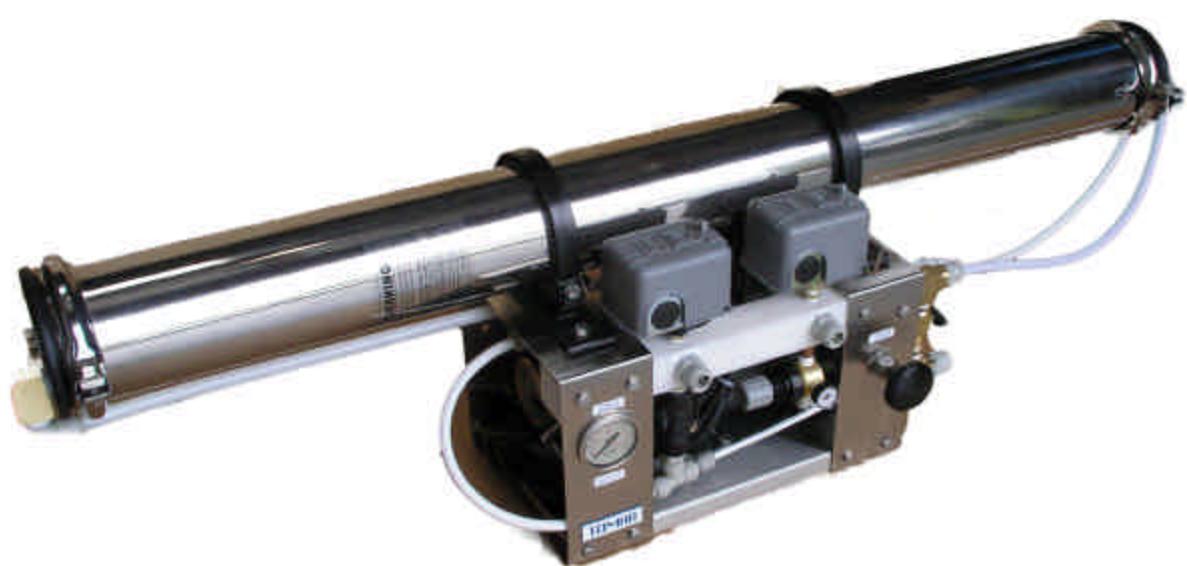


TOMAR TSM-1500

**REVERSE OSMOSIS TREATMENT SYSTEM
OWNER'S MANUAL**

**Tomar Water Systems Inc.
804 North Twin Oaks Valley Road #118
San Marcos, CA 92069**

tsm200man 07/06



TOMAR TSM-1500 R.O. SYSTEM

TABLE OF CONTENTS

1.0 INTRODUCTION	2
1.1 SYSTEM SPECIFICATIONS	2
2.0 SYSTEM ITEM IDENTIFICATION	3
2.1 SYSTEM ITEM DESCRIPTIONS	5
2.2 SYSTEM OPTIONS	6
3.0 PRE-INSTALLATION PROCEDURES	6
3.1 PACKAGING	6
3.2 RO SYSTEM OPERATION	6
3.2.1 FEED WATER CONSIDERATIONS	6
3.2.2 OPERATING PARAMETER SETTINGS	7
3.2.3 OPERATING PARAMETER CONDITIONS	7
3.3 PRE-FILTRATION	7
3.4 FAST FLUSH FEATURE	7
4.0 INSTALLATION	8
4.1 LOCATION	8
4.2 PLUMBING	8
4.2.1 WATER SUPPLY CONNECTION	8
4.2.2 DRAIN CONNECTION	8
4.2.3 PRODUCT TANK CONNECTIONS	8
4.3 ELECTRICAL (See Figure 3)	11
4.3.2 EXTERNAL PRESSURE TANK	11
5.0 INITIAL START, FLUSH AND PERFORMANCE VERIFICATION	11
5.1 INITIAL START AND FLUSHING	11
5.2 PERFORMANCE VERIFICATION	11
5.2.1 RECOVERY	12
5.2.2 REJECTION	12
5.2.3 LOW FEED PRESSURE SWITCH TEST	12
5.2.4 TANK PRESSURE SWITCH TEST	12
6.0 MAINTENANCE	12
6.1 DAILY SYSTEM CHECKS	12
6.2 MONTHLY SYSTEM CHECKS	12
6.3 SEMI-ANNUAL SERVICE	13
6.4 PERIPHERAL EQUIPMENT	13
7.0 SERVICE	13
7.1 LOW FEED PRESSURE SWITCH ADJUSTMENT	13
7.2 TANK PRESSURE SWITCH ADJUSTMENT	13
7.3 MEMBRANE REPLACEMENT	15
7.4 FLOW RESTRICTOR SERVICE	16
8.0 PLANT SHUTDOWN	17
8.1 SHUTDOWN PROCEDURE	17
8.2 RESTART PROCEDURE	17
9.0 PARTS, ACCESSORIES AND SPARES	16
TOMAR LIMITED ONE YEAR WARRANTY	18

Attachments:

Performance test Sheet

Performance Record Data Sheet

NOTE

Systems may vary from manual content due to manufacturer's design changes, options or per customer special configuration requests.

1.0 INTRODUCTION

The Tomar shelf mount TSM-Series are the ideal systems for a wide variety of medium commercial or industrial water purification applications. Standard features include: SS pressure vessel, low energy membrane, 316 SS pressure control needle valve, glycerin filled gauge (vessel-in) and direct drive gauge (tank), fixed displacement pump, thermally protected OPD motor, stainless steel frame with rubber feet, low-feed pressure cutoff switch, fast flush valve, pressure tank switch, pressure tank relief valve, and product water check valve.

1.1 SYSTEM SPECIFICATIONS

MODEL NO.		TSM-1500
Membrane Type		Thin Film (TF)
Membrane(s), Vessel(s)		1-4040, 1
Production Rate†		1500 gpd (5.7 m3/d)
Minimum Concentrate flow (Discharge + Recirculation)		0.9 gpm (0.2 m3/m)
Operating Pressure:		
Nominal		110psi (10.3 bar)
Maximum		150psi (13.8 bar)
Nominal Recovery:		60%
Electrical Power :	110V 50/60 Hz 1 phase	11.0 Amps
	220V 50/60 Hz 1 phase	5.5 Amps
Motor, OPD, Rating & RPM		3/4 HP, 1725
Fixed Displacement Pump		165 gph 0.63 m3/h
System Dimensions		45"Wx10"Dx14"H (114x25x36cm)
Dry Weight		62 lbs (28.2 kg)

† Production rates are based on 110 psig (7.6 bar) net working pressure at 77°F (25°C), running at 15% recovery with feed water at 7.5 pH containing 1500 ppm NaCl. Flow tolerances are ± 15%. Above pressure and flow data based on 60 Hz power. For 50 Hz power multiply all flow and pressure numbers by 0.83 factor to correct for lower motor/pump speed.

NOTE

PRODUCTION TEST DATA FOR THIS SYSTEM SHOULD APPEAR ON THE LAST PAGE OF THIS MANUAL. REFER TO THE SETTINGS AND PERFORMANCE GIVEN FOR THE PRODUCTION TEST RUN DURING THE INITIAL INSTALLATION SETUP AND ANY FUTURE CONTROL ADJUSTMENTS OR MAINTENANCE.

