TM 55-1925-285-13&P

This manual supersedes TM 55-1925-220-24&P, dated 16 August 1991

TECHNICAL MANUAL

OPERATOR, UNIT AND DIRECT SUPPORT
MAINTENANCE MANUAL INCLUDING
REPAIR PARTS AND SPECIAL TOOLS LIST
FOR
OIL WATER SEPARATOR

INLAND AND COASTAL LARGE TUG (LT)
NSN 1925-01-509-7013 (EIC XAG)

HEADQUARTERS, DEPARTMENT OF THE ARMY

30 NOVEMBER 2005

WARNING SUMMARY

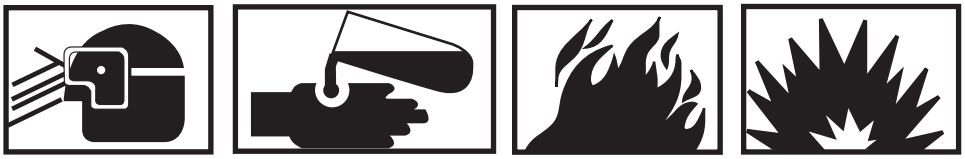
FIRST AID

Although the 128' Large Tug is normally assigned a medic, first aid is still an important skill for all crewmembers. The ability to promptly administer first aid to another crewmember could mean the difference between life and death for that crewmember. First aid procedures for soldiers are contained in FM 4-25.11.

WARNING SUMMARY CONTENT

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this vessel and its equipment. Failure to observe these precautions could result in serious injury to or death of personnel. Also included are explanations of safety and of hazardous materials used within the technical manual.

OILS/CLEANING SOLVENTS



Do not allow hydraulic fluid, engine oil, or cleaning solvents to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling hydraulic fluid, engine oil, and cleaning solvents. Failure to follow these precautions can result in illness or serious injury.

Cleaning solvent is flammable and its vapor is potentially explosive. Do not use cleaning solvent in the vicinity of spark, open flame, or excessive heat. Do not use cleaning solvent in unventilated spaces. Failure to follow these precautions can result in death or serious injury.

CRANES/LIFTING

All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Death or serious injury can result from failure to heed this warning.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

ELECTRICAL

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out. Performing replacement with the circuit energized may result in injury.

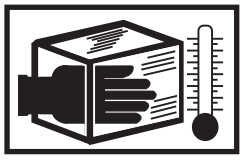
LOCKING HARDWARE

Never reuse locking hardware. Reuse of locking hardware such as lock washers, 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.

EXPLANATION OF SAFETY WARNING ICONS

BIOLOGICAL - abstract symbol bug shows that a material may contain bacteria or viruses that present a danger to life or health.

CHEMICAL - drops of liquid on hand show that the material will cause burns or irritation to human skin or tissue.



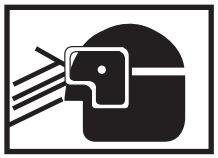
CRYOGENIC - hand in block of ice shows that the material is extremely cold and can injure human skin or tissue.

EAR PROTECTION - headphones over ears show that noise level will harm ears.

ELECTRICAL - electrical wire to arm with electricity symbol running through human body shows that shock hazard is present.

ELECTRICAL - electrical wire to hand with electricity symbol running through hand shows that shock hazard is present.

EXPLOSION - rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition, or high pressure.



EYE PROTECTION - person with goggles shows that the material will injure the eyes.

EXPLANATION OF SAFETY WARNING ICONS (continued)

FALLING PARTS - arrow bouncing off human shoulder and head shows that falling parts present a danger to life or limb.

FIRE - flame shows that a material may ignite and cause burns.

FLYING PARTICLES - arrows bouncing off face show that particles flying through the air will harm face.

FLYING PARTICLES - arrows bouncing off face with face shield show that particles flying through the air will harm face.

HEAVY OBJECT - human figure stooping over heavy object shows physical injury potential from improper lifting technique.

HEAVY PARTS - hand with heavy object on top shows that heavy parts can crush and harm.

HEAVY PARTS - foot with heavy object on top shows that heavy parts can crush and harm.

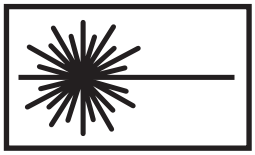
HEAVY PARTS - heavy object on human figure shows that heavy parts present a danger to life or limb.

HEAVY PARTS - heavy object pinning human figure against wall shows that heavy, moving parts present a danger to life or limb.

EXPLANATION OF SAFETY WARNING ICONS (continued)

HELMET PROTECTION - arrow bouncing off head with helmet shows that falling parts present a danger.

HOT AREA - hand over object radiating heat shows that part is hot and can burn.



LASER LIGHT - laser light hazard symbol indicates extreme danger for eyes from laser beams and reflections.

MOVING PARTS - human figure with an arm caught between gears shows that the moving parts of the equipment present a danger to life or limb.

MOVING PARTS - hand with fingers caught between gears shows that the moving parts of the equipment present a danger to life or limb.

MOVING PARTS - hand with fingers caught between rollers shows that the moving parts of the equipment present a danger to life or limb.

POISON - skull and crossbones show that a material is poisonous or is a danger to life.

RADIATION - three circular wedges show that the material emits radioactive energy and can injure human tissue.

SHARP OBJECT - pointed object in hand shows that a sharp object presents a danger to limb.

EXPLANATION OF SAFETY WARNING ICONS (continued)

SHARP OBJECT - pointed object in hand shows that a sharp object presents a danger to limb.

SHARP OBJECT - pointed object in foot shows that a sharp object presents a danger to limb.

SLICK FLOOR - wavy line on floor with legs prone shows that slick floor presents a danger for falling.

VAPOR - human figure in a cloud shows that material vapors present a danger to life or health.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

NOTE: The portion of text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Date of original issue for this manual is:

Original 30 November 2005

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 28 AND TOTAL NUMBER OF WORK PACKAGES IS 27, CONSISTING OF THE FOLLOWING:

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Front Cover	0
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f blank	0
A	0
B blank	0
i - iv	0
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WP 0002 00 (6 pgs)	0
WP 0003 00 (12 pgs)	0
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WP 0026 00 (6 pgs)	0
WP 0027 00 (2 pgs)	0
Glossary-1	0
Glossary-2 blank	0
Index-1-Index-5	0
Index-6 blank	0
Electronic DA Form 2028	0
DA 2028	0
Authentication Page	0
Rear Cover	0

* Zero in this column indicates an original page or work package

HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 NOVEMBER 2005

TECHNICAL MANUAL

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST

FOR

OIL WATER SEPARATOR

INLAND AND COASTAL LARGE TUG (LT)
NSN 1925-01-509-7013 (EIC XAG)

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) Web site. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section on the AEPS public home page. Fill out the form and click on SUBMIT. Using this form on the AEPS site 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 directly to: AMSTA-LC-LPIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

TABLE OF CONTENTS

This manual supersedes TM 55-1925-220-24&P, dated 16 August 1991

TABLE OF CONTENTS (continued)

HOW TO USE THIS MANUAL

USING THIS MANUAL

When using this manual, read and understand the entire maintenance action before performing the task. Also, read and understand all warnings, cautions, and notes as well as general safety precautions that apply to the task to be performed. The warning summary will inform personnel of hazards associated with the equipment to be worked on. However, the summary is not all inclusive and personnel should be aware at all times of hazardous conditions that may arise.

ACCESSING INFORMATION

Information is accessed by referring to the table of contents, located in the front of this manual, or by looking in the alphabetical index, located in the back of this manual.

To locate information using the table of contents, first scan the chapter titles to determine the general area in which your information will be contained. After locating the proper chapter, look beneath the chapter title to find the desired informational or procedural work package title. To the right of the work package title is a work package sequence number. This work package sequence number will direct you to the proper work package. Work packages are arranged in numerical order in this manual.

To locate information using the alphabetical index, look down the subject column on the left side of the page until you find the desired subject. To the right of the subject is the work package sequence number and page number. Go to the indicated work package and indicated page number to find the desired information.

INITIAL SETUP

Initial setup requirements are located directly above many of the procedures in this manual. The information is given to ensure all materials, expendables, tools and any other equipment necessary are readily available for use. The initial setup will be accomplished prior to starting the actual steps of each maintenance procedure. There are five basic headings listed under the initial setup:

Tools and Special Tools: This section lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from table 2 of the Maintenance Allocation Chart (MAC).

Materials/Parts: This section lists all of the materials and parts required to perform the task. If the material or part is needed each time to work package is used, then it is listed here. If the part is optional, replaced on a conditional basis, or is only needed for certain specific procedures within the work package it is not listed.

Personnel Required: This section lists all personnel necessary to perform the task. When a specific MOS or other personnel qualification is required, this MOS or additional requirement is also indicated.

Equipment Condition: This section notes the conditions that must exist before starting the task. The equipment condition will also include any prerequisite maintenance tasks to be performed with reference to the work package number or to the TM number that contains the required maintenance task.

References: This section lists any other publications necessary to complete the task. When there are no references listed, all steps necessary to complete the task are contained within this manual. A listing of reference materials is contained in the Supporting Information chapter at the rear of this manual.

ILLUSTRATIONS

Various visual methods are used to locate and repair components. Locator illustrations in Controls and Indicator tables, Preventive Maintenance Checks and Services (PMCS) tables, exploded views, and cut-away diagrams make the information in the manual easier to understand and follow.

LOCATING MAJOR COMPONENTS

This work package gives a brief description of the major components, and provides illustrations showing the location of the components. Knowing the major components of the system is the first step to understanding system operation and maintenance.

THEORY OF OPERATION

This work package contains the theory of operation for the system. Theory of operation is provided to familiarize the user system operating principles. Once the operating principles are understood, the user is better equipped to operate, troubleshoot, and maintain the system.

DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

This work package describes all of the operator controls and indicators contained in the system. Use of the operator controls and indicators is also described. Turn to the figure that shows the desired control or indicator. Note the key number corresponding to the control or indicator. Refer to the table below the illustration and find the desired key number in the column on the far left hand side. The center column contains the name of the control or indicator and the right hand column briefly describes the control or indicator's function.

OPERATOR INSTRUCTIONS

Work packages are included in this manual to describe operation under usual conditions as well as operation under unusual conditions. Prior to performing any operating procedure, perform the initial setup by obtaining the expendables, tools, materials and other items listed prior to starting the task. Always perform the listed steps in the listed order.

TROUBLESHOOTING PROCEDURES

A troubleshooting index work package is contained in this manual to permit easy location of troubleshooting procedures. Full directions for using the troubleshooting index and the accompanying troubleshooting procedures are contained in the troubleshooting index work packages. The troubleshooting procedure work package(s) immediately follow the troubleshooting index.

MAINTENANCE PROCEDURES

To locate a maintenance procedure, consult the table of contents or the alphabetical index. Each level of maintenance (operator, unit, and direct support) has a chapter dedicated to maintenance procedures for the appropriate level of maintenance. Each maintenance work package contains complete maintenance procedures, starting with initial setup and continuing through follow on service as appropriate. Always ensure that all of the initial setup is complete before beginning a maintenance procedure and always ensure that all warnings, cautions, and notes are heeded.

MAINTENANCE ALLOCATION CHART

The MAC lists all of the authorized maintenance for the system assigns that maintenance to the appropriate maintenance level (operator, unit, and direct support). Use of the MAC is explained fully in the Maintenance Allocation Chart Introduction work package.

REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)

The RPSTL lists all of the repair parts authorized for the system. Illustrations are provided to assist in locating the desired repair parts. Full instructions for use of the RPSTL are contained in the Repair Parts and Special Tools List Introduction work package. Always follow the directions contained in this work package when using the RPSTL.

ALPHABETICAL INDEX

The Alphabetical Index, located in the back of this manual, contains an alphabetical list of all sections of this manual. For example, Location and Description of Major Components is found in section L. The work package sequence number is found on the right side of the title where the Location and Description of Major Components is located. Turn to the work package indicated to find the description and location of each component.

Chapter 1

General Information, Equipment Description, and Theory of Operation for Oil Water Separator

Inland and Coastal Large Tug (LT)

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
GENERAL INFORMATION

SCOPE

The information in this manual applies to all Inland and Coastal Large Tugs (LT) with the Oil Content Monitor (OCM) installation. This manual contains operator instructions and maintenance procedures for the Oil Water Separator (OWS) and for the OCM.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army (DA) forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, Functional Users Manual for The Army Maintenance Management System (TAMMS).

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

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) Web site. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section on the AEPS public home page. Fill out the form and click on SUBMIT. Using this form on the AEPS site 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 directly to: AMSTA-LC-LMIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

Corrosion specifically occurs with metals. It is an electrochemical process that causes the degradation of metals. It is commonly caused by exposure to moisture, acids, bases, or salts. An example is the rusting of iron. Corrosion damage in metals can be seen, depending on the metal, as tarnishing, pitting, fogging, surface residue, and/or cracking.

Plastics, composites, and rubbers can also degrade. Degradation is caused by thermal (heat), oxidation (oxygen), solvation (solvents), or photolytic (light, typically UV) processes. The most common exposures are excessive heat or light. Damage from these processes will appear as cracking, softening, swelling, and/or breaking.

If a corrosion problem is identified, it can be reported using SF 368 (Product Quality Deficiency Report). Use of key words such as “corrosion,” “rust,” “deterioration,” or “cracking” will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA PAM 738-750, Functional Users Manual for The Army Maintenance Management Systems (TAMMS).

OZONE DEPLETING SUBSTANCES

There are no Ozone Depleting Substances (ODS) contained in the OWS or OCM systems.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For procedures to destroy this equipment to prevent its use by the enemy, refer to TM 750-244-6, Procedures for Destruction of Tank - Automotive Equipment to Prevent Enemy Use.

PREPARATION FOR STORAGE OR SHIPMENT

Detailed procedures for preparing the oil water separator for storage or shipment are contained in TB 740-97-4, Preservation of Vessels for Storage and TM 38-470, Storage and Maintenance of Army Prepositioned Stock Materiel. These systems must be prepared for storage or shipment in accordance with that publication.

WARRANTY INFORMATION

Unit maintenance maintains records of the warranty status of equipment on the OWS and OCM systems. The warranty starts on the date found in block 23 of DA Form 2408-9 (Equipment Control Record). Report all defects to your supervisor, who will take appropriate action.

LIST OF ABBREVIATIONS/ACRONYMS

Abbreviation/Acronym	Name
°C	Degrees Centigrade
°F	Degrees Fahrenheit
A	Amp(s)
AAL	Additional Authorization List
BII	Basic Issue Items
cm	Centimeter(s)
COEI	Components of End Item
COTS	Commercial Off the Shelf
COV	Cutoff Valve
CPC	Corrosion Prevention and Control
DA	Department of the Army
EIR	Equipment Improvement Recommendations
EMI	Electromagnetic Interference
ETI	Elapsed Time Indicator
ft	Foot(feet)
ft^2	Square foot(feet)
ft^3/min	Cubic feet per minute
in	Inch(es)
in^3	Cubic Inch(es)
L	Liter(s)
L/min	Liters per minute
lb	Pound(s)
lb/in^2	Pounds per Square Inch
lb-ft	Pounds Feet (torque)
LED	Light Emitting Diode
LT	Large Tug
m	Meter(s)
m^2	Square meter(s)
MAC	Maintenance Allocation Chart
Nm	Newton Meter
NO	Normally Open

LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
OB	Oily Bilge
OCM	Oil Content Monitor
ODS	Ozone Depleting Substance(s)
OWS	Oil Water Separator
OWT	Oily Waste Tank
PCB	Printed Citcuit Board
PMCS	Preventive Maintenance Checks and Services
PPM	Parts Per Million
SDA	Sample and Detection Sub-Assembly
TAMMS	The Army Maintenance Management System
TMDE	Test, Measurement, and Diagnostic Equipment
UVA	Ultrasonic Vibrator Assembly
Vac	Volts, Alternating Current
V/C	Verification Confidence Test
Vdc	Volts, Direct Current

QUALITY OF MATERIAL

Material used for replacement, repair, or modification must meet the requirements of this manual. If quality of material requirements are not stated in this manual, the material must meet the requirements of the drawings, standards, specifications, or approved engineering change proposals applicable to the subject equipment.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
EQUIPMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

OIL WATER SEPARATOR (OWS)

The OWS uses the principles of gravity separation and coalescence to remove oil from water. Storage of oily wastes in the Oily Waste Tank (OWT) prior to treatment enhances this process by allowing some of the oil to separate in the tank, thus reducing the loading on the OWS. The OWS can process from 10 to 15 gal/min (38 to 57 L/min) of bilge water.

OIL CONTENT MONITOR (OCM)

The Model ET-35N oil content monitor system described in this technical manual is designed to monitor and measure the amount of oil that is present in water discharged from the OWS. It is primarily intended to be incorporated into onboard OWS installations on U.S. Military vessels. The OCM system provides control signals to the diverter solenoid valve of the OWS to prevent the overboard discharge of effluent with an oil content greater than 70 parts per million (ppm) while at sea, or greater than 15 ppm while in port, within 12 nautical miles (nmi) of land, or other designated special areas of environmental concern. The ET-35N OCM utilizes the principle of ultrasonic emulsification to affect the turbidity of oil/water mixtures, which can be accurately measured to determine the small traces of oil in the effluent from the OWS. This system can sample effluent streams of at least 2 gal/min (7.6 L/min) (no maximum flow rate) through a nozzle sampler, and is rated for continuous duty.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

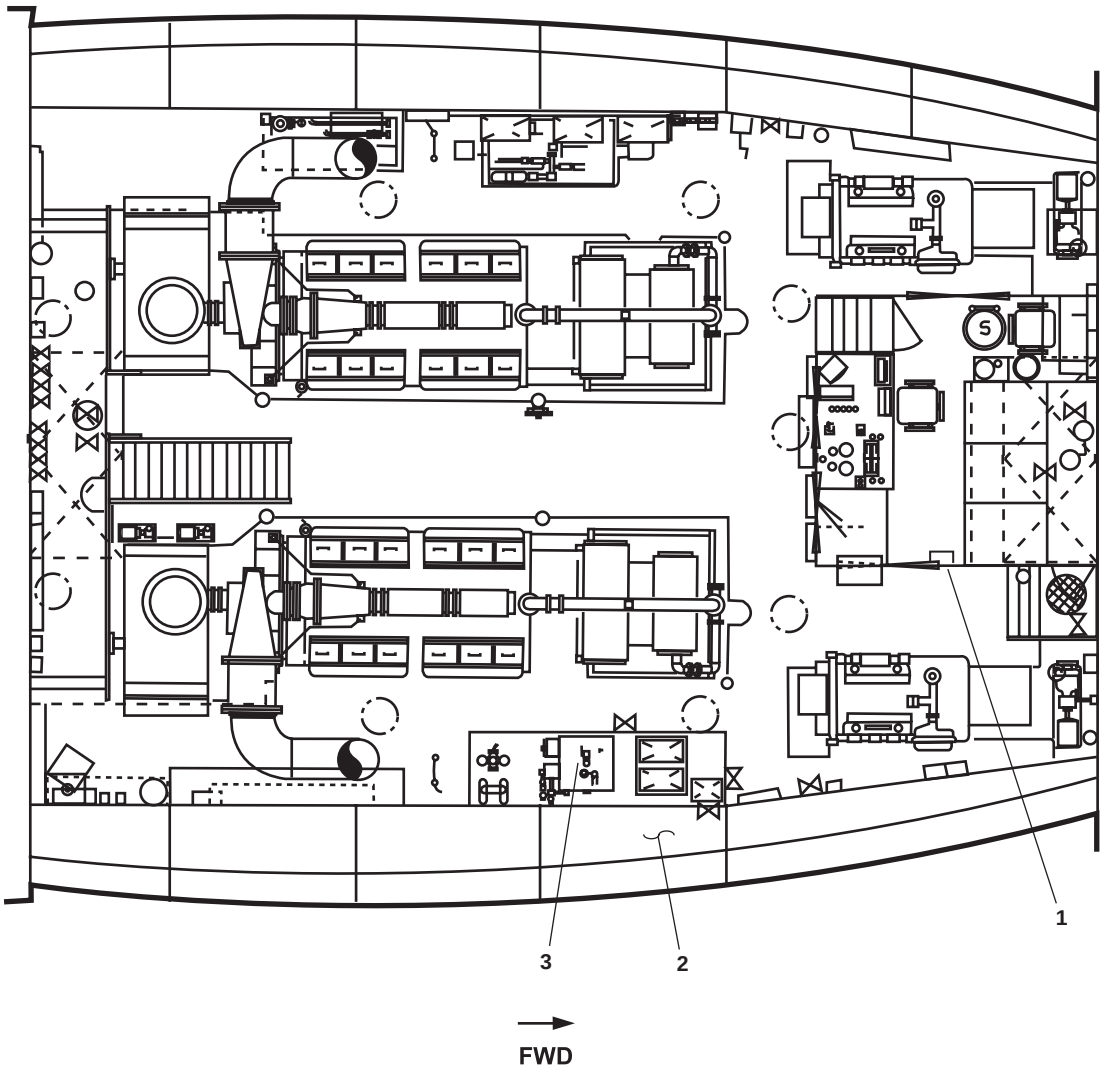


Figure 1. OCM and OWS Major Component Locations (Plan View)

1. OCM Remote Indicator (Alarm) Assembly (figure 1, item 1). This unit, located on the starboard bulkhead of the EOS, is used to display OCM operating information, select the alarm limit (15/70 ppm) of the OCM, and to provide audible and visual alarm indicators when the OCM system detects an unacceptable level of oil content in the effluent.

2. Oily Waste Tank (figure 1, item 2). This tank provides storage for oily bilge water awaiting treatment by the OWS. The tank also stores oil removed by the OWS. Oil and oily water that cannot be sufficiently cleansed by the OWS are stored for discharge to a shore facility.

3. OWS Tank (figure 1, item 3). The OWS is located at frame 33, against the starboard bulkhead. The rectangular, welded carbon steel tank is internally coated with coal tar epoxy, and externally painted with primer and marine enamel. The internal components (baffle, weir, and coalescer boxes) are type II PVC plastic for maximum corrosion resistance. There are no internal fasteners in the OWS tank. The coalescer boxes are filled with special polypropylene granules (beads). To change the coalescer medium, these boxes can be removed from the separator, emptied, refilled, and replaced. The OWS pump and OWS control panel are mounted on the aft side of the OWS tank.

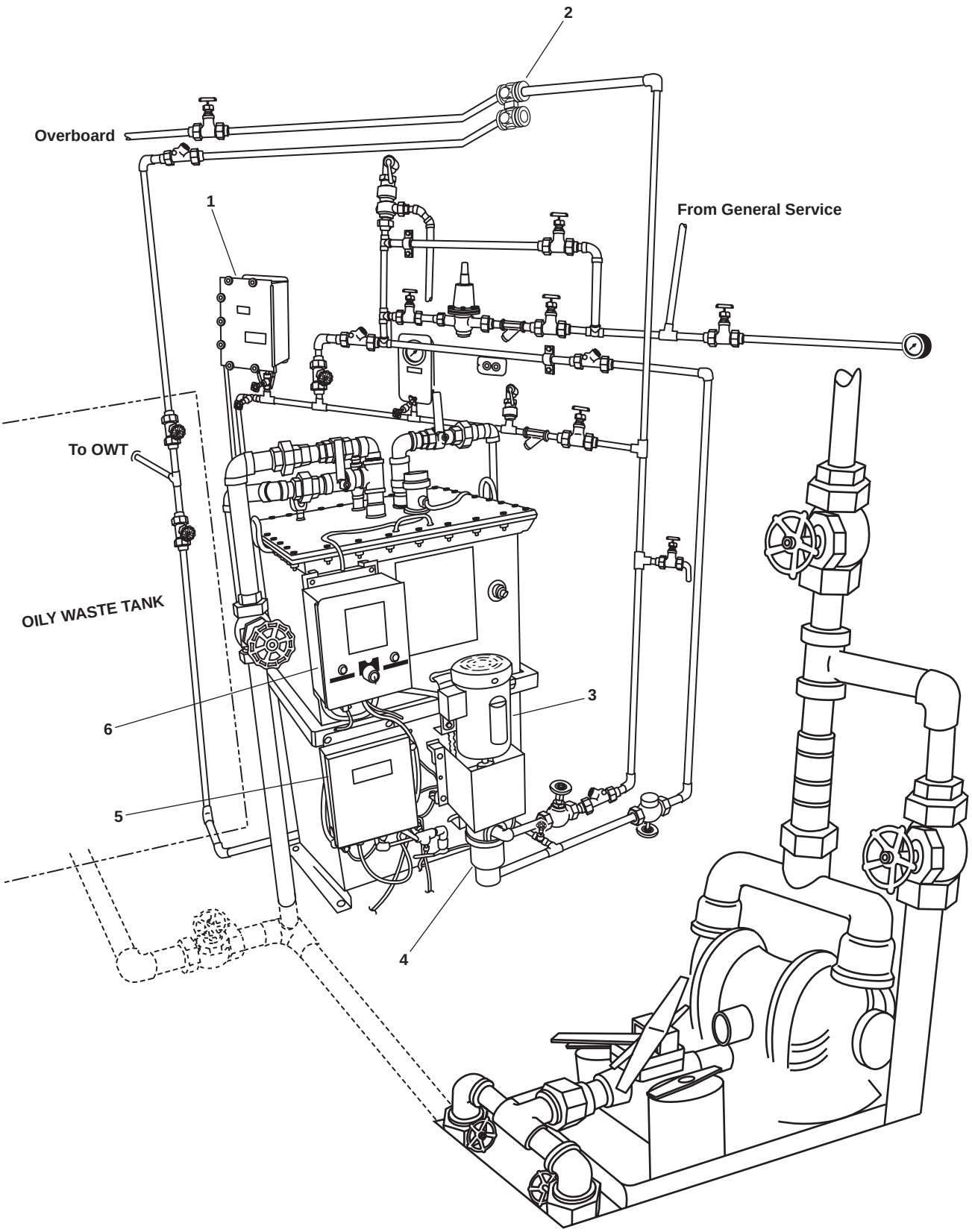


Figure 2. OCM and OWS Major Component Locations (Profile View)

4. OCM Sampling/Sensor Assembly (figure 2, item 1). The sampling/sensor assembly enclosure has two separate internal compartments. One compartment has a drain in its bottom and houses the sample and detection subassembly, which is a wetted part. The second compartment is environmentally sealed to provide maximum protection to the electronic components within. In this compartment are the OCM control circuits and the main indicator panel display. The primary function of the sampling/sensor assembly is to sample and measure the amount of oil contained in OWS discharge water. It provides control signals to the system indicators, and provides control signals to the remote relay assembly, which in turn controls the diverter solenoid valve.

5. Diverter Solenoid Valve (figure 2, item 2). This motor actuated valve directs the discharge flow from the OWS. When discharge oil levels are below the selected limit, the valve directs flow overboard. When discharge oil levels are above the selected limit, the valve directs flow to the OWT. The valve fails to the OWT position if power or the control signal is lost.

6. OWS Pump Motor (figure 2, item 3). This electric motor drives the OWS discharge pump. The motor is controlled from the oily waste control panel.

7. OWS Pump (figure 2, item 4). The OWS pump is a long-coupled progressing cavity pump mounted on the aft side of the OWS tank and is used for effluent discharge and inlet suction. The pump has a castiron housing with stainless steel rotor, Buna-N stator, and carbon-ceramic mechanical seal. The pump is driven by the OWS pump motor.

8. OCM Remote Relay Panel (figure 2, item 5). The remote relay panel contains a relay circuit that controls the operation of a diverter solenoid valve in response to a control (alarm) signal received from the sampling/sensor assembly. The diverter solenoid valve control relay has a 60 second time delay, controlled by a solid-state timer in this assembly. There are no indicators on this unit.

9. Oily Waste Control Panel (figure 2, item 6). OWS control components are enclosed in an enclosure mounted on the aft side of the OWS tank. Appropriate safety features (i.e., safety interlock and fuses) are included on the inner panel. The outer panel contains the control switch (with AUTO, OFF, and MAN positions), a POWER AVAILBALE indicator light, and an OIL DISCHARGE indicator light.

DIFFERENCES BETWEEN MODELS

At the time of issue for this manual, only hull numbers LT-803 and LT-806 have received the OCM installation. There are no differences between models in these two installations. As other vessels are upgraded, this manual will be revised to reflect those installations. Differences between models, if any, will be identified at that time.

EQUIPMENT DATA

Tables 1 and 2 below detail the technical characteristics of the OWS (table 1) and OCM (table 2).

Table 1. Oil Water Separator Technical Characteristics

Item	Data
Manufacturer	Sigma
Model	S1-3.5T-OWS
Treatment Capacity	10 to 15 gal/min (38 to 57 L/min)
Pump	
Manufacturer	Moyno
Model	34401
Pump Housing Material	Cast Iron
Rotor Material	Stainless Steel
Stator Material	Buna N
Seal Type	Carbon/Ceramic Mechanical
Maximum Discharge Head	40 PSI at 10 gal/min (2.8 bar at 38 L/min) 25 PSI at 12 gal/min (1.7 bar at 45 L/min) 10 PSI at 13 gal/min (0.7 bar at 49 L/min) 0 PSI at 15 gal/min (0.0 bar at 57 L/min)
Pump Motor	
Horsepower (kW)	0.5 (0.4)
Operating Speed	1750 r/min
Operating Voltage	230 Vac

Table 2. Oil Content Monitor Characteristics

Item	Data
Overall System Specifications	
Manufacturer	Parmatic Filter Corporation, Sigma Treatment Systems Division
Type	Oil Content Monitor
Model	ET-35N
Pitch and Roll Limitations	Vertical to 45°
Ambient Temperature Limitations	1 to 50 °C (33 to 140 °F)
Humidity Limitations	100%
Vibration Limitations	Meets MIL-STD-167-1
Shock Limitations	Meets MIL-STD-901C, Grade B
Electromagnetic Compatibility (EMC)	Meets MIL-STD-461/462C
Sampling/Sensor Assembly Specifications	
Manufacturer	Parmatic Filter Corporation, Sigma Treatment Systems Division
Input Power Requirements	115 VAC, Single-Phase, 60 HZ, 2 A
Sample (Inlet) Pressure Range	5 to 25 PSI (0.3 1.7 bar) (+/- 20%)
Sample Flow	0.4 to 1 gal/min (1.5 to 3.8 L/min)
Sampling Period	15 seconds
In Port Range	0 to 21 ppm
In-Port Alarm Point	15 ppm (+/- 5 ppm)
At-Sea Range	0 to 140 ppm
At-Sea Alarm Point	70 ppm (+/- 30 ppm)
Remote Indicator (Alarm) Assembly Specifications	
Manufacturer	Parmatic Filter Corporation, Sigma Treatment SystemsDivision
Input Power Requirements	115 VAC, Single-Phase, 60 HZ (from Sampling/Sensor Assembly)
Audible Alarm	Internal Buzzer
Remote Relay Assembly Specifications	
Manufacturer	Parmatic Filter Corporation, Sigma Treatment Systems Division
Input Power Requirements	115 VAC, Single-Phase, 60 HZ (from Sampling/Sensor Assembly)

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION

GENERAL

The Large Tug (LT) utilizes an Oil Water Separator (OWS) to remove oil from bilge water, thus cleansing the bilge water before it is permitted to be discharged overboard. An Oil Content Monitor (OCM) is used in conjunction with the OWS to monitor oil levels in the discharge stream from the OWS. The OCM prevents accidental overboard discharge of oil-contaminated water by sounding an alarm and by redirecting the discharge flow whenever selected discharge oil levels are exceeded. The theory of operation for these two interrelated systems is presented in the paragraphs below.

OIL WATER SEPARATOR (OWS) THEORY

Operation of this OWS is based on the fact that oil is lighter than water, causing oil droplets to rise through a still or slowly flowing body of water. This is known as gravity separation. The larger an oil droplet is, the faster it will rise, and very small droplets may not rise at all. To remove more of the oil as it flows through the OWS, the design also incorporates coalescing sections, in which small droplets contact each other and form larger ones.

A positive displacement pump (figure 1, item 1), mounted downstream of the OWS tank, draws unprocessed oily water from the Oily Waste Tank (OWT) into the separator (figure 1, item 2). The separator consists of a single tank in which several oil-separation zones are created by the inlet weir and baffle arrangement, (figure 1, item 3), two permanent polypropylene coalescer beds (figure 1, item 4), and the water spaces between them. In this design, the oil-water separation is accomplished in two stages. The upper zones of the tank promote gravity separation. The inlet baffle directs the flow of oil droplets away from the upper coalescer bed. This provides an extended retention time for the oil droplets in the upper portion of the tank, which enables the larger oil particles to separate and rise to the tank top. The inlet weir separates the oil accumulated in the tank from the inlet flow. This helps to prevent remixing of the accumulated oil in the tank top during the normal operation and manual

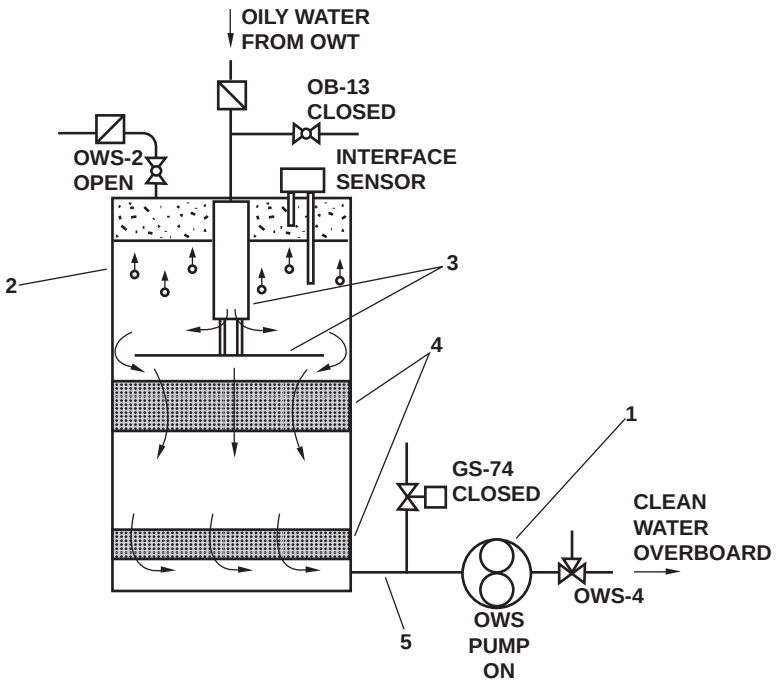


Figure 1. Normal Processing Mode

backflush modes. Oil droplets that flow past the inlet baffle accumulate on the polypropylene granules (beads) in the coalescer, which have 10-mesh screen tops and bottoms to hold the raw polypropylene granules. The polypropylene granules attract oil and repel water (oleophylic-hydrophoic), allowing water to flow through, while the oil remains temporarily trapped in the coalescer granules. As the accumulated oil droplets combine and grow in size (coalesce), they become more buoyant, then break away and rise to the top of the tank. The lower coalescer bed functions like the upper one, but is thinner and acts like a polishing bed. The water space between these beds isolates them, preventing contamination of the lower by the upper. The clarified effluent, having passed through both coalescer beds, is drawn through the outlet in the tank bottom (figure 1, item 5) and piped overboard or recirculated back to the OWT. The destination of the discharge is controlled by the OCM, whose theory of operation is detailed later in this work package.

FACTORS AFFECTING OWS OPERATION

Several factors can have an undesirable effect on OWS operation. Among these factors are emulsified oil, vacuum leaks, and synthetic oil. The effects of each of these factors are explained in the paragraphs below.

EMULSIFIED OIL

The OWS is not designed to separate emulsified oil/water mixtures (mixtures where the oil droplets are thoroughly mixed with the water and are too small to be removed by the coalescer beads). Emulsions can be formed by mechanical agitation or by the addition of emulsifying agents, such as solvents or detergents, to the mixture. To ensure proper operation of the OWS, it is important to keep all such chemicals out of the bilges to the greatest extent possible. One way to do this is to use only short-lived detergents for bilge cleaning or for other operations when cleaning water will enter the bilge area. Table 1 lists two such detergents.

Table 1. Approved Short-Lived Detergents for Bilge Cleaning

Detergent/Quantity	NSN
Allied P-98 by Allied Enterprises	
55 gallon drum	6850-01-278-4420
30 gallon drum	6850-01-278-3858
5 gallon bucket	6850-01-278-4421
General Purpose Detergent, MIL-D-16791	
55 gallon drum	7930-00-282-9700
5 gallon bucket	7930-00-985-6911
1 gallon container	7930-00-282-9699

VACUUM LEAKS

The OWS pump is located on the outlet side of the OWS tank to prevent the emulsification of the oil/water mixture that would occur if the pump were on the inlet side of the tank. The OWS tank and inlet piping are thus under a vacuum, which is measured by the compound pressure/vacuum gauge on the tank top. Depending on the suction lift required, this vacuum will vary. The pump has a 25-foot (7.6 m) vertical lift capability, but a 15-foot (4.6 m) maximum vertical lift is recommended. The vacuum gauge reading should be recorded at startup and referenced as necessary to determine if the inlet basket strainer needs cleaning or if the inlet piping has become clogged. It is important that the inlet piping is tight and leak free (bubble tight under vacuum) to minimize the amount of air the system will process. Since the conductivity type interface sensor cannot distinguish between air and oil, air entering the separator tank can cause the OWS to perform excessively frequent oil discharge cycles.

SYNTHETIC OIL

Since the OWS relies on specific gravity differences between oil and water to separate them, synthetic oils or hydrocarbon sludge heavier than water will not be separated by this unit, and can result in fouled coalescers and piping. Oils with a specific gravity of 0.96 and less can be processed by this unit at its rated flow. Any oils with higher specific gravities should be segregated at their sources, and not allowed into the bilges.

OIL DISCHARGE

The OWS contains an oil-water interface sensor mounted in the top of the tank. The sensor has two probes, each a different length. An electrical current flows between the probes and the tank wall, and the control unit measures the conductivity of the surrounding fluid. Water is highly conductive, while oil and air are not. Therefore, when the tank is full of water, the control unit will sense the high conductivity. When enough oil has accumulated to cover the lower probe tip (figure 2, item 1) (approximately 8-1/2 gallons (32.2 L)), the control unit will sense the drop in conductivity and cause the OWS to enter oil discharge mode. At this point, the red OIL DISCHARGE indicator on the control panel will illuminate. In the oil discharge mode, the OWS pump (figure 2, item 2) stops, and the backflush inlet solenoid valve (figure 2, item 3) opens to apply seawater pressure (reduced to 12 PSI (0.9 bar)) to the OWS tank. Seawater then enters the tank bottom (figure 2, item 4), backflushing the coalescer beds and displacing the accumulated oil in the upper tank zone. A check valve (figure 2, item 5) prevents back-flow through the inlet suction line. The oil is thus forced out through the oil discharge line (figure 2, item 6) and into the OWT. Once the oil is discharged and the displacing water contacts the upper interface probe (figure 2, item 7), the backflush valve will close, and the pump will start, resuming the normal processing mode.

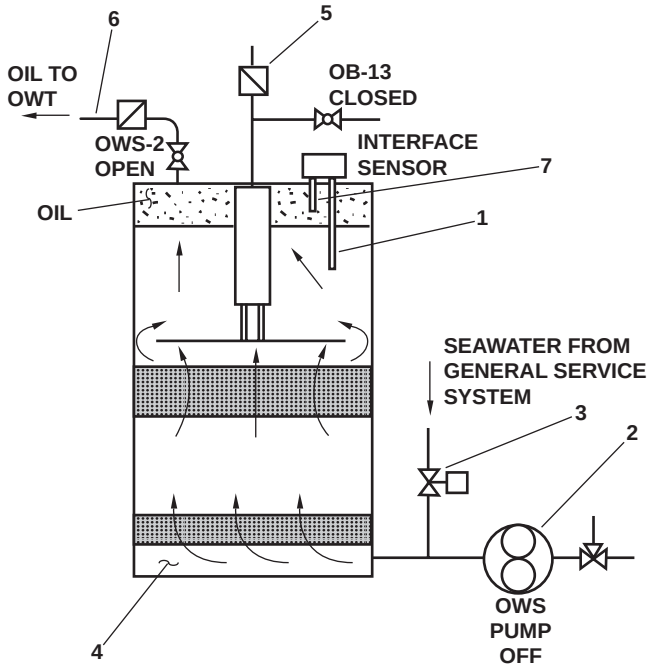


Figure 2. Oil Discharge Mode

OIL CONTENT MONITOR (OCM)

The OCM controls a diverter solenoid valve on the OWS discharge to prevent the overboard discharge of any effluent that has an oil content exceeding the selected limit. The OCM system automatically samples the effluent from the OWS discharge pipe (figure 1, item 5) by way of a nozzle sampler whenever the OWS is operating. The OCM analyzes the sample for oil content, activates alarms, and provides valve control signals to prevent unacceptable effluent from being discharged overboard.

The OCM system is comprised of the sampling/sensor assembly (figure 3, item 1), remote indicator (alarm) assembly (figure 3, item 2), and the remote relay assembly (figure 3, item 3). These three components are electrically interconnected to function as follows:

1. The sampling/sensor assembly (figure 3, item 1) samples the OWS effluent, measures the oil content, and generates electrical signals for the system indicators, alarms, and control relays.

2. The remote indicator (alarm) assembly (figure 3, item 2) is the remote control and indicator unit for the OCM system.

3. The remote relay assembly (figure 3, item 3) is the relay control link between the OCM and the diverter solenoid valve on the OWS discharge piping. The diverter solenoid valve directs the effluent either overboard or to the Oily Waste Tank (OWT).

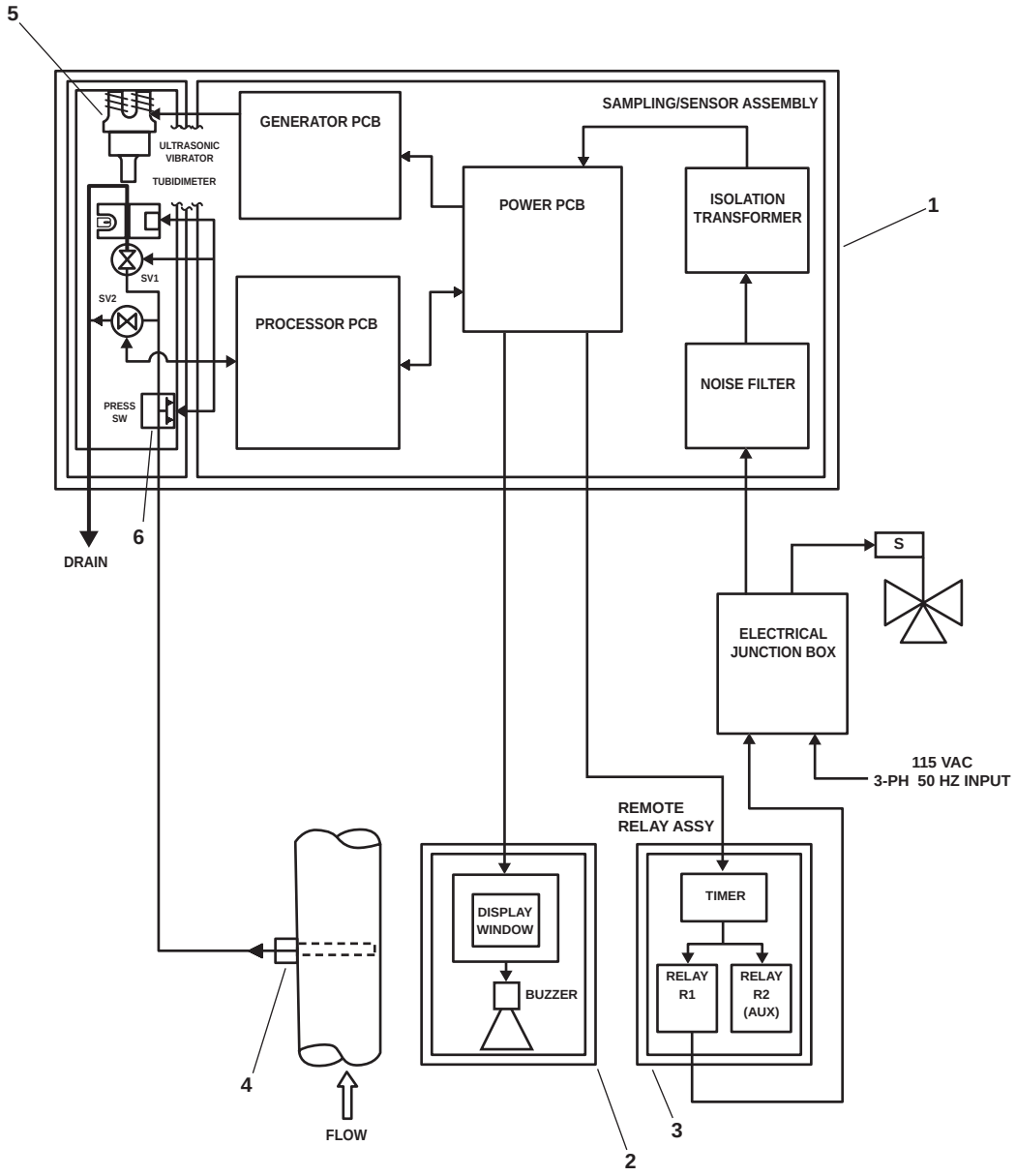


Figure 3. Oil Content Monitor System, Block Diagram

SAMPLING/SENSOR ASSEMBLY

The sampling/sensor assembly is comprised of two parts: the nozzle sampler and the sampling/sensor assembly (the control box). The sampling/sensor assembly is further subdivided into two compartments. One compartment houses the Sample and Detection Subassembly (SDA) and the other compartment houses the electronic components and controls of the OCM. All of the effluent oil content measurements are made by this assembly. The theory of operation for each of these three sections is detailed in the paragraphs below.

NOZZLE SAMPLER

The effluent sample is taken from the OWS effluent discharge through a nozzle sampler (figure 3, item 4; figure 4). This device takes a sample from the effluent stream, which is uniform and typical of the effluent being discharged from the OWS. The OWS effluent pressure delivers the sample to the sampling/sensor assembly. The effluent is pressure regulated at 5 to 25 PSI (0.3 to 1.7 bar) at the sample inlet of the sampling/sensor assembly. Nominal 3/8-inch piping (or tubing) connects the nozzle sampler to the sample inlet on the sampling/sensor assembly.

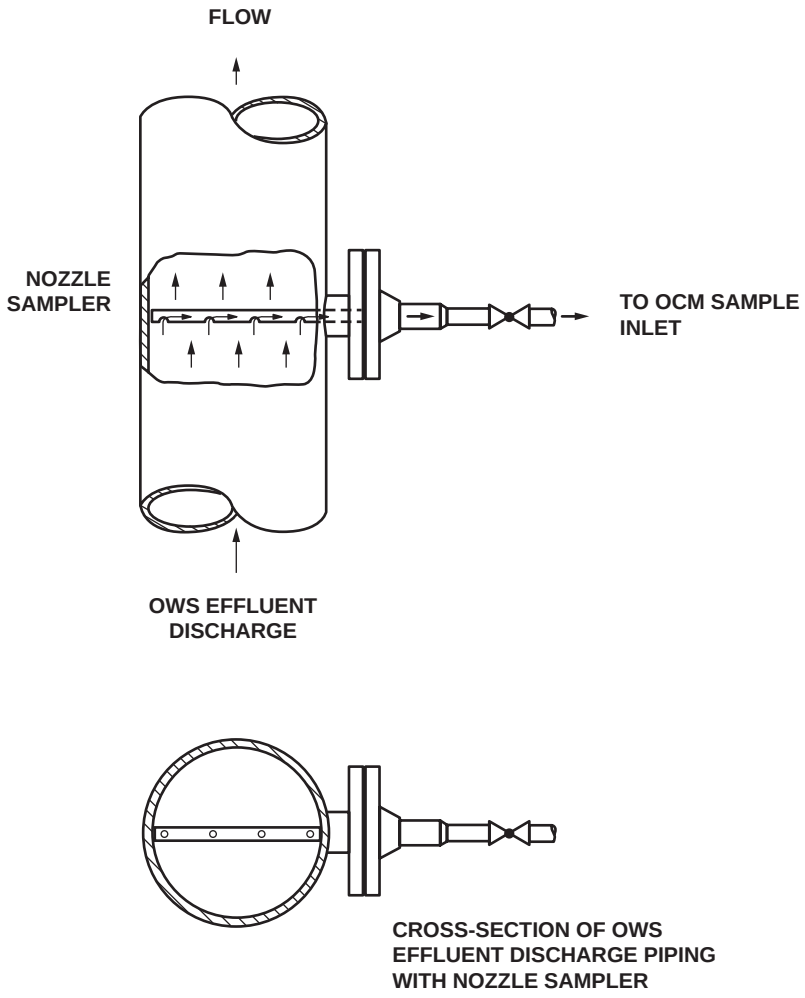


Figure 4. Nozzle Sampler, General Arrangement

SAMPLE AND DETECTION SUBASSEMBLY (SDA)

The SDA (figure 3, item 5; figure 5) controls the flow, emulsification, and turbidity measurements of the effluent sample. It consists of a plastic manifold block with the following components mounted to it: a pressure switch (figure 5, item 1), two solenoid valves (figure 5, items 2 and 3), an ultrasonic vibrator (figure 5, item 4), and a turbidimeter (figure 5, item 5), which takes the turbidity measurements using photoelectric components.

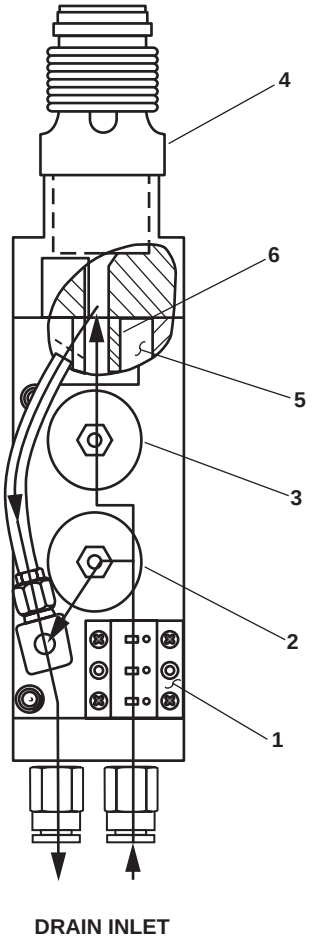


Figure 5. Sample and Detection Subassembly (SDA)

ELECTRONIC COMPONENTS AND CONTROLS

The sampling/sensor assembly provides the following controls and components:

OPERATION SELECTOR switch A1S1 (figure 6, item 1). This switch is a three-position toggle switch (AUTO, OFF, and TEST positions) used to select the mode of operation. With switch A1S1 in the OFF position, none of the system indicators or displays will energize, and the diverter solenoid valve will remain in the recirculate (de-energized) position. With the switch in the AUTO position, the OCM will be energized whenever there is 5 to 25 PSI (0.3 to 1.7 bar) at the sample inlet, as detected by a pressure switch (figure 3, item 6) that is part of the SDA. Pressure at the sample inlet is normally created by the OWS discharge pump, however flushing water pressure will operate the OCM when the sample inlet valve is closed and the flushing inlet valve is opened. The OCM indicators will energize when the required pressure is applied in this AUTO mode. With switch A1S1 in the MAN position, the OCM is energized regardless of the sample pressure or flow. The MAN position is only to be used for troubleshooting and system verification, as operation of the OCM without adequate pressure or flow can damage the unit.

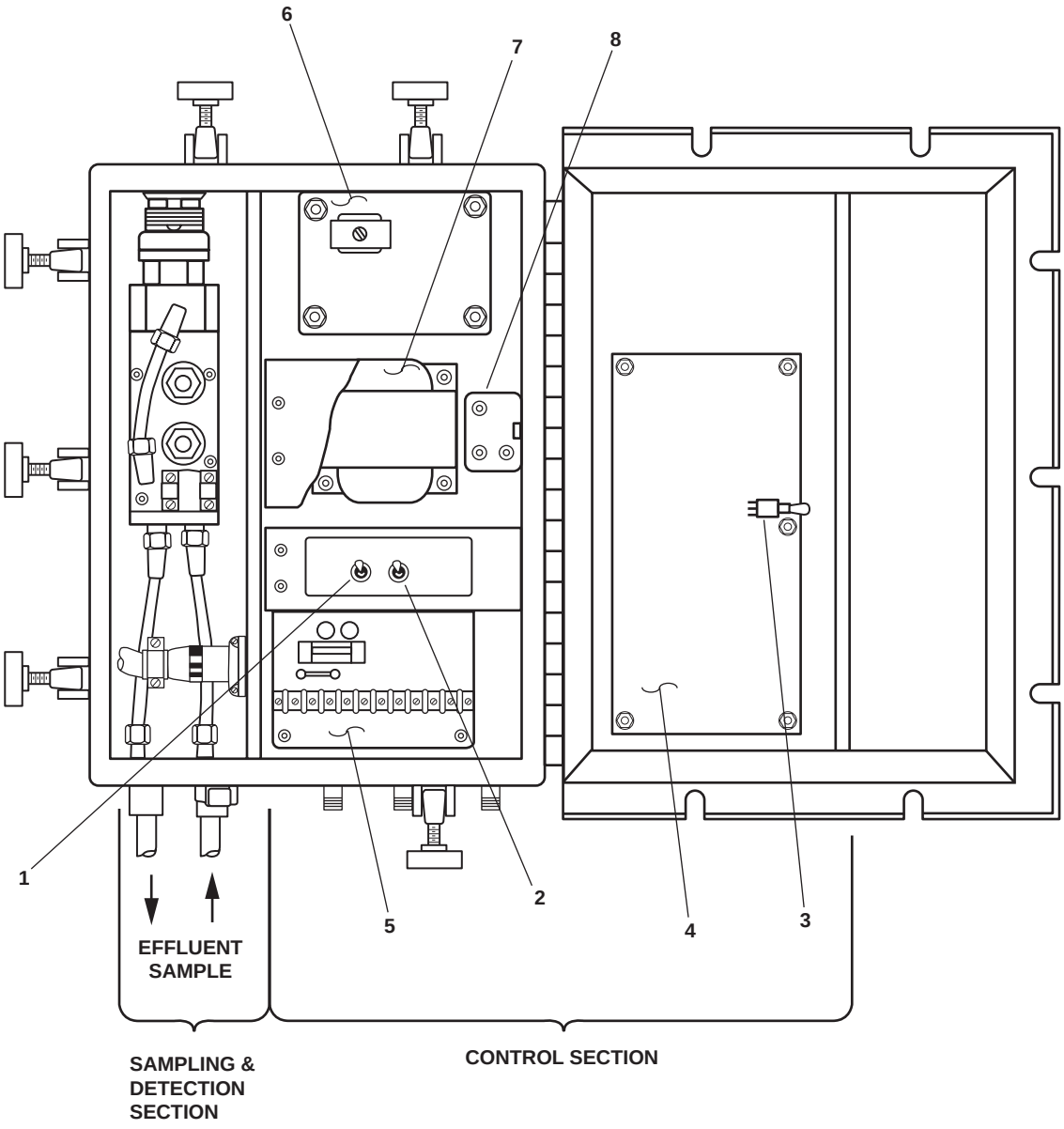


Figure 6. Sampling/Sensor Assembly

ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 6, item 2). This switch is a three-position toggle switch (70 PPM, REMOTE, and 15 PPM positions). Switch A1S2 is used to select the 70 or 15 PPM alarm limits or to enable the remote alarm limit selector switch. With A1S2 in the 70 PPM position, the OCM will activate alarms and energize the diverter solenoid valve when the oil content exceeds 70 ppm (+/- 30 ppm). With A1S2 in the 15 PPM position, the OCM will activate alarms and energize the diverter solenoid valve when the oil content exceeds 15 ppm (+/- 5 ppm). With A1S2 in the REMOTE position, the PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch A2S1 on the remote indicator alarm assembly is engaged, allowing the operator to select the alarm limit from this remote location.

CHECK ALARM toggle switch A1S3 (figure 6, item 3). This switch is used to test the OCM electronics (ON, UP position), or to operate the Ultrasonic Vibrator Assembly (UVA) continuously (DOWN position).

Processor Printed Circuit Board (PCB) (figure 6, item 4). This circuit board provides the primary control signals for the OCM system, including all indicator panel displays. It controls the sampling sequence and solenoid valves. It also electronically measures, stores, and compares the signals provided by the turbidimeter (part of the SDA), and controls the range and alarm limit (ppm) of the OCM. In addition to the main indicator panel, it provides two Light Emitting Diodes (LEDs) on the back side of the Processor PCB that are used for troubleshooting. The CHECK ALARM toggle switch A1S3 (figure 6, item 3), described in the paragraph above, is also installed on the processor PCB.

Power Printed Circuit Board (PCB) (figure 6, item 5). This circuit board provides the electrical interface points with the other PCB's, the SDA, switch plate sub-assembly, remote indicator (alarm) assembly, and remote relay assembly. The circuit board also distributes the 115 Vac power to the other components, produces DC power for the other control circuit components, contains the system fuse (2 amp) providing circuit protection, contains the main alarm limit relay, and contains the Elapsed Time Indicator (ETI).

Generator Printed Circuit Board (PCB) (figure 6, item 6). This circuit board produces a 50 kHz signal, which drives the UVA (part of the SDA).

Noiseless Transformer (figure 6, item 7). This transformer is used to isolate and condition incoming 115 Vac power to reduce Electromagnetic Interference (EMI) noise and susceptibility.

Noise Filter (figure 6, item 8). This filter is used to reduce electrical noise coming into and going out of the OCM through the input power cable so that it does not electrically affect sensitive equipment, and is not affected by other electrical equipment.

REMOTE INDICATOR (ALARM) ASSEMBLY

The cable from the sampling/sensor assembly (A1P2) connects to receptacle A2P1 (figure 7, item 1) on the bottom of the enclosure and provides all power (120 Vac, single-phase, 60 Hz), alarm, and display signals for its operation. The remote indicator (alarm) assembly also provides the following controls and indicators:

PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch A2S1 (figure 7, item 2). This switch alternately selects the OCM alarm limit (15 or 70 PPM) when pressed. This switch functions only when the system is operated in the automatic mode (alarm limit selector switch A1S2 is in the REMOTE position). Each time the switch is pressed, the alarm limit toggles between 15 and 70 ppm.

PUSH TO SILENCE pushbutton switch A2S2 (figure 7, item 3). This pushbutton switch alternately engages and disengages the alarm buzzer when pressed.

The circuitry of the remote indicator (alarm) assembly includes an alarm PCB (figure 8, item 1), an audible buzzer (figure 8, item 2), and an indicator faceplate (figure 7, item 4). The alarm PCB contains the electrical circuits, switches A2S1 and A2S2, LED status displays, and numerical LED effluent oil content display. The audible alarm buzzer is mounted to the back of the enclosure. It is activated when the selected alarm limit is exceeded. The buzzer can be disengaged by the PUSH TO SILENCE pushbutton switch A2S2. The indicator faceplate provides legends for the visual OCM status indicators and switches A2S1 and A2S2.

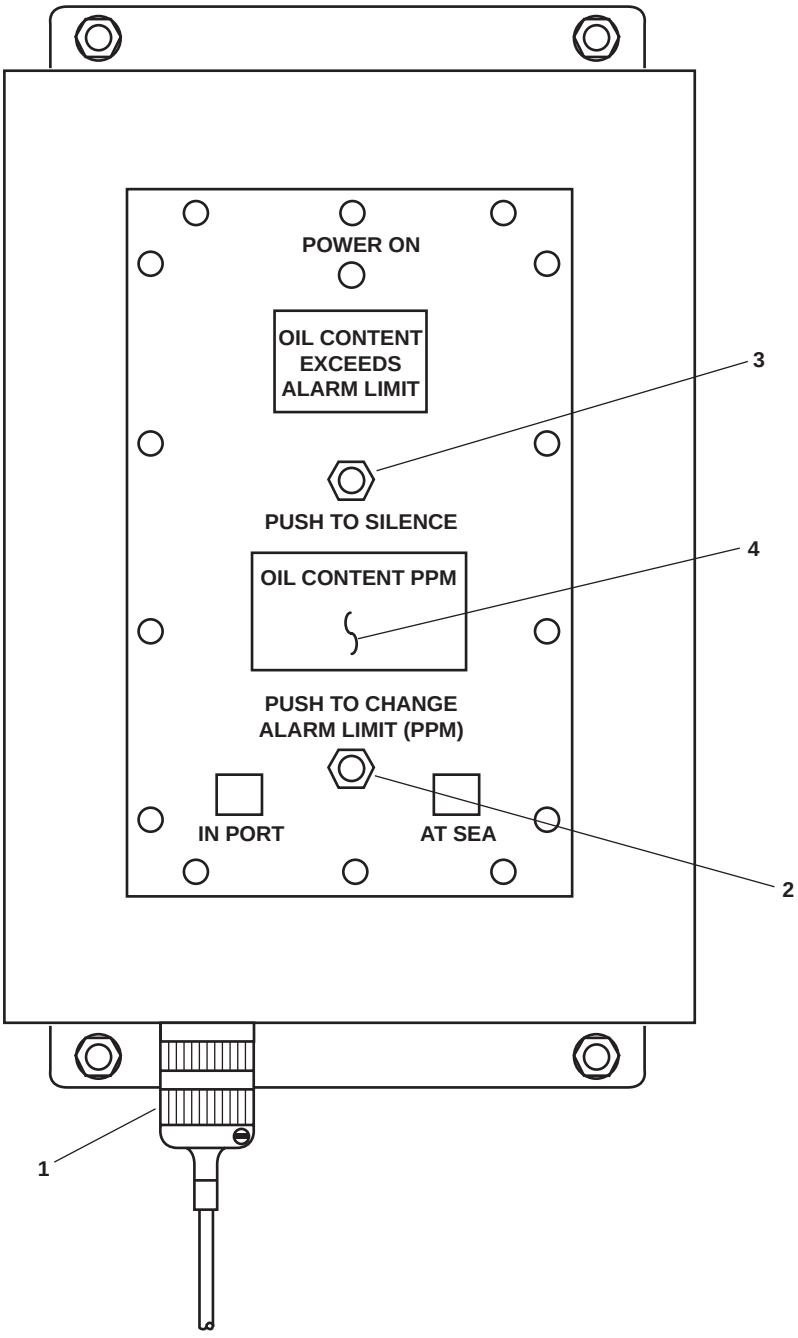


Figure 7. Remote Indicator (Alarm) Assembly, External

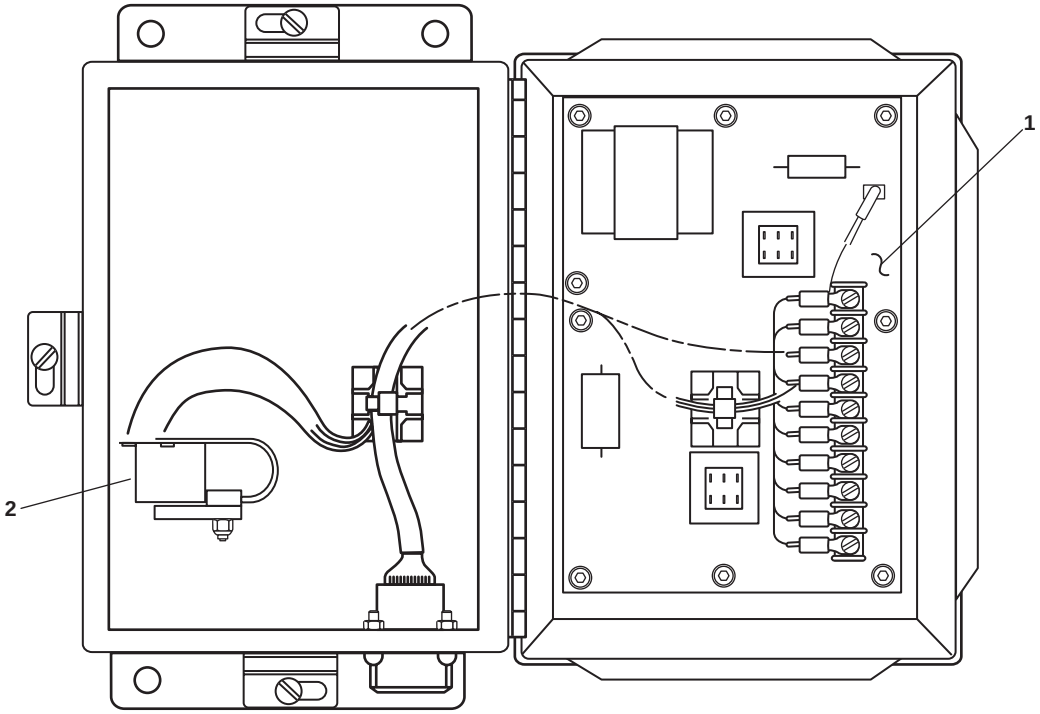


Figure 8. Remote Indicator (Alarm) Assembly, Internal

REMOTE RELAY ASSEMBLY

This assembly is the electrical control interface between the sampling/sensor assembly and the diverter solenoid valve. The cable from the sampling/sensor assembly (A1P3) connects to receptacle A3P1 (figure 9, item 1) on the bottom of the enclosure and provides alarm signals (120 Vac, single-phase, 60 Hz) for its operation. The remote relay assembly contains the following components:

Timer (figure 9, item 2). The timer is a solid state component that provides a time delay (60-second) before the alarm signal from the sampling/sensor assembly activates the two solid state relays. This time delay allows the sampling/sensor assembly to verify that four consecutive samples have oil content below the selected alarm limit before the diverter solenoid valve actuates, thereby preventing illegal overboard discharge and unnecessary valve wear caused by frequent or sporadic alarm signals. Although this timer is adjustable, it should always be set for a 60-second delay.

Solid State Relays (figure 9, items 3 and 4). Two solid state relays are contained in the remote relay assembly. One relay is used to close the 120 Vac diverter solenoid valve circuit. After receiving an alarm signal from the timer, this Normally Open (NO) relay closes after the 60-second delay described above. The other relay is a spare, available for auxiliary use.

Terminal Strip (figure 9, item 5). This strip provides the electrical connection points between the relays and the diverter solenoid valve circuit.

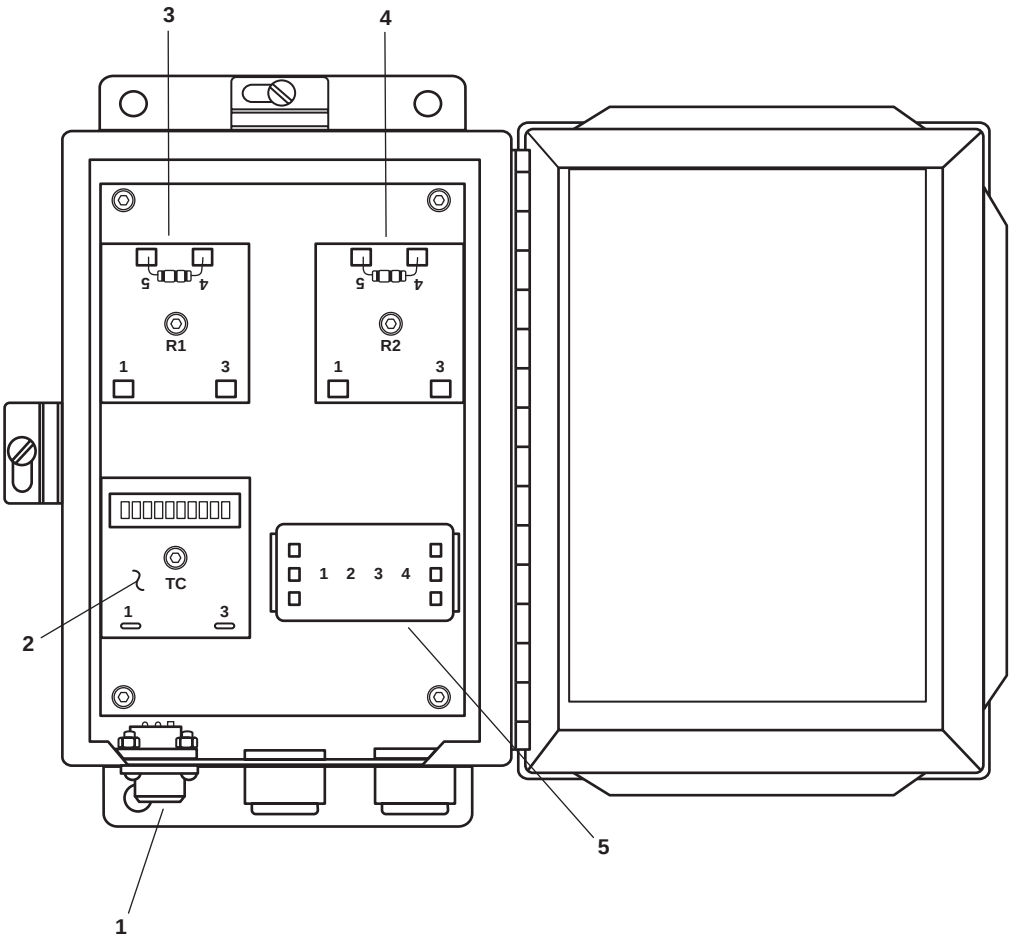


Figure 9. Remote Relay Assembly

OCM PRINCIPLE OF OPERATION

Sampling and measurement of the effluent begins when the pressure switch (figure 5, item 1) is activated (5 PSI (0.3 bar) minimum). The OCM measurement sequence is carried out in cycles. The turbidimeter (figure 5, item 5) measures the turbidity (cloudiness) of the sample before and after it is emulsified by the UVA (figure 5, item 4). Turbidity increases when the oil particles in the water are emulsified. The measured increase in turbidity is proportional to the oil content of the sample. The presence of air bubbles in the sample can affect the turbidity measurement. Their effect is minimized by using low level ultrasonic vibration energy and a short time delay to allow de-bubbling before each turbidity measurement is made.

Two solenoid valves, SV1 (figure 5, item 3) and SV2 (figure 5, item 2), on the SDA, are used to direct the effluent sample into the turbidimeter (figure 5, item 5) for measurement every 15 seconds. A signal opens the upper solenoid valve SV1 and closes the lower solenoid valve SV2, allowing new sample water to displace and flush out the previous one. SV1 then closes, isolating the new sample inside the glass cell (figure 5, item 6) of the turbidimeter. SV2 simultaneously opens, directing the sample stream to a bypass drain. These two valves operate in closed/open positions opposite each other, permitting alternate cycling of sampling and sample bypass. The UVA (figure 5, item 4) of this OCM very effectively cleans the glass cell during each sample cycle.

When the OCM detects oil concentrations that exceed the alarm limit (15 or 70 ppm), alarm signals are sent to the remote indicator (alarm) assembly and the remote relay assembly, which activate their alarm and control functions.

