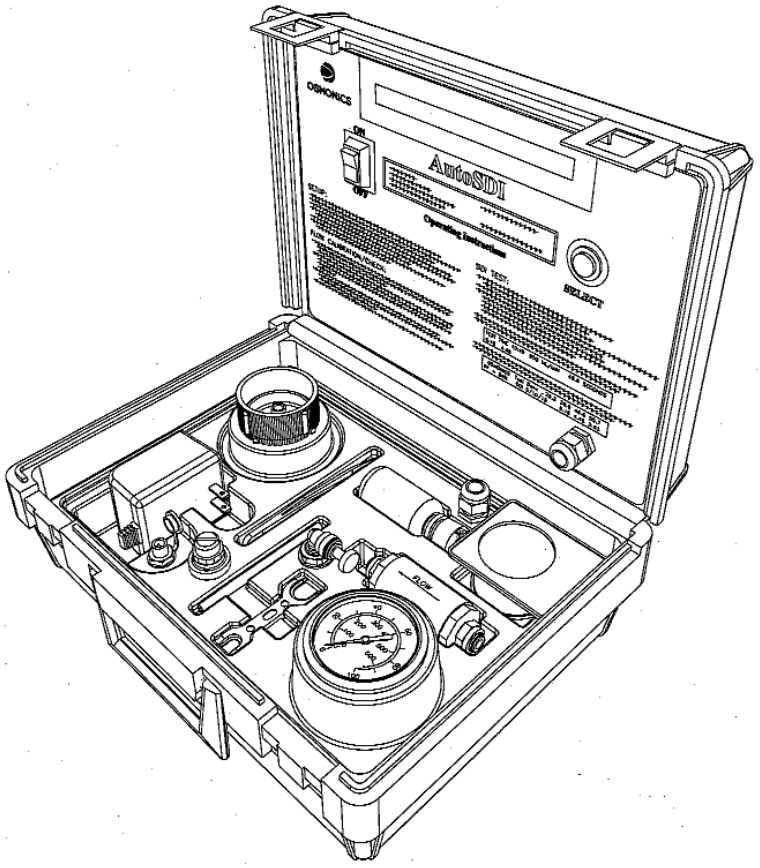
OSMONICS
AUTOSDI®

OPERATION AND
MAINTENANCE MANUAL



Automated Silt Density Index Tester
Built to ASTM D 4189 - 95

GE Infrastructure
Water & Process Technologies

OSMONICS
AUTOSDI
OPERATION AND MAINTENANCE MANUAL

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1.0 INTRODUCTION

The AutoSDI® Kit or Silt Density Index (SDI) Testing System, as shown in Figure 1.1 (AutoSDI Kit), includes tester, carrying case, 12 VDC Power Supply, pressure gage, in-line pre-filter, SDI membrane element filters (box of 100), and Operation and Maintenance Manual. The only thing you need to run SDI tests, other than the SDI Kit, is a sample water feed stream with available pressure of at least 35 psig (2.4 barg) and a flow volume of at least 0.79 gpm (3.0 Lpm). If the feed stream does not meet the minimum pressure requirements, a booster pump kit is available. Per the American Standard for Testing Material (ASTM D 4189-95), water pressure is regulated to 30 psig (2.1 barg) within the AutoSDI tester during flow measurements.

Your Operation and Maintenance Manual provides easy to follow instructions on the use and care of the AutoSDI tester. Please read this manual carefully and keep it near the tester. If you have any questions or problems, please call the GE Customer Support Center at (800) 848 - 1750.

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1.1 Safety Summary

This safety summary does not contain all the safety statements in the manual. Other safety statements are included within the manual text and are enhanced and defined as follows:

NOTE: Indicates statements that provide further information or clarification.

CAUTION: Indicates statements that are used to identify conditions or practices that could result in equipment or other property damage.

WARNING: INDICATES STATEMENTS THAT ARE USED TO IDENTIFY CONDITIONS OR PRACTICES THAT COULD RESULT IN INJURY OR DEATH.

