

# OWNER'S MANUAL

**Lectra/san**<sup>®</sup>

MARINE *flow-thru*  
WASTE TREATMENT  
SYSTEM

Models 12 VDC  
24 VDC  
32 VDC

COAST GUARD CERTIFIED

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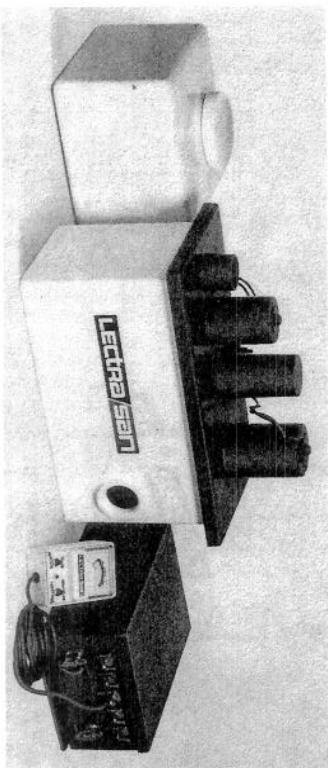
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## LECTRA/SAN\*

### MARINE flow-thru WASTE TREATMENT SYSTEM

#### I. DESCRIPTION

LECTRA/SAN is an electrolytic chlorinator which provides flow-thru treatment of wastewater and is designed to be used with one marine toilet. Operation is automatic and is not affected by even the severe list which is at times experienced in sailing craft. The treatment process destroys bacteria and odors, reduces solids, and lowers the Biochemical Oxygen Demand of the wastewater. The disinfecting agent, hypochlorous acid, is produced during the treatment cycle by electrolyzing the sea water used to flush the toilet. A solution of table salt automatically added to the system serves as a source of the disinfectant when in fresh or brackish waters. The LECTRA/SAN system operates on standard marine DC voltages.



#### II. SYSTEM COMPONENTS

The LECTRA/SAN system consists of 1) a two-chambered Treatment Unit equipped with motors and electrode pack, 2) a Control Unit with treatment indicator, 3) a Logic Unit containing relays and a solid state timing circuit, and 4) a Salt Feed Unit.

\* LECTRA/SAN is a trademark of Diamond Shamrock Corporation  
Patented Under US 3,856,642

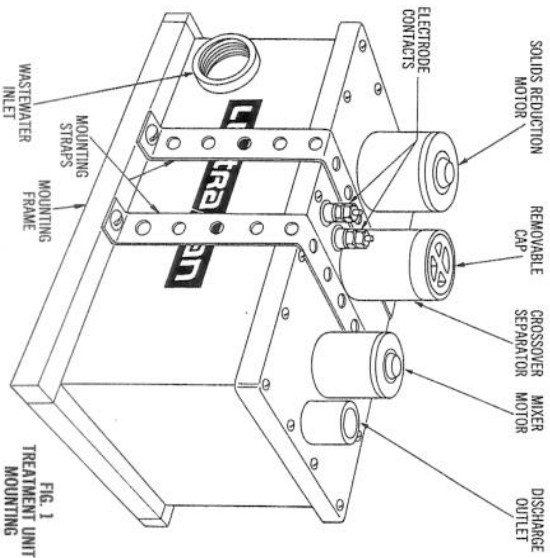
### III. INSTALLATION

See Section X, Materials Required, for a list of items needed to mount and wire LECTRA/SAN.

#### A. MOUNTING

##### 1. Treatment Unit:

The LECTRA/SAN Treatment Unit should be located as close to the toilet as possible, preferably within three feet. It can be installed in any accessible location. By mounting the Treatment Unit at or below the level of the toilet bowl, potential backflow into the bowl is prevented.\* The base of the Treatment Unit should be nested in a wood frame with side support. The frame side should be approximately one inch high. If desired, a rubber pad can be placed under the Treatment Unit to reduce operating noise. Two metal straps (hanger iron) should be used to secure the unit within the mounting frame. See figure 1.



the hose fitting into the inlet hole facing the toilet. Tighten the plug into the hole on the other side of the Treatment Unit. Connect the inlet fitting to the toilet discharge with a 1-1/2" ID neoprene or plastic hose. Do not use metallic pipe for any part of the installation. If the hose must be bent around a sharp corner, use a standard auto radiator hose of the type with the desired curve molded in (not the "flexible" type with annular corrugations). A single hose is preferable to plumbing "ells."

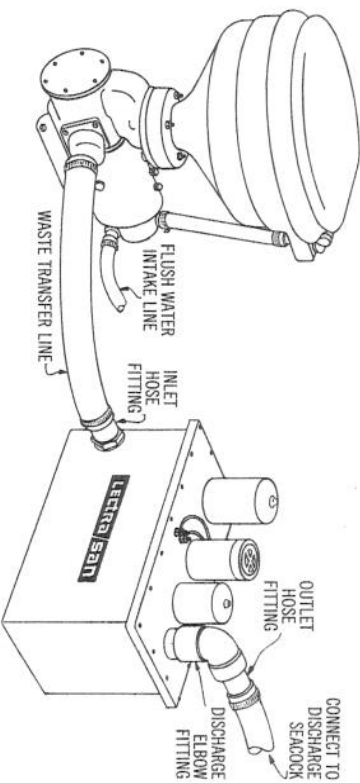


FIG. 2a INSTALLATION WITH CROWN HEAD

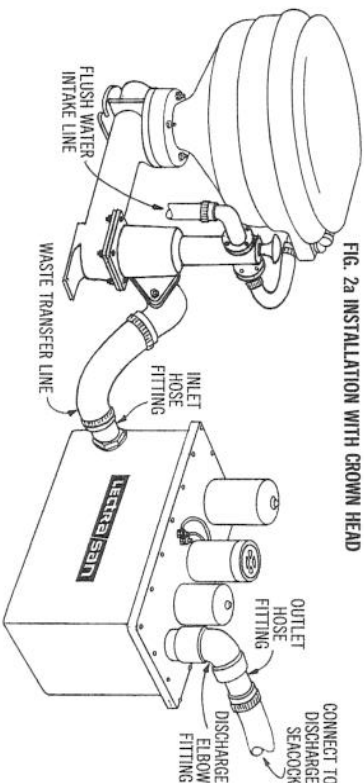


FIG. 2b INSTALLATION WITH MANUAL PUMP TOILET

Refer to Figures 2a and 2b for illustrations of plumbing installation. Put Teflon tape or pipe sealing compound around the threads of the inlet hose fitting and the inlet plug. Tighten

\*The Raritan Crown Head Deep Draft model will prevent backflow.

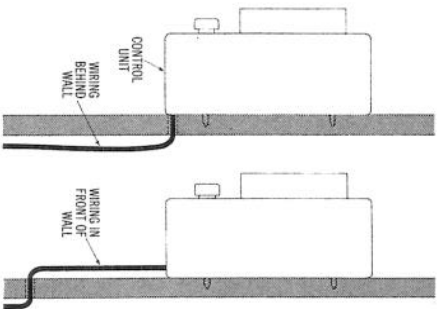
A vented loop should be used when the Treatment Unit is mounted below the water level. Secure the loop (with vent fitting up) above the water level to a bulkhead using a pipe clamp on each leg of the loop. Secure hoses as described above. The vent fitting on the loop should be connected with appropriate size tubing to the exterior of the boat with a standard loop to prevent water intake.