2.0 SYSTEM ITEM IDENTIFICATION (See Figure 1)

1. PRESSURE VESSEL/MEMBRANE ASSEMBLY
2. PUMP
3. MOTOR
4. AUTO/OFF LEVER
5. SOLENOID VALVE
6. BRINE FLOW CONTROL
7. VESSEL IN PRESSURE CONTROL VALVE
8. TANK PRESSURE GAUGE
9. VESSEL IN GAUGE
10. FAST FLUSH VALVE
11. PRODUCT WATER CHECK VALVE
12. LOW FEED PRESSURE SWITCH
13. TANK PRESSURE RELIEF VALVE
14. TANK PRESSURE SWITCH
15. FRAME
16. RUBBER FEET
17. FEED PORT
18. PRODUCT PORT
19. DRAIN PORT

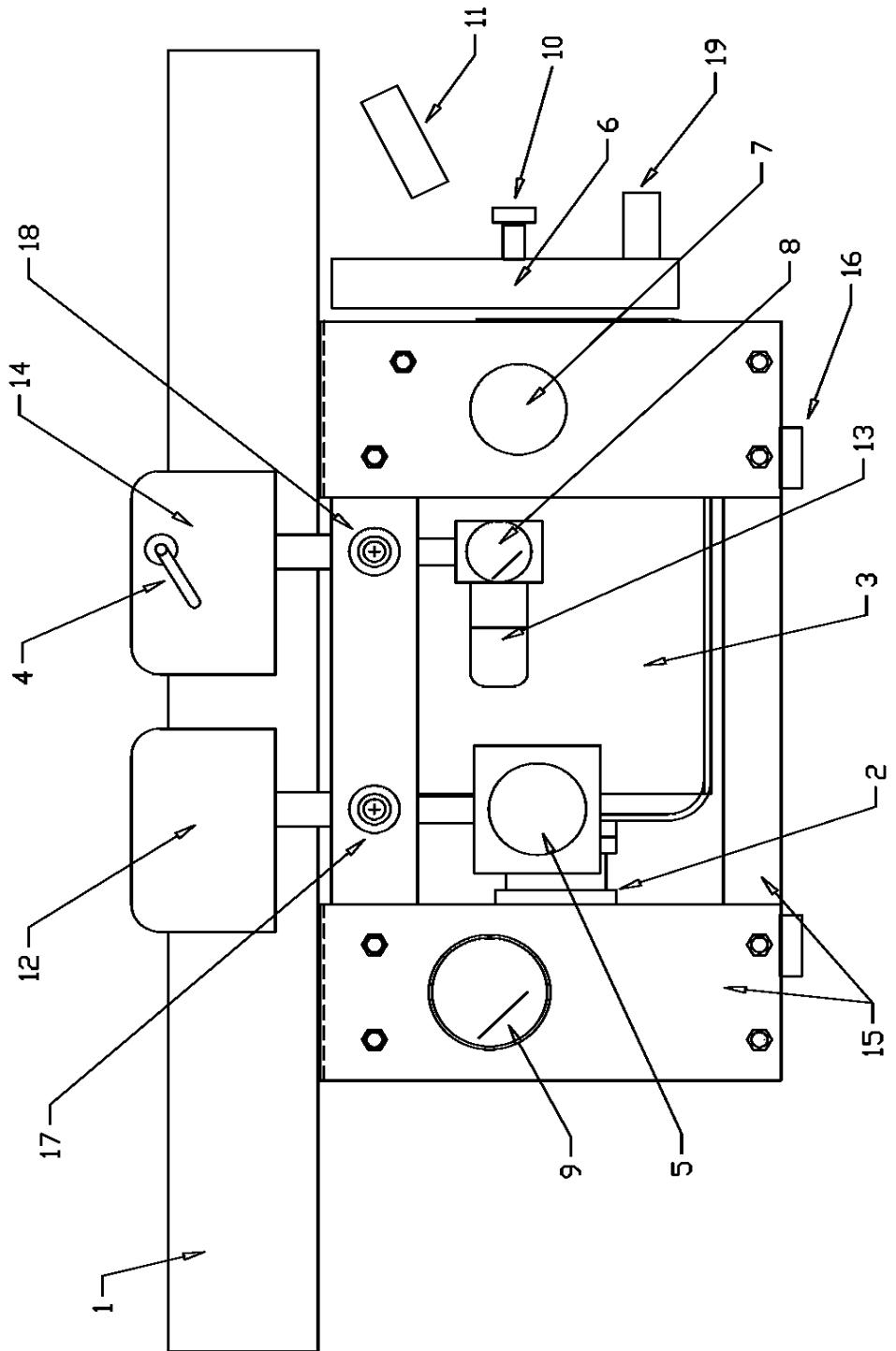


Figure 1. TSM System Configuration

2.1 SYSTEM ITEM DESCRIPTIONS (See Figure 1)

PRESSURE VESSEL/MEMBRANE ASSEMBLY (#1): This is where the dissolved solids are separated from the feed water. This assembly consists of 1 each 4" diameter SS pressure vessel that houses the reverse osmosis (RO) membrane.

PUMP (#2): The pump boosts water pressure in the pressure vessel/membrane assembly to about 150 psig to ensure high dissolved solids rejection and high flow rates. TSM-1500 model comes standard with a brass fixed displacement pump. Your system may have special requirements for high TDS. For additional pump options, see 2.2 SYSTEM OPTIONS.

MOTOR (#3): Used to drive the pump. All models utilize a 3/4 HP carbonator style motor. The motor is Open Drip Proof construction (OPD) with thermal overload protection.

AUTO/OFF LEVER (#4): This lever is located on the side of the tank pressure switch. In the AUTO position, system operation is controlled by pressure in the product water bladder storage tank. In the OFF position the system is deactivated. In this regard, the AUTO/OFF lever can be used to turn the system on or off.

SOLENOID VALVE (#5): Electrically operated valve that prevents water from flowing through the system when it is not in operation. The coil and body are separate replaceable units.

BRINE FLOW CONTROL (#6): This assembly contains the orifice flow restrictor sized to produce approximately 150-200 psi in the pressure vessel/membrane with the PRESSURE CONTROL valve (re-circulation valve) closed. The brine flow is directed to drain.

VESSEL IN PRESSURE CONTROL VALVE (#7): A needle valve that controls the amount of brine from the membrane to be re-circulated back into the feed stream. This feature allows for higher recovery rates, see 3.2.2 OPERATING PARAMETERS for guidance. This valve provides control of system operating pressure as well as brine flow rate and TDS.

TANK PRESSURE GAUGE (#8): This gauge displays the pressure within the product water bladder storage tank.

VESSEL-IN GAUGE (#9): This gauge displays the operating pressure at the inlet of the membrane pressure vessel. This pressure indication is used in the setup of the unit and as an early warning of membrane fouling.

FAST FLUSH VALVE (#10) This valve is located on the brine flow control assembly and provides a means of bypassing the flow restrictor orifice. Periodically (at least monthly) this valve should be turned to vertical for 30 to 60 seconds and then returned to the horizontal position while the system is running. This will provide a momentary high velocity flow across the membrane to help flush away any accumulated particles or debris.

PRODUCT WATER CHECK VALVE (#11): This valve is located in the product line coming out of the membrane pressure vessel. It acts to prevent back flow of product water from the pressurized storage tank into the membrane when the system is not operating.

