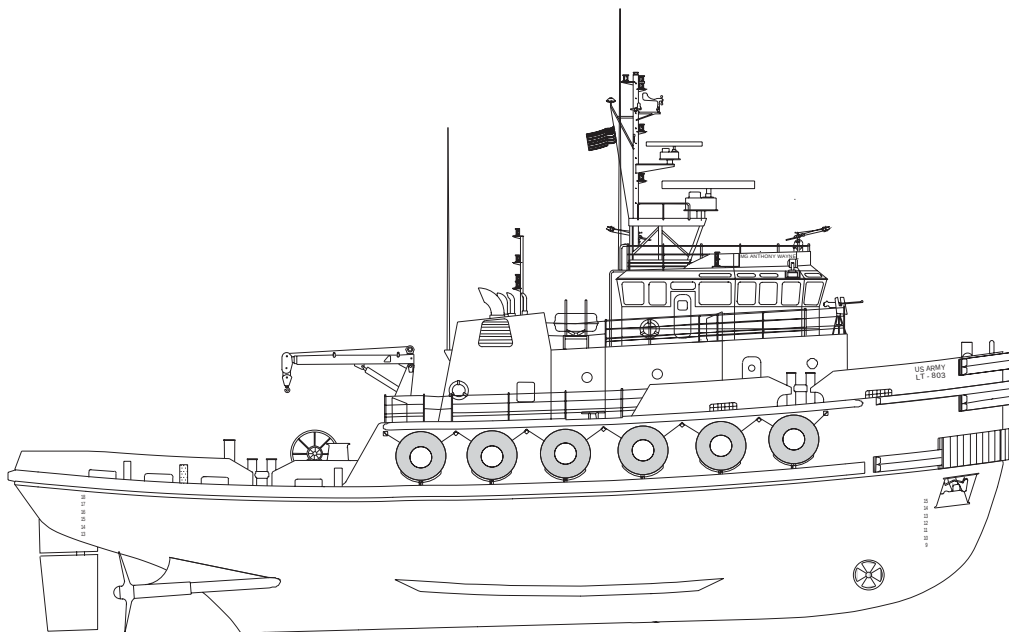


TM 55-1925-273-24&P-1

This manual supersedes TM 55-1925-207-24&P-1, dated 16 August 1991

TECHNICAL MANUAL

UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR INLAND AND COASTAL LARGE TUG (LT) NSN 1925-01-509-7013 (EIC XAG)



DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

**HEADQUARTERS, DEPARTMENT OF THE ARMY
30 NOVEMBER 2005**

WARNING SUMMARY

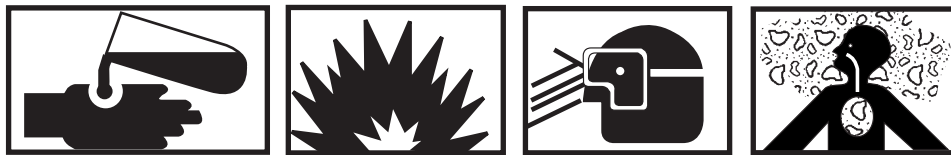
FIRST AID

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 or death to personnel. Also included are explanations of safety and of hazardous materials used within the technical manual.

BATTERIES



Batteries are filled with a sulfuric acid based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective gloves, goggles, faceshield, and an apron must be worn at all times when batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with the skin, flush the area with large volumes of water. If the electrolyte comes in contact with the eyes, flush them with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in death or serious injury.

Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Failure to comply with these precautions can result in death or serious injury.

CHLORINE AND BROMINE STORAGE AND HANDLING



Chlorine and the Water Demineralizer Cartridge (NSN 4610-01-022-9970) which contains the chemical Bromine may not be stored together. Both chemicals, Chlorine and Bromine, must follow the Federal HAZCOM standard (29 CFR 1910.1200) along with the Material Safety Data Sheet (MSDS) for each chemical. Failure to comply could result in injury or death.

CONFINED SPACE ENTRY

Only properly trained personnel may enter confined spaces, or act as entry supervisors and/or attendants for those working in confined spaces. Before entering into a confined space, the space must be cleared for entry and a Confined Space Entry Permit must be secured. All entry into confined spaces must be in accordance with the Organizational Confined Space Entry Standard Operating Procedure and FM 55-502. Entry into an uninspected confined space may result in death or serious injury to personnel.

DIESEL FUEL



Fuel vapors are explosive. Fuel is flammable. Before fueling the tanks or transferring fuel, ensure that firefighting equipment is immediately available for use in case of fire emergency. Do not smoke or allow smoking, or any other open flame in the vicinity of the fueling operation. Wipe clean any fuel spillage and dispose of spilled fuel in accordance with the appropriate local regulations. A fueling watch supervisor shall be stationed to ensure compliance with fueling safety procedures. Failure to comply can result in death or serious injury.

Avoid prolonged exposure of the skin to diesel fuel. Chemical protective gloves and goggles must be worn whenever handling diesel fuel or parts which are saturated with diesel fuel. Failure to comply can result in death or serious injury.

ELECTRICAL



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

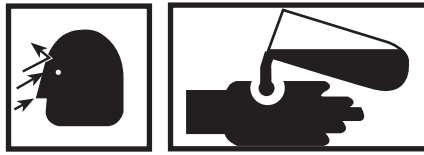
Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions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

GALLEY NOISE HAZARD



All crewmembers working in the galley area must wear Army Hearing Protection Devices (HPDs) and ensure that the galley doors remain closed. Failure to comply could result in injury.

GAYLORD VENTILATION AND FIRE SUPPRESSION SYSTEM



In the event that the Gaylord Ventilation and Fire Suppression system is activated and exposure to the fire suppressant occurs, all personnel exposed should immediately wash out the eyes and shower to remove residual material. Failure to comply could result in injury or death.

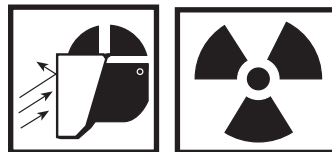
HOT WORK, WELDING, AND GRINDING



Removing components by means of grinding or cutting produces hot, flying particles. These particles can cause serious injury to personnel. These hot particles can also ignite fires in the work area and in adjacent spaces. During and after removal, the work area will be very hot. Wear protective goggles, gloves, and/or apron at all times during cutting and grinding operations. A fire watch must be posted whenever grinding or cutting operations are taking place. Failure to comply with this warning can result in serious injury or death to personnel.

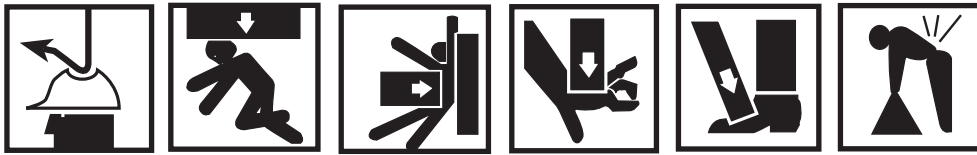
Grinding, needling, and chipping operations produce high velocity flying debris which can become lodged in the skin or in the eyes. Grinding, needling, and chipping in confined spaces can result in debris flying from unexpected directions. All personnel working in the area must wear protective eyewear, gloves, and long sleeves when performing grinding, needling and chipping operations. Failure to comply can result in death or serious injury to personnel.

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.



Unprotected exposure to arc welding rays can cause serious eye damage and radiation burns to the skin. Never perform arc welding operations without using appropriate eye and skin protection. Failure to comply can result in death or serious injury.

LIFTING OPERATIONS AND HEAVY LOADS



All personnel in the vicinity of 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.

Heavy loads can crush. Use a minimum of two crewmembers to lift and hold heavy loads. Do not allow any body parts to come under the load or between the load and a stationary object. Failure to comply can result in serious injury or death.

LOCKING HARDWARE

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.

MACHINE GUN NOISE HAZARD



During M2 caliber 0.50 weapons firing, all personnel standing outside on deck must wear Army Hearing Protection Devices (HPDs). Failure to comply with this warning could result in serious injury.

OILS AND CLEANING SOLVENT



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 comply can result in death 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 comply can result in death or serious injury.

PRESSURIZED LINES

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 death or severe personal injury.

RADIATION, RADIO ANTENNAS

Inspecting antennas with the INSA, radars, transceivers and receiver-transmitters turned on presents a radiation hazard. Ensure all transceivers and receiver-transmitters are turned off prior to inspecting antennas. Ensure that the appropriate circuit breaker has been secured, locked out, and tagged out (see WP 0008) in accordance with FM 55-502. Failure to comply could result in injury or death.

ROTATING EQUIPMENT

Use extreme caution when working around rotating components. Do not allow hands or tools to come in contact with the rotating components. Do not wear loose clothing, jewelry, or anything else which might become entangled in the rotating components. Failure to comply can result in death or serious injury.

SAFETY HARNESS

Ensure that a safety harness is worn when inspecting antennas. Failure to comply could result in injury or death.

SEWAGE

Sewage is a common mode of transmission for parasitic organisms that may have the capability of causing communicable diseases. Chemical protective gloves and a protective apron should be worn to help prevent contact with sewage. After coming in contact with sewage or contaminated equipment, be sure to clean yourself with a disinfectant soap. Avoid sewage contact with skin abrasions, punctures, cuts, and other open wounds. Wipe up and clean any spills and/or contaminated equipment using a disinfectant soap. Failure to comply can result in death or serious illness.

SEWAGE (CONTINUED)



Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source. Avoid open flames and prolonged breathing of fumes. Failure to comply can result in death or serious injury.

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from an outside source. Avoid open flames and prolonged breathing of fumes. Failure to comply can result in death or serious injury.

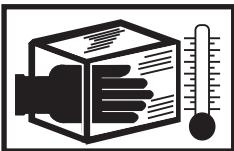
EXPLANATION OF SAFETY WARNING ICONS



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.

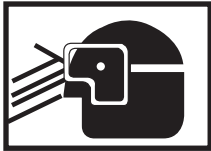


ELECTRICAL - electrical wire to hand with electricity symbol running through hand shows that shock hazard is present.

EXPLANATION OF SAFETY WARNING ICONS (CONTINUED)



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.



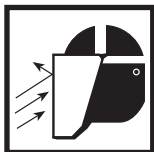
FALLING PARTS - arrow bouncing off human shoulder and head shows that falling parts present a danger to life or limb.



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.

EXPLANATION OF SAFETY WARNING ICONS (CONTINUED)



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.



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.

EXPLANATION OF SAFETY WARNING ICONS (CONTINUED)



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



RADIO TRANSMISSION WARNING - Radiating lines from a radio antenna indicate the danger of radiation and electric shock hazards are present.



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



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

Date of original issue for this manual is:

Original 30 NOVEMBER 2005

**TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 76 AND TOTAL
NUMBER OF WORK PACKAGES IS 308 CONSISTING OF THE FOLLOWING:**

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A-D	0	WP 0040 00 (24 pgs)	0
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Chp 1 title page	0	Chp 2 title page	0
WP 0001 00 (6 pgs)	0	WP 0042 00 (6 pgs)	0
WP 0002 00 (2 pgs)	0	WP 0043 00 (4 pgs)	0
WP 0003 00 (4 pgs)	0	WP 0044 00 (4 pgs)	0
WP 0004 00 (4 pgs)	0	WP 0045 00 (4 pgs)	0
WP 0005 00 (4 pgs)	0	WP 0046 00 (4 pgs)	0
WP 0006 00 (6 pgs)	0	WP 0047 00 (4 pgs)	0
WP 0007 00 (14 pgs)	0	WP 0048 00 (4 pgs)	0
WP 0008 00 (14 pgs)	0	WP 0049 00 (4 pgs)	0
WP 0009 00 (6 pgs)	0	WP 0050 00 (4 pgs)	0
WP 0010 00 (16 pgs)	0	WP 0051 00 (4 pgs)	0
WP 0011 00 (8 pgs)	0	WP 0052 00 (4 pgs)	0
WP 0012 00 (6 pgs)	0	WP 0053 00 (4 pgs)	0
WP 0013 00 (10 pgs)	0	WP 0054 00 (4 pgs)	0
WP 0014 00 (2 pgs)	0	WP 0055 00 (4 pgs)	0
WP 0015 00 (4 pgs)	0	WP 0056 00 (8 pgs)	0
WP 0016 00 (2 pgs)	0	WP 0057 00 (6 pgs)	0
WP 0017 00 (2 pgs)	0	WP 0058 00 (26 pgs)	0
WP 0018 00 (8 pgs)	0	WP 0059 00 (12 pgs)	0
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WP 0022 00 (2 pgs)	0	WP 0063 00 (4 pgs)	0
WP 0023 00 (4 pgs)	0	WP 0064 00 (6 pgs)	0
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WP 0029 00 (10 pgs)	0	WP 0070 00 (4 pgs)	0
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WP 0031 00 (2 pgs)	0	WP 0072 00 (6 pgs)	0
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WP 0034 00 (2 pgs)	0	WP 0075 00 (4 pgs)	0
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WP 0036 00 (4 pgs)	0	WP 0077 00 (4 pgs)	0

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

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WP 0081 00 (44 pgs)	0	WP 0131 00 (6 pgs)	0
WP 0082 00 (12 pgs)	0	WP 0132 00 (4 pgs)	0
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WP 0275 00 (8 pgs)	0	WP 0307 00 (12 pgs)	0
WP 0276 00 (4 pgs)	0	WP 0308 00 (4 pgs)	0
WP 0277 00 (4 pgs)	0	Glossary-1-Glossary-4	0
WP 0278 00 (4 pgs)	0	Index 1-Index-60	0
WP 0279 00 (4 pgs)	0	FO-TOC (2 pgs)	0
Chp 6 title page	0	FO-1 (2 pgs)	0
WP 0280 00 (4 pgs)	0	FO-2 (1 pgs)	0
WP 0281 00 (4 pgs)	0	FO-3 (1 pgs)	0
WP 0282 00 (4 pgs)	0	FO-4 (1 pgs)	0
WP 0283 00 (10 pgs)	0	FO-5 (5 pgs)	0
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WP 0285 00 (4 pgs)	0	FO-7 (8 pgs)	0
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HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 NOVEMBER 2005

TECHNICAL MANUAL

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

FOR

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

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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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 a 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.

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, direct support, and general 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, direct support, general 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 Inland and Coastal Large Tug (LT)

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
GENERAL INFORMATION**

SCOPE

The information in this manual applies to all Large Tug (LT) vessels with the lowered pilothouse configuration. The primary mission of the Army LT consists of ocean and coastal towing as well as docking and undocking operations with large ocean vessels. The vessel's secondary mission is to perform general purpose harbor duties such as positioning floating cranes, etc. The LT is also equipped to provide firefighting duties, a significant capability where ammunition ships are in work. The vessel can be used to perform salvage and recovery operations on disabled or damaged watercraft in coastal or port operational areas. The LT operates in coastal, harbor, and inland waterways, as well as in the open ocean.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army 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.

While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of these materials may be a corrosion problem. 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.

OZONE DEPLETING SUBSTANCES

There are no ozone depleting substances (ODS) aboard the LT. During the CFC changeout program, all ODS were eliminated and the systems that contained them appropriately modified.

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 LT for storage or shipment are contained in TB 740-97-4, Preservation of Vessels for Storage and TM 38-470, Storage of Army Prepositioned Stock Materiel.

WARRANTY INFORMATION

Unit maintenance maintains records of the warranty status of equipment on the LT. 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
ac	Alternating Current
AEPS	Army Electronic Product Support
AFFF	Aqueous Film Forming Foam
AMS	Auxiliary Machinery Space
BERP	Bolted Equipment Removal Plate
BII	Basic Issue Items
C2	Command and Control
C4ISR	Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance
CAPSAT	Coordinated Algebra (II) and Physics Simulated Satellite
CCW	Counterclockwise
CEN	Communication, Electronic, and Navigation
CHT	Sewage Collection, Holding, and Transfer
cm	Centimeter(s)
COEI	Components of End Item
COTS	Commercial Off the Shelf
CPC	Corrosion Prevention and Control
CPU	Central Processing Unit
CW	Clockwise
DA	Department of the Army
dB	Decibel
d/b	Distribution box
dc	Direct Current
DC	Damage Control
Dia	Diameter
DGPS	Differential Global Positioning Sensor
DSC	Digital Selective Calling
ECDIS	Electronic Chart Display and Information System
EDG	Emergency Diesel Generator
EIR	Equipment Improvement Recommendations
EOS	Enclosed Operating Station
EOT	Engine Order Telegraph
EPA	Environmental Protection Agency
EPIRB	Emergency Position Indicating Radio Beacon
EPR	Eductor Pressure
ERWWS	Engine Room Water Washdown System
ESD	Electrostatic Discharge
ETI	Elapsed Time Indicator

LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name

FM	Frequency Modulation
ft	Foot(feet)
ft ²	Square foot(feet)
ft ³ /min	Cubic feet per minute
g	Gram(s)
gal	Gallon(s)
gal/min	Gallons Per Minute
GFE	Government Furnished Equipment
GMDSS	Global Marine Distress Safety System
GPS	Global Positioning System
GRP	Glass Reinforced Plastic
GSS	General Service System
HCFC	Hydrochlorofluorocarbon
HF	Hydrogen Fluoride; High Frequency
hp	Horsepower
HPU	Hydraulic Power Unit
HSLT	High Speed Low Torque
HVAC	Heating, Ventilation, and Air Conditioning
Hz	Hertz
IBS	Integrated Bridge System
IFF	Identification Friend or Foe
in	Inch(es)
in ³	Cubic Inch(es)
INMARSAT	International Maritime Satellite Organizational System
JLOTS	Joint Logistics Over the Shore
kg	Kilogram
kg/cm ²	Kilograms per Square Centimeter
kHz	Kilohertz
km	Kilometer(s)
km/hr	Kilometers per hour
kW	Kilowatt(s)
L	Liter(s)
lb	Pound(s)
lb-ft	Pounds-Feet (torque)
lb-in	Pounds-Inch(es)
LED	Light Emitting Diode
L/min	Liters per minute
LMI	Load Moment Indicator
LOS	Line Of Sight
L/sec	Liters per second
LSHT	Low Speed High Torque
LST	Line of Sight Tactical
LT	Large Tug
m	Meter(s)
m ²	Square meter(s)
M2HB	Browning M2 Heavy Barrel .50 Caliber Machine Gun
MAC	Maintenance Allocation Chart
mb	Millibar

LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
MCR	
MF	Medium Frequency
MHz	Megahertz
mL	Millileter(s)
mm	Millimeter(s)
MOPP IV	Mission Oriented Protective Posture IV
MOS	Military Occupational Specialty
MSD	Marine Sanitation Device
mW	Milliwatt
NAVTEX	Navigation Telex Receiver
NBC	Nuclear, Biological, and Chemical
NCO	Noncommissioned Officer
NDT	Non-Destructive Testing
NFPA	National Fire Protection Agency
Nm	Newton Meter
nmi	Nautical mile(s)
No.	Number
NUC	Not Under Command
OBA	Oxygen Breathing Apparatus
OCM	Oil Content Monitor
ODS	Ozone Depleting Substance(s)
OWS	Oil Water Separator
oz	Ounce(s)
PA	Public Address
PLGR	Precision Lightweight Global Positioning System Receiver
PMCS	Preventive Maintenance Checks and Services
PPE	Personal Protective Equipment
PPM	Parts Per Million
PSI	Pounds per Square Inch
PTO	Power Take-Off
QAWT	Quick-Acting Watertight Door
qt	Quart(s)
r/min	Revolutions per minute
RAI	Rudder Angle Indicator
RF	Radio Frequency
ROWPU	Reverse Osmosis Water Purification Unit
SAR	Search and Rescue
SART	Search and Rescue Transponder
sec	Second(s)
SINGARS	Single Channel Ground and Airborne Radio
SNAP	Significant New Alternatives Policy
SOLAS	Safety of Life at Sea
SOTM	Satellite-On-The-Move
SSB	Single Sideband
SSDG	Ship's Service Diesel Generator
STBD	Starboard
STU	Secure Telephone Unit

LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
t	tonne (metric)
TACSAT	Tactical Satellite
TAMMS	The Army Maintenance Management System
TFT	Thin Film Transistor
TLI	Tank Level Indicator
TMDE	Test, Measurement, and Diagnostic Equipment
TV	Television
UHF	Ultra High Frequency
UPS	Uninterrupted Power Supply
USCG	United States Coast Guard
UVA	Ultrasonic Vibrator Assembly
Vac	Volts, Alternating Current
VCR	Video Cassette Recorder
Vdc	Volts, Direct Current
VHF	Very High Frequency
VICS	Vessel Information and Communication System; Vehicular Interface Control Station
W	Watt(s)
WWS	Water Washdown System
WDCM	Washdown Counter Measure
XMTR	Transmitter
yd	Yard(s)

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.

SAFETY, CARE, AND HANDLING

The following procedures should be observed when handling all Electrostatic Discharge (ESD) sensitive components and units containing such components. Failure to observe all of these precautions can cause permanent damage to the electrostatic device. This damage can cause the device to fail immediately or at a later date when exposed to an adverse environment.

1. Turn off and /or disconnect all power, signal sources, and loads used with the unit.
2. Place the unit on a grounded, non-conductive work surface.
3. Ground the repair operator using a non-conductive wrist strap or other device using 1 megaohm series resistor to protect the operator.
4. Ground any tools (including soldering equipment) that will contact the unit. Contact with the operator's hand provides a sufficient ground for tools that are otherwise electrically isolated.

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5. All electrostatic sensitive replacement components are shipped in non-conductive foam or tubes and must be stored in the original shipping container until installed.
 6. When these devices and assemblies are removed from the unit, they should be placed on the non-conductive work surface or in non-conductive containers.
 7. When not being worked on, place disconnected circuit boards in plastic bags that have been coated or impregnated with a non-conductive material.
 8. Do not handle these devices unnecessarily or remove them from their packages until actually used or tested.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES**

The LT is used for coastal and ocean towing, docking and undocking operations with large ocean vessels such as the SL-7 (FFS), LASH, and SEABEE vessels. The LT is capable of producing 54 long tons of bollard pull. It can tow five 231 A type barges with a payload capacity of 733 long tons per barge or five 231 B type liquid cargo barges with a payload capacity of 578 long tons per barge. The LT can sustain a minimum speed of 5 knots in Sea State 4 when under full tow as described above.

The LT is capable of self-delivery to overseas locations. It has a maximum range of 5000 nautical miles with 25 percent fuel reserve. The LT can handle high side, high flare ships.

The LT is capable of providing limited firefighting, salvage, and rescue help to other ships and shore installations. The vessel has control stations in the pilothouse and auxiliary operating stations located aft on the 01 Level (near the tow winch control station) and on the port and starboard bridge wings. Each auxiliary control station contains engine speed and steering controls, bow thruster controls, and rudder angle indicator. Included in each control station are the indicators necessary for the safe operation of the LT.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
MAIN DECK EXTERIOR**

MAIN DECK EXTERIOR

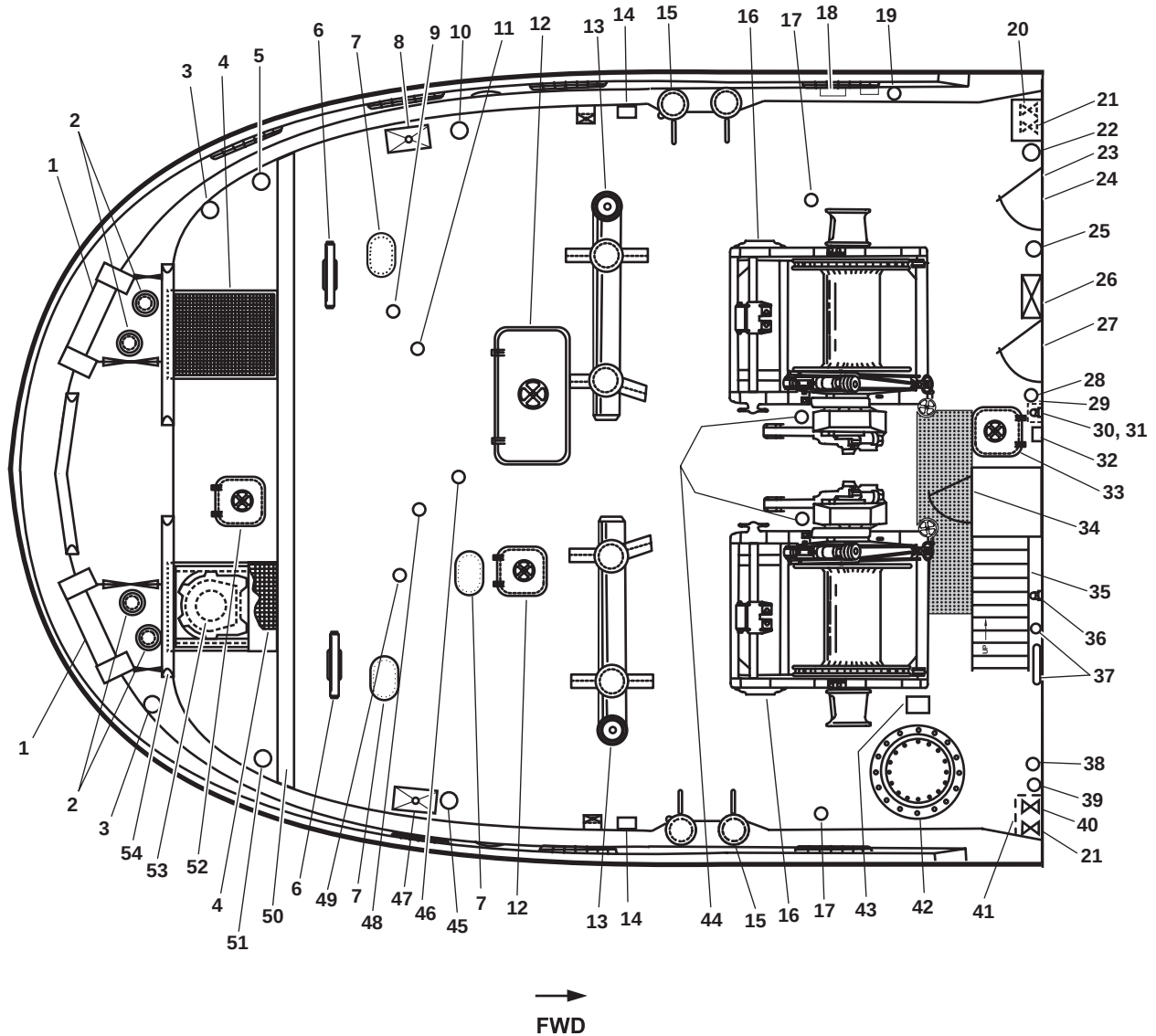


Figure 1. Main Deck Exterior

1. Tow roller (figure 1, item 1). Tow rollers reduce friction on the towing hawsers.
2. Retractable tow pins (figure 1, item 2). Pins guide the lines and hawsers to a desired location.
3. Steering gear compartment vent (figure 1, item 3). The steering gear compartment vents the steering gear compartment to weather.
4. Polyfiber grating (figure 1, item 4). The polyfiber grating protects the rudder motors from damage by the towing hawser.

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5. Fuel oil tank 4P vent and spill container (figure 1, item 5). The fuel oil tank 4P vent vents fuel oil tank 4P to weather. The spill container contains spillage from accidental overfilling.
 6. Cleat (figure 1, item 6). The cleat is used to secure lines. It maintains lateral control of the towing machine wire rope by providing an attachment point for the hawsing strap.
 7. Flush manhole (figure 1, item 7). The flush manhole provides access to the void and the fuel oil tanks.
 8. Tow gear locker natural air vent (figure 1, item 8). This vent provides fresh air ventilation to the port side of the tow gear locker.
 9. Fuel oil tank 4P cutoff valve (figure 1, item 9). This valve provides remote cutoff for fuel oil tank 4 port.
 10. Ballast tank 2P vent (figure 1, item 10). This vent provides ventilation for the port aft ballast tank.
 11. Fuel oil tank 4P sounding tube (figure 1, item 11). This sounding tube permits measurement of the fuel level in fuel oil tank 4 port.
 12. Hatch (figure 1, item 12). The hatch provides access to towing gear locker.
 13. H-bitt (figure 1, item 13). The H-bitt fixture is used to secure the towing hawser.
 14. Tow pin control (figure 1, item 14). The tow pin control raises and lowers the tow pins.
 15. Double bitt (figure 1, item 15). The double bitt is used to secure (moor) the Large Tug (LT). The double bitt is also used for ship handling.
 16. Towing machine (figure 1, item 16). The hydraulically powered towing machine is used for towing other vessels and barges.
 17. Countermeasure washdown sprinkler (figure 1, item 17). This sprinkler uses raw water for removing Nuclear, Biological and Chemical (NBC) contamination from exterior surfaces.
 18. Sound powered telephone with stowage (figure 1, item 18). The sound powered telephone is used for intraship communications.
 19. High level sea chest vent (figure 1, item 19). The high level sea chest vent allows trapped air to be released to the atmosphere.
 20. Portable water fill connection (figure 1, item 20). This connection permits filling of the potable water tanks from a shore supply source.
 21. Sewage shore connection (figure 1, item 21). This quick disconnection is used for sewage transfer to shore facilities.
 22. Port shaft seal vent (figure 1, item 22). This vent vents the port shaft seal to weather.
 23. Vent trunk (figure 1, item 23). The vent truck provides ventilation to the fan room.
 24. Watertight door (figure 1, item 24). This door provides access to the fan room.
 25. Shore power connection (figure 1, item 25). This connection provides a power connection from the shore to the vessel.
 26. Fire station 4 (figure 1, item 26). The firefighting station uses raw water for firefighting. The firefighting station is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
 27. Watertight door (figure 1, item 27). This door provides access to the vestibule.

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28. Aft sea chest vent (figure 1, item 28). The aft sea chest vent allows trapped air to be released to the atmosphere.
 29. Refrigerant vent (figure 1, item 29). This vent allows the refrigeration and environmental control systems discharge valves to discharge refrigerant to weather.
 30. Exterior lighting (figure 1, item 30). The exterior lighting illuminates the aft main deck area.
 31. FM-200 exterior manual pull box (figure 1, item 31). The FM-200 exterior manual pull box is a watertight enclosure. When the exterior manual pull box is activated, the FM-200 fire extinguishing agent is discharged into the engine room and AMS 1 within 60 seconds.
 32. FM-200 alarm bell (figure 1, item 32). The FM-200 alarm bell sounds 60 seconds prior to the discharge of the FM-200 fire extinguishing agent into the engine room alerting the crewmembers of an emergency situation.
 33. Escape hatch (figure 1, item 33). The escape hatch provides an escape access from the AMS 2.
 34. Hydraulic pipework guard raised treadplate (figure 1, item 34). This treadplate provides damage protection for the towing machine piping.
 35. Garbage stowage racks (figure 1, item 35). The garbage stowage racks provide storage for garbage cans beneath the ladder.
 36. Waste oil drain tank vent (figure 1, item 36). This vent vents the waste oil drain tank to weather.
 37. Life ring and personal distress light marker (figure 1, item 37). The life ring is an emergency personal flotation device. The distress light marker is a life saving device that emits a high intensity strobe light. It can also operate in the infrared mode to alert allies when concealment from hostile forces is necessary. The personal distress light marker is designed to flash continuously in either mode for a minimum of 8 hours.
 38. Starboard shaft seal vent (figure 1, item 38). This vent vents the starboard shaft seal to weather.
 39. FM-200 CO₂ vent (figure 1, item 39). The FM-200 vent vents CO₂ from the FM-200 system to weather.
 40. Oily waste discharge shore connection (figure 1, item 40). This connection provides a portal for oily waste discharge.
 41. Vent trunk (figure 1, item 41). The vent trunk provides an exhaust access to weather from AMS 2.
 42. Capstan (figure 1, item 42). The hydraulically powered capstan is used to work lines during mooring and ship handling.
 43. Capstan control station (figure 1, item 43). The capstan control station provides controls to operate the capstan.
 44. Potable water tank vents (figure 1, item 44). These vents vent the potable water tank to the weather.
 45. Ballast tank 2S vent (figure 1, item 45). This vent provides ventilation for the starboard aft ballast tank.
 46. Frame 6-7 void sounding tube (figure 1, item 46). This sounding tube permits sounding of the 6-7 frame void.
 47. Tow gear locker natural air vent (figure 1, item 47). This vent provides fresh air ventilation to the starboard side of the tow gear locker.
 48. Fuel oil tank 4S sounding tube (figure 1, item 48). The fuel oil tank 4S sounding tube is provided to measure the level of fuel oil in fuel oil tank 4S.
 49. Fuel oil tank 4S cutoff valve (figure 1, item 49). This valve provides remote cutoff for fuel oil tank 4 starboard.
 50. Tow bar (figure 1, item 50). The tow bar protects the polyfiber grating and rudder motors from damage caused by contact with the towing hawser(s).

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51. Fuel oil tank 4S vent and spill container (figure 1, item 51). This vent vents fuel oil tank 4S to weather. The spill container contains spillage from accidental overfilling.
 52. Hatch (figure 1, item 52). This hatch provides access to the steering gear compartment.
 53. Rudder motor (figure 1, item 53). The rudder motors move the rudders into the requested position as directed by the helm or auxiliary control stations.
 54. Chaffing bar (figure 1, item 54). The chaffing bar protects the polyfiber grating and the rudder motors from damage caused by contact with the towing hawser(s).

END OF WORK PACKAGE

UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
01 LEVEL EXTERIOR

01 LEVEL EXTERIOR

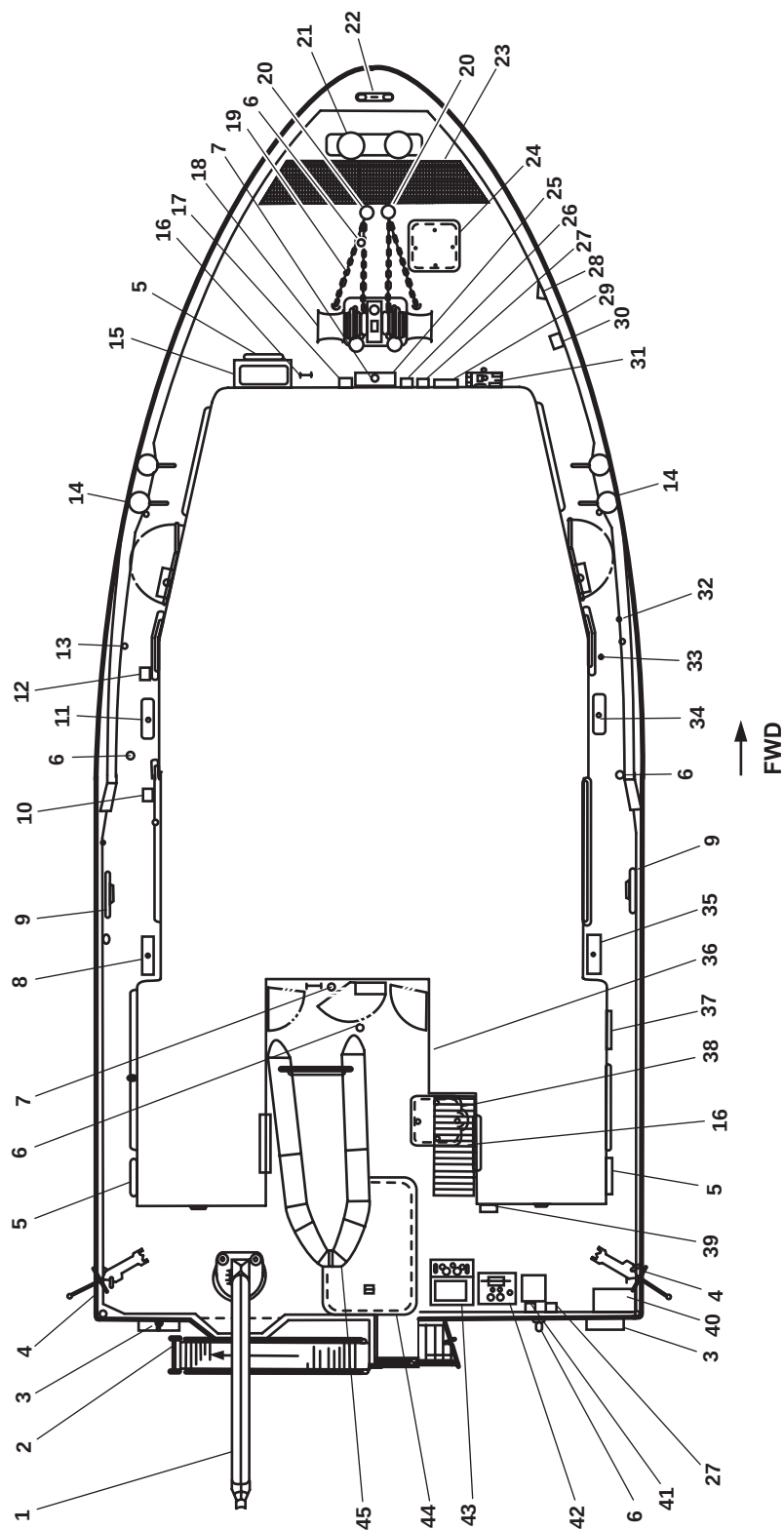


Figure 1. 01 Level Exterior

1. Crane (figure 1, item 1). The hydraulically powered crane is used to deploy and recover the workboat, to install or stow the accommodation ladder, and to handle towing gear.
2. Accommodation ladder (figure 1, item 2). When installed, the accommodation ladder provides easy access from the shore or another vessel.
3. Floodlight (figure 1, item 3). The halide floodlight provides illumination for the fantail.
4. 50 Cal. machine gun mount (figure 1, item 4). The mount supports the air cooled, belt-fed heavy machine gun (M2HB) used for vessel protection.
5. Life ring (figure 1, item 5). The life ring provides an emergency personal flotation device.
6. Countermeasure washdown sprinkler (figure 1, item 6). The countermeasure washdown sprinkler uses raw water to remove Nuclear, Biological, and Chemical (NBC) contamination.
7. Floodlight (figure 1, item 7). The adjustable 200-watt incandescent floodlight provides illumination for the aft 01 level weather deck.
8. Vent for fuel oil tank 3C and fuel oil day tank with the spill container (figure 1, item 8). The vent ventilates the oil and fuel tanks to weather. The spill container catches any overflow of fuel.
9. Cleat (figure 1, item 9). The cleat is used to secure lines.
10. Lube oil fill connection (figure 1, item 10). The lube oil fill connection provides a portal for lube oil transfer to the tanks.
11. Vent for lube oil tank, fuel oil tank 2P, and hydraulic oil tank with the spill container (figure 1, item 11). The vent ventilates the oil and fuel tanks to weather. The spill container catches any overflow of the lube oil, fuel oil, and hydraulic tank.
12. Hydraulic oil fill connection (figure 1, item 12). The hydraulic oil fill connection provides a portal for the hydraulic oil transfer to tank.
13. Lube oil tank sounding tube (figure 1, item 13). The lube oil tank sounding tube determines the level of lube oil present in the storage tank.
14. Double bitt (figure 1, item 14). The double bitt is used for towing operations and for securing (mooring) the vessel.
15. Deck locker (figure 1, item 15). The deck locker provides storage for boatswain's gear.
16. Ladder (figure 1, item 16). The ladder provides access to the 02 level weather deck.
17. Ship's bell (figure 1, item 17). The ship's bell is used for audible signaling under specified conditions.
18. Anchor windlass (figure 1, item 18). The hydraulically powered windlass is used to lower and raise the anchors. An extended shaft drives the wildcat and gypsy.
19. Chain stopper (figure 1, item 19). The chain stopper secures the anchor chain in place.
20. Hawse pipe (figure 1, item 20). The hawse pipe runs through the deck and into the anchor pocket. The hawse pipe guides the anchor chain. When the anchors are hawsed, their shanks are stored in the hawse pipe.
21. H-Bitt (figure 1, item 21). The H-bitt fixture is used to secure towing hawser or mooring lines.
22. Bull nose (figure 1, item 22). The bull nose is a metal fitting at the bow used to guide the towing hawser or mooring line.
23. Hawser drying rack (figure 1, item 23). The hawser drying rack is used for drying the hawser.

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24. Watertight hatch (figure 1, item 24). The watertight hatch provides access to the boatswain's store.
 25. Vents for fuel oil tank 1P and 1S with the spill container (figure 1, item 25). The vent ventilates the oil and fuel tanks 1P and 1S tanks to weather. The spill container catches any overflow of the 1P and 1S tanks.
 26. Intercom (figure 1, item 26). The intercom provides intraship communications.
 27. Sound powered telephone with bell (figure 1, item 27). The sound powered telephone provides intraship communications.
 28. Ballast tank 1 vent (figure 1, item 28). The vent ventilates the ballast tank to weather.
 29. Fire station 9 (figure 1, item 29). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
 30. Sound powered telephone stowage box (figure 1, item 30). The sound powered telephone stowage box provides storage for the sound powered telephone.
 31. Anchor windlass control station (figure 1, item 31). The anchor windlass control station provides controls for the anchor windlass.
 32. Oily waste tank sounding tube (figure 1, item 32). The oily waste tank sounding tube determines the level of oil waste present in the storage tank.
 33. Aqueous Film Forming Foam (AFFF) storage tank vent (figure 1, item 33). The AFFF storage tank vent vents the AFFF tank to weather.
 34. Vents for oily waste tank and fuel oil tanks 3C and 2S with the spill container (figure 1, item 34). The vents ventilate the oily waste tank and fuel oil tanks 3C and 2S to weather. The spill container catches any overflow of the oily waste tank and fuel oil tanks 3C and 2S .
 35. Emergency Diesel Generator (EDG) day tank and fuel oil day tank vents (starboard), spill container, and fill connections (figure 1, item 35). The vents ventilate the EDG day tank and fuel oil day tanks to weather (starboard). The spill container catches any overflow of the day tanks.
 36. Louver vent (figure 1, item 36). The louver vent provides passive ventilation for the emergency diesel generator room.
 37. EDG engine radiator exhaust louver (figure 1, item 37). The EDG engine radiator exhaust louver provides air exhaust access from the EDG compartment.
 38. Flush watertight hatch (figure 1, item 38). The flush watertight hatch provides access to the galley.
 39. Fire station 7 (figure 1, item 39). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
 40. Gasoline can quick jettison rack (figure 1, item 40). The gasoline can quick jettison rack provides storage for three 5-gallon (19 liter) gasoline cans.
 41. Ammunition locker (figure 1, item 41). The ammunition locker provides storage for the .50 cal. machine gun ammunition.
 42. Aft auxiliary control station (figure 1, item 42). The aft auxiliary control station provides speed and directional control for the main propulsion system and steering control for the rudders.
 43. Towing machine control station (figure 1, item 43). The towing machine control station provides controls for the port and starboard towing machine and tow pins.
 44. Soft patch (figure 1, item 44). The soft patch is a watertight bolted panel that can be removed to allow large machinery removal.

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45. Work boat (figure 1, item 45). The work boat is a seven-person, 13 ft (3.9 m) long, rigid bottom, inflatable boat. The workboat is equipped with a console steering unit and a 40 hp (29.8 kW) outboard motor.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
02 LEVEL EXTERIOR**

02 LEVEL EXTERIOR

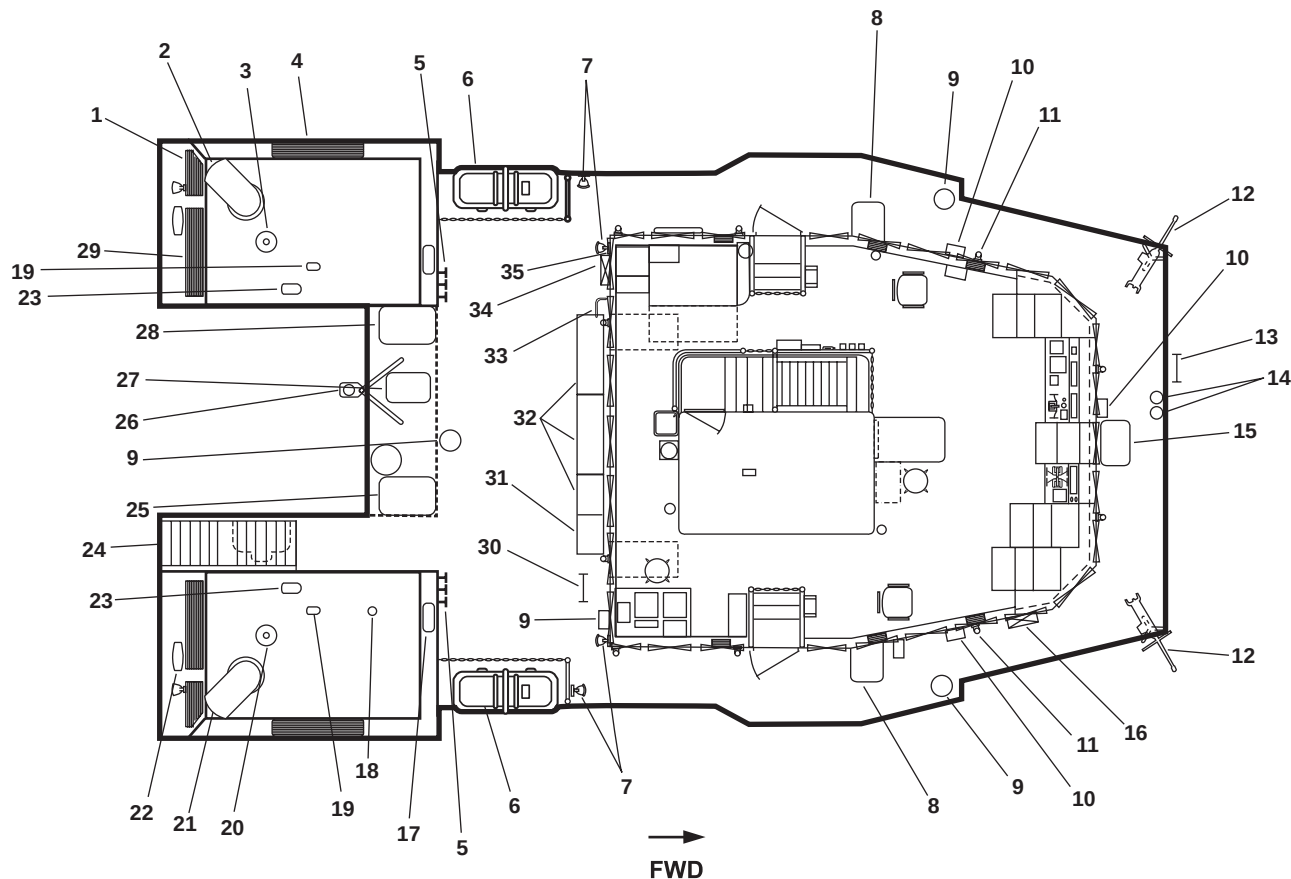


Figure 1. 02 Level Exterior

1. Main engine combustion air intake (figure 1, item 1). The main engine combustion air intake provides fresh air to the main engine's combustion system.
2. Port main engine exhaust (figure 1, item 2). This exhaust discharges the port main engine's exhaust to weather.
3. Medium Frequency (MF), High Frequency (HF), Global Maritime Distress Safety System (GMDSS) whip antenna, model, 5300 (figure 1, item 3). This antenna is coupled to the MF/HF transceiver for the GMDSS. Refer to TM 55-5821-311-10 for details.
4. Engine room vent air exhaust (figure 1, item 4). The engine room vent air exhaust provides exhaust for the engine room.
5. Engine room ventilation damper handles (figure 1, item 5). These three ventilation damper handles OPEN and CLOSE the main engine intake, the engine room ventilation intake, and the engine room exhaust vent.
6. Life raft (figure 1, item 6). The inflatable life raft provides holding capacity for 25 crewmembers.
7. Flood light (port and starboard) (figure 1, item 7). The flood light provides illumination for night towing operations.

8. Bridge wing control station (port and starboard) (figure 1, item 8). The bridge wing control station provides auxiliary control of steering, propulsion engines, and the bow thruster engine.
9. Column bearing repeater stand (figure 1, item 9). The bearing repeater stand is a compass repeater for the gyrocompass system.
10. Sound powered telephone (figure 1, item 10). The sound powered telephone provides communication to various areas of the vessel.
11. Deck light (figure 1, item 11). The deck light provides illumination for 02 deck and surrounding area.
12. Air cooled, belt-fed heavy machine gun (M2HB) (port and starboard) (figure 1, item 12). The M2HB is provided for vessel and crew defense.
13. Vertical ladder (figure 1, item 13). The vertical ladder provides access to the 01 deck.
14. Bow thruster and pump drive engine crankcase ventilation tubes (figure 1, item 14). These tubes vent the bow thruster and the pump drive engine crankcases to weather.
15. Ammunition locker (figure 1, item 15). The ammunition locker provides secure storage for ammunition.
16. Fire station 11 (figure 1, item 16). Firefighting station 11 uses raw water. This fire station is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
17. Port and starboard upper stack access hatch (figure 1, item 17). The upper stack access hatch provides access to the upper stack.
18. Emergency Diesel Engine (EDG) exhaust (figure 1, item 18). This exhaust discharges the EDG's exhaust to weather.
19. Bow thruster engine exhaust (figure 1, item 19). This exhaust discharges the bow thruster's engine exhaust to weather.
20. HF whip tactical antenna, model 4201N (figure 1, item 20). This antenna is coupled to the receiver-transmitter. Refer to TM 55-5825-311-10 for details.
21. Starboard main engine exhaust (figure 1, item 21). This exhaust discharges the starboard main engine's exhaust to weather.
22. Lower stack access hatch (figure 1, item 22). The lower stack access hatch provides access to the lower stack.
23. Ship Service Diesel Generator (SSDG) exhaust vent (figure 1, item 23). This vent discharges the SSDG engine's exhaust to weather.
24. 01/02 deck level ladder (figure 1, item 24). The 01/02 deck level ladder provides access between the 01 and 02 decks.
25. Paint locker (figure 1, item 25). The paint locker provides storage for the vessel's paint and associated supplies. The paint locker is properly outfitted for hazardous materials.
26. Aft mast (figure 1, item 26). The mast provides mounting for many of the vessel's navigation lights and for various antennae.
27. Grenade locker (figure 1, item 27). The grenade locker provides secure storage for grenades.
28. Pyrotechnic locker (figure 1, item 28). The pyrotechnic locker provides secure storage for pyrotechnic materiel.
29. Engine room vent air intake (figure 1, item 29). The engine room vent air intake provides fresh air to the engine room.
30. Vertical ladder (figure 1, item 30). The vertical ladder provides access to the pilothouse top.

- 31. Battery box (figure 1, item 31). The battery box provides dry storage for batteries.
- 32. Emergency gear storage locker (figure 1, item 32). The emergency gear storage locker provides storage for emergency gear.
- 33. Compressed air weather tool connection (figure 1, item 33). This connection provides a quick disconnect for compressed air.
- 34. Fire station 10 (figure 1, item 34). Firefighting station 10 uses raw water. This fire station is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
- 35. Potable water bibb (figure 1, item 35). This hose bibb supplies potable water to the 02 deck level.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
PILOTHOUSE TOP AND MASTS**

PILOTHOUSE TOP

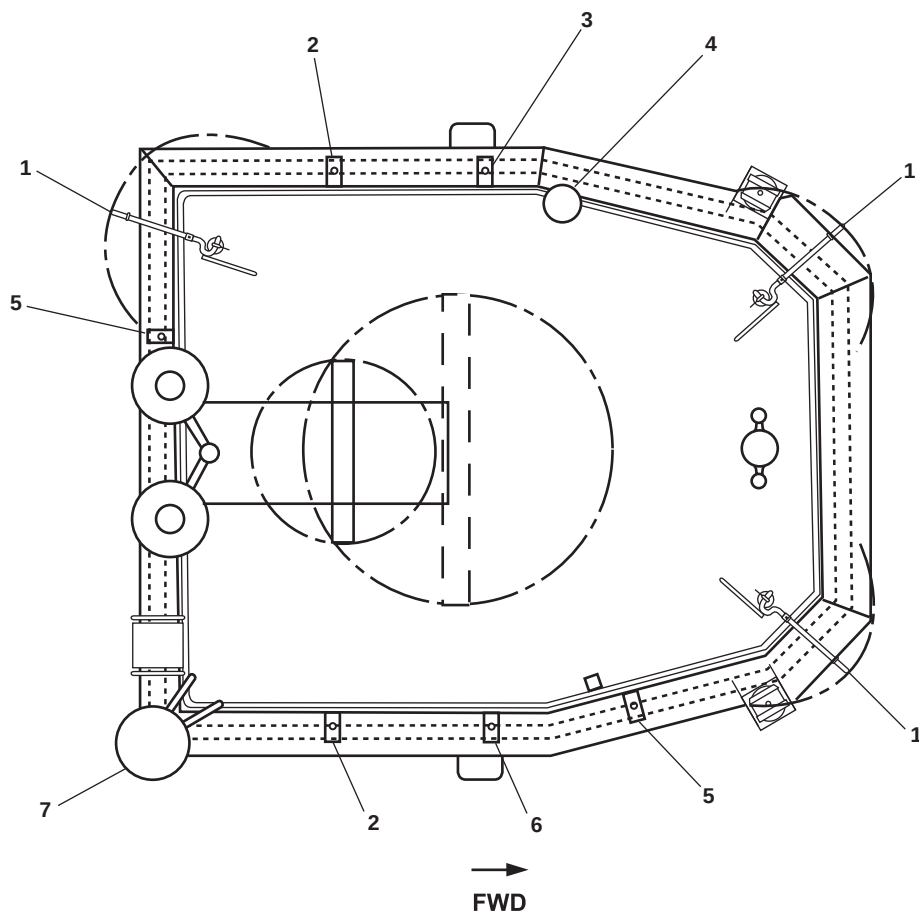


Figure 1. Pilothouse Top

1. Fire monitors (figure 1, item 1). The fire monitors supply water for fighting fires on the vessel, but are used primarily for other vessels.
2. Multimission tactical, multiband (Shakespeare SF3512/VRC) whip antenna (figure 1, item 2). This antenna is coupled to the vessel's Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance (C4ISR) system. Refer to TM 55-5825-311-10 for details.
3. Watch receiver antenna (Shakespeare 390) (figure 1, item 3). This antenna is coupled to the High Frequency (HF) vessel's C4ISR system. Refer to TM 55-5825-311-10 for details.
4. Television (TV) and radio antenna (Naval Electronics Mk 12) (figure 1, item 4). This antenna is coupled to the vessel's entertainment TV.

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5. VHF whip (5225-XT) (figure 1, item 5). This antenna is coupled to the vessel's C4ISR system. Refer to TM 55-5825-311-10 for details.
 6. Navtex receiver antenna (Shakespeare 390) (figure 1, item 6). This antenna is coupled to the vessel's C4ISR system. Refer to TM 55-5825-311-10 for details.
 7. Radio Frequency (RF) transceiver fleet 77 antenna (TT-3008C) (figure 1, item 7). The antenna is couple to International Maritime Satellite Organization (INMARSAT) System. Refer to TM 55-5825-311-10 for details.

MAST: AFT

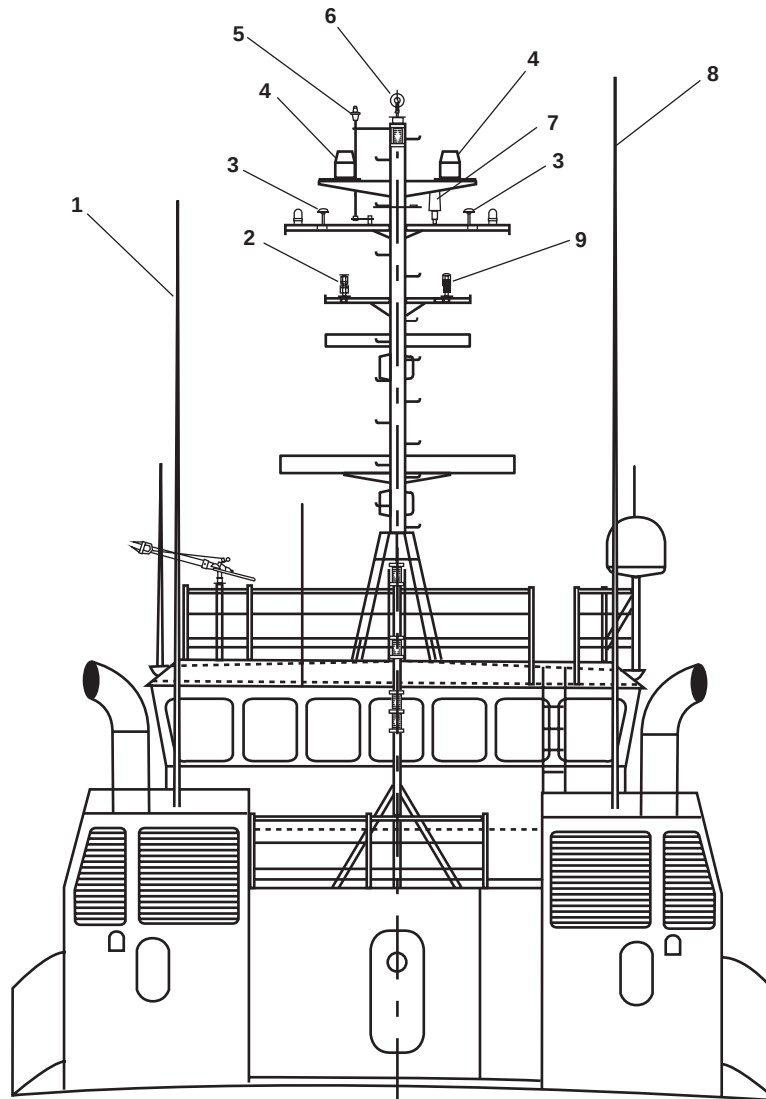


Figure 2. Mast: Aft

1. Medium Frequency (MF)/High Frequency (HF) Global Maritime Distress Safety System (GMDSS) model, 5300 antenna (figure 2, item 1). This antenna is coupled to the MF/HF transceiver for the GMDSS. Refer to TM 55-5825-311-10 for details.
2. Barometric pressure sensor (61202) (figure 2, item 2). This sensor detects exterior atmospheric pressure.
3. Global Positioning System (GPS)/Differential Global Positioning Sensor (DGPS) antenna (figure 2, item 3). This antenna is coupled to the Integrated Bridge System (IBS). Refer to TM 55-5825-311-10 for details.
4. Tactical Satellite (TACSAT) Satellite-On-The-Move (SOTM) GV-2432 antenna (figure 2, item 4). This antenna is coupled with the UHF radio set. Refer to TM 55-5825-311-10 for details.
5. GMDSS J8 INMARSAT Coordinated Algebra (II) & Physics Simulated Satellite (CAPSAT) antenna (figure 2, item 5). This antenna is coupled to the GMDSS. Refer to TM 55-5825-311-10 for details.

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6. Marine wind tracker (model 06206) (figure 2, item 6). The marine wind tracker provides windspeed and direction display. The marine wind tracker also provides detailed information on relative wind angle.
 7. IFF antenna (AS-1778/UPX) (figure 2, item 7). This antenna is coupled to the vessel's C4ISR system. Refer to TM 55-5825-311-10 for details.
 8. HF whip tactical (4201N) antenna (figure 2, item 8). This antenna is coupled to the tactical HF radio system. Refer to TM 55-5825-311-10 for details.
 9. Humidity and temperature sensor (figure 2, item 9). The humidity and temperature sensor detects exterior atmospheric humidity and temperature.

NAVIGATION LIGHTS AND RADARS: STARBOARD

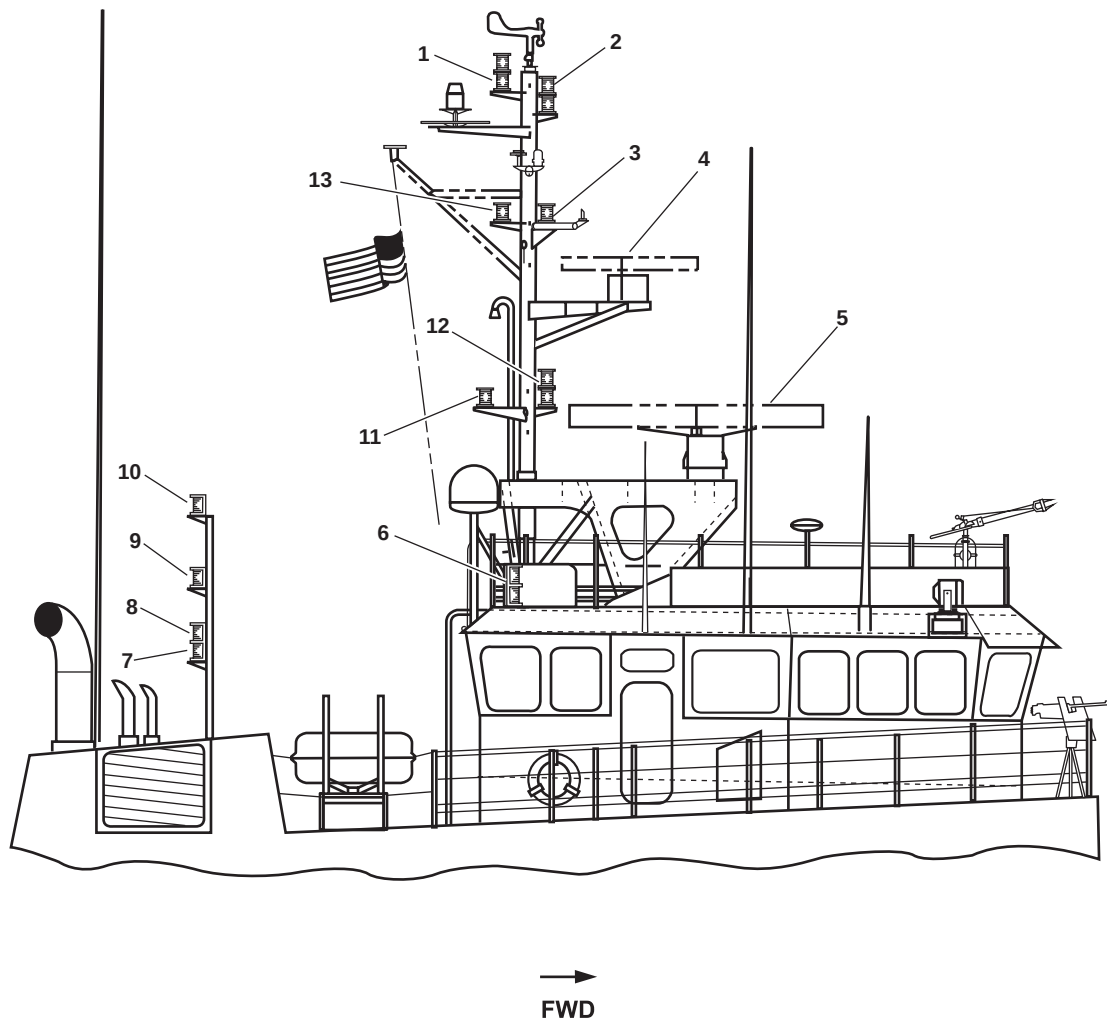


Figure 3. Navigation Lights, And Radars: Starboard View

1. Restricted in ability to maneuver and not under command (top light red) and anchor (bottom light white) lights (figure 3, item 1). The top light illuminates when the vessel has restricted maneuverability. The bottom light illuminates when the vessel's anchor is lowered. Both lights are visible for 360°.
2. Towing (white top light) and steaming (white bottom light) lights (figure 3, item 2). This light illuminates when the vessel is towing and/or steaming. The towing and steaming light provides a 225° arc of white light.
3. Towing and restricted in ability to maneuver white light (figure 3, item 3). This light illuminates when the vessel is towing and/or the vessel has restricted maneuverability. The towing and restricted in ability to maneuver light provides a 225° arc of yellow light.
4. X-Band radar Raytheon M28342 (figure 3, item 4). This radar provides transmission and reception of X-Band radar waves. The X-Band radar communicates imagery to the X-Band modulator XMTR receiver. The X-Band radar is used for prevention of collisions between vessels and as an aid to navigation when close to shore.

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5. S-band radar Raytheon M28346 (figure 3, item 5). This radar provides transmission and reception of S-Band radar waves. The S-Band radar communicates imagery to the S-Band modulator XMTR receiver. The S-Band radar assures target detection in adverse weather where X-Band radars are heavily affected by sea or rain clutter.
 6. Side lights (figure 3, item 6). The side lights provide a 112.5° arc of light. The port side lights are red and the starboard side lights are green.
 7. Stern light (figure 3, item 7). The stern light provides a 135° arc of white light visible from astern the vessel.
 8. Towing stern light (figure 3, item 8). The towing stern light provides a 135° arc of yellow light visible from astern the vessel.
 9. Inland side tow light (figure 3, item 9). The inland side tow light provides a 135° arc of yellow light visible from astern the vessel.
 10. Towing/pushing light (figure 3, item 10). The towing/pushing light provides a 135° arc of yellow light visible from astern the vessel.
 11. Restricted in ability to maneuver and not under command red light (figure 3, item 11). This light illuminates when the vessel has restricted maneuverability and is visible for 360°.
 12. Towing (top white) and restricted in ability to maneuver and not under command (bottom red) lights (figure 3, item 12). The top white light is illuminated during towing operations, and is visible for 225°. The bottom red light is illuminated during restricted maneuverability and is visible for 360°.
 13. Restricted in ability to maneuver white light (figure 3, item 13). This light illuminates when the vessel has restricted maneuverability and is visible for 360°.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
PILOTHOUSE INTERIOR**

PILOTHOUSE INTERIOR (PLAN VIEW)

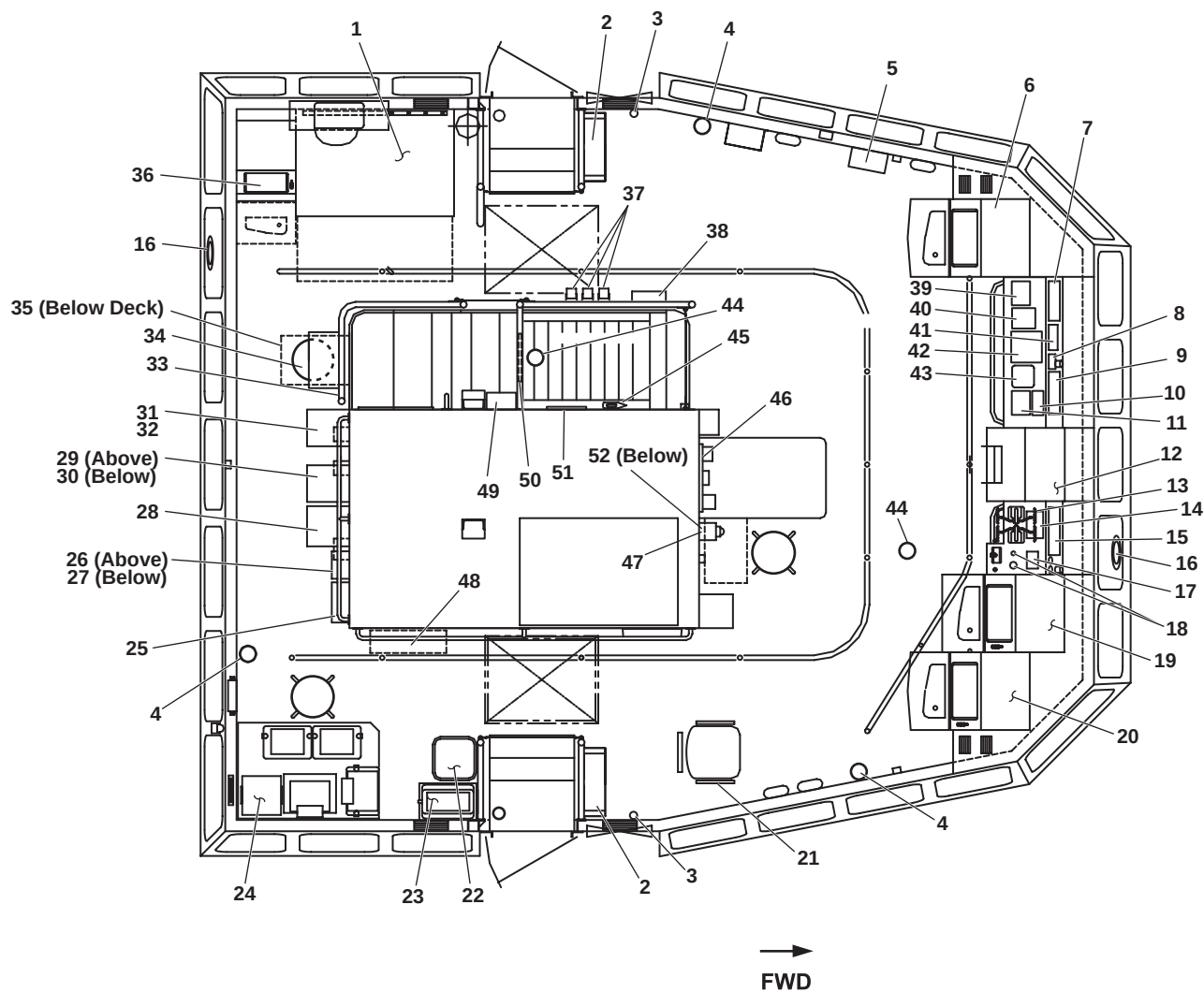


Figure 1. Pilothouse Interior (Plan View)

1. Chart table (figure 1, item 1). The chart table provides open working space for navigation charts.
2. Life preserver storage (figure 1, item 2). Storage is provided for four life preservers. Two are stowed on the port side and two on the starboard side.
3. Search And Rescue Transponder (SART) (figure 1, item 3). Two SARTs are provided, one for each life raft. The SART aids rescue personnel in locating the life rafts.
4. Fire extinguisher (figure 1, item 4). Three 10-pound dry chemical fire extinguishers are located in the pilothouse to permit extinguishing of small fires.

5. Door alarm switchboard (figure 1, item 5). The door alarm switchboard alerts pilothouse personnel to open door conditions for the radio room, arms locker, and main deck fan room. The door alarm switchboard also alerts the pilothouse personnel when the arms locker raw water drenching system has been activated.
6. X Band radar display (figure 1, item 6). The X band radar display is used for navigation.
7. Pilothouse port Heating, Ventilation, and Air Conditioning (HVAC)/fresh air panel (figure 1, item 7). The pilothouse HVAC/fresh air panel provides controls for the port side pilothouse rooftop air conditioning unit and for the pilothouse fresh air fans.
8. Engine Order Telegraph (EOT) power failure panel (figure 1, item 8). The EOT power failure panel notifies pilothouse personnel when an EOT power failure has occurred.
9. EOT transceiver (figure 1, item 9). The EOT transceiver transmits and receives engine order commands between the pilothouse and the EOS.
10. Deck/console lighting panel (figure 1, item 10). The deck/console lighting panel provides controls for deck and console lighting.
11. Starboard searchlight control station (figure 1, item 11). The starboard searchlight control station provides controls for the starboard searchlight.
12. Steering stand (figure 1, item 12). The steering stand provides helm controls for the vessel.
13. Port and starboard main engine throttles (figure 1, item 13). The port and starboard main engine throttles control the speed of the main engines and the direction of rotation of the propeller shafts.
14. Pilothouse starboard HVAC panel (figure 1, item 14). The pilothouse starboard HVAC panel provides controls for the starboard side pilothouse rooftop air conditioning unit.
15. Remote propulsion indicator panel (figure 1, item 15). The remote propulsion indicator panel provides instrumentation for the main engines and for the bow thruster.
16. Clearview screen (figure 1, item 16). Two clearview screens are provided to maximize pilothouse visibility in rain, snow, and sleet. One clearview screen is mounted forward, the other aft.
17. Bow thruster START/STOP controls (figure 1, item 17). The bow thruster START/STOP controls permit pilothouse personnel to START and STOP the bow thruster engine.
18. Bow thruster control (figure 1, item 18). The bow thruster control permits pilothouse personnel to control the speed and direction of the bow thruster.
19. Primary Electronic Chart Display and Information System (ECDIS) display (figure 1, item 19). The primary ECDIS display provides an interface between key navigation components permitting pilothouse personnel to perform trip planning and navigation tasks.
20. S Band radar display (figure 1, item 20). The S band radar display is used for navigation.
21. Navigator's chair (figure 1, item 21). The navigator's chair provides seating for the navigator.
22. Drinking fountain (figure 1, item 22). The drinking fountain provides chilled potable water for personal consumption by pilothouse personnel.
23. Coffee maker (figure 1, item 23). The coffee maker brews coffee and maintains the brewed coffee at an acceptable temperature.

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24. Global Maritime Distress and Safety System (GMDSS) suite (figure 1, item 24). The GMDSS suite provides emergency and distress communication between the Large Tug (LT), other vessels, and shore stations.
 25. 120V radar power distribution panel (figure 1, item 25). The 120V radar power distribution panel provides circuit breakers for the X band and S band radars.
 26. Uninterrupted Power Supply (UPS) bypass and disconnect switch box. (figure 1, item 26). The UPS bypass and disconnect switch box permits bypassing or disconnection of the UPSs for the Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR) gear.
 27. Radar distribution panel isolation transformer (figure 1, item 27). The radar distribution panel isolation transformer protects the radar gear from electrical anomalies.
 28. 24V general alarm battery charger (figure 1, item 28). The 24V general alarm battery charger maintains the charge for the general alarm battery bank.
 29. 24V GMDSS battery charger (figure 1, item 29). The 24V GMDSS battery charger maintains the charge for the GMDSS battery bank.
 30. GMDSS disconnect switch (figure 1, item 30). The GMDSS disconnect switch secures power to the 24V GMDSS battery charger.
 31. 12V marine radio battery charger (figure 1, item 31). The 12V marine radio battery charger maintains the charge for the 12V marine radio battery.
 32. 12V disconnect switch (figure 1, item 32). The 12V disconnect switch secures power to the 12V marine radio battery charger.
 33. Gyrocompass control unit (figure 1, item 33). The gyrocompass control unit provides controls for the gyrocompass.
 34. Gyrocompass (figure 1, item 34). The gyrocompass provides accurate directional data to pilothouse personnel and to key navigational gear.
 35. Integrated Bridge System (IBS) UPS units (figure 1, item 35). The IBS UPS units provided uninterrupted power to the IBS gear.
 36. Backup ECDIS display (figure 1, item 36). The backup ECDIS display provides a second ECDIS work station.
 37. Survival radios (figure 1, item 37). Three survival radios are provided to enable the life rafts to communicate with search and rescue personnel.
 38. First aid kit (figure 1, item 38). The first aid kit provides emergency medical supplies.
 39. Port searchlight control station (figure 1, item 39). The port searchlight control station provides controls for the port searchlight.
 40. Fire pump START/STOP panel (figure 1, item 40). The fire pump START/STOP panel permits pilothouse personnel to START and STOP the fire and general service pumps.
 41. Alarm panel (figure 1, item 41). The alarm panel notifies pilothouse personnel of flooding and of power interruption to key battery chargers.
 42. 21 MC intercom (figure 1, item 42). The 21 MC intercom provides internal communication between stations located throughout the vessel.
 43. Rudder angle indicator (figure 1, item 43). The rudder angle indicator displays the angle and direction of the rudders.

44. Ionization Smoke Detector (figure 1, item 44). Two ionization smoke detectors are mounted in the pilothouse overhead. The ionization smoke detectors activate the fire and smoke alarm system when smoke is detected.
45. Fire axe (figure 1, item 45). The fire axe is used in firefighting and damage control situations.
46. Vehicular Interface Control Station (VICS) (figure 1, item 46). The VICS station permits pilothouse personnel to utilize the tactical radios.
47. Sound powered telephone (figure 1, item 47). The sound powered telephone permits communication among between the pilothouse and the other sound powered telephone stations throughout the vessel.
48. Drawing cabinet (figure 1, item 48). The drawing cabinet provides storage for navigational charts.
49. Navigation light panel (figure 1, item 49). The navigation light panel provides controls and circuit protection for the vessel's navigation lights.
50. Clinometer (heel) (figure 1, item 50). This clinometer indicates the vessel's heel angle.
51. Clinometer (trim) (figure 1, item 51). This clinometer indicates the vessel's trim angle.
52. Damage Control (DC) status board (figure 1, item 52). This board permits pilothouse personnel to post and update the damage control status of the vessel.

PILOTHOUSE INTERIOR (LOOKING TO PORT)

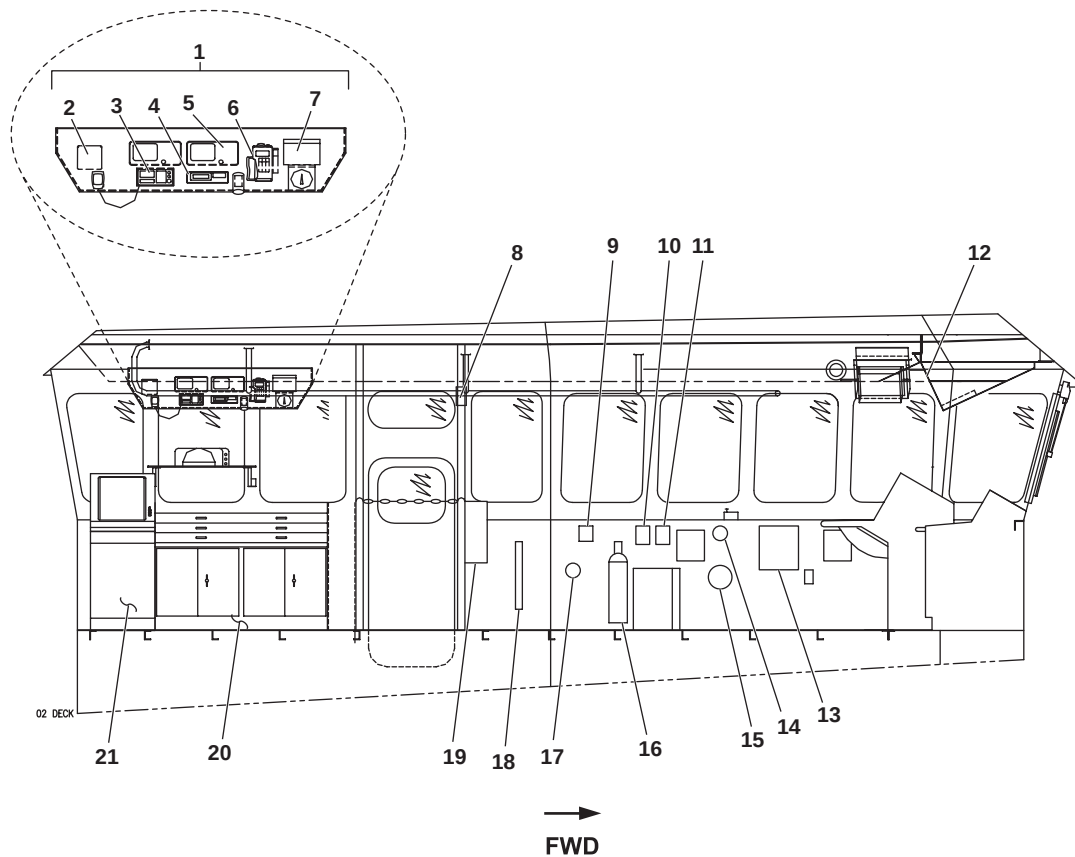
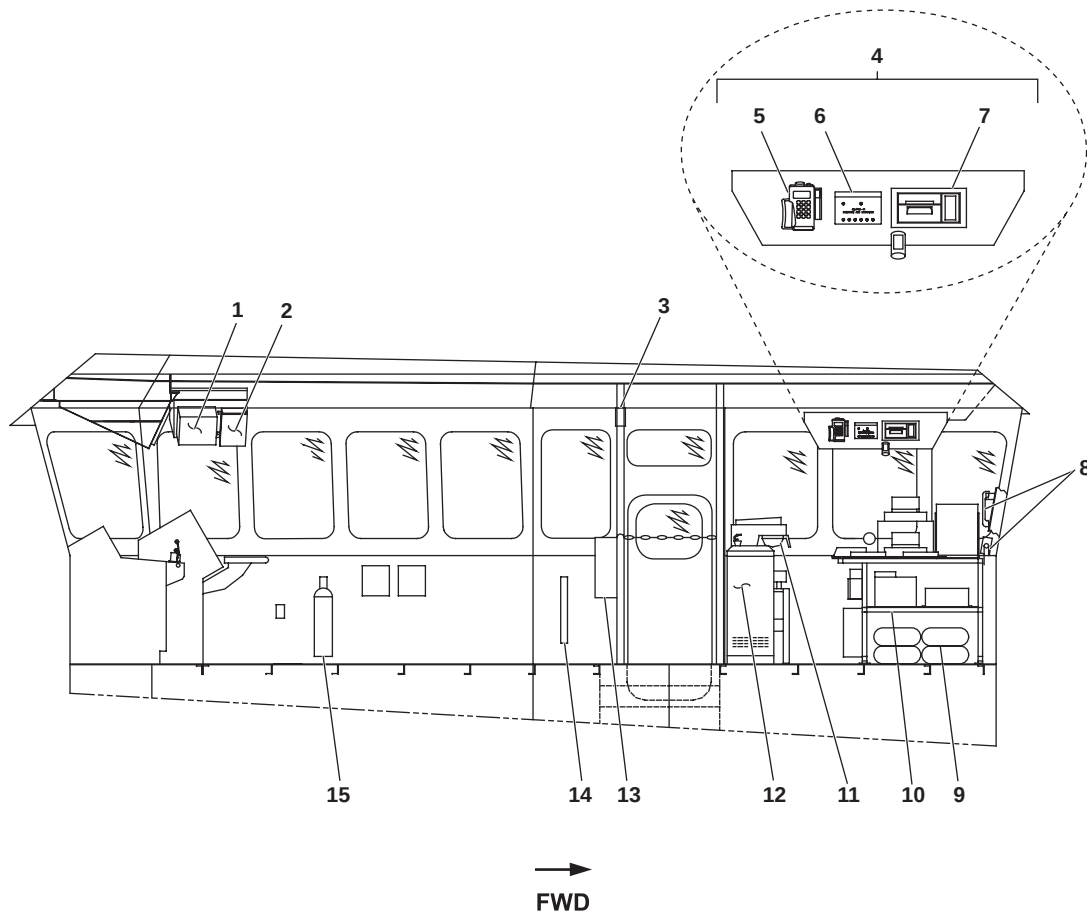


Figure 2. Pilothouse Interior (Looking to Port)

1. Aft chart table overhead console (figure 2, item 1). The aft chart table overhead console contains various pieces of navigation and communication gear including a marine Very High Frequency (VHF) radio, Precision Lightweight GPS (Global Positioning System) Receiver (PLGR), and wind speed/direction readouts.
2. Speaker (figure 2, item 2). This speaker broadcasts output from the marine VHF radio.
3. Marine VHF radio (figure 2, item 3). The marine VHF radio permits communication between the LT and other vessels and shore stations.
4. Wind tracker translator box (figure 2, item 4). The wind tracker translator box receives input from the masthead wind tracker unit and translates that input into a display on the AN/PSN-11 wind tracker.
5. Leica GPS units (figure 2, item 5). These commercial GPS units provide accurate positional information to pilothouse personnel and to various electronic navigational systems.
6. PLGR (figure 2, item 6). This GPS unit provides accurate positional information to pilothouse personnel and to various electronic navigational systems.
7. AN/PSN-11 wind tracker (figure 2, item 7). The AN/PSN-11 wind tracker displays wind speed and wind direction information.
8. Fire alarm pull station (figure 2, item 8). The fire alarm pull station permits pilothouse personnel to manually actuate the fire and smoke detection alarm.
9. Fire detection remote indicator panel (figure 2, item 9). The fire detection remote indicator panel alerts pilothouse personnel to fire and smoke alarm indications from the vessel's four zones.
10. Emergency STOP switch for recirculation fan R01-32-2 (figure 2, item 10). The emergency STOP switch for recirculation fan R01-32-2 permits pilothouse personnel to STOP this fan (located in the 01 level fan room) in an emergency.
11. Emergency STOP switch for exhaust fan E01-44-02 (figure 2, item 11). The emergency STOP switch for exhaust fan E01-44-02 permits pilothouse personnel to STOP this fan (located in the 01 level fan room) in an emergency.
12. IBS distribution panel (figure 2, item 12). The IBS distribution panel provides circuit breakers for the IBS system.
13. Door alarm switchboard (figure 2, item 13). The door alarm switchboard alerts pilothouse personnel to open door conditions for the radio room, arms locker, and main deck fan room. The door alarm switchboard also alerts the pilothouse personnel when the arms locker raw water drenching system has been activated.
14. General alarm contact maker (figure 2, item 14). The general alarm contact maker permits pilothouse personnel to actuate the general alarm system.
15. General alarm bell (figure 2, item 15). The general alarm bell sounds whenever the general alarm system is actuated.
16. Fire extinguisher (figure 2, item 16). Three 10-pound dry chemical fire extinguishers are located in the pilothouse to permit extinguishing of small fires.
17. Fire detector alarm bell (figure 2, item 17). The fire detector alarm bell sounds whenever the fire and smoke alarm system senses an alarm condition in one of its four zones.
18. Search And Rescue Transponder (SART) (figure 2, item 18). Two SARTs are provided, one for each life raft. The SART aids rescue personnel in locating the life rafts.
19. Life preserver storage (port) (figure 2, item 19). Storage is provided for two life preservers.
20. Chart table (figure 2, item 20). The chart table provides open working space for navigation charts.
21. Backup ECDIS display (figure 2, item 21). The backup ECDIS display provides a second ECDIS work station.

PILOTHOUSE INTERIOR (LOOKING TO STARBOARD)**Figure 3. Pilothouse Interior (Looking to Starboard)**

1. Towing strain gauge (figure 3, item 1). The towing strain gauge provides a display of the strain on the towing machines' wire ropes.
2. Fog horn timer (figure 3, item 2). The fog horn timer permits pilothouse personnel to select between programmed fog horn signals.
3. Fire alarm pull station (figure 3, item 3). The fire alarm pull station permits pilothouse personnel to manually actuate the fire and smoke detection alarm.
4. GMDSS suite (figure 3, item 4). The GMDSS suite provides emergency and distress communication between the Large Tug (LT), other vessels, and shore stations.
5. PLGR (figure 3, item 5). This GPS unit provides accurate positional information to pilothouse personnel and to various electronic navigational systems.
6. AN/PSN-11 switchbox (figure 3, item 6). The AN/PSN-11 switchbox permits interface between communication and navigation equipment.
7. Navigational Telex (NAVTEX) receiver (figure 3, item 7). The NAVTEX receiver receives and prints out navigational information.

8. High Frequency (HF)/Single Side Band (SSB) radio (figure 3, item 8). The HF/SSB radio provides long distance communication capability for the LT.
9. Survival suits (figure 3, item 9). Four survival suits are stowed beneath the GMDSS table. The survival suits maximize survivability in abandon ship situations.
10. GMDSS table (figure 3, item 10). The GMDSS table holds many components of the GMDSS suite and provides a work area for GMDSS operation.
11. Coffee maker (figure 3, item 11). The coffee maker brews coffee and maintains the brewed coffee at an acceptable temperature.
12. Drinking fountain (figure 3, item 12). The drinking fountain provides chilled potable water for personal consumption by pilothouse personnel.
13. Life preserver storage (starboard) (figure 3 item 13). Storage is provided for two life preservers.
14. Search And Rescue Transponder (SART) (figure 3, item 14). Two SARTs are provided, one for each life raft. The SART aids rescue personnel in locating the life rafts.
15. Fire extinguisher (figure 3, item 15). Three 10-pound dry chemical fire extinguishers are located in the pilothouse to permit extinguishing of small fires.

PILOTHOUSE INTERIOR (LOOKING FORWARD)

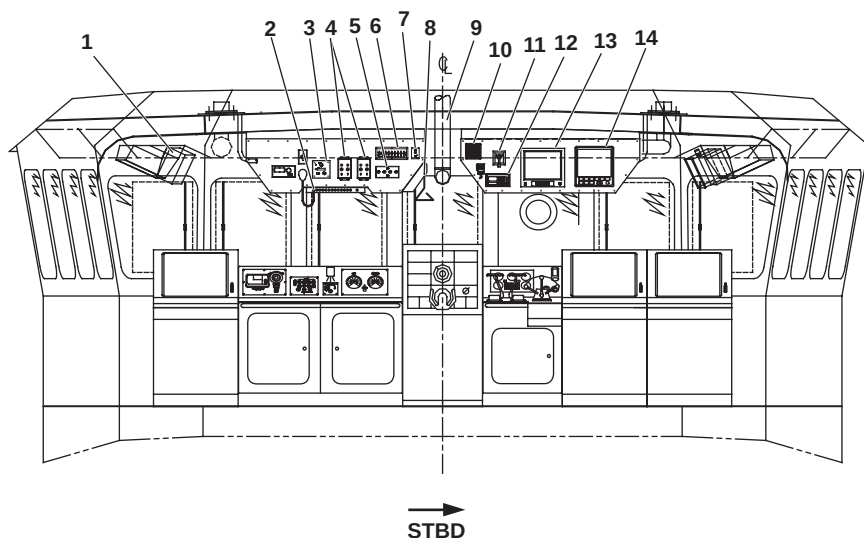


Figure 4. Pilothouse Interior (Looking Forward)

1. Digital Repeater Compass (figure 4, item 1). The digital repeater compass displays vessel heading from the gyrocompass.
2. Public Address (PA) panel (figure 4, item 2). The PA panel controls volume and destination for PA announcements.
3. Speed log (figure 4, item 3). The speed log displays vessel speed.
4. Clearview screen controls (figure 4, item 4). The clearview screen controls provide controls for the forward and aft clearview screens.

5. Windshield wiper control panel (figure 4, item 5). The windshield wiper control panel provides controls for the pilot-house windshield wipers and washers.
6. Window heater switch bank (figure 4, item 6). The window heater switch bank provides individual controls for the heated pilothouse windows.
7. Binnacle light panel (figure 4, item 7). The binnacle light panel provides controls for the binnacle light.
8. Horn pull (figure 4, item 8). The horn pull controls the operation of the ship's whistle (horn).
9. Mirror projection binnacle (figure 4, item 9). The mirror projection binnacle permits the helmsman to view the magnetic compass binnacle mounted on the pilothouse top.
10. Speaker (figure 4, item 10). The speaker broadcasts output from the marine VHF radio.
11. At will and automatic fog whistle controller (figure 4, item 11). The at will and automatic fog whistle controller provides controls for the automatic fog horn and permits selection between at will and automatic operating modes.
12. Marine VHF radio (figure 4, item 12). The marine VHF radio permits communication between the LT and other vessels and shore stations.
13. Nauto conning screen (figure 4, item 13). The nauto conning screen displays navigational information to the helmsman.
14. Depth finder (figure 4, item 14). The depth finder displays the water depth.

PILOTHOUSE INTERIOR (LOOKING FORWARD)

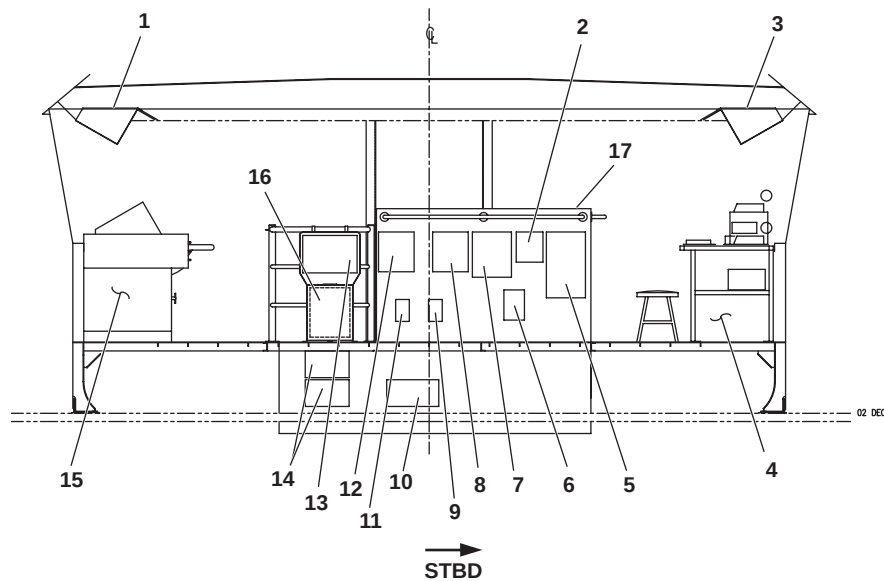


Figure 5. Pilothouse Interior (Looking Forward)

1. Aft chart table overhead console (figure 5, item 1). The aft chart table overhead console contains various pieces of navigation and communication gear including a marine Very High Frequency (VHF) radio, Precision Lightweight GPS (Global Positioning System) Receiver (PLGR), and wind speed/direction readouts. See figure 2 for details.
2. Uninterrupted Power Supply (UPS) bypass and disconnect switch box. (figure 5, item 2). The UPS bypass and disconnect switch box permits bypassing or disconnection of the UPSs for the C4ISR gear.

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3. GMDSS table overhead console (figure 5, item 3). The GMDSS table overhead console holds many of the GMDSS components. See figure 3 for details.
 4. GMDSS table (figure 5, item 4). The GMDSS table holds many components of the GMDSS suite and provides a work area for GMDSS operation.
 5. 120V radar power distribution panel (figure 5, item 5). The 120V radar power distribution panel provides circuit breakers for the X band and S band radars.
 6. Radar distribution panel isolation transformer (figure 5, item 6). The radar distribution panel isolation transformer protects the radar gear from electrical anomalies.
 7. 24V general alarm battery charger (figure 5, item 7). The 24V general alarm battery charger maintains the charge for the general alarm battery bank.
 8. 24V GMDSS battery charger (figure 5, item 8). The 24V GMDSS battery charger maintains the charge for the GMDSS battery bank.
 9. GMDSS disconnect switch (figure 5, item 9). The disconnect switch secures power to the 24V GMDSS battery charger.
 10. UPS unit (figure 5, item 10). This UPS unit provides uninterrupted power for radio room components.
 11. 12 V disconnect switch (figure 5, item 11). The disconnect switch secures power to the 12V marine radio battery charger.
 12. 12V marine radio battery charger (figure 5, item 12). The 12V marine radio battery charger maintains the charge for the 12V marine radio battery.
 13. Gyrocompass control unit (figure 5, item 13). The gyrocompass control unit provides controls for the gyrocompass.
 14. Integrated Bridge System (IBS) UPS units (figure 5, item 14). The IBS UPS units provided uninterrupted power to the IBS gear.
 15. Chart table (figure 5, item 15). The chart table provides open working space for navigation charts.
 16. Gyrocompass (figure 5, item 16). The gyrocompass provides accurate directional data to pilothouse personnel and to key navigational gear.
 17. Radio room (figure 5, item 17). The radio room houses the vessel's secure and tactical communication systems. See figures 7-10 for details.

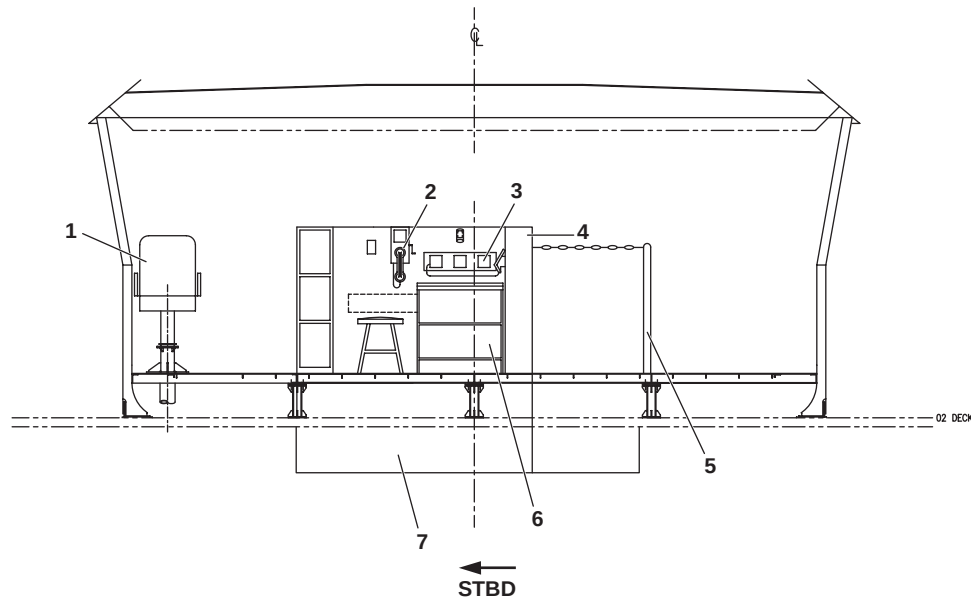
PILOTHOUSE INTERIOR (LOOKING AFT)

Figure 6. Pilothouse Interior (Looking Aft)

1. Navigator's chair (figure 6, item 1). The navigator's chair provides seating for the navigator.
2. Vehicular Interface Control Station (VICS) (figure 6, item 2). The VICS station permits pilothouse personnel to utilize the tactical radios.
3. Sound powered telephone (figure 6, item 3). The sound powered telephone permits communication among between the pilothouse and the other sound powered telephone stations throughout the vessel.
4. Vent trunk (figure 6, item 4). The vent trunk provides ventilation for the radio room.
5. Guard rail (figure 6, item 5). The guard rail prevents personnel from falling into the ladderwell.
6. Log table book case (figure 6, item 6). The log table book case provides storage for books at the log table.
7. Radio room (figure 6, item 7). The radio room houses the vessel's secure and tactical communication systems. See figures 7-10 for details.

1. 120V elcx distribution panel (figure 7, item 1). The 120V elcx distribution panel contains circuit breakers for many of the IBS and C4ISR power supplies.
2. Sound powered telephone headset (figure 7, item 2). The sound powered telephone headset permits the radio operator to communicate via sound powered telephone.
3. Sound powered telephone jack (figure 7, item 3). The sound powered telephone jack provides a connection point for the sound powered telephone headset.
4. General alarm and emergency lighting distribution panel (figure 7, item 4). The general alarm and emergency lighting distribution panel contains circuit breakers for many of the pilothouse 24 Vdc components.
5. Fire extinguisher (figure 7, item 5). A 10-pound dry chemical fire extinguisher is located in the radio room to permit extinguishing of small fires.

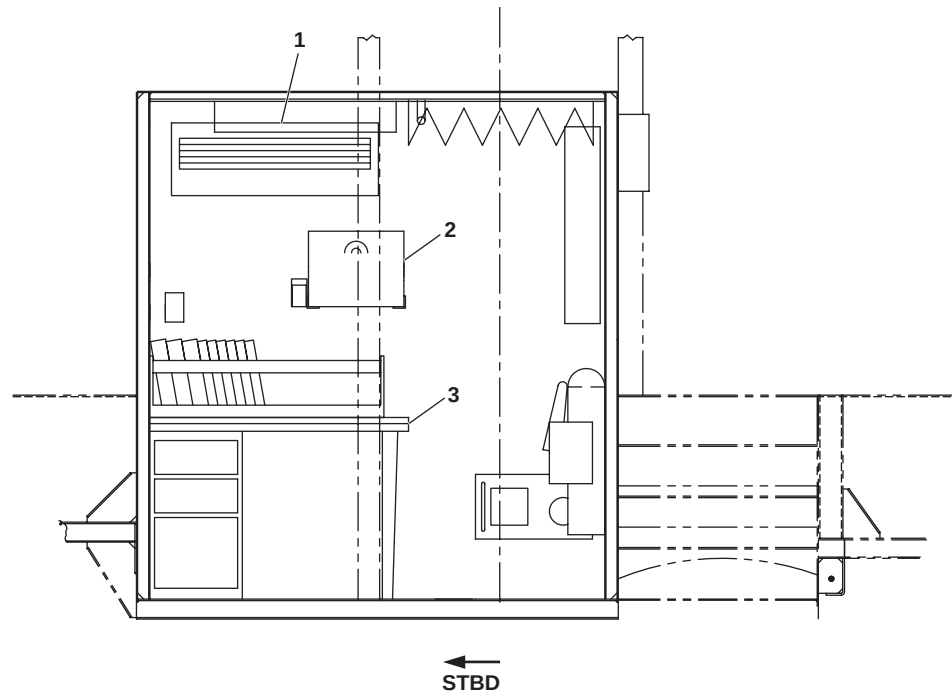
RADIO ROOM INTERIOR (AFT BULKHEAD)

Figure 8. Radio Room Interior (Aft Bulkhead)

1. Air conditioning fan unit (figure 8, item 1). The air conditioning fan unit provides air conditioning for the radio room.
2. Safe (figure 8, item 2). The safe provides secure document storage.
3. Desk (figure 8, item 3). The desk provides a work area in the radio room.

RADIO ROOM FORWARD BULKHEAD (RADIO RACKS)

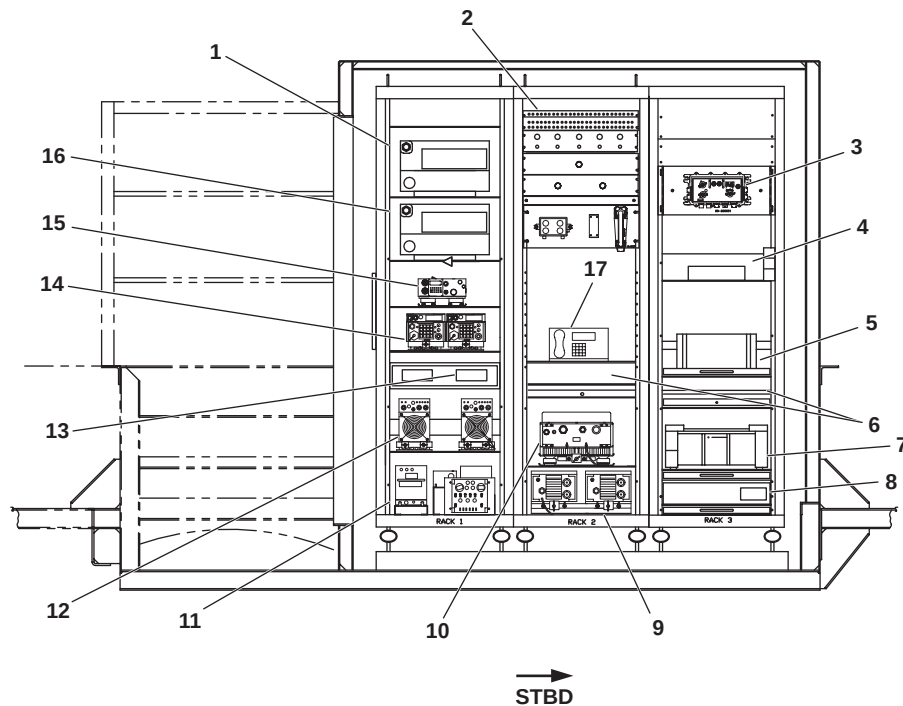


Figure 9. Radio Room Forward Bulkhead (Radio Racks)

1. AN/VRC 103A (figure 9, item 1). The AN/VRC 103A is the tactical radio providing voice and data capability in the 30 to 518 MHz range.
2. DC distribution panel (figure 9, item 2). The dc distribution panel contains circuit breakers for the 24 Vdc communication components located in the radio room.
3. CD-82/VRC (figure 9, item 3). The CD-82-VRC is the interface between the tactical radios and the VICS.
4. Fleet 77 (figure 9, item 4). The Fleet 77 provides satellite communication capability for the vessel.
5. Printer/fax (figure 9, item 5). The printer/fax prints output from the computer and can fax items for transmission.
6. Laptop computers (figure 9, item 6). The laptop computers are used to generate display messages in the C4ISR system.
7. TS-21 (figure 9, item 7). The TS-21 is a tactical secure fax machine.
8. UPS (figure 9, item 8). The UPS provides an uninterrupted power supply for the radio room gear.
9. Power supplies (figure 9, item 9). The power supplies provide power for the AN/VRC 103 radios.
10. Power amp (figure 9, item 10). The power amp is a component of the tactical radios.
11. Identify Friend or Foe (IFF) transceiver (figure 9, item 11). The IFF transceiver permits receipt and transmission of identifying signals.
12. AM 717 (figure 9, item 12). The AM 717s are the power amp and pre-amp for the Line of Sight Tactical (LST) 5D radios.

13. VDC-300 (figure 9, item 12). The VDC-300 is a secure data controller.
14. LST 5D (figure 9, item 14). The LST 5D is a line of sight tactical radio system.
15. AN/PRC 150 (figure 9, item 15). The AN/PRC 150 is a is an HF/VHF tactical radio system.
16. AN/VRC 103B (figure 9, item 16). The AN/VRC 103B is the tactical radio providing voice and data capability in the 30 to 518 MHz range.
17. Secure Telephone Unit (STU) (figure 9, item 17). The STU provides a means of secure landline telephone communication.

RADIO ROOM PLAN VIEW

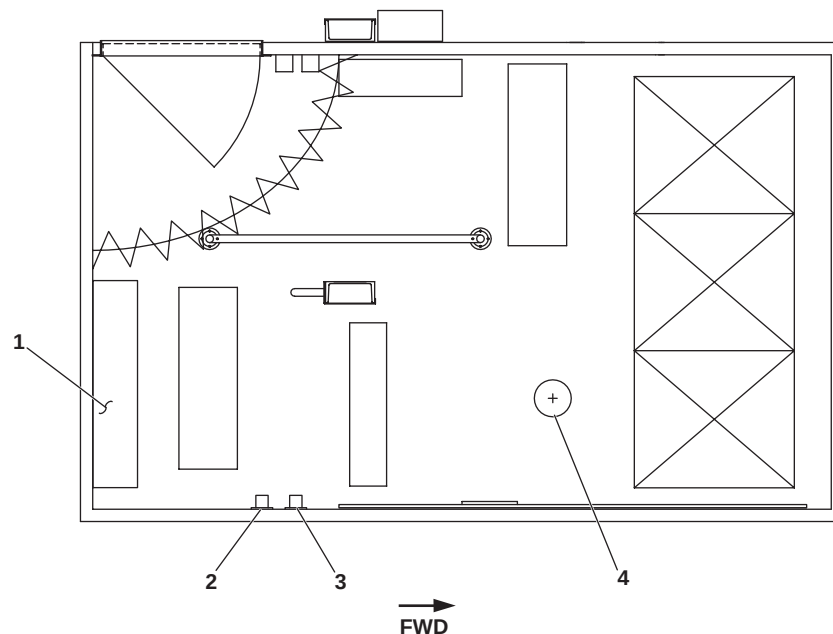


Figure 10. Radio Room Plan View

1. Air conditioning fan unit (figure 10, item 1). The air conditioning fan unit provides air conditioning for the radio room.
2. Fire alarm strobe light (figure 10, item 2). The fire alarm strobe light flashes red when the fire and smoke alarm is activated.
3. General alarm strobe light (figure 10, item 3). The general alarm strobe light flashes amber when the general alarm is activated.
4. Ionization smoke detector (figure 10, item 4). The ionization smoke detector activates the fire alarm system when smoke is detected.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
01 LEVEL INTERIOR**

01 LEVEL INTERIOR

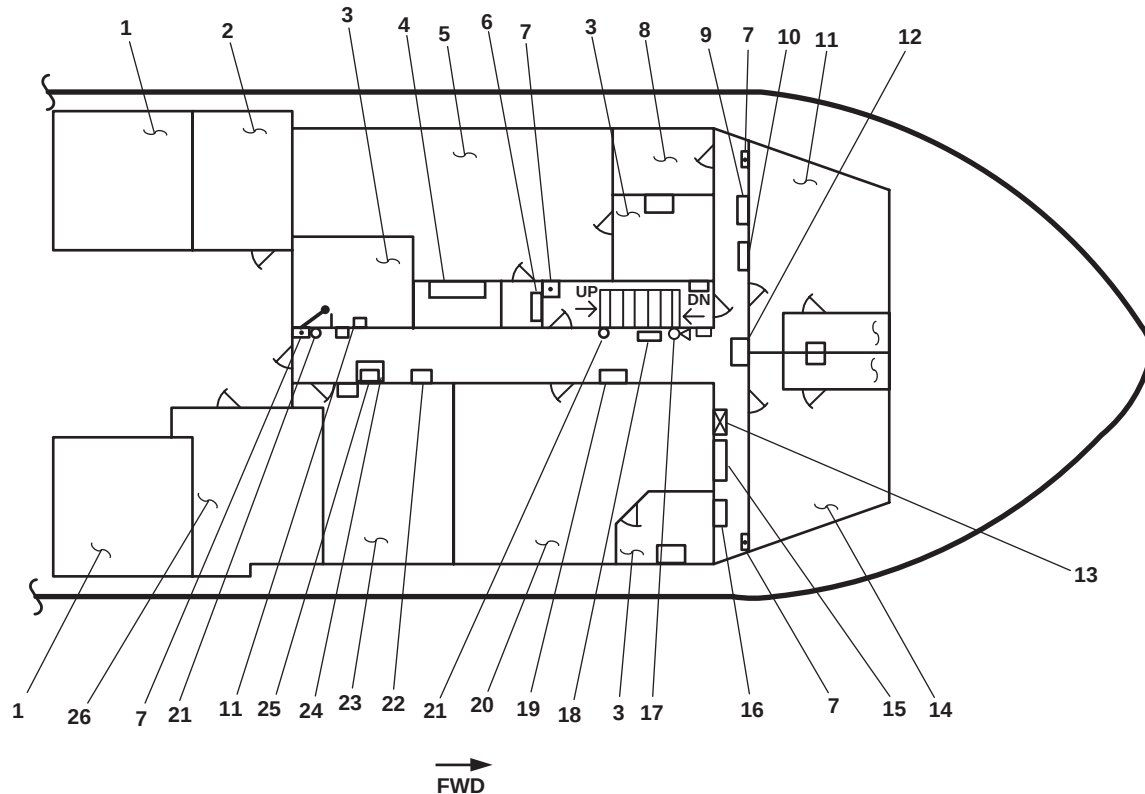


Figure 1. 01 Level Interior

1. Stack (figure 1, item 1). The stack contains the engine exhaust and crankcase vents.
2. Aft fan room (figure 1, item 2). The aft fan room contains Heating, Ventilation, and Air Conditioning (HVAC) and electrical equipment. See figure 2 for details.
3. Sanitary Space (figure 1, item 3). This space contains sanitary facilities, including a water closet, a sink, and a shower.
4. Medical locker (figure 1, item 4). The medical locker provides storage space for medical supplies.
5. Officer's stateroom 2 (figure 1, item 5). The officer's stateroom 2 provides accommodations for four officers. See figure 3 for details.
6. 120V pilothouse emergency distribution panel (figure 1, item 6). This panel provides 120 volts to various navigation system components, the windscreen elements, the intercom system, and the port and starboard search light power supplies.
7. Fire alarm pull station (figure 1, item 7). This fire alarm pull station immediately alerts the crew to the presence of fire when the lever is pulled.
8. Forward fan room (figure 1, item 8). The forward fan room contains HVAC and electrical equipment. See figure 4 for details.

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9. 01 & 02 level reheater 120V fuse box No. 1 (figure 1, item 9). This fuse box provides fused protection for 01 and 02 level reheaters.
 10. Convector heater 120V fuse box No. 2 (figure 1, item 10). This fuse box provides fused protection for 01 and 02 level convection heaters.
 11. Chief Engineer's stateroom (figure 1, item 11). This is the berthing space for the chief engineer. See figure 5 for details.
 12. Drinking fountain (figure 1, item 12). The drinking fountain supplies chilled potable water for personal consumption.
 13. Fire station 8 (figure 1, item 13). Fire station 8 is equipped with 50 feet (15.2 m) of 1-1/2 inch fire hose and an all-purpose nozzle.
 14. Captain's stateroom (figure 1, item 14). This is the berthing space for the vessel master. See figure 6 for details.
 15. 120V distribution panel No. 2 (figure 1, item 15). This distribution panel contains circuit breakers for many of the non-critical electrical circuits on the 01 level.
 16. 220V air conditioning distribution panel (figure 1, item 16). This distribution panel contains circuit breakers for the pilothouse and radio room rooftop air conditioning units.
 17. General alarm bell (figure 1, item 17). The general alarm bell signals various emergency conditions on the vessel.
 18. Fire axe (figure 1, item 18). The fire axe is used to aid the crew in gaining immediate access to a locked or enclosed area in the case of fire.
 19. Key cabinet (figure 1, item 19). The key cabinet provides secure storage for up to 75 keys.
 20. Officer's stateroom 1 (figure 1, item 20). The officer's stateroom 1 provides accommodations for four officers. See figure 7 for details.
 21. Fire extinguisher (figure 1, item 21). The portable dry chemical fire extinguisher is used to extinguish fires on the 01 level.
 22. 120V exterior emergency lighting panel No. 2 (figure 1, item 22). This panel contains circuit breakers for many of the emergency circuits on the 01 and 02 levels.
 23. NCO stateroom (figure 1, item 23). This space provides berthing for two NCOs. See figure 8 for details.
 24. General alarm system distribution panel (figure 1, item 24). This panel provides a junction box to interconnect general alarm system cables.
 25. General alarm contact maker (figure 1, item 25). The general alarm contact maker controls sounding of the general alarm bells.
 26. Emergency Diesel Generator (EDG) room (figure 1, item 26). This space contains the emergency generator and support equipment. See figure 9 for details.

FAN ROOM 01 LEVEL (AFT)

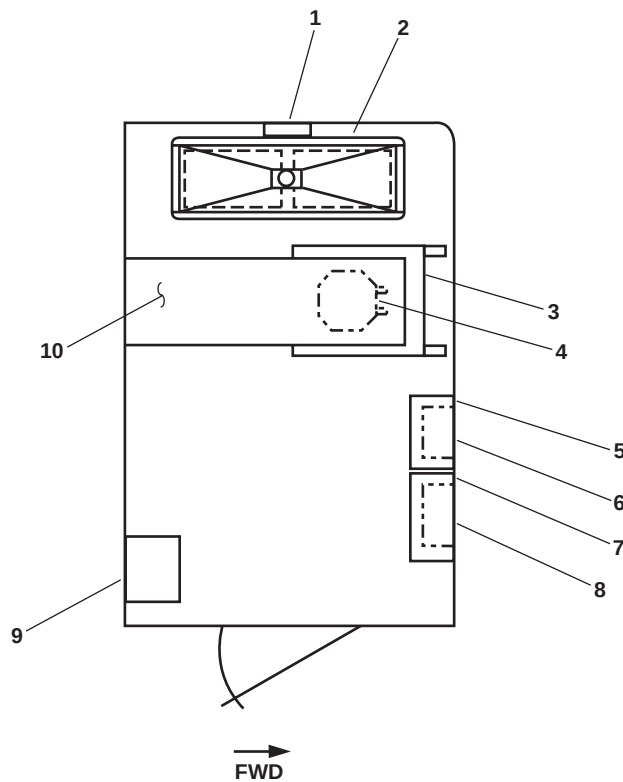
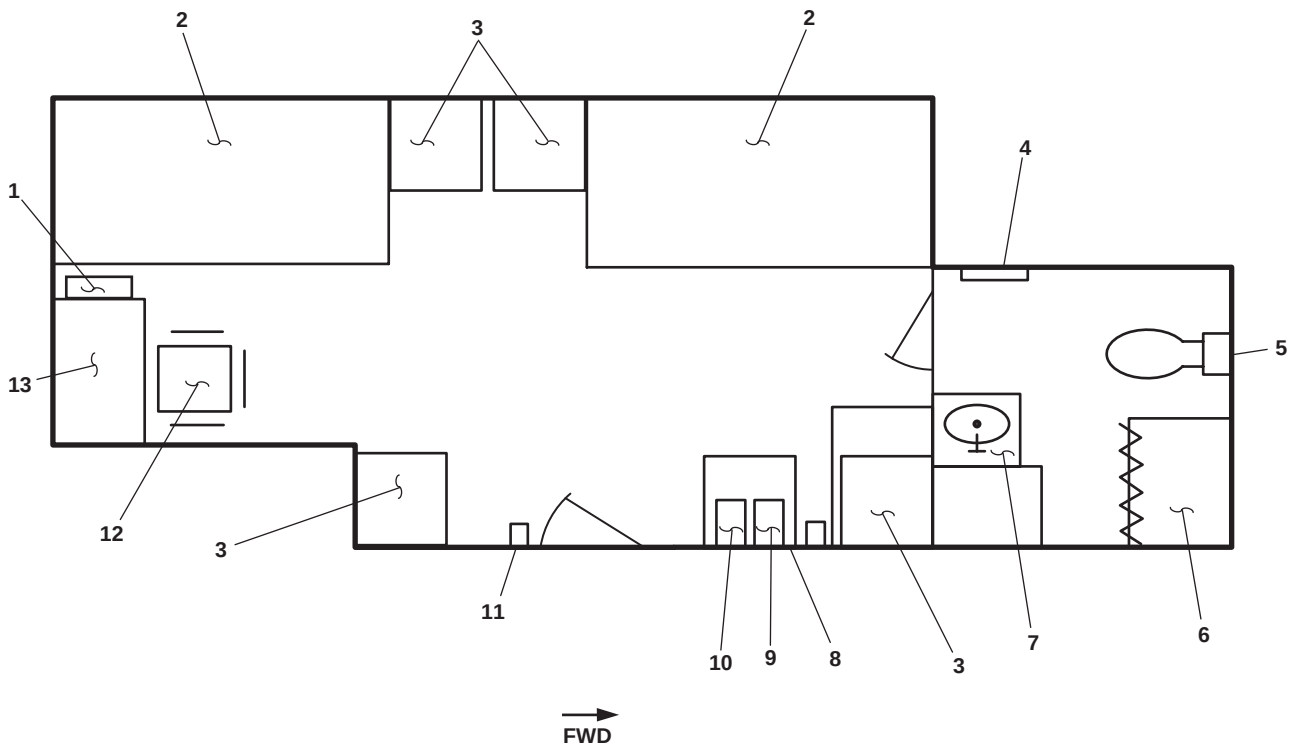
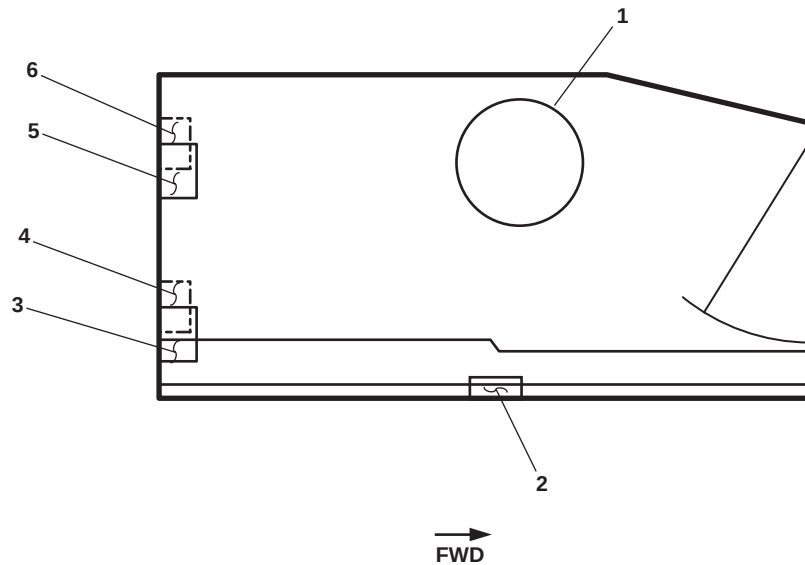


Figure 2. Fan Room 01 Level (Aft)

1. Ventilation fan (figure 2, item 1). This fan removes heat and gases from the battery bank.
2. Battery bank (figure 2, item 2). The battery bank contains two 12 V batteries connected in series to provide emergency 24 Vdc power to various communication and navigation systems.
3. Power supply (figure 2, item 3). The power supply provides power to various 24 Vdc communication and navigation systems, and charges the battery bank.
4. Transformer (figure 2, item 4). The 440V/120V transformer provides 120V power for various communication and navigation systems.
5. 60 amp disconnect switch (figure 2, item 5). This switch disconnects the power supply (figure 2, item 3).
6. HVAC SYSTEM CONTROLLER FOR RHTR 01-32-2 (figure 2, item 6). The controller turns the reheater ON and OFF.
7. 200-amp disconnect switch (figure 2, item 7). This switch disconnects the battery bank.
8. HVAC SYSTEM CONTROLLER FOR PRHTR 01-31-2 (figure 2, item 8). This controller turns the preheater ON and OFF.
9. Preheater (figure 2, item 9). The preheater warms the outside air being drawn into the fan coil unit.
10. Fan coil assemblies for the main deck and the 01 and 02 levels (figure 2, item 10). The fan coil assembly heats and cools the interior spaces on the 01 level. It also provides a portion of the pilothouse heating and cooling.

OFFICER'S STATEROOM 2**Figure 3. Officer's Stateroom 2**

1. Life jacket stowage (figure 3, item 1). The life jacket stowage provides storage for four life jackets.
2. Bunks (figure 3, item 2). The bunks provide sleeping arrangements for two officers.
3. Lockers (figure 3, item 3). The lockers provide personal storage space for each officer.
4. Convection heater (figure 3, item 4). The convection heater supplies supplemental heat to the sanitary space.
5. Water closet (figure 3, item 5). This is the commode for the sanitary space.
6. Shower (figure 3, item 6). The shower is provided for the personnel of officer's stateroom 2.
7. Sink (figure 3, item 7). The sink provides hot and cold potable water for personal hygiene.
8. Refrigerator (figure 3, item 8). A refrigerator is provided for storing perishable goods.
9. Intercom (figure 3, item 9). The intercom provides communication throughout the vessel.
10. Sound powered telephone (figure 3, item 10). The sound powered telephone provides communication with other stations throughout the vessel.
11. Thermostat (figure 3, item 11). The thermostat provides temperature control in the stateroom.
12. Chair (figure 3, item 12). The chair provides a place to sit.
13. Chest/desk combo (figure 3, item 13). The chest/desk combo provides storage space and a desk top for reading or writing.

FORWARD FAN ROOM**Figure 4. Forward Fan Room**

1. AMS 1 supply fan (figure 4, item 1). This fan supplies fresh air to AMS 1.
2. Sanitary spaces exhaust fan (figure 4, item 2). This fan removes foul air from the sanitary spaces.
3. Starboard searchlight power supply (figure 4, item 3) (above). This power supply provides power to the starboard searchlight.
4. Port searchlight power supply (figure 4, item 4) (below). This power supply provides power to the port searchlight.
5. Sanitary spaces exhaust fan (E01-44-2) motor controller (figure 4, item 5) (above). This controller turns the sanitary space exhaust fan ON and OFF.
6. Ship's whistle power supply (figure 4, item 6) (below). This power supply provides power to the ship's whistle (automatic fog horn).

CHIEF ENGINEER'S STATEROOM

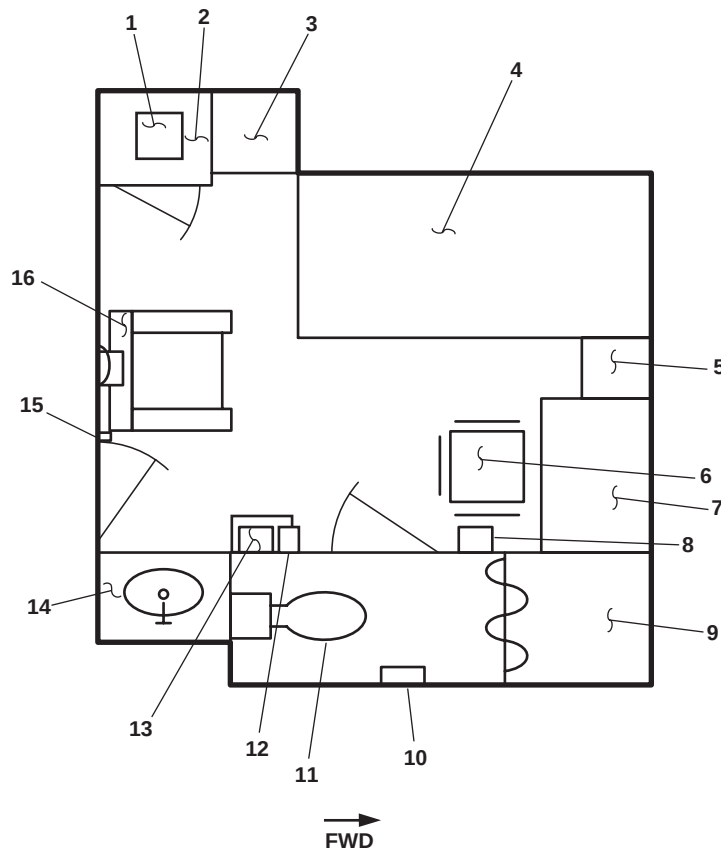


Figure 5. Chief Engineer's Stateroom

1. Refrigerator (figure 5, item 1). The refrigerator provides cold storage for perishable items.
2. File cabinet (figure 5, item 2). The file cabinet with a combination lock provides secure storage for personal items.
3. Safe (figure 5, item 3). The safe provides a secure storage space.
4. Bunk (figure 5, item 4). The bunk provides sleeping arrangements for the chief engineer.
5. Night table (figure 5, item 5). The night table provides storage for miscellaneous items.
6. Chair (figure 5, item 6). The chair provides a place to sit.
7. Chest/desk combo (figure 5, item 7). The chest/desk combo provides storage space and a desktop for reading or writing.
8. Key cabinet (figure 5, item 8). The key cabinet stores keys to gain access to various areas of the vessel.
9. Shower (figure 5, item 9). The shower is provided for the chief engineer.
10. Convection heater (figure 5, item 10). The convection heater supplies supplemental heat to the sanitary space.
11. Water closet (figure 5, item 11). This is the commode for the sanitary space.
12. Intercom and sound powered telephone (figure 5, item 12). The intercom and sound powered telephone provide communication throughout the vessel.

13. Life jacket stowage (figure 5, item 13). The life jacket stowage provides storage for one life jacket.
14. Sink (figure 5, item 14). The sink provides hot and cold potable water for personal hygiene.
15. Thermostat (figure 5, item 15). The thermostat provides temperature control in the stateroom.
16. Reclining lounge chair (figure 5, item 16). This chair is provided for added comfort.

CAPTAIN'S STATEROOM

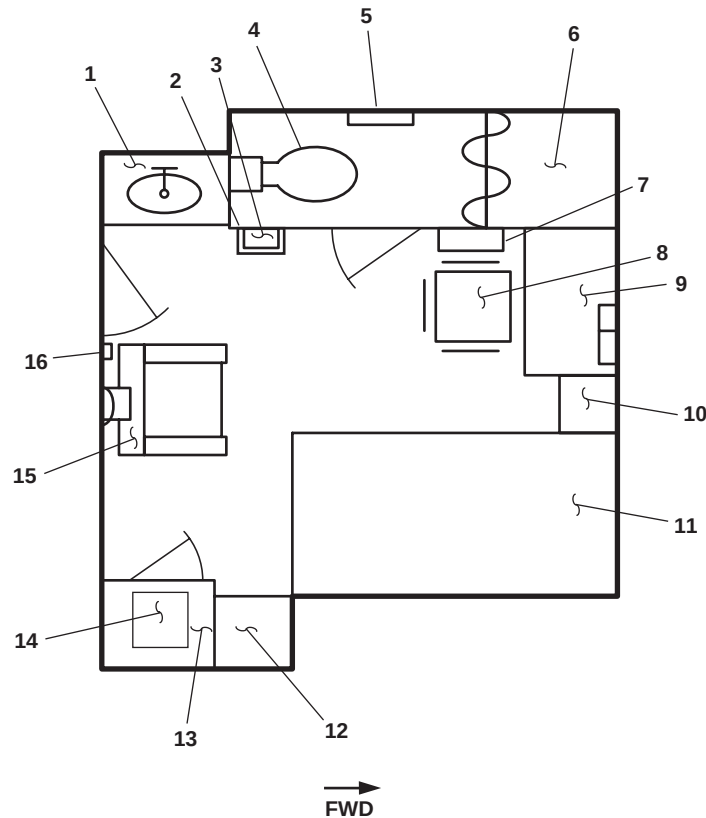


Figure 6. Captain's Stateroom

1. Sink (figure 6, item 1). The sink provides hot and cold potable water for personal hygiene.
2. Intercom and sound powered telephone (figure 6, item 2). The intercom and sound powered telephone provide intraship communication.
3. Life jacket stowage (figure 6, item 3). The life jacket stowage provides storage for one life jacket.
4. Water closet (figure 6, item 4). This is the commode for the sanitary space.
5. Convection heater (figure 6, item 5). The convection heater supplies supplemental heat to the sanitary space.
6. Shower (figure 6, item 6). The shower is provided for the vessel master.
7. Key cabinet (figure 6, item 7). The key cabinet stores keys to gain access to various areas of the vessel.

8. Chair (figure 6, item 8). The chair provides a place to sit.
9. Chest/desk combo (figure 6, item 9). The chest/desk combo provides storage space and a desktop for reading or writing.
10. Night table (figure 6, item 10). The night table provides storage for miscellaneous items.
11. Bunk (figure 6, item 11). The bunk provides sleeping arrangements for the vessel master.
12. Locker (figure 6, item 12). The lockers provide storage space for the vessel master.
13. File cabinet (figure 6, item 13). The file cabinet with a combination lock provides storage for personal items.
14. Refrigerator (figure 6, item 14). The refrigerator provides cold storage for perishable items.
15. Reclining lounge chair (figure 6, item 15). This chair is provided for added comfort.
16. Thermostat (figure 6, item 16). The thermostat provides temperature control in the stateroom.

OFFICER'S STATEROOM 1

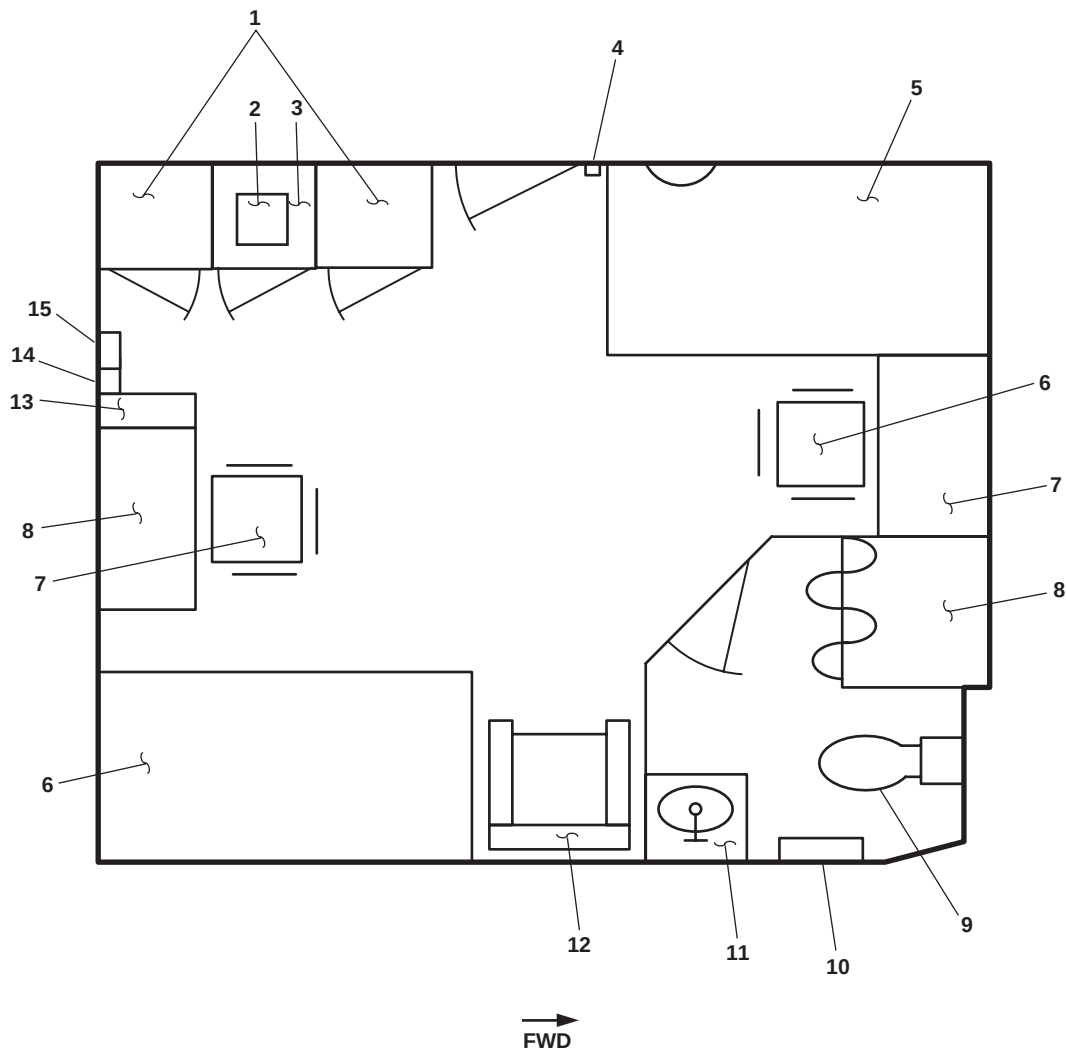
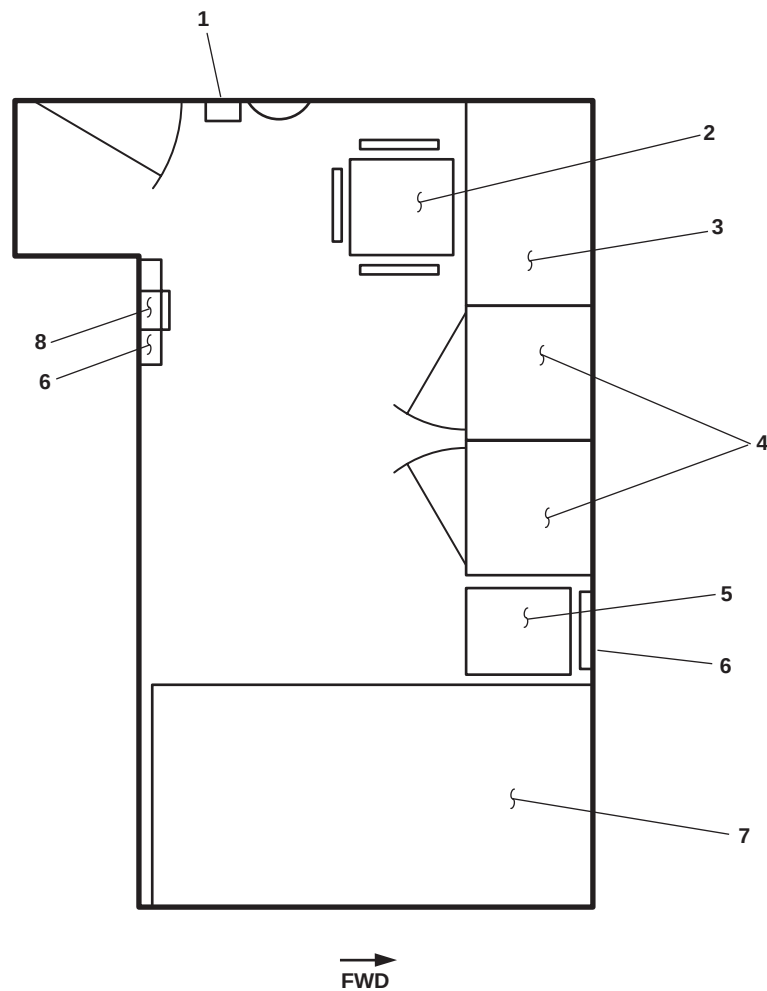


Figure 7. Officer's Stateroom 1

1. Lockers (figure 7, item 1). The lockers provide storage space for personal items.
2. Refrigerator (figure 7, item 2). The refrigerator provides cold storage space for perishable items.
3. File cabinet (figure 7, item 3). The file cabinet with combination lock provides secure storage for personal items.
4. Thermostat (figure 7, item 4). The thermostat provides temperature control in the stateroom.
5. Bunk (figure 7, item 5). The bunk provides sleeping arrangements for two officers.
6. Chair (figure 7, item 6). The chair provides a place to sit.
7. Chest/desk combo (figure 7, item 7). The chest/desk combo provides storage space and a desktop for reading or writing.
8. Shower (figure 7, item 8). The shower is provided for the personnel in officer's stateroom 1.

9. Water closet (figure 7, item 9). This is the commode for the sanitary space.
10. Convection heater (figure 7, item 10). The convection heater supplies supplemental heat to the sanitary space.
11. Sink (figure 7, item 11). The sink provides hot and cold potable water for personal hygiene.
12. Reclining lounge chair (figure 7, item 12). This chair is provided for added comfort.
13. Life jacket stowage (figure 7, item 13). The life jacket stowage provides storage for four life jackets.
14. Intercom (figure 7, item 14). The intercom provides communication throughout the vessel.
15. Sound powered phone (figure 7, item 15). The sound powered phone provide intraship communication.

NCO'S STATEROOM

**Figure 8. NCO's Stateroom**

1. Thermostat (figure 8, item 1). The thermostat provides temperature control in the stateroom.
2. Chair (figure 8, item 2). The chair provides a place to sit.
3. Chest/desk combo (figure 8, item 3). The chest/desk combo provides storage space and a desktop for reading or writing.
4. Lockers (figure 8, item 4). The lockers provide storage space for personal items.
5. Refrigerator (figure 8, item 5). The refrigerator provides cold storage for perishable items.
6. Life jacket stowage (figure 8, item 6). Each life jacket stowage provides storage for one life jacket.
7. Bunks (figure 8, item 7). The bunks provide sleeping arrangements for NCOs.
8. Intercom (figure 8, item 8). The intercom provides intraship communication.

EMERGENCY DIESEL GENERATOR ROOM

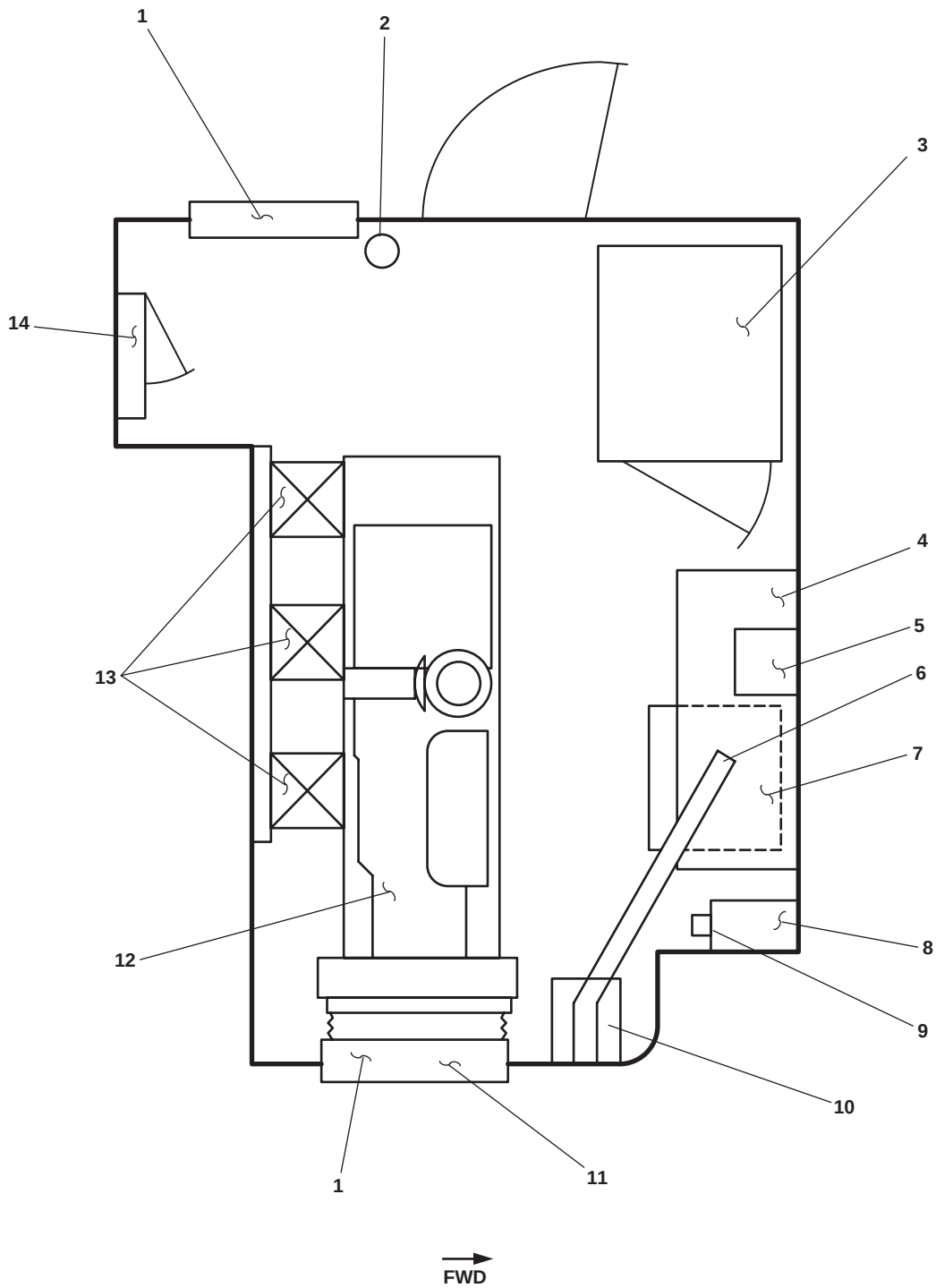


Figure 9. Emergency Diesel Generator Room

1. Fire flap (figure 9, item 1). The fire flap can be manually closed in an emergency to deny oxygen to the space.
2. Fire extinguisher (figure 9, item 2). The portable fire extinguisher is used to put out small fires on the vessel.
3. Emergency switchboard (figure 9, item 3). The emergency switchboard controls various emergency electrical circuits throughout the vessel.
4. Fuel oil day tank (overhead) (figure 9, item 4). The fuel oil day tank stores fuel oil for the emergency diesel generator engine.
5. Intercom (above), sound powered telephone (middle), and telephone storage box (below) (figure 9, item 5). The intercom, sound powered telephone, and telephone storage box provides communication to the rest of the vessel.
6. Battery box vent to atmosphere (figure 9, item 6). The battery box vent vents explosive gases from the battery box to the atmosphere.
7. Battery box (figure 9, item 7). The battery box contains starting batteries for the Emergency Diesel Generator (EDG).
8. Vent trunk (figure 9, item 8). The vent trunk provides a junction where vents from other spaces interconnect.
9. EDG starting battery switch (figure 9, item 9). This switch selects which battery bank starts the EDG.
10. Battery charger (figure 9, item 10). The battery charger maintains the battery charge when the engine is at rest.
11. Air intake supply vent (figure 9, item 11). This vent provides intake air to the diesel engine.
12. Emergency diesel generator set (figure 9, item 12). The emergency diesel generator set provides electrical power to the vessel's emergency circuits in the event of the ship's service diesel generator failure.
13. Transformers (overhead) (figure 9, item 13). The transformers step down 440 Vac to 120 Vac.
14. 120V emergency load center distribution panel (figure 9, item 14). This panel controls the distribution of electrical power to the vessel's 120V emergency lighting and distribution panels as well as to the general alarm battery charger and the EDG jacket water heater.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
MAIN DECK INTERIOR, BERTHING AREAS**

MAIN DECK INTERIOR, BERTHING AREAS

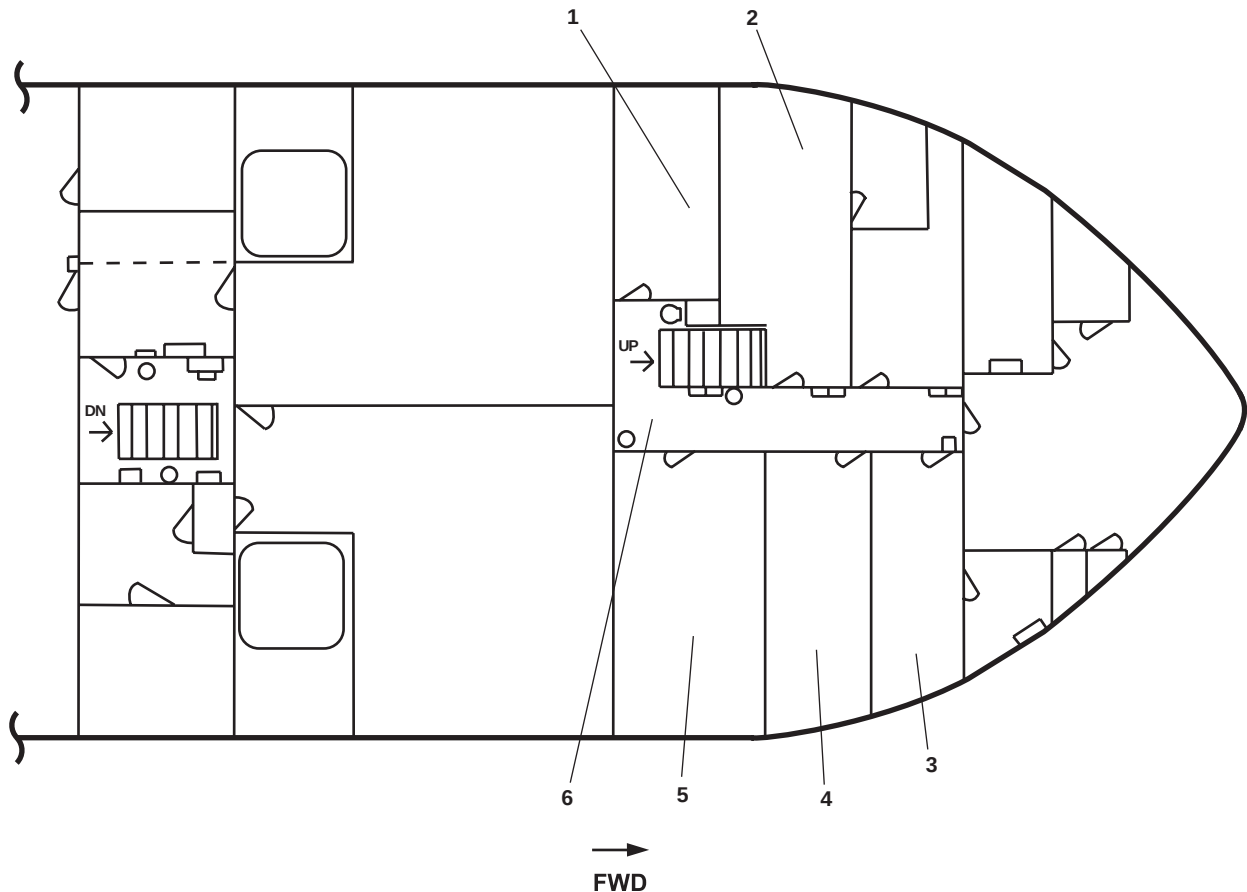


Figure 1. Main Deck Interior, Berthing Areas

1. Sanitary space (figure 1, item 1). The sanitary space includes two showers, two water closets, a convection heater, and two sinks. Details of this space are contained in figure 2.
2. Crew's stateroom 3 (figure 1, item 2). The crew's stateroom 3 contains living accommodations for four crewmembers. Details of this space are contained in figure 3.
3. Crew's stateroom 1 (figure 1, item 3). The crew's stateroom 1 contains living accommodations for two crewmembers. Details of this space are contained in figure 4.
4. Crew's stateroom 2 (figure 1, item 4). The crew's stateroom 2 contains living accommodations for four crewmembers. Details of this space are contained in figure 5.
5. Crew's stateroom 4 (figure 1, item 5). The crew's stateroom 4 contains living accommodations for four crewmembers. Details of this space are contained in figure 6.
6. Passageway (figure 1, item 6). The passageway provides crewmembers an access route to different areas of the vessel. Details of this space are contained in figure 7.

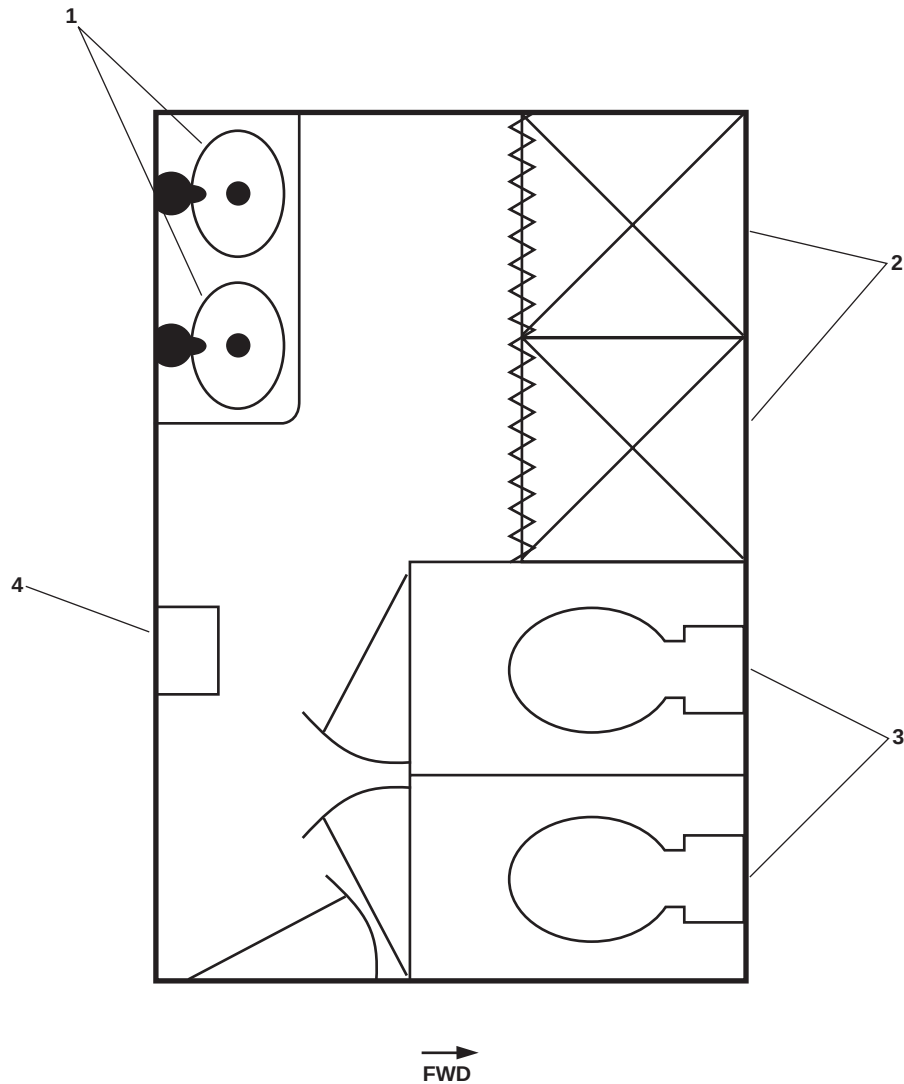
SANITARY SPACE

Figure 2. Sanitary Space

1. Sinks (figure 2, item 1). The sinks provide hot and cold potable water for washing and personal sanitation.
2. Showers (figure 2, item 2). The showers provide hot and cold potable water for washing and personal sanitation.
3. Water closets (figure 2, item 3). The water closets are used as toilets by the crew.
4. Convection heater (figure 2, item 4). The convection heater is used to provide supplemental heat to the sanitary space.

CREW'S STATEROOM 3

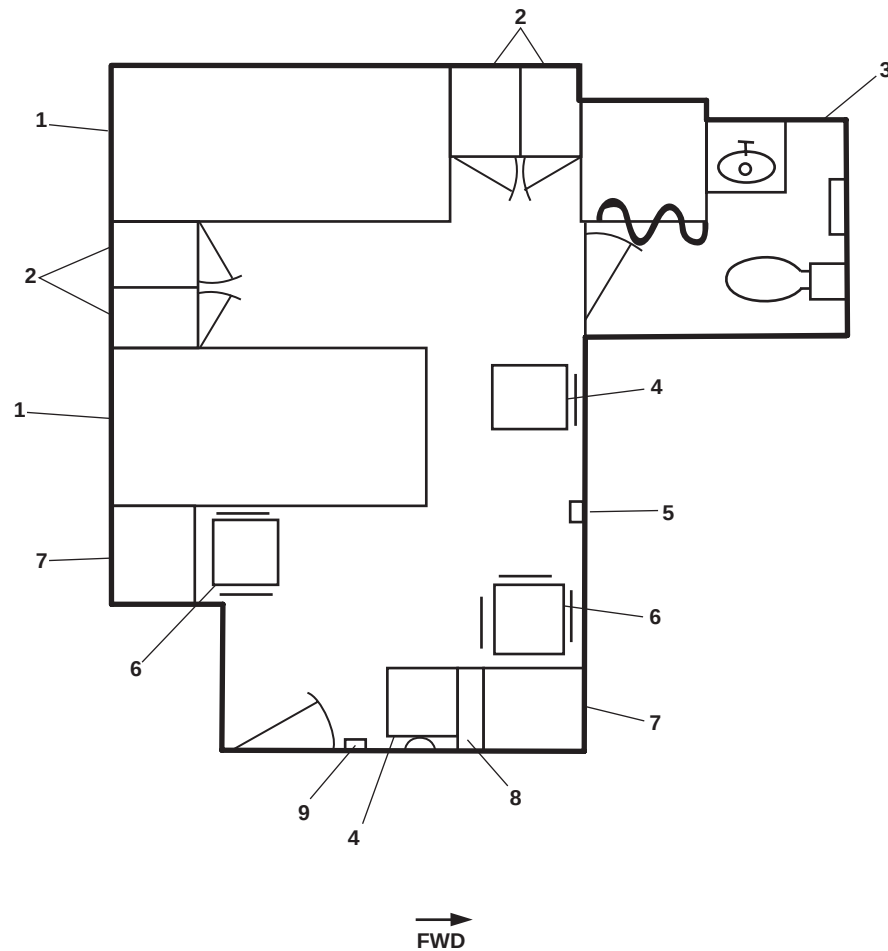


Figure 3. Crew's Stateroom 3

1. Bunks (figure 3, item 1). The bunks provide sleeping structures for four crewmembers.
2. Locker (figure 3, item 2). The lockers provide storage for the crewmembers' clothing and personal items.
3. Sanitary space (figure 3, item 3). The sanitary space includes a sink, water closet, shower, and a convection heater.
4. Night table (figure 3, item 4). The night table provides storage for miscellaneous items.
5. Intercom (figure 3, item 5). The intercom provides communication to the rest of the vessel.
6. Chairs (figure 3, item 6). The chairs provide seating for crewmembers.
7. Chest/desk combo (figure 3, item 7). The chest/desk combo provides storage space and a desktop for reading or writing.
8. Life jacket stowage (figure 3, item 8). The life jacket stowage provides storage for four life jackets.
9. Thermostat (figure 3, item 9). The thermostat provides temperature control in the stateroom.

CREW'S STATEROOM 1

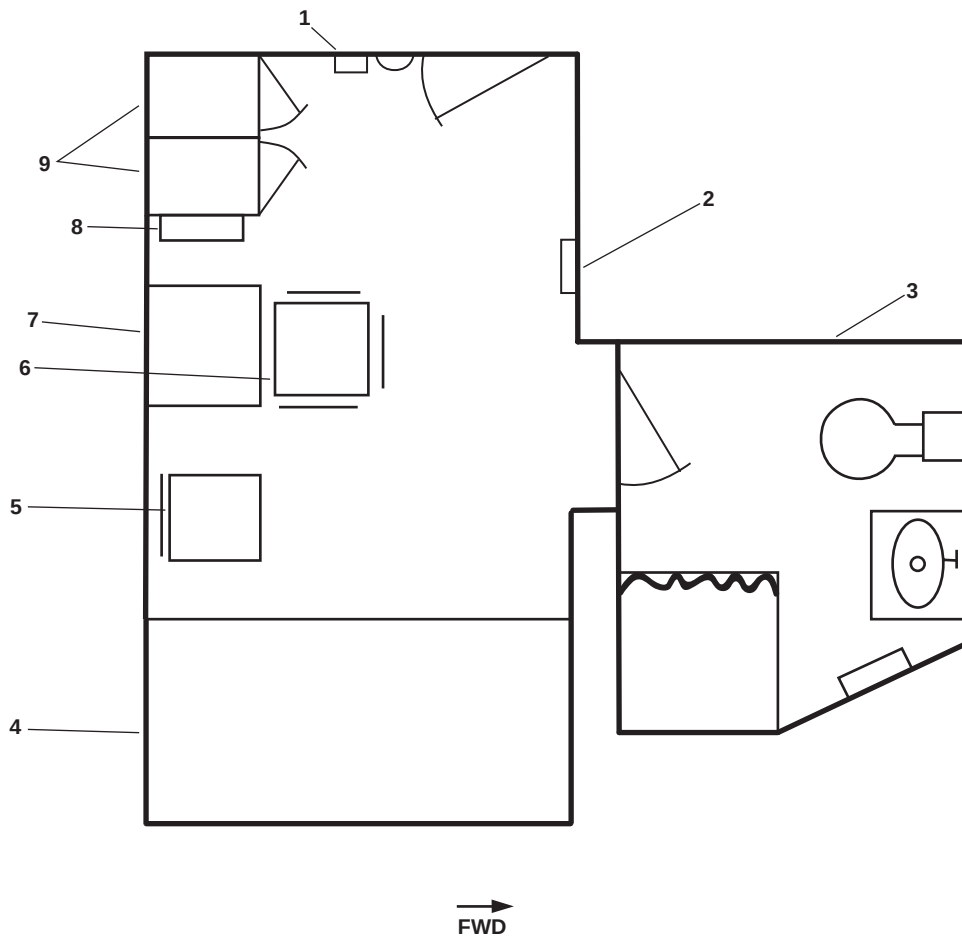


Figure 4. Crew's Stateroom 1

1. Thermostat (figure 4, item 1). The thermostat provides temperature control in the stateroom.
2. Intercom (figure 4, item 2). The intercom provides communication to the rest of the vessel.
3. Sanitary space (figure 4, item 3). The sanitary space includes a sink, water closet, shower, and a convection heater.
4. Bunks (figure 4, item 4). The bunks provide sleeping structures for two officers.
5. Night table (figure 4, item 5). The night table provides storage for miscellaneous items.
6. Chair (figure 4, item 6). The chairs provide seating for crewmembers.
7. Chest/desk combo (figure 4, item 7). The chest/desk combo provides storage space and a desktop for reading or writing.
8. Life jacket stowage (figure 4, item 8). The life jacket stowage provides storage for two life jackets.
9. Locker (figure 4, items 9). The locker provides storage for the crewmembers' clothing and personal items.

CREW'S STATEROOM 2

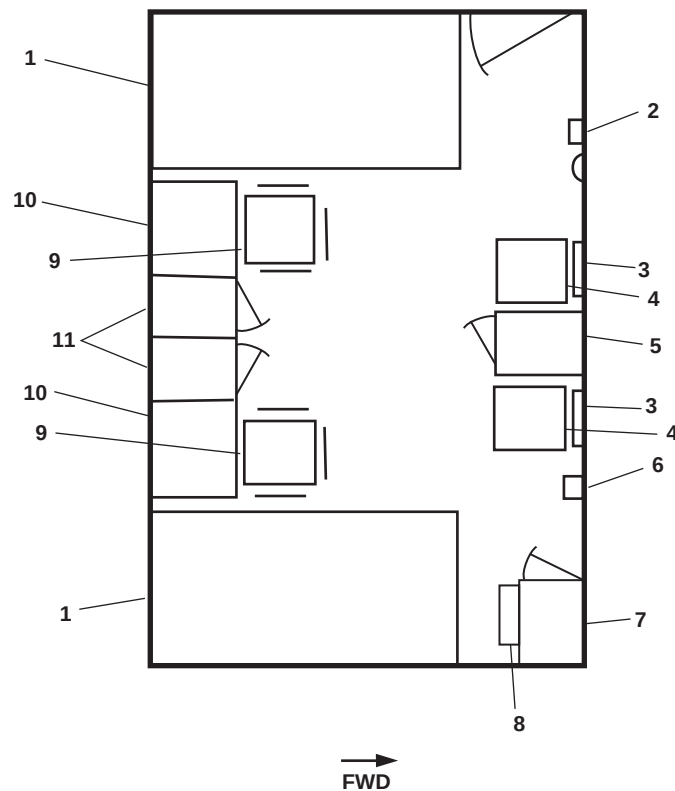
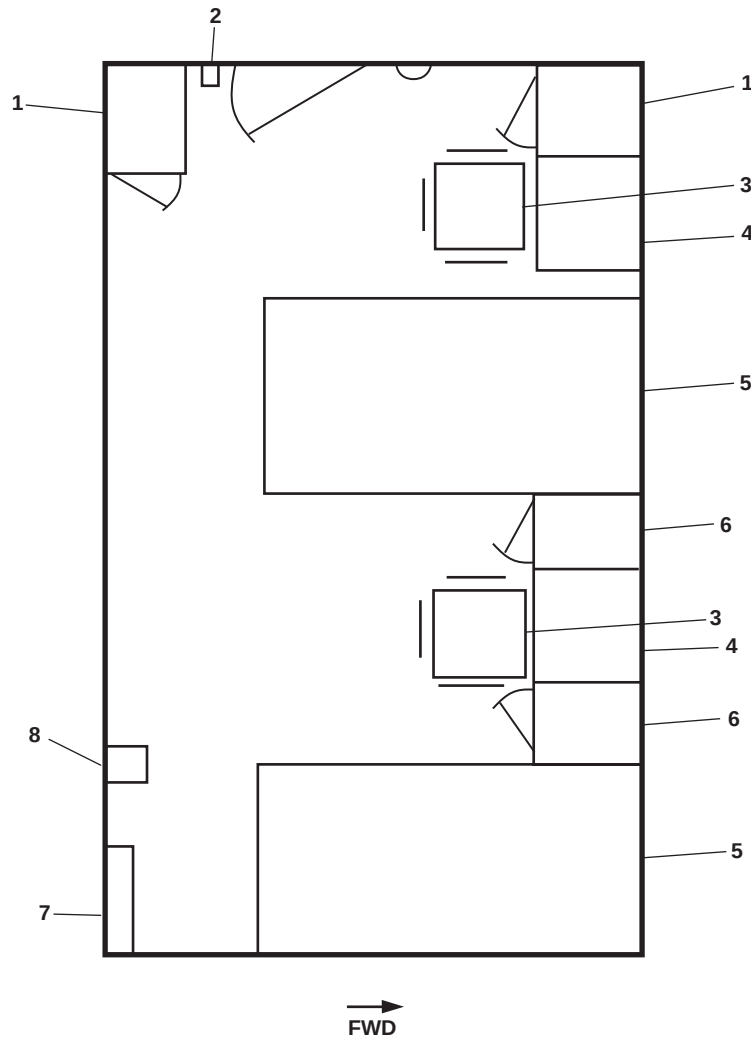


Figure 5. Crew's Stateroom 2

1. Bunks (figure 5, item 1). The bunks provide sleeping structures for two crewmembers.
2. Thermostat (figure 5, item 2). The thermostat provides temperature control in the stateroom.
3. Life jacket stowage (figure 5, item 3). The life jacket stowage provides storage for four life jackets.
4. Night table (figure 5, item 4). The night table provides storage for miscellaneous items.
5. Refrigerator (figure 5, item 5). The refrigerator provides storage for perishable items.
6. Intercom (figure 5, item 6). The intercom provides communication to the rest of the vessel.
7. Locker (figure 5, item 7). The locker provides storage for the crewmembers' clothing and personal items.
8. Life jacket stowage (figure 5, item 8). The life jacket stowage provides storage for four life jackets.
9. Chair (figure 5, item 9). The chair provides seating for crewmembers.
10. Chest/desk combo (figure 5, item 10). The chest/desk combo provides storage space and a desktop for reading or writing.
11. Locker (figure 5, item 11). The locker provides storage for the crewmembers' clothing and personal items.

CREW'S STATEROOM 4**Figure 6. Crew's Stateroom 4**

1. Locker (figure 6, item 1). The locker provides storage space for crewmembers' clothing and personal items.
2. Thermostat (figure 6, item 2). The thermostat provides temperature control in the stateroom.
3. Chairs (figure 6, item 3). The chairs provide seating for crewmembers.
4. Chest/desk combo (figure 6, item 4). The chest/desk combo provides storage space and a desktop for reading or writing.
5. Bunks (figure 6, item 5). The bunks provide sleeping structures for four crewmembers.
6. Night table (figure 6, item 6). The night table provides storage for miscellaneous items.
7. Life jacket stowage (figure 6, item 7). The life jacket stowage provides storage for four life jackets.
8. Intercom (figure 6, item 8). The intercom provides communication to the rest of the vessel.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
MAIN DECK INTERIOR, NON-BERTHING AREAS**

MAIN DECK INTERIOR, NON-BERTHING AREAS

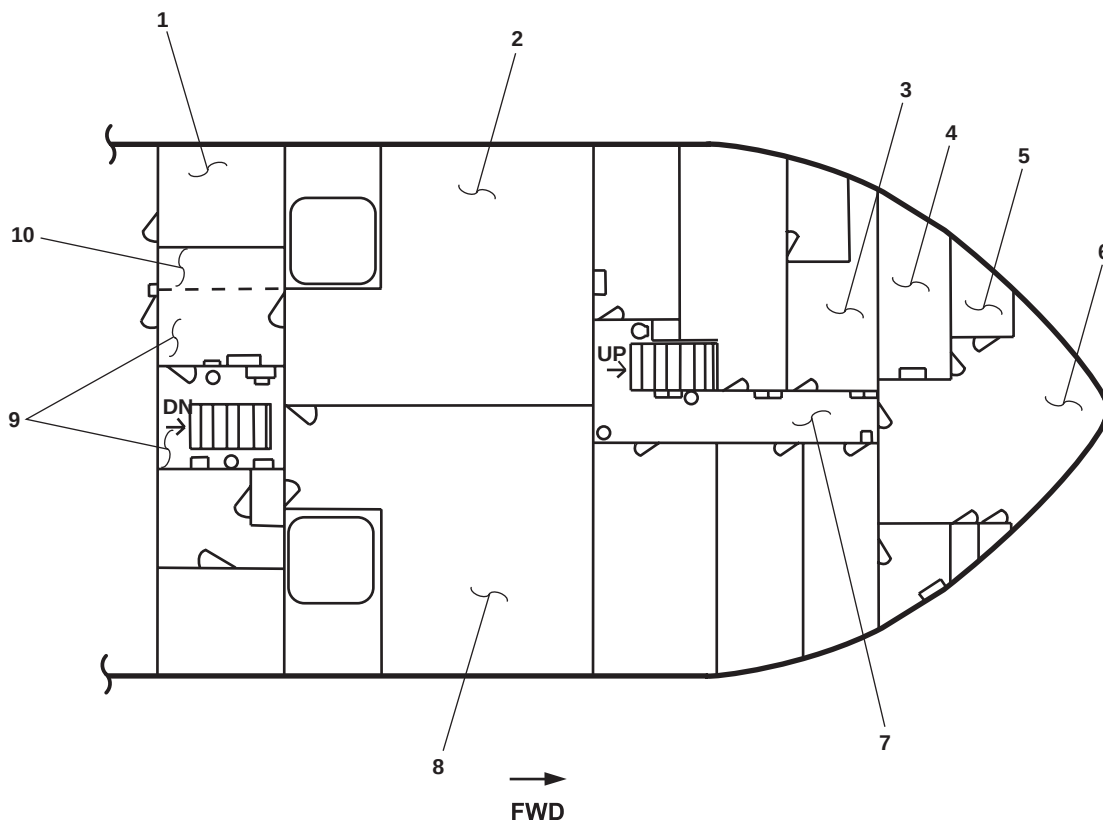


Figure 1. Main Deck Interior, Non-berthing Areas

1. Fan room (figure 1, item 1). This space contains the Heating, Ventilation, and Air Conditioning (HVAC) equipment for the main deck spaces. Details of this space are contained in figure 2.
2. Mess/recreation space (figure 1, item 2). This space is used for feeding the crew and provides a recreation area for watching television and other activities. Details of this space are contained in figure 3.
3. Damage control locker (figure 1, item 3). This space is used for storing much of the vessel's damage control gear. Details of this space are contained in figure 4.
4. Laundry room (figure 1, item 4). This space houses all of the equipment necessary to process the crew's laundry. Details of this space are contained in figure 5.
5. Arms locker (figure 1, item 5). This space provides secure stowage for the vessel's weapons. Details of this space are contained in figure 6.
6. Boatswain's store (figure 1, item 6). This space provides stowage for vessel supplies and equipment. Details of this space are contained in figure 7.

7. Passageway (figure 1, item 7). This space provides passage between the mess/recreation space and the boatswain's store. Access is also provided to the main deck level berthing areas (WP 0009 00). Details of this space are contained in figure 8.
8. Galley (figure 1, item 8). This space contains all of the facilities for storing and preparing food. Details of this space are contained in figure 9.
9. Vestibule (figure 1, item 9). This space provides access between the mess/recreation space (figure 1, item 2), the engine room ladder, and the main deck exterior (fantail). Details of this space are contained in figure 10.
10. Foul weather gear locker (figure 1, item 10). This space provides stowage for the vessel's foul weather gear.

FAN ROOM

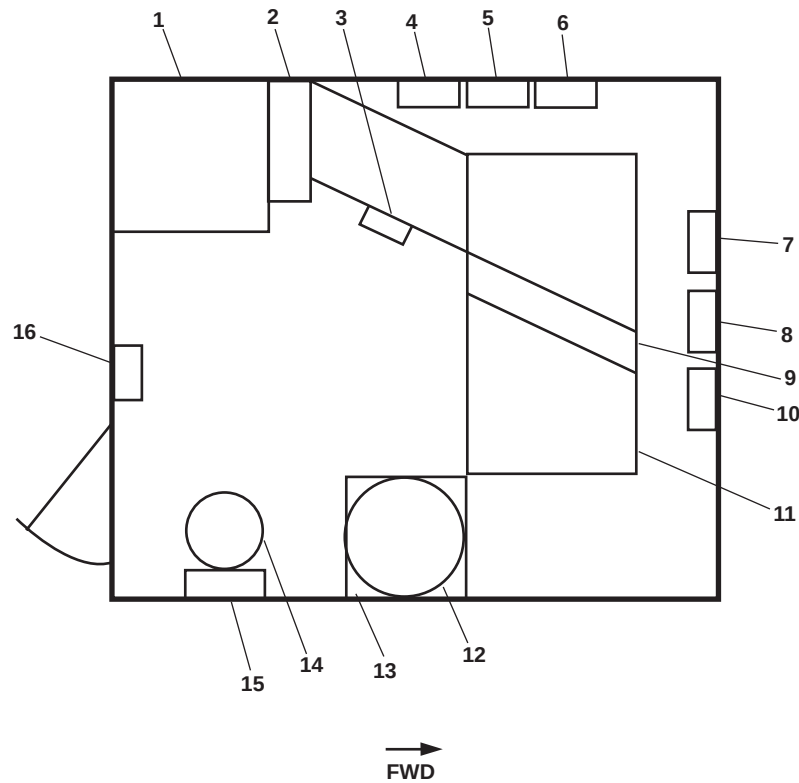
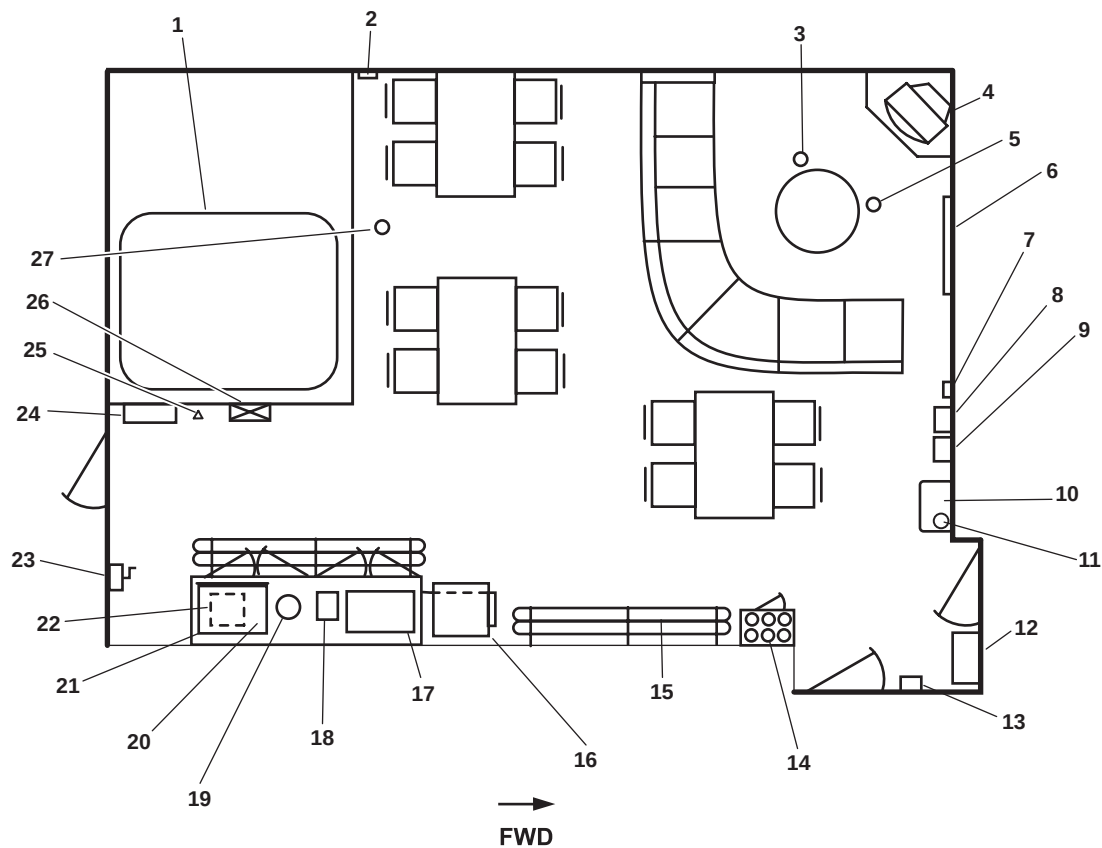


Figure 2. Fan Room

1. Preheater (1-23-2) (figure 2, item 1) (overhead). This electric preheater preheats outside air going to the fan coil unit as required.
2. Manual adjustment dampener (figure 2, item 2) (overhead). The manual adjustment dampener controls the volume of airflow into the ventilation ducting.
3. Thermostat control (figure 2, item 3) (overhead). The thermostat control provides temperature control for the air going to the fan coil unit.
4. Preheater controller (1-23-2) (figure 2, item 4). This controller turns the (1-23-2) preheater ON and OFF.

-
5. Reheater controller (1-25-2) (figure 2, item 5). This controller turns the (1-25-2) reheater ON and OFF.
 6. Preheater controller (1-23-4) (figure 2, item 6). This controller turns the (1-23-4) preheater ON and OFF.
 7. Crew's mess fan coil unit (R1-25-2) controller (figure 2, item 7). This controller provides control of fan coil unit (5).
 8. Galley supply fan (S1-22-4) motor controller (figure 2, item 8). This motor controller provides control of galley supply fan.
 9. Filter supply system (figure 2, item 9) (overhead). The filter supply system provides removal of dirt and foreign particles from the outside air going to the galley supply fan.
 10. AMS 2 supply fan (S1-22-2) motor controller (figure 2, item 10). This motor controller provides control for the AMS 2 supply fan.
 11. Fan coil unit (R 1-25-2) (overhead) (figure 2, item 11). The fan coil unit provides a circulating fan for main deck spaces and an air conditioning coil for cooling.
 12. Galley supply fan (figure 2, item 12). The vaneaxial fan provides makeup air for the galley ventilator hood.
 13. Galley reheater (1-23-4) (figure 2, item 13). The (1-23-4) reheater reheats interior air recirculating to the fan coil unit.
 14. AMS 2 supply fan (S1-22-2) (figure 2, item 14). The AMS 2 vaneaxial supply fan provides forced air supply to AMS 2.
 15. Steering gear oil reservoir (figure 2, item 15) (overhead). The steering gear reservoir has a 15.75 gal (59.6 liter) capacity with a sight glass. This reservoir supplies hydraulic fluid for the steering gear system.
 16. Refrigeration valves manifold (figure 2, item 16). The refrigeration valves manifold is a control center for the vessels refrigeration.



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11. General alarm bell (figure 3, item 10). The general alarm bell signals various emergency conditions on the vessel.
 12. 440V power panel No. 3 (figure 3, item 11). This power panel provides 440 volt power for the main deck supply and exhaust fans, preheaters, and reheaters.
 13. Galley supply fan and crew's mess fan coil unit emergency stop (figure 3, item 12). The galley supply fan and crews mess fan coil unit emergency stop disconnects power to the supply fan and fan coil unit.
 14. Cutlery dispenser with cabinet (figure 3, item 13). The cutlery dispenser contains the eating utensils.
 15. Serving line (figure 3, item 14). The serving line is located adjacent to the roll-up window. The serving line provides a tray rail for cafeteria-style serving.
 16. Mini refrigerator and with icemaker (under) (figure 3, item 15). The mini refrigerator provides cold storage for perishables and produces ice.
 17. Milk dispenser (figure 3, item 16). This dispenses cold milk.
 18. Beverage dispenser (figure 3, item 17). This dispenses cold beverages.
 19. Coffee percolator (figure 3, item 18). The coffee percolator produces and holds hot coffee for consumption.
 20. Cabinet (under) (figure 3, item 19). The cabinet provides dry good storage.
 21. Microwave (over) (figure 3, item 20). The microwave reheats food and beverages.
 22. Toaster (countertop) (figure 3, item 21). The toaster produces toast at various settings.
 23. AMS 2 watertight door remote hand pump (bulkhead) (figure 3, item 22). Hand pump to open or close the AMS 2 watertight door.
 24. 120V main deck, 01 & 02 emergency lighting panel No. 1 (figure 3, item 23). This panel provides power distribution for main deck, 01, and 02 level emergency interior lighting. It also provides 120 volts for the alarm switchboard and the FM-200 system.
 25. Fire axe (figure 3, item 24). The fire axe is used to aid the crew in gaining immediate access to a locked or enclosed area in the case of fire.
 26. Fire station 5 (figure 3, item 24). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
 27. Remote valve operator for valve FO-2, F.O. DAY TK FILL (figure 3, item 25). This remote valve operator operates the fill valve for the port day tank.

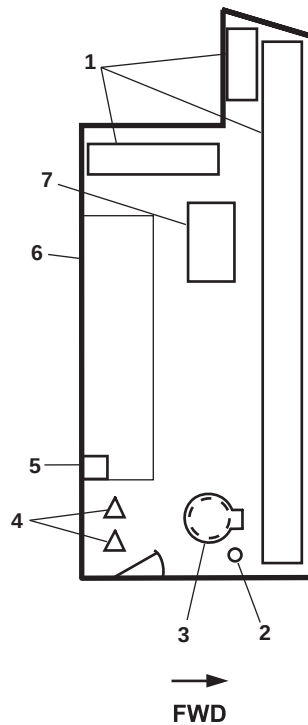
DAMAGE CONTROL LOCKER

Figure 4. Damage Control Locker

1. Shelves (figure 4, item 1). Shelves provide stowage for damage control lumber and equipment.
2. Hydrogen Fluoride (HF) gas sampling port (figure 4, item 2). This port allows sampling of the atmosphere in AMS 1 after the FM-200 system has extinguished a potential fire.
3. Escape hatch (figure 4, item 3). The escape hatch provides an emergency escape from AMS 1.
4. Fire axe (figure 4, item 4). The fire axe is used to aid the crew in gaining immediate access to a locked or enclosed area in case of fire.
5. Sound powered telephone (figure 4, item 5). The sound powered telephone is used for intraship communications.
6. Desk (figure 4, item 6). The desk provides a workspace in the damage control locker.
7. Sound powered telephone system call terminal box (figure 4, item 7). This terminal box provides a junction for many of the vessel's sound powered telephone circuits.

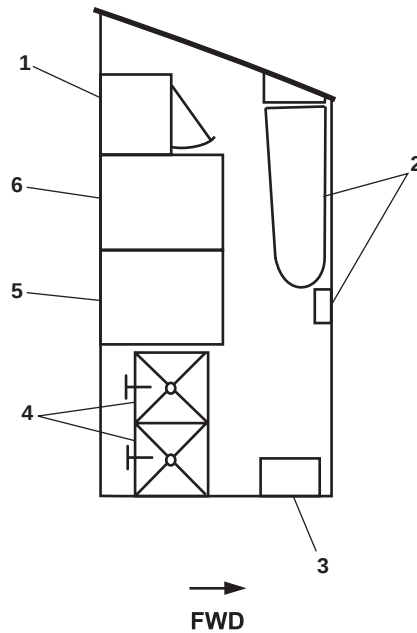
LAUNDRY ROOM

Figure 5. Laundry Room

1. Locker (figure 5, item 1). The locker provides storage for laundry supplies.
2. Iron and ironing board (figure 5, item 2). An iron and a full sized ironing board are provided for garment pressing.
3. Convection heater (figure 5, item 3). The convection heater supplies heat to the laundry room.
4. Deep sinks (figure 5, item 4). Deep sinks are provided for hand laundering and rinsing garments.
5. Washing machine (figure 5, item 5). The washing machine washes garments and washable linens on the vessel.
6. Dryer (figure 5, item 6). The dryer dries garments and linens on the vessel.

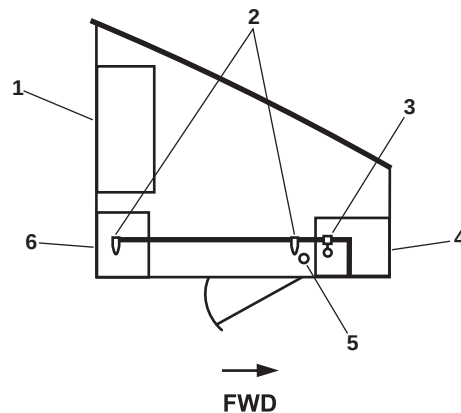
ARMS LOCKER

Figure 6. Arms Locker

1. .50 Cal machine gun locker (figure 6, item 1). The .50 cal machine gun locker stores weapons in a secure location.
2. Sprinkler head assembly (figure 6, item 2). The sprinkler head assembly provides raw water to extinguish fires in the arms locker.
3. Water switch assembly (figure 6, item 3). The water switch assembly sends an emergency condition alarm signal to the pilothouse when water flows into the arms locker sprinkler piping system.
4. Small arms locker (figure 6, item 4). The small arms locker provides secure storage for small arms.
5. Temperature switch (figure 6, item 5). The temperature switch sends an emergency condition alarm signal to the pilothouse when the temperature rises above 105 °F (41 °C) in the arms locker.
6. Ammunition locker (figure 6, item 6). The ammunition locker provides storage for small arms ammunition.

BOATSWAIN'S STORE

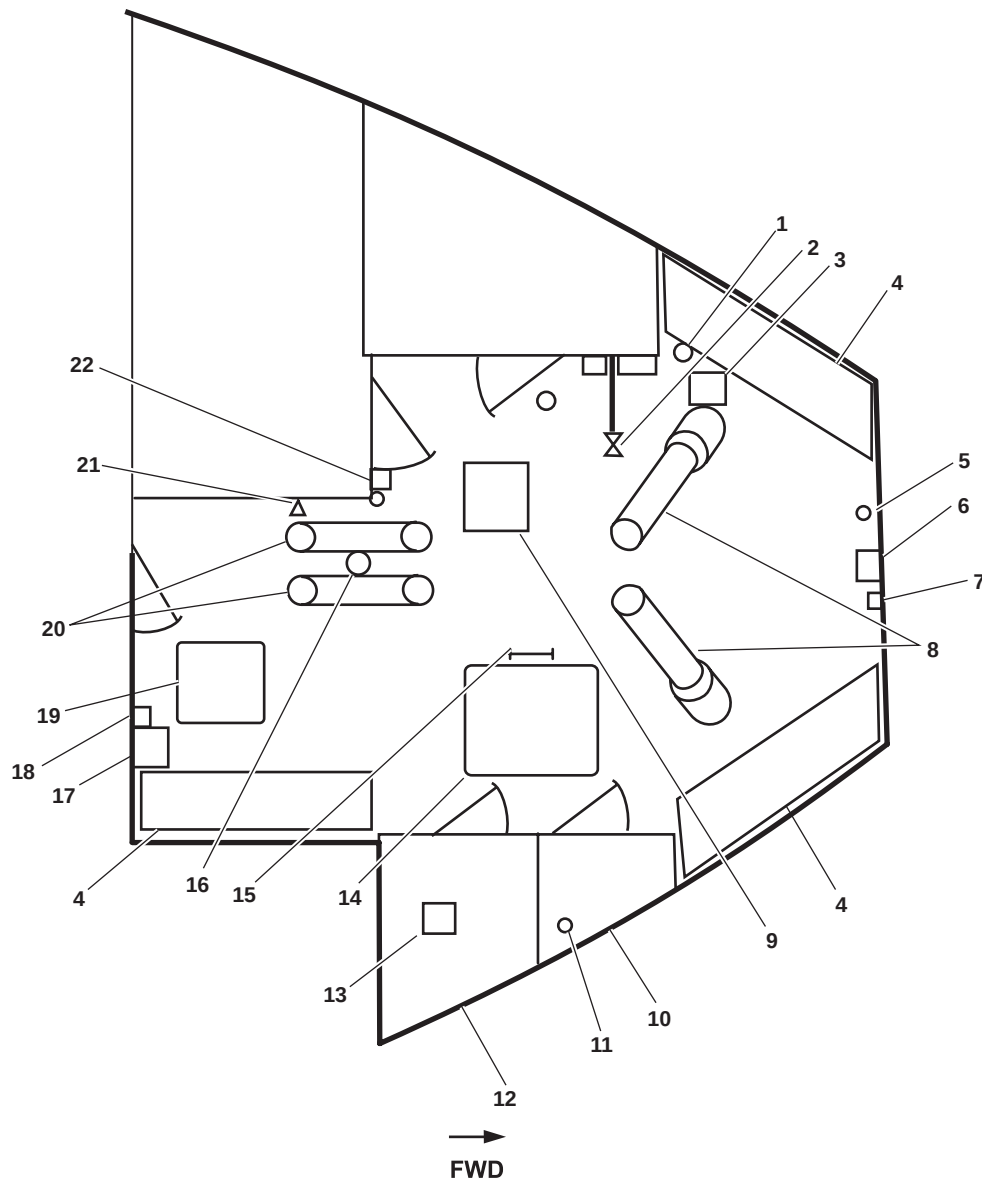


Figure 7. Boatswain's Store

1. Fire extinguisher (figure 7, item 1). The fire extinguisher is used to extinguish small fires on the main deck level.
2. Arms locker sprinkler cutoff valve (figure 7, item 2). The sprinkler cutoff valve controls the supply of raw water to the arms locker drench system sprinkler heads.
3. Arms locker exhaust fan E01-62-2 (figure 7, item 3). The arms locker exhaust fan ventilates the arms locker.
4. Shelves (figure 7, item 4). The shelves provide storage space.
5. General alarm bell (figure 7, item 5). The alarm bell signals various emergency conditions on the vessel.

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6. Public Address (PA) speaker volume control (figure 7, item 6). The PA speaker volume control adjusts the volume level of the PA speaker.
 7. PA Speaker (figure 7, item 7). The PA speaker amplifies messages throughout the vessel.
 8. Hawse pipes (figure 7, item 8). The hawse pipes guide the anchor chains from the anchor windlass to the anchor pocket.
 9. Boatswain's store, arms locker, and laundry supply fan (S01-58-1) (figure 7, item 9). This supply fan provides ventilation to the boatswain's store, arms locker, and laundry.
 10. Cleaning gear locker (with shelves) (figure 7, item 10). The cleaning gear locker provides storage for cleaning supplies.
 11. Remote valve operator. BB-12 (figure 7, item 11). The remote valve operator is a reach rod for operation of BB12, BLST TK 1 SUCT COV.
 12. Linen locker (with shelves) (figure 7, item 12). The linen locker provides storage for clean linen.
 13. Preheater 1-57-1 thermostat (figure 7, item 13). The thermostat turns the preheater ON and OFF.
 14. Hatch (figure 7, item 14). The hatch provides exit to 01 level forward weather deck above.
 15. Vertical ladder (figure 7, item 16). The vertical ladder provides access to 01 level forward weather deck.
 16. Hydraulic motor and disc brake (figure 7, item 17). The hydraulic motor and disc brake is required to operate the anchor windlass as well as stop the anchor windlass.
 17. Boatswain's storeroom supply fan controller and HVAC control (figure 7, item 18). This controller turns the boatswain's storeroom supply fan ON and OFF. The HVAC control turns the HVAC ON and OFF.
 18. HVAC system controller for preheater and reheater 1-57-1 (figure 7, item 19). The HVAC system controller for preheater and reheater 1-57-1 provides electrical power to the preheater and reheater.
 19. Hatch (figure 7, item 20). This hatch provides access to the bow thruster compartment below.
 20. Chain pipes (figure 7, item 21). The chain pipes guide the chain from the anchor windlass to the chain locker.
 21. Fire axe (figure 7, item 15). The fire axe is used to aid the crew in gaining immediate access to a locked or enclosed area in the case of fire.
 22. Arms locker exhaust fan controller (figure 7, item 22). This controller controls power to the arms locker exhaust fan.

MAIN DECK PASSAGEWAY

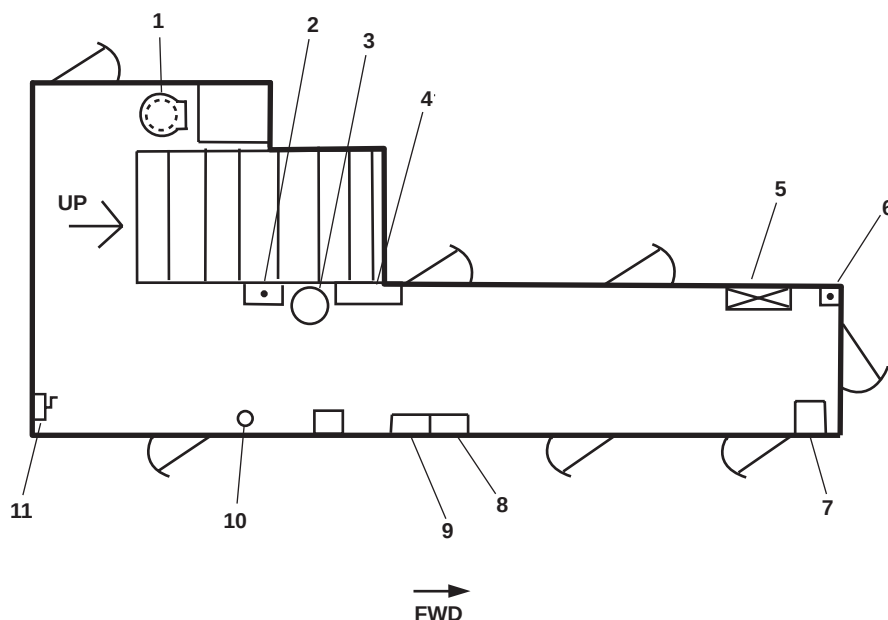


Figure 8. Main Deck Passageway

1. Scuttle (escape hatch) (figure 8, item 1). The scuttle provides an emergency escape from Enclosed Operating Space (EOS).
2. Fire alarm pull station (figure 8, item 2). The fire alarm pull station activates the fire alarm in the EOS and pilothouse when pulled.
3. Fire extinguisher (figure 8, item 3). The fire extinguisher used to extinguish small fires on the main deck level.
4. Life jacket locker (figure 8, item 4). Located under the ladder, the locker provides storage for life jackets.
5. Fire Station 6 (figure 8, item 5). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
6. Fire alarm pull station (figure 8, item 6). The fire alarm pull station activates the fire alarm in the EOS and pilothouse when pulled.
7. Boatswain's store room/arms locker exhaust fan emergency stop (figure 8, item 6). The boatswain's store room/arms locker exhaust fan emergency stop turns OFF ventilation from the arms locker.
8. 120V distribution panel No. 3 (figure 8, item 7). This panel provides 120 volts power for the main deck port and starboard lights, port, starboard and sanitary space electrical receptacles. This panel also provides 120 volts power to the mess room lights, drinking fountain, 01 & 02 level reheater 120V fuse box No. 1, and the Deck Reheater 120V Fuse Box No. 3.
9. Deck Reheater 120V Fuse Box No. 3 (figure 8, item 8). This fuse box provides fuse protection for main deck reheaters.
10. General alarm bell (figure 8, item 9). The general alarm bell signals various emergency conditions on the vessel.
11. AMS 1 Watertight door remote hand pump (bulkhead) (figure 8, item 10). This remote hand pump is used to open or close the AMS 1 watertight door.

GALLEY

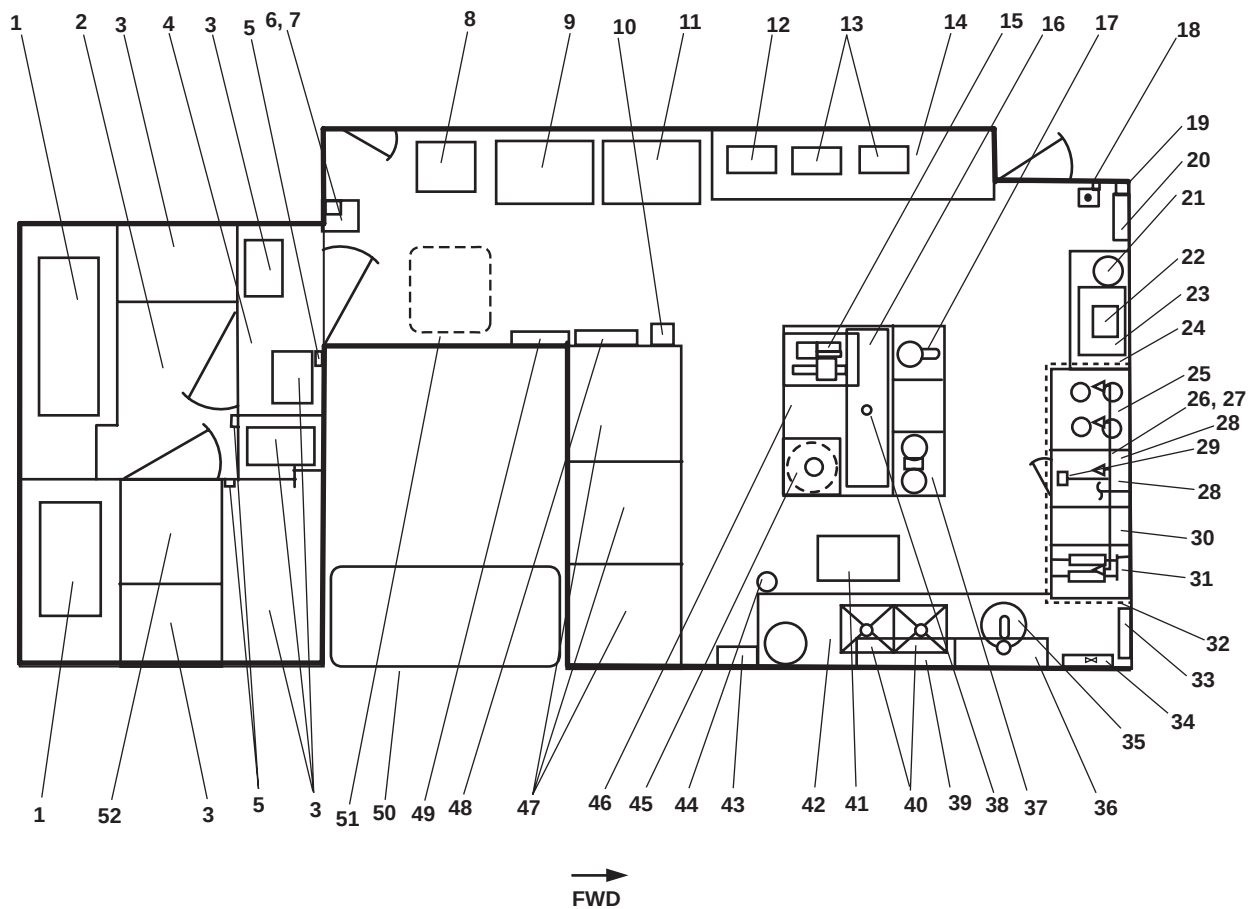


Figure 9. Galley

1. Fan coil unit (figure 9, item 1). One fan coil unit provides cooling capability for the chill box and a second fan coil unit provides cooling capability for the walk-in freezer.
2. Chill box (figure 9, item 2). The chill box is a walk-in refrigerator.
3. Shelves (figure 9, item 3). The shelves are used for storage.
4. Thaw room (figure 9, item 4). The thaw room is used to thaw frozen foods.
5. Freezer alarm switch (figure 9, item 5). The freezer alarm switch is provided in the event a crewmember becomes trapped inside the chill box or freezer. The crewmember can activate the freezer alarm using the freezer alarm switch.
6. Freeze box alarm, freeze box timer, heater connector and disconnect switches (figure 9, item 6). These switches control various functions in the galley reefer area.
7. Defrost heater controller for the vessel's storage refrigerator and freezer system (figure 9, item 7). The defrost heater controller controls the power to the vessel's storage refrigerator and freezer system defroster.
8. Trash compactor and safe (above) (figure 9, item 8). The trash compactor compacts trash, reducing the volume of trash. The safe provides a secured storage area for miscellaneous items.

9. Freezer (figure 9, item 9). The freezer is used for frozen day stores.
10. Sound powered telephone, thermostat (above), and fire extinguisher (below) (figure 9, item 10). The sound powered telephone is used for intraship communications. The thermostat provides temperature control for the galley space. The fire extinguisher is used to put out small fires on the vessel.
11. Refrigerator (figure 9, item 11). Used for day stores requiring refrigeration.
12. Cold well (figure 9, item 12). The cold well is used for serving salads and other cold food.
13. Hot well (figure 9, item 13). The hot well is used for serving hot foods.
14. Steam table (figure 9, item 14). The steam table provides controls for hot wells and dish storage (under).
15. Meat slicer and storage shelves (under) (figure 9, item 15). The countertop mounted meat slicer is used to slice food products. The storage shelves are provided below counter top for storage space.
16. Shelf (over) (figure 9, item 16). The shelf provides storage space.
17. Mixer (figure 9, item 17). The mixer is used to combine ingredients.
18. Manual pull box (figure 9, item 18). The manual pull box allows the crew to manually activate the galley fire suppression system.
19. Thermostat (figure 9, item 19). The thermostat provides temperature control in the galley.
20. 440V power panel No. 2 (figure 9, item 20). This power panel provides 440 volts distribution for the galley equipment.
21. Coffee percolator (figure 9, item 21). Counter top mounted percolator provides hot coffee for the crewmembers.
22. Toaster (figure 9, item 22). Countertop mounted four-slice toaster.
23. Microwave (over) (figure 9, item 23). Microwave oven mounted on shelf overhead is used for quick food preparation.
24. Counter with cabinet (over) (figure 9, item 24). The counter with cabinet is used for storage.
25. Range (figure 9, item 25). Electric range and oven is used for food preparation.
26. Temperature sensing fusible links (within ventilation hood) (figure 9, item 26). The temperature sensing fusible links are the detection portion of the galley fire suppression system. The fusible links allow automatic detection by means of specific alloy melting ratings. When the temperature exceeds the rating of the link, the link separates, allowing the galley fire suppression system to be activated.
27. Distribution nozzles (within ventilation hood) (figure 9, item 27). The distribution nozzles deliver the galley fire suppression extinguishing agent to the galley heat producing equipment.
28. Griddle with cabinet (figure 9, item 28). Electric griddle used for food preparation. Cabinet storage is provided below.
29. Hood damper control knob (figure 9, item 29). The hood damper control knob contains fail-safe circuitry coupled with spring drive, which allows closure of the fire damper even if electrical power is interrupted or turned OFF. The hood damper control knob resets to normal operating position when the fan is restarted.
30. Counter with drawers (figure 9, item 30). The counter with drawers is used for storage.
31. Fryer (figure 9, item 31). The double basket, electric fryer is used for deep fat frying.

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32. Ventilator hood (over) (figure 9, item 32). The ventilator hood is provided for the cooking area ventilation. The ventilator hood contains the automatic cleaning system and fire protection system.
 33. Gaylord ventilation control cabinet (figure 9, item 33). The ventilator control cabinet houses the controls for ventilator hood cleaning system, the fire cycle water spray, and a pull fire box. The ventilation control cabinet sends wash water to the grease extraction baffles and the second wash manifold in the automatic water wash canopy. The Gaylord ventilation control cabinet also activates the fire cycle water spray to extinguish fires within the ventilation hood protecting the ventilation damper from warping due to excessive heat. The Gaylord ventilation control cabinet fire cycle water wash can also be activated by the pull fire box. The pull fire box functions only for the Gaylord ventilator hood.
 34. Galley fire suppression system cabinet (figure 9, item 34). The galley fire suppression system is a wet chemical (Ansulx agent) fire suppressant system designed to constantly monitor the galley's cooking appliances. The galley fire suppression system cabinet is activated by the manual fire pull station or high temperature sensing fusible links located over the deep fryer, the griddle, or the range.
 35. Potato peeler (figure 9, item 35). The countertop-mounted electric peeler is used to peel potatoes.
 36. Shelf (over and under) (figure 9, item 36). The shelf is used for storage.
 37. Baker's scale with drawers (under) (figure 9, item 37). The countertop-mounted scale is used for weighing food. Storage is provided below the counter top.
 38. Thermal heat detector (figure 9, item 38). When the area temperature rises to 135 °F (275 °C) or more, the thermal heat detector activates the fire alarm system.
 39. Shelves (over and under) (figure 9, item 39). The shelves provide storage space.
 40. Double sink with garbage disposal under (figure 9, item 40). The double sink is equipped with a garbage disposal and spray unit.
 41. Ventilator hood exhaust fan (overhead) (figure 9, item 41). The ventilator hood exhaust fan vents air from the galley to weather.
 42. Dishwasher (under) (figure 9, item 42). The industrial type dishwasher is used for sanitizing dishes and utensils.
 43. Galley exhaust fan control panel (figure 9, item 43). The galley exhaust fan control panel houses controls for ventilator hood exhaust fan.
 44. Remote valve operator FO-15 (figure 9, item 44). The deck operator for the remote valve provides control of FO-15 valve that controls fuel oil flow from the starboard day tank.
 45. Countertop with trash can (under) (figure 9, item 45). The countertop is used for food preparation. The trash can is used to discard trash.
 46. Countertop with shelves (under) (figure 9, item 46). The countertop is used for food preparation. Storage is provided below the countertop.
 47. Dry provisions storage (figure 9, item 47). The dry provision storage provides storage space for dry food/or supplies.
 48. 220/110V distribution panel (figure 9, item 48). This panel provides power distribution for the galley, crew's mess, and laundry spaces.
 49. 120V distribution panel No. 1 (figure 9, item 49). This panel contains circuit breakers for various pieces of galley equipment.
 50. Stack (figure 9, item 50). The stack contains engine exhaust vents and crankcase vents.

51. Galley hatch (located above) (figure 9, item 51). The galley hatch provides access for loading or unloading galley stores and appliances.
52. Walk-in freezer (figure 9, item 52). The walk-in freezer is used for bulk frozen food storage.

VESTIBULE

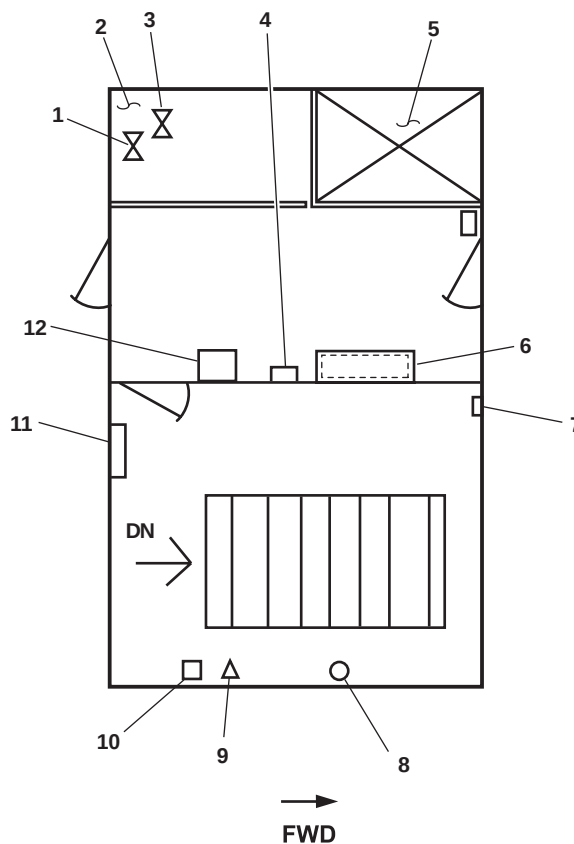


Figure 10. Vestibule

1. FM-55 (figure 10, item 1). Valve FM-55, F STA No. 4 supplies raw water to fire station 4.
2. VIDMAR storage cabinets (figure 10, item 2). The VIDMAR storage cabinets provide stowage for spare and repair parts.
3. Flow control valve (figure 10, item 3). The hydraulic key flow control valve controls the flow of hydraulic fluid to the deck crane.
4. Water Washdown Station (WWS) with HF sampling port (figure 10, item 4). This station permits raw water to flow from the fire main system to the engine room water wash down system. HF gas sampling can also be done at this station.
5. VIDMAR storage cabinets (figure 10, item 5). The VIDMAR storage cabinets provide stowage for spare and repair parts.

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6. Fire and emergency stop panel (figure 10, item 6). FM-200 manual pull box (above), HVAC SYS EMER STOP, the FO XFER Pump EMER STOP (below), fire alarm pull station. The FM-20 manual pull box activates the engine room FM-200 system. The EMER STOP boxes shut OFF fuel oil transfer pumps 1 and 2. The HVAC SYS EMER STOP shuts OFF the AMS 1 and 2 supply fans, the engine room exhaust, and supply fans. The fire alarm pull station activates the fire alarm when pulled.
 7. AMS 2 watertight door pump and reservoir system (figure 10, item 8). This system is used to OPEN and CLOSE the AMS 2 watertight door.
 8. Fire extinguisher (figure 10, item 9). Portable fire extinguisher used to extinguish small fires on the main deck.
 9. Fire axe (figure 10, item 10). Used to aid crew in gaining immediate access to a locked or enclosed area in the case of fire.
 10. Fire alarm pull station (figure 10, item 11). Pulling the handle of the fire alarm pull station activates the fire alarm system.
 11. FM-200 manual pull box (figure 10, item 12). The FM-200 manual box provides a connection to the FM-200 fire activation system in the engine room.
 12. Tow machinery control panel (figure 10, item 7). The tow machinery control panel houses the logic control and circuitry connections for the tow machines.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
ENGINE ROOM**

ENGINE ROOM, PORT SIDE

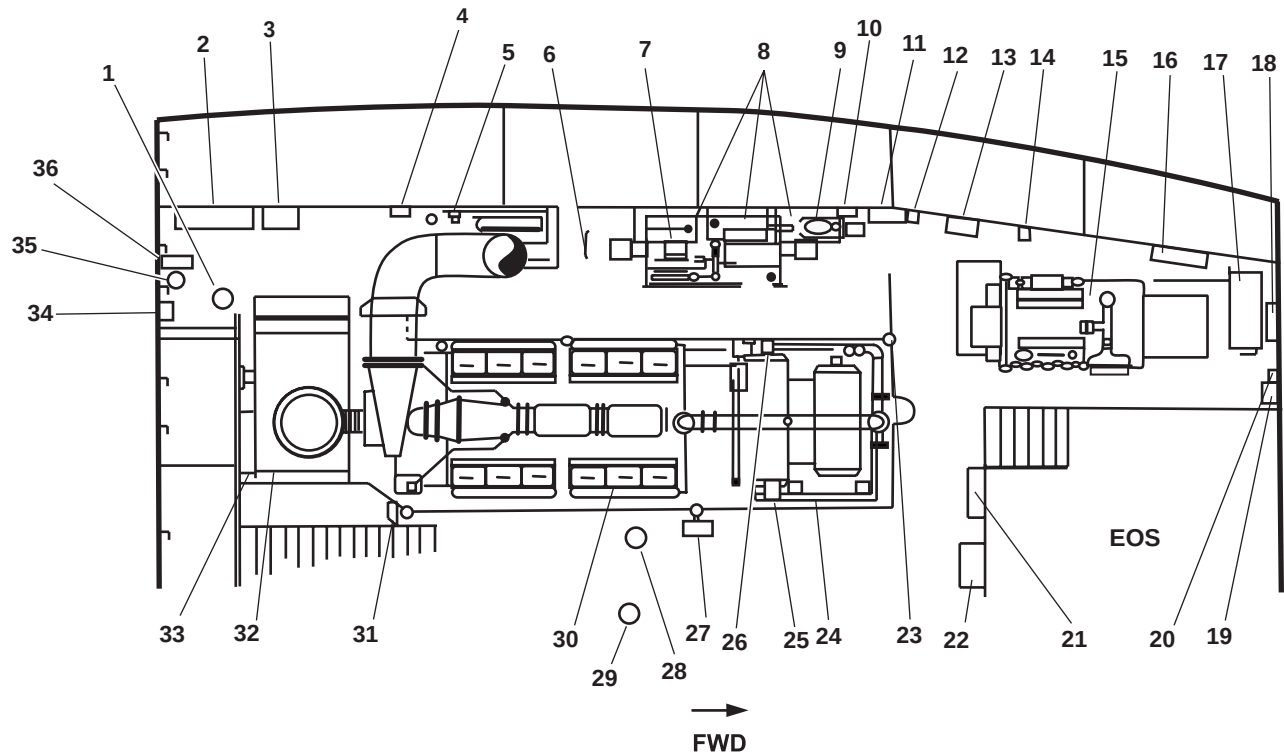


Figure 1. Engine Room, Port Side

1. FM-200 warning light (figure 1, item 1). The FM-200 yellow warning light illuminates when the FM-200 system is activated.
2. Reverse Osmosis Water Purification Unit (ROWPU) battery box (figure 1, item 2). This battery box contains two 12V batteries. The battery bank provides 24 Vdc to the ROWPU to maintain fresh water flush capabilities during vessel layup periods.
3. Drinking fountain (figure 1, item 3). The drinking fountain dispenses cold potable water.
4. ROWPU battery charger (figure 1, item 4). The battery charger maintains the charge of the ROWPU battery bank.
5. Lube oil purifier (figure 1, item 5). The lube oil purifier cleans the lubricating oil for the main engines.
6. Vertical ladder (figure 1, item 6). This ladder provides access to the port fuel oil day tank and the port life boat station on the 02 level.
7. Central hydraulic system hydraulic power unit (figure 1, item 7). The central hydraulic system hydraulic power unit provides hydraulic power for the crane, capstan, anchor windlass, and tow pins. It powers the tow machine when the hydraulic piping is aligned properly.

8. Transformers (figure 1, item 8). Three 440V/120V transformers provide 120V power for the load center distribution panel.
9. Lube oil transfer pump (figure 1, item 9). The lube oil transfer pump is an electrically powered pump used to transfer lube oil within the vessel.
10. Lube oil transfer pump discharge pressure gauge and the lube oil transfer strainer differential pressure gauge (figure 1, item 10). The lube oil transfer pump pressure gauge indicates the discharge pressure of the lube oil transfer pump. The lube oil transfer strainer differential pressure gauge indicates the differential pressure of the strainer.
11. Lube oil manifold (figure 1, item 11). The lube oil manifold provides centralized control of the lube oil piping system.
12. Lube oil transfer pump motor controller (figure 1, item 12). This controller turns the lube oil transfer pump ON and OFF.
13. Lube oil tank level indicator and hand pump (figure 1, item 13). The tank level indicator displays the amount of oil present in the tank. The hydraulic oil hand pump is used to transfer hydraulic oil from the hydraulic oil storage tank.
14. Ship's Service Diesel Generator (SSDG) 2 starting air pressure gauge (figure 1, item 14). This gauge indicates the amount of pressure available to the SSDG 2 starter.
15. SSDG 2 (figure 1, item 15). SSDG 2 is an air-started, fresh water-cooled, diesel engine-driven service generator providing electric power to the main switchboard.
16. Air receiver (figure 1, item 16). The 30 gallon (113.6 liter) air receiver stores air for the control air system.
17. Sewage discharge pump 2 (figure 1, item 17). Sewage discharge pump 2 is an electrically powered pump that pumps the contents of the sewage tank to the sewage shore connection or overboard.
18. Control air dryer (figure 1, item 18). The control air dryer removes moisture from the control air system.
19. Sewage discharge pump 2 motor controller (figure 1, item 19). The sewage discharge pump 2 motor controller turns sewage discharge pump 2 ON and OFF.
20. Sewage discharge pump 2 pressure gauge (figure 1, item 20). This pressure gauge indicates the discharge pressure of sewage discharge pump 2.
21. Engine room distribution panel no. 4 (figure 1, item 21). The engine room distribution panel provides power distribution for engine room equipment.
22. Monitoring system Central Processing Unit (CPU) with 24 volt machinery DC control distribution panel (below) (figure 1, item 22). The monitoring system CPU cabinet contains the central processor for the machinery plant monitoring system. A 24 volt machinery DC control distribution panel provides circuit protection for machinery monitoring, SSDG, 2, FM-200 shutdown, rudder angle, steering gear alarm, pump drive engine, and bow thruster engine.
23. Fire extinguisher (figure 1, item 23). The fire extinguisher is used to extinguish small fires.
24. Engine control panel (figure 1, item 24). This panel provides the controls and status displays for the main engines.
25. Engine alarm horn (figure 1, item 25). The engine alarm horn sounds the engine alarm, indicating various engine conditions and emergencies.
26. Lube oil prime pump and controller (figure 1, item 26). The lube oil prime pump primes the main propulsion engine for operation. Its controller also operates the lube oil pump, permitting the operator to select ON and OFF.
27. Fire station 2 (figure 1, item 27). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.

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28. Machinery plant alarm rotating beacon (figure 1, item 28). A green light illuminates and the beacon rotates when the machinery plant alarm is activated.
 29. General alarm rotating beacon (above) (figure 1, item 29). A red light illuminates and the beacon rotates when the general alarm is activated.
 30. Main engine 2 (figure 1, item 30). Main engine 2 is an air-started, fresh water-cooled, main propulsion engine. Main engine 2 rotates counterclockwise when viewed from the flywheel.
 31. Aft sea chest strainer differential pressure gauge (figure 1, item 31). This gauge indicates the differential pressure across the aft sea chest strainer.
 32. Reduction gear 2 (figure 1, item 32). Reduction gear 2 transfers power from the main engine and provides directional control to the port propeller shaft.
 33. Shaft brake panel 2 (figure 1, item 33). This panel provides control for the port shaft brake.
 34. FM-200 alarm horn/strobe (figure 1, item 34). The FM-200 alarm horn/strobe provides a visible and audible warning 60 seconds before the FM-200 fire suppression agent is released.
 35. Fuel vent flow indicator (figure 1, item 35). The fuel vent flow indicator is provided to check for fuel oil tank accidental overfill.
 36. Fuel oil day tank high level alarm (figure 1, item 36). The fuel oil day tank high level alarm provides a visible and audible alarm when the transfer of fuel oil to the PORT or STARBOARD fuel oil day tanks have exceeded fill levels.

ENCLOSED OPERATING STATION

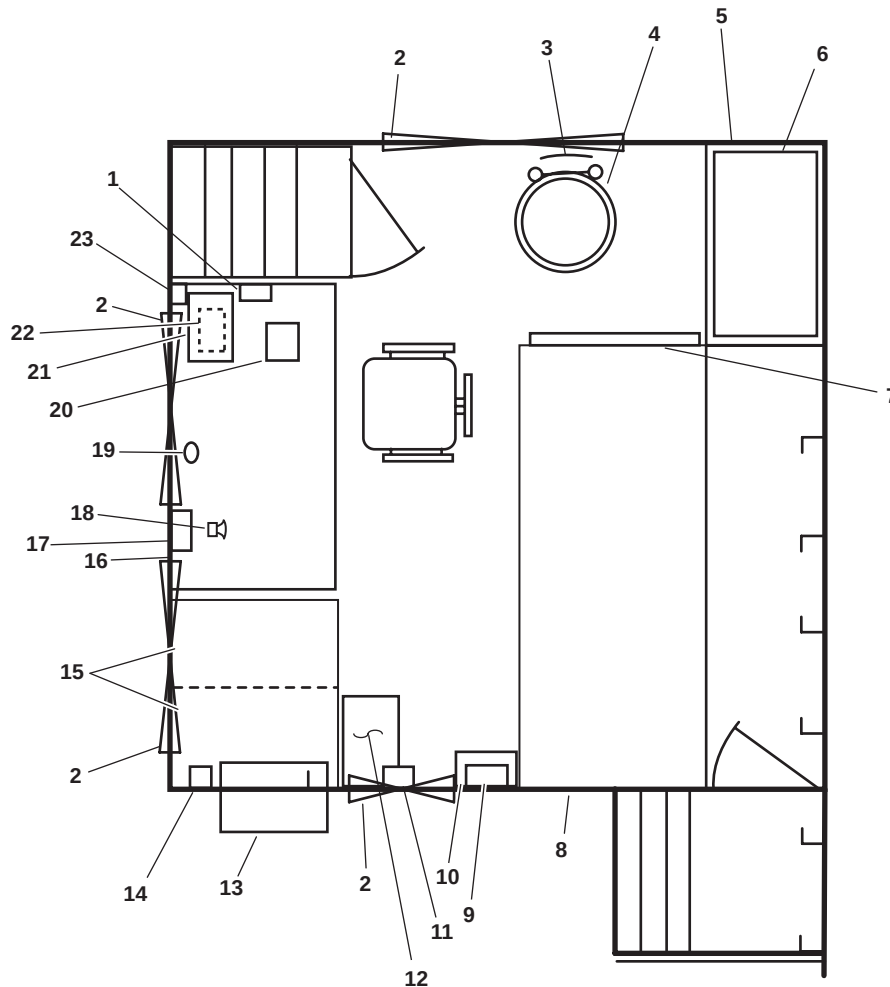


Figure 2. Enclosed Operating Station (EOS)

1. Sound powered telephone (figure 2, item 1). The sound powered telephone provides intraship communications.
2. Window (figure 2, item 2). The window allows observation of the engine room.
3. Vertical ladder (figure 2, item 3). This ladder provides an emergency exit from the EOS to the main deck.
4. Scuttle (escape hatch) (figure 2, item 4). The scuttle provides an emergency exit from the enclosed operating station.
5. Table/book rack (figure 2, item 5). The table/book rack is used for record keeping and storage.
6. Master tank level indicator receiver panel, 7-channel (figure 2, item 6). The master tank level indicator receiver panel has seven meters for remote monitoring of tank levels for the sewage holding tank, oily waste holding tank, potable water tanks, and ballast water tanks.
7. Fire and smoke detection panel, fire alarm bell, and key cabinet (figure 2, item 7). The fire and smoke detection panel provides controls and indicators necessary for controlling and monitoring the fire detection system.
8. Main switchboard (figure 2, item 8). The main switchboard includes facilities for the control of the SSDGs, including paralleling and power distribution (440 Vac).

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9. Ship heel clinometer (figure 2, item 9). The ship's heel clinometer indicates the trim angle of the vessel.
 10. Key box (figure 2, item 10). The key box provides a storage place for various keys.
 11. Remote indicator (alarm) assembly (figure 2, item 11). The remote indicator (alarm) assembly monitors the effluent discharged by the oil water separator. The remote indicator (alarm) assembly emits an audible alarm when the selected alarm value is exceeded.
 12. Special tools locker (figure 2, item 12). The special tools locker is located below the engine room EOS. The special tools locker contains shelves for storage of authorized special tools.
 13. Air conditioner unit (figure 2, item 13). The air conditioner unit provides air conditioning for the EOS.
 14. EOT wrong direction bell (figure 2, item 14). The EOT wrong direction bell indicates that the throttles are not set to desired speed/direction of the pilothouse EOT.
 15. File cabinet (figure 2, item 15). The file cabinet provides storage space for records.
 16. EOS console (figure 2, item 16). The EOS console houses central controls for the main engines and the machinery plant monitoring system.
 17. Ship trim clinometer (figure 2, item 17). The ship's trim clinometer indicates the heel angle of the vessel.
 18. Remote loudspeaker station (figure 2, item 18). The loud speaker station amplifies audio messages to the engine room.
 19. General alarm bell (figure 2, item 19). The general alarm bell sounds the general alarm, indicating various conditions and emergencies.
 20. Intercom (figure 2, item 20). The intercom provides communication from the rest of the vessel.
 21. Tank level indicator receiver panel, 11-channel (figure 2, item 21). This panel has 11 meters for remote monitoring of tank levels for the lube oil storage tank, fuel oil storage tanks, and fuel oil day tanks.
 22. Steering alarm panel (figure 2, item 22). This panel provides remote indicators for the steering gear system.
 23. EOT constant ring bell (figure 2, item 23). The EOT constant ring bell indicates that the pilothouse has changed the desired speed/direction.

ENGINE ROOM, STARBOARD SIDE

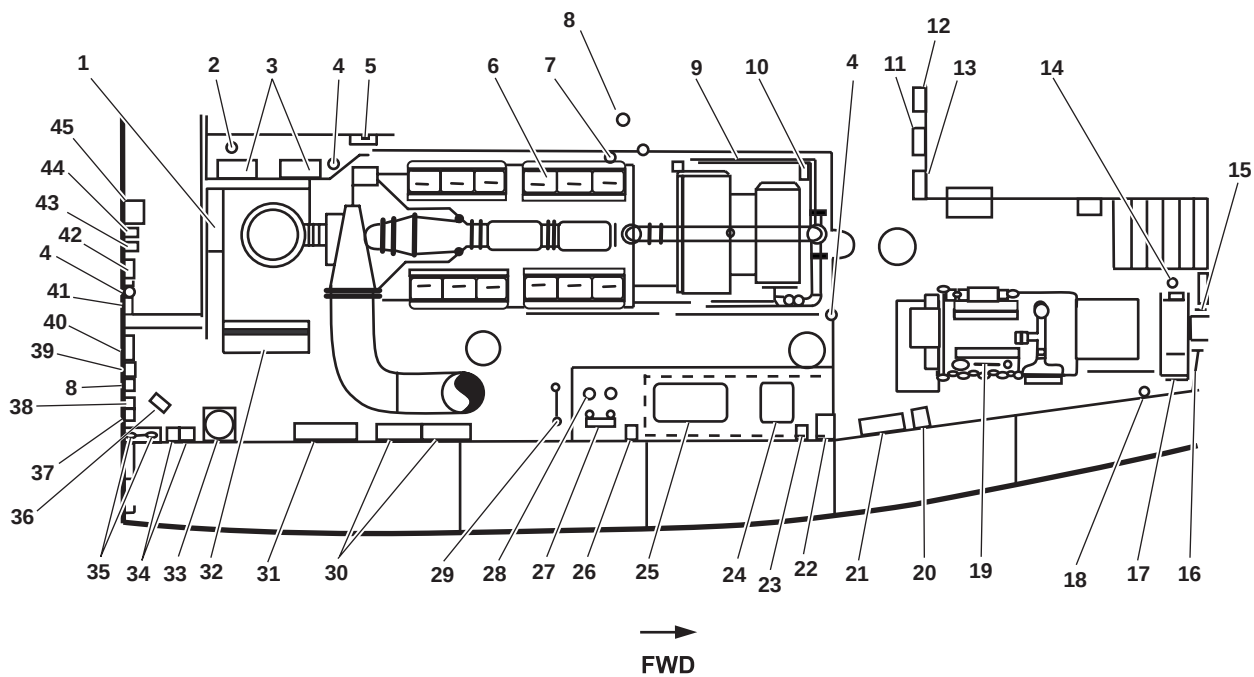


Figure 3. Engine Room, Starboard Side

1. Shaft brake panel 1 (figure 3, item 1). This panel provides control for the starboard shaft brake.
2. Lube oil hand pump (figure 3, item 2). The lube oil hand pump pumps lube oil from the reduction gears to the oily waste system.
3. Reduction gear cooling pumps (figure 3, item 3). The reduction gear cooling pumps are electric pumps that circulate cooling water for the reduction gears.
4. Fire extinguisher (figure 3, item 4). The fire extinguisher is used to extinguish small fires.
5. Fire alarm pull station and reduction gear 1 and 2 fresh water cooling pump pressure gauges (figure 3, item 5). The fire alarm pull station is used to activate the fire alarm. The cooling pump pressure gauges indicate the pressure of the reduction gear coolant.
6. Main engine 1 (figure 3, item 6). Main engine 1 is an air-started, fresh water-cooled main propulsion engine. Main engine 1 rotates clockwise when viewed from the flywheel.
7. General alarm bell (figure 3, item 7). The general alarm bell sounds a general alarm, indicating various conditions and emergencies.
8. General alarm light (figure 3, item 8). The general alarm light illuminates indicating various conditions and emergencies.
9. Engine control panel (figure 3, item 9). The engine control panel houses controls and status displays for the main engines.
10. Engine alarm horn (figure 3, item 10). The engine alarm sounds the engine alarm, indicating various conditions and emergencies.

11. Load center distribution panel (figure 3, item 11). The load center distribution panel supplies 120V to four distribution panels and to the machine shop.
12. Horn and PA speaker with volume control (figure 3, item 12). The horn sounds to alert the crew when the sound powered telephone (in EOS) has an incoming call. The PA speaker with the volume control amplifies messages throughout the engine room.
13. 440V power panel No. 1 (figure 3, item 13). 440V power panel No. 1 provides 440 volt power distribution for engine room equipment.
14. Fire alarm pull station (figure 3, item 14). The fire alarm pull station activates the fire alarm when pulled.
15. Sewage discharge pump 1 motor controller (figure 3, item 15). The sewage discharge pump 1 motor controller turns sewage discharge pump 1 ON and OFF.
16. AMS 1 watertight door hand pump (figure 3, item 16). The AMS 1 watertight door hand pump is used to open and close the AMS 1 sliding watertight door.
17. Sewage discharge pump 1 (figure 3, item 17). Sewage discharge pump 1 is an electrically powered pump that pumps contents of the sewage tank to the sewage shore connection or overboard.
18. Aqueous Film Forming Foam (AFFF) pump suction gauge (figure 3, item 18). This AFFF pump suction gauge indicates the suction pressure of the AFFF pump.
19. Ship's Service Diesel Generator (SSDG) 1 (figure 3, item 19). The SSDG 1 is a battery-started (24 Vdc), fresh water-cooled, diesel engine-driven service generator providing electric power to the main switchboard.
20. Oily waste storage tank level indicator (figure 3, item 20). The oily waste storage tank level indicator displays the amount of oily waste present in the tank.
21. 120V emergency distribution panel No. 1 (figure 3, item 21). The 120 volt emergency distribution panel no. 1 provides emergency power distribution for selected equipment.
22. Battery chargers (figure 3, item 22). Two battery chargers maintain the charge of two battery banks. One charger is for SSDG 1, the other for the machinery plant monitoring system.
23. Oil Content Monitor (OCM) (figure 3, item 23). The OCM monitors the oil content of the effluent discharge from the oil water separator and prevents overboard discharge of contaminated effluent.
24. Battery banks (figure 3, item 24). The upper battery bank provides battery power to start SSDG 1 and the lower battery bank provides power for the machinery plant monitoring system and engine control.
25. Oil water separator (figure 3, item 25). The oil water separator separates oil from water and discharges the water overboard sending only the separated oil back to the oily waste tank.
26. Oily bilge and oil water separator pressure gauges (figure 3, item 26). The oily bilge and oil water separator pressure gauges indicate the amount of pressure within the oily bilge and oil water separators.
27. Oily bilge pump (figure 3, item 27). The oily bilge pump is an air powered pump for removing oily water from bilges and transferring contents of the oily waste drain tank and the oily waste storage tank to the shore connection.
28. Oily bilge strainer (figure 3, item 28). The oily bilge strainer protects the oily bilge pump by removing sediment and debris from the bilge water.
29. Vertical ladder (figure 3, item 29). The vertical ladder provides access to the starboard day tank and the starboard lifeboat station on the 02 level.

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30. Fuel oil tank level indicators (figure 3, item 30). The fuel oil tank level indicators display the amount of fuel oil in the various fuel oil storage tanks on the vessel.
 31. Fuel oil manifold (figure 3, item 31). The fuel oil manifold provides centralized control for the fuel oil piping system.
 32. Reduction gear 1 (figure 3, item 32). Reduction gear 1 transfers power from main engine and provides directional control to the propeller shaft.
 33. Fuel filter/water separator (figure 3, item 33). The fuel filter/water separator is used to remove water and solids from the fuel oil.
 34. Fuel oil transfer pump 1 and 2 motor controllers (figure 3, item 34). The fuel oil transfer pump 1 and 2 motor controllers control the power to the fuel oil transfer pumps.
 35. Fuel oil transfer pumps (figure 3, item 35). The fuel oil transfer pumps are used to transfer fuel within the fuel oil transfer piping system.
 36. Space heater (figure 3, item 36). The space heater provides heated air for the engine room.
 37. Fuel oil transfer pump pressure gauges (figure 3, item 37). The fuel oil transfer pump pressure gauges indicate the fuel oil pressure being discharged from the fuel oil transfer pump.
 38. Fuel oil day tank high level alarm (figure 3, item 38). The fuel oil day tank high level alarm provides a visible and audible alarm when the transfer of fuel oil to the PORT or STARBOARD fuel oil day tanks have exceeded fill levels.
 39. FM-200 relay panel box (figure 3, item 39). The FM-200 relay panel box houses the equipment shutdown relays. These relays shut down the engine room exhaust fans, the engine room supply fans, both SSDGs, the bow thruster engine, the AMS 1 supply fan, the fuel oil transfer pumps, and the pump drive engine.
 40. Reduction gear 1 cooling water pump motor controller (figure 3, item 40). The reduction gear 1 cooling water pump motor controller controls the power to reduction gear water pump 1.
 41. Reduction gear 2 cooling water pump motor controller (figure 3, item 41). The reduction gear 2 cooling water pump motor controller controls the power to reduction gear water pump 2.
 42. Reefer refrigerant piping valve system (figure 3, item 42). The reefer refrigerant piping valve system is provided to operate the chill box and walk-in freezer's refrigerating system.
 43. Engine room exhaust fan 1 and engine room supply fan 1 motor controllers (figure 3, item 43). The engine room exhaust fan 1 and engine room supply fan 1 motor controllers control the ventilation fans for the starboard side of the engine room.
 44. Engine room exhaust fan 2 and engine room supply fan 2 motor controllers (figure 3, item 44). The engine room exhaust fan 2 and engine room supply fan 2 motor controllers control the ventilation fans for the port side of the engine room.
 45. AMS 2 watertight door hand pump (figure 3, item 45). The AMS 2 watertight door hand pump is used to OPEN and CLOSE the AMS 2 sliding watertight door.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
AMS 1 AND BOW THRUSTER COMPARTMENT**

AMS 1 AND BOW THRUSTER COMPARTMENT

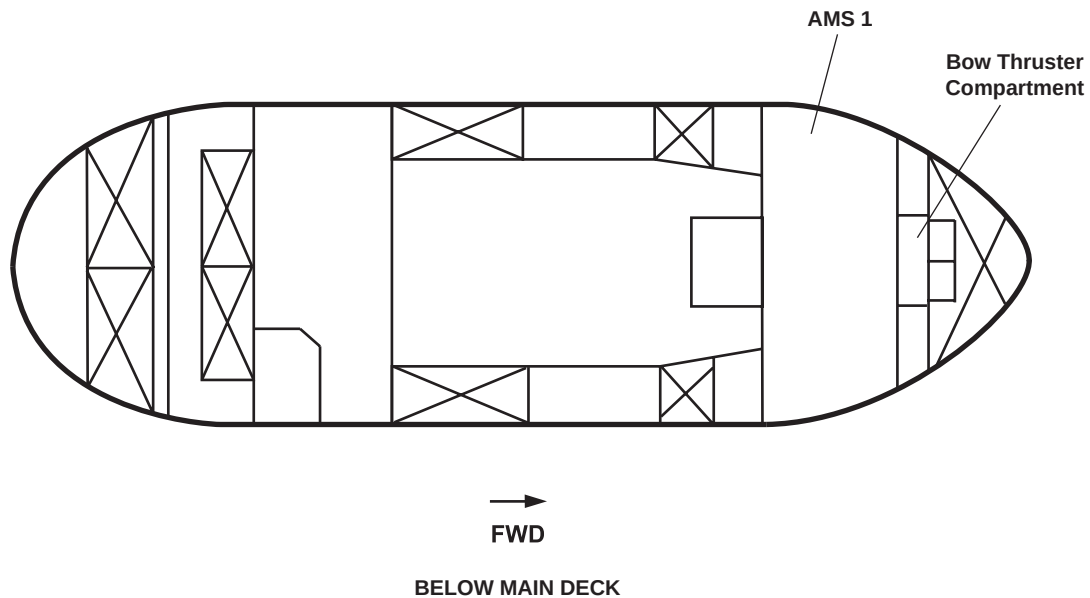


Figure 1. AMS 1 and Bow Thruster Compartment

1. AMS 1 houses the starting air receivers, the bow thruster engine, the pump drive engine, towing machine hydraulic reservoir, Marine Sanitation Device (MSD), and air compressors. Details of this space are contained in figure 2.
2. The bow thruster compartment houses a lube oil reservoir, a general alarm bell, an access hatch, and the bow thruster unit. Details of this space are contained in figure 3.

AMS 1

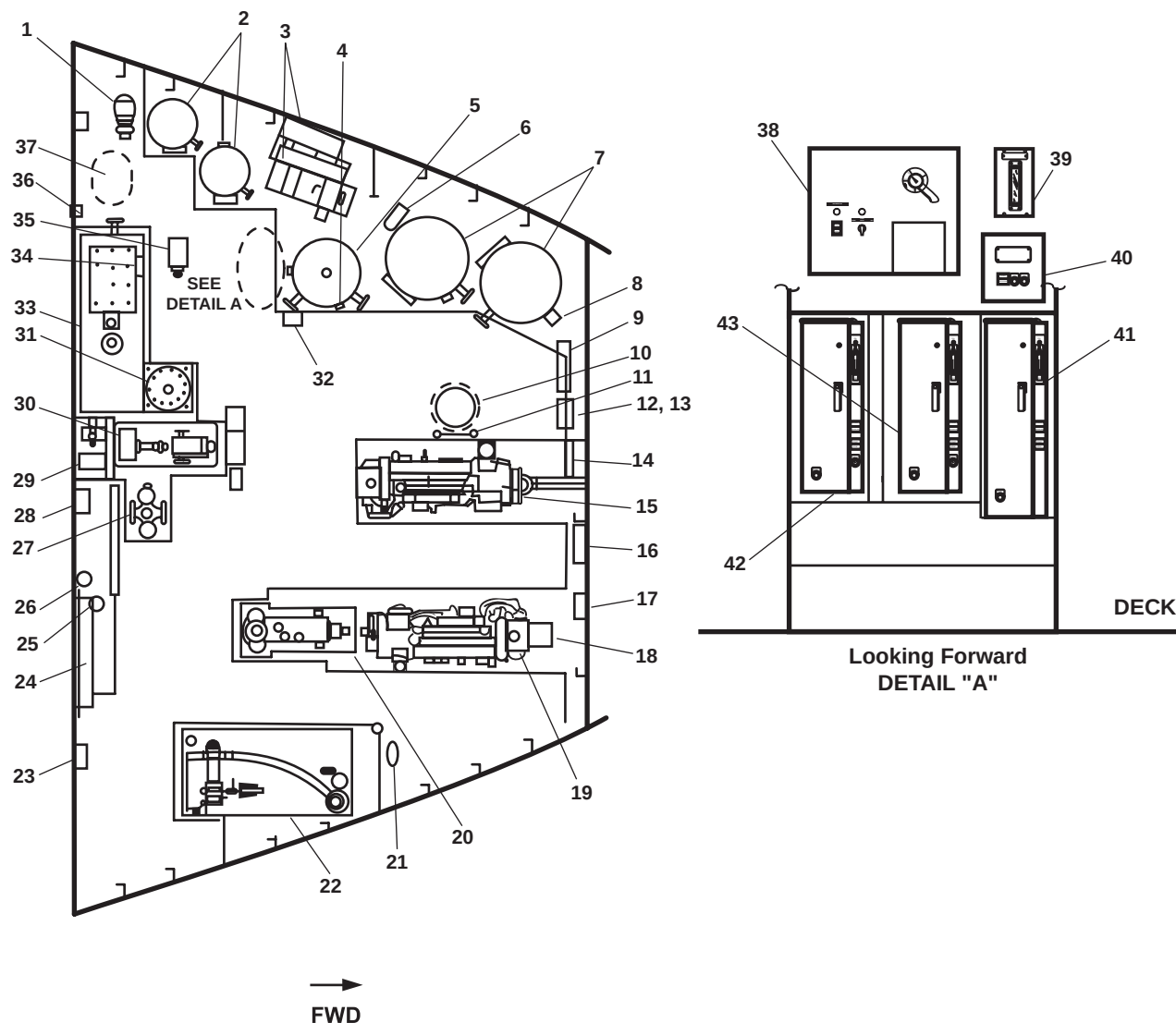


Figure 2. AMS 1

1. Hot water recirculating pump (figure 2, item 1). The hot water recirculating pump provides continuous circulation of hot water in the hot potable water piping system.
2. Hot water heaters (figure 2, item 2). The two hot water heaters provide potable water, heated to the set point temperature, for the hot potable water piping system.
3. Air compressors (figure 2, item 3). The air compressors provide compressed air to the air receivers.
4. Ship's service air pressure gauge (figure 2, item 4). The ship's service air pressure gauge measures air pressure in the ship's service air receiver.
5. Ship's service air receiver (figure 2, item 5). The ship's service air receiver provides storage for the ship's service air.

6. Air compressor 1 and 2 discharge pressure and ship's service air pressure gauges (figure 2, item 6). The air compressor 1 and 2 discharge gauges measure the level of pressure entering the starting air receivers. The ship's service air pressure gauge measures the pressure in the ship's service air receiver.
7. Starting air receiver (figure 2, item 7). The starting air receiver provides storage for diesel engine starting air.
8. Starting air receiver pressure gauge (figure 2, item 8). The starting air pressure gauge measures the air pressure available to the engines' starting motors.
9. 440V power panel No. 4 (figure 2, item 9). This power panel provides 440 volt power distribution for the air compressors 1 and 2, the MSD discharge pump and blower, the hot potable water recirculating pump, the AMS 1 supply fan and the AMS 1 unit heater.
10. Scuttle (escape hatch) (figure 2, item 10). The scuttle provides an emergency escape from AMS 1.
11. Vertical ladder (figure 2, item 11). The vertical ladder leads to the main deck.
12. AMS 1 supply fan motor controller (figure 2, item 12). This controller controls the operation of the AMS 1 supply fan. This controller also permits the operator to select FAST, SLOW, and STOP.
13. BOW THRUSTER BRAKE PANEL (figure 2, item 13). This panel provides local manual control for the bow thruster shaft brake.
14. Space heater (above) (figure 2, item 14). The heater provides heated air for AMS 1.
15. Bow thruster engine (figure 2, item 15). The bow thruster engine drives the bow thruster components.
16. Fire station 3 (figure 2, item 16). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
17. Pump drive engine and bow thruster engine starting air pressure gauges and fire main pressure gauge (figure 2, item 17). The starting air pressure gauges measure the level of air pressure available to the pump drive and the bow thruster starters. The fire main pressure gauge measures the level of pressure available from the firefighting pump.
18. Hydraulic towing machine (figure 2, item 18). The hydraulic oil pump provides pressurized hydraulic oil to power the towing machine, and can be aligned to power the central hydraulic system. It is driven by the pump drive engine.
19. Pump drive engine (figure 2, item 19). The pump drive engine drives the hydraulic towing machine (figure 2, item 17) and the firefighting pump (figure 2, item 20).
20. Firefighting pump (figure 2, item 20). The firefighting pump provides pressurized raw water to the fire monitors located on the pilothouse top. The firefighting pump can also pressurize the fire main.
21. General alarm bell (above) (figure 2, item 21). The general alarm bell sounds indicating various conditions and emergencies.
22. Towing machine hydraulic reservoir (figure 2, item 22). The reservoir provides storage for the towing machine hydraulic system's hydraulic oil.
23. AMS 1 watertight door hand pump (figure 2, item 23). The watertight door hand pump is used to OPEN and CLOSE AMS 1 watertight door.
24. Watertight door (figure 2, item 24). The watertight door provides compartmentalization in emergency situations.
25. General alarm rotating beacon (figure 2, item 25). The general alarm rotating beacon provides a revolving light that indicates a general alarm is in effect.

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26. FM-200 alarm (figure 2, item 26). The FM-200 alarm indicates the FM-200 agent is being released into the engine room and AMS 1.
 27. Duplex strainer (figure 2, item 27). The duplex strainer removes sediment and other large solids from the raw water used to cool the bow thruster engine (figure 2, item 15) and pump drive engine (figure 2, item 19).
 28. Raw water strainer and Aqueous Film Forming Foam (AFFF) proportioner pressure gauges (figure 2, item 28). The raw water strainer differential pressure gauge measures the differential pressure across the raw water strainer. Excessive differential pressure indicates a clogged strainer. The AFFF proportioner pressure gauge indicates the pressure at the AFFF proportioner.
 29. MSD blower (figure 2, item 29). This blower aerates the sewage in the MSD to permit decomposition.
 30. AFFF pump (figure 2, item 30). The AFFF pump supplies AFFF concentrate from the AFFF storage tank to the proportioner.
 31. MSD wet well (figure 2, item 31). The MSD wet well is where the chlorine from the table chlorinator disinfects the effluent discharged from the media tank.
 32. Sound powered telephone and storage box (figure 2, item 32). The sound powered telephone provides intraship communication.
 33. MSD media tank (figure 2, item 33). The MSD media tank is where sewage is biologically decomposed.
 34. MSD discharge pump pressure gauge (figure 2, item 34). This gauge measures the discharge pump pressure.
 35. MSD discharge pump (figure 2, item 35). The MSD discharge pump discharges effluent from the wet well overboard after treatment.
 36. Hot water recirculating pump pressure differential gauge (figure 2, item 36). This gauge indicates the pressure differential across the hot water recirculating pump.
 37. Sewage holding tank (figure 2, item 37). The sewage holding tank (located below tank top level) holds the processed or unprocessed sewage until it is pumped through the shore connection.
 38. MSD motor controller (figure 2, item 38). The MSD motor controller provides overload protection and control for the MSD discharge pump and blower.
 39. Sewage holding tank level indicator (figure 2, item 39). This tank level indicator indicates the level of matter present in the sewage holding tank.
 40. Hot potable water recirculating pump motor controller (figure 2, item 40). This controller turns the hot potable water recirculating pump ON and OFF.
 41. AFFF pump motor controller (figure 2, item 41). This controller provides overload protection and control for the AFFF pump.
 42. Air compressor 2 motor controller (figure 2, item 42). This controller allows the operator to turn the air compressor 2 ON and OFF and to select AUTOMATIC operation.
 43. Air compressor 1 motor controller (figure 2, item 43). This controller allows the operator to turn the air compressor 1 ON and OFF and to select AUTOMATIC operation situations.

BOW THRUSTER COMPARTMENT

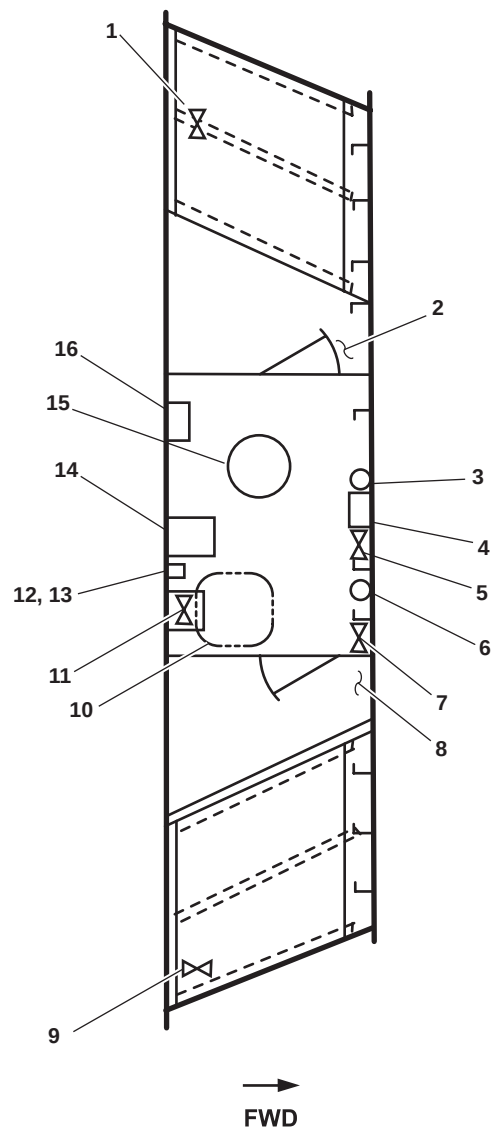


Figure 3. Bow Thruster Compartment

1. OVBD. DISCH. BILGE EDUC valve BB-9 (figure 3, item 1). Valve BB-9 in the OPEN position allows bilge contents to be discharged overboard using eductors.
2. Port stowage locker and shelves (figure 3, item 2). The stowage locker and shelves provide storage space.
3. General alarm bell (figure 3, item 3). The general alarm bell signals various emergency conditions on the vessel.
4. Space heater (figure 3, item 4). The space heater provides heat for the bow thruster compartment.
5. GS-44, BILGE EDUC. shutoff valve (figure 3, item 5). This valve secures the raw water flow from the general service system to the eductors.

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6. Eductor pressure gauge (figure 3, item 6). The eductor pressure gauge indicates the general service system pressure available to the eductor.
 7. Shutoff valve (figure 3, item 7). This valve secures the general service system pressure to the eductor pressure gauge.
 8. Starboard stowage locker and shelves (figure 3, item 8). The stowage locker and shelves provide storage space.
 9. Shutoff valve PW-19, C.W. TO W.C. (figure 3, item 9). This valve secures the cold potable water flow to the water closet.
 10. Hatch (figure 3, item 10). The hatch provides entrance/exit to the bow thruster compartment from the boatswain's locker space.
 11. Vertical ladder and ST-47 upper void FR 54-57 sounding valve (at base of ladder) (figure 3, item 11). The vertical ladder leads to boatswain's locker. The ST-47 upper void FR 54-57 sounding valve is used to sound the void below the bow thruster compartment.
 12. Bow thruster lube oil reservoir (figure 3, item 12). The 10.5 gallons (39.8 liters) lube oil reservoir provides lube oil for the bow thruster system.
 13. Shutoff valve (figure 3, item 13). This valve secures the flow of lube oil from the bow thruster lube oil reservoir to the bow thruster.
 14. Bow thruster (figure 3, item 14). The bow thruster receives power from the bow thruster engine and reversing gear and transmits that power to a propeller that provides athwartships thrust to the vessel's bow during close maneuvering operations.
 15. Flush man hole access (figure 3, item 15). The flush manhole access provides access to the void beneath the bow thruster compartment.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
STEERING GEAR COMPARTMENT, TOWING GEAR LOCKER, AND AMS 2**

BELOW MAIN DECK, AFT OF ENGINE ROOM

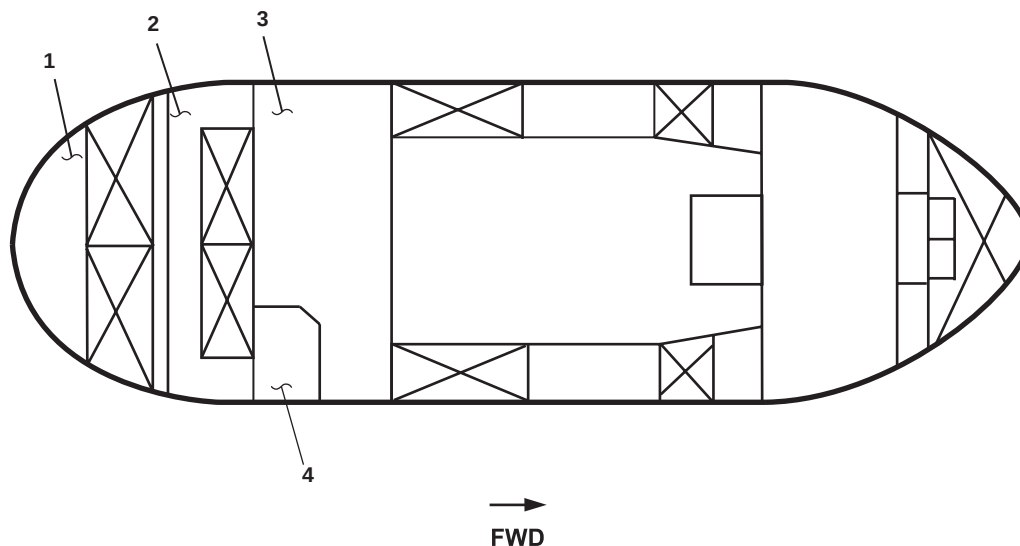


Figure 1. Below Main Deck, Aft of Engine Room

1. Steering gear compartment (figure 1, item 1). This space houses all the equipment necessary to steer the vessel. Details of this space are contained in figure 2.
2. Towing gear locker (figure 1, item 2). This space provides stowage for the vessel's towing gear and equipment. Details of this space are contained in figure 3.
3. AMS 2 (figure 1, item 3). AMS 2 houses the various components and equipment. Details of this space are contained in figure 4.
4. Workshop (figure 1, item 4). The workshop provides workspace and equipment necessary to make on-board repairs. The details of this space are contained in figure 5.