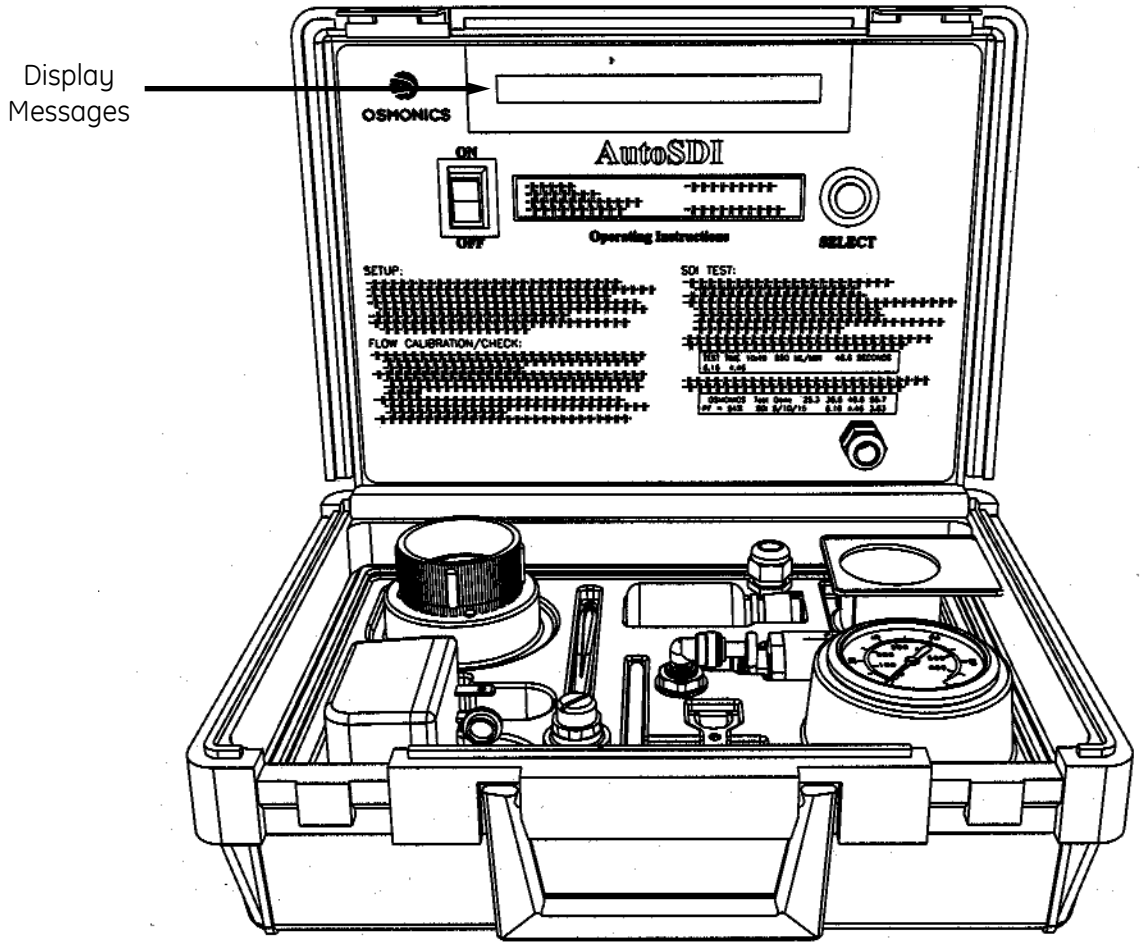

Figure 1.1
AutoSDI Kit

1.2 Silt Density Index (SDI)

Generally speaking, Silt Density Index (SDI) is a measurement used to quantify the amount of particulate contamination in a water sample. Silt Density Index testing is a widely accepted method for estimating the rate at which colloidal and particle fouling will occur in water purification systems, especially applications using reverse osmosis (RO) membrane elements. The SDI test is commonly used to help ensure that feed water suspended solids do not end up fouling RO systems by plugging the micropores in RO membrane elements.

Using a 0.45 micron pore size membrane element filter, 1.85-inches (47 mm) in diameter, the SDI test measures the actual decay in flow rate through the filter. The 0.45 micron filter is chosen because it is more likely to clog from colloidal matter than from hard particles such as sand or scale, similar to the behavior of RO membrane.

Suggested methods to reduce the SDI in RO feed water may include the use of a 1 to 5 micron pre-filter. This may be sufficient to reduce the SDI to acceptable levels prior to reaching an RO system. If not, a combination of pretreatment methods, including sand filtration, microfiltration, ultrafiltration, carbon filtration, and softening, may reduce the SDI as necessary.

Acid feed or cation deionization is sometimes used to adjust the pH in a process water system. If pH adjustment equipment is in use, SDI tests should be run both during the pH adjustment and without it. Comparisons of test results will show whether or not pH adjustment is causing any dissolved solids to precipitate out of solution, altering the amount of particulate contamination in the water. When the pH in the process water stream is adjusted, be aware that the SDI may increase as much as three (3) to five (5) times over the unadjusted value.

1.3 How to Calculate Silt Density Index and Plugging Factor

The AutoSDI calculates SDI based upon the decay in flow rate during a 15-minute period across a new 0.45 micron filter installed in the kit's holding fixture. The AutoSDI ensures flow rate measurement accuracy by maintaining a constant 30 psig (2.07 barg) in the feed stream to the filter. Using 500 mL sample collection times, flow rates are measured at the start of the test and compared to collection times obtained at 5, 10, and 15 minutes. The maximum 5 minute SDI equals 100% divided by 5 minutes or 20 SDI units (percent decay per minute). The maximum 10 minute SDI equals 100% divided by 10 or 10 SDI units. The maximum 15 minute SDI test equals 100% divided by 15 or 6.7 SDI units.

Another frequently used term when measuring levels of suspended solids is the "plugging factor". The plugging factor (PF) is equal to the Measured Value of SDI to the Maximum Value of SDI multiplied by 100. Units of PF are percent; where 100% indicates the filter is completely plugged. For example, if SDI_{15} = 1.4 SDI units, then PF equals 1.4 divided by 6.7 times 100, or 21% plugged.

SDI and PF Calculations

$$SDI_5 = \frac{[1 - (\text{Initial Sec}) / (\text{5 Min Sec})] \times 100}{5}$$

$$SDI_{10} = \frac{[1 - (\text{Initial Sec}) / (\text{10 Min Sec})] \times 100}{10}$$

$$SDI_{15} = \frac{[1 - (\text{Initial Sec}) / (\text{15 Min Sec})] \times 100}{15}$$

$$PF = \frac{(SDI_{15}) \times 100}{\text{Max } SDI_{15}}$$

Initial Sec: Seconds required to collect first 500 mL
5 Min Sec: Seconds required to collect 500 mL starting 5 minutes after start of test.
10 Min Sec: Seconds required to collect 500 mL starting 10 minutes after start of test.
15 Min Sec: Seconds required to collect 500 mL starting 15 minutes after start of test.

Example Data

Sample	Seconds	SDI
Initial	26.5	NA
5 Minute	28.8	1.6
10 Minute	31.0	1.5
15 Minute	33.6	1.4

Example Calculation

$$SDI_{15} = \frac{[1 - (\text{Initial Sec}) / (\text{15 Min Sec})] \times 100}{15}$$

$$SDI_{15} = \frac{[1 - (26.5) / (33.6)] \times 100}{15}$$

$$SDI_{15} = 1.4$$

$$PF = \frac{(1.4 \times 100)}{6.7}$$

$$PF = 21\%$$

1.4 System Specifications

1.4.1 Silt Density Index (SDI) Ranges

Sample	SDI Range
5 Minute	0 - 20
10 Minute	0 - 10
15 Minute	0 - 6.67

1.4.2 Plugging Factor Range

Plugging Factor (PF) Range: 0 - 100%

1.4.3 Electrical Power Selection

115VAC, 50/60Hz, single-phase
230VAC, 50/60Hz, single-phase

1.4.4 Water Supply

Water Flow: 0.79 gpm (3.0 Lpm)
Water Pressure: 35 - 100 psig (2.4 - 6.9 barg)
Water Connection: 1/4-inch outside diameter (OD) plastic tubing (quick connect)

1.4.5 Shipping Dimensions

H x W x D: 10-inches x 15-inches x 12-inches (25 cm x 38 cm x30 cm)
Weight: 8.0 lbs (3.6 kg)

2.0 SET-UP

2.1 Powering the Tester

The AutoSDI system comes complete with a 12 VDC Power Supply (110 or 220V) and a covered receptacle for it on the tester.