LOW FEED PRESSURE SWITCH (#12): This pressure switch turns off the system in the event of low incoming feed pressure. It serves as a pump protection device. It is factory set to cut off if the pressure drops to 12 psi. Once stopped, the feed pressure must increase to 22 psi before the switch will restart the system. The unit automatically restarts if the loss of water pressure was temporary due to some other local water usage.

TANK PRESSURE RELIEF VALVE(#13): The tank pressure relief valve serves to prevent accidental over pressurization of the bladder product water storage tank. The valve is factory adjusted to relieve tank pressure in excess of 75 to 80 psi. This setting can be adjusted by means of the gray knob on the valve however, it should never be adjusted to a pressure greater than the storage tank rated maximum pressure.

TANK PRESSURE SWITCH (#14) : The tank pressure switch operates in concert with a pressurized bladder storage tank. Operation of the system is driven by storage tank pressure sensed by this switch. The tank pressure switch is factory set to shut the system off when the tank pressure is approximately 60 psi and turn the system back on when the tank pressure drops to approximately 40 psi.

FRAME (#15): The system frame includes a base and two channel frames fabricated in stainless steel. All fasteners on the system are stainless steel. The frame provides a mounting for all the RO system components.

RUBBER FEET (#16): These allow for a stable mounting on an uneven surface and for vibration and sound mitigation.

FEED PORT(#17): Filtered feed water is supplied to the system via this 1/2" tube size quick connector.

PRODUCT PORT(#18): Purified product water leaves the system via this 1/2" tube size quick connector. Typically this connector will be plumbed to the product water storage tank.

DRAIN PORT(#19): Concentrated brine water leaves the system through this 1/2" tube size quick connector.

2.2 SYSTEM ACCESSORY EQUIPMENT (OPTIONAL)

10 GALLON BLADDER TANK (not shown): For product water storage. Connection to tanks is by 3/8" quick connector for tank input and 1/2" quick connector for output to usage.

20" PREFILTER ASSEMBLY (not shown): The 20" prefilter assembly comes complete with 10 micron carbon block filter element installed and with a wall mounting bracket. Feed inlet is by a 3/4" FPT connection and outlet to the R.O. system is by 3/8" tubing quick connector.

3.0 PRE-INSTALLATION PROCEDURES

PLEASE READ CAREFULLY. FAILURE TO FOLLOW THESE PROCEDURES CAN RESULT IN DAMAGE TO YOUR SYSTEM AND VOID YOUR WARRANTY.

3.1 PACKAGING

Upon delivery, inspect packaging for damage and report any damage to your delivery carrier at that time. After unpacking the system, inspect it carefully for signs of damage. All damage claims should be made to the delivery carrier.

3.2 RO SYSTEM OPERATION

3.2.1 FEED WATER CONSIDERATIONS

The TSM Series systems require external pre-filtration for proper operation. At minimum, feed water should be prefiltered through a 20", 10 micron sediment filter. If the feed water is chlorinated, an additional 20" carbon filter should be employed to dechlorinate the feed before it enters the TSM. Exposure of the TSM membrane to chlorinated feed water will cause rapid membrane failure.

Tomar TSM-Series are to be used only on microbiologically safe water that conforms to operating parameters per 3.2.3. The user must be sure that water to be treated is both microbiologically safe and non-toxic. Ensure that the operating parameters outlined in 3.2.3 are met at the installation site. Items of most importance are TDS, supply water pressure, flow rate, chlorine level and temperature range.

A water analysis is helpful in determining if any special pre-treatment is needed. If your water analysis shows levels of substances in excess of the maximums stated in 3.2.3 or has TDS greater than 500, contact your Tomar factory representative for any pretreatment that may be required, and/or the maximum allowable recovery without pretreatment.

3.2.2 OPERATING PARAMETER SETTINGS

The TSM-Series operates according to the following parameters, where:

Q_s=Feed water flow rate
Q_b=Brine flow rate (set by orifice size)
Q_r=Recirculation flow rate
Q_p=Product flow rate
Q_{ro}=Flow rate to the RO vessels (pump output)

$$Q_s = Q_b + Q_p \quad Q_{ro} = Q_s + Q_r \quad \text{Recovery} = Q_p/Q_s$$

The fixed displacement type pumps run at 1725 rpm for 60 Hz operation and 1400 rpm for 50 Hz operation. These pumps always deliver a constant flow rate regardless of pressure. The motor operates at higher Hp with increasing system pressure. The pump pressure is controlled by adjusting the Brine flow rate (orifice sizing),(Q_b). Concentrate water flows to the drain. This waste can be reduced by re-circulating some of the concentrate flow back to the pump inlet. The amount of re-circulation (Q_r) reduces the amount of feed water (Q_s) by the same amount, which increases the rate of recovery.

However, recovery should not be greater than 70%. Higher recovery reduces the rejection of dissolved solids. Use the PRESSURE CONTROL valve to set the re-circulation flow rate (Q_r) to the maximum level with the system still producing RO water with an acceptable TDS level. However, for high TDS feed water it is advisable to keep the recovery low to avoid possible fouling of the membrane(s). Tomar can provide a projection from your water analysis to determine safe operating parameters for your system.

3.2.3 OPERATING PARAMETER CONDITIONS

MODEL NO.	TSM-1500
Membrane Type	Thin Film
Feed Pressure	25 psi (1.7 bar)
Minimum Feed Flow Rate	2.4GPM @ 60Hz 0.54M3PH @ 50Hz
Maximum Temperature (Feed)	113°F (45°C)
Maximum Chlorine (continuous)	<0.1 ppm
Maximum Total Dissolved Solids	2,500 ppm
pH Range	3.0 - 10.0
Iron	0.0 ppm
Hydrogen Sulfide	0.0 ppm
Manganese	0.0 ppm
pH Range (optimum rejection)	5.0 - 8.0
Turbidity	< 1.0 NTU
Silt Density Index	<5.0 SDI

3.3 PRE-FILTRATION

Minimum prefiltration for the TSM-1500 with chlorinated tap water feed would be one 20"x2.5" 10 micron carbon block sediment prefilter (not included). This pre-filtration traps sediment and particulates in the feed water and, importantly, also reduces Chlorine and other volatile organic contaminants. During their useful life (6 months to 1 year generally) typical 20" sediment and carbon filter elements will protect the R.O. membrane as long as the feed water Chlorine content does not exceed 1 ppm. If the Chlorine content in the feed water is typically higher than 1 ppm additional carbon pre-filtration may be required to prevent premature membrane damage. The external pre-filtration assembly can be wall mounted close to the TSM system.

3.4 FAST FLUSH FEATURE

TSM systems connected for pressure product tank operation are equipped wth the Tomar Fast Flush valve feature. This membrane saving and water quality enhancing function is easily carried out on a periodic basis.

Depending on feed water quality, the following fast flush procedure should be performed at intervals from weekly to monthly. When the system is operating, turn the fast flush valve knob counter-clockwise to the vertical position (arrow on knob pointing down). Leave the knob in this position for 1 minute, then turn the knob clockwise to the horizontal position (arrow pointing to front). The extra high velocity water flow through the membrane during the flush period acts to remove particles and debris which may have deposited on the membrane feed surface.

