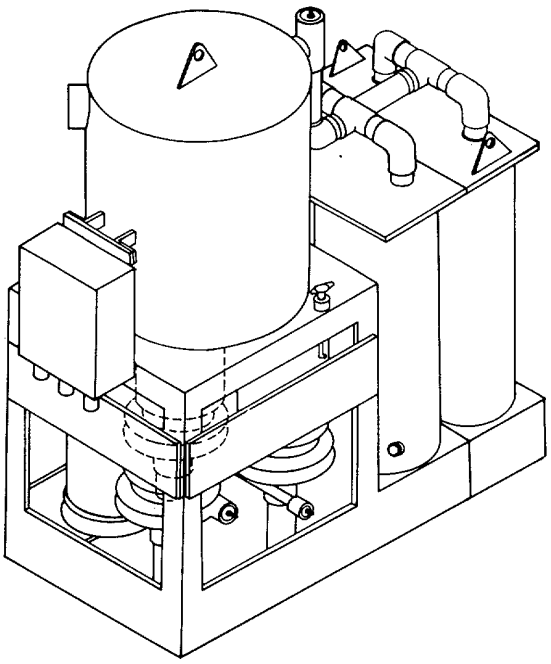
TECHNICAL MANUAL

UNIT, INTERMEDIATE DIRECT SUPPORT
AND INTERMEDIATE GENERAL SUPPORT
MAINTENANCE INSTRUCTIONS

MARINE SANITATION SYSTEM
FOR
LANDING CRAFT UTILITY (LCU)
NSN 1905-01-154-1191



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HEADQUARTERS, DEPARTMENT OF THE ARMY
17 JANUARY 1989

CHANGE

NO. 2

HEADQUARTERS
DEPARTMENT OF THE ARMY,
WASHINGTON, D.C., 30June 1994

Unit, Intermediate Direct Support and Intermediate
General Support Maintenance Instructions
for

MARINE SANITATION SYSTEM
FOR LANDING CRAFT UTILITY (LCU)
(NSN 1905-01-154-1191)

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TM 55-1905-223-24-11, 17 January 1989, is changed as follows:

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CHANGE

NO. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY,
WASHINGTON, D.C., 29 MAY 1991

UNIT, INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE
GENERAL SUPPORT MAINTENANCE INSTRUCTIONS
FOR
MARINE SANITATION SYSTEM
FOR LANDING CRAFT UTILITY (LCU)
(NSN 1905-01-154-1191)

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WARNING

MODIFICATION HAZARD

Unauthorized modifications, alterations or installations of or to this equipment are prohibited and are in violation of AR 750-10. Any such unauthorized modifications, alterations or installations could result in death, injury or damage to the equipment.

ENVIRONMENTAL HAZARD

Decomposition of organic matter in the sewage system will cause disagreeable odors and use up oxygen. Do not remove access covers until fresh air from a known outside source has been supplied to the surrounding area ventilation.

TOXIC AND FLAMMABLE HAZARD

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source. Avoid open flames and prolonged breathing of fumes.

DISEASE HAZARD

Sewage is a common mode of transmission for parasitic organisms that may have the capability of causing communicable diseases. After coming in contact with sewage or contaminated equipment, be sure to clean yourself with a disinfectant soap. Avoid sewage contact with skin abrasions, punctures, cuts, and other open wounds. Wipe up and clean any spills and/or contaminated equipment using a disinfectant soap.

ELECTRICAL HAZARDS

Whenever possible, the power supply to the equipment must be shut off before beginning work on the equipment. Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions.

Be careful not to contact 115-Vac input connections when installing or operating this equipment.

Whenever the nature of the operation permits, keep one hand away from the equipment to reduce the hazard of current flowing through the body.

For Artificial Respiration, refer to FM 21-11.

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TECHNICAL MANUAL

No. 55-1905-223-24-11

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 17 January 1989

UNIT, INTERMEDIATE DIRECT SUPPORT, AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE INSTRUCTIONS FOR THE **MARINE SANITATION SYSTEM** FOR LANDING CRAFT UTILITY (LCU) NSN 1905-01-154-1191

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this manual. If you find any mistakes or if you know of a way to improve these procedures, please let us know. Mail your letter or DA Form 2028 (Recommended Changes to Publications and Blank Forms), or DA Form 2028-2 located in the back of this manual directly to: Commander, US Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. A reply will be furnished directly to you.

TABLE OF CONTENTS

TABLE OF CONTENTS - Continued

CHAPTER 1

INTRODUCTION

SECTION I. GENERAL INFORMATION

1-1. **Scope**. The scope of this manual is as follows:

a. Type of Manual. Unit, intermediate direct support, and intermediate general support.

b. Name of Equipment. The equipment covered by this manual is the ORCA II 24 Marine Sanitation System installed aboard the LCU 2000 class watercraft.

c. Purpose of Equipment. The marine sanitation system collects, treats, and discharges sewage waste.

1-2. **Maintenance Forms, Records, and Reports**. Department of the Army forms and procedures used for equipment maintenance are prescribed by DA PAM 738-750, The Army Maintenance Management System.

1-3. **Destruction of Army Materiel to Prevent Enemy Use**. Refer to TM 750-244-3 for instructions covering the destruction of Army materiel to prevent enemy use.

1-4. **Reporting Equipment Improvements Recommendations (EIR)**. If your sanitation system needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at Commander, U.S. Army Troop Support Command, ATTN: AMSTR-QX, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798. We'll send you a reply.

1-5. **Preparation for Storage or Shipment**. Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the Preventive Maintenance Checks and Services (PMCS) before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness. Disassembly, and repacking of equipment for shipment or short term storage, are covered in paragraph 2-28.

SECTION II. EQUIPMENT DESCRIPTION AND DATA

1-6. **Equipment Characteristics, Capabilities, and Features**. The major characteristics, capabilities, and features of the ORCA II-24 sanitation system are as follows.

a. Characteristics.

(1) Self-contained (with exception of chlorine storage tank, commode warning light, and remote status indicator panel).

(2) Electrically operated.

(3) Automatic.

(4) Sewage processing unit.

b. Capabilities and Features.

(1) Collects, treats, and discharges sewage waste.

(2) Operates with salt, brackish, or fresh water.

(3) Has warning system to indicate tank full conditions.

(4) Provides sanitary service for up to 24 people.

CAUTION

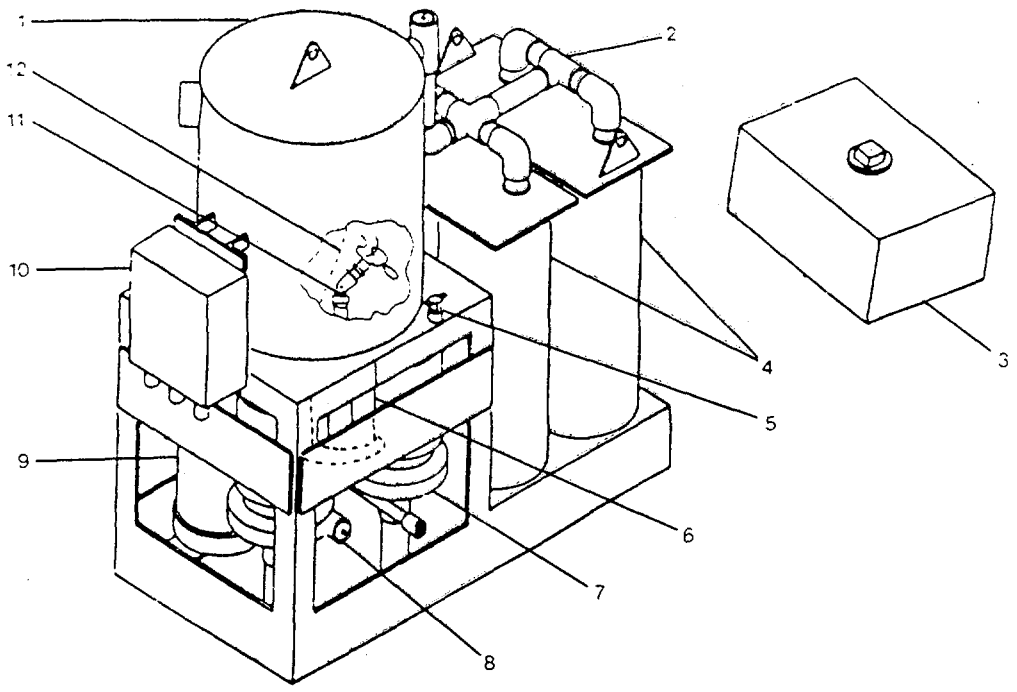
Under no condition may the sewage handling capacity of the individual system be exceeded. An overload condition could cause damage to other system components.

1-7. **Location and Description of Major Components**. FIGURE 1-1 shows the location and description of major components. The following information concerns dataplates on components in the marine sanitation system.

a. Recording Identification Data. Serial numbers and model numbers are shown on dataplates on the equipment. Since wear may cause dataplates (nameplates) or stencils on the equipment to become unreadable, serial numbers, model numbers, Control Parts List (CPL) numbers, and other appropriate data should be recorded. This information is important when servicing and when replacing or ordering parts.

b. Location of Dataplates (Nameplates).

(1) Sanitation Device. The dataplate is located on the left side of the external framework on the electrical junction box (control module assembly) end of the unit.



LEGEND

1. TREATMENT TANK AND COVER. A 14 GALLON TANK ON THE TOP LEFT HAND SIDE OF THE UNIT.
2. VENT PIPING. 1-1/2 INCH, PVC PIPING LOCATED ON THE SEDIMENTATION MODULE COVER ON THE TOP RIGHTHAND SIDE OF THE UNIT.
3. BLEACH STORAGE TANK. A 10 GALLON SEPARATE MOUNTED TANK LOCATED WITHIN 10 FT. OF, AND AT LEAST ONE FT ABOVE THE UNIT.
4. SEDIMENTATION MODULES. FOUR 8 INCH DIAMETER TANKS LOCATED ON THE RIGHT SIDE OF THE UNIT (EACH MODULE CONSISTS OF TWO TANKS).
5. BLEACH METERING VALVE. A VALVE LOCATED ON THE CABINET AND IN FRONT OF THE TREATMENT TANK.
6. FLOW PUMP AND MOTOR. A ½ H.P. CENTRIFUGAL PUMP LOCATED IN THE REAR. RIGHTHAND SIDE OF THE FRAME ENCLOSURE.
7. SLUDGE RETURN PUMP AND MOTOR. A ½ H.P. CENTRIFUGAL PUMP LOCATED IN THE FRONT, RIGHTHAND SIDE OF THE FRAME ENCLOSURE.
8. DISCHARGE PUMP AND MOTOR. A ½ H.P. CENTRIFUGAL PUMP LOCATED IN THE FRONT, LEFTHAND SIDE OF THE FRAME ENCLOSURE.
9. WASTE DISPOSER. A ¾ H.P. GARBAGE DISPOSAL ASSEMBLY LOCATED IN THE REAR, LEFTHAND SIDE OF THE FRAME ENCLOSURE.
10. ELECTRICAL JUNCTION BOX. HOUSES THE ELECTRICAL CONTROLS FOR THE AUTOMATIC OPERATION OF THE UNIT. IT IS LOCATED ON THE LEFT SIDE OF THE TREATMENT TANK.
11. BACKWASH SPRAY NOZZLE. A SPRINKLER HEAD MOUNTED INSIDE THE TREATMENT TANK AND BEHIND THE RETENTION/REDUCTION SCREEN.
12. RETENTION/REDUCTION SCREEN. A SIZE 25/014 WIRE CLOTH SCREEN MOUNTED INSIDE THE TREATMENT TANK.

Figure 1-1. Location and Description of Major Components.

(2) Pumps. The dataplates on all pumps are located on the pump motor housings.

1-8. **Equipment Data**. The following is the general equipment data for the sanitation device and all associated components.

a. Sanitation Device.

Model Orca II 24, by Envirovac Inc.

Capacity:

Sewage	720 gl per day
Persons	24

Dimensions and Weights:

Height	42 inches
Width	18 inches
Length	38 inches
Dry Weight	670 lb
Wet Weight	885 lb

Allowable Pitch and Roll	30 degrees
Allowable Hydrostatic Head.	10 ft water
Hypochlorite Requirement	1.50 gl per day

External Piping Connections:

Sewage Inlet	3 in (FNPT)
Sewage Outlet (at discharge pump)	3/4 in (FNPT)
Vent Outlet	1-1/2 in (FNPT)
Backwash Inlet	1/2 in (FNPT)
Input	110/220 Vac, 1-phase, 50/60 Hz, 30 amp
Current Draw	115/220 Vac, 3.5 kva

b. Associated Components.

Treatment Tank	Capacity, 14 gl

Sedimentation Modules:

Quantity	2
Capacity	4.78 gl each

Waste Disposer:

Waste King, Model WK-750-1-SM	3/4 hp, 115/230 Vac, 60 Hz

Flow Pump and Motor:

Motor:

Baldor, Model CL3503A ..... 1/2 hp, 3450 RPM
115/220 Vac, 60 Hz

Pump: Tecumseh Model 23938

Impeller Diameter ..... 2-7/8 in

Sludge Return Pump and Motor:

Motor:

Baldor, Model CL3503A ..... 1/2 hp, 3450 RPM
115/220 Vac, 60 Hz

Pump: Tecumseh Model 23938

Impeller Diameter ..... 2-7/8 in

Discharge Pump and Motor:

Motor:

Baldor, Model CL3503A ..... 1/2 hp, 3450 RPM
115/220 Vac, 60 Hz

Pump: Tecumseh Model 23938

Impeller Diameter ..... 2-7/8 in

Hypochlorite (Bleach) Storage Tank ..... Capacity, 10 gl

Location Requirements:

Horizontal ..... Within 10 ft of the unit
Vertical ..... Minimum of 1 ft above the unit

Retention/Reduction Screen ..... Wire Cloth, 24/014

Sprinkler Head:

Pressure ..... 30 psi
Flow ..... 2.9 gl per minute
Commode Warning Light ..... 110/120 Vac

1-9. **Safety, Care, and Handling**. Personnel must, at all times, observe all safety regulations while performing maintenance or repairs. Do not perform a maintenance procedure without first reading the entire procedure thoroughly, assuring yourself the task can be done safely. General safety WARNINGS and FIRST AID Data appear in the front matter of this manual. Review these WARNINGS before starting a maintenance task. Also, WARNINGS, CAUTIONS, and NOTES appear in procedures throughout this manual and are of paramount importance to personnel and equipment safety.

SECTION III. PRINCIPLES OF OPERATION

1-10. **Sanitary System General**. FIGURE 1-2 illustrates how the sanitation device interfaces with other external components in the sewage system. For the operation of these individual system components, refer to TM 55-1905-223-10.

1-11. **System Functional Description**. The following describes the sanitation system design and the sewage treatment process.

a. System Design.

(1) The Marine Sanitation Device is a self-contained unit. All of the major components are located within the enclosure panels of the unit, with the exception of the chlorine storage tank.

(2) The system is equipped with an electronic monitoring system which automatically controls the treatment of sewage, warns of any motor shutdown, and pinpoints the problem motor. It also warns of any treatment tank overload condition, thus avoiding damage to other system components or to the vessel's electrical supply.

(3) The control system comprises two modular units. The junction box (control module) (FIGURE 1-3) houses the electronic monitoring circuit and an in- line circuit breaker. The Remote Status indicator, located in the engine room control center, is a panel which indicates individual motor operating conditions, treatment tank overload, and the system operating condition. This is accomplished with constantly lit or flashing panel lights (FIGURE 1-4). Refer to TM 55-1905-223-10.

b. Treatment Process.

(1) The Marine Sanitation Device (MSD) processes sewage from existing facilities. Raw sewage from the sanitation facilities is routed into the treatment tank (1, FIGURE 1-5) for maceration. The macerated sewage is continuously recycled through the treatment tank until the solids are small enough to pass through the retention/reduction screen (2). This screen is under a continuous backwash by an impact sprinkler (3) to prevent a buildup of solids and consequent plugging of the screen. After passing through the retention/reduction screen, the effluent flows into a series of sedimentation tanks where the movement of solids is restricted, forcing fallout of suspended matter. The solids that fall out are then returned to the treatment tank by a sludge return pump for reprocessing.

(2) The effluent will finally pass through the sedimentation modules and be discharged overboard. Disinfection of the effluent is achieved through liquid hypochlorination with common household bleach, and by chemical oxidation within the treatment tank. This is accomplished by using a metering system, which allows an appropriate amount of liquid hypochlorite to flow from a storage container into the treatment tank. A high level warning system is provided with the MSD to indicate a treatment tank full condition. This is done by using a sensor suspended in the tank (4, FIGURE 1-5). The sensor is activated when an 80% tank capacity level is reached. This activation immediately turns on a warning light

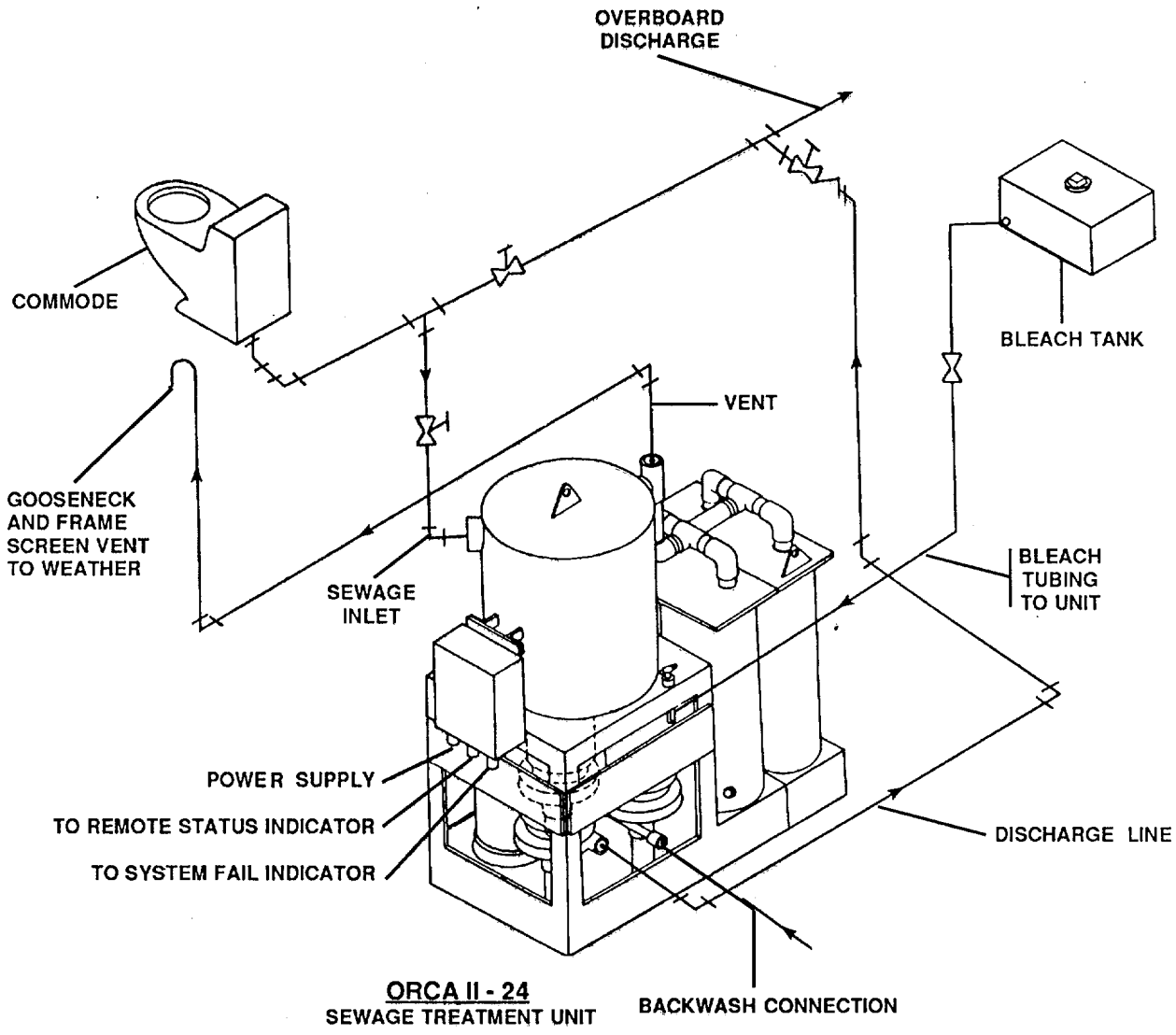


Figure 1-2. Interface of Treatment Unit with External Components.

provided for installation near the commode. After 9 minutes, a light on the Remote Status indicator is also activated by the sensor command and the system is then automatically shut down.

1-12. **Functional Description of Components**. The component descriptions are listed in the order of flow. Refer to FIGURE 1-1 for reference number key.

a. Treatment Tank (1). Provides space for sewage retention and treatment.

b. Waste Disposer Assembly (9). A garbage disposal type unit for shredding treated sewage.

c. Flow Pump (6). Moves the effluent from the treatment tank into the sedimentation modules.

d. Sedimentation Modules (4). Two sets of tanks for the filtration and settlement of suspended solids.

e. Sludge Return Pump (7). Returns the settled sludge from the sedimentation modules to the treatment tank for reprocessing.

f. Retention/Reduction Screen (12). Retains larger solids in the treatment tank until they are broken down by the macerator and able to pass through and into the sedimentation modules.

g. Backwash Spray Nozzle (11). Washes the retention/reduction screen to prevent clogging by the solids.

h. Backwash Solenoid Valve. Controls the backwash water while the system is processing or is in the rest period. It is located on the underside of the unit beneath the treatment tank area (not shown in FIGURE 1-1).

i. Water Pressure Gauge. Indicates the pressure on the backwash water inlet line (not shown in FIGURE 1-1). The gauge line located in the front of the unit is installed in the backwash water line on the underside of the unit.

j. Bleach Storage Tank (3). Provides storage for the disinfecting hypochlorite solution (common household bleach). It is located separate from the unit and has a gravity feed for delivering the bleach to the metering valve on the unit.

k. Chlorination (Bleach) Solenoid Valve. Electrically operated valve (not shown in FIGURE 1-1) controls delivery of bleach from tank to the unit. It operates only when the metering valve is open.

l. Bleach Metering Valve (5). Meters the required amount of hypochlorite solution (bleach) into the treatment tank for disinfection of the effluent.

m. Remote Status Indicator. Indicates any motor malfunction or high level of sewage. This panel is located in the engine room control center (not shown in FIGURE 1-1).

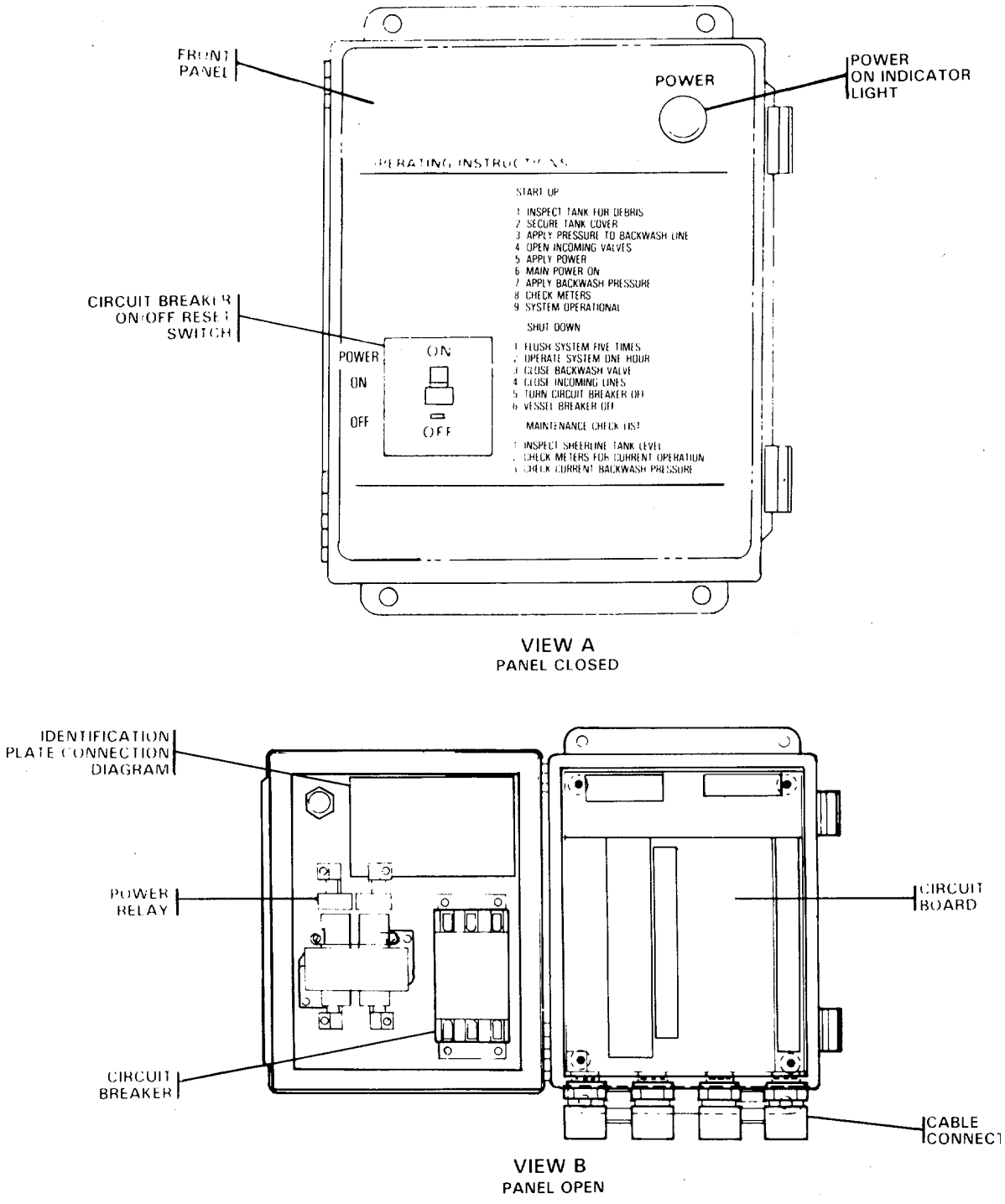


Figure 1-3. Junction Box (Control Module) Major Components.

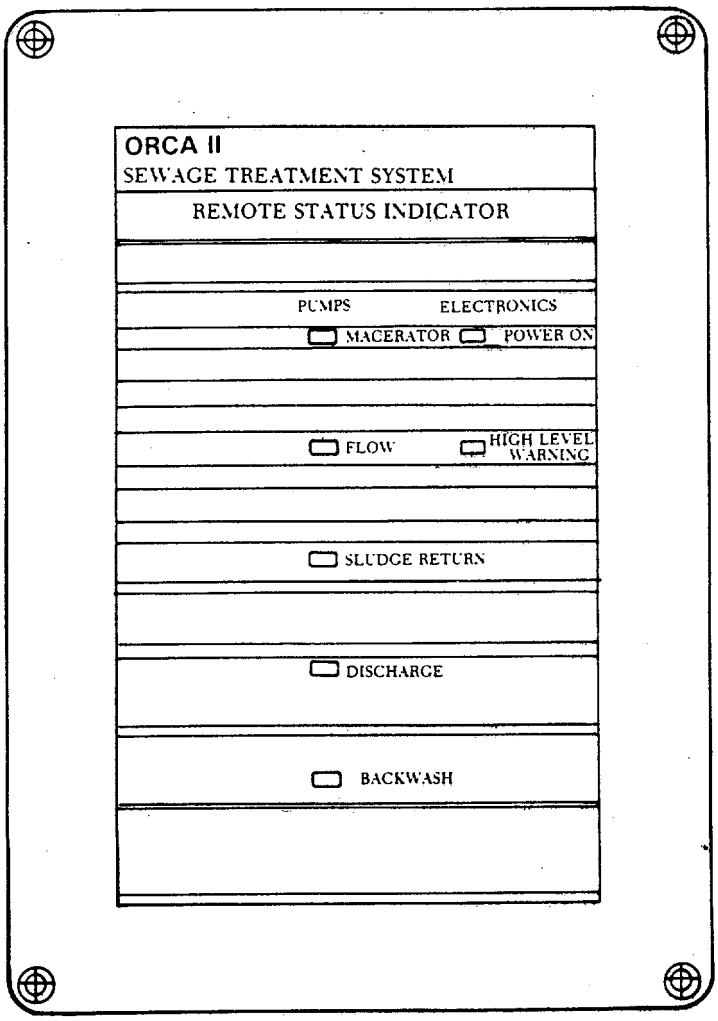


Figure 1-4. Remote Status Indicator Panel (RSI).