## 2. Logic Unit:

The Logic Unit should be located in any accessible area close to the Treatment Unit. Secure the logic box to any strong horizontal or vertical surface with screws or bolts. If a vertical surface is used, position the box so that the side with the holes faces down. On a horizontal surface, this side should face the Treatment Unit.

## 3. Control Unit:

The Control Unit is mounted on a wall in the head. It is supplied with a six foot length of wire (do not shorten) which connects it to the Logic Unit. Remove the face plate and secure the box to the wall with screws. The end of the Control Unit wire is passed through a hole drilled in the wall and is connected to the Logic Unit according to the wiring instructions. The face plate with buttons and meter is then attached to the box. The Instruction Placard should be mounted on the wall.



## 4. Salt Feed Unit:

The Salt Feed Unit should be located in an accessible area so that it can be refilled with salt and water as needed. It should be mounted within six feet of the toilet and the top of the salt feed tank should be lower than the top of the toilet bowl. It is secured in place using a frame made of wood or other suitable material.

The salt feed tank is equipped with a control valve. Attach the check valve and tubing as shown in Figures 3 or 4. Lead the free end of the tubing to the flush water intake fitting on the marine toilet. Cut off any excess tubing. Instructions for connecting the tubing to the toilet are given below.

*Raritan Crown Head*—Figure 3 illustrates the installation

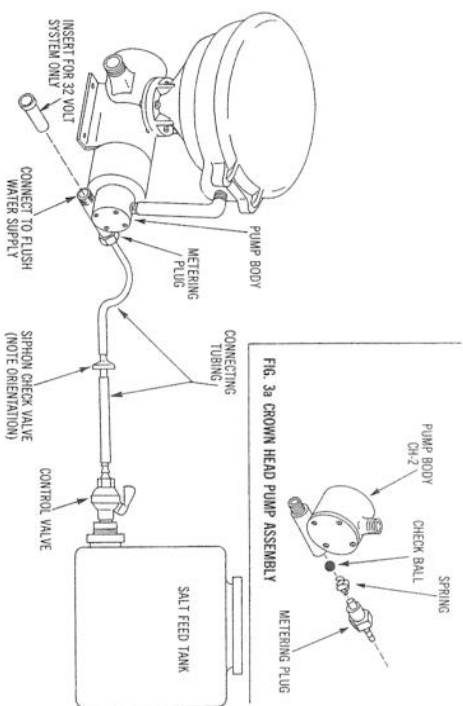


FIG. 3 CROWN HEAD—SALT FEED SYSTEM INSTALLATION

of the Salt Feed Unit to the Crown Head. The LECTRA/SAN Salt Feed Unit is supplied with a T-check valve (part number 41-1013). Remove and discard the existing plug (or metering plug) as well as the ball and spring from the rear pump body (part number CH-2) of the Crown Head. See Figure 3a. Remove the metering plug, spring and ball from the supplied T-check valve and install into the pump body. Be sure that the ball is inserted before the spring. The larger end of the spring should rest against the ball. Connect the end of the tubing to the metering plug. For a 32-volt system with a 32-volt Crown Head, press the supplied intake water Insert (part No. 41-402) into the flush water intake port on the side of the pump assembly opposite the metering plug. Then connect the fresh water supply tubing to the pump fitting.

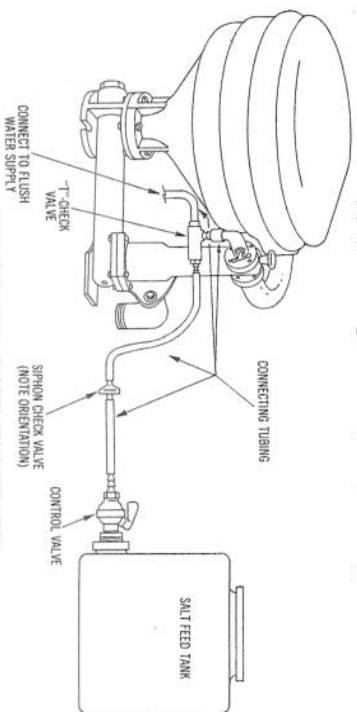


FIG. 4 MANUAL TOILET—SALT FEED SYSTEM INSTALLATION

*Manual Toilets\**—The LECTRA/SAN Salt Feed Unit is supplied with a T-check valve (part number 41-1013) which is used to supply the salt water from the salt feed tank to the flush water. Connect the large end (not

\*Includes Raritan PH and PHE models and most other manual flush toilets.



having the ball) of the T-check valve to the flush water intake fitting of the toilet with a short piece of flexible hose. The flush water intake line is connected to the other large end of the T-check valve.

Connect the 1/4" tubing from the salt feed tank to the metering plug of the T-fitting. See Figure 4. The connections should be secured with hose clamps.

## B. WIRING

Only **stranded** copper wire should be used. The specific sizes of insulated solderless ring and butt connectors which are supplied are listed on page 28. It is recommended that connectors be crimped with a Multipurpose Crimping Tool, ABC-500 (ETC Inc., Cleveland, Ohio) or equivalent. The threads on lug D (Figure 6) are different from those of the other lugs, so care must be taken not to mix the nuts.

### 1. Treatment Unit

a) Cut a length of #10-3 wire to connect between the Logic and Treatment Units and bare all ends for connectors.

Separate 6" of the wires from one end of the outer casing and crimp a solderless ring connector (see page 28 for size) onto each of the three wires.

Pass the prepared end of the wire through hole #2 of the logic box with a strain relief connector (Figure 5). Do not tighten the strain relief connector.

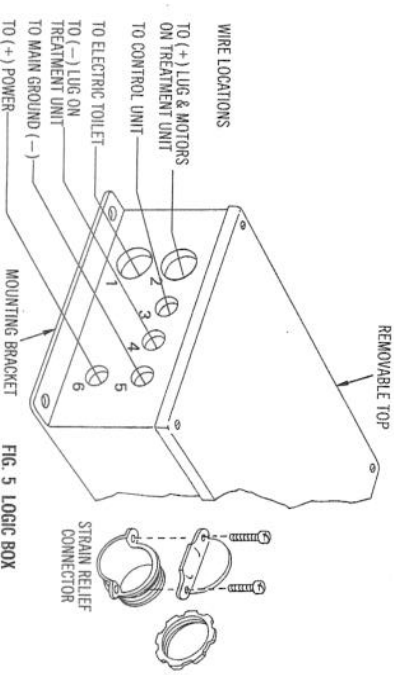


FIG. 5 LOGIC BOX

Attach and secure the **black** #10 wire with ring connector to lug A on the fuse block, the **white** wire to lug B on the fuse block, and the **green** wire to lug D on the board. See Figure 6.

