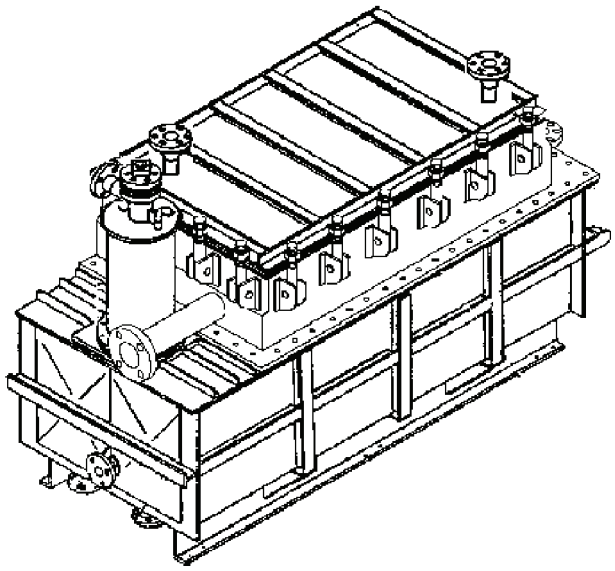
TM 55-1905-223-24-19

TECHNICAL MANUAL

UNIT, INTERMEDIATE DIRECT
SUPPORT
AND INTERMEDIATE GENERAL
SUPPORT
MAINTENANCE INSTRUCTIONS

OIL-WATER SEPARATOR

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



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HEADQUARTERS, DEPARTMENT OF THE ARMY

FEBRUARY 2008

WARNING SUMMARY

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 or injury to personnel or damage to the equipment.

MOVING MACHINERY HAZARDS

Be very careful when operating or working near moving machinery.

Running engines, rotating shafts and other moving machinery parts could cause personal injury or death. Before maintenance is performed on motor driven equipment, the main circuit breaker should be de-energized and labeled “OUT OF SERVICE.” Only authorized maintenance personnel should make repairs to this equipment.

ELECTRICAL HAZARDS

Respect all circuits. Precautions set forth in Naval Ship’s Technical Manual (NSTM), Chapters 300, 302, 310, and 320, shall be observed with respect to electrical equipment and circuits. Special precautionary measures are essential to prevent applying power to the system/equipment at any time maintenance work is in progress. Disconnect power and tag the circuit to warn of a potentially dangerous situation. Use a multimeter to ensure all electrical circuits are de-energized before touching any part of the circuit. Before working on electrical system/ equipment, check with multimeter to ensure that system is not energized. Circuits not known to be dead must be considered live and dangerous at all times. The voltages used to operate this equipment are high enough to cause severe injury or death. When working near electricity, do not use metal rules, flashlights, metallic pencils, or any other objects having exposed conducting material. Troubleshooting procedures frequently require that checks be made while the power is on. Use extreme care to prevent contact with live circuit parts. Touching these parts could result in electrical shock. Be sure to de-energize all equipment before connecting or dis-connecting meters or test leads. When connecting a meter to terminals for measurement, use a range higher than the expected voltage.

DO NOT REPAIR OR ADJUST ALONE

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

TEST EQUIPMENT

Make certain test equipment is in good condition. If a test meter must be held, ground the case of the meter before starting measurements. Do not touch live equipment or personnel working on live equipment while holding a test meter. Some types of measuring devices should not be grounded; such devices should not be held when taking measurements.

INTERLOCKS

Interlocks are provided for safety of personnel and equipment and should be used only for the purpose intended. They should not be battle-shorted or otherwise modified except by authorized maintenance personnel. Do not depend solely upon interlocks for protection. Whenever possible, disconnect power at power distribution source.

For Artificial Respiration, refer to FM 4-25.11.

LIST OF EFFECTIVE PAGES

NOTE: **This manual is a non superseding revision for the Oil-Water Separator System within TM 55-1905-223-24-18-1 and TM 55-1905-223-24-18-2 dated 17 January 1989. Zero in the "Change No." column indicates an original page.**

Date of issue is: 08 February 2008

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TECHNICAL MANUAL

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 08 February 2008

UNIT, INTERMEDIATE DIRECT SUPPORT AND INTERMEDIATE GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

OIL-WATER SEPARATOR FOR LANDING CRAFT UTILITY (LCU) NSN 1905-01-154-1191

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Equipment Technical Publications) through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax or e-mail your letter or DA Form 2028 direct to: TACOM Life Cycle Management Command, ATTN: AMSTA-LC-LMPP/TECH PUBS, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is ROCK-TACOM-TECH-PUBS@conus.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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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 maintenance manual.

b. Model Number and Equipment Name. Oil-Water Separator (OWS) model OPB-10NP/SR02, Oil Content Monitor (OCM) model ET-35N, Water Polisher, part number SN-FH-3P3S, and the Dirty Oil Pump, Model H-125 installed aboard the LCU 2000 Class Watercraft.

c. Purpose of Equipment. To provide separation of oil from oily waste water from the sludge tank, and discharge water in compliance with U. S. Coast Guard regulations and International law.

1-2. Maintenance Forms, Records, and Reports. Department of the Army forms and procedures used for equipment maintenance are those prescribed by DA Pam 750-8, The Army Maintenance Management System (TAMMS) Users Manual.

1-3. Reporting Equipment Improvement Recommendations (EIR). If your Oil-Water Separator (OWS) 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 or performance. If you have Internet access, the easiest and fastest way to report problems or suggestions is to go to https://aeps.ria.army.mil/aepspublic.cfm (scroll down and choose to submit an Equipment Improvement Recommendation (EIR), a Product Quality Deficiency Report (PQDR) or a Warranty Claim Action (WCA). You may also submit your information using an SF 368 (Product Quality Deficiency Report). You can send your SF 368 via e-mail, regular mail, or facsimile using the addresses/facsimile numbers specified in DA Pam 750-8, The Army Maintenance Management System (TAMMS) Users Manual. We will send you a reply.

1-4. Destruction of Army Materiel. Refer to TM 750-244-3 for instructions covering the destruction of Army materiel to prevent enemy use.

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) charts before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness. Repacking of equipment for shipment or storage is covered in Paragraphs 2-32 and 3-13.

SECTION II. EQUIPMENT DESCRIPTION AND DATA

1-6. General Description. The Facet model OPB-10NP/SR02 Oil-Water Separator (OWS) is a single-stage coalescer type unit designed for separating oil from oily waste water from the sludge tank and discharge water overboard in compliance with Federal law. The unit is a vacuum type system to draw water into the coalescer chamber. The system includes an Oil Content Monitor (OCM) to monitor overboard discharge and divert back to the sludge tank when water quality fails to meet a preset level. A water polisher is also included to assist in meeting federal requirements.

1-7. Characteristics, Capabilities, and Features. A very broad view of the oil-water separator is as follows:

a. Characteristics.

(1) Single-stage coalescer chambers with cleanable plates.

(2) Oil content monitor to monitor purity of discharge water prior to overboard discharge.

(3) Water polisher for use when OWS alone fails to meet federal regulations.

b. Capabilities and Features.

(1) Process 10 gallons per minute of oily waste water.

NOTE

Although the OCM has a limit of 70 PPM, DOD vessels are not authorized to operate at this range. In accordance with DOD 4715.6-R1, Regulations On Vessels Owned Or Operated By The Department Of Defense, the only acceptable range of operation is 15 PPM.

(2) Two position switch to monitor 15 ppm or 70 ppm limits.

1-8. Location and Description of Major Components. Figure 1-1 shows the engine room with locations of the major components indicated. Refer to Figure 1-1 and the reference number key below for the descriptions of these components.

a. Separator Tank (1). The separator tank houses the coalescer plates and is located in the engine room starboard side aft of the EOS.

b. Oil-Water Separator (OWS) Pump (2). The OWS pump is located aft of the EOS, near centerline, under the engine room ladder.

c. Water Polisher (3). The water polisher consists of a housing with 9 filters stacked 3 high and 3 wide and located between the separator tank and the OWS pump.

d. Sight Glass (4). The flow sight glass is located on the forward inboard side of the separator tank.

e. Motorized Valve (5). The system operated electric valve is located above the sight glass.

f. Dirty Oil Pump (6). The dirty oil pump is located forward port outboard side of the EOS.

g. Duplex Strainer (7). The duplex strainer is located forward port outboard side of the EOS and inboard of the dirty oil pump.

h. Remote Indicator (Alarm) Assembly (8). The remote indicator (alarm) assembly allows for remote operation and monitoring of the Oil Content Monitor (OCM) system, located inside the EOS on the starboard bulkhead. Refer to Figure 1-2 for a detailed view and Table 1-1 for a list of the controls and indicators for the remote alarm assembly.

i. Motorized Valve (9). The four system operated electric valves are located on the forward and aft starboard side of the separator tank.

j. Oil/Water Sensor (10). The oil/water sensor consists of probes and is mounted on the oil tower on the forward end of the separator tank.

k. Pressure Reducing Valve (11). Reduces seawater feed pressure to the OWS system and is located on starboard side of the separator tank.

l. Oil/Air Sensor (12). The oil/air level sensor consists of probes and is mounted on the aft end of the separator tank.

m. Pressure Switches (13). Two pressure-actuated diaphragm style pressure switches are mounted port side of the separator tank and aft of the water polisher.

n. Compound Gauge (14). The pressure/vacuum gauge consists of electrical contacts for system control and is located port/aft of the separator tank.

o. Control Panel (15). The OWS control panel consists of pushbuttons, switches, indicators and alarm, located on the aft starboard bulkhead. Refer to Figure 1-3 for a detailed view and Table 1-2 for a list of the controls and indicators for the control panel.

p. OCM Sampling/Sensor Assembly (16). The Sampling/Sensor Assembly is the direct interface with the OWS system and is located on the starboard side bulkhead aft of the control panel. Refer to Figure 1-4 for a detailed view and Table 1-3 for a list of the indicators for the sensor detection assembly.

q. OCM Remote Relay Assembly (17). The remote relay is mounted below the OCM diverter valve position indicator on the starboard bulkhead. A junction box for system wiring connections is located directly under the remote relay.

r. Audible Alarm (18). The electric horn is mounted on the starboard bulkhead aft.

s. OCM Diverter Valve Position Indicator (19). The two lamp indicator is mounted aft of the OCM Sensor Detection Assembly (SDA) on the starboard bulkhead.

t. OWS Circuit Breaker Panel (20). The circuit breaker panel is mounted on the aft bulkhead behind and above the OWS separator tank.

u. Gauge Panel (21). The panel houses the purge water pressure gauge, OCM inlet gauge, OWS outlet gauge, and strainer inlet and outlet gauges.

v. Diverter Valve (22). The diverter valve is located aft of the water polisher, below the gauge panel and mounted in the piping system.

w. OCM Circuit Breaker Panel (23). The panel is located on the aft port bulkhead.

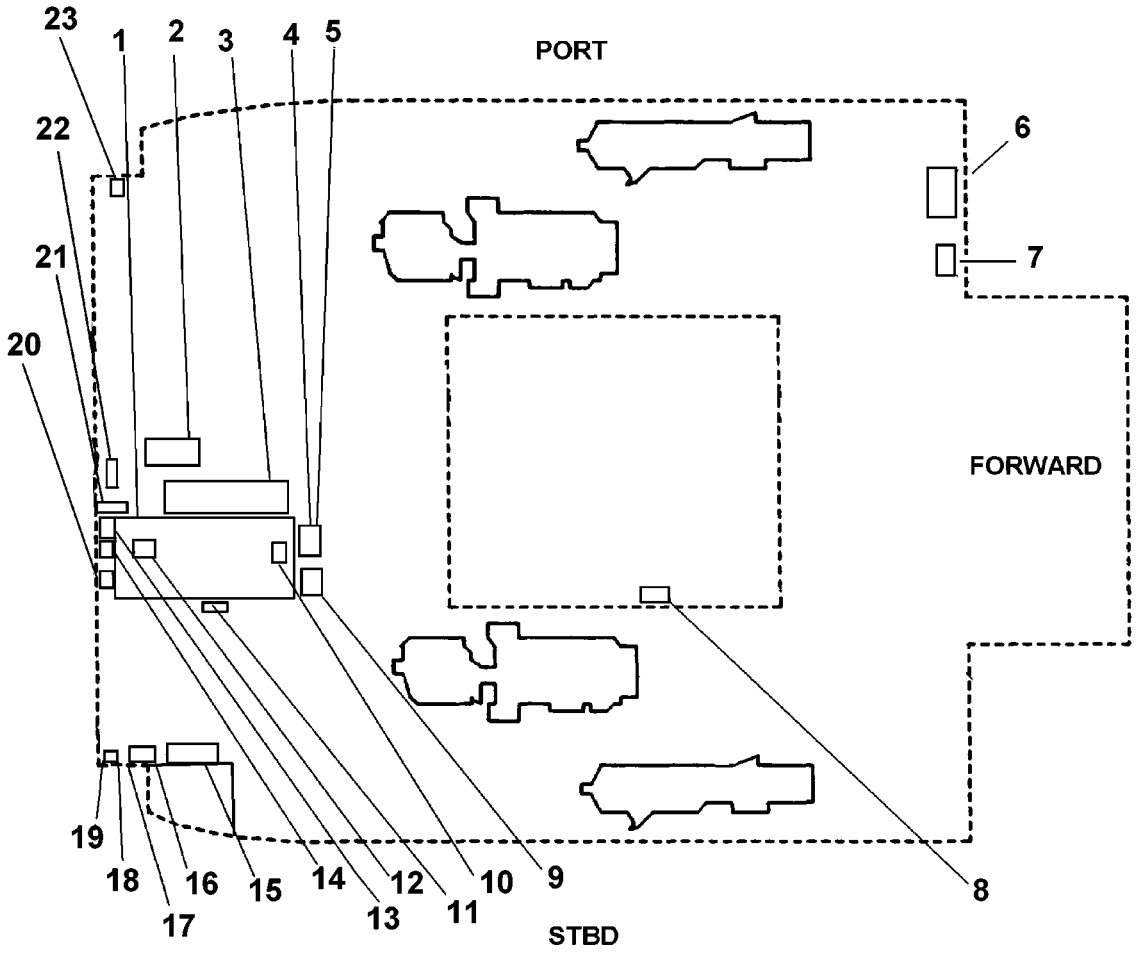

Figure 1-1. Location of Major Components.

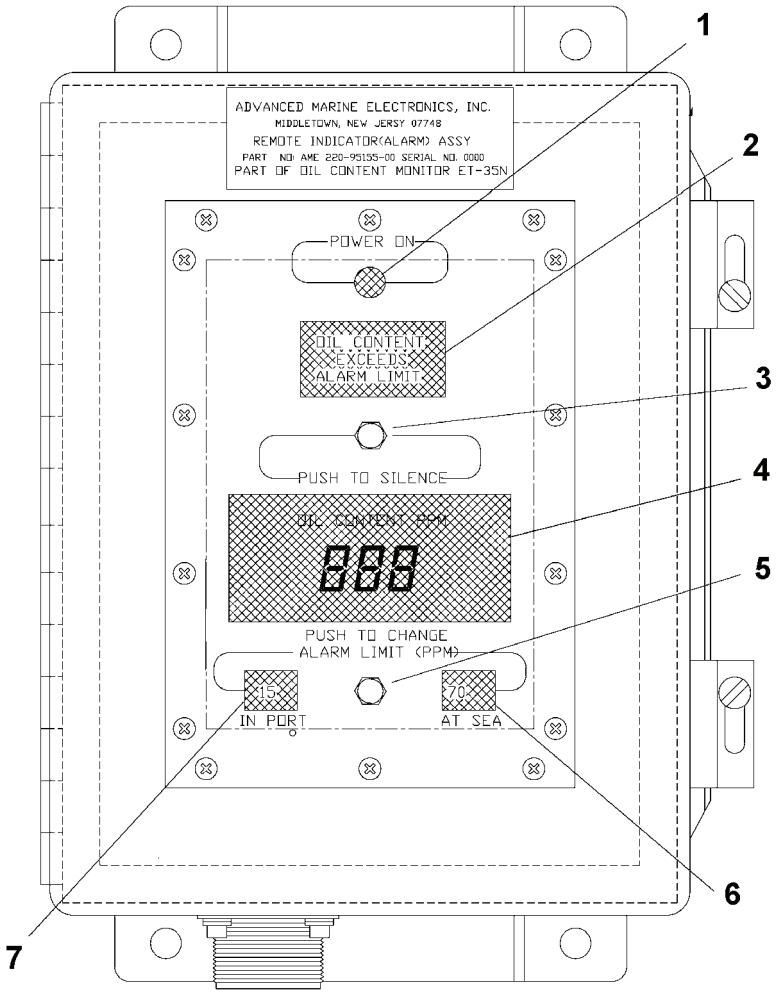

Figure 1-2. OCM Remote Indicator (Alarm) Assembly Controls and Indicators.

NOTE

Although the OCM has a limit of 70 PPM, DOD vessels are not authorized to operate at this range. In accordance with DOD 4715.6-R1, Regulations On Vessels Owned Or Operated By The Department Of Defense, the only acceptable range of operation is 15 PPM.

Table 1-1. OCM Remote Indicator (Alarm) Assembly Controls and Indicators.

No.	Control or Indicator	Function
1	POWER ON	OCM System is operating.
2	OIL CONTENT EXCEEDS ALARM LIMIT	OCM is in alarm status.
3	PUSH TO SILENCE pushbutton switch	Press to engage and disengage the Alarm Buzzer.
4	EFFLUENT OIL CONTENT	Numerical LCD display of oil content.
5	PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch	Press to select the OCM Alarm Limit (15 or 70 PPM). (Refer to note above.)
6	AT-SEA 70	Alarm Limit of 70 PPM. (Refer to note above.)
7	IN-PORT 15	Alarm Limit of 15 PPM.

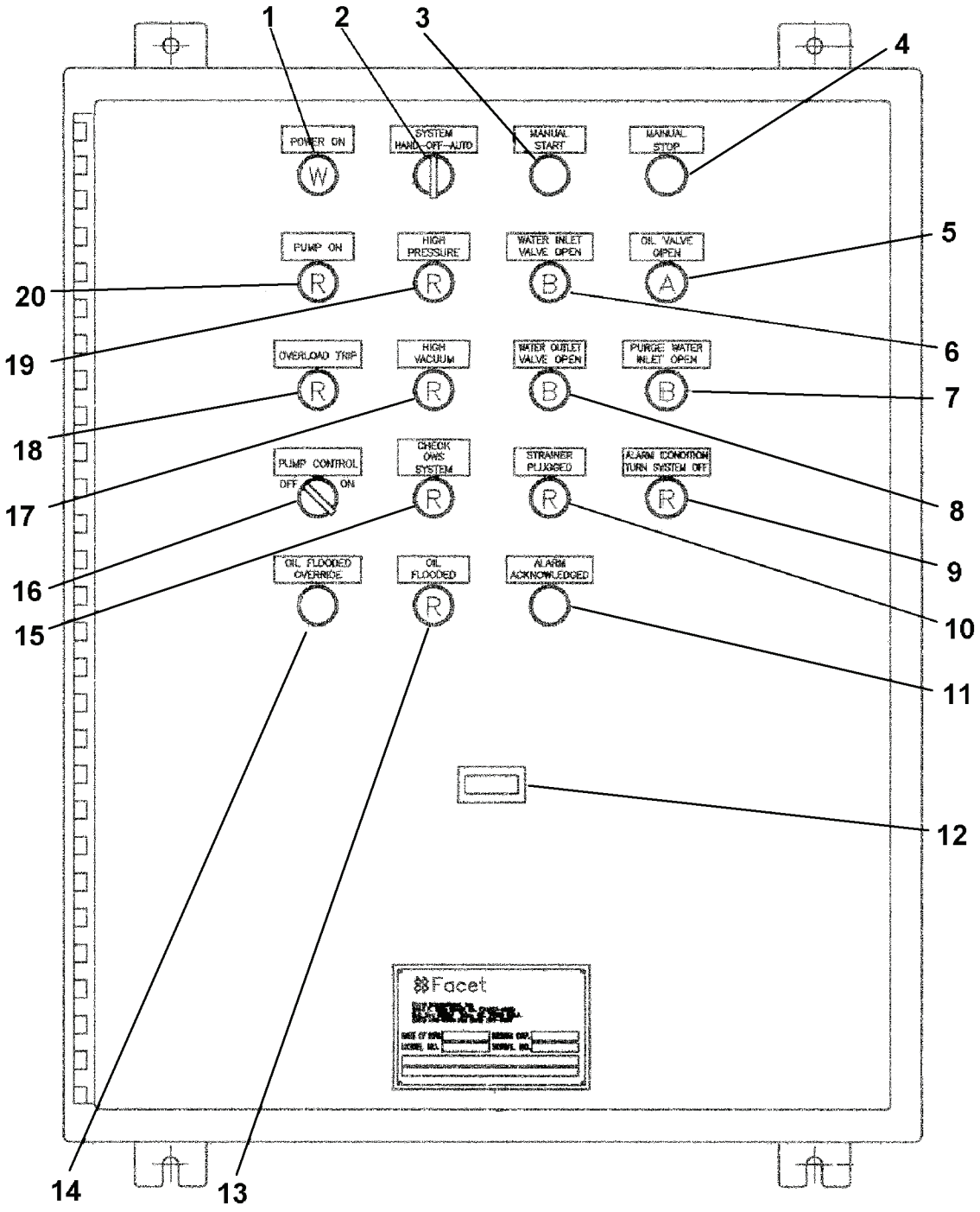

Figure 1-3. OWS Control Panel Assembly Controls and Indicators.

Table 1-2. OWS Control Panel Assembly Controls and Indicators.

No.	Control or Indicator	Function
1	POWER ON Indicator	The white indicator light (LT-1) illuminates when 220 VAC 3-PH 60 Hz is applied to the OWS.
2	SYSTEM HAND-OFF-AUTO Switch	The switch (SS-1) selects the mode of operation of the OWS, either manual or automatic. It has three positions HAND, OFF and AUTO.
3	MANUAL START Pushbutton Switch	Pressing this switch (PB-2) with SYSTEM HAND-OFF-AUTO Switch in HAND, starts the manual operation of the OWS.
4	MANUAL STOP Pushbutton Switch	Pressing this switch (PB-1) with SYSTEM HAND-OFF-AUTO Switch in HAND, stops the manual operation of the OWS.
5	OIL VALVE OPEN Indicator	This amber indicator (LT-8) illuminates when oil outlet valve is open.
6	WATER INLET VALVE OPEN Indicator	This blue indicator (LT-7) illuminates when the water inlet valve is open.
7	PURGE WATER INLET OPEN Indicator	This blue indicator (LT-9) illuminates when the water valve is open.
8	WATER OUTLET VALVE OPEN Indicator	This blue indicator (LT-5) illuminates when the water outlet valve is open.
9	ALARM CONDITION TURN SYSTEM OFF Indicator	This red indicator (LT-13) illuminates when a major fault has occurred in the system and should be immediately secured.
10	STRAINER PLUGGED Indicator	This red indicator (LT-12) illuminates when Remote Differential Pressure Strainer Switch is closed.
11	ALARM ACKNOWLEDGED Pushbutton Switch	If the strainer plugged alarm sounds, pressing this switch (PB-4) silences the alarm.
12	ELAPSE TIMER	This elapse timer (ETI) operates when the motor is operating.
13	OIL FLOODED Indicator	This red indicator (LT-10) illuminates when an excessive amount of oil has collected in the OWS tank section or only air is present.
14	OIL FLOODED OVERRIDE Pushbutton Switch	Pressing this switch (PB-3) allows the OWS system to continue to operate, turns off OIL FLOODED and CHECK OWS SYSTEM indicators and prevents the strainer plugged alarm from being silenced.
15	CHECK OWS SYSTEM Indicator	This red indicator (LT-11) illuminates when any of the five alarm conditions have occurred.
16	PUMP CONTROL OFF-ON Switch	This switch (SS-2) controls the motor. It has two positions ON and OFF.
17	HIGH VACUUM Indicator	This red indicator (LT-4) illuminates when high vacuum has occurred in the system.
18	OVERLOAD TRIP Indicator	The red indicator (LT-6) illuminates when a motor speed overload (motor over current) has occurred.
19	HIGH PRESSURE Indicator	This red indicator (LT-3) illuminates when high pressure has occurred in the system.
20	PUMP ON Indicator	The red indicator (LT-2) illuminates when the pump is operating.

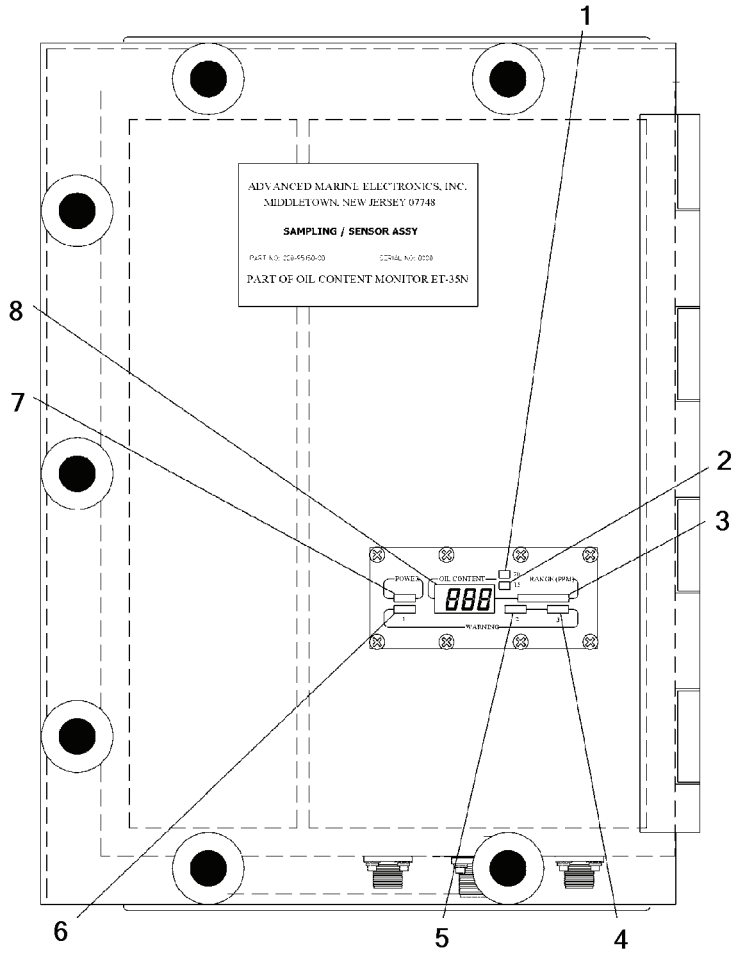

Figure 1-4. OCM Sampling/Sensor Assembly Controls and Indicators.

NOTE

Although the OCM has a limit of 70 PPM, DOD vessels are not authorized to operate at this range. In accordance with DOD 4715.6-R1, Regulations On Vessels Owned Or Operated By The Department Of Defense, the only acceptable range of operation is 15 PPM.

Table 1-3. OCM Sampling/Sensor Assembly Controls and Indicators.

No.	Control or Indicator	Function
1	70 PPM Indicator	Alarm limit set to 70 PPM. (Refer to note above.)
2	15 PPM Indicator	Alarm limit set to 15 PPM.
3	RANGE PPM Indicator	Indicates system is operating.
4	WARNING 3 Indicator	OCM is in WARNING status 3. Dirt or foam in sample, or no flow; maintenance required.
5	WARNING 2 Indicator	OCM is in WARNING status 2. Dirt or bubbles in sample.
6	WARNING 1 Indicator	OCM is in WARNING status 1. OCM Fuse (2 Amp) is blown.
7	POWER Indicator	OCM system power is available.
8	OIL CONTENT LCD Display	Numerical LCD display of oil content.

1-9. Equipment Data. Characteristics and reference data are provided in Table 1-4. Also, see the equipment data given in the operator's manual, TM 55-1905-223-10.

Table 1-4. Equipment Data

Characteristics	Reference Data		Normal Operating Range
Oil-Water Separator (OWS)			
Manufacturer	Facet International Inc.		
Model Number	OPB-10NP/SR02		
Tank Capacity	138 Gallons		
Processing Capacity	10 gpm		
Pump	Jabsco #777-9003		
Pump Construction	Bronze housing, rubber impeller		
Suction Lift	10 feet of water		
Effluent Discharge Head	25 psi		
Pump/Motor	Baldor #1706T		
Gauges:			
Strainer In	Instruments East, 30 PSI – 0 – 30 in Hq.		< 5 PSI difference of Outlet
Strainer Out	Instruments East, 30 PSI – 0 – 30 in Hq.		< 5 PSI difference of Inlet
OWS Outlet Pressure	Weksler, 0 – 30 PSI		5-15 PSI
Purge Water Pressure	Weksler, 0 – 60 PSI		10-12 PSI
Compound Gauge	30 PSI – 0 – 30 in Hq.		< 15 PSI and < 16 in.HG
Oil Content Monitor (OCM)			
Manufacturer	Advanced Marine Electronics		
Model Number	ET-35N		
Monitoring Capacity	10 gpm		
Input Power	230 VAC		
Gauges:			
OCM Inlet Pressure	Weksler, 0 – 30 PSI		5-15 PSI
Water Polisher	Advanced Water Systems		
Effluent Flow Rate	10 gpm		
Filter Media	PLFM		
Number of filter canisters	Nine (9)		
Water polisher pressure gauge	Weksler, 0 – 30 PSI		< 12 PSI
Unit dimensions	OWS Tank:	37" x 31.375" x 68.4375"	
	Control Panel:	31.35" x 24" x 8"	
	OCM:		
	Oil Content Monitor	18.3" x 13.5" x 7.1"	
	Remote Indicator (Alarm)	9.5" x 7" x 4.4"	
	Remote Relay Assembly	9.5" x 7" x 3.8"	
	Water Polisher:	49" x 39" x 16"	
Unit weight (Approximately)	OWS:		
	Dry	940 lbs.	
	Wet	2,400 lbs.	
	OCM:		
	Oil Content Monitor	60.5 lbs.	
	Remote Alarm Panel	6.9 lbs.	
	Relay Assembly	7.4 lbs.	
	Polisher:		
	Dry	694 lbs.	

1-10. Safety, Care, and Handling. Safety precautions must be observed at all times while performing maintenance. General WARNINGS and first-aid data appear in the front of this manual. Review all safety information before starting any task. Carefully read through an entire maintenance procedure before performing any maintenance function. Make sure the task can be done safely. All WARNINGS, CAUTIONS, and NOTES are of great importance to your safety and the safety of the equipment.

SECTION III. PRINCIPLES OF OPERATION

1-11. Oil-Water Separator. The oil-water separator system utilizes four subsystems for operation and consists of the dirty oil pump, oil-water separator, oil content monitor and water polisher. These subsystems are explained as follows. See Figure 1-5 for the OWS system flow diagram.

a. Dirty Oil Pump. The dirty oil pump is a multi-use pump and when used for oil-water separation, is used to pump oily waste water from bilges and other areas to the sludge tank. The dirty oil pump is also used to pump bulk used oil from machinery to the dirty oil tank, and pump from the dirty oil tank to shore discharge facilities. The START/STOP switches and pressure gauge are locally mounted near the pump for ease of operation with remote stop buttons located on the 1st deck port and starboard.

b. Oil-Water Separator (OWS). The OWS subsystem consists of a control panel, separator tank, duplex strainer, pump, oil/air and oil water sensors, compound gauge, sight glass, motorized valves, pressure switches and gauge panel.

(1) Control Panel. The OWS is controlled at the control panel and can be operated in two different modes. HAND is used to operate for troubleshooting purposes and for maintenance functions, and requires the manual START and STOP pushbuttons depressed for operation. AUTO is the normal mode used for processing oily waste water from the sludge tank. The control panel houses system indicators as shown in Figure 1-3 and an internal alarm when system failure occurs.

(2) Separator Tank. The separator tank is where the physical separation occurs when the oil from the water is attracted to the coalescing plates and floats to the top of the tank and into the oil tower. The coalescing plates force the oil in the oily water to rapidly accumulate into large droplets. The coalescing plates are arranged in two horizontal and one vertical stack inside the tank. Zinc anodes are located in the tank to prevent galvanic action and protect the tank. The tank normally operates in a vacuum condition while drawing oily water from the sludge tank. Oils with a specific gravity of 1.0 or greater cannot be separated by this system. Synthetic oils cannot be processed with this system either. Significant amounts of detergents and emulsifying chemicals in the wastewater influent will also affect the ability of the OWS to consistently produce a processed effluent containing less than 15 ppm of oil.

(3) Duplex Strainer. The duplex strainer removes non liquid objects from the oily waste water from the sludge tank. The system does not require shutdown to clean a strainer basket.

(4) OWS Pump. The OWS pump draws suction from the separator tank, and moves the water to overboard discharge or back to the sludge tank. The rubber vane pump requires a flooded suction to prevent pump damage from being run dry. A level sensor mounted in the sludge tank prevents the OWS pump from operating in the AUTO mode when the sludge tank fluid level is low, protecting the pump from running dry.

(5) Oil/Water Sensor. The oil/water sensor consists of three electrodes which detect collected oil and entrapped air in the oil tower. The OWS pump stops the motorized valves, which stops incoming influent. The pump also opens the seawater feed to aid in purging the oil to the dirty oil tank.

(6) Oil/Air Sensor. The oil/air sensor consists of two electrodes and shuts down the system if the separator floods with oil or air. The sensor operates on the same principle described for the oil/water sensor above. When immersed in oil or air, the electrodes deactivate safe-pak (LS2), causing the relay to de-energize. The pump then stops. The effluent valve and oil discharge valve close causing the audible alarm to sound and CHECK OWS SYSTEM and OIL FLOODED indicators to illuminate.

(7) Compound Gauge. The compound gauge is set to shutdown the OWS if either the pressure (15 psi) or vacuum (16 in. Hg) in the separator tank is reached.

(8) Sight Glass. Located in the water discharge piping from the OWS pump to give the operator an indication of system flow and quality.

(9) Motorized Valves. These valves are controlled by the OWS control panel to open and close depending on the signals from the oil/air and oil/water sensors. The four valves control the OWS water supply and discharge, separator tank inlet, and oil discharge to the dirty oil tank. The valves close on system shutdown.

(10) Pressure Switches. The pressure switches sense the pressure of the OWS system and shut down the system when the pressure is either too high or too low.

(11) Gauge Panel. The gauge panel consists of four OWS system gauges and one OCM system gauge for purge water pressure, OCM inlet pressure, OWS outlet pressure, strainer inlet and outlet pressures.

c. Oil Content Monitor (OCM). The OCM controls the directional output of effluent from the OWS by measuring the oil concentration in the processed water. The OCM sensor detection assembly (SDA) houses the control section which sends a signal to the diverter valve to divert water overboard or back to the sludge tank. Flush water of a minimum 5 psi is required to start the OCM and to clean out the detection assembly. The flow through the OCM system is shown in Figure 1-6.

(1) Sensor Detection Assembly (SDA). The SDA samples the processed discharge from the water polisher or OWS (if water polisher is bypassed) and controls the operation of the OWS system. The sample is measured to indicate oil content, and this signal is sent to the LCD display on the remote alarm assembly and on the front panel display of the SDA. The Sensor Detection Assembly, printed circuit board and elapsed timer must be replaced as a set every 2 years or 2,000 hours, whichever occurs first.

NOTE

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(2) Remote Alarm Assembly. The remote alarm assembly displays the current oil content of the processed water, provides a means to change ppm alarm settings from 15 to 70, and an audio/visual alarm when the ppm set point is exceeded.

(3) Remote Relay. The remote relay connects the SDA, remote alarm assembly, audible alarm and OWS system at the control panel. A junction box provides a space for connections of the individual assemblies.

d. Water Polisher. The water polisher contains three rows of filters stacked three high which further aids in removal of oil from the processed water to attain parts per million setting or less.

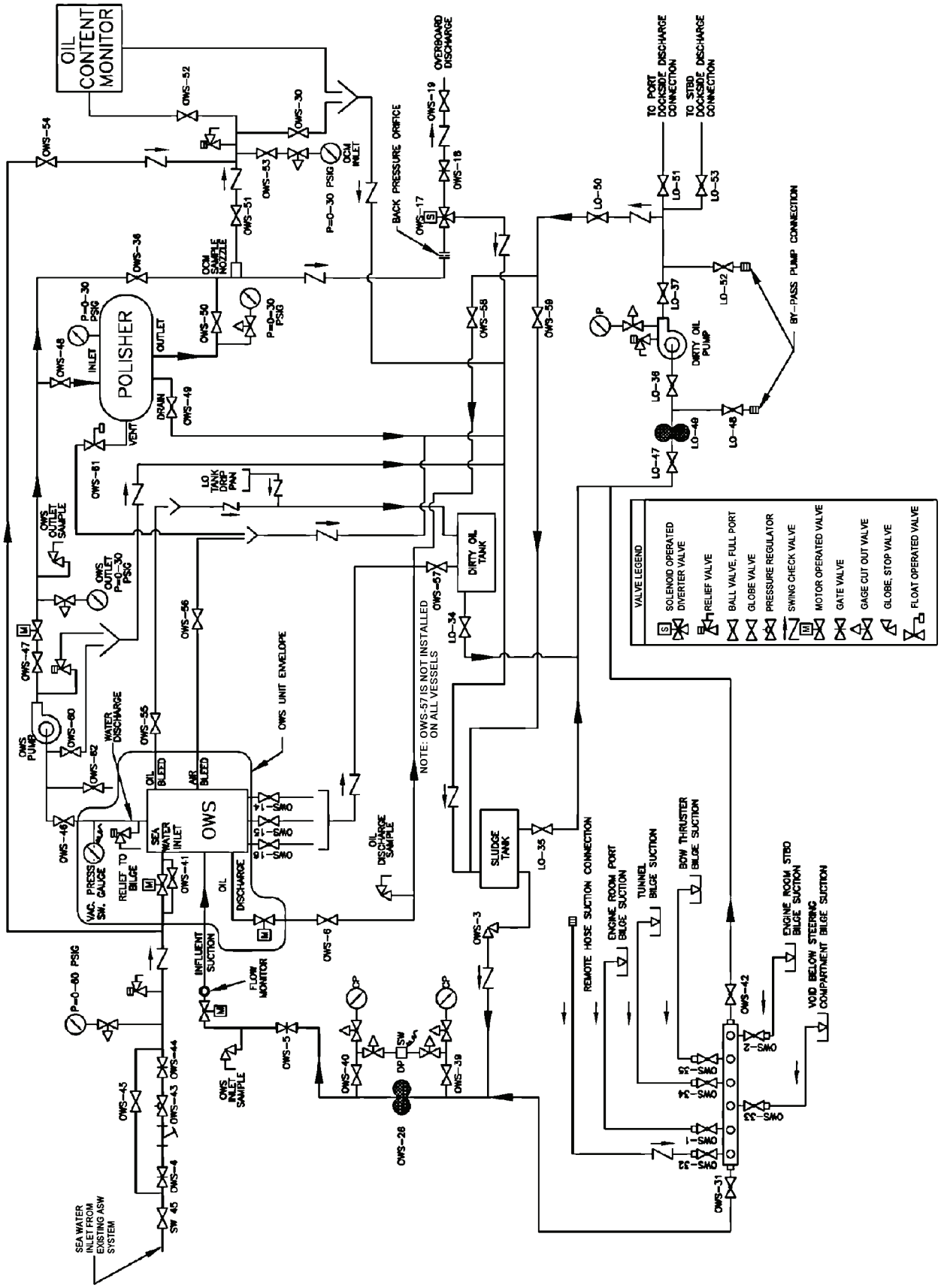
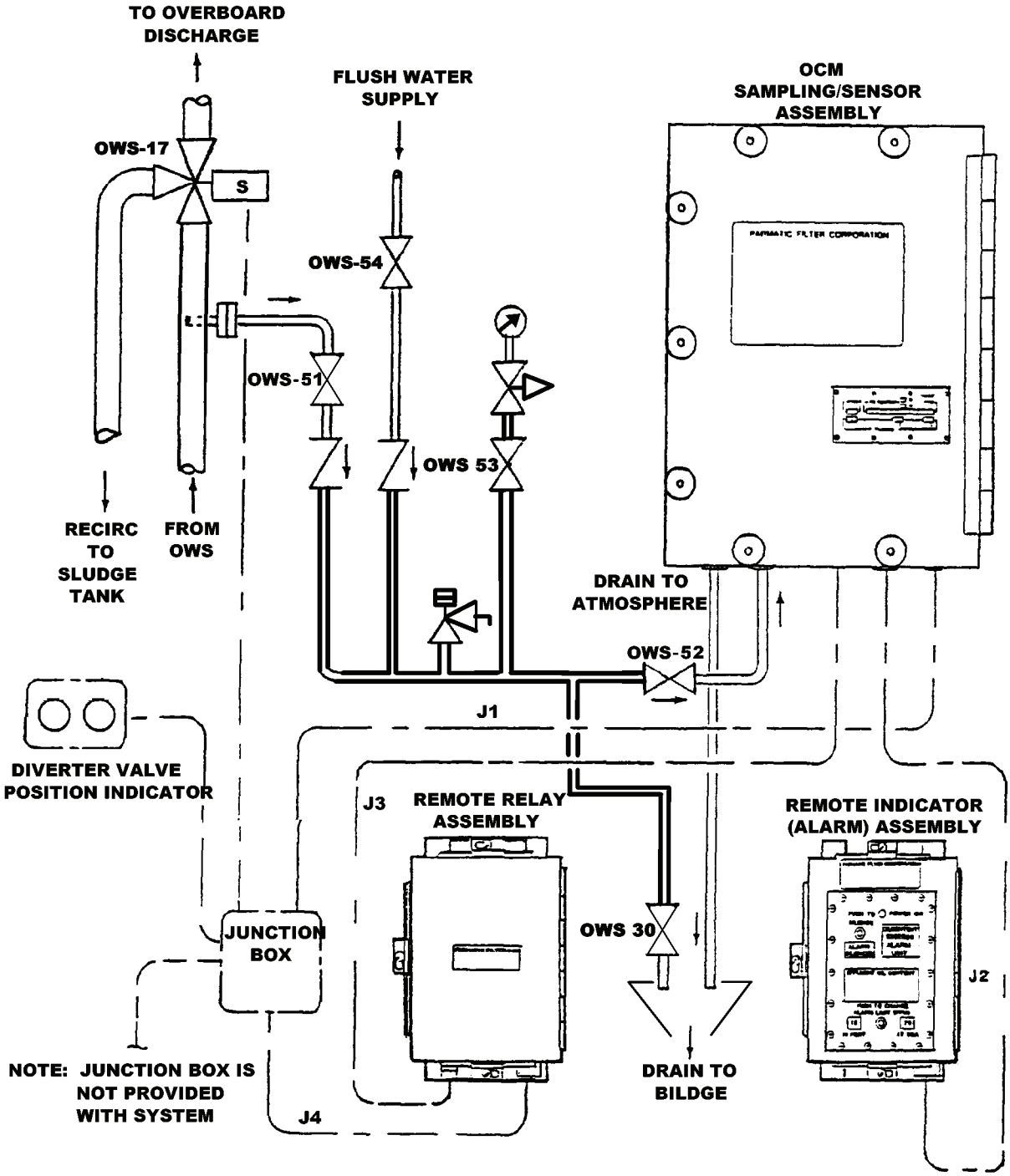


Figure 1-5. OWS System Flow Diagram.