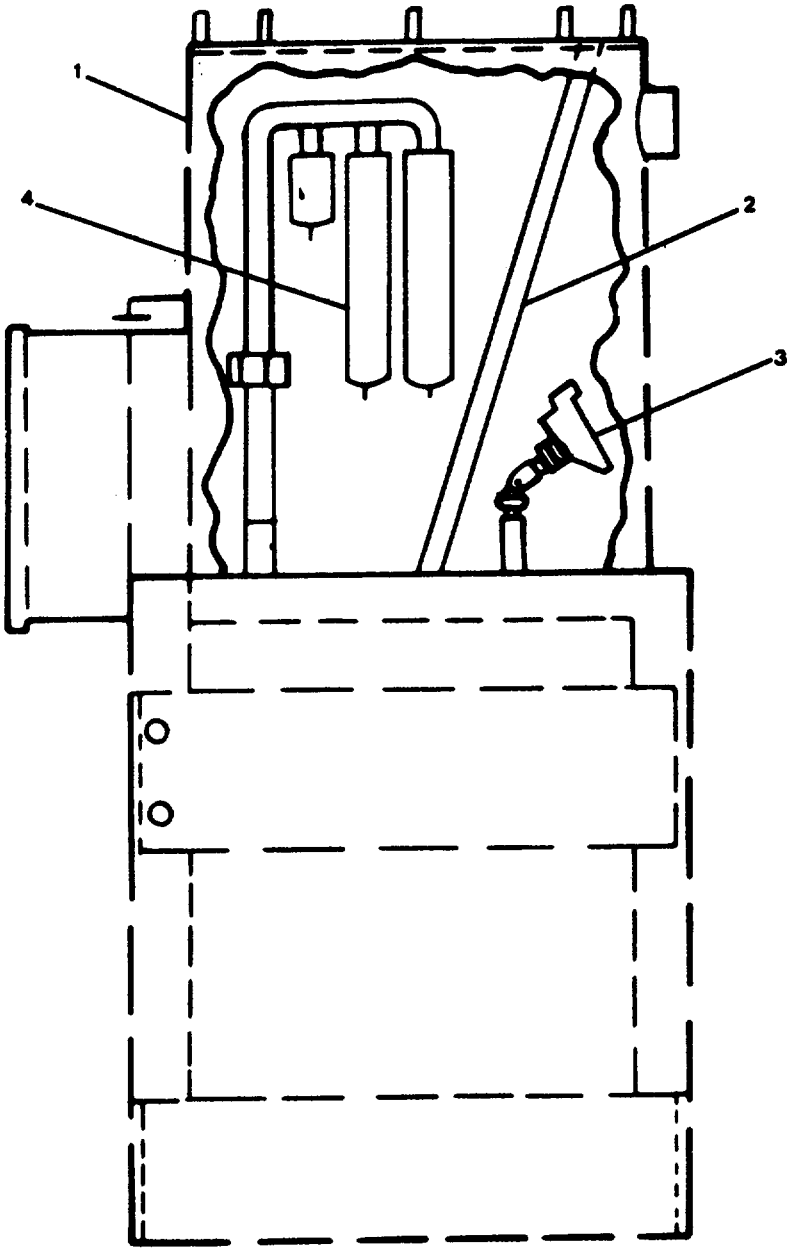


Figure 1-5. Treatment Tank Components.

n. Electrical Junction Box (10) (Control Module Assembly). Provides location for electrical connections, and is the control system that continually monitors motor operation and treatment tank conditions.

o. Level Sensor Assembly. Monitors the treatment tank level by sending a signal to the electrical junction box which controls pump operation. It is located inside the treatment tank (not shown in FIGURE 1-1).

p. Discharge Pump (8). Takes suction from the sedimentation modules and pumps the effluent overboard.

q. Commode Warning Lights (System Fail Indicators). A warning light is located in the 01 level passageway. The commode warning lights will be activated by the tank level indicator on the surge/holding tanks.

r. Vent Piping (2). Vents the sanitation device to the outside air.

CHAPTER 2

UNIT MAINTENANCE INSTRUCTIONS

SECTION I. REPAIR PARTS, SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPNENT (TMDE); AND SUPPORT EQUIPMENT

2-1. **Common Tools and Equipment**. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE) applicable to your unit.

2-2. **Special Tools, TMDE, and Support Equipment**. For special tools, TMDE, and support equipment, refer to the Maintenance Allocation Chart (Appendix B), and to TM 55-1905-223-24P.

2-3. **Repair Parts**. Repair parts are listed and illustrated in the Repair Parts and Special Tools List (TM 55-1905-223-24P) covering unit maintenance of this equipment.

SECTION II. SERVICE UPON RECEIPT

2-4. **Checking Unpacked Equipment**.

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage in accordance with the instructions of DA Pam 738-750.

b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

d. Remove and replace protective caps, plugs, inserts, wrappings, and tape when inspection/inventory is completed. Inspect piping openings for damage. Wipe off dirt, grease, or protective films at time of installation.

2-5. **Deprocessing Unpacked Equipment**. After receipt and inspection of unpacked equipment, make sure that all packing materials, temporary braces, masking tape, etc. are removed from the material before installation.

2-6. **Service Upon Receipt of Material**. To ensure that the sanitation unit will be adequately inspected, serviced, and operationally tested before it is subjected to normal everyday use, the following procedures are required to be performed:

a. Preliminary Inspection.

WARNING

Turn electrical power OFF to unit to prevent electrical shock.

(1) Visually inspect all components of the unit for signs of dents, deterioration, and broken parts.

(2) Check equipment mounting capscrews for tightness.

(3) Check all hose connections and fittings for tightness.

(4) Visually inspect for broken wiring.

(5) Check the condition and tightness of all electrical connections.

(6) Remove the treatment tank cover and inspect the interior carefully for loose debris in the tank.

(7) Fill the unit with water and let stand for 10 minutes. Check for leaks and correct as necessary.

(8) After completion of the above steps, the unit should now be ready for initial startup.

b. Modes of Operation. The sanitary unit operates in three modes: Continuous, Demand, and Disable. The mode control panel is located in the control module assembly. All maintenance personnel and operators must know the different modes of operation before starting, troubleshooting, or performing maintenance functions.

(1) Continuous. In this mode, the unit operates continuously regardless of sewage level in the treatment tank.

(a) The MODE toggle switch (2, FIGURE 2-1) should be in the CONT (continuous) position.

(b) The NORMAL/RESET/DISABLE switch (3) should be in the NORMAL position.

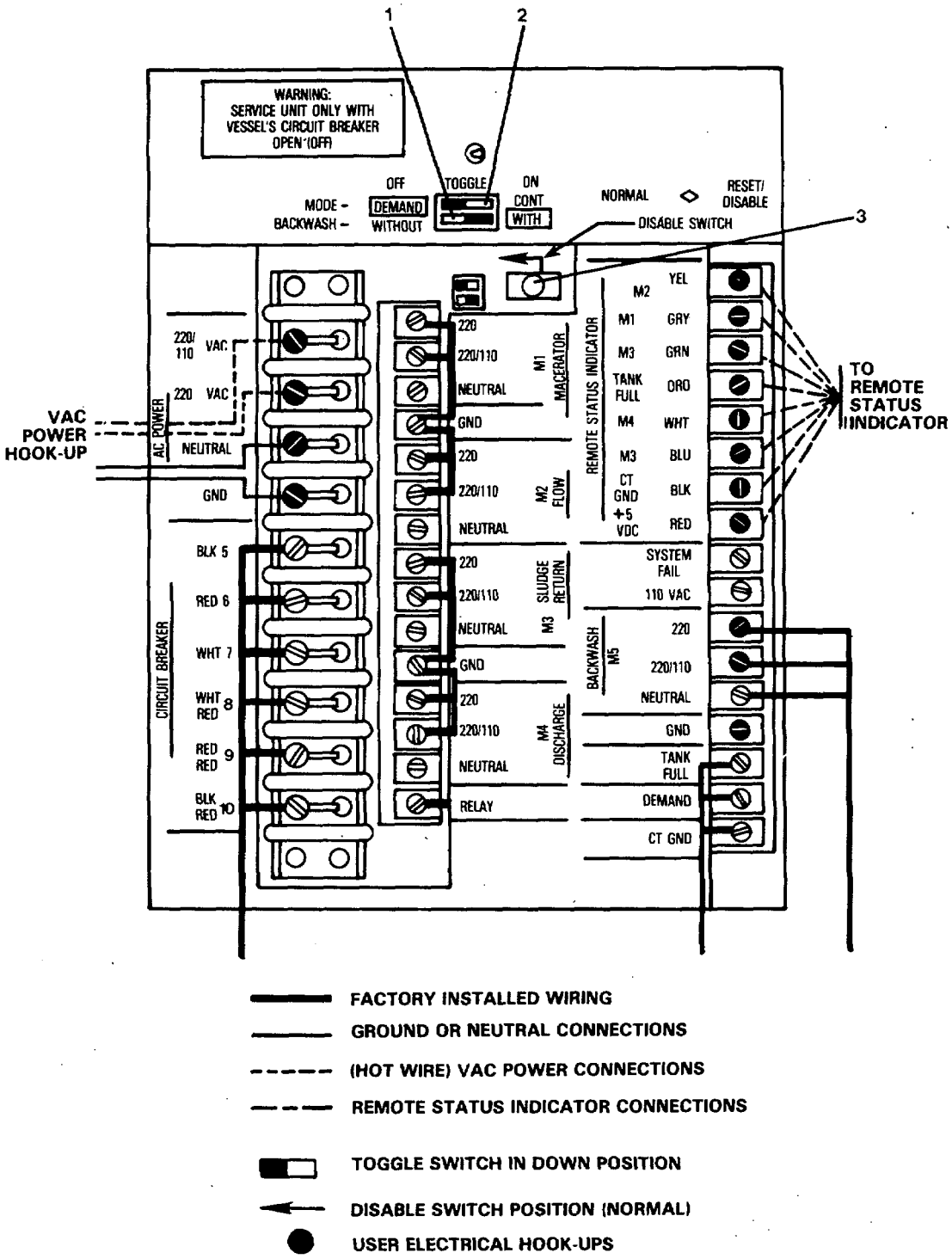


Figure 2-1. Junction Box (Control Module Assembly) Printed Circuit Card and Connections.

(2) Demand. In this mode, the unit comes on when the treatment tank sensor senses sewage. All pumps will operate for about 18 minutes or until the sewage process is complete.

(a) The MODE toggle switch (2, FIGURE 2-1) should be in the DEMAND position.

(b) The NORMAL/RESET/DISABLE DEMAND switch (3) should be in the NORM position.

(3) Disable. In this mode, the unit must be operated manually by the control module circuit breaker. The NORMAL/RESET/DISABLE switch (3) should be in the "DISABLE" position.

c. Initial Startup. Prior to starting the unit for the first time, or after prolonged shutdown, the following procedures are required.

WARNING

Ensure that the vessel's primary circuit breaker and the control module circuit breaker are in the OPEN (OFF) position at the start of these procedures.

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing treatment tank covers. Avoid open flames and prolonged breathing of fumes.

(1) Remove treatment tank cover and gasket during initial startup (paragraph 2-11).

(2) Set the NORMAL/RESET/DISABLE switch (3, FIGURE 2-1) to the NORMAL position.

(3) Fill the chlorine (bleach) storage tank with bleach and check for leaks.

(4) Apply water pressure to the backwash water line.

(5) Open all sewage inlet and discharge valves.

(6) Set the MODE toggle switch (2, FIGURE 2-1) to the DEMAND position.

(7) Set the BACKWASH toggle switch (1) to the WITH position.

WARNING

The control module circuit breaker controls electric current to the pump motors only. Power into the control module assembly must be interrupted/ controlled by the vessel's primary circuit breaker.

(8) Turn vessel's primary power circuit breaker ON (TM 55-1905-223-10). The green POWER ON indicator light on the Remote Status Indicator should now be lit (ON).

(9) Close the circuit breaker (1, FIGURE 2-2) on the control module front panel. The green POWER ON light (2) on the control module 'should now be lit (ON).

(10) Flush commodes until the water level in the treatment tank starts the unit. This should be about 10 seconds after the water comes in contact with the two longest sensing probes in the tank (2, 3, FIGURE 2-3). If the water level in the tank reaches the short probe (1), the high level warning light will be activated. Do not continue to flush commodes under these conditions.

NOTE

If the sanitation unit does not start, reset by placing the NORMAL/DISABLE-RESET switch to the DISABLE-RESET position then back to the NORMAL position. If the unit still does not start, refer to Table 2-2, Troubleshooting.

(11) When the unit has started, six red lights on the remote status indicator should flash in sequence every 10 seconds.

(12) After the unit has started, it will run for about 18 minutes or until the sensing probes in the treatment tank are uncovered. During this time the following run check should be performed.

(13) Run Check.

(a) Adjust the backwash pressure to 30 psi by adjusting the gate valve located on the water inlet to the sanitary unit (TM 55-1905-223-10).

(b) Check all motors for proper operation.

1 Check for overheating of motors.

2 Check pump water connections for leaks and correct as necessary.

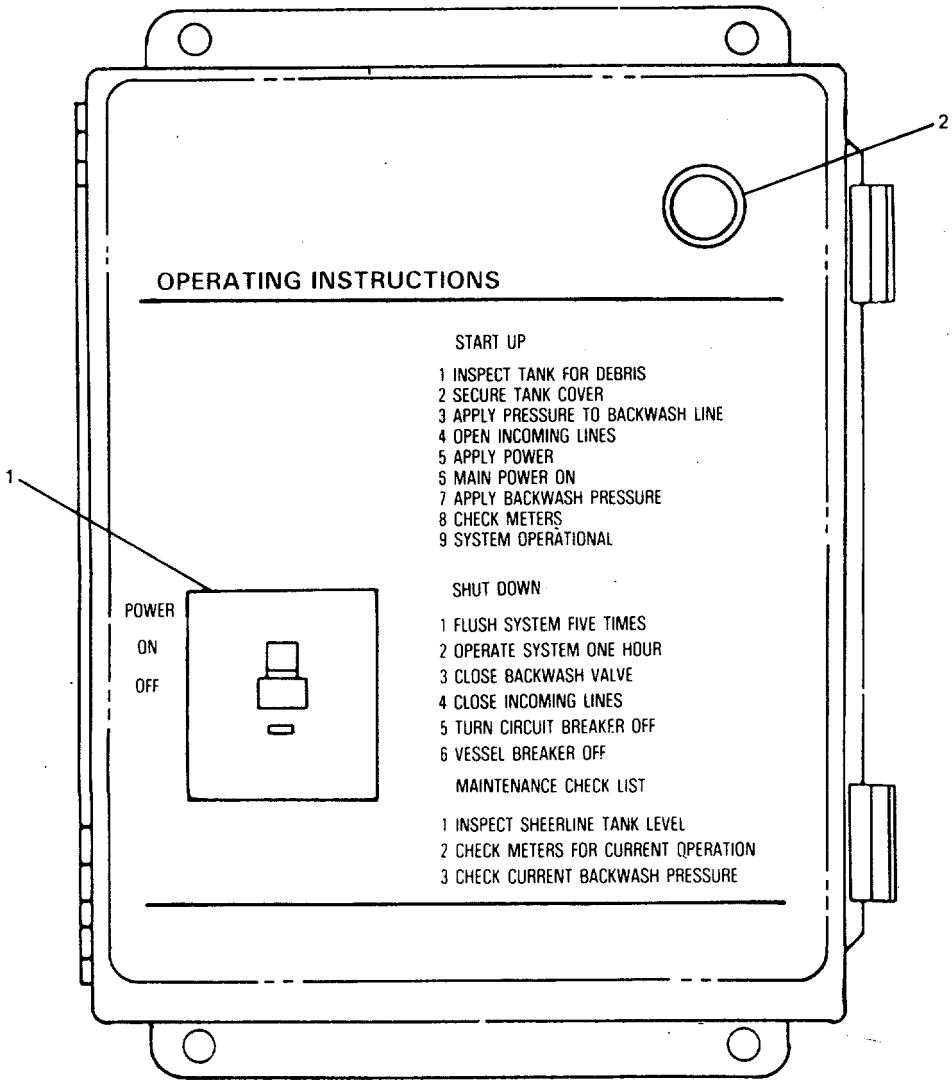


Figure 2-2. Control Module Assembly Front Panel.

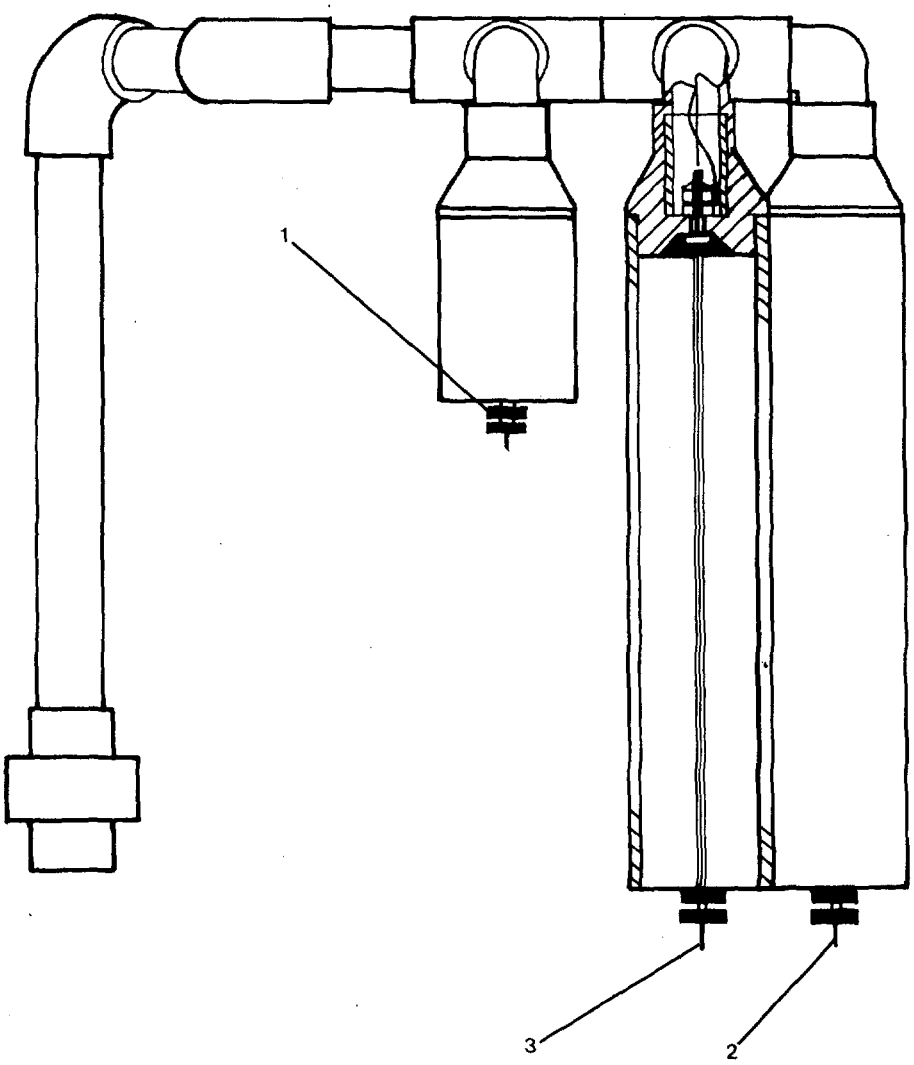


Figure 2-3. Level Sensor Inside Treatment Tank.

3 Repeat startup procedures if any repairs have been made.

WARNING

Turn the electrical power OFF when making repairs to any part of the unit. Refer to shutdown, step d. of this procedure.

4 If motor operation is normal, the pump status lights on the Remote Status Indicator Panel should be OUT (except for the 10 second flashing).

(c) Visually check the backwash impact sprinkler for proper operation (paragraph 2-15).

(14) Replace the treatment tank gasket and cover (paragraph 2-11).

NOTE

Be sure the gasket is in place and the nuts securing the cover are tight. This will prevent leakage should the tank become full.

(15) The sanitation unit should now be operational.

d. Shutdown.

(1) Temporary electrical shutdown for maintenance purposes.

(a) Open the circuit breaker on the control module assembly (OFF position).

(b) Open the vessel's primary circuit breaker to the sanitation unit (OFF position).

(2) For prolonged shutdown, refer to paragraph 2-28.

SECTION III. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

2-7. **Explanation of PMCS Table**. PMCS is designed to keep the equipment ,in good working condition. This is accomplished by performing certain tests, inspections, and services. Table 2-1 lists items to be serviced and the procedures needed to accomplish the PMCS. The "Interval" column tells you when to perform a check or service.If needed, PMCS may be performed more frequently than the indicated interval. The "Procedures" column tells you how to perform the required checks and services. If your equipment does not perform as required, see Table 2-2, Troubleshooting. Report any malfunctions or failures on DA Form 2404. In the "TM" Number column on DA Form 2404, record the appropriate Item Number from the PMCS table.

Table 2-1. Preventive Maintenance Checks and Services (PMCS)

D - Daily M - Monthly B - Bimonthly S - Semiannually A - Annually 2 - Biennially 3 - Every 3 Years

Item No.	Interval							Items To Be Inspected/Serviced	Procedures
	D	M	B	S	A	2	3		
									WARNING ELECTRICAL HAZARD. The voltage used to operate this equipment can cause serious injury. CAUTION Do not operate waste disposer or pumps dry. Lack of liquid may cause severe damage to the unit.
1	•							Waste Disposer	With the unit operating, check for audible and/or visible malfunction. Flush commode if necessary until unit is operating. If noise, vibrations, leaks or other problems are noticed, refer to Item 15 in Table 2-2, Troubleshooting.
2	•							All centrifugal pumps and motors (Flow/Sludge/Return/ Discharge)	With the unit operating, check for audible and/or visible malfunctions. Flush commode(s) if necessary until unit is operating. If noise, vibrations, leaks, or other problems are noticed, refer to Item 12 in Table 2-2, Troubleshooting.
3	•							Backwash Pressure	Check the gauge on the backwash water inlet line for proper setting (30 psi). Adjust the pressure accordingly with the gate valve.
4	•							Bleach Storage Tank	Check the level of the sodium hypochlorite solution (bleach) to ensure a continuous supply to the metering valve.

Table 2-1. Preventive Maintenance Checks and Services (PMCS)

D - Daily M - Monthly B - Bimonthly S - Semiannually A - Annually 2 - Biennially 3 - Every 3 Years

Item No.	Interval							Items To Be Inspected/Serviced	Procedures
	D	M	B	S	A	2	3		
4								Bleach Storage Tank - CONT	WARNING Care must be taken when filling the tank to avoid contact with the skin, excessive inhalation of fumes, or splashing in eyes.
5	•							Flexible couplings, hoses, and lines	Add bleach to the storage tank as required Visually check for leaks and correct as necessary. Refer to the list of trouble-shooting symptoms for specific leaks.
6		•						Marine Sanitation Sewage Treatment Unit	WARNING Turn electrical power OFF. Use vacuum cleaning equipment, dry cloth, or soft bristle brush to remove accumulations of dust and dirt on the exterior of the processing unit, including pumps, motors, and disposer. Visually check the PVC piping on the end and mid sediment tank covers for cracks and breaks. Replace the appropiate cover assembly if piping is damaged (para 2-12 or 2-13).
7			•					Sewage Treatment Unit	Flush and drain the unit. Flush commodes five times, adding one cup of bleach to each flush. When the unit has stopped processing, turn electrical power OFF and drain the unit.

Table 2-1. Preventive Maintenance Checks and Services (PMCS)

D - Daily M - Monthly B - Bimonthly S - Semiannually A - Annually 2 - Biennially 3 - Every 3 Years

Item No.	Interval							Items To Be Inspected/Serviced	Procedures
	D	M	B	S	A	2	3		
8				•				Sacrificial Anode (In the Sediment Tank Drain Plug)	Shut down the unit. Open the circuit breaker on the junction (Off position). Open the vessel's primary circuit breaker to the unit (OFF position). Drain the treatment tanks and check the zinc anode plug in the sedimentation tank and see how much zinc has been given up to electrolysis (paragraph 2-16).
9					•			Electrical connections	WARNING Turn electrical power OFF. Check all electrical connections for tightness: Control Module Assembly (para 2-17), Waste Disposer (para 2-23), Centrifugal Pumps (para 2-20, 2-21 and 2-22), Backwash and bleach solenoids (para 2-18).
10					•			Waste Disposer	WARNING Shut down the unit. Refer to Item 8 of this table. Lubricate the motor bearing. Refer to LO 55-1905-223-12.
11					•			All Centrifugal Pump motors (Discharge, Flow and Sludge)	WARNING Shut down the unit. Refer to item 8 of this table. Lubricate the motor bearings. Refer to LO 55-1905-223-12. Replace the slotted head screw.

Table 2-1. Preventive Maintenance Checks and Services (PMCS)

Item No.	Interval							Items To Be Inspected/Serviced	Procedures
	D	M	B	S	A	2	3		
12							•	Waste Disposer	WARNING Turn electrical power OFF. Inspect internal parts for wear and other damage. Remove waste disposer (paragraph 2-23) and clean with water.
13							•	All Centrifugal pumps (Discharge, Flow and Sludge)	Replace all pumps (paragraphs (2-20, 2-21 and 2-22).

Section IV. UNIT MAINTENANCE TROUBLESHOOTING

2-8.**Troubleshooting.** Both a symptom index and a troubleshooting table are provided. The symptom index will help you locate the information you need for troubleshooting.

SYMPTOM INDEX

SYMPTOM INDEX-CONT

	Troubleshooting Procedure (Table 2-2)
MOTOR	
Motor energized; pump shaft fails to turn	Item 14
REMOTE STATUS INDICATOR	
Pump, motor, and high level warning lights flashing in sequence with the exception of one or more lights	Item 7
Pump light constantly lit	Item 5
SANITARY UNIT	
Unit working, but processes slowly	Item 17
SYSTEM	
Not operating; all lights OFF	Item 6
UNIT	
Operates only in continuous (manual) mode	Item 9
Stops; fails to run in any mode	Item 8
WASTE DISPOSER	
Noisy or vibrates excessively	Item 15

Table 2-1 lists the common fault conditions that may be found during operation or maintenance of the equipment. Look for causes and do corrective actions in the order listed. This manual cannot list every symptom that may show up, and it cannot list all the possible causes and corrective actions. If a symptom is not listed, or if it keeps up after you have performed the corrective actions, notify your supervisor.

Table 2-2. Troubleshooting

MALFUNCTION
TEST OR INSPECTION
CORRECTIVE ACTION

1. Control System stops. High Level Warning Light ON; Power On Light ON. (Remote Status Indicator)

CAUTION

Do not flush commodes with tank full.

STEP 1. Check to see if treatment tank is full. Wait about 9 minutes for sewage level to be reduced to 80 percent of tank capacity. The High Level Light should then go OUT. If, after 9 minutes, the unit automatically shuts down and both lights remain on:

a. Turn the power OFF at the junction box and at the vessel's primary breaker.

b. Drain the tank (paragraph 2-16).

2. Commode warning lights activated by the tank level indicator on the surge/holding tanks.

STEP 1. Check to see if treatment tank is full. Refer to Item 1 of this table.

3. Controlling system not operating, Power On light ON.

STEP 1. Check to see if control module circuit breaker is open (OFF). Close circuit breaker by turning switch ON.

4. Controlling system not operating, Power Light OFF.

STEP 1. Check to see if vessel's primary circuit breaker to the unit is OFF. Close circuit breaker by turning switch ON.

5. A remote status pump light constantly lit, Power On light is lit.

STEP 1. Check for loose connection on motor or in control module. Check all electrical connections and tighten as required.

STEP 2. Check for defective circuit card assembly or control module assembly. Replace circuit card or control module assembly as required (paragraph 2-17).

STEP 3. Check for pump motor failure due to low current (winding separation), or high current (motor overload tripped).

a. Move the NORMAL/DISABLE-RESET switch to RESET.

b. If symptom still exists, replace the appropriate pump assembly (Discharge, paragraph 2-20; Flow, paragraph 2-21 and 2-22.

Table 2-2. Troubleshooting - CONT

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	
6. All lights OFF. System not operating.	
STEP 1.	Check to see if normal/disable switch is in the DISABLE position. Set switch to normal operational mode (paragraph 2-6).
7. Pump Motor and High Level lights, on the Remote Status Panel, flashing in sequence with the exception of one or more lights.	
STEP 1.	Check to see if light emitting diode(s) are defective. Replace the Remove Status Indicator Panel (TM 55-1905-223-24-18).
8. Unit stops or fails to run in any mode.	
STEP 1.	Check to see if primary circuit breaker is OFF. Refer to Item 3 of this table.
STEP 2.	Loose electrical connection. Check connections and secure.
STEP 3.	Check for broken wiring. Check wiring for breaks. Replace as necessary.
STEP 4.	Check for defective control module assembly. Check control module assembly. Replace as required (paragraph 2-17).
STEP 5.	Burned out pump motor. Replace the faulty centrifugal pump system (paragraph 2-20, 2-21, or 2-22).
9. Unit will operate only in continuous (manual) mode.	
STEP 1.	Check to see if level sensor is defective. Check the level sensor assembly (paragraph 2-19). Replace as required.
10. Mode switch fails to change mode of operation when manually set.	
STEP 1.	Check to see if control module circuit board is defective. Replace the circuit board assembly (paragraph 2-17).

Table 2-2. Troubleshooting - CONT

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

11. A centrifugal pump motor runs/turns but fails to operate (discharge, flow, or sludge).

    STEP 1. Check to see if pump is clogged. Remove pump and clean (paragraph 2-20, 2-21, or 2-22).

    STEP 2. Check to see if impeller is loose on shaft. Replace the faulty centrifugal pump (paragraph 2-20, 2-21, or 2-22).

12. A centrifugal pump operates but is noisy or vibrates excessively (discharge, flow, or sludge).

    STEP 1. Check for loose mountings. Tighten mounting hardware (paragraphs 2-20, 2-21, or 2-22).

    STEP 2. Check for broken or damaged impeller. Replace the faulty centrifugal pump (paragraph 2-20, 2-21, or 2-22).

    STEP 3. Check for internal rubbing of motor of defective bearings. Replace pump system (paragraph 2-20, 2-21, or 2-22).

    STEP 4. Check to see if motor shaft is bent. Replace pump assembly (paragraph 2-20, 2-21, or 2-22).

13. Sewage leakage from a pump, disposer, or a piping connection.

    STEP 1. Check for loose bolts, nuts, plugs, or fittings. Tighten bolts, nuts, clamps, plus, or fittings as necessary.

    STEP 2. Check for faulty centrifugal pump. Replace the faulty centrifugal pump (paragraph 2-20, 2-21, or 2-22).

14. Motor energized but pump shaft fails to turn (centrifugal pumps).

    STEP 1. Check for defective motor bearings causing motor binding. Replace pump system (paragraph 2-20, 2-21, or 222).

    STEP 2. Check to see if impeller is jammed or binding in housing. replace the centrifugal pump (paragraph 2-20, 2-21, or 2-22).

15. Waste disposer operates noisy or vibrates excessively.

    STEP 1. Check for loose mountings. Tighten mounting hardware (paragraph 2-23).

Table 2-2. Troubleshooting - CONT

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION	

16. Large amounts of grease or oil on motor surfaces.

    STEP 1. Check for overheating due to defective pump. Replace appropriate centrifugal pump (paragraph 2-20, 2-21, or 2-22).

17. Sanitary unit working but processes slowly.

    STEP 1. Check for partial restriction in sewage lines. Locate restriction and clear (TM 55-1905-223-24-18).