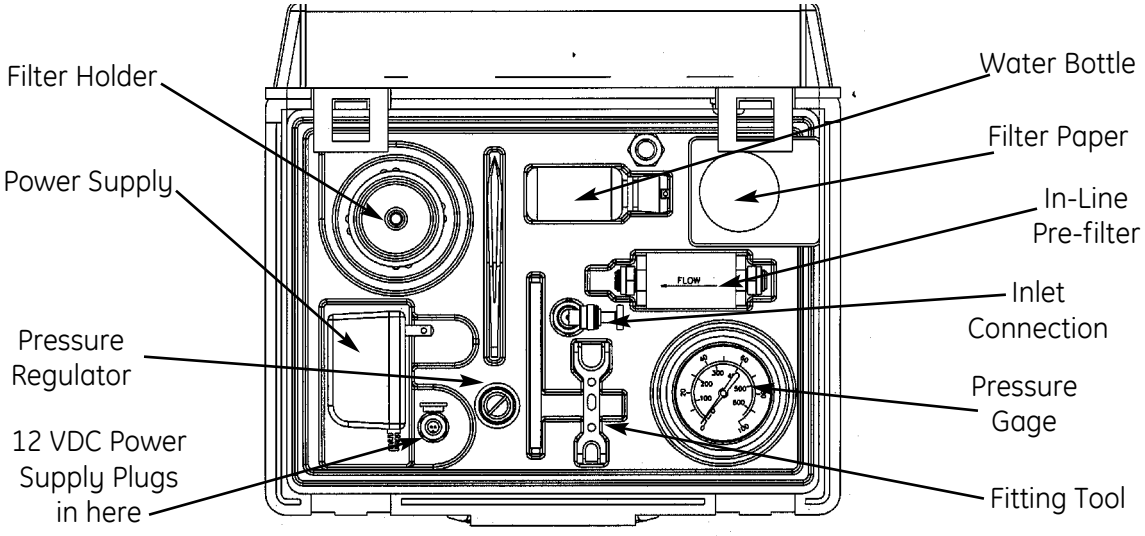

Figure 2.2
Top View of the
AutoSDI System

2.2 Tester Display

A table summarizing the displayed message sequence (Figure 2.3, Front View of the AutoSDI System) can be found in the Sequence of Display Messages (Table 3.1).

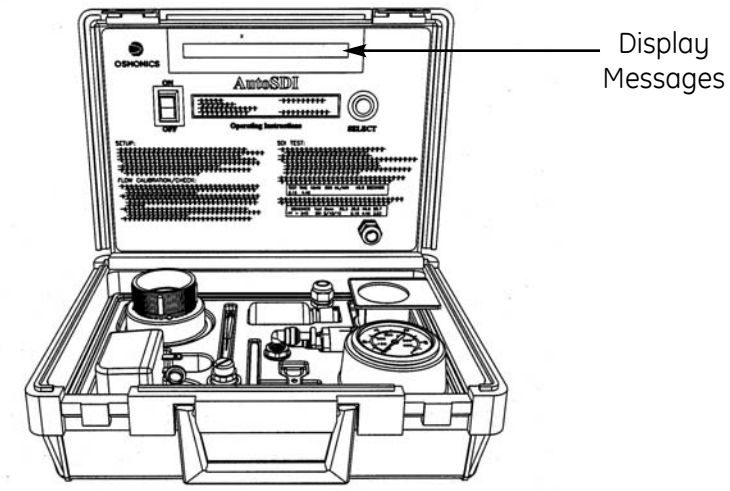

Figure 2.3
Front View of the
AutoSDI System

3.0 OPERATION

Before taking a measurement, be sure you have read and understand the steps in both Section 2.0 (Set-Up) and Section 3.0 (Operation).

3.1 Purge Bubbles From Kit

STEPS

1. Remove the plug from the tee fitting, located at the center of the lower compartment by holding the collet flush to fitting using the plastic tool provided, and pulling the plug out (Figure 3.4, Removing Plug from Inlet Filter).

2. After the plug is removed, insert the 1/4-inch OD tubing and attach the inline pre-filter provided with the kit (Figure 3.4).

3. Insert 1/4-inch plastic OD tubing from the feed water supply into the open fitting on the pre-filter until the tubing bottoms out.

4. Open the filter holder by rotating the upper filter housing counterclockwise.

5. Remove the red plastic cap. If present, remove and discard the used filter.

   NOTE: A new filter may be installed at this point in order to set the pressure regulator to 30 psig (2.1 barg). However, this filter should be replaced with a fresh filter for the SDI test.

6. Replace the upper filter housing by rotating clockwise.

7. Insert the 5/8-inch OD plastic tubing onto the filter holder and direct the tube to a drain.

8. Turn the feed water ON.

9. Plug in the power supply.

10. Turn the ON/OFF switch to ON.

11. Select PURGE Mode.

12. Purge the SDI until water is free of bubbles.

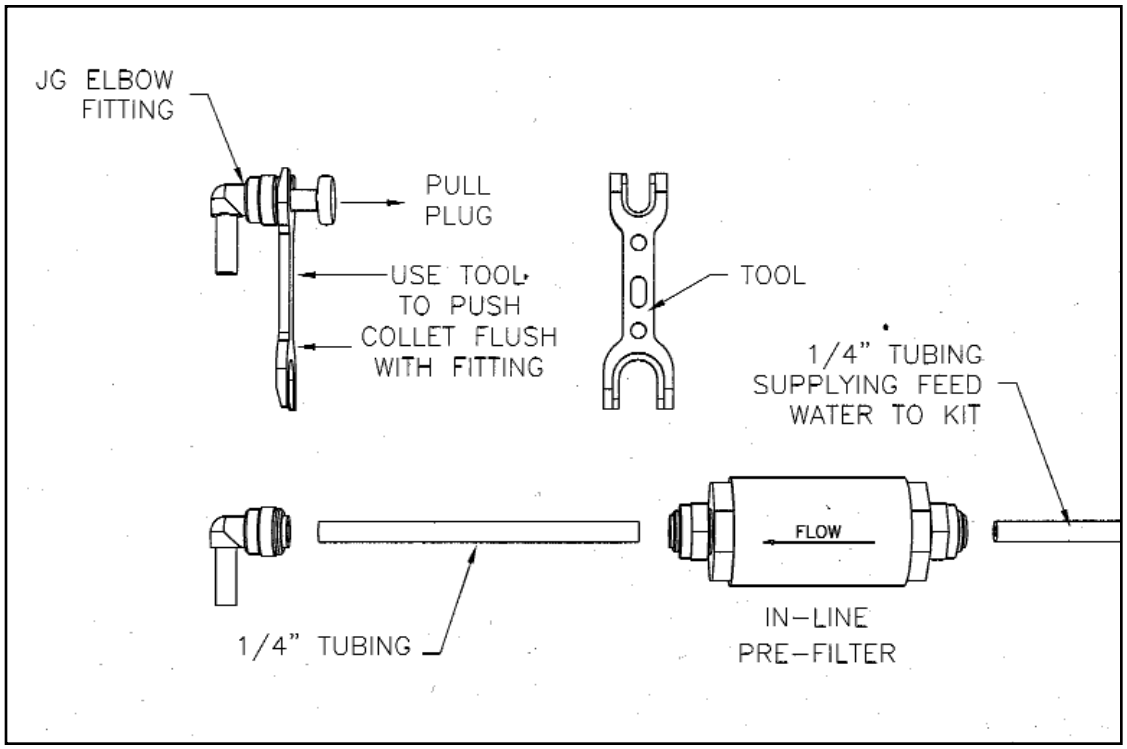

Figure 3.4
Removing Plug From
Inlet Filter

3.2 Installing a New 0.45 Micron Membrane Element Filter

STEPS

1. Turn the ON/OFF switch to OFF.

2. Remove the 5/8-inch outer diameter (OD) plastic tubing from the filter holder.

3. Remove the top of the filter holder by unscrewing counterclockwise and place the holder top on a flat surface, filter support facing up (Figure 3.5, Placing Filter on Filter Holder).