LEGEND:
OWS 17 DIVERTER VALVE
OWS 30 OCM SAMPLE VALVE
OWS 51 SAMPLE INLET VALVE
OWS 52 OCM INLET VALVE
OWS 53 OCM INLET PRESSURE VALVE
OWS 54 FLUSH INLET VALVE

INTERCONNECTION CABLES:
J1 P/N ST25009-1
J2 P/N ST25009-2
J3 P/N ST25009-3
J4 P/N ST25009-4

Figure 1-6. Oil Content Monitor (OCM) System Flow and Electrical Diagram.

CHAPTER 2

UNIT MAINTENANCE INSTRUCTIONS

SECTION I. REPAIR PARTS; SPECIAL TOOLS; TEST, MEASUREMENT, AND DIAGNOSTIC EQUIPMENT (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), CTA 50-970, Expendable/Durable Items (Except: Medical Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment or CTA 8-100, Army Medical Department Expendable/Durable Items, as applicable to your unit.

2-2. Special Tools, TMDE, and Support Equipment. Special tools; test, measurement, and diagnostic equipment; and support equipment requirements are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P. These items are also listed in the Maintenance Allocation Chart (MAC), Appendix B of this manual.

2-3. Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P.

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 750-8.

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 750-8.

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.

e. Remove chocks from resilient mounted components.

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. Preliminary Servicing and Adjustment. It is important that careful preparations and inspection be made before the oil-water separator system is put in use.

a. Initial Setup, Oil-Water Separator (OWS). Before initial start of OWS, make the following inspection:

(1) Inspect OWS piping system to include all fittings and valves for serviceability (Figure 1-5).

(2) Inspect OWS tank for leaks and tank cover is secure.

(3) Inspect OWS pump for leaks (Figure 1-1).

(4) Inspect OWS Control Panel for serviceability (Figure 1-3).

b. Oil Content Monitor (OCM).

(1) Inspect OCM panel for serviceability (Figure 1-4).

(2) Inspect Remote Indicator (Alarm) Panel in EOS for serviceability (Figure 1-2).

c. Water Polisher.

(1) Inspect polisher for leaks and covers are secure (Figure 1-1).

d. Dirty Oil Pump.

(1) Inspect pump for leaks (Figure 1-1).

2-7. Prestart Checks.

a. Verify that OWS has been previously shutdown properly and unit has been appropriately secured from any prior maintenance activity.

b. Verify that circuit breakers for the OWS and OCM are turned on (FO-1, Sheet 2). Ensure that all system valves are closed (Figures 1-5 and 1-6).

c. Verify that sludge tank has sufficient level/volume to operate system (Figure 1-5).

d. Ensure that all associated gauge valves are opened.

NOTE

To conduct troubleshooting or training of the OWS system while inport, align system to recirculate to sludge by pulling both pins on the diverter valve. Ensure overboard discharge valves (OWS-18 and OWS-19) are shut and procede to paragraph 2-8.4.

e. Ensure overboard discharge valves (OWS-18 and OWS-19) are opened.

2-8. Normal Startup.

a. System Startup Procedure

(1) Open the seawater supply valve (SW-45, Figure 1-5) from ASW system to the OWS. Ensure seawater supply bypass valve (OWS 45) is shut.

(a) Ensure that seawater regulator isolation valves (OWS-4 and OWS-44) are opened.

(b) Verify that the purge water supply pressure available is 10-12 psig at the pressure gauge. If not, adjust the pressure regulator valve (OWS-43) accordingly.

(2) Align the valves for the OWS operation as follows: (Figure 1-5)

(a) If operating from the sludge tank, open suction valve (OWS-3).

CAUTION

Avoid processing bilge water with high oil concentrations as this may result in increased maintenance requirements for the OWS. Refer to steps 2-9.a and 2-9.c. If necessary use step 2-9.b.

NOTE

Under normal conditions, the dirty oil pump should be used to pump out bilge pockets to protect OWS system from bulk oil and solids contamination.

(b) If operating from the bilge, open the manifold suction COV (OWS-31), and the appropriate bilge suction valve:

SPACE	VALVE	VALVE LOCATION
Void below steering compartment	(OWS-33)	Forward of Engine Operating Station
Engine room starboard bilge	(OWS-2)	Forward of Engine Operating Station
Engine room port bilge	(OWS-1)	Forward of Engine Operating Station
Remote hose suction	(OWS-32)	Forward of Engine Operating Station
Tunnel bilge suction	(OWS-34)	Forward of Engine Operating Station
Bow thruster suction	(OWS-35)	Forward of Engine Operating Station

(c) If using the polisher, open the polisher inlet and outlet valves (OWS-48 and OWS-50), and ensure polisher bypass valve (OWS-36) is closed.

(d) If not using the polisher, open the polisher bypass valve (OWS-36) and ensure the polisher inlet and outlet valves (OWS-48 and OWS-50), are closed.

(3) Prime the OWS with water as follows: (Figure 1-5)

(a) Open influent inlet valve (OWS-5) to prime suction piping.

(b) Open the forward separator air bleed COV (OWS-56) at the oil discharge tower.

(c) Open the aft separator oil bleed COV (OWS-55) near the backup oil sensor.

NOTE

When filling the OWS, water will always discharge out of the aft oil bleed COV (OWS-55) before the forward air bleed COV (OWS-56) due to the difference of design height.

(d) Open the OWS manual fill valve (OWS-41) on the aft end of the OWS tank.

(e) To prime the OWS pump, open OWS pump suction valve (OWS-46) and inlet prime valve (OWS-60). Observe drain: when a steady stream is observed, close inlet prime valve (OWS-60).

CAUTION

To prevent damage to the OWS, the following step must be followed in the sequence given.

(f) To ensure that the OWS tank is filled properly, fill OWS tank with water until water is observed discharging from the aft oil bleed COV (OWS-55). Close the aft oil bleed COV (OWS-55), continue filling unit until water is observed discharging from the forward air bleed COV (OWS-56). Close the manual fill valve (OWS-41). Close the forward air bleed COV (OWS-56).

(g) Open OWS discharge valve (OWS-6), OWS pump discharge valve (OWS 47) and OWS discharge drain (OWS-57, if installed) to the dirty oil tank.

(4) Flush the OCM as follows:

(a) Select the IN-PORT (15 ppm) (7, Figure 1-2) OCM alarm set point for the OCM.

(b) Ensure OCM selector switch is placed in the AUTO position.

(c) Ensure that the OCM nozzle sampler valve (OWS-51, Figure 1-5) and OCM inlet cutout valve (COV) (OWS-52) are opened.

(d) Open the seawater flushing valve (OWS-54) to flush the OCM. Verify OCM inlet pressure gauge indicates 5 to 15 psig.

(e) Observe that water is discharging from OCM drain.

(f) After 2 to 5 minutes of OCM flushing, close seawater flushing valve (OWS-54).

(5) Start the OWS as follows:

NOTE

AUTO MODE – Use when sludge tank is above 50% of tank capacity. The system will operate without operator assistance.

HAND MODE – Use when sludge tank is partially filled. The operator must depress the start/stop pushbuttons to operate and secure the OWS. Constant monitoring of the system is required.

(a) Select mode of operation with system HAND-OFF-AUTO switch.

(b) Set PUMP CONTROL switch to ON.

(c) Depress the MANUAL START pushbutton (HAND mode only).

(d) Observe the OWS control panel for indicator lights when started as follows:

- OWS discharging overboard - POWER ON, WATER INLET VALVE OPEN, WATER OUTLET VALVE OPEN and PUMP ON indicator lights illuminated.

- OWS recirculating back to sludge tank - POWER ON, OIL VALVE OPEN and PURGE WATER INLET OPEN indicator lights illuminated.

b. <u>During Operation</u>

(1) Observe that the OWS discharge pressure gauge is indicating between 5 to 15 psig.

(2) The following will be observed on the control panel when the OWS goes into the oil discharge mode to the dirty oil tank:

(a) POWER ON, OIL VALVE OPEN and PURGE WATER INLET OPEN indicator lights illuminated.

(b) Once the oil discharge mode is complete, the OWS resumes overboard/recirculation mode.

(3) The OCM 3-way diverter valve (OWS-17) position indicator will be observed indicating the following system modes.

(a) Green light: OWS/polisher effluent is discharging overboard.

(b) Red light: OWS/polisher effluent is recirculating back to the sludge tank.

c. Shutdown Procedure (Normal or Emergency).

(1) Normal

(a) If operating in HAND mode, depress the MANUAL STOP pushbutton. If operating in AUTO mode, depress and hold the MANUAL STOP pushbutton until the OWS pump stops.

(b) Place PUMP CONTROL and SYSTEM HAND-OFF-AUTO switches in the OFF position at the OWS control panel.

(c) Open the OCM seawater flushing valve (OWS-54) and flush OCM for 5 to 10 minutes. Close seawater flushing valve (OWS-54) when complete.

(d) Close the sludge tank suction valve (OWS-3).

(e) To back flush oil tower:

1 Open the air bleed COV (OWS-56) on the oil discharge tower.

2 Open the manual fill valve (OWS-41). Flush OWS until clean water discharges from air bleed COV (OWS-56). Close manual fill valve (OWS-41).

3 Close air bleed COV (OWS-56).

4 Ensure all OWS valves are closed.

(2) Emergency

(a) If operating in HAND mode, depress the MANUAL STOP pushbutton. If operating in AUTO mode, depress and hold the MANUAL STOP pushbutton until the OWS pump stops.

(b) Place PUMP CONTROL and SYSTEM HAND-OFF-AUTO switches in the OFF position at the OWS control panel.

(c) Close the sludge tank suction valve (OWS-3).

2-9. Dirty Oil Transfer Alignment

a. Dirty Oil Pump Bilge Suction Operations to Sludge Tank. (Figure 1-5)

NOTE

Under normal conditions the dirty oil pump should be used to pump out bilge pockets to protect OWS system from bulk oil and solids contamination.

(1) Turn on power at dirty oil pump motor controller. Ensure all OWS and LO valves are closed.

(2) Select desired bilge suction valve:

SPACE	VALVE	VALVE LOCATION
Void below steering compartment	(OWS-33)	Forward of Engine Operating Station
Engine room starboard bilge	(OWS-2)	Forward of Engine Operating Station
Engine room port bilge	(OWS-1)	Forward of Engine Operating Station
Remote hose suction	(OWS-32)	Forward of Engine Operating Station
Tunnel bilge suction	(OWS-34)	Forward of Engine Operating Station
Bow thruster suction	(OWS-35)	Forward of Engine Operating Station

(3) Open valves OWS-42, LO-47, LO-36, LO-37, LO-50, and OWS-59.

(4) Depress dirty oil pump START pushbutton.

(5) Visually verify that selected bilge area has been drained. If bilge does not drain, check dirty oil pump strainer (LO-49) or appropriate bilge suction foot valve strainer for blockage. Ensure that only one suction valve is open at a time.

(6) When dirty oil pump loses suction (indicated on dirty oil pump pressure gauge), depress dirty oil pump STOP pushbutton. Verify bilge water is below bilge suction at foot valve.

(7) Ensure all OWS and LO valves are closed. Secure power at dirty oil pump motor controller.

b. Dirty Oil Pump Sludge Tank to Dirty Oil Tank.

NOTE

The bulk oil in the sludge tank should be pumped to the dirty oil tank if OWS is continuously in the oil discharge mode after the water has been processed by the OWS.

(1) Turn on power at dirty oil pump motor controller. Ensure all LO valves are closed.

CAUTION

Compare soundings from dirty oil and sludge tanks to ensure transfer will not overfill the dirty oil tank.

(2) Open valves LO-35, LO-47, LO-36, LO-37, LO-50, OWS-58 and OWS-57 (if installed).

(3) Depress dirty oil pump START pushbutton and observe dirty oil pump discharge gauge for discharge pressure.

(4) Depress STOP pushbutton upon loss of pressure as indicated on dirty oil pump pressure gauge or if desired tank levels are reached.

(5) Close all opened valves and secure power at the dirty oil pump motor controller.

c. Dirty Oil Pump Bilge Suction Operations to Dirty Oil Tank (Figure 1-5)

CAUTION

In the event of a fuel oil spill, with subsequent AFFF application, the affected bilge pocket should be pumped directly to the dirty oil tank. These agents restrict the sensors ability to sense oil and can result in overboard oily waste discharge.

(1) Turn on power at dirty oil pump motor controller. Ensure all LO valves are closed.

(2) Select desired bilge suction valve:

SPACE	VALVE	VALVE LOCATION
Void below steering compartment	(OWS-33)	Forward of Engine Operating Station
Engine room starboard bilge	(OWS-2)	Forward of Engine Operating Station
Engine room port bilge	(OWS-1)	Forward of Engine Operating Station
Remote hose suction	(OWS-32)	Forward of Engine Operating Station
Tunnel bilge suction	(OWS-34)	Forward of Engine Operating Station
Bow thruster suction	(OWS-35)	Forward of Engine Operating Station

(3) Open valves OWS-42, LO-47, LO-36, LO-37, LO-50, OWS-58 and OWS-57 (if installed).

(4) Depress dirty oil pump START pushbutton.

(5) Visually verify that selected bilge area has been drained. If bilge does not drain, check dirty oil pump strainer (LO-49) or appropriate bilge suction foot valve strainer for blockage. Ensure that only one suction valve is open at a time.

(6) When dirty oil pump loses suction (indicated on dirty oil pump pressure gauge), depress dirty oil pump STOP pushbutton. Verify bilge water is below bilge suction at foot valve.

(7) Ensure all OWS and LO valves are closed. Secure power at dirty oil pump motor controller.

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

2-10. 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 2404/5988E. In the Item Number column on DA Form 2404/5988E, record the appropriate Item Number from the PMCS Table.

The column labeled "Equipment is Not Ready/Available If:" of the PMCS, Table 2-1 is not intended to imply the condition of the vessel. This column only indicates the condition of the equipment.

Table 2-1. Preventive Maintenance Checks and Services

D - During W - Weekly M - Monthly Q - Quarterly S - Semiannually A - Annual A/R-As Required

Item No.	Interval							Items To Be Inspected/Serviced	Procedures	Equipment is Not Ready/Available If:
	D	W	M	Q	S	A	A/R			
1	•							Gauge Panels	Inspect for proper operation, see equipment data Table 1-4. **WARNING** **Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.**	Instrument gauge inoperative.
2								Oil Content Monitor		
				•				Ultrasonic Vibrator Adjustment	Ultrasonic vibrator adjustment: Adjust core of oscillation transformer on ultrasonic generator PCB for maximum resonance (maximum noise output) (Adjustment Task, Paragraph 2-26).	Not possible to determine the coarse adjustment range because only weak or unsteady noise is generated.
							•	OCM Sensor Detection Assembly (SDA)	Clean SDA by flushing (Paragraph 2-8). Inspect for damage.	If warning lights 2 and 3 cannot be cleared by flushing.
							•	OCM Sensor Detection Assembly (SDA), Printed Circuit Board (PCB) and Elapsed Time Indicator (ETI)	Remove and replace as a calibrated set every 2,000 hours of operation or 2 years after calibration date, whichever occurs first (Paragraph 3-12).	ETI indicates more than 2,000 hours or more than 2 years since calibration.

Table 2-1. Preventive Maintenance Checks and Services

D - During W - Weekly M - Monthly Q - Quarterly S - Semiannually A - Annual A/R-As Required

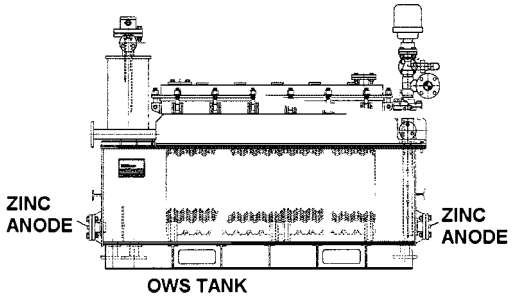
Item No.	Interval							Items To Be Inspected/Serviced	Procedures	Equipment is Not Ready/Available If:
	D	W	M	Q	S	A	A/R			
3					•			OWS Tank	Check zinc anode plug in OWS tank and measure remaining zinc. Replace if less than 3 inches in length (Paragraph 2-14). 	If zinc is less than 3 inches in length.
							•	OWS Tank	Clean coalescer plates when ppm alarm set limit cannot be obtained by the OWS and water polisher (Paragraph 2-14). Inspect tank for damage and deterioration of tank coating.	PPM set point is exceeded IN PORT or AT SEA.
4					•			Oil/Water and Oil/Air Interface Sensors	Clean oil level sensor electrodes and inspect for damage and corrosion. Service and replace as needed (Paragraph 2-15).	Faulty level indication.
5					•			Remote Relay Assembly	Check for loose electrical connections, stuffing tubes and damage to door seals. Repair as necessary (Paragraph 2-28).	
6					•			Relief Valves	Test relief valve in accordance with relief valve data (Paragraph 2-25).	Valve fails to operate.

Table 2-1. Preventive Maintenance Checks and Services

D - During W - Weekly M - Monthly Q - Quarterly S - Semiannually A - Annual A/R-As Required

Item No.	Interval							Items To Be Inspected/Serviced	Procedures	Equipment is Not Ready/Available If:
	D	W	M	Q	S	A	A/R			
									WARNING **Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.**	
7						●	●	Motorized Valves	Clean motorized valves, inspect for damage, and lubricate as required (Paragraph 2-22).	Valve fails to operate.
8						●		Control Panel	Check for loose electrical connections, stuffing tubes and damage to door seals. Repair as necessary (Paragraph 2-20).	
9						●	●	Check Valves	Clean check valves, inspect for damage, repair or replace as necessary (Paragraph 2-31).	
10							●	Sight Glass	Clean and inspect for damage.	
11							●	Diverter Valve	Inspect and check knob for freedom of movement (Paragraph 2-23).	Valve stuck.

SECTION IV. UNIT MAINTENANCE TROUBLESHOOTING PROCEDURES

2-11. 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

Table 2-2 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 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

NOTE

During all troubleshooting, it is assumed vessel power source is operating correctly, start up and shut down procedures correctly followed and all applicable valves are open.

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02

1. POWER ON (OWS) indicator does not illuminate.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 1. Measure for 230 VAC across power in terminals (FO-1, Sheet 2 and FO-2).
If no voltage present, activate main disconnect switch.

STEP 2. Measure for voltage across lampholder terminals.
If voltage present, replace lamp (Paragraph 2-20).

STEP 3. Measure for voltage across lampholder terminals.
If no voltage present, correct wiring or replace lampholder (Paragraph 2-20).

2. System fails to start in HAND mode when MANUAL START pushbutton is depressed.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 1. Measure for voltage across switch.
If no voltage present, replace defective switch (Paragraph 2-20).

STEP 2. Measure for voltage across terminals with pushbutton depressed.
If no voltage present, replace pushbutton (Paragraph 2-20).

3. System fails to start in AUTO mode.

STEP 1. Check that liquid is above the high level sensor in sludge tank.
Wait for liquid level to rise.

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

3. System fails to start in AUTO mode. (cont).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. If sludge tank is full, inspect sludge level sensors and wires (Paragraph 2-15).
If sludge tank level sensors are stuck in the open position: service or repair (Paragraph 2-15).
If sludge tank level senor wires are charred or damaged replace (Paragraph 2-15).

STEP 3. If sludge tank is full, check operation of SAFE-PAK (LS3) (Paragraph 2-20).
Install jumper between TB1-20 and TB1-21 and TB-21 and TB-22 in OWS Control Panel.
If pump starts service or repair sludge tank level sensor (Paragraph 2-15).

STEP 4. SAFE-PAK (LS3) is defective. Measure for voltage across TB1-40 and TB1-N in OWS Control Panel.
If no voltage is present replace SAFE-PAK (LS3) (Paragraph 2-20).
If voltage is present replace relay K-8 (Paragraph 2-20).

STEP 5. Relay R1 is defective. Measure for voltage across TB1-3 and TB1-N in OWS Control Panel.
If no voltage is present replace Relay R1 (Paragraph 2-20).

4. Check OWS System light illuminated with malfunction light.

STEP 1. Pump overload trip indicator is illuminated. Allow pump to cool, reset OL1 inside OWS Control Panel (Figure 1-3).
If OL1 continues to trip, service or repair pump and motor (Paragraphs 2-16 and 2-17).

STEP 2. Oil flooded indicator is illuminated. Check oil discharge sample.
If oil flooded; drain OWS to dirty oil tank.
If contaminated or contains bubbles drain and service level sensors (Paragraph 2-15).

STEP 3. High pressure indicator is illuminated. Purge water and oil discharge valves remain open.
Shut purge water and oil discharge valves by deenergizing OWS. Ensure compound gauge is set at 15 psig (Paragraph 2-21).
Verify valve lineup (Paragraph 2-8).
Service or repair OWS pump or motor (Paragraphs 2-16 and 2-17).
Service or repair Motorized valves (Paragraph 2-22).
Service or repair Diverter valve (Paragraph2-23).
Service or repair Relief valve (Paragraph 2-25).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

4. Check OWS System light illuminated with malfunction light. (cont).

STEP 4. High vacuum indicator is illuminated. OWS system operation will stop.
Shut purge water and oil discharge valves by deenergizing OWS. Ensure compound gauge is set at 16in. Hg. (Paragraph 2-21).
Verify valve lineup (Paragraph 2-8).
Service or repair OWS pump or motor (Paragraphs 2-16 and 2-17).
Service or repair Motorized valves (Paragraph 2-22).
Test and replace Relief valves (Paragraph 2-25).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 5. Strainer plugged indicator is illuminated. Indicates differential pressure greater than 5 psi.
Service (PMCS, TM 55-1905-223-10) or repair strainer (Paragraph 2-24).
Adjust or replace differential pressure switch (Paragraph 2-30).

5. Separator flooded shutdown.

STEP 1. Open valve OWS-55 (Figure 1-5). While depressing OVERRIDE pushbutton, depress MANUAL START pushbutton.
If air comes from OWS-55, prime system by opening OWS-41.
If oil comes from OWS-55, restart system, remove oil.

6. No oil removal.

STEP 1. Remove Oil/Water sensor leads from terminals of interface.
If oil removal starts, service or repair sensor rod (Paragraph 2-15).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. Measure for voltage across SAFE-PAK (LS1) Load terminal and TB1-N (FO-2, Sheet 2).
If no voltage present, replace SAFE-PAK LS1 (Paragraph 2-20).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 - CONT

6. No oil removal. (cont).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 3. Secure power and check contacts of relay R2 for continuity (FO-2, Sheet 2).
If continuity does not exist, replace relay R2 (Paragraph 2-20).

STEP 4. Defective oil discharge motorized operated valve. Check for voltage across terminals TB1-8 and TB1-N (FO-2, Sheet 1).
If no voltage is present, replace motorized operated valve actuator (Paragraph 2-22).
If voltage is present go to Troubleshooting item 7: Motorized operated valve will not open or close.

7. Motorized operated valve will not open or close.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 1. Open or Close limit switch is out of adjustment. Verify position of valve mechanical indication.
If valve mechanical indication is open and OWS control panel does not indicate open, adjust open and close limit switches (Paragraph 2-22).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 2. Defective Open or Close limit switch. Manually activate open and close limit switch and check for continuity (FO-2, Sheet 1).
If there is no continuity replace valve actuator (Paragraph 2-22).

STEP 3. Open valve actuator windings. Check for continuity of valve actuator windings (FO-2, Sheet 1).
If there is no continuity replace valve actuator (Paragraph 2-22).

STEP 4. Valve has seized. Remove valve actuator and check for valve freedom of movement (Paragraph 2-22).
If valve will not manually rotate or binding is noticed, replace valve (Paragraph 2-22).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 - CONT

8. STRAINER PLUGGED illuminates when differential pressure (DP) is less than 5 in. Hg.

STEP 1. Check valve lineup (Paragraph 2-8).
Open/Shut valves as required for desired system lineup.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. With system running, measure for voltage across DP switch terminals (FO-1, Sheet 1 and FO-2).
If voltage present, perform maintenance on differential pressure switch (Paragraph 2-30).

9. STRAINER PLUGGED does not illuminate when differential pressure is greater than 5 in Hg.

STEP 1. Check valve lineup (Paragraph 2-8).
Open/Shut valves as required for desired system lineup.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. With system running, measure for voltage across lamp holder terminals (FO-1, Sheet 1 and FO-2.)
If voltage present, replace lamp (Paragraph 2-20).

STEP 3. With system running, measure for voltage across DP switch terminals (FO-1, Sheet 1 and FO-2.)
If no voltage present, perform maintenance on differential pressure switch (Paragraph 2-30).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

10. System fails to secure from oil discharge mode.

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 1. Verify that water is being discharged. Take a sample at valve OWS-23. Secure power and install jumpers on terminals TB1-11, TB1-12 and TB1-13. Restart system.
If system secures from oil discharge mode, service or repair sensor rod (Paragraph 2-15).
If system continues to operate in oil discharge mode, replace SAFE-PAK (LS1) (Paragraph 2-20).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. Defective Relay R2. Check for voltage between LOAD of SAFE-PAK (LS1) and TB1-N.
If voltage is present, replace R2 (Paragraph 2-20).

STEP 3. Motor operated valves for Oil Discharge and Water Discharge are not functioning. Check for voltage across terminals TB1-8 and TB1-N for Oil Discharge and TB1-7A and TB1-N for Water Discharge.
Troubleshoot Oil Discharge and Water Discharge using Troubleshooting item 7: Motorized operated valve will not open or close.

11. Depressing MANUAL STOP pushbutton does not stop system.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 1. Measure for voltage across MANUAL STOP pushbutton terminals while depressing MANUAL STOP pushbutton (FO-2, Sheet 1).
If no voltage present, replace MANUAL STOP pushbutton (Paragraph 2-20).
If voltage present, replace relay R1 (Paragraph 2-20).

Table 2-2. Troubleshooting - CONT

Malfunction
Test or Inspection
Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

12. System fails to secure when sludge tank is pumped dry.

STEP 1. Secure system. Remove level sensor assemblies and visually check for dirt/sludge buildup.
Service or replace sludge tank level sensor(s) (Paragraph 2-15).
Replace SAFE-PAK (LS3-3) (Paragraph 2-15).

13. Pump fails to start when MANUAL START pushbutton is depressed.

STEP 1. Check control panel for illuminated indicator lamps to ensure power source is available to system.
Activate main disconnect switch.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. No power to pump motor.
Measure for 230 VAC across motor terminals (FO-1, Sheet 1 and FO-2.)
If no voltage present, see Troubleshooting item 4.

STEP 3. Depress MANUAL START pushbutton and check for voltage across terminals.
If voltage exists, replace MANUAL START pushbutton (Paragraph 2-20).

STEP 4. Place PUMP CONTROL switch to on and check for voltage across terminals.
If voltage exists, replace PUMP CONTROL switch (Paragraph 2-20).

STEP 5. Check for continuity of motor windings.
If motor windings are open, repair/replace motor (Paragraphs 2-16 or 2-17).

14. OCM not operational during OWS operation.

STEP 1. Move OCM selector switch to MANUAL for 3-5 seconds to provide power to the OCM and bypass the OCM pressure switch.
If POWER ON (OCM) indicator illuminates, move switch to AUTO.
If POWER ON (OCM) indicator does not illuminate, check main disconnect switch.

STEP 2. Cable is loose or damaged. Verify connection, inspect for damage.
Tighten cable or remove and repair as required.

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

14. OCM not operational during OWS operation. (cont).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 3. No 115 VAC. Measure for 115 VAC across INPUT terminals on Power PCB Assembly (Figure 2-18, Sheet 3).
If no voltage present, activate main disconnect switch.

STEP 4. Low sample pressure to the OCM. Verify 10 to 12 psi (minimum 5 psi at startup) at OCM inlet pressure gauge and flow from OCM drain, check with flush water (OWS-54) as required.
Adjust inlet pressure for 10 to 12 psi. Clear blockages from OCM nozzle sampler to SDA inlet tubing. Verify OCM valve line up (Paragraph 2-8).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 5. Fuse on Power PCB Assembly is blown. WARNING 1 (Red LED) is lit. Check that fuse is in place and intact.
Replace fuse as required (Paragraph 2-26).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 6. OCM Operation Selector Switch Assembly is disconnected or defective. Verify that switch assembly is plugged into the Power PCB (11, Figure 2-18, Sheet 1).
Plug switch assembly into Power PCB. Remove the switch assembly and check for continuity between N.O., N.C. and C contacts on switch. Replace/repair switch assembly as required (Paragraph 2-26).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

14. OCM not operational during OWS operation. (cont).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 7. Noise Filter Defective. 115 VAC measured across input but not measured at output terminals (Figure 2-18, Sheet 3).
Replace Noise Filter POWER ON indicator (Paragraph 2-26).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 8. Transformer is defective. 115 VAC measured across input but not at output wire leads (INPUT terminals on Power PCB Assembly) (Figure 2-18, Sheet 3).
Repair wire leads or replace Transformer (Paragraph 2-26).

NOTE

If steps 1 through 8 do not correct the malfunction then the fault is in a PCB board.

STEP 9. Processor or Power PCB is defective. Inspect for damaged, charred or burnt components.
Replace defective Power PCB (Paragraph 2-26) or Processor PCB with Calibration Kit (Paragraph 3-12).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

15. WARNING 1 (Red LED) illuminated (Figure 1-4).

STEP 1. Fuse on Power PCB Assembly is blown.
Verify that fuse is in place, check for continuity through fuse.
Replace fuse as required (13, Figure 2-18, Sheet 1).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

16. WARNING 2 (Red LED) illuminated (Figure 1-4).

STEP 1. High level of contaminants in the sample water.
Take sample from OCM drain, and check for solids, water color or bulk oil.
If water is darker than light tea, then the solids content is too high (Figure 1-4). Service or repair duplex strainer (Paragraph 2-24).
Service the OWS (Paragraph 2-14).

STEP 2. High level of air bubbles in the sample water.
Check for air leaks in the OWS discharge or Nozzle Sampler piping.
Tighten all pipe joints and valve seals; remove sources of air leaks.

STEP 3. SDA glass cell defective.
Service or repair SDA glass cell (Paragraph 2-26).

17. WARNING 3 (Red LED) illuminated (Figure 1-4).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 1. High level of detergent, dirt and/or bubbles in the sample water.
Take sample from OCM drain, and check for dirt, color and suds. Water darker than light tea means the solids content is too high; suds indicate detergents or air bubbles.
Reduce the amount of solids. Service or repair duplex strainer (Paragraph 2-24).
Check for air leaks in the OWS discharge or Nozzle Sampler piping.
Tighten all pipe joints and valve seals; remove sources of air leaks.
Perform Operational Check and OCM Flush (Paragraph 2-8).
If WARNING 3 (Red LED) goes out, sample mixture is the problem. Service OWS tank (Paragraph 2-14).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 2. Cable Assembly between Power Assembly and Sample/Detection Assembly is loose or defective.
Fasten Cable Assembly or repair as required (Paragraph 2-26).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

17. WARNING 3 (Red LED) illuminated (Figure 1-4). (cont.).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 3. Ultrasonic Vibrator Assembly and Generator PCB out of adjustment or defective.
Check for good Ultrasonic Vibrator Signal (Paragraph 2-26). Adjust the vibrator signal as required. If vibrator cannot be adjusted properly, use new Generator PCB to test.
Replace Generator PCB as required, or check wiring (Paragraph 2-26).

STEP 4. SDA assembly is dirty or defective. Service SDA (Paragraph 2-26).
If any components are damaged replace with calibration kit (Paragraph 3-12).

18. WARNING 2 and WARNING 3 (Red LEDs) illuminated (Figure 1-4).

STEP 1. OCM requires immediate service.
Perform all PMCS.

CAUTION

Do not use unapproved detergents when cleaning, may cause damage to equipment.

STEP 2. High level of detergent, dirt and/or bubbles in the sample water.
Take sample from OCM drain, and check for dirt, color and suds. Water darker than light tea means the solids content is too high; suds indicate detergents or air bubbles.
Reduce the amount of solids. Service or repair duplex strainer (Paragraph 2-24).
Check for air leaks in the OWS discharge or Nozzle Sampler piping.
Tighten all pipe joints and valve seals; remove air leaks.
Perform Operational Check and OCM Flush (Paragraph 2-8).
If WARNING 2 and WARNING 3 (Red LED) goes out, sample mixture is the problem. Service OWS tank (Paragraph 2-14).

STEP 3. Extremely high level of oil in the sample (50% or more).
Take sample from OCM drain, and check for heavy oil content. Check OWS for gross malfunction, or other source of oil in sample piping.
Service or repair OWS (Paragraph 2-14). Flush all OWS piping prior to discharge overboard, flush all OCM sample piping (Paragraph 2-8).
Verify lower switch of the dirty oil tank level assembly was replaced with correct Float, Switch, Liquid (Paragraph 2-15).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

19. Unstable oil content display. PPM values jump high then low.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 1. Ultrasonic Vibrator Assembly and Generator PCB out of adjustment or defective.
Check for good Ultrasonic Vibrator Signal (Paragraph 2-26). Adjust the Vibrator signal as required. If Vibrator cannot be adjusted properly, use new Generator PCB to test.
Replace Generator PCB (Paragraph 2-26) as required, or check wiring.

CAUTION

Do not use unapproved detergents when cleaning, may cause damage to equipment.

STEP 2. High level of detergent, dirt and/or bubbles in the sample water.
Take sample from OCM drain, and check for dirt, water color and suds. Water darker than light tea means the solids content is too high; suds indicate detergents or air bubbles.
Reduce the amount of solids. Service or repair duplex strainer (Paragraph 2-24).
Check for air leaks in the OWS discharge or Nozzle Sampler piping.
Tighten all pipe joints and valve seals; remove sources of air leaks.
Perform Operational Check and OCM Flush (Paragraph 2-8).
If PPM values return to normal, sample mixture is the problem. Service OWS tank (Paragraph 2-14).

STEP 3. OWS failure, allowing large slugs of oil to be discharged.
Take sample from OCM drain, and check for heavy oil content.
Check OWS for major failure, or other source of oil in sample piping.
Service or repair OWS (Paragraph 2-14). Flush all OWS piping prior to discharge overboard, flush all OCM sample piping (Paragraph 2-8).

20. Oil sheen in discharged effluent.

NOTE

Although the OCM has a limit of 70 PPM, DOD vessels are not authorized to operate at this range. In accordance with DOD 4715.6-R1, Regulations On Vessels Owned Or Operated By The Department Of Defense, the only acceptable range of operation is 15 PPM.

STEP 1. Alarm limit set to 70 PPM. Check RANGE/ALARM LIMIT indicators; above 15 PPM may result in a sheen.
Set ALARM LIMIT (PPM) SELECTOR to 15 PPM.

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

20. Oil sheen in discharged effluent. (cont).

STEP 2. Verify diverter valve is NOT pinned in the overboard position.
Remove lock pin (45, Figure 2-15, Sheet 1) from diverter valve.

STEP 3. Diverter Valve defective. 115 VAC signal to valve circuit when OCM alarms (after 60 sec delay), but valve does not divert flow to sludge tank.
Repair or replace Diverter Valve (Paragraph 2-23).

STEP 4. Cable Assembly J3 to Remote Relay Assembly from Sampling/Sensor Assembly connector loose or defective. Verify cable connections, check continuity as required.
Repair, replace or tighten cable and connectors as required (Paragraph 2-26).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 5. Perform Verification/Confidence Test (Paragraph 2-26).
Identify the related symptom and perform corrective maintenance action to reduce oil sheen in discharged effluent.

STEP 6. Remote Relay Assembly defective.
Replace Remote Relay Assembly (Paragraph 2-28).

21. OWS discharge is diverted inboard when OCM detects less than alarm limit.

STEP 1. Verify diverter valve is pinned to the solenoid.
Replace knob pin (8, Figure 2-15 Sheet 1) into the diverter valve.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. Diverter Valve malfunction: stuck in sludge tank position. Verify no 115 VAC signal to Diverter Valve (there should not be any voltage present).
If 115 VAC signal is present, repair/replace Diverter Valve (Paragraph 2-23).
If 115 VAC signal is not present, perform Verification/Confidence Test (Paragraph 2-26).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 - CONT

21. OWS discharge is diverted inboard when OCM detects less than alarm limit. (cont).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 3. Cable Assembly J3 to Remote Relay Assembly from Sampling/Sensor Assembly (Figure 1-6) connector loose or defective. Verify cable connections, check continuity as required.
Repair, replace or tighten cable and connectors as required (Paragraph 2-26).

STEP 4. Remote Relay Assembly defective.
Replace Remote Relay Assembly (Paragraph 2-28).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 5. Power PCB Assembly defective. Verify alarm jumpers are in first "B" and second "A" position (Figure 2-18, Sheet 2), verify no voltage across terminals 2 and 4, 2 and 6, and 2 and 7 when in ALARM.
Replace Power PCB Assembly or correct wiring as required (Paragraph 2-26).

22. Indicators and displays inoperative while OCM is operating.

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 1. Cable Assembly J2 connectors to Remote Indicator (Alarm) Assembly from Sampling/Sensor Assembly (Figure 1-6) connector loose or defective. Verify cable connections, check continuity as required.
Repair, replace or tighten cable and connectors as required (Paragraph 2-26).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 – CONT

22. Indicators and displays inoperative while OCM is operating. (cont).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. Alarm PCB defective or incorrectly wired. Verify 115 VAC across terminals 2 and 3 on Alarm PCB, verify wiring (Figure 2-18, Sheet 3, FO-1, Sheet 1 and FO-2, Sheet 1.)
If 115 VAC across terminals 2 and 3, replace Alarm PCB correct wires as required (Paragraph 2-27).

STEP 3. Cable Assembly defective. Verify 115 VAC across 2 and 4 on Power PCB, verify wiring (Figure 2-18, Sheet 3). Check continuity of Cable Assembly as required.
If 115 VAC across 2 and 4 on Power PCB but not on Alarm PCB, repair/replace cable assembly(s) (Paragraph 2-26 and Paragraph 2-27).

STEP 4. Power PCB Assembly not properly connected or defective. Verify Power PCB wiring (Figure 2-18, Sheet 3), 115 VAC across terminals 1 and 2, and 2 and 4.
If 115 VAC across 1 and 2 but not 2 and 4, replace Power PCB (Paragraph 2-26).

STEP 5. Processor PCB is defective. Inspect for damaged, charred or burnt components.
Replace defective Processor PCB with Calibration Kit (Paragraph 3-12).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

23. PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch (A2S1) (Figure 1-2) on Remote Indicator (Alarm) Assembly does not change Alarm Limit of OCM.

STEP 1. Alarm Limit Selector Switch (A1S2) in the Sampling/Sensor Assembly not in the REMOTE position.
Put selector switch (A1S2) in REMOTE Position (Figure 2-18, Sheet 1).

STEP 2. Switch (A2S1) Defective. Check Switch (A2S1) and wiring for defects.
Repair/replace Cable Assembly or Alarm PCB as required (Paragraph 2-26).

STEP 3. Cable Assembly defective. Check Switch (A1S2) and wiring for defects.
Repair/replace Cable Assembly (Paragraph 2-26).

Table 2-2. Troubleshooting - CONT

Malfunction Test or Inspection Corrective Action

OIL- WATER SEPARATOR, MODEL OPB-10NP/SR02 - CONT

24. Audible Alarm inoperative when OCM is in Alarm mode on Remote Indicator (Alarm) Assembly.

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

STEP 1. Audible Alarm is silenced. Press the PUSH TO SILENCE pushbutton switch (A2S2) several times; the ALARM SILENCED indicator will alternately illuminate.
Press the PUSH TO SILENCE pushbutton switch (A2S2) to reactivate.

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 2. Alarm Buzzer is defective. Verify that the OIL CONTENT EXCEEDS ALARM LIMIT indicator (Red LED) is illuminated, the ALARM SILENCED indicator is not lit, but switch A2S2 works. Check for 115 VAC to the Buzzer.
Replace Buzzer (Paragraph 2-27).

STEP 3. Cable Assembly defective. Verify 115 VAC across 2 and 3 on Power PCB (11, Figure 2-18, Sheet 1), verify wiring is correct. Check continuity of Cable Assembly as required.
If 115 VAC across 2 and 3 on Power PCB but not across 1 and 2 on Alarm PCB, repair/replace cable assembly(s) (Paragraph 2-26 and Paragraph 2-27).

STEP 4. Power PCB Assembly defective. Verify alarm jumpers are in first "B" and second "A" position (Figure 2-18, Sheet 2). Verify wiring and check for 115 VAC across terminals 2 and 5 when in alarm.
Replace Power PCB if 115 VAC across 2 and 5 (Paragraph 2-26) is not detected.

25. PUSH TO SILENCE switch (A2S2) does not function properly when OCM is in alarm mode.

STEP 1. Defective wiring or switch (part of item P/N ST5001).
Press the PUSH TO SILENCE switch (A2S2) several times; the ALARM SILENCED indicator will alternately light.
Repair wiring, replace switch, or Alarm PCB as required (Paragraph 2-27).