Separate 6" of the free ends of the same #10-3 wire from the **outer** casing and crimp a solderless butt

connector to the ends of the **black** and **white** wires. Slip the rubber boot onto the **green** wire. Crimp a solderless ring connector to the bare end of the wire. Attach and secure the **green** wire with ring connector to the (+) lug on top of the Treatment Unit. Press rubber boot over (+) lug. See Figure 6. Crimp the bare end of the orange wire from the solids reduction

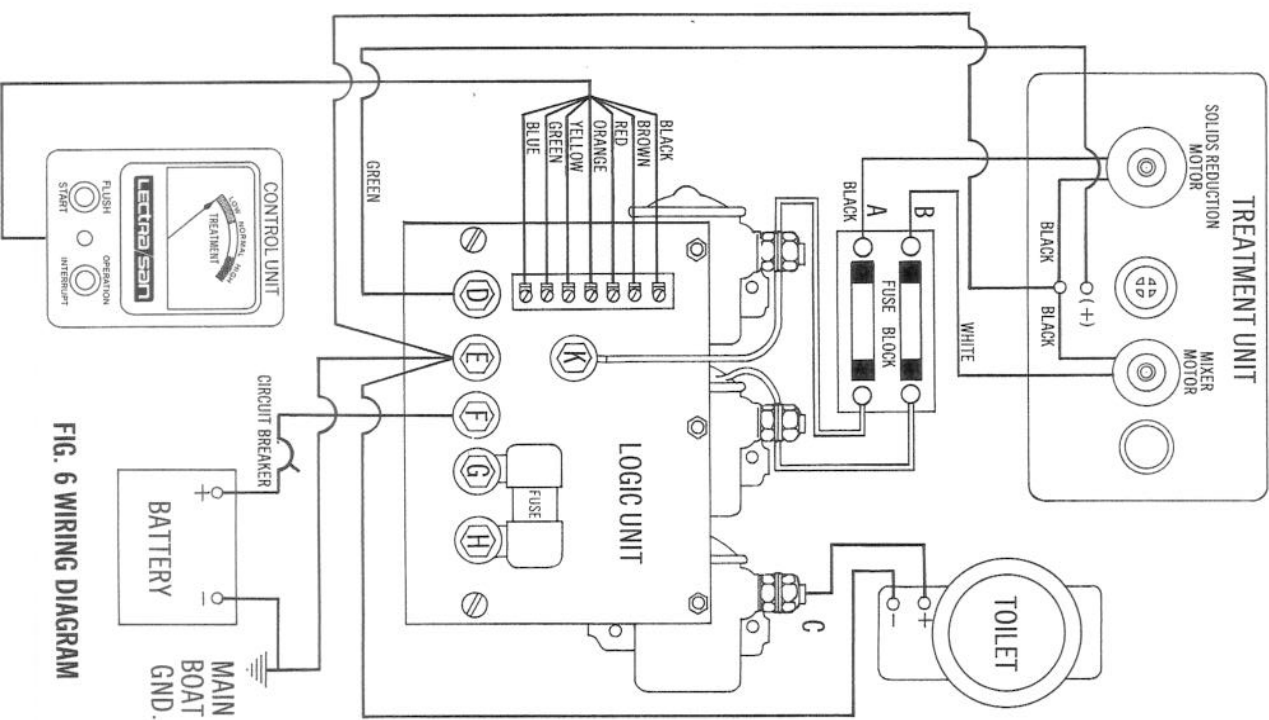


FIG. 6 WIRING DIAGRAM

motor (large motor) to the **black** wire butt connector. Crimp the bare end of the orange wire from the mixer motor (smaller motor) to the **white** wire butt connector.

- b) Cut a length of #6-1 wire to connect between the Logic and Treatment Units, bare both ends, and crimp a ring connector to each end.

Pass one end of the #6 wire through hole #4 of the logic box with a strain relief connector and bend the wire around the circuit board to attach to lug E. Do not tighten the nut onto the lug and don't tighten the strain relief connector.

Attach the other end of the #6 wire with ring connector to the (—) lug on top of the Treatment Unit. Do not tighten the nut onto the lug.

- c) Crimp the black wires from both motors on the Treatment Unit into one solderless ring connector.

Attach and secure both black wires with the ring connector to the (—) lug on top of the Treatment Unit.

## 2. Control Unit:

- a) Pass the free end of the 7 conductor (color-coded) wire through hole #3 of the logic box with a strain relief connector. Do not tighten the strain relief connector.

b) Attach and secure each colored wire to the proper color-coded terminal on the terminal board as shown in Figure 6. The bare wire ends slip between the gripping plates and are not secured directly to the screws.

## 3. Electric Toilet: (for manual flush toilets, go on to No. 4, page 10)

- a) Cut a length of #10-2 (#8-2 for Deep Draft Model Crown Head and 32 volt Standard Crown Head) wire to connect between the toilet and Logic Unit and bare all ends for connectors.

Separate 7" of the wires from one end of the outer casing and crimp solderless ring connectors onto all four ends. One of the separated wires should be fitted with a ring connector for a 5/16" lug.

- b) Pass the end with 7" of free wires through hole #1 of the logic box with strain relief connector. Do not tighten the strain relief connector.

Attach and secure the end of the wire with the 5/16" ring connector to lug C. Attach the other wire to lug E, but do not tighten the nut. There should now be two wires connected to lug E.

- c) Attach and secure the other two ends of the #10-2 (or #8-2) wire with ring connectors to the two terminals of the electric toilet. If polarity is shown on the toilet motor, attach the wire which is connected to lug C to the (+) terminal on the toilet motor.

## 4. Battery Power:

During the treatment cycle the Models 12 and 24 VDC LECTRA/SAN will draw about 50 amps of current for the two minute operating period. This is only 1-1/2 amp hours of battery power. The Model 32 VDC requires even less current. The entire system is protected by a 50 amp fuse and the two motors are independently fused. It is recommended that the power supply wires from the battery be connected to a switchboard having 50-60 amp rated circuit breaker. See Figure 6 on page 8.

- a) Cut two lengths of #6-1 wire (or #4-1 wire if wires will be more than 15 feet long) to connect between the battery and the Logic Unit. Use the (+) terminal on the battery supply or a terminal on a (+) battery switch for (+) power and the main ground connection for (—) power.

Bare the ends of both #6 (or #4) wires and crimp solderless ring connectors onto all four ends.

- b) Pass the end of one #6 (or #4) wire through hole #5 and strain relief connector of the logic box and bend the wire in the box to connect to lug E. Attach the ring connector to lug E and tighten the nut. If an electric toilet is being used, there should now be three wires connected to lug E. With a manual toilet, two wires should now be connected to lug E. Do not tighten the strain relief connector.

- c) The other end of the wire connected to lug E should now be secured to the main ground (—) location.

d) Pass the end of the second #6 (or #4) wire through hole #6 and strain relief connector of the logic box, and bend the wire in the box to connect to lug F. Attach the ring connector to lug F and tighten the nut.

- e) Check the alignment of all wires in the logic box and make sure all wires are attached to the proper lugs and all nuts tightened. See Figure 6.

**Tighten all strain relief connectors on the Logic Unit.**

- f) Attach and secure the free end of the wire connected to lug F to the (+) terminal of a 50 to 60 amp circuit breaker in the boat's power supply box. Be sure to route the wire away from all moving engine parts.

## IV. LECTRA/SAN START-UP

**Important:** Serious damage can occur to the system if LECTRA/SAN is operated without water in the Treatment Unit.

When operating in sea water there is sufficient salt in the flush water to generate disinfecting agent without the need for supplemental salt addition. Boats operating in fresh or brackish water must use the Salt Feed System to automatically provide the needed salt. The salt feed tank has a capacity of two gallons, and contains sufficient solution to provide salt for as many as 60 uses in fresh water and up to 150 uses in brackish water. The valve on the salt feed tank can be adjusted to provide the proper feed rate of salt solution to the Treatment Unit.