4. Open the filter box and, with tweezers, remove a 0.45 micron membrane element filter. Discard the used filter spacers and interleaves. Using tweezers, place a new 0.45 micron filter on the filter holder top. Filter orientation is not important (Figure 3.5).

   CAUTION: Be careful not to include a filter interleaf and not to damage the filter disk with the tweezer.

5. Wet the membrane element filter with a few drops of water until no dry areas can be seen (Figure 3.5).

6. Add water to the lower membrane element filter holder using a water bottle. This will eliminate bubbles at the filter surface (Figure 3.5).

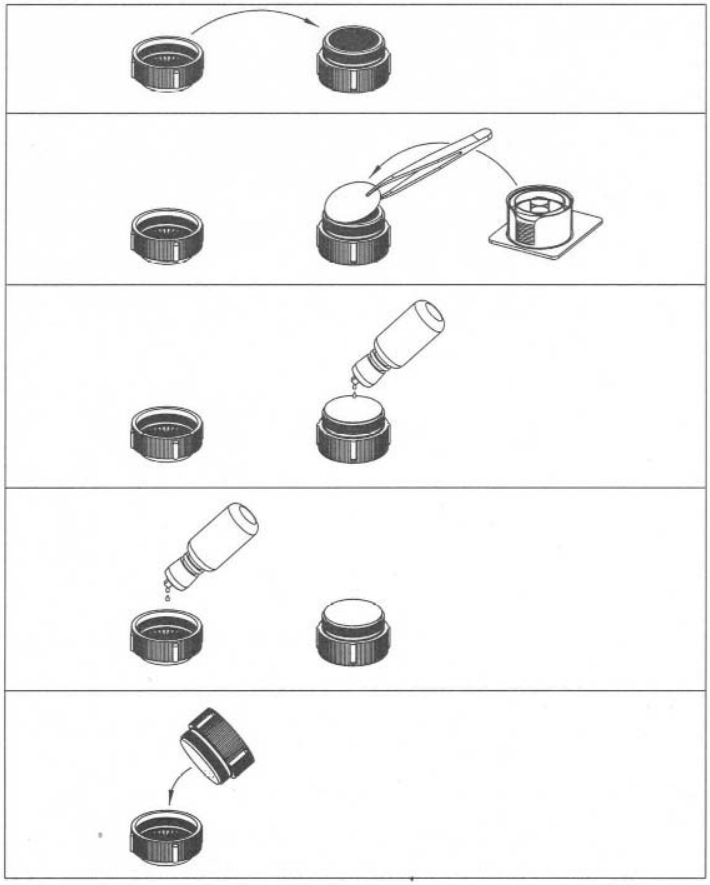

Figure 3.5
Placing Filter on
Filter Holder

7. Replace upper filter housing. Turn top filter over and screw into bottom filter holder mounted in the kit (Figure 3.5).

3.3 Run SDI Test

STEPS

1. Place 5/8-inch OD plastic tubing onto the filter holder.

2. Verify that at least 35 psig (2.4 barg) and 0.79 gpm (3.0 Lpm) sample water flow is available to the AutoSDI kit.

NOTE: Use an SDI booster pump kit if adequate pressure and flow are not available.

3. Turn ON/OFF switch ON.

4. Adjust pressure to 30 psig (2.1 barg) using the regulator knob. Pressure should be 29 - 30 psig (2.0 - 2.1 barg) at the beginning of the test when the first 500 mL sample is taken.

   If the pressure cannot be adjusted to 30 psig (2.1 barg) during the short 60 mL purge time, continue to adjust the pressure to 30 psig (2.1 barg) during the first sample time. Once set to 30 psig (2.1 barg), turn the ON/OFF switch to OFF. Remove used filter and install with new filter (Section 3.2, Installation of a New 0.45 Micron Membrane Element Filter). Start the SDI test again. This time, the pressure will be set to 30 psig (2.1 barg) at the beginning of the sample period.

   The SDI test will run for 15 minutes. At the end of the test, the AutoSDI unit will display the initial, 5, 10, and 15 minute (T0, T5, T10, and T15) test times. The 5, 10, and 15 minute SDI values and the 15 minute PF.

   To repeat an SDI test on the same water, purging is not necessary. Turn the ON/OFF switch OFF, change the filter, and turn the ON/OFF switch ON. The SDI test will be repeated.

   CAUTION: THE PRESSURE REGULATOR IS SUPPLIED WITH A LOCK OUT. THIS NUT STOPS THE REGULATOR PRESSURE ADJUSTMENT KNOB FROM BEING TURNED TOO FAR. IF THE LOCK NUT IS REMOVED AND THE ADJUSTMENT KNOB IS BOTTOMED-OUT IN THE CLOCKWISE DIRECTION, THE REGULATOR WILL DEVELOP LEAKS AND THE KIT WILL FAIL TO OPERATE PROPERLY.

   CAUTION: THE WATER TEMPERATURE MUST REMAIN CONSTANT THROUGHOUT THE TEST. THIS IS NECESSARY BECAUSE THE FLOW RATE CHANGES BY ABOUT 3% per °C. IF TEMPERATURE IS NOT MONITORED, THEN SDI TEST RESULTS MAY NOT REPEAT FOR MULTIPLE TESTS ON THE SAME WATER SOURCE.

3.4 Sequence of Display Messages

3.4.1 Test Mode

The following table summarizes the messages displayed on the AutoSDI tester.

Table 3.1
Sequence of Display Messages - Test Mode

To Enter Test Mode: Turn Power Switch ON.

TEST MODE SCREEN #	MESSAGE	DESCRIPTION	GO TO SCREEN
1	**AutoSDI Revision - A** **OSMONICS**	Start-up screen showing software revision.	2
2	**SELECT to Start Test** **OSMONICS AutoSDI**	Display alternates every few seconds between this Screen and Screen 3. Press SELECT on this Screen to Start Test.	5
3	**SELECT to STOP PURGE** **OSMONICS AutoSDI**	Display alternates every few seconds between this Screen and Screen 2. Press SELECT on this Screen to purge air from unit.	4
4	**PURGING Unit 000 mL/sec** **SELECT to STOP PURGE**	Unit purges until SELECT button is pressed to stop Purge Cycle.	2
5	**PURGING Unit 000 mL/sec 0000**	Unit purges approximately 60 mL of water prior to starting test.	6
6	**TEST TIME 00.00 000 mL/sec 00.0 sec** **SAMPLING - TO**	Unit measures time T0 for the first 500 mL sample. Total test time, flow rate and T0 time are displayed.	7
7	**TEST TIME 00.00 000 mL/sec 00.0 sec** **OSMONICS AutoSDI**	Unit waits until total test time is 5:00 minutes. Total test time, flow rate and T0 final test time are displayed during this period.	8