26. Dirty Oil Pump output falls below 11 GPM.
STEP 1. Verify bilge water is below bilge suction foot valve (Paragraph 2-9).
If bilge water is above bilge suction at foot valve perform Dirty Oil Pump adjustment (Paragraph 2-18).

SECTION V. UNIT MAINTENANCE PROCEDURES

2-12. General. This section provides unit maintenance for the oil-water separator system, oil content monitor, and water polisher. The tasks are for testing, alignment, inspection, service, adjustment, repair, removal and replacement of subassembly components. These tasks are addressed in the following Paragraphs.

MAINTENANCE OF OIL-WATER SEPARATOR

2-13. The unit level replacement and repair tasks of the Oil-Water Separator are accomplished through maintenance procedures in paragraphs 2-14 thru 2-31 of this chapter. Inspections, checks, services, and adjustments are covered in PMCS, Table 2-1 and TM55-1905-223-10.

2-14. OWS Tank. (Figure 2-1)

This task covers: a. Inspect, b. Service, c. Repair.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273
Hoist, Chain, Hand-Operated, Hook Chain Fall 1/2 ton,
3950-00-235-4236
Torque Wrench (30 - 300 inch pounds),
5120-01-092-3278
Torque Wrench (30 - 300 foot pounds),
5120-01-125-5190
Lifting Sling,
3940-01-183-9412

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Cleaning Compound, Solvent, Item 1, Appendix C
Epoxy, Polyamide, Item 3, Appendix C
Rags, Wiping, Item 12, Appendix C
Warning Tags, Item 19, Appendix C

INSPECT

Inspection of the Oil-Water Separator Tank is accomplished through Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10) and (PMCS), Table 2-1 and maintenance procedures.

SERVICE

a. Perform Paragraph 3-11, Oil-Water Separator Tank removal steps a and b before cleaning coalescing plates and removing zinc anodes.

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

(1) Loosen 20 swing bolts (2, Figure 2-1) and swing away from top cover (3).

CAUTION

Take care not to damage tank cover gasket (3).

(2) Remove top cover (3) by lifting straight up and off using 1/2 ton chainfall and lifting sling.

(3) Remove vertical plate assembly (6) and gasket (7).

(4) Remove flow blocks (10) located between tank wall and horizontal plate (PORT) assembly (9).

NOTE

When removing horizontal plate assemblies (6, 7) identify position of installation and remove by lifting on stainless steel plate clamp wrapping the plate assemblies.

(5) Remove horizontal plate (PORT) assembly (9) and horizontal plate (STBD) assembly (8).

(6) Lay horizontal plate assemblies (8, 9) and vertical plate assemblies (6) on their side and spray with freshwater. Ensure all sediment is removed from between the plates.

CAUTION

When cleaning tank, do not use sharp objects that may damage tank's internal coating.

(7) Spray interior of tank to ensure all sediment is removed. If damage is discovered during tank cleaning, conduct tank repairs prior to installation of plate assemblies.

(8) Inspect top cover gasket (5) for damage. Replace if required.

(9) Inspect vertical plate gasket (7) for damage. Replace if required.

(10) Inspect interior of tank and cover for damage to finish.

(11) Inspect zinc anodes (11). Replace if length is 3 inches or shorter.

(12) Install horizontal plate (PORT) assembly (9) and horizontal plate (STBD) assembly (8).

(13) Install flow blocks (10) between tank wall and horizontal plate (PORT) assembly (9).

(14) Install vertical plate gasket (7) and vertical plate assembly (6).

(15) Ensure top cover gasket (5) is installed correctly and not damaged.

(16) Install top cover (3) on tank. Torque all swing bolts (2) lightly once; then torque bolts in accordance with torque table in Appendix D.

(17) Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

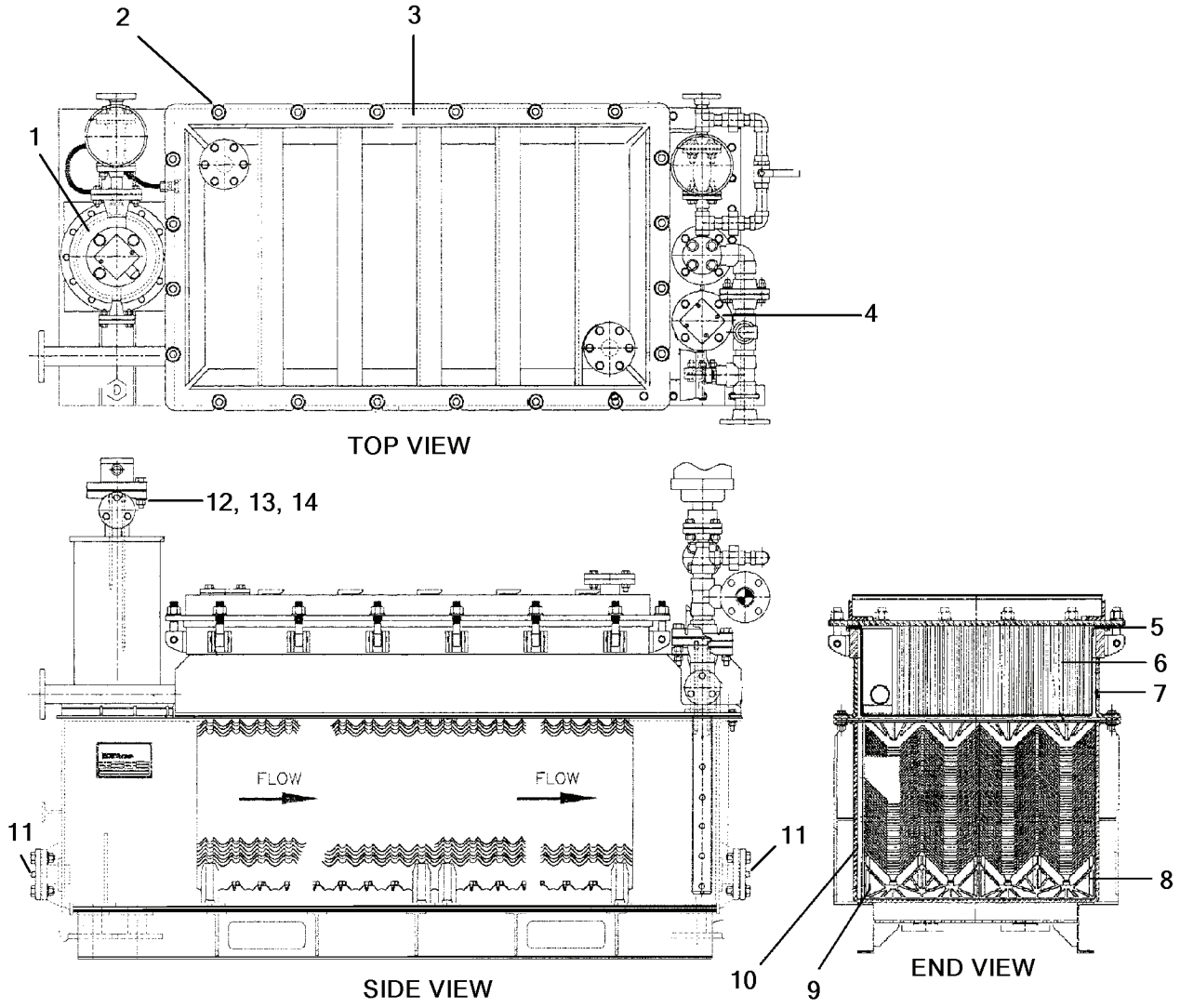
REPAIR

a. Repair of the OWS tank consists of:

(1) Replacing the zinc anodes (11).

(2) Replacing the vertical plate gasket (7).

(3) Touching up the polyamide epoxy coating in the tank.



LEGEND:

1. OIL/AIR INTERFACE SENSOR
2. TOP COVER SWING BOLTS
3. TOP COVER
4. OIL/WATER INTERFACE SENSOR
5. TOP COVER GASKET
6. VERTICAL PLATE ASSEMBLY
7. VERTICAL PLATE GASKET
8. HORIZONTAL PLATE (STBD)
9. HORIZONTAL PLATE (PORT)
10. FLOW BLOCK
11. ZINC ANODE
12. CAP SCREW
13. LOCKWASHER
14. SELF LOCKING NUT

Figure 2-1. Oil-Water Separator.

2-15. Oil Level Sensors. (Figures 2-1, 2-2 and 2-3)

This task covers: a. 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
Multimeter,
6625-01-265-6000

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Sensing Rod 8.94", P/N 6059949P2
Sensing Rod 10", P/N 6059949P3
Sensing Rod 15", P/N 6059949P1
Lockwasher 5/8", P/N 6057182
Lockwasher, P/N 10926
Nut, Self locking, 1/2 x 13, P/N M45913/1-8CG5C
Float Assembly Kit, P/N 10654
Cleaning Solvent, Item 1, Appendix C
Rags, Wiping, Item 12, Appendix C
Warning Tags, Item 19, Appendix C

NOTE

Three oil level sensors are located in the oil-water separator system: two in the OWS tank, and one inside the sludge tank. For purposes of maintenance, all three are included here. The two oil interface sensors (Oil/Air and Oil/Water) are identical. The oil/water sensor has two electrodes and the oil/air sensor uses three electrodes.

SERVICE

Servicing involves cleaning rods and floats. Refer to removal section.

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death or injury to personnel or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new hardware.

1. OWS Level Sensors (Oil/Air and Oil/Water) (1 and 4, Figure 2-1):

    a. Remove cover (2, Figure 2-2) by removing screws (1); label and disconnect wires from electrode holder (6).

    b. Remove and inspect cover gasket (3) for cracks and tears.

    c. Remove sensor flange self locking nuts (14, Figure 2-1) and hardware, discard self locking nuts and retain other hardware for installation.

    d. Raise sensor and flange gasket (8, Figure 2-2) upward until probe is clear of tank. Inspect gasket (8) for cracks and tears.

    e. Clean and inspect probe for chips, cracks or pitting. If chips, cracks or pitting are identified on the probe then a new probe will be required before installation.

    f. Clean any dirt and sludge from center hole of mounting flange.

    g. Clean flange gasket mating surfaces.

    h. Install sensor using replacement procedure.

2. Sludge Tank Level Sensor (Figure 2-2 and Figure 2-3):

    a. Label and disconnect wires inside the OWS junction box (Figure 2-3).

    b. Remove stuffing tube (2) retaining nut and stuffing tube packing (1).

    c. Remove wires from OWS junction box stuffing tube (2).

    d. Remove eight nuts (15) and washers (16) from flange (17). Retain nuts (15) and washers (16) for replacement.

    e. Raise level switch assembly flange (17) and gasket (13) upward until level switch assembly is clear of the sludge tank. Inspect gasket (13) for cracks and tears.

    f. Remove fasteners connecting mounting bracket (19, Figure 2-2) to mounting plate (11, Figure 2-3). Retain for installation. Remove level sensor to suitable work location.

    g. Unscrew nut (12, Figure 2-2) from bottom of stuffing tube assembly (11).

    h. Remove lockwasher (13), shield cap (14) and two magnets (15). Discard lockwasher (13).

    i. Remove float (16), bushing (17) and shield (18). Unscrew stuffing tube assembly (11) from mounting bracket (19).

    j. Clean and inspect float (16), bushing (17) and shield (18). Replace if damage is identified.

    k. Test and install level sensor using replacement procedure.

REPAIR

1. OWS Level Sensors:

    a. Replace defective rod(s) (9, 10 and 20, Figure 2-2) and electrode holders (6) when deterioration is noticed.

    b. Check flange gasket (8) and replace as required.

2. Repair of the Sludge Tank Level Sensor is by replacement of:

   a. The sludge tank level sensor assembly.

   b. The shield cap (18).

REPLACEMENT

1. OWS Level Sensors (Oil/Air and Oil/Water) (1 and 4, Figure 2-1):

   a. Place flange gasket (8, Figure 2-2) on flange mating surface.

   b. Insert sensor assembly into tank.

   c. Attach sensor to flange using flange bolts and hardware retained from removal and new self locking nut (14, Figure 2-1).

   d. Torque flange bolts (using a cross method tightening and torque wrench) to specification found in Appendix D.

   e. Connect wires to electrode holders (6, Figure 2-2) as labeled during removal.

   f. Install cover gasket (3) and cover (2) by installing screws (1) retained from removal.

   g. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

2. Sludge Tank Level Sensor (Figures 2-2 and 2-3):

   a. Screw stuffing tube assembly (11, Figure 2-2) into mounting bracket (19).

NOTE

The Sludge Tank utilizes the same Switch Liquid Level, W/10' Cable for both the Upper and lower tank Level Switches. However, the lower Tank Level Switch Requires replacement of the Float, Switch, Liquid Level Kit -with P/N 166053.

   b. Install bushing (17) and float (upper or lower) (16) on lower portion of stuffing tube assembly (11).

CAUTION

Do not overtighten nut (12) or damage to shield (18) may occur.

   c. Install shield cap (14) with two magnets (15), new lockwasher (13) and nut (12) retained from removal (Figure 2-2).

NOTE

The Sludge Tank utilizes the same Switch Liquid Level, W/10' Cable for both the Upper and lower tank Level Switches. However, the lower Tank Level Switch Requires replacement of the Float, Switch, Liquid Level Kit -with P/N 166053.

   d. Check operation of float (upper or lower) (16) and stuffing tube assembly (11) by connecting a multimeter to the stuffing tube electrical leads (Figure 2-2).

   e. Checking the float (upper switch) (16) proceed as follows:

      (1) With the float (upper switch) (16) resting on the shield cap (14), the multimeter should indicate open circuit.

(2) Raise float (upper switch) (16) up off of the shield cap (14) to actuate stuffing tube assembly switch and the multimeter should indicate closed circuit. Replace components as required if test is unsatisfactory.

f. Checking the float (upper switch) (16) proceed as follows:

(1) With the float (lower switch) (16) resting on the shield cap (14), the multimeter should indicate closed circuit.

(2) Raise float (lower switch) (16) up off of the shield cap (14) to actuate stuffing tube assembly switch and the multimeter should indicate open circuit. Replace components as required if test is unsatisfactory.

g. Attach float mounting bracket (19, Figure 2-2) to mounting plate (11, Figure 2-3) using mounting hardware retained from removal.

h. Place flange gasket (13) on flange mating surface (Figure 2-3).

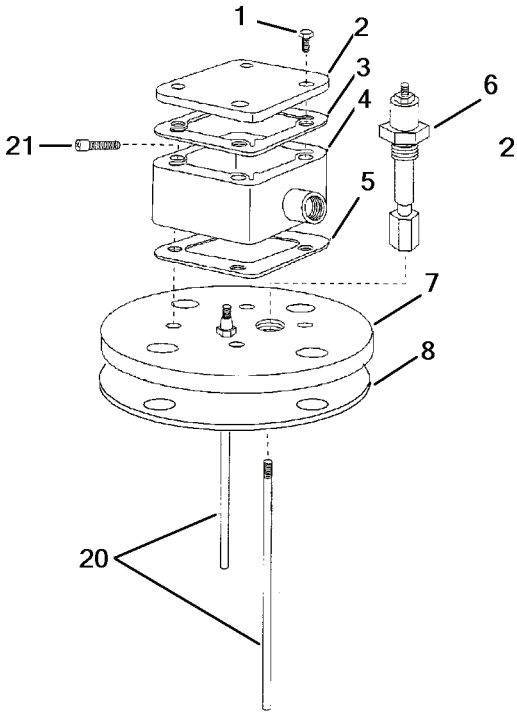
i. Lower level switch assembly flange (17) into sludge tank on flange gasket (13, Figure 2-3).

j. Install eight washers (16) and nuts (15) onto flange (17, Figure 2-3). Torque flange bolts (using a cross method tightening and torque wrench) to specification found in Appendix D.

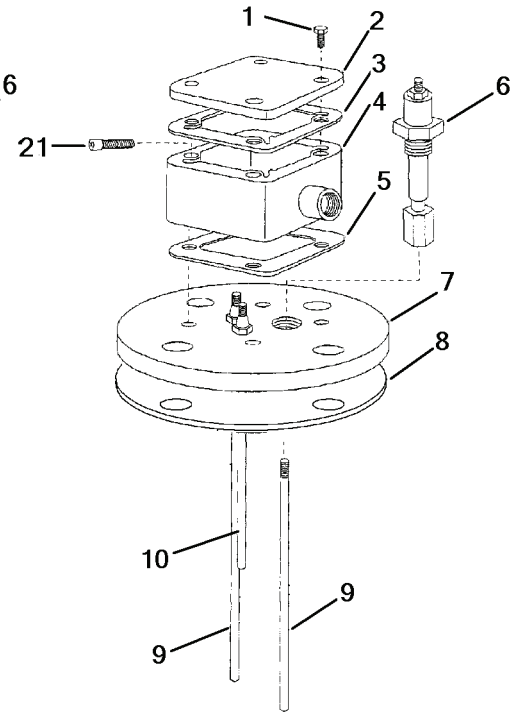
k. Thread wires through OWS junction box stuffing tube packing (1), stuffing tube (2) and tighten stuffing tube assembly (Figure 2-3).

l. Connect wires from ship cable in OWS junction box as labeled during removal (Figure 2-3).

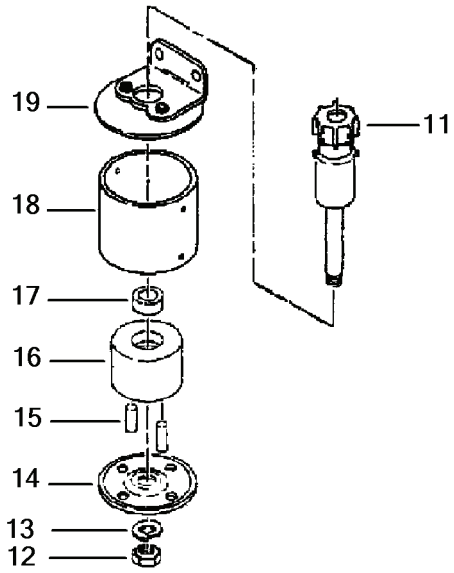
m. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



OIL/AIR INTERFACE SENSOR
(AFT END OF TANK)



OIL/WATER INTERFACE SENOR
(TOWER END OF TANK)

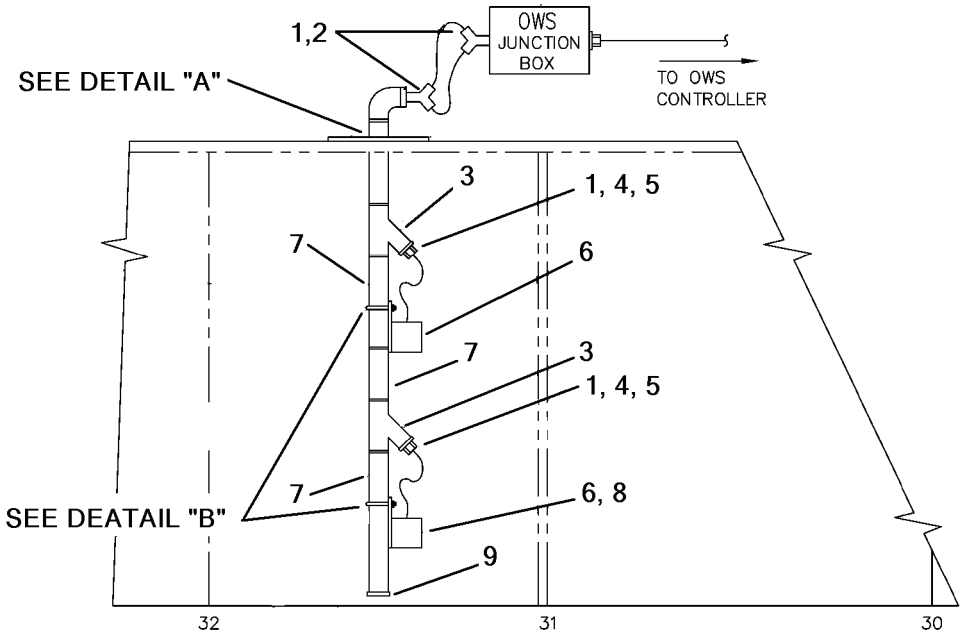


SLUDGE TANK LEVEL SENSOR

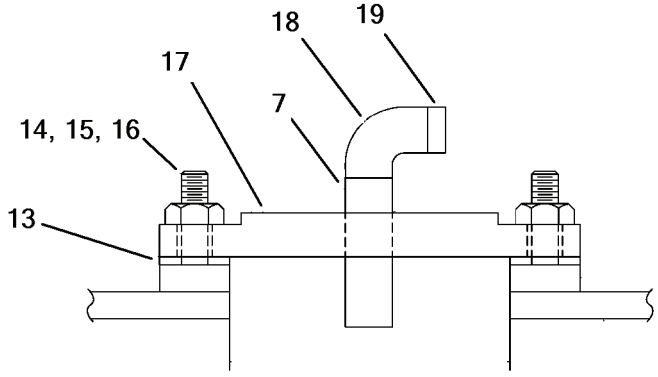
LEGEND:

1. SCREW
2. COVER
3. GASKET
4. JUNCTION BOX
5. GASKET
6. ELECTRODE HOLDER
7. FLANGE
8. FLANGE GASKET
9. SENSING ROD 15”
10. SENSING ROD 8.94”
11. STUFFING TUBE
12. NUT
13. LOCKWASHER
14. SHIELD CAP
15. MAGNET (2)
16. FLOAT
17. BUSHING
18. SHIELD CAP
19. MOUNTING BRACKET
20. SENSING ROD 10”
21. SCREW

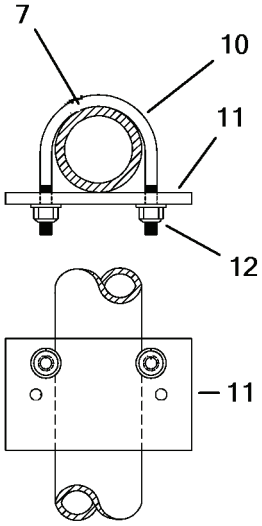
Figure 2-2. Oil Level Sensors.



SLUDGE TANK LEVEL SWITCH ASSEMBLY



DETAIL "A"
SLUDGE TANK PENETRATION



DETAIL "B"
TANK LEVEL SWITCH
MOUNTING PLATE

LEGEND:

1. STUFFING TUBE, PACKING
2. STUFFING TUBE (Y)
3. LATERAL (Y)
4. ADAPTER
5. STUFFING TUBE
6. LEVEL SWITCH
7. TUBE
8. FLOAT, LEVEL SWITCH
9. CAP
10. U-BOLT
11. PLATE
12. NUT, HEX HEAD
13. GASKET
14. STUD
15. NUT
16. WASHER
17. FLANGE
18. ELBOW
19. ADAPTER

Figure 2-3. Sludge Tank Level Switch Arrangement.

2-16. OWS Pump. (Figure 2-4 and 2-5)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273
Tool Set, Measuring, Machinist's
5280-00-278-9919
Puller, Mechanical, Gear and Bearing,
5120-00-288-7710

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Oil-Water Separator Pump, P/N 777-9003
Pump Service Kit, P/N 90118-0003
Cleaning Solvent, Item 1, Appendix C
Gasket Material, Item 4, Appendix C
Grease, Item 5, Appendix C
Lubricating Sealant, Item 9, Appendix C
Rags, Wiping, Item 12, Appendix C
Warning Tags, Item 19, Appendix C

INSPECT

Inspection of the Oil-Water Separator Pump is accomplished through Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10).

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. Remove coupling guard (2) to expose coupling (3) for disassembly (Figure 2-4).

b. If pump is to be replaced or moved to a different work location, remove the pump mounting hardware and piping flange connections. Retain hardware for installation. Inspect gasket for cracks or tears and retain hardware for installation. If pump is not required to be moved proceed to step d.

c. Utilizing a bearing puller, remove pump coupling hub (6, Figure 2-5).

d. Remove end cover screws (14), end cover (13) and gasket (12).

e. Grasp hub of impeller (11) with water pump pliers and withdraw from body (10).

f. Remove screw (9) and cam (17); clean sealant from cam (17) and body (10) bore.

g. Remove wearplate (16).

h. Remove bearing to body retaining ring (5).

i. Press on impeller drive end of shaft (1) to remove shaft (1) and bearing (4) assembly.

j. Remove ceramic seal seat and seat gasket from shaft. Press carbon seal seat out of body towards impeller bore.

k. Remove bearing shaft retaining ring (2).

l. Support bearing inner race, press on drive end of shaft to remove shaft from bearing. Do not attempt to remove bronze bushing which is pinned to shaft.

REPAIR

Inspect all parts from removal procedure for wear or damage and replace as necessary.

REPLACEMENT

a. If pump was moved from foundation for replacement proceed to step n, otherwise proceed to step b.

b. Press shaft (1) into bearing (4), using care to support inner race of bearing.

c. Install bearing to shaft retaining ring (2) with flat side toward bearing.

d. Insert splined end of shaft (1) through bearing bore until bearing (4) contacts body (10).

e. Lubricate rubber grommet in ceramic seal seat with water and install on shaft, grommet toward bearing. Install seal (carbon toward ceramic seat) in seal bore and press flush with bottom of impeller bore.

f. Pressing on bearing outer race, install bearing into bore.

g. Install bearing to body retaining ring (5) in body (10) groove with flat side toward bearing.

h. Install wearplate (16) in body (10) bore, aligning slot in wearplate (16) with dowel pin in body (10).

i. Apply a thin coat of sealant to cam screw (9) threads and top side of cam (17) and install in body (10) with cam screw (9).

j. Lubricate impeller bore and end surfaces of impeller (11) with light coat of water pump grease and start impeller into bore with a rotary motion until splines engage, then push into bore.

k. Install gasket (12) and end cover (13) and secure with end cover screws (14).

l. Align keyways of coupling hub (6) and pump shaft (1) with shaft key (3) and press coupling hub onto shaft ensuring key stays centered and flush.

m. Insert hub setscrew (7) and tighten. If pump was removed from foundation proceed to step n, otherwise proceed to step q.

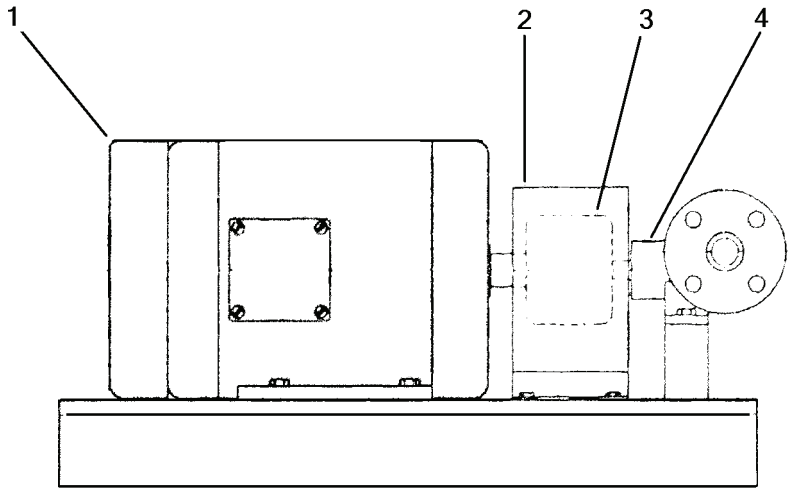
n. Install pump on mounting foundation, shim pump feet as required to ensure there is no distortion to pump casing.

o. Attach piping flange connection using hardware retained from removal. If gasket damage was identified on removal, install new gasket.

p. Fasten pump mounting hardware retained from removal.

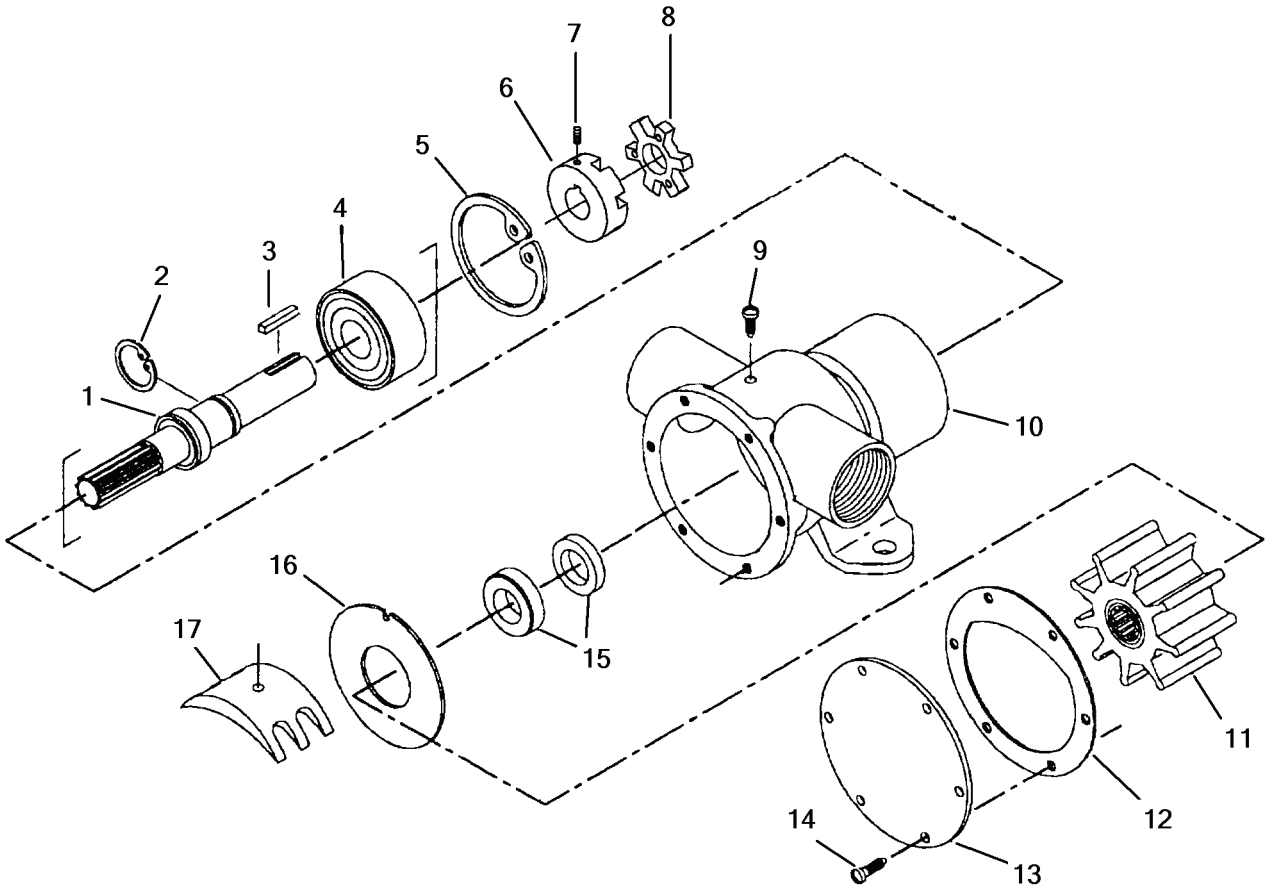
q. Perform coupling alignment (Paragraph 2-17).

r. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:
1. OWS PUMP MOTOR
2. COUPLING GUARD
3. COUPLING
4. OWS PUMP

Figure 2-4. OWS Pump And Motor Assembly.



LEGEND:

1. SHAFT
2. RETAINING RING (BEARING TO SHAFT)
3. KEY
4. BEARING
5. RETAINING RING (BEARING TO BODY)
6. COUPLING HUB
7. SETSCREW, HUB
8. COUPLING INSERT
9. SCREW (HUB)
10. BODY
11. IMPELLER
12. GASKET
13. END COVER
14. SCREW
15. SEAL
16. WEARPLATE
17. CAM

Figure 2-5. OWS Pump.

2-17. OWS Pump Motor. (Figure 2-4, 2-6 and 2-7)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273
Dial Indicator,
5210-00-277-8840
Tool Set, Measuring, Machinist's,
5280-00-278-9919

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Cleaning Solvent, Item 1, Appendix C
Grease, Item 5, Appendix C
Rags, Wiping, Item 12, Appendix C
Shim, Item 14, Appendix C
Straight Edge, Item 17, Appendix C
Warning Tags, Item 19, Appendix C

ALIGN

Perform coupling alignment as follows:

CAUTION

Align the motor to the pump or distortion to piping connections or pump casing may occur.

NOTE

Maximum allowable parallel misalignment is 0.015 inch and maximum angular misalignment is 0.018 inch.

a. With coupling hubs and star insert installed, ensure motor coupling hub is pushed flush with pump coupling hub.

b. Align shafts so that a straight edge will rest squarely on both coupling hubs.

c. Using a feeler gauge, insert the appropriate gauge between the insert and hub at 4 different points, 90 degrees apart to ensure angular alignment. Adjust position of the motor accordingly to achieve equal clearances at all 4 points.

d. Attach the dial indicator as illustrated in Figure 2-6 on the pump end coupling hub ensuring anvil (stem) on dial indicator is compressed halfway into indicator to check for parallel alignment.

e. Zero in the dial indicator.

f. Rotate pump shaft to 180 degrees from top and check dial indicator reading at the bottom.

NOTE

Always make adjustments half of the reading as it will affect the dial reading at the 0 degree position.

(1) Example: If reading is positive, motor is lower than pump, add shims between all four motor foundation bolts in between the feet and base foundation to raise the motor to a +0.010.

(2) Example: If reading is negative then motor is higher than the pump. Tighten down motor foundation bolts to achieve a reading of -0.010.

g. Recheck dial reading at the 0 degree position after each adjustment.

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. Remove coupling guard (2) to expose coupling (3) for disassembly (Figure 2-4).

b. Remove motor foundation bolts and slide motor (1) back to separate coupling halves (3). Retain hardware for installation.

c. Remove conduit box cover (13, Figure 2-7) removing screws (12).

d. Label and disconnect wires in conduit box to ensure proper motor rotation after installation. (Proper motor rotation is counterclockwise facing shaft end.)

e. Remove coupling hub (17), machine key (16) and flexible coupling insert (18) from motor shaft with bearing puller.

f. If motor is to be replaced proceed to replacement procedure for installation of new motor; if bearing replacement is to be completed proceed to repair procedure.

REPAIR (Figure 2-7)

Repair of the OWS pump motor is by replacement of the following items (Figure 2-7); Fan impeller (4), Rotor assembly (8), Spring washer (9), Bearing (10), Bearing (11), Machine key (16) and Flexible coupling insert (18).

NOTE

If other maintenance is required to repair the motor, then motor replacement is required.

To repair the OWS pump motor perform the following steps;

a. Perform removal procedure.

b. Remove three screws (2) securing fan housing (3). Remove fan housing.

c. Remove mounting hardware and fan impeller(4). Retain hardware for installation.

d. Remove four bolts (6) and nuts (15).

e. Remove end bell (5 and 14).

f. Remove spring washer (9) from motor shaft.

g. Remove bearings (10 and 11) from motor shaft.

h. Visually inspect all removed components for wear, damage and corrosion.

i. Install bearings (10 and 11).

j. Install spring washer (9) onto motor shaft.

k. Install rotor assembly (8) into the stator assembly (7).

l. Replace end bells (5 and 14) onto the stator assembly (7).

m. Insert the four t bolts (6); securing with the four hex nuts (15).

n. Install the fan impeller (4) with removed hardware.

o. Replace fan housing (3); securing with three screws (2).

p. Proceed to replacement procedure.

REPLACEMENT

a. Insert machine key (16) into slot on motor shaft.

b. Install coupling hub (17) onto shaft and align with machine key (16).

c. Install flexible coupling insert (18) and coupling hub (19) onto coupling hub (17) and shaft.

d. Place motor on foundation aligning coupling hubs (17 and 19) of both motor and pump.

e. Align motor feet bolt holes over bolt holes in foundation and insert mounting bolts with nuts. Do not tighten mounting hardware; allow sufficient play for insertion of shims for coupling alignment.

f. Perform coupling alignment before proceeding to step g.

g. Install coupling guard (2, Figure 2-4).

h. Connect wires in conduit box as labeled on removal to ensure proper motor rotation. (Proper motor rotation is counterclockwise facing shaft end.) If motor rotation is not counterclockwise reverse any two incoming power leads.

i. Install conduit box cover (13, Figure 2-7) with screws (12).

j. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

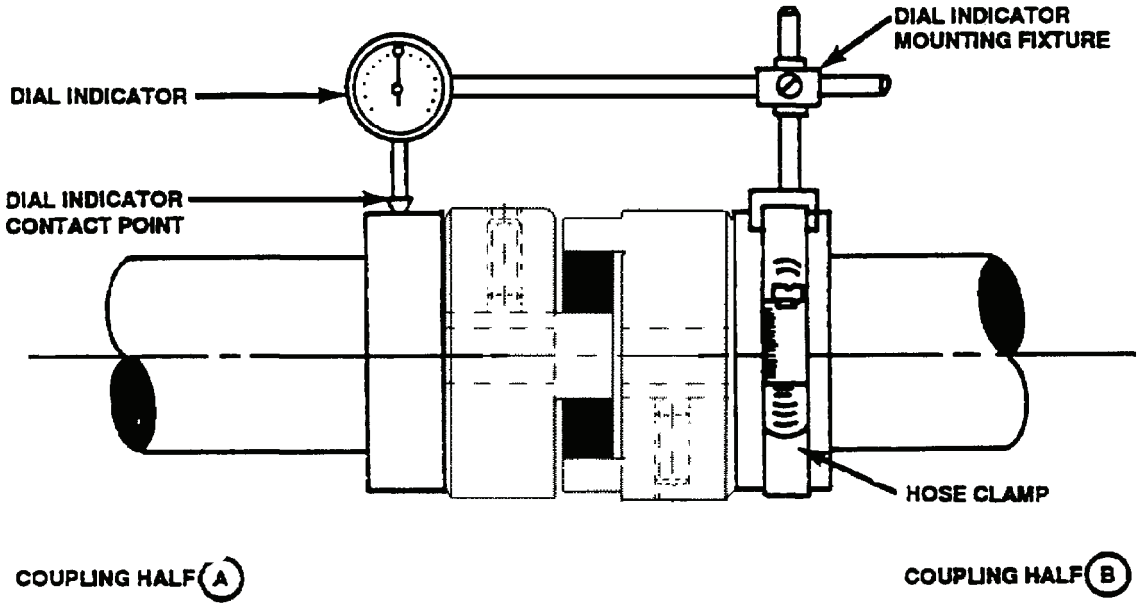
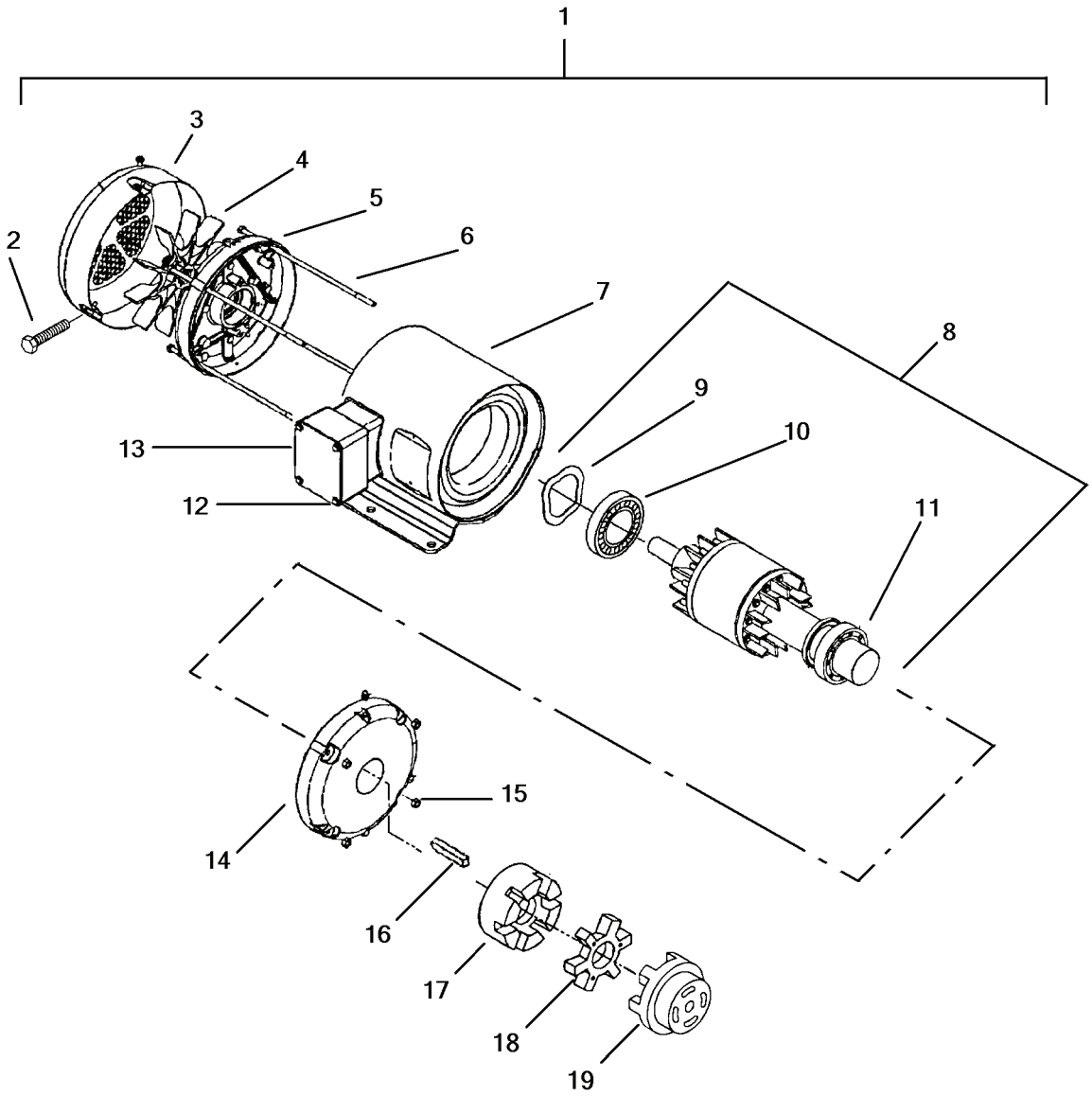


Figure 2-6. Coupling Alignment.