3.5 TANK PRESSURE RELIEF VALVE

The product water tank pressure relief valve is located near the middle under surface of the TSM system manifold. This device protects the pressure tank from over pressure by bypassing product water once the tank pressure reaches its adjusted setpoint. The relief valve is factory set to relieve if the tank pressure reaches 75 to 80 psi. This adjustment is by means of the gray knob at the left side of the valve. This knob locks when pushed in preventing unintended adjustment. To adjust, the knob must be pulled out until it clicks. *Under no circumstances should this relief valve be set at a pressure higher than the tank manufacturer's maximum pressure rating.*

4.0 INSTALLATION

PLEASE READ CAREFULLY. FAILURE TO FOLLOW THESE PROCEDURES CAN RESULT IN DAMAGE TO YOUR SYSTEM AND VOID YOUR WARRANTY.

4.1 LOCATION

It is recommended that systems be located where they are protected from harsh environments such as rain, snow and extreme temperatures (both hot and cold). The TSM-Series is intended for indoor installation. TSM-Series can be located just about anywhere inside where there is a water and electrical supply and a drain for the brine discharge. Keep in mind, however, that they should be out of normal traffic patterns but easily accessible for monitoring and service. The hazards of flooding in the event of plumbing failure should also be considered in the location selection.

The TSM unit is provided with rubber feet as standard for free standing shelf or table installation. Two holes are provided in the TSM base plate to allow the system to be secured in place with bolts or lag screws. It is recommended to use stainless steel fasteners for this purpose to avoid rust or corrosion. The unit can be wall mounted as well using an intermediate optional bracket (not supplied).

4.2 PLUMBING (See Figure 2)

Always abide by local plumbing codes when installing the system. If installation procedures conflict with your local plumbing codes, STOP and consult your dealer or licensed plumber for recommendations.

Three 1/2" quick connect (QC) tube fittings are provided for the feed water, product water and drain connections. The feed water and product water connections are located on the front manifold face and the drain connection is at the lower right side. If necessary, 1/2" stem to quick connect elbow fittings can be installed to accomodate the tubing installations.

4.2.1 WATER SUPPLY CONNECTION

The feed water supply for the TSM system must be able to maintain at least 25 psi at a flow rate of 2.4 gpm. When the RO starts there is generally a momentary drop in feed water pressure. If this momentary drop goes below 12 psi, the system will shut down. It will also re-start when the feed pressure then rises back up to 22 psi or higher. If such on/off cycling is seen during installation startup of the TSM it is an indication that the feed water supply is borderline for the needs of the system. If a better pressure supply cannot be arranged it may be necessary to either install a feed water boost pump or a feed water bladder pressure tank. The latter is the simpler solution in the event that the feed water supply is only marginally weak during system startup.

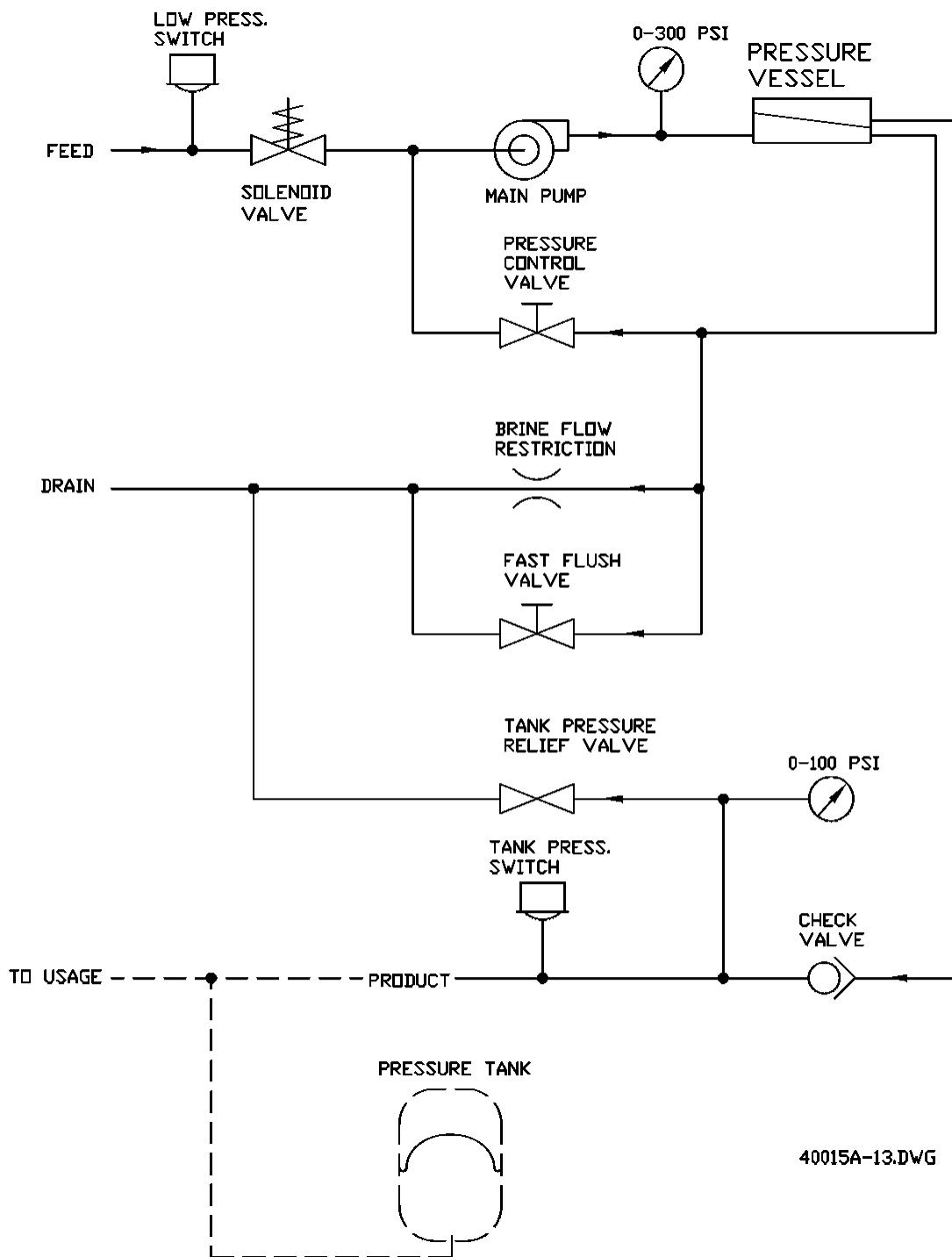
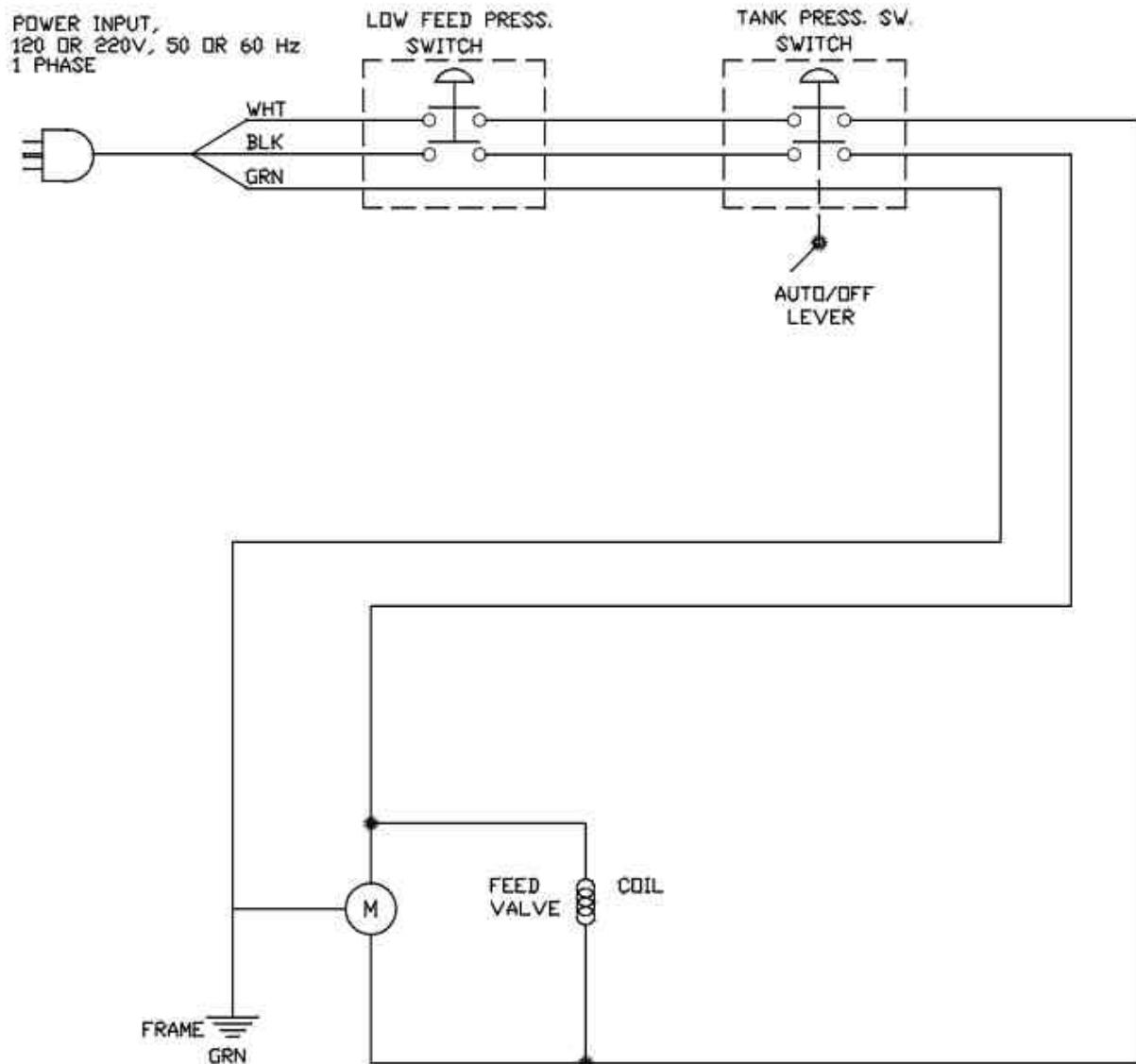