18. Leakage from treatment tank cover.

    STEP 1. Check for loose capscrews in cover. Tighten as necessary using the sequence shown in FIGURE 2-5.

    STEP 2. Check for defective gasket. Remove tank cover and replace the gasket (paragraph 2-11).

19. No backwash water being supplied to the unit (proper reading on the backwash gauge).

    STEP 1. Check to see if auxiliary pump is not on line. Check auxiliary pump. Place on line (TM 55-1905-223-10).

    STEP 2. Check to see if backwash switch is in the control module in the WITHOUT BACKWASH position. Place switch in the WITH BACKWASH position (paragraph 2-6).

    STEP 3. Check for loose connection or broken wiring to the backwash solenoid valve. Check connection and wiring to the solenoid valve and correct as necessary (paragraph 2-28).

    STEP 4. Check for defective backwash solenoid valve. Replace the solenoid valve (paragraph 2-25).

Table 2-2. Troubleshooting - CONT

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
20. No chlorine bleach being supplied to the treatment tank.
STEP 1. Check to see if there is no bleach in storage tank.
WARNING Chemical Hazard. Avoid contact with skin and splashing in eyes.
Check storage tank for leaks. Replace tank if necessary (para. 2-26).
STEP 2. Check to see if metering valve is closed. Open metering valve by turning counterclockwise (FIGURE 1-1 and Item 5 of this table).
STEP 3. Check for restricted supply. Check line for restriction and clear as necessary.
STEP 4. Check to see if chlorination (bleach) solenoid valve is defective. Replace solenoid valve (paragraph 2-25).

SECTION V. UNIT MAINTENANCE PROCEDURES

2-9. General. The maintenance procedures in this section provide step-by-step instructions in the order in which the work is most logically accomplished. The following general safety precautions apply to the Marine Sanitation device and must be observed when performing all maintenance procedures in this chapter.

WARNING

ENVIRONMENTAL HAZARD. Putrefaction of organic matter in the sewage system will cause disagreeable odors and an oxygen deficient atmosphere. Do not remove access covers until fresh air from a known outside source has been supplied to the surrounding area ventilation.

WARNING

CHEMICAL HAZARD. Effulent contains bleach. Avoid contact with skin and eyes. Avoid prolonged breathing of fumes.

WARNING

DISEASE HAZARD. After contact with sewage or contaminated equipment, clean yourself with disinfectant soap before performing hand-to-mouth functions such as eating, drinking, and smoking, etc. Clean up all spills with disinfectant.

WARNING

TOXIC AND FLAMMABLE HAZARD. Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing covers, drain plugs, hoses, and fittings. Avoid open flames and prolonged breathing of fumes.

MAINTENANCE OF THE MARINE SANITATION SYSTEM

2-10. The unit level Replacement and Repair tasks of the marine sanitation system are accomplished through maintenance procedures in paragraphs 2-11 thru 2-27 of this chapter. Inspections, checks, services, and adjustments are covered in PMCS, Table 2-1.

2-11. Repair Sewage Treatment Unit Assembly. FIGURE 2-4.

This task covers:

a. Inspection **b. Test** **c. Service,**
d. Removal **e. Repair** **f. Replacement**

INITIAL SETUP:

Tools

Tool kit, general mechanic's, 5180-00-699-5273
Tool kit, electrician's, 5180-00-391-1087
Lifting fixture P/N 3822512
Lifting straps P/N 3375958
Torque wrench (ft-lb), 5120-01-125-5190

Equipment Condition

All commodes tagged "Out of Service, Do Not Operate."
All electrical power off to sanitary unit.
External sewage inlet and outlet valves closed.
Refer to the following paragraph in this maintenance manual:
Treatment unit drained (Table 2-2, Item 1.)

Materials/Parts.

Tubing clamp, Item 1, Appendix C
Pipe thread lubricant, teflon, Item 2, Appendix C
Treatment unit assembly P/N 3900001
Cover gasket P/N 3600019-
Container, 1 qt (for catching bleach runoff)
Container, 5 gal or larger (for catching sewage runoff)
Disinfectant, Item 3, Appendix C
Warning tags, Item 10, Appendix C

INSPECTION

Inspection of the sewage treatment unit assembly is accomplished through PMCS and maintenance procedures. For initial inspection, start up, and run check, refer to paragraph 2-6.

TEST

a. Test the level sensor assembly (paragraph 2-19).

b. Test the centrifugal pump motors. The test procedures for testing the discharge, flow, and sludge pump motors are the same. Refer to test procedures in paragraph 2-20.

SERVICE

Service to the Sewage Treatment Unit Assembly is accomplished through PMCS, Table 2-1.

REMOVAL

WARNING

SHOCK HAZARD. Make sure the electrical power to the unit is off to prevent injury to personnel.

a. Turn electrical power to the unit OFF and tag.

b. Close external water supply valve to the backwash water line.

c. Disconnect all cable connectors (11, FIGURE 2-4) to the electrical junction box.

d. Open the junction box and do the following:

(1) Tag and disconnect all external wires to the junction box.

(2) Pull the external wires through the bottom of the junction box. Mark the locations where each cable is removed so that it can be installed in the same connector on the new unit.

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing covers, drain plugs, hoses, and fittings. Avoid open flames and prolonged breathing of fumes.

e. Plug all openings to the unit and the incoming lines as they are disconnected. Use appropriate pipe plugs, caps, rags, or equivalent.

f. Disconnect vent connection (3) and plug the opening.

g. Close the bleach metering valve (5).

WARNING

CHEMICAL HAZARD. Wear eye protection. Avoid excessive breathing of fumes.

h. Place a tubing clamp on the bleach line to the metering valve. Hold a container under the connection to catch bleach runoff, and disconnect the bleach line from the metering valve.

i. Close the backwash gate valve on the unit at point (7). Disconnect the backwash water supply at the valve.

j. Disconnect sewage inlet pipe (12) and plug the openings in the tank and in the inlet line.

k. Disconnect sewage discharge line (8). Hold a container under the connection to catch any sewage runoff while disconnecting. Plug openings.

l. Remove the mounting screws, nuts, and washers (10) from the base of the unit (9).

m. Connect a lifting fixture and straps to lifting eyes (2 and 4).

WARNING

Stand clear during lifting operations to avoid personal injury.

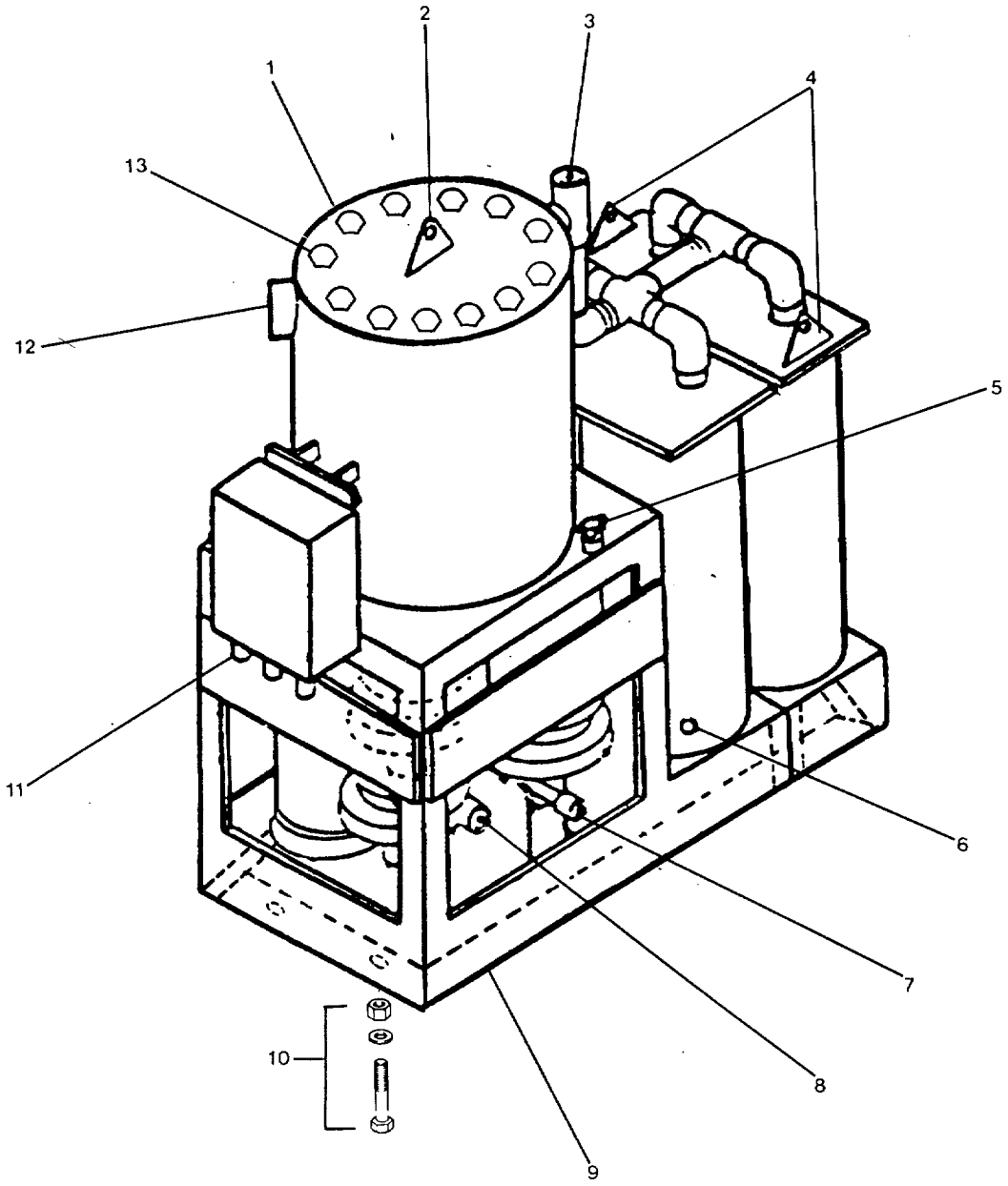


Figure 2-4. References Used When Replacing the Treatment Unit.

n. Hoist the treatment unit clear of its mounting and remove it from the compartment.

o. Clean all spills with disinfectant.

p. When the treatment unit has been removed to an outside location, remove the drain plug (6, FIGURE 2-4) and drain excess effluent into a portable container for disposal.

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing treatment tank covers. Avoid open flames and prolonged breathing of fumes.

q. To remove the treatment tank cover:

(1) Remove 12 capscrews and washers (13) in the tank cover (1, FIGURE 2-4).

(2) Lift the cover and cover gasket from the tank. Discard gasket.

r. Clean and flush the unit with fresh water and disinfectant.

REPAIR

Repair to the sewage treatment unit assembly is by replacement of the treatment tank cover gasket. Refer to the Removal and Replacement steps of this procedure.

REPLACEMENT

NOTE

Do not install the treatment tank cover and gasket until the unit has been installed and inspected.

a. Attach the lifting fixture to lifting eyes (2 and 4, FIGURE 2-4) and lift the new sanitation treatment unit into place on its mounting foundation.

b. Install mounting screws, nuts, and washers (10) in the base of the unit (9) and tighten to 34 ft-lb.

c. Remove the lifting fixture.

d. Connect sewage discharge line (8, FIGURE 2-4).

e. Remove the temporary inlet plug and connect the sewage inlet pipe (12).

f. Connect the backwash water supply line (7).

NOTE

Make sure the bleach metering valve is closed when connecting tubing.

g. Connect the bleach line (tubing) to the metering valve (5). Remove the clamp that was placed on the tubing during the removal process.

h. Remove the temporary plug in the vent line and connect the vent pipe (3).

i. Apply teflon lubricant to the threads and install the drain plug (6).

j. Refer to tags and notes and run external wiring through the bottom connectors (11) to the junction box. Make sure each cable is returned to the same location that it was removed from on the old unit. Tighten connectors until snug.

k. Refer to tags and connect all wiring inside the junction box. Make sure each wire is connected to its proper terminal.

l. Conduct preliminary inspection, startup, and run check (paragraph 2-6).

m. Install tank access cover gasket and cover (1).

(1) Make sure gasket surfaces are clean, and install the gasket.

(2) Position the cover and install the 12 capscrews and washers (13). Make sure the gasket stays in position when installing the capscrews. Tighten capscrews to 31 ft-lb, using the sequence shown in FIGURE 2-5.

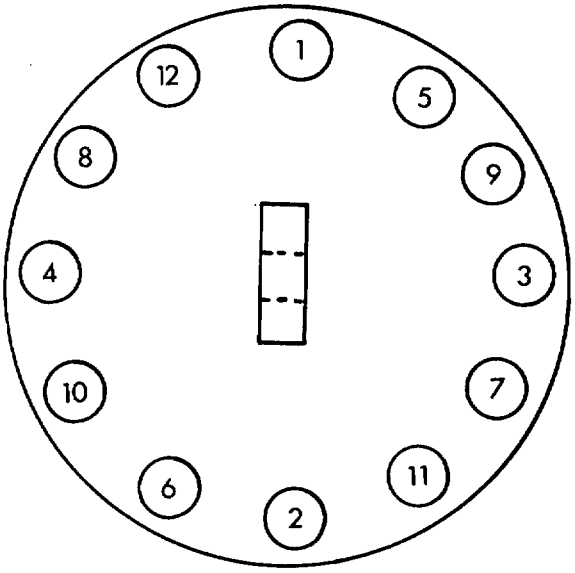


Figure 2-5. Treatment Tank Cover Torque Sequence.

2-12. Repair End Sediment Tank Cover Assembly. (FIGURE 2-6)

This task covers:
a. Removal **b. Repair** **c. Replacement.**

INITIAL SETUP:

Tools

Tool kit, general mechanic's,
5180-00-699-5273
Torque wrench (in-lb)
5120-01-092-3278
Torque wrench (ft-lb)
5120-01-125-5190

Equipment Condition

All commodes tagged "Out of Service,
Do Not Operate."

Materials/Parts

Warning tags, Item 10, Appendix C
Crocus cloth (fine), Item 4,
Appendix C
End sediment tank cover assembly
P/N 3600025
Gasket P/N 300021
Disinfectant, Item 3, Appendix C

LOCATION	ITEM	ACTION	REMARKS

REMOVAL

a. Flush the system as follows:

(1) Operate the sanitary unit.

(2) While the unit is operating, flush the system with five flushes from a commode or commodes.

(3 Wait until the unit has stopped running.

b. Turn electrical power off and tag at the primary breaker to the unit.

c. Close the bleach metering valve.

d. Close the backwash water supply valve.

e. Close external sewage inlet and discharge valves (TM 55-1905-223-24-18).

f. Remove the hose clamps and disconnect the flexible coupling in the vent piping on the cover assembly at point (3) in FIGURE 2-6.

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source, before removing treatment tank covers. Avoid open flames and prolonged breathing of fumes.

g. The cover assembly consists of a plate joined by a common section of PVC vent piping. Remove the cover carefully so as not to crack or damage the piping.

h. Remove capscrews, nuts and washers (2, FIGURE 2-6).

i. Remove cover assembly (4).

j. Remove and discard the cover gasket (1).

REPAIR

NOTE

The PVC piping and joints must be water tight.

a. Check the PVC piping for signs of cracks or breaks. Replace the cover assembly if damaged.

b. Replace the end cover gasket (1, FIGURE 2-6). Refer to the removal and replacement steps in this procedure.

REPLACEMENT

a. Clean the gasket sealing surfaces on the sediment tank and cover assembly.

b. Position the gasket (1, FIGURE 2-6) on the sediment tank.

NOTE

Make sure the gasket stays in position while replacing the cover.

c. The end of the vent pipe (3, FIGURE 2-6) must be placed in the flexible coupling when positioning the cover. Position the cover (4) on the tank and gasket.

d. Install the six capscrews, nuts, and washers (2) in the cover. Tighten each capscrew finger-tight only.

e. Tighten the capscrews to 31 ft-lb in the sequence shown in FIGURE 2-7.

f. Tighten the clamps on the flexible coupling to 40 inch-pounds.

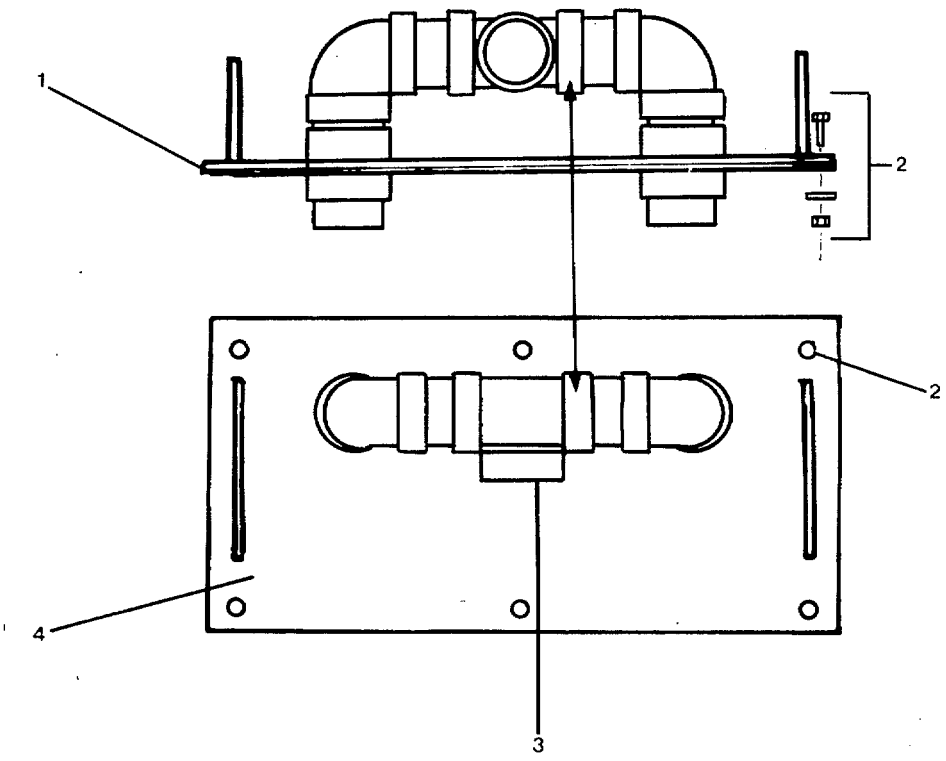


Figure 2-6. End Sediment Tank Cover Assembly.

g. Open backwash water supply valve.

h. Open bleach metering valve.

i. Open external sewage and outlet valves (TM 55-1905-223-24-18).

j. Restore electrical power, start the unit, and conduct run check (paragraph 2-6).

k. Clean any spills with disinfectant.

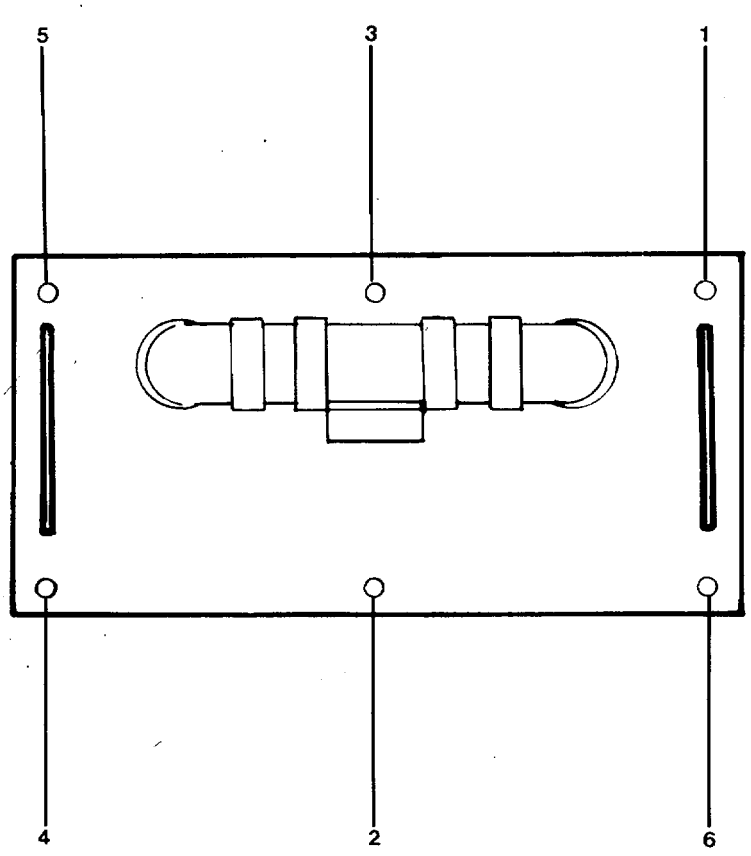


Figure 2-7. Sediment Tank Cover Torque Sequence.

2-13. Repair Mid Sediment Tank Cover Assembly. (FIGURE 2-8)

This task covers:
a. Removal **b. Repair** **c. Replacement.**

INITIAL SETUP:

Tools

Tool kit, general mechanic's,
5180-00-699-5273
Torque wrench (in-lb)
5120-01-092-3278
Torque wrench (ft-lb)
5120-01-125-5190

Equipment Condition

All commodes tagged "Out of Service,
Do Not Operate."

Materials/Parts

Warning tags, Item 10, Appendix C
Crocus cloth (fine), Item 4,
Appendix C
Mid sediment tank cover assembly
P/N 3600026
Gasket P/N 3600021
Disinfectant, Item 3, Appendix C

LOCATION	ITEM	ACTION	REMARKS

REMOVAL

a. Flush the system as follows:

(1)Operate the sanitary unit.

(2)While the unit is operating, flush the system with five flushes from a commode or commodes.

(3)Wait until the unit has stopped running.

WARNING

SHOCK HAZARD. Turn electrical power OFF.

b. Turn electrical power off at the primary breaker to the unit.

c. Close the bleach metering valve.

d. Close the backwash water supply valve.

e. Close external sewage inlet and discharge valves (TM 55-1905-223-24-18).

f. Remove the end sediment tank cover assembly (paragraph 2-12).

g. Remove the hose clamps and disconnect the flexible coupling in the vent piping on the cover assembly at point (3) in FIGURE 2-8.

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing treatment tank covers. Avoid open flames and prolonged breathing of fumes.

h. The cover assembly consists of a plate joined by a common section of PVC vent piping. Remove the cover carefully so as not to crack or damage the piping.

i. Remove the six capscrews, nuts, and washers (2, FIGURE 2-8).

j. Remove the cover assembly (4).

k. Remove the cover gasket (1). Discard the gasket.

REPAIR

NOTE

The PVC piping and joints must be water tight.

a. Check the PVC vent piping for signs of cracks or breaks. If the piping is cracked or broken at any point, the cover assembly must be replaced. Refer to Removal and Replacement steps in this procedure.

b. Replace the mid sediment tank cover gasket (1, FIGURE 2-8). Refer to the Removal and Replacement steps in this procedure.

REPLACEMENT

a. Clean the gasket sealing surfaces on the sediment tank and cover assembly (4, FIGURE 2-8).

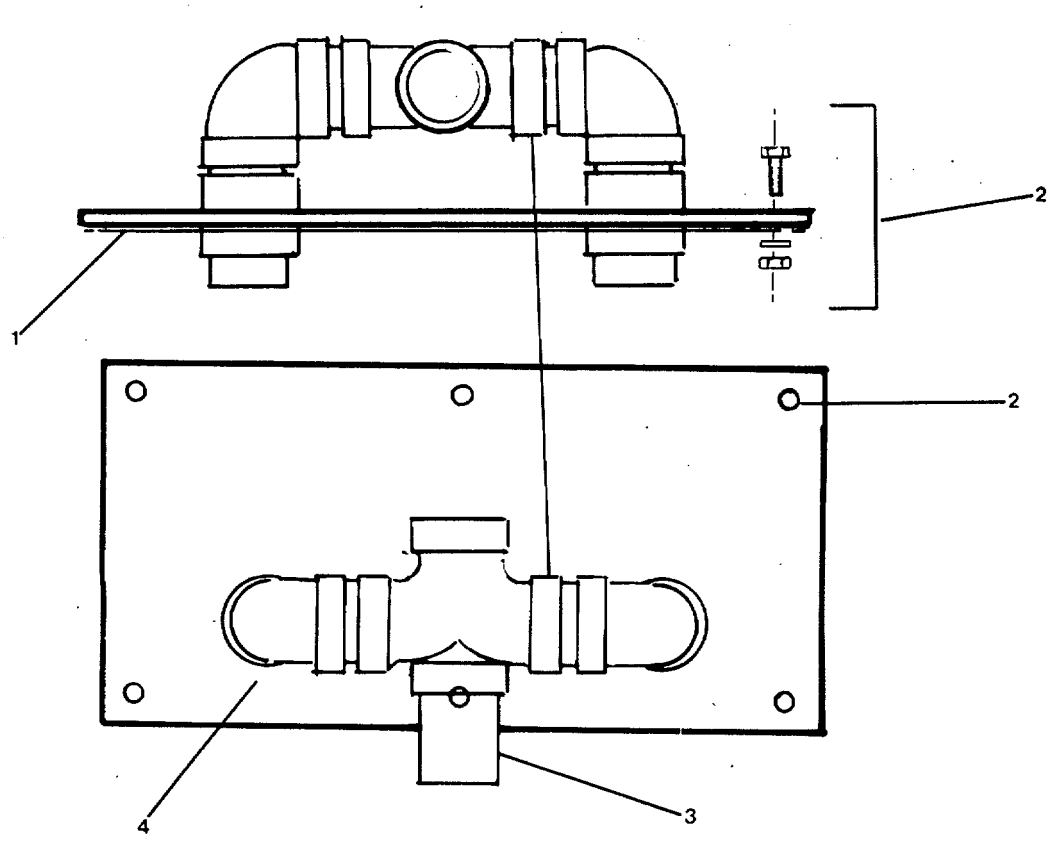


Figure 2-8. Mid Sediment Tank Cover Assembly.

b. Position the gasket (1, FIGURE 2-8) on the sediment tank.

NOTE

Make sure the gasket stays in position while replacing the cover.

c. The end of the vent pipe (3, FIGURE 2-8) must be placed in the flexible coupling when positioning the cover. Position the cover (4) on the tank and gasket.

d. Install the six capscrews, nuts, and washers (2) in the cover. Tighten each capscrew finger-tight only.

e. Refer to FIGURE 2-7 and tighten capscrews in the sequence shown to 31 ft-lb.

f. Tighten the clamp on the flexible coupling to 40 inch-pounds.

g. Install the end sediment tank cover (paragraph 2-12).

h. Open the backwash water supply valve.

i. Open the bleach metering valve.

j. Open external sewage inlet and outlet valves.

k. Restore electrical power, start the unit, and conduct run check (paragraph 2-6).

l. Clean spills with disinfectant.

2-14. Repair Screen Assembly. (FIGURE 2-9)

This task covers:
a. Removal **b. Replacement.**

INITIAL SETUP:

Tools

Tool kit, general mechanic's, 5180-00-699-5273

Materials/Parts

Disinfectant, Item 3, Appendix C
Screen assembly P/N 3500044
Grommet fasteners P/N 3500-43-001
Rivets P/N 3500043-002
Wire fabric P/N 3500044
Warning tag, Item 10, Appendix C

Equipment Condition

System flushed with water
Electrical power OFF and tagged to the unit
External sewage inlet and outlet valves closed
Backwash water supply valve closed (para. 2-25).
Bleach metering valve closed (para. 2-25).

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing treatment tank covers. Avoid open flames and prolonged breathing of fumes.

REMOVAL

a. Remove the treatment tank cover and gasket (paragraph 2-11).

b. Remove the 12 nylon rivet and grommet fasteners that hold the wire fabric in place (2, 3, FIGURE 2-9). Cut the fasteners if necessary. Discard the old grommets and rivets.

c. Remove the wire fabric screen (1).

REPAIR

Repair to the screen assembly is by replacement of the grommet fasteners, blind rivets, and wire fabric screen. Refer to the removal and replacement steps in this procedure.

REPLACEMENT

a. Place a new screen (1, FIGURE 2-9) in position. Attach the screen around the edges with 12 new nylon rivet and grommet fasteners (2 and 3).

b. Replace the treatment tank gasket and cover (paragraph 2-11).

c. Open the external sewage outlet and inlet valves, the backwashwater supply valve, and the bleach metering valve.

d. Restore electrical power.

e. Operate the unit and check cover and gasket for leaks. Correct as necessary.

f. Clean any spills with disinfectant.

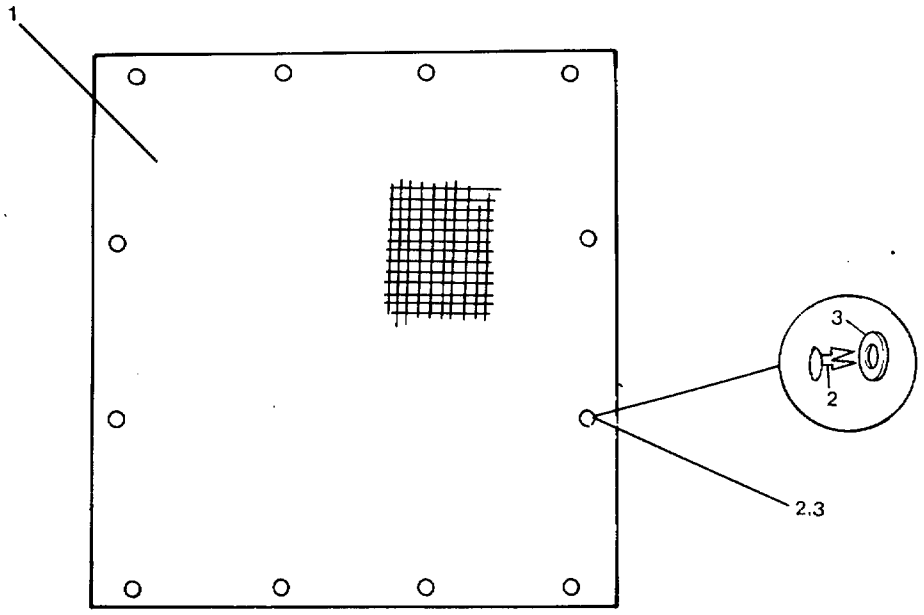


Figure 2-9. Screen Assembly (Inside Treatment Tank).