LEGEND:

1. OWS PUMP MOTOR
2. SCREW
3. FAN HOUSING
4. FAN IMPELLER
5. END BELL
6. BOLT
7. STATOR ASSEMBLY
8. ROTOR ASSEMBLY
9. SPRING WASHER
10. BEARING
11. BEARING
12. SCREW
13. CONDUIT BOX COVER
14. END BELL
15. NUT
16. MACHINE KEY
17. COUPLING HUB
18. FLEXIBLE COUPLING INSERT
19. COUPLING HUB

Figure 2-7. OWS Pump Motor.

2-18. Dirty Oil Pump. (Figures 2-8 , 2-9 and 2-11)

This task covers: a. Inspect, b. Adjust, c. Removal, d. Repair, e. Replacement.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Dirty Oil Pump, P/N H-125 C.I.
Bearing, P/N 5847
Seal, Rotating, P/N 5579A
Plate, Wear, P/N 5405F
Shoe, P/N 5561PB
Cleaning Solvent, Item 1, Appendix C
Grease, Item 5, Appendix C
Oil, Item 10, Appendix C
Warning Tags, Item 19, Appendix C

INSPECT

Inspection of the Dirty Oil Pump is accomplished through Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10).

ADJUST

Adjustment involves removing one of the two front cover gaskets (24, Figure 2-9) from between the wear plate (22) and front cover (25) when output capacity is below 11 gpm.

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. Remove coupling guard (3) from base (5, Figure 2-8).

b. Close the nearest inlet and outlet valves.

c. Drain pump by means of drain plug (27, Figure 2-9) in the front cover (25).

d. Disconnect the inlet and outlet piping connections.

e. Remove eight body nuts (4) from front cover (25).

f. Remove front cover (25).

g. Remove three port plate screws (28) from the front cover (25).

NOTE

Mark location of sliding shoes (20) within pump unit. If the shoes are to be reinstalled, ensure the orientation of the shoes are the same as when removed. When installing new shoes, ensure the orientation of the original marked shoes are the same.

h. Separate pump wear plate (22) from front cover (25). Mark the position of the shoes (20).

i. Grasp shoe (20) and remove from rotor (18) by pulling straight out. Remove all three shoes (20).

j. Mark coupling flanges (2, Figure 2-8) in a manner that they may be returned to their respective shafts when reassembling. Remove the four pump mounting bolts and slide pump (4) away from motor (1).

k. Loosen two set screws from coupling flange (20, Figure 2-11), and remove with machine key (22).

l. Remove bearing cover screws (16, Figure 2-9) from drive end bearing cover (2) and outer end bearing cover (15).

m. Remove end covers (2) and (15).

CAUTION

Do not rotate bearing locking collar more than one-quarter turn to prevent collar from locking in opposite direction.

NOTE

A pin punch may be used to loosen tight collars.

n. Loosen set screws in bearing locking collars (part of 3) and remove collars by rotating in direction of pump shaft rotation. (Proper motor rotation is counterclockwise facing shaft end.)

o. File down any burrs on the shaft left by set screws, using a finishing file.

p. Remove body nuts (4) from bearing housing (13).

CAUTION

Remove bearing housings (13) straight away from the pump body (32) to prevent damage to working faces of the shaft seals (5).

q. Tighten forcing screws (14) intermittently.

r. Remove one bearing housing (13) with bearing (3) still intact.

CAUTION

Replace the seals (5) if they are removed for a maintenance action.

NOTE

A little oil or grease on the shaft makes the stationary shaft seal (part of 5) slide off more easily.

s. Remove rotating seal (part of 5) from shaft.

t. Remove rotor (18), from removed bearing housing (13) end.

u. Remove rotating seal (part of 5) from shaft.

v. Remove opposite bearing housing (13) as described in step p.

w. Remove stationary seal (part of 5) from bearing housings.

x. Remove bearing (3) from bearing housing (11).

y. Remove blank flange nut (12) from the blank flange stud (9).

z. Remove the blank flange (11) and blank flange gasket (10).

REPAIR

a. Repair to the dirty oil pump consists of replacing the following components as described in the replacement procedures: drive end bearing cover (2) and outer end bearing cover (15), bearings (3), shaft seals (5), bearing housing gaskets (7), blank flange gasket (10), rotor (18), shoes (20), pump wear plate (22), port plate gasket (23), front cover gasket (24), drain plug (27) and port plate screw (28).

b. Any further repair to the dirty oil pump (1) requires the replacement of the dirty oil pump unit (1).

REPLACEMENT

CAUTION

When handling the seals, take extreme care not to damage or soil the mating surfaces of the face ring and seat, or to get oil or other liquid on them. Avoid skin contact on mating surfaces.

a. Before mounting rotating seal (part of 5) on rotor (18), lightly coat end of rotor with oil, which will allow shaft seals to slide easily into the correct position when all parts are reassembled.

b. Mount seals (5) on rotor (18) in extended position and not compressed. Insert stationary seal (part of 5) in recesses on bearing housings (13). A light oil coating on outside of seal seats (part of 5), taking care not to soil seat, will facilitate installation in bearing housing recess.

c. Mount bearing housing (13) on pump body, (opposite drive end), replacing all torn or damaged gaskets.

CAUTION

Maintain rotor in as much a horizontal position as possible to avoid stressing seal face in bearing housing. Insert rotor end through seal face with constant pressure.

d. Through open end of pump body, insert rotor through body into bearing housing already mounted on pump.

e. Mount opposite bearing housing to body.

f. Mount bearings (3) in bearing housings (13), using caution not to damage bearing races or pump body. To facilitate bearing mounting, a small amount of grease should be used on race and bearing housing.

g. Outer end bearing locking collar (part of 3) should be flush with shoulder on rotor shaft. This locates the shaft axially. Tighten locking collar in direction opposite shaft rotation. To make collar flush with rotor shaft shoulder, tap rotor shaft with mallet hammer. Tighten set screw.

h. Mount other bearing locking collar.

i. Replace both end covers (2) and (15).

NOTE

If the shoes (20) are to be reinstalled, ensure the orientation of the shoes are the same as when removed. When installing new shoes, ensure the orientation of the original marked shoes are the same.

j. Install shoes (20) on rotor (18) by inserting shoes on cams.

CAUTION

Align gasket to front cover for proper seal.

k. Install new port plate gasket (23) onto front cover (25).

l. Insert screws (28) through front cover (25) and into the pump wear plate (22).

m. Tighten screws and examine gasket again for proper alignment.

NOTE

If gasket has gaps or tears after tightening screws, step (k) through step (m) must be repeated to ensure a tight fit.

n. Replace front cover (25) on pump body (32) (dowel pins (19) will align position) making certain two gaskets are installed and are in good condition, free of tears and dirt.

o. Install new blank flange gasket (10) onto the blank flange stud (9).

p. Replace the blank flange (11); securing with the blank flange nuts (12).

q. Replace shaft key (31)on to rotor (18) at install coupling hub (20, Figure 2-11); securing with set screws (21). Reposition pump and secure mounting bolts. When the motor and pump are spaced correctly, the distance as measured with calipers (2, Figure 2-10) is 2.375 inches.

r. Realign flexible coupling (2, Figure 2-8) by performing alignment procedures (Paragraph 2-19).

WARNING

Do not operate equipment unit with coupling guard (3, Figure 2-8) removed. Serious personnel injury may result.

s. Replace coupling guard (3) on base (5, Figure 2-8).

t. Reconnect the inlet and outlet piping connections.

u. Open the nearest inlet and outlet valves.

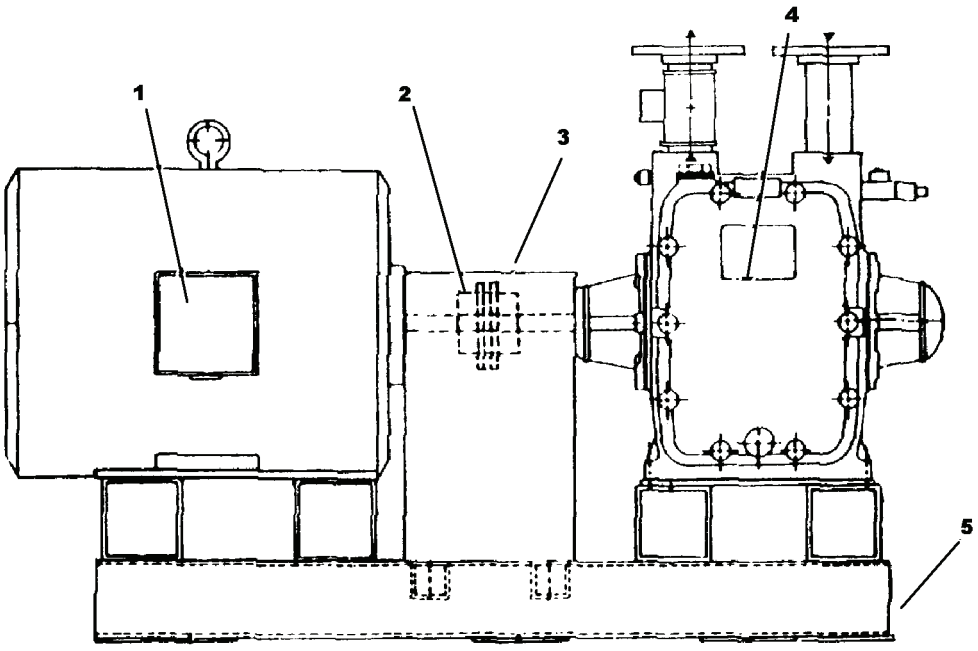
CAUTION

Do not operate pump unit before initial filling (or after maintenance/disassembly) to avoid damage to internal moving parts.

v. Prime the dirty oil pump by removing filler plug (30, Figure 2-9) and fill pump completely with liquid.

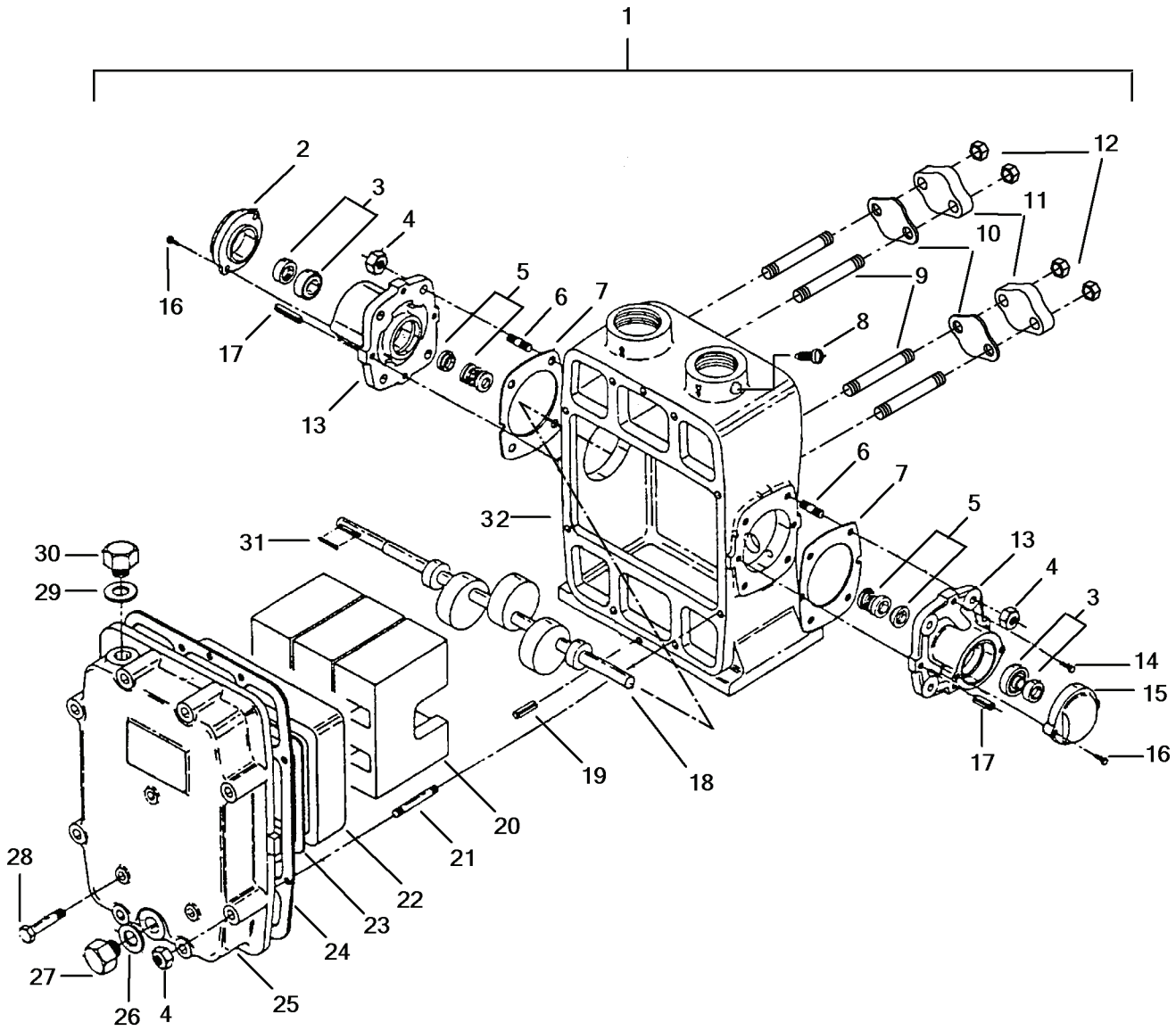
w. Replace filler plug (30).

x. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:
1. MOTOR
2. COUPLING
3. COUPLING GUARD
4. PUMP
5. MOUNTING BASE

Figure 2-8. Dirty Oil Pump And Motor Assembly.



LEGEND:

1. DIRTY OIL PUMP
2. BEARING COVER, DRIVE END
3. BEARING
4. BODY NUT
5. SHAFT SEAL
6. END STUD
7. BEARING HOUSING GASKET
8. CASE PLUG
9. BLANK FLANGE STUD
10. BLANK FLANGE GASKET
11. BLANK FLANGE
12. BLANK FLANGE NUT
13. BEARING HOUSING
14. FORCING SCREW
15. BEARING COVER, OUTER END
16. BEARING COVER SCREW
17. BEARING HOUSING DOWEL
18. ROTOR
19. FRONT COVER DOWEL
20. SHOE
21. FRONT STUD
22. PUMP WEAR PLATE
23. PORT PLATE GASKET
24. FRONT COVER GASKET
25. FRONT COVER
26. DRAIN PLUG WASHER
27. DRAIN PLUG
28. PORT PLATE SCREW
29. FILLER PLUG WASHER
30. FILLER PLUG
31. SHAFT KEY
32. PUMP BODY

Figure 2-9. Dirty Oil Pump.

2-19. Dirty Oil Pump Motor. (Figures 2-8, 2-10 and 2-11)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273
Tool Set, Measuring, Machinist's,
5280-00-278-9919
Puller, Mechanical, Gear and Bearing,
5120-00-288-7710

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Cleaning Solvent, Item 1, Appendix C
Grease, Item 5, Appendix C
Rags, Wiping, Item 12, Appendix C
Shim, Item 14, Appendix C
Straight Edge, Item 17, Appendix C
Warning Tags, Item 19, Appendix C

ALIGN

Perform coupling alignment as follows:

CAUTION

Align the motor to the pump or distortion to piping connections or pump casing may occur.

NOTE

Maximum allowable parallel misalignment is 0.015 inch and maximum angular misalignment is 0.070 inch.

a. With coupling hubs (18 and 20, Figure 2-11) and flexible coupling insert (19) installed, ensure motor coupling hub is pushed flush with pump coupling hub.

b. Check parallel alignment by placing a straight edge (1, Figure 2-10) across the two hubs (18 and 20, Figure 2-11).

   (1) If there is a gap between a hub and the straight edge, use a feeler gauge and measure the gap. If the gap is greater than 0.015 inches then realign the shafts by adjusting horizontally, adding or removing shims.

   (2) Repeat, at a minimum of three different points, with out rotating the shaft until all gaps are less then 0.015 inches.

c. Check the angular alignment by placing a caliper (2, Figure 2-10) on the outside of both hubs and record the measurement. Take and record at least three more measurements; determine the maximum and minimum readings.

NOTE

When an adjustment is to be made during angular alignment checks, ensure parallel alignment checks are repeated

d. Subtract the minimum reading from the maximum reading to determine the angular misalignment. If the angular misalignment is greater the 0.070 inches realign the shafts and repeat parallel and angular alignment steps.

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. Remove coupling guard (3, Figure 2-8) to expose coupling (2) for disassembly.

b. Remove motor foundation bolts and slide motor (1) back to separate coupling halves (2). Retain mounting hardware for installation.

c. Remove conduit box cover (8, Figure 2-11) by removing conduit box screws (9).

d. Label and disconnect wires in conduit box to ensure proper motor rotation after installation. (Proper motor rotation is counterclockwise facing shaft end.)

e. Remove setscrew (21) from coupling hub (18) and slide hub with machine key (14) from rotor (12).

f. If motor is to be replaced proceed to replacement procedure for installation of new motor, if repair is to be completed proceed to repair procedure.

REPAIR (Figure 2-11)

Repair of the dirty oil pump motor (1, Figure 2-11) consists of replacing the following components: Clamp (4), Fan impeller (5), Annular ball bearings (11 or 13) and Flexible coupling insert (19).

NOTE

If other maintenance is required to repair the motor, then motor replacement is required.

To repair the dirty oil pump motor (1), perform the following procedure:

a. Perform removal procedure.

b. Remove attaching screws (2) securing fan housing (3). Remove fan housing.

c. Remove clamp (4) and fan impeller(5).

d. Remove bolts (16) securing end bells (7 and 15). Remove end bell (7) and shim (10).

e. Remove forsheda (17) and end bell (15).

f. Remove annular ball bearings (11 and 13) from rotor assembly (12) using standard bearing puller.

g. Visually inspect for wear, damage and corrosion.

h. Install new annular ball bearings (11 and 13) onto rotor assembly (12).

i. Install end bell (15) and forsheda (17).

j. Install shim (10) and end bell (7).

k. Install bolts (16) through end bell (15) to end bell (7).

l. Install fan impeller (5) and clamp (4).

m. Install fan housing (3); secure using attaching screws (2).

n. Install coupling hub (18) with machine key (14) onto motor shaft; secure with setscrews (21).

o. Proceed to replacement procedure step b.

REPLACEMENT

a. Install coupling hub (18, Figure 2-11) with machine key (14) onto motor shaft; secure with setscrews (21).

b. Install flexible coupling insert (19) into coupling hub (18).

c. Place motor on foundation aligning coupling hubs of both motor (18) and pump (20). When the motor and pump are spaced correctly, the distance as measured with calipers (2, Figure 2-10) is 2.375 inches.

d. Align motor feet bolt holes over bolt holes in foundation and insert mounting bolts with nuts. Do not tighten mounting hardware, allow sufficient play for insertion of shims for coupling alignment.

e. Perform coupling alignment before proceeding to step f.

f. Install coupling guard (3, Figure 2-8).

g. Connect wires in conduit box as labeled on removal to ensure proper motor rotation. (Proper motor rotation is counterclockwise facing shaft end.) If motor rotation is not counterclockwise reverse any two incoming power leads.

h. Install conduit box cover (8, Figure 2-11); securing with conduit box screws (9).

i. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

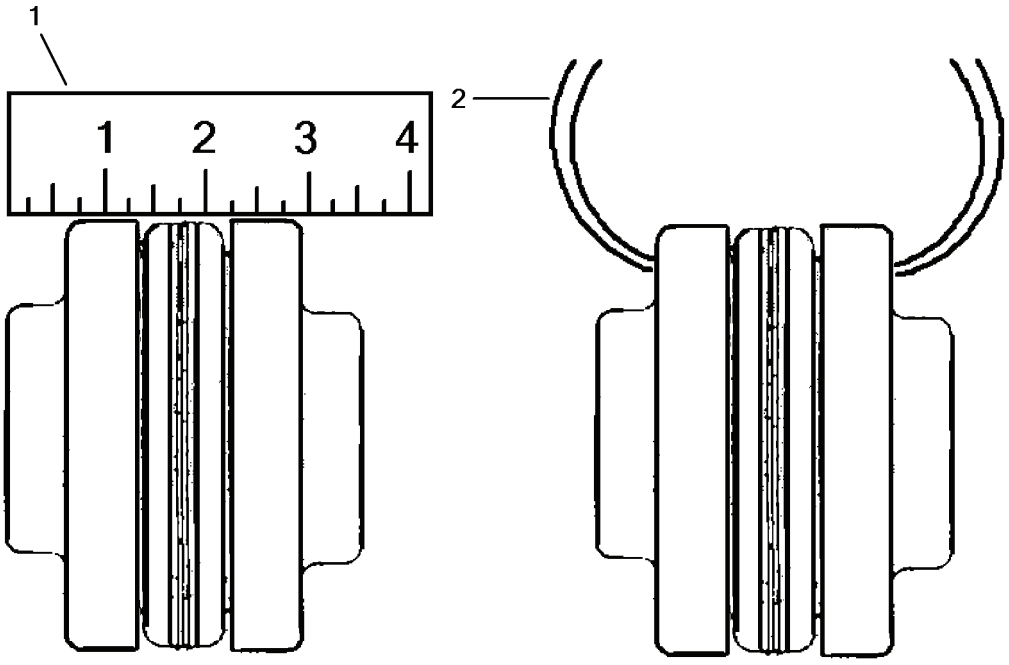
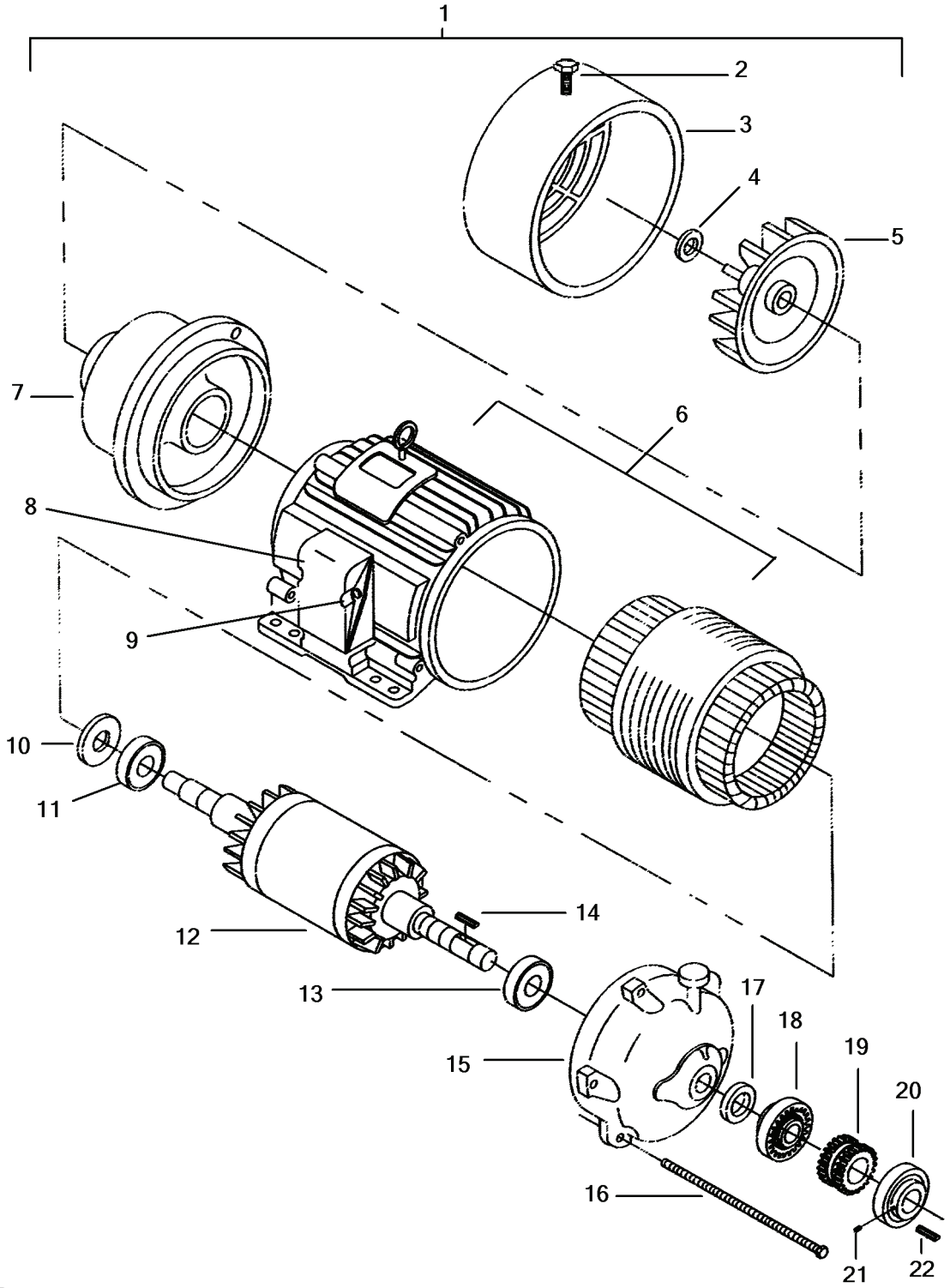


Figure 2-10. Dirty Oil Pump Coupling Alignment.



LEGEND:

1. AC MOTOR
2. SCREW
3. FAN HOUSING
4. CLAMP
5. FAN IMPELLER
6. STATOR ASSEMBLY
7. END BELL
8. CONDUIT BOX COVER
9. CONDUIT BOX SCREW
10. SHIM
11. ANNULAR BALL BEARING
12. ROTOR ASSEMBLY
13. ANNULAR BALL BEARING
14. MOTOR MACHINE KEY
15. END BELL
16. HEX BOLT
17. FORSHEDA
18. COUPLING HUB
19. FLEXIBLE COUPLING INSERT
20. COUPLING HUB
21. SETSCREW
22. PUMP MACHINE KEY

Figure 2-11. Dirty Oil Pump Motor.

2-20. Control Panel. (Figure 2-12)

This task covers: a. Inspect, b. Repair.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273
Tool Kit, Electrician's,
5180-00-391-1087
Iron, Soldering,
3439-00-204-3858

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Insulation Sleeving, Electrical, Item 7, Appendix C
Solder, Tin Alloy, Item 16, Appendix C
Warning Tags, Item 19, Appendix C

INSPECT

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

Inspect door locking devices for security, door gaskets for serviceability and terminal screws for tightness. Check for signs of condensation inside panel, and discolored connectors from possible system malfunctions. Perform Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10).

REPAIR

Repair is through replacement of fuses (15 or 18, Figure 2-12), lamps (6A, 7A, 8A or 30A), relays (19, 23, 26 or 27), switches (28 or 29) and transformer (16) and pushbutton switches (3, 5 or 9).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

1. Replacement of fuses (15 or 18):

   a. Using fuse puller, pull fuse (15 or18) away from fuse block (14 or 17).

   b. Install fuse (15 or 18) with a fuse puller by pushing fuse into fuse block (14 or 17).

2. Replacement of lamps (6A, 7A, 8A or 30A), relays (19, 23, 26 or 27), switches (3, 4, 9, 28 or 29) and transformer (16) and pushbutton switches (3, 5 or 9):

   a. When applicable; remove heat shrink sleeving from electrical terminals on unit and unsolder interconnecting wires.

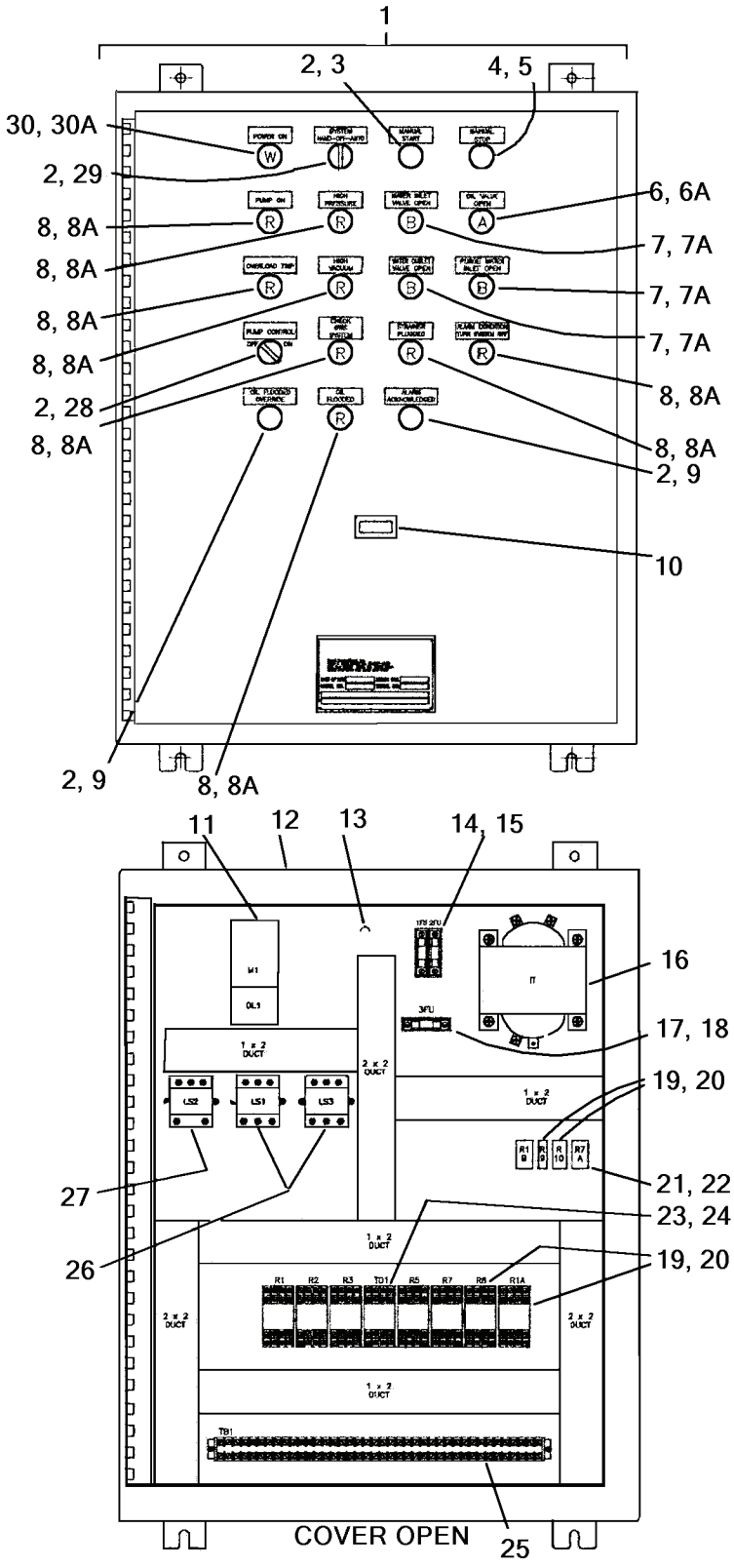
b. Disconnect interconnecting wires from electrical terminals on unit to be replaced. Label wires.

c. Unfasten mounting hardware and remove unit. Retain hardware for installation.

d. Install replacement unit and tighten mounting hardware.

e. Connect interconnecting wires to electrical terminals on unit.

f. When applicable install heat shrink sleeving as required and solder interconnecting wires to electrical terminals on unit.



LEGEND

1. CONTROL PANEL ENCLOSURE
2. N.O. CONTACT BLOCK
3. GREEN PUSH SWITCH
4. RED PUSH SWITCH
5. N.C. CONTACT SWITCH
6. AMBER PILOT LIGHT
6A. INCANDESCENT LAMP
7. BLUE PILOT LIGHT
7A. INCANDESCENT LAMP
8. RED PILOT LIGHT
8A. INCANDESCENT LAMP
9. BLACK PUSH SWITCH
10. LCD DISPLAY ELAPSE TIMER
11. STARTER
12. UNIVERSAL ENCLOSURE
13. UNIVERSAL PANEL
14. 2 POLE FUSE BLOCK
15. 6A 250V FUSE
16. 500 VA TRANSFORMER
17. 1 POLE FUSE BLOCK
18. 5A 250V FUSE
19. RELAY
20. SOCKET
21. RELAY
22. SOCKET
23. TIME DELAY RELAY
24. PLUG-IN SOCKET
25. TERMINAL STRIP
26. ELECTROMAGNETIC RELAY
27. SOLID STATE RELAY
28. SELECTOR SWITCH
29. SELECTOR SWITCH
30. WHITE PILOT LAMP
30A. INCANDESCENT LAMP

Figure 2-12. OWS Control Panel.

2-21. Gauge Panel (All System Gauges). (Figure 2-13)

This task covers: a. Inspect, b. Adjust, c. Repair.

INITIAL SETUP

Tools	Equipment Condition
Tool Kit, General Mechanic's, 5180-00-699-5273	TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Warning Tags, Item 19, Appendix C

INSPECT

Inspection of the gauge panel is accomplished through Preventive Maintenance Checks and Services (PMCS), Table 2-1 and maintenance procedures.

ADJUST

The vacuum switch compound pressure gauge (6, Figure 2-13) shutdown setpoints are adjustable. If the OWS shuts down at the wrong setting adjust as follows:

a. To adjust the pressure setting; rotate the outer adjustment on the gauge face to 15 psi.

b. To adjust the vacuum setting; rotate the inner adjustment on the gauge face to 16 in. Hg.

REPAIR

Repair is by replacement of gauges.

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

Remove gauge from panel by performing the following steps.

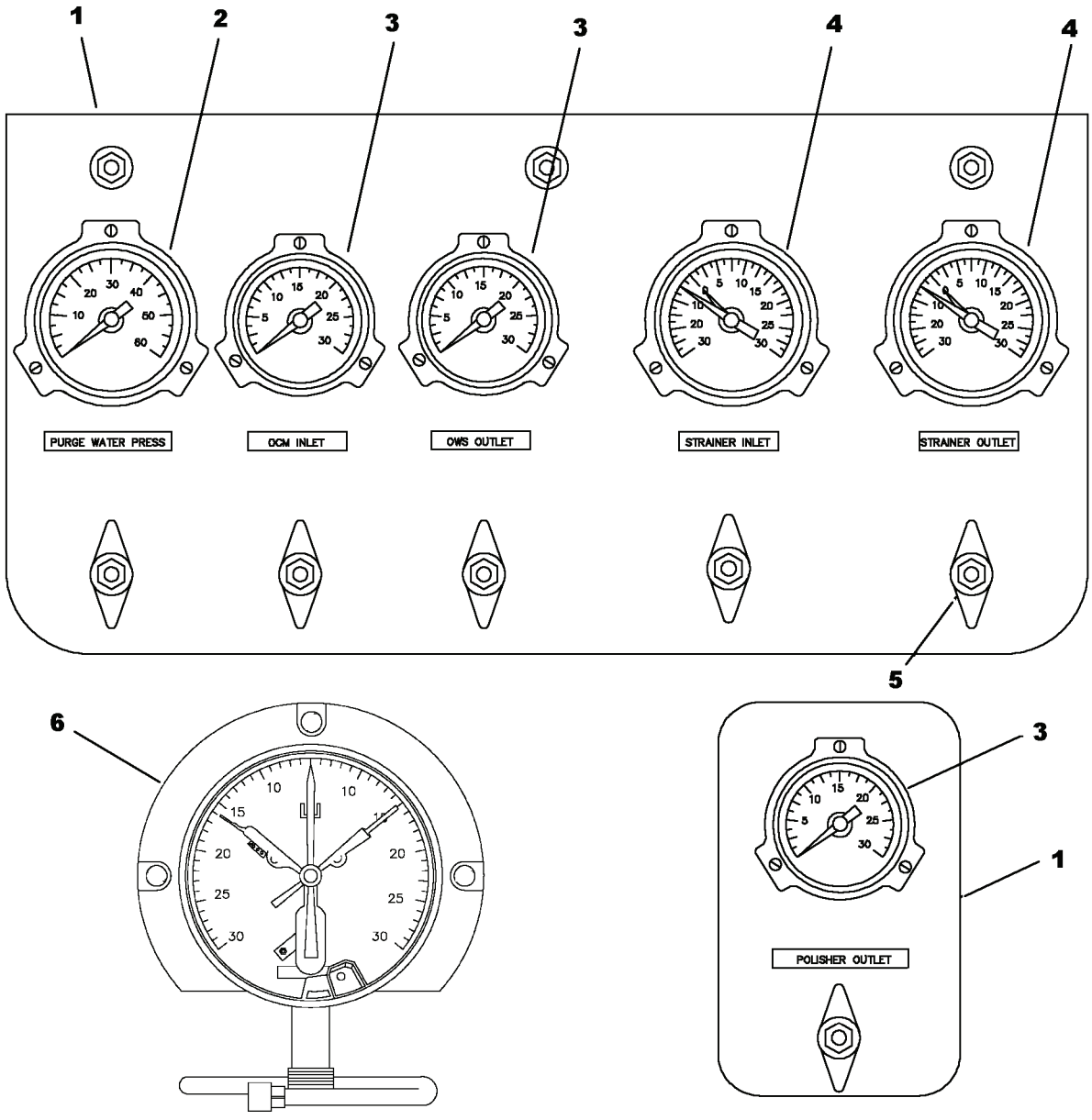
a. Remove piping connection from system to gauge.

b. Remove mounting screws holding gauge to panel.

REPLACEMENT

a. Mount gauge into gauge panel using screws removed during removal.

b. Attach piping to gauge port connection. Check for leaks when system is placed back in service.



LEGEND:
1. PANEL, GAUGE
2. GAUGE, PRESSURE 0-60 PSI
3. GAUGE, PRESSURE 0-30 PSI
4. GAUGE, COMPOUND, 30” TO 30 PSI
5. GAUGE, ISOLATION VALVE
6. GAUGE, COMPOUND, 30” TO 30 PSI VACUUM SWITCH

Figure 2-13. Gauge Panel (All System Gauges).

2-22. Motorized Valves. (Figure 2-14)

This task covers: a. Adjust, b. Service, c. Removal, d. Repair, e. Replacement.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Valve, Ball, Actuated, 3/4" P/N 688888
Valve, Ball, Actuated, 1 1/2" P/N 6051688
Washer, Lock, 3/8", Monel P/N 6052706
Washer, Lock, #10, Monel P/N 6052594
Cleaning Solvent, Item 1, Appendix C
Gasket, Material, Item 4, Appendix C
Rags, Wiping, Item 12, Appendix C
Warning Tags, Item 19, Appendix C

ADJUST

NOTE

The Oil Discharge (Master) and Purge Water (Slave) motorized valves and the Influent (Master) and Pump Discharge (Slave) motorized valves are dependant on each other for proper operation. Valve adjustment must be made for each Master and Slave motorized valve as a set.

The cam adjustments can be made while the valve is installed in the system.

a. Remove the cover from the actuator assembly (1, Figure 2-14) by unscrewing.

b. To adjust valve open cam (Figure 2-14, exploded view), loosen set screw on cam 1 (valve open) (3).

c. Rotate cam clockwise (A) for under-travel and counterclockwise (B) for over-travel. Tighten set screw when adjustment is correct.

d. To adjust valve close cam, loosen set screw on cam 2 (valve closed) (2).

e. Rotate cam clockwise (A) for over-travel and counterclockwise (B) for under-travel.

f. Tighten set screw when adjustment is correct.

g. Replace cover on the actuator assembly (1).

SERVICE

Service of the Motorized Valve is accomplished through Preventive Maintenance Checks and Services (PMCS), Table 2-1 and maintenance procedures.

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or damage to equipment.

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death or injury to personnel or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new hardware.

NOTE

Determine the position of the valve prior to removal, to ensure proper installation.

a. Remove cover from the actuator assembly (1, Figure 2-14) and place cover in safe location.

CAUTION

Care shall be taken not to damage cam mechanisms.

b. Label and disconnect electrical leads.

c. Remove actuator assembly (1) by removing four screws (11) and four lock washers (10). Place actuator assembly in a safe location if it is to be reused.

d. Remove nuts (6) and bolts (4) to remove the ball valve (5) from piping system. Place the valve in a vise or other suitable retention tool in such a fashion so as to allow access to the valve and motor/valve adaptor (10).

e. Match mark the actuator (1), motor/valve adapter (12) and ball valve (5). Remove capscrews (11) and lock washers (10) to remove the actuator (1) from the mounting bracket (7). Discard lock washers.

f. Remove motor/valve adapter (12). Retain for replacement.

g. Remove mounting bracket (7) from valve (5) by removing lock washers (8) and screws (9). Retain for replacement. Discard lock washers.

REPAIR

Repair of the Motorized Valve is by replacement of actuator (1, Figure 2-14) or ball valve (4).

REPLACEMENT

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death or injury to personnel or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new hardware.

a. Install mounting bracket (7, Figure 2-14) onto ball valve (5) using new lock washers (8) and capscrews (9).

b. Install motor/valve adapter (12).