TEST MODE SCREEN #	MESSAGE	DESCRIPTION	GO TO SCREEN
8	**TEST TIME 00.00 000 mL/sec 00.0 sec SAMPLING - T5**	Unit measures time T_5 for the second 500 mL sample. Total test time, flow rate and T_5 time are displayed.	9
9	**TEST TIME 00.00 000 mL/sec 00.0 sec 0.00 OSMONICS AutoSDI SAMPLING - T10**	Unit waits until total test time is 10:00 minutes. Total test time, flow rate, final T_5 time, and SDI_5 are displayed during this period.	10
10	**TEST TIME 00.00 000 mL/sec 00.0 sec 0.00 SAMPLING - T10**	Unit measures time T_{10} for the third 500 mL sample. Total test time, flow rate, T_{10} time, and SDI_5 are displayed during this period.	11
11	**TEST TIME 00.00 000 mL/sec00.0 sec 0.00 0.00 OSMONICS AutoSDI**	Unit waits until total time is 15:00 to start T_{15}. Total test time, flow rate, T_{10} final test time, SDI_5 and SDI_{10} are displayed.	12
12	**TEST TIME 00.00 000 mL/sec 000.0 sec 0.00 0.00 SAMPLING - T15**	Unit measures time T_{15}. for the fourth and final 500 mL sample. Total test time, flow rate, T_5. time, SD_5. and SDI_{10} are displayed	13
13	**OSMONICS TEST DONE 00.0 00.0 00.0 00.0 PF = 00% SDI 5/10/15 = 0.00 0.00 0.00**	Test completed display. Final values for T0, T_5, T_{10}, T_{15}, plugging factor, SDI_5, SDI_{10}, and SDI_{15} are displayed.	Done
14	**ERROR - LOW FLOW SDI 5/10/15 = 0.00 0.00 0.00**	Occurs during test mode if flow <2 mL/sec or if T5, T10 or T15 > 200 sec or T5, T10 or T15 < T0. Displays up to maximum SDI completed.	Done

3.4.2 Calibration Mode

To Enter Calibration Mode: Press Select Button while turning Power Switch ON.

Table 3.2
Sequence of Display Messages
Calibration Mode

CALIBRATE MODE SCREEN #	MESSAGE	DESCRIPTION	GO TO SCREEN
1	**SELECT to Calibrate Unit** **Calibrate MODE**	Display alternates every few seconds between this Screen and Screen 2. Press SELECT on this Screen to start calibration.	3
2	**SELECT to Check Unit** **Calibrate MODE**	Display alternates every few seconds between this Screen and Screen 1. Press SELECT on this Screen to start Check.	12
3	**SELECT to Start** **Calibrate MODE**	Allows time to set-up for 500 mL calibration. Press SELECT when ready.	4
4	**Purging Unit 0 sec** **Calibrate MODE**	Unit purges for 3 seconds to remove air bubbles and to fill tube with water.	5
5	**WAIT - collect sample - 0 sec** **Calibrate MODE**	Unit pauses for 3 seconds, allowing time to move tube over collection vessel.	6
6	**SELECT to STOP 500 mL** **000** **Calibrate MODE**	Unit begins delivering water and displays flow meter pulses. Press SELECT when 500 mL have been delivered.	7
7	**SELECT to ACCEPT K = 0000** **Calibrate MODE**	Display alternates every few seconds between this screen and Screen 8. K-factor (# pulses/500 mL) is displayed. Press SELECT on this Screen to accept new calibration.	12
8	**SELECT to REJECT** **Calibrate MODE**	Display alternates every few seconds between this Screen and Screen 7. Press SELECT on this Screen to reject new calibration.	9

CALIBRATE MODE SCREEN #	MESSAGE	DESCRIPTION	GO TO SCREEN
9	**SELECT to REPEAT** **Calibrate MODE**	Display alternates every few seconds between this Screen and Screen 10. Press SELECT on this Screen to REPEAT the calibration sequence.	1
10	**SELECT to STOP** **Calibrate MODE**	Display alternates every few seconds between this Screen and Screen 9. Press SELECT on this Screen to Exit Calibration Mode.	11
11	**Calibrate ERROR** **Cycle Power to RESET**	The old calibration constant (K-factor) remains in memory and the new one is discarded. Cycle power to reset.	Done
12	**SELECT to Start** **CHECK MODE**	Allows time to set-up for 500 mL check. Press SELECT when ready.	13
13	**Purging Unit 0 sec** **CHECK MODE**	Unit purges for 3 seconds to remove air bubbles and fill tube with water.	14
14	**WAIT- collect sample - 0 sec** **CHECK MODE**	Unit purges for 3 seconds, allowing time to move tube over collection vessel.	15
15	**CHECK 500 mL 000 mL/sec 0000** **CHECK MODE**	Unit begins delivering 500 mL sample. Display shows flow rate and flow meter pulses counting down from K-factor to zero (0).	16
16	**Calibrate CHECK Done K = 0000** **Cycle Power to RESET**	Check is completed. K-factor is displayed. Cycle power to reset.	Done
17	**ERROR** **Cycle Power to RESET**	Occurs during Calibration Mode if the flow stops. Cycle power to reset.	Done

3.5 Verification of Flow Meter Accuracy

The user can perform the following flow calibration and check.

3.5.1 Flow Meter Calibration

To enter the Calibration Mode, press and hold the SELECT Button while turning the unit ON. The display will alternate between Calibrate Unit and Check Unit. Press the SELECT Button to choose Calibrate Unit.

The Calibration Unit Mode has a Purge Cycle (to remove air bubbles), a brief pause, and a sample fill cycle. During the pause, move the tube from the drain to a 500 mL sample container. When the unit has delivered 500 mL, press the SELECT Button. The AutoSDI display will alternate between ACCEPT or REJECT Calibration.

If REJECT is selected, the old calibration value will remain in memory.

3.5.2 Flow Meter Check

To enter Calibration Mode, press and hold the SELECT button while turning the unit ON. The display will alternate between Calibrate Unit and Check Unit. Press the SELECT Button to choose Check Unit.

The Check Unit Mode has a Purge Cycle (to remove air bubbles), a brief pause, and a sample fill cycle. During the pause, move the tube from the drain to the 500 mL sample container. The AutoSDI will deliver what it considers to be a 500 mL sample. If the sample volume is incorrect, calibrate the flow meter as described in Section 3.5.1 (Flow Meter Calibration).

4.0 MAINTENANCE AND SERVICE GUIDE

The AutoSDI is a reliable piece of field-test equipment. However, potential problems may include:

1. Damage to case and platform due to improper handling.
2. Malfunction of the solenoid valve due to large particles in the feed water (dirt, rust, resin, etc.).
3. Pressure regulator damage, caused by insufficient feed water flow and pressure, [35 psig (2.4 barg) at 0.79 gpm (3.0 Lpm)] are the minimums], resulting in users trying to compensate by over-tightening the regulator knob.
4. Corrosion to power connector pins caused by wetting the AutoSDI platform.
5. Damaged Pressure Gage.
6. Damaged Flow Meter.
7. Damaged Circuit Board.
8. Damaged LCD.