END OF WORK PACKAGE

Chapter 2

Operator Instructions
for
Oil Water Separator

Inland and Coastal Large Tug (LT)

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

OIL WATER SEPARATOR (OWS) AND OIL CONTENT MONITOR (OCM), ENGINE ROOM

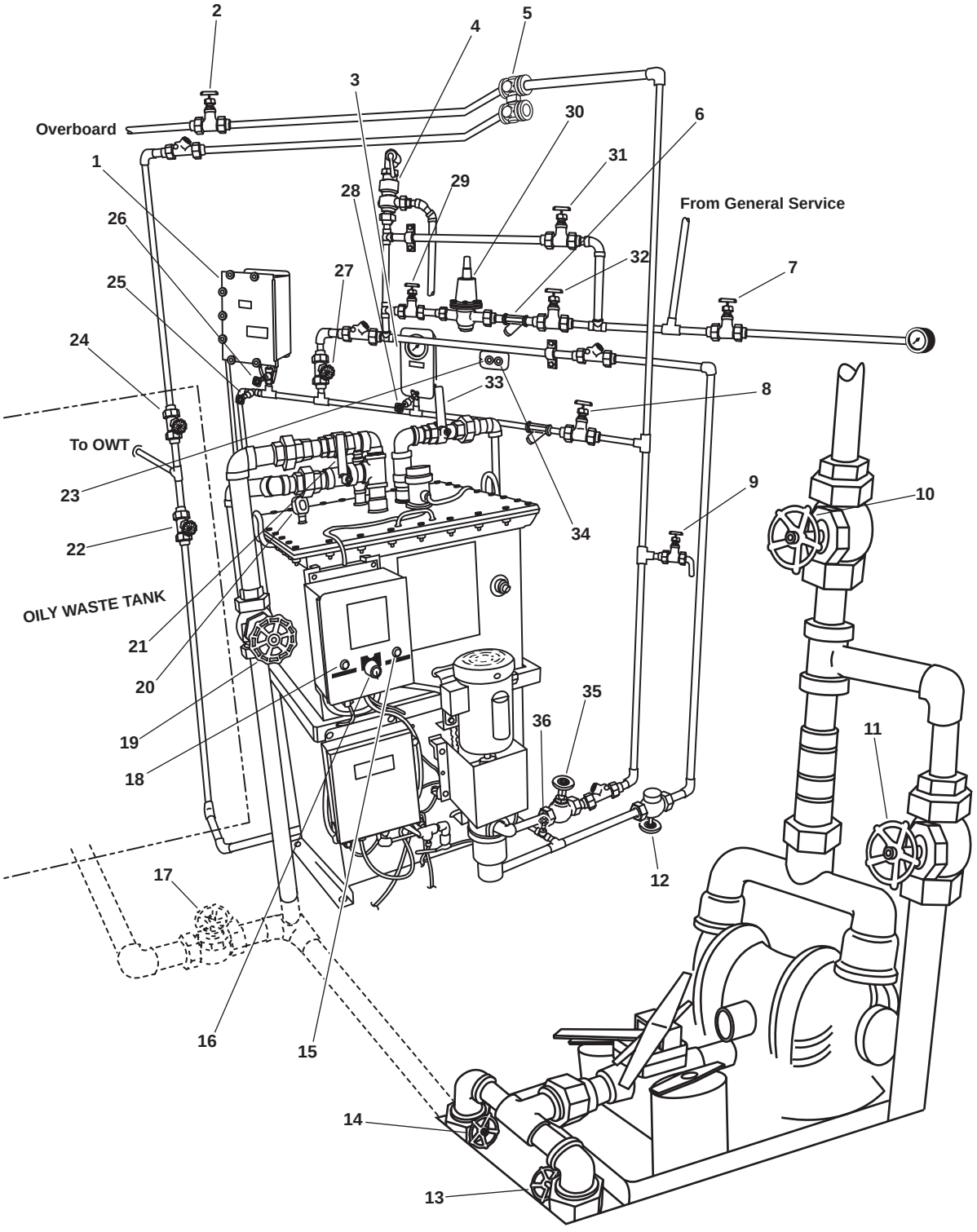


Figure 1. Oil Water Separator (OWS) and Oil Content Monitor (OCM), Engine Room

Table 1. Oil Water Separator (OWS) and Oil Content Monitor (OCM), Engine Room (refer to figure 1)

Key	Control/Indicator	Function
1	OCM Sampling/Sensor Assembly	This assembly contains the controls for operating the OCM and the readouts that monitor the system operation. See figure 2 for details.
2	OB-10 OWS OVBD DISCHARGE Valve	This valve controls the flow of OWS discharge overboard.
3	OCM-G1 OCM INLET PRESSURE Gauge	This gauge indicates the inlet pressure into the OCM.
4	OCM Pressure Relief	This relief valve is set at 20 lb in ^{2} (1.37 bar).
5	OWS-4 OCM 3-WAY DIVERTER (Diverter Solenoid Valve)	This diverter solenoid valve directs OWS discharge flow overboard or back to the Oily Waste Tank (OWT) depending upon the oil content in the discharge flow.
6	Strainer	This strainer removes large particles from the general service water.
7	OWS-24 SW TO OWS PRESS GAGE ISOLATION Valve	This valve allows general service water pressure to the OILY WTR SEP Gauge Isolation Valve PRESS gauge.
8	OCM-1 OCM NOZZLE SAMPLER COV Valve	This valve allows effluent from the OWS pump discharge to the OCM SAMPLER COV Valve.
9	OWS-6 OWS PITOT SAMPLE Valve	This valve permits the sampling of the OWS discharge effluent.
10	OB-9 XFR PUMP DISCH TO SHORE Valve	This valve secures oil discharge from the oily bilge pump to the shore.
11	OB-8 XFR PUMP TO OILY WATER TANK Valve	This valve secures oil discharge from the bilge pump to the waste oil storage tank.
12	GS-74 OWS BACKFLUSH INLET SOLENOID Valve	This valve permits back flushing of the OWS.
13	OB-14 COV-XFR PUMP SUCTION Valve	This valve secures the oily water discharge from the bilge.
14	OB-13 OWT TO XFR PUMP SUCTION Valve	This valve controls the flow of oily water from the OWS discharge pump.
15	OIL DISCHARGE Indicator	This lamp illuminates to indicate that oil is being discharged to the OWT.
16	OWS Control Switch	This switch controls operation of the OWS. The switch has three positions: AUTO, OFF, and MAN. The AUTO position is not functional on the Large Tug. In the OFF position, the OWS is off. In the MAN position, the OWS operates continuously.
17	OB-16 OILY WATER FROM OWT COV Valve	This valve secures oily waste suction from the oily waste storage tank.
18	POWER AVAILABLE Indicator	This lamp illuminates to indicate that power is available to the OWS.

Table 1. Oil Water Separator (OWS) and Oil Content Monitor (OCM), Engine Room (refer to figure 1) (continued)

Key	Control/Indicator	Function
19	OB-15 OWS INLET Valve	This valve controls flow of oily water from the oily waste tank into the OWS.
20	OWS-G2 OWS VESSEL PRESS Gauge	This gauge indicates the amount of vacuum or pressure present inside the OWS tank.
21	OWS-1 OWS MANUAL BACKFLUSH	This valve allows the user to verify that the OWS tank is full of water.
22	OB-17 OILY WATER TANK INLET Valve	This valve controls the discharge flow into the oily waste holding tank from the OWS during the OWS automatic oil discharge mode.
23	OCM DIVERTER VALVE POSITION INDICATOR-DISCHARGE TO OVERBOARD	This lamp illuminates (green) to indicate that the OCM diverter solenoid valve is set to discharge overboard.
24	OWS-10 OWS RECIRCULATING COV Valve	This valve permits recirculation of oily waste through the oily waste holding tank and back to the OWS for additional purification.
25	OCM-3 OCM SAMPLING VALVE	This valve permits sampling of the OCM input flow.
26	OCM-4 OCM INLET Valve	This valve secures the flow of fluids into the OCM.
27	OCM-2 OCM BACKFLUSH WATER Valve	This valve controls the flow of backflush water to the OCM.
28	OCM-8 OCM GAGE ISOLATION Valve	This valve secures the pressure to OCM-G1 OCM INLET PRESS gauge.
29	OWS-8 BACKFLUSH WTR FROM PRESS RDCR Valve	This valve controls the flow of backflush water from GS-73 GENERAL SERVICE PRESS RDCR.
30	GS 73 GENERAL SERVICE PRESS RDCR	This reduces the general service water pressure to 12 lb in^2 (.82 bar)
31	OWS-9 BACKFLUSH WTR PRESS RDCR BYPASS Valve	This valve permits general service raw water to bypass GS-73 GENERAL SERVICE PRESS RDCR.
32	OWS-7 BACKFLUSH WTR TO PRESS RDCR Valve	This valve controls the flow of raw water to GS-73 GENERAL SERVICE PRESS RDCR.
33	OWS-2 OWS OIL DISCHARGE	This valve secures the oil discharge from the OWS to the OWT.
34	OCM DIVERTER VALVE POSITION INDICATOR-DISCHARGE TO OILY WASTE TANK	This lamp illuminates (red) to indicate that the OCM diverter solenoid valve is set to discharge to the oily waste tank.
35	OWS-3 OWS PUMP DISCHARGE	This valve controls the discharge from the OWS pump.
36	OWS-5 OWS DISCHARGE Valve	This valve controls the discharge flow from the OWS.

OCM SAMPLING/SENSOR ASSEMBLY

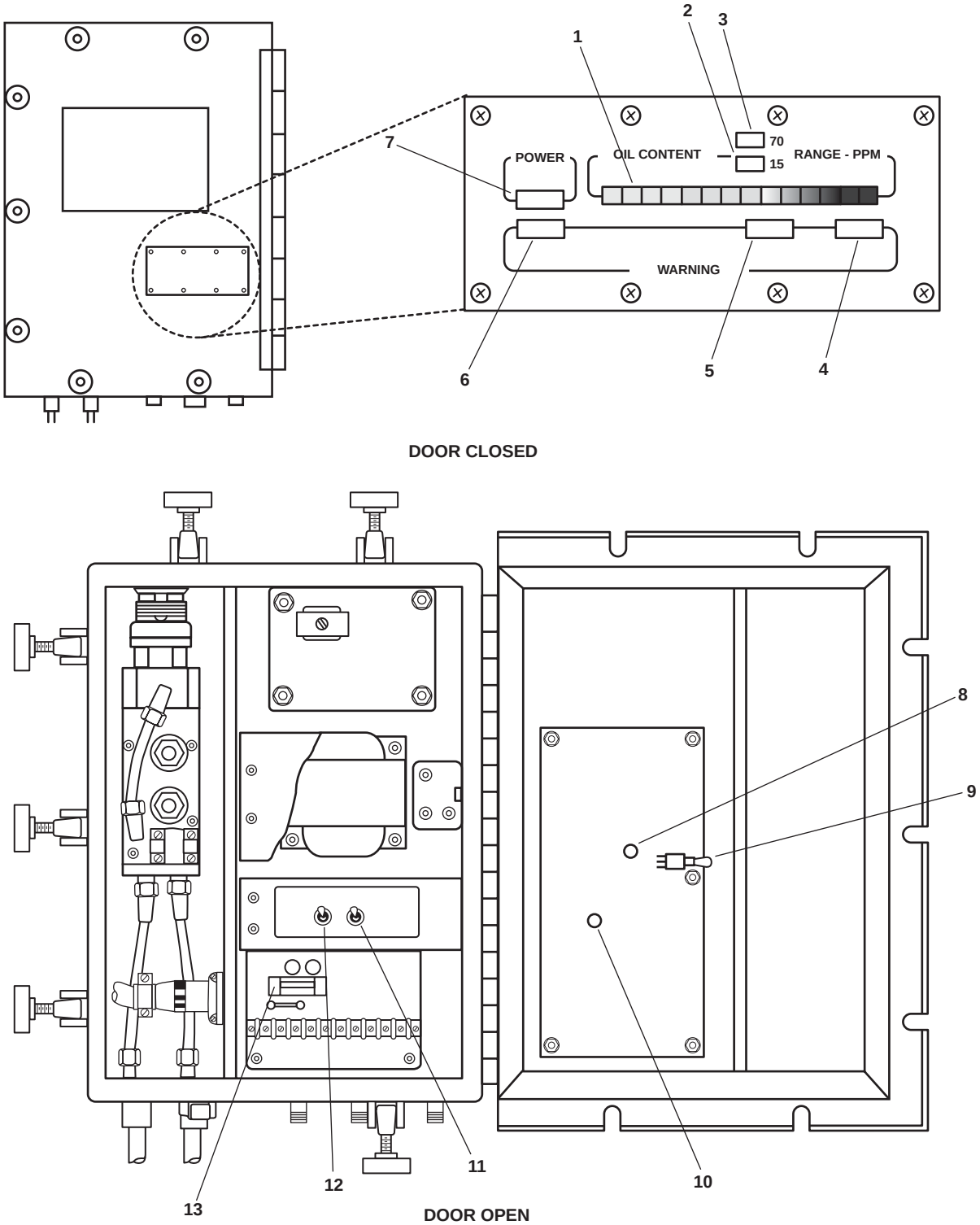


Figure 2. OCM Sampling/Sensor Assembly

Table 2. OCM Sampling/Sensor Assembly (refer to figure 2)

Key	Control/Indicator	Function
1	OIL CONTENT Display	This display indicates the effluent oil content in parts per million (ppm) relative to the selected alarm limit. Green display units are below the alarm limit, and red display units are above the alarm limit.
2	15 PPM Range Indicator	This illuminates to indicate that the 15 PPM alarm limit is selected.
3	70 PPM Range Indicator	This illuminates to indicate that the 70 PPM alarm limit is selected.
4	WARNING 3 Indicator	This illuminates to indicate dirt or foam in the sample, or no flow through the OCM.
5	WARNING 2 Indicator	This illuminates to indicate dirt or bubbles in the sample.
6	WARNING 1 Indicator	This illuminates to indicate that the OCM fuse (2 amp) is blown.
7	POWER Indicator	This illuminates to indicate that the OCM is operating.
8	A1DS8 Indicator Light Emitting Diode (LED)	This illuminates to indicate that the sample detection assembly is ON.
9	CHECK Alarm Switch A1S3	When this switch is in the DOWN position, the Ultrasonic Vibrator Assembly (UVA) operates continuously. To perform OCM electronics tests, the switch is placed in the DOWN position.
10	A1DS9 Indicator (LED)	This indicator flashes when the OCM is in alarm mode (effluent oil content exceeds alarm limit).
11	ALARM LIMIT Selector Switch A1S2	This switch permits the operator to select the 70 or 15 PPM alarm limits, or to enable the remote alarm limit selector switch. In the 70 PPM position, the OCM will activate alarms and energize the diverter valve when the oil content exceeds 70 ppm (+/- 30 ppm). In the 15 PPM position, the OCM will activate alarms and energize the diverter valve when the oil content exceeds 15 ppm (+/- 5 ppm). In the REMOTE position, the PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch on the remote indicator assembly is engaged, allowing the operator to select the alarm limit from this remote location.
12	OPERATION SELECTOR Switch A1S1	This switch permits the operator to select the mode of operation. With the switch in the OFF position, none of the system indicators or displays will energize, and the diverter solenoid valve will remain in the recirculate (de-energized) position. With the switch in the AUTO position, the OCM will be energized whenever there is 5 to 25 PSI (0.3 to 1.7 bar) at the sample inlet. With the switch in the TEST position, the OCM is energized regardless of the sample pressure or flow. The TEST position is only to be used for troubleshooting and system verification, as operation of the OCM without adequate pressure or flow can damage the unit.
13	Elapsed Time Indicator (ETI)	The ETI keeps track of the hours that the OCM has been in use. Maintenance is performed on the OCM at 500-hour intervals.

REMOTE INDICATOR (ALARM) ASSEMBLY

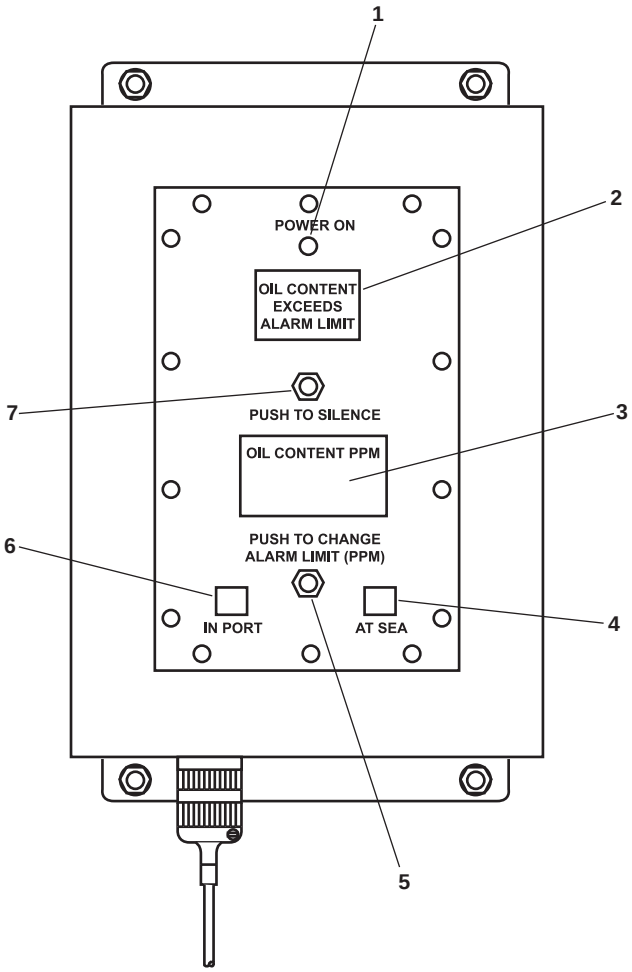


Figure 3. Remote Indicator (Alarm) Assembly

Table 3. Remote Indicator (Alarm) Assembly (refer to figure 3)

Key	Control/Indicator	Function
1	POWER ON Indicator	This illuminates to indicate that the OCM is operating.
2	OIL CONTENT EXCEEDS ALARM LIMIT Indicator	This illuminates to indicate that the effluent oil content exceeds the selected alarm limit.
3	OIL CONTENT PPM Display	This displays the effluent oil content in ppm.
4	70 PPM AT SEA Indicator	This illuminates to indicate that the 70 PPM (at sea) alarm limit is selected.
5	PUSH TO CHANGE ALARM LIMIT PPM Switch	This switch toggles between the 15 and 70 PPM alarm limit settings when the alarm limit selector switch in the sampling/sensor assembly is set to REMOTE.
6	15 PPM IN PORT Indicator	This illuminates to indicate that the 15 PPM (in port) alarm limit is selected.
7	PUSH TO SILENCE Switch	Push this pushbutton switch to toggle the alarm silence function ON and OFF.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
TM 55-1925-273-10
WP 0006 00

Equipment Conditions:
Fire and general service pump providing general service water to the vessel (TM 55-1925-273-10)

SECURITY MEASURES FOR ELECTRONIC DATA

No electronic data are used or stored by any of the Oil Water Separator (OWS) or Oil Content Monitor (OCM) components.

OPERATING PROCEDURES

OWS Startup and Normal Operation

1. Set to OFF the OWS switch (figure 1, item 1) on the OWS control panel (figure 1, item 2).

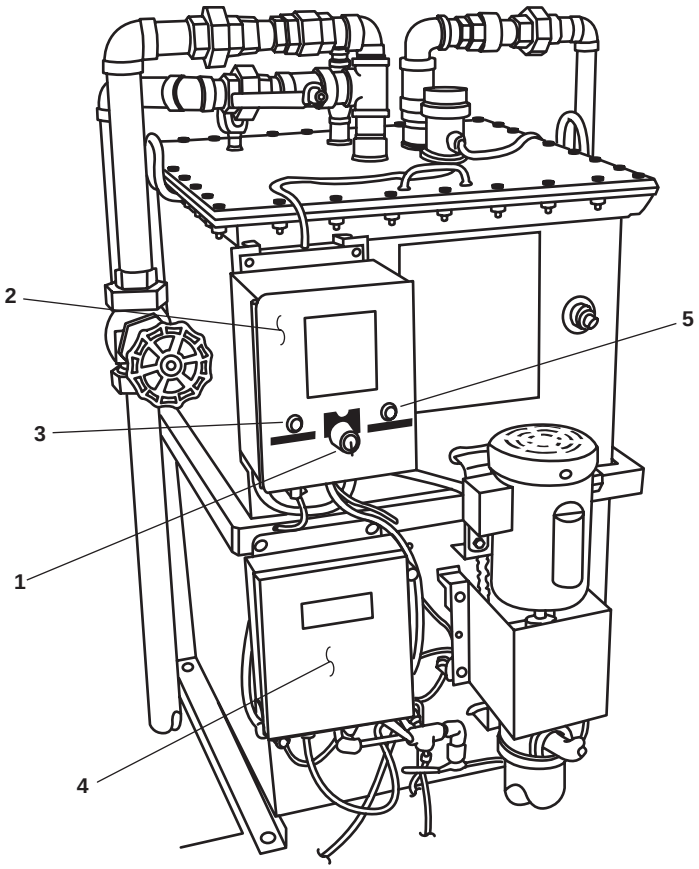


Figure 1. OWS Control Panel

2. Set to ON the OILY WATER SEPARATOR circuit breaker (figure 2, item 1) in the 120V distribution panel No. 4. The green POWER AVAILABLE indicator (figure 1, item 3) will illuminate to indicate that the OWS control panel has power available.

3. Align the OWS, the Oily Bilge (OB), and OCM valves as indicated in table 1 and figure 3.

4. If the OWS and the system inlet piping are not completely filled with water, purge all air from the system by performing a manual backflush, as described in WP 0006 00.

⚠ CAUTION

The OCM will operate regardless of fluid flow through the monitor when the OCM OPERATION SELECTOR Switch A1S1 is in the TEST position. Operating the OCM without flow through it for more than 2 minutes will result in damage to the OCM. Failure to comply with this caution will result in damage to the equipment.

5. Set the OCM OPERATION SELECTOR Switch A1S1 (figure 4, item 1) to the OFF position.

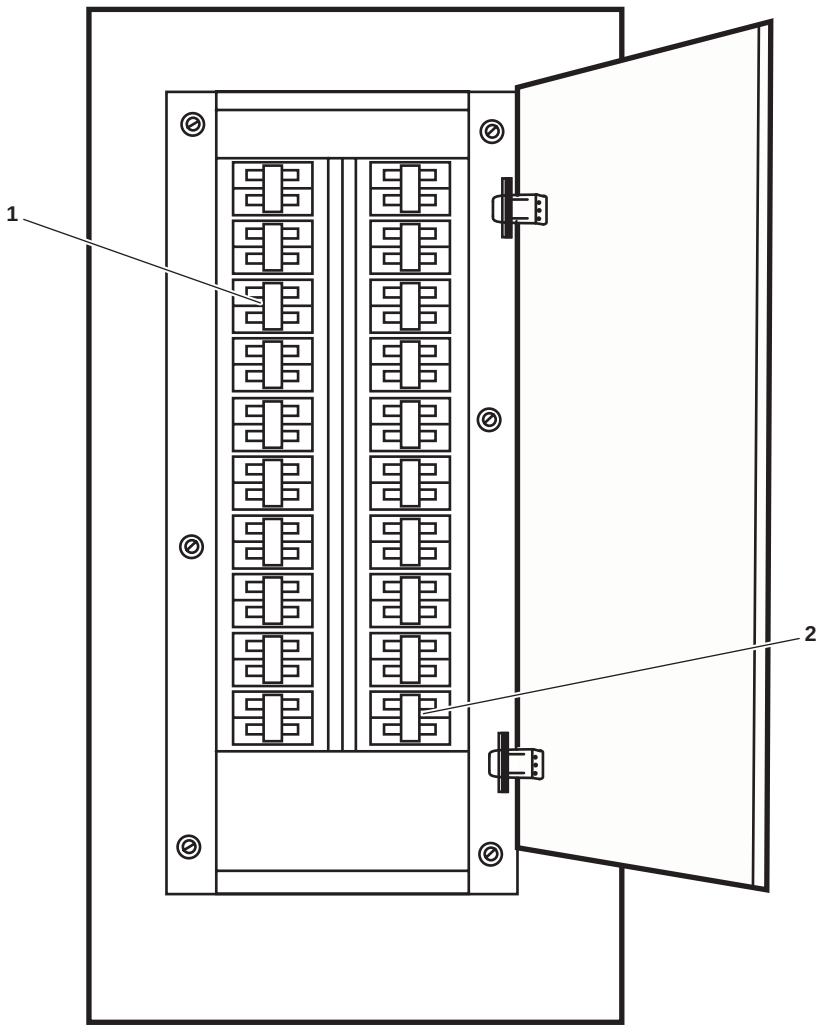


Figure 2. 120V Distribution Panel No. 4

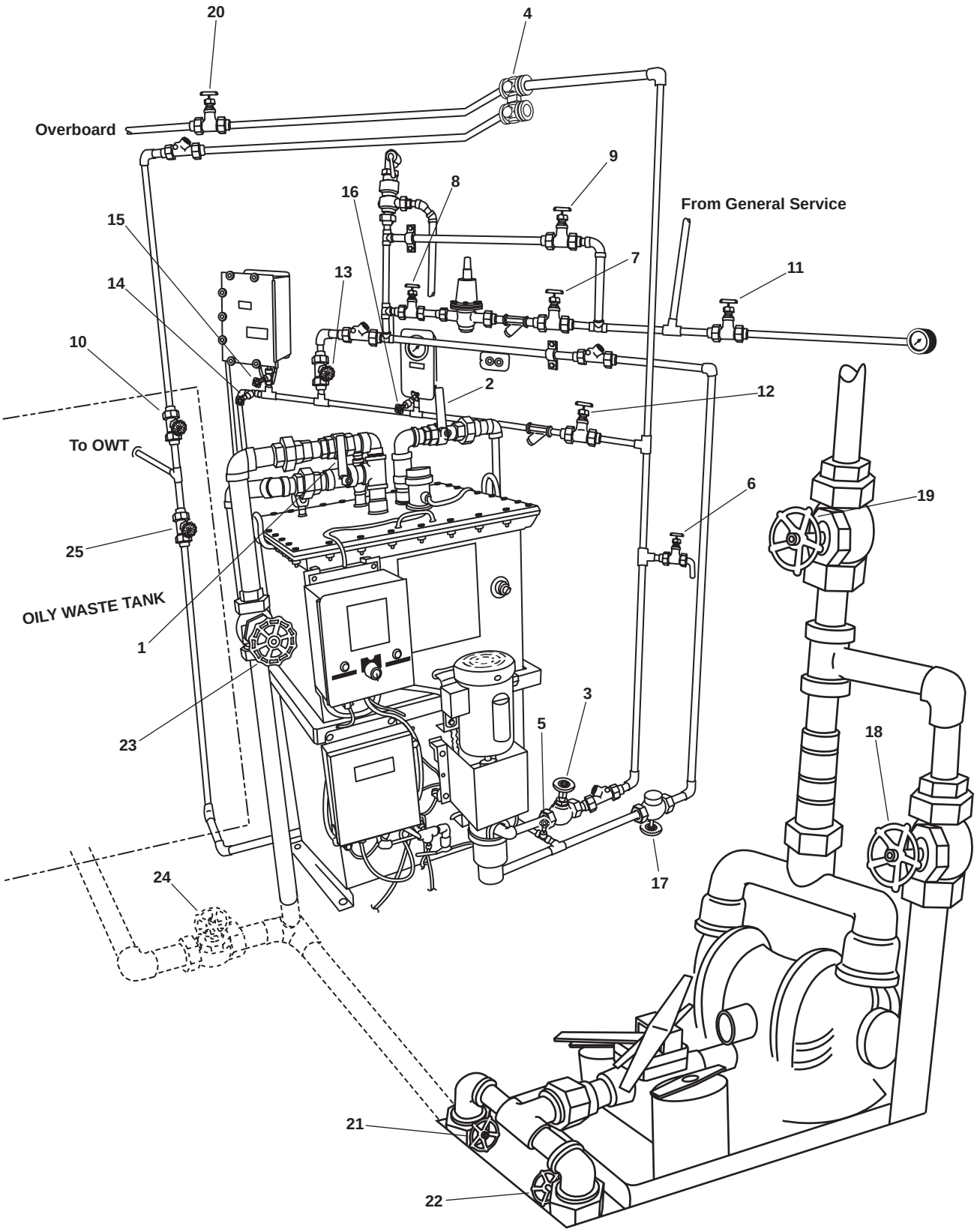


Figure 3. OWS, OB, and OCM Piping

Table 1. Valve Positions During Operation Under Usual Conditions

Item Number (Figure 3)	Valve Number	Function	Position During Operation Under Usual Conditions
1	OWS-1	OWS MANUAL BACKFLUSH	CLOSED
2	OWS-2	OWS DISCHARGE	OPEN
3	OWS-3	OWS PUMP DISCHARGE	OPEN
4	OWS-4	OCM 3-WAY DIVERTER	Controlled by OCM
5	OWS-5	OWS DISCHARGE	OPEN
6	OWS-6	OWS PITOT SAMPLE	CLOSED
7	OWS-7	BACKFLUSH WTR TO PRESS RDCR	OPEN
8	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	OPEN
9	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
10	OWS-10	OWS RECIRCULATING COV	OPEN
11	OWS-24	SW TO OWS PRESS GAGE ISOLATION	OPEN
12	OCM-1	OCM NOZZLE SAMPLER COV	OPEN
13	OCM-2	OCM BACKFLUSH WATER	CLOSED
14	OCM-3	OCM SAMPLING VALVE	CLOSED
15	OCM-4	OCM INLET	OPEN
16	OCM-8	OCM GAGE ISOLATION	OPEN
17	GS-74	OWS BACKFLUSH INLET SOLENOID	Automatic (Ensure that the manual override handle is in the CLOSED position (CCW) with the valve stem all the way out)
18	OB-8	XFR PUMP TO OILY WATER TANK	CLOSED
19	OB-9	XFR PUMP DISCH TO SHORE	CLOSED
20	OB-10	OWS OVERBOARD DISCHARGE	OPEN
21	OB-13	OWT TO XFR PUMP SUCTION	CLOSED
22	OB-14	COV-XFR PUMP SUCTION	CLOSED
23	OB-15	OWS INLET	OPEN
24	OB-16	WATER FROM OWT COV	OPEN
25	OB-17	OILY WATER TANK INLET	OPEN

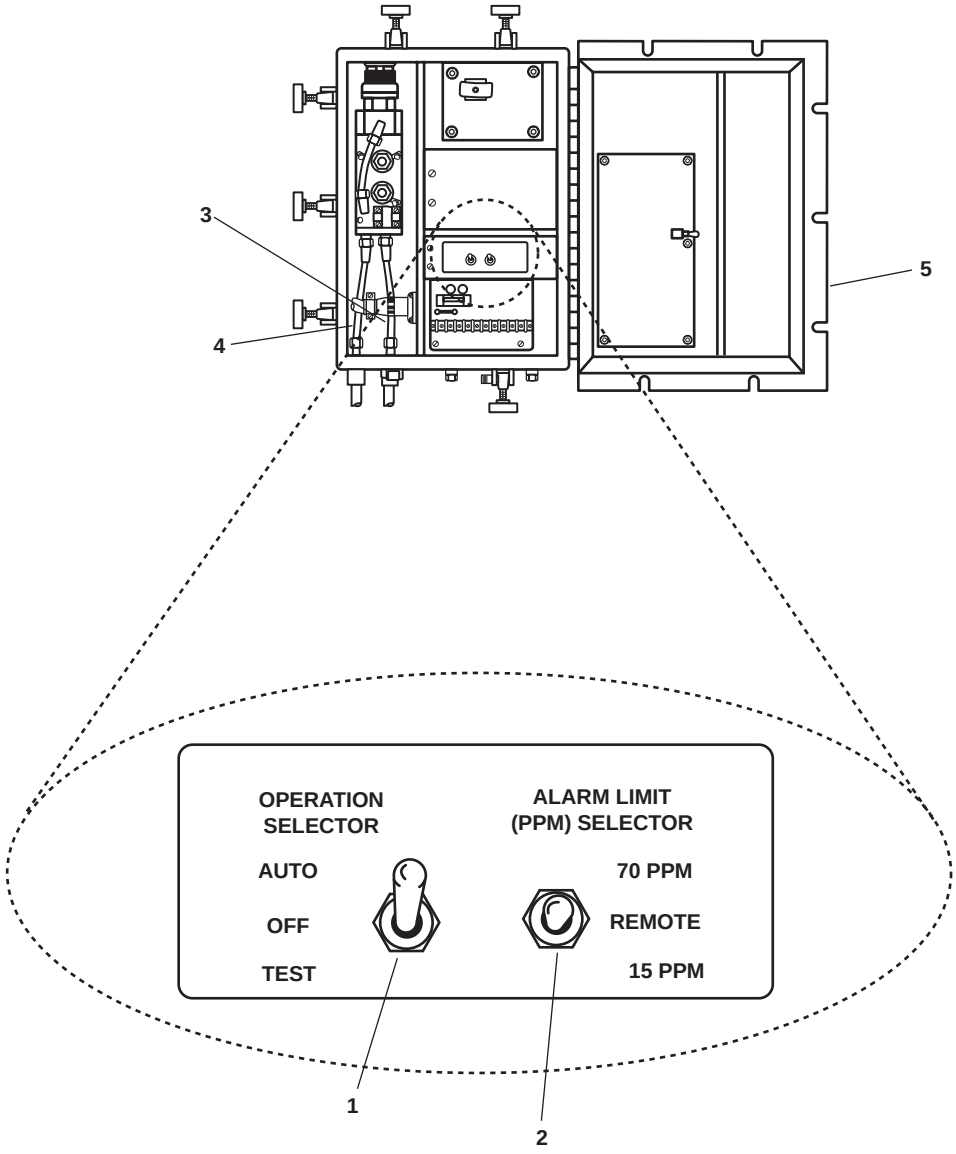


Figure 4. Sampling/Sensor Assembly Interior

6. Set the OIL CONTENT MONITOR circuit breaker (figure 2, item 2) in the 120V distribution panel No. 4 to ON. The red indicator (figure 5, item 1) on the OCM diverter valve position indicator (figure 5, item 2) will illuminate to signal that the OCM has power available.

NOTE

With the OPERATION SELECTOR Switch A1S1 in the AUTO position, the OCM will not operate until the pressure switch senses a pressure between 5 to 25 PSI (0.3 to 1.7 bar) at the OCM sample inlet. The OCM will automatically shut down if the pressure at the OCM sample inlet falls below 5 PSI (0.3 bar).

7. Position the OPERATION SELECTOR Switch A1S1 (figure 4, item 1) to AUTO.

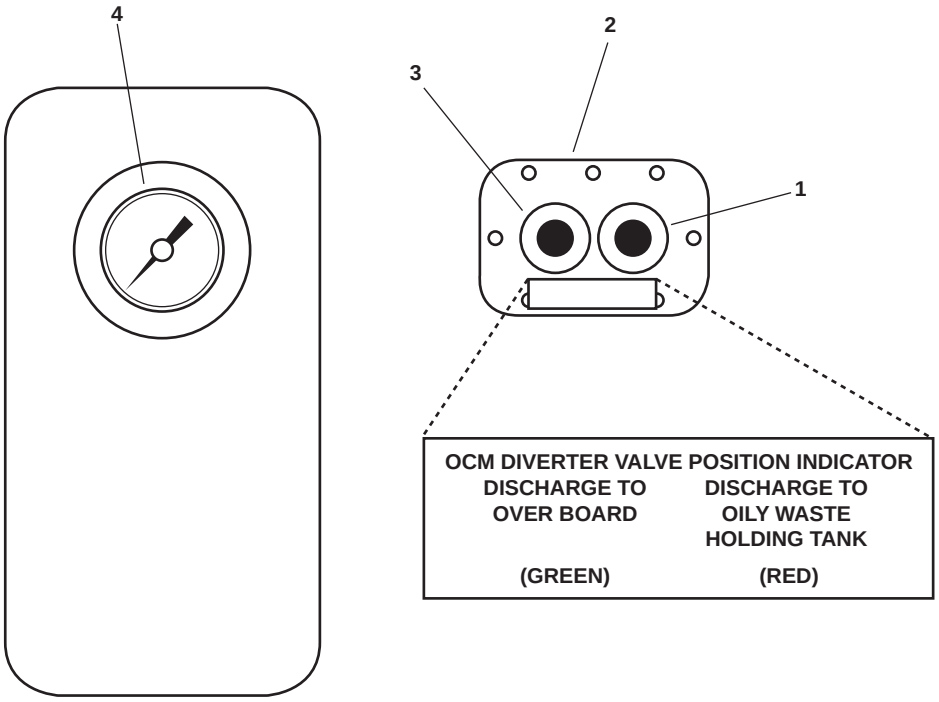


Figure 5. OCM Diverter Valve Position Indicator

NOTE

Placing the ALARM LIMIT (PPM) SELECTOR Switch A1S2 in the 15 PPM or 70 PPM position disables the Remote Indicator Assembly.

8. If the Remote Indicator Assembly (figure 6) is not used, set the ALARM LIMIT (PPM) SELECTOR Switch A1S2 (figure 4, item 2) to the 15 PPM position for OWS operation within 12 nautical miles of land or the 70 PPM position for OWS operation outside 12 nautical miles of land. To utilize the Remote Indicator Assembly, set the ALARM LIMIT (PPM) SELECTOR switch A1S2 to the REMOTE position.

⚠ CAUTION

The OCM must have flow through it while in operation. Operating the OCM without flow through it for more than 2 minutes will result in damage to the OCM. Failure to comply with this caution will result in damage to the equipment.

9. Set the OWS control panel switch (figure 1, item 1) to MAN. The OWS pump will start, drawing oily water through the unit. The pump will continue to run as long as the switch is in the MAN position.

10. Verify that the OCM has fluid flowing through the OCM sample inlet tubing (figure 4, item 3) and is discharging fluid through the OCM sample discharge tubing (figure 4, item 4). If the OCM does not have fluid flow within 2 minutes, turn the OWS control panel switch (figure 1, item 2) to OFF and notify the maintenance supervisor. If the OCM does have fluid flow within 2 minutes continue with the procedure.

11. Close and secure the sampling/sensor assembly door (figure 4, item 5).

12. If the Remote Indicator was selected, The PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch A2S1 (figure 6, item 1) on the remote indicator (alarm) assembly (figure 6, item 2) must be set to the proper PPM. Select the IN PORT (15 PPM) or AT SEA (70 PPM) alarm limit by pushing the PUSH TO CHANGE ALARM LIMIT (PPM) pushbutton switch A2S1 until the IN PORT indicator (figure 6, item 3) or the AT SEA indicator (figure 6, item 4) illuminates.

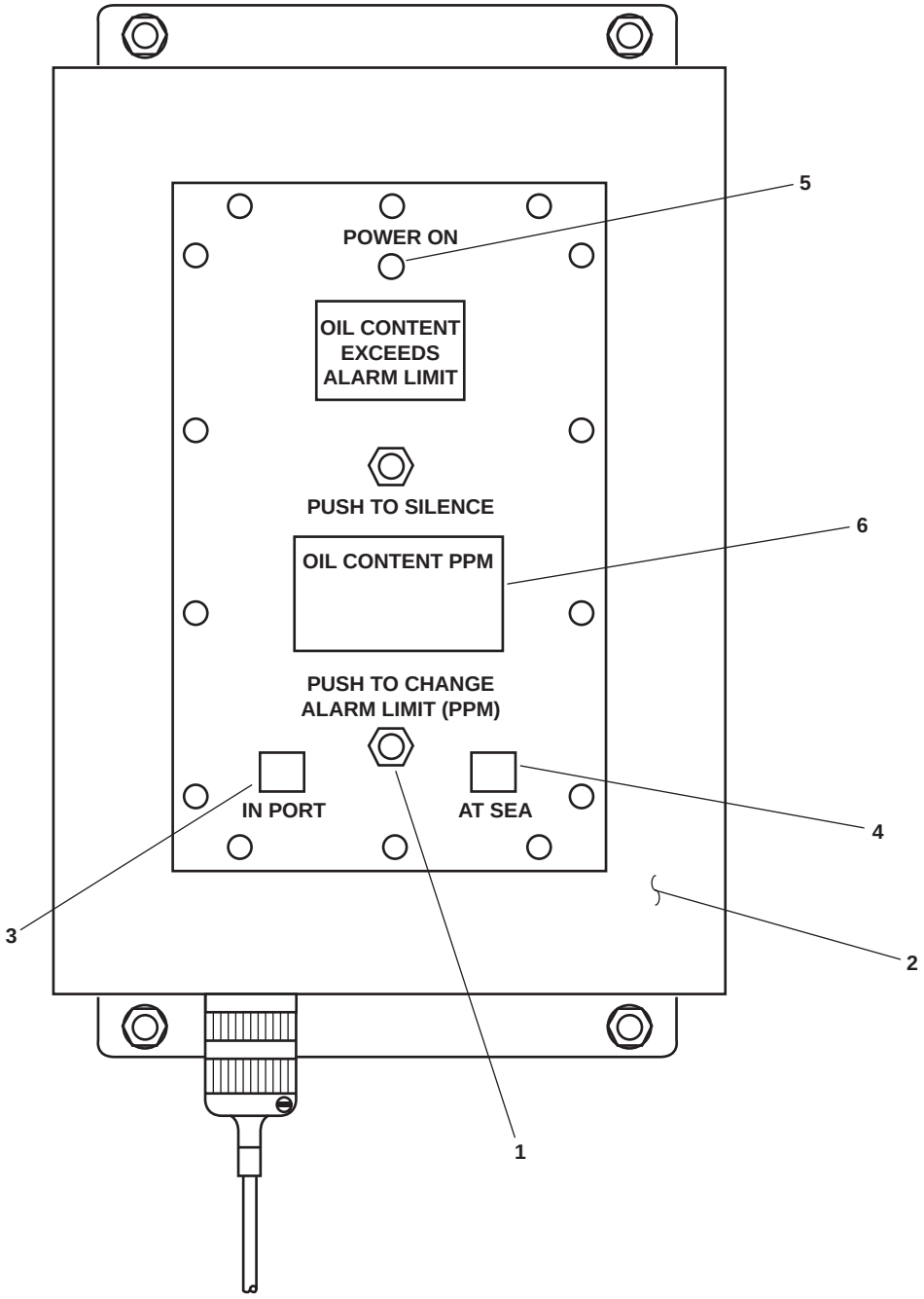


Figure 6. Remote Indicator (Alarm) Assembly

13. Verify that the OCM is operating properly by checking the following OCM system indicators:

    a. The POWER indicator A1DS1 (figure 7, item 1) on the OCM display (figure 7, item 2) is illuminated.

    b. The RANGE-PPM indicator (figure 7, item 3) on the OCM display (figure 7, item 2) indicates the PPM Selected.

    c. The sampling/sensor assembly Light Emitting Diodes (LEDs) (figure 7, item 4) on the OCM display (figure 7, item 2) are illuminated.

    d. OCM WARNING 1 (figure 7, item 5) on the OCM display (figure 7, item 2) is not illuminated.

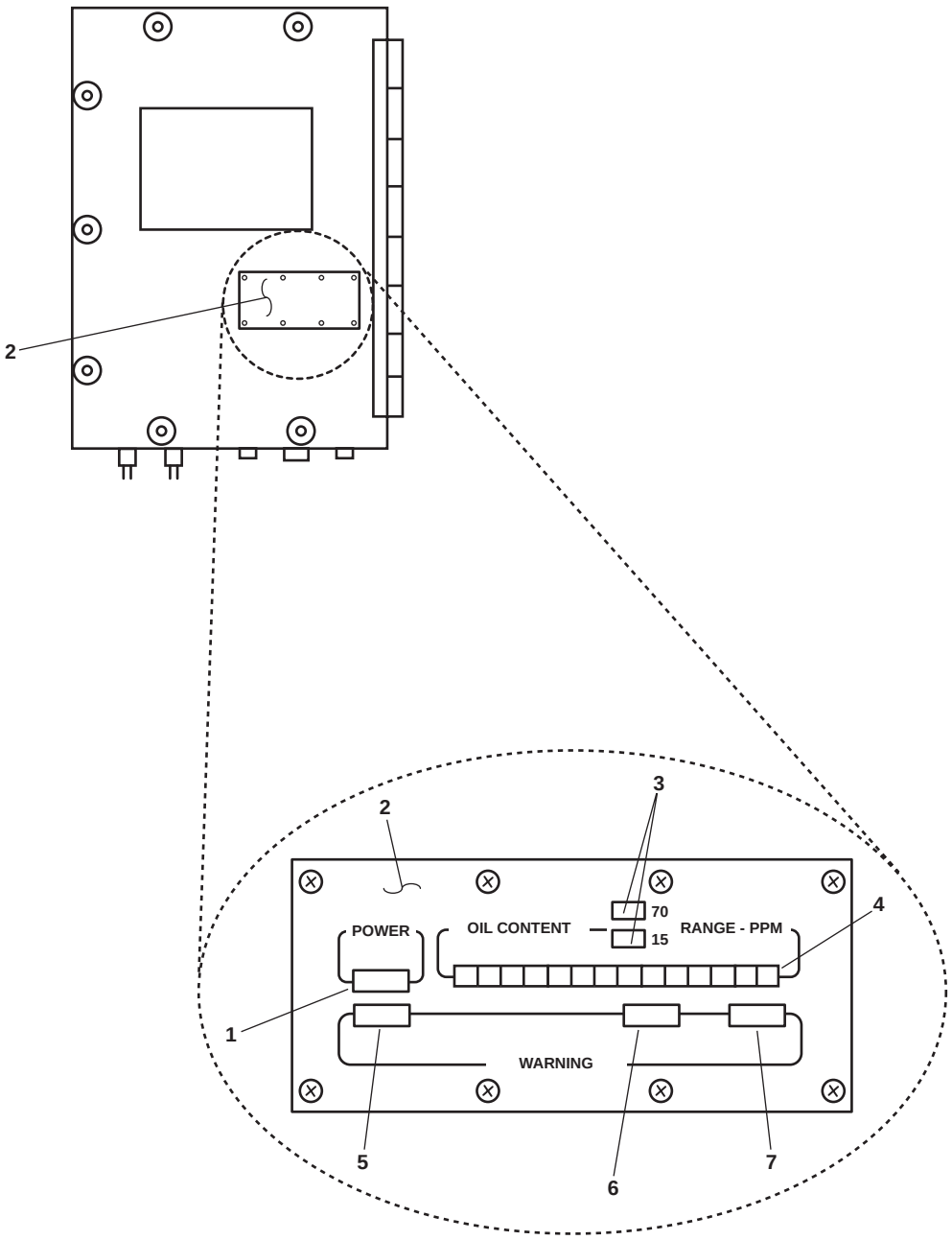


Figure 7. Sampling/Sensor Assembly Indicators

⚠ CAUTION

OCM WARNING 2 and 3 may cycle on and off depending on the amount of dirt, bubbles, foam, or air in the sample. If OCM WARNING 2 or 3 illuminate for more than 60 seconds continuously, check the OCM to ensure flow is present. Operating the OCM without flow through it for more than 2 minutes will result in damage to the OCM. Failure to comply with this caution will result in damage to the equipment.

e. OCM WARNING 2 (figure 7, item 6) on the OCM display (figure 7, item 2) is not illuminated.

f. OCM WARNING 3 (figure 7, item 7) on the OCM display (figure 7, item 2) is not illuminated.

g. The POWER ON indicator A2DS1 (figure 6, item 5) is illuminated on the Remote Indicator Assembly (figure 6, item 2) if the ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 4, item 2) is in the REMOTE position.

h. The appropriate alarm limit indicator (figure 6, items 3 and 4) is illuminated on the Remote Indicator Assembly (figure 6, item 2) to correspond with the alarm limit selected if the ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 4, item 2) is in the REMOTE position.

NOTE

There may be up to a one-minute delay between the time when the OCM turns on and when a numeric PPM value is displayed.

i. The OIL CONTENT PPM (figure 6, item 6) is displayed on the Remote Indicator Assembly (figure 6, item 2) if the ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 4, item 2) is in the REMOTE position.

j. The Diverter Valve Position Indicator (figure 5, item 2) illuminates green (figure 5, item 3) for overboard discharge and illuminates red (figure 5, item 1) for discharge to the Oily Waste Holding Tank.

NOTE

When the OCM is turned OFF, or is inactive because sample pressure is outside the operating pressure range, the effluent diverter solenoid valve will be in its default position, recirculating effluent to the Oily Waste Tank (OWT). When the OCM is activated by its pressure switch, it must detect four consecutive “good” samples (at 15-second intervals) before the remote relay assembly will send a signal to the diverter solenoid valve, diverting effluent flow overboard. If the effluent oil concentration rises above the set alarm level for one sample, the Remote Relay Assembly will remove the signal, causing the diverter solenoid valve to return to its default (recirculating) position. Loss of control signal or power to the diverter solenoid valve also causes it to return to its default position.

k. The OCM Sample Inlet Pressure Gauge (figure 5, item 4) indicates a pressure between 5 and 25 PSI (0.3 to 1.7 bar).

l. Monitor the effluent diverter solenoid valve (figure 3, item 4) to ensure that it is being automatically controlled by a signal from the OCM remote relay assembly (figure 1, item 4).

NOTE

Oil Discharge from the OWS to the OWT is automatic during manual operation. When enough oil has collected in the top of the OWS tank to cover the tip of the lower sensor probe, the OWS will enter the oil discharge mode. The yellow OIL DISCHARGE indicator on the OWS control panel will light and the OWS pump will stop. The OWS backflush inlet solenoid valve will open, admitting raw water at about 12 PSI (0.8 bar) to force the oil out of the OWS tank and into the OWT. When enough oil has been discharged that the upper sensor probe is again covered with water, the OWS will automatically return to processing mode. The yellow OIL DISCHARGE light will turn off, the OWS backflush inlet solenoid valve will close, and the OWS pump will start.

14. Monitor the operation of the OWS. A temporary automatic shutdown of the OWS is normal. Do not drain the OWT below 10 percent during normal OWS operation. Fouling of the OWS will occur.

OWS SHUTDOWN

1. Turn the OWS control panel switch (figure 1, item 1) to the OFF position.

2. Position OPERATION SELECTOR switch A1S1 (figure 4, item 1) to OFF.

3. Perform OCM backflush by OPENING OCM 2 (figure 3, item 13) and CLOSING OCM 1. Continue OCM backflush until all liquid from the OCM discharge tube (figure 4, item 4) is clear.

4. Perform OWS manual backflush (WP 0006 00).

5. Return all valves from table 1 to the CLOSED position.

6. At 120V distribution panel No. 4, set the following circuit breakers to OFF:

   a. OILY WATER SEPARATOR (figure 2, item 1).

   b. OIL CONTENT MONITOR (figure 2, item 2).

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER UNUSUAL CONDITIONS

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

References:
TM 55-1925-273-10
WP 0015 00

Equipment Conditions:
Fire and general service pump providing general service water to the vessel (TM 55-1925-273-10).

SECURITY MEASURES FOR ELECTRONIC DATA

No electronic data are used or stored by any of the Oil Water Separator (OWS) or Oil Control Monitor (OCM) components.

UNUSUAL OPERATING CONDITIONS

The following operating conditions are detailed in this work package:

1. OCM Operation in TEST Mode. The OCM should only be operated in the TEST mode when verifying the OCM system operation, troubleshooting, or performing maintenance.

2. Manual Backflush of the OWS. Manual backflush of the OWS is performed during system maintenance or in the event of the backflush solenoid inlet valve failure.

OCM OPERATION IN TEST MODE

⚠ CAUTION

The OCM should only be operated in the TEST mode when verifying the OCM system operation, troubleshooting, or performing maintenance. In the TEST mode, the OCM will operate similarly to the AUTO mode, except that it will operate continuously, regardless of pressure at the sample inlet. This means that in the TEST mode, the OCM could be operated with no flow through it, causing damage to the OCM after just 2 minutes.

1. Set the OWS switch (figure 1, item 1) on the OWS control panel (figure 1, item 2) to OFF.

2. Set to ON the OILY WATER SEPARATOR circuit breaker (figure 2, item 1) in the 120V distribution panel No. 4. The green POWER AVAILABLE indicator (figure 1, item 3) will illuminate to indicate that the OWS control panel has power available.

3. Align the OWS, the Oily Bilge (OB), and OCM valves as indicated in table 1 and figure 3.

4. If the OWS and the system inlet piping are not completely filled with water, purge all air from the system by performing a manual backflush, as described later in this work package.

5. Ensure that OCM OPERATION SELECTOR Switch A1S1 (figure 4, item 1) is set to OFF.

6. Set to ON the OIL CONTENT MONITOR circuit breaker (figure 2, item 2) in the 120V distribution panel No. 4. The red indicator (figure 5, item 1) on the OCM diverter valve position indicator (figure 5, item 2) will illuminate to signal that the OCM has power available.

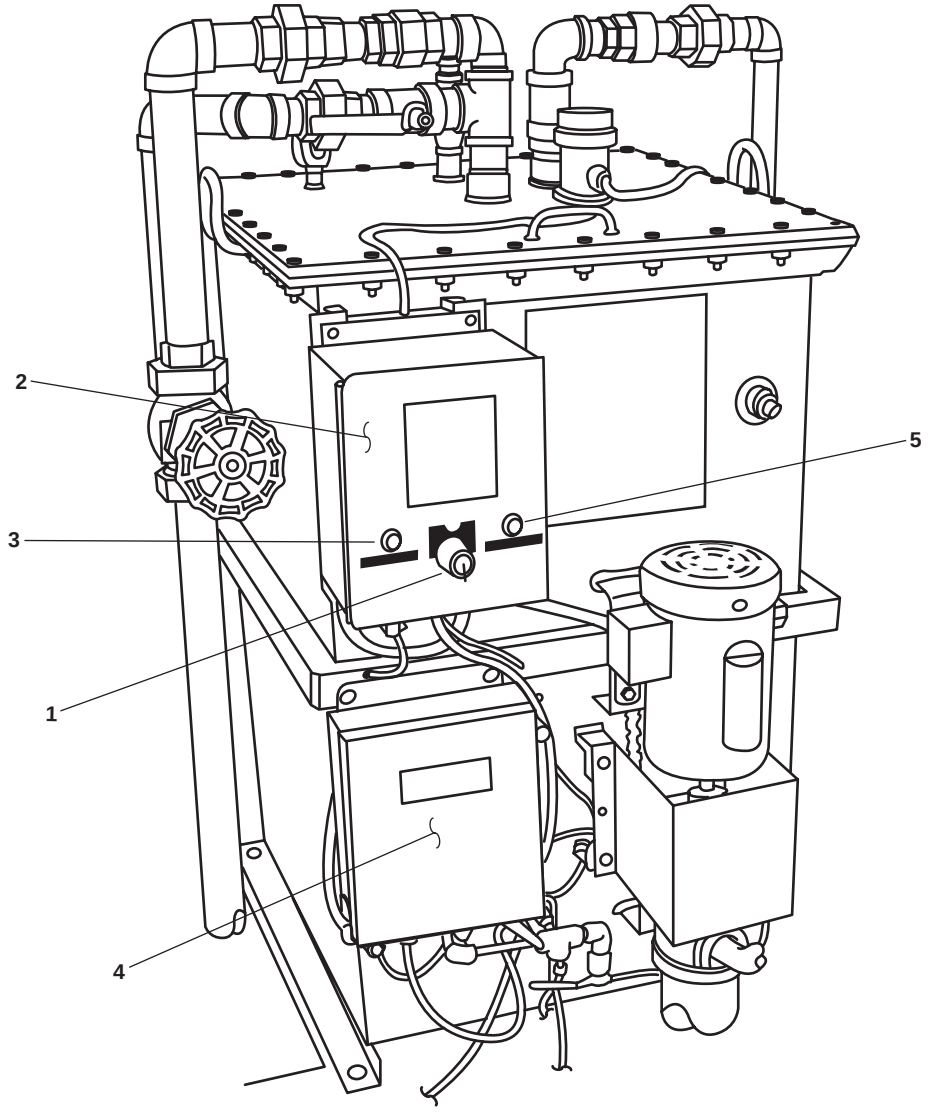


Figure 1. OWS Control Panel

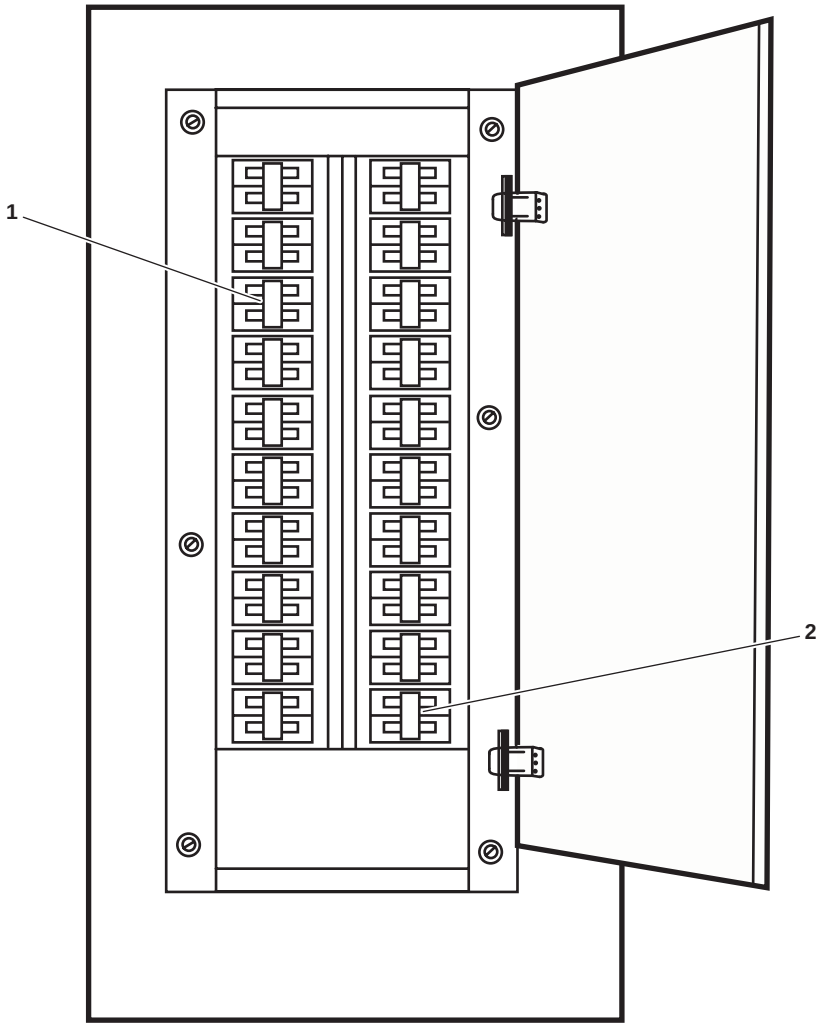


Figure 2. 120V Distribution Panel No. 4

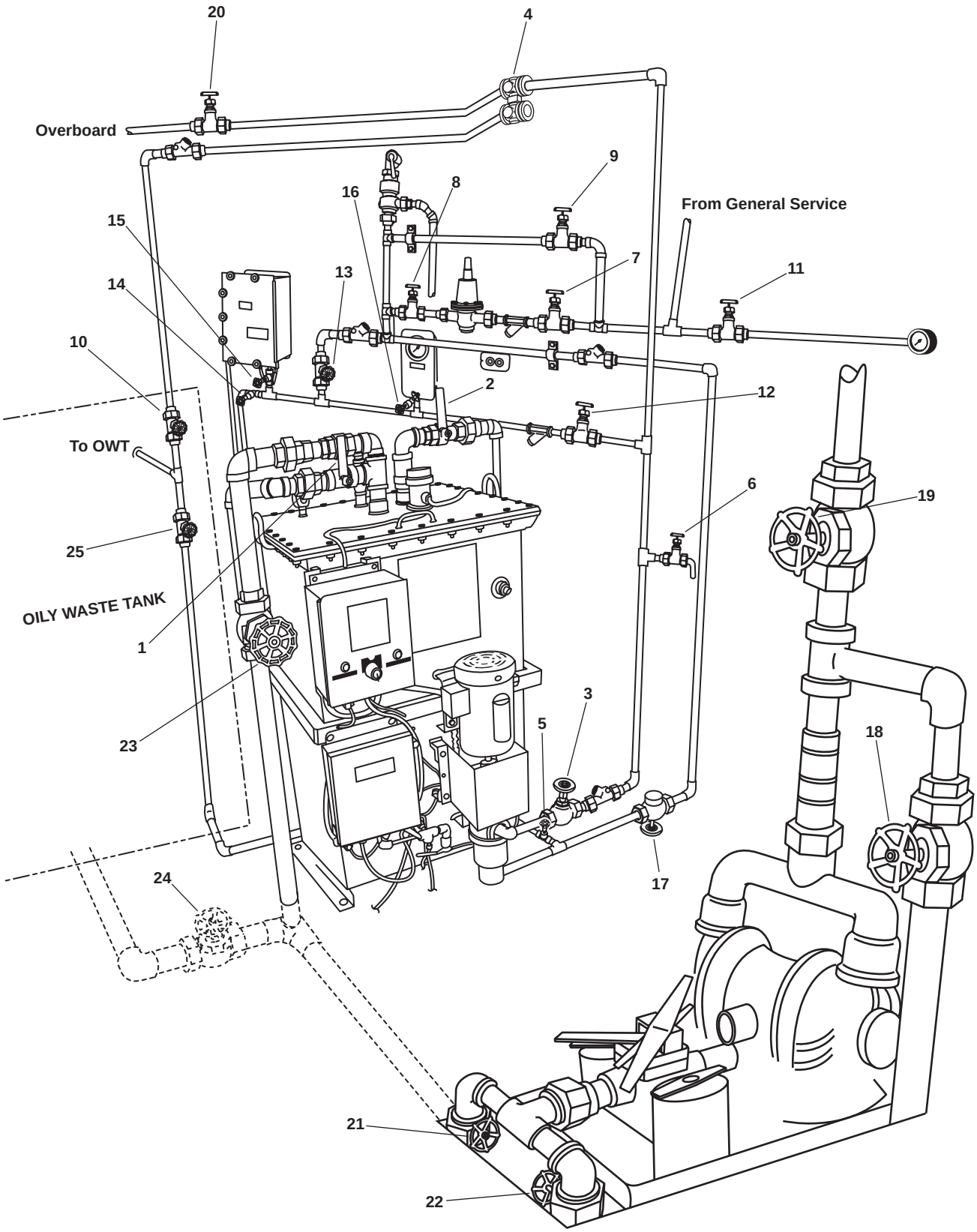


Figure 3. OWS, OB, and OCM Piping

Table 1. Valve Positions During OCM Operation In Test Mode

Item Number (Figure 3)	Valve Number	Function	Position During Operation Under Usual Conditions
1	OWS-1	OWS MANUAL BACKFLUSH	CLOSED
2	OWS-2	OWS DISCHARGE	OPEN
3	OWS-3	OWS PUMP DISCHARGE	OPEN
4	OWS-4	OCM 3-WAY DIVERTER	Controlled by OCM
5	OWS-5	OWS DISCHARGE	OPEN
6	OWS-6	OWS PITOT SAMPLE	CLOSED
7	OWS-7	BACKFLUSH WTR TO PRESS RDCR	OPEN
8	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	OPEN
9	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
10	OWS-10	OWS RECIRCULATING COV	OPEN
11	OWS-24	SW TO OWS PRESS GAGE ISOLATION	OPEN
12	OCM-1	OCM NOZZLE SAMPLER COV	OPEN
13	OCM-2	OCM BACKFLUSH WATER	CLOSED
14	OCM-3	OCM SAMPLING VALVE	CLOSED
15	OCM-4	OCM INLET	OPEN
16	OCM-8	OCM GAGE ISOLATION	OPEN
17	GS-74	OWS BACKFLUSH INLET SOLENOID	Automatic (Ensure that the manual override handle is in the CLOSED position (CCW) with the valve stem all the way out)
18	OB-8	XFR PUMP TO OILY WATER TANK	CLOSED
19	OB-9	XFR PUMP DISCH TO SHORE	CLOSED
20	OB-10	OWS OVERBOARD DISCHARGE	OPEN
21	OB-13	OWT TO XFR PUMP SUCTION	CLOSED
22	OB-14	COV-XFR PUMP SUCTION	CLOSED
23	OB-15	OWS INLET	OPEN
24	OB-16	WATER FROM OWT COV	OPEN
25	OB-17	OILY WATER TANK INLET	OPEN

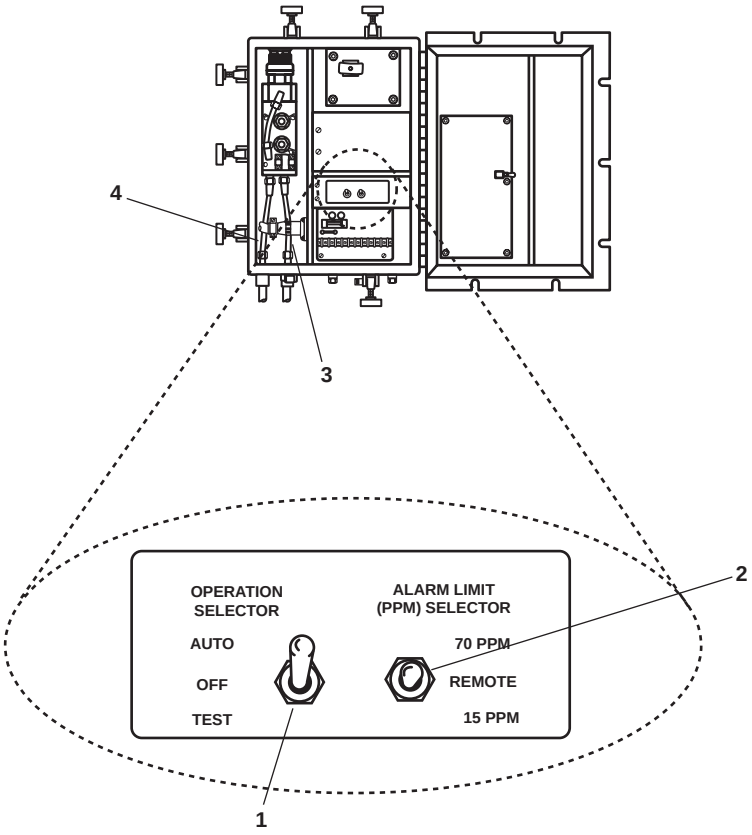


Figure 4. Sampling/Sensor Assembly Interior

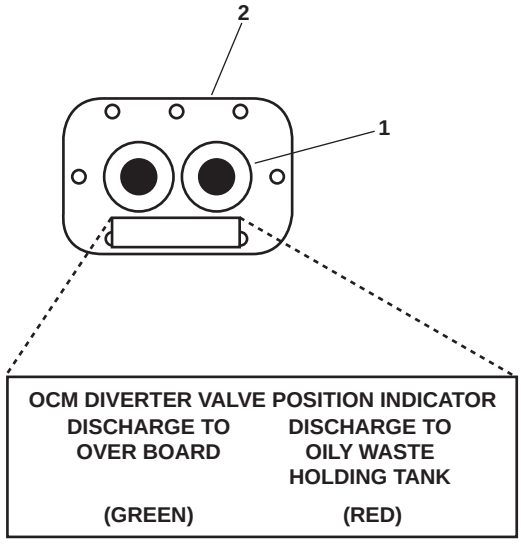


Figure 5. Diverter Valve Position Indicator

7. Position the OCM ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 4, item 2) to either the 15 PPM position for OWS operation within 12 nautical miles of land or 70 PPM for OWS operation outside 12 nautical miles of land.

8. Determine the source of fluid flow for the OCM. For fluid flow from the OWS, set the OWS control panel switch (figure 1, item 1) to MAN. The OWS pump will start, drawing oily water through the unit. The pump will continue to run as long as the switch is in the MAN position. For clean raw water from the general service pump, CLOSE valve OCM 1 (figure 3, item 12) and OPEN valve OCM 2 (figure 3, item 13).

⚠ CAUTION

The OCM will operate regardless of the pressure at the sample inlet or fluid flow through the monitor when the OCM OPERATION SELECTOR Switch A1S1 is in the TEST position. Operating the OCM without flow through it for more than 2 minutes will result in damage to the OCM. Do not secure the sampling/sensor assembly door with the OCM OPERATION SELECTOR Switch A1S1 in the TEST position. Failure to comply with this caution will result in damage to the equipment.

9. Position the OCM OPERATION SELECTOR switch A1S1 (figure 4, item 1) to Test.

10. Verify that the OCM has fluid flowing through the OCM sample inlet tubing (figure 4, item 3) and is discharging fluid through the OCM sample discharge tubing (figure 4, item 4). If the OCM does not have fluid flow within 2 minutes, set the OWS control panel switch (figure 1, item 1) to OFF and notify the maintenance supervisor. If the OCM does have fluid flow within 2 minutes, continue with the procedure.

11. Perform the required maintenance, troubleshooting, or system verification checks and return the OCM OPERATION SELECTOR switch A1S1 (figure 4, item 1) to the AUTO mode as soon as the necessary procedure has been completed.

OWS SHUTDOWN

1. Set the OWS control panel switch (figure 1, item 1) to the OFF position.

2. Set OPERATION SELECTOR switch A1S1 (figure 4, item 1) to OFF.

3. Perform OCM backflush by CLOSING OCM 1 (figure 3, item 12) and OPENING OCM 2 (figure 3, item 13). Continue OCM backflush until all liquid from the OCM discharge tube (figure 4, item 4) is clear.