Figure 2. System Plumbing Diagram



30019-1T1

Figure 3. System Electrical Schematic Diagram

4.2.2 DRAIN CONNECTION

Run the brine line to an appropriate drain and secure as possible. Be sure to check your local plumbing codes to see if an air gap between the system and the drain is required.

4.2.3 PRODUCT TANK CONNECTIONS

The connection to the product pressure tank should not be made until the system is flushed and tested as outlined in 5.0. Run the line to drain first and connect to the tank only after flushing is complete.

4.3 ELECTRICAL (See Figure 3)

WARNING!

DO NOT CONNECT POWER UNTIL THE SYSTEM IS COMPLETELY INSTALLED AND READY TO RUN.

The TSM-Series systems come standard with the proper plug for the power requirement. Be sure the receptacle you use is on a circuit that has a Ground Fault Interrupter (GFI) and has sufficient capacity for the operating current as listed in 1.0 SYSTEMS SPECIFICATIONS.

4.3.2 EXTERNAL PRESSURE TANK

The TSM system is configured for use with a bladder type pressure tank with the tank pressure switch mounted on the system manifold. A product water check valve is already installed in the system. It is only necessary to connect the product water fitting to the pressure tank. It is recommended that the pressure tank be equipped with ball shutoff valve for use in isolating the tank during system maintenance.

5.0 INITIAL START, FLUSH AND PERFORMANCE VERIFICATION

Although TSM-Series systems are fully tested at the factory prior to shipping, it is strongly recommended to flush and verify your system's performance on-site, particularly if the unit was not installed immediately on arrival from the factory.

5.1 INITIAL START AND FLUSHING

New membranes have a preservative on them that needs to be flushed before use. Although the system was run at the factory, additional flushing is recommended. Run the product line to a drain and run the system until the product TDS has stabilized, about 15 minutes.

Fully open the PRESSURE CONTROL valve by turning the knob counterclockwise

Turn on the water supply to the unit and check for leaks up to the solenoid valve.

Place the AUTO/OFF lever on the tank pressure switch at OFF.

Connect the TSM electrical power cord into the 120 or 220VAC power source.

Place the AUTO/OFF lever at AUTO. If the system shuts down or cycles on and off rapidly it will be necessary to take corrective action. It is probably due to the feed pressure falling off and not recovering. It will be necessary to provide a more adequate feed to the RO or to lower the low pressure switch setting. The switch should not be adjusted below a minimum of 5 psi operating. To adjust the low pressure switch setting see 7.1 LOW PRESSURE SWITCH ADJUSTMENT.

Open the Fast Flush valve until air is cleared from the system then close the valve. After the system has run for a few minutes, close the PRESSURE CONTROL valve until the system pressure gauge reads 110 psi.

Allow the system to flush for 15 minutes with all water discharged to drain. Periodically check for leaks and check the system VESSEL IN pressure gauge. It is likely that the pressure will drift from 110psi during the flushing; if it does, adjust the PRESSURE CONTROL valve to correct the pressure back to the original setting. DO NOT LET SYSTEM PRESSURE RISE ABOVE 200 PSI . Open the PRESSURE CONTROL valve (turn counter-clockwise) to decrease the pressure.

After completion of the flush procedure, the product water outlet should be connected to the storage tank.

5.2 PERFORMANCE VERIFICATION

Factory test data is supplied with the system (see last page of this manual). This data reflects unit performance with city water available at the factory. To ensure optimum performance, on-site data should be taken and compared to the factory test data. This data should be taken after the system has been run for at least one hour. Some deviations may be seen due to differences in feed water TDS and temperature between the site and factory.

5.2.1 RECOVERY

Compute the recovery according to the following formulas: Recovery=Qp/Qs where Qs=Qb+Qp, as discussed in 3.2.2 OPERATING PARAMETERS.

5.2.2 REJECTION

This testing is done with observations obtained using a TDS meter (not supplied). If the feed water TDS value is not known, use the TDS meter to measure the TDS in the feed water (take a sample from a nearby tap). Calculate percent rejection using the formula below:

$$(\text{Feed TDS}-\text{Product TDS}) / (\text{Feed TDS})^* 100 = \% \text{ Rejection}$$

Rejection should be 96% or better. For example, where the feed TDS is 600 and the product TDS is 24, the percent rejection is:

$$(600-24) / 600 * 100 = 96\%.$$

5.2.3 LOW FEED PRESSURE SWITCH TEST

Test of the low feed pressure switch requires that a pressure gauge be installed on the feed water source. While the system is running, slowly shut off the water supply to the system. The system should shut off at about 12 psi on the feed source gauge. If the system does not shut off by at least 7 psi, re-establish the water supply. DO NOT LET THE SYSTEM RUN WITHOUT AN ADEQUATE WATER SUPPLY TURNED ON. PUMP DAMAGE WILL OCCUR. Turn the system off and refer to 7.1 for low pressure switch adjustment.