2-15. Replace Impact Sprinkler. (FIGURE 2-10)

This task covers:
a. Removal **b. Replacement.**

INITIAL SETUP:

Tools

Tool kit, general mechanic's, 5180-00-699-5273

Materials/Parts

Pipe thread lubricant, teflon, Item 2, Appendix C
Impact sprinkler P/N 3500042-003
Warning tags, Item 10, Appendix C

Equipment Condition

System flushed with water
Electrical power OFF and tagged to the unit

Screen assembly removed (paragraph 2-14)

WARNING

Toxic and flammable vapors are generated in the , sewage system. Provide ventilation from outside source before removing treatment tank covers. Avoid open flames and prolonged breathing of fumes.

REMOVAL

NOTE

The sprinkler head is located inside the treatment tank (1, FIGURE 2-10).

a. Remove the treatment tank cover and gasket (paragraph 2-11).

b. Disconnect the sprinkler coupling (2). Remove the sprinkler (1).

REPLACEMENT

a. Apply Teflon lubricant to the pipe threads on the new sprinkler (1).

b. Make sure the sprinkler is properly adjusted towards the retention/ reduction screen (3, FIGURE 2-10) when connecting the coupling.

c. Connect the sprinkler coupling (2).

d. Install the screen assembly (3) (paragraph 2-14).

e. Replace the treatment tank cover and gasket (paragraph 2-11).

f. Open the backwash inlet valve in the water line coming to the unit.

g. Open the sewage outlet and inlet valves in the external piping.

h. Open the bleach metering valve.

i. Restore electrical power.

j. Operate the unit and adjust the backwash water pressure gauge to 30 psi.

NOTE

The backwash pressure gauge is located on the incoming water line to the unit (paragraph 2-25).

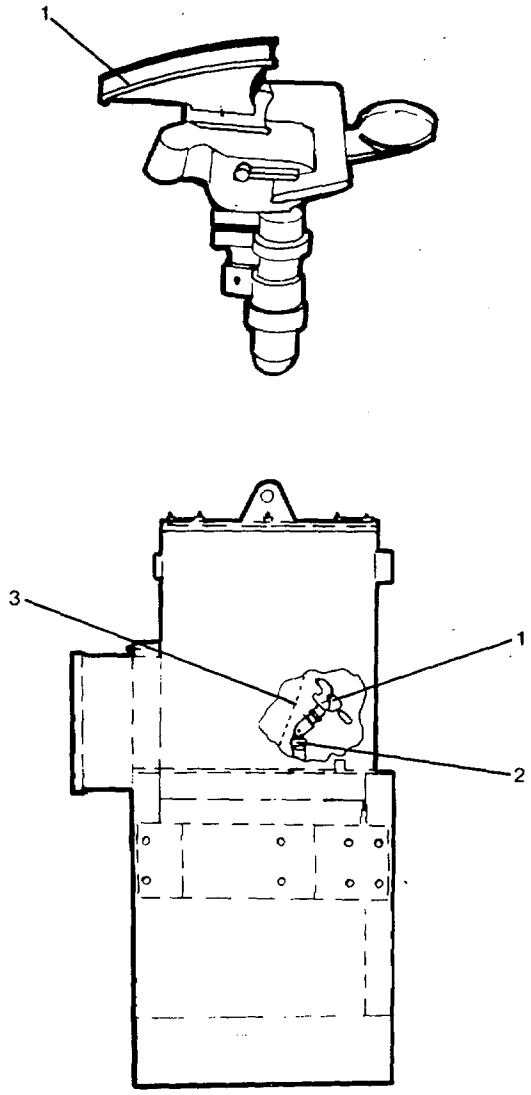


Figure 2-10. Impact Sprinkler (Inside Treatment Tank)

2-16. Repair Sewage Treatment Unit Subassembly.

This task covers:
a. Removal, b. Repair d. Replacement

INITIAL SETUP:

Tools

Tool kit, general mechanic's,
5180-00-699-5273
Torque wrench (in-lb)
5120-01-092-3278
Torque wrench (ft-lb)
5120-01-125-5190

Materials/Parts

Coupling, hose, flexible
P/N 2503178-001
Pipe thread lubricant, Teflon
Item 2, Appendix C
Treatment/sediment tank P/N 390003
Corrosion preventive anode
P/N 35000041
PVC pipe fittings
PVC solvent/cleaner
Item 5, Appendix C
PVC cement glue, Item 6,
Appendix C
Container, 5 gl (to catch sewage
runoff)
Disinfectant, Item 3, Appendix C
Warning tags, Item 10, Appendix C

Equipment Conditions

System flushed with water
Electrical power OFF and tagged
External sewage inlet and outlet
valves closed
Bleach metering valve closed
Backwash water supply valve closed
End sediment tank cover assembly
removed (paragraph 2-12)
Mid sediment tank cover assembly
removed (paragraph 2-13)

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing treatment tank covers. Avoid open flames and prolonged breathing of fumes.

REMOVAL

NOTE

Only the end treatment/sediment tank assembly is replaceable as a separate unit. The mid tanks and main treatment tank are constructed as a part of the sewage treatment unit.

a. Remove the anode/plug (9, FIGURE 2-11) and drain the sediment modules to their lowest level into a portable container for disposal.

b. Flush and drain all four sediment tanks with fresh water and disinfectant.

c. Disconnect all piping/fittings from the underside of the end sediment tank assembly (8, 9, 10, FIGURE 2-12).

d. Disconnect adapters (6, 7, 11, FIGURE 2-12) from inside of the sediment tanks to remove fittings (3, 4, 5, 12).

NOTE

The mid section tanks have the same internal and external piping fittings and may be removed and replaced as required.

e. Remove the bolts, washers, and nuts (6, 7, 8, FIGURE 2-11) on the inside the framework base on each side of the unit to detach the end sediment tank assembly.

f. Remove the mounting bolts, nuts, and washers (11, FIGURE 2-11) holding the assembly to its mounting foundation.

g. Remove the end sediment tank assembly (5).

h. Disconnect the vent piping by unscrewing at point (3) and disconnect the adapter (2) to remove the vent section (4) from the main treatment tank (1).

i. Disconnect the two hose clamps (2, FIGURE 2-12) to remove the flexible coupling (1).

REPAIR

a. Replace adapters (6, 7, 11, FIGURE 2-12) and fittings (3, 4, 5, 12) in both sediment tank sections (end and mid) if cracked or broken.

b. Replace the PVC fittings (8, 9, 10, FIGURE 2-12) on both sediment tank sections (end and mid) if cracked or broken.

c. Replace the flexible coupling (1, FIGURE 2-12) on the vent section if cracked or deteriorated.

d. Check the corrosion preventative anode/plug (9, FIGURE 2-11) to see how much zinc has been given up to electrolysis.

(1) The anode part of a new plug measures 2 in (length) by 0.750 in (diameter).

(2) Replace the anode if it has deteriorated to one half or more of its original diameter.

REPLACEMENT

WARNING

PVC solvent and glue are toxic and flammable. Provide adequate ventilation before using. Avoid breathing of fumes. Do not use near flames or other open lights.

NOTE

Glued pipe joints must be cleaned with the PVC solvent/cleaner and glued with PVC cement glue. Threaded fittings must have a Teflon pipe thread lubricant applied to the threads when they are replaced.

a. Replace the vent section (4, FIGURE 2-11) as follows:

(1) Glue any joint that requires gluing with PVC cement glue. Clean each joint with PVC solvent/cleaner before gluing.

(a) Follow the directions provided with the solvent and the glue.

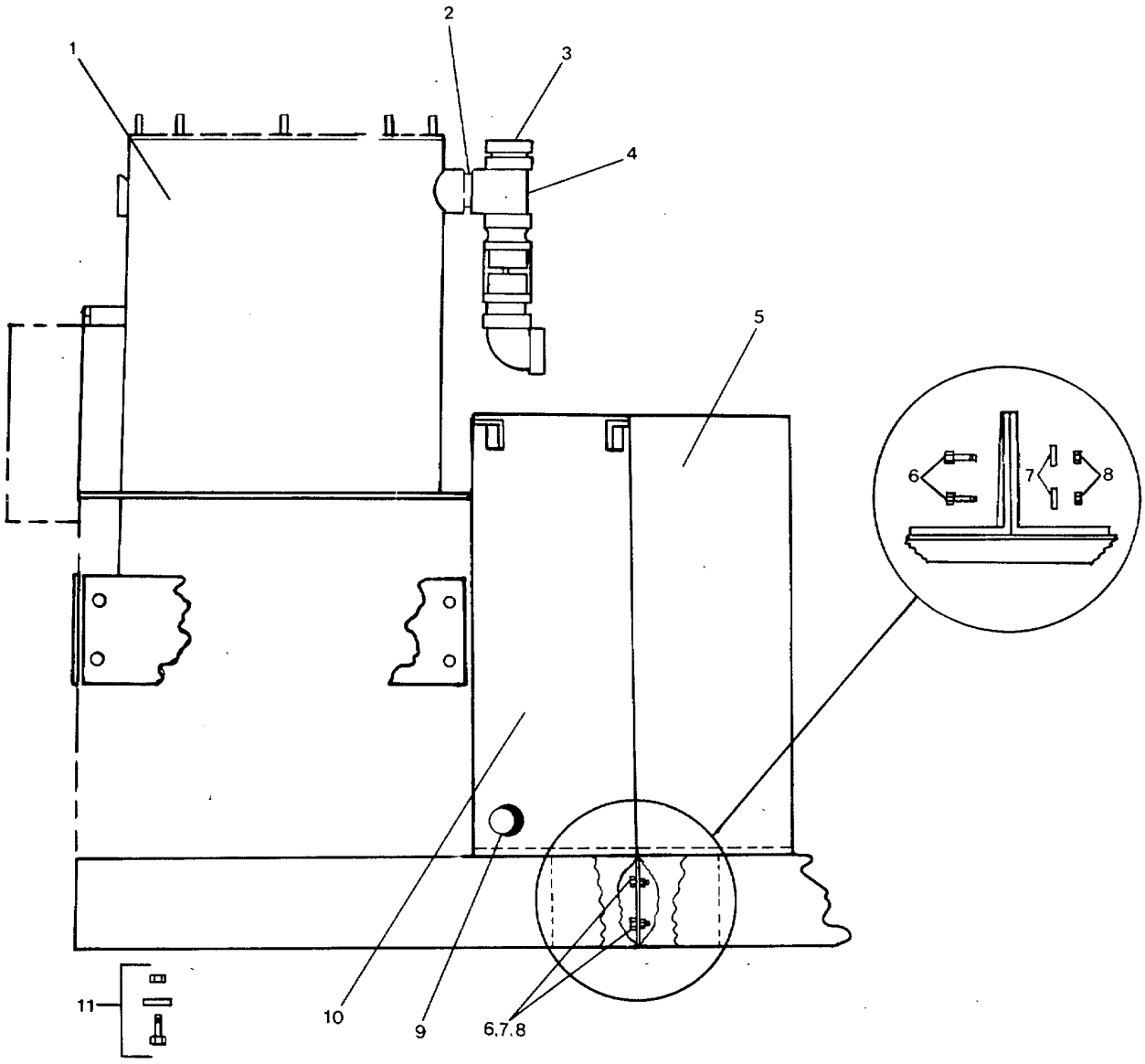


Figure 2-11. Sewage Treatment and Sediment Tank Subassembly.

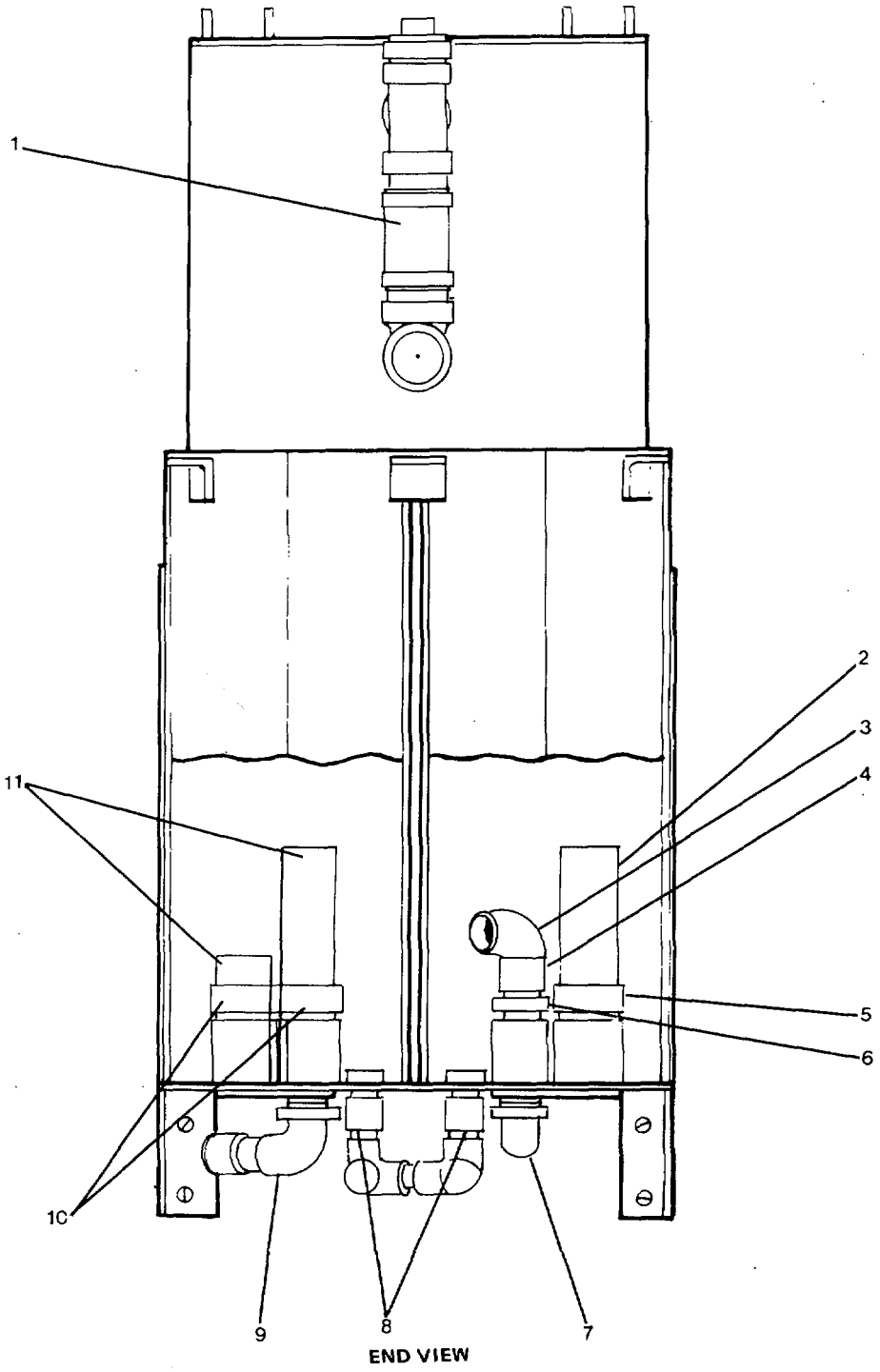


Figure 2-12. Treatment and Sediment Tank Piping/Connections.

(b) Make sure the joint is evenly coated with glue. Do not use an excessive amount of glue.

(c) Make sure each part is positioned properly as each joint is glued.

(2) Apply Teflon pipe thread lubricant to threaded adapter (2, FIGURE 2-11) and install.

(3) Join the vent section with the flexible coupling (1, FIGURE 2-12). Tighten the clamps on the coupling to 40 inch-pounds.

(4) Connect the external vent pipe at point (3, FIGURE 2-11) on the treatment tank (1). Clean the connection and apply Teflon thread lubricant when connecting.

b. Place the end sediment tank assembly tank assembly (5, FIGURE 2-11) in position on the mounting foundation and install the bolts, washers, and nuts (6, 7, 8) to connect the assembly to the main unit. Do not tighten the bolts and nuts until the foundation mounting bolts are aligned and installed.

c. Install the foundation mounting bolts, washers, and nuts (11, FIGURE 2-11).

d. Tighten all mounting bolts to 34 ft-lb.

e. Connect the piping and fitting (8, 9, 10, FIGURE 2-12) to the underside ofthe assembly. When gluing is required, follow the instructions given in a.(1)(a) of this procedure.

f. Replace internal sediment tank fitting as required. Follow the instructions in a.(1)(a) and (b) of this procedure.

g. Apply Teflon lubricant to the threads and install the anode/plug (9, FIGURE 2-11) in tank (10). Tighten until snug.

h. Install the mid sediment tank cover assembly (paragraph 2-13).

i. Install the end sediment tank cover assembly (paragraph 2-12).

j. Open the bleach metering valve.

k. Open external sewage inlet and outlet valves.

l. Restore electrical power.

m. Operate the unit and check for leaks. Correct as required.

2-17. Repair Control Module Assembly. (FIGURE 2-13)

This task covers: **a. Inspection/Service, b. Removal, c. Repair, d. Replacement.**

INITIAL SETUP

Tools

Tools kit, general mechanic's,
5180-00-699-573
Tool kit, electrician's,
5180-00-391-1087

Equipment Condition

Electrical power OFF and tagged to the sanitary unit at the primary breaker

Materials/Parts

Lens P/N 3500054-003
Lamp P/N 2402839-008
Control module assembly P/N 3800005
Circuit card assembly P/N 3700021-002
Circuit breaker P/N 3500053-001
Power relay P/N 3500054-001
Lampholder P/N 3500049
Warning tags, Item 10, Appendix C

INSPECTION/SERVICE

Inspection and service to the control module assembly are accomplished through PMCS (Table 2-1) and maintenance procedures.

REMOVAL

WARNING

Make sure electrical power is OFF at primary breaker to the sanitation unit before attempting any maintenance function in this procedure.

WARNING

Make sure electrical power is OFF to avoid injury to personnel.

a. Remove the circuit card assembly (5, FIGURE 2-13) as follows:

CAUTION

To prevent damage to the equipment, each wire removed from the circuit card must be tagged, with location marked, to ensure they are reconnected exactly as removed.

(1) Open the control module assembly door (19, FIGURE 2-13) to reveal the circut card (5) and wiring connection. See FIGURE 2-14 for printed circuit card details.

(2) Tag, disconnect, and mark the locations of each wire connected to TB1, TB2, and TB3 on the circuit card assembly (FIGURE 2-14).

NOTE

All terminal connections should be free from wiring.

(3) Remove the screw (3, FIGURE 2-13) in each corner that mounts the circuit card and to the panel enclosure.

(4) Remove the circuit card from the panel enclosure (4, FIGURE 2-13).

(5) If only the circuit card is being replaced, go to step (d) of the following replacement procedure.

b. Remove the circuit breaker (11, FIGURE 2-13) as follows:

NOTE

A front view of breaker switch is shown in (18) FIGURE 2-13.

(1) Open the control module door to reveal the circuit breaker (11, FIGURE 2-13) on the back side of the door.

(2) Tag, disconnect, and mark location of all wires connected to each end of the circuit breaker.

(3) Remove the mounting nuts (10, FIGURE 2-13) and remove the breaker.

(4) If only the circuit breaker is being replaced, go to step (c) of the following replacement procedure.

c. Remove the power relay (14, FIGURE 2-13) as follows:

(1) Open the control module door to reveal the power relay (14, FIGURE 2-13).

(2) Tag, disconnect, and mark location of all wires to the relay.

(3) Remove the two mounting nuts (12, FIGURE 2-13) and remove the relay.

(4) If only the power relay is being replaced, go to step (b) of the following replacement procedure.

d. Remove the POWER ON lens and light (2, FIGURE 2-13) as follows:

(1) Remove the hex retaining nut (15, FIGURE 2-13) located on the back side of the module door.

(2) Remove the lens from the front side of the door. Remove the lampholder and bulb from the back side of the door.

(3) Remove the lamp (bulb) from the holder (16, FIGURE 2-13).

(4) To replace the lampholder tag and disconnect the wire attached to it.

(5) To replace the lens, lamp, or Lampholder go to step (a) of the replacement procedure.

e. To remove the control module assembly as a complete unit, use the following procedure.

(1)Open the control module (junction box) door (19, FIGURE 2-13).

(2) Disconnect the red and the black chlorinating solenoid wires, from the bottom corner terminals (13, FIGURE 2-13) of the power relay (14) mounted to the back side of the door. Tag with location of wires.

(3) Remove the red and black solenoid wires that were disconnected above from the polyethylene spiral wrapping that harnesses the wiring to the door mounted components.

NOTE

These are the only wires that have to be disconnected and freed from the door mounted components.

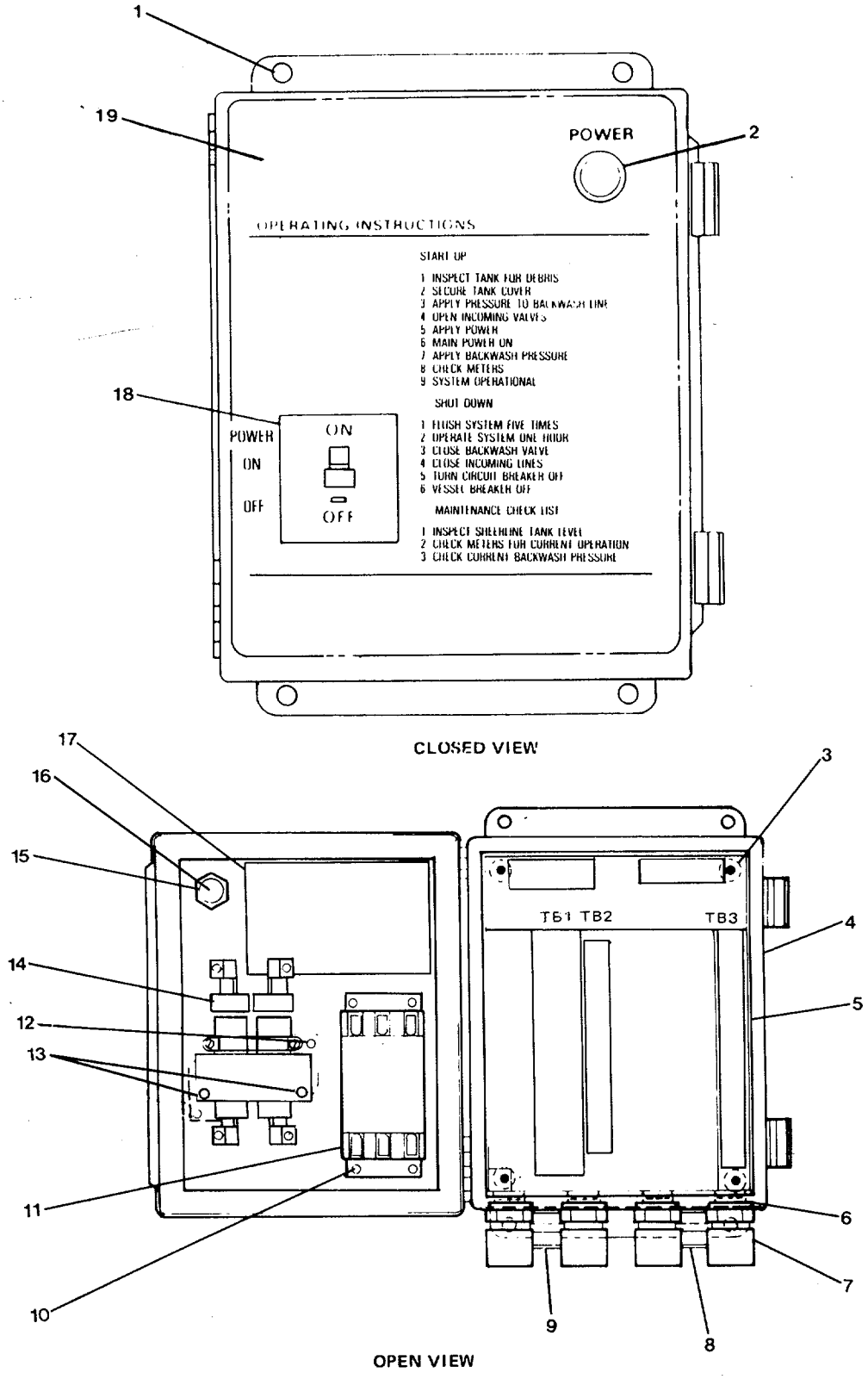
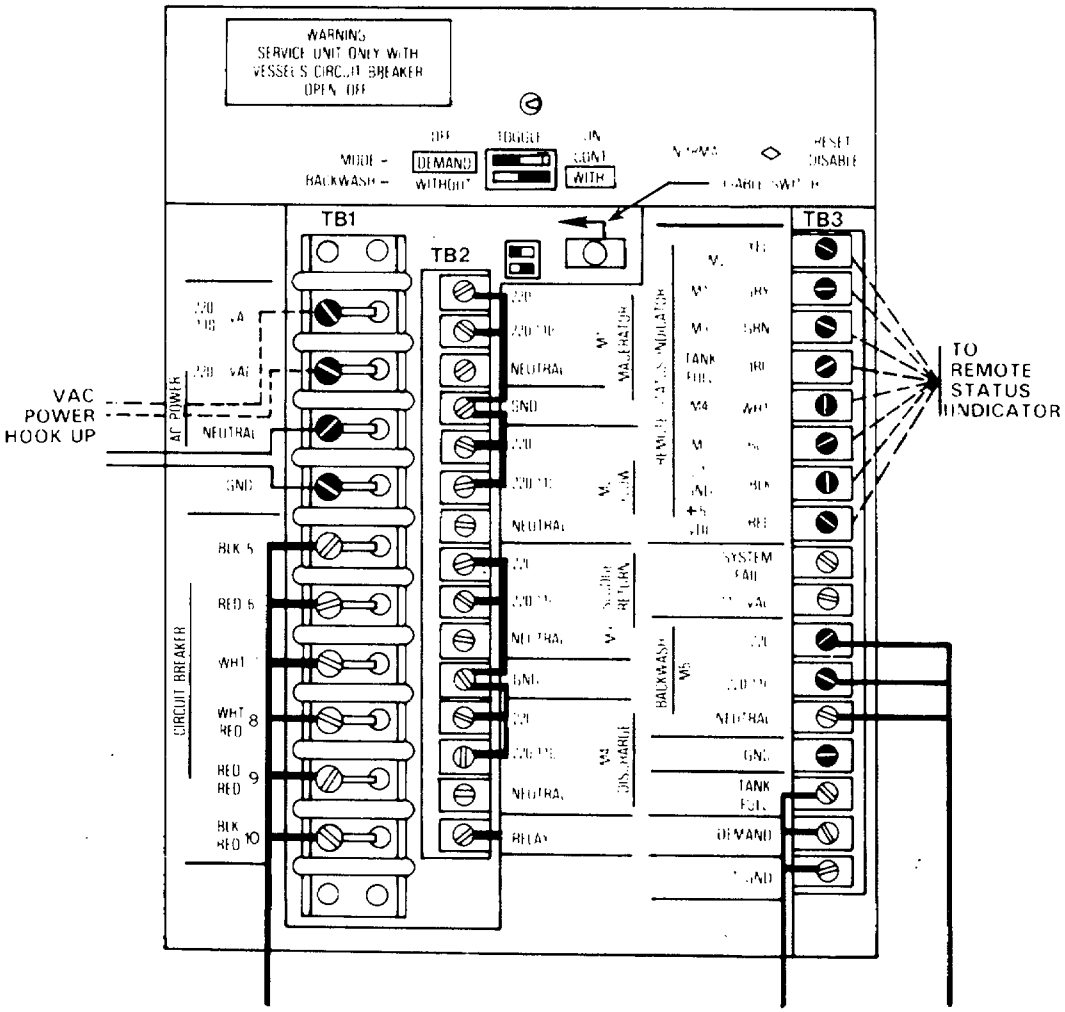


Figure 2-13. Control Module Assembly (Circuit Card Details Excluded).



FACTORY INSTALLED WIRING

GROUND OR NEUTRAL CONNECTIONS

(HOT WIRE) VAC POWER CONNECTIONS

REMOTE STATUS INDICATOR CONNECTIONS

TOGGLE SWITCH IN DOWN POSITION

DISABLE SWITCH POSITION (NORMAL)

USER ELECTRICAL HOOK UPS

Figure 2-14. Circuit Card Assembly.

(4) Tag and disconnect the ac power and ground wires on terminals 1 thru 4 on terminal board one (TB1) on the circuit board. Tag all wires with locations from which they were removed. See terminals marked VAC power hookup in FIGURE 2-14 on the left side terminal strip.

(5) Tag and disconnect all wires from terminal board two (TB2). See middle terminal strip in FIGURE 2-14.

(6) Tag and disconnect all wires on terminal board three (TB3). See right side terminal strip in FIGURE 2-14.

(7) Disconnect the 10 cable clamp connectors (7, 8, 9, FIGURE 2-13). Slip each set of wires through and free of the lockouts (6).

NOTE

Tag and mark the location of each cable clamp connector as it is removed from the assembly so that it can be returned to the same conduit hole in the new box.

(8) Drop each connector and cable from the assembly. Pull all wiring clear. The box should now be free of all external wiring.

NOTE

Leave the cable connectors attached to the cable for reuse of new box.

(9) Close the door to the assembly and remove the four mounting screws (1, FIGURE 2-13). Remove the control module assembly.

REPAIR

a. Repair to the control module assembly is by replacement of the following components:

(1) Power ON lens, lamp, or lamp holder.

(2) Power relay.

(3) Circuit breaker.

(4) Circuit card assembly.

b. Refer to the removal and replacement steps of this procedure.

REPLACEMENT

NOTE

A circuit diagram is contained on the information plate (17, FIGURE 2-13).

a. To replace the lens, lamp, or lampholder of the POWER ON light, do the following:

(1) Replace a new lamp in the lampholder (16, FIGURE 2-13).

(2) Position the lens (2) in the front side of the assembly door. Position the holder and lamp in the rear side of the door and install the retaining nut (15, FIGURE 2-13).

(3) Attach the two wires to the terminals on the back of the lampholder (16).

(4) Close the assembly door, restore power, and check for proper operation.

b. To replace the power relay, do the following:

(1) Position the power relay (14, FIGURE 2-13) on the rear of the door and install the mounting nuts. (12)

(2) Refer to tags and connect all wires to their proper terminals on the relay.