Since most boats are used extensively at dockside, LECTRA/SAN operating conditions should be established for dockside operation. The following steps should be taken for start-up:

### A. FILL SALT FEED TANK

Close off the valve on the salt feed tank. Disconnect the tubing from the tank. Add three boxes (five pounds) of ordinary table salt to the empty salt tank. Fill the salt tank about one-half full with hot water and stir or shake for a minute or two to dissolve the major portion of the salt. Then fill the salt tank to the neck with hot water and stir or shake for about three or four minutes to dissolve the remaining salt. (See note below.) After filling the salt feed tank replace the tank in its proper location and reconnect the tubing.

### B. ADJUST CONTROL VALVE ON SALT FEED TANK

Set the salt feed control valve to the position shown in the following table in order to establish the initial salt feed rate. Select the valve position for your type of dockside water.

Dockside Water			
Initial Valve Setting	Fresh Water	Brackish Water	Seawater
Open	Open	3/4 Open	Closed

#### NOTE :

Table salt normally contains a small amount of a drying agent which will not dissolve in water. This material settles to the bottom of the tank and normally will cause no problem. However, the tank should be rinsed out before it is refilled in order that this insoluble material does not accumulate in the tank. An alternative is to use a five-pound bag of cooker's and canner's salt which will dissolve completely.

### C. FILL TREATMENT UNIT

For electric toilet operation, press and hold down the Flush button on the Control Unit for sixty seconds and **then** press the Operation Interrupt button to cancel the treatment cycle. This will fill both compartments of the Treatment Unit with water.

For manual flush toilets, pump the flush handle about 50 times to fill both chambers of the Treatment Unit. Check the water level in the Treatment Unit through the Crossover/Separator. The water level in both compartments must be no more than one inch **below** the cover.

### D. TEST OPERATION

Push the Flush/Start button to activate LECTRA/SAN for a test treatment cycle. Check for the following conditions:

- 1) Operating light "on".
- 2) After one-half minute, the treatment cycle begins and treatment meter registers.
- 3) Note position of indicating needle.
- 4) After about two and one-half minutes, treatment cycle ends; operating light goes off and meter reading goes to zero.

### E. ADJUST CONTROL VALVE ON SALT FEED TANK

For optimum start-up, the needle should rest in the area between Normal and High as shown in the accompanying figure.

In actual use the meter reading will be slightly lower due to the presence of wastewater in the Treatment Unit. If meter reading is below the recommended range, open control valve slightly; close the control valve slightly if reading is above the range. This should be the final adjustment needed for the proper salt feed rate.

**The full effect of any valve adjustment will be indicated on the meter only after about five uses.**

This is because water in the Treatment Unit must be replaced by flush water of the new salt concentration.

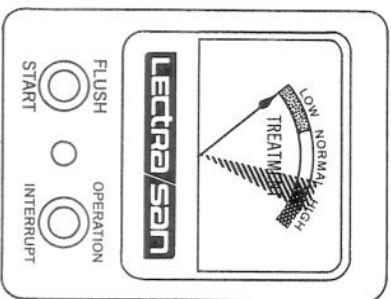


FIG. 7 LECTRA/SAN CONTROL UNIT

## V. LECTRA/SAN OPERATION

### A. GENERAL

The two operating principles of LECTRA/SAN are:

- 1) Reduction of solid waste to indiscernable particles; and
- 2) Oxidation of waste matter and destruction of odors and bacteria.

LECTRA/SAN operation is completely automatic. The user has only to activate the treatment cycle by depressing the Flush button on the wall-mounted Control Unit. This turns on the operating light, flushes the electric toilet, feeds salt to the flush water (if needed), starts the mixer motor and discharges previously treated wastewater. The flush action continues for as long as the button is depressed, and normally requires six to ten seconds. (Manual toilets are flushed by hand immediately **after** depressing the Start button.) The mixer motor continues to operate and after about 35 seconds the solids reduction motor\* and electrodes are activated. Disinfecting agent is generated to oxidize the waste and destroy bacteria and odor. This phase of the treatment cycle continues for two minutes at which time the operating cycle is complete and the system automatically shuts down. During the two minute operating period a small amount of by-product gas, similar to battery gas, is formed and is discharged through the effluent line. There can be no accumulation of gas because LECTRA/SAN operates completely filled with water. The toilet can be used during the treating cycle, but the flush should be deferred until the operating light is "off".

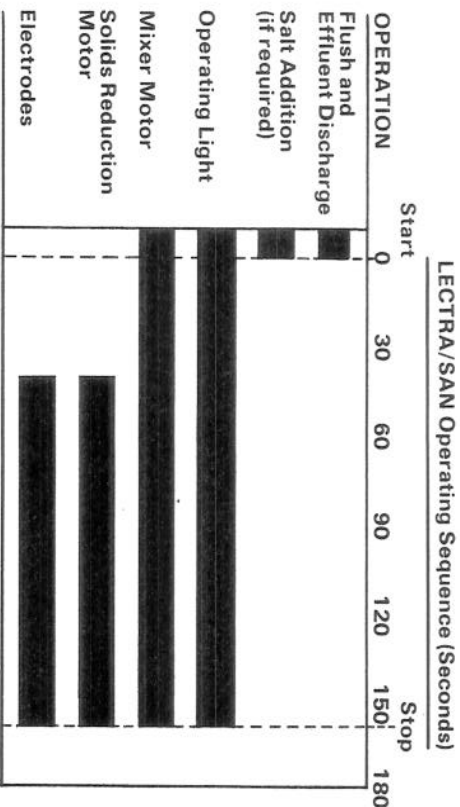
The oxidizing and disinfecting agent is produced by passing electricity through the conductive salt water solution in the LECTRA/SAN Treatment Unit. Although LECTRA/SAN operates on the principle of electrolysis, extensive testing has shown that electrolytic corrosion of metal boat fittings is negligible.

\*It is normal for the motors on the Treatment Unit to be hot to the touch after an operating cycle.



## B. OPERATING SEQUENCE

A schematic illustration of the LECTRA/SAN operating sequence is shown in the table below.



## C. OPERATING INSTRUCTIONS

Instructions for operating the LECTRA/SAN System with both electric and manual toilets are given below.

### Electric Toilet

1. After using the toilet, flush for the minimum time required to clear the bowl by holding down the Flush button on the Control Unit. This will normally take six to ten seconds.
2. After two and one-half minutes, the treatment cycle will be complete and the unit will automatically shut down. (See Note below.)
3. The toilet is now ready for the next use.
4. The toilet can be used during the treatment cycle, but the flush should be deferred until the operating light is "off".

### Manual Toilets\*

1. **After using the toilet, but before flushing,** push the Start button on the Control Unit to activate the system.
2. Pump the flush handle vigorously to clear the bowl. This will normally take six to ten strokes.
3. After about two and one-half minutes, the treatment cycle will be complete and the unit will automatically shut down. (See Note below.)
4. The toilet is now ready for the next use.
5. The toilet can be used during the treatment cycle, but the flush should be deferred until the operating light is "off".

### NOTE:

During the treatment cycle note the position of the indicator needle on the Control Unit. If it is not registering in the Normal range (and the salt feed tank is not empty) make the adjustment shown at top of page 16.

\*Includes Raritan PH model and other manual flush toilets.