5.2.4 TANK PRESSURE SWITCH TEST

With the product line connected to the tank and usage demand on, and with the TSM running, slowly close the usage demand. The tank pressure gauge should start to rise as the tank fills. The system should shut off when the gauge reads about 60 psi. Now, by opening the usage demand the tank pressure should begin to drop, and the system should turn on when the pressure drops below about 40 psi. If the system fails to shut off at 60 psi, refer to 7.2 for tank pressure switch adjustment.

6.0 MAINTENANCE

Tomar TSM-Series systems are designed for simple operation with minimal user intervention. Tomar recommends keeping accurate performance records and following a regular preventive maintenance schedule to maximize the life of your system. A performance record sheet is provided at the back of this manual for you to copy and keep near your system. This record sheet will be important for warranty verification and trouble shooting, as well as possibly suggesting more or different pre-treatment.

6.1 DAILY SYSTEM CHECKS

Your water supply pressure can vary from time to time. This can also affect your system operating pressure. Therefore, it is recommended to check and adjust your system pressure daily to ensure maximum water production rates and quality. Maintenance of the external pre-filtration cartridges is also very important. Plugging of the sediment filter can lead to system shutdown due to inadequate feed pressure/flow. Exhaustion of the carbon filter (if installed) can cause premature membrane failure due to chlorine degradation.

6.2 MONTHLY SYSTEM CHECKS

In addition to the daily checks, it is recommended to repeat the procedure in 5.2 and record all data on your performance record sheet.

6.3 SEMI-ANNUAL SERVICE

Even If you do not see any indication of filter plugging as indicated in the Daily System Checks, it is recommended to change the pre-filter cartridge at least every six months.

6.4 PERIPHERAL EQUIPMENT

Peripheral equipment such as special pre-filters, post-filters, and tanks, external to the TSM, may also have periodic maintenance requirements. It is essential to maintain these as they can have a dramatic effect on the performance of your system. Refer to their specific manuals for proper maintenance procedures.

7.0 SERVICE

7.1 LOW FEED PRESSURE SWITCH ADJUSTMENT

The low feed pressure switch (switch on the left top of the manifold) is factory set to turn the system off if feed pressure drops below 12 psi and will re-start the system when feed pressure reaches 22 psi. This switch can be adjusted to as low as 4 psi, called the cut-out setting (stop). The cut-in (start) adjustment can be set as high as 45 psi. The difference between the two settings is referred to as differential. The low pressure switch on TSM systems has a differential of 6-20 psi.

* Before servicing, always disconnect power to the unit to avoid shock.

* To adjust, remove the switch cover and refer to the diagram inside.

* Turn the tall center adjustment nut counterclockwise to decrease cut-out pressure and clockwise to increase cut-out pressure. This adjustment will also change cut-in pressure to maintain the same differential pressure.

* Turn the lower side adjustment nut counterclockwise to decrease cut-in pressure and clockwise to increase cut-in pressure. Under normal circumstances, it is not necessary to adjust this switch setting. This adjustment does not change the low cut-out setting.

* Replace cover, restart and check operation of the switch.

7.2 TANK PRESSURE SWITCH ADJUSTMENT

The tank pressure switch (located on the right top of the manifold) is factory set to turn the system off when the tank pressure reaches approximately 60 psi and then restart when the tank pressure drops below 40 psi. The cut-in can be set as low as 5 psi and the cut-out can be set as high as 65 psi. The differential range is limited to 15-30 psi.

* Before servicing, always disconnect power to the unit to avoid shock.

* To adjust, remove the switch cover and refer to the diagram inside.

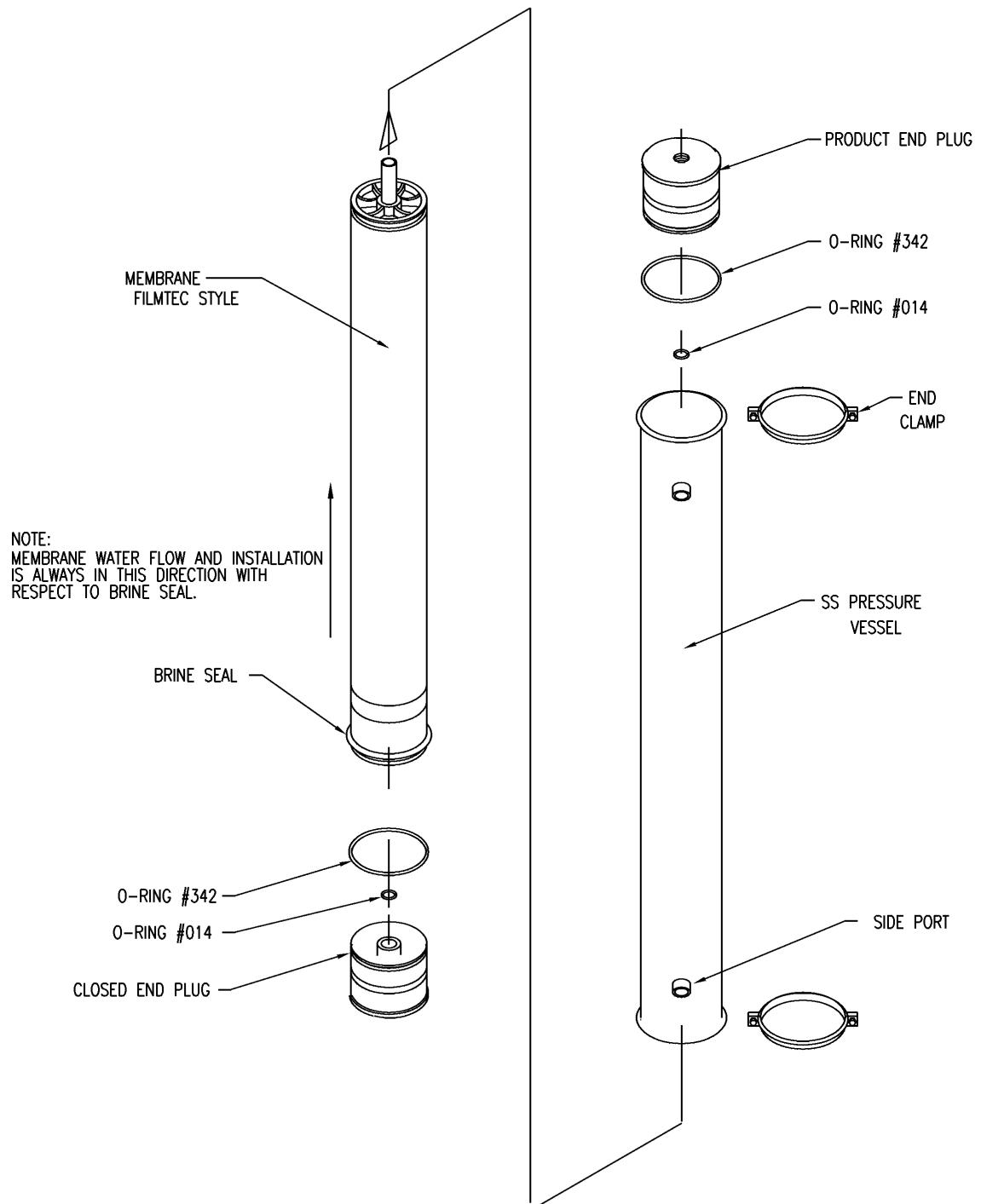


Figure 4. SS Vessel/Membrane Assembly

- * Turn the tall center adjustment nut counterclockwise to decrease cut-out pressure and clockwise to increase cut-out pressure. This adjustment will also change cut-in pressure to maintain the same differential pressure.
- * Turn the lower side adjustment nut counterclockwise to decrease cut-in pressure and clockwise to increase cut-in pressure. Under normal circumstances, it is not necessary to adjust this switch setting. This adjustment does not change the low cut-out setting.
- * Replace cover, restart and check operation of the switch.