(3) Close the assembly, restore power, and check for proper operation of the unit.

c. To replace the circuit breaker (11, FIGURE 2-13), do the following:

(1) Position the circuit breaker on the rear of the door and install the mounting nuts (10, FIGURE 2-13).

(2) Refer to tags and connect all wires to their proper terminals on the circuit breaker.

(3) Close the assembly door, restore power, and check the unit for proper operation.

d. To replace the circuit card assembly (5, FIGURE 2-13), do the following:

(1) Position the circuit card in the panel enclosure (4) and install the mounting screw (3) in each corner of the card.

(2) Refer to tags, and FIGURE 2-14, and connect all wires to their proper terminals on the circuit card.

(3) Close the assembly door, restore power, and check the unit for proper operation.

e. To replace the complete control module assembly, do the following:

(1) Position a new control module assembly and install the four mounting screws (1, FIGURE 2-13)

(2) Remove the 10 conduit knockouts in the bottom of the junction box if they are still in place.

(3) Return each set of wires, with its cable connector (7,8, 9, FIGURE 2-13), to the same conduit hole that it was removed from on the hold assembly.

(4) Run each set of wires through a connector locknut (6, FIGURE 2-13) on the inside of the box. Screw the lockouts to the threads on the connectors and tighten.

(5) Reconnect all wires to terminal board (TB1, TB2, and TB3). Make sure each wire is returned to the same position that it was connected to in the old assembly (See FIGURE 2-14 for circuit card details).

(6) Place the red and the black chlorinating solenoid wires back into the spiral wrapping door harness.

(7) Connect the chlorinating solenoid wires to their proper terminals (13, FIGURE 2-13) on the power relay (14).

(8) Close the assembly door (19).

(9) Restore electrical power.

(a) Turn the primary breaker to the unit ON.

(b) Throw the control module breaker switch (18, FIGURE 2-13) to the ON position.

(10) Run the sanitary unit and check for proper operation (TM 55-1905-223-10).

2-18. Repair Equipment Routing Cable Assembly.

This task covers: **a. Inspection, b. Removal, c. Repair, d. Replacement.**

INITIAL SETUP

Tools

Tool kit, general mechanic's,
5180-00-699-5273
Tool kit, electrician's,
5180-00-391-1087

Equipment Condition

Electrical power OFF and tagged at the primary breaker to the sanitation unit.

Materials/Parts

Electrical tape, Item 11, Appendix C
Warning tags, Item 10, Appendix C
Gasket P/N 2502271
Cable, maritime P/N 3599004-003
Cable, maritime P/N 3599004-002
Equipment routing cable assembly
P/N 3800006

NOTE

The equipment routing cables assembly includes six individual maritime electrical cables with their attaching hardware. These cables are for routing the four pump motors, chlorination solenoid, and backwash solenoid to the control module assembly. Refer to paragraph 2-17 and FIGURE 2-14 for disconnecting the individual cables from the control module assembly.

INSPECTION

WARNING

SHOCK HAZARD. Make sure electrical power is OFF to the sanitary unit.

a. Check all maritime cable terminals for tightness in the control module assembly (paragraph 2-17).

b. Check all cable connections to pump motors, solenoids, and the waste disposer for tightness.

c. Visually check the maritime cable wires for worn insulation. Repair or replace the appropriate maritime cable as required. Refer to repair or removal and replacement steps in this procedures.

REMOVAL

(Refer to FIGURE 2-15 to identify the attaching point of each cable.)

a. The procedure for disconnecting the cable from each of the pumps and the waste disposer is the same. Refer to FIGURE 2-15 for pump locations, and remove the cable from the appropriate pump as follows:

(1) Loosen the cable connector (3, FIGURE 2-15) at the electrical connection box on the pump.

(2) Remove the electrical box cover from the pump and disconnect the wires from the pump terminals. Tag all wires so that they can be returned to the same terminals on the pump when installing the new cable.

(3) Remove the locknut from the cable connector (3) on the inside of the electrical box cover. Withdraw the cable (1, FIGURE 2-15) and connector from the cover.

(4) Remove the conduit elbow (2) from the end of the cable. Remove the connector and gasket (4).

(5) Disconnect the other end of the cable from the circuit board in the control module assembly. Refer to FIGURE 2-14 for identification on pump terminals in the control module assembly.

(6) Loosen the appropriate cable connector on the control module assembly and withdraw the cable (paragraph 2-17).

(7) All wires should now be disconnected. Remove the cable from the sanitary unit.

b. The procedures for disconnecting the cable from the chlorination solenoid and the backwash solenoid are the same except where noted. Refer to FIGURE 2-15 for solenoid locations. Remove the cable from the appropriate solenoid as follows:

(1) Loosen the cable connector (4, FIGURE 2-15) on the solenoid.

(2) Remove the cover plate (5), tag and disconnect the wiring from the solenoid. Note the locations of each wire on the solenoid terminals so that they can be returned to the same position on the new cable.

(3) Remove the locknut from the cable connector elbow and remove the cable (6) gasket, elbow, and connector from the solenoid.

(4) Disconnect the other end of the cable from the circuit board in the control module assembly. Refer to FIGURE 2-14 for identification of the solenoid terminals in the control module assembly.

(5) Disconnect the chlorination solenoid wires from the power relay in the control module assembly (13, FIGURE 2-13) when replacing the chlorination solenoid cable.

(6) Loosen the appropriate cable connector on the control module assembly and withdraw the cable (paragraph 2-17).

(7) All wires should now be disconnected. Remove the cable from the sanitary unit.

REPAIR

a. Check for worn or frayed insulation on electrical wires. Replace if necessary.

b. Other repair to the equipment routing cable assembly is by replacement of the appropriate maritime cable. Refer to the removal and replacement steps in this procedures.

REPLACEMENT

a. The procedure for replacing the cable on each pump and the waste disposer is the same. Refer to FIGURE 2-15 for pump locations. Connect the appropriate cable as follows:

(1) Run the cable (1) through the same cable connector on the control module assembly that the old cable was removed from (paragraph 2-17).

(2) Connect the electrical wires to their proper terminals on the circuit board. Refer to FIGURE 2-14 for pump terminal identification.

(3) Tighten the cable connector at the control module assembly.

(4) Route the cable to the appropriate pump.

(5) Run the pump end of the cable through the connector nut (4, FIGURE 2-15) gasket, and elbow. Position the cable in the electrical box cover to the pump and install the locknut to the elbow and tighten.

(6) Connect the wires to their proper terminals on the pump.

(7) Install the electrical box cover on the pump and tighten the cable connector nut (4).

b. The procedure for replacing the cable on the chlorination solenoid and the backwash solenoid are the same except where noted. Refer to FIGURE 2-15 for solenoid locations. Connect the appropriate cable as follows:

(1) Run the cable (6) through the same cable connector on the control module assembly that the old cable was removed from (paragraph 2-17).

(2) Connect the wires to the proper terminals in the control module.

(a) Attach the backwash solenoid wires to their proper terminals on the circuit card (See FIGURE 2-14 for terminal identification).

(b) Attach the chlorination solenoid wires to the terminals (13, FIGURE 2-13) on the power relay in the control module assembly.

(3) Tighten the cable connector until snug at the control module assembly.

(4) Route the cable (6, FIGURE 2-13) to the appropriate solenoid.

(5) Run the solenoid end of the cable through the connector nut (4, FIGURE 2-15) and elbow (6).

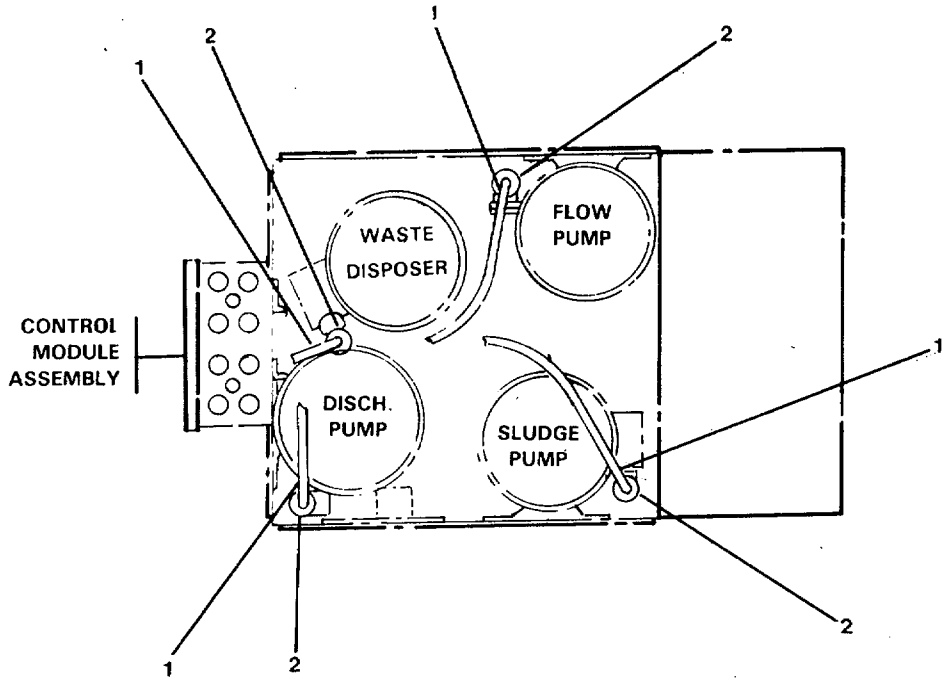
(6) Connect the wires to their proper terminals on the solenoid.

(7) Install the electrical connection cover plate (5, FIGURE 2-15).

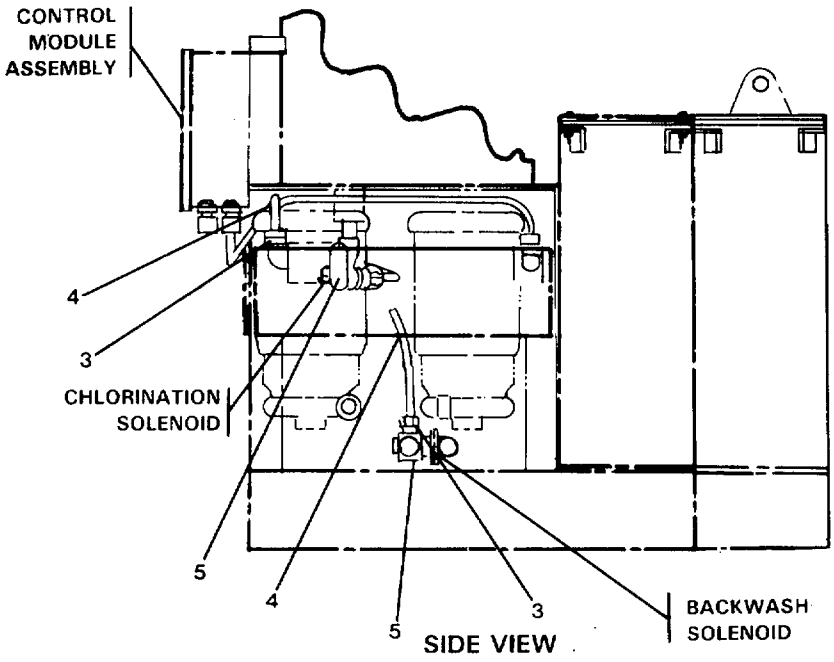
c. Restore electrical power at primary breaker (TM 55-1905-223-10).

d. Turn the circuit breaker on the control module to the ON position.

e. Run the sanitation unit and check for proper operation (paragraph 2-6).



BOTTOM VIEW



SIDE VIEW

Figure 2-15. Cable Routing.

2-19. Replace Level Sensor Assembly

This task covers: a. Inspection/Test, b. Removal, c. Replacement.

INITIAL SETUP

Tools

Tool kit, general mechanic's
5180-00-699-5273
Tool kit, electrician's
5180-00-391-1087
Multimeter
6625-01-139-2512

Equipment Conditions

Sanitary unit in the normal operational (DEMAND) mode (paragraph 2-6).

Materials/Parts

Soap, Item 9, Appendix C
Level sensor assembly P/N 3700048
Brush, non-metallic, Item 8, Appendix C
Warning tags, Item 10, Appendix C

INSPECTION/TEST

a. Refer to the terminal board 3 (TB3) (4, FIGURE 2-17). Use a multimeter on the voltage scale and check for proper voltage at the level sensor terminals in the control module assembly. Check the voltage between CT GND and DEMAND terminals on TB3. Also check between CT GND and TANK FULL terminals on TB3. Both readings should be 110-120 Vac. If there is no voltage, or if the voltage is lower than required, check the control module assembly (Table 2-2, Item 5).

b. If the sanitary unit does not operate in the normal (DEMAND) mode, do the following:

(1) Place the mode switch on the control module assembly in the continuous mode (paragraph 2-6).

(2) If the sanitary unit operates properly in the continuous mode, either the level sensor connections or the control module assembly are defective.

WARNING

Turn electrical power OFF to avoid personal injury.

c. Turn all electrical power OFF to the sanitary unit (paragraph 2-6).

d. Check the TANKFULL DEMAND, and CT GND connections on TB3 in the control module assembly for tightness (4, FIGURE 2-14). Tighten connections.

e. Conduct startup and run check to check for proper operation (paragraph 2-6).

f. If the sanitary unit still operates only in the continuous mode, do the following:

WARNING

Turn all electrical power OFF to avoid personal injury.

(1) Turn all electrical power OFF to the sanitary unit.

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing covers, drain plugs, hoses, and fittings. void open flames and prolonged breathing of fumes.

(2) Drain the sanitary unit (paragraph 2-16).

(3) Remove the treatment tank cover (paragraph 2-11).

(4) Check the level sensor assembly for cracks, breaks, or other damage. Replace the level sensor assembly if damaged.

(5) If the level sensor assembly is not damaged, do the following:

(a) Clean the tips of the sensing probes (1, 2, 3, FIGURE 2-3) with a soft bristle non-metallic brush and mild soap. Be careful not to bend or damage the probes during cleaning.

(b) Leave the treatment tank cover off the sanitary unit and conduct startup and run check (paragraph 2-6).

(c) If the sanitary unit still fails to operate properly, replace the level sensor assembly.

REMOVAL

a. Turn all electrical power to the sanitary unit OFF.

b. Drain the sanitary unit (Table 2-2, Item 1).

c. Remove treatment tank cover (paragraph 2-11). Remove tank gasket.

NOTE

Draining of the unit should have reduced the level of any remaining effluent to a point below the probes. Ladle out effluent as necessary to facilitate in disconnecting the level sensor.

d. Tag and disconnect the sensor wiring (2, FIGURE 2-16) in the control module assembly at their terminals on the circuit card assembly. See FIGURE 2-17 for terminal identification. The level sensor terminals are at the bottom of TB3 marked TANK FULL, DEMAND, and CT GND.

e. Loosen the cable connector and remove the wiring from the control module assembly.

f. Disconnect the mounting connection (3, FIGURE 2-16) from the underside of the unit.

g. Disconnect the probes bracket screw (4).

h. Remove the assembly (1) from the treatment tank.

REPLACEMENT

a. Run the wiring, (2, FIGURE 2-16) of a new assembly (1) through the opening in the treatment tank.

b. Position the level sensor assembly in the treatment tank and connect the probe bracket with screw (4).

c. Install the mounting connection (3) from the underside of the unit.

d. Run the wiring through the cable connector on the control module assembly. Tighten the connector until snug.

e. Connect the wiring to their proper terminals on the circuit card assembly in the control module. Refer to (4, FIGURE 2-17) for terminal identification. The level sensor terminals are on TB3 marked TANKFULL, DEMAND and CT GND.

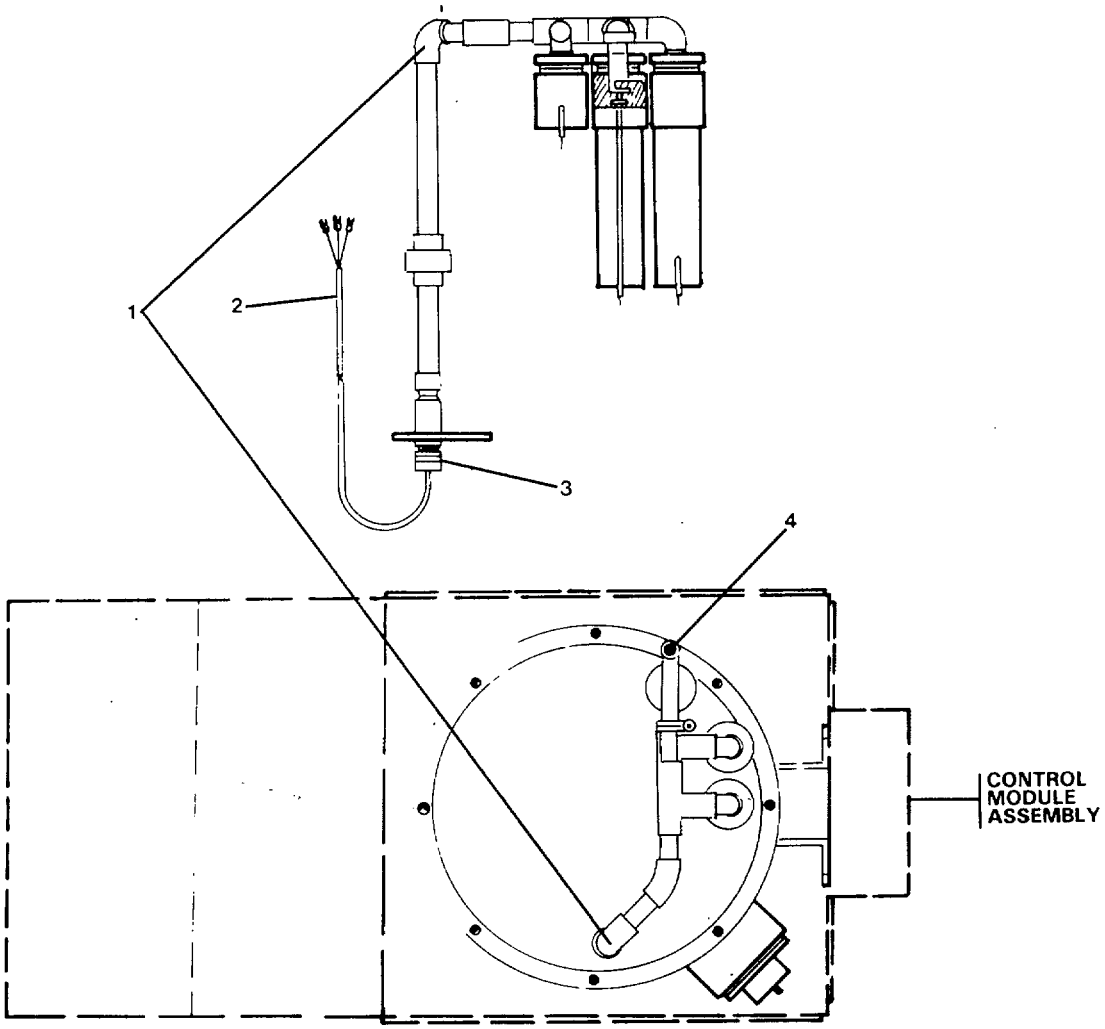


Figure 2-16. Level Sensor Assembly.

f. Install a new treatment tank gasket and replace the cover (paragraph 2-11).

g. Start up unit, operate, and conduct run check (paragraph 2-6).

2-20. Repair Discharge Pump System

This task covers: **a. Inspection, b. Test, c. Service, d. Removal e. Repair f. Replacement**

INITIAL SETUP

Tools

Tool kit, general mechanic's, 5180-00-699-5273
Tool kit, electrician's, 5180-00-391-1087
Multimeter, 6625-01-139-2512
Torque wrench 30-200 (in-lb), 5120-01-092-3278
Torque wrench 30-200 (ft-lb), 5120-01-125-5190

Equipment Condition

Electrical power OFF and tagged to the sanitary unit.
External sewage inlet and outlet valves closed.
Bleach metering valve closed.
Backwash water supply valve closed.
Refer to the following paragraph. in this maintenance manual.
System drained (paragraph 2-16).

Materials/Parts

Disinfectant, Item 3, Appendix C
Pipe thread lubricant, teflon Item 2, Appendix C
Discharge pump system P/N 3600034
Shallow pan type container (to catch runoff)
Centrifugal pump only P/N 3600033
Warning tags, Item 10, Appendix C

INSPECTION

Inspection of the discharge pump system is accomplished through PMCS and maintenance procedures.

WARNING

SHOCK HAZARD. Turn all electrical power to the sanitation unit OFF.

TEST

NOTE

Open the external sewage valves and backwash water supply valve while conducting test procedure.

a. If the pump system does not operate, conduct the following checks and test:

(1) With the electrical power OFF, open the control module assembly and check the pump leads on the circuit board for breaks or loose connections. Refer to (5) FIGURE 2-17 for terminal identification. Tighten connections or replace leads as required.

(2) Turn electrical power ON and place the sanitary unit in the CONTINUOUS mode (paragraph 2-6b). Flush one of the commodes.

(3) Use a multimeter and test for proper voltage across the poles marked 220 and 220/110 on the pump terminals on the circuit board in the control module assembly. Refer to (5) FIGURE 2-17 for terminal identification.

(a) The voltage should be 220/240 Vac.

(b) If there is no voltage at the terminals, replace the circuit board assembly (paragraph 2-17).

(c) If the correct voltage reading is obtained on the terminals, go to the next step (4).

(4) Turn the electrical power OFF.

(5) Remove the electrical box cover on the inoperative pump to reveal the cable connections (paragraph 2-18). Check for broken leads and secure connections.

(a) Position the cover away from possible contact with the electrical connections.

(b) Turn the electrical power ON and place the sanitary unit in a CONTINUOUS mode (paragraph 2-6b).

(c) Use a multimeter and check the voltage on the pump terminals.

(d) If there is no voltage present, replace the electrical cable (paragraph 2-18).

(e) If the proper voltage is obtained (220/240 Vac), and pump still does not operate, the pump system is defective.

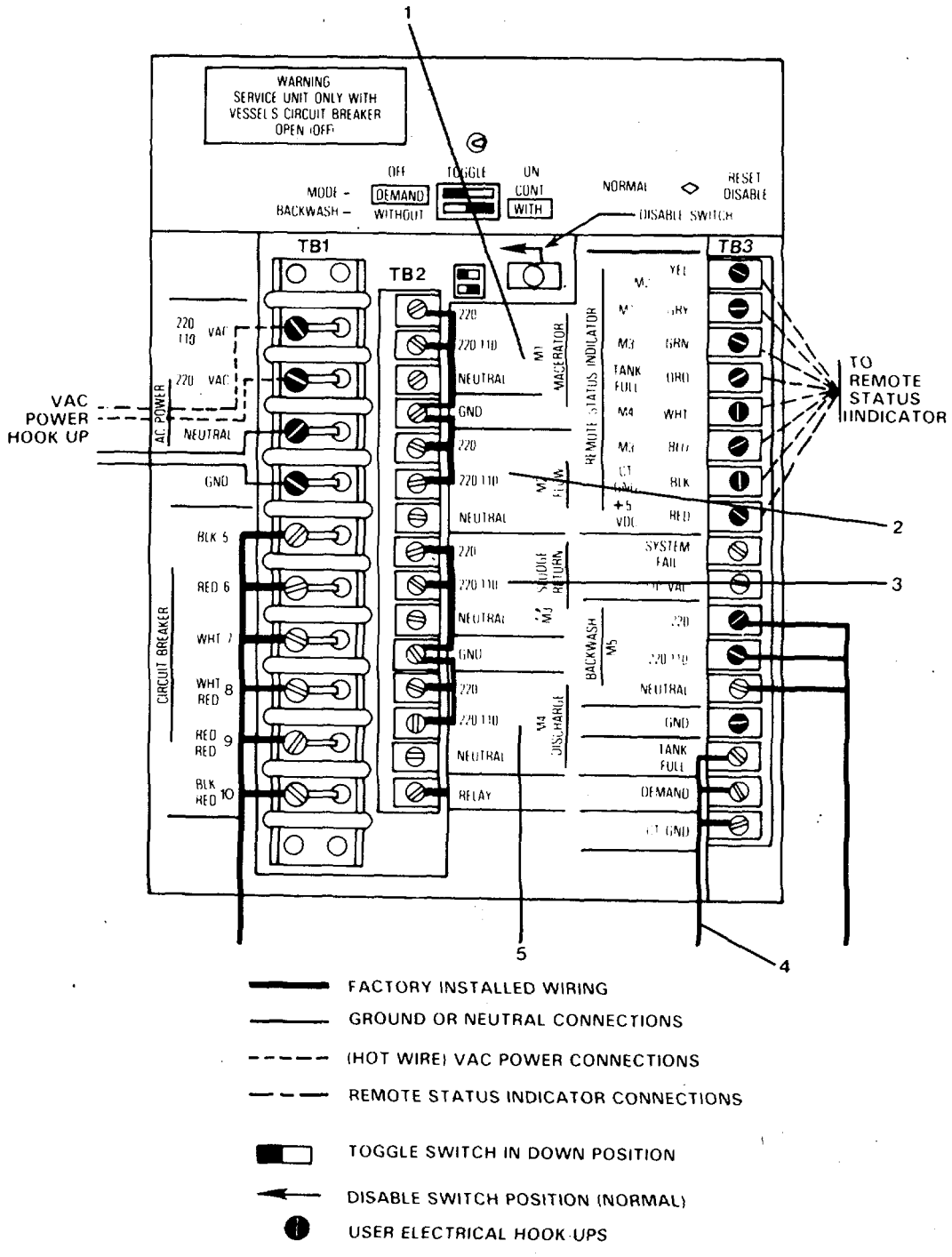


Figure 2-17. Pump Circuits on Circuit Card Assembly.

b. Replace the pump system. Refer to the removal and replacement steps of this procedure.

SERVICE

Service to the discharge pump is accomplished through PMCS.

REMOVAL

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing covers, hoses, drain plugs, and fittings. Avoid open flames and prolonged breathing of fumes.

WARNING

Make sure the electrical power is OFF to prevent personal injury.

a. Make sure the external sewage line valves and the backwash water valve are closed.

b. Disconnect the electrical cable from the discharge pump system (paragraph 2-18).

WARNING

Although the system has been drained, a small amount of effluent may still be contained within the pump. Avoid splashing in eyes when disconnecting hoses.

c. Disconnect the discharge line from the pump (5, FIGURE 2-18).

d. Loosen the clamps (1, FIGURE 2-18) and remove the hose (2). Place a shallow pan under the hose connections while disconnecting to catch any runoff.

e. Remove the mounting screws, nuts, and washer (6, FIGURE 2-18) and remove the pump from the sanitary unit.

f. Remove the PVC fittings (3, 4) from the pump inlet and outlet.

NOTE

Flush the pump with water and disinfectant before disposal or further handling.

g. Remove the pump from the motor as follows;

(1) Remove four bolts and washers (1, FIGURE 2-19) that hold the pump adapter (2) to the motor.

(2) Loosen two bolts (4) and nuts and washers (6) on the shaft drive clamp (3) through the opening (7) in the side of the adapter.

(3) Slide shaft sleeve (5) and adapter from the shaft of the motor. The pump is now free from the motor.

REPAIR

Repair to the discharge pump system is by replacing the centrifugal pump or by replacing the system. Refer to the removal and replacement steps of this procedure.

REPLACEMENT

a. Mount the pump to the motor as follows:

(1) Make sure the shaft is clean.

(2) Insert the motor shaft through the adapter (2, FIGURE 2-19) and into the shaft sleeve (5). Maintain pressure against the impeller shaft sleeve through the inlet opening in the pump until the drive clamp bolts (4) are secure.

(3) Tighten two bolts (4) and nuts and washers (6) in the drive clamp assembly (3) through opening (7) in the adapter (2). Tighten to 200 in-lb.

(4) Install four bolts and washers (1) that mount the adapter (2) and pump to the motor housing. Tighten bolts to 34 ft-lb.

NOTE

The discharge pump system is now ready to be mounted on the sanitary unit.

b. Mount the pump and motor to its mounting plate on the sanitary unit with the four mounting screws (6, FIGURE 2-18).

c. Install the PVC inlet and outlet connections as follows:

(1) Apply teflon lubricant to the pipe threads.

(2) Screw the connections into their proper locations. Tighten the connections until snug.

CAUTION

Do not over tighten. PVC fittings may crack.

(3) Make sure the connections are aligned with their respective hose connections.

d. Install the inlet hose (2, FIGURE 2-18) and tighten the clamps (1). Tighten to 40 in-lb.

e. Connect the discharge line (5, FIGURE 2-18).

f. Connect the electrical cable to the discharge pump system (paragraph 2-18).

g. Open the following valves:

(1) Sewage inlet and outlet.

(2) Bleach metering.

(3) Backwash water supply.

h. Restore electrical power, start the unit, and conduct run check (paragraph 2-6c).