The following are procedures for repairing most failures.

4.1 Procedure for Removing and Installing Platform

STEPS

1. Place a flat head screwdriver or similar tool in the far right-hand corner of the case. Pry up the corresponding corner of the platform by pushing the tool away from you.

2. After freeing the far right-hand corner from the case, insert your fingers into the opening and slide your hand to the front of the case while pulling upward. Continue sliding your hand to the front left-hand corner and pull up on the front of the platform, flipping it over and out of the lower portion of the case.

3. To reinstall the platform into the lower portion of the case, first flip the platform right side up and push the far corners of the platform into the rear of the case. Then push the front corners of the platform into the case.

4.2 Procedure for Replacing Solenoid Valve

STEPS

1. Remove the platform (Section 4.1, Procedure for Removing and Installing Plateform).

2. Remove the OD tubing from the solenoid valve.

3. Cut the plastic ties securing the solenoid valve to the platform.

4. Remove the heat shrink tubing from the solenoid valve wires up to the point of solder connection to the seven (7) conductor cable. Desolder the wires and remove, noting wire connections.

5. Cut the wires on the new solenoid valve to the desired length and slide on a piece of heat shrink tubing (optional). Solder to the wires from the 7 conductor cable.

6. Slide the heat shrink tubing over the solder joints and shrink it with a heat gun or wrap the solder joints and wires with electrical tape.

7. Remount the solenoid valve to the platform using plastic ties and reinsert the tubing into the fittings, making sure that the feed line is plugged into the high-pressure side.

8. Reinstall the platform (Section 4.1, Procedure for Removing and Installing Plateform).

4.3 Procedure for Replacing Pressure Regulator

STEPS

1. Remove the platform (Section 4.1, Procedure for Removing and Installing Plateform).

2. Disconnect the tubing from the defective pressure regulator, noting where each tube was connected.

3. Remove the defective pressure regulator from the platform and replace it with the new one.

4. Reconnect the tubing.

5. Reinstall the platform (Section 4.1).

4.4 Procedure for Replacing Pressure Gage

STEPS

1. Remove the platform (Section 4.1).

2. Disconnect the tubing from the elbow fitting located on the back of the pressure gage. Remove the old gage from the platform.

3. Remove the elbow fitting from the old gage and install on the new gage.

4. Install the new pressure gage in the platform and reattach the tubing.

5. Reinstall the platform (Section 4.1).

4.5 Procedure for Replacing Flow Meter

STEPS

1. Remove the platform (Section 4.1).

2. Remove the heat shrink tubing covering the wires from the flow meter to the solder connection to the 7 conductor cable. Desolder and remove the wire connections.

3. Remove the tubing from the flow meter and cut the plastic ties securing it in place.

4. Remove the defective flow meter from the platform, remove the fittings, reinstall the fittings on the new flow meter, and install the new flow meter. Secure it in place with the plastic ties provided.

   CAUTION: Make sure the arrow on the new flow meter is pointing in the same direction as the old flow meter.

5. Strip back the white insulation on the flow meter cable. Clip off the blue wire. Strip back the insulation on the red, black, and yellow wires from the flow meter and slide on a piece of heat shrink tubing behind the stripped portion of each wire (optional). Solder the flow meter wires to the 7-conductor cable wires, black to black, red to red, and yellow to white.

6. Cover the solder joints using the heat shrink tubing and shrink it using a heat gun or wrap with electrical tape.

   CAUTION: Avoid overheating the wires from the flow meter because the insulation melts easily.

7. Reattach the tubing into the fittings on the new flow meter.

8. Reinstall the platform (Section 4.1).

4.6 Procedure for Replacing Filter Holder on Platform

STEPS

1. Remove the platform (Section 4.1).

2. Remove the pressure regulator (Section 4.3).

3. Remove the PVC elbow from the filter holder and turn the platform right side up. Remove the filter holder from the platform.

4. Attach the PVC elbow to the new filter holder and install it in the platform.

5. Reinstall the pressure regulator (Section 4.3).

6. Reinstall the platform (Section 4.1).

4.7 Procedure for Replacing Circuit Board

STEPS

1. Peel off the label from inside the lid and lay it face down on the platform.

2. Remove the ABS mounting plate, prying it free from the lid and laying it down

3. Remove all the wires from the terminals, noting terminal locations, and disconnect the Liquid Crystal Display (LCD) ribbon connector from the circuit board.

4. Remove the four (4) machine screws from the corners of the circuit board and remove the circuit board.

5. Attach the new circuit board with the four (4) machine screws.

6. Reattach the LCD ribbon connector and reconnect the wires.

7. Snap the ABS mounting plate into the lid.

8. If possible, re-affix the original label making sure to center the LCD display in the opening on the label. If the original label was damaged or removed, refer to Section 4.9 (Procedure for Replacing Label) for instructions on installing a new label.

4.8 Procedure for Replacing Liquid Crystal Display (LCD)

STEPS

1. Remove the ABS mounting plate (Section 4.7, Procedure for Replacing Circuit Board).

2. Remove the four (4) machine screws from the Liquid Crystal Display (LCD) and remove the LCD from the lid.

3. Disconnect the red and black wires from the circuit board, noting connection locations, and unplug the ribbon connector from the LCD.

4. Desolder the data connector socket,and red and black wires from the old LCD and solder them to the new LCD.

5. Connect the ribbon connector. Make sure the red strip on the ribbon is positioned on the side designated by the number "1" on the back of the new LCD

6. Remove the mounting hardware from the old LCD and attach it to the new LCD. Mount the new LCD with the four (4) machine screws.

7. Reconnect the red and black wires from the new LCD to the circuit board.

8. Reinstall the ABS mounting plate (Section 4.7).

9. If possible, re-affix the original label. Be sure to center the LCD display in the opening on the label. If the original label was damaged on removal, refer to Section 4.9 for instructions on installing a new label.

4.9 Procedure for Replacing Label

STEPS

1. Cut old label at the holes for the gray cable.

2. Remove the switch overlays from the old label and reposition them over the switches on the ABS mounting plate.

3. Slit the new label at the hole for the gray cable and position the new label.

4. Peel the backing from the new label and affix the new label in place. Make sure to center the LCD display in the opening on the new label.

4.10 Procedure for Replacing Two-Pin Connection

STEPS

1. Remove the plastic nut and weather-tight cap. Push the 2-pin panel connector into the platform.

2. Remove the platform (Section 4.1, Procedure for Removing and Installing Platform).

3. Desolder both wires from the 2-pin panel connector and discard the old 2-pin panel connector.

   NOTE: The orange wire is located next to a "dot" on the connector.

4. Position the new 2-pin panel connector into the hole in the platform so that th "dot" on the back of the new 2-pin connector is on the left.