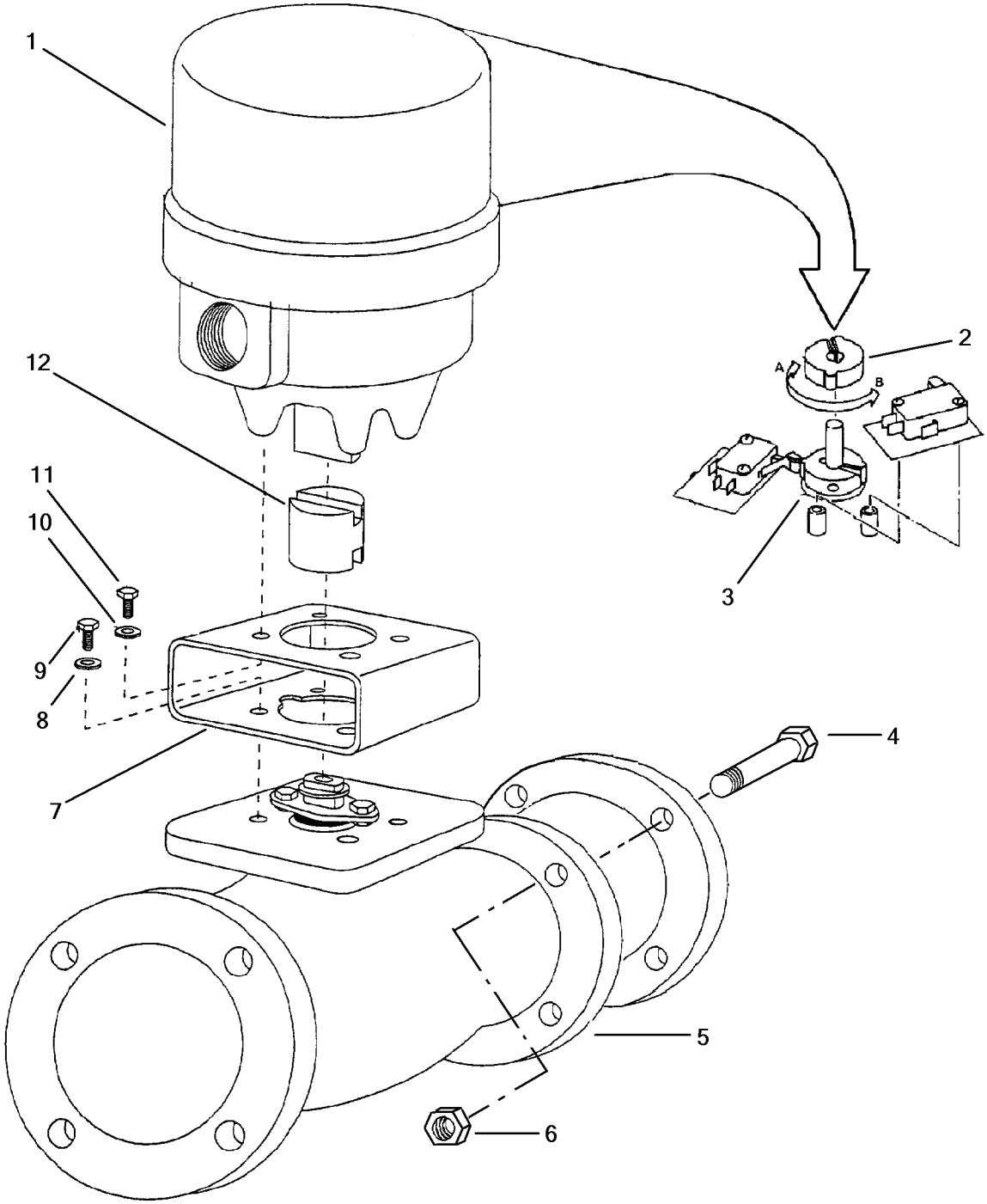
c. Install ball valve (4) in piping system using gasket material (cut to size) at both valve flange faces and nuts (6) and bolts (4). Install flange bolts and torque to value specified in Appendix D.

d. Install actuator assembly (1) and secure to mounting bracket (7) using new lock washers (10) and capscrews (11).

e. Thread electrical leads through conduit fitting and connect electrical leads as labeled during removal.

f. Perform adjust procedure.

g. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:

1. ACTUATOR ASSEMBLY
2. CAM 2 (VALVE CLOSED)
3. CAM 1 (VALVE OPEN)
4. BOLT
5. VALVE, BALL (3/4” and 1-1/2”)
6. NUT
7. MOUNTING BRACKET
8. LOCK WASHER
9. CAPSCREW
10. LOCK WASHER
11. CAPSCREW
12. MOTOR/VALVE ADAPTER

Figure 2-14. Motorized Valves.

2-23. Diverter Valve. (Figure 2-15)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's, 5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Actuator, Solenoid, P/N AE3352170001
Spring, P/N 71104P0G1
Switch, P/N 50313POX9
Disc, Valve, P/N 04774AOP2
Cleaning Solvent, Item 1, Appendix C
Gasket, Material, Item 4, Appendix C
Rags, Wiping, Item 12, Appendix C
Warning Tags, Item 19, Appendix C

INSPECT

Inspection of the diverter valve is accomplished through Preventive Maintenance Checks and Services (PMCS), Table 2-1 and Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10).

REMOVAL

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death or injury to personnel or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new hardware.

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. Remove cover from terminal box (17, Figure 2-15); inspect O-ring (18) for cracks and tears.

b. Label and disconnect terminal eyes (19) from terminal block (20).

c. Loosen screws (26) and remove cover from limit switch (24).

d. Label and disconnect wires inside limit switch (24) and remove wires from switch body.

e. Remove nuts (55), bolts (58), washers and move diverter valve assembly away from piping flanges (57).

e. Discard gasket (56).

REPAIR

Repair of the diverter valve is by replacement of the actuator (2), valve disc (52), compression spring (43), switch assembly (23), fluid valve stem (28), knob (7), resistor (46) and actuator arm switch (27).

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death or injury to personnel or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new hardware.

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

1. Solenoid actuator.
   a. Remove cover from terminal box (17), inspect O-ring (18) for cracks and tears.
   b. Label and disconnect terminal eyes (19) from terminal block (20).
   c. Remove screws (12) and lockwashers (13) from valve bracket (44).
   d. Rotate solenoid (5) counterclockwise from pipe nipple (4). Gently pull solenoid wires through elbow (3) and pipe nipple (4).
   e. Install new solenoid (5), thread wires through elbow (3) and pipe nipple (4).
   f. Ensure plunger (11) is properly located inside solenoid (5).
   g. Secure solenoid (5) to valve bracket (44) using screws (12) and new lockwashers (13).
   h. Reconnect terminal eyes (19) as labeled during removal onto terminal block (20).
   i. Install cover onto terminal box (17), using new O-ring (18) if required.
   j. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.
2. Switch assembly (23).
   a. Loosen screws (26) and remove cover from limit switch (24).
   b. Label and disconnect wires inside limit switch (24) and remove wires from switch body.
   c. Remove two mounting screws holding limit switch (24) to bracket (44).
   d. Install limit switch (24) onto bracket (44) using mounting screws removed in step c.
   e. Reconnect wires inside limit switch (24) as labeled in step b.
   f. Install cover onto limit switch (24) using screws (26).
   g. Adjust indication arm (27) by loosening arm setscrew and adjusting arm until correct valve position is indicated, then tighten setscrew.
   h. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.
3. Teflon valve disc (52).
   a. Perform removal procedure.

b. Remove four bolts (47) and lockwashers (48) from valve body (49) and bonnet (61). Remove valve body (49).

c. Remove screw (50) and retaining disc (51), then remove valve disc (52).

d. Install new valve disc (52) and secure using screw (50) and retaining disc (51).

e. Install valve body (49) to bonnet (61) using four bolts (47) and new lockwashers (48).

f. Perform replacement procedure.

g. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

4. Spring (43).

NOTE

The spring replacement requires the use of a pair of needle nose pliers and a flat tip screwdriver. Ensure the spring is not extended or removal will be difficult.

a. Work screwdriver between eye bolt (22) and spring (43).

b. Grasp end of spring (43) with needle-nose pliers and remove from eye bolt (22).

c. Place end of new spring (43) into eye bolt (22) and screwdriver in opposite end of spring (43).

d. Work flat tip of screwdriver into other eye bolt (22) and lever (42) end of spring onto eye bolt while extending the spring.

f. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

5. Resistor (46).

a. Remove cover from terminal box (17), inspect O-ring (18) for cracks and tears.

b. Label and disconnect terminal eyes (19) connected to resistor (46), from terminal block (20).

c. Remove and replace resistor (46).

d. Reconnect terminal eyes (19) as labeled during removal onto terminal block (20).

e. Install cover onto terminal box (17), using new O-ring (18) if required.

f. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

REPLACEMENT

a. Clean piping flange (57) mating surfaces.

b. Place diverter valve between piping flanges (57) and install a new gasket (56) at each flange face.

c. Match bolt holes and insert bolts (58), washers and nuts (55) until hand tight. Torque to specification found in Appendix D.

d. Reconnect wires (19) as labeled during removal onto terminal block (20).

e. Install cover onto terminal box (17), using new O-ring (18) if required.

f. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

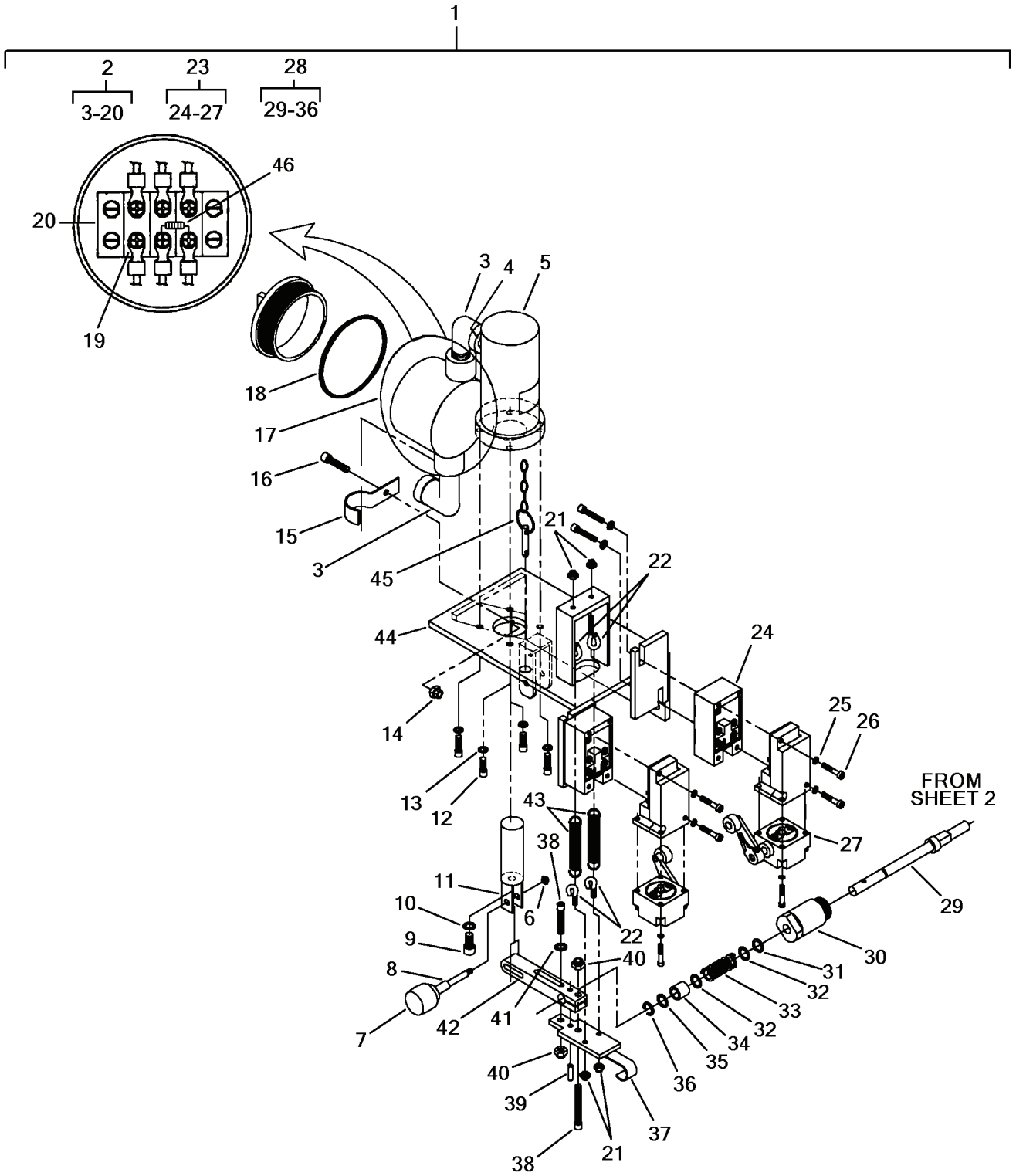
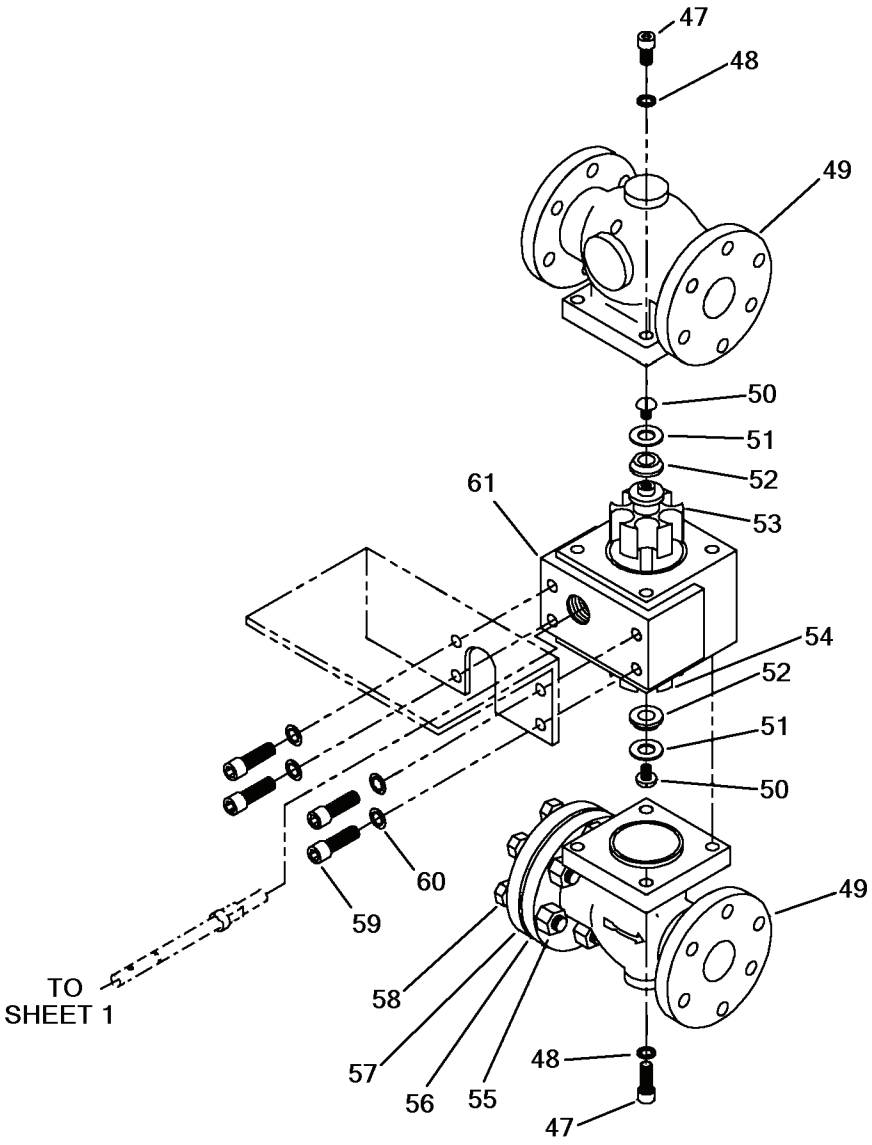


Figure 2-15. Diverter Valve (Sheet 1 of 2).



LEGEND:

1. VALVE SOLENOID
2. ACTUATOR
3. ELBOW
4. PIPE NIPPLE
5. SOLENOID
6. PIN NUT KNOB
7. KNOB
8. KNOB PIN
9. SCREW
10. LOCKWASHER
11. PLUNGER
12. SCREW
13. LOCKWASHER
14. NUT
15. CLAMP
16. SCREW
17. TERMINAL BOX
18. O-RING
19. TERMINAL EYE
20. TERMINAL BLOCK
21. FLEX NUT
22. EYE BOLT
23. SWITCH ASSEMBLY
24. SPDT SWITCH
25. LOCKWASHER
26. SCREW
27. SWITCH ARM
28. FLUID VALVE STEM
29. ROTARY SHAFT
30. HOUSING
31. O-RING
32. O-RING
33. SPRING
34. BUSHING
35. WASHER
36. RETAING RING
37. FINGER ASSEMBLY
38. SCREW
39. PIN
40. NUT
41. WASHER
42. LEVER
43. SPRING
44. BRACKET
45. LOCK PIN
46. RESISTOR
47. BOLT
48. LOCKWASHER
49. VALVE BODY
50. SCREW
51. RETAINING DISC
52. VALVE DISC
53. PISTON TOP
54. PISTON BOTTOM
55. NUT
56. GASKET
57. FLANGE
58. BOLT
59. BOLT
60. LOCKWASHER
61. VALVE BONNET

Figure 2-15. Diverter Valve (Sheet 2 of 2).

2-24. Duplex Strainer. (Figure 2-16)

This task covers: a. Inspect, b. Service, c. Repair.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Cleaning Solvent, Item 1, Appendix C
Rags, Wiping, Item 12, Appendix C
Warning Tags, Item 19, Appendix C

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

INSPECT

Inspection of the Duplex Strainer is accomplished through Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10).

SERVICE

Service of the Duplex Strainer is accomplished through Preventive Maintenance Checks and Services (PMCS TM 55-1905-223-10).

REPAIR

Repair of the Duplex Strainer (Figure 2-16) is by replacement of:

NOTE

The Hayward Model 50 duplex strainer was installed with some installations of the OWS. The Hayward Model 50 is obsolete and is replaced by the Eaton Model 53BTX. Available replacement parts for the Hayward Model 50 is limited to items (10 and 12), all others may only be obtained via local purchase.

a. O-ring (11 or 12).

b. Strainer (9 or 10).

NOTE

In the event that the cartridge O-rings, seats or seals need replacement, parts kit, seal replacement P/N ST053K15BT, is available and includes cartridge extraction tool and instructions.

c. Parts Kit (53BTX) (Items 15 through 18).

To repair the Duplex strainer perform the following task:

a. Position handle (4) to opposite basket that maintenance is being conducted.

b. Remove applicable eye nut (5) from stud (13).

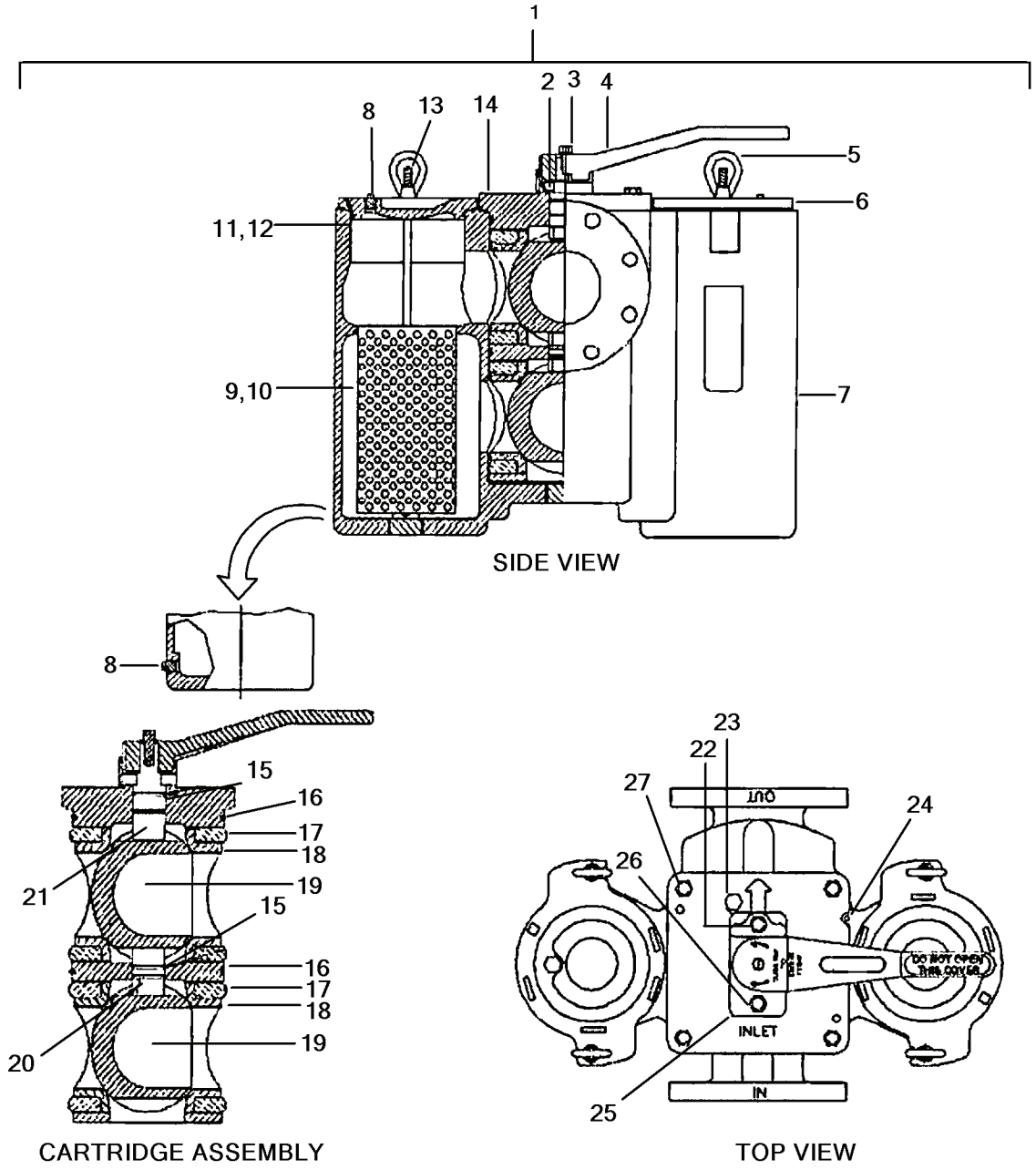
c. Remove strainer cover (6).

d. Remove and replace O-rings (11 or 12), strainer (9 or 10), repair kit components (15 through 18) as necessary.

e. Replace cover (6); securing with eye nuts (5).

f. Position handle (4) over basket that was repaired.

g. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:

1. DUPLEX STRAINER
2. WASHER
3. CAPSCREW
4. VALVE HANDLE
5. EYE NUT
6. COVER
7. DUPLEX STRAINER BODY
8. PLUG
9. STRIANER (MODEL 53BTX)
10. STRAINER (MODEL 50)
11. O-RING (MODEL 53BTX)
12. O-RING (MODEL 50)
13. STUD
14. CARTRIDGE
15. STEM O-RING
16. CARTRIDGE O-RING
17. SEAL
18. SEAT
19. BALL
20. MIDDLE STEM
21. TOP STEM
22. CAPSCREW
23. VENT VALVE
24. PIN
25. STEM RETAINER
26. CAPSCREW
17. CAPSCREW

Figure 2-16. Duplex Strainer.

2-25. Relief Valves. (Figure 2-17)

This task covers: a. Inspect, b. Test, c. Removal, d. Replacement.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Cleaning Solvent, Item 1, Appendix C
Rags, Wiping, Item 12, Appendix C
Warning Tags, Item 19, Appendix C

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

INSPECT

Inspection consists of checking valve for leakage or damage.

TEST

The relief valve test should be performed while the system is in operation and discharging overboard.

NOTE

Ensure that valve opens at 28 psig and fully closes at 23 psig.

a. Create back pressure to system by slowly closing OWS pump discharge valve (OWS 47) until tank pressure gauge on gauge panel reads 28 psig.

b. Verify flow through relief valve.

c. Fully open OWS pump discharge valve (OWS 47).

d. Verify that there is no leakage from relief valve. If relief valve does not open or close fully; replace.

REMOVAL.

a. Remove the two union nuts (2, Figure 2-17) from piping.

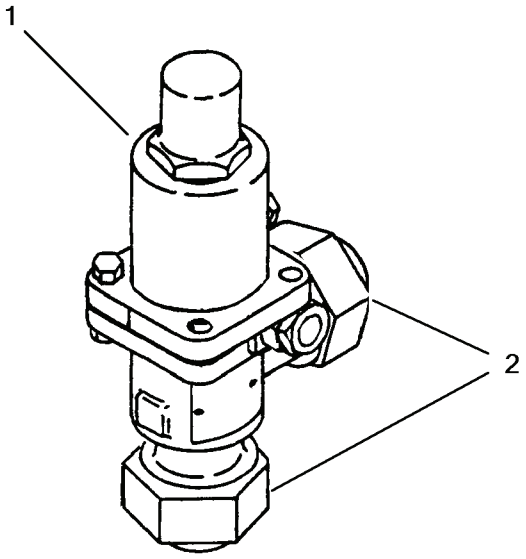
b. Remove relief valve (1).

REPLACEMENT

a. Replace relief valve (1) in piping.

b. Tighten union nuts (2) onto the piping.

c. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:
1. RELIEF VALVE
2. UNION NUT

Figure 2-17. Relief Valve.

2-26. Oil Content Monitor Assembly. (Figures 1-5, 1-6, 2-18, 2-19 and 2-20)

This task covers: a. Inspect, b. Test, c. Service, d. Adjust, e. Repair.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273
Tool Kit, Electrician's,
5180-00-391-1087
Allen Wrenches, 5120-01-087-3616
Iron, Soldering
3439-00-204-3858

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).
TM 55-1905-223-10, Main Engine Secured, Locked Out and Tagged (FM 55-502) while conducting service and adjustment task.

Materials/Parts

Cleaning Solvent, Item 1, Appendix C
Cotton Swab, Item 2, Appendix C
Pipe Cleaner, Item 11, Appendix C
Rags, Wiping, Item 12, Appendix C
Silicon, RTV, Item 15, Appendix C
Warning Tags, Item 19, Appendix C

INSPECT

Inspection of the Oil Content Monitor is accomplished through Preventive Maintenance Checks and Services (PMCS), Table 2-1 and Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10).

TEST (Figure 2-18)

WARNING

This procedure is performed on the system while in operation. Exercise extreme care when working on/around live equipment.

NOTE

The Verification/Confidence test requires two personnel to effectively perform.

If at any point in this test procedure the required response called for in the particular procedural step does not take place, discontinue the procedure until further troubleshooting uncovers the fault.

Verification/Confidence. At initial installation or after any electrical repair or component replacement, perform the Verification/Confidence Test step-by-step as follows:

a. Ensure the ASW Pump is on.

b. Ensure that the Sample Inlet Valve (OWS-51) and Flush Inlet Valve (OWS-54) are closed (Figure 1-6).

c. Ensure that Operation Selector Switch (A1S1) (15, Figure 2-18, Sheet 1) in the Sampling/Sensor Assembly enclosure is in the OFF position.

d. Turn main disconnect switch to the ON position to supply power to the OCM system (FO-1, Sheet 2).

e. Set the Operation Selector Switch (A1S1) (15, Figure 2-18, Sheet 1) in the Sampling/Sensor Assembly enclosure to the AUTO position; set Alarm Limit (PPM) Selector Switch (A1S2) to 15 PPM position.

f. Open the Flush Inlet Valve (OWS-54) and OCM Inlet Valve (OWS-52) and verify Pressure Regulating Valve (OWS-43) for an inlet pressure of 10 to 12 psig (Figure 1-5).

g. Verify that the following occurs:

(1) The Main Indicator Display POWER indicator illuminates green; 15 PPM range indicator illuminates.

(2) Water is discharged through the OCM drain.

(3) The system solenoid valves begin cyclical control of the water.

(4) The Remote Indicator (Alarm) Assembly display POWER indicator illuminates green, and that the 15 PPM indicator illuminates.

h. If any leaks are evident in the Sample and Detection Assembly, close the Flush Inlet Valve (OWS-54) and position the Operation Selector Switch into the OFF position. Turn main disconnect switch to the OFF position to disconnect power to the OCM before repairing the leaks as required.

i. Gradually close the Flush Inlet Valve (OWS-54) until it is fully closed. Then, gradually open the Flush Inlet Valve (OWS-54) until it is fully open. Verify that the following occurs:

(1) Inlet pressure does not exceed 12 psig.

(2) OCM energizes when inlet pressure exceeds 5 psig, and deenergizes when inlet pressure drops below 5 psig. The Pressure Switch is preset at the factory to switch ON and OFF at 4.5 psig (+/- 0.5 psig).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

j. Position Operation Selector Switch (A1S1) to the OFF position. Verify that the following occurs:

(1) Main Indicator Display is inactive.

(2) Remote Indicator Display is inactive.

(3) No flow from the OCM sample drain.

NOTE

Operation Selector Switch (A1S1) has two label configurations which are (AUTO OFF TEST) or (AUTO OFF MAN); the text in this technical manual uses the MAN position.

k. Position Operation Selector Switch (A1S1) to MAN position. Verify that the following occurs:
(1) Main Indicator Display POWER indicator illuminates; 15 PPM range indicator illuminates.

(2) Remote Indicator Display POWER and 15 PPM indicators illuminate.

NOTE

Although the OCM has a limit of 70 PPM, DOD vessels are not authorized to operate at this range. In accordance with DOD 4715.6-R1, Regulations On Vessels Owned Or Operated By The Department Of Defense, the only acceptable range of operation is 15 PPM. Steps l and m are for the Verification/Confidence Test only.

l. Position the Alarm Limit (PPM) Selector Switch (A1S2) to the 70 PPM position. Observe the following:

(1) The Main Indicator Display 70 PPM range indicator illuminates.

(2) The Remote Indicator Display 70 PPM AT-SEA indicator illuminates with Operation Selector Switch (A1S1) in the AUTO position and the Flush Inlet Valve (OWS-54) open.

m. Position the Alarm Limit (PPM) Selector Switch (A1S2) to the REMOTE position. Press Push To Change Alarm Limit (A2S1) pushbutton to alternately select 15 PPM IN-PORT and 70 PPM AT-SEA. Observe that the Main Indicator Display ranges match.

n. Hold Processor Test/Check Switch (A1S3) on the Processor PCB within the Sampling/Sensor Assembly (door) up into the check on position. Hold for 90 seconds. Verify that the following occur:

(1) Within 20 seconds the Main Indicator Display will show red LED's, and the green LED's will flash.

(2) Within 20 seconds the red OIL CONTENT EXCEEDS ALARM LIMIT indicator on the Remote Indicator Display will illuminate, and a high numerical PPM value will be displayed, and the audible alarm will buzz.

(3) Within 80 seconds the Diverter Valve will actuate and switch positions from overboard to sludge tank.

o. Press PUSH TO SILENCE pushbutton (A2S2) on the Remote Indicator (Alarm). Buzzer should silence.

p. Release Processor PCB Test/Check Switch(A1S3) and verify that the following occur:

(1) The Main Indicator Display stops flashing and shows a low-level reading (0 to 3 PPM).

(2) The Remote Indicator Assembly alarm indicator goes out, and the PPM display shows a low-level reading (0 to 3 PPM).

(3) The Diverter Valve will change positions from sludge tank to overboard discharge.

q. Fully close Flush Inlet Valve (OWS-54).

r. Position the Operation Selector Switch (A1S1) to the AUTO position and proceed as follows:

(1) Open Sample Inlet Valve (OWS-51).

(2) Startup the OWS so that 5 to 15 psig pressure is present in the OWS Pump discharge piping.

(3) Verify that the OCM activates and the POWER indicator illuminates.

(4) Shutdown OWS to drop OCM inlet pressure to below 5 psig.

(5) Verify that the OCM deactivates and the POWER indicator goes out.

s. Startup the OWS so that 5 to 25 psig pressure is present in the OWS pump discharge piping. Proceed as follows:

(1) After 60 seconds, hold Processor PCB Test/Check Switch(A1S3) up in the Check on position. Hold for 90 seconds. Verify that the following occurs:

(a) Within 20 seconds, the Main Indicator Display will show red LED's and the green LED's will flash.

(b) Within 80 seconds the Diverter Valve will actuate and switch positions from overboard to sludge tank.

(c) While the Diverter Valve is in the sludge tank position, there is 5 to 25 psig pressure at the Sample Inlet, and the OCM continues to operate.

t. Release Processor PCB Test/Check Switch(A1S3). The OCM will now sample and control the OWS effluent discharge. Releasing switch A1S3 will not necessarily take the OCM out of ALARM.

(1) If the OCM remains in ALARM for more than 30 seconds after the Processor PCB Test/Check Switch(A1S3) is released; verify the OCM operation by introducing flushing water to the unit by opening Flush Inlet Valve (OWS 54).

(2) If the OCM display stops flashing and shows a low-level reading (0 to 3 PPM) with flushing water, close Flush Inlet Valve (OWS 54).

(3) Close If OCM Alarm engages, the OWS should be checked for proper operation.

u. Shutdown the OWS and verify that the OCM deenergizes when the OWS is shutdown.

v. Perform UVA signal adjustment procedure. Position the Alarm Limit (PPM) Selector Switch (A1S2) to the 15 PPM position. The OCM is now ready to operate.

SERVICE

To perform the Sensor Detection Assembly (SDA) service, proceed as follows:

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

NOTE

If pitting, scratches or other blemishes are identified during any part of this service, reassemble SDA and perform removal and replacement procedure Paragraph 3-12.

Ensure OCM Inlet Valve (OWS-52) (Figure 1-6) is shut.

a. Loosen handnuts (1) securing sampling/sensor assembly enclosure door (2). Open door (2, Figure 2-19).

b. Locate SDA (9) on left-rear of enclosure (10).

c. Disconnect SDA cable connector (4).

d. Remove mounting hardware (8) from SDA (9). Retain hardware for installation.

e. Lift SDA (9) up and away from the enclosure (10).

f. Release tubing (5 and 7) from the quick-connect fittings (6 and 8) by compressing the quick connect fitting collets and simultaneously pulling the tube in the opposite direction.

g. Inspect tubing (5 and 7) for damage. Clean tubing (5 and 7) using pipe cleaner and mild detergent or alcohol or replace as necessary.

CAUTION

The Turbidimeter (9, Figure 2-20) (component of the SDA) and Processor PCB (3, Figure 2-19) are factory calibrated as a matched set. If either component requires replacement, the set must be replaced. Do not separate or mix these components. Matched calibration is necessary for proper operation and cannot be performed in the field.

h. Unfasten UVA mounting screws (1) and remove plastic anchor clips (2, Figure 2-20).

i. Lift out UVA (21) and gasket (20) from vibrator housing (3).

j. Clean and inspect UVA components.

k. Unfasten vibrator housing (3) mounting screws (4) at top of SDA.

l. Loosen nut on elbow fitting (19) on vibrator housing (3). Lift vibrator housing (3) off manifold block (9) of the SDA.

m. Lift turbidimeter (8) out of manifold block (9) and remove O-rings (5 and 6) on top and bottom. Inspect O-rings for cuts or tears, replace if required.

n. Remove glass cell (7) from turbidimeter (8).

o. Clean and inspect turbidimeter components.

p. Remove solenoid valves (16) from manifold block (9).

q. Remove O-rings (17) from manifold block (9).

r. Remove machine screw (13) and manifold end plate (12) with O-rings (11).

CAUTION

Use of abrasive or sharp-edged tools to clean plastic parts may cause damage to the unit.

s. Inspect the ports and valve seat surfaces on the manifold block (9) (plastic block) and clean as necessary using cotton swab, pipe cleaner and mild detergent.

CAUTION

Do not install upper and lower solenoid valves in wrong position. They are not interchangeable.

t. Place O-rings (11) onto manifold end plate (12); secure to manifold block (9) with machine screws (13).

u. Put O-rings (17) into position on manifold block (plastic block) (9).

v. Secure the solenoid valves (16) onto the manifold block (plastic block) (9).

CAUTION

Exterior surfaces of the Glass Cell (8) and interior surfaces of the Turbidimeter (9) must be clean and free of any moisture prior to assembly. Inspect, clean, and dry as required prior to reassembly.

w. Insert glass cell (7) into turbidimeter (8) and install O-rings (5 and 6) in top and bottom.

CAUTION

If assembly does not fit together snugly without force, check for misplaced or pinched O-Rings (6 and 7).

x. Carefully replace turbidimeter (8) into manifold block (9). Place vibrator housing (3) on top and fasten in place using screws (4). Install screws in a cross method sequence; numerically 4A through 4D (Figure 2-20). Use cross method pattern to tighten.

y. Install elbow fitting (19) on vibrator housing (3).

CAUTION

Plastic anchor clips (2) have cutaway notches on one side to fit the UVA (21). Do not install clips upside down or backwards.

z. Install gasket (20) and UVA (21).

aa. Fasten UVA (21) and anchor clips (2) with mounting screws (1).

ab. Push inlet (5, Figure 2-19) and drain (7) tubing into the SDA quick-connect fittings (8) until they stop.

ac. Holding the SDA, insert tubes (5 and 7) into the enclosure quick connect fittings (6) mounted in the sampling/sensor assembly.

ad. Hold SDA (10) in position and refasten mounting hardware (9).

ae. Connect cable connector (4) to OCM control panel (29, Figure 2-18, Sheet 3).

af. Open OCM Inlet Valve (OWS-52) (Figure 1-6) and check tubing for leaks. If tubes leak; correct as required.

ag. Perform UVA adjustment procedure (Paragraph 2-26).

ah. Perform system Verification/Confidence Test (Paragraph 2-26).

ai. Close Sampling/Sensor Assembly enclosure door (2, Figure 2-19); tighten down handnuts (1).

ADJUST (Figure 2-18)

WARNING

This procedure is performed on the system while in operation. Exercise extreme care when working on/around energized equipment.

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

NOTE

Do not attempt this procedure in an excessively noisy environment or if you have a hearing impairment. In such instances, the use of an engine stethoscope may make the audible determinations possible.

a. Ensure ASW Pump is on

b. Make certain that the power remains connected while performing this adjustment (FO-1, Sheet 2). Use shipboard safety procedures for working on energized electrical components.

c. Loosen handnuts (1, Figure 2-19) securing Sampling/Sensor Assembly cover (2) and open.

d. Verify that Operation Selector Switch (A1S1) (15, Figure 2-18, Sheet 1) is in AUTO position.

e. Close Sample Inlet Valve (OWS-51).

f. Open Flush Inlet Valve (OWS-54), so that water flows through the OCM and the pressure switch is activated.

g. Verify that the OCM System is operating by observing red LED (A1DS8) (6, Figure 2-18, Sheet 1) on the back of the Processor PCB.

h. Verify that water is flowing through the Sample and Detection Assembly. Flow can be seen through the clear plastic tubing located on the front of this assembly.

i. Listen for high-pitched tones from the UVA that repeat every 15 seconds (2-second tone, then 5-second tone, repeat cycle). This tone must be fine-tuned for its loudest noise and steadiest pitch by adjusting the Oscillator Transformer (Figure 2-18, Sheet 2) located on the Generator PCB.

j. Locate the Oscillator Transformer on the Generator PCB. Turning the plastic oscillator core (screw) of this transformer changes the signal to the vibrator. Adjustment of the oscillator core must be made in strict accordance with step j through step q and the warnings and cautions below:

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

CAUTION

The locknut on the adjustable plastic transformer core will damage the threads if overtightened. After making the fine-tune adjustment, gently hand-tighten it.

When adjusting the oscillator core, use a wide blade (1/16-in. thick), insulated-handle screwdriver that fits snugly into the core slot without damage.

k. Rotate the oscillator core locknut counterclockwise one turn to allow free adjustment of the plastic core.

l. Hold Processor PCB Test/Check Switch (A1S3) (9, Figure 2-18, Sheet1) on the Processor PCB in the down position. This will cause a continuous oscillation signal that is more easily adjusted then the normal intermittent signal.

(1) Alternately turn the Oscillator Transformer core clockwise and counterclockwise to determine the limits of the audible coarse adjustment range. When the Oscillator Core is tuned within the “coarse adjustment range”, the UVA will produce an audible high-pitched noise. This noise will become gradually louder as the core is adjusted towards the midpoint of this range and will be loudest and have its most steady pitch when fine-tuned to the midpoint. The noise will decrease as the core is adjusted away from the midpoint. (Figure 2-18, Sheet 2.)

m. Using a marker pen, put temporary marks on the metal portion of the Oscillator Transformer, indicating the limits of the coarse adjustment range. The core should then be turned to the center of this coarse adjustment range, which is the fine-tune position. If it is not possible to determine the coarse adjustment range because only weak or unsteady noise is generated, refer to Troubleshooting (Table 2-2) for appropriate action.

n. Release Processor PCB Test/Check Switch(A1S3).

o. Tighten the oscillator core locknut by turning it clockwise while holding the core in the fine-tune position with the screwdriver. Do not overtighten the locknut as it can damage the core threads.

p. Close enclosure door.

q. Tighten down handnuts.

REPAIR

CAUTION

The Turbidimeter Assembly(8, Figure 2-20) (component of the SDA) Elapsed Time Indicator (14, Figure 2-18, Sheet 1) and Processor PCB (3, Figure 2-19) are factory calibrated as a matched set. If either component requires replacement, the set must be replaced. Do not separate or mix these components. Matched calibration is necessary for proper operation and cannot be performed in the field.

1. Repair of the Oil Content Monitor is by replacement of the following components:

   a. Cable assembly (25, Figure 2-18, Sheet 3).

   b. Filter, Radio Frequency (26).

   c. Transformer, Noiseless (19, Figure 2-18, Sheet 1).

   d. Power PCB Fuse (13).

   e. Switches (9, 10 or 15).

   f. Circuit Cards (8, 11 or 20).

   g. Glass Cell (7, Figure 2-20).

   h. O-Rings (5, 6, 11 or 17).

   i. Gasket (20).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

2. Loosen handnuts securing Sampling/Sensor Assembly door. Open door.

3. To repair Cable Assembly (24, Figure 2-18, Sheet 3):

   a. Locate and tag cable connections for installation.

   b. Gently pull cable plugs from cable plug sockets.

c. In the same manner as tagged for removal, gently push new cable into cable sockets.

d. Close enclosure door; tighten down handnuts.

e. Perform system Verification/Confidence Test procedure.

4. To repair the Filter, Radio Frequency (26, Figure 2-18, Sheet 3):

a. Label and disconnect the ground wires and input power wires from the Radio Frequency Filter.

b. Unfasten Filter, Radio Frequency mounting hardware using an allen wrench and pull out of enclosure. Retain hardware for installation.

c. Install new Filter, Radio Frequency with mounting hardware using an allen wrench.

d. Connect ground wires and input power wires to new Radio Frequency Filter.

e. Close enclosure door; tighten down handnuts.

f. Perform system Verification/Confidence Test procedure.