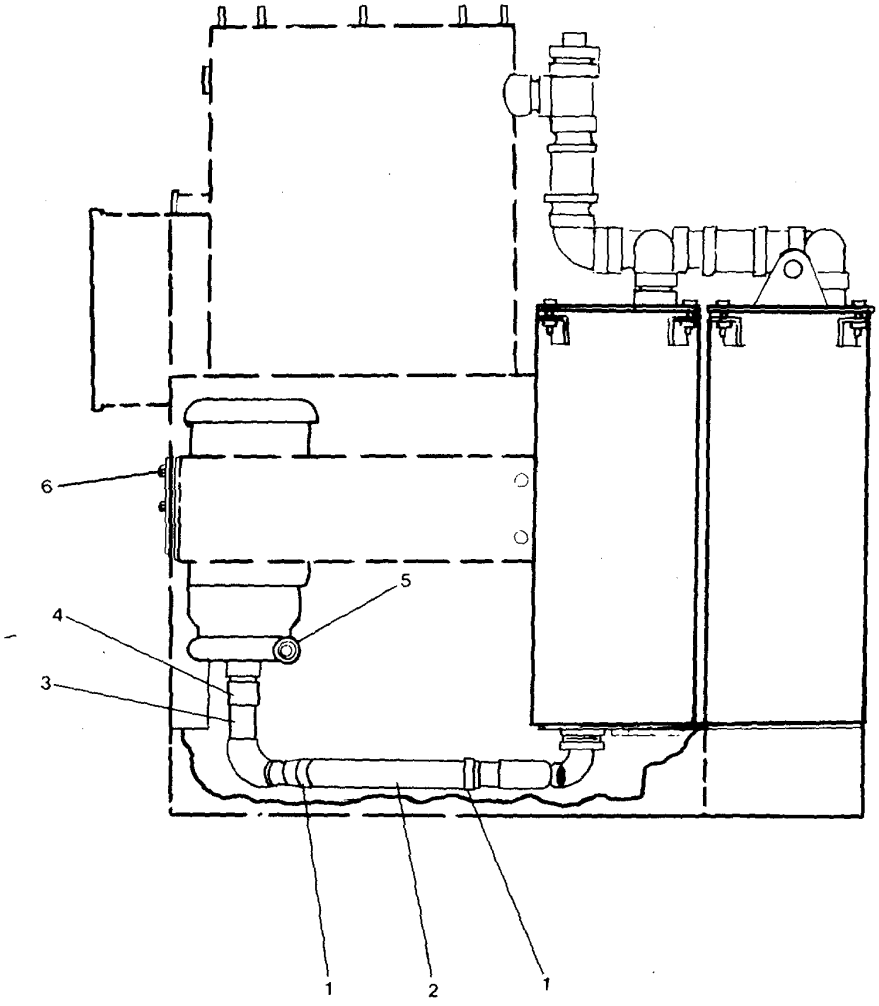


Figure 2-18. Discharge Pump System.

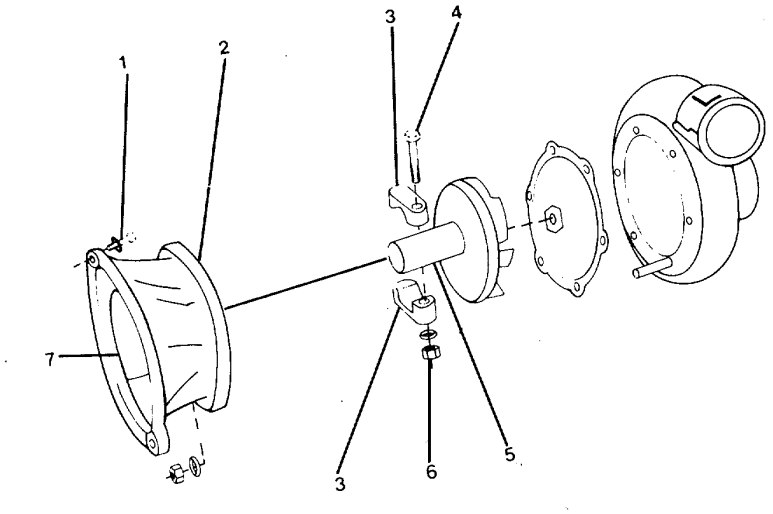


Figure 2-19. Centrifugal Pump.

2-21. Repair Flow Pump System.

This task covers:

a. Inspection, b. Test, c. Service, d. Removal, e. Repair, f. Replacement.

INITIAL SETUP:

Tools

Multimeter,
6625-01-139-2512
Torque wrench 30-200 (in-lb),
5120-01-092-3278
Torque wrench 30-200 (ft-lb)
5120-01-125-5190
Tool kit, general mechanic's,
5180-00-699-5273
Tool kit, electrician's,
5180-00-1087

Equipment Condition

Electrical power OFF to the sanitary unit.
External sewage inlet and outlet valves closed.
Bleach metering valve closed.
Backwash water supply valvea closed.
Refer to the following paragraph in this maintenance manual.
System drained (paragraph 2-16).

Materials/Parts

Pipe thread lubricant, teflon,
Item 2, Appendix C
Flow pump system P/N 3600034
Centrifugal pump P/N 3600033
Disinfectant, Item 3, Appendix C
Shallow pan type container
(to catch run off)
Warning tags, Item 10, Appendix C

INSPECTION

Inspection of the flow pump system is accomplished through PMCS and maintenance procedures.

TEST

The test procedures for the flow pump system are the same as for the discharge pump system. Refer to the test procedures in paragraph 2-20; reference (2, FIGURE 2-17).

SERVICE

Service to the flow pump system is accomplished through PMCS.

REMOVAL

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing covers, hoses, drain plugs, and fittings. Avoid open flames and prolonged breathing of fumes.

WARNING

Make sure the electrical power is OFF to prevent personal injury.

a. Make sure the external sewage line valves and the backwash water valve are closed.

b. Disconnect the electrical cable from the pump system (paragraph 2-18).

WARNING

Although the system has been drained, a small amount of effluent may still be contained within the pump. Avoid splashing in eyes when disconnecting hoses.

c. Disconnect the outlet hose (5, FIGURE 2-20) from the pump at hose clamps (4).

d. Loosen the clamps (1, FIGURE 2-20) and remove the hose (2). Place a shallow pan under the hose connections while disconnecting to catch any runoff.

e. Remove the mounting screws, nuts, and washers (7, FIGURE 2-20) and remove the pump from the sanitary unit.

f. Remove the PVC fittings from the pump inlet and outlet (3, 6, FIGURE 2-20).

NOTE

Flush the pump with water and disinfectant before disposal or further handling.

g. Remove the pump from the motor as follows: (Refer to FIGURE 2-19).

(1) Remove the four bolts and washers (1, FIGURE 2-19) that hold the pump adapter (2) to the motor.

(2) Loosen the two bolts (4) and nuts and washers (6) on the shaft drive clamp (3) through the opening in the adapter (7).

(3) Slide the shaft sleeve (5) and adapter (2) from the shaft of the motor. The pump is now free from the motor.

REPAIR

Repair to the flow pump system is by replacing the centrifugal pump or by replacing the system. Refer to the removal and replacement steps of this procedure.

REPLACEMENT

a. Mount the pump to the motor as follows: (Refer to FIGURE 2-19).

(1) Make sure the shaft is clean.

(2) Insert the motor shaft through the adapter (2) and into the shaft sleeve (5,). Maintain pressure against the impeller shaft sleeve (5) through the inlet opening in the pump until the drive clamp bolts (4) are tightened.

(3) Tighten the two bolts (4) and nuts and washers (6) in the drive clamp assembly (3) through the opening (7) in the adapter. Tighten to 200 in-lb.

(4) Install the four bolts and washers (1) that mount the adapter (2) and pump to the motor housing. Tighten to 34 ft-lb.

NOTE

The flow pump system is now ready to be mounted on the sanitary unit.

b. Mount the pump and motor to its mounting plate on the sanitary unit with the four mounting screws (7, FIGURE 2-20). Tighten to 34 ft-lb.

c. Install the PVC inlet and outlet connections (3, 6, FIGURE 2-20) as follows:

(1) Apply teflon lubricant to the pipe threads.

(2) Screw the connections into their proper locations. Tighten the connections until snug.

CAUTION

Do not over tighten. PVC fittings may crack.

(3) Make sure the connections are aligned with their respective hose connections.

d. Install the inlet hose (2, FIGURE 2-20) and clamps (1). Tighten to 40 in-lb.

e. Connect the outlet hose (5, FIGURE 2-20) with hose clamps (4). Tighten the clamps to 40 in-lb.

f. Connect the electrical cable to the pump system (paragraph 2-18).

g. Open the following valves:

(1) Sewage inlet and outlet

(2 Bleach metering

(3) Backwash water supply

h. Restore electrical power, start the unit, and conduct run check (paragraph 2-6).

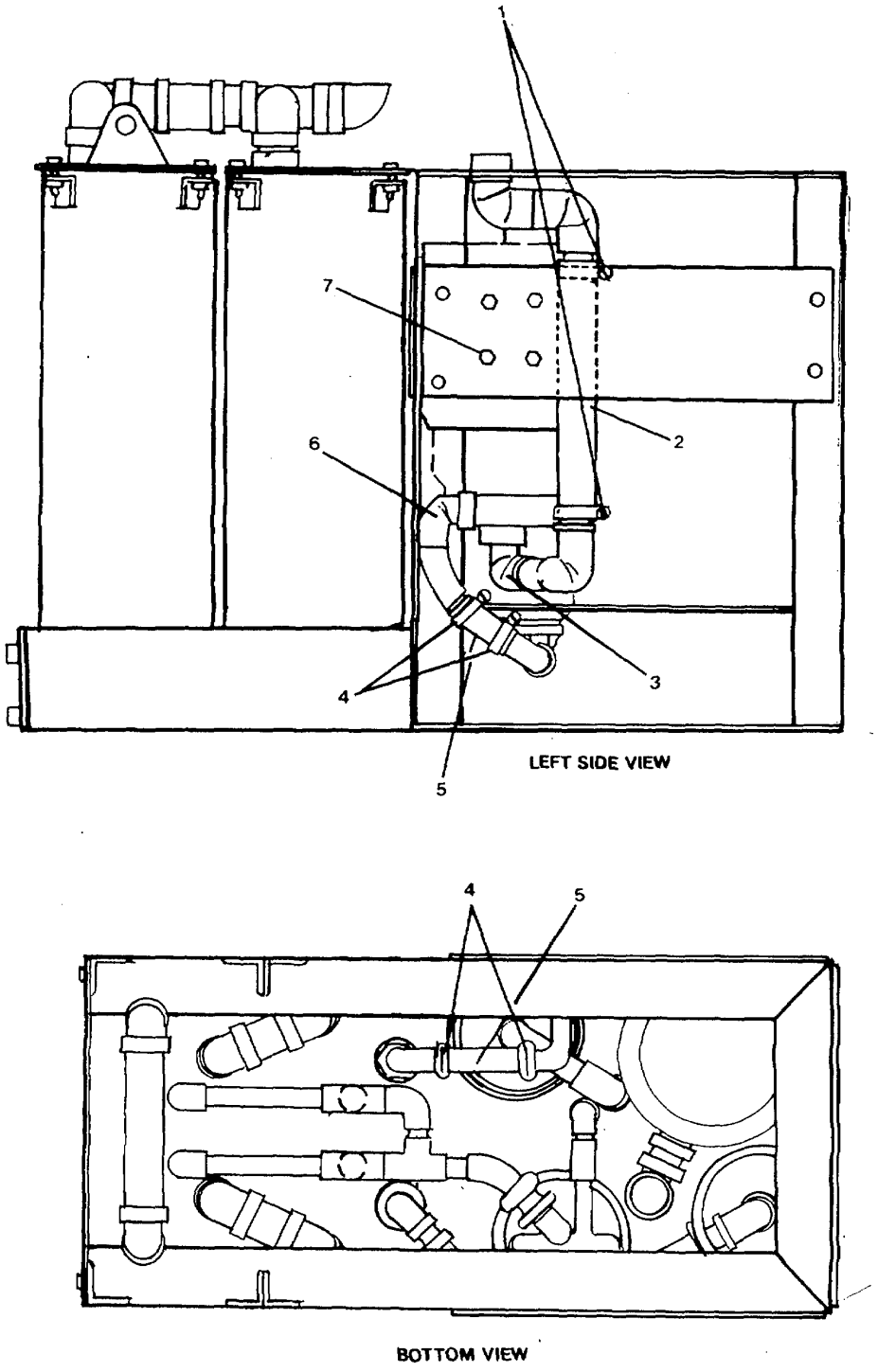


Figure 2-20. Flow Pump System.

2-22. Repair Sludge Pump System.

This task covers:

a. Inspection, b. Test, c. Service, d. Removal, e. Repair, f. Replacement.

INITIAL SETUP:

Tools

Tool kit, general mechanic's,
5180-00-699-5273
Tool kit, electrician's,
5180-00-391-1087
Multimeter 6625-01-139-2512
Torque wrench (in-lb)
5120-01-092-3278
Torque wrench (ft-lb)
5120-01-125-5190

Materials/Parts

Pipe thread lubricant, teflon,
Item 2, Appendix C
Sludge pump system P/N 3600034
Centrifugal pump only P/N 3600033
Disinfectant, Item 3, Appendix C
Shallow pan type container
(to catch the runoff)

Equipment Condition

Electrical power OFF and tagged to the sanitary unit
External sewage inlet and 9utlet valves closed
Bleach metering valve closed
Backwash water supply valve closed
System drained (paragraph 2-16)

INSPECTION

Inspection of the sludge pump system is accomplished through PMCS and maintenance procedures.

TEST

The test procedures for the sludge pump system are the system are the same as for the discharge pump system. Refer to the test procedures in paragraph 2-20; reference (3, FIGURE 2-17).

SERVICE

Service to the sludge pump system is accomplished through PMCS.

REMOVAL

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing covers, hoses, drain plugs, and fittings. Avoid open flames and prolonged breathing of fumes.

WARNING

Make sure the electrical power is OFF to prevent personal injury.

a. Make sure the external sewage line valves and the backwash water valve are closed.

b. Disconnect the electrical cable from the sludge pump system (paragraph 2-18).

WARNING

Although the system has been drained, a small amount of effluent may still be contained within the pump. Avoid splashing in eyes when disconnecting hoses.

c. Disconnect the outlet hose (2, FIGURE 2-21) from the pump at hose clamps (1).

d. Loosen the clamps (4, FIGURE 2-21) and remove the hose (5). Place a shallow pan under the hose connections while disconnecting to catch any runoff.

e. Remove the mounting screws, nuts, and washers (7, FIGURE 2-21) and remove the pump from the sanitary unit.

f. Remove the PVC fittings from the pump inlet and outlet (3, 6, FIGURE 2-21).

NOTE

Flush the pump with water and disinfectant before disposal or further handling.

g. Remove the pump from the motor as follows: (Refer to FIGURE 2-19)

(1) Remove four bolts and washers (1, FIGURE 2-19) that hold the pump and adapter (2) to the motor.

(2) Loosen the two bolts (4) and nuts and washers (6) on the shaft drive clamp (3) through the opening (7) in the adapter (2).

(3) Slide the shaft sleeve (5) and adapter (2) from the shaft of the motor. The pump is now free from the motor.

REPAIR

a. Test the sludge pump motor in accordance with test procedures in paragraph 2-20.

b. Repair to the sludge pump system is by replacing the centrifugal pump or by replacing the system. Refer to the removal and replacement steps of this procedure.

REPLACEMENT

a. Mount the pump to the motor as follows: (Refer to FIGURE 2-19).

(1) Make sure the shaft is clean.

(2) Insert the motor shaft through the adapter (2) and into the shaft sleeve (5).

(3) Tighten the two bolts (4) and nuts and washers (6) in the drive clamp assembly (3) through the opening (7) in the adapter (2). Tighten to 200 in-lb.

(4) Install the four bolts and washers (1) that mount the adapter and pump to the motor housing. Tighten to 34 ft-lb.

NOTE

The sludge pump system is now ready to be mounted on the sanitary unit.

b. Mount the pump and motor to its mounting plate on the sanitary device with the four mounting screws (7, FIGURE 2-21). Tighten to 34 ft-lb.

c. Install the PVC inlet and outlet connections (3, 6, FIGURE 2-21) as follows:

(1) Apply teflon lubricant to the pipe threads.

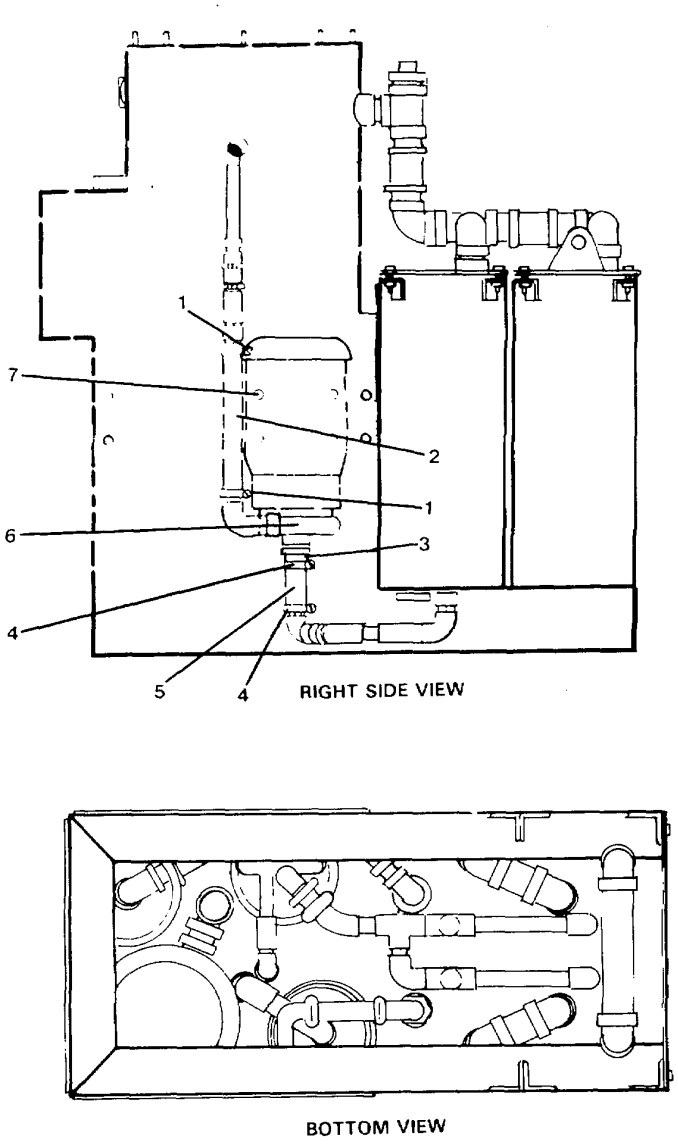


Figure 2-21. Sludge Pump System.

(2) Screw the connections into their proper locations. Tighten the connections until snug.

CAUTION

Do not overtighten. PVC fittings may crack.

(3) Make sure the connections are aligned with their respective hoseconnections. I

d. Install the inlet hose (5, FIGURE 2-21) and clamps (4). Tighten to 40 in-lb.

e. Install the outlet hose (2, FIGURE 2-21) with clamps (1). Tighten to 40 in-lb.

f. Connect the electrical cable to the pump system (paragraph 2-18).

g. Open the following valves:

(1) Sewage inlet and outlet

(2) Bleach metering

(3) Backwash water supply

h. Restore electrical power, start the unit and conduct run check (paragraph 2-6) (TM 55-1905-223-10).

2-23. Repair Waste Disposer.

This task covers:

a. Inspection/Service, b. Removal
c. Repair, d. Replacement.

INITIAL SETUP:

Tools

Tool kit, general mechanic's, 5180-00-699-5273
Tool kit, electrician's, 5180-00-391-1087
Torque wrench (in-lb), 5120-01-092-3278
System drained (paragraph 2-16)

Equipment Condition

Electrical power OFF and tagged to the sanitary unit
External sewage inlet and outlet valves closed
Bleach metering valve closed
Backwash supply valve closed

Materials/Parts

Oil, Item 12, Appendix C
Pipe thread lubricant, teflon, Item 2, Appendix C
Waste disposer P/N 3500110
Disinfectant, Item 3, Appendix C
Container, 1 gl (to catch runoff)
Warning tags, Item 10, Appendix C
Rags, Item 7, Appendix C

INSPECTION/SERVICE

Inspection and service to the waste disposer are accomplished through PMCS and maintenance procedures.

REMOVAL

WARNING

SHOCK HAZARD. Make sure electrical power is OFF.

a. Disconnect the electrical cable from the macerator pump system (paragraph 2-18).

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing covers, hoses, drain plugs, and fittings. Avoid open flames and prolonged breathing of fumes.

WARNING

Although the system has been drained, a small amount of effluent may still be contained within the disposer. Avoid splashing in eyes.

b. Hold a container under the connection to catch sewage (effluent) runoff. Remove pipe plug (4, FIGURE 2-22) and drain the disposer (6).

c. Support the disposer while loosening connections.

d. Loosen the two clamps (1, FIGURE 2-22) on the flexible coupling (2).

e. Loosen the quick mount clamp (8) and the hush cushion (7). Slide the disposer (6) downward and off of the sanitary unit connections.

f. Support the unit on a work surface and remove the adapter (5), tee (3), and flexible coupling (2).

g. Temporarily plug the sanitary unit piping connections with rags or other suitable material until you are ready to install a new waste disposer.

NOTE

The upper housing (pump portion) and the ac motor are removed as a single unit.

REPAIR

Repair to the waste disposer authorized at unit level is the replacement of the alternating current (ac) motor. The upper housing (pump portion) is also replaced with the ac motor as a single unit. Refer to the removal and replacement steps in this procedure.

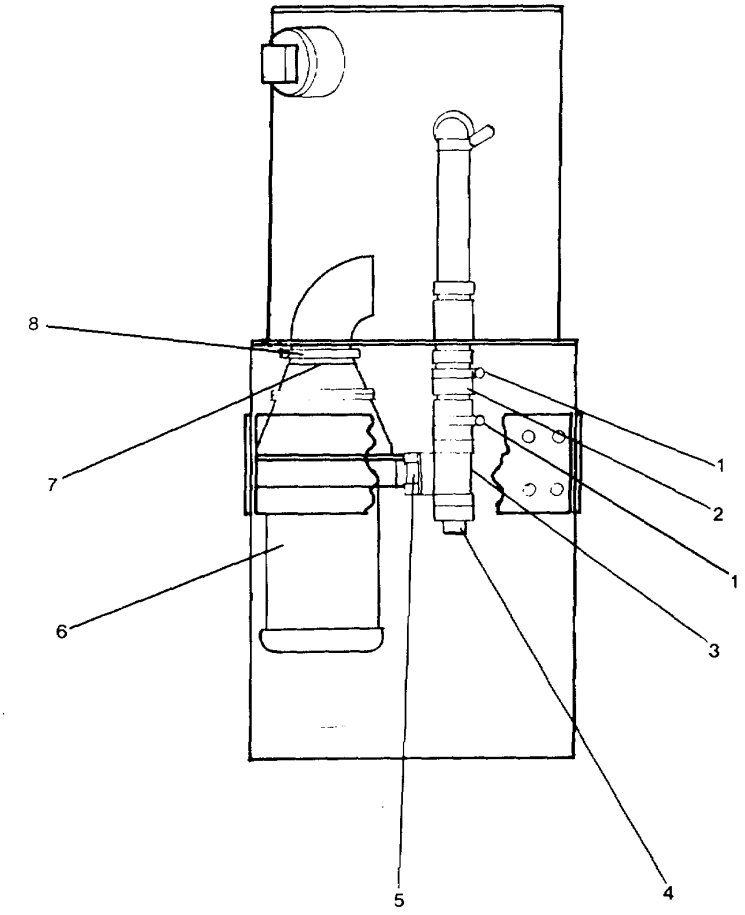


Figure 2-22. Waste Disposer.

REPLACEMENT

a. Mount the waste disposer onto the sanitary unit as follows (refer to FIGURE 2-22).

(1) Apply teflon pipe lubricant to the threads and connect the adapter (5, FIGURE 2-22), tee (3) and flexible coupling (2) (that were removed from the old disposer) to the outlet connection on the new waste disposer (6). Position properly and install the adapter.

(2) Remove the temporary plugs that were placed in the piping connections after removing the old macerator.Clean the connections with dry rags.

(3) Loosen the quick-mount clamp (8, FIGURE 2-22) and position the waste disposer inlet and flexible coupling (2) in line with the piping and slide the disposer upward and onto the piping.

WARNING

Keep the waste disposer supported while making the piping connections to the sanitary device.

(4) Position the hush cushion (7) and quick-mount clamp (8) and tighten the quick-mount clamp to 40 in-lb.

(5) Tighten the flexible coupling clamps (1) on the flexible coupling (2) to 40 in-lb.

NOTE

The waste disposer should now be supported by the mounting clamps.

(6) Apply teflon pipe thread lubricant to threads and install pipe plug (4).

b. Connect the electrical cable to the waste disposer (paragraph 2-18).

c. Open the sewage inlet and outlet valves, the backwash water supply valve, and the bleach metering valve.

d. Restore power, start the unit, and conduct run check (paragraph 2-6).

2-24. Replace Alternating Current Motor.

The alternating current (ac) motor on the waste disposer is removed and replaced with the upper housing (pump portion) attached as a single unit. Refer to removal and replacement steps in paragraph 2-23.

2-25. Repair Piping Croup.

This task covers:

a. Inspection, b. Removal,
c. Repair, d. Replacement.

INITIAL SETUP:

Tools

Tool kit, general mechanic's, 5180-00-391-699-5273
Tool kit, electrician's, 5180-00-391-1087
Torque wrench 30-200 (in-lb) 5120-01-092-3278

Equipment Condition

Electrical power OFF and tagged to the sanitary unit.
External sewage inlet and outlet valves closed.
Bleach metering valve closed.
External water line valve to the sanitary unit closed (TM 55-1905-223-24-18).
Refer to the following paragraph in this maintenance manual.
System drained (paragraph 2-16).

Materials/Parts

Tubing clamp, Item 1, Appendix C
Pipe thread lubricant, teflon, Item 2, Appendix C
Gate valve P/N 2503378-003
Pressure gauge P/N 3500035
Backwash solenoid valve P/N 2600912-007
Ball check valve P/N 2503855-001
Chlorination (bleach) solenoid valve P/N 3500039-001
Needle valve P/N 3500014
Flexible coupling P/N 2503178-001
Container, 1 qt (to catch bleach or effluent runoff)
Warning tags, Item 10, Appendix C

INSPECTION

Inspection of the piping group is accomplished through PMCS.

REMOVAL

WARNING

SHOCK HAZARD. Make sure electrical power is OFF.

a. Remove the gate valve (3, FIGURE 2-23):

(1) Disconnect the water supply line at the valve inlet (1, FIGURE 2-23).

(2) Remove the gate valve (3) from the pipe nipple.

b. Remove the dial indicating pressure gauge (5, FIGURE 2-23):

(1) Loosen the locknut at the base of the gauge.

(2) Remove the gauge by turning it counterclockwise.

c. Remove the backwash water solenoid valve (2, FIGURE 2-23):

(1) Disconnect the electrical cable from the solenoid valve (paragraph 2-18).

(2) Disconnect the solenoid valve from the piping elbow (1, FIGURE 2-23).

d. Remove the ball check valve (7, FIGURE 2-23):

(1) Disconnect the check valve at point (6) on each side of the check valve.

(2) The lower section of piping will be disconnected when the check valve is removed.

WARNING

CHEMICAL HAZARD. This piping contains bleach. Avoid contact with skin and splashing in eyes.

e. Remove the chlorination (bleach) solenoid valve (2, FIGURE 2-24) and the bleach metering needle valve (6):

(1) Disconnect the electrical cable from the solenoid valve (paragraph 2-18).

(2) Place a tubing clamp on the incoming bleach tubing (7) to stop the flow of bleach from the storage tank.

(3) Hold a small container under the connections to catch bleach runoff and disconnect the fittings (5) on each side of the metering valve (6). Remove the end of the tubing (7) from the valve.

(4) Disconnect fittings (3, 10), on each side of the solenoid valve (2), and fitting (8). Remove the tubing sections (4, 9).

(5) Remove the solenoid valve (2) from its mounting bracket (1).

(6) Remove the bleach metering needle valve (6, FIGURE 2-24) as follows:

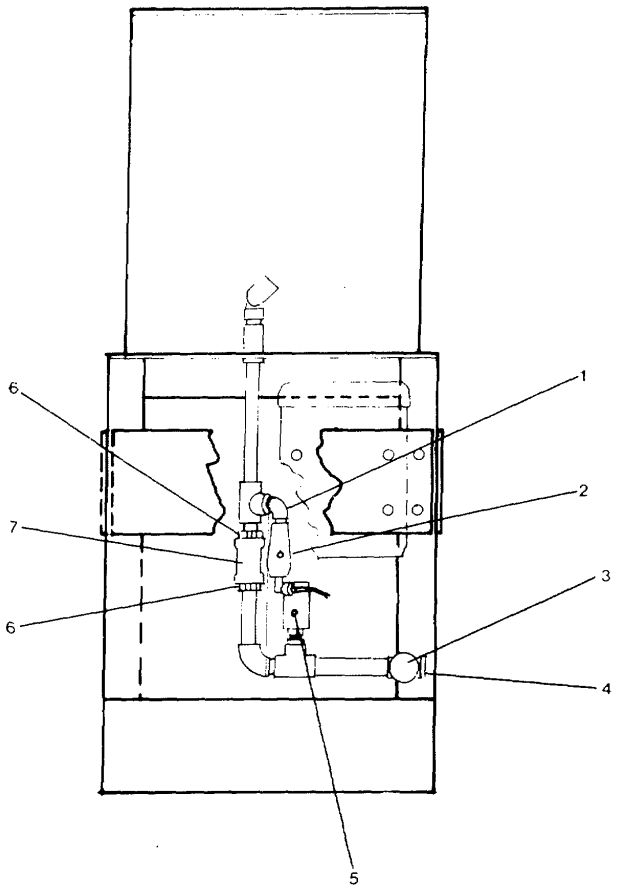


Figure 2-23. Backwash Water Piping Croup.

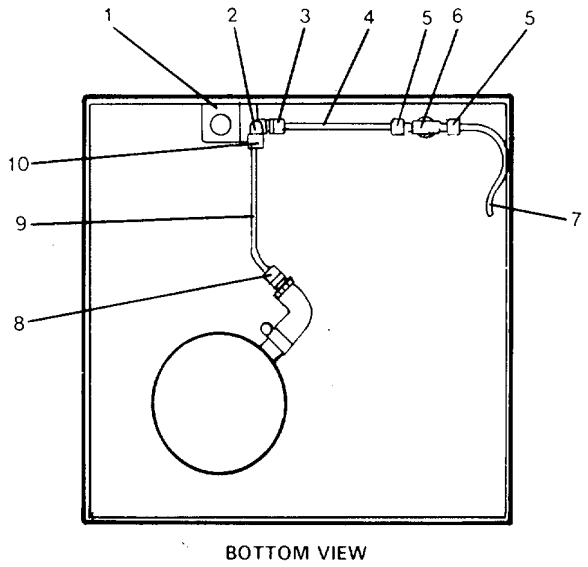


Figure 2-24. Chlorine (Bleach) Piping Group.