Meter Reading

High  
Low

Salt Feed Valve Adjustment

Close valve slightly  
Open valve slightly

If after about six uses the meter reading is still not normal, review the Start-Up Procedures in Section IV.

## D. SALT FEED ADJUSTMENTS

The salt feed rate was originally set for dockside operation (Section IV, LECTRA/SAN START-UP). When sailing into waters that are significantly more or less saline, an adjustment of the salt feed valve should be made according to the following table:

### Boat Movement

To fresh water  
To open sea

### Salt Feed Valve Adjustment

Open valve  
Close valve

## E. SALT FEED TANK REFILLING PROCEDURES

The level in the salt feed tank should be checked periodically and refilled as needed according to the following instructions:

1. Note and mark valve position and close off the valve.
2. Disconnect tubing from tank and rinse out the tank.
3. Add three (3) boxes (five pounds) of table salt to the tank.
4. Fill tank one-half full with hot water and stir or shake for a few minutes.
5. Fill tank to the neck with hot water and stir or shake for a few minutes.
6. Replace the tank, reconnect the tubing, and reposition the valve.

## F. BOARDING AND DEPARTING PROCEDURES

If the boat is not used for more than a two-day period, a treatment cycle should be routinely run prior to use. This is done by momentarily depressing the Start button on the Control Unit to activate LECTRA/SAN without flushing the toilet.

When the boat is to be left for long periods, an extended flush and treatment cycle should be performed. For electric toilets, depress the Flush button for thirty (30) seconds. For manual toilets, pump the flush handle 40-50 times and then depress the Start button.

## VI. TROUBLESHOOTING

Although LECTRA/SAN has been designed and engineered to be trouble-free, component or unit malfunction may cause the system to become inoperative or to operate incorrectly. A number of possible problems and their probable causes are listed below along with corrective action to be taken to remedy the problem. The corrective action steps should be performed in the order shown until the cause of the problem is corrected.

Problem	Possible Cause	Corrective Action
System Inoperative	A. Faulty Fuse	A-1. Check fuse in Logic Unit with voltmeter. If there is no voltage between lugs E and H (Fig. 6), fuse is faulty. Replace fuse.
	B. No power to Logic Unit	B-1. Check for proper voltage (12, 24, or 32 VDC) with voltmeter between lugs E and F in Logic Unit (See Fig. 6). If there is voltage, go on to C. B-2. Check power connections to Logic Unit and power supply. B-3. Check for dead battery or faulty converter.

Incorrect Sequencing of Treatment Cycle*	C. Improperly wired Control Unit	C-1. Check for proper wiring of Control Unit to Logic Unit and tighten terminals.
	D. Faulty Control System	D-1. Replace Control Unit and Logic Unit.
	A. Incorrectly Wired System	A-1. Review Wiring Instructions and check all wiring (See Fig. 6).
	B. Faulty Control System	B-1. Replace Control Unit and Logic Unit.

Low Meter Reading

A. Insufficient Salt	A-1. Check salt feed tank supply; refill if empty (Section V-E).
B. Low Voltage	A-2. Check for restriction in the salt feed line. A-3. Open salt feed valve slightly (Section IV-E). B-1. Test voltage with voltmeter between electrode lugs on Treatment Unit during treatment cycle. Low voltage is less than 11.5 V (23V for Model 24 VDC

\* See diagram in Section V-B for correct sequencing of treatment cycle.

Problem  
Low Meter Reading

Possible Cause

Corrective Action

Zero Meter Reading, but Solids Reduction Motor Operates	A. No Power to Electrodes	A-1. Check salt feed tank supply; refill if empty (Section V-E).
	B. Meter Wiring Disconnected	B-1. Check meter wires and connections in Control Unit and Logic Unit.
	C. No Salt	C-1. Check salt feed tank supply; refill if empty (Section V-E).
	D. Faulty Meter	D-1. During the treatment cycle, check for about 25 millivolts between terminals on back of Control Unit treatment meter. If voltage is between 20 and 30 millivolts, replace Control Unit.
High Meter Reading	A. Excessive Salt	A-1. Close salt feed valve slightly (See Section IV-E).
	B. Faulty Meter	B-1. During the treatment cycle, check for about 25 millivolts between terminals on back of Control Unit treatment meter. If voltage is between 20 and 30 millivolts, replace Control Unit.
	C. Electrodes Bent	C-1. Remove electrode pack and realign plates.
Zero Meter Reading, but Solids Reduction Motor Operates	A. No Power to Electrodes	A-1. If no power, check for proper wiring and tighten connections to Treatment and Logic Units.
	B. Meter Wiring Disconnected	B-1. Check meter wires and connections in Control Unit and Logic Unit.
	C. No Salt	C-1. Check salt feed tank supply; refill if empty (Section V-E).
	D. Faulty Meter	D-1. During the treatment cycle check for (about) 25 millivolts between terminals on back of Control Unit and Logic Unit.

\* Does not apply for new installations.

## VII. PREVENTIVE MAINTENANCE

To assure continued trouble-free performance of the LECTRA/SAN System, a number of routine preventive maintenance procedures should be performed periodically. The following table lists the parts to be checked, the recommended frequency of maintenance, and the maintenance procedures to be taken.

Part	Frequency	Maintenance Steps
Salt Feed Tank	Monthly	<ol style="list-style-type: none"> <li>1. Thoroughly rinse and wipe out tank.</li> <li>2. Check to make sure the tiny vent hole in tank cap is not blocked.</li> <li>3. Rinse out control valve with fresh water.</li> </ol>
Salt Feed Line	Every two months.	<ol style="list-style-type: none"> <li>1. Remove tubing from salt feed tank and from toilet, and remove metering plug. Check all parts for obstructions.</li> <li>2. Wash out tubing, siphon check valve, and metering plug with fresh water.</li> </ol>
Treatment Unit	Every two months.	<ol style="list-style-type: none"> <li>1. Check to see that cover hold down bolts are properly tightened.</li> <li>2. Clean cover, motors, and electrical contacts.</li> <li>1. Inspect and clean electrical connections.</li> <li>2. Inspect logic box for signs of dampness.</li> </ol>
Logic Unit	Every two months.	<ol style="list-style-type: none"> <li>1. Inspect all hose fittings and check for tight hose clamps.</li> </ol>
Hose Fittings	Every two months.	<ol style="list-style-type: none"> <li>1. Flush the system for 60 seconds to clean out the Treatment Unit. Operate one treatment cycle.</li> <li>2. If the Treatment Unit is mounted below water level, disconnect the hose from the vented loop on the Treatment Unit side of the loop. Drain any excess liquid from hose into a pan for disposal. Clean out vent line.</li> </ol>
Electrode Pack	Every six months.	<ol style="list-style-type: none"> <li>3. Remove the crossover cap and use a hand or electric pump to lower level of liquid in the Treatment Unit to about three inches below the cover.</li> <li>4. Either remove Treatment Unit cover, remove electrode pack, and clean plates with a small stiff brush (but not a wire brush) or</li> <li>5. Add one-half pint of concentrated muriatic (hydrochloric) acid to each side of the Crossover/Separator. Allow at least a one hour acid cleaning period before again using the toilet.</li> <li>1. Inspect all boat fittings for corrosion and leaks.</li> </ol>