4. Perform OWS manual backflush as described later in this work package.

5. Return all valves from table 1 to the CLOSED position.

6. Set to OFF the OILY WATER SEPARATOR circuit breaker (figure 2, item 1) in 120V distribution panel No. 4.

7. Set to OFF the OIL CONTENT MONITOR circuit breaker (figure 2, item 2) in 120V distribution panel No. 4.

MANUAL BACKFLUSH OF THE OWS

1. Set to OFF the OWS switch (figure 1, item 1) on the OWS control panel (figure 1, item 2).

2. Align the OWS, the OB, and OCM valves as indicated in table 2 and figure 6.

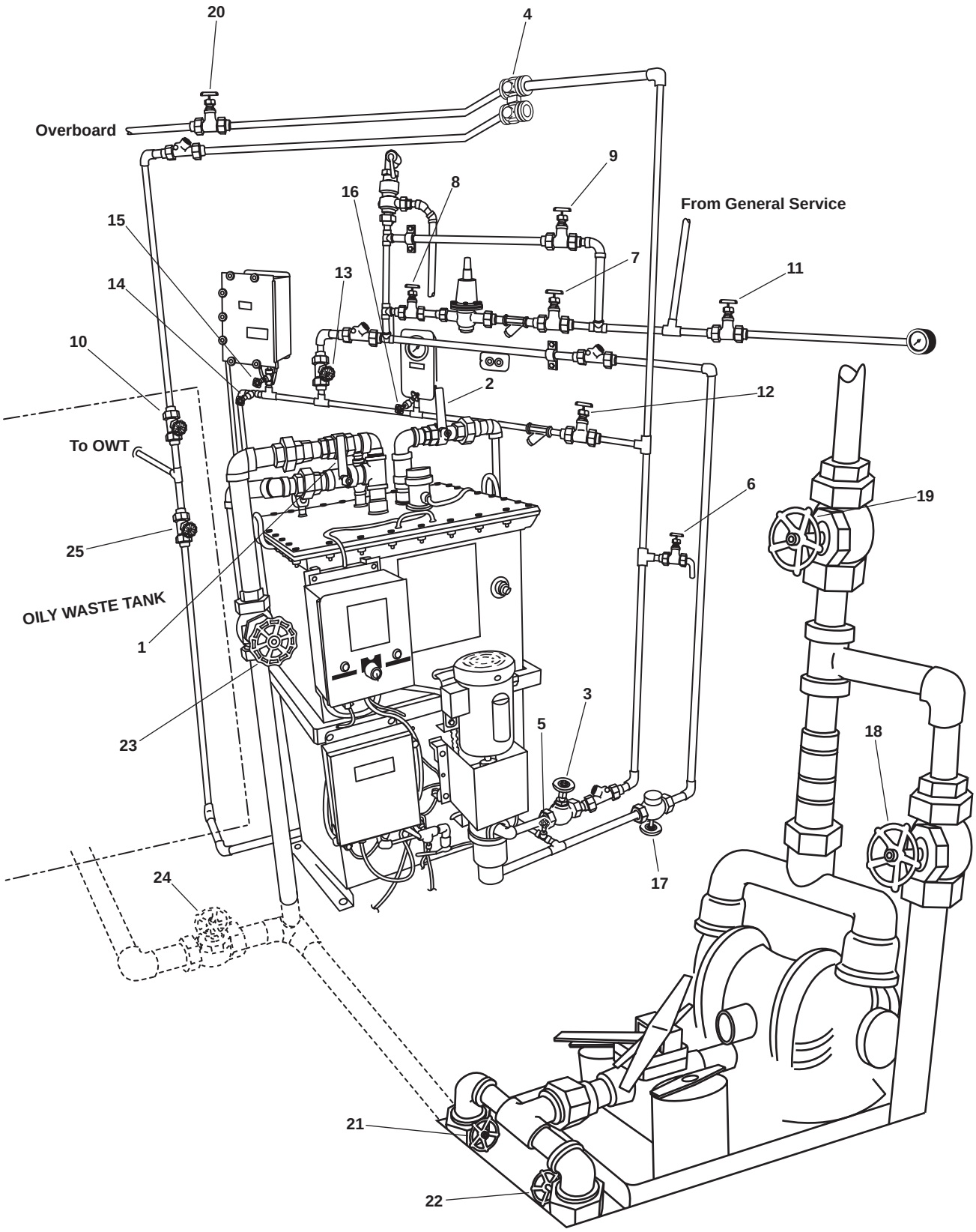


Figure 6. OWS, OB, and OCM Piping

Table 2. Valve Positions For Manual Backflush During Operation Under Unusual Conditions

Item Number (Figure 6)	Valve Number	Function	Position During Operation Under Usual Conditions
1	OWS-1	OWS MANUAL BACKFLUSH	OPEN
2	OWS-2	OWS DISCHARGE	OPEN
3	OWS-3	OWS PUMP DISCHARGE	CLOSED
4	OWS-4	OCM 3-WAY DIVERTER	Controlled by OCM
5	OWS-5	OWS DISCHARGE	OPEN
6	OWS-6	OWS PITOT SAMPLE	CLOSED
7	OWS-7	BACKFLUSH WTR TO PRESS RDCR	OPEN
8	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	OPEN
9	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
10	OWS-10	OWS RECIRCULATING COV	CLOSED
11	OWS-24	SW TO OWS PRESS GAGE ISOLATION	OPEN
12	OCM-1	OCM NOZZLE SAMPLER COV	CLOSED
13	OCM-2	OCM BACKFLUSH WATER	CLOSED
14	OCM-3	OCM SAMPLING VALVE	CLOSED
15	OCM-4	OCM INLET	CLOSED
16	OCM-8	OCM GAGE ISOLATION	CLOSED
17	GS-74	OWS BACKFLUSH INLET SOLENOID	Automatic (Ensure that the manual override handle is in the CLOSED position (CCW) with the valve stem all the way out)
18	OB-8	XFR PUMP TO OILY WATER TANK	CLOSED
19	OB-9	XFR PUMP DISCH TO SHORE	CLOSED
20	OB-10	OWS OVERBOARD DISCHARGE	CLOSED
21	OB-13	OWT TO XFR PUMP SUCTION	CLOSED
22	OB-14	COV-XFR PUMP SUCTION	CLOSED
23	OB-15	OWS INLET	CLOSED
24	OB-16	WATER FROM OWT COV	CLOSED
25	OB-17	OILY WATER TANK INLET	OPEN

NOTE

After CLOSING OWS 1, the OWS will continue to backflush, sending trapped oil along with the flushing water to the Oily Waste Tank until the flushing water is secured. Observe the Oily Waste Tank TLI to ensure that the Oily Waste Tank is not filled with flushing water.

3. Observe the pipe end of OWS-1 for flushing water to be discharged to the bilge. When the flushing water is discharged to the bilge, the OWS and all inlet piping are filled. Close OWS-1.

MANUAL BACKFLUSH SHUTDOWN

1. Return all valves from table 2 to the CLOSED position.

2. Notify the maintenance supervisor that the OWS has been backflushed.

UNUSUAL ENVIRONMENT/WEATHER

ROUGH SEAS

The OWS is designed to operate at inclinations up to 22.5 degrees. Angles greater than that could cause remixing of separated oil and water, degrading performance. Violent side-to-side or fore-and-aft motions could also degrade performance. For this reason, the OWS should only be operated during relatively calm sea states if possible.

FREEZING TEMPERATURES

If the secured OCM will be exposed to freezing temperatures, remove and drain the sampling/sensor assembly (WP 0015 00).

END OF WORK PACKAGE

Chapter 3

Troubleshooting Procedures for Oil Water Separator

Inland and Coastal Large Tug (LT)

OPERATOR AND UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
TROUBLESHOOTING INDEX

USE OF THE INDEX

Troubleshooting begins by identifying the equipment and the malfunction. Table 1 contains the operator troubleshooting procedures, and table 2 contains the unit troubleshooting procedures. The equipment list is contained in the left column of the tables, and the malfunctions are listed in the center column of the tables. Once the correct equipment and malfunction are located, look immediately to the right for the work package and procedure that correspond to the malfunction. After locating the appropriate work package and procedure, turn to that procedure, and follow the instructions in the paragraph that follows.

USE OF TROUBLESHOOTING PROCEDURES

Functional flow logic tree troubleshooting procedures are used for all troubleshooting procedures in this manual. In this troubleshooting style, a pill shaped symbol (figure 1) is used to depict the beginning or end point of a procedure. Decision points are depicted by diamond shaped symbols (figure 2). Action points, as well as warnings, cautions, and notes are contained in rectangular symbols (figure 3). Procedures that are too large for one page are joined together by the circular shaped connector symbols (figure 4). The connector symbol will denote which page and step to go to (or come from) on another page. Finally, when flowchart lines cross, the technician must ensure that the correct path is followed. Crossing lines (figure 5) indicate that the points connect. Lines that cross with a jump symbol in the center (figure 6) indicate that the points do not connect. The technician must correctly follow the arrows to complete the troubleshooting procedure.

Look for the pill shaped beginning symbol in the upper left corner of the procedure. This symbol should contain the identified malfunction or symptom. Starting from this point, follow the arrowed lines through the procedure. Remember that the diamond shaped symbols denote a decision step. At each of these points you will be required to make a decision and to follow the appropriate line for that decision. Continue to follow the arrowed lines through the procedure until the malfunction or symptom is corrected.

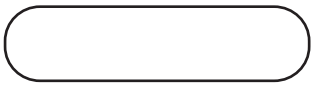


Figure 1. Pill Shaped Symbol

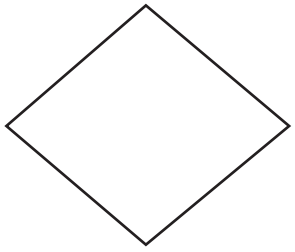


Figure 2. Diamond Shaped Symbol

Figure 3. Rectangle Shaped Symbol

Figure 4. Circular Shaped Symbol

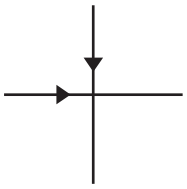


Figure 5. Crossed Lines Are Connected

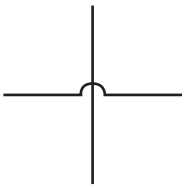


Figure 6. Crossed Lines Are Not Connected

Table 1. Operator Troubleshooting Preocedures

Equipment	Symptom	Work Package, Procedure
OCM	OCM has no power	WP 0008 00, Procedure 1
	OCM will not start	WP 0008 00, Procedure 2
OWS	OWS control panel has no power	WP 0008 00, Procedure 3
	OWS pump will not start	WP 0008 00, Procedure 4

Table 2. Unit Troubleshooting Procedures

Equipment	Symptom	Work Package, Procedure
OCM	Audible alarm inoperative when OCM is in ALARM mode	WP 0009 00, Procedure 20
	Diverter solenoid vlave works opposite of intended control function	WP 0009 00, Procedure 21
	OCM POWER ON indicator does not light	WP 0009 00, Procedure 11
	OCM WARNING 1 (Red LED) lit	WP 0009 00, Procedure 12
	OCM WARNING 2 (Red LED) lit	WP 0009 00, Procedure 13
	OCM WARNING 2 and WARNING 3 (Red LEDs) lit	WP 0009 00, Procedure 15
	OCM WARNING 3 (Red LED) lit	WP 0009 00, Procedure 14
	OWS discharge is diverted inboard when OCM detects less than alarm limit	WP 0009 00, Procedure 17
	PUSH TO CHANGE ALARM LIMIT switch A2S1 does not change alarm limit of OCM	WP 0009 00, Procedure 19
	Remote indicator (alarm) assembly indicators inoperative while OCM is operating	WP 0009 00, Procedure 18
	Unstable oil content display, PPM values jump high, then low	WP 0009 00, Procedure 16
OWS	Frequent oil discharge	WP 0009 00, Procedure 8
	High oil content in effluent	WP 0009 00, Procedure 5
	Low or no effluent discharge	WP 0009 00, Procedure 4
	Oil does not discharge (backflush) from OWS	WP 0009 00, Procedure 9
	OWS fails to operate in MAN mode	WP 0009 00, Procedure 7
	OWS pump deadheaded	WP 0009 00, Procedure 3
	OWS relief valve opens or fails to reseat	WP 0009 00, Procedure 6
	Pump noisy	WP 0009 00, Procedure 10
	Vacuum unusually high during normal processing	WP 0009 00, Procedure 1
	Vacuum unusually low during normal processing	WP 0009 00, Procedure 2

END OF WORK PACKAGE

OPERATOR MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OPERATOR TROUBLESHOOTING PROCEDURES

INITIAL SETUP:

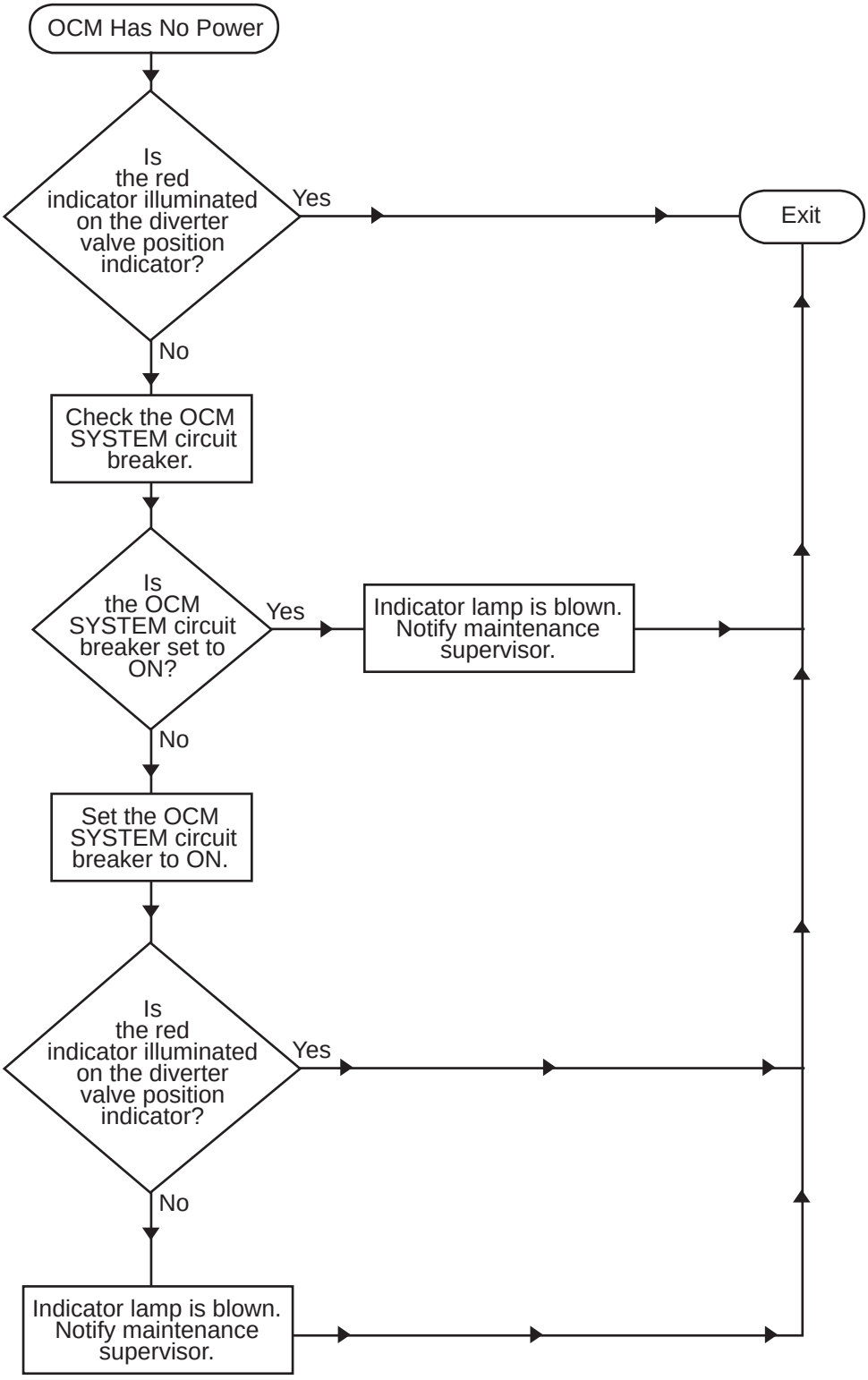
Personnel Required:
One Watercraft Engineer, 88L

References:
WP 0005 00

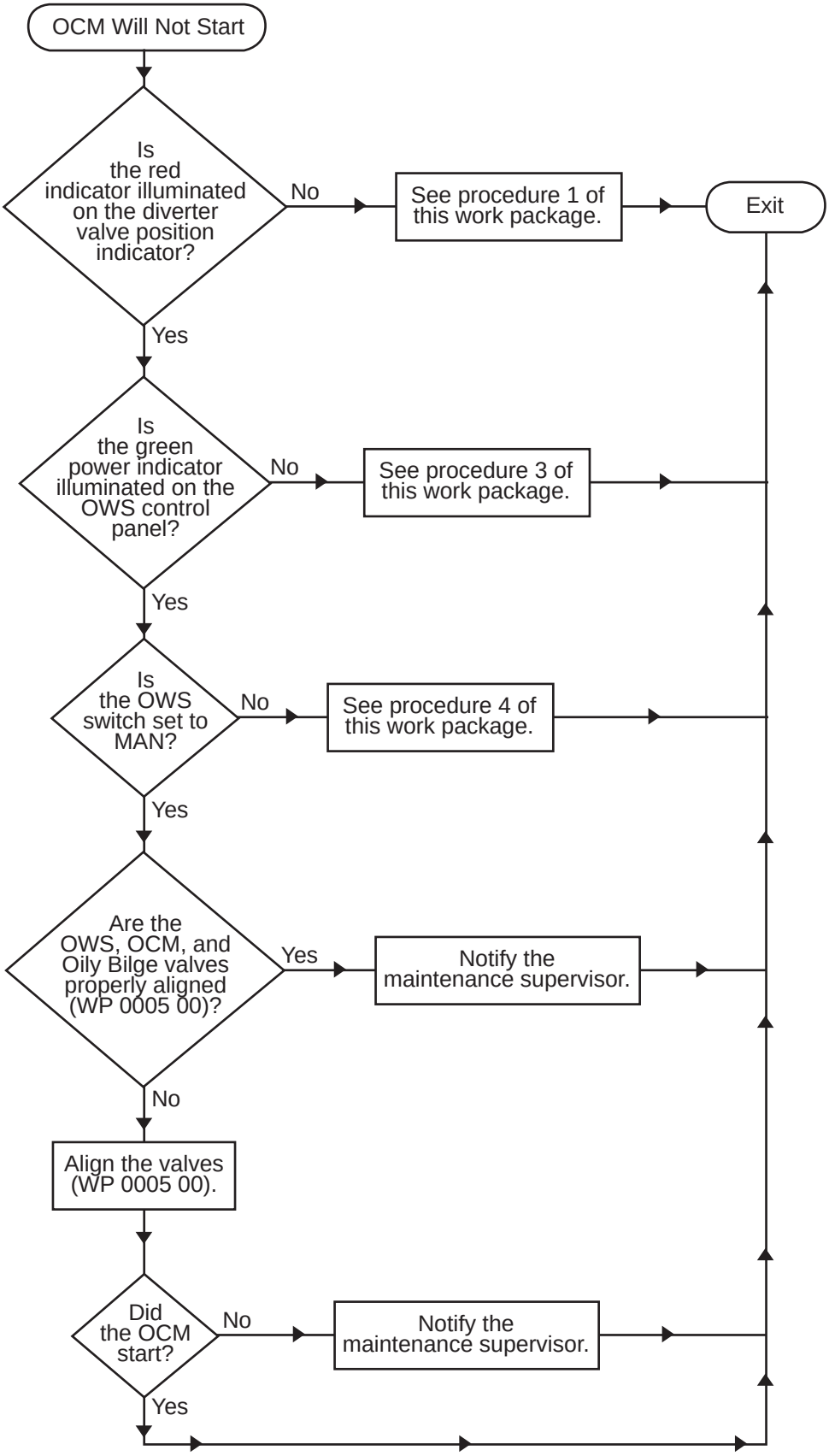
INTRODUCTION

The following troubleshooting procedures are included in this work package:

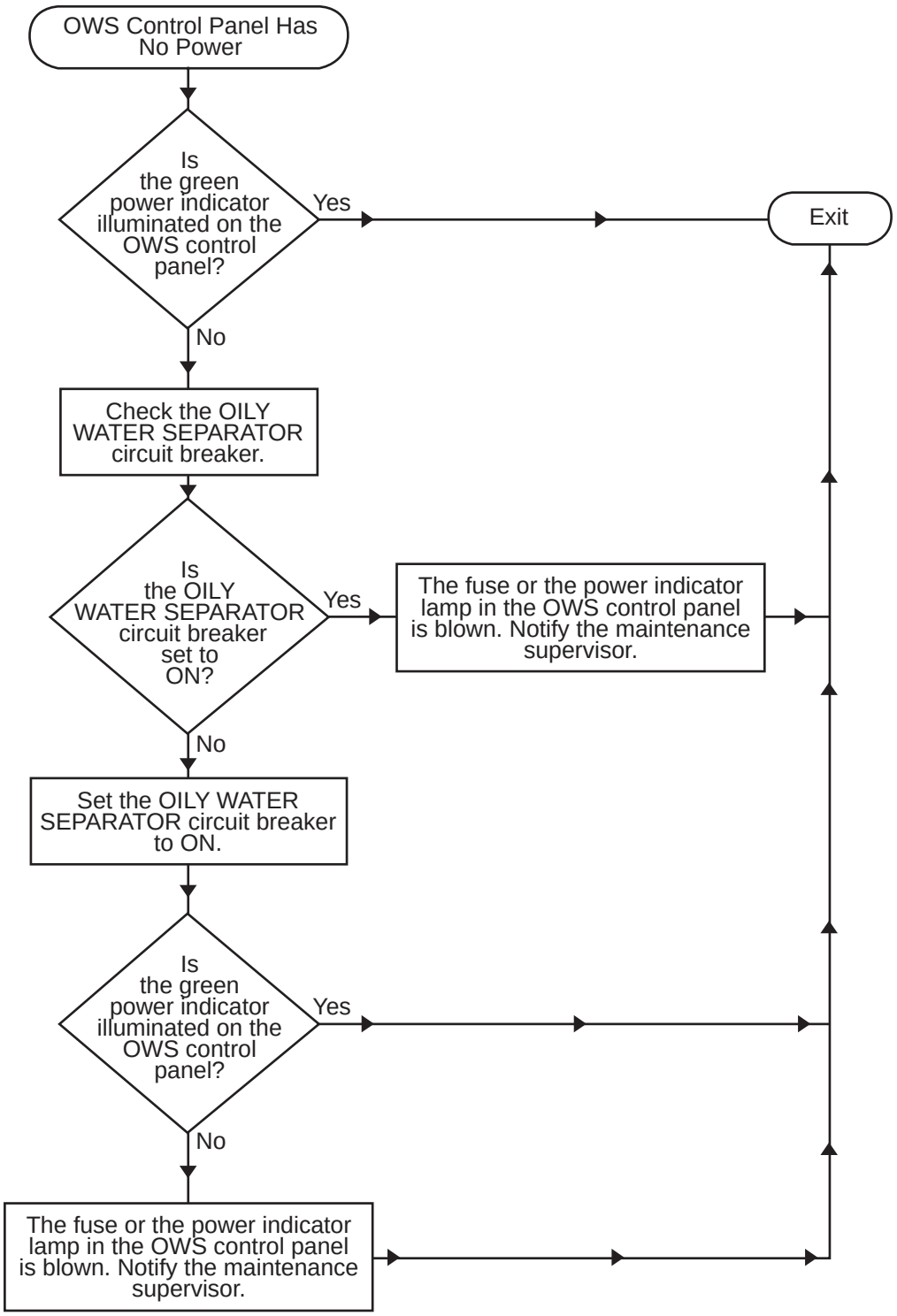
TROUBLESHOOTING PROCEDURES



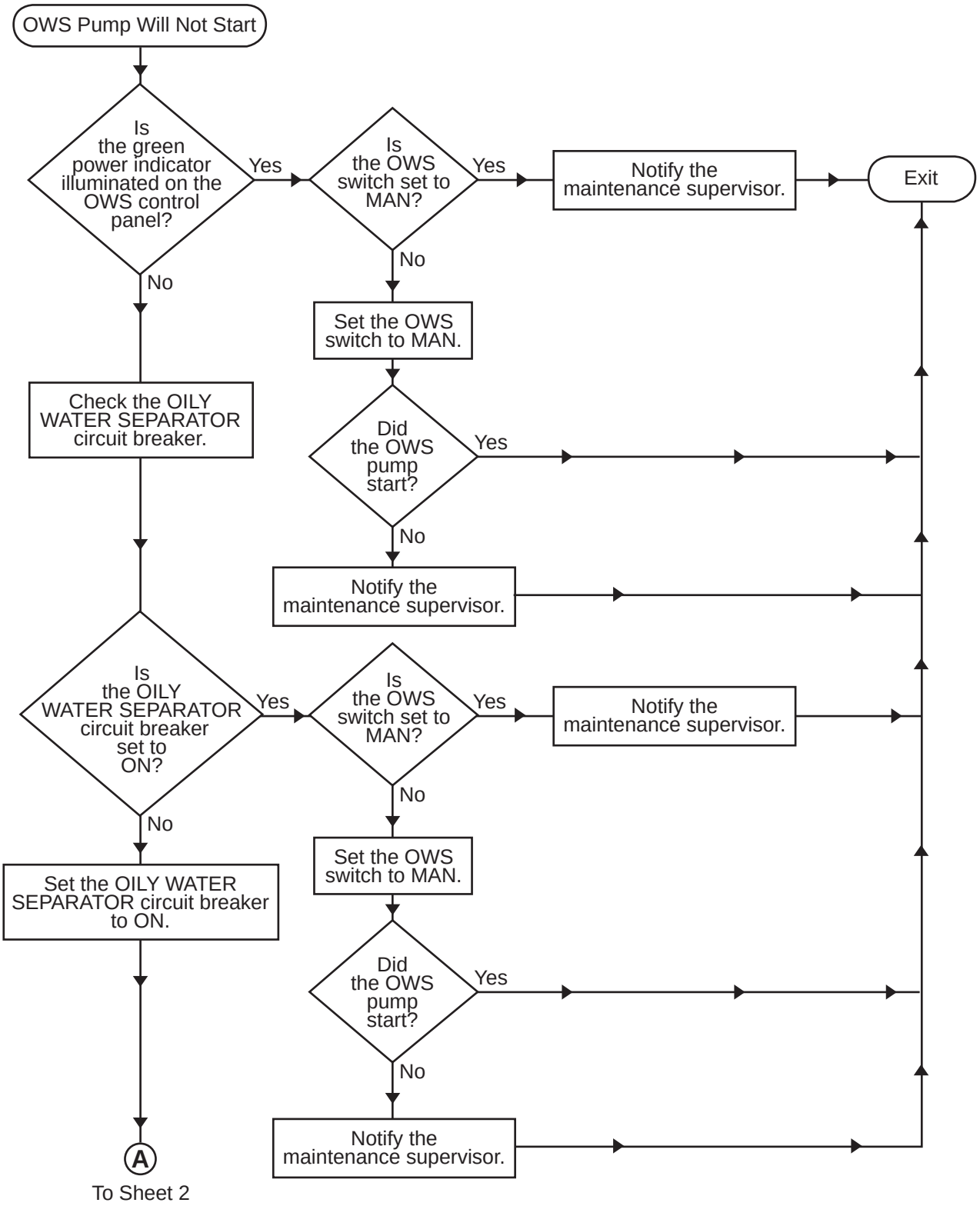
Procedure 1. OCM Has No Power



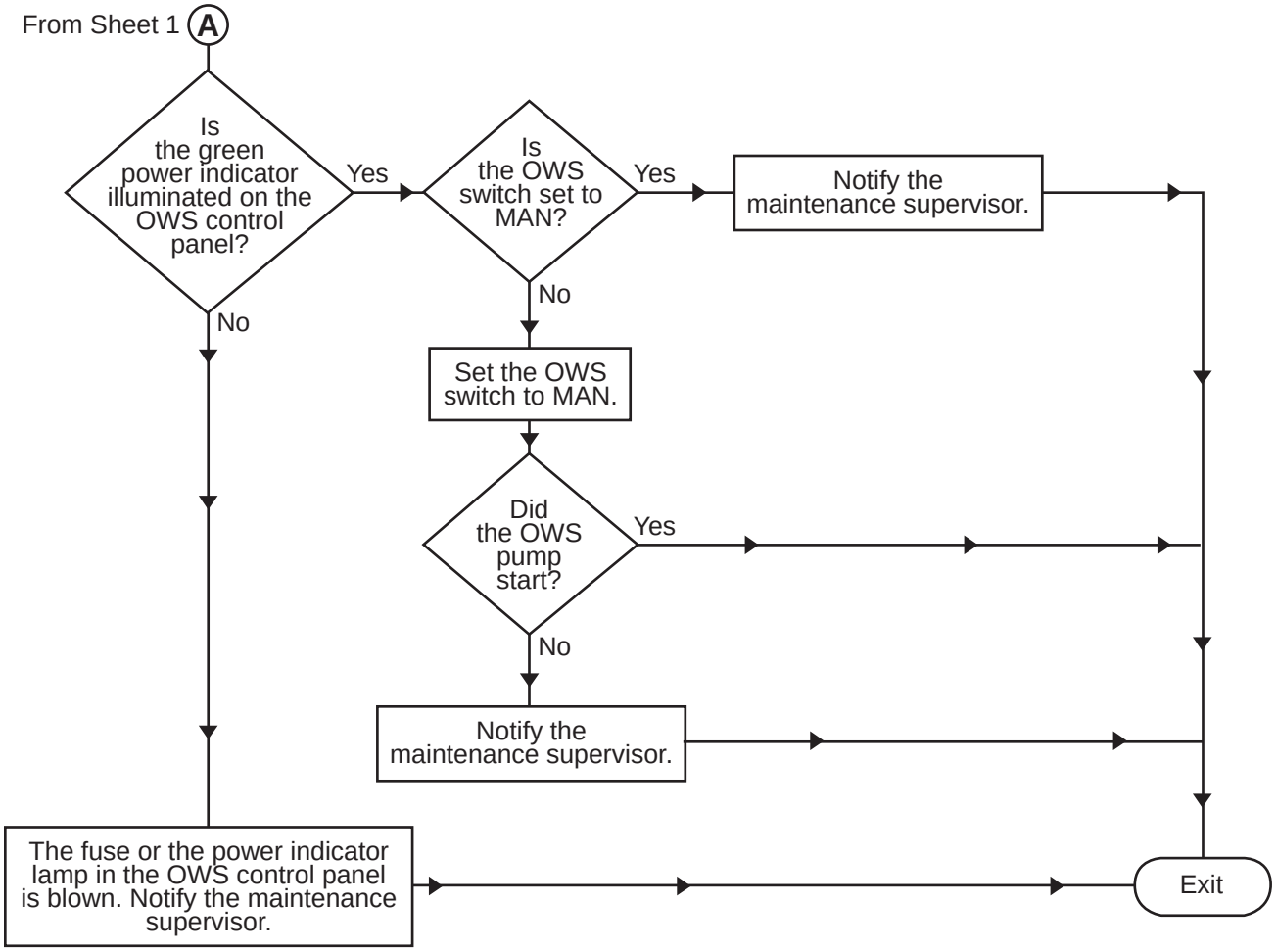
Procedure 2. OCM Will Not Start



Procedure 3. OWS Control Panel Has No Power



Procedure 4. OWS Pump Will Not Start (Sheet 1 of 2)



Procedure 4. OWS Pump Will Not Start (Sheet 2 of 2)

END OF WORK PACKAGE

UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0023 00)
Tool Kit, Electrician's (Item 2, Table 2, WP 0023 00)
Multimeter (Item 3, Table 2, WP 0023 00)

Personnel Required:
Two Watercraft Engineers, 88L

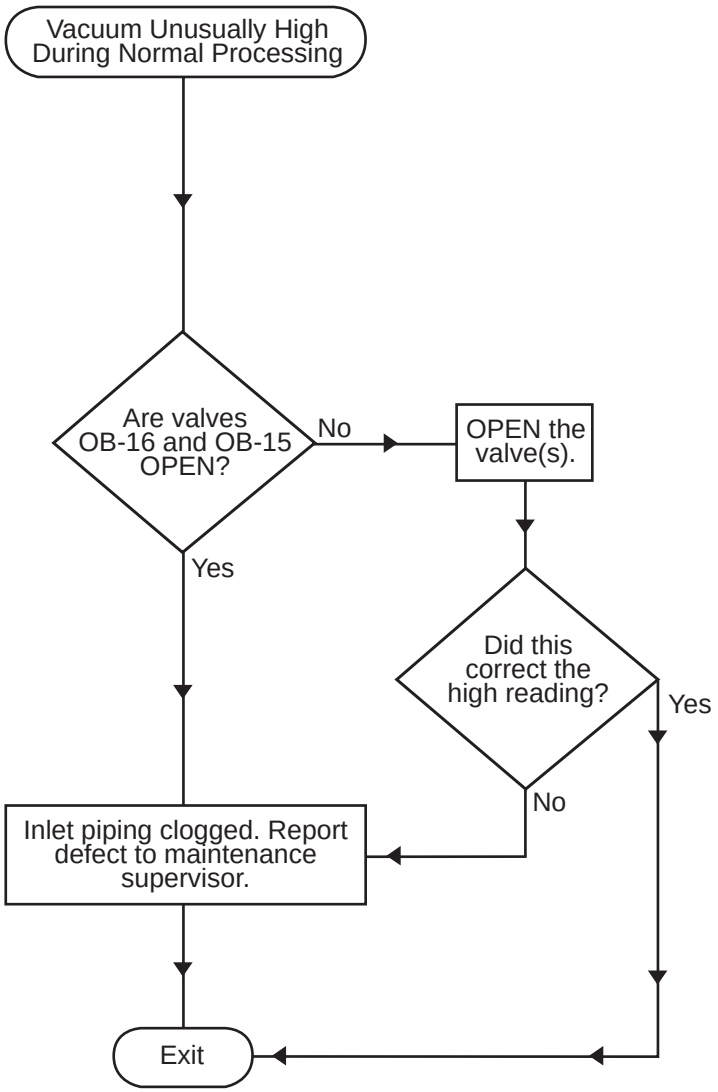
References:
FM 55-509

References (continued):
TM 55-1925-273-10
WP 0003 00
WP 0005 00
WP 0006 00
WP 0013 00
WP 0014 00
WP 0015 00
WP 0016 00
WP 0017 00
WP 0018 00
WP 0023 00

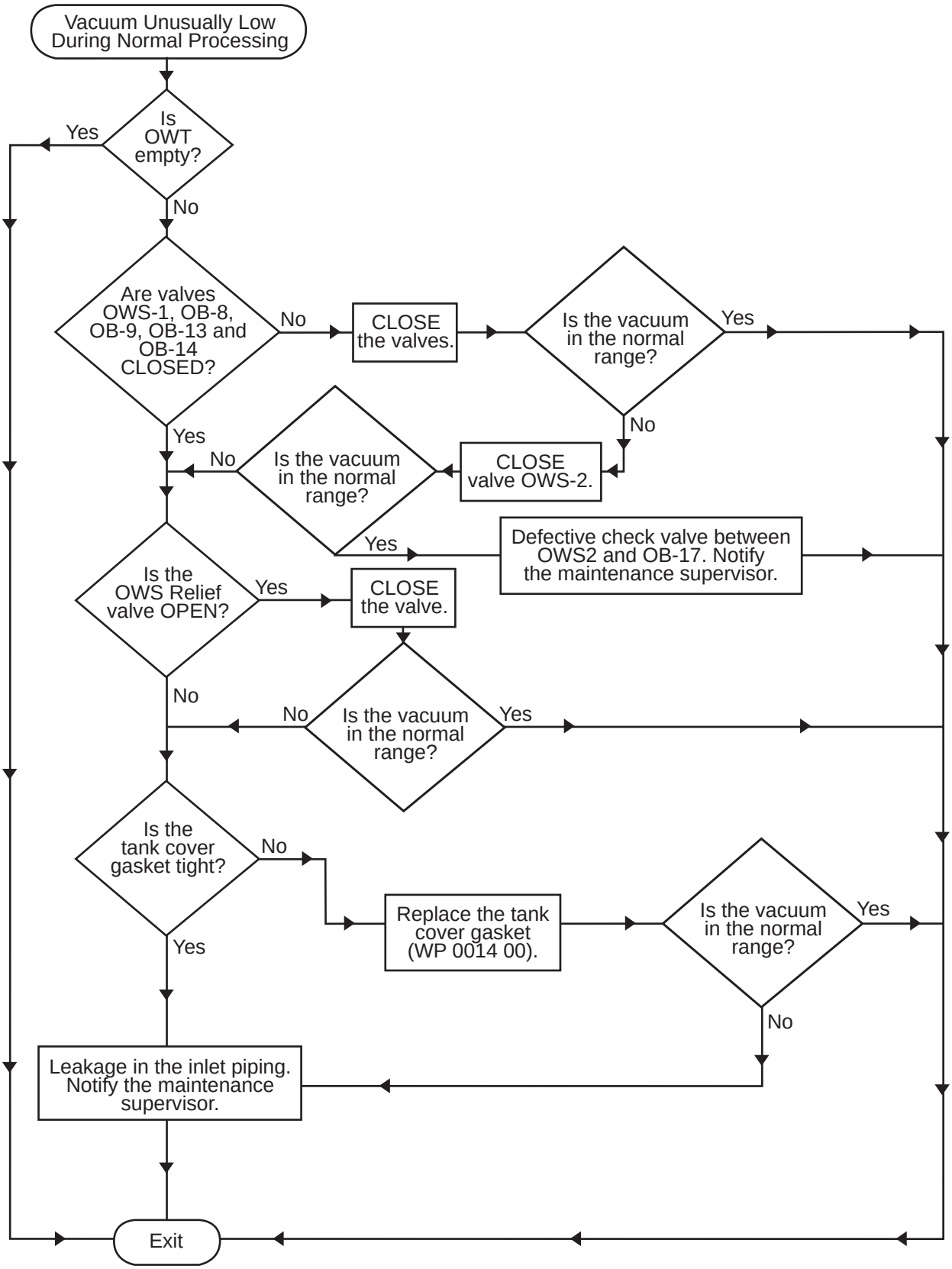
INTRODUCTION

The following troubleshooting procedures are included in this work package:

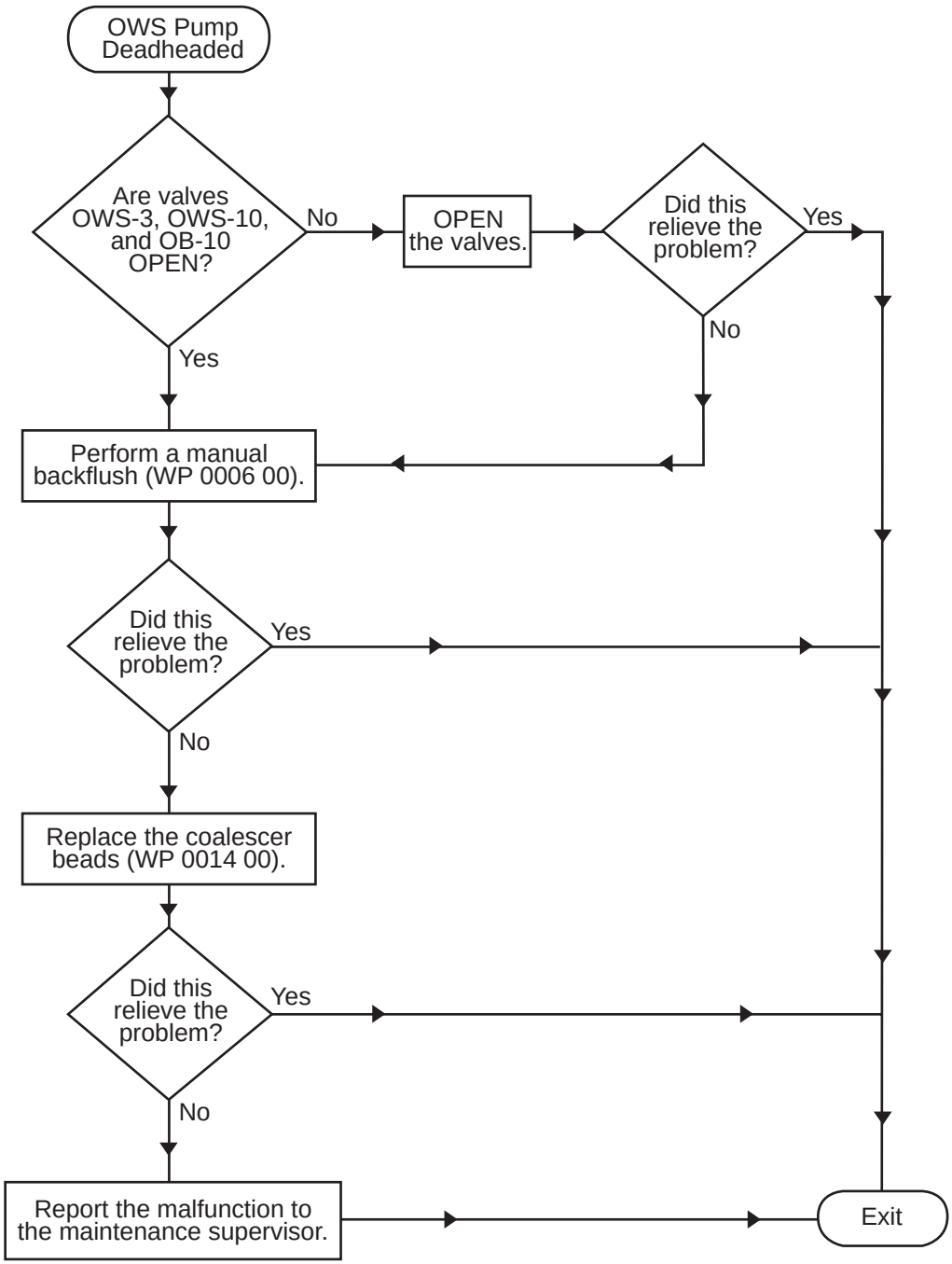
TROUBLESHOOTING PROCEDURES



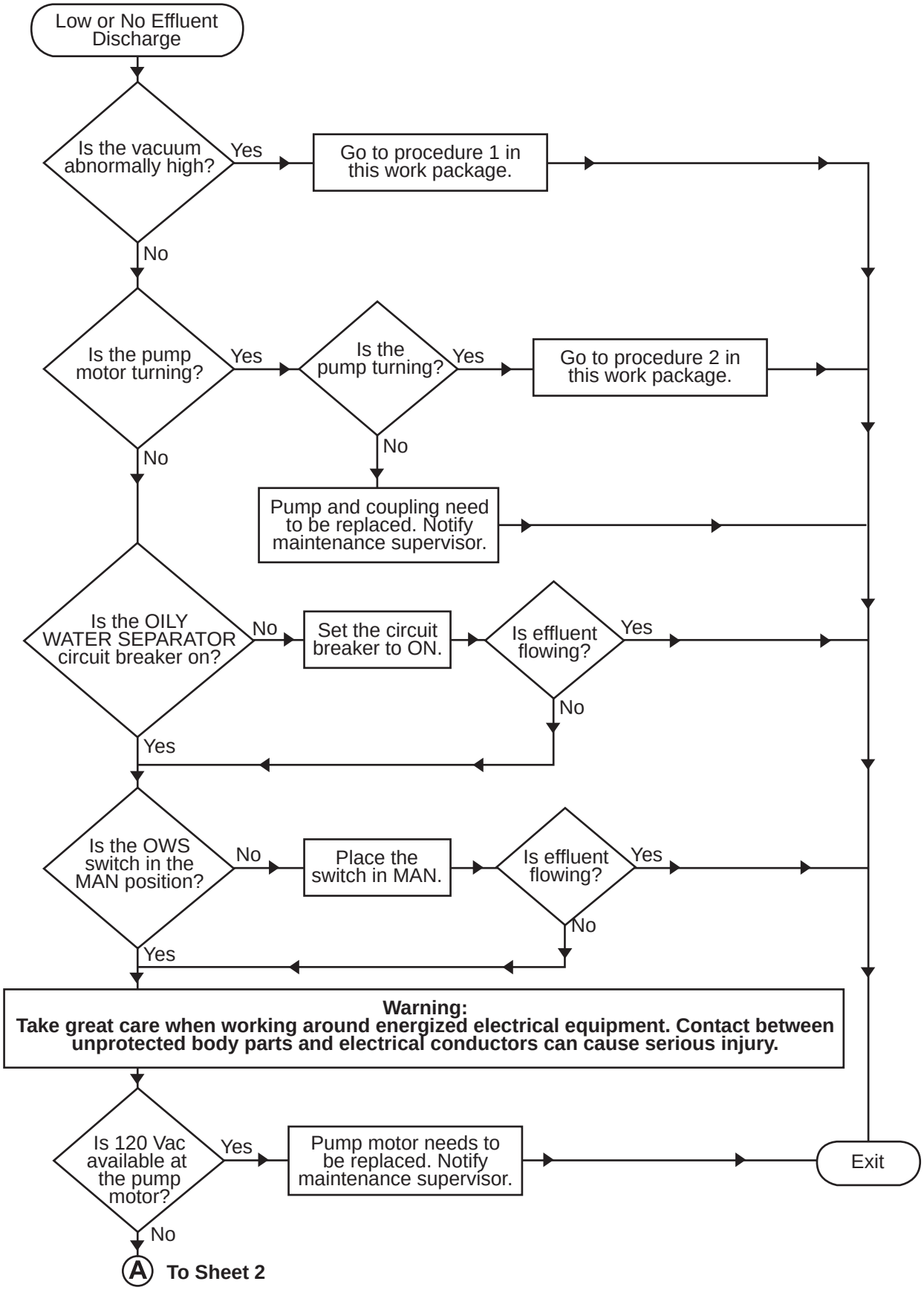
Procedure 1. Vacuum Unusually High During Normal Processing



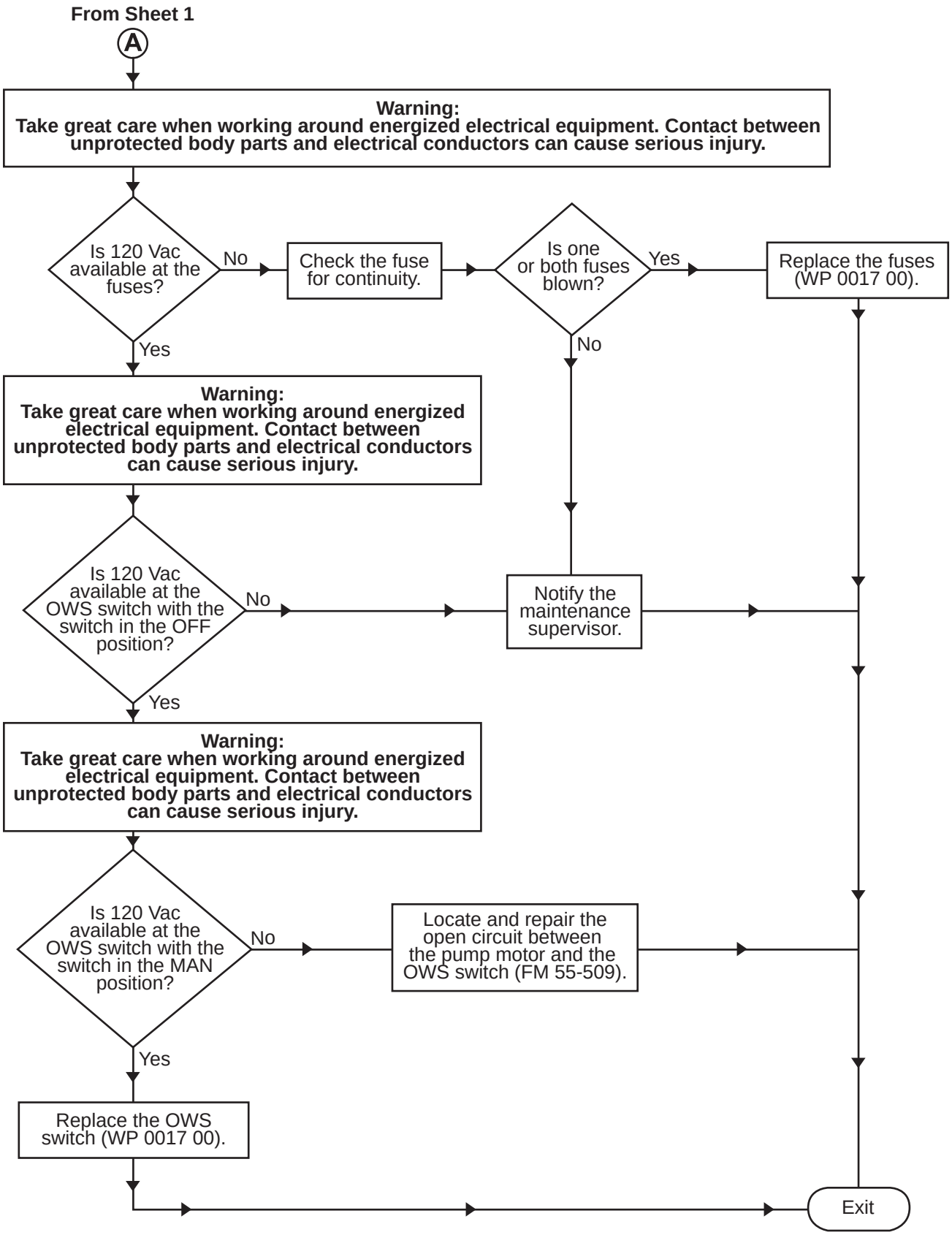
Procedure 2. Vacuum Unusually Low During Normal Processing



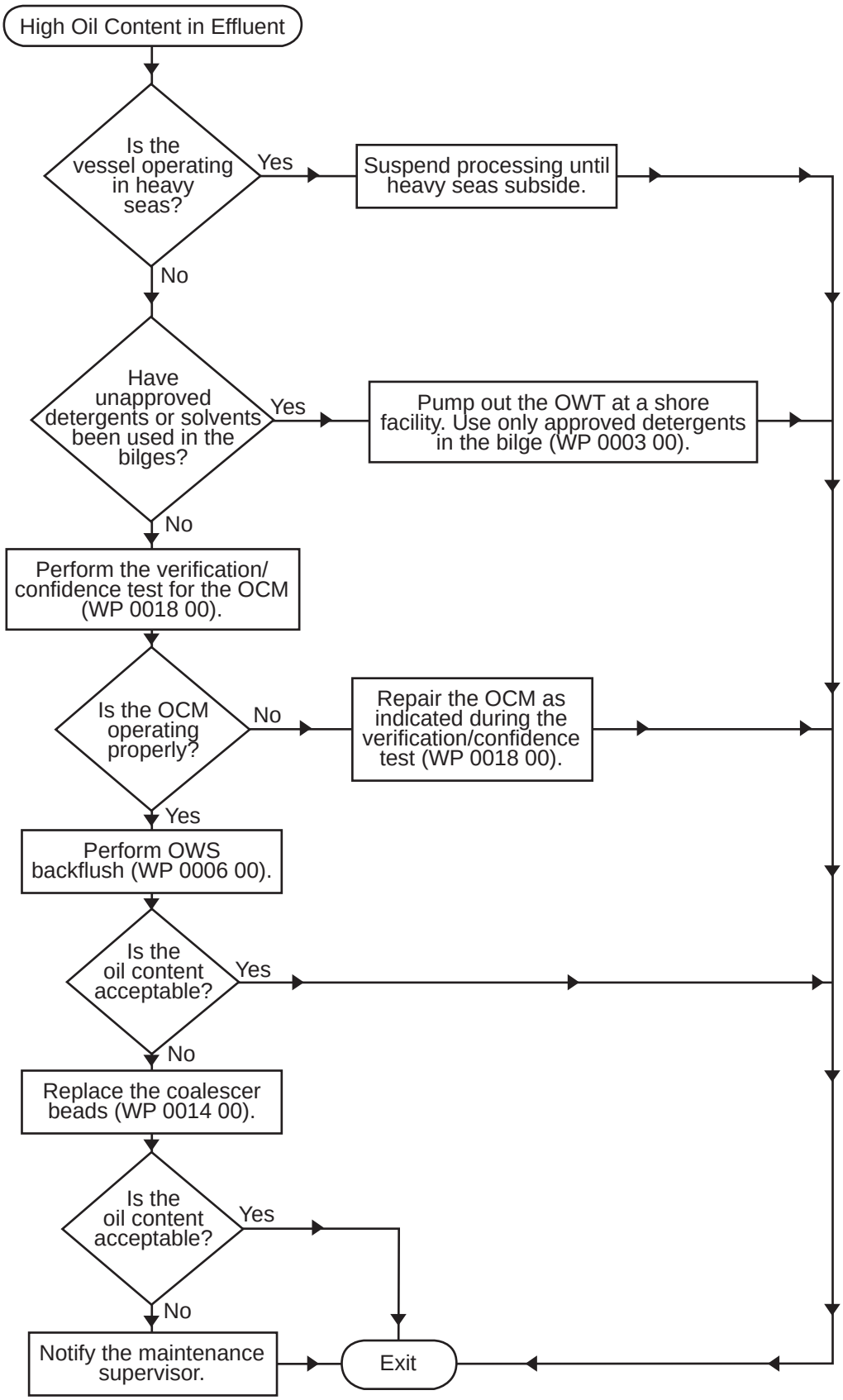
Procedure 3. OWS Pump Deadheaded



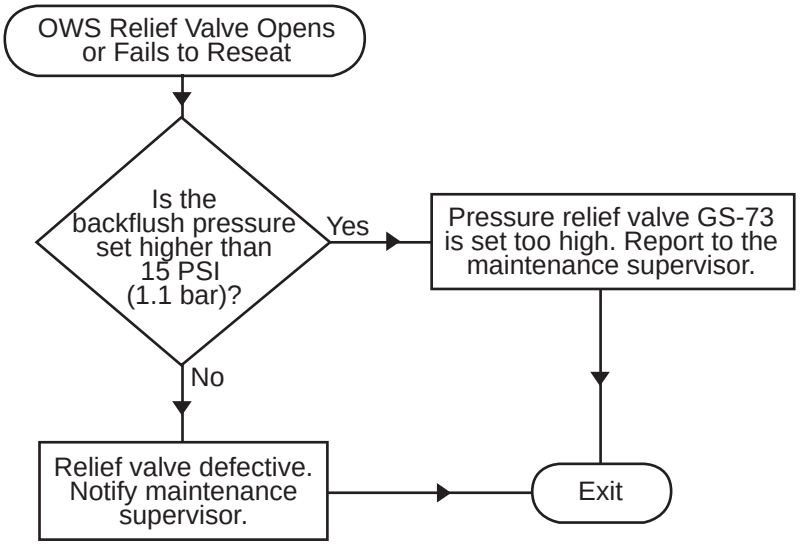
Procedure 4. Low Or No Effluent Discharge (Sheet 1 of 2)



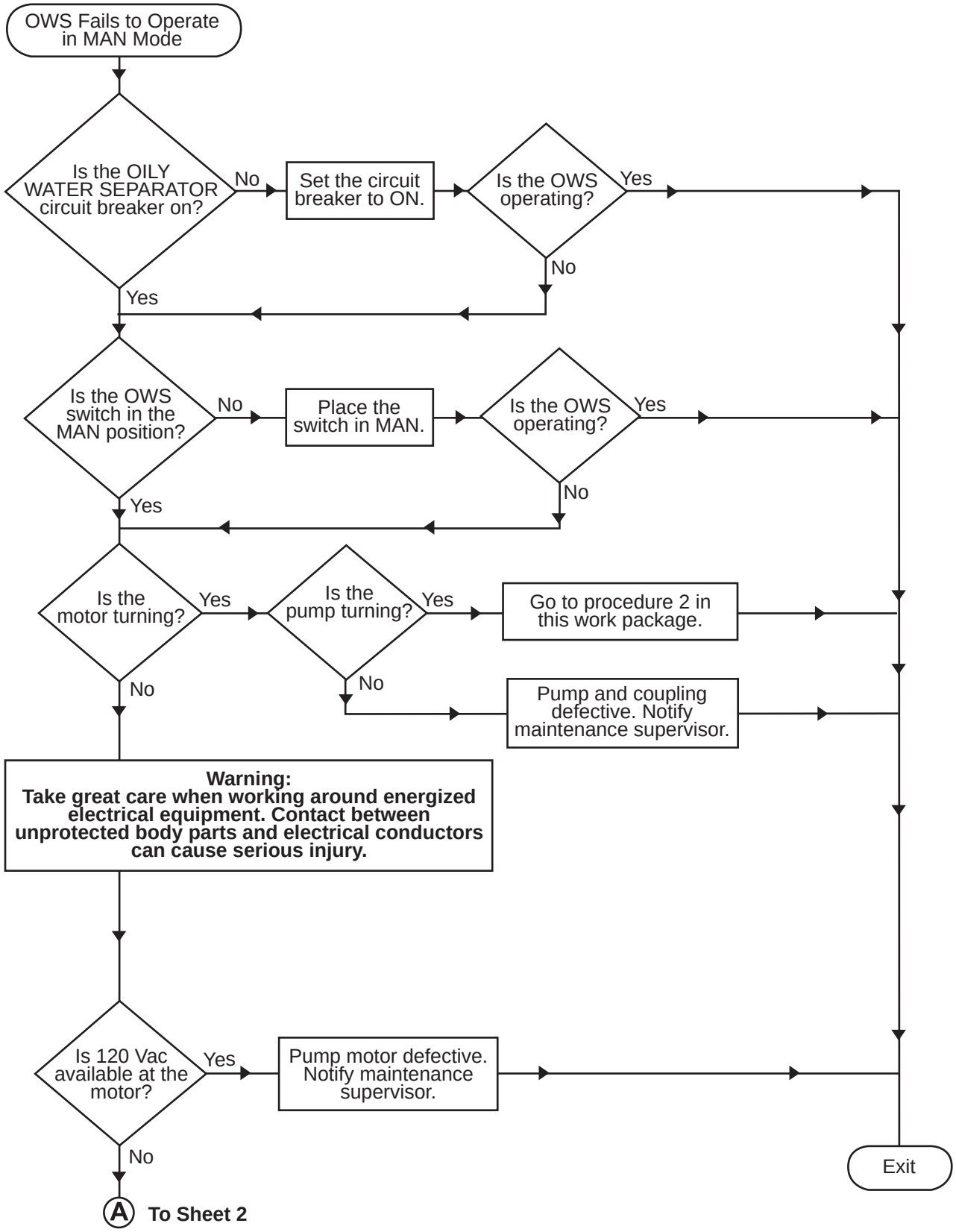
Procedure 4. Low Or No Effluent Discharge (Sheet 2 of 2)



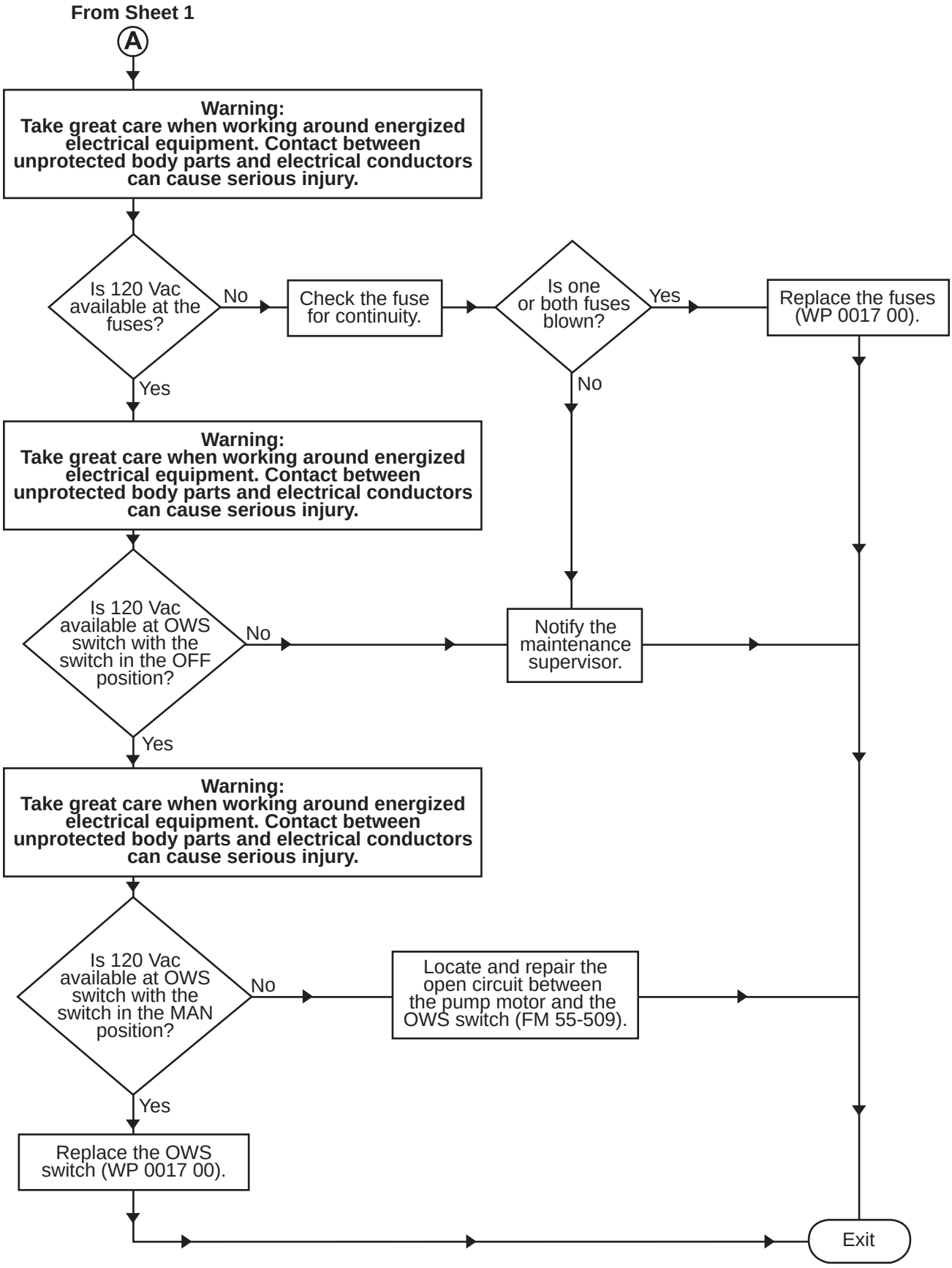
Procedure 5. High Oil Content In Effluent



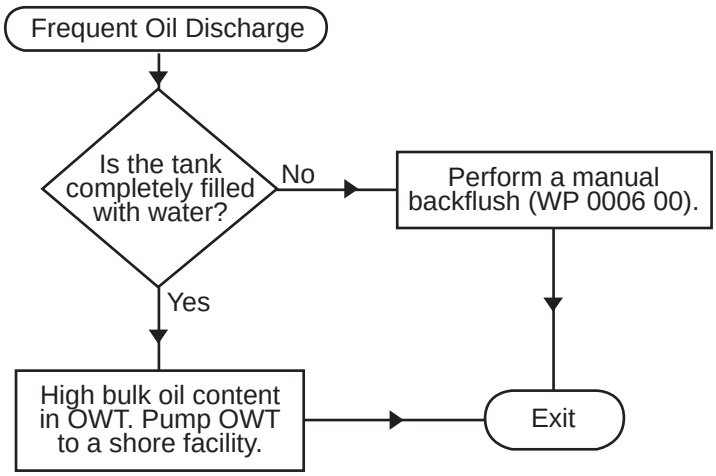
Procedure 6. OWS Relief Valve Opens Or Fails To Reseat



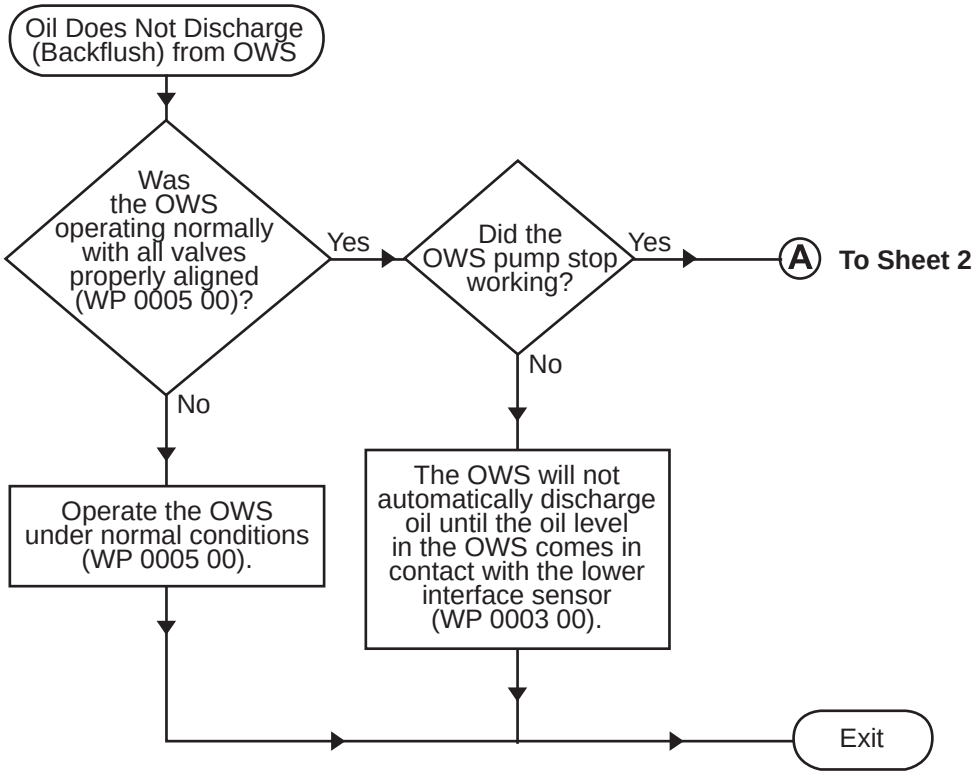
Procedure 7. OWS Fails To Operate In MAN Mode (Sheet 1 of 2)



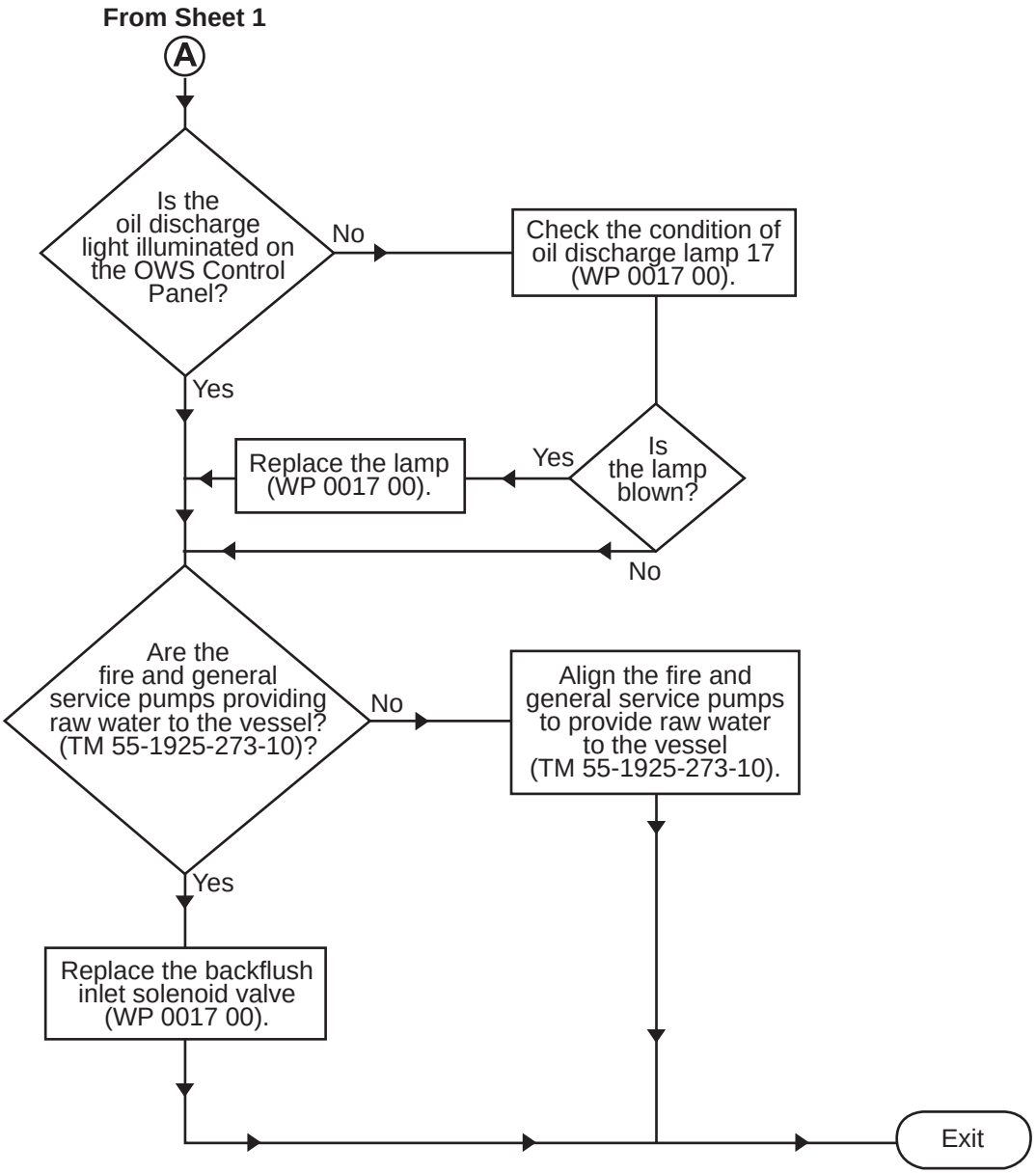
Procedure 7. OWS Fails To Operate In MAN Mode (Sheet 2 of 2)