STEERING GEAR COMPARTMENT

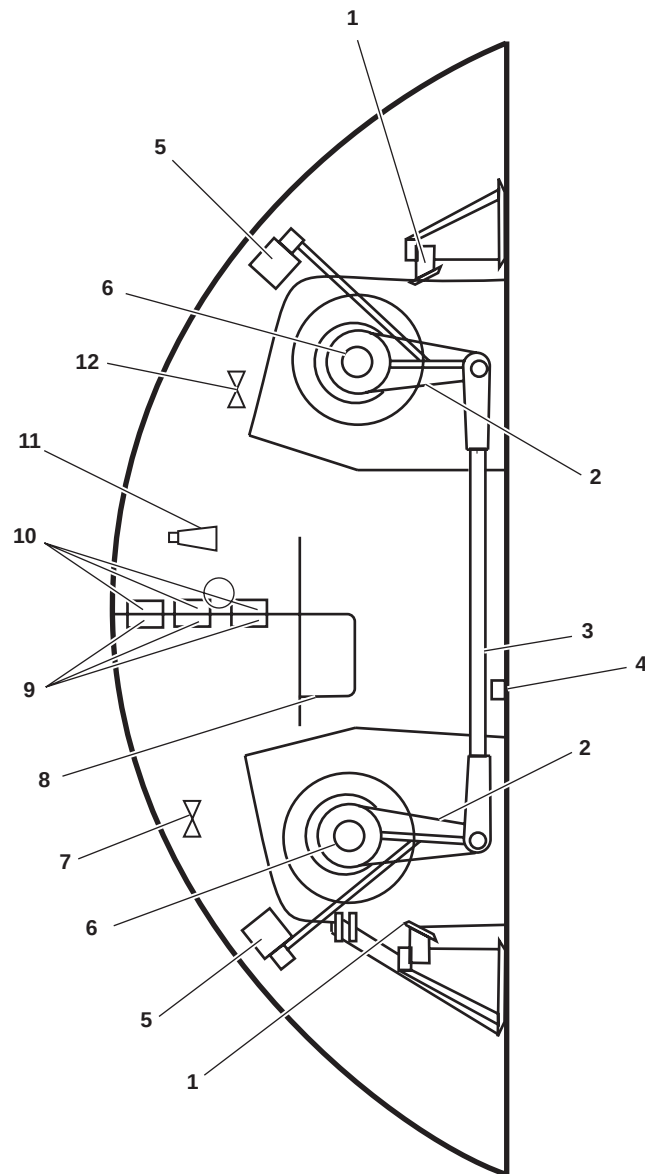


Figure 2. Steering Gear Compartment

1. Rudder stop (figure 2, item 1). The rudder stop limits the swing of the rudder to a maximum of 35 degrees to port or starboard.
2. Tiller arm (figure 2, item 2). The tiller arm connects the rudder post to the tie bar.
3. Tie bar (figure 2, item 3). The tie bar connects the tillers, providing unified tiller movement.
4. Raw water eductor gauge (figure 2, item 4). The raw water eductor gauge indicates the pressure available at the eductor.
5. Steering system rudder feedback unit (figure 2, item 5). The steering system rudder feedback unit displays the status and angle of the rudder.

6. Rudderpost (figure 2, item 6). The rudderpost is the shaft that allows the rudder to pivot 35 degrees to port or starboard.
7. Overboard discharge bilge eductor valve BB-8 (figure 2, item 7). This valve, when OPEN, allows water to be removed from the bilge of the steering compartment to the eductor and overboard.
8. Raised access hatch (figure 2, item 8). The raised access hatch provides entrance/exit to the steering gear compartment.
9. Starboard tow pin control valves (figure 2, item 9). These solenoid valves control the raising and lowering of the starboard tow pins.
10. Port tow pin control valves (figure 2, item 10). These solenoid valves control the raising and lowering of the port tow pins.
11. Eductor (figure 2, item 11). The eductor is part of the bilge ballast general service system. When placed online it can rapidly remove water from a compartment.
12. BB-11, OVBD. DISCH. BILGE EDUC. (figure 2, item 12). This valve secures the overboard flow from the eductor.

TOWING GEAR LOCKER

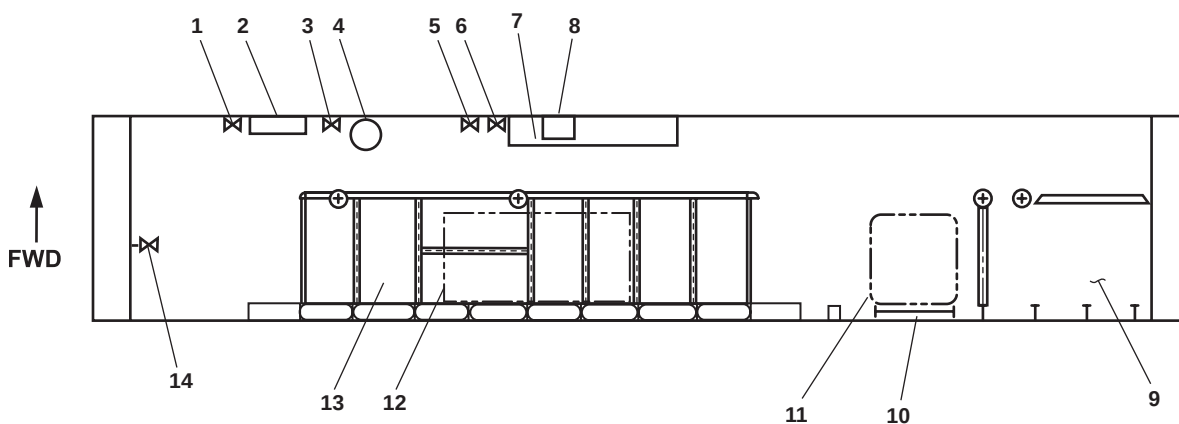


Figure 3. Towing Gear Locker

1. PW-10, POT. WTR. TK. PORT. DR (figure 3, item 1). This valve permits draining of the port potable water tank into the bilge.
2. Eductor valves (figure 3, item 2). The eductor valves control the operation of the eductor for this space.
3. PW-11, POT. WTR. TK. STBD. DR. (figure 3, item 3). This shutoff valve permits draining of the starboard potable water tank into the bilge.
4. General alarm bell (figure 3, item 4). The alarm bell signals various emergency conditions on the vessel.
5. ST-4, BLST TK 2P SNDG. (figure 3, item 5). This valve permits sounding of the port ballast tank.
6. ST-3, BLST TK 2P SNDG. (figure 3, item 6). This valve permits sounding of the starboard ballast tank.
7. Shelving (figure 3, item 7). Shelving provides stowage for towing gear and equipment.
8. Space heater (figure 3, item 8). The space heater provides heat to the towing gear locker.

9. Mooring line stowage bin (figure 3, item 9). The mooring line stowage bin provides storage for mooring lines.
10. Vertical ladder (figure 3, item 10). This ladder provides access to the main deck.
11. Raised access hatch (figure 3, item 11). The raised access hatch provides access to the main deck for personnel.
12. Raised access hatch (figure 3, item 12). The raised access hatch provides access to the towing gear stowage bin for stowing and retrieving gear.
13. Towing gear stowage bin (figure 3, item 13). The towing gear stowage bin provides storage for towing gear and the shore power cable.
14. BB-11, OVBD, DISCH, BILGE EDUC. (figure 3, item 14). This valve secures the overboard flow from the eductor.

AMS 2

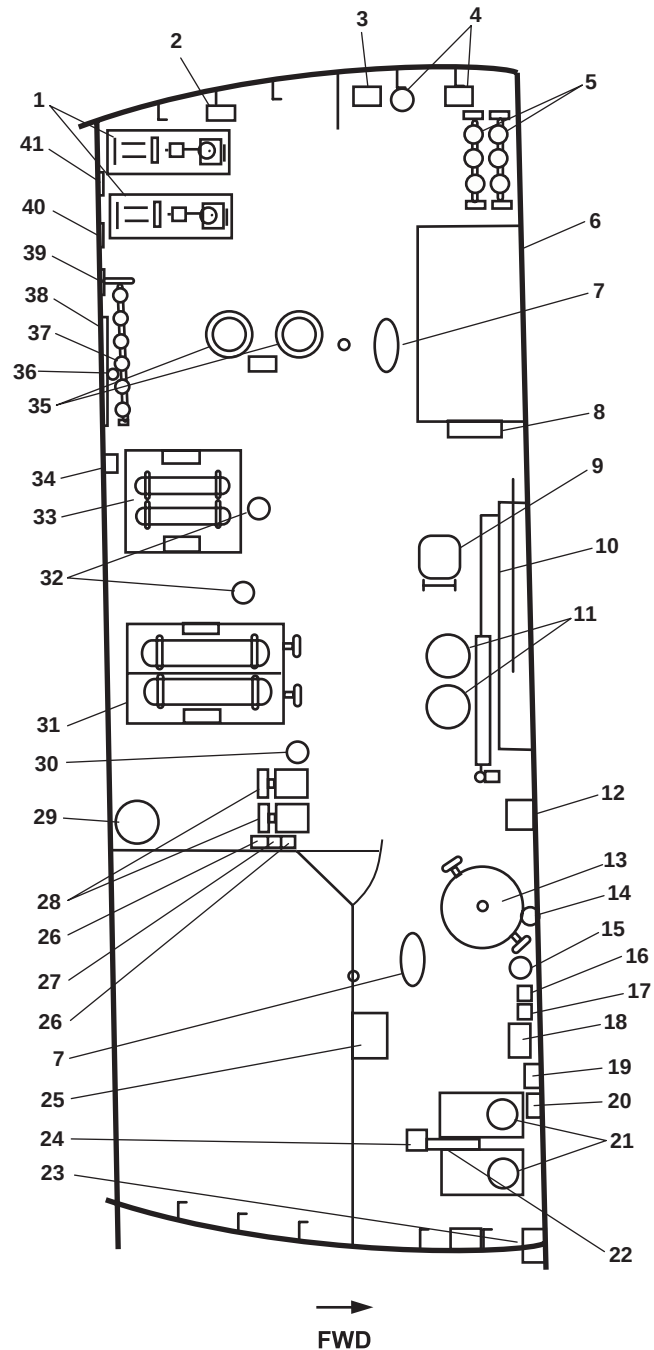


Figure 4. AMS 2

1. Bilge and ballast pumps (figure 4, item 1). The bilge and ballast pumps are electric motor-driven pumps used to pump the bilges and fill or drain the ballast tanks.
2. Bilge and ballast pump pressure gauges (figure 4, item 2). These pressure gauges indicate the discharge pressure of the bilge and ballast pumps.
3. Ballast tank, tank level indicators (figure 4, item 3). These indicators display the fluid level in the ballast tanks.

4. Brominator system (figure 4, item 4). The brominator introduces bromine into the potable water tanks.
5. Ballast manifold (figure 4, item 5). This duplex manifold provides centralized control of the fluid level within the ballast tanks.
6. Reverse Osmosis Water Purification Units (ROWPU) (figure 4, item 6). Two ROWPUs convert raw water to fresh water at a rate of 33 to 99 gal/hr (125.6 to 250 L/hr). ROWPU 1 converts raw water to fresh water at a rate of 66 gal/hr (249.8 L/hr). ROWPU 2 converts raw water to fresh water at a rate of 33 gal/hr (125.6 L/hr).
7. Access hatch for shaft alleys (figure 4, item 7). The access hatch is a hinged deck plate that provides access to the shaft alleys.
8. 440V power panel No. 5 (figure 4, item 8). This panel provides 440 volts power distribution for AMS 2 equipment.
9. Scuttle (escape hatch) and ladder (figure 4, item 9). The scuttle and ladder provide an emergency escape from AMS 2.
10. Hydraulic sliding watertight door (figure 4, item 10). This door is a hydraulically powered sliding watertight door used to prevent flooding from one compartment to another.
11. Two 600 lb (223.9 kg) FM-200 cylinders (figure 4, item 11). These FM-200 cylinders store the FM-200 extinguishing agent used in the engine room and AMS 1 overhead fire suppression system.
12. Watertight door hydraulic hand pump (figure 4, item 12). This hand pump is used to open and close the engine room sliding watertight door.
13. Potable water hydropneumatic tank (figure 4, item 13). The potable water hydropneumatic tank provides water pressure to the potable water system.
14. FM-200 delay bypass cylinder (figure 4, item 14). When CLOSED, the FM-200 bypass cylinder provides a 60-second delay before the FM-200 extinguishing agent is released. When OPEN, the FM-200 bypass cylinder redirects CO₂ pressure to activate the FM-200 system immediately.
15. CO₂ cylinder (figure 4, item 15). CO₂ cylinders store the CO₂ gas that actuates the FM-200 system.
16. Pressure switch PS-1 (figure 4, item 16). Pressure switch PS-1 shuts down the ventilation fans, SSDG's, bow thruster engine and bow-driven engine, and activates the FM-200 amber strobes in the engine room, AMS 1 and AMS 2. The FM-200 alarm bell on the exterior bulkhead of the engine room vestibule sounds when the FM-200 fire suppressant system is activated.
17. Pressure switch PS-1A (figure 4, item 17). Pressure switch PS-1A activates the FM-200 electric horns in AMS 1 and the engine room when the FM-200 fire suppressant system is activated.
18. Gyro compass repeater (figure 4, item 18). The gyro compass repeater aids steering operations during steering emergencies by displaying the vessel's heading at the emergency steering station. The gyro compass repeater is fed from the vessel's gyro compass located in the pilothouse.
19. Steering gear emergency hand pump (figure 4, item 19). This hand pump provides hydraulic pressure and directional control to the steering gear in an emergency.
20. Rudder angle indicator (figure 4, item 20). The rudder angle indicator displays the position angle of the rudder.
21. Steering hydraulic power pack (figure 4, item 21). These two power packs, each with a motor and an onboard hydraulic pump, provide hydraulic pressure to the steering gear.
22. Steering hydraulic power pack motor controllers (figure 4, item 22). These motor controllers provide electrical protection and control to the steering power pack electric motors.

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23. Workshop exhaust fan (figure 4, item 23). The workshop exhaust fan exhausts air from the workshop to the weatherdeck.
 24. Sound powered telephone (figure 4, item 24). The sound powered telephone provides intraship communication.
 25. Fire station 1 (figure 4, item 25). The firefighting station uses raw water and is equipped with 50 feet (15.24 m) of 1-1/2 inch hose and an all-purpose nozzle.
 26. Potable water pump motor controllers (figure 4, item 26). These controllers provide control and circuit protection for potable water pumps electric motors.
 27. Potable water tank level indicators and potable water pump gauges (figure 4, item 27). The potable water tank level indicators display the level of potable water in the storage tanks. The potable water pump gauges display water pumps 1 and 2 discharge pressures.
 28. Potable water pumps (figure 4, item 28). The potable water pumps supply potable water to the potable water hydropneumatic tank.
 29. 200 lb (75 kg) FM-200 cylinder (figure 4, item 29). This FM-200 cylinder provides FM-200 extinguishing agent to the bilge in the engine room.
 30. General alarm bell (figure 4, item 30). The alarm bell sounds an alarm, indicating various conditions and emergencies.
 31. Air conditioning condensing unit (figure 4, item 31). The air conditioning condensing unit is used with the HVAC system.
 32. General alarm rotating beacon and FM-200 rotating beacon (figure 4, item 32). The general alarm rotating beacon indicates a general alarm is in effect. The FM-200 revolving yellow light indicates the FM-200 system will be activated within 60 seconds.
 33. Refrigeration condensing unit (figure 4, item 33). The refrigeration condensing unit is used with the fan coil units located in the walk-in freezer and chill box located aft of the galley.
 34. Stern tube seal pressure gauges (figure 4, item 34). These gauges indicate the air pressure applied to the stern tube seal.
 35. Fire and general service pumps (figure 4, item 35). These two pumps provide pressurized raw water to the fire main, general service system, and the washdown countermeasure system.
 36. Fire and general service pump pressure gauges (figure 4, item 36). These gauges display the discharge pressure of the fire and general service pumps.
 37. Bilge manifold (figure 4, item 37). This simplex manifold provides centralized control for bilge pumping operations.
 38. Fire and general service pump 1 motor controller (figure 4, item 38). This motor controller controls the operation of the fire and general service pump 1.
 39. Fire and general service pump 2 motor controller (figure 4, item 39). This controller controls the operation of the fire and general service pump 2.
 40. Bilge and ballast pump 1 motor controller (figure 4, item 40). This controller controls the operation of the bilge and ballast pump 1.
 41. Bilge and ballast pump 2 motor controller (figure 4, item 41). This controller controls the operation of the bilge and ballast service pump 2.

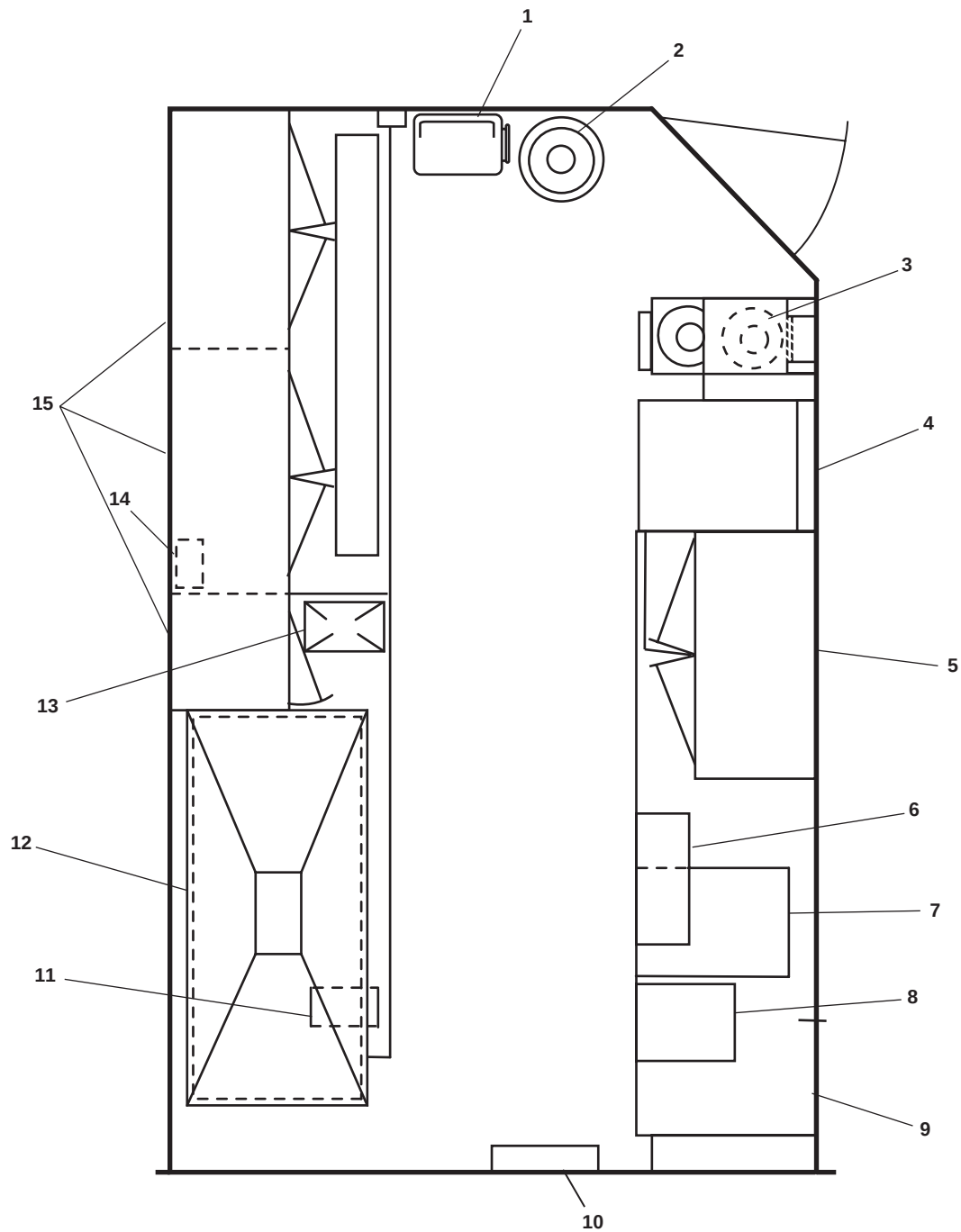
WORKSHOP

Figure 5. Workshop

1. Hand truck (figure 5, item 1). The hand truck is used to transport heavy items.
2. Waste can (figure 5, item 2). The waste can provides storage for non-toxic waste.
3. Cutting torch outfit (figure 5, item 3). The cutting torch outfit is used for metal cutting and shaping.

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4. Wall locker (figure 5, item 4). The wall locker provides storage for tools and equipment.
 5. Cabinet (over) (figure 5, item 5). The cabinet provides storage space.
 6. Bench grinder (figure 5, item 6). The grinder is used for tool sharpening and various equipment repairs.
 7. Arc welder (below) (figure 5, item 7). The arc welder is used for repair of the vessel's equipment.
 8. Drill press (figure 5, item 8). The drill press is used for drilling holes for repair of the vessel's equipment.
 9. Workbench (figure 5, item 9). The workbench is used as a work area for repair of defective units and components.
 10. Space heater (figure 5, item 10). This heater provides heat for the workshop and AMS 2 compartment.
 11. Pipe vise (figure 5, item 11). The hinged jaw pipe vise is used for holding equipment or components during repairs.
 12. Vent hood (figure 5, item 12). The vent hood and exhaust fan remove air and fumes from the workshop area during welding operations.
 13. Bench vise (figure 5, item 13). The bench vise is used for holding equipment or components during repairs.
 14. Vent hood exhaust fan controller (figure 5, item 14). The vent hood exhaust fan controller turns the exhaust fan ON and OFF.
 15. Cabinet (figure 5, item 15). The cabinet provides storage for tools and equipment.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS
SHAFT ALLEYS**

STARBOARD SHAFT ALLEY

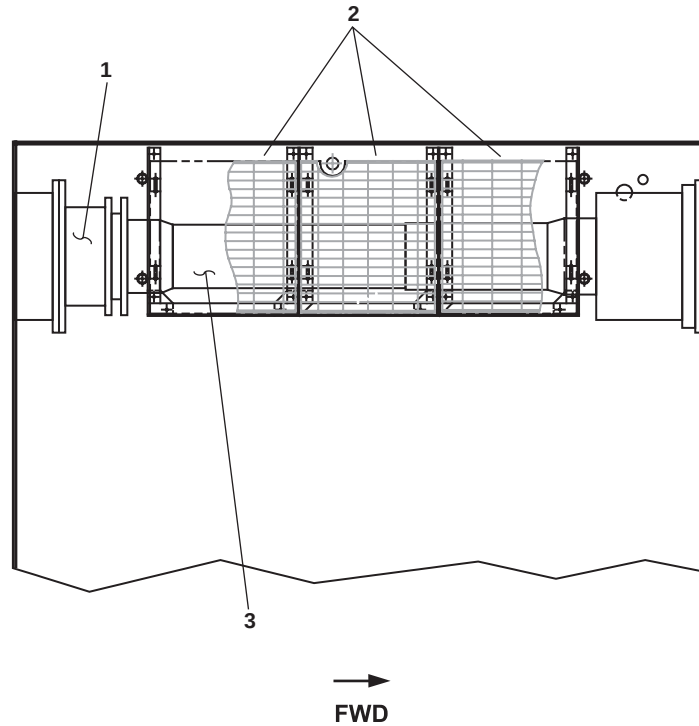


Figure 1. Starboard Shaft Alley

1. Starboard shaft seal (figure 1, item 1). The starboard shaft seal prevents raw water leakage from around the propeller shaft.
2. Grating (figure 1, item 2). Grating is provided to permit personnel access into the starboard shaft alley while the vessel is underway.
3. Starboard propeller shaft (figure 1, item 3). The starboard propeller shaft transmits torque between the reduction gear and the propeller.

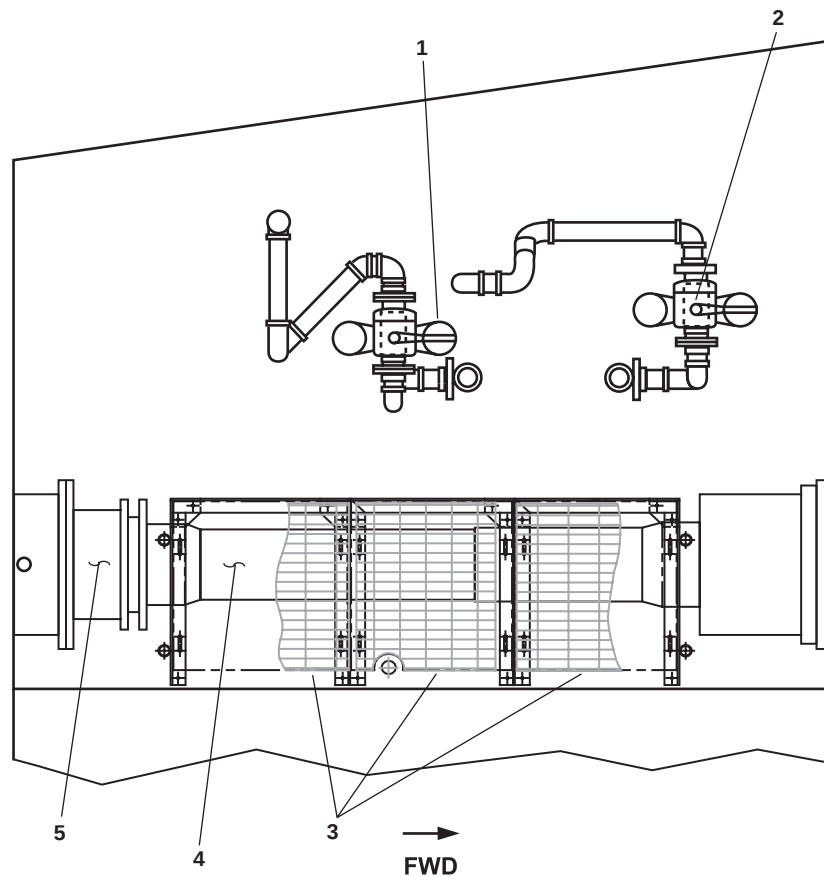


Figure 2. Port Shaft Alley

PORT SHAFT ALLEY

1. Aft duplex strainer (figure 2, item 1). The aft duplex strainer removes large particulates from the raw water suction to fire and general service pump 2.
2. Forward duplex strainer (figure 2, item 2). The forward duplex strainer removes large particulates from the raw water suction to fire and general service pump 1.
3. Grating (figure 2, item 3). Grating is provided to permit personnel access into the port shaft alley while the vessel is underway.
4. Port propeller shaft (figure 2, item 4). The port propeller shaft transmits torque between the reduction gear and the propeller.
5. Port shaft seal (figure 1, item 1). The port shaft seal prevents raw water leakage from around the propeller shaft.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS:
TANKS**

TANK LOCATIONS

Refer to figures 1 and 2 for fluid tank locations.

TANK CAPACITIES

Tables 1 and 2 describe the various fluid tanks incorporated into the Large Tug's (LT) hull structure. The Tank column contains the name of the tank. The Item Number column directs the crewmember to the appropriate tank location as shown in figures 1 and 2. The capacity column list each tank's capacity by volume.

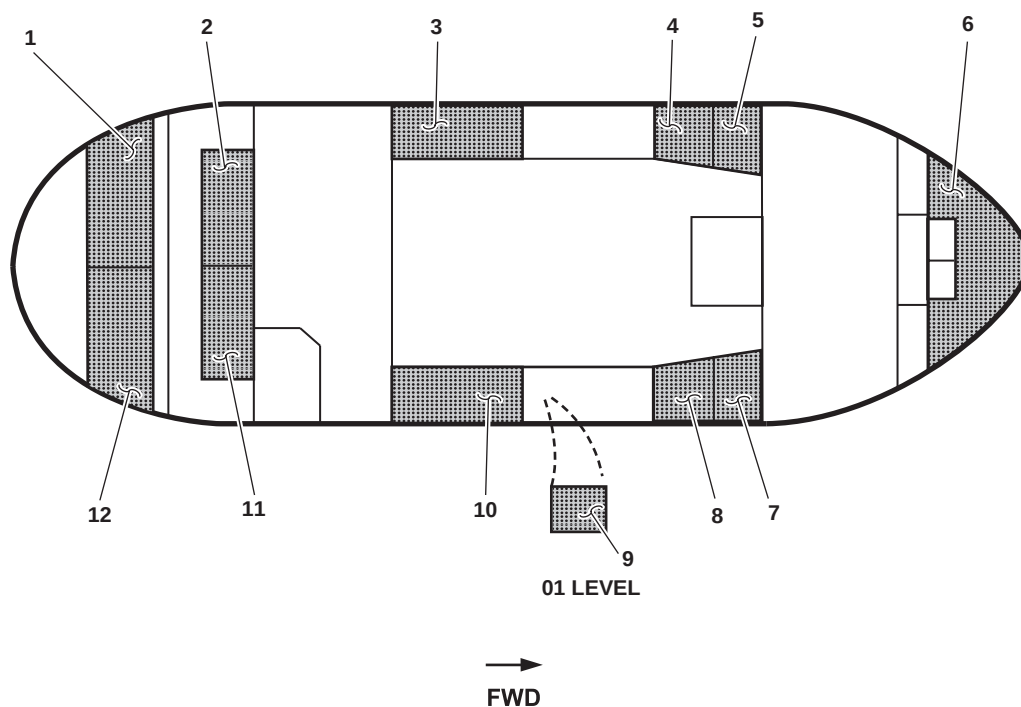


Figure 1. Above Tank Top Level Fluid Tank Locations

Table 1. Above Tank Top Level Fluid Tank Capacities

Tank	Item Number (Figure 1)	Capacity (Gallons/Liters)
Fuel Oil		
FO DAYTANK P	3	4,368/16,535
FO DAYTANK S	10	4,368/16,535
EDG DAYTANK	9	100/379

Table 1. Above Tank Top Level Fluid Tank Capacities (continued)

Tank	Item Number (Figure 1)	Capacity (Gallons/Liters)
Fuel Oil (continued)		
FOT 4P	1	8,018/30,351
FOT 4S	12	8,018/30,351
TOTAL		24,872/94,151
Oily Waste		
Oily Waste Storage Tank	8	2,495/9,444
Oil		
Lube Oil Storage Tank	4	2,495/9,444
Hydraulic Oil	5	513/1,942
Potable Water		
Potable Water Tank P	2	3,864/14,626
Potable Water Tank S	11	3,864/14,626
TOTAL		7,728/29,252
Ballast Water		
Ballast Water Tank 1	6	11,858/44,887
Miscellaneous		
AFFF Tank	7	525/1,987

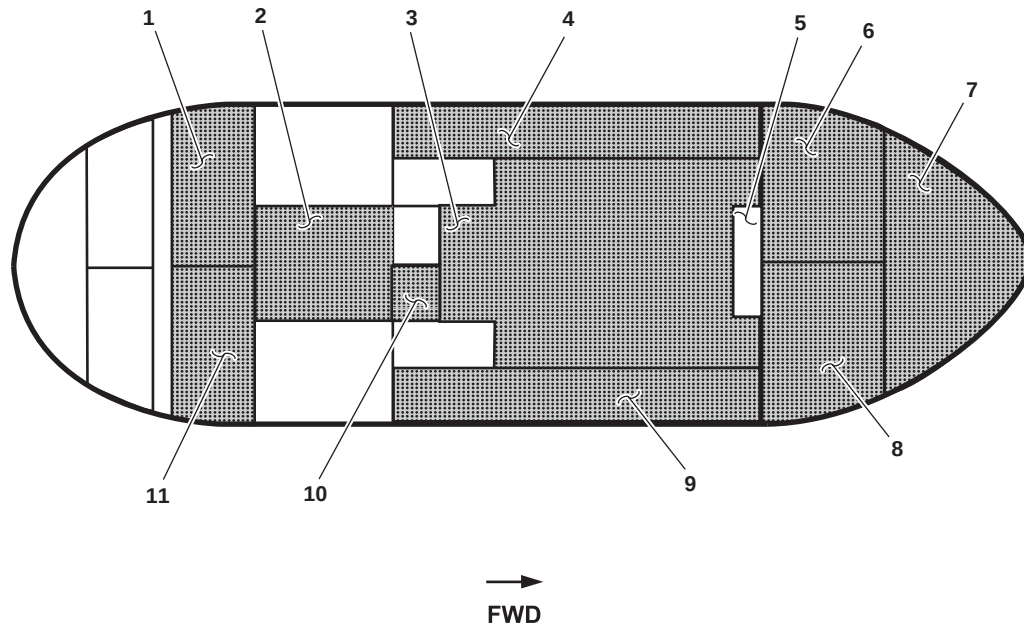


Figure 2. Below Tank Top Level Fluid Tank Locations

Table 2. Below Tank Top Level Fluid Tank Capacities

Tank	Item Number (Figure 2)	Capacity(Gallons/Liters)
Ballast Water		
Ballast Water Tank 2P	1	4,707/17,817
Ballast Water Tank 2S	11	4,707/17,817
TOTAL		9,414/35,634
Oily Waste		
Oily Waste Drain Tank	10	513/1,941
Fuel Oil		
FOT 1 P	6	9,364/35,447
FOT 1 S	8	9,364/35,447
FOT 2C	3	17,845/67,551
FOT 2P	4	5,083/19,241

Table 2. Below Tank Top Level Fluid Tank Capacities (continued)

Tank	Item Number (Figure 2)	Capacity (Gallons/Liters)
Fuel Oil (continued)		
FOT 2S	9	5,083/19,241
FOT 3C	2	8,767/33,187
TOTAL		55,539/210,238
Miscellaneous		
Sewage Holding Tank	6	2,021/7,650

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
DIFFERENCES BETWEEN MODELS**

GENERAL

At the time of this publication, only hull number LT-803 has received the lowered pilothouse and other vessel modifications. Differences between models will be identified as other vessels are modified.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
EQUIPMENT DATA**

Table 1. Equipment Data

Length	
Overall	128 feet 4 inches (39.1 m)
Between perpendiculars	123 feet 4 inches (37.6 m)
Beam, molded	36 feet 0 inches (10.9 m)
Depth, molded	19 feet 10 inches (6 m)
Draft, designed	15 feet 6 inches (4.7 m)
Light	14 feet 4 inches (4.3 m)
60% Consumables	15 feet 11 inches (4.8 m)
Max load	16 feet 10 inches (5 m)
Displacement	
Designed draft	909 long tons (923.58 metric tonnes)
Light ship	786 long tons (798 metric tonnes)
60% Consumables	951 long tons (966 metric tonnes)
Max load	1057 long tons (1073.96 metric tonnes)
Brake horsepower	5100 bhp (3803 kW)
Speed	
Self delivery	12 knots
Self delivery without tow	13.5 knots @ 85% MCR
Sea state 2 @ max load	12 knots
Under maximum tow	5 knots
Bollard pull	54.6 long tons
Max tow (50 long tons)	5 knots @ 85% MCR
Sea state 4 @ max load	5 knots
Sea state 5 @ max load	maintain steerage-way
Minimum cruising range	500 nautical miles
Propeller	Twin, fixed pitch, 11 feet, 0 inches (3.4 m) diameter
Propulsion engines	2 each; type Turbo, each rated at 2550 bhp/kW @ 900 r/min
Reduction gears and clutch	2 each; two speed Ahead, one speed Astern
Crew	8 officers, 15 enlisted
Emergency generator	65 kW, 440 Vac, 60 Hz
Bow thruster	Fixed pitch (tunnel type) reversible
Towing machine	Twin single drum, side-by-side, each drum fitted with 2500 ft (762 m) of 2 1/4" wire, diesel/hydraulic driven

Table 1. Equipment Data (continued)

Crane	360 degree rotation, telescoping boom, 1500 lb (680 kg) capacity @ max extension
Anchor windlass	Hydraulic powered
Capstan	36 in (0.9 m) diameter
Steering gear	Electro/hydraulic twin powered
Marine sanitation device	One self-contained system capable of supporting the ship's crew
Monitoring system	Computerized system to monitor major machinery and equipment
Pump drive engine	Diesel engine providing power to towing machine and pumps
Air compressors	Two electric powered compressors supply two starting receivers 400 gal (1514 L)
Desalination plant	Reverse osmosis type (TM 55-1925-282-14&P)
Workboat	Inflatable ridged bottom with a 40hp (29.8 kW) engine
Life rafts	Two each, 25 man USCG approved inflatable with hydrostatic release
Tank capacities	See WP 0015 00

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
MAIN PROPULSION ENGINES**

PROPULSION PLANT

There are two main propulsion plants installed. Each plant consists of a main engine coupled to a two-speed reversing reduction gear. The output shaft of the reduction gear is coupled to the propeller shaft. Each propeller shaft is equipped with a pneumatically operated shaft brake system. The shaft brake system is designed to lock the shaft when the reduction gear is in neutral. The machinery plant monitoring system monitors the propulsion plant. Operational control is provided by a pneumatic control system.

MAIN PROPULSION ENGINES

Two main propulsion engines are provided. Both engines are marine V-12 cylinders, 2 cycle diesel engines equipped with a turbocharger and an aftercooler. Both engines are air started using compressed air from the air starting system. The port engine is left-hand rotating; the starboard is right-hand rotating.

ENGINE CONTROL PANEL

The engine control panel contains indicators that monitor the operation of both engines. Gauges monitor oil pressure, fuel pressure, air pressure, engine speed, cylinder temperature, and hours of operation. Eight warning lights monitor selected engine parameters. Switches are provided for starting, stopping, and testing alarms.

GOVERNOR

The operator sets the desired engine speed using the throttle control at the station in command. The governor converts the air pressure from the throttle controls to the proper setting of the engine injector rack linkage, which controls fuel to the cylinders. The governor also contains a manual shutdown button mounted on top for shutdown locally or in an emergency situation.

FUEL SYSTEM

The engine fuel oil system consists of four front mounted fuel filter/water separators (figure 1, item 1), a hand pump (figure 1, item 2), an engine mounted duplex fuel filter set (figure 1, item 3), a fuel supply manifold (figure 1, item 4), and fuel return manifold (figure 1, item 5). The fuel pump draws in fuel from the day tank to the engine front mounted fuel filter/water separator (figure 1, item 1). Fuel then passes through the duplex filter element and is sent to the fuel manifold. Fuel in the fuel manifold of the injection pump housing is the supply for the injection pumps. Injection pumps (one per cylinder) send fuel to the fuel injection nozzle. A small amount of fuel is pumped into the cylinder at a very high pressure through the needle valve and the spray tip of the fuel injector (figure 1, item 6). The amount of fuel injected depends upon the position of the plunger, which is controlled by the injector rack and governor. Excess fuel flowing through the fuel return manifold is then returned to the day tank. Excess fuel also cools and lubricates the injectors.

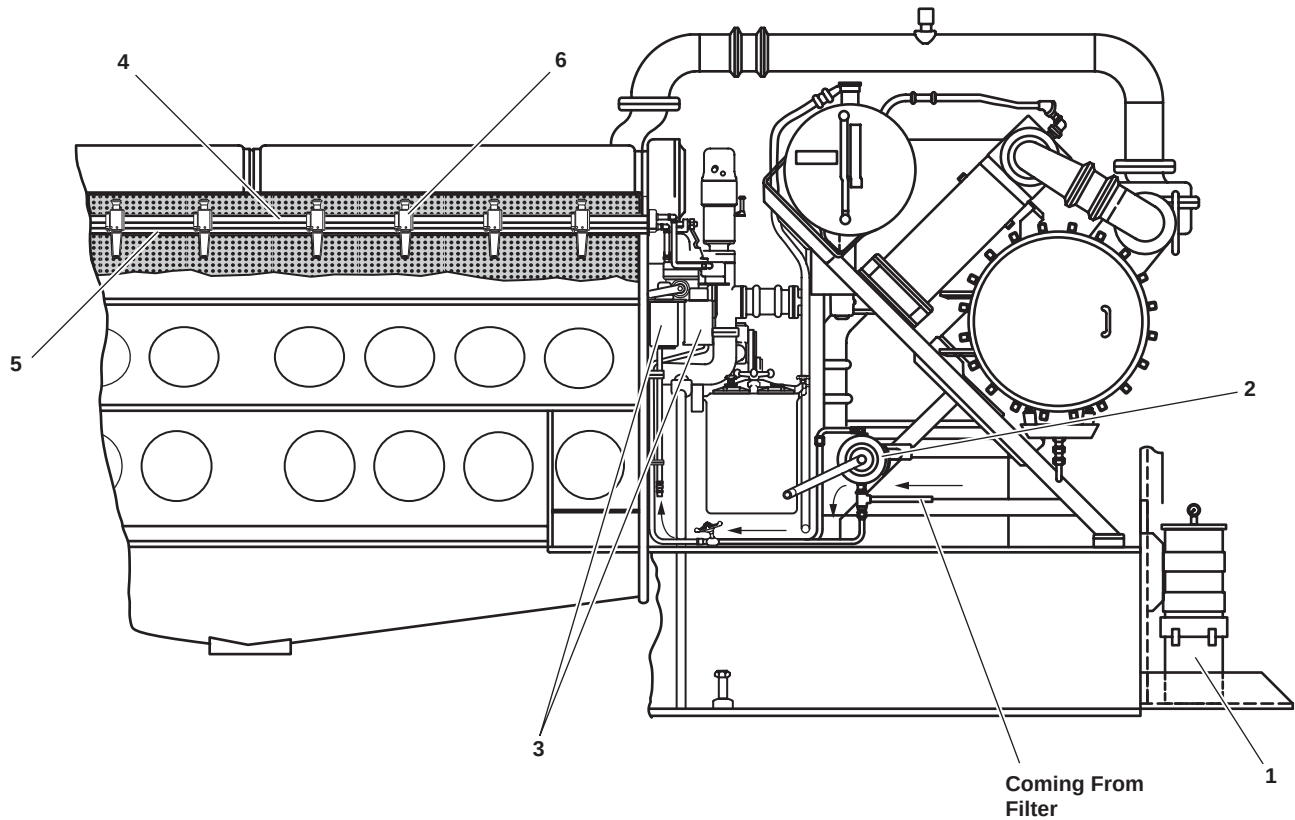


Figure 1. Main Engine Fuel System

AIR INTAKE SYSTEM

Air is ducted from the weather decks to the main propulsion engines. The air is thoroughly cleaned by passing through the air intake filters, protecting the engine from abrasive material as well as protecting the lubricating oil from contaminants. Filtered air is provided to the engine air box (figure 2, item 1) after being pressurized by the turbocharger (figure 2, items 2 and 3).

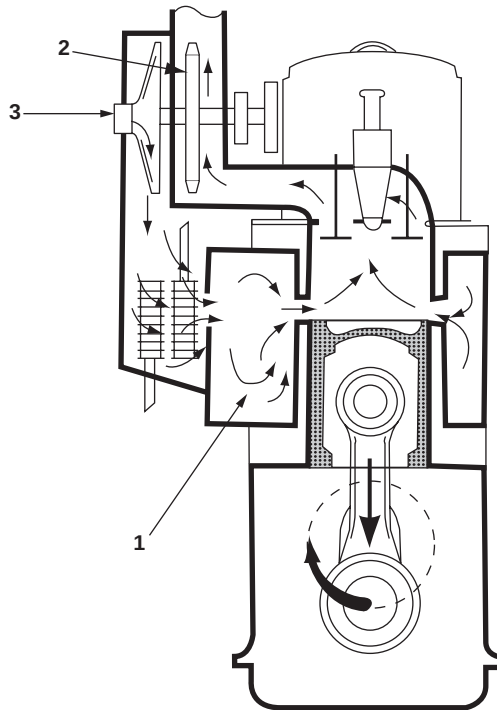


Figure 2. Engine Operation and Air Starting System

ENGINE EXHAUST SYSTEM

Exhaust gases from the engine cylinder are discharged from the cylinder heads into the exhaust manifold and turbocharger turbine (figure 2, item 3). Going through the turbine, the gases pass through the turbocharger ducting, up the stack, and to the atmosphere. The engine exhaust also has condensation drain lines and temperature sensors.

AIR STARTING SYSTEM

The engine air starting system consists of a lower air starting motor (figure 3, item 1), an upper air starting motor (figure 3, item 2), a strainer (figure 3, item 3), a solenoid valve (figure 3, item 4), an air start valve (figure 3, item 5), an air line lubricator (figure 3, item 6), a shutoff valve, and the start button. Compressed air at 200 PSI (14 bar) is supplied from the vessel's starting air system. When the start button is pushed, the solenoid valve is energized (to the OPEN position), allowing air from the starting air system to pass through the solenoid valve and strainer to the pinion gear area of the lower starting motor (figure 3, item 1). A throttle interlock prevents starting of the engine if the throttle is not in the NEUTRAL position. The air entering the pinion gear area moves the pinion gear forward to engage with the engine ring gear. Movement of the pinion gear uncovers a port, allowing air pressure to enter the upper starting motor (figure 3, item 2) which, in turn, engages its pinion gear with the ring gear. With the pinion gears now engaged, air is released from the uncovered port in the upper motor. In addition to maintaining gear engagement, the air opens the air start valve, releasing the main starting air supply. Air passes through the air start valve and into a flexible hose assembly connected to each air starting motor. The multivane motors drive the pinion gears, rotating the ring gear, cranking the engine.

Both pinion gears must be engaged to start the engine. The system is designed so that no attempt can be made to start the engine using one motor. There is also a manual cutoff valve in the system. When maintenance is being performed, the cutoff valve is closed to prevent accidental cranking of the main propulsion engine being serviced.

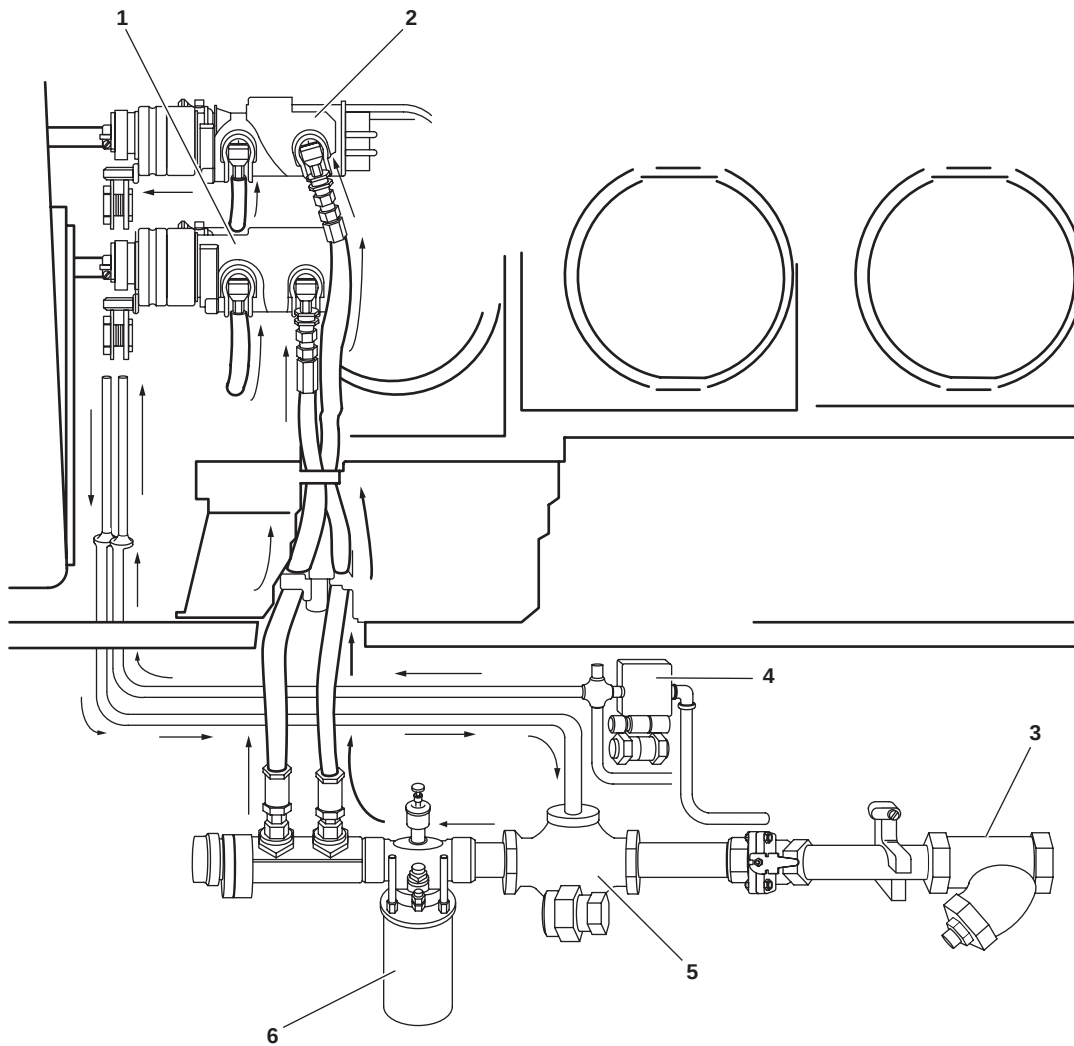


Figure 3. Engine Air Starting System

LUBRICATING OIL SYSTEM

The complete engine lubricating oil system is a combination of five separate systems, holding 125 gallons (473 liters) of lubricating oil. The five separate systems are: the main lubricating system, the piston cooling system, the scavenging oil system, the turbocharger lubrication (soakback) system, and the prelube system. Each system has its own oil pump. The main lube oil pump and main lube oil and piston cooling oil pump (figure 4, item 1), although individual pumps, are both contained in one housing and driven from a common drive shaft. The scavenging oil (figure 4, item 2), soakback, and prelube pumps are separate pumps. All pumps except the soakback and the prelube pumps are driven from the accessory gear train at the front of the engine.

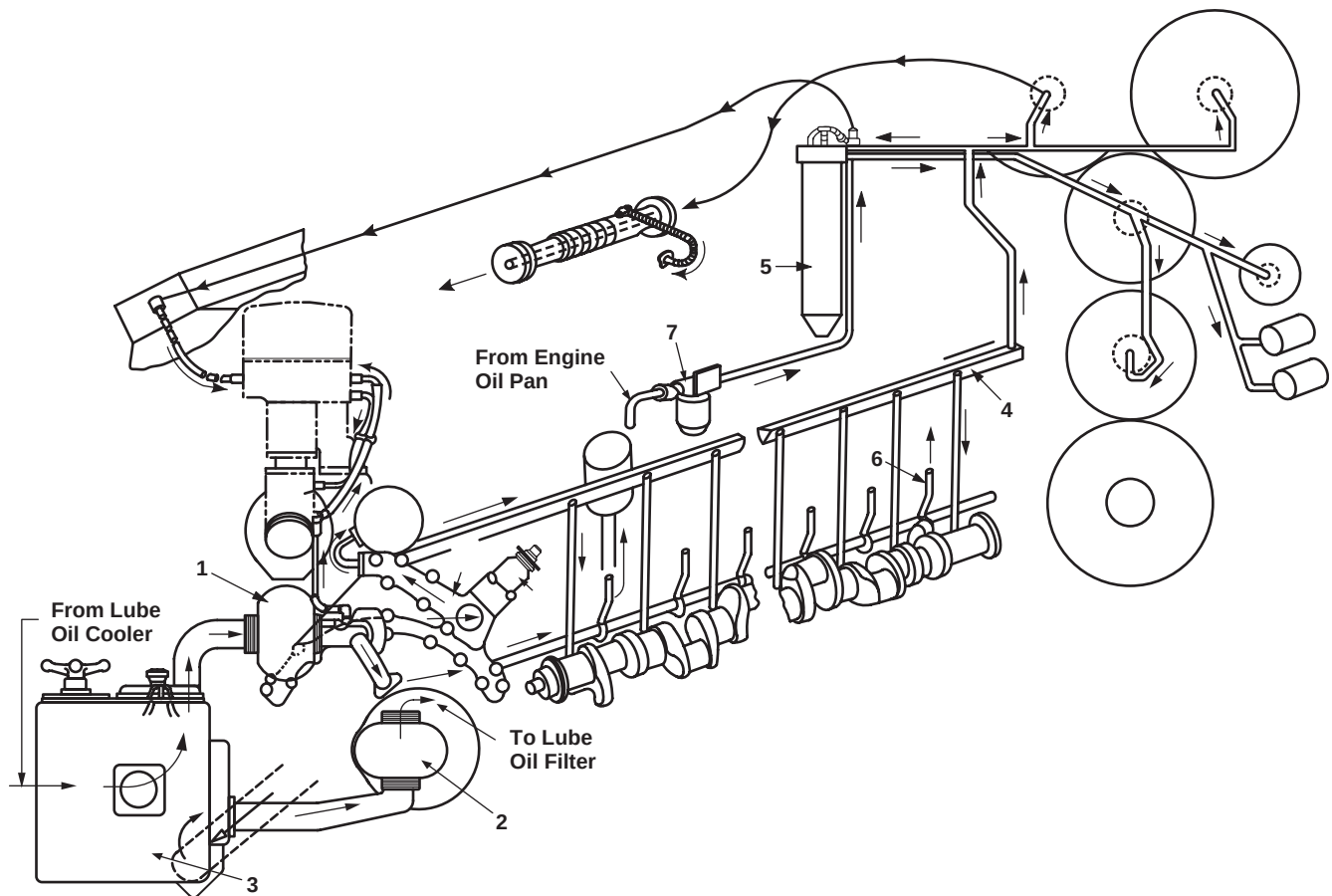


Figure 4. Main Engine Lubrication System

MAIN LUBRICATION OIL SYSTEM

The main lubricating oil system supplies oil under pressure to most of the moving parts of the engine. The main lube oil and piston cooling oil pump (figure 4, item 1) take oil from the strainer housing (figure 4, item 3) at the right front of the engine. Oil from the main lube oil and piston cooling oil pump goes into the main oil manifold (figure 4, items 4), which is located above the crankshaft and extends the length of the engine.

Oil tubes at the center of each main bearing “A” frame conduct oil from the main manifold (figure 4, item 4) to the upper half of the crankshaft bearings. Drilled passages in the crankshaft supply oil to the connecting rod bearings, damper, and accessory drive gear at the front of the crankshaft. Runoff oil from the adjacent main bearings lubricates the crankshaft thrust bearings.

Oil from the main lube oil manifold (figure 4, item 4) enters the gear train at the idler gear stubshaft bracket located at the rear of the engine. Oil passages in the stubshaft bracket distribute the oil. One passage conducts oil to both the right and left bank camshaft drive, gear stubshaft brackets, and to a manifold connected to the turbocharger oil filter (figure 4, item 5). After passing through the turbocharger oil filter, the oil enters the return line in the manifold and flows back to the idler gear stubshaft. A passage in the idler gear stubshaft bracket directs lube oil to the upper and lower stubshaft bearings. Filtered oil enters the turbocharger oil system from the upper idler gear stubshaft.

An oil passage in the turbocharger oil filter (figure 4, item 5) head, parallel to the turbocharger oil filter output line, is connected to a passage in the turbocharger oil manifold. An oil pressure line is connected between the manifold passage and the low oil pressure device in the governor.

Oil enters the hollow bore camshafts from the camshaft drive stubshafts. Radial holes in the camshaft conduct oil to each camshaft bearing. An oil line from one camshaft bearing at each cylinder supplies oil to the rocker arm shaft, the rocker arm cam follower assemblies, the hydraulic lash adjuster, and the injector rocker arm button. Runoff oil returns to the oil pan through passages between the top deck and the oil pan. Passages in the turbocharger conduct oil to the turbocharger bearings, idler gear, planet gear assembly, and auxiliary drive bore.

PISTON COOLING OIL SYSTEM

Internal parts of the piston are lubricated and cooled by the piston cooling oil pump of the main lube oil and piston cooling oil pump (figure 4, item 1). The piston cooling oil pump receives oil from a common suction with the main lube oil pump and routes oil to the two piston cooling oil manifolds extending the length of the engine, one on each side. A piston cooling oil pipe (figure 4, item 6) at each cylinder directs a flow of oil through the carrier to cool the underside of the piston crown and the ring belt. Some of this oil enters the oil grooves in the piston pin bearing and the excess oil drains out through holes in the carrier crown to the sump.

SCAVENGING OIL SYSTEM

The scavenging oil system pump (figure 4, item 2) takes oil through the scavenging oil strainer from the oil pan sump or reservoir. The pump forces the oil through the oil filters and oil cooler that are located forward of engine. Oil then returns to the strainer housing to supply the main lube oil pump and piston cooling oil pump with cooled and filtered oil. Excess oil spills over a dam in the strainer housing and returns to the oil pan.

TURBOCHARGER LUBRICATION (SOAKBACK) SYSTEM

Prior to the engine startup, a soakback pump lubricates the turbocharger. Oil is drawn from the engine oil sump and passes through a soakback pump filter (figure 4, item 7). Oil is then supplied to the turbocharger through external piping, which is connected to the engine-mounted filter housing. In operation, the turbocharger is lubricated by the main oil pressure pump of the main lube oil and piston cooling oil pump (figure 4, item 1) through internal passages within the engine. Before entering the turbocharger, the oil passes through an engine mounted turbocharger filter (figure 4, item 5).

To ensure lubrication of the turbocharger bearings prior to the engine start and the removal of residual heat from the turbocharger after engine shutdown, a separate lube oil pressure source is provided. This pressure is controlled automatically through the engine START and STOP controls. An electrically driven pump drawing lube oil from the oil pan pumps the oil through a soak back oil filter and the head of the turbocharger oil filter directly into the turbocharger bearing area. The motor driven pump and filter are located on the starboard side of the engine.

A pressure relief valve set at 379 PSI (26 bar) is located in the head of the turbocharger oil filter (figure 4, item 5). When the engine starts, and while the motor driven pump is still running, main lube oil pressure from the engine-driven pump becomes greater than the motor driven pump pressure. Since there is no outlet for the lower pressure oil, the relief valve will open when the pressure builds up to 379 PSI (26 bar), and the oil will return to the pan through a passage in the turbocharger oil filter head mounting flange. Also located in the turbocharger oil filter head is a bypass valve, set at 483 PSI (33 bar). This valve will open to permit motor driven pump pressure to bypass a plugged filter element so that lubrication can be supplied to the turbocharger to prevent turbo damage.

TURBOCHARGER OIL FILTER

The turbocharger oil filter (figure 4, item 5) provides additional protection for the high-speed bearings and other lubricated areas of the turbocharger by filtering the oil just before it is admitted to the turbocharger. Oil enters the filter through a cast manifold and, after passing through the filter, returns to the upper idler gear stubshaft and into the turbocharger. The filter element is pleated paper construction, and is disposable. The filter is mounted on the camshaft drive housing at the right bank of the engine.

PRELUBE SYSTEM

The prelube system includes a prelube pump and related piping. The prelube system is used to circulate oil through the piston cooling and main lube oil systems before starting the engine after extended shutdowns or repairs. Oil for the prelube system is drawn from the oil pan.

COOLING SYSTEM

Each main engine cooling system consists of two engine-driven centrifugal water pumps, replaceable inlet water manifolds with an individual jumper line to each liner, cylinder head discharge elbows, an outlet manifold through which water is circulated, and keel coolers. The two centrifugal water pumps are mounted on the accessory drive housing and are driven by the governor drive gear. Engine coolant is also circulated through each aftercooler located in the turbocharger air discharge duct to cool the air before it enters the engine air box. The engine coolant flows through an external piping system to the keel coolers. The keel coolers transfer heat from the engine coolant to the sea. The cooling system is discussed in greater depth in WP 0019 00.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
ENGINE COOLING SYSTEMS**

GENERAL

Several different types of engine cooling systems are used on board the LT. Both main engines, and both Ship's Service Diesel Generator (SSDG) engines utilize keel cooler systems (figure 1). The Emergency Diesel Generator (EDG) uses a radiator cooling system (figure 2). The bow thruster and pump drive engines use heat exchanger systems (figure 3). The paragraphs below describe each of these cooling systems in detail.

ENGINE COOLING SYSTEM COMPONENTS

ENGINE COOLANT

All engines described use engine coolant. The engine coolant is a mixture of water and ethylene glycol antifreeze. This mixture of water and antifreeze protects against freezing, overheating, and corrosion. A 50/50 mixture of ethylene glycol antifreeze and water will freeze at -34°F (-36.7°C), which is significantly lower than the freezing temperature of water alone. The same 50/50 mixture has a boiling point of up to 276°F (135.6°C) depending upon cooling system pressure. Ethylene glycol antifreeze also contains additives that help prevent corrosion of system components.

CENTRIFUGAL PUMPS

Centrifugal pumps circulate the engine coolant throughout the cooling system on each engine.

COOLANT PASSAGES

Coolant passages route engine coolant to and around cylinders, cylinder heads, and other vital components.

OIL COOLER

Oil coolers provide cooling for oil that is heated while lubricating the engine.

AFTERCOOLER

Engine coolant is circulated through the aftercooler, which is located in the turbocharger air discharge duct, to cool the intake air before it enters the engine.

EXPANSION TANK

The expansion tank (figure 1, item 1) is a reservoir for the coolant. It is the highest place in the cooling system. The volume of the coolant can change in the expansion tank without affecting the coolant level in the remainder of the cooling system.

PRESSURE CAP

The expansion tank (figure 1, item 1) in conjunction with the pressure cap (figure 1, item 2) controls the pressure of the cooling system. Excessive coolant pressure will vent through the pressure cap.

RAW WATER STRAINER

A raw water strainer filters out large debris that may block or contaminate the cooling systems.

SEACHEST

The seachest is a compartment (three in quantity) located near the center line on the bottom of the vessel. This is where raw water is drawn into the vessel cooling systems to provide firefighting water, and to make fresh water.

RAW WATER PUMP

The raw water pump draws raw water from the sea chest through a duplex raw water strainer. After leaving the duplex raw water strainer, the raw water is routed to the engine's cooling system. There the raw water pump circulates the raw water through the heat exchanger (figure 3, item 1) where it absorbs heat from the engine coolant.

KEEL COOLER

NOTE

Only the main and SSDG engines have keel coolers (figure 1, item 5) as part of their systems.

The keel cooler (figure 1, item 5) is mounted on the external hull of the vessel and transfers heat from the engine coolant directly to the sea.

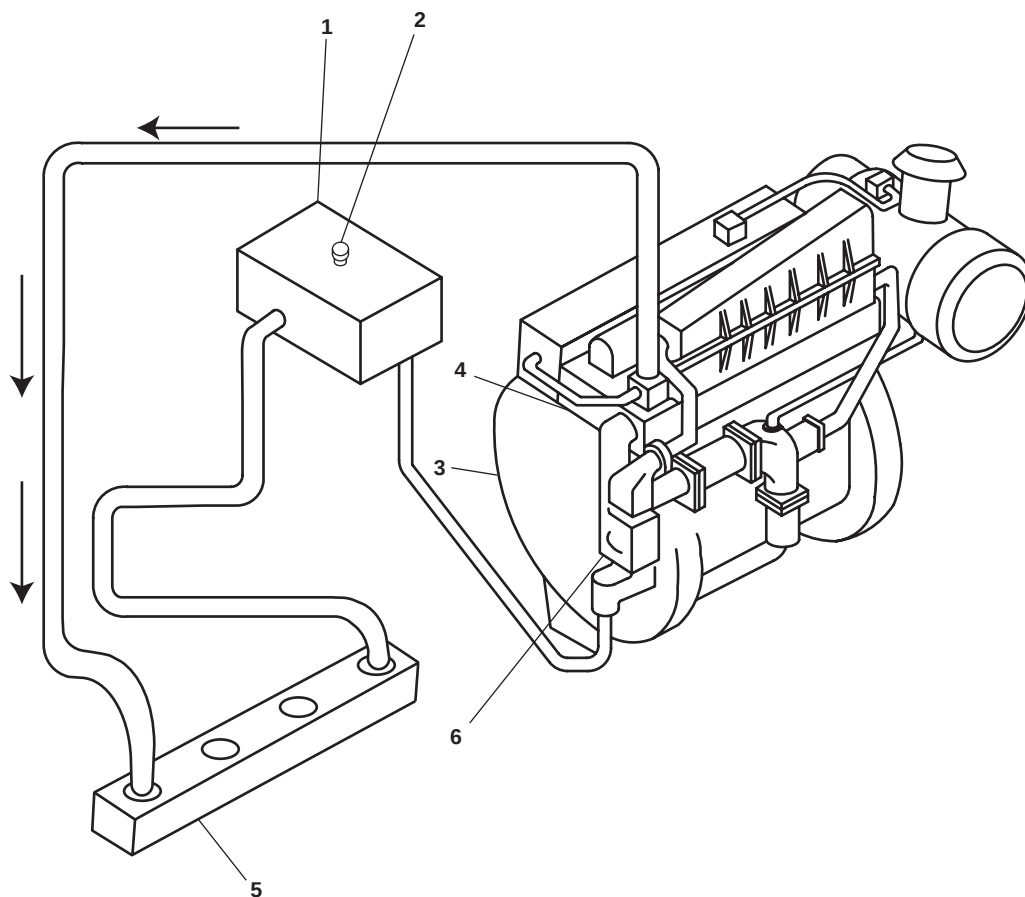


Figure 1. Typical Keel Cooler Engine Cooling System

RADIATOR**NOTE**

Only the EDG engine has a radiator as part of its system.

Coolant flows from the EDG's coolant regulator (figure 2, item 1) to the radiator (figure 2, item 2) inlet (figure 2, item 3). The radiator utilizes many cooling fins to dissipate heat from the coolant to the air as it flows through its tubing. When the coolant reaches the bottom of the radiator (figure 2, item 2), the coolant should be cooled significantly before it flows toward the EDG engine water pump (figure 2, item 4).

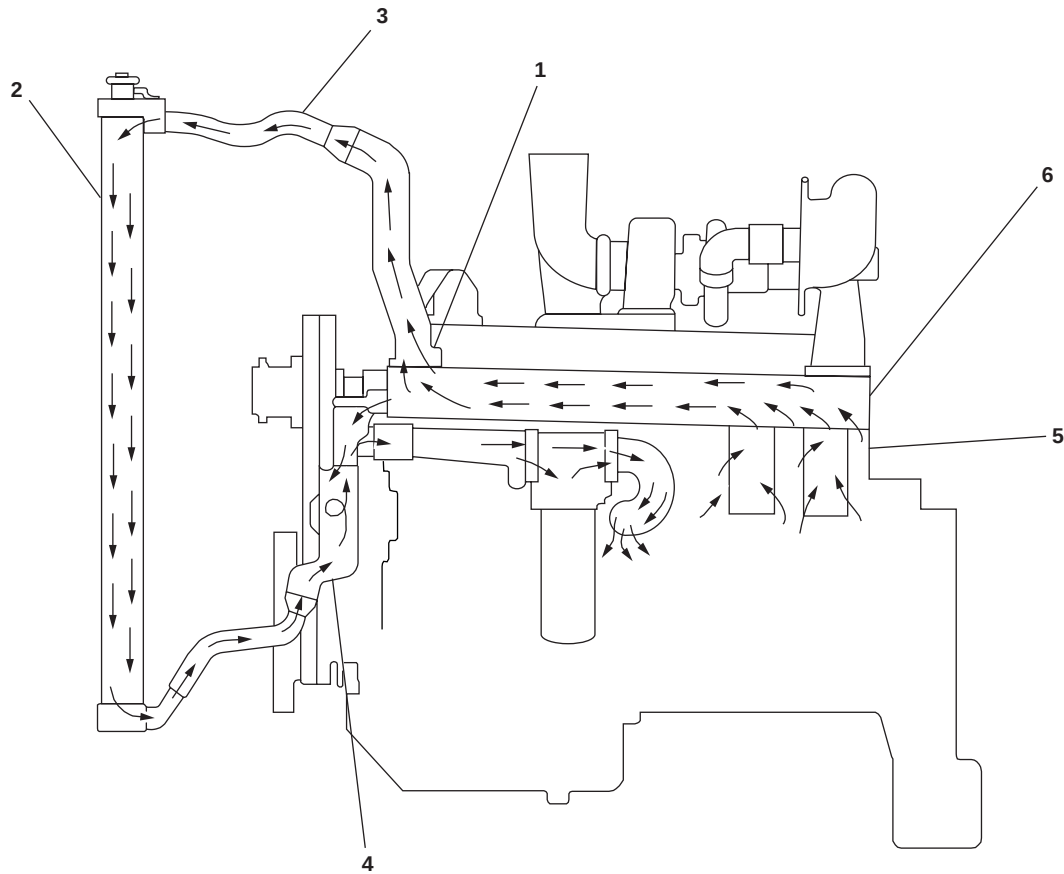


Figure 2. Typical Radiator Engine Cooling System

HEAT EXCHANGER**NOTE**

Only the bow thruster and the pump drive engines have heat exchangers.

The heat exchanger (figure 3, item 1) contains a large number of tubes. Engine coolant circulates inside the tubes while raw water circulates outside the tubes. As the engine coolant and raw water flows through the heat exchanger, the raw water absorbs the heat from the engine coolant and carries that heat away.

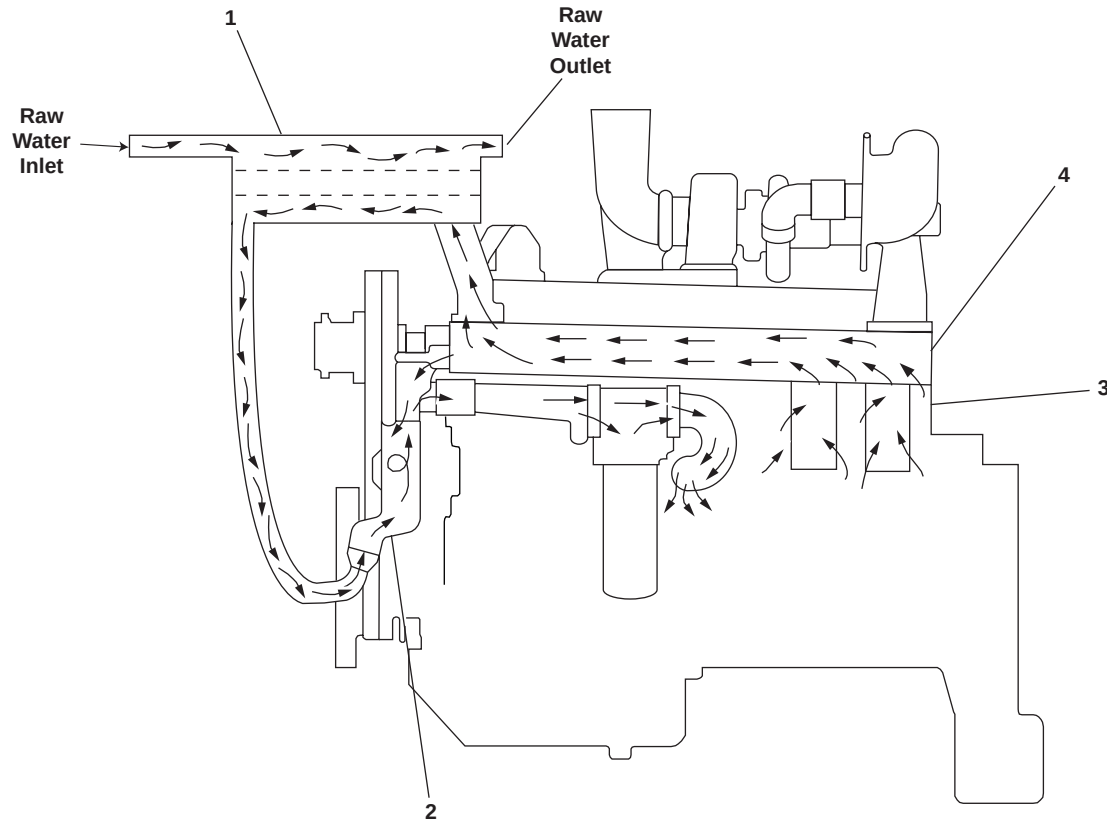


Figure 3. Typical Heat Exchanger Engine Cooling System

KEEL, RADIATOR, AND HEAT EXCHANGER COOLING SYSTEMS OPERATIONS

MAIN ENGINE AND SSDG KEEL COOLED SYSTEMS

The coolant is circulated through the closed-loop cooling system by an engine-driven water pump (figure 1, item 6). As the coolant circulates through the engine, it absorbs heat from the engine's cylinder block (figure 1, item 3), cylinder heads (figure 1, item 4), exhaust manifold surfaces, engine oil, and from the marine transmission oil. After circulating through the engine, the coolant passes through the keel cooler (figure 1, item 5) that is longitudinally recessed in the hull. As the coolant circulates through the keel cooler, the heat absorbed from the engine is transferred to the raw water outside the hull. After the coolant has passed through the keel cooler, it reenters the engine through the water pump (figure 1, item 6) to begin the cooling cycle again.

EDG ENGINE RADIATOR COOLED SYSTEMS OPERATIONS

The coolant is circulated through the closed-loop cooling system by an engine-driven water pump (figure 2, item 4). As the coolant circulates through the engine, it absorbs heat from the engine's cylinder block (figure 2, item 5), cylinder head (figure 2, item 6), exhaust manifold surfaces, and engine oil. After circulating through the engine, the coolant passes through the radiator (figure 2, item 1). As the coolant circulates through the radiator, the heat absorbed from the engine is transferred to the air circulating through the radiator fins. After the coolant passes through the radiator, it reenters the engine through the engine-driven water pump to begin the cooling cycle again.

BOW THRUSTER AND THE PUMP DRIVE ENGINES HEAT EXCHANGER SYSTEMS OPERATIONS

The coolant is circulated through the closed-loop cooling system by an engine-driven water pump (figure 3, item 2). As the coolant circulates through the engine, it absorbs heat from the engine's cylinder block (figure 3, item 3), cylinder head (figure 3, item 4), exhaust manifold surfaces, engine oil, and the marine transmission oil. After circulating through the engine, the coolant passes through the heat exchanger (figure 3, item 1). As the coolant circulates through the heat exchanger, the heat absorbed from the engine is transferred to the raw water circulating through the heat exchanger tubing. After the coolant has passed through the heat exchanger, it reenters the engine through the engine-driven water pump to begin the cooling cycle again.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
REVERSE REDUCTION GEAR SYSTEM**

GENERAL

There are two main propulsion plants on the vessel. Each propulsion plant consists of a main engine coupled to a two-speed reversing reduction gear. The output shaft of the reduction gear is coupled to the propeller shaft.

The reverse reduction gear reduces the engine output revolutions per minute (r/min) and reverses rotational direction (when required) to the propeller shaft. Gear ratios are: Ahead 1 4.677:1, Ahead 2 and Astern 5.444:1. Direction of rotation and hydraulic clutch operation of each engine are controlled by a throttle control on the EOS console, pilothouse console, or auxiliary control stations. A shaft brake is designed to lock the shaft when the reduction gear is in neutral.

LUBRICATION SYSTEM

A high-pressure gear pump (figure 1, item 1) is driven at engine speed to provide oil for clutch actuation and lubrication of the reduction gear. A pressure-increasing valve (figure 1, item 2) maintains high oil pressure for clutch lockup. The excess oil that bypasses the pressure-increasing valve is used for lubricating the gears, bearings, and clutch plates. The oil is cooled by a cooler (heat exchanger) (figure 1, item 3). If the oil flow ceases, the flow indicator (flow alarm) (figure 1, item 4) switch will sound an alarm and bring the reduction gear to neutral.

COOLING SYSTEM

A fresh water cooling system (figure 2) transfers heat from the reduction gear lubricating oil through the cooler (heat exchanger) (figure 1, item 3). Water from the cooling system is cooled in turn through keel coolers (figure 2, item 1). Water is circulated by an electric motor-driven coolant pump (figure 2, item 6).

HAND PUMP

A hand pump is provided to drain the PORT and STARBOARD reduction gear sumps.

REDUCTION GEAR RATIO SELECTION

A selector valve in the EOS console allows selection of the desired forward reduction gear ratio. The reduction gear selector will be disabled whenever the throttle control is not in the center (NEUTRAL) position, or command is at a station other than the EOS.

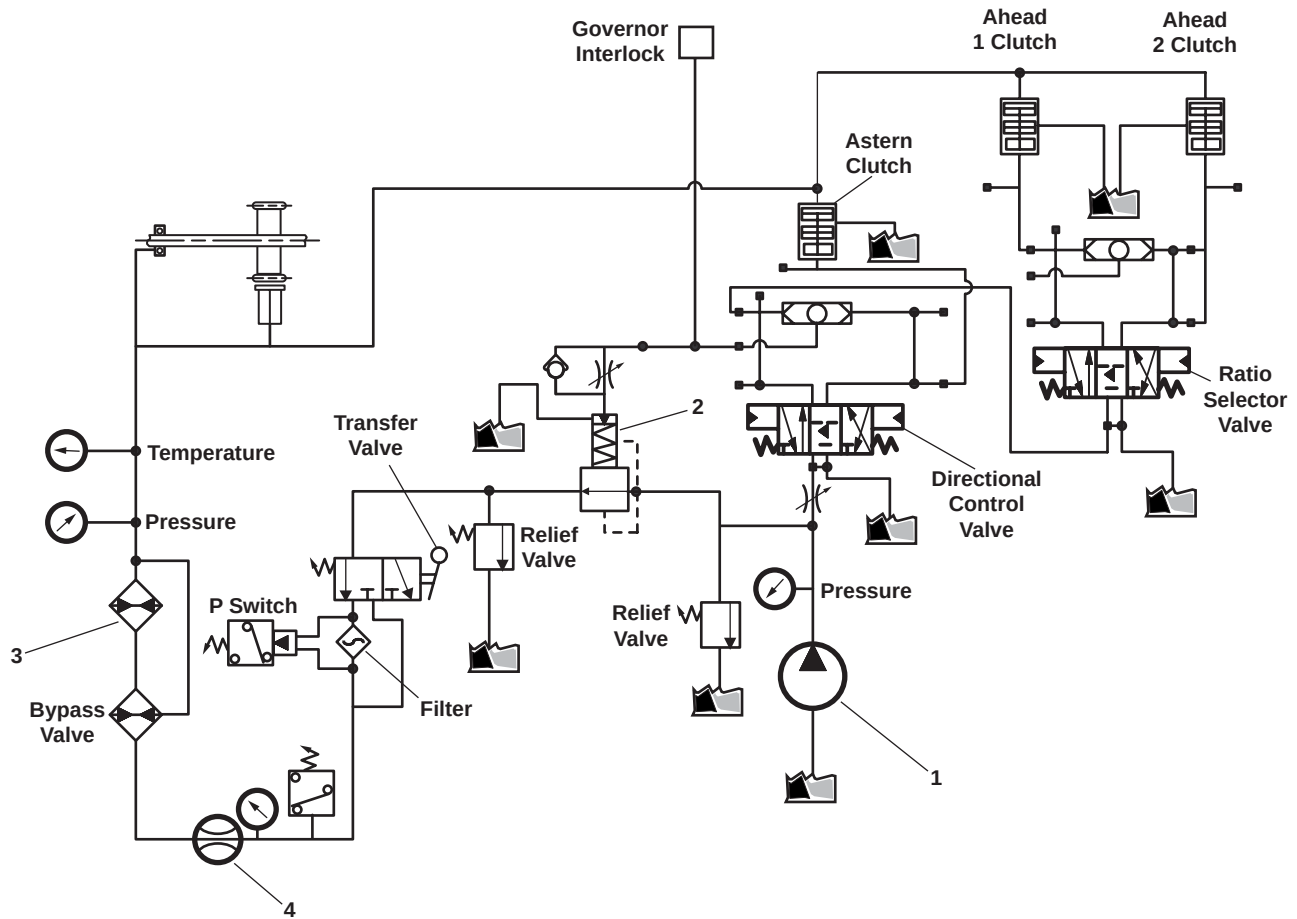


Figure 1. Reverse Reduction Gear Schematic

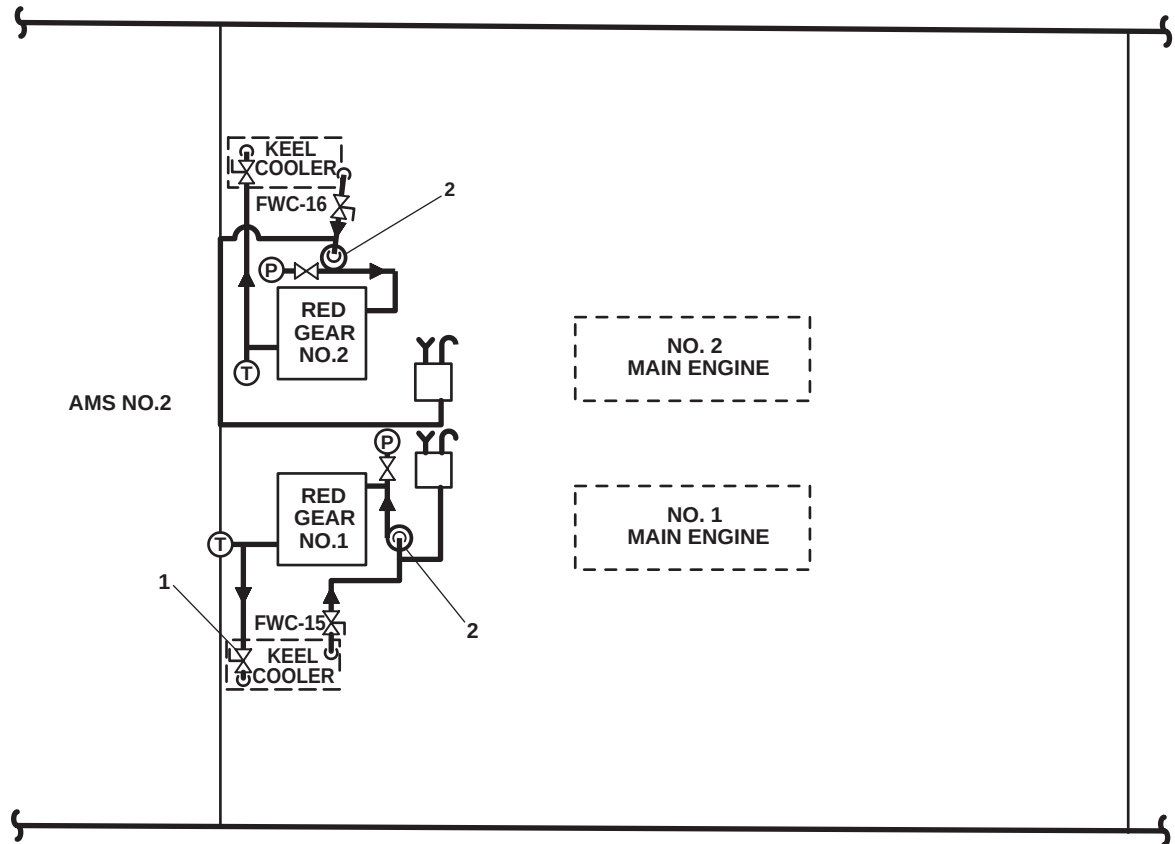


Figure 2. Reduction Gear Fresh Water Cooling System

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
PROPELLER SHAFTS AND PROPELLERS**

GENERAL

The propeller shafts (figure 1, item 1) and propellers (figure 1, item 2) create AHEAD or ASTERN thrust for the vessel. The propeller shafts are powered by the main engines (figure 1, item 3) through a two-speed reversing reduction gear (figure 1, item 4). The output shaft of the reversing reduction gear is coupled to one end of each propeller shaft. On the other end of the propeller shaft is the propeller.

PROPELLER SHAFTS

The propeller shafts (figure 1, item 1) transfer torque to the propellers (figure 1, item 2). The torque is generated by the main engines (figure 1, item 3) and is transferred to the propeller shafts by the reversing reduction gears (figure 3, item 4).

PROPELLERS

The propeller (figure 1, item 2) is designed to operate in either a clockwise or counterclockwise direction. Direction of rotation is determined by operator input into the reversing reduction gear (figure 1, item 4). Main engine speed controls the thrust force. Displacement of raw water in a given direction generates an equal recoil force in the opposite direction, moving the vessel.

SHAFT SEAL

Shaft seals (figure 1, item 5) are installed on each propeller shaft (figure 1, item 1). The shaft seal's function is to seal the shaft alleys from leakage. Each shaft seal allows a small amount of raw water to leak past during rotation of the propeller shafts. This leakage prevents the shaft seals from being destroyed by heat. The shaft seals may also be inflated to stop all leakage during periods of extended layup. See figure 2 for details of the shaft seal.

SHAFT BRAKE

Each propeller shaft (figure 1, item 1) is equipped with a hydropneumatically operated shaft brake (figure 1, item 6). The shaft brake system is designed to lock the propeller shaft when the reversing reduction gear (figure 1, item 4) is in NEUTRAL. When placed in NEUTRAL, the shaft brake actuator sends 1200 to 1500 PSI (82.7 to 103.4 bar) of hydraulic pressure to the shaft brake, bringing the propeller shaft and propeller (figure 1, item 2) to a full stop. Movement of the throttle 20 degrees AHEAD or ASTERN causes the shaft brake to immediately release. See figure 3 for details of the shaft brake.

SYSTEM OPERATION

With the shaft seals (figure 1, item 5) manually deflated, and the throttle moved into the ASTERN or AHEAD position, the shaft brakes (figure 1, item 6) are immediately released. The main engines (figure 1, item 3) and reversing reduction gears (figure 1, item 4) plant begins to turn the propellers shafts (figure 1, item 1) and propellers (figure 1, item 2) in the desired direction of rotation, causing the LT to move in the desired direction.

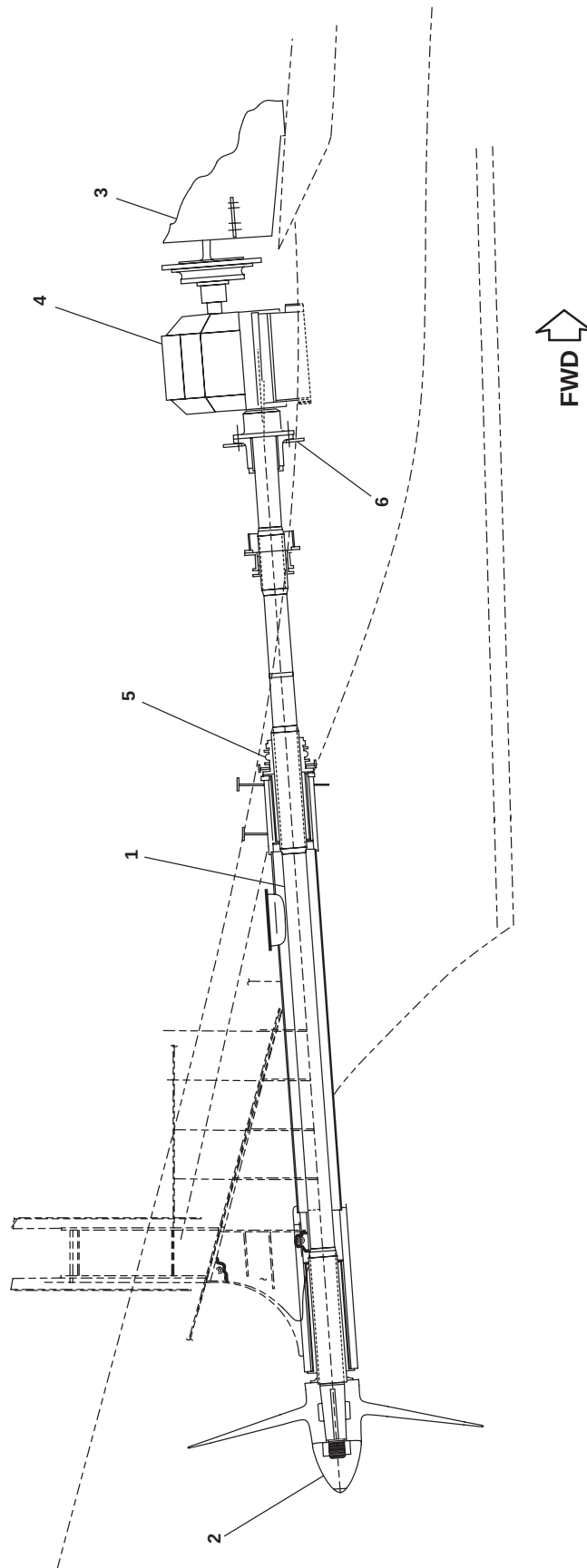


Figure 1. Propeller Shaft and Propellers

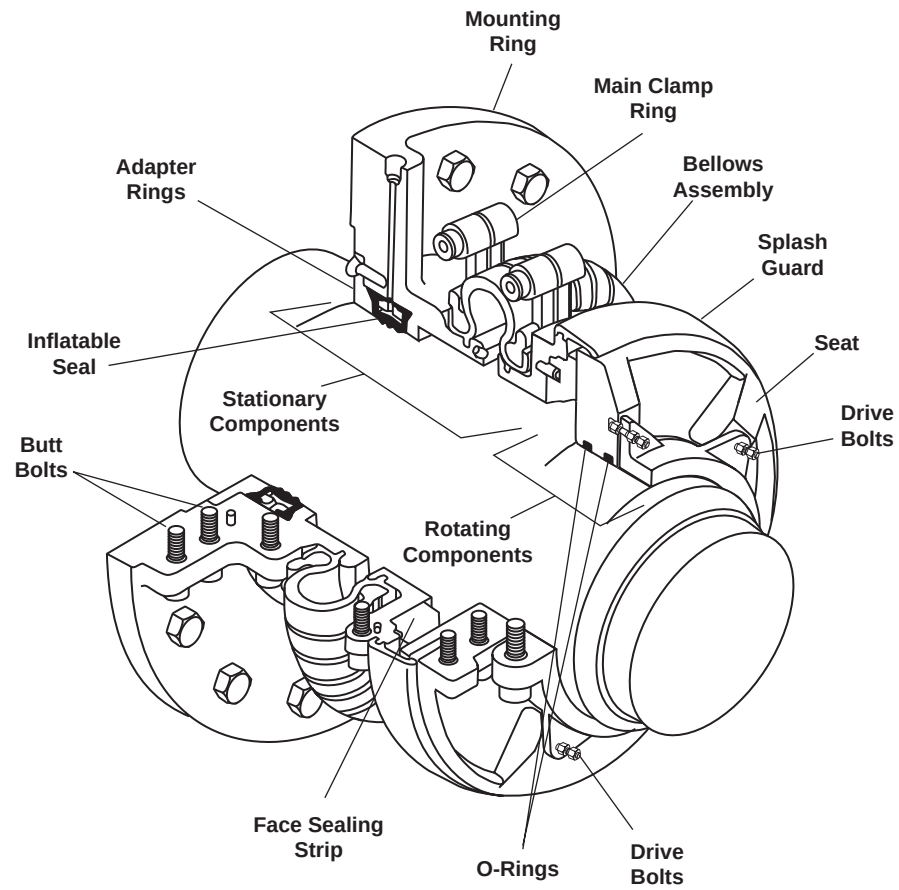


Figure 2. Shaft Seal

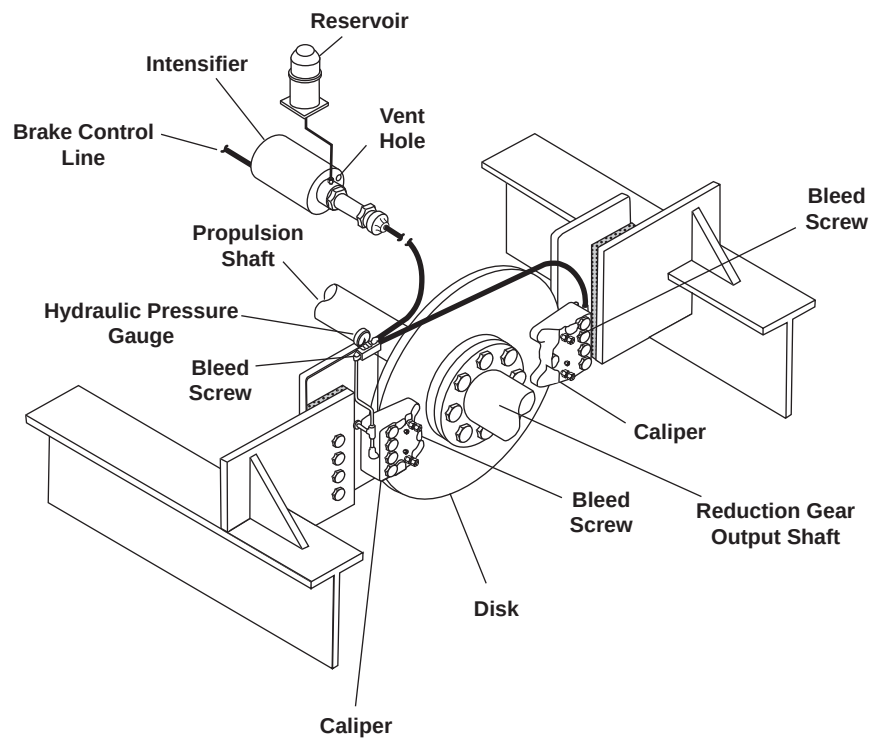


Figure 3. Disk Brakes

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
BOW THRUSTER SYSTEM**

GENERAL

The bow thruster system is comprised of a bow thruster set, bow thruster engine, and reduction gear.

BOW THRUSTER SET

The bow thruster is used in combination with the vessel's main propulsion system to give the Large Tug (LT) added maneuverability. A fixed propeller (figure 1, item 1) is driven through a right angle reduction gearbox (figure 1, item 2) by the bow-thruster engine (figure 1, item 3). The propeller is designed to operate in either a clockwise or counterclockwise direction, as selected by the operator on the control panel. Engine speed controls the thrust force. Displacement of raw water in a given direction generates an equal recoil force in the opposite direction, moving the bow of the LT as needed. Control of the bow thruster can be local or remote from the bow thruster control panel on the pilothouse console and auxiliary control stations.

BOW THRUSTER ENGINE

The bow thruster engine (figure 1, item 3) is a turbocharged, 4-cycle, inline 6-cylinder marine diesel engine. The engine is air started. It has its own lubricating oil, cooling, and fuel oil systems. A jacket water heater is provided to ease cold weather starting.

The raw water cooling system consists of a horizontal centrifugal pump driven off the bow thruster engine, a duplex strainer, and a piping system. When the bow thruster engine is operating, the centrifugal pump draws raw water from the sea chest through a duplex strainer. This raw water is routed to the heat exchanger, where the heat from engine coolant is transferred to the raw water. The heated raw water is then pumped overboard (refer to WP 0019 00).

REDUCTION GEAR

A reverse reduction gear (figure 1, item 4) reduces the engine output revolutions per minute (r/min) and reverses rotational direction to the drive shaft (figure 1, item 5). Direction of rotation and hydraulic clutch operation is controlled by a throttle control on the pilothouse console or auxiliary control stations. The reduction gear is equipped with a shaft brake. The shaft brake is designed to lock the drive shaft when the reduction gear is in neutral.

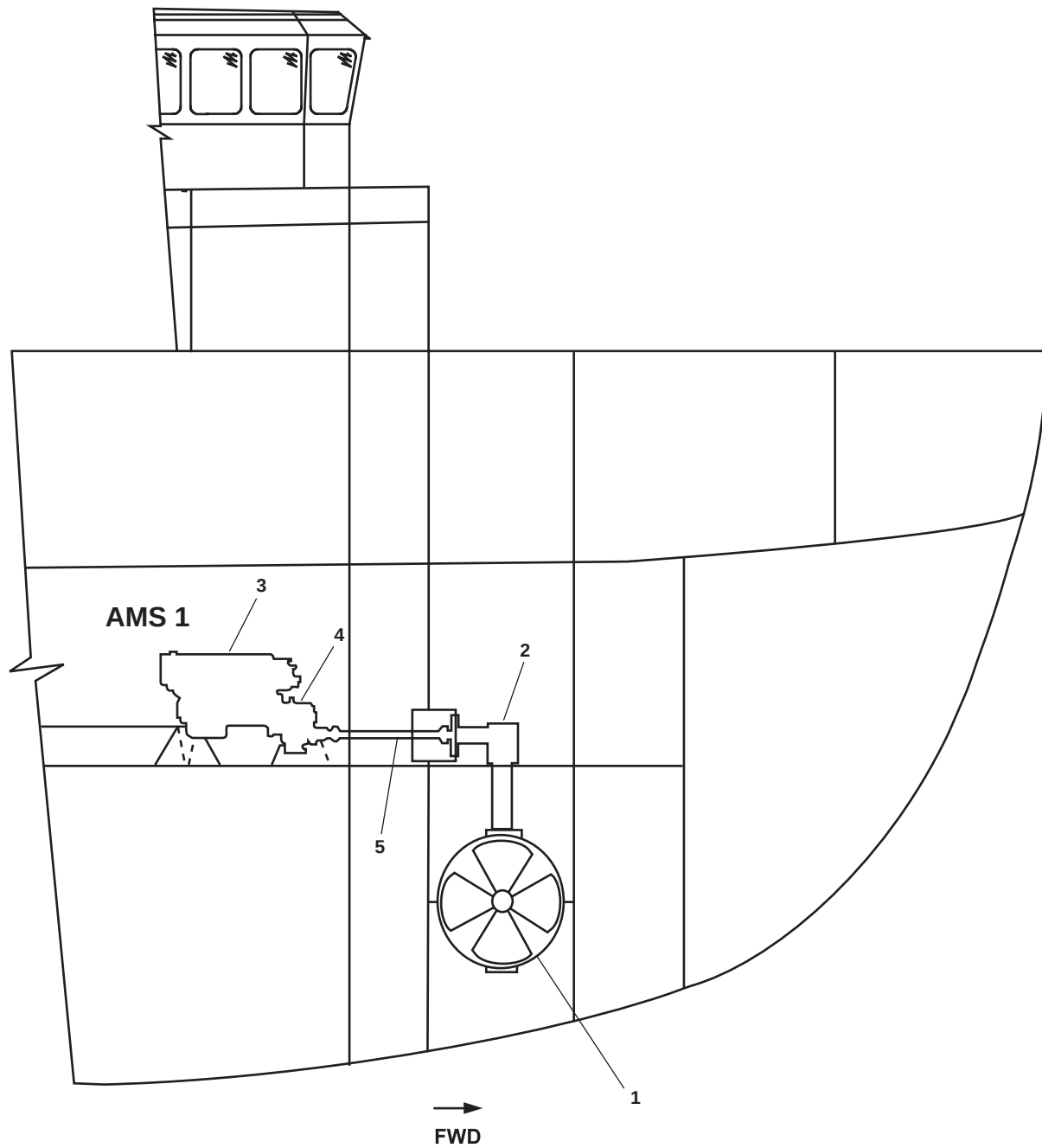


Figure 1. Bow Thruster Components

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
FUEL SYSTEM**

GENERAL

The fuel oil system (figure 1) consists of four front mounted fuel filter/water separators, an engine mounted duplex fuel filter set, a fuel supply manifold, and a fuel return manifold. The fuel pump draws in fuel from the day tank to the engine front mounted fuel filter/water separator. Fuel passes through the filter element set to the fuel manifold of the fuel injection pump housing. Fuel in the fuel manifold of the injection pump housing is the supply for the injection pumps. Injection pumps (one per cylinder) send fuel to the fuel injection nozzle. A small amount of fuel is pumped into the cylinder, at a very high pressure, through the needle valve and the spray tip of the injector. The amount of fuel injected depends upon the position of the plunger, which is controlled by the injector rack and governor. Excess fuel flows through the fuel return manifold and is then returned to the day tank. Excess fuel also cools and lubricates the injector.

FUEL OIL FILL AND TRANSFER PIPING SYSTEM

The fuel oil fill and transfer piping system (figure 2) replenishes the vessel's fuel oil tanks from deck discharge/fill connections. The system also replenishes fuel oil day tanks (PORT and STARBOARD) and the emergency diesel generator day tank by transferring fuel oil from the storage tanks. System control is maintained through a manifold and a combination of valves as shown in figure 2. Fuel oil can be transferred from any storage tank to any day tank and from one storage tank to another. Power to fuel oil transfer pump 1 is supplied by the emergency switchboard and controlled by a local START/STOP pushbutton and an emergency STOP switch located outside the engine room. Power to fuel oil transfer pump 2 is supplied by the main switchboard through 440V power panel No. 1 and is controlled by a local START/STOP pushbutton and an emergency STOP pushbutton located outside the engine room. Each pump shuts down upon activation of any FM-200 pressure switch (refer to WP 0033 00). Fuel oil purification is provided by a fuel filter/water separator between the manifold and the fuel oil transfer pump.

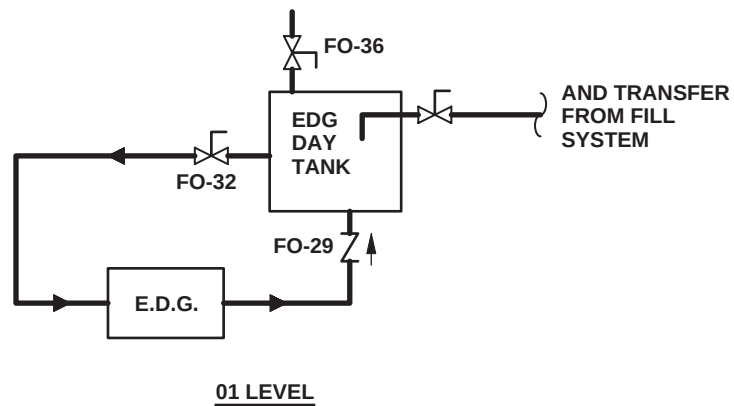
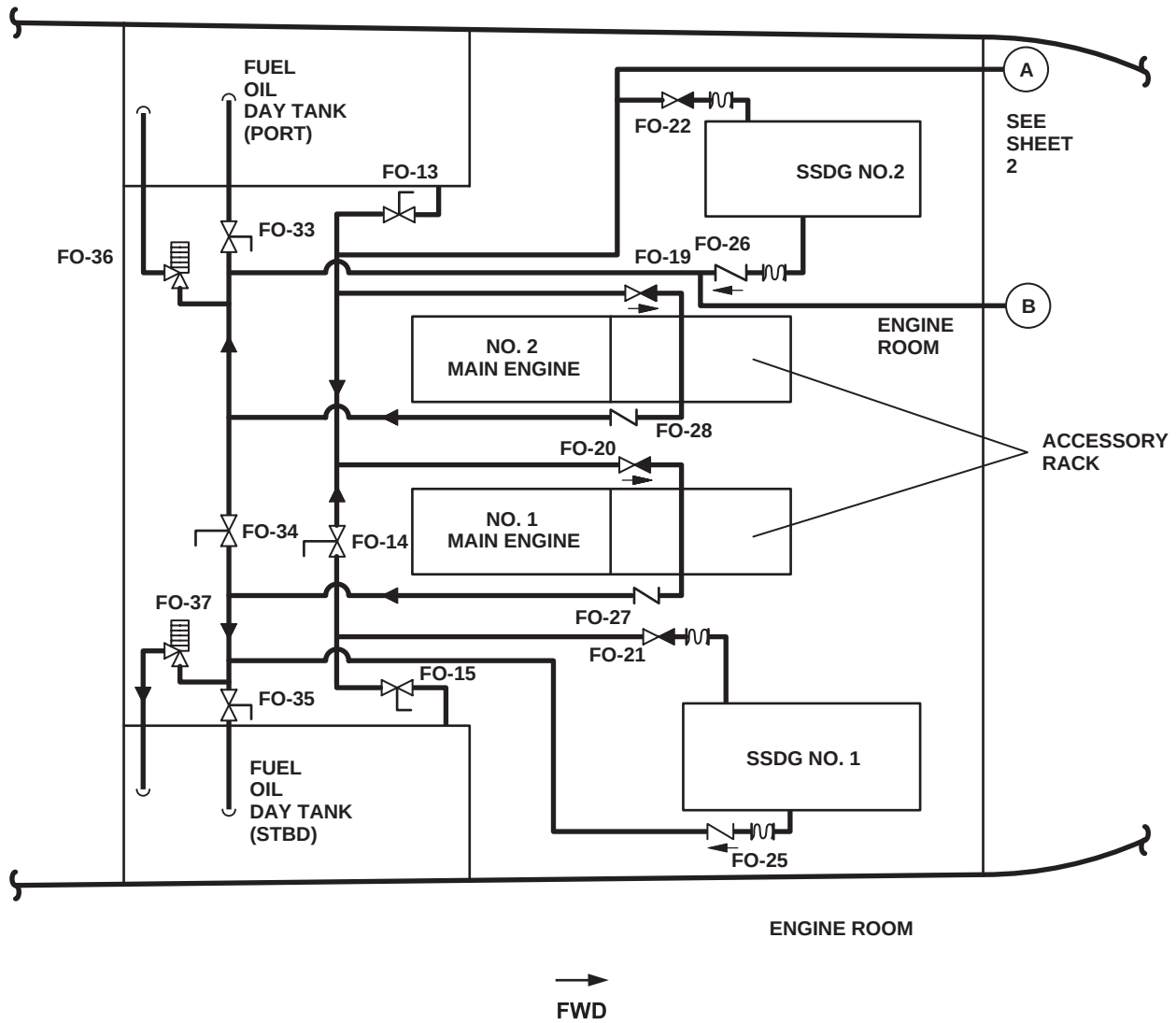


Figure 1. Fuel System (Sheet 1 of 2)

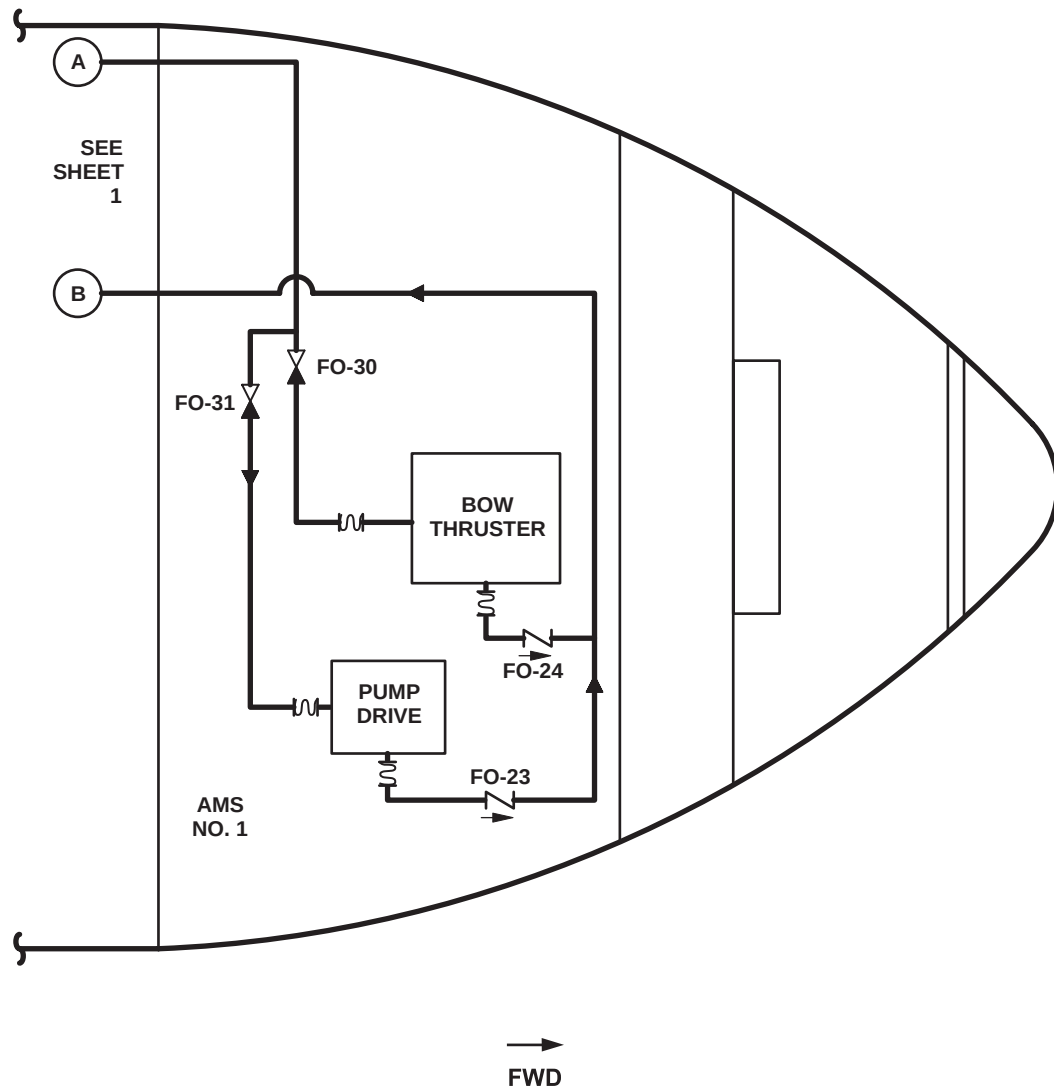


Figure 1. Fuel System (Sheet 2 of 2)

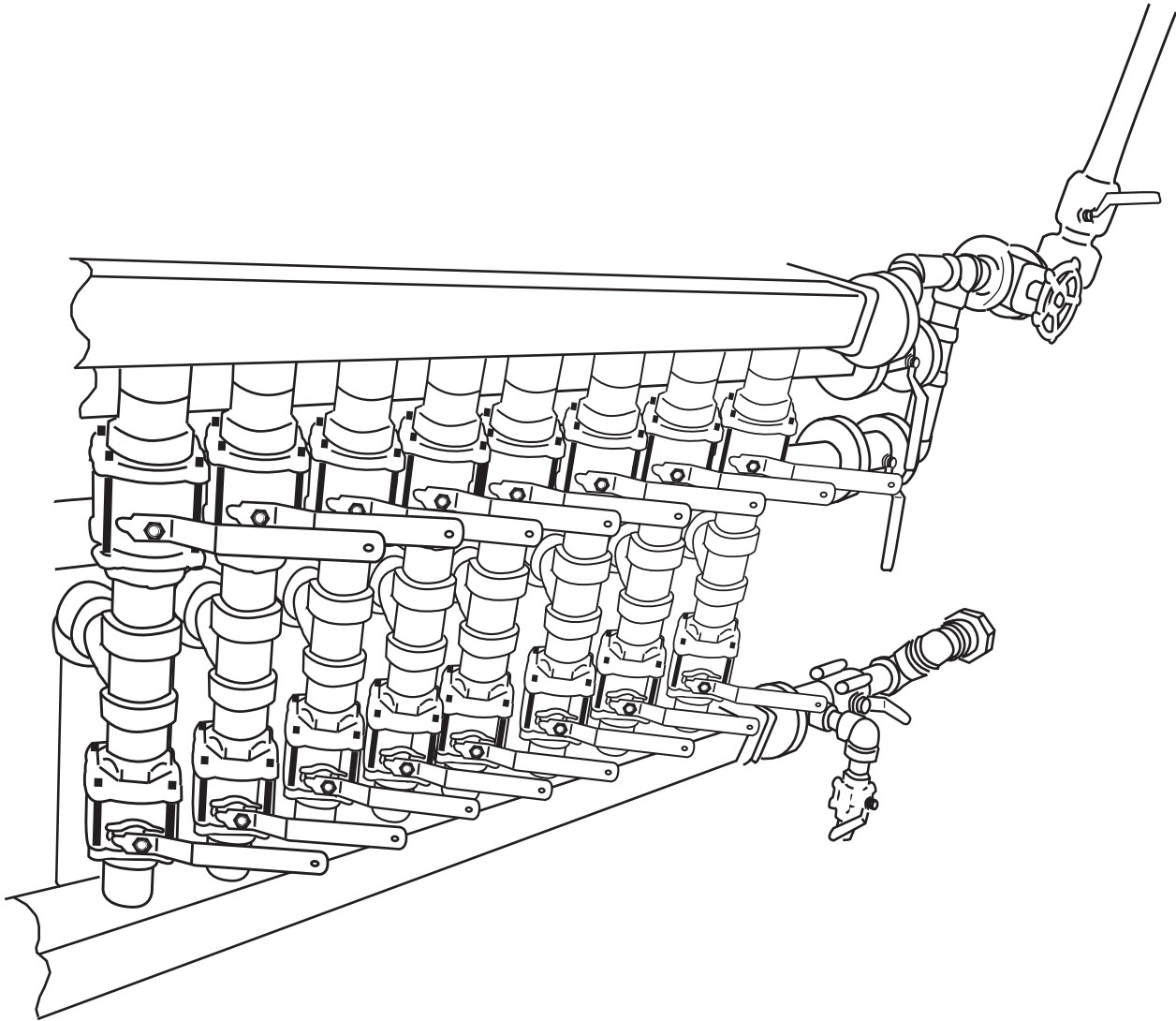


Figure 2. Fuel Oil Fill and Transfer Manifold

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
LUBRICATING AND HYDRAULIC OIL FILL AND TRANSFER SYSTEM**

GENERAL

The lubricating oil fill and transfer piping system (figure 1) supplies clean lubricating oil to fill and replenish the main propulsion engines, the Ship's Service Diesel Generators (SSDGs), the pump drive engine and the bow thruster engine.

Major components of the system include the following: a lube oil purifier (figure 1, item 1), a main engine lube oil transfer manifold (figure 1, item 2), a lube oil transfer manifold (figure 1, item 3), a lube oil transfer pump (figure 1, item 4), a lube oil storage tank, an oily waste drain tank (figure 1, item 5), an oily waste storage tank (figure 1, item 6), and a hand pump.

LUBE OIL PURIFIER

The lube oil purifier (figure 1, item 1) separates water from oil and simultaneously removes solids suspended in the oil. Clean oil is returned to the engine sump. Lube oil purifier waste products (water and solids) are pumped to the oily waste drain tank (figure 1, item 5).

MAIN ENGINE LUBE OIL TRANSFER MANIFOLD

The main engine lube oil transfer manifold (figure 1, item 2) is a duplex manifold used to control the flow of lube oil to and from the main engines. Valves are interlocked, so lube oil can only be drawn from one main engine and returned to the same main engine.

LUBE OIL TRANSFER MANIFOLD (3-WAY MANIFOLD)

The lube oil transfer manifold (3-way manifold) (figure 1, item 3) is a simplex manifold used to control the flow of lube oil to the SSDGs, the main engine lube oil transfer manifold (figure 1, item 2), the bow thruster engine (figure 1, item 7), and the pump drive engine (figure 1, item 8).

LUBE OIL TRANSFER PUMP

The rotary vane type lube oil transfer pump (figure 1, item 4) has a rated output of 15 gal/min (68.2 l/minute) at 25 PSI (1.7 bar). The lube oil transfer pump is driven by a 1 hp electric motor. Power is supplied from the main switchboard, through 440V power panel No. 1, to the motor controller.

OILY WASTE DRAIN TANK

The oily waste drain tank (figure 1, item 5) receives and holds the waste discharge from the lube oil purifier (figure 1, item 1) and engine sumps. Oily waste is transferred via the oily bilge piping system to the oily waste storage tank (figure 1, item 6).

OILY WASTE STORAGE TANK

The oily waste storage tank (figure 1, item 6) provides a holding tank that supplies oily water to be processed by the oil water separator. The tank also receives the oil output from the oil water separator. When appropriate, the oily waste discharge pump can empty the oily waste storage tank through the shore connection.

LUBE OIL HAND PUMP

A lube oil hand pump (figure 1, item 9) is provided to drain the port and starboard reduction gear sumps.

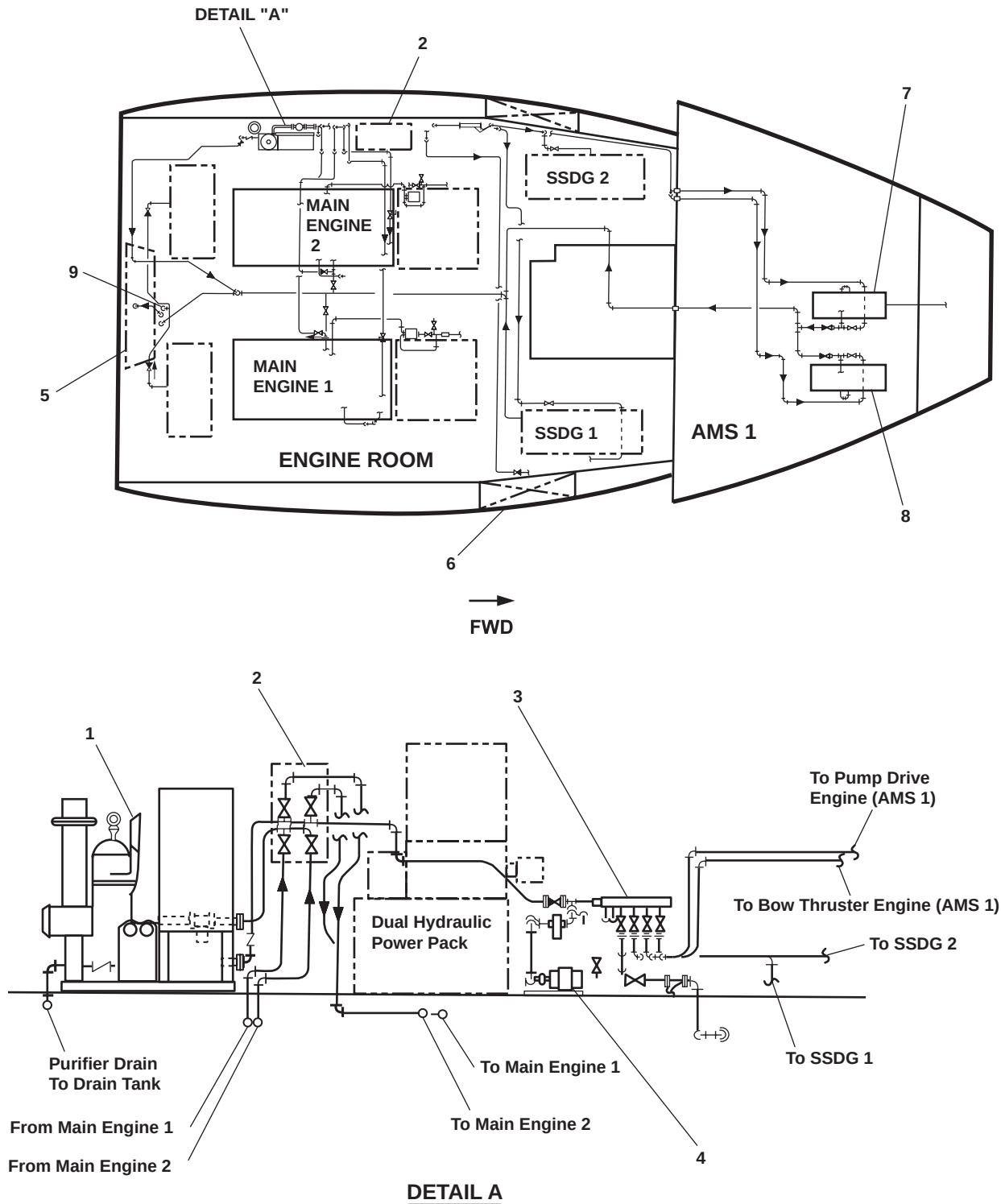


Figure 1. Lubricating Oil Fill and Transfer Piping System

SYSTEM OPERATION

The lubrication oil fill and transfer system transfers lubricating oil from the lube oil storage tank to the main engine, SSDG sumps, bow thruster engine sump, and pump drive engine sump. System alignment is maintained by the lube oil transfer manifold (3-way manifold) (figure 1, item 2) and a combination of valves. A fast lube oil drain system allows dirty oil and sludge to be discharged from the engine sumps to the oily waste drain tank (figure 1, item 5) using gravity drains. Dirty oil from the port and starboard reduction gears is discharged to the oily waste drain tank using the lube oil hand pump (figure 1, item 9). Power for the lube oil transfer pump is supplied from the main switchboard, through 440V power panel No. 1. A lube oil purifier (figure 1, item 1) purifies the lube oil for the main engines. Power for the lube oil purifier is supplied from main switchboard. Each unit has a START/STOP pushbutton adjacent to the unit.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
STEERING SYSTEM**

GENERAL

The steering gear system is an electrically driven, hydraulically operated system (figure 1) that positions the rudders in response to steering commands.

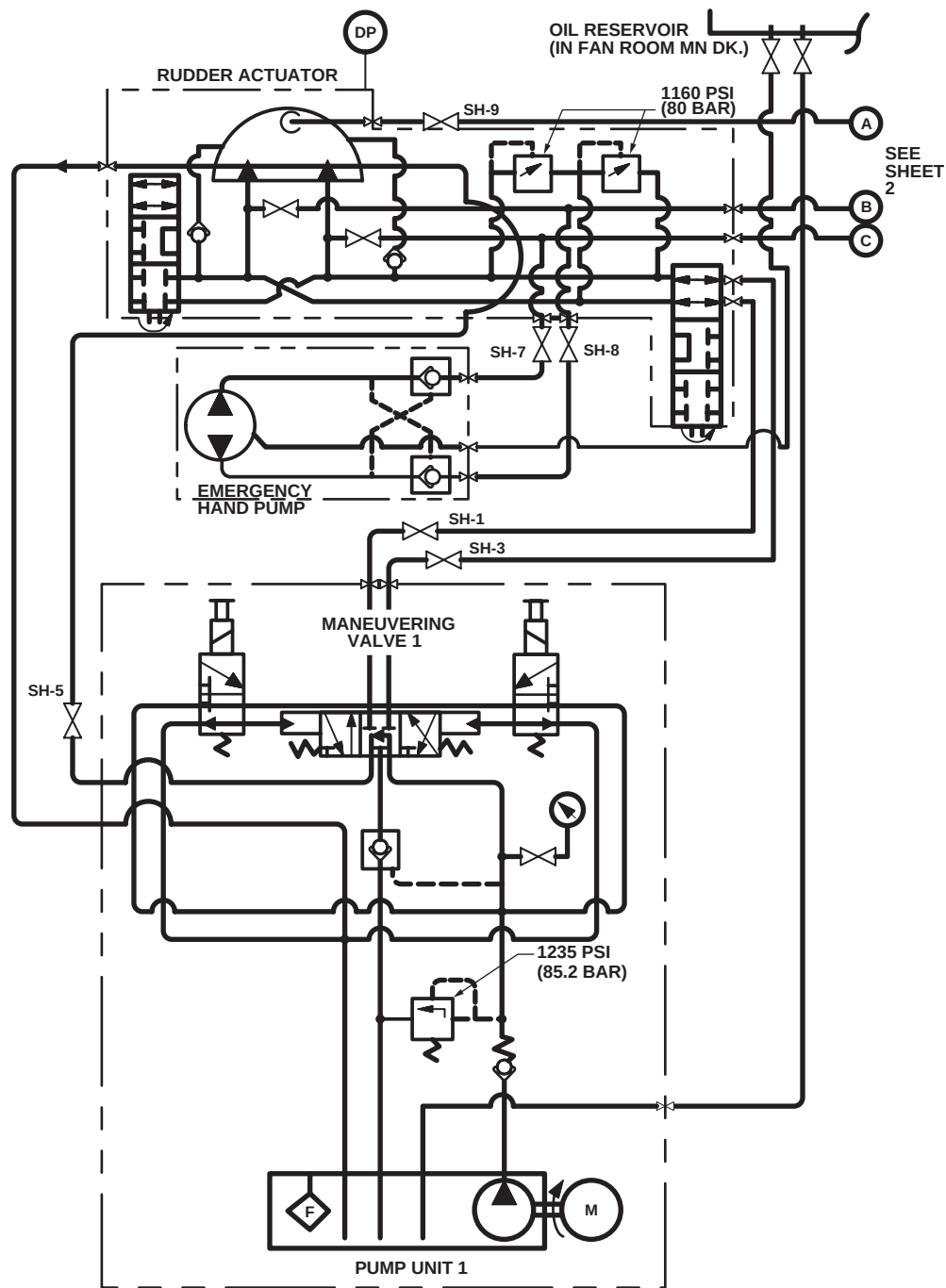


Figure 1. Steering Gear Hydraulic System Schematic (Sheet 1 of 2)

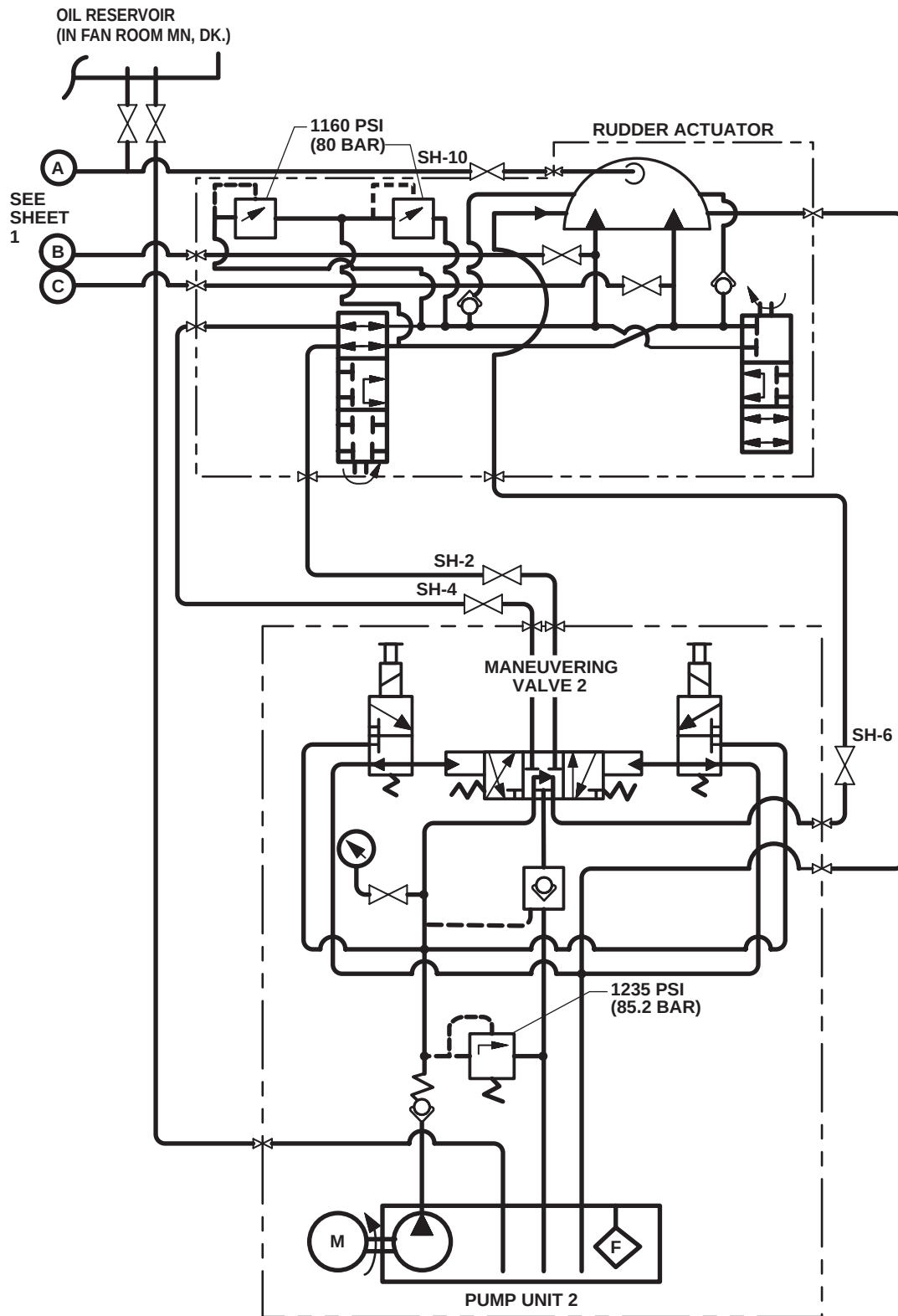


Figure 1. Steering Gear Hydraulic System Schematic (Sheet 2 of 2)

SYSTEM COMPONENTS

OIL RESERVOIR

The oil reservoir (figure 2, item 1) stores the hydraulic oil for the steering gear system.

STEERING GEAR PUMP UNIT

Each steering gear hydraulic pump unit (figure 2, item 2) consists of an electric motor, a hydraulic pump, solenoid actuated hydraulic valves (maneuvering valves), and its own oil tank. The steering gear hydraulic pump units 1 and 2 supply the hydraulic pressure to the rudder actuators (figure 2, item 3) that move the rudders into the commanded position.

SURGE ARRESTOR

The surge arrestor (figure 2, item 4) absorbs pressure fluctuations between the oil reservoir (figure 2, item 1), the steering gear hydraulic pump units (figure 2, item 2), and the rudder actuator (figure 2, item 3) to prevent damage to the steering gear system.

EMERGENCY HAND PUMP

The emergency hand pump (figure 2, item 5) provides manual directional control to the steering gear when electrical control has been lost at the helm or auxiliary stations.

RUDDER ACTUATORS

The rudder actuators (figure 2, item 3) move the rudders into the requested position (port or starboard direction) as directed by the helm or auxiliary control stations.

STEERING SYSTEM STARTER PANEL (PORT AND STARBOARD)

The steering system starter panels (figure 2, item 6) provide electrical power and control to the steering gear hydraulic pump units (figure 2, item 2). The steering gear starter panels turn the steering gear hydraulic pump units (figure 2, item 2) ON and OFF (locally or remotely).

HELM STATION

The helm station is the vessel's main steering control station and is located in the pilothouse.

SOLENOID ACTUATED HYDRAULIC VALVES (MANEUVERING VALVES)

The solenoid actuated hydraulic valves (maneuvering valves) (figure 1) receive input from the helm or auxiliary steering stations. They respond to this input by directing hydraulic pressure to the rudder actuators (figure 2, item 3). Direction and volume of the flow are determined by the input from the helm or auxiliary steering station.

AUXILIARY STEERING STATIONS

Auxiliary stations are used in place of the helm station to provide remote commands to the steering gear system. The auxiliary steering stations consist of the starboard pilothouse wing station, the port pilothouse wing station, and the aft control station.

SYSTEM OPERATION SUMMARY

The commands to move the rudder actuators (figure 2, item 3) originate from movement of the vessel's helm (wheel) or movement of the helm at the auxiliary control stations. This sends a signal to the solenoid actuated hydraulic valves (figure 1) in the hydraulic power unit. The solenoid actuated hydraulic valves direct the flow of hydraulic fluid from the reservoir (figure 2, item 1) to the steering gear hydraulic pump units (figure 2, item 2) and to the rudder actuators (figure 2, item 3). In the event of the loss of all electrical power, the emergency hand pump (figure 2, item 5) provides the steering gear system with hydraulic pressure to resume steering control.

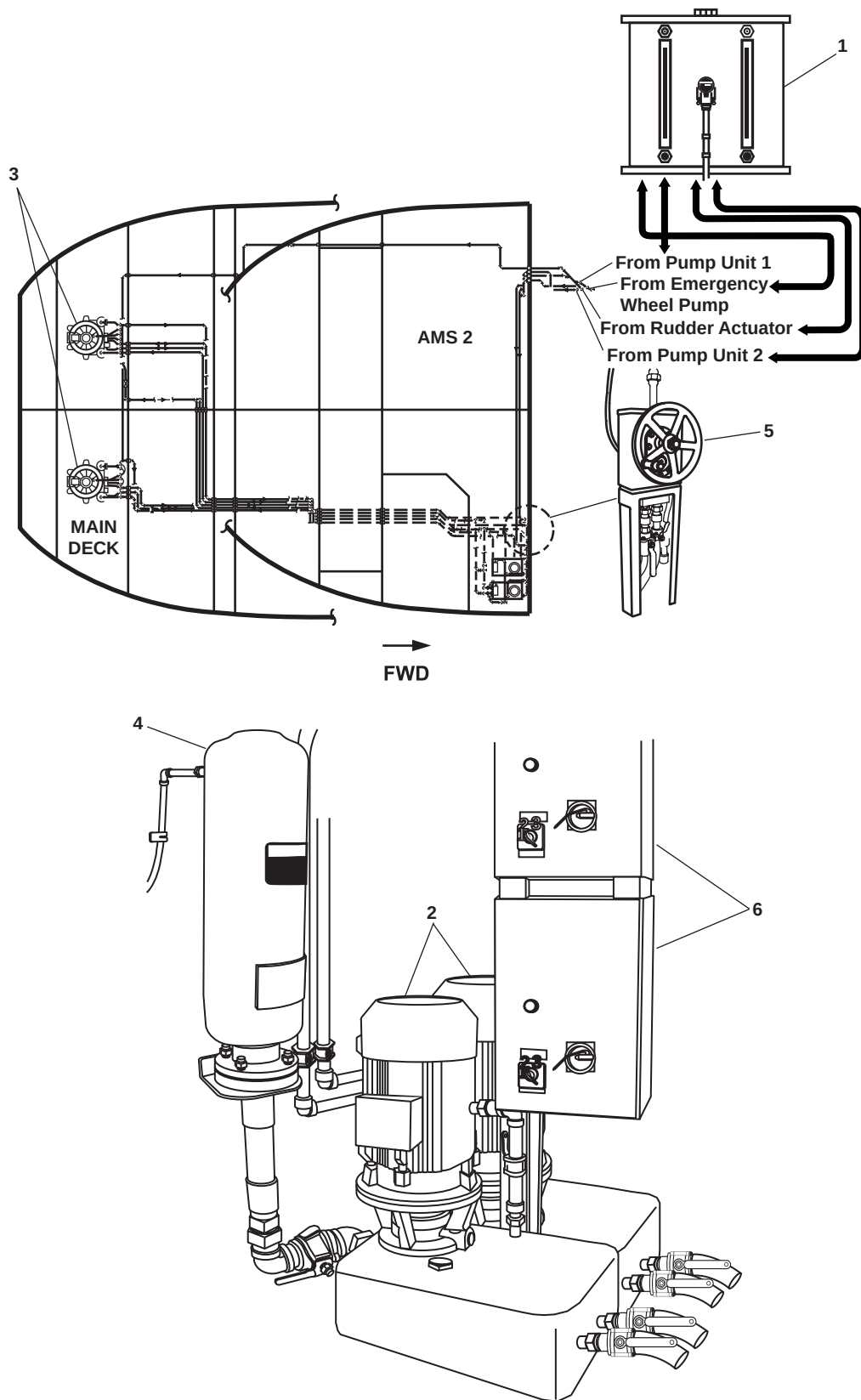


Figure 2. Steering Gear Pump Unit and Hydraulic Layout

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
HYDRAULIC SYSTEMS**

GENERAL

The LT is provided with three separate hydraulic systems. These systems are: the steering gear hydraulic system, the central hydraulic system, and the towing machine hydraulic system. Each system has its own pumps, filters, piping, reservoir, and controls.

THE STEERING GEAR HYDRAULIC SYSTEM

The steering gear hydraulic system is an electrically driven system (figures 1 and 2). The main function of the steering gear hydraulic system is to power the rudder actuators in response to steering commands from the helm or auxiliary stations.

The system components of the steering gear hydraulic system consist of: the helm station, an oil reservoir, two unit pumps, a surge arrestor, an emergency hand pump, rudder actuators, solenoid actuated hydraulic valves (maneuvering valves), and three auxiliary steering stations. The emergency hand pump (figure 2) provides hydraulic pressure and directional control to the steering gear when electrical control has been lost at the helm or auxiliary stations. Refer to WP 0025 00 for further details.

THE CENTRAL HYDRAULIC SYSTEM

The central hydraulic system (figures 3, 4, 5) provides hydraulic power for the crane, the capstan, tow pins, and anchor windlass. It may also be aligned to provide hydraulic power to both towing machines. A crossover allows the towing machine hydraulic system (figure 6) to power the central hydraulic system (figure 3) in the event of failure of the central hydraulic system (figure 4) or power pack (figure 6). The central hydraulic system (figure 3, 4, and 5) is comprised of a hydraulic fluid reservoir, two pump units, filter, and control panel. Refer to WP 0040 00 for further details.

TOWING MACHINE HYDRAULIC SYSTEM

The towing machine hydraulic system (figure 6) provides hydraulic power for the port and starboard towing machines. It may also be aligned to provide hydraulic power the central hydraulic system (figures 3, 4, and 5). The hydraulic towing machine system consists of: a diesel engine (pump drive engine), a pump unit, a reservoir, and a hydraulic oil cooler.

PUMP DRIVE ENGINE

The pump drive engine, located in AMS 1 (starboard side), powers a dual pump, open-loop hydraulic system. The maximum hydraulic flow is proportional to the pump drive engine's speed. The hydraulic fluid flow is controlled by a proportional directional control valve (figure 6, item 1) mounted on the towing machine drive motor. The pilot signal to the directional control valve is from the remote control lever located on the operator's console. A crossover allows this hydraulic system (figure 6) to power the central hydraulic system (figures 3, 4, and 5) in the event of failure of the central hydraulic system (figure 4).

OIL RESERVOIR

The oil reservoir stores the hydraulic fluid for the hydraulic towing machine system.

HYDRAULIC OIL COOLER

The hydraulic oil cooler (figure 6, item 2) (located at the reservoir) uses raw water to cool hydraulic fluid that was heated while operating the towing machine.

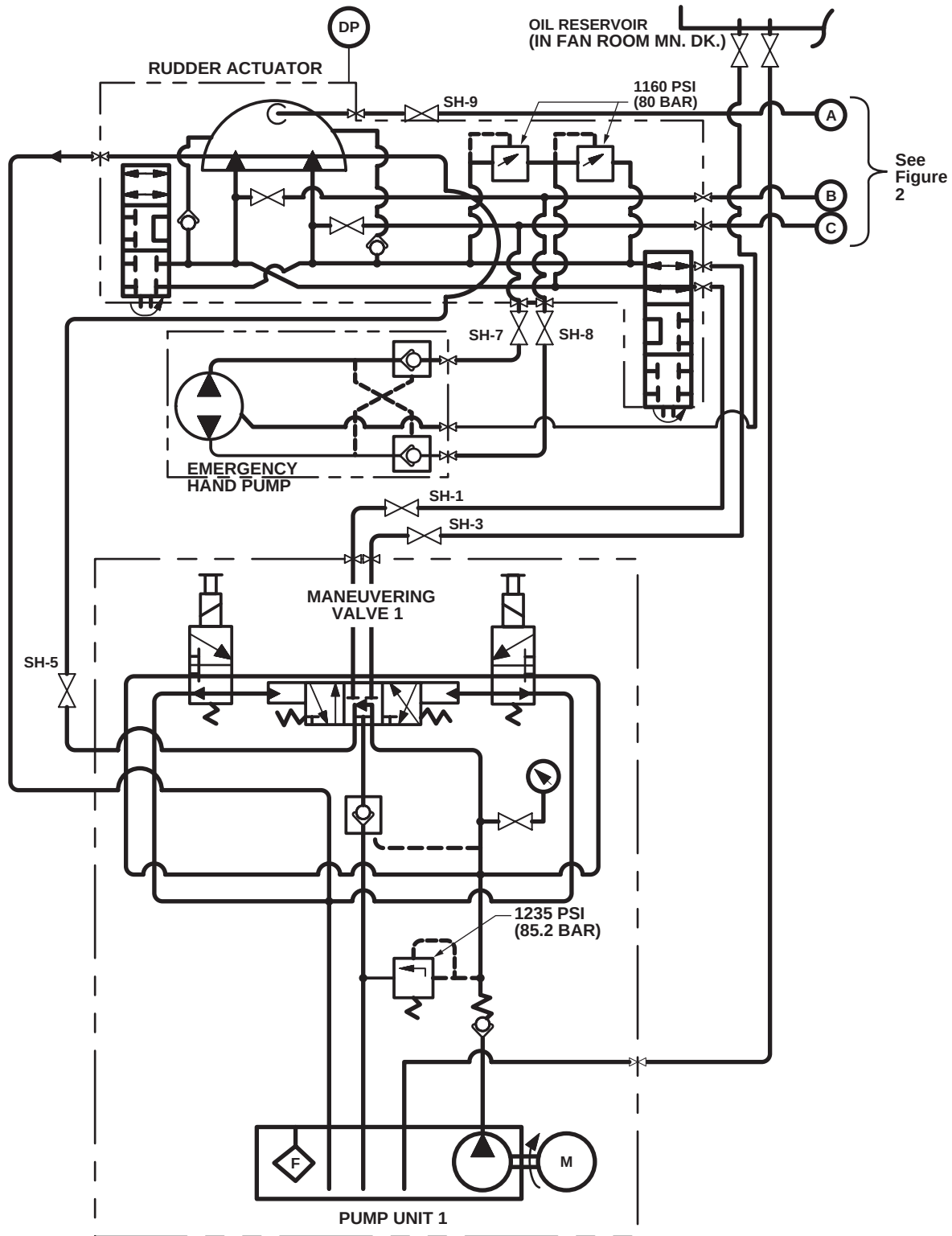


Figure 1. Steering Gear Hydraulic System Schematic (Pump 1)

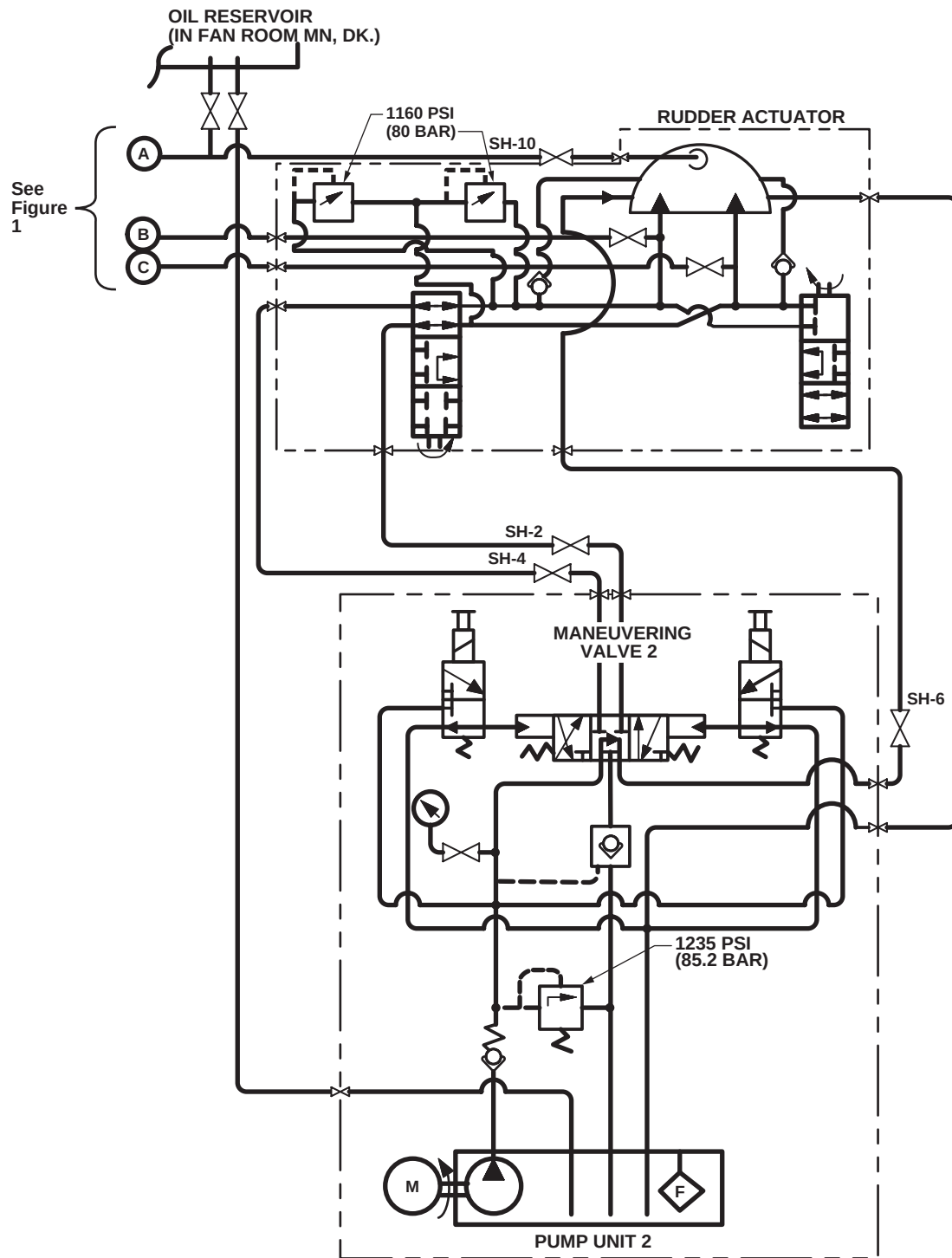


Figure 2. Steering Gear Hydraulic System Schematic (Pump 2)

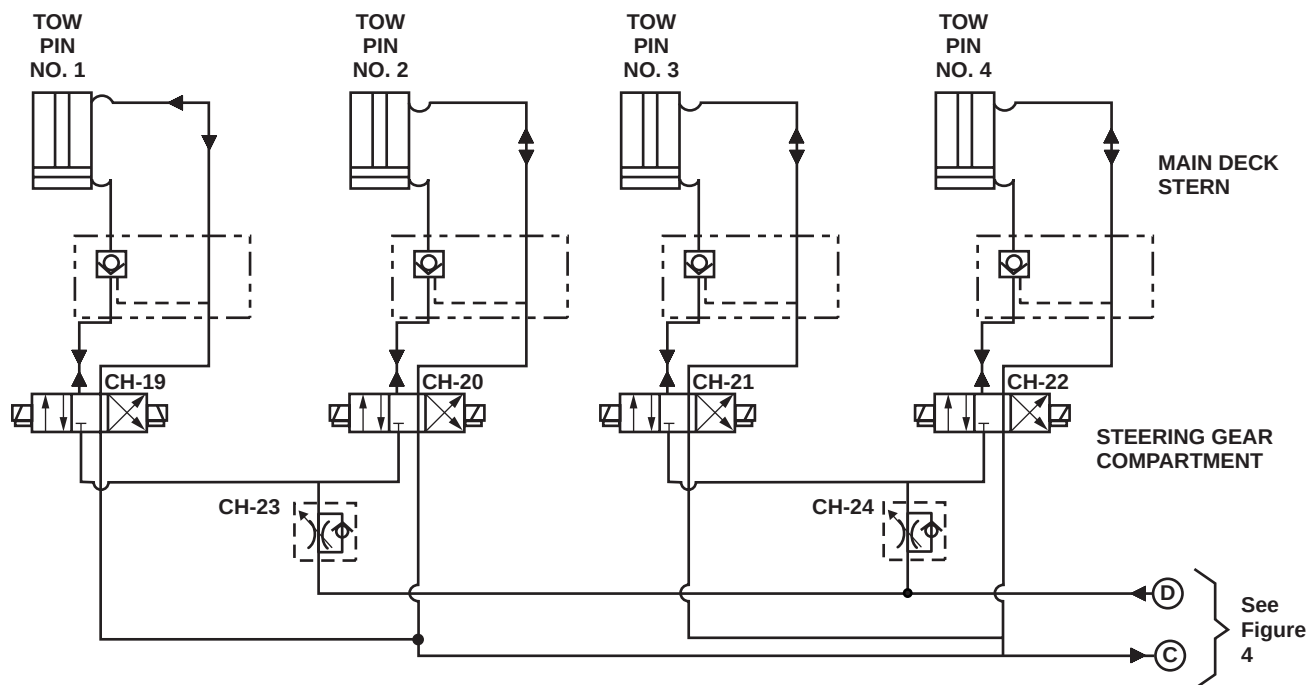


Figure 3. Central Hydraulic System (Main Deck)

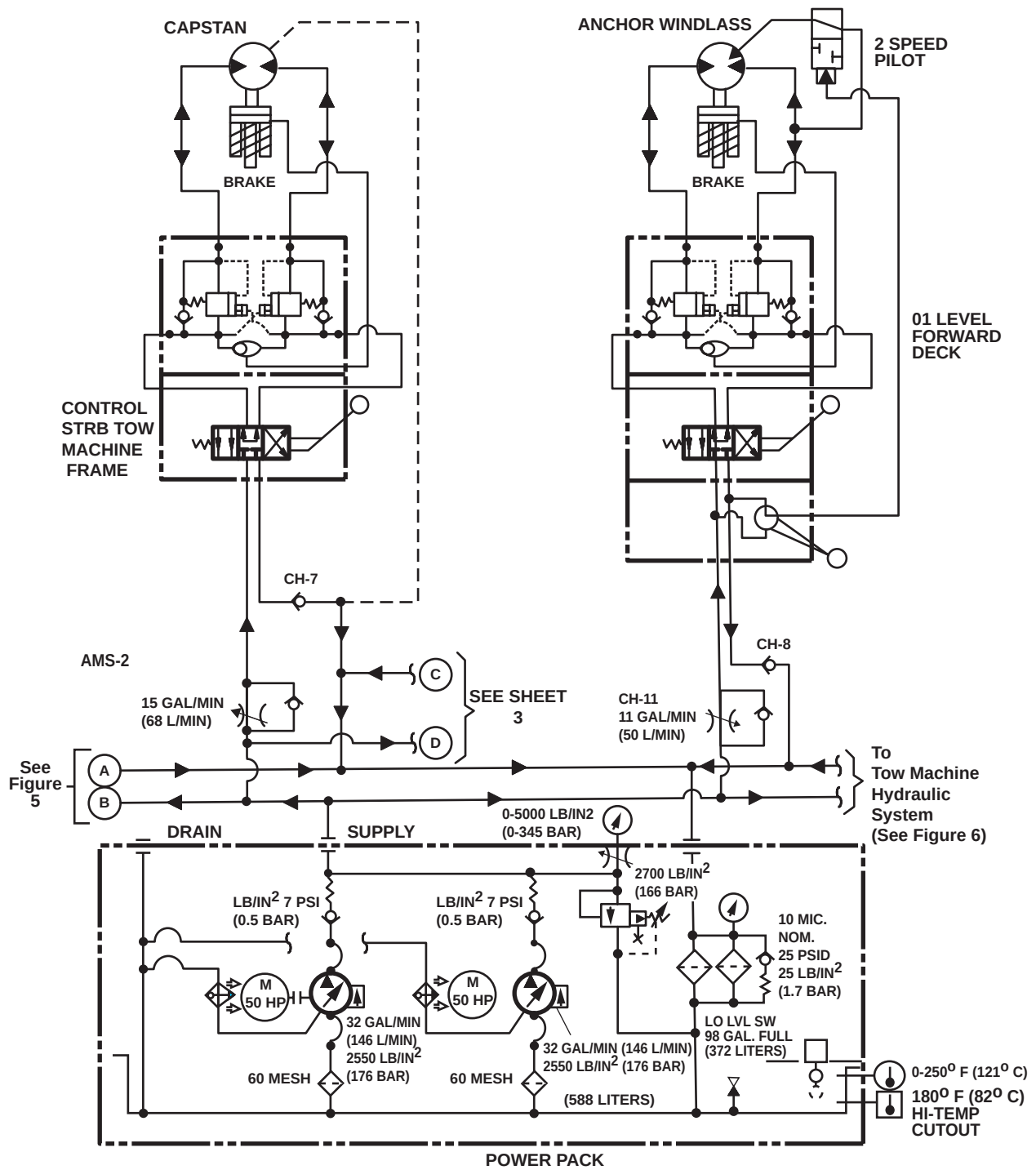


Figure 4. Central Hydraulic System (Power Pack)

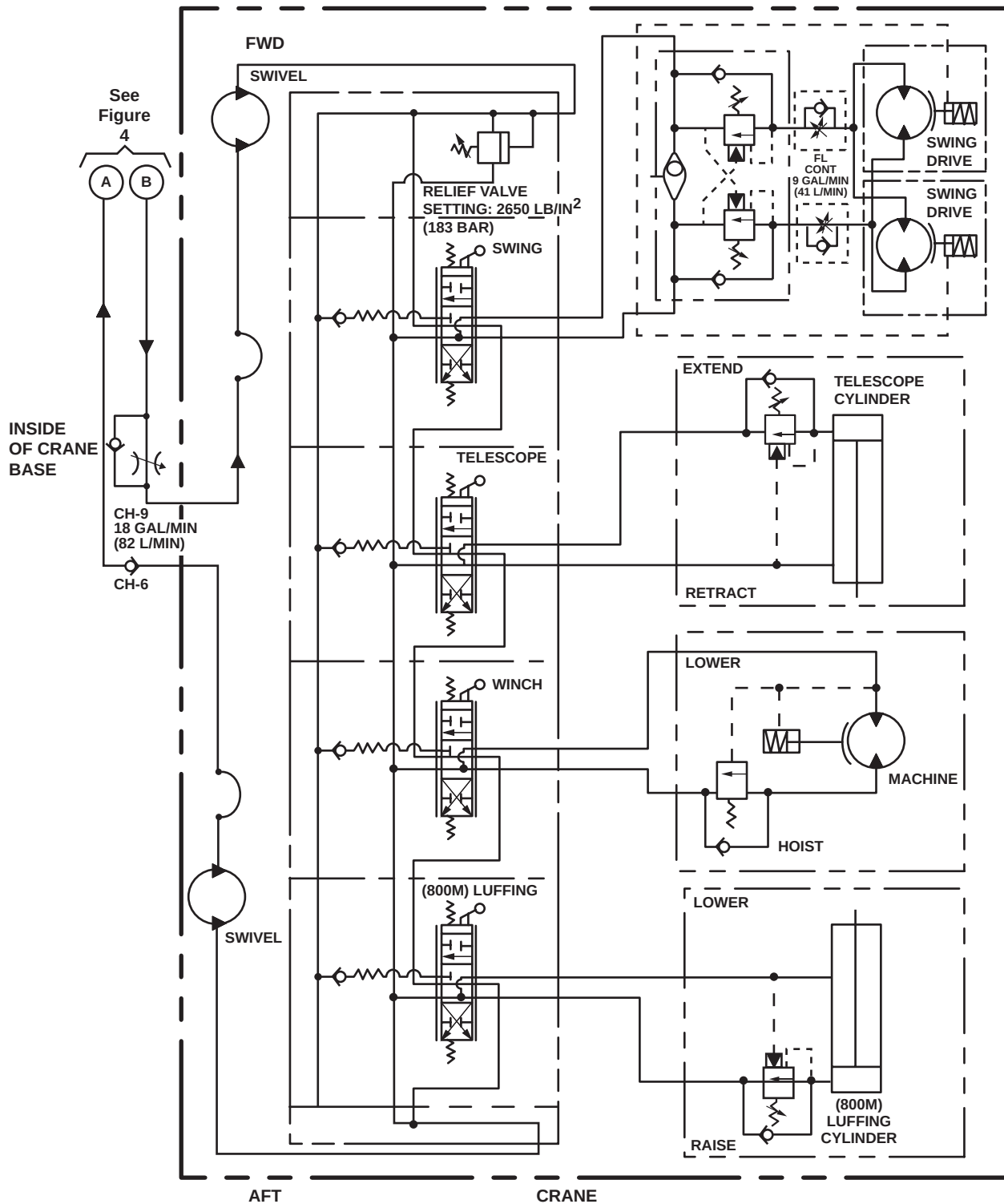


Figure 5. Central Hydraulic System (Crane)

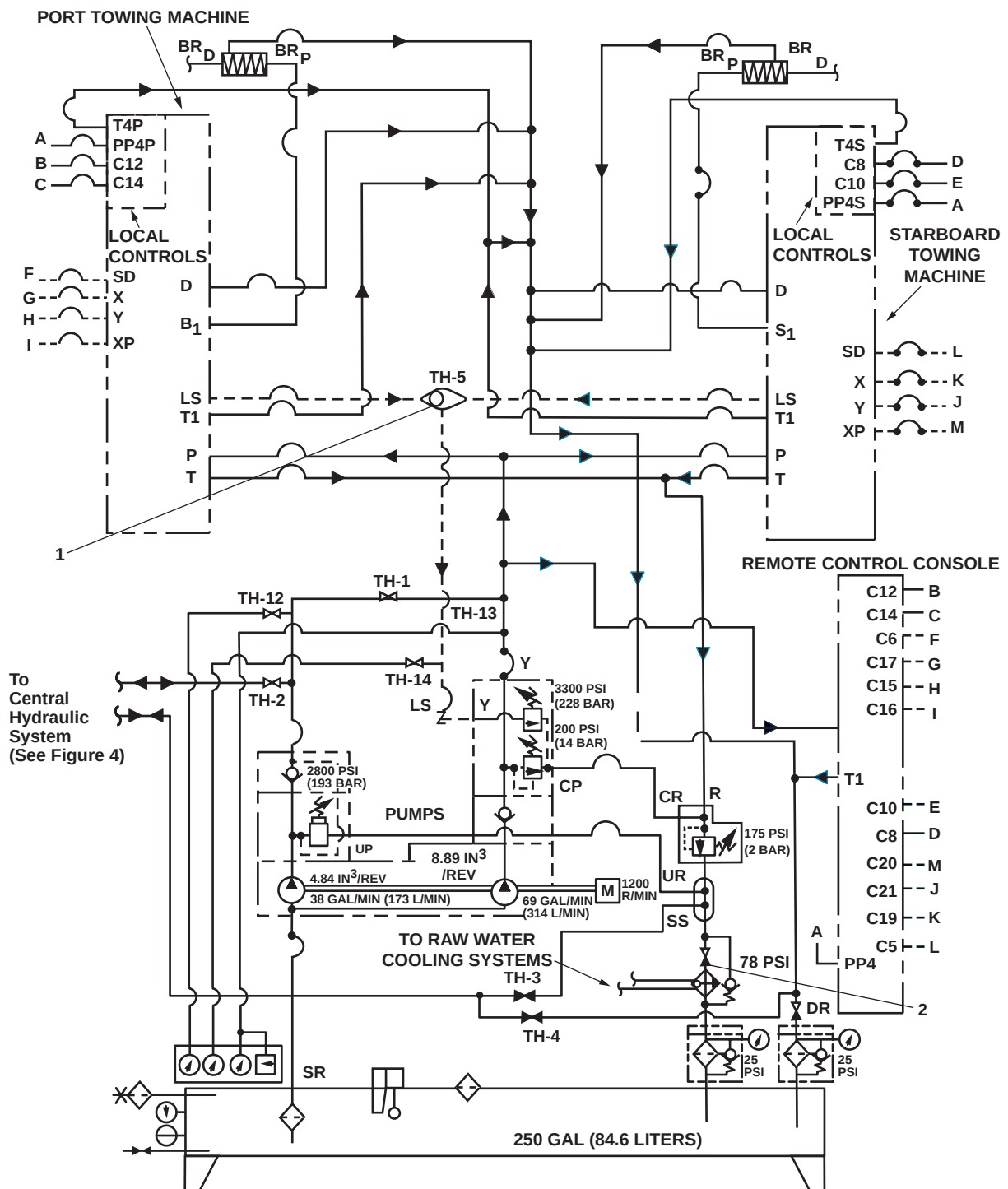


Figure 6. Towing Machine Hydraulic System

PUMP UNIT

The pump unit has a maximum flow of 98 gal/min (371 L/min) at 1,800 r/min and with the pump unloading, the maximum flow is 63 gal/min (238.5 L/min) at 1,800 r/min. The pump flow is proportional to the pump drive engine speed and can be increased or decreased by adjusting the engine speed. The pumps have a displacement of 4.84 in³/rev (123 mm³/rev) and 8.89 in³/rev (225.8 mm³/rev), and will produce a maximum pressure of 3,500 PSI (241 bar) continuous or 4,000 PSI (275.8 bar) intermittent.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
COMPRESSED AIR SYSTEM**

GENERAL

This work package describes the theory of operation for the Inland and Coastal Large Tug's (LT) compressed air system. The theory of operation for the system as a whole is discussed first. Following the system theory of operation, the theory of operation for the air compressor is discussed.

SYSTEM

Two electric powered, two-stage air compressors (figure 1, item 1) compress air for use throughout the vessel. See the Air Compressor paragraph below for theory of operation for the compressors.

After leaving the compressors (figure 1, item 1), the compressed air passes through air dryers (figure 1, item 2). These air dryers remove moisture from the air before the air reaches the starting air receivers (figure 1, item 3). Removal of moisture from the compressed air is necessary to prevent the accumulation of water in the receivers. This accumulated water can corrode the interior of the receivers, and can also travel downstream in the compressed air system damaging components further down the line. Each dryer is equipped with a bypass valve (figure 1, item 4) to permit air to bypass the dryer in the event of a dryer failure.

All air discharged from the air compressors (figure 1, item 1) arrives first at the starting air receivers (figure 1, item 3). Here, the air is stored at 250 PSI (17.2 bar) to ensure that an adequate supply of compressed air is on hand for use in starting the main engines, the bow thruster engine, the pump drive engine, and the engine for SSDG 2. SSDG 1 is equipped with an electric starter, and does not require compressed air.

Compressed air for ship's service use (air tools, ship's whistle, sea chest blowdowns, etc.) is stored in the ship's service air receiver (figure 1, item 5). This receiver is supplied from the starting air receivers (figure 1, item 3) through a regulator (figure 1, item 6). This regulator reduces the starting air pressure to 125 PSI (8.6 bar) before the air is permitted to enter the ship's service air receiver. A bypass valve (figure 1, item 7) permits manual filling of the ship's service air receiver in the event of a regulator failure.

All three receivers (figure 1, items 3 and 5) are equipped with relief valves (figure 1, item 8), local pressure gauges (figure 1, item 9), manual drain valves (figure 1, item 10), and automatic drain valves (figure 1, item 11). The relief valves prevent overpressurization of the receivers, which could result in catastrophic failure. The relief valve for the starting air system is set at 275 PSI (19.0 bar) and the relief for the ship's service system is set for 137.5 PSI (9.5 bar). The manual drains permit manual draining of water from the receivers. They also permit the system to be drained when receiver or compressed air system maintenance is required. The automatic drains open on a preset schedule, keeping the receivers drained under normal operating conditions.

Although the starting air is stored at 250 PSI (17.2 bar), this pressure is too high for the engines' starters to accommodate without damage. Therefore, each engine's starting air piping is fitted with a regulator. The regulator for the bow thruster engine (figure 1, item 12) and the pump drive engine (figure 1, item 13) each reduces the starting air pressure to 125 PSI (8.6 bar). The regulators (figure 1, item 14) for the main engines each reduce the engines' starting air pressure to 200 PSI (13.8 bar).

Additional regulators are provided for the forward (figure 1, item 15) aft (figure 1, item 16) and high level (figure 1, item 17) sea chest blowouts. These reducing valves reduce the ship's service air to 25 PSI (1.7 bar) to prevent damage to the sea chests.

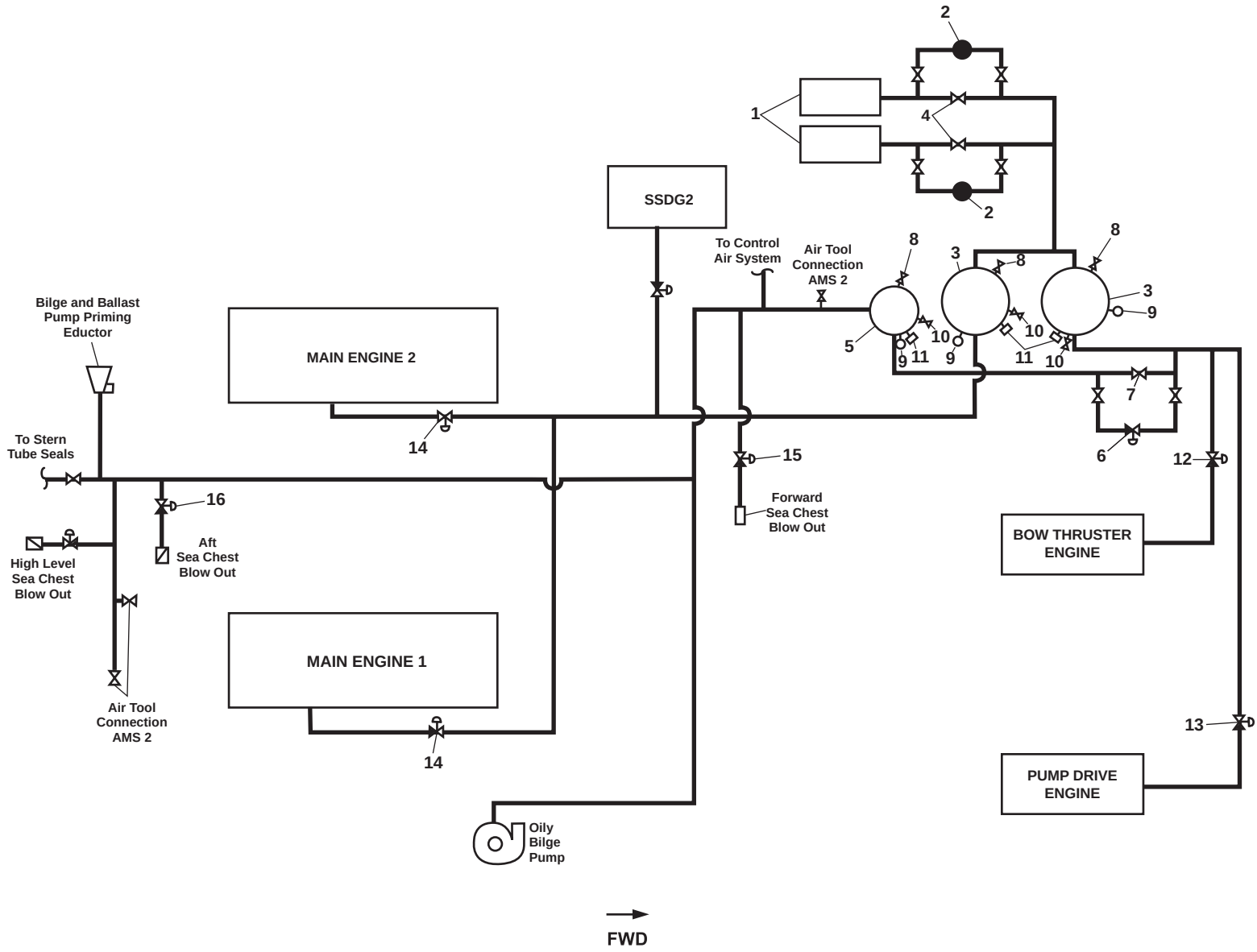


Figure 1. Compressed Air System Simplified Schematic

AIR COMPRESSOR

COMPRESSION

The compressor's crankshaft (figure 2, item 1) is turned by an electric motor, via a V-belt drive. As the crankshaft turns, the pistons move up and down. During the downstroke of the low-pressure piston (figure 2, item 2), air is drawn through an intake valve in the head of the compressor into the low-pressure cylinder (figure 2, item 3). During the upstroke of the piston, this air is compressed.

The air that was compressed by the low-pressure piston (figure 2, item 2) is then released through a discharge valve in the head of the compressor to a finned tube intercooler where the heat resulting from compression is allowed to dissipate. The cooler compressed air is then drawn into the high-pressure cylinder by the downstroke of the high-pressure piston (figure 2, item 4). On the upstroke of the high-pressure piston, the air is further compressed before being discharged through a discharge valve in the compressor head. At this point, the compressed air enters the vessel's compressed air piping system enroute to the starting air receivers.

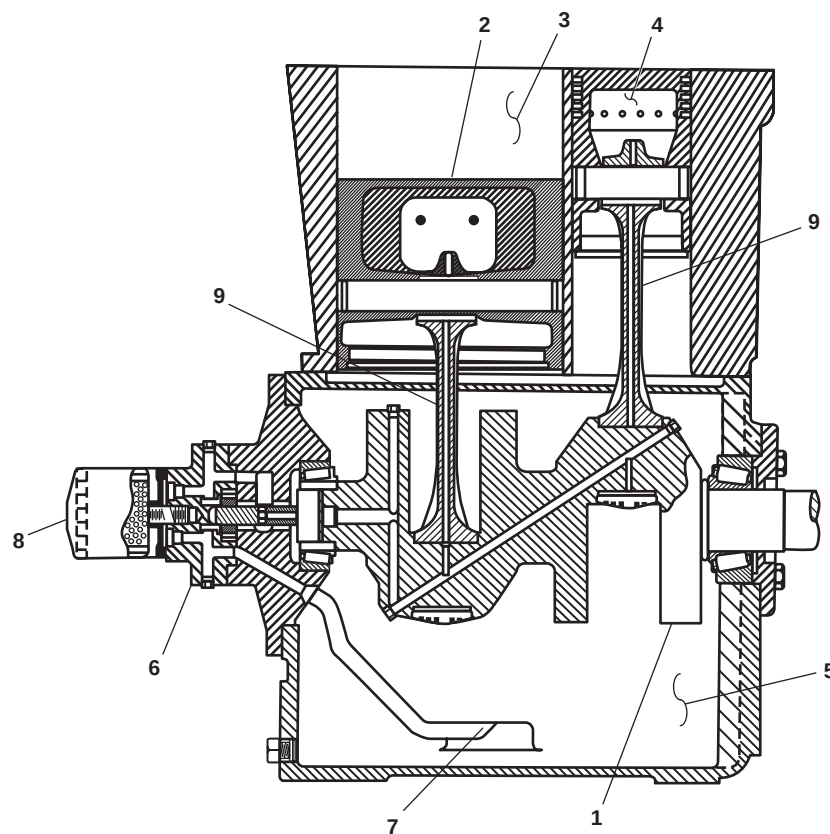


Figure 2. Air Compressor

LUBRICATION

The air compressor is pressure lubricated. The moving parts within the crankcase (figure 2, item 5) are supplied with lubrication by a positive displacement, gerotor type oil pump (figure 2, item 6). Oil is drawn up from the bottom of the crankcase to the oil pump through an oil sump strainer screen (figure 2, item 7). The oil is then forced under pressure through the oil filter (figure 2, item 8). After being filtered, the oil travels under pressure through drilled journals in the crankshaft (figure 2, item 1) and connecting rods (figure 2, item 9) to lubricate crankshaft bearings, wrist pin bearings, and the cylinder walls.

COOLING

The fan blades of the compressor pulley force ambient air across the fins of the cylinder heads and intercooler fins to cool the compressor.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
CONTROL AIR SYSTEM**

GENERAL

The control air system provides dry compressed air to the throttles and transfer valves in the pilothouse control console (figure 1, item 1) and auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2) of the Large Tug (LT). The control console and auxiliary control stations are where the commands to maneuver the vessel originate.

The major components of the control air system consist of an air dryer (figure 1, item 3), pilothouse control console (figure 1, item 1), auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2), the EOS console (figure 1, item 4), the reduction gear ratio selector, and indicator system.

AIR DRYER

The air dryer removes the moisture from the compressed air before it is supplied to the control consoles and auxiliary control stations.

CONTROL CONSOLES

The control console is the main control station where commands originate to engage the main propulsion and the bow thruster engine.

AUXILIARY CONTROL STATIONS

The auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2) are standby control stations where commands originate to engage the main propulsion and the bow thruster engines in place of the main control console (pilothouse) (figure 1, item 1).

EOS CONSOLE

The EOS control console (figure 1, item 4) contains the controls for selection of reduction gear ratios and engine throttle controls. Pneumatic valves in each console and control station provide the necessary control of the system.

REDUCTION GEAR RATION SELECTION

A selector in the EOS control console (figure 1, item 4) allows selection of the desired forward reduction gear ratio. The reduction gear selector will be disabled whenever the throttle control is not in the center or the NEUTRAL position, or command is at a station other than the EOS control console.

IN COMMAND INDICATORS

The pilothouse control console (figure 1, item 1) and the EOS control console (figure 1, item 4) have indicators to show which of the five stations has command and which clutch(es) are selected. The auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2) have a single indicator to show when that station is in command.

CONTROL AIR SYSTEM OPERATION

The transfer of command to the pilothouse console (figure 1, item 1) or one of the auxiliary control stations (STARBOARD, PORT, and AFT) (figure 1, item 2) is initiated from the EOS console (figure 1, item 4). An engine room watchstander positions the EOS COMMAND TRANSFER control from the EOS to the REMOTE position. At the selected station, the operator pulls up and holds the COMMAND TRANSFER plunger until air (compressed) pressure is indicated on the CONTROL AIR PRESSURE gauge. Once the gauge indicates air pressure, transfer is complete and all other control stations are disabled. Transfer between the pilothouse console and an auxiliary control station is accomplished by pulling up the COMMAND TRANSFER plunger at the desired station until air pressure is indicated on the CONTROL AIR PRESSURE gauge.

at approximately 110 to 120 PSI (7.58 to 8.27 bar). This also disables all other stations. The throttle and transfer valve become active at the directed control station. The EOS may regain control at any time by placing EOS COMMAND TRANSFER control to the EOS position. Main engine starting circuits are disabled whenever a clutch is selected or command is at a station other than EOS.

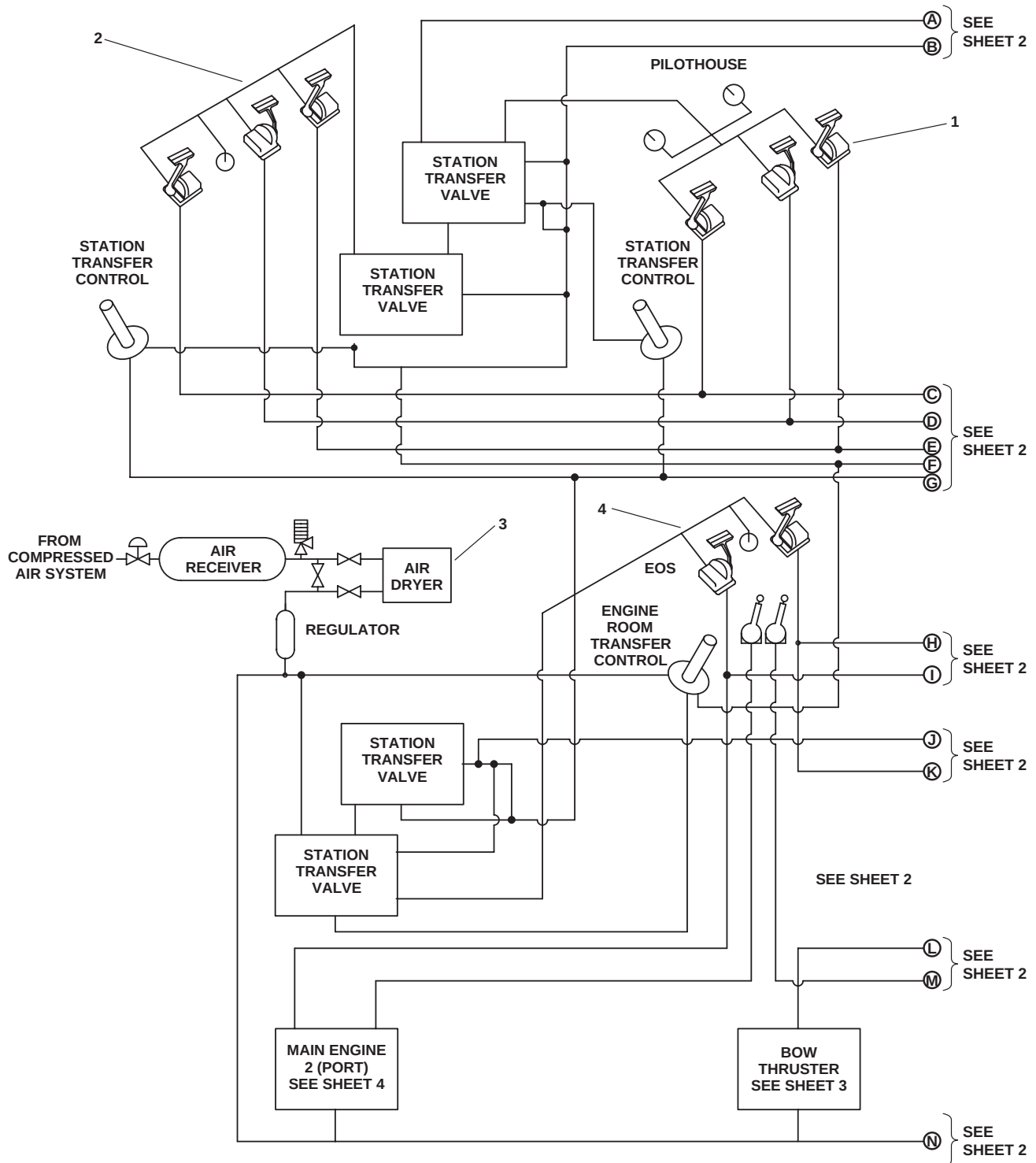


Figure 1. Control Air System (Sheet 1 of 4)

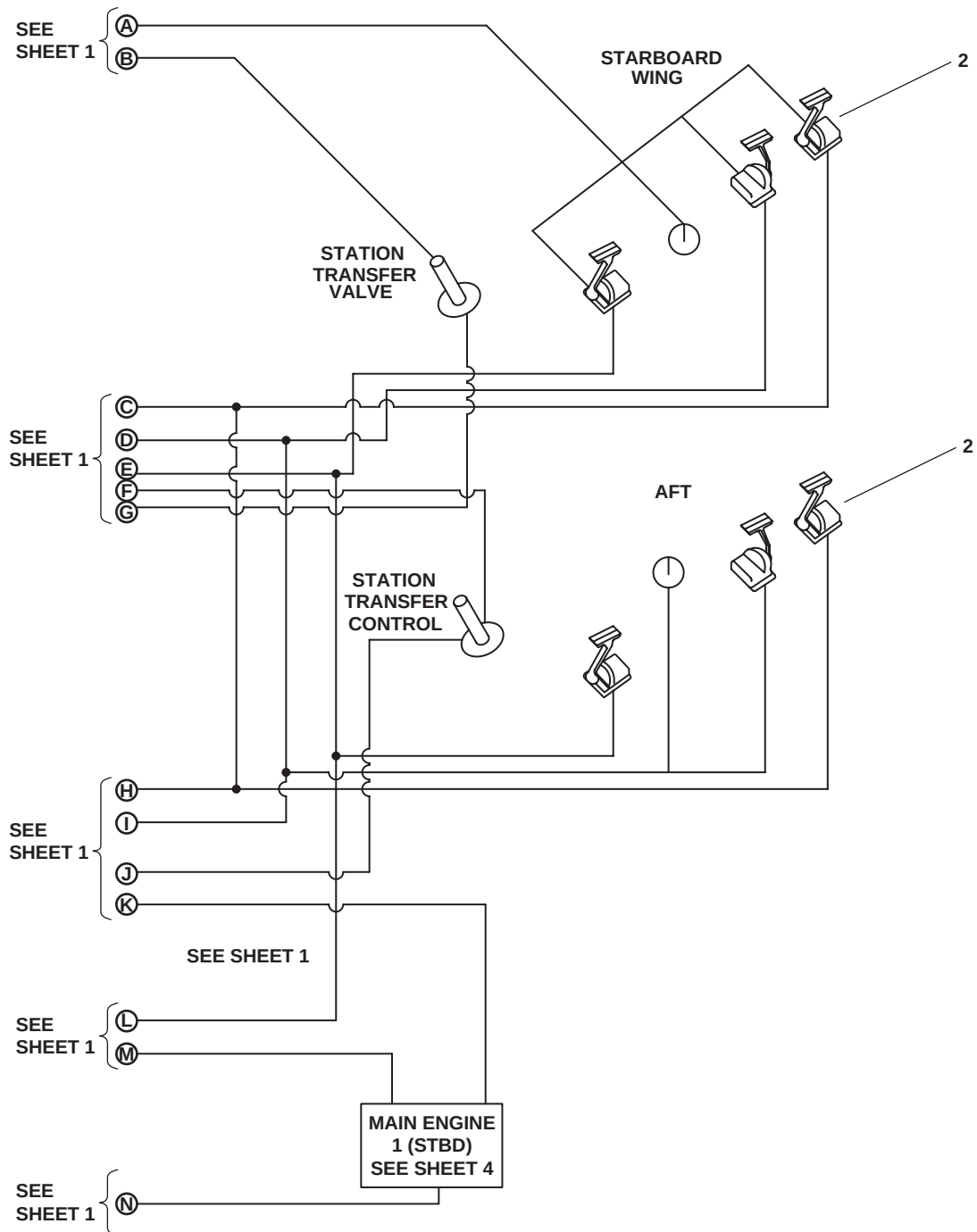


Figure 1. Control Air System (Sheet 2 of 4)

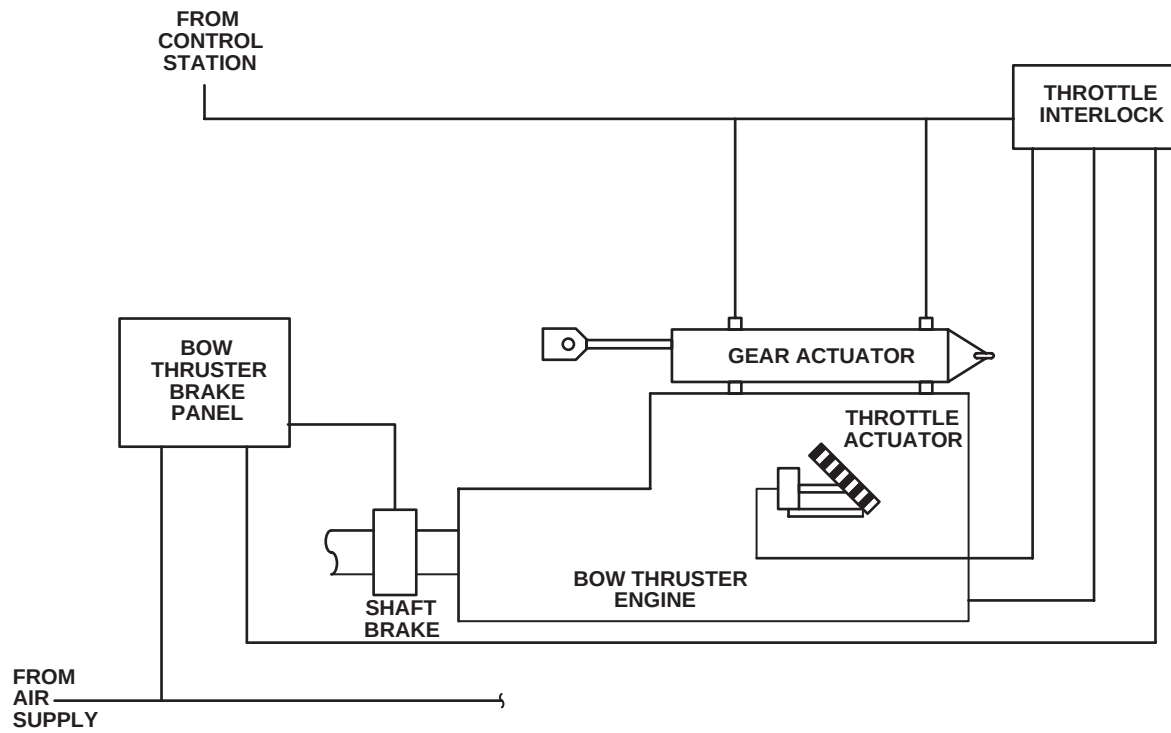


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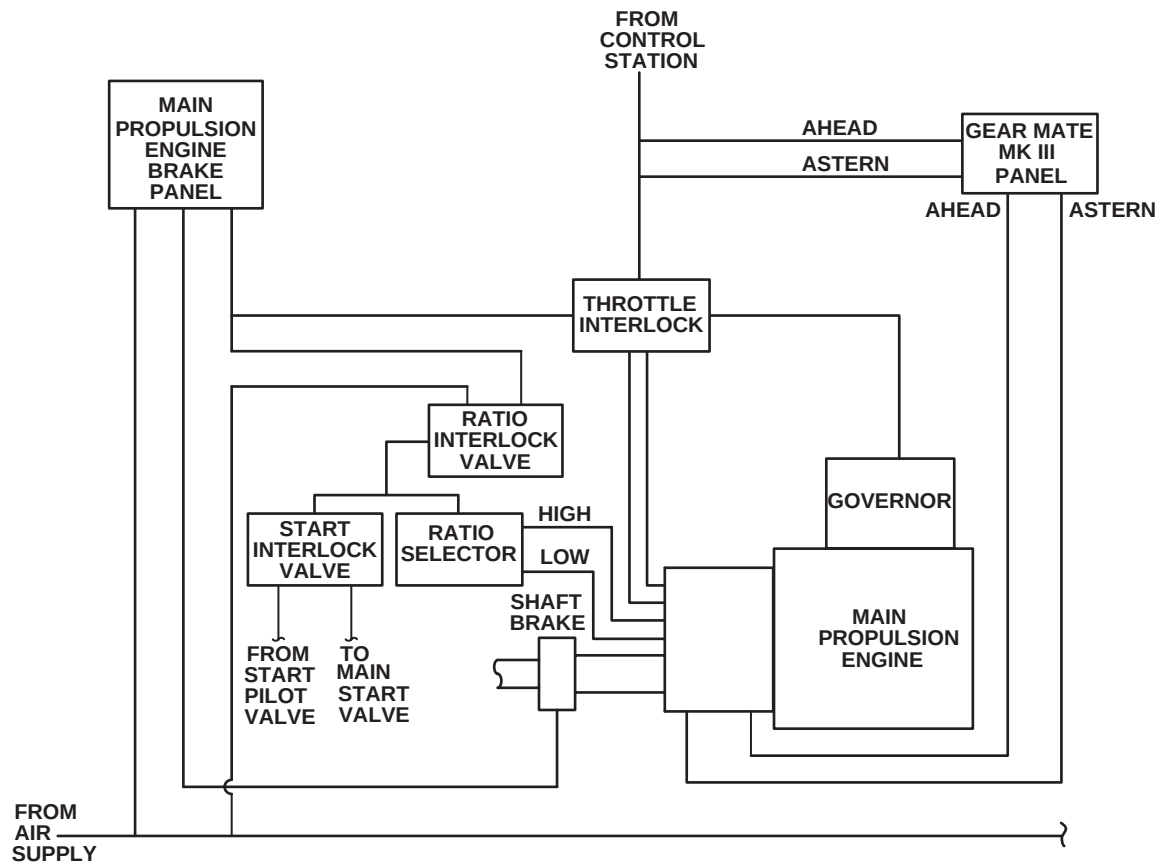


Figure 1. Control Air System (Sheet 4 of 4)

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
POTABLE WATER SYSTEM**

GENERAL

The potable water system supplies cold and hot water to the galley, drinking fountains, showers, toilets, sinks, hot water heaters (figure 1, item 1), and other areas throughout the LT. The potable water system also supplies potable water to replenish the coolant in the engine cooling piping systems.

The potable water system consists of two potable water tanks (figure 2, item 1), two reverse osmosis water purification units (figure 2, item 2), a proportioning bromine feeder (figure 2, item 3), two potable water pumps (figure 2, item 4) a hydropneumatic tank (figure 2, item 5) with pressure switches, two potable hot water heaters and a hot potable water recirculating pump (figure 1, item 2).

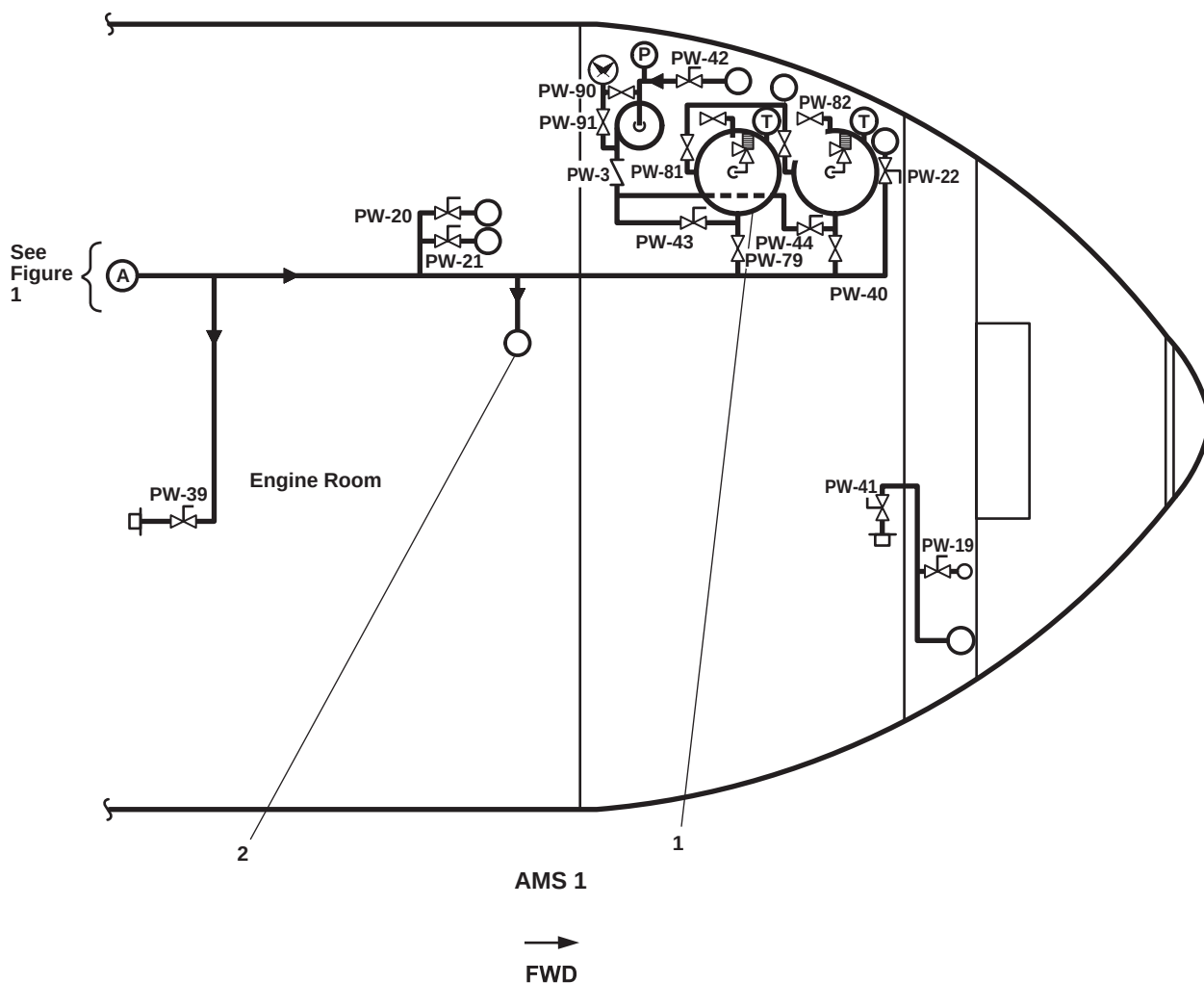


Figure 1. Potable Water System (AMS 1)

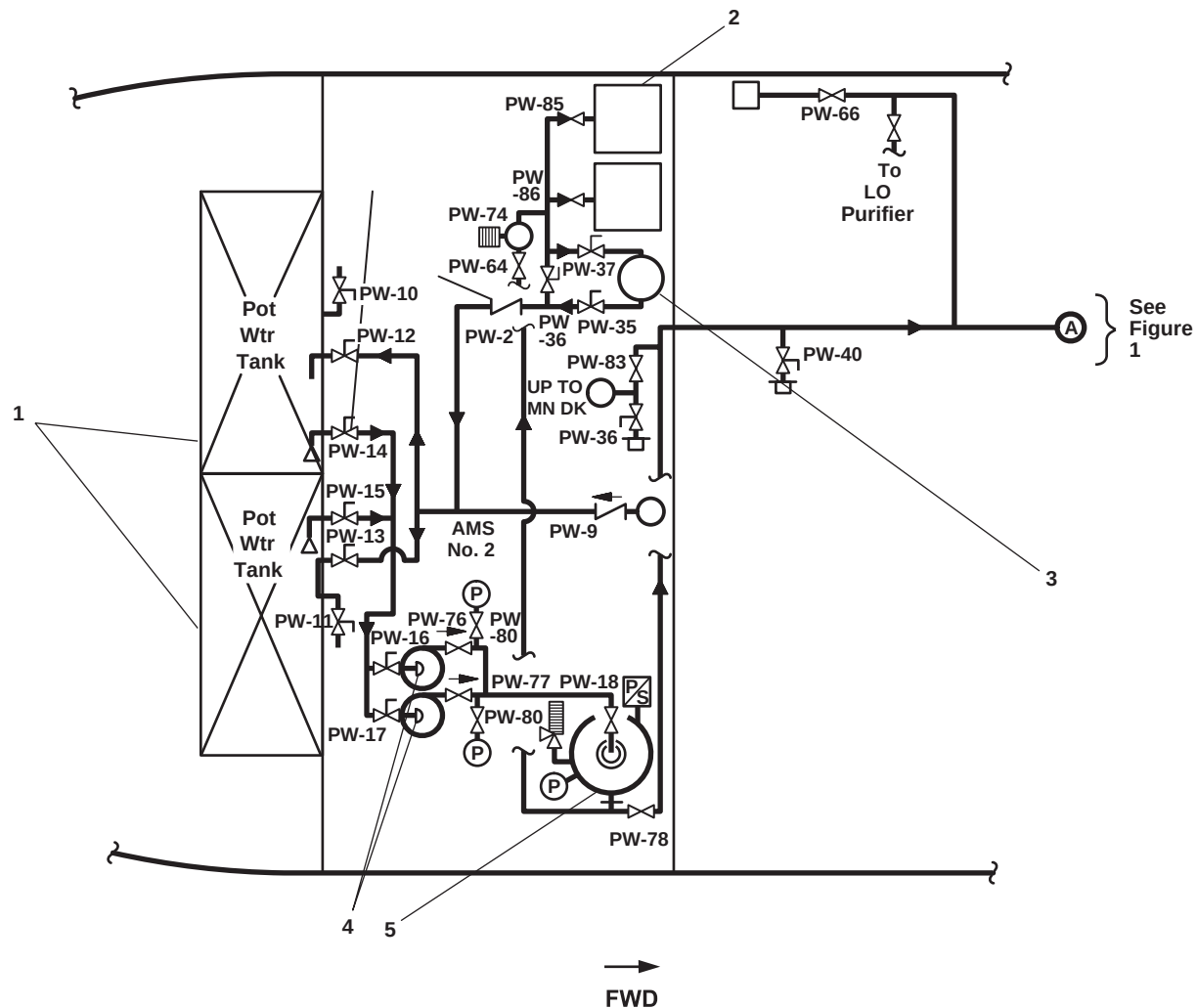


Figure 2. Potable Water System (AMS 2)

POTABLE WATER TANKS

Two potable water tanks (figure 1, item 1) (port and starboard) are mounted in a watertight void between frames 14 and 25. The potable water tanks are used to store potable water. These tanks have fill connectors and a piping vent on the main deck. The potable water tank levels are monitored by Tank Level Indicators (TLIs) located in AMS 2 and the EOS.

VENT

The potable water tank vent has an inverted check valve. This vent provides ventilation to the tank as the tank level changes. The inverted check valve opening is protected by a screen to keep insects and other contaminants from entering the system.

FILL CONNECTORS

The fill connectors (figure 3, items 1 and 2) allow the potable water tanks (figure 2, item 1) to be filled from an external source of treated water.

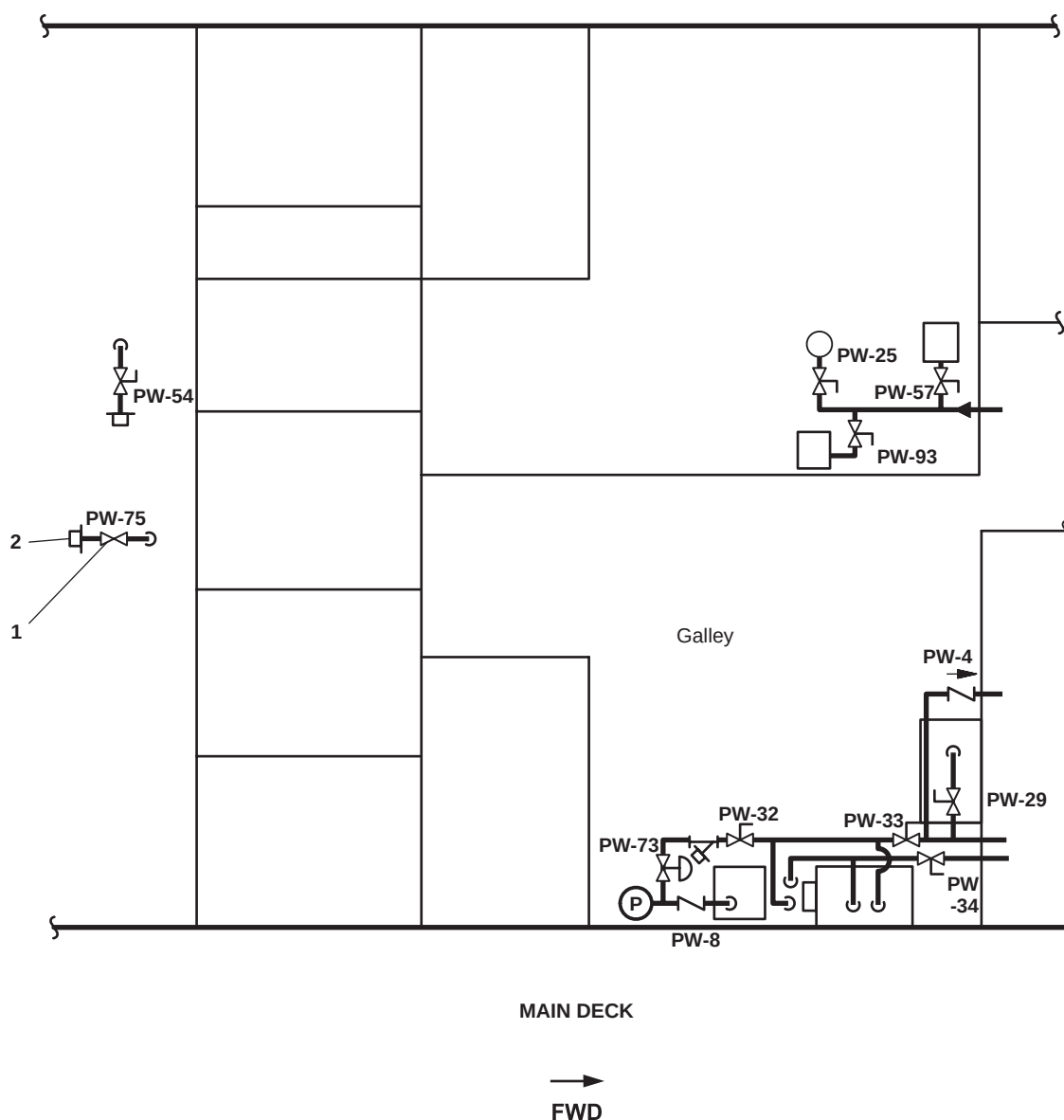


Figure 3. Potable Water System (Main Deck Galley)

POTABLE WATER PUMPS 1 AND 2

Two horizontal centrifugal potable water pumps draw potable water from either the port or starboard potable water tanks. The potable water is routed, under pressure, to the hydropneumatic tank. Both pumps are rated for 15 gal/min (68.2 Liter/minute) at 60 PSI (4.1 bar). Both pumps are driven by an electric 3 hp motor. Power to both potable water pumps is supplied from 440V power panel No. 5. Both potable water pumps are controlled by a pressure switch.

PRESSURE SWITCH

The potable water pump pressure switch automatically turns on the pump in use when pressure drops to 40 PSI (2.76 bar) in the hydropneumatic tank. The pressure switch de-energizes the pump in use when pressure reaches 60 PSI (4.1 bar).

PROPORTIONING BROMINE FEEDER

The proportioning bromine feeder (figure 2, item 3) treats potable water by adding a predetermined quantity of bromine to

disinfect the water (ensure that the water supplied to the potable water tanks is bacteriologically safe for human consumption) as the water is being discharged from the reverse osmosis water purification units (figure 1, item 1) to the potable water storage tanks (figure 2, item 1). The quantity of bromine added depends on the raw water intake to the reverse osmosis water purification units (figure 2, item 2). If the raw water is considered non-contaminated, a low feed rate is used. If the raw water is considered contaminated, a high feed rate is used. The feed rate is manually selected. The bromine feeder also injects bromine as water recirculates to and from the potable water tanks.

HYDROPNEUMATIC TANK

The hydropneumatic tank is a pressurized potable water tank; it maintains potable water supply pressure for the potable water system. Pressurized potable water is supplied from the hydropneumatic tank to the potable water heaters and various areas throughout the vessel. The initial charging of the hydropneumatic tank to 60 PSI (4.1 bar) is accomplished using the compressed air system. Once charged, the pressure switch activates the potable water pumps (figure 1, item 4) to maintain water pressure.

HOT WATER HEATER

Two hot water heaters (figure 1, item 1) are provided to supply hot water to the galley, all faucets, showers, and the laundry compartment. The hot water heaters heat the potable water supply and maintain a setpoint temperature. Power for the hot water heaters is supplied from the main switchboard.

HOT WATER RECIRCULATING PUMP

A hot water recirculating pump (figure 1, item 2) operates continuously to recirculate hot water throughout the potable water system. The pump is rated for 10 gal/min (45.5 L/minute) at 20 PSI (1.4 bar), and is driven by a 440 Vac, 2 hp motor.

ROWPU THEORY OF OPERATION

PRINCIPLES OF REVERSE OSMOSIS

The specific process through which osmosis occurs is called ion exclusion. A concentration of ions at the membrane surface forms a barrier that allows pure water molecules to pass while excluding molecules of foreign materials.

OSMOSIS

Osmosis is the diffusion of two mixable solutions through a semi-permeable membrane in such a manner as to equalize their concentrations. Natural osmosis occurs when a substance of lesser salinity naturally diffuses through a membrane into a higher concentration salinity. Cellular functions in the human body function in this manner. The process is very energy efficient in that it requires very little heat or pressure. However, the warmer the liquids, the more efficient the process due to the activity of the molecules. It is a natural function for liquids of unequal density to try to equalize themselves with one another when they are in molecular contact. In natural osmosis, liquids that are less saline attempt to equalize pressure by becoming more saline. The membrane of a living cell (figure 4, item 1) passes lower density saline solution (figure 4, item 2) into higher density saline solutions (figure 4, item 3). This happens because the lower density solution (figure 5, item 1) inside the cell naturally moves to equilibrium with the higher density solution (figure 5, item 2) the cell is located in. The cell membrane (figure 5, item 3) allows liquid to pass, but it prevents particles (figure 5, item 4) from passing.

REVERSE OSMOSIS

Osmosis is an important process to life, but it does not produce water that is palatable to humans. In order to produce water, the osmosis process must be reversed. The same principles apply, but some form of energy is necessary to force osmosis reversal. Thus, the process called 'reverse osmosis' was engineered to overcome the natural phenomenon of osmosis. Reverse osmosis works by forcing water of a higher salinity content through some type of semi-permeable membrane in an effort to remove the impurities. Salt is one of the impurities that is removed during the reverse osmosis process, and this makes it possible to create potable drinking water from undrinkable water sources.

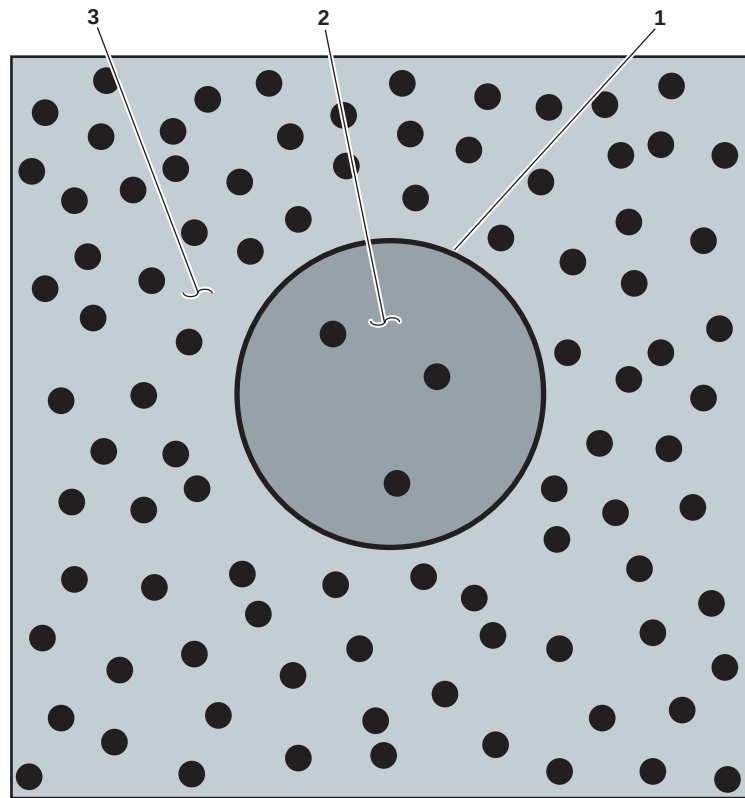


Figure 4. Living Cell Prior to Naturally Occurring Osmosis

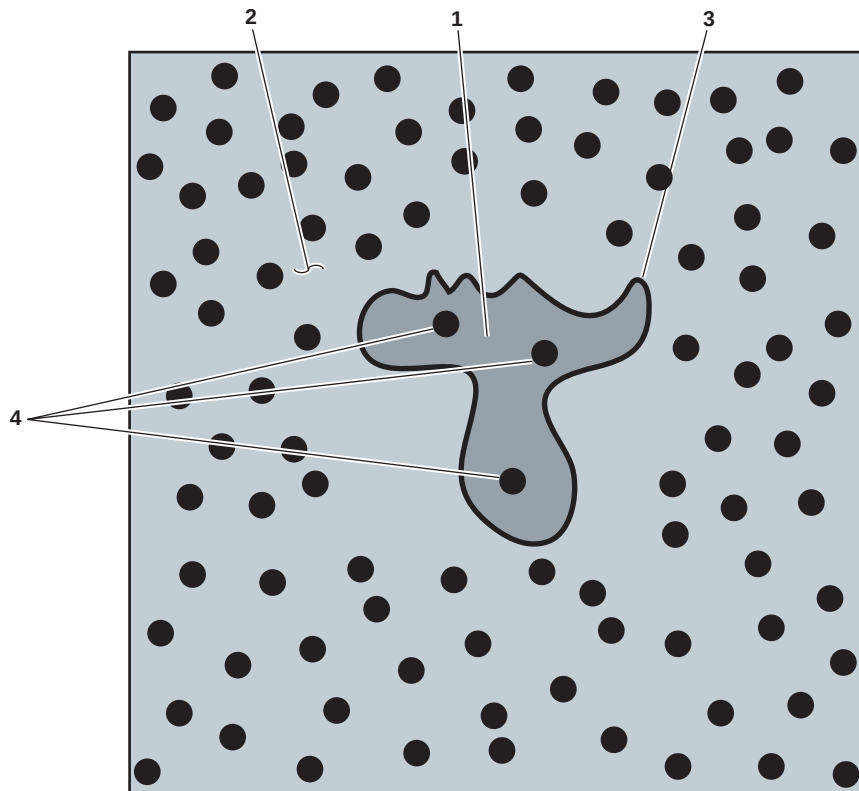


Figure 5. Living Cell After Naturally Occurring Osmosis

PRINCIPLES OF REVERSE OSMOSIS

Osmosis is defined as the spontaneous passage of a liquid from a diluted solution to a more concentrated solution across a semi-permeable membrane. This allows the passage of the solvent (water), but halts the dissolved solids (solutes). In naturally occurring osmosis, this transfer of water from one side of the membrane to the other will continue until the pressure is equalized on both sides of the membrane. When at equilibrium, the quantities of liquid passing in either direction is equal. The force created that causes osmosis to occur is called 'osmotic pressure'. In natural occurring functions, fluids will flow from the purer side to the saline side of the membrane until the osmotic pressures are equalized. If the osmotic pressure on the saline side of the membrane is higher, fluid is forced to flow through the membrane in reverse. This is how the solution containing the higher salt concentration flows into the solution with the lower salt concentration. This process is called Reverse Osmosis (RO).

SPIRAL WOUND MEMBRANE

Reversing a natural occurring process requires solutions to many problems. The first problem is how to efficiently recreate the effect so that a sufficient quantity of fresh water can be produced. Natural osmosis occurs at the cellular level. This means that since there are billions of cells in the body using osmosis, there must be billions of reactions occurring at the same time. All these reactions occur in a relatively small space. We can't create billions of cells, but we can create one large one that does the same thing. So, the solution is to increase the surface area using one giant cell. The giant cell theory led to the development of the spiral wound membranes that are used in the ROWPU.

If each side of the membrane were unrolled and laid flat, they would cover an area of fifteen square acres. The membrane sheets are only two molecules thick, and they are rolled into spirals and placed into tubes that are about four feet long and three inches in diameter. Reverse osmosis requires the membranes to be very thin, and they are delicate and sensitive to damage when mishandled. The membranes are also very sensitive to clogging. In natural osmosis, the fluids do their job by going back and forth. When water is made for potable use, the fluid only flows one way. This causes clogs due to the build up of solids, so the solids must be removed.

The solids are washed away by allowing more water to flow past the saline side of the membranes than is allowed to pass through the membrane. The ratio for the ROWPU is five gallons of raw water used for every two gallons of fresh water produced. Mechanically, the membranes act as filters to keep the salt and other impurities from passing to the fresh water side. If the solids were not removed, the membranes would quickly clog. The raw water is also passed through various filters that remove impurities down to 5 microns in size. This results in greatly increasing the life of the membranes and a cost effective and low maintenance unit.

WATER TEMPERATURE EFFECT

Water flow through the membrane is significantly affected by the water temperature. The higher the water temperature, the more active the water molecules. The more active the water molecules, the easier it is to push them through the membranes. This means that at any given pressure, the flow rate will increase as water temperature increases. When the temperature is reduced, the flow rate for a given pressure is reduced. The operating pressure also has a direct effect on product water quantity. It takes less pump pressure to achieve the unit's rated capacity in warmer water. In order to reach the rated service life of the membranes, the system must be operated at the lowest pressure necessary to achieve the designed product water flow rate. In warm water, the system will easily make more water than rated capacity. However, exceeding rated capacity will shorten the service life of the membranes.

REVERSE OSMOSIS WATER PURIFICATION UNIT (ROWPU) OPERATING PRINCIPLES

The LT's General Service (GS) system provides raw water to the ROWPU. ROWPU 1 can make 1500 gallons (5678 liters) a day, and ROWPU 2 can make 800 gallons (3028 liters) a day. These values are easily achievable if the high pressure pumps do not exceed 900 PSI (62 bar) and if overall differential pressure never exceeds 25 PSI (1.7 bar). The raw water entering the system passes through three filtering cycles so that solids no larger than 5 microns will enter the membranes. After being filtered, the raw water is pressurized and directed to a semi-permeable membrane. The semi-permeable membrane permits the passage of water and rejects the other contaminants. After passing through the membrane, waste water is expelled via the general service system overboard discharge, and potable water is sent to the brominator for chemical treatment before being discharged to the potable water tanks.

COMPONENTS OF THE ROWPU

Table 1 outlines the major functional components of the ROWPU system. The item number corresponds to the callouts in figure 6. The components are outlined in a logical fashion that will allow the reader to understand the basic operating principles of the ROWPU. The ROWPU contains two units. ROWPU 1 (the starboard unit) is fitted with two reverse osmosis membranes, and ROWPU 2 (the port unit) has only one membrane.

Table 1. Major Functional Components of the ROWPU System (Refer to Figure 6)

Item No. (Refer to Figure 6)	Nomenclature	Description
1	ROWPU System General Service Pressure Reducing Valve	The pressure reducing valve ensures that overall general service system pressure is maintained at a maximum of 60 PSI (4.1 bar).
2	ROWPU System Raw Water Cutout Valve	The cutout valve allows the operator to secure raw water to the ROWPU system.
3	ROWPU System Raw Water Pressure Regulator	The pressure regulator maintains the raw water supply to the ROWPU system at a constant pressure of 40 PSI (2.8 bar).
4	ROWPU System Pressure Relief Valve	The pressure relief valve protects the ROWPU system by providing pressure relief when raw water pressure exceeds 50 PSI (3.4 bar).
5	ROWPU System Media Filter	The media filter uses sand as a substrate to remove larger particles that would cause clogging of the 20-micron pre-filter. The substrate in the media filter requires very infrequent change out due to the ability to back flush. During back flushing, the media filter is completely isolated from the rest of the ROWPU system, while raw water from the general service system cleans and flushes debris overboard. The media filter prolongs the service life of the 20-micron filter.
6	20-micron Filter	The 20-micron pre-filter removes all particulate in the raw water not removed by the media filter down to particles 20 microns in size. This filter serves to prolong the service life of the 5-micron pre-filter.
7	5-Micron Filter	The 5-micron pre-filter removes all particulate in the raw water not removed by the 20-micron pre-filter down to particles 5 microns in size. This filter serves to prolong the service life of the reverse osmosis membranes.
8	High Pressure Pumps	The high pressure pumps provide a source of low volume, high pressure raw water to the reverse osmosis membranes. The high pressure pumps are rated to deliver 4 gallons (15.1 liters) of filtered raw water per minute, at a maximum operating pressure of 900 PSI (62 bar). The high pressure pumps provide the fluid energy necessary to cause the osmosis process to be reversed in the membranes.

Table 1. Major Functional Components of the ROWPU System (continued) (Refer to Figure 6)

Item No. (Refer to Figure 6)	Nomenclature	Description
9	Reverse Osmosis Membranes	The membranes convert filtered raw water into drinking water by allowing only water molecules to pass through its spiraled membrane. The high pressure/low volume pumps push raw water through the membranes to make fresh water, and they push the brine out of the membranes and overboard.
10	Solenoid Operated 3-Way Diverter Valve	The solenoid operated 3-way diverter valves are controlled by the system controllers (figure 6, item 14). The controllers sense the salinity of the product water output by the membranes. If the product water salinity is within tolerances, the product water is sent to the brominator and on to the potable water tanks. If product water salinity is too high, the product water is diverted and sent overboard as ROWPU system product brine.
11	ROWPU System Product Brine Discharge	Brine is the by-product of reverse osmosis. The brine is pumped overboard via the general service system overboard discharge. The ROWPU system is protected from the general service system by means of a check valve that acts as a backflow preventor.
12	Fresh Water Flush Pump	The fresh water flush pump is a low pressure pump that is used to clean and to prepare the ROWPU system for use. It is a 24 Vdc pump controlled by the system controller. The fresh water pump uses filtered potable water to purge raw water from the filtration system and from the raw water side of the reverse osmosis membranes. When the ROWPU is not in use, the system controllers automatically perform a fresh water flush once a week. The fresh water flush serves to prolong the life of the membranes, and it eliminates the need to 'pickle' the membranes for layup.
13	Charcoal Filters	The charcoal filters remove sediment and foul odors from the potable water used during flushing cycles. The charcoal filters also block bromine and chlorine from passing into the reverse osmosis membranes. The charcoal filters are secured when the ROWPU is making product water, and are protected by cutoff valves and a backflow preventor.
14	System Controllers	The system controllers are microprocessor-based water purification monitors and controllers. They control power to the pumps, monitor the quality of the output potable water, and monitor system operating pressures. The system controller turns the high pressure and fresh water flush pumps ON and OFF as required by system demands and operating conditions. The system controller also measures the salinity of the product water and controls the position of the solenoid operated 3-way diverter valve accordingly. Finally, the system controllers monitor system operating pressures. Any system pressure out of tolerance will cause the controller to stop the process and indicate an alarm. Power input to the system controllers is 450 Vac and 24 Vdc.

Table 1. Major Functional Components of the ROWPU System (continued) (Refer to Figure 6)

Item No. (Refer to Figure 6)	Nomenclature	Description
15	ROWPU System 24 Vdc Control Panel	The breaker and meter provide the operator with a means of monitoring and securing 24 Vdc to the ROWPU locally. The battery will still maintain a charge even if this switch is OFF. This switch must be ON in order for the ROWPU to monitor the system and conduct fresh water flushes.
16	ROWPU 24 Vdc Fuse Box	The fuse box provides 24 Vdc circuit protection in the event of a battery bank or battery charger casualty.
17	ROWPU System 24 Vdc Battery Bank	The battery bank provides power to the controllers and to the fresh water flushing pump during layup periods. A properly maintained and charged battery will provide adequate power to maintain the weekly fresh water flushing cycle for up to 90 days without recharging.
18	ROWPU System 24 Vdc Battery Charger/Power Supply	The battery charger/power supply provides 24 Vdc to recharge the battery, and it provides 24 Vdc during normal ROWPU operation.

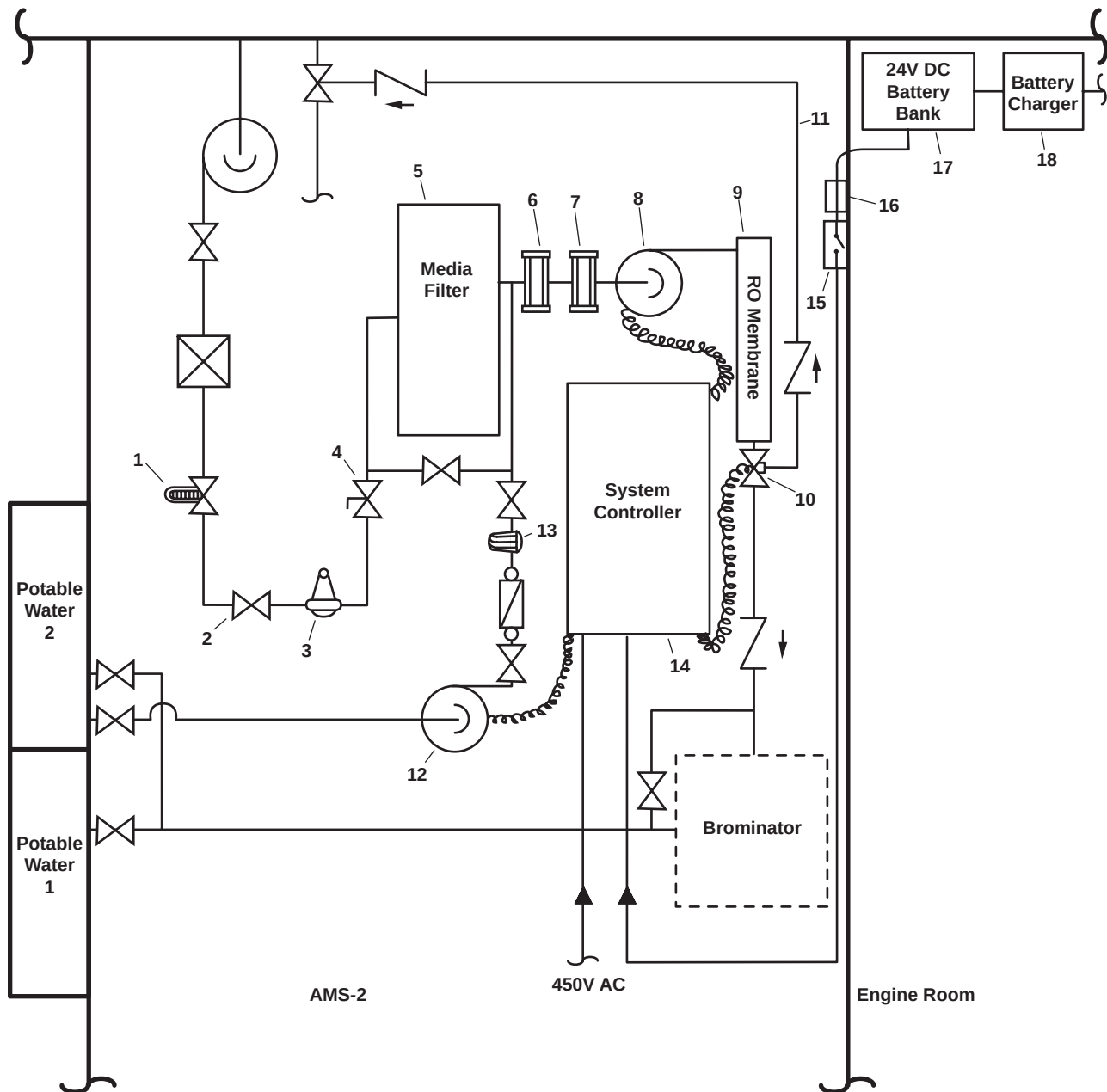


Figure 6. ROWPU System Diagram

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
BILGE AND BALLAST SYSTEMS**

GENERAL

The bilge system removes liquid from the vessel's bilges, preventing the Large Tug (LT) from flooding or causing flood damage during rough sea conditions where bilge fluids could wash onto deck plates or onto vital equipment in the engine room. An oily water system is also installed as a part of the bilge system. The oily water system pumps, stores, and treats oily water from the engine room and AMS 1 bilges.

The ballast system maintains stability of the vessel by transferring raw water to and from the vessel's three ballast tanks.

THE BILGE SYSTEM

The bilge system consists of: eductors, bilge, and ballast pumps (figure 1, item 1), bilge manifold, and bilge piping.

EDUCTORS

Eductors are jet-type pumps that contain no moving parts. An eductor moves liquid from one place to another by entraining the pumped liquid in a rapidly flowing stream of liquid utilizing the venturi effect.

BILGE AND BALLAST PUMPS

The bilge and ballast pumps (figure 1, item 1) are horizontally mounted, self-priming, centrifugal pumps, each with a rated output of 100 gal/min (379 L/minute) at 50 PSI (3.46 bar). The bilge and ballast pumps are driven by a 5 hp electric motor. Electric power for bilge and ballast pump 1 is provided from the emergency switchboard. Electric power for bilge and ballast pump 2 is provided from the main switchboard. Discharge from the pumps can be directed either overboard or to the duplex ballast manifold (figure 1, item 2).

BILGE MANIFOLD

The bilge manifold (figure 1, item 3) provides selection and control of piping alignment. The bilge manifold is connected to a simplex strainer (figure 1, item 4) on the suction side of the bilge and ballast pumps (figure 1, item 1).

BILGE PIPING

Six piping branches are provided from the bilge manifold (figure 1, item 3), two each to the engine room and AMS 1, and one each to the shaft alley (PORT) and shaft alley (STARBOARD). Each piping branch is equipped with a check valve and bellmouth at its end.

OILY WATER SYSTEM

The oily water system components consists of: an oily waste drain tank (figure 2, item 1), an oily waste storage tank (figure 2, item 2), an oily waste discharge pump (figure 2, item 3), an Oil Water Separator (OWS) (figure 2, item 4), and an Oil Content Monitor (OCM).

OILY WASTE DRAIN TANK

The oily waste drain tank (figure 2, item 1) receives and stores waste discharge from the lube oil purifier and engine sumps. Oily waste is transferred to the oily waste storage tank (figure 2, item 2).

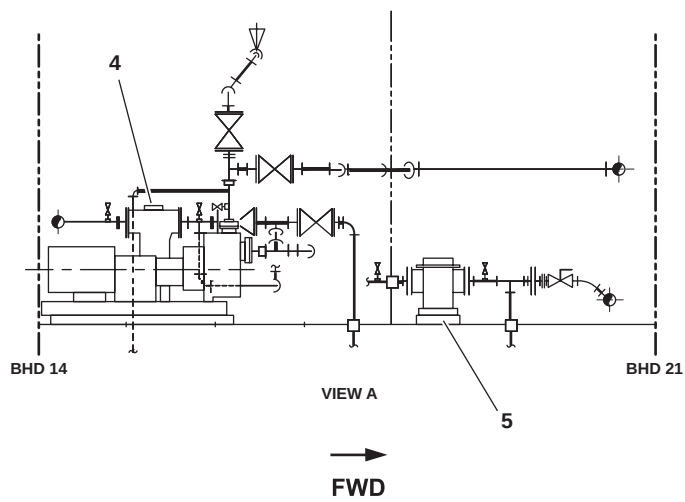
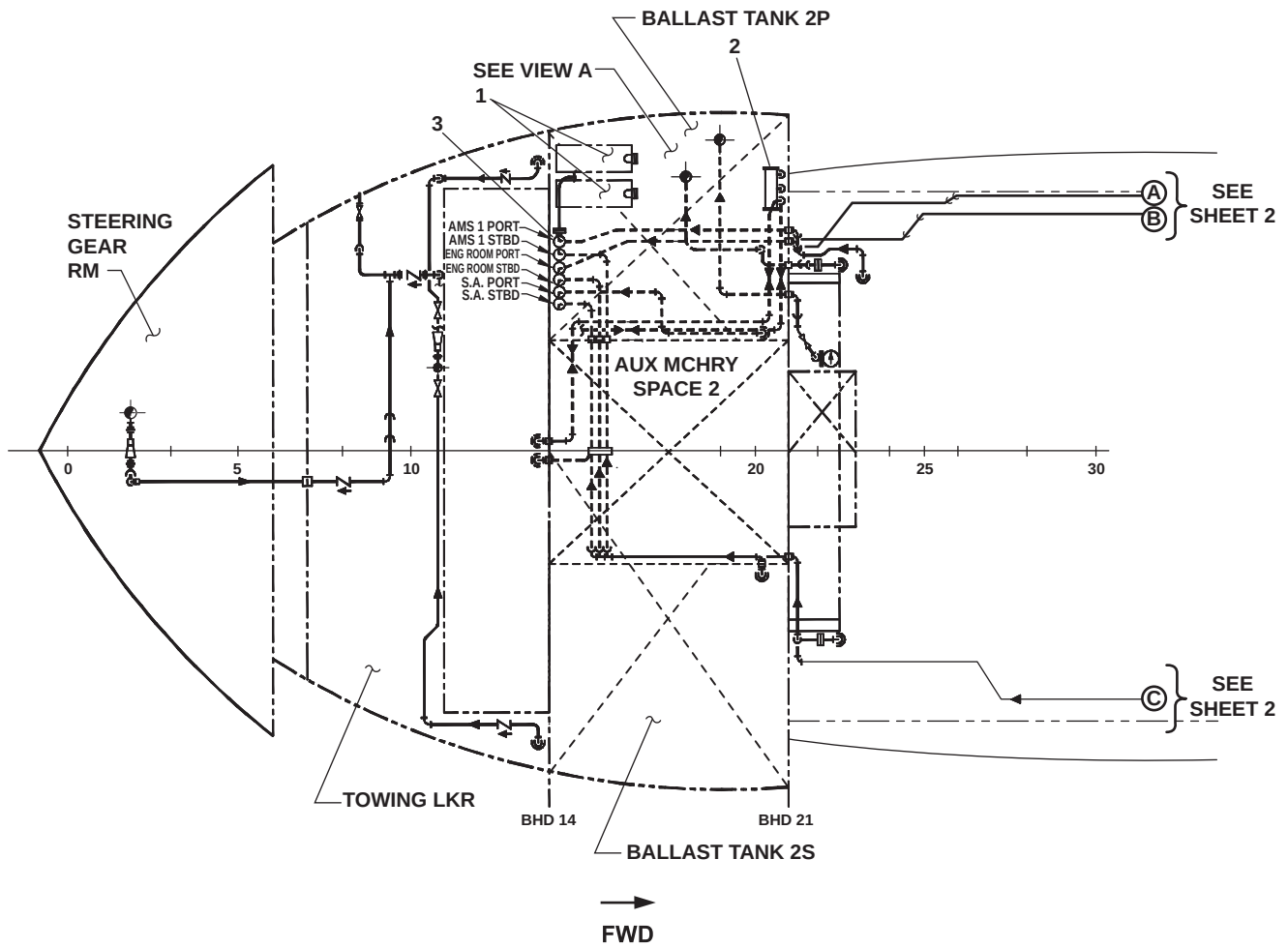


Figure 1. Bilge and Ballast Systems (Sheet 1 of 2)

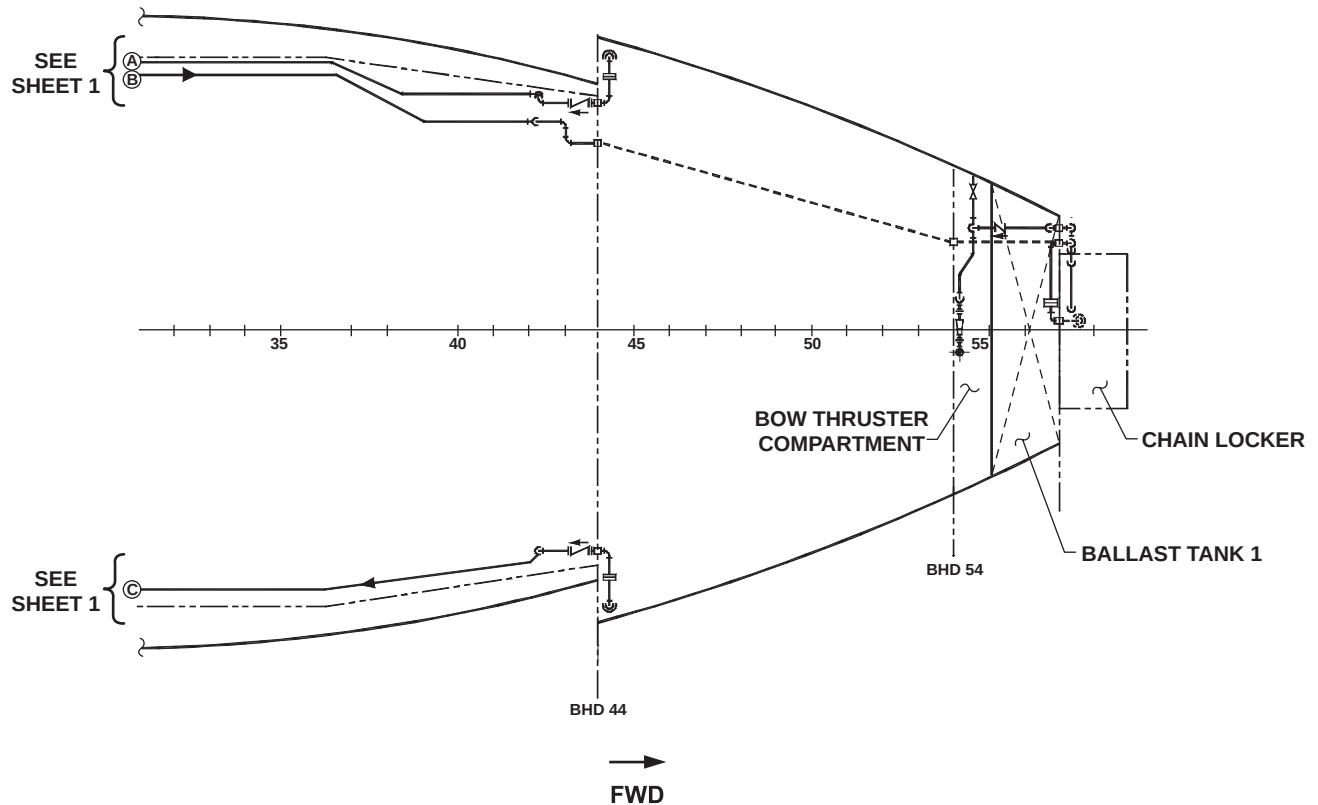


Figure 1. Bilge and Ballast Systems (Sheet 2 of 2)

OILY WASTE STORAGE TANK

The oily waste storage tank (figure 2, item 2) provides a holding tank that supplies oily water to be processed by the OWS (figure 2, item 4). The oily waste storage tank also receives the oil output from the OWS. When appropriate, the oily waste discharge pump (figure 2, item 3) can empty the oily waste storage tank through the shore connection (figure 2, item 5).

OILY WASTE DISCHARGE PUMP

The oily waste discharge pump (figure 2, item 3) is an air powered diaphragm pump. The compressed air used to drive the pump is provided by the ship's service air system. The oily waste discharge pump's suction can be directed to either the piping system or the oily waste drain tank (figure 2, item 1). The oily waste discharged pump's suction can also be used for removing oily water from the bilges and to transfer the contents of the oily waste drain tank or the oily waste storage tank (figure 2, item 2) or to a shore connection.

OIL WATER SEPARATOR

The OWS (figure 2, item 4) separates and removes oil from bilge water. Two outputs from the OWS are provided. Power is supplied to the OWS from the main switchboard. The oil-water separation is accomplished in two stages.

The inlet baffle redirects the flow of oil droplets away from the upper coalescer bed. The inlet weir separates the oil accumulated in the tank from the inlet flow. Oil droplets that flow past the inlet baffle accumulate on the polypropylene granules (beads) in the coalescer beds. The polypropylene granules attract oil and repel water (oleophobic-hydrophobic), allowing water to flow through while the oil remains are temporarily trapped in the coalescer granules. The lower coalescer bed functions like the upper coalescer bed 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 OWS's (figure 2, item 4) bottom.

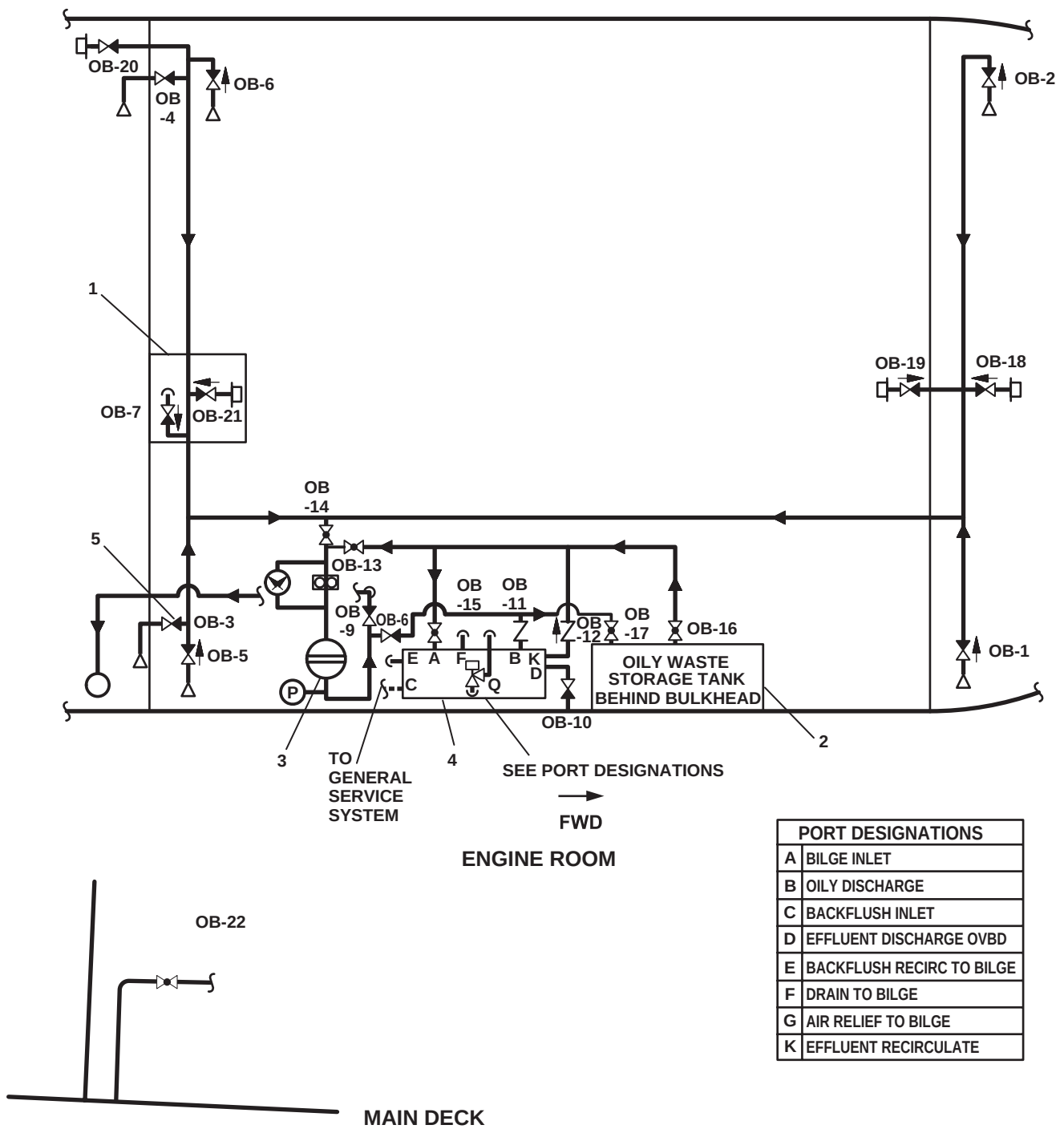


Figure 2. Oily Bilge System

Clean water enters the OWS's (figure 2, item 4) tank bottom, back flushing the coalescer beds and displacing the accumulated oil in the upper tank zone. This oil is discharged through the oil discharge check valve. Oily waste is pumped into the oily waste storage tank (figure 2, item 2). Clear water is discharged overboard. When the oil content in the overboard discharge exceeds acceptable standards, the water discharge is automatically redirected to the oily waste storage tank (figure 2, item 2).

OIL CONTENT MONITOR

An Oil Content Monitor (OCM) is provided inline the OWS's (figure 2, item 4) discharge line. When the oil content in the overboard discharge exceeds acceptable standards, the water discharge is automatically redirected to the oily waste storage tank (figure 2, item 2) for retreatment. The oil content level is preset. A solenoid-activated valve determines the discharge direction of the overboard discharge.

SYSTEM OPERATION

The oily waste drain tank (figure 2, item 1) receives and holds the waste discharge from the lube oil purifier and engine sumps. Oily waste is transferred via the oily bilge piping system and the oily waste discharge pump (figure 2, item 3) to the oily waste storage tank (figure 2, item 2). The oily waste storage tank supplies oily water to be processed by the OWS (figure 2, item 4). The oily waste storage tank also receives the oil discharged from the OWS. The eductor discharges the treated water overboard. When appropriate, the oily waste discharge pump can empty the oily waste storage tank through the shore connection (figure 2, item 5). If the OCM detects that the oil content in overboard discharge exceeds (the preset) acceptable standards, the water discharge is automatically redirected back to the oily waste storage tank.

THE BALLAST SYSTEM

The ballast system consists of: the bilge and ballast pumps (figure 1, item 1), duplex strainer, (figure 1, item 5) ballast duplex manifold (figure 1, item 2), ballast piping (see figure 1), and the ballast tanks (see figure 1).

BALLAST MANIFOLD

A duplex ballast manifold (figure 1, item 2) provides selection and control of the ballast system piping alignment. The ballast manifold is connected through a simplex strainer (figure 1, item 4) to the suction side of the bilge and ballast pumps (figure 1, item 1).

BALLAST TANK SYSTEM OPERATION

The ballast system transfers raw water to and from ballast tanks (see figure 1) utilizing and the ballast duplex manifold (figure 1, item 2), bilge and ballast pumps (figure 1, item 1), and ballast piping to maintain balance of the vessel. Discharge from the bilge and ballast pumps can be directed either overboard or to the ballast tanks (see figure 1).

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
MARINE SANITATION DEVICE**

GENERAL

The Marine Sanitation Device (MSD) receives, treats, and discharges all sewage generated aboard the LT. The system is comprised of a vented media tank, chlorinator, wet well, discharge pump, and blower.

SYSTEM

All raw sewage from the water closets on the main deck and 01 level flows to the media tank (figure 1, item 1). Potable water for flushing carries waste from the toilets to the media tank using 4" drain lines and 1 ½" vents.

The water level in the media tank is maintained at a constant level. As raw sewage enters the media tank via the 4" inlet (figure 1, item 2), an equal volume of treated clear effluent is displaced into the spillover pipe (figure 1, item 3). This effluent passes through the tablet chlorinator (figure 1, item 4), where it is disinfected.

As the water passes through the tablet chlorinator (figure 1, item 4), calcium hypochlorite tablets are dissolved, releasing chlorine into the effluent. The amount of chlorine released is proportional to flow. A full feed tube (figure 1, item 5) holds 20 five-ounce tablets, equaling 6.25 lb (2.83 kg). Expected tablet consumption is determined by water usage. Leaking fixtures will greatly increase water usage and tablet consumption.

Clear and odorless water flows from the media tank (figure 1, item 1) through the spillover pipe (figure 1, item 3) and trap into the wet well (figure 1, item 6). The wet well is a retention tank sized for adequate disinfection time during peak flow periods. The wet well vent (figure 1, item 7) is open to the immediate environment. The disinfected water is discharged overboard by the discharge pump (figure 1, item 8).

The discharge pump (figure 1, item 8) handles the peak flows expected for the system. The pump assembly includes a pump, isolation valve, discharge pressure gauge, float switch for automatic operation, motor, and a motor starter. As the water level in the wet well rises, the "pump on" float switch automatically starts the discharge pump, which discharges the water overboard. When sufficient effluent is discharged from the wet well, the float switch stops the discharge pump.

A separate sewage holding tank holds sewage during maintenance or transfer of sewage or graywater to a shore connection. Piping is provided to bypass the Marine Sanitation Device (MSD), sending sewage and graywater (wastewater system) directly to the holding tank. Two pumps are provided for the sewage holding tank (SEWAGE DISCHARGE PUMP NO. 1 and SEWAGE DISCHARGE PUMP NO. 2) so that the tank contents can be pumped overboard or to shore. A connection is also provided between the MSD media tank and the sewage holding tank, allowing the contents of the media tank to be drained by gravity to the sewage holding tank for maintenance.

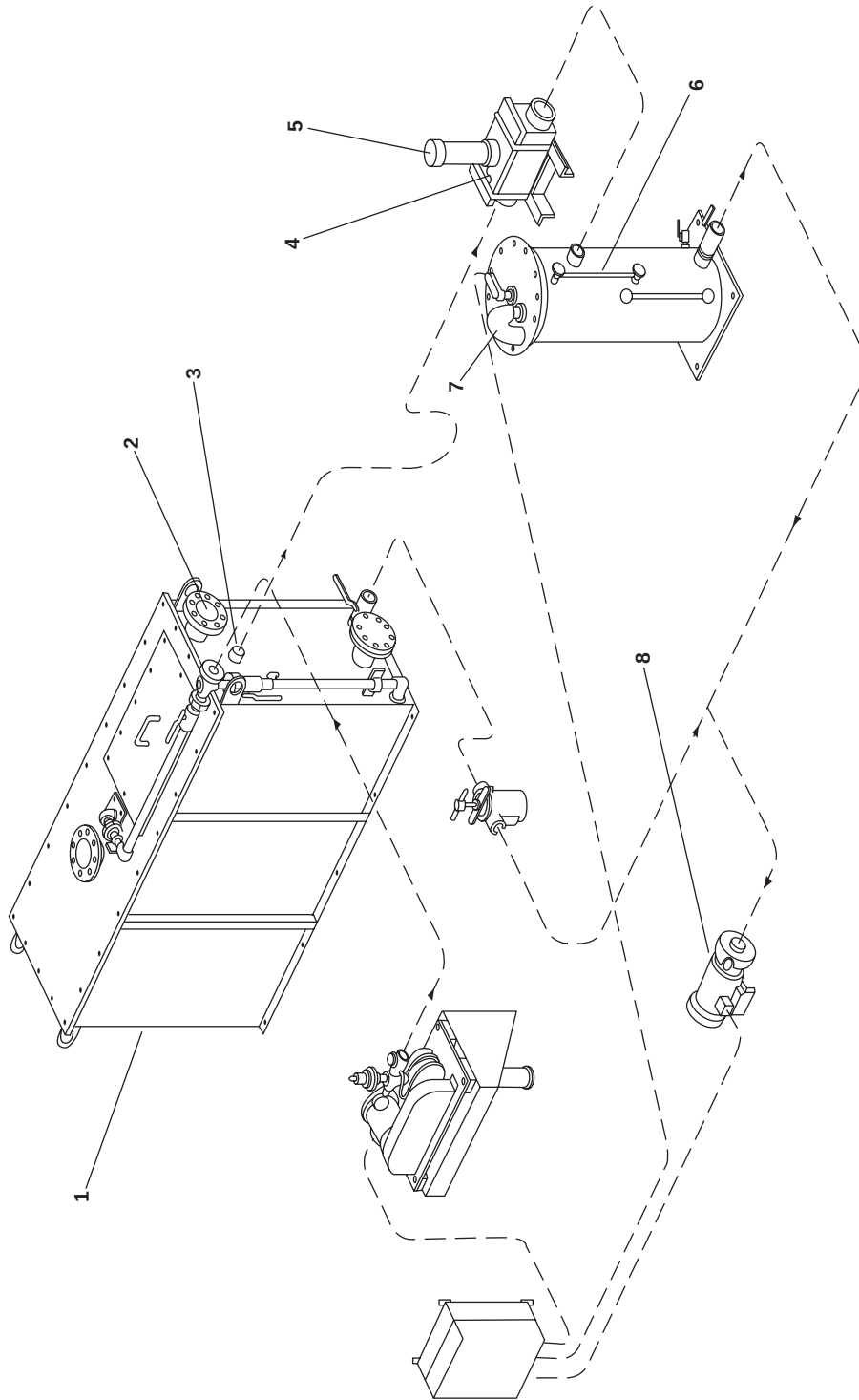


Figure 1. MSD Schematic

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FIRE MAIN, WASHDOWN, AND SPRINKLER SYSTEMS**

GENERAL

The fire main, arms control room sprinkler, general service and fire fighting system, and the Engine Room Water Washdown System (ERWWS) protect the LT from fire damage. The ERWWS is designed to be used in conjunction with the FM-200 fixed fire extinguishing system. Refer to WP 0033 00 for details on the FM-200 fire suppression system. The Wash Down Counter Measure (WDCM) aides in eliminating Nuclear, Biological, and Chemical (NBC) contamination from the vessel's exterior.

FIRE MAIN

The fire main is made up of two electrically driven pumps and one diesel engine-driven pump. The two electric fire pumps, located in AMS 2, are rated at 250 gal/min (946 L/min) with a discharge pressure of 125 PSI (8.6 bar). The diesel engine-driven fire pump is located in AMS 1. It is rated at 1000 gal/min (3785 L/min) with a discharge pressure of 125 PSI (8.6 bar). A local start/stop control for all pumps is provided, and each pump can be controlled from the pilothouse.

FIRE MONITORS

Three fire monitors (figure 1) are provided primarily to fight fires on other vessels when rendering aid. The monitors are located on the top of the pilothouse to provide 360 degree coverage of the vessel. Each monitor is rated at 500 gal/min (1893 L/min) with a 100 PSI (6.9 bar) discharge pressure. The monitors are capable of directional and elevation control, and they can dispense both raw water and Aqueous Film-Forming Foam (AFFF). The diesel engine-driven pump is required when operating more than one fire monitor.

AFFF is also known as "light water." It is synthetic, film-forming foam designed for use in shipboard firefighting systems. When used properly, it provides a vapor seal over a fuel spill, and it is designed to extinguish class BRAVO fires. AFFF is a highly effective extinguishing agent for smothering large fires, particularly those in oil, gasoline, and jet fuels. The foam proportioning equipment in combination with the fire monitors and diesel engine-driven pump generate a very effective foam blanket. AFFF is equivalent to raw water when it is used to extinguish class A fires.