Problem	Possible Cause	Corrective Action
Zero Meter Reading, but Solids Reduction Motor Operates	E. Faulty Electrode Pack	Unit treatment meter. If voltage registers, the meter is faulty and the Control Unit must be replaced. E-1. During the treatment cycle the voltage between lugs D and K (Fig. 6) should register about 25 millivolts. Check with voltmeter. If no voltage, electrode pack is faulty and must be replaced. E-2. If there is voltage, re-check meter wires and connections in Control Unit and Logic Unit.
Motor(s) Inoperative (Solids Reduction, Mixer or Toilet Flush Motor)	A. No Power to Motor B. Faulty Motor Relay in Logic Unit*	A-1. Check motor fuses at A and B (see Fig. 6) in Logic Unit. Replace if "blown." A-2. Check for proper wiring of motor to Logic Unit (See Figure 6). B-1. During motor operating period test for voltage with voltmeter between the following points: —Solids Reduction Motor —lugs A and E in Logic Unit —Mixer Motor—lugs B and E in Logic Unit —Flush Motor—lugs C and E in Logic Unit Refer to Figure 6 for lug locations. If no voltage, replace Logic Unit.
Toilet does not flush	A. Salt Feed tank empty B. Toilet motor inoperative	A-1. Refill salt feed tank (Section V-E). B-1. See Motors Inoperative, above. C-1. Replace motor.

\*The solids reduction motor relay is not faulty if the treatment meter operates.

## VIII. STORAGE

### A. WINTER STORAGE

The LECTRA/SAN Salt Feed Unit and Treatment Unit should be prepared for winter storage according to the following instructions:

#### Salt Feed Unit

- 1) Remove tubing from salt feed tank and toilet, and remove metering plug. Wash out tubing, siphon check valve, and metering plug with fresh water.
- 2) Wash inside of salt feed tank with soapy water. Rinse thoroughly with fresh water. Dry tank inside and outside.
- 3) Reconnect salt feed unit and store empty and dry.

Treatment Unit (Procedures a or b below can be used.)

#### a. WET STORAGE

- 1) Flush the electric toilet for at least 60 seconds to clean out the Treatment Unit and then **push the Operation Interrupt button** to cancel treatment cycle. For manual toilets, pump the handle vigorously 50-60 times to clean out the Treatment Unit.
- 2) Close the control valve on the salt feed tank.
- 3) Close the inlet seacock. Remove the inlet hose from the toilet pump assembly.
- 4) Temporarily attach a short length of hose to the inlet pump where the permanent hose was removed. Place one end of the hose into a gallon of "permanent-type" antifreeze (ethylene glycol). Flush the toilet by depressing the Flush button, (or by pumping the handle on manual toilets) until all the antifreeze has been delivered **and then depress the Operation Interrupt button**. A total of two gallons of antifreeze is required to properly protect the system. **DO NOT USE ANTILEAK ANTIFREEZE.**
- 5) Close the outlet seacock and reconnect the inlet hose to the toilet pump assembly.
- 6) Let the antifreeze remain in the system until the boat is recommissioned. **NEVER USE ALCOHOL OR KEROSENE TO WINTERIZE LECTRA/SAN.**

### b. DRY STORAGE

- 1) Same as a(1) above.
- 2) If the Treatment Unit is mounted below water level, disconnect the hose from the vented loop on the Treatment Unit side of the loop. Drain any excess liquid from hose into a pan for disposal.
- 3) Remove the cap from the top of the Crossover/Separator and use a hand or electric pump to remove all the water from **both** compartments of the Treatment Unit.
- 4) It is recommended that the electrode pack be inspected and cleaned. Remove the cover of the Treatment Unit and pull out the Electrode Pack. Rinse the electrodes with fresh water and clean the plates with a stiff brush (but not a wire brush), or soak the electrodes in dilute muriatic acid for about one hour and then brush clean after rinsing. Replace Electrode Pack and resecure Treatment cover.

### B. RECOMMISSIONING

When recommissioning the boat in the spring from wet storage, open both seacocks and flush the toilet for two minutes to purge the system of all the antifreeze solution and then press the Operation Interrupt button. For manual toilets, pump the handle at least 50 times to flush the system. Alternatively, a manual or electric pump can be used to clean out both chambers of the Treatment Unit through the Crossover/Separator.

The LECTRA/SAN System is put back in operation by following the Start-Up Instructions given in Section IV.

**WARNING. IT IS VERY IMPORTANT TO HAVE COMPLETELY FLUSHED THE SYSTEM OF ANTIFREEZE BEFORE OPERATING LECTRA/SAN. THE CHEMICAL REACTION BETWEEN THE DISINFECTANT AND ETHYLENE GLYCOL CAN GENERATE HEAT.**



# IX. PARTS LIST\*

## TREATMENT UNIT

Item	Part No.	Description
1	42-1003	Mixer Motor, 2-1/2" Dia., 12 VDC
1	43-1003	Mixer Motor, 2-1/2" Dia., 24 VDC
1	44-1003	Mixer Motor, 2-1/2" Dia., 32 VDC
2	41-17	Hose Fitting (2)
3	41-15	Discharge Elbow Fitting
4	41-66	Electrode Lug Nuts, 1/4"-20, Brass (4)
5	41-68	Electrode Lug Washer, 1/4", Brass (4)
6	41-47	Sealing Washer (2)
7	41-50	Cover Hold Down Bolt, 10-32 x 3/4" (18)
8	41-7	Motor Shaft Bushing (2)
10	41-58	Motor Hold Down Bolt, 10-32 x 3/4", Stainless Steel (2)
11	41-9	Mixer Impeller
12	41-64	Impeller Lock Washer, #12, Stainless Steel (2)
13	41-62	Impeller Bolt, 12-24 x 5/8", Stainless Steel (2)
14	41-52	Cover Hold Down Nut, 10-32 (18)
15	41-1	Treatment Unit Tank
16	41-19	Inlet Plug
17	41-4	Electrode Pack, 12 Volt DC
17	41-6	Electrode Pack, 24 Volt DC
17	41-5	Electrode Pack, 32 Volt DC
18	41-13	Gasket
19	41-80	Impeller Set Screw, 6-32 x 3/16" Stainless Steel
20	41-11	Solids Reduction Impeller
21	41-3	Treatment Unit Cover
23	41-2	Crossover/Separator Cap
24	41-8	Motor Shaft Seal (2)
25	41-84	Slinger (2)
26	42-1001	Solids Reduction Motor, 3" Dia., 12 VDC
26	43-1001	Solids Reduction Motor, 3" Dia., 24 VDC
26	44-1001	Solids Reduction Motor, 3" Dia., 32 VDC
27	41-401	Boot for (+) lug on Treatment Unit
—	42-0000	Treatment Unit, 12 VDC, complete (Items 1-27)
—	43-0000	Treatment Unit, 24 VDC, complete (Items 1-27)
—	44-0000	Treatment Unit, 32 VDC, complete (Items 1-27)
—	42-0001-S	Treatment Unit Cover Assembly, 12 VDC, complete (includes items 1, 4, 5, 6, 7, 8, 10, 11, 12, 13, 19, 20, 21, 23, 24, 25, 26, 27)
—	43-0001-S	Treatment Unit Cover Assembly 24 VDC, complete (includes items 1, 4, 5, 6, 7, 8, 10, 11, 12, 13, 19, 20, 21, 23, 24, 25, 26, 27)
—	44-0001-S	Treatment Unit Cover Assembly 32 VDC, complete (includes items 1, 4, 5, 6, 7, 8, 10, 11, 12, 13, 19, 20, 21, 23, 24, 25, 26, 27)

\*Quantities are one (1) unless otherwise noted.