7.3 MEMBRANE REPLACEMENT (See Figure 4)

Tomar recommends membrane replacement when the TDS rejection falls below 70%. A properly maintained and operated system typically should have at least a two (2) year service life. Your system may require more frequent membrane changes depending on your feed water. Always flush new membranes as outlined in: 5.2 INITIAL START AND FLUSH.

- * Close feed water and tank valves and release pressure from system by opening a usage faucet or valve and run the system using the AUTO/OFF lever.. Place the lever at AUTO until the feed pressure goes to zero then place the lever at OFF.
- * Before servicing, always disconnect power to the unit to avoid shock. Due to its rigidity, the 3/8" feed tubing may be more easily removed at the same time the feed end vessel cap is removed.
- * Tag and disconnect the four tubing connections on the desalinator. These are the feed and vessel in pressure gauge lines on the left end and product and brine lines on the right end plug.
- * Remove the end plug retaining clamps by removing the clamping bolts. See Figure 4.
- * In the next step, it is best if you can remove the membrane in the direction of flow as labeled on the outside of the vessel.
- * The end plugs may not be easily removed after months or years of running. Grasp an end plug and, while keeping the system from moving, pull and twist the end cap. Take care not to exert any unusual force on the fittings installed in each end cap. The membrane may or may not come out of the vessel along with one of the caps. If not, once the caps are removed, use a piece of PVC pipe to push the membrane out, exiting the vessel from left to right. Discard the old membrane.
- * Clean vessel and plugs with a mild detergent soap and rinse thoroughly.
- * Inspect all O-rings for cracks or nicks. Replace as necessary. Lubricate O-rings with an appropriate petroleum or silicone based-lubricant and re-install on all adapters and end plugs.
- * Lubricate the brine seal on the inlet end of the new membrane. Install new membrane into the feed end of vessel in the direction shown in Figure 4 (from left to right). Be sure to note the brine seal end.
- * Install end plugs into their proper ends. IF END PLUGS ARE INSTALLED ON THE WRONG ENDS, THE SYSTEM WILL NOT OPERATE PROPERLY.
- * Install the endplug clamps and their bolts.
- * Connect feed, brine, and product lines to their proper vessel cap connectors.
- * Restore water and power; check for leaks.

Note: A new membrane should be flushed after being installed - perform the flushing procedure given in 5.1.

7.4 FLOW RESTRICTOR SERVICE

The brine flow restrictor for the TSM systems is a part of the fast flush valve assembly. If it is necessary to remove the flow restrictor for cleaning, inspection or replacement proceed as follows.

With the system turned off refer to the black plastic valve plug mounted in the fast flush valve body. At the end opposite of the V handle is a thin circlip which retains the valve plug in the valve bore. Rotate the V handle until the gap in the circlip is visible. Take a small pen knife blade or similar and wedge the blade between the open end of the circlip and the valve body. Gently twist the blade until the end of the circlip pops out of the circlip groove. Remove the circlip with tweezers or small needlenose pliers. Pull and rotate the valve plug out of the valve body. Do not lose the face O ring installed in the valve plug center. The flow restrictor orifice is located in the center of the face O ring position. Do not use any sharp metal wire or drill bits to clean the orifice. Any change in the orifice diameter will significantly change system performance. After cleaning or replacement, lube the valve plug O rings with O ring grease and re-install the plug in reverse order to the removal procedure. After flow restrictor service, the system brine flow rate should be tested to ensure it is within normal flow range for the specific TSM model.

8.0 PLANT SHUTDOWN

RO systems that are subject to medium or long term shutdown (one month or longer) require periodic flushing to prevent degradation of system elements. The duration between flushes depends on feed water, usage conditions, type of unit and duration of the shutdown.

If the system is in long term shutdown, flushing procedure should be performed at a minimum once every month. Higher than normal (500 ppm) TDS feed water and/or the system located in elevated temperature environments may require the shutdown procedure to be performed more frequently. If there is known microbial activity in the feed water the shutdown procedure should be performed at least weekly.

8.1 SHUTDOWN PROCEDURE

Before making any of the valve changes indicated below, run the system and record the operating pressures and flows. This will aid in putting the unit back in service in the future.

For subsequent periodic flushes, leave the valve settings as directed below and reinstall the feed water sediment filter and flush as directed.

Dump the pressure in the tank to zero so product flow can occur by opening a usage faucet.

Flushing can be accomplished by running the unit for 5 minutes with no valve changes.

Observe the product and brine water at the beginning of the flush operation. If either the product or brine seem to be fouled, a more frequent flushing is indicated.

8.2 RESTART PROCEDURE

Perform a flush cycle as indicated above. Turn the RO system on and adjust the PRESSURE CONTROL valve to produce the original operating pressure and flow conditions. Open the tank valve, close the usage faucet to allow pressure to build in the tank. Observe that the unit shuts off at the correct tank pressure.

Check the condition of the water in the product storage tank. It may be necessary to run 2 or 3 tankfuls, dumping each one to drain to ensure the product water is clean and fresh and ready for use.

9.0 PARTS, ACCESSORIES AND SPARES

Where the spares schedule is shown at the group heading, determine the component installed in your RO unit. We recommend spares be available after the time indicated. Some components scheduled for spares are for options, different voltages or 50 Hz units. Ensure the spares you choose are applicable to your RO system. Feed water conditions may indicate more frequent replacement, particularly for filtration and membranes.