5. Replace the weather-tight cap and secure the new 2-pin panel connector in place with the plastic nut.

6. Strip-back a small portion of insulation from each wire to the connector and slide on a piece of heat-shrink tubing (optional) past the stripped portion of each wire.

7. Solder the orange wire to the pin parallel to the "dot" on the bottom of the new 2-pin connector. Then solder the blue wire to the remaining pin on the connector.

8. Slide the heat-shrink tubing down over the solder joints and shrink it using a heat gun or wrap the wires with electrical tape.

   NOTE: Do not hold the heat gun in one place for too long, you could melt the platform.

9. Reinstall the platform (Section 4.1).

5.0 TROUBLESHOOTING

This troubleshooting guide can assist you in identifying common operating problems you may experience with your machine. The operator can easily correct many of these problems, however, for those that persist or are not understood you should contact GE Customer Support Center (Section 1.0, Introduction). Have the following information available when calling the Customer Support Center:

1. Machine installation date
2. Model number
3. Detailed description of problem

Table 5.3
Troubleshooting Guide

PROBLEM	SOLUTION
Water flows through kit even when though kit is OFF	Solenoid valve stuck in the open position by debris. Contact GE Technical Service for assistance.
Solenoid valve does not open when power turned ON	Possible solenoid valve failure or loose connection to circuit board. Contact GE Technical Service for assistance.
Display shows no flow when there is water flow through the kit.	Possible flow meter failure. Contact GE Technical Service for assistance.
Pressure regulator will not adjust to 30 psig (2.1 barg) even when fully open	Insufficient feed pressure and flow. Must be at least 35 psig (2.4 barg) and 0.79 gpm (3 Lpm). Adjust at source or use a booster pump kit.
Pressure regulator will not adjust to 30 psig (2.1 barg) even with sufficient feed pressure and flow.	Possible pressure regulator failure. Contact GE Technical Service for assistance.
Pressure gage will not return to zero.	Possible pressure gage failure. Contact GE Technical Service for assistance.

PROBLEM	SOLUTION
AutoSDI kit shuts off and restarts prior to finishing the 15 minute SDI test.	Possible circuit board failure. Contact GE Technical Service for Assistance.
It is difficult to remove the inlet feed tubing from the John Guest (JG) 1/4-inch slip elbow fitting.	Do not attempt to remove the inlet feed tubing if the tubing is still under pressure. Relieve the feed tubing pressure, hold the collet toward the inlet feed tubing using the tool provided and slide out the inlet tubing.
The 15 minute SDI test results do not repeat for multiple tests on the same water source.	Inspect the filter after SDI test for evidence of bubbles. A bubble is indicated by the white circular spot(s) on the SDI filter. The SDI test must be done with bubble-free water. Be sure the bottom filter is at least 1/2 full of water as the filter holder top is screwed into place. This will ensure that initial bubbles will be purged out as the filter holder top is screwed into place.
	Pressure is not constant during the 15 minute test. Pressure should be29 - 31 psig (2.0 - 2.1 barg) at the beginning of the test. An invalid test will result if the pressure is below 29 psig (2.0 barg) or above 31 psig (2.1 barg) at the start of the first sample period and then is adjusted later during the test. If the pressure is set properly at the beginning of the test, and the SDI is greater than 3, the pressure at the end of the test may be 2 -3 psig (29 - 43.5 barg) higher than the setting at the beginning of the test. This is normal. If desired, it is acceptable to adjust the pressure down to 30 psig (2.1 barg) for the final 500 mL sample. This is not required since the SDI error (at the SDI level of 3) is only 0.1 units for each psi above 30 psig (2.1 barg), the SDI can be corrected to 3.9.

PROBLEM	SOLUTION
The 15 minute SDI test results do not repeat for multiple tests on the same water source. (continued)	Water quality is not constant. The SDI test must be done with constant feed water quality for the entire 15 minute test. Flush the feed water through the SDI kit prior to placing a filter into the filter holder. The feed water temperature is changing. The test must be done with feed water that does not change more than 1°C (33.8°F).
5 Minute, 10 Minute, 15 Minute SDI's are not the same values	This is normal, especially for high SDI waters. What this means is that the plugging of the filter is not linear. The units of SDI are percent plugged per minute. The non-linearity means that the filter is plugging at a faster rate during the beginning of the test. As the filter plugs, the plugging rate begins to decline. The 15 minute SDI is always used as the reporting standard - assuming that the water is clean enough to successfully reach and complete the 15 minute SDI sample period.
It is difficult to remove the clear tubing from the filter holder after a test is completed	Rock the clear tubing back and forth, gently pulling the tubing off the filter discharge connection.

PROBLEM	SOLUTION
Water leaks out of the bottom of the kit every time a test is completed	A small amount of water should drain out of the bottom during each test. When water is added to the lower filter housing compartment at the beginning of the test, water overflows the filter housing and is drained out of the bottom of the kit. The water that is added to the bottom housing is necessary to ensure that the test starts without any air bubbles trapped on the filter surface. The more water that is added to the lower housing, the lower the risk of bubbles. Bubbles indicated at the end of the test when the used filter is inspected. A white spot indicates a bubble was present. The test results will be invalid. One indication of a valid test is a used filter that is uniform in color with no spots.
No water flow through AutoSDI	The in-line pre-filter is plugged. The AutoSDI test is normally done with very clean appearing water, containing only microscopic suspended solids. If the test water is contaminated with visible particles, the test should not be run. However, if contamination does plug the in-line pre-filter, there is a method to clean out the contamination. Remove the in-line pre-filter to see if the contamination has been removed. If the contamination cannot be flushed from the in-line pre-filter it must be replaced.

6.0 RETURN GOODS AUTHORIZATION (RGA) PROCEDURE

If you wish to return goods for repair, warranty evaluation and/or credit, please have your original sales order or invoice available when you call GE. Call (800) 848 - 1750 and ask to speak with Customer Service. A GE Customer Service representative will provide instructions and a return goods authorization number, which needs to be clearly written on the outside of the box used to ship your materials. All equipment must be shipped to GE with the freight pre-paid by the customer. Call our Customer Service Center with any questions or issues concerning freight claims and a representative will discuss your situation.

All materials to be returned must be rendered into a non-hazardous condition prior to shipping.