(a) Open the needle valve handle (1, FIGURE 2-25) fully counterclockwise.

(b) Turn the hex connection (2) countercl9ckwise and remove the handle and needle portion from the valve body (3).

(c) Turn the locknut (5) counterclockwise and remove it from the valve body. The valve is now free of its mounting.

(d) Withdraw the valve body (3) from its mounting surface (4) on the underside of the unit.

f. Remove the waste disposer piping group as follows: (Refer to FIGURE 2-22).

(1) Hold a container under the connection to catch effluent runoff and remove the pipe plug (4, FIGURE 2-22) to drain the disposer pump and piping.

(2) Loosen the clamps (1) on the flexible coupling (2).

(3) Disconnect the piping from the waste disposer outlet at adapter (5).

(4) Slide the piping section down and remove it from the sanitary unit.

REPAIR

a. Repair to the piping group is by replacement of the following components:

(1) Waste disposer flexible coupling.

(2) Bleach solenoid valve.

(3) Bleach metering valve.

(4) Backwash solenoid valve.

(5) Gate valve.

(6) Pressure gauge.

(7) Ball check valve.

b. Refer to the removal and replacement steps of this procedure.

REPLACEMENT

a. Replace the water disposer piping group as follows (refer to FIGURE 2-22):

(1) Position the flexible coupling (2, FIGURE 2-22) and clamps (1) on the Tee connection (3). Slide coupling up and onto the sanitary unit.

NOTE

Apply teflon pipe thread lubricant to adapter threads before installing.

(2) Align the Tee connection (3) with the waste disposer outlet. Connect the piping to the pump with adapter (5).

(3) Tighten the clamps (1) on the flexible coupling (2) to 40 in-lb.

(4) Apply teflon pipe lubricant to the threads and install the pipe plug (4) into the Tee connection (3).

b. Replace the chlorination (bleach) solenoid valve and bleach metering needle valve as follows:

(1) Replace the bleach solenoid valve:

(a) nstall the solenoid valve (2, FIGURE 2-24) on its mounting bracket (7).

(b) Install tubing sections (5) and (4) into the solenoid valve (2) and hand tighten fittings (3, 8, and 10).

(c) If the metering valve was not removed, connect the tubing (4) to the metering valve (6) at connection (5). Connect the tubing (7) to connection (5) on the other side of the valve (6). Remove the tubing clamp from bleach tubing (7).

(d) If the metering valve (6) was removed, install the valve (step 2) as follows:

(2) Install the bleach metering needle valve (6, FIGURE 2-24) as follows:

NOTE

Apply teflon pipe lubricant to all threaded fittings.

(a) Position the valve body (3, FIGURE 2-25) from the underside of the sanitary unit and install the locknut (5) from the topside of the unit (4). Align the valve body with the bleach tubing and hand tighten the locknut.

(b) Insert the handle and needle portion of the valve into the valve body.

(c) Connect the hex fitting (2) to the valve body and secure until snug.

(d) Close the valve by turning the handle (1) clockwise.

(e) Install bleach tubing (4, FIGURE 2-24) and (7) at fittings (5) on each side of the valve body.

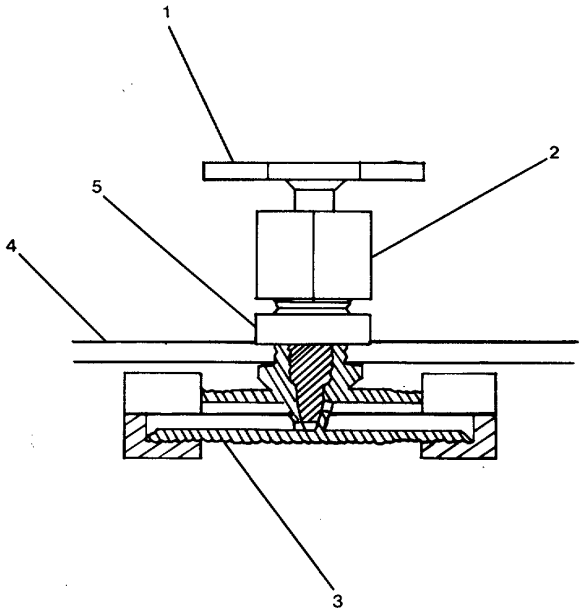


Figure 2-25. Bleach Metering Needle Valve.

(f) Remove the tubing clamp from bleach tubing (7).

(3) Connect the electrical cable to the bleach solenoid (paragraph 2-18).

c. Replace the ball check valve (7, FIGURE 2-23).

(1) Position the check valve in the backwash piping and connect the hex fittings (6) on each side of the check valve. Make sure the direction of flow through the valve is towards the treatment tank on top of the unit.

(2) Secure the hex fittings (6) and hand tighten.

d. Replace the backwash solenoid valve (2, FIGURE 2-23).

(1) Install the solenoid valve (2) onto the piping elbow at connection (1).

(2) Connect the electrical cable to the backwash water solenoid valve (paragraph 2-18).

e. Replace the dial indicating pressure gauge (5, FIGURE 2-23).

(1) Apply teflon pipe lubricant to the threads of the new gauge.

(2) Install the gauge into the backwash water piping. Turn the gauge clockwise to install.

(3) Align the gauge and secure the locknut at the base of the gauge and hand tighten.

f. Replace the gate valve (3, FIGURE 2-23).

(1) Apply teflon pipe lubricant to the connections, and install the gate valve (3) to the waterline piping on each side of the valve.

(2) The water inlet is now connected to the sanitary unit. Close the valve by turning the handle fully clockwise.

(3) Open the external water supply valve to the sanitary unit. Check for leaks at the inlet (4) of the gate valve (3) and correct as required.

(4) Open the gate valve (3).

g. Open the bleach metering valve.

h. Restore electrical power (TM 55-1905-223-10), start the unit, and conduct run check (paragraph 2-6).

2-26. Repair Bleach Tank Assembly.

This task covers:
a. Inspection/Service, b. Removal, c. Repair, d. Replacement.

INITIAL SETUP:

Tools

Tool kit, general mechanic's
5180-00-699-5273

Equipment Condition

Electrical power OFF and tagged to the sanitary unit

Materials/Parts

Bleach tank assembly P/N 3700019
Container, 10 gl, closable
(for draining old tank)
Warning tags, Item 10, Appendix C
Bleach, Item 13, Appendix C

INSPECTION/SERVICE

Inspection and service on the bleach tank assembly is accomplished through PMCS.

REMOVAL

NOTE

The bleach tank is located separately from the sanitary main unit. A 1/4-inch gravity feed line is attached from the tank to the metering valve on the unit (3, FIGURE 2-24).

a. Close the metering valve on the main unit by turning clockwise.

b. Remove the fill plug (2, FIGURE 2-26) from the adapter (1) in the tank (3).

WARNING

Avoid splashing bleach in eyes when disconnecting lines.

c. Disconnect the bleach line (7, FIGURE 2-24) at the metering valve connection (5), and drain the bleach from the tank into a portable

container. This will drain the tank and line. Close the cap or lid on the container when the tank has finished draining.

d. Disconnect the bleach line at the adapter elbow (5, FIGURE 2-26) on the tank (3).

e. Screw the fill plug (2) back into the tank.

f. Remove the tank straps from mounting.

REPAIR

Repair to the bleach tank is by replacement of the assembly. Refer to the removal and replacement steps of this procedure.

REPLACEMENT

a. Position the new tank (2, FIGURE 2-24) in its mounting.

b. Connect the bleach line to the adapter elbow (5, FIGURE 2-26).

c. Connect the bleach line (7, FIGURE 2-24) to the metering valve connection (5) on the sanitary device.

WARNING

Avoid splashing bleach in eyes while filling storage tank.

d. Fill the tank with bleach. Any bleach removed from the old tank may be suitable for re-use.

e. Install the fill plug (2, FIGURE 2-26) in the adapter (1) on top of the tank.

f. Open the metering valve on the main unit by turning counterclockwise.

g. Visually check the tank, line, and connections for leaks. Correct as necessary.

h. estore electrical power, start the unit, and conduct run check (paragraph 2-6).

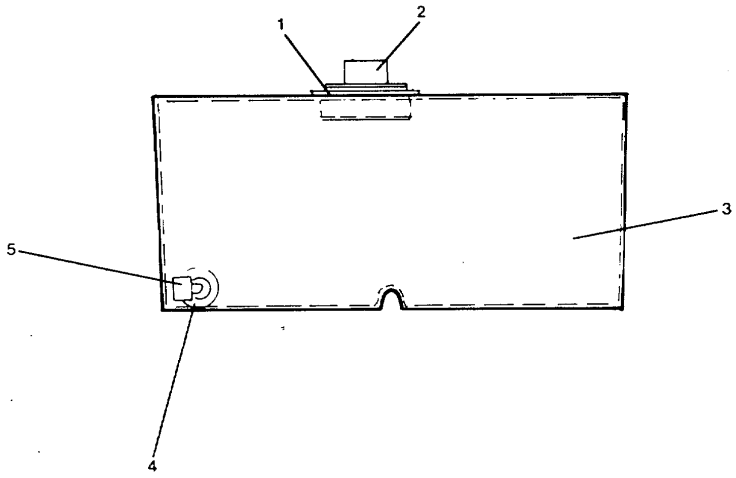


Figure 2-26. Bleach Tank Assembly.

2-27. Repair Commode Warning Light Assembly

This task covers:
a. Removal, b. Repair, c. Replacement

INITIAL SETUP:

Tools

Tool kit, general mechanic's,
5180-00-699-5273
Tool kit, electrician's
5180-00-391-1087

Equipment Condition

Electrical power OFF and tagged to the sanitary unit

Materials/Parts

Light lens P/N 350005-003
Lamp bulb P/N 2502839-008
or
Commode warning light assembly
P/N 3600030
Warning tags, Item 10, Appendix C

NOTE

The sanitary system has a commode warning light and audible alarm mounted in the 01 level passageway. A tank FULL condition exits when the red light is ON. The toilet(s) must not be flushed until the light is out. See caution plate on the light case (3, FIGURE 2-27).

WARNING

Make sure electrical power is OFF to avoid injury to personnel.

REMOVAL

a. Remove panel screws (4, FIGURE 2-27) from each corner of the assembly (1). Remove front panel (2) to expose the lamp socket (7) with wiring connections.

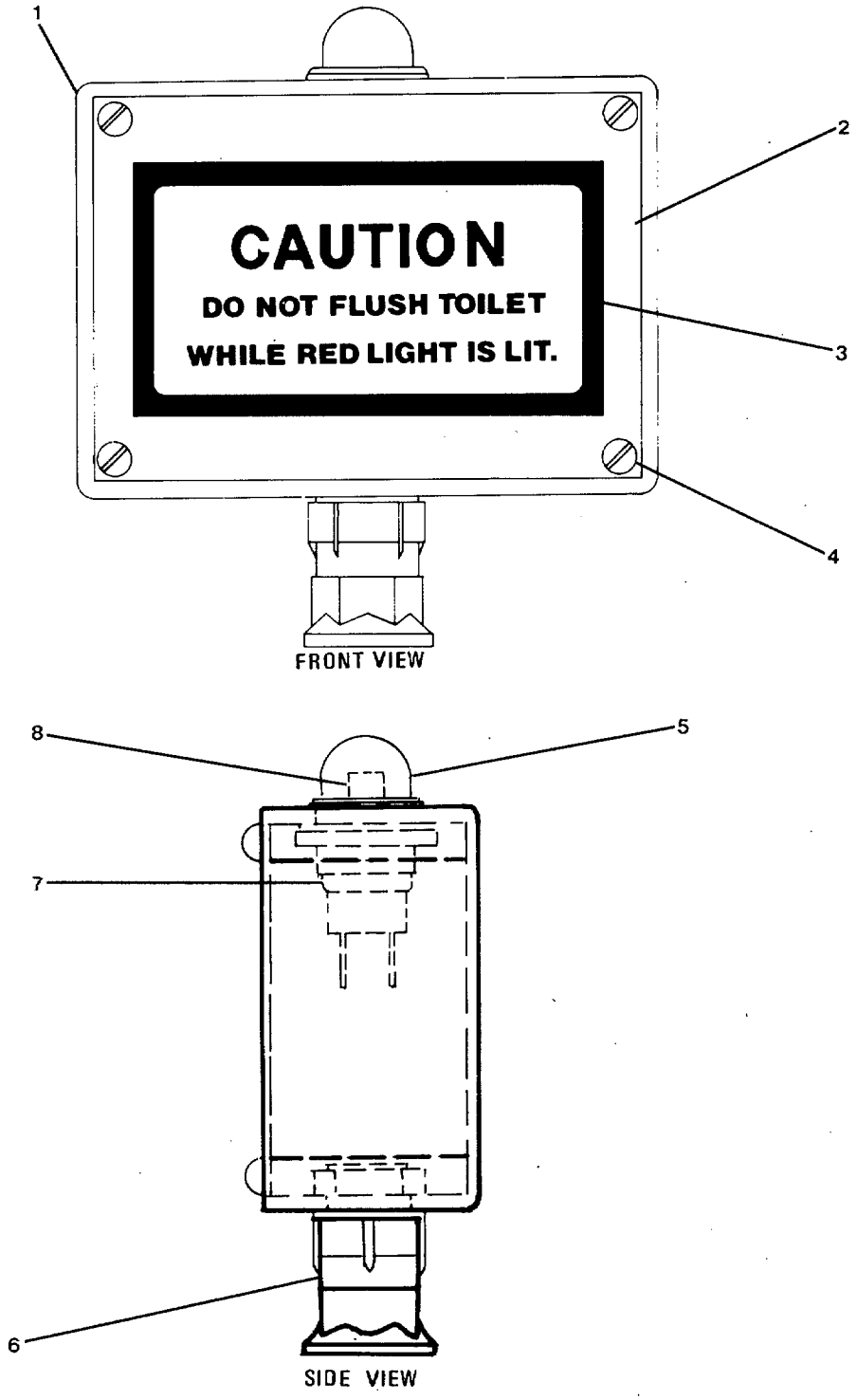


Figure 2-27. Commode Warning Light Assembly.

b. Unscrew the locknut on the lamp socket (7) from inside the case of the assembly. Remove the socket with bulb (8) and the red lens (5).

c. Remove the bulb (8) from the socket (7).

d. Remove the electrical wires from the terminals on the base of the lamp socket (7).

e. Disconnect the cable connector (6).

f. Remove the assembly from its mounting and withdraw the electrical wires through the bottom of the cable connector.

REPAIR

Repair to the commode warning light assembly is by the replacement of the lens, lamp bulb or by replacement of the assembly. Refer to the Removal and Replacement steps of this procedure.

REPLACEMENT

a. Pull the electrical wires through the cable connector (6, FIGURE 2-27) on the bottom of the assembly.

b. Mount the assembly and tighten the cable connector until snug.

c. Insert a new bulb (8) in the socket (7).

d. Position the red lens (5) in the assembly (1) and connect the socket and bulb with the socket locknut.

e. Connect the electrical wires to the terminals on the base of the socket.

f. Install the front panel (2) with the four screws (4).

g. Restore electrical power, start the unit, and conduct run check (paragraph 2-6).

SECTION VI. PREPARATION FOR STORAGE OR SHIPMENT

2-28. Prolonged Shutdown of the MSD. If for any reason the sanitation device is to be out-of-use for an extended period of time (over 30 days), the following procedures are required for shutdown.

a. Operate the sanitary unit for 1 hour.

b. While the unit is operating, flush the system with five flushes from the commode(s), adding one cup of chlorine bleach to each flush over a 1-hour period time.

c. Close the backwash water valve to the unit.

d. Close the external sewage inlet and outlet valves to the unit.

e. Close the chlorine metering valve.

f. Turn the junction box circuit breaker OFF.

g. Turn the primary circuit breaker to the unit OFF.

NOTE

When returning the sanitary device to normal operation, refer to paragraph 2-6 for startup and run check.

CHAPTER 3

INTERMEDIATE DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

SECTION I. REPAIR PARTS, SPECIAL TOOLS LIST (RPSTL): TEST, MEASUREMNT AND DIAGNOSTIC EQUIPMENT (TMDE); AND SUPPORT EQUIPMENT

3-1. Common Tools and Equipment. For authorized common tools and equipment, refer to Modified Table of Organization and Equipment (MTOE) applicable to your unit.

3-2. Special Tools, TMDE, and Support Equipment. For special tools, TMDE, and support equipment, refer to the Maintenance Allocation Chart (Appendix B), and to TM 55-1905-223-24P.

3-3. Repair Parts. Repair Parts as listed and illustrated in the Repair Parts and Special Tools List (TM 55-1905-223-24P) covering Intermediate Direct Support Maintenance of this equipment.

SECTION II. SERVICE UPON RECEIPT

3-4. Checking Unpacked Equipment.

a. Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage in accordance with the instructions of DA Pam 738-750.

b. Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA Pam 738-750.

c. Check to see whether the equipment has been modified.

d. Remove protective caps, plugs, inserts, wrappings, and tape when inspection/inventory is completed. Inspect piping openings for damage. Wipe off dirt, grease, o# protective films at time of installation.

e. Remove chocks from resilient mounted components.

SECTION III. INTERMEDIATE DIRECT SUPPORT PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

3-5. Explanation of PMCS Table. PMCS is designed to keep the equipment in good working condition. This is accomplished by performing certain tests, inspections, and services. Table 3-1 lists items to be serviced and the procedures needed to accomplish the PMCS. The "Interval" column tells you when to perform a check or service. If needed, PMCS may be performed more frequently than the indicated interval. The "Procedures" column tells you how to perform the required checks and services. If your equipment does not perform as required, see Table 3-2, Troubleshooting. Report any malfunctions or failures on DA Form 2404. In the "TM" Number column on DA Form 2404, record the appropriate Item Number from the PMCS table.

Table 3-1. Preventive Maintenance Checks and Services

(To Be performed every 3 years)

Item No.	Items To Be Inspected/Serviced	Procedures
1	Waste Disposer	WARNING ELECTRICAL HAZARD. The voltage used to operate this equipment can cause serious injury or death. CAUTION Do not operate waste disposer or pumps dry. Lack of liquid may cause damage to the unit. Check the turntable, cutter blades, and grind ring for wear and other damage (paragraph 3-9)

SECTION IV. INTERMEDIATE DIRECT SUPPORT TROUBLESHOOTINC

3-6. **Troubleshooting**. Both a symptom index and a troubleshooting table are provided. The symptom index will help you locate the information you need for troubleshooting.

SYMPTOM INDEX

Table 3-2 lists the common fault conditions that may be found during operation or maintenance of the equipment. Look for causes and do corrective actions in the order listed. This manual cannot list every symptom that may show up, and it cannot list all of the possible causes and corrective actions. If a symptom is not listed, or if it keeps up after you have performed the corrective actions, notify your supervisor.

TABLE 3-1. Operator Troubleshooting Procedures

MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION
1. A remove status pump light constantly lit, Power On light is lit.
STEP 1. Check for pump motor failure due to low current (winding separation), or highcurrent (motor overload tripped). If symptom still exists, replace the capacitor or the motor on the waste disposer (paragraph 3-9 as required by test).
2. Unit stops or fails to run.
STEP 1. Defective capacitor on the waste disposer. Replace faulty capacitor on the waste disposer as required by test (paragraph 3-9).
3. Centrifugal pump operates but is noisy or vibrates excessively (discharge, flow, or sludge.
STEP 1. Check for debris trapped in pump. Remove and clear pump (paragraph 2-20,2-21, or 2-22 for removal; paragraph 3-9 t clear).
4. Sewage leakage from a pump or a piping connection.
STEP 1. Check for defective shaft seal or gasket. Replace the faulty seal or gasket on the waste disposer.
5. Waste disposer operates noisy or vibrates excessively.
STEP 1. Check for debris trapped in disposer. Remove disposer and clear debris (paragraph 3-9).
STEP 2. Check for broken rippers. Replace the waste disposer turntable and ripper assembly (paragraph 3-9).
STEP 3. Check for defective motor bearings. Replace the waste disposer bearing (paragraph 3-9).
6. Large amounts of grease or oil on motor surfaces.
STEP 1. Check for overheating due to motor binding. On waste disposer motor, replace the bearing or motor as required (paragraph 3-9).
7. Sanitary unit working but processes slowly.
STEP 1. Check for worn or damaged rippers in the waste disposer. Replace the waste disposal turntable and rippers (paragraph 3-9).

SECTION V. INTERMEDIATE DIRECT SUPPORT MAINTENANCE PROCEDURES

3-7. **General**. The maintenance procedures in this section provide step-by-step instructions in the order in which the work is most logically accomplished. The following general safety precautions apply to the marine sanitation system and must be observed when performing all maintenance procedures in this manual. Maintenance procedures required at the Intermediate Direct Support level to the components in the Marine Sanitation System are given in paragraphs 3-8 through 3-10 of this Chapter.

WARNING

Environmental Hazard. Provide ventilation from a known outside air supply before opening any covers, plates, or connections.

WARNING

Chemical Hazard. Effluent contains bleach. Avoid contact with skin and eyes. Avoid prolonged breathing of fumes.

WARNING

Disease Hazard. After contact with sewage or contaminated equipment, clean yourself with disinfectant soap before performing hand-to-mouth functions such as eating, drinking, and smoking. etc. Clean up all spills with disinfectant.

WARNING

Toxic and Flammable Hazard. Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source before removing covers, drain plugs, hoses, and fittings. Avoid open flames and prolonged breathing of fumes.

3-8. Repair Sewage Treatment Unit Assembly.

REPAIR

Repair to the sewage treatment unit assembly is accomplished through unit level maintenance procedures and by the procedures in paragraphs 3-9 and 3-10 of this chapter.

3-9. Repair Waste Disposer.

This task covers: Repair

INITIAL SETUP:

Tools

Tool kit, general mechanic's, 5180-00-699-5273
Tool kit, electrician's, 5180-00-391-1087
Multimeter, 6625-01-139-2512

Equipment Condition

Refer to the following paragraph in this maintenance manual.
Waste disposer removed (paragraph 2-23) in this maintenance manual.

Materials/Parts

Upper housing gaskets, P/Ns 00-27-091 and 00-27-020
Turntable rippers, P/N 01-22-061
Alternating current motor P/N 3700039-42
Gaskets P/Ns 01-21-757, 01-21-754 and 01-21-741
Capacitor P/N 01-21-735
Stationary switch P/N 01-21-752
Seal set P/N 00-94-073
Oil, Item 12, Appendix C
Warning tags, Item 10, Appendix C
Crocus cloth (fine), Item 4, Appendix C

REPAIR

a. Repair to the upper housing (pump portion) of the waste disposer is by replacement of the housing gaskets and the rippers.

(1) Disassemble the upper housing for parts replacement as follows (FIGURE 3-1).

(a) Remove the quick mount clamp (1, FIGURE 3-1) and the hush cushion (2) from the top (inlet) to the upper housing (3).

(b) Remove the screws (4) and nuts (7) and remove the housing (3) and gasket (5).

(c) Remove the screws (6), nuts (20), and washers (19), and remove the housing (14) and gasket (12).

(d) Remove the turntable screw (11) and washer (8) from the end of the motor shaft and remove the turntable (9). Remove the rippers (10) from the turntable (9).

(e) Lift the grind ring (13) from the housing (21).

(f) Remove the seal set (15), shims (22, 23, 24), slinger (16), and spacer (17) from the end of the motor shaft.

(2) Assemble the upper housing as follows (FIGURE 3-1).

(a) Apply a light coat of oil to the motor shaft and install the spacer (17), slinger (16), shims (22, 23, 24), and seal set (15) onto the shaft.

(b) Position the grind ring (13) in the motor end housing (21).

(c) Install the rippers (10) on the turntable (9).

(d) Install the turntable washer (8) and screw (11).

CAUTION

Make sure the gaskets (12, 5) are positioned properly when replacing the housings (14, 3).

(e) Position the gasket (12) and the housing (14) on the motor end housing (21). Install the screws (6), washers (19), and nuts (20) and tighten alternately from one side to the other. Tighten until snug.

(f) Position the gasket (5) and housing (3) on the lower housing (14) and install screws (4) and nuts (7). Tighten the screws alternately from one side to the other. Tighten until snug.

(g) Place the hush cushion (2) and quick-mount clamp (1) on the housing (3). Tighten the clamp just enough to hold it in position until the waste disposer is replaced back onto the sanitary unit.

b. Repair to the alternating current (ac) motor on the waste disposer is by the replacement of gaskets, seal set, capacitor, and stationary switch. Test the ac motor before it is removed from the sanitary unit.

(1) Test the ac motor as follows (refer to FIGURES 3-1 and 3-2):

(a) Make sure there is voltage to the control module assembly (paragraph 2-17). Refer to (1) FIGURE 3-2 for power supply terminals.

(b) Check for power to the motor at the waste disposer terminals in the control module assembly. Place the sanitary unit in the continuous mode (paragraph 2-6).

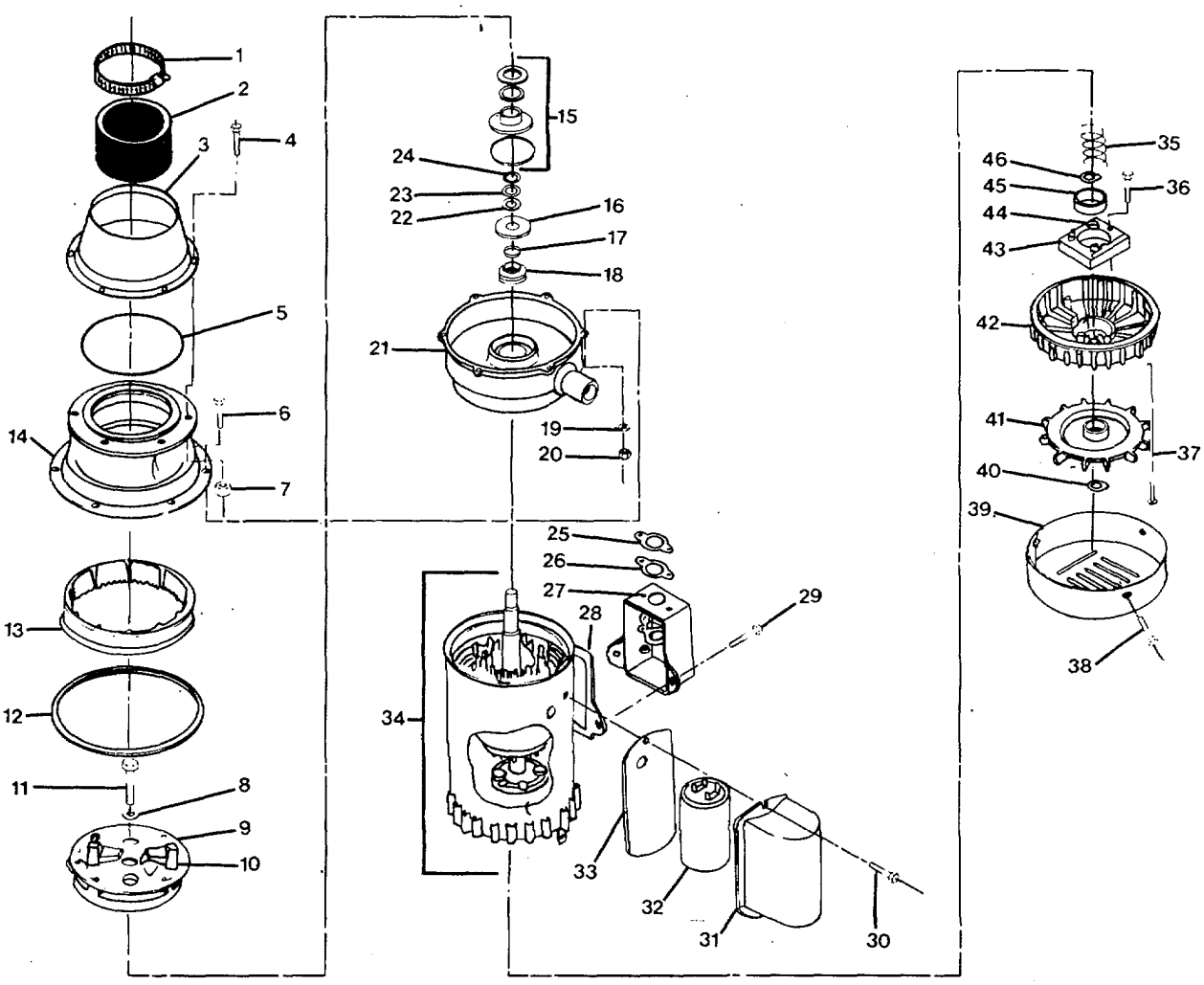


Figure 3-1. Waste Disposer - Exploded View.

1 Use a multimeter and, test for proper voltage across the poles marked 220 and 220/110 on the macerator terminals on the circuit card in the control module assembly. Refer to FIGURE 3-2 for terminal identification.

2 The voltage should be 220-240 Vac.

3 If there is no voltage at the terminals, replace the circuit card assembly (paragraph 2-17).

4 If the correct voltage reading is obtained on the terminals, go to the next step (c).

WARNING

SHOCK HAZARD. Turn electrical power OFF.

(c) Turn the electrical power OFF to the sanitary unit and check the waste disposer (macerator) leads in the control module assembly for loose or broken leads (paragraph 2-17). Refer to (2) FIGURE 3-2 for terminal identification on the circuit card. Tighten or correct as required.

1 Check for proper operation.

2 If the motor is still inoperative, go to next step (d)

WARNING

SHOCK HAZARD. Turn electrical power OFF.

(d) Turn the electrical power OFF.

(e) Remove the electrical box cover on the inoperative pump to reveal the cable connections (paragraph 2-18). Check for broken leads and tighten connections.