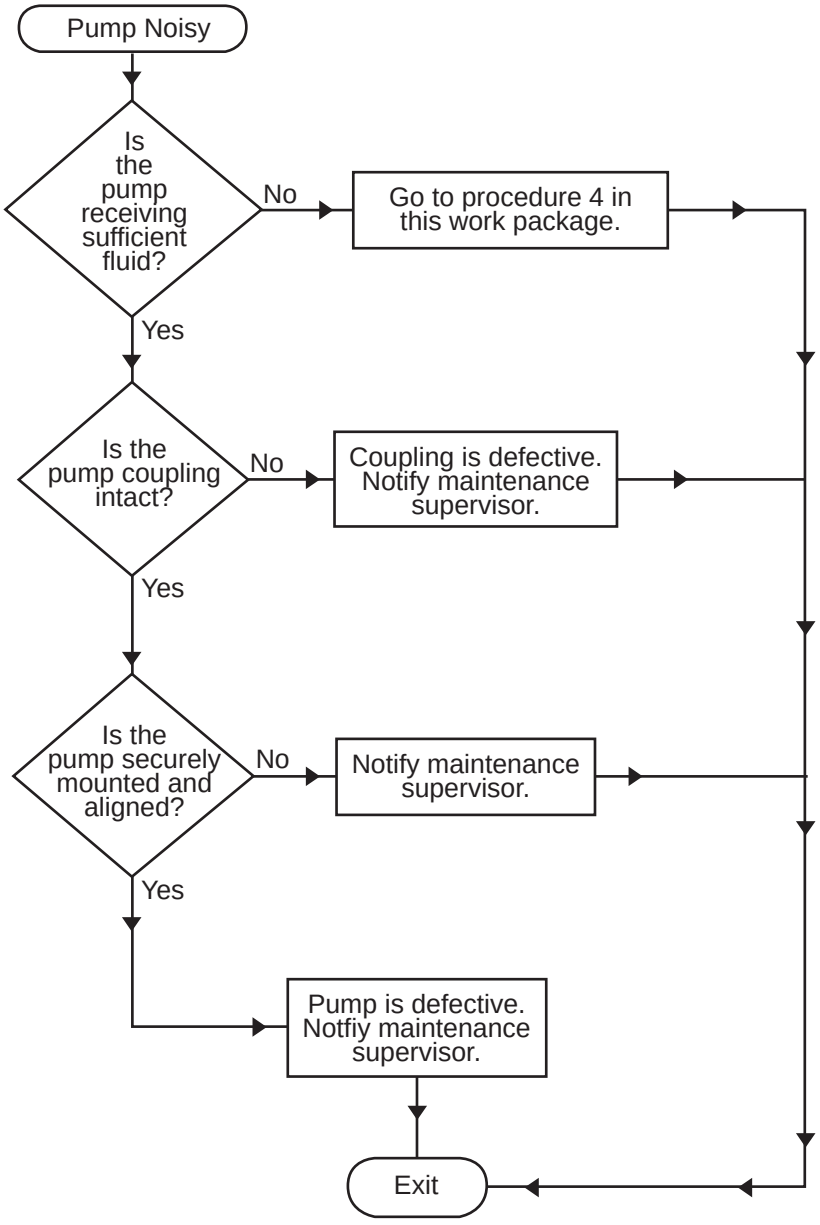
Procedure 8. Frequent Oil Discharge



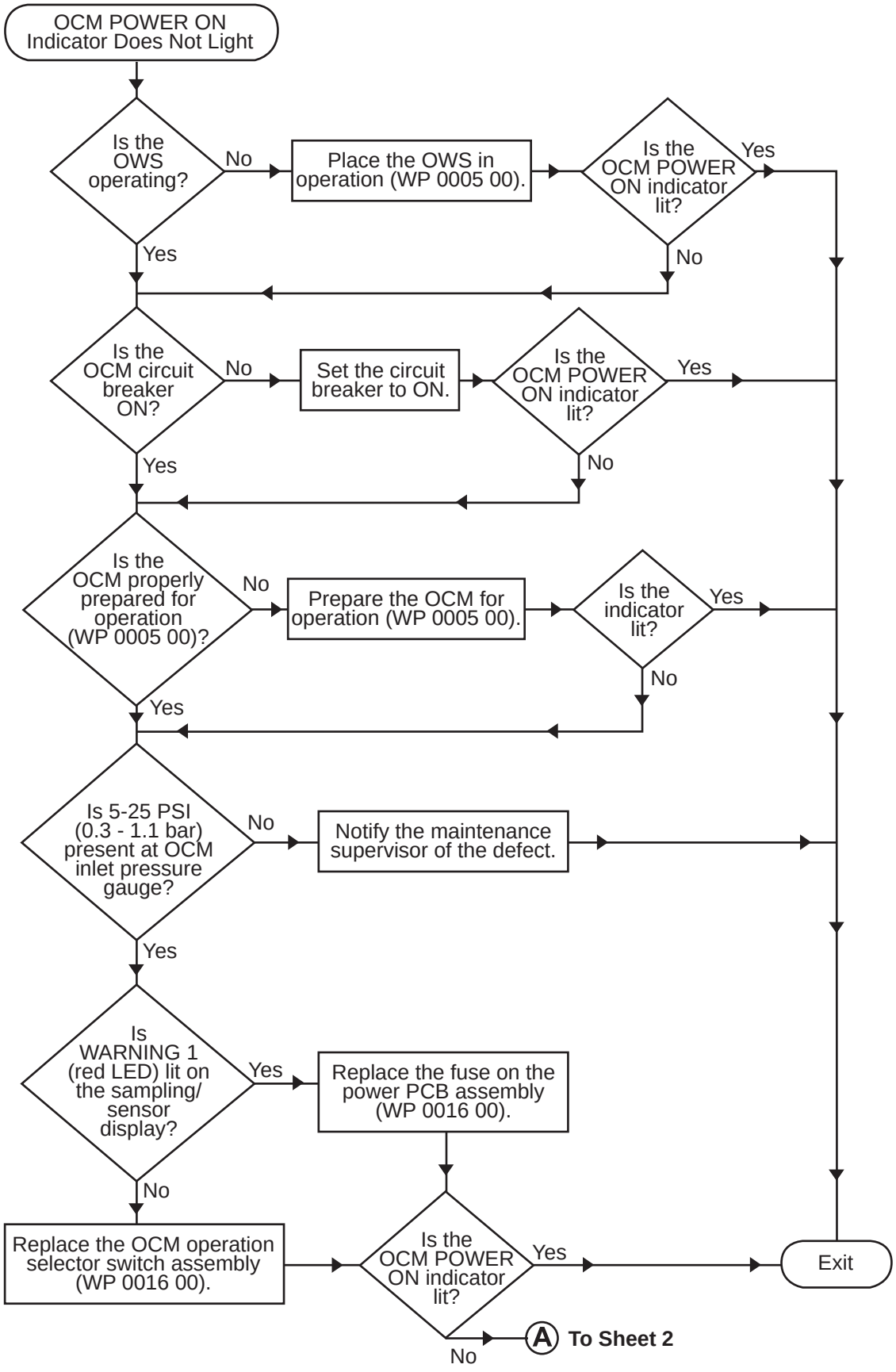
Procedure 9. Oil Does Not Discharge (Backflush) From OWS (Sheet 1 of 2)



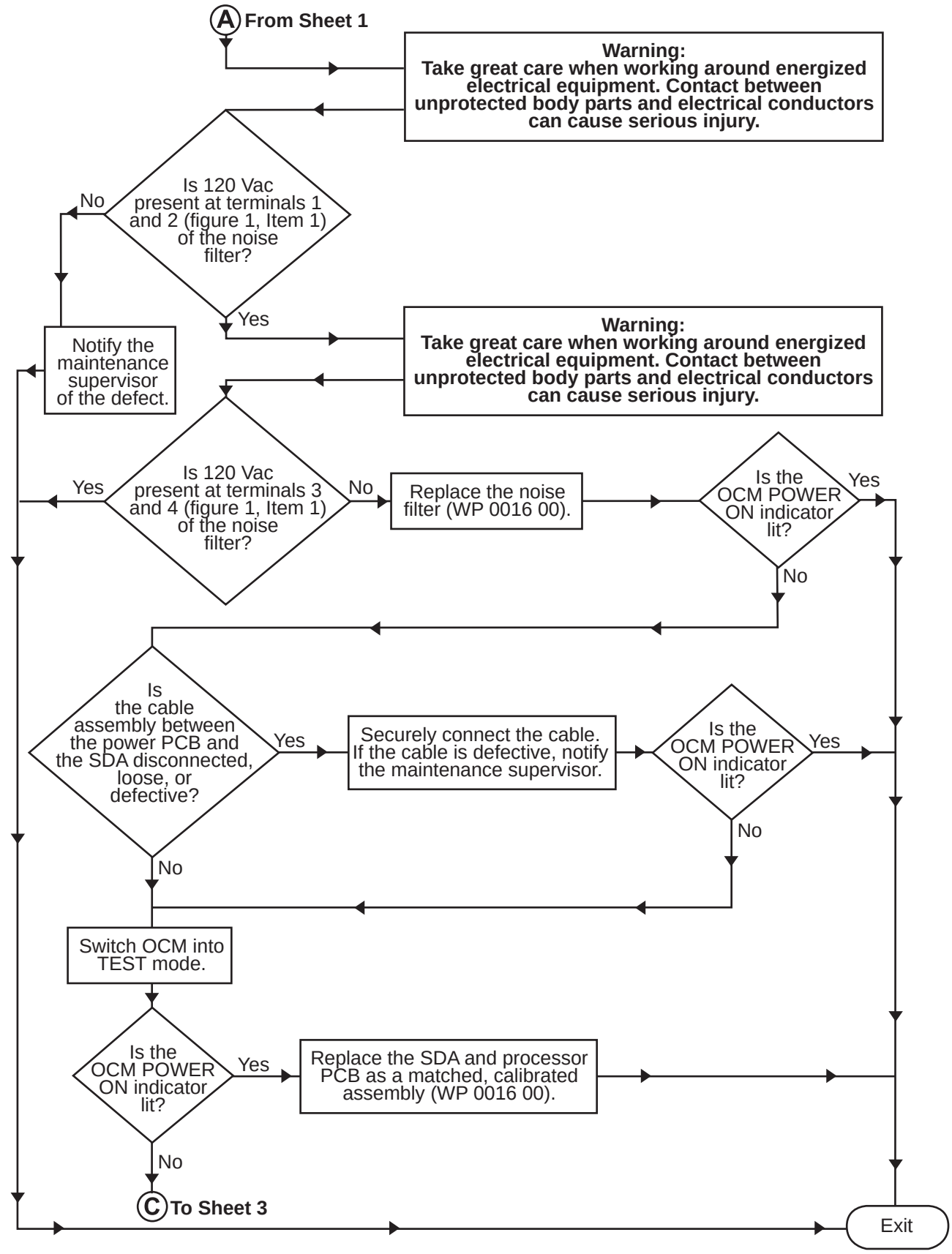
Procedure 9. Oil Does Not Discharge (Backflush) From OWS (Sheet 2 of 2)



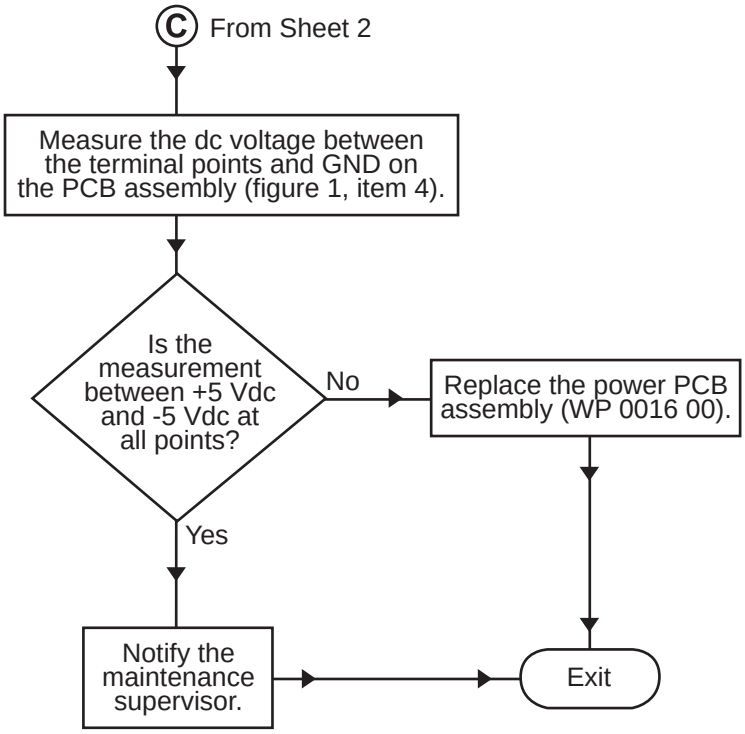
Procedure 10. Pump Noisy



Procedure 11. OCM POWER ON Indicator Does Not Light (Sheet 1 of 3)



Procedure 11. OCM POWER ON Indicator Does Not Light (Sheet 2 of 3)



Procedure 11. OCM POWER ON Indicator Does Not Light (Sheet 3 of 3)

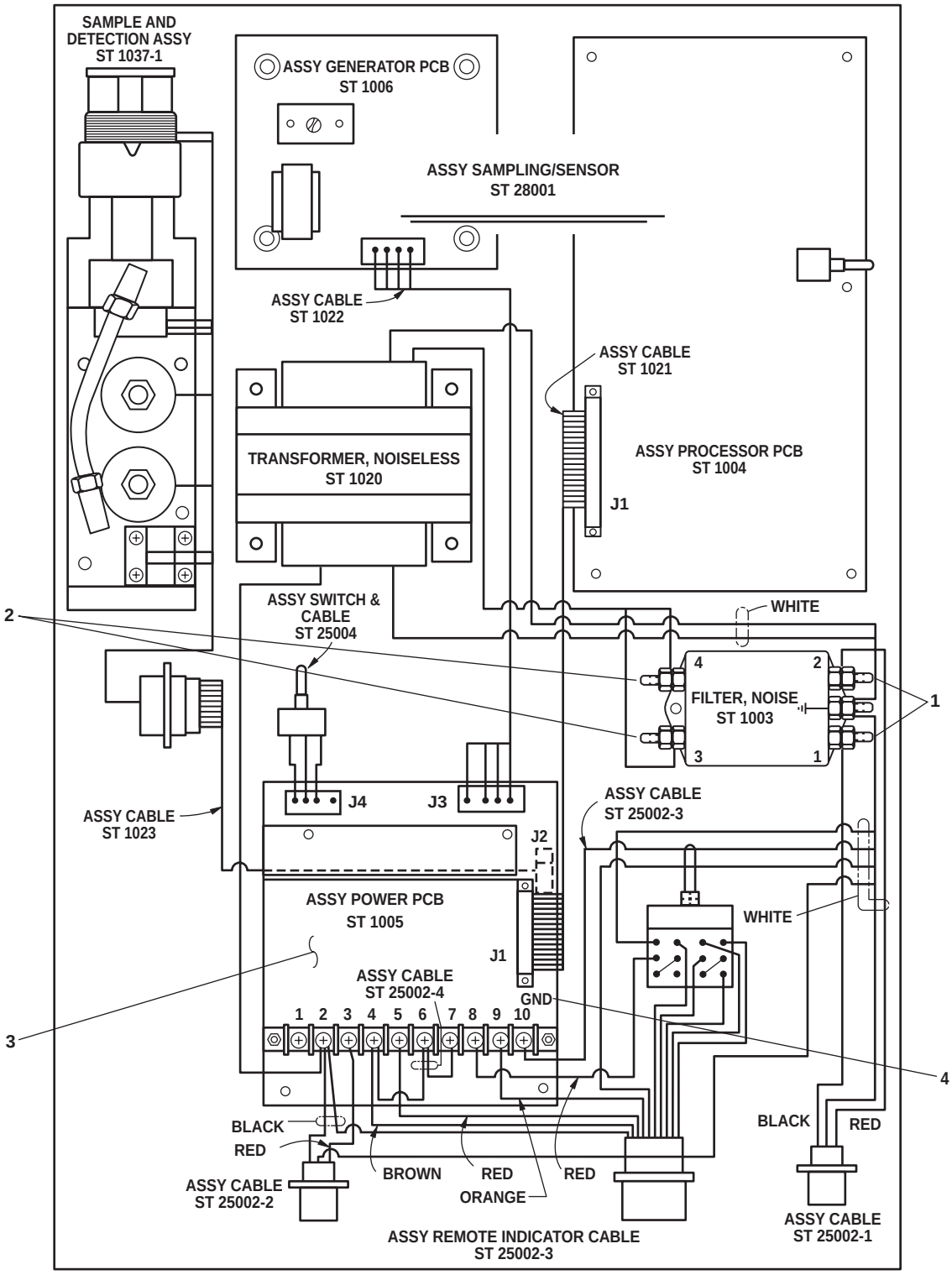
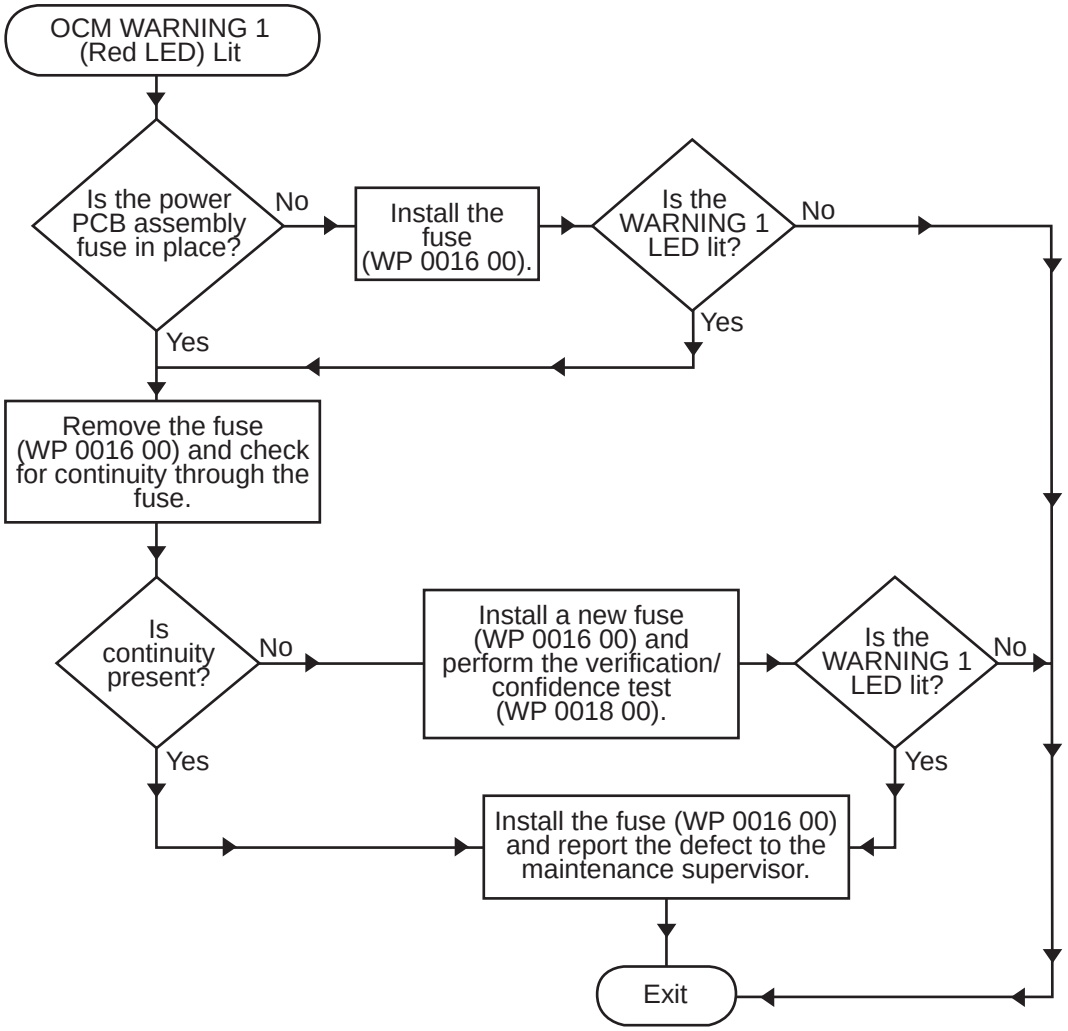
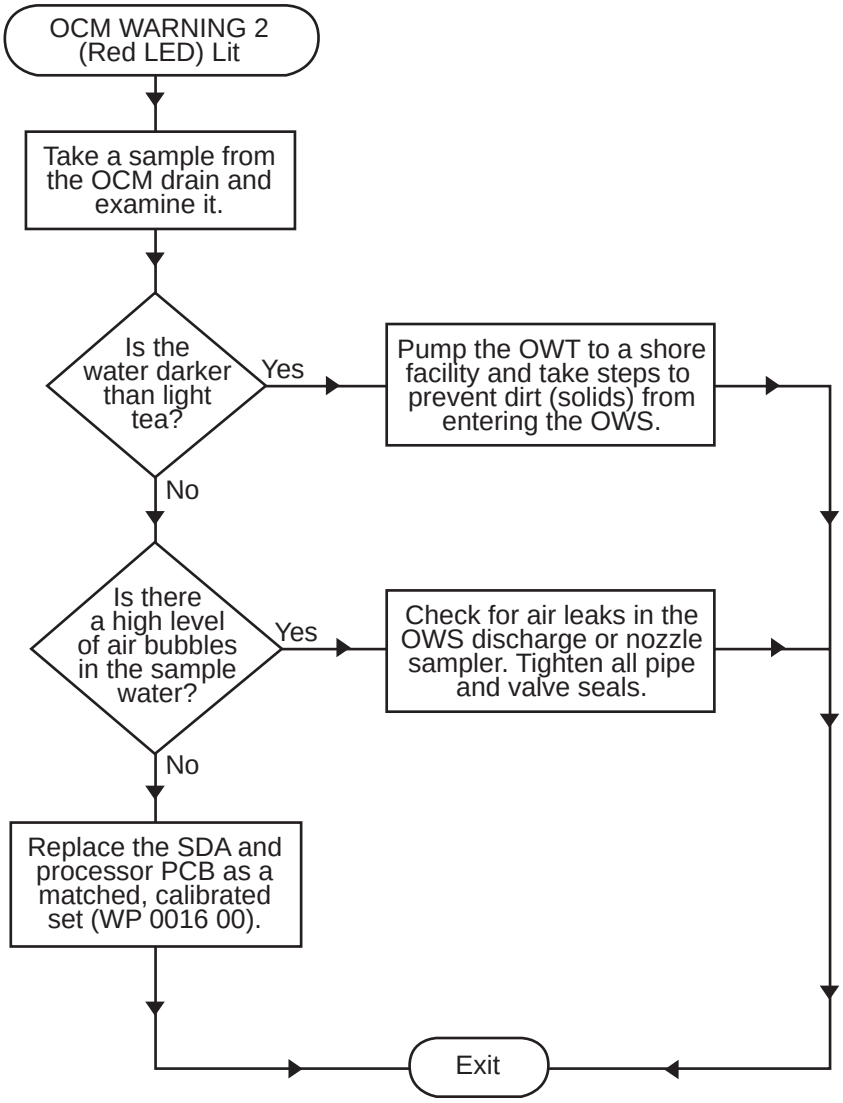


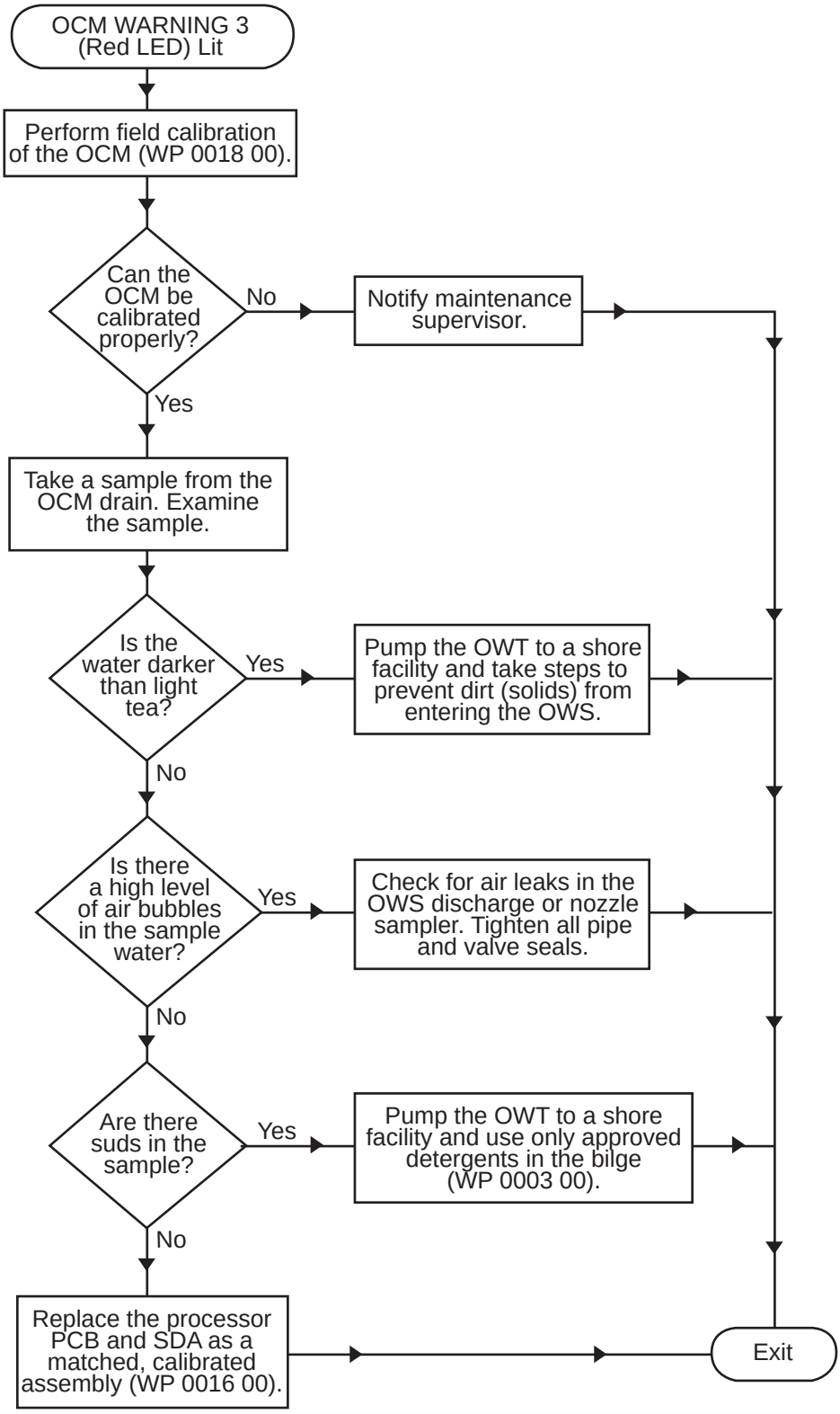
Figure 1. OCM Sampling/Sensor Assembly Wiring Diagram



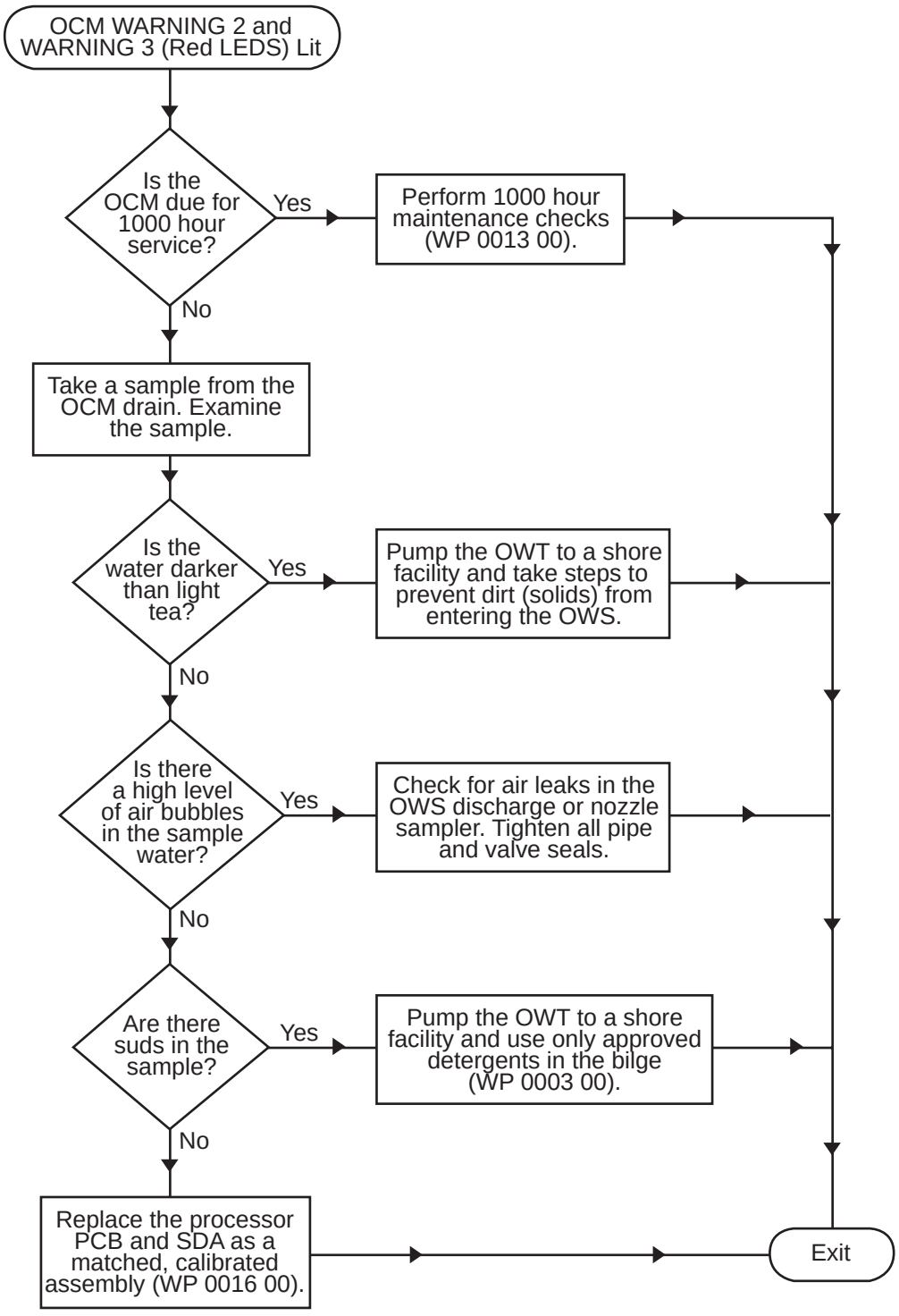
Procedure 12. OCM WARNING 1 (Red LED) Lit



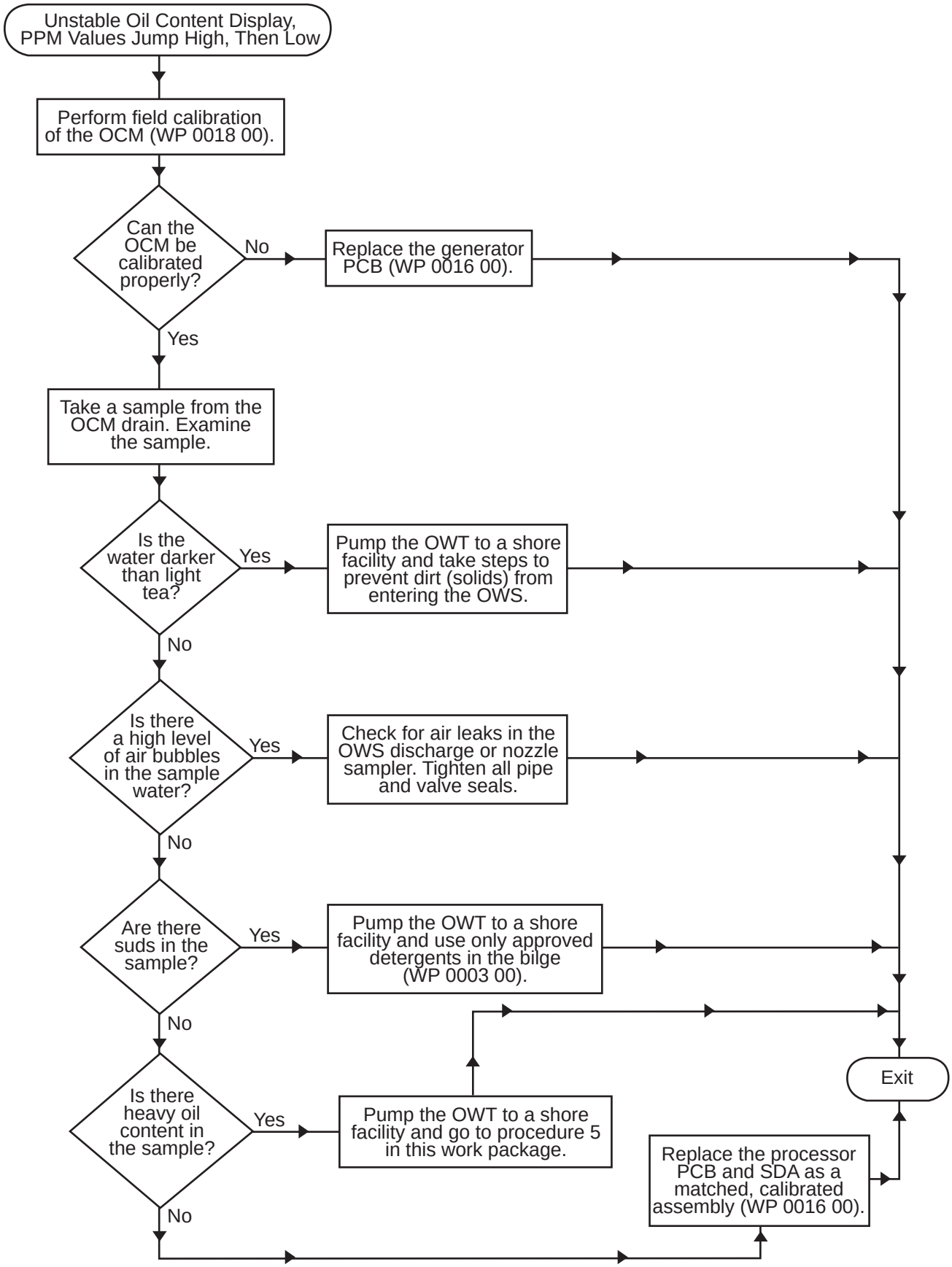
Procedure 13. OCM WARNING 2 (Red LED) Lit



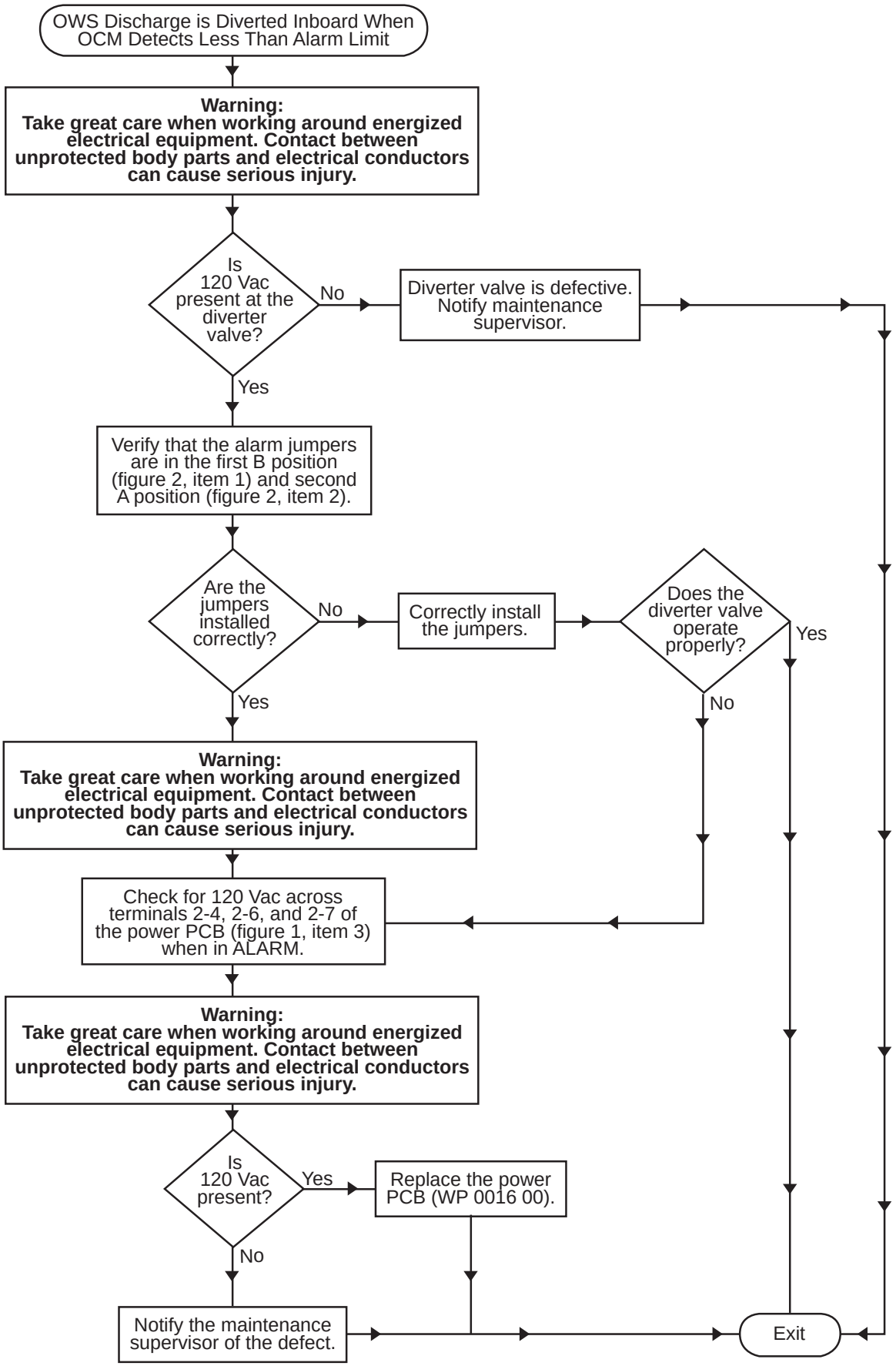
Procedure 14. OCM WARNING 3 (Red LED) Lit



Procedure 15. OCM WARNING 2 And WARNING 3 (Red LEDs) Lit



Procedure 16. Unstable Oil Content Display, PPM Valves Jump High, Then Low



Procedure 17. OWS Discharge Is Diverted Inboard When OCM Detects Less Than Alarm Limit

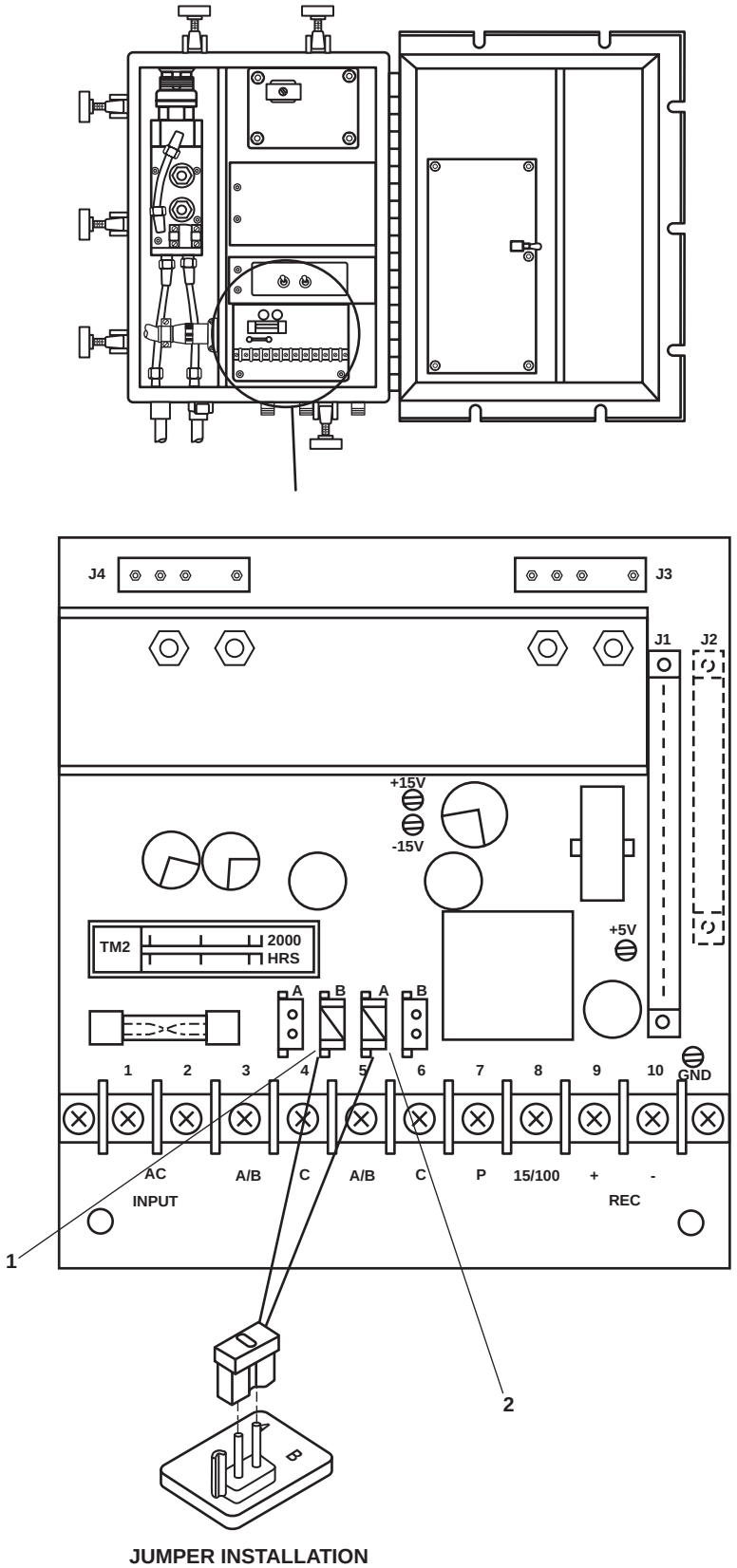
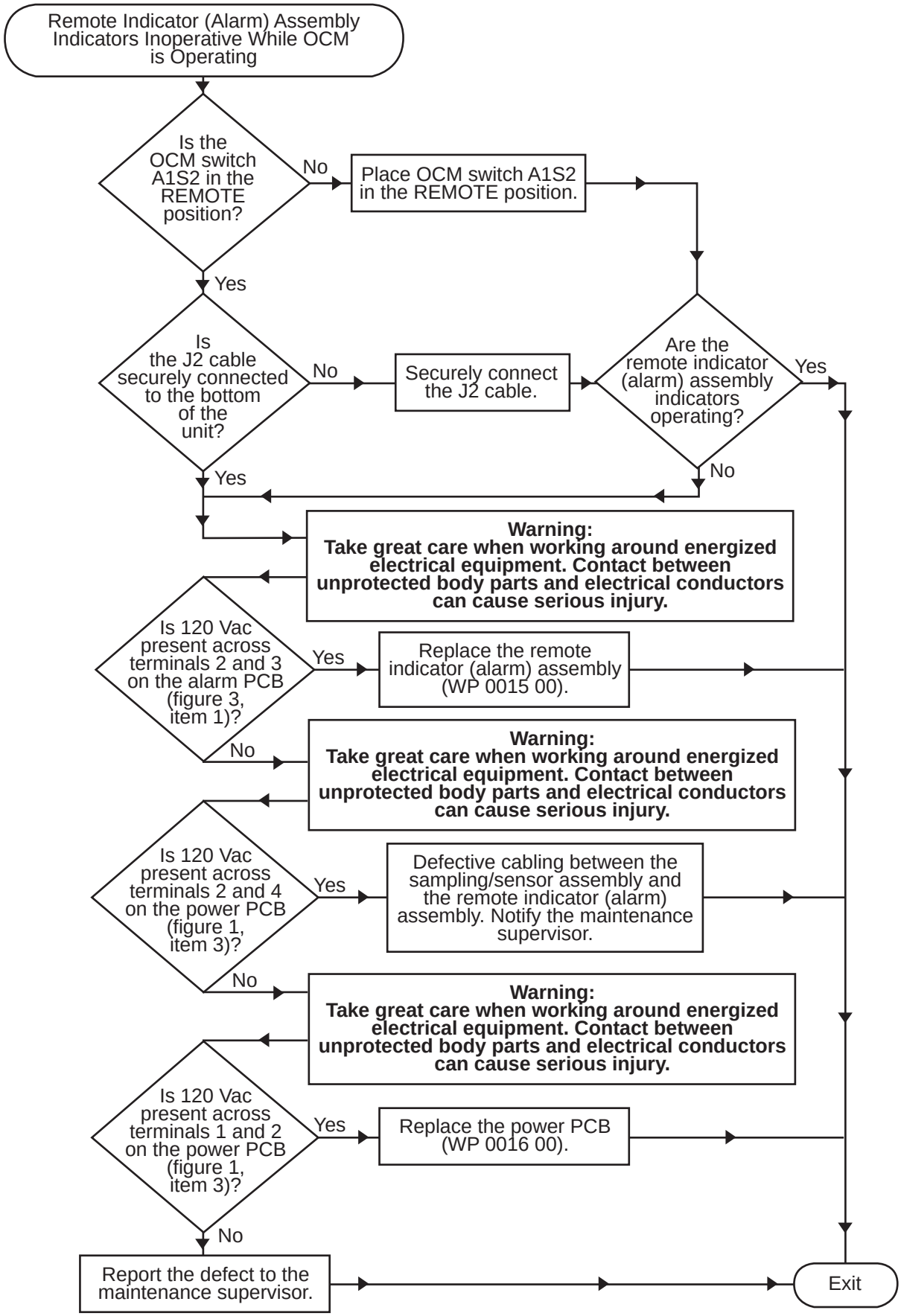


Figure 2. Sampling/Sensor Assembly, Power PCB Jumper Installation



Procedure 18. Remote Indicator (Alarm) Assembly Indicators Inoperative While OCM Is Operating

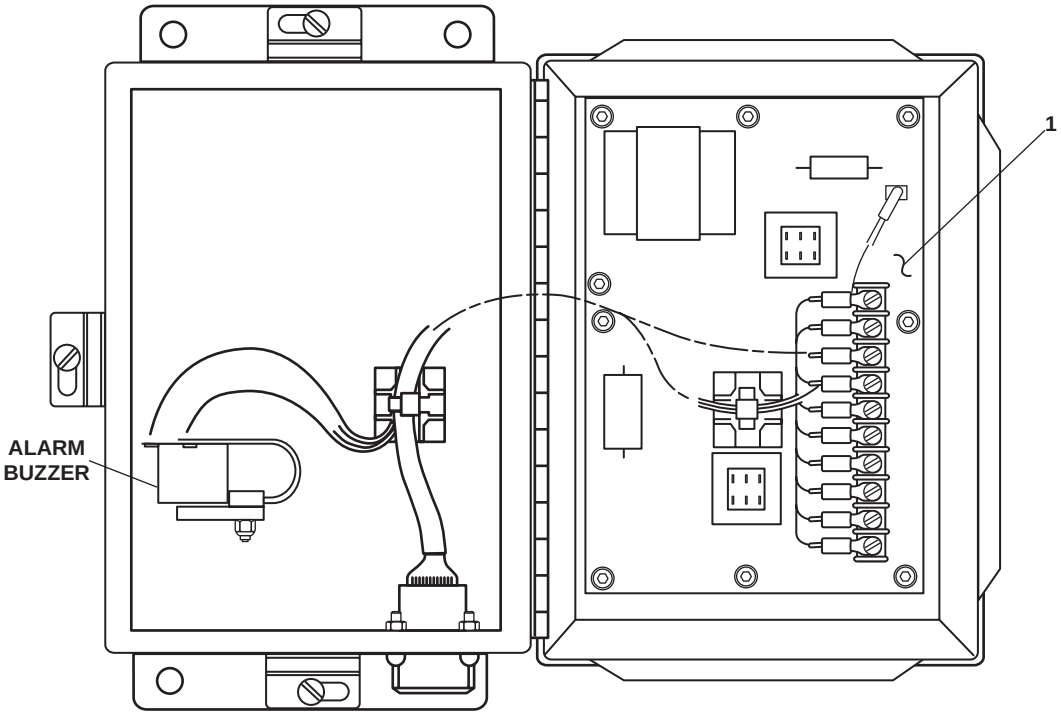
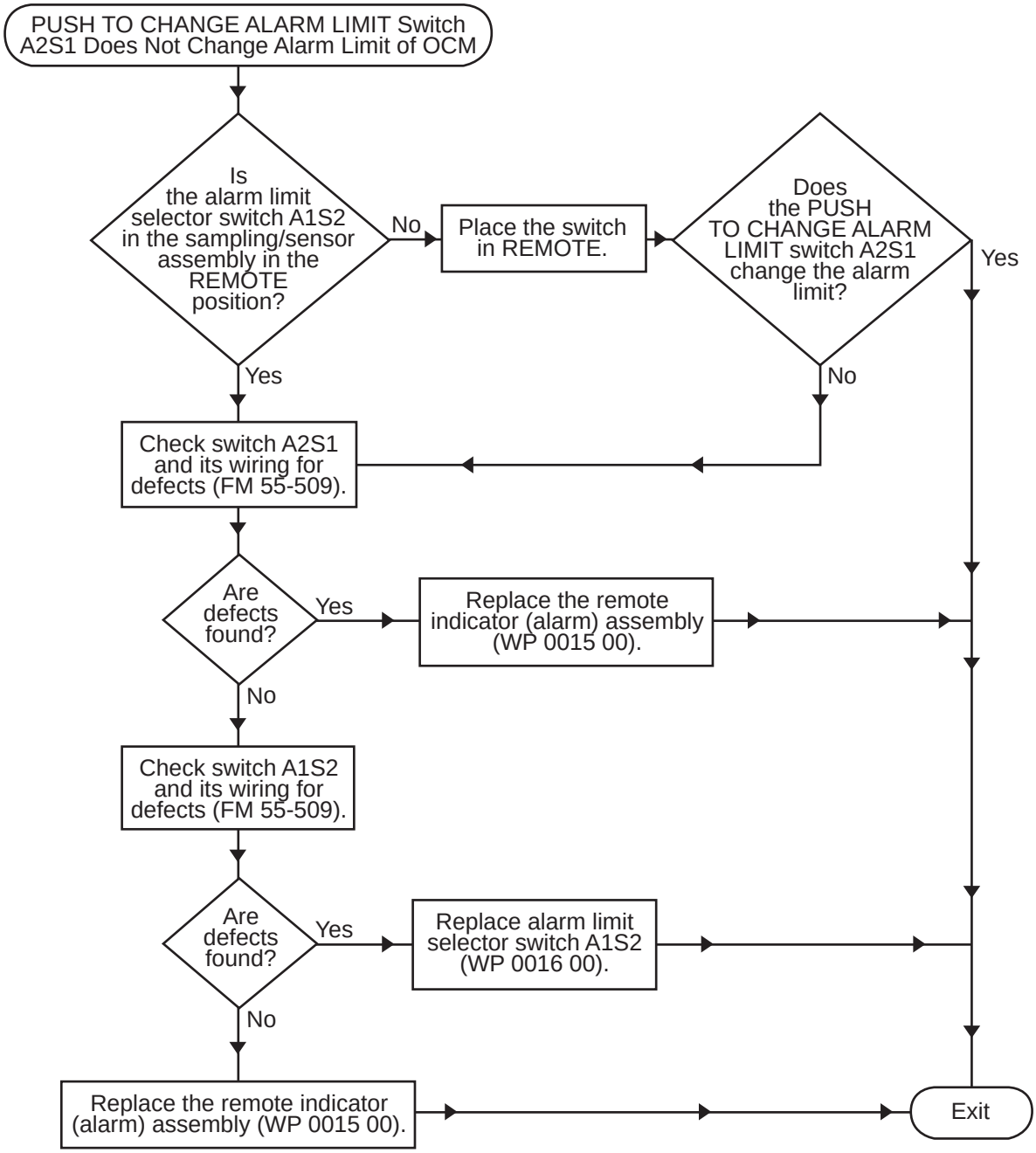
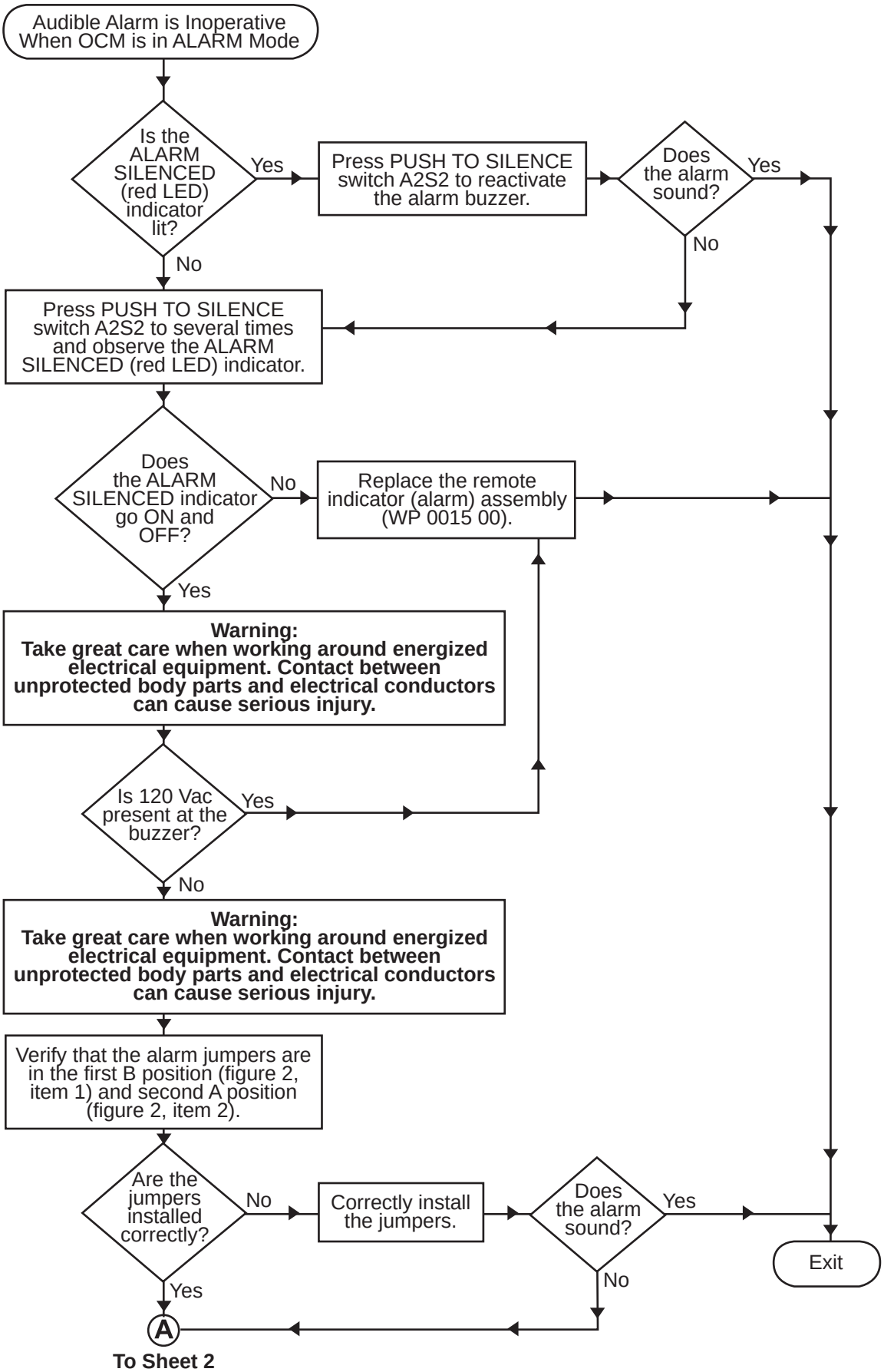


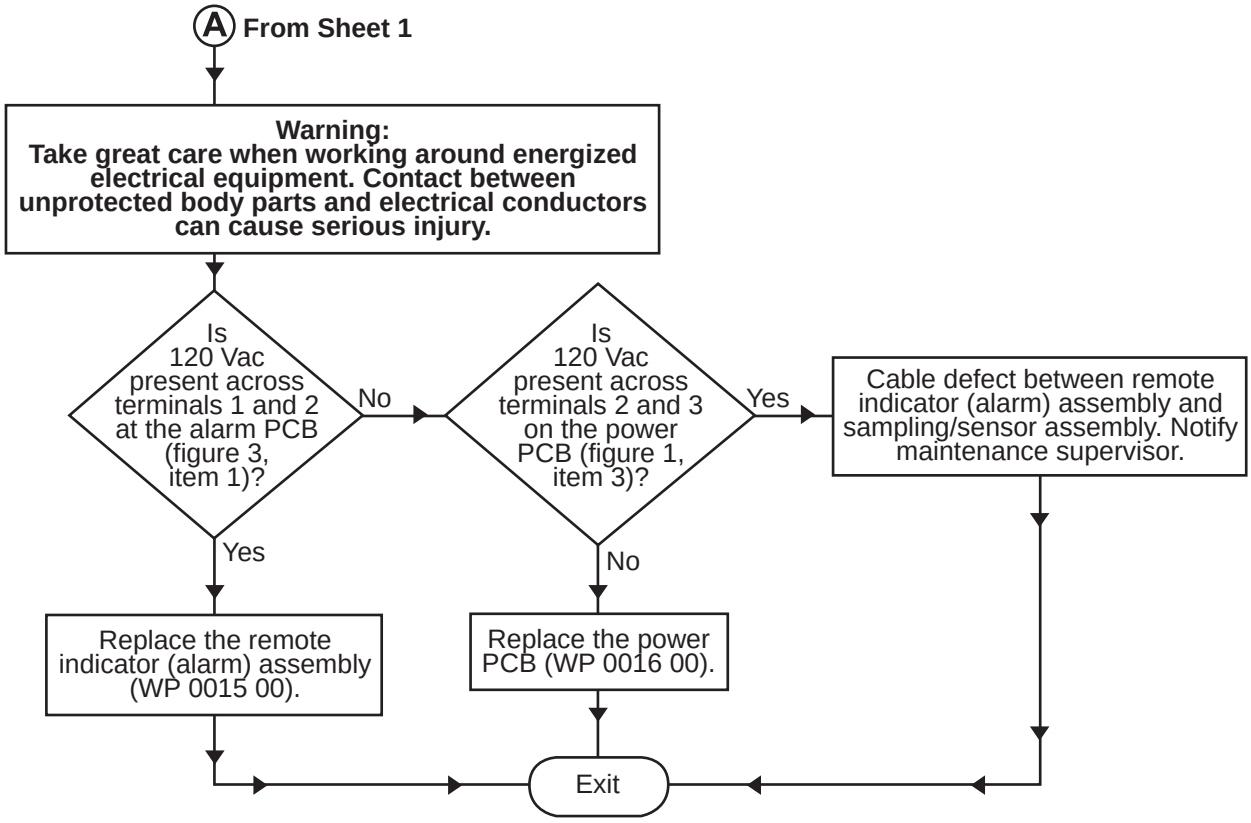
Figure 3. Remote Indicator (Alarm) Assembly



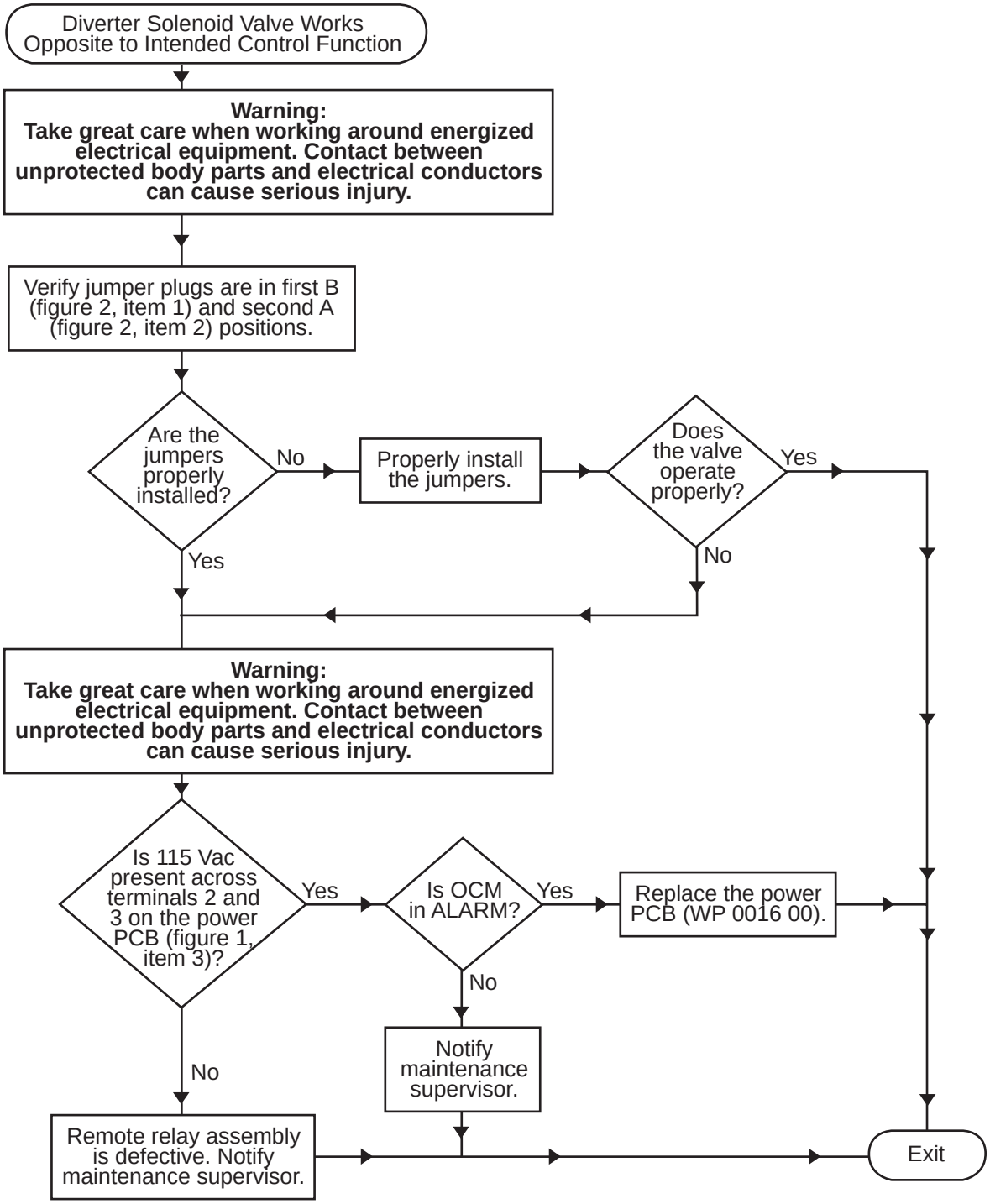
Procedure 19. PUSH TO CHANGE ALARM LIMIT Switch A2S1 Does Not Change Alarm Limit Of OCM



Procedure 20. Audible Alarm Inoperative When OCM Is In ALARM Mode (Sheet 1 of 2)



Procedure 20. Audible Alarm Inoperative when OCM Is In ALARM Mode (Sheet 2 of 2)



Procedure 21. Diverter Solenoid Valve Works Opposite To Intended Control Function

END OF WORK PACKAGE

Chapter 4

Maintenance Instructions for Oil Water Separator

Inland and Coastal Large Tug (LT)

OPERATOR AND UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
SERVICE UPON RECEIPT AND PREPARATION FOR STORAGE

INITIAL SETUP:

References:
TB 740-97-4
WP 0012 00
WP 0013 00

SERVICE UPON RECEIPT

SHELTER REQUIREMENTS

The Oil Water Separator (OWS) and all of its components are mounted out of the weather in the engine room. No further shelter requirements apply to this unit.

PRELIMINARY SERVICING OF EQUIPMENT AND PRELIMINARY CHECKS AND ADJUSTMENTS OF EQUIPMENT

Perform all operator and unit Preventive Maintenance Checks and Services (PMCS) up through and including the annual level. Operator PMCS procedures are contained in WP 0012 00. Unit PMCS procedures are contained in WP 0013 00.

PREPARATION FOR STORAGE OR SHIPMENT

The OWS is prepared for storage or shipment along with the remainder of the Large Tug (LT). Complete instructions for this preparation are contained in TB 740-97-4, Preservation of Vessels for Storage.

END OF WORK PACKAGE

OPERATOR AND UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION

PURPOSE AND USE OF PMCS DATA

PMCS is performed to keep the oil water separator in operating condition. The checks are used to find, correct, and report problems so that defects may be discovered and corrected. PMCS is to be accomplished each day the oil water separator is operated using the appropriate work packages. Pay attention to all WARNINGS, CAUTIONS, and NOTES that precede individual steps. WARNINGS indicate possible danger to personnel. CAUTIONS indicate possible damage to equipment. NOTES are for clarification and additional information. An explanation is prepared for each PMCS check entry, and for any general checks and services common to an entire piece of equipment or system. An explanation of PMCS chart columns follows:

ITEM NUMBER COLUMN

The checks and services are numbered within a specific work package in chronological order.

INTERVAL

This column indicates the periodicity of the check or service.

1. Before oil water separator operation, do Before PMCS.
2. During oil water separator operation, do During PMCS.
3. After oil water separator operation, do After PMCS.
4. Once a week do Weekly PMCS.
5. Do Monthly PMCS once a month. If equipment has not been operated in a month, also do During PMCS at the same time as Monthly PMCS.
6. Do Quarterly PMCS once a quarter. If the equipment has not been operated in a quarter, also do After PMCS at the same time as Quarterly PMCS.
7. Do Semiannual PMCS once every six months. If the equipment has not been operated within the last six months, also do the Monthly PMCS at the same time as Semiannual PMCS.
8. Do Annual PMCS once a year.
9. If a deficiency is noted when performing PMCS, fix it, if possible, using troubleshooting procedures and/or maintenance procedures. If the deficiency cannot be corrected, write up the items not fixed on DA Form 2404 for unit maintenance. For further information on how to use this form, see DA PAM 738-750.

MANHOUR

This column indicates the projected amount of time that is expected to take to complete the check or service. Checks and services that require additional personnel include a cumulative amount of time.

ITEM TO BE CHECKED OR SERVICED

This column lists the equipment or item to be checked or serviced.

PROCEDURE COLUMN

This column contains a brief description of how to perform the checks and services, or it contains the reference to the work package or technical manual that contains the procedural information. Carefully follow the instructions. If the necessary tools are not available, or if the procedure tells you to, have organizational maintenance do the work.

EQUIPMENT NOT READY/AVAILABLE IF

Lists the criteria that will limit the use of equipment, or make it not ready for use. Depending on the severity of the limitation, the oil water separator may not be able to operate and perform its primary mission. The terms "ready/available" and "mission capable" refer to the same status: Equipment is on hand and can perform its combat mission. If tools required to perform PMCS are not listed in the work package, notify unit maintenance. Write up items not fixed on DA Form 2404 for unit maintenance. For further information on how to use this form, see DA PAM 738-750.

DOCUMENTATION OF PMCS ITEM FAILURES

PMCS item failures are to be recorded on DA Form 2404, Equipment Inspection, and Maintenance Worksheet, and forwarded to Unit Maintenance via the vessel's Chief Engineer. Documentation of PMCS item failures must include the compartment location and item number within the work package to ensure proper dissemination. All corrected faults will be recorded on DA Form 4640 (Harbor Boat Deck Department Log for Class A&B Vessels) and DA Form 4993 (Harbor Boat Engine Department Log for Class A and C-1 Vessels). All uncorrected faults will be transcribed to a DA Form 2407, Maintenance Request, and the appropriate log entry must be made. The crew will service the LT as outlined by the intervals contained in the PMCS tables.

CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems be reported so that they can be corrected and improvements made to prevent future problems. Corrosion is typically associated with rusting of metals, but it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of materials may indicate a corrosion problem. Suspected corrosion problems should be reported using SF 368 (Product Quality Deficiency Report). Use of key words such as "corrosion," "rust," "deterioration," or "cracking" will ensure that the information is identified as a CPC problem.

LEAKAGE DEFINITION

⚠ CAUTION

Equipment operation is allowable with minor leakages (Class I or II) except for fuel leaks. Of course, consideration must be given to the fluid capacity of the item or system being checked. When in doubt, ask your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS. Class III leaks should be reported immediately to your supervisor. It is necessary to know how fluid leakage affects the status of the reverse osmosis water purification unit. The following are definitions of the classes of leakage an operator or crewmember needs to know to be able to determine the condition of the leak. Learn and then be familiar with them. When in doubt, ask your supervisor.

LEAKAGE CLASSIFICATIONS I, II, III

Leakage classifications. Leakage definitions for operator/crew PMCS shall be classified as follows:

1. Class I: Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

2. Class II: Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.

3. Class III: Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

INSPECTION

Look for signs of a problem or trouble. Senses help here. You can feel, smell, hear, or see many problems. Be alert when on the vessel. Inspect to see if items are in good condition. Are they correctly assembled, stowed, secured, excessively worn, leaking, corroded, or properly lubricated? Correct any problems found or notify unit maintenance. There are some common items to check all over the oil water separator. These include the following:

1. Bolts, clamps, nuts, and screws: Continuously check for looseness. Look for chipped paint, bare metal, rust, or corrosion around bolt and screw heads and nuts. Tighten them when you find them loose. If tools are not available, notify unit maintenance.

2. Welds: Many items on the oil water separator are welded. To check these welds, look for chipped paint, rust, corrosion, or gaps. When these conditions exist, notify unit maintenance on DA Form 2404.

3. Electrical wires, connectors, and harnesses: Tighten loose connectors. Look for cracked or broken insulation, bare wires, and broken connectors. If any are found, notify unit maintenance.

4. Hoses and fluid lines: Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots mean a leak. A stain by a fitting or connector can also mean a leak. When you find a leak, notify unit maintenance.

GENERAL STATEMENT OF LUBRICATION REQUIREMENTS

Any lubricants called out by PMCS in this manual are identified by standard military symbols IAW MIL-HDBK-113 and MIL-HDBK-275.

LUBRICATION SERVICE INTERVALS - NORMAL CONDITIONS

For safer, more trouble free operations, make sure that your oil water separator is serviced when it needs it. For the proper lubrication and service intervals, see WP 0012 00 and WP 0013 00.

LUBRICATION SERVICE INTERVALS - UNUSUAL CONDITIONS

The oil water separator may require extra service and care when it is operated under unusual conditions. High or low temperatures, long periods of hard use, or continued use in a dirty environment will break down the lubricants and fluids, requiring more frequent service.

LUBRICATION UNIVERSALS

1. Always clean fittings before lubricating them. Failure to do so can force contaminants into the bearing.

2. Always use the PMCS work packages as the guide for lubrication.

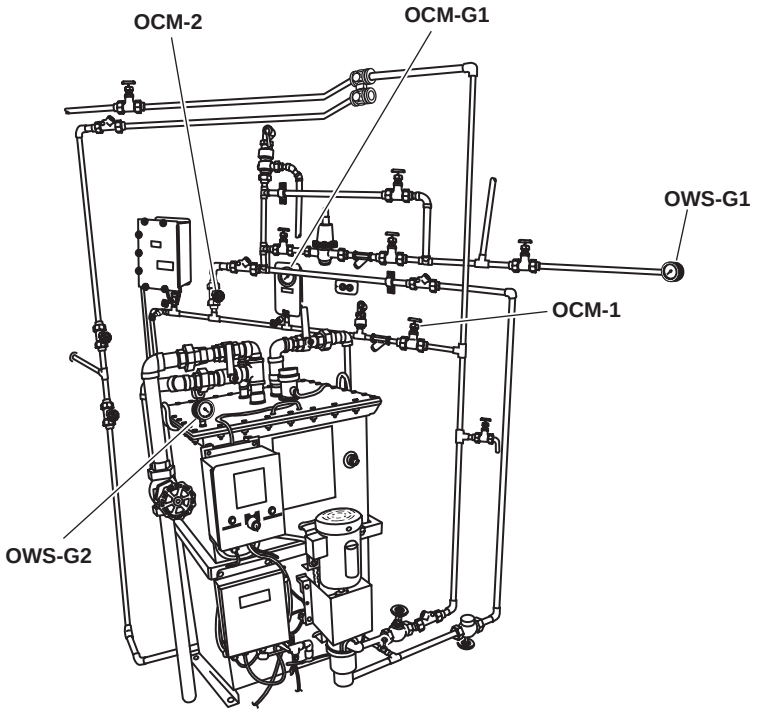
3. Never use the wrong type/grade of lubricant.