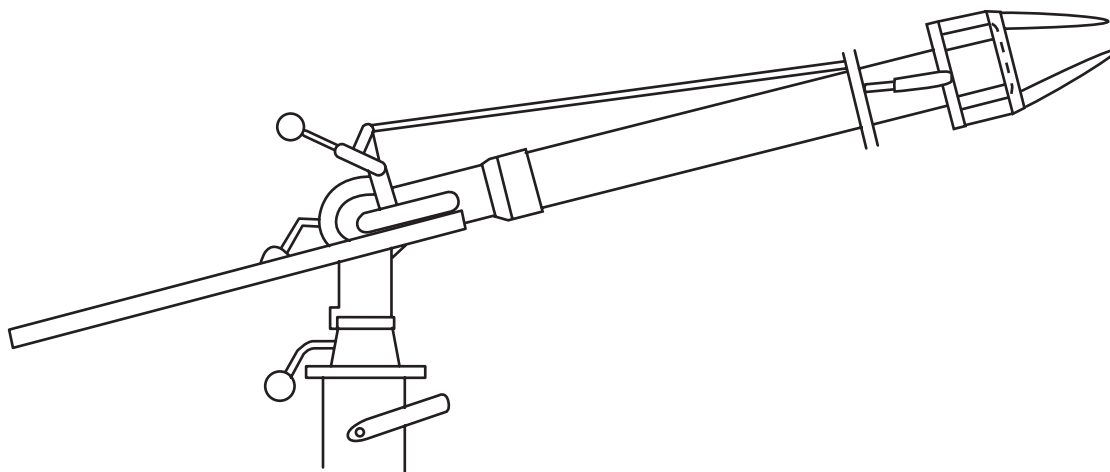


Figure 1. Fire Monitor

The unique action of AFFF stems from its ability to make a lightwater film float on flammable fuels. As foam is applied over the flammable liquid surface, an aqueous solution drains from the foam bubbles. The aqueous solution then floats out over the surface of the flammable liquid to provide a vapor seal. This aqueous film-forming action enhances extinguishment and prevents reflash, even when the foam blanket is disturbed. Flammable liquids such as fuel that have not been ignited can be protected with this action. AFFF can be used alone or in combination with dry chemical powder.

FIRE STATIONS

There are 11 fire stations located throughout the vessel. Each is provided with 50 feet (5.2 meters) of 1-1/2 inch diameter high pressure fire hose (figure 2, item 1), a spanner wrench (figure 2, item 2), and an all-purpose nozzle (figure 2, item 3).

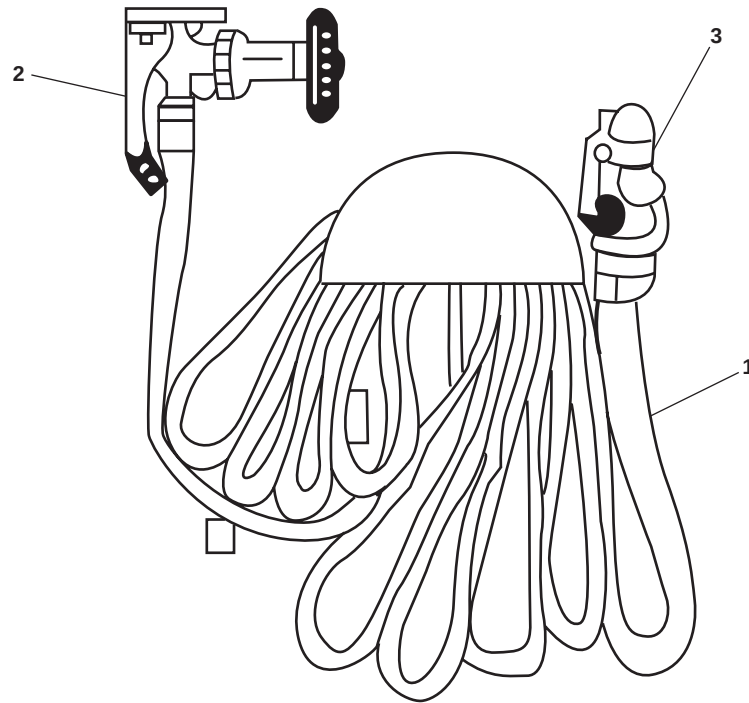


Figure 2. Fire Station

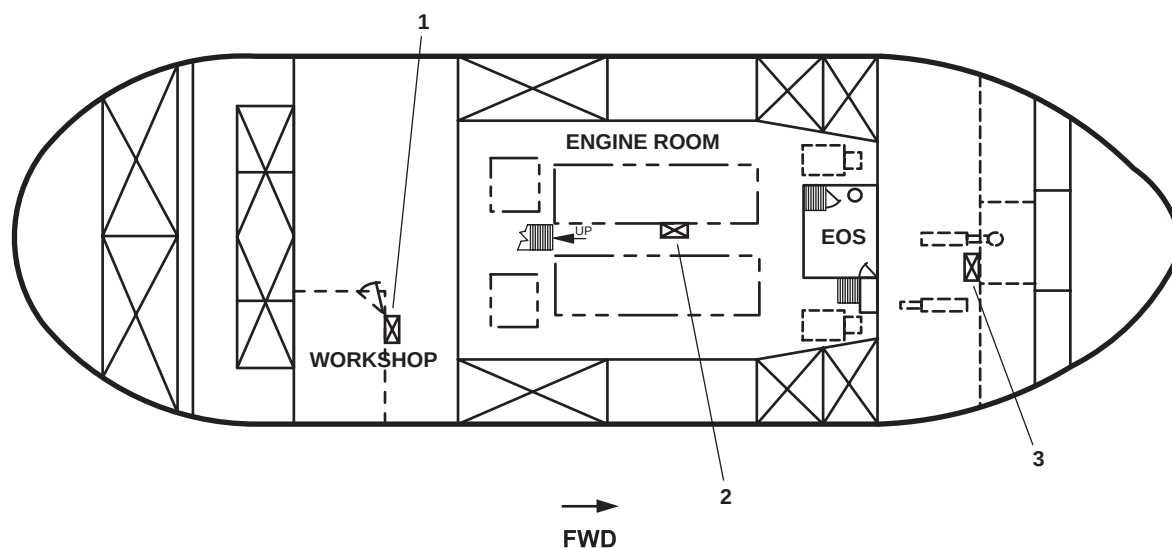
The purpose of the fire stations is to make pressurized firefighting water available to multiple locations on the vessel. The fire stations are capable of shooting 70 gallons (265 liters) of water per minute (in a solid stream) about 75 feet (23 meters) when pressurized to 100 PSI (6.9 bar). Refer to table 1 and figures 3 and 4 for fire station locations.

Table 1. Fire Station Locations**Interior fire stations:**

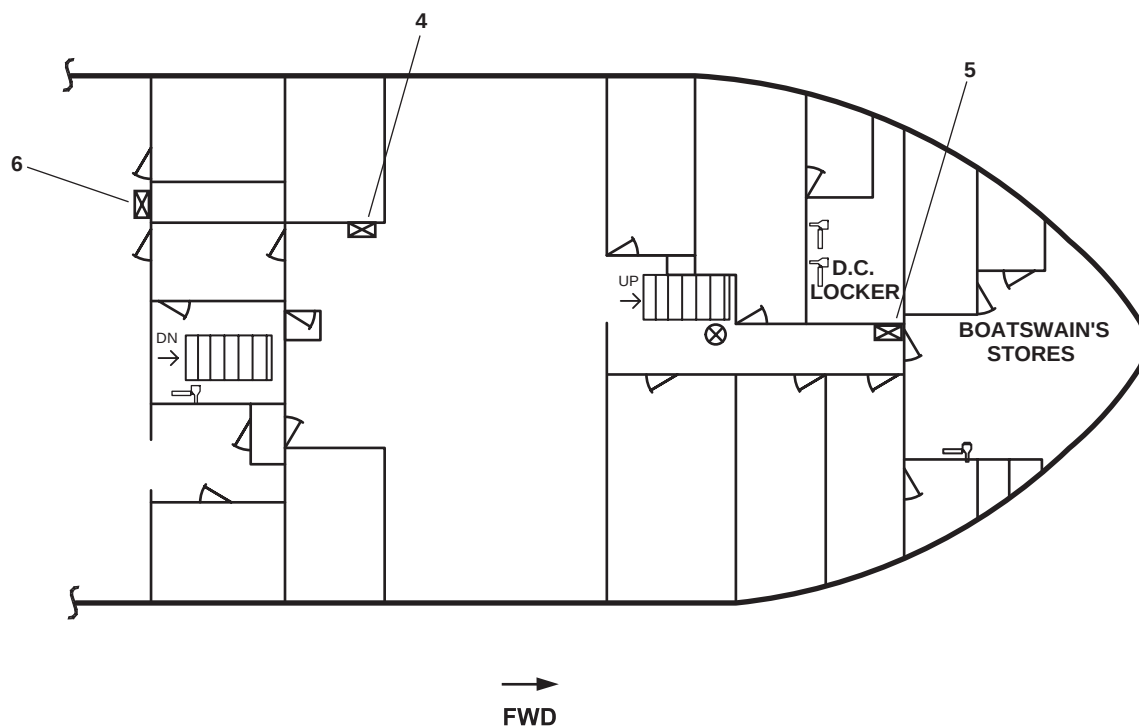
Number	Location
1 (figure 3, item 1)	AMS-2, Starboard side aft of steering hydraulic station, Frame 14
2 (figure 3, item 2)	Engine room, amidships between main engines, Frame 32
3 (figure 3, item 3)	AMS-1, forward bulkhead between auxiliary engines, Frame 54
5 (figure 3, item 4)	Main deck, crew's mess, frame 28
6 (figure 3, item 5)	Main deck, amidships outside damage control center, frame 53
8 (figure 4, item 1)	01 level, starboard side aft of captain's cabin, frame 45

Exterior fire stations:

Number	Location
4 (figure 3, item 6)	Main deck, weather, port side below stack, frame 21
7 (figure 4, item 2)	01 level, weather, starboard side aft of stack, frame 24
9 (figure 4, item 3)	01 level, weather, starboard, frame 54 (removed when underway)
10 (figure 4, item 4)	02 level, weather, port side aft of pilothouse, frame 37
11 (figure 4, item 5)	02 level, weather, starboard side, frame 50 secured.



BELOW MAIN DECK



MAIN DECK

Figure 3. Main Deck and Below Main Deck Fire Station Locations

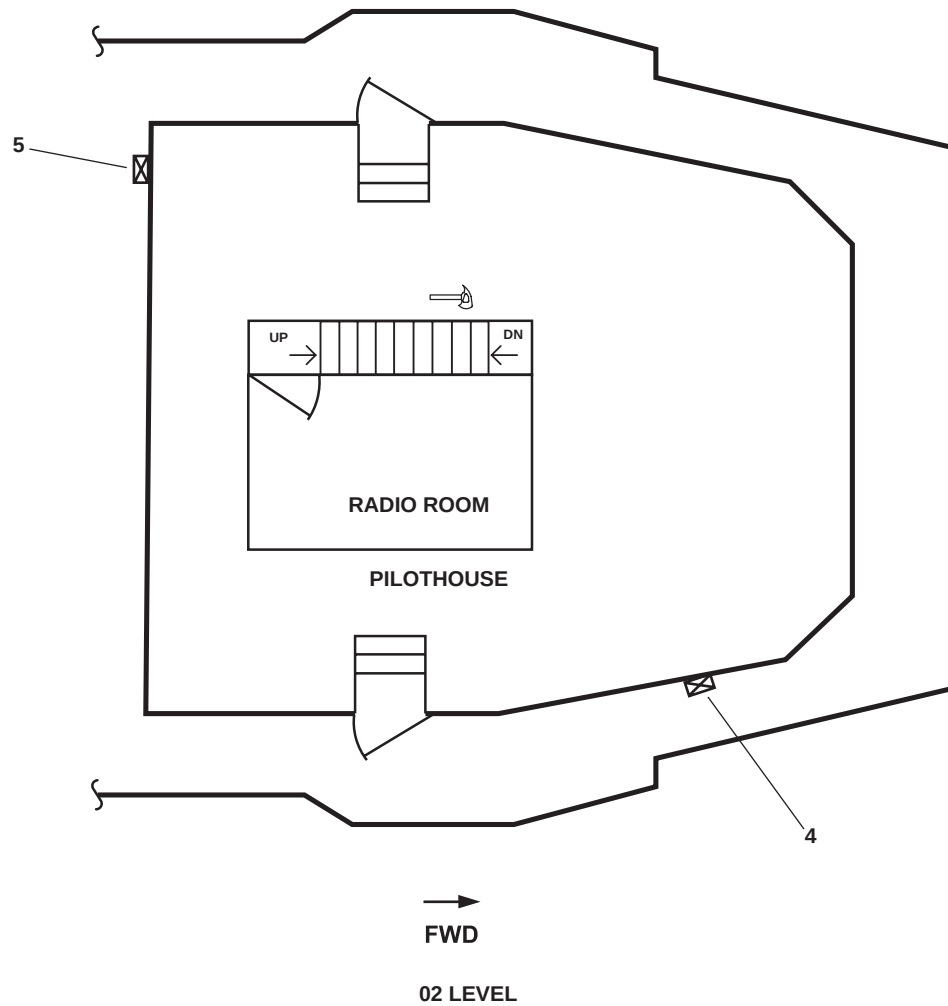
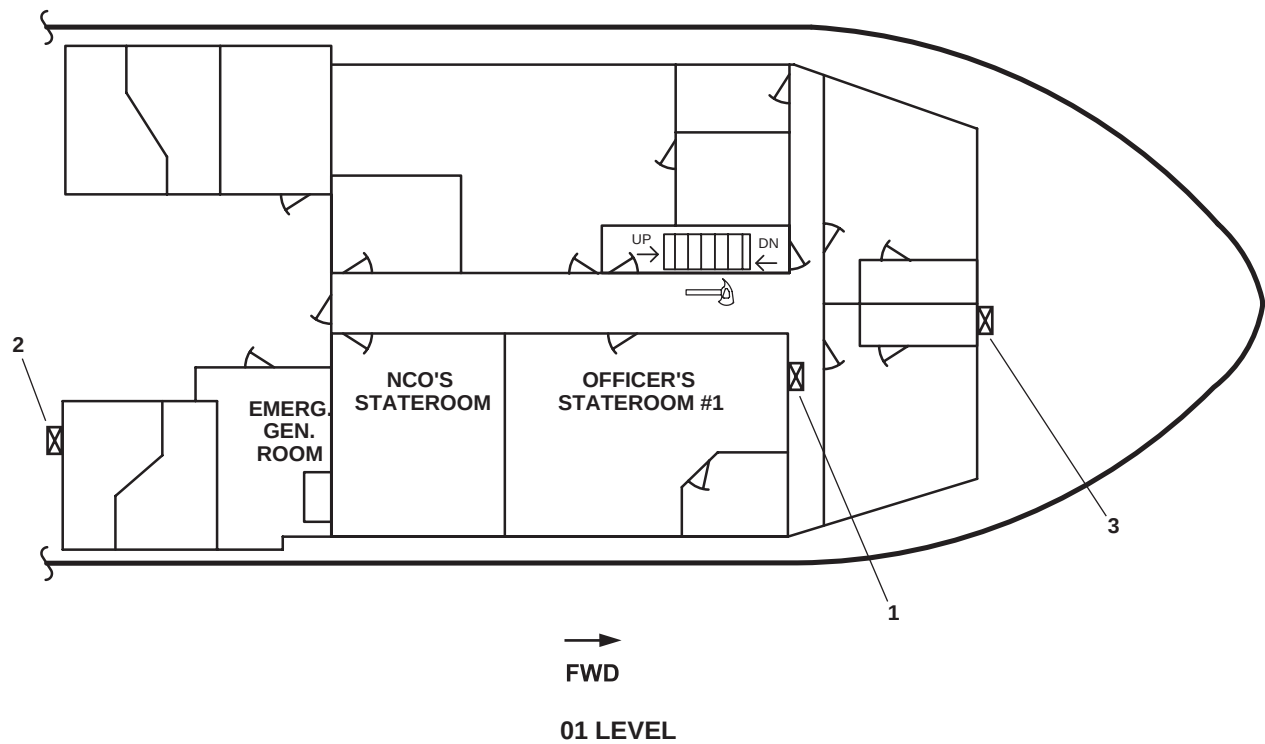


Figure 4. Pilothouse and 01 Level Fire Station Locations

AQUEOUS FILM FORMING FOAM (AFFF) PUMP

The AFFF pump (figure 5) is located in AMS 1. It is a horizontal gear pump with a rated capacity of 60 gallons (227.1 liters) per minute. Normal operating pressure is 125 PSI (8.6 bar). The AFFF pump is part of a system that includes a ready service tank, the AFFF pump, a proportioner, and piping specifically suited for the delivery of AFFF. AFFF can only be expended from the fire monitors. AFFF is stored in its own tank in concentrate form. The pump is used to force AFFF concentrate through the proportioner into the fire main at a rate of 6 parts foam concentrate to 94 parts raw water. When in use, the 525-gallon tank is capable of producing 13,344 gallons of AFFF. One or more fire monitors shooting AFFF will expend the ready service tank in less than nine minutes.

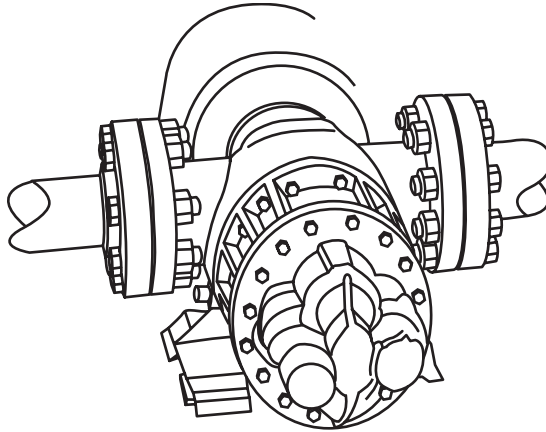


Figure 5. AFFF Pump

DIESEL ENGINE-DRIVEN FIREFIGHTING PUMP

The diesel engine-driven firefighting pump (figure 6) is located in AMS 1. Its rated capacity is 1000 gal/min (3785 L/min) with a discharge pressure of 125 PSI (8.6 bar). Its primary purpose is to provide raw water to the fire monitors. The secondary purpose of the pump is to pressurize the fire main and general service system in the event of a malfunction of the fire and general service pumps.

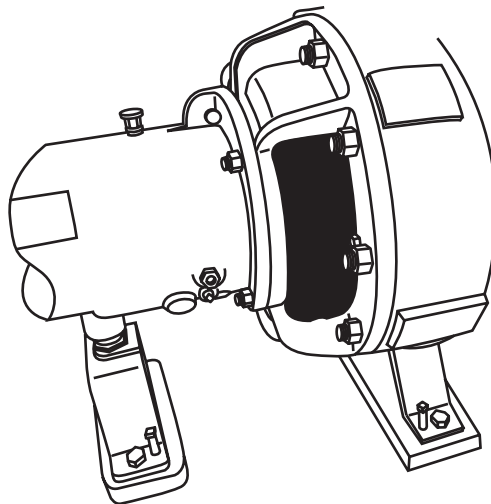


Figure 6. Diesel Engine-Driven Firefighting Pump

WASHDOWN COUNTERMEASURE (WDCM) SYSTEM

The vessel has an installed WDCM system that is capable of forming a protective umbrella of raw water over the superstructure of the vessel. It is designed for protection against Nuclear, Biological, and Chemical (NBC) contaminants. If time allows, the vessel should be wet down before an NBC attack. NBC agents would then be washed immediately overboard. The WDCM system is more effective as a preventive measure than as a decontamination measure. Another benefit of using the WDCM system is that it cools the external superstructure of the vessel. This can aid in removing excess heat from the vessel in the event of fire.

SPRINKLER SYSTEMS

AMMUNITION STORAGE LOCKERS

The arms and ammunition storage locker is equipped with a flooding system designed to cool the contents in case of fire in, near, or around the locker. However, if the surrounding area becomes heated, maintain a safe distance from the source of the fire while applying high velocity water fog.

Temperature stability in ammunition and pyrotechnic storage areas is essential to prevent decomposition and deterioration of stored devices. Ready service lockers and other ammunition stowage spaces are designed to maintain temperatures within prescribed limits under normal operating conditions. The stability of smokeless powder decreases at temperatures in excess of 100 °F (37.8 °C). Stowage in airtight spaces at temperatures of 70 °F (21.1 °C) or less is necessary to ensure normal life of any service ordnance. Mechanical cooling is necessary if temperatures will exceed 100 °F (37.8 °C). If mechanical cooling is not provided, artificial methods, such as water spray or wet canvas covers can be used to reduce the high temperature.

ARMS LOCKER DRENCHING SYSTEM

The arms locker drenching system is connected to the fire main system. The system is designed to provide raw water to the arms locker in the event of a fire or excessive high temperature. The arms locker drenching system has to be manually activated. The system can be activated in the boatswain's locker (local) or from the 01 level (remote) at the bow by means of a reach rod valve system.

System activation occurs when the thermal heat detector (figure 7, item 1) senses a temperature above 105 °F (40.5 °C). The thermal heat detector sends an alarm signal to the pilothouse indicating a high temperature situation in the arms locker. The crew would then investigate the situation and if necessary, the fire main system would be charged. Once it is determined that the alarm condition exists and the fire main system is charged, the manual activation valve (figure 7, item 2) is OPENED either locally or remotely. As raw water enters the piping system in the arms locker, a pressure switch (figure 7, item 3) activates an alarm in the pilothouse to indicate that the arms locker drenching system has been activated. The raw water from the fire main flows into the arms locker and out of two sprinkler heads (figure 7, item 4). Once activated, the system will continue the flow of raw water into the arms locker until the manual activation valve is closed, or the fire main system is secured.

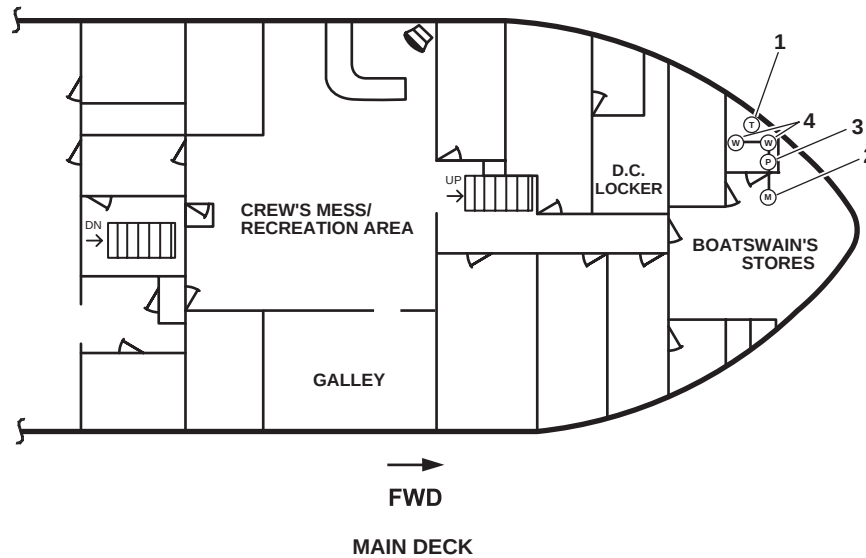


Figure 7. Arms Locker Drenching System

ENGINE ROOM WATER WASHDOWN SYSTEM (ERWWS)

The purpose of the ERWWS (figure 8) is to quickly reduce the temperature in the protected space to minimize the production of Hydrogen Fluoride (HF) gas generated as a result of FM-200 agent contact with hot surfaces and flame above 1,300 °F (704.4 °C). The sprinkler water also acts to keep smoke particulate down and expedites ventilation of the compartment when the fire is extinguished. The ERWWS is not designed or intended to be a stand-alone fire extinguishing system. It is designed to be used in conjunction with the installed FM-200 fire suppression system. Use of the ERWWS reduces the risk of HF exposure by reducing temperatures within the protected space.

The ERWWS is constructed of all stainless steel components. In order to operate the ERWWS, the fire main must be charged and, at a minimum, fire and general service pump 1 must be online at maximum operating pressure. To provide an adequate volume of raw water for the ERWWS, valves FM-17, FIRE/G.S. PMP. No. 1 DISCH. TO GS. and FM-15, FIRE/G.S. PMP. No. 2 DISCH. TO GS. must be CLOSED prior to activation of the ERWWS. The ERWWS requires a minimum of 145 gal/min (548.9 L/min) at 104 PSI (7.17 bar) to operate as intended.

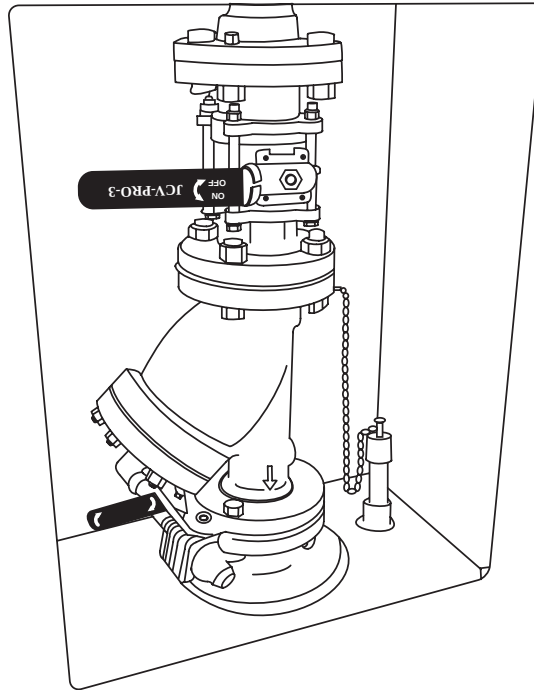


Figure 8. Engine Room Water Washdown Station

END OF WORK PACKAGE

When the FM-200 system is actuated, ventilation to and from the engineering spaces, the ship's service diesel generators, and the bow thruster and pump drive engines are automatically shut down to prevent FM-200 gas from being extracted from the spaces. When a FM-200 pull box is actuated, horns sound, strobes flash, and the FM-200 alarm bell sounds to alert personnel to evacuate the space. A 60-second delay is provided before the FM-200 agent is released to allow evacuation of the engineering spaces.

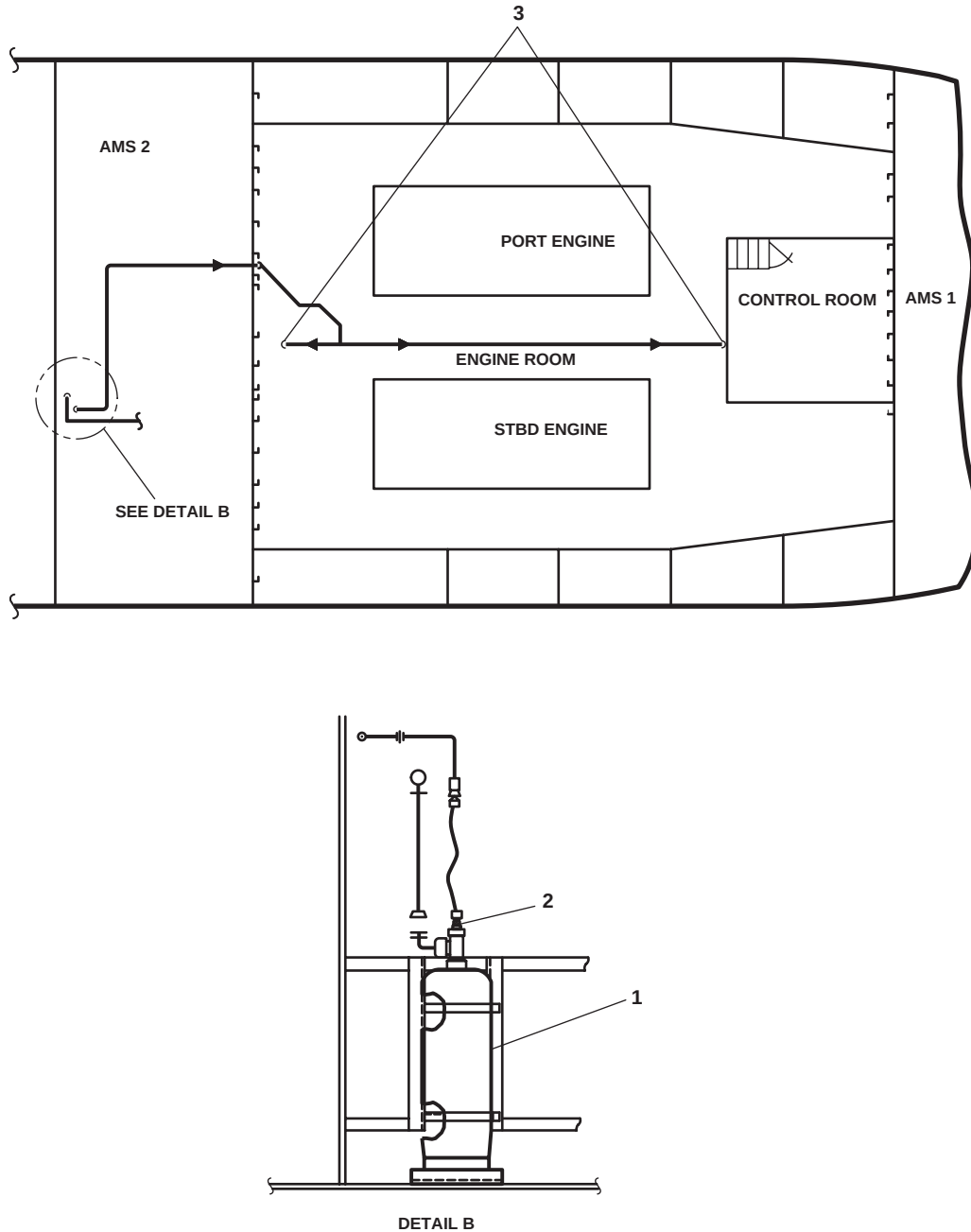


Figure 2. FM-200 Component Locations (Bilge Systems)

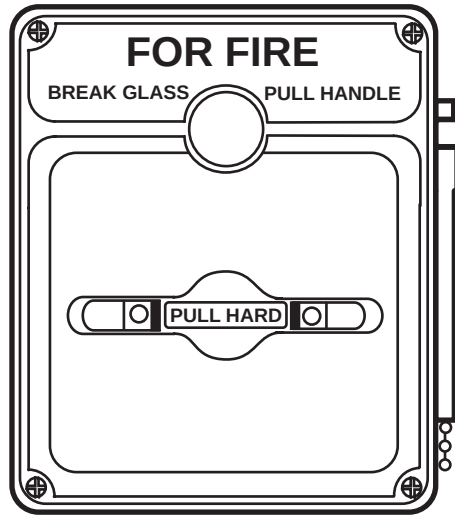


Figure 3. Interior FM-200 Pull Box

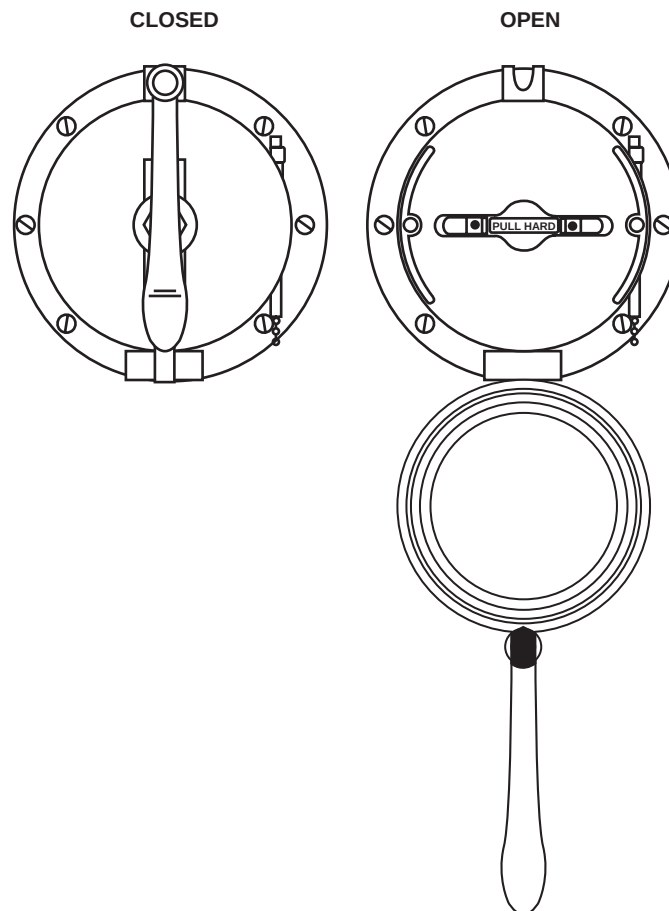


Figure 4. Exterior FM-200 Pull Box

FM-200 FIRE SUPPRESSION ALARM SYSTEM

The purpose of the FM-200 fire suppression alarm system is to warn personnel on the hold deck (AMS 1, engine room, and AMS 2) that the FM-200 fire suppression system is actuating. When the FM-200 fire suppression alarm sounds, personnel have 60 seconds to evacuate the spaces before the FM-200 system is discharged.

The fire suppression alarm system is needed because the FM-200 agent produces Hydrogen Fluoride (HF) gas when exposed to temperatures at or above 1,300 °F (704.4 °C). When the FM-200 system is actuated, ventilation to and from the engineering spaces, the ship's service diesel generators, the fuel oil transfer pumps, and the bow thruster and pump drive engines are automatically shut down to prevent the FM-200 agent from being extracted from the spaces. Although the FM-200 agent itself is breathable, the atmosphere in the engineering spaces will rapidly degrade to a casualty condition as HF gas may be present. Personnel in these spaces must have warning to evacuate or make preparations to find breathable air.

The FM-200 fire suppression alarm system is an automatically actuated alarm system. When the FM-200 system is actuated, pressurized CO₂ from the system's actuating circuit closes the alarm switch. This switch in turn energizes the strobe lights, horns, and bell. Locations of the strobe lights, horns, and bell are illustrated in figure 5. Once the alarm begins to sound, the occupants of the engine room and AMS 1 have 60 seconds before FM-200 agent is released. The FM-200 fire suppression alarm system consists of five amber strobe lights, two horns, and one bell. Three strobe lights are mounted in the engine room, and one each in AMS 1 and AMS 2. The alarm system bell is mounted on the weather deck aft of the engine room access vestibule.

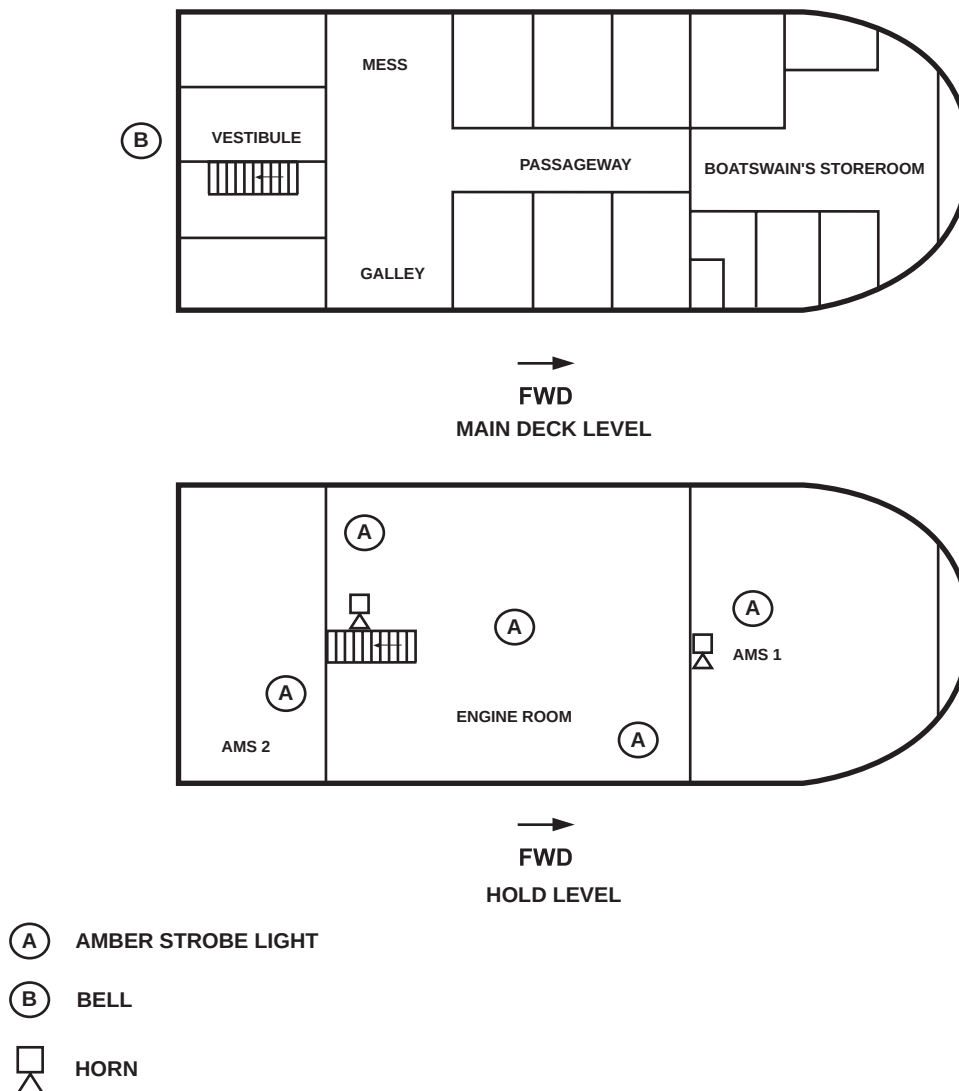


Figure 5. Components by Locations of the FM-200 Fire Suppression Alarm System

The strobe lights and bell are powered by 120V emergency lighting panel No. 1 via pressure switch PS-1 (figure 6, item 1). The fire suppression alarm system has two horns. One horn is mounted in the engine room and the other in AMS 1. The horns are powered by the emergency generator battery charger circuit via pressure switch PS-1A (figure 6, item 2). As illustrated in figure 6, the use of two separate power sources provides greater assurance that personnel in the hold level will be warned if the FM-200 fire suppression system is activated.

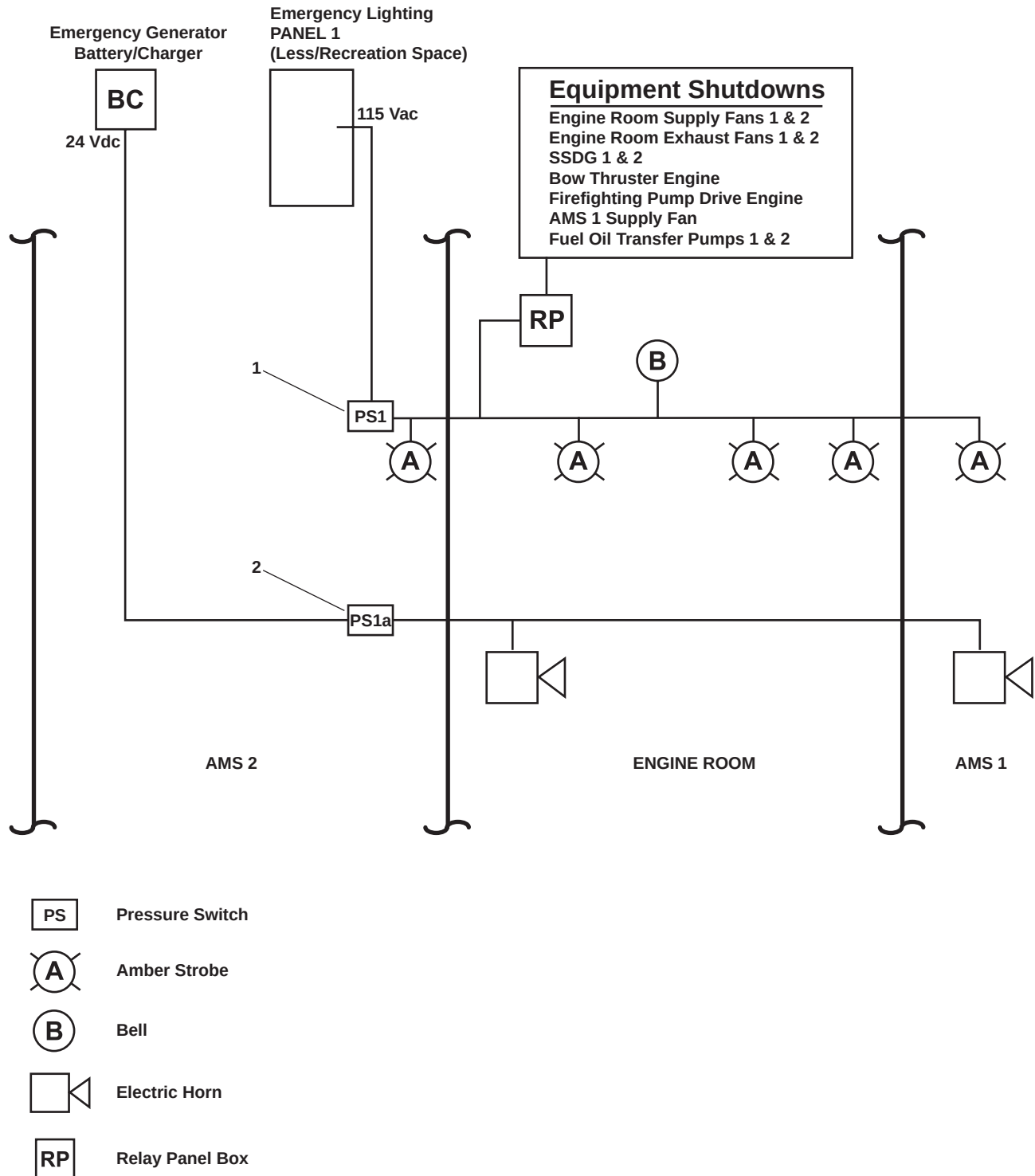


Figure 6. Fire Suppression Alarm System Schematic

ENGINE ROOM WATER WASHDOWN SYSTEM (ERWWS)

The purpose of the ERWWS is to quickly reduce the temperature in the protected space to minimize the production of Hydrogen Fluoride (HF) gas generated as a result of FM-200 agent contact with hot surfaces and flame above 1,300 °F (704.4 °C). The sprinkler water also acts to keep smoke particulate down and expedites ventilation of the compartment when the fire is extinguished. The ERWWS is not designed or intended to be a stand-alone fire extinguishing system. It is designed to be used in conjunction with the installed FM-200 fire suppression system. Use of the ERWWS reduces the risk of HF exposure by reducing temperatures within the protected space.

The ERWWS is constructed of all stainless steel components. In order to operate the ERWWS, the fire main must be charged and, at a minimum, fire and general service pump 1 must be online at maximum operating pressure. To provide an adequate volume of raw water for the ERWWS, valves FM-17, FIRE/G.S. PMP No. 1 DISCH TO GS and FM-15, FIRE/G.S. PMP. No. 2 DISCH TO GS. must be CLOSED prior to activation of the ERWWS. The ERWWS requires a minimum of 145 gal/min (548.9 L/min) at 104 PSI (7.17 bar) to operate as intended.

Activation of the ERWWS is accomplished by opening WWS-1 (figure 7, item 1). WWS-1 is located in the engine room vestibule on the main deck at frame 25. The ERWWS shall be activated prior to actuation of the FM-200 fire suppression system. The ERWWS is a Hydrogen Fluoride (HF) gas mitigating water washdown system that provides general overhead coverage to the protected spaces. The ERWWS consists of simple overhead sprinkler heads (figure 8) piped directly to the fire main. The ERWWS receives raw water directly from fire and general service pump 1. Fire and general service pump 1 is powered by the Emergency Diesel Generator (EDG) switchboard and will have to be restarted remotely from the pilothouse once the EDG comes online.

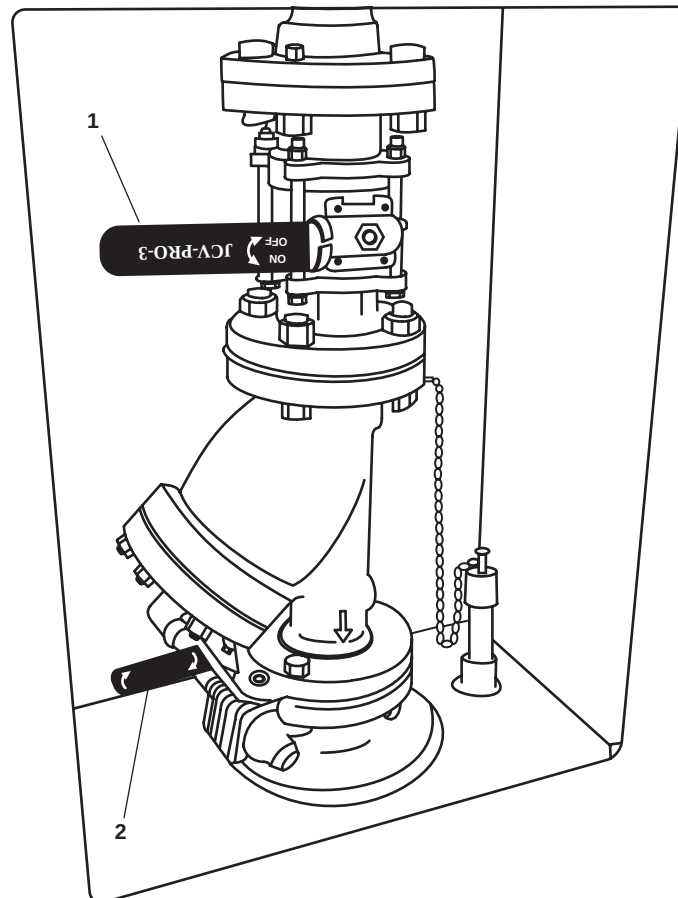


Figure 7. Engine Room Water Washdown Station

When the FM-200 fire suppression system is actuated to extinguish a fire, allow the ERWWS to operate for a minimum of fifteen minutes. During the ERWWS operating period, valve WWS-2 (figure 7, item 2) should be OPENED for ten seconds every three minutes. WWS-2 is the ERWWS strainer blow off and will flush foreign matter from the inline strainer basket during operation of the ERWWS. The ERWWS operating instructions (figure 9) are posted above the ERWWS station valves in the main deck vestibule.

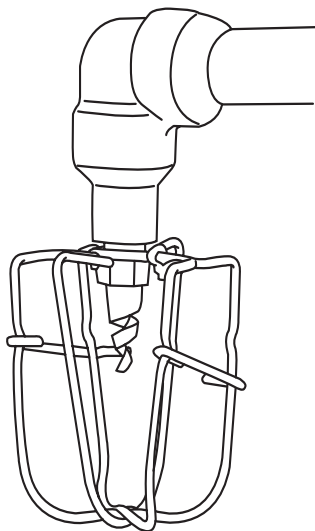


Figure 8. Engine Room Water Washdown System Sprinkler Head

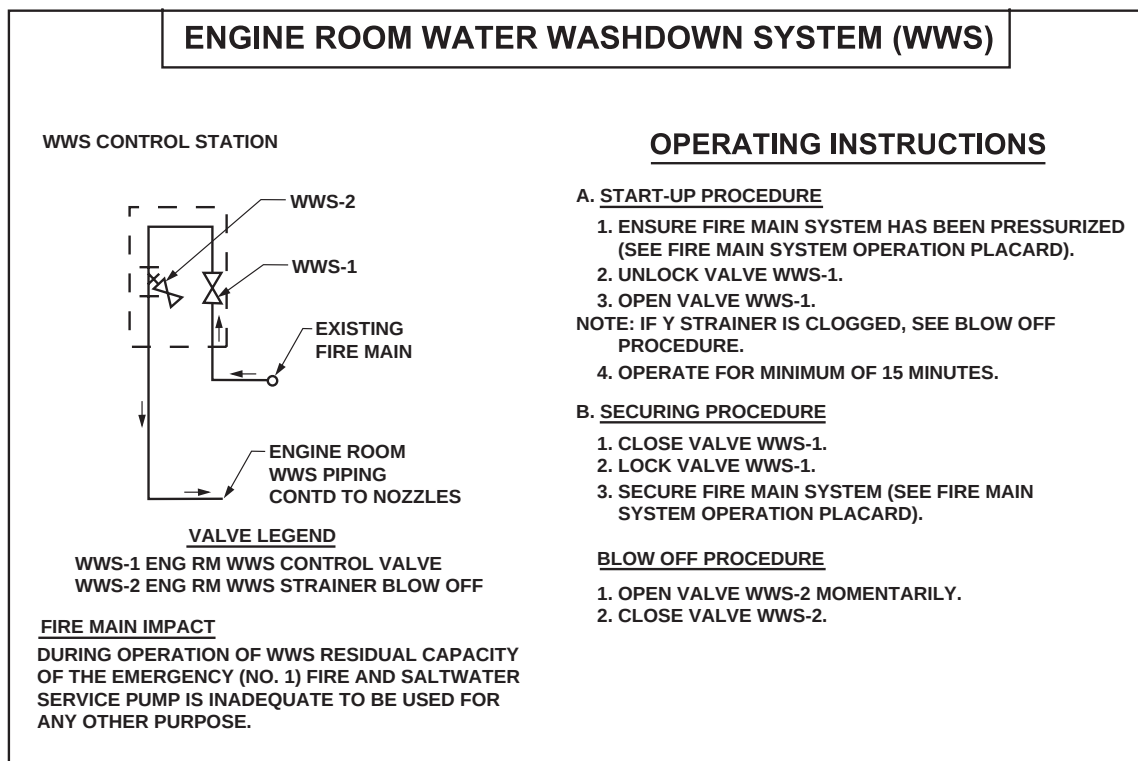


Figure 9. Engine Room Water Washdown System Operating Instructions

GALLEY FIRE SUPPRESSION SYSTEM

The galley fire suppression system is designed to extinguish fires that originate in the galley and the galley cooking equipment. The galley fire suppression system is a pre-engineered, wet chemical, cartridge operated, regulated pressure type extinguishing system. The system is capable of manual activation through the use of a manual pull box (figure 10, item 1) or automatic actuation through the use of fusible links (figure 10, items 2 and 3) rated at 500 °F (260 °C) and 360 °F (182 °C), respectively.

The extinguishing agent is formulated with an aqueous solution of organic salts with a pH range between 7.8 and 8.2. It is designed for flame knock down and foam coverage of grease related fires. The wet chemical agent is stored in a 3-gallon (11.3 liter) carbon steel tank housed in a stainless steel enclosure (figure 10, item 4) mounted on the starboard bulkhead of the galley. The storage tank has a working pressure of 100 PSI (6.9 bar). The extinguishing agent is propelled by the use of a gas cartridge of carbon dioxide or nitrogen gas and delivered to the distribution nozzles (figure 10, item 5). The distribution nozzle tips have blow off caps to keep the nozzle orifices free of cooking grease buildup.

Activation of the galley fire suppression system is accomplished manually by pulling the manual pull box (figure 10, item 1) or automatically by the melting of a fusible link (figure 10, items 2 and 3). Once the system has been manually or automatically activated, the gas charge propels the extinguishing agent (figure 10, item 4) to the distribution nozzles (figure 10, item 5). The electrical source for the protected equipment is not shut off, and the agent and the hot grease mix to form foam. This foam temporarily seals the combustible vapors, helping to inhibit re-ignition. The crew must secure the galley heat producing equipment. Once the galley fire suppression system has been activated, the Gaylord washdown system (figure 10, item 6) is activated in the fire cycle and sprays water into the Gaylord hood ventilation ductwork. Ventilation ducts are automatically secured by the activation of the Gaylord washdown system.

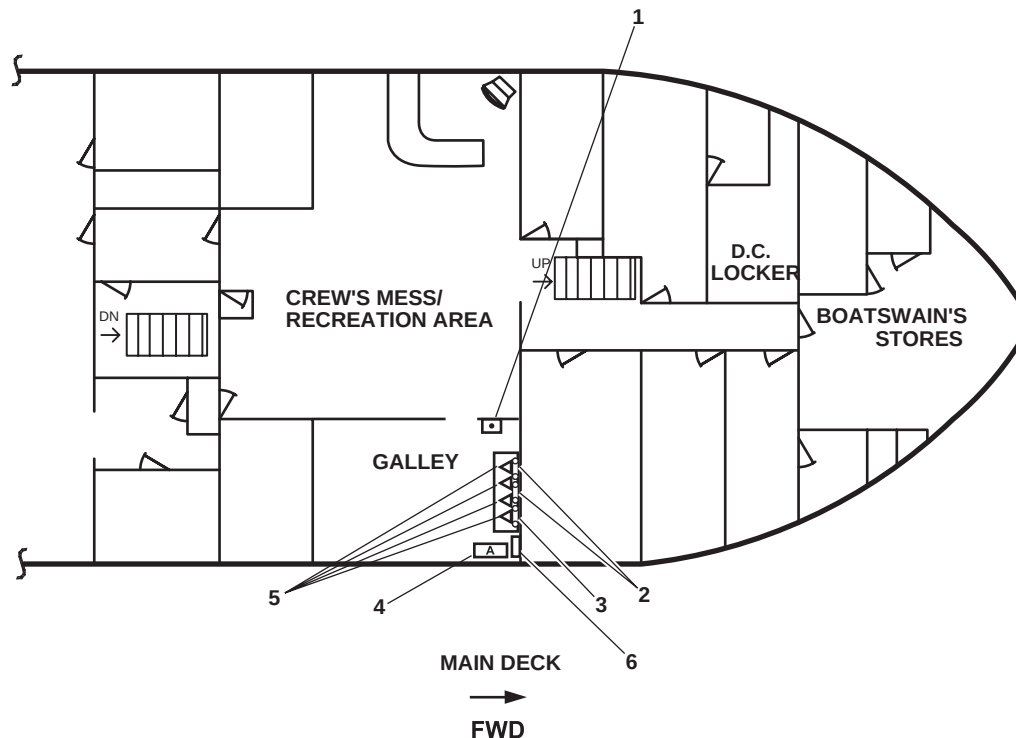


Figure 10. Galley Fire Suppression System

ARMS LOCKER DRENCHING SYSTEM

The arms locker drenching system is connected to the fire main system. The system is designed to provide raw water to the arms locker in the event of a fire or excessive high temperatures. The arms locker drenching system must be manually activated once the fire main has been charged. The system can be activated in the boatswain's locker (local) or from the 0-1 level (remote) at the bow by means of a reach rod valve system.

System activation occurs when the thermal heat detector (figure 11, item 1) senses a temperature above 105 °F (40.5 °C). The thermal heat detector sends an alarm signal to the pilothouse indicating high temperature conditions in the arms locker. The crew shall then investigate the situation and, if necessary, the fire main system would be charged. Once it is determined that the alarm condition exists and the fire main system is charged, the manual activation valve (figure 11, item 2) is OPENED either locally or remotely. As raw water enters the piping system in the arms locker, a pressure switch (figure 11, item 3) activates an alarm in the pilothouse to indicate that the arms locker drenching system has been activated. The raw water from the fire main flows into the arms locker and out of two sprinkler heads (figure 11, item 4). Once activated, the system will continue the flow of raw water into the arms locker until the manual activation valve is closed or the fire main system is secured.

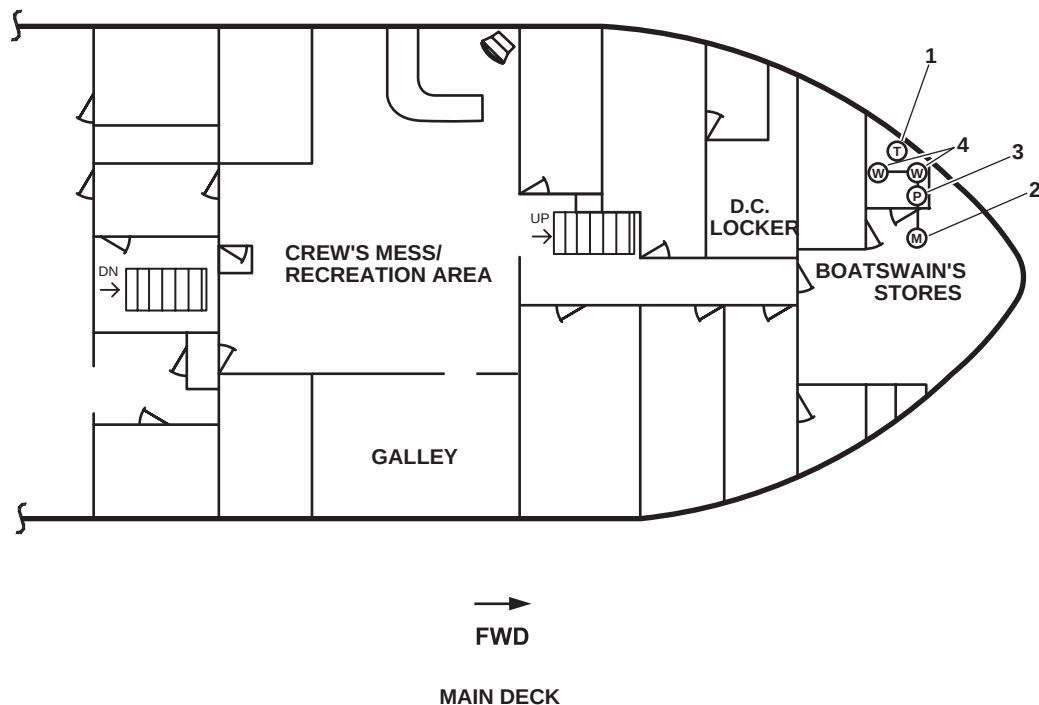


Figure 11. Arms Locker Drenching Systems

EXTINGUISHING AGENTS

DRY CHEMICAL

The extinguishing agent dispensed from portable hand-held equipment used on the LT is dry chemical based (figure 12). Dry sodium bicarbonate chemical is non-toxic, non-corrosive, and non-abrasive. It can be used effectively on oil fires, and it is four times more effective than equal weights of CO₂ in extinguishing a flammable liquid fire. Dry chemical is also effective on electrical fires. Because the agent has little effect on the removal of heat, repeated applications may be required to prevent the fire from reflashing. Dry chemical is the most effective hand held extinguisher in combating an oil spray fire. The effective range of this agent is 13 to 22 feet (4 to 6.7 meters). Dry chemical can cover a large area, but the residue left behind is difficult to remove.

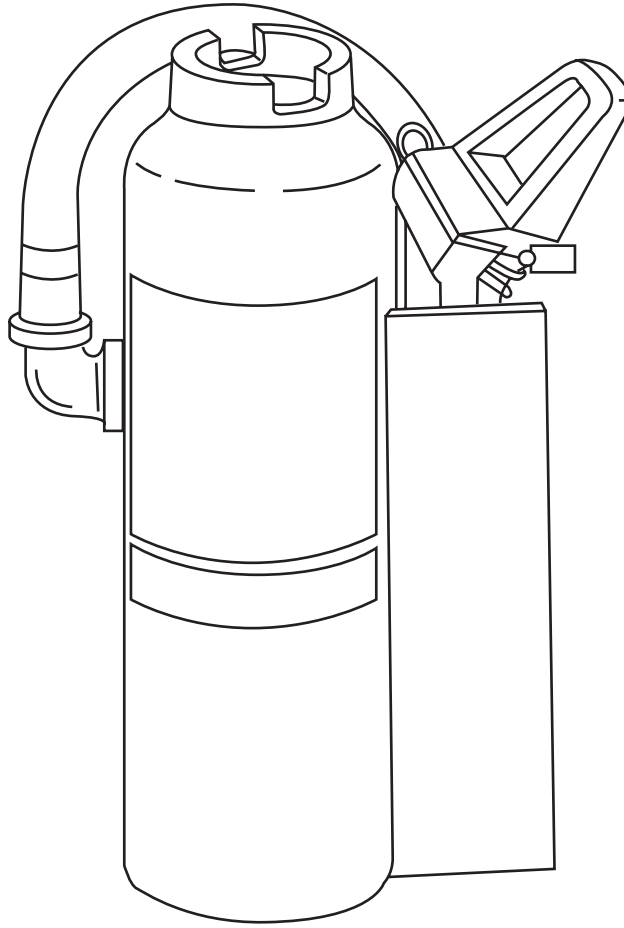


Figure 12. Portable Dry Chemical Extinguisher

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
POWER GENERATION SYSTEM**

GENERAL

The power generation system provides the LT with service power of 440 Vac, 3-phase, 60 Hz, 275 kW and emergency power of 440 Vac 3-phase, 60 Hz, 65 kW. Service power is generated by one or both of the ship's service diesel generator (SSDG) sets. The SSDG supplies power to the main switchboard and the emergency switchboard through a bus tie circuit breaker. The emergency diesel generator produces emergency power for continued operation of vital systems and equipment should loss of service power occur. Refer to figure 1 for an overall block diagram of the power generation system.

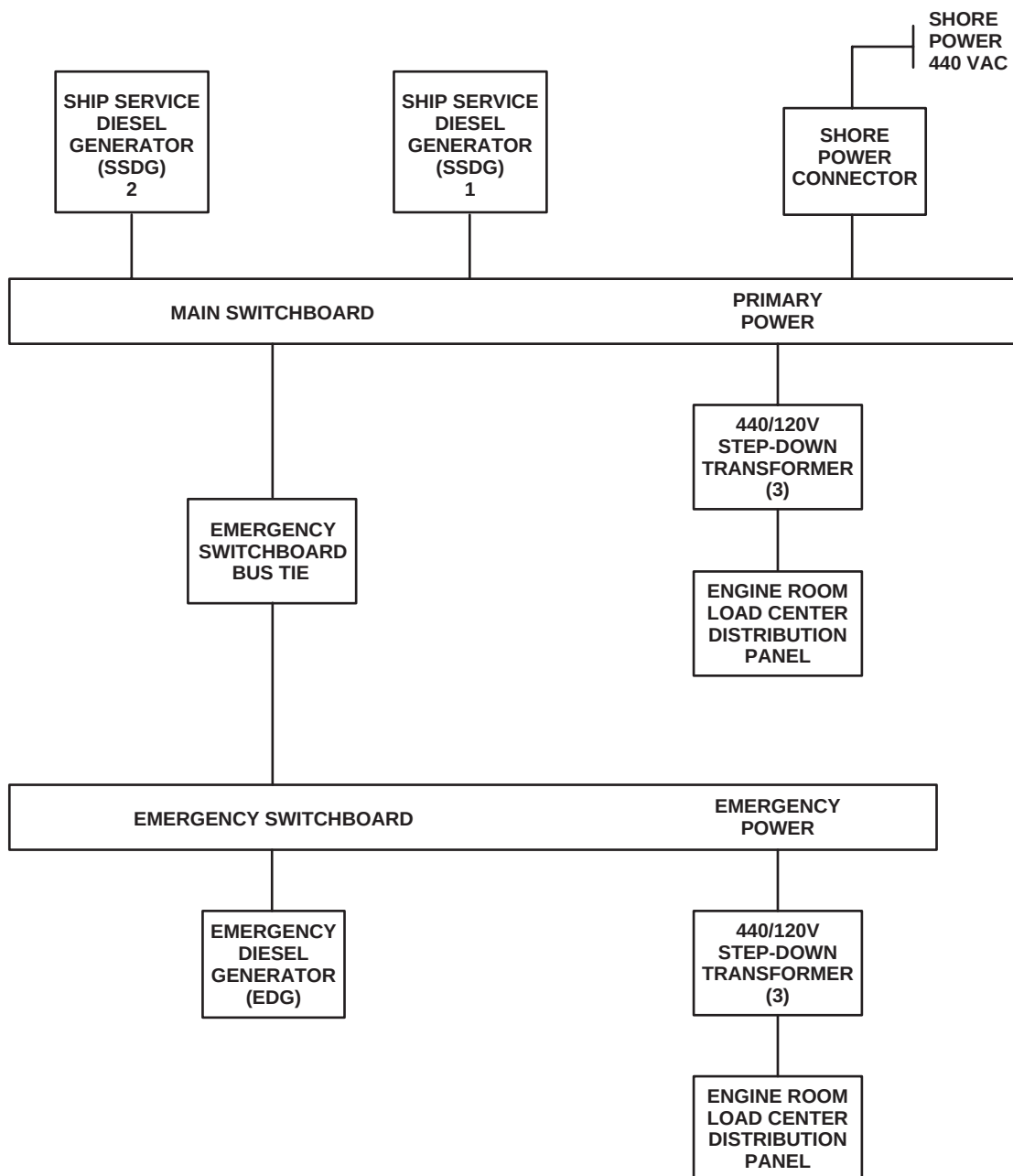


Figure 1. Power Generation System Block Diagram

A bus tie transfer breaker isolates the emergency switchboard from the main switchboard upon loss of service power. The bus tie breaker is located in the emergency switchboard and allows emergency power to be supplied through the emergency switchboard.

In port, the LT is capable of receiving 440 Vac shore power through a shore power cable terminating at a shore power connector. When connected, the shore power cable supplies both the main switchboard and the emergency switchboard.

SHIP'S SERVICE DIESEL GENERATOR (SSDG) SET

GENERAL

Each ship's service generator consists of a diesel engine, which is directly coupled to its generator. The engine and generator are mounted on a common foundation.

SHIP'S SERVICE DIESEL GENERATOR ENGINE

A turbocharged V8 diesel engine provides power to the generator. The port ship's service diesel generator engine 2 is air-started while the starboard diesel generator engine 1 is electrically started. Engine control and monitoring are provided from the EOS and local control panel.

SHIP'S SERVICE DIESEL GENERATOR

Two 275-kW brushless exciter generators provide 440 Vac, 3-phase, 60 Hz power to the main switchboard. Each generator is capable of providing 110 percent of the necessary at-sea load for the propulsion and safety of the vessel under normal conditions. The generators may be operated in parallel; however, normal operation has one generator on line. For parallel operation, controls necessary to parallel the generators are provided on the main switchboard, located in the EOS.

EMERGENCY DIESEL GENERATOR (EDG) SET

General

The emergency diesel generator set consists of a diesel engine that is directly coupled to the emergency generator. The engine and generator are mounted on a common foundation.

EMERGENCY DIESEL GENERATOR ENGINE

An in-line 4-cylinder diesel engine provides power to the emergency generator. The engine is electrically started (24 Vdc), has its own lubricating oil, cooling and fuel oil systems. The engine is cooled by a fresh water cooling system utilizing a radiator for heat transfer. Jacket water heater is provided for cold weather starting. Switchboard automatic bus transfer equipment automatically opens the bus tie circuit breaker, starts the engine, and closes the emergency generator breaker when power is lost from the main switchboard.

EMERGENCY DIESEL GENERATOR

The emergency diesel generator provides power (440 Vac, 3-phase, 60 Hz, 65 kW) to the emergency switchboard within 20 seconds of a ship's service power system failure.

SHORE POWER CONNECTOR

A shore power connector (440 Vac, 400 amps) is located on the main deck, aft of the exterior bulkhead. The shore power connector provides the capability of connecting the vessel's electrical system to a shore power source.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
ELECTRICAL SYSTEM**

GENERAL

The 128' Large Tug (LT) uses alternating current (440 Vac, 220 Vac, and 120 Vac) and direct current (24 Vdc) electrical systems. These electrical systems supply all of the electrical needs of the LT vessel.

The alternating current electrical system uses a 3-phase system. The 440 Vac (volts alternating current) system has two power sources. Power may be derived from the diesel generator or from an outside power source via the shore power receptacle and the shore power cable. The 220 and 110 Vac systems receive power through step-down transformers.

The direct current electrical system is a two-wire isolated ground system. A 24 Vdc (volts direct current) supplies many of the lighting, communication, and accessory systems for the LT.

The main components of the vessel's electrical system consist of the ship's service main switchboard, the emergency switchboard, load centers, power panels, motor controllers, and related wiring. The system distributes 440 Vac, 220 Vac, 120 Vac, and emergency power throughout the vessel. Power (440 Vac, 3-phase, 60 Hz) is received from the power generation system and routed via the main switchboard and emergency switchboard to the selected equipment and panels.

ALTERNATING CURRENT ELECTRICAL SYSTEM

The alternating current electrical system consists of the ship's service main switchboard, the emergency switchboard, transformers, distribution panels, motor controllers, and related wiring.

MAIN SWITCHBOARD

The main switchboard is located in the EOS and provides the generator selection, shore power selection, and power distribution for the ship's service 440 Vac. Refer to figure 1 for a block diagram of the main switchboard. The main switchboard consists of transformers, as well as ammeters, voltmeters, kilowatt meters, frequency meters, a phase rotation meter, and a synchronization meter that provides power monitoring.

Controls are provided for the automatic generator voltage regulation and the generator engine speed regulation. The switchboard motorized bus tie breaker also serves as an emergency 440 Vac power feedback source for the main switchboard from the emergency switchboard to the power selected equipment systems during emergency power conditions. An interlock system is incorporated into the switchboard to prevent damage to the switchboard by not allowing power from two sources to be supplied at the same time (see table 1).

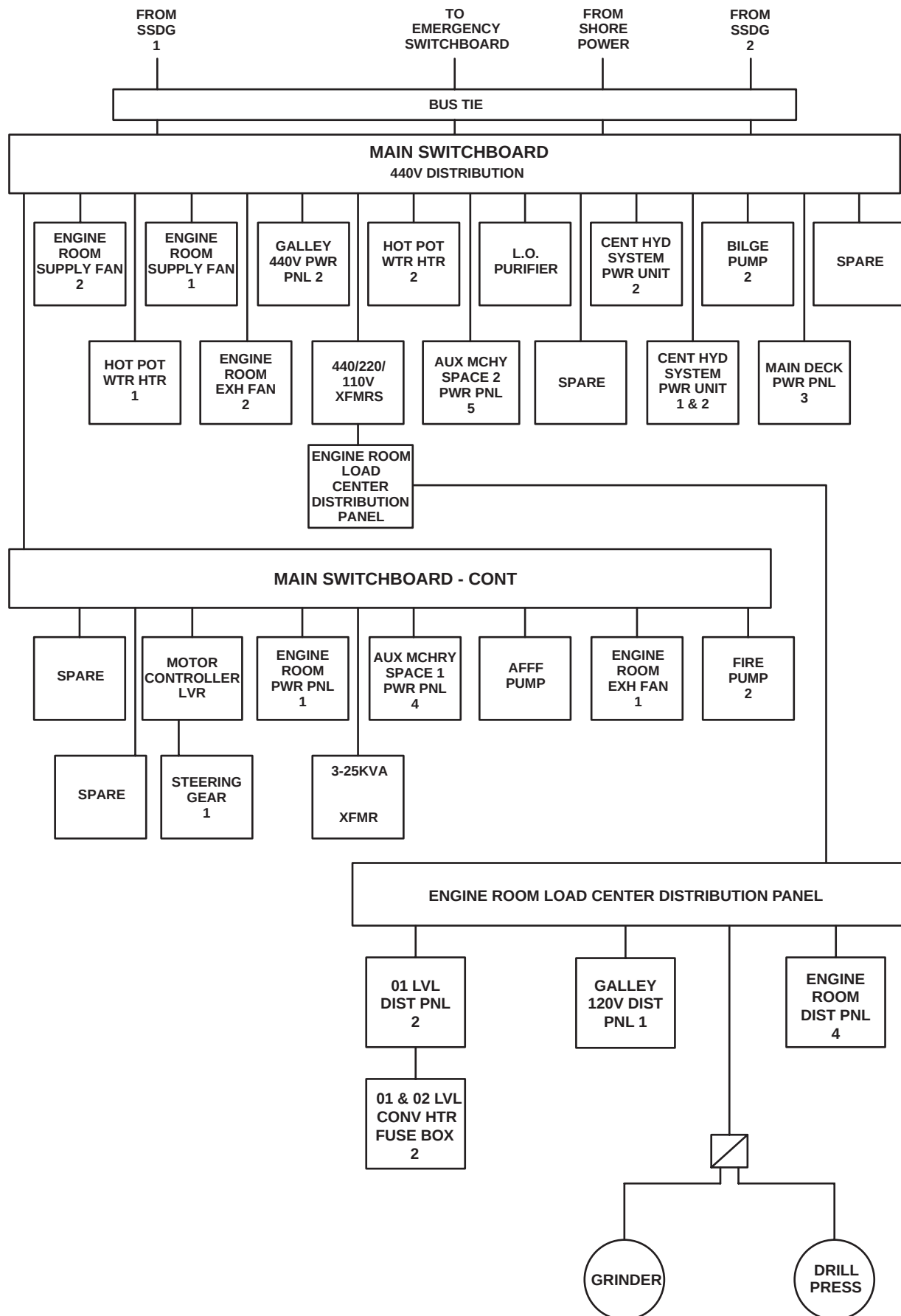


Figure 1. Main Switchboard Block Diagram (Sheet 1 of 2)

Table 1. Main Switchboard Interlocks**NOTE**

The following interlock conditions occur when the SSDG 1, SSDG 2, or shore power is feeding the main switchboard, the main bus tie is closed, and the FEEDBACK switch is in the NORMAL position:

Circuit Breaker Closed	Cannot Close
SSDG 1 Circuit Breaker	Shore Power Circuit Breaker
SSDG 2 Circuit Breaker	Shore Power Circuit Breaker
Shore Power Circuit Breaker	SSDG 1 Circuit Breaker
Shore Power Circuit Breaker	SSDG 2 Circuit Breaker
Main Bus Tie Circuit Breaker (Emergency Switchboard)	EDG Circuit Breaker
1S/E Bus Tie Circuit Breaker	2S/E Bus Tie Circuit Breaker
2S/E Bus Tie Circuit Breaker	1S/E Bus Tie Circuit Breaker

NOTE

The following interlock conditions occur when the Emergency Diesel Generator is running, and the FEEDBACK switch is in the NORMAL position:

Circuit Breaker Closed	Cannot Close
EDG Circuit Breaker (Emergency Switchboard)	Main Bus Tie Circuit Breaker

NOTE

The following interlock conditions occur when the EDG is running, and the FEEDBACK switch is in the FEEDBACK position:

Circuit Breaker Closed	Cannot Close
EDG & Main Bus Tie Circuit Breaker (Emergency Switchboard)	SSDG #1 Circuit Breaker
EDG & Main Bus Tie Circuit Breaker (Emergency Switchboard)	SSDG #2 Circuit Breaker
EDG & Main Bus Tie Circuit Breaker (Emergency Switchboard)	Shore Power Circuit Breaker

EMERGENCY SWITCHBOARD

The emergency switchboard is located in the emergency generator room and normally receives 440 Vac primary power from the main switchboard through the bus tie. Refer to figure 2 for a block diagram of the emergency switchboard. The emergency switchboard bus tie provides 440 Vac to the emergency switchboard. Upon loss of the ship's service power from the main switchboard, a bus tie transfer breaker located within the emergency switchboard isolates the emergency switchboard and provides automatic or manual starting of the emergency generator. A voltmeter, ammeter, and a frequency meter provide the power monitoring capability.

A main switchboard bus tie circuit breaker and feedback switch permit the distribution of emergency power (440 Vac) to the main switchboard. The EDG circuit breaker is prevented from being closed by an interlock system when primary power is being provided through the bus tie circuit breaker. Power distribution (440 Vac) is accomplished through circuit breakers on the switchboard.

TRANSFORMERS

The LT contains three step-down transformers that are located in the engine room and convert 440 Vac to 220/110 Vac. The transformers provide 120 Vac for the engine room load center. The LT also contains three step-down transformers, located in the emergency generator room (overhead), that provide 120 Vac power to the EMERG LOAD CTR DISTRIBUTION PANEL.

DISTRIBUTION PANELS

There are several distribution panels located throughout the LT. The following paragraph describes the essential distribution panels used within the alternating current electrical system. The distribution panels house the circuit breakers and the fuses that control and protect the circuits throughout the vessel.

The engine room load center distribution panel supplies 120 Vac to several power panels, and workshop equipment. The EMERG LOAD CTR DISTRIBUTION PANEL provides 120 Vac emergency power distribution to numerous emergency distribution panels, in addition to the battery chargers. The 220/110 V distribution panel provides power distribution for the galley, the crew's mess, and laundry spaces. The ENG RM DIST PNL NO. 4 provides power distribution for the engine room equipment, the welder, refrigerated stores controls, emergency generator strip heater and emergency switchboard heater. The radio room electronics distribution panel provides 120 Vac power to the communications equipment and battery charger.

MOTOR CONTROLLERS

There are eight types of motor controllers that provide the start and stop function of the motor and overload protection for the motor, as well as the status of the motor operation via the power available indicators and motor operating speed indicators.

DC ELECTRICAL SYSTEM

The direct current electrical system consists of the battery chargers, battery banks, and distribution panels.

STORAGE BATTERIES

Six independent 24 Vdc battery banks are provided. Refer to figure 3 for a block diagram of the battery power distribution system. One set of batteries provides starting power for the EDG engine. The second set provides starting power for SSDG 1. The third set of batteries provides power for the general alarm system. A fourth set of batteries provides power to the radio room DC panel, which supplies selected Communication, Electronic, and Navigation (CEN) equipment. Set five provides power (24 Vdc) for the machinery plant monitoring system and engine control. The sixth set of batteries provides 24 Vdc for the Reverse Osmosis Water Purification Unit (ROWPU).

BATTERY CHARGERS

Battery chargers for each battery bank are provided. The battery chargers are supplied 120 Vac from the emergency load center distribution panel (see figure 2 for the emergency switchboard block diagram). One charger is for the SSDG 1, and the other charger is for the machinery plant monitoring system and engine control.

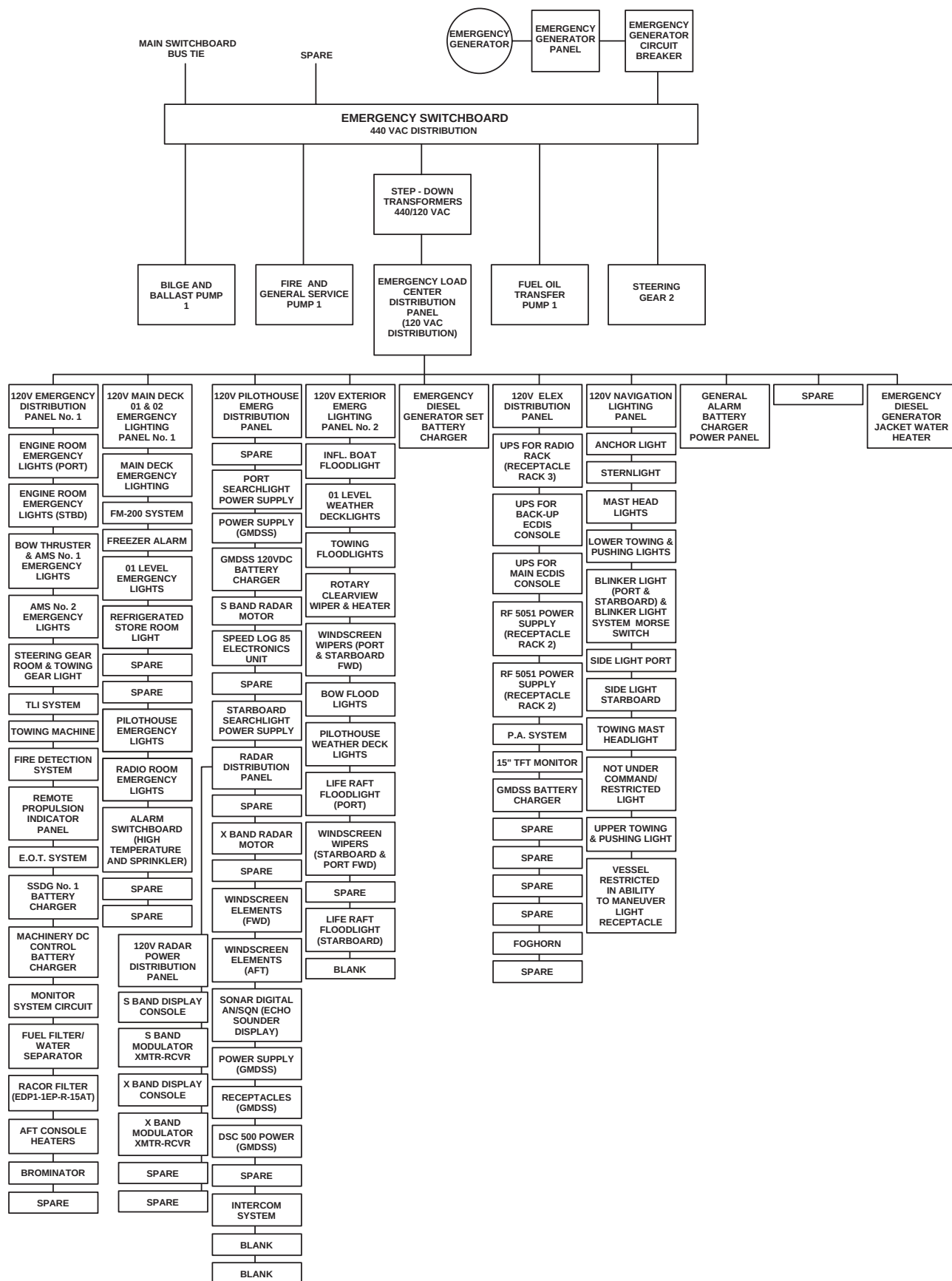
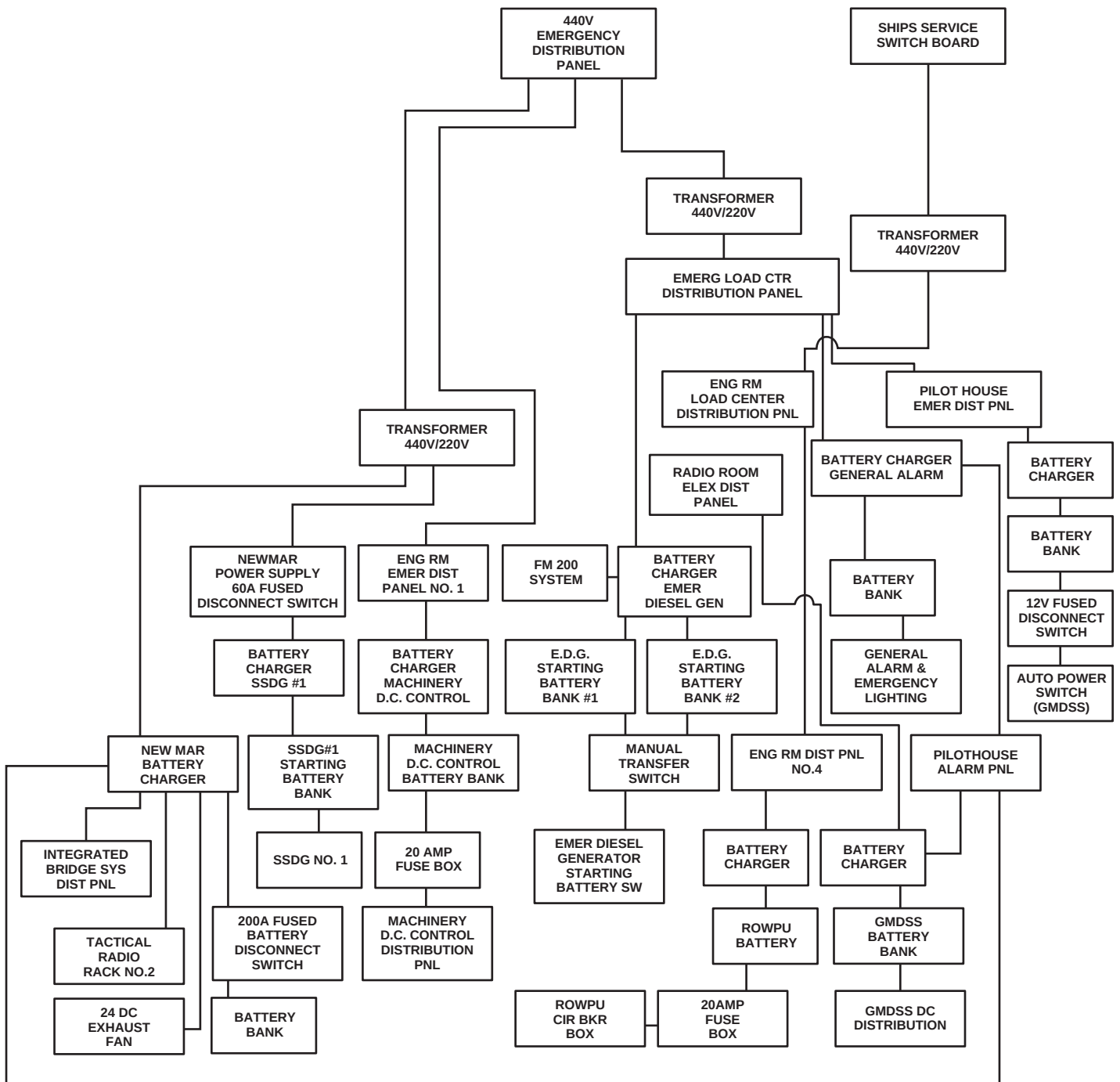


Figure 2. Emergency Switchboard Block Diagram



BATTERY BANKS

Battery banks provide battery power to start the SSDG 1 and provide power for the machinery plant monitoring system and engine control.

DISTRIBUTION PANELS

There are distribution panels located throughout the LT that are provided for Vdc electrical system operation. The distribution panels house the circuit breakers and the fuses that control and protect the circuits throughout the vessel.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
INTERNAL COMMUNICATION SYSTEMS**

GENERAL

The Large Tug (LT) has three independent interior communication systems. The systems can be grouped into two types: voice communication and non-voice communication. The voice communication system consists of the sound powered telephone system and the intercommunication (intercom) system. The non-voice communications system consists of the Engine Order Telegraph (EOT).

INTERCOMMUNICATION (INTERCOM) SYSTEM

The intercom system is a 20-station system that requires 120 Vac power. The 120 Vac power is provided from the pilothouse emergency distribution panel. The intercom system is a party-line type voice communication system. When it is used, other stations may join the discussion, but they cannot initiate a second discussion. Refer to table 1 for a list of intercom stations.

Table 1. Intercom Stations

Station Number	Location
1	PILOTHOUSE TOP
2	PILOTHOUSE
3	PORT BRDG WING
4	STBD BRDG WING
5	FWD 02 WEATHER DECK
6	AFT 02 WEATHER DECK
7	FORE DECK
8	CH ENG. S.R.
9	CAPTAIN'S S.R.
10	OFFICER S.R. 1
11	OFFICER S.R. 2
12	EMER GEN ROOM
13	AFT COUNT & GUNNER
14	D.C. LOCKER
15	CREW MESS
16	GALLEY
17	FANTAIL

Table 1. Intercom Stations (continued)

Station Number	Location
18	BOW THRUSTER
19	E.O.S.
20	EMGR STEERING GR.

SOUND POWERED TELEPHONE SYSTEM

The sound powered telephone system provides voice communications throughout the vessel by means of fixed phone stations and portable units. Since the system is powered by voice only, it is functional even when a loss of power occurs. There are two circuits within the sound powered telephone system. One circuit is a dedicated line between the pilothouse and the radio room. The other circuit provides communication throughout the LT. Refer to figure 1 for a simplified functional diagram of the sound powered telephone system.

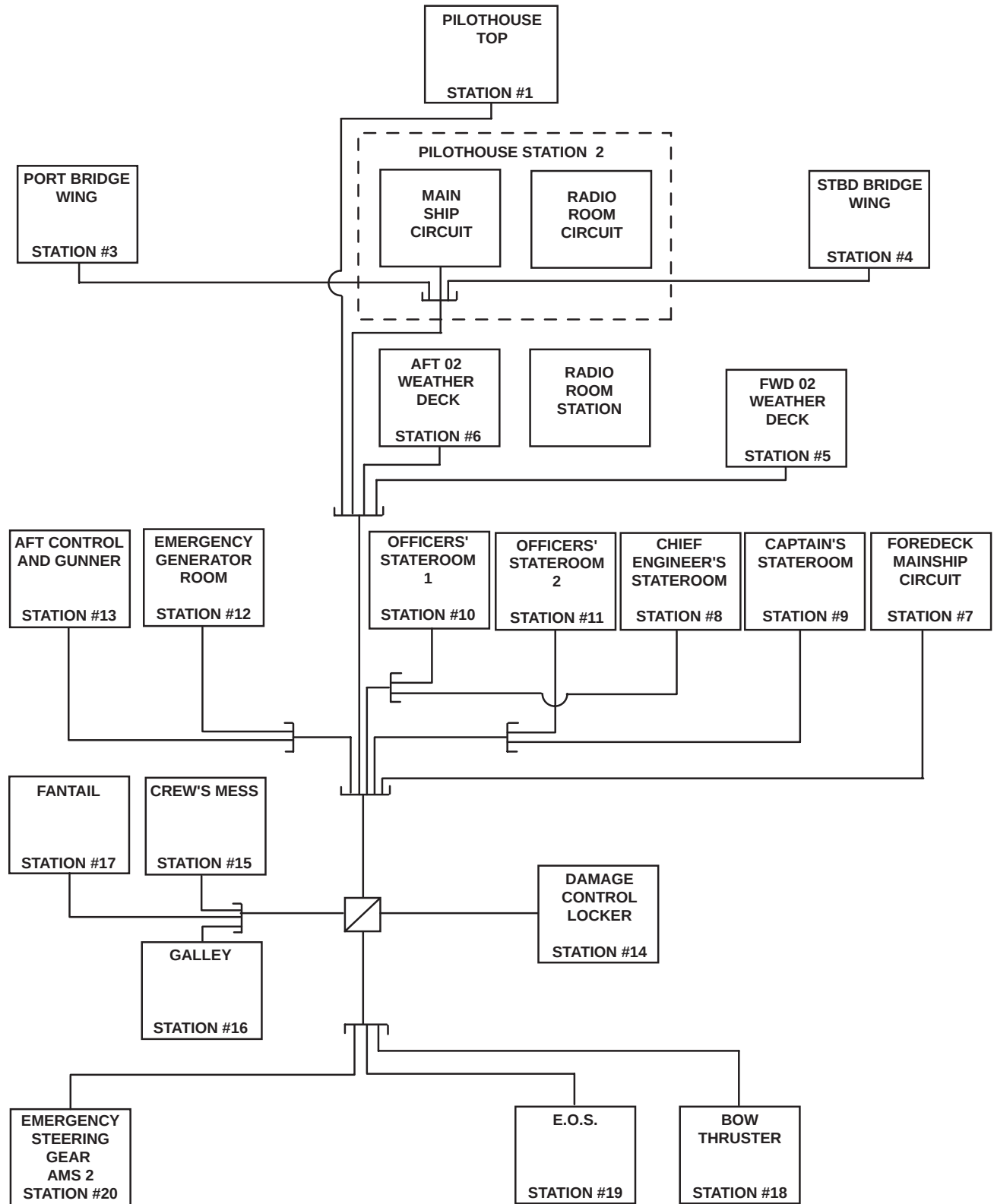
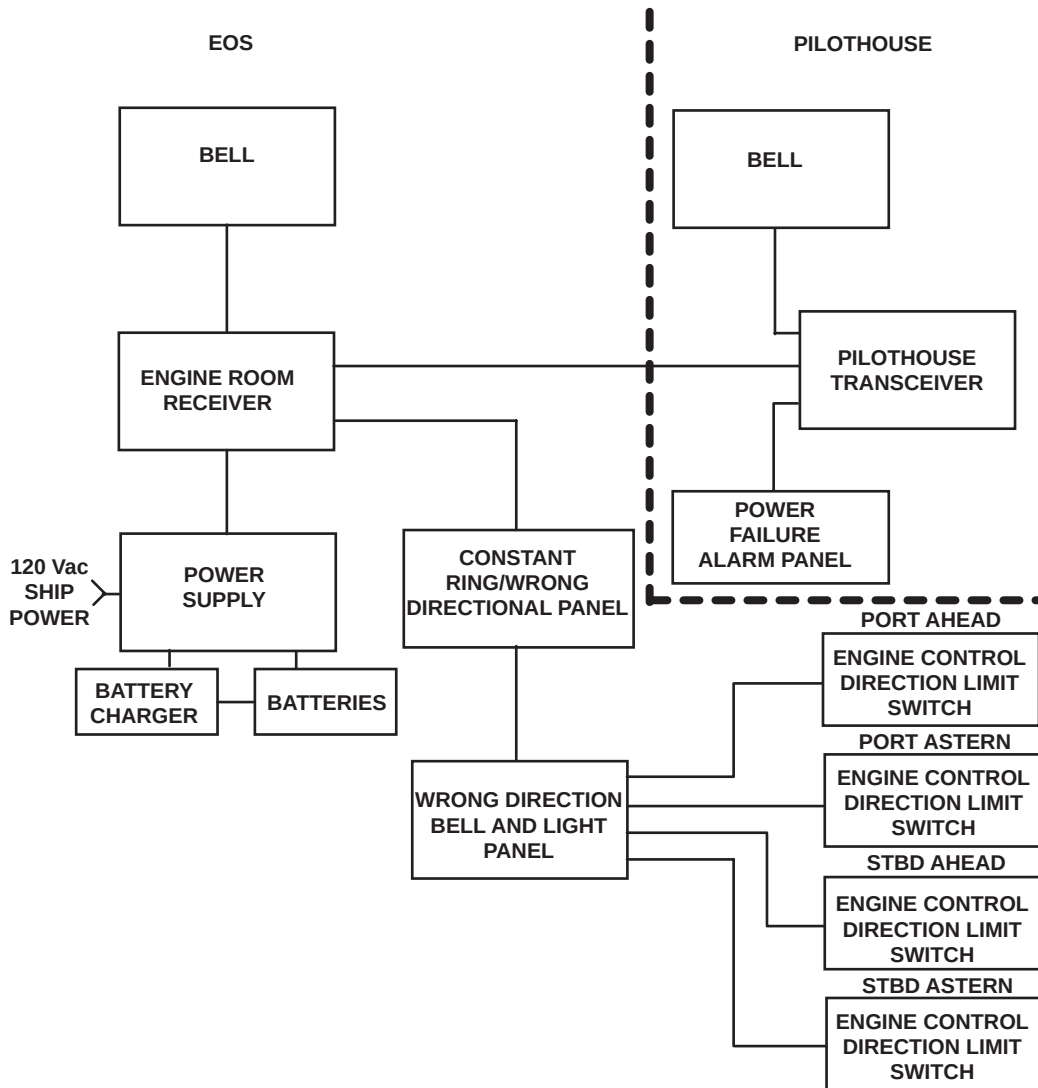


Figure 1. Sound Powered Telephone System Functional Diagram

ENGINE ORDER TELEGRAPH (EOT)

The EOT system is a 24 Vdc system used to transmit command from the pilothouse to the EOS. The EOT is used when the pilothouse is not in control of the propulsion plant. An alarm bell sounds to notify the operator if controls are not set to provide requested speed and direction. The power supply incorporates an internal battery charger and backup battery. Refer to figure 2 for a simplified block diagram of the EOT.



END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
ALARM SYSTEMS**

GENERAL

The LT is equipped with four alarm systems. The fire alarm system alerts the crew when a fire is detected via sensors located throughout the LT. The general alarm system is used to alert the crew to a general alarm condition. The door alarm system consists of alarms located in various locations throughout the LT to alert the crew of entry into certain spaces within the LT, or not to enter when high temperature has been detected, or when a sprinkler system has been activated. The FM-200 fire suppression system gives the crew a 60-second warning prior to discharge of the FM-200 system.

FIRE ALARM SYSTEM

GENERAL

The fire alarm system alerts the crew to the presence of a fire by sounding an alarm via sensors located throughout the LT or when it has been manually activated through a fire alarm pull station. See figure 1 for a schematic diagram of the fire alarm system.

The fire alarm system consists of the fire and smoke detection panel located in the EOS; a remote indicating panel located in the pilothouse; a terminal box, heat rise detectors (thermostats), infrared detectors, and smoke detectors located in various compartments; fire alarm pull stations; and a 10 inch (254 mm) bell. The heat detectors are arranged in various zones throughout the vessel. When a fire condition is detected, the associated sensor sends an alarm signal via a zone module located in the fire and smoke detection panel to the applicable fire control panel indicators. When pulled, the fire alarm pull station also sends an alarm signal via the zone module to the applicable fire detector panel indicators.

FIRE AND SMOKE DETECTION PANEL

The fire and smoke detection panel is located in the EOS and alerts the crew to any fire detector faults in the fire detection system as well as alarm indications via LED indicators. See figure 2 for a depiction of the fire and smoke detection panel.

The panel contains indicator lights that illuminate when a fire is detected within the applicable zone area. The POWER FLASHING indicator illuminates to indicate that power is being supplied to the fire and smoke detection panel. The WHEN ON BATTERY indicator will flash when the fire and smoke detection panel is on battery power. The ALARM FLASHING WHEN SILENCED indicator illuminates when an alarm for one or more zones has been detected and will flash after the audible alarm has been silenced. The DC VOLTS meter indicates the dc voltage of the fire and smoke detection system while the DC AMPS meter indicates the fire and smoke detection system dc amperage. BATTERY TROUBLE indicator will be illuminated when the system detects a low charge in the battery system.

REMOTE INDICATING PANEL

The remote indicating panel is located in the pilothouse and alerts the pilothouse crew to the presence of fire. The panel contains four indicators that will illuminate the appropriate zone indicator for which the fire or smoke is detected.

HEAT RISE DETECTORS

There are three thermal heat detectors that are mounted in the 01 level passageway and in the boatswain's store and passageway. The heat detectors send a signal to the remote indicating panel when fire is detected, triggering the appropriate alarm.

SMOKE DETECTORS

There are 15 smoke detectors located in various locations throughout the LT. The smoke detectors contain a set of normally open contacts that close when smoke is detected. When the contacts are closed, a signal is sent to the remote indicating panel that will sound the appropriate alarm.

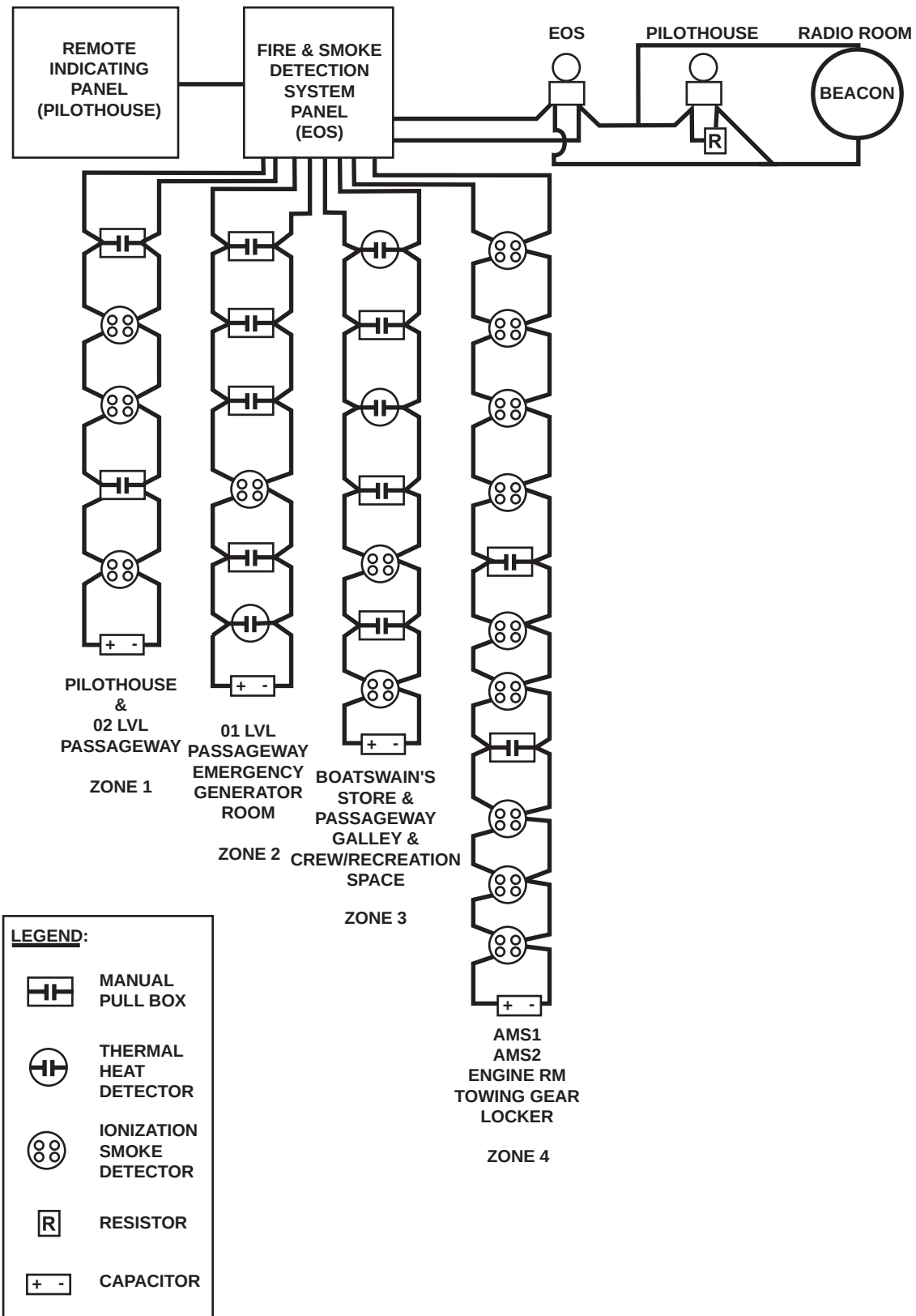


Figure 1. Fire Alarm System Schematic

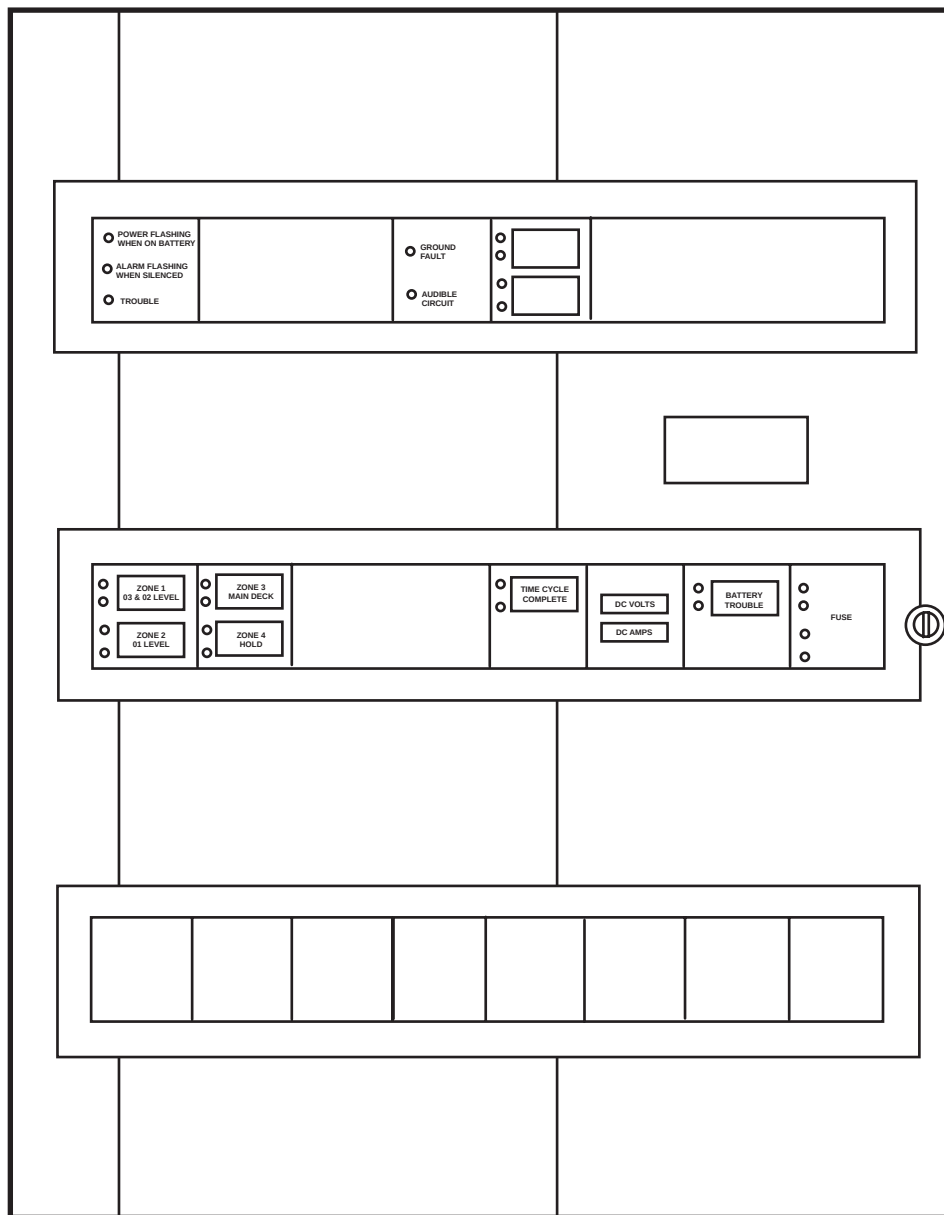


Figure 2. Fire and Smoke Detection Panel

GENERAL ALARM SYSTEM

GENERAL

The general alarm system is used to alert the vessel's crew to general alarm conditions. The system is controlled from the pilothouse and the 01 level passageway by contact makers located in the pilothouse and the 01 level passageway. When activated, alarm bells sound in various places throughout the LT. The general alarm system is powered by a 24 Vdc power supply via the general alarm battery bank. In the auxiliary machinery spaces and in the engine room, the system is equipped with relays that provide 120 Vac to rotating lights during alarm conditions. A simplified block diagram of the general alarm system is provided in figure 3.

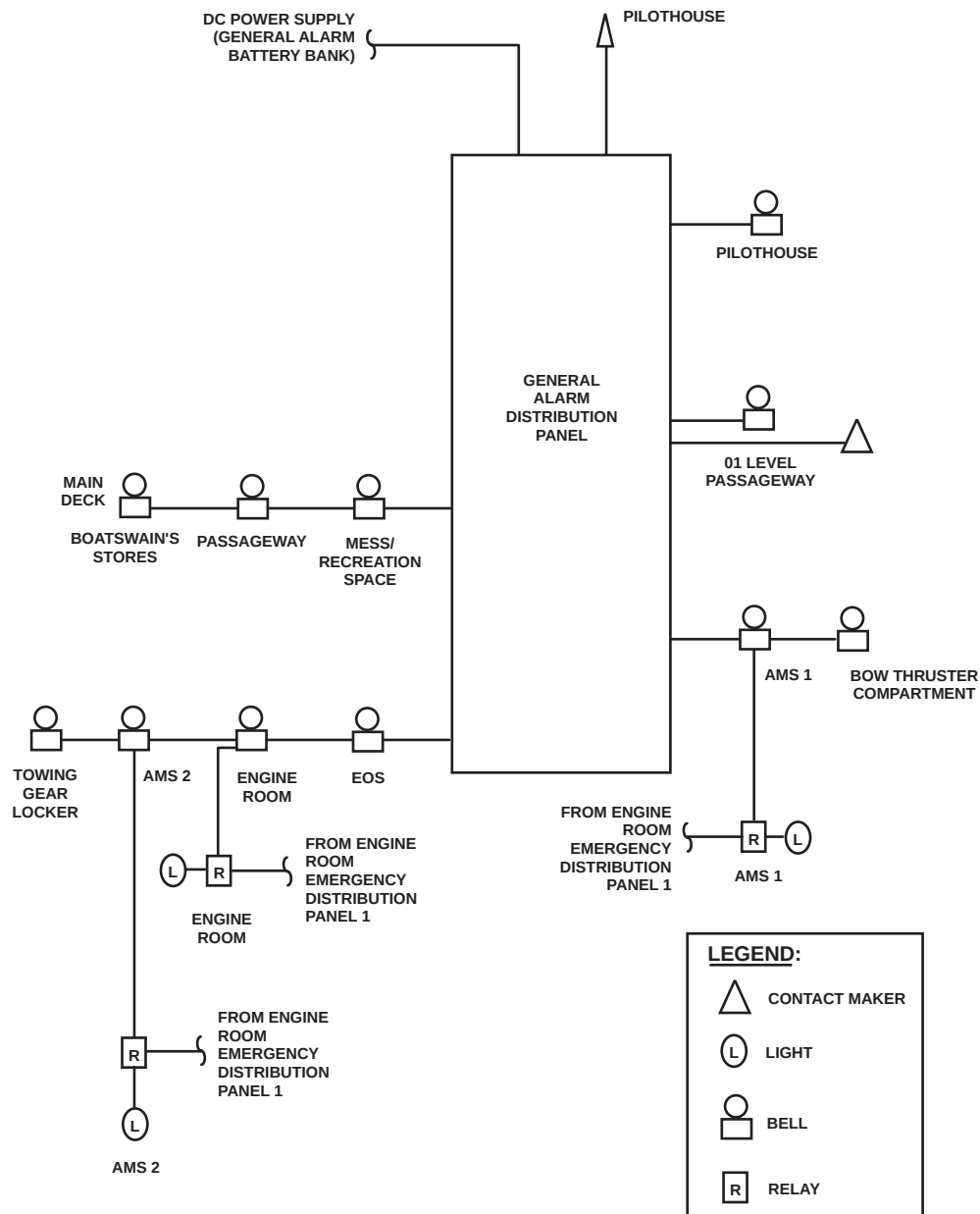


Figure 3. General Alarm System Simplified Block Diagram

ALARM BELLS

The general alarm system has 11 alarm bells located throughout the vessel. When the pilothouse switch or 01 level passageway switch is closed (ON), current flows to the alarm bells and they ring.

CONTACT MAKER

Contact makers located in the pilothouse and in the 01 level passageway control the general alarm system. When the switches are closed (ON), current flows to the alarms bells and they sound.

GENERAL ALARM DISTRIBUTION PANEL

The general alarm distribution panel, located in the 01 level passageway, is a junction box that is used to interconnect the general alarm system cables and to connect the contact makers and the alarm bells. The junction box also contains 12 fuses that protect the system from damage due to overload.

DOOR ALARM SYSTEM

GENERAL

The door alarm system consists of alarms located in the radio room, arms stowage room, the main deck fan room, and the freezer. The radio room door and arms stowage alarms alert the pilothouse to entry to the radio room or fan room, high temperature in the arms stowage room, or activation of the arms stowage room sprinkler system. The freezer alarm alerts the crew when the freezer alarm has been activated. Refer to figure 4 for a block diagram of the radio room, arms stowage, and the main deck fan room door alarms and figure 5 for a block diagram of the freezer alarm.

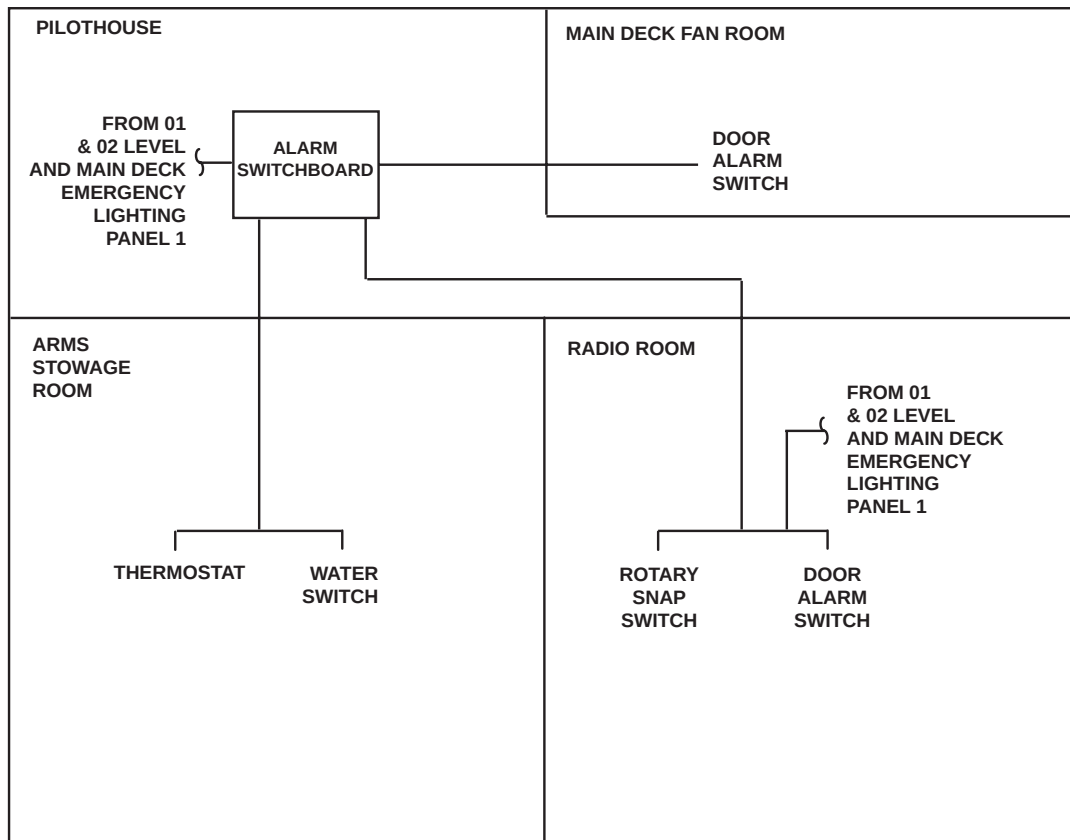


Figure 4. Radio Room, Arms Stowage, and Main Deck Fan Room Door Alarm Block Diagram

RADIO ROOM DOOR ALARM SYSTEM

The radio room door alarm system uses 120 Vac supplied from the 01 & 02 level and main deck emergency lighting panel No. 1. When the door to the radio room is open, an alarm buzzer and indicator on the alarm switchboard located in the pilothouse is activated. A manual rotary snap switch is provided inside the radio room to disable the radio room door alarm.

ARMS STOWAGE ALARM SYSTEM

The arms stowage alarm system is a 120 Vac alarm system. Power is supplied from the 01 & 02 level and main deck emergency lighting panel No. 1. Two sensors are provided, a high temperature sensor and a sprinkler sensor. The high temperature sensor detects unusually high temperature in the arms stowage room and activates the pilothouse sprinkler system alarms. The sprinkler sensor is a water flow switch that is installed on the downstream side of the sprinkler control valve. When the sprinkler control valve opens, water passes through the sprinkler control valve and through the water switch to the sprinklers. Water passing through the water switch activates the pilothouse alarms. Both audible and visual alarms are provided in the pilothouse at the alarm switchboard.

MAIN DECK FAN ROOM ALARM SYSTEM

This alarm system is a 120 Vac alarm system. Power is supplied from the 01 & 02 level and main deck emergency lighting panel No. 1. When the main deck fan room door is open, an alarm buzzer and light on the alarm switchboard in the pilot-house is activated. There is no local switch to disable the alarm.

FREEZER ALARM SYSTEM

The freezer alarm system consists of three pilot lights, switches, and a buzzer. The system power is supplied from the 01 & 02 level and main deck emergency lighting panel No. 1. The switches are located in the thaw room, chill room, and freezer room. When operated, the switches energize the buzzer in the galley to alert personnel that someone is trapped in the room. Refer to figure 5 for the freezer alarm block schematic.

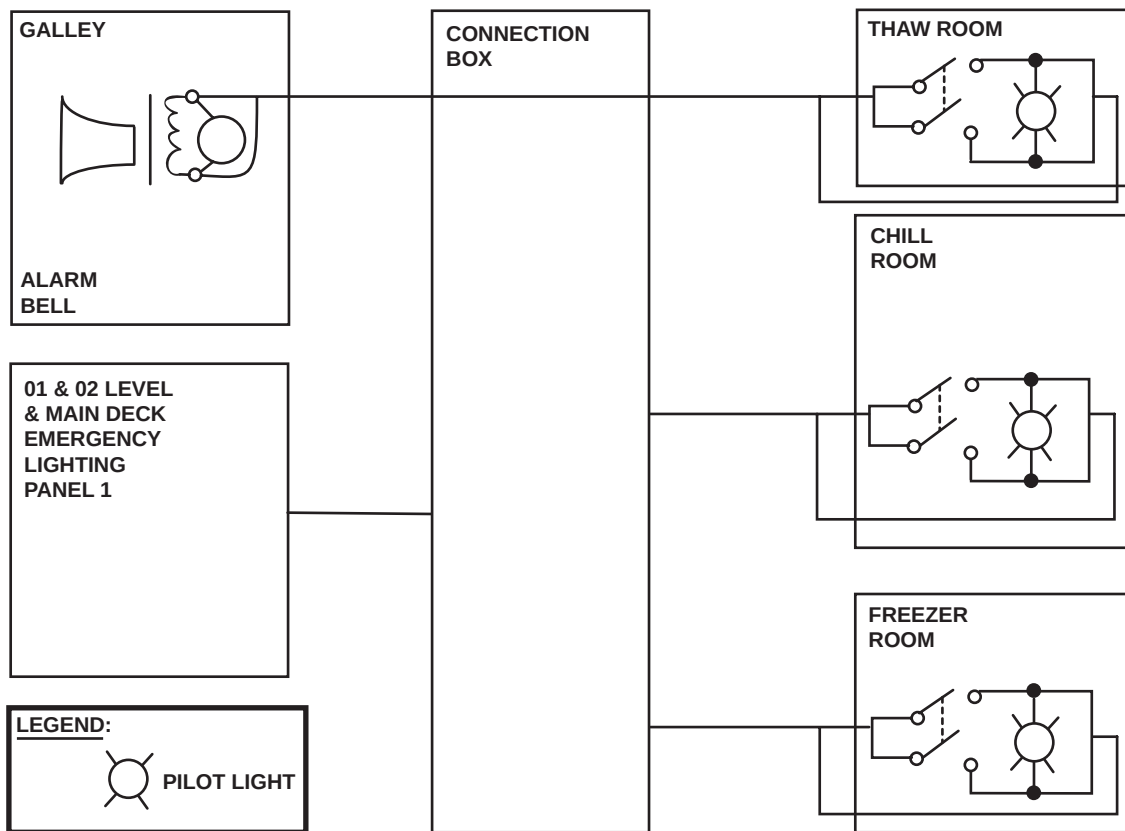


Figure 5. Freezer Alarm Block Diagram

FM-200 FIRE SUPPRESSION ALARM SYSTEM

GENERAL

The FM-200 fire suppression alarm system is a manually actuated, stand-alone total flooding fire suppression system. The engine room and AMS 1 are equipped with the FM-200 fire suppression system. The FM-200 fire suppression alarm system consists of two pressure actuated switches, amber strobe lights, electric horns, and an alarm bell. Refer to figure 6 for the FM-200 fire suppression alarm system schematic.

When the FM-200 system is actuated, pressurized CO₂ from the system's actuating circuit closes the alarm system's pressure actuated switch. These switches, in turn, energize the alarm system's strobe lights, horns, and bell. Once the alarm begins sounding, the occupants of the engine room and AMS 1 have 60 seconds to evacuate the space prior to discharge of the FM-200 fire suppression agent.

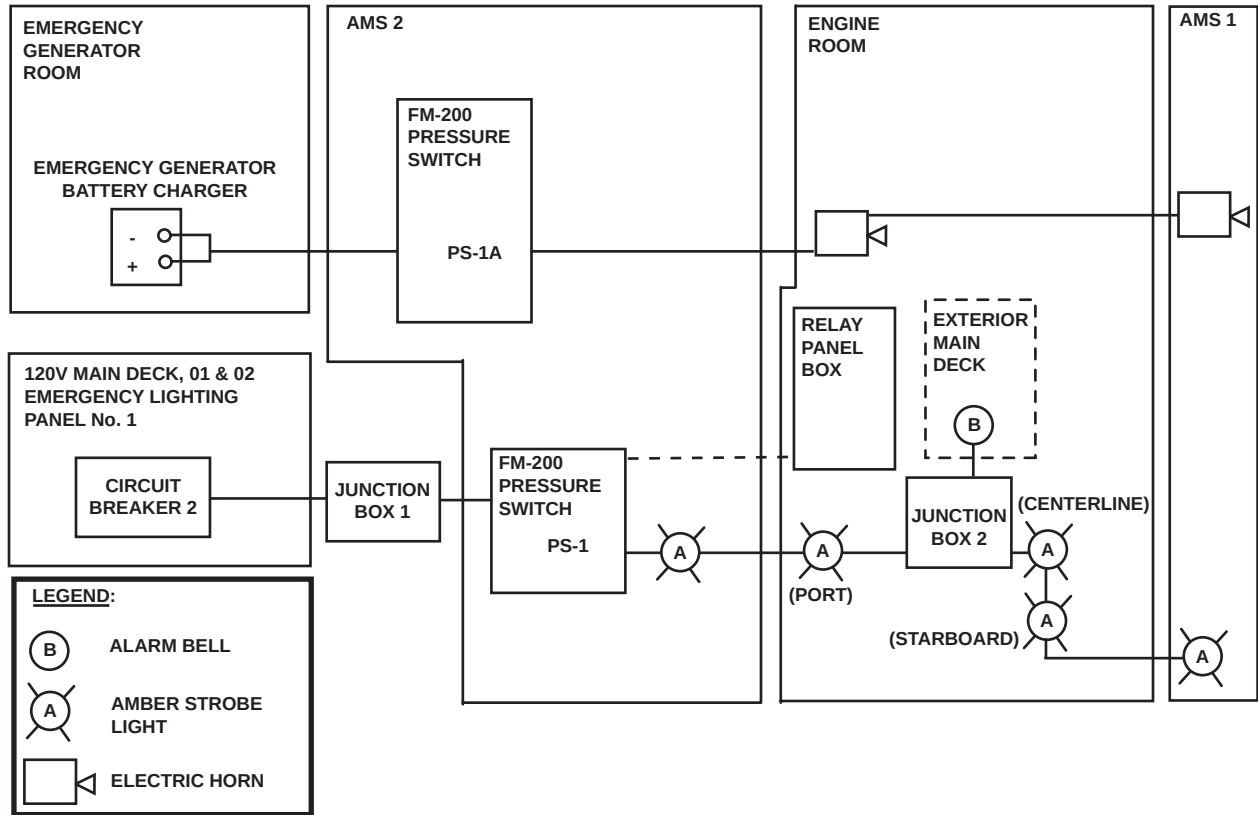


Figure 6. FM-200 Fire Suppression Alarm System Schematic

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
HEATING, VENTILATION, AND AIR CONDITIONING (HVAC) SYSTEMS**

GENERAL

The Heating, Ventilation, and Air Condition system (HVAC) supplies the Large Tug (LT) with controlled heat and conditioned air. The HVAC system also controls the exhaust and vented air circulation in appointed areas on the vessel (figures 1, 2, 3, and 4). Major components of the HVAC system include the following:

DUCT HEATERS

Duct heaters are flange mounted electric heaters installed in ducting. These heaters are referred to as preheaters or reheaters depending on their application.

PREHEATER

The preheater heats outside air before distribution.

REHEATER

The reheater ensures that air supplied to a compartment is at the proper temperature.

CONVECTION HEATER

The convection heaters are convection type electric space heaters. They are used in the laundry spaces and sanitary spaces.

SPACE HEATERS

The space heaters are forced air electric space heaters. The space heaters are used in machinery spaces, laundry spaces, and the bow thruster compartment and towing gear locker.

NATURAL SUPPLY AND EXHAUST VENTS

Natural supply vents are provided in the towing gear locker, emergency generator room, and bow thruster compartment. Exhaust vents are provided in AMS 1 and AMS 2.

VENTILATION FANS

All ventilation fans are vaneaxial direct drive, with electric motors that provide forced air ventilation. The galley supply fan, galley ventilator hood exhaust fan, sanitary space exhaust fans, and workshop exhaust fan are single speed fans. All other workspace fans are 2-speed fans.

FAN COIL UNITS

Fan coil units contain a coil for cooling (air conditioning); a preheater (for heating the spaces); and a single speed electric motor, belt-driven centrifugal fan. Two horizontal fan coil units are provided on the LT. One unit serves the main deck spaces, the other serves the 01 level and above.

EOS AIR CONDITIONER

The EOS air conditioner supplies heated or cooled air. An integral fan provides forced air.

AIR CONDITIONING CONDENSER UNITS

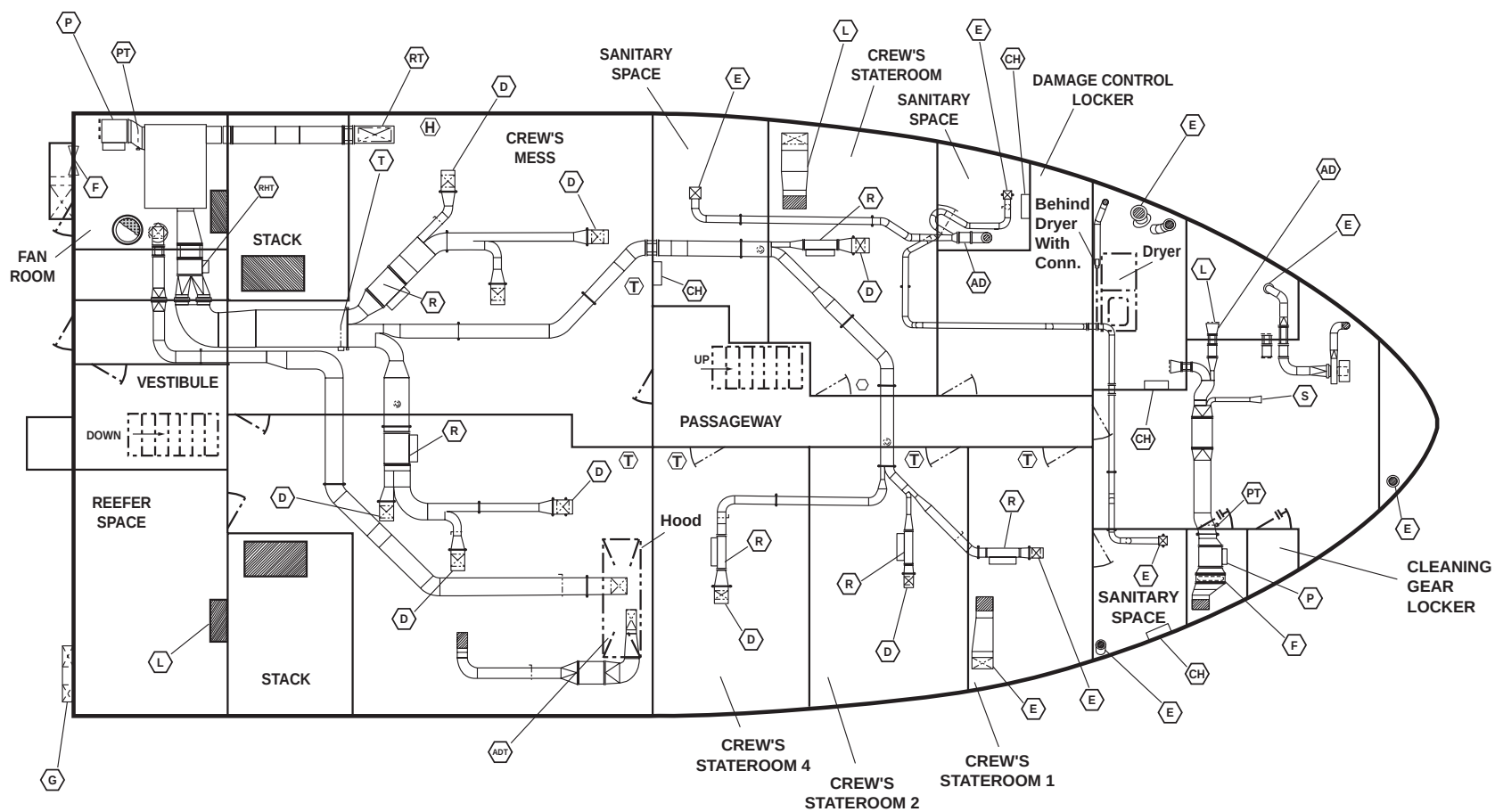
The vessel's two fan coil units are supplied with refrigerant by two condensing units located in AMS 2. Each condensing unit has a capacity of 14.6 tons of refrigeration under normal operating conditions. Controls are provided for automatic operation and capacity variation for light loads. Refer to WP 0039 00 for condensing unit details.

PILOTHOUSE ROOFTOP AIR CONDITIONING UNITS

Two heating and cooling units provide conditioned air to the pilothouse. The two units are mounted on the pilothouse rooftop and are controlled by separate programmable thermostats located on the pilothouse console. Each unit has a washable filter in the return duct.

RADIO ROOM ROOFTOP AIR CONDITIONING UNIT

The radio room rooftop air conditioning unit provides conditioned air to the radio room. The condenser unit is mounted on the pilothouse rooftop and the fan cooling unit is mounted in the radio room. The radio room rooftop air conditioning unit is controlled by a remote control programmable thermostat located in the radio room.

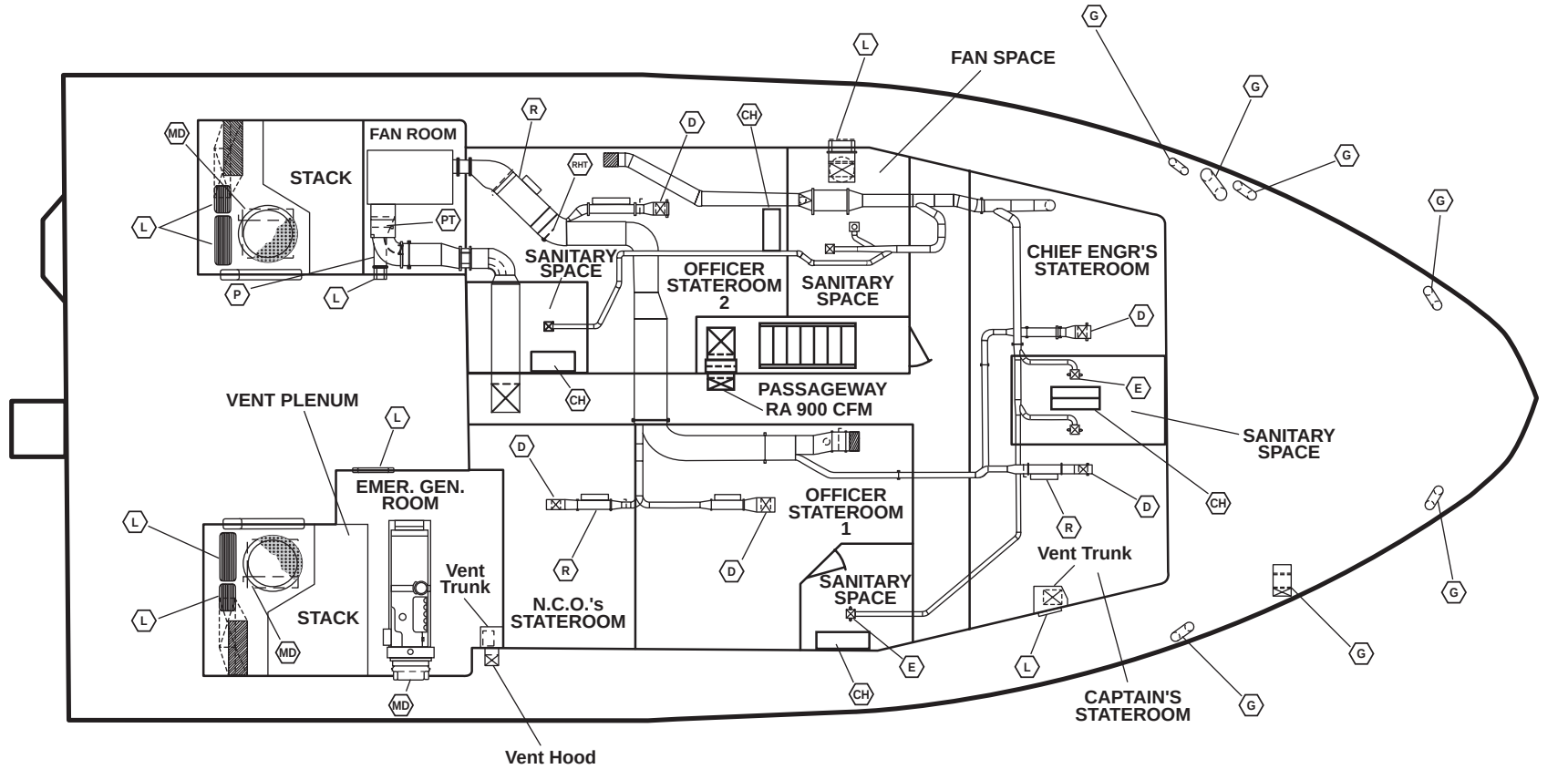


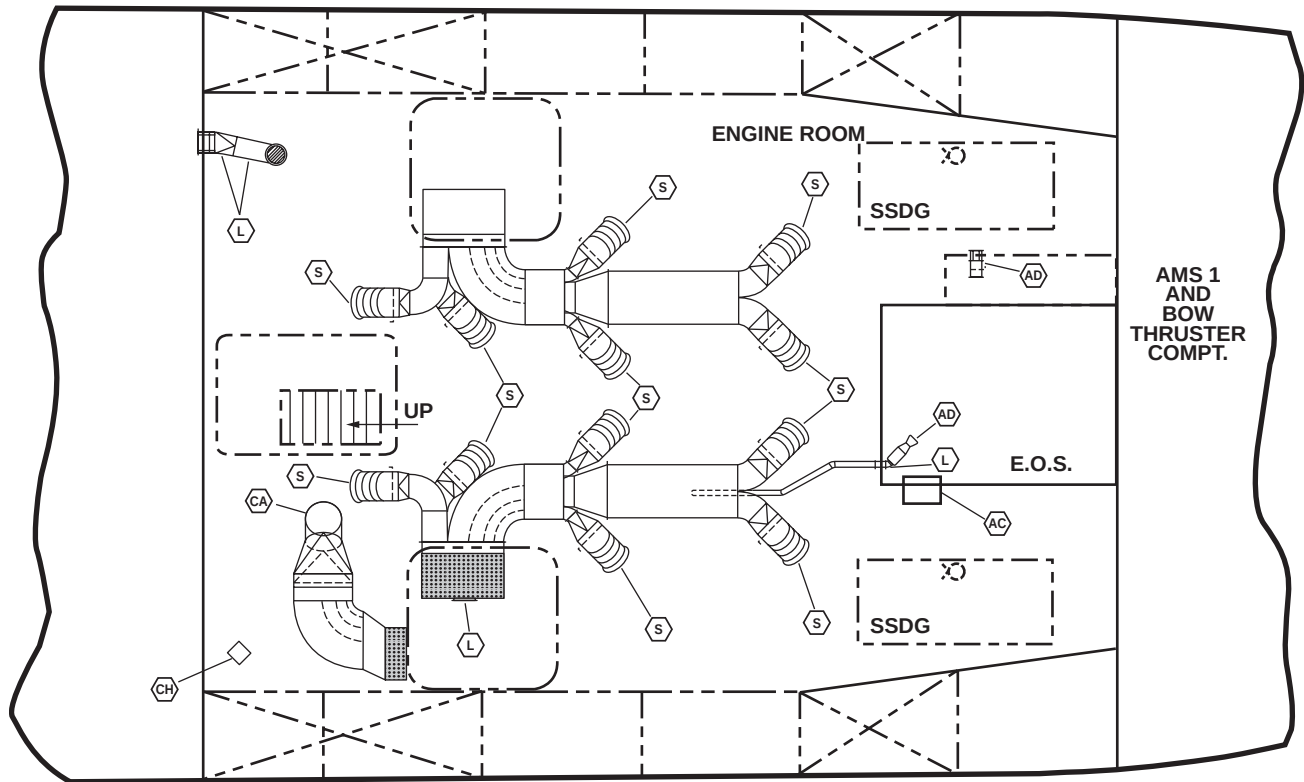
(D) Diffuser	(H) Humidistat	(MD) Manual Fire Damper
(RT) Return	(T) Room Thermostat	(S) Supply
(E) Exhaust	(P) Preheater	(G) Gooseneck
(L) Louver	(R) Reheater	(AD) Auto Fire Damper
(CH) Convection Heater	(PT) Preheater Thermostat	(ADT) Auto Fire Damper Thermostat
(RHT) Reheater Thermostat	(F) Filter	

Figure 1. Main Deck

0038 00-3

Figure 2. 01 Level





D Diffuser	H Humidistat	MD Manual Fire Damper
RT Return	T Room Thermostat	S Supply
E Exhaust	P Preheater	G Gooseneck
L Louver	R Reheater	AD Auto Fire Damper
CH Convection Heater	PT Preheater Thermostat	ADT Auto Fire Damper Thermostat
RHT Reheater Thermostat	F Filter	AC EOS AC Unit
CA Main Engine Combustion Air		

Figure 3. Engine Room

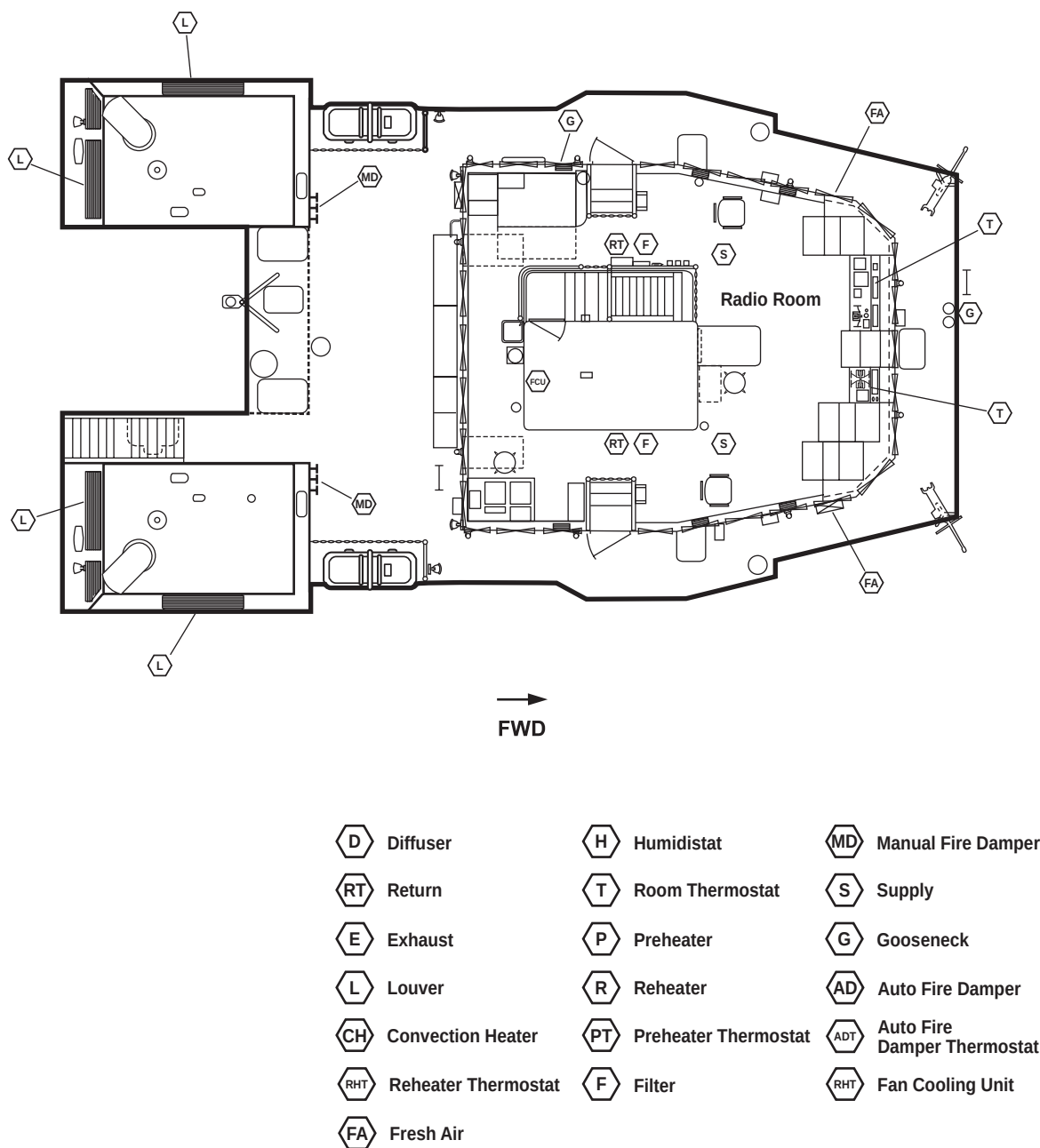


Figure 3. 02 Level

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
REFRIGERATION SYSTEM**

The Large Tug (LT) refrigeration system provides cooling for the chill box, walk-in freezer, and thaw room (refer to figures 1 and 2). Major components of the refrigeration system include: two condensing units (figure 2) two unit coolers (figure 2), an expansion valve (figure 2), compressor (figure 2), condenser (figure 2), receiver (figure 2), local controls and indicators, and control box (figure 2).

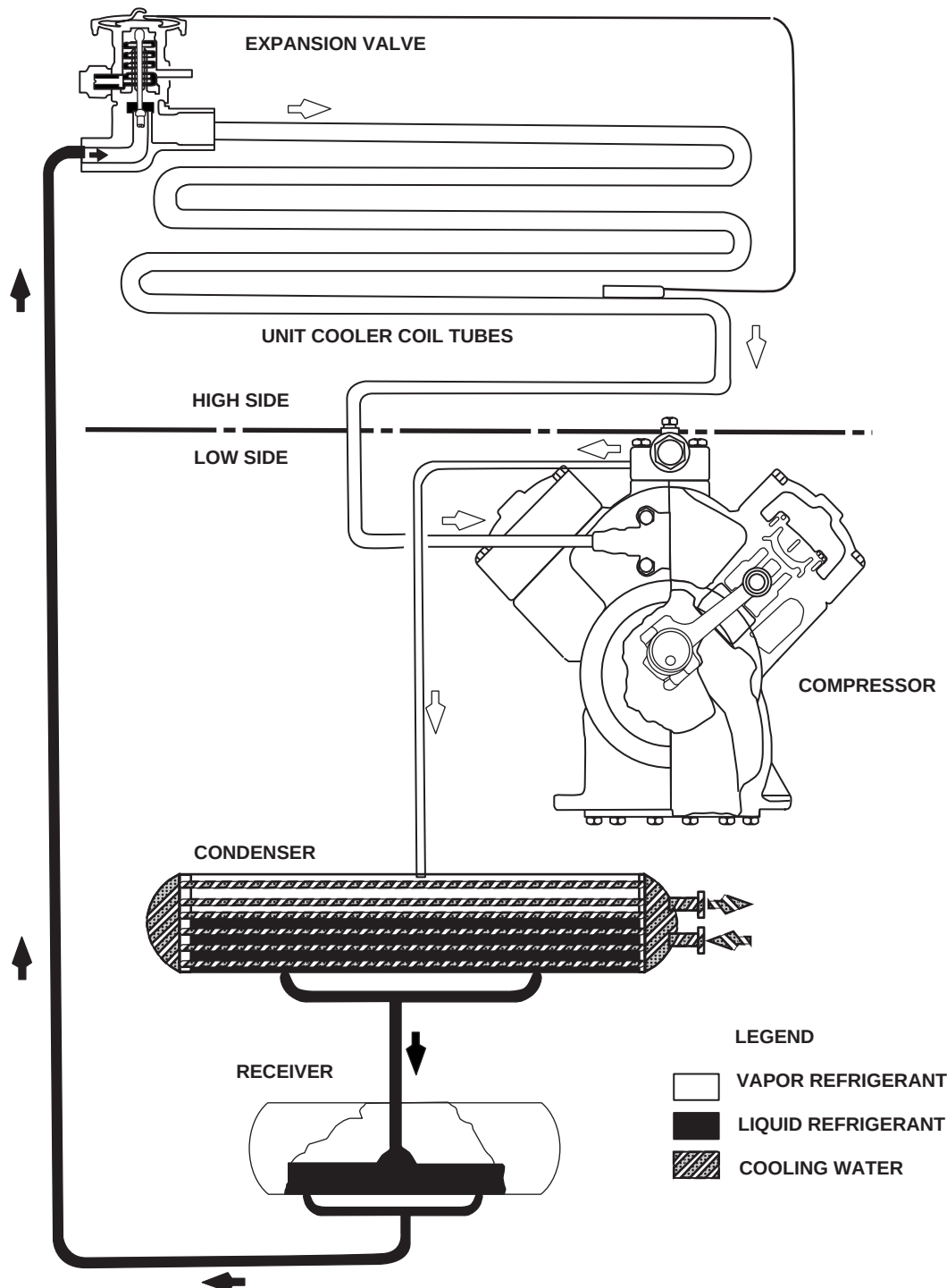
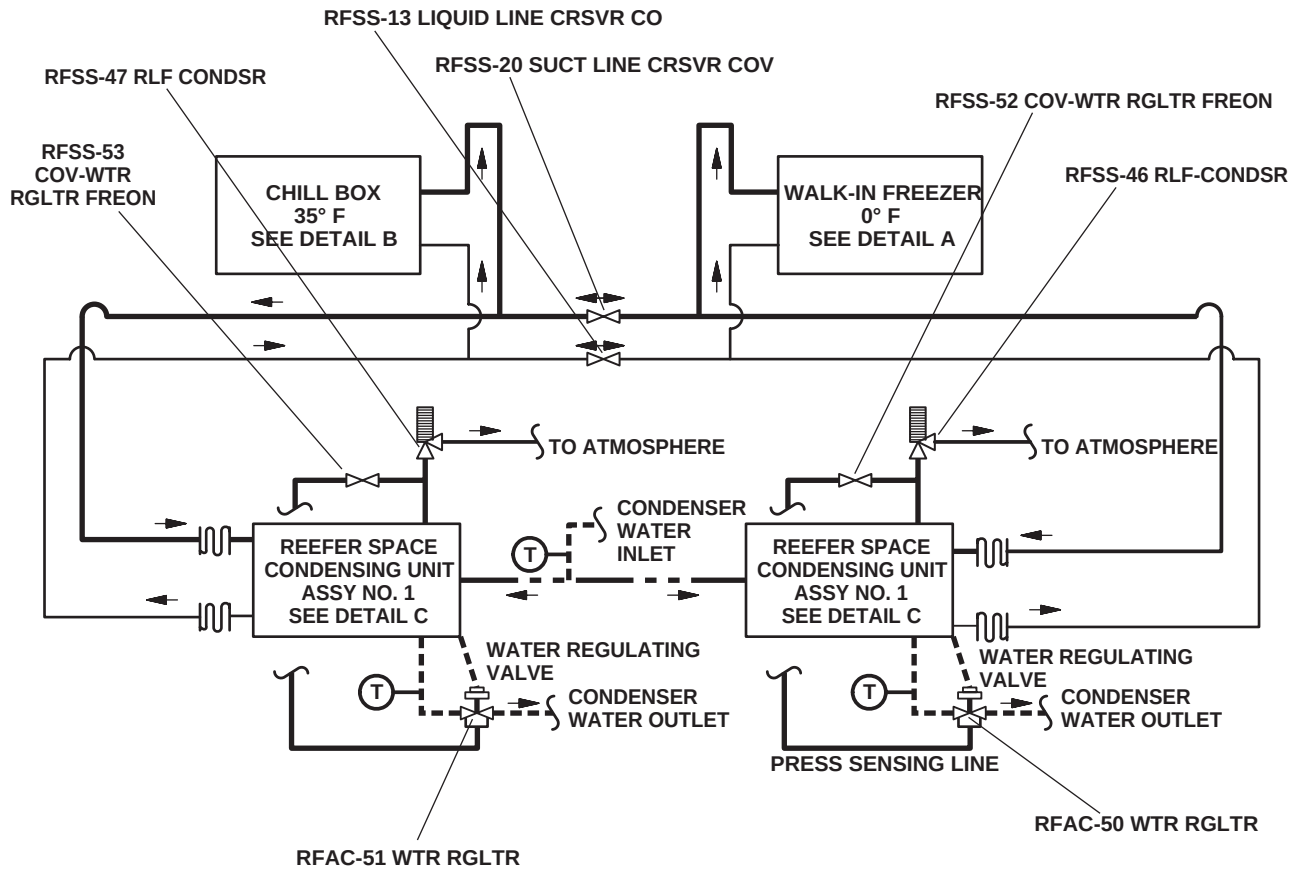


Figure 1. Typical Refrigeration Cycle

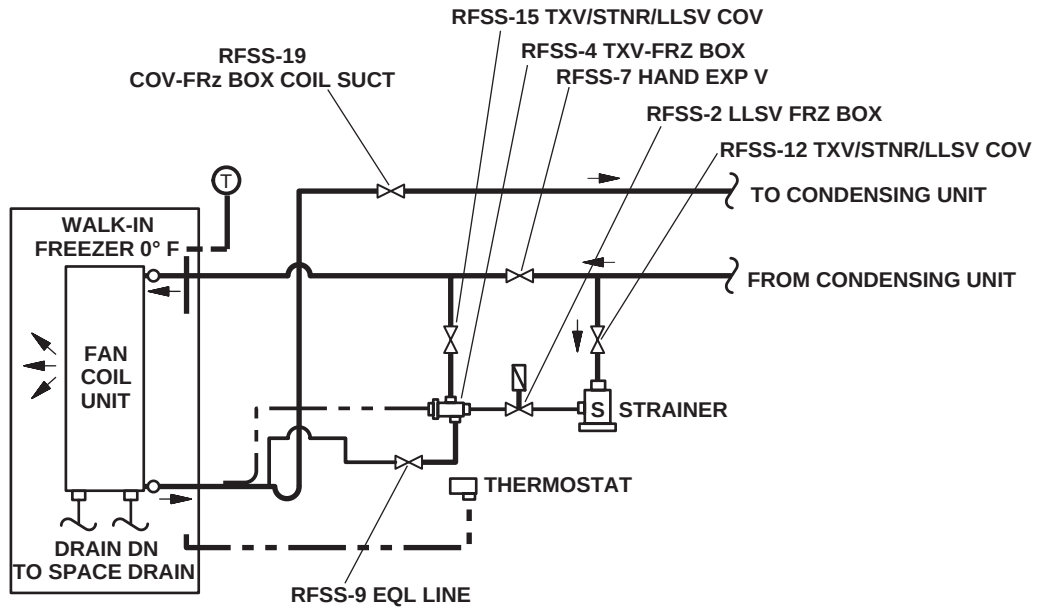


AMS-2 INTERCONNECTING PIPING

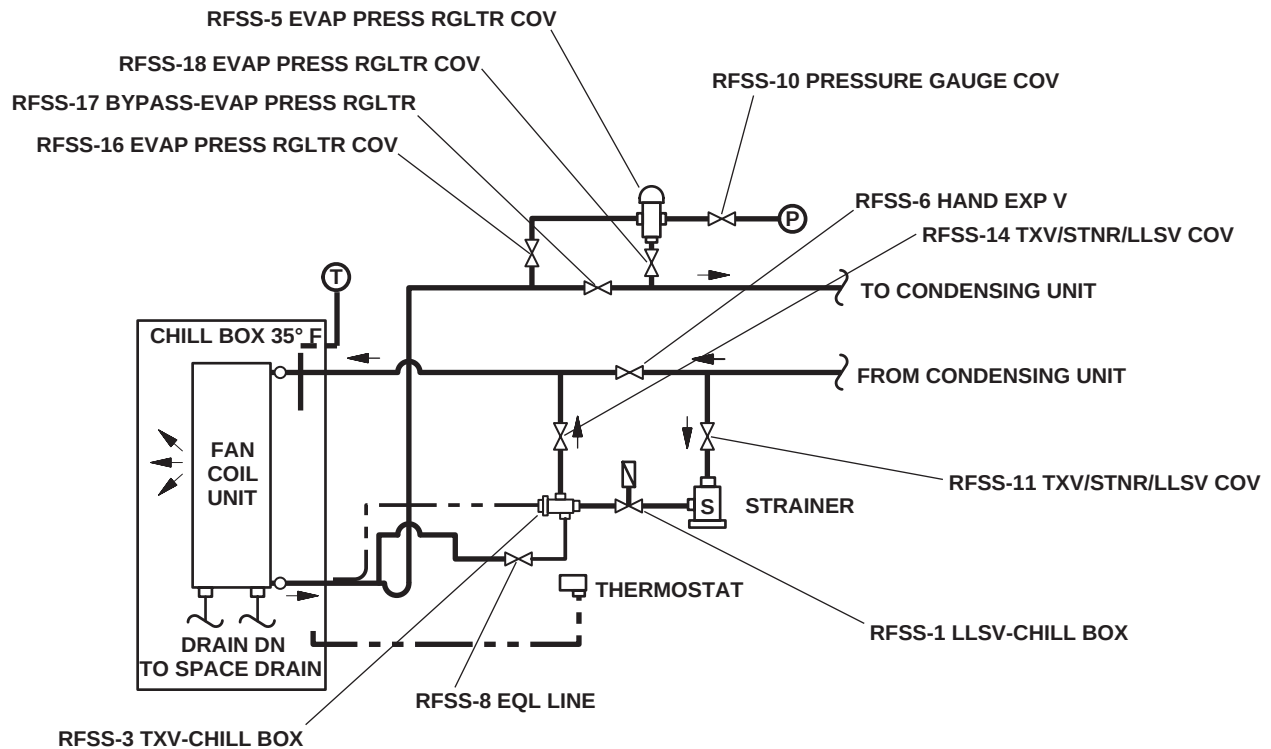
Abbreviations/Acronyms

COV	Cutoff Valve
EQL	Equalizing
EVAP	Evaporator
EXP	Expansion
FRZ	Freeze
LLSV	Liquid Line Solenoid Valve
PRESS	Pressure
RFSS	Refrigeration, Ship's Service
RGLTR	Regulator
STNR	Strainer
SUCT	Suction
TXV	Thermal Expansion Valve
V	Valve

Figure 2. Refrigeration System (Sheet 1 of 3)

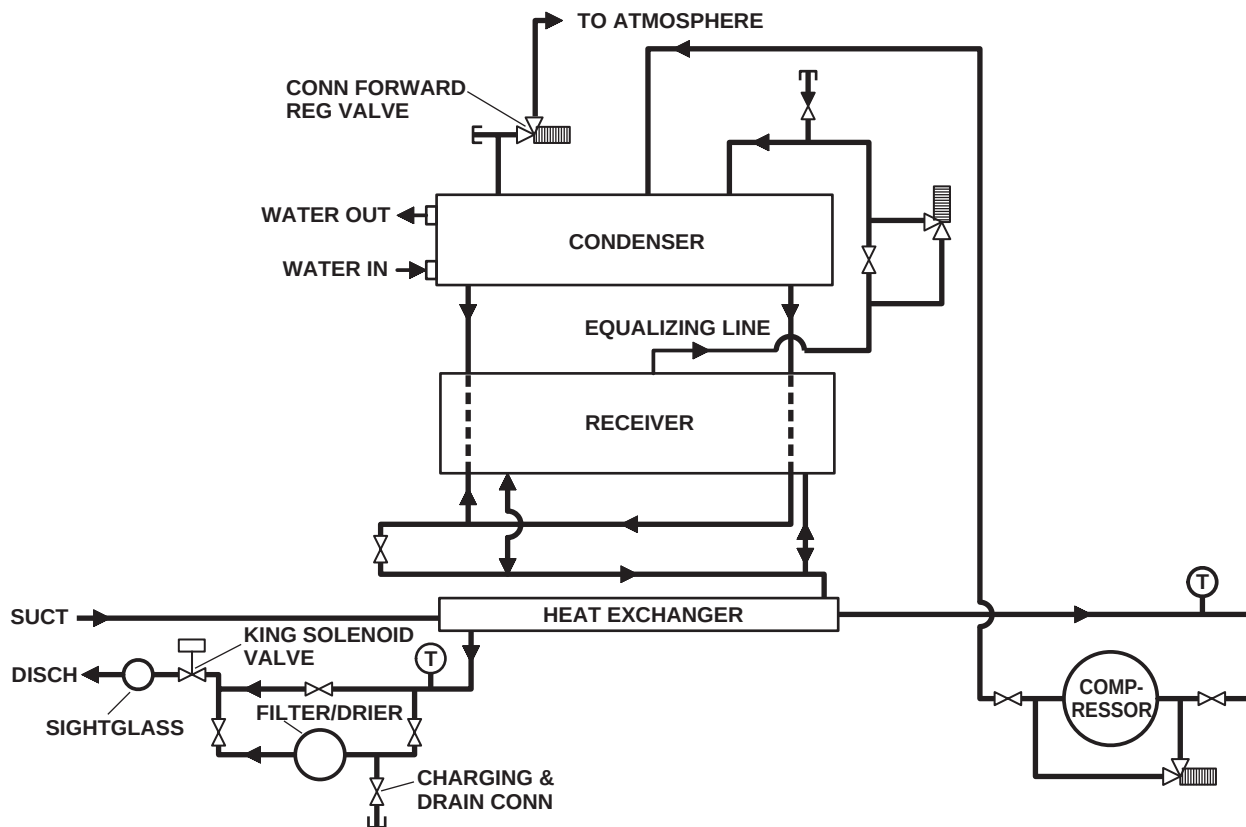


**DETAIL A
WALK-IN FREEZER**



**DETAIL B
CHILL BOX**

Figure 2. Refrigeration System (Sheet 2 of 3)



DETAIL C
AMS-2

Figure 2. Refrigeration System (Sheet 3 of 3)

CONDENSER UNIT

The condenser unit is the system's heat exchanger. It transfers heat from the refrigerant to raw water circulated by the general service system.

UNIT COOLER

The unit cooler contains coils that transfer heat from the air to the refrigerant. Two fans circulate air across the coils to improve heat transfer. A timer provides timed defrost cycles for the freeze room unit to clear the coils of frost buildup. This circuit is also fitted with a "fail safe" feature to prevent the defrost cycle from running too long. Water generated from the defrost cycle drains to a drip pan (figure 2) and into drain lines. Drain lines within the refrigerated spaces are fitted with heat tape to prevent freezing.

EXPANSION VALVE

The expansion valve (figures 1 and 2) regulates the amount of refrigerant delivered to the cooling coil. The amount of refrigerant needed in the coil depends on the temperature of the space being cooled.

COMPRESSOR

The compressor compresses heated refrigerant from the unit cooler to improve heat transfer in the condenser.

RECEIVER

The receiver serves as a liquid refrigerant reservoir. It receives liquid refrigerant from the condenser unit and supplies it to the expansion valve.

CONTROL BOX

A control box, mounted on the condenser, provides controls and indicators necessary for operation of the condenser unit.

LOCAL CONTROLS AND INDICATORS

Local controls and indicators include a defrost timer for the freezer room, thermostats for the chill room and freezer room, and temperature gauges for the chill room, freezer room, and thaw room.

REFRIGERANT SYSTEM OPERATION

The local controls and indicators on the control box communicate the desired temperatures and functions for the chill room, freezer room, and thaw room. The local controls and indicators also indicate the current temperatures for the chill room, freezer room, and thaw room. Liquid refrigerant is supplied to the unit cooler tubes (figure 1) by the expansion valve (figure 1), which is actuated by both pressure and temperature of the refrigerant in the system. The refrigerant then flows through unit cooler tubes where it evaporates (figure 1). As the refrigerant evaporates, it absorbs heat from the air passing over the unit cooler tubes. After leaving the unit coolers, the gaseous refrigerant is routed to the compressor. On the down stroke of the compressor's (figure 1) piston, refrigerant vapor flows into the compressor (figures 1 and 2). The compressor (figure 1) compresses this refrigerant vapor, raising its temperature and pressure. The compressor (figure 1) discharges the now high-pressure, superheated refrigerant vapor to the condenser (figure 1), where it flows around the tubes through which raw water is being circulated. As the refrigerant vapor transfers its heat to the raw water, the temperature of the refrigerant vapor drops to the condensing point, turning the refrigerant vapor into liquid. The refrigerant, now in liquid form, is sub-cooled slightly below its condensing point. The refrigerant liquid flows on to the receiver (figure 1). The receiver (figure 1) acts as a temporary storage space and surge tank for the liquid refrigerant. The receiver also serves as a vapor seal to keep vapor out of the liquid line to the expansion valve. The refrigerant begins its cooling cycle again.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
DECK MACHINERY**

CENTRAL HYDRAULIC POWER UNIT (HPU)

Under usual conditions the central hydraulic system HPU supplies hydraulic power to the anchor windlass, the capstan, the deck crane, and the tow pins. The central HPU can also be aligned to power the towing machines in an emergency. The central hydraulic system HPU is comprised of two electric motor-driven hydraulic pumps, a system relief valve, a system pressure gauge, a reservoir, suction and return filters, safety monitoring and shutoff devices, and a central hydraulic power unit motor controller. Each component is described in greater detail in the paragraphs below. Following the description of the components, an overview of the unit's operation is presented.

HYDRAULIC PUMPS

Two hydraulic pumps (figure 1, item 1) provide hydraulic pressure and flow to the central hydraulic system. Each pump is rated at 32 gal/min (121 L/min) at 2550 PSI (176 bar). Each pump is driven by its own 50 horsepower (37.3 kW) electric motor (figure 1, item 2). During normal operation, only one pump is operated. Under special circumstances, when hydraulic flow demands are high, both pumps may be operated. However, the hydraulic fluid temperature must be closely monitored during two-pump operation to prevent overheating of the system. Spring loaded check valves (figure 1, item 3) are provided at the outlet of each pump to prevent backflow through the idle pump when only one pump is in use. The spring loaded check valves are permanently set to OPEN at 7 PSI (0.5 bar) to provide minimal restriction to hydraulic flow.

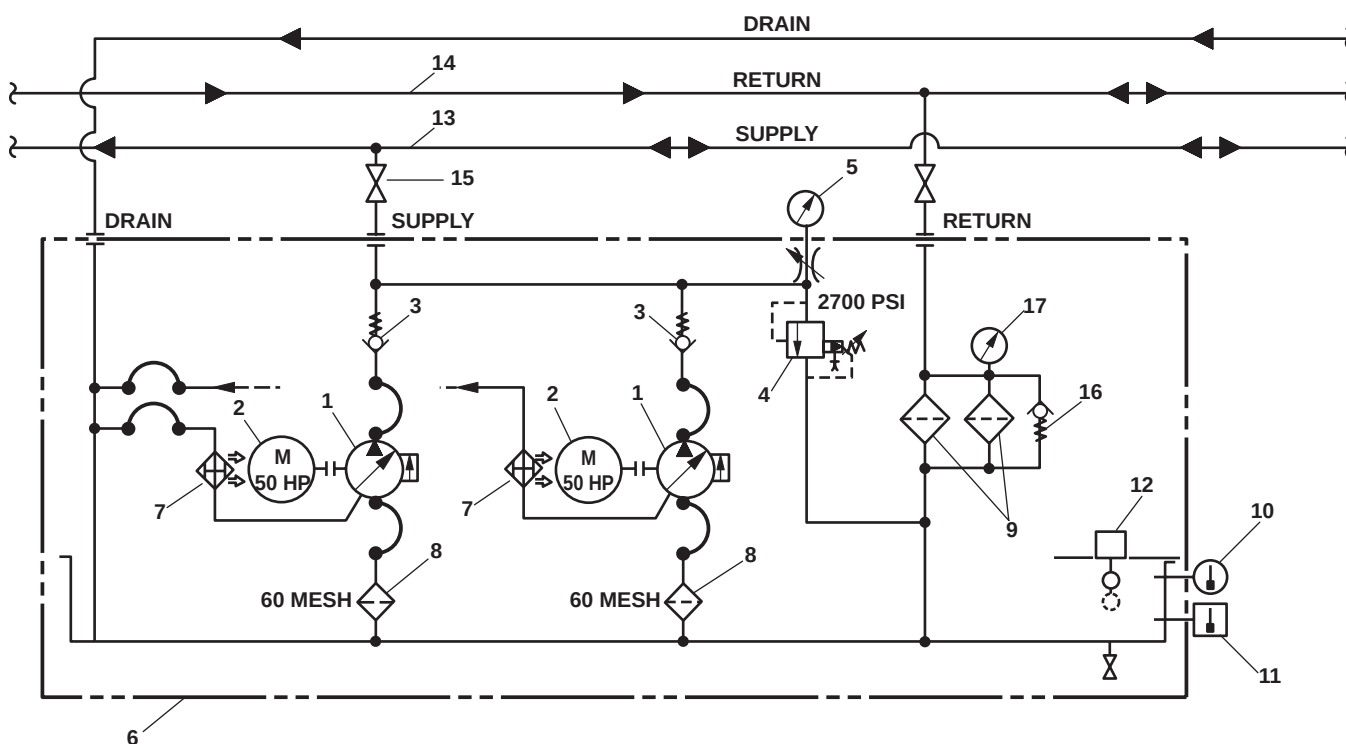


Figure 1. Central Hydraulic Power Unit Hydraulic Schematic

SYSTEM RELIEF VALVE

A single system relief valve (figure 1, item 4) provides protection against overpressurization of the central hydraulic system. If the system pressure exceeds 2700 PSI (186 bar), the relief valve opens and vents the excess pressure back to the reservoir.

SYSTEM PRESSURE GAUGE

A system pressure gauge (figure 1, item 5) provides a direct indication of the system's operating pressure. The gauge reads from 0 to 5000 PSI (0 to 345 bar).

RESERVOIR

A 150 gallon (568 liter) reservoir (figure 1, item 6) stores the hydraulic fluid for the central hydraulic system. The reservoir also provides a mounting location for most of the central HPU's components. The central hydraulic system's fluid is cooled by dissipating its heat through the walls of the reservoir to the air in the engine room. Hydraulic fluid coolers (figure 1, item 7) are provided for the hydraulic pump drain fluid. These hydraulic fluid to air coolers are mounted inboard of the electric motors.

SUCTION AND RETURN FILTERS

Suction strainers (figure 1, item 8) are provided at the inlet for each hydraulic pump (figure 1, item 1) to remove large particulate matter from the hydraulic fluid before it enters the hydraulic pump. Return filters (figure 1, item 9) are also provided for the system. The return filters are rated at 10 microns and remove small particulate matter from the hydraulic fluid as it is returned to the reservoir.

SAFETY MONITORING AND SHUTOFF DEVICES

A 0-250 °F (-17 to 121 °C) temperature gauge (figure 1, item 10) is provided to monitor hydraulic fluid temperature in the reservoir. The temperature gauge is supplemented by a 180 °F (82 °C) high temperature cutoff switch (figure 1, item 11). When the hydraulic fluid temperature exceeds 180 °F (82 °C), the cutoff switch illuminates the HIGH OIL TEMP lamp, sounds an alarm, and secures power to the hydraulic pumps' electric motors (figure 1, item 2). The central hydraulic system is also protected by a low level switch (figure 1, item 12). This switch indicates either FULL or LOW for the reservoir fluid level. When the hydraulic fluid level reaches the LOW mark (98 gallons (371 liters)), the switch illuminates the LOW OIL LEVEL lamp, sounds an alarm, and secures the power to the hydraulic pump's electric motors.

CENTRAL HYDRAULIC POWER UNIT MOTOR CONTROLLER

The central hydraulic power unit motor controller (figure 2, item 1), mounted forward and above the system's reservoir, provides the primary source of control for the central hydraulic system. Remote START/STOP control of the system is also provided via controls on the EOS console (figure 3).

The central hydraulic power unit motor controller contains a REMOTE/OFF/ON selector switch (figure 2, item 2). This switch permits the operator to determine whether the ON/OFF control will be achieved locally (OFF and ON positions) or remotely (REMOTE position) from the EOS. The P1/P2/P1&P2 selector switch (figure 2, item 3) permits the operator to select which pump(s) will operate when the system is turned ON. The MAIN SWITCH (figure 2, item 4) is the primary power disconnect for the system's electric power. READY (figure 2, item 5) and RUNNING (figure 2, item 6) indicator lights are provided for each pump to indicate the pump's condition. LOW OIL LEVEL (figure 2, item 7) and HI OIL TEMP (figure 2, item 8) lights are also provided to signal these alarm conditions. The final components of the control panel are the reset switches (figure 2, item 9). These pushbutton switches permit the operator to reset the electric motor(s) after the thermal resets have tripped.

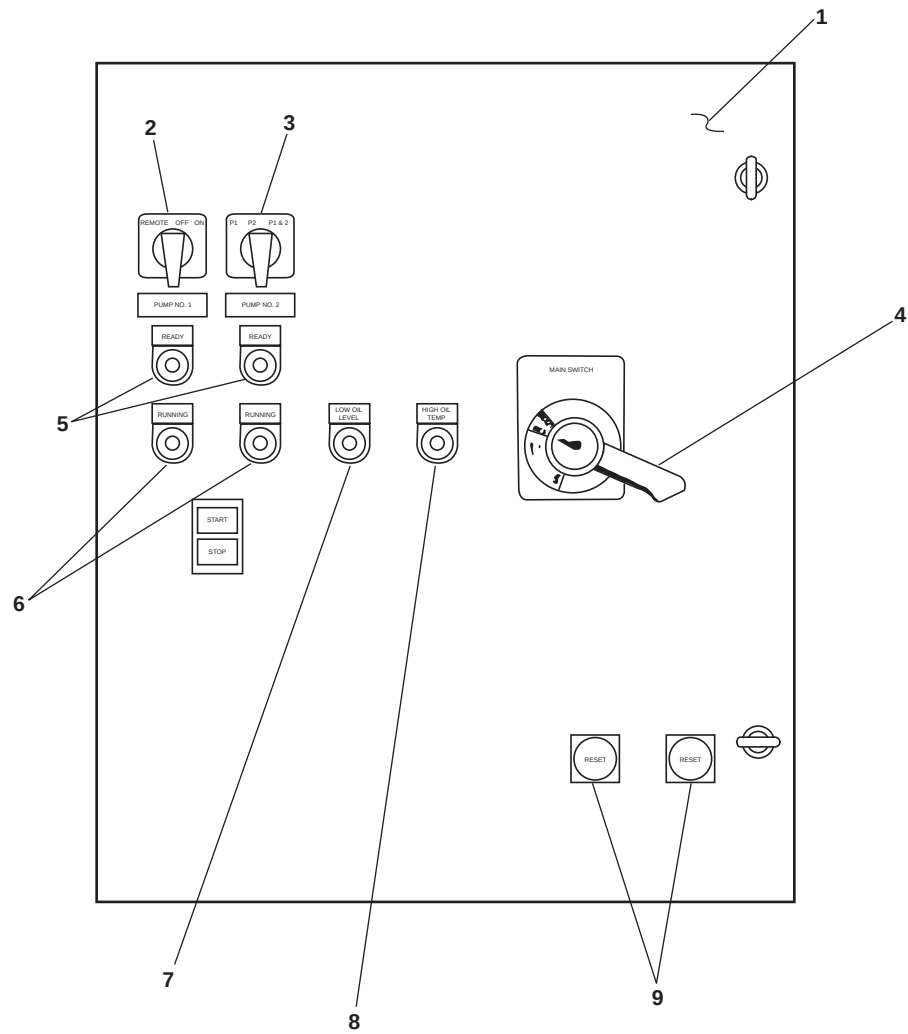


Figure 2. Central Hydraulic Power Unit Motor Controller

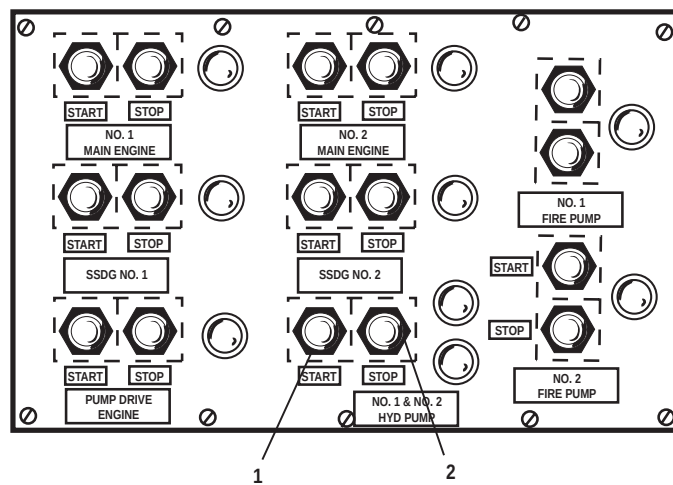


Figure 3. Machinery Control Panel in EOS

HYDRAULIC OPERATION

When the operator powers up one or both hydraulic pumps, power is sent to the electric motor(s) (figure 1, item 2) for the selected hydraulic pump(s) (figure 1, item 1). Once the hydraulic pump is turning, it draws hydraulic fluid through the suction strainer (figure 1, item 7) and into the hydraulic pump. The hydraulic pump pressurizes the hydraulic fluid in response to the amount of restriction on the system. If the restriction is low (no load applied), system pressure is very low. If the restriction is high (load applied), the system pressure will vary in response to the load. The pressurized hydraulic fluid exits the hydraulic pump and flows through the supply piping (figure 1, item 13) to the downstream components (capstan, anchor windlass, deck crane, and tow pins), where the hydraulic pressure and flow are transformed into physical work. Hydraulic fluid exiting the downstream components returns to the reservoir (figure 1, item 6) through the return piping (figure 1, item 14) and the return filters (figure 1, item 9).

If the restriction is extraordinarily high due to an overloaded downstream component or a closed cutoff valve (figure 1, item 15), the system relief valve opens at 2700 PSI (186 bar) to vent hydraulic fluid back to the reservoir (figure 1, item 6). This prevents catastrophic damage to the hydraulic pump, piping, and other hydraulic components.

The return filters (figure 1, item 9) are provided with a bypass valve (figure 1, item 16) and a restriction gauge (figure 1, item 17). If the filter restriction rises above 25 PSI (1.7 bar), the bypass valve opens, permitting hydraulic fluid to bypass the filters and to return to the reservoir (figure 1, item 6). Because permitting unfiltered hydraulic fluid to return to the reservoir opens the door to eventual system failure, the restriction gauge is provided to enable timely return filter changes. Performing regular filter changes helps to ensure that the central hydraulic system and its components enjoy a long service life.

ELECTRICAL OPERATION

When the main disconnect switch (figure 4, item 1) is CLOSED (ON), power is supplied to the control panel (figure 2, item 1).

Power (440 Vac) from the main disconnect switch (figure 4, item 1) flows through a transformer (figure 4, item 2) where it is converted to a lower voltage for the control circuitry. Leaving the transformer, the power is supplied to the REMOTE/OFF/ON switch (figure 4, item 3), to the low oil level switch (figure 4, item 4), and to the thermal overload reset switches (figure 4, item 5).

If the REMOTE/OFF/ON switch (figure 4, item 3) is in the OFF position, the switch is OPEN and no power is supplied to the low oil level switch's (figure 4, item 4) Normally Closed (NC) contacts. If the switch is in the ON position, the switch is CLOSED between terminals 13 and 14, supplying power to the low oil level switch's NC contacts. If the switch is in the REM position, the switch is CLOSED between terminals 21 and 22, supplying power to the REMOTE/OFF/ON switch (figure 4, item 3) in the EOS console. When the START pushbutton (figure 3, item 1) is pressed, the switch CLOSES, supplying power to the low oil level switch's NC contacts. When the STOP pushbutton (figure 3, item 2) is pressed, the switch is OPEN, securing power to the low oil level switch's NC contacts.

When power is supplied from the REMOTE/OFF/ON switch (figure 4, item 3), and when the low oil level switch's (figure 4, item 4) NC contacts are CLOSED (hydraulic fluid level is above the low mark), power is supplied to the high temperature cutoff switch (figure 4, item 6). The high temperature cutoff switch has both NC and Normally Open (NO) contacts. The NC contacts supply power to the P1/P2/P1&P2 (figure 4, item 7) switch, while the NO contacts supply power to the HIGH OIL TEMP light (figure 4, item 8).

When the P1/P2/P1&P2 switch (figure 4, item 7) is in the P1 position, the switch is CLOSED between terminals 1 and 2 and OPEN between all other terminals. This supplies power to the pump 1 control relay (figure 4, item 9). When the pump 1 control relay is powered, it CLOSES between terminals 9 and 5 and OPENS between terminals 9 and 1. This powers the pump 1 starter (figure 4, item 10) and the pump 1 RUNNING light (figure 4, item 11). When the pump 1 control relay is not powered, it CLOSES between terminals 9 and 1 and OPENS between terminals 9 and 5. This illuminates the number 1 pump READY light (figure 4, item 12) and secures power to the motor by opening the pump 1 starter.

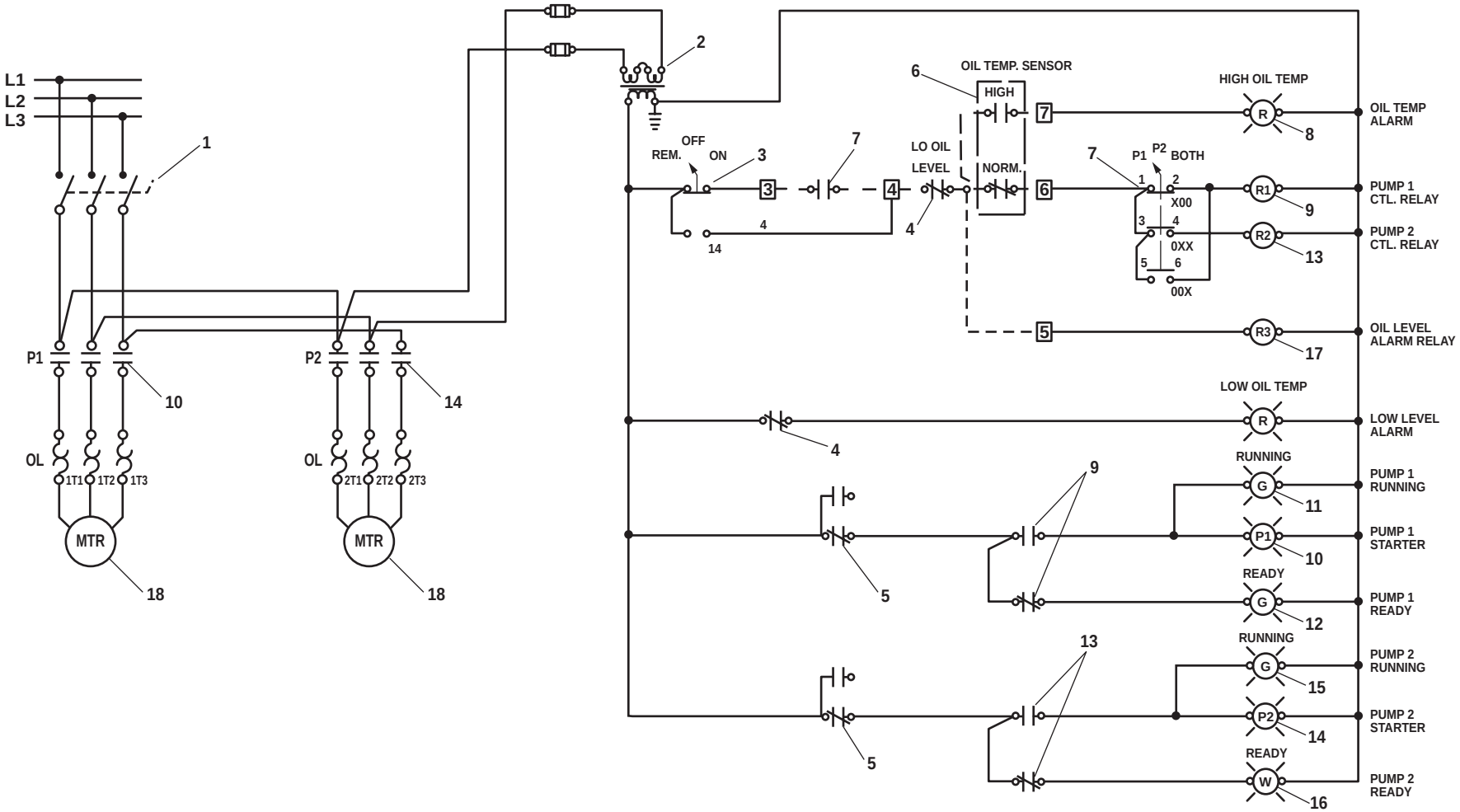


Figure 4. Central Hydraulic Power Unit Electrical Schematic

When the P1/P2/P1&P2 switch (figure 4, item 7) is in the P2 position, the switch is CLOSED between terminals 3 and 4 and OPEN between all other terminals. This supplies power to the pump 2 control relay (figure 4, item 13). When the pump 2 control relay is powered, it CLOSES between terminals 9 and 5 and OPENS between terminals 9 and 1. This powers the pump 2 starter (figure 4, item 14) and the pump 2 RUNNING light (figure 4, item 15). When the pump 2 control relay is not powered, it CLOSES between terminals 9 and 1 and OPENS between terminals 9 and 5. This illuminates the number 2 pump READY light (figure 4, item 16) and secures power to the motor by opening the pump 2 starter.

When the P1/P2/P1&P2 switch (figure 4, item 7) is in the BOTH position, the switch is CLOSED between terminals 3, 4, 5, and 6, and OPEN between terminals 1 and 2. This supplies power to both control relays (figure 4, items 9 and 13) and both starters and lights are powered as described in the two preceding paragraphs.

The low level switch (figure 4, item 4) has both NO and NC contacts. The NO contacts supply power to the LOW OIL LEVEL light (figure 4, item 17) while the NC contacts supply power to the high temperature cutoff switch (figure 4, item 7). When the hydraulic fluid level in the reservoir drops below 98 gallons (371 liters), the NO contacts CLOSE, illuminating the LOW OIL LEVEL light, and the NC contacts OPEN, securing power to the pump motors (figure 4, item 18).

TOWING MACHINE HYDRAULIC SYSTEM

The towing machine hydraulic system provides the primary power for the towing machines. In emergency situations, the towing machine hydraulic system can also be aligned to supply hydraulic power to the central hydraulic system. The towing machine hydraulic system is comprised of a diesel engine, a hydraulic pump, relief valves, a reservoir, a heat exchanger, suction and return filters, and gauges and indicators. Each of these components, except the diesel engine, is described in the paragraphs below. The diesel engine has its own technical manual (TM 55-1925-211-24). Following the description of the components, the operation of the towing machine hydraulic system is described.

HYDRAULIC PUMP

A diesel engine-driven, dual vane, hydraulic pump (figure 5, sheet 1, item 1) provides the hydraulic power for the towing machine hydraulic system. The hydraulic pump is actually two hydraulic pumps in one housing. One hydraulic pump section is rated at 69 gal/min (261 L/min) at 1800 r/min while the other hydraulic pump section is rated at 38 gal/min (144 L/min) at 1800 r/min. This dual vane hydraulic pump arrangement permits the towing machine hydraulic system, when properly configured, to supply the central hydraulic system and the towing machine hydraulic system simultaneously. Each dual vane section is provided with its own check valve (figure 5, sheet 1, item 2). The check valves prevent one vane section from backfeeding into the other during hydraulic pump operation.



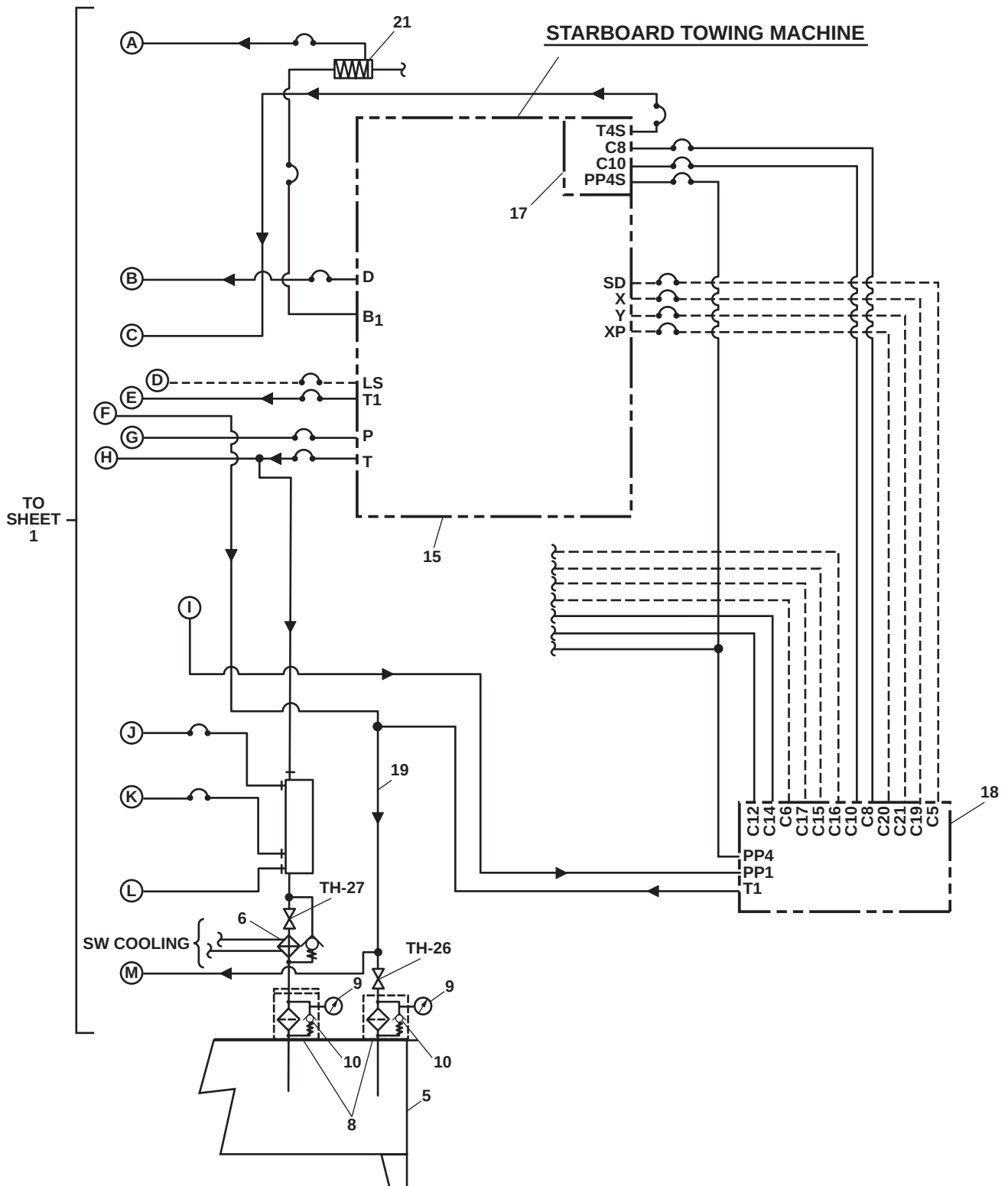


Figure 5. Towing Machine Hydraulic System (Sheet 2 of 2)

RELIEF VALVES

Two relief valves are installed in the towing machine hydraulic system. The first relief valve is the system relief (figure 5, sheet 1, item 3). This valve is set to open at 3300 PSI (228 bar) to prevent overpressurization of the towing machine hydraulic system. The second relief valve (figure 5, sheet 1, item 4) is set to open at 2800 PSI (193 bar). Under heavy system loading, this valve opens and permits the flow from the lower volume vane section to flow unrestricted back to the reservoir. This action effectively unloads the lower volume vane section, preventing the hydraulic pump from overloading the diesel engine.

RESERVOIR

A 350 gallon (1325 liter) reservoir (figure 5, sheets 1 and 2, item 5) contains the hydraulic fluid for the towing machine hydraulic system. The reservoir also acts as a mounting point for the heat exchanger, the filters, and the gauges and indicators for the towing machine hydraulic system.

HEAT EXCHANGER

A heat exchanger (figure 5, sheet 2, item 6) is provided to cool the hydraulic fluid. As the hydraulic fluid returns to the reservoir (figure 5, sheets 1 and 2, item 5), it flows through the heat exchanger where its heat is dissipated to the raw water that is pumped through the heat exchanger. A solenoid actuated valve controls raw water flow to the heat exchanger. The valve permits raw water to flow through the heat exchanger when the hydraulic fluid is hot and secures the flow when it is cold. Additional hydraulic fluid cooling is also provided by dissipation of heat through the walls of the reservoir to the air in AMS 1.

SUCTION AND RETURN FILTERS

A suction strainer (figure 5, sheet 1, item 7) is located in the hydraulic pump (figure 5, sheet 1, item 1) suction line. This suction strainer removes the larger particulate contaminants from the hydraulic fluid before it enters the hydraulic pump. Two return filters (figure 5, sheet 2, item 8) remove smaller particulate contaminants, down to 10 microns, from the hydraulic fluid before it is returned to the reservoir (figure 5, sheets 1 and 2, item 5). Each return filter is fitted with a restriction gauge (figure 5, sheet 2, item 9) and a bypass valve (figure 5, sheet 2, item 10). If the filter restriction rises above 25 PSI (1.7 bar), the bypass valve opens, permitting hydraulic fluid to bypass the filters and return to the reservoir. Because permitting unfiltered hydraulic fluid to return to the reservoir opens the door to eventual system failure, the restriction gauge is provided to enable timely return filter changes. Performing regular return filter changes helps to ensure that the central hydraulic system and its components enjoy a long service life.

GAUGES AND INDICATORS

Pressure gauges (figure 5, sheet 1, item 11) are installed to provide an indication of the system operating pressure. The gauges measure pressure from both dual vane sections of the hydraulic pump (figure 5, sheet 1, item 1) as well as drain pressure. A combination hydraulic fluid level/hydraulic fluid temperature indicator (figure 5, sheet 1, item 12) is also installed to permit monitoring of hydraulic fluid level and temperature.

SYSTEM OPERATION

When the diesel engine is started, the hydraulic pump (figure 5, sheets 1 and 2, item 1) begins turning. As it turns, it draws hydraulic fluid from the reservoir (figure 5, sheets 1 and 2, item 5) through the suction strainer (figure 5, sheet 1, item 7) and into the vane sections' inlets. The hydraulic pump pressurizes the hydraulic fluid in response to the amount of restriction on the system. If the restriction is low (no load applied), system pressure is very low. If the restriction is high (load applied), the system pressure will vary in response to the load. The pressurized hydraulic fluid exits the pump and flows through the supply piping (figure 5, sheet 1, item 13) to the towing machines (figure 5, sheet 1, item 14; figure 5, sheet 2, item 15) and their controls (figure 5, sheet 1, item 16; figure 5, sheet 2, items 17 and 18) where the hydraulic pressure and flow are transformed into physical work. Hydraulic fluid exiting the downstream components returns to the reservoir through the return piping (figure 5, sheet 2, item 19) and the return filters (figure 5, sheet 2, item 8).

CAPSTAN

The capstan (figure 6) receives its hydraulic power from the central Hydraulic Power Unit (HPU).

Both the supply (figure 6, item 1) and return (figure 6, item 2) lines flow through the capstan control valve (figure 6, item 3). When the capstan control valve is in the NEUTRAL position, the supply line is CLOSED, and no supply flow is permitted to enter the capstan motor (figure 6, item 4). At the same time, both sides of the capstan motor are OPEN to the return piping. When the capstan control valve is shifted toward the return spring, the supply is routed to the right side of the capstan motor (figure 6, item 5) and return flow comes from the left side of the capstan motor (figure 6, item 6), causing capstan motor rotation. When the capstan control valve (figure 6, item 3) position is reversed, flow to the capstan motor is reversed, reversing the direction of motor rotation.

Supply flow is controlled by a flow control valve (figure 6, item 7) that permits a maximum of 15 gal/min (57 L/min) to enter the capstan control valve (figure 6, item 3). This flow control valve prevents overspeed operation of the capstan.

Counterbalance valves (figure 6, item 8) are installed between the capstan control valve (figure 6, item 3) and the capstan motor. The counterbalance valves act as a hydraulic brake to prevent the capstan from overrunning the hydraulic motor. The counterbalance valves also ensure that the capstan motor (figure 6, item 4) will only turn when pressure is applied from the capstan control valve.

A fail safe brake (figure 6, item 9) is fitted between the capstan's gear train and the capstan motor (figure 6, item 4). This brake is a spring-applied, pressure-released design. In this design, an internal spring assembly applies the brake until hydraulic pressure is applied to release it. In the capstan circuit, hydraulic pressure is supplied to the fail safe brake assembly any time that the capstan control valve (figure 6, item 3) is moved away from the NEUTRAL position. When the capstan control valve (figure 6, item 3) is returned to the neutral position, the pressure is removed from the fail safe brake and the springs apply the brake, providing a mechanical braking action to the capstan motor output shaft.

A shuttle valve (figure 6, item 10) is provided to prevent fail safe brake pressure from returning directly to the reservoir at the counterbalance valves (figure 6, item 8).

The capstan motor (figure 7, item 1) drives the capstan through a double reduction planetary gear assembly (figure 7, item 2). The fail safe brake (figure 7, item 3) is fitted between the capstan motor and the double reduction planetary gear assembly. The double reduction planetary gear assembly decreases the speed and increases the torque of the capstan motor output shaft and transmits that torque to the double reduction planetary gear assembly output shaft (figure 7, item 4) and its attached pinion gear (figure 7, item 5). The pinion gear, in turn, drives the capstan ring gear (figure 7, item 6), further reducing output speed and increasing output torque. The ring gear is directly connected to the capstan drum (figure 7, item 7), thus ring gear rotation yields capstan drum rotation.

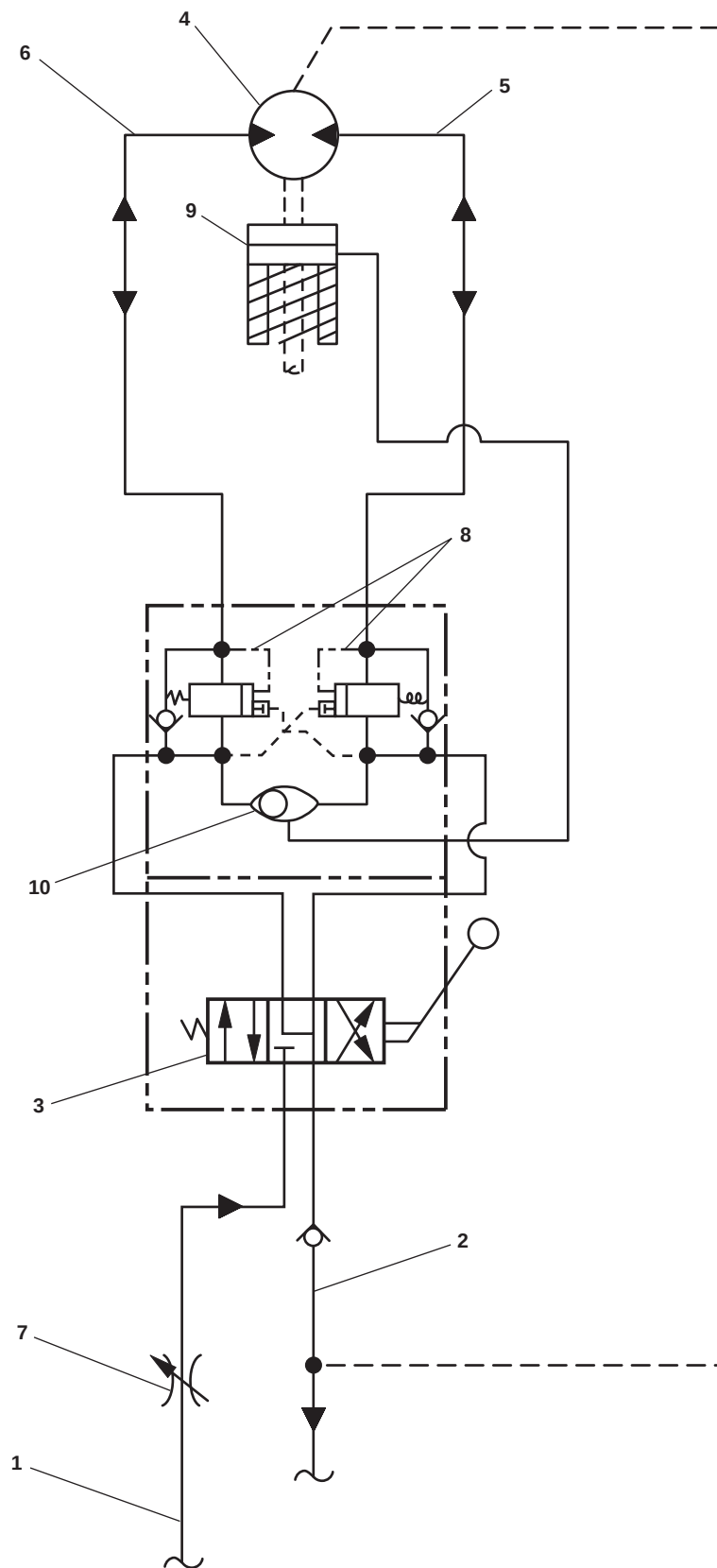


Figure 6. Capstan Hydraulic System

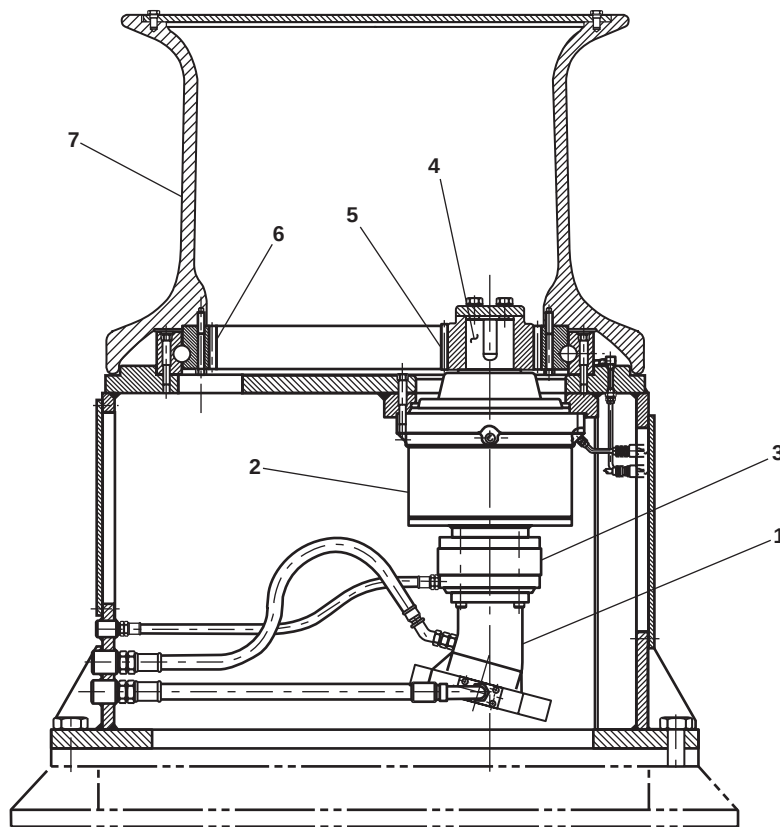


Figure 7. Capstan Mechanical Operation

ANCHOR WINDLASS

During operation under usual conditions, the anchor windlass is powered by the central hydraulic system.

Supply pressure comes into the anchor windlass control valve (figure 8, item 1) through a flow control valve (figure 8, item 2). The flow control valve is set to permit 11 gal/min (42 L/min) to enter the anchor windlass control valve. This prevents overspeed operation of the anchor windlass.

The anchor windlass control valve (figure 8, item 1) is comprised of a HIGH/LOW speed selector valve (figure 8, item 3), a directional control valve (figure 8, item 4), and a counterbalance valve (figure 8, item 5).

When the HIGH/LOW speed selector valve (figure 8, item 3) is in the LOW speed position, pressure is removed from the two speed pilot valve (figure 8, item 6) that removes pressure from the pilot port (figure 8, item 7) of the anchor windlass motor (figure 8, item 8). When pressure is removed from the pilot port, the anchor windlass motor is in the Low Speed, High Torque (LSHT) mode. When the HIGH/LOW speed selector valve is in the HIGH position, pressure is applied to the two speed pilot valve that supplies pressure to the pilot port of the anchor windlass motor. When pressure is applied to the pilot port, the anchor windlass motor shifts into High Speed, Low Torque (HSLT) mode. In this mode, the anchor windlass motor speed is roughly doubled and torque roughly halved.

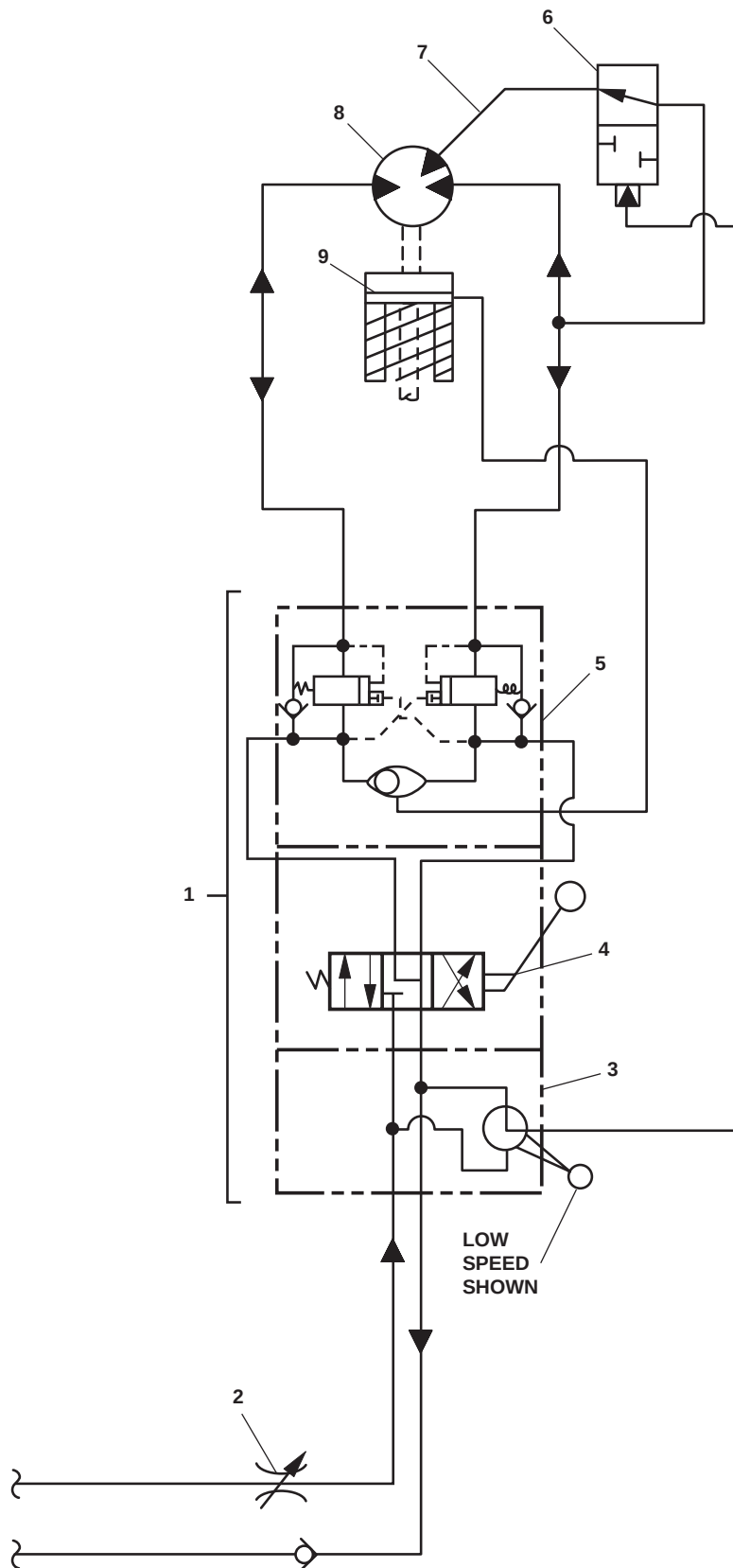
ANCHOR WINDLASS

Figure 8. Anchor Windlass Hydraulic System

The directional control valve (figure 8, item 4) permits the operator to choose the direction of rotation of the anchor windlass as well as its speed of rotation. When the directional control valve (figure 8, item 4) is in the NEUTRAL position, the supply line is CLOSED, and no supply flow is permitted to enter the anchor windlass motor (figure 8, item 8). At the same time, both sides of the anchor windlass motor are OPEN to the return piping. When the directional control valve (figure 8, item 4) is shifted toward the return spring, the supply is routed to the right side of the anchor windlass motor and the return flow comes from the left side of the anchor windlass motor, causing motor rotation. When the directional control valve position is reversed, flow to the anchor windlass motor is reversed, reversing the direction of anchor windlass motor rotation.

A counterbalance valve (figure 8, item 5) is installed between the directional control valve (figure 8, item 4) and the anchor windlass motor (figure 8, item 8). The counterbalance valves act as a hydraulic brake to prevent the anchor windlass from overrunning the anchor windlass motor. The counterbalance valves also ensure that the anchor windlass motor will only turn when pressure is applied from the directional control valve.

A fail safe brake (figure 8, item 9) is fitted between the anchor windlass gear train and the anchor windlass motor (figure 8, item 8). This fail safe brake is a spring-applied, pressure-released design. In this design, an internal spring assembly applies the fail safe brake until hydraulic pressure is applied to release it. In the anchor windlass circuit, hydraulic pressure is supplied to the fail safe brake assembly any time that the directional control valve (figure 8, item 4) is moved away from the NEUTRAL position. When the directional control valve is returned to the NEUTRAL position, the pressure is removed from the fail safe brake and the springs apply the brake, providing a mechanical braking action to the anchor windlass motor output shaft.

Output from the anchor windlass motor (figure 9, item 1; figure 8, item 8) goes through the fail safe brake (figure 9, item 2; figure 8, item 9) and to the driveshaft (figure 9, item 3). The driveshaft turns the input shaft (figure 9, item 4) of the worm gear (figure 9, item 5) that rotates the anchor windlass main shaft (figure 9, item 6). The main shaft is permanently fixed to the gypsy heads (figure 9, item 7), therefore the gypsy heads rotate whenever the anchor windlass motor (figure 9, item 1; figure 8, item 8) rotates. The wildcats (figure 9, item 8) can be connected to the main shaft via a dog clutch (figure 9, item 9). The dog clutch permits the gypsy heads to rotate separately from the wildcats, thus the lines can be handled by the gypsy heads without disturbing the anchor chains.

Manual braking is provided for the wildcats (figure 9, item 8) by band brakes (figure 9, item 10). Each wildcat is provided with a band brake providing individual control for each anchor chain. The band brakes are actuated by turning the brake handwheel (figure 9, item 11). The brake handwheel tightens the brake band around the wildcat drum (figure 9, item 12), slowing or stopping wildcat rotation.

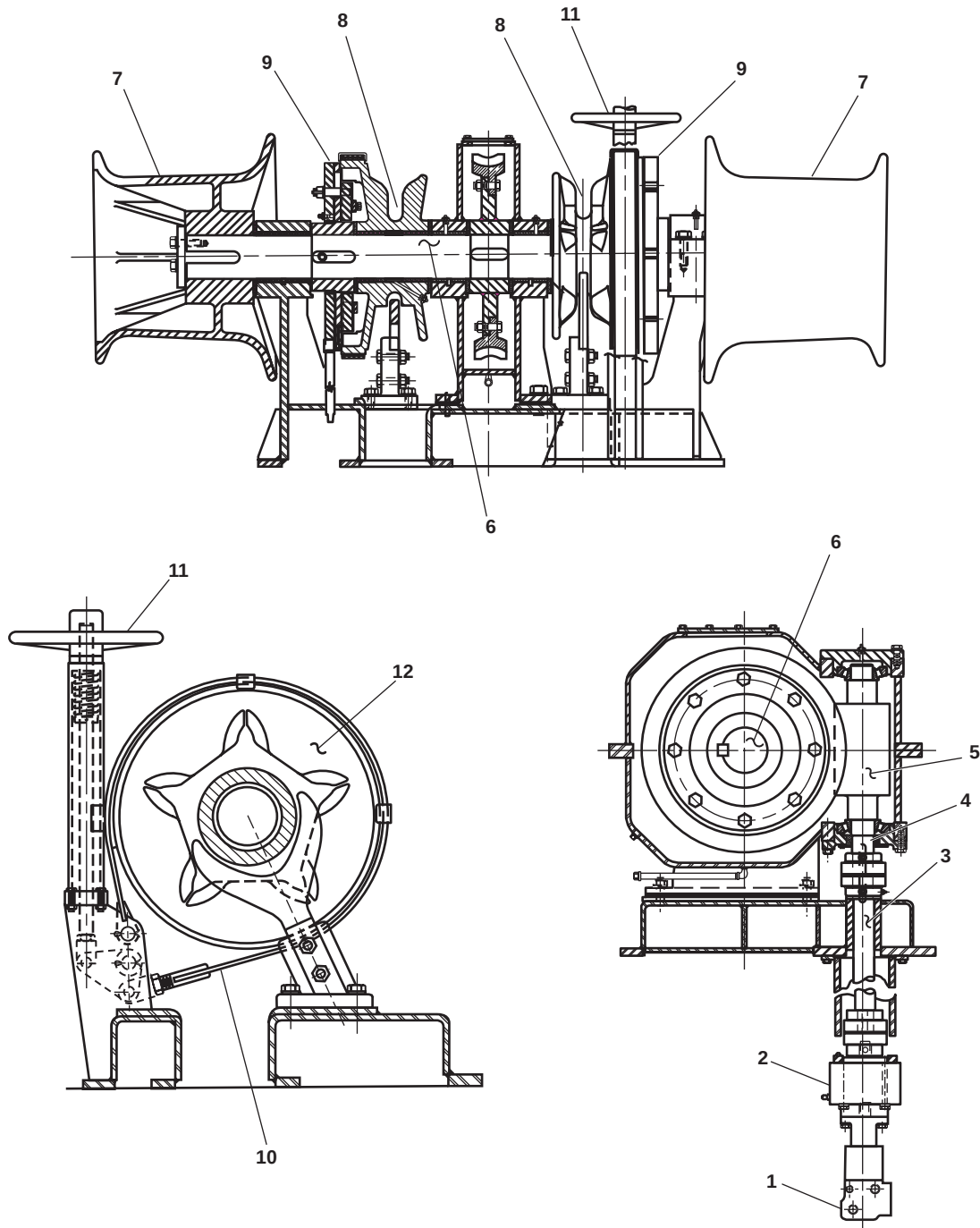


Figure 9. Anchor Windlass Mechanical Operation

CRANE

During operation under usual conditions, the crane is powered by the central hydraulic system.

Supply and return flow for the crane passes through a swivel (figure 10, item 1) before arriving at the control valve bank (figure 10, item 2). The swivel permits hydraulic fluid to flow to and from the crane's controls as the crane rotates.

The control valve bank (figure 10, item 2) is made up of a relief valve (figure 10, item 3), directional control valves for the swing (figure 10, item 4), telescope (figure 10, item 5), winch (figure 10, item 6), and luffing (figure 10, item 7) functions. The relief valve is set for 2650 PSI (183 bar) and prevents overpressurization of the crane's hydraulic components. The directional control valves are all manually operated via control handles. These directional control valves control the direction and volume of hydraulic fluid flowing to the swing motors (figure 10, item 8), the telescope cylinder (figure 10, item 9), the winch motor (figure 10, item 10), and the luffing cylinder (figure 10, item 11).

The swing motors (figure 10, item 8) are protected by a double counterbalance valve (figure 10, item 12) and by two flow control valves (figure 10, item 13). The double counterbalance valve prevents the swing motors from turning unless hydraulic pressure is applied to rotate them. The double counter balance valve also prevents a load from overriding the swing motors and swinging the boom uncontrollably. The flow control valves, each set for 9 gal/min (34 L/min), prevent the boom from swinging too quickly.

The swing motors (figure 10, item 8) are also provided with fail safe brakes (figure 10, item 14). These brakes are spring-applied, and pressure-released and provide the primary braking method for the swing system.

Both the telescope (figure 10, item 9) and luffing cylinders (figure 10, item 11) are equipped with holding valves (figure 10, item 15). The holding valves prevent the telescope and luffing cylinders from retracting until pressure is supplied to the rod side of the cylinder. When no pressure is applied to the rod side of the cylinder, a check valve (figure 10, item 16) inside the holding valve prevents return hydraulic fluid from exiting the piston side of the cylinder. If this return hydraulic fluid cannot exit, the cylinder cannot retract. When pressure is applied to the rod side of the cylinder, a portion of this pressure is routed through the internal pilot line to open the holding valve. Once the holding valve is OPEN, return flow is permitted from the piston side of the cylinder, and retraction occurs.

The winch motor (figure 10, item 10) is also equipped with a holding valve (figure 10, item 17). This valve operates just like the holding valve described above, except that it prevents return flow from the winch motor when the motor is operating in the LOWER direction. This prevents the load from overrunning the motor and causing uncontrolled lowering of the load. The winch motor is also fitted with a fail safe brake. Like the winch motor brakes, this brake is spring-applied and pressure-released, and provides the primary braking method for the winch.

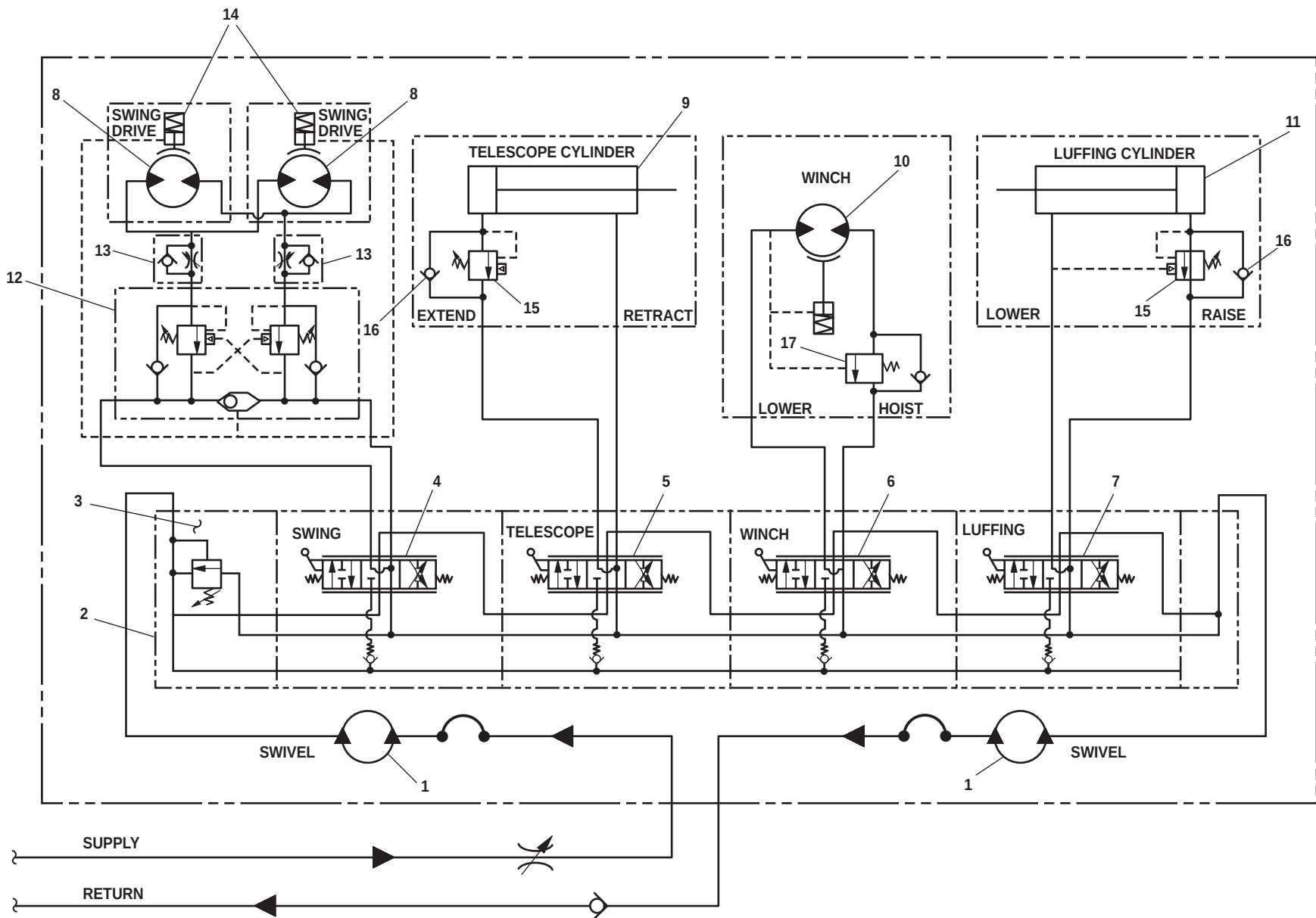


Figure 10. Crane Hydraulic System

TOW PINS

During operation under usual conditions, the tow pins are powered by the central hydraulic system.

Each tow pin is raised and lowered by its own hydraulic cylinder (figure 11, item 1). The cylinders are extended or retracted by supplying pressurized hydraulic fluid to the rod side (retract) or to the piston side (extend) of the hydraulic cylinder.

Movement of the hydraulic cylinders (figure 11, item 1) is controlled by solenoid operated directional control valves (figure 11, item 2), one valve for each cylinder. When the directional control valve is in the NEUTRAL position, the supply line is blocked and both sides of the hydraulic cylinder are OPEN to the reservoir (return). When the hydraulic control valve is shifted to the right (right solenoid energized), hydraulic pressure is directed to the piston side of the hydraulic cylinder and the cylinder extends. During extension, the hydraulic fluid forced out of the rod side of the hydraulic cylinder passes through the directional control valve and back to the reservoir.

When the directional control valve (figure 11, item 2) is shifted to the left (left solenoid energized), hydraulic pressure is directed to the piston side of the hydraulic cylinder (figure 11, item 1) and the cylinder retracts. Retraction of the cylinder is further controlled by the holding valve (figure 11, item 3). Holding valve operation is explained below.

In order to prevent uncontrolled or undesired retraction of the tow pins, each hydraulic cylinder (figure 11, item 1) is provided with a holding valve (figure 11, item 3). The holding valve prevents the cylinder from retracting until pressure is supplied to the rod side of the cylinder. When no pressure is applied to the rod side of the cylinder, a check valve (figure 11, item 4) inside the holding valve prevents return hydraulic fluid from exiting the piston side of the cylinder. If this return hydraulic fluid cannot exit, the cylinder cannot retract. When pressure is applied to the rod side of the cylinder, a portion of this pressure is routed through the internal pilot line (figure 11, item 5) to OPEN the holding valve. Once the holding valve is OPEN, return flow is permitted from the piston side of the cylinder and retraction occurs.

Supply to each pair (port and starboard) of tow pin cylinders (figure 11, item 1) is restricted by a flow control valve (figure 11, item 6). The flow control valve ensures that the tow pin cylinders extend and retract at a controlled rate of speed.

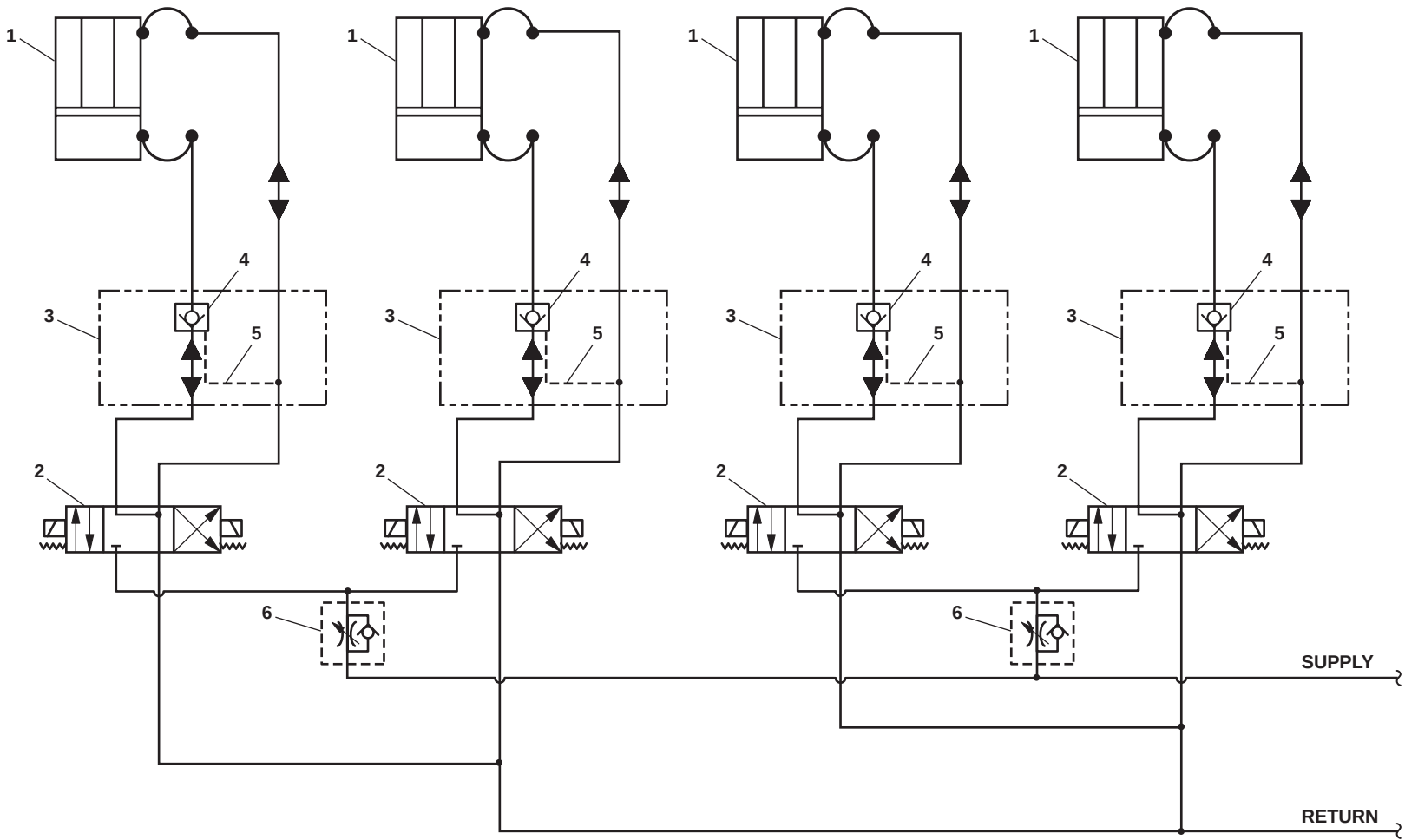


Figure 11. Tow Pin Hydraulic System

TOWING MACHINES

HYDRAULIC/MECHANICAL OPERATING THEORY

Under operation under usual conditions, the towing machines are powered by the towing machine hydraulic system. Hydraulic fluid flows to and from the towing machines (figure 5, sheet 1, item 14; figure 5, sheet 2, item 15) by the supply (figure 5, sheet 1, item 19) and return (figure 5, sheet 2, item 20) lines. Once at the towing machines, the hydraulic flow is controlled by the manually operated local controls, or by solenoid operated remote control valve. Hydraulic power operates the hydraulic motors (figure 12, item 1) and the hydraulic brake cylinders (figure 5, sheets 1 and 2, item 21; figure 12, item 2). All other operations are controlled mechanically.

When the manual or remote control valve directs hydraulic flow to the hydraulic motor (figure 12, item 1), pressure is also applied to release the hydraulic brake cylinders (figure 5, sheet 1, item 21; figure 12, item 2). The main shaft then rotates in the desired direction as decided by the direction of hydraulic fluid flow. If the operator desires the drum (figure 12, item 3) to rotate when the main shaft rotates, the clutch band brake must be applied. See the paragraph below for an explanation of this brake.

In addition to the hydraulic braking described above, both a clutch band brake and an auxiliary brake assembly are installed. The clutch band brake is operated by the outboard control handle (figure 12, item 4) and the auxiliary (figure 12, item 5) brake is operated by the inboard control handle. The auxiliary brake provides primary braking for the drum (figure 12, item 3). It brakes nothing else. The clutch band brake's primary function is to lock the drum to the main shaft. Its secondary function is as a brake for the drum.

In order to lock the drum (figure 12, item 3) to the main shaft, the clutch brake lining acts on the surface of the outer (orbit) gear assembly of a planetary reduction gear. When the sun gear (figure 13, item 1), which is attached to the main shaft (figure 13, item 2) rotates, the planet gears (figure 13, item 3) rotate, too. If the orbit gear (figure 13, item 4) is held stationary, in this case by the clutch band brake, the carrier (figure 13, item 5) will rotate in the same direction as the main shaft, but at a lower speed. In the towing machine, the carrier is attached directly to the drum (figure 12, item 3), so carrier rotation equals drum rotation. If the main shaft is held stationary by the hydraulic brake, the clutch band brake acts as a drum

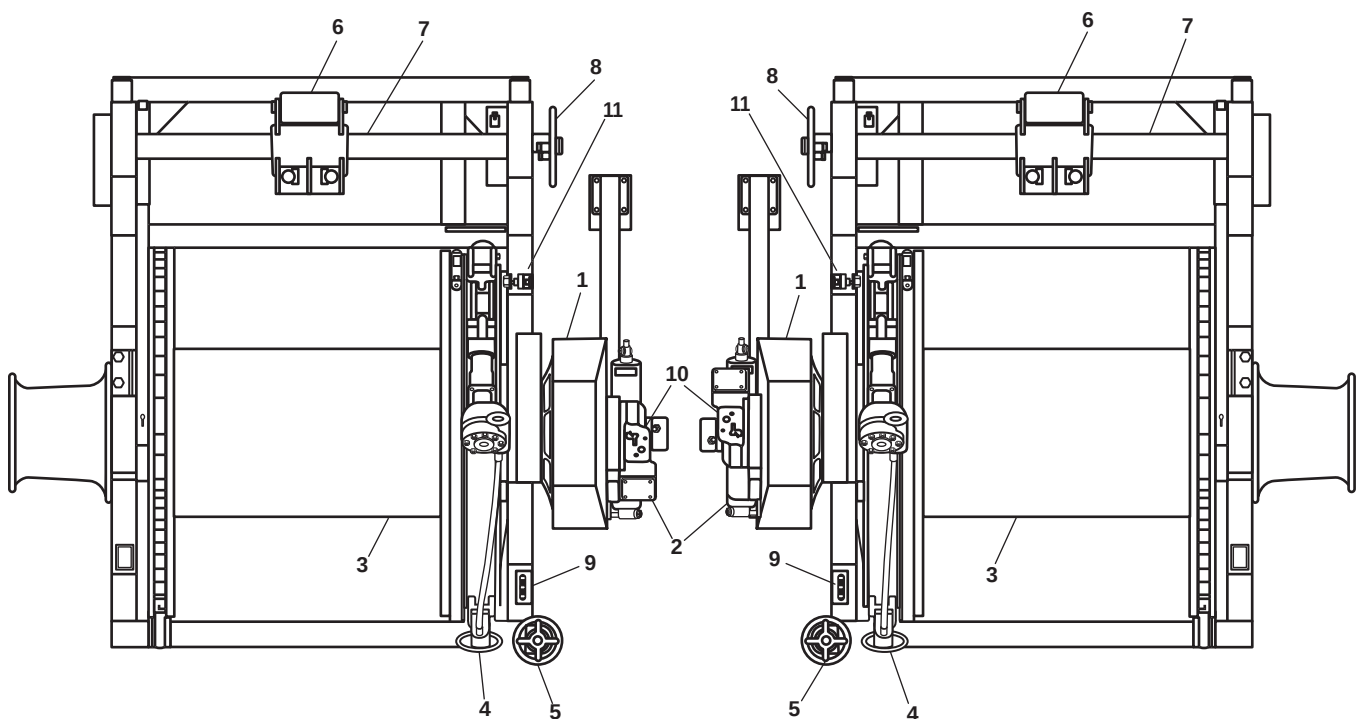


Figure 12. Towing Machine Mechanical Operation

brake, because the carrier cannot rotate against a stationary main shaft unless the orbit gear is also permitted to rotate. Thus, braking of the orbit gear results in braking of the drum.

During certain operating modes, for example use of the gypsy heads, the drum (figure 12, item 3) must remain stationary while the main shaft rotates. The auxiliary brake (figure 12, item 5) secures the brake drum during these operations. This braking action is accomplished by pulling a friction-lined brake band tight against the outer diameter of the drum.

A level wind assembly (figure 12, item 6) is provided on each towing machine. The level wind assembly is driven by a worm gear shaft (figure 12, item 7) that rotates in response to drum (figure 12, item 3) rotation. This assembly helps to ensure that the wire rope always winds evenly onto the drum. Alignment and adjustment of the level wind assembly is accomplished with the adjusting wheel (figure 12, item 8).

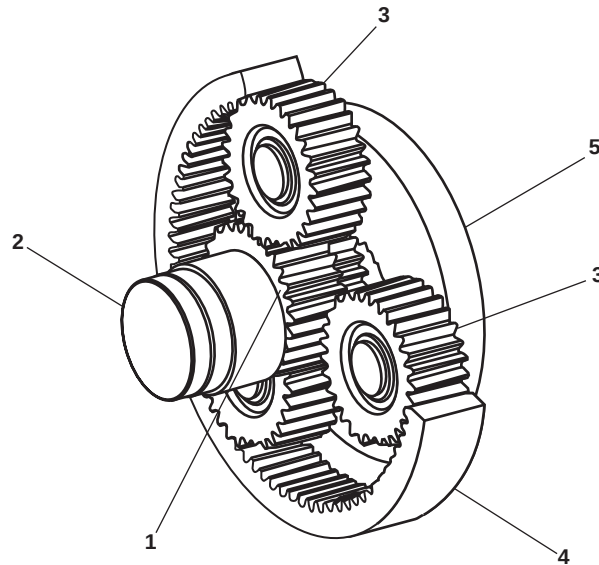


Figure 13. Planetary Reduction Gear Operation

ELECTRICAL OPERATING THEORY

Primary control of the towing machines is from the towing machine control panel (operator) on the 01 level aft. This operating location places the operator safely away from the towing machines and wire ropes during towing operations. The local control stations (figure 12, item 9) are provided only for emergency or maintenance operation.

Towing machine main shaft rotation is controlled by the PAYOUT/HEAVE lever (figure 14, item 1). This lever controls a solenoid-operated valve which, in turn, controls the flow of hydraulic fluid to the hydraulic motor (figure 12, item 1).

Two speed control for the towing machine hydraulic motor (figure 12, item 1) is controlled by the speed control switch (figure 14, item 2). This switch energizes and deenergizes a solenoid-controlled pilot valve that shifts the hydraulic motor between low and high speed.

Remote shutdown of the pump drive engine is controlled by the HYDRAULIC PUMP ENGINE SHUTDOWN switch (figure 14, item 3). When CLOSED, this switch enables pump drive engine operation. When OPEN, the pump drive engine and central hydraulic power unit are both shut down.

Each towing machine is provided with a CABLE OFF indicator (figure 14, item 4) that also stops the central hydraulic motors. This indicator receives input from a worm gear-driven sensor (figure 12, item 10). This sensor measures drum (figure 12, item 3) rotation and converts this rotation into feet of cable payed off. The sensor input is directed through the

towing machine control panel mounted on the starboard bulkhead of the main deck vestibule. There the input is analyzed and output to the CABLE OFF indicator.

A LINE PULL meter (figure 14, item 5) is also installed for each towing machine. This meter measures the amount of strain present on the wire rope. This meter receives its input from a torque strain sensor mounted on the towing machine's main shaft. The sensor input is directed through the towing machine control panel mounted on the starboard bulkhead of the main deck vestibule. There the input is analyzed and output to the line tension meter.

It is important for the operator to know if the clutch brake is slipping. Clutch brake slippage means that additional cable is paying off the drum, causing a potential for trouble. To alert the operator to clutch brake slippage, a CLUTCH BRAKE SLIPPAGE alarm (figure 14, item 6) is installed. When excessive slippage occurs, the alarm sounds a warning horn and

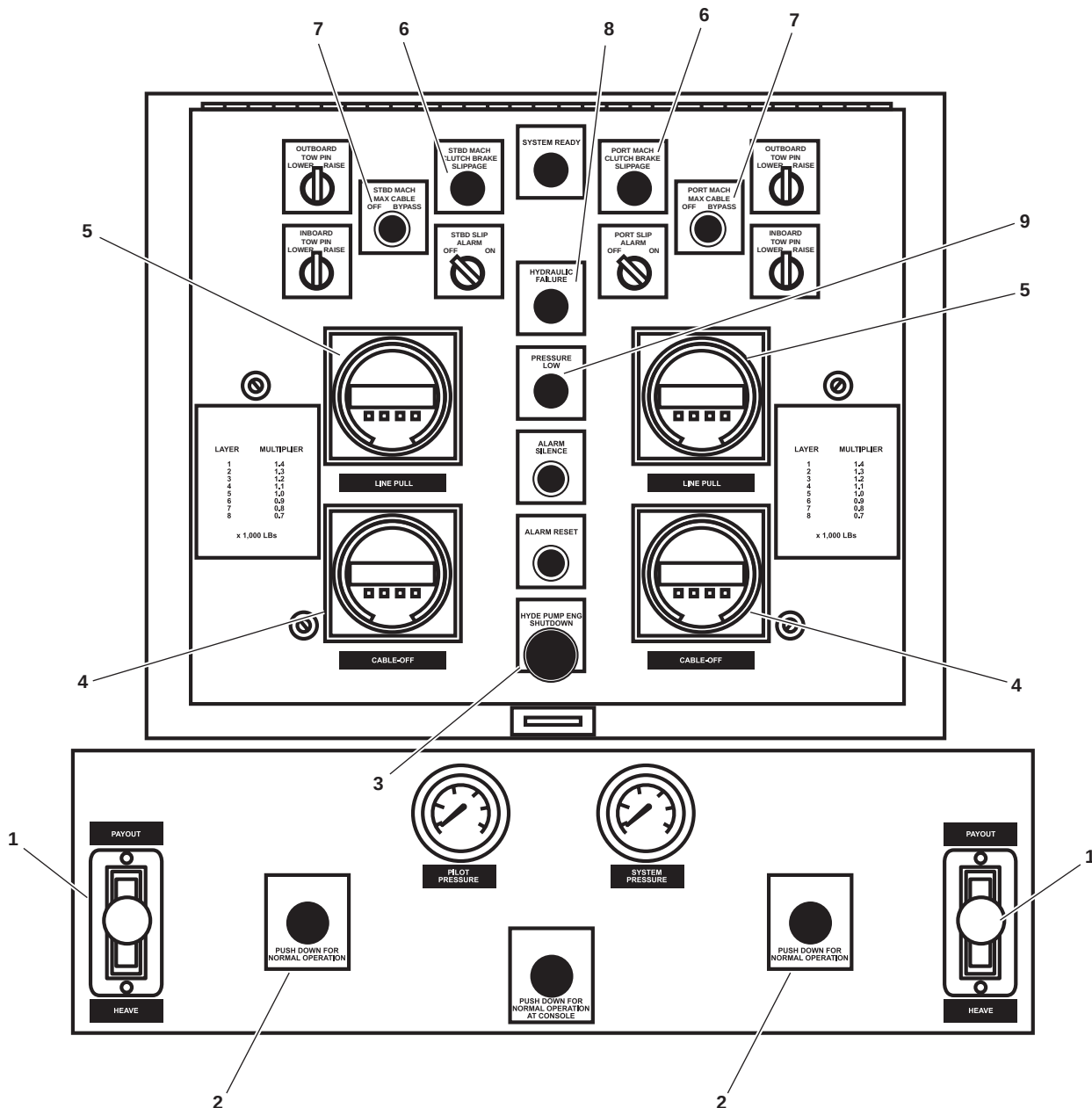


Figure 14. Towing Machine Control Panel (Operator), 01 Level

illuminates a light on the towing machine control panel (operator) on the 01 level. A similar alarm indicator is also installed in the pilothouse. The alarm operates by means of a proximity switch (figure 12, item 11). When a hub member passes close by the proximity switch, the switch closes. When the hub member passes away, the switch opens. The signal from this switch is routed to the towing machine control panel mounted on the starboard bulkhead of the main deck vestibule. There the input is analyzed and when the signal reaches the predetermined limit for excessive slippage, the alarm light is illuminated, and the alarm horn sounds.

Operating with too little cable on the drum can cause loss of the tow cable. To prevent this, a maximum cable OFF shutdown is installed. When the cable OFF indicator system indicates that less than 300 feet (91 meters) of cable remains on the drum, the payout function of the towing machine is disabled and the STBD or PORT MACH MAX CABLE OFF BYPASS pushbutton indicator (figure 14, item 7) illuminates. This function operates by deenergizing the solenoid operated directional control valve that controls the paying out of the tow cable. If it is desired to pay off cable beyond the automatic cutoff point, the operator can press the STBD or PORT MACH MAX CABLE OFF BYPASS pushbutton indicator to bypass the cutoff.

The operator is alerted to the presence of towing machine hydraulic system faults (low hydraulic fluid level, high hydraulic fluid temperature) by an indicator light (figure 14, item 8) and alarm horn. The alarm is indicated at the towing machine control panel (operator) and in the pilothouse. These alarm conditions are activated by Normally Open (NO) switches for hydraulic fluid level and hydraulic fluid temperature. When the hydraulic fluid level falls too low or its temperature rises too high, the appropriate switch closes, and the alarm is activated.

A similar alarm is activated when the system hydraulic fluid pressure falls too low. This alarm also lights a lamp (figure 14, item 9) and sounds the horn when the Normally Open (NO) system hydraulic fluid pressure switch closes.

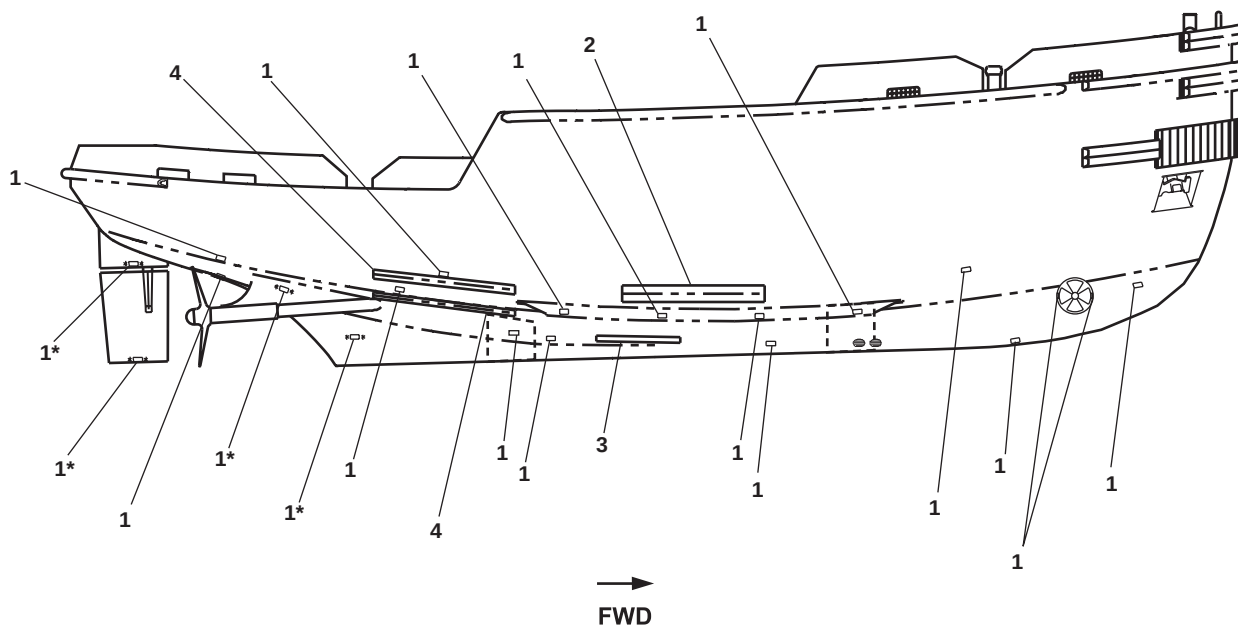
END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION
CATHODIC PROTECTION SYSTEM**

GENERAL

Galvanic corrosion is one common form of corrosion in marine environments. It occurs when two dissimilar metals are brought into electrical contact under water. When a galvanic couple form, one of the metals in the couple becomes the anode (figure 1, item 1) and corrodes faster than it would all by itself, while the other becomes the cathode and corrodes more slowly than it would alone. Either (or both) metals in the couple may or may not corrode by itself (themselves) in raw water. When contact with a dissimilar metal is made, however, the self-corrosion rates will change: corrosion of the anode will accelerate; corrosion of the cathode will decelerate or even stop.

The Large Tug (LT) hull is fitted with a series of zinc sacrificial anodes (figure 1, item 1) to protect the vessel from galvanic corrosion. The location of the zinc sacrificial anodes is shown in figure 1. When galvanic corrosion occurs on the vessel, the zinc anode erodes, protecting the vessel's hull and components (cathodes). Sacrificial zinc anodes are also installed in the cooling system for the SSDG (figure 1, item 2), reduction gears (figure 1, item 3), and main engines, figure 1, item 4).



* Anodes At Same Position On Both Sides Of Rudder.

Figure 1. Cathodic Protection System

END OF WORK PACKAGE

Chapter 2

Troubleshooting Procedures for Inland and Coastal Large Tug (LT)

**UNIT MAINTENANCE
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 unit, direct support, and general support maintenance troubleshooting procedures index. The equipment list is contained in the left column of the table, 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.