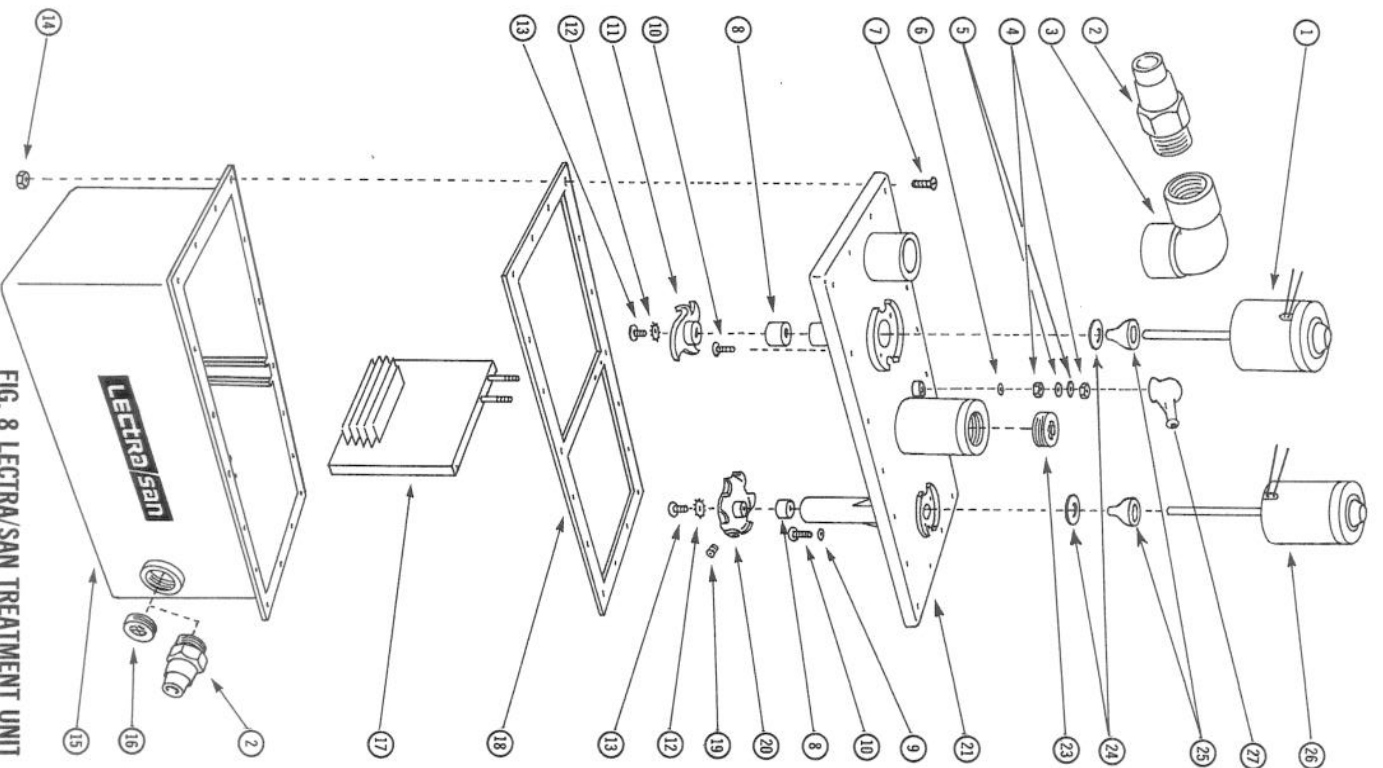


FIG. 8 LECTRA/SAN TREATMENT UNIT

## LOGIC UNIT

Item	Part No.	Description
1	41-10	Logic Box
2	42-4003	Logic Unit Circuit Board, 12 VDC
2	43-4003	Logic Unit Circuit Board, 24 VDC
2	44-4003	Logic Unit Circuit Board, 32 VDC
3	41-82	Circuit Board Fuse
4	41-12	Logic Box Cover
5	41-76	Cover Hold Down Screws, 1/4-20 x 5/8" (4)
6	41-41	Strain Relief Connector, 3/4" (2)
7	41-45	Hole Plug, 3/4"
8	41-39	Strain Relief Connector, 1/2" (4)
9	41-407	Fuse Block
10	41-404	Fuse, Fusetron MDL 25 (For Model 12 VDC and 24 VDC)
10	41-406	Fuse, Fusetron MDL 15 (For Model 32 VDC)
11	41-403	Fuse, Fusetron MDL 6-1/4 (For Model 12 VDC and 24 VDC)
11	41-405	Fuse, Fusetron MDL 5 (For Model 32 VDC)
—	42-4000	Logic Unit, 12 VDC, Complete (Items 1-11)
—	43-4000	Logic Unit, 24 VDC, Complete (Items 1-11)
—	44-4000	Logic Unit, 32 VDC, Complete (Items 1-11)

## CONTROL UNIT

Item	Part No.	Description
12	42-3000	Control Unit, 12 VDC
12	43-3000	Control Unit, 24 VDC
12	44-3000	Control Unit, 32 VDC