4. Never use too much lubricant.

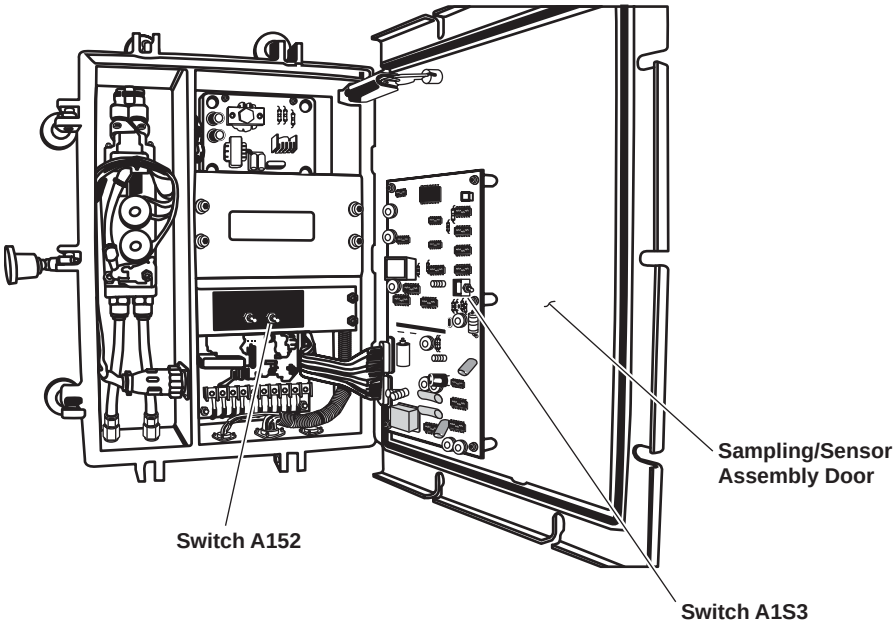
END OF WORK PACKAGE

OPERATOR MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES INCLUDING LUBRICATION

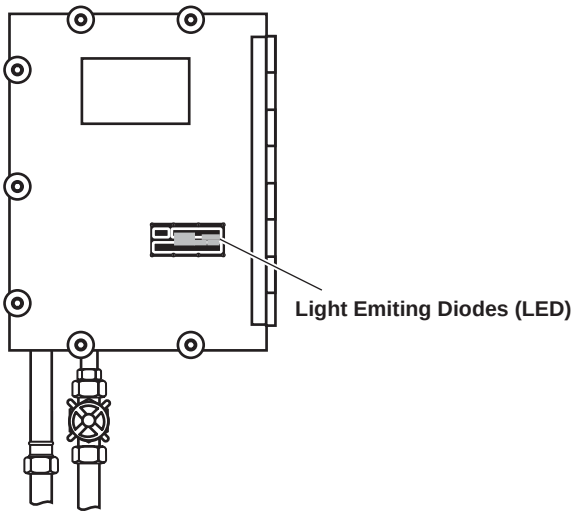
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	During	0.1	OWS Vessel Pressure	Gauge OWS-G2 (on top of OWS vessel) reads less than 25 inHg (635 mmHg).	Reading above 25 $in^{H}g$ (635mmHg)
2	During	0.1	Raw Water to OWS	Pressure Gauge OWS-G1 reads less than 15 PSI (1.0 bar).	Reading above 15 PSI (1.0 bar)
3	During	0.1	OCM Inlet Pressure	Gauge OCM-G1 reads less than 20 PSI (1.4 bar).	Reading above 20 PSI (1.4 bar)
4	Weekly	0.3	Operational Check and System Flush	CLOSE OCM nozzle sampler cutoff valve (OCM-1) and OPEN OCM backflush water valve (OCM-2). (WP 0004 00). Flush water through OCM for 15 minutes.	



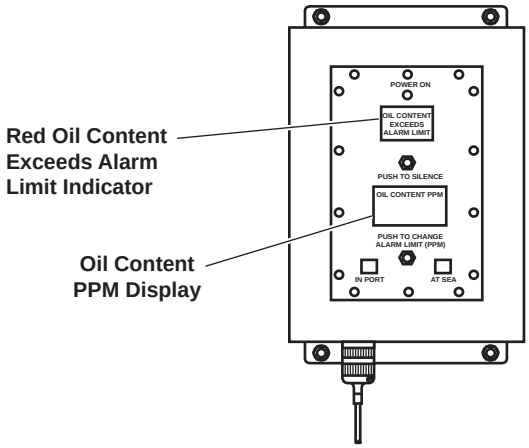
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
5	Weekly	0.1	Zero PPM Check	Set the ALARM LIMIT (A1S2) switch to 15 PPM range (WP 0004 00) while performing the flush in item 4 above. The oil content should show a stable 0 to 3 ppm oil content reading.	The display does not stabilize at 0 to 3 ppm.
6	Weekly	0.1	Alarm Check	After a stable 0 to 3 ppm reading is displayed in the zero ppm check, OPEN the sampling/sensor assembly door. a. Hold the ALARM CHECK (A1S3) switch on the processor PCB within the sampling/sensor assembly door UP in the CHECK ON position for 90 seconds and observe the following:	The display does not react as expected.



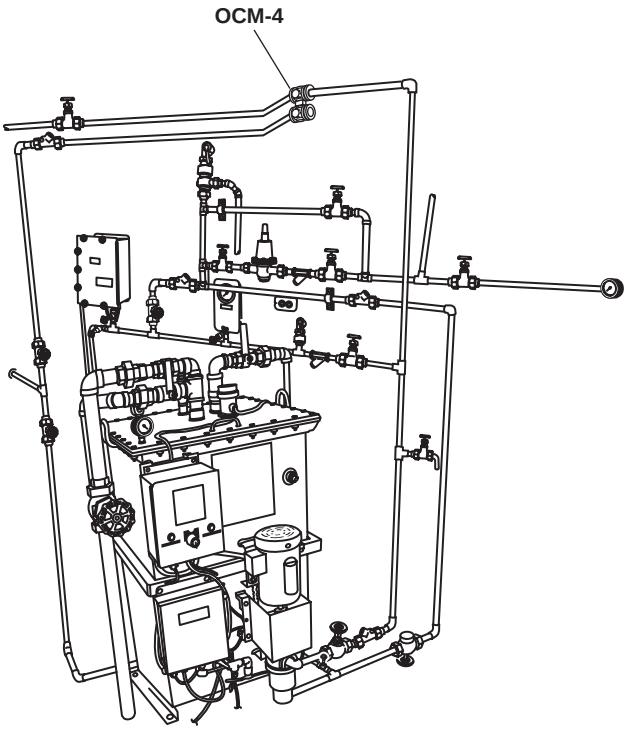
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				(1) Within 20 seconds, the sampling/sensor assembly's red and green LEDs will begin to flash.	



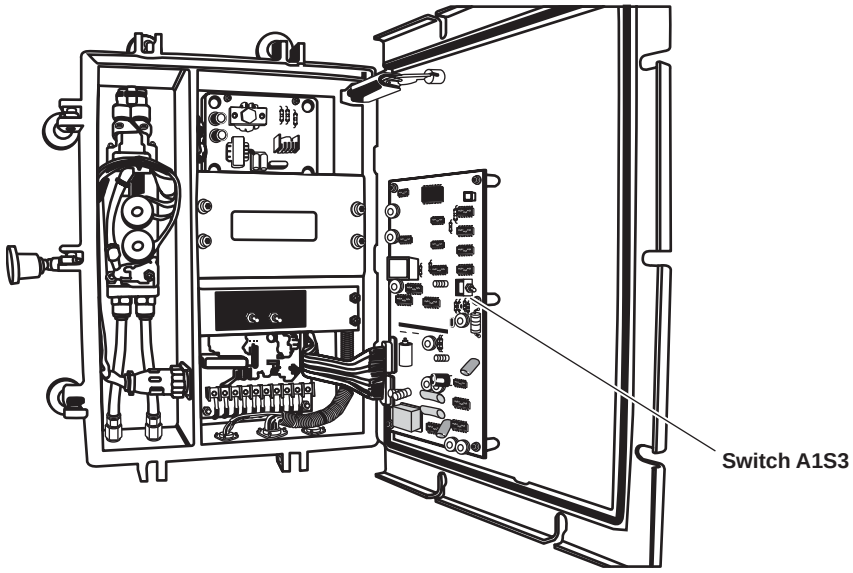
(2) Within 20 seconds, the OCM remote indicator alarm assembly's red OIL CONTENT EXCEEDS ALARM LIMIT indicator will light up, a high numerical PPM value will be displayed on the OIL CONTENT PPM display, and the audible alarm will buzz.



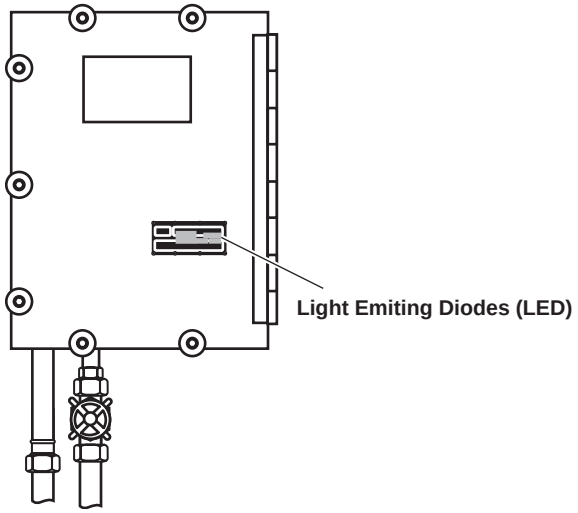
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				(3)Within 80 seconds, the diverter valve OCM-4 will actuate and switch positions from overboard discharge to recirculate to the oily waste holding tank.	



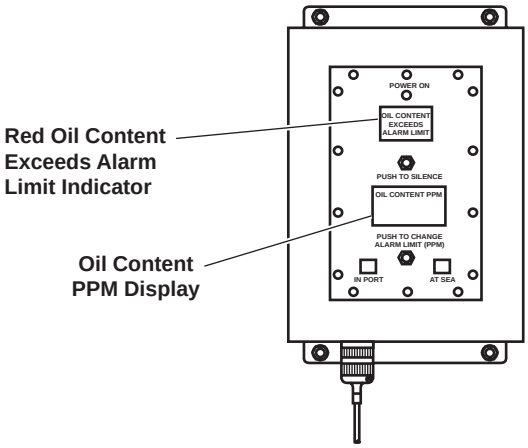
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				b. Release the sampling/sensor assembly's ALARM CHECK (A1S3) switch and verify that the following occur:	



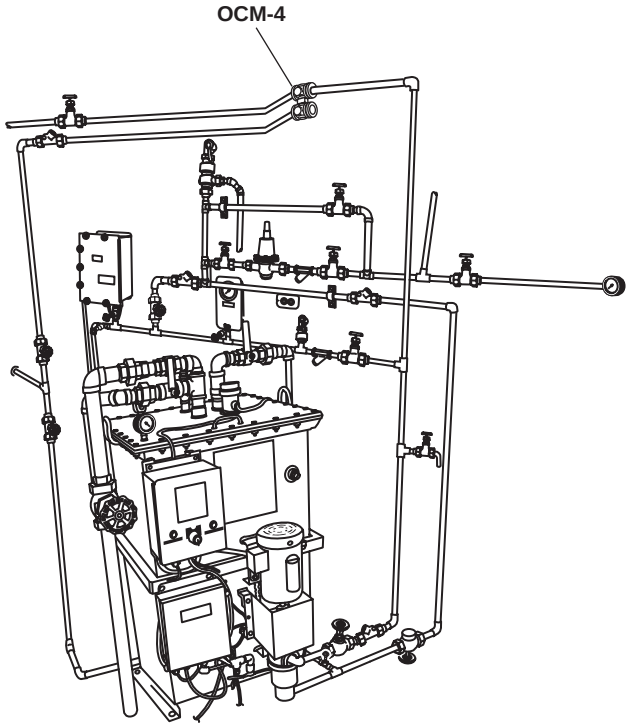
(1) The sampling/sensor assembly's red and green LEDs stop flashing and display a low level reading (0 to 3 ppm).



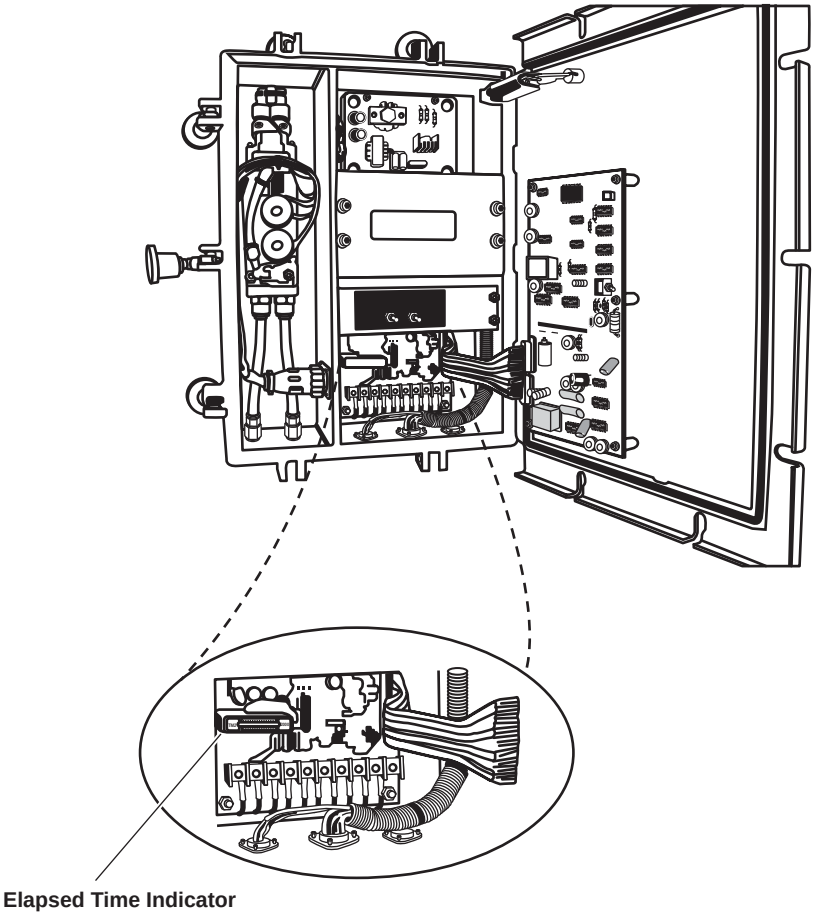
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				(2) The OCM remote indicator alarm assembly buzzer silences, and the OIL CONTENT PPM display shows a low level reading (0 to 3 ppm).	



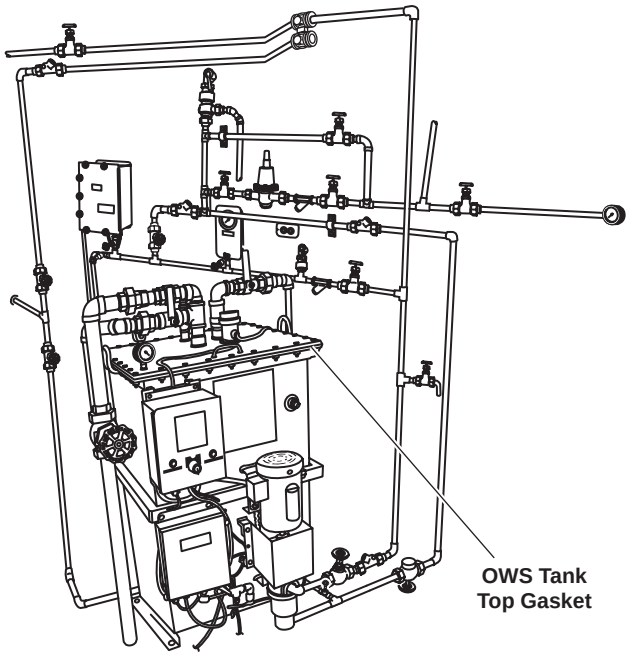
				(3) The diverter solenoid valve OCM-4 will change position from recirculate to overboard discharge.	



ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
7	Weekly	0.1	Elapsed Time Check	Check the elapsed time indicator. Maintenance is required every 500 hours. Notify unit maintenance if any multiple of 500 hours (e.g., 500, 1000, 1500, 2000) is indicated.	
8	Annually	5.0	Coalescer Beads	Replace the coalescer beads (WP 0014 00).	



ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
9	Annually	0.2	OWS Tank Top Gasket	Inspect the OWS tank top gasket. Replace the gasket (WP 0014 00) if any cracks, breaks, or deterioration are present.	Gasket is damaged.



END OF WORK PACKAGE

UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES INCLUDING LUBRICATION

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	Annually	0.2	Oil Water Separator (OWS).	Refer to DS Maintenance for Inspection of the OWS tank interior. The tank interior shall be continuous with no cracks, peeling, or chips.	Tank interior is cracked, peeling, or chipped.
2	500 Hours	0.5	Field Calibration	Perform field calibration of the Oil Content Monitor (OCM) (WP 0018).	OCM cannot be field calibrated.
3	1000 Hours	3.0	Sampling and Detection Sub-Assembly (SDA) and Processor Printed Circuit Board (PCB)	Replace the SDA and the processor PCB (WP 0016 00) as a matched calibrated set.	
4	1500 Hours	0.5	Field Calibration	Perform field calibration of the OCM (WP 0018).	OCM cannot be field calibrated.
5	2000 Hours	3.0	SDA, Processor PCB, Elapsed Time Indicator (ETI)	Replace the SDA and the processor PCB, (WP 0016 00) as a matched, calibrated set. Replace the ETI (WP 0016 00).	

END OF WORK PACKAGE

Chapter 5

Operator Maintenance Instructions for Oil Water Separator

Inland and Coastal Large Tug (LT)

OPERATOR MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OIL WATER SEPARATOR, SERVICE

INITIAL SETUP:

Tools and Special Tools:
- Tool Kit, General Mechanic's (Item 1, Table 2, WP 0023 00)
- Funnel, Steel w/Strainer, 1 GAL (Item 5, Table 2, WP 0023 00)
- Suitable Screen Covered Drain Pan

Materials/Parts:
- Dry Cleaning Solvent (Item 2, Table 1, WP 0027 00)
- Gloves, Chemical and Oil Protective (Item 1, Table 3, WP 0026 00)
- Goggles, Industrial (Item 4, Table 3, WP 0026 00)
- Isopropyl Alcohol (Item 4, Table 1, WP 0027 00)
- Rags, Wiping (Item 6, Table 1, WP 0027 00)
- Tag, Danger (Item 10, Table 1, WP 0027 00)
- Tape, Antiseizing (Item 11, Table 1, WP 0027 00)
- Coalescer Beads (Item 6, Figure 1 WP 0025 00)

Materials/Parts (continued):
- Gasket, Coalescer (Item 7, Figure 1, WP 0025 00)
- Gasket, Tank (Item 5, Figure 1, WP 0025 00)

Personnel Required:
- Two Watercraft Engineers, 88L

References:
- FM 55-502
- WP 0005 00
- WP 0006 00
- WP 0023 00
- WP 0025 00
- WP 0026 00
- WP 0027 00

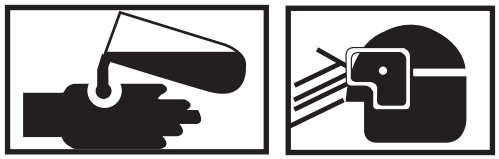
Equipment Conditions:
- Set to OFF the OILY WATER SEPARATOR circuit breaker in the 120V distribution panel No. 4. Lock out and tag out (FM 55-502).

DISASSEMBLY

1. Align the Oil Water Separator (OWS), the Oily Bilge (OB), and Oil Content Monitor (OCM) valves as indicated in table 1 and figure 1.

2. Place a suitable screen covered drain pan under the OWS outlet piping (figure 2, item 1).

WARNING



Do not allow oily water to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling oily water. Failure to follow these precautions can result in illness or serious injury.

Oily water hoses and lines may be under pressure. Loosen connection fittings on hoses and lines slowly. Allow oily water to run around threads of the connection fittings, releasing pressure before disconnecting the union. Releasing pressurized oily water suddenly may cause severe personal injury.

3. Slowly loosen the drain plug (figure 2, item 2) in the OWS outlet piping (figure 2, item 1) and allow any trapped pressure to escape.

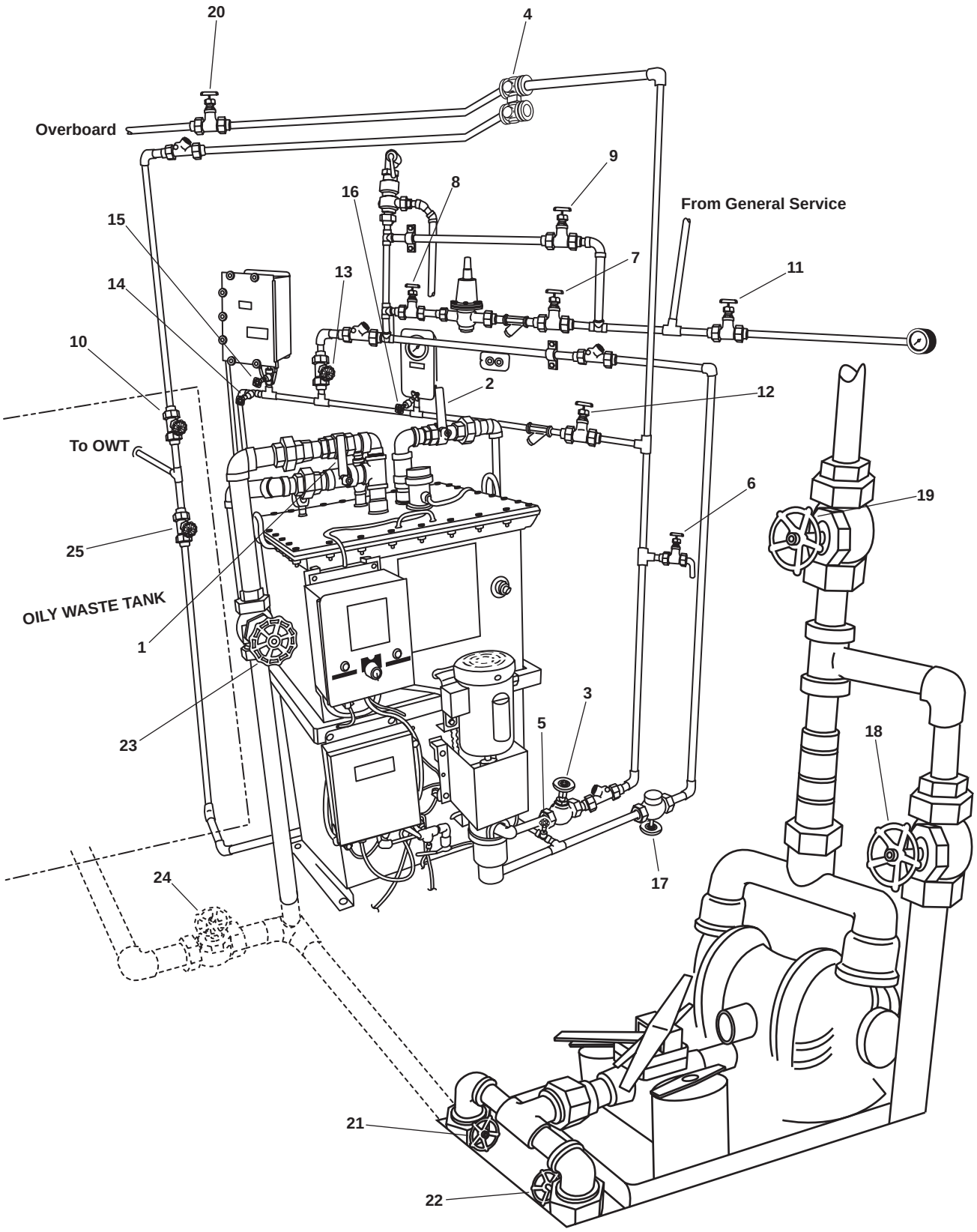


Figure 1. OWS, OB, and OCM Piping

Table 1. Valve Positions During OWS Service

Item Number (Figure 1)	Valve Number	Function	Position During Operation Under Usual Conditions
1	OWS-1	OWS MANUAL BACKFLUSH	CLOSED
2	OWS-2	OWS DISCHARGE	CLOSED
3	OWS-3	OWS PUMP DISCHARGE	CLOSED
4	OWS-4	OCM 3-WAY DIVERTER	Controlled by OCM
5	OWS-5	OWS DISCHARGE	CLOSED
6	OWS-6	OWS PITOT SAMPLE	CLOSED
7	OWS-7	BACKFLUSH WTR TO PRESS RDCR	CLOSED
8	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	CLOSED
9	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
10	OWS-10	OWS RECIRCULATING COV	CLOSED
11	OWS-24	SW TO OWS PRESS GAGE ISOLATION	CLOSED
12	OCM-1	OCM NOZZLE SAMPLER COV	CLOSED
13	OCM-2	OCM BACKFLUSH WATER	CLOSED
14	OCM-3	OCM SAMPLING VALVE	CLOSED
15	OCM-4	OCM INLET	CLOSED
16	OCM-8	OCM GAGE ISOLATION	CLOSED
17	GS-74	OWS BACKFLUSH INLET SOLENOID	Automatic (Ensure that the manual override handle is in the CLOSED position (CCW) with the valve stem all the way out)
18	OB-8	XFR PUMP TO OILY WATER TANK	CLOSED
19	OB-9	XFR PUMP DISCH TO SHORE	CLOSED
20	OB-10	OWS OVERBOARD DISCHARGE	CLOSED
21	OB-13	OWT TO XFR PUMP SUCTION	CLOSED
22	OB-14	COV-XFR PUMP SUCTION	CLOSED
23	OB-15	OWS INLET	CLOSED
24	OB-16	WATER FROM OWT COV	CLOSED
25	OB-17	OILY WATER TANK INLET	CLOSED

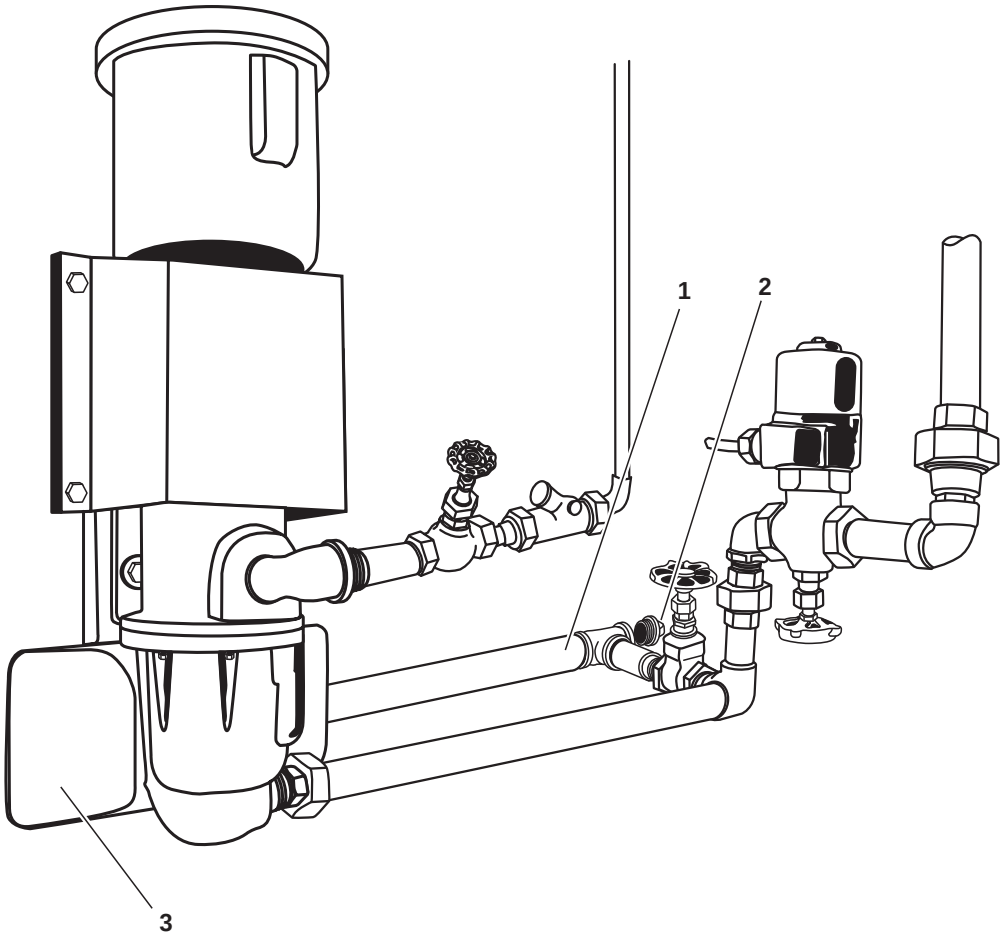


Figure 2. OWS Outlet Piping

4. Remove the drain plug (figure 2, item 2) from the OWS outlet piping (figure 2, item 1) and allow the OWS tank (figure 2, item 3) to drain.

⚠ CAUTION

Failure to use two wrenches while loosening pipe fittings, couplings, and valves may cause damage to the valves, fittings, couplings, and piping.

5. Slowly loosen the union (figure 3, item 1) and allow any trapped pressure to escape. Disconnect the union after all the pressure has escaped.

6. Disconnect the unions (figure 3, items 2, 3, and 4).

7. Remove the cap (figure 3, item 5) and label and disconnect the interface sensor cable (figure 3, item 6).

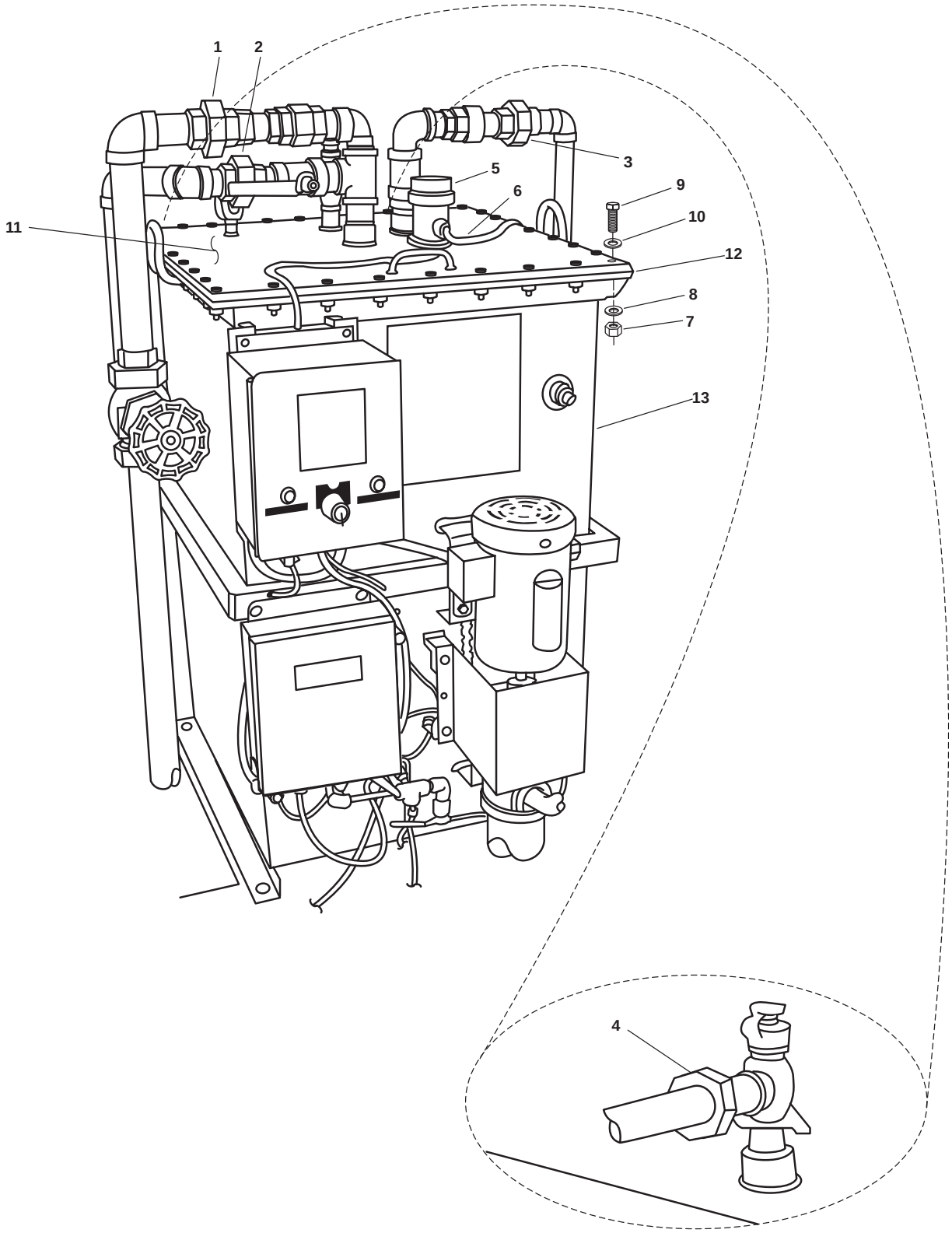


Figure 3. Oil Water Separator

8. Inspect the interface sensor cable's (figure 3, item 6) connections for corrosion or sludge buildup. Clean the connections using a clean wiping rag.

9. Remove the 32 nuts (figure 3, item 7), 32 washers (figure 3, item 8), 32 bolts (figure 3, item 9), and the 32 washers (figure 3, item 10) securing the OWS tank cover (figure 3, item 11).

WARNING

Heavy loads can crush. Do not allow any body parts to come under the tank cover or between the tank cover and a stationary object. Death or serious injury can result.

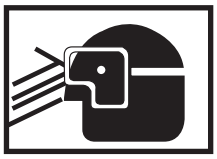
NOTE

When removing the OWS tank cover, take precautions to ensure that the sensitive switch probes are not damaged.

10. Carefully lift and remove the OWS tank cover (figure 3, item 11).

11. Remove the cover gasket (figure 3, item 12) from the OWS tank cover (figure 3, item 11). Discard the gasket.

WARNING



Removing components by means of wire brushing produces flying particles. These particles can cause serious injury to personnel. Protective goggles, gloves, and long sleeves must be worn at all times during wire brushing operations. Failure to comply with this warning can result in serious injury to personnel.

12. Using a wire brush, remove any remaining pieces of the OWS cover gasket (figure 3, item 12) and adhesive from the OWS tank cover (figure 3, item 11) and OWS tank (figure 3, item 13).

13. Remove the inlet baffle (figure 4, item 1) and weir (figure 4, item 2) from the OWS tank (figure 4, item 3).

NOTE

No fasteners are used to secure the coalescer boxes inside the tank. These components are held in place by the cover and the weir.

14. Remove the upper coalescer box (figure 4, items 4) from the OWS tank (figure 4, item 3).

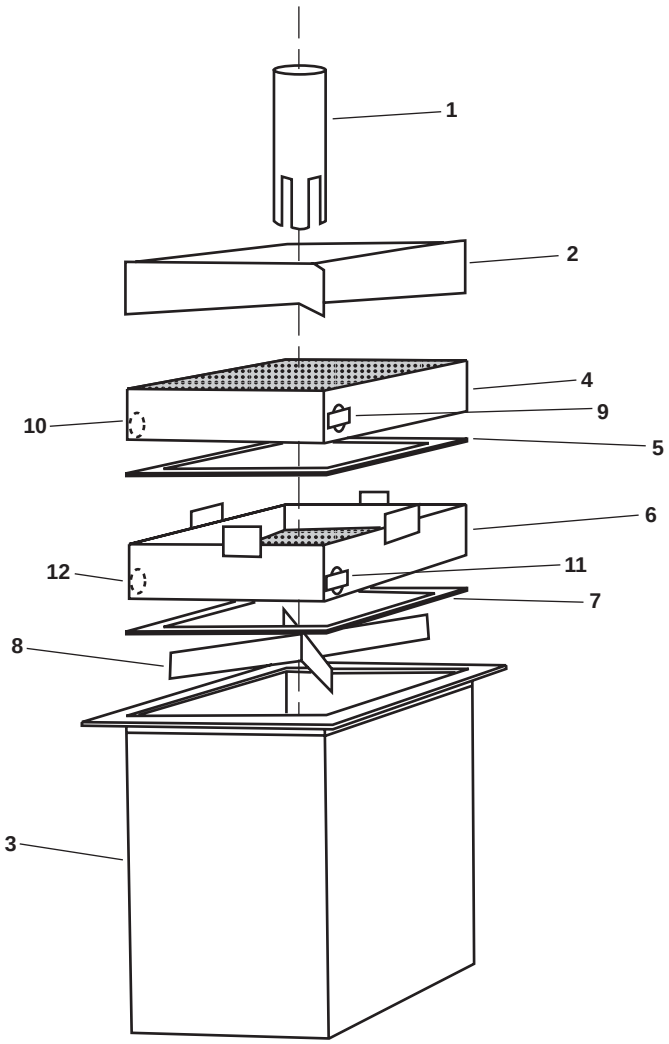


Figure 4. OWS Tank Assembly

15. Remove the upper coalescer box gasket (figure 4, items 5) from the OWS tank (figure 4, item 3). Discard the upper coalescer box gasket.

16. Remove the lower coalescer box (figure 4, items 6) from the OWS tank (figure 4, item 3).

17. Remove the lower coalescer box gasket (figure 4, item 7) from the OWS tank (figure 4, item 3). Discard the lower coalescer box gasket.

18. Remove the bottom standoff (figure 4, item 8) from the OWS tank (figure 4, item 3).

⚠ CAUTION

Do not use hot steam or cleaning solvents to clean the coalescer boxes, as damage to the coalescer box will occur.

19. Remove the upper plug (figure 4, item 9) and lower plug (figure 4, item 10) from the upper coalescer box (figure 4, item 4). Insert a water hose into the upper plug hole and flush the beads out of the lower plug hole into a suitable screen covered drain pan with a steady flow of clean water.

20. Install the lower plug (figure 4, item 10) in the upper coalescer box (figure 4, item 4) and pour in the new/clean beads using a funnel. Completely fill the coalescer box and install the upper plug (figure 4, item 9).

21. Remove the upper plug (figure 4, item 11) and lower plug (figure 4, item 12) from the lower coalescer box (figure 4, item 6). Insert a water hose into the upper plug hole and flush the beads out of the lower plug hole into a suitable screen covered drain pan with a steady flow of clean water.

22. Install the lower plug (figure 4, item 12) in the lower coalescer box (figure 4, item 6) and pour in the new/clean beads using a funnel. Completely fill the coalescer box and install the upper plug (figure 4, item 11).

ASSEMBLY

1. Install the bottom standoff (figure 4, item 8) into the OWS tank (figure 4, item 3).

2. Install a new lower coalescer box gasket (figure 4, item 7) into the OWS tank (figure 4, item 3).

3. Install the lower coalescer box (figure 4, item 6) into the OWS tank (figure 4, item 3).

4. Install a new upper coalescer box gasket (figure 4, item 5) into the OWS tank (figure 4, item 3).

5. Install a new upper coalescer box (figure 4, item 4) into the OWS tank (figure 4, item 3).

6. Install the inlet baffle (figure 4, item 1) and weir (figure 4, item 2) into the OWS tank (figure 4, item 3).

WARNING

Cleaning solvent is flammable and its vapor is potentially explosive. Do not use cleaning solvent in the vicinity of spark, open flame, or excessive heat. Do not use cleaning solvent in unventilated spaces. Failure to follow these precautions can result in death or serious injury.

7. Clean the OWS tank (figure 3, item 13) and the OWS tank cover (figure 3, item 11) gasket contact surfaces using isopropyl alcohol.

NOTE

The new adhesive backed cover gasket will not stick to the OWS tank cover or the OWS.

8. Install a new cover gasket (figure 3, item 12) onto the top of the OWS tank (figure 3, item 13).

WARNING

Heavy loads can crush. Do not allow any body parts to come under the tank cover or between the tank cover and a stationary object. Death or serious injury can result.

NOTE

While installing the tank cover, take precautions to prevent the sensitive switch probes from being damaged.

9. Carefully lower the OWS tank cover (figure 3, item 11) onto the OWS tank (figure 3, item 13) and the cover gasket (figure 3, item 12).

10. Install the 32 bolts (figure 3, item 9), the 32 washers (figure 3, item 10), the 32 washers (figure 3, item 8), and the 32 nuts (figure 3, item 7), securing the OWS tank cover (figure 3, item 11). Tighten the 32 bolts securely.

11. Connect the oil-water interface sensor cable (figure 3, item 6) and install the cap (figure 3, item 5). Tighten the cap snugly.

⚠ CAUTION

Never attempt to connect union connections with only one wrench. Damage to the vessel's standing piping could occur. Always use two wrenches.

12. Connect the unions (figure 3, items 1, 2, 3, and 4). Tighten the unions securely.

13. Wrap the male threads of the drain plug (figure 2 item 2) with antiseizing tape and install it in the OWS outlet drain piping (figure 2, item 1).

14. Remove the lockouts and tagouts (FM 55-502).

15. Perform OWS manual backflush (WP 0006 00).

16. Return the OWS to normal operation (WP 0005 00).

17. Closely observe all pipe joints, checking for leakage.

18. Return the OWS to the desired readiness condition.

END OF WORK PACKAGE

Chapter 6

Unit Maintenance Instructions for Oil Water Separator

Inland and Coastal Large Tug (LT)

UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OIL CONTENT MONITOR, REPLACE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0023 00)

Materials/Parts:
Tag, Danger (Item 10, Table 1, WP 0027 00)
Tape, Antiseizing (Item 11, Table 1, WP 0027 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
TB 43-0218
WP 0005 00
WP 0023 00
WP 0027 00

Equipment Conditions:
Set to OFF OILY WATER SEPARATOR and OIL CONTENT MONITOR circuit breakers on 120V distribution panel No. 4. Lock out and tag out (FM 55-502).

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.

REMOTE INDICATOR (ALARM) ASSEMBLY REPLACEMENT

NOTE

The Remote Indicator (Alarm) Assembly is located on the starboard bulkhead in the EOS.

REMOVAL

1. Disconnect the Oil Content Monitor (OCM) remote indicator (alarm) cable connector (figure 1, item 1) from the remote indicator (alarm) assembly (figure 1, item 2).

2. Remove the four bolts (figure 1, item 3) and lockwashers (figure 1, item 4) securing the remote indicator (alarm) assembly (figure 1, item 2) to the bulkhead. Discard the lockwashers.

3. Remove the remote indicator (alarm) assembly (figure 1, item 2).

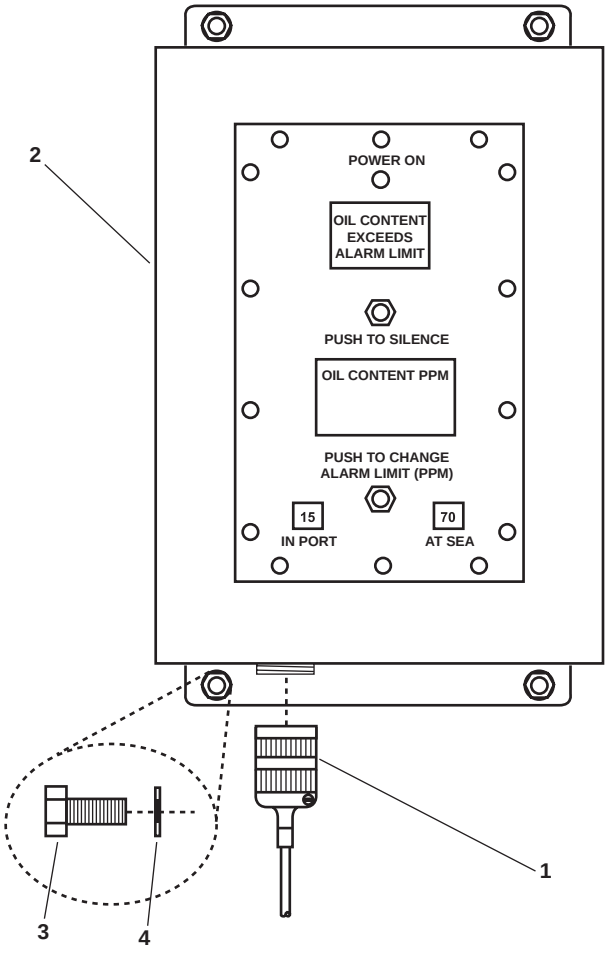


Figure 1. Remote Indicator Assembly Removal

INSTALLATION

1. Position the remote indicator (alarm) assembly (figure 1, item 2) on the bulkhead.

2. Install the four bolts (figure 1, item 3) and new lockwashers (figure 1, item 4) securing the remote indicator (alarm) assembly (figure 1, item 2) to the bulkhead. Securely tighten the four bolts.

3. Connect the remote indicator (alarm) cable connector (figure 1, item 1) to the remote indicator (alarm) assembly's (figure 1, item 2) receptacle.

4. Perform the Follow-On Service procedure at the end of this work package.

REMOTE RELAY ASSEMBLY REPLACEMENT

REMOVAL

1. Disconnect the sampling/sensor cable connector (figure 2, item 1) from the remote relay assembly (figure 2, item 2).

2. Disconnect the OCM junction box cable connector (figure 2, item 3) from the remote relay assembly (figure 2, item 2).

3. Remove the four bolts (figure 2, item 4), four nuts (figure 2, item 5), four flat washers (figure 2, item 6), and four lockwashers (figure 2, item 7) securing the remote relay assembly (figure 2, item 2) to the Oil Water Separator (OWS) tank. Discard the lockwashers.

4. Remove the remote relay assembly (figure 2, item 2) from the OWS tank.

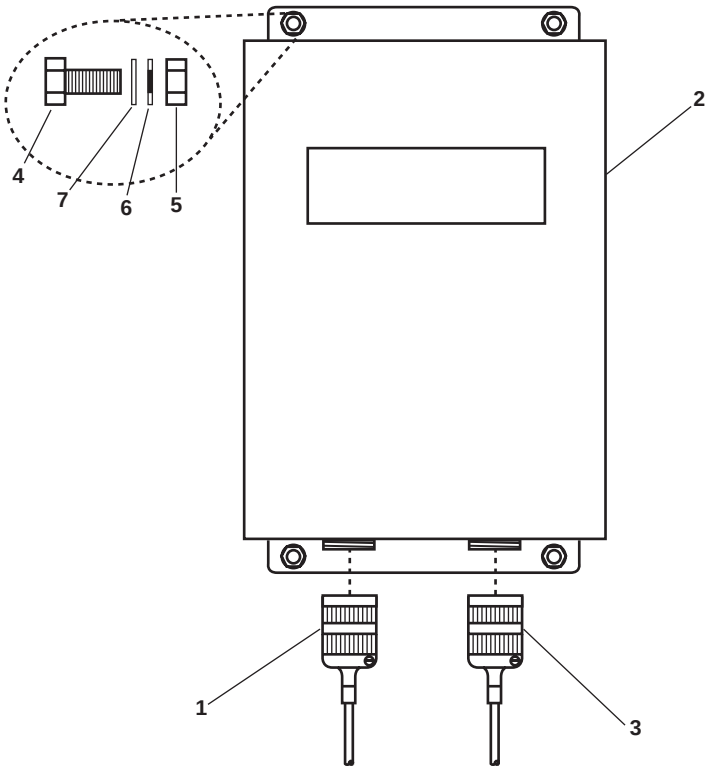


Figure 2. Remote Relay Assembly Removal

INSTALLATION

1. Position the remote relay assembly (figure 2, item 2) on the OWS tank.

2. Install the four bolts (figure 2, item 4), four nuts (figure 2, item 5), four flat washers (figure 2, item 6), and four new lockwashers (figure 2, item 7) securing the remote relay assembly (figure 2, item 2).

3. Connect the OCM junction box cable connector (figure 2, item 3) to the remote relay assembly (figure 2, item 2).

4. Connect the sampling/sensor cable connector (figure 2, item 1) to the remote relay assembly (figure 2, item 2).

5. Perform the Follow-On Service procedure at the end of this work package.

SAMPLING/SENSOR ASSEMBLY REPLACEMENT

REMOVAL

⚠ CAUTION

Never attempt to disconnect union connections with only one wrench. Damage to the vessel's standing piping or to the pump's piping could occur. Always use two wrenches.

1. CLOSE, lock out and tag out OCM-4. Disconnect the union fittings (figure 3, items 1 and 2) at the bottom of the sampling/sensor assembly (figure 3, item 3).

2. Label and disconnect the remote relay cable connector (figure 3, item 4) from the sampling/sensor assembly (figure 3, item 3).

3. Label and disconnect the remote indicator cable connector (figure 3, item 5) from the sampling/sensor assembly (figure 3, item 3).

4. Label and disconnect the OCM junction box cable connector (figure 3, item 6) from sampling/sensor assembly (figure 3, item 3).

5. Remove the four nuts (figure 3, item 7), four flat washers (figure 3, item 8), and four lockwashers (figure 3, item 9) from the studs (figure 3, item 10), securing the sampling/sensor assembly (figure 3, item 3) to the bulkhead. Discard the lockwashers.

6. Remove the sampling/sensor assembly (figure 3, item 3) from the bulkhead.

7. Remove the inlet fitting (figure 3, item 1) and outlet fitting (figure 3, item 2) from the sampling/sensor assembly (figure 3, item 3). Set the fittings aside for installation.

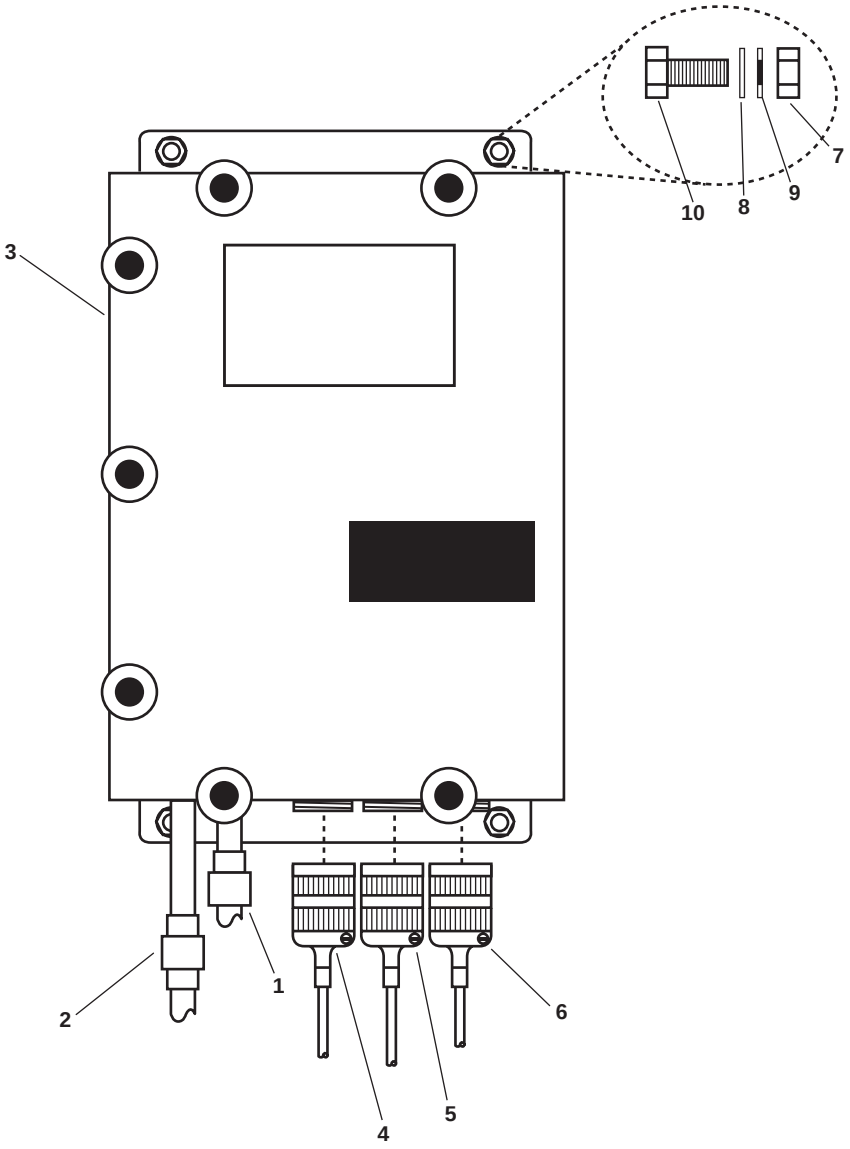


Figure 3. Sampling/Sensor Assembly

INSTALLATION

1. Clean the male pipe threads of the inlet (figure 3, item 1) and outlet (figure 3, item 2) fittings and wrap the threads with antiseizing tape.

2. Install the inlet fitting (figure 3, item 1) and outlet fitting (figure 3, item 2) onto the sampling/sensor assembly (figure 3, item 3).

3. Position the sampling/sensor assembly (figure 3, item 3) on the bulkhead.

4. Install the four nuts (figure 3, item 7), four flat washers (figure 3, item 8), and four new lockwashers (figure 3, item 9) on the studs (figure 3, item 10).

5. Connect the OCM junction box cable connector (figure 3, item 6) to the sampling/sensor assembly (figure 3, item 3).

6. Connect the remote indicator cable connector (figure 3, item 5) to the sampling/sensor assembly (figure 3, item 3).

7. Connect the remote relay cable connector (figure 3, item 4) to the sampling/sensor assembly (figure 3, item 3).

⚠ CAUTION

Failure to use two wrenches while connecting pipe fittings, couplings, and valves may cause damage to the valves, fittings, couplings, and piping.

8. Connect the unions (figure 3, items 1 and 2) to their piping.

9. Perform the Follow-On Service procedure at the end of this work package.

FOLLOW-ON SERVICE

1. Remove the lockout and tagouts (FM 55-502).

2. Test the OWS and OCM for normal operation (WP 0005 00).

3. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OIL CONTENT MONITOR, REPAIR

INITIAL SETUP:

Tools and Special Tools:
- Tool Kit, General Mechanic's (Item 1, Table 2, WP 0023 00)
- Multimeter (Item 3, Table 2, WP 0023 00)
- Tool, Ball Driver (Item 4, Table 2, WP 0023 00)

Materials/Parts:
- Dry Cleaning Solvent (Item 2, Table 1, WP 0027 00)
- Gloves, Chemical and Oil Protective (Item 1, Table 3, WP 0026 00)
- Goggles, Industrial (Item 4, Table 3, WP 0026 00)
- Silicone Compound (Item 7, Table 1, WP 0027 00)
- Strap, Tiedown, Electrical (Item 9, Table 1, WP 0027 00)
- Tag, Danger (Item 10, Table 1, WP 0027 00)

Personnel Required:
- Two Watercraft Engineers, 88L

References:
- FM 55-502
- TB 43-0218
- WP 0005 00
- WP 0018 00
- WP 0023 00
- WP 0026 00
- WP 0027 00

Equipment Conditions:
- Set to OFF the OIL CONTENT MONITOR circuit breaker on 120V distribution panel No. 4. Lock out and tag out (FM 55-502).

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.

REPAIR SAMPLING/SENSOR ASSEMBLY

OPERATION SELECTOR AND ALARM LIMIT (PPM) SELECTOR SWITCH REPLACEMENT

REMOVAL

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Loosen the seven hand nuts (figure 1, item 1) securing the sampling/sensor assembly (figure 1, item 2) and open the door (figure 1, item 3).

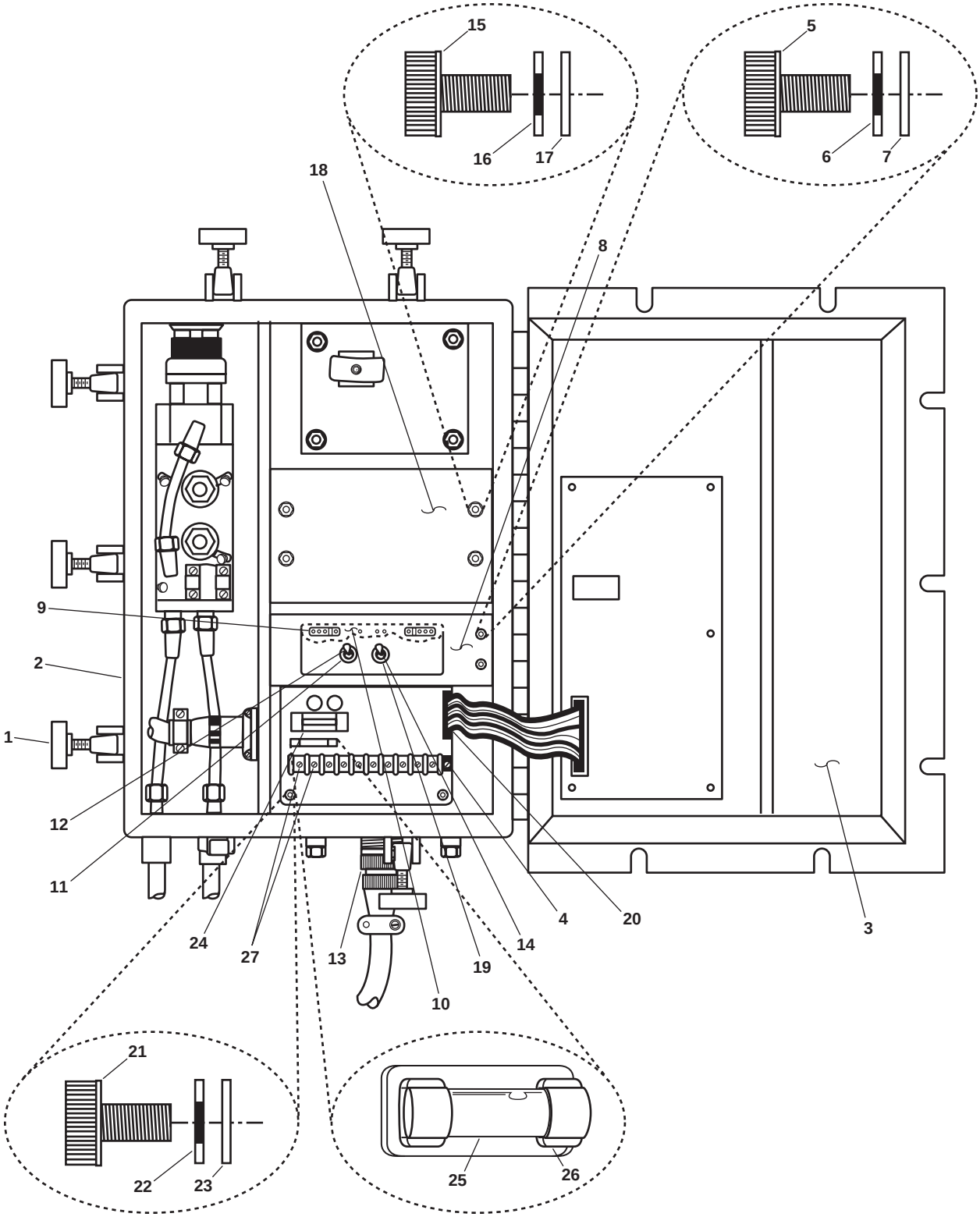


Figure 1. Sampling/Sensor Assembly

2. Using a multimeter, check for available voltage at the Power Printed Circuit Board (PCB) terminal (figure 1, item 4). If voltage is present, check that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Remove the four cap screws (figure 1, item 5), four lockwashers (figure 1, item 6), and four flat washers (figure 1, item 7) securing the switch plate assembly (figure 1, item 8). Discard the lockwashers.

NOTE

OPERATION SELECTOR switch A1S1 is part of a switch and cable sub-assembly and must be replaced as a unit.

4. Remove the switch plate assembly (figure 1, item 8) from the sampling/sensor assembly (figure 1, item 2) and disconnect the OPERATION SELECTOR switch A1S1 cable assembly (figure 1, item 9) from the POWER PCB connector (figure 1, item 10).

NOTE

Before removing OPERATION SELECTOR switch A1S1 from the switch plate assembly, note its position. Installed in the upside down position, the switch will not correspond with the legend on the switch plate.

5. Remove the nut (figure 1, item 11) from OPERATION SELECTOR switch A1S1 (figure 1, item 12).

6. Remove OPERATION SELECTOR switch A1S1 (figure 1, item 12) from the switch plate assembly (figure 1, item 8).

NOTE

Refer to the sampling/sensor assembly wire schematic for clarity of the color coded wire and junction locations.

7. Label and disconnect the color coded wires from the POWER PCB terminal (figure 1, item 4) that connects the ten-wire electrical connector (figure 1, item 13) (black, brown, red, orange) and ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 1, item 14) (red). Refer to figure 2.

8. Remove the four cap screws (figure 1, item 15), four lock washers (figure 1, item 16), and four flat washers (figure 1, item 17) securing the transformer hold down plate (figure 1, item 18). Discard the lock washers.

9. Remove the transformer hold down plate (figure 1, item 18) to gain access to the noise filter (figure 3, item 1).

10. Remove the nut (figure 3, item 2) and the flat washer (figure 3, item 3) from ground stud (figure 3, item 4) of the noise filter (figure 3, item 1). Label and remove the wiring (figure 3, item 5) from the noise filter.

11. Remove the nut (figure 1, item 19) from ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 1, item 14).

NOTE

Before removing ALARM LIMIT (PPM) SELECTOR switch A1S2 from the switch plate, note its position. Installed in the upside down position, the switch will not correspond with the legend on the switch plate.

12. Remove ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 1, item 14) from the switch plate assembly (figure 1, item 8).

13. Carefully remove any tiedown straps holding ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 1, item 14) wires to the enclosure or other wire bundles.

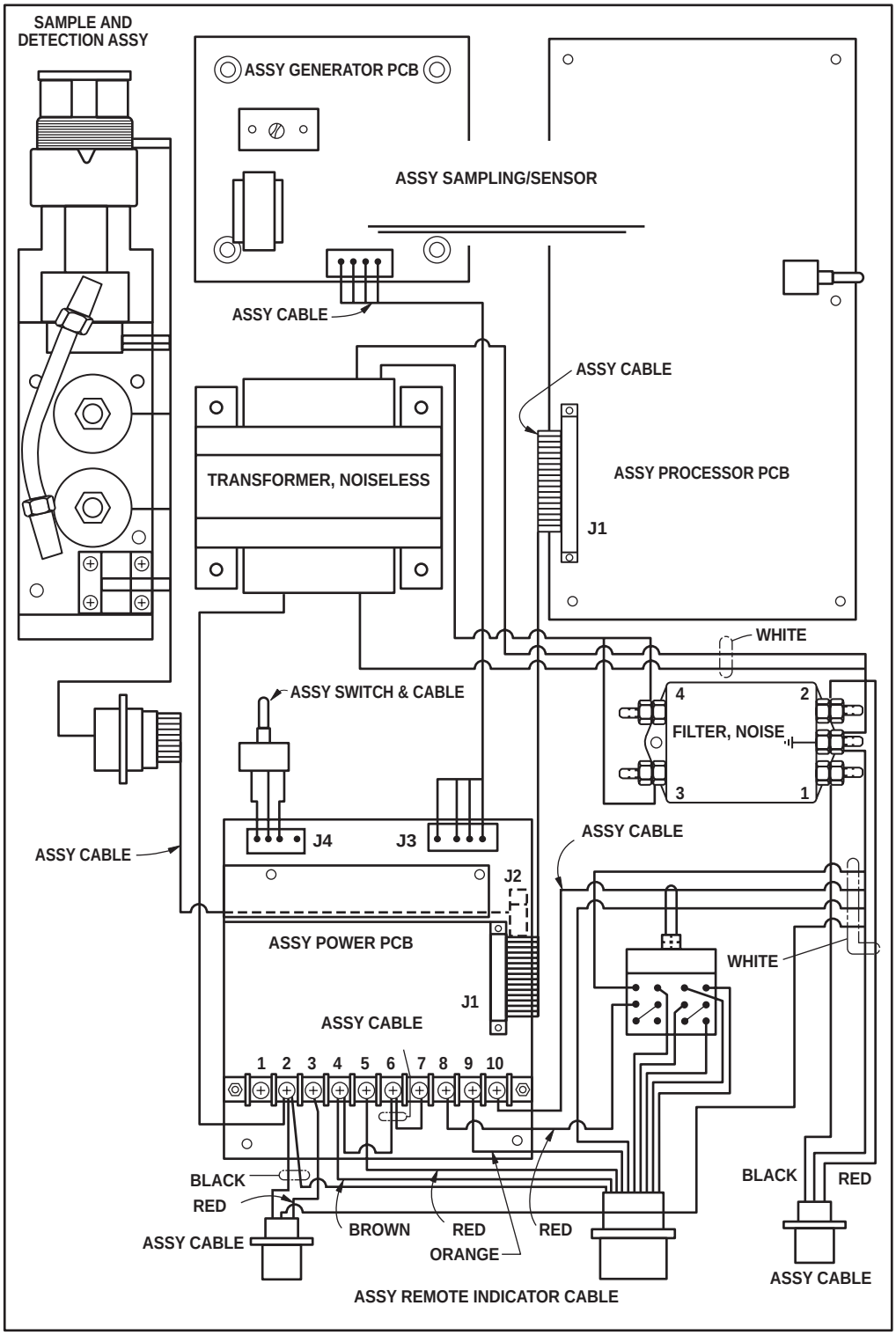


Figure 2. Sampling/Sensor Assembly Wire Schematic

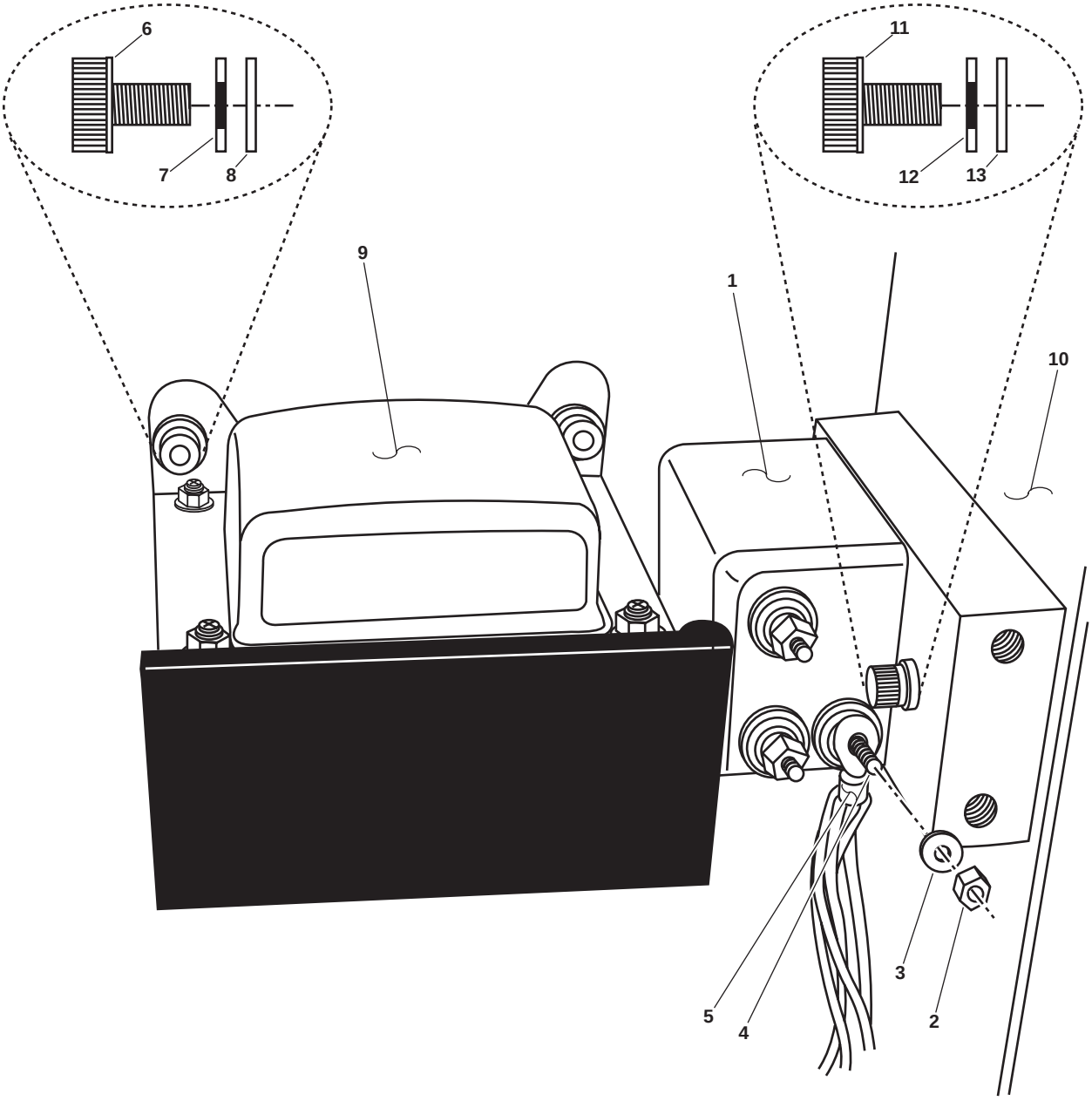


Figure 3. Transformer and Noise Filter Assembly

14. Remove the four cap screws (figure 4, item 1), the four lockwashers (figure 4, item 2), and the four flat washers (figure 4, item 3) securing the electrical connector (figure 4, item 4) to the sampling/sensor assembly (figure 4, item 5). Remove the electrical connector and the connector gasket (figure 4, item 6). Discard the connector gasket and the lockwashers.

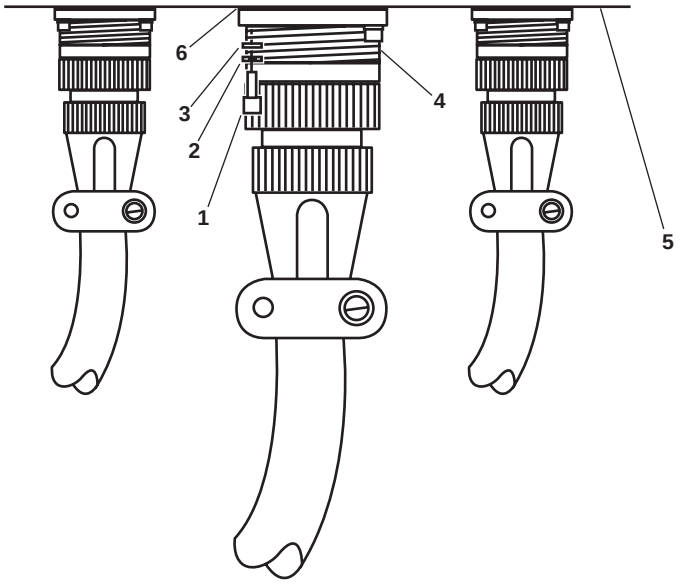


Figure 4. Electrical Connector Assembly

INSTALLATION

1. Install ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 1, item 14) into the switch plate assembly (figure 1, item 8).

