as a switch for driving the dosing system (e.g. dosing pump)
4. Not used contact
5. Jumper for enabling (jumper in) or disabling (jumper removed) the overtime control
6. Trimmer for overtime setting (typically from 5 to 30 minutes)

⚠ All external cables connected to the rear panel should end with cable lugs.

⚠ A circuit breaker (rated 6A max.) must be connected in close proximity to the equipment, and in a position easy to reach by the operator, for disconnection of the instrument and of all the devices connected to the relays.

OPERATIONS

REAR PANEL CONNECTIONS

Terminals #1: Probe

- Connect the HI 7634-00 probe by following the wires colour indications.

Terminals #2: Power Supply

- Model BL983313-0: connect the 2 wires of a 12 Vdc power adapter to the terminals +12 Vdc and GND.
- Model BL983313-1: connect a 3-wire power cable to the terminals while paying attention to the correct earth (PE), line (L) and neutral (N1 for 115 V or N2 for 230 V) contacts.

Terminals #3: Dosing Contact

- This contact drives the dosing system, accordingly to the selected setpoint.

Note: The setpoint has a typical hysteresis value comparable to the meter accuracy.

Terminals #4: Not Used Contact

Overtime system: jumper (#5) and trimmer (#6)

- This system allows the user to set a maximum dosing period, by adjusting the rear trimmer from 5 (min) to approx. 30 (max) minutes.
- When the set time is exceeded, any dosing action stops, the LED indicator on the front panel will blink Red and the LCD will show the "TIMEOUT" warning message. To exit the overtime condition, set the OFF/Auto/ON switch to "OFF" position, and then to "Auto" again.
- For disabling the overtime feature, simply remove the jumper on the rear panel.

Note: The overtime system works only if the OFF/Auto/ON switch is in "Auto" position.

OPERATING THE METER

Before proceeding make sure that:

- the meter has been calibrated;
- the setpoint value has been properly adjusted;
- all rear panel wiring and selections are correct;
- the Auto/OFF/ON switch is in the desired position.

Install or immerse the probe in the solution to be monitored, then press the "MEAS" key (if necessary).
The LCD will show the EC (µS/cm) value. The LED indicator will light up Green when the meter is in measurement mode and dosing is not active, while will light up Orange/Yellow for signaling that a dosing action is in progress.

CALIBRATION

To calibrate the meter, proceed as follows:

- ensure the meter is in measurement mode;
- immerse the probe in HI 7031 calibration solution (1413 µS/cm);
- shake briefly and wait for reading to stabilize;
- adjust the "CAL" trimmer to read "1413 µS" on the LCD.

SETPOINT

Press the "SET" key: the display will show the default or previously adjusted value, together with the "SET" indication. Using a small screwdriver adjust the "SET" trimmer until the desired setpoint value is displayed.
After 1 minute the meter automatically returns to the normal mode; or press the "MEAS" key.

PROBE MAINTENANCE

To improve the probe performance and prolong its life, it is recommended to clean it regularly.

- Immerse the tip of the probe in HI 7061 Cleaning Solution at least for one hour.
- If a more thorough cleaning is required, brush the metal pins with very fine sandpaper.
- After cleaning, rinse the probe with tap water and recalibrate the meter.
- When not in use, clean the probe before storing it.

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