1 Position the cover away from possible contact with the electrical connections.

2 Turn the electrical power ON and place the sanitary unit in a CONTINUOUS mode (paragraph 2-6b).

3 Use a multimeter and check the voltage on the motor terminals.

4 If there is no voltage present, replace the electrical routing cable to the waste disposer motor (paragraph 2-18).

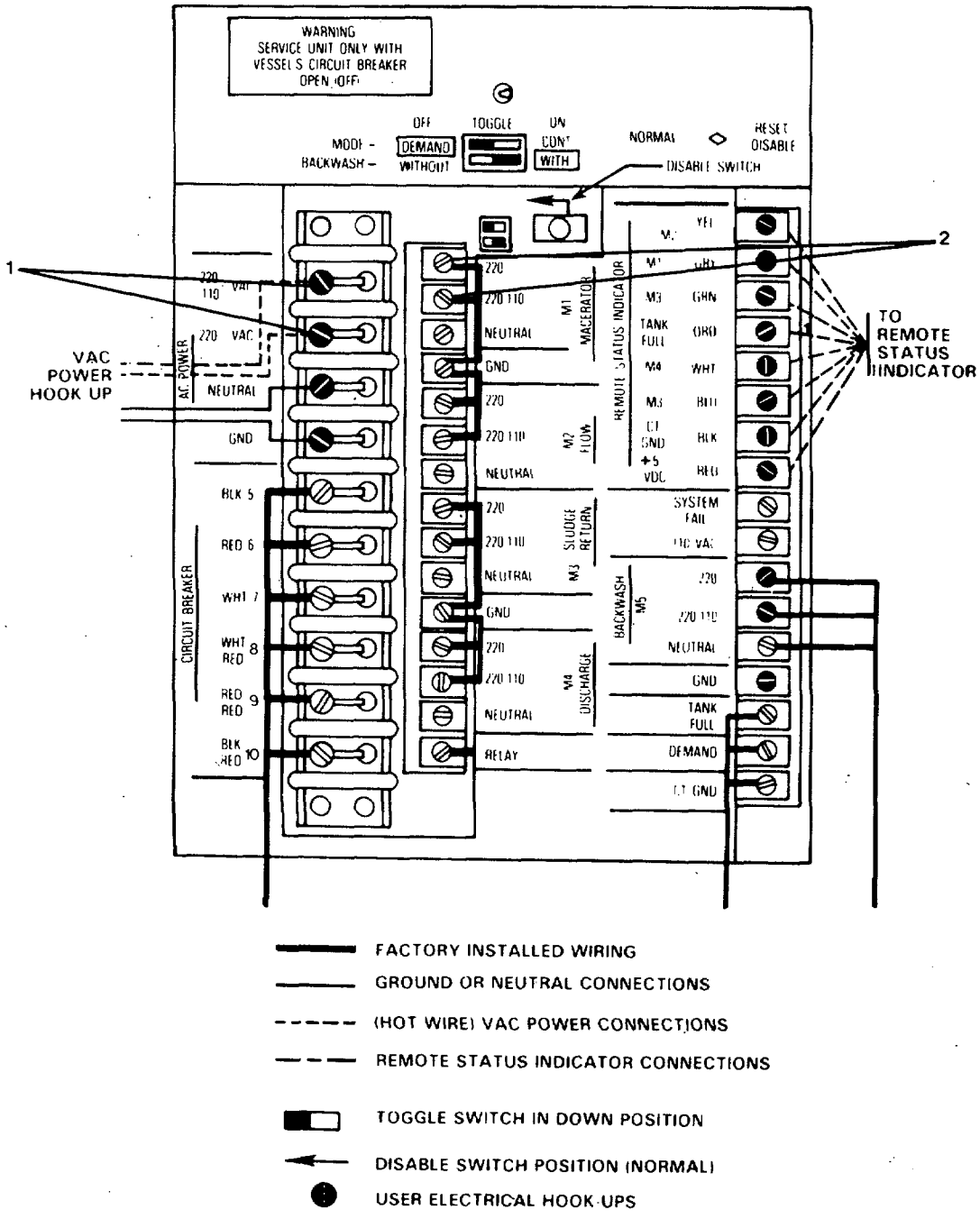


Figure 3-2. Power Supply and Waste Disposer Terminals in the Control Module Assembly.

5 If the proper voltage is obtained (220-.240 Vac), and the motor still does not operate, go to next step (g).

WARNING

SHOCK HAZARD. Turn electrical power OFF.

(f) Turn the electrical power OFF to the sanitary unit and check the capacitor (32, FIGURE 3-1) as follows:

1 With the electrical power OFF, remove the machine screws (30, FIGURE 3-1). Remove the capacitor case (31) for access to the capacitor (32). Discharge the capacitor before removing. Avoid contact with motor and capacitor while discharging to avoid electrical shock.

2 The capacitor may retain an electrical charge after the power has been turned OFF to the motor. Discharge the capacitor by grounding one of the terminals on the capacitor to the metal housing on the motor with an insulated handle screwdriver. Avoid contact with the metal portions of the motor or screwdriver while discharging.

3 Tag and remove the electrical leads from the capacitor.

4 Check the capacitor (32) against a known good capacitor. Connect the electrical leads to their proper terminals on the capacitor.

5 Install the case (31) with the screws (30) to hold the capacitor in place.

6 Turn the electrical power ON, start the sanitary unit, and check the motor for proper operation (paragraph 2-6).

7 If the motor is still inoperative, continue with next step (e).

WARNING

SHOCK HAZARD. Turn electrical power OFF.

(g) Turn the electrical power OFF and check the motor for an open, shorted, or grounded condition.

1 Tag and remove the cable leads from the motor terminals. Clean the motor terminals.

2 Use a multimeter on the ohms setting and check for a short in the windings. Check the resistance between the power supply terminals (red and black) on the motor. If no deflection (infinity) is obtained on the meter, the windings are open. If a full deflection (zero reading) is obtained, the motor windings are shorted.

3 Replace the ac motor assembly if an open or shorted condition exists.

4 Use a multimeter on the ohms (10,000 ohms scale) setting and check for an external ground. Check each terminal on the motor by placing one multimeter lead to a motor terminal and the other lead to a clean, unpainted spot on the metal housing of the motor. If any deflection or resistance other than infinity is shown on the meter, the motor has an external ground and must be replaced.

c. Install the waste disposer on the sanitary unit (paragraph 2-23).

3-10. Repair Alternating Current Motor.

This task covers: Repair

INITIAL SETUP:

Tools

Tool kit, general mechanic's, 5180-00-699-5273
Tool kit, electrician's, 5180-00-391-1087

Equipment Condition

Refer to the following paragraph in this maintenance manual.
Waste disposer removed (paragraph 2-23).
AC motor removed (paragraph 2-24).

Materials/Parts

Gaskets P/Ns 01-21-757, 01-21-754 and 01-21-741
Capacitor P/N 01-21-752

REPAIR

a. Disassemble the ac motor for parts replacement as follows (refer to FIGURE 3-1).

(1) Disassemble the upper housing from the motor. Refer to paragraph 3-9a.

(2) Remove the screws (29, FIGURE 3-1) and the conduit box (27) and gasket (28). Remove gasket plate (25) and gasket (26).(

(3) Remove the machine screws (30) and remove the capacitor case (31).

(4) Disconnect and tag the electrical leads to the capacitor (32). Remove the capacitor and gasket (33).

(5) Remove the bearing (18, FIGURE 3-1) from the motor end housing (21) as follows:

(a) Remove the three screws (38) and remove the fan guard (39) from the motor.

(b) Remove the four thru-motor bolts (37) from the motor (34). This will disconnect the motor housing (21).

(c) Clean the shaft with a cloth, or crocus cloth if necessary, before removing the bearing and upper motor housing.

(d) Remove the motor housing (21) and bearing (18) from the motor shaft.

(6) Remove the lock ring (40, FIGURE 3-1) and remove the fan (41), the fan shield (42), and switch (43) from the bottom end of the motor shaft.

(7) Remove screws (36) and remove the switch (43) from the fan shield (42).

(8) Remove the end bearing (45), snap ring (46), and spring (35) from the shaft.

b. Assemble the ac motor as follows (FIGURE 3-1):

(1) Clean the motor shaft with fine crocus cloth and apply a light coat of oil to the shaft.

(2) Install the spring (35, FIGURE 3-1), snap ring (46), and end bearing (45) onto the motor shaft.

(3) Install switch (43) to the shield (42) with screws (36). Install the fan shield and switch, the fan (41), and lock ring (40) onto motor shaft.

(4) Install the four thru-motor bolts (37) to connect the upper end motor housing (21) to the motor. Install the fan guard (39) with the three screws (38).

(5) Install the motor bearing (18) on the upper end of ther shaft. Seat the bearing in the end housing (21).

(6) Install the capacitor gasket (33), connect the electrical leads to their proper terminals on the capacitor (32), and install the case (31) with the two machine screws (30).

(7) Install the conduit box (27) and box gasket (28) onto the motor (34) with screws (29)t

(8) Install the gasket (26) and plate (25). Refer to paragraph 3-9a(12).

(9) Assemble the upper housing onto the motor assembly.

SECTION VI. PREPARATION FOR STORAGE OR SHIPMENT

3-11. Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the Preventive Maintenance Checks and Services (PMCS) charts before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness. Refer also to Chapter 2, Section VI.

CHAPTER 4

INTERMEDIATE GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

4-1. Maintenance procedures for the marine sanitation system are performed at the unit and intermediate direct support levels. There are no maintenance requirements at the intermediate general support level.

APPENDIX A

REFERENCES

A-1. **Scope**. This paragraph lists the manuals, bulletins, specifications, and miscellaneous publications referenced in this manual or required for maintenance activities.

A-2. **Field Manuals**.

FM 21-11	First Aid for Soldiers
FM 31-70	Basic Cold Weather Manual
FM 55-501	Marine Crewman's Handbook

A-3. **Technical Manuals**.

TM 43-0139	Painting Instructions for Field Use
TM 43-0144	Painting of Vessels
TM 55-1905-223-10	Operator's Manual for Landing Craft, Utility (LCU)
TM 55-1905-223-24-18	LCU 2000 Class Basic Craft Maintenance Manual
TM 55-1905-223-24P	Repair Parts and Special Tools List for the LCU 2000 Class Watercraft
TM 750-244-3	Destruction of Army Materiel to Prevent Enemy Use

A-4. **Technical Bulletins**.

TB 55-1900-207-24	Treatment of Cooling Water in Marine Diesel Engines
TB 740-97-4	Preservation of Vessels for Storage

A-5. **Military Specifications**.

MIL-C-16173C	Rust Preventive, Type P-1
MIL-L-644	Preservative Oil, Type P-9
MIL-L-21260	Preservative Oil, Type P-10

A-6. **Miscellaneous Publications**.

DA Pam 738-750	The Army Maintenance Management System
LO 55-1905-223-12	Lubrication Order for the LCU 2000 Class Watercraft
*AMC-R 750-11	Use of Lubricants, Fluids, and Associated Products

A-7. **Forms**.

DA Form 2028 and 2028-2	Recommended Changes to Publications and Blank Forms
DA Form 2404	Equipment Maintenance and Inspection Worksheet
DA Form 2408-16	Logsheet
DA Form 2410	Logsheet
SF Form 368	Quality Deficiency Report

*Supercedes Darcom-R 750-11

Appendix B. MAINTENANCE ALLOCATION CHART (MAC)

SECTION I. INTRODUCTION

B-1 THE ARMY MAINTENANCE SYSTEM MAC.

a This introduction (Section I) provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

b The Maintenance Allocation Chart (MAC) in Section II designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component will be consistent with the capacities and capabilities of the designated maintenance levels, which are shown in the MAC in column (4) as:

Unit - includes two subcolumns: C (operator/crew) and O (unit) maintenance.
Direct Support - includes an F subcolumn.
General Support - includes an H subcolumn.
Depot - includes a D subcolumn.

c Section III lists the tools and test equipment (both special tools and common tools sets) required for each maintenance function as referenced from Section 11.

d Section IV contains supplemental instructions and explanatory notes for a particular maintenance function as referenced from Section II.

B-2 MAINTENANCE FUNCTIONS . Maintenance functions will be limited to and defined as follows:

a Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (i.e., by sight, sound, or feel).

b Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards.

C Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontamination, when required), to replace filters, to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases.

d Adjust. To maintain or regulate, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameters.

e Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h Replace. To remove an unserviceable item and install a serviceable counterpart in its place. Replace is authorized by the MAC and is shown as the 3rd position code of the SMR code.

i Repair. The application of maintenance services[1] including fault location/troubleshooting[2], removal installation, and disassembly/assembly[3] procedures, and maintenance actions[4] to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), and item, or system.

j Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications (i.e., DMWR). Overhaul in normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k Rebuild. Consists of those service/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours, miles, etc.) considered in classifying Army equipment and components.

B-3 EXPLANATION OF COLUMNS IN THE MAC, SECTION II

a Column 1 - Group Number. Column 1 lists functional group code numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the next higher assembly.

b Column 2 - Component/Assembly. Column 2 contains the names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c Column 3 - Maintenance Function. Column 3 lists the functions to be performed on the item listed in column 2. (For detailed explanation of these functions, see paragraph A-2.)

d Column 4 - Maintenance Category. Column 4 specifies, by the listing of a work time figure in the appropriate subcolumn(s), the category of maintenance authorized to perform the function listed in Column 3. This figure represents the active time required to perform that maintenance function at the indicated category of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance categories, appropriate work time figures will be shown for each category. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance/quality control time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the maintenance allocation chart.

The symbol designations for the various maintenance categories are as follows:

C Operator or Crew
O Unit Maintenance
F Direct Support Maintenance (DS)
H General Support Maintenance (GS)
D Depot Maintenance

---

[1]Service - Inspect, test, service, adjust, align, calibrate, and/or replace.

[2]Fault location/troubleshooting - The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or unit under test (UUT).

[3]Disassemblylassembly - The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identification as maintenance significant).

[4]Actions - Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

e Column 5 - Tools and Equipment. Column 5 specifies, by number code, those common tool sets (not individual tools); special tools; Test, Measurement, and Diagnostic Equipment (TMDE); and support equipment required to perform the designated function, which shall be keyed to the tools listed in Section Ill.

f Column 6 - Remarks. This column shall, when applicable, contain a letter code, in alphabetic order, which shall be keyed to the remarks contained in Section IV.

B-4 EXPLANATION OF COLUMNS IN TOOL AND TEST EQUIPMENT REQUIREMENTS, SECTION Ill.

a Column 1 - Reference Code. The tool and test equipment reference code correlates with a number code used in the MAC, Section II, Column 5.

b Column 2 - Maintenance Category. The lowest category of maintenance authorized to use the tool or test equipment.

c Column 3 - Nomenclature. Name or identification of the tool or test equipment.

d Column 4 - National Stock Number. The National stock number (NSN) of the tool or test equipment.

e Column 5 - Tool Number. The manufacturer's part number.

B-5 EXPLANATION OF COLUMNS IN REMARKS, SECTION IV.

a Column 1 - Reference Code. The letter code recorded in Column 6, Section II.

b Column 2 - Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

SECTION II. MAINTENANCE ALLOCATION CHART FOR MARINE SANITATION SYSTEM

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
11	MARINE SANITATION	INSPECT	0.5					1, 2	
	SYSTEM	TEST	2.5						
		SERVICE	6.0					1	
		ADJUST	*1.5*					1, 2	
		REPLACE		15.0				1, 2, 3, 4	
		REPAIR	1.0	1.5	7.0			1, 2, 3, 4	
		OVERHAUL					*		D
1101	SEWAGE TREATMENT	INSPECT	0.5					1	
	UNIT ASSEMBLY	TEST	2.0						
		SERVICE	5.5					1	
		REPLACE		13.0				1, 2, 4–6	
		REPAIR	1.0	1.0	21.5			1, 2, 4–6	
110101	COVER ASSEMBLY,	REPLACE		0.5				1, 3, 4	
	END SEDIMENT TANK	REPAIR		1.0				1, 3, 4	
110102	COVER ASSEMBLY,	REPLACE		0.5				1, 3, 4	
	MID SEDIMENT TANK	REPAIR		1.0				1, 3, 4	
110103	SCREEN ASSEMBLY	REPLACE	0.5					1	
		REPAIR		1.0				1	
110104	SPRINKLER, IMPACT	REPLACE		0.5				1	A
110105	SEWAGE TREATMENT	REPLACE		1.0				1, 3, 4	B
	UNIT, SUB ASSEMBLY	REPAIR	1.0	1.5				1, 3, 4	C
11010501	MODULE CONTROL	INSPECT	0.5					1, 2	
	ASSEMBLY	SERVICE	0.5					1, 2	
		REPLACE	1.0					1, 2	
		REPAIR		2.0				1, 2	
11010502	CABLE, EQUIPMENT	INSPECT		0.5					
	ROUTING ASSEMBLY	REPLACE		1.0				1, 2	
		REPAIR		1.5				1, 2	
11010503	LEVEL SENSOR	INSPECT	0.5					1, 2	
	ASSEMBLY	TEST	1.0					1, 2, 7	
		REPLACE		1.0				1, 2	A

SECTION II. TOOLS AND TEST EQUIPMENT REQUIREMENTS FOR MARINE SANITATION SYSTEM

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
11010504	PUMP SYSTEM,	INSPECT	0.5					1, 2	
	DISCHARGE	TEST	0.5					1, 2, 7	
		SERVICE	0.5					1, 2	
		REPLACE	1.0					1 - 4	
		REPAIR		1.5				1 - 4	
11010505	PUMP SYSTEM, FLOW	INSPECT	0.5					1, 2	
		TEST	0.5					1, 2, 7	
		SERVICE	0.5					1, 2	
		REPLACE	1.0					1 - 4	
		REPAIR		1.5				1 - 4	
11010506	PUMP SYSTEM,	INSPECT	0.5					1, 2	
	SLUDGE	SERVICE	0.5					1, 2	
		REPLACE	1.0					1 - 4, 7	
		REPAIR		1.5				1 - 4, 7	
11010507	DISPOSER, WASTE	INSPECT	0.5					1, 2	
		SERVICE	0.5					1, 2	
		REPLACE		1.0				1 - 3	
		REPAIR		1.5	2.0			1 - 3, 7	
11010507	MOTOR, ALTERNATING	REPLACE		1.0				1, 2	
01	CURRENT	REPAIR			1.5			1, 2	
11010508	PIPING GROUP	INSPECT	0.5					1	
		REPLACE		1.0				1 - 3	
		REPAIR		1.5				1 - 3	
1102	TANK ASSEMBLY,	INSPECT	0.5					1	
	BLEACH	SERVICE	0.5					1	
		REPLACE	1.0					1	
		REPAIR		1.5				1	
1103	COMMODE WARNING	REPLACE	1.0					1, 2	
	LIGHT ASSEMBLY	REPAIR		1.5				1, 2	

SECTION III. TOOLS AND TEST EQUIPMENT REQUIREMENTS FOR MARINE SANITATION SYSTEM

TOOL OR TEST EQUIP-MENT REF CODE	MAINTE-NANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	C, O, F	Tool Kit, General Mechanics	5180-00-699-5273	(50980)SC-180-90-CL-N05
2	C, O, F	Tool Kit, Electricians	5180-00-391-1087	
3	C, O	Torque Wrench (30 - 300 inch pounds)	512001-092-3278	(80064) 9000S6202-73125ALT2
4	C, O	Torque Wrench (30 - 300 foot pounds)	5120-01-125-5190	
5	C, O	Lifting Sling	3940-01-183-9412	(15434) 3375958
6	C, O	Lifting Fixture		(15434) 3822512
7	C, O, F	Multimeter	6625-01-139-2512	(80058) AN/PSM-5

SECTION IV. REMARKS FOR MARINE SANITATION SYSTEM

REFERENCE CODE	REMARKS
A	REPAIR OF THIS ITEM IS BY REPLACEMENT
B	TAKE DISCHARGE SAMPLES TO VISUALLY CHECK FOR CLEANLINESS AND CHECK FOR UNPLEASANT ODOR. PURGE IF REQUIRED.
C	IT IS RECOMMENDED THAT UNIT BE DRAINED AND PURGED EVERY 60 DAYS
D	DEPOT LEVEL REPAIR / MAINTENANCE WILL BE PERFORMED ON A CASE BY CASE BASIS SUBJECT TO APPROVAL AND FUNDING BY THE NATIONAL MAINTENANCE POINT (NMP).

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APPENDIX C

EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

SECTION I. INTRODUCTION

C-1. Scope. This appendix lists expendable supplies and materials you will need to operate and maintain the equipment. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V, Repair Parts, and Heraldic Items), or CTA 8-100 Army Medical Department Expendable Items.

C-2. Explanation of Columns. The following provides an explanation of columns found in the tabular listings.

a. Column (1) - Item Number. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (for example, "Use cleaning compound, item 5, App. C"1).

b. Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed item.

C - Operator/Crew
O - Organizational Maintenance
F - Direct Support Maintenance
H - General Support Maintenance

c. Column (3) - National Stock Number. This is the National stock number assigned to the item; use it to request or requisition the item.

d. Column (4) - Description. Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturers (FSCM) in parentheses followed by the part number.

e. Column (5) - Unit of Measure (U/M). Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (for example, ea, in, pr) If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.

SECTION II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION	(5) U/M
1	0	5120-00-223-8846	Clamp, tubing, 1/4 inch	SE
2	0	8030-00-582-5191	Lubricant, pipe thread, teflon	RO
3	0	6840-00-530-7109	Disinfectant	GL
4	0	5350-00-221-0872	Crocus cloth, fine	
5	0	6850-01-078-9117	Solvent/Cleaner, PVC	BT
6	0	6515-01-154-2148	Cement glue, PVC	BT
7	0	7920-00-140-0869	Rags	BX
8	0	7920-00-178-8315	Brush, non-metallic, small	EA
9	0	7930-00-253-0779	Soap (Scrubbing)	LB
10	0	2835-00-015-0246	Warning tags	HD
11	0	5970-00-185-8531	Tape, electrical	RO
12	0	9150-00-111-3199	Oil, lubricating, SAE 10	CN

APPENDIX D

TORQUE VALUES

D-1. Scope. SAE capscrews are graded according to the strength of the capscrew. They are marked on the head so the correct strength and torque value are known. The tables in this appendix will list the capscrew markings with correct torque values as well as values for pipe plugs and metric bolts.

CAUTION

When replacing capscrews, always use a capscrew of the same measurement and strength as the capscrew being replaced. Using incorrect capscrews can result in equipment damage. Bolts threaded into aluminum require much less torque.

NOTE

Always use torque values listed in the tables when specific torque values are unknown. The torque values listed in the tables are based on the use of lubricated threads.

Table D-1. Capscrew Markings and Torque Values

Capacity Body Size		SAE Grade #5 Cast Iron or Steel			SAE Grade #6 or #7 Cast Iron or Steel			SAE Grade #8 Cast Iron or Steel		
		Torque			Torque			Torque		
Inches	-Thread	ft-lb	kgm	N•m	ft-lb	kgm	N•m	ft-lb	kgm	N•m
1/4	-20	8	1.1064	10.8465	10	1.3630	13.5582	12	1.6596	16.2698
	-28	10	1.3830	13.5582				14	1.9362	18.9815
5/16	-18	17	2.3511	23.0489	19	2.6277	25.7605	24	3.3192	32.5396
	-24	19	2.6277	25.7605				27	3.7341	36.6071
3/8	-16	31	4.2873	42.0304	34	4.7022	46.0978	44	6.0852	59.6560
	-24	35	4.8405	47.4536				49	6.7767	66.4351
7/16	-14	49	6.7767	66.4351	55	7.6065	74.5700	70	9.6810	94.9073
	-20	55	7.6065	74.5700				78	10.7874	105.7538
1/2	-13	75	10.3725	101.6863	85	11.7555	115.2445	105	14.5215	142.3609
	-20	85	11.7555	115.2445				120	16.5860	162.6960
9/16	-12	110	15.2130	149.1380	120	16.5960	162.6960	155	21.4365	210.1490
	-18	120	16.5960	162.6960				170	23.5110	230.4860
5/8	-11	150	20.7450	203.3700	167	23.0961	226.4186	210	29.0430	284.7180
	-18	170	23.5110	230.4860				240	33.1920	325.3920
3/4	-10	270	37.3410	366.0660	280	38.7240	379.6240	375	51.8625	508.4250
	-16	295	40.7985	399.9610				420	58.0860	568.4360
7/8	- 9	395	54.6285	535.5410	440	60.8520	596.5520	605	83.6715	820.2590
	-14	435	60.1605	589.7730				675	93.3525	915.1650
1.0	- 8	590	81.5970	799.9220	660	91.2780	894.8280	910	125.8530	1233.7780
	-14	660	91.2780	849.8280				990	136.9170	1342.2420

Table D-1. Capscrew Markings and Torque Values - CONT

Capscrew Head Markings

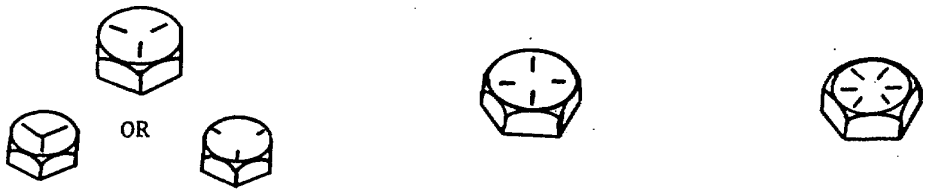

Table D-2. Pipe Plug Torque Values

Size			In Aluminum Components		In Cast Iron or Steel Components	
Thread	Actual Thread O.D.		Torque		Torque	
in	mm	(in)	N·m	(ft-lb)	N·m	(ft-lb)
1/16	8.1	(0.32)	5	(45 in-lb)	15	(10)
1/8	10.4	(0.41)	15	(10)	20	(15)
1/4	13.7	(0.54)	20	(15)	25	(20)
3/8	17.3	(0.68)	25	(20)	35	(25)
1/2	21.6	(0.85)	35	(25)	55	(40)
3/4	26.7	(1.05)	45	(35)	75	(55)
1	33.5	(1.32)	60	(45)	95	(70)
1-1/4	42.2	(1.66)	75	(55)	115	(85)
1-1/2	48.3	(1.90)	85	(65)	135	(100)

Table D-3. Metric Bolt Torque Values

Thread for general purposes	Cast Iron or Steel			
	Head Mark 4		Head Mark 7	
	Torque		Torque	
(size x pitch (mm))	ft-lb	(N·m)	ft-lb	(N·m)
6 x 1.0	2.2 to 2.9	(3.0 to 3.9)	3.6 to 5.8	(4.9 to 7.8)
8 x 1.25	5.8 to 8.7	(7.9 to 12)	9.4 to 14	(13 to 19)
10 x 1.25	12 to 17	(16 to 23)	20 to 29	(27 to 39)
12 x 1.25	21 to 32	(29 to 43)	35 to 53	(47 to 72)
14 x 1.5	35 to 52	(48 to 70)	57 to 85	(77 to 110)
16 x 1.5	51 to 77	(67 to 100)	90 to 120	(130 to 160)
18 x 1.5	74 to 110	(100 to 150)	130 to 170	(180 to 230)
20 x 1.5	110 to 140	(150 to 190)	190 to 240	(160 to 320)
22 x 1.5	150 to 190	(200 to 260)	250 to 320	(340 to 430)
24 x 1.5	190 to 240	(260 to 320)	310 to 410	(420 to 550)

GLOSSARY

SECTION I. ABBREVIATIONS

Abbreviation	Definition
ac	Alternating current
FNPT	Female National Pipe Thread
ft-lb	foot-pound
gl	gallon
hp	horsepower
Hz	Hertz
in-lb	inch-pound
kva	kilovolt ampere
MSD	Marine Sanitation Device
psi	pounds per square inch
PVC	polyvinylchloride plastic
RPM	Revolutions per Minute
RSI	Remote Status Indicator
vac	Voltage Alternating Current

SECTION II. DEFINITIONS OF UNUSUAL TERMS

ANODE - A corrosion preventive zinc plug used for reducing the effects of electrolysis on other metals.

BACKWASH - A reversal of liquid flow for the purpose of clearing or unclogging a screen or filter.

CAPACITOR - A device possessing the property of capacitance. A typical capacitor consists of two conducting surfaces separated by an insulating material. A capacitor stores electrical energy, blocks the flow of dc current and permits the flow of ac current to a degree largely dependent on the capacitance and the frequency of the applied ac current.

CHLORINATION - The process of adding chlorine (bleach) to the treatment unit.

CIRCUIT - An electrical path through which an electric current may flow from a voltage supply to a load and return. A closed or complete circuit is one where current is flowing. An open circuit is one where the path has been disrupted, such as an open switch or circuit breaker, thus stopping current flow.

CIRCUIT BREAKER - A protective device for opening a circuit when current flow exceeds a predetermined value.

GLOSSARY - Cont

SECTION II. DEFINITIONS OF UNUSUAL TERMS - CONT

EFFLUENT	-	Treated and processed sewage.
ELECTROLYSIS	-	The decomposition into ions of a chemical compound in solution by the action of an electric current passing through the solution.
HYPOCHLORITE	-	Common household type bleach.
JUNCTION BOX	-	Main electrical box on a piece of equipment where the electrical power supply is connected to other components on the equipment. Another term for Control Module Assembly.
MACERATOR	-	A waste disposal unit for the purpose of chopping, cutting, or shredding waste material.
METERING VALVE	-	A valve which allows a preset quantity of a liquid to pass through over a certain period of time.
MODE	-	A method of operation.
MULTIMETER	-	An instrument designed to measure electrical potential (voltage, current, and resistance).
RELAY	-	An electromechanical device having a magnetic coil which, when energized, opens or closes several sets of contacts.
RUNOFF	-	Small amounts of a liquid that may have settled in hoses and lines and will be expelled when connections in the hoses or lines are loosened or disconnected.
SEDIMENTATION MODULE(s)	-	Treatment tanks that allow for the settlement of materials which have not been totally processed for discharge.
SEWAGE	-	Human waste material.
SLUDGE	-	The material which has not been totally processed and has settled in the sedimentation modules (treatment tanks). This material is returned to the macerator for reprocessing.
SOLENOID	-	An electromechanical device which, when energized, acts on a movable core or plunger in the center of the energizing coil to perform mechanical work.
VOLTMETER	-	An instrument designed to measure electrical potential or voltage.

ALPHABETICAL INDEX

ALPHABETICAL INDEX - CONT

By Order of the Secretary of the Army:

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General, United States Army
Chief of Staff

Official:

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Brigadier General, United States Army
The Adjutant General

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PREVIOUS EDITIONS ARE OBSOLETE.

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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