2. Install the nut (figure 1, item 19) on the ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 1, item 14).

3. Connect the wiring (figure 3, item 5) to the ground stud (figure 3, item 4) of the noise filter (figure 3, item 1) and secure it with the flat washer (figure 3, item 3) and the nut (figure 3, item 2).

4. Install the transformer hold down plate (figure 1, item 18) and secure it with the four cap screws (figure 1, item 15), four new lockwashers (figure 1, item 16), and four flat washers (figure 1, item 17).

5. Connect the color coded wires to the POWER PCB terminal (figure 1, item 4) that connects the ten-wire electrical connector (figure 1, item 13) (black, brown, red, orange) and the ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 1, item 14)(red).

6. Install OPERATION SELECTOR switch A1S1 (figure 1, item 12) in the switch plate assembly (figure 1, item 8).

7. Install the nut (figure 1, item 11) on OPERATION SELECTOR switch A1S1 (figure 1, item 12).

8. Install the switch plate assembly (figure 1, item 8) into the sampling/sensor assembly (figure 1, item 2) and connect OPERATION SELECTOR switch A1S1 cable assembly (figure 1, item 9) to the POWER PCB (figure 1, item 10).

9. Install the four cap screws (figure 1, item 5), four new lockwashers (figure 1, item 6), and four flat washers (figure 1, item 7) in the switch plate assembly (figure 1, item 8).

10. Install a new connector gasket (figure 4, item 6) onto the electrical connector (figure 4, item 4).

11. Install the electrical connector (figure 4, item 4) onto the bottom of the sample/sensor assembly (figure 4, item 5) and secure it with the four screws (figure 4, item 1), four new lockwashers (figure 4, item 2) and four flat washers (figure 4, item 3).

12. Install tiedown straps as required being careful not to pull any ALARM LIMIT (PPM) SELECTOR switch A1S2 (figure 1, item 14) wiring from its connection points. Install tie wraps as required to hold the wires to the sampling/sensor assembly (figure 1, item 2) or other wire bundles.

13. Close the sampling/sensor assembly's (figure 1, item 2) door (figure 1, item 3) and tighten the seven hand nuts (figure 1, item 1).

14. Perform the Follow-On Service procedure at the end of this work package.

POWER PCB REPLACEMENT

REMOVAL

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Loosen the seven hand nuts (figure 1, item 1) securing the sampling/sensor assembly (figure 1, item 2) and open the door (figure 1, item 3).

2. Using a multimeter, check for available voltage at the Power PCB terminal (figure 1, item 4). If voltage is present, check that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Label and disconnect all wires from the POWER PCB terminal J1 (figure 1, item 4).

4. Remove the four cap screws (figure 1, item 5), four lockwashers (figure 1, item 6), and four flat washers (figure 1, item 7) from the switch plate assembly (figure 1, item 8). Discard the lockwashers.

5. Carefully remove the switch plate assembly (figure 1, item 8) from the sampling/sensor assembly (figure 1, item 2) and disconnect the OPERATION SELECTOR switch A1S1 cable assembly (figure 1, item 9) from the POWER PCB (figure 1, item 10).

NOTE

Refer to the sampling/sensor assembly wire schematic (figure 2) for clarity of the color coded wire and junction locations.

6. Unplug the ribbon cable (figure 1, item 20) from junction connectors J1 and J4 on the POWER PCB (figure 1, item 4).

7. Remove the four cap screws (figure 1, item 21), four lockwashers (figure 1, item 22), and four flat washers (figure 1, item 23) securing the POWER PCB (figure 1, item 4) to the sampling/sensor assembly (figure 1, item 2). Discard the lockwashers.

8. Remove the POWER PCB (figure 1, item 4).

9. Remove the elapsed time indicator (ETI) (figure 1, item 24) from the POWER PCB (figure 1, item 4) by pulling it straight out. Retain the ETI for installation on the new POWER PCB.

INSTALLATION

1. Install the POWER PCB (figure 1, item 4) into the sampling/sensor assembly (figure 1, item 2) and secure it with the four cap screws (figure 1, item 21), four new lockwashers (figure 1, item 22), and four flat washers (figure 1, item 23).

2. Apply a small drop of silicone compound to the underside of the ETI (figure 1, item 24) and install the ETI securely onto the POWER PCB board (figure 1, item 4).

⚠ CAUTION

When installing the ribbon cable, make certain that the wires are kept free of the secured components and do not get pinched or damaged during assembly of the sampling/sensor assembly. Failure to comply with this caution will result in damage to the equipment.

3. Plug the ribbon cable (figure 1, item 20) into the J1 and J4 connectors on the POWER PCB (figure 1, item 4).

4. Connect OPERATION SELECTOR switch A1S1 cable assembly (figure 1, item 9) to the POWER PCB (figure 1, item 10).

5. Install the switch plate assembly (figure 1, item 8) into the sampling/sensor assembly (figure 1, item 2).

6. Install the four cap screws (figure 1, item 5), four new lockwashers (figure 1, item 6), and four flat washers (figure 1, item 7) in the switch plate assembly (figure 1, item 8).

7. Connect the loose wires of the POWER PCB to the Power PCB terminal (figure 1, item 4).

8. Close the sampling/sensor assembly door (figure 1, item 3) and tighten the seven hand nuts (figure 1, item 1).

9. Perform the Follow-On Service procedure at the end of this work package.

POWER PCB FUSE REPLACEMENT

REMOVAL

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Loosen the seven hand nuts (figure 1, item 1) securing the sampling/sensor assembly (figure 1, item 2) and open the door (figure 1, item 3).

2. Using a multimeter, check for available voltage at the Power PCB terminal (figure 1, item 4). If voltage is present, check that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Remove the fuse (figure 1, item 25) from the fuse holder (figure 1, item 26) on the POWER PCB (figure 1, item 4).

INSTALLATION

⚠ CAUTION

Fuses must be replaced with an identical type with the same rating. Changing ratings can cause serious damage to the circuit it is meant to protect.

1. Install the fuse (figure 1, item 25) into the fuse holder (figure 1, item 26) on the POWER PCB (figure 1, item 4).

2. Close the sampling/sensor assembly door (figure 1, item 3) and tighten the seven hand nuts (figure 1, item 1).

3. Perform the Follow-On Service procedure at the end of this work package.

TRANSFORMER AND NOISE FILTER REPLACEMENT

REMOVAL

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Loosen the seven hand nuts (figure 1, item 1) securing the sampling/sensor assembly (figure 1, item 2) and open the door (figure 1, item 3).

2. Using a multimeter, check for available voltage at the Power PCB terminal (figure 1, item 4). If voltage is present, check that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Remove the four cap screws (figure 1, item 15), four lockwashers (figure 1, item 16), and four flat washers (figure 1, item 17) securing the transformer hold down plate (figure 1, item 18). Discard the lockwashers.

4. Remove the transformer hold down plate (figure 1, item 18).

NOTE

There are three wire terminals on the front of the noise filter and two wire terminals on the rear of the noise filter.

5. Remove the five nuts (figure 3, item 2) and five washers (figure 3, item 3) from the front and rear of the noise filter (figure 3, item 1). Label and disconnect the wiring.

6. Remove the four cap screws (figure 3, item 6), four lockwashers (figure 3, item 7), and the four flat washers (figure 3, item 8) from the transformer (figure 3, item 9). Discard the lockwashers.

7. Disconnect the transformer wiring (figure 1, item 27) from the Power PCB terminal (figure 1, item 4).

8. Remove the transformer (figure 3, item 9) with its wiring from the sampling/sensor assembly (figure 3, item 10).

9. Remove the two cap screws (figure 3, item 11), two lockwashers (figure 3, item 12), and two flat washers (figure 3, item 13) securing the noise filter (figure 3, item 1) to the sampling/sensor assembly (figure 3, item 10). Discard the lockwashers.

10. Remove the noise filter (figure 3, item 1) from the sampling/sensor assembly (figure 3, item 10).

INSTALLATION

1. Position the noise filter (figure 3, item 1) in the sampling/sensor assembly (figure 3, item 10) and install the two cap screws (figure 3, item 11), two new lockwashers (figure 3, item 12), and two flat washers (figure 3, item 13).

2. Position the transformer (figure 3, item 9) and it's wiring in the sampling/sensor assembly (figure 3, item 10) and install the four cap screws (figure 3, item 6), four new lockwashers (figure 3, item 7), and the four flat washers (figure 3, item 8).

3. Connect the wiring to the noise filter (figure 3, item 1) and secure it with the five nuts (figure 3, item 2) and the five washers (figure 3, item 3).

4. Connect the transformer's wiring (figure 1, item 27) to terminals 1 and 2 of the POWER PCB (figure 1, item 4).

5. Position the transformer hold down plate (figure 1, item 18) in the sampling/sensor assembly (figure 1, item 2) and secure it with the four flat washers (figure 1, item 17), four new lockwashers (figure 1, item 16), and four cap screws (figure 1, item 15).

6. Close the sampling/sensor assembly door (figure 1, item 3), and tighten the seven hand nuts (figure 1, item 1).

7. Perform the Follow-On Service procedure at the end of this work package.

SAMPLING AND DETECTION SUB-ASSEMBLY (SDA) AND PROCESSOR PCB REPLACEMENT

REMOVAL

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Loosen the seven hand nuts (figure 5, item 1) and open the door (figure 5, item 2) of the sampling/sensor assembly (figure 5, item 3).

2. Using a multimeter, check for available voltage at the Power PCB terminal (figure 1, item 4). If voltage is present, check that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

⚠ CAUTION

The SDA and the PROCESSOR PCB assembly are calibrated as a matched set. If either component requires replacement, replace both components with a new SDA and PROCESSOR PCB assembly matched set. Failure to comply with this caution may result in damage to the equipment.

3. Disconnect the SDA (figure 5, item 4) cable connector (figure 5, item 5).

NOTE

One flat washer was omitted from the mounting hardware. Refer to figure 5 for position.

4. Remove the four cap screws (figure 5, item 6), four lockwashers (figure 5, item 7), and three flat washers (figure 5, item 8) securing the SDA (figure 5, item 4). Discard the lockwashers.

5. Lift the SDA (figure 5, item 4) up and away from the sampling/sensor assembly (figure 5, item 3) with out removing it.

6. While gently pulling the inlet and outlet drain tubing (figure 5, item 9), push up on the tube's quick-disconnect fitting (figure 5, item 10) to release the inlet and outlet tubing from the fitting.

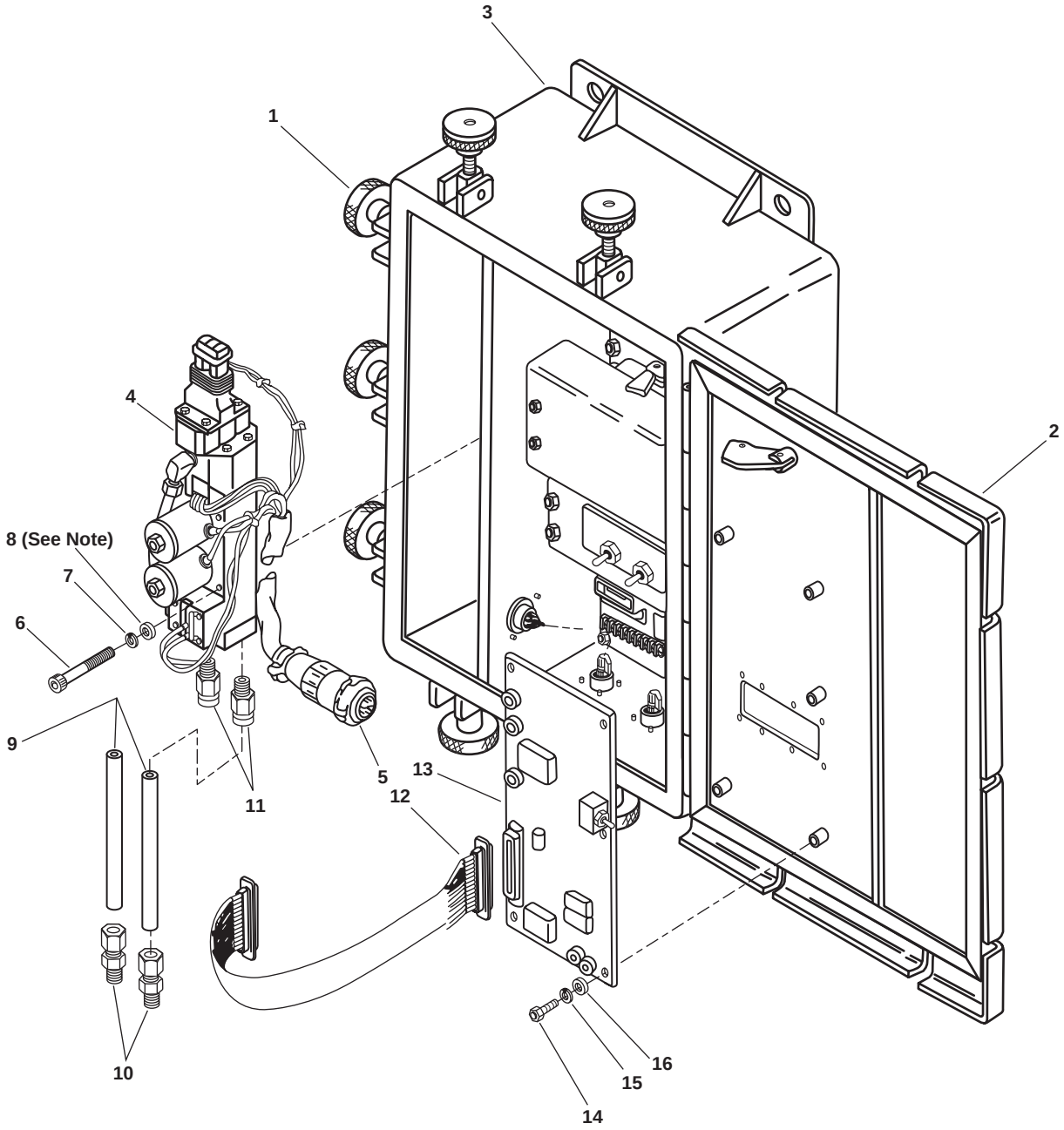
7. Remove the SDA (figure 5, item 4) from the sampling/sensor assembly (figure 5, item 3).

8. Remove the inlet and outlet drain tubing (figure 5, item 9) from the male connectors (figure 5, item 11).

9. Disconnect the wire ribbon (figure 5, item 12) from the PROCESSOR PCB assembly (figure 5, item 13).

10. Remove the four cap screws (figure 5, item 14), four lockwashers (figure 5, item 15), and four flat washers (figure 5, item 16) from the PROCESSOR PCB assembly (figure 5, item 13).

11. Remove the PROCESSOR PCB assembly (figure 5, item 13) from the sampling/sensor assembly (figure 5, item 3).



NOTE: Omit flat washer (Item 8) for this position only.

Figure 5. Sampling and Detection Sub-assembly (SDA) and Processor PCB

INSTALLATION

⚠ CAUTION

The SDA and the PROCESSOR PCB assembly are calibrated as a matched set. If either component requires replacement, procure a new matched set. Failure to comply with this caution may result in damage to the equipment.

1. Position the PROCESSOR PCB assembly (figure 5, item 13) in the sampling/sensor assembly (figure 5, item 3) and secure it with the four cap screws (figure 5, item 14), four lockwashers (figure 5, item 15), and four flat washers (figure 5, item 16).

2. Check that the LEDs on the front of the Processor PCB are in alignment with the proper display callouts on the face of the sampling/sensor assembly's door (figure 5, item 2). If necessary, gently bend the LEDs into proper alignment as required.

3. Connect the wire ribbon (figure 5, item 12) to the PROCESSOR PCB assembly (figure 5, item 13).

4. Install the inlet and outlet drain tubing (figure 5, item 9) on to the male connectors (figure 5, item 11).

5. Position the SDA (figure 5, item 4) in the sampling/sensor assembly (figure 5, item 3) and connect the inlet and outlet drain tubing (figure 5, item 9) by pushing down into the quick-disconnect fitting (figure 5, item 10) until the tubes stop.

NOTE

Only three flat washers are used with the mounting hardware. Refer to figure 5 for the proper position where a flat washer is not necessary.

6. Secure the SDA (figure 5, item 4) with the four cap screws (figure 5, item 6), four lockwashers (figure 5, item 7), and three flat washers (figure 5, item 8).

7. Connect the SDA cable connector (figure 5, item 5).

8. Close the sampling/sensor assembly door (figure 5, item 3) and tighten the seven hand nuts (figure 5, item 1).

9. Perform the Follow-On Service procedure at the end of this work package.

DIVERTER VALVE INDICATOR BULBS REPLACEMENT

REMOVAL

1. Loosen the seven hand nuts (figure 5, item 1) and open the door (figure 5, item 2) of the sampling/sensor assembly (figure 5, item 3).

2. Using a multimeter, check for available voltage at the Power PCB terminal (figure 1, item 4). If voltage is present, check that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Remove the three screws (figure 6, item 1) and nameplate (figure 6, item 2) from the bottom of the diverter valve indicator assembly cover (figure 6, item 3).

4. Remove the five screws (figure 6, item 4) and five washers (figure 6, item 5) from the bottom of the diverter valve indicator assembly cover (figure 6, item 3).

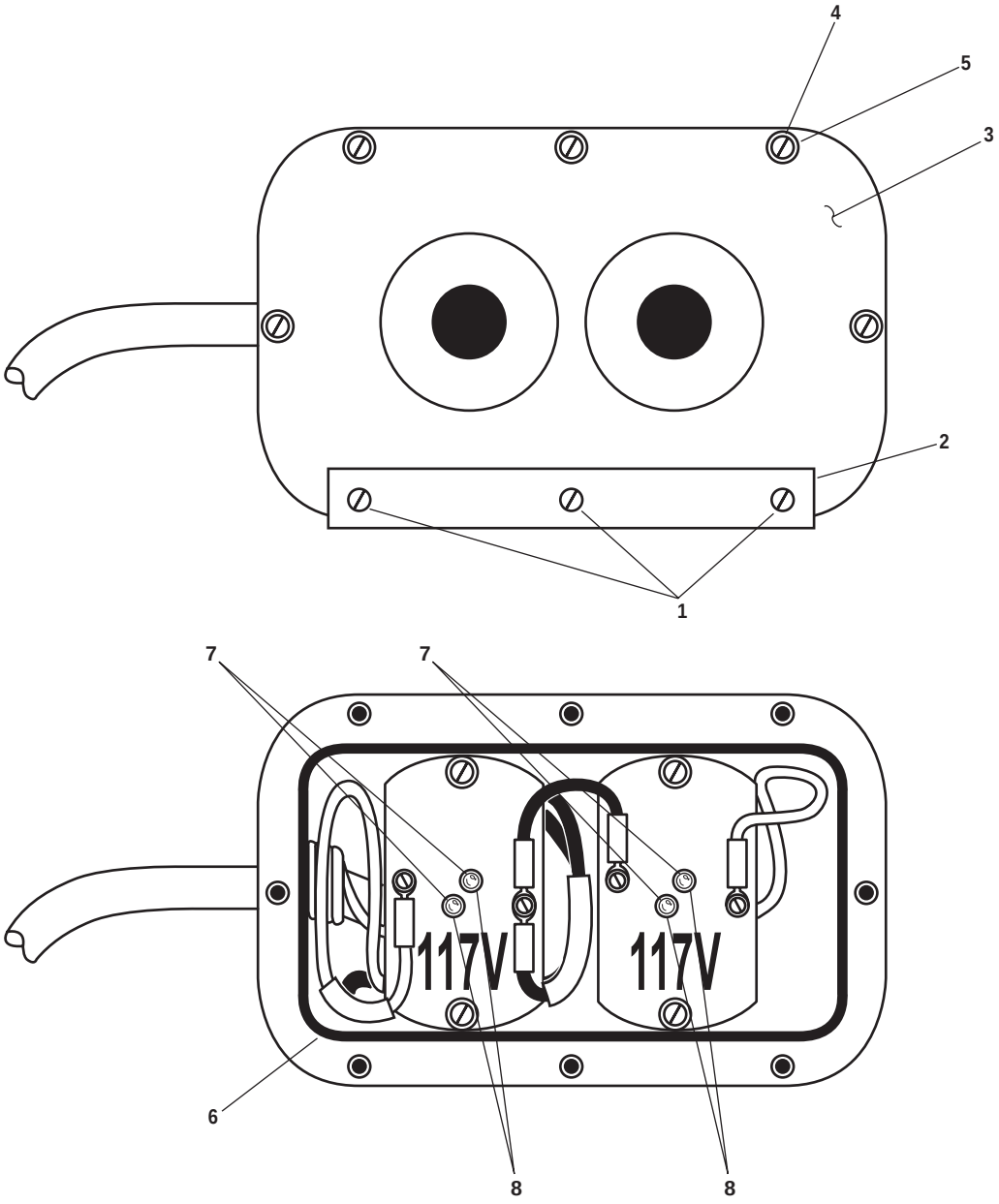


Figure 6. Diverter Valve Indicator Assembly

5. Remove the diverter valve indicator assembly cover (figure 6, item 3) and O-ring (figure 6, item 6). Discard the O-ring.

6. Unscrew the desired bulb (figure 6, item 7) from the applicable lamp holder (figure 6, item 8).

INSTALLATION

1. Screw the desired bulb (figure 6, item 7) into the applicable lamp holder (figure 6, item 8).

2. Position a new O-ring (figure 6, item 6) in the diverter valve indicator assembly cover (figure 6, item 3).

NOTE

The nameplate and its three screws should be positioned on the bottom of the diverter valve indicator assembly cover. No washers are used between the nameplate and the screws. Washers are used with the remaining five screws.

3. Install the diverter valve indicator assembly cover (figure 6, item 3) and secure it with five screws (figure 6, item 5), five washers (figure 6, item 5), three screws (figure 6, item 1), and nameplate (figure 6, item 2).

4. Close the door (figure 6, item 3) and tighten the seven hand nuts (figure 6, item 1) securing the sampling/sensor assembly (figure 6, item 2).

5. Perform the Follow-On Service procedure at the end of this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).

2. Perform the verification/confidence test (WP 0018 00).

3. Operate the OWS and OCM (WP 0005 00) checking for normal, leak-free operation.

4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OIL WATER SEPARATOR, REPAIR

INITIAL SETUP:

Tools and Special Tools:
- Tool Kit, General Mechanic's (Item 1, Table 2, WP 0023 00)
- Multimeter (Item 3, Table 2, WP 0023 00)
- Suitable Drain Pan

Materials/Parts:
- Face Shield, Industrial (Item 2, Table 3, WP 0026 00)
- Gloves, Chemical and Oil Protective (Item 1, Table 3, WP 0026 00)
- Goggles, Industrial (Item 4, Table 3, WP 0026 00)
- Tag, Danger (Item 10, Table 1, WP 0027 00)
- Tape, Antiseizing (Item 11, Table 1, WP 0027 00)

Personnel Required:
- Two Watercraft Engineers, 88L

References:
- FM 55-502
- WP 0005 00
- WP 0023 00
- WP 0026 00
- WP 0027 00

Equipment Conditions:
- Set to OFF the OILY WATER SEPARATOR circuit breaker in the 120V distribution panel No. 4. Lock out and tag out (FM 55-502).

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.

OIL WATER SEPARATOR (OWS) CONTROL BOX

LAMP REPLACEMENT

REMOVAL

WARNING

Death or serious injury can result from contact with live electrical circuits. Before beginning work on this, or any other electrical circuit or equipment, make certain electrical power is OFF, locked out, and tagged out IAW FM-55-502.

1. Open the OWS control box door (figure 1, item 1) by loosening the two door latch screws (figure 1, item 2).

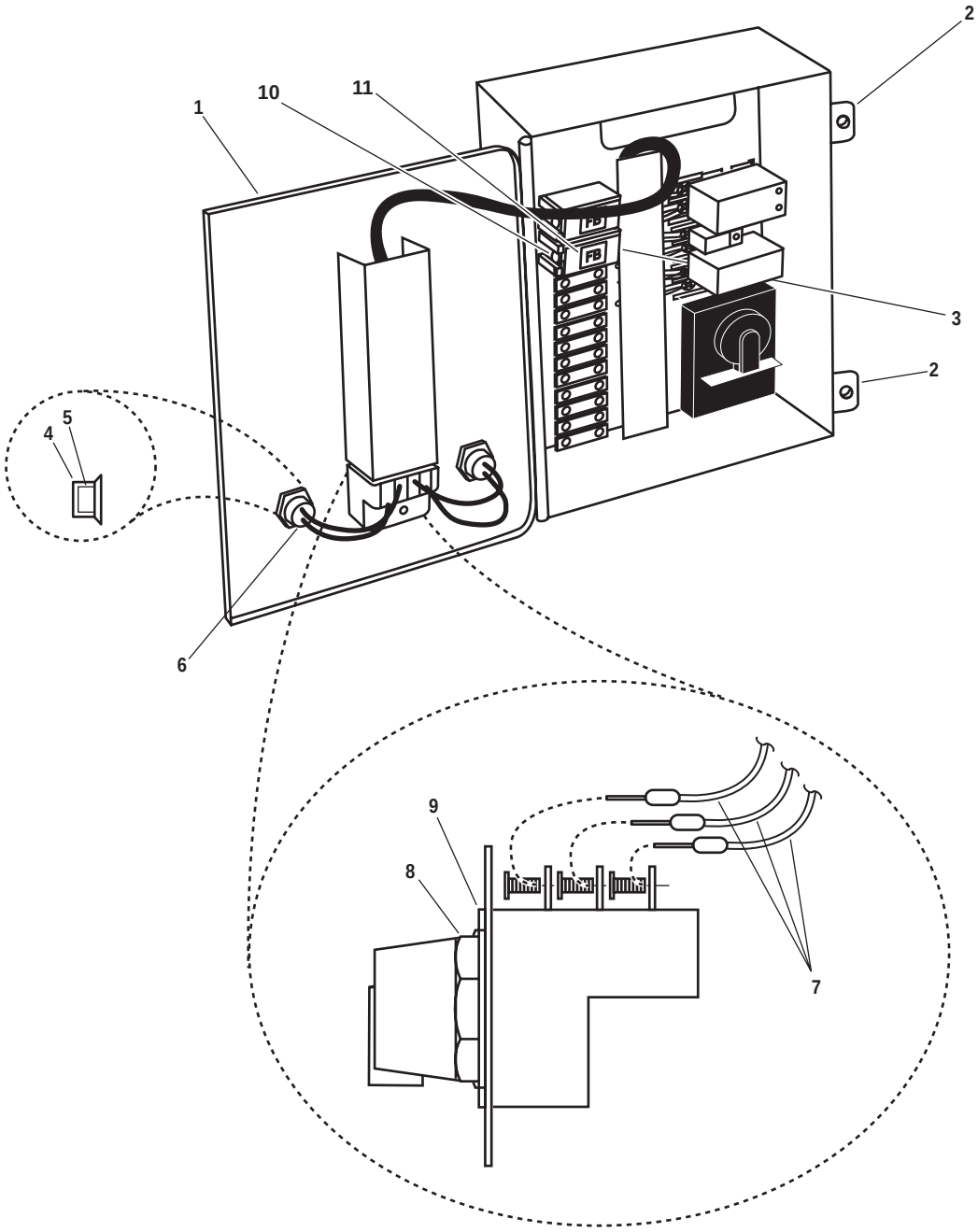


Figure 1. OWS Control Box

2. Using a multimeter, check for voltage at the fuse (figure 1, item 3). If voltage is present, check to ensure that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Unscrew and remove the light indicator lens cap (figure 1, item 4).

4. Remove the lamp (figure 1, item 5) from the indicator light housing (figure 1, item 6) by pushing it straight in.

INSTALLATION

1. Install the lamp (figure 1, item 5) into the indicator light housing (figure 1, item 6).

2. Thread the lens cap (figure 1, item 4) into the indicator light housing (figure 1, item 6) until it is finger tight.

3. Close the OWS control box door (figure 1, item 1) and secure it by tightening the two door latch screws (figure 1, item 2).

4. Perform the Follow-On Service procedure at the end of this work package.

SWITCH REPLACEMENT

REMOVAL

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Open the OWS control box door (figure 1, item 1) by loosening the two door latch screws (figure 1, item 2).

2. Using a multimeter, check for voltage at the fuse (figure 1, item 3). If voltage is present, check to ensure that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Label and disconnect the wiring (figure 1, item 7) from the switch (figure 1, item 8).

NOTE

Before removing the switch from the switch plate assembly, note its position. Installed in the upside down position, the switch will not correspond with the legend on the switch plate**.**

4. Loosen and remove the retainer ring (figure 1, item 9) securing the switch (figure 1, item 8) to the OWS control box door (figure 1, item 1).

5. Remove the switch (figure 1, item 8) from the OWS control box door (figure 1, item 1).

INSTALLATION

NOTE

Install the switch on the switch plate assembly in its noted position. Installed in the upside down position, the switch will not correspond with the legend on the switch plate.

1. Install the switch (figure 1, item 8) into the OWS control box door (figure 1, item 1) and secure it with the retainer ring (figure 1, item 9).

2. Connect the wiring (figure 1, item 7) to the switch (figure 1, item 8).

3. Close the OWS control box door (figure 1, item 1) and secure it by tightening the two door latch screws (figure 1, item 2).

4. Perform the Follow-On Service procedure at the end of this work package.

FUSE REPLACEMENT

REMOVAL

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Open the OWS control box door (figure 1, item 1) by loosening the two door latch screws (figure 1, item 2).

2. Using a multimeter, check for voltage at the fuse (figure 1, item 3). If voltage is present, check to ensure that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Remove the fuse (figure 1, item 3) from the socket (figure 1, item 10) by pulling the fuse holder (figure 1, item 11) straight out.

INSTALLATION

⚠ CAUTION

Fuses must be replaced with an identical type with the same rating. Changing ratings can cause serious damage to the circuit it is meant to protect. Failure to comply with this caution will result in damage to the equipment.

1. Install the fuse (figure 1, item 3) into the fuse holder (figure 1, item 11) by pushing it straight into the fuse holder.

2. Install the fuse (figure 1, item 3) into the socket (figure 1, item 10) by pushing the fuse holder (figure 1, item 11) straight into the socket.

3. Close the OWS control box door (figure 1, item 1) and secure it by tightening the two door latch screws (figure 1, item 2)

4. Perform the Follow-On Service procedure at the end of this work package.

ELECTRO MAGNETIC RELAY (PUMP) REPLACEMENT

REMOVAL

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Open the OWS control box door (figure 1, item 1) by loosening the two door latch screws (figure 1, item 2).

2. Using a multimeter, check for voltage at the fuse (figure 1, item 3). If voltage is present, check to ensure that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Remove the electro magnetic relay (figure 2, item 1) by pulling it straight out of its socket (figure 2, item 2).

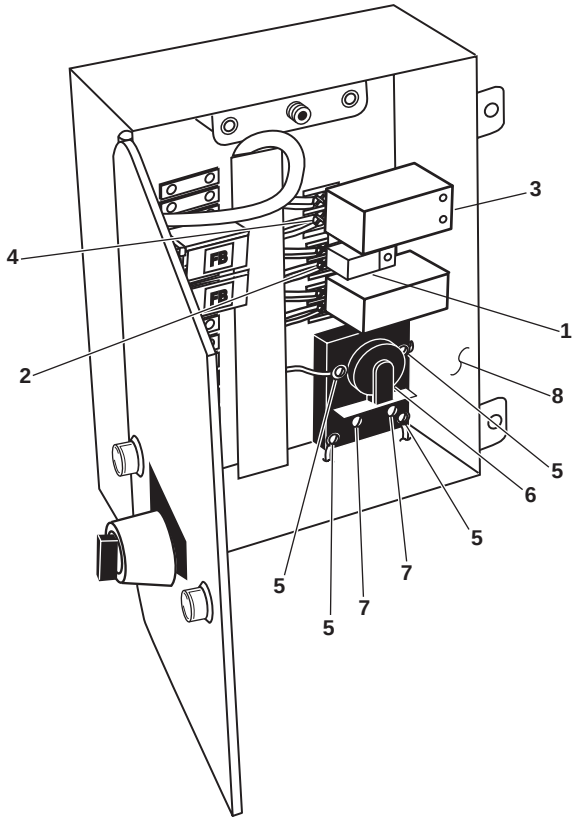


Figure 2. Solid State and Electro Magnetic Relay Removal

INSTALLATION

1. Install the electro magnetic relay (figure 2, item 1) by lining up the pins and gently pushing it into the socket (figure 2, item 2).

2. Close the OWS control box door (figure 1, item 1) and secure it by tightening the two door latch screws (figure 1, item 2).

3. Perform the Follow-On Service procedure at the end of this work package.

SOLID STATE RELAY (INTERFACE SENSOR RELAY) REPLACEMENT

REMOVAL

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Open the OWS control box door (figure 1, item 1) by loosening the two door latch screws (figure 1, item 2).

2. Using a multimeter, check for voltage at the fuse (figure 1, item 3). If voltage is present, check to ensure that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Remove the solid state relay (figure 2, item 3) by pulling it straight out of the socket (figure 2, item 4).

INSTALLATION

1. Install the solid state relay (figure 2, item 3) by lining up the pins and gently pushing it into the socket (figure 2, item 4).

2. Close the OWS control box door (figure 1, item 1) and secure it by tightening the two door latch screws (figure 1, item 2).

3. Perform the Follow-On Service procedure at the end of this work package.

ELECTRO MAGNETIC RELAY (PROCESS RELAY) REPLACEMENT

REMOVAL

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

1. Open the OWS control box door (figure 1, item 1) by loosening the two door latch screws (figure 1, item 2).
2. Using a multimeter, check for voltage at the fuse (figure 1, item 3). If voltage is present, check to ensure that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the wiring (figure 2, item 5) from the electro magnetic relay (figure 2, item 6).
4. Remove the two screws (figure 2, item 7) from the electro magnetic relay (figure 2, item 6).
5. Remove the electro magnetic relay (figure 2, item 6) from the OWS control box (figure 2, item 8).

INSTALLATION

1. Position the electro magnetic relay (figure 2, item 6) in the OWS control box (figure 2, item 8) and secure it with the two screws (figure 2, item 7).
2. Connect the wiring (figure 2, item 5) to the electro magnetic relay (figure 2, item 6) using the labels from step 3 of Removal as a guide.
3. Remove the labels from the wiring (figure 2, item 5).
4. Close the OWS control box door (figure 1, item 1) and secure it by tightening the two door latch screws (figure 1, item 2).
5. Perform the Follow-On Service procedure at the end of this work package.

PRESSURE GAUGE REPLACEMENT

REMOVAL

WARNING

Pressure can be trapped in the piping even after the OWS has been shut off from the rest of the oily water system. Injury to personnel or surrounding components can occur. Allow pressure to escape before completely removing the pressure gauge.

1. Slowly remove the pressure gauge (figure 3, item 1) from its fitting (figure 3, item 2).
2. Plug the fitting (figure 3, item 2) to prevent contamination of the OWS.

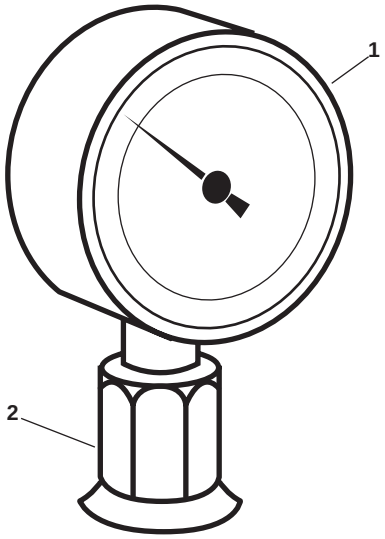


Figure 3. Pressure Gauge Replacement

INSTALLATION

1. Apply antiseizing tape to the male threads of the new pressure gauge (figure 3, item 1).
2. Thread the new pressure gauge (figure 3, item 1) into the fitting (figure 3, item 2). Tighten the pressure gauge snugly.
3. Perform the Follow-On Service procedure at the end of this work package.

BACKFLUSH INLET SOLENOID VALVE REPLACEMENT

REMOVAL

1. Align the OWS, the Oily Bilge (OB), and Oil Content Monitor (OCM) valves as indicated in table 1 and figure 4.

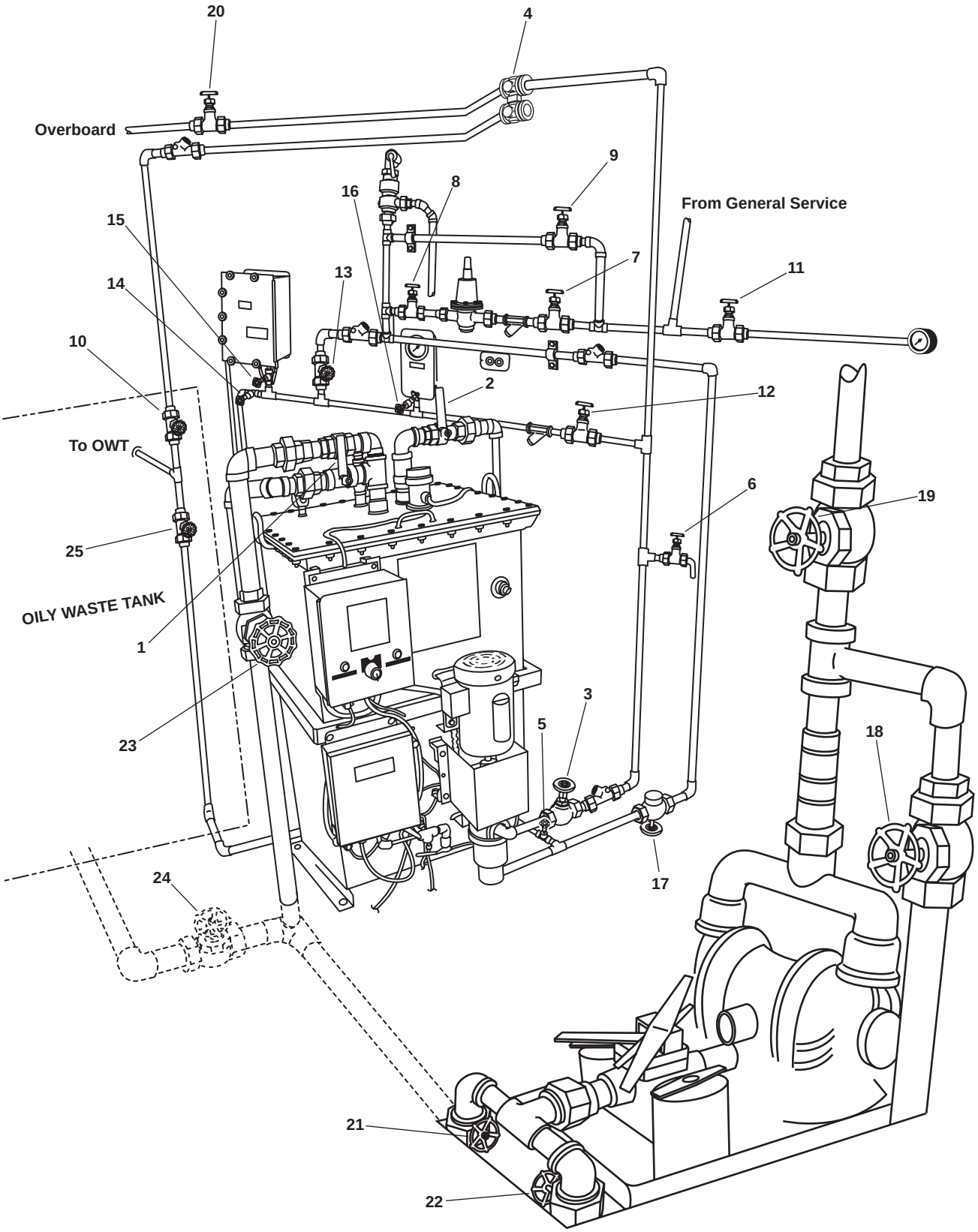


Figure 4. OWS, OB and OCM Piping

Table 1. Valve Positions During Replacement of the Backflush Inlet Solenoid Valve

Item Number (figure 4)	Valve Number	Function	Position During Operation Under Usual Conditions
1	OWS-1	OWS MANUAL BACKFLUSH	CLOSED
2	OWS-2	OWS DISCHARGE	CLOSED
3	OWS-3	OWS PUMP DISCHARGE	CLOSED
4	OWS-4	OCM 3-WAY DIVERTER	Controlled by OCM
5	OWS-5	OWS DISCHARGE	CLOSED
6	OWS-6	OWS PITOT SAMPLE	CLOSED
7	OWS-7	BACKFLUSH WTR TO PRESS RDCR	CLOSED
8	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	CLOSED
9	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
10	OWS-10	OWS RECIRCULATING COV	CLOSED
11	OWS-24	SW TO OWS PRESS GAGE ISOLATION	CLOSED
12	OCM-1	OCM NOZZLE SAMPLER COV	CLOSED
13	OCM-2	OCM BACKFLUSH WATER	CLOSED
14	OCM-3	OCM SAMPLING VALVE	CLOSED
15	OCM-4	OCM INLET	CLOSED
16	OCM-8	OCM GAGE ISOLATION	CLOSED
17	GS-74	OWS BACKFLUSH INLET SOLENOID	Automatic (Ensure that the manual override handle is in the CLOSED position (CCW) with the valve stem all the way out)
18	OB-8	XFR PUMP TO OILY WATER TANK	CLOSED
19	OB-9	XFR PUMP DISCH TO SHORE	CLOSED
20	OB-10	OWS OVERBOARD DISCHARGE	CLOSED
21	OB-13	OWT TO XFR PUMP SUCTION	CLOSED
22	OB-14	COV-XFR PUMP SUCTION	CLOSED
23	OB-15	OWS INLET	CLOSED
24	OB-16	WATER FROM OWT COV	CLOSED
25	OB-17	OILY WATER TANK INLET	CLOSED

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

2. Open the OWS control box door (figure 1, item 1) by loosening the two door latch screws (figure 1, item 2).

3. Using a multimeter, check for voltage at the fuse (figure 1, item 3). If voltage is present, check to ensure that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

4. Remove the gasket nut (figure 5, item 1) from the back flush inlet solenoid valve (figure 5, item 2) and label and disconnect the wiring (figure 5, item 3).

5. Place a suitable drain pan under the union (figure 5, item 4) and the backflush inlet solenoid valve (figure 5, item 2).

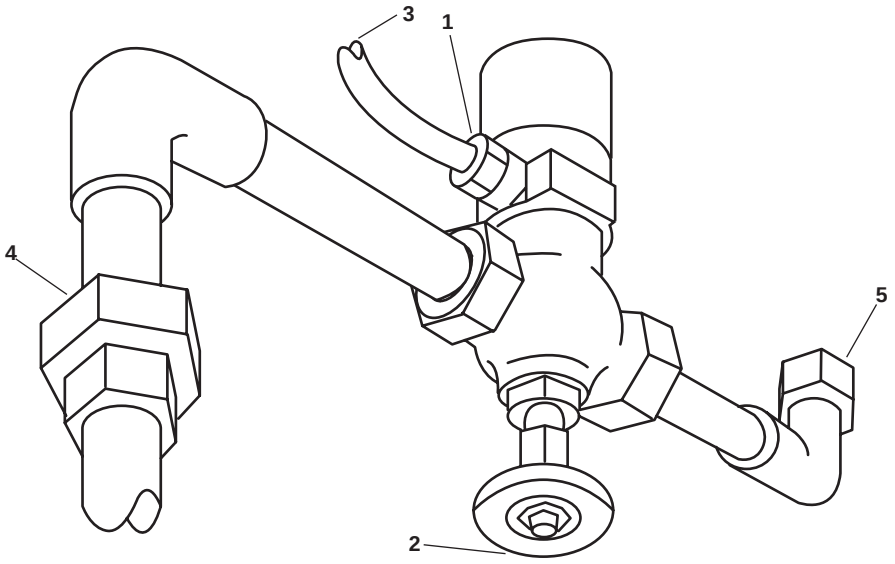


Figure 5. Back Flush Inlet Valve Removal

WARNING

Water hoses and lines may be under pressure. Relieve pressure by operating the appropriate control valve, if possible. Loosen fittings on hose lines slowly. Allow water to run around threads of fitting, releasing pressure before disconnecting fitting. Releasing pressurized water suddenly may cause severe personal injury.

⚠ CAUTION

Never attempt to disconnect union connections with only one wrench. Damage to the vessel's standing piping or to the pump's piping could occur. Always use two wrenches. Failure to comply with this caution will result in damage to the equipment.

6. Slowly loosen the unions (figure 5, items 4 and 5) and allow any trapped pressure to escape.

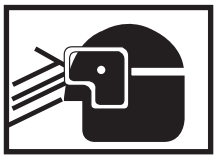
7. Disconnect the unions (figure 5, items 4 and 5).

8. Remove the unions (figure 5, items 4 and 5) and other fittings from the back flush solenoid valve (figure 5, item 2) and set aside for later assembly.

9. Plug the vessel's standing piping to prevent any contamination of the OWS.

INSTALLATION

WARNING



Removing components by means of wire brushing produces flying particles. These particles can cause serious injury to personnel. Protective goggles, gloves, and long sleeves must be worn at all times during wire brushing operations. Failure to comply with this warning can result in serious injury to personnel.

1. Using a wire brush, clean all old sealant from the male pipe threads of the unions (figure 5, items 4 and 5) and attached piping.

⚠ CAUTION

Although antiseizing tape is necessary on the connecting pipe threads, none will be allowed or necessary on the union threads. Leakage will result from applying antiseizing tape to union threads. Failure to comply with this caution may result in damage to the equipment.

2. Apply antiseizing tape to the male pipe threads of piping (figure 5, items 4).

3. Install the unions (figure 5, item 4 and 5) and the attached piping into the backflush inlet solenoid valve (figure 5, item 2).

⚠ CAUTION

Never attempt to connect union connections with only one wrench. Damage to the vessel's standing piping or to the pump's piping could occur. Always use two wrenches. Failure to comply with this caution will result in damage to the equipment.

4. Connect the unions (figure 5, items 4 and 5) to the vessel's piping.

5. Connect the wiring (figure 5, item 3) to the backflush inlet solenoid valve (figure 5, item 2).

6. Remove the labels from the wiring (figure 5, item 3) and install the gasket nut (figure 5, item 1).

7. Perform the Follow-On Service procedure at the end of this work package.

DIVERTER SOLENOID VALVE REPLACEMENT

REMOVAL

1. Remove the two bolts (figure 6, item 1), two nuts (figure 6, item 2), two flat washers (figure 6, item 3), and two lockwashers securing the removable pipe hanger half (figure 6, item 5) to the stationary pipe hanger half (figure 6, item 6). Remove the removable pipe hanger half and discard the lockwashers.

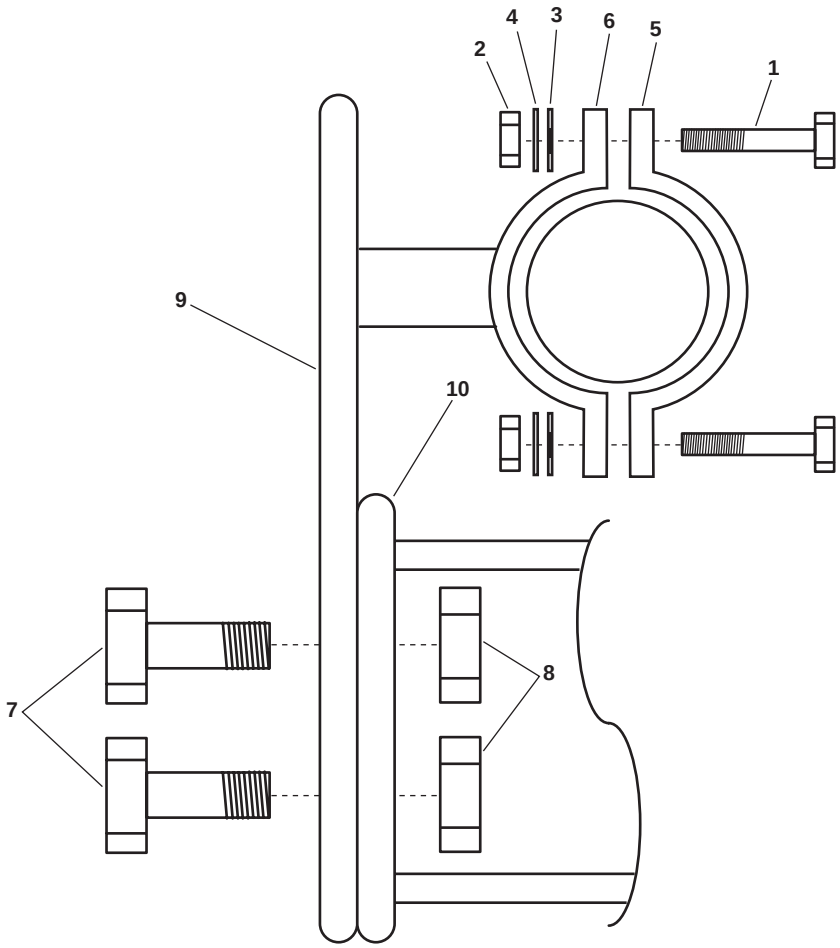


Figure 6. Diverter Solenoid Valve Pipe Hanger

2. Remove the two bolts (figure 6, item 7) and two nuts (figure 6, item 8) securing the pipe hanger bracket (figure 6, item 9) to its foundation. Remove the pipe hanger bracket.

3. Unscrew the cover (figure 7, item 1) from the diverter solenoid valve junction box (figure 7, item 2). Remove and discard the gasket (figure 7, item 3).

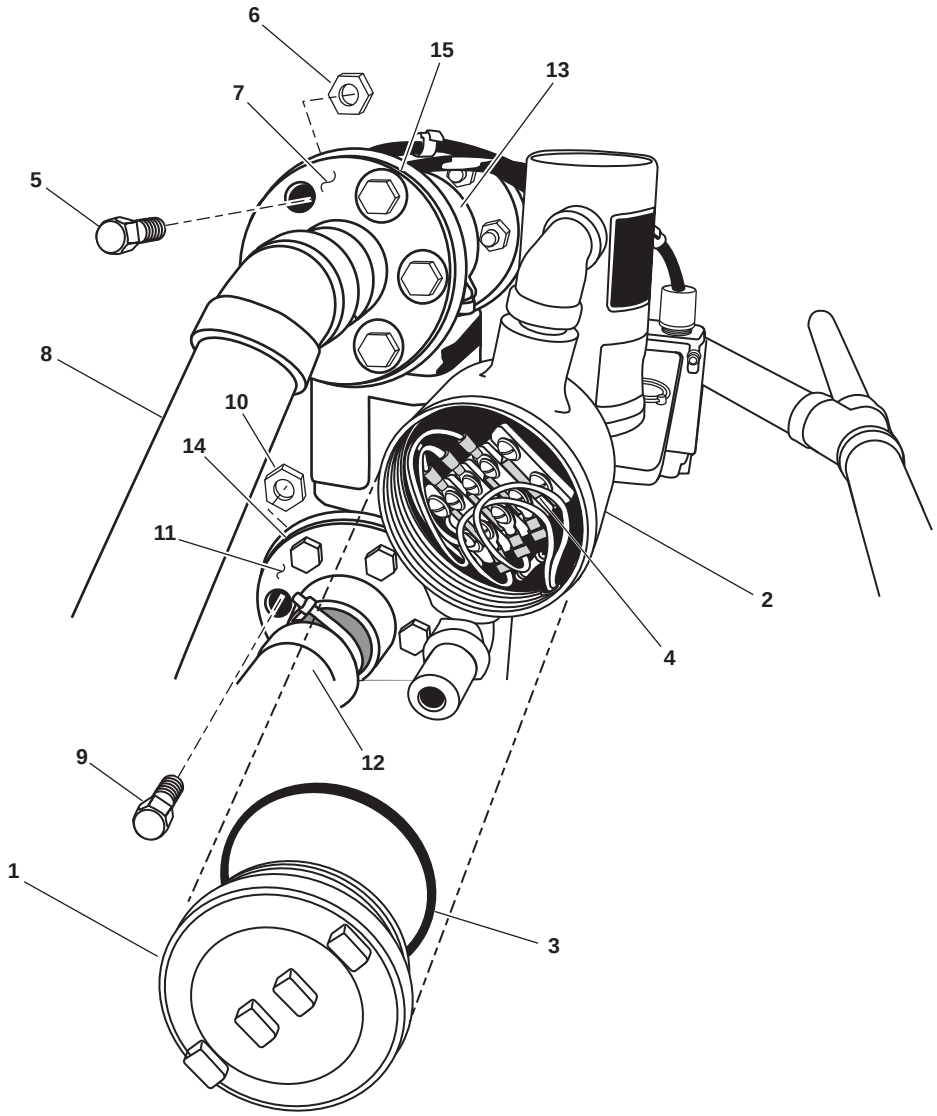


Figure 7. Diverter Solenoid Valve Junction Box

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

4. Using a multimeter, check for voltage at the wire terminals (figure 7, item 4). If voltage is present, check to ensure that the proper circuit breaker is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

5. Label and disconnect the wiring in the diverter solenoid valve junction box (figure 7, item 2).

6. Remove the two screws (figure 8, item 1) and two washers (figure 8, item 2) from the covers (figure 8, item 3) of the two solenoids (figure 8, item 4).

7. Remove the covers (figure 8, item 3) from the two solenoids (figure 8, item 4).

8. Label and disconnect the wiring in the two solenoids (figure 8, item 4).

9. Remove the 6 bolts (figure 7, item 5) and 6 nuts (figure 7, item 6) from the overboard discharge flange (figure 7, item 7) of the overboard discharge piping (figure 7, item 8).

10. Remove the 6 bolts (figure 7, item 9) and six nuts (figure 7, item 10) from the oily waste tank discharge flange (figure 7, item 11) of the oily waste tank piping (figure 7, item 12).

NOTE

Have another crewmember assist in the final removal of the diverter solenoid valve. One crewmember will not be able to hold the diverter solenoid valve and remove the remaining 6 bolts and nuts.

11. Remove the 6 bolts (figure 8, item 5) and the 6 nuts (figure 8, item 6) from the inlet flange (figure 8, item 7) of the OWS discharge piping (figure 8, item 8).

12. Remove the diverter solenoid valve (figure 7, item 13) from the overboard discharge piping (figure 7, item 8), the oily waste tank piping (figure 7, item 12), and the OWS discharge piping (figure 8, item 8).

13. Remove and discard the flange gaskets (figure 7, items 14, and 15) and (figure 8, item 9).

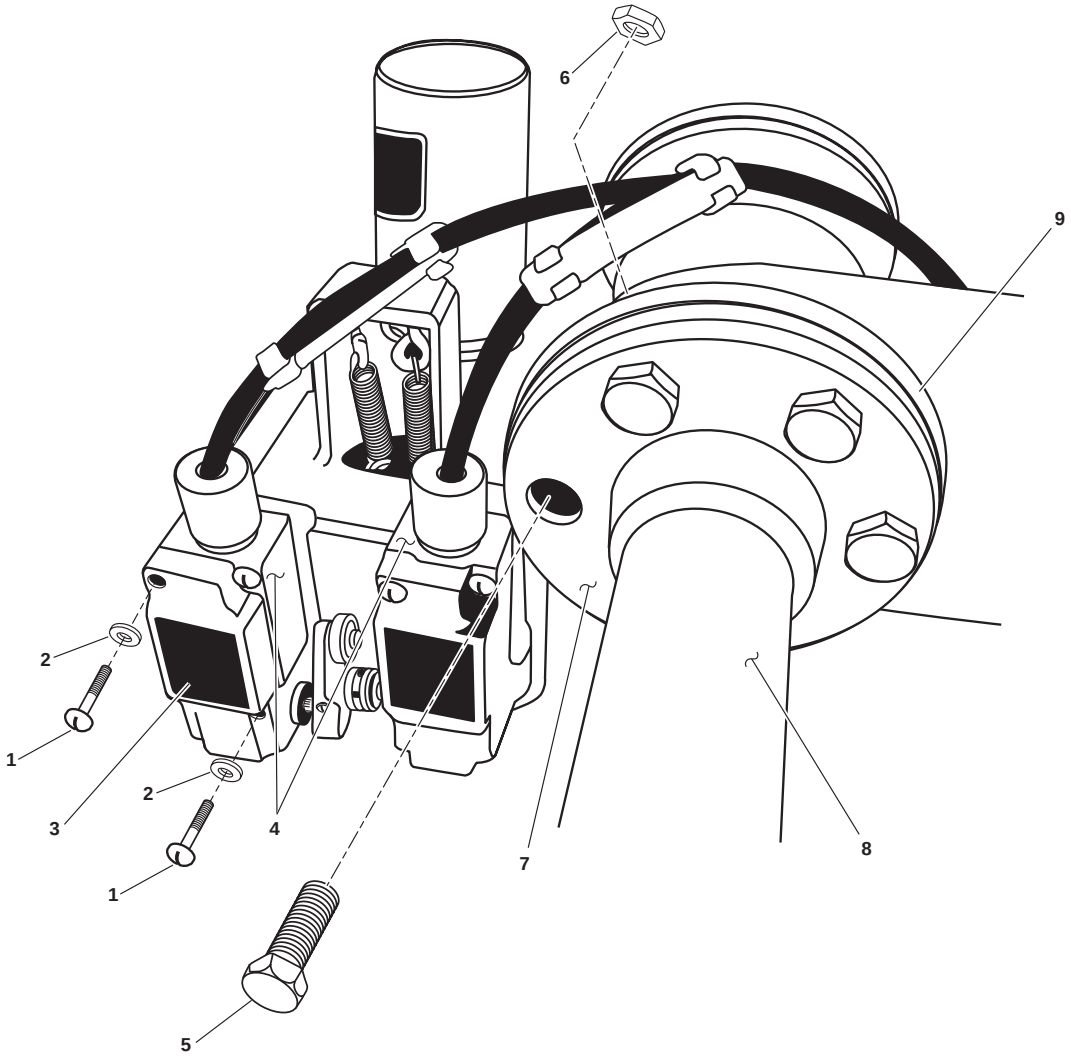


Figure 8. Diverter Solenoids

INSTALLATION

NOTE

Installation of the diverter solenoid valve requires two crewmembers. One crewmember will hold the diverter solenoid valve while the second crewmember installs the gaskets, bolts and nuts.

1. Position the diverter solenoid valve (figure 7, item 13) between the overboard discharge piping (figure 7, item 8), the oily waste tank piping (figure 7, item 12), and the OWS discharge piping (figure 8, item 8).

2. Install the new flange gaskets (figure 7, items 15 and 14) and (figure 8, item 9).

3. Install the 6 bolts (figure 8, item 5) and the 6 nuts (figure 8, item 6) in the inlet flange (figure 8, item 7) of the OWS discharge piping (figure 8, item 8).

4. Install the 6 bolts (figure 7, item 9) and six nuts (figure 7, item 10) in the oily waste tank discharge flange (figure 7, item 11) of the oily waste tank piping (figure 7, item 12).

5. Install the 6 bolts (figure 7, item 5) and 6 nuts (figure 7, item 6) in the overboard discharge flange (figure 7, item 7) of the overboard discharge piping (figure 7, item 8).

6. Connect the wiring to the two solenoids (figure 8, item 4) using the labels from step 6 of removal as a guide.

7. Install the covers (figure 8, item 3) on the two solenoids (figure 8, item 4).

8. Install the two screws (figure 8, item 1) and two washers (figure 8, item 2) in the covers (figure 8, item 3) of the two solenoids (figure 8, item 4).

9. Connect the wiring to the diverter solenoid valve junction box (figure 7, item 2) using the labels from step 3 of removal as a guide.

10. Install a new gasket (figure 7, item 3) on the cover (figure 7, item 1) of the diverter solenoid valve junction box (figure 7, item 2) and install it on the diverter solenoid junction box.

11. Position the pipe hanger bracket (figure 6, item 9) on its foundation. Install, but do not tighten, the two bolts (figure 6, item 7) and two nuts (figure 6, item 8).

12. Install the removable pipe hanger half (figure 6, item 6) and secure it with the two bolts (figure 6, item 1), two nuts (figure 6, item 2), two flat washers (figure 6, item 3), and two new lockwashers.

13. Tighten the two bolts (figure 6, item 7) and two nuts (figure 6, item 8).

14. Perform the Follow-On Service procedure at the end of this work package.

THREADED VALVE REPLACEMENT (TYPICAL)

NOTE

All OCM and OWS threaded valves are of the “union connection” type. The following procedure describes the typical procedure for replacing any “union type” threaded valves. Examples of these valves in the OCM and OWS systems include gate valves, globe valves, swing check valves, the pressure redusing valve, and the Y-strainers.

REMOVAL

1. Align the OWS, the Oily Bilge (OB), and Oil Content Monitor (OCM) valves as indicated in table 1 and figure 4. Lock out and tag out (FM 55-502) the valves immediately upstream and downstream of the valve that will be changed.

2. Position a suitable drain pan beneath the work area.

⚠ CAUTION

Never attempt to disconnect union connections with only one wrench. Damage to the vessel’s standing piping or to the valve could occur. Always use two wrenches. Failure to comply with this caution will result in damage to the equipment.

3. Slowly loosen the unions (figure 9, item 1) and allow any trapped pressure to escape.

4. Disconnect the unions (figure 9, item 1) from the valve (figure 9, item 2) and remove the valve from its piping (figure 9, item 3).

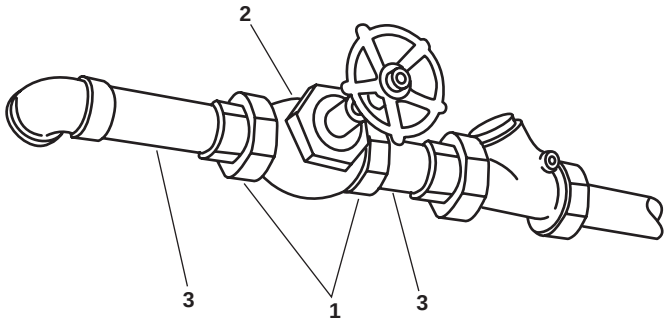


Figure 9. Threaded Valve Replacement (Typical)

INSTALLATION

1. Position the valve (figure 9, item 2) in its piping (figure 9, item 3).

⚠ CAUTION

Never attempt to connect union connections with only one wrench. Damage to the vessel's standing piping or to the valve could occur. Always use two wrenches. Failure to comply with this caution will result in damage to the equipment.

2. Secure the valve (figure 9, item 2) by tightening the unions (figure 9, item 1).

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Return the OWS to normal operation (WP 0005 00).
3. Closely observe all pipe joints, checking for leakage.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OIL CONTENT MONITOR, CALIBRATE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0023 00)

Materials/Parts:
Tag, Danger (Item 10, Table 1, WP 0027 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
WP 0005 00
WP 0016 00
WP 0023 00
WP 0027 00

Equipment Conditions:
Oil Content Monitor (OCM) operating in normal condition (WP 0005 00).

CALIBRATION

Two types of calibration are accomplished for the OCM. Field calibration is accomplished during or following troubleshooting procedures. It may also follow certain maintenance procedures. The 2000 Hour/2 Year calibration is accomplished by ordering calibrated replacement components, removing the existing calibrated components, installing the new calibrated components, and returning the old components to the manufacturer to be laboratory calibrated. Both calibration methods are contained in this work package.

FIELD CALIBRATION

1. Loosen the seven hand nuts (figure 1, item 1) securing the sampling/sensor assembly (figure 1, item 2) and open the door (figure 1, item 3).

2. Verify that the OPERATION SELECTOR switch (A1S1) (figure 1, item 4) is in the AUTO position.

3. Align the OCM, Oil Water Separator (OWS), and (Oily Bilge) OB valves as indicated in table 1 and figure 2 for Field Calibration and the Verification Confidence Test.

4. Verify that the OCM system is operating by observing the red LED A1DS8 (figure 1, item 5) on the back of the Processor Printed Circuit Board (PCB).

5. Observe fluid flow through the clear plastic tubing (figure 1, item 6) located on the front of the Sample and Detection Sub-assembly (SDA).

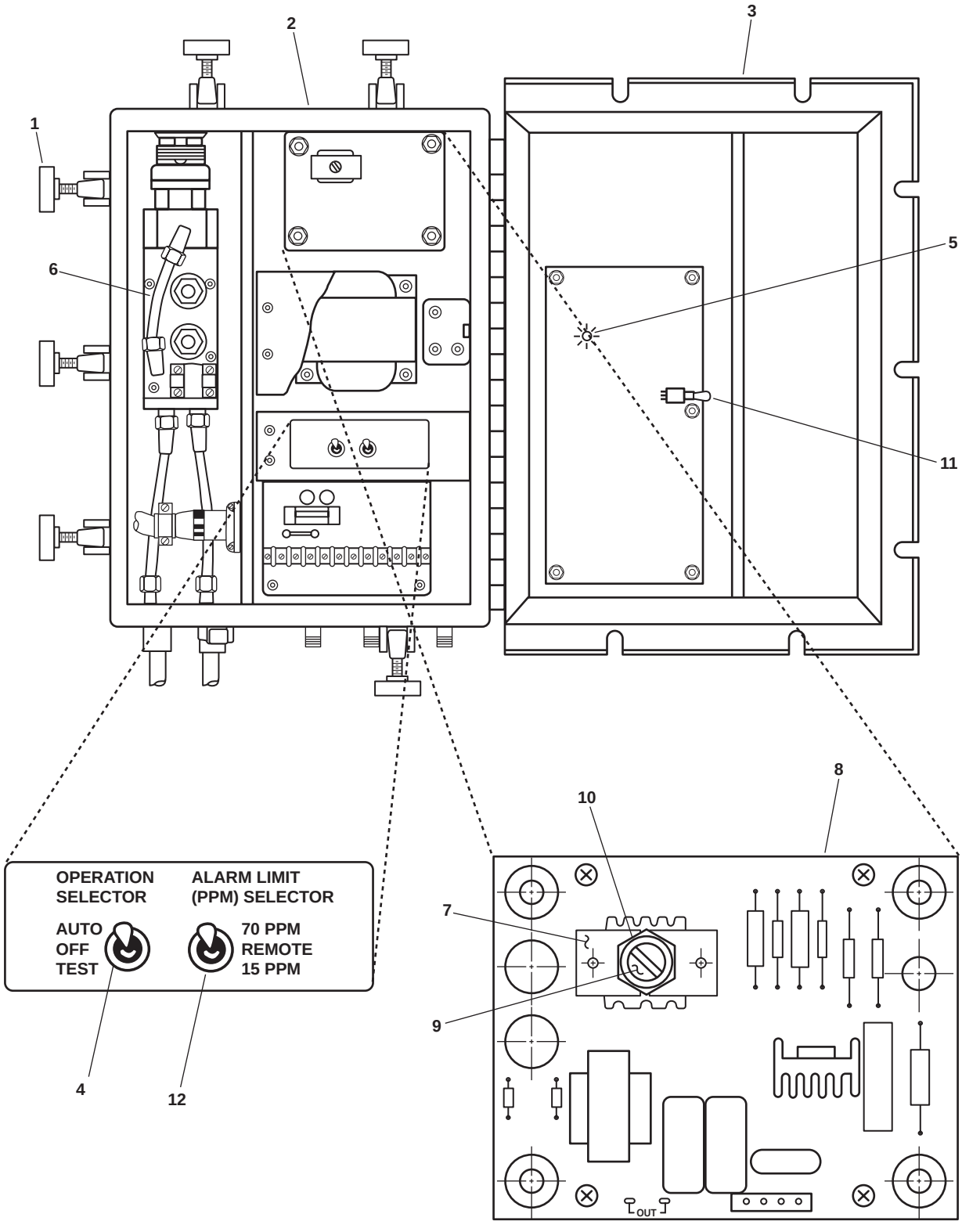


Figure 1. Sampling/Sensor Assembly Controls

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

⚠ CAUTION

When adjusting the oscillator core screw, use a wide blade 1/16-inch thick insulated-handle screwdriver that fits snugly into the oscillator core screw slot without damage. Failure to comply could result in damage to equipment.

NOTE

This procedure relies on the detection of an audible signal produced by the Ultrasonic Vibrator Sub-assembly (UVA) as it is adjusted with a coarse adjustment range. Do not attempt this procedure in an excessively noisy environment (engines running) or if you have a hearing impairment. In such instances, the use of an engine stethoscope may make the audible determinations possible.

6. Locate the oscillator transformer (figure 1, item 7) on the generator PCB (figure 1, item 8), and place the screwdriver tip into the oscillator core screw (figure 1, item 9).

7. While holding the oscillator core screw (figure 1, item 9) stationary, turn the oscillator core locknut (figure 1, item 10) counterclockwise one complete turn to allow free adjustment of the plastic oscillator core screw.

NOTE

Holding the processor PCB TEST/CHECK switch A1S3 on the processor PCB in the DOWN position will cause a continuous oscillation signal that is more easily adjusted than the normal intermittent signal.

8. Hold the processor PCB TEST/CHECK switch A1S3 (figure 1, item 11) on the processor PCB in the TEST (DOWN) position.

NOTE

When the oscillator transformer core screw is tuned within the “coarse adjustment range,” the UVA will produce an audible high-pitched tone. This tone will become gradually louder as the oscillator transformer core screw 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 tone will decrease as the oscillator transformer core screw is adjusted away from the midpoint.

9. Alternately turn the oscillator transformer core screw (figure 1, item 9) clockwise and counter clockwise to determine the limits of the audible coarse adjustment range. Refer to figure 3.