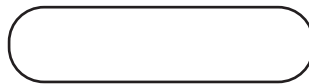


Figure 1. Pill Shaped Symbol

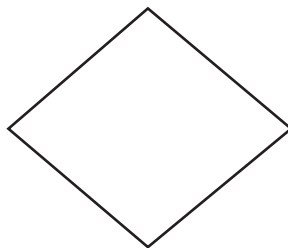


Figure 2. Diamond Shaped Symbol



Figure 3. Rectangle Shaped (Action) Symbol



Figure 4. Circular Shaped (Connector) Symbol

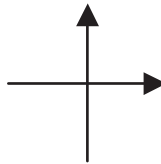


Figure 5. Crossed Lines Are Connected

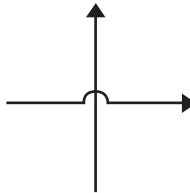


Figure 6. Crossed Lines Are Not Connected

Table 1. Troubleshooting Procedures Index

Equipment	Malfunction	Work Package, Procedure
Arc Welder	Arc Welder Does Not Power Up Low or No Weld Output No High Frequency Function	WP 0078 00, Procedure 1 WP 0078 00, Procedure 2 WP 0078 00, Procedure 3
Alarm System: Arms Storage, Radio Room and Fan Room	No Alarm Sounds At Alarm Switchboard Small Arms Room Sprinkler Alarm Malfunction Small Arms Room Temperature Malfunction Radio Room Door Alarm Malfunction Fan Room Door Alarm Malfunction	WP 0069 00, Procedure 1 WP 0069 00, Procedure 2 WP 0069 00, Procedure 3 WP 0069 00, Procedure 4 WP 0069 00, Procedure 5
Battery Chargers	Battery Charger Does Not Charge Batteries	WP 0066 00, Procedure 1
Bench Grinder	Bench Grinder Will Not Run Bench Grinder Does Not Grind Evenly	WP 0077 00, Procedure 1 WP 0077 00, Procedure 2

Table 1. Troubleshooting Procedures Index (continued)

Equipment	Malfunction	Work Package, Procedure
Bilge and Ballast Pumps	No Power to the Pump Pump Does Not Deliver Any Fluid Pump Leaks Fluid	WP 0050 00, Procedure 1 WP 0050 00, Procedure 2 WP 0050 00, Procedure 3
Bridge Wing Heaters and Pilothouse Console Light	Bridge Wing Heater Is Inoperative Pilothouse Console Light Does Not Illuminate	WP 0070 00, Procedure 1 WP 0070 00, Procedure 2
Day Tank High Level Alarms	Day Tank High Level Alarm Shows No Indication of Power Day Tank High Level Alarm Does Not Sound	WP 0057 00, Procedure 1 WP 0057 00, Procedure 2
Distribution Panels	No Power to Equipment from Distribution Panel	WP 0060 00, Procedure 1
Drill Press	Drill Press Does Not Run Drill Press Does Not Rotate/Spin Smoothly Drill Press Chuck Does Not Tighten Sufficiently to Hold Drill Bit Drill Press Spindle Does Not Raise and Lower Correctly Drill Press Table Does Not Raise, Lower, or Rotate Correctly	WP 0076 00, Procedure 1 WP 0076 00, Procedure 2 WP 0076 00, Procedure 3 WP 0076 00, Procedure 4 WP 0076 00, Procedure 5
Emergency Switchboard	No Power to Equipment from the Emergency Switchboard No Power to the Emergency Switchboard Meter(s) Do(es) Not Indicate That Power Is Available to the Emergency Switchboard Light(s) Not Lit on the Emergency Switchboard No Control of Main Switchboard Bus Tie Circuit Breaker	WP 0059 00, Procedure 1 WP 0059 00, Procedure 2 WP 0059 00, Procedure 3 WP 0059 00, Procedure 4 WP 0059 00, Procedure 5
Engine Order Telegraph	No Indication of Power to the EOT System Pilothouse Order Not Received in the EOS No Alarm Bell Function	WP 0071 00, Procedure 1 WP 0071 00, Procedure 2 WP 0071 00, Procedure 3
Fire and General Service Pumps	No Power to the Pump Pump Does Not Deliver Any Water Pump Leaks Fluid	WP 0053 00, Procedure 1 WP 0053 00, Procedure 2 WP 0053 00, Procedure 3
Floodlights	Floodlight Does Not Illuminate	WP 0062 00, Procedure 1
Fuel Oil Filter/Water Separator	No or Low Fuel Output Unit Leaks Fuel Unit Will Not Drain	WP 0055 00, Procedure 1 WP 0055 00, Procedure 2 WP 0055 00, Procedure 3
Fuel Oil Transfer Pump	No Power to Pump Pump Does Not Deliver Any Liquid Pump Leaks Fuel	WP 0047 00, Procedure 1 WP 0047 00, Procedure 2 WP 0047 00, Procedure 3

Table 1. Troubleshooting Procedures Index (continued)

Equipment	Malfunction	Work Package, Procedure
General Alarm System	Alarm Does Not Actuate Alarm Actuates, But Bell Does Not Sound Alarm Actuates, But Rotating Beacon Does Not Function	WP 0072 00, Procedure 1 WP 0072 00, Procedure 2 WP 0072 00, Procedure 3
Hot Potable Water Heater	Hot Water Heater Tank Relief Valve Discharges Continuously Not Enough or No Hot Water	WP 0074 00, Procedure 1 WP 0074 00, Procedure 2
Hot Potable Water Recirculation Pump	No Power to Pump Pump Does Not Deliver Any Liquid Pump Leaks Water	WP 0052 00, Procedure 1 WP 0052 00, Procedure 2 WP 0052 00, Procedure 3
Hydraulic Watertight Doors	Door Does Not Move When Operating Hand Pump Door Does Not Seal Watertight System Leaks Hydraulic Oil	WP 0043 00, Procedure 1 WP 0043 00, Procedure 2 WP 0043 00, Procedure 3
Intercommunication	No Power to Intercom System Intercom Unit Does Not Send or Receive Call Troubleshoot Known Faulty Intercom Unit	WP 0068 00, Procedure 1 WP 0068 00, Procedure 2 WP 0068 00, Procedure 3
Lighting, Interior	Interior Fluorescent Lights Do Not Illuminate Interior Incandescent Lights Do Not Illuminate	WP 0061 00, Procedure 1 WP 0061 00, Procedure 2
Lube Oil Transfer Pump	No Power to Pump Pump Does Not Deliver Any Liquid Pump Leaks Lube Oil	WP 0046 00, Procedure 1 WP 0046 00, Procedure 2 WP 0046 00, Procedure 3
Main Switchboard	No Power to Equipment from Main Switchboard No Power to the Main Switchboard Meter(s) Do(es) Not Indicate That Power Is Available to the Main Switchboard Light(s) Not Lit on the Main Switchboard	WP 0058 00, Procedure 1 WP 0058 00, Procedure 2 WP 0058 00, Procedure 3 WP 0058 00, Procedure 4
Motor Controllers	Type 1 Motor Controller Does Not Start Motor Type 2 Motor Controller Does Not Start Motor Type 3 Motor Controller Does Not Start Motor Type 4, Type 5, or Type 6 Motor Controller Does Not Start Motor	WP 0065 00, Procedure 1 WP 0065 00, Procedure 2 WP 0065 00, Procedure 3 WP 0065 00, Procedure 4
Navigation Lights	Navigation Light Does Not Illuminate Yardarm Light Does Not Blink/Illuminate	WP 0063 00, Procedure 1 WP 0063 00, Procedure 2

Table 1. Troubleshooting Procedures Index (continued)

Equipment	Malfunction	Work Package, Procedure
Oily Bilge Pump	Pump Runs Slowly or Not At All Pump Runs But Moves Little or No Fluid Air Bubbles in the Pump Discharge or Fluid Comes Out of the Air Exhaust	WP 0049 00, Procedure 1 WP 0049 00, Procedure 2 WP 0049 00, Procedure 3
Portable Electric Pumps	Pump Will Not Run Pump Shuts OFF Unexpectedly Pump Turns ON, But Delivers No or Low Fluid	WP 0054 00, Procedure 1 WP 0054 00, Procedure 2 WP 0054 00, Procedure 3
Potable Water Pumps	No Power to the Potable Water Pump Pump Does Not Deliver Any Water Pump Leaks Water	WP 0051 00, Procedure 1 WP 0051 00, Procedure 2 WP 0051 00, Procedure 3
Prelubrication Oil Pump	No Power to the Pump Pump Does Not Deliver Oil Pump Leaks Oil	WP 0044 00, Procedure 1 WP 0044 00, Procedure 2 WP 0044 00, Procedure 3
Reduction Gear Cooling Pumps	No Power to the Reduction Gear Cooling Pump Pump Does Not Deliver Any Liquid Pump leaks Cooling Water	WP 0045 00, Procedure 1 WP 0045 00, Procedure 2 WP 0045 00, Procedure 3
Rotary Clearview Screens	No Power to Rotary Clearview Screen Heater Does Not Function Screen Motor Does Not Rotate	WP 0075 00, Procedure 1 WP 0075 00, Procedure 2 WP 0075 00, Procedure 3
Searchlights	No Power to Searchlight Searchlight Does Not Illuminate Searchlight Does Not Move Up-Down and Left-Right Remotely	WP 0064 00, Procedure 1 WP 0064 00, Procedure 2 WP 0064 00, Procedure 3
Sewage Discharge Pumps	No Power to the Sewage Discharge Pump Pump Does Not Deliver Any Fluid Pump Leaks Fluid	WP 0048 00, Procedure 1 WP 0048 00, Procedure 2 WP 0048 00, Procedure 3
Signal Horn	Signal Horn Does Not Sound Automatic Timer Function Does Not Work	WP 0073 00, Procedure 1 WP 0073 00, Procedure 2
Sound Powered Telephones	No or Low Transmission or No Receipt of Voice Communications At a Station No Ring or Call Horn Does Not Sound	WP 0067 00, Procedure 1 WP 0067 00, Procedure 2 WP 0067 00, Procedure 3

Table 1. Troubleshooting Procedures Index (continued)

Equipment	Malfunction	Work Package, Procedure
Tank Level Indicators	Tank Level Indicator Shows No Indication of Power	WP 0056 00, Procedure 1
	Tank Level Indicator Alarm Horn Does Not Sound	WP 0056 00, Procedure 2
	Tank Level Indicator Control Panel Meter Does Not Deflect Correctly	WP 0056 00, Procedure 3
	Tank Level Indicator Remote Meter Does Not Follow the Control Panel Meter	WP 0056 00, Procedure 4
	No Level Change Indicated on Meter When Tank Level Changes	WP 0056 00, Procedure 5

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
HYDRAULIC WATERTIGHT DOORS**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0088 00
WP 0295 00 (volume 2)

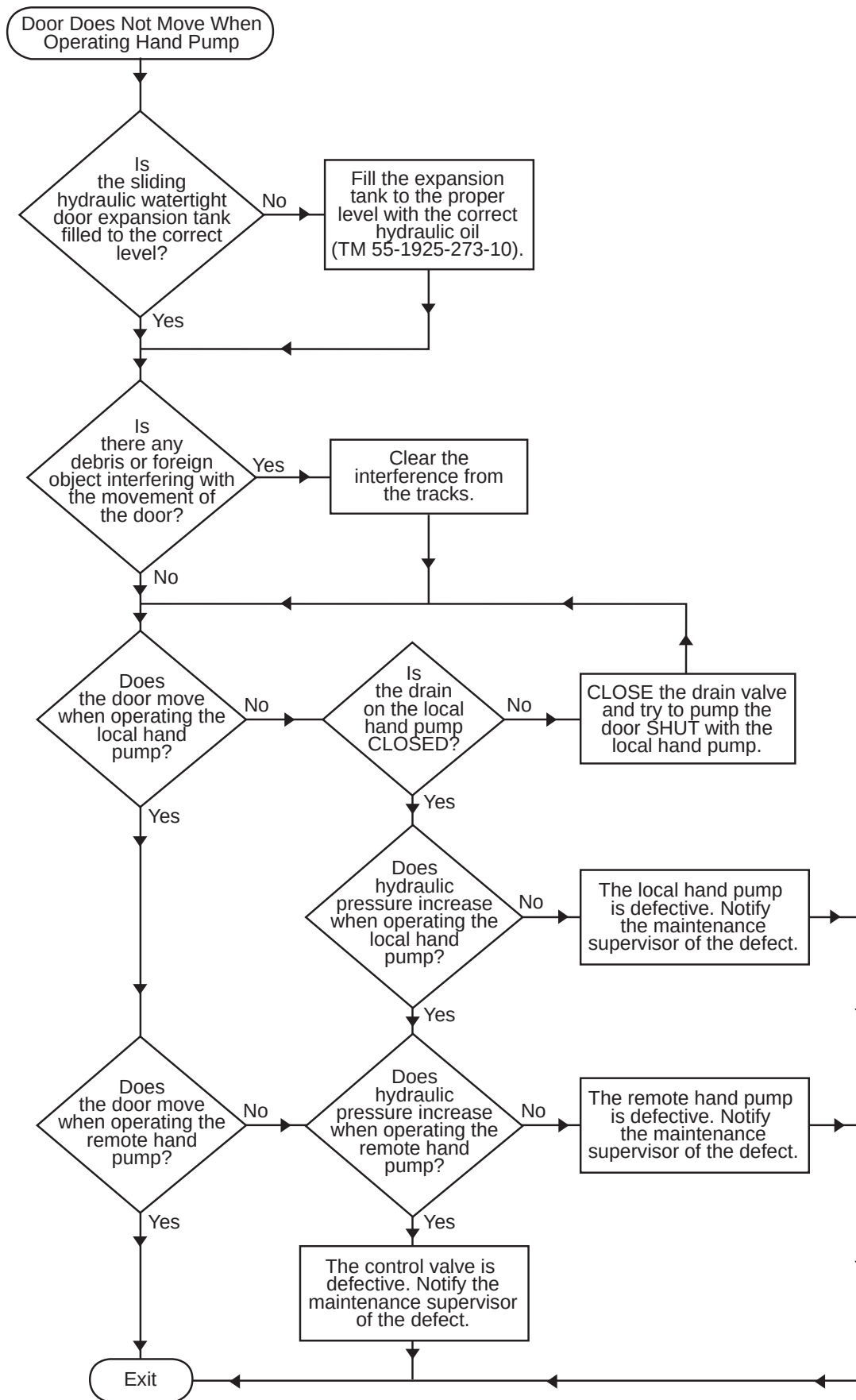
Personnel Required:

Two Watercraft Engineers, 88L

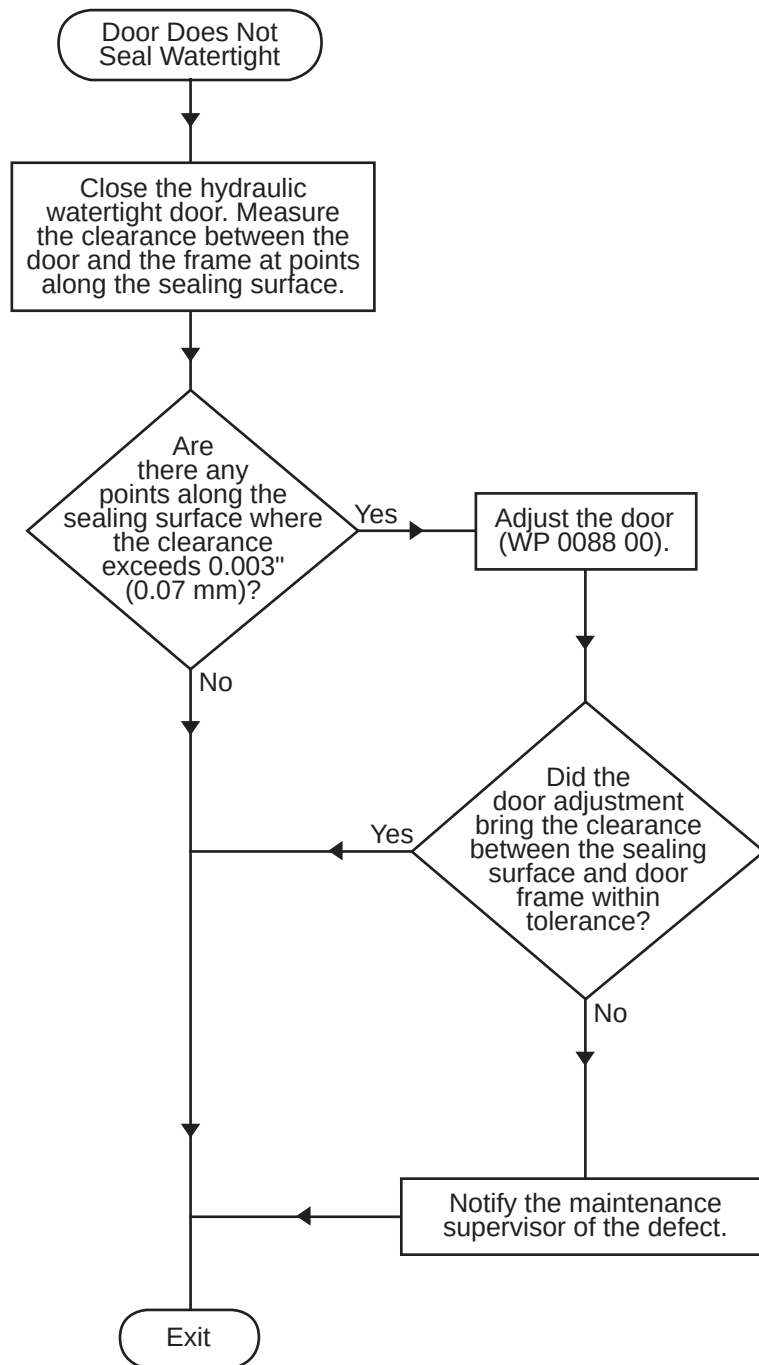
INTRODUCTION

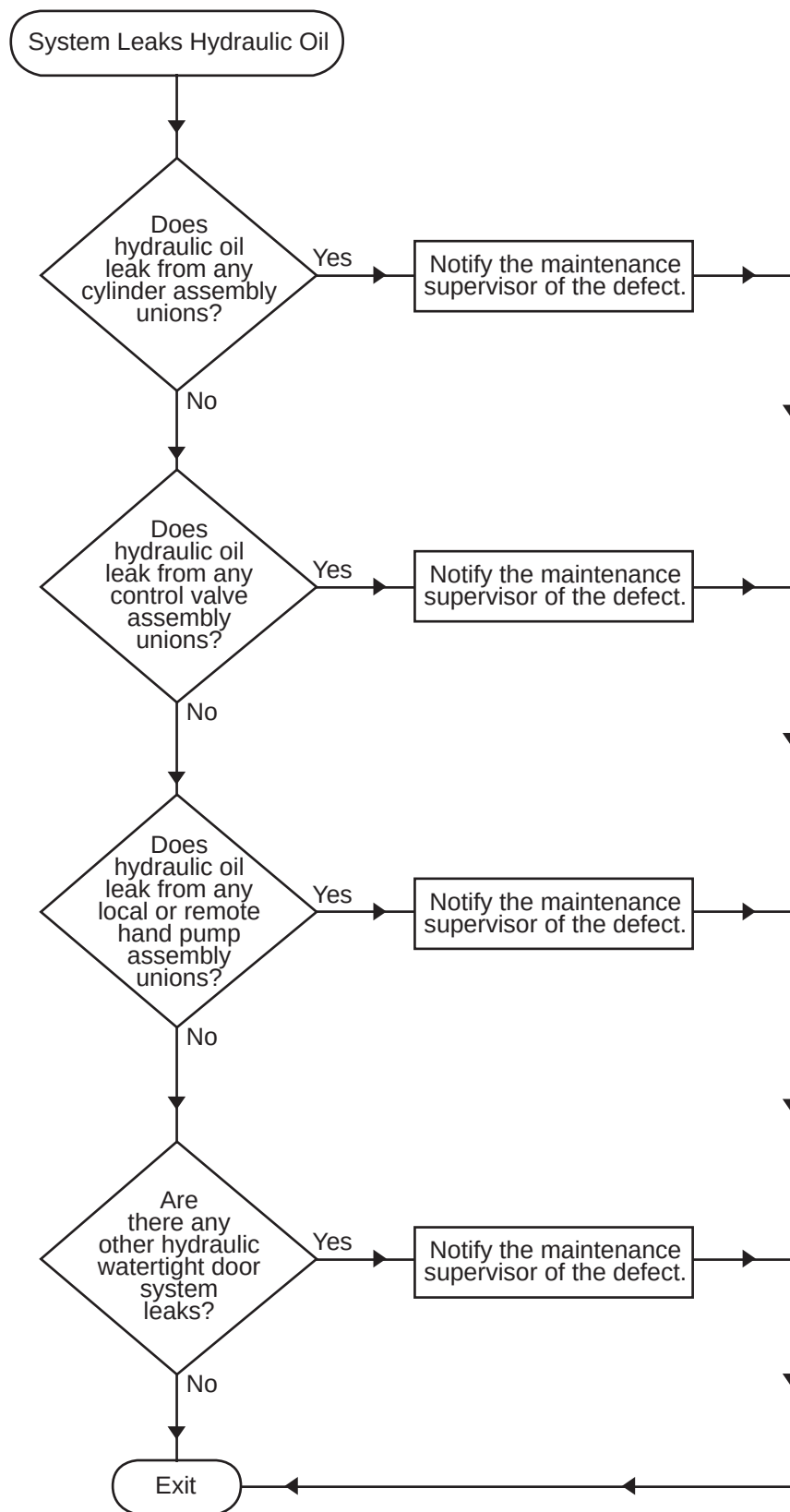
The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Door Does Not Move When Operating Hand Pump	1
Door Does Not Seal Watertight	2
System Leaks Hydraulic Oil	3



Procedure 1. Door Does Not Move When Operating Hand Pump

**Procedure 2. Door Does Not Seal Watertight**

**Procedure 3. System Leaks Hydraulic Oil****END OF WORK PACKAGE**

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
PRELUBRICATION OIL PUMP**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0065 00
WP 0096 00
WP 0295 00 (volume 2)

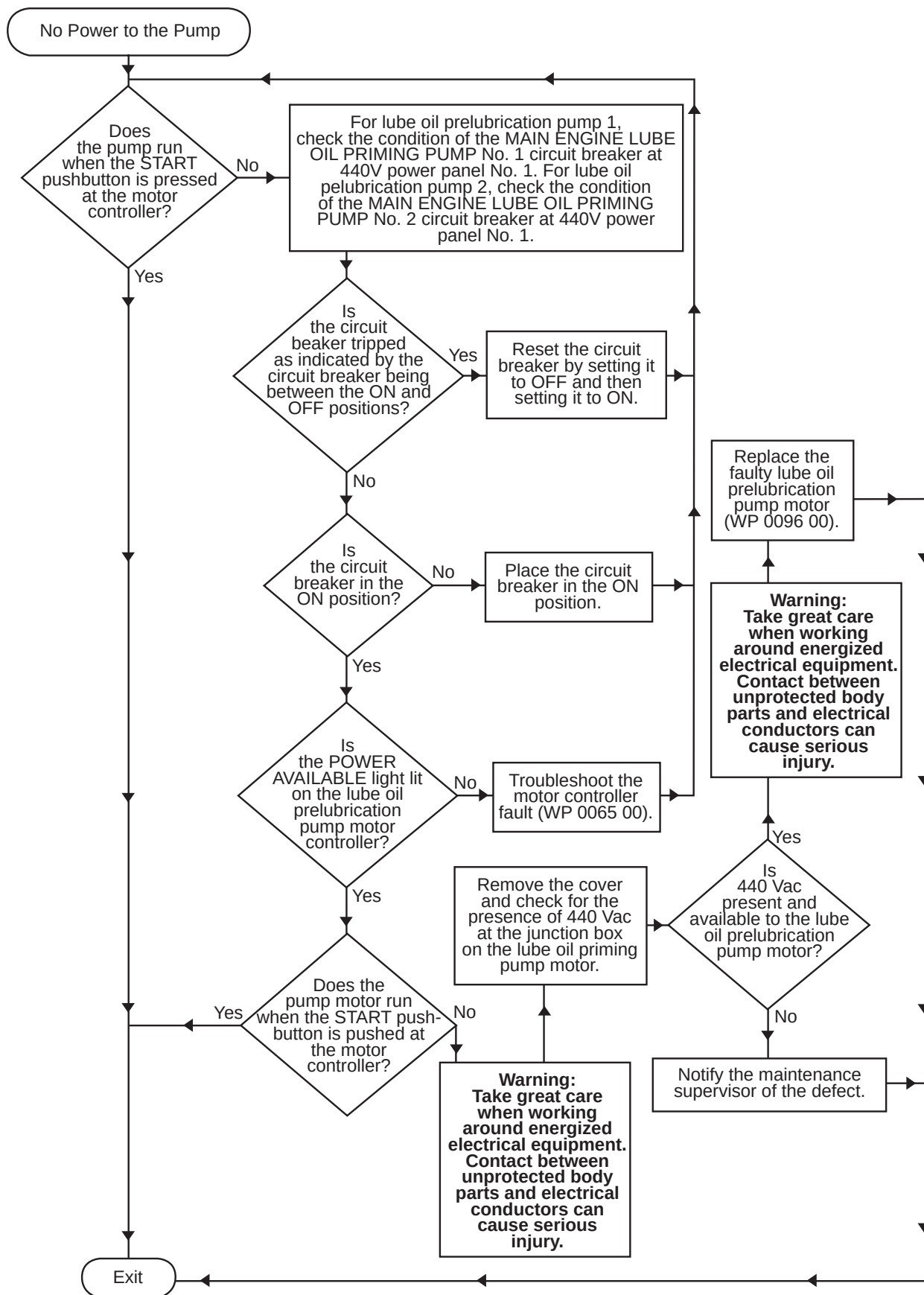
Personnel Required:

Two Watercraft Engineers, 88L

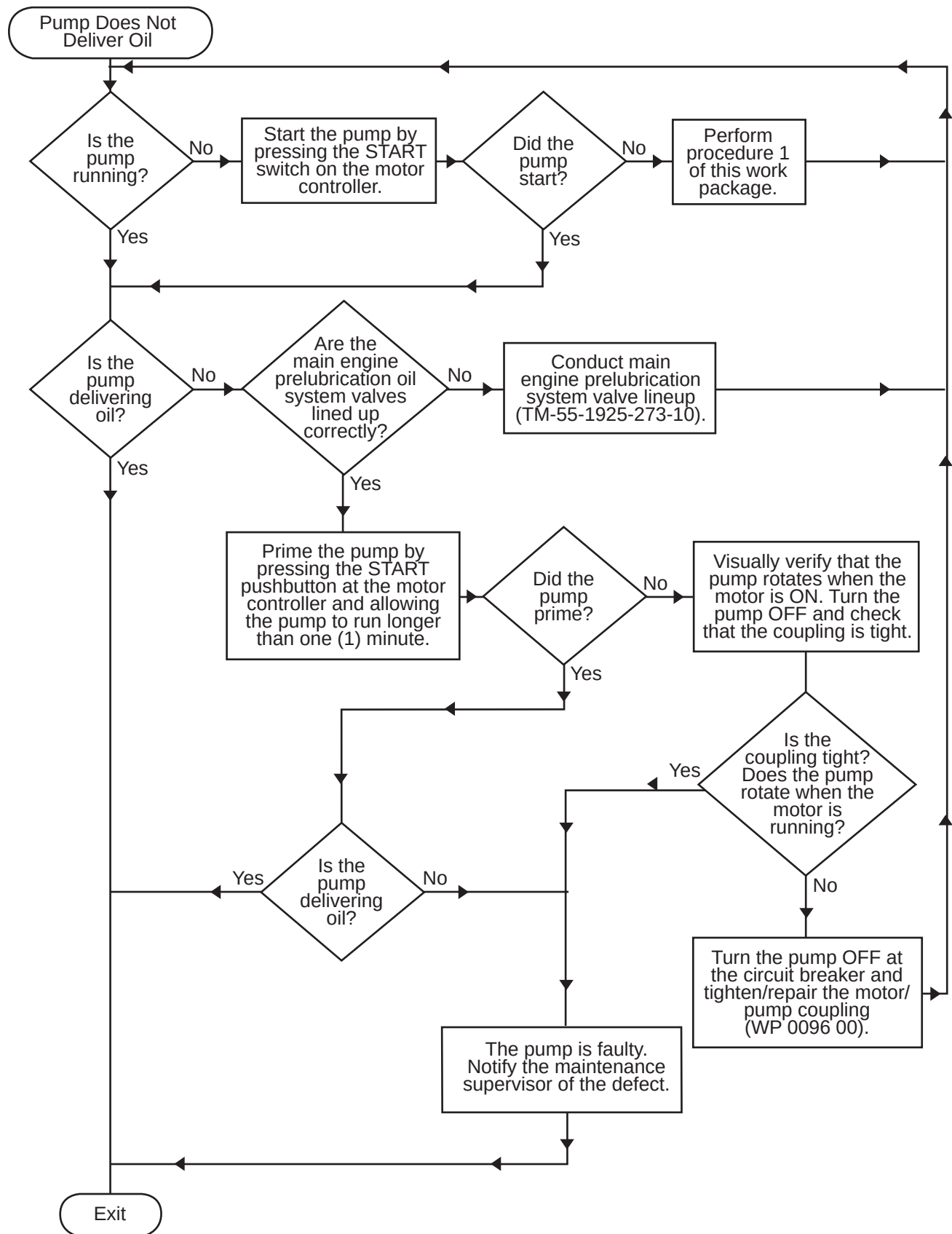
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The following unit troubleshooting procedures are included in this work package:

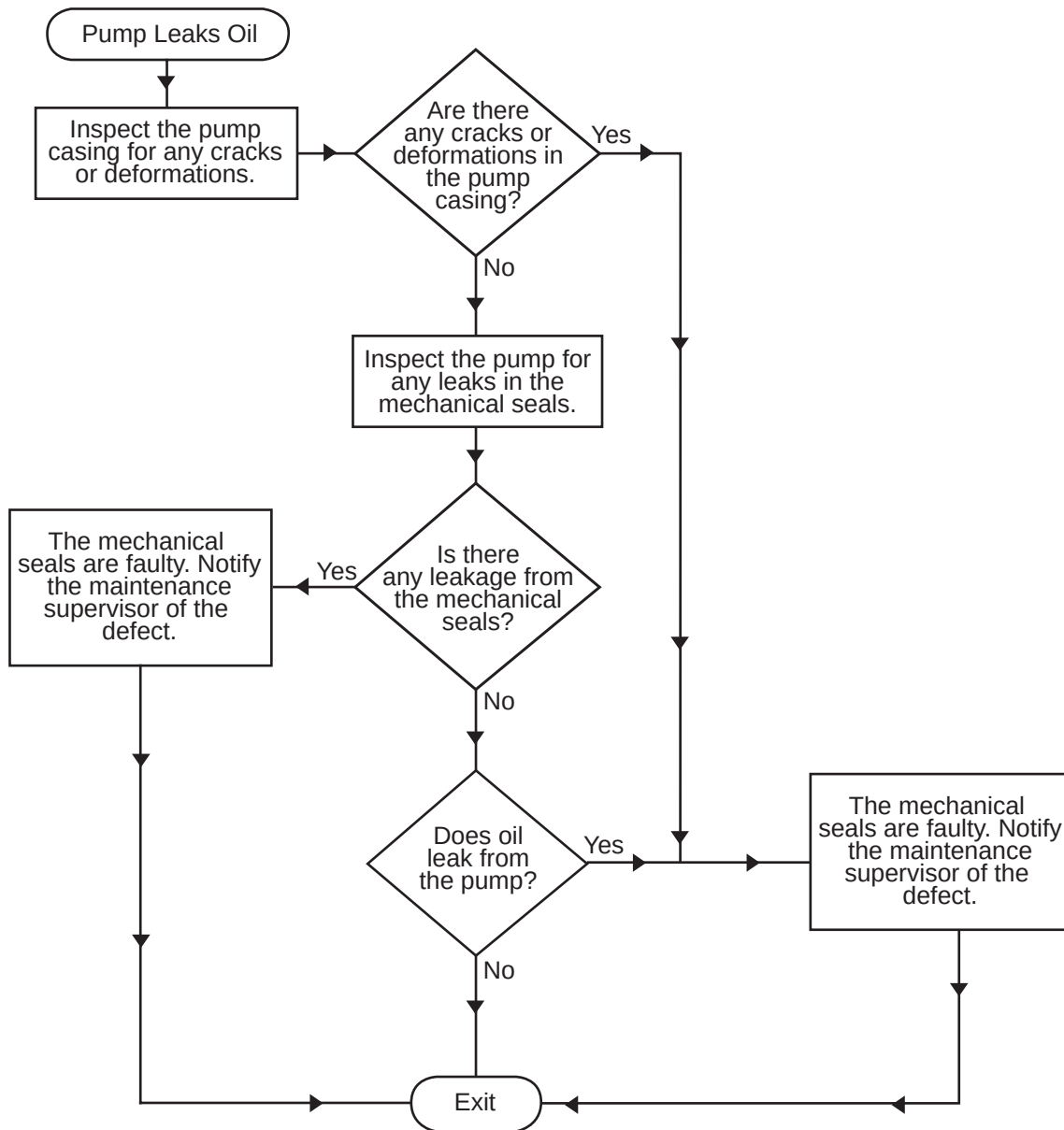
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to the Pump	1
Pump Does Not Deliver Oil	2
Pump Leaks Oil	3



Procedure 1. No Power to the Pump



Procedure 2. Pump Does Not Deliver Oil

**Procedure 3. Pump Leaks Oil**

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

REDUCTION GEAR COOLING PUMP

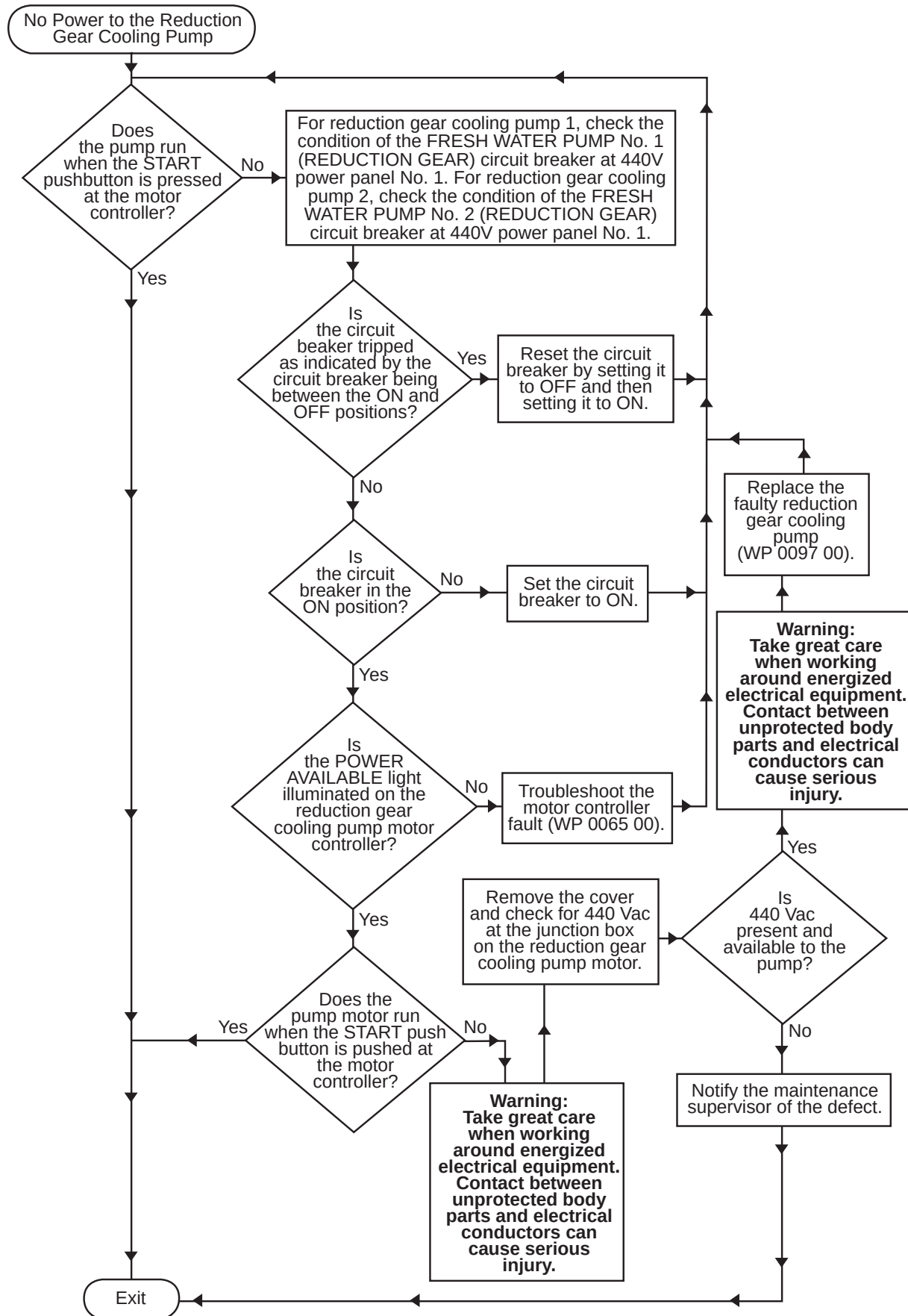
INITIAL SETUP:

Tools and Special Tools:	References:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00)	TM-55-1925-273-10
Multimeter (Item 16, Table 2, WP 0295 00)	WP 0065 00
	WP 0097 00
	WP 0295 00
Personnel Required:	
Two Watercraft Engineers, 88L	

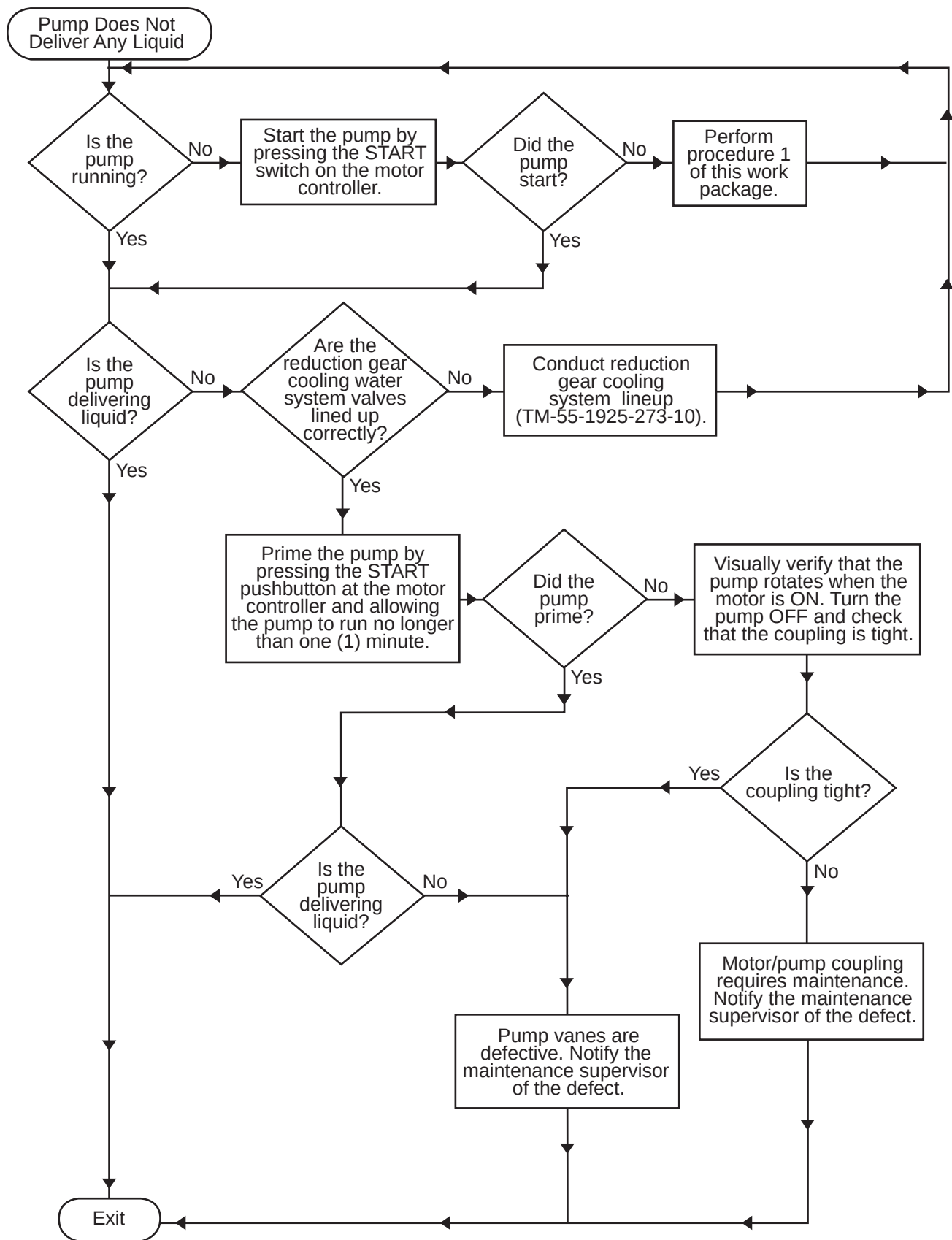
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

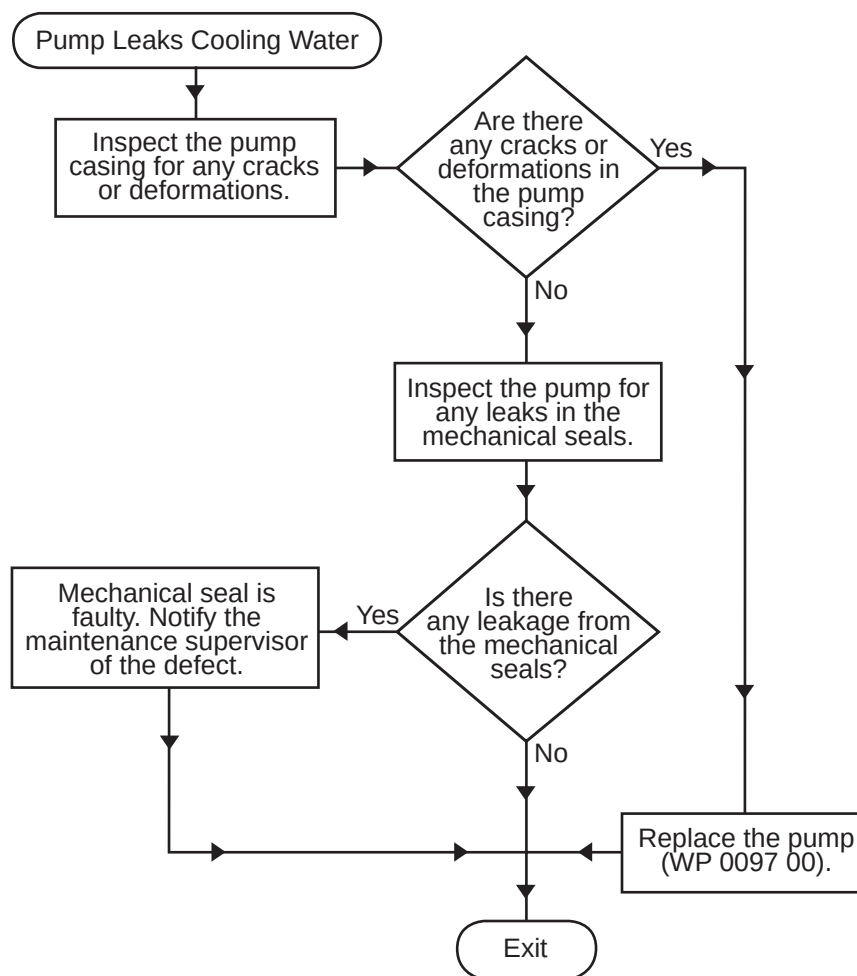
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to the Reduction Gear Cooling Pump	1
Pump Does Not Deliver Any Liquid	2
Pump Leaks Cooling Water	3



Procedure 1. No Power to the Reduction Gear Cooling Pump



Procedure 2. Pump Does Not Deliver Any Liquid

**Procedure 3. Pump Leaks Cooling Water**

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

LUBE OIL TRANSFER PUMP

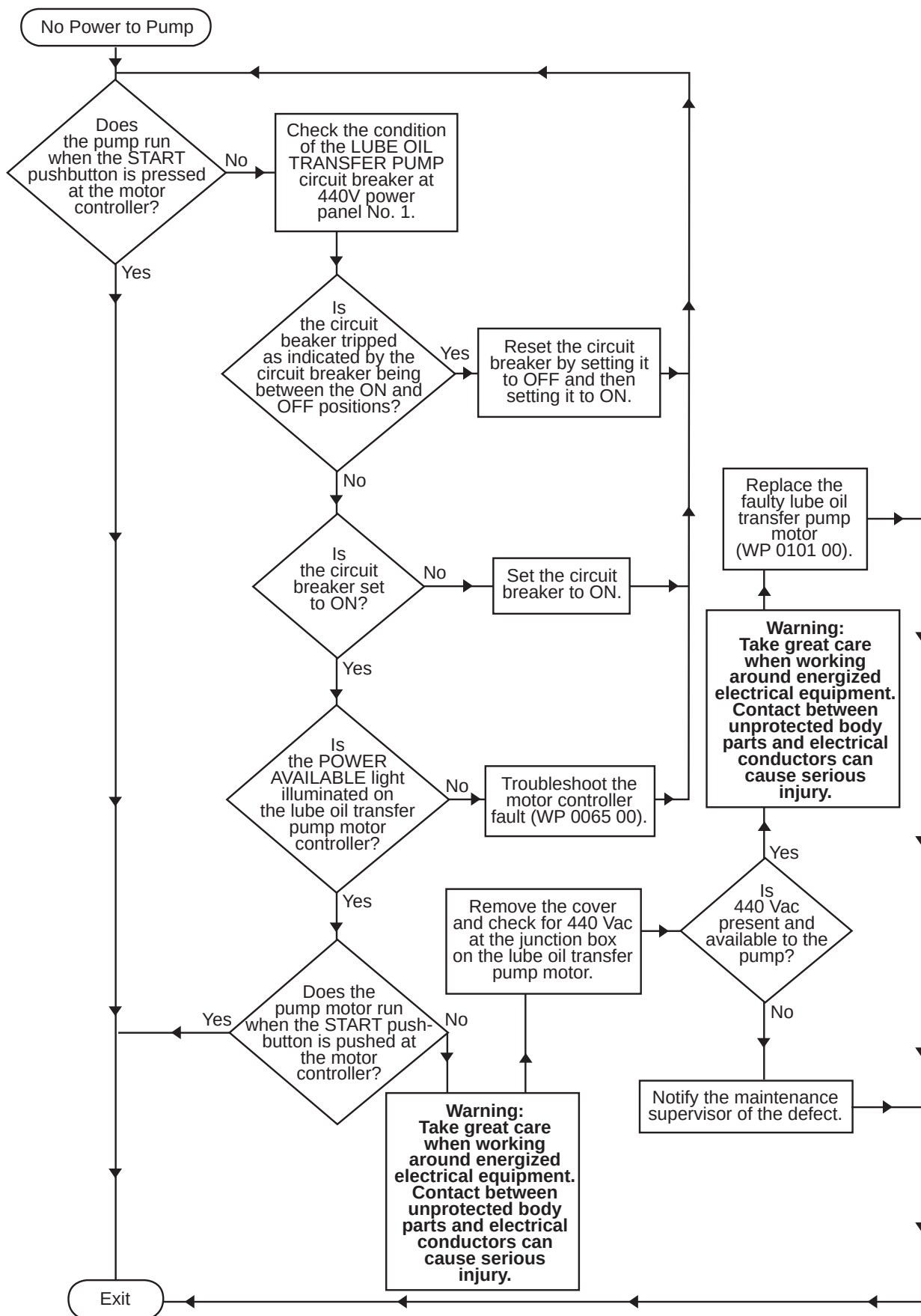
INITIAL SETUP:

Tools and Special Tools:	References:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)	TM 55-1925-273-10
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)	WP 0065 00
	WP 0101 00
	WP 0102 00
Personnel Required:	WP 0295 00 (volume 2)
Two Watercraft Engineers, 88L	

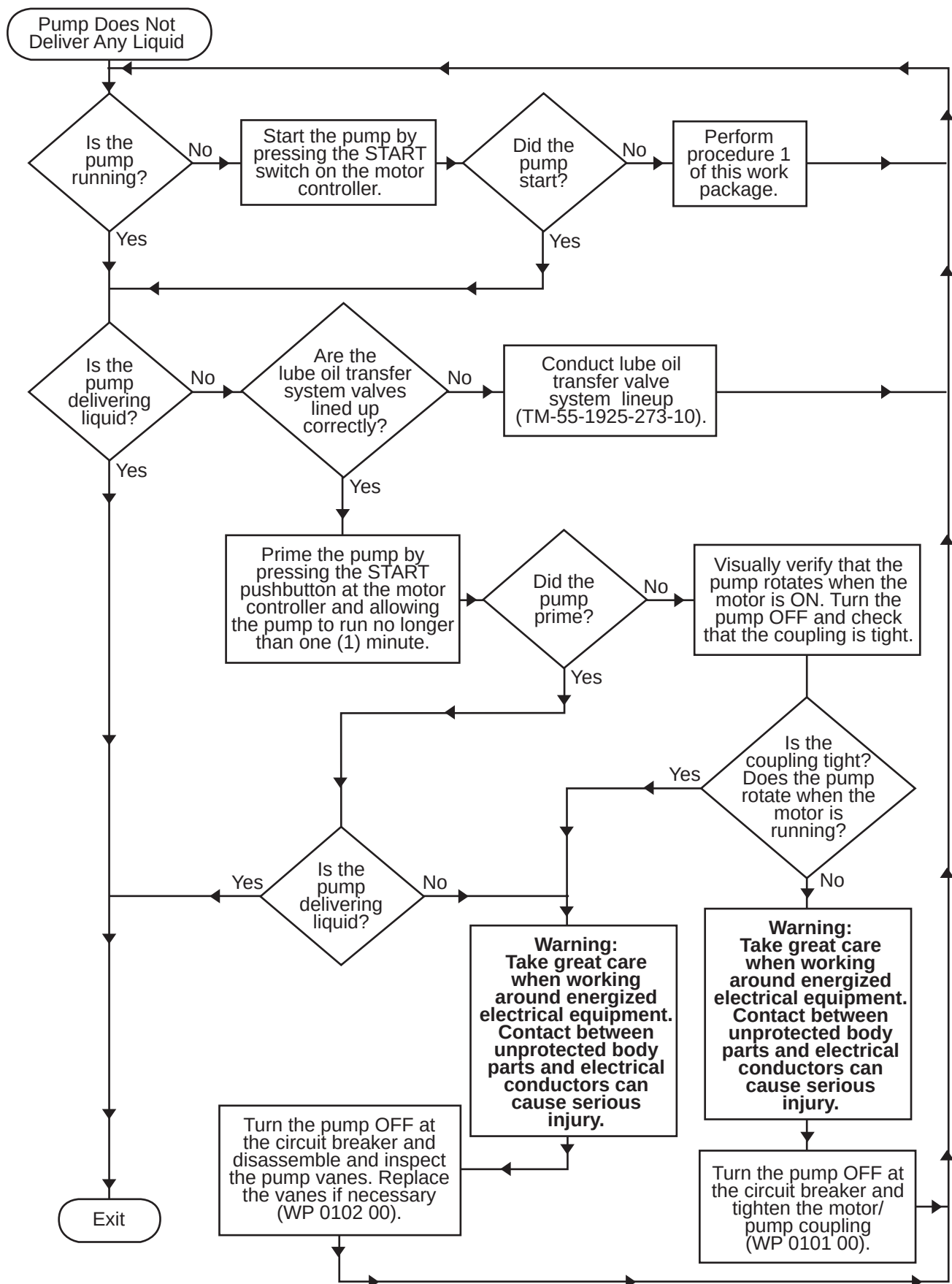
INTRODUCTION

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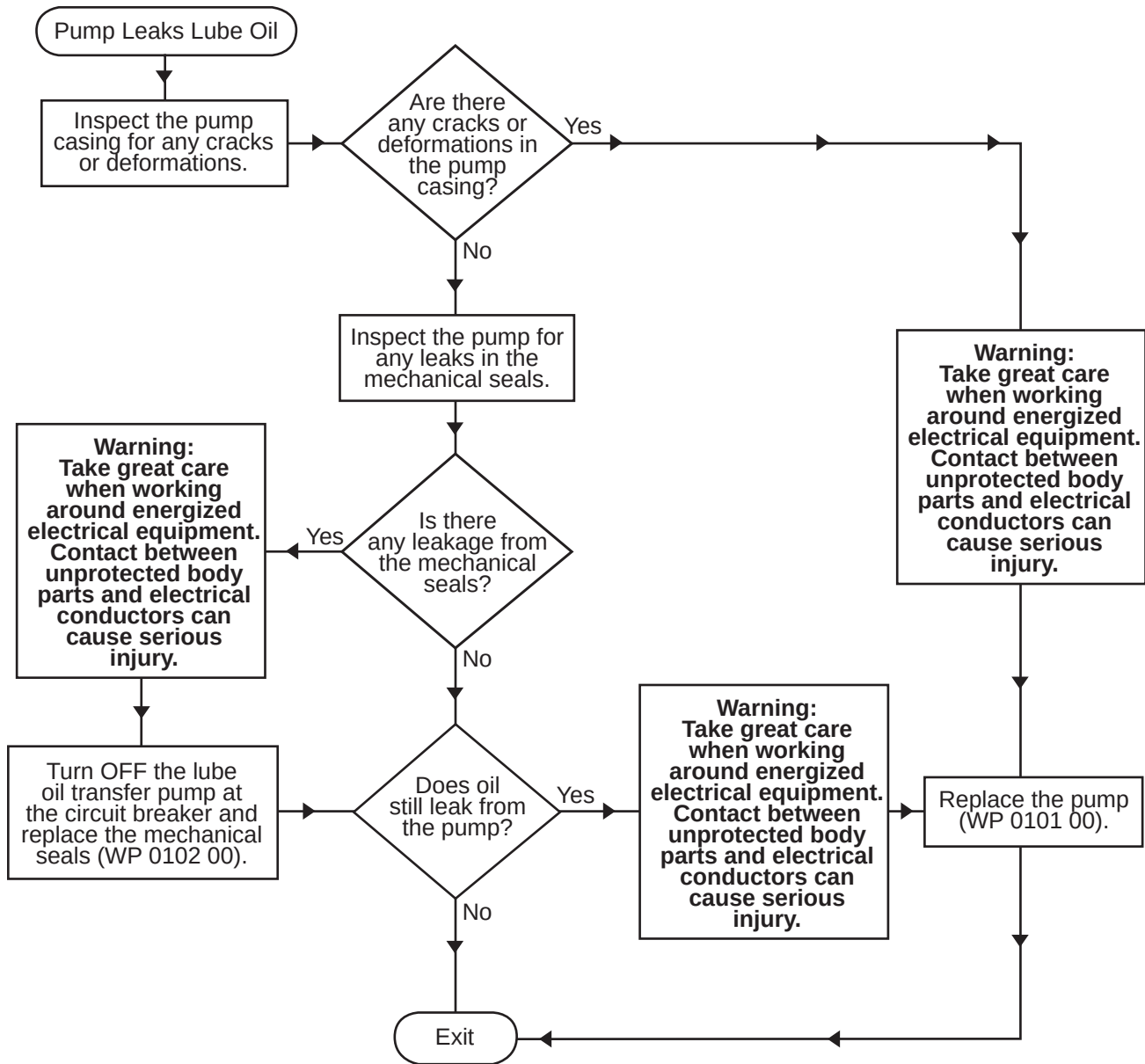
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Pump	1
Pump Does Not Deliver Any Liquid	2
Pump Leaks Lube Oil	3



Procedure 1. No Power to Pump



Procedure 2. Pump Does Not Deliver Any Liquid



Procedure 3. Pump Leaks Lube Oil

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

FUEL OIL TRANSFER PUMP

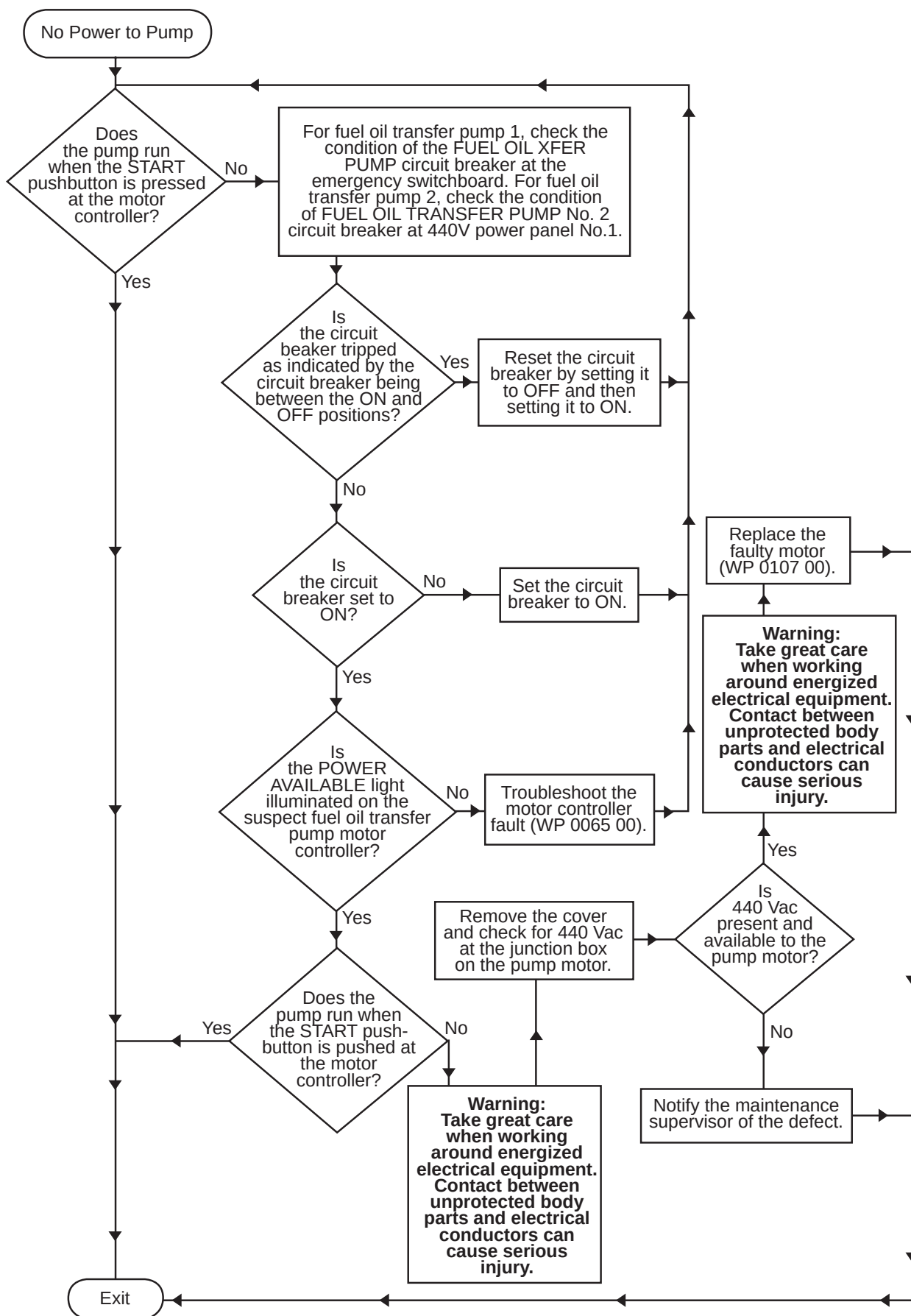
INITIAL SETUP:

Tools and Special Tools:	References:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)	TM 55-1925-273-10
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)	WP 0065 00
	WP 0105 00
	WP 0106 00
Personnel Required:	WP 0107 00
Two Watercraft Engineers, 88L	WP 0295 00 (volume 2)

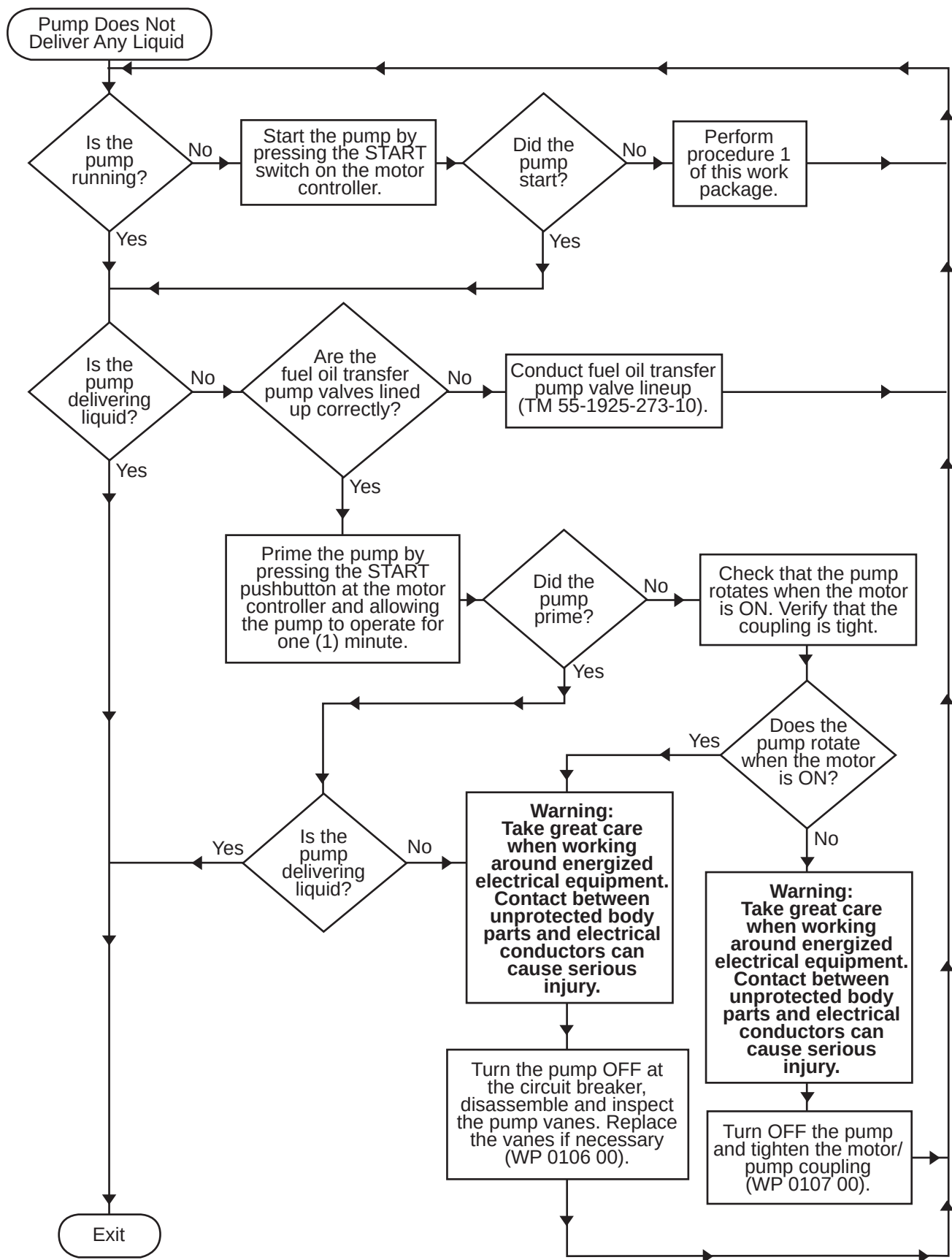
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

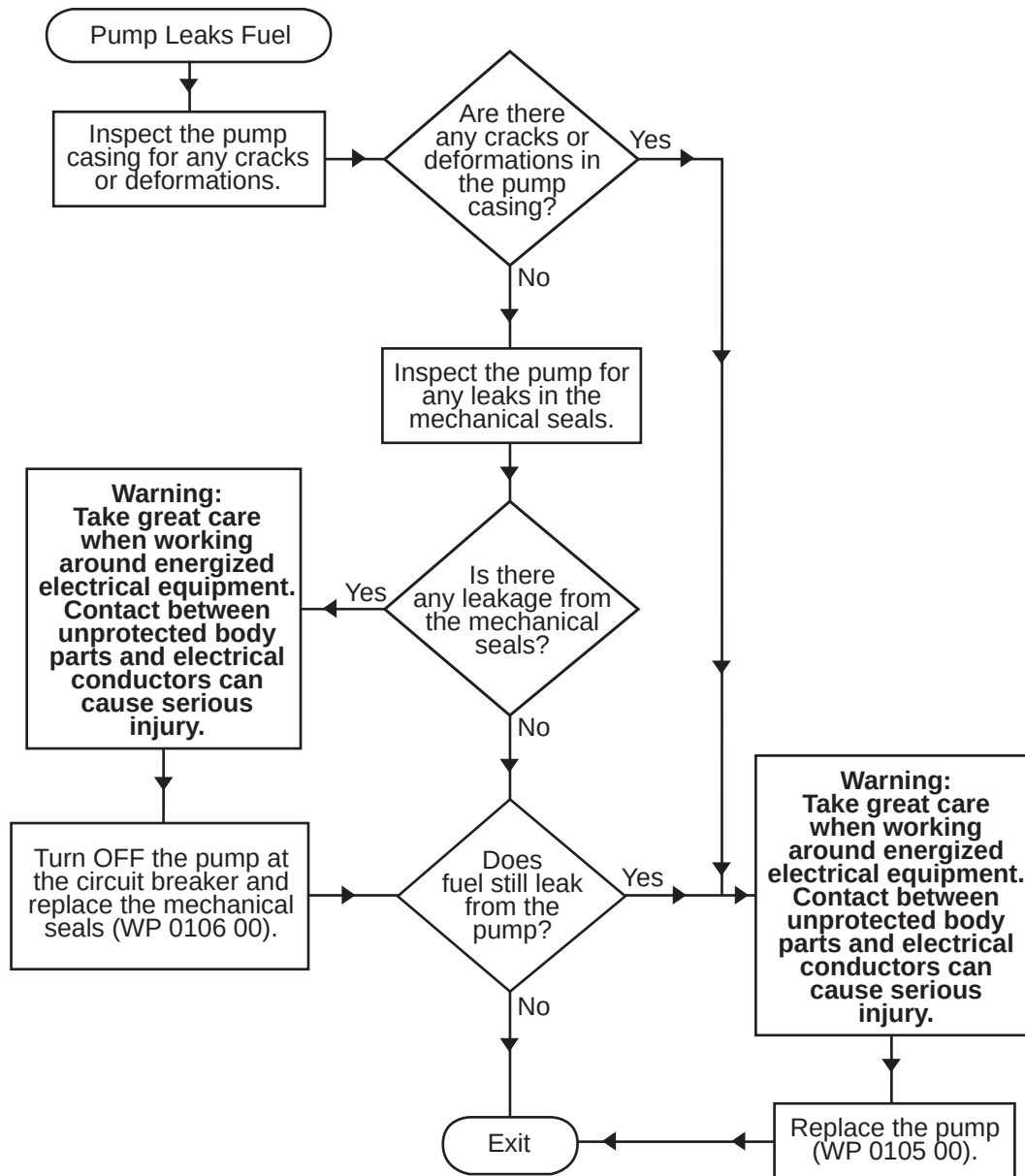
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Pump	1
Pump Does Not Deliver Any Liquid	2
Pump Leaks Fuel	3



Procedure 1. No Power to Pump



Procedure 2. Pump Does Not Deliver Any Liquid

**Procedure 3. Pump Leaks Fuel**

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
SEWAGE DISCHARGE PUMP**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0065 00
WP 0162 00
WP 0295 00 (volume 2)

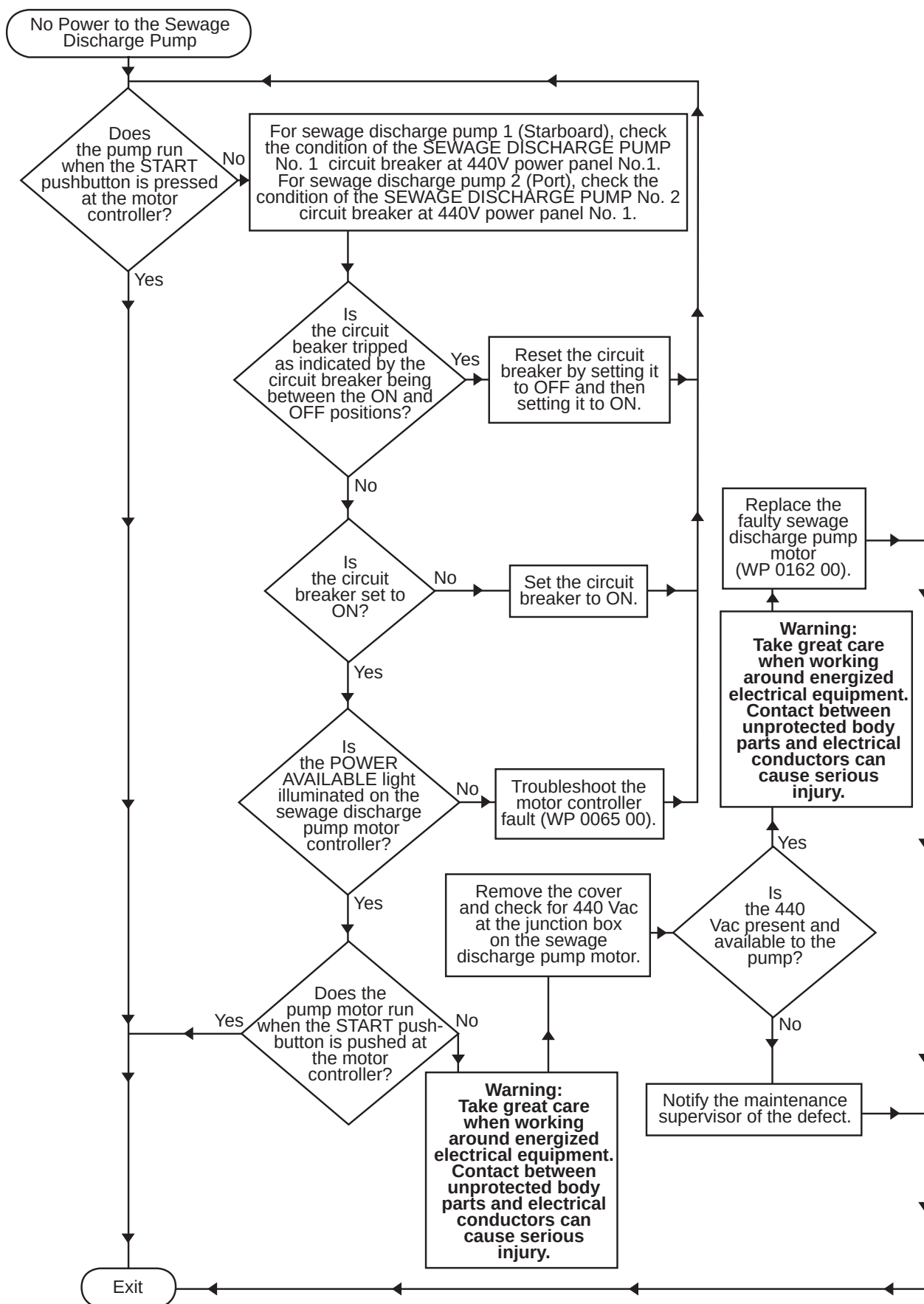
Personnel Required:

Two Watercraft Engineers, 88L

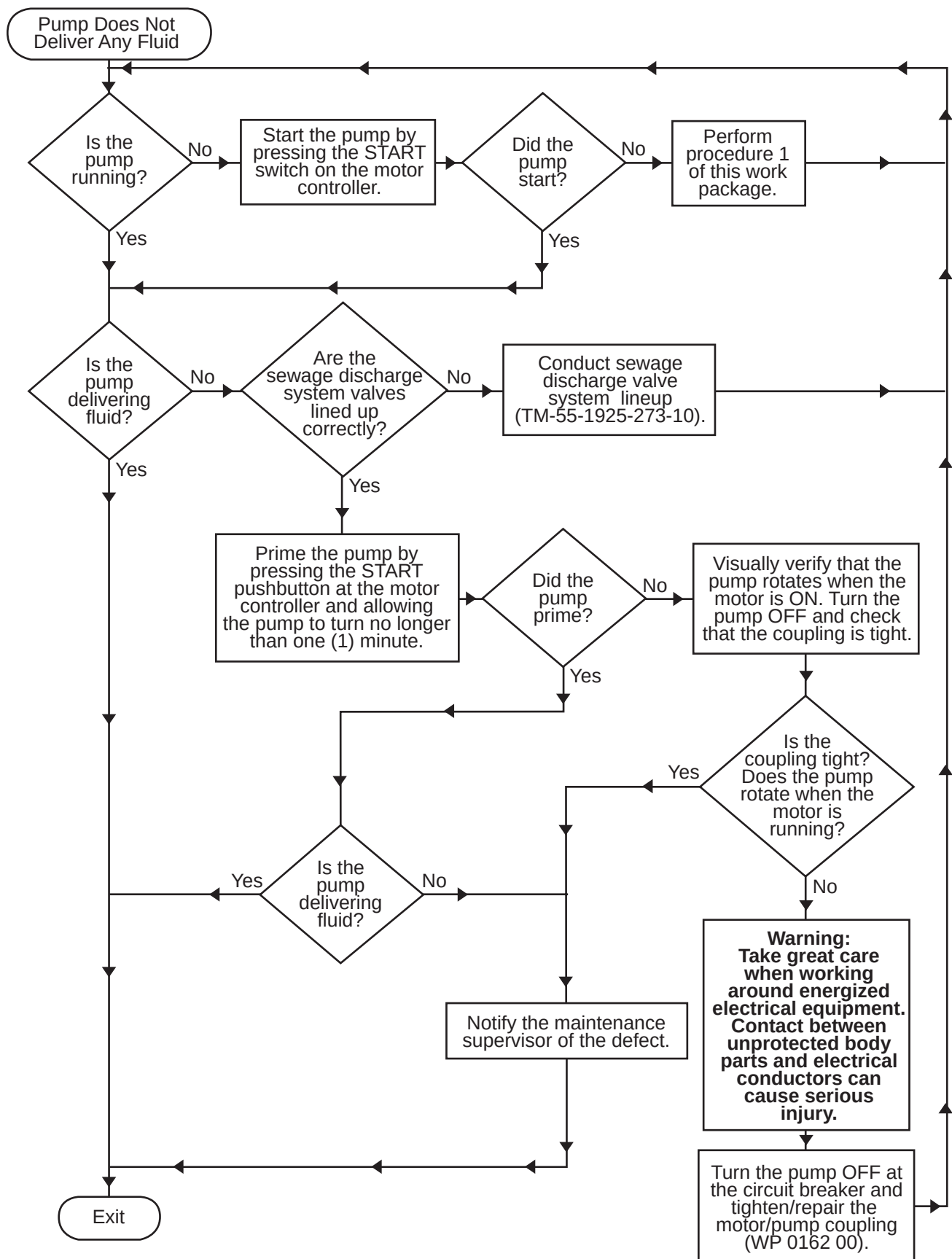
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

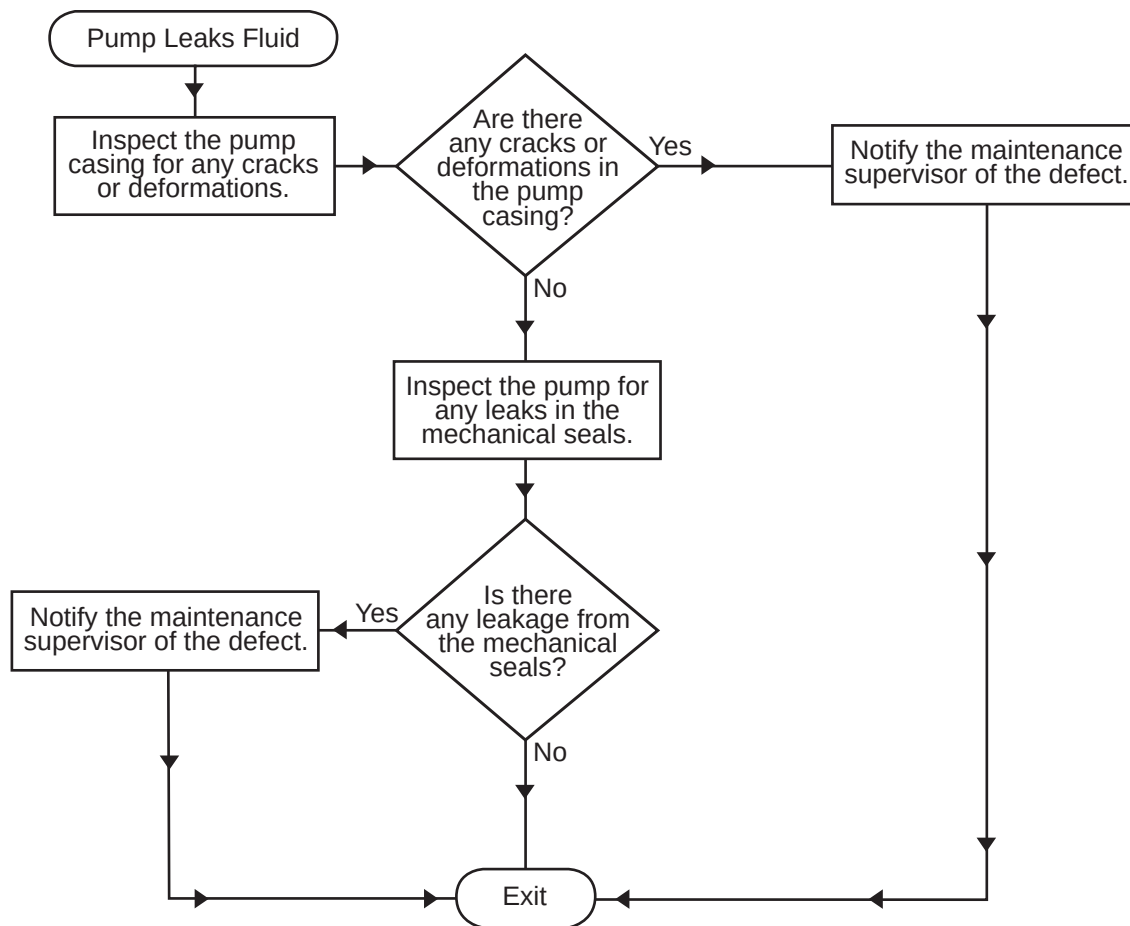
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to the Sewage Discharge Pump	1
Pump Does Not Deliver Any Fluid	2
Pump Leaks Fluid	3



Procedure 1. No Power to the Sewage Discharge Pump



Procedure 2. Pump Does Not Deliver Any Fluid

**Procedure 3. Pump Leaks Fluid**

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
OILY BILGE PUMP**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0165 00
WP 0166 00
WP 0295 00 (volume 2)

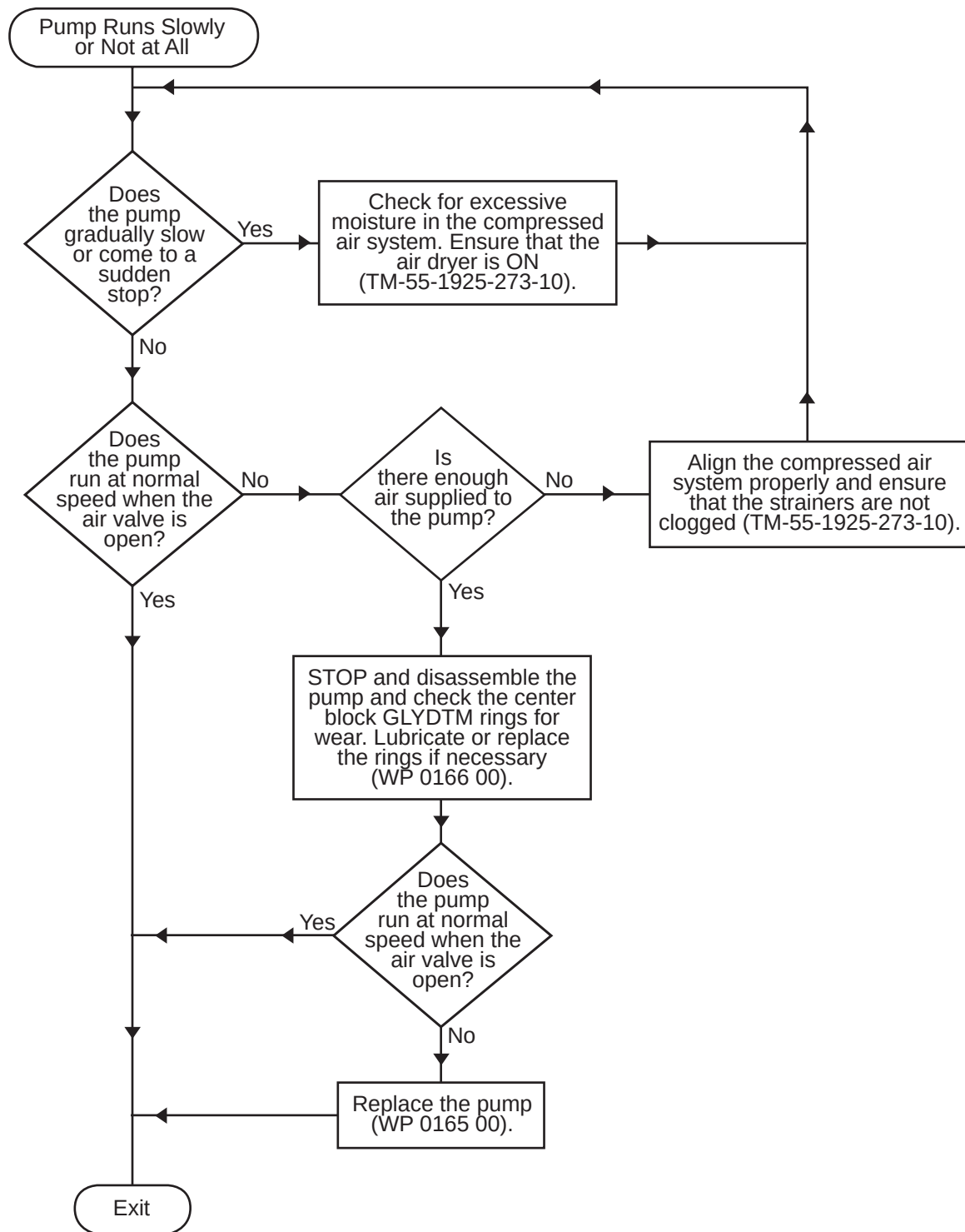
Personnel Required:

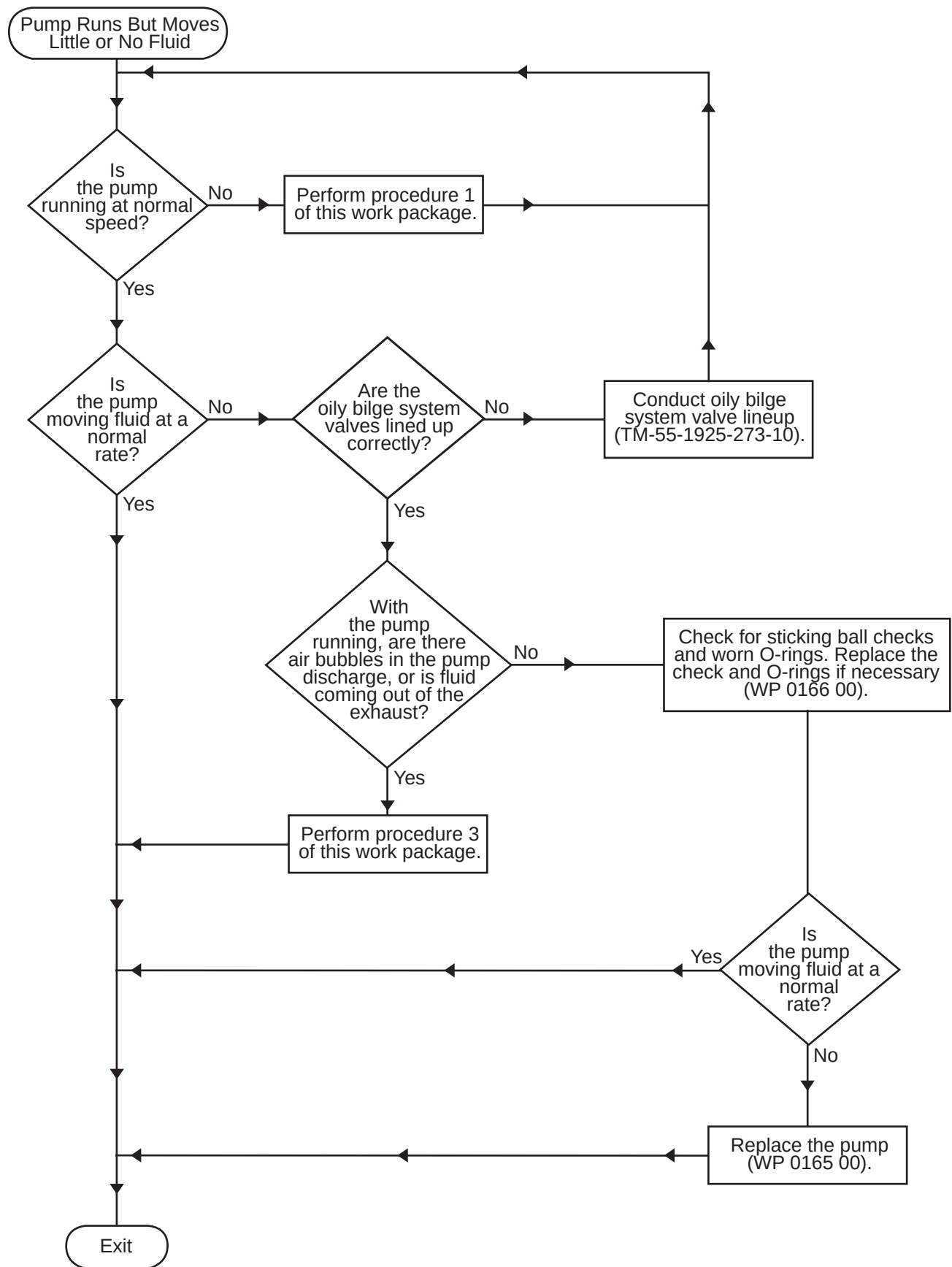
Two Watercraft Engineers, 88L

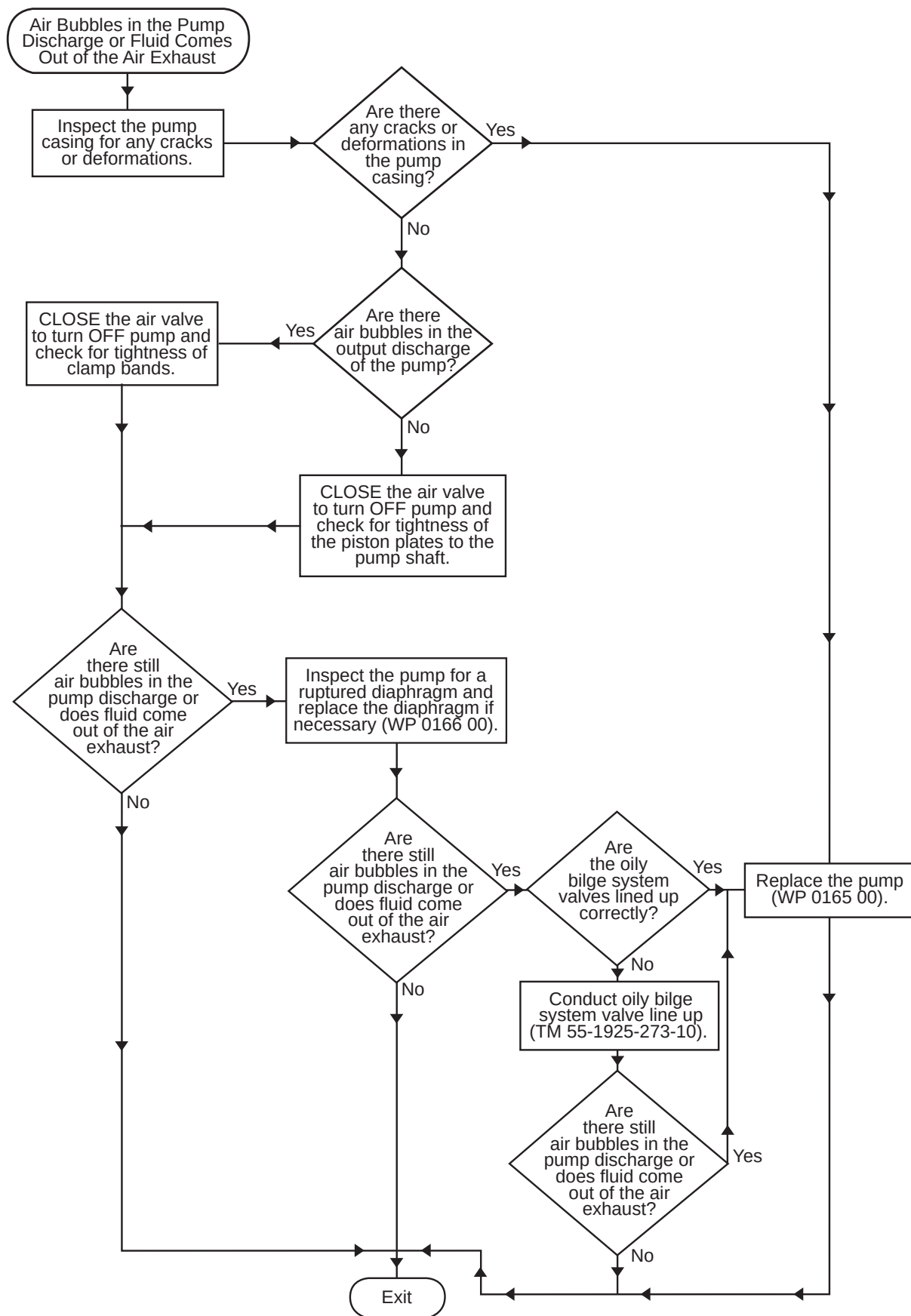
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Pump Runs Slowly or Not at All	1
Pump Runs But Moves Little or No Fluid	2
Air Bubbles in the Pump Discharge or Fluid Comes Out of the Air Exhaust	3

**Procedure 1. Pump Runs Slowly or Not at All**

**Procedure 2. Pump Runs But Moves Little or No Fluid**



Procedure 3. Air Bubbles in the Pump Discharge or Fluid Comes Out of the Air Exhaust

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

BILGE AND BALLAST PUMPS

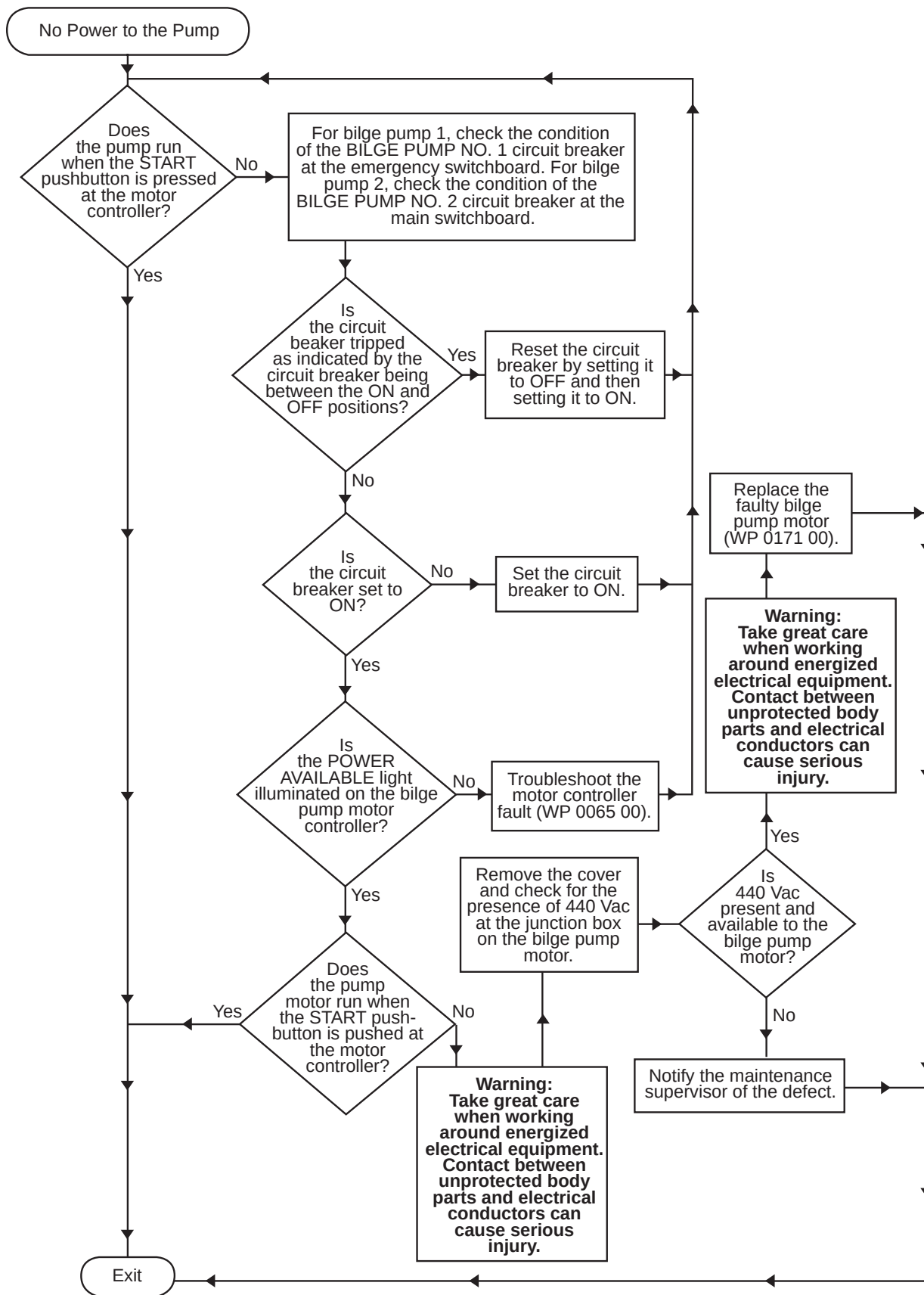
INITIAL SETUP:

Tools and Special Tools:	References:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)	TM 55-1925-273-10
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)	WP 0065 00
	WP 0169 00
	WP 0170 00
Personnel Required:	WP 0171 00
Two Watercraft Engineers, 88L	WP 0295 00 (volume 2)

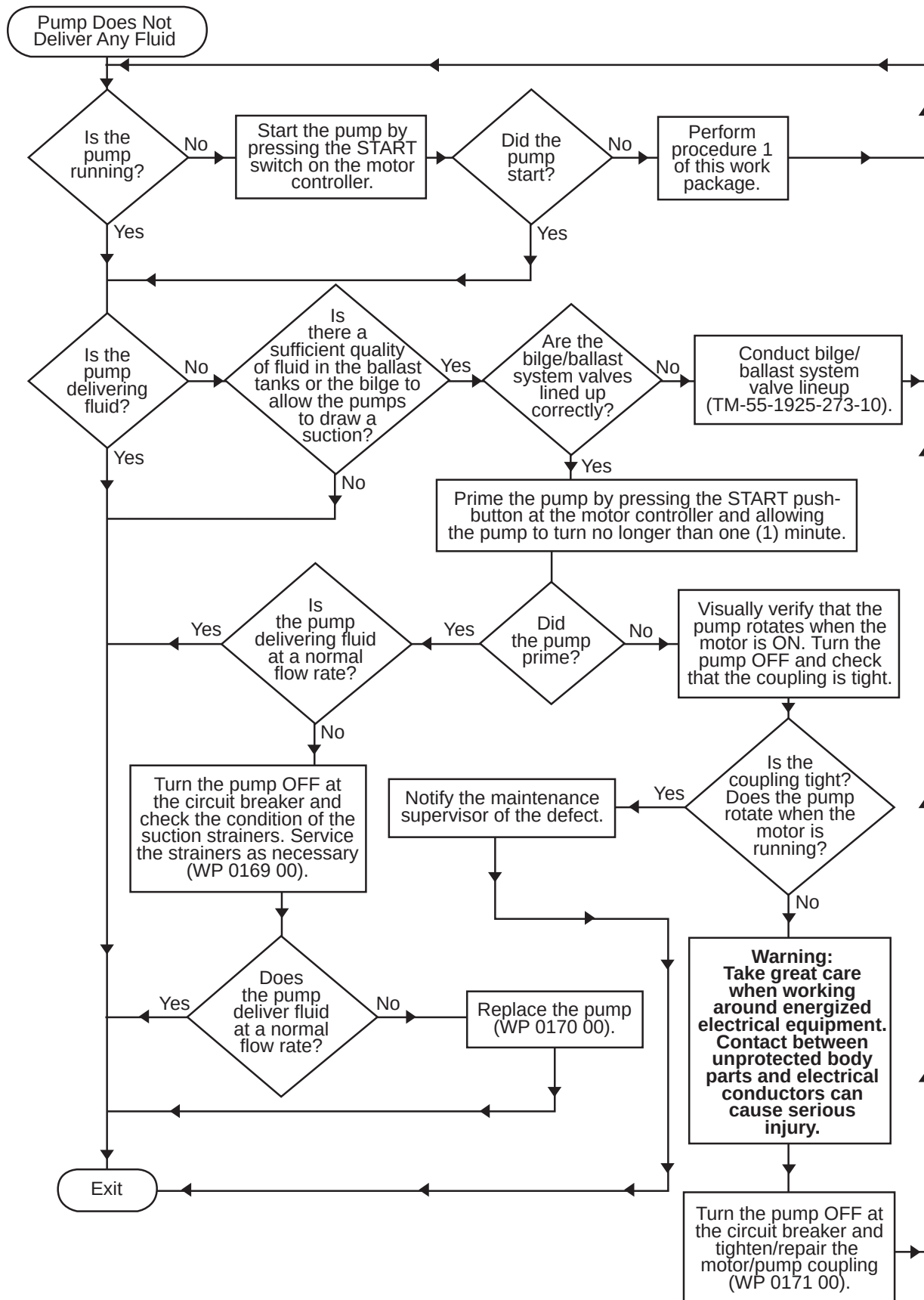
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

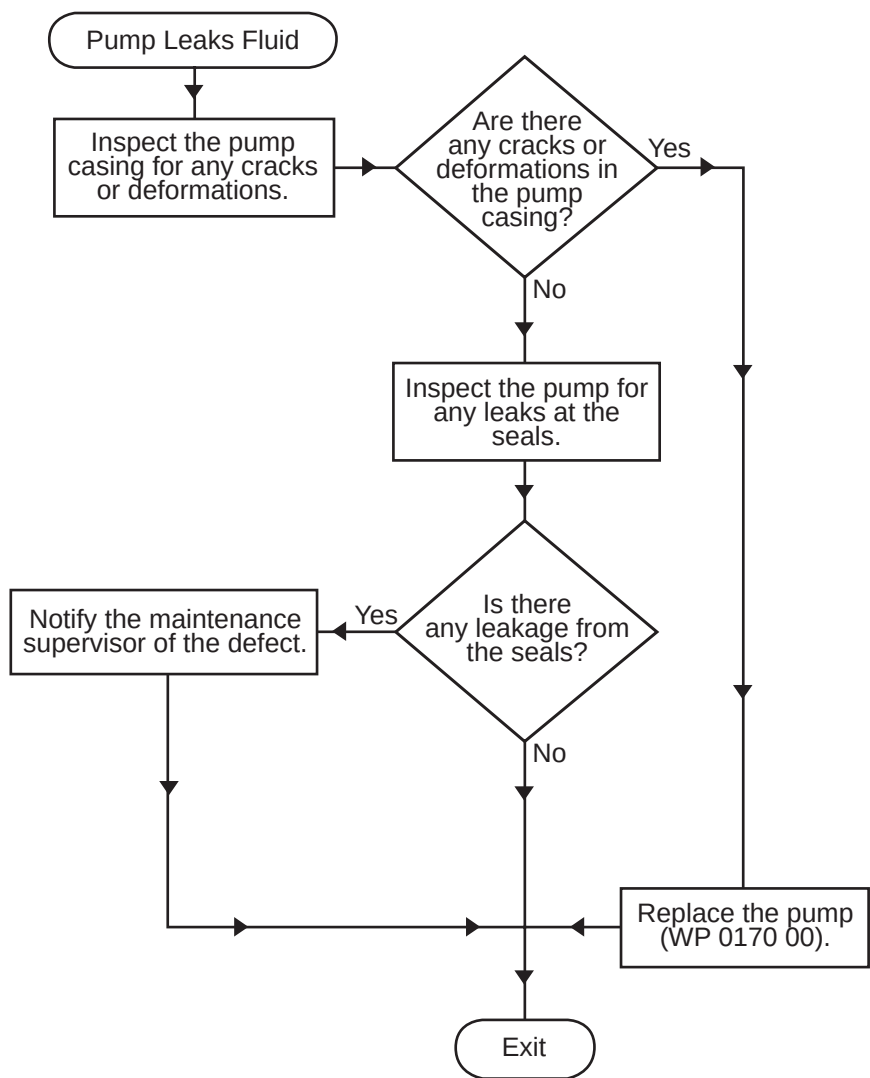
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to the Pump	1
Pump Does Not Deliver Any Fluid	2
Pump Leaks Fluid	3



Procedure 1. No Power to the Pump



Procedure 2. Pump Does Not Deliver Any Fluid



Procedure 3. Pump Leaks Fluid

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
POTABLE WATER PUMP**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0065 00
WP 0175 00
WP 0176 00
WP 0295 00 (volume 2)

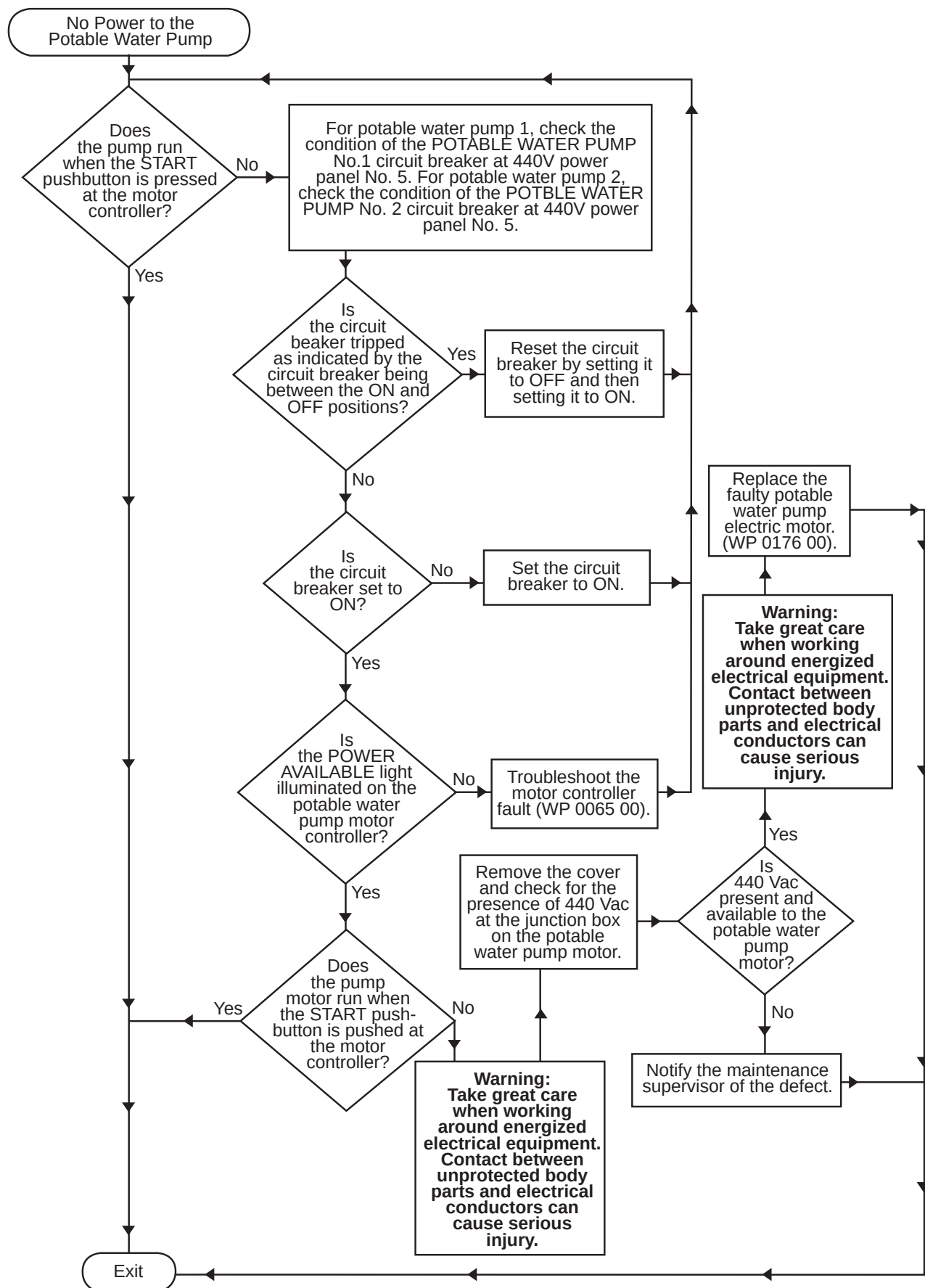
Personnel Required:

Two Watercraft Engineers, 88L

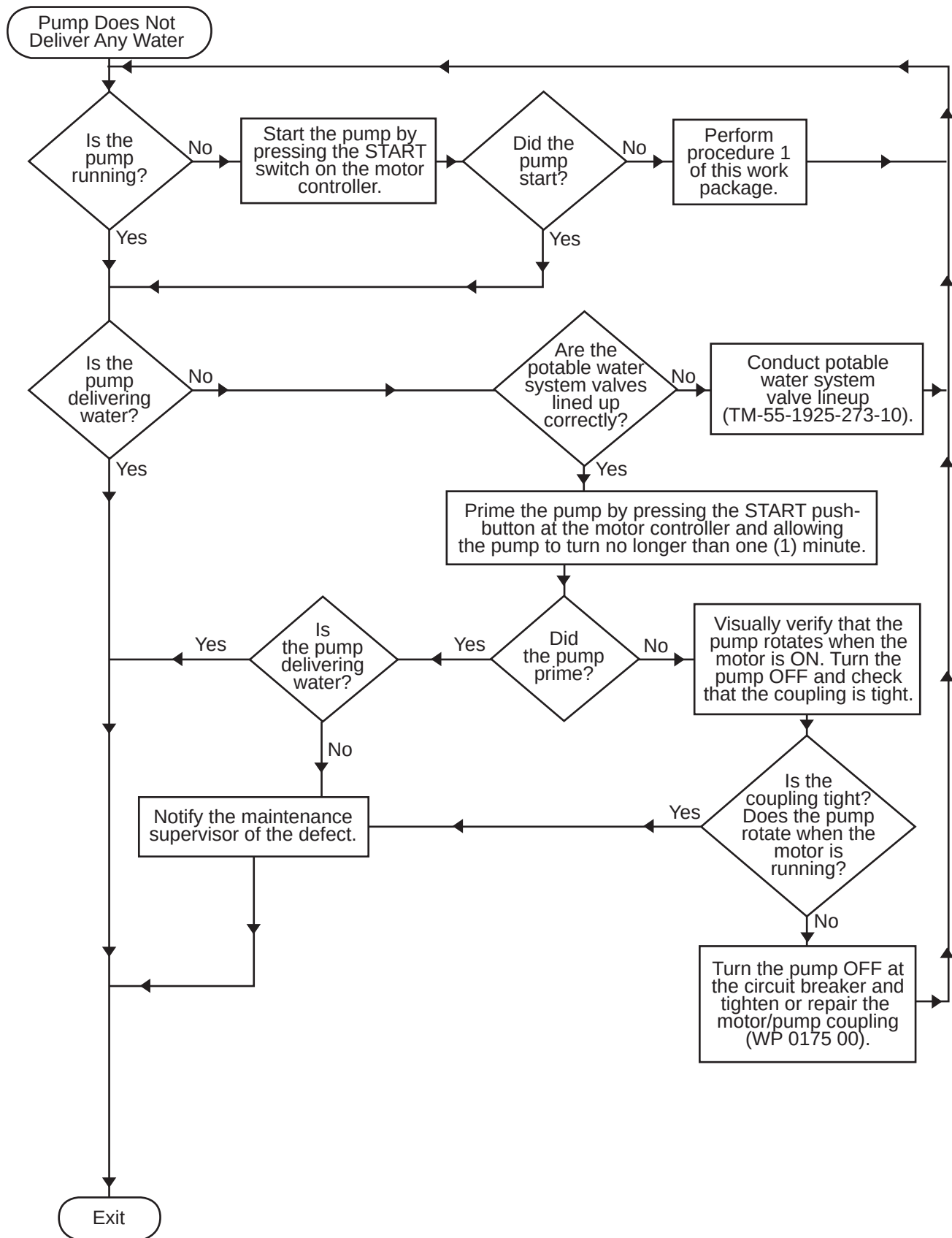
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

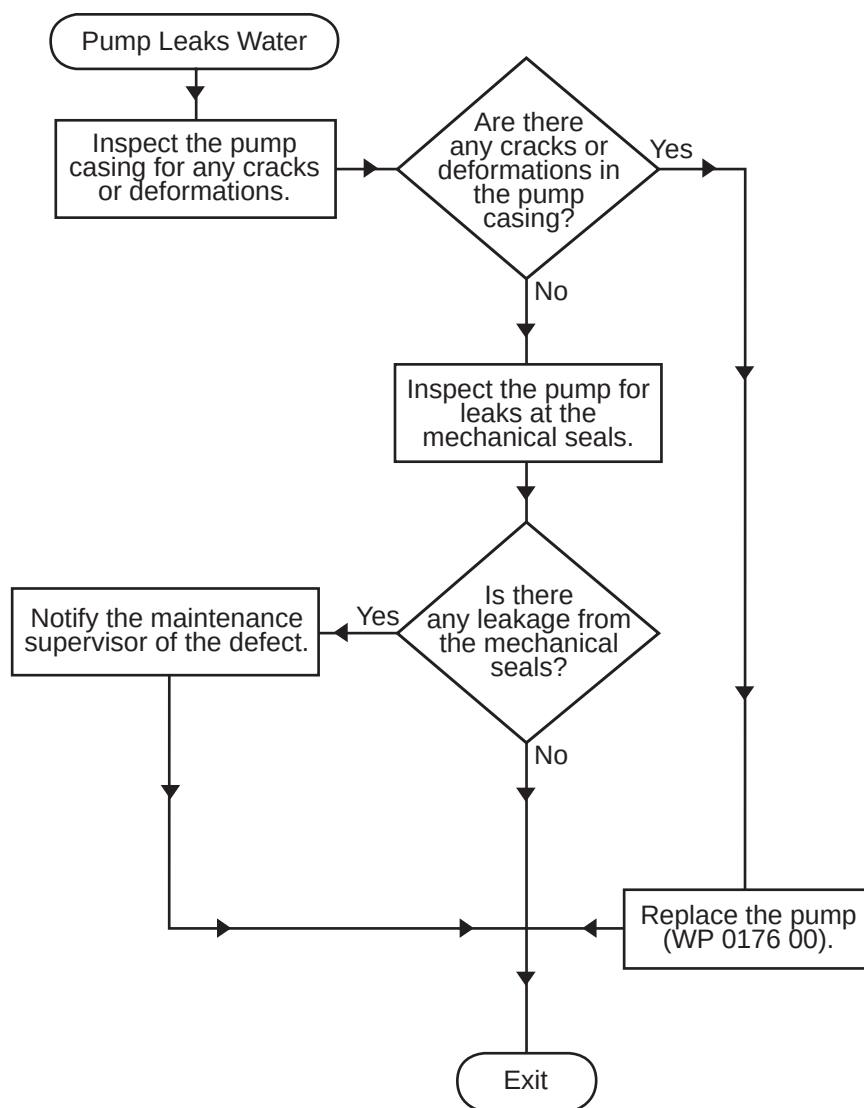
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to the Potable Water Pump	1
Pump Does Not Deliver Any Water	2
Pump Leaks Water	3



Procedure 1. No Power to the Potable Water Pump



Procedure 2. Pump Does Not Deliver Any Water

**Procedure 3. Pump Leaks Water**

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
HOT POTABLE WATER RECIRCULATION PUMP**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0065 00
WP 0185 00
WP 0295 00 (volume 2)

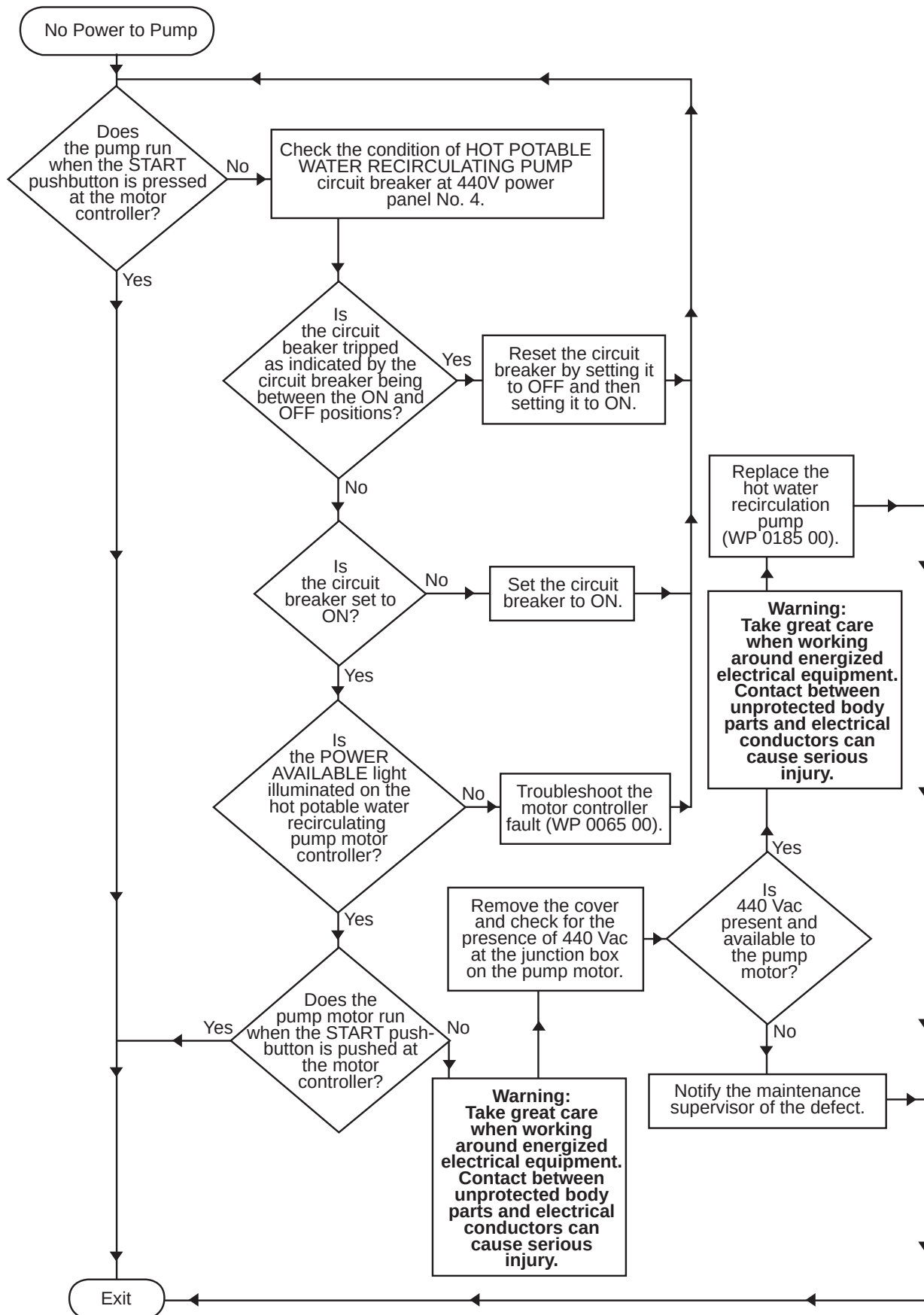
Personnel Required:

Two Watercraft Engineers, 88L

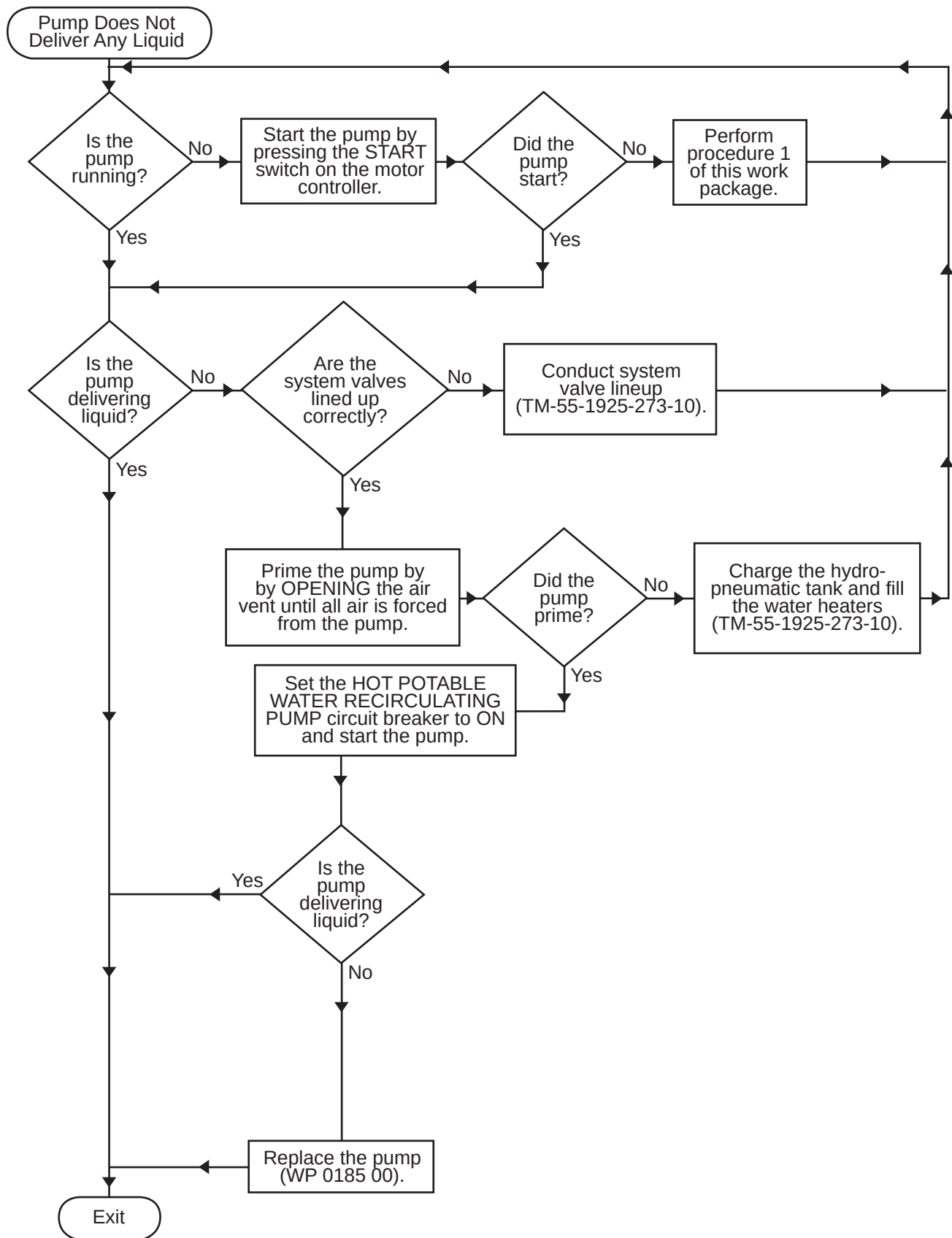
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

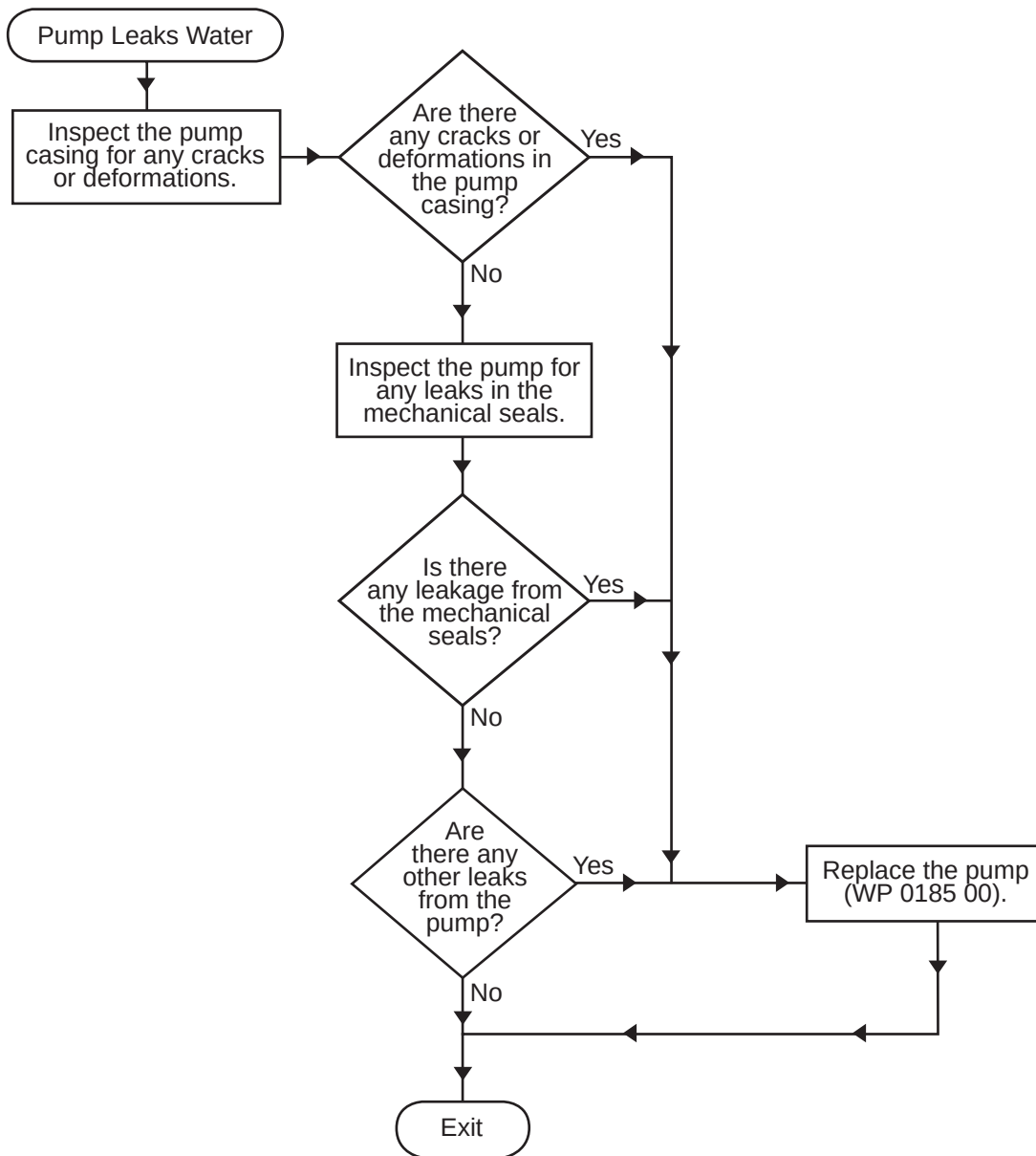
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Pump	1
Pump Does Not Deliver Any Liquid	2
Pump Leaks Water	3



Procedure 1. No Power to Pump



Procedure 2. Pump Does Not Deliver Any Liquid



Procedure 3. Pump Leaks Water

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
FIRE AND GENERAL SERVICE PUMP**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0065 00
WP 0188 00
WP 0295 00 (volume 2)

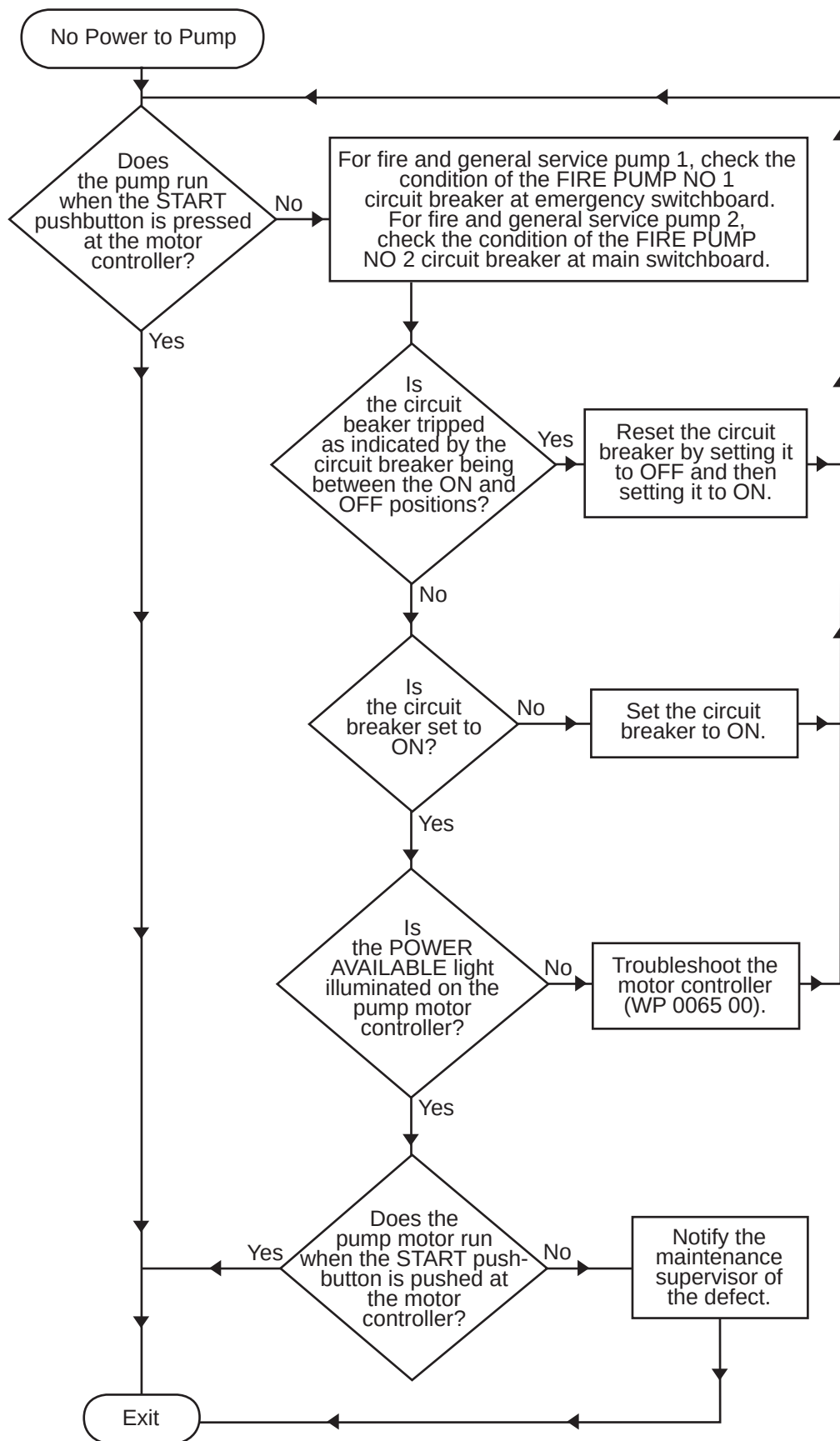
Personnel Required:

Two Watercraft Engineers, 88L

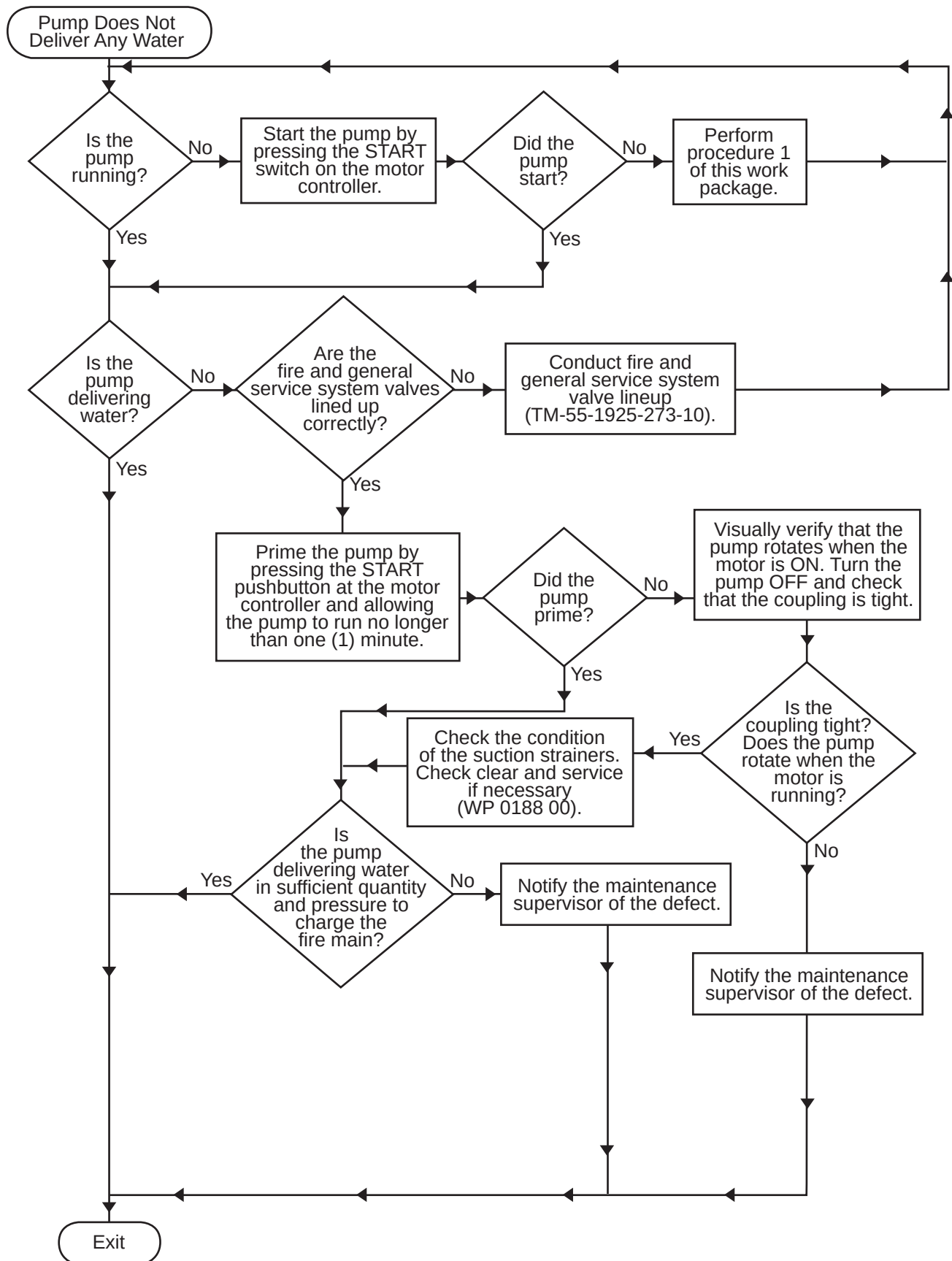
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

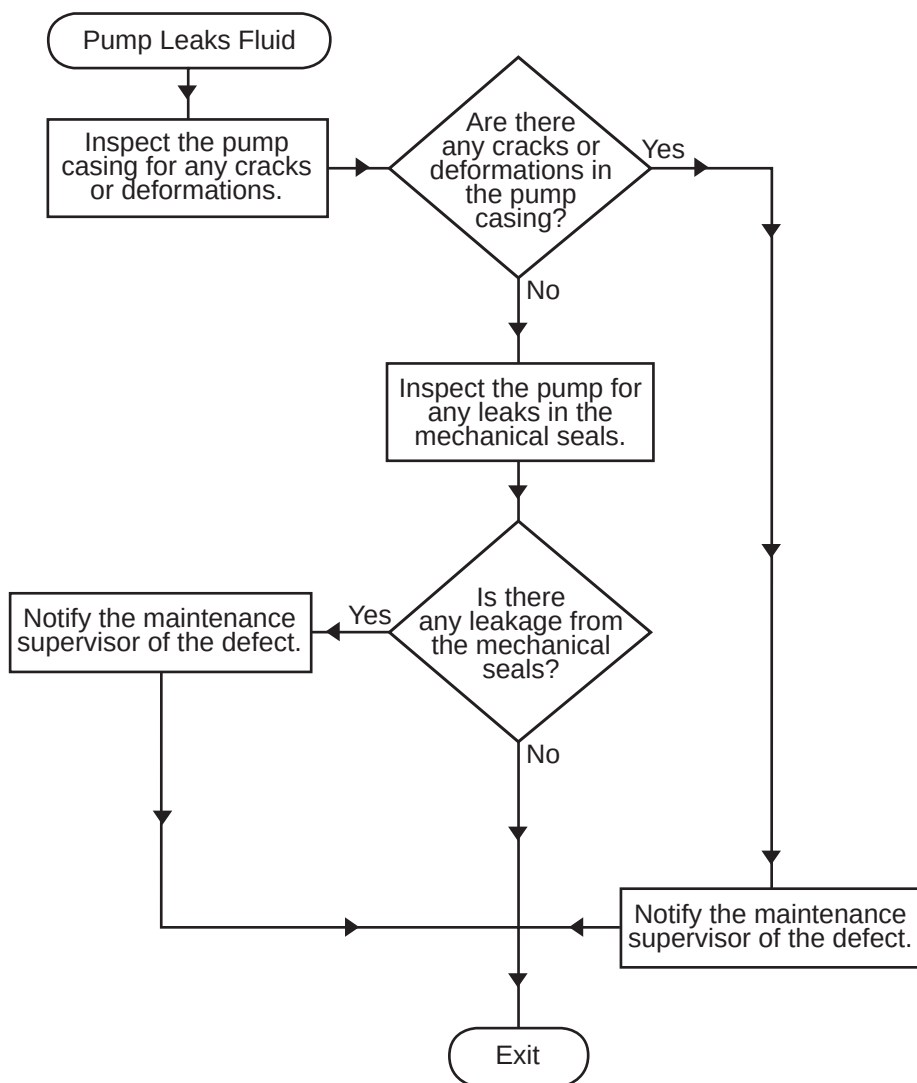
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to the Pump	1
Pump Does Not Deliver Any Water	2
Pump Leaks Fluid	3



Procedure 1. No Power to the Pump



Procedure 2. Pump Does Not Deliver Any Water

**Procedure 3. Pump Leaks Fluid**

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

PORTABLE ELECTRIC PUMP

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician’s (Item 11, Table 2, WP 0295 00,
Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0189 00
WP 0295 00 (volume 2)

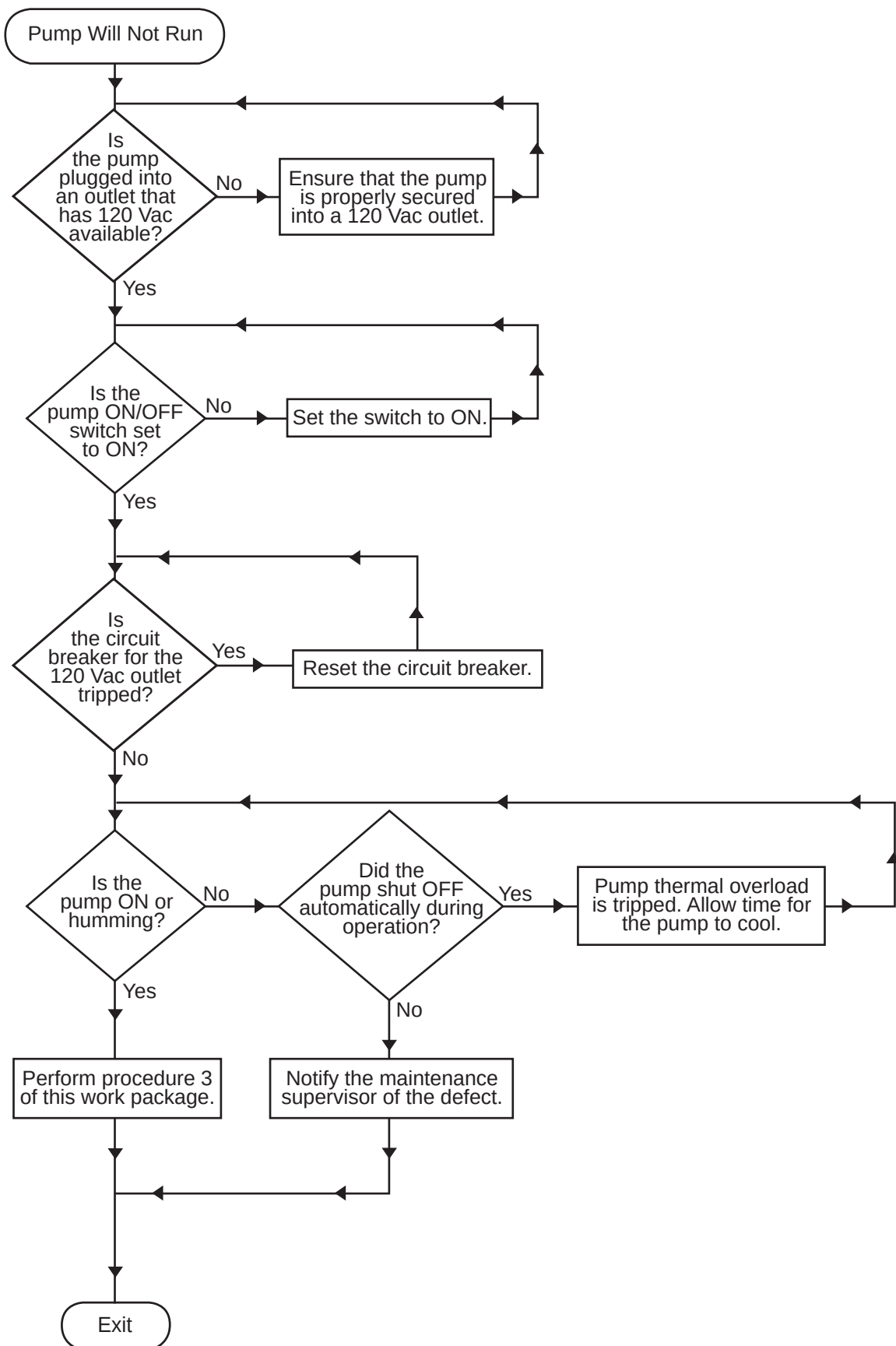
Personnel Required:

Two Watercraft Engineers, 88L

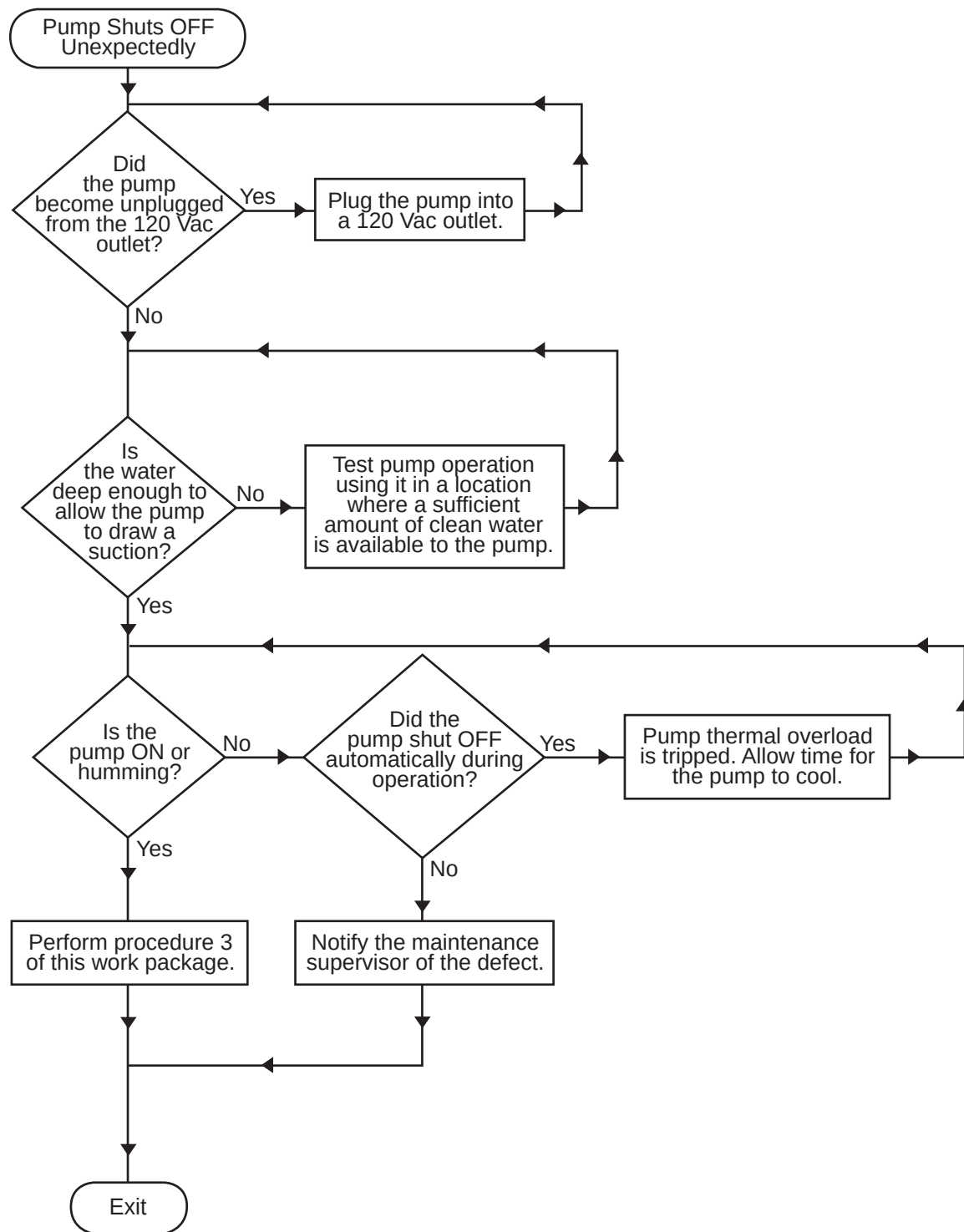
INTRODUCTION

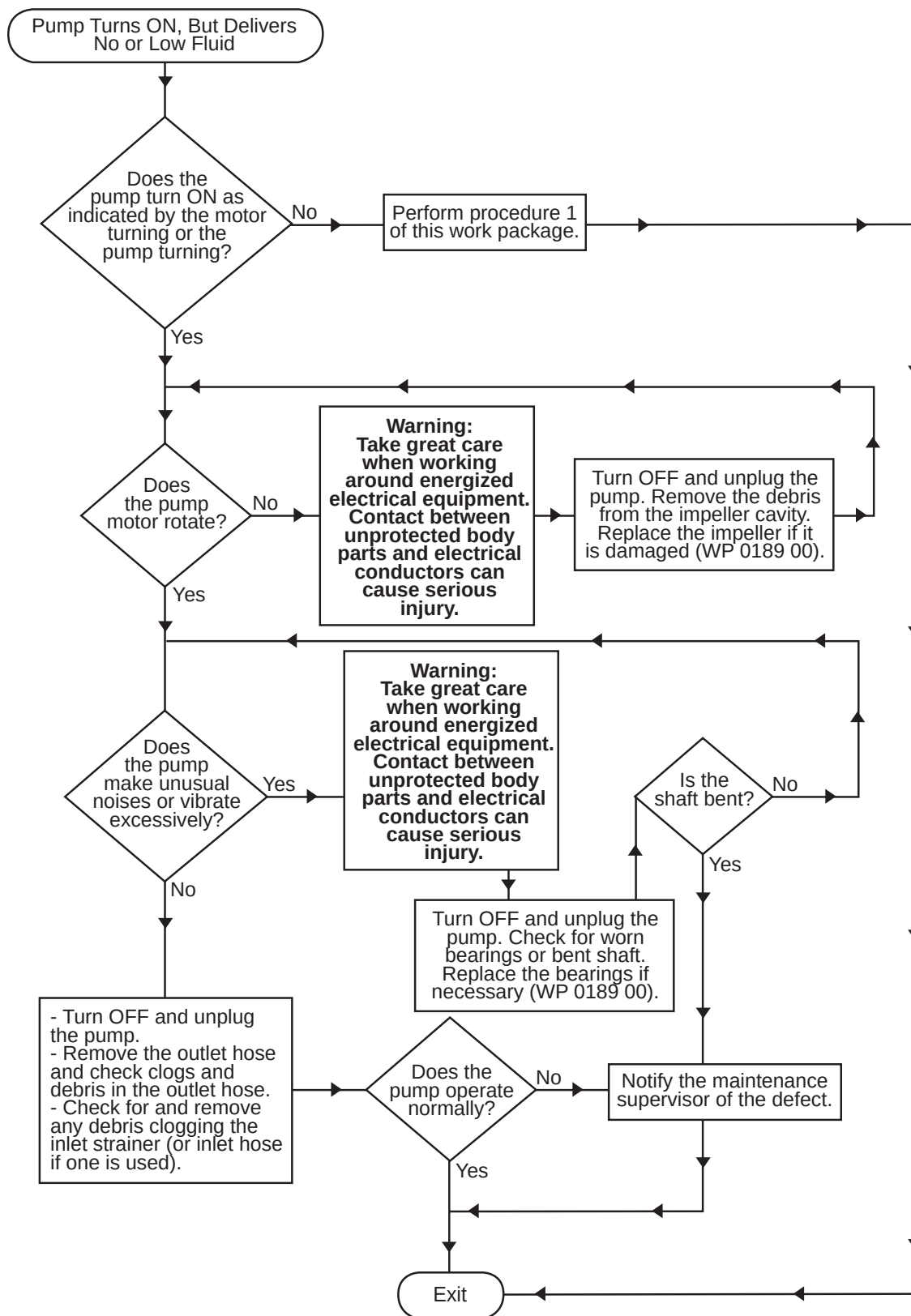
The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Pump Will Not Run	1
Pump Shuts OFF Unexpectedly	2
Pump Turns ON, But Delivers No or Low Fluid	3



Procedure 1. Pump Will Not Run

**Procedure 2. Pump Shuts OFF Unexpectedly**



Procedure 3. Pump Turns ON, But Delivers No or Low Fluid

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
FUEL OIL FILTER/WATER SEPARATOR**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References:

WP 0108 00
WP 0109 00
WP 0295 00 (volume 2)

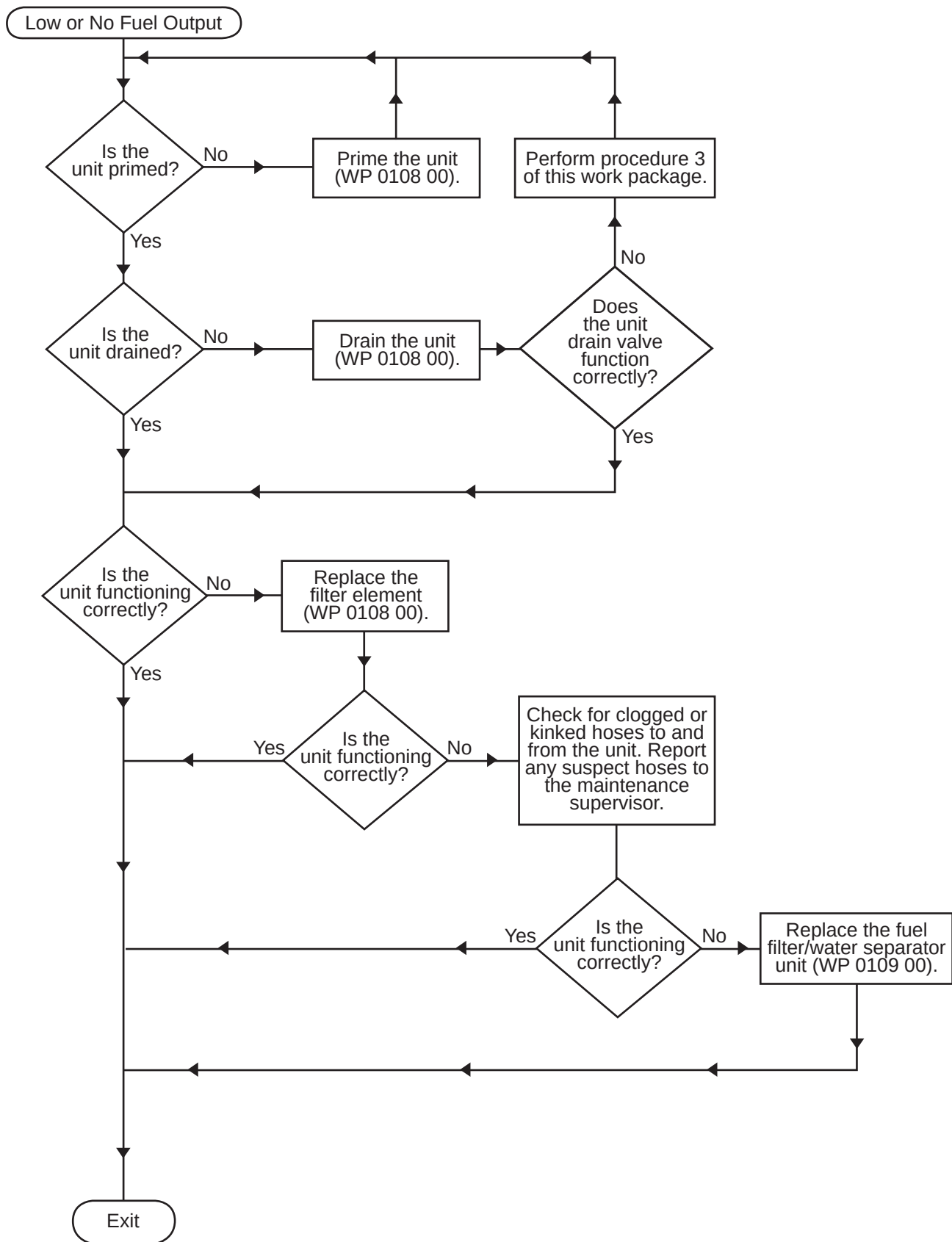
Personnel Required:

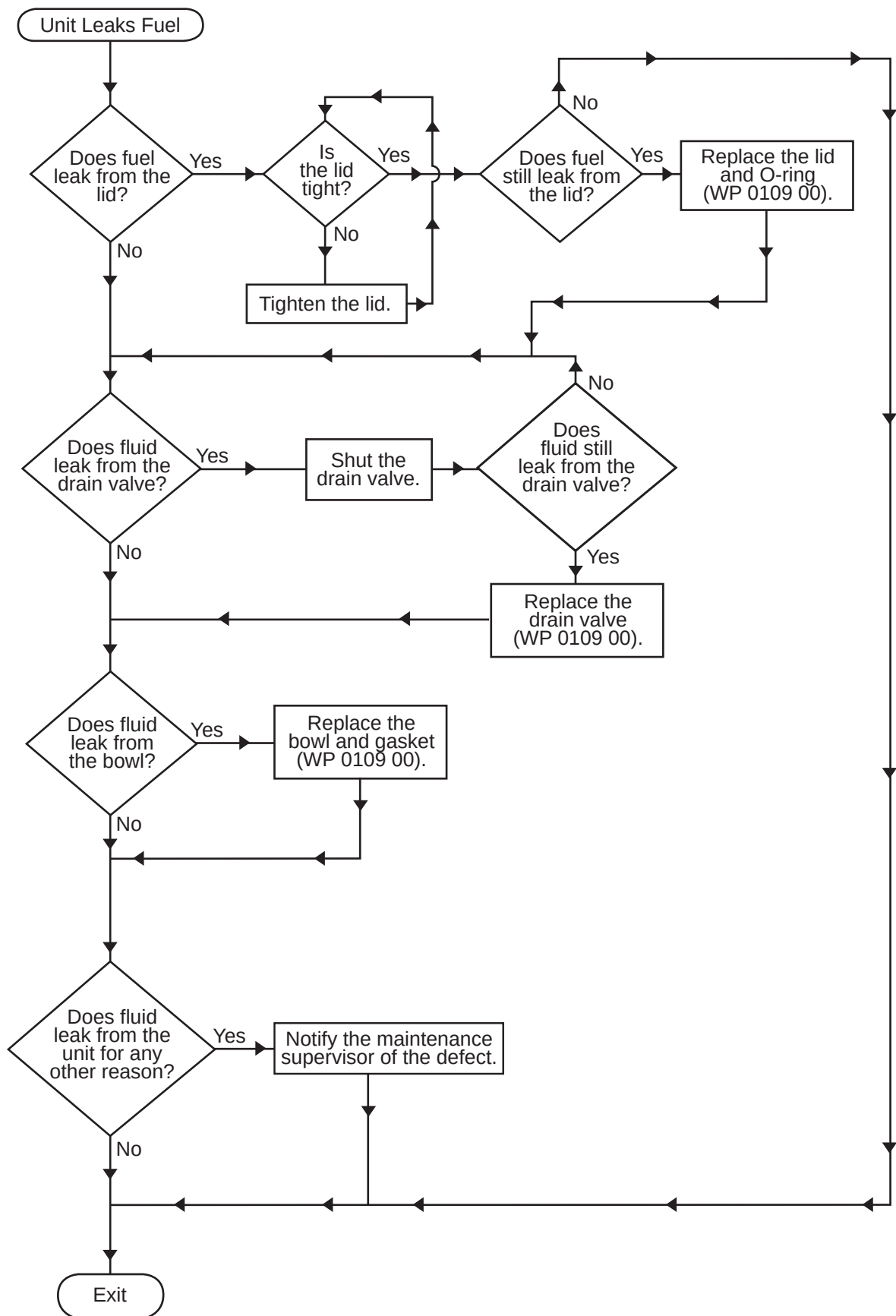
Two Watercraft Engineers, 88L

INTRODUCTION

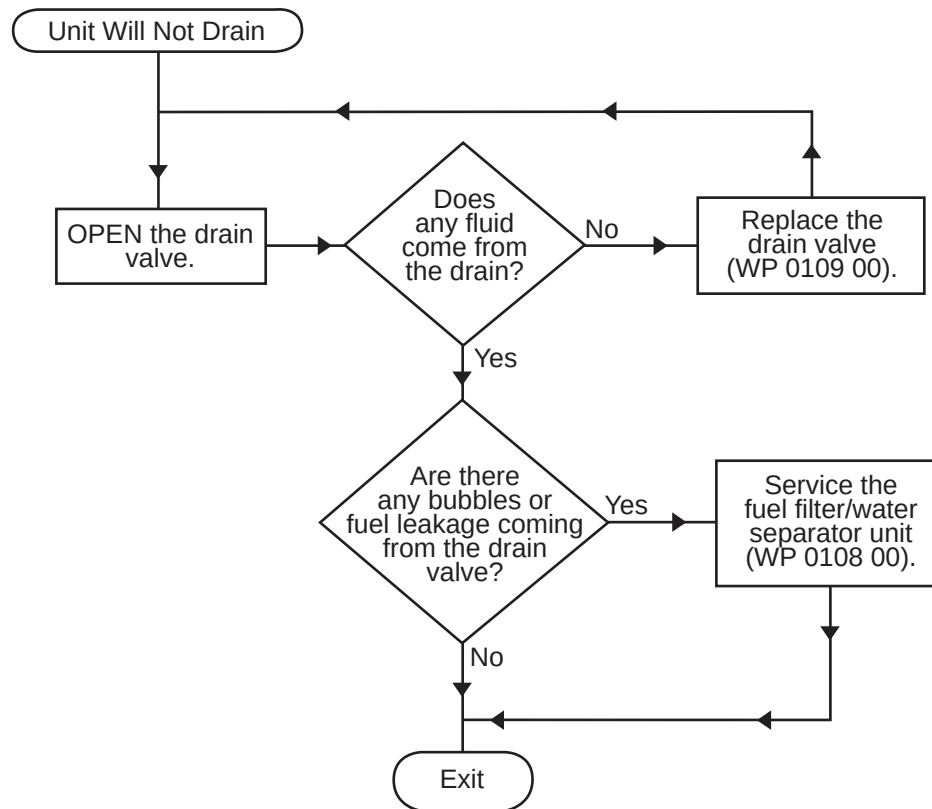
The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
No or Low Fuel Output	1
Unit Leaks Fuel	2
Unit Will Not Drain	3

**Procedure 1. No or Low Fuel Output**



Procedure 2. Unit Leaks Fuel

**Procedure 3. Unit Will Not Drain****END OF WORK PACKAGE**

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

TANK LEVEL INDICATORS

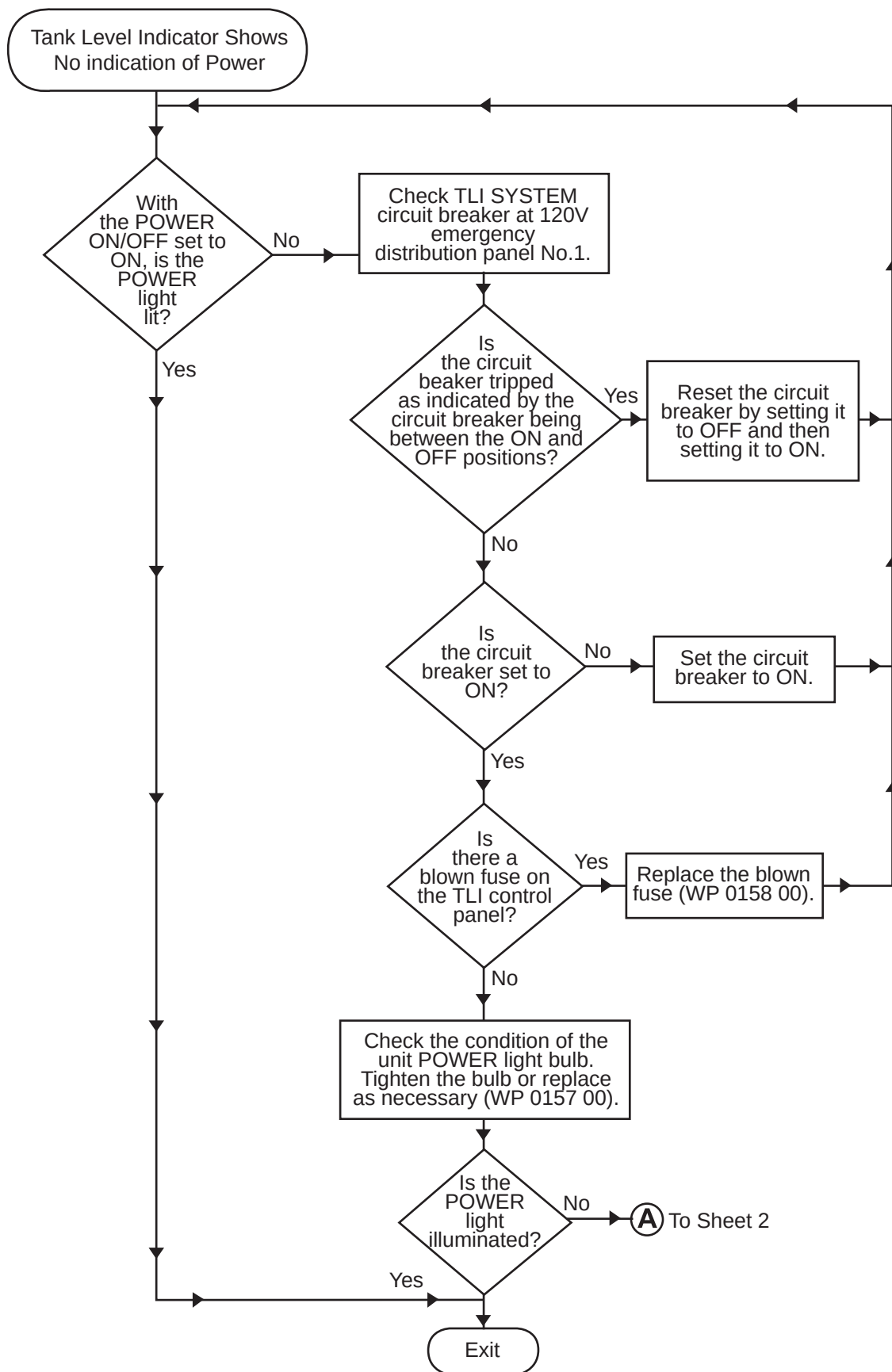
INITIAL SETUP:

Tools and Special Tools:	References:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00)	WP 0156 00
Multimeter (Item 16, Table 2, WP 0295 00)	WP 0157 00
	WP 0158 00
	WP 0295 00
Personnel Required:	
Two Watercraft Engineers, 88L	

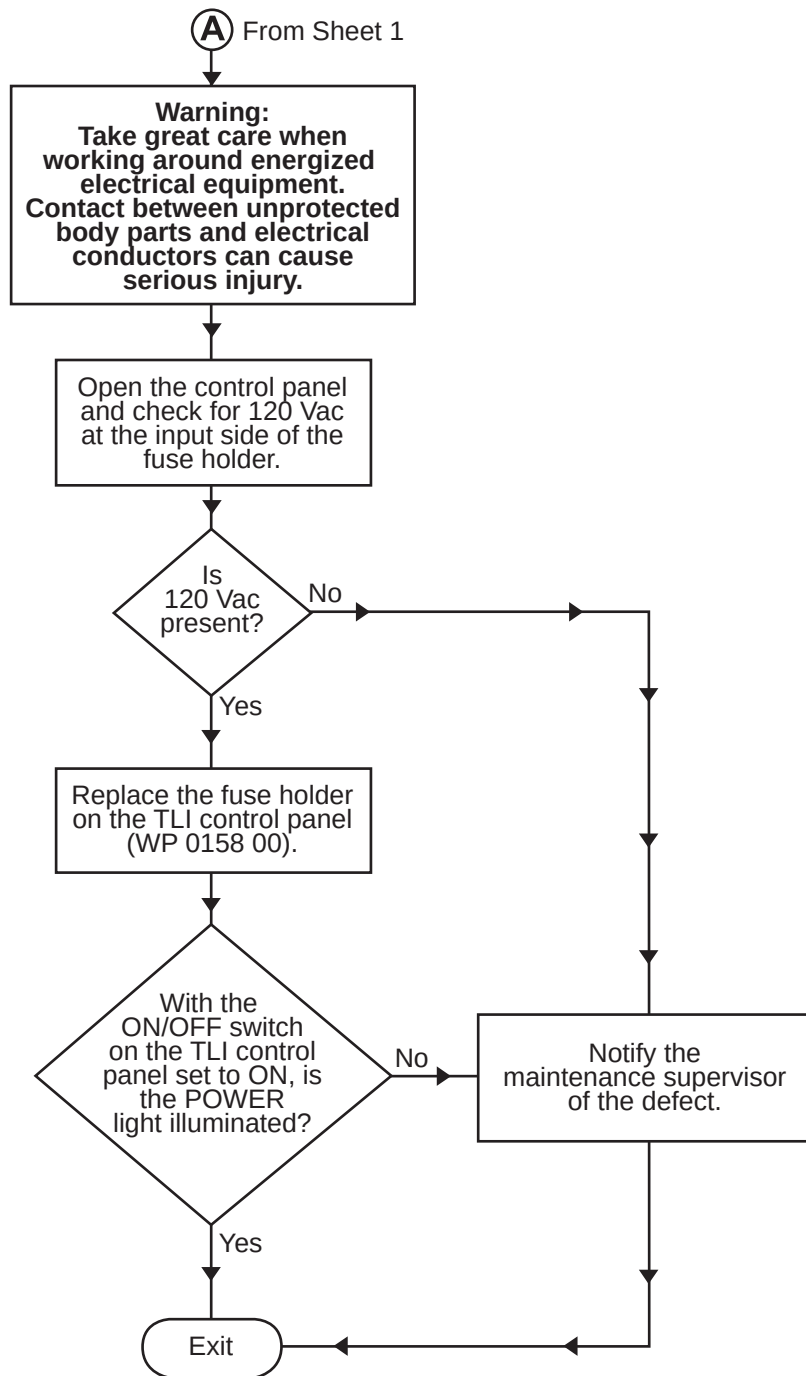
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

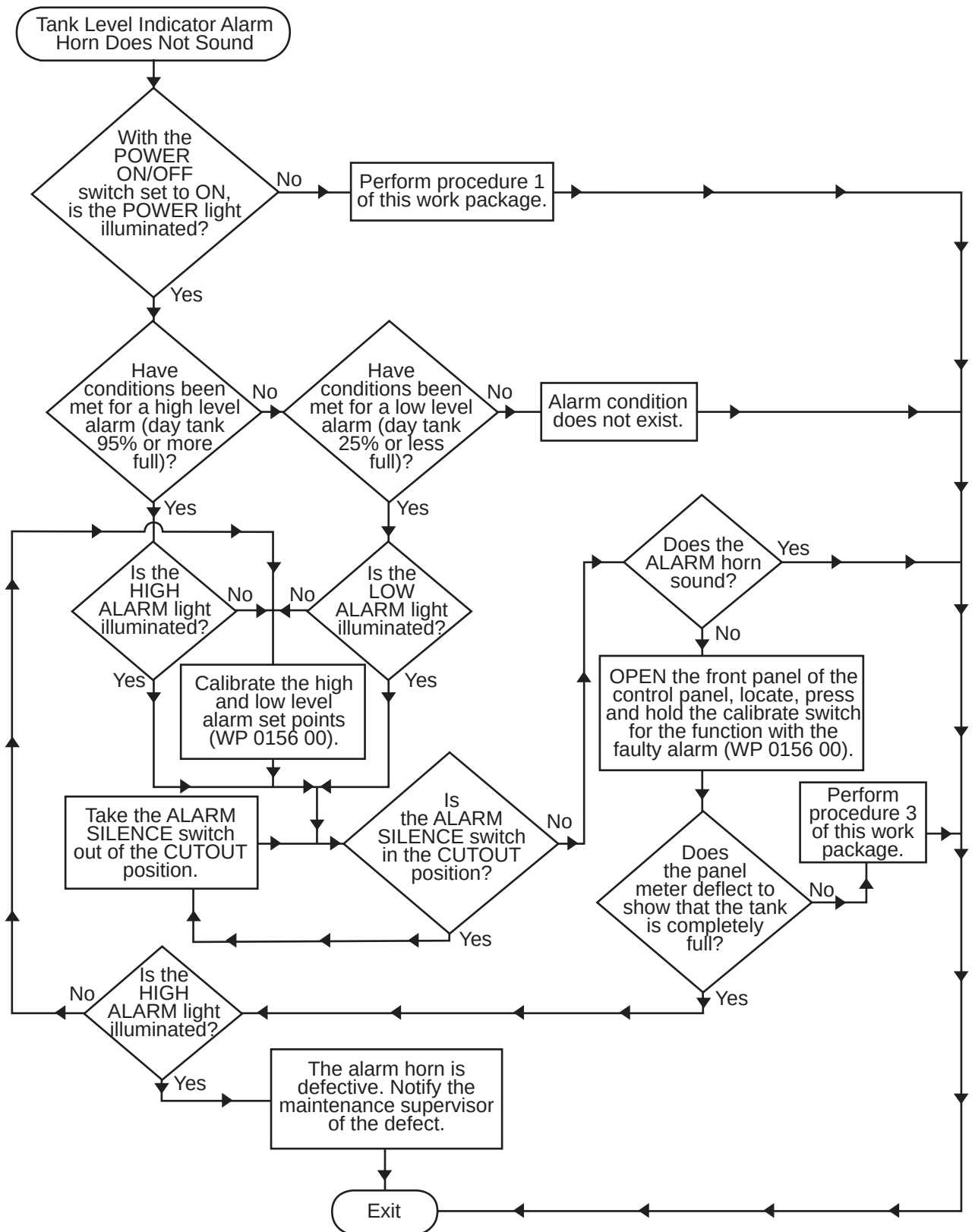
<u>Malfunction/Symptom</u>	<u>Procedure</u>
Tank Level Indicator Shows No Indication of Power	1
Tank Level Indicator Alarm Horn Does Not Sound	2
Tank Level Indicator Control Panel Meter Does Not Deflect Correctly	3
Tank Level Indicator Remote Meter Does Not Follow the Control Panel Meter	4
No Level Change Indicated on Meter When Tank Level Changes	5



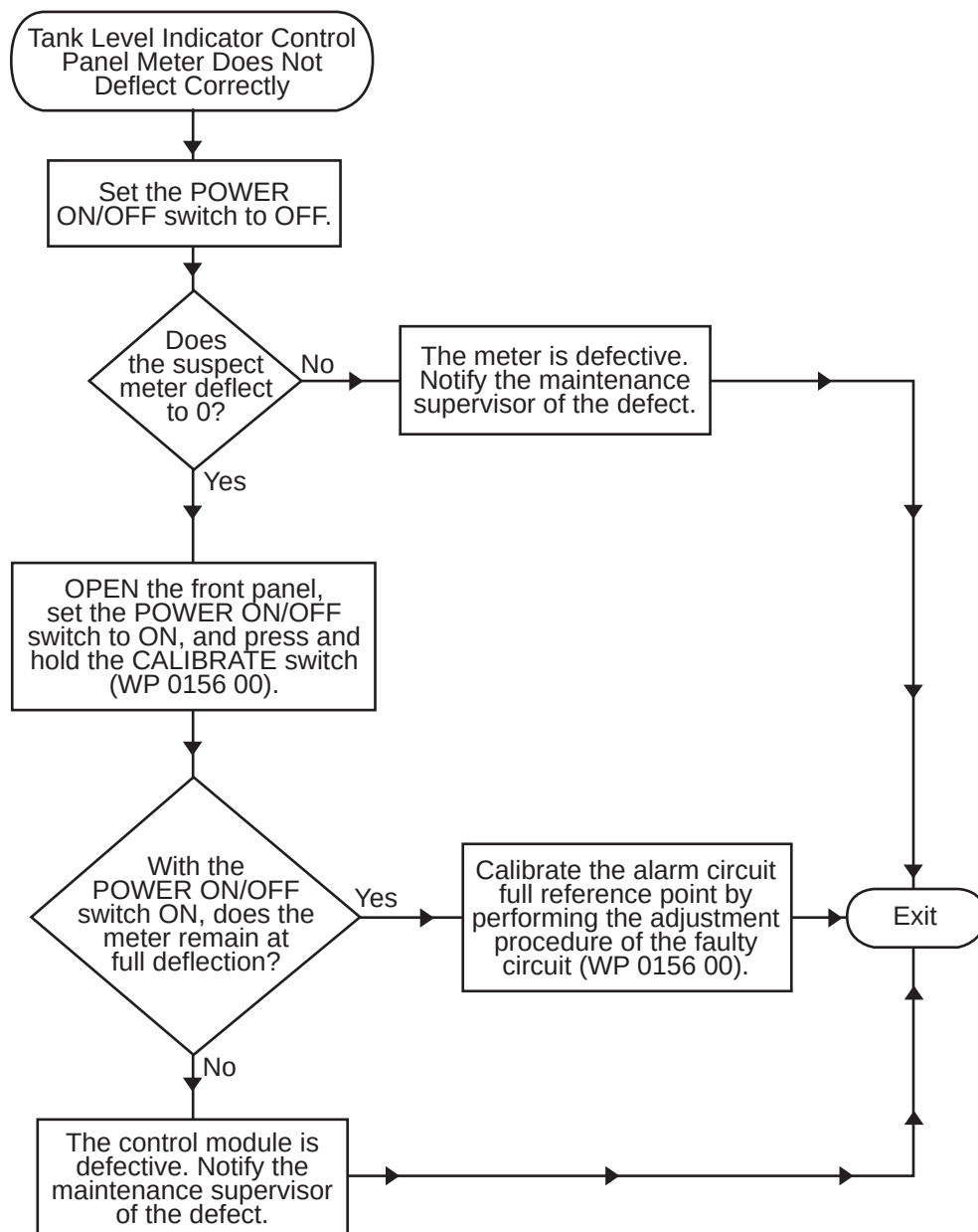
Procedure 1. Tank Level Indicator Shows No Indication Of Power (Sheet 1 of 2)



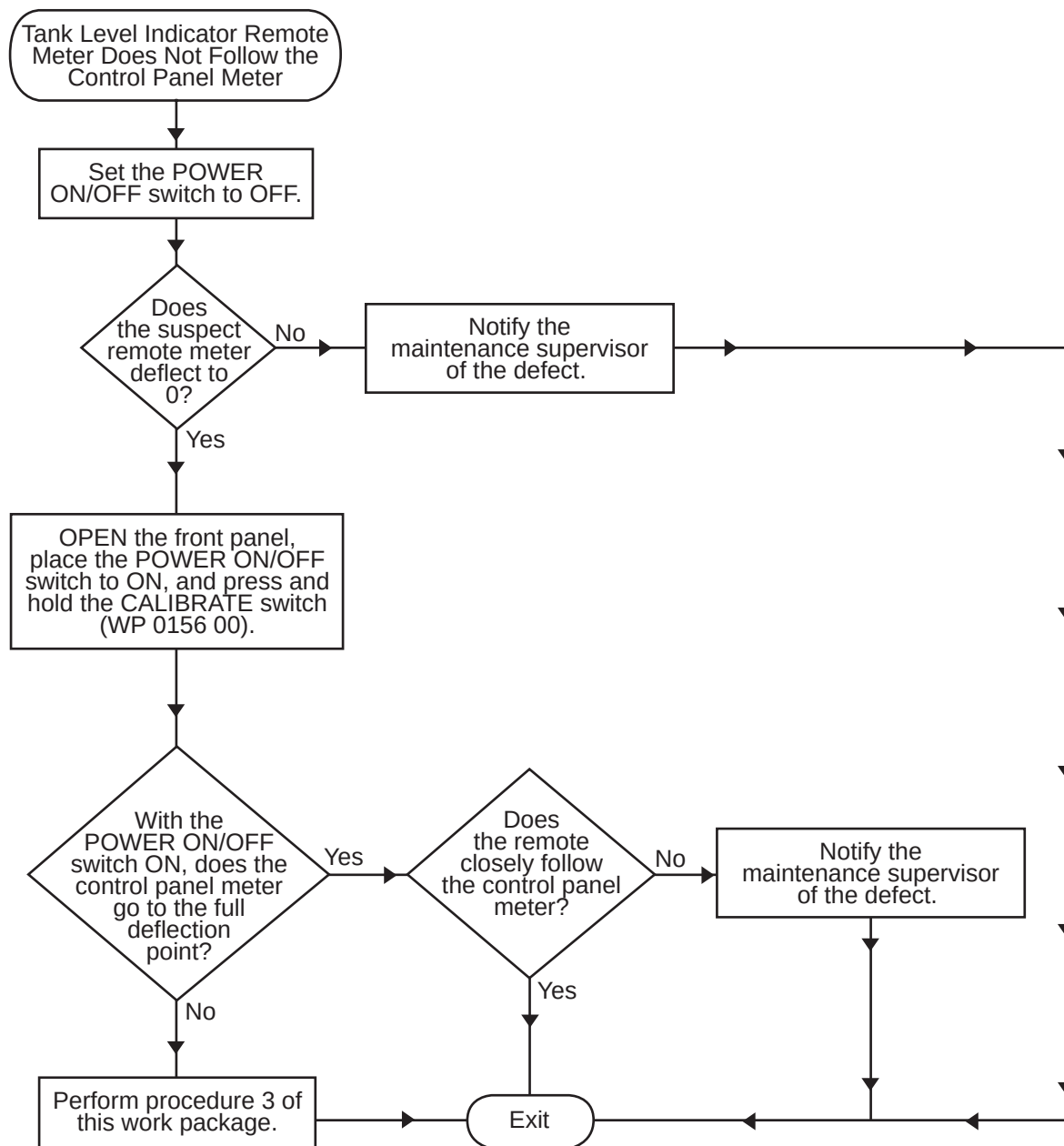
Procedure 1. Tank Level Indicator Shows No Indication Of Power (Sheet 2 of 2)

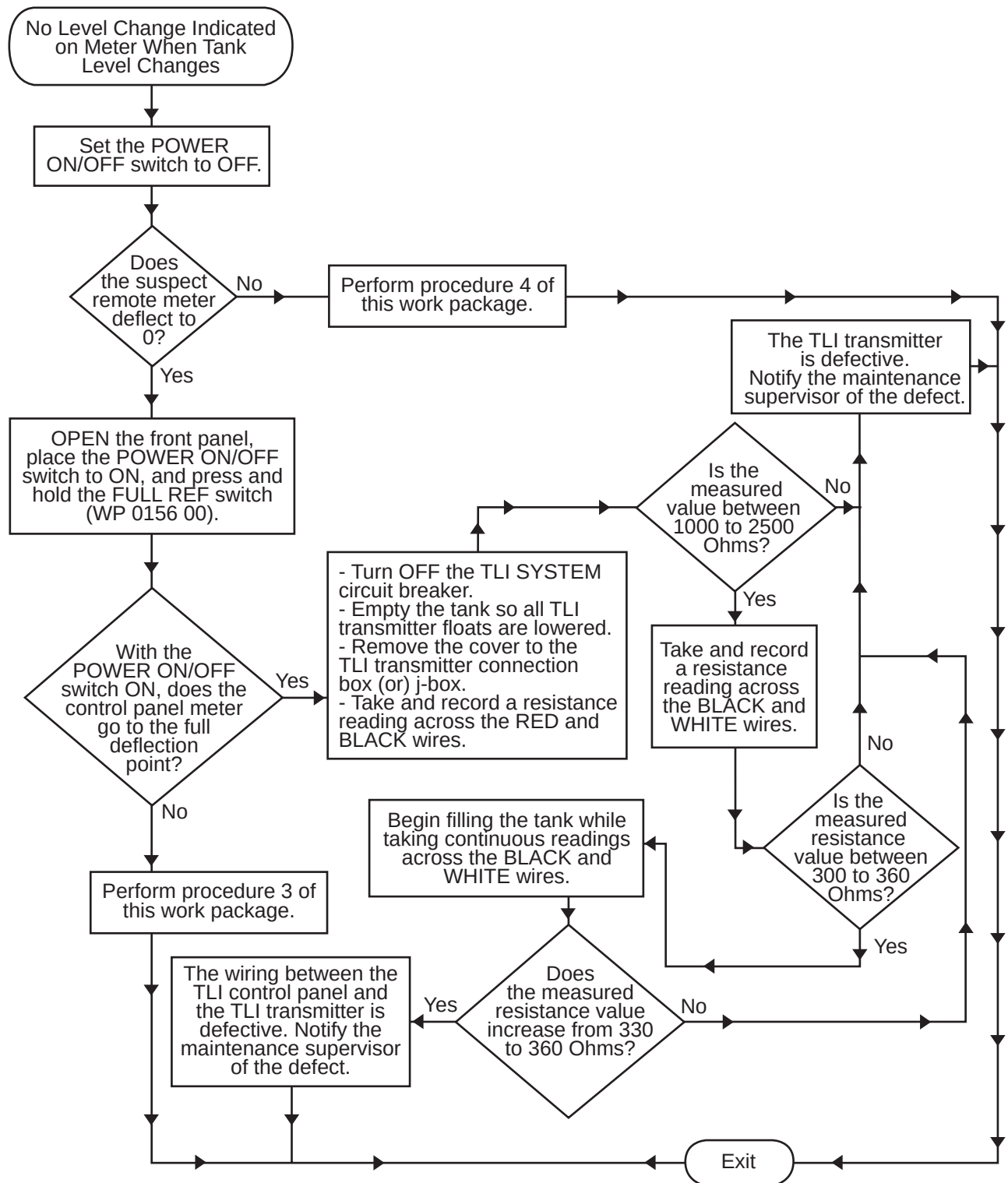


Procedure 2. Tank Level Indicator Alarm Horn Does Not Sound



Procedure 3. Tank Level Indicator Control Panel Meter Does Not Deflect Correctly

**Procedure 4. Tank Level Indicator Remote Meter Does Not Follow the Control Panel Meter**



Procedure 5. No Level Change Indicated On Meter When Tank Level Changes

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
DAY TANK HIGH LEVEL ALARMS**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00,
Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

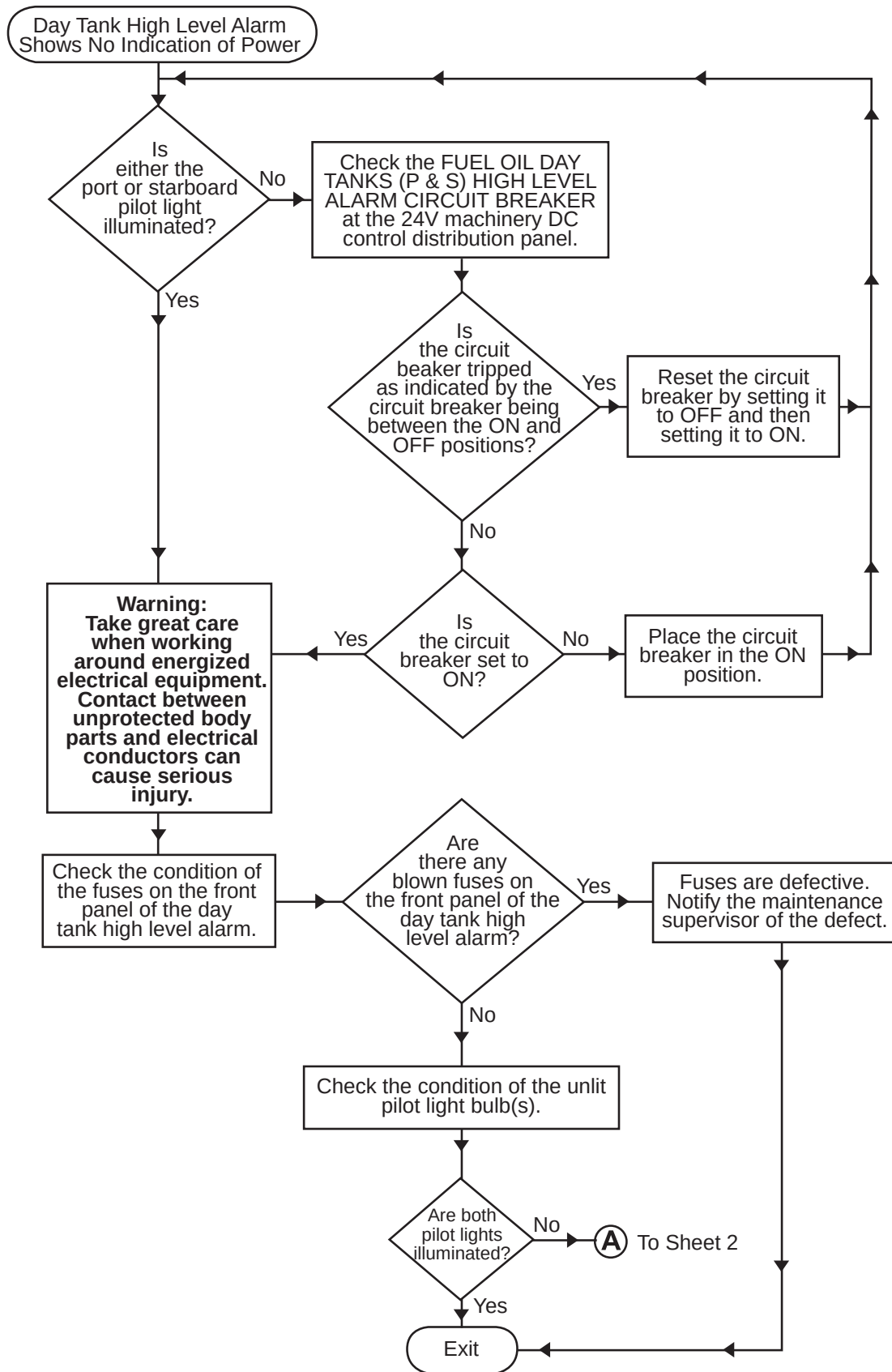
References:

WP 0295 00 (volume 2)

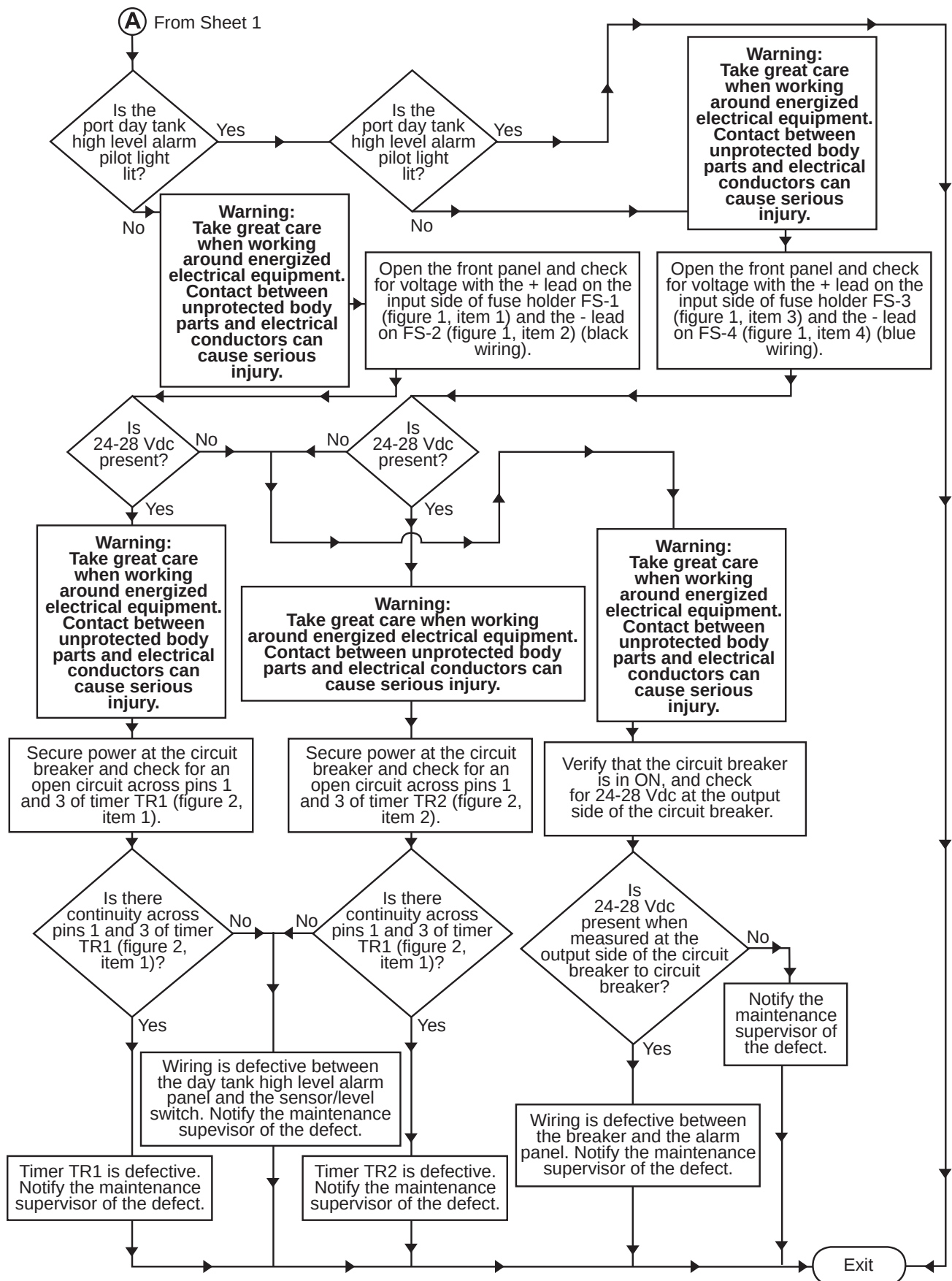
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Day Tank High Level Alarm Shows No Indication of Power	1
Day Tank High Level Alarm Does Not Sound	2



Procedure 1. Day Tank High Level Alarm Shows No Indication of Power (Sheet 1 of 2)



Procedure 1. Day Tank High Level Alarm Shows No Indication of Power (Sheet 2 of 2)

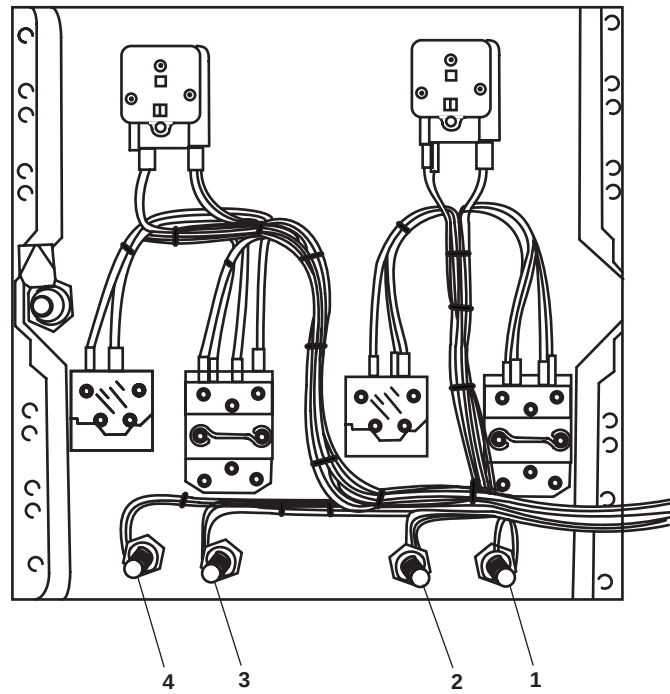


Figure 1. Day Tank High Level Alarm Inside Front Panel

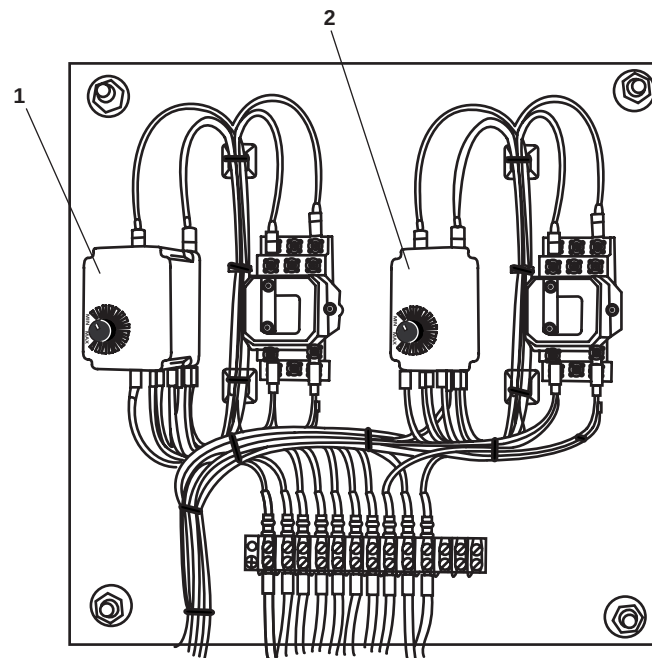
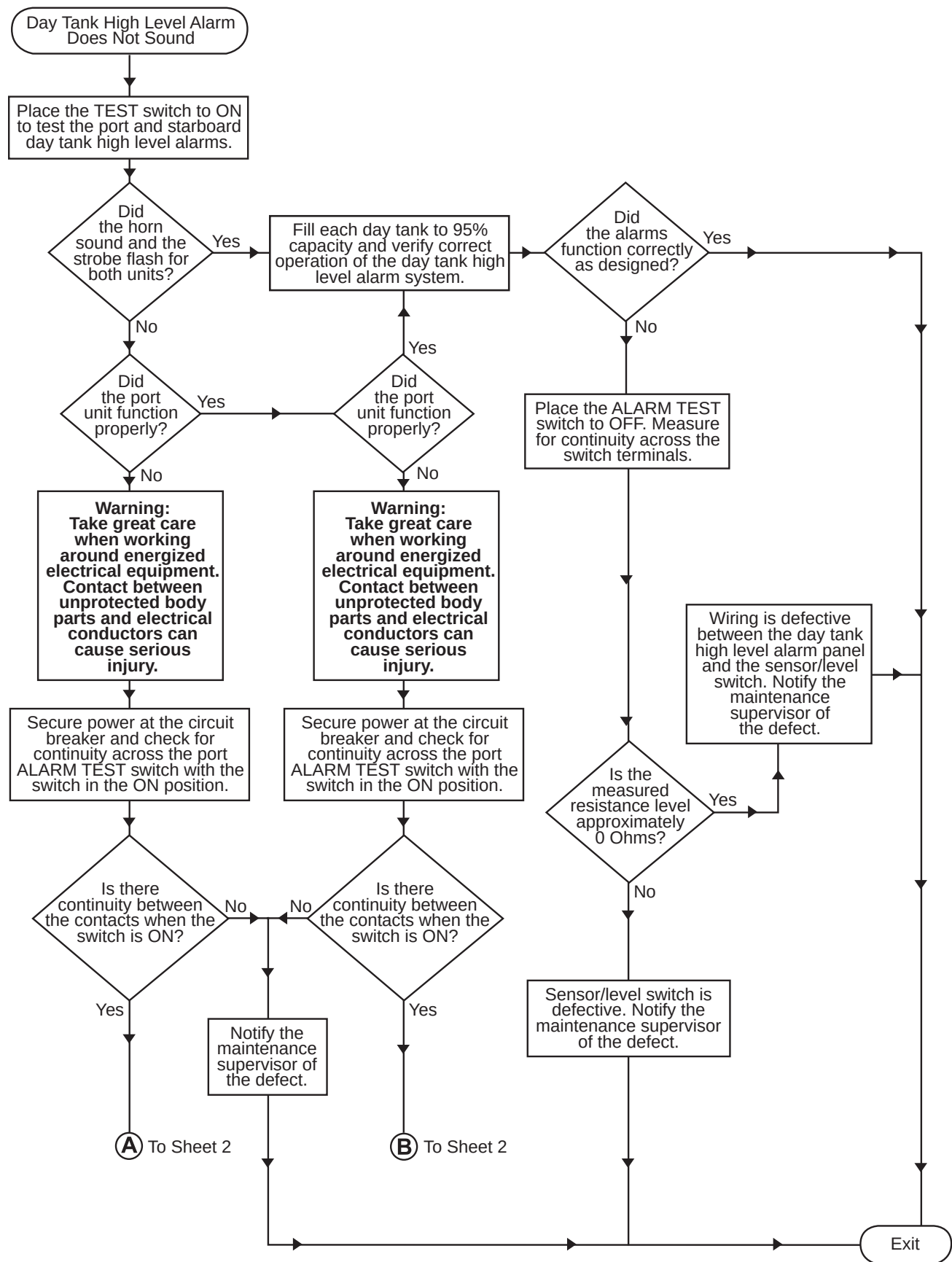
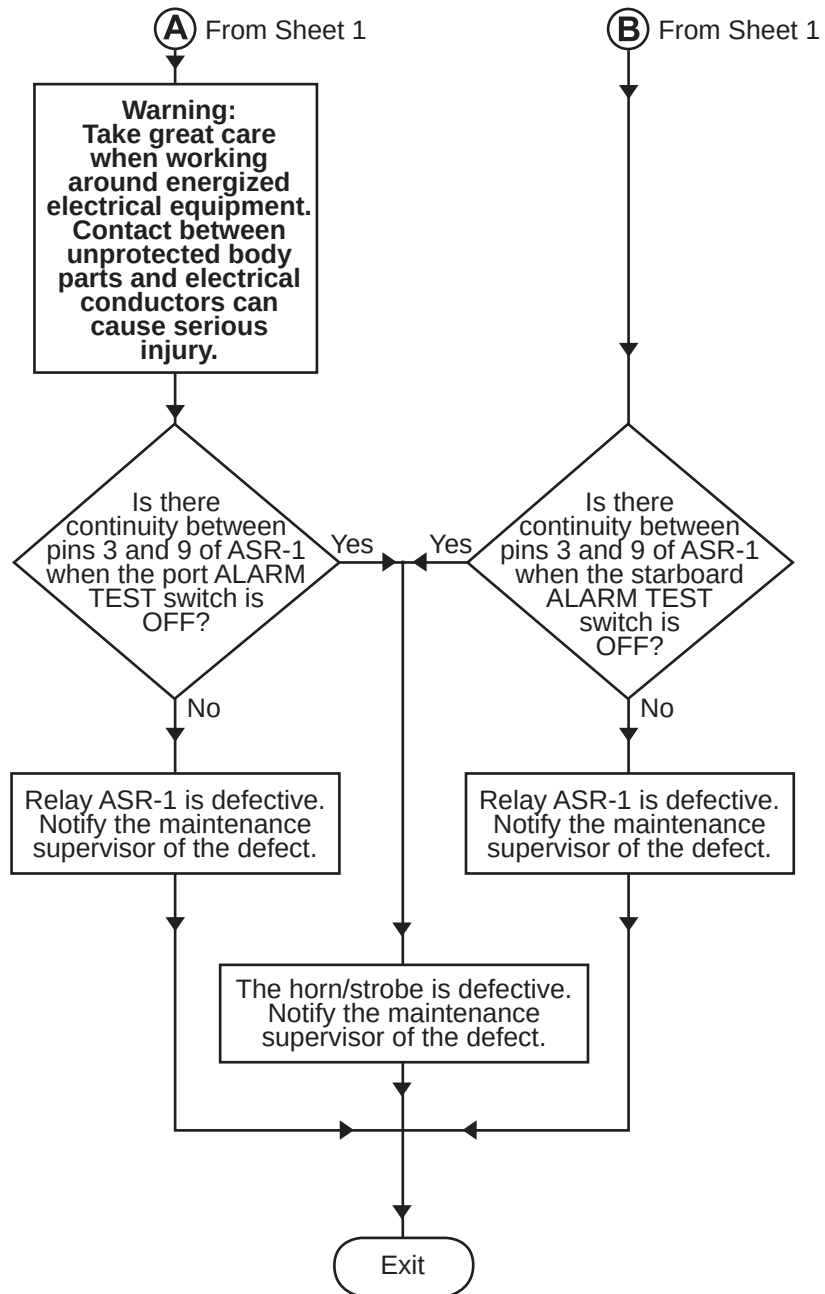


Figure 2. Day Tank High Level Alarm Main Electrical Components



Procedure 2. Day Tank High Level Alarm Does Not Sound (Sheet 1 of 2)

**Procedure 2. Day Tank High Level Alarm Does Not Sound (Sheet 2 of 2)**

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

MAIN SWITCHBOARD

INITIAL SETUP:

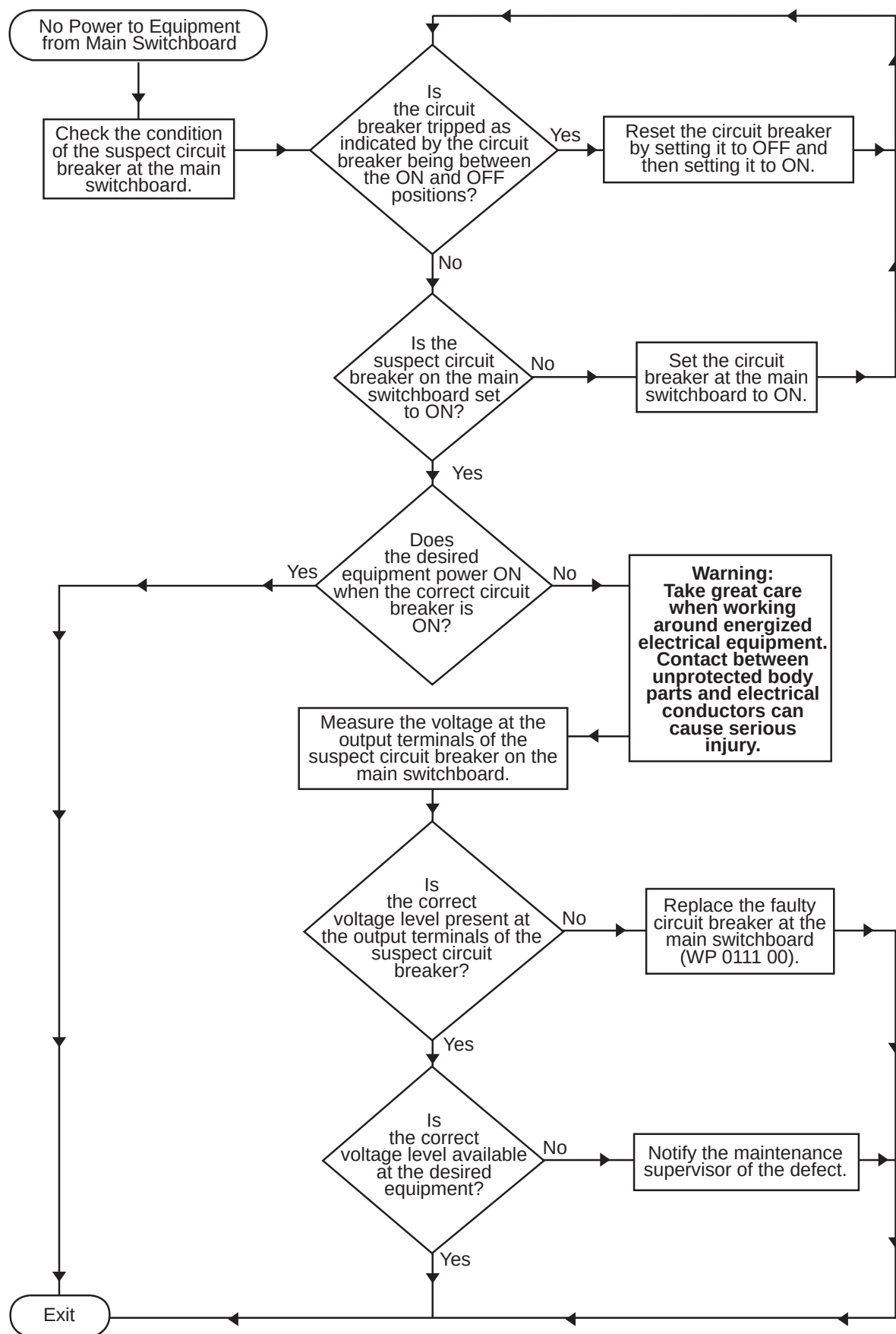
Tools and Special Tools:	References:
Tool Kit, Electrician’s (Item 11, Table 2, WP 0295 00)	WP 0111 00
Multimeter (Item 16, Table 2, WP 0295 00)	WP 0295 00

Personnel Required:
Two Watercraft Engineers, 88L

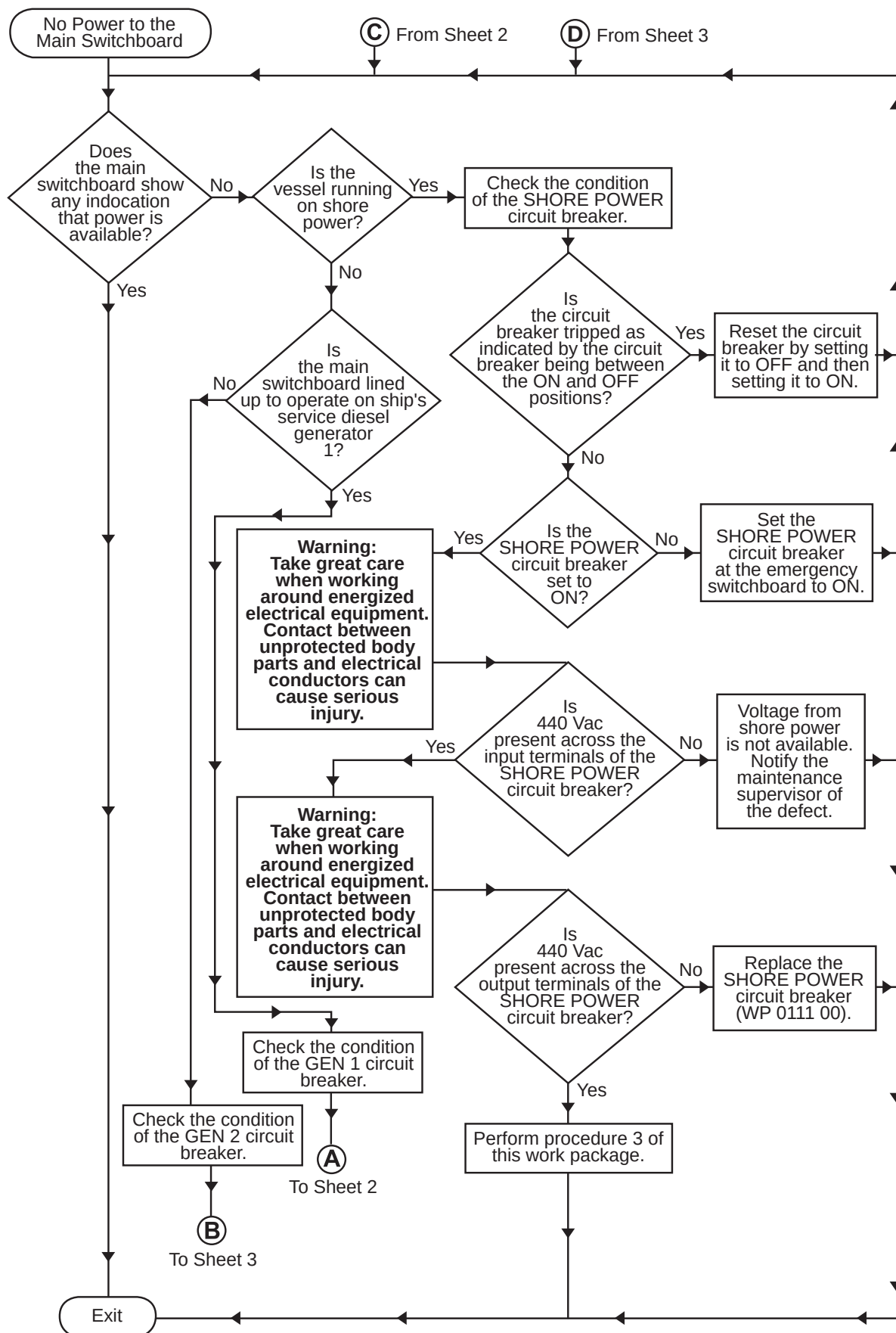
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

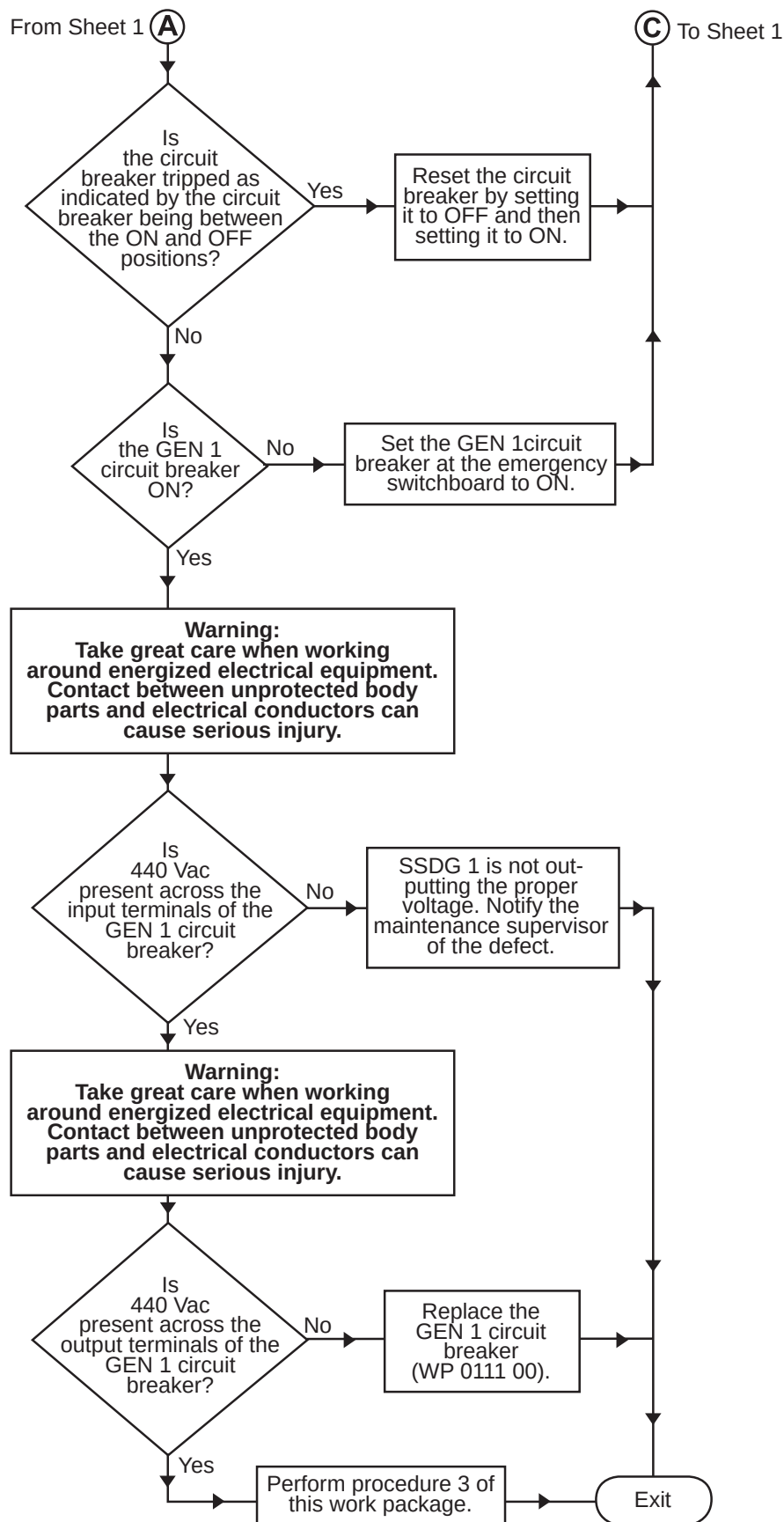
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Equipment from Main Switchboard	1
No Power to the Main Switchboard	2
Meter(s) Do(es) Not Indicate That Power is Available to the Main Switchboard	3
Light(s) Not Lit on the Main Switchboard	4



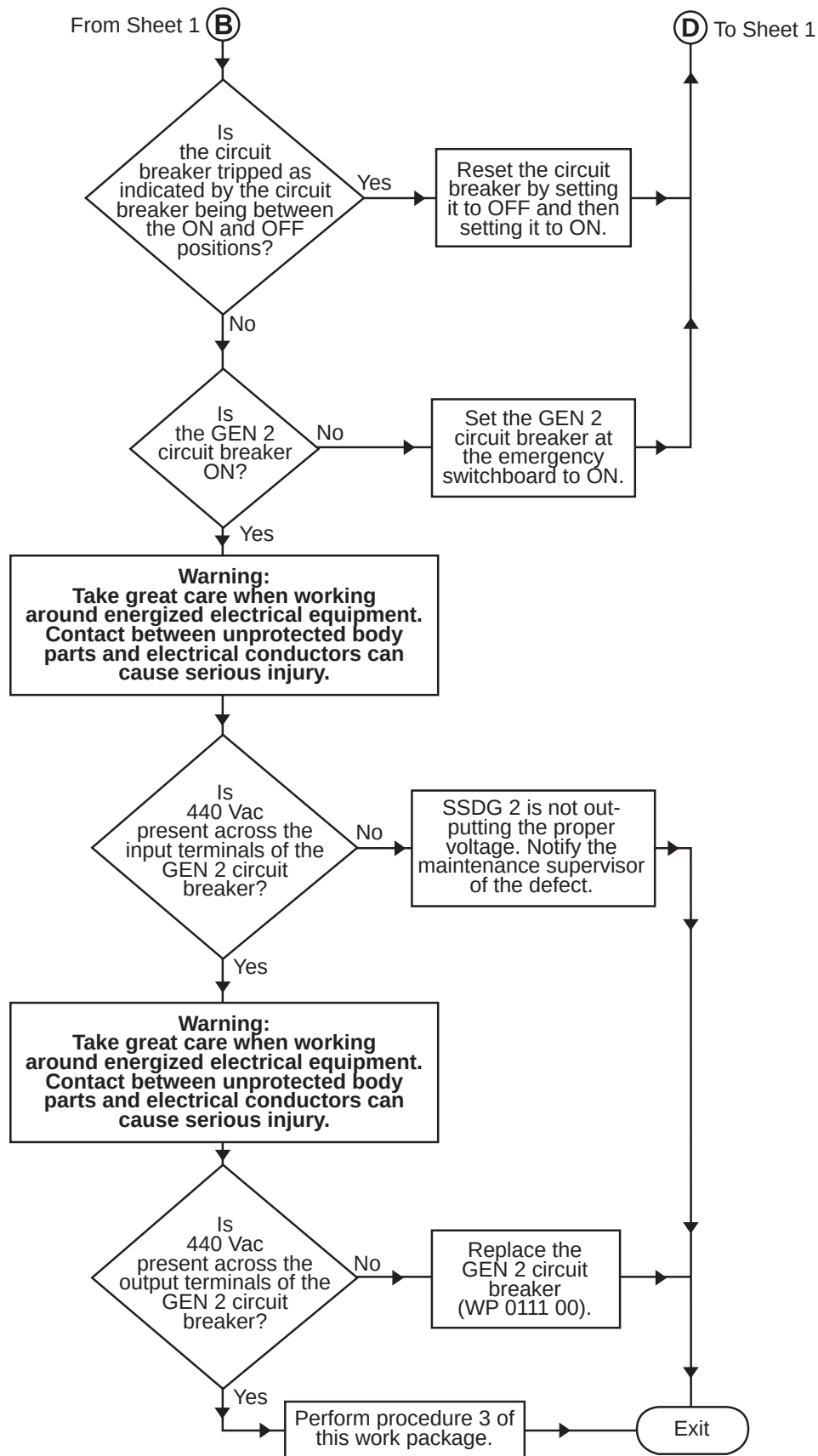
Procedure 1. No Power to Equipment from Main Switchboard



Procedure 2. No Power to the Main Switchboard (Sheet 1 of 3)

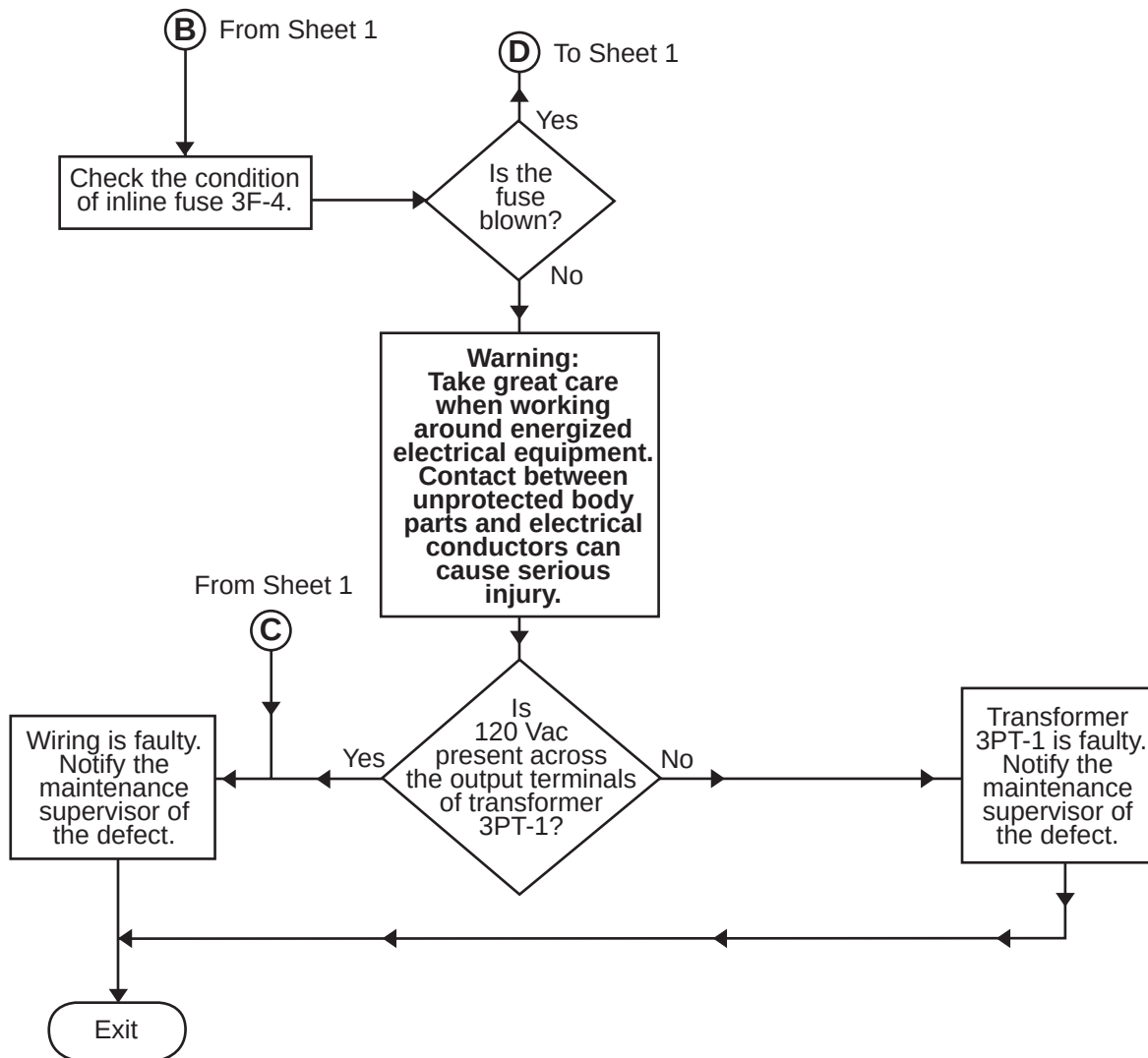


Procedure 2. No Power to the Main Switchboard (Sheet 2 of 3)

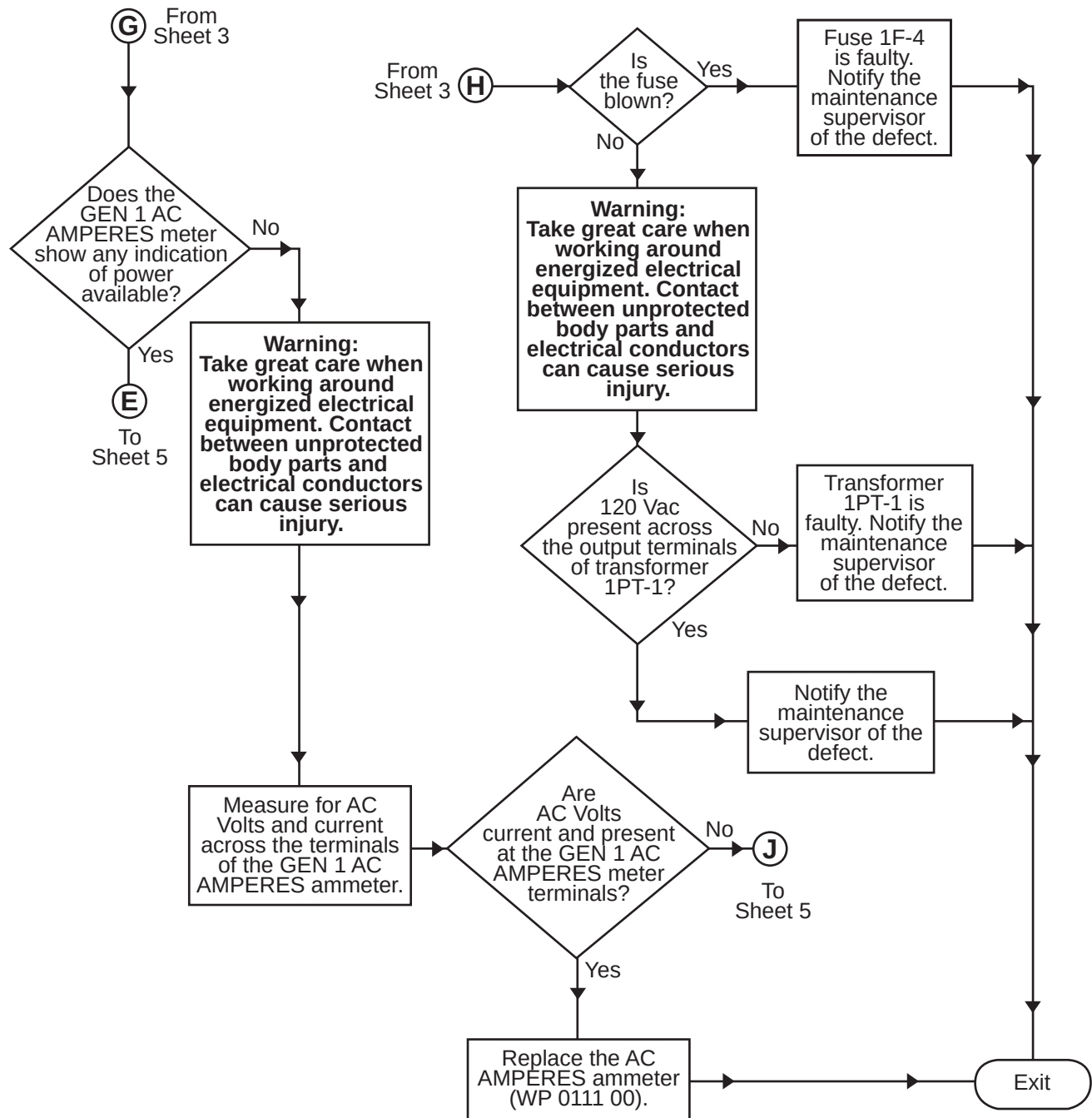


Procedure 2. No Power to the Main Switchboard (Sheet 3 of 3)

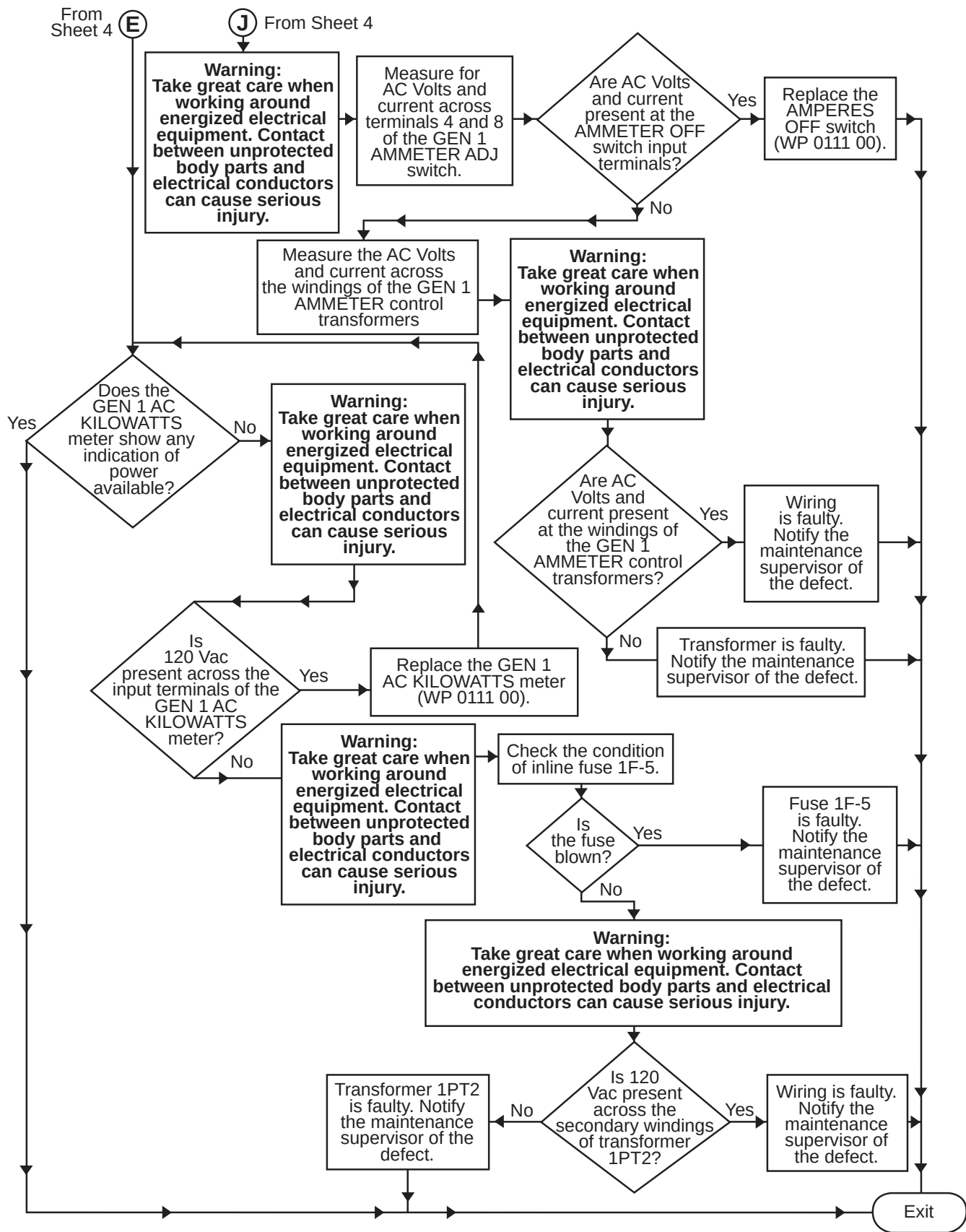




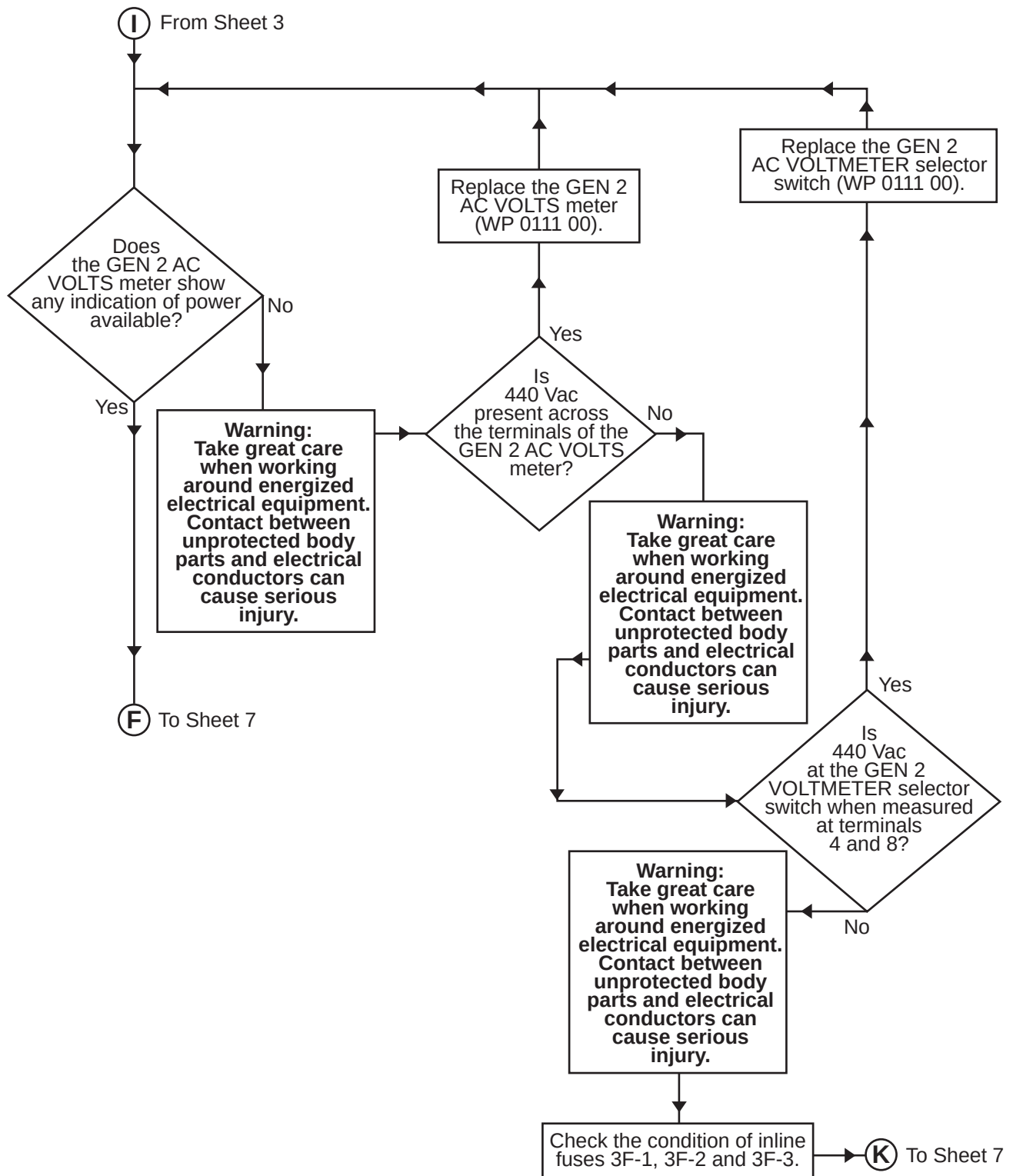
Procedure 3. Meter(s) Do(es) Not Indicate That Power is Available to the Main Switchboard (Sheet 2 of 9)



Procedure 3. Meter(s) Do(es) Not Indicate That Power is Available to the Main Switchboard (Sheet 4 of 9)

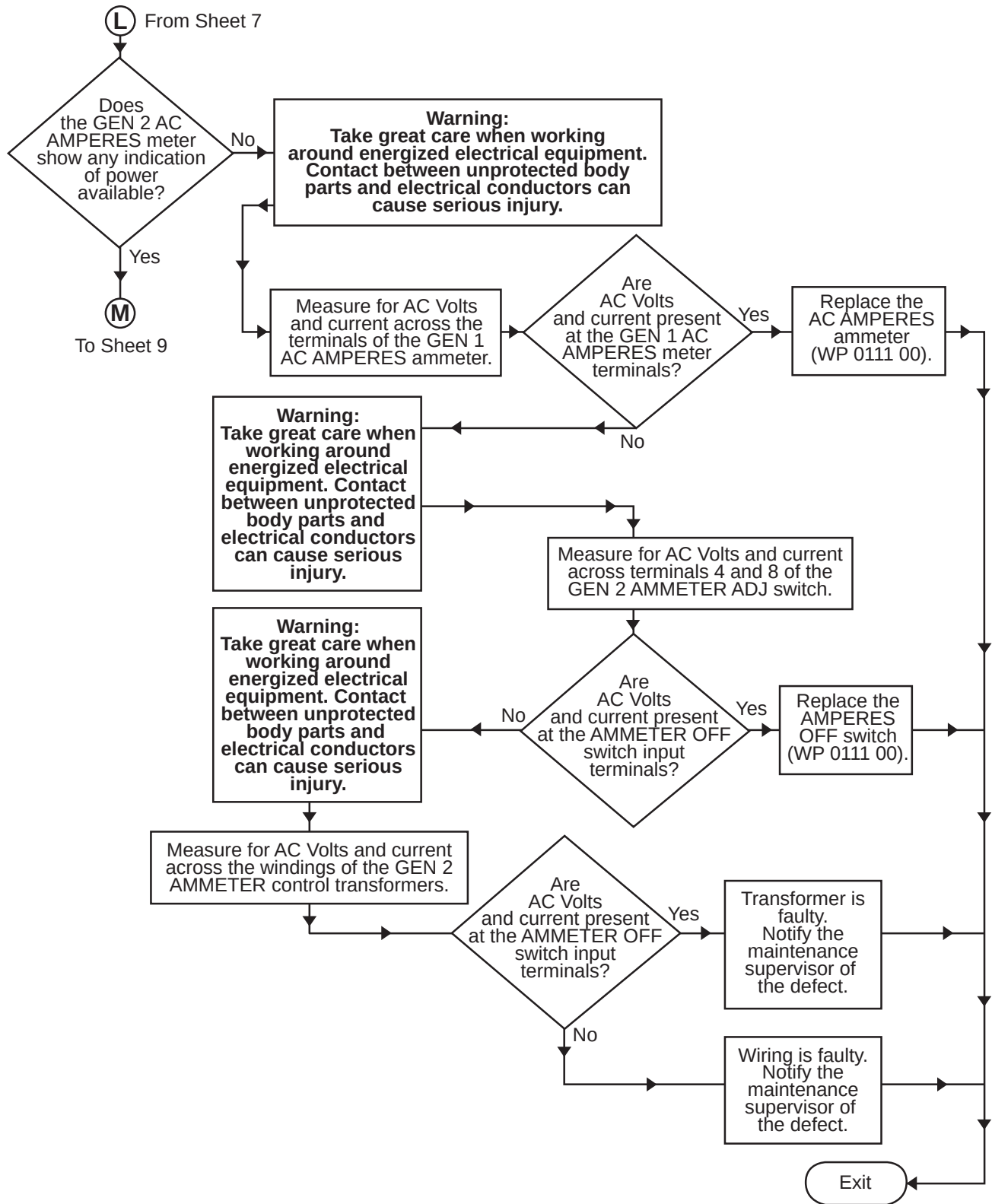


Procedure 3. Meter(s) Do(es) Not Indicate That Power is Available to the Main Switchboard (Sheet 5 of 9)

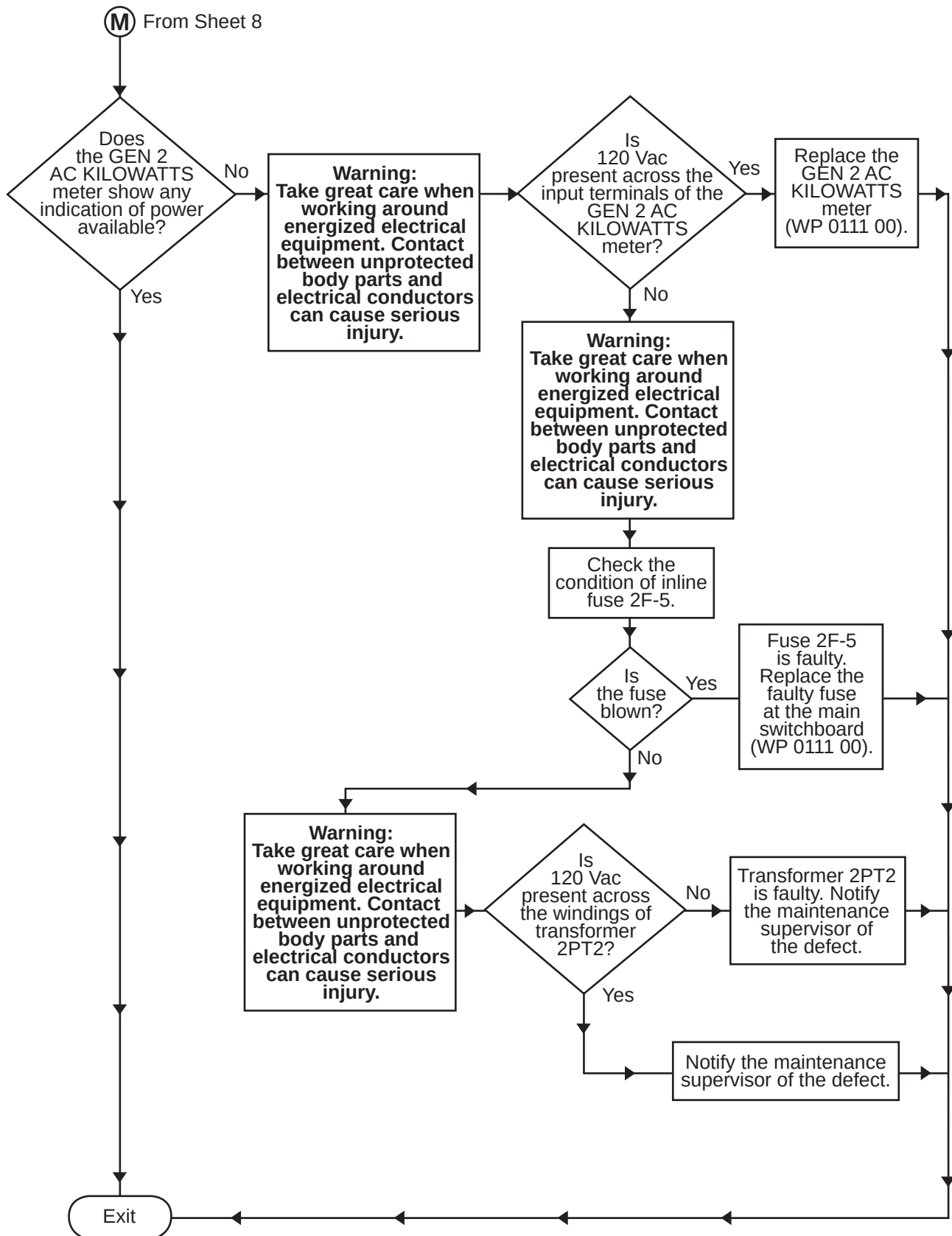


Procedure 3. Meter(s) Do(es) Not Indicate That Power is Available to the Main Switchboard (Sheet 6 of 9)

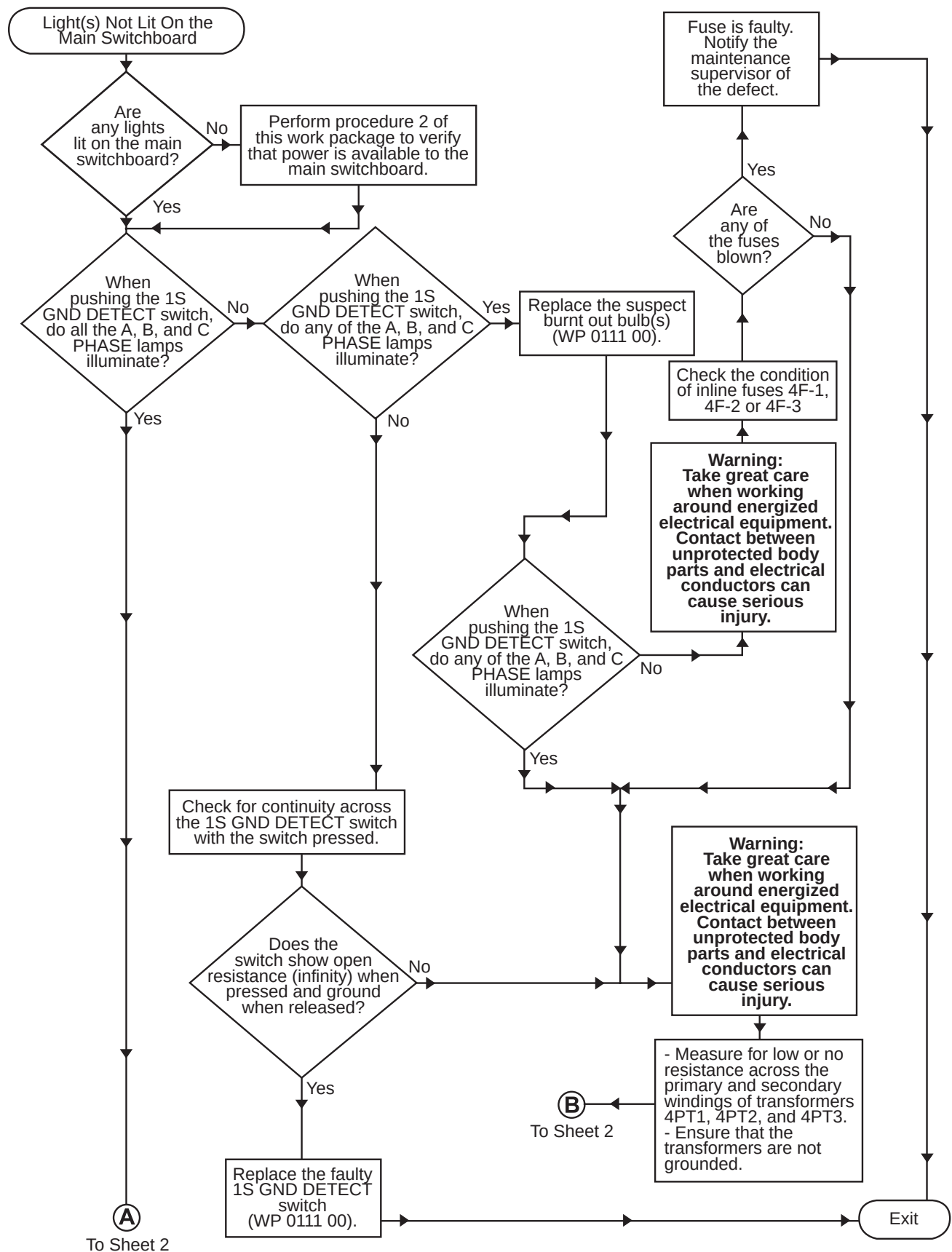




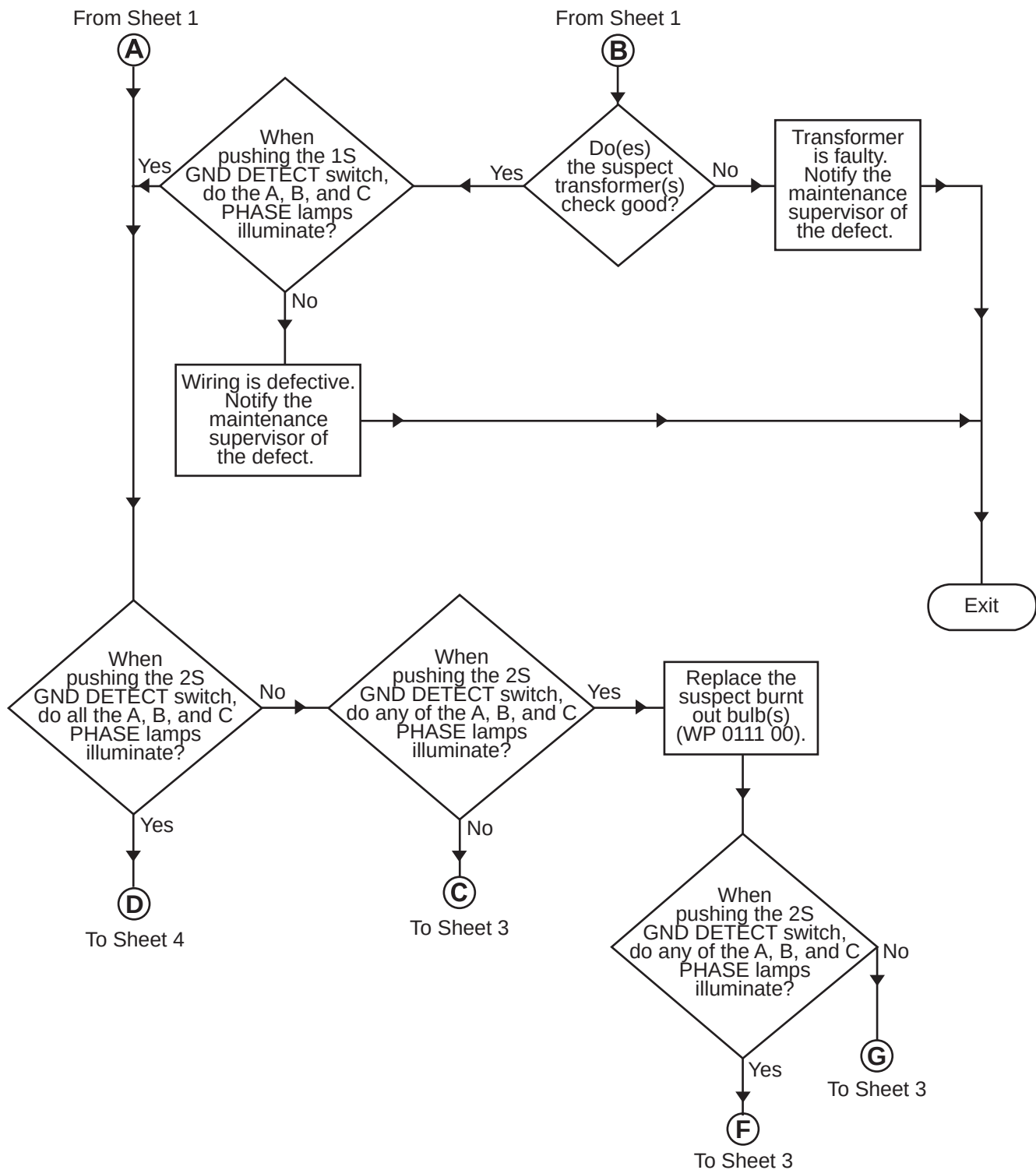
Procedure 3. Meter(s) Do(es) Not Indicate That Power is Available to the Main Switchboard (Sheet 8 of 9)



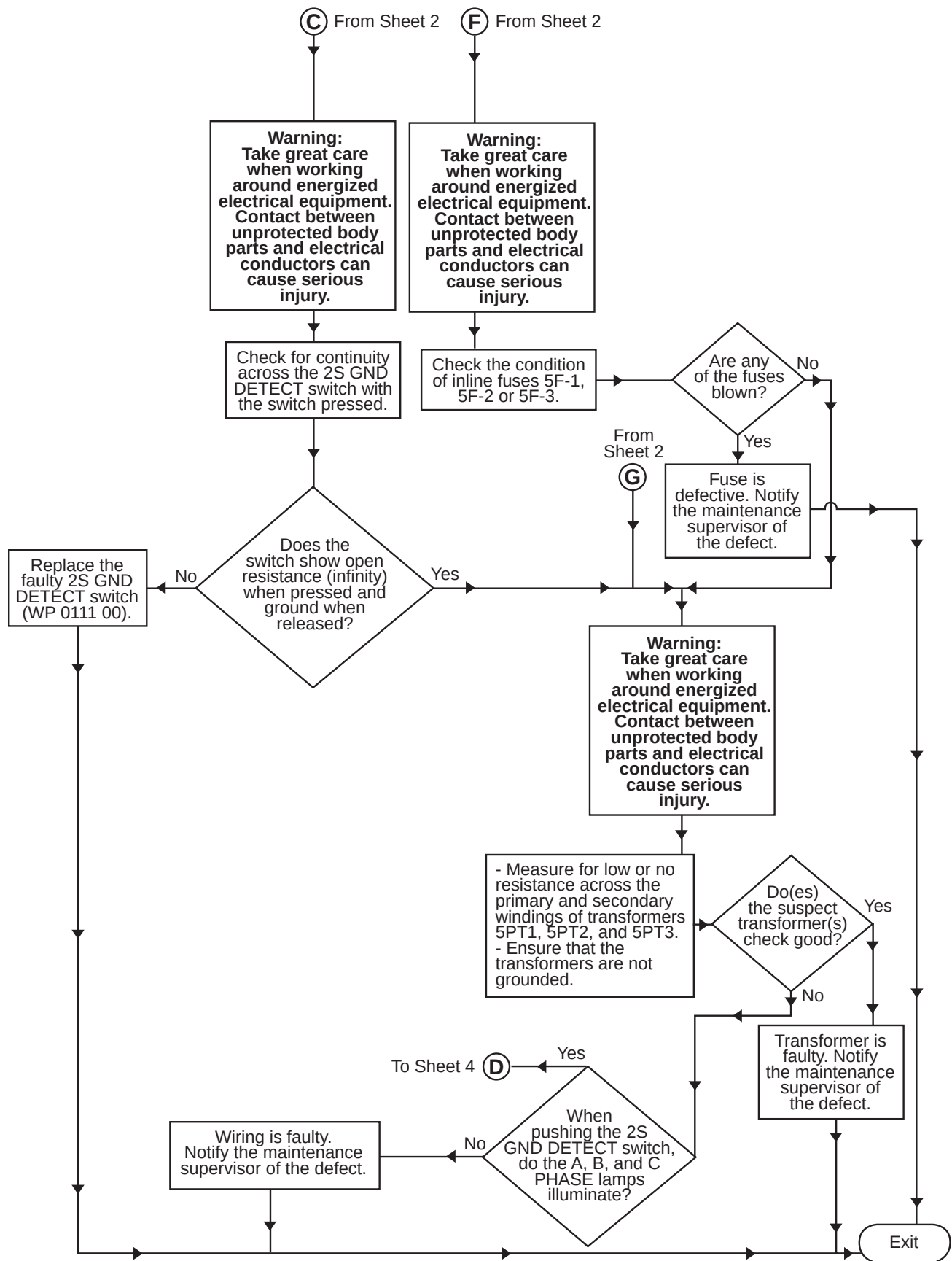
Procedure 3. Meter(s) Do(es) Not Indicate That Power is Available to the Main Switchboard (Sheet 9 of 9)



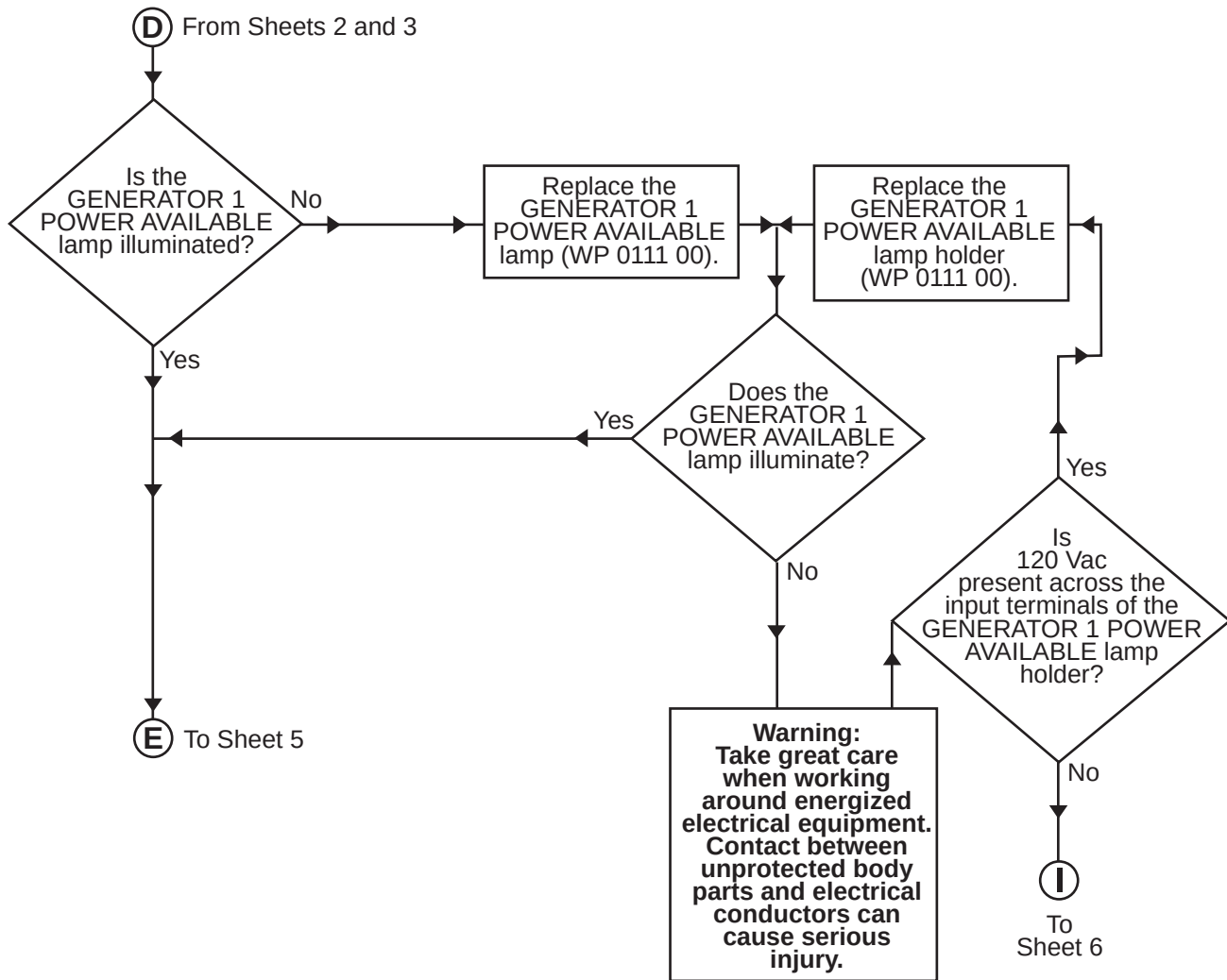
Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 1 of 12)



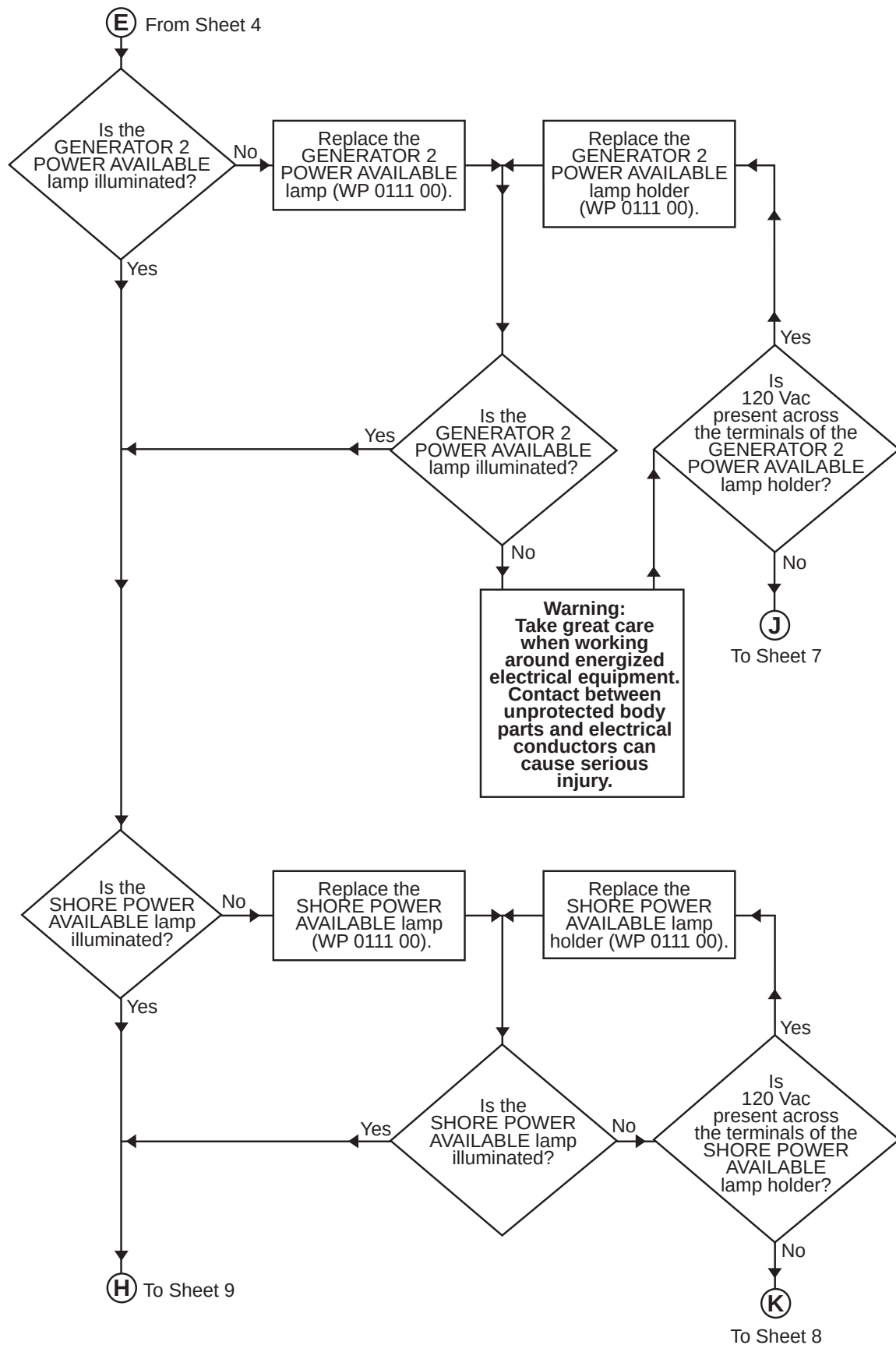
Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 2 of 12)