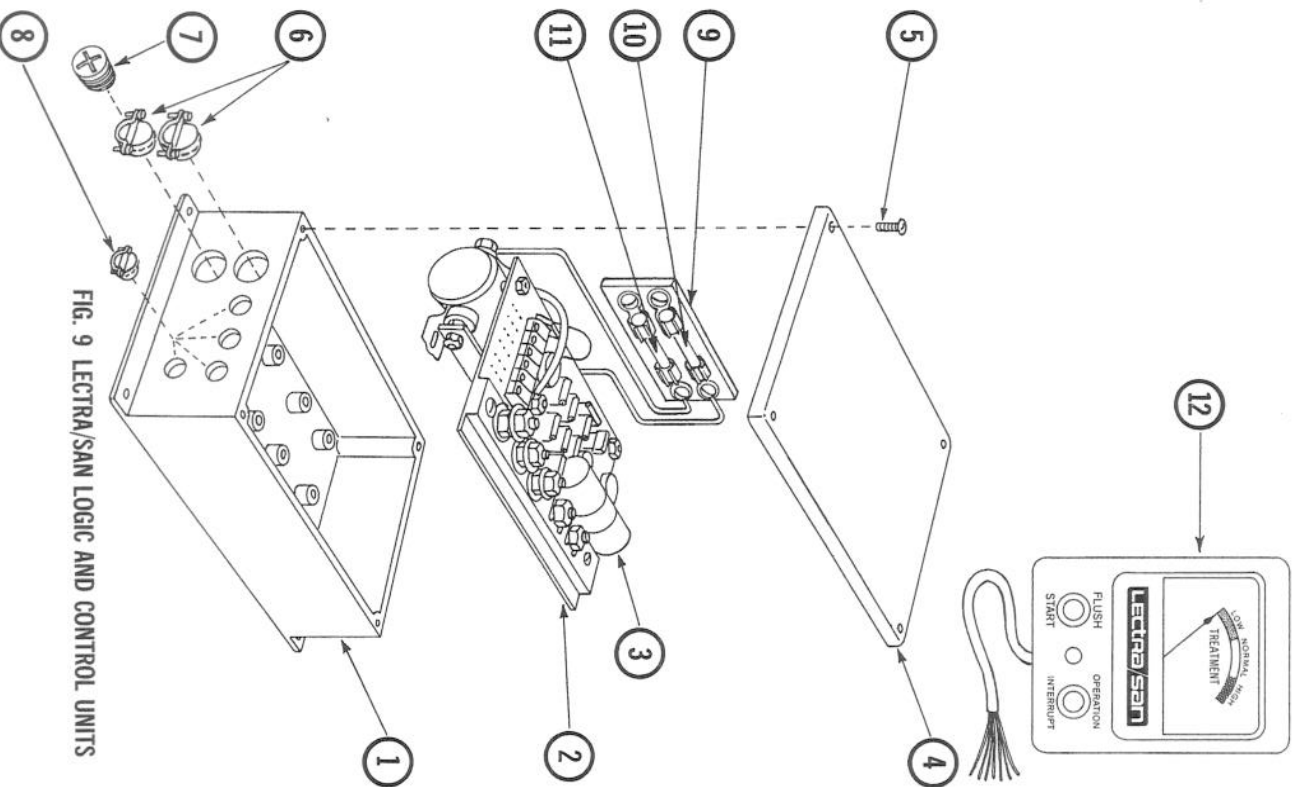


FIG. 9 LECTRA/SAN LOGIC AND CONTROL UNITS

## SALT FEED UNIT

Item	Part No.	Description
1	41-1001	Salt Feed Tank
2	41-1003	Salt Feed Tank Cap
3	41-1005	Tank Adapter
4	41-1007	Control Valve
5	41-1011	Siphon Check Valve
6	41-1009	Tubing, 1/4"
7	41-1013	T-Check Valve Assembly
8	41-1013-4	Metering Plug
9	41-1013-2	Spring
10	41-1013-3	Check Ball
11	41-1013-1	T-Check Valve Body
12	41-402	Insert, Model 32 VDC only
—	41-1101	Salt Feed Unit Complete (Items 1-12)

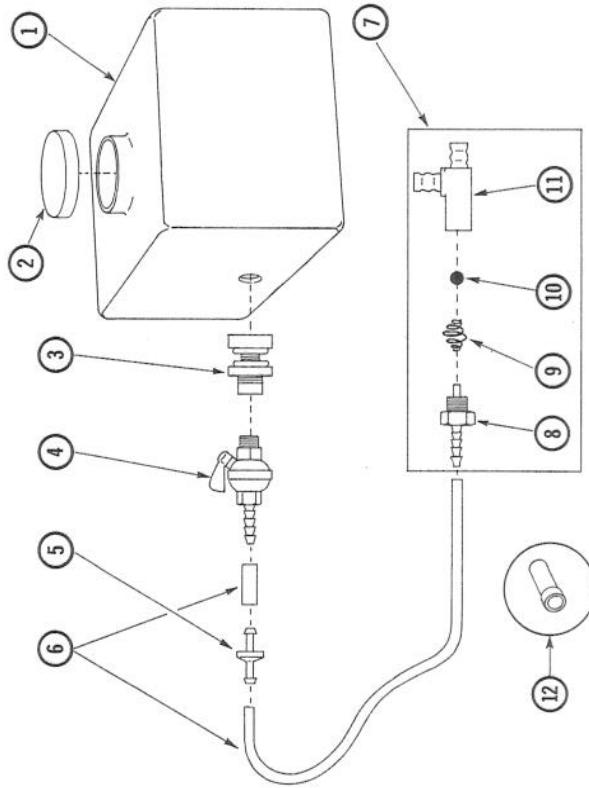


FIG. 10 SALT FEED SYSTEM

## MISCELLANEOUS

Part Number	Description
41-600	Owner's Manual
41-601	Wall Placard
41-408	Ring Connector, ETC #E-660-14 (6)
41-409	Butt Splice Connector, ETC #C-246 (2)
41-410	Ring Connector, ETC #C-230-14 (6)
41-411	Ring Connector, ETC #C-236-06 (6)
41-412	Ring Connector, ETC #C-230-56

## X. MATERIALS REQUIRED

The following materials are not supplied and are needed to mount the LECTRA/SAN System:

WOOD for Treatment Unit box frame.

TEFLON TAPE or PIPE SEALING COMPOUND

PERFORATED HANGER IRON to secure Treatment Unit in frame.

PVC (polyvinyl chloride) CEMENT

1-1/2" ID NEOPRENE or PLASTIC HOSE for connecting Treatment Unit to toilet and to the through-the-hull discharge fitting.

VENTED LOOP, 1-1/2" Dia. (optional)

1-1/2" HOSE CLAMPS (4)

SCREWS or BOLTS for mounting logic box, control box, and Treatment Unit box frame.

The wire sizes needed to wire the LECTRA/SAN System are given below. **Connectors are supplied.**

To Connect	Wire Size Required	Insulated Solderless Connectors to be used
Treatment Unit and Logic Unit	#10-3	Butt Splice (2) Ring Tongue (2) for 1/4" lug Ring Tongue (2) for #6 stud
Logic Unit and Battery	#6-1	Ring Tongue (2) for 1/4" lug
— (If less than 15' between)	#6-1 (two lengths)	Ring Tongue (4) for 1/4" lug
— (If more than 15' between)	#4-1 (two lengths)	Ring Tongue (4) for 1/4" lug*
Electric Toilet and Logic Unit	#10-2	Ring Tongue (3) for 1/4" lug Ring Tongue (1) for 5/16" lug
Treatment Unit motors to Treatment Unit (—) lug	—	Ring Tongue (1) for #10 wire and 1/4" lug

\*Not supplied. Use ETC No. F-667-14 or No. F666-14.

## XI SPECIFICATIONS

Design Capacity: For use with one marine head.

Use Capacity: Four (4) persons (average).

Electrical:	Model 12 VDC	Model 24 VDC	Model 32 VDC
Voltage	12 VDC	24 VDC	32 VDC
Power	1-1/2 Amp hrs	1-1/2 Amp hrs	1 Amp hr
Current	50 Amps	42 Amps	35 Amps

Maximum Angle of Pitch and Roll: Thirty degrees (30°).

Use Environment: For use in fresh, brackish or salt water.

	Treatment Unit	Logic Unit	Control Unit	Salt Feed Unit
Size, inches	16	10	4	9
length	8-3/4	8	3	9
width	8-1/2	4	2	6
height	13	—	—	7
overall height	3	—	—	2
Capacity, gal.	13	7-1/2	1	1-1/4
Weight, lbs.	PVC	PVC	PVC	Polyethylene
Material				

All recommendations and suggestions appearing in this manual concerning the use of our products are based upon tests and data believed to be reliable. Since the actual use by others is beyond our control, no guarantee, expressed or implied, is made by Diamond Shamrock Corporation as to the effects of such use or the results to be obtained, nor is any information to be construed as a recommendation to infringe any patent or to practice any process in violation of any law or any government regulation.



# OWNER'S MANUAL



MARINE *flow-thru*  
WASTE TREATMENT  
SYSTEM

Models 12 VDC  
24 VDC  
32 VDC

COAST GUARD CERTIFIED

Raritan Engineering Co.  
1025 N. High Street  
Millville, N. J. 08332

MANUFACTURER

## Diamond Shamrock

ELECTRODE CORPORATION  
CHARDON, OHIO 44024