5. To repair the Noiseless Transformer (19, Figure 2-18, Sheet 1):

a. Locate noiseless transformer cover plate (16) in center of enclosure.

b. Remove mounting hardware using an allen wrench. Retain hardware for installation.

c. Remove noiseless transformer cover plate (16).

d. Label and remove noiseless transformer output wires from the Power PCB (input), terminals 1 and 2 (Figure 2-18, Sheet 3).

e. Disconnect noiseless transformer input wires and ground wire from the Filter, Radio Frequency (26, Figure 2-18, Sheet 3). Label wires.

f. Remove noiseless transformer (19) mounting hardware. Retain for installation. Remove noiseless transformer (19).

g. Install noiseless transformer using mounting hardware retained from removal.

h. Connect noiseless transformer input and ground wires to the Filter, Radio Frequency (25).

i. Connect noiseless transformer output wires to the Power PCB (input), terminals 1 and 2 on left.

j. Fasten noiseless transformer cover plate mounting hardware, retained from removal, using an allen wrench.

k. Close enclosure door; tighten down handnuts.

l. Perform system Verification/Confidence Test procedure.

6. To repair the Power PCB Fuse (13, Figure 2-18, Sheet 1):

a. Locate Power PCB (11) in lower rear of enclosure, and fuse (13) on the front left side of it, just above the terminal barrier.

b. Remove faulty fuse (13).

CAUTION

Fuse must be replaced with identical type and rating. Changing rating can cause serious damage to the circuits it is meant to protect.

c. Apply silicone adhesive (RTV) to each end of replacement fuse, and install into fuse holder.

d. Close enclosure door, tighten down handnuts.

e. Perform Verification/Confidence Test procedure.

7. To repair the Operation Selector Switch (A1S1) (15, Figure 2-18, Sheet 1) and Alarm Limit (PPM) Selector Switch (A1S2) (10, Figure 2-18, Sheet 1):

a. Loosen handnuts securing door of Sampling/Sensor Assembly. Open door.

b. Locate switch plate subassembly and unfasten mounting hardware. Retain hardware for installation.

c. Ease forward and unplug Operation Selector Switch (A1S1) (15) cable connector from the Power PCB.

d. The Operation Selector Switch (A1S1) (15) is part of a switch and cable assembly which should be removed as a unit.

CAUTION

Make note of the original position of the Operation Selector switch (A1S1) before removing from the Switch Plate. The replacement switch must be installed with the same orientation.

e. Remove Operation Selector Switch (A1S1) (15) from switch plate using wrench.

f. The Alarm Limit (PPM) Selector Switch (A1S2) (10) is part of Cable Assembly P/N ST25003 and must be removed as an assembly. To remove this assembly, proceed as follows: (Figure 2-18)

(1) Disconnect the ten-wire circular connector (part of Cable Assembly ST25003) (28, Figure 2-18, Sheet 3) from the bottom of the enclosure.

(2) Disconnect the color coded wires from Power PCB terminal strip that connects to the ten-wire circular connector (black from [2], brown from [4], red from [5], orange from [9] and red from [8]).

(3) Remove mounting hardware on transformer cover plate. Retain hardware for installation. Remove cover plate for access to the Filter, Radio Frequency (26, Figure 2-18, Sheet 3).

(4) Disconnect the wire (white) from the ground stud on the Filter, Radio Frequency (26, Figure 2-18, sheet 3).

(5) Remove switch from switch plate using wrench.

(6) Carefully clip off any Ty-raps holding switch wires to the enclosure or to other wire bundles.

(7) Remove Cable Assembly, which includes the switch, wires, and connector.

CAUTION

Install switch in original position. The reverse position will not correspond with the legend on the switch plate.

(8) Install new Alarm Limit (PPM) Selector Switch (A1S2) (10, Figure 2-18, Sheet 1) onto switch plate, in the proper orientation, then tighten the switch nut.

(9) Install circular connector onto bottom of enclosure, including EMI gasket.

CAUTION

During disassembly, do not damage EMI gasket under circular connector. Do not omit it during reassembly.

(10) Connect (white) wire to Filter, Radio Frequency (26, Figure 2-18, Sheet 3) ground stud.

(11) Connect wires to the Power PCB terminal strip from the ten-wire circular connector (black from [2], brown from [4], red from [5], orange from [9]) and switch (red from [8]).

(12) Neatly bundle wires every 2 inches and fasten with small Ty-raps.

(13) Install the transformer hold-down plate and fasten with mounting hardware.

g. Install switch plate subassembly and fasten with mounting hardware.

h. Close enclosure door, tighten down handnuts.

i. Perform system Verification/Confidence Test procedure.

8. To repair the Processor PCB Test/Check Switch (9, Figure 2-18, Sheet 1):

a. Locate Processor PCB (8, Figure 2-18, Sheet 1) on open door.

b. Disconnect ribbon cable (25, Figure 2-18, Sheet 3) from Processor PCB.

c. Remove mounting hardware for the Processor PCB. Retain hardware for installation.

d. Identify the location of the Processor PCB Test/Check switch on rear of PCB board.

e. Remove solder from connection with a soldering gun.

f. Pull Processor PCB Test/Check Switch from PCB board.

g. Install new Processor PCB Test/Check Switch onto the PCB board ensuring the connections pass through the board in the same manner as removed.

h. Solder the connections to the PCB board.

i. Replace the Processor PCB board onto the door and secure with mounting hardware retained from removal.

j. Reconnect ribbon cable to Processor PCB

k. Close enclosure door, tighten down handnuts.

l. Perform system Verification/Confidence Test procedure.

9. To repair the Generator PCB (19, Figure 2-18, Sheet 1):

a. Locate Generator PCB (19) mounted in top rear of enclosure, and two power resistors mounted on the right side wall of the enclosure (Figure 2-18).

b. Disconnect Ribbon Cable (23, Figure 2-18, Sheet 3) connector from Generator PCB.

c. Remove mounting hardware for power resistors. Retain hardware for installation.

CAUTION

The generator PCB is fastened to the enclosure with four socket head cap screws. Do not remove any other hardware on generator PCB.

d. Remove mounting hardware for Generator PCB (19), and remove it. Retain hardware for installation. It is not necessary to remove the heat sink from behind the Generator PCB (19). Leave heat sink in place.

CAUTION

Verify that power resistor wires connected to Generator PCB are clear from the mounting points and the Heat Sink, so that they are not pinched or damaged when installing the Generator PCB.

e. Install new Generator PCB (19) and fasten mounting hardware.

f. Apply liberal amount of thermal grease to underside of power resistors and reinstall onto wall of enclosure. Fasten mounting hardware.

g. Clean any excess grease from edges of the heat sink and power resistors.

h. Reconnect ribbon cable connector (23, Figure 2-18, Sheet 3) to Generator PCB.

i. Perform UVA signal adjustment procedure.

j. Close enclosure door, tighten down handnuts.

k. Perform system Verification/Confidence Test procedure.

10. To repair the Power PCB (11, Figure 2-18, Sheet 1):

a. Locate Power PCB (11) in lower rear of enclosure, and switch plate subassembly which partially covers the Power PCB.

b. Label and disconnect all wires connected to the terminal strip of the Power PCB (11). Tag wires.

c. Remove mounting hardware for switch plate subassembly(12). Retain hardware for installation.

d. Gently pull switch plate subassembly forward and unplug operation selector switch A1S1 (15) connector from power PCB (11).

e. Disconnect ribbon cable from connectors J1 and J4 on power PCB (11).

f. Remove mounting hardware for Power PCB (11). Retain hardware for installation.

g. Gently pull Power PCB (11) forward, and unplug ribbon cable from connector J2 on underside of PCB.

h. Remove Power PCB (11). Remove ETI (14). Apply a small (pea size) drop of silicone adhesive (RTV) to the underside of the ETI (14), and install onto the new Power PCB.

i. Gently connect ribbon cable from SDA to Power PCB connector J2.

CAUTION

When installing ribbon cables, make certain that wires are kept free of the fastened items and do not get pinched when assembled.

j. Fasten Power PCB mounting hardware.

k. Plug in ribbon cable from Processor PCB and Generator PCB into the proper connectors, J1 and J3.

l. Connect Alarm Limit (PPM) Selector Switch (A1S2) (10) wires to terminal strip of Power PCB (11).

m. Plug-in Operation Selector Switch (A1S1) (15) cable subassembly into J4.

n. Fasten mounting hardware for switch plate subassembly.

o. Close enclosure door, tighten down handnuts.

p. Perform system Verification/Confidence Test procedure.

11. To repair the Processor PCB (8, Figure 2-18, Sheet 1).

a. Locate Processor PCB (8) on open door.

b. Disconnect ribbon cable (24, Figure 2-18, Sheet 3).

c. Remove mounting hardware for the Processor PCB. Retain hardware for installation.

d. Gently pull away from door far enough to locate the connecting wires to indicators mounted to door.

e. Tag and remove wires from the indicators mounted on the door.

f. Replace the Processor PCB and reconnect removed indicator wires.

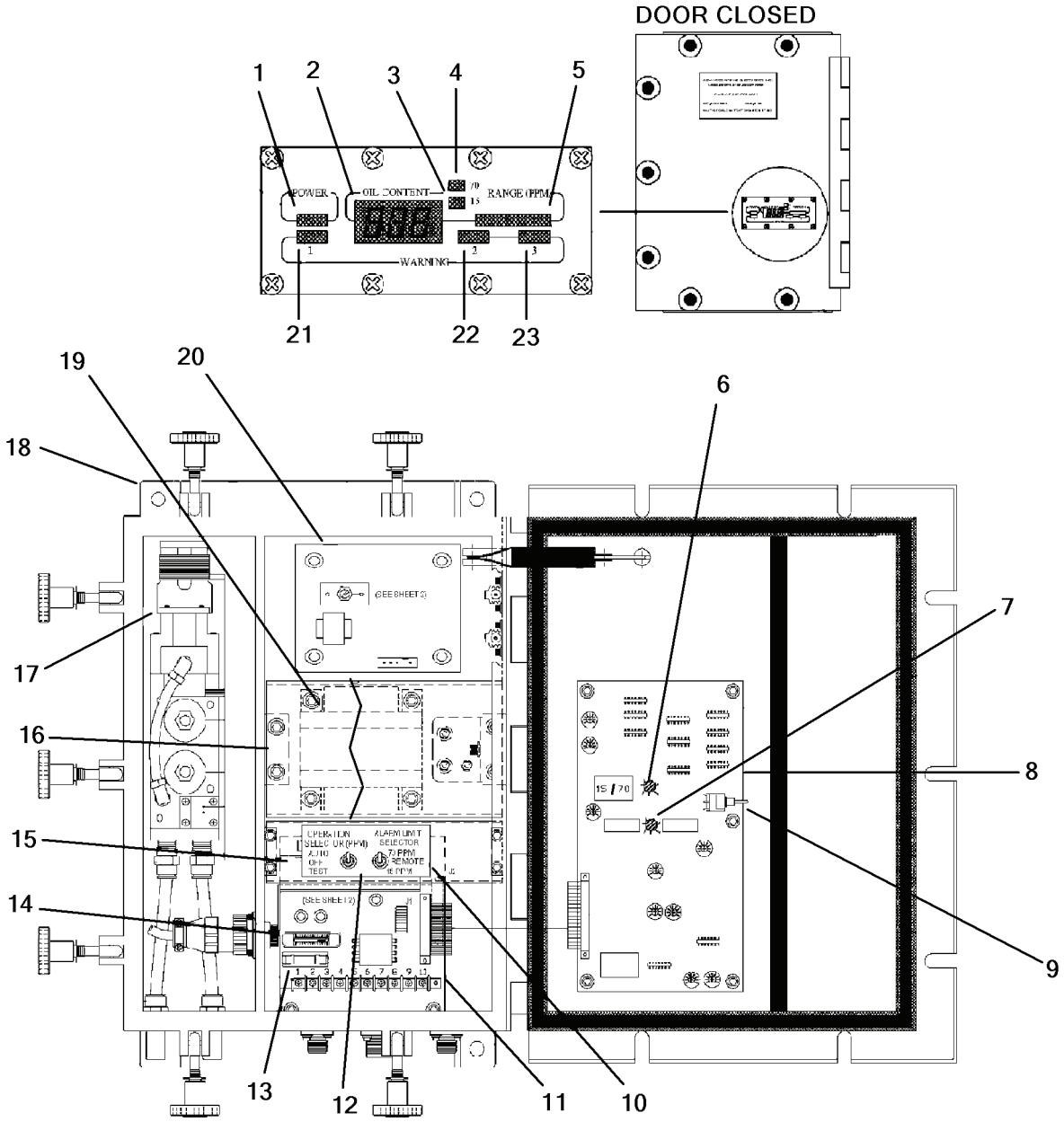
g. Place Processor PCB into position and secure with mounting hardware.

h. Connect the ribbon cable (24, Figure 2-18, Sheet 3) to the Processor PCB.

i. Close enclosure door, tighten down handnuts.

j. Perform system Verification/Confidence Test procedure.

12. To repair the Glass Cell (7, Figure 2-20), O-rings (5, 6, 11 or 17) and Gasket (20); perform service procedures and replace.



LEGEND:

1. POWER INDICATOR (A1DS1)
2. OIL CONTENT LCD DISPLAY (A1DS4)
3. 15 PPM INDICATOR (A1DS3)
4. 70 PPM INDICATOR (A1DS2) (NOT USED)
5. RANGE PPM INDICATOR (A1DS10)
6. SAMPLE DETECTION ON INDICATOR (A1DS8)
7. OCM ALARM INDICATOR (A1DS9)
8. PROCESSOR PCB
9. PROCESSOR PCB TEST/CHECK SWITCH
10. ALARM LIMIT SELECTOR SWITCH (A1S2)
11. POWER PCB
12. SWITCH MOUNTING PLATE
13. POWER PCB FUSE
14. ELAPSED TIME INDICATOR (ETI)
15. OPERATION SELECTOR SWITCH (A1S1)
16. TRANSFORMER COVER PLATE
17. SENSOR DETECTION ASSEMBLY
18. SAMPLING/SENSOR ASSEMBLY
19. NOISELESS TRANSFORMER
20. GENERATOR PCB
21. WARNING 1 INDICATOR (A1DS5)
22. WARNING 2 INDICATOR (A1DS6)
23. WARNING 3 INDICATOR (A1DS7)
24. ELECTRICAL CABLE ASSEMBLY (SHEET 3)
25. ELECTRICAL CABLE ASSEMBLY (SHEET 3)
26. FILTER, RADIO FREQUENCY (SHEET 3)
27. POWER UNIT CABLE ASSEMBLY (SHEET 3)
28. REMOTE ALARM CABLE ASSEMBLY (SHEET 3)
29. REMOTE RELAY CABLE ASSEMBLY (SHEET 3)
30. SDA POWER CABLE ASSEMBLY (SHEET 3)

Figure 2-18. OCM Sampling/Sensor Assembly (Sheet 1 of 3).

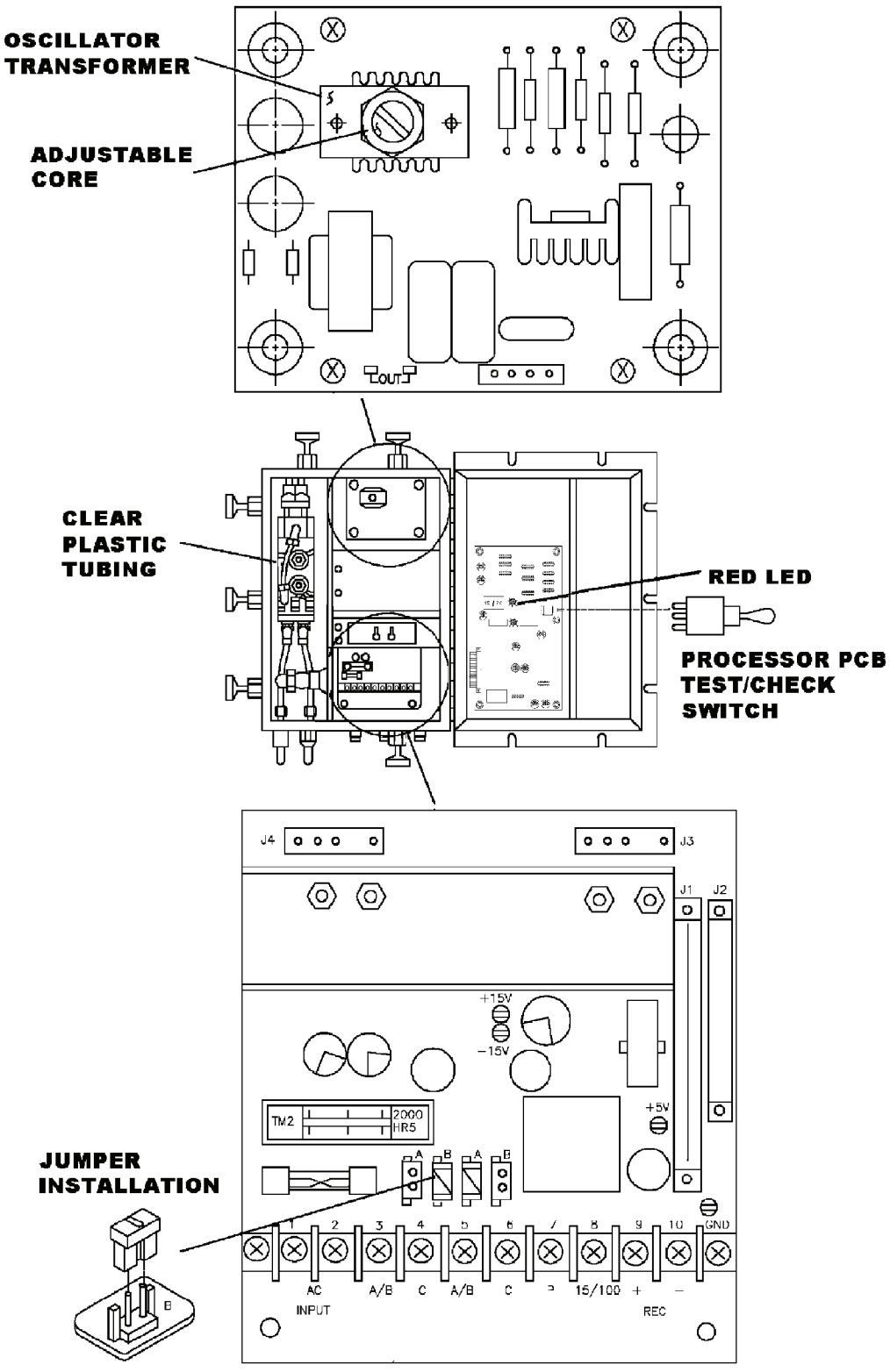


Figure 2-18. OCM Sampling/Sensor Assembly (Sheet 2 of 3).

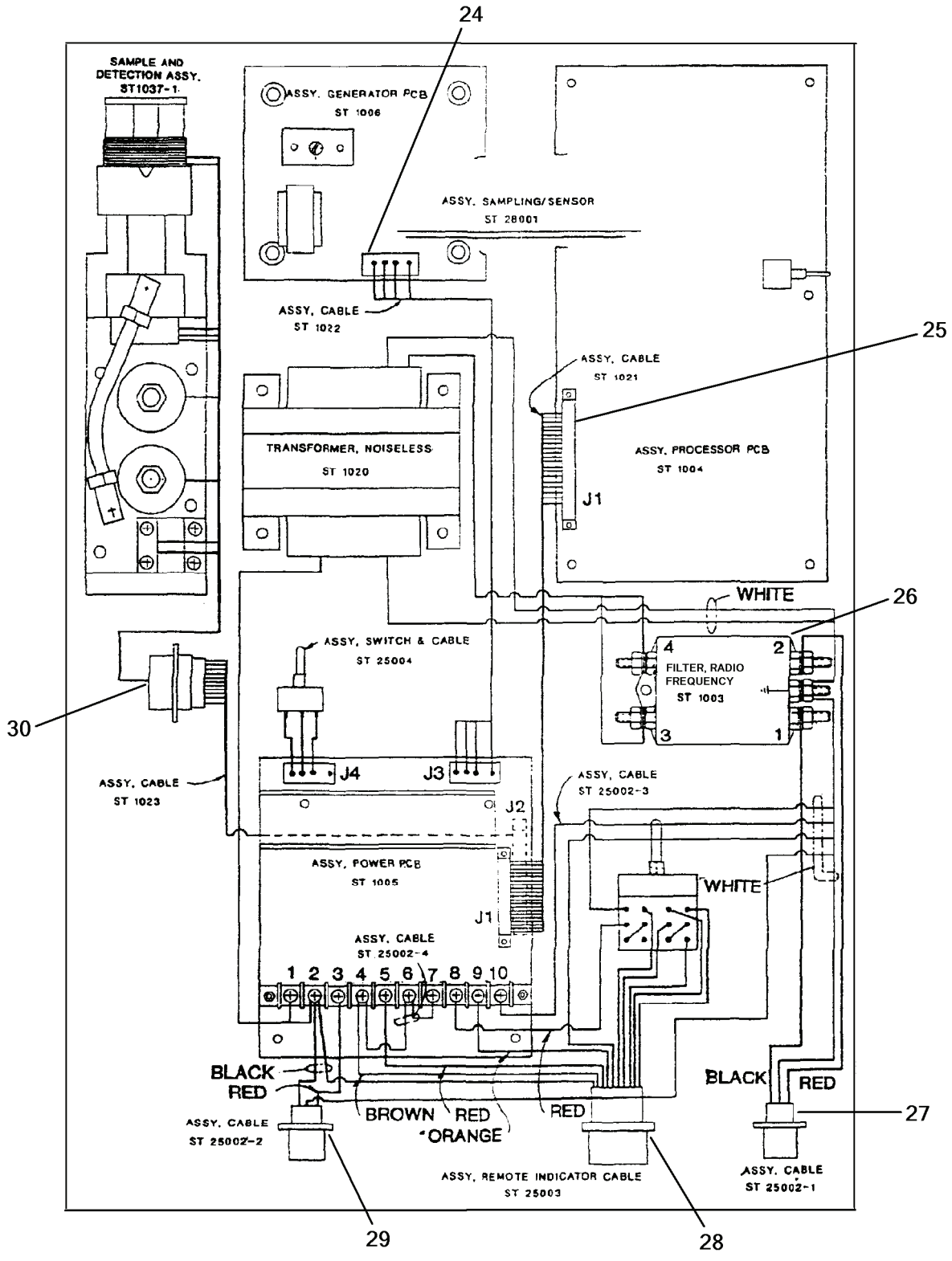
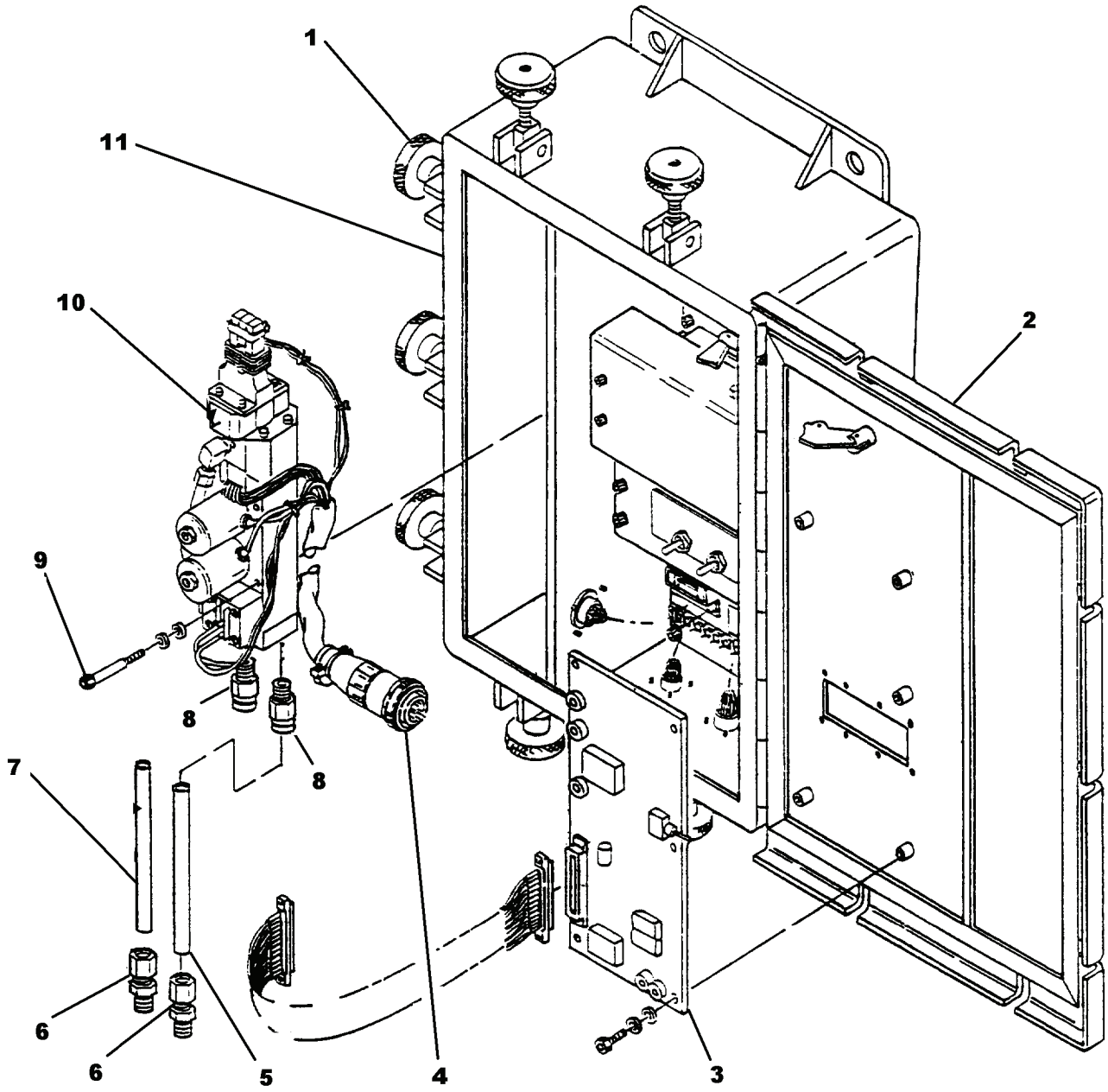
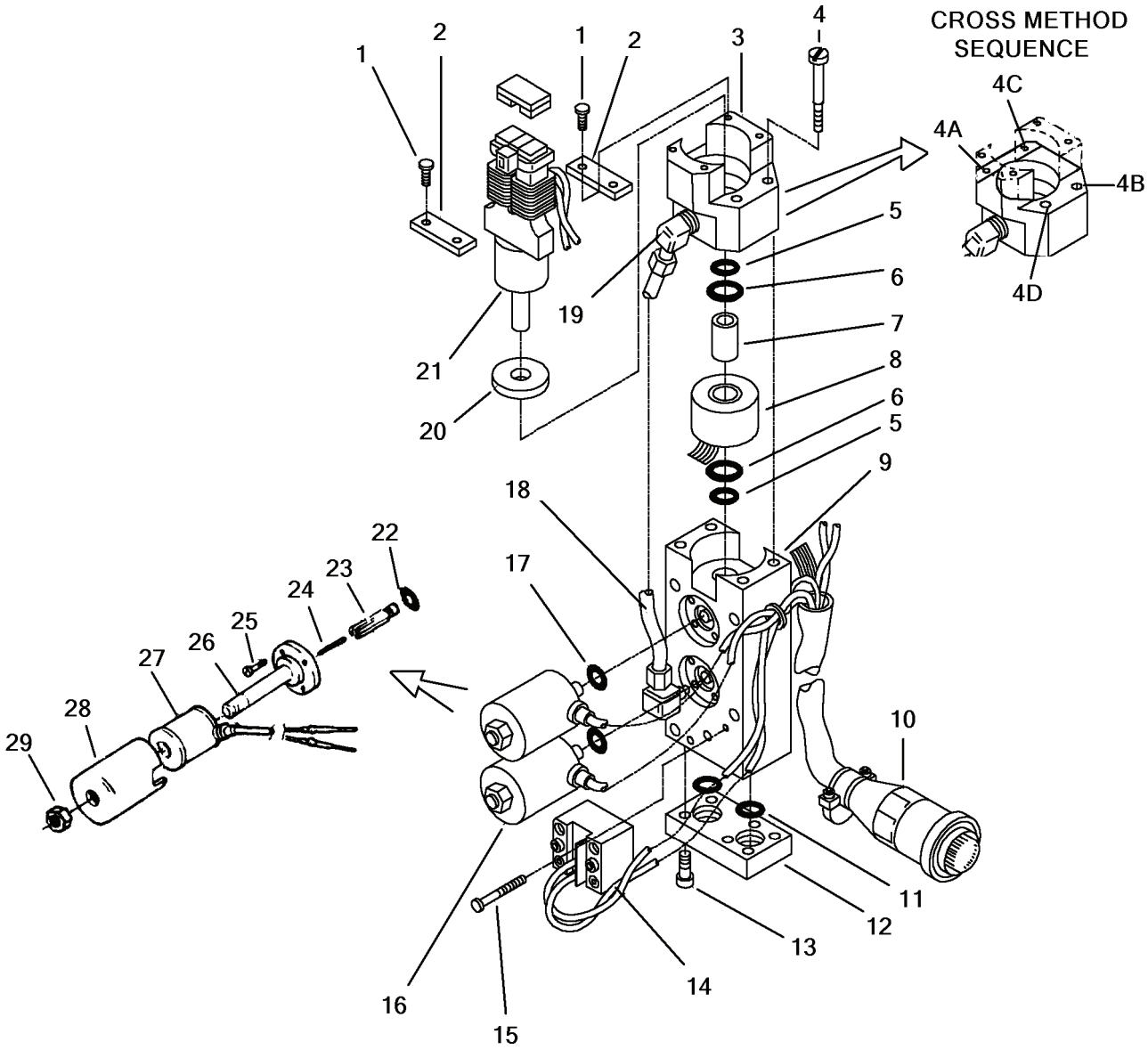


Figure 2-18. OCM Sampling/Sensor Assembly (Sheet 3 of 3).



LEGEND:
1. HANDNUTS
2. ENCLOSURE DOOR
3. PROCESSOR PCB
4. SDA CABLE CONNECTOR
5. INLET TUBING
6. ENCLOSURE QUICK-CONNECT FITTINGS
7. DRAIN TUBING
8. SDA QUICK-CONNECT FITTINGS
9. MOUNTING HARDWARE
10. SENSOR DETECTION ASSEMBLY (SDA)
11. ENCLOSURE

Figure 2-19. Oil Content Monitor Sampling And Detection Assembly.



LEGEND:

1. MACHINE SCREW
2. ANCHOR CLIP
3. VIBRATOR HOUSING
4. MACHINE SCREW
5. O-RING
6. O-RING
7. GLASS CELL
8. TURBIDIMETER ASSEMBLY
9. MANIFOLD BLOCK
10. CONNECTOR
11. O-RING
12. MANIFOLD END PLATE
13. MACHINE SCREW
14. PRESSURE SWITCH
15. MACHINE SCREW
16. SOLENOID VALVE
17. O-RING
18. MANIFOLD TUBING
19. ELBOW FITTING
20. GASKET
21. UVA ASSEMBLY
22. O-RING
23. PLUNGER
24. SPRING
25. SCREW
26. SOLENOID VALVE BODY
27. SOLENOID VALVE COIL
28. COVER
29. LOCKING NUT

Figure 2-20. Sampling And Detection Assembly (Exploded View).

2-27. Remote Indicator (Alarm) Assembly. (Figure 2-21)

This task covers: a. Inspect, b. Repair.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Circuit Card Assembly, P/N AME-220-95155-01
Warning Tags, Item 19, Appendix C

INSPECT

Inspection of the Remote Indicator (Alarm) Assembly is accomplished through Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10).

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. Loosen door closure clamp screws (3, Figure 2-21, Sheet 1) of assembly and open door.

b. Remove retaining nuts (5 and 8).

c. Remove rubber boots (3 and 5).

d. Disconnect cable assembly connector (13, Figure 2-21, Sheet 2).

e. Remove the six capscrews (16), lockwashers (15) and flat washers (14) from circuit card assembly (12).

NOTE

The two electrical leads between the Alarm Buzzer and the Alarm PCB are permanent components of the circuit card assembly. Do not attempt to remove them.

f. Remove the circuit card assembly (12) from the Remote Indicator (Alarm) Assembly.

g. Disconnect and tag PUSH TO SILENCE switch (A2S2) (6, Figure 2-21, Sheet 1) wires from the circuit card assembly (12, Figure 2-21, Sheet 2).

h. Disconnect and tag PUSH TO CHANGE ALARM LIMIT (PPM) switch (A2S1) (9, Figure 2-21, Sheet 1) wires from the circuit card assembly (12, Figure 2-21, Sheet 2).

REPAIR

Repair of the OCM Remote Indicator is by replacement of the following components:

a. Rubber Boots (4 and 7, Figure 2-21, Sheet 1).

b. PUSH TO SILENCE switch (A2S2) (6, Figure 2-21, Sheet 1).

c. PUSH TO CHANGE ALARM LIMIT (PPM) switch (A2S1) (9, Figure 2-21, Sheet 1).

d. Circuit Card Assembly (12, Figure 2-21, Sheet 2).

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

REPLACEMENT

a. Connect the PUSH TO CHANGE ALARM LIMIT (PPM) switch (A2S1) (9, Figure 2-21, Sheet 1) wires to the circuit card assembly (12, Figure 2-21, Sheet 2).

b. Connect the PUSH TO SILENCE switch (A2S2) (6, Figure 2-21, Sheet 1) wires to the circuit card assembly (12, Figure 2-21, Sheet 2).

c. Replace the circuit card assembly (12) in the Remote Indicator (Alarm) Assembly.

d. Replace the six flat washers (14), lockwashers (15) and capscrews (16) securing the circuit card assembly (12) to the Remote Indicator (Alarm) Assembly.

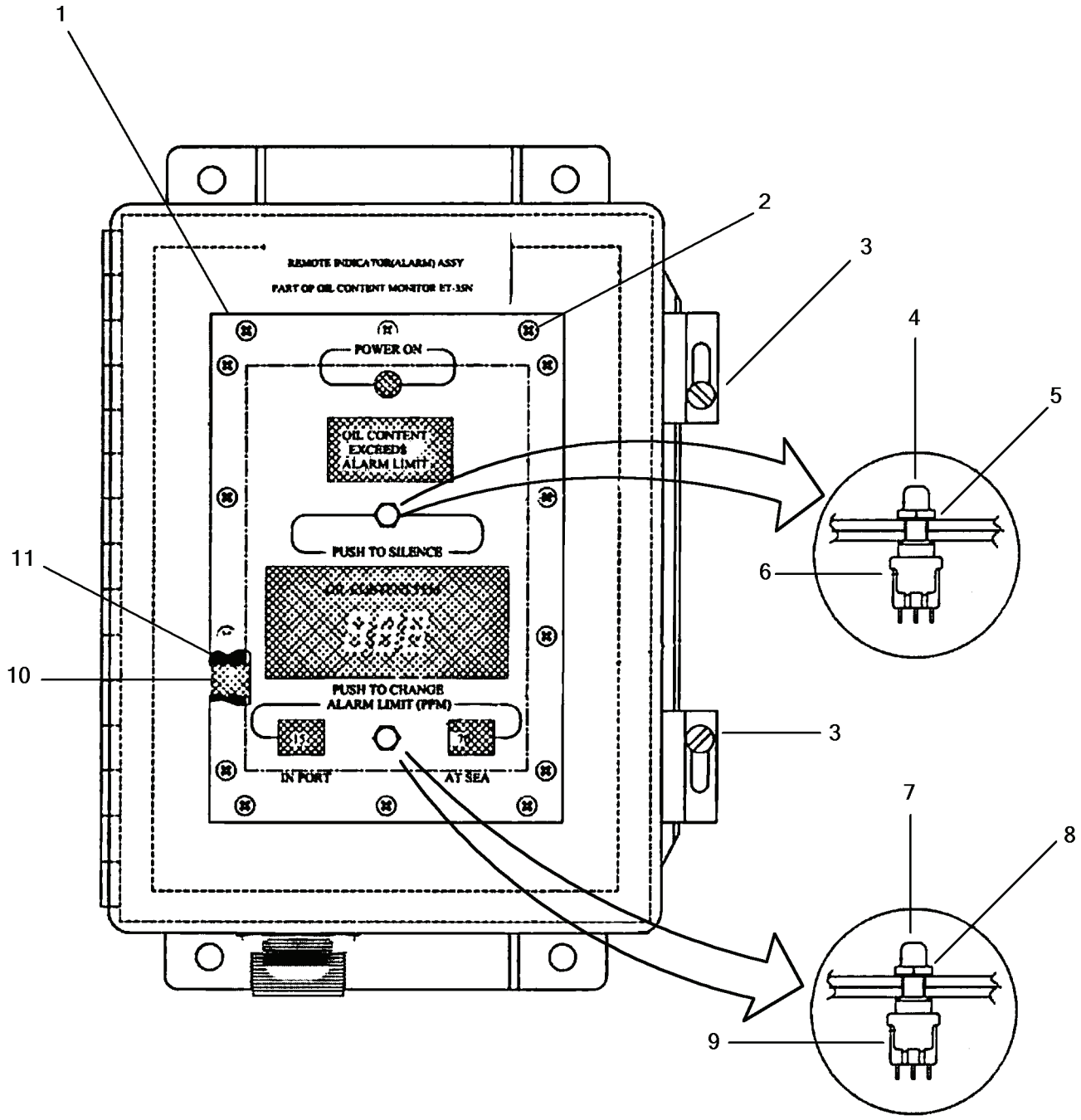
e. Connect the cable assembly connector (13, Figure 2-21, Sheet 2) as illustrated.

f. Replace rubber boots (3 and 5).

g. Replace retaining nuts (5 and 8, Figure 2-21, Sheet 1).

h. Close door and tighten door closure clamp screws (3).

i. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:

1. FACE PLATE
2. SELF SEAL SCREW
3. DOOR CLOSURE CLAMP
4. ALARM SILENCE RUBBER BOOT
5. RETAINING NUT
6. PUSH TO SILENCE SWITCH
7. PPM SELECTOR RUBBER BOOT
8. RETAINING NUT
9. PUSH TO CHANGE ALARM LIMIT (PPM) SWITCH
10. EMI/RFI FACEPLATE SCREEN
11. FACE PLATE GASKET
12. CIRCUIT CARD ASSEMBLY
13. CABLE ASSEMBLY CONNECTOR
14. FLAT WASHER
15. LOCKWASHER
16. CAPSCREW

Figure 2-21. Remote Indicator (Alarm) Assembly (Sheet 1 of 2).

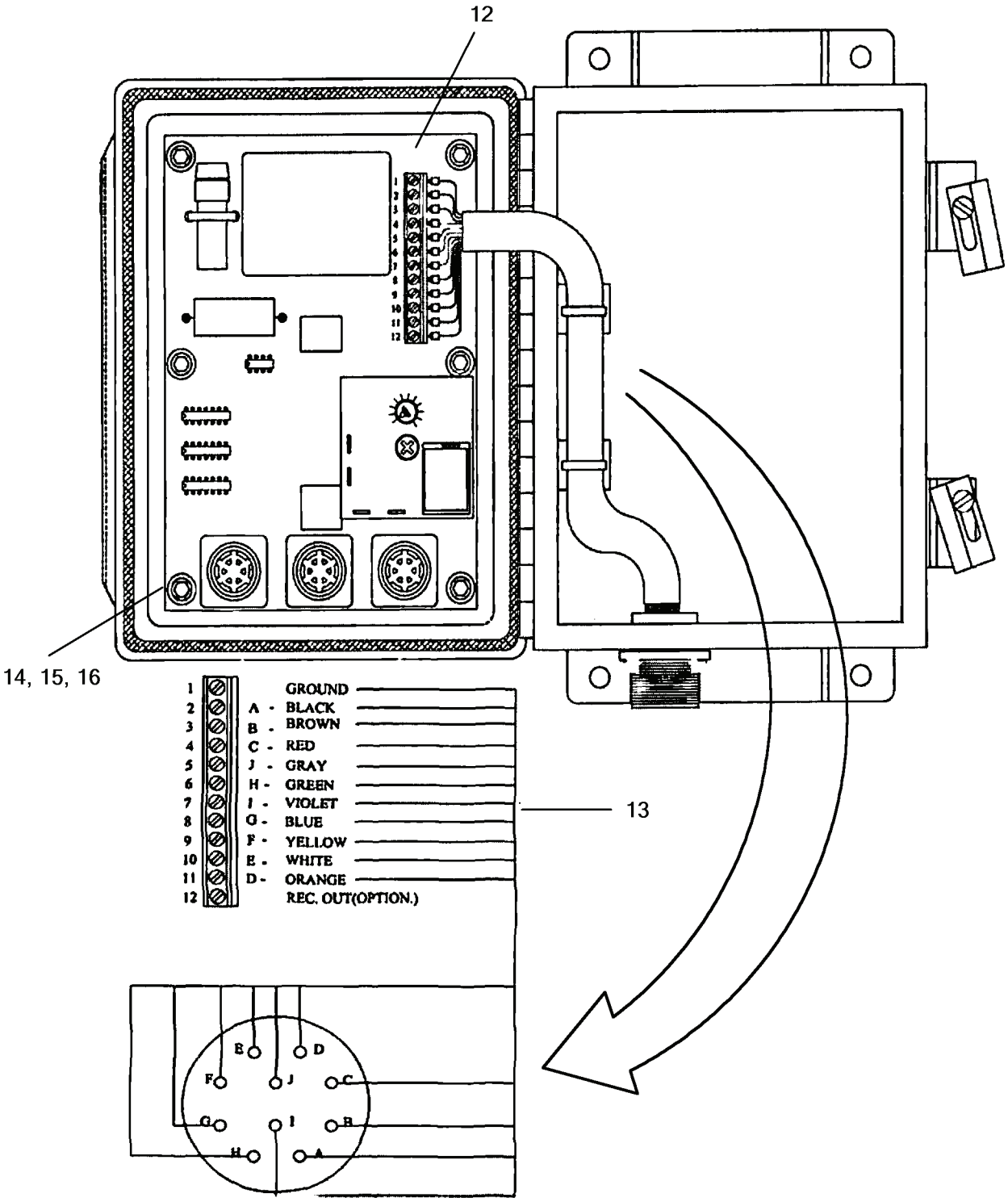


Figure 2-21. Remote Indicator (Alarm) Assembly (Sheet 2 of 2).