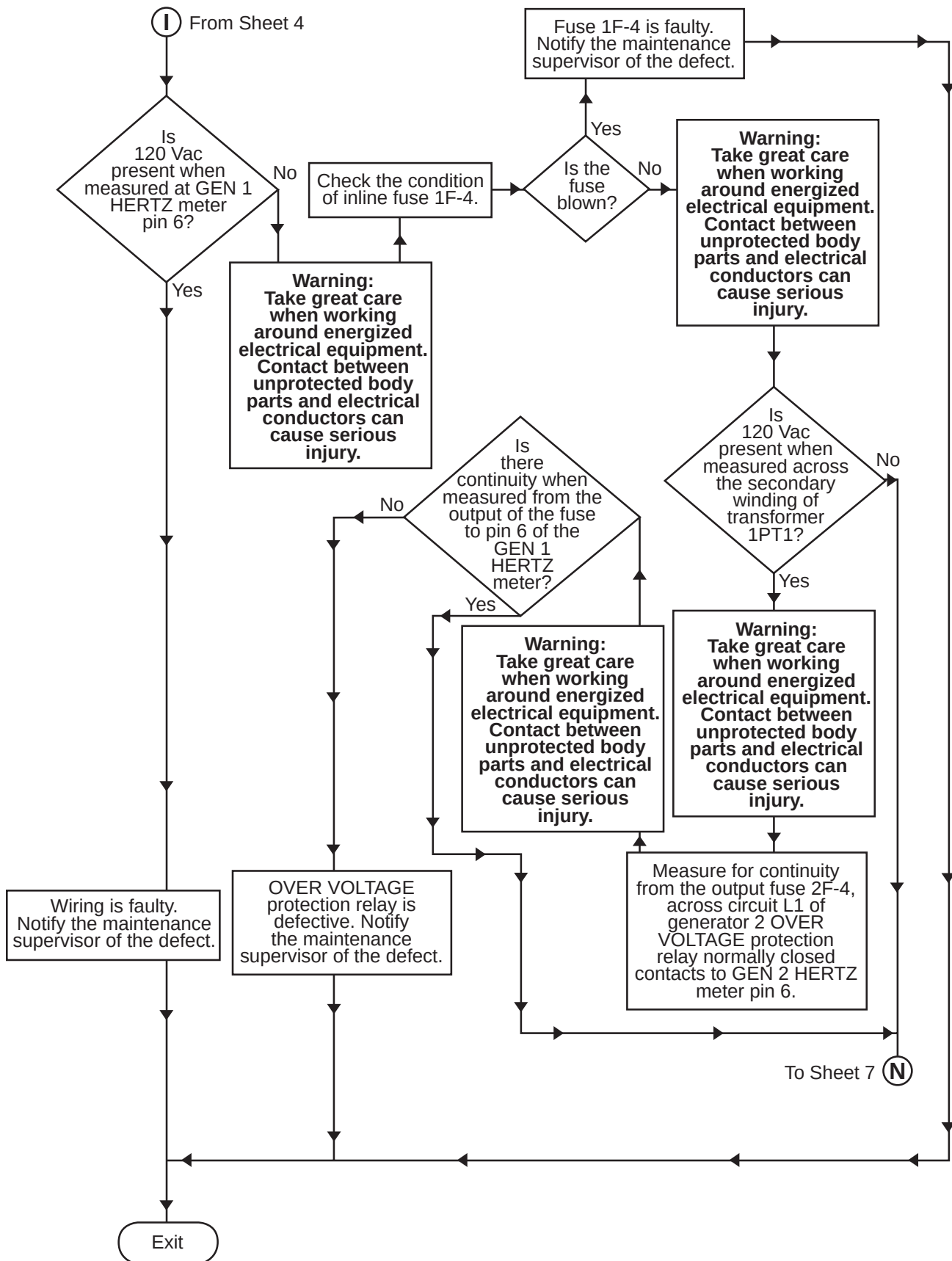
Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 3 of 12)



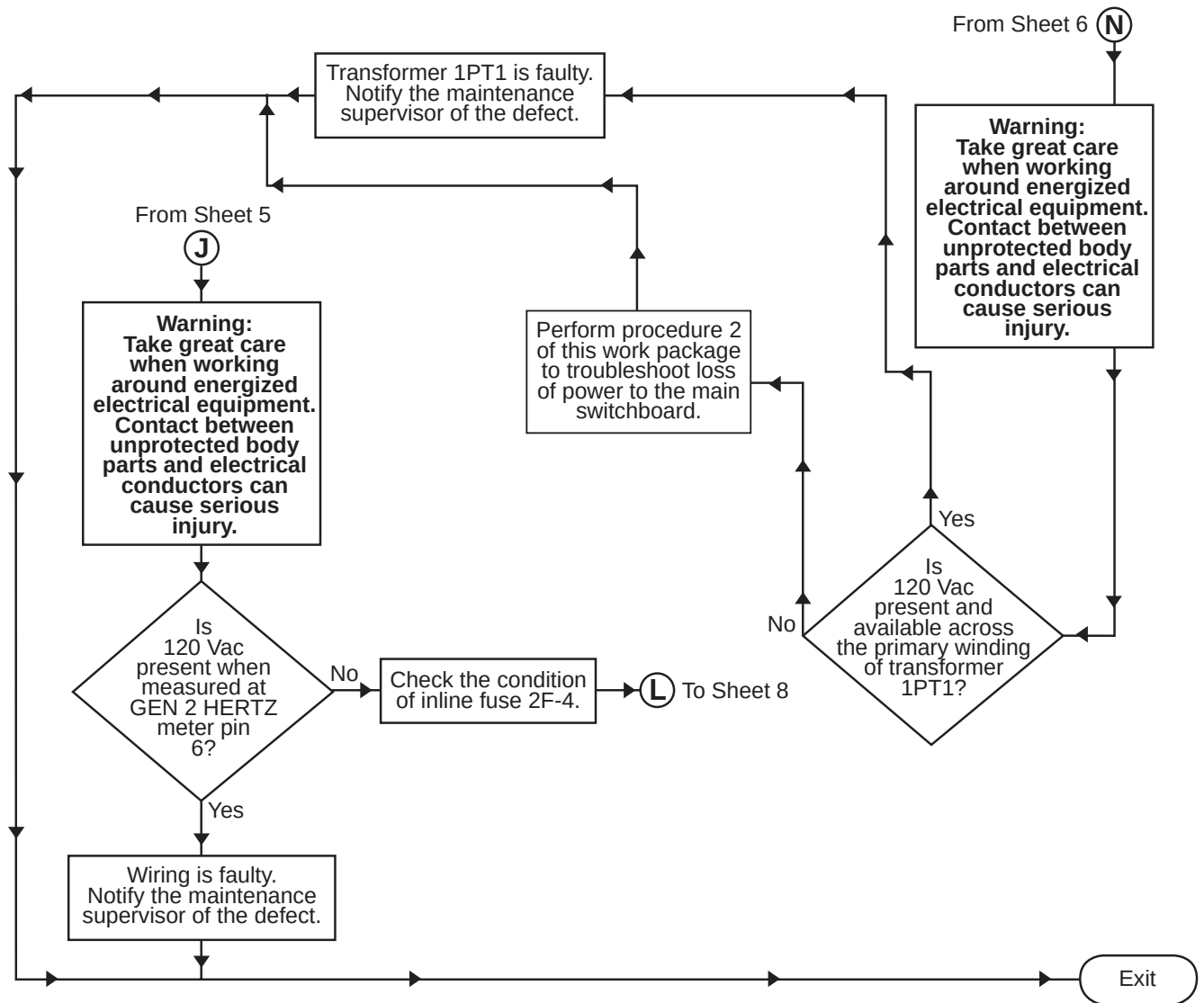
Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 4 of 12)



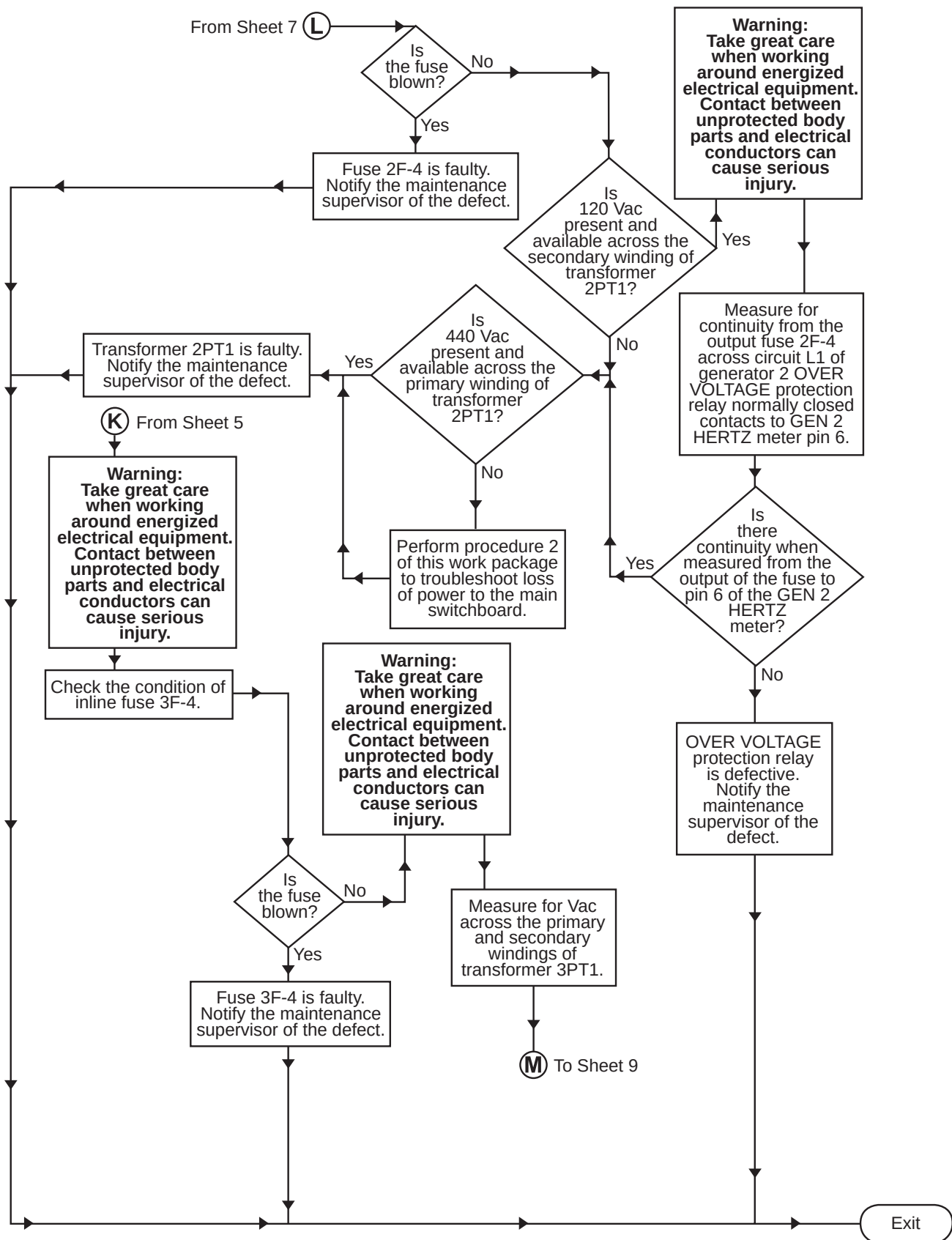
Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 5 of 12)



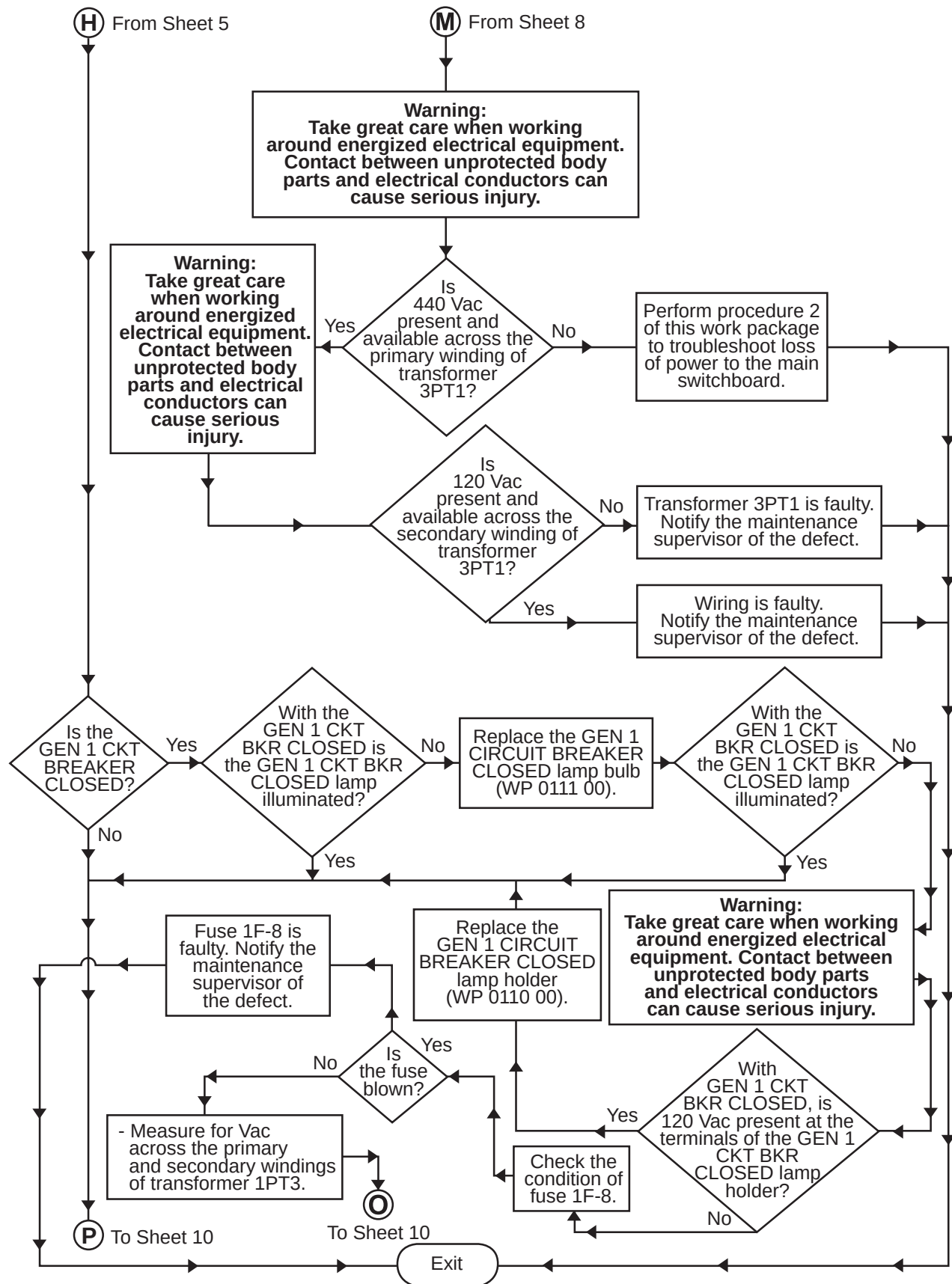
Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 6 of 12)



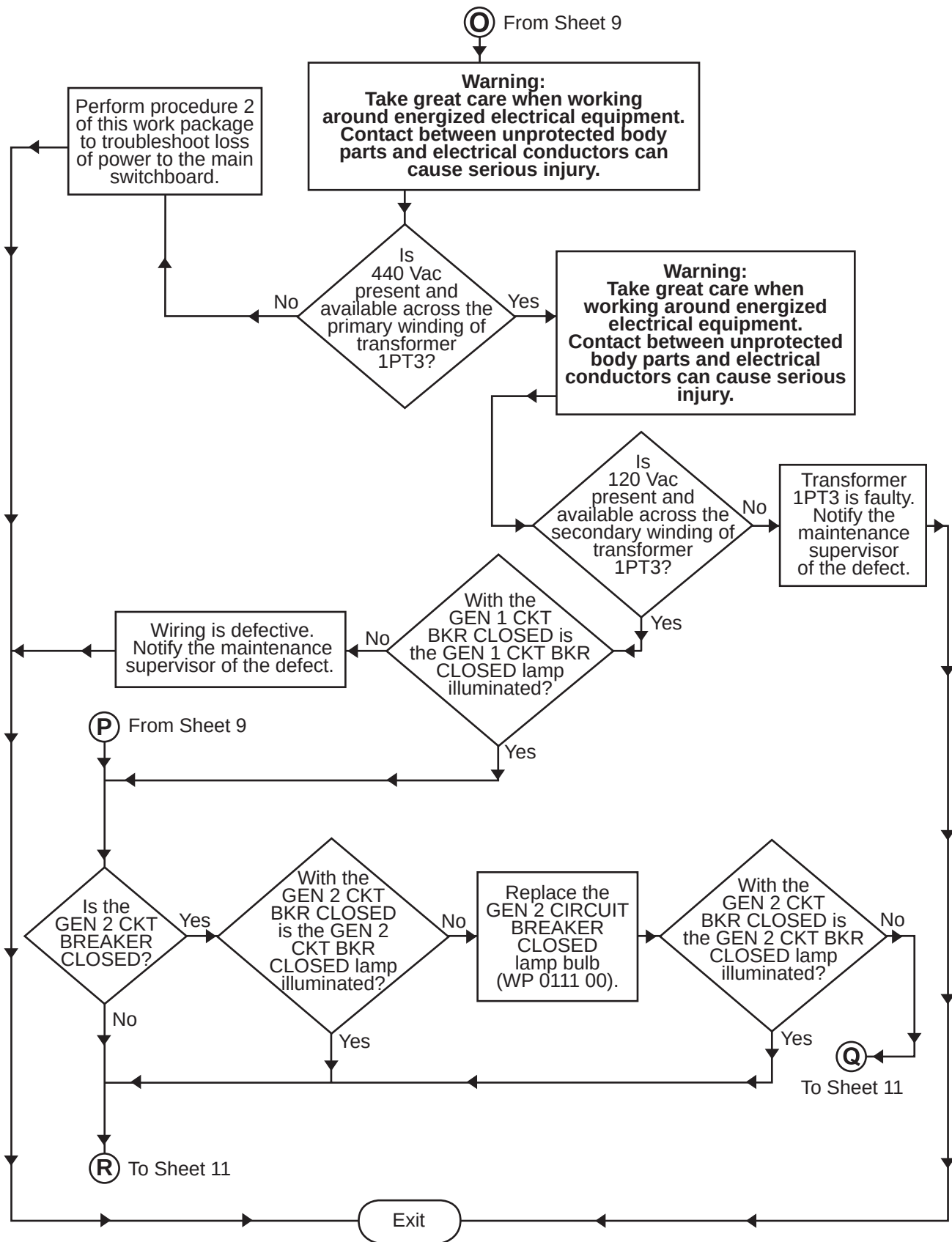
Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 7 of 12)



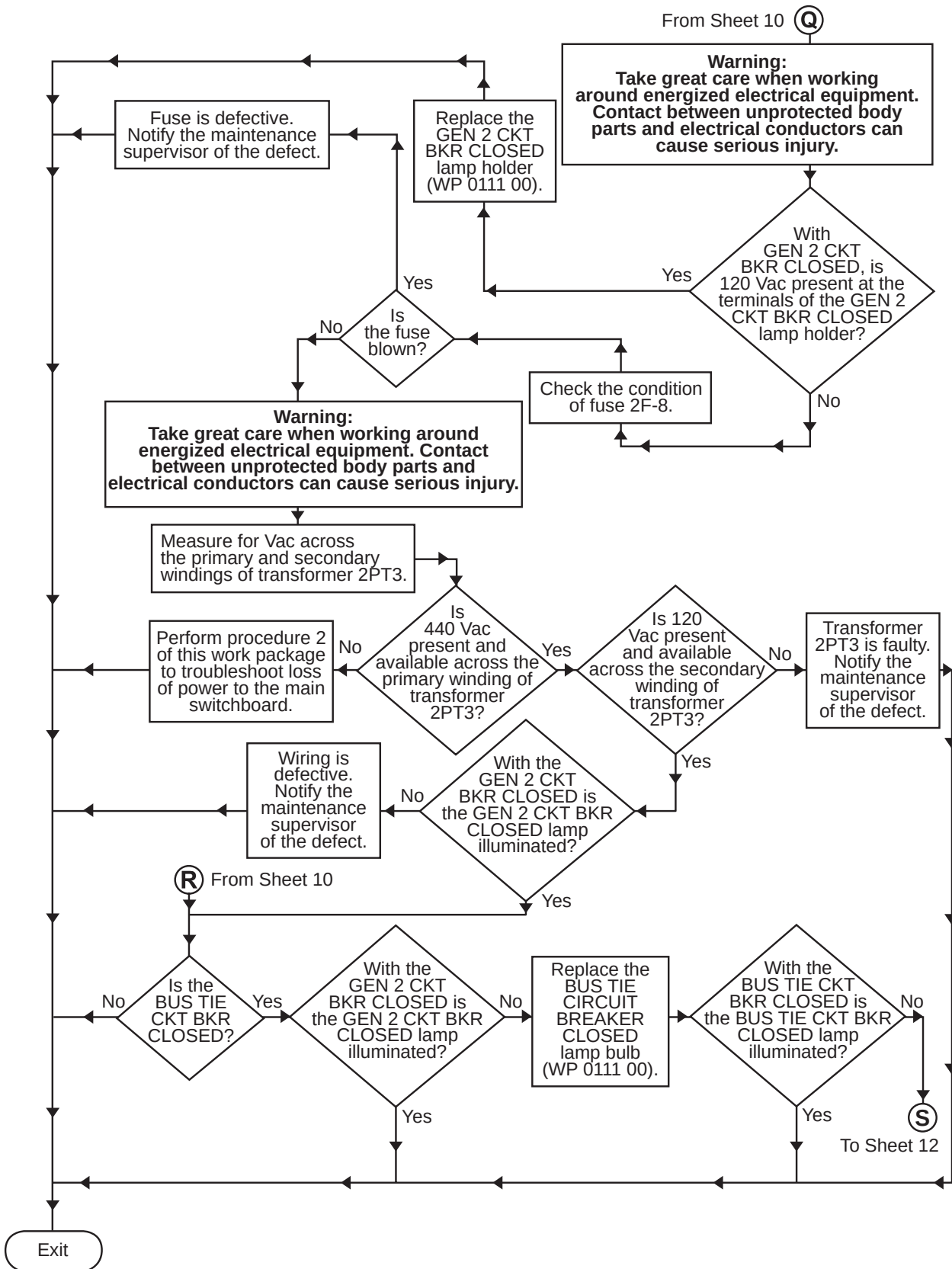
Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 8 of 12)



Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 9 of 12)

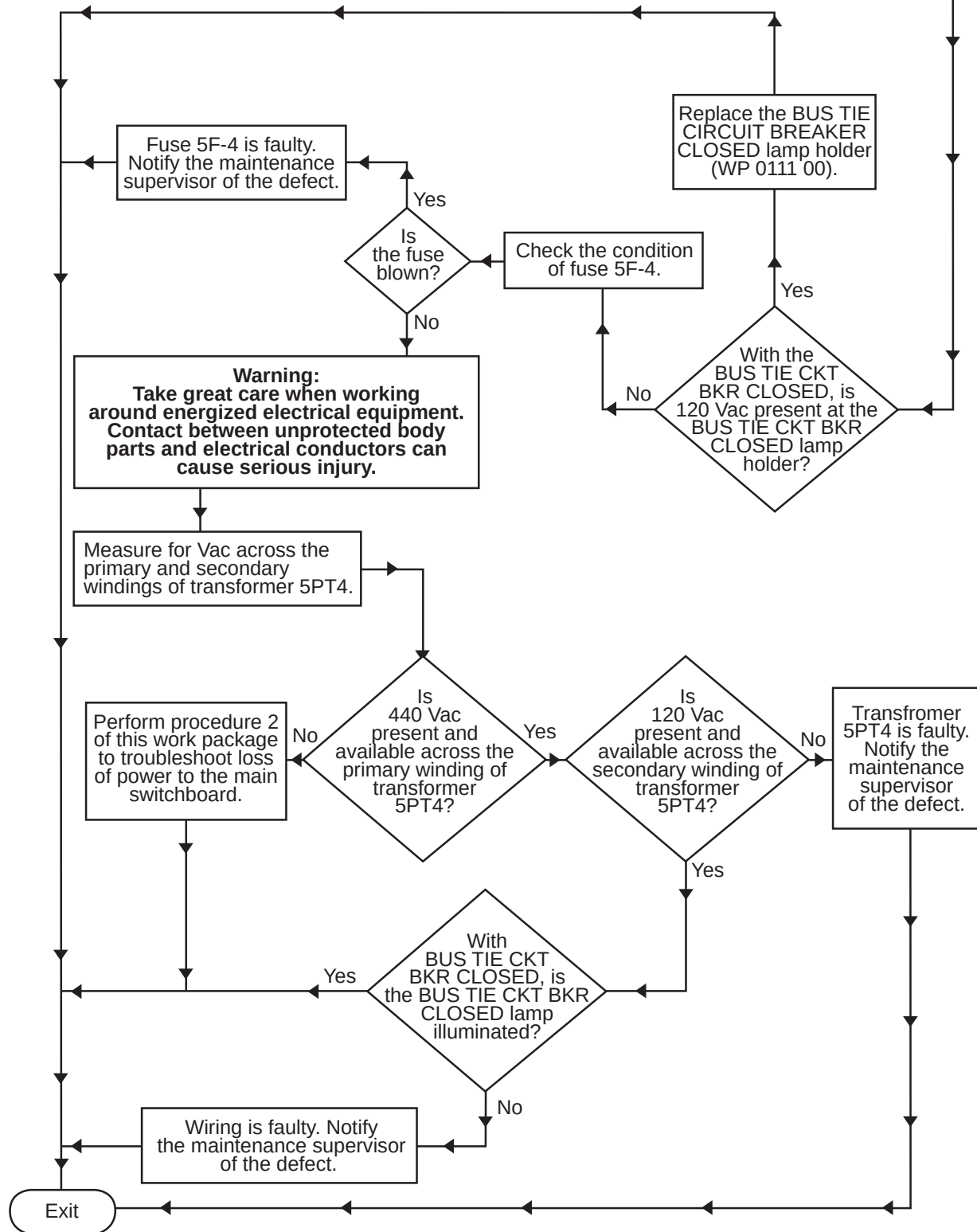


Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 10 of 12)



Procedure 4. Light(s) Not Lit On the Main Switchboard (Sheet 11 of 12)

From Sheet 11 (S)



Procedure 4. Light(s) Not Lit On the Emergency Switchboard (Sheet 12 of 12)

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
EMERGENCY SWITCHBOARD**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00)
Multimeter (Item 16, Table 2, WP 0295 00)

References:

WP 0112 00
WP 0295 00

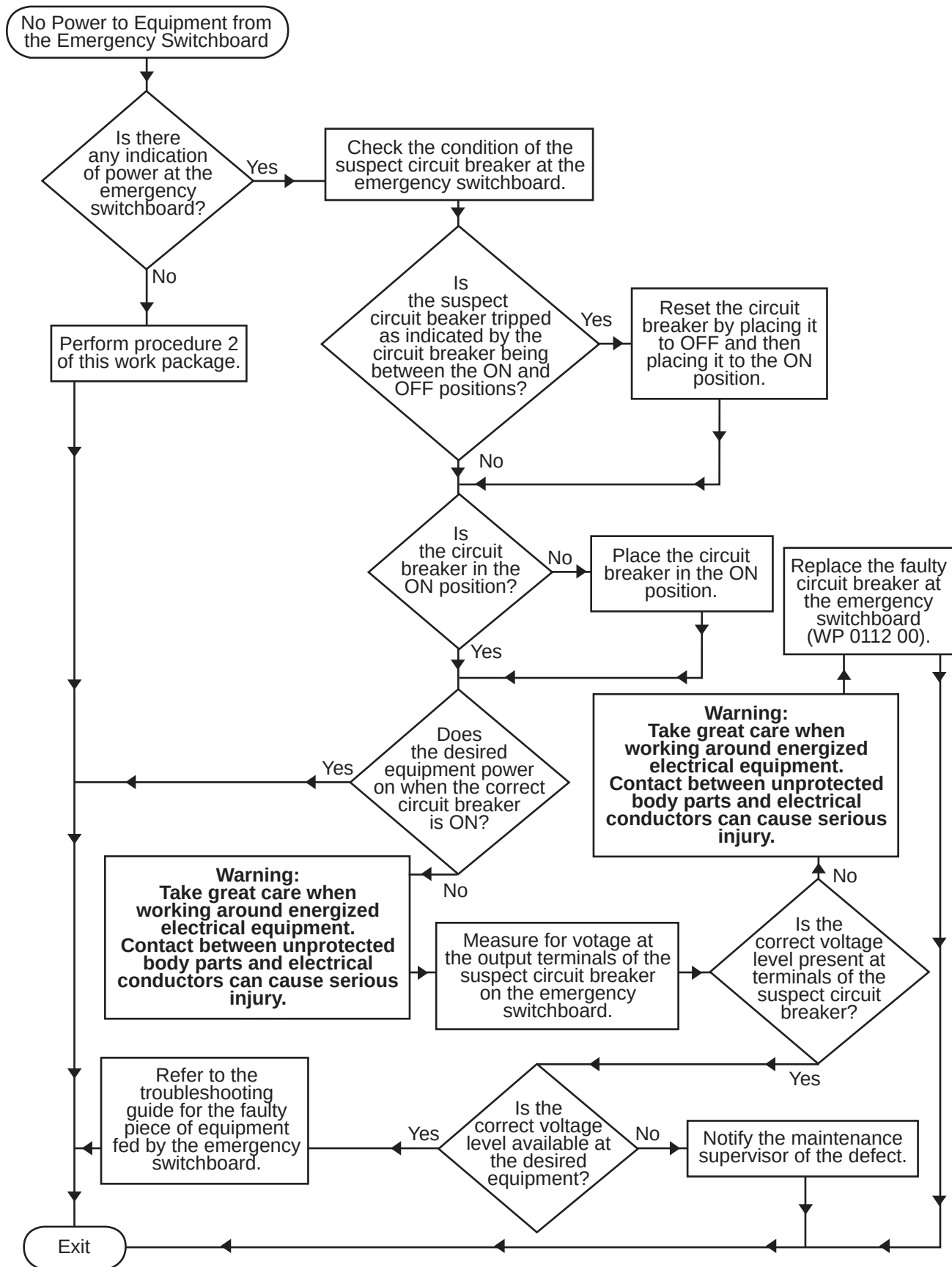
Personnel Required:

Two Watercraft Engineers, 88L

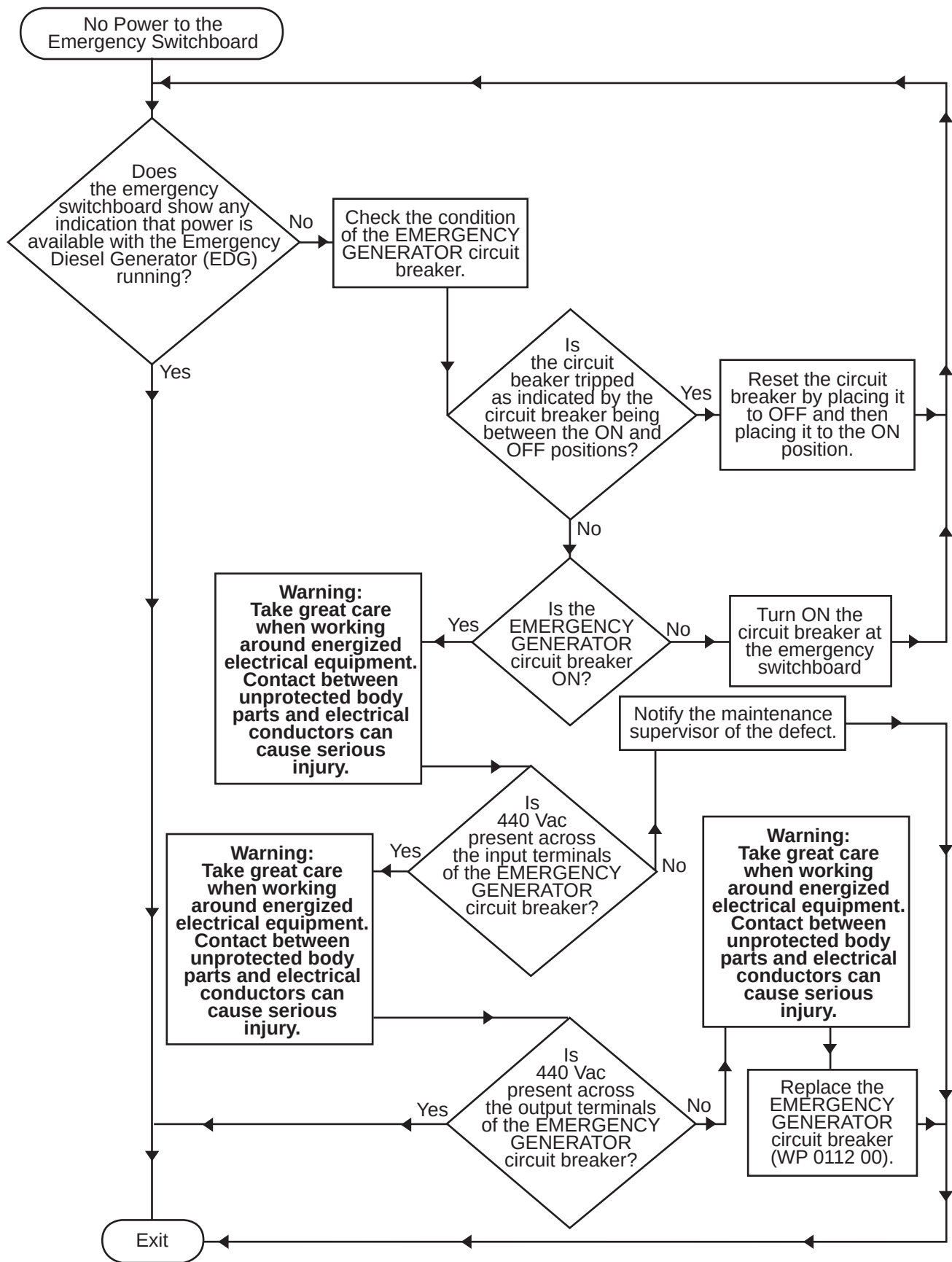
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Equipment from the Emergency Switchboard	1
No Power to the Emergency Switchboard	2
Meter(s) Do Not Indicate That Power is Available to the Emergency Switchboard	3
Light(s) Not Lit on the Emergency Switchboard	4
No Control of Main Switchboard Bus Tie Circuit Breaker	5



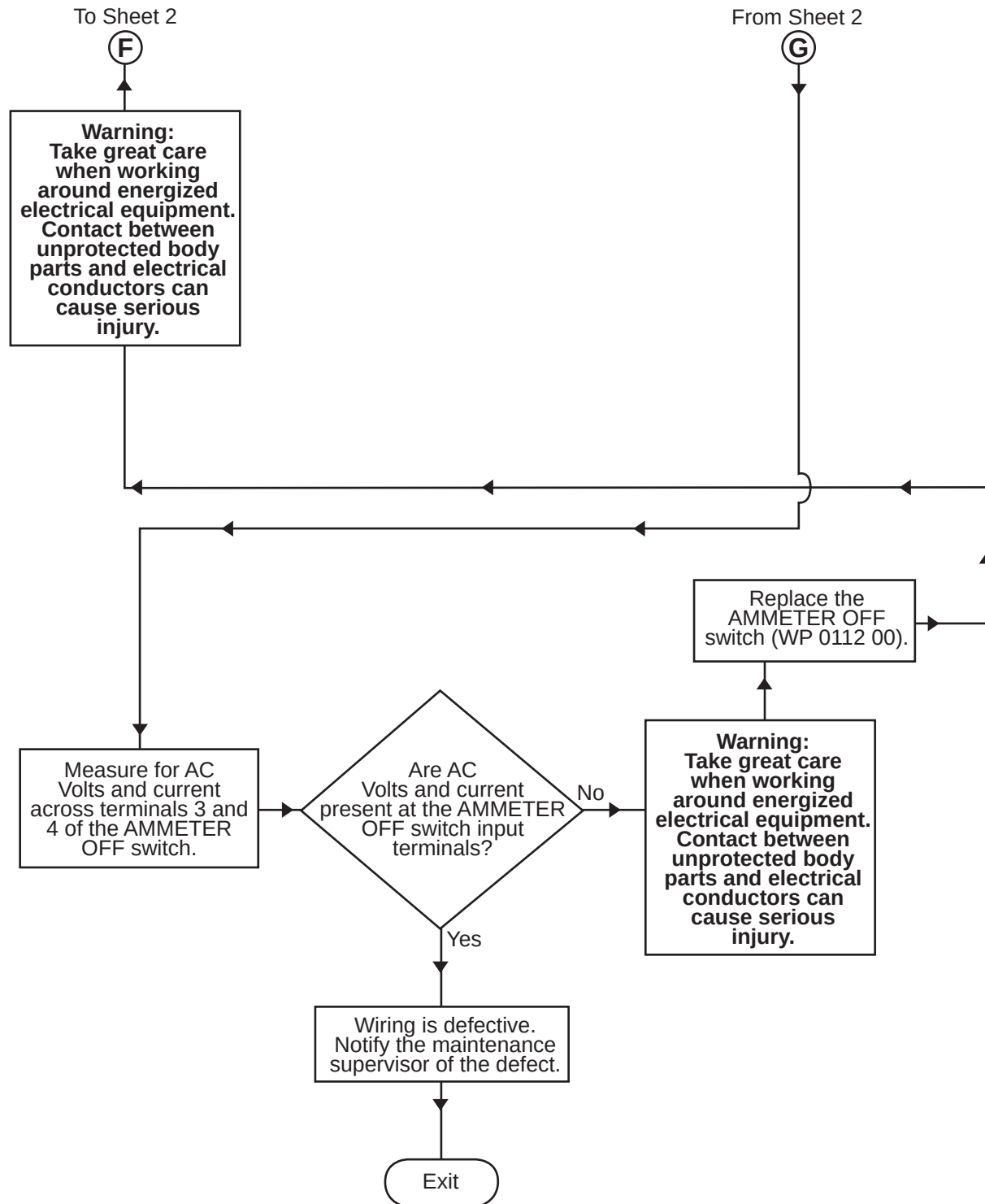
Procedure 1. No Power to Equipment from the Emergency Switchboard

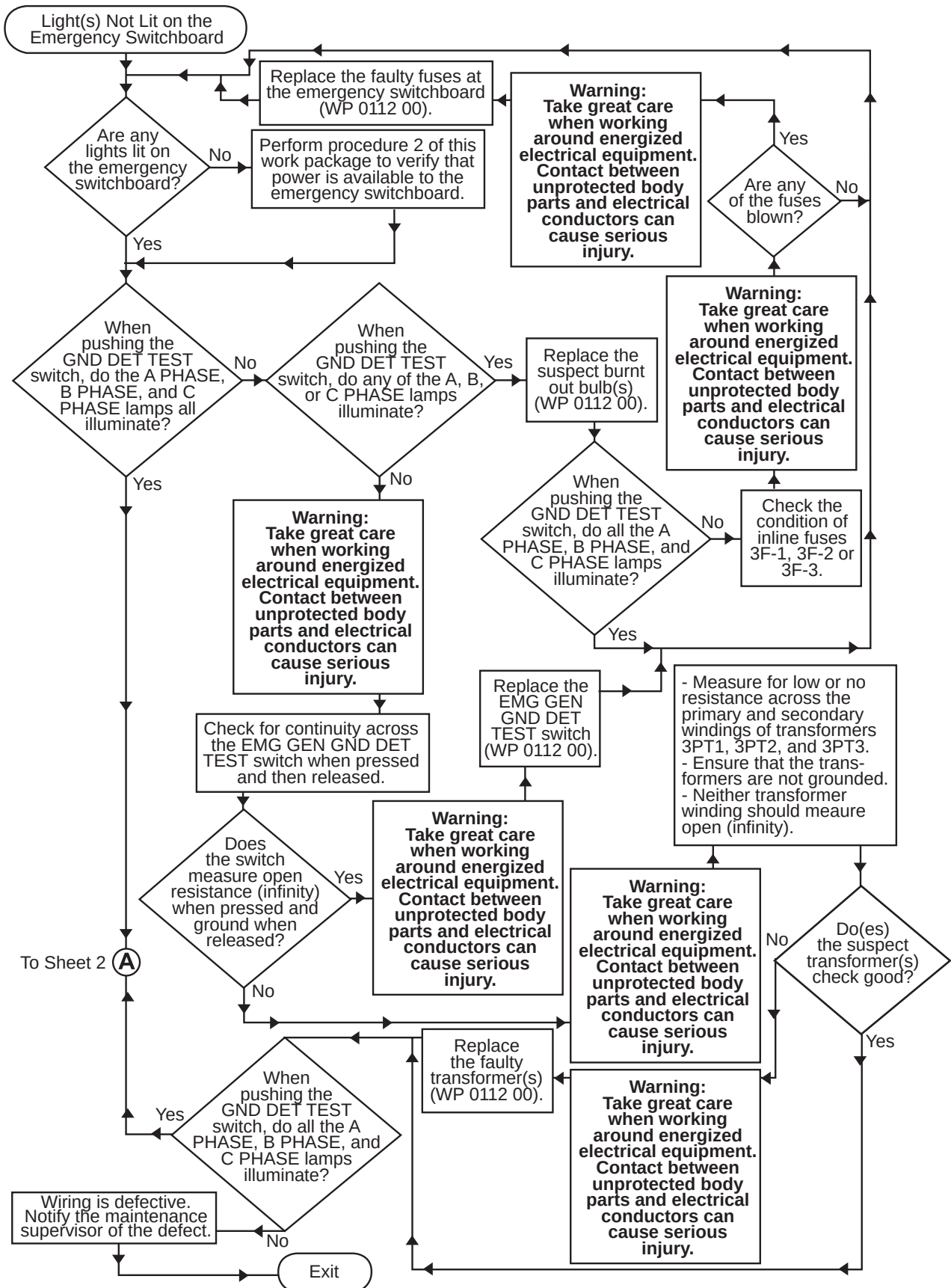


Procedure 2. No Power to the Emergency Switchboard

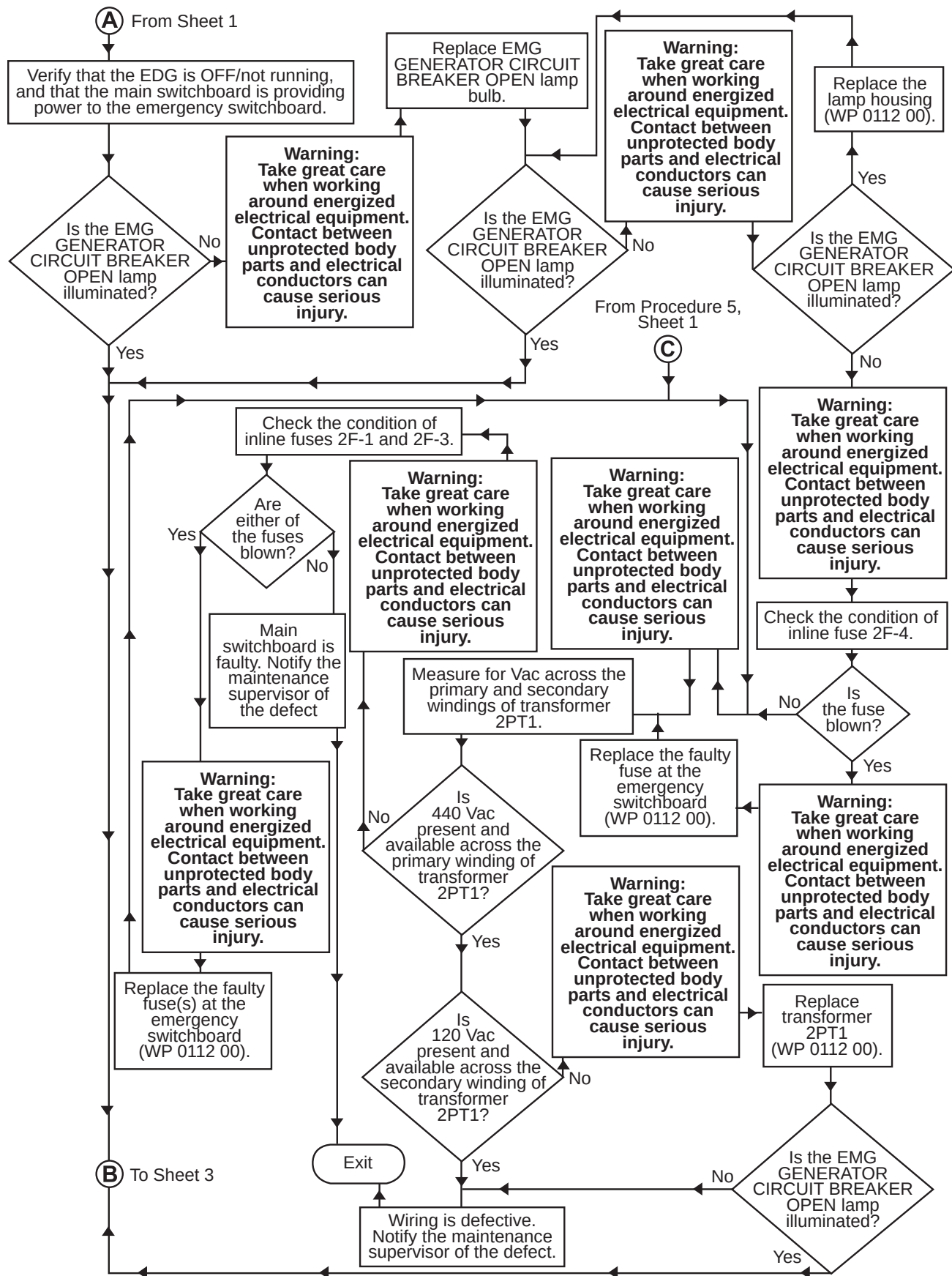




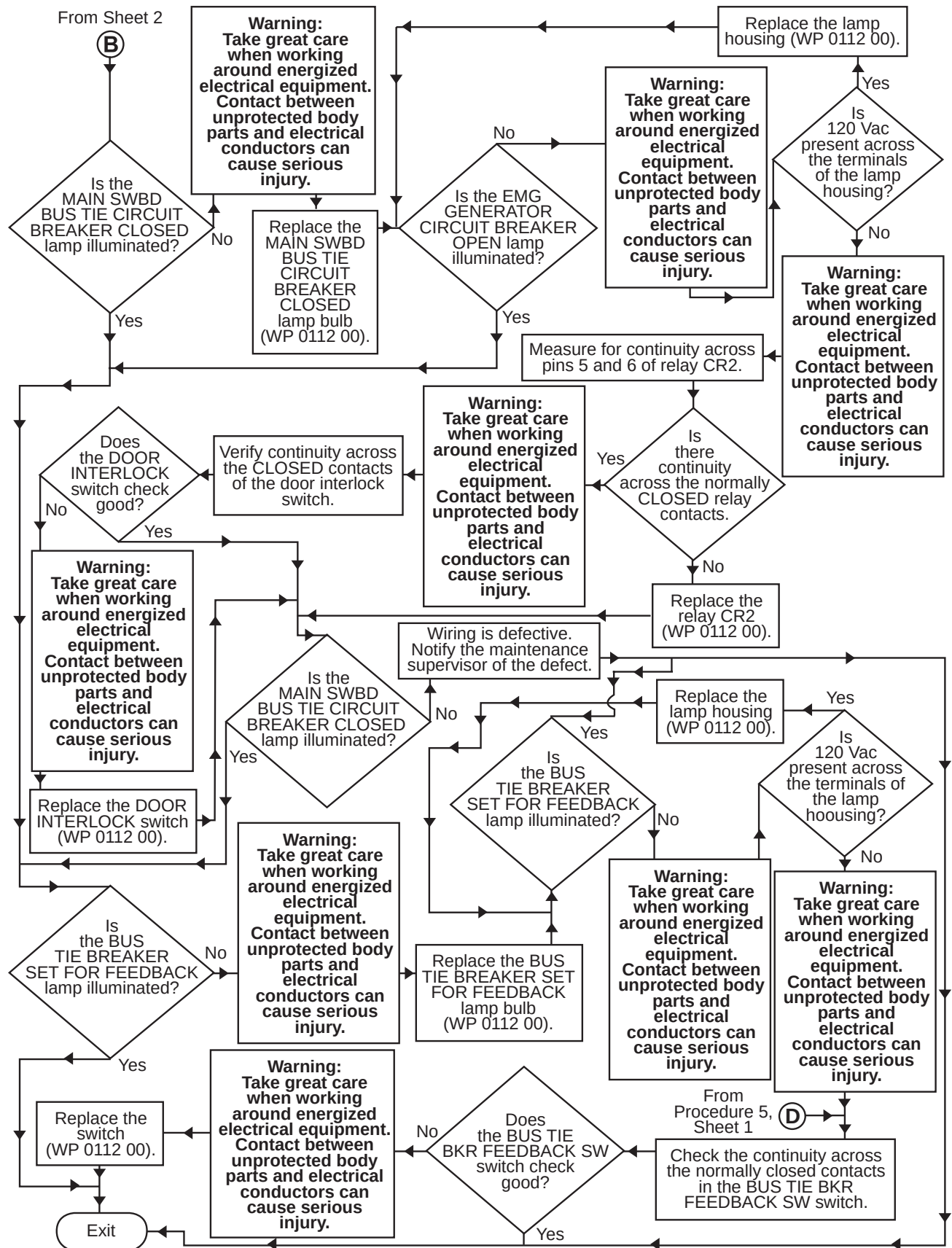




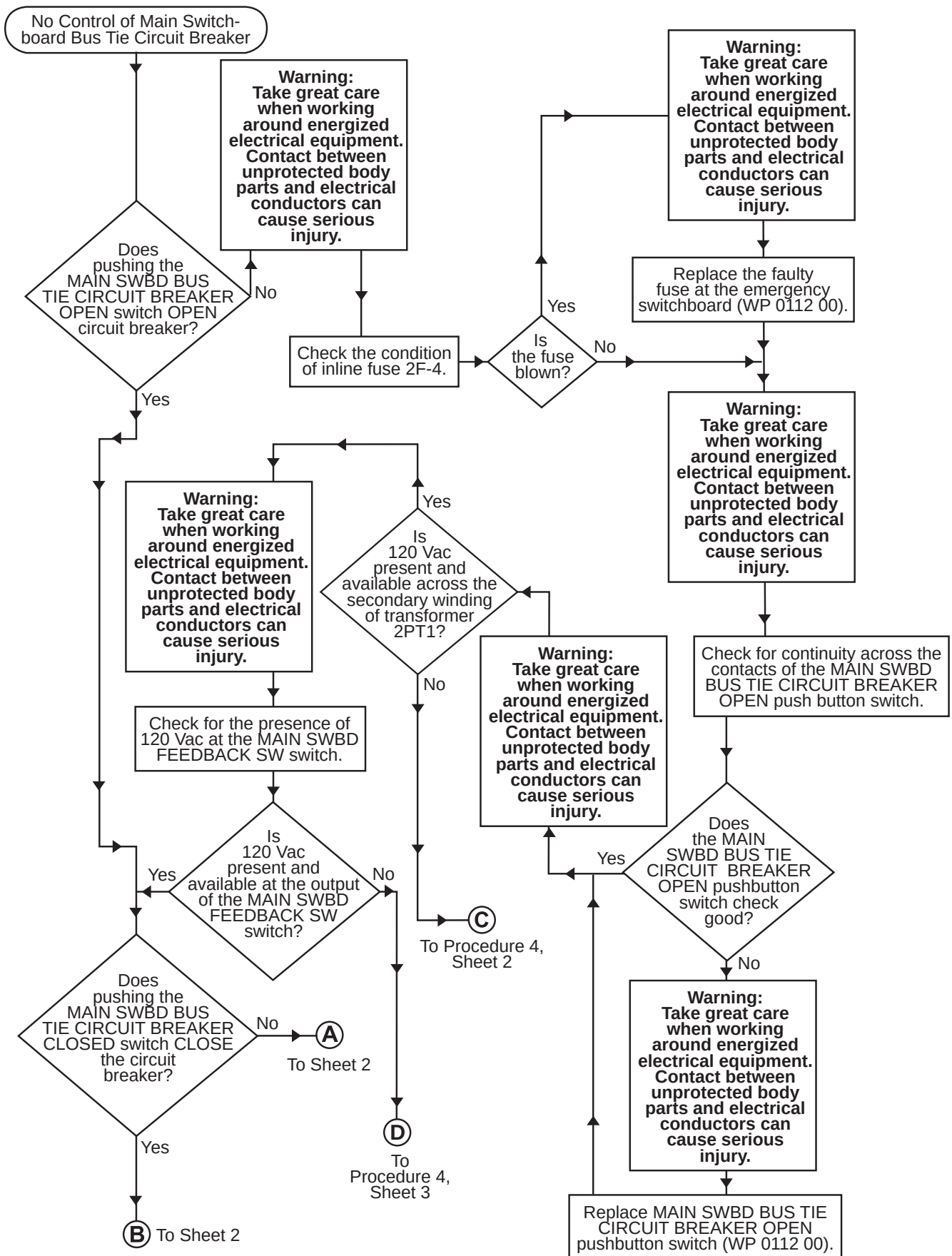
Procedure 4. Light(s) Not Lit on the Emergency Switchboard (Sheet 1 of 3)



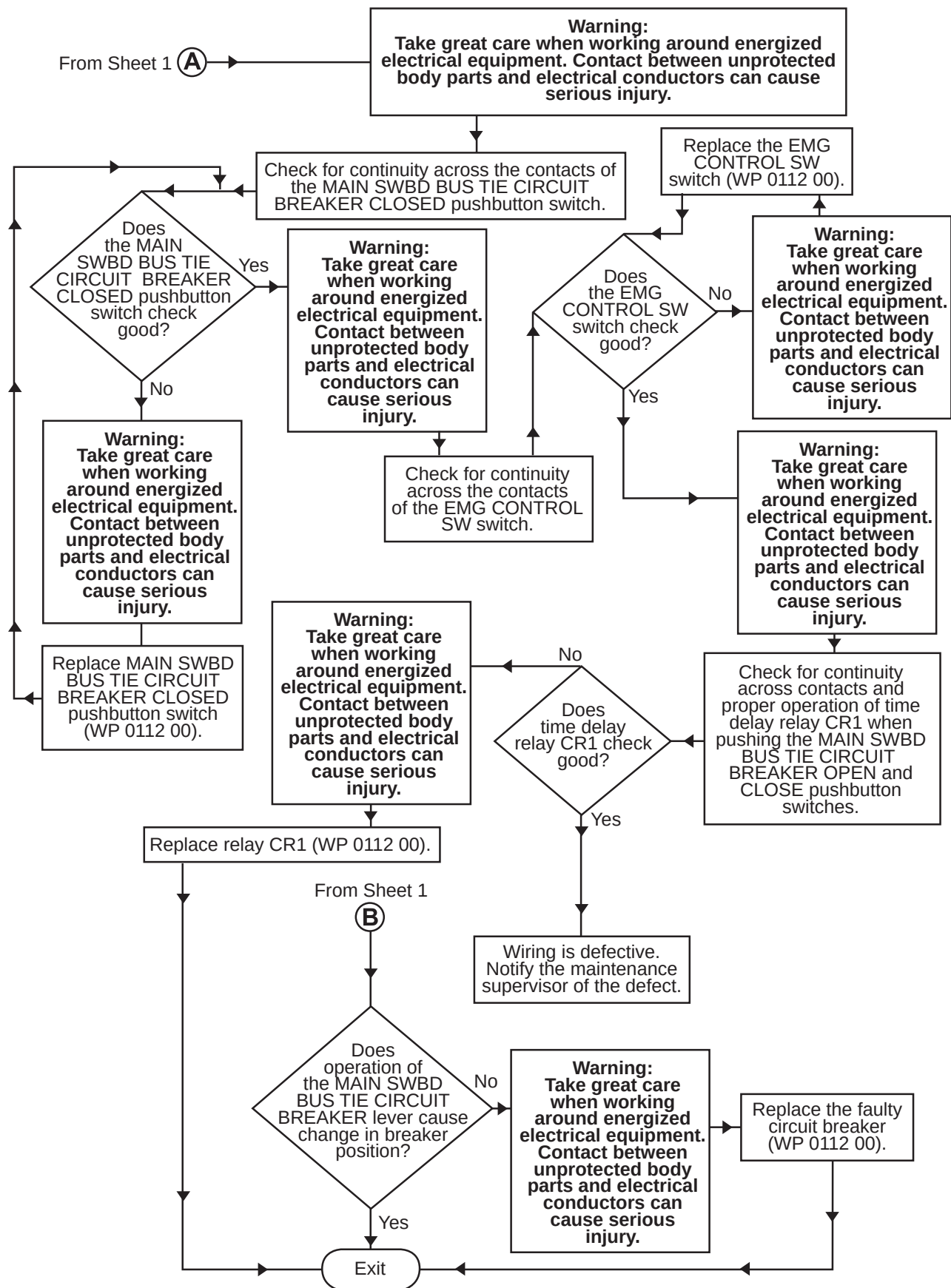
Procedure 4. Light(s) Not Lit on the Emergency Switchboard (Sheet 2 of 3)



Procedure 4. Light(s) Not Lit on the Emergency Switchboard (Sheet 3 of 3)



Procedure 5. No Control of Main Switchboard Bus Tie Circuit Breaker (Sheet 1 of 2)



Procedure 5. No Control of Main Switchboard Bus Tie Circuit Breaker (Sheet 2 of 2)

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
DISTRIBUTION PANELS**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0114 00
WP 0295 00 (volume 2)

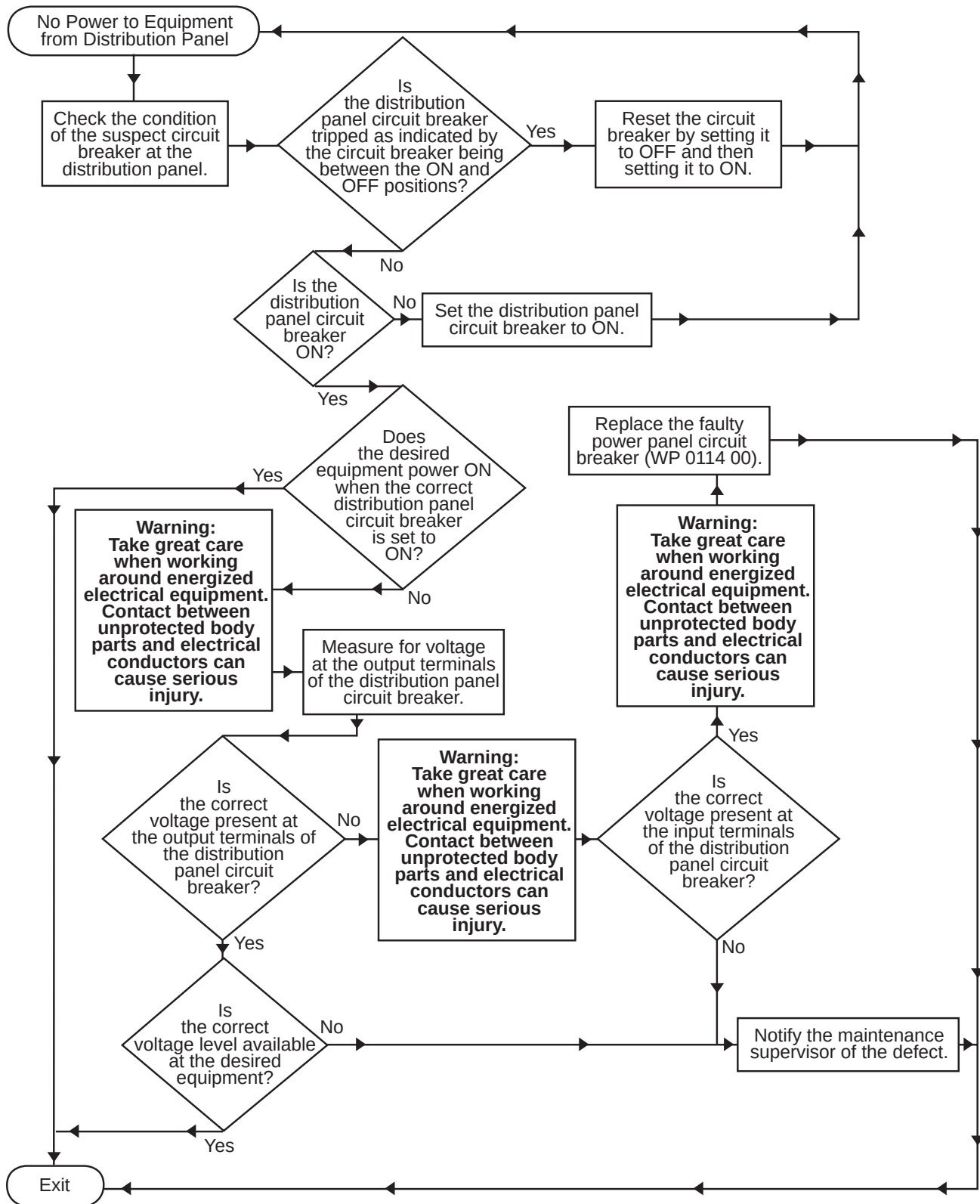
Personnel Required:

Two Watercraft Engineers, 88L

INTRODUCTION

The following unit troubleshooting procedure is included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Equipment from Distribution Panel	1



Procedure 1. No Power to Equipment from Distribution Panel

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
LIGHTING, INTERIOR**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0118 00
WP 0119 00
WP 0295 00 (Volume 2)

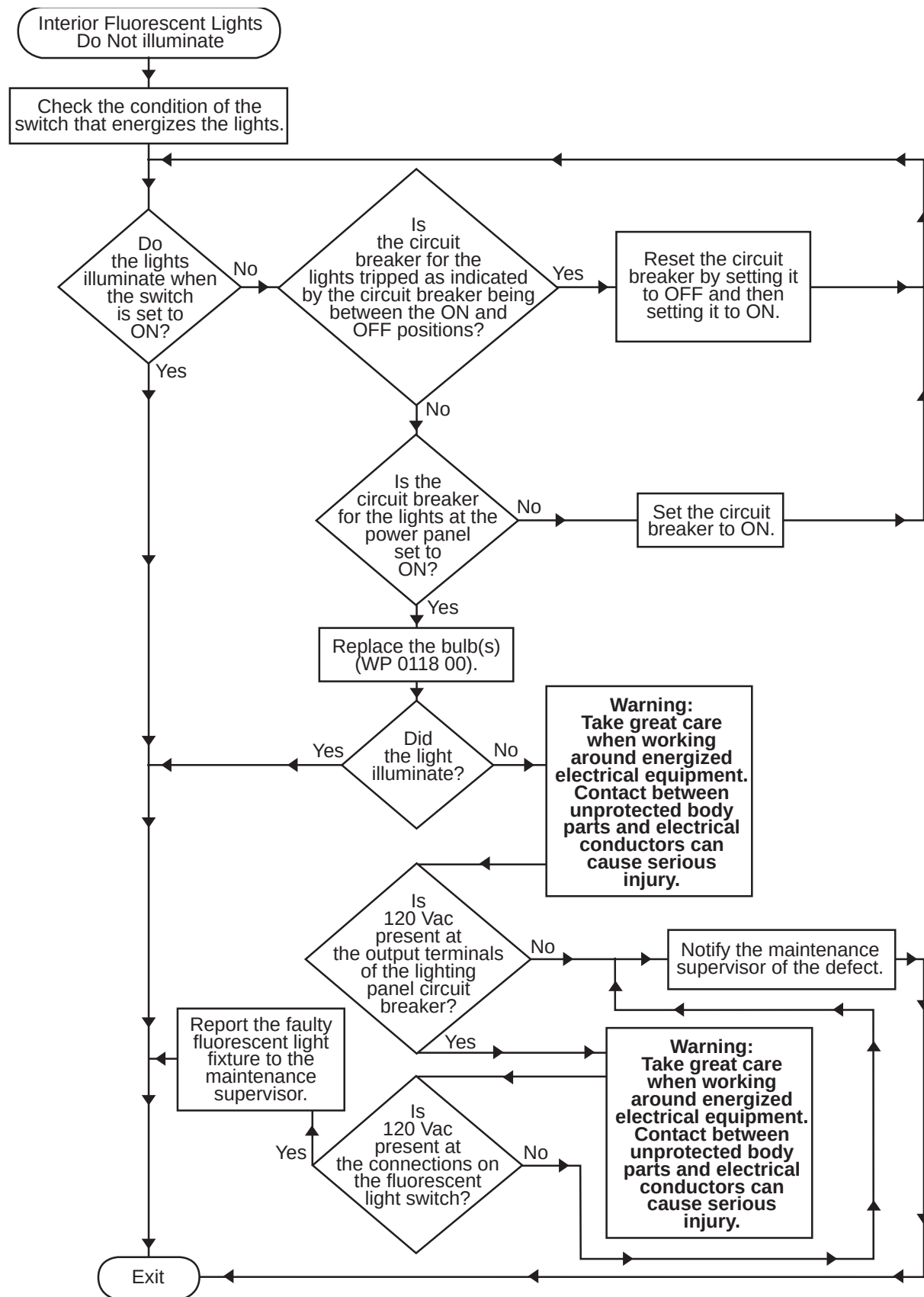
Personnel Required:

Two Watercraft Engineers, 88L

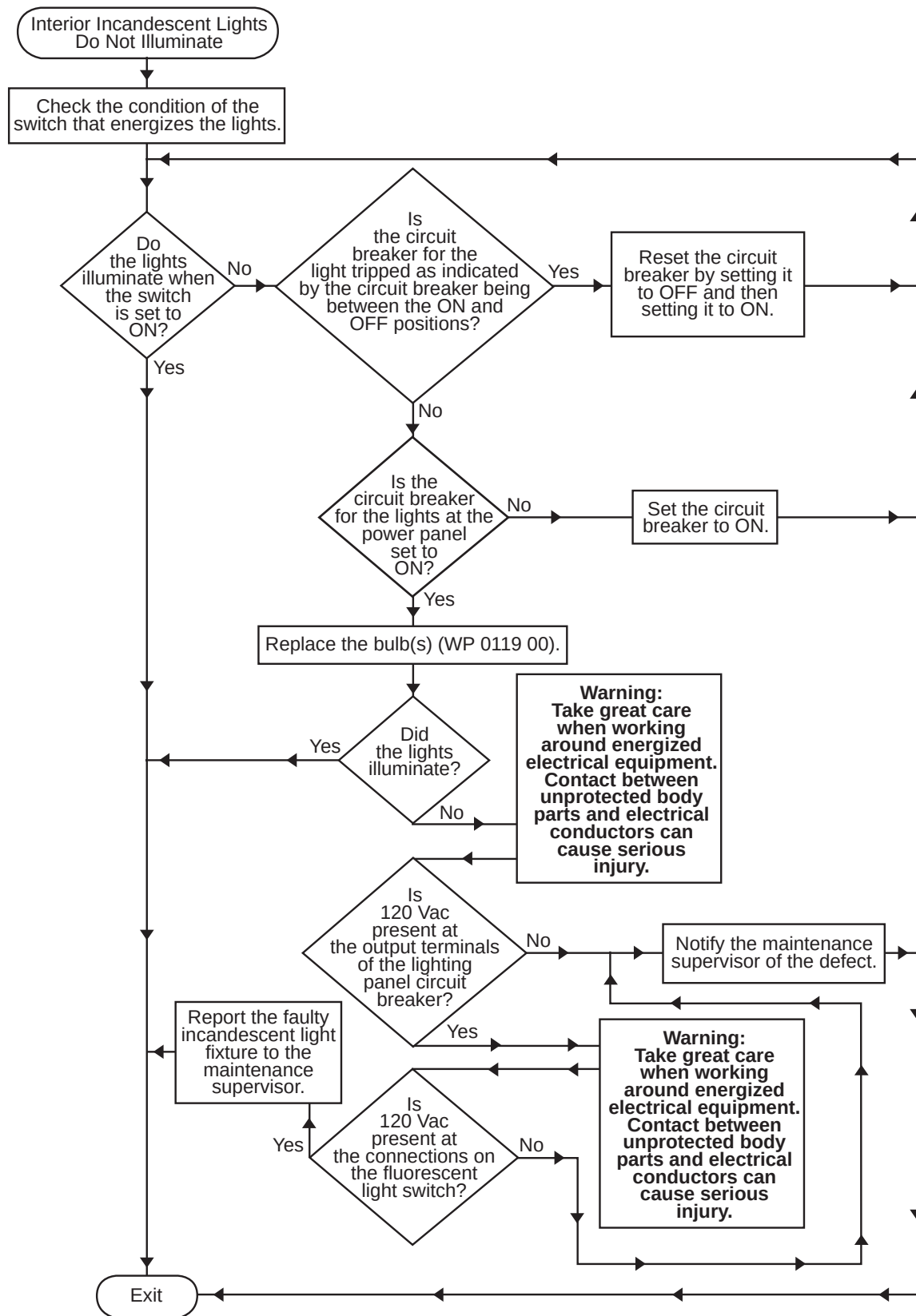
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Interior Fluorescent Lights Do Not Illuminate	1
Interior Incandescent Lights Do Not Illuminate	2



Procedure 1. Interior Fluorescent Lights Do Not Illuminate



Procedure 2. Interior Incandescent Lights Do Not Illuminate

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
FLOODLIGHTS**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0121 00
WP 0295 00 (Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

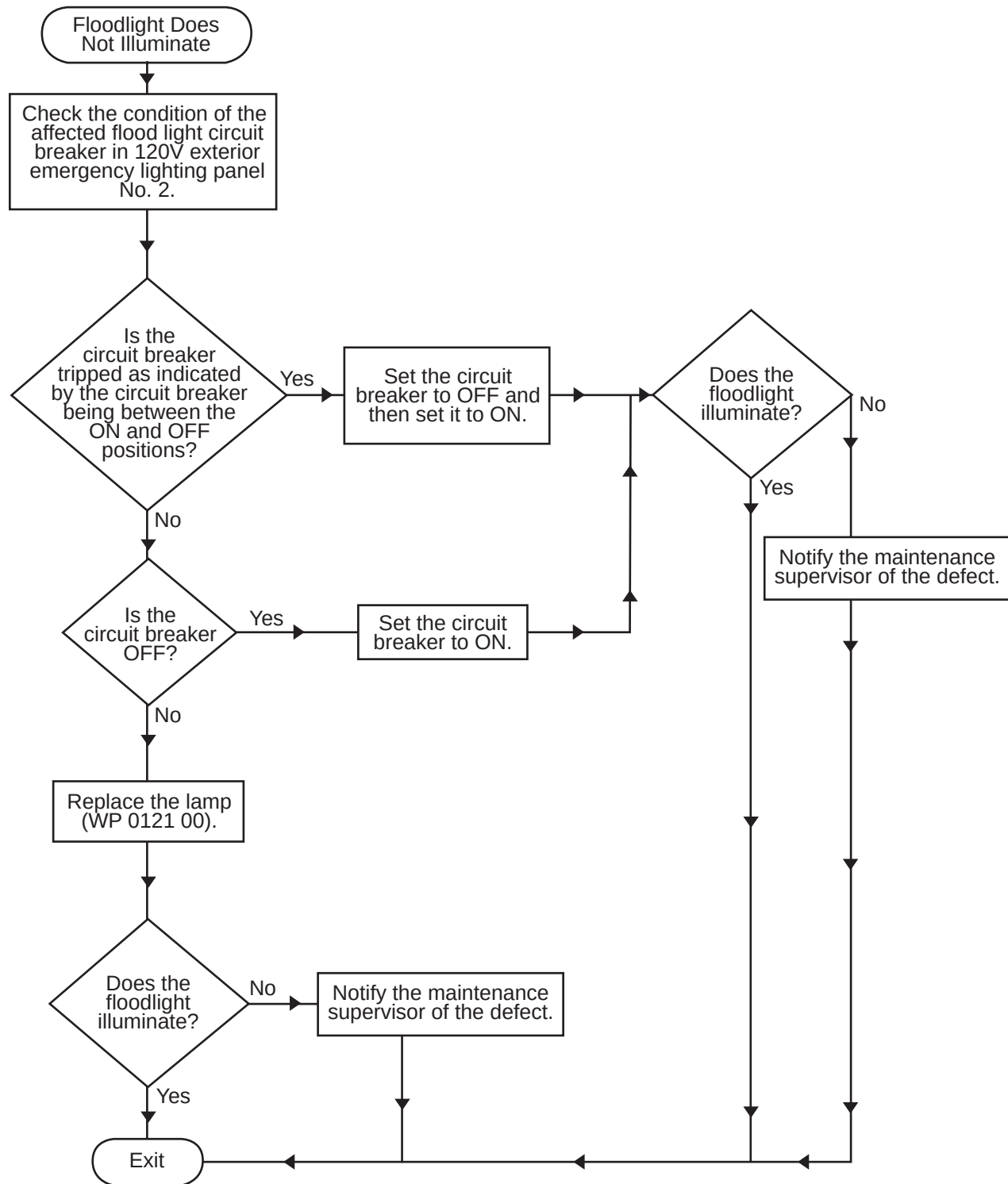
INTRODUCTION

The following unit troubleshooting procedure is included in this work package:

Malfunction/Symptom

Procedure

Floodlight Does Not Illuminate 1

**Procedure 1. Floodlight Does Not Illuminate****END OF WORK PACKAGE**

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

NAVIGATION LIGHTS

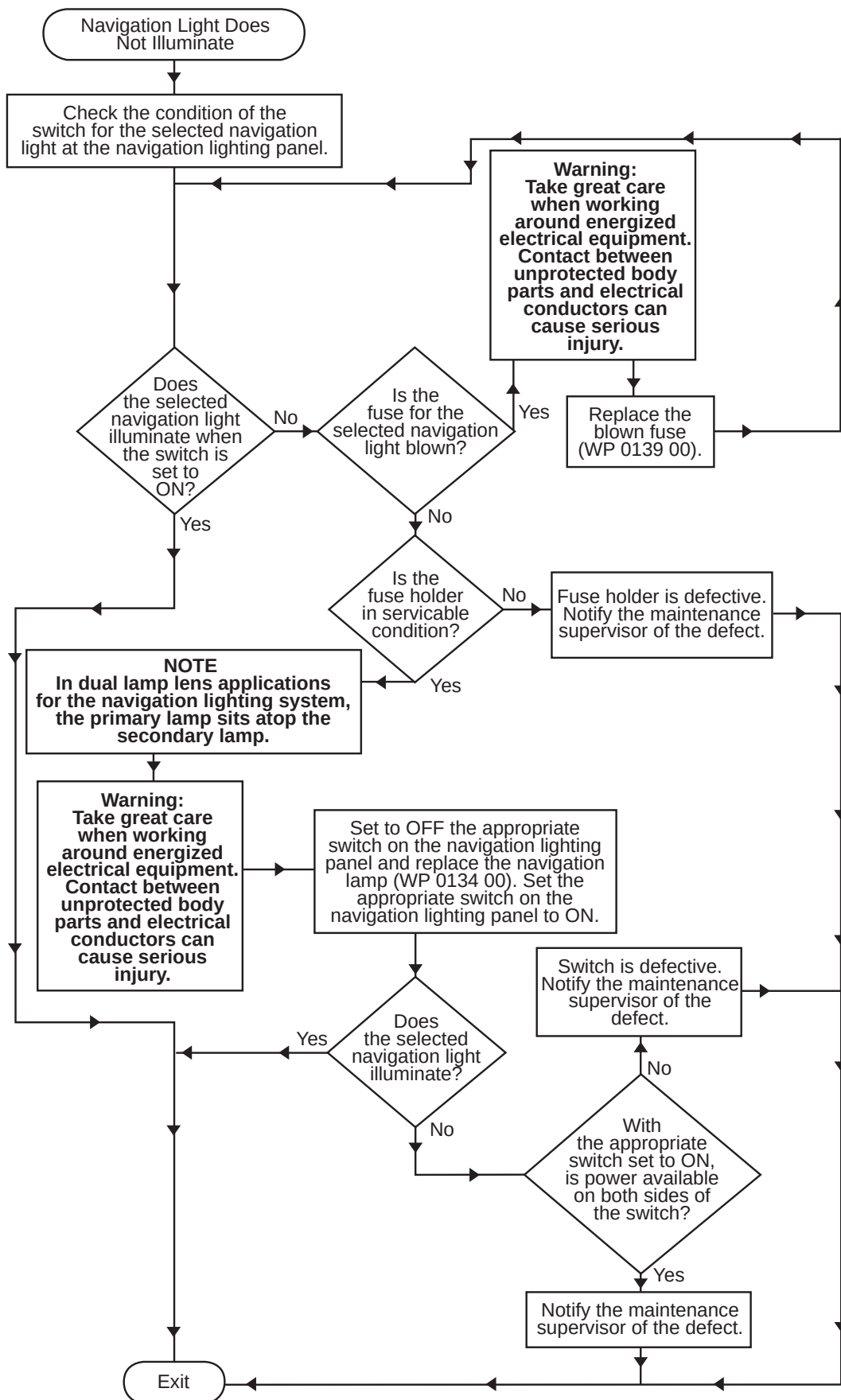
INITIAL SETUP:

Tools and Special Tools:	References:
Tool Kit, Electrician’s (Item 11, Table 2,	WP 0134 00
WP 0295 00, Volume 2)	WP 0136 00
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)	WP 0137 00
	WP 0139 00
Personnel Required:	WP 0295 00 (volume 2)
Two Watercraft Engineers, 88L	

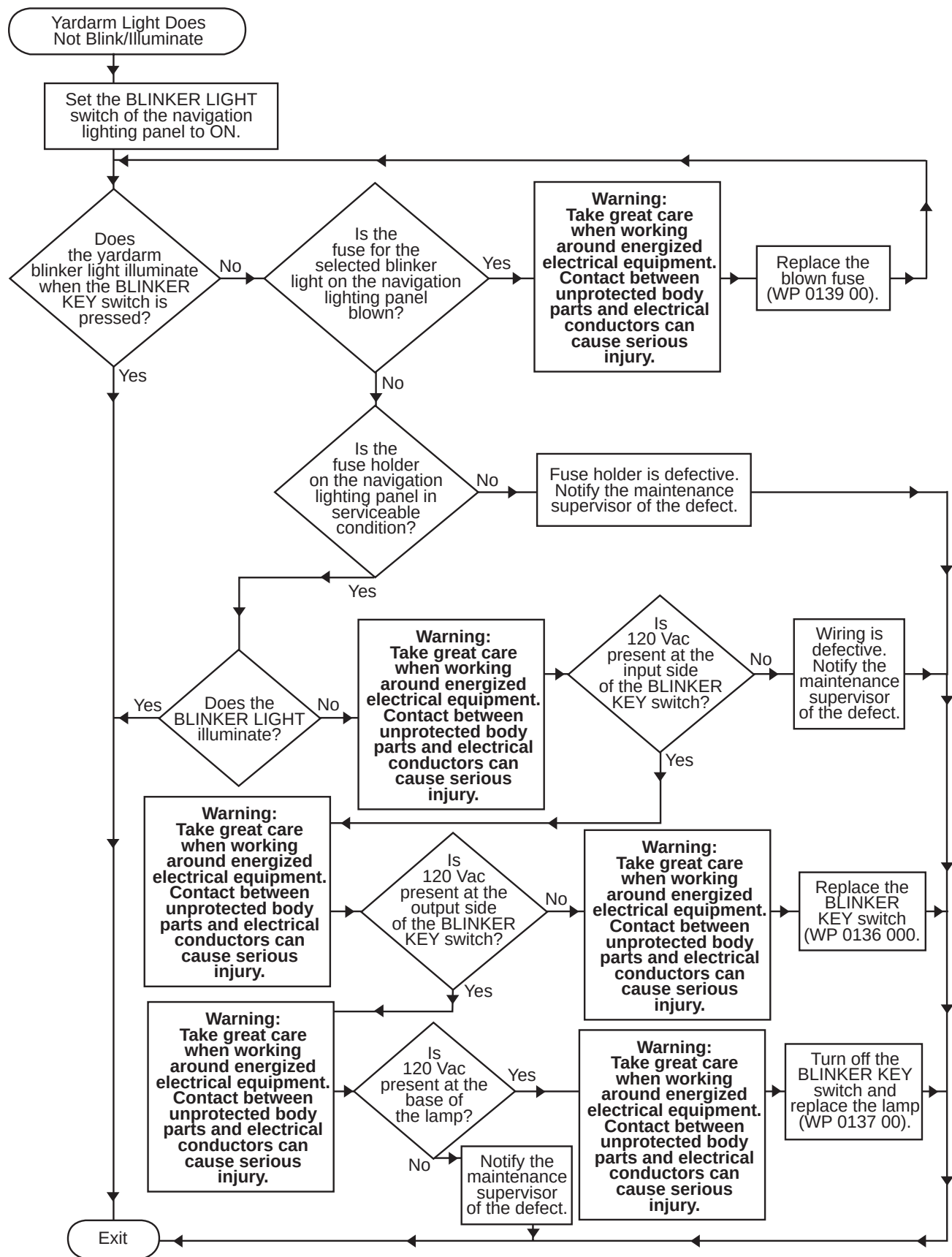
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Navigation Light Does Not Illuminate	1
Yardarm Light Does Not Blink/Illuminate	2



Procedure 1. Navigation Light Does Not Illuminate



Procedure 2. Yardarm Light Does Not Blink/Illuminate

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

SEARCHLIGHTS

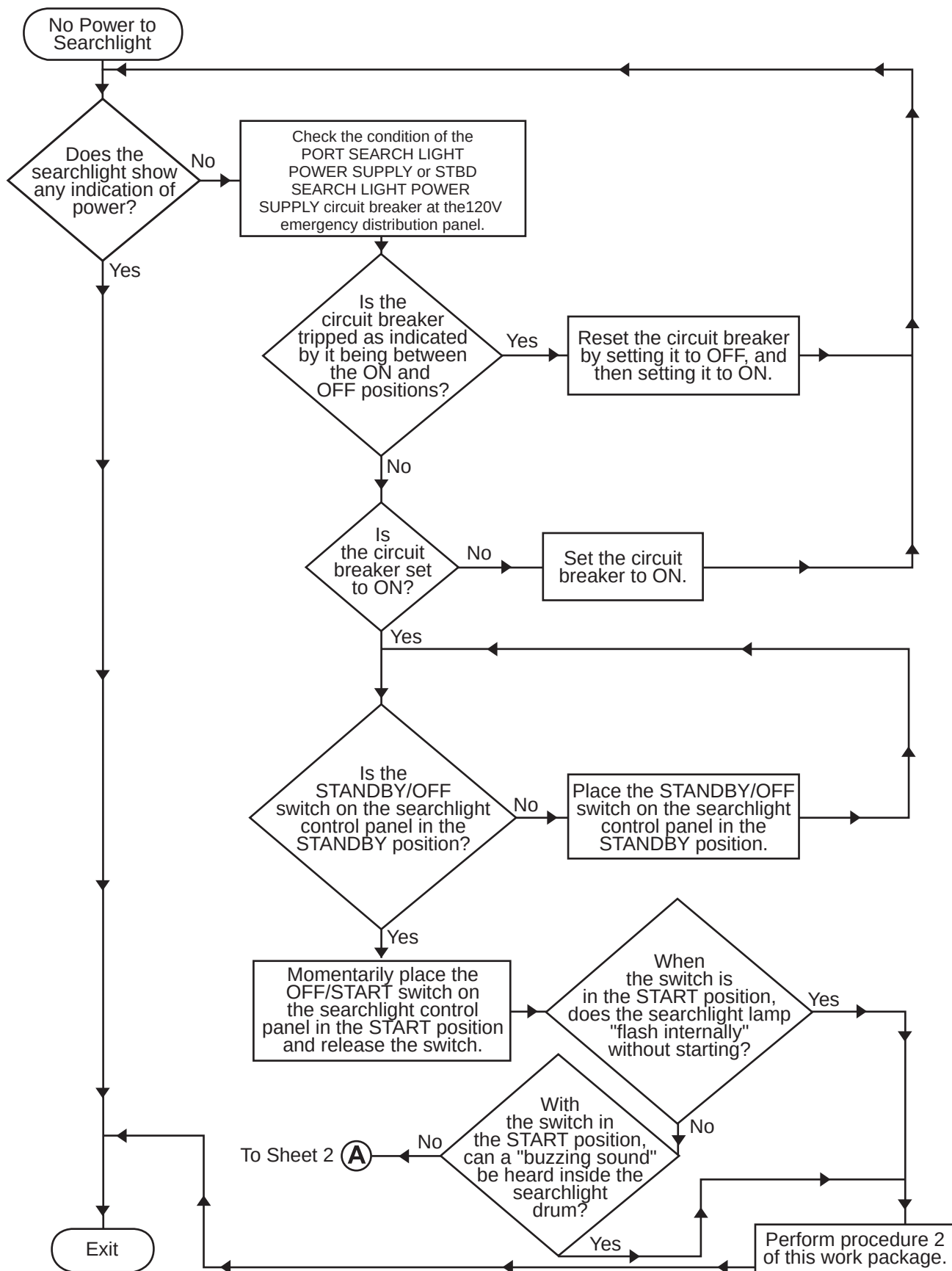
INITIAL SETUP:

Tools and Special Tools:	Personnel Required:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)	Two Watercraft Engineers, 88L
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)	References:
	WP 0133 00
	WP 0295 00 (volume 2)

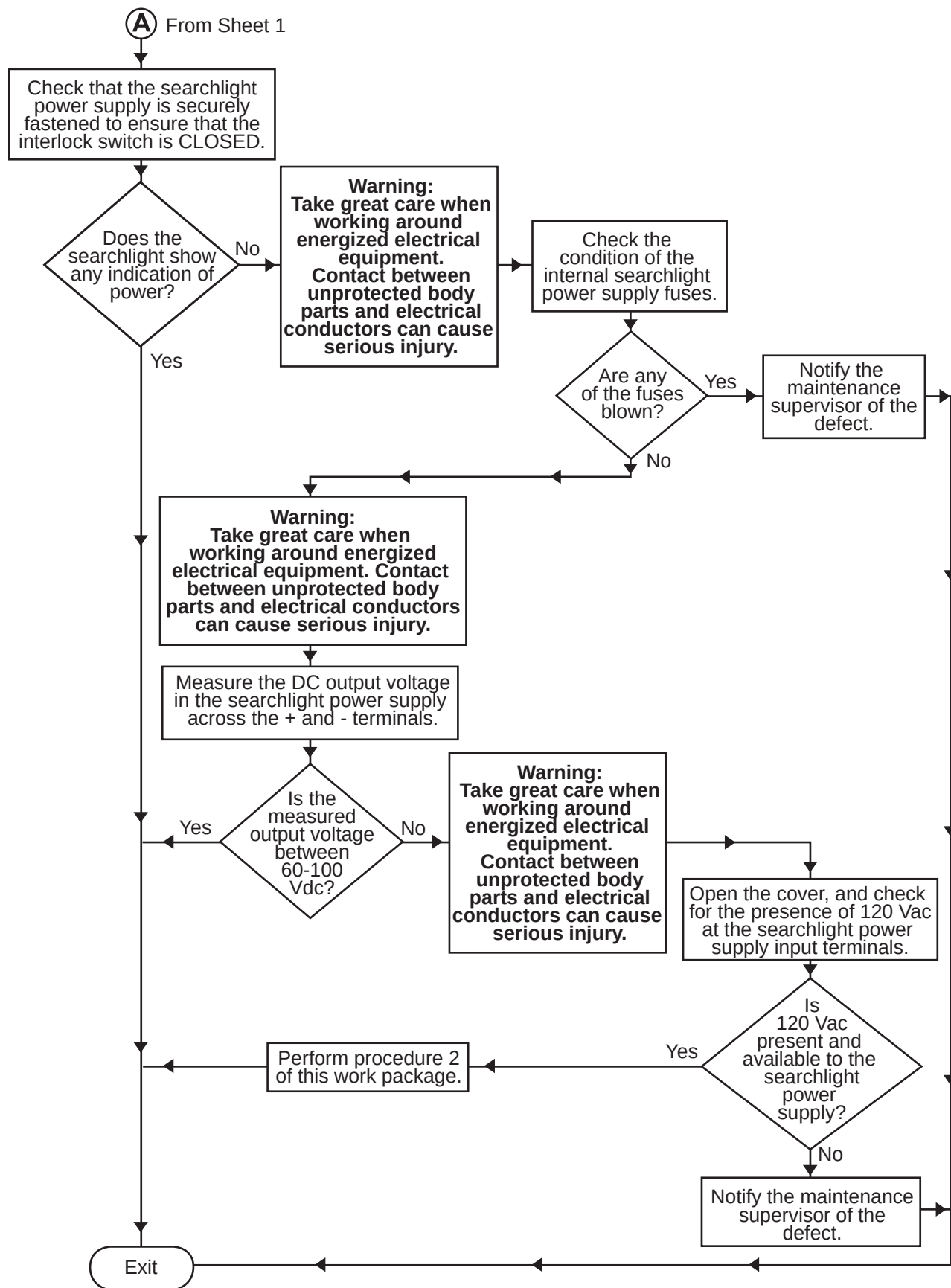
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

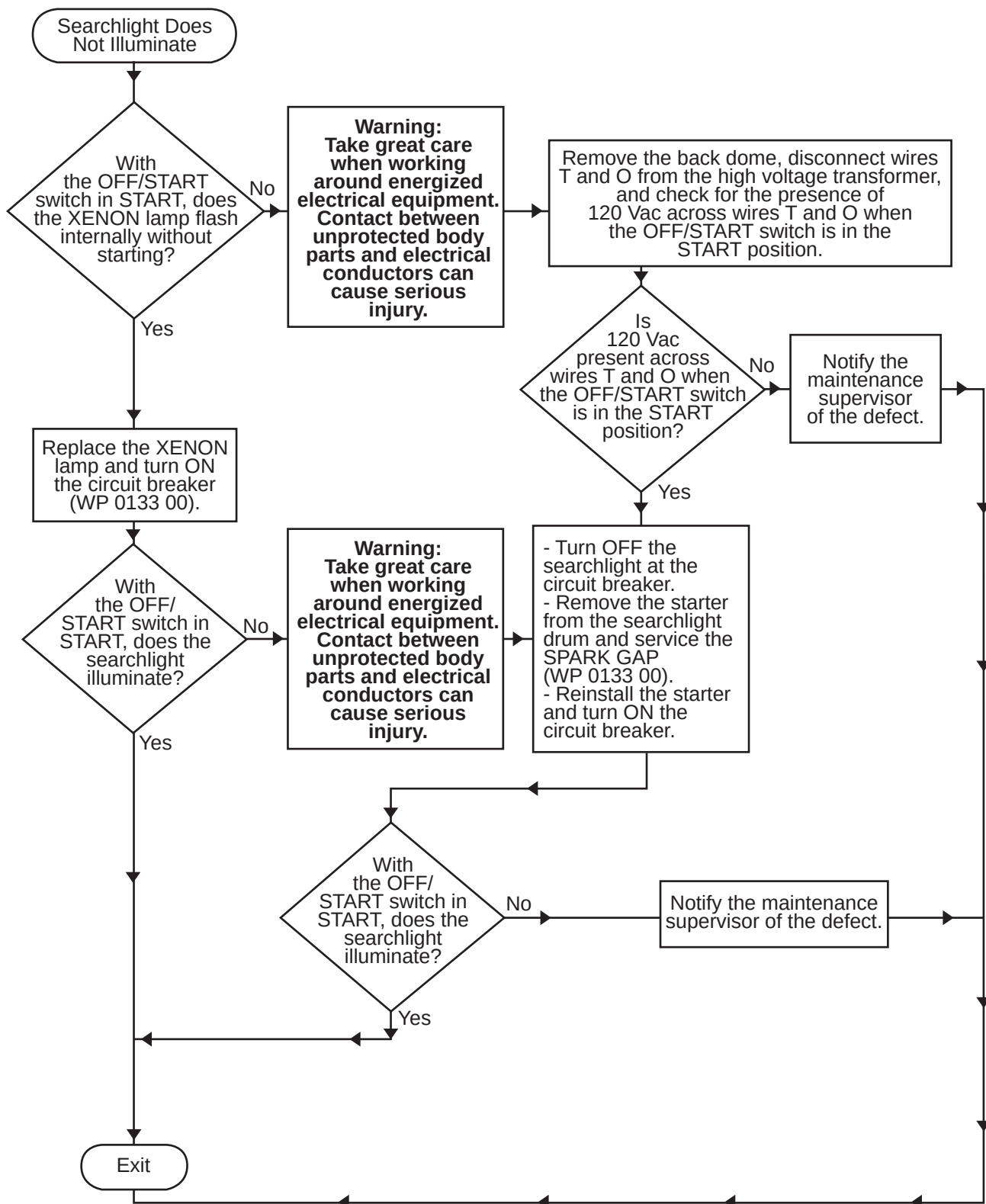
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Searchlight	1
Searchlight Does Not Illuminate	2
Searchlight Does Not Move Up-Down and Left-Right Remotely	3



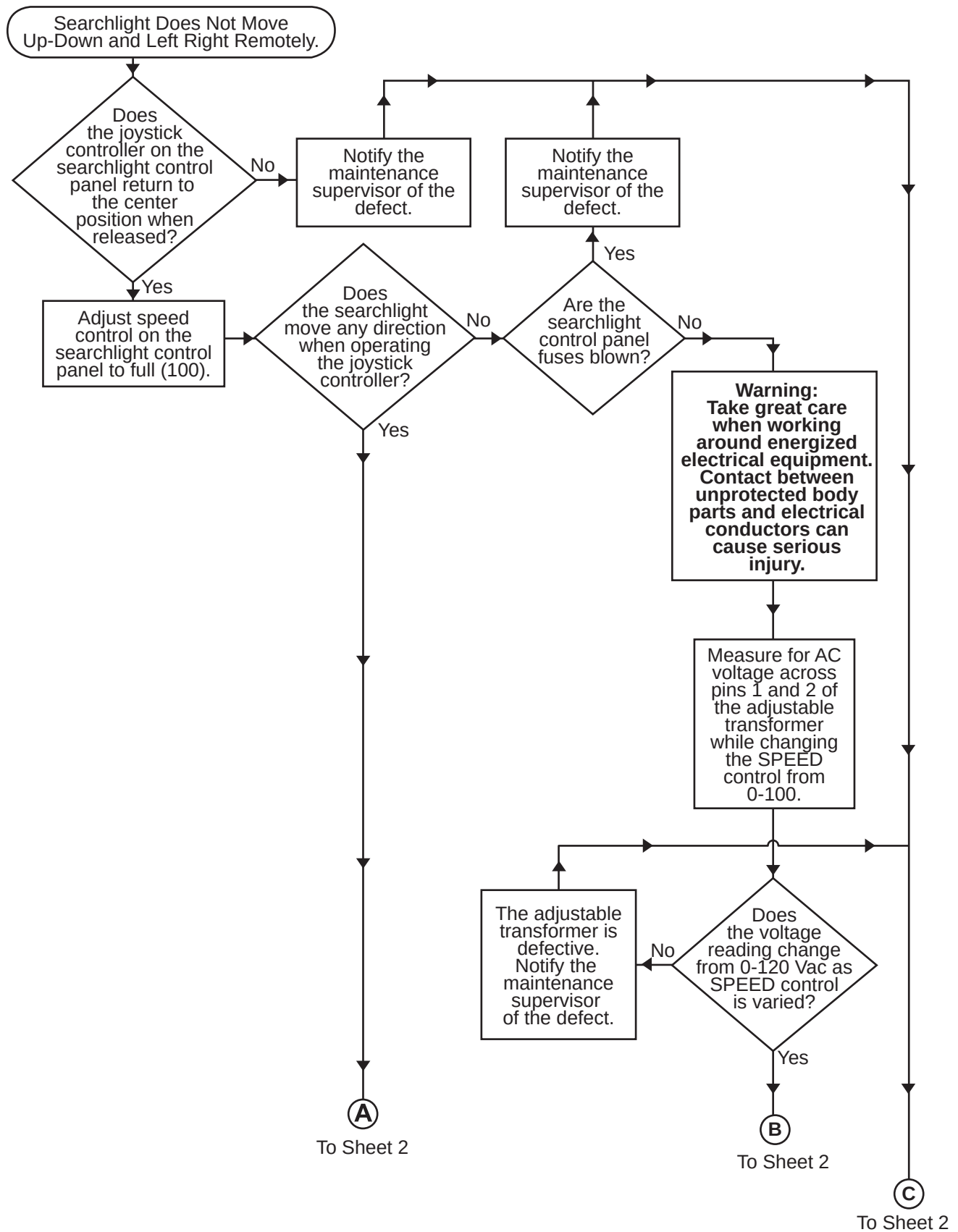
Procedure 1. No Power to Searchlight (Sheet 1 of 2)



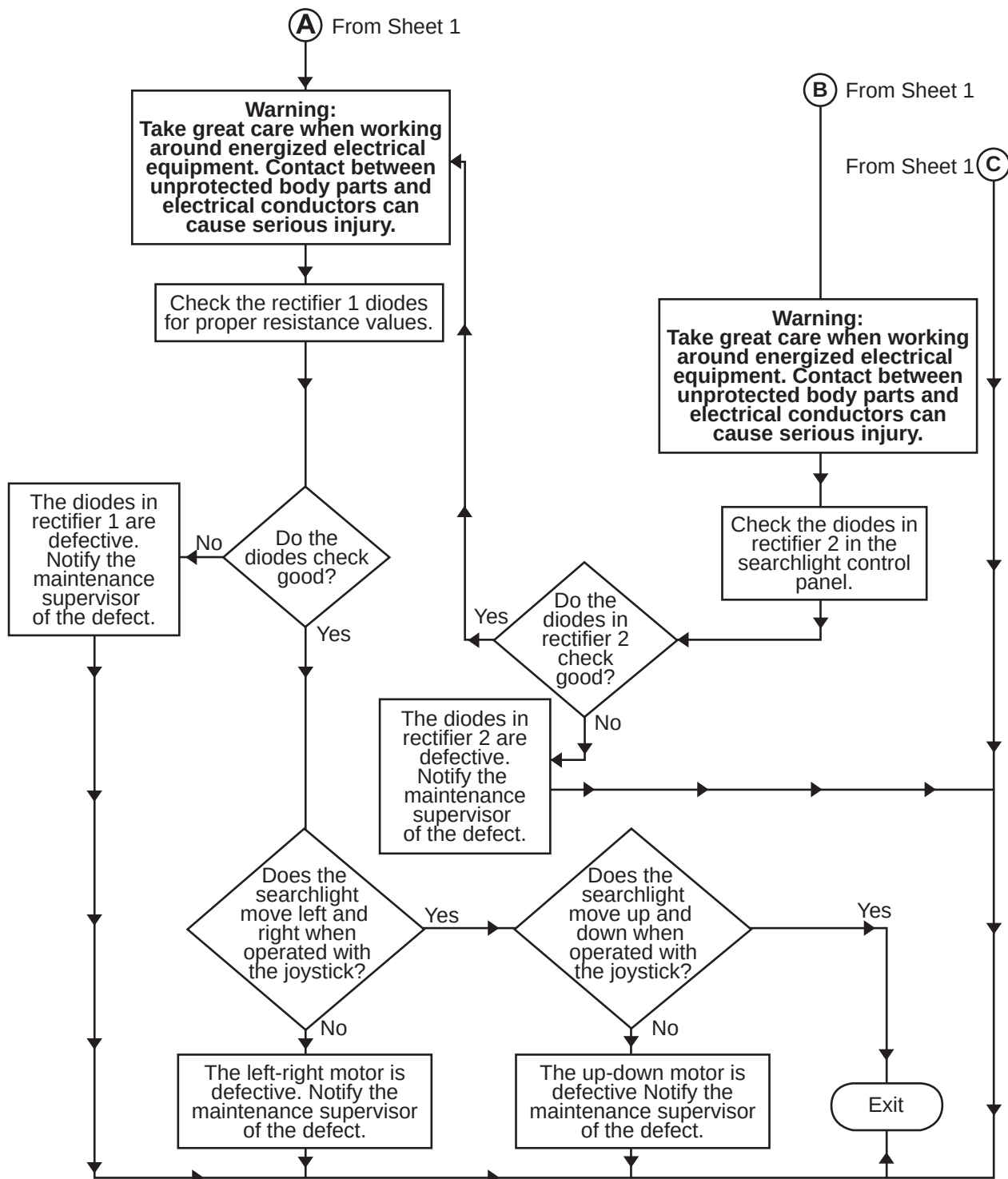
Procedure 1. No Power to Searchlight (Sheet 2 of 2)



Procedure 2. Searchlight Does Not Illuminate



Procedure 3. Searchlight Does Not Move Up-Down and Left-Right Remotely (Sheet 1 of 2)



Procedure 3. Searchlight Does Not Move Up-Down and Left-Right Remotely (Sheet 2 of 2)

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
MOTOR CONTROLLERS**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

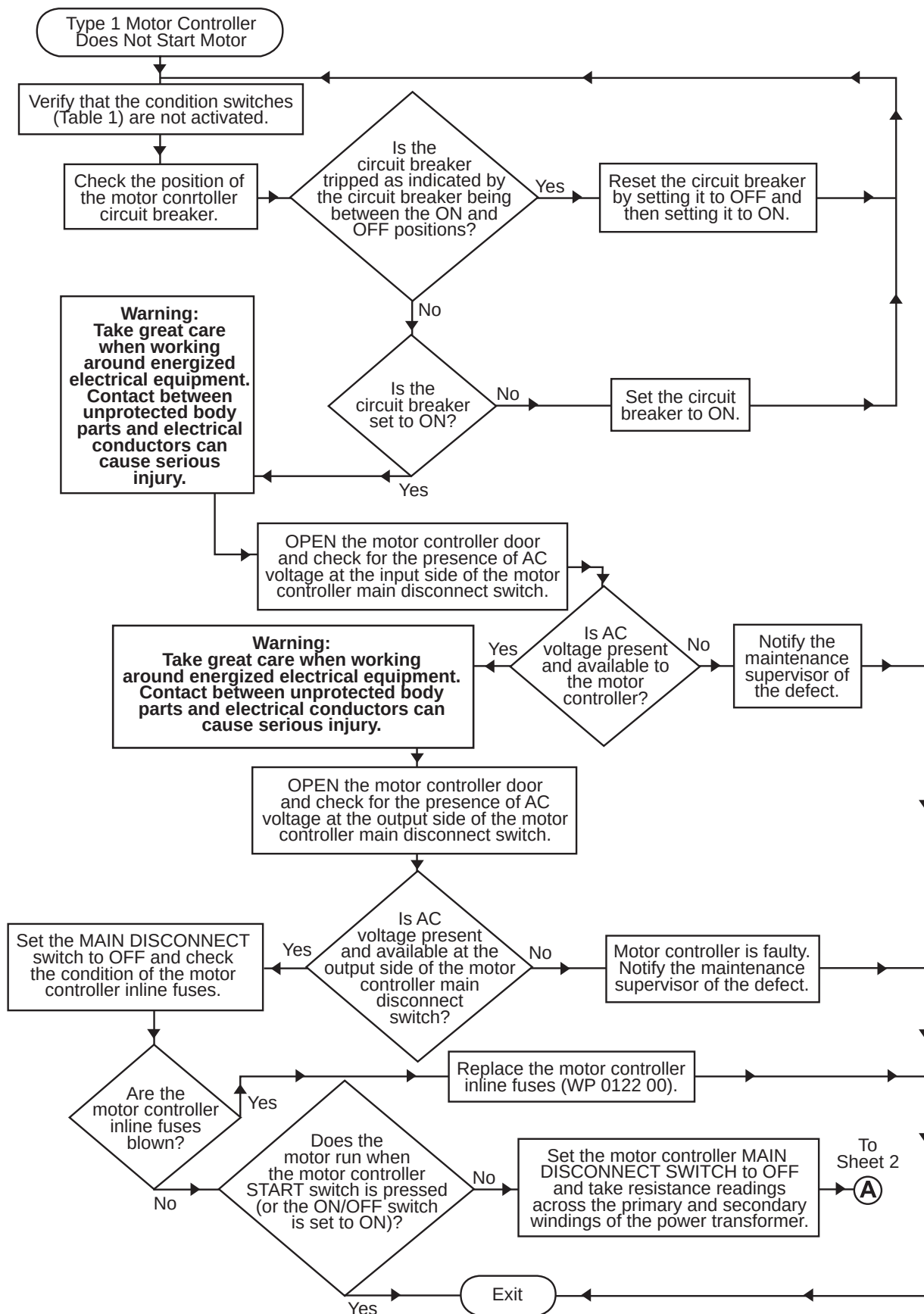
References:

WP 0122 00
WP 0123 00
WP 0124 00
WP 0125 00
WP 0126 00
WP 0127 00
WP 0295 00 (volume 2)

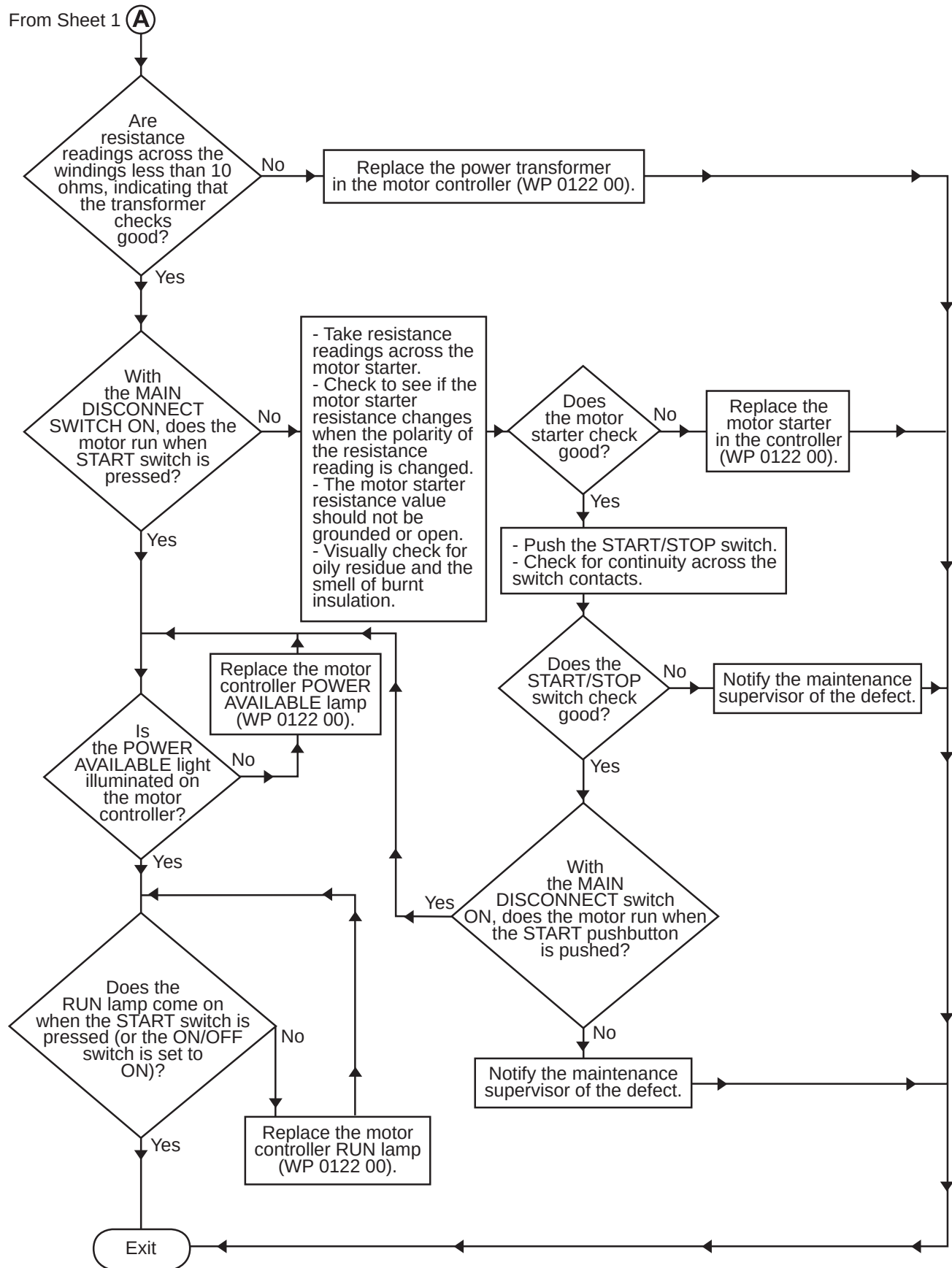
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

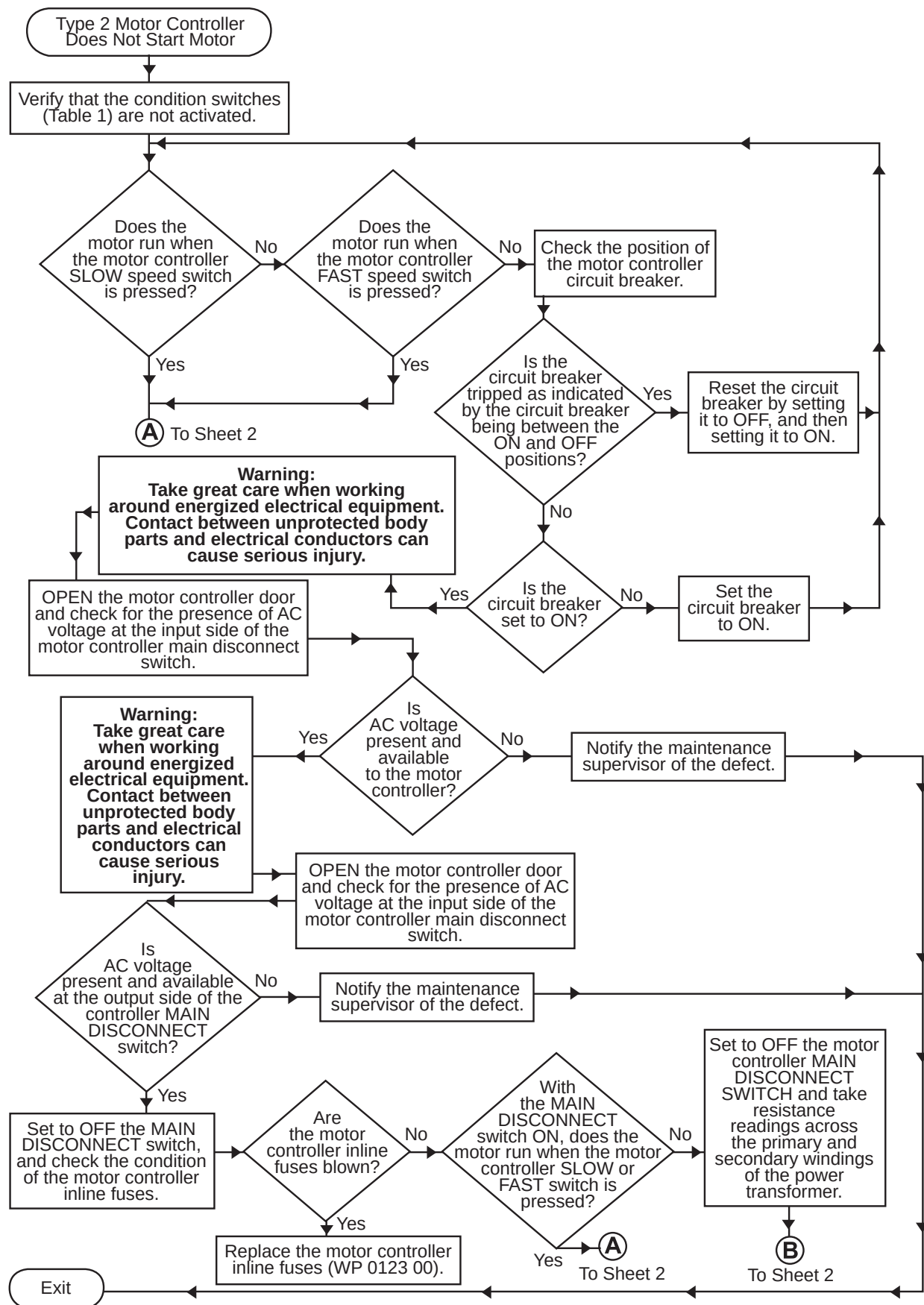
<u>Malfunction/Symptom</u>	<u>Procedure</u>
Type 1 Motor Controller Does Not Start Motor	1
Type 2 Motor Controller Does Not Start Motor	2
Type 3 Motor Controller Does Not Start Motor	3
Type 4, Type 5, or Type 6 Motor Controller Does Not Start Motor	4



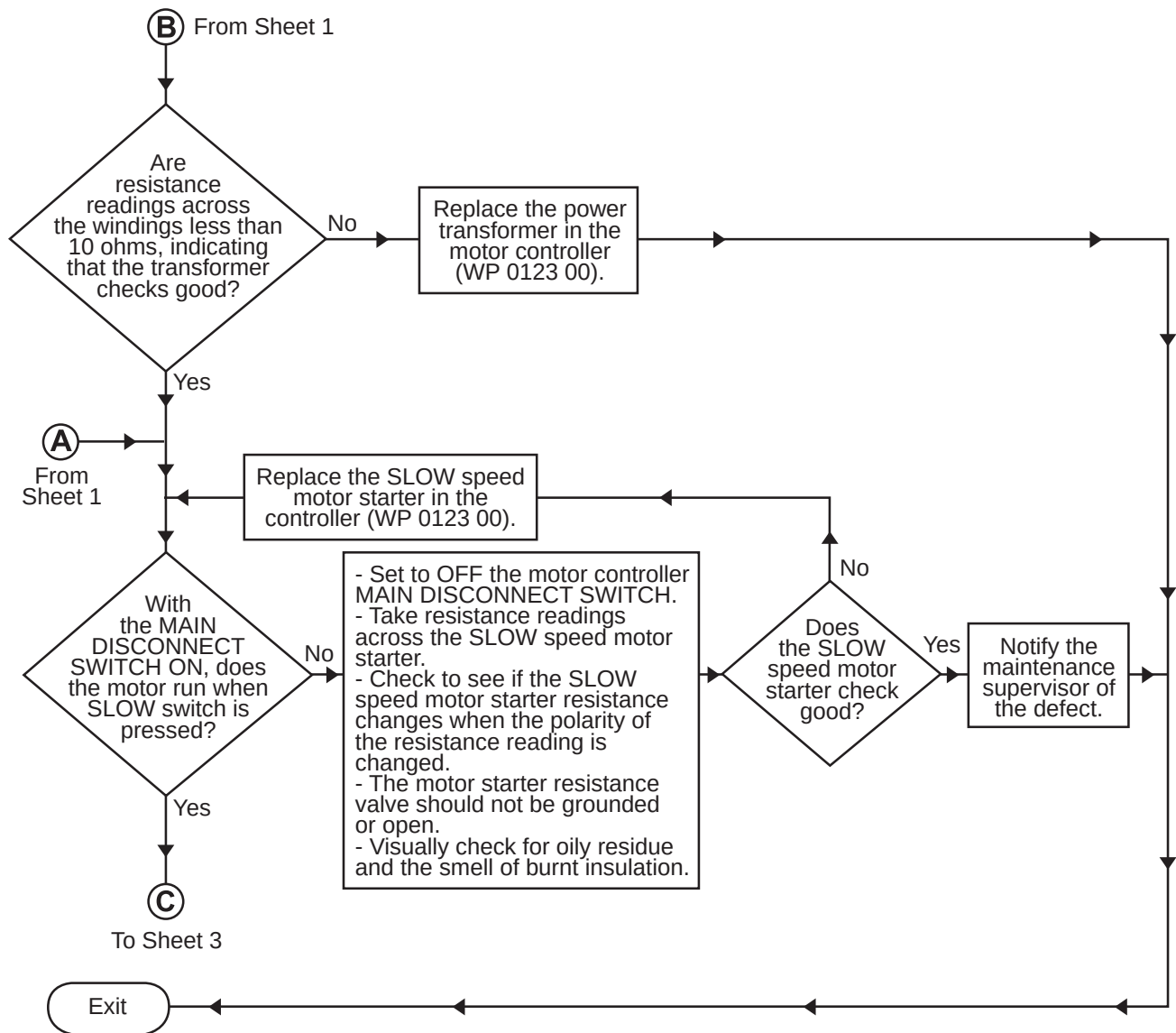
Procedure 1. Type 1 Motor Controller Does Not Start Motor (Sheet 1 of 2)



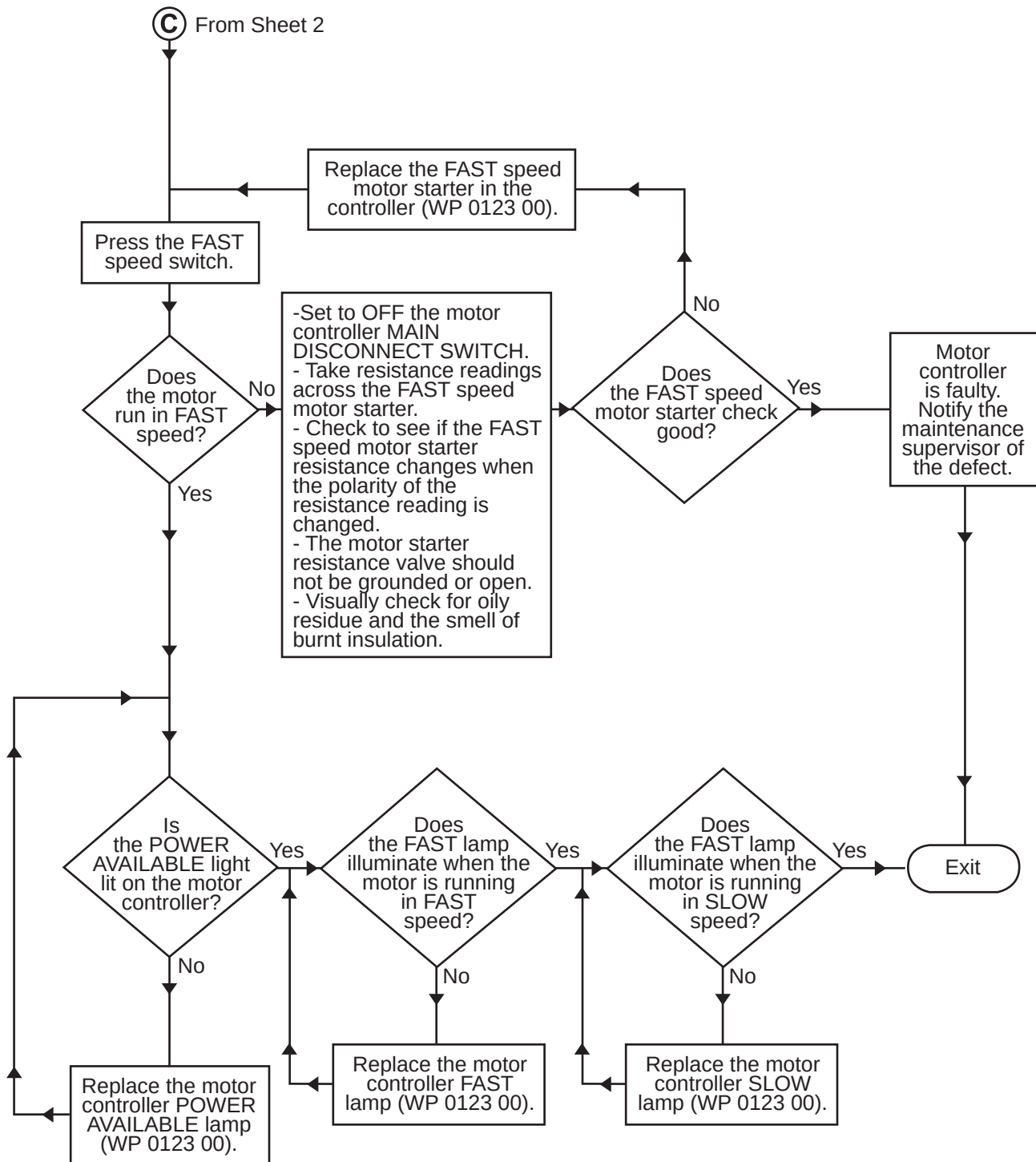
Procedure 1. Type 1 Motor Controller Does Not Start Motor (Sheet 2 of 2)



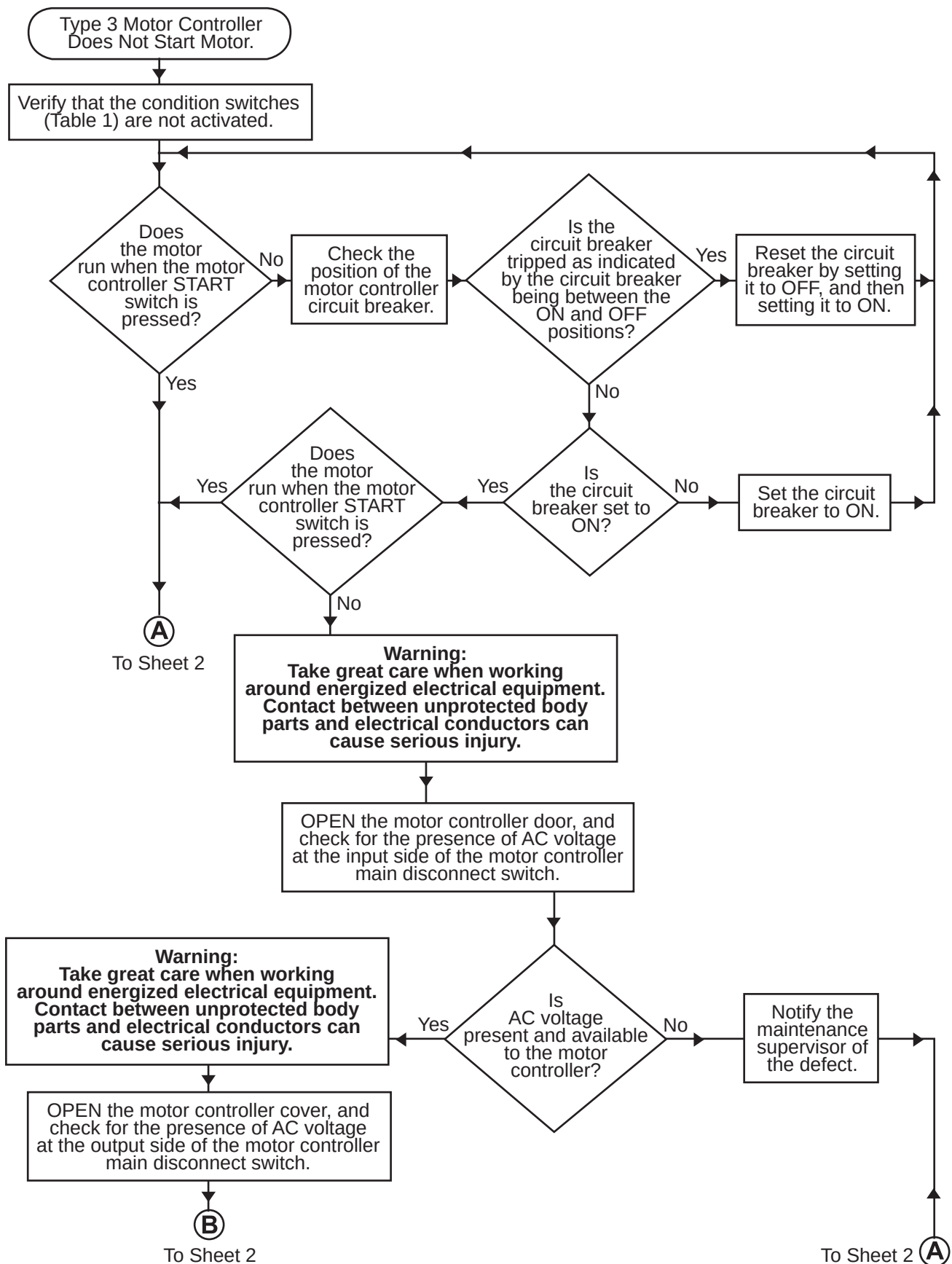
Procedure 2. Type 2 Motor Controller Does Not Start Motor (Sheet 1 of 3)



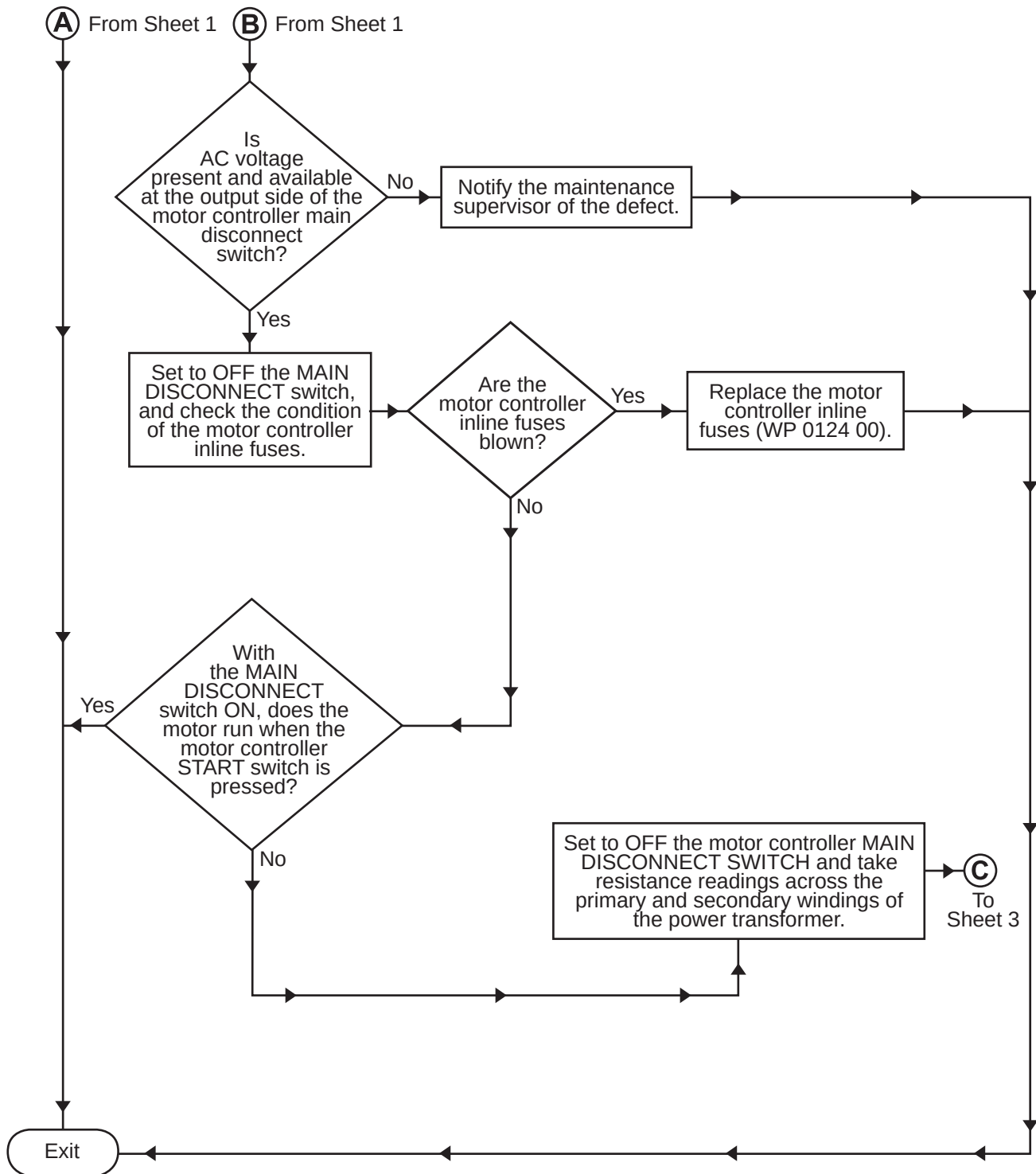
Procedure 2. Type 2 Motor Controller Does Not Start Motor (Sheet 2 of 3)



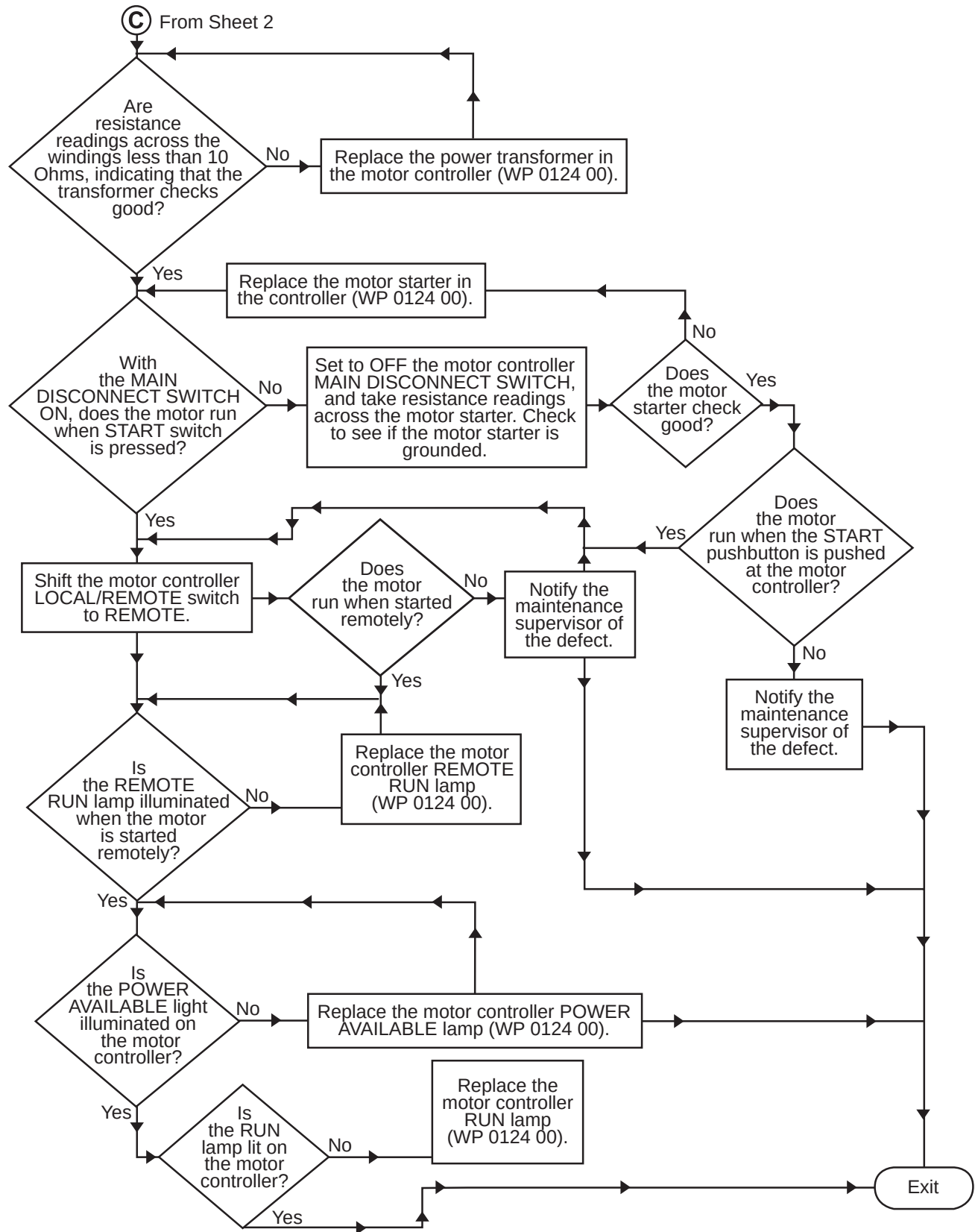
Procedure 2. Type 2 Motor Controller Does Not Start Motor (Sheet 3 of 3)



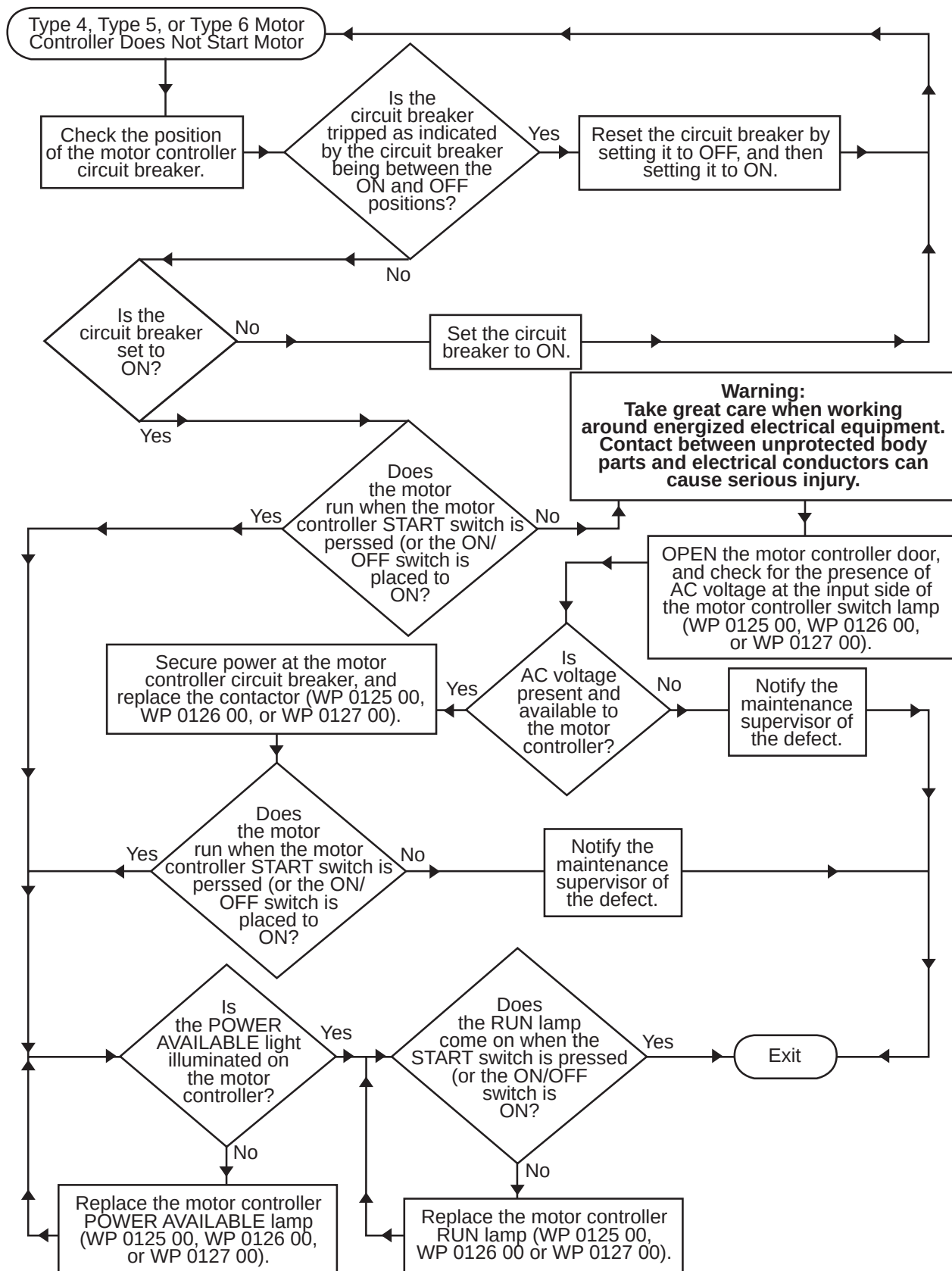
Procedure 3. Type 3 Motor Controller Does Not Start Motor (Sheet 1 of 3)



Procedure 3. Type 3 Motor Controller Does Not Start Motor (Sheet 2 of 3)



Procedure 3. Type 3 Motor Controller Does Not Start Motor (Sheet 3 of 3)



Procedure 4. Type 4, Type 5, or Type 6 Motor Controller Does Not Start Motor

Table 1. Motor Controller Type, Condition Switches, and Procedure

Nomenclature	Type	Condition Switches	Troubleshooting Procedure
01, 02 and 03 Level Fan Coil Units	1	- Emergency Stop Switch	Procedure 1
AFFF Pump	1	N/A	Procedure 1
Air Compressors 1 and 2	3	- Pressure Switch	Procedure 3
AMS 1 Supply Fan	2	- Emergency Stop Switch - FM-200 Pressure Switch - Remote Lockout Switch	Procedure 2
AMS 2 Supply Fan	2	- Emergency Stop Switch	Procedure 2
Bilge and Ballast Pumps 1 and 2	3	- Remote Start Switch - Remote Run Light	Procedure 3
Boatswain's Store Room Supply Fan	2	- Paint Locker Exhaust Fan Interlock Switch	Procedure 2
Crew's Mess Fan Coil Unit	1	- Emergency Stop Switch - Gaylord Exhaust Ventilator Thermostat Shutdown Switch	Procedure 1
Engine Room Exhaust Fans 1 and 2	2	- Supply Fan Interlock Switch - Remote Lockout Switch	Procedure 2
Engine Room Supply Fans 1 and 2	2	- Emergency Stop Switch - FM-200 Pressure Switch - Remote Lockout Switch - Exhaust Fan Interlock Switch	Procedure 2
Fire and General Service Pumps 1 and 2	3	- Remote Start Switch - Remote Stop Switch - Remote Run Light	Procedure 3
Fuel Oil Transfer Pumps 1 and 2	1	- Remote Stop Switch - FM-200 Pressure Switch	Procedure 1
Galley Supply and Exhaust Fans	1	- Emergency Stop Switch - Galley Supply Fan Interlock Switch - Gaylord Exhaust Ventilator Thermostat Shutdown Switch	Procedure 1
Hot Potable Water Recirculation Pump	4	N/A	Procedure 4
Lube Oil Priming Pumps 1 and 2	6	N/A	Procedure 4
Lube Oil Transfer Pump	1	N/A	Procedure 1

Table 1. Motor Controller Type, Condition Switches, and Procedure (continued)

Nomenclature	Type	Condition Switches	Troubleshooting Procedure
Paint Locker Exhaust Fan	2	- Emergency Stop Switch - FM-200 pressure switch - Boatswain's locker supply fan	Procedure 2
Potable Water Pumps 1 and 2	3	- Pressure Switch	Procedure 3
Reduction Gear Cooling Pumps 1 and 2	1	N/A	Procedure 1
Sanitary Space Exhaust Fan	1	- Emergency Stop Switch	Procedure 1
Sewage Discharge Pumps 1 and 2	1	N/A	Procedure 1
Weld Hood Exhaust Fan	5	N/A	Procedure 4

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
BATTERY CHARGERS**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0129 00
WP 0148 00
WP 0295 00 (volume 2)

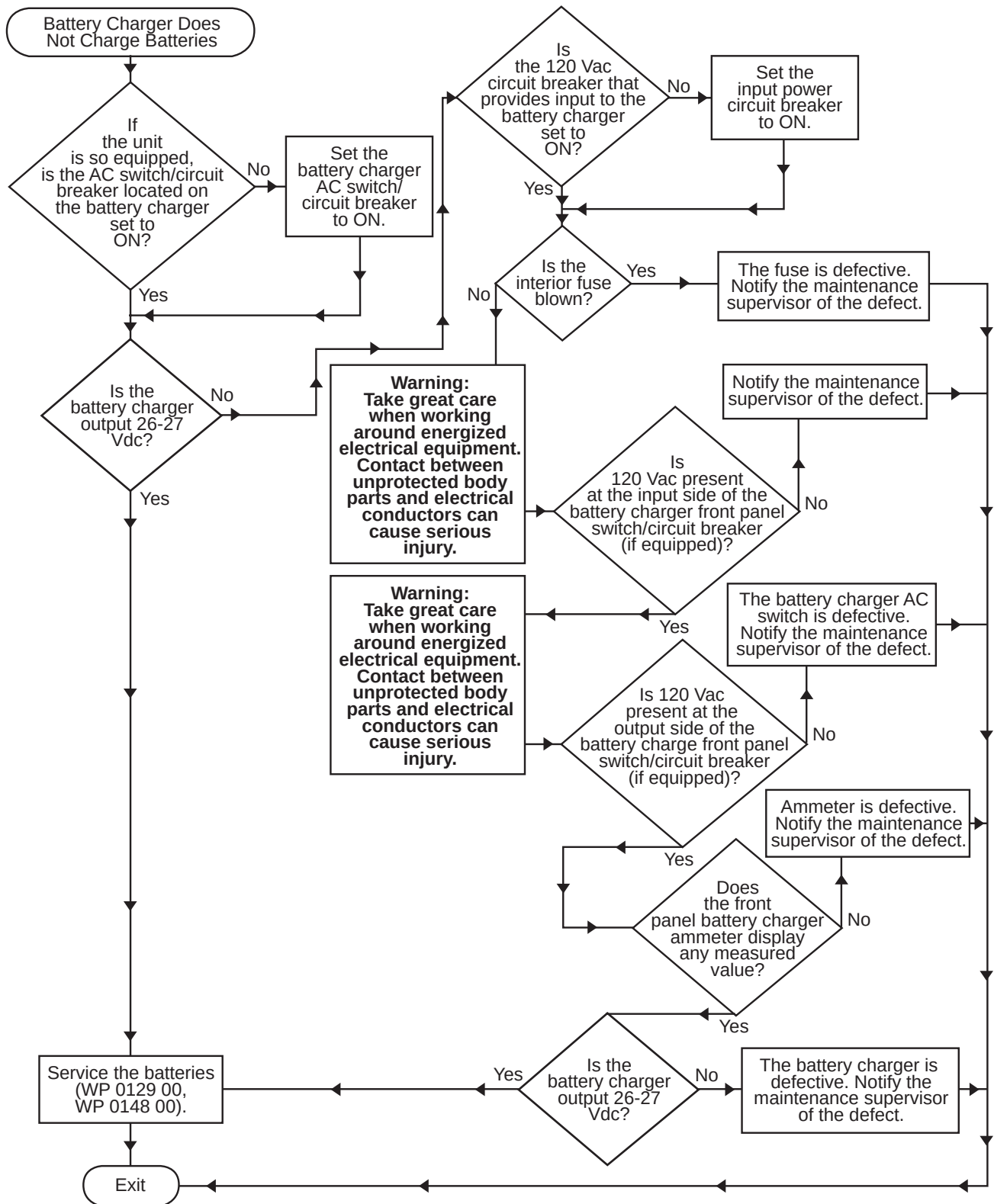
Personnel Required:

Two Watercraft Engineers, 88L

INTRODUCTION

The following unit troubleshooting procedure is included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Battery Charger Does Not Charge Batteries	1



Procedure 1. Battery Charger Does Not Charge Batteries

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
SOUND POWERED TELEPHONES**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0295 00 (volume 2)

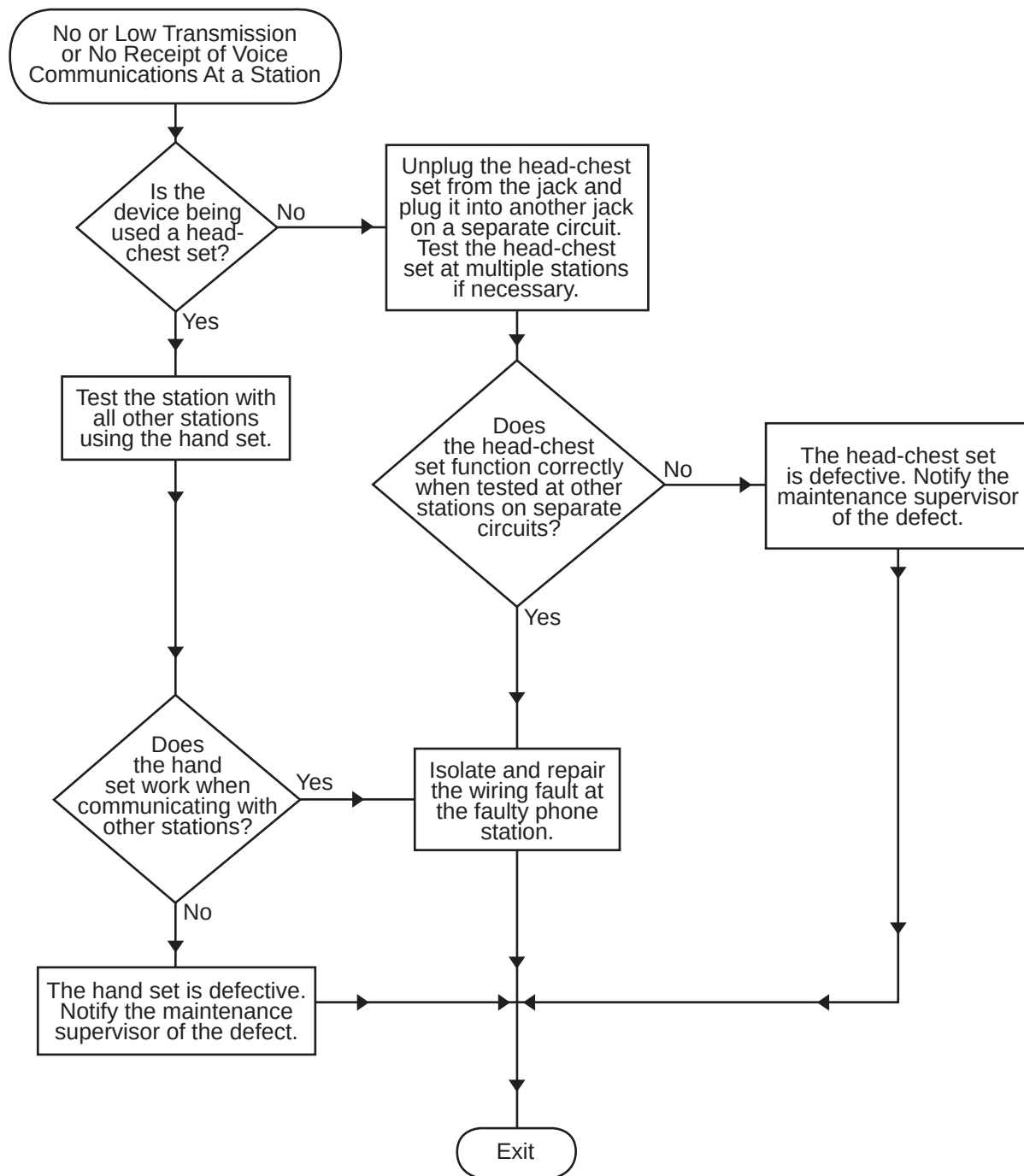
Personnel Required:

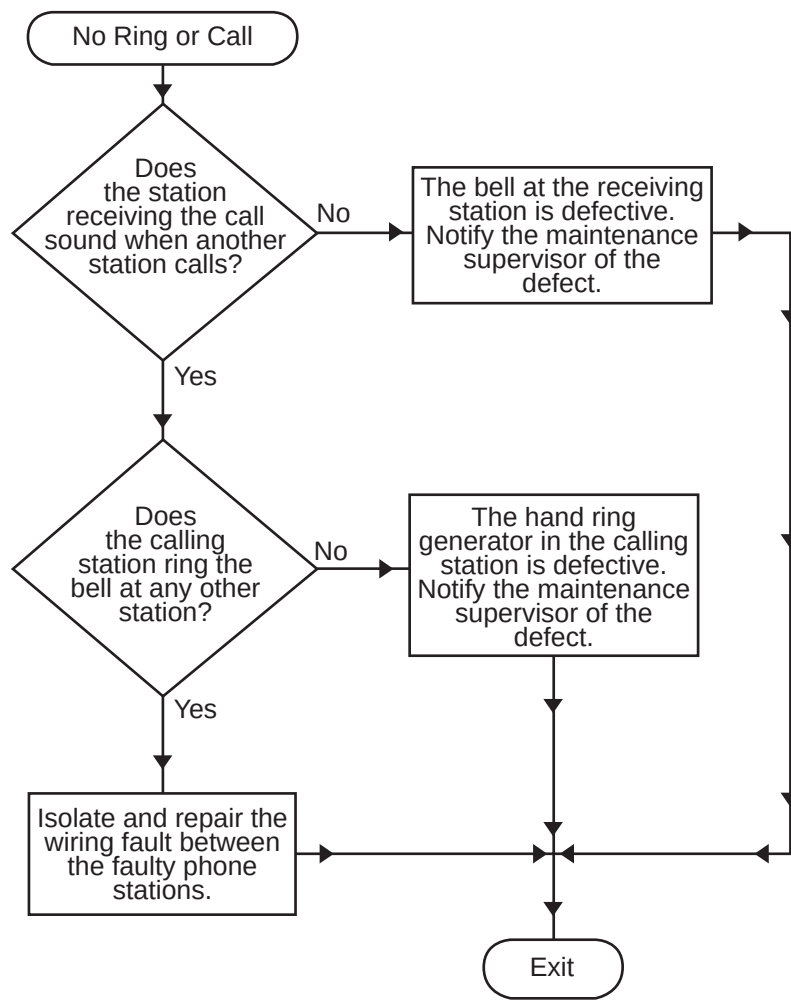
Two Watercraft Engineers, 88L

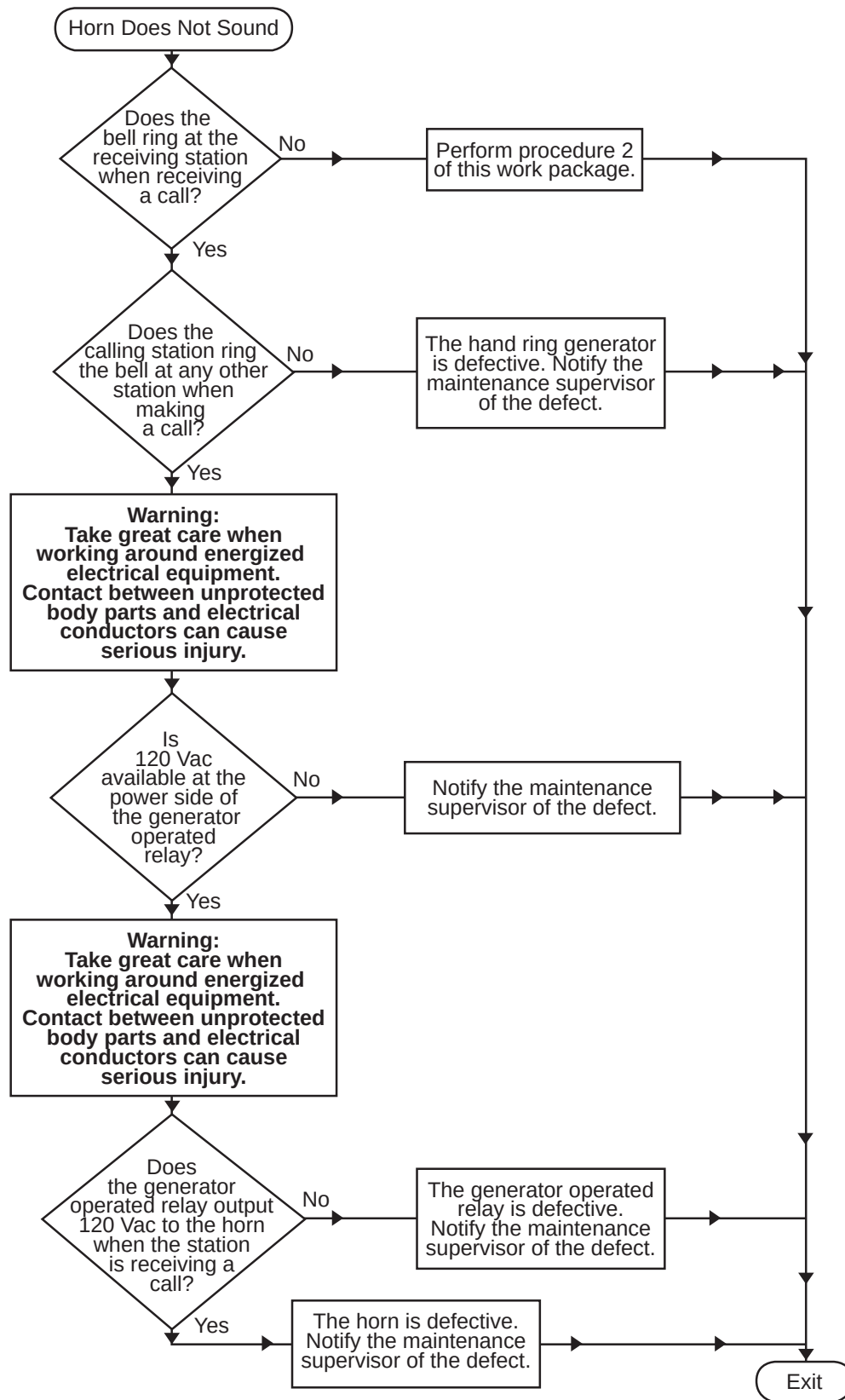
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
No or Low Transmission or No Receipt of Voice Communications At a Station	1
No Ring or Call	2
Horn Does Not Sound	3

**Procedure 1. No or Low Transmission or No Receipt Of Voice Communications At a Station**

**Procedure 2. No Ring or Call**



Procedure 3. Horn Does Not Sound

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
INTERCOMMUNICATION**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)
Intercommunication Test Fixture (Item 24, Table 2,
WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

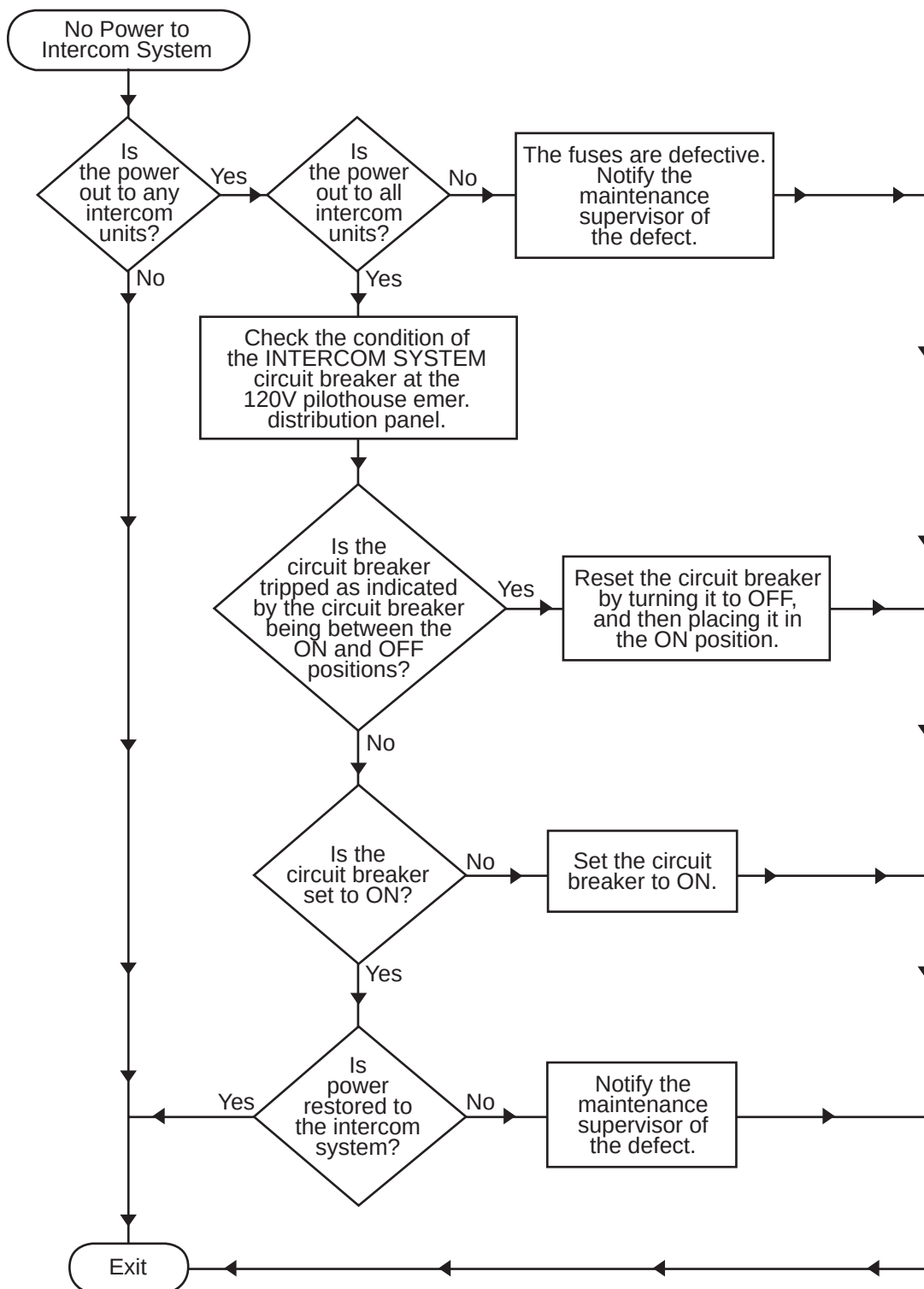
References:

WP 0295 00 (volume 2)

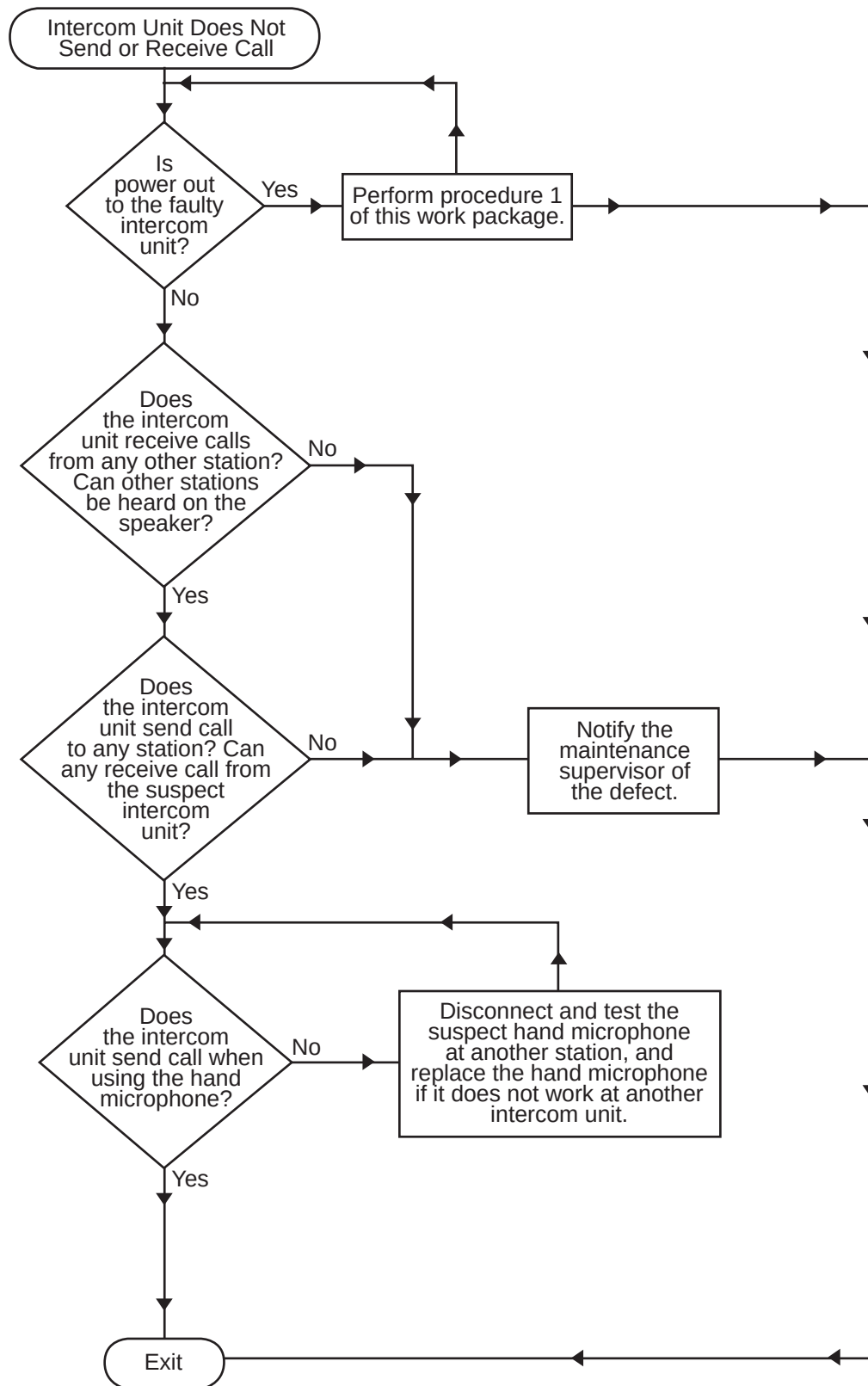
INTRODUCTION

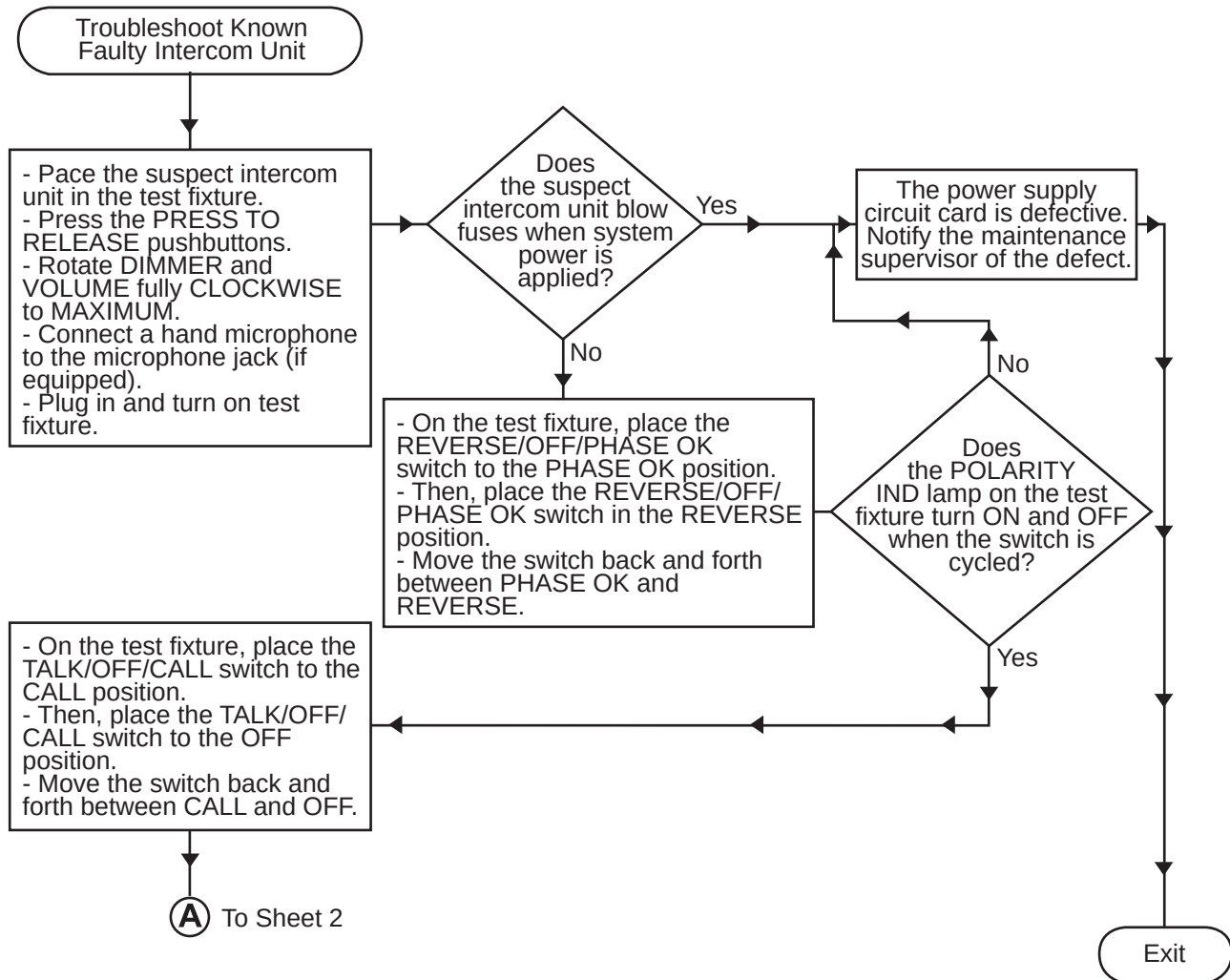
The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Intercom System	1
Intercom Unit Does Not Send or Receive Call.....	2
Troubleshoot Known Faulty Intercom Unit	3

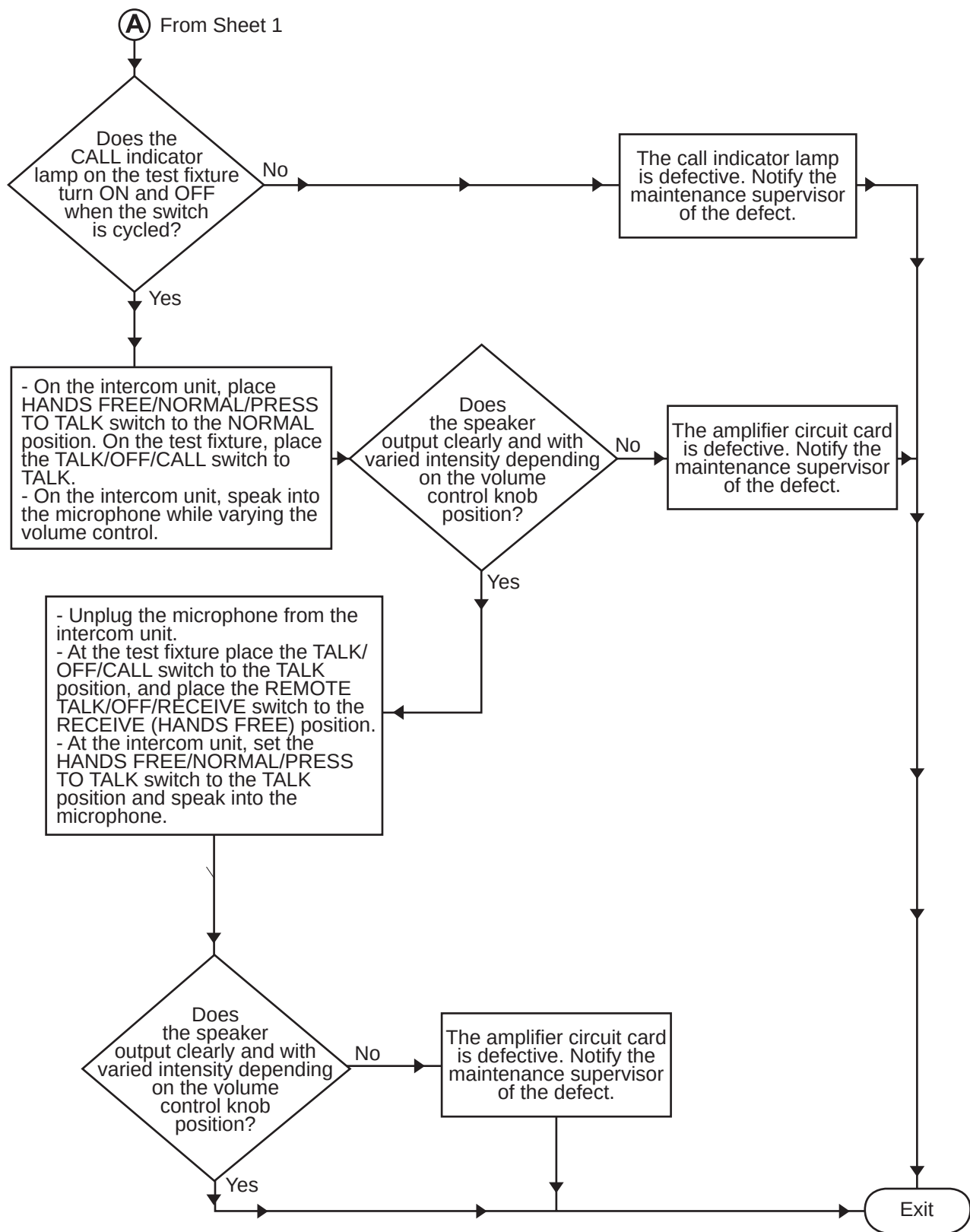


Procedure 1. No Power to Intercom System

**Procedure 2. Intercom Unit Does Not Send or Receive Call**



Procedure 3. Troubleshoot Known Faulty Intercom Unit (Sheet 1 of 2)



Procedure 3. Troubleshoot Known Faulty Intercom Unit (Sheet 2 of 2)

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

ALARM SYSTEMS, ARMS STORAGE AND RADIO ROOM

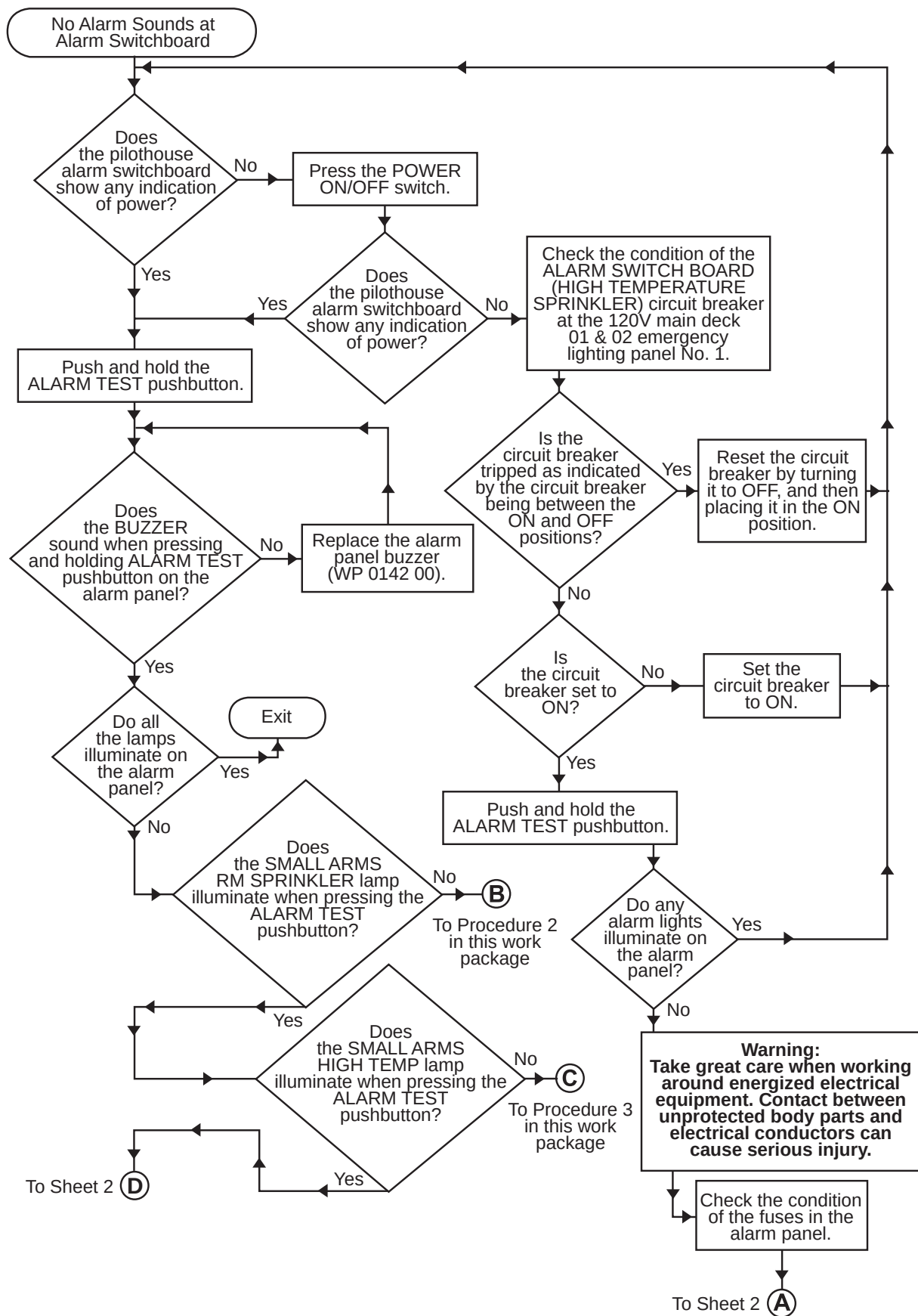
INITIAL SETUP:

Tools and Special Tools:	Personnel Required:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)	Two Watercraft Engineers, 88L
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)	References:
	WP 0142 00
	WP 0295 00 (volume 2)

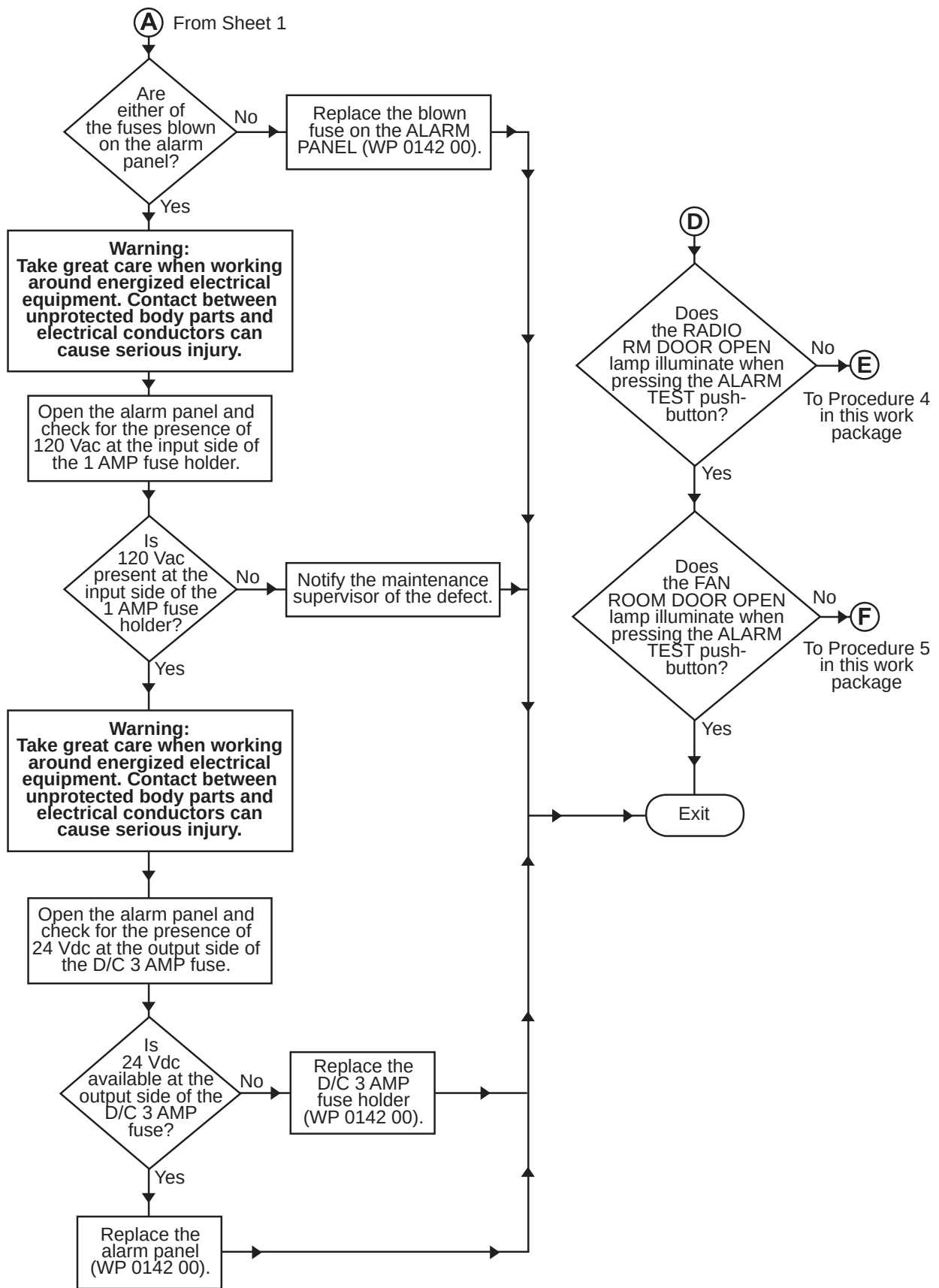
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

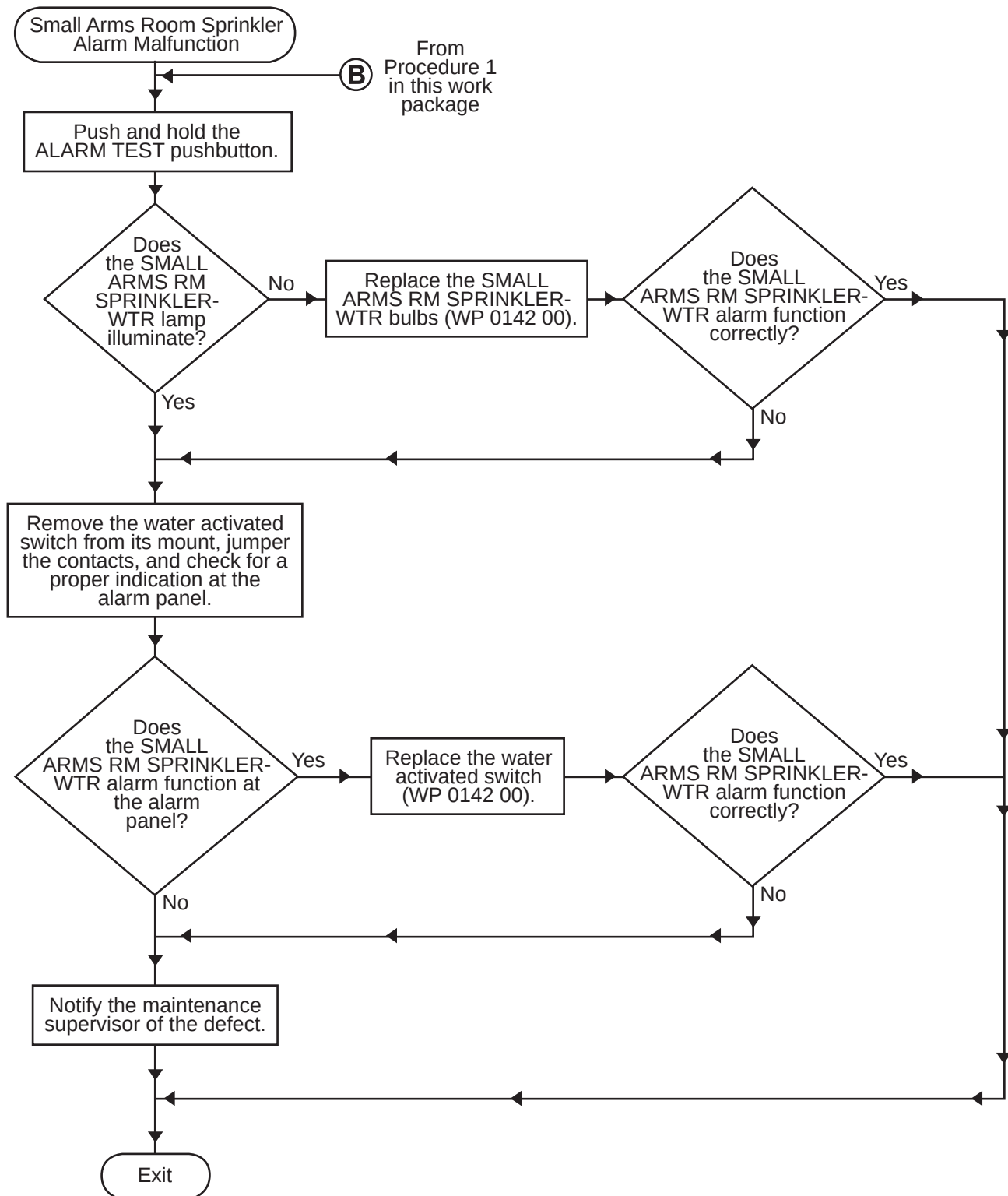
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Alarm Sounds at Alarm Switchboard	1
Small Arms Room Sprinkler Alarm Malfunction	2
Small Arms Room Temperature Alarm Malfunction	3
Radio Room Door Alarm Malfunction	4
Fan Room Door Alarm Malfunction	5



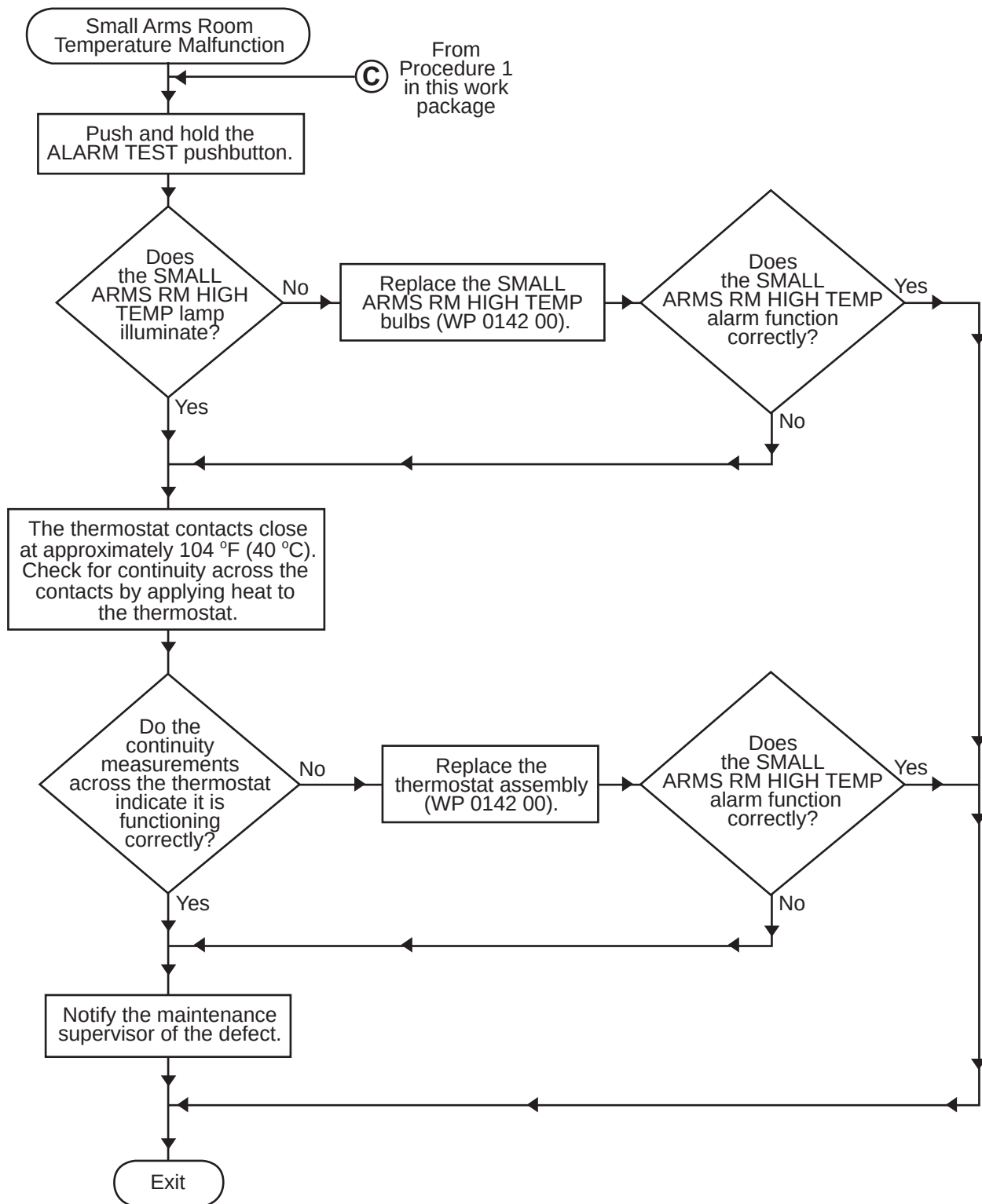
Procedure 1. No Alarm Sounds at Alarm Switchboard (Sheet 1 of 2)

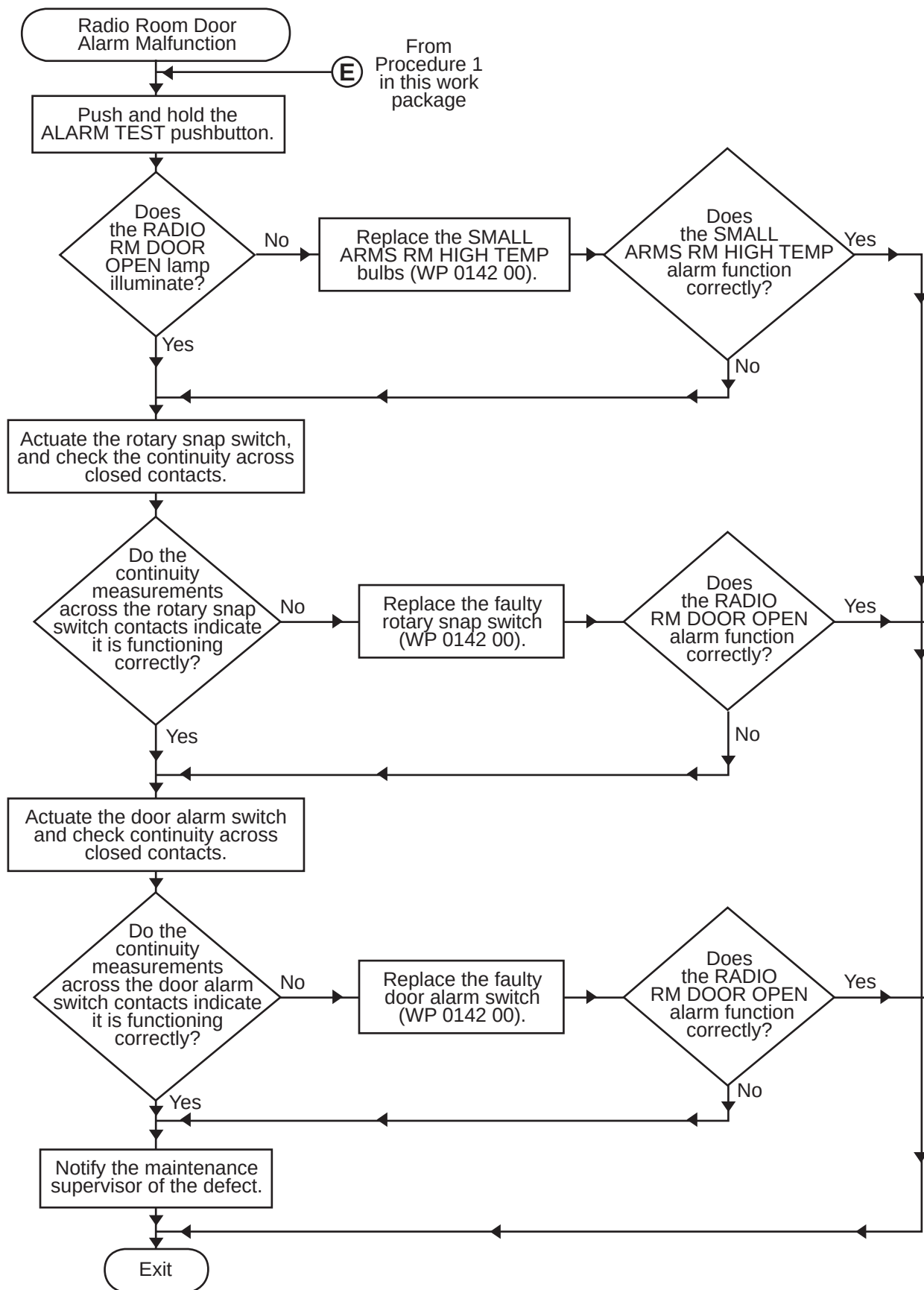


Procedure 1. No Alarm Sounds at Alarm Switchboard (Sheet 2 of 2)

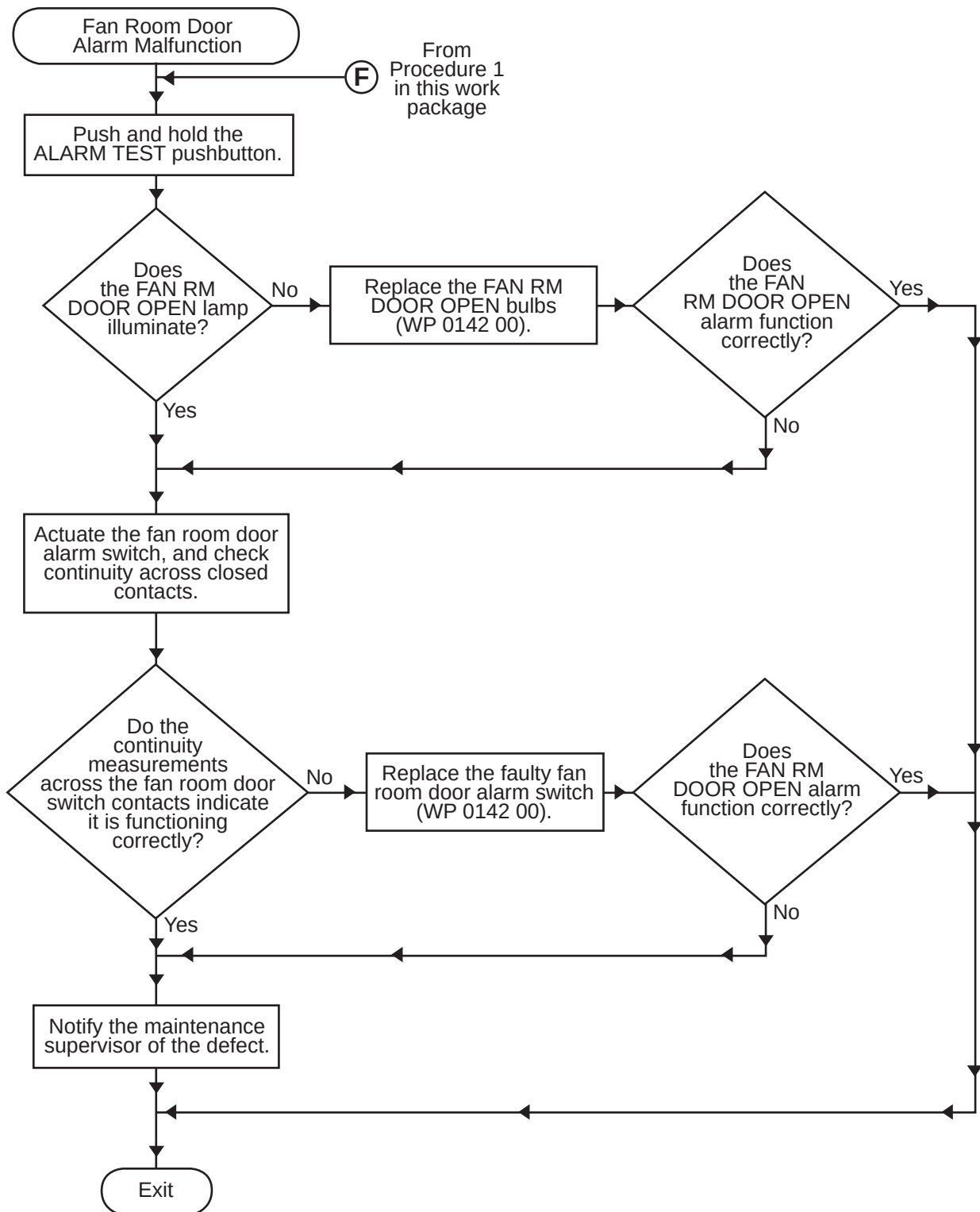


Procedure 2. Small Arms Room Sprinkler Alarm Malfunction

**Procedure 3. Small Arms Room Temperature Alarm Malfunction**



Procedure 4. Radio Room Door Alarm Malfunction

**Procedure 5. Fan Room Door Alarm Malfunction**

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
PILOTHOUSE WING HEATERS AND PILOTHOUSE CONSOLE LIGHT**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00,
Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0094 00
WP 0295 00 (volume 2)

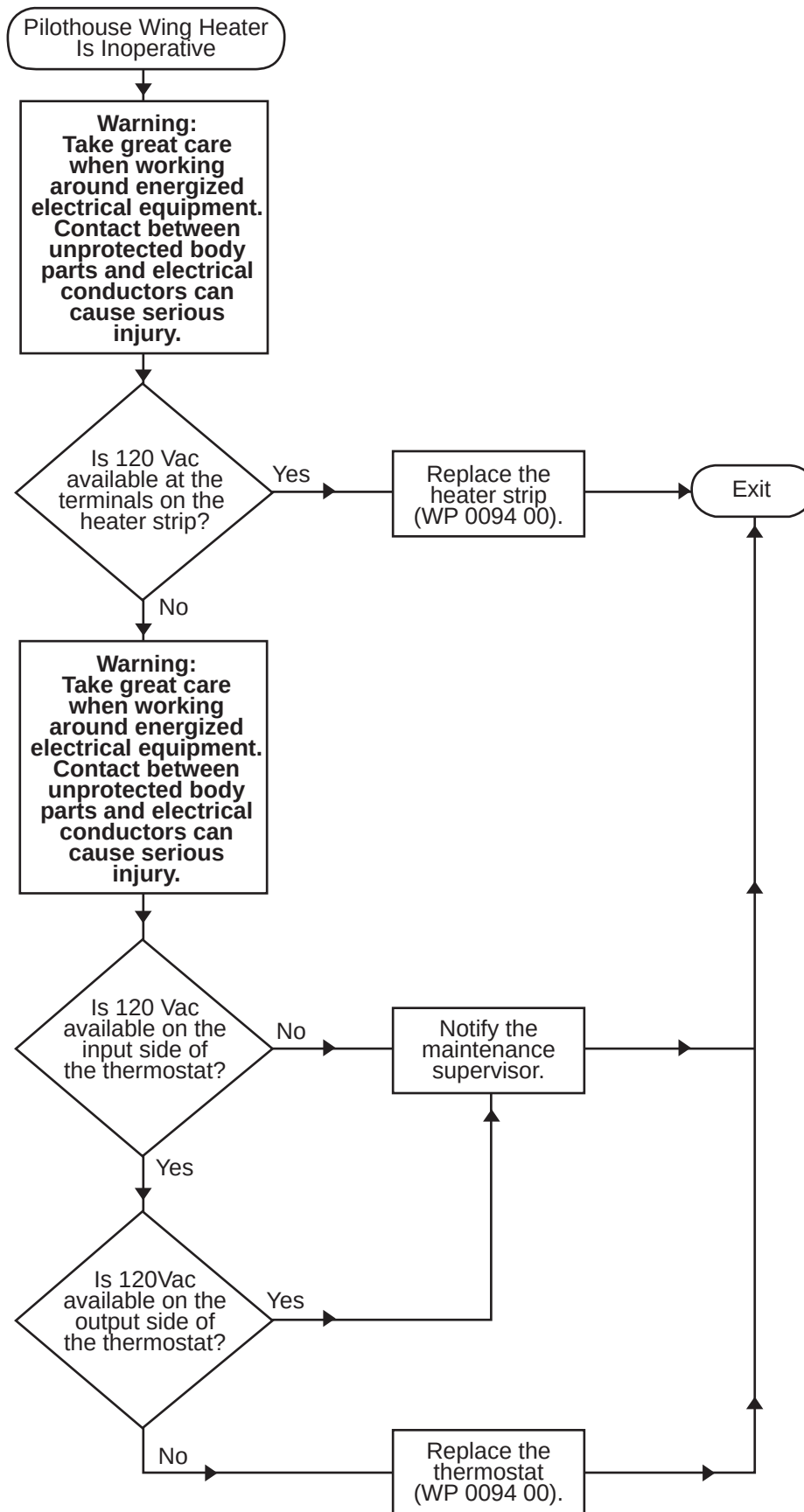
Personnel Required:

Two Watercraft Engineers, 88L

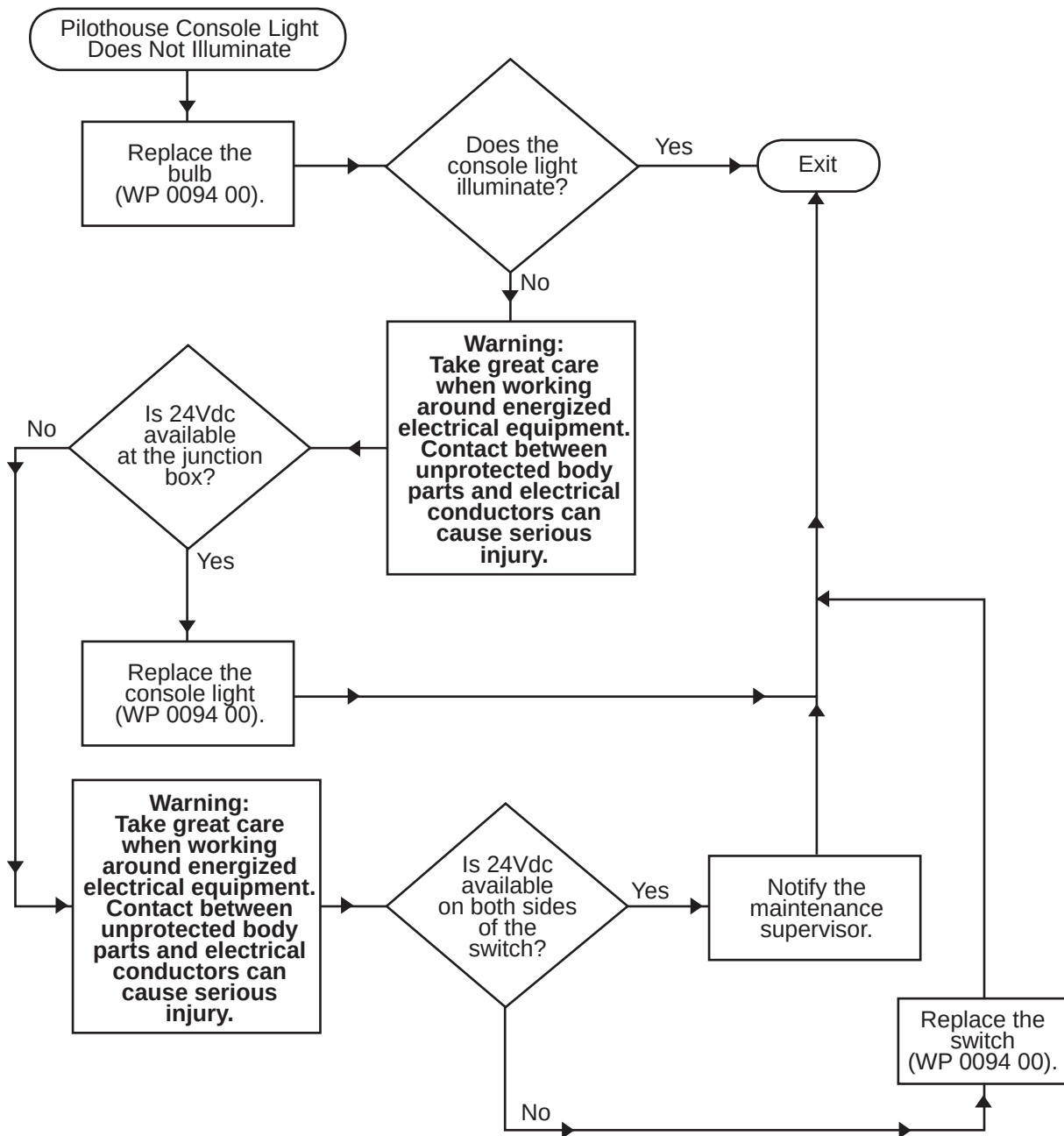
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Pilothouse Wing Heater Is Inoperative	1
Pilothouse Console Light Does Not Illuminate	2



Procedure 1. Pilothouse Wing Heater is Inoperative



Procedure 2. Pilothouse Console Light Does Not Illuminate

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

ENGINE ORDER TELEGRAPH

INITIAL SETUP:

- Tools and Special Tools:

Tool Kit, Electrician’s (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)
- References:

WP 0295 00 (volume 2)

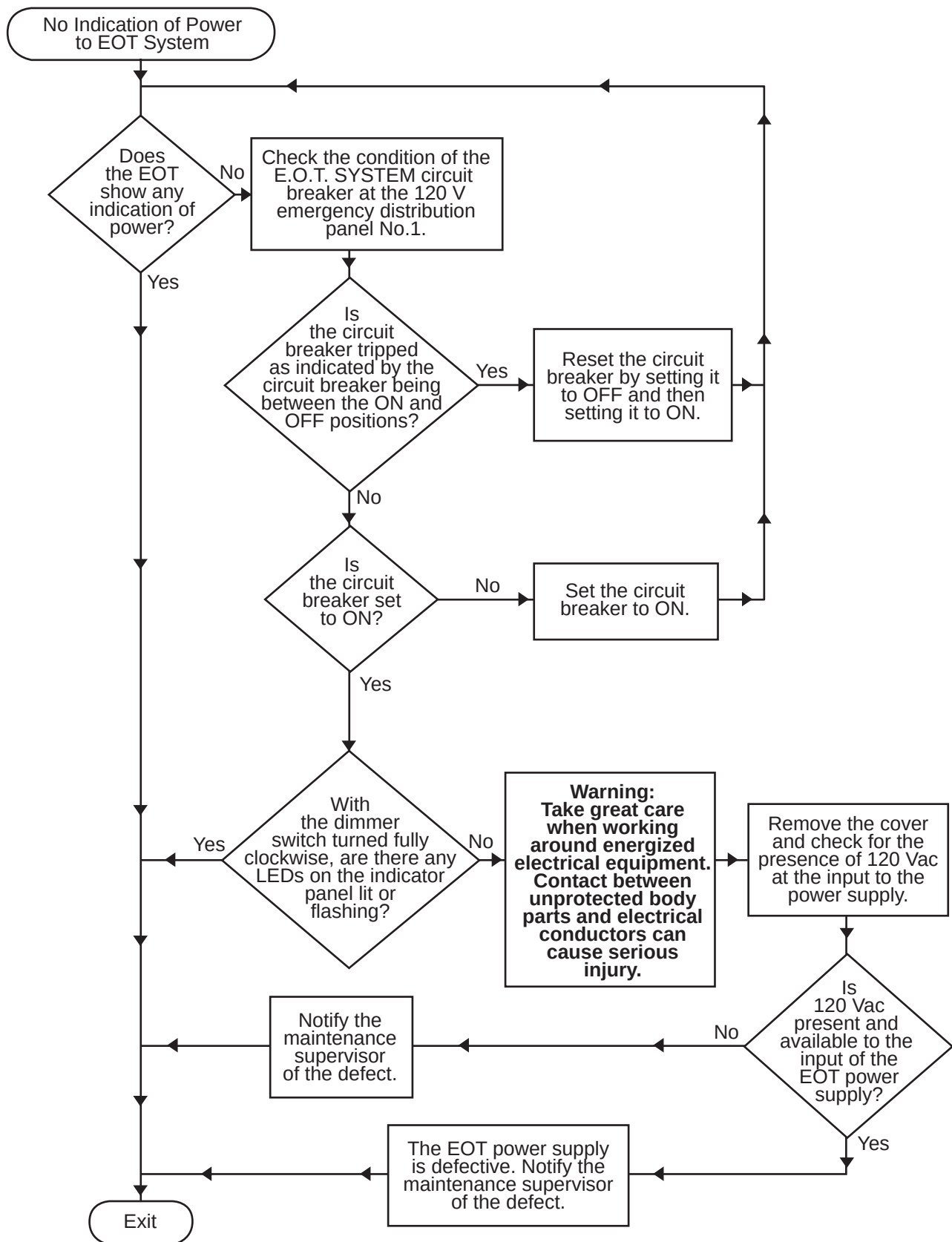
- Personnel Required:

Two Watercraft Engineers, 88L

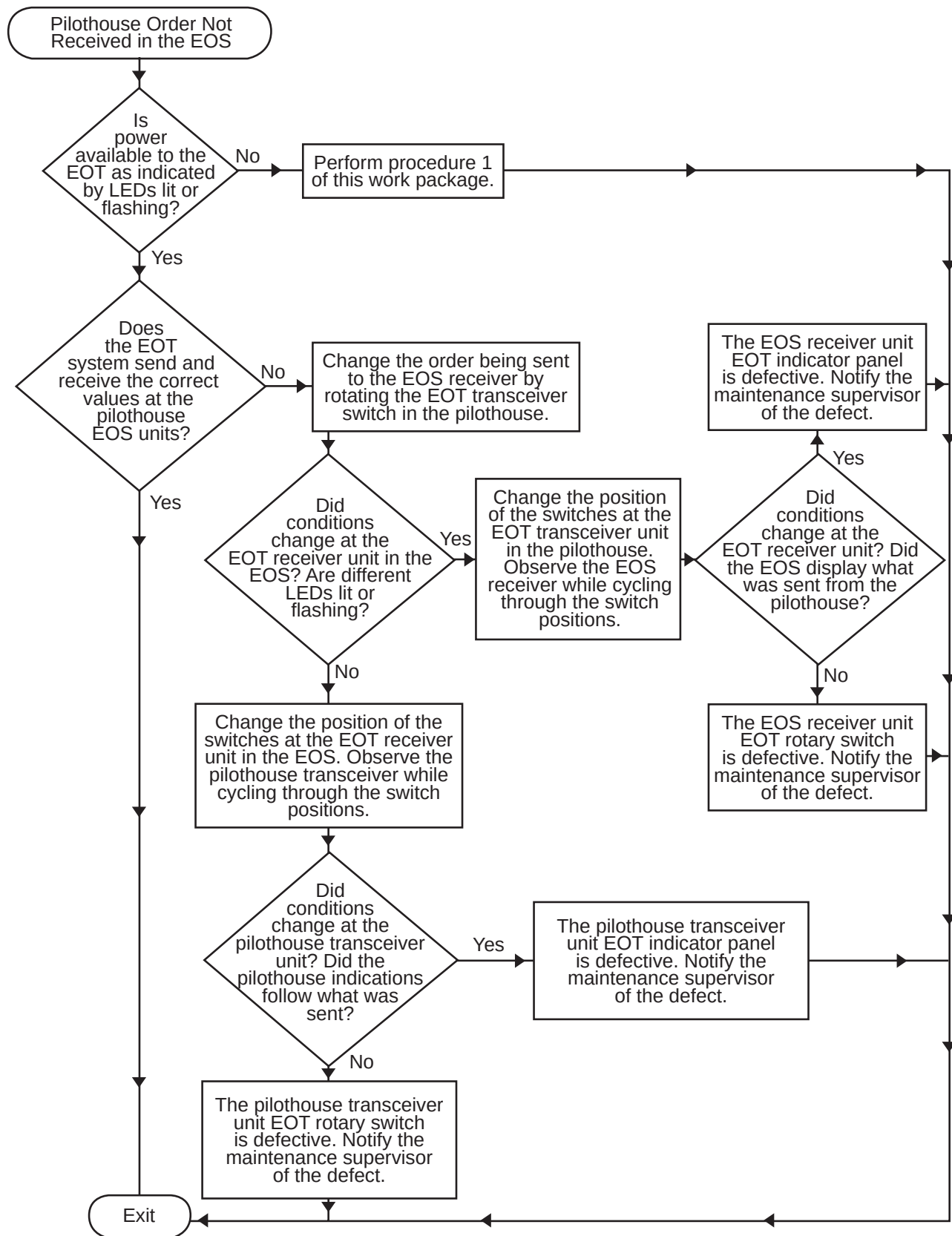
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

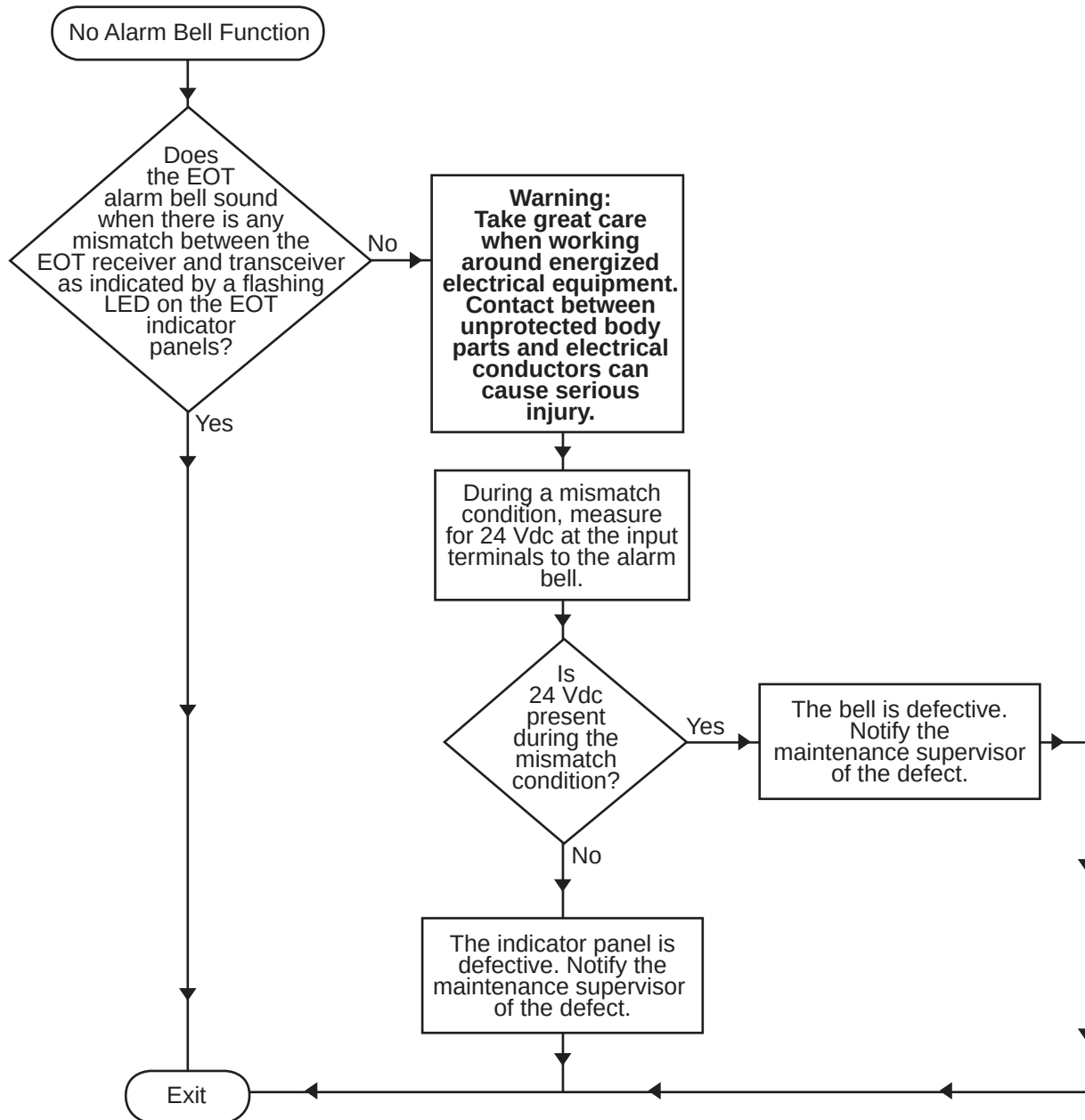
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Indication of Power to EOT System	1
Pilothouse Order Not Received in the EOS	2
No Alarm Bell Function	3



Procedure 1. No Indication of Power to EOT System



Procedure 2. Pilothouse Order Not Received In The EOS



Procedure 3. No Alarm Bell Function

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
GENERAL ALARM SYSTEM**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00,
Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0143 00
WP 0144 00
WP 0145 00
WP 0146 00
WP 0295 00 (volume 2)

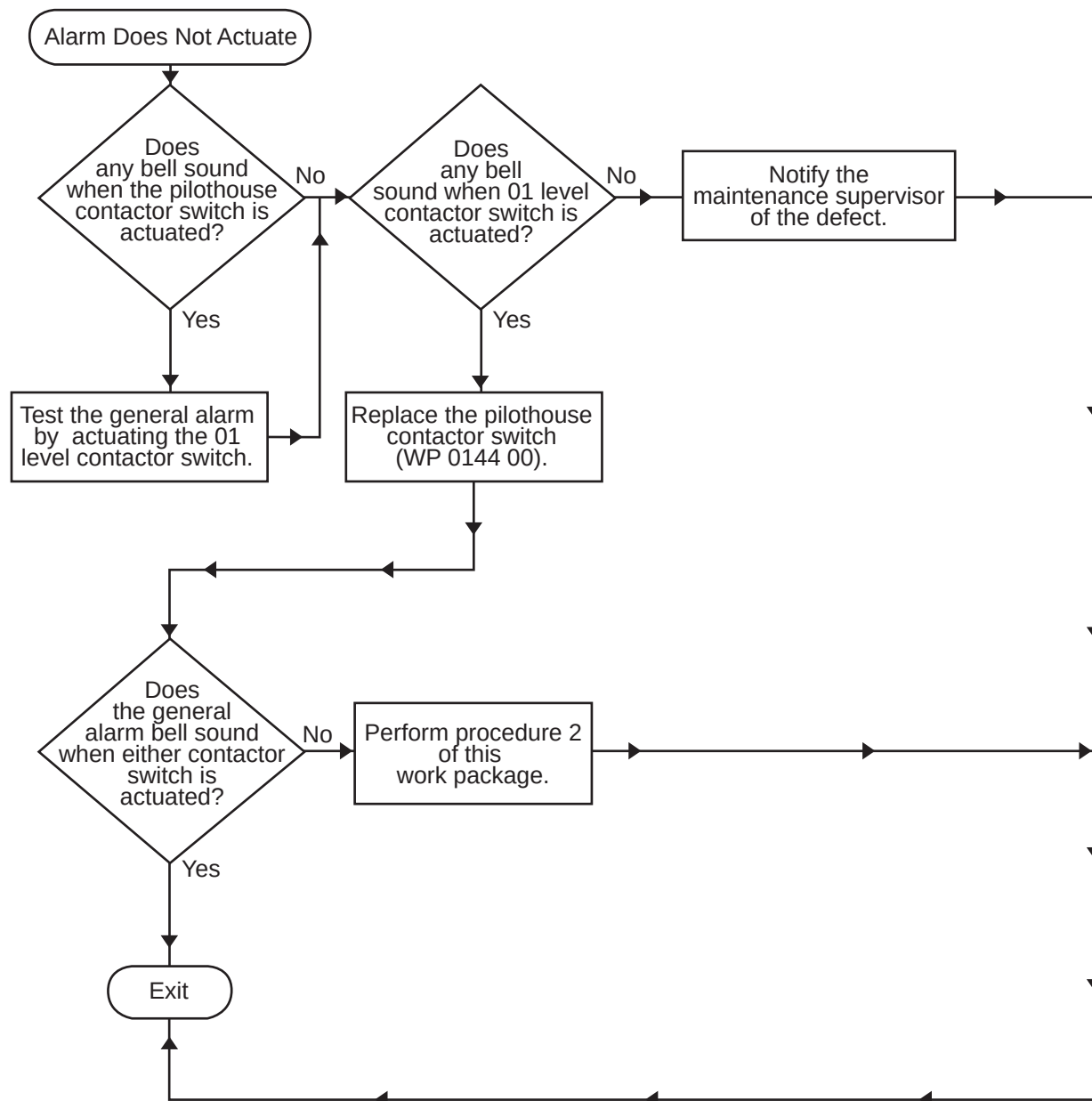
Personnel Required:

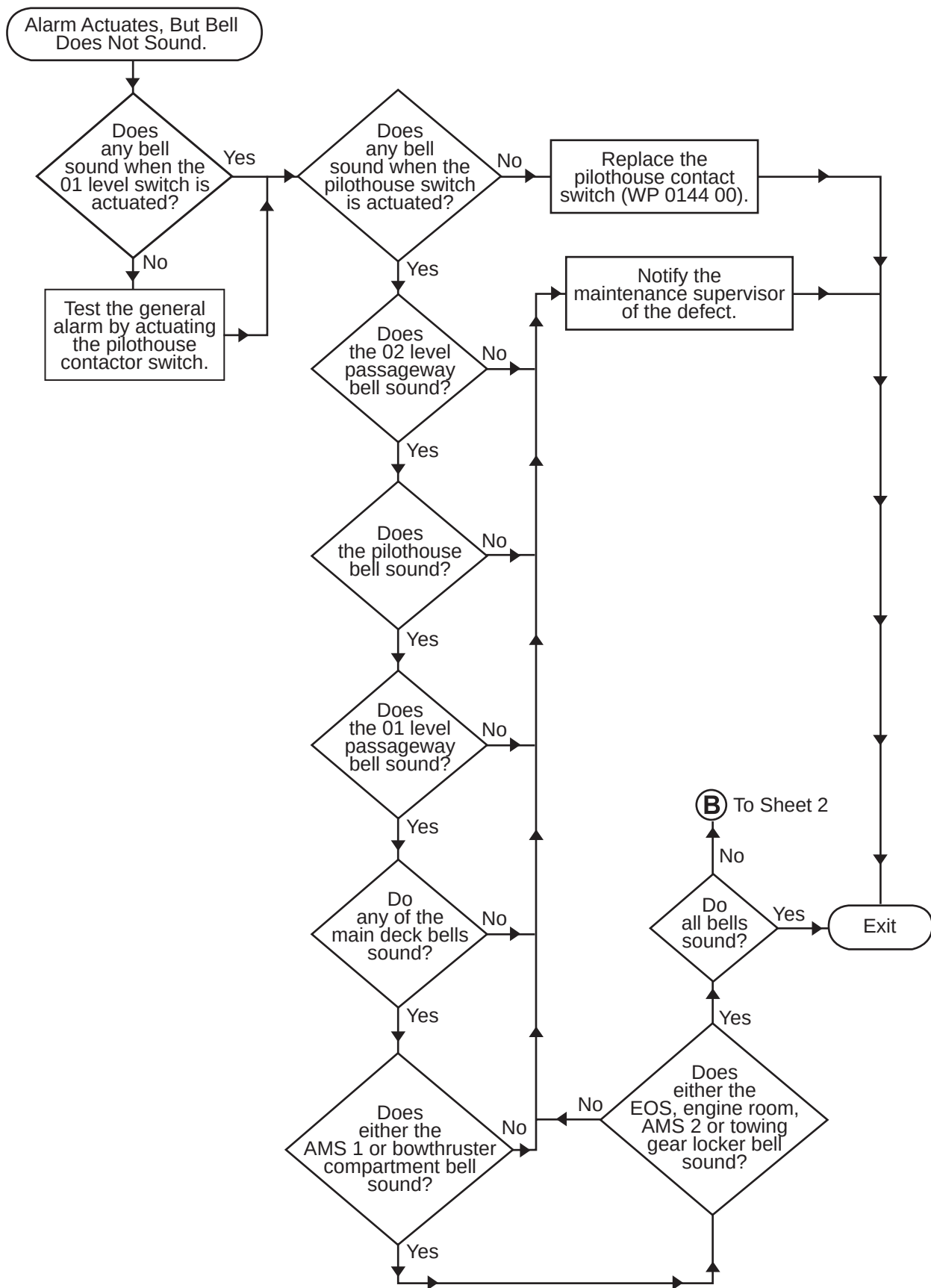
Two Watercraft Engineers, 88L

INTRODUCTION

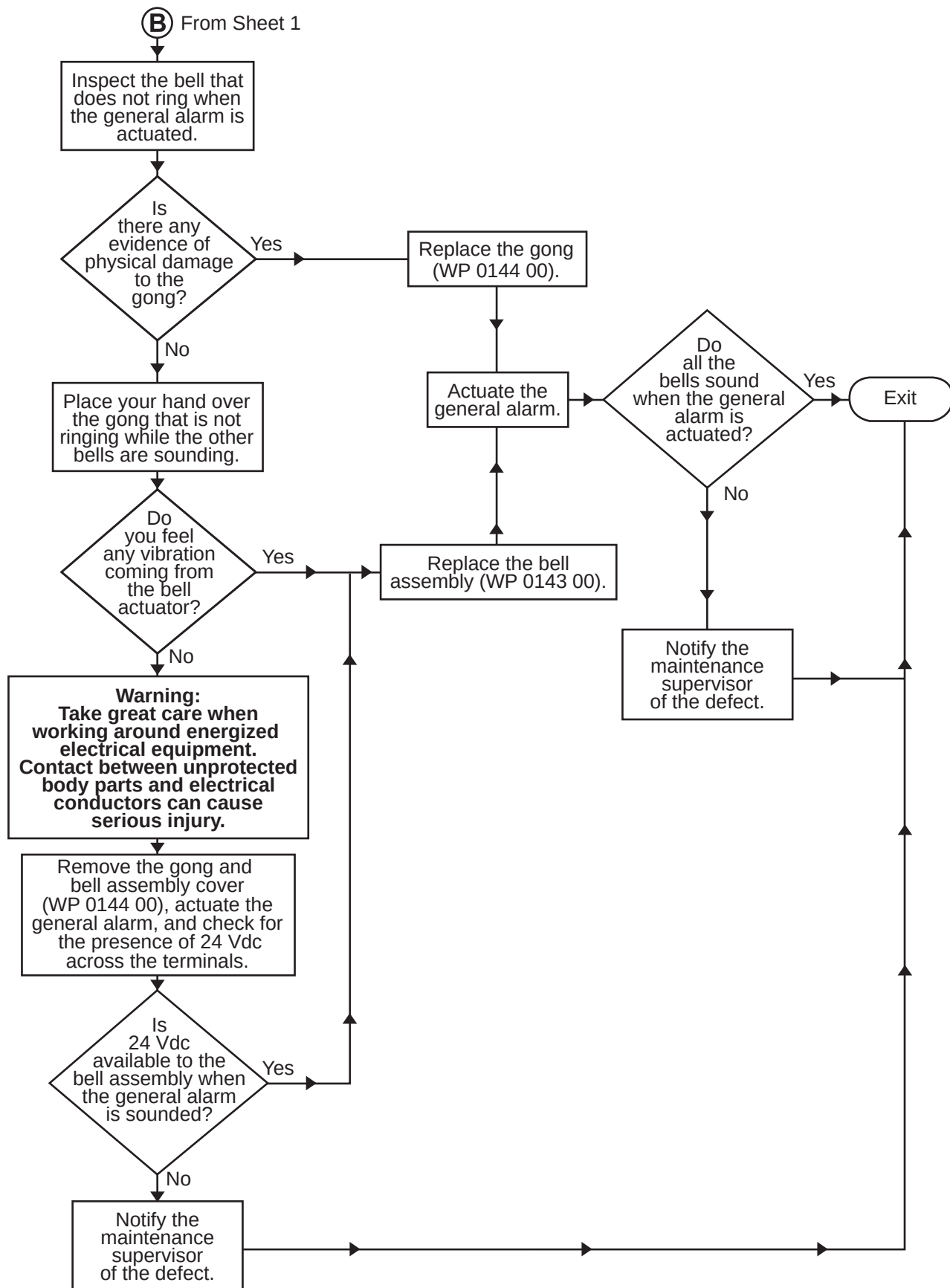
The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Alarm Does Not Actuate	1
Alarm Actuates, But Bell Does Not Sound	2
Alarm Actuates, But Rotating Beacon Does Not Function	3

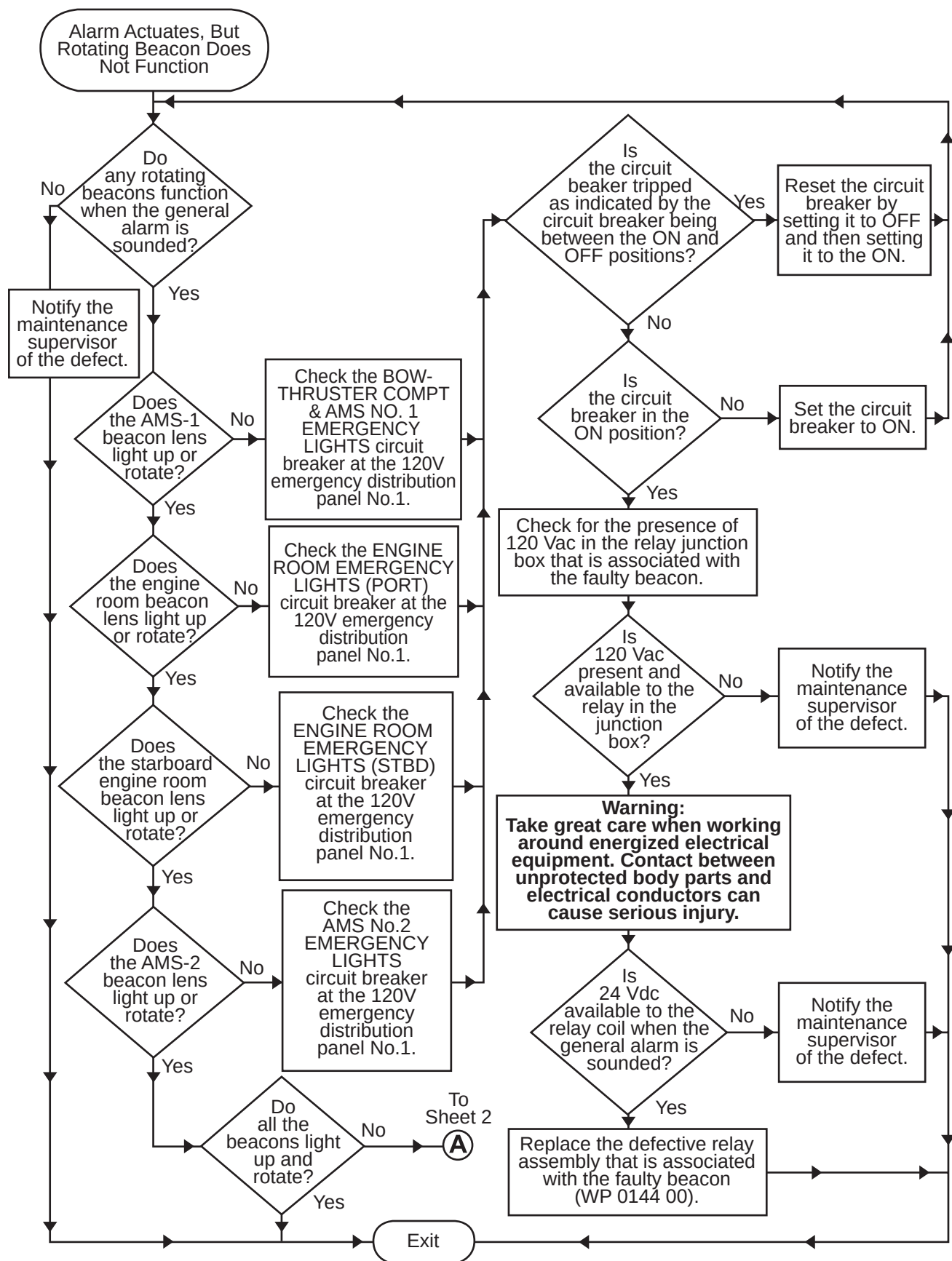
**Procedure 1. Alarm Does Not Actuate**



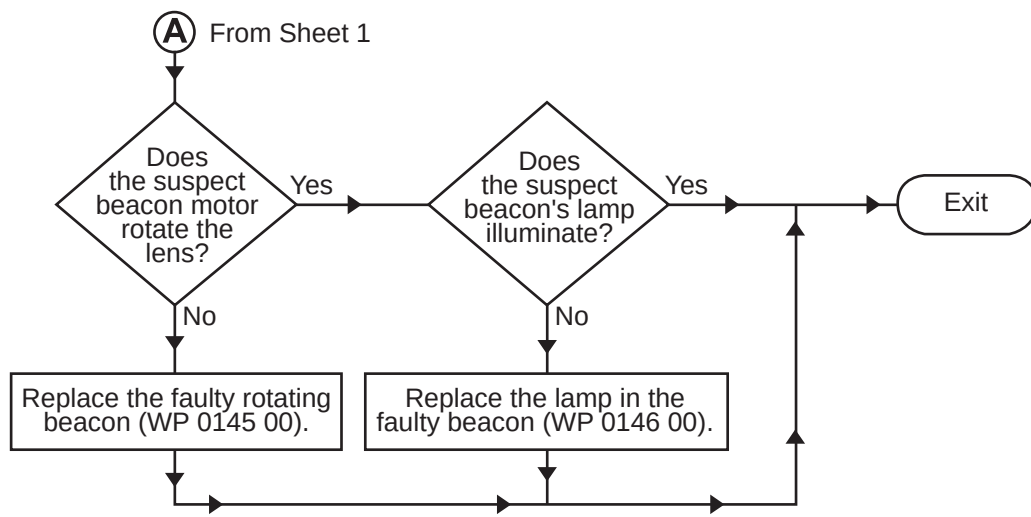
Procedure 2. Alarm Actuates, But Bell Does Not Sound (Sheet 1 of 2)



Procedure 2. Alarm Actuates, But Bell Does Not Sound (Sheet 2 of 2)



Procedure 3. Alarm Actuates, But Rotating Beacon Does Not Function (Sheet 1 of 2)



Procedure 3. Alarm Actuates, But Rotating Beacon Does Not Function (Sheet 2 of 2)

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
SIGNAL HORN**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00,
Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0153 00
WP 0295 00 (volume 2)

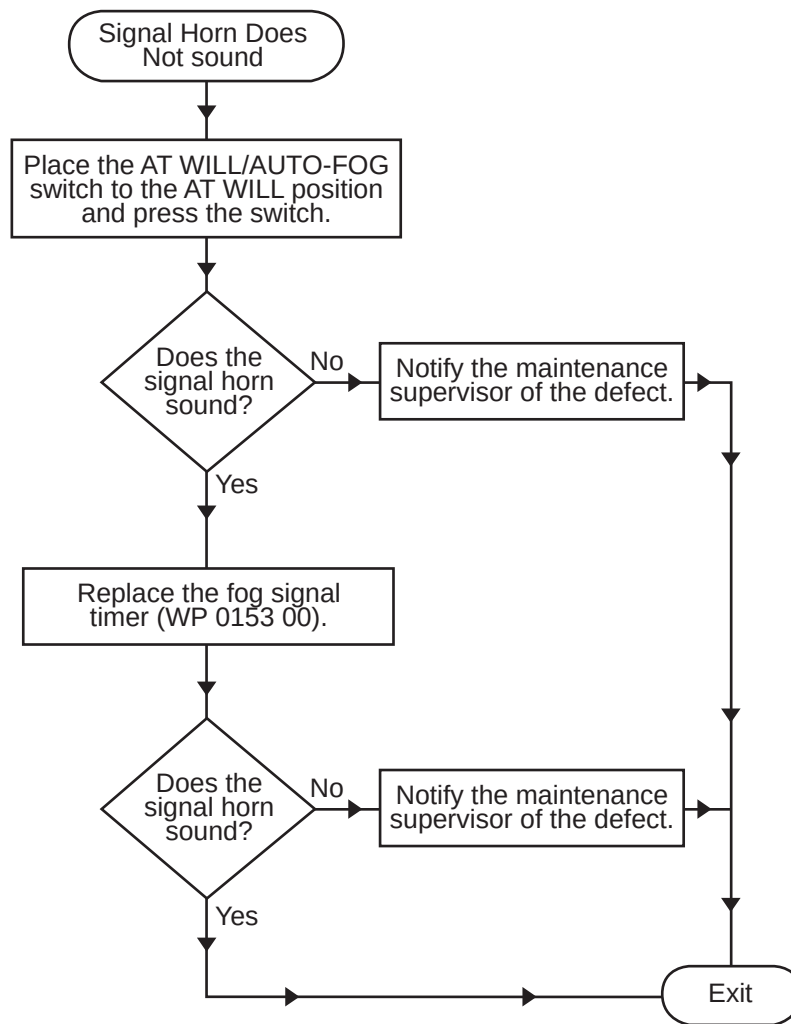
Personnel Required:

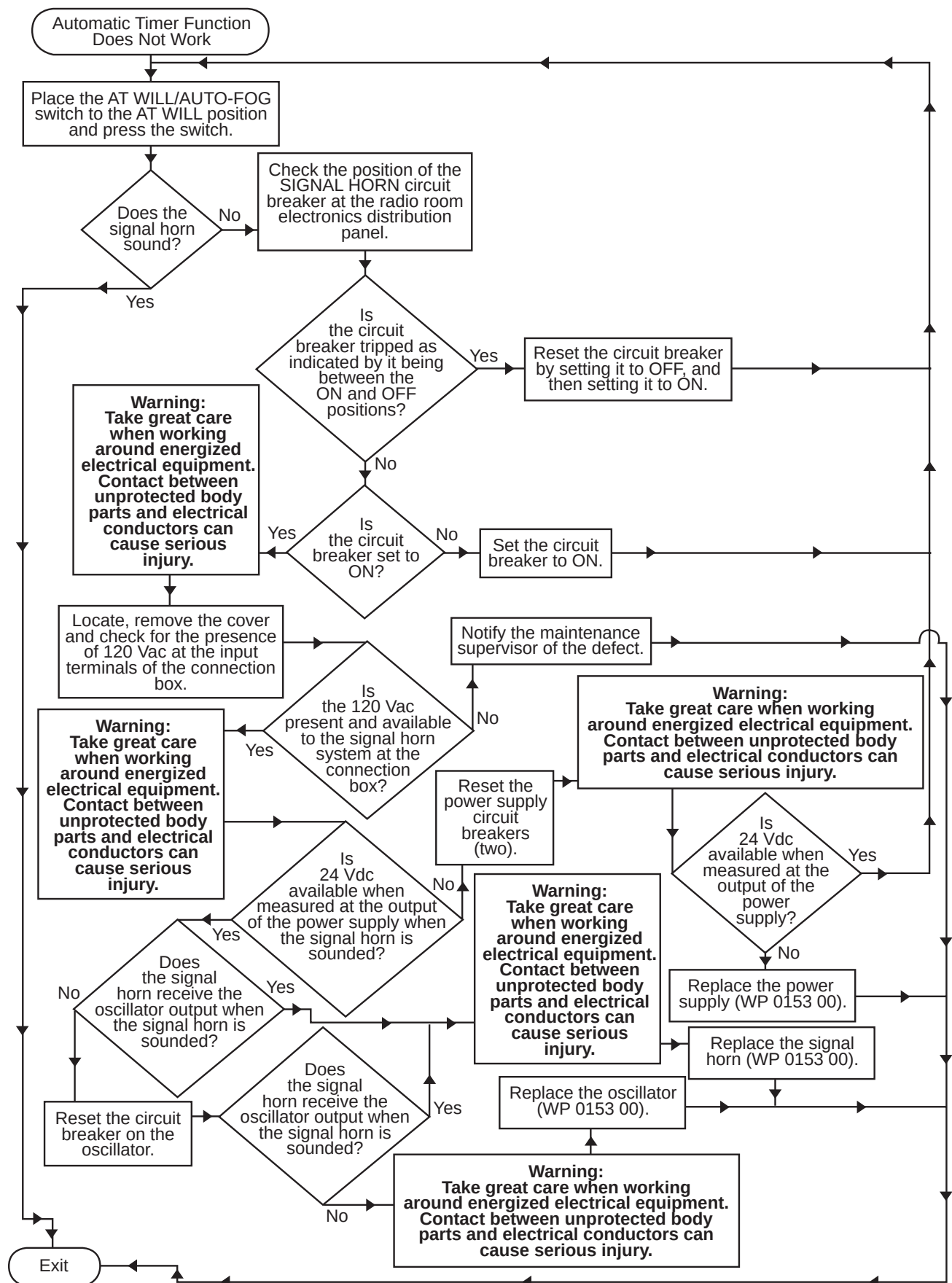
Two Watercraft Engineers, 88L

INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedure</u>
Signal Horn Does Not Sound	1
Automatic Timer Function Does Not Work	2

**Procedure 1. Signal Horn Does Not Sound**



Procedure 2. Automatic Timer Function Does Not Work

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

HOT WATER HEATER

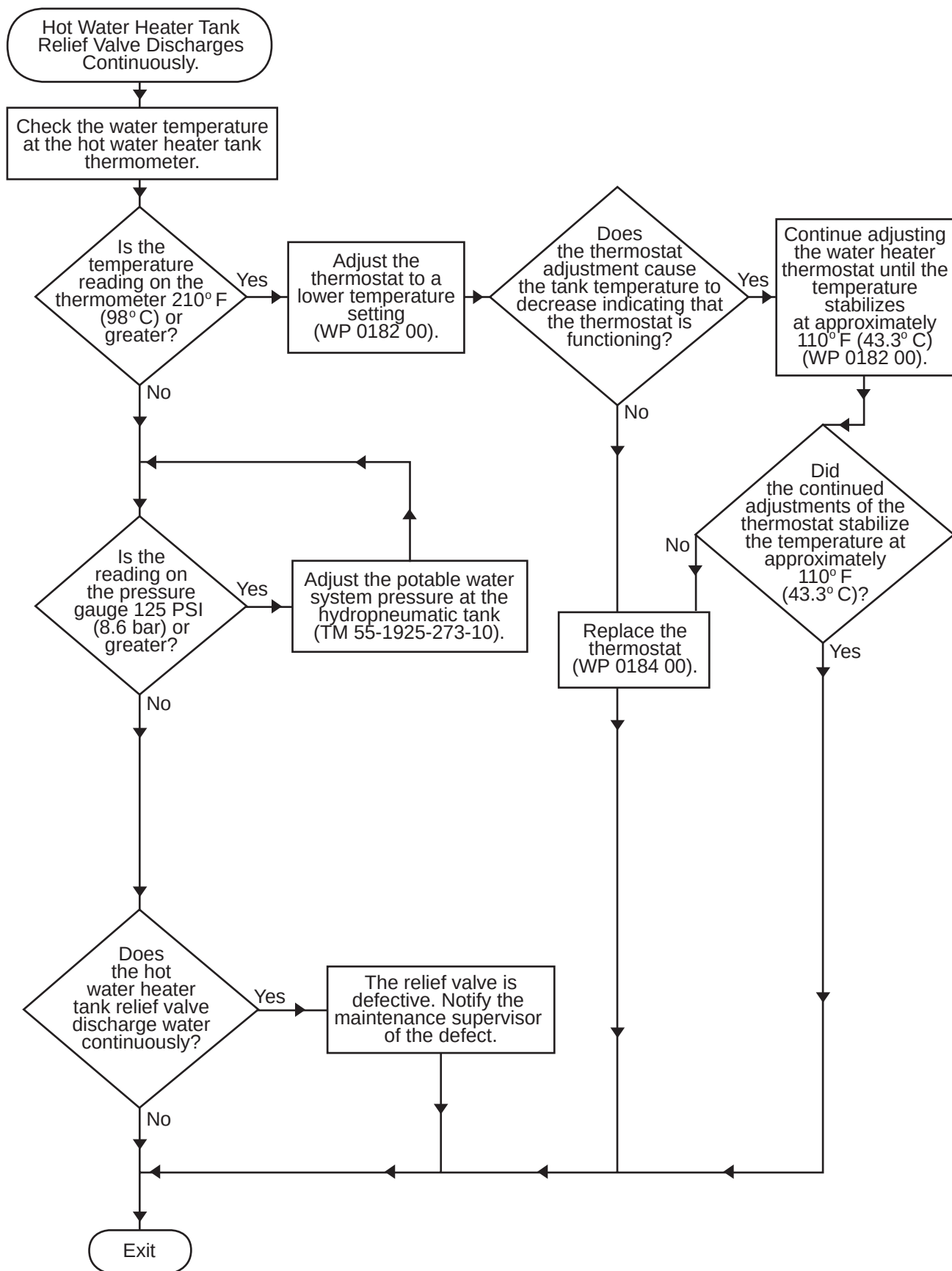
INITIAL SETUP:

Tools and Special Tools:	References:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)	TM 55-1925 273-10
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)	WP 0052 00
	WP 0182 00
	WP 0184 00
Personnel Required:	WP 0295 00 (volume 2)
Two Watercraft Engineers, 88L	

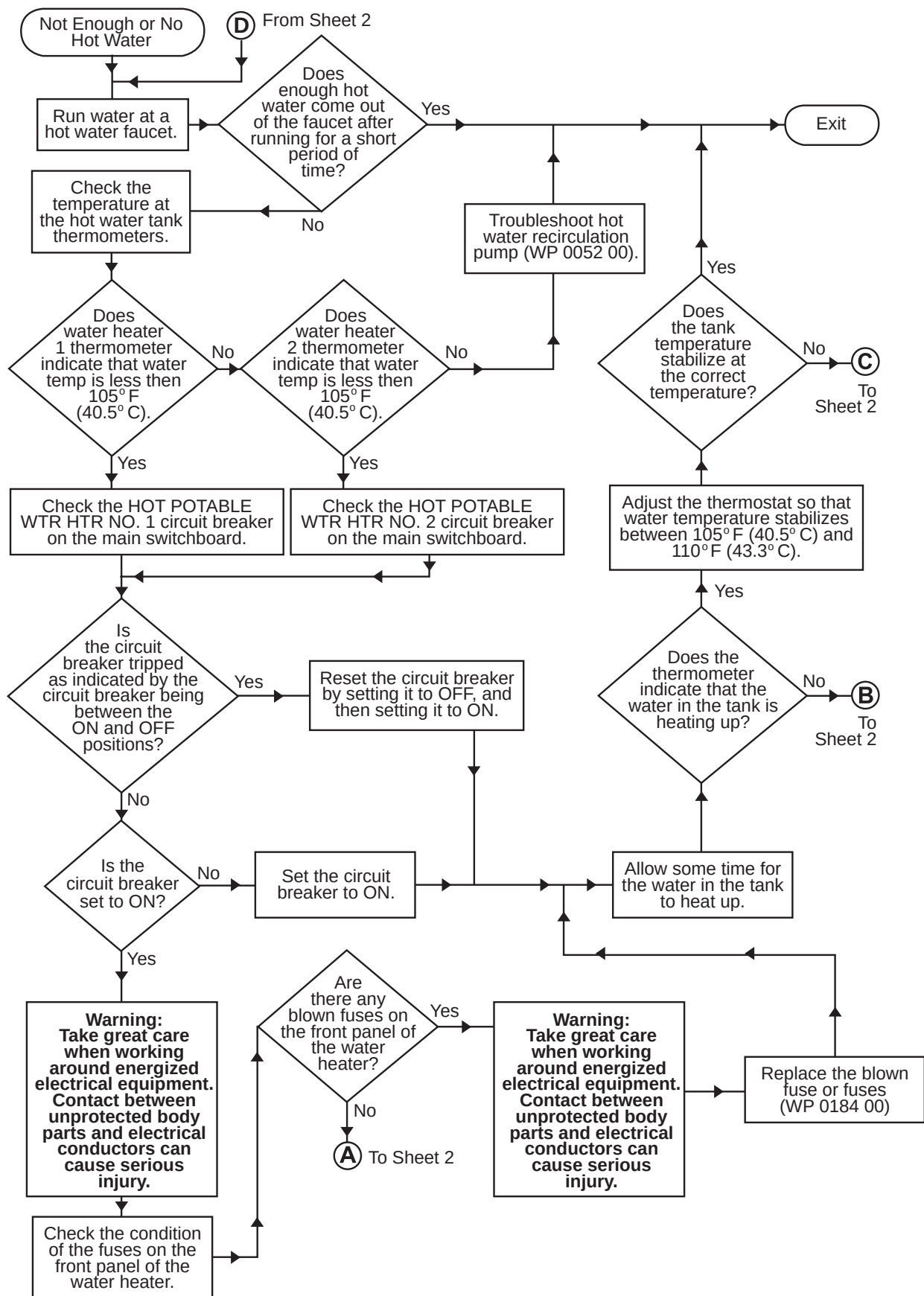
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

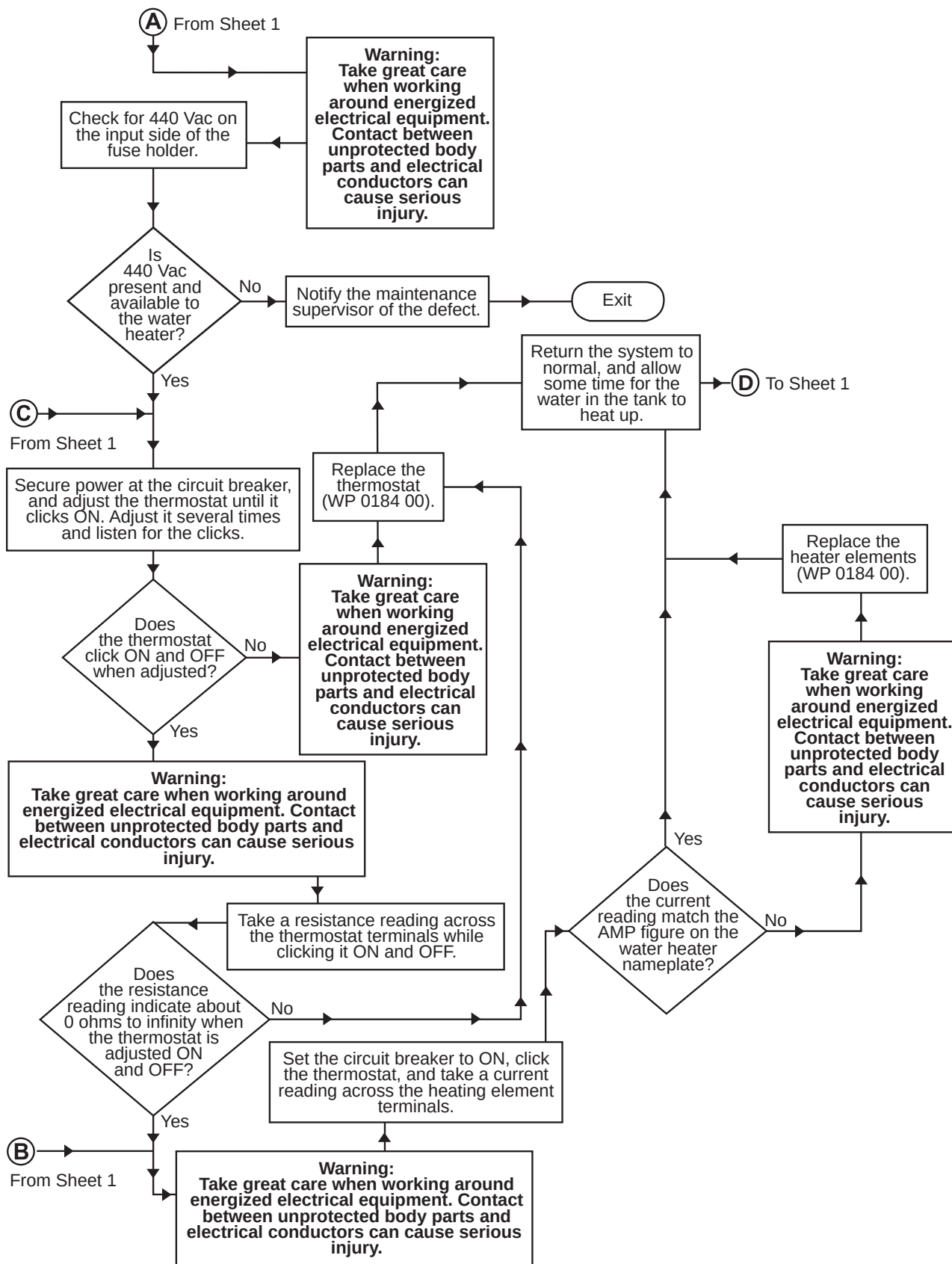
<u>Malfunction/Symptom</u>	<u>Procedure</u>
Hot Water Heater Tank Relief Valve Discharges Continuously	1
Not Enough or No Hot Water	2