Table 1. Valve Positions During Field Calibration and the Verification Confidence Test

Item Number (Figure 2)	Valve Number	Function	Position During Operation Under Usual Conditions
1	OWS-1	OWS MANUAL BACKFLUSH	CLOSED
2	OWS-2	OWS DISCHARGE	CLOSED
3	OWS-3	OWS PUMP DISCHARGE	CLOSED
4	OWS-4	OCM 3-WAY DIVERTER	Controlled by OCM
5	OWS-5	OWS DISCHARGE	CLOSED
6	OWS-6	OWS PITOT SAMPLE	CLOSED
7	OWS-7	BACKFLUSH WTR TO PRESS RDCR	OPEN
8	OWS-8	BACKFLUSH WTR FROM PRESS RDCR	OPEN
9	OWS-9	BACKFLUSH WTR PRESS RDCR BYPASS	CLOSED
10	OWS-10	OWS RECIRCULATING COV	CLOSED
11	OWS-24	SW TO OWS PRESS GAGE ISOLATION	OPEN
12	OCM-1	OCM NOZZLE SAMPLER COV	CLOSED
13	OCM-2	OCM BACKFLUSH WATER	OPEN
14	OCM-3	OCM SAMPLING VALVE	CLOSED
15	OCM-4	OCM INLET	OPEN
16	OCM-8	OCM GAGE ISOLATION	OPEN
17	GS-74	OWS BACKFLUSH INLET SOLENOID	Automatic (Ensure that the manual override handle is in the CLOSED position (CCW) with the valve stem all the way out)
18	OB-8	XFR PUMP TO OILY WATER TANK	CLOSED
19	OB-9	XFR PUMP DISCH TO SHORE	CLOSED
20	OB-10	OWS OVERBOARD DISCHARGE	CLOSED
21	OB-13	OWT TO XFR PUMP SUCTION	CLOSED
22	OB-14	COV-XFR PUMP SUCTION	CLOSED
23	OB-15	OWS INLET	CLOSED
24	OB-16	WATER FROM OWT COV	CLOSED
25	OB-17	OILY WATER TANK INLET	CLOSED

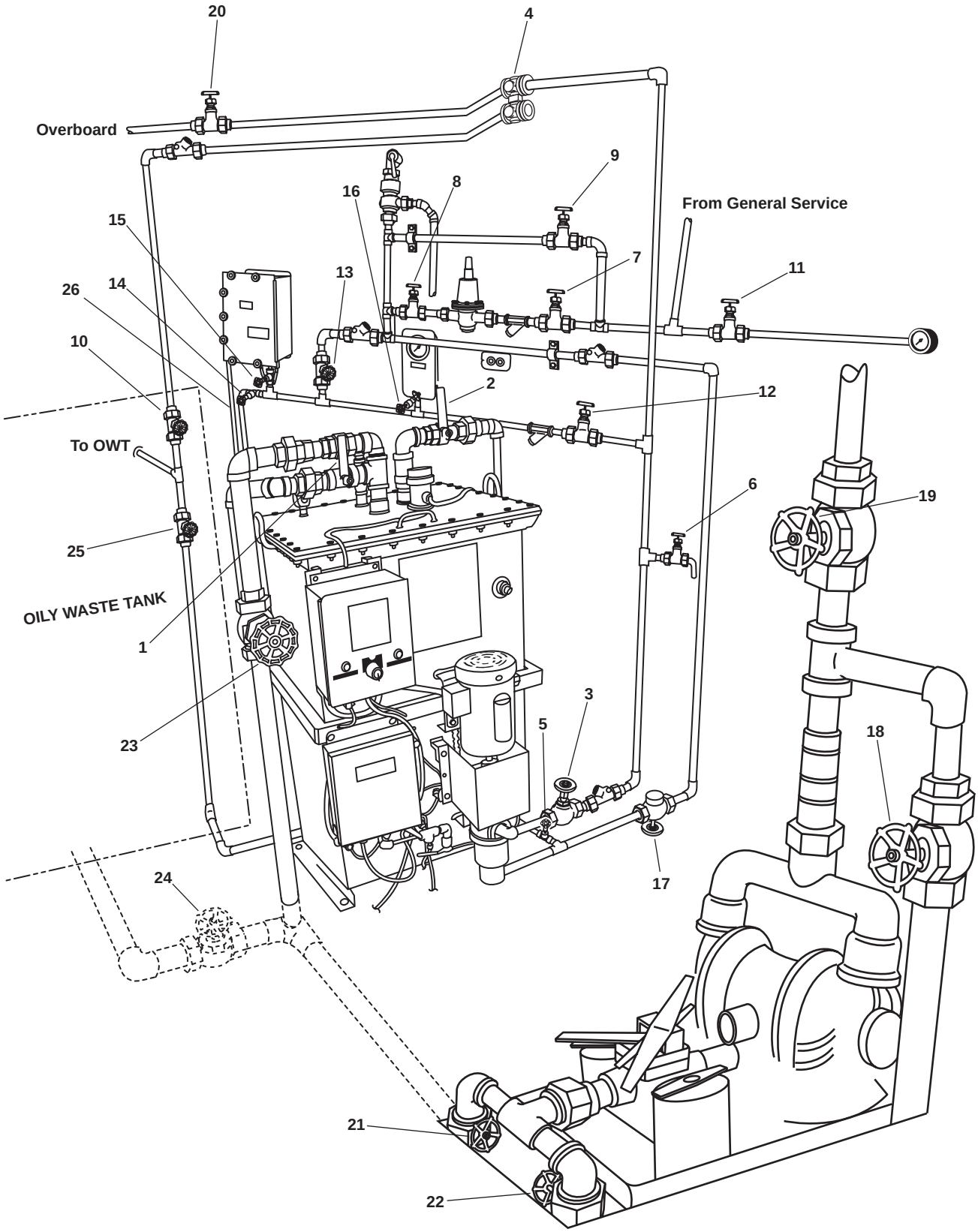


Figure 2. OWS, OB, and OCM Piping

10. Using a marking pen, make temporary markings on the metal portion of the oscillator transformer (figure 1, item 7), indicating the limits of the coarse adjustment range.

11. Turn the oscillator transformer core screw (figure 1, item 9) to the center of this coarse adjustment range, which is the fine-tuned position.

12. Release the processor PCB TEST/CHECK switch (A1S3) (figure 1, item 11).

⚠ CAUTION

Do not over tighten the oscillator core locknut. Damage to the oscillator transformer core screw threads could occur. After making the fine tune adjustment, gently hand tighten the oscillator core locknut. Failure to comply with this caution will result in damage to the equipment.

13. Tighten the oscillator core locknut (figure 1, item 10) by turning it clockwise while holding the oscillator transformer core screw in the fine-tune position using the wide blade 1/16 inch thick insulated handle screwdriver.

14. Perform the Verification Confidence (V/C) Test that is described later in this work package.

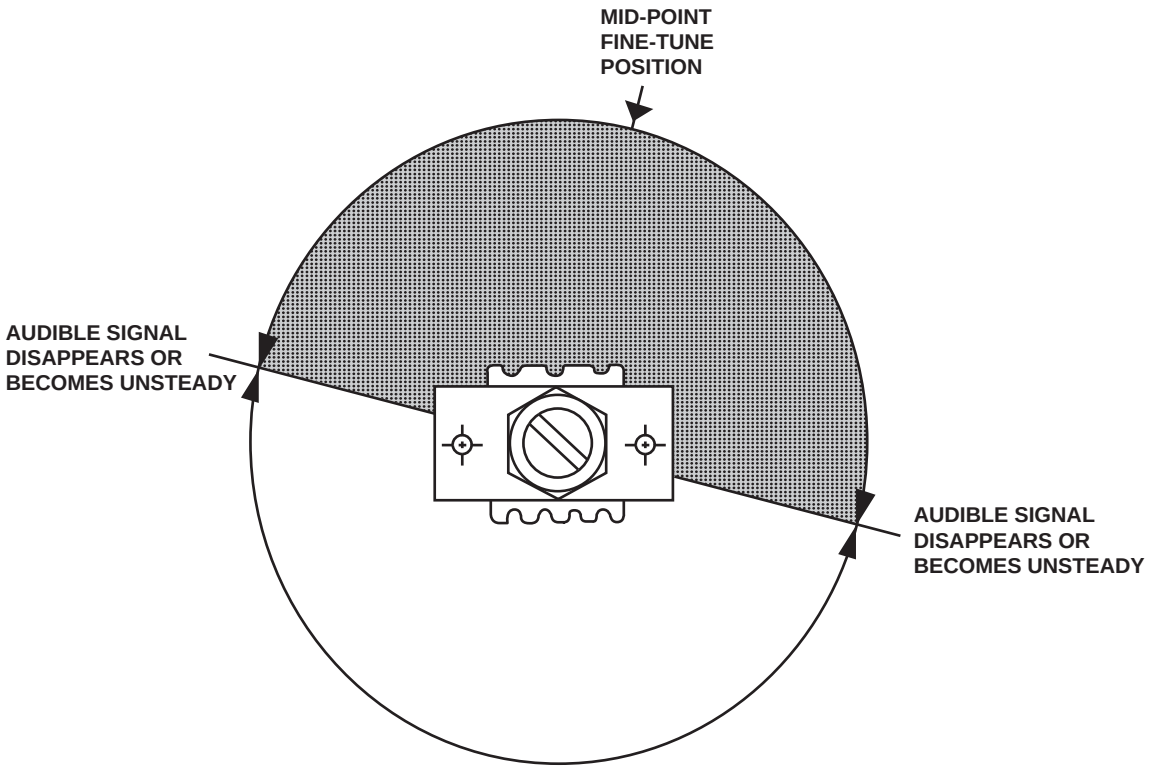


Figure 3. Ultrasonic Vibrator (UVA) Adjustment, Audible Method

2000 HOUR/2 YEAR CALIBRATION

The 2000 hour/2 year calibration for the OCM is accomplished by ordering calibrated replacement components, removing the existing calibrated components, installing the new calibrated components, and returning the old components to the manufacturer to be laboratory calibrated. The vessel must order certain replacement parts as part of the OCM maintenance whenever one of the following is reached: 2000 hours of operating time (as per elapsed time indicator) or 2 years after calibration date. The vessel should order, through the normal supply channel, Maintenance Kit, Electronic Equipment (NSN 6625-01-456-5671) which will supply a calibrated SDA, processor PCB, and an Elapsed Time Indicator (ETI). To accomplish the 2000 hour/2 year calibration, remove the old SDA, PCB, and ETI and install the calibrated set. Replacement of these components is detailed in WP 0016 00. Return the removed components to the sender through normal supply channel. After replacing the components, perform the V/C test below.

VERIFICATION CONFIDENCE (V/C) TEST

1. Align the OCM, OWS, and OB valves as indicated in table 1 and figure 2 for Field Calibration and the Verification Confidence Test.

2. Set the OPERATION SELECTOR switch (A1S1) (figure 1, item 4) in the sampling/sensor assembly (figure 1, item 2) to the AUTO position.

3. Set the ALARM LIMIT (PPM) SELECTOR switch (A1S2) (figure 1, item 12) to the REMOTE position.

4. Verify that the following occur:

    a. The sampling/sensor assembly POWER indicator (figure 4, item 1) lights up green, and the 15 PPM range indicator (figure 4, item 2) lights up.

    b. Water is discharged through the OCM drain.

    c. The system solenoid valves begin cyclical control of the water.

    d. The OCM remote indicator alarm assembly display POWER indicator (figure 5, item 1) lights up green, and the IN PORT 15 PPM indicator (figure 5, item 2) lights up.

5. If any leaks are evident in the sample and detection sub-assembly, place the sampling/sensor assembly OPERATION SELECTOR switch (figure 1, item 4) into the OFF position, return all valves from table 1 to the closed position and set the OCM circuit breaker to OFF, lock out, and tag out (FM 55-502) before repairing the leaks. Return the system to the desired operating state following the repairs.

6. Gradually cycle the OCM BACKFLUSH WATER valve, OCM-2 (figure 2, item 13) to the fully closed position and back to the fully open position.

7. Verify that the following occur:

NOTE

The pressure switch is preset to switch ON and OFF when the inlet pressure drops between 4 to 5 PSI (0.276 to 0.335 bar).

    a. The inlet pressure does not exceed 25 PSI (1.7 bar).

    b. The OCM comes ON when the inlet pressure exceeds 5 PSI (0.335 bar), and goes OFF when the inlet pressure drops below 5 PSI (0.335 bar).

8. Switch the sampling/sensor assembly OPERATION SELECTOR switch (A1S1) (figure 1, item 4) to the OFF position and verify that:

   a. The sampling/sensor assembly is inactive.

   b. The OCM remote indicator alarm assembly is inactive.

   c. No flow is coming from the OCM sample drain (figure 2, item 26).

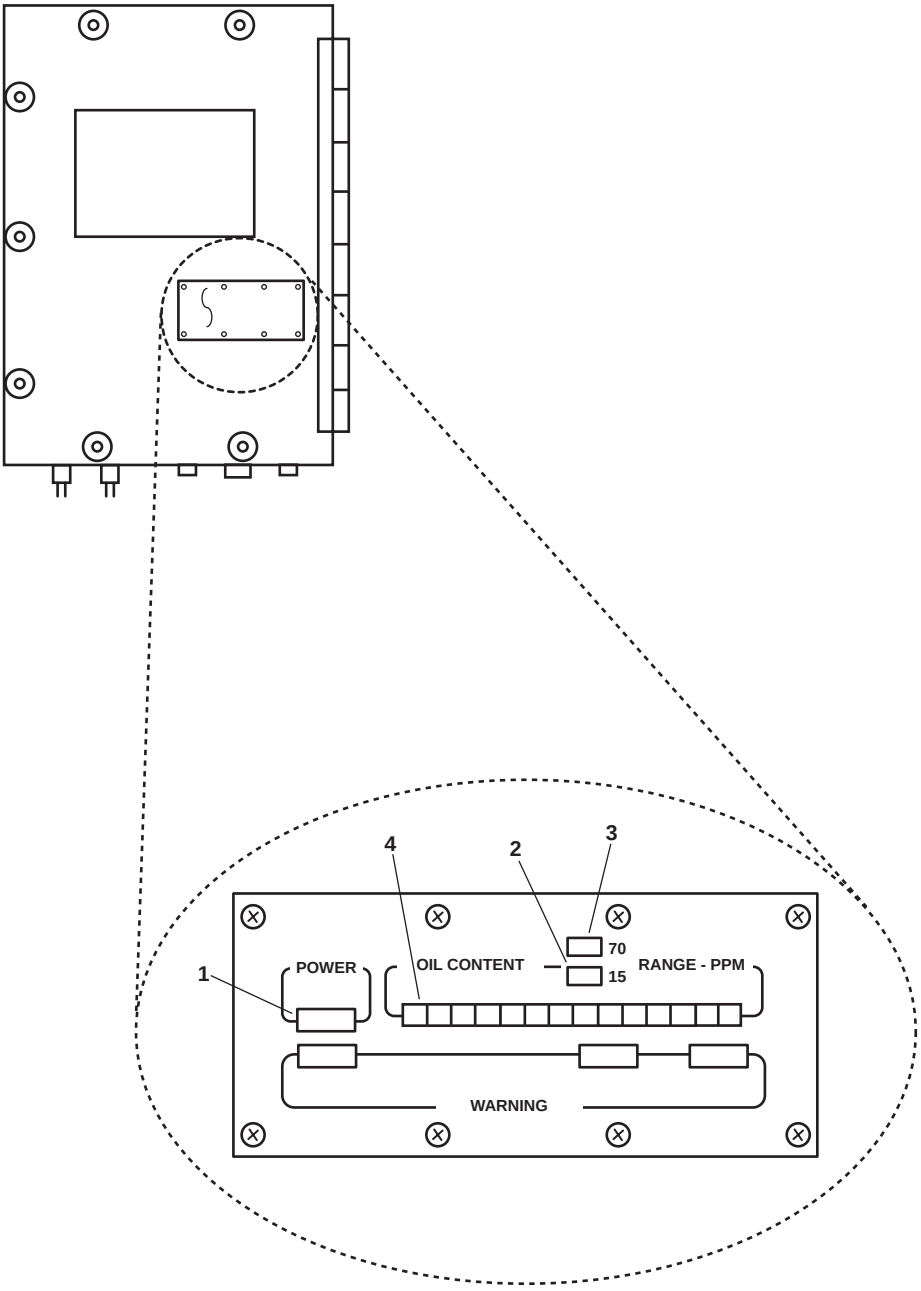


Figure 4. Sampling/Sensor Assembly Indicators

9. Switch the OPERATION SELECTOR switch (A1S1) (figure 1, item 4) to the TEST position and observe that the following occur:

   a. The sampling/sensor assembly POWER indicator (figure 4, item 1) lights up and the 15 PPM range indicator (figure 4, item 2) lights up.

   b. The OCM remote indicator alarm assembly's POWER indicator (figure 5, item 1) lights up.

   c. The OCM remote indicator alarm assembly's IN PORT 15 PPM indicator (figure 5, item 2) lights up.

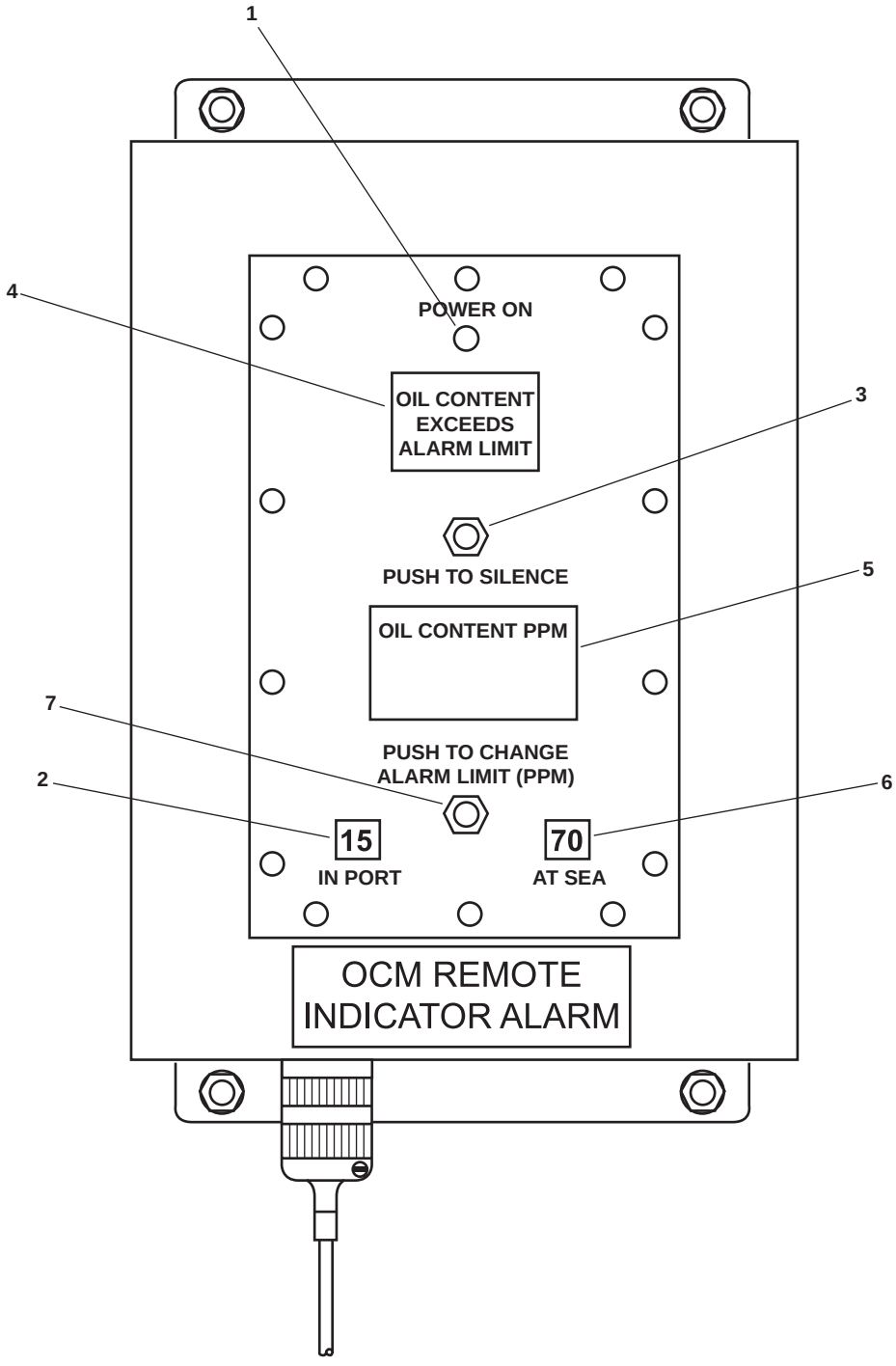


Figure 5. Remote Indicator Alarm Assembly, Controls, and Indicators

10. Switch the sampling/sensor assembly ALARM LIMIT (PPM) SELECTOR switch (A1S2) (figure 1, item 12) to the 70 PPM position and observe that the following occur:

    a. The sampling/sensor assembly 70 PPM range indicator (figure 4, item 3) lights.

    b. The OCM remote indicator (alarm) assembly 70 PPM AT SEA indicator (figure 5, item 6) lights up with the OPERATION SELECTOR switch (A1S1) (figure 1, item 4) in the AUTO position.

11. Switch the ALARM LIMIT (PPM) SELECTOR switch (A1S2) (figure 1, item 12) to the REMOTE position. Press PUSH TO CHANGE THE ALARM LIMIT (PPM)(A2S1) push button (figure 5, item 7) to alternately select 15 PPM IN-PORT and 70 PPM AT-SEA.

12. Observe that the sampling/sensor assembly LED indicator's (figure 4, items 2 and 3) ranges match the OCM remote indicator (alarm) assembly in port and at sea indicators (figure 5, items 2 and 6).

13. While the OCM is alarming, press the PUSH TO SILENCE (A2S2) button (figure 5, item 7) on the OCM remote indicator alarm assembly and observe that the audible buzzer is silenced. The buzzer will automatically sound the next time the OCM experiences an alarm condition.

14. Hold the ALARM CHECK (A1S3) switch (figure 1, item 11) on the processor PCB within the sampling/sensor assembly door (figure 1, item 3) UP in the CHECK ON position for 90 seconds and observe that the following occur:

    a. Within 20 seconds, the sampling/sensor assembly's red and green LEDs (figure 4, item 4) will begin to flash.

    b. Within 20 seconds, the OCM remote indicator alarm assembly's red OIL CONTENT EXCEEDS ALARM LIMIT indicator (figure 5, item 4) will light up, a high numerical PPM value will be displayed on the OIL CONTENT PPM display (figure 5, item 5), and the audible alarm will buzz.

    c. Within 80 seconds, the OCM 3-WAY DIVERTER valve OWS-4 (figure 2, item 4) will actuate and switch positions from overboard discharge to recirculate to the oily waste holding tank.

15. Release the sampling/sensor assembly's ALARM CHECK (A1S3) switch (figure 1, item 11) and verify that the following occur:

    a. The sampling/sensor assembly's red and green LEDs (figure 4, item 4) stop flashing and display a low-level reading (0 to 3 ppm).

    b. The OCM remote indicator alarm assembly buzzer silences, and the OIL CONTENT PPM (figure 5, item 5) display shows a low-level reading (0 to 3 ppm).

    c. The OCM 3-WAY DIVERTER valve OWS-4 (figure 2, item 4) will change position from recirculate to overboard discharge.

16. Position the OPERATION SELECTOR switch (A1S2) (figure 1, item 4) to the OFF position.

17. Return all valves from table 1 to the CLOSED position.

18. Align the OCM, OWS, and OB valves for operation under usual conditions (WP 0005 00).

19. Position the OPERATION SELECTOR switch (A1S2) (figure 1, item 4) to the AUTO position and proceed as follows:

⚠ CAUTION

Do not start the OWS without having the valves properly aligned. Damage to the OWS pump will occur. Failure to comply with this caution will result in damage to the equipment.

a. Start up the OWS (WP 0005 00) to cause 5 to 15 PSI (0.345 to 1.034 bar) pressure in the OWS pump discharge.

b. Verify that the sampling/sensor assembly activates and the POWER indicator (figure 4, item 1) lights up.

c. Shut down (WP 0005 00) the OWS to drop the sampling/sensor assembly inlet pressure to below 5 PSI (0.345 bar).

20. Start up the OWS (WP 0005 00) to apply 5 to 25 PSI (0.345 to 1.72 bar) pressure to the OWS pump discharge piping and perform the following:

a. After 60 seconds, hold the ALARM CHECK switch A1S3 (figure 1, item 11) in the CHECK ON position for 90 seconds and verify that the following occur:

b. Within 20 seconds, the sampling/sensor assembly's red green LEDs (figure 4, item 4) will begin to flash.

c. Within 80 seconds, the OCM 3-WAY DIVERTER valve OWS-4 (figure 2, item 4) will activate and switch positions from overboard to recirculate.

d. While the OCM 3-WAY DIVERTER valve OWS-4 (figure 2, item 4) is in the recirculate position, there is 5 to 25 PSI (0.345 to 1.72 bar) pressure at the sample inlet, and the OCM continues to operate.

NOTE

Releasing the switch A1S3 will not necessarily take the OCM out of ALARM.

21. Release the ALARM CHECK switch A1S3 (figure 1, item 11) and verify the following:

a. The OCM samples and controls the OWS effluent discharge.

b. If the OCM remains in alarm for more than 30 seconds after the ALARM CHECK (A1S3) switch (figure 1, item 11) is released, verify the OCM operation by introducing flushing water to the unit. Proceed to Introducing Flushing Water To The OCM procedure below.

22. Shut down the OWS and the OCM (WP 0005 00).

INTRODUCING FLUSHING WATER TO THE OCM

1. Verify that the OCM circuit breaker is set to ON (WP 0005 00).

2. Align the OCM, OWS, and OB valves as indicated in table 1 and figure 2 for Field Calibration and the Verification Confidence Test.

3. Verify that the following occur:

a. The sampling/sensor assembly POWER indicator (figure 4, item 1) lights green and the 15 RANGE PPM indicator (figure 4, item 2) lights up.

b. Water is discharged through the sampling/sensor assembly drain (figure 2, item 26).

c. The OCM remote indicator alarm assembly POWER indicator (figure 5, item 1) lights green, and the IN PORT 15 PPM indicator (figure 5, item 2) lights up.

4. If any leaks are evident in the sample and detection sub assembly, perform steps a through d below. If there are no leaks, continue with the procedure at step 5

   a. Place the sampling/sensor assembly's OPERATION SELECTOR switch (figure 1, item 4) into the OFF position.

   b. Place all valves from table 1 in the CLOSED position.

   c. Set the OIL CONTENT MONITOR circuit breaker OFF, lock out, and tag out (FM 55-502) before repairing the leaks.

   d. Repair the leak, remove the lockouts and tagouts, and return the OCM to the desired operating state.

5. Slowly close the OCM BACKFLUSH WATER valve OCM-2 (figure 2, item 13) until it is fully closed. Slowly open the valve until it is fully open.

6. Verify the following:

   a. The inlet pressure does not exceed 25 PSI (1.72 bar).

   b. The OCM activates when the inlet pressure exceeds 5 PSI (0.345 bar) and deactivates when the inlet pressure drops below 5 PSI (0.345 bar).

7. Switch the OPERATION SELECTOR switch (A1S1) (figure 1, item 4) to the OFF position and verify the following:

   a. The sampling/sensor assembly is inactive.

   b. The OCM remote indicator alarm assembly display is inactive.

   c. There is no flow from the OCM sample drain.

8. Switch the OPERATION SELECTOR switch (A1S1) (figure 1, item 4) to the TEST position and verify that the following occur:

   a. The sampling/sensor assembly POWER indicator (figure 4, item 1) lights up, and the 15 RANGE PPM indicator (figure 4, item 2) lights up.

   b. The OCM remote indicator alarm assembly's POWER ON indicator (figure 5, item 1) lights up, and the 15 IN PORT indicator (figure 5, item 2) lights up.

9. Switch the ALARM LIMIT (PPM) SELECTOR switch (A1S2) (figure 1, item 12) to the 70 PPM position and observe the following:

   a. The sampling/sensor assembly's 70 RANGE PPM indicator (figure 4, item 3) lights up.

   b. The OCM remote indicator alarm assembly's AT-SEA indicator (figure 5, item 6) lights up.

10. Place the OPERATION SELECTOR switch (A1S1) (figure 1, item 4) is in the AUTO position.

11. Switch the ALARM LIMIT (PPM) SELECTOR switch (A1S2) (figure 1, item 12) to the REMOTE position.

12. Press the OCM remote indicator alarm PUSH TO CHANGE ALARM LIMIT (A2S1) button (figure 5, item 7) to alternately select IN PORT (figure 5, item 2) and AT SEA (figure 5, item 6).

13. Observe that the sampling/sensor assembly's RANGE PPM (figure 4, items 2 and 3) ranges match.

14. While the OCM is alarming, press the PUSH TO SILENCE (A2S2) button (figure 5, item 4) on the OCM remote indicator alarm assembly and observe that the audible buzzer is silenced. The buzzer will automatically sound the next time the OCM experiences an alarm condition.

15. Hold the sampling/sensor assembly's ALARM CHECK switch A1S3 (figure 1, item 11) on the processor PCB within the sampling/sensor assembly door (figure 1, item 3) in the CHECK ON position for 90 seconds and verify that the following occur:

    a. Within 20 seconds, the sampling/sensor assembly's red and green LEDs (figure 4, item 4) begin to flash.

    b. Within 20 seconds, the OCM remote indicator alarm assembly's red OIL CONTENT EXCEEDS ALARM LIMIT indicator (figure 5, item 4) lights up, a high numerical ppm value is displayed on the OIL CONTENT PPM display (figure 5, item 5), and the audible alarm buzzes.

    c. Within 80 seconds, the diverter valve OCM-4 (figure 2, item 8) actuates and switches positions from overboard discharge to recirculate to the oily waste holding tank.

16. Release the sampling/sensor assembly's ALARM CHECK (A1S3) (figure 1, item 11) switch and verify that the following occur:

    a. The sampling/sensor assembly's red and green LEDs (figure 4, item 4) stop flashing and display a low-level reading (0 to 3 ppm).

    b. The OCM remote indicator alarm assembly buzzer silences, and the OIL CONTENT PPM (figure 5, item 5) display shows a low level reading (0 to 3 ppm).

17. Shut down the OCM and the OWS (WP 0005 00).

END OF WORK PACKAGE

Chapter 7

Direct Support Maintenance Instructions for Oil Water Separator

Inland and Coastal Large Tug (LT)

DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OIL WATER SEPARATOR, REPAIR

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0023 00)

Materials/Parts:
Detergent, General Purpose (Item 1, Table 1, WP 0027 00)
Dry Cleaning Solvent (Item 2, Table 1, WP 0027 00)
Gloves, Chemical and Oil Protective (Item 1, Table 3, WP 0026 00)
Goggles, Industrial (Item 4, Table 3, WP 0026 00)
Hardener, Ceilcoat Flaketar "B" (Item 3, Table 1, WP 0027 00)
Primer, Ceilcoat Flaketar "A" (Item 5, Table 1, WP 0027 00)
Rags, Wiping (Item 6, Table 1, WP 0027 00)
Solvent, Cleaning, Ceilcote T-410 (Item 8, Table 1, WP 0027 00)
Switch, Sensitive (Item 3, Figure 1, WP 0025 00)
Tag, Danger (Item 10, Table 1, WP 0027 00)
Tape, Antiseizing (Item 11, Table 1, WP 0027 00)

Materials/Parts (continued):
Valve, Safety Relief (Item 2, Figure 1, WP 0025 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
WP 0003 00
WP 0005 00
WP 0006 00
WP 0014 00
WP 0023 00
WP 0025 00
WP 0026 00
WP 0027 00

Equipment Conditions:
Set to OFF the OILY WATER SEPARATOR and OIL CONTENT MONITOR circuit breakers in 120V distribution panel No. 4. Lock out and tag out (FM 55-502).

REPAIR OIL WATER SEPARATOR (OWS) TANK INTERNAL COATING

DISASSEMBLY

1. Remove the Oil Water Separator (OWS) tank cover and internal components (WP 0014 00).

⚠ CAUTION

Do not use hot steam or cleaning solvents to clean the coalescer boxes, as damage to the coalescer box will occur.

NOTE

The water used to wash the beads out of the coalescer boxes will be oily and should be directed to the bilge for collection in the oily waste tank.

2. Wash the interior of the tank with clean warm water and an approved short-lived detergent (WP 0003 00).

3. Inspect the inside coating of the tank and lid for chipping, scratches, cracks, rust, or loose coating.

4. Remove any rust or loose paint by sanding or buffing. Sand all bare spots including the area surrounding the spot.

5. Clean the sanded or buffed area using Ceilcote cleaning solvent T-410.

NOTE

All coating repairs should be done at temperatures over 70 ºF (21 ºC). Ensure that all surfaces are dry.

6. Mix equal amounts of Ceilcoat Flaketar's A and B components (a two-part coal tar epoxy) per manufacturer's instructions.

NOTE

The Ceilcoat Flaketar's mixture pot life depends on the temperature. At 76 ºF (24.4 ºC), pot life is 1-1/2 to 2 hours.

7. Apply a light coat (approximately 8 mils) of Ceilcoat Flaketar to the affected area using a disposable paint brush. After 4 hours, apply a final (second) light coat (approximately 8 mils).

8. Allow the new coating to cure for at least five days before putting OWS back into service.

ASSEMBLY

1. Install the OWS tank's internal components and tank cover (WP 0014 00).

2. Perform the Follow-On Service procedure at the end of this work package.

SAFETY RELIEF VALVE REPLACEMENT

REMOVAL

WARNING

Oily water hoses and lines may be under pressure. Loosen fittings on the hose lines slowly. Allow oily water to run around threads of fitting, releasing pressure before disconnecting fitting. Releasing pressurized oily water suddenly may cause severe personal injury.

⚠ CAUTION

Never attempt to disconnect union connections with only one wrench. Damage to the vessel's standing piping or to the safety relief valve piping could occur. Always use two wrenches.

1. Slowly loosen the outlet union (figure 1, item 1) and allow any trapped pressure to escape.

2. After all pressure has been released, completely disconnect the outlet union (figure 1, item 1) from the OWS safety relief valve (figure 1, item 2).

3. Remove the safety relief valve (figure 1, item 2).

4. Remove the outlet pipe (figure 1, item 3) from the OWS safety relief valve (figure 1, item 2). Retain the outlet pipe for installation.

5. Plug or tape over the open lines and exposed unions on the OWS tank (figure 1, item 4) to prevent contamination of the OWS.

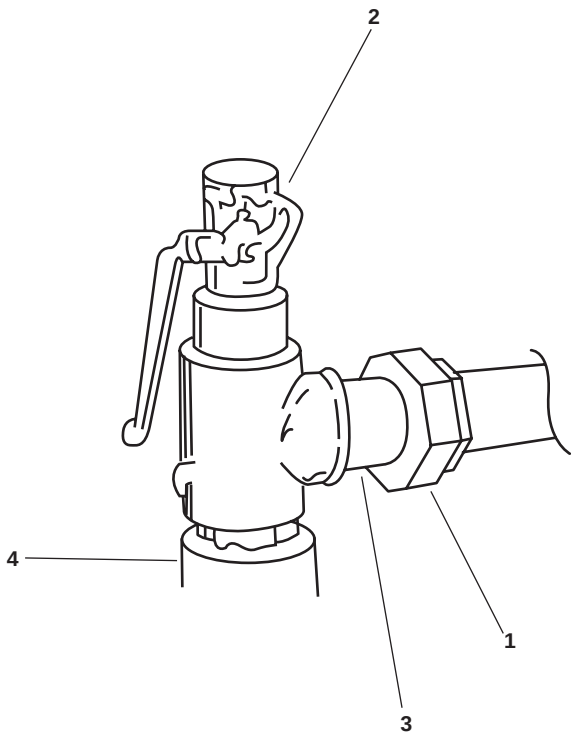


Figure 1. Safety Relief Valve

INSTALLATION

Removing components by means of wire brushing produces flying particles. These particles can cause serious injury to personnel. Protective goggles, gloves, and long sleeves must be worn at all times during wire brushing operations. Failure to comply can result in serious injury to personnel.

Do not allow cleaning solvents to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling hydraulic fluid, engine oil, and cleaning solvents. Failure to follow these precautions can result in illness or serious injury.

1. Clean the male pipe threads of the outlet pipe (figure 1, item 3) using a wire brush and dry cleaning solvent.

2. Apply antiseizing tape on the male threads of the outlet pipe (figure 1, item 3). Install the outlet pipe into the OWS safety relief valve (figure 1, item 2). Tighten the outlet pipe securely.

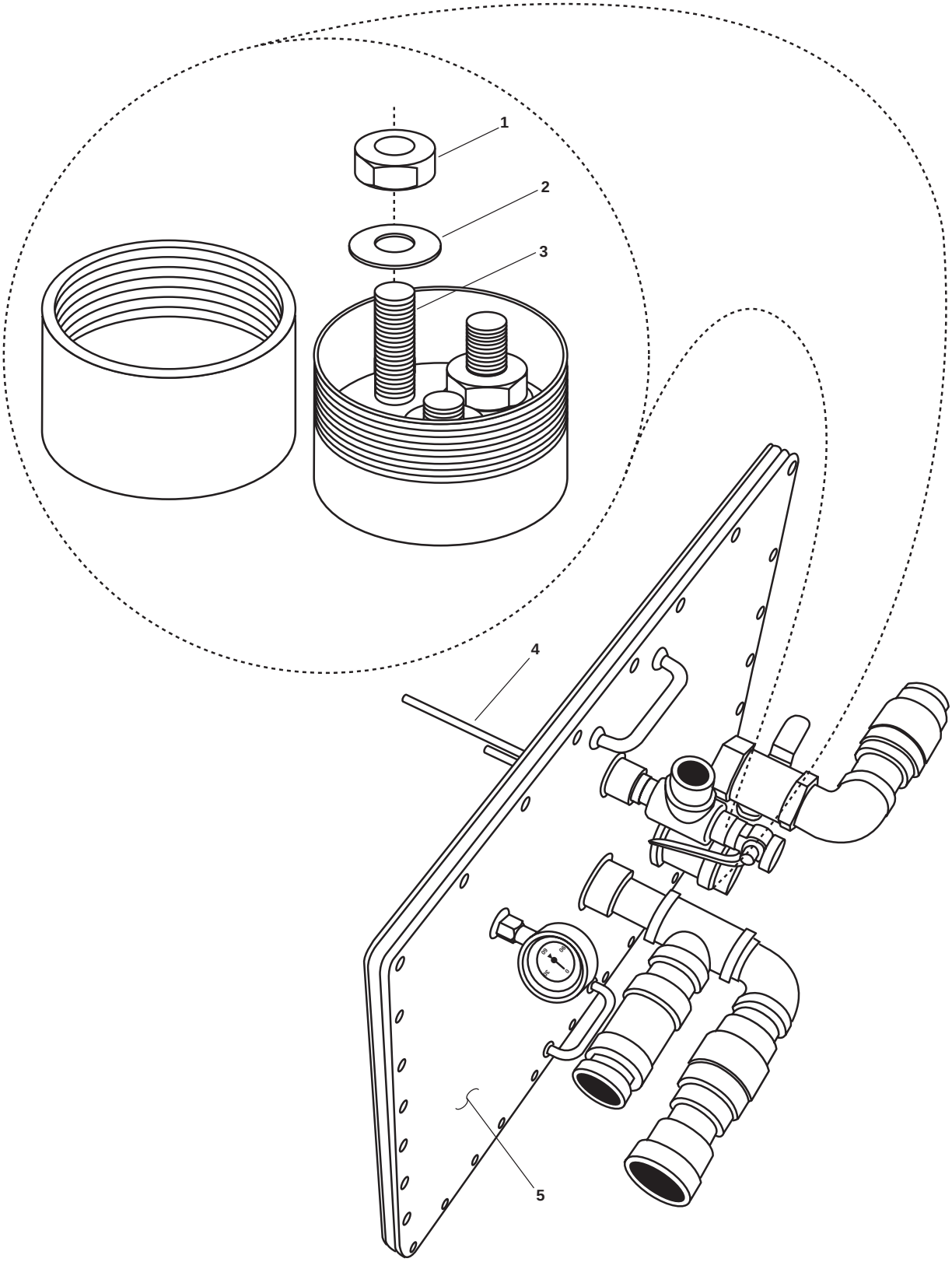


Figure 2. OWS Tank Cover from OWS Tank

3. Apply antiseizing tape on the male threads of the safety relief valve (figure 1, item 2). Thread the safety relief valve into the OWS tank (figure 1, item 4).

CAUTION

Never attempt to connect union connections with only one wrench. Damage to the vessel's standing piping or to the safety relief valve piping could occur. Always use two wrenches.

4. Connect the outlet union (figure 1, item 1) to the OWS safety relief valve (figure 1, item 2).

5. Perform the Follow-On Service procedure at the end of this work package.

SENSITIVE SWITCH REPLACEMENT

REMOVAL

1. Perform the disassembly procedure of OWS service (WP 0014 00).

2. Remove the three nuts (figure 2, item 1) and three flat washers (figure 2, item 2) from the sensitive switch studs (figure 2, item 3).

3. Remove the sensitive switch (figure 2, item 4) from the OWS tank cover (figure 2, item 5).

INSTALLATION

1. Install the sensitive switch (figure 2, item 4) into the OWS tank cover (figure 2, item 5).

2. Install the three flat washers (figure 2, item 2) and the three nuts (figure 2, item 1) on the sensitive switch studs (figure 2, item 3).

3. Perform the assembly procedure of OWS service (WP 0014 00).

4. Perform the Follow-On Service procedure at the end of this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).

2. Perform OWS manual backflush (WP 0006 00).

3. Return the OWS to normal operation (WP 0005 00).

4. Closely observe all pipe joints, checking for leakage.

5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OIL WATER SEPARATOR PUMP, REPLACE

INITIAL SETUP:

Tools and Special Tools:
- Tool Kit, General Mechanic's (Item 1, Table 2, WP 0023 00)
- Multimeter (Item 3, Table 2, WP 0023 00)
- Suitable Drain Pan

Materials/Parts:
- Dry Cleaning Solvent (Item 2, Table 1, WP 0027 00)
- Gloves, Chemical and Oil Protective (Item 1, Table 3, WP 0026 00)
- Goggles, Industrial (Item 4, Table 3, WP 0026 00)
- Rags, Wiping (Item 6, Table 1, WP 0027 00)
- Tag, Danger (Item 10, Table 1, WP 0027 00)
- Tape, Antiseizing (Item 11, Table 1, WP 0027 00)

Personnel Required:
- Two Watercraft Engineers 88L

References:
- FM 55-502
- TB 43-0218
- WP 0005 00
- WP 0023 00
- WP 0026 00
- WP 0027 00

Equipment Conditions:
- CLOSE valves OB-15 OWS INLET, OWS-1 OWS MANUAL BACKFLUSH, OWS-2 OWS OIL DISCHARGE, OWS-3OWS PUMP DISCHARGE, OWS-4 OCM 3-WAY DIVERTER, OWS-5 OWS DISCHARGE, OWS-22 OWS SAMPLE, and GS-74 OWS BACKFLUSH INLET SOLENOID. Lock out and tag out (FM 55-502).
- Set to OFF OILY WATER SEPARATOR and OIL CONTENT MONITOR circuit breakers on 120V distribution panel NO. 4. Lock out and tag out (FM 55-502).

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.

ELECTRIC MOTOR REPLACEMENT

REMOVAL

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

NOTE

Electrical junction boxes may vary in size, shape, and mounting position of the box on the electric motor frame. Electrical junction box covers may vary in number and placement of screws holding the cover in place.

1. Remove the four bolts (figure 1, item 1) securing the electrical junction box cover (top) (figure 1, item 2).

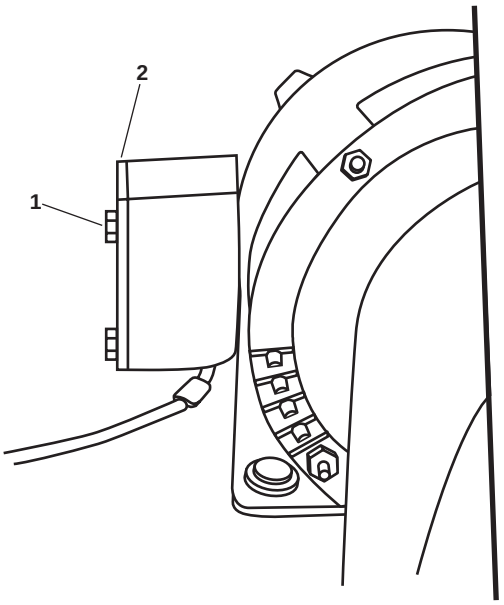


Figure 1. Electrical Junction Box

2. Remove the junction box cover (top) (figure 1, item 2).

3. Using a multimeter, check for available voltage at the wiring terminals. If voltage is present, check that the proper circuit breakers are locked out and tagged out. If no voltage is present, continue with the procedure.

4. Label and disconnect the electrical wiring.

5. Remove the four bolts (figure 2, item 1) four lockwashers (figure 2, item 2), and four flat washers (figure 2, item 3), from the coupling guard (figure 2, item 4). Discard the lockwashers.

6. Remove the coupling guard (figure 2, item 4).

7. Loosen the electric motor coupling flange setscrew (figure 3, item 1).

8. Slide the electric motor coupling flange (figure 3, item 2) towards the electric motor (figure 3, item 3).

9. Remove the four nuts (figure 3, item 4), the four lockwashers (figure 3, item 5), eight flat washers (figure 3, item 6), and four bolts (figure 3, item 7). Discard the four lockwashers.

10. Remove the electric motor (figure 3, item 3) from its foundation.

11. Slide the electric motor coupling flange (figure 3, item 2) off the electric motor shaft. Retain the coupling flange for installation.

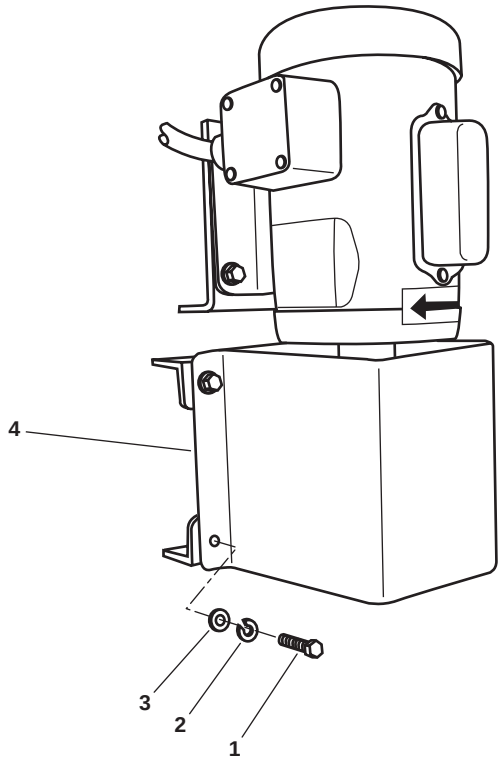


Figure 2. Coupling Guard Removal

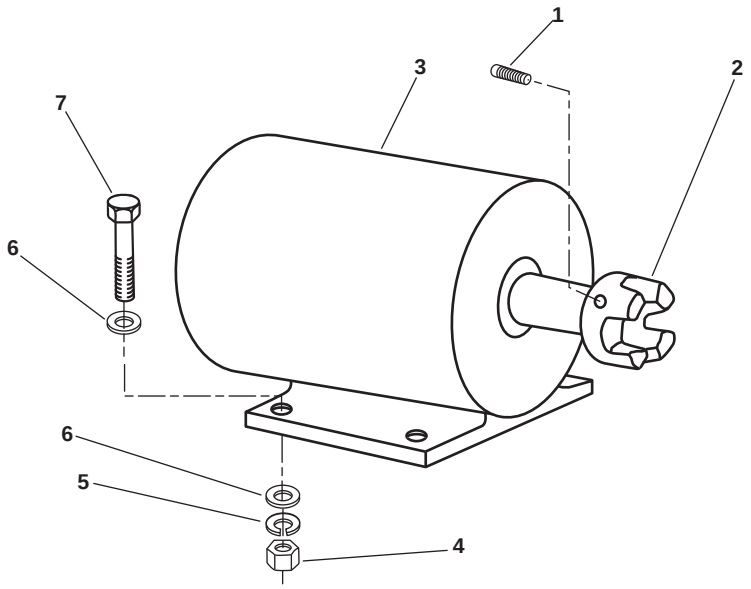


Figure 3. Electric Motor Removal

INSTALLATION

1. Slide the electric motor coupling flange (figure 3, item 2) onto the electric motor shaft (refer to figure 3) with the flat end towards the electric motor (figure 3, item 3) housing.

2. Position the electric motor (figure 3, item 3) on its foundation with the mounting holes aligned.

3. Install the four bolts (figure 3, item 7), eight flat washers (figure 3, item 6), four new lockwashers, (figure 3, item 5) and four nuts (figure 3, item 4). Do not tighten the bolts at this time.

4. Perform the Alignment procedure at the end of this work package.

PUMP REPLACEMENT

REMOVAL

WARNING

Hydraulic hoses and lines may be under pressure. Relieve pressure by operating the appropriate control valve, if possible. Loosen fittings on hose lines slowly. Allow oil to run around threads of fitting, releasing pressure before disconnecting fitting. Releasing pressurized oil suddenly may cause severe personal injury.

⚠ CAUTION

Never attempt to disconnect union connections with only one wrench. Damage to the vessel's standing piping or to the pump's piping could occur. Always use two wrenches.

1. Place a suitable drain pan under the Oil Water Separator (OWS) pump (figure 4, item 1).

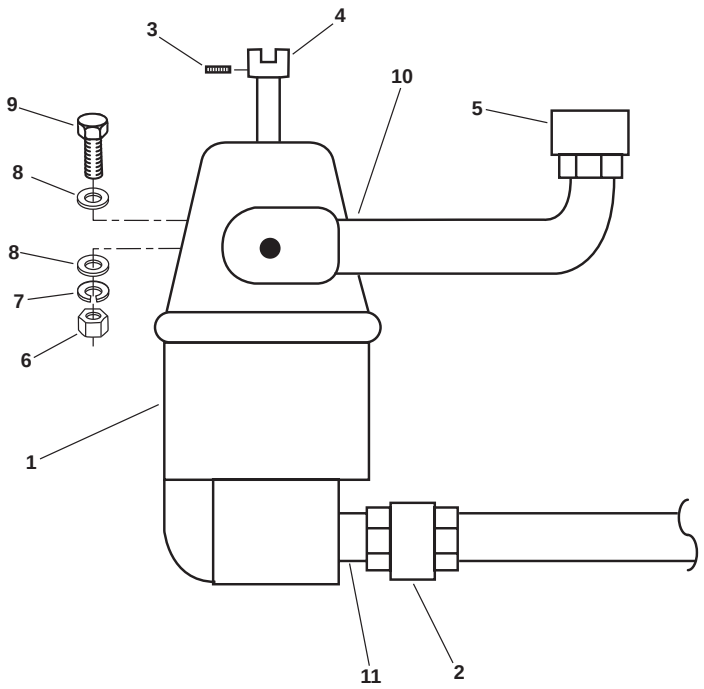


Figure 4. Pump Removal

2. Slowly loosen the outlet union (figure 4, item 2) and allow any trapped pressure to escape.

3. After all pressure has been released, completely disconnect the outlet union (figure 4, item 2) from the OWS pump (figure 4, item 1).

4. Loosen the OWS pump's (figure 4, item 1) coupling flange setscrew (figure 4, item 3).

5. Slide the coupling flange (figure 4, item 4) towards the OWS pump (figure 4, item 1).

⚠ CAUTION

Never attempt to disconnect union connections with only one wrench. Damage to the vessel's standing piping or to the pump's piping could occur. Always use two wrenches.

6. Disconnect the inlet union (figure 4, item 5).

7. Remove the three nuts (figure 4, item 6), three lockwashers (figure 4, item 7), six flat washers (figure 4, item 8), and three bolts (figure 4, item 9) securing the OWS pump (figure 4, item 1) to its foundation. Remove the OWS pump and discard the lockwashers.

8. Plug or tape over the exposed unions on the vessel's standing piping to prevent contamination of the oily water system.

9. Remove the inlet pipe (figure 4, item 10) and the outlet pipe (figure 4, item 11) from the OWS pump (figure 4, item 1). Retain the outlet pipe and the inlet pipe for installation on the new or repaired OWS pump.

10. Remove the coupling flange (figure 4, item 4) from OWS pump (figure 4, item 1) and retain for installation.

INSTALLATION

WARNING

Removing components by means of wire brushing produces flying particles. These particles can cause serious injury to personnel. Protective goggles, gloves, and long sleeves must be worn at all times during wire brushing operations. Failure to comply can result in serious injury to personnel.

Do not allow hydraulic fluid, engine oil, or cleaning solvents to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling hydraulic fluid, engine oil, and cleaning solvents. Failure to follow these precautions can result in illness or serious injury.

1. Clean the male pipe threads of the inlet pipe (figure 4, item 10) and the outlet pipe (figure 4, item 11) using a wire brush and dry cleaning solvent.

2. Apply antiseizing tape on the male threads of the inlet pipe (figure 4, item 10) and the outlet pipe (figure 4, item 11). Install the inlet and pipe into the OWS pump (figure 4, item 1).

3. Position the OWS pump (figure 4, item 1) on its foundation with the mounting holes aligned.

4. Install the three bolts (figure 4, item 9), the six flat washers (figure 4, item 8), the three new lockwashers (figure 4, item 7) and the three nuts (figure 4, item 6) securing the OWS pump (figure 4, item 1). Do not tighten the bolts at this time.

⚠ CAUTION

Never attempt to connect union connections with only one wrench. Damage to the vessel's standing piping or to the pump's piping could occur. Always use two wrenches.

5. Connect and tighten the outlet union (figure 4, item 2) securely.

6. Connect and tighten the inlet union (figure 4, item 5) securely.

7. Perform the Alignment procedure below.

ALIGNMENT

1. Align the pump coupling flange and the electric motor coupling flange together leaving approximately 0.016-inch (0.41 mm) space between the ends of both flanges. Refer to figure 5.

2. Check the alignment between the pump coupling flange and the electric motor coupling flange. Refer to figure 5.

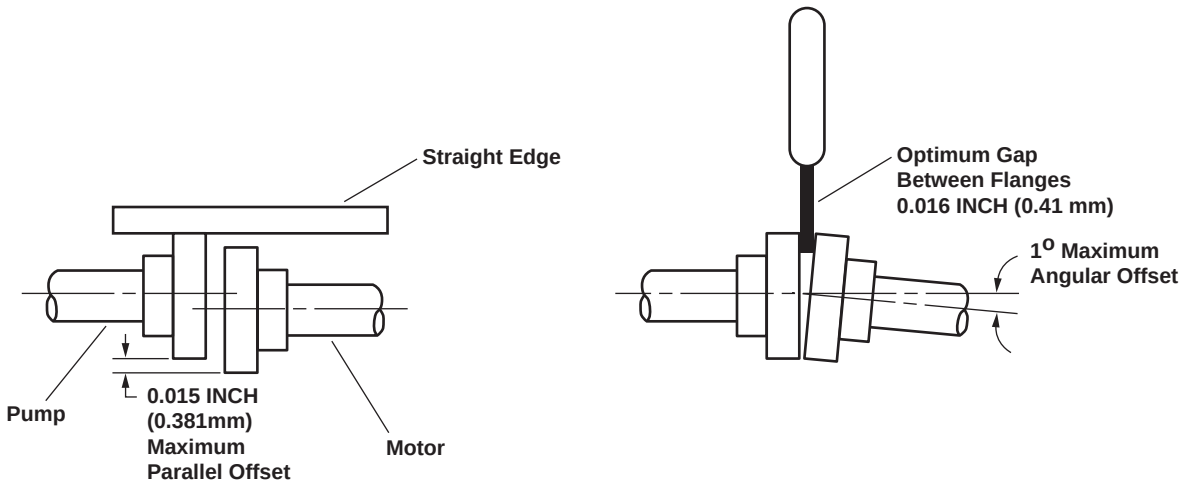


Figure 5. Alignment of Pump Coupling Flange and Motor Coupling Flange

3. The maximum angular offset shall be no more than 1 degree and maximum parallel offset shall be no more than 0.015 inch (0.381 mm). Refer to figure 5.

4. Tighten the electric motor's coupling flange setscrew (figure 3, item 1).

5. Tighten the pump's coupling flange setscrew (figure 4, item 3).

6. Tighten the four bolts (figure 3, item 6) securing the electric motor (figure 3, item 3).

7. Tighten the three bolts (figure 4, item 9) securing the OWS pump (figure 4, item 1).

8. Install the coupling guard (figure 2, item 4) with four bolts (figure 2, item 1), four new lockwashers (figure 2, item 2), and four flat washers (figure 2, item 3).

9. Connect the electrical wiring and remove the tags.

10. Install the electrical junction box cover (figure 1, item 2) with the four bolts (figure 1, item 1).

11. Remove the lockouts and tagouts (FM 55-502).

12. Operate the OWS (WP 0005 00), checking for proper operation. The pump should operate without unusual noises, vibrations, or leakage.

13. Closely observe all pipe joints, checking for leakage.

14. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

Chapter 8

Supporting Information for Oil Water Separator

Inland and Coastal Large Tug (LT)

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
REFERENCES

This work package lists all field manuals, forms, technical manuals, and miscellaneous publications referenced in this manual.

ARMY REGULATIONS

AR 700-138	Army Logistics Readiness and Sustainability

FIELD MANUALS

FM 4-25.11	First Aid
FM 55-502	Watercraft Safety
FM 55-509	Introduction to Marine Electricity

TECHNICAL MANUALS

TM 38-470	Storage and Maintenance of Army Prepositioned Stock Materiel
TM 55-1925-273-10	Operator's Manual for Inland and Coastal Large Tug (LT) NSN 1925-01-509-7013
TM 750-244-6	Procedures for Destruction of Tank--Automotive Equipment to Prevent Enemy Use

TECHNICAL BULLETINS

TB 43-0218	Inspection, Use, and Tightening of Metal Fasteners Used on Tank-Automotive Equipment
TB 740-97-4	Preservation of Vessels for Storage

FORMS AND PAMPHLETS

DA Form 2028	Recommended Changes To Equipment Technical Publications
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2407	Maintenance Request
DA Form 2408-9	Equipment Control Record
DA Form 4640	Harbor Boat Deck Department Log for Class A&B Vessels
DA Form 4993	Harbor Boat Engine Department Log for Class A and C-1 Vessels
DA PAM 738-750	Functional Users Manual for The Army Maintenance Management System (TAMMS)
SF 368	Product Quality Deficiency Report

HANDBOOKS AND STANDARDS

MIL-HDBK-113	Guide for the Selection of Lubricants, Functional Fluids, Preservatives, and Specialty Products for Use in Ground Equipment Systems
MIL-HDBK-275	Guide for the Selection of Lubricant Fluids and Compounds for Use in Flight Vehicles and Components

END OF WORK PACKAGE

OPERATOR, UNIT AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
MAINTENANCE ALLOCATION CHART (MAC)
INTRODUCTION

THE ARMY MAINTENANCE SYSTEM MAC

This introduction provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

The MAC (immediately following the introduction) 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 shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on 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.

The tools and test equipment requirements (immediately following the MAC) list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

The remarks (immediately following the tools and test equipment requirements) contain supplemental instructions and explanatory notes for a particular maintenance function.

MAINTENANCE FUNCTIONS

Maintenance functions are limited to and defined as follows:

1. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel). This includes scheduled inspection and gagings and evaluation of cannon tubes.

2. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.

3. Service. Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases. This includes scheduled exercising and purging of recoil mechanisms.

4. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

5. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

6. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments of 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.

7. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

8. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

9. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures, and maintenance actions 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), end item, or system.

NOTE

The following definitions are applicable to the "repair" maintenance function:

Services. Inspect, test, service, adjust, align, calibrate, and/or replace.

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).

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., identified as maintenance significant).

Actions. Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

10. 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. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

11. Rebuild. Consists of those services/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 materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

EXPLANATION OF COLUMNS IN THE MAC

Column (1) Group Number. Column (1) lists FGC numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

Column (2) Component/Assembly. Column (2) contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

Column (3) Maintenance Function. Column (3) lists the functions to be performed on the item listed in column (2). (For a detailed explanation of these functions refer to "Maintenance Functions" outlined above.)

Column (4) Maintenance Level. Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown

for each level. 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 time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

C Operator or crew maintenance
O Unit maintenance
F Direct support maintenance
L Specialized repair activity (SRA)
H General support maintenance
D Depot maintenance

NOTE

The "L" maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by a work time figure in the "H" column of column (4), and an associated reference code is used in the REMARKS column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

Column (5) Tools and Equipment Reference Code. Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

Column (6) Remarks Code. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

EXPLANATION OF COLUMNS IN THE TOOLS AND TEST EQUIPMENT REQUIREMENTS

Column (1) Tool or Test Equipment Reference Code. The tool or test equipment reference code correlates with a code used in column (5) of the MAC.

Column (2) Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

Column (3) Nomenclature. Name or identification of the tool or test equipment.

Column (4) National Stock Number (NSN). The NSN of the tool or test equipment.

Column (5) Tool Number. The manufacturer's part number, model number, or type number.

EXPLANATION OF COLUMNS IN THE REMARKS

Column (1) Remarks Code. The code recorded in column (6) of the MAC.

Column (2) Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
MAINTENANCE ALLOCATION CHART

Table 1. MAC for Oil Water Separator for Inland and Coastal Large Tug

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP	(6) REMARKS
			FIELD			SUSTAINMENT			
			UNIT		DIRECT SUPPORT	GENERAL SUPPORT	DEPOT		
			C	O	F	H	D		
050605	Oil Water Separator	Inspect	1.0						
		Service	6.0					1,5	
		Replace					--		
		Repair		1.0	8.0			1,2,3	
05060501	Oil Content Monitor	Replace		1.0				1	
		Repair		1.0				1,3,4	
		Calibrate		2.0				1	
05060502	Pump	Inspect	0.5						
		Replace			3.0			1,3	

Table 2. Tools and Test Equipment for Oil Water Separator for Inland and Coastal Large Tug

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
1	O	Tool Kit, General Mechanic's	5180-00-629-9783	SC5180-90-CL-N55 (50980)
2	F	Tool Kit, Electrician's	5180-00-313-3045	SC5180-90-CL-N35 (50980)
3	O	Multimeter	6625-01-265-6000	27 W/ACCE (89536)
4	O	Tool, Ball Driver		ST1045-4 (25204)
5	O	Funnel, Steel w/Strainer	7240-00-144-5995	631 (82378)

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE OIL WATER SEPARATOR FOR INLAND AND COASTAL LARGE TUG (LT) REPAIR PARTS AND SPECIAL TOOLS LIST INTRODUCTION

SCOPE

This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for performance of operator, unit, and direct support maintenance of the oil water seperator for the Inland and Coastal Large Tug (LT). It authorizes the requisitioning, issue, and disposition of spares, repair parts, and special tools as indicated by the source, maintenance, and recoverability (SMR) codes.

GENERAL

In addition to the Introduction work package, this RPSTL is divided into the following work packages.

1. Repair Parts List Work Packages. Work packages containing lists of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. These work packages also include parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Sending units, brackets, filters, and bolts are listed with the component they mount on. Bulk materials are listed by item name in FIG. BULK at the end of the work packages. Repair parts kits are listed separately in their own functional group and work package. Repair parts for reparable special tools are also listed in a separate work package. Items listed are shown on the associated illustrations.

2. Special Tools List Work Packages. Work packages containing lists of special tools, special TMDE, and special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in the DESCRIPTION AND USABLE ON CODE (UOC) column). Tools that are components of common tool sets and/or Class VII are not listed.

3. Cross-Reference Indexes Work Packages. There are two cross-reference indexes work packages in this RPSTL: the National Stock Number (NSN) Index work package and the Part Number (P/N) Index work package. The National Stock Number Index work package refers you to the figure and item number. The Part Number Index work package refers you to the figure and item number.

EXPLANATION OF COLUMNS IN THE REPAIR PARTS LIST AND SPECIAL TOOLS LIST WORK PACKAGES

ITEM NO. (Column (1)). Indicates the number used to identify items called out in the illustration.

SMR CODE (Column (2)). The SMR code containing supply/requisitioning information, maintenance level authorization criteria, and disposition instruction, as shown in the following breakout:

Source Code	**Maintenance Code**		**Recoverability Code**
XX 1st two positions: How to get an item.	XX 3rd position: Who can install, replace, or use the item.	4th position: Who can do complete repair* on the item.	X 5th position: Who determines disposition action on unserviceable items.

*Complete Repair: Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

Source Code. The source code tells you how you get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source codes follow:

Source Code	Application/Explanation
PA PB PC PD PE PF PG	Stock items; use the applicable NSN to requisition/request items with these source codes. They are authorized to the level indicated by the code entered in the 3rd position of the SMR code. **NOTE** Items coded PC are subject to deterioration.
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance level indicated in the 3rd position of the SMR code. The complete kit must be requisitioned and applied.
MO-Made at unit/AVUM level MF-Made at DS/AVIM level MH-Made at GS level ML-Made at SRA MD-Made at depot	Items with these codes are not to be requisitioned/requested individually. They must be made from bulk material which is identified by the P/N in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the bulk material group work package of the RPSTL. If the item is authorized to you by the 3rd position code of the SMR code, but the source code indicates it is made at higher level, order the item from the higher level of maintenance.
AO-Assembled by unit/AVUM level AF-Assembled by DS/AVIM level AH-Assembled by GS level AL-Assembled by SRA AD-Assembled by depot	Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3rd position of the SMR code authorizes you to replace the item, but the source code indicates the item is assembled at a higher level, order the item from the higher level of maintenance.
XA	Do not requisition an "XA" coded item. Order the next higher assembly.(Refer to NOTE below.)
XB	If an item is not available from salvage, order it using the CAGEC and P/N.
XC	Installation drawings, diagrams, instruction sheets, field service drawings; identified by manufacturer's P/N.
XD	Item is not stocked. Order an XD-coded item through normal supply channels using the CAGEC and P/N given, if no NSN is available. **NOTE** Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes except for those items source coded "XA" or those aircraft support items restricted by requirements of AR 750-1.

Maintenance Code. Maintenance codes tell you the level(s) of maintenance authorized to use and repair support items. The maintenance codes are entered in the third and fourth positions of the SMR code as follows:

Third Position. The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to the following levels of maintenance:

Maintenance Code	Application/Explanation
C -	Crew or operator maintenance done within unit/AVUM maintenance.
O -	Unit level/AVUM maintenance can remove, replace, and use the item.
F -	Direct support/AVIM maintenance can remove, replace, and use the item.
H -	General support maintenance can remove, replace, and use the item.
L -	Specialized repair activity can remove, replace, and use the item.
D -	Depot can remove, replace, and use the item.

Fourth Position. The maintenance code entered in the fourth position tells you whether or not the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (perform all authorized repair functions).

NOTE

Some limited repair may be done on the item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes.

Maintenance Code	Application/Explanation
O -	Unit/AVUM is the lowest level that can do complete repair of the item.
F -	Direct support/AVIM is the lowest level that can do complete repair of the item.
H -	General support is the lowest level that can do complete repair of the item.
L -	Specialized repair activity (enter specialized repair activity designator) is the lowest level that can do complete repair of the item.
D -	Depot is the lowest level that can do complete repair of the item.
Z -	Nonrepairable. No repair is authorized.
B -	No repair is authorized. No parts or special tools are authorized for maintenance of "B" coded item. However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

Recoverability Code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is shown in the fifth position of the SMR code as follows:

Recoverability Code	Application/Explanation
Z -	Nonreparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in the third position of the SMR code.
O -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the unit level.

Recoverability Code	Application/Explanation
F -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support level.
H -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support level.
D -	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item are not authorized below depot level.
L -	Reparable item. Condemnation and disposal not authorized below Specialized Repair Activity (SRA).
A -	Item requires special handling or condemnation procedures because of specific reasons (such as precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.

NSN (Column (3)). The NSN for the item is listed in this column.

CAGEC (Column (4)). The Commercial and Government Entity Code (CAGEC) is a five-digit code which is used to identify the manufacturer, distributor, or Government agency/activity that supplies the item.

PART NUMBER (Column (5)). Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

NOTE

When you use an NSN to requisition an item, the item you receive may have a different P/N from the number listed.

DESCRIPTION AND USABLE ON CODE (UOC) (Column (6)). This column includes the following information:

1. The federal item name, and when required, a minimum description to identify the item.

2. P/Ns of bulk materials are referenced in this column in the line entry to be manufactured or fabricated.

3. Hardness Critical Item (HCI). A support item that provides the equipment with special protection from electromagnetic pulse (EMP) damage during a nuclear attack.

4. The statement END OF FIGURE appears just below the last item description in column (6) for a given figure in both the repair parts list and special tools list work packages.

QTY (Column (7)). The QTY (quantity per figure) column indicates the quantity of the item used in the breakout shown on the illustration/figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column instead of a quantity indicates that the quantity is variable and quantity may change from application to application.

EXPLANATION OF CROSS-REFERENCE INDEXES WORK PACKAGES FORMAT AND COLUMNS

1. National Stock Number (NSN) Index Work Package.

STOCK NUMBER Column. This column lists the NSN in National item identification number (NIIN) sequence. The NIIN consists of the last nine digits of the NSN.

NSN (e.g., 5385-01-574-1476) NIIN	When using this column to locate an item, ignore the first four digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

FIG. Column. This column lists the number of the figure where the item is identified/located. The figures are in numerical order in the repair parts list and special tools list work packages.

ITEM Column. The item number identifies the item associated with the figure listed in the adjacent FIG. column. This item is also identified by the NSN listed on the same line.

2. Part Number (P/N) Index Work Package. P/Ns in this index are listed in ascending alphanumeric sequence (vertical arrangement of letter and number combinations which places the first letter or digit of each group in order A through Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

PART NUMBER Column. Indicates the P/N assigned to the item.

FIG. Column. This column lists the number of the figure where the item is identified/located in the repair parts list and special tools list work packages.

ITEM Column. The item number is the number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

Fabrication Instructions. Bulk materials required to manufacture items are listed in the bulk material functional group of this RPSTL. Part numbers for bulk material are also referenced in the Description Column of the line item entry for the item to be manufactured/fabricated. Detailed fabrication instructions for items source coded to be manufactured or fabricated are found in the applicable procedure.

Index Numbers. Items which have the word BULK in the figure column will have an index number shown in the item number column. This index number is a cross-reference between the NSN / P/N index work packages and the bulk material list in the repair parts list work package.

HOW TO LOCATE REPAIR PARTS

1. When NSNs or P/Ns Are Not Known.

First. Using the table of contents, determine the assembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and lists are divided into the same groups.

Second. Find the figure covering the functional group or the subfunctional group to which the item belongs.

Third. Identify the item on the figure and note the number(s).

Fourth. Look in the repair parts list work packages for the figure and item numbers. The NSNs and part numbers are on the same line as the associated item numbers.

2. When NSN Is Known.

First. If you have the NSN, look in the STOCK NUMBER column of the NSN index work package. The NSN is arranged in NIIN sequence. Note the figure and item number next to the NSN.

Second. Turn to the figure and locate the item number. Verify that the item is the one you are looking for.

3. When P/N Is Known.

First. If you have the P/N and not the NSN, look in the PART NUMBER column of the P/N index work package. Identify the figure and item number.

Second. Look up the item on the figure in the applicable repair parts list work package.