2-28. Remote Relay Assembly. (Figure 2-22)

This task covers: a. Inspect, b. Adjust, c. Repair.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Relay, Solid State, Time Delay, P/N AME-10302
Relay, Solid State , P/N AME-10301
Resistor, 10K, 5W, P/N AME-10304
Warning Tags, Item 19, Appendix C

INSPECT

Inspection of the remote relay assembly is accomplished through Preventive Maintenance Checks and Services (PMCS), Table 2-1 and maintenance procedures.

ADJUST

NOTE

DIP switches (7) are designed in 1, 2, 4, 8, 16, 32, 64, 128, 256, and 512 second settings; in most cases 4, 8, 16, and 32 should be in the up (ON) position and all others down (OFF). Time is determined by adding the value of the DIP switches in the ON position.

Adjustment of the time delay relay (10, Figure 2-22) is by the position of the DIP switches (7) on the time delay relay The optimum setting is 60 seconds, and a settling time between adjustments of 5 minutes is required to insure the correct timing is attained.

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. Loosen door closure clamp screws (1) of assembly and open cover.

NOTE

Removal of the components inside the remote relay assembly is limited to the two relays (one primary and one spare), the time delay relay and two resistors.

b. Locate the components to be repaired or replaced.

c. To remove the solid state relays (3):

(1) Loosen the four terminal capscrews (4) to remove the resistor (5) and wires.

(2) Unscrew the two relay capscrews (2) and remove the solid sate relay (3).

d. To remove the time delay relay (10):

(1) Disconnect wires from terminals 1 and 3.

(2) Unscrew time delay relay capscrew (9) and remove time delay relay (10).

REPAIR

Repair of the remote relay assembly is by replacement of the following components:

a. Solid state relay (3).

b. Resistor (5).

c. Time delay relay (10).

REPLACEMENT

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. To replace the time delay relay (10):

(1) Replace time delay relay (10) and tighten the time delay relay capscrew (9).

(2) Reconnect wires to terminals 1 and 3.

(3) Check position of DIP switches (7).

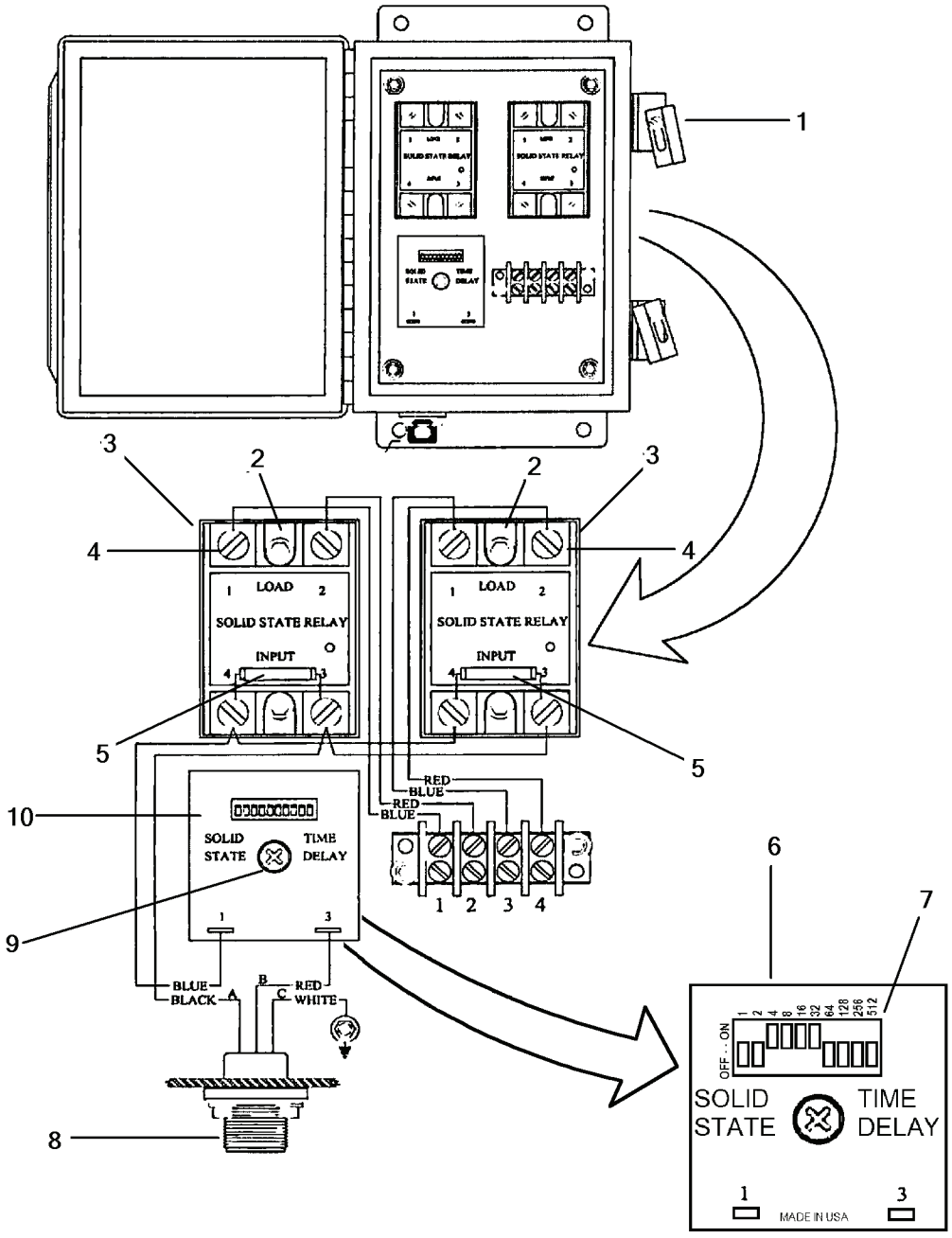
b. To replace the solid state relays (3):

(1) Replace the solid state relay (3) and tighten the two relay capscrews (2).

(2) Replace the resistor and wires and tighten the four terminal capscrews (4).

c. Close cover and tighten door closure clamp screws (1).

d. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:

1. DOOR CLOSURE CLAMP SCREWS
2. SOLID STATE RELAY CAPSCREWS
3. SOLID STATE RELAY
4. SOLID STATE RELAY TERMINAL CAPSCREWS
5. 10K, 5W FIXED RESISTOR
6. TIME DELAY RELAY (DETAIL VIEW)
7. DIP SWITCHES
8. CABLE CONNECTOR
9. TIME DELAY CAPSCREW
10. TIME DELAY RELAY

Figure 2-22. Remote Relay Assembly.

2-29. Water Polisher. (Figure 2-23)

This task covers: a. Inspect, b. Service, c. Repair.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's, 5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Kit, Gaket, P/N 55548
Kit, Float, P/N 55448
Kit, Valve Mechanism, P/N 69849
Filter Element, P/N SN-1213-09 (9 Ea Per Set)
Lubricating Grease, Item 8, Appendix C
Warning Tags, Item 19, Appendix C

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

INSPECT

Inspection of the water polisher is accomplished through Preventive Maintenance Checks and Services (PMCS, TM 55-1905-223-10).

SERVICE

NOTE

Cartridges should be replaced when the inlet to outlet pressure difference rises to +/- 5 psi OWS outlet pressure.

a. Remove hatch covers (2, Figure 2-23) and gaskets (18).

b. Remove PVC hold-down bracket (19) by lift and turning. Retain for installation.

c. Remove spent cartridges (20) by lifting and rotating each cartridge.

d. Each cartridge butt seal and unit spindle must be lubricated prior to next step.

e. Replace cartridges (20) by lowering new cartridge into space - locate spindle, push down and turn until cartridge drops 2" to seat.

f. After all nine cartridges are set and seated, reinstall PVC hold-down bracket (19) by pushing down over the top spindle.

g. Reset hatch covers (2) and gaskets (18) after lubricating top and bottom of gasket (1" perimeter).

h. Start inlet flow with discharge line open. Bleed off air after flow is established by loosening each hatch cover slightly. The majority of air will bleed off through the automatic gas vent.

i. Tighten hatches when fluid appears and return to service. (Float operated air valve (3) will vent remaining air.)

REMOVAL

NOTE

The water polisher is a durable component which does not wear out through normal use. Removal is required when the housing is uneconomical to repair.

a. Remove vent valve (2) from top of water polisher (Figure 2-23).

b. Disconnect piping to inlet and outlet of housing, and cap off pipes disconnected.

c. Remove eight bed plate bolts and washers; attach a suitable lifting device to remove water polisher.

REPAIR

Repair to the water polisher consists of replacing the cover gaskets (18), pressure gauge (17), replacement of the vent valve (4) or repairing the vent valve with gasket (5), float kit (6, 7 and 8) or valve mechanism kit (7, 8, 9, 12, 13, 14 and 15).

a. To replace the cover gasket (18):

(1) Loosen tee handles (16) and remove hatch covers (2).

(2) Removed old gasket.

(3) Install new gasket (18) after lubricating top and bottom of gasket (1" perimeter).

(4) Replace hatch covers (2) and tighten tee handles (16).

b. To replace the pressure gauge (17):

(1) Disconnect all piping from pressure gauge.

(2) Disconnect mounting hardware and remove gauge. Retain hardware for installation.

(3) Install new gauge and reconnect all mounting hardware.

(4) Reconnect all associated piping to gauge.

c. To replace or repair the vent valve (4);

(1) Remove vent valve by turning in a counter clockwise direction.

(2) Remove the eight capscrews (10) and pull the valve cover (11) with the float assembly attached off of the vent valve.

(3) Inspect all float components to determine which repair kit is required.

(a) Gasket (5) (Step 4), float kit (6, 7 and 8) (Step 5) or valve mechanism kit (7, 8, 9, 12, 13, 14 and 15) (Step 6).

(4) Remove gasket (5) and replace with new. If this is only repair required proceed to step 7.

(5) To replace only the float kit: remove the machine screw (8) and lock washer (7) to release the float (6) from arm (15). Install new float kit to arm by securing float (6) with washer (7) and machine screw (8). If this is the only repair required proceed to step 7.

(6) To replace only the valve mechanism kit proceed as follows:

(a) Remove machine screw (8) and washer (7) from float (6): retaining float for installation.

(b) Pull the pin (13) from the seat bracket (9) releasing the seat bracket, arm (15), seat (14) and seat gasket from the bottom of the valve cover (11) .

(c) Place seat (14) onto the arm (15) and pass thought the seat bracket:

(d) Set seat cover (12) on the arm passed through the seat bracket; align the holes on the seat bracket (9) with the arm (15) and push pin (13) through the holes.

(e) Replace retained float (6) onto arm (15) and secure with washer (7) and machine screw (8).

(f) Check for ease of movement of float by raising and lowering several times.

(7) Align gasket (5) onto the valve body (4). Place valve cover (11) with attached float assembly onto the gasket and secure with eight capscrews (10).

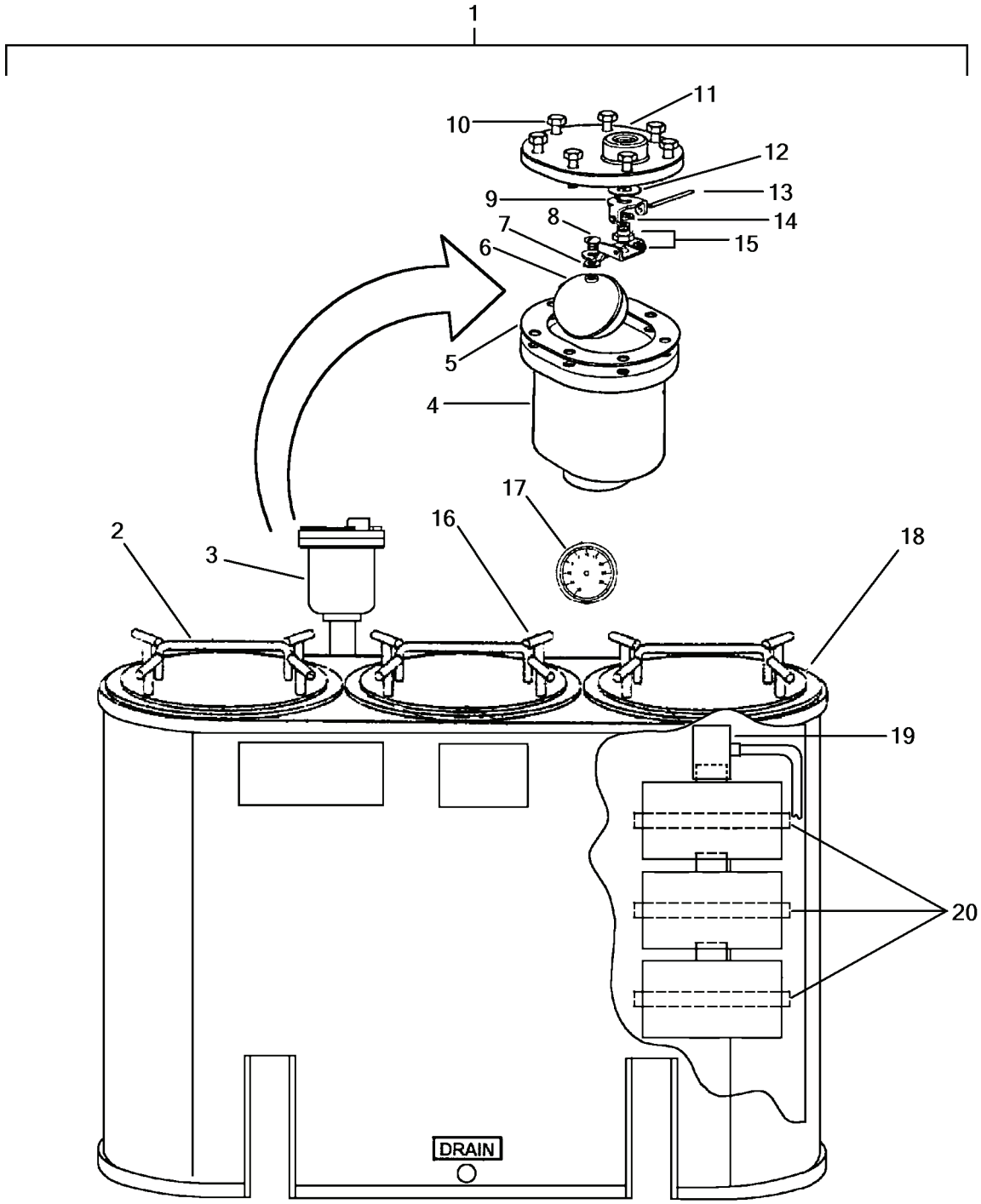
d. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

REPLACEMENT

a. Install water polisher on bed plate and secure with eight bolts and washers.

b. Connect piping inlet and outlet, and direct vent valve discharge tube to the drain funnel.

c. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:
1. WATER POLISHER
2. HATCH COVER
3. FLOAT OPERATED AIR VALVE
4. BODY VALVE
5. GASKET
6. FLOAT
7. LOCK WASHER
8. MACHINE SCREW
9. SEAT BRACKET
10. CAPSCREW
11. VALVE COVER
12. SEAT GASKET
13. PIN
14. SEAT
15. ARM
16. TEE HANDLE
17. DIAL INDICATING 1-30 PSI PRESSURE GAUGE
18. GASKET
19. PVC HOLD DOWN BRACKET
20. FLUID FILTER ELEMENT

Figure 2-23. Water Polisher.

2-30. Differential Pressure Switch. (Figure 2-24)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's, 5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Warning Tags, Item 19, Appendix C

ADJUST

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

NOTE

The differential screw, which governs the point at which the contacts open, may be turned clockwise to widen the differential slightly.

a. Turn differential screw (3, Figure 2-24) counterclockwise against stop for minimum differential.

b. Increase pressure to point where circuit is to close (5 psi).

c. If contacts are open, turn range screw (2) slowly counterclockwise until contacts just close.

d. If contacts are already closed, turn range screw (2) clockwise until contacts open; then turn slowly counterclockwise until contacts just close. This sets the closing point.

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

a. Disconnect piping to differential pressure switch (1).

b. Remove cover by loosening cover screw (5). Label and disconnect wiring from differential pressure switch internally and remove from housing.

c. Remove mounting hardware from differential pressure switch housing. Retain hardware for installation.

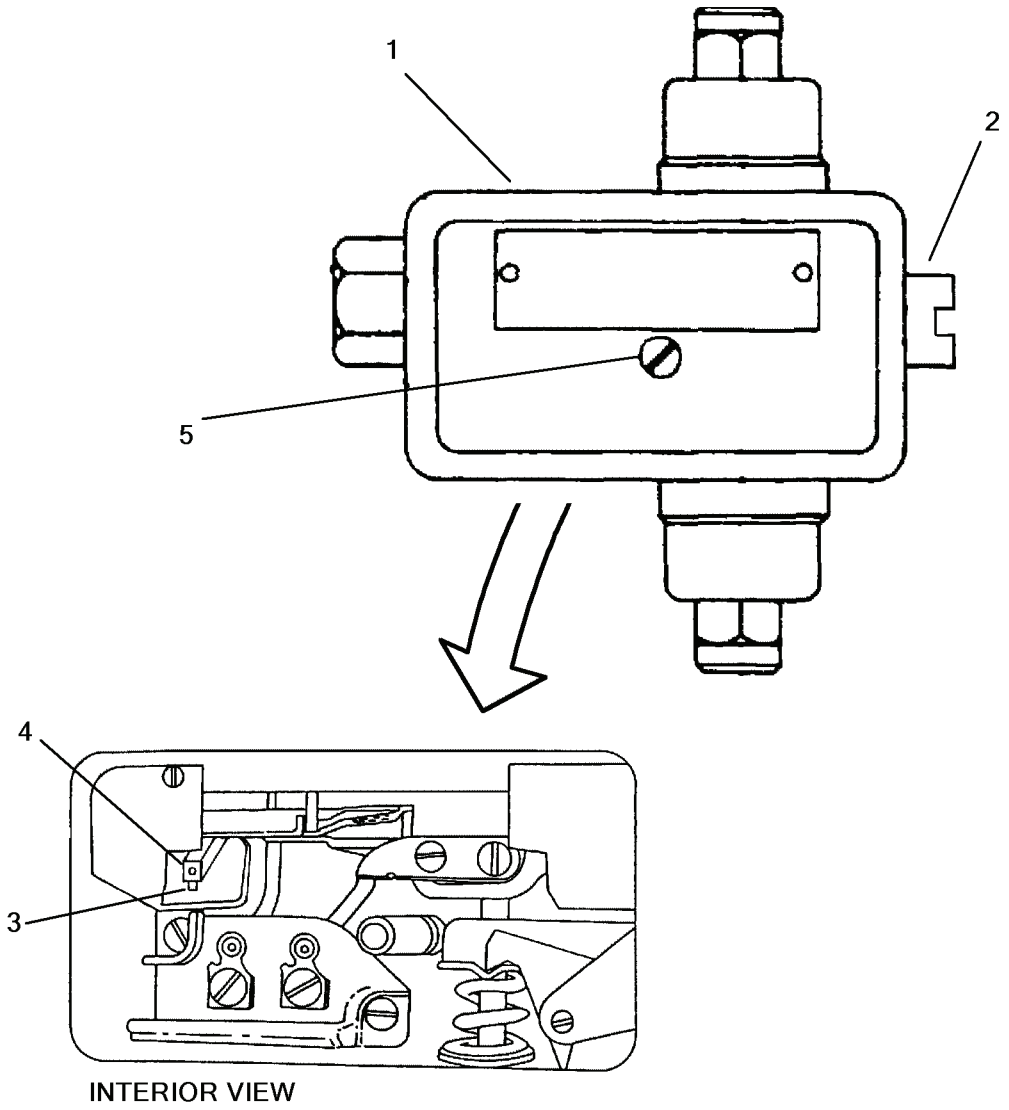
REPLACEMENT

a. Install new differential pressure switch using mounting hardware retained from removal.

b. Connect wiring to differential pressure switch as labeled in removal.

c. Connect and tighten piping to differential pressure switch.

d. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:
1. DIFFERENTIAL PRESSURE SWITCH
2. RANGE ADJUSTMENT SCREW
3. DIFFERENTIAL ADJUSTMENT
4. SETSCREW
5. COVER SCREW

Figure 2-24. Differential Pressure Switch.

2-31. Check Valve. (Figure 2-25)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's, 5180-00-699-5273

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Secured, Locked Out and Tagged (FM 55-502).

Materials/Parts

Tape, Teflon, Item 18, Appendix C
Warning Tags, Item 19, Appendix C

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

INSPECT

Inspection of the check valve is accomplished through Preventive Maintenance Checks and Services (PMCS), Table 2-1 and maintenance procedures.

REMOVAL

a. Unfasten union nuts (1, Figure 2-25) and slide off of tail pieces (2).

b. Remove check valve body (5), preformed packing (3), and retainer ring (2) from inlet and outlet passages.

c. Clean and inspect parts, replace check valve if parts are damaged.

REPAIR

Repair of the check valve is by replacement.

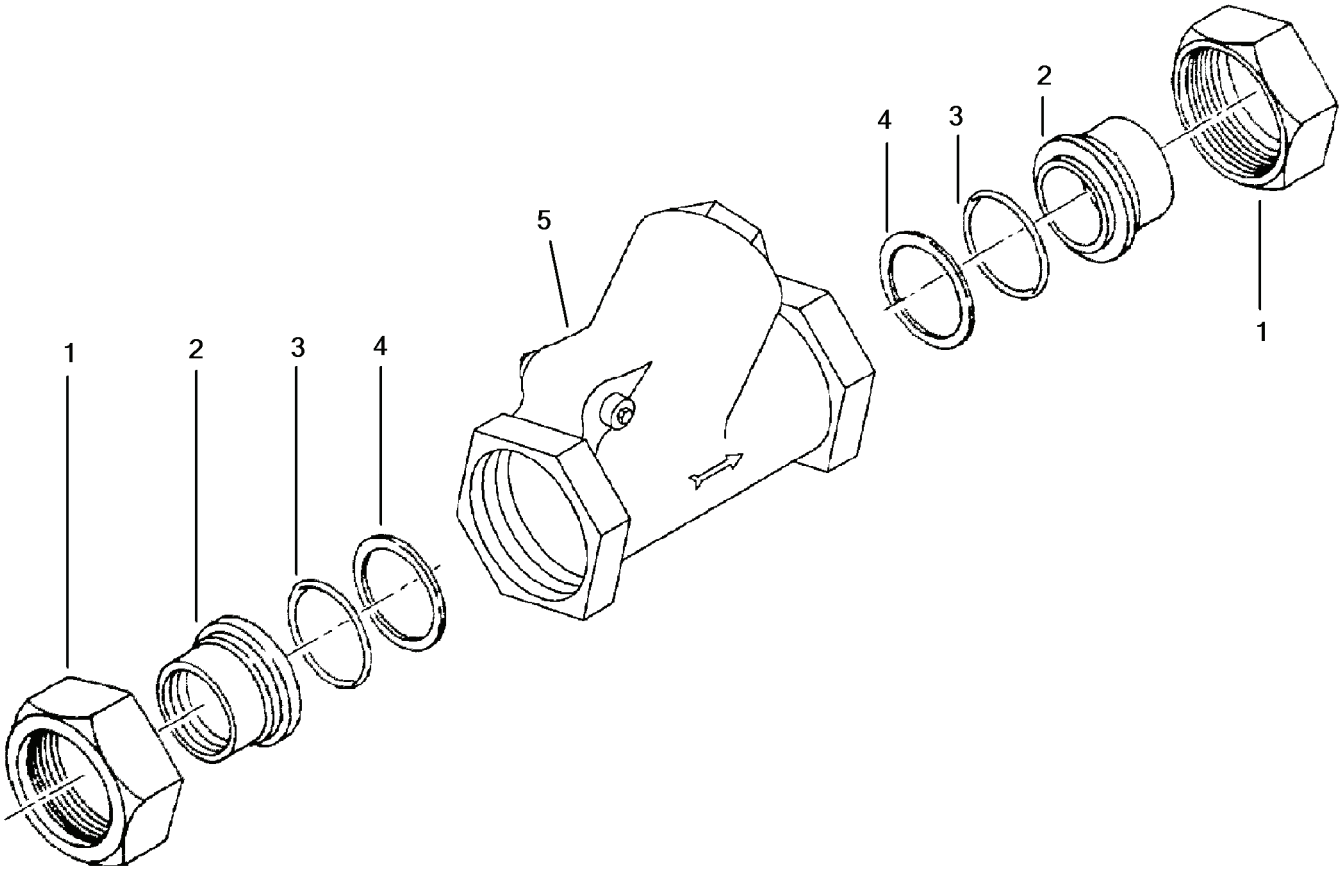
REPLACEMENT

NOTE

Apply Teflon Tape to all threaded fittings.

a. Position new check valve (5), preformed packing (3) and retaining ring (4) with system piping tail piece (2) and tighten union nut (1).

b. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.



LEGEND:
1. UNION NUT
2. TAIL PIECE
3. PREFORMED PACKING
4. RETAINER RING
5. BODY

Figure 2-25. Check Valve.

SECTION VI. PREPARATION FOR STORAGE OR SHIPMENT

2-32. Administrative Storage. 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. Prepare components for shipment or limited storage in accordance with the following instructions.

a. Pumps should be completely drained and dried.

b. Shaft extensions and other exposed machine surfaces should be coated with an easily removable rust preventive.

c. Place a corrosion inhibitor in the pump casing, such as Gulf-no-Rust Engine Oil, Grade 3, which conforms to MIL-L-21260.

d. Cover components to protect them from weather and direct sunlight.

e. Either allow proper ventilation or tightly seal cover with a suitable amount of desiccant to ensure dryness.

f. Storage locations for pumps that are near a source of vibration must be avoided.

g. Care should be taken to prevent extremes in temperature (below 32°F and above 110°F).

h. Shafts should be rotated 10-15 times, 2 or 3 times a month while in storage.

i. If component(s) is/are to be in extended storage, repeat preparation procedures every 6 months.

CHAPTER 3

INTERMEDIATE DIRECT SUPPORT MAINTENANCE INSTRUCTIONS

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

3-1. Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, Expendable/Durable Items (Except: Medical Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment or CTA 8-100, Army Medical Department Expendable/Durable Items, as applicable to your unit.

3-2. Special Tools, TMDE, and Support Equipment. Special tools; test, measurement, and diagnostic equipment; and support equipment requirements are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P-1. These items are also listed in the Maintenance Allocation Chart (MAC), Appendix B of this manual.

3-3. Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P.

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 750-8.

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 750-8.

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.

e. Remove chocks from resilient mounted components.

3-5. Initial Setup Procedure. Includes operational checks and inspections that are not performed for a routine startup. Direct support maintenance personnel will perform initial setup in accordance with the operator's manual TM 55-1905-223-10.

3-6. Normal Startup. Refer to operator's manual TM 55-1905-223-10.

3-7. Shutdown Procedure (Usual or Unusual). Refer to operator's manual TM 55-1905-223-10.

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

3-8. General. Refer to Chapter 2, Section III (Table 2-1).

SECTION IV. INTERMEDIATE DIRECT SUPPORT TROUBLESHOOTING

3-9. 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 3-1 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 persists after you have performed the corrective actions, notify your supervisor.

Table 3-1. Direct Support Troubleshooting

Malfunction Test or Inspection Corrective Action

NOTE

During all troubleshooting, it is assumed vessel power source is operating correctly, start up and shut down procedures correctly followed and all applicable valves are open.

1. OWS tank does not reach operating vacuum pressure.

   STEP 1. Check OWS piping connections for leaks.
   Tighten leaking piping, or replace flange gaskets as required.

   STEP 2. Check OWS tank cover for secure fasteners and seal around sealing area.
   Replace OWS tank if distorted beyond repair (Paragraph 3-11).

2. High ppm in effluent and system continues to discharge overboard.

   STEP 1. Check OCM SDA calibration date and last replacement.
   Replace SDA, PCB and elapsed timer if calibration is expired (Paragraph 3-12).

3. OCM not operational during OWS operation.

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

   STEP 1. Ribbon Cable Assembly between Power PCB and Processor PCB is disconnected or damaged.
   Verify that cable is connected (Figure 3-2).
   Visually check for damage and check continuity as required (Paragraph 3-12).
   Fasten cable at both PCB connections and replace as required.

   STEP 2. Cable Assembly between Power PCB and Sample/Detection Assembly disconnected, loose, or defective.
   Verify that cable is connected (Figure 3-2). Visually check for damage and check continuity as required (Paragraph 3-12).
   Fasten cable at both PCB connections and replace as required.

   STEP 3. Pressure Switch on Sensor Detection Assembly is defective.
   Switch OCM into MANUAL mode; verify POWER ON indicator illuminates in MANUAL. Switch OCM to AUTO mode; verify POWER ON indicator illuminates. If OCM is in AUTO position and indicator does not illuminate with 5 to 15 psi sample inlet pressure; Check continuity of switch contacts (N.O., N.C. and C).
   Use flushing water (OWS-54) to test automatic on/off control.
   Replace with Calibration Kit (Paragraph 3-12).

Table 3-1. Direct Support Troubleshooting

Malfunction Test or Inspection Corrective Action

3. OCM not operational during OWS operation. (cont).

WARNING

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

STEP 4. Power PCB Assembly defective.
Measure +5 VDC and -5 VDC between test points and GND on the Power PCB Assembly. It is defective if the proper voltage is not measured.
Replace the Power PCB Assembly (Paragraph 3-12).

STEP 5. Processor PCB Assembly defective.
Check the system for proper operation with the new board before securing it tightly into place.
Replace with Calibration Kit (Paragraph 3-12).

4. WARNING 2 and WARNING 3 (Red LEDs) illuminated.

STEP 1. SDA, ETI and Processor PCB are defective. All other troubleshooting efforts have not corrected symptom.
Replace components using Calibration Kit (Paragraph 3-12).

SECTION V. INTERMEDIATE DIRECT SUPPORT MAINTENANCE PROCEDURES

3-10. General. This section provides direct support maintenance for the oil-water separator tank and oil content monitor assembly. To review the principles of operation for the oil-water separator subsystem, refer to Chapter 1, Section III. Removal and replacement tasks for the oil-water separator tank and repair tasks for the oil content monitor are in the following paragraphs.

3-11. Oil-Water Separator Tank. (Figure 3-1)

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

INITIAL SETUP

Tools

Tool Kit, General Mechanic's, 5180-00-699-5273
Lifting Sling, 3940-01-183-9412
Hoist, Chain, Hand-Operated, Hook Chain Fall 1/2 Ton, 3950-00-235-4236
Torque Wrench (30-300 inch-lbs.), 5120-01-092-3278
Torque Wrench (30-300 ft-lbs), 5120-01-125-5190

Equipment Condition

TM 55-1905-223-10, Oil-Water Separator Shutdown and Tagged “Out of Service – Do Not Operate” (FM 55- 502).

Materials/Parts

Oil-Water Separator, P/N 689642
Cleaning Solvent, Item 1, Appendix C
Rags, Wiping, Item 12, Appendix C
Warning Tags, Item 19, Appendix C

REMOVAL

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death, injury or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new hardware.

a. Drain water from water pump by opening OWS-62 (10, Figure 3-1).

b. Drain OWS tank by opening valves OWS-14 (6), OWS-15 (7) and OWS-16 (8).

c. Remove four nuts, lockwashers and bolts each from flanges and disconnect flanges at the OWS tank influent inlet (9), effluent discharge (3), OWS drain valves (6, 7 and 8) and the oil discharge line (1).

d. Identify, tag and disconnect all attached electrical cables.

e. Disconnect piping from air bleed (12) and oil bleed (11).

f. Remove eight bolts securing OWS tank skid base (5) to deck plate.

g. Attach lifting sling to four lifting points on skid base (5).

h. Remove oil-water separator.

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death, injury or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new hardware.

REPLACEMENT

a. Position oil-water separator properly and attach skid base (5) to deck plate with eight bolts. Refer to Appendix D for proper torque of fasteners.

b. Remove lifting sling from four lifting points on skid base (5).

c. Mate up flanges for OWS tank influent inlet (9), effluent discharge (3), OWS drain valves (6, 7 and 8) and the oil discharge line (1) install with new flange gaskets. Install four bolts, new lockwashers and nuts each from flanges and tighten to torque indicated in Appendix D of this manual for the particular fastener used.

d. Connect piping to air bleed (12) and oil bleed (11).

e. Reconnect all electrical cables.

f. Operate the OWS (Paragraphs 2-6 through 2-8) and check for proper operation.

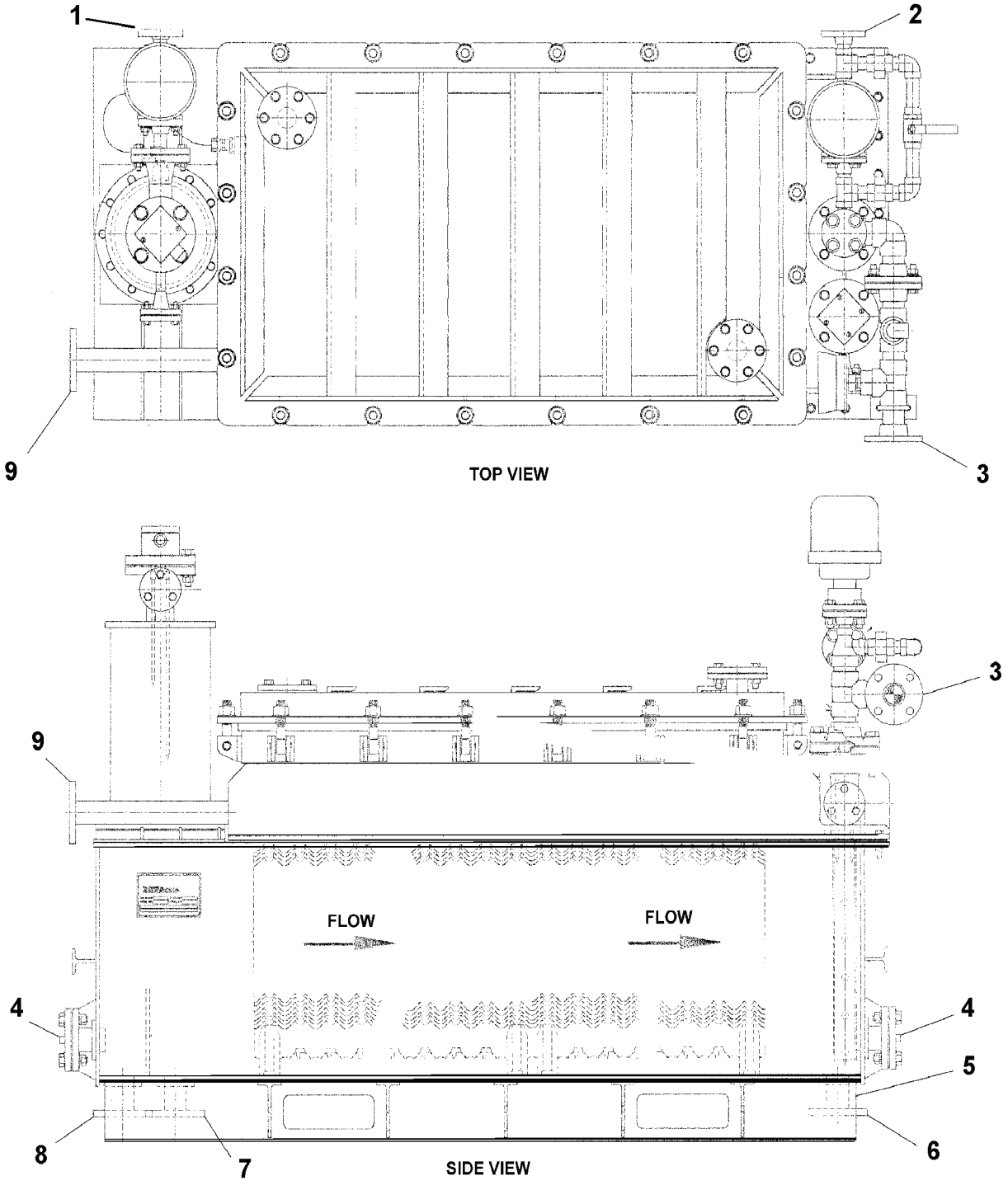
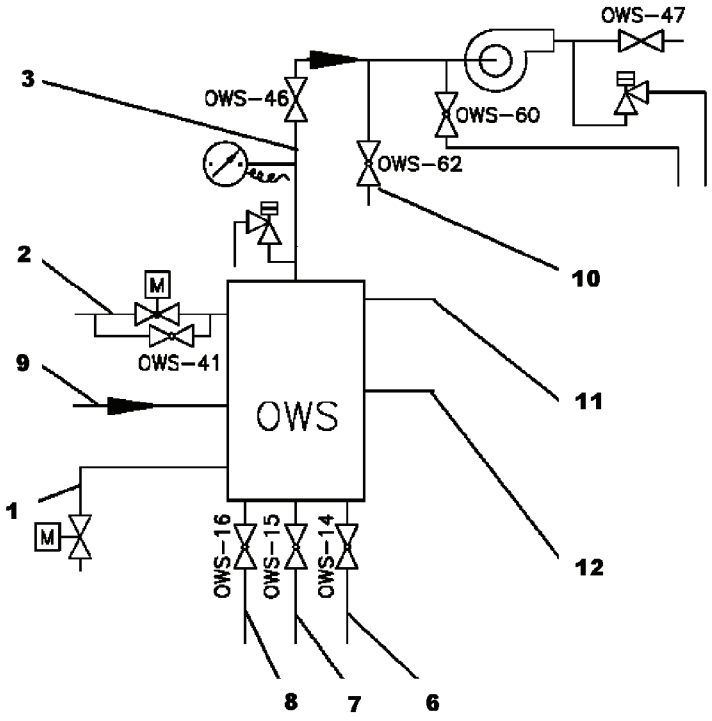


Figure 3-1. Oil-Water Separator (Sheet 1 of 2).



LEGEND:
1. OIL DISCHARGE
2. PURGE WATER INLET
3. EFFLUENT DISCHARGE
4. ZINC ANODE
5. OWS TANK SKID BASE
6. OWS-14 TANK DRAIN
7. OWS-15 TANK DRAIN
8. OWS-16 TANK DRAIN
9. OWS TANK INFLUENT INLET
10. OWS-62 LOW POINT DRAIN
11. OIL BLEED
12. AIR BLEED

Figure 3-1. Oil-Water Separator (Sheet 2 of 2).

3-12. Oil Content Monitor Assembly. (Figure 3-2)

This task covers: a. Service, b. Repair.

INITIAL SETUP

Tools

Tool Kit, General Mechanic's,
5180-00-699-5273
Allen Wrenches, 5120-01-087-3616
Tool Kit, Electrician's,
5180-00-391-1087

Equipment Condition

TM 55-1905-223-10, oil-water separator shutdown and tagged "Out of Service – Do Not Operate" (FM 55- 502).

Materials/Parts

Calibration Kit, P/N AME-1385
Cleaning Solvent, Item 1, Appendix C
Rags, Wiping, Item 12, Appendix C
Silicone, RTV, Item 15, Appendix C
Warning tags, Item 19, Appendix C

SERVICE

To service the oil content monitor assembly; remove and replace the SDA, PCB and ETI as a calibrated set every 2,000 hours of operation or 2 years after calibration date, whichever occurs first.

REMOVAL (Figure 3-2)

WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized may result in death or injury to personnel or equipment damage.

CAUTION

The Turbidimeter (component of the SDA) and Processor PCB are factory calibrated as a matched set. If either component requires replacement, the set must be replaced. Do not separate or mix these components. Matched calibration is necessary for proper operation and cannot be performed in the field.

NOTE

Ensure OCM Inlet Valve (OWS-52) (Figure 1-6) is shut.

a. Loosen handnuts (1) securing Sampling/Sensor Assembly enclosure door (2). Open door (2).

b. Locate SDA (10) on left-rear of enclosure (11).

c. Disconnect SDA cable connector (4).

d. Remove mounting hardware (9) from SDA (9). Retain hardware for installation.

e. Lift SDA (10) up and away from the enclosure (11).

f. Release tubing (5 and 7) from the quick-connect fittings (6 and 8) by compressing the quick connect fitting collets and simultaneously pulling the tube in the opposite direction.

g. Locate Processor PCB (3) on enclosure door (2).

h. Disconnect ribbon cable connector from bottom-left of door (2).

i. Unfasten mounting hardware and remove Processor PCB (3). Retain hardware for installation.

j. Locate ETI (12).

k. Remove old ETI (12) (pull out).

CAUTION

The Turbidimeter (component of the SDA) and Processor PCB are factory calibrated as a matched set. If either component requires replacement, the set must be replaced. Do not separate or mix these components. Matched calibration is necessary for proper operation and cannot be performed in the field.

REPAIR

Repair of the oil content monitor is by replacement of the Calibration Maintenance Kit (SDA, PCB and ETI).

CAUTION

The Turbidimeter (component of the SDA) and Processor PCB are factory calibrated as a matched set. If either component requires replacement, the set must be replaced. Do not separate or mix these components. Matched calibration is necessary for proper operation and cannot be performed in the field.

REPLACEMENT

a. Apply small quantity of silicone adhesive (RTV) to underside of new ETI (12), and install onto Power Supply PCB.

b. Install new Processor PCB (3). Do not tighten mounting hardware.

c. Check that LEDs on front of PCB (3) are in alignment with the Main Indicator Display by looking through the front of the display. Use gentle pressure to bend LEDs into alignment as required.

d. Tighten mounting hardware.

e. Connect ribbon cable connector.

f. Push inlet (5) and drain (7) tubing into the SDA quick-connect fittings (8) until they stop.

g. Holding the SDA, insert tubes (5 and 7) into the enclosure quick connect fittings (6) mounted in the sampling/sensor assembly.