	SPARES SCHEDULE
MOTOR	2 years
*102612 Motor, 3/4Hp, HLV//60Hz/1P, OPD	
PUMP	1 year
102041 Pump, 165 GPH, Brass	
102101 Pump, 165 GPH, SS	
PUMP ATTACHMENT	
*101168 Clamp V-band	
VESSEL	
*101216 Pressure Vessel Assy, 4"ODx40"L, SS, FT Style	
*100083 Pressure Vessel Endcap O ring Kit, 2 large rings, 4 small rings	
MEMBRANE	
*107807 Membrane, 4040, TF, Low Energy, FT Style	2 years
MONITORING AND CONTROL	
*105803 Valve, Solenoid Body, 3/8"fpT	2 years
102304 Valve, Needle, 1/4"fpT, 0.73cv, SS	
*100113 Gauge, 100 psi, 1.0", Direct Drive	2 years
*107224 Gauge, 300 psi, 2.0", SS Case, Bronze Internals, Glycerin Filled	2 years
*105082 Switch, Tank, (NC), 40-60 psi	2 years
*105031 Switch, Low Pressure, (NO), 12-22 psi	2 years
MISCELLANEOUS	
*107658 Base, Stainless Steel	
*101173 Frame Channel, RH, SS	
*101174 Frame Channel, LH, SS	
*101910 Clamp, 4" Vessel Mounting	
*105210 Foot, Rubber	
*100598 Check Valve, 3/8" Quick Connect	
100974 Tank Pressure Relief Valve	
102347 Fast Flush Valve	
102348 Flow Restrictor Valve Plug (Specify TSM Model)	
ELECTRICAL	
105374 Coil, Solenoid, 110V, 60Hz	1 year
105375 Coil, Solenoid, 220V, 50/60 Hz	

* = Standard

TOMAR LIMITED ONE YEAR WARRANTY FOR LIGHT COMMERCIAL/INDUSTRIAL SYSTEMS

EXTENT OF WARRANTY COVERAGE

The Tomar Limited Warranty extends to the original purchaser of the system. This warranty covers all parts and factory labor needed to repair any Tomar-provided item that proves to be defective in material, workmanship, or factory preparation. The warranty applies for the first full year from date of purchase. Items subject to normal maintenance, such as o-rings, filter elements, etc. are not covered under this warranty. Items replaced under warranty will be warranted for a period of one year from the date of return shipment of the repaired or replacement unit to the owner.

DISCLAIMERS

This warranty applies if the system is installed and used in compliance with the instructions enclosed with the system.

This warranty does not cover the cost of repairs or adjustments to the unit, that may be needed, due to the use or installation of improper parts, equipment, or materials. This warranty does not cover unauthorized alteration of the unit or failure of a unit caused by such alteration or by unauthorized repairs.

The Tomar Limited Warranty does not cover malfunctions of your unit due to misuse, alteration, lack of regular maintenance, misapplication, tampering, or operating at too high a recovery. In addition, damage to the unit due to fire, accident, negligence, act of God, or events beyond the control of Tomar are not covered by this warranty.

Tomar warrants the membranes per the manufacturers' warranty. These warranties generally cover faulty material and workmanship for anywhere from 1 to 3 years. Membrane fouling will normally not be covered. The manufacturers' warranty of elements selected will be provided on demand.

Tomar warrants all items supplied by outside vendors, that are used as part of the system provided, per the manufacturer's warranties. These warranties generally cover faulty material and workmanship for 1 year.

INCIDENTAL AND CONSEQUENTIAL DAMAGES

Tomar will not assume the responsibility for payment of incidental or consequential damages, such as lost time, inconvenience, damage to personal property, loss of revenue, commercial losses, postage, travel, telephone expenditures, or other losses of this nature, which result from failure of this unit to comply with expressed or implied warranties.

OWNER'S WARRANTY RESPONSIBILITIES

Under the provisions of this warranty, the owner is expected to timely perform regular maintenance on the unit, as explained in the Tomar Operating and Maintenance Guide. Neglect, improper maintenance, abuse, or unapproved modifications may invalidate this warranty. Should the unit develop a defect or otherwise fail to perform within the provisions of this warranty, you must notify your Tomar dealer or Tomar directly.

In order to process your claim in a timely manner a Returned Goods Authorization (RGA) number will be assigned. Include the RGA number, with an explanation of the observed defect, with the item being returned. Items returned under the RGA will be reviewed by Tomar or forwarded to the original manufacturer for evaluation. Items returned to Tomar must be sent prepaid.

Tomar is a Registered Trademark of Tomar Water Systems.

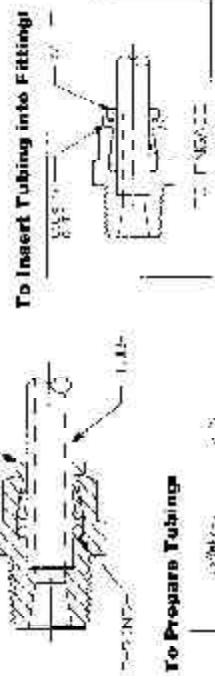
NOTES

PERFORMANCE RECORD

Parker TrueSeal™ Assembly Instructions



COLLAR



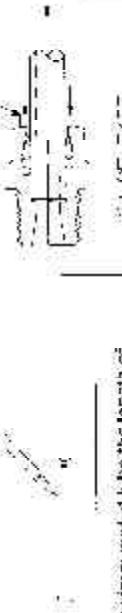
To Prepare Tubing

To Prepare Tubing



1. Insert tube straight into fitting until it bottoms out (inferior shoulder is visible). If desired, do not exceed safety stop "SC". May also be inserted past bottom.

To Release Tubing from Fitting



4. Pull collar toward body and pull on tubing to release tube. To re-use fitting, begin assembly at step one. Safety clip (if used) must be removed to allow for disassembly.

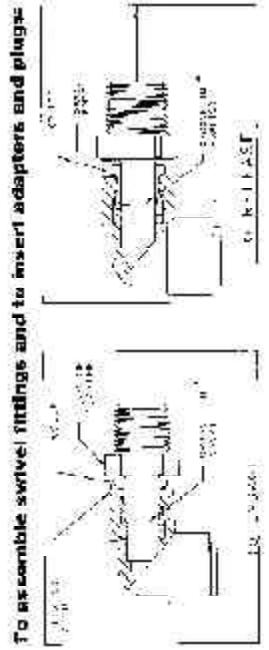
Insertion (See table below)

Tube Size	Insertion Length	
	Inch	mm
1/2 O.D.	11/16	17
3/8 O.D.	15/16	21
1/4 O.D.	3/4	19
1/2 O.D.	7/8	22

U.S. Patent 5,645,113



Patent Pending



To Assemble Swivel fittings and to insert adapters and plugs

1. Insert tube end of adapter (end with the groove) into proximal end of fitting (i.e. distric combination). When the adapter is completely inserted, a "click" will be heard & solar orbital safety clip "SC" may also be inserted (as shown).
2. Remove locking clip (if used) and bush collar toward body to release adapter or plug. To reuse fitting, begin assembly at step one.

Parker TrueSeal™ fittings with all plastic collars can be used with the following tubing materials: polyethylene, polybutylene, PVDF, vinyl, thermoplastic, and so forth (3/8 and 1/2" fittings and all sizes of vinyl should use TrueSeal™ fittings with non-stripper collars) can be used with tubing listed above (non-copper tubing, stainless steel or glass tubing and/or metal tubing, or stainless steel tubing and fittings).

Please refer to Parker catalog #680 or #680 UC complete information about tubes, fittings and fittings.

"Only Parker TrueSeal™ adapters and plugs can be used in the Parker TrueBase™ fitting.

Note: Provide adequate air space between fittings. Do not leave valve bodies, in-line shutoff controls or other hardware and components in line design or your water handling application causing damage. Plastic fittings containing chlorine that are used in water 80°F (27°C) or above can leach chlorine into water over time. This can affect taste and odor. The amount of chlorine that can leach depends on the environment (air density) of the applicator. However, Parker TrueSeal™ fittings are designed to withstand chlorine concentrations up to 1000 ppm.

Part # 46711-00-0000
Buna Product Series
Gauge: 16 Gage
ID: 3/8" - 1/2" O.D.
Fax: 509/545-4511