Procedure 1. Hot Water Heater Tank Relief Valve Discharges Continuously



Procedure 2. Not Enough or No Hot Water (Sheet 1 of 2)



Procedure 2. Not Enough or No Hot Water (Sheet 2)

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

ROTARY CLEARVIEW SCREENS

INITIAL SETUP:

- Tools and Special Tools:

Tool Kit, Electrician’s (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)
- References:

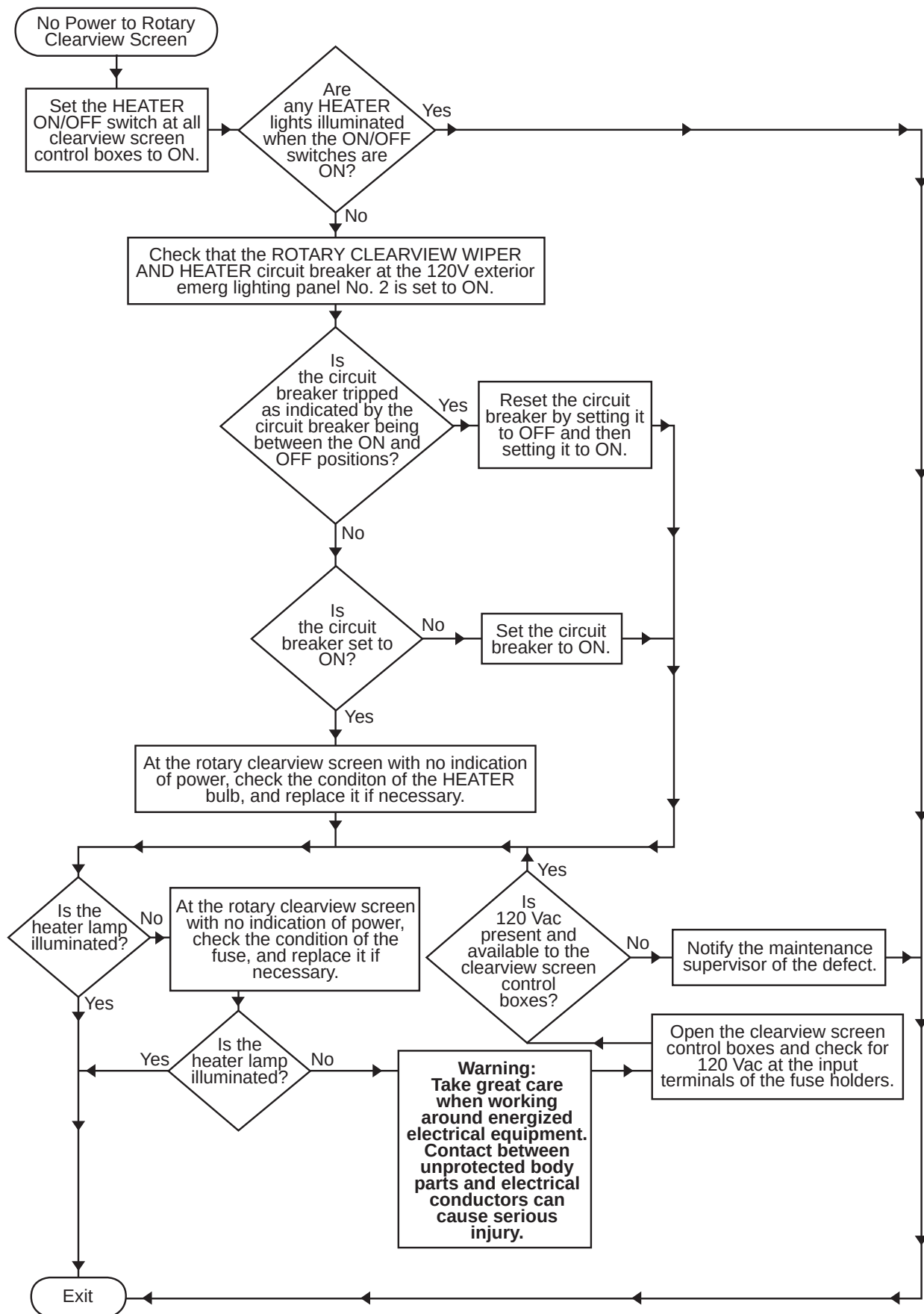
WP 0295 00 (volume 2)

- Personnel Required:**
Two Watercraft Engineers, 88L

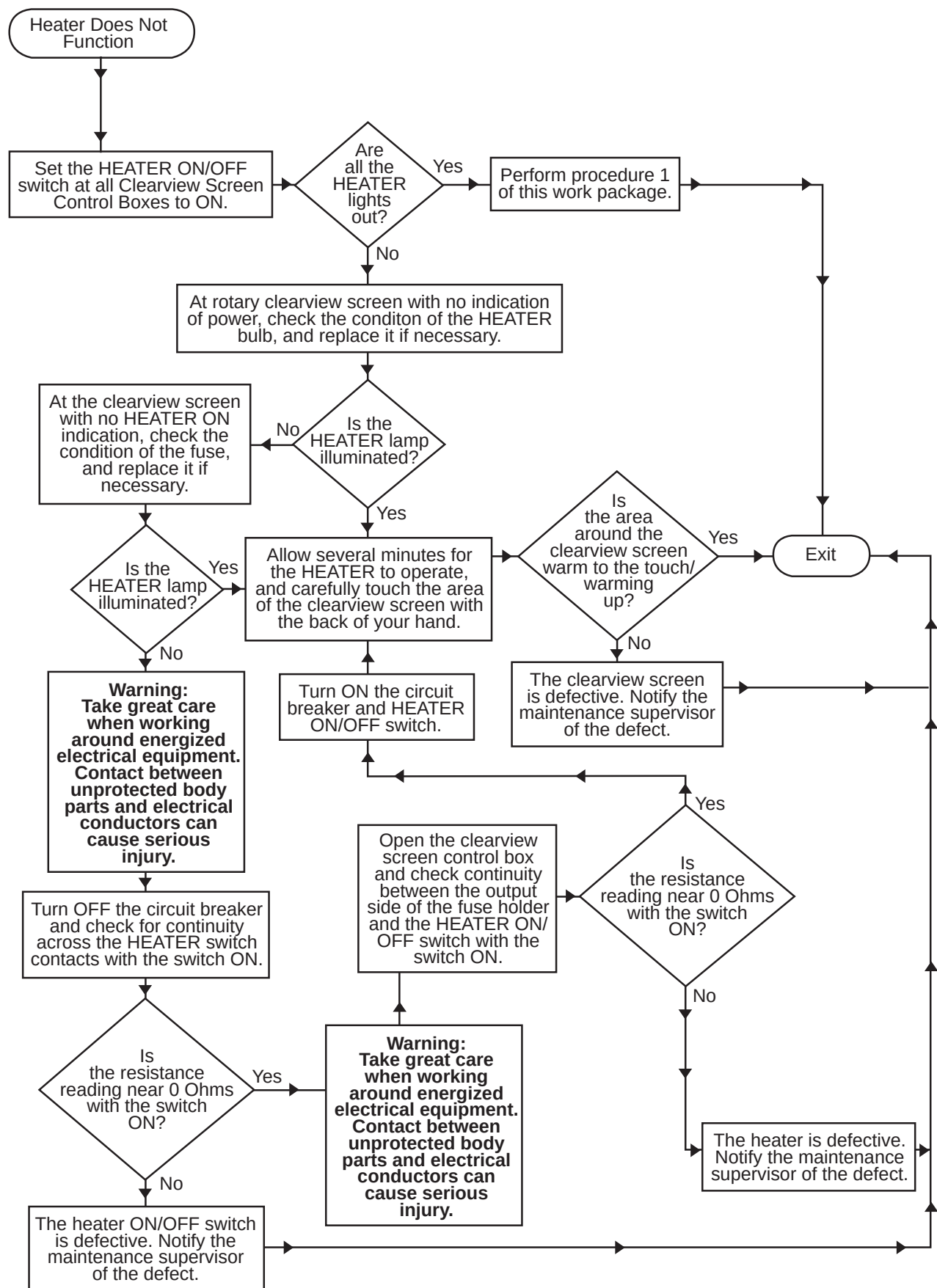
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

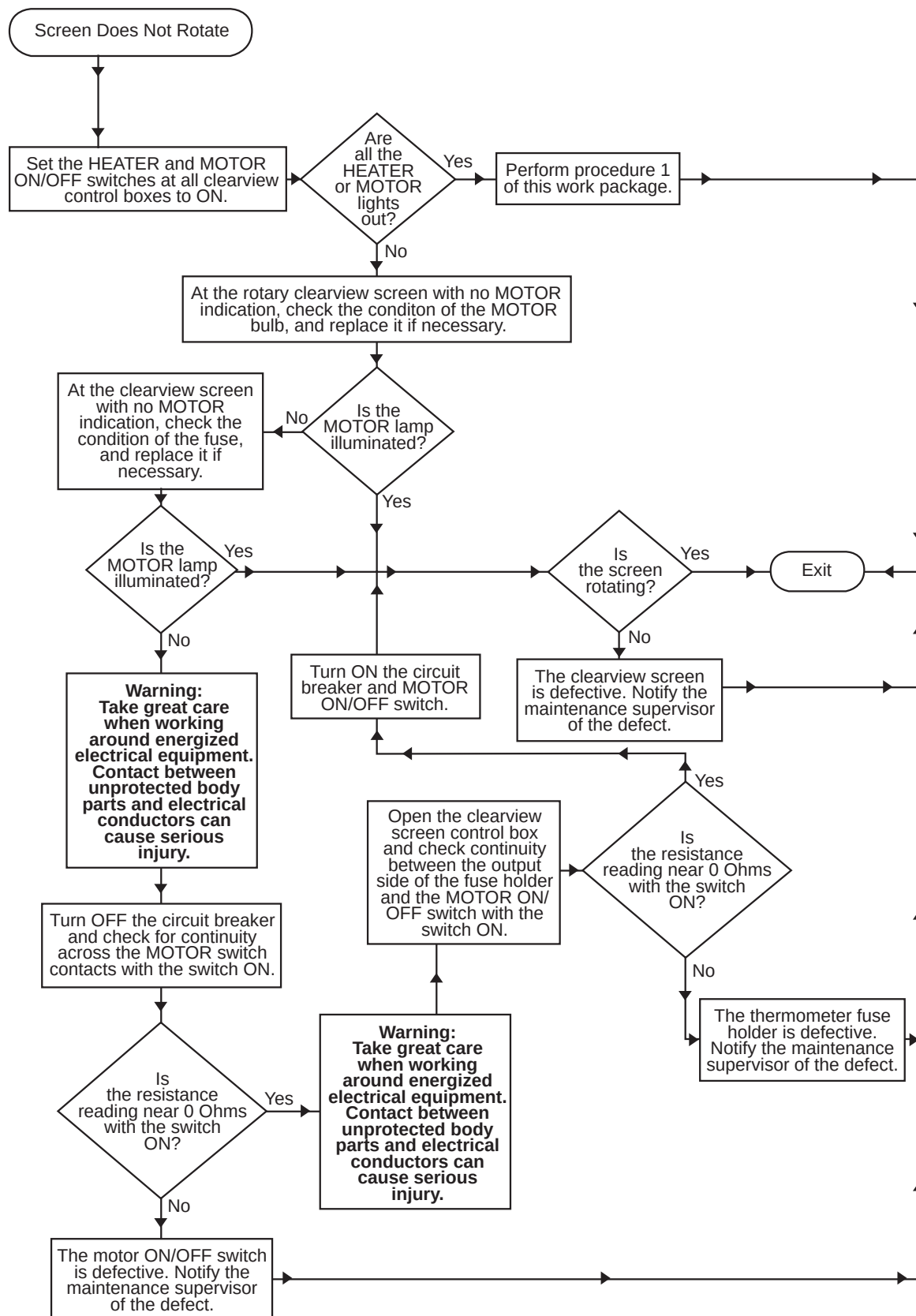
<u>Malfunction/Symptom</u>	<u>Procedure</u>
No Power to Rotary Clearview Screen	1
Heater Does Not Function	2
Screen Motor Does Not Rotate	3



Procedure 1. No Power to Rotary Clearview Screen



Procedure 2. Heater Does Not Function



Procedure 3. Screen Does Not Rotate

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
DRILL PRESS**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0190 00
WP 0295 00 (volume 2)

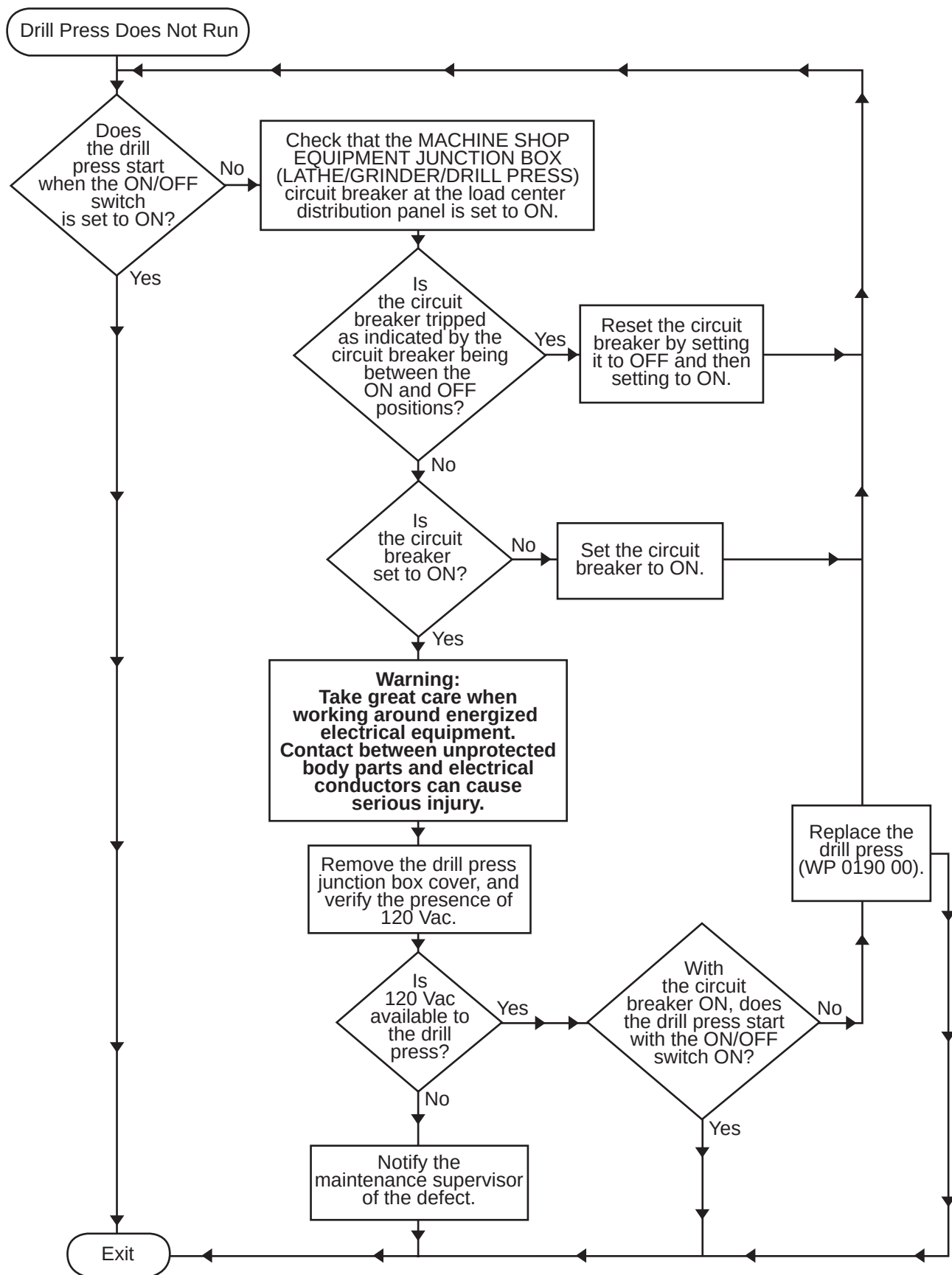
Personnel Required:

Two Watercraft Engineers, 88L

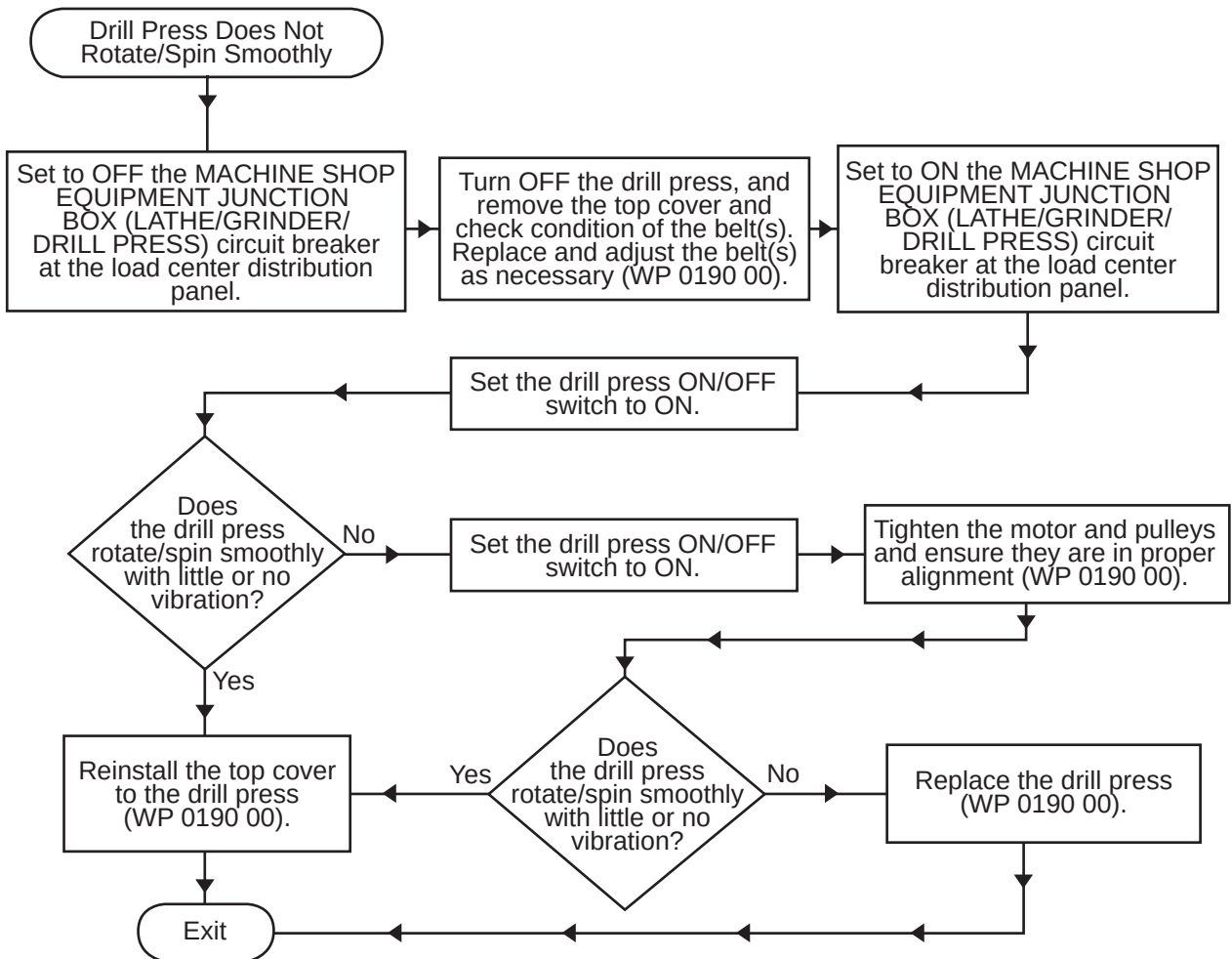
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

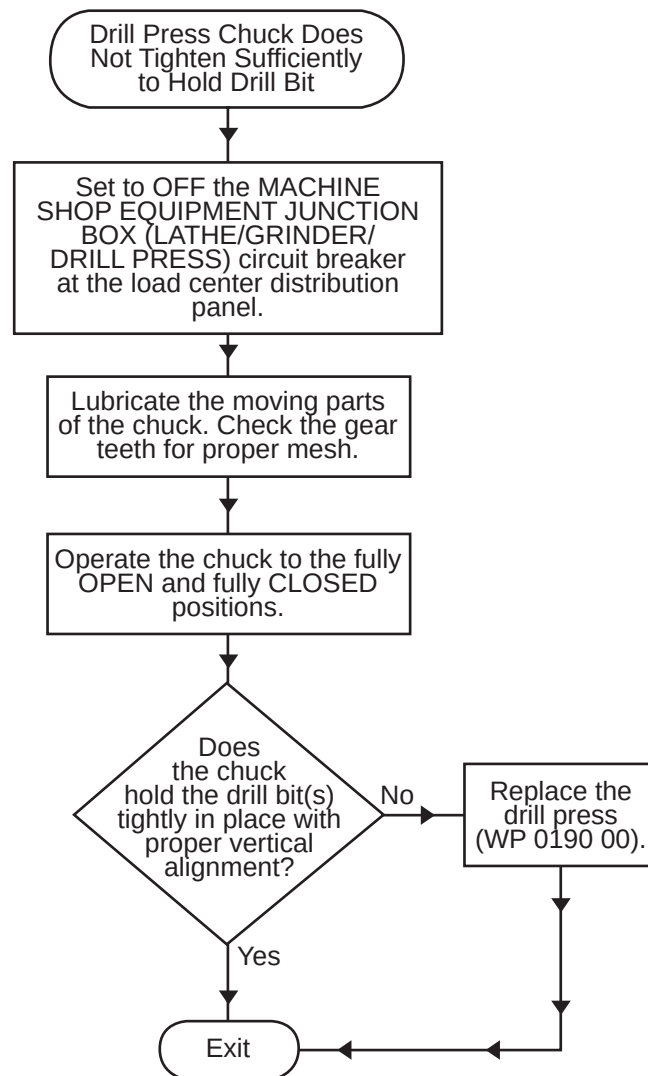
<u>Malfunction/Symptom</u>	<u>Procedure</u>
Drill Press Does Not Run	1
Drill Press Does Not Rotate/Spin Smoothly	2
Drill Press Chuck Does Not Tighten Sufficiently to Hold Drill Bit	3
Drill Press Spindle Does Not Raise and Lower Correctly	4
Drill Press Table Does Not Raise, Lower, or Rotate Correctly	5



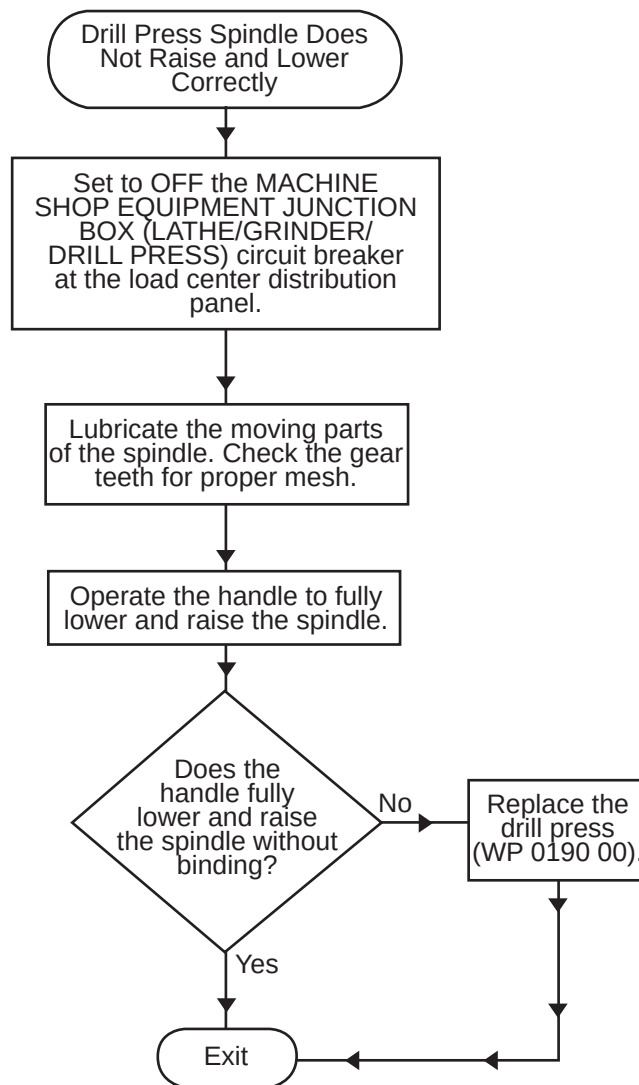
Procedure 1. Drill Press Does Not Run



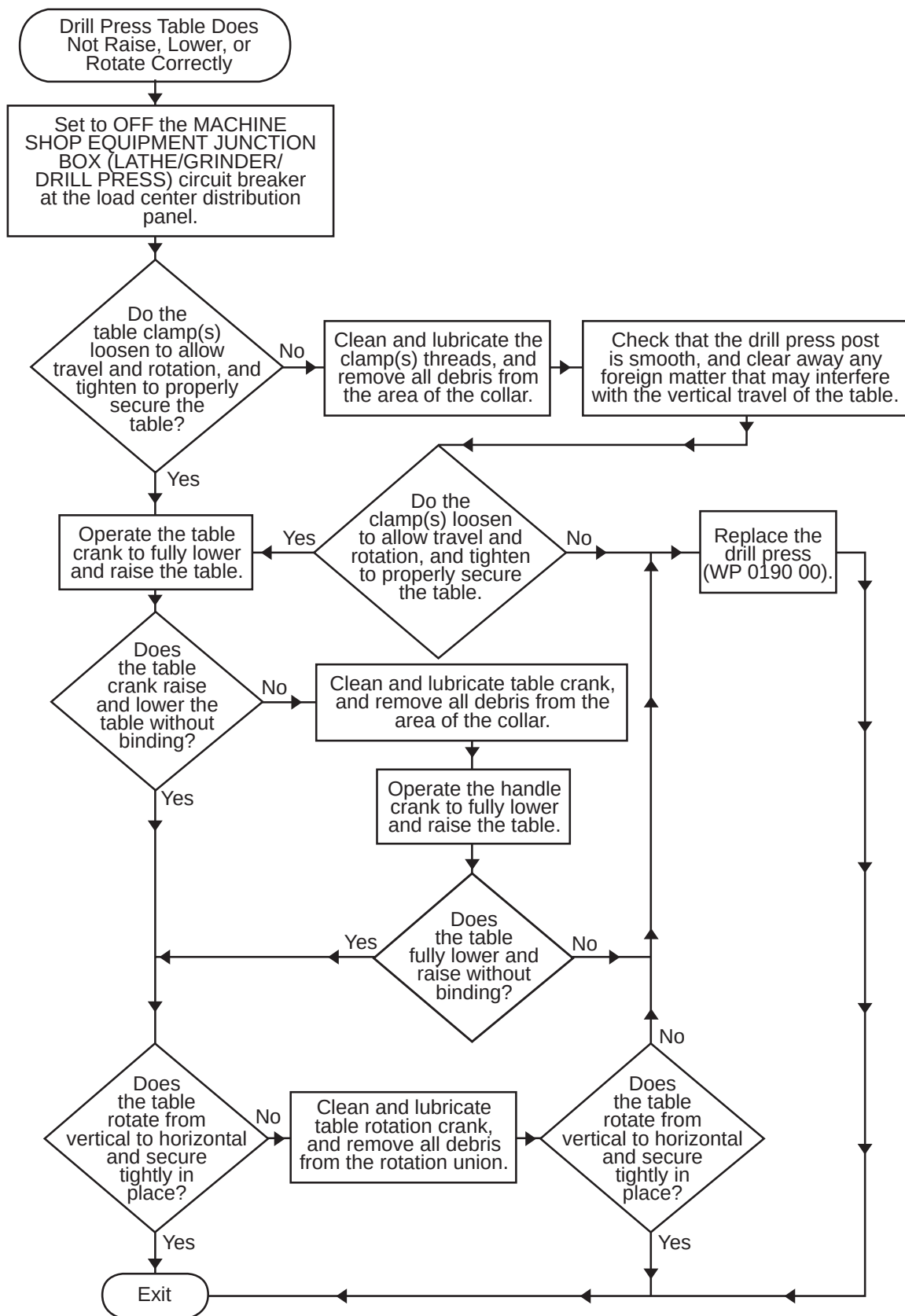
Procedure 2. Drill Press Does Not Rotate/Spin Smoothly



Procedure 3. Drill Press Chuck Does Not Tighten Sufficiently to Hold Drill Bit



Procedure 4. Drill Press Spindle Does Not Raise and Lower Correctly



Procedure 5. Drill Press Table Does Not Raise, Lower, or Rotate Correctly

END OF WORK PACKAGE

UNIT MAINTENANCE

INLAND AND COASTAL LARGE TUG (LT)

UNIT TROUBLESHOOTING PROCEDURES

BENCH GRINDER

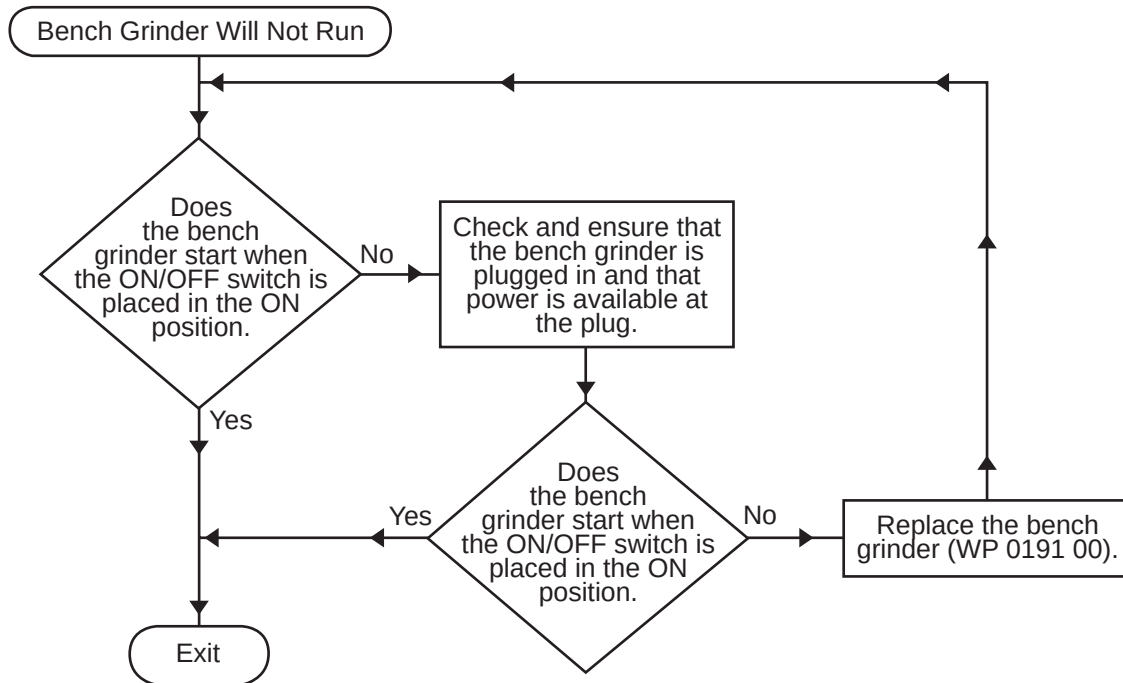
INITIAL SETUP:

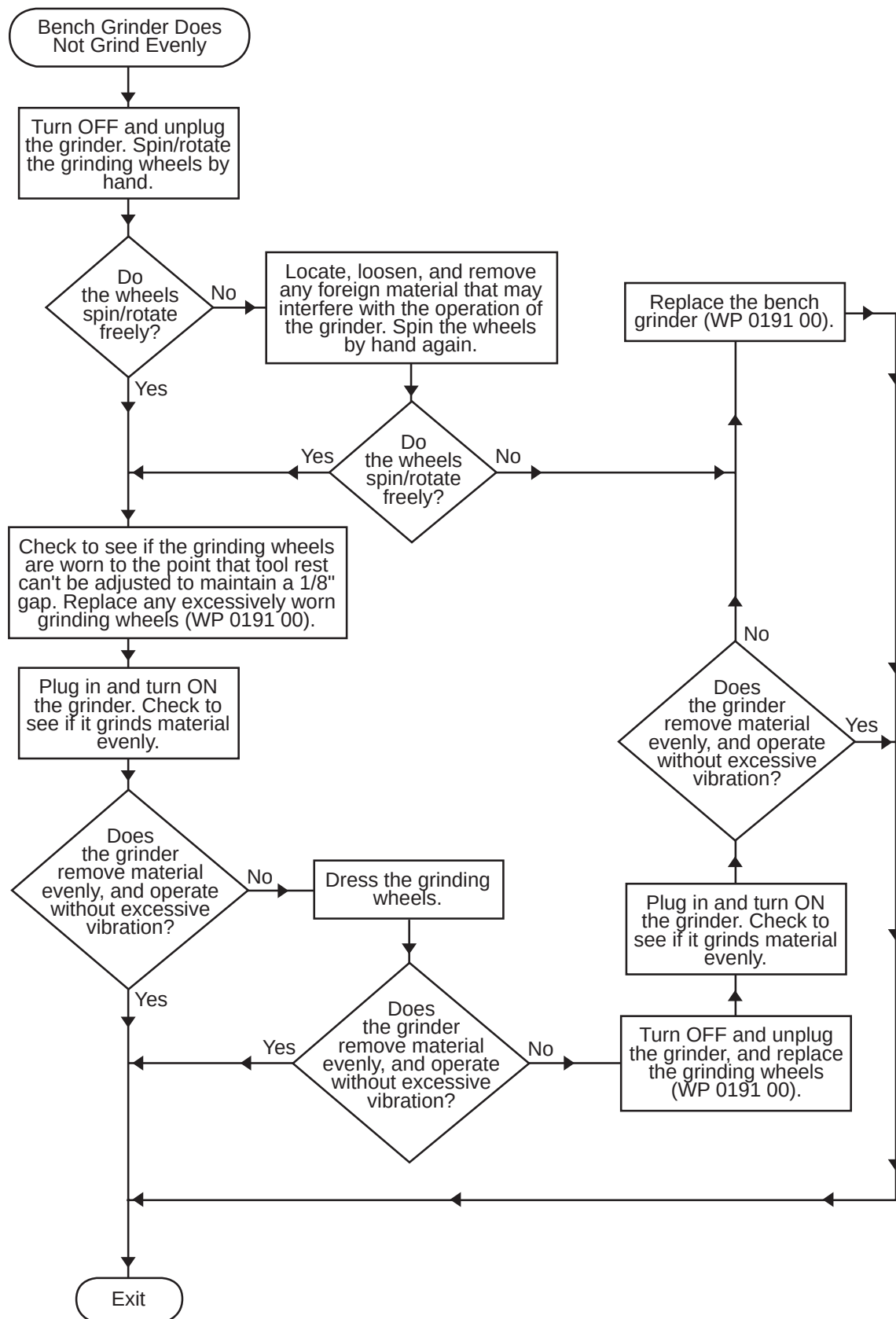
Tools and Special Tools:	Personnel Required:
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)	Two Watercraft Engineers, 88L
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)	References:
	WP 0191 00
	WP 0295 00 (volume 2)

INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

<u>Malfunction/Symptom</u>	<u>Procedures</u>
Bench Grinder Will Not Run	1
Bench Grinder Does Not Grind Evenly	2

**Procedure 1. Bench Grinder Will Not Run**



Procedure 2. Bench Grinder Does Not Grind Evenly

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES
ARC WELDER**

INITIAL SETUP:

Tools and Special Tools:

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00,
Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

WP 0192 00
WP 0295 00 (volume 2)

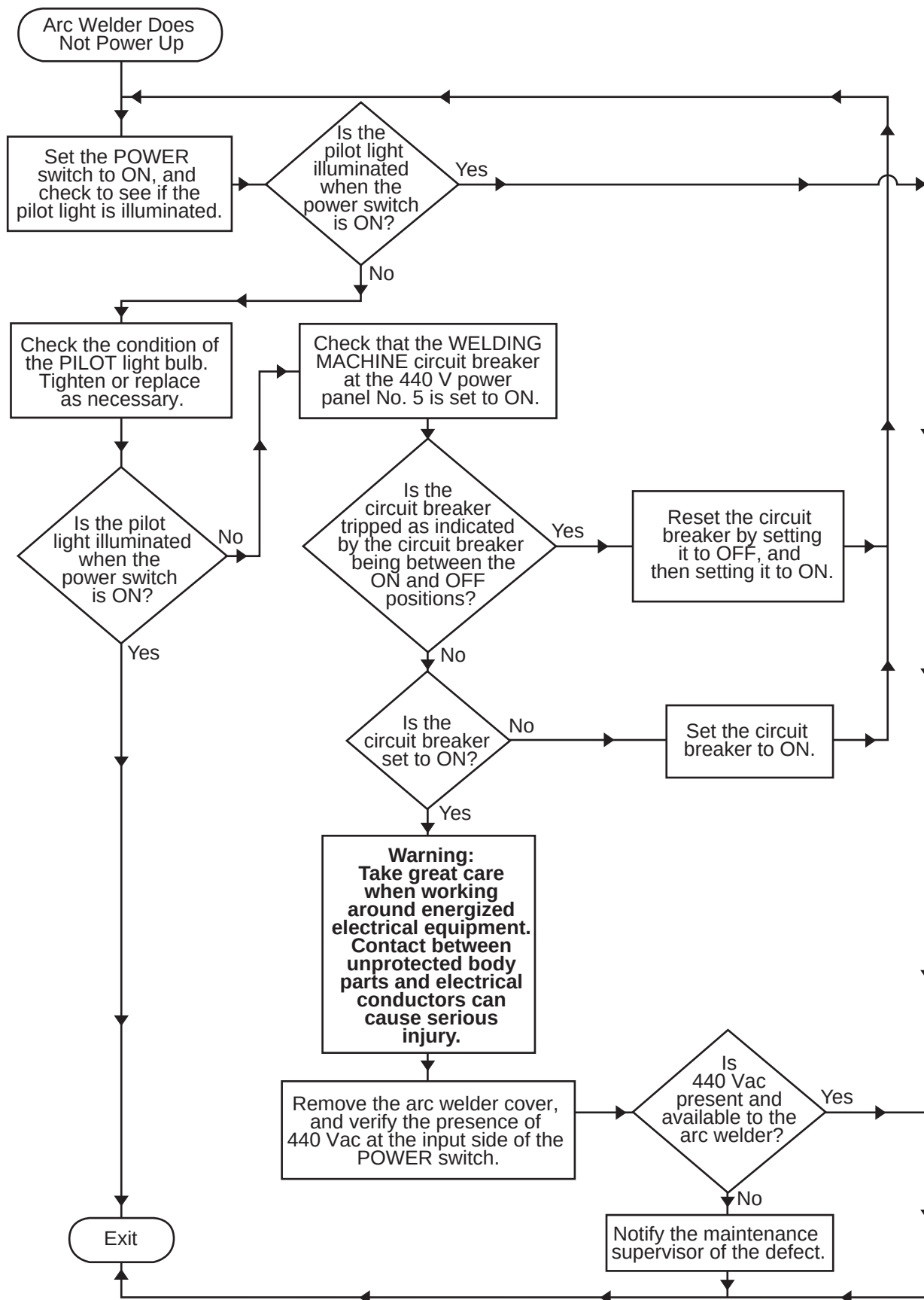
Personnel Required:

Two Watercraft Engineers, 88L

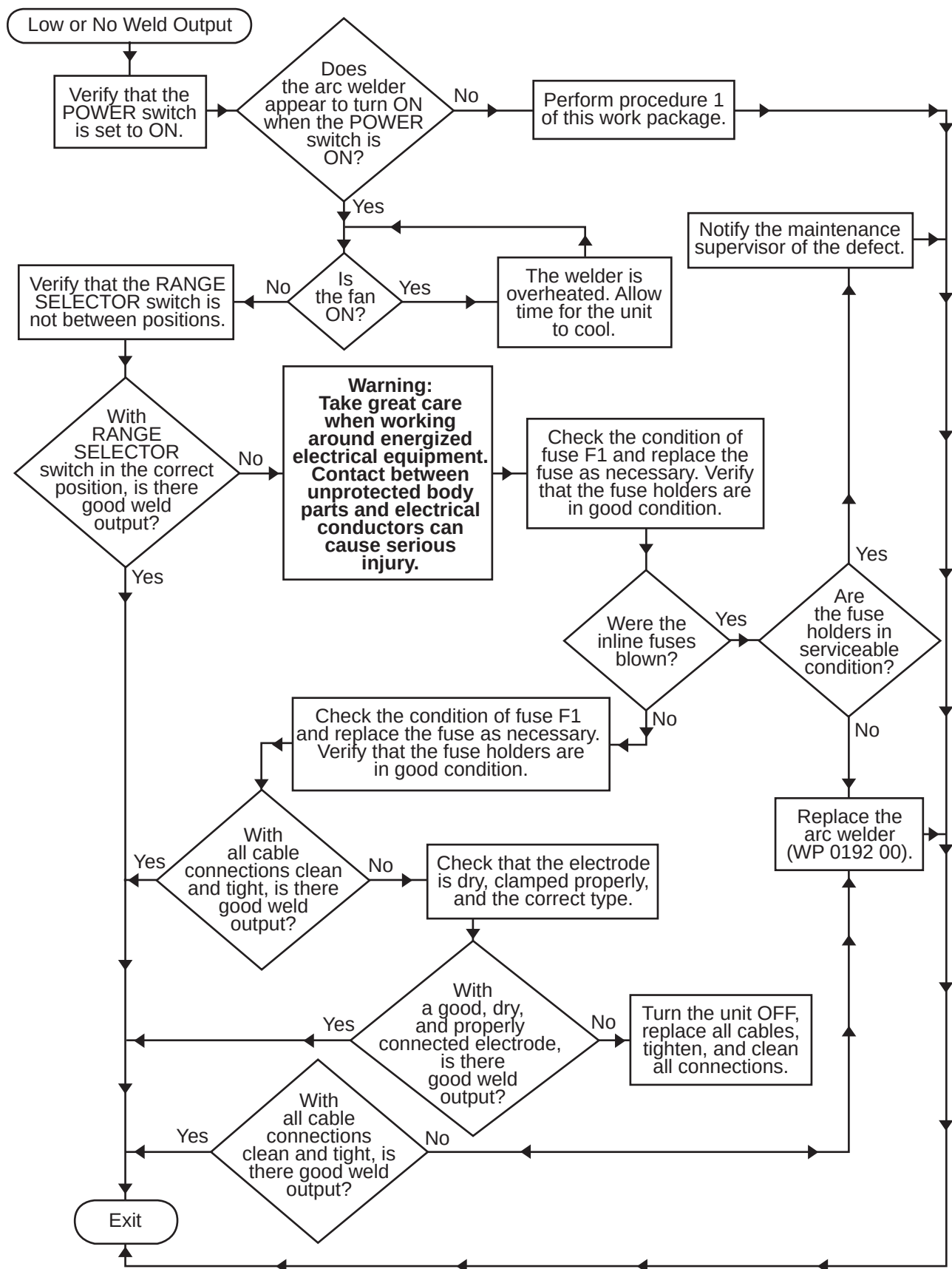
INTRODUCTION

The following unit troubleshooting procedures are included in this work package:

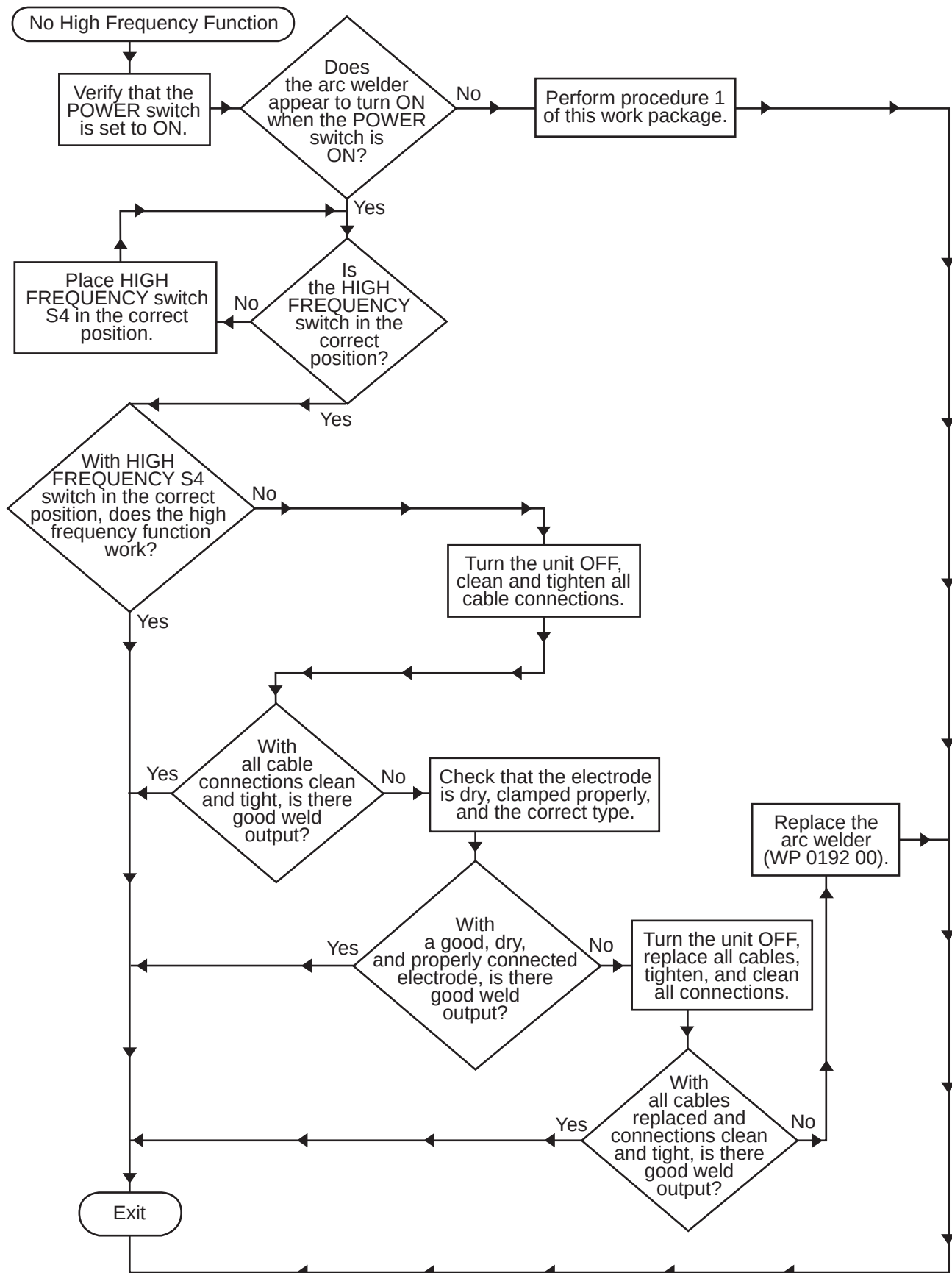
<u>Malfunction/Symptom</u>	<u>Procedure</u>
Arc Welder Does Not Power Up	1
Low or No Weld Output	2
No High Frequency Function	3



Procedure 1. Arc Welder Does Not Power Up



Procedure 2. Low or No Weld Output



Procedure 3. No High Frequency Function

END OF WORK PACKAGE

Chapter 3

**Service Upon Receipt and
Preventive Maintenance Checks
and Services (PMCS)
for
Inland and Coastal Large Tug (LT)**

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
SERVICE UPON RECEIPT**

Initial Setup:**Personnel Required:**

One Vessel Master
One First Mate
One Second Mate
One Third Mate
One Chief Engineer
One First Engineer
One Second Engineer
One Third Engineer
Six Watercraft Engineers, 88L
Six Watercraft Operators, 88K
Two Cooks
One Medic

References:

TM 55-1925-273-10
TB 740-97-4
WP 0081 00
WP 0082 00
WP 0083 00
WP 0084 00
DA Form 2404
DA PAM 738-750

SITING REQUIREMENTS**LOCATION**

The primary mission of the Inland and Coastal Large Tug (LT) consists of ocean and coastal towing as well as docking and undocking operations with large ocean vessels. The vessel's secondary mission is to perform general purpose harbor duties such as positioning floating cranes, etc. With this mission capability in mind, the LT may be located along any waterway sufficiently deep to support the vessel. The vessel may be located adjacent to a pier, barge, or other berthing, or may lie at anchor as port conditions dictate.

PROXIMITY TO POWER SOURCES

The LT is completely self-sufficient with regard to electrical power. Two ship's service diesel generators and an emergency diesel generator supply all of the electrical needs of the vessel. The vessel's electrical needs may also be supplied by a shore power connection to a shore facility or to another vessel. The shore supply source must be 440 Vac (Volts alternating current), three phase. The LT is outfitted with a shore power cable to make this connection.

SHELTER REQUIREMENTS

The LT requires no shelter. When not in use, the vessel is moored alongside a pier, alongside another vessel, or is anchored.

SERVICE UPON RECEIPT**GENERAL**

The services performed upon receipt of a new or used vessel are the responsibility of the receiving organization and will be performed by the crew and the issuing activity.

WARNING

Before volatile materials are brought aboard, or the engines are started, ensure that firefighting equipment is immediately available for use in case of fire emergency. Failure to comply could endanger personnel and/or equipment.

INSPECTING AND SERVICING THE INLAND AND COASTAL LARGE TUG

The crew and issuing activity will conduct a 100 percent inventory of the vessel and required components per the Basic Issue Items (BII) List (TM 55-1925-273-10), the Component of End Item (COEI) List (TM 55-1925-273-10), and Onboard Spare Parts List (OBSL) (TM 55-1925-273-10). Any shortages will be listed and reported to the proper authority for corrective action. The crew will perform all of the operator PMCS as listed in TM 55-1925-273-10 and all of the unit PMCS as listed in WP 0081 00 through WP 0084 00 up to and including those done annually. All defects and shortages will be recorded on DA Form 2404 as per DA PAM 738-750.

USED EQUIPMENT

A vessel received from storage will be inspected as specified in the paragraph above. However, storage personnel will have performed the depreservation operation and outfitted and operated the vessel prior to the arrival of the crew.

INSTALLATION INSTRUCTIONS

If the LT has been in storage, or has been transported as deck cargo aboard a transport ship, perform the following procedures:

1. If preservation was performed on the vessel, depreservation is detailed in TB 740-97-4.
2. Reactivation of the vessel after movement is detailed in TB 740-97-4.
3. Open all vessel hatches, doors, windows, and portholes to ventilate the vessel interior.
4. Fill the potable water tank with potable water from an approved source.
5. Fill both fuel tanks with diesel fuel from an approved source.

PRELIMINARY SERVICING OF EQUIPMENT AND PRELIMINARY CHECKS AND ADJUSTMENTS OF EQUIPMENT

Perform all operator and unit PMCS up through and including the annual level. Operator PMCS procedures are contained in TM 55-1925-273-10. Unit PMCS procedures are contained in WP 0081 00 through WP 0084 00.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
PMCS INTRODUCTION**

PURPOSE AND USE OF PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) DATA

PMCS is performed to keep the Large Tug (LT) 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 LT 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. Prior to operating the LT, do Before PMCS.
2. During LT operation, do During PMCS.
3. Once a week do Weekly PMCS.
4. 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.
5. 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.
6. 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.
7. Do Annual PMCS once a year.
8. 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 Equipment Inspection, 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 indicates, have organizational maintenance do the work.

EQUIPMENT NOT READY/AVAILABLE IF

This column 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 LT 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 LT. 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 LT. 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 LT 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 (MIL-HDBK-113 and MIL-HDBK-275).

LUBRICATION SERVICE INTERVALS - NORMAL CONDITIONS

For safer, more trouble free operations, make sure that the LT is serviced when required. For the proper lubrication and service intervals, refer to work packages WP 0081 00 through WP 0084 00.

LUBRICATION SERVICE INTERVALS - UNUSUAL CONDITIONS

The LT 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.

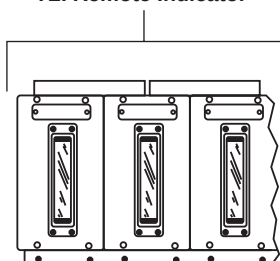
END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES INCLUDING LUBRICATION
BELOW MAIN DECK LEVEL

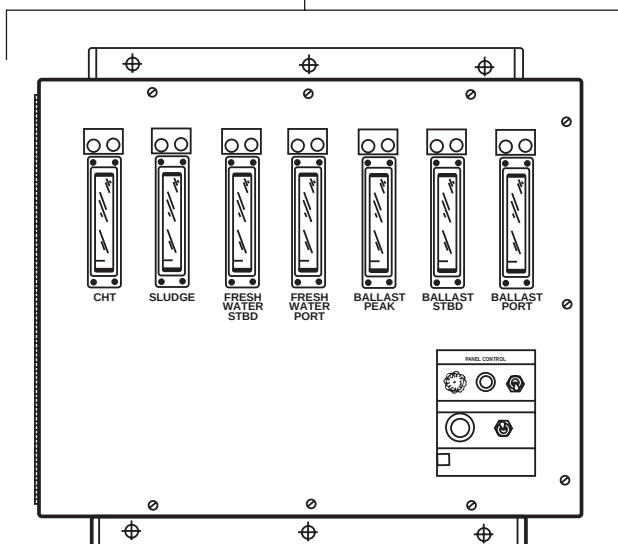
Table 1. Preventive Maintenance Checks and Services Including Lubrication

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	Before	2.0	TANK LEVEL INDICATOR PANELS AND RECEIVERS	Test and Inspect TLI receivers and transmitters a. Observe level at local receiver. Compare reading with receiver panel in EOS. b. Inspect units for any missing or damaged parts or indicators.	Any unacceptable difference in readings between control panel indicators and remote indicators. Any unserviceable part.

TLI Remote Indicator



Master TLI in EOS



Fuel Oil and Lube Oil Master TLI in EOS

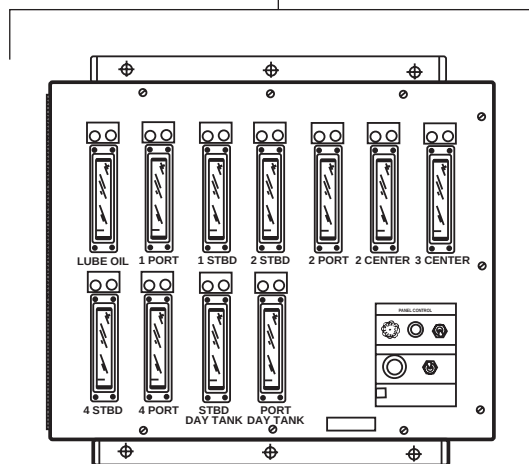


Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
2	Before	0.2	AFT SEACHEST STRAINERS	Shift and clean strainers. Refer to WP 0188 00.	Strainers are unserviceable.
3	Before	0.2	HIGH LEVEL SEACHEST STRAINERS	Shift and clean strainers. Refer to WP 0188 00.	Strainers are unserviceable.

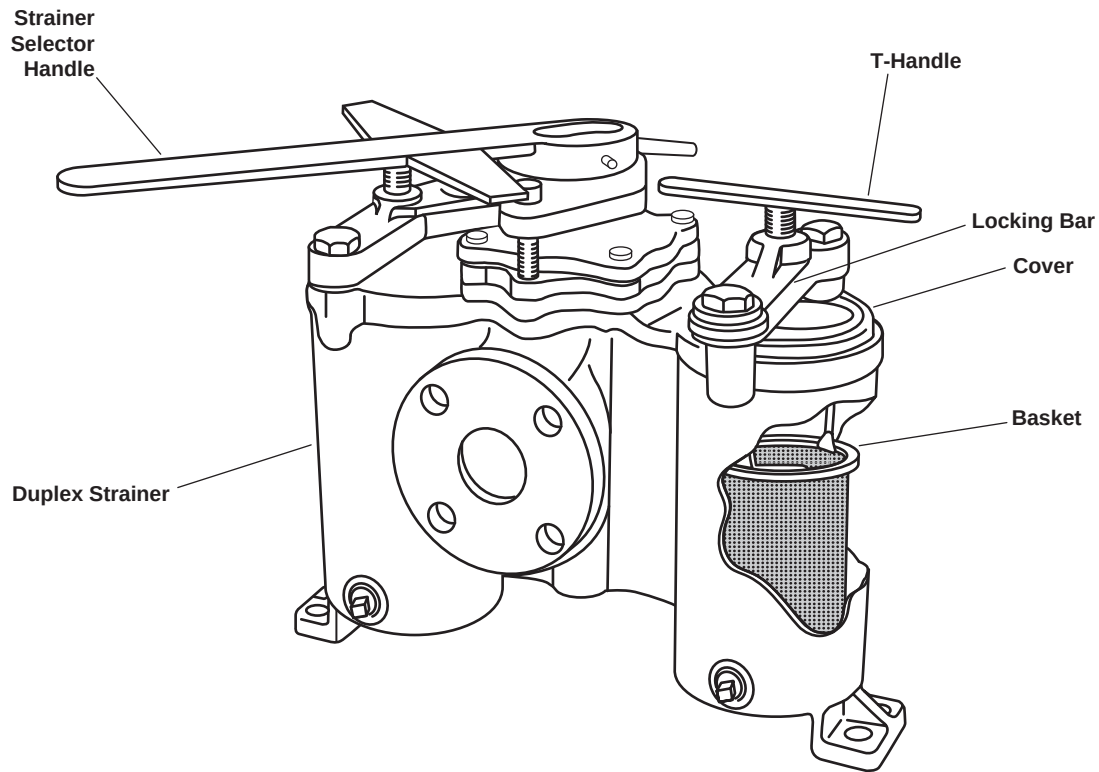


Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

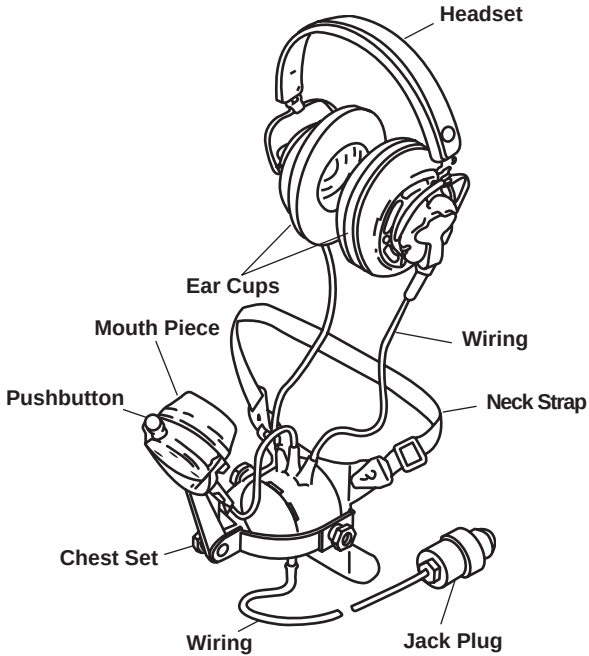
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
4	During	1.0	SOUND POWERED TELEPHONES Head Set-Chest Set	Inspect and service as follows: Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

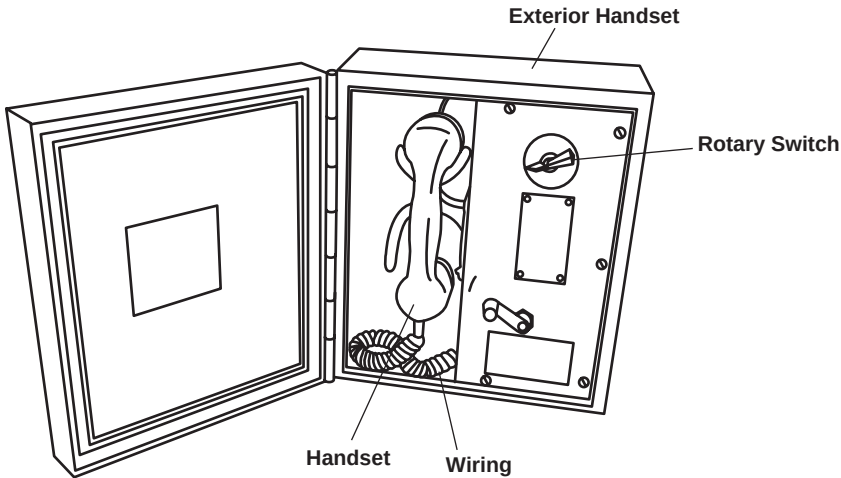
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
5	During	1.0	Exterior Handsets	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
 The diagram shows a perspective view of an open exterior handset unit. The unit is rectangular with a hinged door on the left. Inside the unit, a handset is mounted on a vertical support. A coiled cord, labeled 'Wiring', connects the handset to the base of the unit. On the right side of the interior panel, there is a circular 'Rotary Switch' with a keyhole. The entire unit is labeled 'Exterior Handset'.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

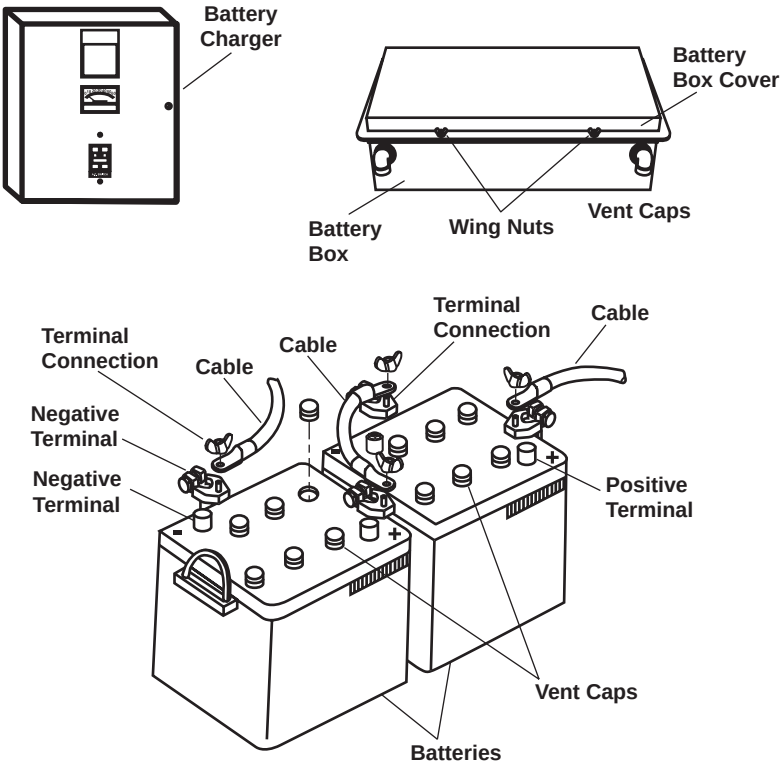
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
6	During	0.5	PROPELLER	Inspect Propellers. Observe for unusual noise or vibration. WARNING  Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Failure to comply can result in serious injury or death.	Any excessive vibration.
7	Weekly	1.0	BATTERY	Test and service the equipment batteries. Refer to WP 0128 00 and WP 0129 00. 	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
8	Weekly	0.7	MAIN SWITCHBOARD	Inspect and test as follows: - Visually inspect exterior of switchboard for damaged or missing circuit breakers, meters, controls, or indicators. - Press ground detector PUSH TO TEST pushbuttons, and verify that the lamps illuminate.	Any missing, or damaged control, meter, or circuit breaker. Ground fault detector lamps do not illuminate.

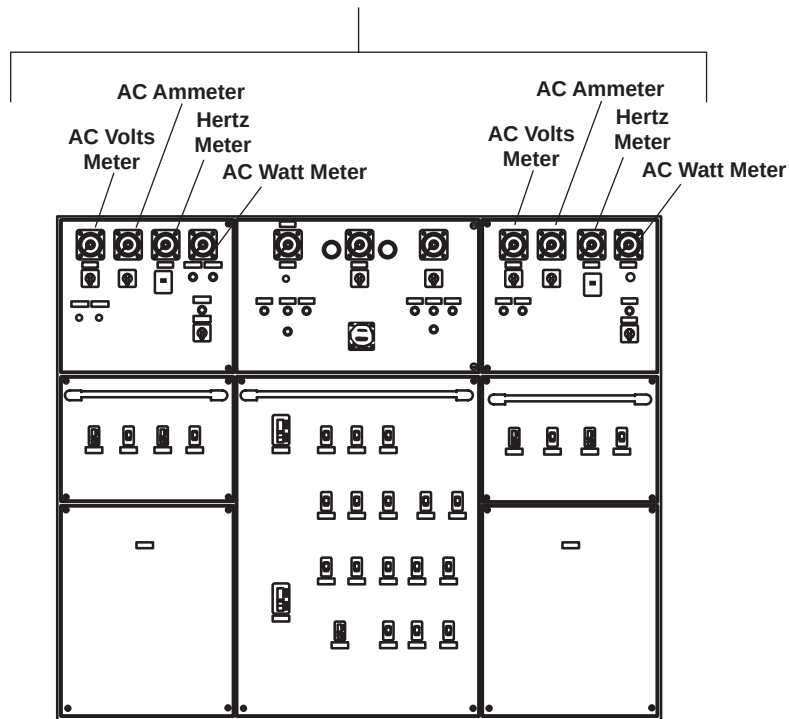
Main Switchboard

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
9	Weekly	0.2	LOAD CENTER	Visually inspect the load center for damaged or missing circuit breakers, controls, or indicators.	Any missing or damaged part.
10	Weekly	1.5	FLUORESCENT AND INCANDESCENT LIGHTS	a. Check for proper operation of switches and bulbs. b. Check and for loose connections, cracked, or missing lenses and secure mounting.	

The diagram shows a schematic of electrical equipment. At the top is a rectangular unit with a circular component labeled 'Interior Lighting'. Below this are four main panels: '120V Distribution Panel No. 4' on the left, '24 Volt Machinery DC Distribution Panel' in the center, 'Load Center Distribution Panel' on the right, and '440V Power Panel No.1' on the far right. The panels are interconnected by lines representing wiring.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
11	Weekly	0.3	Engine Order Telegraph	Move selector through each position ensuring corresponding indicator lights and bells. Verify operation of wrong direction alarm system.	

The diagram illustrates the engine control console with the following labeled components:

- EOS Console
- Remote Propulsion Indicator Panel
- Command Transfer
- Control Air Pressure
- Engine Order Telegraph
- Steering Gear Alarm Panel
- 21MC Intercom
- Remote Start Panel
- Port Reduction Gear Ahead/Astern Selector
- Port Main Engine Throttle Clutch
- Starboard Main Engine Throttle Clutch
- Stbd Reduction Gear Ahead/Astern Selector
- Display Machinery Plant Monitoring System

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
12	Weekly	1.0	SOUND POWERED TELEPHONES Head Set-Chest Set	Inspect and service as follows: Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

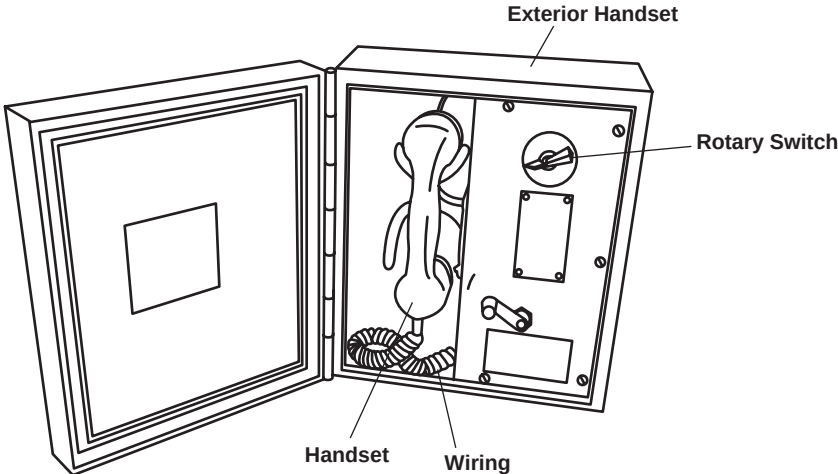
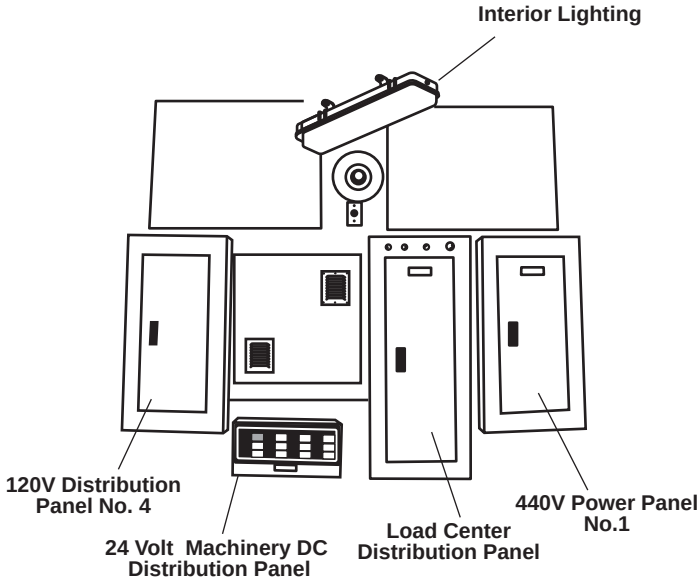
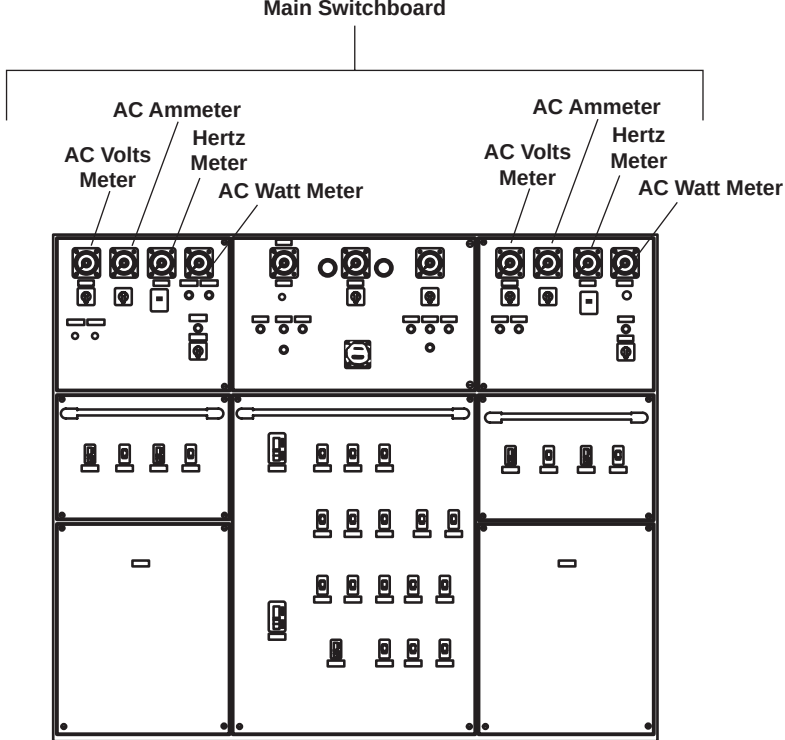
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
13	Weekly	1.0	Exterior Handsets	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
					
14	Monthly	0.5	MAIN SWITCHBOARD / ENGINE ROOM LOAD CENTER DISTRIBUTION PANEL	Wipe down and clean exterior.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
15	Monthly	6.0	AMS 1 AND 2 WATERTIGHT DOOR REMOTE HAND PUMP STATIONS	Main Switchboard 	
				Inspect and service as follows: ⚠ CAUTION Do not operate door with pressure shutoff valves closed, as this will back-pressure the local hand pump and cause the seals to rupture. - Operate the hand pump to close the door and ensure smooth operation of the pump and correct operation of the door. - Check reservoir oil level on dipstick and fill with hydraulic oil (OH) as required.	

Door does not operate.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

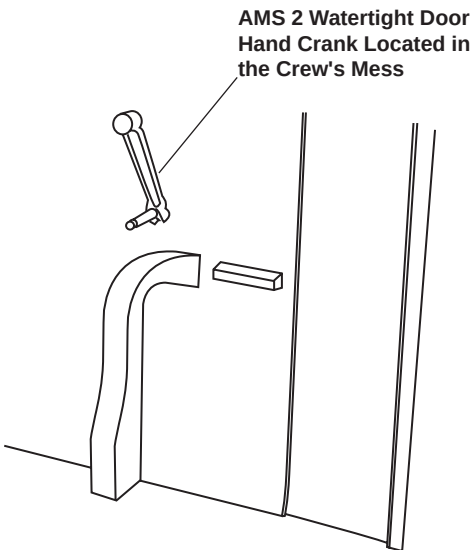
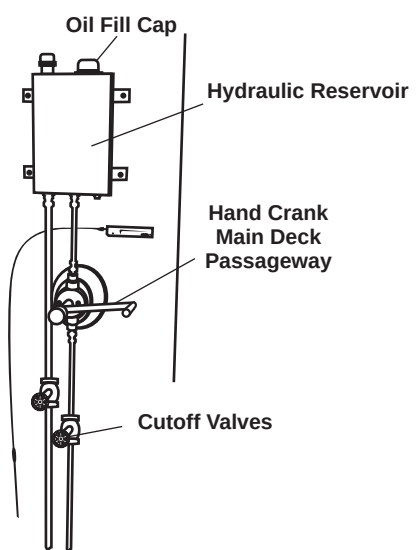
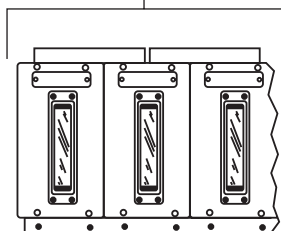
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				c. Check that hydraulic system is bled at all high points to remove trapped air. Turn bleeder valve handle to release trapped air. d. Check oil level dipstick in expansion tank. Add oil as required. e. Inspect hydraulic cylinder assembly for leaks and damage. f. Inspect hydraulic control valve assembly for leaks and damage. g. Visually inspect tracks for secure mounting and damage. Adjust tracks (WP 0088 00) as required. h. Inspect local hand pump for secure mounting and damage.	Bleeder valve missing or unserviceable. Low oil level. Class III leaks exist. Unserviceable damage. Class III leaks exist. Unserviceable damage. Tracks damaged or not mounted securely.
			 AMS 2 Watertight Door Hand Crank Located in the Crew's Mess	 Oil Fill Cap Hydraulic Reservoir Hand Crank Main Deck Passageway Cutoff Valves	

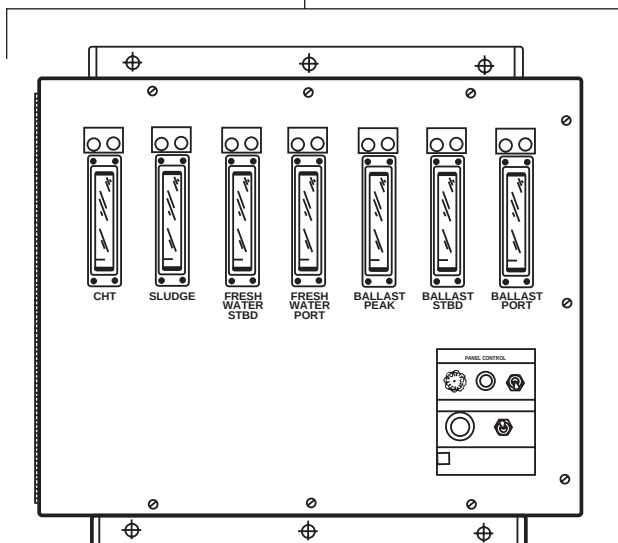
Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
16	Monthly	2.0	TANK LEVEL INDICATORS PANELS AND RECEIVERS	Test and Inspect TLI receivers and transmitters. a. Observe level at local receiver. Compare reading with receiver panel. b. Inspect units for any missing or damaged parts or indicators.	Any unacceptable difference in readings between control panel indicators and remote indicators. Any unserviceable part.

TLI Remote Indicator



Master TLI in EOS



Fuel Oil and Lube Oil Master TLI in EOS

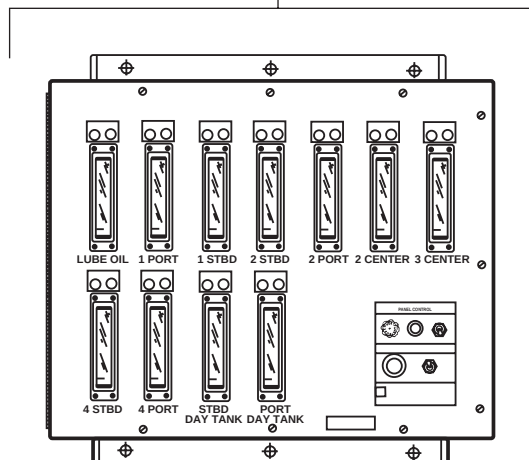


Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

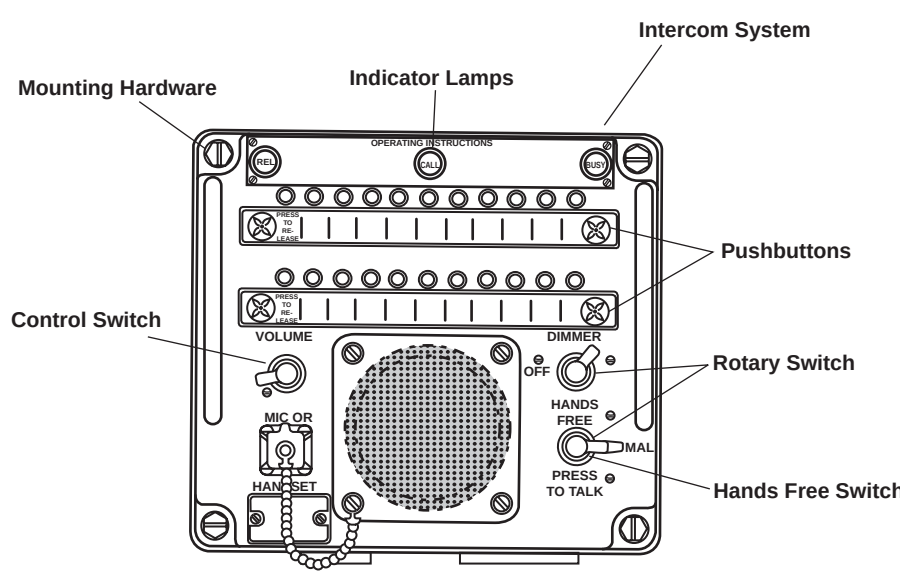
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
17	Monthly	6.0	INTERCOM SYSTEM	Perform operational test of the intercom system by communicating with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
 The diagram shows a rectangular intercom unit with various controls and indicators. Labels with leader lines point to the following components: Mounting Hardware: Screws at the corners of the unit. Indicator Lamps: A row of small circular lamps at the top. Intercom System: The overall unit. Pushbuttons: Two rows of buttons, each with a 'PRESS TO RELEASE' label. Control Switch: A rotary switch on the left side. VOLUME: A control knob below the control switch. MIC OR HANDSET: A connector for a microphone or handset. DIMMER: A rotary switch on the right side. Rotary Switch: A switch with 'OFF' and 'HANDS FREE' positions. Hands Free Switch: A switch with 'MAL' and 'PRESS TO TALK' positions.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

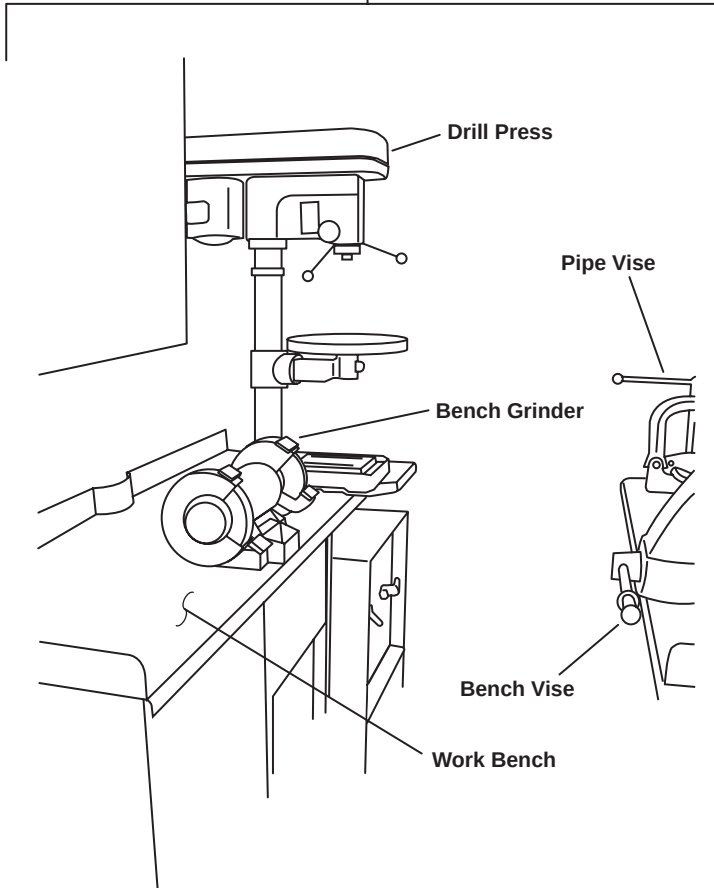
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
18	Monthly	0.5	WORKSHOP	a. Inspect all precautionary labels for legibility. b. Inspect workshop for loose parts, tools, or heavy objects that may fall or slide in heavy seas, and secure loose objects. c. Ensure that decking is secure, lights are operational, and that the shop is clean and free of salt deposits. d. Verify that no flammable liquids are stowed in shop, and that the shop is free of trash and other solid flammables.	
Workshop 					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

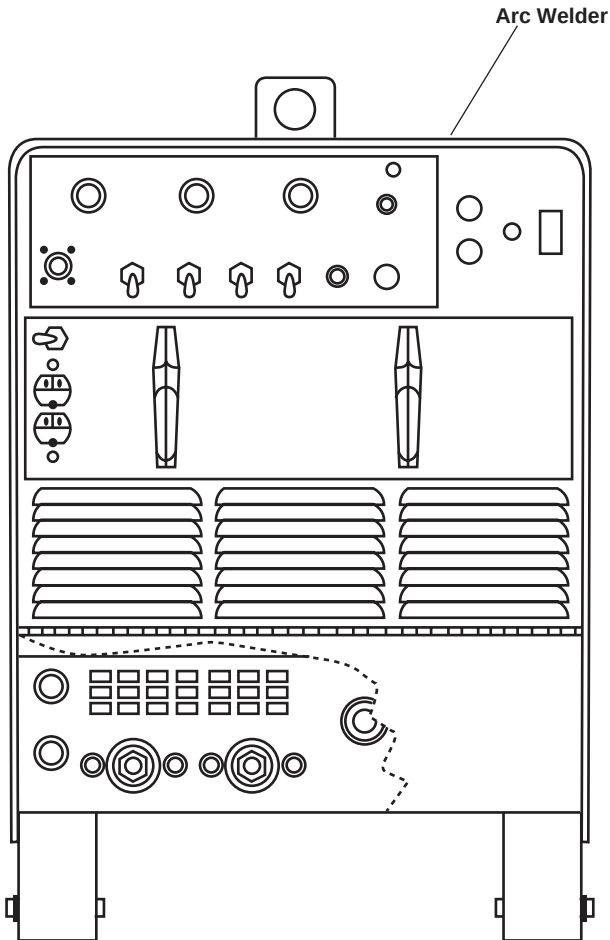
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
19	Quarterly	0.5	ARC WELDING MACHINE	Inspect cables for breaks in insulation. Repair or replace damaged cables. Clean and tighten connections. 	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

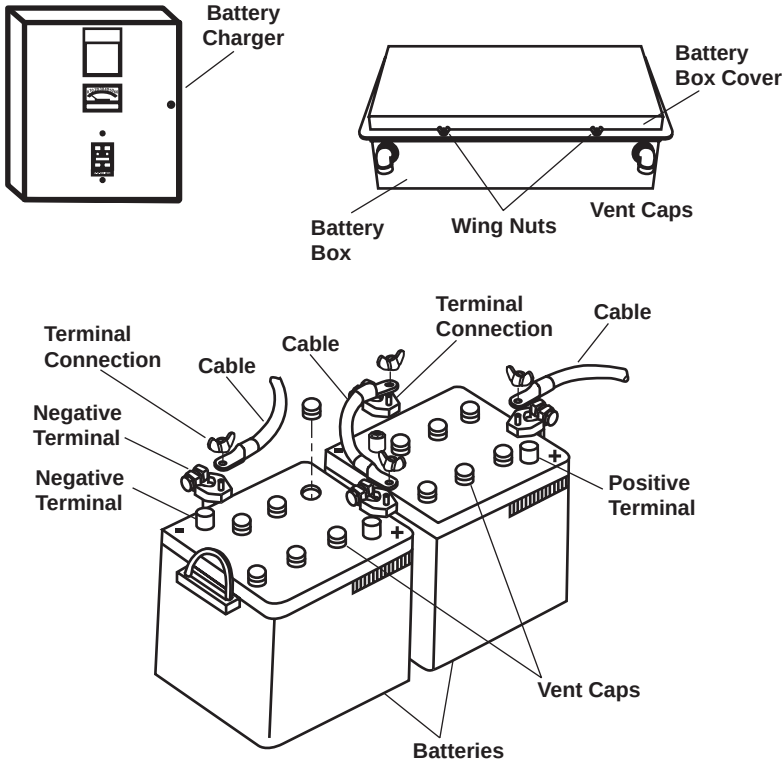
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
20	Quarterly	0.4	BATTERY CHARGERS	Inspect as follows: - Check for the visible damage and corrosion. - Inspect for chipped paint or excessive wear. - Check for secure mounting, and ensure tightness and no parts missing. - Inspect for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation.	
 The diagram illustrates the components of a battery charger and battery box. The top left shows a 'Battery Charger' unit. The top right shows a 'Battery Box Cover' with 'Wing Nuts' and 'Vent Caps' on the 'Battery Box'. The bottom shows a detailed view of the 'Batteries' with 'Terminal Connection', 'Cable', 'Negative Terminal', 'Positive Terminal', and 'Vent Caps' labeled.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
21	Quarterly	0.5	KEEL COOLERS	Inspect keel coolers. Visually inspect keel cooler piping connections for cracks, leaks, and secure mounting.	Class III leaks or loose mounting.
22	Semiannual	1.0	HOT WATER HEATERS	Inspect the water heaters as follows: - Check the heaters for damage and corrosion. - Inspect for chipped paint or excessive wear. - Check for secure mounting, and ensure tightness and no parts missing. - Inspect for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Inspect for leaks or drips from the tank, valves, and pipes. - Inspect the integrity and material condition of the tank insulation.	

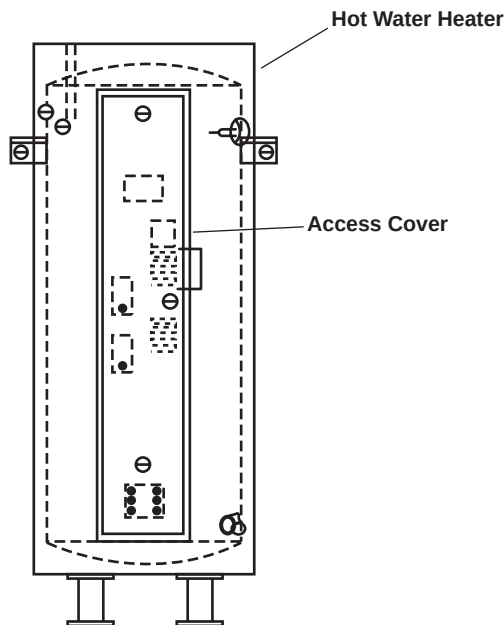


Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

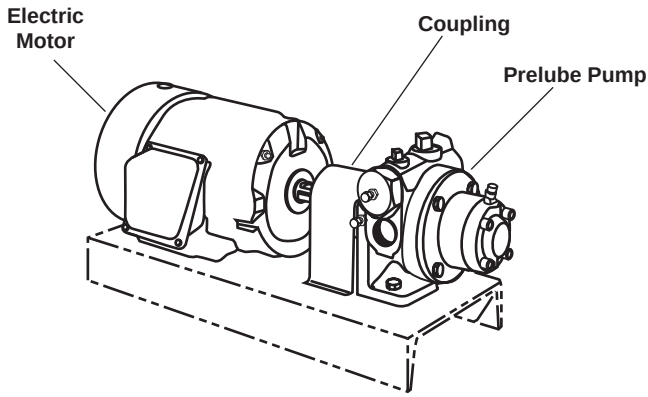
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
23	Semiannual	0.2	PRE-LUBRICATION OIL PUMP MOTORS	Inspect the electric motors as follows: - Inspect the motor casing for damage and corrosion. - Check motor for chipped paint or excessive metal wear. - Look for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Ensure that the motor is not in the path of any leak, drip, or spray from any valves, pipes, and hoses.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

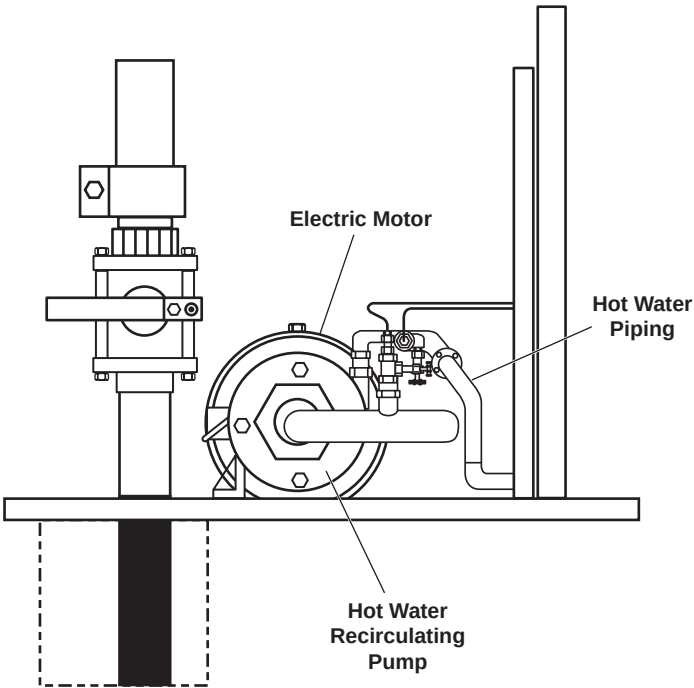
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
24	Semiannual	0.6	HOT WATER RECIRCULATION PUMP	Inspect the pump as follows: - Inspect the pump casing for damage and corrosion. - Check for chipped paint or excessive metal wear. - Look for cracks and leaks. - Check for secure mounting, and ensure tightness and no parts missing. - Check that the pump is not in the path of any leak, drip, or spray from any valves, pipes, and hoses.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

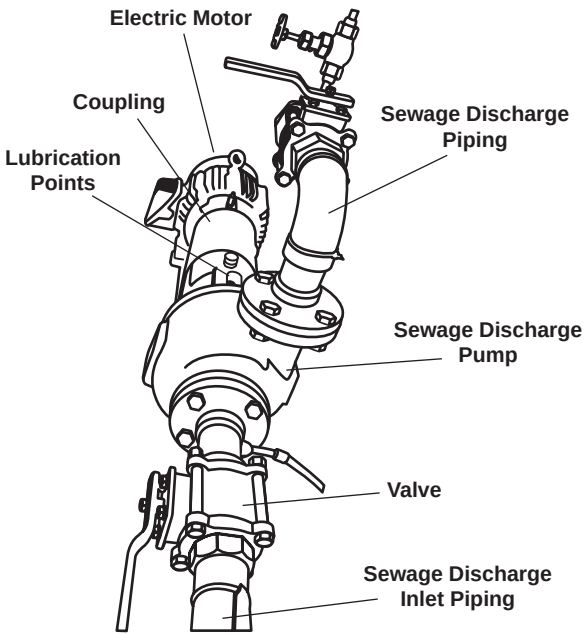
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
25	Semiannual	0.5	SEWAGE DISCHARGE PUMP MOTORS	Inspect the electric motors as follows: - Inspect the motor casing for damage and corrosion. - Check motor for chipped paint or excessive metal wear. - Look for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Ensure that the motor is not in the path of any leak, drip, or spray from any valves, pipes, and hoses.	
 The diagram illustrates a sewage discharge pump assembly. At the top, an 'Electric Motor' is connected to a 'Coupling'. Below the coupling, 'Lubrication Points' are indicated on the motor housing. The motor is connected to a 'Sewage Discharge Pump' via a 'Sewage Discharge Piping' line. A 'Valve' is located on the side of the pump assembly. At the bottom, the 'Sewage Discharge Inlet Piping' is shown entering the pump unit.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

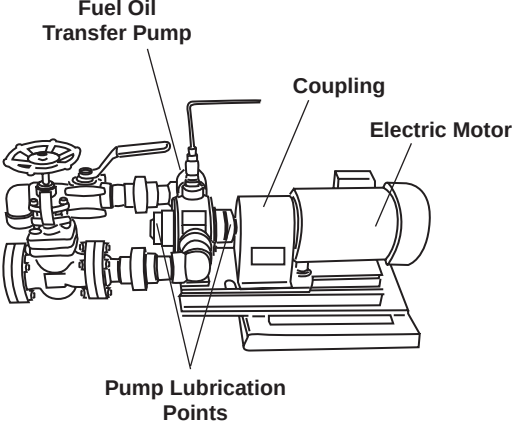
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
26	Semiannual	0.2	FUEL OIL TRANSFER PUMP MOTORS	Inspect the electric motors as follows: - Inspect the motor casing for damage and corrosion. - Check motor for chipped paint or excessive metal wear. - Look for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Ensure that the motor is not in the path of any leak, drip, or spray from any valves, pipes, and hoses.	
			Fuel Oil Transfer Pump  Pump Lubrication Points		

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

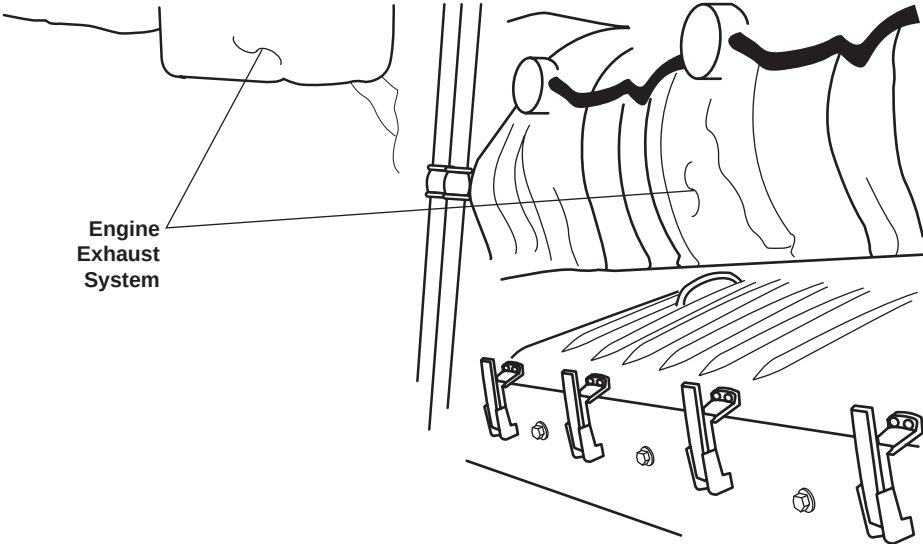
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
27	Semiannual	1.0	ENGINE EXHAUST SYSTEM	Inspect engine exhaust system as follows: - Inspect for missing insulation and hot spots. - Check for cracks in piping. - Ensure that all fasteners and mounts are secure with no parts missing. - Inspect for exhaust gas leakage when engines are running.	
 The diagram illustrates the engine exhaust system. It shows the engine block with an exhaust manifold. A line points from the text 'Engine Exhaust System' to the manifold. Below the manifold, there are several pipes and fasteners. The pipes are shown with various joints and clamps. The fasteners are shown as small circles. The diagram is a technical drawing with clear lines and labels.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

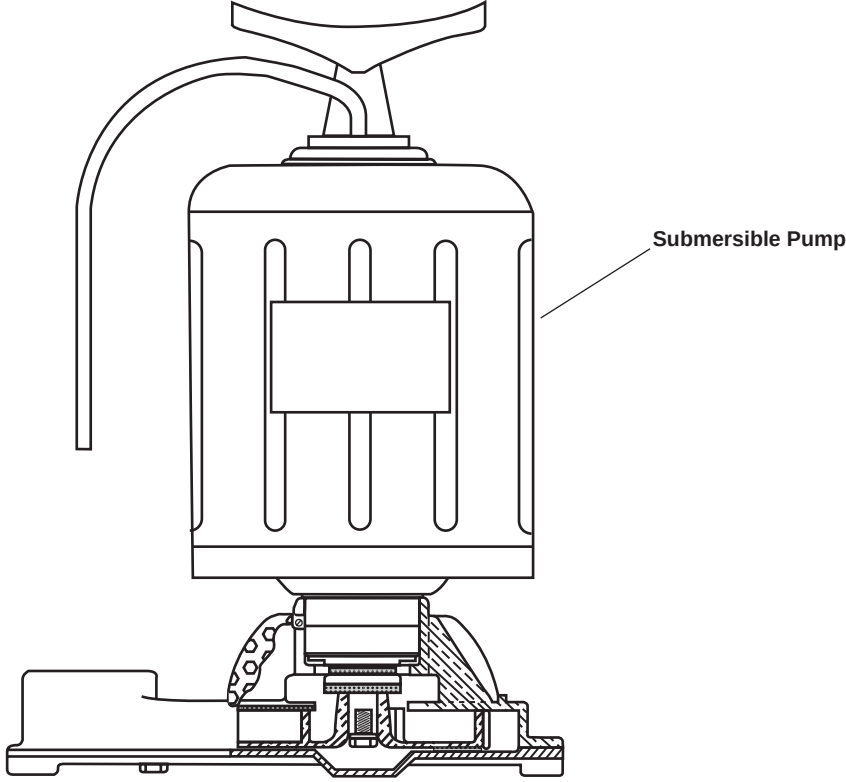
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
28	Semiannual	0.1	SUBMERSIBLE PUMP	Inspect as follows: - Check the unit for damage and corrosion. - Inspect for chipped paint or excessive metal wear. - Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. - Look for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Inspect the plug for serviceability.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

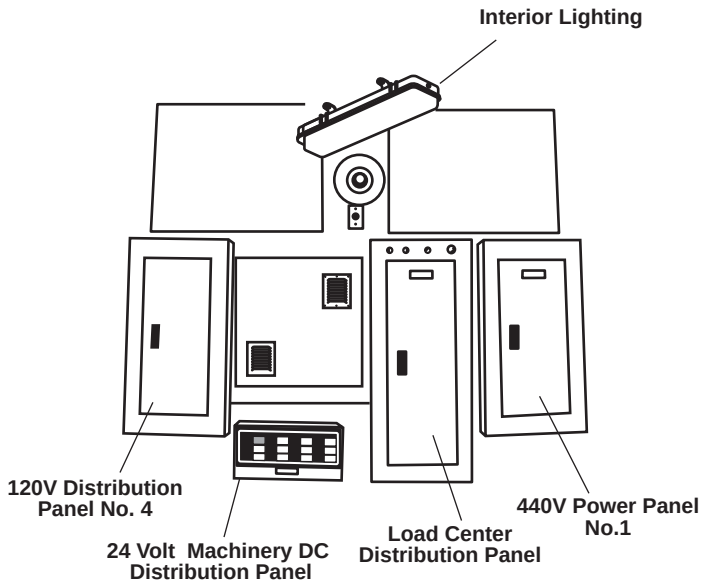
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
29	Semiannual	0.2	DISTRIBUTION PANELS	Inspect as follows: a. Inspect electrical and mechanical fasteners for secure mounting. b. Inspect the gasket material for damage, dry rot, or inadequate compression. c. Inspect fuse dips to ensure that the fuse retainers are in place. d. Inspect cable and component insulation for discoloration or deterioration. e. Operate switches/circuit breakers to detect irregular or faulty operation.	
 The diagram shows a top-down view of an electrical control room. At the top center is a rectangular panel labeled 'Interior Lighting'. Below it is a circular gauge or indicator. In the center is a large 'Load Center Distribution Panel'. To the left of the Load Center is a '120V Distribution Panel No. 4'. Below the Load Center is a '24 Volt Machinery DC Distribution Panel'. To the right of the Load Center is a '440V Power Panel No.1'. Each panel has a door with a handle and a lock.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

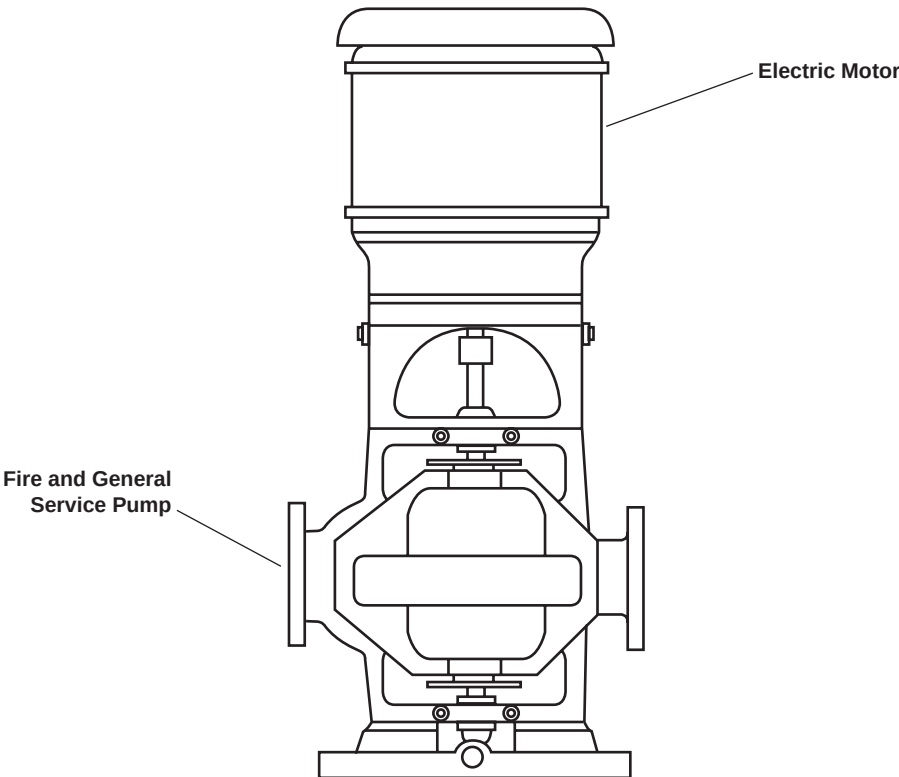
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
30	Semiannual	0.5	FIRE AND GENERAL SERVICE PUMP MOTORS	Inspect the electric motors as follows: - Inspect the motor casing for damage and corrosion. - Check motor for chipped paint or excessive metal wear. - Look for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Ensure that the motor is not in the path of any leak, drip, or spray from any valves, pipes, and hoses.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

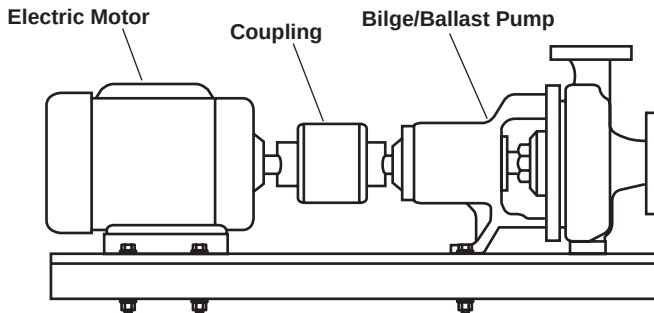
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
31	Semiannual	0.5	BILGE AND BALLAST PUMP MOTORS	Inspect the electric motors as follows: - Inspect the motor casing for damage and corrosion. - Check motor for chipped paint or excessive metal wear. - Look for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Ensure that the motor is not in the path of any leak, drip, or spray from any valves, pipes, and hoses.	
 The diagram illustrates a mechanical assembly consisting of three main components connected in a horizontal line. On the left is an 'Electric Motor' with a rectangular body and cooling fins. It is connected to a 'Coupling' in the center, which is a smaller cylindrical component. To the right of the coupling is the 'Bilge/Ballast Pump', which has a more complex, multi-part design with various ports and a large circular flange on its right side. All three components are mounted on a common horizontal base plate, which is supported by four small feet. Labels with leader lines point to each of the three components.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

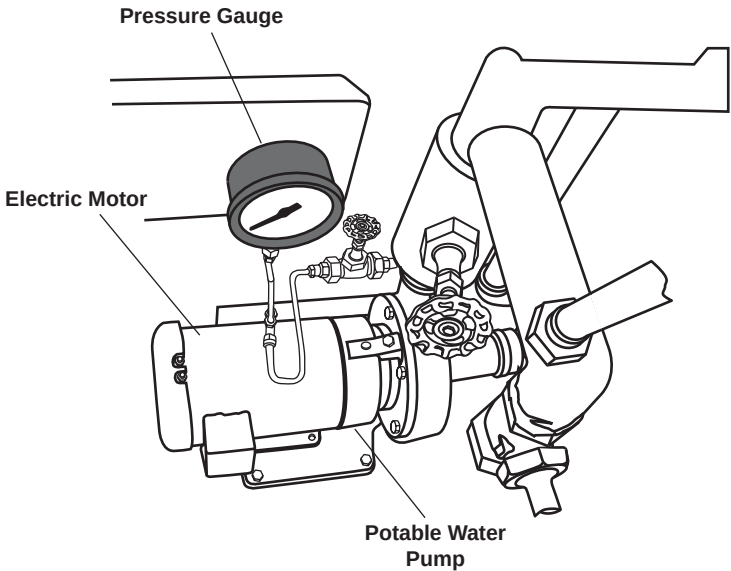
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
32	Semiannual	0.2	POTABLE WATER PUMP MOTORS	Inspect the electric motors as follows: - Inspect the motor casing for damage and corrosion. - Check motor for chipped paint or excessive metal wear. - Look for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Ensure that the motor is not in the path of any leak, drip, or spray from any valves, pipes, and hoses.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
33	Semiannual	5.4	ALL MOTOR CONTROLLERS	Inspect and test all motor controllers as follows: - Check the motor controller housing for damage and corrosion. - Inspect for chipped paint or metal wear. - Check for secure mounting, and ensure tightness and no parts missing. - Inspect for cracks and deterioration of the electrical wiring. - Check for evidence of burning or overheating of the wire insulation. - Check that the motor controller is not in the path of any leak, drip, or spray from valves, pipes, and hoses. - Test, operate, and verify that the motor controller operates correctly. - Check that all indicators function correctly. - Check that all switches operate normally.	

Motor Controller

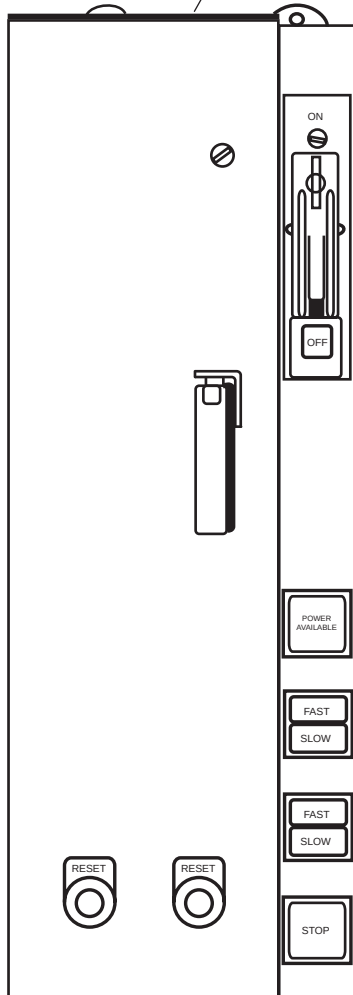


Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
34	Annual	0.9	PRE-LUBRICATION OIL PUMPS	Inspect and service the pumps as follows: a. Set to OFF the MAIN ENGINE LUBE OIL PRIMING PUMP No. 1. circuit breaker and the MAIN ENGINE LUBE OIL PRIMING PUMP No. 2. circuit breaker at 440V power panel No. 1. Lock out and tag out (FM 55-502). WARNING  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 cleaning solvents. Failure to follow these precautions can result in illness, serious injury, or death. b. Clean and inspect the pump casing using dry cleaning solvent and rags. c. Check for damage and corrosion. d. Inspect for chipped paint or excessive metal wear. e. Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. f. Remove the lockouts and tagouts (FM 55-502) and return equipment to readiness condition.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

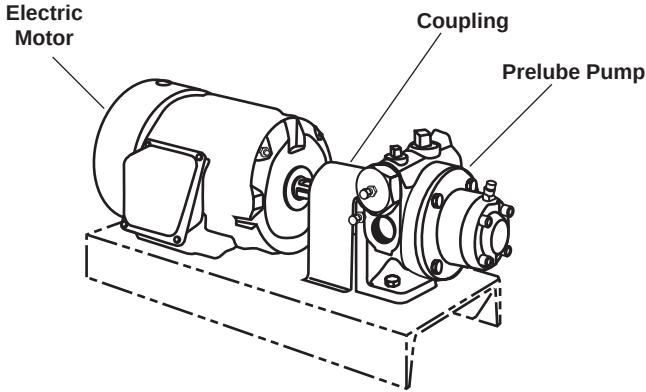
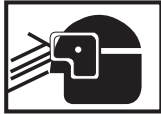
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
35	Annual	0.9	 LUBE OIL TRANSFER PUMP	Inspect and service the pump as follows: - Set to OFF the LUBE OIL TRANSFER PUMP. circuit breaker at 440V power panel No. 1. Lock out and tag out (FM 55-502). WARNING   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 cleaning solvents. Failure to follow these precautions can result in illness, serious injury, or death. - Clean and inspect the pump casing using dry cleaning solvent and rags. - Check for damage and corrosion. - Inspect for chipped paint or excessive metal wear.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				e. Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. f. Remove the lockouts and tagouts (FM 55-502) and return equipment to readiness condition.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
36	Annual	2.0	SEWAGE DISCHARGE PUMPS	Inspect and service the pumps as follows: a. Set to OFF the SEWAGE DISCHARGE PUMP No. 1. and the SEWAGE DISCHARGE PUMP No. 2. circuit breakers at 440V power panel No. 1. Lock out and tag out (FM 55-502). WARNING   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 cleaning solvents. Failure to follow these precautions can result in illness, serious injury, or death. b. Clean and inspect the pump casing using dry cleaning solvent and rags. c. Check for damage and corrosion. d. Inspect for chipped paint or excessive metal wear. e. Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. f. Remove the lockouts and tagouts (FM 55-502) and return equipment to readiness condition.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
37	Annual	1.2	REDUCTION GEAR COOLING PUMPS	Inspect and service the pumps as follows: a. Set to OFF the FRESH WATER PUMP No. 1, (REDUCTION GEAR). and the FRESH WATER PUMP No. 2, (REDUCTION GEAR) circuit breakers at 440V power panel No. 1. Lock out and tag out (FM 55-502).	

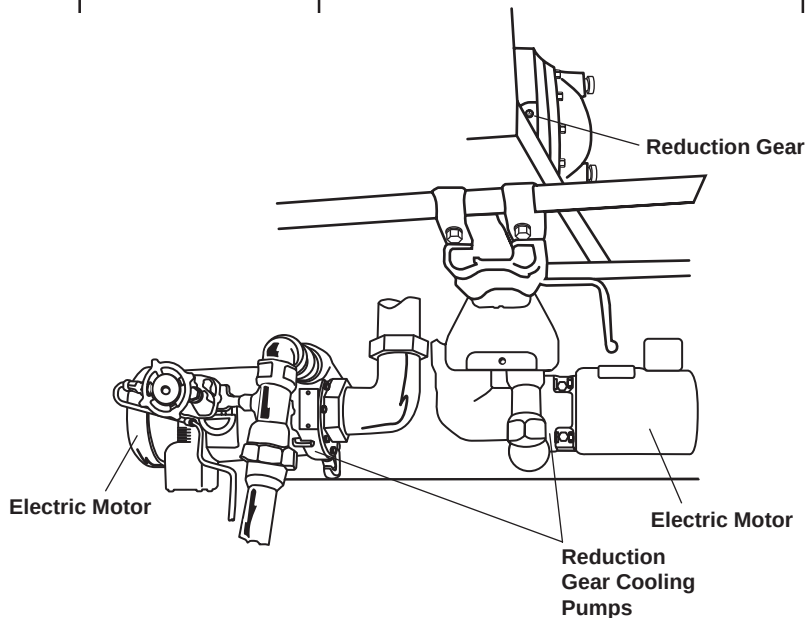
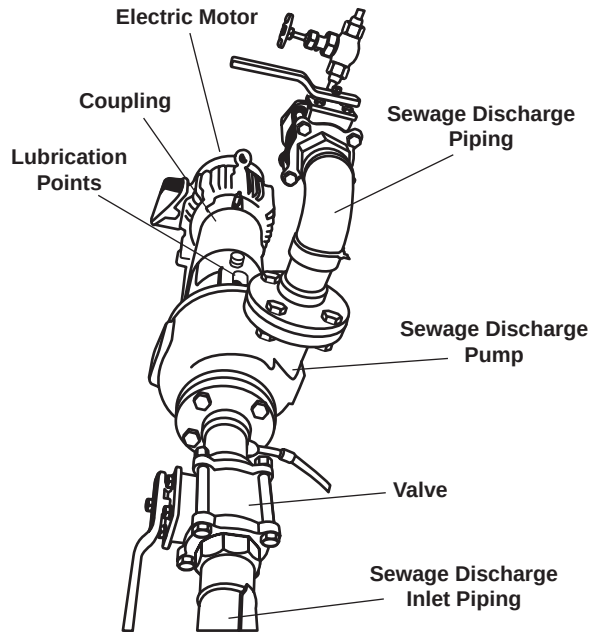


Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				b. Open and/or remove access covers as necessary. WARNING  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 cleaning solvents. Failure to follow these precautions can result in illness, serious injury, or death. c. Clean and inspect the pump casing using dry cleaning solvent and rags. d. Check for damage and corrosion. e. Inspect for chipped paint or excessive metal wear. f. Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. g. Remove the lockouts and tagouts (FM 55-502) and return equipment to readiness condition.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
38	Annual	0.9	FUEL OIL TRANSFER PUMPS	Inspect and service the pumps as follows: - Set to OFF the FO XFER PMP (1) circuit breaker at the emergency switchboard. Lock out and tag out (FM 55-502). - Set to OFF the FUEL OIL TRANSFER PUMP No. 2 circuit breaker at 440V power panel No. 1. Lock out and tag out (FM 55-502). WARNING   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 cleaning solvents. Failure to follow these precautions can result in illness, serious injury, or death. - Clean and inspect the pump casing using dry cleaning solvent and rags. - Check for damage and corrosion. - Inspect for chipped paint or excessive metal wear. - Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. - Remove the lockouts and tagouts (FM 55-502) and return equipment to readiness condition.	

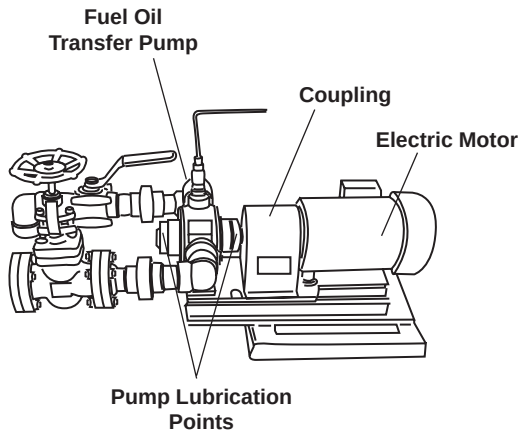


Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
39	Annual	1.5	BILGE AND BALLAST PUMPS	Inspect and service the pumps as follows: - Set to OFF the BILGE PUMP #1 circuit breaker at the emergency switchboard. Lock out and tag out (FM 55-502). - Set to OFF the BILGE PUMP No. 2 circuit breaker at the main switchboard. Lock out and tag out (FM 55-502). WARNING   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 cleaning solvents. Failure to follow these precautions can result in illness, serious injury, or death. - Clean and inspect the pump casing using dry cleaning solvent and rags. - Check for damage and corrosion. - Inspect for chipped paint or excessive metal wear. - Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. - Remove the lockouts and tagouts (FM 55-502) and return equipment to readiness condition.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
40	Annual	1.8	POTABLE WATER PUMPS	Inspect and service the pump as follows: - Set to OFF the POTABLE WATER PUMP No. 1. and the POTABLE WATER PUMP No. 2. circuit breakers at 440V power panel No. 5. Lock out and tag out (FM 55-502). WARNING 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 cleaning solvents. Failure to follow these precautions can result in illness, serious injury, or death. - Clean and inspect the pump casing using dry cleaning solvent and rags. - Check for damage and corrosion. - Inspect for chipped paint or excessive metal wear.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

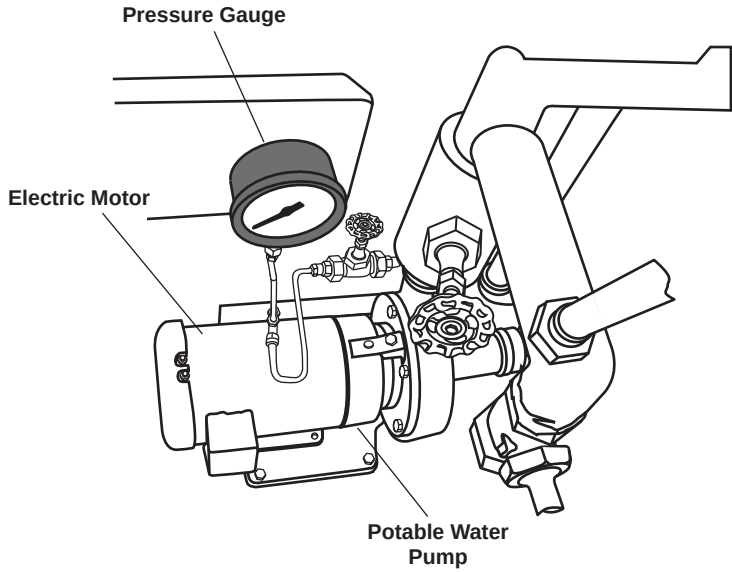
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				e. Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. f. Remove the lockouts and tagouts (FM 55-502) and return equipment to readiness condition. 	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
41	Annual	2.0	FIRE AND GENERAL SERVICE PUMPS	Inspect and service the pumps as follows: - Set to OFF the FIRE PUMP #1 circuit breaker at the emergency switchboard. Lock out and tag out (FM 55-502). - Set to OFF the FIRE PUMP No. 2 circuit breaker at the main switchboard. Lock out and tag out (FM 55-502). WARNING   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 cleaning solvents. Failure to follow these precautions can result in illness, serious injury, or death. - Clean and inspect the pump casing using dry cleaning solvent and rags. - Check for damage and corrosion. - Inspect for chipped paint or excessive metal wear. - Check that the unit is not in the path of any leak, drip, or spray from valves, pipes, and hoses. - Check for loose or broken pump/motor couplings. - Remove the lockouts and tagouts (FM 55-502) and return equipment to readiness condition.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

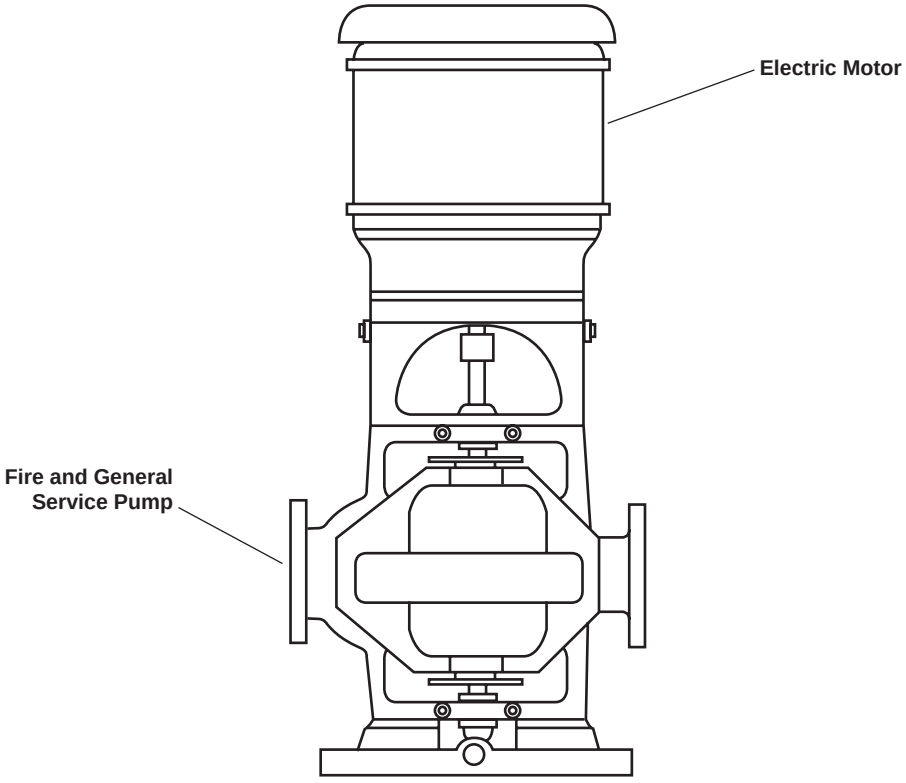
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				i. Check sea chest valves for proper operation. Sea chest is clogged when suction pressure is greater than 50 PSI (3.45 bar). j. Check gauges for normal readings. Fire main discharge pressure should be 50 to 90 PSI (3.45 to 6.21 bar) against dead head. k. General service pressure should be greater than 50 PSI (3.45 bar) under normal operating conditions at 50 PSI (3.45 bar) under normal operating conditions.	Sea chest cannot be cleared, and suction pressure cannot be lowered below 50 PSI (3.45 bar). Fire main discharge pressure above 90 PSI (6.21 bar) or below 50 PSI (3.45 bar). Unable to maintain general service discharge pressure
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

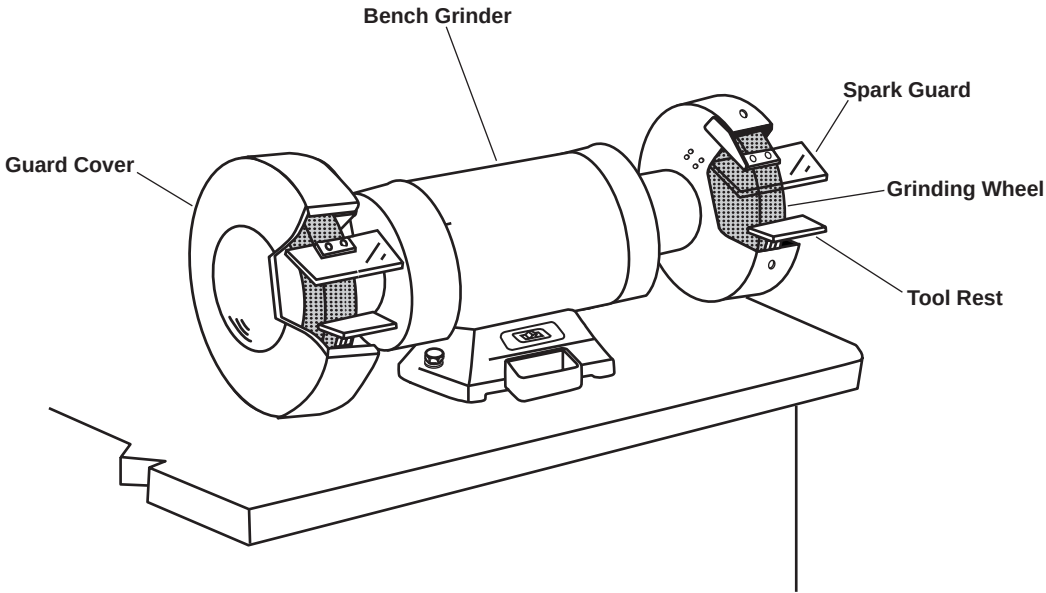
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
42	Annual	0.4	BENCH GRINDER	Inspect and service as follows: - Inspect the grinding wheels for serviceability and dress as required. - Visually check that tool rest is in correct position and is securely mounted. - Rotate the vise clamp wheels and check for ease of motion. - Look for loose connections on the grinder, excess buildup of metal residue and chips on the grinding wheels. - Check that spark guard is clear, undamaged, and securely mounted.	
					
43	Annually	0.7	DRILL PRESS	Inspect and service as follows: Check for worn or frayed belts, frayed electrical wiring or power cord, loose connections, missing bits and pieces, worn or damaged pulleys, dirt buildup and corrosion.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

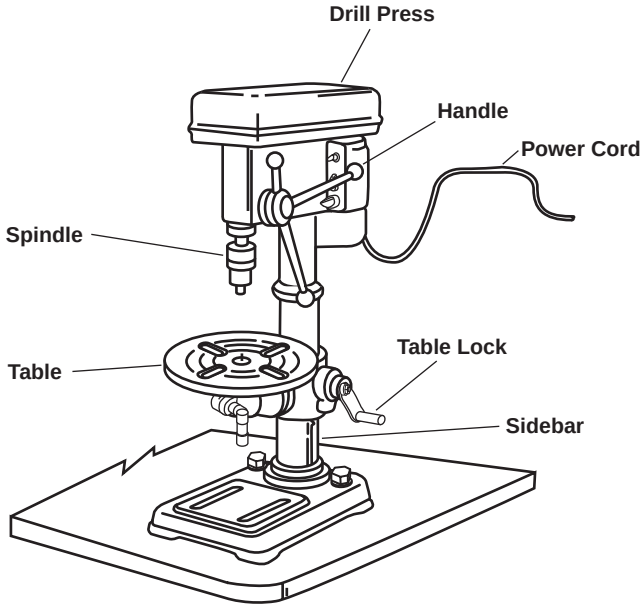
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				b. Check that drive belt tension is correct and adjust if necessary. c. Check that spindle and motor pulleys are tight and secure and adjust as necessary. d. Ensure that table vertical travel is smooth and unobstructed. Lubricate with general purpose grease as necessary. Refer to table 2. e. Check that 360° table swing is smooth and unobstructed. Lubricate with general purpose grease as necessary. Refer to table 2. f. Check that table tilts in either direction. g. Check that spindle vertical travel is smooth and unobstructed. Lubricate with hydraulic fluid as necessary. Refer to table 2. h. Inspect sidebars for smooth travel. Lubricate with general purpose grease as necessary. Refer to table 2.	
			 The diagram shows a bench-mounted drill press. Labels with leader lines point to the following components: 'Drill Press' at the top motor housing, 'Handle' on the side of the motor, 'Power Cord' extending from the back, 'Spindle' pointing to the vertical shaft, 'Table' pointing to the circular worktable, 'Table Lock' pointing to a lever on the side of the table, and 'Sidebar' pointing to the vertical support on the right side of the table.		

Table 2. Lubrication Chart

Item	Lubricant	Military Specification
Bilge and Ballast Pumps	Grease, General Purpose	MIL-G-18709
Drill Press	Grease, General Purpose	MIL-G-18709
Drill Press	Oil OE/HDO-30	
Fire and General Service Pumps	Grease, General Purpose	MIL-G-18709
Fuel Oil Transfer Pump	Grease, General Purpose	MIL-G-18709
Fuel Oil Transfer Pump Motor	Grease, General Purpose	MIL-G-18709
Lube Oil Transfer Pump	Grease, General Purpose	MIL-G-18709
Lube Oil Transfer Pump Motor	Grease, General Purpose	MIL-G-18709
Potable Water Pumps	Grease, General Purpose	MIL-G-18709
Pre-Lubrication Pumps	Grease, General Purpose	MIL-G-18709
Reduction Gear Cooling Pumps	Grease, General Purpose	MIL-G-18709
Sewage Discharge Pump	Grease, General Purpose	MIL-G-18709
Sliding Hydraulic Water Tight Door	Oil OE/HDO-30	
Sliding Hydraulic Water Tight Door	Grease, General Purpose	MIL-G-18709

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES INCLUDING LUBRICATION
MAIN DECK LEVEL**

Table 1. Preventive Maintenance Checks and Services Including Lubrication

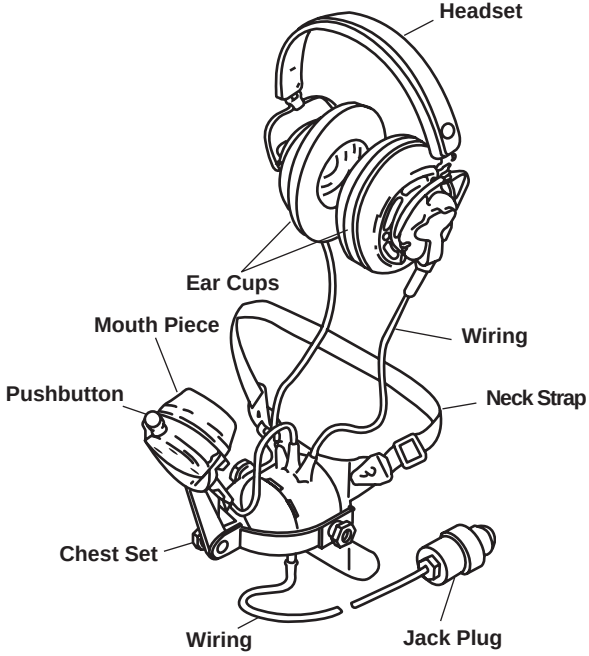
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	During	1.0	SOUND POWERED TELEPHONES Head Set-Chest Set	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.  The diagram illustrates the components of a Headset-Chest Set. At the top, a headset is shown with two ear cups and a microphone. Below it, a chest set is depicted with a pushbutton and a microphone. The headset is connected to the chest set via a neck strap and wiring. A jack plug is also shown connected to the chest set wiring.	Communications not clear and undistorted.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

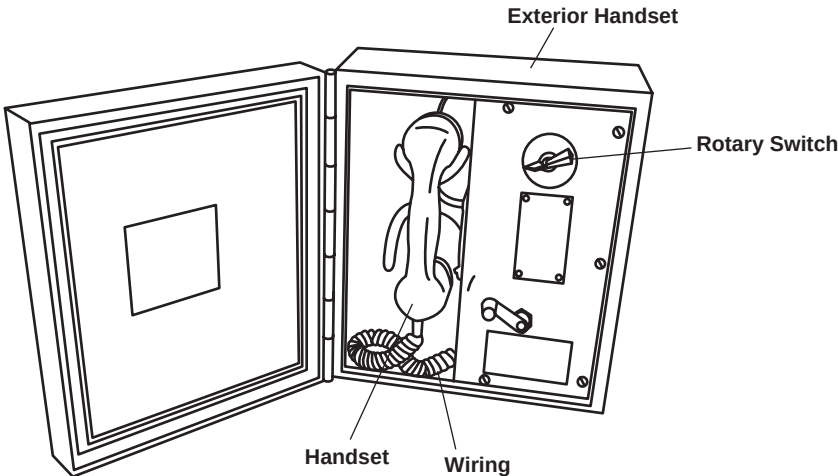
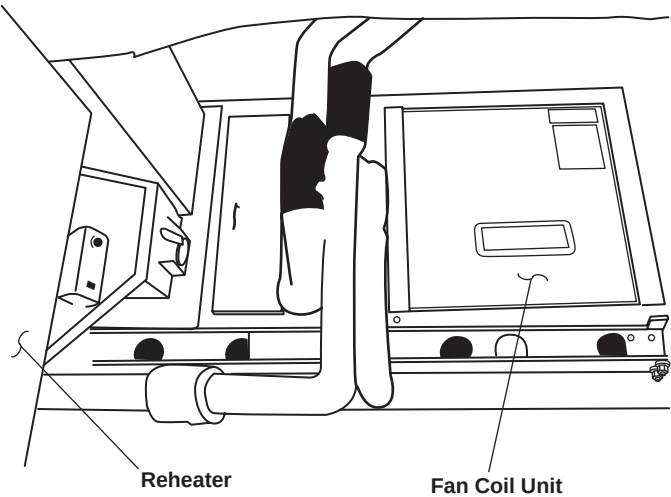
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
2	During	1.0	Exterior Handsets	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
					
3	During	0.5	FAN COIL UNIT	Check air filters for condition, cleanliness, and buildup of salt. Clean as required.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

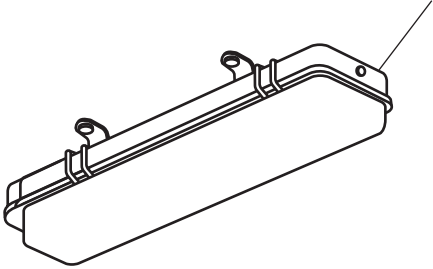
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
4	Weekly	1.5	FLUORESCENT AND INCANDESCENT LIGHTS	a. Check for proper operation of switches and bulbs. b. Check and for loose connections, cracked, or missing lenses and secure mounting. Interior Lighting 	
5	Weekly	0.1	WALK-IN REFRIGERATOR FREEZER	Test the walk-in refrigerator/freezer alarm by pushing the alarm button and verifying that the alarm sounds in all locations.	Alarm fails to sound in all locations.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

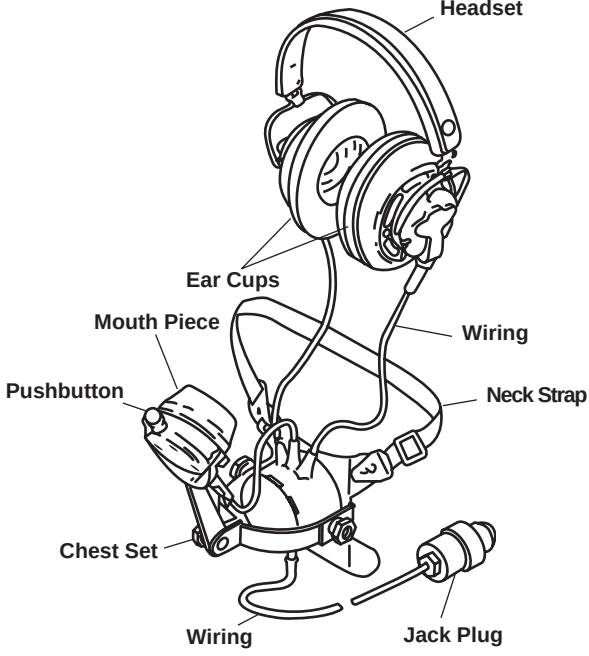
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
6	Weekly	1.0	SOUND POWERED TELEPHONES Head Set-Chest Set	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
 The diagram illustrates a Headset-Chest Set. It features a headset with two ear cups and a headband. A mouth piece is attached to the side of the headset. A wiring cable connects the headset to a chest set. The chest set includes a pushbutton and a jack plug. A neck strap is also attached to the chest set. The diagram is labeled with the following parts: Headset, Ear Cups, Mouth Piece, Wiring, Neck Strap, Pushbutton, Chest Set, and Jack Plug.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

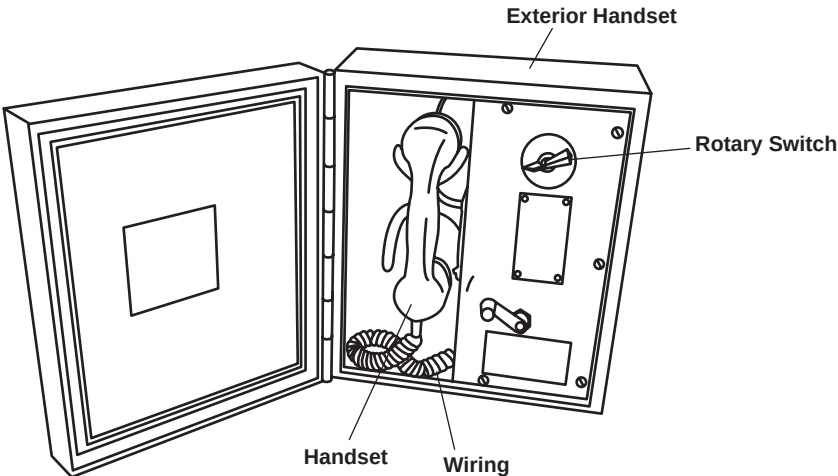
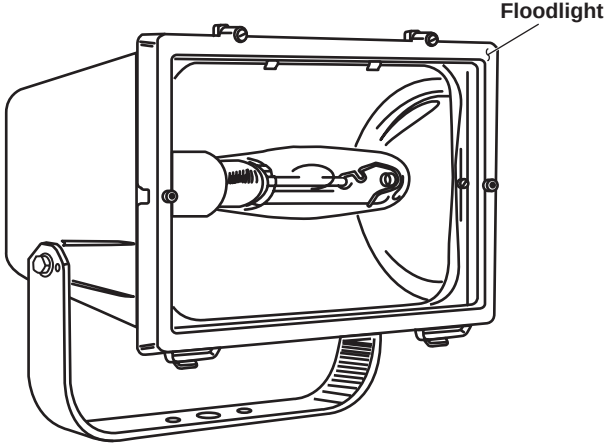
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
7	Weekly	1.0	Exterior Handsets	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
					
8	Weekly	2.0	FLOODLIGHTS	a. Check for proper operation of switches and bulbs. b. Check for loose connections, cracked, or missing lenses and secure mounting.	Floodlights nonfunctional. Any loose connections, missing lens, or unsecure mounting.
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

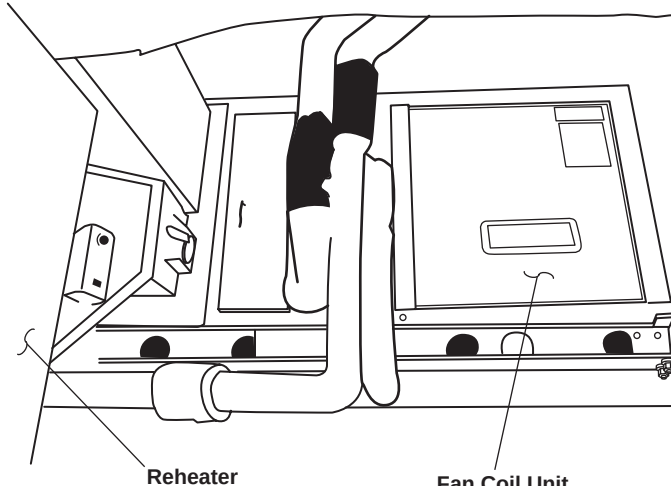
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
9	Weekly	0.5	FAN COIL UNIT	Check air filters for condition, cleanliness, and buildup of salt. Replace as required.	
 Reheater Fan Coil Unit					
10	Monthly	1.0	AMS 1 AND 2 WATERTIGHT DOOR REMOTE HAND PUMP STATIONS	a. Operate the hand pump to close the door and ensure smooth operation of the pump and correct operation of the door. b. Check reservoir oil level on dipstick and fill with hydraulic oil (OH) as required. Refer to table 2.	Door does not operate.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

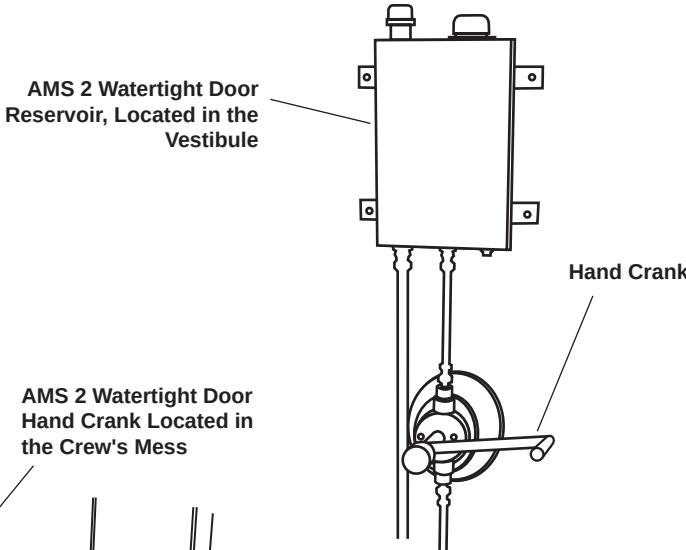
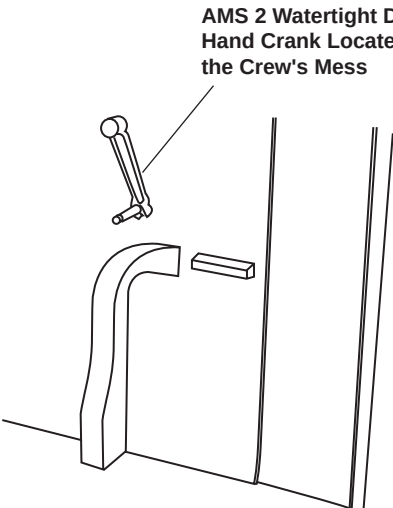
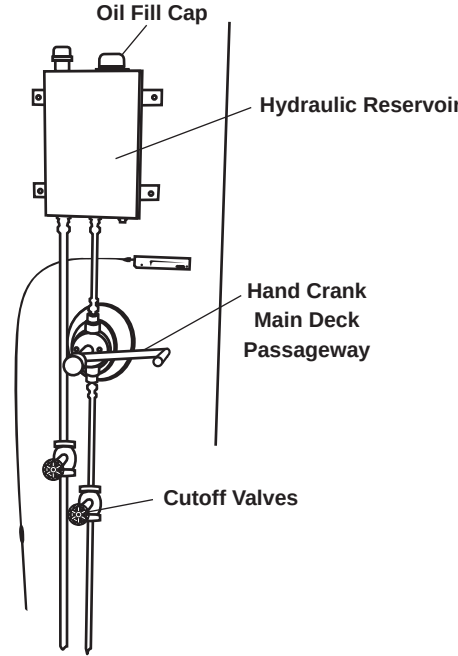
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
					
					
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

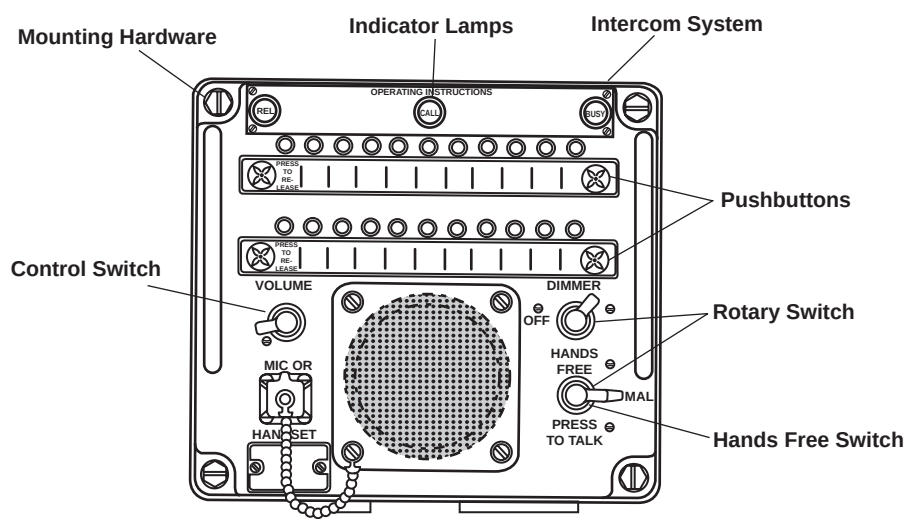
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
11	Monthly	6.0	INTERCOM SYSTEM	a. Perform operational test of the intercom system by communicating with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
 The diagram shows a rectangular control panel for an intercom system. It features a central speaker grille. Above the grille are two rows of pushbuttons, each with a 'PRESS TO TALK' label. To the left of the grille is a 'VOLUME' knob and a 'MIC OR HAN-SET' switch. To the right is a 'DIMMER' knob and a 'HANDS FREE' switch. At the bottom right is a 'PRESS TO TALK' button. The panel is mounted on a base with 'Mounting Hardware' indicated. Labels with leader lines point to 'Indicator Lamps' at the top, 'Intercom System' at the top right, 'Pushbuttons' on the right, 'Control Switch' on the left, 'Rotary Switch' on the right, and 'Hands Free Switch' on the right.					
12	Semiannual	0.1	FAN COIL UNIT	Grease two fittings on fan housing with a lubricating gun filled with general purpose grease. Refer to table 2.	
13	Semiannual	0.2	EMERGENCY DISTRIBUTION PANEL	a. Inspect electrical and mechanical fasteners; tighten loose connections. Use lockwashers or jam nuts where necessary to keep connections tight. b. Inspect the rubber/neoprene gasket material for damage, dry rot, or inadequate compression. c. Inspect fuse dips to ensure that the fuse retainers are in place. d. Inspect cable and component insulation for discoloration or deterioration.	
14	Annual	2.2	FAN COIL UNIT AND MOTOR CONTROLLER	a. Inspect the motor casing. b. Check for damage and corrosion.	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

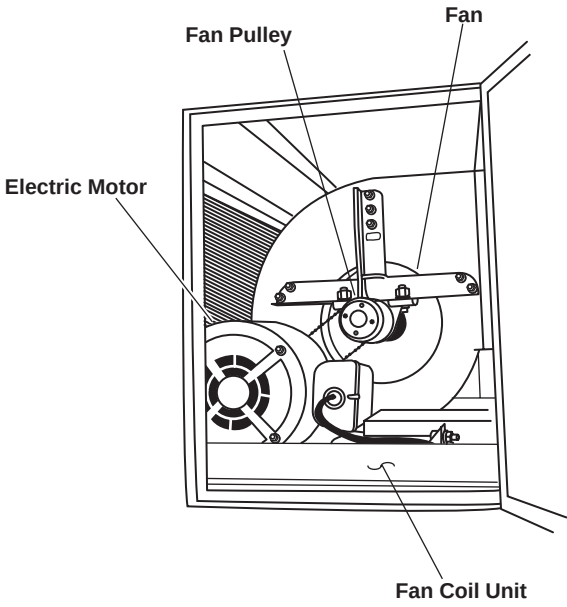
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
				c. Inspect motor for chipped paint or excessive metal wear. d. Inspect for cracks and deterioration of the electrical wiring. e. Inspect the motor electrical wiring and connections. f. Check for evidence of burning or overheating of the wire insulation. g. Check that the motor is not in the path of any leak, drip, or spray from valves, pipes, and hoses. h. Test, operate, and verify that controller operates correctly. i. Check that all indicators function correctly.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

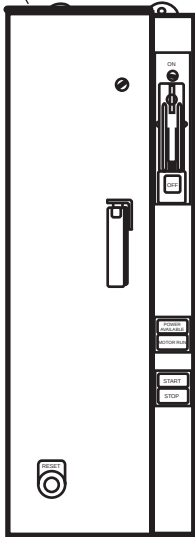
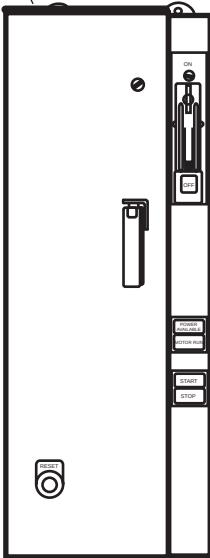
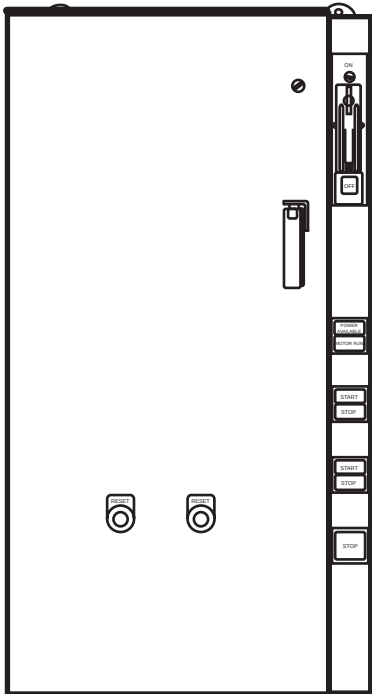
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
15	Annual	0.3	GALLEY SUPPLY FAN MOTOR CONTROLLER	a. Inspect the casing for secure mounting. b. Check for damage and corrosion. c. Inspect chipped paint or excessively worn switches. d. Inspect for cracks and deterioration of the electrical wiring. e. Check for evidence of burning or overheating of the wire insulation. f. Check that the motor controller is not in the path of any leak, drip, or spray from valves, pipes, and hoses. g. Test, operate, and verify that controller operates correctly. h. Check that all indicators function correctly.	
Crew's Mess Fan Coil Unit Motor Controller  Galley Supply Fan Motor Controller  					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

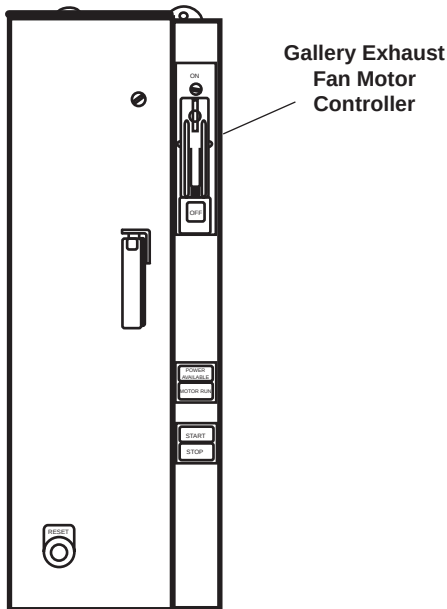
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
16	Annual	0.3	GALLEY EXHAUST FAN MOTOR CONTROLLER	a. Inspect the casing for secure mounting. b. Check for damage and corrosion. c. Inspect chipped paint or excessively worn switches. d. Inspect for cracks and deterioration of the electrical wiring. e. Check for evidence of burning or overheating of the wire insulation. f. Check that the motor controller is not in the path of any leak, drip, or spray from valves, pipes, and hoses. g. Test, operate, and verify that controller operates correctly. h. Check that all indicators function correctly. 	

Table 2. Lubrication Chart

Item	Lubricant	Military Specification
Fan Coil Unit	Grease, General Purpose	MIL-G-18709
Sliding Hydraulic Watertight Door	Oil OE/HDO-30	

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES INCLUDING LUBRICATION
01 LEVEL**

Table 1. Preventive Maintenance Checks and Services Including Lubrication

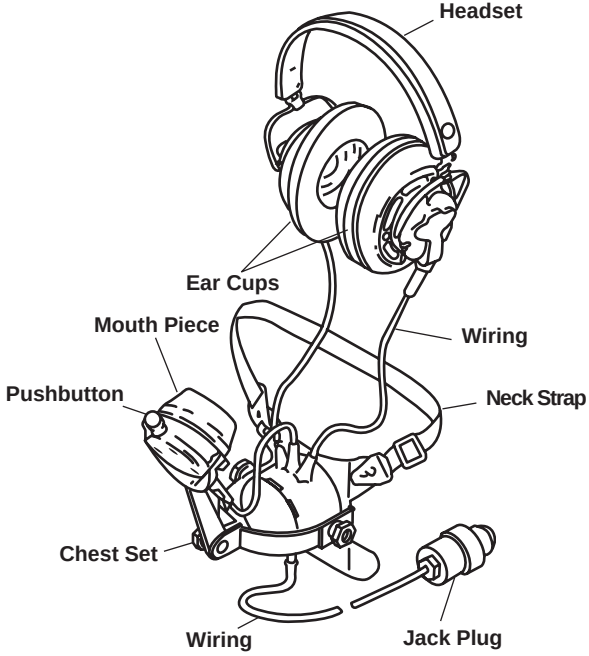
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	During	1.0	SOUND POWERED TELEPHONES Head Set-Chest Set	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.  The diagram illustrates the components of a Headset-Chest Set. It includes a headset with two ear cups and a microphone. The headset is connected to a chest set via wiring. The chest set features a pushbutton and a neck strap. A jack plug is also shown connected to the wiring.	Communications not clear and undistorted.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

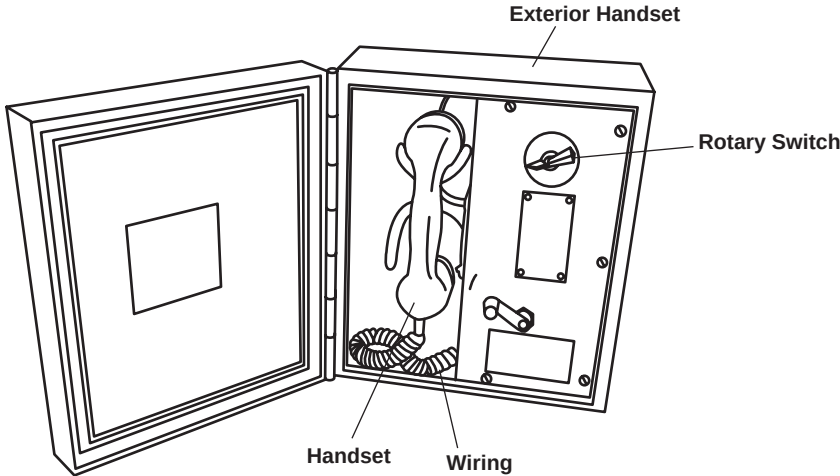
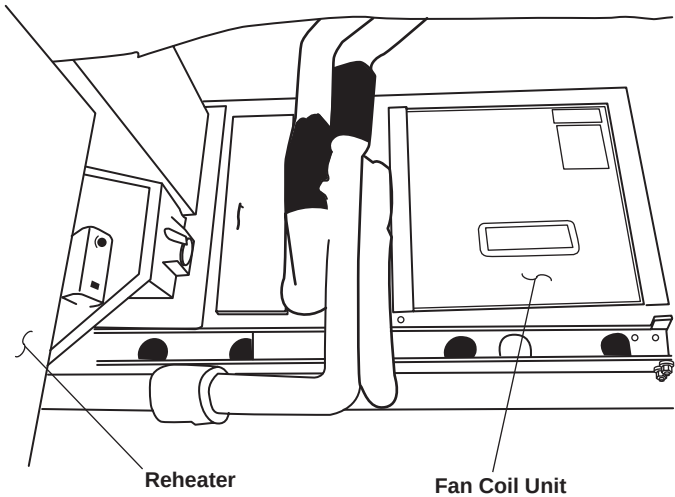
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
2	During	1.0	Exterior Handsets	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
					
3	During	0.5	FAN COIL UNIT	Check air filters for condition, cleanliness, and buildup of salt. Clean as required.	
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

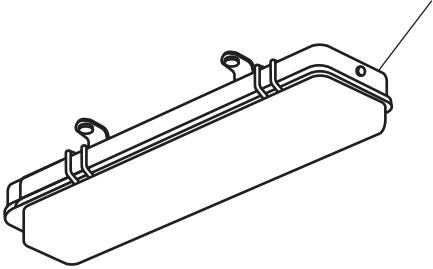
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
4	Weekly	1.5	FLUORESCENT AND INCANDESCENT LIGHTS	a. Check for proper operation of switches and bulbs. b. Check and for loose connections, cracked, or missing lenses and secure mounting. Interior Lighting 	

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

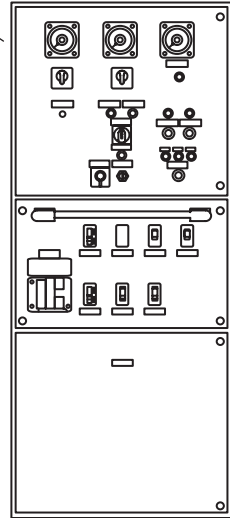
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
6	Weekly	0.1	EMERGENCY SWITCHBOARD	a. Visually inspect exterior of switchboard for damaged or missing circuit breakers, meters, controls, or indicators. b. Press ground detector PUSH TO TEST buttons, and verify that the lamps illuminate. Emergency Switchboard 	Any missing, or damaged control, meter, or circuit breaker. Ground fault detector lamps do not illuminate.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

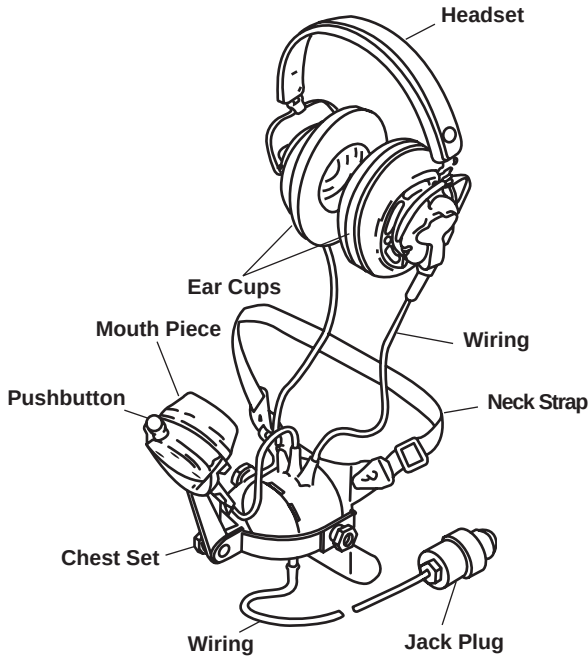
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
7	Weekly	1.0	SOUND POWERED TELEPHONES Head Set-Chest Set	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood. 	Communications not clear and undistorted.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

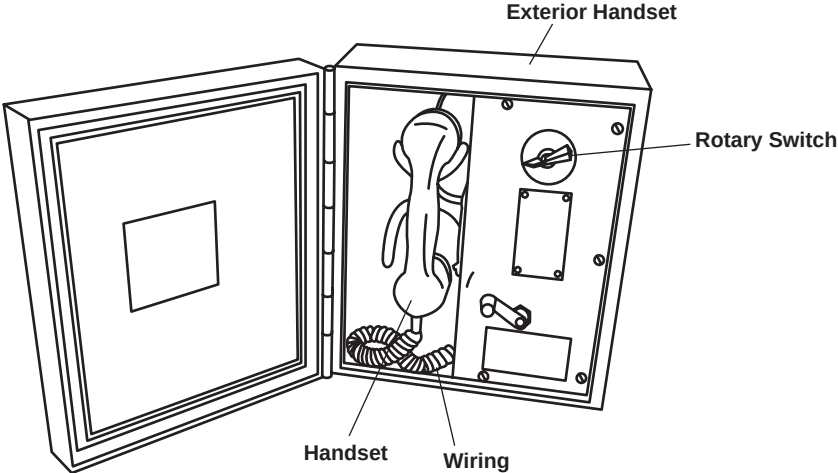
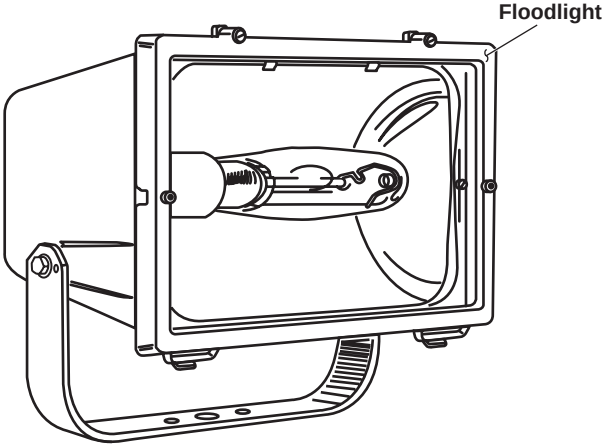
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
8	Weekly	1.0	Exterior Handsets	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood. 	Communications not clear and undistorted.
9	Weekly	2.0	FLOODLIGHTS	a. Check for proper operation of switches and bulbs. b. Check for loose connections, cracked, or missing lenses and secure mounting. 	Floodlights nonfunctional. Any loose connection, missing lens or unsecure mounting.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

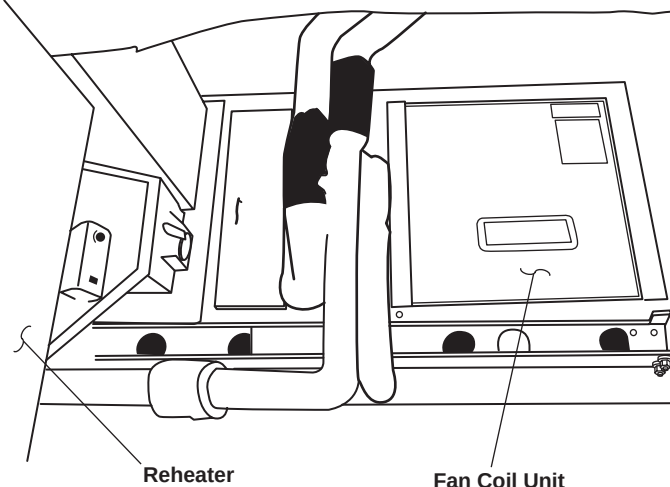
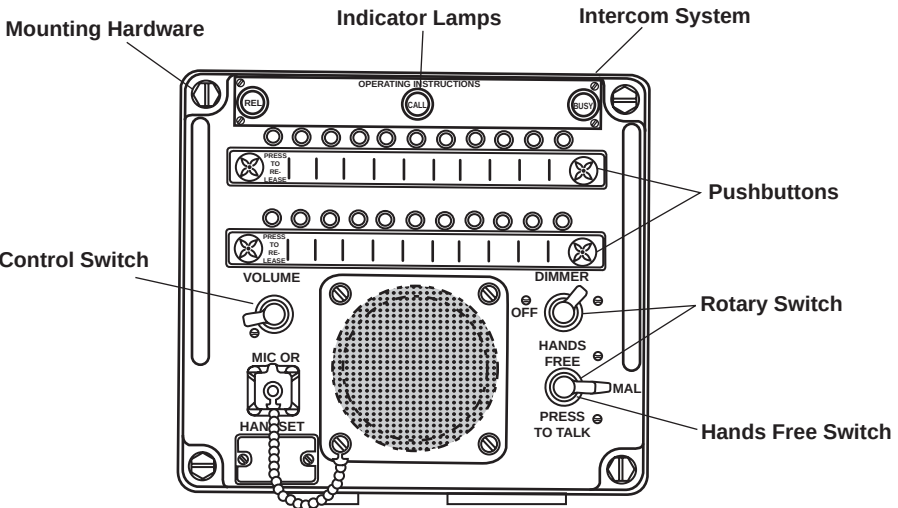
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
10	Weekly	0.5	FAN COIL UNIT	Check air filters for condition, cleanliness, and buildup of salt. Replace as required.	
 Reheater Fan Coil Unit					
11	Monthly	1.0	INTERCOM SYSTEM	Perform operational test of the intercom system by communicating with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
 Mounting Hardware Indicator Lamps Intercom System Pushbuttons Control Switch VOLUME DIMMER Rotary Switch Hands Free Switch Hands Free Switch					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
12	Semiannual	0.1	FAN COIL UNIT	Grease two fittings on fan housing with a lubricating gun filled with general purpose grease. Refer to table 2.	
13	Annual	2.2	FAN COIL UNIT AND MOTOR CONTROLLER	a. Inspect the motor casing. b. Check for damage and corrosion. c. Inspect motor for chipped paint or excessive metal wear. d. Inspect for cracks and deterioration of the electrical wiring. e. Inspect the motor electrical wiring and connections. f. Check for evidence of burning or overheating of the wire insulation. g. Check that the motor is not in the path of any leak, drip, or spray from valves, pipes, and hoses. h. Test, operate, and verify that controller operates correctly. i. Check that all indicators function correctly.	

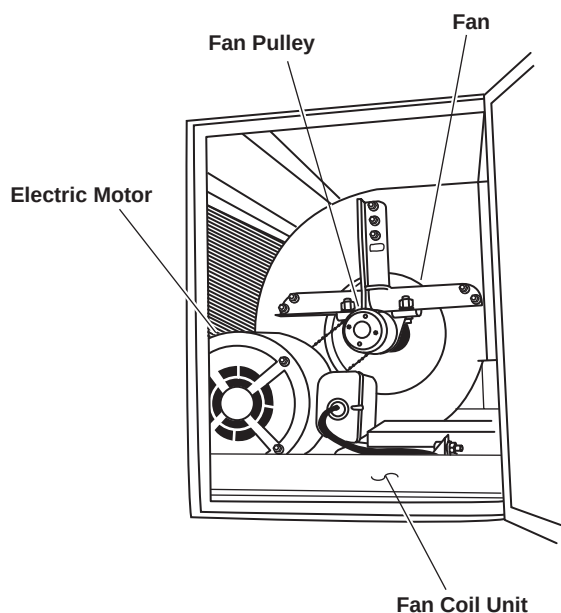


Table 2. Lubrication Chart

Item	Lubricant	Military Specification
Fan Coil Unit	Grease, General Purpose	MIL-G-18709

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT, AND GENERAL SUPPORT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
PREVENTIVE MAINTENANCE CHECKS AND SERVICES INCLUDING LUBRICATION
02 LEVEL AND ABOVE**

Table 1. Preventive Maintenance Checks and Services Including Lubrication

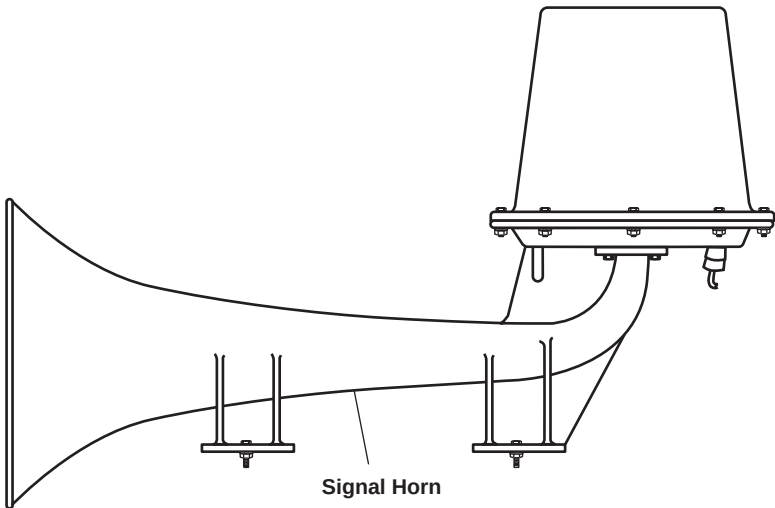
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	Before	0.2	SIGNAL HORN	a. Inspect for any obvious damage or nonfunctional part. b. Sound the signal horn to ensure that it operates properly.	Any damaged or nonfunctional part. Horn does not sound.
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

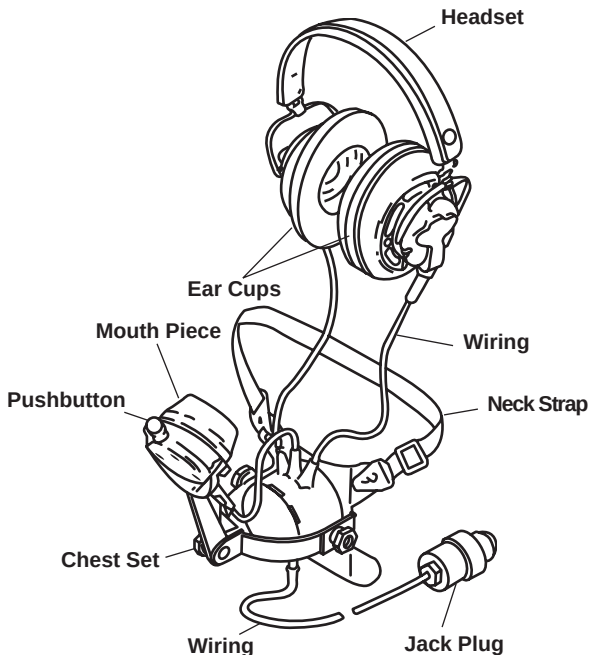
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
2	During		SOUND POWERED TELEPHONES Head Set-Chest Set	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood. 	Communications not clear and undistorted.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

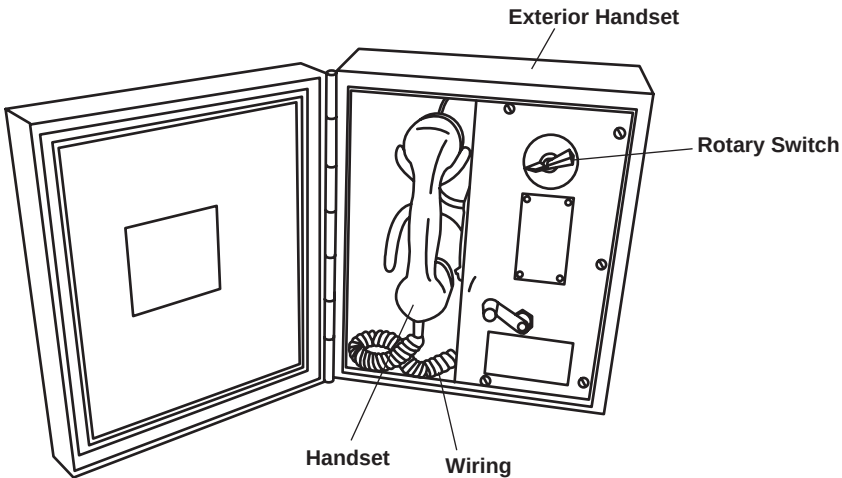
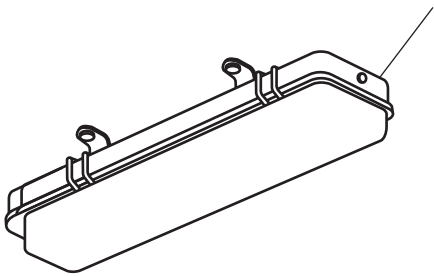
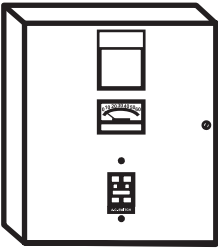
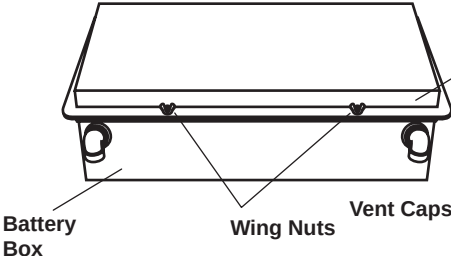
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
3	During		Exterior Handsets	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
 The diagram shows a perspective view of an open exterior handset unit. The unit is rectangular with a hinged door on the left. Inside the unit, a handset is mounted on a vertical support. A rotary switch is located on the right side of the unit. Wires are visible at the bottom of the unit. Labels with leader lines point to the 'Exterior Handset' (the entire unit), 'Rotary Switch', 'Handset', and 'Wiring'.					
4	Weekly	1.5	FLUORESCENT AND INCANDESCENT LIGHTS	a. Check for proper operation of switches and bulbs. b. Check and for loose connections, cracked, or missing lenses and secure mounting.	
 The diagram shows a perspective view of a rectangular interior lighting fixture. It has a hinged door on the left side. Labels with leader lines point to the 'Interior Lighting' fixture.					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
5	Weekly	1.0	BATTERY	Service batteries (WP 0129 00 and 0148 00).	



Battery
Charger

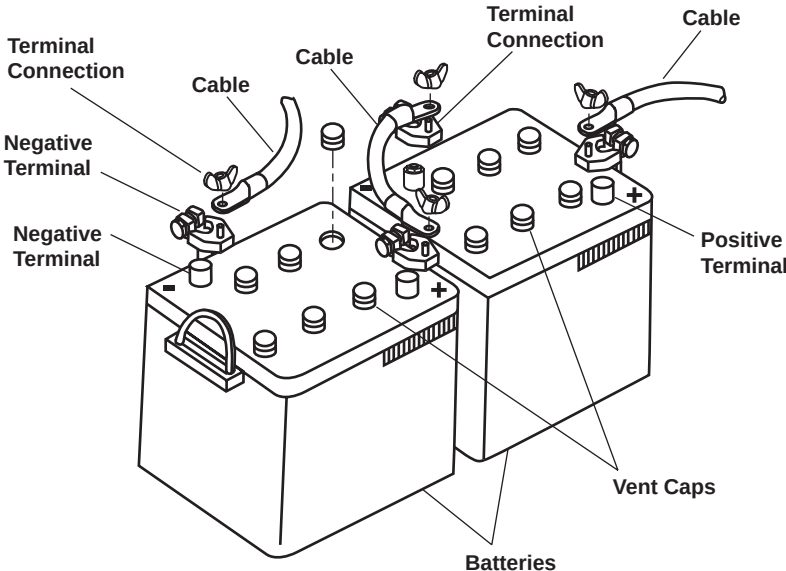


Battery
Box Cover

Battery
Box

Wing Nuts

Vent Caps



Terminal
Connection

Cable

Negative
Terminal

Negative
Terminal

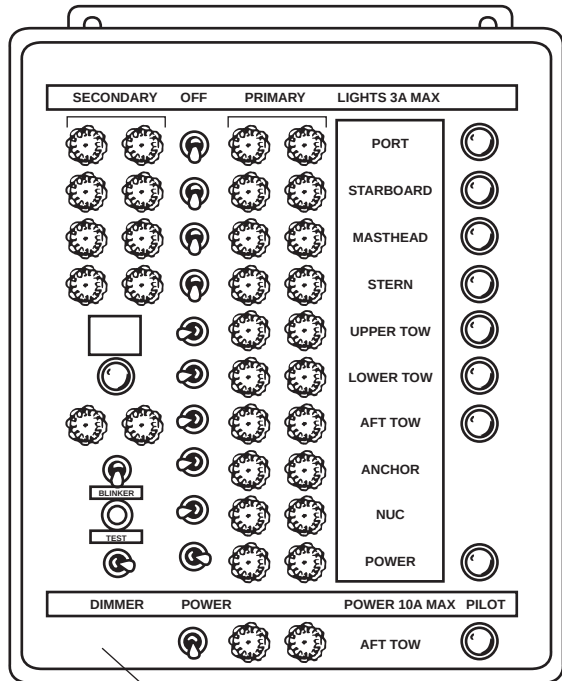
Positive
Terminal

Vent Caps

Batteries

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
6	Weekly	0.5	NAVIGATION PANEL LIGHTS AND SWITCHES	a. Inspect for cleanliness, breakage, and toggle switch movement. b. Ensure that navigation lights operate properly when switches are in the primary and secondary positions. c. Verify that primary and secondary interlock linkages function correctly.	Any broken switches. Any light that does not operate from the primary and secondary switch position. A nonfunctional interlock position.



Navigation Lighting Panel

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

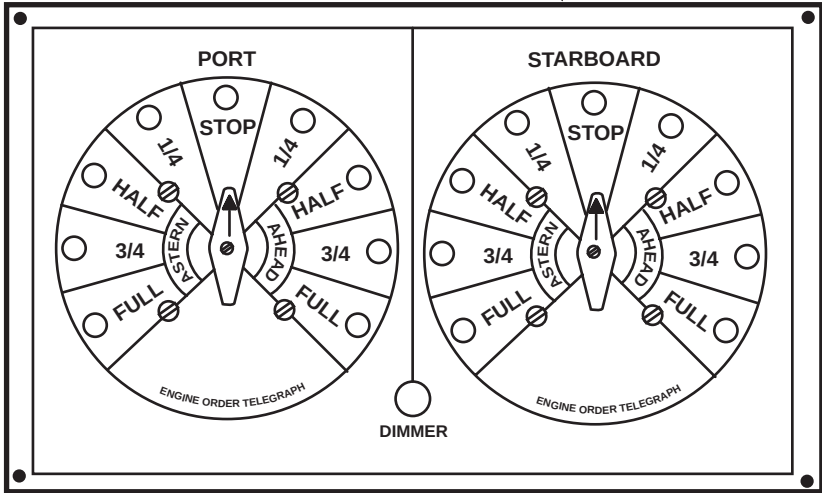
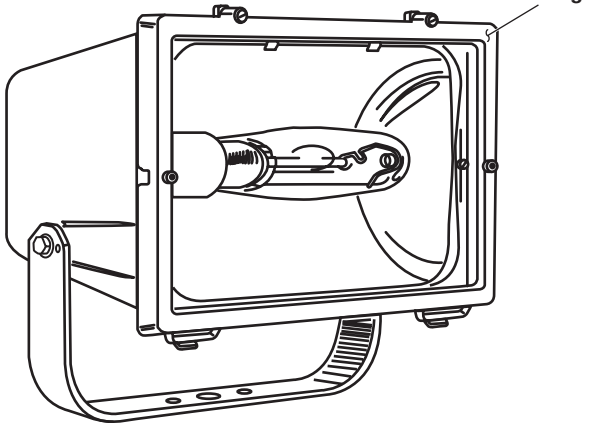
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
7	Weekly	0.2	Engine Order Telegraph	Move selector through each position ensuring corresponding indicator lights and bells. Verify operation of wrong direction alarm system.	Any nonfunctional indicator or alarm.
Engine Order Telegraph 					
8	Weekly	2.0	FLOODLIGHTS	- Check for proper operation of switches and bulbs. - Check for loose connections, cracked, or missing lenses and secure mounting.	Floodlights nonfunctional. Any loose connection, missing lens, or unsecure mounting.
Floodlight 					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

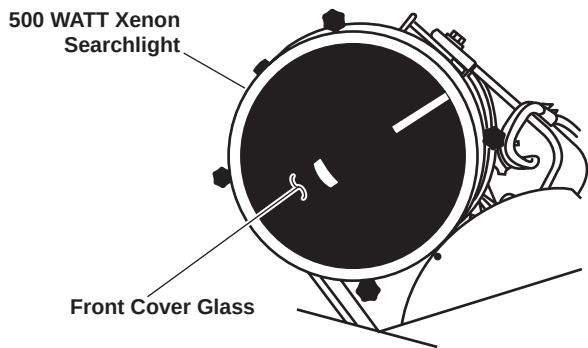
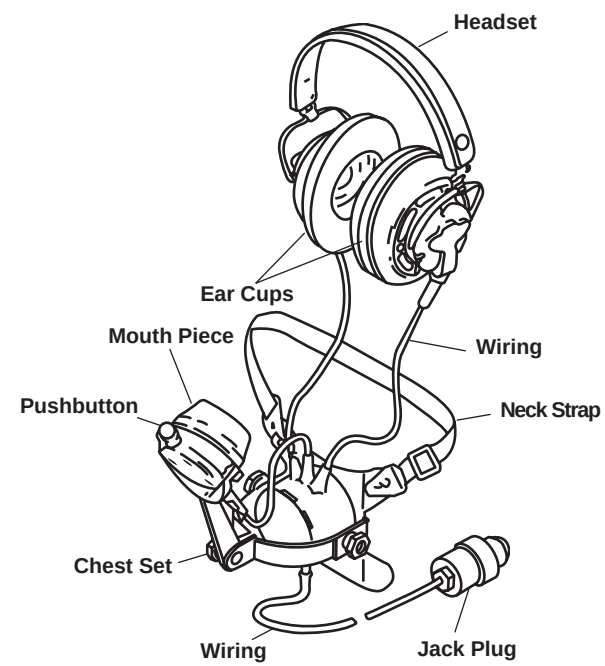
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
9	Weekly	4.0	500 WATT XENON SEARCHLIGHTS	Service searchlights (WP 0133 00).	
					
10	Weekly		Head Set-Chest Set	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
					

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

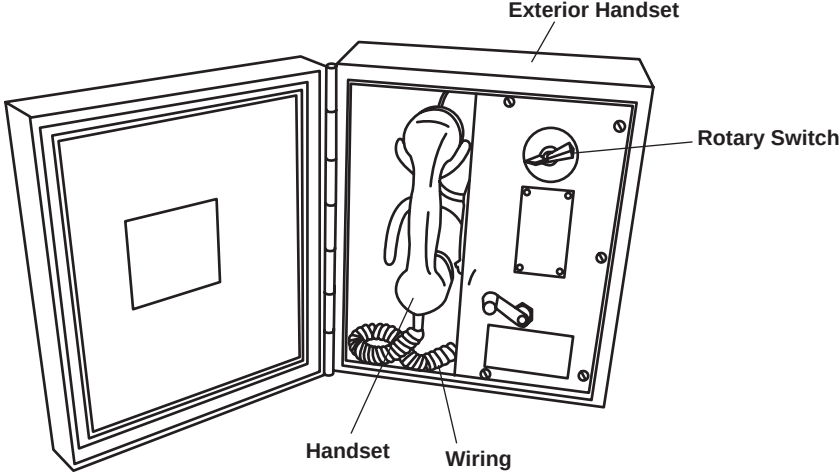
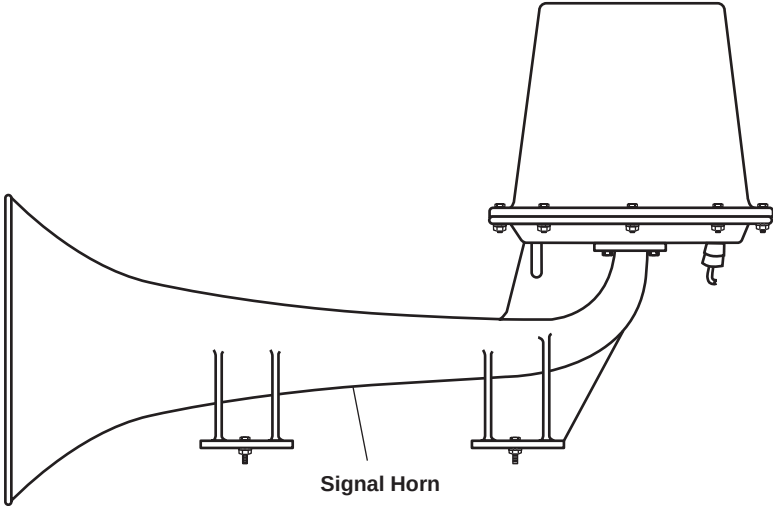
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
11	Weekly		Exterior Handsets	Check the two-way voice capability of the headset with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood. 	Communications not clear and undistorted.
12	Monthly	0.2	SIGNAL HORN	a. Inspect for any obvious damage or nonfunctional part. b. Sound the signal horn to ensure that it operates properly 	Any damaged or nonfunctional part. Horn does not sound.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

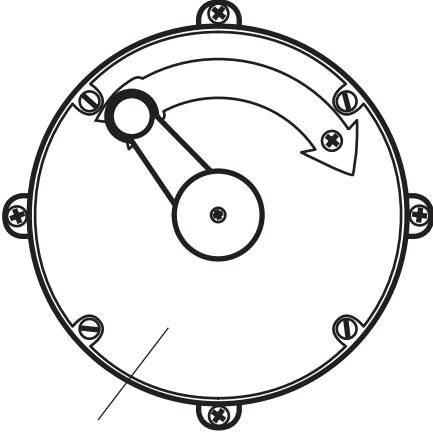
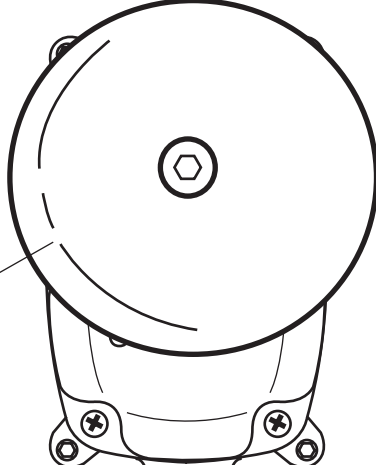
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
13	Monthly	1.0	GENERAL ALARM SYSTEM	a. Inspect general alarm operators, bells, and rotating beacons for obvious damage. b. Operate general alarm switches in pilothouse and 02 level passageway, and verify operation of all bells and rotating beacons.  General Alarm Contactor  General Alarm Bell	Any damaged part. Any part nonfunctional.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
14	Monthly	8.0	MASTS AND YARDARM	Service the masts and yardarm a. Inspect for structural damage. b. Inspect mast foundation for damage or cracks. Inspect navigation lights for mechanical damage. c. Verify that all navigational equipment and lights are functional by inspecting for broken and/or missing lens, bulbs and gaskets on light fixtures, and turning the lights on and off to test for proper operation as follows: (1) Port running light (2) Starboard running light (3) Masthead lights (4) Stern lights (5) Anchor lights (6) Not-Under-Command lights (7) Yardarm blinker lights (8) Tow lights d. Inspect preservation on the masts and yardarm. Check for rust and corrosion.	Any structural damage. Any cracks. Any nonfunctional light.

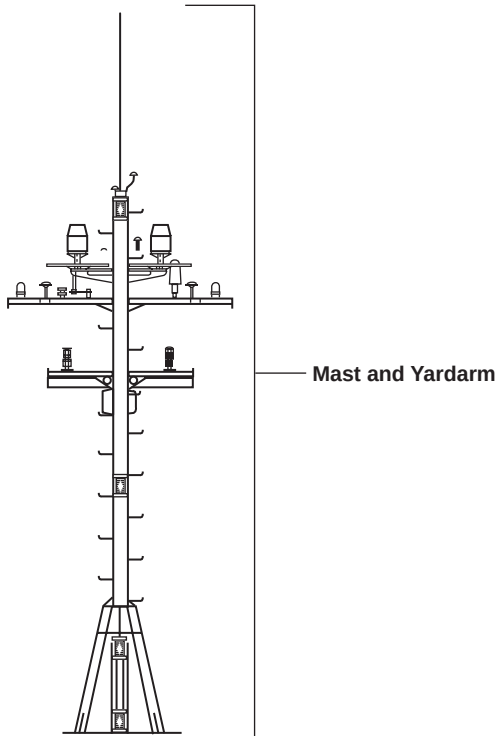


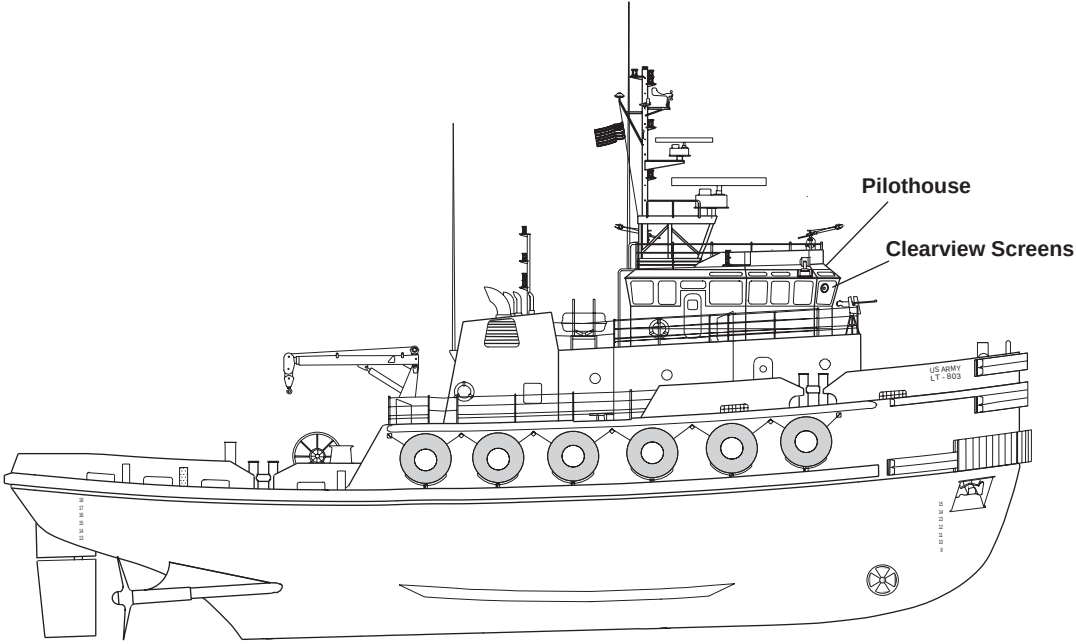
Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
15	Monthly	6.0	INTERCOM SYSTEM	Perform operational test of the intercom system by communicating with all other stations. Transmissions and receptions should be clear, undistorted, and easily understood.	Communications not clear and undistorted.
The diagram shows a rectangular control panel for an intercom system. At the top, there are two indicator lamps labeled 'CALL' and 'BUSY'. Below them is a row of ten pushbuttons. To the left of the pushbuttons is a control switch. Below the pushbuttons is a volume knob and a dimmer knob. To the right of the dimmer is a rotary switch with positions for 'OFF', 'HANDS FREE', and 'MAL'. Below the rotary switch is a hands-free switch labeled 'PRESS TO TALK'. At the bottom left, there is a microphone or handset port labeled 'MIC OR HANDSET'. The panel is mounted on a surface using four mounting hardware screws.					
16	Monthly	1.0	PILOTHOUSE	- Clean the pilothouse and stow items in the pilothouse for sea. - Check the chart table or for secure mounting and illumination control. - Verify that all navigation lights operate properly when the respective light switches on the navigation lighting panel are in the primary and secondary position. - Sound the general alarm, and ensure that all bells and lights operate in all compartments. - Check the fire & detection system remote indicator panel for obvious damage, and test operate. - Test and operate the emergency stop switches for exhaust and recirculation fans.	Any bell or light does not function. Obvious damage or unit does not operate when tested. Switches fail to operate.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
17	Quarterly	1.0	CLEARVIEW SCREENS	g. Check the open steering compass repeater for broken glass. h. Check the helm for any obvious damage. i. Check the alarm switchboard for obvious damage, and press the ALARM TEST button. j. Inspect the pilothouse console for obvious damage. Ensure that the throttle controls operate smoothly and do not bind. k. Check the first aid kit and verify that items are serviceable and within periodicity. a. Inspect rotary windows for obvious damage and secure mounting. b. Inspect control box exterior for obvious damage and secure mounting. c. Service the clearview screens as follows: (1) Inspect the unit for correct assembly. (2) Turn on the clearview screen and verify correct operation. (3) Turn on the heater units and verify the units heat up properly. (4) Deenergize units after service test.	Glass is broken. Any damage which could affect operation. Obvious damage or alarm test does not function. Any critical control or indicator that is unserviceable. Any damaged or nonfunctional unit.

Table 1. Preventive Maintenance Checks and Services Including Lubrication (continued)

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
 The image is a side-view line drawing of a US Army Landing Vehicle Tracked (LVT). It features a hull with the number '25-8000' on the bow and 'US ARMY LT-803' on the stern. The vehicle has a series of six large, circular flotation devices along its side. A crane is mounted on the deck. The superstructure includes a pilothouse with multiple windows, some of which are labeled 'Clearview Screens'. Various antennas and sensors are visible on the roof of the pilothouse. The drawing is positioned within the 'ITEM TO BE CHECKED OR SERVICED' column of the table.					

END OF WORK PACKAGE

Chapter 4

Unit Maintenance Instructions for Inland and Coastal Large Tug (LT)

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HULL, CHOCKS, BITTS AND TIEDOWNS, AND VOIDS AND COMPARTMENTS; SERVICE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Tool Kit, Welder's (Item 3, Table 2, WP 0295 00, Volume 2)
Gloves, Leather (Item 37, Table 2, WP 0295 00, Volume 2)
Faceshield, Industrial (Item 38, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Three Watercraft Operators, 88K (trained in confined space entry)
One Watercraft Engineer, 88L
One Entry Supervisor/Attendant
Fire Watch As Required for Grinding (FM 55-502)

References:

FM 55-502
Organizational Confined Space Entry SOP
TB 55-1900-204-24
WP 0093 00
WP 0295 00 (volume 2)

Equipment Conditions:

Manhole removed for applicable void (WP 0093 00).
Voids must be prepared for confined space entry with Confined Space Entry Permit secured (Organizational Confined Space Entry SOP and FM 55-502).

SERVICE DECK DRAINS

1. Use a stiff brush and fresh water to clean any debris from the deck drain (figure 1, item 1).
2. If debris still clogs the deck drain grate (figure 1, item 1), remove the two screws (figure 1, item 2) and remove the deck drain grate. The deck drain grate may now be cleaned with a wire brush and fresh water.
3. Install the deck drain grate (figure 1, item 1) and secure it with two screws (figure 1, item 2).

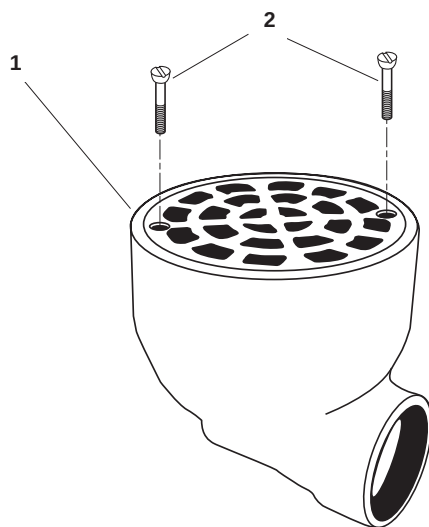


Figure 1. Deck Drain

SERVICE VOIDS

WARNING

Entry into an uninspected confined space may result in death or serious injury to personnel. Only properly trained personnel may enter confined spaces, or act as entry supervisors and/or attendants for those working in confined spaces. Before entering into a confined space, the space must be cleared for entry and a Confined Space Entry Permit must be secured. All entry into confined spaces must be in accordance with the Organizational Confined Space Entry Standard Operating Procedure and FM 55-502.

1. Visually inspect the voids for any damage or deterioration (hull pierced, rust, etc.). If minor damage or deterioration is noted, clean, prime, and paint as described in steps 4-5. If more serious damage is detected, notify the maintenance supervisor.
2. Check for signs of water, oil, or other signs of leakage into watertight compartments. If liquids are present in the compartment, notify the maintenance supervisor.
3. Check for any unusual signs of stress to the structure. Stress can be detected by looking for cracks, broken welds, dented or bulging plating, and unexpected gaps in plating or frame members. Report any signs of unusual stress to the maintenance supervisor.

WARNING

Cleaning components by means of grinding produces hot, flying particles. These particles can cause serious injury to personnel or ignite fires in the work area. Wear protective goggles, gloves, and/or aprons at all times. A fire watch must be posted whenever grinding operations are taking place. Failure to comply with this warning can result in serious injury or death to personnel and damage to the vessel.

4. If minor damage such as rust and/or missing paint is found, thoroughly clean the damaged area to bare metal by grinding or wire brushing.
5. After the area is cleaned, prime and paint as necessary (TB 55-1900-204-24).
6. Install the manhole cover (WP 0093 00).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MAST, SERVICE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Gloves, Leather (Item 37, Table 2, WP 0295 00, Volume 2)
Faceshield, Industrial (Item 38, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TB 55-1900-204-24
TM 55-5825-311-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP0307 00, Volume 2)

Equipment ConditionS:

Set to OFF the S BAND RADAR MOTOR circuit breaker, the X BAND RADAR MOTOR circuit breaker, and the RADAR DISTRIBUTION PANEL circuit breaker in the 120V pilothouse emergency distribution panel. Lock out and tag out (FM 55-502).
Set to OFF all communication equipment (TM 55-5825-311-10). Lock out and tag out (FM 55-502).

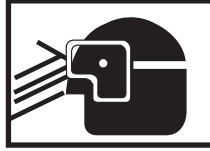
Personnel Required:

Two Watercraft Operators, 88K
Fire Watch as Required for grinding (FM 55-502)

SERVICE**WARNING**

Electromagnetic radiation from the radar and communication equipment has the potential for serious radiation burns. Lock out and tag out radar and communication equipment (FM 55-502). Failure to comply with this warning can result in serious injury or death to personnel.

1. Visually inspect the masts for any damage or deterioration (structure dented, rust, etc.). If minor damage or deterioration is noted, clean, prime, and paint as described in steps 4-5. If serious damage is discovered, notify the maintenance supervisor.
2. Check that all antennas, lights, and other mounted hardware are solidly mounted to the mast's structures. If loose components are found, notify the maintenance supervisor.
3. Check for any unusual signs of stress to the structure. Stress can be detected by looking for cracks, broken welds, dented or bulging piping, and unexpected gaps in welded joints. Report any signs of unusual stress to the maintenance supervisor.

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.

4. If minor damage such as rust and/or missing paint is found, thoroughly clean the damaged area to bare metal with a wire brush.
5. After the area is cleaned, prime and paint as necessary (TB 55-1900-204-24).

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
WINDOWS, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

TB 43-0218
WP 0295 00 (volume 2)
WP 0296 00 (volume 2)

Materials/Parts:

Cotter Pin (Item 10, Figure 2, WP 0296 00, Volume 2)

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.

NOTE

This work package details repair of the portholes found throughout the vessel's berthing areas. Replacement of the pilothouse windows is a depot level maintenance task.

DISASSEMBLY

1. Unscrew the locking nut (figure 1, item 1) from the rod (figure 1, item 2).
2. Remove the cotter pin (figure 1, item 3) and flat washer (figure 1, item 4). Discard the cotter pin.

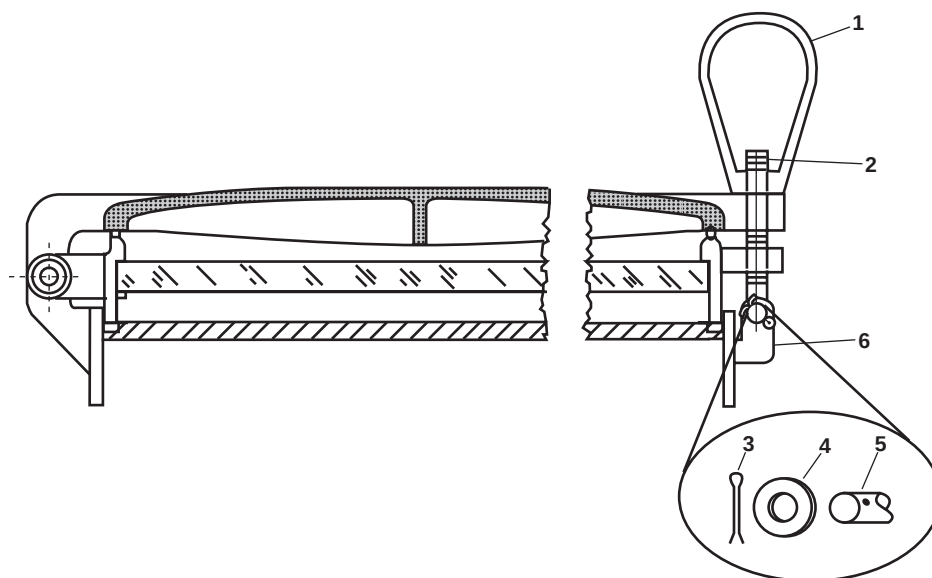


Figure 1. Bell Nut Housing

3. Use a hammer and punch to drive out the machine screw (figure 1, item 5).
4. Remove the rod (figure 1, item 2) from the boss (figure 1, item 6).

ASSEMBLY

1. Position the rod (figure 1, item 2) in the boss (figure 1, item 6), and secure it with the machine screw (figure 1, item 5).
2. Thread the locking nut (figure 1, item 1) onto the rod (figure 1, item 2).
3. Install the flat washer (figure 1, item 4) and a new cotter pin (figure 1, item 3).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HYDRAULIC WATERTIGHT DOORS, ADJUST

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References:

FM 55-502
WP 0295 00 (volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

Equipment Conditions:

Door(s) CLOSED and hand pumps locked out and tagged out (FM 55-502).
Operational sound powered telephones.

ADJUSTMENT**NOTE**

The clearance between the door and frame at all points along the sealing surface should be less than 0.003 inch (0.07 mm), but not close enough to cause the door to stick in the closed position when full power is applied for opening.

1. Check the clearance with a 0.003 inch (0.07 mm) feeler gauge. It should not pass through at any point along the sealing surface.
2. If the door sticks or if the clearance is exceeded, adjust the clearance by turning the set bolts (figure 1, item 1) in or out to obtain the required clearance.

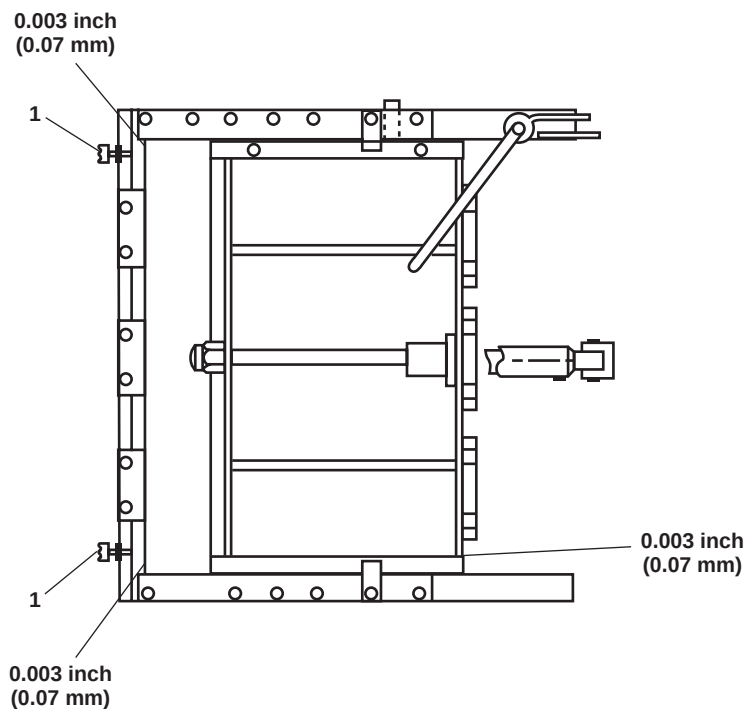


Figure 1. Adjust Hydraulic Watertight Door

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HYDRAULIC WATERTIGHT DOORS, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
 Lubricating Gun (Item 25, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Door(s) OPEN and hand pumps locked out and tagged out (FM 55-502).

Materials/Parts:

Dry Cleaning Solvent (Item 57, Table 1, WP 0307 00, Volume 2)
 Grease, General Purpose (Item 75, Table 1, WP 0307 00, Volume 2)
 Rag, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
 Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

DISASSEMBLY

1. Remove the grease fitting (figure 1, item 1).
2. Remove the hex nut (figure 1, item 2) and the metal guide (figure 1, item 3).

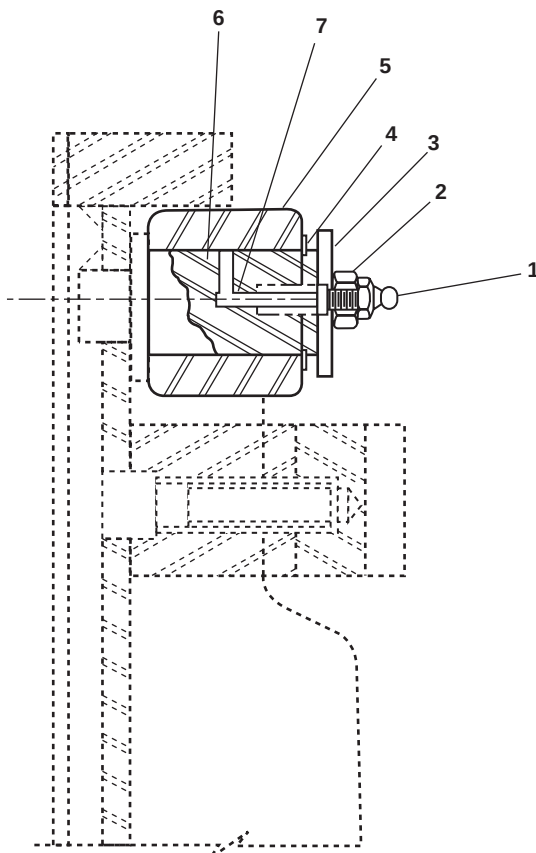


Figure 1. Hydraulic Watertight Door

3. Remove the washer (figure 1, item 4).

WARNING

The watertight doors are extremely heavy. Two crewmembers are required to raise and secure the door. Do not attempt to lower or raise the door without assistance. Failure to comply with this warning can result in death or serious injury.

4. If removing a bottom roller, pry the door up and secure it in position.
5. Slide the roller (figure 1, item 5) off the pin (figure 1, item 6).

CLEANING AND INSPECTION**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.

1. Clean all metal parts with cleaning solvent and dry with clean wiping rags.
2. Inspect the door roller for corrosion, pitting, deep scratches, or other damage that would prevent smooth operation. If the damage is found, the roller must be replaced.
3. Clean the pin with cleaning solvent to remove all excess grease. Inspect the pin for corrosion, pitting, deep scratches, or other damage that would prevent smooth operation. If damage is found, notify the maintenance supervisor.
4. Clean the old grease out of the 90-degree cavity (figure 1, item 7).

ASSEMBLY

1. Apply a liberal coating of grease to the inside of the door roller (figure 1, item 5) and to the pin (figure 1, item 6). Slide the door roller over the pin.
2. Install the washer (figure 1, item 4).
3. Install the metal guide (figure 1, item 3), hex nut (figure 1, item 2), and grease fitting (figure 1, item 1).
4. Using a grease gun, apply general purpose grease to the grease fitting (figure 1, item 1) and thoroughly grease the new door roller.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
WATERTIGHT DOORS, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

Materials/Parts:

Grease, General Purpose, (Item 75, Table 1,
WP 0307 00, Volume 2)
Plunger, Packing (Setscrew) (Item 7, Figure 4,
WP 0296 00, Volume 2)
Bushing, Sleeve (Item 10, Figure 4, WP 0296 00,
Volume 2)

References:

WP 0295 00 (volume 2)
WP 0296 00 (volume 2)
WP 0307 00 (volume 2)

DISASSEMBLY

1. Remove the jam nut (figure 1, item 1) from the handle (figure 1, item 2).
2. Remove the pin (figure 1, item 3), from the dog (figure 1, item 4) and the flanged bushing (figure 1, item 5).
3. Remove the handle (figure 1, item 2) from the dog (figure 1, item 4).
4. Remove the dog (figure 1, item 4) from the watertight door sleeve (figure 1, item 6).
5. Remove the packing plunger (figure 1, item 7) from the watertight door sleeve (figure 1, item 6). Discard the packing plunger.
6. Remove the sleeve bushing (figure 1, item 8) from the watertight door sleeve (figure 1, item 6). Discard the plain bushing.
7. Remove the flanged bushing (figure 1, item 5) from the watertight door sleeve (figure 1, item 6).
8. Remove the helical compression spring (figure 1, item 9) from the watertight door sleeve (figure 1, item 6).

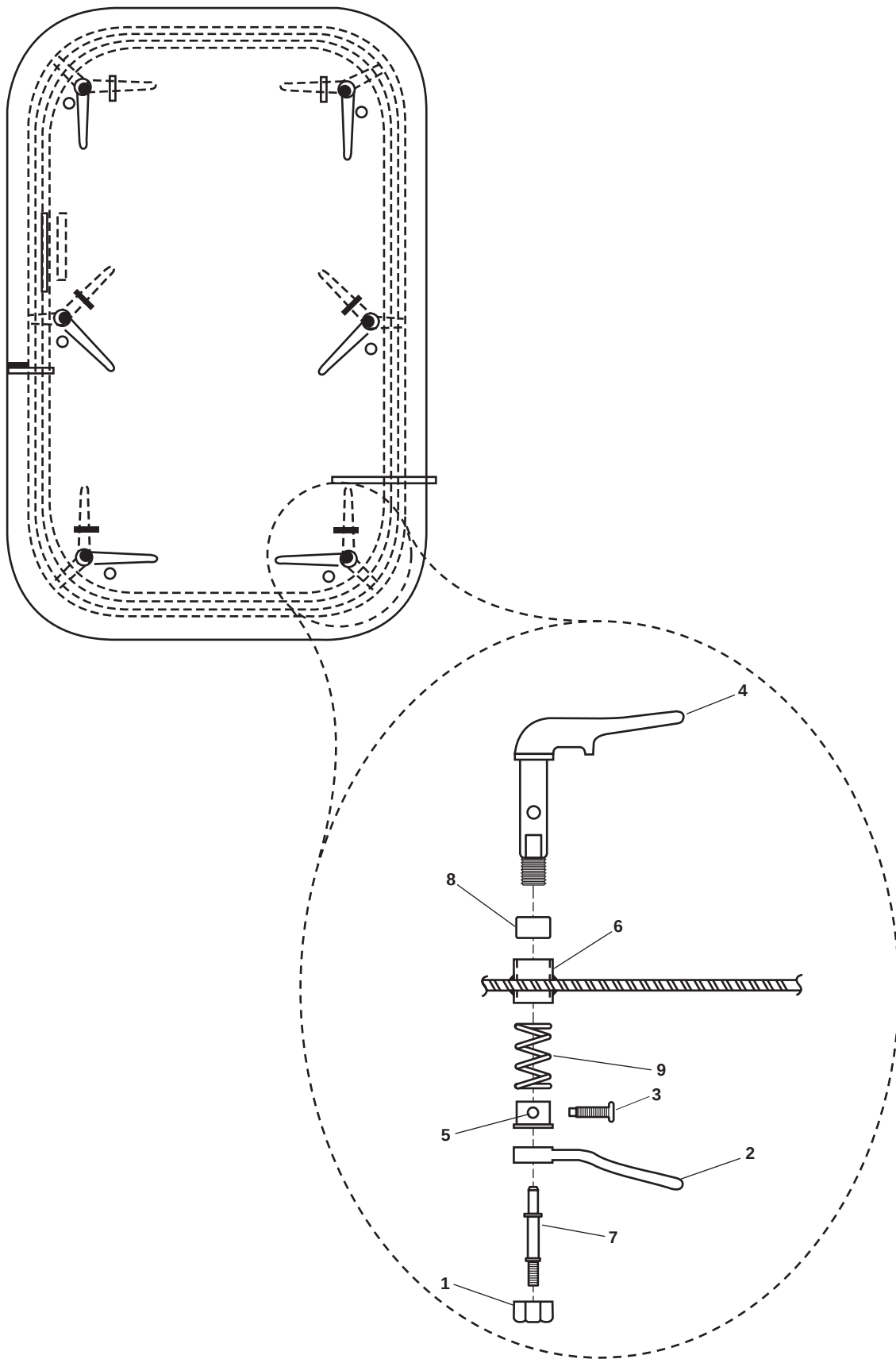


Figure 1. Watertight Door

ASSEMBLY

1. Inspect the helical compression spring (figure 1, item 9) for cracks. Replace it if it is cracked. Apply a light coat of general purpose grease to the helical compression spring and install it in the watertight door sleeve (figure 1, item 6).
2. Lubricate the flanged bushing (figure 1, item 5) with a light coat of general purpose grease and install it in the watertight door sleeve (figure 1, item 6).
3. Lubricate a new sleeve bushing (figure 1, item 8) with a light coat of general purpose grease and install it in the watertight door sleeve (figure 1, item 6).
4. Install the new packing plunger (figure 1, item 7) in the watertight door sleeve (figure 1, item 6).
5. Install the dog (figure 1, item 4) in the watertight door sleeve (figure 1, item 6).
6. Install the pin (figure 1, item 3), in the dog (figure 1, item 4) and the flanged bushing (figure 1, item 5).
7. Install the handle (figure 1, item 2) on the dog (figure 1, item 4).
8. Install the jam nut (figure 1, item 1) on the handle (figure 1, item 2).

END OF WORK PACKAGE

2. Inspect the sleeve (figure 1, item 3) and bushings (item 1, item 4) for wear or damage.
3. Remove the sleeve (figure 1, item 3) and bushing (item 1, item 4) if any damage or wear are noted.

INSTALLATION

1. If the sleeve (figure 1, item 3) and bushing (item 1, item 4) are being replaced, install a new sleeve and bushing in the watertight hatch.
2. Install the dog/handle set (figure 1, item 2) in the watertight hatch and secure them with the jam nut (figure 1, item 1).
3. Using a lubricating gun, lubricate the sleeve (figure 1, item 3) with general purpose grease at the grease fitting (figure 1, item 5).
4. Operate the hatch and check for smooth and positive dogging action. If the dogging action is not smooth, repeat the procedure ensuring that the sleeve (figure 1, item 3) is receiving grease. If rough operation continues, notify the maintenance supervisor.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
WATERTIGHT SCUTTLES, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References:

WP 0295 00 (volume 2)

Personnel Required:

One Watercraft Engineer, 88L

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.

DISASSEMBLY

1. Remove the two self-locking nuts (figure 1, item 1) and handwheel (figure 1, item 2) from the scuttle (figure 1, item 3). Discard the self-locking nuts.
2. Remove all six cotter pins (figure 1, item 4) from the cylindrical pins (figure 1, item 5), then remove the cylindrical pins. Discard the cotter pins.
3. Loosen the setscrews (figure 1, item 6) and remove the dog arms (figure 1, item 7) and guides (figure 1, item 8) from the scuttle.
4. Remove the hex steel adjusters (figure 1, item 9) and springs (figure 1, item 10).
5. Remove the grease fittings (figure 1, item 11).
6. Remove the spider (figure 1, item 12) and shim (figure 1, item 13) from the scuttle.

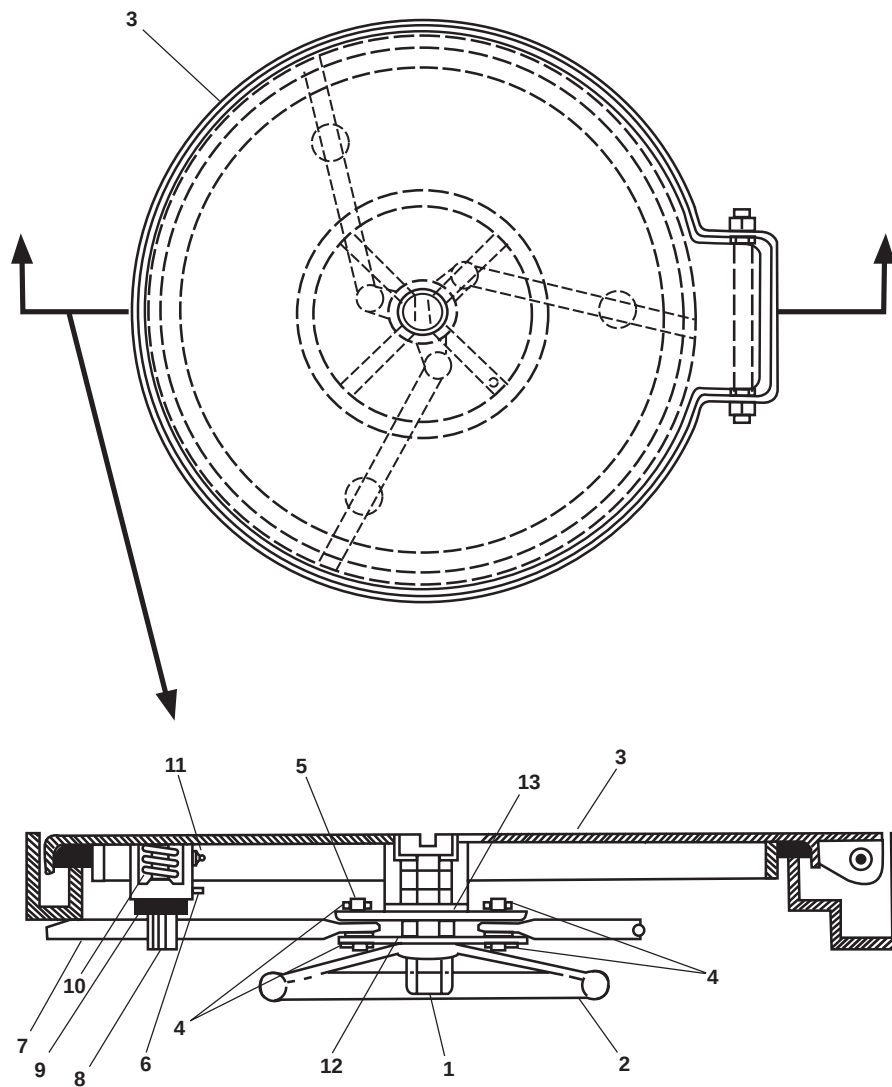


Figure 1. Repair Watertight Scuttle

ASSEMBLY

1. Install the shim (figure 1, item 13) and the spider (figure 1, item 12).
2. Place the springs (figure 1, item 10) and hex steel adjusters (figure 1, item 9) in position.
3. Install the grease fitting (figure 1, item 11).
4. Install the guides (figure 1, item 8) with dog arms (figure 1, item 7) and tighten the setscrews (figure 1, item 6).
5. Install the cylindrical pins (figure 1, item 5) in the dog arms.
6. Secure the cylindrical pins using six new cotter pins (figure 1, item 4).
7. Install the handwheel (figure 1, item 2) and secure it with two new self-locking nuts (figure 1, item 1).
8. Operate the scuttle and check for smooth and positive dogging action.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
WATERTIGHT MANHOLES, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Tool Kit, Carpenter's (Item 9, Table 2, WP 0295 00,
Volume 2)

Materials/Parts:

Gasket (Item 1, Figure 7, WP 0296 00, Volume 2)

Personnel Required:

One Watercraft Operator 88K
One Watercraft Engineer 88L
(One of these must be trained in confined space entry)

Personnel Required (continued):

One Entry Supervisor/Attendant

References:

FM 55-502
Organizational Confined Space Entry SOP
TB 55-1900-242-24
TB 43-0144
WP 0295 00 (volume 2)
WP 0296 00 (volume 2)

MANHOLE (RAISED)

WARNING

Entry into an uninspected confined space may result in death or serious injury to personnel. Only properly trained personnel may enter confined spaces, or act as entry supervisors and/or attendants for those working in confined spaces. Before entering into a confined space, the space must be cleared for entry and a Confined Space Entry Permit must be secured. All entry into confined spaces must be in accordance with the Organizational Confined Space Entry Standard Operating Procedure and FM 55-502.

REMOVAL

1. Remove all nuts (figure 1, item 1) and washers (figure 1, item 2) from the studs (figure 1, item 3).
2. Remove the manhole cover (figure 1, item 4) from the closure.
3. Remove the gasket (figure 1, item 5) from the manhole cover.
4. Thoroughly clean the gasket sealing area on the manhole cover and on the hull structure, using a scraper and/or wire brush.

INSPECTION

1. Inspect the gasket sealing area for nicks, burrs, or deformities that would prevent the gasket from sealing properly.

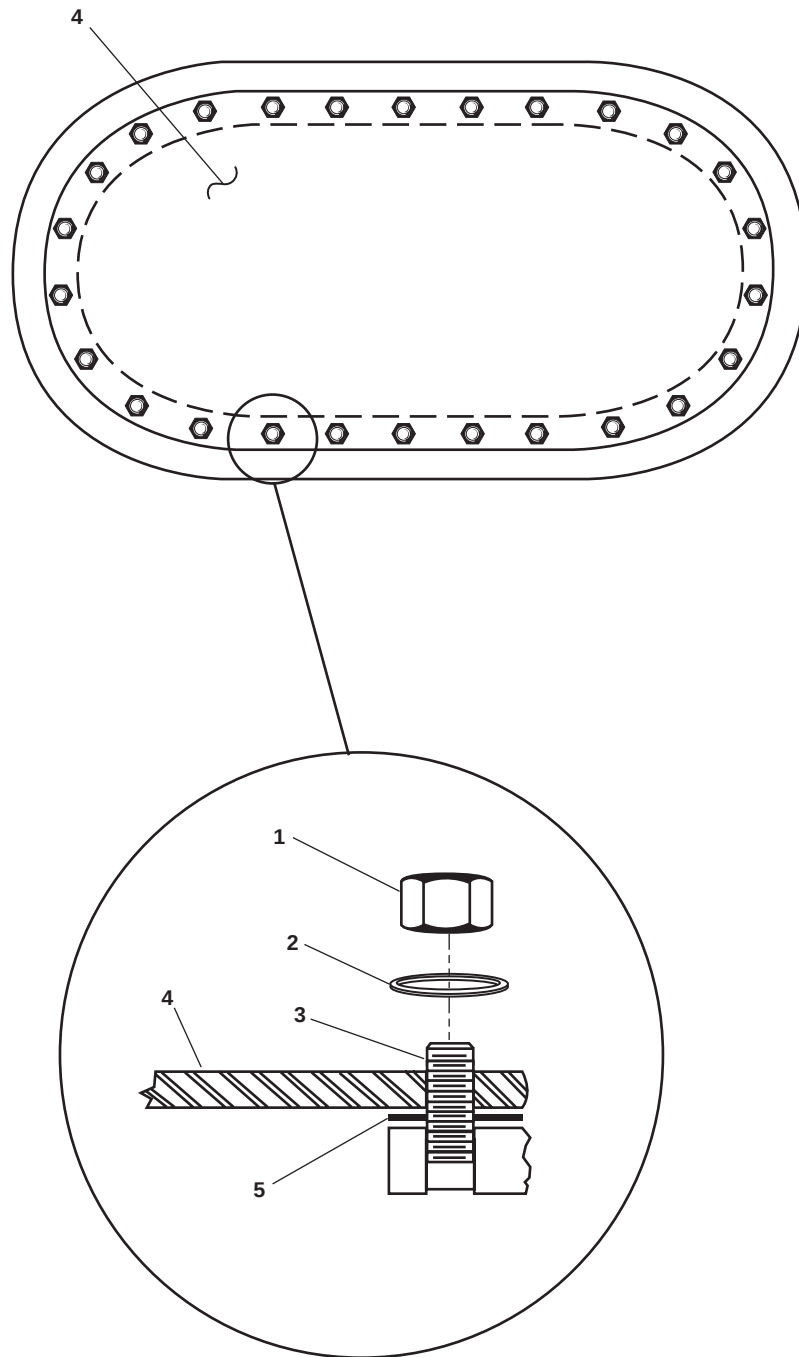


Figure 1. Manhole (Raised)

WARNING

Removing components by means of grinding or cutting produces hot, flying particles. These particles can cause serious injury to personnel or ignite fires in the work area. Wear protective goggles, gloves, and/or aprons at all times. A fire watch must be posted whenever grinding or cutting operations are taking place. Failure to comply with this warning can result in serious injury or death to personnel and damage to the vessel.

- a. Small defects may be corrected by grinding or filing.
 - b. Larger defects may require welding repair. If this is the case, report the defect to the maintenance supervisor.
2. Inspect all studs for any thread damage and stability of mounting. Report any studs or threads that are damaged or insecurely mounted to the maintenance supervisor.

INSTALLATION

1. On a flat surface, lay out clean, dry boards or other material to protect the deck.
2. Roll out the new gasket material.
3. Using the manhole as a template and a craftsman's knife, cut the new gasket to match the manhole's dimensions.
4. Position the new gasket (figure 1, item 5) over the studs (figure 1, item 3).
5. Place the manhole cover (figure 1, item 4) on the closure.
6. Secure the cover using washers (figure 1, item 2) and nuts (figure 1, item 1).
7. After replacement is complete, touch up the paint on the affected areas (TB 43-0144).

MANHOLE (FLUSH)**REMOVAL**

1. Remove the screws (figure 2, item 1) from the manhole cover (figure 2, item 2).
2. Remove the manhole cover (figure 2, item 2) from the closure.
3. Remove the gasket (figure 2, item 3) from the manhole cover.

INSPECTION

Inspect the flush manhole using the procedure detailed for the raised manhole.

INSTALLATION

1. On a flat surface, lay out clean, dry boards or other material to protect the deck.
2. Roll out the new gasket material.

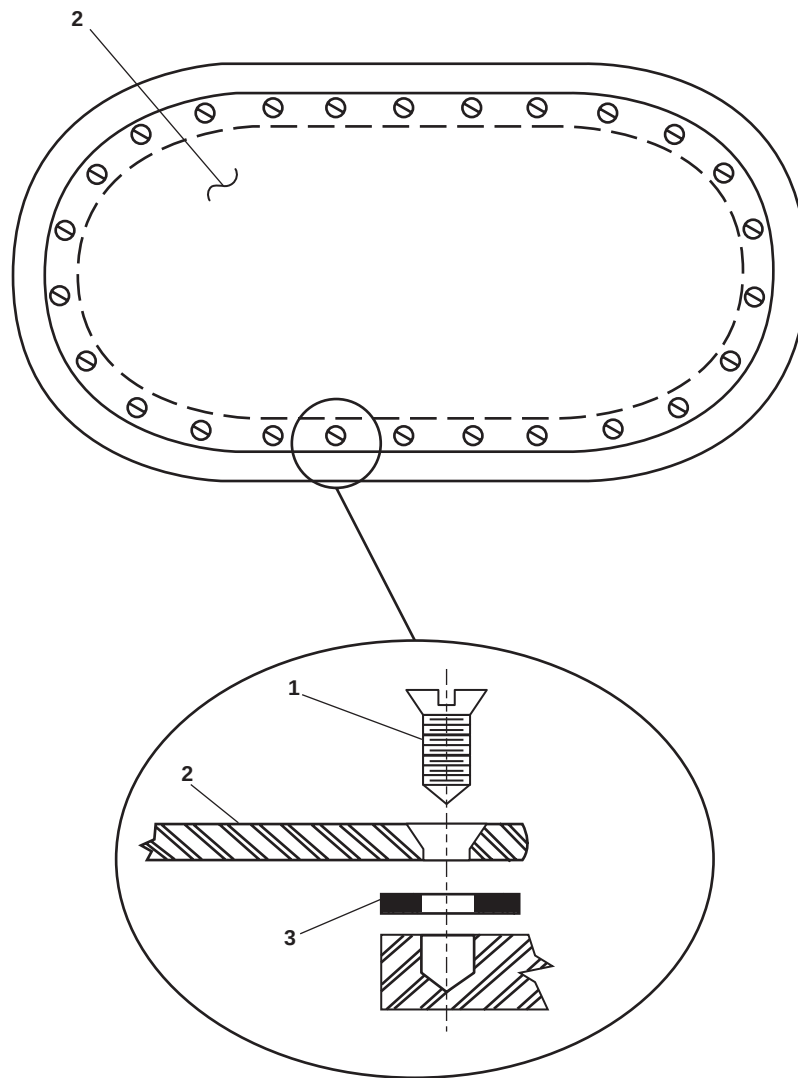


Figure 2. Manhole (Flush)

3. Using the manhole as a template and a craftsman's knife, cut the new gasket to match the manhole's dimensions.
4. Install the new gasket (figure 2, item 3) on the manhole cover (figure 2, item 2).
5. Place the manhole cover (figure 2, item 2) on the closure.
6. Install the screws (figure 2, item 1) on the manhole cover.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
PILOTHOUSE, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Silicone Compound (Item 157, Table 1, WP 0307 00,
Volume 2)
Strap, Tiedown, Electrical Components (Item 172,
WP 0307 00, Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
Tape, Insulation, Electrical (Item 178, Table 1,
WP 0307 00)

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.

WINDSHIELD WIPER BLADE REPLACEMENT**REMOVAL**

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

NOTE

This procedure is applicable to all of the wiper blades regardless of their position.

1. At 120V exterior emergency lighting panel No. 2, set to OFF, lock out, and tag out (FM 55-502) the WINDSCREEN WIPERS. (PORT & STARBOARD FWD). circuit breaker (figure 1, item 1) and the WINDSCREEN WIPERS. (STARBOARD & PORT FWD). circuit breaker (figure 1, item 2).

2. Remove the three allen head screws (figure 2, item 1) and three locknuts (figure 2, item 2) from the blade attachment clip (figure 2, item 3). Discard the locknuts.
3. Remove the end cap (figure 2, item 4) from the windshield wiper blade assembly (figure 2, item 5).
4. Remove the windshield wiper blade (figure 2, item 6) and blade attachment clip (figure 2, item 3) from the windshield wiper blade assembly (figure 2, item 5).

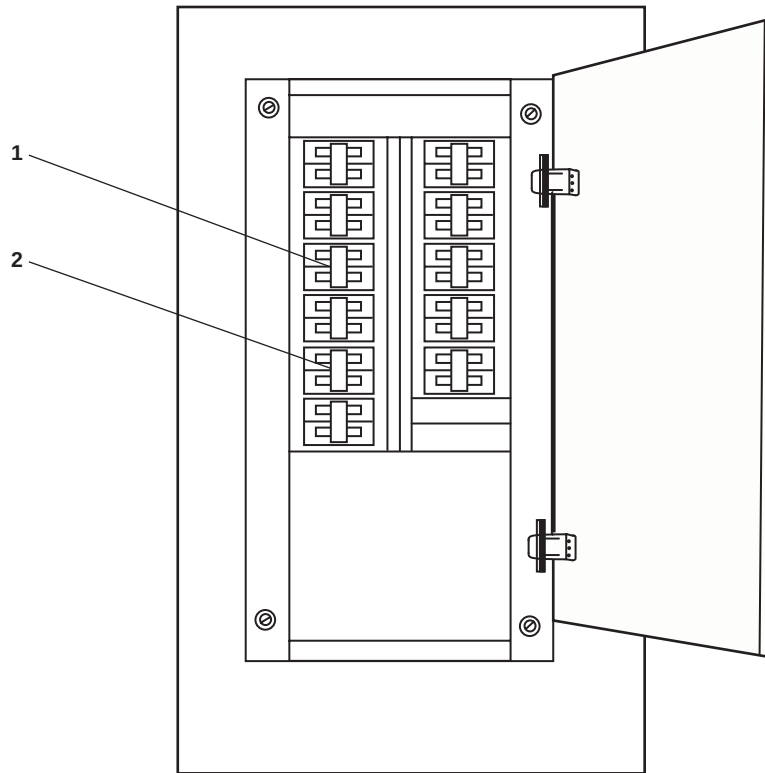


Figure 1. 120V Exterior Emergency Lighting Panel No. 2

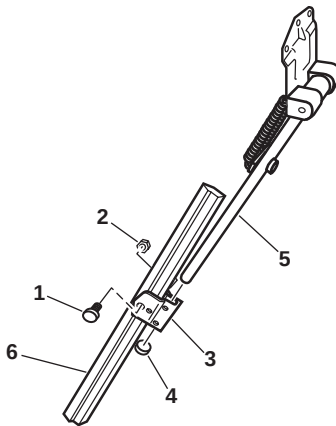


Figure 2. Wiper Blade Replacement

INSTALLATION

1. Install the new windshield wiper blade (figure 2, item 6) and blade attachment clip (figure 2, item 3) onto the windshield wiper blade assembly (figure 2, item 5) and secure it with three allen head screws (figure 2, item 1) and three new locknuts (figure 2, item 2).
2. Install the end cap (figure 2, item 4) onto the windshield wiper blade assembly (figure 2, item 5).
3. At 120V exterior emergency lighting panel No. 2, remove the lockouts, and tagouts (FM 55-502) and set to ON the WINDSCREEN WIPERS. (PORT & STARBOARD FWD). circuit breaker (figure 1, item 1) and the WINDSCREEN WIPERS. (STARBOARD & PORT FWD). circuit breaker (figure 1, item 2).
4. Operate the windshield wipers (TM 55-1925-273-10) and check for proper operation.
5. Return the windshield wipers to the desired readiness condition (TM 55-1925-273-10).

PILOTHOUSE WING CONSOLE THERMOSTAT REPLACEMENT

REMOVAL

1. At 01 & 02 level reheater 120V fuse box No. 1, remove the PORT BRIDGE WING CONSOLE HEATER. fuses (figure 3, item 1) and STARBOARD BRIDGE WING CONSOLE HEATER. fuses (figure 3, item 2). Lock out and tag out (FM 55-502).
2. Remove the 15 screws (figure 4, item 1) and the access plate (figure 4, item 2).
3. Inspect the gasket (figure 4, item 3) for damage. Replace the gasket as required.

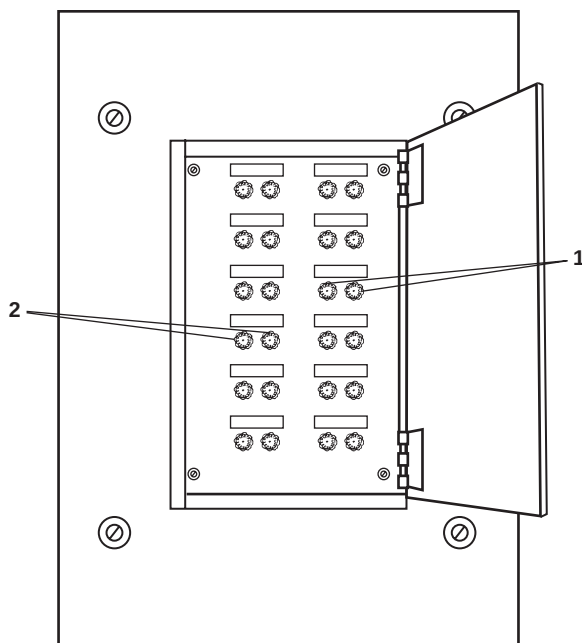


Figure 3. 01 & 02 Level Reheater 120V Fuse Box No. 1

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement with the circuit energized may result in injury or death.

4. Remove the two screws (figure 5, item 1) and the junction box cover (figure 5, item 2).
5. Use a multimeter to check for available voltage at the thermostat wiring (figure 5, item 3). If voltage is present, ensure that the proper fuses are removed, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
6. Label and disconnect the thermostat wiring (figure 5, item 3) inside the junction box (figure 5, item 4).
7. Pull the thermostat wiring (figure 5, item 3) out of the junction box (figure 5, item 4).
8. Remove the nut (figure 5, item 5) and remove the thermostat (figure 5, item 6) from its bracket (figure 5, item 7).

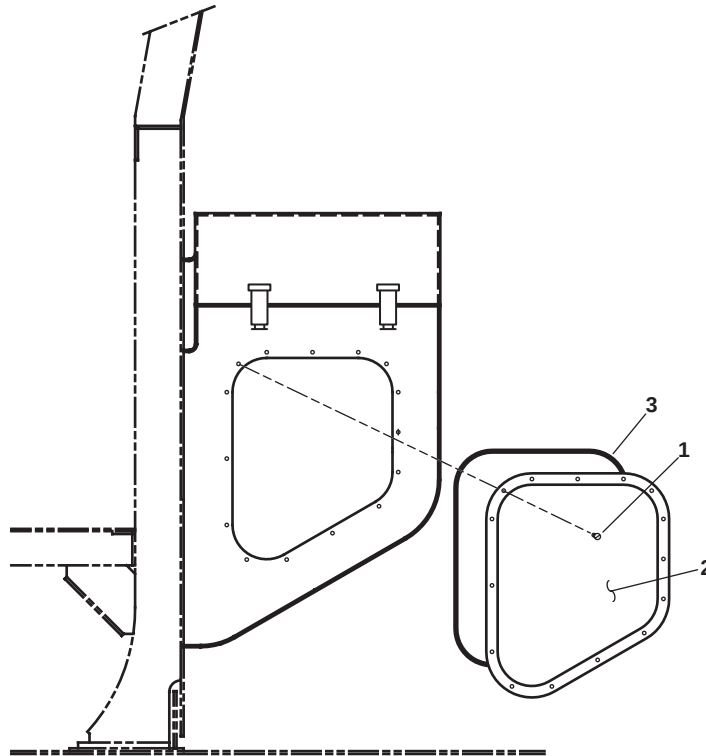


Figure 5. Pilothouse Wing Console (Starboard Shown, Port Opposite Hand)

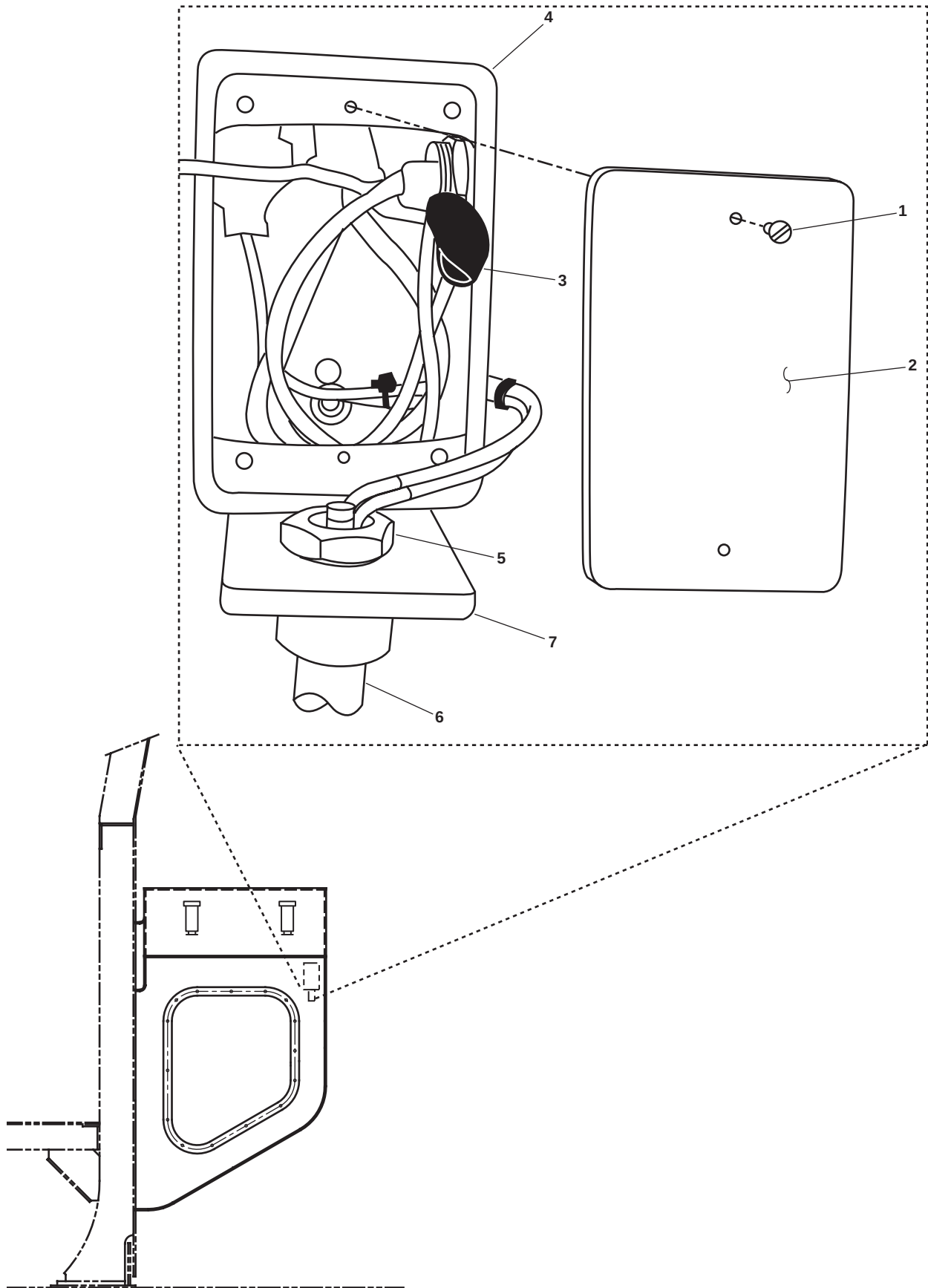


Figure 5. Pilothouse Wing Console Thermostat

INSTALLATION

1. Position the thermostat (figure 5, item 6) in its bracket (figure 5, item 7) and secure it with the nut (figure 5, item 5).
2. Feed the thermostat wiring (figure 5, item 3) into the junction box (figure 5, item 4).
3. Connect the thermostat wiring (figure 5, item 3) in the junction box (figure 5, item 4) and insulate it with electrical tape. Remove the labels installed during removal.
4. Install the junction box cover (figure 5, item 2) and secure it with two screws (figure 5, item 1).
5. If a new gasket (figure 4, item 3) is required, fabricate one from bulk gasket material using the cover as a template.
6. Apply a thin coat of silicone compound to the access plate (figure 4, item 2) side of the gasket (figure 4, item 3).
7. Install the access plate (figure 4, item 2) and gasket (figure 4, item 3) and secure them with 15 screws (figure 4, item 1).
8. Remove the lockouts and tagouts (FM 55-502) installed during step 1 of the Removal procedure.
9. Install the fuses removed during step 1 of the Removal procedure.
10. If the ambient temperature is below 70 °F (21 °C), observe the console after one hour and note that the outer surfaces of the bridge wing are noticeably warm to the touch.

PILOTHOUSE WING CONSOLE HEATER REPLACEMENT

REMOVAL

1. At 01 & 02 level reheater 120V fuse box No. 1, remove the PORT BRIDGE WING CONSOLE HEATER. fuses (figure 3, item 1) and STARBOARD BRIDGE WING CONSOLE HEATER. fuses (figure 3, item 2). Lock out and tag out (FM 55-502).
2. Remove the 15 screws (figure 4, item 1) and the access plate (figure 4, item 2).
3. Inspect the gasket (figure 4, item 3) for damage. Replace the gasket as required.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement with the circuit energized may result in injury or death.

4. Use a multimeter to check for available voltage at the heater wiring terminals (figure 6, item 1). If voltage is present, ensure that the proper fuses are removed, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Label and disconnect the heater wiring (figure 6, item 2) at the terminals (figure 6, item 1).
6. Remove the two bolts (figure 6, item 3), two nuts (figure 6, item 4), two flat washers (figure 6, item 5), and two lockwashers (figure 6, item 6) that secure the heater element (figure 6, item 7) to its mounts (figure 6, item 8). Remove the heater element from its mounts and discard the lockwashers.

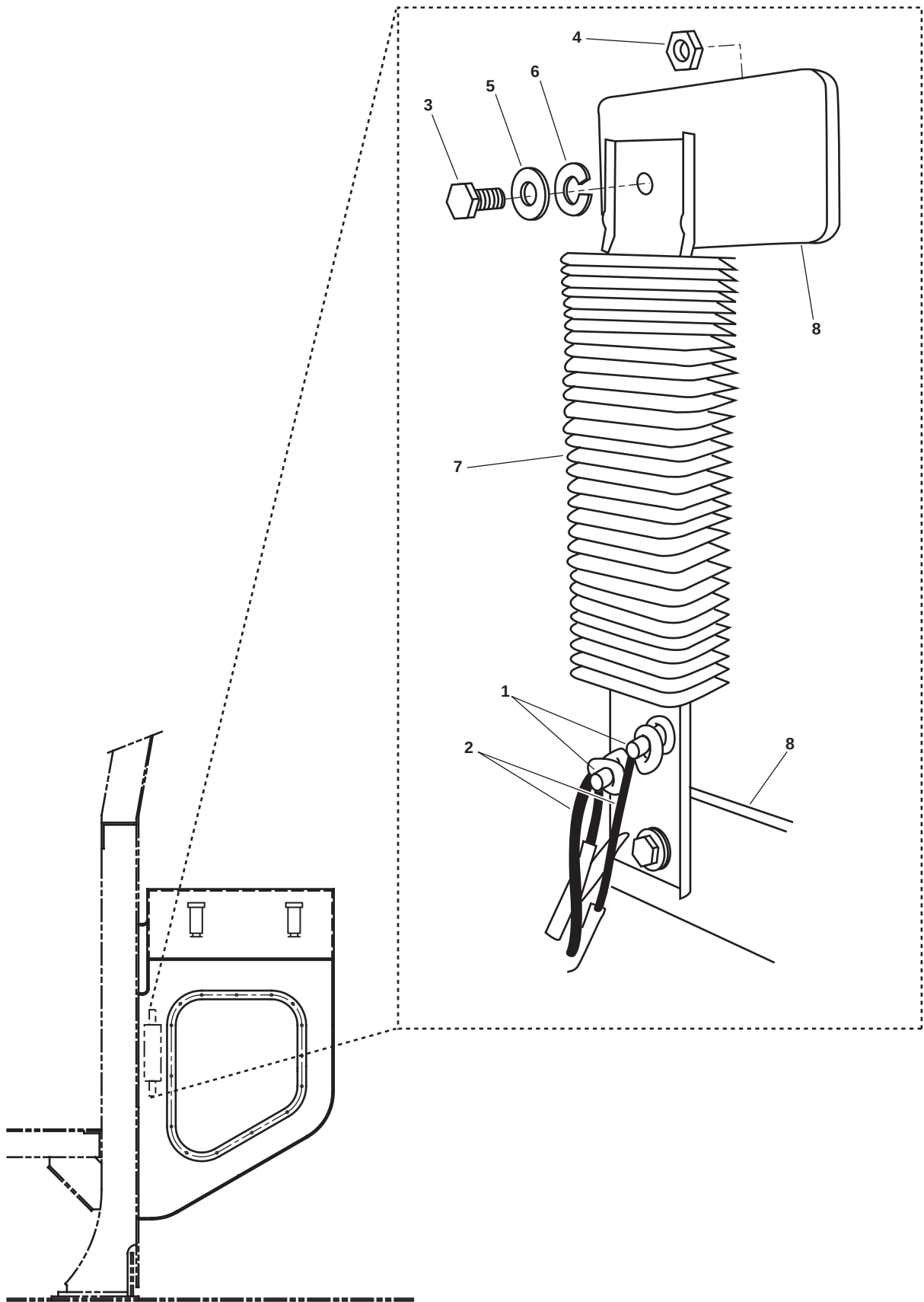


Figure 6. Pilothouse Wing Console Heater

INSTALLATION

1. Position the heater element (figure 6, item 7) on its mounts (figure 6, item 8) and secure it with the two nuts (figure 6, item 4), two flat washers (figure 6, item 5), and two new lockwashers (figure 6, item 6).
2. Connect the heater wiring (figure 6, item 2) to the terminals (figure 6, item 1). Removal the labels installed during removal.
3. If a new gasket (figure 4, item 3) is required, fabricate one from bulk gasket material using the cover as a template.
4. Apply a thin coat of silicone compound to the access plate (figure 4, item 2) side of the gasket (figure 4, item 3).
5. Install the access plate (figure 4, item 2) and gasket (figure 4, item 3) and secure them with 15 screws (figure 4, item 1).
6. Remove the lockouts and tagouts (FM 55-502) installed during step 1 of the Removal procedure.
7. Install the fuses removed during step 1 of the Removal procedure.
8. If the ambient temperature is below 70 °F (21 °C), observe the console after one hour and note that the outer surfaces of the bridge wing are noticeably warm to the touch.

NAVIGATOR'S SEAT REPLACEMENT

REMOVAL

WARNING



Before removing the clamp, the navigator's seat must be supported. Failure to comply could result in injury or death.

1. Position one crewmember to hold the navigator's seat (figure 7, item 1).
2. While holding the navigator's seat (figure 7, item 1), loosen the nut (figure 7, item 2) and remove the clamp (figure 7, item 3).
3. Lift the navigator's seat (figure 7, item 1) and pedestal (figure 7, item 4) from the base (figure 7, item 5) as an assembly.
4. Remove the four bolts (figure 7, item 6), four nuts (figure 7, item 7), four flat washers (figure 7, item 8), and four lockwashers (figure 7, item 9). Remove the base (figure 7, item 5) from the foundation (figure 7, item 10) and discard the lockwashers.