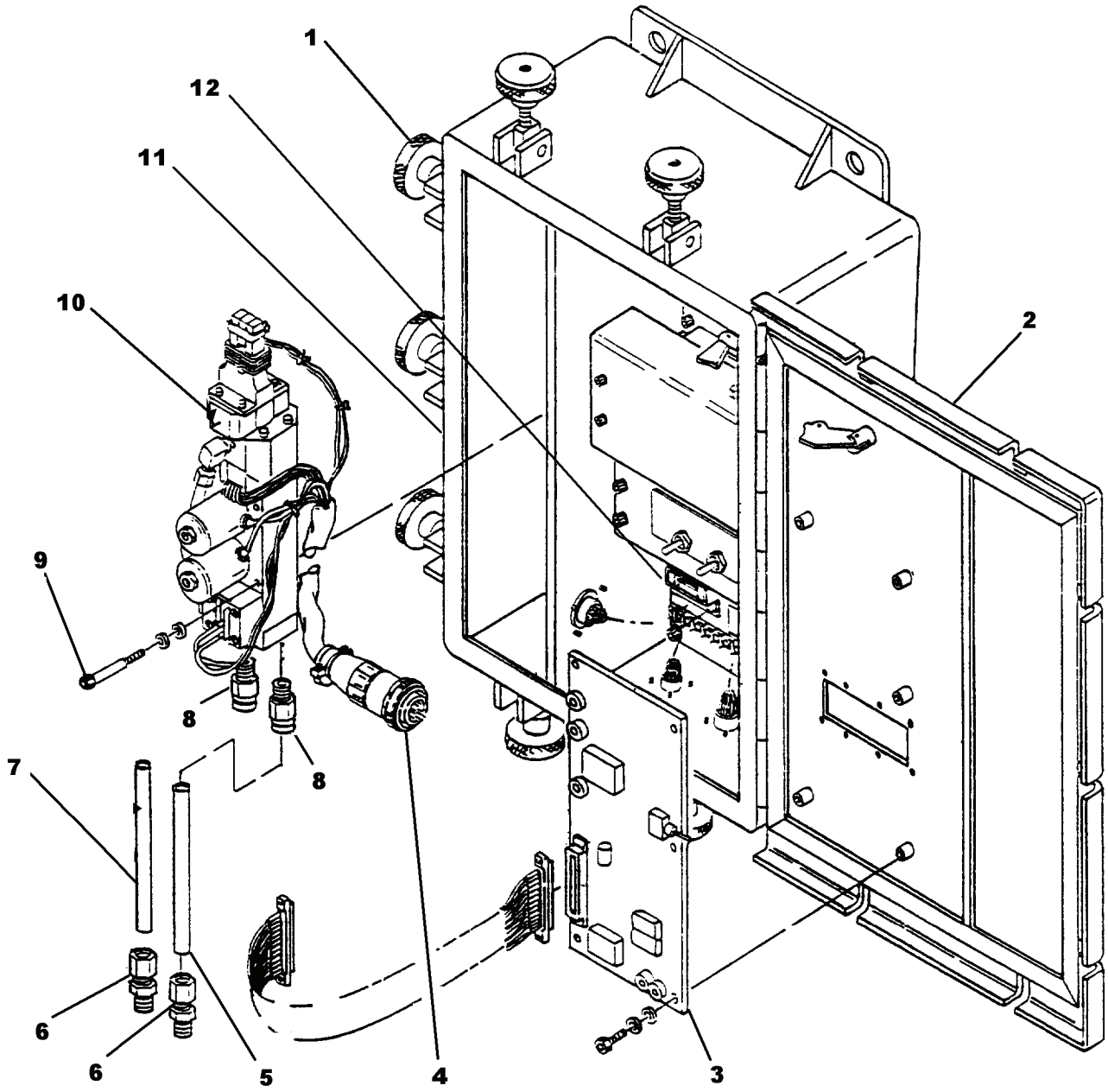
h. Hold SDA (9) in position and refasten mounting hardware (8).

i. Connect SDA cable connector (4) to OCM control panel.

j. Perform UVA adjustment (Paragraph 2-26).

k. Perform system Verification/Confidence Test (Paragraph 2-26).

l. Close Sampling/Sensor Assembly enclosure door (2); tighten down handnuts (1).



LEGEND:

1. HANDNUTS
2. ENCLOSURE DOOR
3. PROCESSOR PCB
4. SDA CABLE CONNECTOR
5. INLET TUBING
6. ENCLOSURE QUICK-CONNECT FITTINGS
7. DRAIN TUBING
8. SDA QUICK-CONNECT FITTINGS
9. MOUNTING HARDWARE
10. SENSOR DETECTION ASSEMBLY (SDA)
11. ENCLOSURE
12. ELAPSED TIME METER (ETI)

Figure 3-2. Oil Content Monitor, Maintenance Kit Electrical Equipment.

SECTION VI. PREPARATION FOR STORAGE OR SHIPMENT

3-13. Administrative Stowage. 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. Prepare components for shipment or limited storage in accordance with the following instructions.

a. Pumps should be completely drained and dried.

b. Shaft extensions and other exposed machine surfaces should be coated with an easily removable rust preventive.

c. Place a corrosion inhibitor in the pump casing, such as Gulf No-Rust Engine Oil, Grade 3, which conforms to MIL-L-21260.

d. Cover components to protect them from weather and direct sunlight.

e. Either allow proper ventilation or tightly seal cover with a suitable amount of desiccant to ensure dryness.

f. Storage locations for pumps that are near a source of vibration must be avoided.

g. Care should be taken to prevent extremes in temperature (below 32°F and above 110°F).

h. Shafts should be rotated 10-15 times, 2 or 3 times a month while in storage.

i. If components(s) is/are to be in extended storage, repeat preparation procedures every 6 months.

CHAPTER 4

INTERMEDIATE GENERAL SUPPORT MAINTENANCE INSTRUCTIONS

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

4-1. Common Tools and Equipment. For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, Expendable/Durable Items (Except: Medical Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment or CTA 8-100, Army Medical Department Expendable/Durable Items, as applicable to your unit.

4-2. Special Tools, TMDE, and Support Equipment. Special tools; test, measurement, and diagnostic equipment; and support equipment requirements are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P. These items are also listed in the Maintenance Allocation Chart (MAC), Appendix B of this manual.

4-3. Repair Parts. Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P.

SECTION II. SERVICE UPON RECEIPT

4-4. 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 750-8.

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 750-8.

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.

e. Remove chocks from resilient mounted components.

4-5. Initial Setup Procedure. Includes operational checks and inspections that are not performed for a routine startup. Direct support maintenance personnel will perform initial setup, refer to Chapter 2 of this technical manual and the operator's manual TM 55-1905-223-10.

4-6. Normal Startup. Direct support maintenance personnel will perform normal startup, refer to Chapter 2 of this technical manual and the operator's manual TM 55-1905-223-10.

4-7. Shutdown Procedure (Usual or Unusual). Direct support maintenance personnel will perform shutdown procedure, refer to Chapter 2 of this technical manual and the operator's manual TM 55-1905-223-10.

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

4-8. PMCS. There is no PMCS at the general support level. Refer to Chapter 2, Section III.

SECTION IV. INTERMEDIATE GENERAL SUPPORT TROUBLESHOOTING

4-9. Troubleshooting. There is no troubleshooting at the general support level. Refer to Chapter 3, Section IV.

SECTION V. INTERMEDIATE GENERAL SUPPORT MAINTENANCE PROCEDURES

4-10. General. There are no maintenance procedures at the general support level. Refer to Chapter 3, Section V.

SECTION VI. PREPARATION FOR STORAGE OR SHIPMENT

4-11. Storage. Refer to Chapter 2, Section VI.

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 4-25.11	First Aid
FM 31-70	Basic Cold Weather Manual
FM 55-501	Marine Crewman's Handbook
FM 55-502	Army Watercraft Safety

A-3. Technical Manuals.

TM 55-1905-223-10	Operator's Manual for Landing Craft, Utility (LCU)
TM 55-1905-223-24-18-1/2	LCU 2000 Class Basic Craft Maintenance Manual
TM 55-1905-223-24P-1/2/3/4	Repair Parts and Special Tools List for the LCU 2000 Class Watercraft
TM 750-244-3	Destruction of Army Materiel to Prevent Enemy Use
TM 43-0139	Painting Instructions for Army Materiel

A-4. Technical Bulletins.

TB 43-0144	Painting of Watercraft
TB 55-1900-207-24	Treatment of Cooling Water in Marine Diesel Engines
TB 740-97-4	Preservation of Vessels for Storage
TB-55-1900-204-24	Welding on Watercraft

A-5. Military Specifications.

MIL-PRF-16173	Corrosion Preventive Compound, Solvent Cutback, Cold-Application
MIL-PRF-21260	Lubricating Oil, Internal Combustion Engine, Preservative Break-In
MIL-PRF-32033	Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low Temperature)

A-6. Miscellaneous Publications.

DOD 4715.6-R1	Regulations On Vessels Owned Or Operated By The Department Of Defense
DA PAM 750-8	The Army Maintenance Management System (TAMMS) Users Manual
LO 55-1905-223-12	Lubrication Order for the LCU 2000 Class Watercraft
AR 750-10	Army Modification Program

A-7. Forms.

CTA 8-100	Army Medical Department Expendable/Durable Items
CTA 90-970	Army Expendable/Durable Items
DA Form 2028	Recommended Changes to Equipment Technical Publications Blank Forms
DA Form 2404/5988E	Equipment Inspection and Maintenance Worksheet
DA Form 2408-16	Logsheet
DA Form 2410	Logsheet
SF Form 368	Product Quality Deficiency Report

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 lll lists the tools and test equipment (both special tools and common tools sets) required for each maintenance function as referenced from Section II.
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 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 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 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 is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

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[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]Disassembly/assembly - 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.

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 B-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
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 III.
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 III.

a. Column I - 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.

MAINTENANCE ALLOCATION CHART
FOR
OIL-WATER SEPARATOR SYSTEM (cont)

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT	(6) REMARKS
			FIELD			SUSTAINMENT			
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
19	OIL-WATER SEPARATOR SYSTEM	INSPECT	0.1					1	
1901	OWS TANK	INSPECT	0.1	0.5				1	
		SERVICE		8.0				1,3,4	
		REPLACE			8.0			1,3,4,5,9	
		REPAIR		16.0				1,3,4,5,9	
190101	OIL LEVEL SENSORS	SERVICE		0.5				1	
		REPLACE		0.5				1,10,11	
		REPAIR		0.5				1,10,11	
1902	OWS PUMP	INSPECT	0.1					1	A
		REPLACE		1.5				1,2,6	
		REPAIR		0.5				1,2,6	
190201	OWS PUMP MOTOR	ALIGN		1.0				1,7,2	
		REPLACE		1.5				1,6	
		REPAIR		3.0				1,6	
1903	DIRTY OIL PUMP	INSPECT	0.1					1	
		ADJUST		1.0				1	
		REPLACE		2.0				1	
		REPAIR		4.0				1	
190301	DIRTY OIL PUMP MOTOR	ALIGN		1.0				1,7,2	
		REPLACE		1.5				1,6	
		REPAIR		3.0				1,6	
1904	CONTROL PANEL	INSPECT	0.2	0.1					
		REPAIR		2.0				1,11,12	
1905	GAUGE PANEL (ALL SYSTEM GAUGES)	INSPECT		0.1					
		ADJUST		0.2					
		REPLACE		1.0				1	B

MAINTENANCE ALLOCATION CHART
FOR
OIL-WATER SEPARATOR SYSTEM (cont)

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT	(6) REMARKS
			FIELD			SUSTAINMENT			
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
1906	MOTORIZED VALVES	SERVICE		0.5					
		ADJUST		0.5				1	
		REPLACE		1.5				1	
		REPAIR		2.0				1	
1907	DIVERTER VALVE	INSPECT	0.1	0.1					
		REPLACE		2.0				1	
		REPAIR		4.0				1	
1908	DUPLEX STRAINER	INSPECT	0.1						
		SERVICE	0.3					1	C
		REPAIR		3.0				1	
1909	RELIEF VALVES	INSPECT		0.3					
		TEST		0.3				1	
		REPLACE		0.5				1	B
1910	OIL CONTENT MONITOR ASSEMBLY	INSPECT	0.3	0.5				1,11	
		TEST		1.0					
		SERVICE		1.5	1.0			1,8,11	
		ADJUST		1.0				11	
		REPAIR		2.0	1.0			1,8,11,12	D
1911	REMOTE INDICATOR (ALARM) ASSEMBLY	INSPECT	0.3						
		REPAIR		1.0				1	
1912	REMOTE RELAY ASSEMBLY	INSPECT		0.1					
		ADJUST		0.5					
		REPAIR		0.5				1	B

MAINTENANCE ALLOCATION CHART
FOR
OIL-WATER SEPARATOR SYSTEM (cont)

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQPT	(6) REMARKS
			FIELD			SUSTAINMENT			
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
1913	WATER POLISHER	INSPECT	0.1						
		SERVICE		2.0				1	
		REPAIR		2.0				1	
1914	DIFFERENTIAL PRESSURE SWITCH	ADJUST		0.5				1	
		REPLACE		1.0				1	B
1915	CHECK VALVE	INSPECT		0.2					
		REPLACE		1.0				1	B

SECTION III. TOOLS AND TEST EQUIPMENT REQUIREMENTS FOR OIL-WATER SEPARATOR SYSTEM

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL STOCK NUMBER	PART NUMBER
1	O, F	Tool Kit, General Mechanic's	5180-00-629-5273	(50980) SC-5180-90-CL-N05
2	F, H	Tool Set, Measuring, Machinist's	5280-00-278-9919	(50980) SC-5280-95-CL-A01-HR
3	O, F	Torque Wrench (30 - 300 inch pounds)	5120-01-092-3278	(08194) 2002MR
4	O, F	Torque Wrench (30 - 300 foot pounds)	5120-01-125-5190	(05047) B107.14M
5	O, F	Lifting Sling	3940-01-183-9412	(15434) 3375958
6	F	Puller, Mechanical, Gear and Bearing	5120-00-288-7710	(81348) GGG-P-781
7	F	Dial Indicator	5210-00-277-8840	(57163) 196A
8	F	Allen Wrenches	5120-01-087-3616	(55719) AWM110DK
9	O, F	Hoist, Chain, Hand-Operated, Hook Chain fall 1/2 Ton SPNSN, 1/2 Ton	3950-00-235-4236	(81349) MILH904
10	O, F	Multimeter	6625-01-265-6000	(80058) AN/PSM-45A
11	O, F	Tool Kit, Electrician's	5180-00-391-1087	(80244) 5180-00-391-1087
12	O, F	Iron, Soldering	3439-00-204-3858	(81349) W-S-570

SECTION IV. REMARKS
FOR
OIL-WATER SEPARATOR SYSTEM

REFERENCE CODE	REMARKS
A	SEMI-ANNUAL: CHECK ALIGNMENT OF PUMP AND MOTOR. SHIM UP IF NECESSARY IF MISALIGNMENT OCCURS FREQUENTLY, INSPECT THE ENTIRE PIPING SYSTEM. UNBOLT PIPING AT SUCTION AND DISCHARGE FLANGES TO SEE IF IT SPRINGS AWAY THEREBY INDICATING STRAIN ON THE CASING. INSPECT ALL PIPING SUPPORTS FOR SOUNDNESS AND EFFECTIVE SUPPORT OF LOAD. ANNUALLY: REMOVE THE ROTATING ELEMENT INSPECT THOROUGHLY FOR WEAR, AND ORDER REPLACEMENT PARTS IF NECESSARY. CHECK WEARING CLEARANCES.
B	REPAIR IS BY REPLACEMENT.
C	SERVICE IS ACCOMPLISHED THROUGH PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS), OF TM 55-1905-223-10 AND MAINTENANCE PROCEDURES.
D	THIS ITEM IS A CANDIDATE FOR DIRECT EXCHANGE WITH THE VENDOR.

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/Durable 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").

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 parenthesis 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 STOCK	(3) NATIONAL NUMBER	(4) DESCRIPTION	(5) U/M
1	F	6850-01-278-4421	Cleaning Compound, Solvent (IBTR5) 997140	GL
2	F	6515-00-225-9648	Cotton Swab (81348) GGA00616	BX
3	O		Epoxy, Polyamide (FlexKote #707)	GL
4	F	5330-00-641-1193	Gasket Material (81348) HH-P-46	SH
5	O	9150-00-180-6382	Grease (81349) MIL-PRF-24139	CN
6	O	4930-00-287-5419	Grease Gun (58536) A-A-50477	EA
7	O	5970-00-109-3303	Insulation Sleeving, Electrical (1001) 2674051	EA
8	F	9150-00-235-5555	Lubricating Grease (81349) MIL-DTL-23549	LB
9	F	4940-01-123-4843	Lubricating Sealant (59678) 13222E6227	GL
10	H	9150-00-111-3199	Oil (81349) MIL-L-21260	CN
11	F	9920-00-292-9946	Pipe Cleaner (19203) 840507	BX
12	F	7920-00-205-1711	Rags, Wiping (81349) DDD-R-30	EA
13	F	1680-01-194-9799	Rubber Gloves	EA
14	H		Shim	EA
15	O	9160-01-515-2484	Silicone, RTV (45152) 3119525	TU
16	O	3439-01-011-7281	Solder, Tin Alloy (81346) ASTM B32	LB
17	O	4921-00-381-2733	Straight Edge (10001) 692117	EA
18	O	8030-00-899-3534	Tape, Teflon (81349) MIL-T-27730	RO
19	O	2835-00-015-0246	Warning Tag (70210) S8145-55	EA

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		
Inches-Thread		TORQUE			TORQUE			TORQUE		
		Ft-Lb	kgm	Nm	Ft-Lb	kgm	Nm	Ft-lb	kgm	Nm
1/4	-29	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
	-18	17	2.3511	23.0489	19	2.6277	25.7605	24	3.3192	32.5396
5/16	-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	105.753
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

Capscrew Head Markings

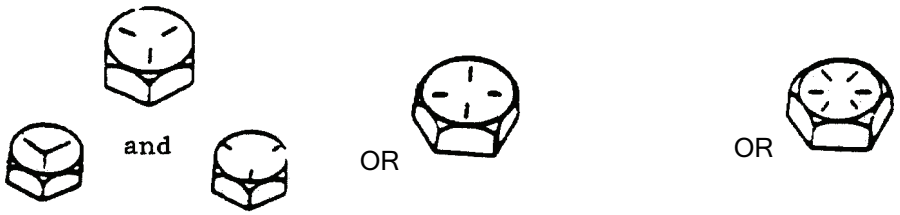

Table D-2. Pipe Plug Torque Values

Size			In Aluminum Components Torque		In Cast Iron or Steel Components Torque	
Thread	Actual	Thread O.D				
in	Nm	(in)	Nm	(ft-lbs)	Nm	(ft-lbs)
1/16	8.1	(0.32)	5	(45 in-lbs)	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

	Cast Iron or Steel			
Thread for general purposes	Head Mark 4 Torque		Head Mark 7 Torque	
(size x pitch (mm)	ft-lb.	(Nm)	ft-lb.	(Nm)
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

A	ANNUAL
A/R	AS REQUIRED
AME	ADVANCED MARINE TECHNOLOGY INC
AMP	AMPERE
ASSY	ASSEMBLY
ASW	AUXILIARY SEAWATER
AUTO	AUTOMATIC
BT	BOTTLE
CN	CAN
COV	CUTOUT VALVE
D	DAILY
EA	EACH
EIR	EQUIPMENT IMPROVEMENT RECOMMENDATIONS
ETI	ELAPSE TIMER
EOS	ENGINEERING OPERATING STATION
DP	DIFFERENTIAL PRESSURE
F	FAHRENHEIT
FM	FIELD MANUAL
FSCM	FEDERAL SUPPLY CODE OF MANUFACTURERS
FT	FOOT/FEET
FT-LBS	FOOT POUNDS
GL	GALLON
GPM	GALLONS PER MINUTE
HG	MERCURY
HZ	HERTZ
IN	INCH
IN-LBS	INCH POUNDS
KGM	KILOGRAM
LBS	POUNDS
LCD	LIQUID CRYSTAL DISPLAY
LED	LIGHT EMITTING DIODE
LO	LUBE OIL
LT	LIGHT
M	MONTHLY
MAC	MAINTENANCE ALLOCATION CHART
MM	MILLIMETER
MTOE	MODIFIED TABLE OF ORGANIZATION AND EQUIPMENT
Nm	NEWTON METER
NMP	NATIONAL MAINTENANCE POINT
NSN	NATIONAL STOCK NUMBER
OCM	OIL CONTENT MONITOR
OD	OUTSIDE DIAMETER
OWS	OIL-WATER SEPARATOR
P/N	PART NUMBER
PB	PUSH BUTTON
PCB	PRINTED CIRCUIT BOARD
PDQR	PRODUCT QUALITY DEFICIENCY REPORT
PG	PAGE
PH	PHASE
PMCS	PREVENTIVE MAINTENANCE CHECKS AND SERVICES
PPM	PARTS PER MILLION
PSI	POUNDS PER SQUARE INCH
PSIG	POUND PER SQUARE INCH GAUGE
Q	QUARTERLY
RPSTL	REPAIR PARTS AND SPECIAL TOOLS LIST
S	SEMI-ANNUAL
SAE	SOCIETY OF AUTOMOTIVE ENGINEERS

SDA	SENSOR DETECTION ASSEMBLY
SH	SHEET
SS	SWITCH
STBD	STARBOARD
SW	SEAWATER
TAMMS	THE ARMY MAINTENANCE MANAGEMENT SYSTEM
TM	TECHNICAL MANUAL
TMDE	TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT
U/M	UNIT OF MEASURE
UVA	ULTRASONIC VIBRATOR ASSEMBLY/SUBASSEMBLY
V	VOLTS
VAC	VOLTS ALTERNATING CURRENT
VDC	VOLTS DIRECT CURRENT
W	WEEKLY
WCA	WARRANTY CLAIM ACTION

ALPHABETICAL INDEX

These are the instructions for sending an electronic 2028.
The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17 and 27.
From: "Whomever" whomever@avma27.army.mil
To: whomever@avma27.army.mil
To: TACOM-TECH-PUBS@ria.army.mil
Subject:DA Form 2028
1. ***From:*** Joe Smith
2. ***Unit:*** home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19-OCT-93
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9. ***Pub Title:*** TM
10. ***Publication Date:*** 11-APR-88
11. ***Change Number:*** 12
12. ***Submitter Rank:*** MSG
13. ***Submitter Fname:*** Joe
14. ***Submitter Mname:*** T
15. ***Submitter Lname:*** Smith
16. ***Submitter Phone:*** 123-123-1234
17. ***Problem:*** 1
18. ***Page:*** 1
19. ***Paragraph:*** 3
20. ***Line:*** 4
21. ***NSN:*** 5
22. ***Reference:*** 6
23. ***Figure:*** 7
24. ***Table:*** 8
25. ***Item:*** 9
26. ***Total:*** 123
27. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.

Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE: Date form is filled out.

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*

Mailing address found on title block page.

FROM: *(Activity and location) (Include ZIP Code)*

Your mailing address.

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER:	DATE:	TITLE:
TM X-XXXX-XXX-XXX	Date of the TM.	Title of TM.

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Exact wording of recommended change must be given)
	0019 00 1	3	1	1		Step No. 2 says to secure doors open with locking bar or hooks from where to what? The bars or hooks are not identified.
	0019 00 4	4	1	1		Step No. 19 states to remove locking bars, pins or hooks from where to what? The bars, pins or hooks are not identified. Where are they stored?

SAMPLE

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Doe, John, CPL	755-1313	*CPL John Doe*

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE:

PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER:	DATE:	TITLE:
TM X-XXXX-XXX-XXX	Date of the TM.	Title of TM.

PAGE NO.	COLM NO.	LINE NO.	FEDERAL STOCK NUMBER	REFERENCE NO.		FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

SAMPLE

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and*
blank forms. Additional blank sheets may be used if more space is needed.)

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Doe, John, CPL	755-1313	*CPL John Doe*

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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 25-30; the proponent agency is OAASA

Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE

TO *(Forward to proponent of publication or form) (Include ZIP Code)*
AMSTA-LC-LMPP/TECH PUBS TACOM-RI
1 Rock Island Arsenal
Rock Island, IL 61299-7630

FROM *(Activity and location) (Include ZIP Code)*

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 55-1905-223-24-19	08 Feb 08	OIL-WATER SEPARATOR FOR LANDING CRAFT UTILITY NSN 1905-01-154-1191

ITEM	PAGE	PARA-GRAPH	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

** Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO *(Forward direct to addressee listed in publication)*	FROM *(Activity and location) (Include ZIP Code)*	DATE
AMSTA-LC-LMPP/TECH PUBS TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630		

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 55-1905-223-24-19	08 Feb 08	OIL-WATER SEPARATOR FOR LANDING CRAFT UTILITY NSN 1905-01-154-1191

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III – REMARKS *(Any general remarks, recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

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Rock Island, IL 61299-7630

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DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. USAPA V3.01

TO *(Forward direct to addressee listed in publication)*	FROM *(Activity and location) (Include ZIP Code)*	DATE
AMSTA-LC-LMPP/TECH PUBS TACOM-RI 1 Rock Island Arsenal Rock Island, IL 61299-7630		

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR.
General, United States Army

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0802505

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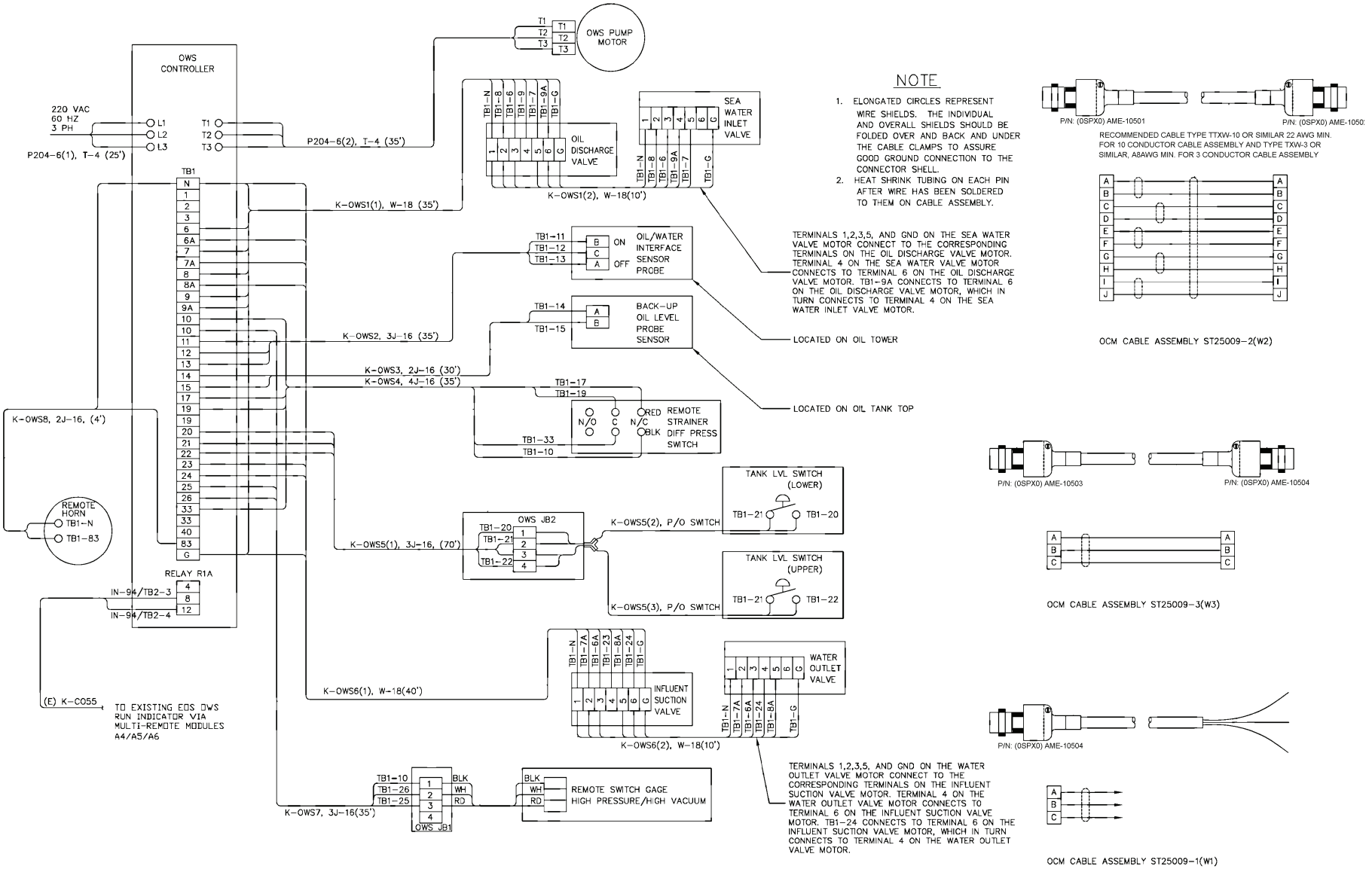
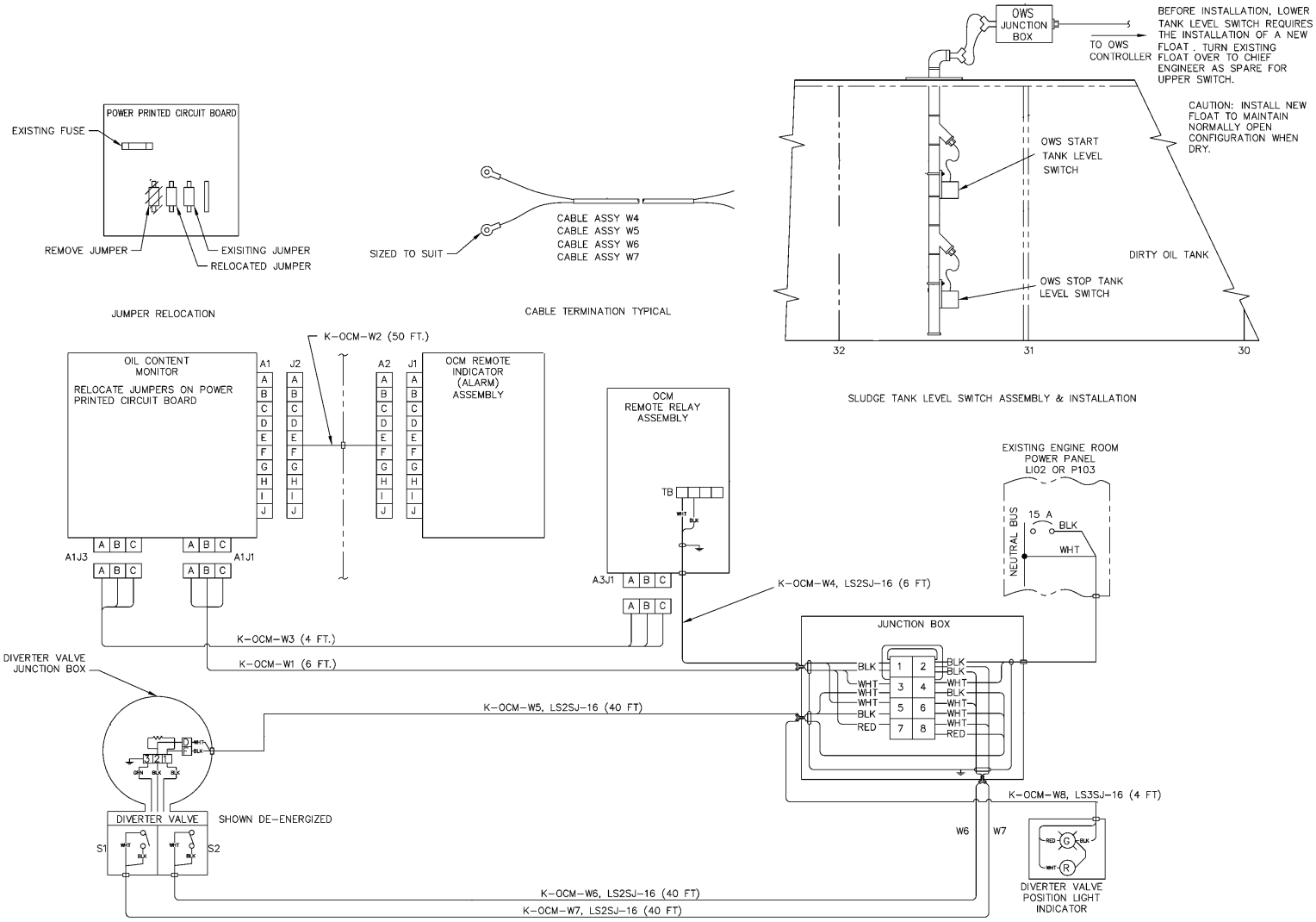


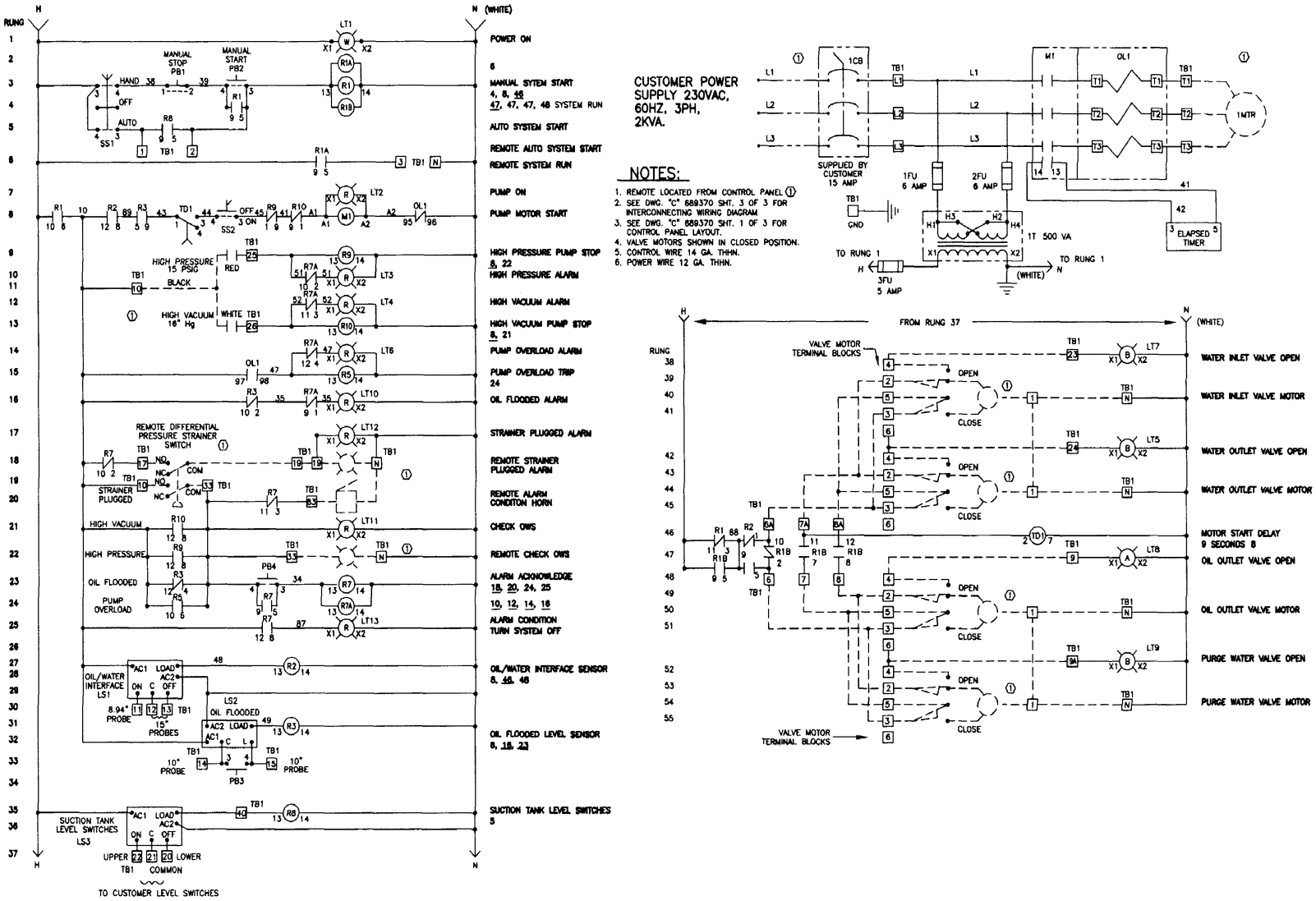
OILY WATER SEPERATOR CONTROL WIRING

FO-1. Electrical Schematic (SID) (Sheet 1 of 2)

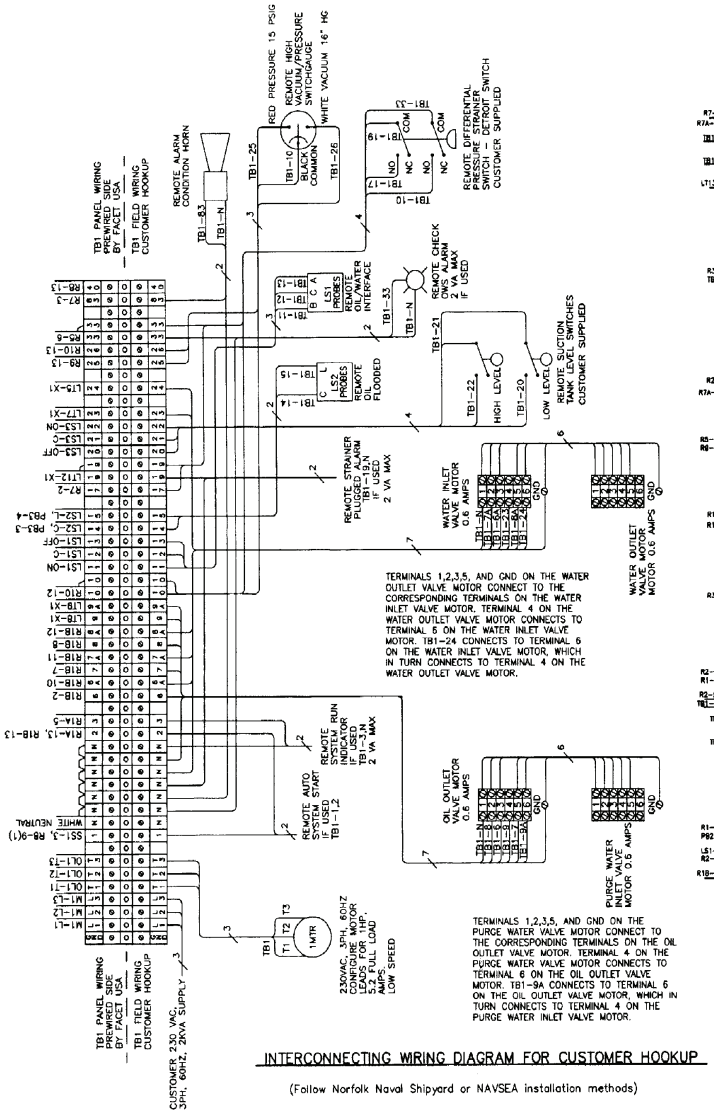


OIL CONTENT MONITOR ELECTRICAL SCHEMATIC
ENGINE ROOM

FO-1. Electrical Schematic (SID) (Sheet 2 of 2)

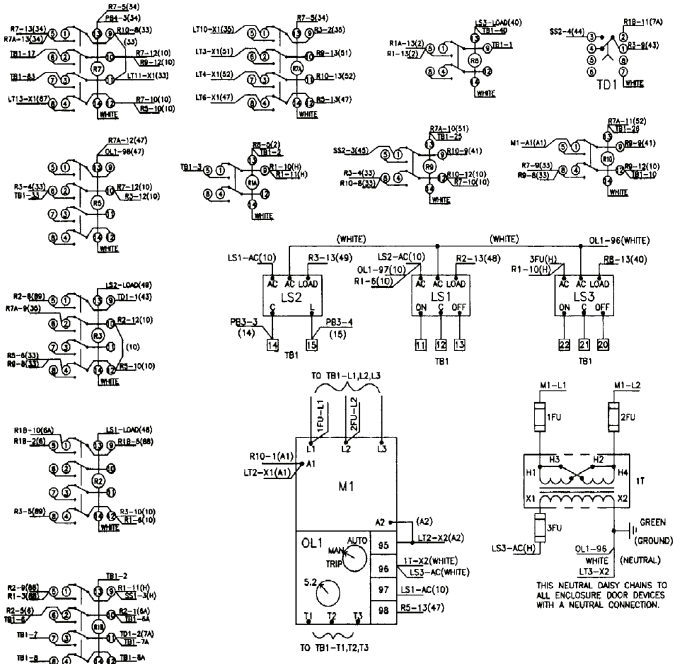


FO-2. Electrical Schematic (OEM) (Typical) (Sheet 1 of 2)



INTERCONNECTING WIRING DIAGRAM FOR CUSTOMER HOOKUP

(Follow Norfolk Naval Shipyard or NAVSEA installation methods)



CONTROL PANEL COMPONENT PHYSICAL WIRING

NOTES:

1. ALL PAN MOUNTED DEVICE NEUTRALS DAISY CHAIN TO THE NEAREST NEUTRAL CONNECTION.
2. SEE DWG. "C" 689370 SHT. 1 OF 3 FOR CONTROL PANEL LAYOUT.
3. SEE DWG. "C" 689370 SHT. 2 OF 3 FOR ELECTRICAL SCHEMATIC.
4. ALL DOOR MOUNTED DEVICES TERMINATE AT TB1 OR AT A PAN MOUNTED DEVICE.
5. CONTROL WIRE 14 GAGE THHN.
6. POWER WIRE 12 GAGE THHN.

FO-2. Electrical Schematic (OEM) (Typical) (Sheet 2 of 2)

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 milliliters = .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	.983	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

PIN: 084599-000