END OF WORK PACKAGE

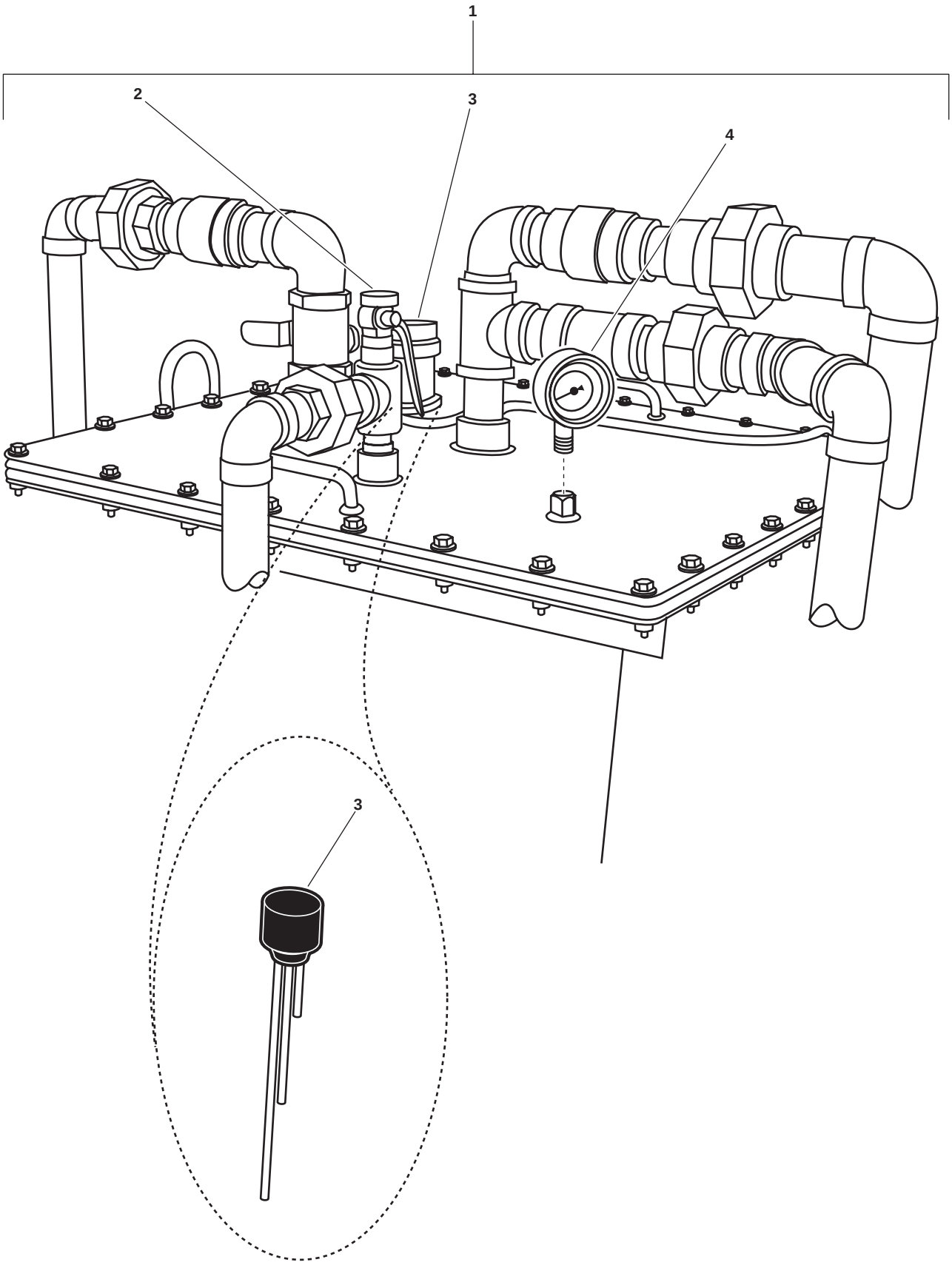


Figure 1. Oil Water Separator (Sheet 1 of 8)

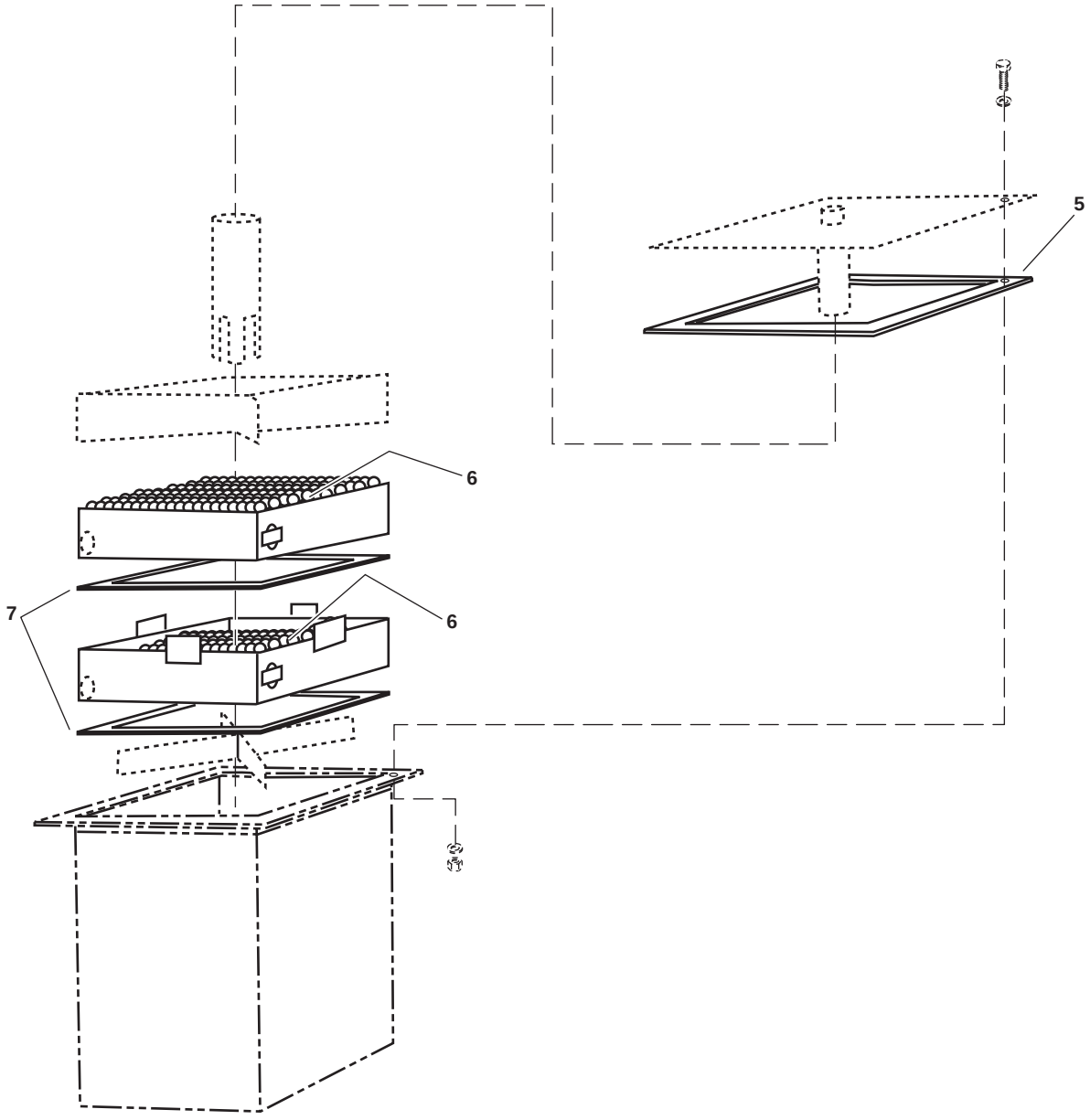


Figure 1. Oil Water Separator (Sheet 2 of 8)

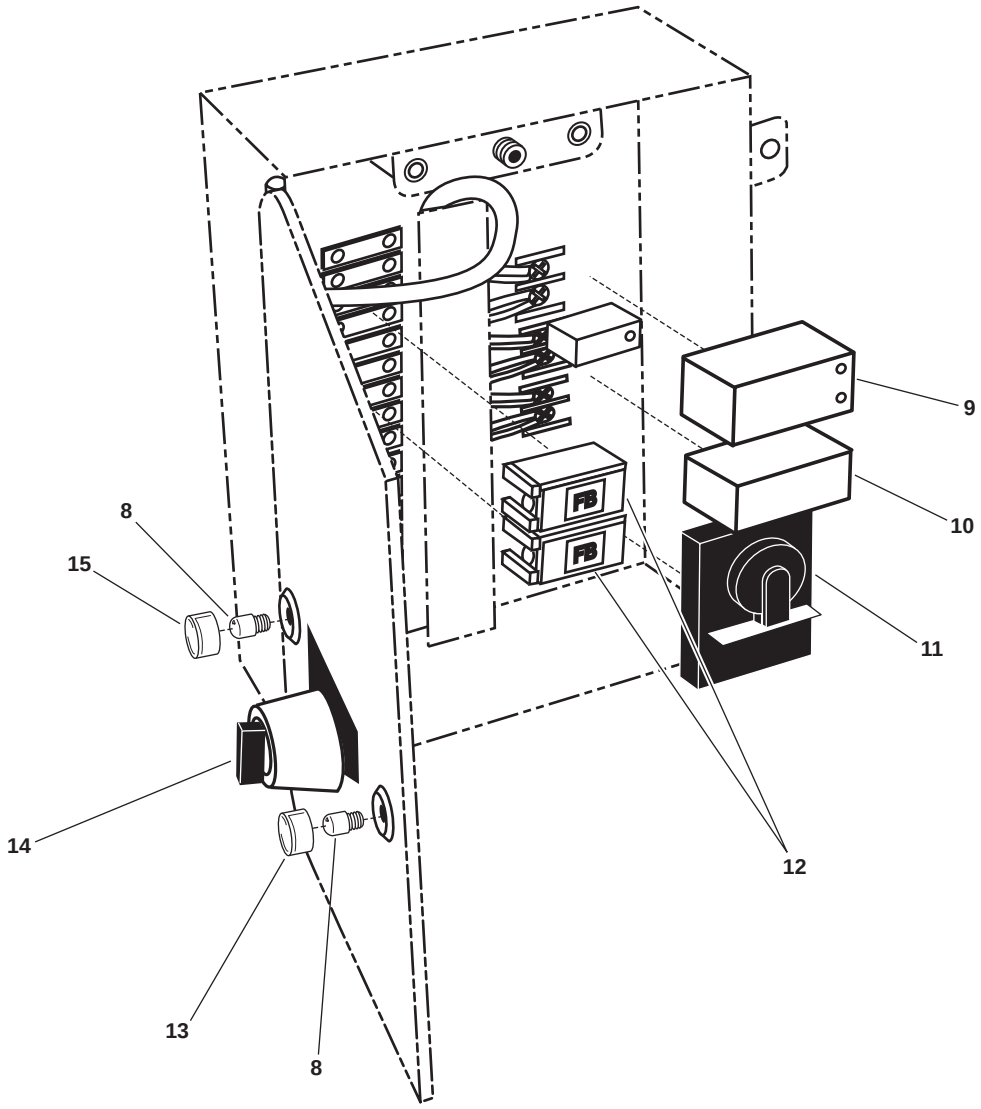


Figure 1. Oil Water Separator (Sheet 3 of 8)

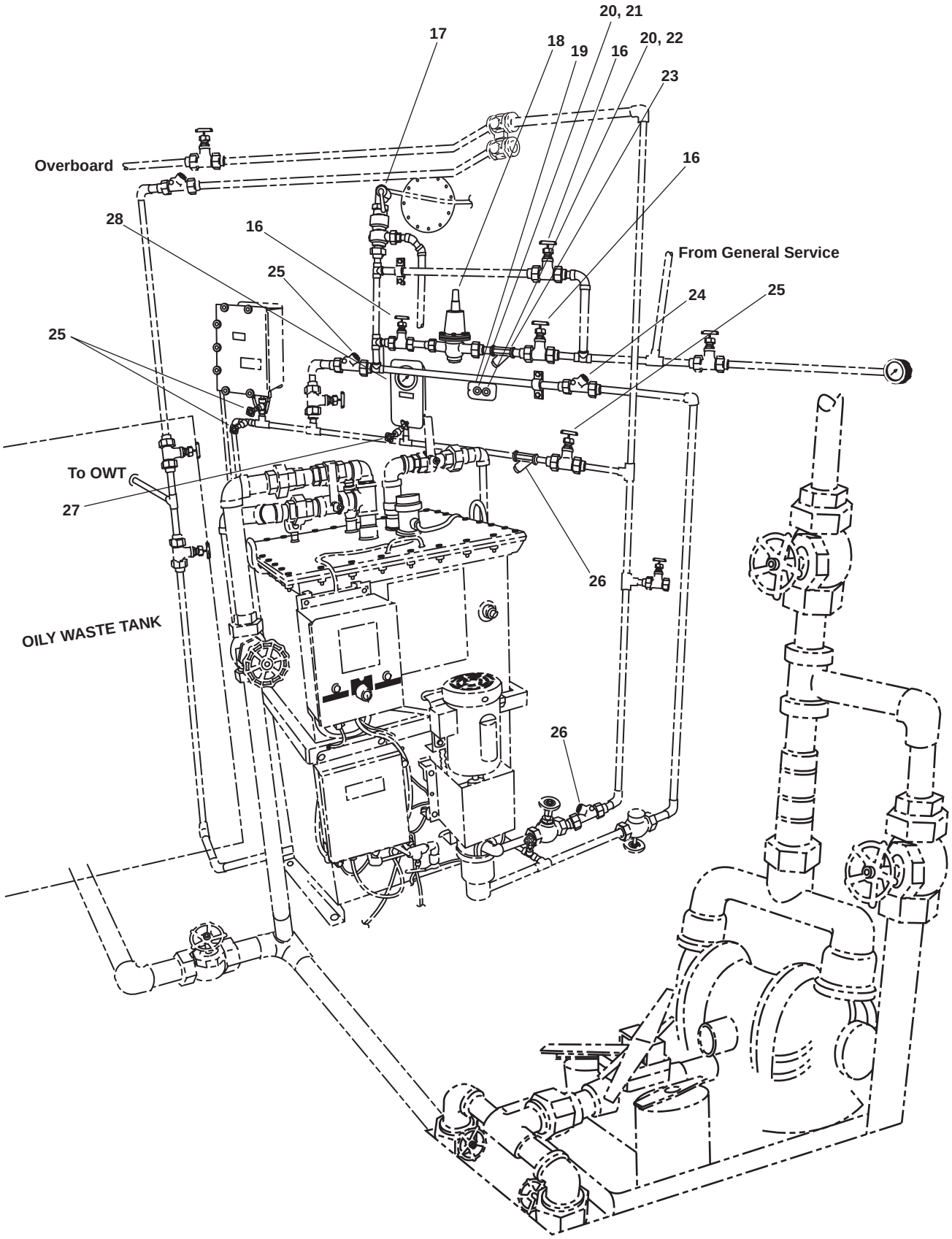


Figure 1. Oil Water Separator (Sheet 4 of 8)

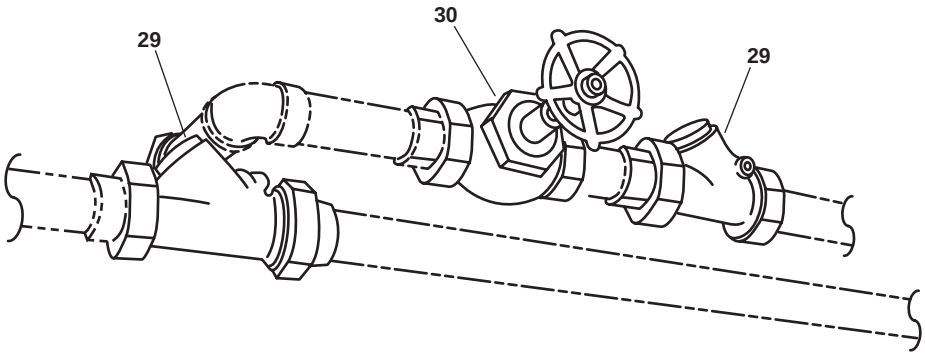


Figure 1. Oil Water Separator (Sheet 5 of 8)

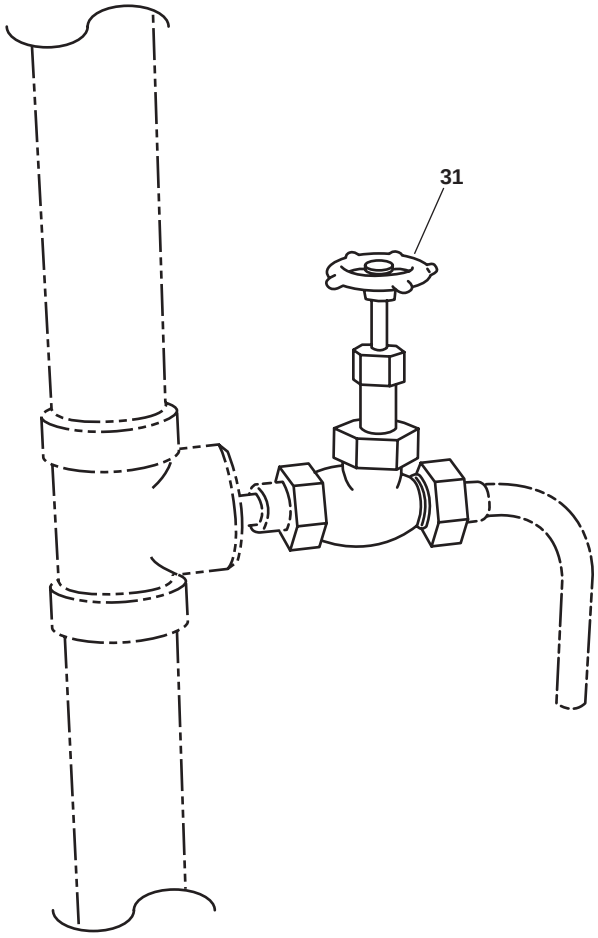


Figure 1. Oil Water Separator (Sheet 6 of 8)

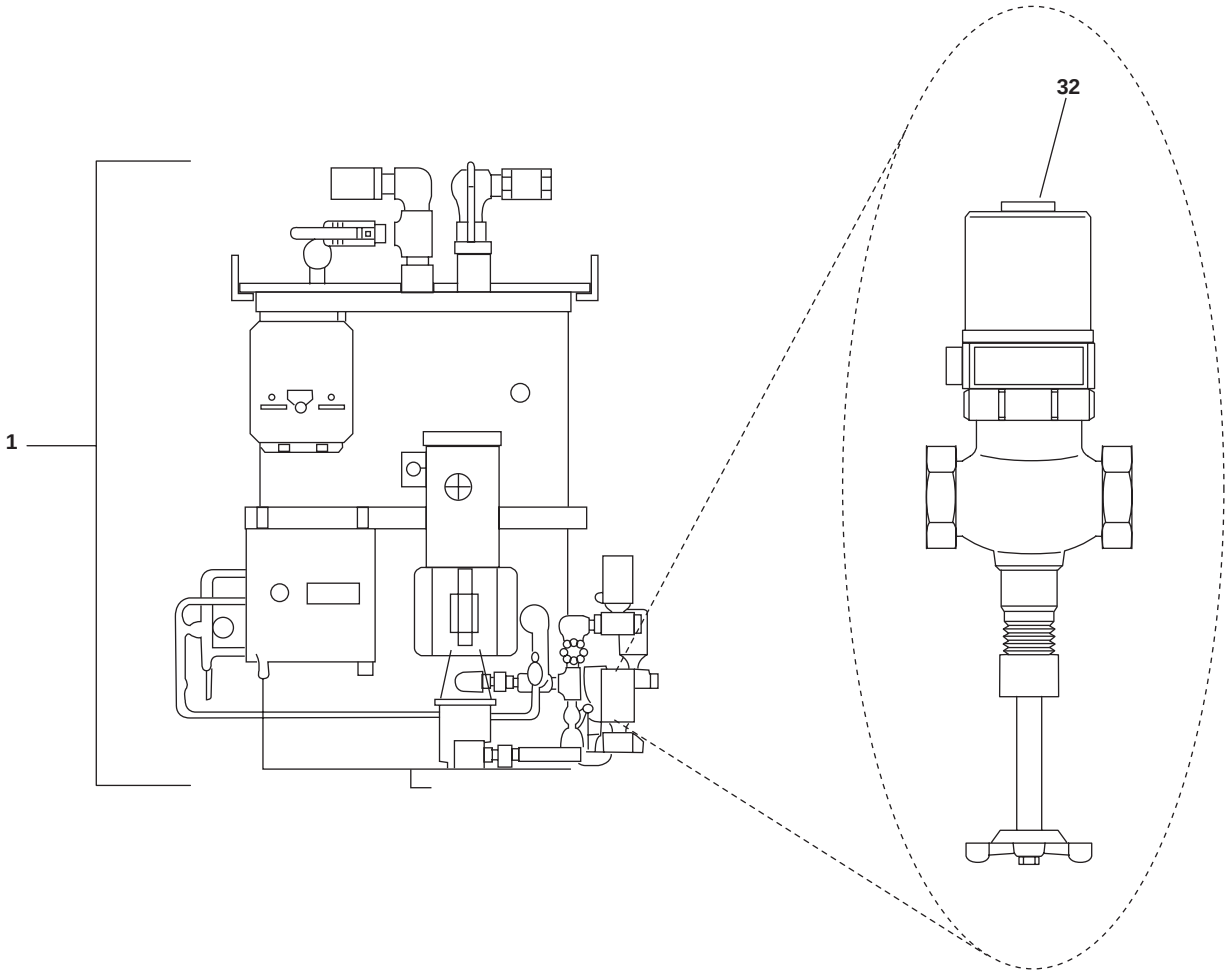


Figure 1. Oil Water Separator (Sheet 7 of 8)

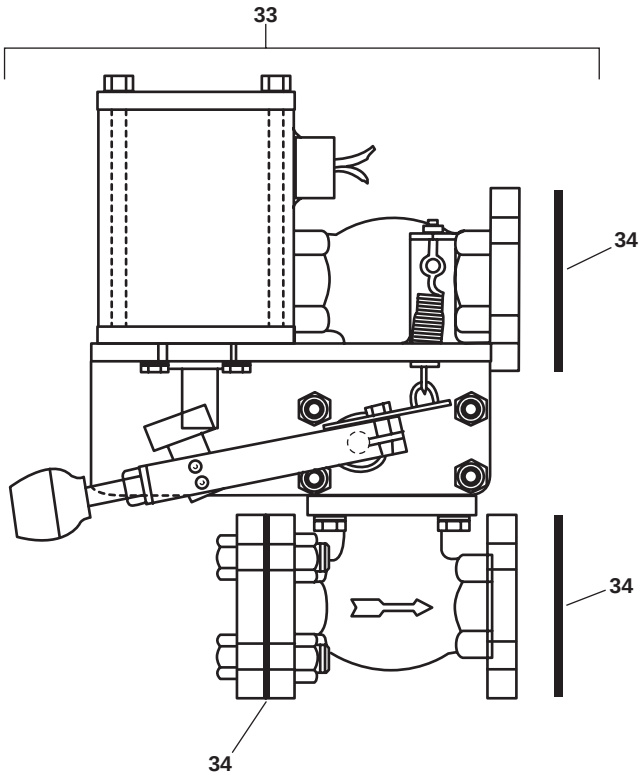


Figure 1. Oil Water Separator (Sheet 8 of 8)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 050605	
					FIG. 1 OIL WATER SEPARATOR	
1	XDOFF		63269	S1-3.5T-OWS	OILY WATER SEPARATE	1
2	XDOZZ	4820-01-301-1613	63269	30-202-04	.VALVE,SAFETY RELIEF	1
3	XDFZZ	5930-01-197-1984	80207	23TL6-4	.SWITCH,SENSITIVE	1
4	XDOZZ	6685-01-048-4682	38508	J1454	.GAGE,PRESSURE	1
5	PAFZZ	5330-01-365-5783	63269	S1-4-009-4	.GASKET	1
6	XDFZZ	4330-01-262-1237	63269	POLYPROPYLENE BEADS	.BEADS,COALESCING	65
7	XDFZZ	5330-01-478-0347	25204	S1-008-9-K16	.GASKET	2
8	PAOZZ	6240-01-415-8477	63269	PC1035-19	.LAMP,INCANDESCENT	2
9	XDFZZ	5945-01-271-5494	63269	SV220/115	.RELAY,SOLID STATE LIQUID LEVEL CONTROL	1
10	PAFZZ	5945-00-258-3096	56365	8501JN2	.RELAY,ELECTROMAGNET	1
11	XDFZZ	5945-01-257-4018	60886	RH1B-U-AC-120V	.RELAY,ELECTROMAGNET	1
12	PAOZZ	5920-01-268-0403	64393	FMN10	.FUSE	2
13	XDOZZ	6210-01-425-7287	63269	PC1035-14	.LENS,LIGHT YELLOW	1
14	XDFZZ	5930-01-428-4130	63269	ST11095-3	.SWITCH,ROTARY	1
15	XDOZZ	6210-01-425-7284	63269	PC1035-11	.LENS,LIGHT GREEN	1
16	XDOZZ		0WLX8	414101.150	.VALVE,GATE,3/4"	3
17	XDOOO	4820-01-436-4216	55378	40398-402	.VALVE,REGULATING,FL VALVE, RELIEF, SET AT 20 PSIG	1
18	XDOZZ		0WLX8	502101.150	.VALVE,PRESURE REDUC VALVE, PRESSURE REDUCING, SET AT 12 PSIG	1
19	XDOOO	6210-01-282-8694	80064	9000-S6202-73920 SYM2816.1	.INDICATOR,DUAL LAMP INDICATOR, DUAL LAMP, VALVE POSITION	1
20	XDOZZ	6240-00-155-7836	08806	T-1 3/4	..LAMP,INCANDESCENT	2
21	XDOZZ	6210-00-548-0187	96906	MS17153-15	..LENS,LIGHT	1
22	XDOZZ	6210-00-548-0186	96906	MS17153-7	..LENS,LIGHT	1
23	XDOZZ		0WLX8	690101.150	.STRAINER, 3/4"	1
24	XDOZZ		0WLX8	414501.150	.VALVE,SWING CHECK	2
25	XDOZZ	4820-01-448-7250	80064	803-4384536 1/4 IN	.VALVE,GLOBE	5
26	XDOZZ		0WLX8	414501.040	.VALVE,SWING CHECK	2
27	XDOZZ		0WLX8	533201-1/4 OD	.VALVE,GAGE,1/4" OD	1
28	XDOZZ	6685-01-207-9785	64467	EA23-3PDF-RWBX	.GAGE,PRESSURE,DIAL	1

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
29	XDOZZ		0WLX8	414501.300	.VALVE,SWING CHECK	2
30	XDOZZ		0WLX8	414101.300	.VALVE,GATE,1-1/2"	2
31	XDOZZ	4820-01-268-8378	02570	M-1RS6-A	.VALVE,ANGLE	1
32	XDOZZ	4810-01-342-0573	63269	M018A43	.VALVE,SOLENOID	1
33	PAOZZ	4810-01-312-3996	87229	AE3352170001	.VALVE,SOLENOID VALVE, DIVERTER, 3-WAY SELONOID, 1-1/2 NPS	1
34	PAOZZ	5330-01-529-2543	0B6K6	701125-015	.GASKET	3
					End of Figure	

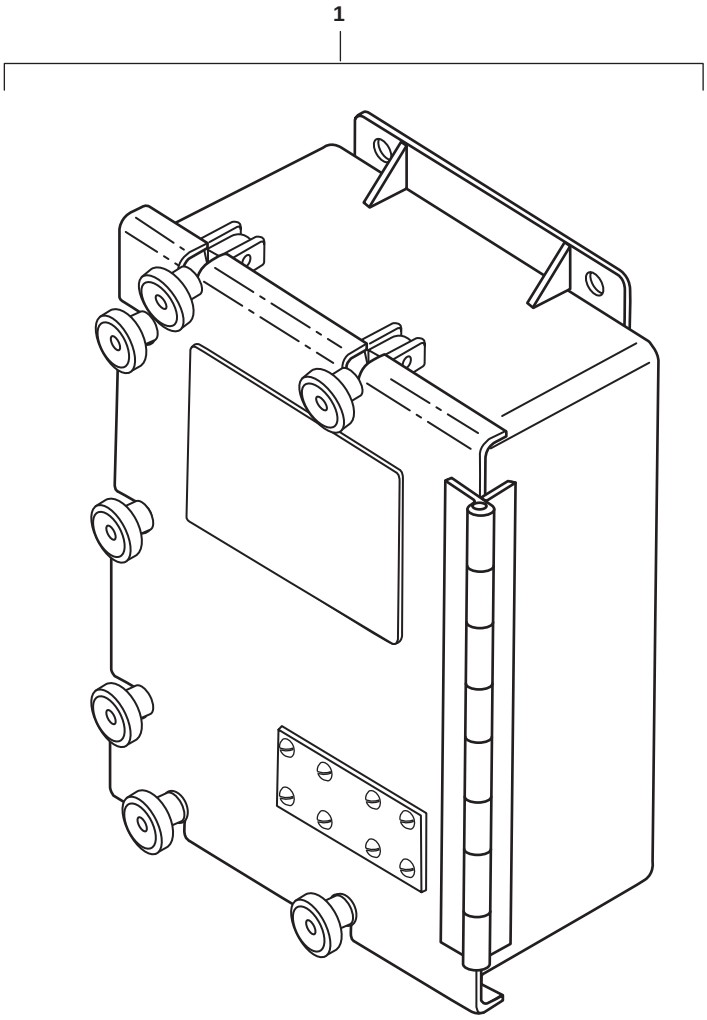


Figure 2. Oil Content Monitor (Sheet 1 of 6)

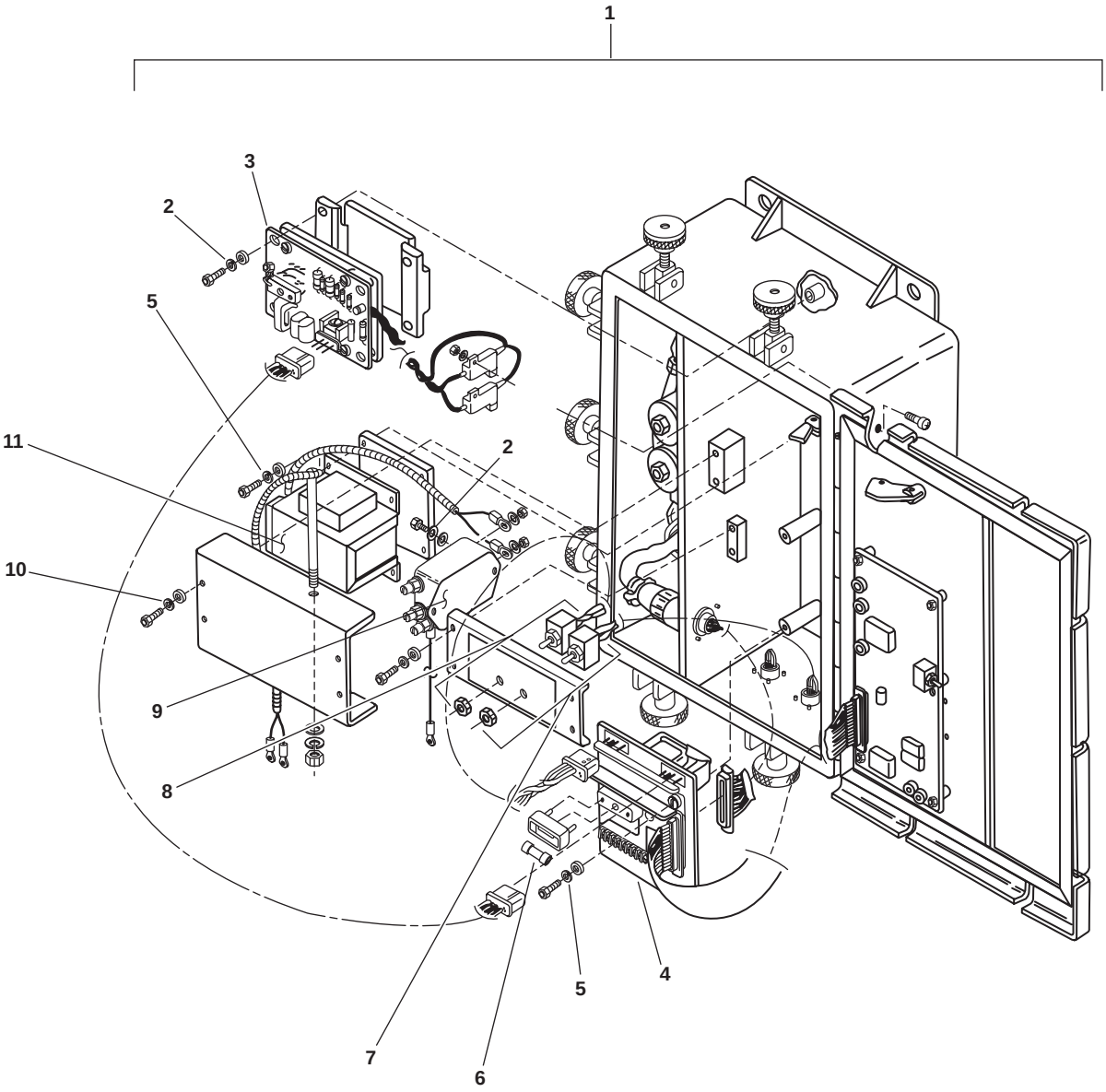


Figure 2. Oil Content Monitor (Sheet 2 of 6)

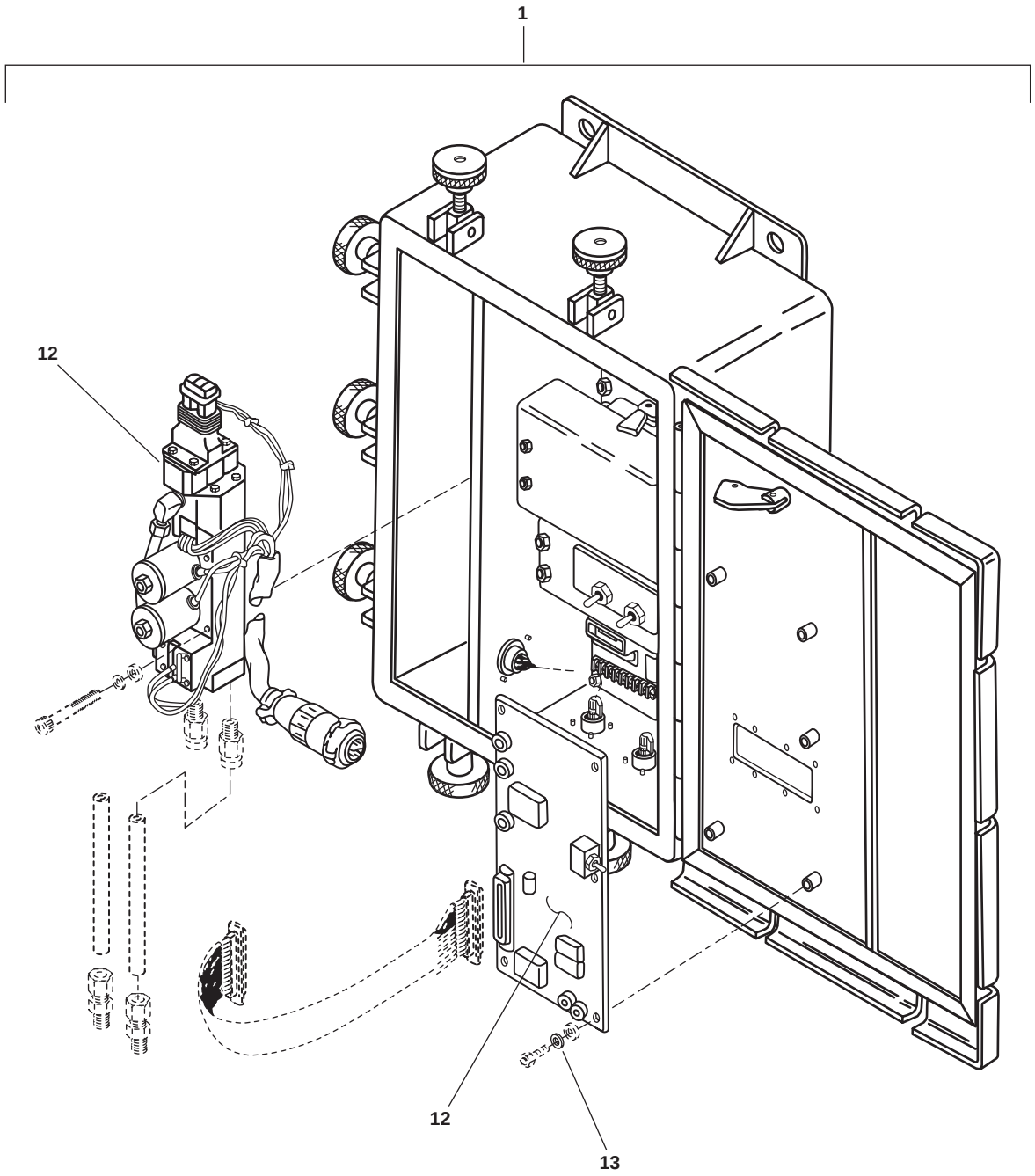


Figure 2. Oil Content Monitor (Sheet 3 of 6)

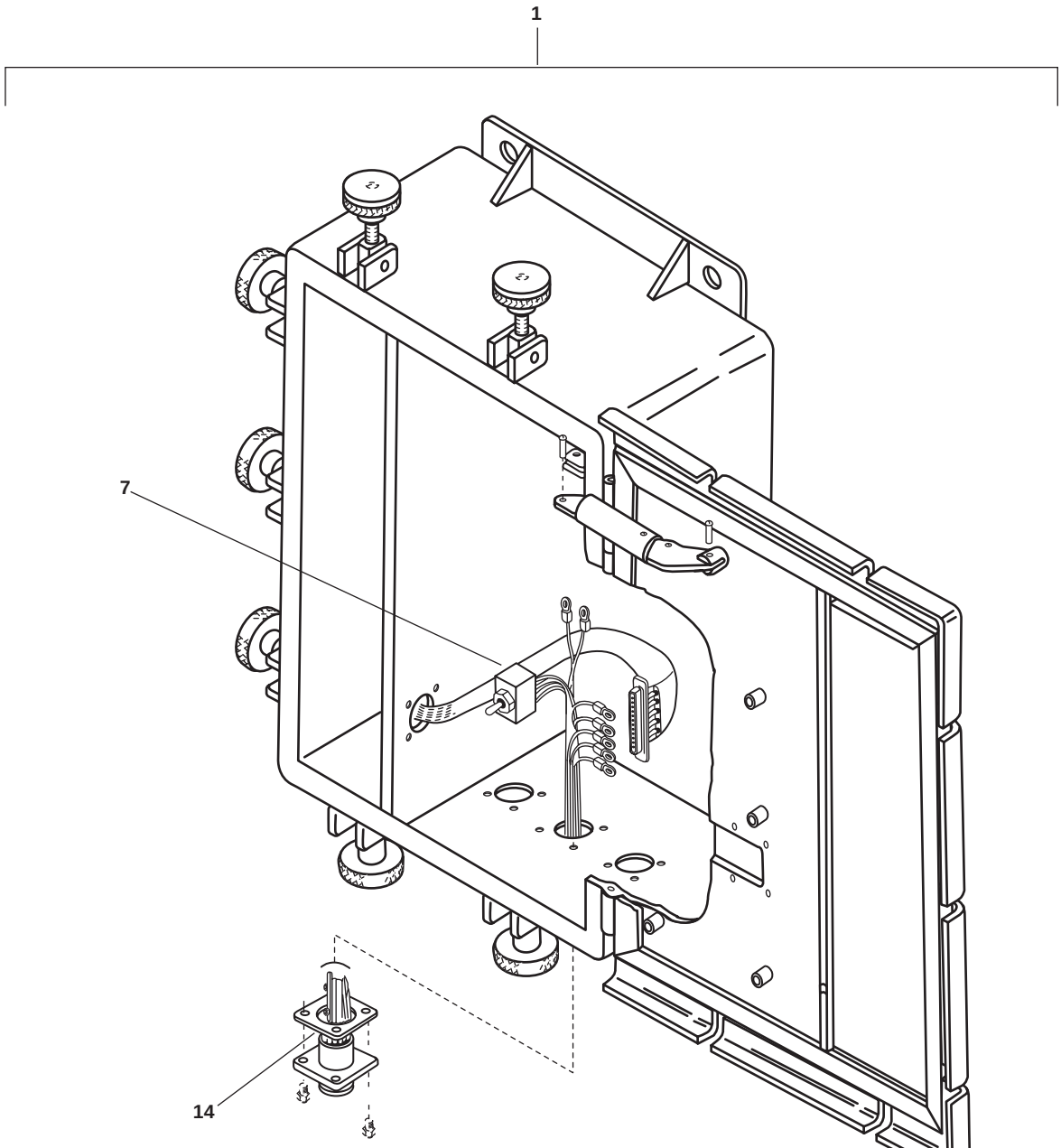


Figure 2. Oil Content Monitor (Sheet 4 of 6)

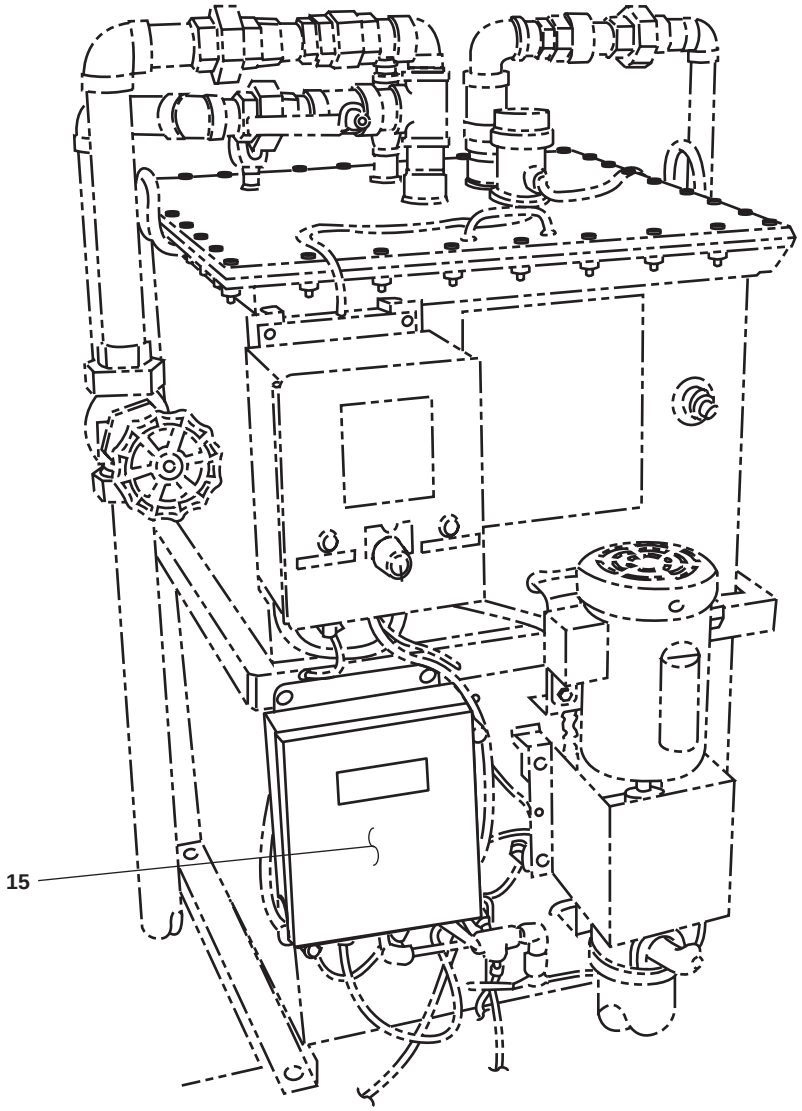


Figure 2. Oil Content Monitor (Sheet 5 of 6)

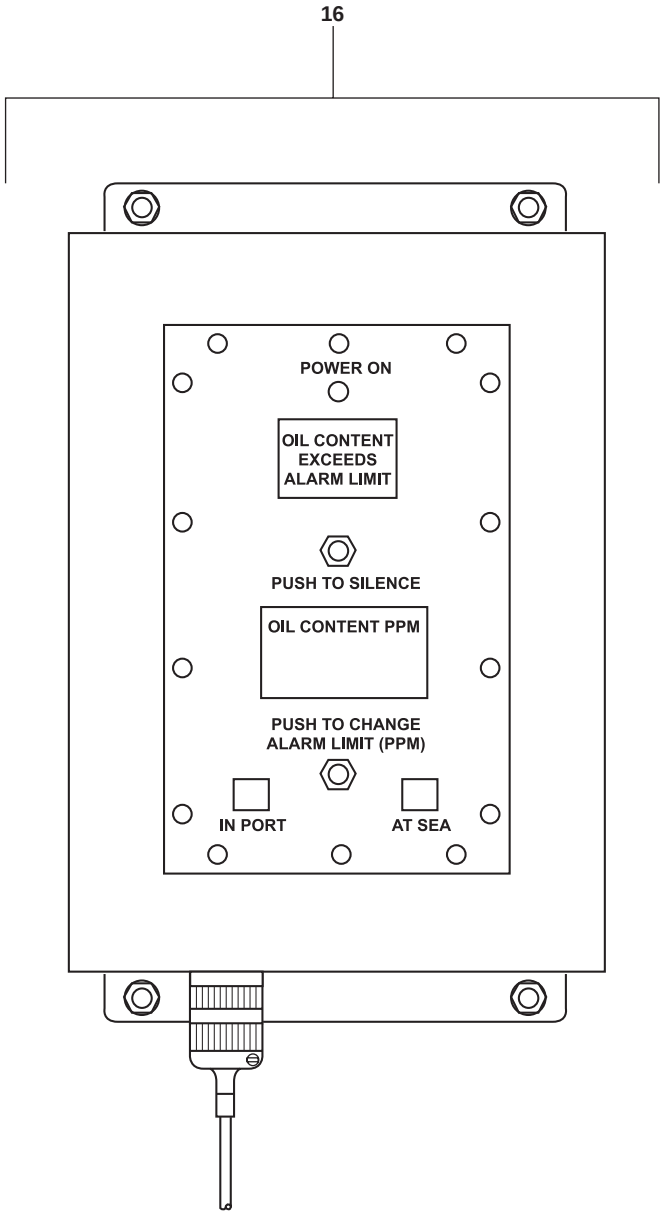


Figure 2. Oil Content Monitor (Sheet 6 of 6)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 05060501	
					FIG. 2 OIL CONTENT MONITOR	
1	XDOOO	6625-01-488-7577	0SPX0	AME 220-95150-00	PANEL,TEST,ELECTRIC OIL CONTENT MONITOR	1
2	XDOZZ	5310-00-933-8120	80205	MS35338-138	.WASHER,LOCK	16
3	XDOZZ	5998-01-490-9911	0SPX0	OCM-35N-002 ITEM 12	.CIRCUIT CARD ASSEMB CIRCUIT CARD ASSEMBLY, GENERATOR	1
4	XDOZZ	5998-01-490-9921	0SPX0	OCM-35N-002 ITEM 14	.CIRCUIT CARD ASSEMB CIRCUIT CARD ASSEMBLY, POWER SUPPLY	1
5	XDOZZ	5310-01-389-6984	96906	MS35338-137	.WASHER,LOCK	8
6	PAOZZ	5920-01-491-1509	0SPX0	AME-10220	.FUSE,CARTRIDGE	1
7	XDOZZ	5930-01-489-5945	0SPX0	AME-10205	.SWITCH,TOGGLE	1
8	XDOZZ	5930-01-489-5947	0SPX0	AME-10204	.SWITCH,TOGGLE	1
9	XDOZZ	5915-01-491-1502	0SPX0	OCM-35N-002 ITEM 16	.FILTER,RADIO FREQUE	1
10	XDOZZ	5310-00-933-8121	80205	MS35338-139	.WASHER,LOCK	5
11	XDOZZ	5950-01-490-0971	0SPX0	OCM-35N-002 ITEM 15	.TRANSFORMER,POWER	1
12	PAOZZ	6625-01-456-5671	25204	PC-1385	.MAINTENANCE KIT	1
13	XDOZZ	5310-00-929-6395	80205	MS35338-136	.WASHER,LOCK	5
14	XDOZZ	5330-01-360-5307	25204	ST28001 ITEM 26	.RETAINER,PACKING GASKET, CONNECTOR	2
15	XDOOO	5945-01-488-7589	0SPX0	AME 220-95158-00	RELAY ASSEMBLY OCM REMOTE RELAY PANEL	1
16	XDOOO	6350-01-490-5506	0SPX0	AME 220-95155-00	ALARM,AUDIBLE-VISUA	1
					End of Figure	

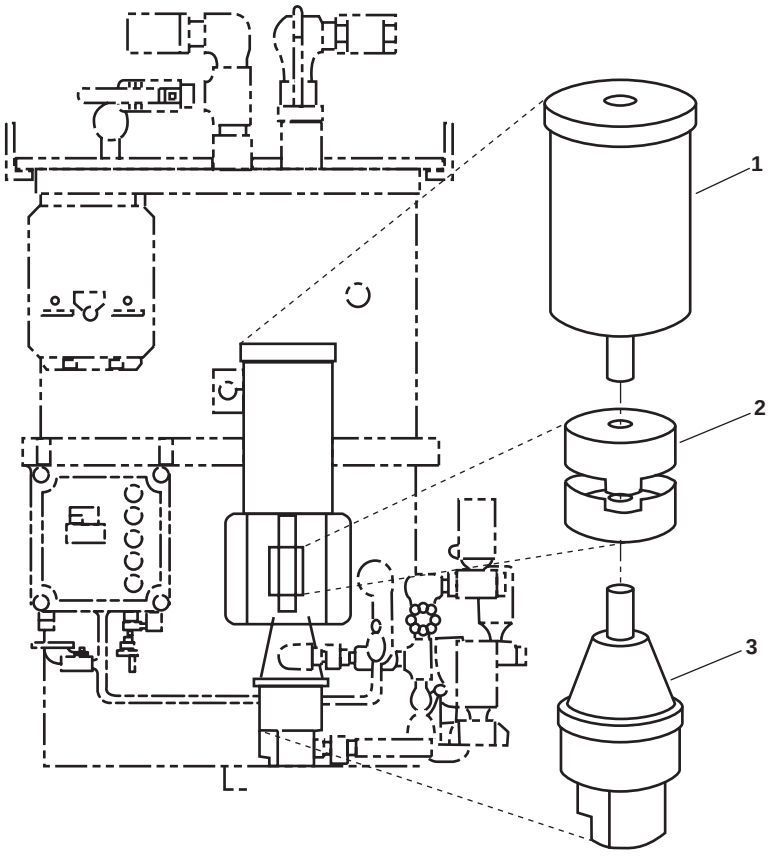


Figure 3. Pump

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 05060502	
					FIG. 3 PUMP	
1	XDFZZ		05472	JL3504A	.MOTOR,AC	1
2	XDFZZ	3010-01-108-5711	88758	320-1511-000	.COUPLING,SHAFT,FLEX	1
3	XDFZZ	4320-01-103-8054	88758	34401	.PUMP,ROTARY	1
					End of Figure List	

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM
6240-00-155-7836	1	20
5945-00-258-3096	1	10
6210-00-548-0186	1	22
6210-00-548-0187	1	21
5310-00-929-6395	2	13
5310-00-933-8120	2	2
5310-00-933-8121	2	10
6685-01-048-4682	1	4
4320-01-103-8054	3	3
3010-01-108-5711	3	2
5930-01-197-1984	1	3
6685-01-207-9785	1	28
5945-01-257-4018	1	11
4330-01-262-1237	1	6
5920-01-268-0403	1	12
4820-01-268-8378	1	31
5945-01-271-5494	1	9
6210-01-282-8694	1	19
4820-01-301-1613	1	2
4810-01-312-3996	1	33
4810-01-342-0573	1	32
5330-01-360-5307	2	14
5330-01-365-5783	1	5
5310-01-389-6984	2	5
6240-01-415-8477	1	8
6210-01-425-7284	1	15
6210-01-425-7287	1	13
5930-01-428-4130	1	14
4820-01-436-4216	1	17
4820-01-448-7250	1	25
6625-01-456-5671	2	12
5330-01-478-0347	1	7
6625-01-488-7577	2	1
5945-01-488-7589	2	15
5930-01-489-5945	2	7
5930-01-489-5947	2	8
5950-01-490-0971	2	11
6350-01-490-5506	2	16
5998-01-490-9911	2	3
5998-01-490-9921	2	4
5915-01-491-1502	2	9
5920-01-491-1509	2	6
5330-01-529-2543	1	34

PART NUMBER INDEX

PART NUMBER	FIG.	ITEM
23TL6-4	1	3
30-202-04	1	2
320-1511-000	3	2
34401	3	3
40398-402	1	17
414101.150	1	16
414101.300	1	30
414501.040	1	26
414501.150	1	24
414501.300	1	29
502101.150	1	18
533201-1/4 OD	1	27
690101.150	1	23
701125-015	1	34
803-4384536 1/4 IN	1	25
8501JN2	1	10
9000-S6202-73920SYM2816.1 19	1	1
AE3352170001	1	33
AME 220-95150-00	2	1
AME 220-95155-00	2	16
AME 220-95158-00	2	15
AME-10204	2	8
AME-10205	2	7
AME-10220	2	6
EA23-3PDF-RWBX	1	28
FMN10	1	12
J1454	1	4
JL3504A	3	1
M-1RS6-A	1	31
M018A43	1	32
MS17153-15	1	21
MS17153-7	1	22
MS35338-136	2	13
MS35338-137	2	5
MS35338-138	2	2
MS35338-139	2	10
OCM-35N-002 ITEM 12	2	3
OCM-35N-002 ITEM 14	2	4
OCM-35N-002 ITEM 15	2	11
OCM-35N-002 ITEM 16	2	9
PC-1385	2	12
PC1035-11	1	15
PC1035-14	1	13
PC1035-19	1	8
POLYPROPYLENE BEADS	1	6
RH1B-U-AC-120V	1	11
S1-008-9-K16	1	7
S1-3.5T-OWS	1	1
S1-4-009-4	1	5
ST11095-3	1	14
ST28001 ITEM 26	2	14
SV220/115	1	9
T-1 3/4	1	20

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LISTS

INTRODUCTION

SCOPE

This work package lists COEI and BII for the Oil Water Separator (OWS) for the Inland and Coastal Large Tug (LT) to help you inventory items for safe and efficient operation of the equipment.

GENERAL

The COEI and BII information is divided into the following lists:

Components of End Item (COEI). This list is for information purposes only and is not authority to requisition replacements. These items are part of the OWS for the Inland and Coastal Large Tug (LT). As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Items of COEI are removed and separately packaged for transportation or shipment only when necessary. Illustrations are furnished to help you find and identify the items.

Basic Issue Items (BII). These essential items are required to place the OWS for the Inland and Coastal Large Tug (LT) in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the OWS for the Inland and Coastal Large Tug (LT) during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

EXPLANATION OF COLUMNS IN THE COEI LIST AND BII LIST

Column (1) Illus Number. Gives you the number of the item illustrated.

Column (2) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes.

Column (3) Description, CAGEC, and Part Number. Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The stowage location of COEI and BII is also included in this column. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parentheses) and the part number.

Column (4) Usable On Code. When applicable, gives you a code if the item you need is not the same for different models of equipment.

Column (5) Unit of Issue (U/I). Indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (2).

Column (6) Qty Rqr. Indicates the quantity required.

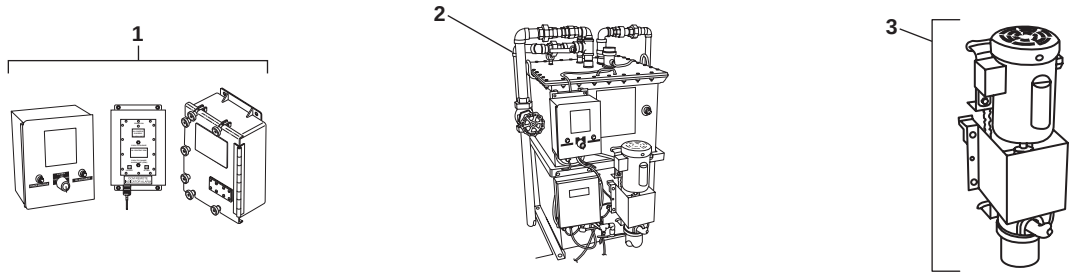


Table 1. Components of End Item List

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
1	6625-01-488-7577	PANEL, TEST, ELECTRICAL (engine room, starboard side) (0SPX0) AME 220-95150-00	128	EA	1
2		OIL WATER SEPARATOR (engine room, starboard side) (63269) S1-3.5T-OWS	128	EA	1
3	4320-01-103-8054	PUMP, ROTARY (engine room, starboard side) (88758) 34401	128	EA	1

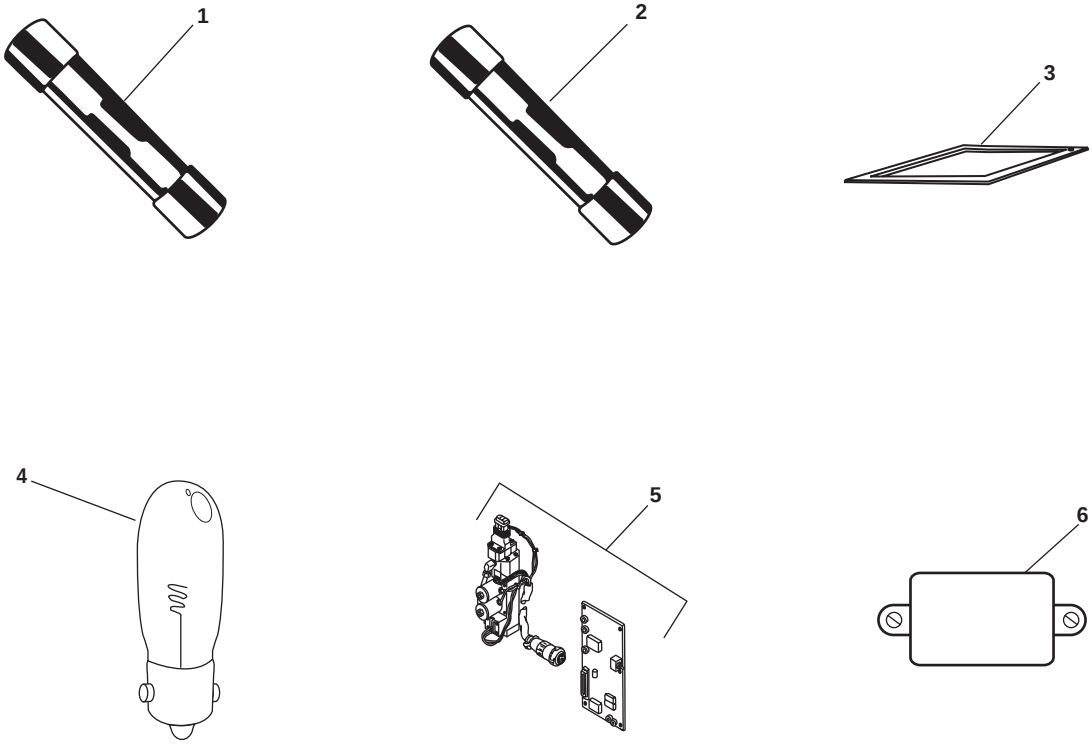


Table 2. On Board Spares List

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
1	5920-01-268-0403	FUSE (vestibule Vidmar) (64393) FMN10	128	EA	2
2	5920-01-491-1509	FUSE, CARTRIDGE (vestibule Vidmar) (0SPX0) AME-10220	128	EA	1
3	5330-01-365-5783	GASKET (vestibule Vidmar) (63269) S1-4-009-4	128	EA	1
4	6240-01-415-8477	LAMP, INCANDESCENT (vestibule Vidmar) (63269) PC1035-19	128	EA	2
5	6625-01-456-5671	MAINTENANCE KIT (bosun's locker) (25204) PC-1385	128	KT	1
6	5945-00-258-3096	RELAY, ELECTROMAGNET (vestibule Vidmar) (56365) 8501JN2	128	EA	1

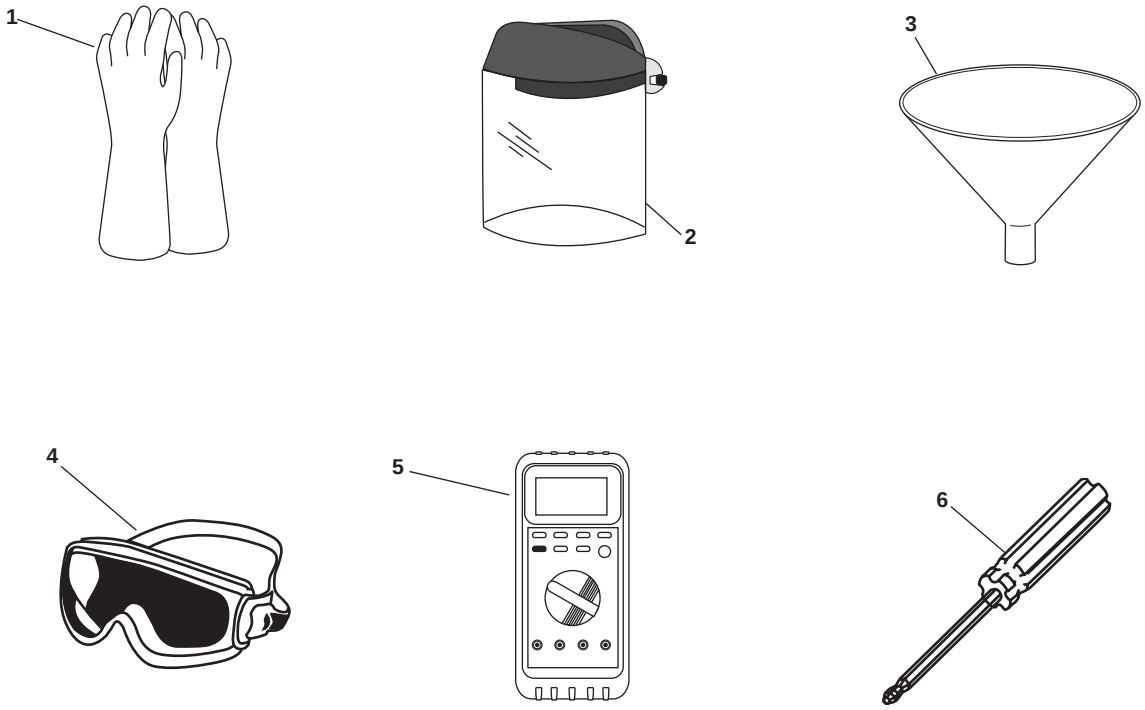


Table 3. Basic Issue Items List

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
1	8415-01-013-7384	GLOVES, CHEMICAL AND OIL PROTECTIVE (bosun's locker) (81349) MIL-G-87066	128	PR	2
2	4240-00-542-2048	FACESHIELD, INDUSTRIAL, CLEAR K11 PLASTIC VISOR (machine shop) (80204) ANSI Z87.1	128	EA	1
3	7240-00-144-5995	FUNNEL, STEEL W/STRAINER 1 GAL (on station) (82378) 631	128	EA	1
4	4240-00-190-6432	GOGGLES, INDUSTRIAL (machine shop) (80204) ANSI Z87.1-1989	128	PR	2
5	6625-01-265-6000	MULTIMETER, AN/PSM45A (DC locker) (89536) 27 W/ACCE	128	EA	1
6		TOOL, BALL DRIVER (machine shop) (25204) ST1045-4	128	EA	1

Table 3. Basic Issue Items List (continued)

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
7	5180-00-313-3045	TOOL KIT, ELECTRICIAN'S (AMS 2) (50980) SC5180-90-CL-N35	128	KT	1
8	5180-00-629-9783	TOOL KIT, GENERAL MECHANIC'S (machine shop) (50980) SC5180-90-CL-N55	128	KT	1

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
EXPENDABLE AND DURABLE ITEMS LIST

INTRODUCTION

SCOPE

This work package lists expendable and durable items that you will need to operate and maintain the oil water separator for the Inland and Coastal Large Tug (LT). This list is for information only and is not authority to requisition the listed items. 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.

EXPLANATION OF COLUMNS IN THE EXPENDABLE/DURABLE ITEMS LIST

Column (1) Item Number. This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., “Use brake fluid (item 5, WP 0098 00).”).

Column (2) Level. This column identifies the lowest level of maintenance that requires the listed item (include as applicable: C = Operator/Crew, O = Unit, F = Direct Support, H = General Support, D = Depot).

Column (3) National Stock Number (NSN). This is the NSN assigned to the item, which you can use to requisition it.

Column (4) Item Name, Description, Commercial and Government Entity Code (CAGEC), and Part Number (P/N). This column provides the other information you need to identify the item.

Column (5) Unit of Issue (U/I). Indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (3).

Table 1. Expendable and Durable Items List

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER (NSN)	(4) ITEM NAME, DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/I
1	C	7930-00-985-6911	DETERGENT, GENERAL PURPOSE (83421) 7930-00-985-6911	CN
2	C	6850-00-281-1985	DRY CLEANING SOLVENT (02978) PS661	GL
3	F		HARDENER, CEILCOAT (16605) FLAKETAR 661	GL
4	C	6810-00-983-8551	ISOPROPYL ALCOHOL, TECHNICAL (83148) TT-I-735	QT
5	F		PRIMER, CEILCOAT (16605) FLAKETAR 675	GL
6	C	7920-00-205-1711	RAG, WIPING, 50LB BALE (80244) 7920-00-205-1711	BE
7	O	6850-00-177-5094	SILICONE COMPOUND, 2 OZ PER TUBE (71984) DC4-2OZ	TU
8	F		SOLVENT, CLEANING (16605) CEILCOTE T-410	GL
9	O	5975-01-034-5871	STRAP, TIEDOWN, ELECTRICAL COMPONENTS (96906) MS3367-7-0	HD
10	O		TAG, DANGER (USED FOR LOCKOUT/TAGOUT) (3HPE6) 0116-LF-115-4300	BX
11	O	8030-00-889-3535	TAPE, ANTISEIZING, 1/2 IN X 260 IN (96214) 417043-2	EA

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
GLOSSARY

Backflush	The process of clearing contaminants from a system by reversing the flow through the system.
Baffle	A device used to deflect, check, or regulate flow. In the OWS, baffles direct the flow of water through the tank.
Coalescence	The process by which two substances join together. In the OWS, coalescence bonds the oil to the coalescer beads.
Effluent	The fluid flowing from the system. In the OWS, the effluent is the fluid flowing from the OWS.
Emulsification	The process of dispersing one liquid into another as a series of very small droplets. In the OWS, emulsification disperses the oil droplets into the water.
Gravity Separation	The process by which oil droplets slowly rise to the surface of a still or slowly flowing body of water.
Oil/Water Interface	The boundary line between oil and water. In the OWS, the oil floats on top of the water until it is removed by backflushing.
Turbidity	Cloudiness; lack of clarity, or purity. In the OCM, the turbidity of the sample water is measured to determine its oil content.
Ultrasonic	Vibrations having a frequency above the human ear's audibility limit of approximately 20,000 hertz.
Weir	A plate used to divert the flow of liquid and to separate its parts. In the OWS, a weir helps to separate the floating oil from the surface of the water.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
OIL WATER SEPARATOR FOR
INLAND AND COASTAL LARGE TUG (LT)
ALPHABETICAL INDEX

P

Q

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army

0529218

DISTRIBUTION: To be distributed in accordance with the initial distribution requirements for IDN: 255635, requirements for TM 55-1925-285-13&P.

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
8. ***Pub no:*** 55-1915-200-10
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?

* 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

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*

☆ U.S. GOVERNMENT PRINTING OFFICE 1981 341-646/8606

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)*	**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 55-1925-285-13&P		Operator, Unit, and Direct Support Maintenance Manual Including Repair Parts and Special Tools List For Oil Water Separator Inland and Coastal Large Tug (LT) NSN 1925-01-509-7013 (EIC XAG)

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

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

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

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TM 55-1925-285-13&P		Operator, Unit, and Direct Support Maintenance Manual Including Repair Parts and Special Tools List For Oil Water Separator Inland and Coastal Large Tug (LT) NSN 1925-01-509-7013 (EIC XAG)

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 or 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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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

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TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

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PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

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TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

Metric Conversion Factors

Mc x F = Cf		
Measurement to be Converted (Mc)	Factor (F)	Converted Measurement (Cf)
Meters (m)	x 39.37	= Inches (in.)
Meters (m)	x 3.281	= Feet (ft)
Meters (m)	x 1.094	= Yards (yd)
Inches (in.)	x 25.40	= Millimeters (mm)
Inches (in.)	x 2.54	= Centimeters (cm)
Inches (in.)	x 0.0254	= Meters (m)
Inches (in.)	x 25400	= Micrometers (µm)
Feet (ft)	x 0.305	= Meters (m)
Square feet (ft^2)	x 0.093	= Square meters (m^2)
Foot-Pounds	x 1.35582	= Newton meters (N m)
Newton meters (N m)	x 0.73756	= Foot Pounds
Yards (yd)	x 0.914	= Meters (m)
Square yards (yd^2)	x 0.836	= Square meters (m^2)
Square Inches (in^2)	x 6.452	= Square Centimeters (cm^2)
Cubic Inches (in^3)	x 16.39	= Cubic Centimeters (cm^3)
Cubic Centimeters (cm^3)	x 0.061	= Cubic Inches (in^3)
Cubic Feet (ft^3)	x 0.028	= Cubic Meters (cm^3)
Gallons (gal)	x 3.785	= Liters (L)
Liters (L)	x 0.2642	= Gallons (gal)
Kilometers (km)	x 0.5397	= Nautical miles (nmi)
Meters (m)	x 0.0005397	= Nautical miles (nmi)
Nautical miles (nmi)	x 1.853	= Kilometers (km)
Fluid Ounces (oz)	x 29.574	= Milliliters (mL)
Pounds (lb)	x 0.4536	= Kilograms (kg)
Kilograms (kg)	x 2.2046	= Pounds (lb)
Kilopascals (kPa)	x 0.145	= Pounds (lb) per Square Inch (psi)
Pounds per Square Inch (psi)	x 6.895	= Kilopascals (kPa)
Degrees Centigrade (°C)	(°C x 1.8) + 32	= Degrees Fahrenheit (°F)
Degrees Fahrenheit (°F)	(°F-32) ÷ 1.8	= Degrees Centigrade (°C)
Bar	x 14.5	= Pounds per Square Inch (psi)
Pounds per Square Inch (psi)	x 0.06894	= Bar
Horsepower (hp)	x 0.746	= Kilowatt (kW)
Kilowatt (kW)	x 1.341	= Horsepower (hp)

PIN: 082858-000