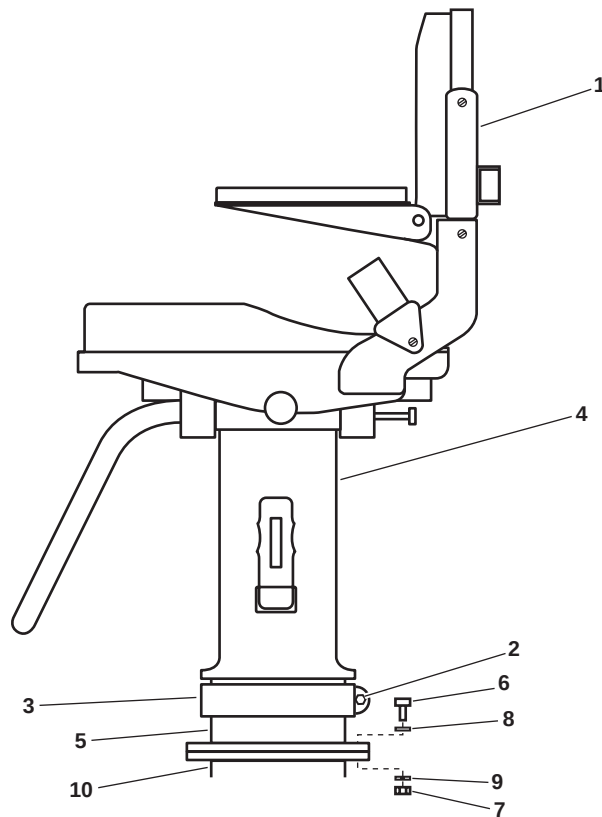


Figure 7. Navigator's Seat

INSTALLATION

1. Position the base (figure 7, item 5) on the foundation (figure 7, item 10) and secure it with our bolts (figure 7, item 6), four nuts (figure 7, item 7), four flat washers (figure 7, item 8), and four new lockwashers (figure 7, item 9).
2. Position the navigator's seat (figure 7, item 1) and pedestal (figure 7, item 4) on the base (figure 7, item 5) as an assembly.

NOTE

The seat and pedestal will swivel on the base until the clamp is tightened. Before fully tightening the clamp, ensure that the seat is positioned facing the desired direction.

3. While one crewmember supports the navigator's seat (figure 7, item 1), the second crewmember installs the clamp (figure 7, item 3) and tightens the nut (figure 7, item 2).

PILOTHOUSE CONSOLE ILLUMINATION LIGHT BULB REPLACEMENT**REMOVAL**

1. At the general alarm and emergency lighting distribution panel, set to OFF the STALK LIGHTS (figure 8, item 1) and PILOTHOUSE ILLUMINATION (figure 8, item 2) circuit breakers. Lock out and tag out (FM 55-502).



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement with the circuit energized may result in injury or death.

2. Turn the ON/OFF switch (figure 9, item 1) past the OFF position until it clicks.
3. Pull the ON/OFF switch (figure 9, item 1) out of the pilothouse console illumination light assembly (figure 9, item 2).
4. Push IN slightly and turn the bulb (figure 9, item 3) approximately 1/8 turn counterclockwise. Remove the bulb.

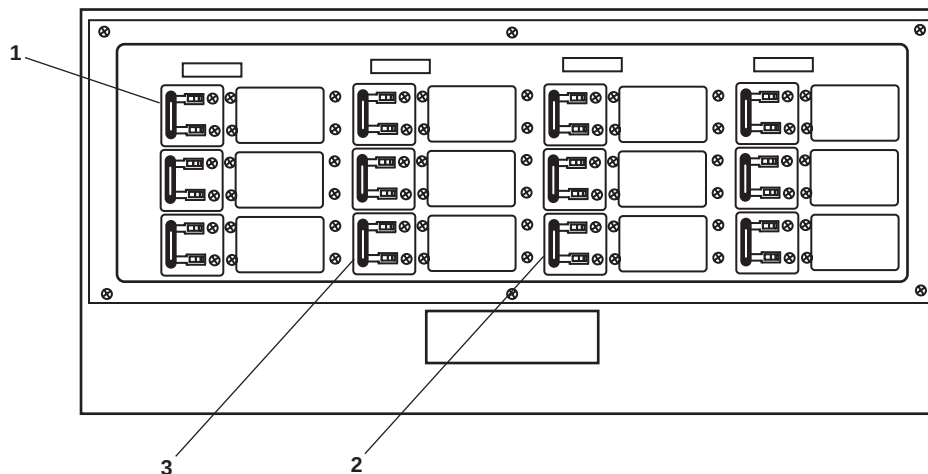


Figure 8. General Alarm and Emergency Lighting Distribution Panel

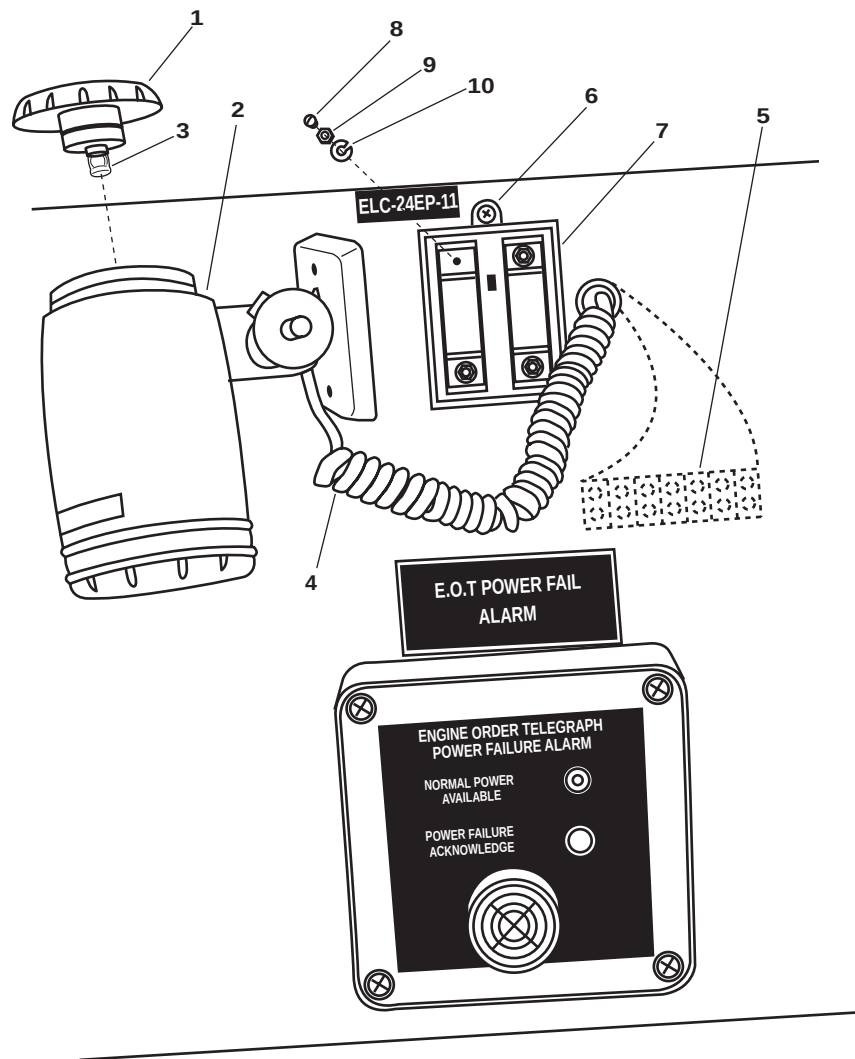


Figure 9. Pilothouse Console Illumination Light

INSTALLATION

1. Position a new bulb (figure 9, item 3) in the ON/OFF switch (figure 9, item 1), push it straight IN, and turn it approximately 1/8 turn clockwise to latch it.
2. Position the ON/OFF switch (figure 9, item 1) in the pilothouse console illumination light assembly (figure 9, item 2) and turn it toward the ON position until it clicks into place.
3. Remove the lockouts and tagouts (FM 55-502) installed during step 1 of the Removal procedure.
4. Set to ON the circuit breakers set to OFF during step 1 of the Removal procedure and return the unit to the desired readiness condition (TM 55-1925-273-10).

PILOTHOUSE CONSOLE ILLUMINATION LIGHT REPLACEMENT

REMOVAL

1. At the general alarm and emergency lighting distribution panel, set to OFF the STALK LIGHTS (figure 8, item 1) and PILOTHOUSE ILLUMINATION (figure 8, item 2) circuit breakers. Lock out and tag out (FM 55-502).



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement with the circuit energized may result in injury or death.

2. Use a multimeter to check for available voltage at the pilothouse console illumination light wiring (figure 9, item 4) terminals on the terminal block (figure 9, item 5). If voltage is present, ensure that the proper circuit breakers are secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the pilothouse console illumination light wiring (figure 9, item 4) terminals at the terminal block (figure 9, item 5).
4. Press IN on the locking tab (figure 9, item 6) and slide the pilothouse console illumination light (figure 9, item 2) from its base (figure 9, item 7).
5. Remove the four screws (figure 9, item 8), four nuts (figure 9, item 9) and four lockwashers (figure 9, item 10) securing the base (figure 9, item 7) to the console. Discard the lockwashers and remove the base.

INSTALLATION

1. Position the base (figure 9, item 7) on the console and secure it with four screws (figure 9, item 8), four nuts (figure 9, item 9) and four new lockwashers (figure 9, item 10).
2. Slide the pilothouse console illumination light (figure 9, item 2) into the base (figure 9, item 7) until the lock tab (figure 9, item 6) clicks and secures the pilothouse console illumination light.
3. Connect the pilothouse console illumination light wiring (figure 9, item 4) terminals at the terminal block (figure 9, item 5). Remove the labels installed during removal.
4. Remove the lockouts and tagouts (FM 55-502) installed during step 1 of the Removal procedure.
5. Set to ON the circuit breakers set to OFF during step 1 of the Removal procedure and return the unit to the desired readiness condition (TM 55-1925-273-10).

PILOTHOUSE ALARM PANEL LED REPLACEMENT

REMOVAL

1. At the general alarm and emergency lighting panel, set to OFF the PILOT HOUSE ALARM PNL circuit breaker (figure 8, item 3). Lock out and tag out (FM 55-502).
2. Remove the four screws (figure 10, item 1), four nylock nuts (figure 10, item 2), and four nylon washers (figure 10, item 3) that secure the pilothouse alarm panel (figure 10, item 4) to the port main console. Remove the alarm panel from the port main console.

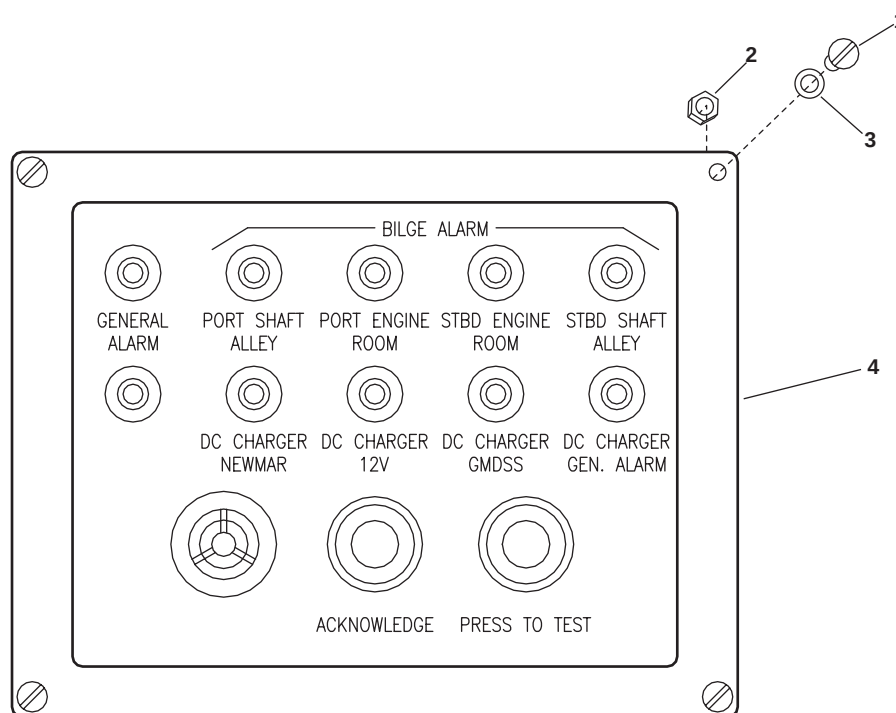


Figure 10. Pilothouse Alarm Console



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement with the circuit energized may result in injury or death.

3. Use a multimeter to check for available voltage at the terminal block (figure 11, item 1). If voltage is present, ensure that the proper circuit breakers are secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Cut the wire ties (figure 11, item 2) from the wire harness (figure 11, item 3) as necessary to determine which wires lead to the defective LED.
5. At the terminal block (figure 11, item 1), label and disconnect the wiring (figure 11, item 3) to the defective LED.
6. Remove the nut (figure 12, item 1) and star washer (figure 12, item 2) and remove the LED (figure 12, item 3) and its integral wiring from the pilothouse alarm panel (figure 12, item 4). Discard the star washer.

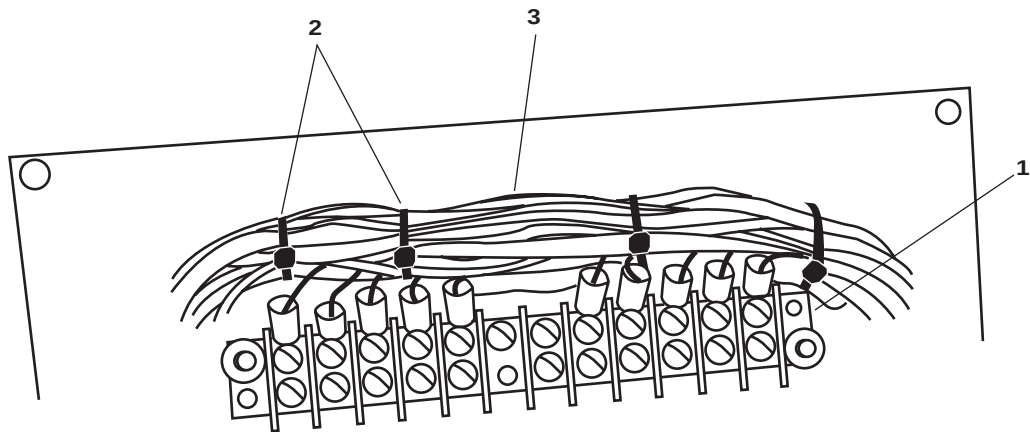


Figure 11. Pilothouse Alarm Console (Back Side)

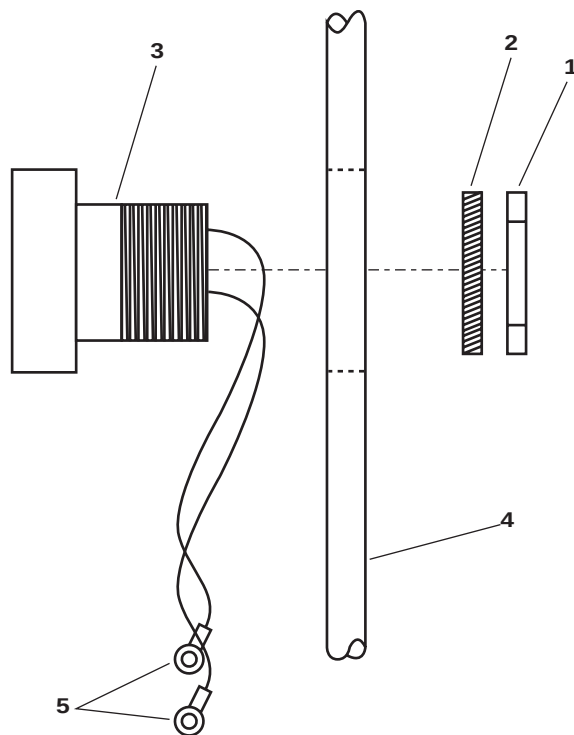


Figure 12. LED Replacement

INSTALLATION

1. Position the LED (figure 12, item 3) and its integral wiring in the pilothouse alarm panel (figure 12, item 4) and secure it with the nut (figure 12, item 1) and a new star washer (figure 12, item 2).
2. Crimp new solderless connectors to the wiring (figure 12, item 5) to match the connectors used on the removed LED (figure 12, item 3).
3. Connect the wiring (figure 11, item 3) at the terminal block (figure 11, item 1) and secure the wire harness (figure 11, item 3) using new wire ties.
4. Position the pilothouse alarm panel (figure 10, item 4) on the port main console and secure it with four screws (figure 10, item 1), four new nylock nuts (figure 10, item 2), and four nylon washers (figure 10, item 3).
5. Remove the lockouts and tagouts (FM 55-502) installed in step 1 of the Removal procedure.
6. Set to ON the PILOT HOUSE ALARM PNL circuit breaker (figure 8, item 3).

PILOTHOUSE ALARM PANEL PUSHBUTTON REPLACEMENT

REMOVAL

1. At the general alarm and emergency lighting panel, set to OFF the PILOT HOUSE ALARM PNL circuit breaker (figure 8, item 3). Lock out and tag out (FM 55-502).
2. Remove the four screws (figure 10, item 1), four nylock nuts (figure 10, item 2), and four nylon washers (figure 10, item 3) that secure the alarm panel (figure 10, item 4) to the port main console. Remove the alarm panel from the port main console.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement with the circuit energized may result in injury or death.

3. Use a multimeter to check for available voltage at the terminal block (figure 11, item 1). If voltage is present, ensure that the proper circuit breakers are secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Loosen, but do not remove, the tension screw (figure 13, item 1).
5. Label and disconnect the wiring (figure 13, item 2) from the pushbutton contact block (figure 13, item 3).
5. Pull OUT on the locking tab (figure 13, item 4) and separate the contact block (figure 13, item 3) from the operator (figure 13, item 5). Remove the operator from the pilothouse alarm panel (figure 13, item 6).

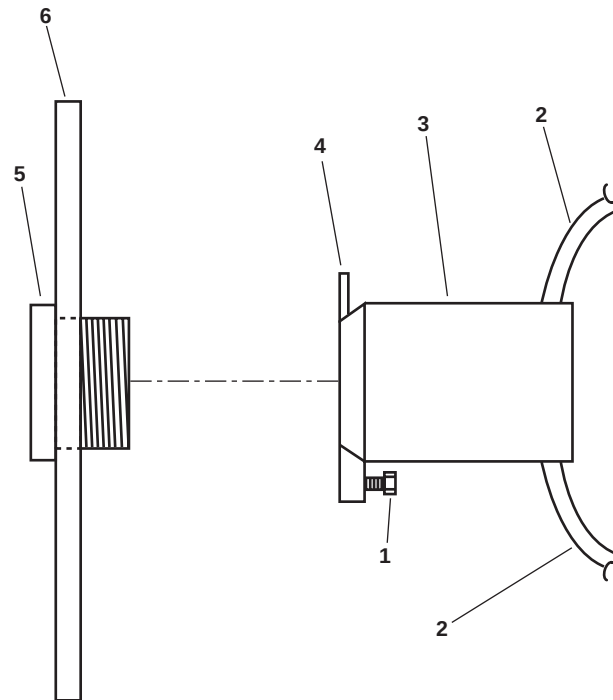


Figure 13. Pilothouse Alarm Panel Pushbutton Replacement

INSTALLATION

1. Position the operator (figure 13, item 5) in the pilothouse alarm panel (figure 13, item 6).
2. Place the contact block (figure 13, item 3) over the operator (figure 13, item 5) and jiggle it into position. Push IN on the lock tab (figure 13, item 4) and secure the contact block to the operator.
3. Snug the tension screw (figure 13, item 1).
4. Connect the wiring (figure 13, item 2) to the contact block (figure 13, item 3) and remove the labels installed during removal.
5. Position the pilothouse alarm panel (figure 10, item 4) on the port main console and secure it with four screws (figure 10, item 1), four new nylock nuts (figure 10, item 2), and four nylon washers (figure 10, item 3).
6. Remove the lockouts and tagouts (FM 55-502) installed in step 1 of the Removal procedure.
7. Set to ON the PILOT HOUSE ALARM PNL circuit breaker (figure 8, item 3).

PILOTHOUSE ALARM PANEL BUZZER REPLACEMENT

REMOVAL

1. At the general alarm and emergency lighting panel, set to OFF the PILOT HOUSE ALARM PNL circuit breaker (figure 8, item 3). Lock out and tag out (FM 55-502).
2. Remove the four screws (figure 10, item 1), four nylock nuts (figure 10, item 2), and four nylon washers (figure 10, item 3) that secure the alarm panel (figure 10, item 4) to the port main console. Remove the alarm panel from the port main console.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement with the circuit energized may result in injury or death.

3. Use a multimeter to check for available voltage at the terminal block (figure 11, item 1). If voltage is present, ensure that the proper circuit breakers are secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and disconnect the wiring (figure 14, item 1) at the terminals (figure 14, item 2).
5. Unscrew the face ring (figure 14, item 3) and remove the buzzer (figure 14, item 4) from the pilothouse alarm panel (figure 14, item 5).

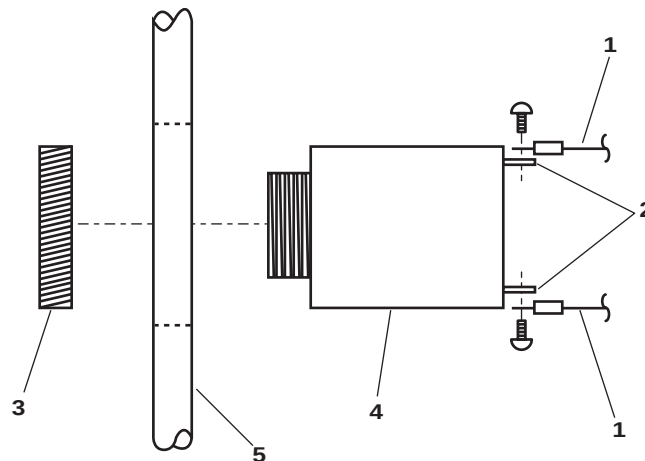


Figure 14. Pilothouse Alarm Panel Buzzer Replacement

INSTALLATION

1. Position the buzzer (figure 14, item 4) in the pilothouse alarm panel (figure 14, item 5) and secure it with the face ring (figure 14, item 3).
2. Connect the wiring (figure 14, item 1) to the terminals (figure 14, item 2) and remove the labels installed during removal.
3. Position the pilothouse alarm panel (figure 10, item 4) on the port main console and secure it with four screws (figure 10, item 1), four new nylock nuts (figure 10, item 2), and four nylon washers (figure 10, item 3).
4. Remove the lockouts and tagouts (FM 55-502) installed in step 1 of the Removal procedure.
5. Set to ON the PILOT HOUSE ALARM PNL circuit breaker (figure 8, item 3).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MAIN ENGINE PRELUBRICATION OIL PUMP, PUMP END; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
 Suitable Drain Pan

Personnel Required:

One Watercraft Engineer, 88L

Reference:

FM 55-502
 TB 43-0218
 WP 0096 00
 WP 0295 00 (volume 2)
 WP 0297 00 (volume 2)
 WP 0307 00 (volume 2)

Materials/Parts:

Sealing Compound, Anti-Seize (Item 154, Table 1, WP 0307 00, Volume 2)
 Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
 Pump Unit, Rotary (Item 3, Figure 10, WP 0297 00, Volume 2)

Equipment Conditions:

CLOSE valve LO-47 C.O.V. PRELUBE PMP. DISCH or valve LO-48 C.O.V. PMP. DISCH. Lock out and tag out (FM 55-502).
 Main engine prelubrication pump electric motor removed (WP 0096 00).

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lock wire 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.

PUMP REPLACEMENT**REMOVAL**

1. Position a suitable drain pan beneath the pressure gauge plug (figure 1, item 1).

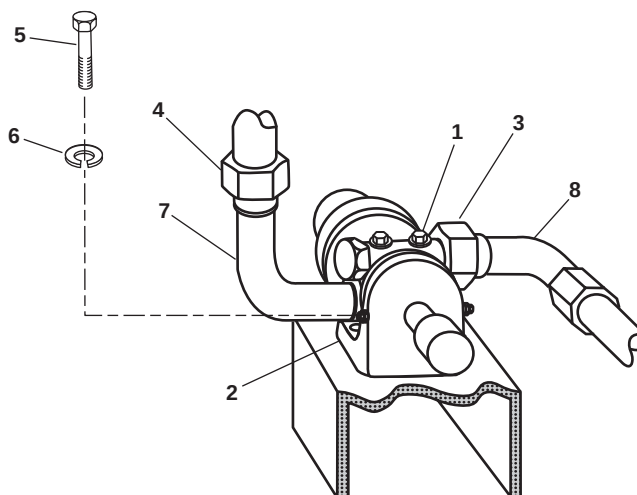
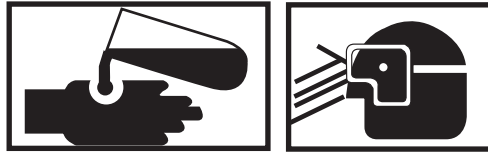


Figure 1. Main Engine Prelubrication Pump

WARNING

Oil 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.

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.

2. Slowly OPEN the pressure gauge plug (figure 1, item 1) to relieve pressure from the main engine prelubrication pump (figure 1, item 2). Allow the lube oil to drain into the suitable drain pan.

! CAUTION

Never disconnect piping unions with only one wrench. Damage to the vessel's piping or to the pump's piping could occur. Always use the two wrench method.

3. Using the two wrench method, disconnect the inlet union (figure 1, item 3) and the outlet union (figure 1, item 4) from the vessel's piping.
4. Remove the two bolts (figure 1, item 5) and two lockwashers (figure 1, item 6) that secure the main engine prelubrication pump (figure 1, item 2) to the foundation, and remove the main prelubrication pump (figure 1, item 2). Discard the lockwashers.
5. Remove the outlet piping elbow (figure 1, item 7) and the inlet piping elbow (figure 1, item 8) from the main engine prelubrication pump (figure 1, item 2).

INSTALLATION

1. Install the outlet piping elbow (figure 1, item 7) and the inlet piping elbow (figure 1, item 8) on the main engine prelubrication pump (figure 1, item 2).
2. Install the main engine prelubrication pump (figure 1, item 2) on the foundation, and secure it with the two bolts (figure 1, item 5) and two new lockwashers (figure 1, item 6). Do not tighten the bolts at this time.

! CAUTION

Never connect piping unions with only one wrench. Damage to the vessel's piping or to the pump's piping could occur. Always use the two wrench method.

3. Using the two wrench method, install the inlet union (figure 1, item 3) and the outlet union (figure 1, item 4) to the vessel's piping.

4. Tighten the bolts (figure 1, item 5) to secure the main engine prelubrication pump (figure 1, item 2) to the foundation.
5. Perform the Main Engine Prelubrication Pump Electric Motor Replacement Installation procedure (WP 0096 00).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MAIN ENGINE PRELUBRICATION OIL PUMP, ELECTRIC MOTOR; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
 WP 0295 00, Volume 2)
 Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
 Volume 2)
 Motor, Alternating C (Item 1, Figure 10,
 WP 0297 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 TB 43-0218
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0297 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the MAIN ENGINE LUBE OIL PRIMING PUMP No. 1. circuit breaker or the MAIN ENGINE LUBE OIL PRIMING PUMP No. 2. circuit breaker in 440V power panel No. 1. 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.

REMOVAL**NOTE**

Electrical junction boxes may vary in size, shape, and mounting position of the box on the motor frame. Electrical junction box covers may vary in number and placement of screws holding the cover in place.

1. Remove the four screws (figure 1, item 1) holding the electrical junction box cover (top) (figure 1, item 2).
2. Remove the junction box cover (top) (figure 1, item 2).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

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

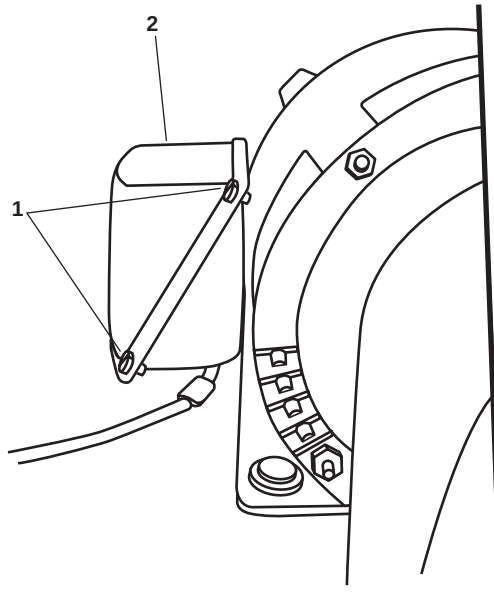


Figure 1. Electrical Junction Box

4. Label and remove the wiring.
5. Remove the two bolts (figure 2, item 1), two lockwashers (figure 2, item 2) and the two flat washers (figure 2, items 3) from the coupling guard (figure 2, item 4). Discard the lockwashers.
6. Remove the coupling guard (figure 2, item 4).
7. Loosen the motor coupling flange setscrew (figure 3, item 1).

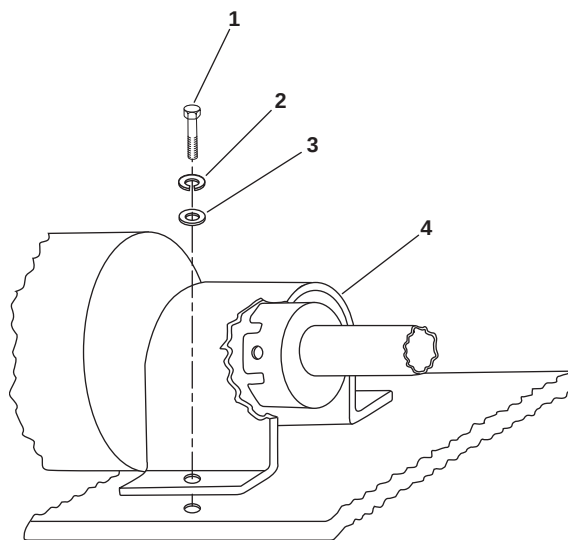


Figure 2. Coupling Guard

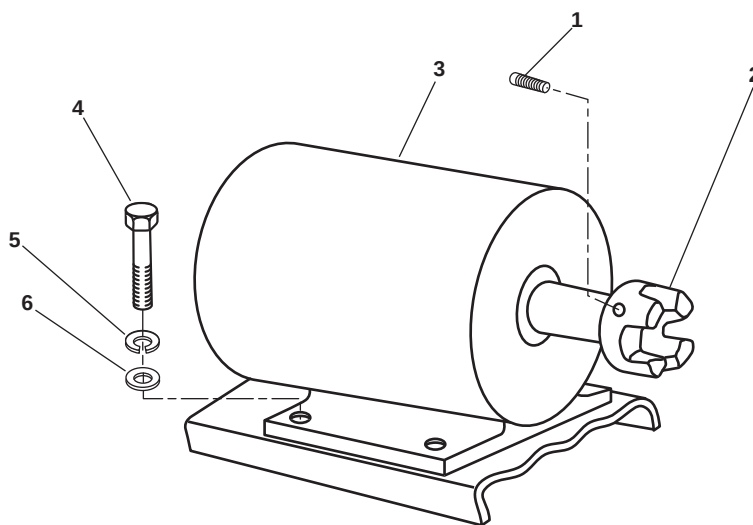


Figure 3. Electric Motor

8. Slide the motor coupling flange (figure 3, item 2) towards the motor (figure 3, item 3).
9. Remove the four bolts (figure 3, item 4), four lockwashers (figure 3, item 5), and the four flat washers (figure 3, item 5). Discard the lockwashers.
10. Remove the motor (figure 3, item 3) from the foundation.
11. Slide the motor coupling flange (figure 3, item 2) off the motor shaft.

INSTALLATION

1. Slide the motor coupling flange (figure 3, item 2) onto the motor shaft (refer to figure 3) with the flat end towards the motor (figure 3, item 3) housing.
2. Position the motor (figure 3, item 3) on the foundation with the mounting holes aligned.
3. Install the four bolts (figure 3, item 4), four new lockwashers (figure 3, item 5), and the four flat washers (figure 3, item 6). Do not tighten at this time.
4. Align the pump coupling flange (figure 4, item 1) and the motor coupling flange (figure 4, item 2) together leaving approximately 0.016 inch (0.41 mm) space between the ends of both flanges. Refer to figure 4.
5. Check the alignment between the pump coupling flange (figure 4, item 1) and the motor coupling flange (figure 4, item 2).
6. The maximum angular offset shall be 1 degree and maximum parallel offset shall be 0.015 inch (0.381 mm). Refer to figure 4.
7. Tighten the motor coupling flange setscrew (figure 3, item 1).
8. Tighten the four bolts (figure 3, item 4).

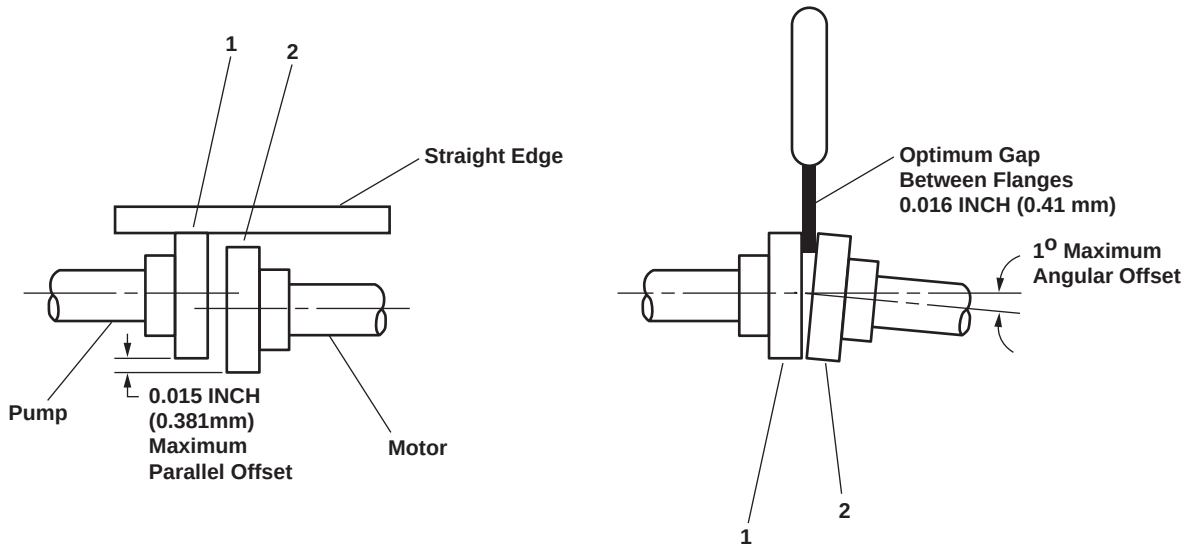


Figure 4. Alignment of Pump Coupling Flange and Motor Coupling Flange

9. Install the coupling guard (figure 2, item 4) with the two bolts (figure 2, item 1), two new lockwashers (figure 2, item 4), and the two flat washers (figure 2, items 3). Tighten the bolts.
10. Install the wiring using the labels from step 4 of Removal as a guide. Remove the labels.
11. Install the junction box cover (figure 1, item 2) and secure it with the screws (figure 1, item 1).
12. Remove the lockouts and tagouts (FM 55-502).
13. Operate the main engine prelubrication pump under usual conditions (TM 55-1925-273-10) and check for proper operation.
14. Return the main engine prelubrication pump to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
REDUCTION GEAR COOLING PUMP, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Multimeter (Item 16 Table 2, WP 0295 00, Volume 2)
Suitable Drain Pan

References (continued):

TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0297 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
Pump, Reduction Gear Cooling (Item 2, Figure 11, WP 0297 00, Volume 2)

Equipment Conditions:

Set to OFF the FRESH WATER PUMP No. 1, (REDUCTION GEAR), or the FRESH WATER PUMP No. 2, (REDUCTION GEAR). circuit breaker in 440V power panel No. 1. Lock out and tag out (FM 55-502).
CLOSE valves FWC-13, F.W. FR. RED. GEAR No. 1 TO KEEL CLR and FWC-15, F.W. FR. KEEL CLR TO RED. GEAR No. 1 or FWC-14, F.W. FR. RED. GEAR No. 2 TO KEEL CLR and FWC-16, F.W. FR. KEEL CLR TO RED. GEAR No. 2. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218

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.

REMOVAL

1. Remove the four screws (figure 1, item 1) that secure the junction box cover (figure 1, item 2).
2. Remove the junction box cover (figure 1, item 2) from the junction box (figure 1, item 3).

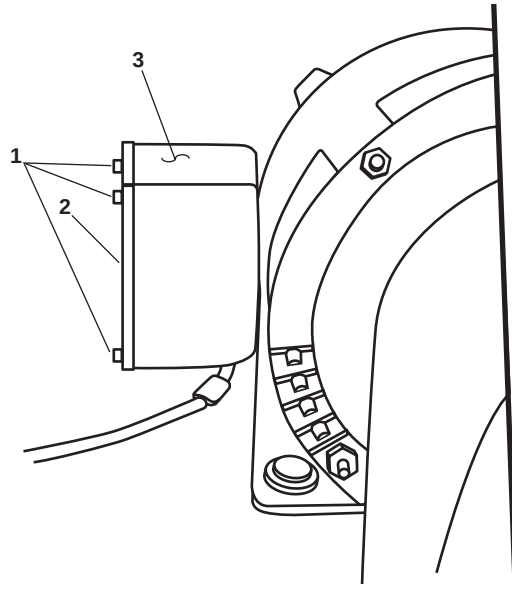


Figure 1. Electrical Junction Box

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the wiring in the junction box (figure 1, item 3). If voltage is present, check that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and remove the wiring in the junction box (figure 1, item 3).
5. Place a suitable drain pan under the reduction gear cooling pump (figure 2, item 1).
6. Disconnect the tubing (figure 2, item 2) from the discharge pressure cutoff valve (figure 2, item 3).
7. Remove the insulation from the elbow joint (figure 2, item 4).

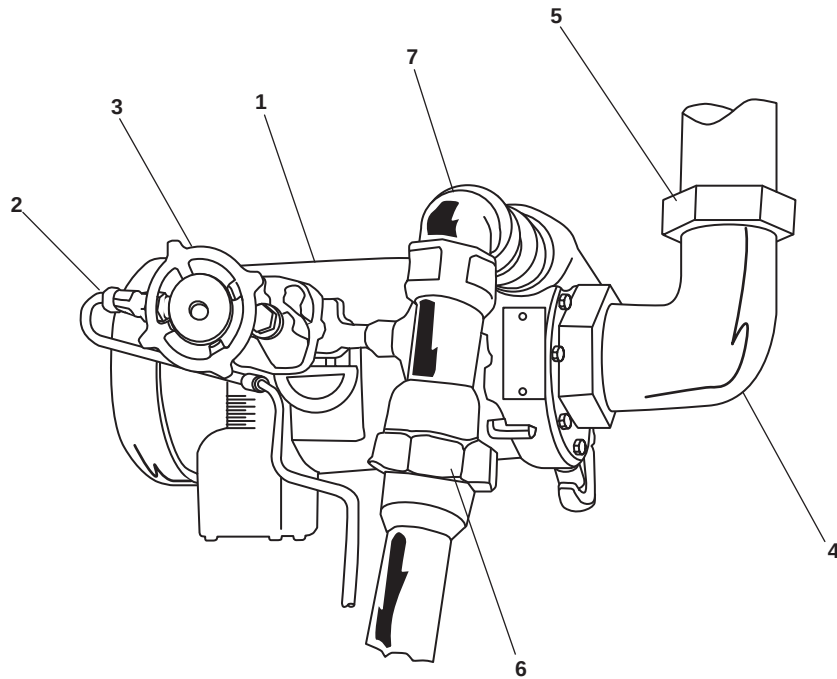
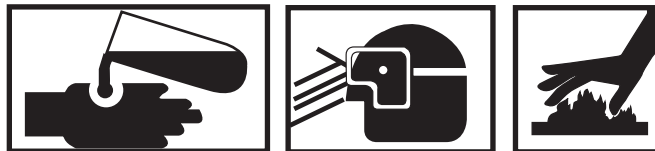


Figure 2. The Reduction Gear Cooling Pump Assembly

WARNING



Do not allow used antifreeze 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 antifreeze. Failure to comply can result in illness, serious injury, or death.

Always wear gloves when handling hot components. Handling hot components with bare hands or skin may result in severe burns.

⚠ CAUTION

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

8. Loosen, but do not disconnect, the union (figure 2, item 5) connecting the elbow joint (figure 2, item 4) to the reduction gear cooling pump (figure 2, item 1).

9. Permit water from the union (figure 2, item 5) to drain into the suitable drain pan. After the coolant stops draining, disconnect the union.
10. Disconnect the union (figure 2, item 6) at the reduction gear cooling pump outlet (figure 2, item 7).
11. Remove bolts (figure 3, item 1), lockwashers (figure 3, item 2), and flat washers (figure 3, item 3). Discard the lockwashers.
12. Place the pump on a secure workstation and remove the elbows (figure 2, items 4 and 7) from the pump. Retain the elbows for installation on the replacement pump.

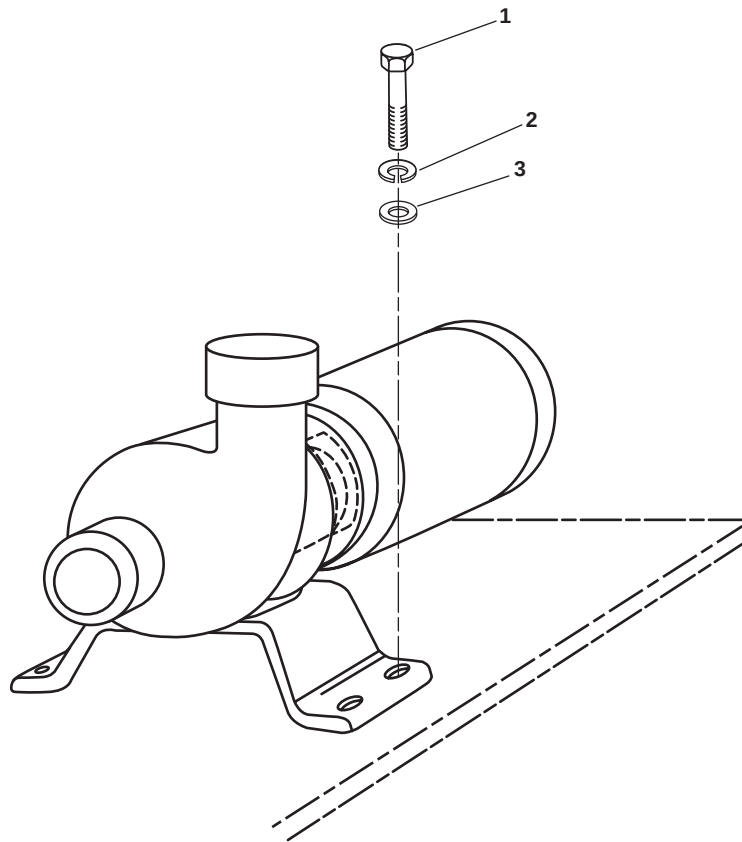


Figure 3. The Reduction Gear Cooling Pump Assembly (Mounting Hardware)

INSTALLATION

1. Thoroughly clean the pipe threads on the elbows (figure 2, items 4 and 7) of all old sealant.

 CAUTION

Although antiseizing tape is necessary on the elbow joint pipe threads, none will be allowed or necessary on the union threads. Leakage will result from applying antiseizing tape to union threads.

2. Apply antiseizing tape onto the threaded end of the elbow joint (figure 2, item 4). Do not apply sealant tape to the unions (figure 2, items 5 and 6) or their threads.
3. Install the elbow joints (figure 2, item 4 and 7) into the pump (figure 2, item 1) and tighten the elbow joints. After the elbow joints are tightened, they must be aligned to mate with the cooling piping at the pump's foundation.
4. Position the reduction gear cooling pump on the foundation, install the bolts (figure 3, item 1) with new lockwashers (figure 3, item 2) and flat washers (figure 3, item 3). Do not tighten the bolts at this time.
5. Connect the unions (figure 2, items 5 and 6) onto the vessel's existing piping. Minor reorientation of the elbows (figure 2, items 4 and 7) may be necessary to properly align the unions.

 CAUTION

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

6. Tighten the unions (figure 2, items 5, and 6) securely.
7. Tighten the bolts (figure 3 item 4) to secure the pump to the foundation.
8. Clean all the old antiseizing tape off of the threads of the discharge pressure cutoff valve (figure 2, item 3). Apply antiseizing tape to the tubing connection (figure 2, item 2) threads and connect the tubing to the discharge pressure cutoff valve (figure 2, item 3).
9. Connect the wiring in the junction box (figure 1, item 3) using the labels from step 4 of Removal as a guide. Remove the labels.
10. Install the junction box cover (figure 1, item 2) and secure it in place with the four screws (figure 1, item 1).
11. Remove the lockouts and tagouts (FM 55-502).
12. Operate the reduction gear cooling pump under normal conditions (TM 55-1925-273-10) and check for leaks and proper operation.
13. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
KEEL COOLERS, INSPECT**

INITIAL SETUP:**Tools and Special Tools:**

Flashlight (Item 22, Table 2, WP 0295 00)
Gloves, Leather (Item 37, WP 0295 00)

Reference:

FM 55-502
WP 0295 00
WP 0307 00

Materials/Parts:

Rag, Wiping (Item 139, Table 1, WP 0307 00)

Equipment Conditions:

Vessel operating on shore power
Confined Space Entry Permit secured (FM 55-502) for both port and starboard shaft alleys
CLOSE valves CA-8 STG AIR TO ME #2, CA-9 STG AIR TO ME # 1, FO-21 F.O. SPLY TO S.S.D.G. No.1, and FO-22 F.O. SPLY TO S.S.D.G No.2.
Lock out and tag out (FM 55-502)

Personnel Required:

One Crewmember any MOS trained in Confined Space Entry
One Confined Space Entry Supervisor/Attendant
One Watercraft Engineer, 88L

MAIN PROPULSION KEEL COOLER INSPECTION

WARNING

Entry into an uninspected confined space may result in death or serious injury to personnel. Only properly trained personnel may enter confined spaces, or act as entry supervisors and/or attendants for those working in confined spaces. Before entering into a confined space, the space must be cleared for entry and a Confined Space Entry Permit must be secured. All entry into confined spaces must be in accordance with the Organizational Confined Space Entry Standard Operating Procedure and FM 55-502. Failure to comply with this warning may result in serious personal injury or death.

The keel coolers work area can be very hot. Wear protective leather gloves. Failure to comply with this warning may result in personal injury or death.

1. Enter into the port shaft alley and, using a flashlight, visually inspect around the PORT side main engine keel cooler piping (figure 1, item 1) and valves, checking for obvious wear, rust, or coolant leakage.
2. Inspect the coolant piping extending between the PORT side keel cooler piping (figure 1, item 1) and the main engine 2 (figure 1, item 2) for obvious wear, rust, or coolant leakage.
3. Repeat steps 1 and 2 for the STARBOARD keel cooler piping (figure 1, item 3) inspection, entering the starboard shaft alley and inspect from the STARBOARD keel cooler piping to the main engine 1 (figure 1, item 4).
4. Perform the Follow-On Service procedure at the end of this work package.

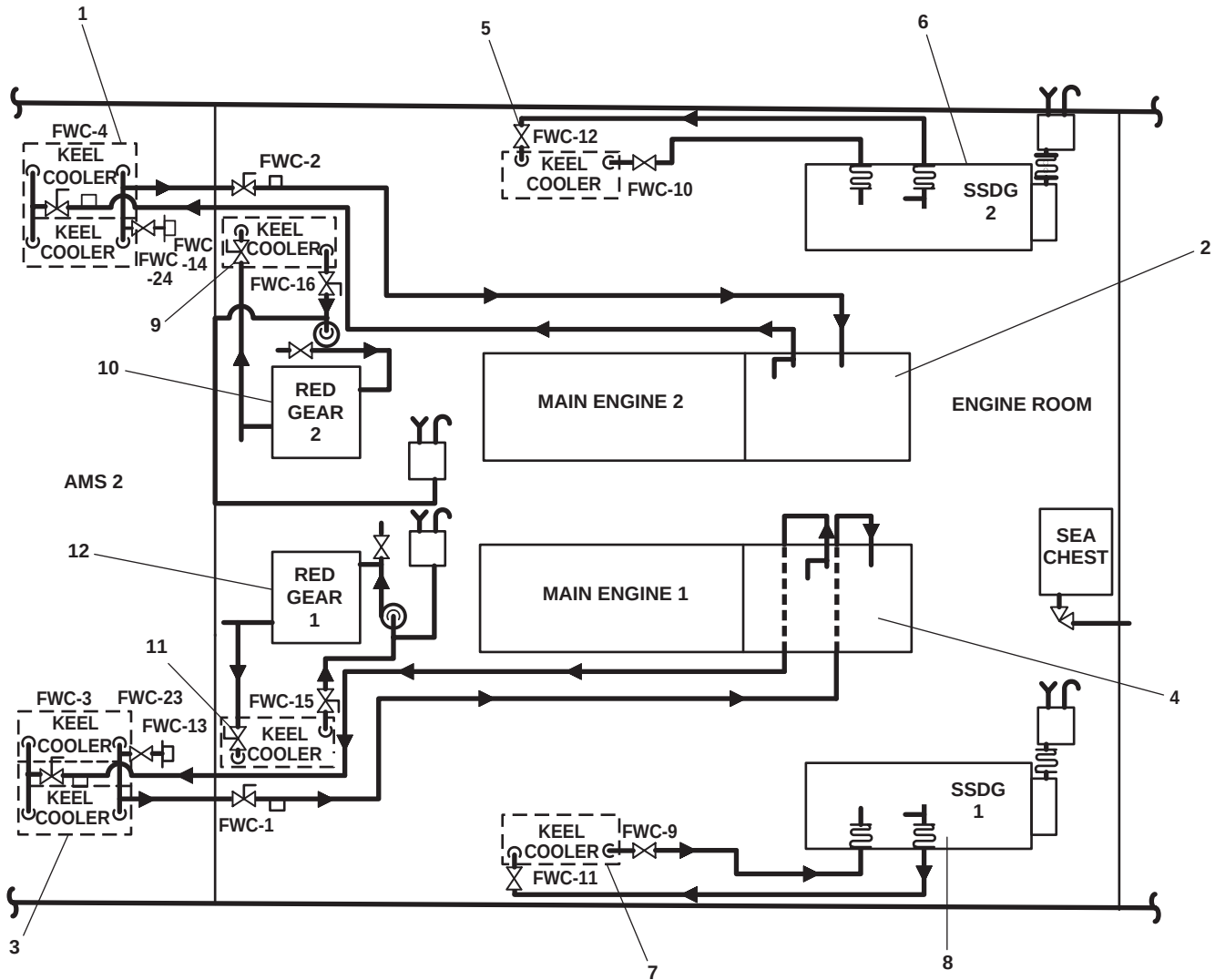


Figure 1. Keel Cooler Piping

SHIP'S SERVICE DIESEL GENERATOR (SSDG) KEEL COOLER INSPECTION

WARNING

Work area can be very hot. Wear protective leather gloves. Failure to comply with this warning may result in personal injury or death.

1. Enter into the bilge and, using a flashlight, visually inspect around the PORT side SSDG keel cooler piping (figure 1, item 5) and valves checking for obvious wear, rust, or coolant leakage.
2. Inspect the coolant piping extending between the PORT side keel cooler (figure 1, item 5) and SSDG 2 (figure 1, item 6).
3. Enter into the bilge and, using a flashlight, visually inspect around the STARBOARD side SSDG keel cooler piping (figure 1, item 7) and valves checking for obvious wear, rust, or coolant leakage.

4. Inspect the coolant piping extending between the PORT side keel cooler (figure 1, item 7) to SSDG 1 (figure 1, item 8).
5. Perform the Follow-On Service procedure at the end of this work package.

REDUCTION GEAR KEEL COOLER INSPECTION

1. Enter into the bilge and, using a flashlight, visually inspect around the PORT side reduction gear keel cooler piping (figure 1, item 9) and valves, checking for obvious wear, rust, or coolant leakage.
2. Inspect the coolant piping extending between the PORT side keel cooler (figure 1, item 9) and reduction gear 2 (figure 1, item 10).
3. Enter into the bilge and, using a flashlight, visually inspect around the STARBOARD side reduction gear keel cooler piping (figure 1, item 11) and valves, checking for obvious wear, rust, or coolant leakage.
4. Inspect the coolant piping extending between the STARBOARD side keel cooler (figure 1, item 11) and the reduction gear 1 (figure 1, item 12).
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. Return the vessel to the desired operating condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LUBE OIL SYSTEM VALVES, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 1, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
 Suitable Drain Pan

Reference:

FM 55-502
 MIL-STD-769
 S9086-VH-STM-010/CH-635
 TB 43-0218
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Materials/Parts:

Dry Cleaning Solvent (Item 57, Table 1, WP 0307 00, Volume 2)
 Rag, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
 Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
 Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)

Equipment Conditions:

Set to OFF the LUBE OIL TRANSFER PUMP. circuit breaker in 440V power panel No. 1. Lock out and tag out (FM 55-502).
 Set to OFF the MAIN ENGINE LUBE OIL PRIMING PUMP No. 1. or the MAIN ENGINE LUBE OIL PRIMING PUMP No. 2. circuit breaker in 440V power panel No. 1. Lock out and tag out (FM 55-502).
 CLOSE all affected valves upstream and downstream of the valve being replaced. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

WARNING

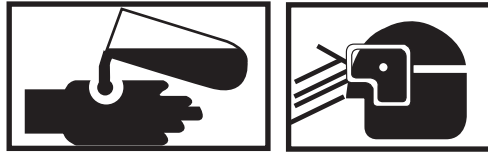
Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death, injury, or damage to equipment. In accordance with TB 43-0218, ensure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

NOTE

The valve replacement procedures in this work package are for typical valves used in the lube oil system. Actual removal and installation of the valves in this work package may differ slightly from the procedures as written.

REPLACE TYPICAL ONE-INCH BALL VALVE (FLANGE)**REMOVAL**

1. Place a suitable drain pan under the ball valve (figure 1, item 1).

WARNING

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, serious injury, or death.

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.

2. Slowly loosen the four bolts (figure 1, item 2), and allow any pressure to vent and fluid to drain into the suitable drain pan.
3. Remove the four bolts (figure 1, item 2) and the four nuts (figure 1, item 3).
4. Remove and discard the gasket (figure 1, item 4).
5. Loosen and remove the four bolts (figure 1, item 5) and the four nuts (figure 1, item 6) on the opposite side of the valve (figure 1, item 1).
6. Remove the valve (figure 1, item 1) from the from the vessel's piping.
7. Remove and discard the gasket (figure 1, item 7).

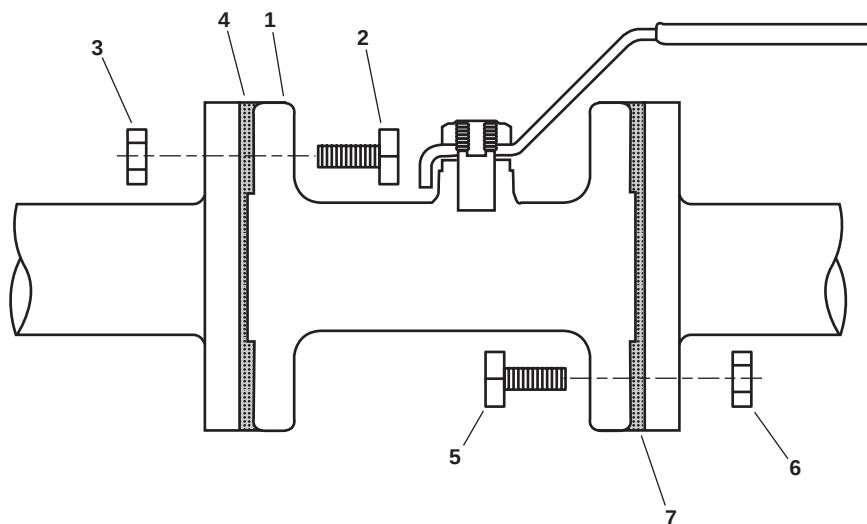
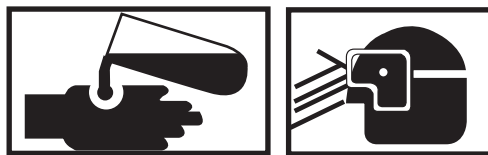


Figure 1. Typical Ball Valve (Flanged)

INSTALLATION**WARNING**

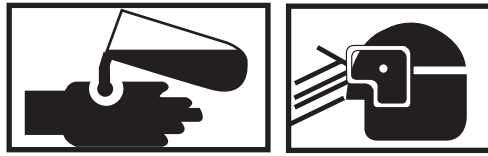
Removing components by means of wire brushing produces flying particles. These particles can cause serious injury to personnel. Protective goggles, gloves, and long sleeves must be worn at all times during wire brushing operations. Failure to comply with this warning can result in serious injury or death.

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, serious injury, or death.

1. Using a wire brush and dry cleaning solvent, clean the flange surfaces of the valve (figure 1, item 1) and the vessel's piping.
2. Position the valve (figure 1, item 1) between the vessel's piping.
3. Install the new gaskets (figure 1, items 4 and 7) between the valve (figure 1, item 1) and the vessel's piping.
4. Install the four bolts (figure 1, item 2) and four nuts (figure 1, item 3) to secure the valve (figure 1, item 1) to the vessel's standing piping. Tighten the bolts.
5. Install the four bolts (figure 1, item 5) and four nuts (figure 1, item 6) to secure the opposite side of the valve (figure 1, item 1) to the vessel's piping. Tighten the bolts.
6. Perform the Follow-On Service procedure at the end of this work package.

REPLACE TYPICAL BALL VALVE (THREADED)**REMOVAL**

1. Place a suitable drain pan under the ball valve (figure 2, item 1).

WARNING

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, serious injury, or death.

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 unions with only one wrench. Damage to the vessel's piping or to the valve's piping could occur. Always use two wrenches.

2. Slowly loosen, but do not disconnect, the union (figure 2, item 2) connecting the vessel's piping to the valve (figure 2, item 1).

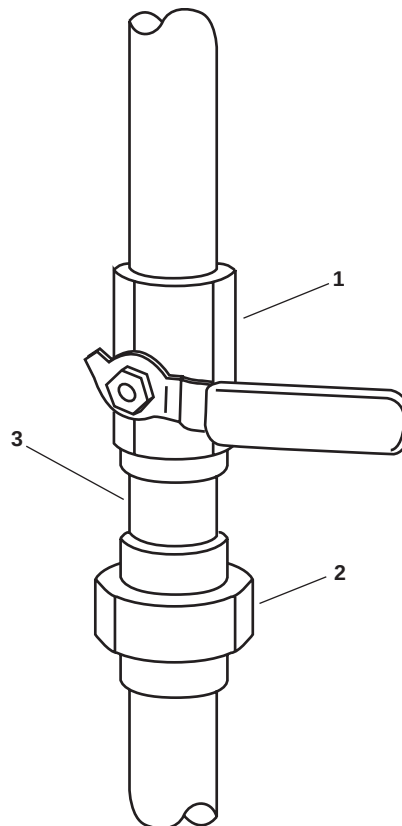


Figure 2. Typical Ball Valve (Threaded)

3. Permit any pressure to vent and any fluid to drain from the union (figure 2, item 2) into the suitable drain pan. After the lube oil stops draining, disconnect the union.
4. Disconnect the opposite end of the valve (figure 2, item 1) and remove it from the vessel's piping.
5. Remove the nipple (figure 2, item 3) from the valve (figure 2, item 1).

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 or death.

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, serious injury, or death.

1. Using a wire brush and dry cleaning solvent, clean the female threaded end of the valve (figure 2, item 1) and the male threaded end of vessel's piping.
2. Using a wire brush and dry cleaning solvent, clean the male threaded end of the nipple (figure 2, item 3).
3. Apply antiseizing tape to the male threaded end of the nipple (figure 2, item 3) and install the nipple into the valve (figure 2, item 1).

! CAUTION

Although antiseizing tape is necessary on the valve's connection pipe threads, none will be allowed or necessary on the union threads. Leakage will result from applying antiseizing tape to union threads.

4. Apply antiseizing tape to the male threaded end of the vessel's piping. Do not apply antiseizing tape to the union (figure 2, item 2) or its threads.
5. Install the valve (figure 2, item 1) in the vessel's piping.
6. Connect the union (figure 2, items 2) onto the vessel's piping.

! CAUTION

Never attempt to connect unions with only one wrench. Damage to the vessel's piping or to the valve's piping could occur. Always use two wrenches.

7. Tighten the union (figure 2, item 2) securely.
8. Perform the Follow-On Service procedure at the end of this work package.

REPLACE TYPICAL ANGLE HOSE GLOBE VALVE (FLANGED)**REMOVAL**

1. Place a suitable drain pan under the valve cap (figure 3, item 1).

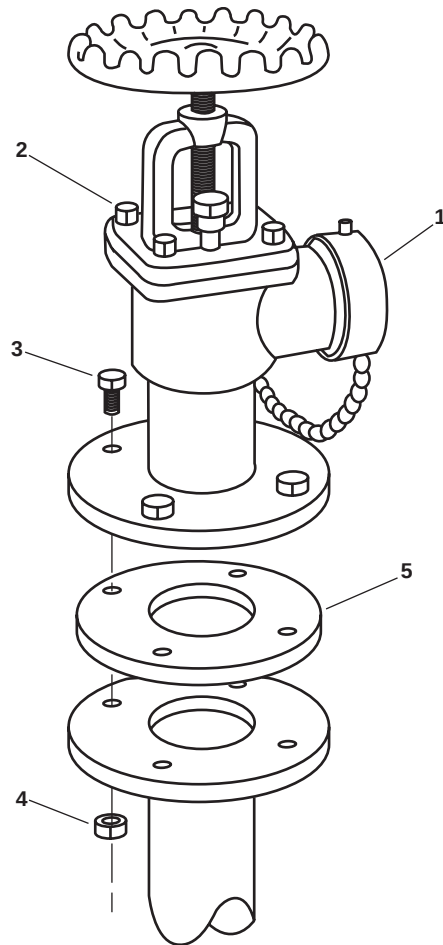
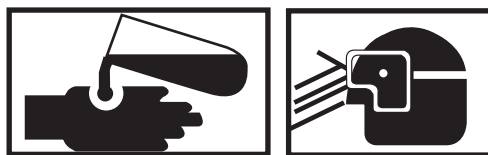


Figure 3. Typical Angle Hose Globe Valve (Flanged)

WARNING

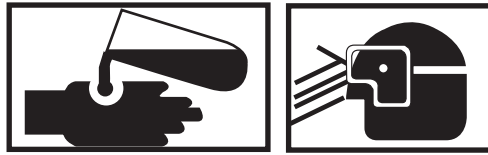
Do not allow hydraulic fluid, engine oil, or cleaning solvents to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling hydraulic fluid, engine oil, and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

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.

2. Remove the cap (figure 3, item 1) and slowly OPEN the valve (figure 3, item 2). Permit any pressure to vent and any fluid to drain from the valve into the suitable drain pan.
3. Remove the four bolts (figure 3, item 3) and four nuts (figure 3, item 4) that secure the valve (figure 3, item 2).
4. Remove the valve (figure 3, item 2) from the vessel's piping.
5. Remove and discard the gasket (figure 3, item 5).

INSPECTION

1. Inspect the connecting flange for corrosion, deformation, and scoring.
2. Inspect the cap (figure 3, item 1) threads for corrosion, deformation, and scoring.

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 or death.

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, serious injury, or death.

1. Using a wire brush and dry cleaning solvent, clean the piping flange of the vessel's piping.
2. Install a new gasket (figure 3, item 5) onto the piping flange of the vessel's piping.
3. Install the valve (figure 3, item 2) onto the flange on the vessel's piping, and secure it with the four bolts (figure 3, item 3) and the four nuts (figure 3, item 4).
4. Perform the Follow-On Service procedure at the end of this work package.

REPLACE TYPICAL GLOBE STOP CHECK VALVE**REMOVAL**

1. Place a suitable drain pan under the valve (figure 4, item 1).

! CAUTION

Loose-fitting, long-sleeved, and long-legged clothing is recommended to prevent irritation from exposure to insulation. Gloves are also recommended. Skin irritation can occur if the skin contacts insulation.

2. Slide the insulation sleeves (figure 4, items 2 and 3) off and away from the mounting flanges.
3. Partially OPEN the valve (figure 4, item 1) to equalize any pressure on both sides of the valve.
4. Note the direction of flow on the valve (figure 4, item 1) and the vessel's piping.

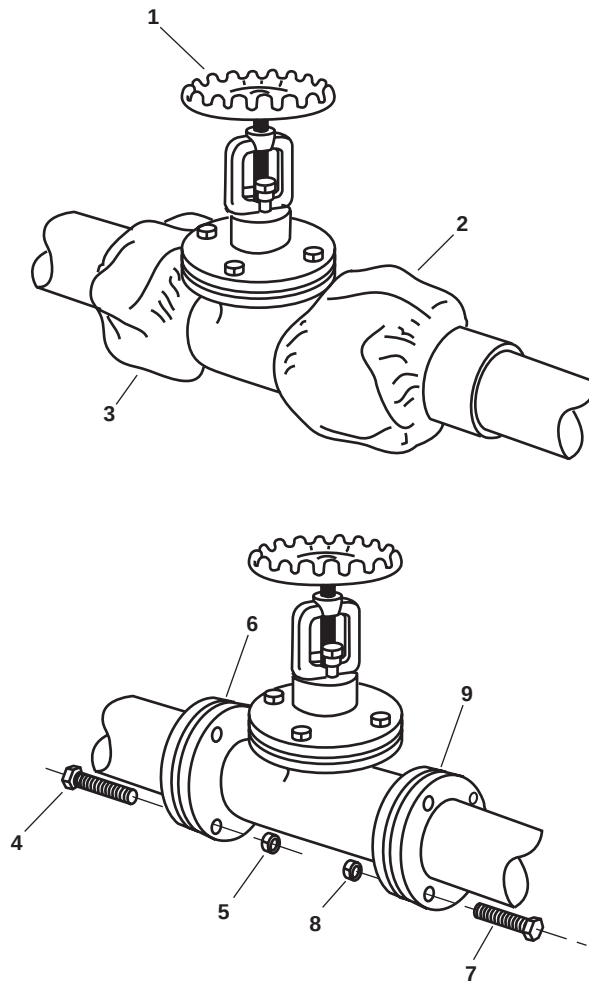
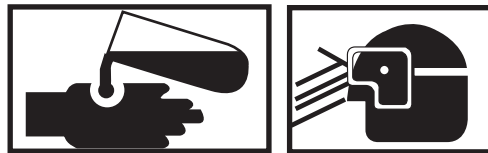


Figure 4. Typical Globe Stop Check Valve (Flanged)

WARNING



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, serious injury, or death.

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.

5. Slowly loosen the four bolts (figure 4, item 4) and nuts (figure 4, item 5). Permit any pressure to vent and any fluid to drain from the valve into the suitable drain pan.

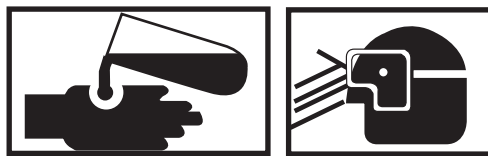
6. After the fluid drains from the valve (figure 4, item 1), remove the four bolts (figure 4, item 4) and four nuts (figure 4, item 5) that secure the valve.
7. Remove and discard the gasket (figure 4, item 6).
8. Loosen and remove the four bolts (figure 4, item 7) and nuts (figure 4, item 8).
9. Remove the valve (figure 4, item 1) from the vessel's piping.
10. Remove and discard the gasket (figure 4, item 9).

INSPECTION

1. Inspect the connecting flange for corrosion, deformation, and scoring.
2. Inspect the insulation sleeves (figure 4, items 2 and 3) for any rips, tears, or obvious damage.
3. Refer to MIL-STD-769 and S9086-VH-STM-010/CH-635 for repair and replacement of insulation.

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 or death.

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, serious injury, or death.

1. Using a wire brush and dry cleaning solvent, clean the piping flange of the vessel's piping.

⚠ CAUTION

During installation, verify the correct direction of flow. Failure to comply with this caution can result in pump failure.

2. Install the new gaskets (figure 4, items 6 and 9) onto the piping flanges of the vessel.
3. Place the valve (figure 4, item 1) in the vessel's piping using the direction of flow notes from step 4 of Removal as a guide.
4. Secure the valve (figure 4, item 1) to the vessel's piping with the four bolts (figure 4, item 4) and the four nuts (figure 4, item 5).

5. Install the four bolts (figure 4, item 7) and the four nuts (figure 4, item 8) to secure the opposite side of the valve (figure 4, item 1) to the vessel's piping.

CAUTION

Loose-fitting, long-sleeved, and long-legged clothing is recommended to prevent irritation from exposure to insulation. Gloves are also recommended. Skin irritation can occur if the skin contacts insulation.

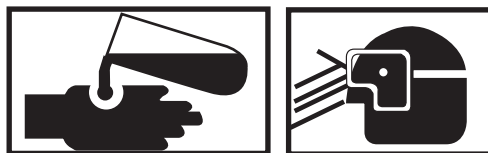
6. Install the insulation sleeves (figure 4, items 2 and 3) over the valve's (figure 4, item 1) flanges.
7. Perform the Follow-On Service procedure at the end of this work package.

REPLACE TYPICAL SWING CHECK VALVE (FLANGED)

REMOVAL

1. Place a suitable drain pan under the valve (figure 5, item 1).
2. Note the direction of flow on the valve (figure 5, item 1) and the vessel's piping.

WARNING



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, serious injury, or death.

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.

3. Slowly loosen the four bolts (figure 5, item 2) and nuts (figure 5, item 3). Permit any pressure to vent and any fluid to drain from the valve into the suitable drain pan.
4. After the fluid drains from the valve (figure 5, item 1) remove the four bolts (figure 5, item 2) and four nuts (figure 5, item 3).
5. Remove and discard the gasket (figure 5, item 4).
6. Remove the four bolts (figure 5, item 5) and nuts (figure 5, item 6) from the opposite side of the valve (figure 5, item 1).
7. Remove the valve (figure 5, item 1) from the vessel's piping.
8. Remove and discard the gasket (figure 5, item 7).

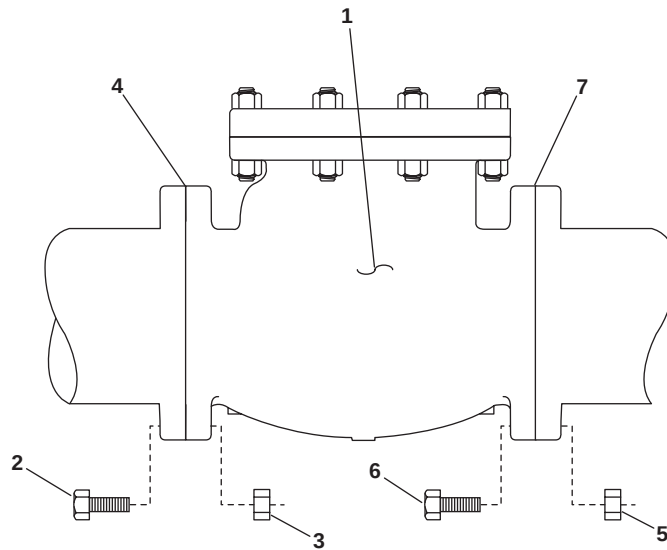
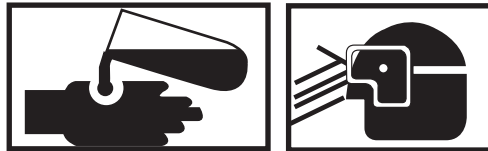


Figure 5. Typical Swing Check Valve (Flanged)

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 or death.

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, serious injury, or death.

1. Using a wire brush and dry cleaning solvent, clean the flange surfaces of the valve (figure 5, item 1) and the vessel's piping.
2. Install the new gaskets (figure 1, items 4 and 7) between the valve (figure 5, item 1) and the vessel's piping.

 CAUTION

During installation, verify the correct direction of flow. Failure to comply with this caution can result in pump failure.

3. Place the valve (figure 5, item 1) in the vessel's piping using the direction of flow notes from step 2 of Removal as a guide.
4. Secure the valve (figure 5, item 1) to the vessel's piping and secure it with the four bolts (figure 5, item 2) and four nuts (figure 5, item 3).
5. Install the four bolts (figure 5, item 5) and four nuts (figure 5, item 6) to secure the opposite side of the valve (figure 5, item 1) to the vessel's piping.
6. 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. Operate the lube oil system under usual conditions (TM 55-1925-273-10).
3. Check for leaks and for proper operation of the lube oil system.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LUBE OIL SYSTEM VALVES, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References:

WP 0099 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

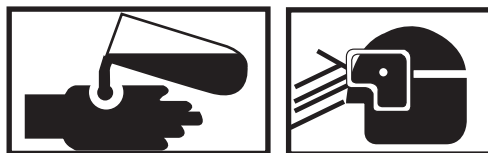
Rag, Wiping (Item 139, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Lube oil system valve removed (WP 0099 00).

Personnel Required:

One Watercraft Engineer, 88L

FLANGED BALL VALVE REPAIR**DISASSEMBLY****WARNING**

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 comply can result in death or serious injury.

1. Remove the nut (figure 1, item 1) and the handle (figure 1, item 2) from the valve body (figure 1, item 3).
2. Remove the gland nut (figure 1, item 4) from the valve body (figure 1, item 3).
3. Remove the gland nut packing (figure 1, item 5) from the valve body (figure 1, item 3). Discard the gland nut packing.
4. Remove the valve stem (figure 1, item 6) from the valve body (figure 1, item 3).
5. Remove the valve stem packing (figure 1, item 7) from the valve body (figure 1, item 3). Discard the valve stem packing.
6. Remove the retainer (figure 1, item 8) from the valve body (figure 1, item 3).
7. Remove the gasket (figure 1, item 9) from the valve body (figure 1, item 3). Discard the gasket.
8. Remove the valve seat (figure 1, item 10), the ball (figure 1, item 11), and the valve seat (figure 1, item 12) from the valve body (figure 1, item 3).

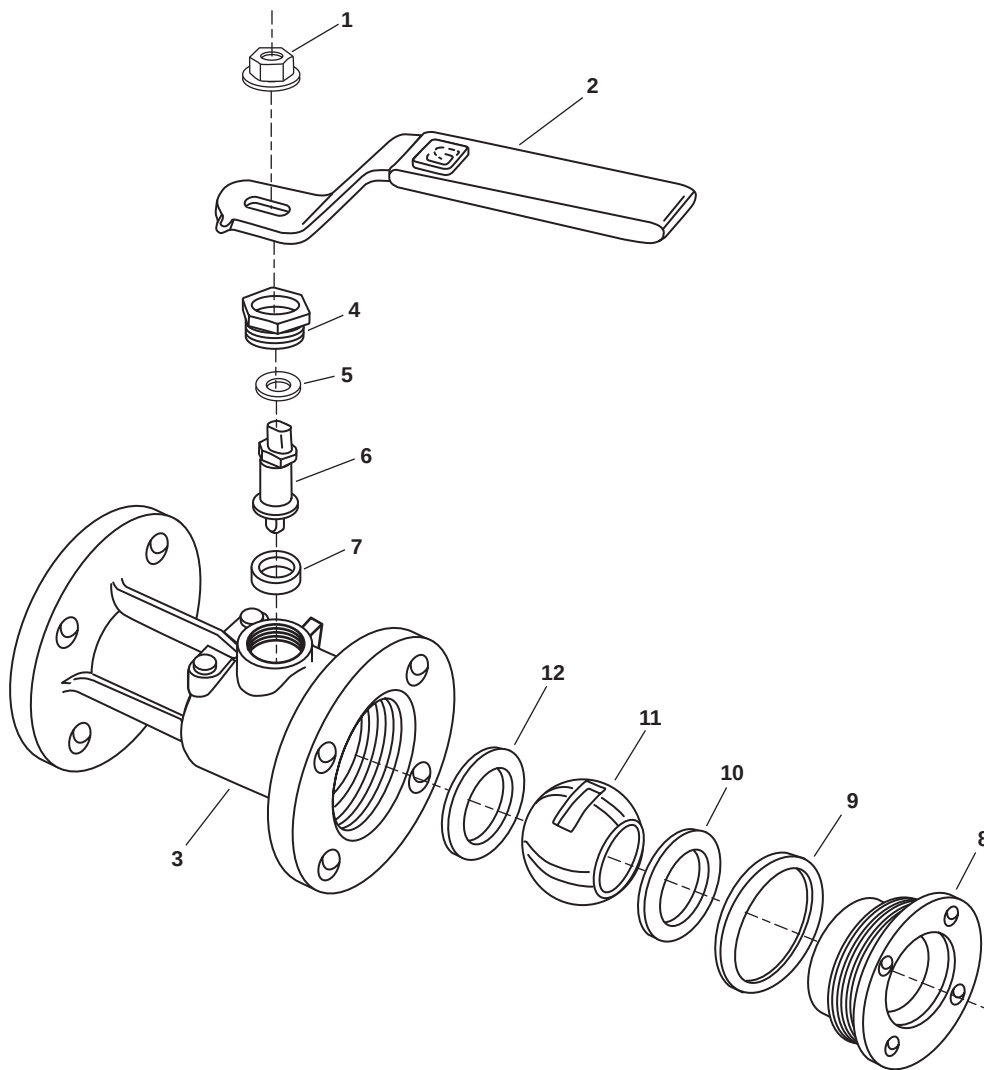
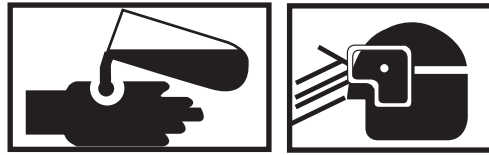


Figure 1. Flanged Ball Valve

ASSEMBLY

1. Inspect all valve components for wear and damage.
2. Clean the parts of the valve (figure 1, item 1) using clean wiping rags and water.
3. Install the valve seat (figure 1, item 12), the ball (figure 1, item 11), the valve seat (figure 1, item 10), and a new gasket (figure 1, item 9) in the valve body (figure 1, item 3). Secure them with the retainer (figure 1, item 8).
4. Install a new valve stem packing (figure 1, item 7) in the valve body (figure 1, item 3).
5. Install the valve stem (figure 1, item 6) in the valve body (figure 1, item 3).
6. Install a new gland nut packing (figure 1, item 5) in the valve body (figure 1, item 3). Secure it with gland nut (figure 1, item 4).
7. Install the handle (figure 1, item 2) on the valve stem (figure 1, item 6). Secure it with the nut (figure 1, item 1).
8. Perform the Follow-On Service at the end of this work package.

FLANGED GLOBE VALVE REPAIR**DISASSEMBLY****WARNING**

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 comply can result in death or serious injury.

1. Remove the nut (figure 2, item 1) and hand wheel (figure 2, item 2) from the valve stem (figure 2, item 3).
2. Remove the four bolts (figure 2, item 4) and four nuts (figure 2, item 5). Remove the bonnet (figure 2, item 6) from the valve body (figure 2, item 7).
3. Remove and discard the gasket (figure 2, item 8).
4. Remove the spiral-wound gasket (figure 2, item 9) and the disk (figure 2, item 10) from the valve body (figure 2, item 7). Discard the spiral-wound gasket and the disk.
5. Remove the O-ring (figure 2, item 11) from the bonnet (figure 2, item 6). Discard the O-ring.

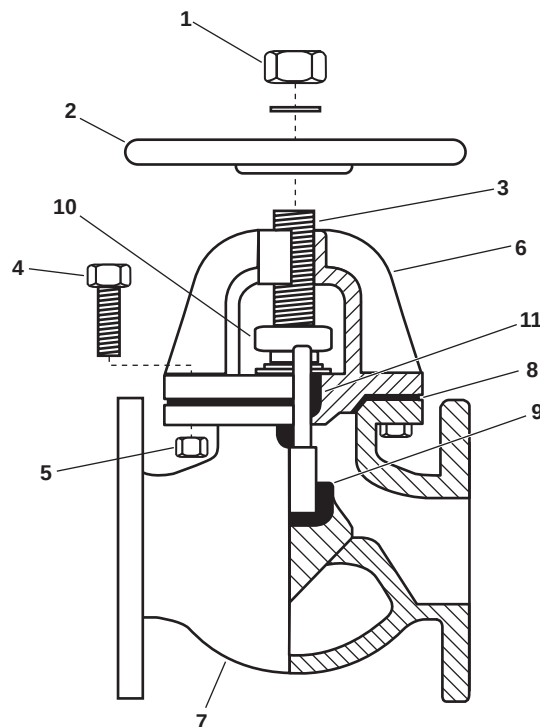


Figure 2. Flanged Globe Valve

ASSEMBLY

1. Inspect all valve components for wear and damage.
2. Clean the parts of the valve (figure 1, item 1) using clean wiping rags and water.
3. Install a new O-ring (figure 2, item 11) and secure it in the bonnet (figure 2, item 6).
4. Install a new disk (figure 2, item 10) and a new spiral-wound gasket (figure 2, item 9) in the valve body (figure 2, item 7).
5. Install a new gasket (figure 2, item 8) between the valve body (figure 2, item 7) and the bonnet (figure 2, item 6).
6. Install the bonnet (figure 2, item 6) and secure it to the valve body with the four bolts (figure 2, item 4) and four nuts (figure 2, item 5).
7. Install the hand wheel (figure 2, item 2) on the valve stem (figure 2, item 3) and secure it with the nut (figure 2, item 1).
8. Perform the Follow-On Service procedure at the end of this work package.

FLANGED CHECK VALVE REPAIR

DISASSEMBLY



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 comply can result in death or serious injury.

1. Remove the nuts (figure 3, item 1) and bolts (figure 3, item 2), and remove the cover (figure 3, item 3) from the valve body (figure 3, item 4).
2. Remove the gasket (figure 3, item 5) from the cover (figure 3, item 3). Discard the gasket.
3. Remove the valve hinge pin (figure 3, item 6), and valve seat (figure 3, item 7). Discard the valve seat.
4. Remove the plug (figure 3, item 8) from the valve body (figure 3, item 4).

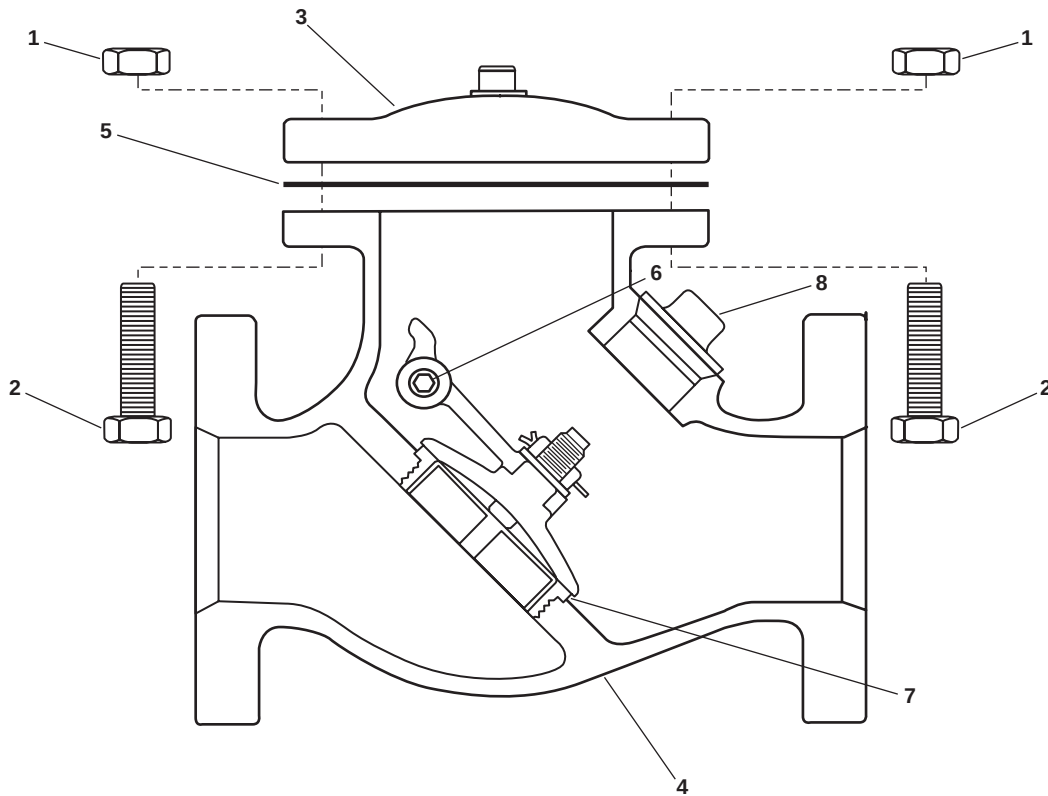


Figure 3. Flanged Check Valve

ASSEMBLY

1. Inspect all valve components for wear and damage.
2. Clean the parts of the valve (figure 3, item 4) using clean wiping rags and water.
3. Install a new valve seat (figure 3, item 7) and secure it inside the valve body (figure 3, item 4) with the valve hinge pin (figure 3, item 6).
4. Install a new gasket (figure 3, item 5) on the cover (figure 3, item 3) and secure it to the valve body (figure 3, item 4) with the nuts (figure 3, item 1) and bolts (figure 3, item 2).
5. Install the plug (figure 3, item 8) in the valve body (figure 3, item 4).
6. Perform the Follow-On Service at the end of this work package.

FOLLOW-ON SERVICE

Perform the applicable valve replacement installation procedure (WP 0099 00).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LUBE OIL TRANSFER PUMP, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)
Suitable Drain Pan

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Tape, Antiseizing (Item 175, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set to OFF the LUBE OIL TRANSFER PUMP circuit
breaker in 440V power panel No. 1. Lock out and
tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

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.

REMOVAL**NOTE**

Electrical junction boxes may vary in size, shape, and mounting position of the box on the motor frame. Electrical junction box covers may vary in number and placement of screws holding the cover in place.

1. Remove the four screws (figure 1, item 1) holding the electrical junction box cover (figure 1, item 2).
2. Remove the junction box cover (figure 1, item 2).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Using a multimeter, check for voltage at the wiring terminals. If voltage is present, ensure that the proper motor controller is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

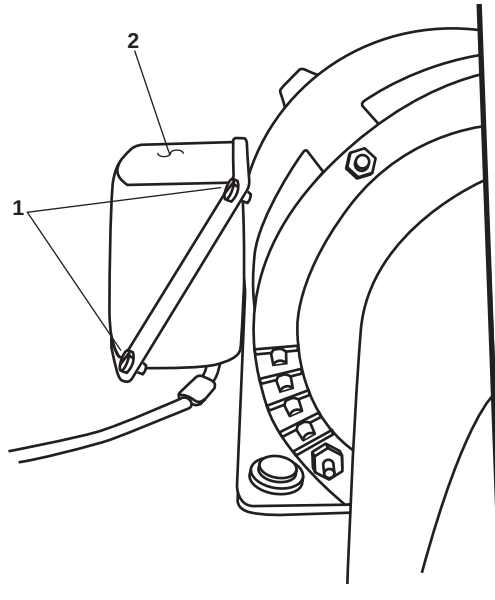


Figure 1. Electrical Junction Box

4. Label and disconnect the electrical wiring.
5. Remove the two bolts (figure 2, item 1), the two lockwashers (figure 2, item 2), and the two 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 motor coupling flange setscrew (figure 3, item 1).

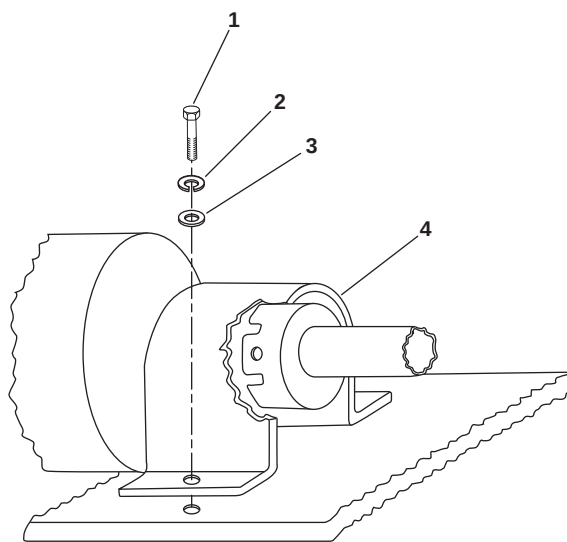


Figure 2. Coupling Guard

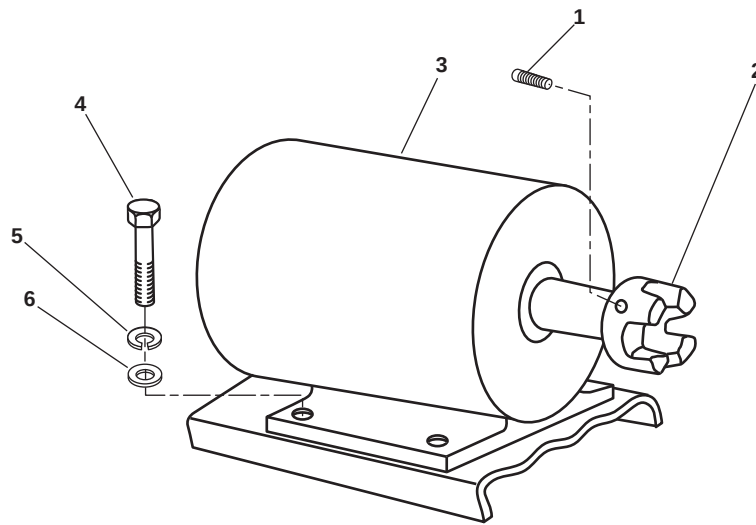


Figure 3. Electric Motor

8. Slide the motor coupling flange (figure 3, item 2) towards the motor (figure 3, item 3).
9. Remove the four bolts (figure 3, item 4), the four lockwashers (figure 3, item 5), and the four flat washers (figure 3, item 6). Discard the lockwashers.
10. Remove the motor (figure 3, item 3) from the foundation.
11. Slide the motor coupling flange (figure 3, item 1) off the motor shaft.
12. Place a suitable drain pan under the lube oil transfer pump (figure 4, item 1).

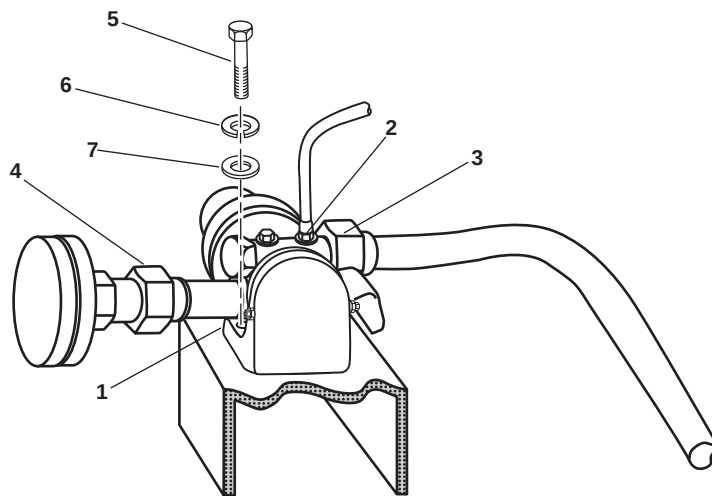


Figure 4. Lube Oil Transfer Pump Removal

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 serious personal injury or death.

13. Slowly loosen the pressure gauge piping (figure 4, item 2) to relieve pressure from the lube oil transfer pump (figure 4, item 1). Allow any lube oil to drain into the suitable drain pan.
14. After all pressure has been released, completely disconnect the pressure gauge piping (figure 4, item 2) from the lube oil transfer pump (figure 4, item 1).

 CAUTION

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

15. Loosen and disconnect the lube oil piping at the lube oil transfer pump (figure 4, item 1) inlet union (figure 4, item 3) and the outlet union (figure 4, item 4).
16. Remove the two bolts (figure 4, item 5), the two lockwashers (figure 4, item 6), and the two flat washers (figure 4, item 7) securing the lube oil transfer pump (figure 4, item 1) to the foundation. Discard the lockwashers.
17. Remove the lube oil transfer pump (figure 4, item 1) from the foundation.

INSTALLATION

1. Position the lube oil transfer pump (figure 4, item 1) on the foundation.
2. Install the two bolts (figure 4, item 5), two new lockwashers (figure 4, item 6), and two flat washers (figure 4, item 7) in the lube oil transfer 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 piping or to the pump's piping could occur. Always use two wrenches.

3. Connect and tighten unions (figure 4, item 3 and 4) on the lube oil transfer pump (figure 4, item 1).
4. Tighten the bolts (figure 4, item 5) securing the lube oil transfer pump (figure 4, item 1) to the foundation.
5. Apply antiseizing tape to the pipe threads of the discharge pressure gauge piping. Connect the discharge pressure gauge piping (figure 4, item 2) to lube oil transfer pump (figure 4, item 1) and tighten the piping connection.
6. Slide the motor coupling flange (figure 3, item 2) onto the motor shaft (refer to figure 3) with the flat end towards the motor (figure 3, item 3) housing.
7. Position the motor (figure 3, item 3) on the foundation with the mounting holes aligned.
8. Install the four bolts (figure 3, item 4), four new lockwashers (figure 3, item 5), and the four flat washers (figure 3, item 6). Do not tighten at this time.

9. Align the pump coupling flange (figure 5, item 1) and the motor coupling flange (figure 5, item 2) together leaving approximately 0.016 inch (0.41 mm) space between the ends of both flanges. Refer to figure 5.
10. Check the alignment between the pump coupling flange (figure 5, item 1) and the motor coupling flange (figure 5, item 2).
11. The maximum angular offset shall be 1 degree and maximum parallel offset shall be 0.015 inch (0.381 mm). Refer to figure 5.

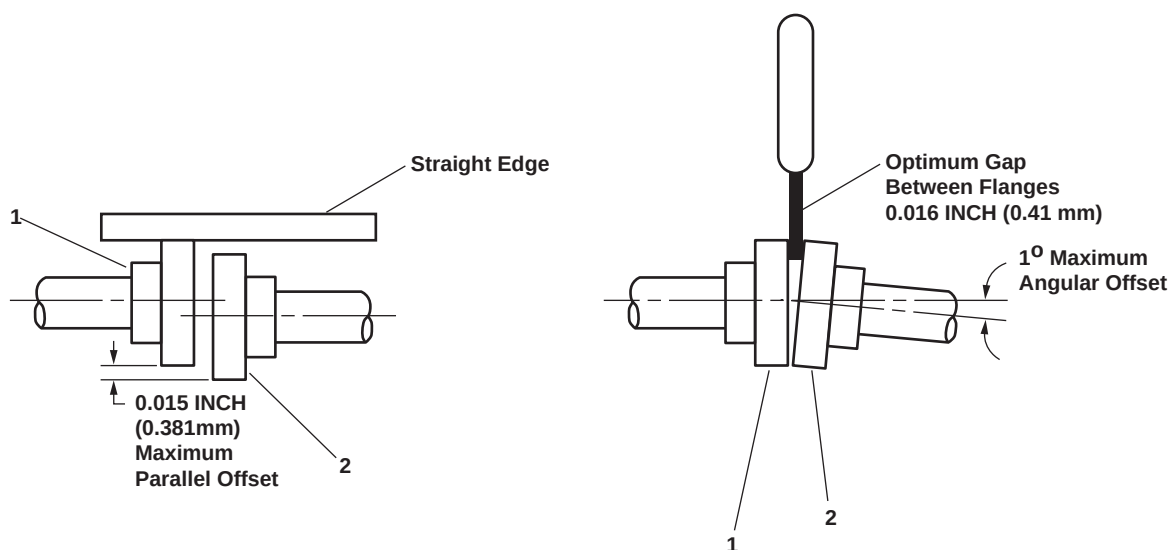


Figure 5. Alignment of Pump Coupling Flange and Motor Coupling Flange

12. Tighten the motor coupling flange setscrew (figure 3, item 1).
13. Tighten the four bolts (figure 3, item 4).
14. Install the coupling guard (figure 2, item 4) and secure it with the two bolts (figure 2, item 1), two new lockwashers (figure 2, item 2), and the two flat washers (figure 2, items 3). Tighten the bolts.
15. Connect the electrical wiring using the labels from step 4 of Removal as a guide. Remove the labels.
16. Install the electrical junction box cover (figure 1, item 2) and secure it with the four screws (figure 1, item 1). Tighten the screws.
17. Remove the lockouts and tagouts (FM 55-502).
18. Operate the lube oil transfer pump under usual conditions (TM 55-1925-273-10) and check for proper operation.
19. Return the lube oil transfer pump to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LUBE OIL TRANSFER PUMP, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP0295 00, Volume 2)
 Torque Wrench (0-250 FT-LB) (Item 4, Table 2, WP0295 00, Volume 2)
 Tool, Locknut (Item 17, Table 2, WP 0295 00, Volume 2)
 Lubricating Gun, Hand (Item 25, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Dry Cleaning Solvent (Item 57, Table 1, WP 0307 00, Volume 2)
 Grease, General Purpose (Item 75, Table 1, WP 0307 00, Volume 2)
 Lubrication Oil, Engine (Item 99, Table 1, WP 0307 00, Volume 2)

Materials/Parts (continued):

Bearing, Ball, Annular (Item 6, Figure 14, WP 0297 00, Volume 2)
 Gasket (Item 9, Figure 14, WP 0297 00, Volume 2)
 Grease Seal (Item 5, Figure 14, WP 0297 00, Volume 2)
 Vane Pump Rotary (Item 8, Figure 14, WP 0297 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

Reference:

TM 55-1925-273-10
 WP 0101 00
 WP 0295 00 (volume 2)
 WP 0297 00 (volume 2)
 WP 0307 00 (volume 2)

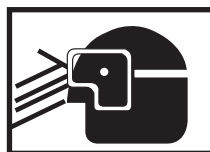
Equipment Conditions:

Lube oil transfer pump removed (WP 0101 00).

DISASSEMBLY

1. Loosen the locknut (figure 1, item 1) and remove the adjusting screw (figure 1, item 2) from the cover (figure 1, item 3).

WARNING



The cover is under spring pressure. Use appropriate eye and safety protection during disassembly of the lube oil transfer pump. Failure to comply with this warning may result in severe personal injury or death.

2. Remove the cover (figure 1, item 3) and O-ring (figure 1, item 4). Discard O-ring.
3. Remove the spring guide (figure 1, item 5) and preformed packing (spring) (figure 1, item 6).
4. Remove the disc and valve (figure 1, item 7) from the pump body (figure 1, item 8).
5. Remove the grease fitting (figure 1, item 9) from the mounting bracket (figure 1, item 10).
6. Remove the grease fitting relief (figure 1, item 11) from the mounting bracket (figure 1, item 10).
7. Remove the four cap screws (figure 1, item 12) from the mounting bracket (figure 1, item 10).

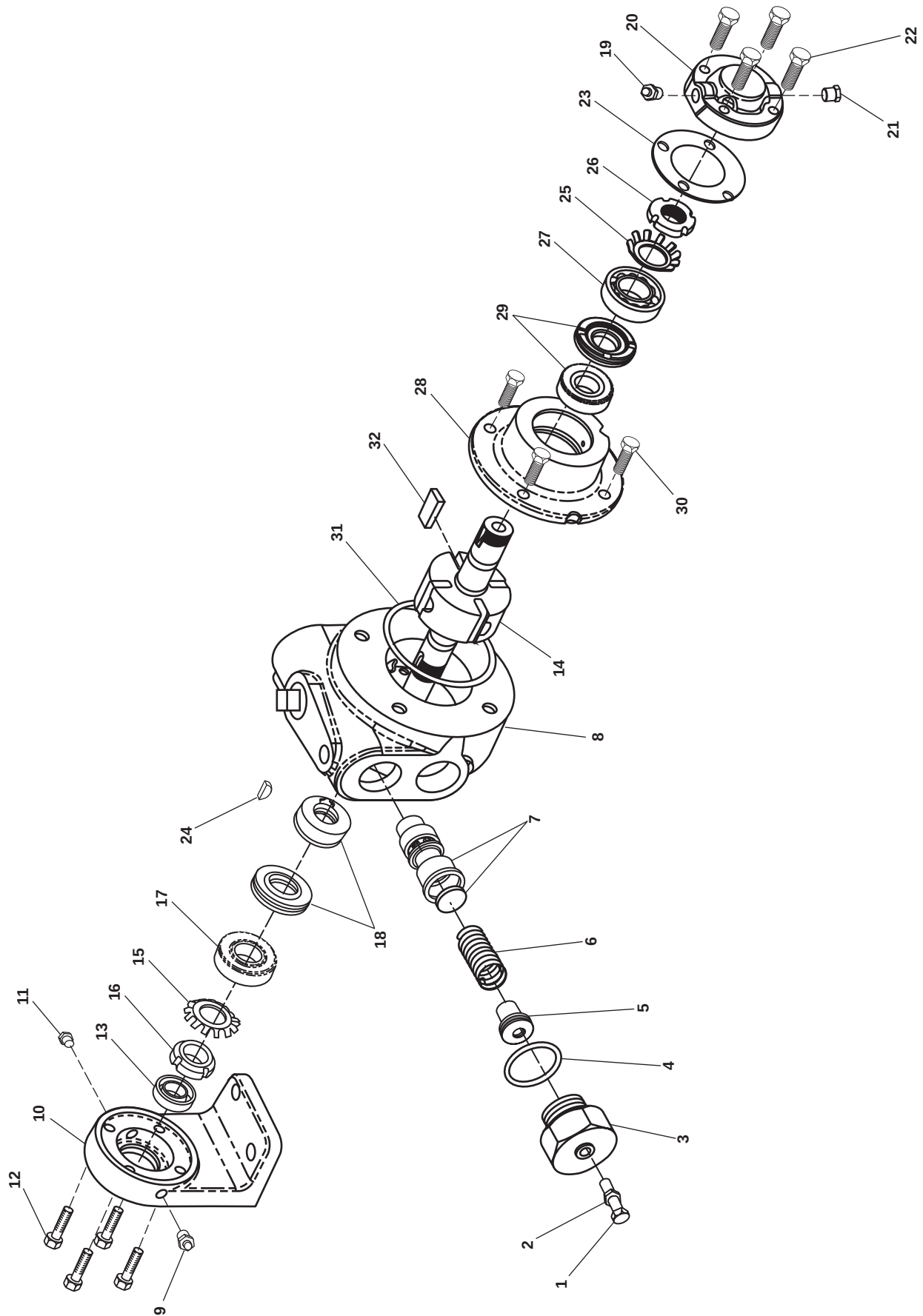


Figure 1. Lube Oil Transfer Pump

8. Slide the mounting bracket (figure 1, item 10) and the grease seal (figure 1, item 13) off the rotor and shaft assembly (figure 1, item 14). Discard the grease seal.
9. Remove the lockwasher (figure 1, item 15) and the bearing locknut (figure 1, item 16) from the rotor and shaft assembly (figure 1, item 14) using the lockout tool. Do not discard the lockwasher and bearing locknut.
10. Remove the ball bearing (figure 1, item 17) from the pump body (figure 1, item 8). Discard the ball bearing.
11. Remove the mechanical seal (figure 1, item 18) from the rotor and shaft assembly (figure 1, item 14).
12. Remove the grease fitting (figure 1, item 19) from the bearing cover (figure 1, item 20).
13. Remove the grease fitting relief (figure 1, item 21) from the bearing cover (figure 1, item 20).
14. Remove the four cap screws (figure 1, item 22) from the bearing cover (figure 1, item 20) and slide the bearing cover and the gasket (figure 1, item 23) off the rotor and shaft assembly (figure 1, item 14). Discard the gasket.
15. Remove the shaft key (figure 1, item 24) from the rotor and shaft assembly (figure 1, item 14).
16. Remove the lockwasher (figure 1, item 25) and the bearing locknut (figure 1, item 26) from the rotor and shaft assembly (figure 1, item 14) using the lockout tool. Do not discard the lockwasher and bearing locknut.
17. Remove the ball bearing (figure 1, item 27) from the head (figure 1, item 28).
18. Remove the mechanical seal (figure 1, item 29) from the head (figure 1, item 28).
19. Remove the four cap screws (figure 1, item 30) from the head (figure 1, item 28) and remove the head from the pump body (figure 1, item 8).
20. Remove the O-ring (figure 1, item 31) from the head (figure 1, item 28). Discard the O-ring.
21. Remove the rotor and shaft assembly (figure 1, item 14) from the pump body (figure 1, item 8).
22. Remove the vanes (figure 1 item, 32) from the rotor and shaft assembly (figure 1, item 14). Discard the vanes.

CLEANING AND INSPECTION

WARNING



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

1. Using dry cleaning solvent, clean all the removed parts. Check for any burrs on the rotor and shaft assembly, the pump body, and all other removed parts. Inspect all component parts for unusual wear or damage and replace as required.
2. Allow all parts to air dry prior to assembly.

ASSEMBLY

1. Install new vanes (figure 1 item, 32) in the rotor and shaft assembly (figure 1, item 14).
2. Lubricate the rotor and shaft assembly (figure 1, item 14) with engine lubricating oil and install it in the pump body (figure 1, item 8).
3. Lubricate a new O-ring (figure 1, item 31) with engine lubricating oil and install it on the head (figure 1, item 28).
4. Install head (figure 1, item 28) on the pump body (figure 1, item 8) and secure it with the four cap screws (figure 1, item 30).
5. Install the mechanical seal (figure 1, item 29) in the head (figure 1, item 28).
6. Install a new ball bearing (figure 1, item 27) in the head (figure 1, item 28).
7. Install the lockwasher (figure 1, item 25) and the bearing locknut (figure 1, item 26) on the rotor and shaft assembly (figure 1, item 14) using the lockout tool.
8. Install the shaft key (figure 1, item 24) on the rotor and shaft assembly (figure 1, item 14).
9. Install a new gasket (figure 1, item 23) on the bearing cover (figure 1, item 20) and slide the bearing cover on the rotor and shaft assembly (figure 1, item 14).
10. Secure the bearing cover (figure 1, item 20) to the head (figure 1, item 28) with the four cap screws (figure 1, item 22).
11. Install the grease fitting relief (figure 1, item 21) in the bearing cover (figure 1, item 20).
12. Install the grease fitting (figure 1, item 19) in the bearing cover (figure 1, item 20).
13. Install the mechanical seal (figure 1, item 18) on the rotor and shaft assembly (figure 1, item 14).
14. Install a new ball bearing (figure 1, item 17) in the pump body (figure 1, item 8).
15. Install the lockwasher (figure 1, item 15) and the bearing locknut (figure 1, item 16) on the rotor and shaft assembly (figure 1, item 14) using the lockout tool.
16. Install a new grease seal (figure 1, item 13) in the mounting bracket (figure 1, item 10) and slide the mounting bracket on the rotor and shaft assembly (figure 1, item 14).
17. Secure the mounting bracket (figure 1, item 10) to the pump body (figure 1, item 8) with the four cap screws (figure 1, item 12).
18. Install the grease fitting relief (figure 1, item 11) in the mounting bracket (figure 1, item 10).
19. Install the grease fitting (figure 1, item 9) in the mounting bracket (figure 1, item 10).
20. Install the disc and valve (figure 1, item 7) in the pump body (figure 1, item 8).
21. Install the spring guide (figure 1, item 5) and preformed packing (spring) (figure 1, item 6) in the pump body (figure 1, item 8).
22. Install a new O-ring (figure 1, item 4) on the cover (figure 1, item 3) and install the cover in the pump body (figure 1, item 8).
23. Install the adjusting screw (figure 1, item 2) in the cover (figure 1, item 3). Do not tighten the locknut (figure 1, item 1) at this time.

24. Using a lubricating gun, lubricate the lube oil transfer pump bearings at the grease fittings (figure 1, items 9 and 19) with general purpose grease until the grease comes out of the grease fitting relief (figure 1, items 11 and 21).
25. Install the lube oil transfer pump (WP 0101 00).
26. Operate the lube oil transfer pump under usual conditions (TM 55-1925-273-10).
27. To adjust the discharge pressure:
 - a. Loosen the locknut (figure 1, item 2).
 - b. With the pump running, turn the adjusting screw (figure 1, item 1) clockwise to increase pressure or counterclockwise to decrease pressure until the desired discharge pressure is attained.
 - c. Tighten the locknut (figure 1, item 2).
28. Return the lube oil transfer pump to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FUEL SYSTEM VALVES, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 1, WP 0295 00, Volume 2)
 Faceshield, Industrial (Item 38, Table 1, WP 0295 00, Volume 2)
 Suitable Drain Pan

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 TB 43-0218
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Materials/Parts:

Dry Cleaning Solvent (Item 57, Table 1, WP 0307 00, Volume 2)
 Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)

Equipment Conditions:

CLOSE all valves upstream and downstream of the affected valve. 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.

THREADED BALL VALVE REPLACEMENT**REMOVAL**

WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Do not smoke or allow smoking, or any other open flame in the vicinity of fuel sounding operations. Wipe clean any fuel spillage and dispose of spilled fuel and fuel-soaked rags in accordance with the appropriate local regulations. Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts which are saturated with diesel fuel. Failure to comply can result in serious injury or death.

1. Place a suitable drain pan under the ball valve (figure 1, item 1) and the fuel oil filter/water separator assembly (figure 1, item 2).
2. Unscrew the swivel connector (figure 1, item 3) from the fuel oil filter/water separator assembly (figure 1, item 2).

3. Unscrew the ball valve (figure 1, item 1) from the fuel manifold (figure 1, item 4).
4. Cap the fuel manifold (figure 1, item 4) opening to prevent contamination of the fuel system.

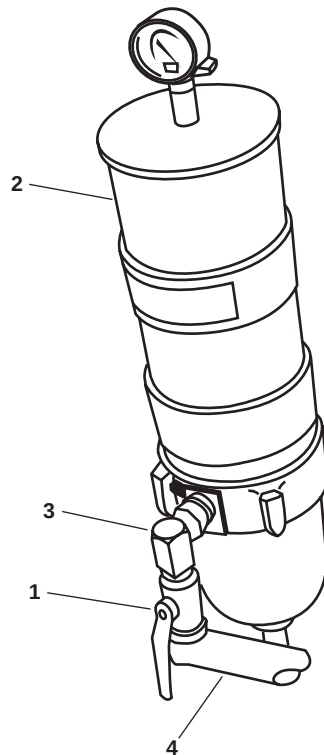


Figure 1. Typical Threaded Ball Valve

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 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 threads of the fuel manifold (figure 1, item 4) connector using dry cleaning solvent and a wire brush.

2. Clean the applicable male threads of the swivel connector (figure 1, item 3) using dry cleaning solvent and a wire brush.
3. Clean the female threads of ball valve (figure 1, item 1) using dry cleaning solvent and a wire brush.
4. Apply antiseizing tape to the male threads of the fuel manifold (figure 1, item 4).
5. Install the ball valve (figure 1, item 1) onto the fuel manifold (figure 1, item 4).
6. Install the swivel connector (figure 1, item 3) into the ball valve (figure 1, item 1).
7. Perform the Follow-On Service procedure at the end of this work package.

TYPICAL TWO-WAY BALL VALVE (FLANGED)

REMOVAL

WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Do not smoke or allow smoking, or any other open flame in the vicinity of fuel sounding operations. Wipe clean any fuel spillage and dispose of spilled fuel and fuel-soaked rags in accordance with the appropriate local regulations. Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts which are saturated with diesel fuel. Failure to comply can result in serious injury or death.

! CAUTION

Valves can trap pressurized media in the cavity. This pressure can remain even after the valve has been removed from the line. Partially open the valve to make sure there is no pressure to, or in, the valve before removing the any bolts.

1. Place a suitable drain pan under two-way ball valve (figure 2, item 1).
2. Slowly loosen the bolts (figure 2, item 2) on one end of two-way ball valve (figure 2, item 1) and break the seal between two-way ball valve and the vessel's piping.
3. After the fuel oil drains from two-way ball valve (figure 2, item 1), remove all the bolts (figure 2, item 2) and the nuts (figure 2, item 3).
4. Remove the bolts (figure 2, item 4) and the nuts (figure 2, item 5) from the opposite side of the two-way ball valve (figure 2, item 1).
5. Lift the two-way ball valve (figure 2, item 1) clear of vessel's piping.
6. Remove and discard the gaskets (figure 2, items 6 and 7) from the ends of two-way ball valve (figure 2, item 1) and the vessel's piping.

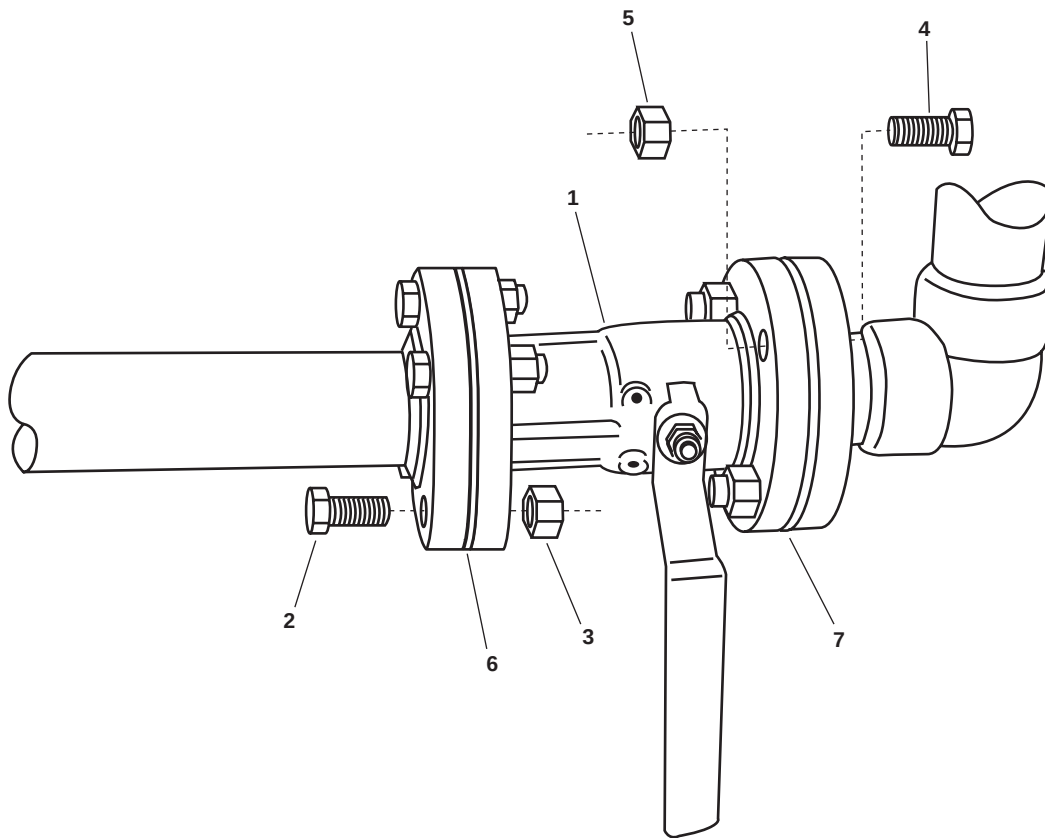


Figure 2. Typical Two-Way Ball Valve

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 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 flanges of two-way ball valve (figure 2, item 1) and vessel's piping using dry cleaning solvent and a wire brush.

2. Install the two-way ball valve (figure 2, item 1) and new gaskets (figure 2, items 6 and 7) in the vessel's piping.
3. Install the bolts (figure 2, items 2 and 4) and nuts (figure 2, items 3 and 5) to secure the two-way ball valve (figure 2, item 1). Tighten the bolts.
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. Test operate the fuel oil transfer system under usual conditions (TM 55-1925-273-10).
3. Observe the valve and connections, checking for leakage.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FUEL SYSTEM VALVES, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

FM 55-502
WP 0103 00
WP 0295 00 (volume 2)
WP 0297 00 (volume 2)

Materials/Parts:

Gasket (Item 5, Figure 15, WP 0297 00, Volume 2)
Packing Material (Item 26, Figure 15, WP 0297 00, Volume 2)

Equipment Conditions:

Fuel system valve removed (WP 0103 00).

FLANGED GATE VALVE REPAIR**DISASSEMBLY****WARNING**

Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this warning can result in death or serious injury.

Avoid prolonged exposure of the skin to diesel fuel. Chemical protective gloves and goggles must be worn whenever handling diesel fuel or parts, which are saturated with diesel fuel. Failure to comply with this warning can result in serious injury.

1. Remove the nut (figure 1, item 1) and the flat washer (figure 1, item 2) from the valve (figure 1, item 3).
2. Remove the handle (figure 1, item 4) from the valve (figure 1, item 3).
3. Remove the gland nut (figure 1, item 5) from the valve (figure 1, item 3).
4. Remove the gasket (figure 1, item 6) from the valve (figure 1, item 3). Discard the gasket.
5. Remove the packing (figure 1, item 7) from the valve (figure 1, item 3). Discard the packing.



ASSEMBLY

WARNING

Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this warning can result in death or serious injury.

Avoid prolonged exposure of the skin to diesel fuel. Chemical protective gloves and goggles must be worn whenever handling diesel fuel or parts, which are saturated with diesel fuel. Failure to comply with this warning can result in serious injury.

1. Install the new packing (figure 1, item 7) in the valve (figure 1, item 3).
2. Install the new gasket (figure 1, item 6) in the valve (figure 1, item 3).
3. Install the gland nut (figure 1, item 5) on the valve (figure 1, item 3).
4. Install the handle (figure 1, item 4) on the valve (figure 1, item 3), and secure it with the nut (figure 1, item 1) and the flat washer (figure 1, item 2).
5. Perform the applicable valve replacement procedure (WP 0103 00).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FUEL OIL TRANSFER PUMP, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
Suitable Drain Pan

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0107 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)

Equipment Conditions:

Electric motor removed (WP 0107 00).
CLOSE valves FO-6, C.O.V.-F.O. XFER PMP No. 1 SUCTION, FO-7, C.O.V.-F.O. XFER PMP No. 2 SUCTION, FO-8, C.O.V.-F.O. XFER PMP No. 1 DISCHARGE, and FO-9, C.O.V.-F.O. XFER PMP No. 2 DISCHARGE. Lock out and tag out (FM 55-502).

Personnel Required:

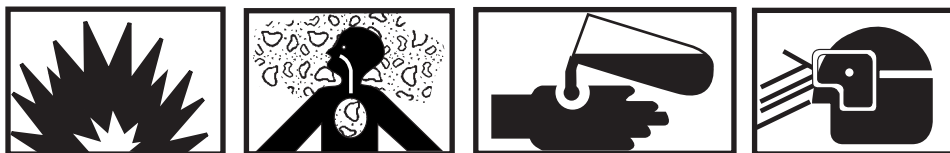
Two Watercraft Engineers, 88L

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.

REMOVAL

WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts, which are saturated with diesel fuel. Failure to comply can result in serious injury or death.

1. Place a suitable drain pan under the fuel oil transfer pump.

! CAUTION

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

2. Slowly loosen the pressure gauge piping (figure 1, item 1) to relieve pressure from the fuel oil transfer pump (figure 1, item 2). Allow any fuel oil to drain into the suitable drain pan.
3. After all pressure has been released, remove the pressure gauge piping (figure 1, item 1) from the fuel oil transfer pump (figure 1, item 2).

! 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.

4. Disconnect the fuel oil piping at the fuel oil transfer pump (figure 1, item 2) inlet and outlet unions (figure 1, item 3 and 4).
5. Remove the four bolts (figure 1, item 5), four nuts (figure 1, item 6), four flat washers (figure 1, item 7), and four lockwashers (figure 1, item 8) securing the fuel oil transfer pump (figure 1, item 2) to its foundation. Discard the lockwashers.

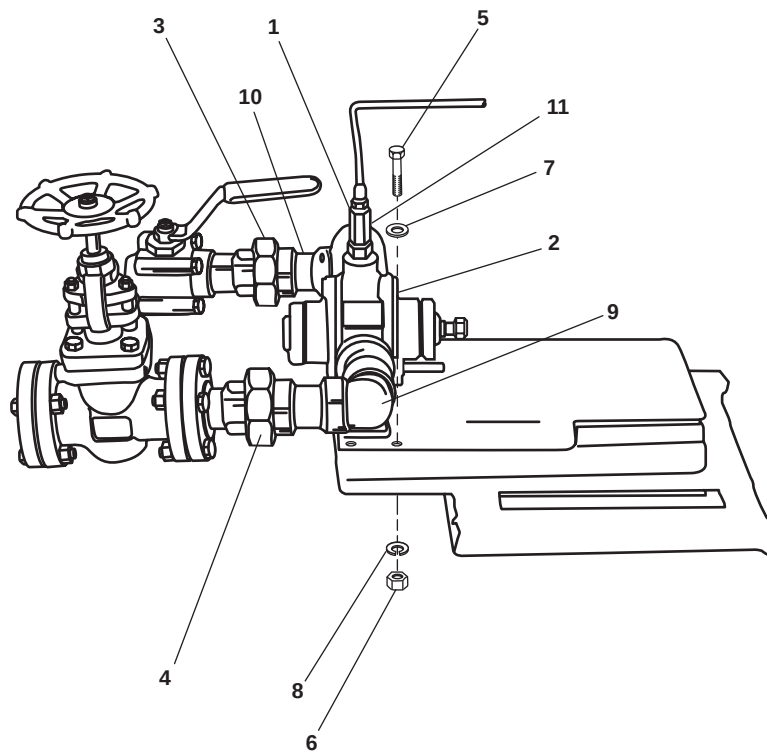


Figure 1. Fuel Oil Transfer Pump

6. Remove the fuel oil transfer pump (figure 1, item 2) from its foundation.

NOTE

Observe the positioning of the elbows before removing them from the unit. Refer to figure 1.

7. Remove the inlet (figure 1, item 9) and outlet elbows (figure 1, item 10) and discharge pressure fittings (figure 1, item 11) from the applicable sides of the fuel oil transfer pump (figure 1, item 2). Retain the fittings for installation on the new or repaired pump.

INSTALLATION

1. Apply antiseizing tape on the pipe threads of the inlet (figure 1, item 9) and outlet elbows (figure 1, item 10), and discharge pressure fittings (figure 1, item 11). Install the elbows and discharge fittings on the fuel oil transfer pump (figure 1, item 2).
2. Position the fuel oil transfer pump (figure 1, item 2) on its foundation.
3. Install the four bolts (figure 1, item 5), four nuts (figure 1, item 6), four flat washers (figure 1, item 7), and four new lockwashers (figure 1, item 8) in the fuel oil transfer pump (figure 1, item 2). 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.

4. Connect and tighten the unions (figure 1, item 3 and 4) on the fuel oil transfer pump (figure 1, item 2).
5. Tighten the four bolts (figure 1, item 5) securing the fuel oil transfer pump (figure 1, item 2) to its foundation.
6. Connect the discharge pressure gauge piping (figure 1, item 1) to fuel oil transfer pump (figure 1, item 2) and tighten the piping connection.
7. Install the electric motor (WP 0107 00).
8. Operate the fuel oil transfer pump under usual conditions (TM 55-1925-273-10), checking for leaks and proper operation.
9. Return the fuel oil transfer pump to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FUEL OIL TRANSFER PUMP, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Torque Wrench (Item 4, Table 2, WP 0295 00, Volume 2)
Tool, Locknut (Item 17, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Dry Cleaning Solvent (Item 57, Table 1, WP 0307 00, Volume 2)
Grease, General Purpose (Item 75, Table 1, WP 0307 00, Volume 2)
Bearing, Ball (Item 11, Figure 16, WP 0297 00, Volume 2)
Seal, Grease (Item 15, Figure 16, WP 029700, Volume 2)

Materials/Parts (continued):

Lockwasher (Item 10, Figure 16, WP 0297 00, Volume 2)
O-Ring (Item 9, Figure 16, WP 0297 00, Volume 2)
O-Ring (Item 12, Figure 16, WP 0297 00, Volume 2)
O-Ring (Item 13, Figure 16, WP 0297 00, Volume 2)
Push Rod (Item 7, Figure 16, WP 0297 00, Volume 2)
Vane (Item 8, Figure 16, WP 0297 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

TM 55-1925-273-10
WP 0105 00
WP 0295 00 (volume 2)
WP 0297 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

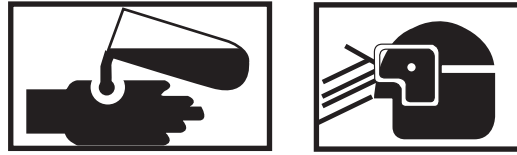
Fuel oil transfer pump removed (WP 0105 00)

DISASSEMBLY**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.

Loosen jam nut slowly. Removing jam nut suddenly may cause severe personal injury from spring pressure.

1. Remove the relief valve cap (figure 1, item 1) from the cover (figure 1, item 2).
2. Loosen the jam nut (figure 1, item 3) and remove the adjusting screw (figure 1, item 4) and the O-ring (figure 1, item 5). Discard the O-ring.

WARNING

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.

3. Remove the cover (figure 1, item 2) from the casing (figure 1, item 6).
4. Remove the O-ring (figure 1, item 7) from the cover (figure 1, item 2). Discard the O-ring.
5. Remove the washer (figure 1, item 8), the spring (figure 1, item 9), and the valve (figure 1, item 10) from the casing (figure 1, item 6).
6. Remove the woodruff key (figure 1, item 11) from the rotor and shaft assembly (figure 1, item 12).
7. Remove the grease fitting (figure 1, item 13) from the inboard bearing cover (figure 1, item 14).
8. Remove the grease fitting relief (figure 1, item 15) from the inboard bearing cover (figure 1, item 14).
9. Remove the cap screws (figure 1, item 16) from the inboard bearing cover (figure 1, item 14).
10. Slide the inboard bearing cover (figure 1, item 14), inboard bearing cover gasket (figure 1, item 17), and the grease seal (figure 1, item 18) off the rotor and shaft assembly (figure 1, item 12). Discard the bearing cover gasket and the grease seal.
11. Remove the cap screws (figure 1, item 19) from the inboard head (figure 1, item 20) and slide the head off the rotor and shaft assembly (figure 1, item 12).
12. Remove the bearing lockwasher (figure 1, item 21) and the bearing locknut (figure 1, item 22) using a locknut tool. Discard the bearing lockwasher.
13. Remove the grease fitting (figure 1, item 23) from the outboard bearing cover (figure 1, item 24).
14. Remove the grease fitting relief (figure 1, item 25) from the outboard bearing cover (figure 1, item 24).
15. Remove the cap screws (figure 1, item 26) from the outboard bearing cover (figure 1, item 24).
16. Slide the outboard bearing cover (figure 1, item 24) and the outboard bearing cover gasket (figure 1, item 27) off the rotor and shaft assembly (figure 1, item 12). Discard the outboard bearing cover gasket.
17. Remove the cap screws (figure 1, item 28) from the outboard head (figure 1, item 29) and slide the outboard head off the rotor and shaft assembly (figure 1, item 12).
18. Remove the lockwasher (figure 1, item 30) and the bearing locknut (figure 1, item 31) from the rotor and shaft assembly (figure 1, item 12) using a locknut wrench. Discard the lockwasher.
19. Remove the ball bearing (figure 1, item 32) from the inboard head (figure 1, item 20).

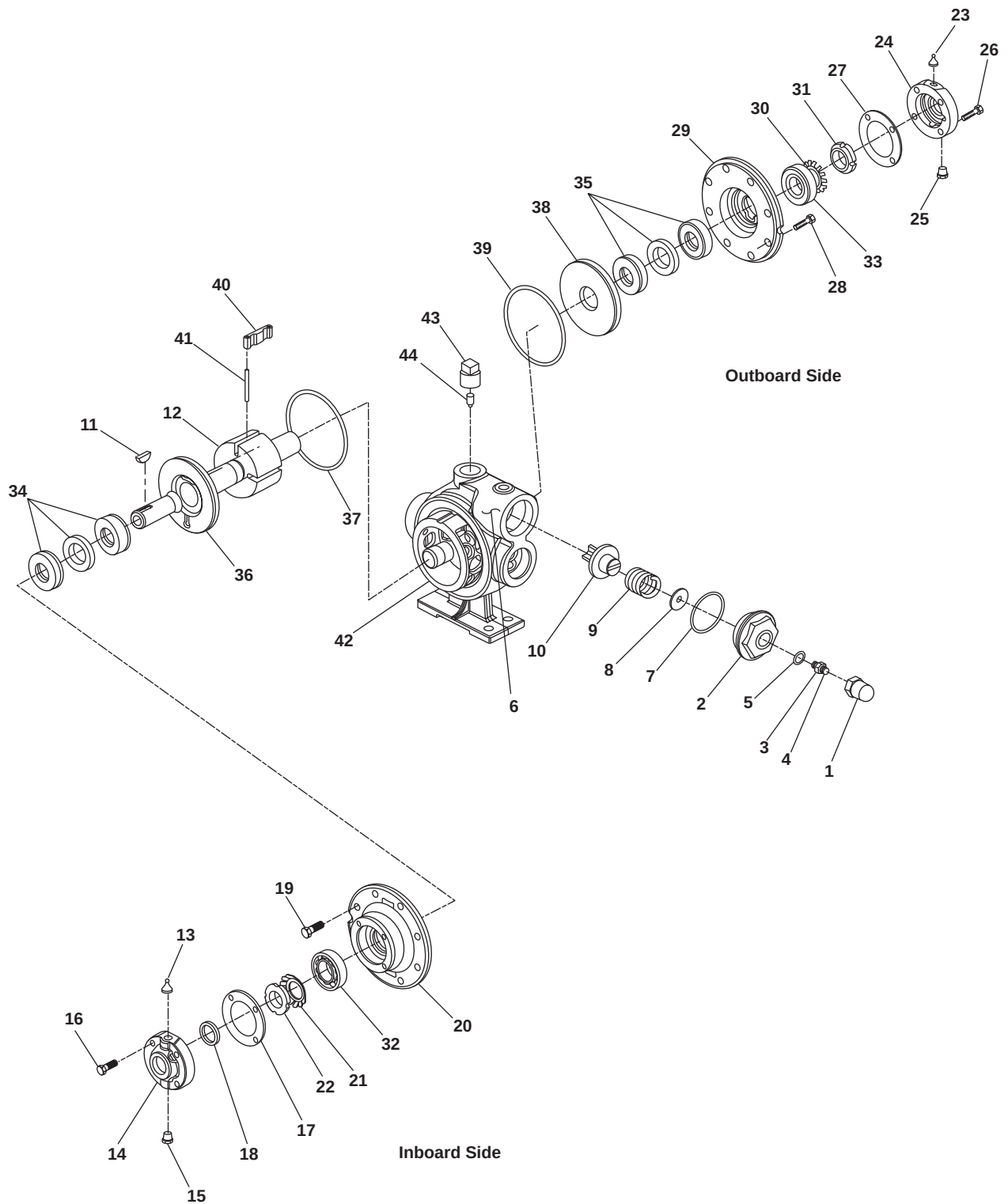


Figure 1. Fuel Oil Transfer Pump (Exploded View)

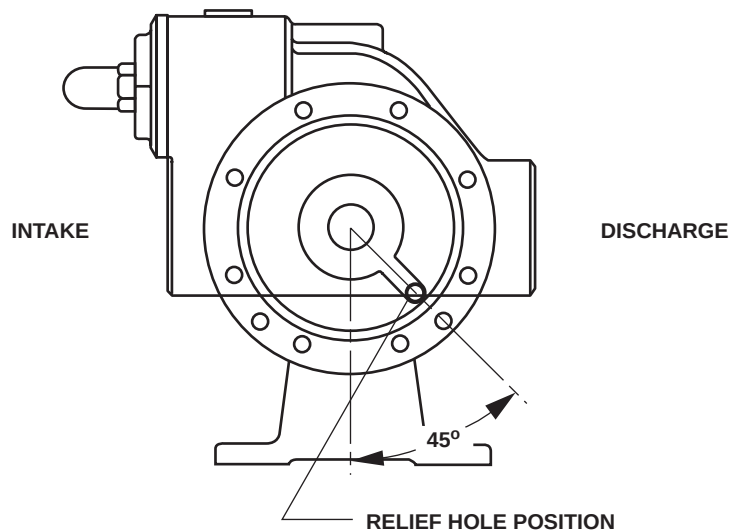


Figure 2. Fuel Oil Transfer Pump

20. Remove the ball bearing (figure 1, item 33) from the outboard head (figure 1, item 29).
21. Remove the mechanical seal (figure 1, item 34) from the rotor and shaft assembly (figure 1, item 12).
22. Remove the remaining mechanical seal (figure 1, item 35) from the opposite side of the pump.
23. Carefully remove the disc (figure 1, item 36) and the head O-ring (figure 1, item 37). Discard the head O-ring.
24. Carefully remove the disc (figure 1, item 38) and the head O-ring (figure 1, item 39). Discard the head O-ring.
25. Remove the rotor and shaft assembly (figure 1, item 12) from the casing (figure 1, item 6) with one hand cupped underneath the assembly to keep the vanes (figure 1, item 40) and the pushrods (figure 1, item 41) from falling out.
26. Remove the vanes (figure 1 item, 40) and the push rods (figure 1, item 41) from the rotor and shaft assembly (figure 1, item 12).
27. Remove the liner (figure 1, item 42) from the casing (figure 1, item 6).
28. Remove the gauge plug (figure 1, item 43) and the liner set screw (figure 1, item 44) from the casing (figure 1, item 6).

CLEANING AND INSPECTION**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.

Using dry cleaning solvent, clean all the removed parts. Check for burrs on the liner (figure 1, item 42) the rotor and shaft assembly (figure 1, item 12) the casing (figure 1, item 6), and all other removed parts. Inspect all component parts for unusual wear or damage, and replace as required.

ASSEMBLY

1. Install the liner (figure 1, item 42) into the casing (figure 1, item 6).

NOTE

The word "INTAKE" cast on the liner must face the intake port of the pump casing.

2. Align the liner (figure 1, item 42) keyway with the liner setscrew (figure 1, item 44) bore that extends down into the casing (figure 1, item 6) and slide the liner in the casing.
3. Uniformly tap the outer edge of the liner (figure 1, item 42) with a rubber mallet to fully insert into the casing (figure 1, item 6). Install the setscrew (figure 1, item 44) and gauge plug (figure 1, item 43).
4. Place the disc (figure 1, item 38) against the liner (figure 1, item 42) with the seal cavity outward and disc relief hole located as shown in figure 2.
5. Without installing the head O-ring (figure 1, item 39), temporarily attach the outboard head (figure 1, item 29) and the bearing (figure 1, item 33) in the casing (figure 1, item 6).
6. Install and hand tighten two cap screws (figure 1, item 28), 180 degrees apart. The outboard head (figure 1, item 29) will be used to hold and align the rotor and shaft assembly (figure 1, item 12) while the inboard side of the pump is being assembled.

NOTE

Use care when handling the rotor and shaft assembly while installing the vanes and push rods.

7. Insert the vanes (figure 1, item 40) in the bottom two rotor slots with the relief grooves facing in the direction of pump rotation and the rounded edges outward. Refer to figure 3.
8. Hold the vanes (figure 1, item 40) in place while installing the push rods (figure 1, item 41) in the rotor and shaft assembly (figure 1, item 12).
9. Install the rotor and shaft assembly (figure 1, item 12) in the casing (figure 1, item 6), and install the remaining two vanes (figure 1, item 40) in the rotor.

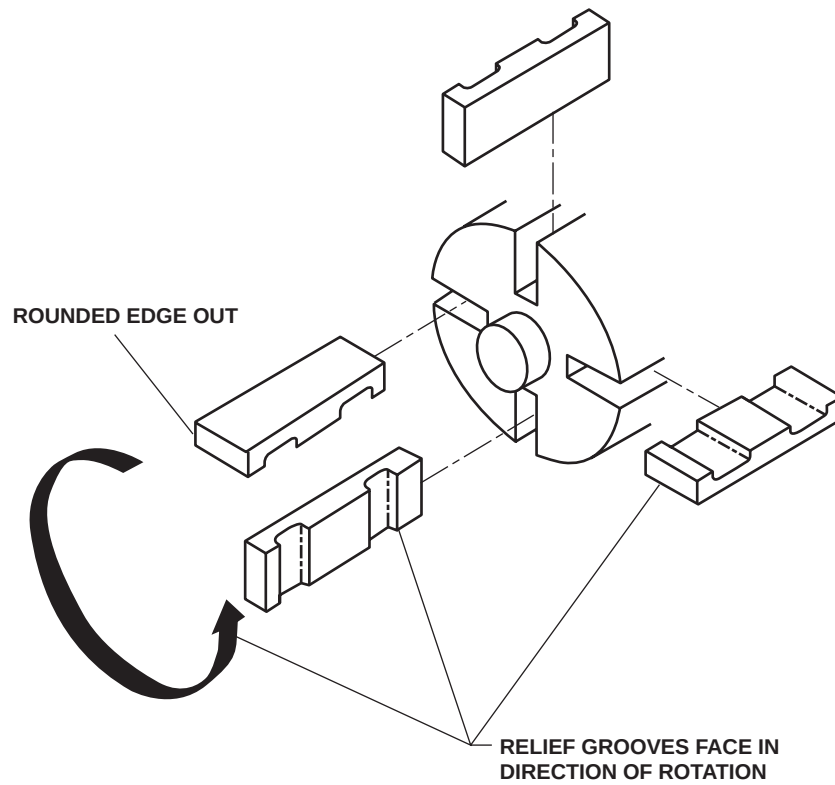


Figure 3. Rotor / Vane Orientation

10. Install a new inboard head O-ring (figure 1, item 37) on the disc (figure 1, item 36).
11. Install the disc (figure 1, item 36) with the seal cavity facing outward on the inboard side of the pump. The disc relief hole should be located as shown in figure 2.
12. Install the mechanical seal (figure 1, item 34) on the rotor shaft assembly (figure 1, item 12) as illustrated in figure 4.

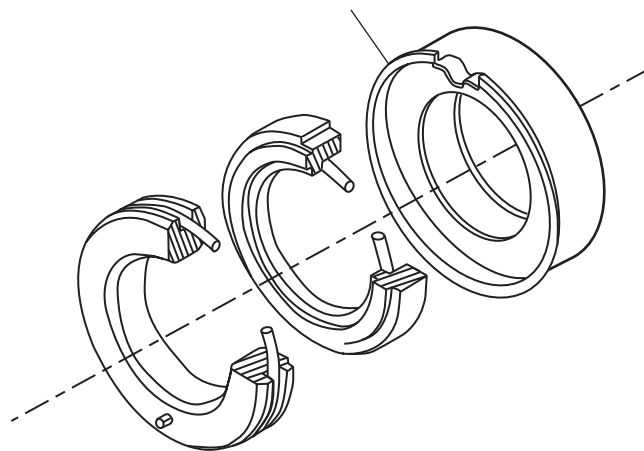


Figure 4. Mechanical Seal

13. Install the inboard head (figure 1, item 20) on the rotor and shaft assembly (figure 1, item 12).
14. Position the inboard head (figure 1, item 20) with the small weep hole towards the bottom of the pump. Install and uniformly tighten the cap screws (figure 1, item 19) 90° apart. Torque the cap screws to 30 lbs-ft (41 Nm).
15. Hand pack the ball bearing (figure 1, item 32) with general purpose grease.

NOTE

The bearing balls should face outward, with the grease shield inward. The bearing must be fully and squarely seated in the head.

16. Install the bearing (figure 1, item 32) in the inboard head (figure 1, item 20).
17. Turn the casing (figure 1, item 6) around and remove the outboard head (figure 1, item 29).
18. Install a new outboard head O-ring (figure 1, item 39) on the disc (figure 1, item 38).
19. Install the disc (figure 1, item 38) on the rotor and shaft assembly (figure 1, item 12).
20. Install the mechanical seal (figure 1, item 35) on the rotor and shaft assembly (figure 1, item 12) as illustrated in figure 4.

NOTE

The bearing balls should face outward, with the grease shield inward. The bearing must be fully and squarely seated in the head.

21. Hand pack the bearing (figure 1, item 30) with general purpose grease and install it in the outboard head (figure 1, item 29).
22. Install the outboard head (figure 1, item 29) on the casing (figure 1, item 6).
23. Lightly tap the rims of the inboard head (figure 1, item 20) and the outboard head (figure 1, item 29) with a soft-faced mallet into the correct position until the rotor and shaft assembly (figure 1, item 12) does not turn freely.
24. Install the remaining cap screws (figure 1, items 19 and 28) to secure the inboard head (figure 1, item 20) and the outboard head (figure 1, item 29). Uniformly torque the cap screws to 30 lbs-ft (41 Nm).

CAUTION

It is important that the bearing locknuts and bearing lockwashers are installed and adjusted properly. Over tightening locknuts can cause bearing failure or a broken lockwasher tang. Loose locknuts will allow the rotor on the shaft and rotor assembly to shift against the discs causing premature wear.

NOTE

Ensure the inner tang "A" of the bearing lockwasher is located in the slot of the shaft and rotor assembly threads, bending the bearing lockwasher slightly, if necessary.

25. On the inboard end of the shaft and rotor assembly (figure 1, item 12), install a new bearing lockwasher (figure 1, item 21) with the tangs facing outwards and the bearing locknut (figure 1, item 22) with the tapered end inward.
26. On the outboard end of the shaft and rotor assembly (figure 1, item 12), install a new bearing lockwasher (figure 1, item 30) with the tangs facing outwards and the bearing locknut (figure 1, item 31) with the tapered end inward.

! CAUTION

Do not over tighten, bend, or shear the lockwasher inner tang.

27. Using the locknut tool, tighten both bearing locknuts (figure 1, items 22 and 31) to ensure that the bearings (figure 1, items 32 and 33) are bottomed in the outboard and inboard head's (figure 1, items 20 and 29) recess.
28. Using the locknut tool, loosen both bearing locknuts (figure 1, items 22 and 31) one complete turn.
29. Using the locknut tool, tighten the bearing locknut (figure 1, item 22) until a slight drag is felt when turning the shaft and rotor assembly (figure 1, item 12) by hand.
30. Using the locknut tool, back off the bearing locknut (figure 1, item 22) the width of one lockwasher tang "B" (figure 5). Secure the bearing locknut by bending the closest aligned bearing lockwasher tang into the slot in the bearing locknut. The pump should turn freely when rotated by hand.

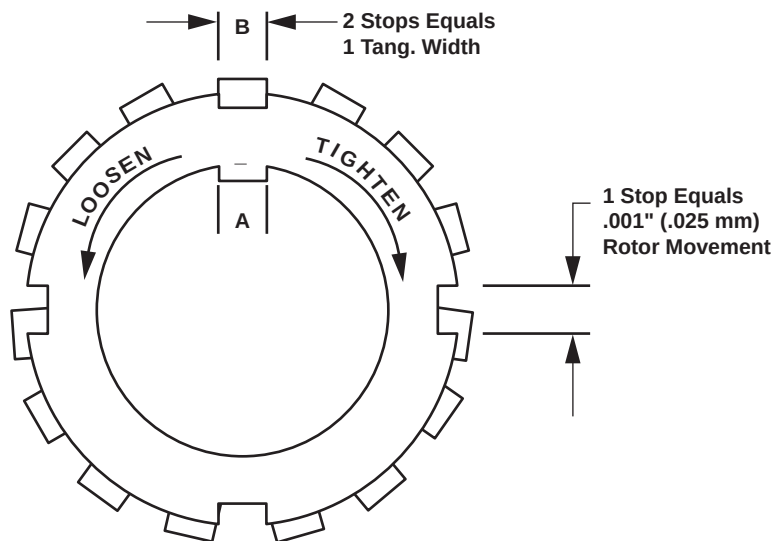


Figure 5. Vane Installation

31. Tighten the bearing locknut (figure 1, item 31) by hand until it is snug against the bearing (figure 1, item 33).
32. Using the locknut tool, tighten the bearing locknut (figure 1, item 31) the width of one lockwasher tang. Refer to figure 5.
33. Using the locknut tool, tighten the bearing locknut (figure 1, item 31) just past the desired tang, then back off the locknut to align the tang with the locknut slot. Refer to figure 5.
34. Secure the bearing locknut (figure 1, item 31) by bending the aligned bearing lockwasher (figure 1, item 30) tang into the slot in the bearing locknut (figure 1, item 31). The assembly should continue to turn freely when rotated by hand.
35. Check the adjustment by grasping the bearing locknut (figure 1, item 31) and the bearing lockwasher (figure 1, item 30) and rotating them back and forth. If this cannot be accomplished, one or both bearing locknuts (figure 1, item 22 or 31) are too tight. Alternately loosen the bearing locknuts one stop at a time 0.001 in. (0.0254 mm) (figure 5) until the correct adjustment is achieved.

36. Grease the outside diameter of the grease seal (figure 1, item 18) with general purpose grease and install it in the inboard bearing cover (figure 1 item 14) with the lip of the grease seal sinward (towards the pump).
37. Install a new bearing cover gasket (figure 1, item 17) on the inboard head (figure 1, item 20).
38. Install the inboard bearing cover (figure 1, item 14) on the inboard head (figure 1, item 20).
39. Install a new bearing cover gasket (figure 1, item 27) on the outboard head (figure 1, item 29).
40. Install the outboard bearing cover (figure 1, item 24) on the outboard head (figure 1, item 29).
41. Install and torque the cap screws (figure 1, item 16) to 30 lbs-ft (41 Nm).
42. Install and torque the cap screws (figure 1, item 26) to 30 lbs-ft (41 Nm).
43. Install the grease fitting (figure 1, item 23) in the outboard bearing cover (figure 1, item 24).
44. Install the grease fitting relief (figure 1, item 25) in the outboard bearing cover (figure 1, item 24).
45. Install the grease fitting (figure 1, item 13) in the inboard bearing cover (figure 1, item 14).
46. Install the grease fitting relief (figure 1, item 15) in the inboard bearing cover (figure 1, item 14).
47. Install the valve (figure 1, item 10), the spring (figure 1, item 9), and the washer (figure 1, item 8) in the casing (figure 1, item 6).
48. Install a new O-ring (figure 1, item 7) on the cover (figure 1, item 2).
49. Install the cover (figure 1, item 2) on the casing (figure 1, item 6).
50. Install the adjusting screw (figure 1, item 4) , jam nut (figure 1, item 3), and a new O-ring (figure 1, item 5) in the cover (figure 1, item 2).
51. Install the relief valve cap (figure 1, item 1) on the cover (figure 1, item 2).
52. Install the fuel oil transfer pump (WP 0105 00).
53. Operate the fuel oil transfer pump under usual conditions TM 55-1925-273-10 and check for proper operation. If the fuel oil transfer pump discharge pressure requires adjustment, loosen the jam nut (figure 1, item 3) and turn the adjusting screw (figure 1, item 4) clockwise to increase discharge pressure or counterclockwise to decrease discharge pressure.
54. Return the fuel oil transfer pump to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FUEL OIL TRANSFER PUMP, ELECTRIC MOTOR; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References (continue):

TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

For fuel oil transfer pump 2, set to OFF the FUEL OIL
TRANSFER PUMP No. 2. circuit breaker in 440V
power panel No. 1. Lock out and tag out (FM 55-502).
For fuel oil transfer pump 1, set to OFF the FUEL OIL
XFER PUMP No. 1. circuit breaker on the emergency
switchboard. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218

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.

REMOVAL**NOTE**

Electrical junction boxes may vary in size, shape, and mounting position of the box on the motor frame. Electrical junction box covers may vary in number and placement of screws holding the cover in place.

1. Remove the four screws (figure 1, item 1) holding the electrical junction box cover (figure 1, item 2).
2. Remove the junction box cover (figure 1, item 2).

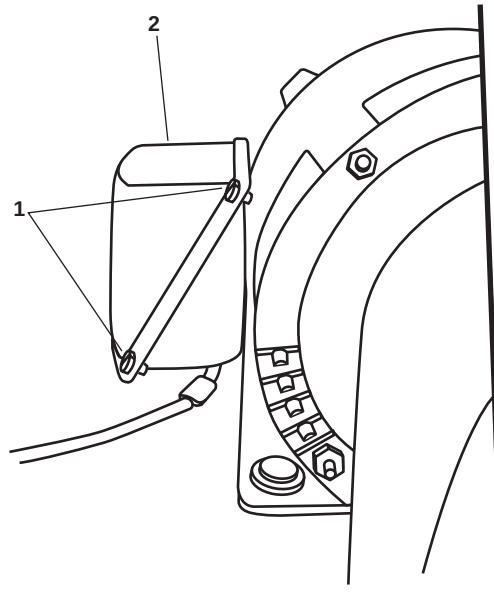


Figure 1. Electrical Junction Box

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Using a multimeter, check for voltage at the wiring terminals. If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and disconnect the electrical wiring.
5. Remove the two bolts (figure 2, item 1), two lockwashers (figure 2, item 2) and two flat washers (figure 2, items 3) from coupling guard (figure 2, item 4). Discard the lockwashers.
6. Remove the coupling guard (figure 2, item 4).
7. Loosen the motor coupling flange setscrew (figure 3, item 1).
8. Slide the motor coupling flange (figure 3, item 2) towards the motor (figure 3, item 3).
9. Remove the four bolts (figure 3, item 4), four lockwashers (figure 3, item 5), and four flat washers (figure 3, item 6). Discard the lockwashers.

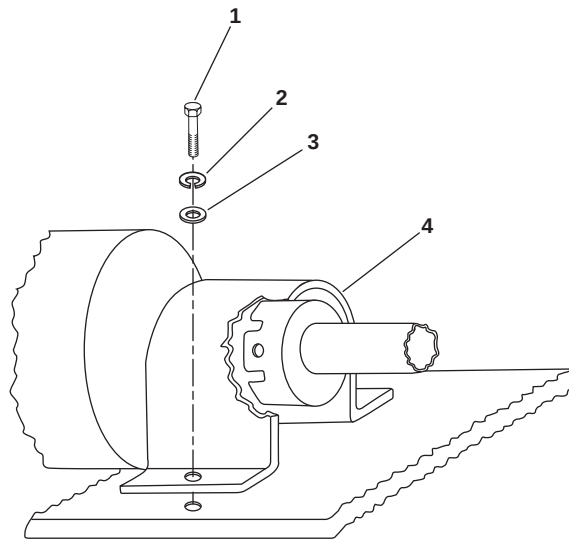


Figure 2. Coupling Guard

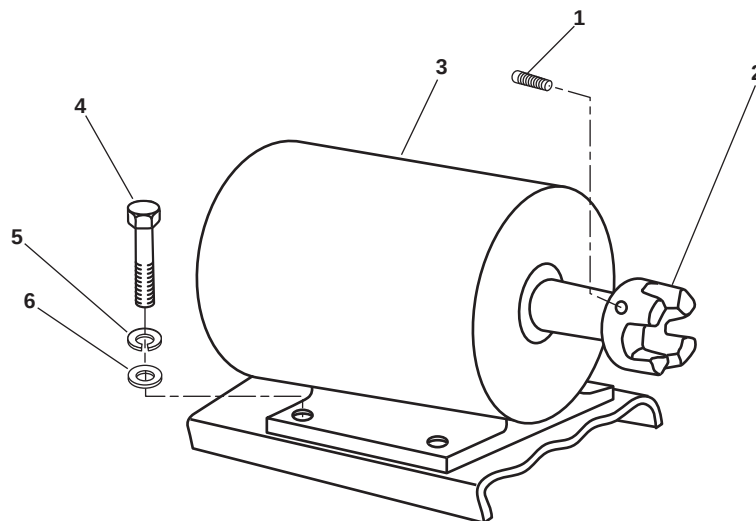


Figure 3. Electric Motor

10. Remove the motor (figure 3, item 3) from the pump foundation.
11. Slide the motor coupling flange (figure 3, item 1) off the motor shaft.

INSTALLATION

1. Slide the motor coupling flange (figure 3, item 2) onto the motor shaft (refer to figure 3) with the flat end towards the motor (figure 3, item 3) housing.
2. Position the motor (figure 3, item 3) on the pump foundation with the mounting holes aligned.
3. Install four bolts (figure 3, item 4), four new lockwashers (figure 3, item 5), and four flat washers (figure 3, item 6). Do not tighten at this time.

4. Align the pump coupling flange (figure 4, item 1) and the motor coupling flange (figure 4, item 2) together leaving approximately 0.016 inch (0.41 mm) space between the ends of both flanges. Refer to figure 4.
5. Check the alignment between the pump coupling flange (figure 4, item 1) and the motor coupling flange (figure 4, item 2).
6. The maximum angular offset shall be 1 degree and maximum parallel offset shall be 0.015 inch (0.381 mm). Refer to figure 4.

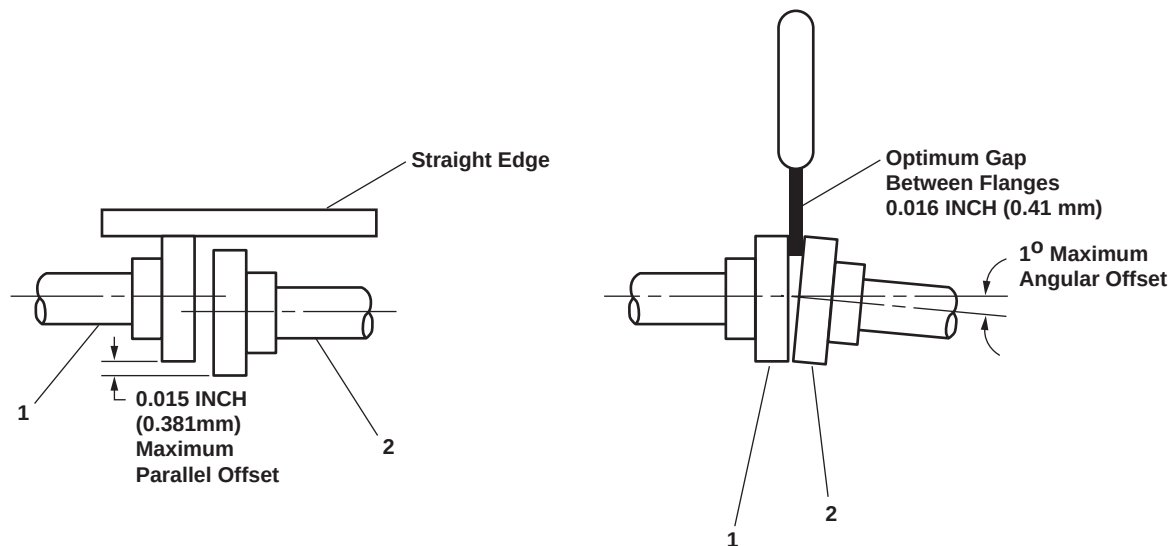


Figure 4. Alignment of Pump Coupling Flange and Motor Coupling Flange

7. Tighten the motor coupling flange setscrew (figure 3, item 1).
8. Tighten the four bolts (figure 3, item 4).
9. Install the coupling guard (figure 2, item 4) and secure it with two bolts (figure 2, item 1), two new lockwashers (figure 2, item 4), and two flat washers (figure 2, items 3).
10. Connect the electrical wiring using the labels from step 4 of Removal as a guide. Remove the labels.
11. Install the electrical junction box cover (figure 1, item 2) and secure it with the four screws (figure 1, item 1).
12. Remove the lockouts and tagouts (FM 55-502).
13. Operate the fuel oil transfer pump under usual conditions (TM 55-1925-273-10) and check for proper operation.
14. Return the fuel oil transfer pump to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FUEL OIL FILTER/WATER SEPARATOR, SERVICE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
 Suitable Drain Pan

Materials/Parts (continued):

Gasket, Bowl (Item 3, Figure 17, WP 0297 00, Volume 2)
 Filter Element (Item 4, Figure 17, WP 0297 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

Materials/Parts:

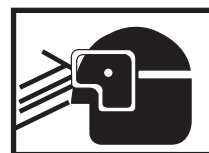
Dry Cleaning Solvent (Item 57, Table 1, WP 0307 00, Volume 2)
 Rag, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
 Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)
 Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

References:

FM 55-502
 WP 0295 00 (volume 2)
 WP 0297 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Affected fuel oil filter/water separator isolated from the fuel oil system, locked out, and tagged out (FM 55-502).

SERVICE**WARNING**

Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts which are saturated with diesel fuel. Failure to comply can result in serious injury or death.

1. Position a suitable drain pan beneath the fuel oil filter/water separator.
2. Remove the pressure gauge (figure 1, item 1), brass fitting (figure 1, item 2), and the O-ring (figure 1, item 3), from the lid (figure 1, item 4). Discard the O-ring.
3. Remove the lid (figure 1, item 4) and the gasket (figure 1, item 5). Discard the gasket.
4. Grasp the molded handle on top of the filter element (figure 1, item 6) and remove the filter element from the cylinder (figure 1, item 7) by slowly twisting and pulling upward.
5. Remove the drain valve (figure 1, item 8) and O-ring (figure 1, item 9) from the bowl (figure 1, item 10). Discard the O-ring.

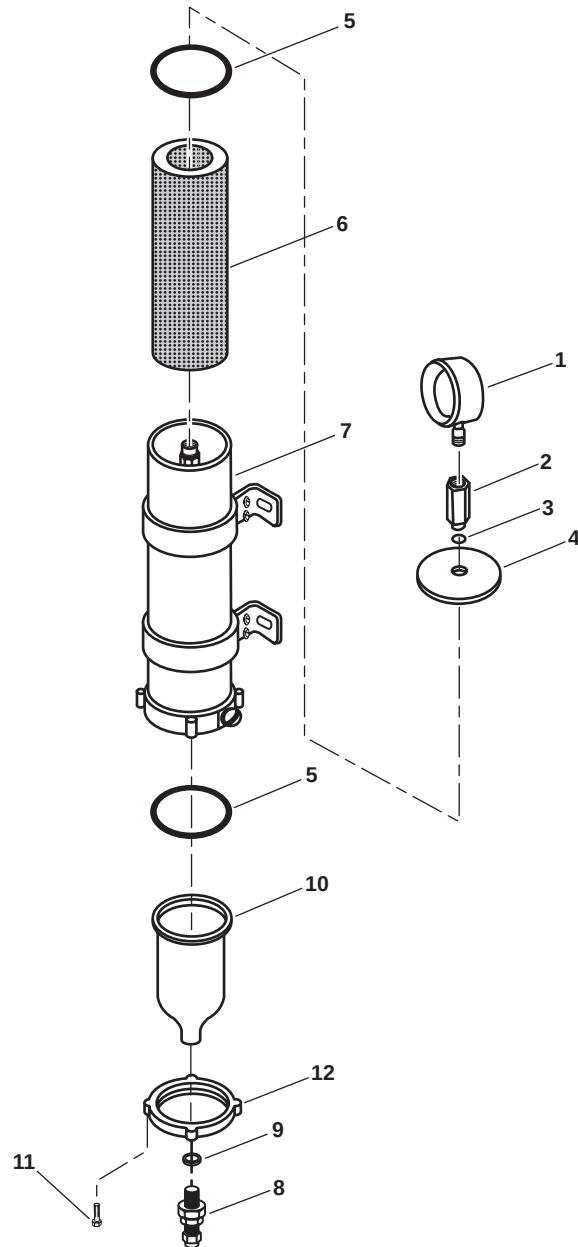
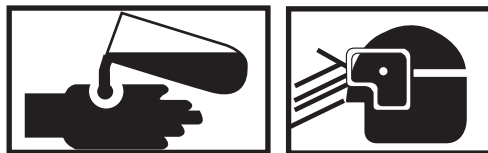


Figure 1. Fuel Oil Filter/Water Separator

6. Flush the cylinder (figure 1, item 7) and bowl (figure 1, item 10) with clean diesel fuel.
7. If contamination is still present in the bowl (figure 1, item 10) after flushing, remove the bowl retainer screws (figure 1, item 11), and remove the retaining ring (figure 1, item 12) and gasket (figure 1, item 5) from the cylinder (figure 1, item 7). Discard the gasket.

WARNING

Do not allow hydraulic fluid, engine oil, or dry cleaning solvent 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 dry cleaning solvent. Failure to comply can result in illness, serious injury or death.

8. Remove the bowl (figure 1, item 10) and clean it with dry cleaning solvent. Dry the bowl with clean wiping rags.
9. Install a new gasket (figure 1, item 5) on the bowl (figure 1, item 10).
10. Position the bowl (figure 1, item 10) on the cylinder (figure 1, item 7) and secure the bowl to the cylinder with the retaining ring (figure 1, item 12) and retainer screws (figure 1, item 11).
11. Replace the drain valve (figure 1, item 8) using a new O-ring (figure 1, item 9).
12. Install a new filter element (figure 1, item 6) into the cylinder (figure 1, item 7) using a twisting, downward motion.
13. Prime the fuel oil filter/water separator by filling it with clean diesel fuel.
14. Install a new gasket (figure 1, item 5) on the lid (figure 1, item 4).
15. Install the lid (figure 1, item 4) on the cylinder (figure 1, item 7).
16. Apply antiseizing tape to the male threads of the pressure gauge (figure 1, item 1) and brass fitting (figure 1, item 2).
17. Install the new O-ring (figure 1, item 3) in the lid (figure 1, item 4). Install the brass fitting (figure 1, item 2) in the lid the (figure 1, item 4).
18. Install the pressure gauge (figure 1, item 1) into the brass fitting (figure 1, item 3).
19. Remove the lockouts and tagouts (FM 55-502).
20. Place the fuel oil filter/water separator back online and check for fuel leaks.
21. Return the fuel oil filter/water separator to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FUEL OIL FILTER/WATER SEPARATOR, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
 Suitable Drain Pan

Materials/Parts:

Dry Cleaning Solvent (Item 57, Table 1, WP 0307 00, Volume 2)
 Rag, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
 Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)
 Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
 Gasket, Bowl (Item 3, Figure 17, WP 0297 00, Volume 2)

Materials/Parts (continue):

Filter Element (Item 4, Figure 17, WP 0297 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

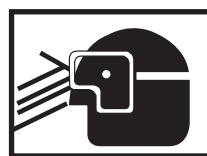
FM 55-502
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0297 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Affected fuel oil filter/water separator isolated from the fuel oil system, locked out, and tagged out (FM 55-502).

DISASSEMBLY

WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts which are saturated with diesel fuel. Failure to comply can result in serious injury or death.

1. Position a suitable drain pan beneath the fuel oil filter/water separator.
2. Remove the pressure gauge (figure 1, item 1), brass fitting (figure 1, item 2), and the O-ring (figure 1, item 3) from the lid (figure 1, item 4). Discard the O-ring.
3. Remove the lid (figure 1, item 4) and the gasket (figure 1, item 5). Discard the gasket.
4. Grasp the molded handle on top of the filter element (figure 1, item 6) and remove the filter element from the cylinder (figure 1, item 7) by slowly twisting and pulling upward.
5. Remove the drain valve (figure 1, item 8) and O-ring (figure 1, item 9) from the bowl (figure 1, item 10). Discard the O-ring.

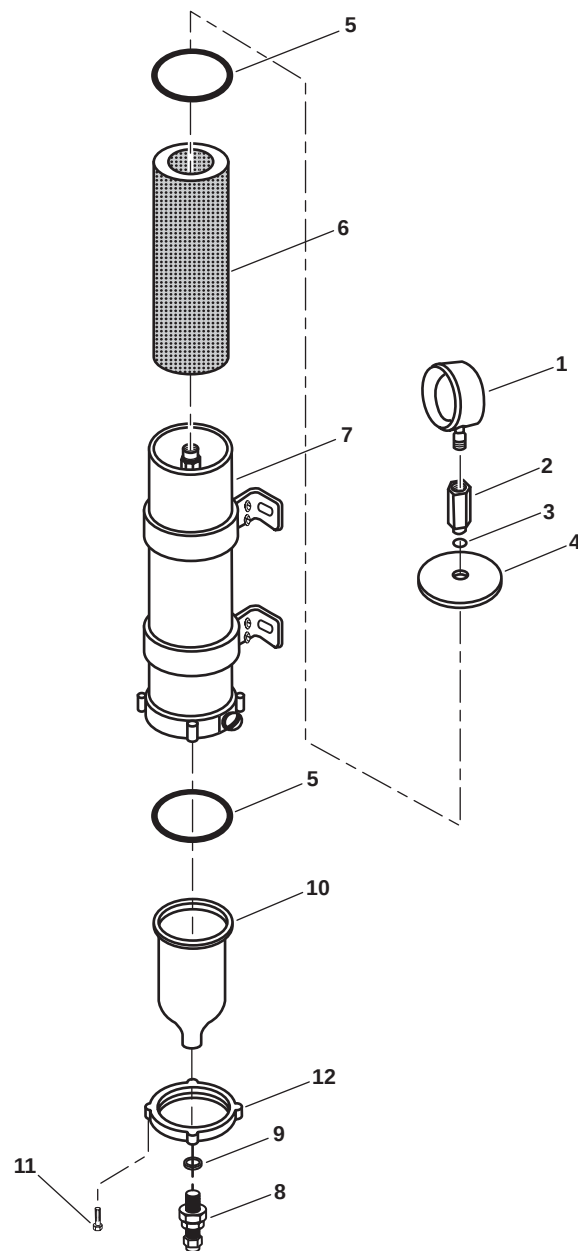


Figure 1. Fuel Oil Filter/Water Separator

6. Remove the bowl retainer screws (figure 1, item 11) and the retaining ring (figure 1, item 12), bowl (figure 1, item 10), and gasket (figure 1, item 5) from the cylinder (figure 1, item 7). Discard the gasket.

INSPECTION

1. Inspect the bowl (figure 1, item 10) and the lid (figure 1, item 4) for any obvious damage such as scratches, cracks, or deformations that could prevent proper mating of sealing surfaces that permit fuel leakage. Replace any defective cover or lid.
2. Inspect the bowl (figure 1, item 10) and the lid (figure 1, item 4) O-ring grooves for distortion, burrs or corrosion, which might damage O-rings during installation, operation, or could prevent proper mating of sealing surfaces that permit fuel leakage. Replace any defective parts.

ASSEMBLY

1. Install a new gasket (figure 1, item 5) on the bowl (figure 1, item 10). Secure the bowl to the cylinder (figure 1, item 7) with the retaining ring (figure 1, item 12) and retainer screws (figure 1, item 11).
2. Replace the drain valve (figure 1, item 8) using a new O-ring (figure 1, item 9).
3. Install a new filter element (figure 1, item 6) into the cylinder (figure 1, item 7) using a twisting, downward motion.
4. Prime the fuel oil filter/water separator by filling it with clean diesel fuel.
5. Install the lid (figure 1, item 4) with a new gasket (figure 1, item 5) on the cylinder (figure 1, item 7).
6. Apply antiseizing tape to the male threads of the pressure gauge (figure 1, item 1) and brass fitting (figure 1, item 3).
7. Install the new O-ring (figure 1, item 3) in the lid (figure 1, item 4). Install the brass fitting (figure 1, item 2) in the lid the (figure 1, item 4).
8. Install the pressure gauge (figure 1, item 1) on the brass fitting (figure 1, item 2).
9. Remove the lockouts and tagouts (FM 55-502).
10. Operate the fuel oil transfer system under usual conditions (TM 55-1925-273-10).
11. Check the fuel oil filter/water separator for leaks and proper operation.
12. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
ELECTRICAL POWER SYSTEM, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to off the SHORE POWER circuit breaker on the
main switchboard (middle center panel). Lock out
and tag out (FM 55-502).

Shore power, if applicable, secured, locked out, and
tagged 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.

SHORE POWER RECEPTACLE REPLACEMENT**REMOVAL**

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Use a multimeter to check for voltage at the applicable terminals (figure 1, item 1). If voltage is present, ensure that the appropriate circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
2. Remove the four screws (figure 1, item 2), four lockwashers (figure 1, item 3), and four flat washers (figure 1, item 4) that secure the shore power receptacle (figure 1, item 5) to the junction box (figure 1, item 6) mounted on the bulkhead of the vessel. Discard the lockwashers.

3. Label and disconnect the wiring (figure 1, item 7) from the terminal connection (figure 1, item 8).
4. Remove the shore power receptacle (figure 1, item 5) from the junction box (figure 1, item 6).

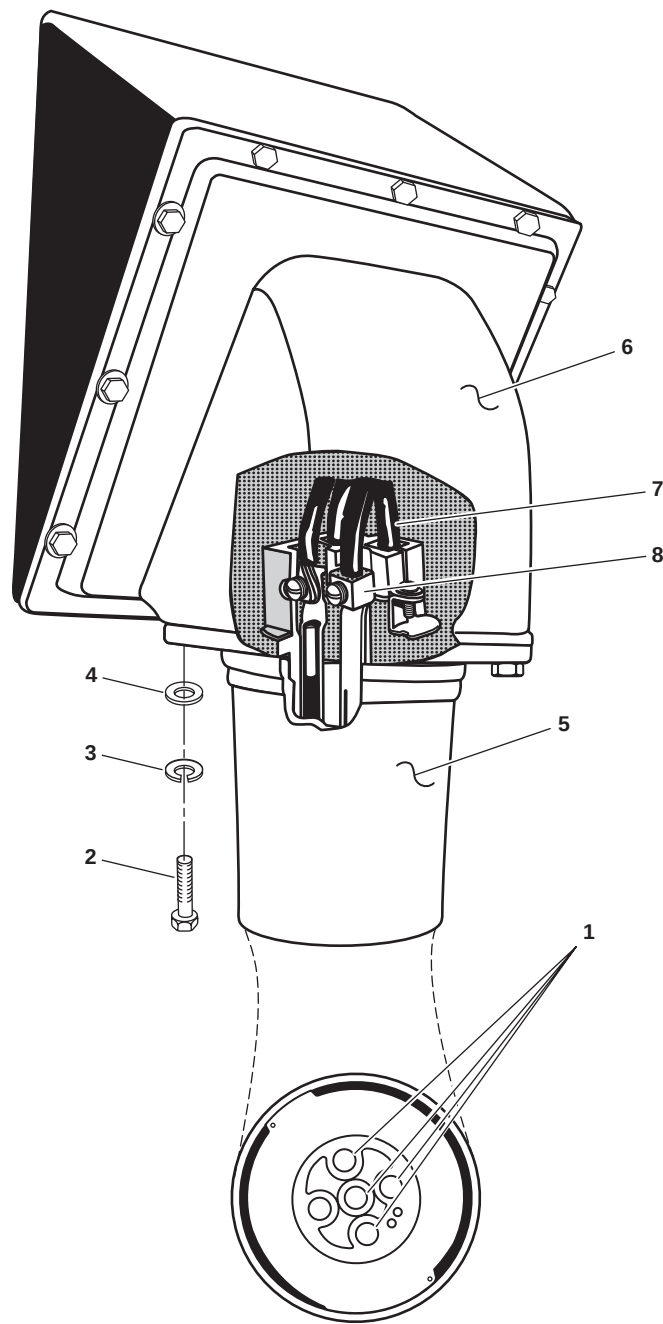


Figure 1. Shore Power Receptacle Repair

INSTALLATION

1. Install the shore power receptacle (figure 1, item 5) on the junction box (figure 1, item 6).
2. Install the electrical wiring (figure 1, item 7) to the appropriate terminal connection (figure 1, item 8) using the labels from step 3 of Removal as a guide. Remove the labels.

NOTE

New lockwashers are supplied with the new shore power receptacle.

3. Install the four screws (figure 1, item 2), four new lockwashers (figure 1, item 3), and four flat washers (figure 1, item 4) that secure the receptacle to the junction box (figure 1, item 6).
4. Perform the Follow-On Service procedure at the end of this work package.

SHORE POWER CABLE CONNECTOR REPLACEMENT

REMOVAL

1. Loosen the strain relief clamp (figure 2, item 1) by loosening the two screws (figure 2, item 2) that secure the strain relief clamp to the shore power cable (figure 2, item 3).

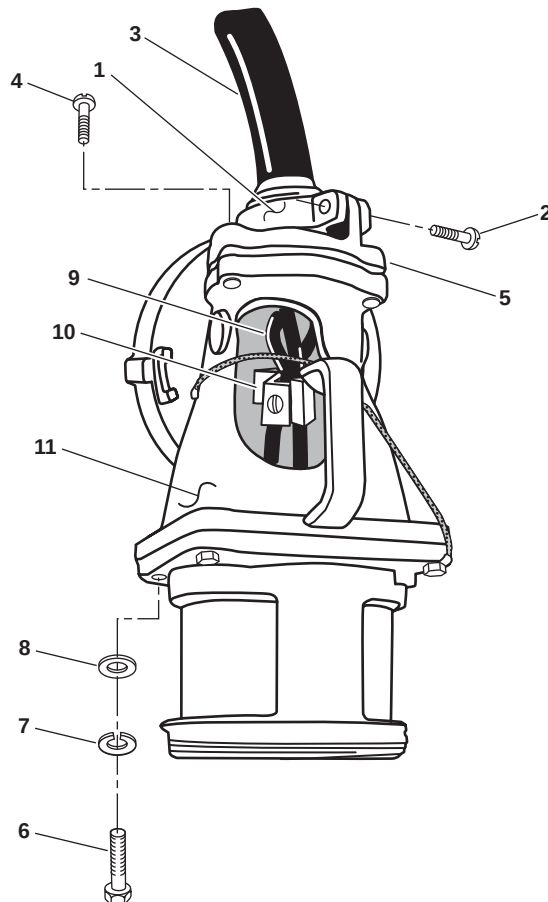


Figure 2. Shore Power Cable Connector Repair

2. Remove the three screws (figure 2, item 4) securing the strain relief clamp housing (figure 2, item 5).
3. Remove the four screws (figure 2, item 6), four lockwashers (figure 2, item 7), and four flat washers (figure 2, item 8) and slide the assembly down the shore power cable (figure 2, item 3) far enough to gain access to the wiring. Discard the lockwashers.
4. Label and disconnect the wiring (figure 2, item 9) from the terminals (figure 2, item 10).
5. Remove the connector (figure 2, item 11) from the shore power cable (figure 2, item 3).

INSTALLATION

1. Install the shore power cable (figure 2, item 3) through the strain relief clamp (figure 2, item 1), the strain relief clamp housing (figure 2, item 5), and into the connector (figure 2, item 11).
2. Install the wiring (figure 2, item 9) to the terminals (figure 2, item 10) using the labels from step 4 of Removal as a guide. Remove the labels.
3. Install the four screws (figure 2, item 6), four new lockwashers (figure 2, item 7), and four flat washers (figure 2, item 8) securing the connector (figure 2, item 11) to the shore power cable (figure 2, item 3).
4. Slide the strain relief clamp housing (figure 2, item 5) down to the connector (figure 2, item 11).
5. Install the three screws (figure 2, item 4) securing the strain relief clamp housing (figure 2, item 5) to the connector (figure 2, item 11). Tighten the three screws evenly around the strain relief clamp housing.
6. Secure the strain relief clamp (figure 2, item 1) to the power cable (figure 2, item 3) by tightening the two screws (figure 2, item 2).
7. 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 Connect to Shore Power Operation Under Usual Conditions (TM 55-1925-273-10) and check for proper operation of the shore power receptacle.
3. Return the shore power receptacle to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MAIN SWITCHBOARD, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
 WP 0295 00, Volume 2)
 Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
 Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the GEN. 2 CKT BKR. circuit breaker on the main switchboard (upper left panel). Lock out and tag out (FM 55-502).
 Set to OFF the GEN. 1 CKT BKR. circuit breaker on the main switchboard (upper right panel). Lock out and tag out (FM 55-502).

Equipment Conditions (continued):

Set to OFF the BUS TIE circuit breaker on the main switchboard (lower center panel). Lock out and tag out (FM 55-502).
 Set to OFF the SHORE POWER circuit breaker on the main switchboard (middle center panel). Lock out and tag out (FM 55-502).
 Set to OFF the EMG. GEN. SWBD. BUS TIE #2 circuit breaker on the main switchboard (lower left panel). Lock out and tag out (FM 55-502).
 Set to OFF all circuit breakers located on the top left panel of the main switchboard.
 CLOSE valve FO-21, F.O. SPLY TO S.S.D.G. No. 1. Lock out and tag out (FM 55-502).
 CLOSE valve FO-22, F.O. SPLY TO S.S.D.G. No. 2. Lock out and tag out (FM 55-502).
 CLOSE valve FO-32, F.O. SPLY TO ENG (Emergency Diesel Generator). Lock out and tag out (FM 55-502).
 External light source available for work areas.

TOP LEFT AND RIGHT PANELS

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

LAMP REPLACEMENT**REMOVAL**

1. Remove the indicator lens cover (figure 1, item 1) from the main switchboard panel (figure 1, item 2).
2. Remove the incandescent lamp (figure 1, item 3) from the main switchboard panel (figure 1, item 2).

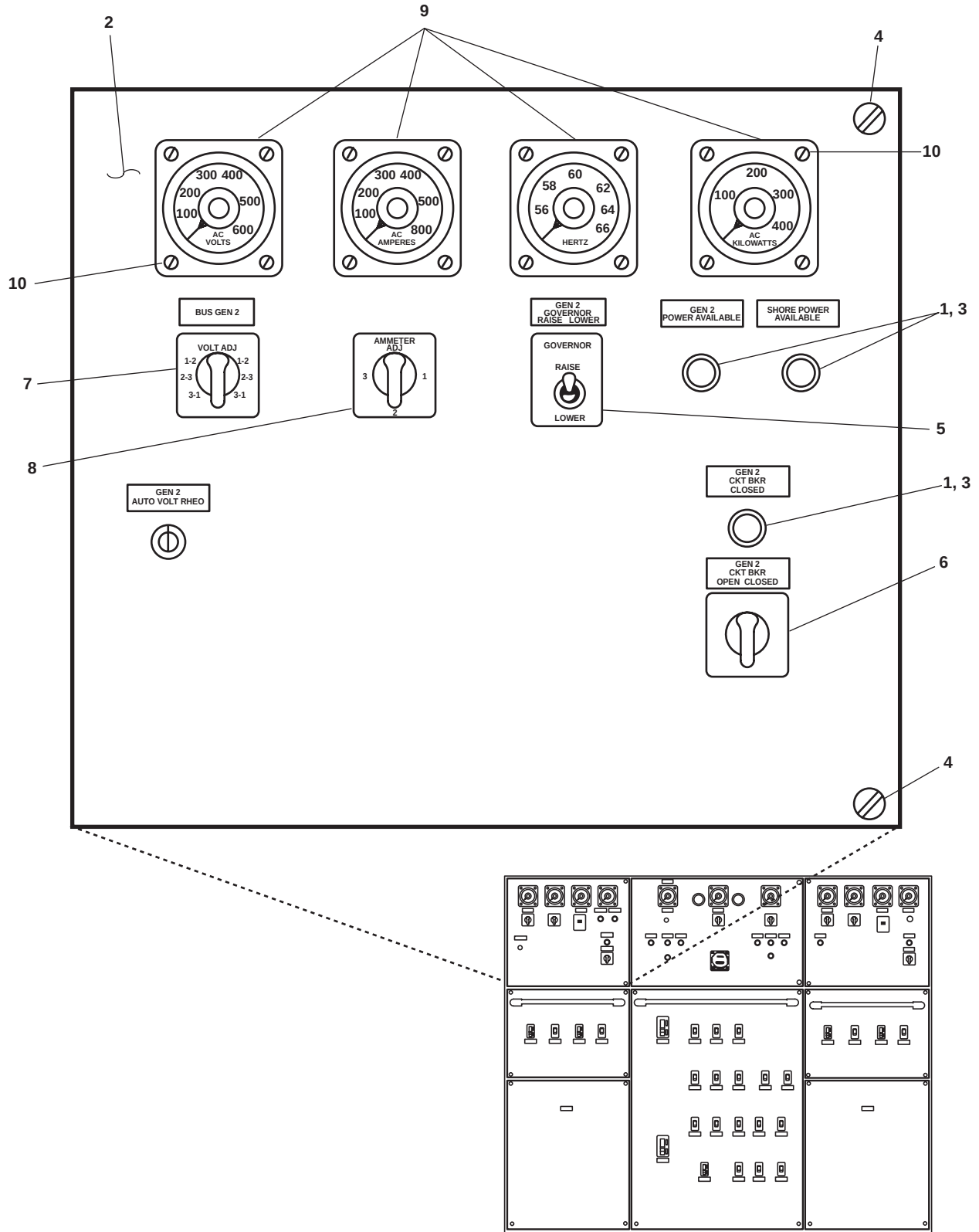


Figure 1. Main Switchboard Top Left Panel

INSTALLATION

1. Install the incandescent lamp (figure 1, item 3) in the main switchboard panel (figure 1, item 2).
2. Install the lens cover (figure 1, item 1) on the main switchboard panel (figure 1, item 2).
3. Perform the Follow-On Service procedure at the end of this work package.

ACCESS TO TOP LEFT AND RIGHT INNER PANEL

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Loosen the captive screws (figure 1, item 4) on the main switchboard panel (figure 1, item 2).
2. Open the main switchboard panel (figure 1, item 2).

SWITCH REPLACEMENT

REMOVAL

1. Perform the Access to Top Left and Right Inner Panel procedure in this work package.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the applicable governor toggle switch (figure 1, item 5), circuit breaker switch (figure 1, item 6), and/or the applicable select switch (figure 1, items 7 and 8) to be replaced. If voltage is present, ensure that the appropriate circuit breakers and engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the wiring to the applicable select switch (figure 2, items 1 and 2), circuit breaker switch (figure 2, item 3), and/or governor toggle switch (figure 2, item 4) that is required to be replaced.
4. Remove the knob(s) and the mounting hardware from the applicable circuit breaker/switch that is being replaced.
5. Remove the applicable circuit breaker/switch from the main switchboard panel (figure 1, item 2).

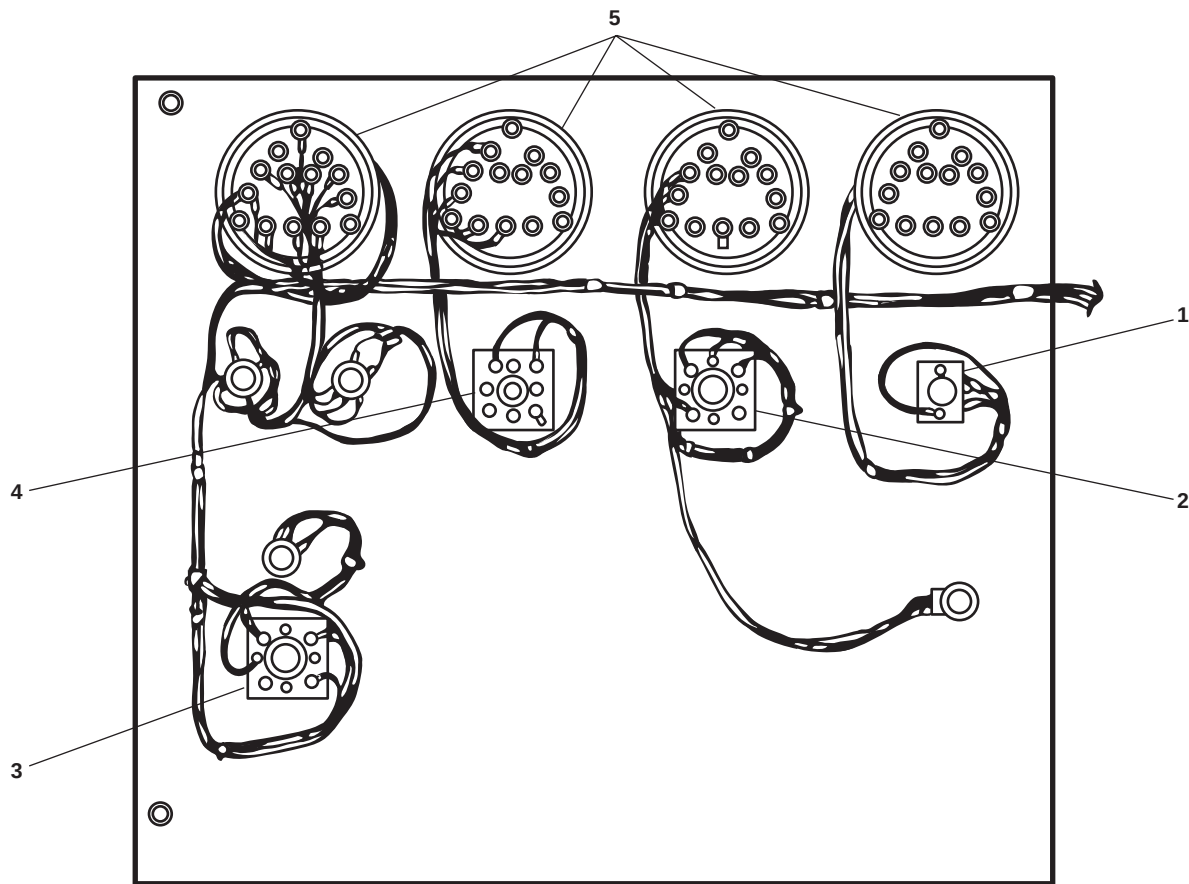


Figure 2. Main Switchboard Top Left Aft Panel (Rear)

INSTALLATION

1. Install the replacement select switch (figure 1, items 7 and 8), the circuit breaker switch (figure 1, item 6), and/or the governor toggle switch (figure 1, item 5) through the rear of the main switchboard panel (figure 1, item 2).
2. Install the mounting hardware on the replacement select switches (figure 2, items 1 and 2), the circuit breaker switch (figure 2, item 3), and/or the toggle switch (figure 2, item 4).
3. Install the wiring to the appropriate switch using the labels from step 3 of Removal as a guide. Remove the labels.
4. Perform the Securing Top Left and Right Inner Panel procedure in this work package.
5. Perform the Follow-On Service procedure at the end of this work package.

METER REPLACEMENT

REMOVAL

1. Perform the Access to Top Left and Right Inner Panel procedure in this work package.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the applicable meter (figure 1, item 9). If voltage is present, ensure that the appropriate circuit breakers and engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove the four screws (figure 1, item 10) from the applicable meter (figure 1, item 9).
4. Label and disconnect the electrical wiring to the applicable meter (figure 2, item 5) that is being replaced.
5. Remove any associated hardware from the applicable meter(s) being replaced.
6. Remove the meter(s) from the main switchboard panel (figure 1, item 2).

INSTALLATION

1. Install the meter(s) (figure 1, item 9) through the rear of the main switchboard panel (figure 1, item 2).
2. Install the four screws (figure 1, item 10) in the meter (figure 1, item 9).
3. Install any associated mounting hardware on the meter (figure 1, item 9).
4. Connect the electrical wiring to the meter (figure 2, item 5) using the labels from step 4 of Removal as a guide. Remove the labels.
5. Perform the Securing the Top Left and Right Inner Panel procedure in this work package.
6. Perform the Follow-On Service procedure at the end of this work package.

SECURING THE TOP LEFT AND RIGHT INNER PANEL

1. Close the main switchboard panel (figure 1, item 2).
2. Secure the main switchboard panel by tightening the captive screws (figure 1, item 4).

MIDDLE LEFT AND RIGHT PANELS**CIRCUIT BREAKER REPLACEMENT****REMOVAL****NOTE**

The circuit breaker may have internally mounted and/or factory installed accessories.

1. Loosen the captive screws (figure 3, item 1) on the door panel (figure 3, item 2).
2. Remove the door panel (figure 3, item 2) using the handrail (figure 3, item 3).

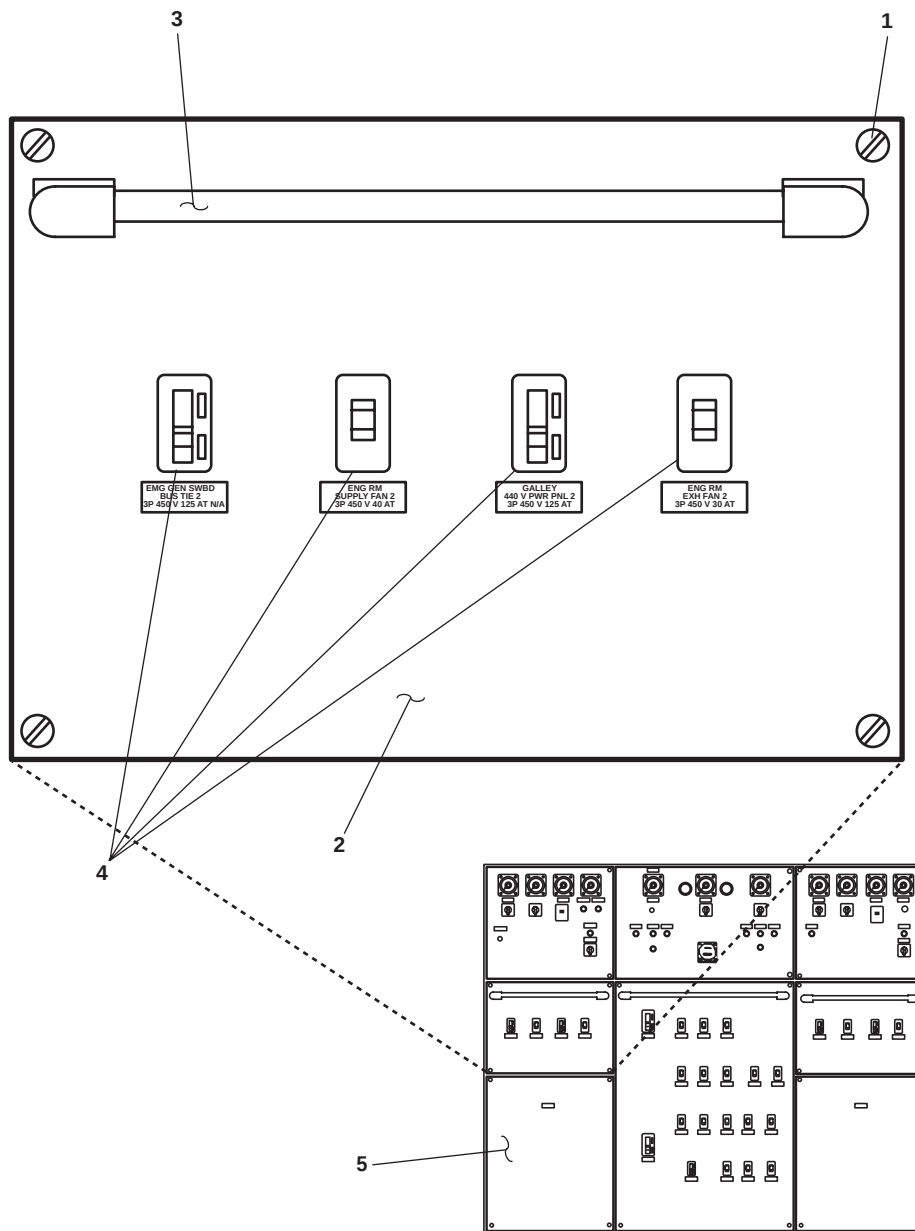


Figure 3. Main Switchboard Middle Left Panel

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the applicable circuit breaker (figure 3, item 4). If voltage is present, ensure that the appropriate circuit breakers and engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Loosen the associated screws from the circuit breaker (figure 3, item 4).
5. Remove the circuit breaker (figure 3, item 4) from the main switchboard (figure 3, item 5).

INSTALLATION

1. Install the circuit breaker (figure 3, item 4) in the main switchboard (figure 3, item 5).
2. Tighten the associated screws on the circuit breaker (figure 3, item 4).
3. Install the door panel (figure 3, item 2) using the handrail (figure 3, item 3) on the main switchboard (figure 3, item 5).
4. Tighten the captive screws (figure 3, item 1).
5. Perform the Follow-On Service procedure in this work package.

TOP CENTER PANEL**ACCESS TO TOP CENTER INNER PANEL****WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Loosen the captive screws (figure 4, item 1) on the door panel (figure 4, item 2).
2. Open the door panel (figure 4, item 2).

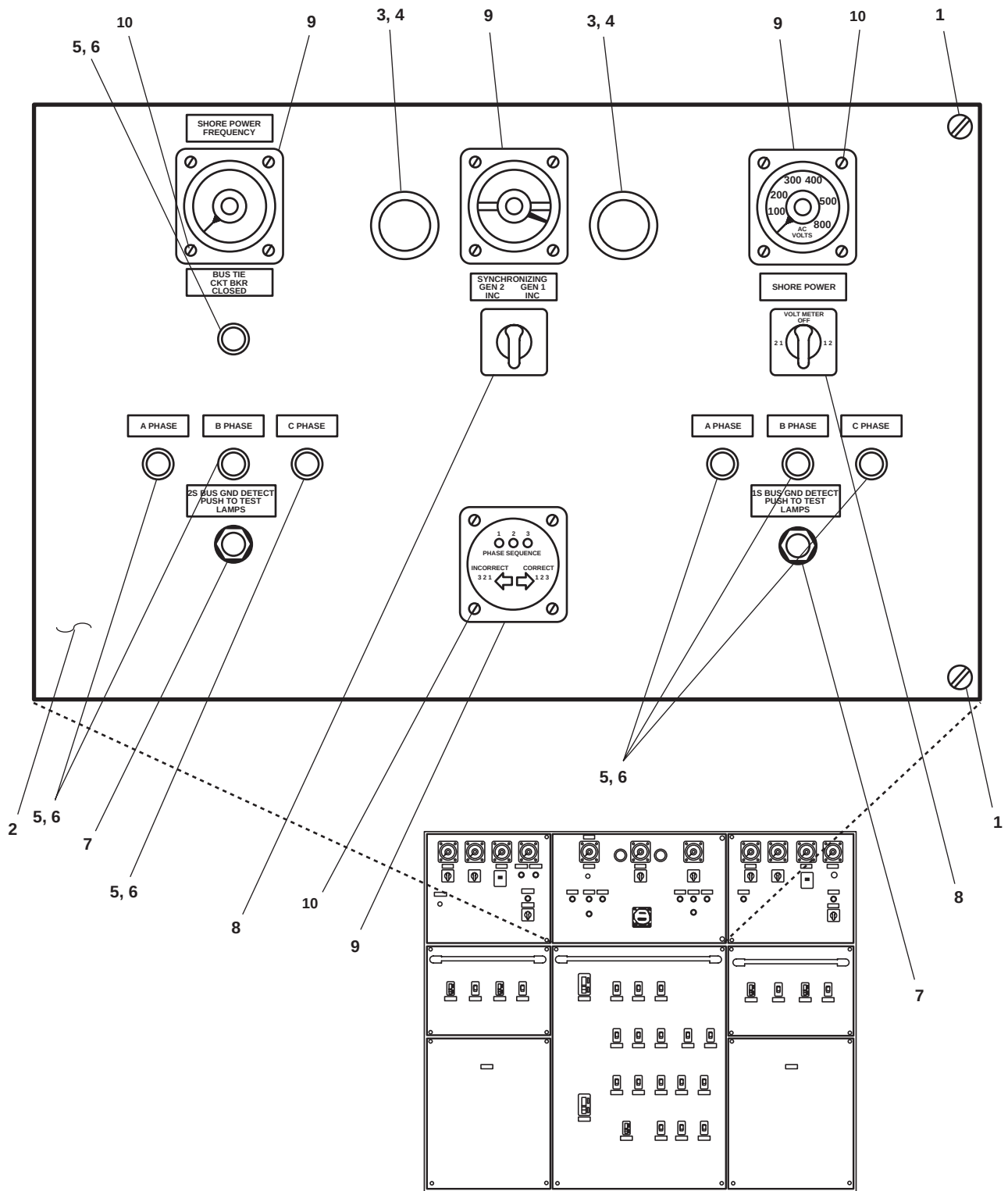


Figure 4. Main Switchboard Top Center Panel

REMOVAL

SYNC LIGHT REPLACEMENT

1. Remove the sync light and lens cover (figure 4, item 3) from the door panel (figure 4, item 2).
2. Remove the lamp (figure 4, item 4) from the door panel (figure 4, item 2).

INSTALLATION

1. Install the lamp (figure 4, item 4) in the door panel (figure 4, item 2).
2. Install the sync light and lens cover (figure 4, item 3) on the door panel (figure 4, item 2).
3. Perform the Follow-On Service procedure in this work package.

LAMP REPLACEMENT

REMOVAL

1. Remove the indicator lens cover (figure 4, item 5) from the door panel (figure 4, item 2).
2. Remove the incandescent lamp (figure 4, item 6) from the door panel (figure 4, item 2).

INSTALLATION

1. Install the incandescent lamp (figure 4, item 6) in the door panel (figure 4, item 2).
2. Install the indicator lens cover (figure 4, item 5) on the door panel (figure 4, item 2).
3. Perform the Follow-On Service procedure in this work package.

PUSHBUTTON REPLACEMENT

REMOVAL

1. Perform the Access to Top Center Inner Panel procedure in this work package.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the applicable pushbutton(s) (figure 4, item 7). If voltage is present, ensure that the proper circuit breakers and engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove any associated hardware from the applicable pushbutton(s) (figure 4, item 7).

4. Label and disconnect the electrical wiring to the pushbutton (figure 5, item 1).
5. Remove the pushbutton (figure 5, item 1) from the door panel (figure 4, item 2).

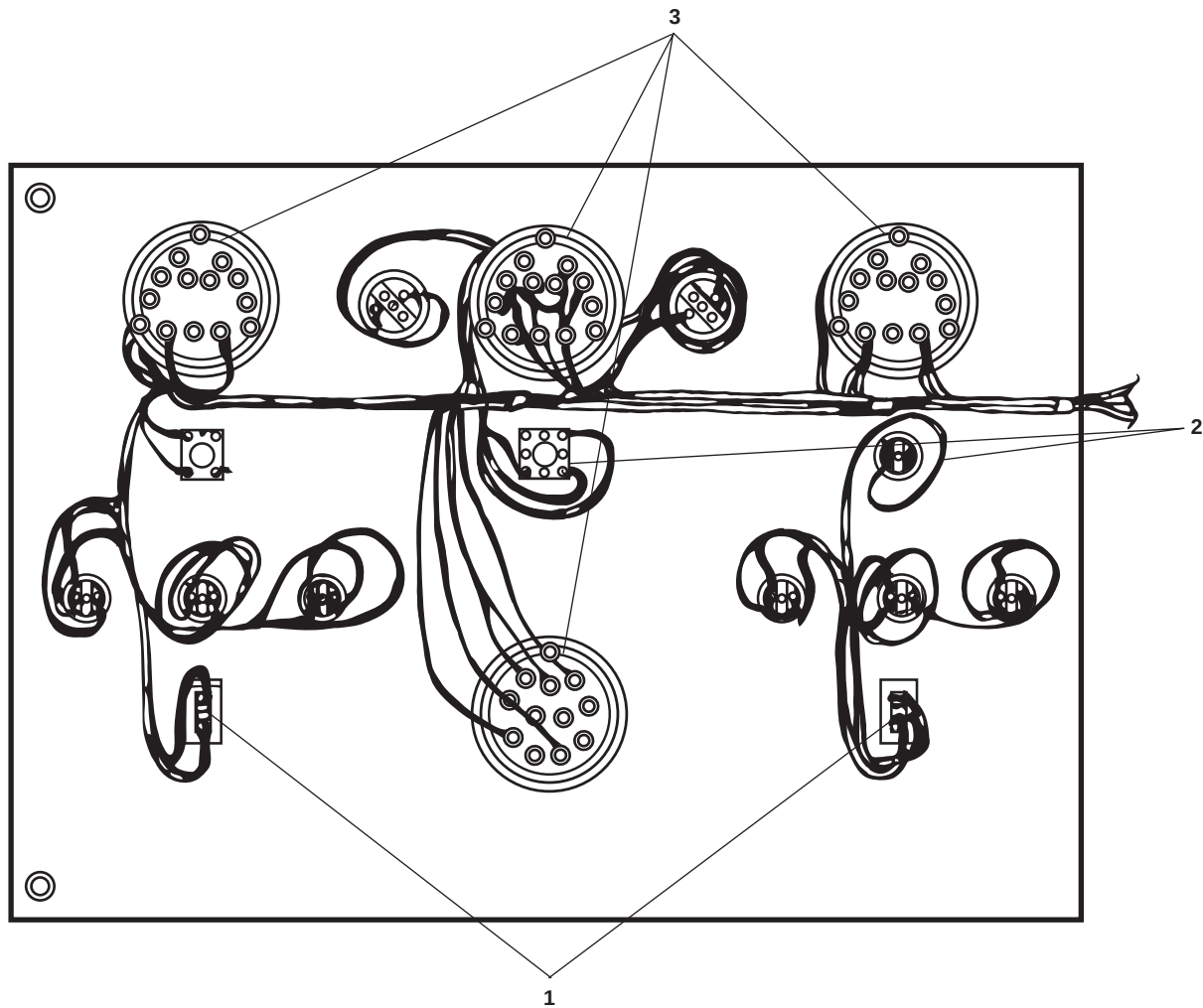


Figure 5. Main Switchboard, Top Center Panel (Rear)

INSTALLATION

1. Install the pushbutton(s) (figure 5, item 1) in the door panel (figure 4, item 2).
2. Install the associated hardware for the pushbutton (figure 5, item 1).
3. Connect the electrical wiring to the pushbutton (figure 5, item 1) using the labels from step 4 of Removal as a guide. Remove the labels.
4. Perform the Securing the Top Center Inner Panel procedure in this work package.
5. Perform the Follow-On Service procedure in this work package.

SWITCH REPLACEMENT

REMOVAL

1. Perform the Access to Inner Panel procedure in this work package.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the applicable switch (figure 4, item 8). If voltage is present, ensure that the appropriate circuit breakers and engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring to the applicable switch (figure 5, item 2).
4. Remove the knob(s) and the associated hardware from the applicable switch (figure 4, item 8).
5. Remove the switch (figure 4, item 8) from the door panel (figure 4, item 2).

INSTALLATION

1. Install the switch (figure 5, item 2) through the rear of the door panel (figure 4, item 2).
2. Install the associated hardware on the switch (figure 4, item 8).
3. Connect the electrical wiring to the switch (figure 5, item 2) using the labels from step 3 of Removal as a guide. Remove the labels.
4. Perform the Securing the Top Center Inner Panel procedure in this work package.
5. Perform the Follow-On Service procedure in this work package.

METER REPLACEMENT

REMOVAL

1. Perform the Access to Top Center Inner Panel procedure in this work package.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the applicable meter (figure 4, item 9) to be replaced. If voltage is present, ensure that the appropriate circuit breakers and engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with this procedure.
3. Remove the four screws (figure 4, item 10) from the meter (figure 4, item 9).
4. Label and disconnect the electrical wiring from the meter (figure 5, item 3).
5. Remove any associated hardware attached from the meter (figure 5, item 3).
6. Remove the meter (figure 5, item 3) from the door panel (figure 4, item 2).

INSTALLATION

1. Install the meter (figure 5, item 3) through the rear of the door panel (figure 4, item 2).
2. Install the associated hardware on the meter (figure 5, item 3).
3. Connect the electrical wiring to the meter (figure 5, item 3) using the labels from step 4 of Removal as a guide. Remove the labels.
4. Perform the Securing the Top Inner Panel procedure in this work package.
5. Perform the Follow-On Service procedure in this work package.

SECURING THE TOP CENTER INNER PANEL

1. Close the door panel (figure 4, item 2).
2. Secure the top inner panel by tightening the captive screws (figure 4, item 1).

BOTTOM CENTER PANEL**NOTE**

Procedures for the repair of the circuit breakers are basically the same as those described in the Middle Left and Right Panels procedure in this work package and illustrated by figure 3. For configuration variance of the circuit breakers (figure 6, item 1) see figure 6.

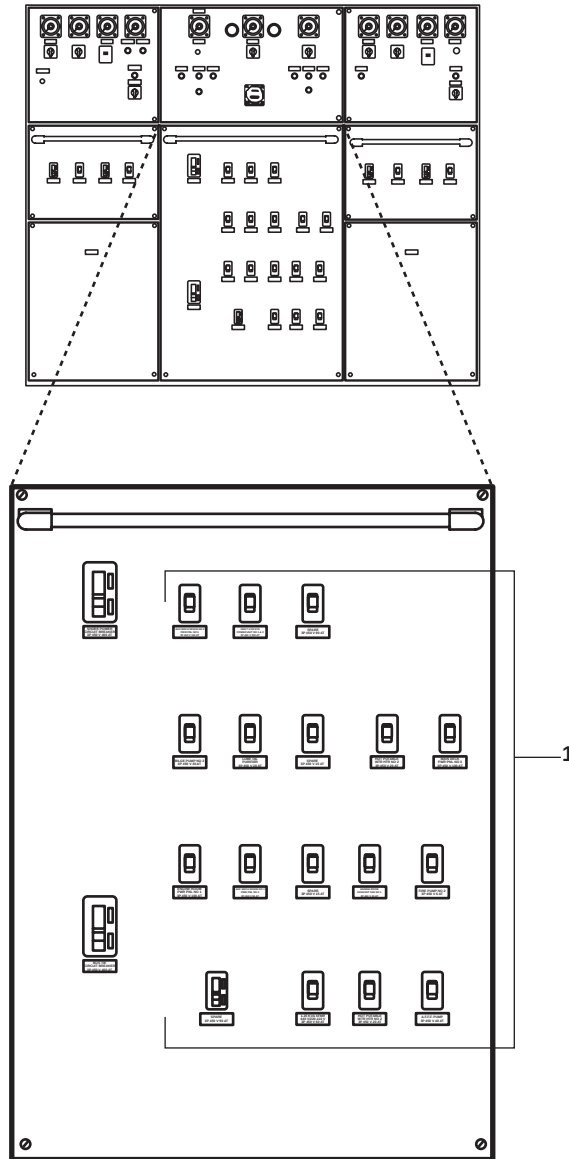


Figure 6. Main Switchboard Bottom Center Panel

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

CIRCUIT BREAKERS REPLACEMENT

Procedures for the removal and installation of the circuit breakers are basically the same as those described in the Middle Left and Right Panels procedure in this work package and illustrated by figure 3. For configuration variance of the circuit breakers (figure 6, item 1), see figure 6.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Perform the Preparation for Use and Power Generation Operation Under Usual Conditions (TM 55-1925-273-10) and verify proper operation of the main switchboard.
3. Return the main switchboard to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
EMERGENCY SWITCHBOARD, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0231 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

CLOSE valves FO-21, F.O. SPLY TO S.S.D.G. No.1; FO-22, F.O. SPLY TO S.S.D.G. No.2; and FO-32, F.O. SPLY TO ENG. Lock out and tag out (FM 55-502).
Shore power receptacle locked out and tagged out (FM 55-502).
External lighting source available for work areas.

Personnel Required:

Two Watercraft Engineers, 88L

ACCESS TO TOP INNER PANEL

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Loosen the emergency switchboard door panel captive screws (figure 1, item 1).
2. Open the emergency switchboard door panel (figure 1, item 2).

LAMP REPLACEMENT**REMOVAL**

1. Remove the indicator lens cover (figure 1, item 3) from the emergency switchboard door panel (figure 1, item 2).
2. Remove the incandescent lamp (figure 1, item 4) from the emergency switchboard door panel (figure 1, item 2).

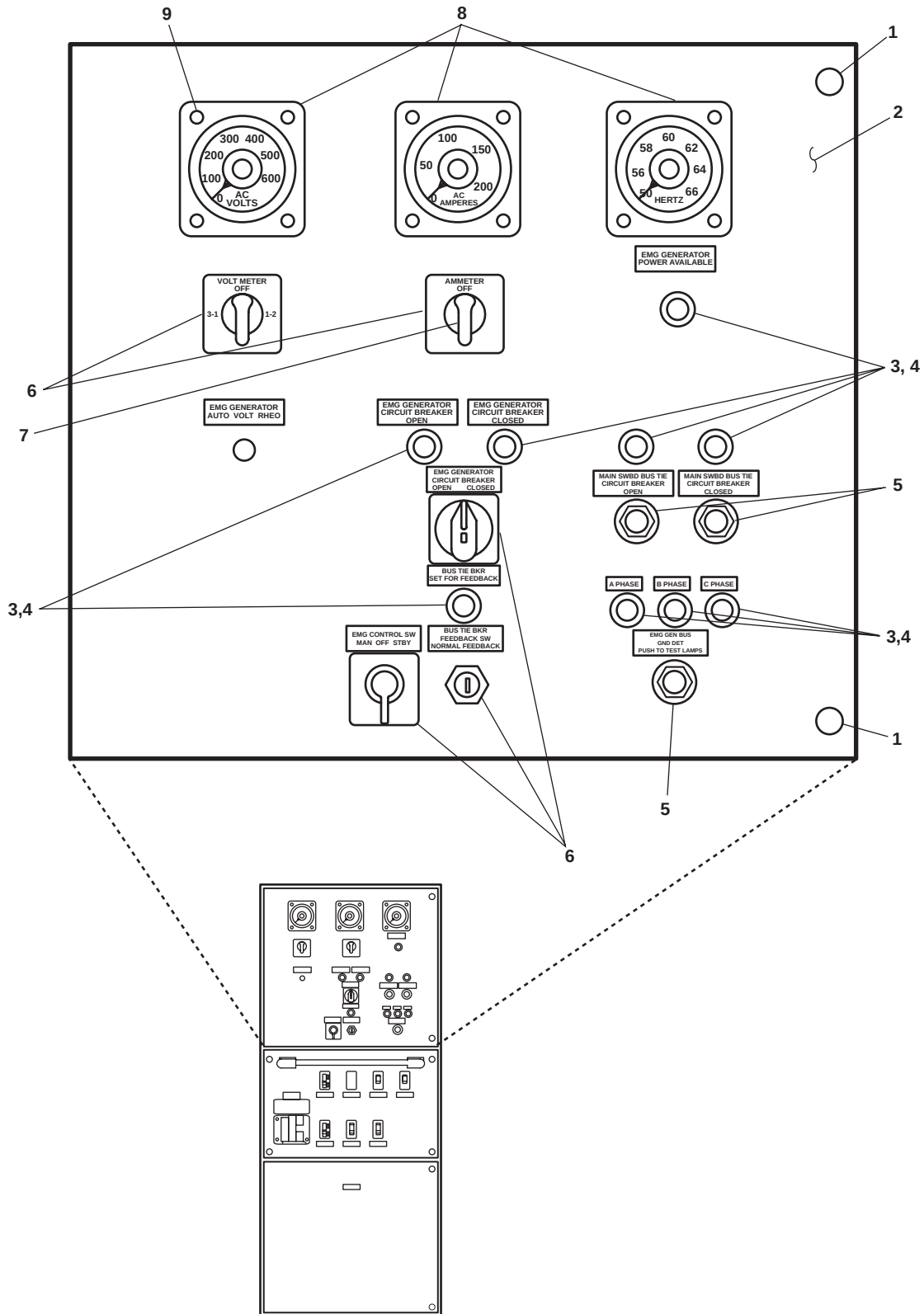


Figure 1. Emergency Switchboard Top Panel

INSTALLATION

1. Install the incandescent lamp (figure 1, item 4) in the emergency switchboard door panel (figure 1, item 2).
2. Install the indicator lens cover (figure 1, item 3) on the emergency switchboard door panel (figure 1, item 2).
3. Perform the Secure the Top Inner Panel procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

PUSHBUTTON REPLACEMENT

REMOVAL

1. Perform the Access to Top Inner Panel procedure in this work package.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the pushbutton(s) (figure 1, item 5). If voltage is present, ensure that the proper engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove any associated hardware from the pushbutton(s) (figure 1, item 5).
4. Label and disconnect the electrical wiring to the pushbutton(s) (figure 1, item 5).
5. Remove the pushbutton (figure 1, item 5) from the emergency switchboard door panel (figure 1, item 2).

INSTALLATION

1. Install the pushbutton(s) (figure 1, item 5) in the rear of the emergency switchboard door panel (figure 1, item 2).
2. Install the associated hardware on the pushbutton(s) (figure 1, item 5).
3. Connect the electrical wiring to the pushbutton(s) (figure 1, item 5) using the labels from step 4 of Removal as a guide. Remove the labels.
4. Perform the Secure the Top Inner Panel procedure in this work package.
5. Perform the Follow-On Service procedure at the end of this work package.

SWITCH REPLACEMENT

REMOVAL

1. Perform the Access to Top Inner Panel procedure at the beginning of this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the select switch (figure 1, item 6). If voltage is present, ensure that the proper engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring to the select switch (figure 1, item 6).
4. Remove the knob (figure 1, item 7) and the associated hardware from the select switch (figure 1, item 6).
5. Remove the select switch (figure 1, item 6) from the emergency switchboard door panel (figure 1, item 2).

INSTALLATION

1. Install the select switch (figure 1, item 6) through the rear of the emergency switchboard door panel (figure 1, item 2).
2. Install the associated hardware and the knob (figure 1, item 7) the select switch (figure 1, item 6).
3. Connect the electrical wiring to the select switch (figure 1, item 6) using the labels from step 3 of Removal as a guide. Remove the labels.
4. Perform the Secure the Top Inner Panel procedure in this work package.
5. Perform the Follow-On Service procedure at the end of this work package.

METER REPLACEMENT**REMOVAL**

1. Perform the Access to Top Inner Panel procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the meter (figure 1, item 8). If voltage is present, ensure that the proper engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Remove the four screws (figure 1, item 9) from the applicable meter (figure 1, item 8).
4. Label and disconnect the electrical wiring to the meter (figure 1, item 8).
5. Remove any associated hardware attached to the meter (figure 1, item 8).
6. Remove the meter (figure 1, item 8) from the emergency switchboard door panel (figure 1, item 2).

INSTALLATION

1. Install the meter (figure 1, item 8) through the rear of the emergency switchboard door panel (figure 1, item 2).
2. Install the four screws (figure 1, item 7) on the meter (figure 1, item 8).
3. Install the associated hardware on the meter (figure 1, item 8).
4. Connect the electrical wiring to the meter (figure 1, item 8) using the labels from step 4 of Removal as a guide. Remove the labels.
5. Perform the Secure the Top Inner Panel procedure in this work package.
6. Perform the Follow-On Service procedure at the end of this work package.

SECURE THE TOP INNER PANEL

1. Close the emergency switchboard door panel (figure 1, item 2).
2. Secure the top inner panel by tightening the captive screws (figure 1, item 1).

ACCESS TO MIDDLE INNER PANEL



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Loosen the emergency switchboard door panel captive screws (figure 2, item 1).
2. Remove the emergency switchboard door panel (figure 2, item 2) using the handrail (figure 2, item 3).
3. Store the emergency switchboard door panel (figure 2, item 2) in a safe place.

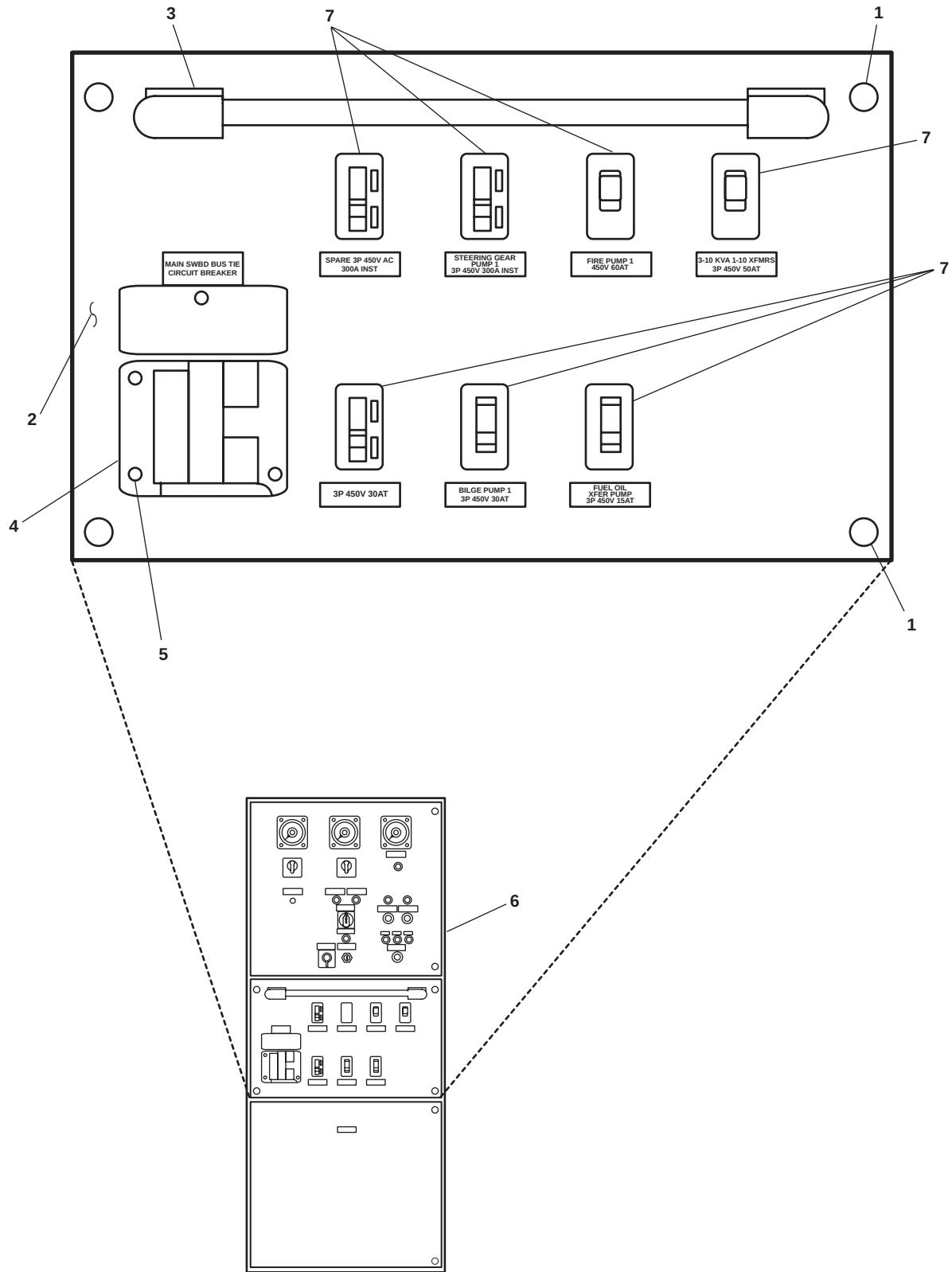


Figure 2. Emergency Switchboard Middle Panel

CIRCUIT BREAKER REPLACEMENT

REMOVAL

NOTE

The circuit breaker may have internally mounted and/or factory installed accessories.

1. Perform the Access to Middle Inner Panel procedure in this work package.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the circuit breaker (figure 1, item 5). If voltage is present, ensure that the proper engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove the screws (figure 2, item 5) from the circuit breaker (figure 2, item 4).
4. Remove the circuit breaker (figure 2, item 4) from the emergency switchboard (figure 2, item 6).

INSTALLATION

1. Install the circuit breaker (figure 2, item 4) in the emergency switchboard (figure 2, item 6).
2. Install the screws (figure 2, item 5) in the circuit breaker (figure 2, item 4).
3. Perform the Secure the Middle Inner Panel procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

SWITCH REPLACEMENT

REMOVAL

1. Perform the Access to Middle Inner Panel procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the circuit breaker switch (figure 2, item 7). If voltage is present, ensure that the proper engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring to the applicable circuit breaker switch (figure 2, item 7).
4. If applicable, remove any associated hardware from the circuit breaker switch (figure 2, item 7).
5. Remove the applicable circuit breaker switch (figure 2, item 7) from the emergency switchboard (figure 2, item 6).

INSTALLATION

1. Install the replacement circuit breaker switch (figure 2, item 7) through in the emergency switchboard (figure 2, item 6).
2. Install the associated hardware on the circuit breaker switch (figure 2, item 7).
3. Connect the electrical wiring to the circuit breaker switch (figure 2, item 7) using the labels from step 3 of Removal as a guide. Remove the labels.
4. Perform the Secure the Middle Inner Panel procedure in this work package.
5. Perform the Follow-On Service procedure at the end of this work package.

SECURE THE MIDDLE INNER PANEL

1. Install the emergency switchboard door panel (figure 2, item 2) using the handrail (figure 2, item 3).
2. Install the emergency switchboard door panel captive screws (figure 2, item 1).

ACCESS TO EMERGENCY SWITCHBOARD BACK PANEL

Access to the back panel is gained by going through the front panel of the emergency switchboard. Perform the Access to Middle Inner Panel procedure or the Access to Top Inner Panel procedure in this work package.

FUSE REPLACEMENT**REMOVAL**

1. Perform the Access to Emergency Switchboard Back Panel procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the fuse(s) (figure 3, item 1). If voltage is present, ensure that the proper engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Using a fuse puller, remove the fuse(s) (figure 3, item 1) from the fuse holder(s).

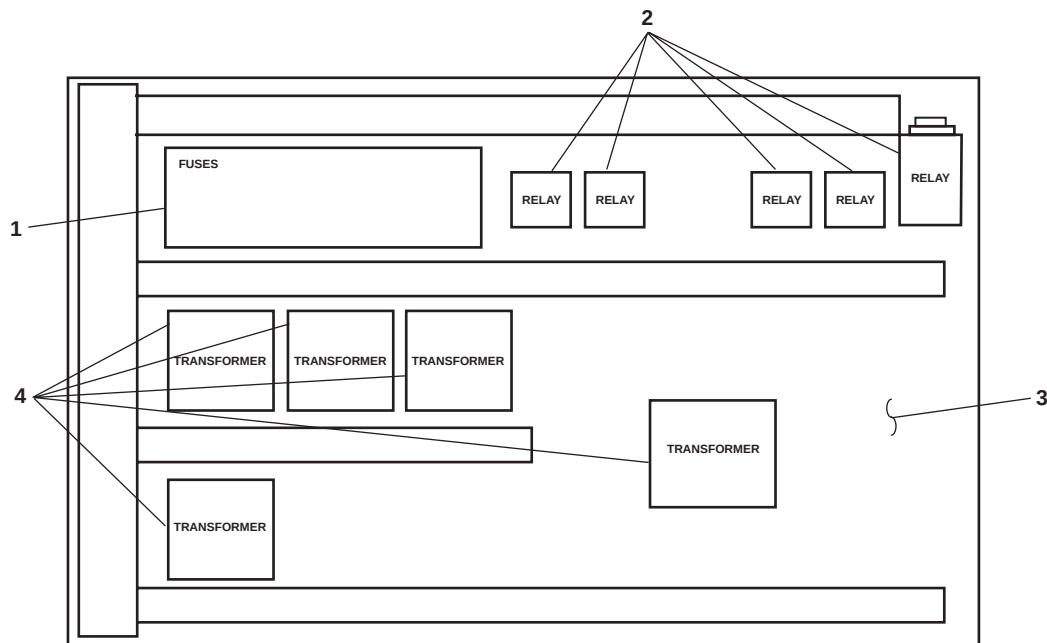


Figure 3. Emergency Switchboard Back Panel Layout

INSTALLATION

1. Using a fuse puller, install the fuse(s) (figure 3, item 1) in the fuse holder(s).
2. Perform the Secure the Emergency Switchboard Back Panel procedure in this work package.
3. Perform the Follow-On Service procedure at the end of this work package.

RELAY REPLACEMENT

REMOVAL

1. Perform the Access to Emergency Switchboard Back Panel procedure in this work package.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the relay(s) (figure 3, item 2). If voltage is present, ensure that the proper engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring attached to the relay (figure 3, item 2).
4. Remove the relay (figure 3, item 2) from the emergency switchboard (figure 3, item 3).

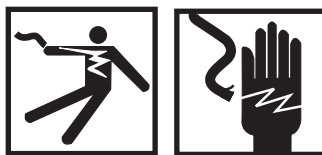
INSTALLATION

1. Install the relay(s) (figure 3, item 2) in the emergency switchboard (figure 3, item 3).
2. Connect the electrical wiring to the relay (figure 3, item 2) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Secure the Emergency Switchboard Back Panel procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

TRANSFORMER REPLACEMENT

REMOVAL

1. Perform the Access to Emergency Switchboard Back Panel procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the transformer (figure 3, item 4). If voltage is present, ensure that the proper engine fuel oil valves have been secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring to the transformer (figure 3, item 4).
4. Remove the associated mounting hardware from the transformer (figure 3, item 4).
5. Remove the transformer (figure 3, item 4) from the emergency switchboard (figure 3, item 3).

INSTALLATION

1. Install the transformer (figure 3, item 4) with the associated mounting hardware in the emergency switchboard (figure 3, item 3).
2. Connect the electrical wiring to the transformer (figure 3, item 4) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Secure the Emergency Switchboard Back Panel procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

SECURE THE EMERGENCY SWITCHBOARD BACK PANEL

Perform the Secure the Middle Inner Panel procedure or the Secure the Top Inner Panel procedure in this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Perform Preparation for Use operation under usual conditions (TM 55-1925-273-10) and Power Generation operation under usual conditions (TM 55-1925-273-10).
3. Return the emergency generator to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
ENGINE ROOM EMERGENCY LOAD CENTER, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
 WP 0295 00, Volume 2)
 Tool Kit, Electrician's (Item 11, Table 2,
 WP 0295 00, Volume 2)
 Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00
 Volume 2)

Equipment Conditions:

Set to OFF the 3-25KVA 1Ø XMRS circuit breaker at the
 main switchboard. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers 88L

ACCESS INNER LOAD CENTER**DISASSEMBLY**

1. Press the key latch (figure 1, item 1) and open the door (figure 1, item 2).
2. Loosen the screws (figure 1, item 3) and remove the face panel (figure 1, item 4).
3. Remove the screws (figure 1, item 5) from the inner panel (figure 1, item 6). Remove the inner panel.

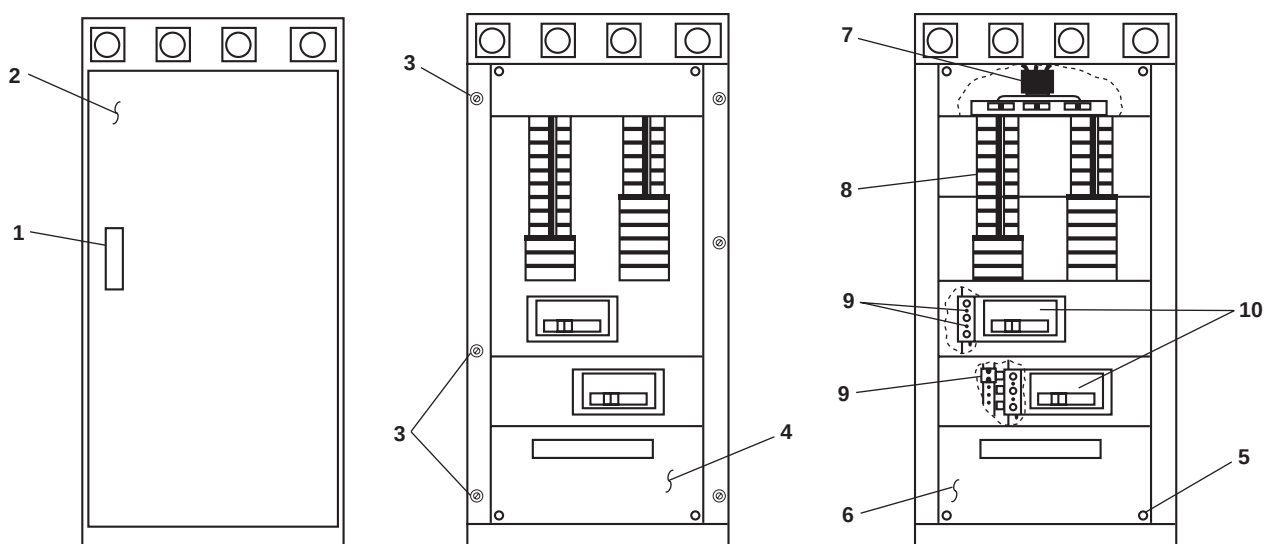


Figure 1. Load Center

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

4. Use a multimeter to check for voltage at the fuses (figure 1, item 7). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

ASSEMBLY

1. Install the inner panel (figure 1, item 6) and secure it with the screws (figure 1, item 5).
2. Install the face panel (figure 1, item 4) and secure it with the screws (figure 1, item 3).
3. Remove the lockouts and tagouts (FM 55-502).
4. Set the circuit breaker to ON.
5. Test operate all affected circuit breakers and the applicable equipment under usual conditions (TM 55-1925-273-10).
6. Close the door (figure 1, item 2) and secure it with the key latch (figure 1, item 1).
7. Return the equipment to the desired readiness condition.

FUSE REPLACEMENT**REMOVAL**

1. Perform the Access Inner Load Center Disassembly procedure in this work package.
2. Remove the fuse(s) (figure 1, item 7) with a fuse puller.

INSTALLATION

1. Install the fuse(s) (figure 1, item 7) with a fuse puller.
2. Perform the Access Inner Load Center Assembly procedure in this work package.

PLUG-IN CIRCUIT BREAKER REPLACEMENT**REMOVAL**

1. Perform the Access Inner Load Center Disassembly procedure in this work package.
2. Remove the applicable plug-in circuit breaker(s) (figure 1, item 8) by pushing in on the end of the circuit breaker nearest the center of the panel and pulling out in an arcing motion on the other end of the circuit breaker.

INSTALLATION

1. Install the circuit breaker (figure 1, item 8) by positioning one end of the circuit breaker under the D-lip and pushing the other end in an arcing motion until it snaps into place.
2. Perform the Access Inner Load Center Assembly procedure in this work package.

STANDARD CIRCUIT BREAKER REPLACEMENT**REMOVAL**

1. Perform the Access Inner Load Center Disassembly procedure in this work package.
2. Remove the screws (figure 1, item 9) and remove the applicable circuit breaker (figure 1, item 10).

INSTALLATION

1. Install the circuit breaker (figure 1, item 10) and secure it with the screws (figure 1, item 9).
2. Perform the Access Inner Load Center Assembly procedure in this work package.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
POWER DISTRIBUTION PANEL, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
 Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
 Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

All applicable circuit breakers that provide power to the affected power panel set to OFF. Lock out and tag out (FM 55-502).

CIRCUIT BREAKER REPLACEMENT**REMOVAL**

1. Press the key latch (figure 1, item 1) and open the door (figure 1, item 2).
2. Loosen the screws (figure 1, item 3) and remove the face panel (figure 1, item 4).
3. Remove the screws (figure 1, item 5) from the inner panel (figure 1, item 6). Remove the inner panel.

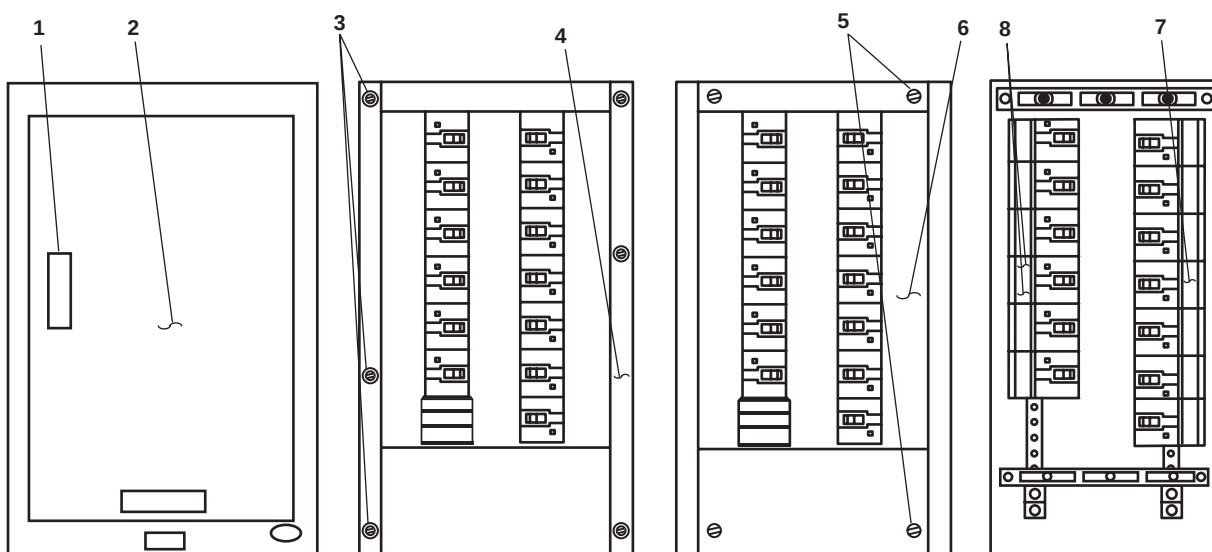


Figure 1. Power Panel

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

4. Use a multimeter to check for voltage at the circuit breaker(s) (figure 1, item 7). If voltage is present, ensure that the correct circuit breaker(s) is (are) set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Remove the screws (figure 1, item 8) and remove the applicable circuit breaker (figure 1, item 7).

INSTALLATION

1. Install the circuit breaker (figure 1, item 7) and secure it with the screws (figure 1, item 8).
2. Install the inner panel (figure 1, item 6) and secure it with the screws (figure 1, item 5).
3. Install the face panel (figure 1, item 4) and secure it with the screws (figure 1, item 3).
4. Remove the lockouts and tagouts (FM 55-502).
5. Set the circuit breaker(s) to ON.
6. Test operate all affected circuit breakers and the applicable equipment under usual conditions (TM 55-1925-273-10).
7. Close the door (figure 1, item 2) and secure it with the key latch (figure 1, item 1).
8. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LIGHTING FIXTURE, JUNCTION BOX (TYPICAL); REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Lamp, Incandescent (Item 5, Figure 42, WP 0299 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0299 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

On associated lighting panel, set the circuit breaker(s) to
OFF. Lock out and tag out (FM 55-502).

LAMP REPLACEMENT**REMOVAL****WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the guard (figure 1, item 1) from the fixture.
2. Remove the globe (figure 1, item 2) from the fixture.
3. Remove the lamp (figure 1, item 3) from the lamp socket.

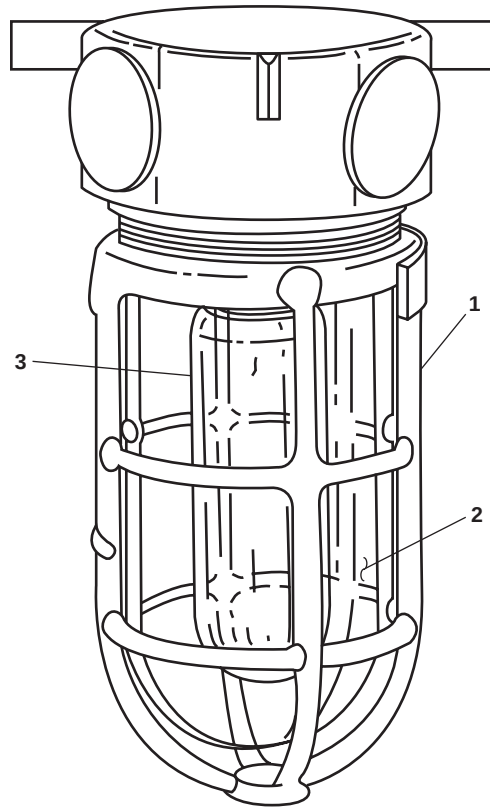


Figure 1. Junction Box Lighting

INSTALLATION

1. Install the lamp (figure 1, item 3) in the lamp socket hand tight.
2. Install the globe (figure 1, item 2) in the fixture hand tight.
3. Install the guard (figure 1, item 1) in the fixture hand tight.
4. Remove the lockouts and tagouts (FM 55-502).
5. Set the associated circuit breaker(s) to ON.
6. Perform a functional test by turning the light ON and OFF to ensure that the light operates properly.
7. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LIGHTING FIXTURE, BRACKET (TYPICAL); REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0299 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Fixture, Light, Bracket (Item 1, Figure 43, WP 0299 00,
Volume 2)

Equipment Conditions:

Set the circuit breaker(s) to OFF at the applicable lighting panel. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

REMOVAL

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the guard (figure 1, item 1).
2. Remove the globe (figure 1, item 2).
3. Remove the lamp (figure 1, item 3).

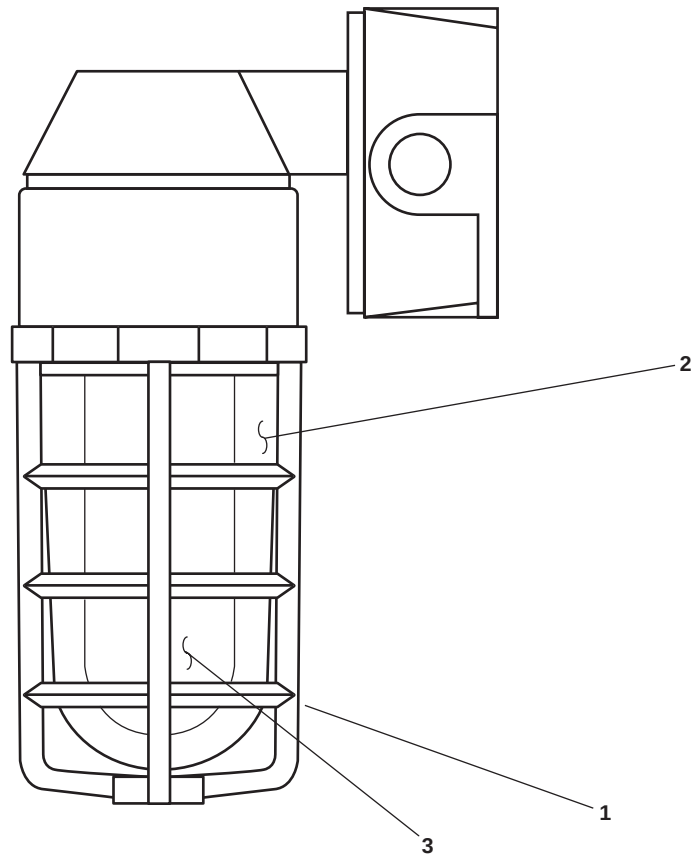


Figure 1. Lighting Fixture Bracket

INSTALLATION

1. Install the lamp (figure 1, item 3) in the lamp socket hand tight.
2. Install the globe (figure 1, item 2) in the fixture hand tight.
3. Install the guard (figure 1, item 1) in the fixture hand tight.
4. Remove the lockouts and tagouts (FM 55-502).
5. Set appropriate circuit breaker(s) to ON.
6. Perform a functional test by turning the light ON and OFF to ensure proper operation.
7. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FLUORESCENT FIXTURE, RECESSED; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
 WP 0295 00, Volume 2)

References:

FM 55-502
 WP 0295 00 (volume 2)
 WP 0299 00 (volume 2)
 WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
 Volume 2)
 Lamp, Fluorescent (Item 2, Figure 44, WP 0299 00,
 Volume 2)

Equipment Conditions:

Set the circuit breaker(s) to OFF on the applicable light-
 ing panel. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

REMOVAL

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Loosen the captive-knurled screws (figure 1, item 1) and remove the diffuser (figure 1, item 2).
2. Remove the fluorescent lamps (figure 1, item 3) from the fixture.

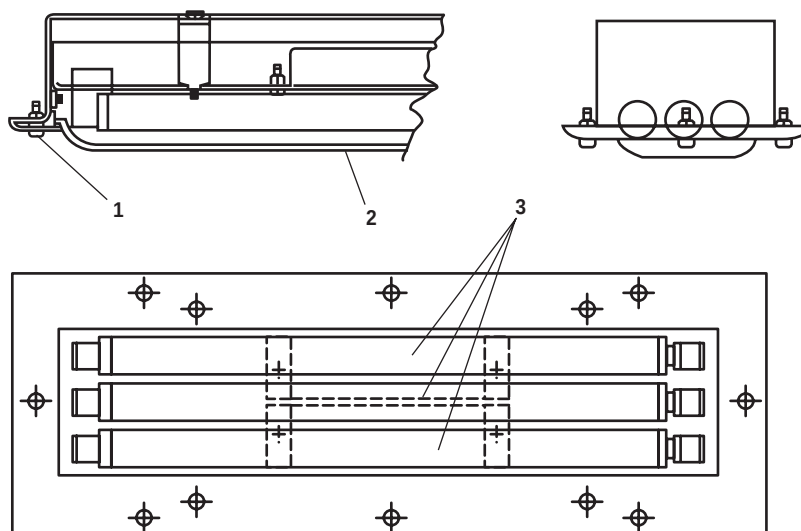


Figure 1. Fluorescent Fixture (Recessed)

INSTALLATION

1. Install the fluorescent lamps (figure 1, item 3) in the fixture.
2. Install the diffuser (figure 1, item 2) in the fixture and secure it with the captive screws (figure 1, item 1).
3. Remove the lockouts and tagouts (FM 55-502).
4. Set the applicable circuit breaker(s) to ON.
5. Perform a functional test by turning the light ON and OFF to ensure that the light operates properly.
6. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FLUORESCENT LIGHT, SURFACE MOUNT; REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0299 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Lamp, Fluorescent (Item 5, Figure 45, WP 0299 00,
Volume 2)

Equipment Conditions:

Set to OFF the circuit breakers on the applicable lighting
panel. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers 88L

REMOVAL**WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Release the latches (figure 1, item 1) that secure the diffuser (figure 1, item 2).

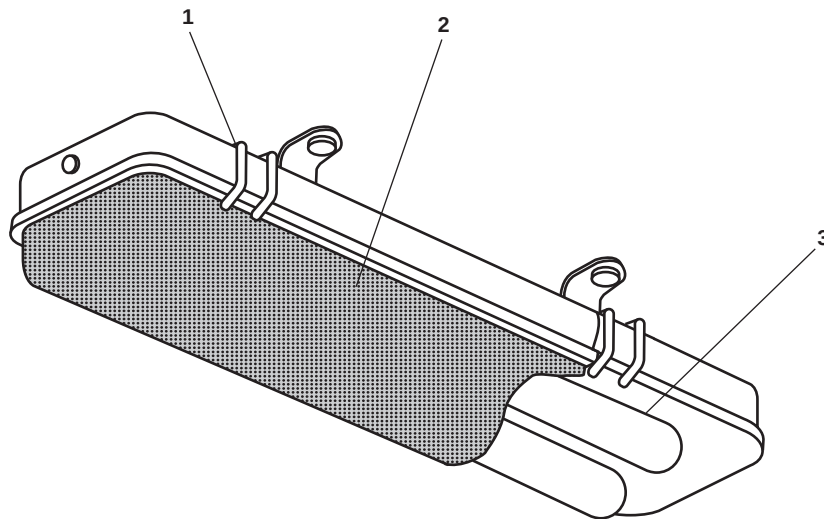


Figure 1. Fluorescent Light, Surface Mount

2. Remove the diffuser (figure 1, item 2).
3. Remove the fluorescent lamps (figure 1, item 3) from the fixture.

INSTALLATION

1. Install the fluorescent lamps (figure 1, item 3) in the fixture.
2. Install the diffuser (figure 1, item 2) in the fixture and secure it with the latches (figure 1, item 1).
3. Remove the lockouts and tagouts (FM 55-502).
4. Set the associated circuit breaker(s) to ON.
5. Perform a functional test by turning the light ON and OFF.
6. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
LIGHTING FIXTURE, WATERTIGHT INCANDESCENT EXPLOSION PROOF (TYPICAL); REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0299 00 (volume 2)
WP 030700 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Lamp, Incandescent (Item 3, Figure 46, WP 0299
00, Volume 2)

Equipment Conditions:

Set to OFF the circuit breaker(s) on the applicable light-
ing panel. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

REMOVAL**WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the screws (figure 1, item 1) and remove the guard (figure 1, item 2) from the lighting fixture (figure 1, item 3).
2. Remove the globe (figure 1, item 4) from the lighting fixture (figure 1, item 3).
3. Remove the lamp (figure 1, item 5) from the lamp socket (figure 1, item 6).

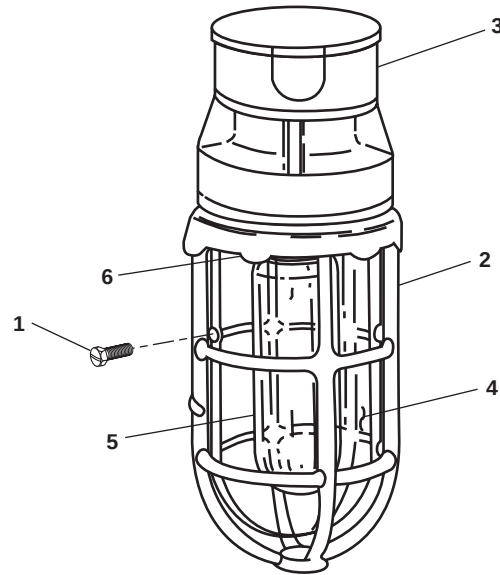


Figure 1. Explosion Proof Lighting Fixture

INSTALLATION

1. Install the lamp (figure 1, item 5) into the lamp socket (figure 1, item 6) hand tight.
2. Install the globe (figure 1, item 4) until hand tight.
3. Install the guard (figure 1, item 2) and secure it with the screw (figure 1, item 1).
4. Remove the lock outs and tag outs (FM 55-502).
5. Set the applicable circuit breaker(s) to ON.
6. Perform a functional test by turning the light ON and OFF.
7. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FLOODLIGHTS, REPLACE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

References:

FM 55-502
TB 43-0218
WP 0295 00 (volume 2)
WP 0299 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Floodlight (Item 3, Figure 47, WP 0299 00,
Volume 2)

Equipment Conditions:

At 120V exterior emergency lighting panel No. 2 set the
applicable floodlight circuit breaker to OFF. Lock
out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

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.

REMOVAL

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the cover from the floodlight junction box.
2. Use a multimeter to check the wiring leads for available voltage. If voltage is present, ensure that the proper circuit breaker is secured, locked out, and tagged out. If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring at the floodlight junction box.
4. Remove the mounting bolts (figure 1, item 1), nuts (figure 1, item 2), flat washers (figure 1, item 3), and lockwashers (figure 1, item 4). Discard the lockwashers.
5. Remove the floodlight (figure 1, item 5) from the foundation.

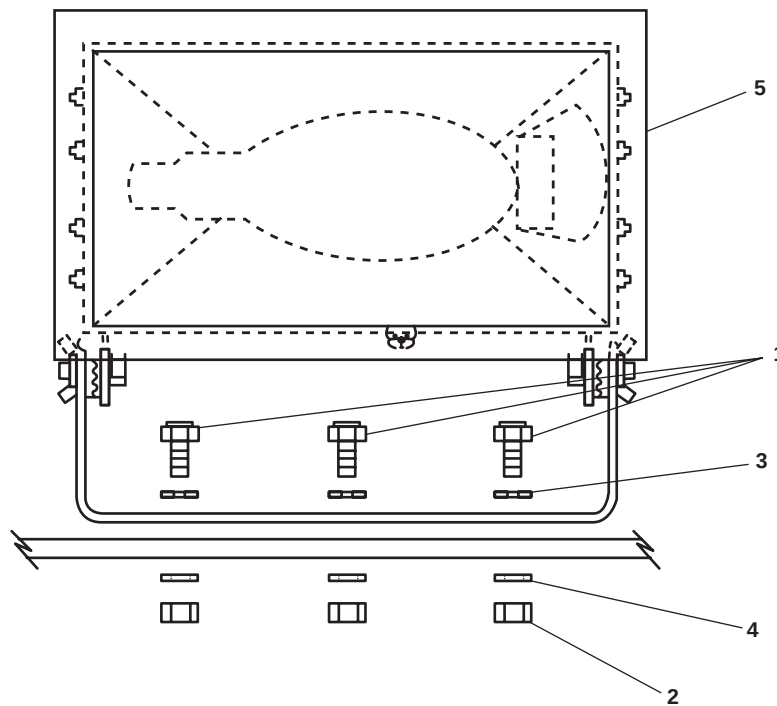


Figure 1. Replace Metal Halide Floodlight

INSTALLATION

1. Position the floodlight (figure 1, item 5) on the foundation.
2. Secure the floodlight (figure 1, item 5) to the foundation with the mounting bolts (figure 1, item 1), nuts (figure 1, item 2), washers (figure 1, item 3), and new lockwashers (figure 1, item 4).
3. Connect electrical wiring using the labels from Removal step 3 as a guide. Remove the labels.
4. Remove the lockouts and tagouts (FM 55-502).
5. Set the applicable floodlight circuit breaker to ON.
6. Perform a functional test by turning the light ON and OFF to ensure proper operation.
7. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FLOODLIGHTS, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0299 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set to OFF the associated floodlight circuit breaker at
120V exterior emergency lighting panel No. 2. Lock
out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

LAMP REPLACEMENT**WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

REMOVAL

1. Remove the nuts (figure 1, item 1) that secure the access plate (figure 1, item 2).
2. Remove the access plate (figure 1, item 2).
3. Remove the lamp (figure 1, item 3) from the fixture.