7.0 SPARE PARTS LIST

ITEM	PART NUMBER
Analyzer, AutoSDI Test Kit, 115VAC (includes Manual)	1227464
Analyzer, AutoSDI Test Kit, 230VAC (includes Manual)	1227473
AutoSDI Operation and Maintenance Manual	1227468
AutoSDI Power Supply, 115VAC to 12VDC	1106483
AutoSDI Power Supply, 230VAC to 12VDC	1106484
AutoSDI Booster Pump, 115VAC [(0.8 gpm (3.0 Lpm) @ 65 psig (4.5 barg)]	1106581
AutoSDI Booster Pump, 230VAC [(0.8 gpm (3.0 Lpm) @ 65 psig (4.5 barg)]	1233011
AutoSDI Connector, 2 Pin, Panel Mount	1106424
AutoSDI Filter Holder	1106432
O-Ring Kit for AutoSDI Filter Holder (top and bottom)	1106654
AutoSDI Membrane Filters, 0.45 m, 47 mm D (100 filters/box)	1215281
AutoSDI In-line Pre-filters	1106359
AutoSDI Case Label	1227467
AutoSDI Tweezers	1106475
AutoSDI Water Bottle	1106461
AutoSDI LCD Display	1106427
AutoSDI populated circuit board	1227466
AutoSDI pressure gage, 100 psig (6.9 barg)	1116808
AutoSDI Pressure Regulator, 300 psig (20.7 barg)	1106463
AutoSDI Solenoid Valve, 12VDC	1106476

8.0 WARRANTY

8.1 Warranty Terms

Subject to the terms and conditions set forth hereinafter, Seller (GE or any of its authorized subsidiaries) warrants to the original purchaser (hereafter the "Buyer") that the products manufactured by Seller are free from defects in material and in workmanship for twelve (12) months from the Warranty Commencement Date (as defined below) only when used strictly in accordance with the applicable operating instructions and within the range of the operating conditions specified by Seller for each such product. This Warranty does not extent to equipment or components manufactured by others into which a Seller product has been incorporated or to equipment or components which have been incorporated into a Seller product but, if allowable, Seller hereby assigns, without warranty, to the Buyer its interest, if any, under any warranty made by the manufacturer of such equipment or component. This Warranty does not cover disposable items such as fuses, lamps, filters, cartridges, or other such disposable items, which must be replaced periodically under the normal and foreseeable operating conditions of the goods warranted hereby.

8.2 Warranty Commencement Date

The Warranty Commencement Date for each Seller product shall be the later of the date of: (1) receipt by the Buyer, or (2) the date of installation at the Buyer's premises provided that such installation must occur within three (3) months of shipment from the Seller's manufacturing facility in Minnetonka, Minnesota. In no event shall the Warranty Commencement Date exceed three (3) months from the shipment from the Seller's manufacturing facility. The Buyer shall provide proof of purchase in order to exercise rights granted under this Warranty. If requested by GE, the Buyer must also provide proof of the installation date. Proof of installation shall be returned by Buyer to Seller within thirty (30) days after installation by virtue of supplying a Warranty Validation Card supplied with each Seller product fully completed and signed in ink by Buyer and the authorized installer of the product.

8.3 Warranty Service

SELLER'S OBLIGATION UNDER THIS WARRANTY IS LIMITED TO REPAIR OR REPLACEMENT (AT SELLER'S SOLE OPTION) OF ANY PRODUCT, OR COMPONENT THEREOF, PROVED TO BE DEFECTIVE IN MATERIAL OR WORKMANSHIP WITHIN THE COVERED WARRANTY PERIOD. The Buyer, at the Buyer's risk and expense, shall be responsible for returning such product or component, upon obtaining a Return Goods Authorization (RGA) number from the Seller, freight prepaid, and in conformance with any special packaging and shipping instructions set forth on the operation documentation or RGA instructions, or as otherwise reasonably required, to the Seller's address set forth below, together with (1) RGA number issued by Seller at Buyer's request; (2) proof of purchase and, if necessary, proof of installation date; (3) a description of the suspected defects; (4) the serial number of the Seller product alleged to be defective; and (5) a description of the type of water pretreatment equipment which has been utilized in connection with the product, if any. Seller shall, in Seller's reasonable

discretion, be the sole judge of whether a returned product or component is defective in material or workmanship. Required or replaced products or components shall be returned to the Buyer by the Seller, freight prepaid by Seller, via UPS ground or best way surface freight. In genuine emergency situation, Seller will (at Seller's sole option) forward replacement parts to Buyer without waiting for authorized return of the questionable part(s). In such cases, Buyer will issue a purchase order or other payment guarantee prior to shipment. If the returned part is found to have been misused or abused, the defective part is not received by Seller within thirty (30) days, the Buyer will be invoiced for replacement part(s) provided. This Warranty does not cover or include labor and/or travel to the Buyer's premise or location or any other location. Charges will be made for the usual and customary Seller costs and associated expenses incurred by Seller in providing Warranty Service at any location other than Seller's factory at the address set forth below, and Seller reserves the right to precondition such travel to Buyer's premises upon prepayment of Seller's anticipated costs of attending such premises.

8.4 Voidability of Warranty

This Warranty shall be void and unenforceable as to any Seller product which has been damaged by accident, mishandling, abuse or has been repaired, modified, altered, disassembled or otherwise tampered with by anyone other than Seller or an authorized Seller service representative; or, if any replacement parts are not authorized by Seller have been used, or, the product has not been installed, operated and maintained in strict accordance and adherence with the operating documentation and manuals for such product. Any express warranty, or similar representation of performance set forth in the operation documentation for a reverse osmosis or ultrafiltration membrane incorporated into a Seller product shall be void and unenforceable unless the feed water requirements set forth in the operating documentation for such product are unequivocally and strictly adhered to.

8.5 Limitations and Exclusions

THIS WARRANTY AND REMEDIES DESCRIBED HEREIN AND HEREINABOVE ARE EXCLUSIVE AND IN LIEU OF ANY AND ALL OTHER WARRANTY OR REMEDIES, EXPRESSED OR IMPLIED, INCLUDING WITHOUT LIMITATION, ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL THE SELLER BE LIABLE FOR ANY CONSEQUENTIAL, INCIDENTAL OR OTHER SIMILAR TYPES OF DAMAGES, OR FOR DAMAGES FOR THE LOSS OF PRODUCTION OR PROFITS, OR INJURY TO PERSON OR PROPERTY. NO PERSON HAS ANY AUTHORITY TO BIND SELLER TO OTHER THAN WHAT IS SET FORTH ABOVE.

THIS WARRANTY GIVES THE BUYER SPECIFIC LEGAL RIGHTS AND THE BUYER MAY ALSO HAVE OTHER RIGHTS WHICH VARY FROM JURISDICTION TO JURISDICTION. THE PARTIES RECOGNIZE AND AGREE, THAT IN ALL RESPECTS THE LAWS OF THE STATE OF MINNESOTA SHALL APPLY TO AND SHALL GOVERN ANY INTERPRETATION OR LEGAL SIGNIFICANCE OF THIS DOCUMENT.

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Any questions about this Warranty and all warranty service returns should be addressed to:

GE Infrastructure
Water & Process Technologies
Attn: Customer Service Center
5951 Clearwater Drive
Minnetonka, MN 55343 USA

P/N 1227468 Rev C

For more information call 952-933-2277 or 800-848-1750 in the U.S., or visit **www.gewater.com**.

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