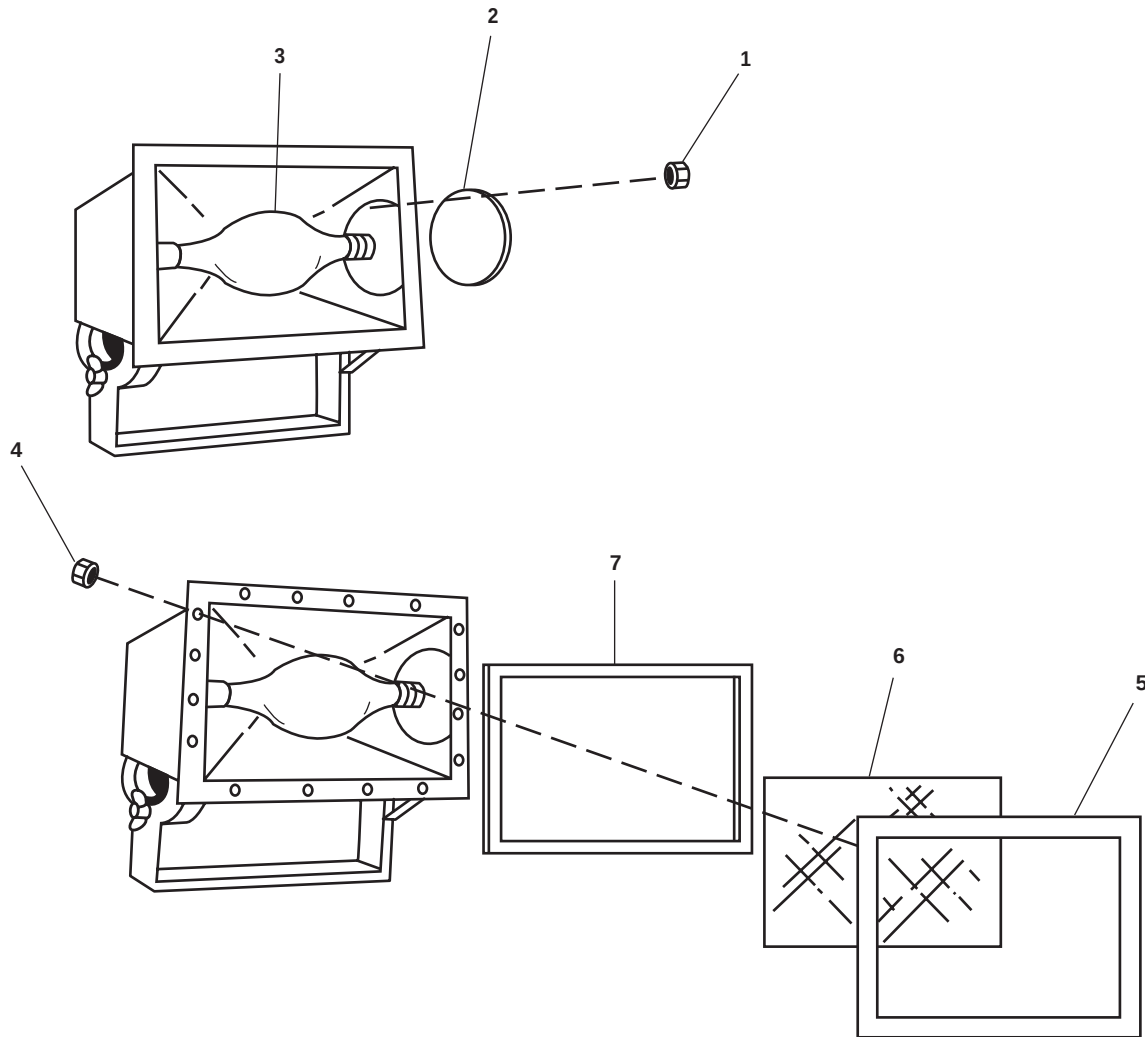


Figure 1. Metal Halide Floodlight

INSTALLATION

1. Install the lamp (figure 1, item 3) in the fixture.
2. Install the access plate (figure 1, item 2) and secure it with the nuts (figure 1, item 1).
3. Perform the Follow-On Service procedure at the end of this work package.

LENS REPLACEMENT

REMOVAL

1. Remove the nuts (figure 1, item 4).
2. Remove the lens frame (figure 1, item 5), lens (figure 1, item 6), and gasket (figure 1, item 7). Discard the gasket.

INSTALLATION

1. Install a new gasket (figure 1, item 7), lens (figure 1, item 6), and lens frame (figure 1, item 5).
2. Secure the lens frame to the housing with the nuts (figure 1, item 4).
3. 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. Set the associated floodlight circuit breaker to ON.
3. Test operate the floodlights (TM 55-1925-273-10).
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MOTOR CONTROLLER; REDUCTION GEAR COOLING PUMP, SEWAGE DISCHARGE PUMP 1 & 2,
LUBE OIL TRANSFER PUMP, POTABLE WATER PUMP 1 & 2, GALLEY SUPPLY FAN, GALLEY
EXHAUST FAN, SANITARY SPACE EXHAUST FAN, CREW MESS FAN COIL UNIT, 01, 02, 03 LEVELS
FAN COIL UNIT, AIR COMPRESSOR 1 & 2, FUEL OIL TRANSFER PUMP, AFFF PUMP; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Condition:

Set the applicable circuit breaker to OFF. Lock out and
tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers 88L

LAMP REPLACEMENT**REMOVAL****WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the lens cover (figure 1, item 1).
2. Remove the lamps from the indicators.

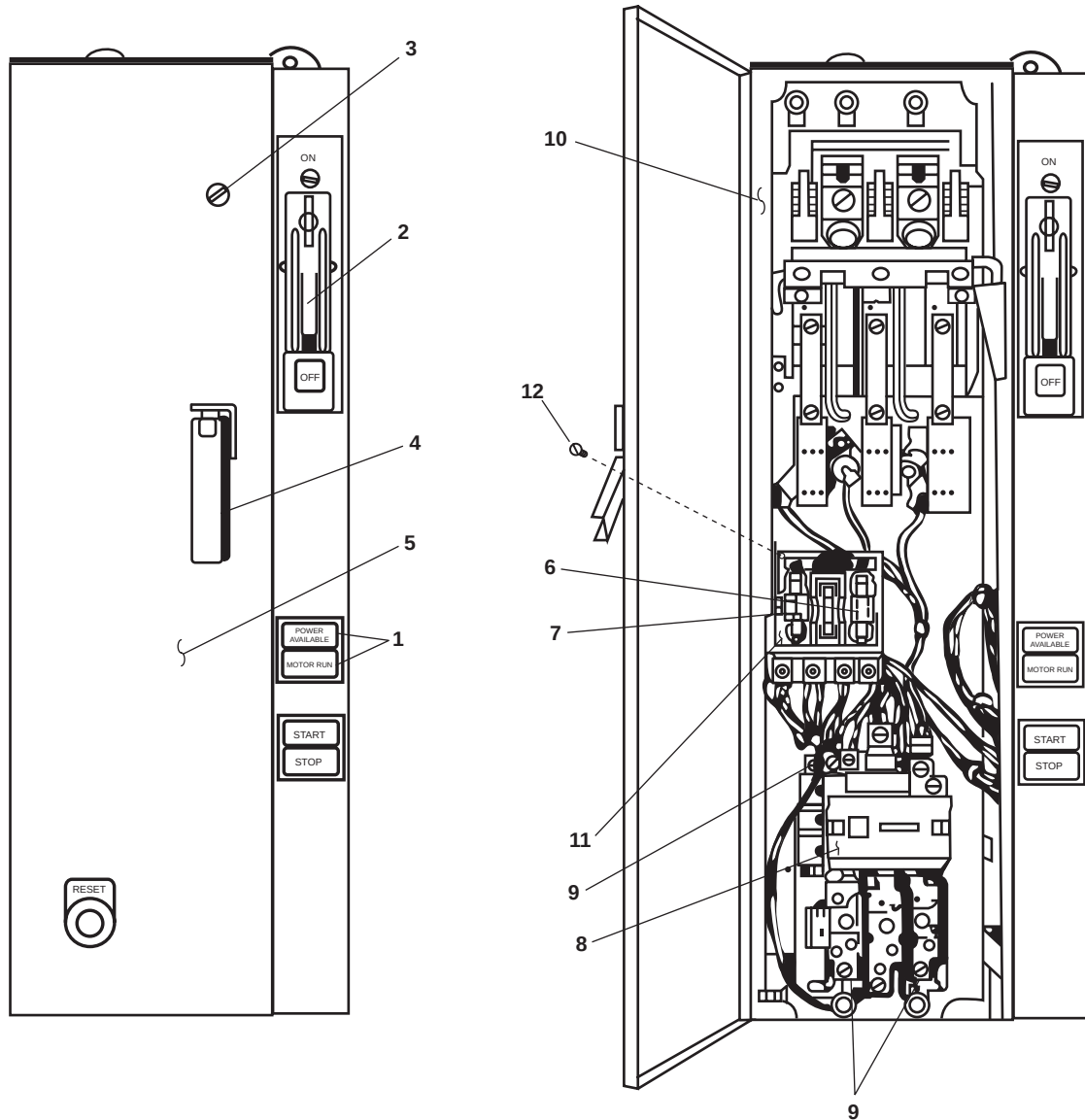


Figure 1. Motor Controller Type 1 (Typical)

INSTALLATION

1. Install lamps and lens covers (figure 1, item 1).
2. Perform the Follow-On Service procedure at the end of this work package.

ACCESS TO INNER MOTOR CONTROLLER

NOTE

The switch handle must be set to OFF to open the door.

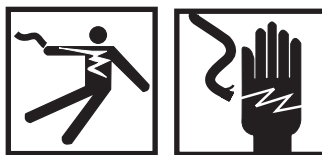
1. Set the switch handle (figure 1, item 2) to OFF.
2. Loosen the motor controller door screw (figure 1, item 3).
3. Turn the handle (figure 1, item 4) to open the door (figure 1, item 5).

FUSE REPLACEMENT

REMOVAL

1. Perform the Access to Inner Motor Controller procedure in this work package.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, items 6 and 7). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove the cartridge fuses (figure 1, item 6) and/or the slo-blo fuse (figure 1, item 7) using a fuse puller.

INSTALLATION

1. Install the cartridge fuses (figure 1, item 6) and/or the slo-blo fuse (figure 1, item 7) using a fuse puller.
2. Perform the Secure the Motor Controller procedure in this work package.
3. Perform the Follow-On Service procedure at the end of this work package.

MOTOR STARTER REPLACEMENT

REMOVAL

1. Perform the Access to Inner Motor Controller procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, items 6 and 7). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring attached to the motor starter (figure 1, item 8).
4. Remove the screws (figure 1, item 9) that secure the motor starter (figure 1, item 8) to the motor controller back plate (figure 1, item 10).
5. Remove the motor starter (figure 1, item 8).

INSTALLATION

1. Install the motor starter (figure 1, item 8) on the motor controller back plate (figure 1, item 10) and secure it with the screws (figure 1, item 9).
2. Connect the electrical wiring to the motor starter (figure 1, item 8) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Secure the Motor Controller procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

TRANSFORMER REPLACEMENT**REMOVAL**

1. Perform the Access to Inner Motor Controller procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, items 6 and 7). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Label and disconnect the electrical wiring attached to the transformer (figure 1, item 11).
4. Remove the screws (figure 1, item 12) holding the transformer (figure 1, item 11) to the motor controller back plate (figure 1, item 10).
5. Remove the transformer (figure 1, item 11).

INSTALLATION

1. Install the transformer (figure 1, item 11) on the motor controller back plate (figure 1, item 10) and secure it with the screws (figure 1, item 12).
2. Connect the electrical wiring to the transformer (figure 1, item 11) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Secure the Motor Controller procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

SECURE THE MOTOR CONTROLLER

1. Close the motor controller door (figure 1, item 5) and tighten the handle (figure 1, item 4).
2. Secure the door by tightening the door screw (figure 1, item 3).
3. Set the switch handle (figure 1, item 2) to ON.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Set the applicable circuit breaker(s) to ON.
3. Operate the motor controller for the affected system (TM 55-1925-273-10).
4. Verify proper operation of the motor controller.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MOTOR CONTROLLER, LUBE OIL PRIMING PUMP 1 AND LUBE OIL PRIMING PUMP 2; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Contact Set, Relay (Item 2, Figure 50, WP 0300 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0300 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the MAIN ENGINE LUBE OIL PRIMING
PUMP No. 1 circuit breaker, or the MAIN ENGINE
LUBE OIL PRIMING PUMP No. 2. circuit breaker
at 440V power panel No. 1. 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.

CONTACTOR ASSEMBLY REPLACEMENT**REMOVAL**

1. Remove the screw (figure 1, item 1) and then remove the front cover (figure 1, item 2) from the motor controller.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the contactor terminals (figure 2, item 1). If voltage is present, ensure that the proper circuit breaker has been set to OFF, 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 2).

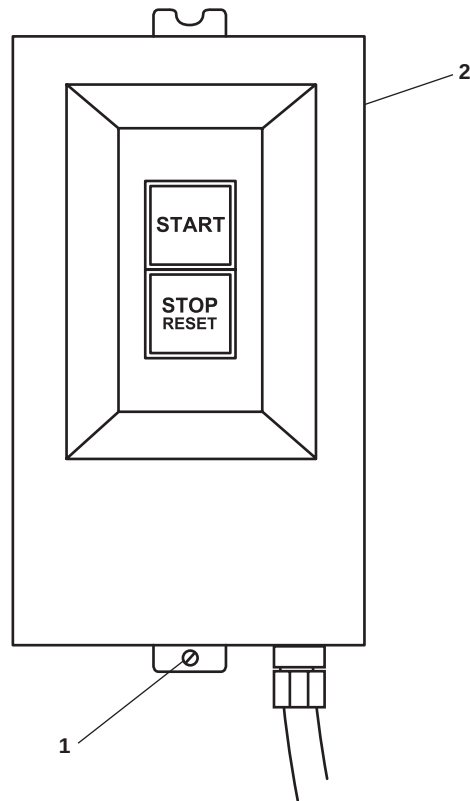


Figure 1. Motor Controller Type 6 (Typical)

4. Remove the screws (figure 2, item 3), flat washers (figure 2, item 4), lockwashers (figure 2, item 5), and nuts (figure 2, item 6). Discard the lockwashers.
5. Remove the contactor assembly (figure 1, item 7) from the motor controller.

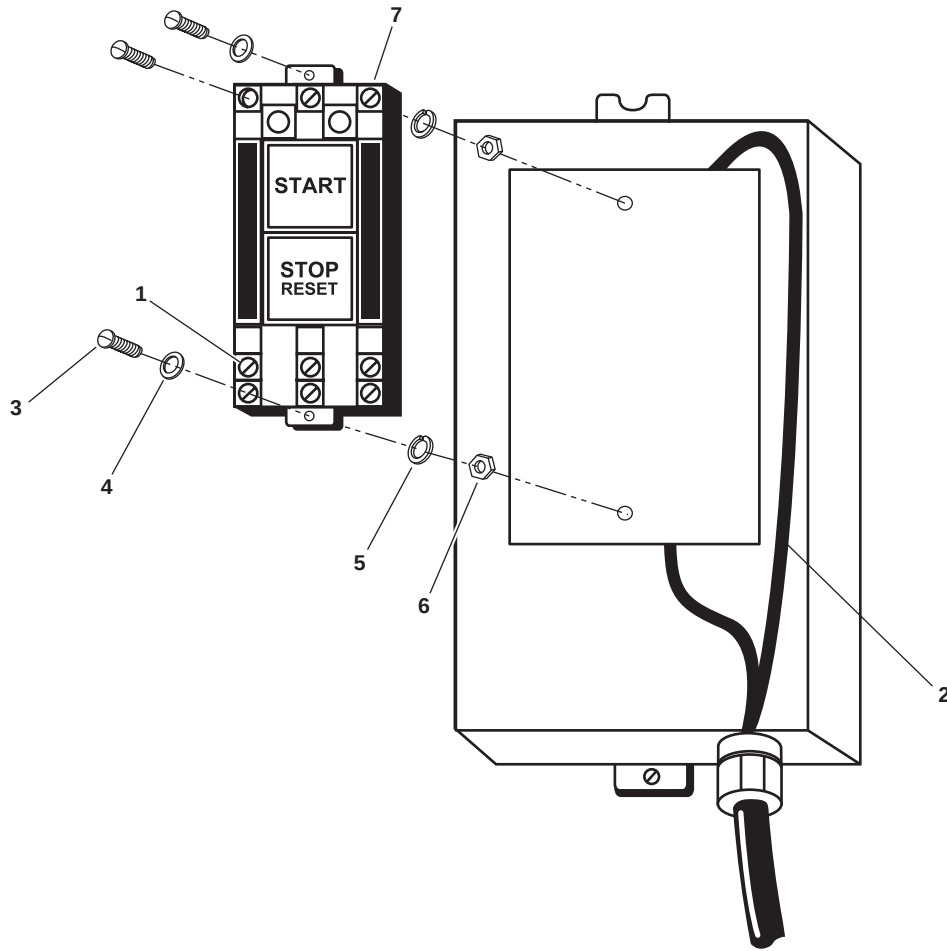


Figure 2. Motor Controller Type 6 – Cover Removed

INSTALLATION

1. Install the contactor assembly (figure 1, item 7) in the motor controller and secure it with the screws (figure 2, item 3), flat washers (figure 2, item 4), new lockwashers (figure 2, item 5), and nuts (figure 2, item 6).
2. Install the wiring (figure 2, item 2) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Install the front cover (figure 1, item 2) and secure it with the screws (figure 1, item 1).
4. Remove lockouts and tagouts (FM 55-502).
5. Set the circuit breaker to ON.
6. Operate the motor controller for the affected system (TM 55-1925-273-10), ensuring proper operation.
7. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MOTOR CONTROLLER; AMS 1 & 2 SUPPLY FAN, BOATSWAIN'S STORE ROOM SUPPLY FAN, ARMS
LOCKER EXHAUST FAN, ENGINE ROOM SUPPLY FAN 1 & 2, ENGINE ROOM EXHAUST FAN 1 & 2;
REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set the applicable circuit breaker to OFF. Lock out and
tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

LAMP REPLACEMENT**REMOVAL****WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in damaged equipment and serious injury or death.

1. Remove the lens cover (figure 1, item 1).
2. Remove the lamps from the indicators.

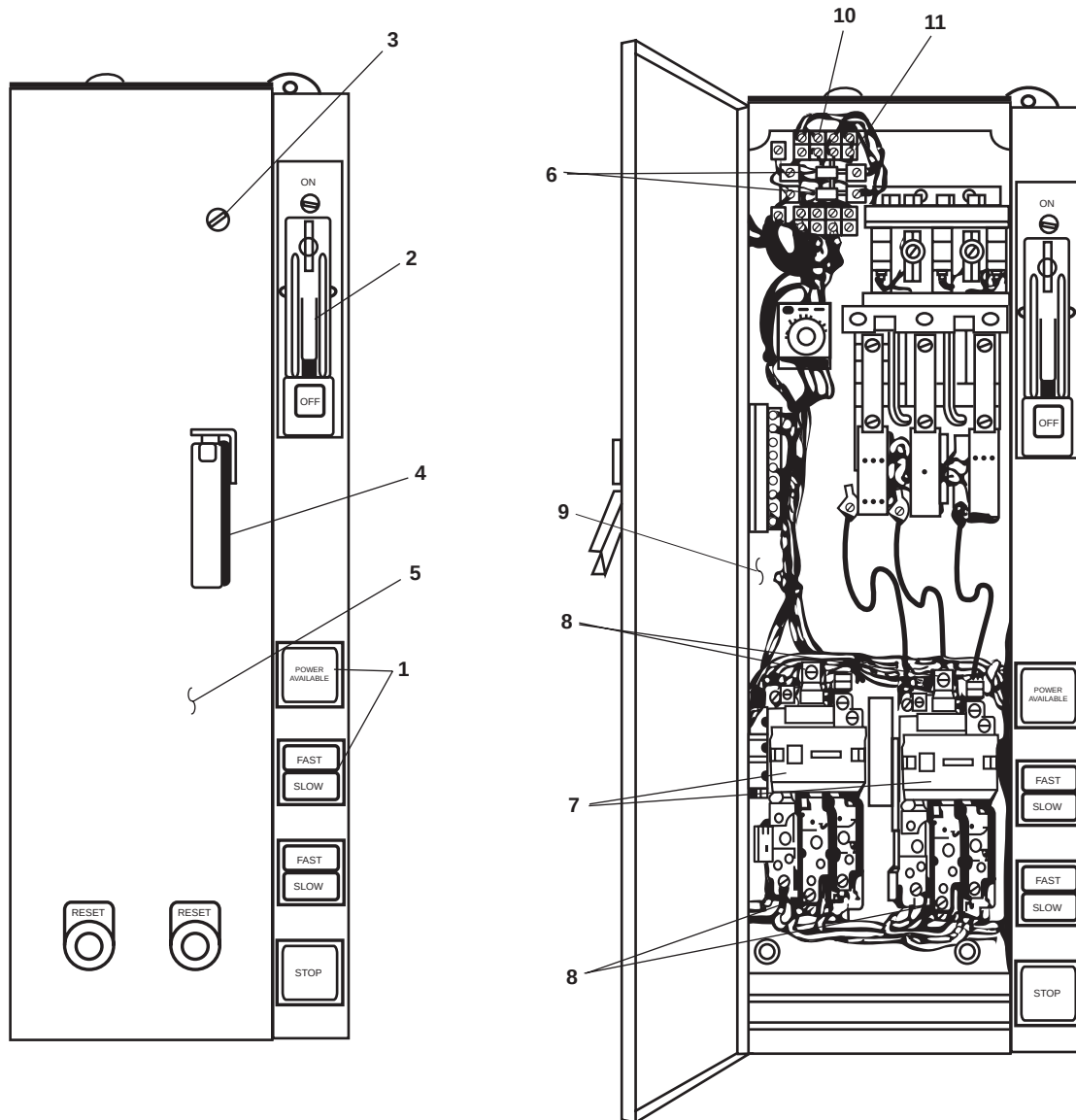


Figure 1. Motor Controller Type 2 (Typical)

INSTALLATION

1. Install the lamps and lens covers (figure 1, item 1).
2. Perform the Follow-On Service procedure at the end of the work package.

ACCESS TO INNER MOTOR CONTROLLER

NOTE

The switch handle must be set to OFF to open the door.

1. Set the switch handle (figure 1, item 2) to OFF.
2. Loosen the motor controller door screw (figure 1, item 3).
3. Turn the handle (figure 1, item 4) and open the door (figure 1, item 5).

FUSE REPLACEMENT

REMOVAL

1. Perform the Access to Inner Motor Control procedure in this work package.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in damaged equipment and serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, item 6). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove the cartridge fuse(s) (figure 1, item 6) with a fuse puller.

INSTALLATION

1. Install the cartridge fuse(s) (figure 1, item 6) with a fuse puller.
2. Perform the Secure the Motor Controller procedure in this work package.
3. Perform the Follow-On Service procedure at the end of this work package.

MOTOR STARTER REPLACEMENT

REMOVAL

1. Perform the Access to Inner Motor Control procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in damaged equipment and serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, item 6). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring attached to the motor starter (figure 1, item 7).
4. Remove the screws (figure 1, item 8) that secure the motor starter (figure 1, item 7) to the motor controller back plate (figure 1, item 9).
5. Remove the motor starter (figure 1, item 7).

INSTALLATION

1. Install the motor starter (figure 1, item 7) on the motor controller back plate (figure 1, item 9) and secure it with the screws (figure 1, item 8).
2. Connect the electrical wiring to the motor starter (figure 1, item 7) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Secure the Motor Controller procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

TRANSFORMER REPLACEMENT**REMOVAL**

1. Perform the Access to Inner Motor Control procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in damaged equipment and serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, item 6). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Label and disconnect electrical wiring attached to the transformer (figure 1, item 10).
4. Remove the screws (figure 1, item 11) that secure the transformer (figure 1, item 10) to the motor controller back plate (figure 1, item 9).
5. Remove the transformer (figure 1, item 10).

INSTALLATION

1. Install the transformer (figure 1, item 10) on the motor controller back plate (figure 1, item 9) and secure it with the screws (figure 1, item 11).
2. Connect the electrical wiring to the transformer (figure 1, item 10) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Secure the Motor Controller procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

SECURE THE MOTOR CONTROLLER

1. Close the motor controller door (figure 1, item 5) and tighten the handle (figure 1, item 4).
2. Secure the door by tightening the door screw (figure 1, item 3).
3. Set the switch handle (figure 1, item 2) to ON.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Set the applicable circuit breaker to ON.
3. Operate the motor controller for the affected system (TM 55-1925-273-10).
4. Verify proper operation of the motor controller.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MOTOR CONTROLLER; BILGE & BALLAST PUMP 1 & 2, FIRE & GENERAL SERVICE PUMP #1 & #2;
REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set the applicable circuit breaker to OFF. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

LAMP REPLACEMENT**REMOVAL****WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the lens cover (figure 1, item 1).
2. Remove the lamps from the indicators.

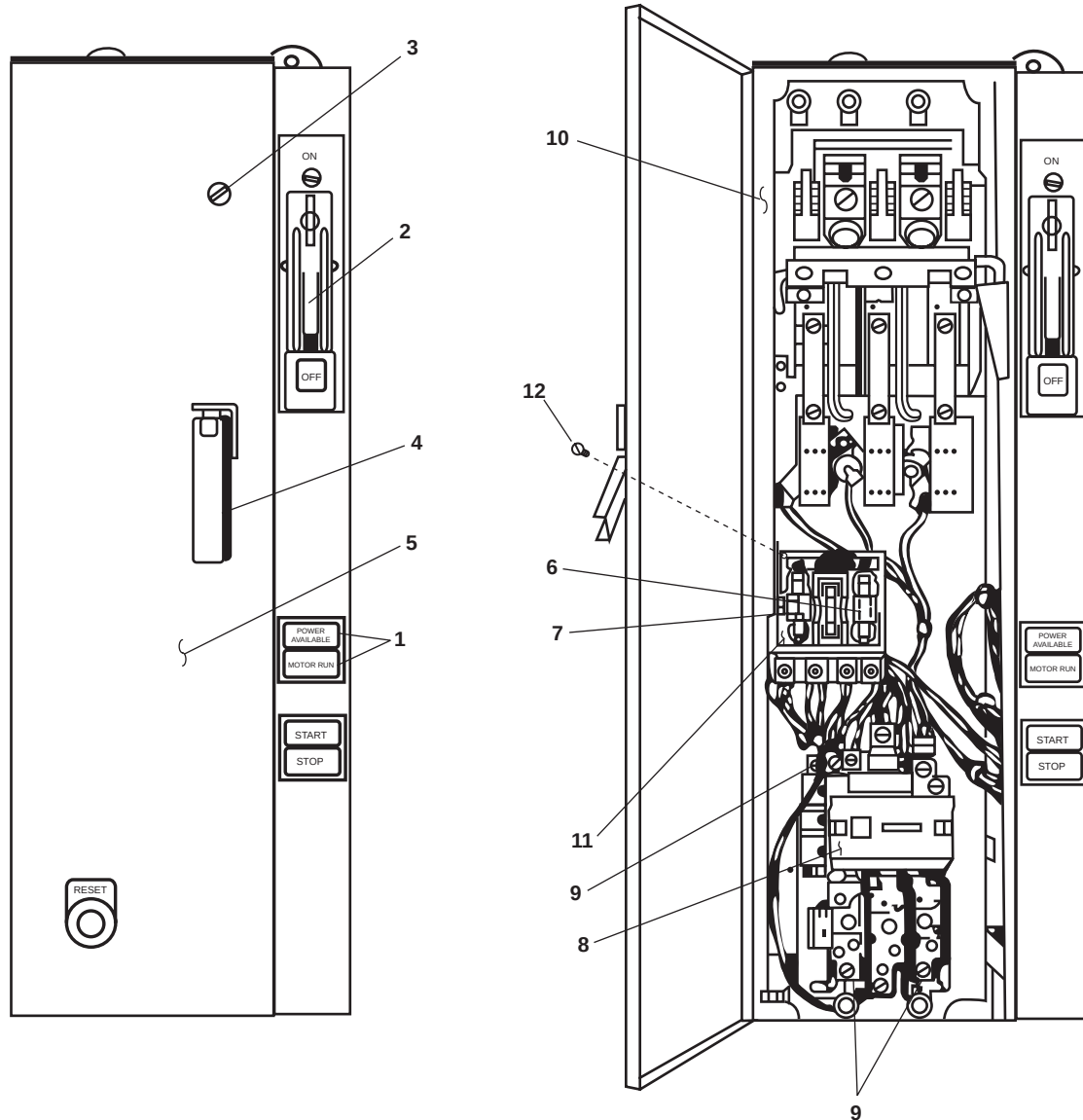


Figure 1. Motor Controller Type 3 (Typical)

INSTALLATION

1. Install the lamps and lens covers (figure 1, item 1).
2. Perform the Follow-On Service procedure at the end of the work package.

ACCESS TO INNER MOTOR CONTROLLER

NOTE

The switch handle must be set to OFF to open the door.

1. Set the switch handle (figure 1, item 2) to OFF.
2. Loosen the motor controller door screw (figure 1, item 3).
3. Turn the handle (figure 1, item 4) and open the door (figure 1, item 5).

FUSE REPLACEMENT

REMOVAL

1. Perform the Access to Inner Motor Control procedure in this work package.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, items 6 and 7). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove the cartridge fuse(s) (figure 1, item 6) and/or the slo-blo fuse (figure 1, item 7) using a fuse puller.

INSTALLATION

1. Install the cartridge fuse(s) (figure 1, item 6) and/or the slo-blo fuse (figure 1, item 7) using a fuse puller.
2. Perform the Secure the Motor Controller procedure in this work package.
3. Perform the Follow-On Service procedure at the end of this work package.

MOTOR STARTER REPLACEMENT

REMOVAL

1. Perform the Access to Inner Motor Control procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, items 6 and 7). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the electrical wiring attached to the motor starter (figure 1, item 8).
4. Remove the screws (figure 1, item 9) that secure the motor starter (figure 1, item 8) to the motor controller back plate (figure 1, item 10).
5. Remove the motor starter (figure 1, item 8).

INSTALLATION

1. Install the motor starter (figure 1, item 8) on the motor controller back plate (figure 1, item 10) and secure it with the applicable screws (figure 1, item 9).
2. Connect the electrical wiring to the motor starter (figure 1, item 8) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Secure the Motor Controller procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

TRANSFORMER REPLACEMENT**REMOVAL**

1. Perform the Access to Inner Motor Control procedure in this work package.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the fuses (figure 1, items 6 and 7). If voltage is present, ensure that the proper circuit breakers have been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Label and disconnect electrical wiring attached to the transformer (figure 1, item 11).
4. Remove the screws (figure 1, item 12) that secure the transformer (figure 1, item 11) to the motor controller back plate (figure 1, item 10).
5. Remove the transformer (figure 1, item 11).

INSTALLATION

1. Install the transformer (figure 1, item 11) on the motor controller back plate (figure 1, item 10) and secure it with the screws (figure 1, item 12).
2. Connect the electrical wiring to the transformer (figure 1, item 11) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Secure the Motor Controller procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

SECURE THE MOTOR CONTROLLER

1. Close the motor controller door (figure 1, item 5) and turning the handle (figure 1, item 4).
2. Secure the door by tightening the door screw (figure 1, item 3).
3. Set the switch handle (figure 1, item 2) to ON.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Set the applicable circuit breaker to ON.
3. Operate the motor controller for the affected system (TM 55-1925-273-10).
4. Verify proper operation of the motor controller.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MOTOR CONTROLLER, HOT POTABLE WATER RECIRCULATING PUMP; REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker at 440V power panel No. 4. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

LAMP REPLACEMENT

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the lens cover (figure 1, item 1).
2. Remove the lamps from the indicators.
3. Install the lamp and lens covers (figure 1, item 1).
4. Perform the Follow-On Service procedure at the end of this work package.

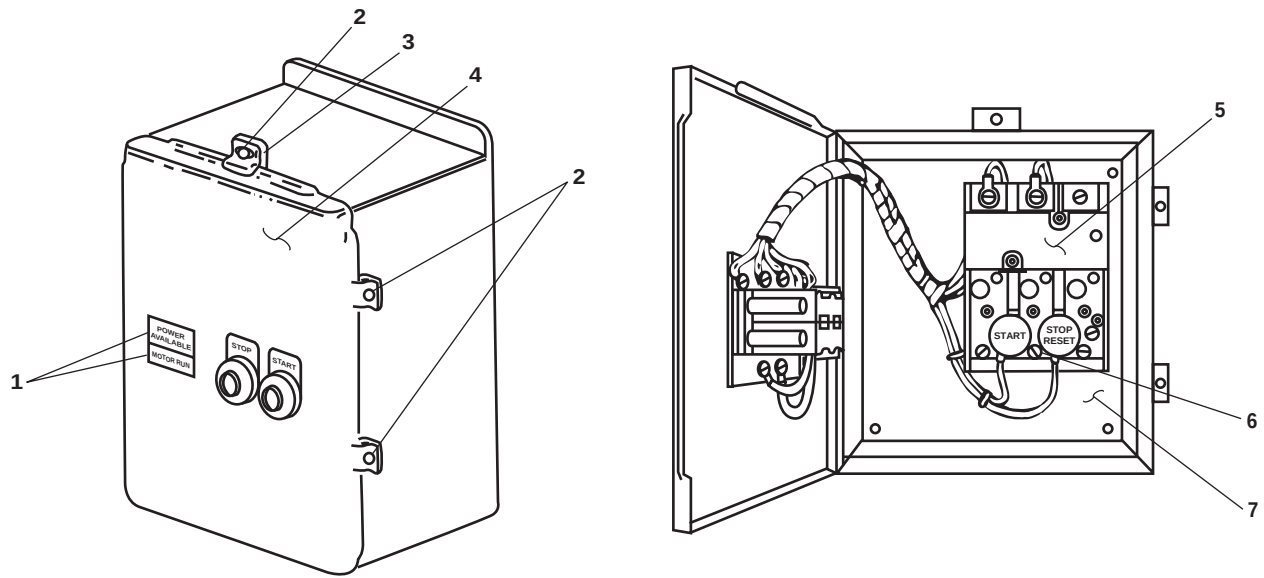
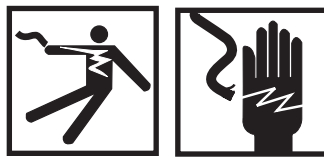


Figure 1. Motor Controller Type 4

STARTER ASSEMBLY REPLACEMENT

REMOVAL

1. Loosen the screws (figure 1, item 2) until the clamps (figure 1, item 3) clear the lip of the door (figure 1, item 4).
2. Open the motor controller door (figure 1, item 4).



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the motor starter (figure 1, item 5). If voltage is present, ensure that the proper circuit breaker has been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and disconnect the electrical wiring attached to the motor starter (figure 1, item 5).
5. Remove the four screws (figure 1, item 6) that secure the motor starter (figure 1, item 5) to the motor controller back plate (figure 1, item 7).
6. Remove the motor starter (figure 1, item 5) from the motor controller.

INSTALLATION

1. Install the motor starter (figure 1, item 5) on the motor controller back plate (figure 1, item 7) and secure it with the four screws (figure 1, item 6).
2. Connect the electrical wiring to the motor starter (figure 1, item 5) using the labels from step 4 of Removal as a guide. Remove the labels.
3. Close the motor controller door (figure 1, item 4) and secure it with the clamp (figure 1, item 3)
4. Tighten the door screw (figure 1, item 2).

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Set the circuit breaker to ON.
3. Operate the motor controller for the affected system (TM 55-1925-273-10).
4. Verify proper operation of the motor controller.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
MOTOR CONTROLLER, WELD HOOD EXHAUST FAN; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0300 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Starter, Motor (Item 2, Figure 59, WP 0300 00,
Volume 2)

Equipment Conditions:

Set to OFF the WORKSHOP EXHAUST FAN EO2-16-
1. circuit breaker at 120V distribution panel No. 4.
Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

MOTOR STARTER REPLACEMENT**REMOVAL**

1. Loosen the screws (figure 1, item 1) until the clamps (figure 1, item 2) clear the lip of the door (figure 1, item 3).
2. Open the motor controller door (figure 1, item 3).



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the motor starter (figure 1, item 4). If voltage is present, ensure that the proper circuit breaker has been set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and disconnect the electrical wiring attached to the motor starter (figure 1, item 4).
5. Remove the screws (figure 1, item 5) holding the motor starter (figure 1, item 4) to the motor controller door (figure 1, item 3).
6. Remove the motor starter (figure 1, item 4) from the motor controller.

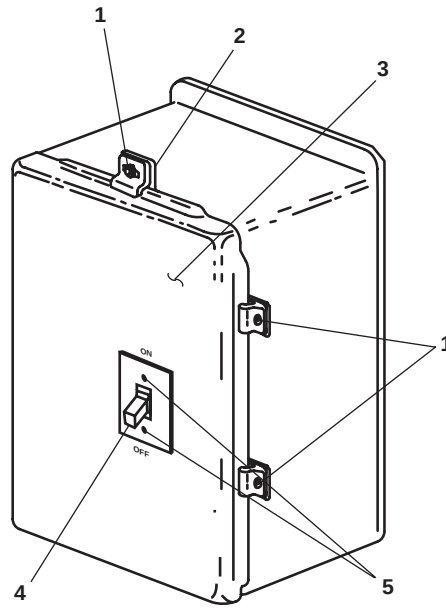


Figure 1. Motor Controller Type 5 (Typical)

INSTALLATION

1. Install the motor starter (figure 1, item 4) on the motor controller door (figure 1, item 3) and secure it with the screws (figure 1, item 5).
2. Connect the electrical wiring to the motor starter (figure 1, item 4) using the labels from step 4 of Removal as a guide. Remove the labels.
3. Close the motor controller door (figure 1, item 3) and rotate the clamp (figure 1, item 2) until it is over the lip of the door.
4. Secure the motor controller door (figure 1, item 3) by tightening the door screws (figure 1, item 1).
5. Remove the lockouts and tagouts (FM 55-502).
6. Set the circuit breaker to ON.
7. Operate the motor controller for the affected system (TM 55-1925-273-10).
8. Ensure that the system starts and stops properly.
9. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY, POWER SUPPLY SYSTEM; TEST

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
 Tester, Battery Electrolyte (Item 14, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
 Faceshield, Industrial (Item 38, Table 2, WP 0295 00, Volume 2)
 Apron, Utility (Item 39, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Distilled Water, Technical (Item 56, Table 1, WP 0307 00, Volume 2)

Personnel Required:

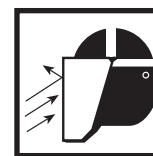
Two Watercraft Engineers, 88L

References:

FM 55-502
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the switch for the applicable battery charger.

TESTING**WARNING**

Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Failure to comply with these precautions can result in death or serious injury.

Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, face shield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with the skin or eyes, flush the area with large volumes of water. Continue flushing the affected areas until medical assistance arrives.

1. Remove the battery filler caps (figure 1, item 1) and check the liquid level of each battery cell. The liquid level should be at the bottom of the split ring on each cell.

NOTE

To get an accurate reading, the liquid of the battery cell should be at normal height when the battery is tested. Any water added to the battery should be thoroughly mixed with the electrolyte by charging the battery before testing. If the battery is dry, and a field charge is not permitted, replace defective battery.

2. If necessary, add distilled water to the battery and bring it to its normal level.

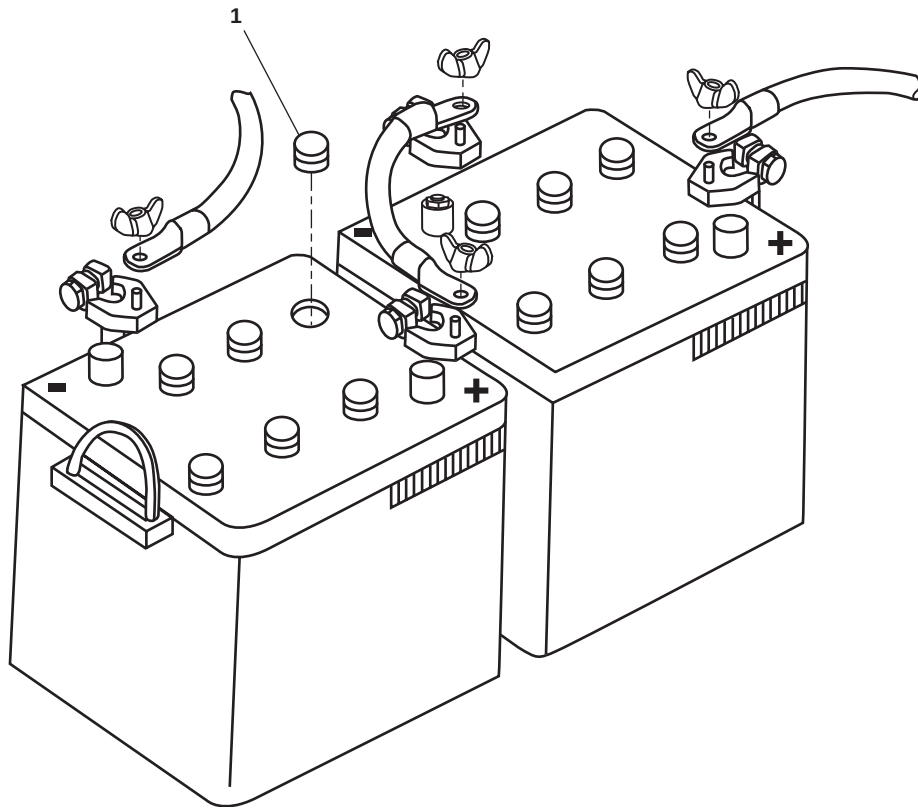


Figure 1. Battery, Power Supply System

3. Set to ON the switch for the applicable battery charger, and charge the battery so that the water mixes with the existing electrolyte.
4. After charging, set to OFF the switch for the applicable battery charger, and insert the tip of the tester into a cell and draw enough electrolyte to float the glass hydrometer in the barrel of the tester.
5. Take and record the electrolyte specific gravity reading.
6. Check the tester thermometer. Record the thermometer reading along with the specific gravity reading.
7. Return the electrolyte to the battery cell and install the battery cap (figure 1, item 1).
8. Repeat steps 4 through 7 for all the other battery cells.
9. If the temperature of the electrolyte is above or below 80 degrees Fahrenheit, the specific gravity reading must be adjusted as follows:
 - a. For every 10 degrees Fahrenheit below 80 degrees Fahrenheit, subtract four specific gravity units (0.004) from the electrolyte reading taken.
 - b. For every 10 degrees above 80 degrees Fahrenheit, add four specific gravity units (0.004) to the electrolyte reading taken (see the examples below).

EXAMPLE 1

The battery electrolyte temperature reading is 60 degrees Fahrenheit and the hydrometer shows a specific gravity of 1.240. Since 60 degrees is two 10's below 80 degrees Fahrenheit, you must subtract two 4's or eight specific gravity units (0.008) from the hydrometer reading. This leaves a corrected specific gravity reading of 1.232.

EXAMPLE 2

The battery electrolyte temperature is down to 20 degrees Fahrenheit and the hydrometer shows a specific gravity of 1.256. Subtract 20 from 80 to get six 10's difference, therefore, six 4's (0.024) must be subtracted from 1.256. This gives a corrected specific gravity of 1.232.

EXAMPLE 3

The battery electrolyte temperature reading is 100 degrees Fahrenheit and the hydrometer specific gravity reading is 1.224. The electrolyte temperature is two 10's above 80 degrees Fahrenheit. You must add two 4's or eight specific gravity units (0.008) to the original float reading to get a corrected specific gravity reading of 1.232

10. A fully charged battery should have a specific gravity (adjusted to 80 degrees Fahrenheit) of 1.260 to 1.270. If the adjusted specific gravity is below 1.225, charge the battery.
11. After charging, again check each cell of the battery as described above, each cell must be within 0.025 specific gravity of all the other cells. If a greater difference exists between any two cells, the battery is defective. Replace the battery.
12. After using tester, flush it with clean, clear water.
13. Install the battery caps (figure 1, item 1).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY, POWER SUPPLY SYSTEM; SERVICE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
 Faceshield, Industrial (Item 38, Table 2, WP 0295 00, Volume 2)
 Apron, Utility (Item 39, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Distilled Water, Technical (Item 56, Table 1, WP 0307 00, Volume 2)
 Petrolatum, Technical (Item 129, Table 1, WP 0307 00, Volume 2)
 Rag, Wiping (Item 139, Table 1, WP 0307, Volume 2)

Materials/Parts (continued):

Sodium Bicarbonate, Technical (Item 161, Table 1, WP 0307 00, Volume 2)
 Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 WP 0128 00
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the applicable battery charger circuit breaker.
 Lock out and tag out (FM 55-502).

WARNING



Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, faceshield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with skin or eyes, flush affected area with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in serious injury or death.

NOTE

Whenever working with batteries, the negative cable must be disconnected first, the positive cable next, and the interconnecting cable (if installed) last. When connecting the batteries, the interconnecting cable (if installed) must be connected first, the positive cable next, and the negative cable last.

1. Label and remove the negative battery cable (figure 1, item 1) from the battery post connectors (figure 1, item 2).

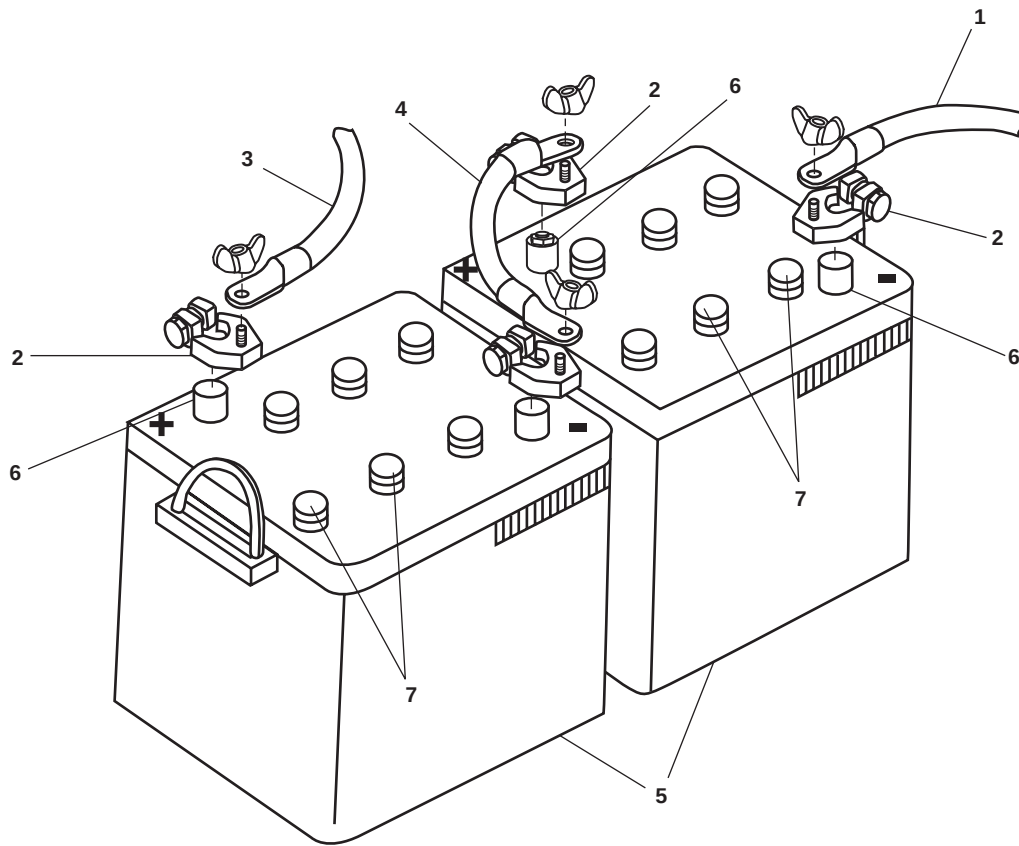


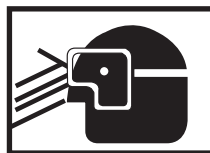
Figure 1. Battery Bank Power Supply System

2. Label and remove the positive battery cable (figure 1, item 3) from the battery post connectors (figure 1, item 2).
3. Label and remove the interconnecting cable (figure 1, item 4) from the battery post connectors (figure 1, item 2).

⚠ CAUTION

Do not apply any prying or twisting force to the battery posts. Doing so can cause the posts to break internally, permanently disabling the battery. If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.

4. Remove the battery post connectors (figure 1, item 2) from the batteries (figure 1, item 5) taking care not to apply any prying or twisting force to the battery posts (figure 1, item 6). If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.

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.

5. Use a wire brush to remove all deposits from the battery posts (figure 1, item 6), battery post connectors (figure 1, item 2), and battery cable ends (figure 1, items 1, 3, and 4).
6. Inspect the battery posts (figure 1, item 6), battery post connectors (figure 1, item 2), and battery cable ends (figure 1, items 1, 3, and 4) for damage. Replace any battery with posts damaged to the extent that the battery post connectors will not fit securely, and replace damaged battery post connectors and/or battery cables.
7. Prepare a 50/50 mix of technical sodium bicarbonate and water. Scrub the battery tops, battery cable ends (figure 1, items 1, 3, and 4), and the battery post connectors (figure 1, item 2) with the mixture.
8. Rinse the cleaned areas with fresh water, and remove any water and debris with clean wiping rags.
9. Remove the battery caps (figure 1, item 7) and check the electrolyte level in each cell. The level should be to the bottom of the split ring. If any cells are low, add technical distilled water to bring the cells to the proper level.
10. Install the battery caps (figure 1, item 7).
11. Install the battery terminal connectors (figure 1, item 2) onto the battery posts (figure 1, item 6) and tighten them snugly.
12. Install the interconnecting cables (figure 1, item 4) on both batteries.
13. Install the positive cables (figure 1, item 3) on both batteries.
14. Install the negative cables (figure 1, item 1) on both batteries.
15. Apply a thin coating of technical petrolatum to the exposed portions of the battery posts (figure 1, item 6), battery terminal connectors (figure 1, item 2), and battery cable ends (figure 1, items 1, 3, and 4).
16. Remove the lockouts and tagouts (FM 55-502).
17. Test the battery and battery charger (WP 0128 00).
18. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY, POWER SUPPLY SYSTEM; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
Faceshield, Industrial (Item 38, Table 2, WP 0295 00, Volume 2)
Apron, Utility (Item 39, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
WP 0128 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the applicable circuit breaker. Lock out and tag out (FM 55-502).

Materials/Parts:

Battery (Item 11, Table 1, WP 0307 00, Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

REMOVAL**WARNING**

Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, faceshield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with skin or eyes, flush affected area with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in serious injury or death.

1. Remove the hex nut and flat washer (figure 1, item 1) from the J-bolt (figure 1, item 2).
2. Remove the battery hold down (figure 1, item 3).
3. Remove the wood spacer bar (figure 1, item 4).
4. Label and remove the negative battery cable (figure 2, item 1) from the battery bank.
5. Label and remove the positive battery cable (figure 2, item 2) from the battery bank.

6. Label and remove the connector battery cable (figure 2, item 3) from the battery bank.

! CAUTION

Do not apply any prying or twisting force to the battery posts. Doing so can cause the posts to break internally, permanently disabling the battery. If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.

7. Remove the battery post connectors (figure 2, item 4) from the batteries (figure 2, item 5), taking care not to apply any prying or twisting force to the battery posts (figure 2, item 6). If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.
8. Remove the batteries (figure 2, item 5) from the compartment.

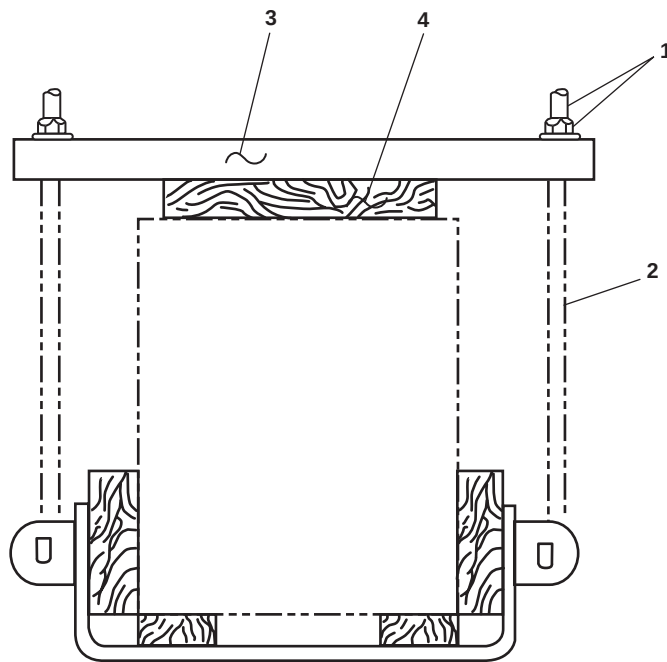


Figure 1. Battery Replacement

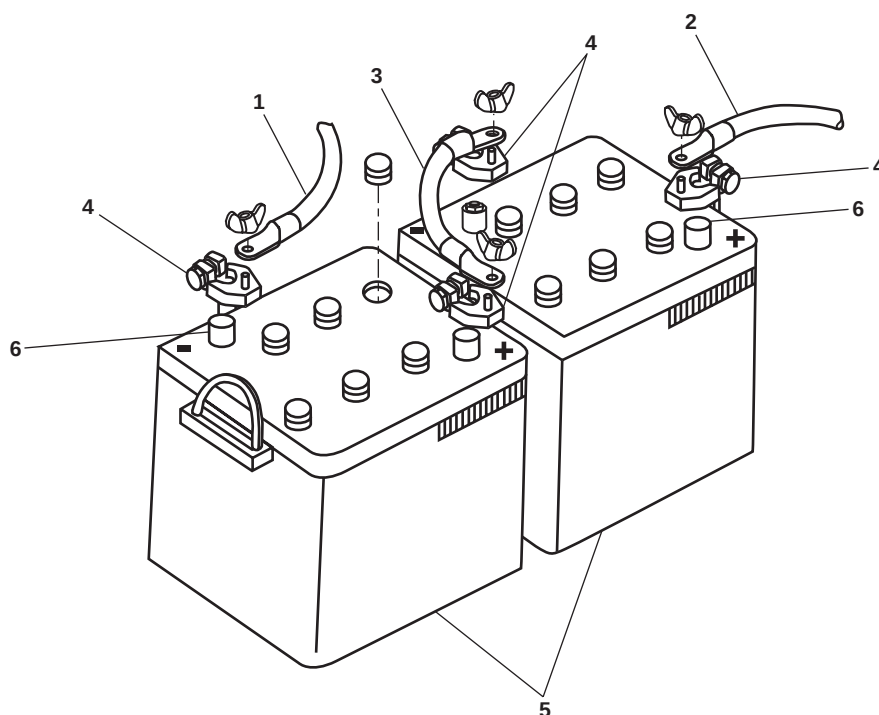


Figure 2. Battery, Power Supply System

INSTALLATION

WARNING



Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, faceshield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with skin or eyes, flush affected area with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in serious injury or death.

⚠ CAUTION

Ensure that there are no foreign objects, such as loose nuts, on the bottom of the battery box. The battery could be damaged if placed on foreign objects.

1. Place the new batteries (figure 2, item 5) into the battery compartment.

-
2. Install the battery post connectors (figure 2, item 4) on the battery posts (figure 2, item 6).
 3. Install the connector battery cable (figure 2, item 3) on the batteries (figure 2, item 5) using the labels from step 6 of Removal as a guide. Remove the labels.
 4. Install the positive battery cable (figure 2, item 2) on the batteries (figure 2, item 5) using the labels from step 5 of Removal as a guide. Remove the labels.
 5. Install the negative battery cable (figure 2, item 1) on the batteries (figure 2, item 5) using the labels from step 4 of Removal as a guide. Remove the labels.
 6. Install the wood spacer bar (figure 1, item 4).
 7. Install the battery hold down (figure 1, item 3) and secure it with the J-bolts (figure 1, item 2), washers, and nuts (figure 1, item 1).
 8. Remove the lockouts and tagouts (FM 55-502).
 9. Set to ON the applicable circuit breaker and test the battery charger and battery.
 10. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY, POWER SUPPLY SYSTEM; REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
Apron, Utility (Item 39, Table 2, WP 0295 00 Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
WP 0128 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

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.

BATTERY REPLACEMENT

WARNING



Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, faceshield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with skin or eyes, flush affected area with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in serious injury or death.

REMOVAL

1. Set to OFF the applicable battery charger circuit breaker. Lock out and tag out (FM 55-502).
2. Remove the hex nut and flat washer (figure 1, item 1) from the J-bolt (figure 1, item 2).
3. Remove the battery hold down (figure 1, item 3).
4. Remove the wood spacer (figure 1, item 4).

NOTE

A typical battery bank consists of two 12 Vdc (Volts direct current) batteries connected in series to produce 24 Vdc. Proper labeling when removing the battery leads will ensure that the battery is connected correctly during installation.

5. Label and remove the negative battery cable (figure 2, item 1) from the battery bank (figure 2, item 2).
6. Label and remove the positive battery cable (figure 2, item 3) from the battery bank (figure 2, item 2).

⚠ CAUTION

Do not apply any prying or twisting force to the battery posts. Doing so can cause the posts to break internally, permanently disabling the battery. If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.

7. Remove the battery post connectors (figure 2, item 5) from the battery bank (figure 2, item 2), taking care not to apply any prying or twisting force to the battery posts (figure 2, item 6). If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the battery bank.
8. Label remove the connector battery cable (figure 2, item 4) from the battery bank (figure 2, item 2).

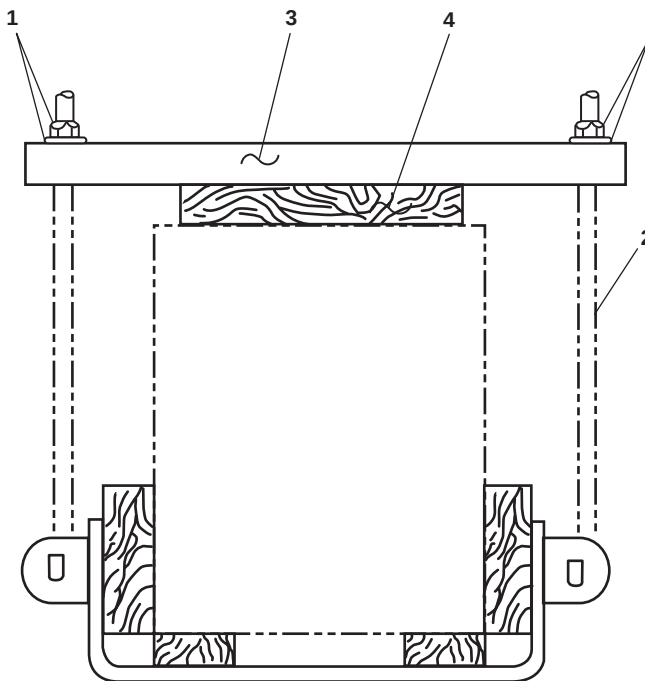


Figure 1. Battery Replacement

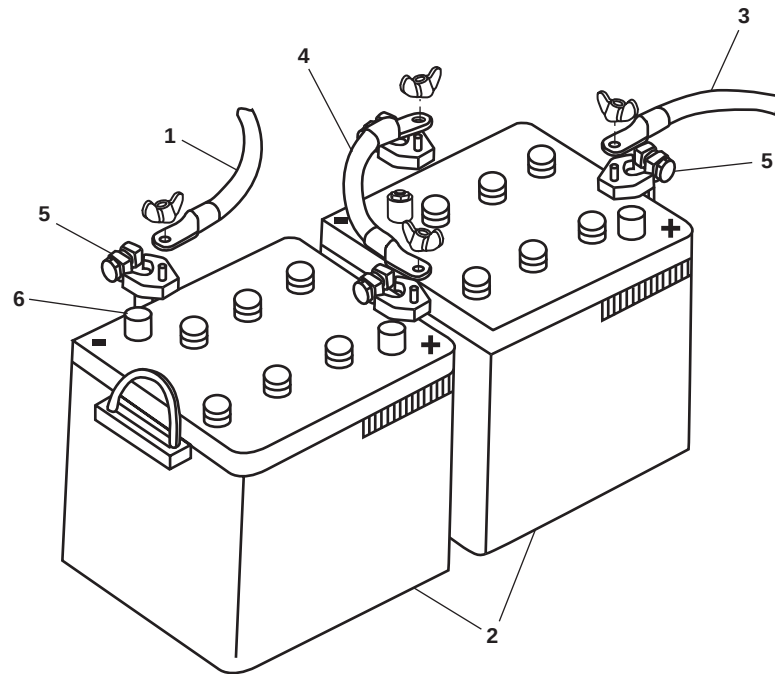


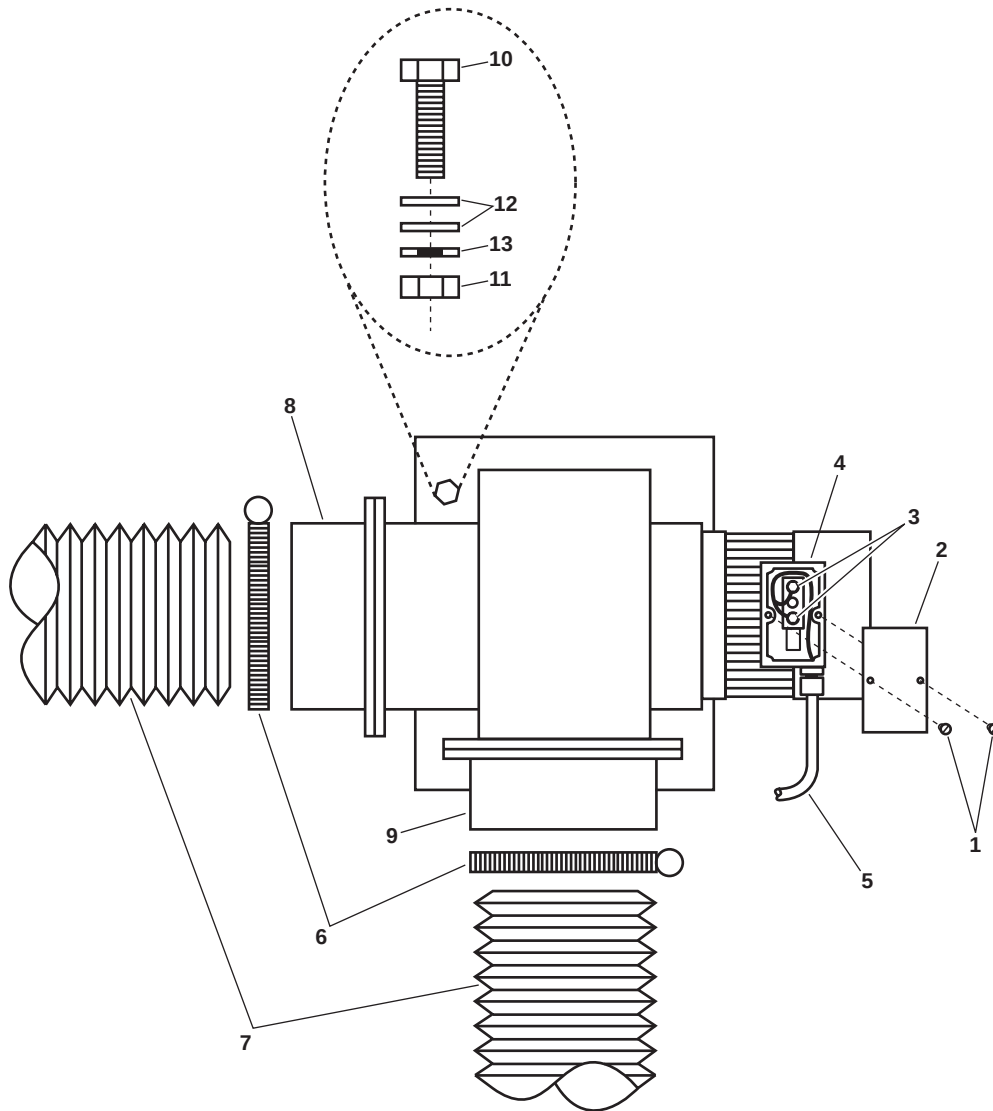
Figure 2. Battery Bank

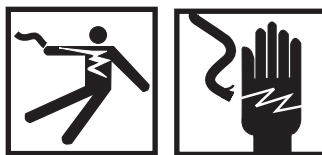
INSTALLATION

1. Install the battery post connectors (figure 2, item 5) on the battery posts (figure 2, item 6).
2. Install the connector battery cable (figure 2, item 1) on the battery bank (figure 2, item 2) using the labels from step 6 of Removal as a guide. Remove the labels.
3. Install the positive battery cable (figure 2, item 3) to the battery bank (figure 2, item 2) using the labels from step 6 of Removal as a guide. Remove the labels.
4. Install the negative battery cable (figure 2, item 1) to the battery bank (figure 2, item 2) using the labels from step 6 of Removal as a guide. Remove the labels.
5. Install the wood spacer (figure 1, item 4).
6. Install the battery hold down (figure 1, item 3) and secure it with the J-bolts (figure 1, item 2), washers, and nuts (figure 1, item 1).
7. Remove the lockouts and tagouts (FM 55-502).
8. Set to ON the applicable battery charger circuit breaker.
9. Test the battery charger and battery (WP 0128 00).
10. Return the equipment to the desired readiness condition.

BATTERY BOX EXHAUST FAN (01 LEVEL FAN ROOM) REPLACEMENT**REMOVAL**

1. Set to OFF the 60A FUSED DISCONNECT SWITCH located on the forward bulkhead of the 01 level fan room. Lock out and tag out (FM 55-502).
2. Remove the two screws (figure 3, item 1) and junction box cover (figure 3, item 2).

**Figure 3. Battery Box Fan Replacement**

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for available voltage at the wiring terminals (figure 3, item 3) inside the junction box (figure 3, item 4). If voltage is present, ensure that the proper switch is secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and disconnect the wiring (figure 3, item 5) from the wiring terminals (figure 3, item 3) inside the junction box (figure 3, item 4).
5. Loosen the hose clamps (figure 3, item 6) and remove the flexible hoses (figure 3, item 7) from the inlet (figure 3, item 8) and discharge (figure 3, item 9) flanges.
6. Remove the four bolts (figure 3, item 10), four nuts (figure 3, item 11), eight flat washers (figure 3, item 12), and four lockwashers (figure 3, item 13). Discard the lockwashers. Remove the fan.

INSTALLATION

1. Position the fan and secure it with four bolts (figure 3, item 10), four nuts (figure 3, item 11), eight flat washers (figure 3, item 12), and four new lockwashers (figure 3, item 13).
2. Attach the flexible hoses (figure 3, item 7) to the inlet (figure 3, item 8) and discharge (figure 3, item 9) flanges and secure them with the hose clamps (figure 3, item 6).
3. Connect the wiring (figure 3, item 5) to the terminals (figure 3, item 3) inside the junction box (figure 3, item 4) using the labels from step 4 of Removal as a guide. Remove the labels.
4. Install the junction box cover (figure 3, item 2) and secure it with two screws (figure 3, item 1).
5. Remove the lockouts and tagouts (FM 55-502) and return the equipment to the desired readiness condition (TM 55-1925-273-10).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY CHARGER, POWER SUPPLY SYSTEM; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
FM 55-509-1
WP 0128 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the applicable battery charger circuit breaker.
Lock out and tag out (FM 55-502).

WIRING REPAIR

Proper repair of wiring consists of replacement of the damaged wiring. When an electrical casualty requires expedient repairs, the repair may be made by splicing. Splicing is authorized for repair of damaged cables and wiring harnesses if most of the wiring is in good useable electrical condition. The cable or wiring harness must be replaced in its entirety at the most opportune time. For proper splicing methods, refer to FM 55-509-1.

DISASSEMBLY

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in injury or death.

1. Use a multimeter to check for voltage at the wire terminals (figure 1, item 1). If voltage is present, ensure that the proper circuit breakers are set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
2. Remove any covers or interference that restrict access to the wires being removed.
3. Label all wiring to be removed, and make a sketch of the work area to permit proper assembly.
4. Remove the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3), and remove the wire (figure 1, item 4).
5. Follow the wire (figure 1, item 4) to the opposite end, freeing it from the vessel's structure as required.
6. Remove the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3), and remove the wire (figure 1, item 4) at the opposite end.
7. Perform steps 1-5 for any other wires that require removal.

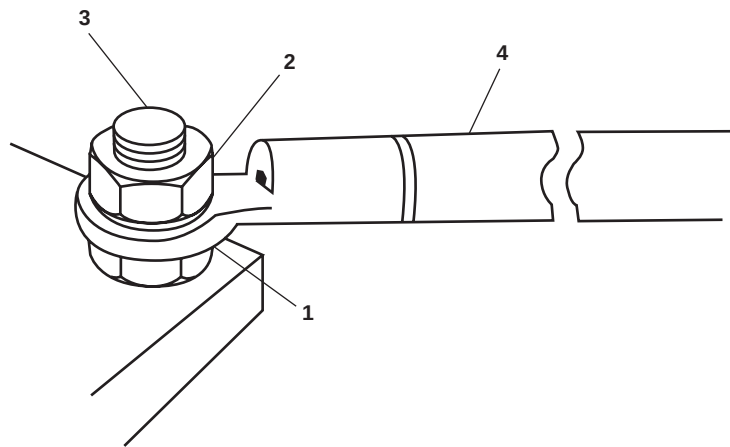


Figure 1. Typical Wire Terminal

ASSEMBLY

1. Determine the wires to be connected by referring to the sketches and labels from step 3 of Disassembly as guides.
2. Install the new wires (figure 1, item 4) along the same path as the old wires, and secure them in the same manner as the old wiring assembly.
3. Install the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3) at both ends of the wire.
4. Remove any remaining labels.
5. Install any covering or interference removed during the Disassembly procedure.
6. Perform the Follow-On Service procedure at the end of this work package.

AC FUSE REPLACEMENT

REMOVAL

1. Loosen the captive screw (figure 2, item 1) and OPEN the battery charger door (figure 2, item 2).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in injury or death.

2. Use a multimeter to check for voltage at the ac fuses (figure 2, item 3). If voltage is present, ensure that the proper circuit breakers are set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

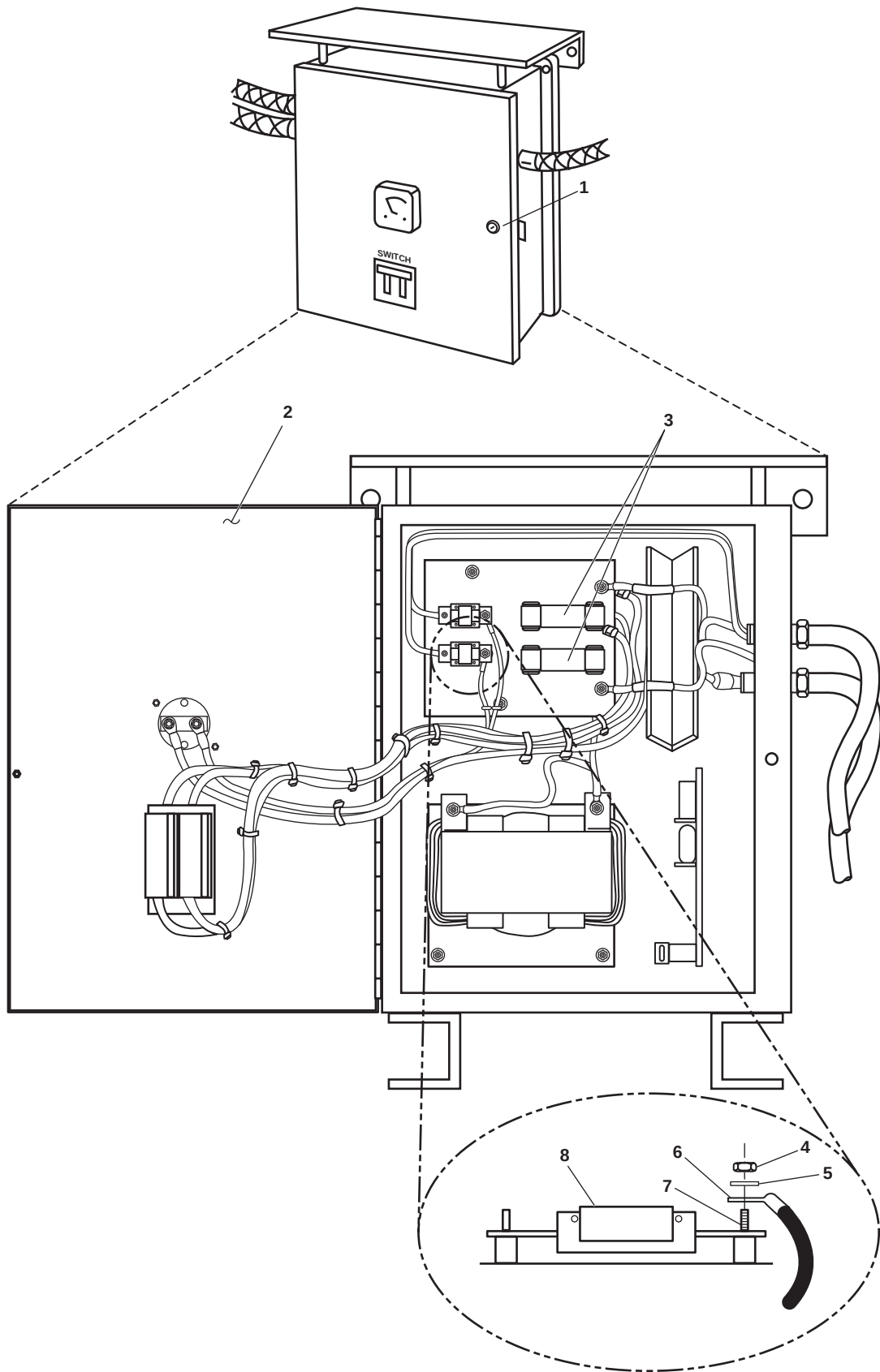


Figure 2. Battery Charger

3. Remove the ac fuses (figure 2, item 3) using a fuse puller.

INSTALLATION

1. Install the ac fuses (figure 2, item 3) using a fuse puller.
2. CLOSE the battery charger door (figure 2, item 2) and secure it with the captive screw (figure 2, item 1).
3. Perform the Follow-On Service at the end of this work package.

DC FUSE REPLACEMENT

1. Loosen the captive screw (figure 2, item 1) and OPEN the battery charger door (figure 2, item 2).



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in injury or death.

2. Use a multimeter to check for voltage at the ac fuses (figure 2, item 3). If voltage is present, ensure that the proper circuit breakers are set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove the nut (figure 2, item 4) and flat washer (figure 2, item 5), and remove the wire terminal (figure 2, item 6) from the post (figure 2, item 7).
4. Remove the dc fuse (figure 2, item 8) from the post (figure 2, item 7).

INSTALLATION

1. Install the dc fuse (figure 2, item 8) and the wire terminal (figure 2, item 6) on the post (figure 2, item 7) and secure them with the nut (figure 2, item 4) and flat washer (figure 2, item 5).
2. CLOSE the battery charger door (figure 2, item 2) and secure it with the captive screw (figure 2, item 1).
3. Perform the Follow-On Service procedure in this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Set the circuit breaker to ON.
3. Test the battery and the battery charger (WP 0128 00).
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
SEARCHLIGHTS, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
Wrench, Lamp (Item 12, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Leather (Item 37, Table 2, WP 0295 00, Volume 2)
Suitable Rubber Ink Eraser

Materials/Parts:

Rag, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

LAMP REPLACEMENT**REMOVAL**

1. At the 120V pilothouse emergency distribution panel set the PORT SEARCHLIGHT POWER SUPPLY or STARBOARD SEARCHLIGHT POWER SUPPLY circuit breaker to OFF. Lock out and tag out (FM 55-502).
2. Release the latch (figure 1, item 1) that secures the glass cover (figure 1, item 2), and open the cover.
3. Loosen, but do not remove, the two clamp screws (figure 1, item 3).
4. Remove the insulator assembly (figure 1, item 4) from the ring assembly (figure 1, item 5) and gently let it dangle on the end of the positive wire lead (figure 1, item 6).
5. Insert the lamp wrench (figure 1, item 7) slots over the drive pins (figure 1, item 8) on the lamp (figure 1, item 9).

WARNING

High pressures exist inside the lamp, especially when hot. The lamp could explode. Protect eyes and wear gloves when handling the lamp. Failure to comply with this warning could cause severe injury, blindness, or death.

CAUTION

Handle the lamp only in its protective cover. Premature lamp failure may result from handling the lamp with bare hands.

6. Remove the lamp (figure 1, item 9) from the enclosure.
7. Install a protective cover on the lamp (figure 1, item 9).

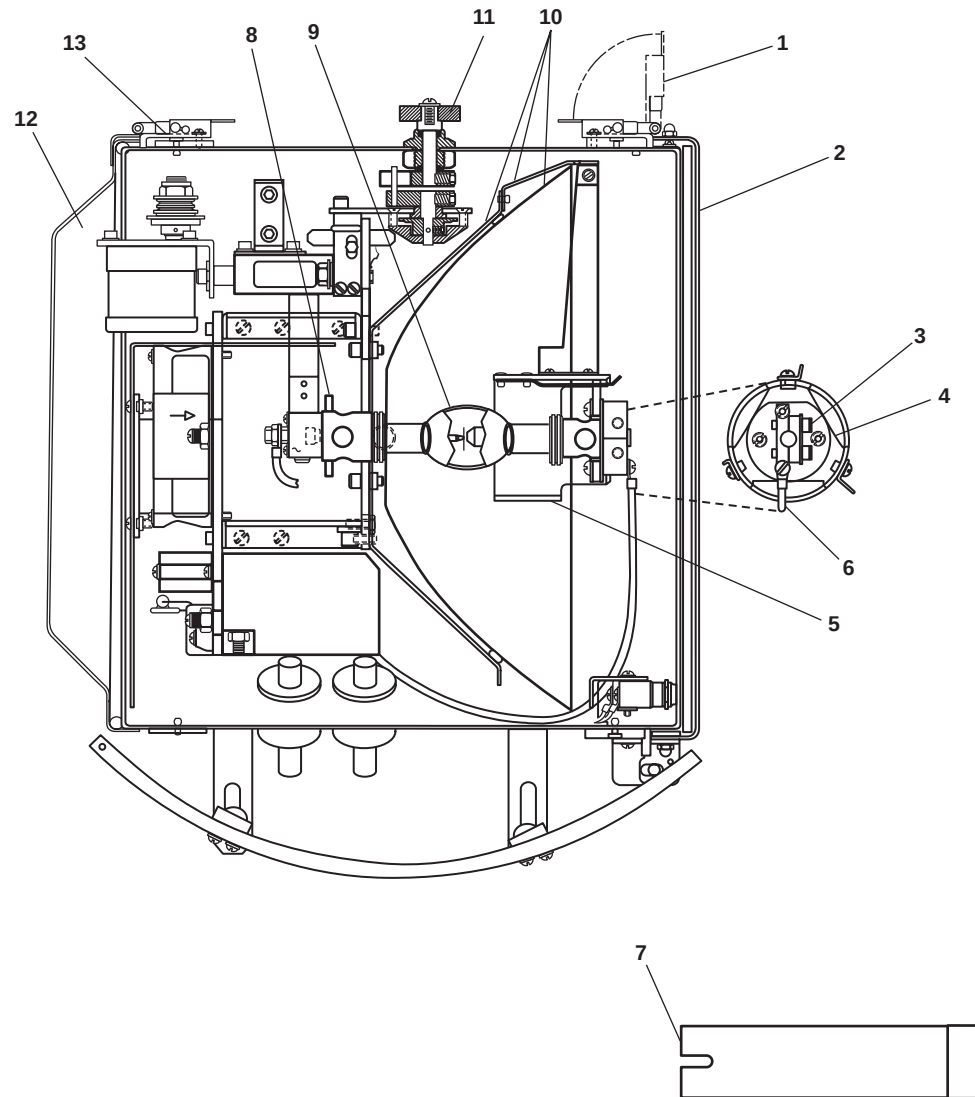


Figure 1. Searchlight Lamp

INSTALLATION

WARNING



High pressures exist inside the lamp, especially when hot. The lamp could explode. Protect eyes and wear gloves when handling the lamp. Failure to comply with this warning could cause severe injury, blindness, or death.

! CAUTION

Handle the lamp only in its protective cover. Premature lamp failure may result from handling the lamp with bare hands.

1. Install the lamp (figure 1, item 9) using the lamp wrench (figure 1, item 7).
2. Install the insulator assembly (figure 1, item 4) and secure it to the ring assembly (figure 1, item 5) with the clamp screws (figure 1, item 3).
3. Close the glass cover (figure 1, item 2) and secure it with the latch (figure 1, item 1).
4. Perform the Follow-On Service procedure at the end of this work package.

SERVICE

DISASSEMBLY

1. At the 120V pilothouse emergency distribution panel set the PORT SEARCHLIGHT POWER SUPPLY or STARBOARD SEARCHLIGHT POWER SUPPLY circuit breaker to OFF. Lock out and tag out (FM 55-502).
2. Release the latch (figure 1, item 1) that secures the glass cover (figure 1, item 2) and open the cover.
3. With a water-dampened, clean wiping rag, wipe down the reflector (figure 1, item 10).
4. If the reflector becomes exceptionally tarnished, it can be cleaned with a good quality silver polish.
5. Spray the glass cover (figure 1, item 2) with commercial glass cleaner and wipe it dry with a clean wiping rag.

ASSEMBLY

1. Close the glass cover (figure 1, item 2), and secure it with the latch (figure 1, item 1).
2. Perform the Follow-On Service procedure at the end of this work package.

LUBRICATION

Approximately once every 3 months or more frequently as required, lubricate the points as indicated in table 1.

Table 1. Lubrication Points (refer to figure 2)

Location	Lubricant/Quantity
Fitting at top of arms for trunnion bearings (figure 2, item 1)	Approx. 1-2 applications from a standard grease gun
Fitting at edge of rotating base (figure 2, item 2) for bearing balls	Approx. 1-2 applications from a standard grease gun

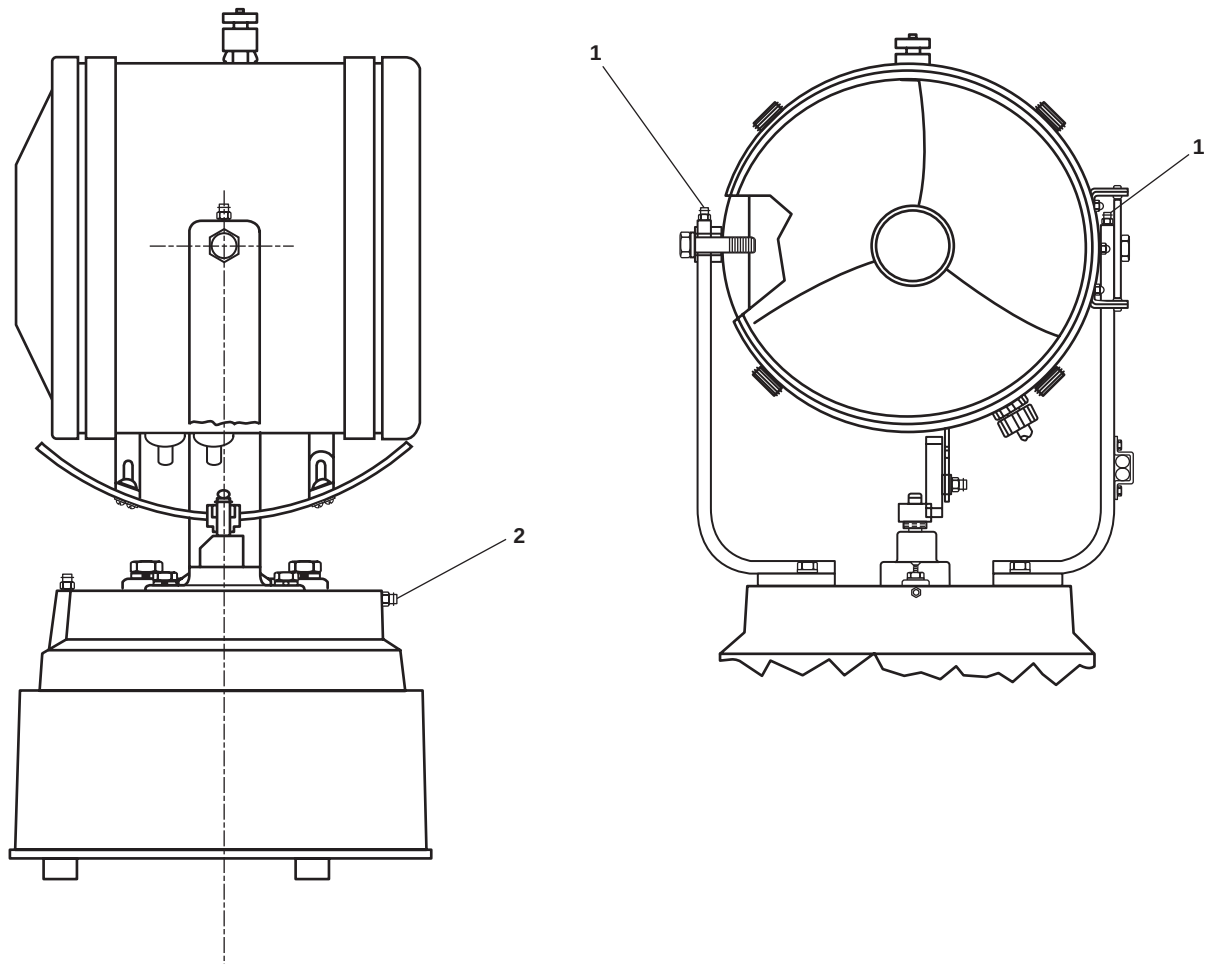


Figure 2. Searchlight Service

SEARCHLIGHT ALIGNMENT**DISASSEMBLY****WARNING**

Avoid direct or reflected radiation from the lamp. Do not stand close in front of the searchlight. Cover the glass when the lamp is lighted. Failure to comply could result in injury or death.

1. Turn the searchlight ON and shine the beam on a vertical flat surface approximately 20-50 feet from the searchlight.
2. Rotate the focus knob (figure 1, item 11) until the beam is as sharp and concentrated as possible.
3. Remove the rear cover (figure 1, item 12) by releasing the toggle clamps (figure 1, item 13).
4. Adjust the clamp screws (figure 3, item 1) so that the horizontal disk wheel (figure 3, item 2) and the vertical alignment disk wheel (figure 3, item 3) are free to turn. Do not loosen so much that the lamp support sags.
5. Rotate the horizontal disk wheel (figure 3, item 2) until a bright spot is centered horizontally in the beam.
6. Rotate the vertical alignment wheel (figure 3, item 3) until the bright spot is centered vertically in the beam.
7. Tighten the clamp screws (figure 3, item 1) to hold the alignment.
8. Rotate the focus knob (figure 1, item 11) to check the appearance of the beam at various focus settings. Circular areas in the beam should be essentially concentric.

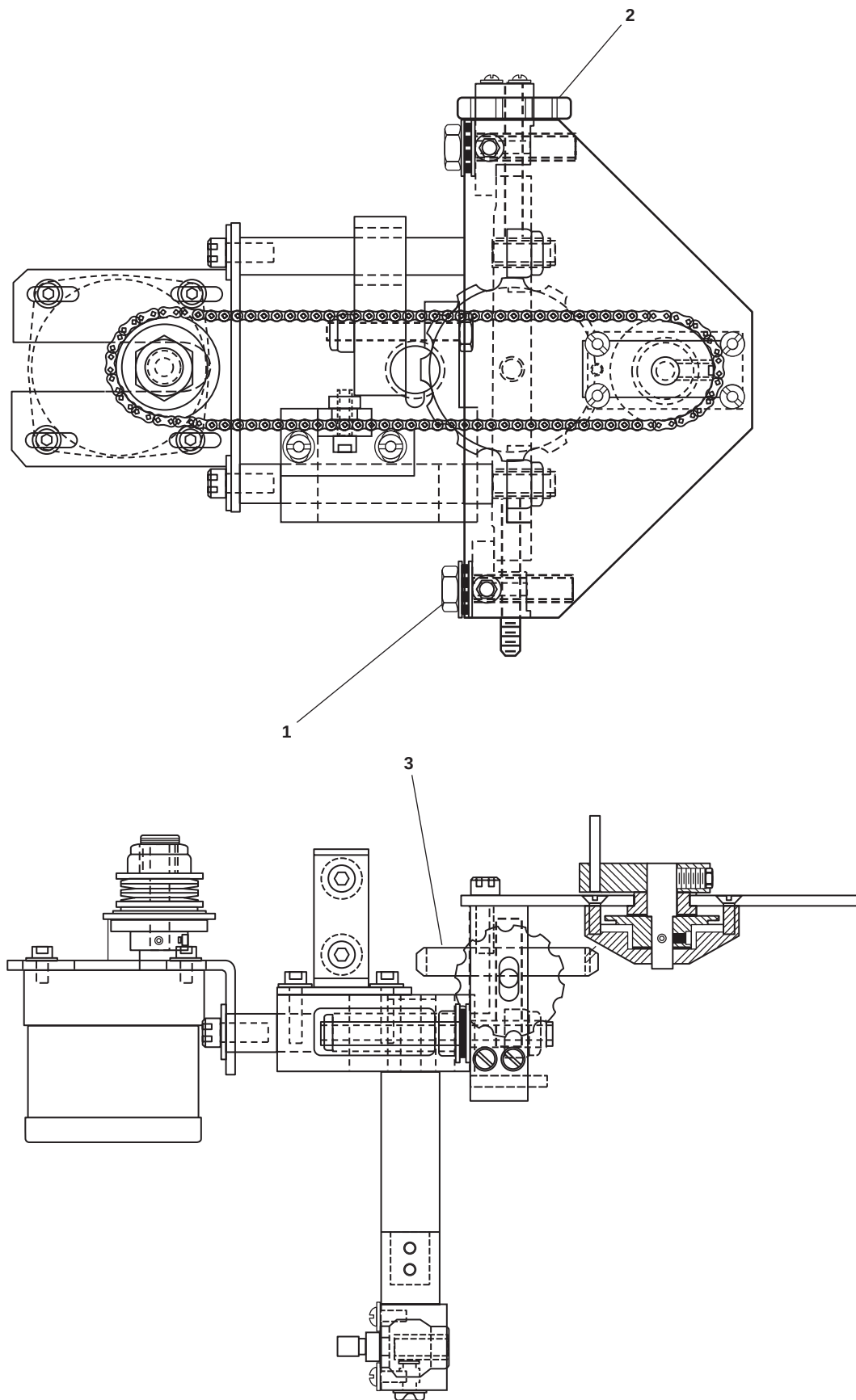


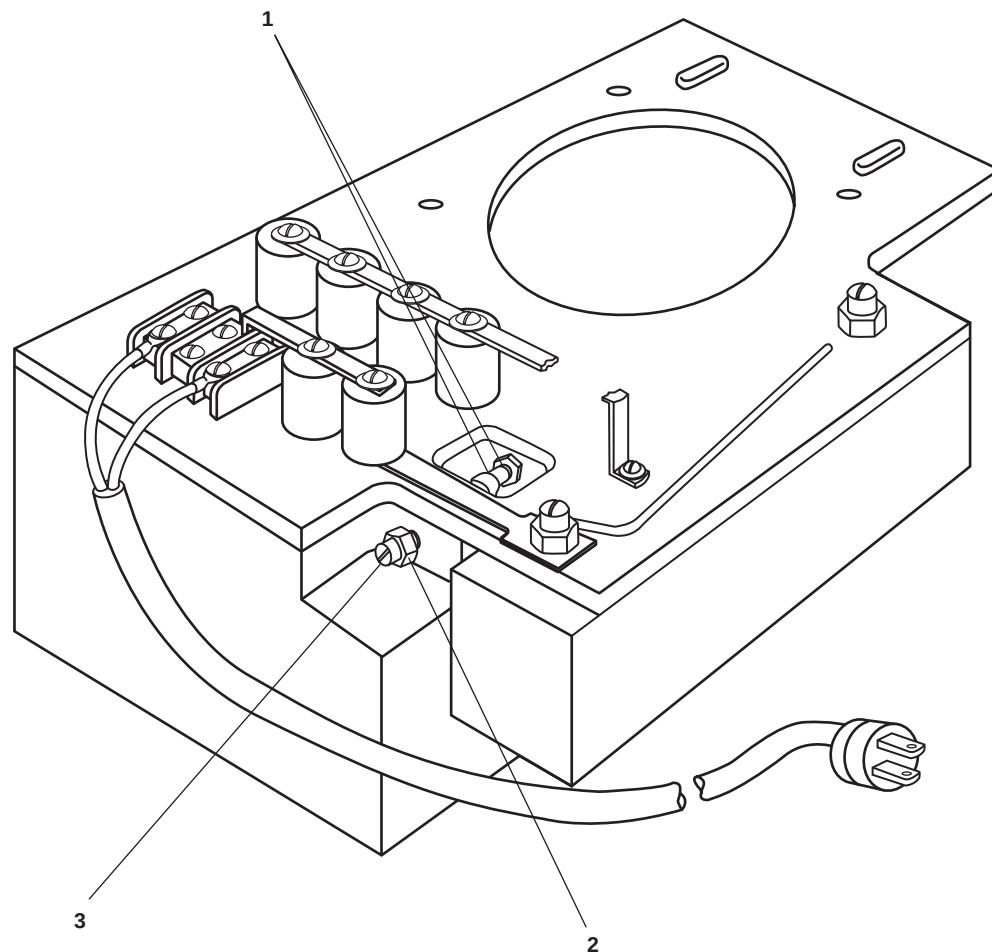
Figure 3. Searchlight Alignment

ASSEMBLY

1. Install the rear cover (figure 1, item 12) and secure it with the toggle clamps (figure 1, item 13).
2. Return the equipment to the desired readiness condition.

SPARK GAP ADJUSTMENT

1. At the 120V pilothouse emergency distribution panel set the PORT SEARCH LIGHT POWER SUPPLY or STARBOARD SEARCH LIGHT POWER SUPPLY circuit breaker to OFF. Lock out and tag out (FM 55-502).
2. Clean the spark gap contacts (figure 4, item 1) with a rubber ink eraser.
3. Loosen the jam nut (figure 4, item 2).
4. Adjust the bolt (figure 4, item 3) until the proper measurement is reached. Use a feeler gauge to ensure that the gap is between 0.030 + or - 0.005 in.
5. Tighten the jam nut (figure 4, item 2).

**Figure 4. Lamp Starter**

6. Measure the gap again to make sure it has not shifted.
7. 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. Set the circuit breaker to ON.
3. Test operate the searchlight to verify proper operation. Perform the Alignment and Lubrication procedures in this work package if needed.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
NAVIGATION (RUNNING) LIGHTS, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
WP 0295 00 (volume 2)
WP 0301 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
Gasket (Item 2, Figure 63, WP 0301 00, Volume 2)
Lamp, Incandescent (Item 4, Figure 63, WP 0301 00, Volume 2)

Equipment Conditions:

Set to OFF the PILOT HOUSE EMERGENCY DISTRIBUTION PANEL. circuit breaker at the 120V emergency load center distribution panel; set to OFF the PORT SEARCH LIGHT. circuit breaker, or STARBOARD SEARCH LIGHT. circuit breaker at the navigation lighting panel. 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.

SINGLE LENS/DOUBLE LENS LIGHT FIXTURES REPLACEMENT**REMOVAL****NOTE**

Single lens navigation lights are structurally identical, but differ in the color of the lens. Double lens navigation lights are also structurally identical, but differ in lens color. This procedure is applicable to the four single lens and the four double lens navigation lights on the vessel.

1. Loosen the setscrew (figure 1, item 1) and remove the lid (figure 1, item 2) and gasket (figure 1, item 3). Discard the gasket.
2. Remove the clamp (figure 1, item 4).
3. Remove the lens (figure 1, item 5).
4. Remove the lamp (figure 1, item 6) from the socket (figure 1, item 7).

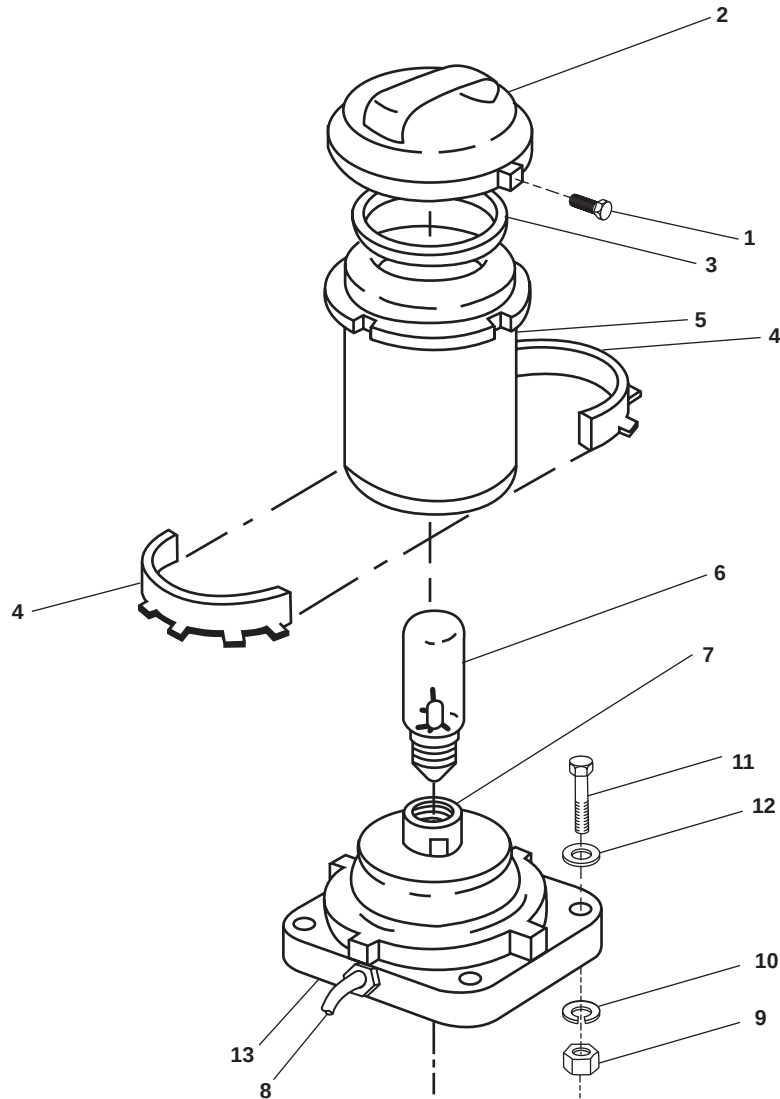


Figure 1. Repair Navigation Light (Single Lens)

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

5. Use a multimeter to check for voltage at the lamp socket. If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). In no voltage is present, continue with the procedure.

6. Label and remove the wiring (figure 1, item 8).
7. Remove the four nuts (figure 1, item 9), four lockwashers (figure 1, item 10), four bolts (figure 1, item 11), and four flat washers (figure 1, item 12) that secure the light fixture (figure 1, item 13). Discard the lockwashers.
8. Remove the light fixture (figure 1, item 13) from its foundation.

INSTALLATION

1. Install the new light fixture (figure 1, item 13) on its foundation and secure it with the four bolts (figure 1, item 11), four flat washers (figure 1, item 12), four new lockwashers (figure 1, item 10), and four nuts (figure 1, item 9).
2. Install the wiring (figure 1, item 8) to the light fixture (figure 1, item 13) using the labels from step 6 of Removal as a guide. Remove the labels.
3. Install the lamp (figure 1, item 6) in the socket (figure 1, item 7) hand tight.
4. Install the lens (figure 1, item 5) and secure it with the clamp (figure 1, item 4).
5. Install a new gasket (figure 1, item 3) and the lid (figure 1, item 2), securing them with the setscrew (figure 1, item 1).
6. Remove the lockouts tagouts (FM 55-502).
7. Set the circuit breaker to ON.
8. Perform a functional test by turning the light ON and OFF to ensure proper operation.
9. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
NAVIGATION (RUNNING) LIGHTS, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set to OFF the NAVIGATION LIGHTING PANEL. circuit breaker at the 120V emergency load center distribution panel. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

SINGLE LENS LAMP BULBS AND/OR LENSES REPLACEMENT**REMOVAL****WARNING**

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

NOTE

Single lens navigation lights are structurally identical, but differ in the color of the lens. This procedure is applicable to the four single lens navigation lights on the vessel. Use the correct replacement color when replacing a lens.

1. Loosen the setscrew (figure 1, item 1) and remove the lid (figure 1, item 2) and gasket (figure 1, item 3). Discard the gasket.
2. Remove the clamp (figure 1, item 4).
3. Remove the lens (figure 1, item 5).
4. Remove the lamp (figure 1, item 6) from the socket (figure 1, item 7).

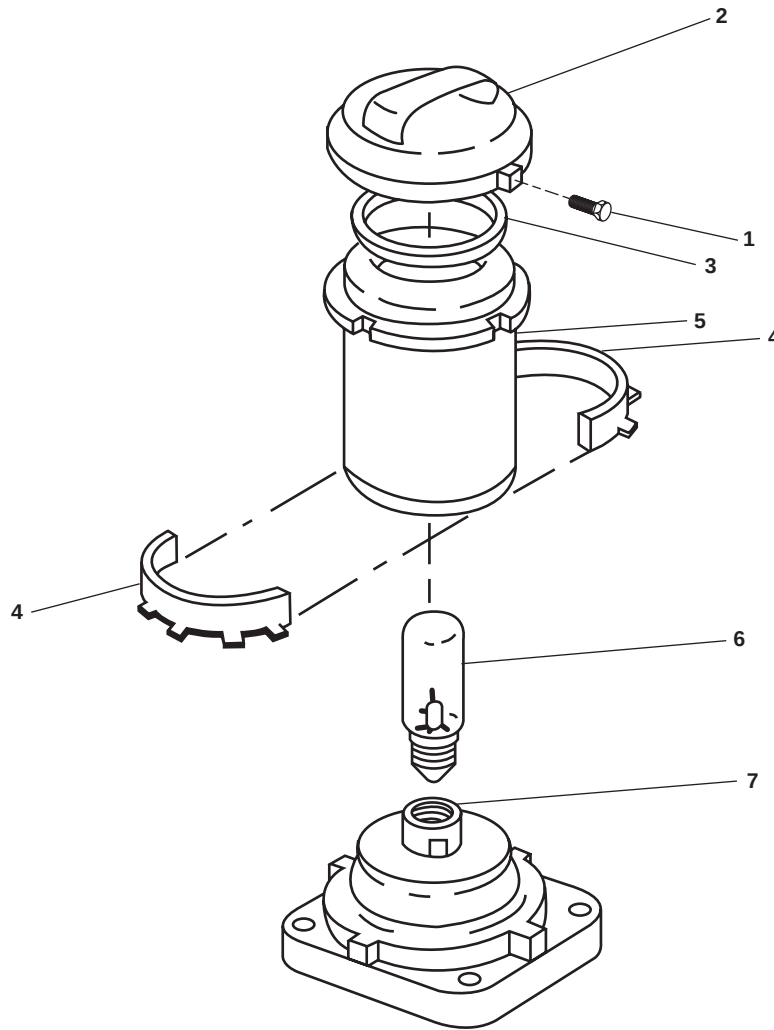


Figure 1. Repair Navigation Light (Single Lens)

INSTALLATION

1. Install the new lamp (figure 1, item 6) in the socket (figure 1, item 7).
2. Install the lens (figure 1, item 5) and secure it with the clamp (figure 1, item 4).
3. Install a new gasket (figure 1, item 3) and the lid (figure 1, item 2), securing them with the setscrew (figure 1, item 1).
4. Perform the Follow-On Service procedure at the end of this work package.

DOUBLE LENS LAMP BULBS AND/OR LENSES REPLACEMENT**REMOVAL****NOTE**

Double lens navigation lights are structurally identical, but differ in the color of the lens. This procedure is applicable to the four double lens navigation lights on the vessel. Use the correct replacement color when replacing a lens.

1. Loosen the setscrew (figure 2, item 1) and remove the lid (figure 2, item 2) and gasket (figure 2, item 3). Discard the gasket.
2. Remove the upper clamp (figure 2, item 4).
3. Remove the upper lens (figure 2, item 5) and the screen (figure 2, item 6).
4. Remove the upper lamp (figure 2, item 7) from the upper socket (figure 2, item 8).
5. Remove the lower clamp (figure 2, item 9).
6. Remove the lower lens (figure 2, item 10).
7. Remove the lower lamp (figure 2, item 11) from the lower socket (figure 2, item 12).

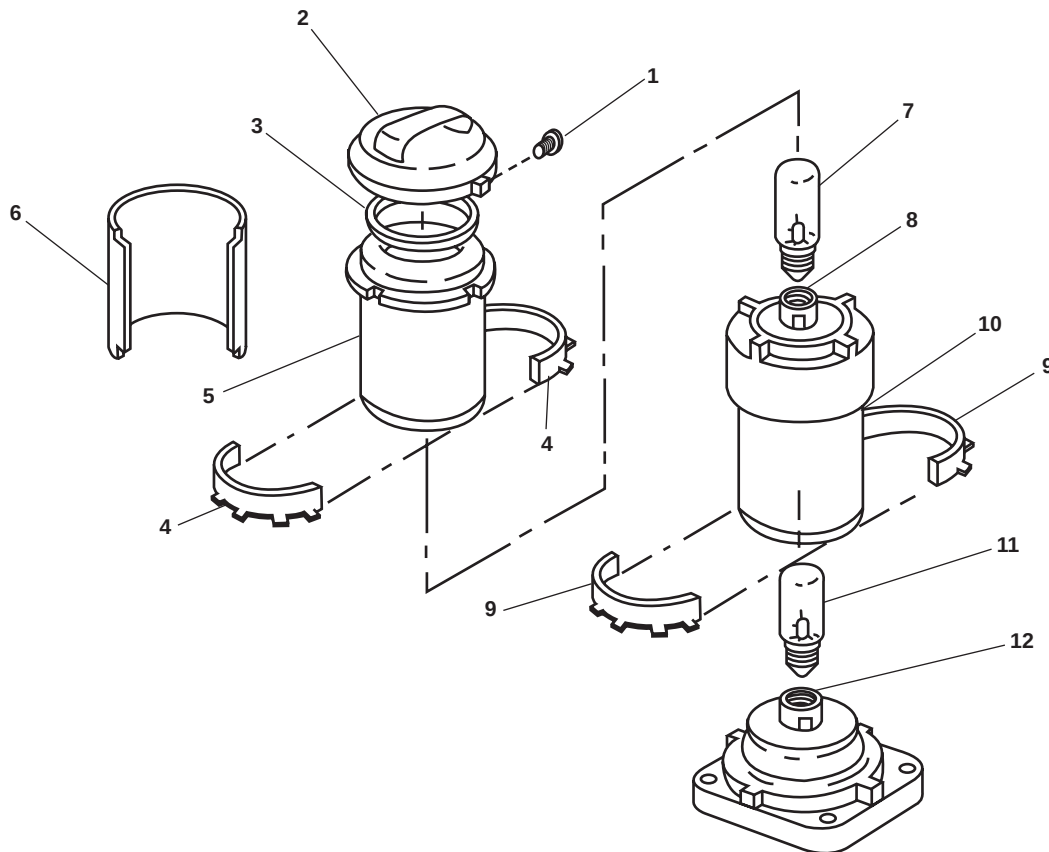


Figure 2. Repair Navigation Light (Double Lens)

INSTALLATION

1. Install the new lamp (figure 2, item 11) into the socket (figure 2, item 12).
2. Install the lower lens (figure 2, item 10) and secure it with the lower clamp (figure 2, item 9).
3. Install the upper lamp (figure 2, item 7) in the upper socket (figure 2, item 8).
4. Install the upper lens (figure 2, item 5) and screen (figure 2, item 6), securing them with the clamp (figure 2, item 4).
5. Install a new gasket (figure 2, item 3) and the lid (figure 2, item 2), securing them with the setscrew (figure 2, item 1).
6. 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. Set the circuit breaker to ON.
3. Perform a functional test by turning the light(s) ON and OFF to ensure proper operation.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
YARDARM BLINKER LIGHT AND KEY, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TB 43-0218
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

Equipment Conditions:

Set to OFF the NAVIGATION LIGHTING PANEL circuit breaker at the 120V emergency load center distribution panel. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

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.

YARDARM LIGHT REPLACEMENT**REMOVAL**

1. Remove the bolts (figure 1, item 1), retaining ring (figure 1, item 2), and lens (figure 1, item 3) from the existing light.
2. Remove the bulb (figure 1, item 4) from the socket.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the light. If voltage is present, ensure that the proper breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is available, continue with the procedure.
4. Label and remove the wiring (figure 1, item 5) from the existing light.
5. Remove the two bolts (figure 1, item 6), two nuts (figure 1, item 7), two flat washers (figure 1, item 8), and two lockwashers (figure 1, item 9) that secure the light to its foundation. Discard the lockwashers.
6. Remove the light from its foundation.

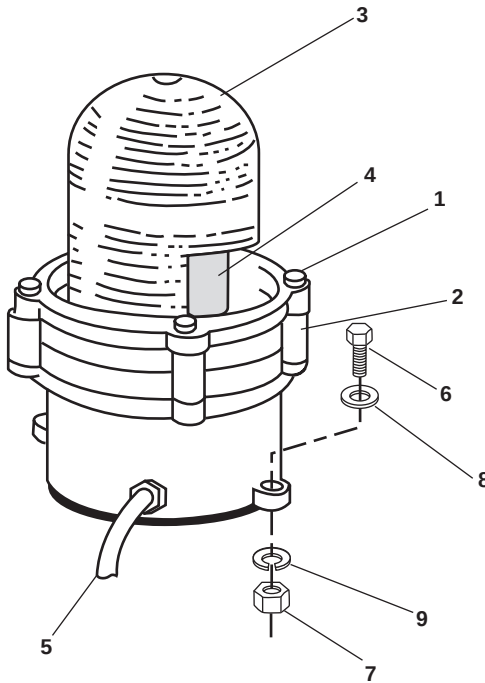


Figure 1. Yardarm Blinker Light

INSTALLATION

1. Install the light on its foundation and secure it with the two bolts (figure 1, item 6), two flat washers (figure 1, item 8), two new lockwashers (figure 1, item 9), and two nuts (figure 1, item 7).
2. Install the wiring (figure 1, item 5) inside the light using the labels from step 4 of Removal as guide. Remove the labels.
3. Install the lamp (figure 1, item 4).
4. Install the lens (figure 1, item 3) and retaining ring (figure 1, item 2), securing them with the bolts (figure 1, item 1).
5. Perform the Follow-On Service procedure at the end of this work package.

YARDARM BLINKER KEY REPLACEMENT

REMOVAL

1. Remove the four screws (figure 2, item 1) that secure the cover (figure 2, item 2) to the base (figure 2, item 3).
2. Remove the cover (figure 2, item 2) to expose the terminals for the switch (figure 2, item 4).

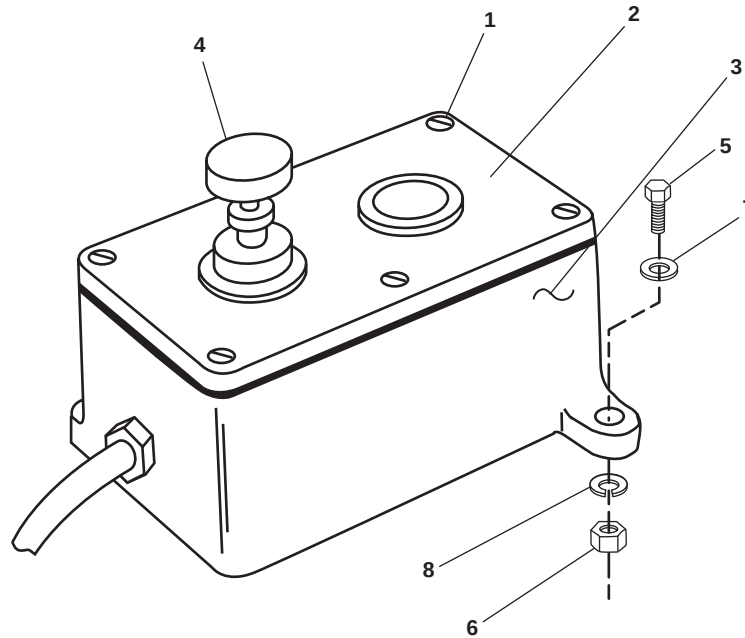


Figure 2. Yardarm Blinker Key

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the switch contacts (figure 3, item 1). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and remove the wiring (figure 3, item 2) from the switch terminals (figure 3, item 1) and from the light terminals (figure 3, item 3).
5. Loosen the strain relief (figure 3, item 4) and remove the wiring (figure 3, item 2) from the base (figure 3, item 5).
6. Remove the two bolts (figure 2, item 5), two nuts (figure 2, item 6), two flat washers (figure 2, item 7), and two lockwashers (figure 2, item 8) that secure the base (figure 2, item 3) to its foundation. Discard the lockwashers.
7. Remove the base (figure 2, item 3).

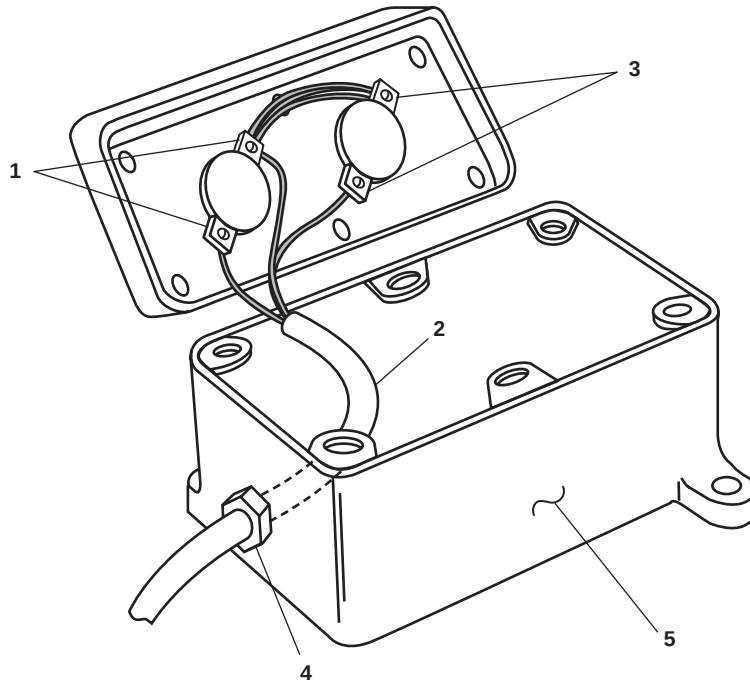


Figure 3. Blinker Key Wiring

INSTALLATION

1. Install the blinker key base (figure 2, item 3) on its foundation and secure it with the two bolts (figure 2, item 5), two flat washers (figure 2, item 7), two new lockwashers (figure 2, item 8), and two nuts (figure 2, item 6).
2. Install the wiring (figure 3, item 2) through the base (figure 3, item 5) and tighten the strain relief (figure 3, item 4).
3. Install the wiring (figure 3, item 2) to the switch terminals (figure 3, item 1) and to the light terminals (figure 3, item 3) using the labels from step 4 of Removal as a guide. Remove the labels.
4. Install the cover (figure 2, item 2) on the base and secure it with the four screws (figure 2, item 1).
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. Set the circuit breaker to ON.
3. Test operate the light by turning it ON and cycling the blinker switch ON and OFF.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
YARDARM BLINKER LIGHT AND KEY, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0301 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Gasket (Item 5, Figure 65, WP 0301 00, Volume 2)
Lamp, Incandescent (Item 3, Figure 65, WP 0301 00,
Volume 2)

Equipment Conditions:

At the 120V emergency load center distribution panel,
set the NAVIGATION LIGHTING PANEL. circuit
breaker to OFF. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

YARDARM LAMP AND/OR LENS REPLACEMENT**REMOVAL**

1. Remove the four screws (figure 1, item 1), retaining ring (figure 1, item 2), and lens (figure 1, item 3).
2. Remove and discard the gasket (figure 1, item 4).
3. Remove the lamp (figure 1, item 5) from the lamp socket.

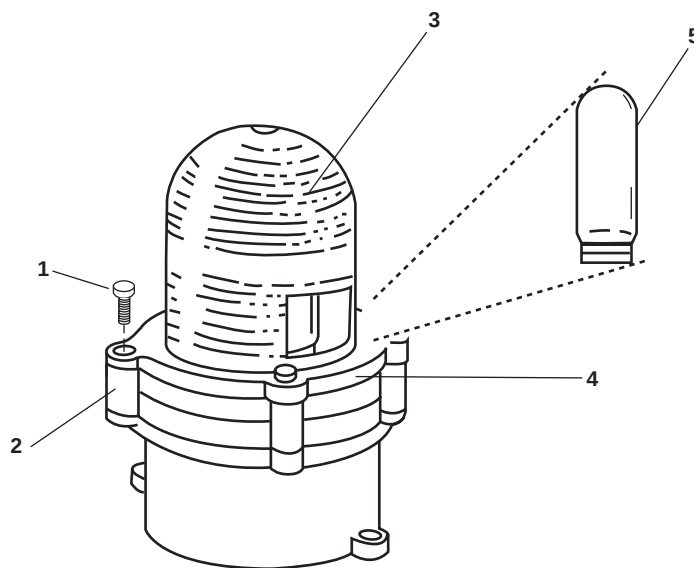


Figure 1. Yardarm Light

INSTALLATION

1. Install the lamp (figure 1, item 5) in the lamp socket hand tight.
2. Install the new gasket (figure 1, item 4), lens, (figure 1, item 3) and retaining ring (figure 1, item 2) and secure them with the four screws (figure 1, item 1).
3. Remove the lockouts and tagouts (FM 55-502).
4. Set the circuit breaker to ON.
5. Perform the functional test by turning the light ON and OFF to ensure proper operation.
6. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
NAVIGATION LIGHTING PANEL, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502

TM 55-1925-273-10

WP 0295 00 (volume 2)

WP 0307 00 (volume 2)

Equipment Conditions:

At the emergency load center distribution panel, set the NAVIGATION LIGHTING PANEL. circuit breaker to OFF. Lock out and tag out (FM 55-502).

REMOVAL

1. Label all wiring inside the navigation lighting panel.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at all terminals inside the navigation lighting panel. If voltage is present, verify that the correct circuit breaker is set to OFF, locked out and tagged out. If no voltage is present, continue with the procedure.

NOTE

Unit replacement of the navigation lighting panel consists of locking out and tagging out the panel, then notifying direct support maintenance that the panel is ready for removal.

3. Notify direct support maintenance that the navigation lighting panel is ready for removal.

INSTALLATION**NOTE**

After direct support maintenance has replaced the navigation lighting panel, the following steps may be completed.

1. Remove any labels that were installed in Removal step 1.

2. Remove the lockouts and tagouts (FM 55-502).
3. Set the circuit breaker to ON.
4. Operate the navigation panel (TM 55-1925-273-10) and closely observe all lamps, fuses, and toggle switches to ensure proper operation.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
NAVIGATION LIGHTING PANEL, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
 WP 0295 00, Volume 2)

References:

FM 55-502
 WP 0295 00 (volume 2)
 WP 0301 00 (volume 2)
 WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
 Volume 2)
 Lamp, Incandescent (Item 6, Figure 66, WP 0301 00,
 Volume 2)

Equipment Conditions:

Set to OFF the NAVIGATION LIGHTING PANEL.
 circuit breaker at the 120V emergency load center
 distribution panel. Lock out and tag out (FM 55-
 502).

Personnel Required:

Two Watercraft Engineers, 88L

NAVIGATION LIGHTING PANEL BULB REPLACEMENT
REMOVAL

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the locking ring (figure 1, item 1) and the indicator lens (figure 1, item 2) from the light.

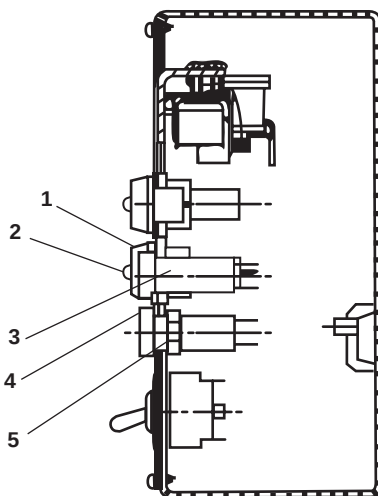


Figure 1. Navigation Lighting Panel

2. Remove the lamp (figure 1, item 3) from the socket.

INSTALLATION

1. Install the lamp (figure 1, item 3) in the socket finger tight.
2. Install the indicator lens (figure 1, item 2) and secure it with the locking ring (figure 1, item 1).
3. Perform the Follow-On Service procedure at the end of this work package.

FUSE REPLACEMENT

REMOVAL

1. Remove the fuse holder cap (figure 1, item 4) from the panel.
2. Remove the fuse from the fuse holder cap (figure 1, item 4).

INSTALLATION

1. Install the new fuse in the fuse holder cap (figure 1, item 4).
2. Install the fuse holder cap (figure 1, item 4) and fuse into the fuse holder (figure 1, item 5).
3. 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. Set the circuit breaker to ON.
3. Test the replaced components of the navigation lights to ensure that the lamps and their associated fuses operate properly.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
INTERIOR COMMUNICATIONS, REPLACE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0302 00 (volume 2)

Materials/Parts:

Amplifier, Audio (Item 1, Figure 67, WP 0302 00,
Volume 2)

PUBLIC ADDRESS SYSTEM AMPLIFIER REPLACEMENT

1. On the front panel assembly (figure 1, item 1) of the amplifier (figure 1, item 2), set the ON/OFF power switch (figure 1, item 3) to OFF.
2. Unplug the power cord from the outlet.
3. Label and remove all wires attached to the amplifier (figure 1, item 2).
4. Remove any associated mounting hardware securing the amplifier (figure 1, item 2).
5. Remove the public address system amplifier.

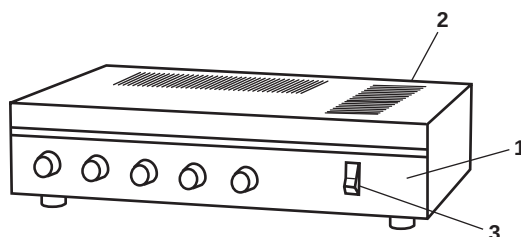


Figure 1. Public Address System Amplifier

INSTALLATION

1. Install the amplifier (figure 1, item 2) and secure it with the mounting hardware.
2. Install the wiring to the amplifier using the labels from step 3 of Removal as a guide. Remove the labels.
3. Set the ON/OFF switch (figure 1, item 3) to ON.
4. Check that the public address system operates properly (TM 55-1925-273-10).

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
INTERIOR COMMUNICATIONS, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
FM 55-509-1
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

Equipment Conditions:

Set to OFF the INTERCOM SYSTEM circuit breaker at
the 120V pilothouse emergency distribution panel.
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.

LOUDSPEAKER REPLACEMENT**REMOVAL**

1. Remove the screws (figure 1, item 1) that secure the cover (figure 1, item 2) to the loudspeaker (figure 1, item 3).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Using a multimeter, check for voltage at the terminals (figure 1, item 4). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and remove the electrical wiring (figure 1, item 5) from the terminals (figure 1, item 4).
4. Remove the bolts (figure 1, item 6), nuts (figure 1, item 7), lockwashers (figure 1, item 8), and flat washers (figure 1, item 9) that secure the loudspeaker (figure 1, item 3) to the bulkhead. Remove the loudspeaker and discard the lockwashers.

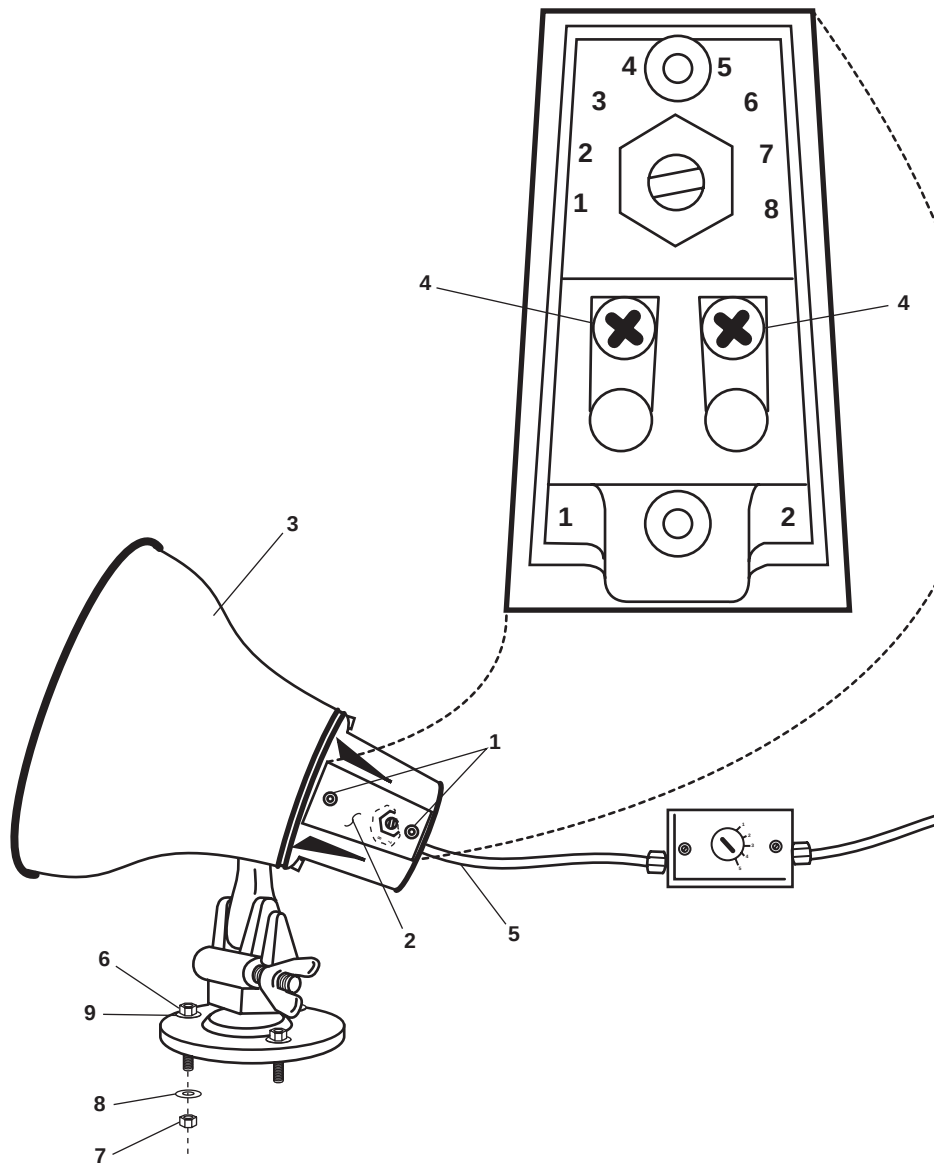


Figure 1. Interior/Exterior Loudspeaker Depiction (Typical)

INSTALLATION

1. Install the loudspeaker (figure 1, item 3) on the bulkhead and secure it with the bolts (figure 1, item 6), nuts (figure 1, item 7), new lockwashers (figure 1, item 8), and flat washers (figure 1, item 9).
2. Install the electrical wiring (figure 1, item 5) to the terminals (figure 1, item 4) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Install the cover (figure 1, item 2) on the loudspeaker (figure 1, item 3) and secure it with the screws (figure 1, item 1).
4. Perform the Follow-On Service procedure at the end of the work package.

ELECTRICAL WIRING REPLACEMENT

REPAIR

Proper repair of wiring consists of replacement of the damaged wiring. When an electrical casualty requires expedient repairs, the repair may be made by splicing. Splicing is authorized for repair of damaged cables and wiring harnesses if most of the wiring is in good useable electrical condition. The cable or wiring harness must be replaced in its entirety at the most opportune time. For proper splicing methods, refer to FM 55-509-1.

DISASSEMBLY

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in injury or death.

1. Use a multimeter to check for voltage at the wire terminals (figure 1, item 1). If voltage is present, ensure that the proper circuit breakers are set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
2. Remove any covers or interference that restrict access to the wires being removed.
3. Label all wiring to be removed, and make a sketch of the work area to permit proper assembly.
4. Remove the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3), and remove the wire (figure 1, item 4).

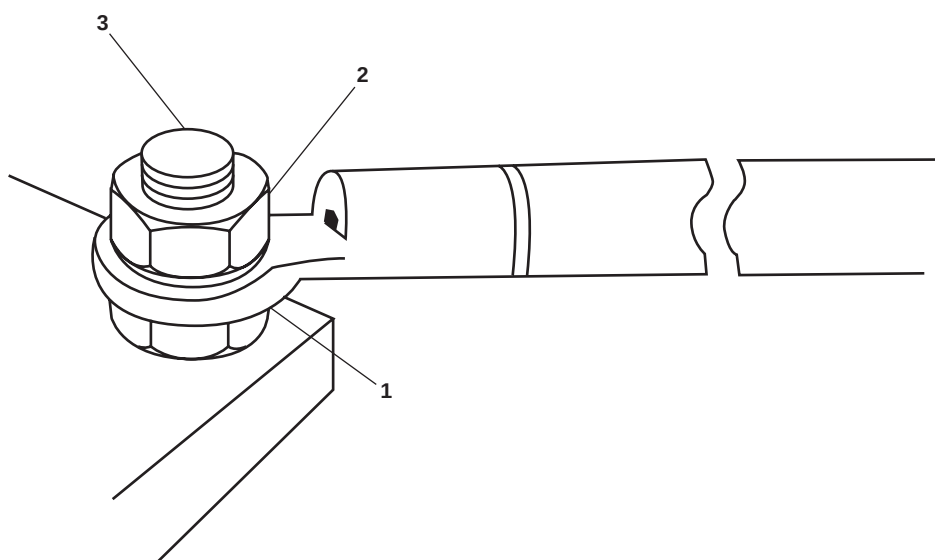


Figure 2. Electrical Wiring Terminal Depiction (Typical)

5. Follow the wire (figure 1, item 4) to the opposite end, freeing it from the vessel's structure as required.
6. Remove the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3), and remove the wire (figure 1, item 4) at the opposite end.
7. Perform steps 1-5 for any other wires that require removal.

ASSEMBLY

1. Determine the wires to be connected by referring to the sketches and labels from step 3 of Disassembly as guides.
2. Install the new wires (figure 1, item 4) along the same path as the old wires, and secure them in the same manner as the old wiring assembly.
3. Install the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3) at both ends of the wire.
4. Remove any remaining labels.
5. Install any covering or interference removed during the Disassembly procedure.
6. 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. Set the circuit breaker to ON.
3. Operate the public address system under usual conditions (TM 55-1925-273-10).
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
ALARM SYSTEM, ARMS STORAGE AND RADIO ROOM; REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00,
Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set to OFF the ALARM SWITCHBOARD. (HIGH TEM-
PERATURE & SPRINKLER). circuit breaker at
120V main deck 01 & 02 emergency lighting panel
No. 1. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

ALARM INDICATOR BULBS (SQUARE LENS) REPLACEMENT**REMOVAL**

1. Remove the square protective lens cover (figure 1, item 1).
2. Remove the lamp (figure 1, item 2).

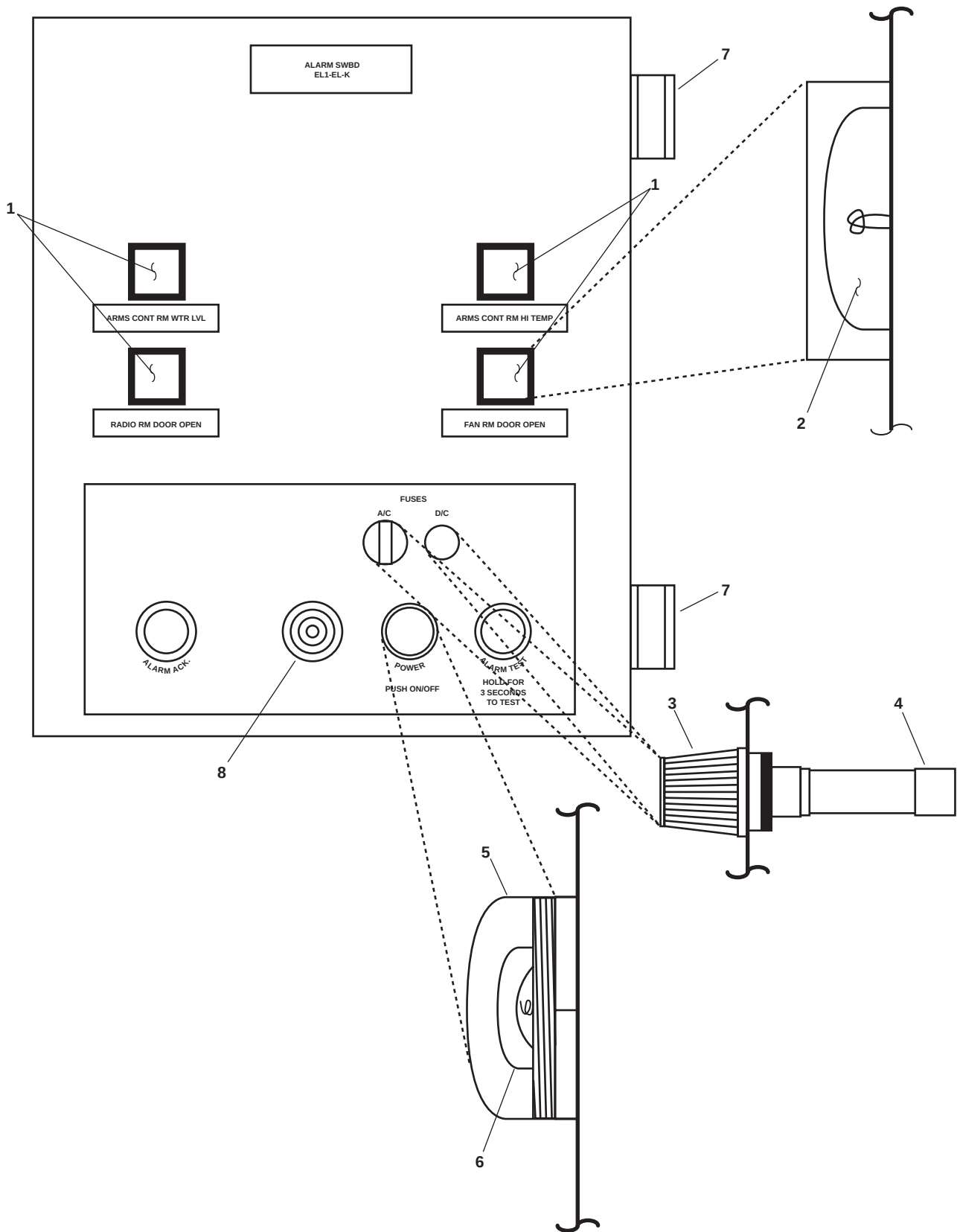


Figure 1. Alarm Panel Components (Exterior View)

INSTALLATION

1. Install the lamp (figure 1, item 2) finger tight.
2. Install the protective lens cover (figure 1, item 1).
3. Perform the Follow-On Service procedure at the end of this work package.

FUSE REPLACEMENT**REMOVAL**

1. Remove the fuse holder (figure 1, item 3) from the panel.
2. Remove the fuse (figure 1, item 4) from the fuse holder (figure 1, item 3).

INSTALLATION

1. Install the fuse (figure 1, item 4) in the fuse holder (figure 1, item 3).
2. Install the fuse holder (figure 1, item 3) in the panel.
3. Perform the Follow-On service procedure at the end of this work package.

ALARM PANEL SWITCH/INDICATOR BULB (ROUND LENS) REPLACEMENT**REMOVAL**

1. Remove the protective lens cover (figure 1, item 5).
2. Remove the lamp (figure 1, item 6) from the panel.

INSTALLATION

1. Install the new lamp (figure 1, item 6) finger tight.
2. Install the protective lens cover (figure 1, item 5) on the panel.
3. Perform the Follow-On service procedure at the end of this work package.

ALARM INDICATOR LAMP ASSEMBLY (SQUARE LENS) REPLACEMENT**REMOVAL**

1. Perform the Alarm Indicator Bulbs (Square Lens) Replacement Removal procedure in this work package.
2. Loosen the two clamping screws (figure 1, item 7) and open the front panel.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

4. Use a multimeter to check for voltage at the fuse holders (figure 2, item 1). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Label and remove the wiring (figure 2, item 2) from the lamp assembly (figure 2, item 3) at the terminals (figure 2, item 4).
6. Remove the retaining screws (figure 2, item 5) that secure the lamp assembly (figure 2, item 3). Remove the lamp assembly from the alarm panel.

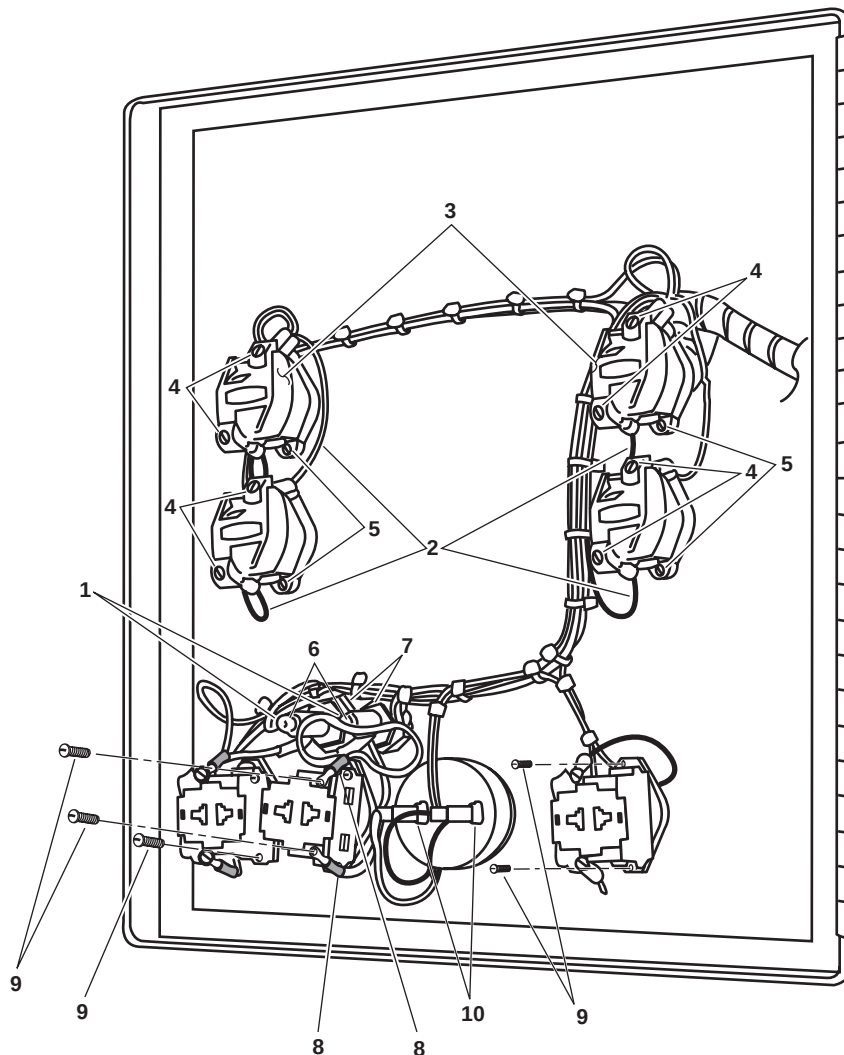


Figure 2. Alarm Panel Components (Internal View)

INSTALLATION

1. Install the lamp assembly (figure 2, item 3) in the alarm panel, securing it with the retaining screws (figure 2, item 5).
2. Install the wiring (figure 2, item 2) using the labels from step 5 of Removal as a guide. Remove the labels.
3. Close the front panel and tighten the clamping screws (figure 1, item 7).
4. Perform the Alarm Indicator Bulbs (Square Lens) Replacement Installation procedure in this work package.

FUSE HOLDER ASSEMBLY REPLACEMENT

REMOVAL

1. Perform the Fuse Replacement Removal procedure in this work package.
2. Loosen the clamping screws (figure 1, item 7) and open the front panel.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the fuse holders (figure 2, item 1). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and remove the wiring from the terminals of the fuse holder assembly (figure 2, item 6) to be removed.
5. Remove the retaining nut (figure 2, item 7) that secures the fuse holder assembly (figure 2, item 6), and remove it from the alarm panel.

INSTALLATION

1. Install the fuse holder assembly (figure 2, item 6) in the alarm panel, and secure it with the retaining nut (figure 2, item 7).
2. Install the wiring to the fuse holder assembly (figure 2, item 6) using the labels from step 4 of Removal as a guide. Remove the labels.
3. Close the front panel and tighten the clamping screws (figure 1, item 7).
4. Perform the Fuse Replacement Installation procedure in this work package.

ALARM PANEL SWITCH/INDICATOR ASSEMBLY (ROUND LENS) REPLACEMENT

REMOVAL

1. Perform the Alarm Panel Switch/Indicator Assembly (Round Lens) Replacement Removal procedure in this work package.
2. Loosen the two clamping screws (figure 1, item 7) and open the front panel.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the fuse holders (figure 2, item 1). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and remove the wiring from the terminals (figure 2, item 8) of the alarm panel switch/indicator assembly.
5. Remove the retaining screws (figure 2, item 9). Remove the alarm panel switch/indicator assembly from the alarm panel.

INSTALLATION

1. Install the alarm panel switch/indicator assembly in the alarm panel, and secure it with the retaining screws (figure 2, item 9).
2. Install the wiring to the alarm panel switch/indicator assembly using the labels from step 4 of Removal as a guide. Remove the labels.
3. Close the front panel and tighten the clamping screws (figure 1, item 7).
4. Perform the Alarm Panel Switch/Indicator Assembly (Round Lens) Replacement Installation procedure in this work package.

AUDIBLE ALARM BUZZER ASSEMBLY REPLACEMENT

REMOVAL

1. Loosen the clamping screws (figure 1, item 7) and open the front panel.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the fuse holders (figure 2, item 1). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and remove the wiring from the terminals (figure 2, item 10) of the audible alarm buzzer.
4. Remove the knurled retaining ring (figure 1, item 8). Remove the audible alarm buzzer from the alarm panel.

INSTALLATION

1. Install the audible alarm buzzer in the alarm panel and secure it with the knurled retaining ring (figure 1, item 8).
2. Install the wiring to the audible alarm buzzer (figure 2, item 10) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Close the front panel and tighten the clamping screws (figure 1, item 7).
4. Perform the Follow-On Service procedure at the end of this work package.

THERMOSTAT ASSEMBLY (ARMS LOCKER) REPLACEMENT**REMOVAL**

1. Remove the four screws (figure 3, item 1) that secure the thermostat cover (figure 3, item 2). Remove the thermostat cover.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the thermostat terminals (figure 3, item 3). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and remove the wiring from the terminals (figure 3, item 3) of the thermostat.
4. Remove the two screws (figure 3, item 4) that secure the thermostat assembly to the mounting bracket (figure 3, item 5).
5. Remove the electrical conduit (figure 3, item 6) and wires (figure 3, item 3) from the thermostat assembly.

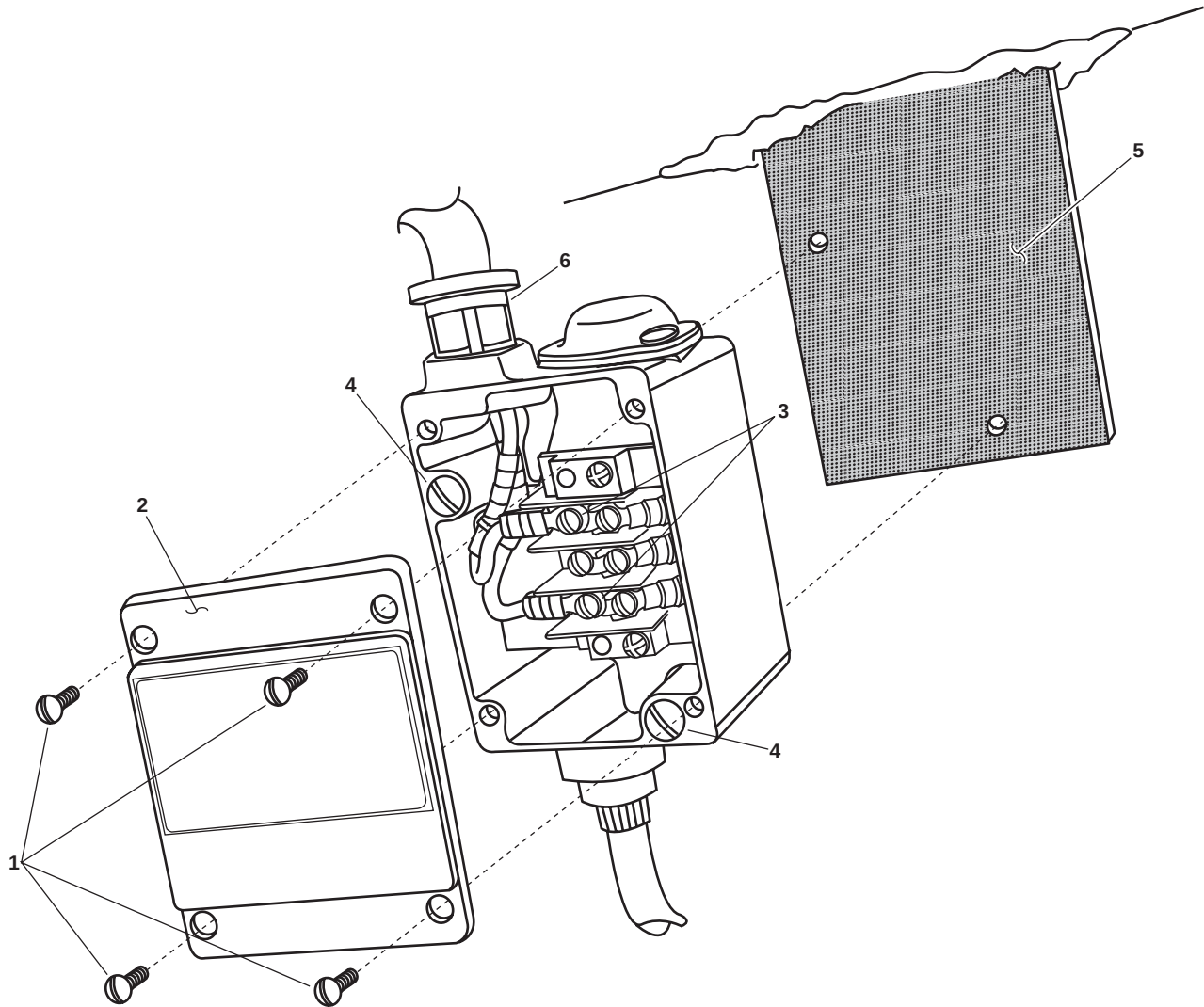


Figure 3. Thermostat Assembly

INSTALLATION

1. Install the wiring (figure 3, item 3) in the thermostat, securing it with the conduit retaining nut (figure 3, item 6).
2. Install the thermostat switch assembly on the mounting bracket (figure 3, item 5) and secure it with the two screws (figure 3, item 4).
3. Install the wiring to the terminals (figure 3, item 3) of the thermostat using the labels from Removal step 3 as a guide. Remove the labels.
4. Install the thermostat cover (figure 3, item 2), and secure it with the four screws (figure 3, item 1).
5. Perform the Follow-On service procedure at the end of this work package.

ARMS LOCKER SPRINKLER WATER SWITCH ASSEMBLY REPLACEMENT

REMOVAL

1. CLOSE valve FM-52, FM TO ARMS CONT RM. Lock out and tag out (FM 55-502).
2. Remove the three nuts (figure 4, item 1) that secure the arms locker sprinkler water switch back plate assembly (figure 4, item 2).
3. Separate the arms locker water switch back plate assembly (figure 4, item 2) from the arms locker sprinkler water switch mounting plate (figure 4, item 3) to reveal the arms locker sprinkler water switch terminals.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

4. Use a multimeter to check for voltage at the exposed terminals of the arms locker sprinkler water switch (figure 4, item 4). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

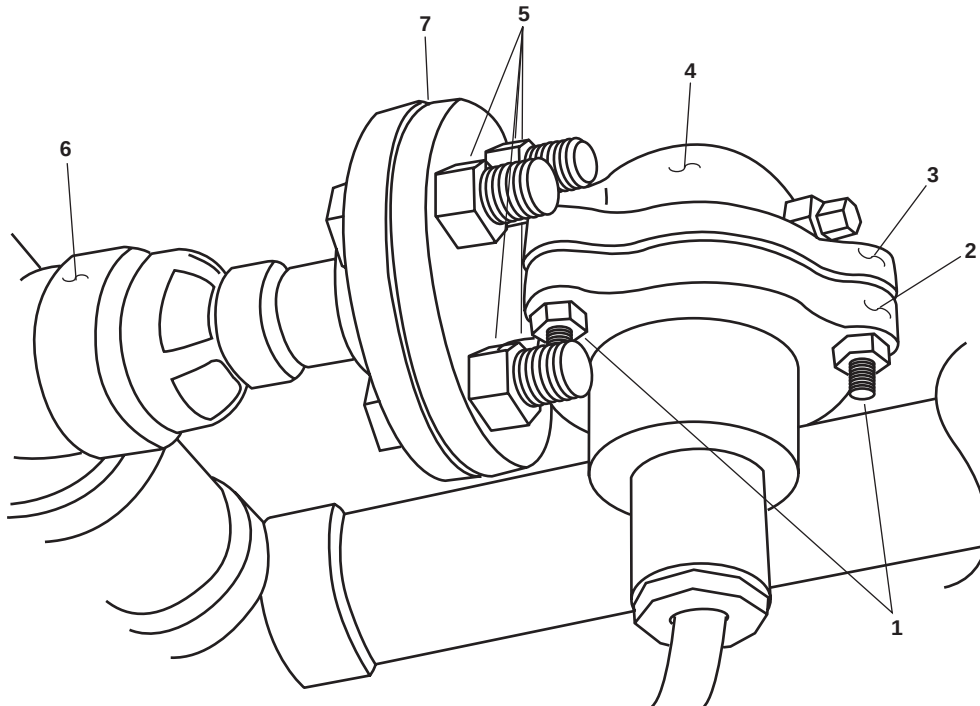


Figure 4. Arms Locker Water Switch Assembly

5. Label and remove the wiring from the terminals connected to the arms locker sprinkler water switch (figure 4, item 4).
6. Remove the four bolts and nuts (figure 4, item 5) that secure the arms locker sprinkler water switch (figure 4, item 4) to the fire main (figure 4, item 6).
7. Remove the arms locker sprinkler water switch (figure 4, item 4) and gasket (figure 4, item 7). Discard the gasket.

INSTALLATION

1. Install the arms locker sprinkler water switch (figure 4, item 4) with a new gasket (figure 4, item 7), securing them with the four bolts (figure 4, item 5).
2. Install the wiring to the terminals of the arms locker sprinkler water switch (figure 4, item 4) using the labels from step 5 of Removal as a guide. Remove the labels.
3. Install the arms locker sprinkler water switch back plate assembly with the cover (figure 4, item 2), and secure it with the three bolts (figure 4, item 1).
4. Remove the lockouts and tagouts (FM 55-502).
5. OPEN valve FM-52, FM TO ARMS CONT RM.
6. Check for leaks at the new gasket (figure 4, item 7).

REPLACE ROTARY SNAP SWITCH ASSEMBLY

REMOVAL

1. Remove the four screws (figure 5, item 1) and remove the rotary snap switch cover (figure 5, item 2).

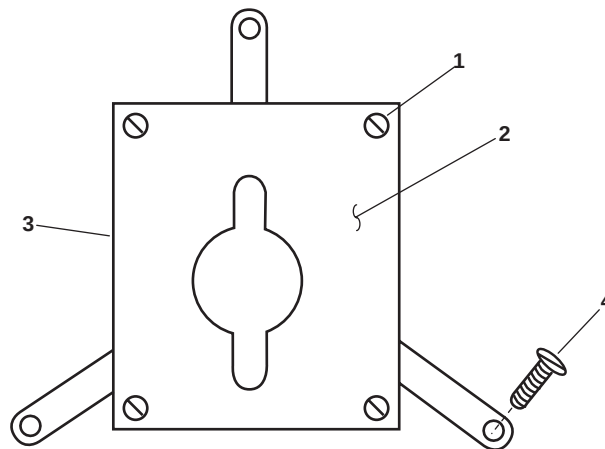
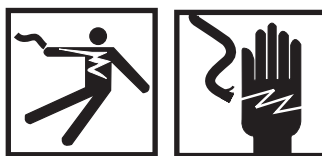


Figure 5. Rotary Snap Switch Assembly

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the terminals inside the rotary snap switch (figure 5, item 3). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and remove the wiring from the rotary snap switch (figure 5, item 3).
4. Remove the three screws (figure 5, item 4) that secure the rotary snap switch (figure 5, item 3) to the bulkhead mounting bracket.
5. Remove the rotary snap switch assembly (figure 5, item 3) from its bulkhead mounting bracket.

INSTALLATION

1. Install the rotary snap switch (figure 5, item 3) on the bulkhead mounting bracket, securing it with the three screws (figure 5, item 4).
2. Install the wiring to the rotary snap switch (figure 5, item 3) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Install the rotary snap switch cover (figure 5, item 2), securing it with the four screws (figure 5, item 1).
4. Perform the Follow-On Service procedure at the end of this work package.

REPLACE DOOR ALARM SWITCH ASSEMBLY**REMOVAL**

1. Remove the three screws (figure 6, item 1) and remove the door alarm switch cover (figure 6, item 2).

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the terminals inside the door alarm switch (figure 6, item 3). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Label and remove the wiring from the door alarm switch (figure 6, item 3).
4. Remove the three nuts (figure 6, item 4) that secure the door alarm to the bulkhead.
5. Remove the door alarm switch from the bulkhead.

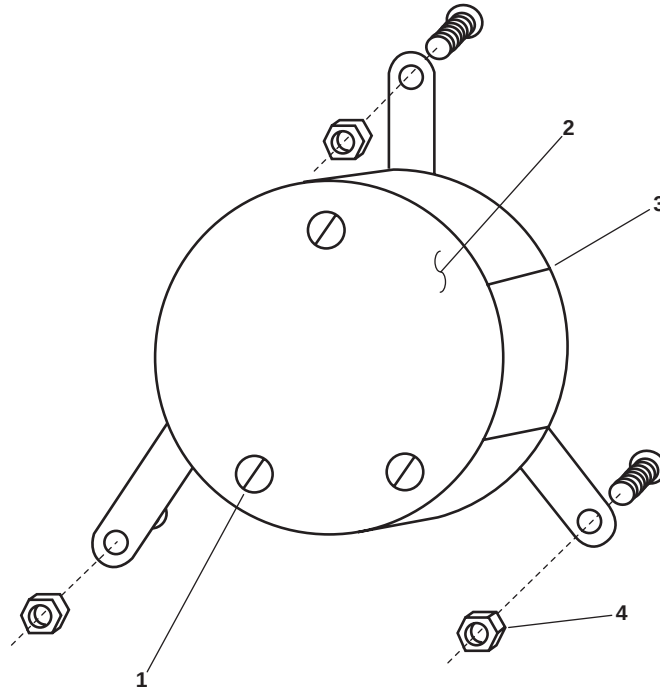


Figure 6. Door Alarm Switch Assembly

INSTALLATION

1. Install the door alarm switch (figure 6, item 3) on the bulkhead studs, securing it with the three nuts (figure 6, item 4).
2. Install the door alarm switch (figure 6, item 3) wiring using the labels from step 3 of Removal as a guide. Remove the labels.
3. Install the door alarm switch cover (figure 6, item 2), securing it with the three screws (figure 6, item 1).
4. Perform the Follow-On Service procedure at the end of this work package.

REPLACE ALARM PANEL ASSEMBLY

REMOVAL

1. Loosen the two clamping screws (figure 1, item 7) and open the front panel.

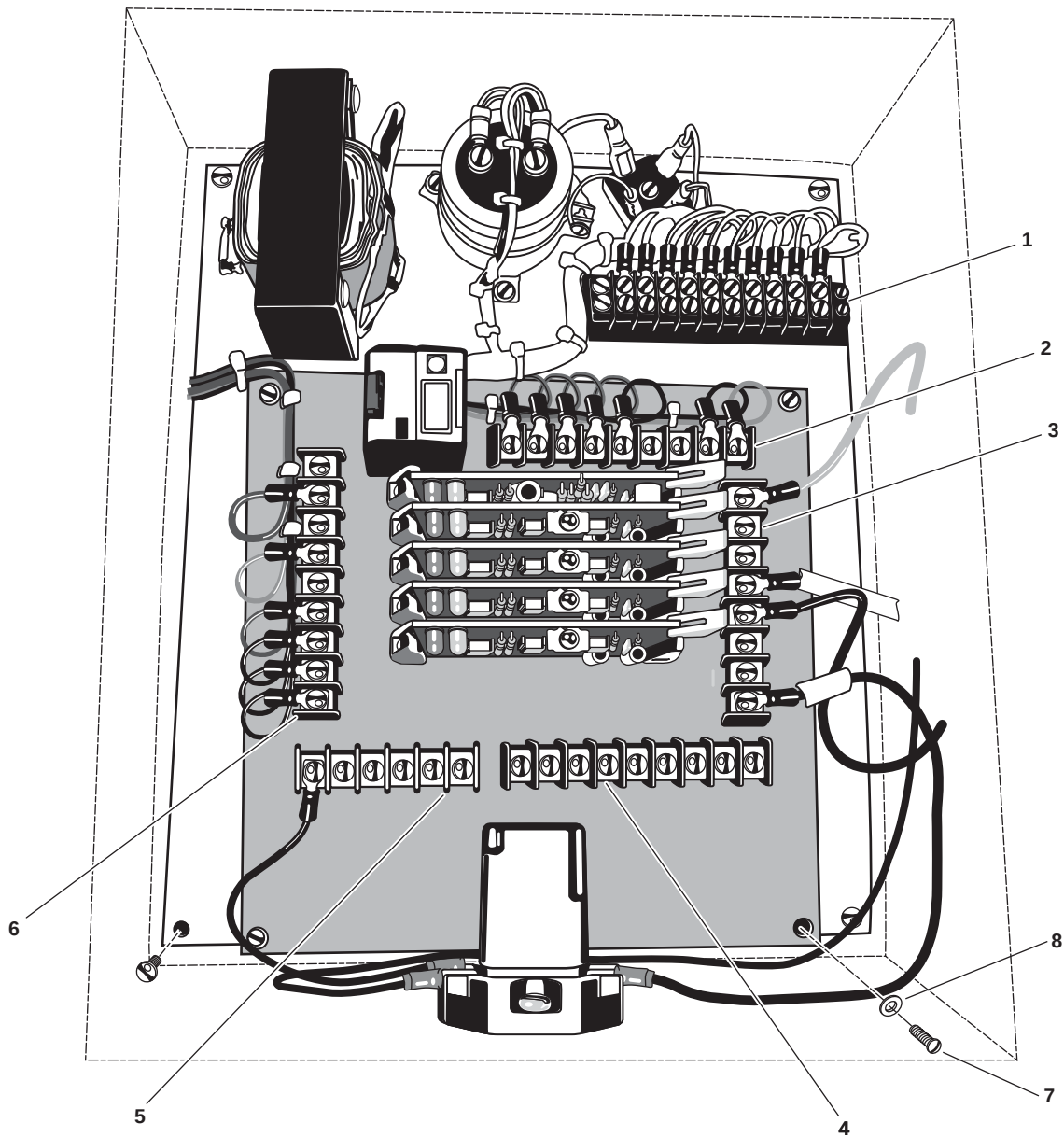


Figure 7. Alarm Panel Assembly

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the connection points on the back of all fuse holders (figure 2, item 1) and terminal boards (figures 7, items 1, 2, 3, 4, 5 and 6). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Label and remove the wiring from the terminals that are part of the cables that penetrate the alarm panel. Remove the wiring and cables from the alarm panel.
4. Remove the four bolts (figure 7, item 7) and four flat washers (figure 7, item 8). Remove the alarm panel from the bulkhead.

INSTALLATION

1. Install the alarm panel, securing it to bulkhead with the four bolts (figure 7, item 7) and four flat washers (figure 7, item 8).
2. Install the cables and connect the wiring to the terminal boards (figures 7, items 1, 2, 3, 4, 5 and 6) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Close the front panel and tighten the clamping screws (figure 1, item 7).
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. Set the circuit breaker to ON.
3. Test the each alarm circuit, ensuring the proper operation of each of the alarms on the alarm panel.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
GENERAL ALARM SYSTEM, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00)
Multimeter (Item 16, Table 2, WP 0295 00)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
WP 0295 00
WP 0307 00

Equipment Conditions:

Set to OFF the GENERAL ALARM BATTERY CHARGER circuit breaker at 120V emergency load center distribution panel. Lock out and tag out (FM 55-502).

Set to OFF the applicable compartment alarm switch at the general alarm feeder distribution panel. Lock out and tag out (FM 55-502).

Set to OFF the ENGINE ROOM EMERGENCY LIGHTS. (PORT). circuit breaker, or the ENGINE ROOM EMERGENCY LIGHTS. (STBD). circuit breaker, or the BOW THRUSTER & AMS No. 1. EMERGENCY LIGHTS. circuit breaker, or the AMS No. 2. EMERGENCY LIGHTS. circuit breaker at 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502).

BELL ASSEMBLY REPLACEMENT**REMOVAL**

1. Remove the bolt (figure 1, item 1) and washer (figure 1, item 2) that secure the gong (figure 1, item 3) to the bell actuator assembly cover (figure 1, item 4). Remove the gong from the bell actuator assembly cover.
2. Remove the six retaining screws (figure 1, item 5) that secure the bell actuator assembly cover (figure 1, item 4). Remove the bell actuator assembly cover from the bell actuator assembly.
3. Turn the bell actuator assembly cover (figure 1, item 4) over to reveal the internal electrical components (figure 2, item 1).

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

4. Use a multimeter to check for voltage at the terminals (figure 2, item 2). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Label and remove the wiring from the terminals (figure 2, item 2) of the bell actuator assembly cover (figure 1, item 4).

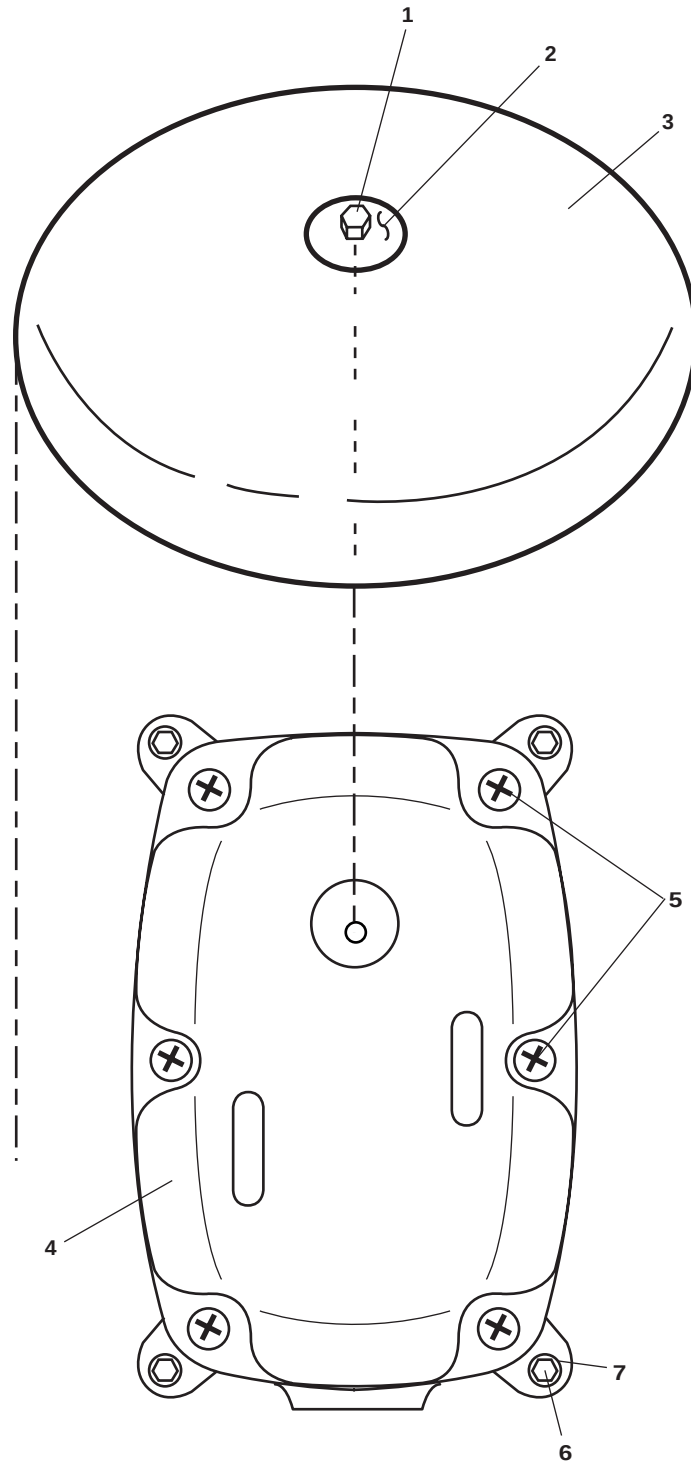


Figure 1. General Alarm Bell Assembly

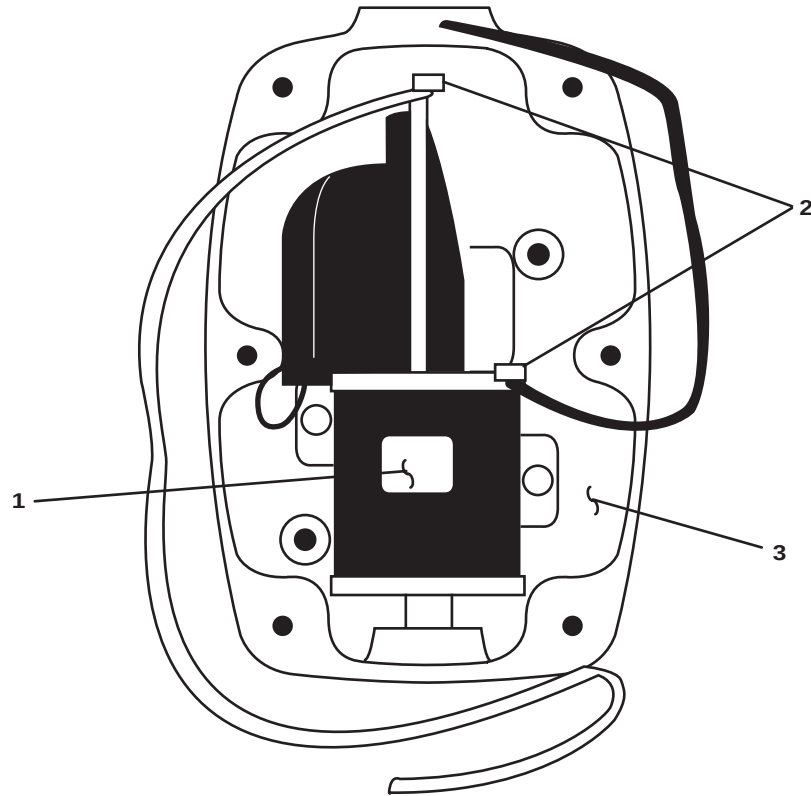


Figure 2. Contactor Switch Assembly

6. Label and remove all wiring from the bell actuator assembly.
7. Remove the four bolts (figure 1, item 6) and four washers (figure 1, item 7) that secure the bell actuator assembly to the bulkhead. Remove the bell actuator assembly from the bulkhead.

INSTALLATION

1. Install the bell actuator assembly to the bulkhead, securing it in place with the four bolts (figure 1, item 6) and four washers (figure 1, item 7).
2. Install the wiring using the labels from steps 5 and 6 of Removal as a guide. Remove the labels.
3. Install the bell actuator assembly cover (figure 1, item 4), securing it to the bell actuator assembly with the six retaining screws (figure 1, item 5).
4. Install the gong (figure 1, item 3) on the bell actuator assembly cover (figure 1, item 4), securing it with the bolt (figure 1, item 1) and flat washer (figure 1, item 2).
5. Perform the Follow-On Service procedure at the end of this work package.

CONTACTOR SWITCH ASSEMBLY REPLACEMENT

REMOVAL

1. Remove the four screws (figure 3, item 1) that secure the contactor switch cover (figure 3, item 2). Remove the contactor switch cover.
2. Turn the contactor switch cover (figure 3, item 2) over to reveal the internal electrical components (figure 4, item 1).

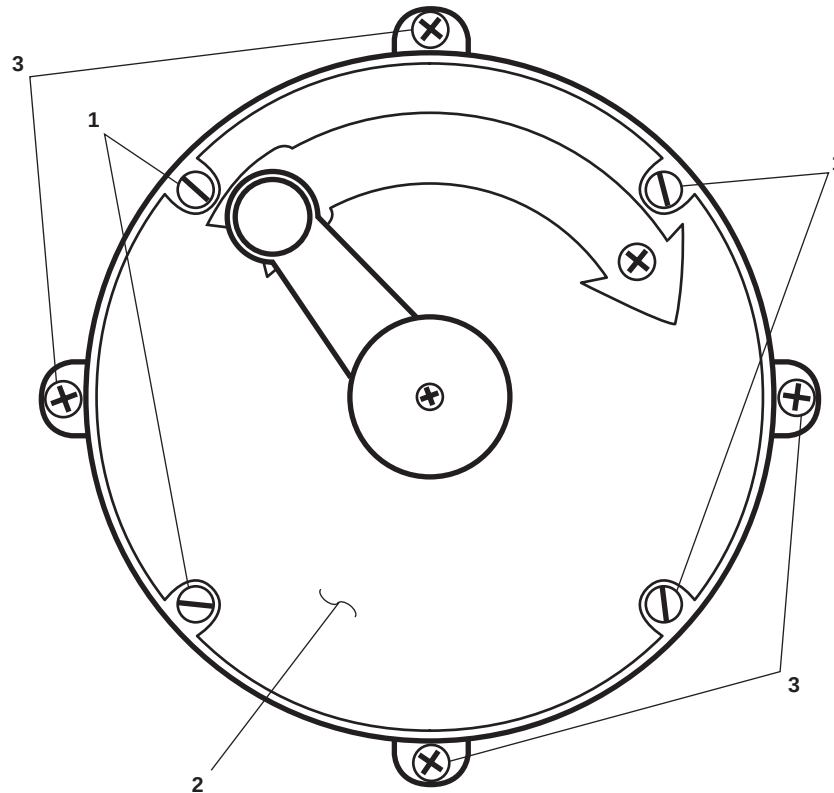


Figure 3. Contactor Switch Cover

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the terminals (figure 4, item 2). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

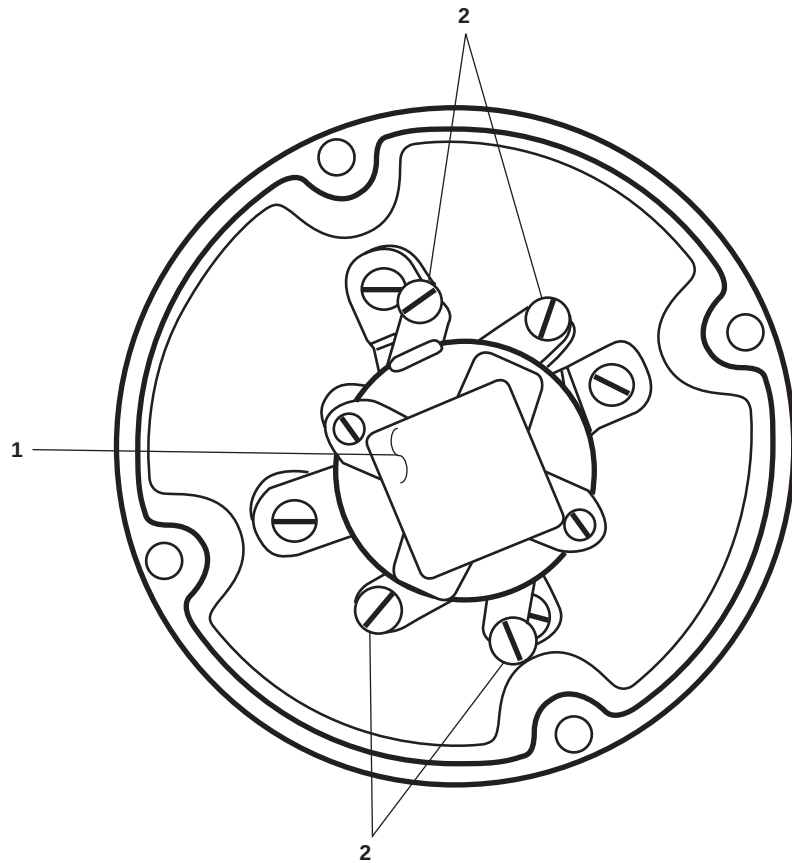


Figure 4. Contactor Terminal

4. Label and remove the wiring from the terminals (figure 4, item 2) on the contactor switch.
5. Label and remove all wiring from the contactor switch assembly.
6. Remove the four screws (figure 3, item 3) that secure the contactor switch assembly. Remove the contactor switch assembly from the bulkhead.

INSTALLATION

1. Install the contactor switch assembly to the bulkhead, securing it with the four screws (figure 3, item 3).
2. Install the wiring using the labels from steps 4 and 5 of Removal as a guide. Remove the labels.
3. Install the contactor switch cover (figure 3, item 2), securing it with the four screws (figure 3, item 1).
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. Set the circuit breakers to ON.
3. Test the general alarm, ensuring proper operation of the general alarm system.
4. Return equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
GENERAL ALARM SYSTEM, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the GENERAL ALARM BATTERY CHARGER. circuit breaker at the 120V emergency load center distribution panel. Lock out and tag out (FM 55-502).

Set to OFF the applicable compartment alarm switch at the general alarm feeder distribution panel. Lock out and tag out (FM 55-502).

Set to OFF the ENGINE ROOM EMERGENCY LIGHTS. (PORT). circuit breaker, or the ENGINE ROOM EMERGENCY LIGHTS. (STBD). circuit breaker, or the BOW THRUSTER & AMS No. 1. EMERGENCY LIGHTS. circuit breaker, or the AMS No. 2. EMERGENCY LIGHTS. circuit breaker at 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502).

GONG REPLACEMENT**REMOVAL**

1. Remove the bolt (figure 1, item 1) and washer (figure 1, item 2).
2. Remove the gong (figure 1, item 3) from the bell assembly (figure 1, item 4).

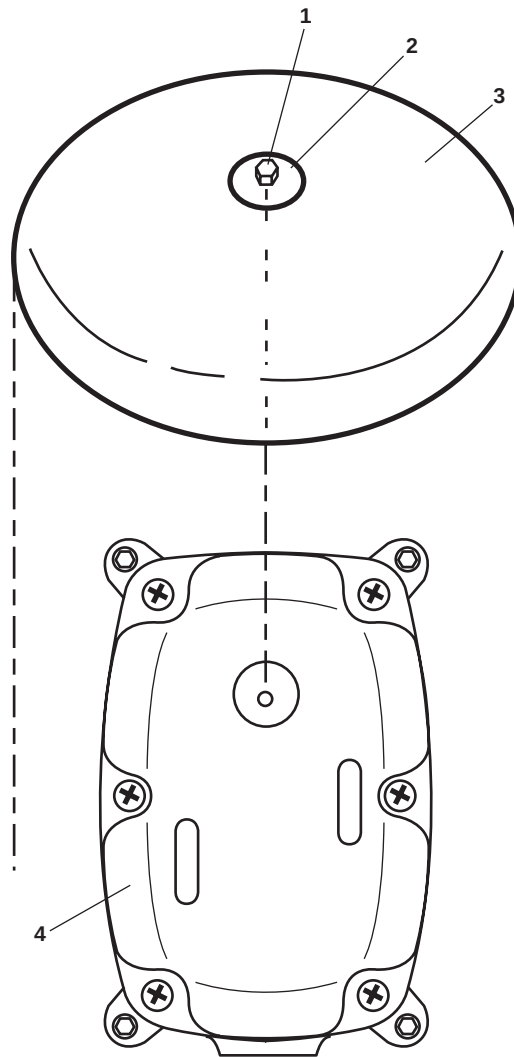


Figure 1. General Alarm Bell Assembly

INSTALLATION

1. Install the gong (figure 1, item 3) on the bell assembly (figure 1, item 4), securing it with the bolt (figure 1, item 1) and washer (figure 1, item 2).
2. Perform the Follow-On Service procedure at the end of this work package.

CONTACTOR SWITCH REPLACEMENT

REMOVAL

1. Remove the four screws (figure 2, item 1) that secure the contactor switch cover (figure 2, item 2).
2. Remove the contactor switch cover (figure 2, item 2) from the actuator assembly. Turn it over to reveal the internal components.

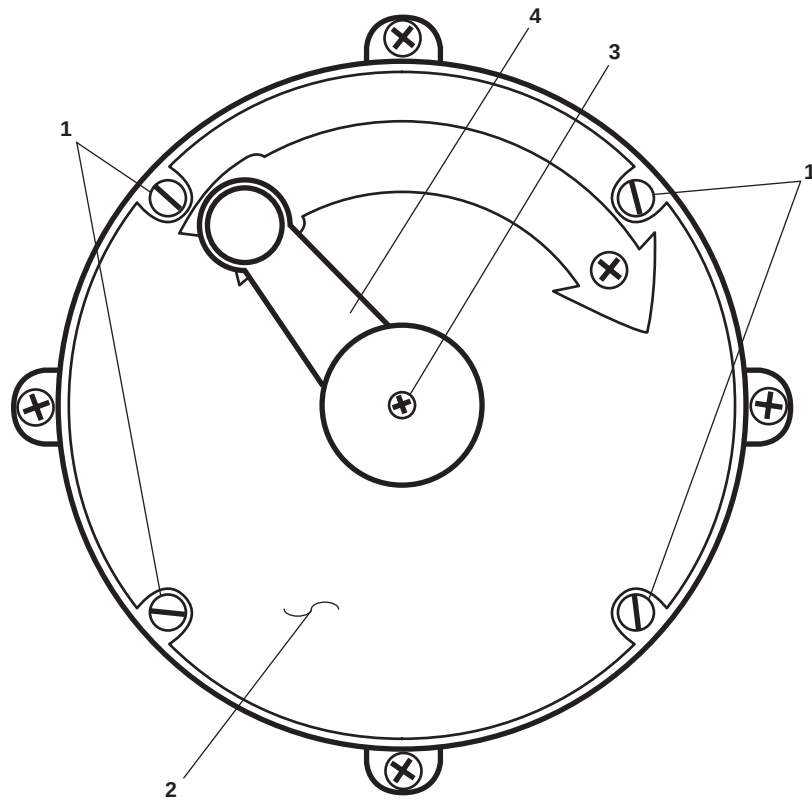


Figure 2. Contactor Switch Assembly

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the terminals (figure 3, item 1) on the contactor switch (figure 3, item 2). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and remove the wiring from the terminals (figure 3, item 1) on the contactor switch (figure 3, item 2).
5. Remove the retaining screw (figure 2, item 3) that secures the actuator (figure 2, item 4) to the switch pinion.
6. Remove the actuator (figure 2, item 4).
7. Remove the four screws (figure 3, item 3) that secure the contactor switch (figure 3, item 2). Remove the contactor switch from the contactor switch cover (figure 3, item 4).

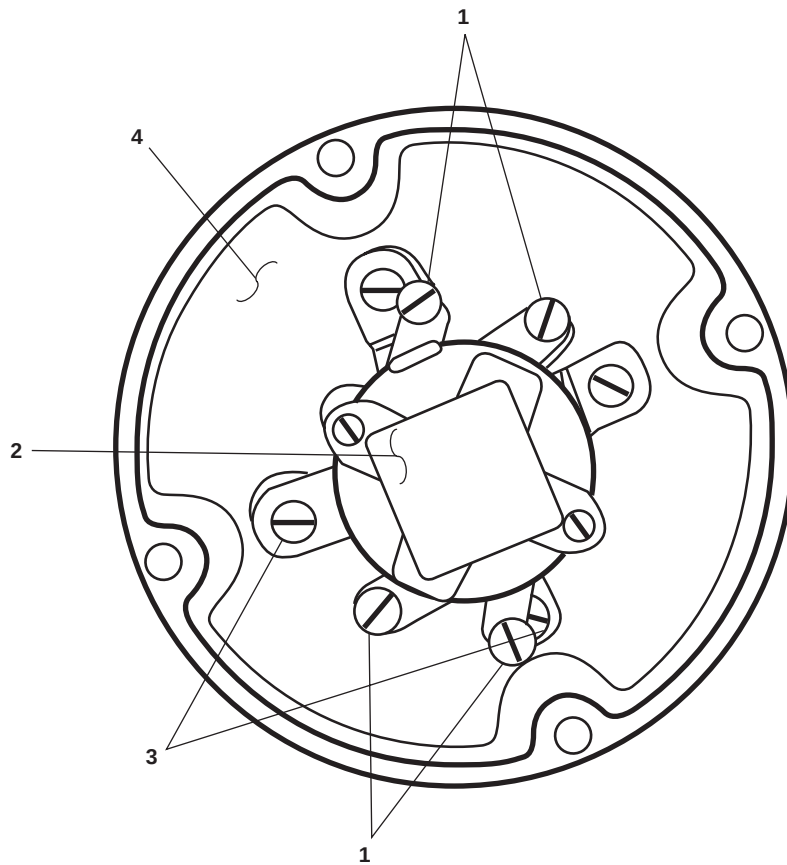


Figure 3. Contactor Switch, Rear View

INSTALLATION

1. Install the new contactor switch (figure 3, item 2) on the contactor switch cover (figure 3, item 4), securing it with the four screws (figure 3, item 3).
3. Install the wiring using the labels from step 4 of Removal as a guide. Remove the labels.
4. Install the contactor switch cover (figure 2, item 2), securing it with the four screws (figure 2, item 1).
5. Install the actuator (figure 2, item 4) on the switch pinion, securing it with the retaining screw (figure 2, item 3).
6. Perform the Follow-On Service procedure at the end of this work package.

RELAY REPLACEMENT

REMOVAL

1. At the general alarm system distribution panel located in the 01 level passageway, loosen the retaining screws, remove the cover, and open the relay protective enclosure.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Remove the screws (figure 4, item 1) that secure the hold down spring (figure 4, item 2).
3. Remove the hold down spring (figure 4, item 2).
4. Remove the relay (figure 4, item 3) by gently pulling it free from the socket (figure 4, item 4).

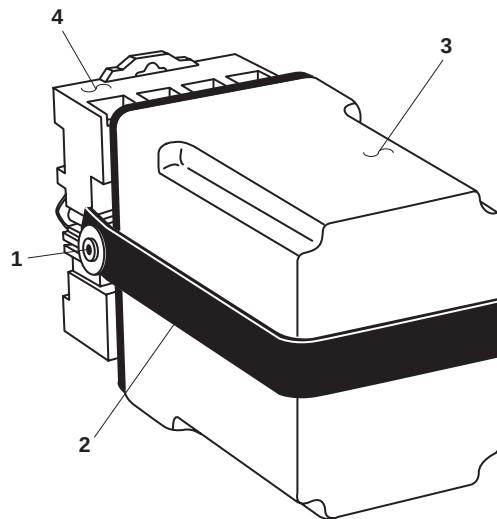


Figure 4. Relay Assembly

INSTALLATION

1. Install the relay (figure 4, item 3) by lining up the pins and gently pushing it into the relay socket (figure 4, item 4) until it snaps into place.
2. Install the hold down spring (figure 4, item 2) over the relay (figure 4, item 3), securing it with the screws (figure 4, item 1).
3. Ensure that no other components inside the panel are loose or damaged in the relay protective enclosure.

-
4. At the general alarm system distribution panel located in the 01 level passageway, install the cover and secure it with the screws.
 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. Set the circuit breakers to ON.
3. Test the general alarm, ensuring proper operation of the general alarm system.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
ROTATING BEACON, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Gasket (Item 4, Figure 73, WP 0302 00, Volume 2)
Light, Beacon (Item 1, Figure 73, WP 0302 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0302 00 (volume 2)

References (continued):

WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the GENERAL ALARM BATTERY CHARGER. circuit breaker at 120V emergency load center distribution panel. Lock out and tag out (FM 55-502).

Set to OFF the applicable compartment alarm switch at the general alarm feeder distribution panel. Lock out and tag out (FM 55-502).

Set to OFF the ENGINE ROOM EMERGENCY LIGHTS. (PORT). circuit breaker, or ENGINE ROOM EMERGENCY LIGHTS. (STBD). circuit breaker, or BOW THRUSTER & AMS No. 1. EMERGENCY LIGHTS. circuit breaker, or AMS No. 2. EMERGENCY LIGHTS. circuit breaker to OFF at 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502).

REMOVAL

1. Loosen the locking screw (figure 1, item 1) just enough to allow removal of the clamp ring (figure 1, item 2).
2. Remove the clamp ring (figure 1, item 2) by sliding it over the bottom of the dome (figure 1, item 3).
3. Remove the dome (figure 1, item 3) from the base (figure 1, item 4).
4. Remove and discard the gasket (figure 1, item 5).

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

5. Use a multimeter to check for voltage at the at connection points under the wire nuts (figure 1, item 6). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

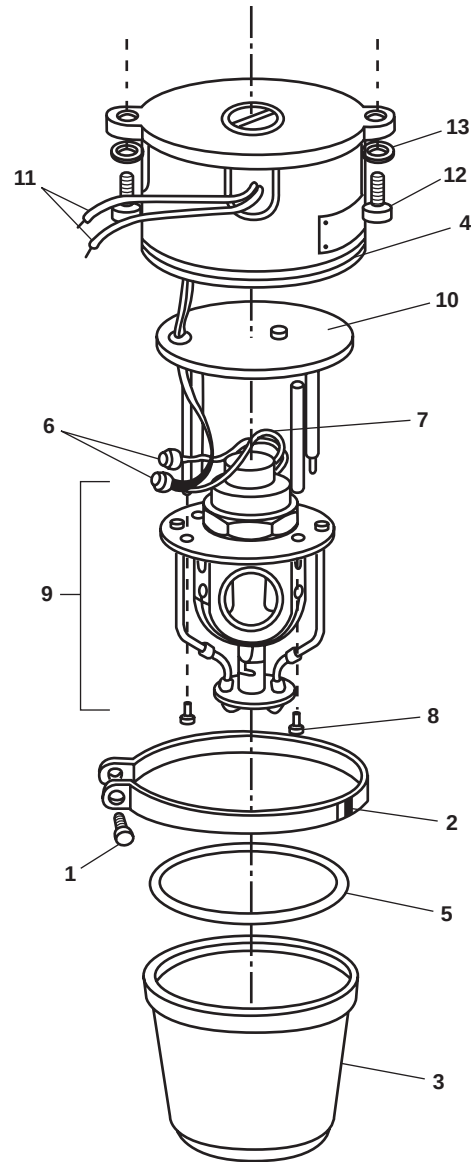


Figure 1. General Alarm Rotating Beacon

6. Label and disconnect the wiring (figure 1, item 7).
7. Remove the four retaining screws (figure 1, item 8) that secure the roto-beam assembly (figure 1, item 9). Remove it from the base plate (figure 1, item 10).
8. Remove the base plate (figure 1, item 10) to gain access to the inside of the base (figure 1, item 4) of the beacon.
9. Label and remove the wiring (figure 1, item 11) inside the base (figure 1, item 4).
10. Remove the bolts (figure 1, item 12) and washers (figure 1, item 13) that secure the base (figure 1, item 4) to the mounting bracket.

INSTALLATION

1. Secure the base (figure 1, item 4) of the beacon to the mounting bracket with the bolts (figure 1, item 12) and washers (figure 1, item 13).
2. Install the wiring (figure 1, item 11) inside the base (figure 1, item 4) of the beacon using the labels from step 9 of Removal as a guide. Remove the labels.
3. Install the base plate (figure 1, item 10).
4. Install the roto-beam assembly (figure 1, item 9) securing it with the four retaining screws (figure 1, item 8).
5. Install the wiring (figure 1, item 7) using the labels from step 6 of Removal as a guide. Remove the labels.
6. Place a new gasket (figure 1, item 5) in the recessed ridge on top of the open end of the dome (figure 1, item 3).
7. Place the open end of the dome (figure 1, item 3) in contact with the base (figure 1, item 4), and install the clamp ring (figure 1, item 2) over the junctions where the base (figure 1, item 4) and dome (figure 1, item 3) meet.
8. Tighten the locking screw (figure 1, item 1) to secure the clamp ring (figure 1, item 2) until the dome (figure 1, item 3) is securely fastened in place on the base (figure 1, item 4).
9. Remove the lockouts and tagouts (FM 55-502).
10. Set the circuit breakers to ON.
11. Test the general alarm system, ensuring proper operation of the rotating beacon.
12. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
ROTATING BEACON, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the GENERAL ALARM BATTERY CHARGER. circuit breaker at 120V emergency load center distribution panel. Lock out and tag out (FM 55-502).

Set to OFF the applicable compartment alarm switch at the general alarm feeder distribution panel. Lock out and tag out (FM 55-502).

Set to OFF the ENGINE ROOM EMERGENCY LIGHTS. (PORT). circuit breaker, or ENGINE ROOM EMERGENCY LIGHTS. (STBD). circuit breaker, or BOW THRUSTER & AMS No. 1. EMERGENCY LIGHTS. circuit breaker, or AMS No. 2. EMERGENCY LIGHTS. circuit breaker at 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502).

DOMES REPLACEMENT**REMOVAL**

1. Loosen the locking screw (figure 1, item 1) just enough to allow removal of the clamp ring (figure 1, item 2).
2. Remove the clamp ring (figure 1, item 2) by sliding it over the bottom of the dome (figure 1, item 3).
3. Remove the dome (figure 1, item 3) from the base (figure 1, item 4) of the beacon.
4. Remove and discard the gasket (figure 1, item 5).

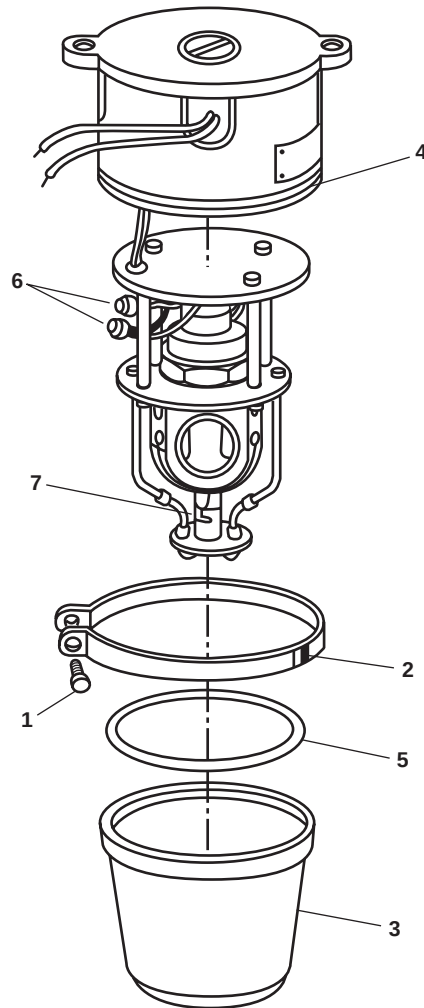


Figure 1. General Alarm Rotating Beacon

INSTALLATION

1. Place a new gasket (figure 1, item 5) in the recessed ridge on top of the open end of the dome (figure 1, item 3).
2. Install the dome (figure 1, item 3) by inserting the open end in the base (figure 1, item 4).
3. Install the clamp ring (figure 1, item 2) over the recessed junctions where the base (figure 1, item 4) and dome (figure 1, item 3) meet.
4. Tighten the locking screw (figure 1, item 1) until the dome (figure 1, item 3) is securely fastened in place on the base (figure 1, item 4).
5. Perform the Follow-On Service procedure at the end of this work package.

LAMP REPLACEMENT

REMOVAL

1. Perform the Dome Replacement Removal procedure in this work package.



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the connection points under the wire nuts (figure 1, item 6). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Rotate the lamp (figure 1, item 7) $\frac{1}{4}$ of a turn counterclockwise, and remove it from the lamp holder.

INSTALLATION

1. Install the lamp (figure 1, item 7) in the lamp holder, and rotate it $\frac{1}{4}$ of a turn clockwise to secure it in place.
2. Perform the Dome Replacement Installation procedure in this work package.
3. 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. Set the circuit breakers to ON.
3. Test the general alarm system, ensuring proper operation of the rotating beacon.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY CHARGER, GENERAL ALARM; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
FM 55-509-1
WP 0128 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the applicable battery charger circuit breaker.
Lock out and tag out (FM 55-502).

WIRING REPAIR

Proper repair of wiring consists of replacement of the damaged wiring. When an electrical casualty requires expedient repairs, the repair may be made by splicing. Splicing is authorized for repair of damaged cables and wiring harnesses if most of the wiring in good useable electrical condition. The cable or wiring harness must be replaced in its entirety at the most opportune time. For proper splicing methods, refer to FM 55-509-1.

DISASSEMBLY

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in injury or death.

1. Use a multimeter to check for voltage at the wire terminals (figure 1, item 1). If voltage is present, ensure that the proper circuit breakers are set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
2. Remove any covers or interference that restrict access to the wires being removed.
3. Label all wiring to be removed, and make a sketch of the work area to permit proper assembly.
4. Remove the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3), and remove the wire (figure 1, item 4).
5. Follow the wire (figure 1, item 4) to the opposite end, freeing it from the vessel's structure as required.
6. Remove the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3), and remove the wire (figure 1, item 4) at the opposite end.
7. Perform steps 1-5 for any other wires that require removal.

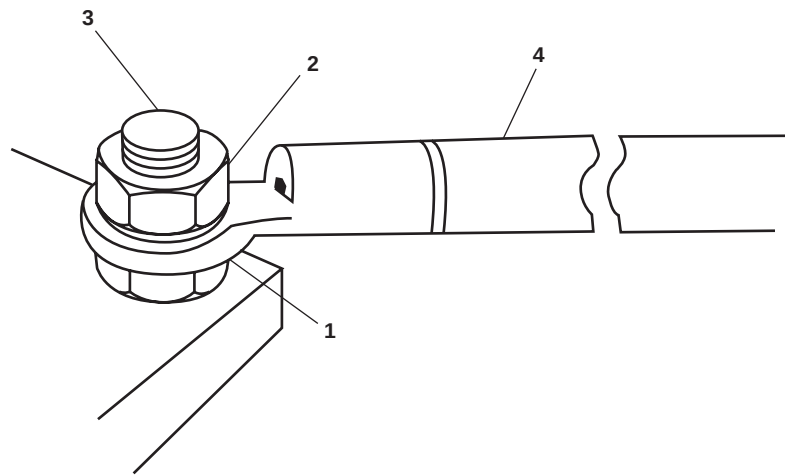


Figure 1. Typical Wire Terminal

ASSEMBLY

1. Determine the wires to be connected by referring to the sketches and labels from step 3 of Disassembly as guides.
2. Install the new wires (figure 1, item 4) along the same path as the old wires, and secure them in the same manner as the old wiring assembly.
3. Install the nuts (figure 1, item 2) that secure the wire terminals (figure 1, item 1) to the post (figure 1, item 3) at both ends of the wire.
4. Remove any remaining labels.
5. Install any covering or interference removed during the Disassembly procedure.
6. Perform the Follow-On Service procedure at the end of this work package.

AC FUSE REPLACEMENT

REMOVAL

1. Loosen the captive screw (figure 2, item 1) and OPEN the battery charger door (figure 2, item 2).



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in injury or death.

2. Use a multimeter to check for voltage at the ac fuses (figure 2, item 3). If voltage is present, ensure that the proper circuit breakers are set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

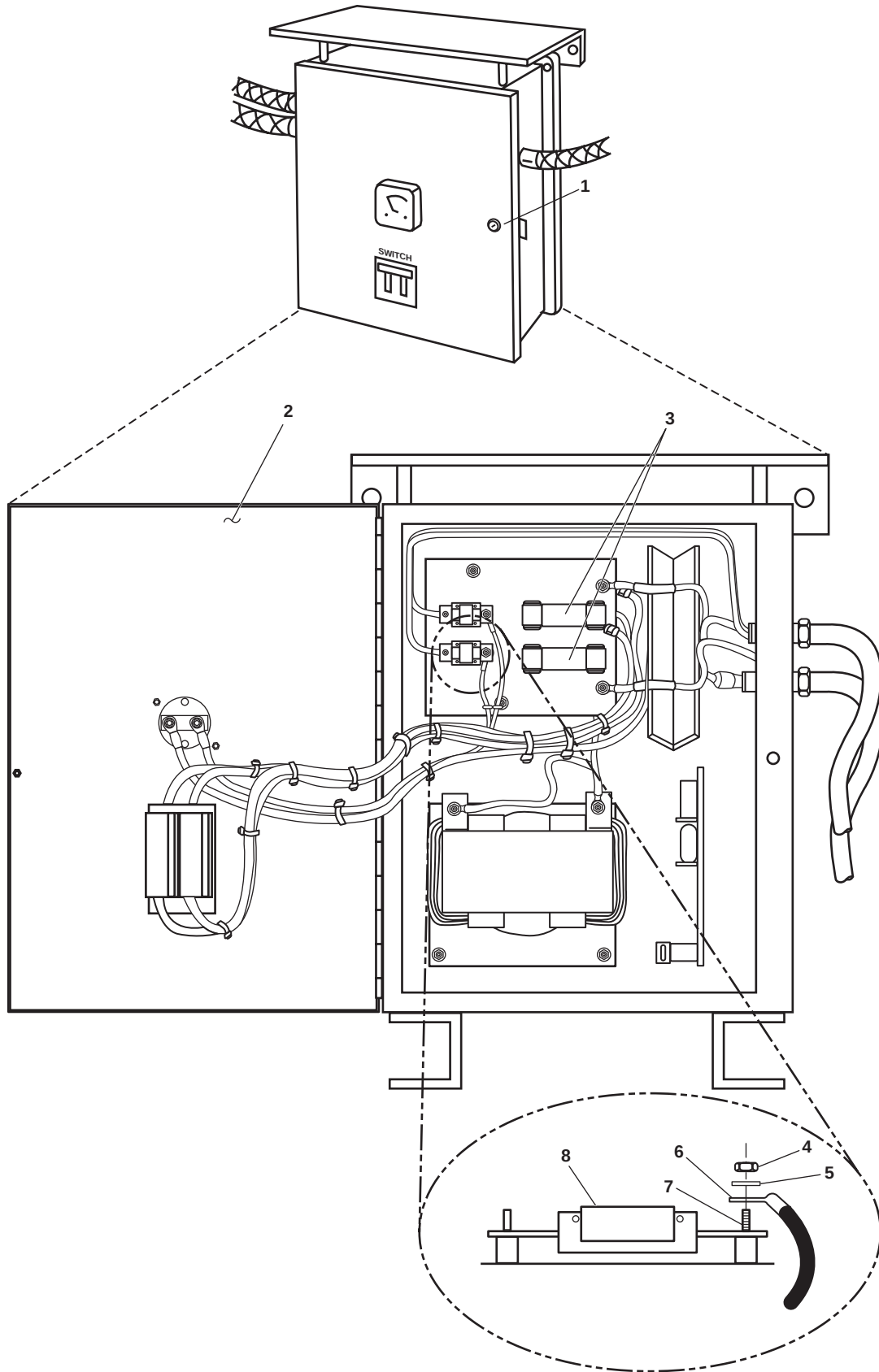


Figure 2. Battery Charger

3. Remove the ac fuses (figure 2, item 3) using a fuse puller.

INSTALLATION

1. Install the ac fuses (figure 2, item 3) using a fuse puller.
2. CLOSE the battery charger door (figure 2, item 2) and secure it with the captive screw (figure 2, item 1).
3. Perform the Follow-On Service at the end of this work package.

DC FUSE REPLACEMENT

1. Loosen the captive screw (figure 2, item 1) and OPEN the battery charger door (figure 2, item 2).



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in injury or death.

2. Use a multimeter to check for voltage at the ac fuses (figure 2, item 3). If voltage is present, ensure that the proper circuit breakers are set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Remove the nut (figure 2, item 4) and flat washer (figure 2, item 5), and remove the wire terminal (figure 2, item 6) from the post (figure 2, item 7).
4. Remove the dc fuse (figure 2, item 8) from the post (figure 2, item 7).

INSTALLATION

1. Install the dc fuse (figure 2, item 8) and the wire terminal (figure 2, item 6) on the post (figure 2, item 7) and secure them with the nut (figure 2, item 4) and flat washer (figure 2, item 5).
2. CLOSE the battery charger door (figure 2, item 2) and secure it with the captive screw (figure 2, item 1).
3. Perform the Follow-On Service procedure in this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Set the circuit breaker to ON.
3. Test the battery charger and the battery (WP 0128 00).
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY BANK, GENERAL ALARM SYSTEM; SERVICE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
 Faceshield, Industrial (Item 38, Table 2, WP 0295 00, Volume 2)
 Apron, Utility (Item 39, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Distilled Water, Technical (Item 56, Table 2, WP 0307 00, Volume 2)
 Petrolatum, Technical (Item 129, Table 1, WP 0307 00, Volume 2)

Materials/Parts (continued):

Rag, Wiping (Item 139, Table 1, WP 0307, Volume 2)
 Sodium Bicarbonate, Technical (Item 161, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 WP 0128 00
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the applicable battery charger circuit breaker.
 Lock out and tag out (FM 55-502).

WARNING



Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, faceshield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with skin or eyes, flush affected area with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in serious injury or death.

NOTE

Whenever working with batteries, the negative cable must be disconnected first, the positive cable next, and the interconnecting cable (if installed) last. When connecting the batteries, the interconnecting cable (if installed) must be connected first, the positive cable next, and the negative cable last.

1. Label and remove the negative battery cable (figure 1, item 1) from the battery post connectors (figure 1, item 2).

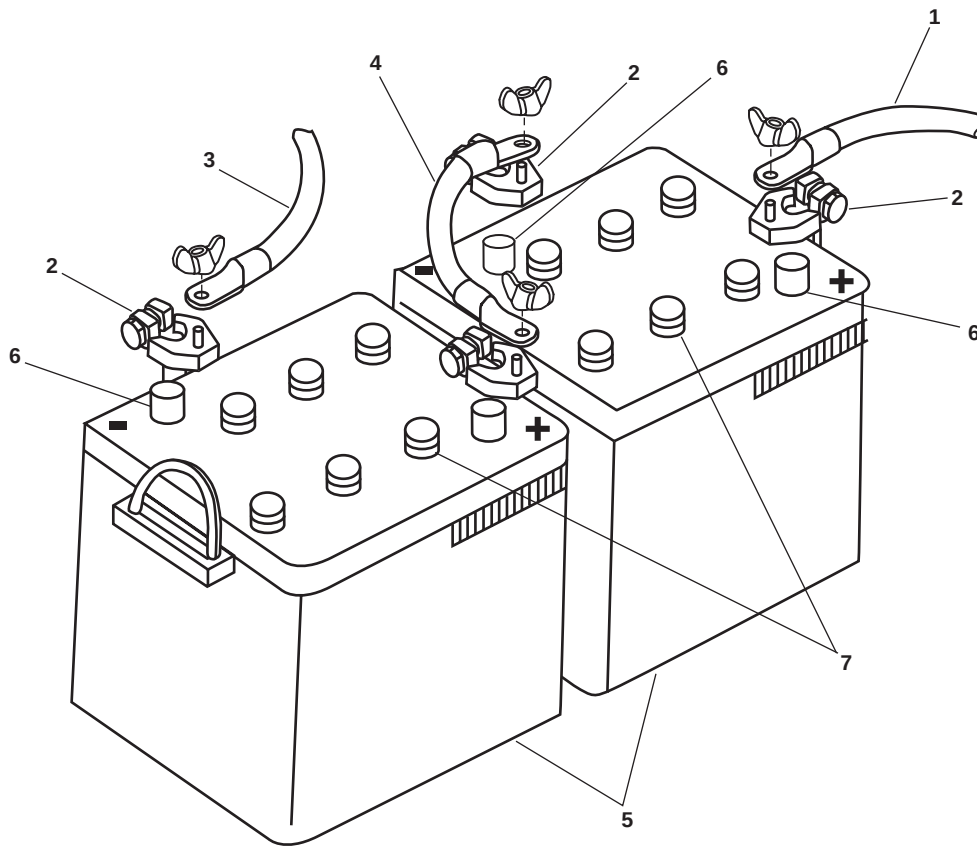


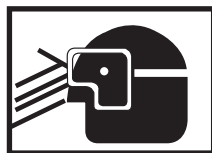
Figure 1. Battery Bank Power Supply System

2. Label and remove the positive battery cable (figure 1, item 3) from the battery post connectors (figure 1, item 2).
3. Label and remove the interconnecting cable (figure 1, item 4) from the battery post connectors (figure 1, item 2).

⚠ CAUTION

Do not apply any prying or twisting force to the battery posts. Doing so can cause the posts to break internally, permanently disabling the battery. If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.

4. Remove the battery post connectors (figure 1, item 2) from the batteries (figure 1, item 5) taking care not to apply any prying or twisting force to the battery posts (figure 1, item 6). If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.

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.

5. Use a wire brush to remove all deposits from the battery posts (figure 1, item 6), battery post connectors (figure 1, item 2), and battery cable ends (figure 1, items 1, 3, and 4).
6. Inspect the battery posts (figure 1, item 6), battery post connectors (figure 1, item 2), and battery cable ends (figure 1, items 1, 3, and 4) for damage. Replace any battery with posts damaged to the extent that the battery post connectors will not fit securely, and replace damaged battery post connectors and/or battery cables.
7. Prepare a 50/50 mix of technical sodium bicarbonate and water. Scrub the battery tops, battery cable ends (figure 1, items 1, 3, and 4), and the battery post connectors (figure 1, item 2) with the mixture.
8. Rinse the cleaned areas with fresh water, and remove any water and debris with clean wiping rags.
9. Remove the battery caps (figure 1, item 7) and check the electrolyte level in each cell. The level should be at the bottom of the split ring. If any cells are low, add technical distilled water to bring the cells to the proper level.
10. Install the battery caps (figure 1, item 7).
11. Install the battery terminal connectors (figure 1, item 2) onto the battery posts (figure 1, item 6) and tighten them snugly.
12. Install the interconnecting cables (figure 1, item 4) on both batteries (figure 1, item 5).
13. Install the positive cables (figure 1, item 3) on both batteries (figure 1, item 5).
14. Install the negative cables (figure 1, item 1) on both batteries (figure 1, item 5).
15. Apply a thin coating of technical petrolatum to the exposed portions of the battery posts (figure 1, item 6), battery terminal connectors (figure 1, item 2), and battery cable ends (figure 1, items 1, 3, and 4).
16. Remove the lockouts and tagouts (FM 55-502).
17. Test the battery and battery charger (WP 0128 00).
18. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY BANK, GENERAL ALARM SYSTEM; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
Faceshield, Industrial (Item 38, Table 2, WP 0295 00, Volume 2)
Apron, Utility (Item 39, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the applicable circuit breaker. Lock out and tag out (FM 55-502).

Materials/Parts:

Battery (Item 11, Table 1, WP 0307 00, Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

REMOVAL**WARNING**

Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, faceshield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with skin or eyes, flush affected area with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in serious injury or death.

1. Remove the hex nut and flat washer (figure 1, item 1) from the J-bolt (figure 1, item 2).
2. Remove the battery hold down (figure 1, item 3).
3. Remove the wood spacer bar (figure 1, item 4).
4. Label and remove the negative battery cable (figure 2, item 1) from the battery bank.
5. Label and remove the positive battery cable (figure 2, item 2) from the battery bank.

6. Label and remove the connector battery cable (figure 2, item 3) from the battery bank.

⚠ CAUTION

Do not apply any prying or twisting force to the battery posts. Doing so can cause the posts to break internally, permanently disabling the battery. If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.

7. Remove the battery post connectors (figure 2, item 4) from the batteries (figure 2, item 5), taking care not to apply any prying or twisting force to the battery posts (figure 2, item 6). If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.
8. Remove the batteries (figure 2, item 5) from the compartment.

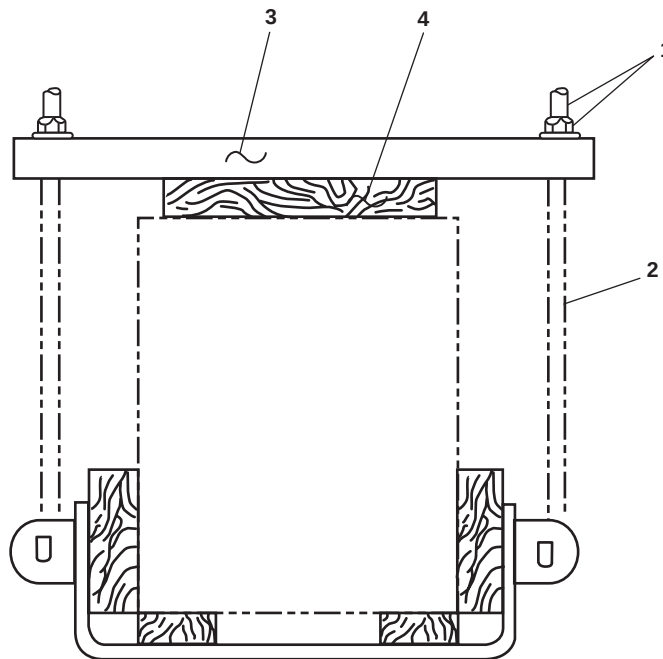


Figure 1. Battery Replacement

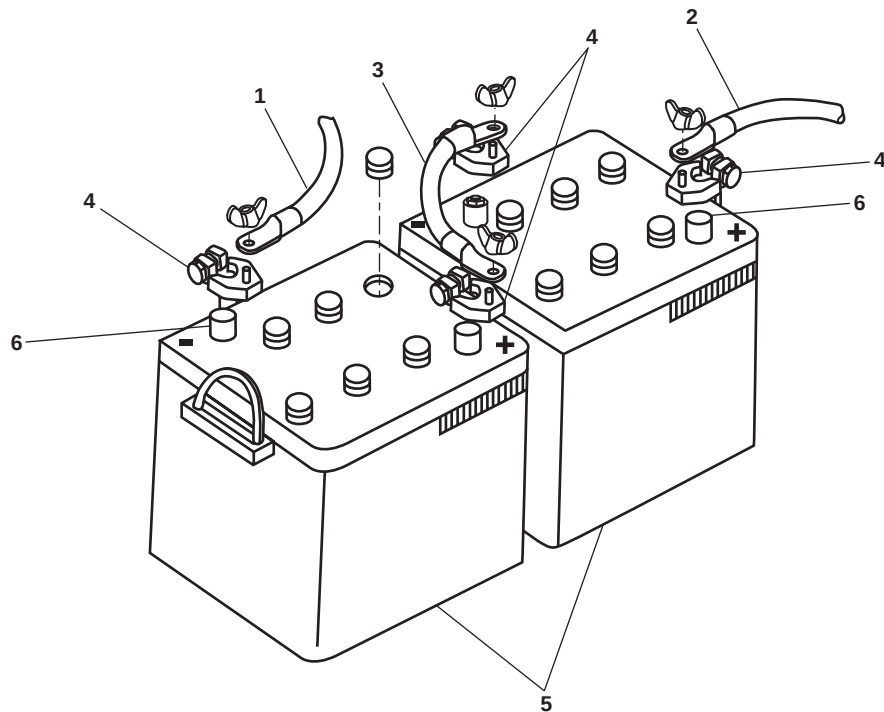
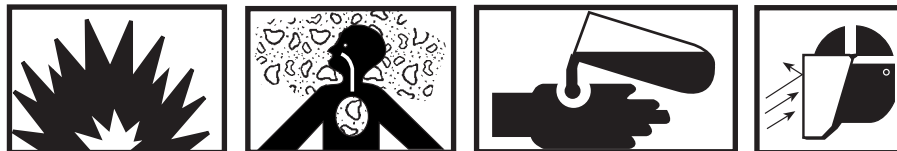


Figure 2. Battery, Power Supply System

INSTALLATION

WARNING



Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, faceshield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with skin or eyes, flush affected area with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in serious injury or death.

⚠ CAUTION

Ensure that there are no foreign objects, such as loose nuts, on the bottom of the battery box. The battery could be damaged if placed on foreign objects.

1. Place the new batteries (figure 2, item 5) into the battery compartment.

-
2. Install the battery post connectors (figure 2, item 4) on the battery posts (figure 2, item 6).
 3. Install the connector battery cable (figure 2, item 3) on the batteries (figure 2, item 5) using the labels from step 6 of Removal as a guide. Remove the labels.
 4. Install the positive battery cable (figure 2, item 2) on the batteries (figure 2, item 5) using the labels from step 5 of Removal as a guide. Remove the labels.
 5. Install the negative battery cable (figure 2, item 1) on the batteries (figure 2, item 5) using the labels from step 4 of Removal as a guide. Remove the labels.
 6. Install the wood spacer bar (figure 1, item 4).
 7. Install the battery hold down (figure 1, item 3) and secure it with the J-bolts (figure 1, item 2), washers, and nuts (figure 1, item 1).
 8. Remove the lockouts and tagouts (FM 55-502).
 9. Set to ON the applicable circuit breaker and test the battery charger and battery.
 10. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BATTERY BANK, GENERAL ALARM SYSTEM; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
Apron, Utility (Item 39, Table 2, WP 0295 00 Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
WP 0148 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

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.

BATTERY REPLACEMENT**WARNING**

Batteries produce hydrogen gas. This gas is explosive. Keep the work area free of sparks, open flame, and excessive heat. Take care to prevent conductive metal tools from arcing between the positive and negative terminals. Batteries are filled with a sulfuric acid-based electrolyte. This electrolyte is extremely corrosive to human tissue and to many other materials. Chemical protective nitrile gloves, chemical protective goggles, faceshield, and chemical protective apron must be worn at all times when the batteries are being serviced. If electrolyte comes in contact with clothing or other material, wash the affected area with large volumes of fresh water. If electrolyte comes in contact with skin or eyes, flush affected area with large volumes of water. Continue flushing the affected area until medical assistance arrives. Failure to comply can result in serious injury or death.

REMOVAL

1. Set to OFF the applicable battery charger circuit breaker. Lock out and tag out (FM 55-502).
2. Remove the hex nut and flat washer (figure 1, item 1) from the J-bolt (figure 1, item 2).
3. Remove the battery hold down (figure 1, item 3).
4. Remove the wood spacer (figure 1, item 4).

NOTE

A typical battery bank consists of two 12 Vdc (Volts direct current) batteries connected in series to produce 24 Vdc. Proper labeling when removing the battery leads will ensure that the battery is connected correctly during installation.

5. Label and remove the negative battery cable (figure 2, item 1) from the battery bank (figure 2, item 2).
6. Label and remove the positive battery cable (figure 2, item 3) from the battery bank (figure 2, item 2).

⚠ CAUTION

Do not apply any prying or twisting force to the battery posts. Doing so can cause the posts to break internally, permanently disabling the battery. If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the batteries.

7. Remove the battery post connectors (figure 2, item 5) from the battery bank (figure 2, item 2), taking care not to apply any prying or twisting force to the battery posts (figure 2, item 6). If the battery post connectors are difficult to remove from the battery posts, spread the battery post connectors to loosen them before attempting to remove them from the battery bank.
8. Label remove the connector battery cable (figure 2, item 4) from the battery bank (figure 2, item 2).

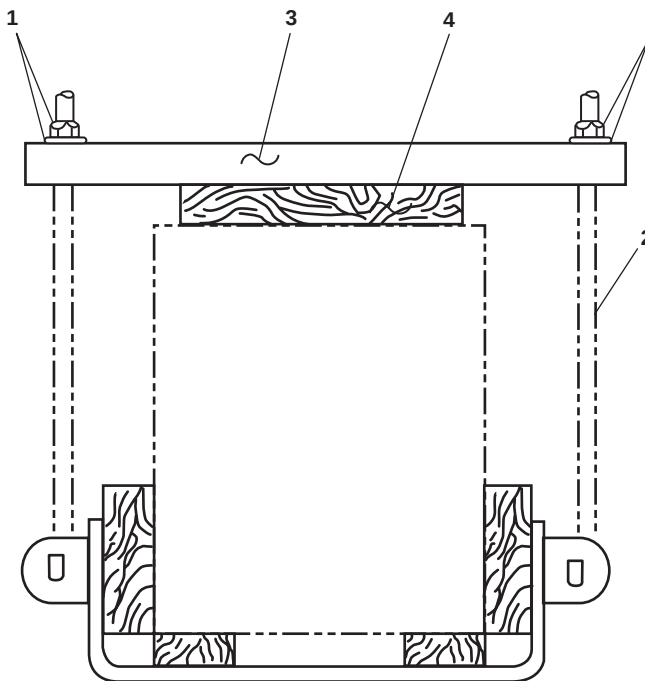


Figure 1. Battery Replacement

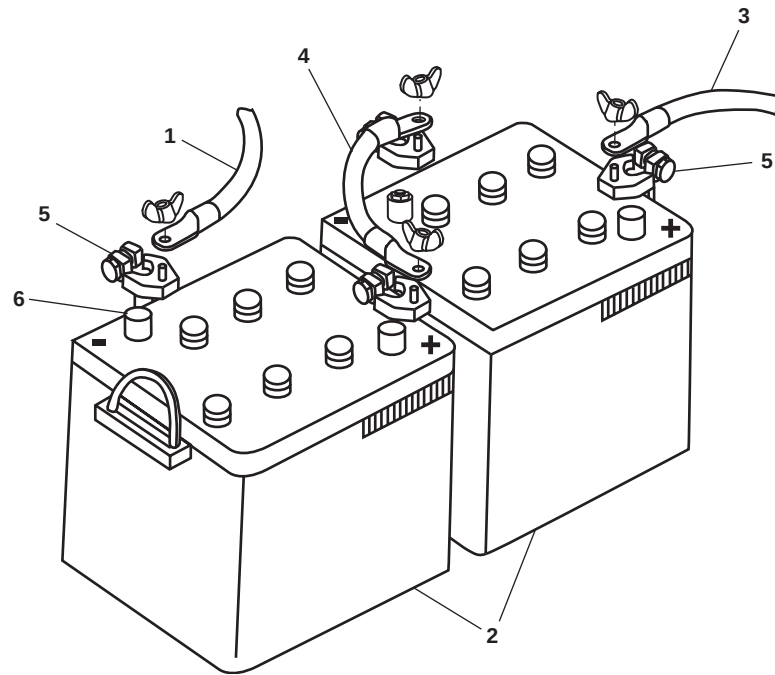


Figure 2. Battery Bank

INSTALLATION

1. Install the battery post connectors (figure 2, item 5) on the battery posts (figure 2, item 6).
2. Install the connector battery cable (figure 2, item 1) on the battery bank (figure 2, item 2) using the labels from step 6 of Removal as a guide. Remove the labels.
3. Install the positive battery cable (figure 2, item 3) to the battery bank (figure 2, item 2) using the labels from step 6 of Removal as a guide. Remove the labels.
4. Install the negative battery cable (figure 2, item 1) to the battery bank (figure 2, item 2) using the labels from step 6 of Removal as a guide. Remove the labels.
5. Install the wood spacer (figure 1, item 4).
6. Install the battery hold down (figure 1, item 3) and secure it with the J-bolts (figure 1, item 2), washers, and nuts (figure 1, item 1).
7. Remove the lockouts and tagouts (FM 55-502).
8. Set to ON the applicable battery charger circuit breaker.
9. Test the battery charger and battery (WP 0148 00).
10. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
ENTERTAINMENT SYSTEM, REPLACE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

WP 0295 00 (volume 2)
WP 0302 00 (volume 2)

Materials/Parts:

Cable (Item 1, Figure 76, WP 0302 00, Volume 2)
Television (Item 3, Figure 76, WP 0302 00, Volume 2)
VCR (Item 2, Figure 76, WP 0302 00, Volume 2)

Equipment Conditions:

Television and video cassette recorder set to OFF and unplugged.

Personnel Required:

Two Watercraft Operators, 88K

REMOVAL**WARNING**

Replace or repair components only after the affected circuit has been unplugged from the outlet. Performing replacement with the circuit energized may result in injury or death.

1. Disconnect the cable (figure 1, item 1) from the TV jack (figure 1, item 2) on the rear of the VCR (figure 1, item 3) and from the input jack (figure 1, item 4) on the rear of the television (figure 1, item 5).
2. Remove the VCR (figure 1, item 3).
3. Remove the television (figure 1, item 5).

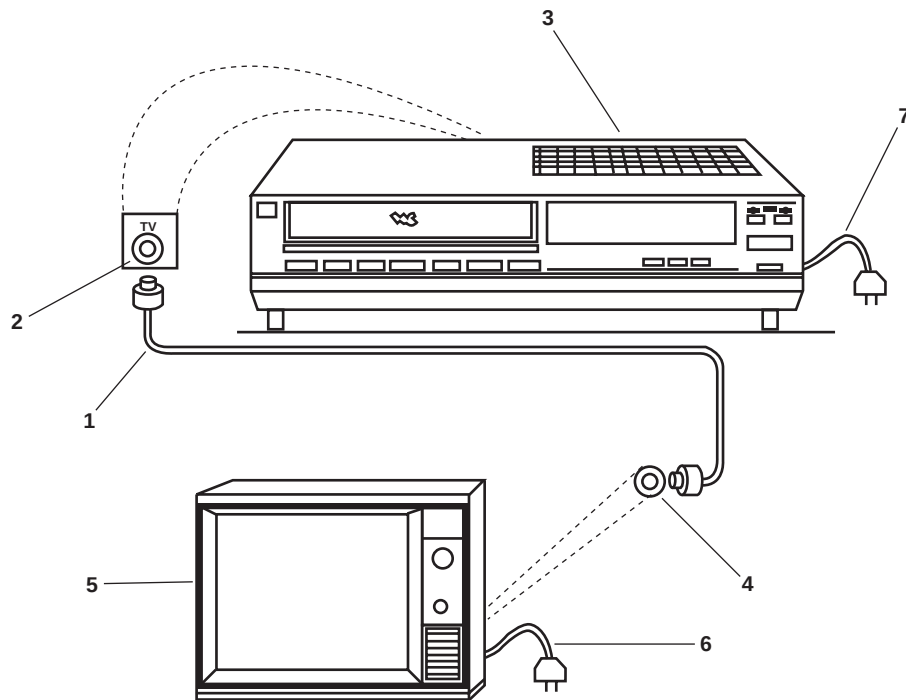


Figure 1. Entertainment System

INSTALLATION

1. Install the VCR (figure 1, item 3).
2. Install the television (figure 1, item 5).
3. Connect the cable (figure 1, item 1) into the input jack (figure 1, item 4) on the rear of the television (figure 1, item 5) and into the TV jack (figure 1, item 2) on the rear of the VCR (figure 1, item 3).
4. Install the television plug (figure 1, item 6) and the VCR plug (figure 1, item 7) into the wall outlet.
5. Perform a functional check by turning the television and VCR ON, checking for proper operation.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
ENTERTAINMENT SYSTEM, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

WP 0295 00 (volume 2)
WP 0302 00 (volume 2)

Materials/Parts:

Cable (Item 1, Figure 76, WP 0302 00, Volume 2)

Equipment Conditions:

Television and video cassette recorder set to OFF and unplugged.

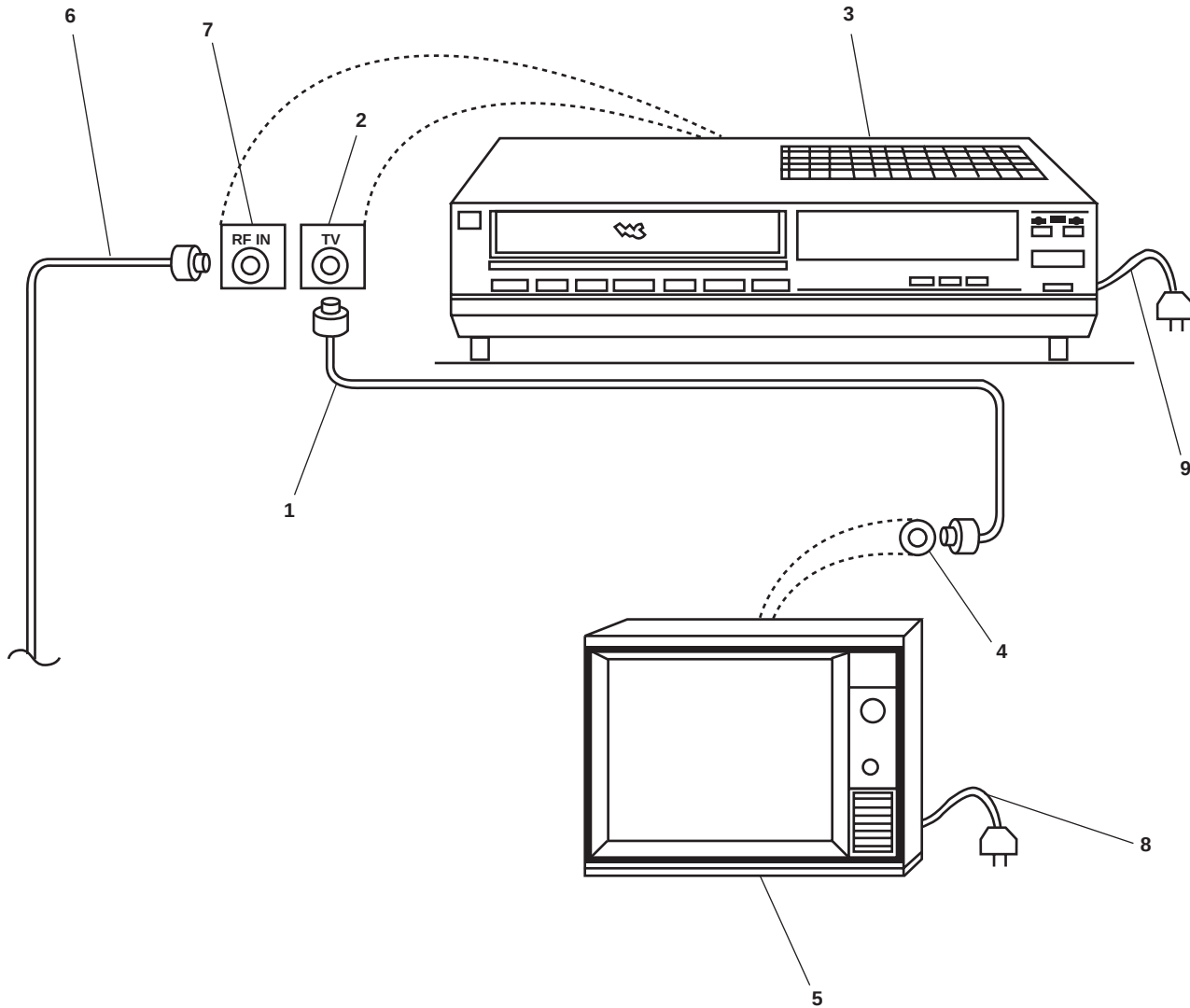
Personnel Required:

Two Watercraft Engineers, 88L

REMOVAL**WARNING**

Replace or repair components only after the affected circuit has been unplugged from the outlet. Performing replacement with the circuit energized may result in injury or death.

1. Disconnect the cable (figure 1, item 1) from the TV jack (figure 1, item 2) on the rear of the VCR (figure 1, item 3) and from the input jack (figure 1, item 4) on rear of the television (figure 1, item 5).
2. Remove the cable (figure 1, item 6) going to the RF IN jack (figure 1, item 7) on rear of the VCR (figure 1, item 3).
4. Remove the VCR (figure 1, item 3).
6. Remove the television (figure 1, item 5).



INSTALLATION

1. Install the television (figure 1, item 5).
2. Install the VCR (figure 1, item 3).
3. Connect the cable (figure 1, item 6) into the RF jack (figure 1, item 7) on the rear of the VCR.
4. Connect the cable (figure 1, item 1) to the input jack (figure 1, item 4) on rear of the television (figure 1, item 5) and to the television jack (figure 1, item 2) on the rear of the VCR (figure 1, item 3).
5. Install the television plug (figure 1, item 8) and the VCR plug (figure 1, item 9) into the wall outlet.
6. Perform a functional check by turning the television and VCR ON and checking for proper operation.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
SIGNAL HORN, REPLACE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TB 43-0218
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

At 120V elex distribution panel, set the FOG HORN.
circuit breaker to OFF. Lock out and tag out (FM 55-
502).

Personnel Required:

Two Watercraft Engineers, 88L

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.

HORN REPLACEMENT**REMOVAL**

1. Remove the housing top cover (figure 1, item 1) by removing the capscrews (figure 1, item 2), washers (figure 1, item 3), and nylock nuts (figure 1, item 4). Discard the nylock nuts.
2. Loosen the gland nut (figure 1, item 5), to relieve tension on the wiring (figure 1, item 6).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for the presence of voltage at the wiring (figure 1, item 6). If voltage is present, verify that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and remove the wiring (figure 1, item 6).
5. Remove the two bolts (figure 1, item 7), two lockwashers (figure 1, item 8), and two nuts (figure 1, item 9) that secure the horn assembly (figure 1, item 10). Discard the lockwashers.
6. Remove the horn assembly (figure 1, item 10) from its foundation.

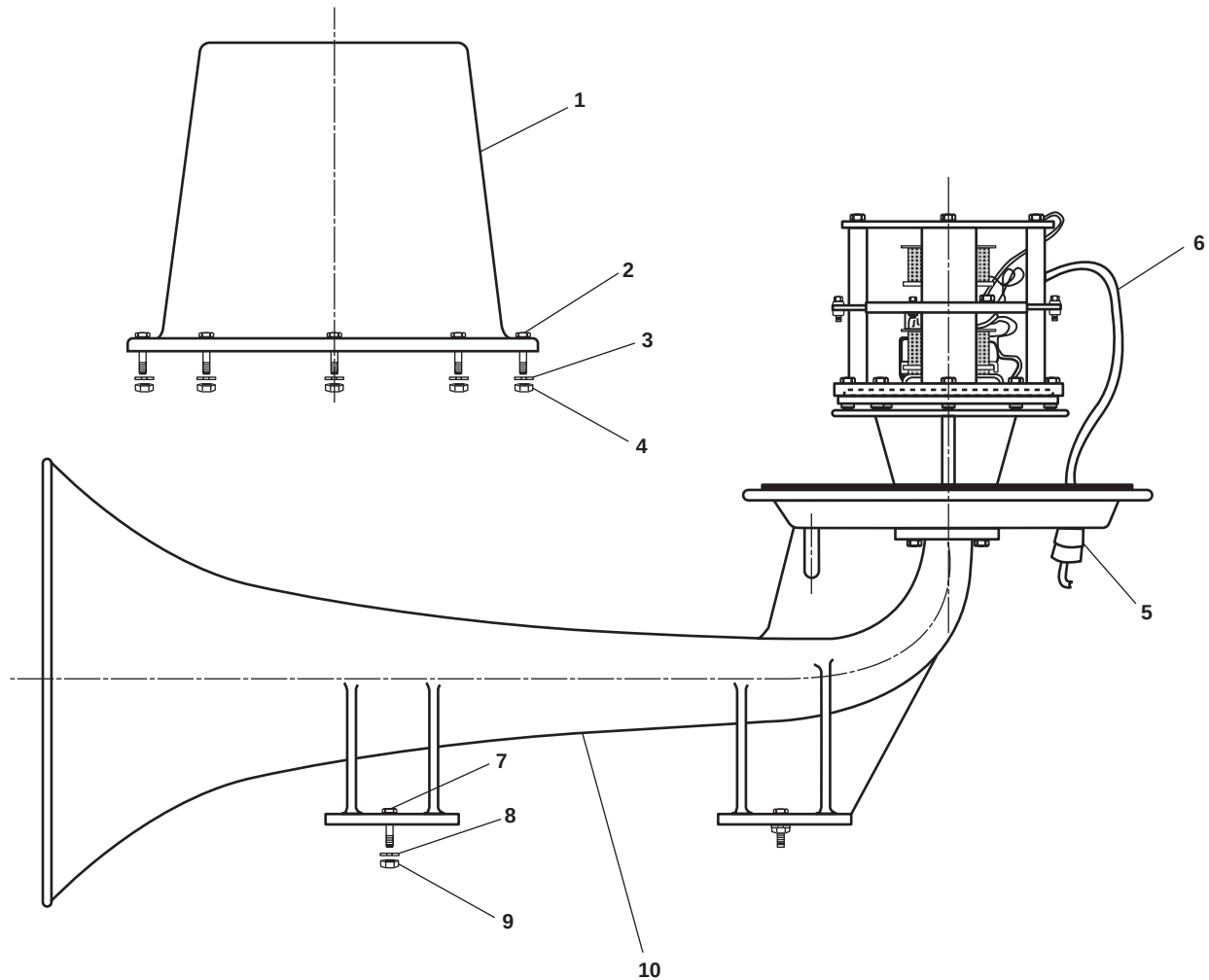


Figure 1. Signal Horn

INSTALLATION

1. Install the horn assembly (figure 1, item 10) and secure it with the two bolts (figure 1, item 7), two new lockwashers (figure 1, item 8), and two nuts (figure 1, item 9).
2. Connect the wiring (figure 1, item 6) using the labels from Removal step 4 as a guide. Remove the labels.
3. Install the housing top cover (figure 1, item 1) and secure it with the capscrews (figure 1, item 2), washers (figure 1, item 3), and new nylock nuts (figure 1, item 4).
4. Perform the Follow-On Service at the end of this work package.

POWER SUPPLY REPLACEMENT

REMOVAL

1. Remove the four bolts (figure 2, item 1) that secure the cover (figure 2, item 2) to the power supply. Remove the cover.

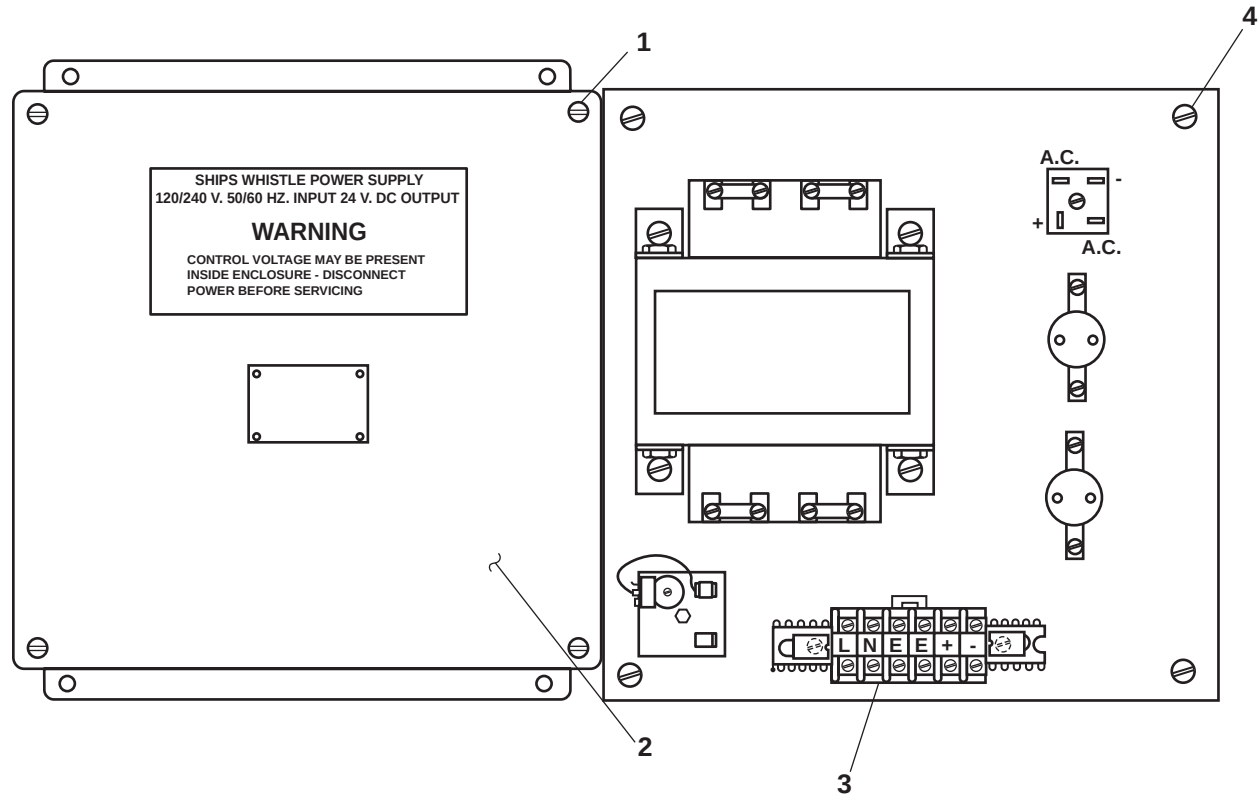


Figure 2. Signal Horn Power Supply

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for the presence of voltage at the terminal board (figure 2, item 3). If voltage is present, verify that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and remove the wiring from the terminal board (figure 2, item 3).
4. Remove the four screws (figure 2, item 4) and remove the power supply from the bulkhead.

INSTALLATION

1. Install the power supply on the bulkhead and secure it with the four screws (figure 2, item 4).
2. Install the wiring at the terminal board (figure 2, item 3) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Install the cover (figure 2, item 2) and secure it with the screws (figure 2, item 1).
4. Perform the Follow-On Service at the end of this work package.

OSCILLATOR REPLACEMENT

REMOVAL

1. Remove the four screws (figure 3, item 1) that secure the cover (figure 3, item 2) to the oscillator. Remove the cover.

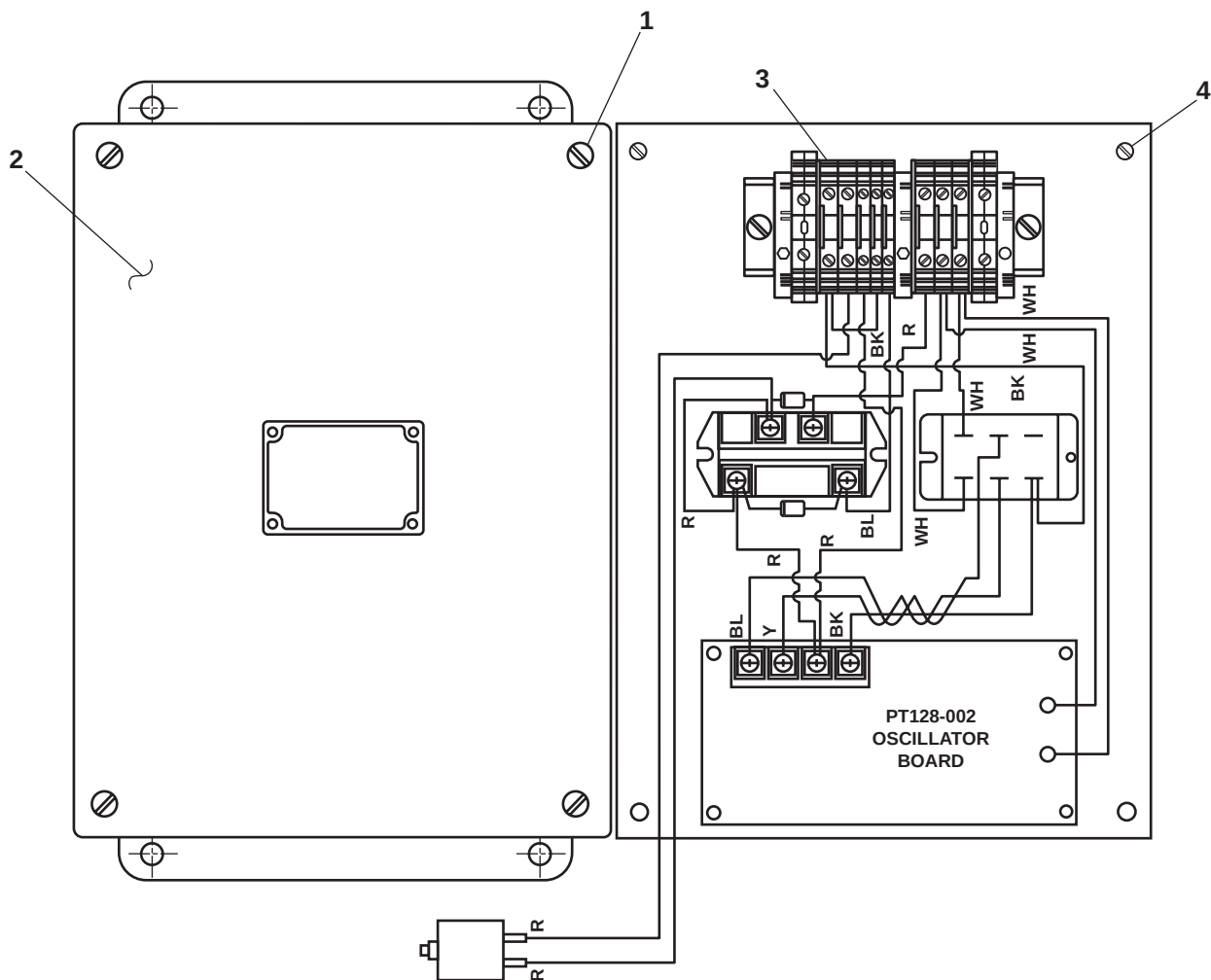


Figure 3. Oscillator

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for the presence of voltage at the terminal board (figure 3, item 3). If voltage is present, verify that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and remove the wiring from the terminal board (figure 3, item 3).
4. Remove the four screws (figure 3, item 4) and remove the oscillator.

INSTALLATION

1. Install the oscillator and secure it with the four screws (figure 3, item 4).
2. Install the wiring to the terminal board (figure 3, item 3) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Install the cover (figure 3, item 2) and secure it with the four screws (figure 3, item 1).
4. Perform the Follow-On Service at the end of this work package.

TIMER REPLACEMENT**REMOVAL**

1. Remove the four screws (figure 4, item 1) that secure the cover (figure 4, item 2) to the timer.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for the presence of voltage at the terminal board (figure 4, item 3). If voltage is present, verify that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the wiring from the terminal board (figure 4, item 3).
4. Remove the four screws (figure 4, item 4) and remove the timer from the bulkhead.

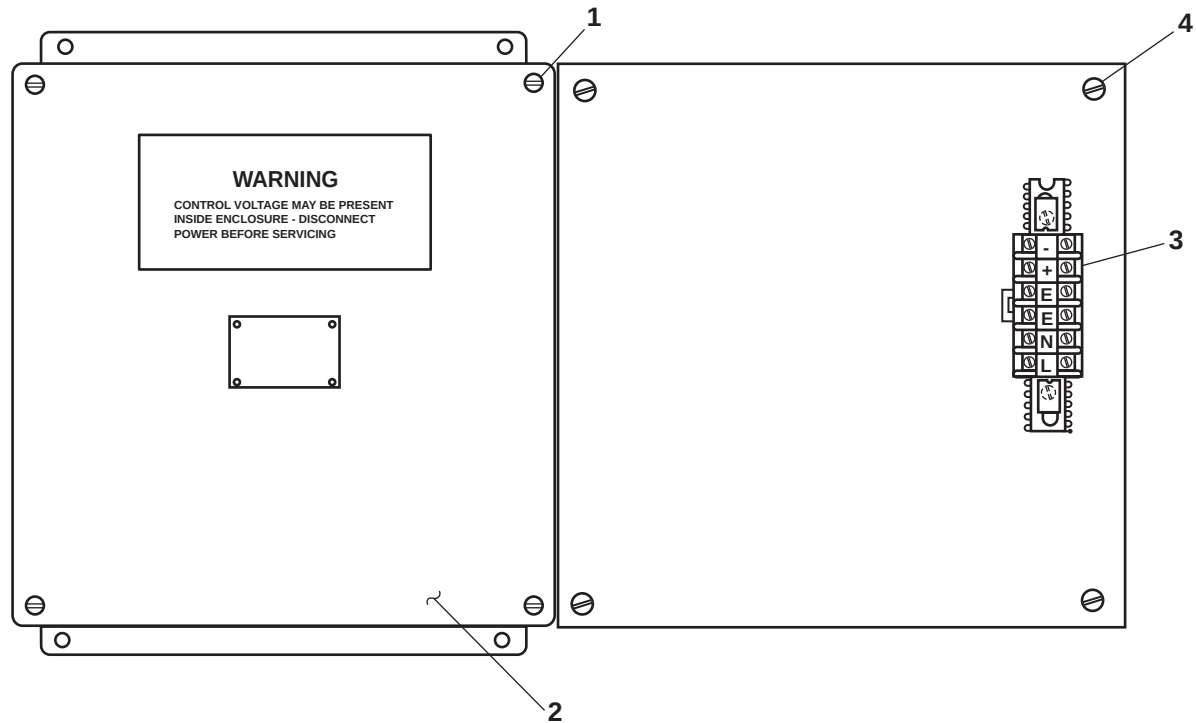


Figure 4. Timer

INSTALLATION

1. Install the timer on the bulkhead and secure it with the four screws (figure 4, item 4)
2. Install the wiring to the terminal board (figure 4, item 3) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Install the cover (figure 4, item 2) and secure it with the four screws (figure 4, item 1).
4. Perform the Follow-On Service at the end of this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Set the circuit breaker to ON.
3. Test operate the signal horn to check it for proper operation.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
TANK LEVEL INDICATORS, TEST

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0295 00 (volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

Equipment Conditions:

TLI system operating under usual conditions
(TM 55-1925-273-10).

1. Set the ON/OFF switch (figures 1 and 2, item 1) on the Tank Level Indicators (TLI) control panel in the EOS to OFF.
2. Verify that the fluid meters on the control panel (figures 1 and 2, item 2) and at the remote indicator panel (figure 3, item 1) deflects to zero.

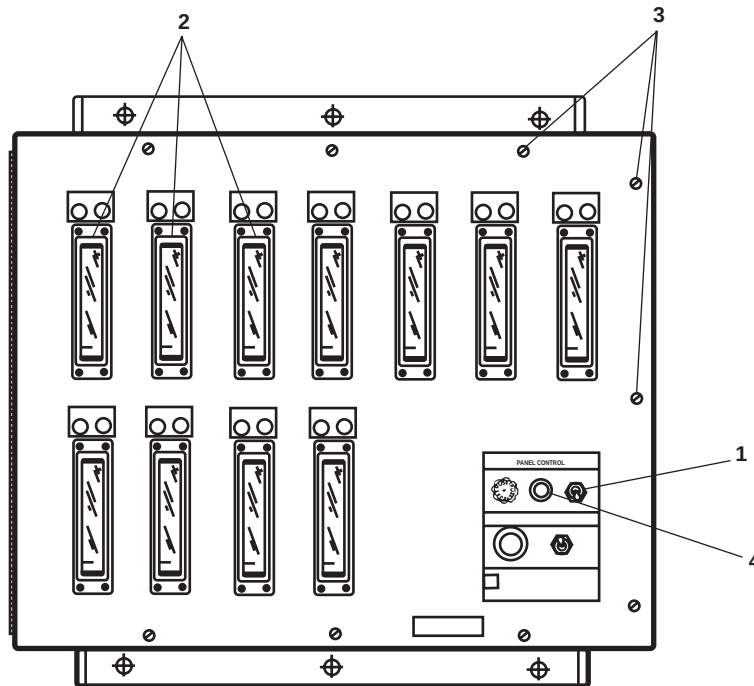


Figure 1. 11 Channel TLI Control Panel

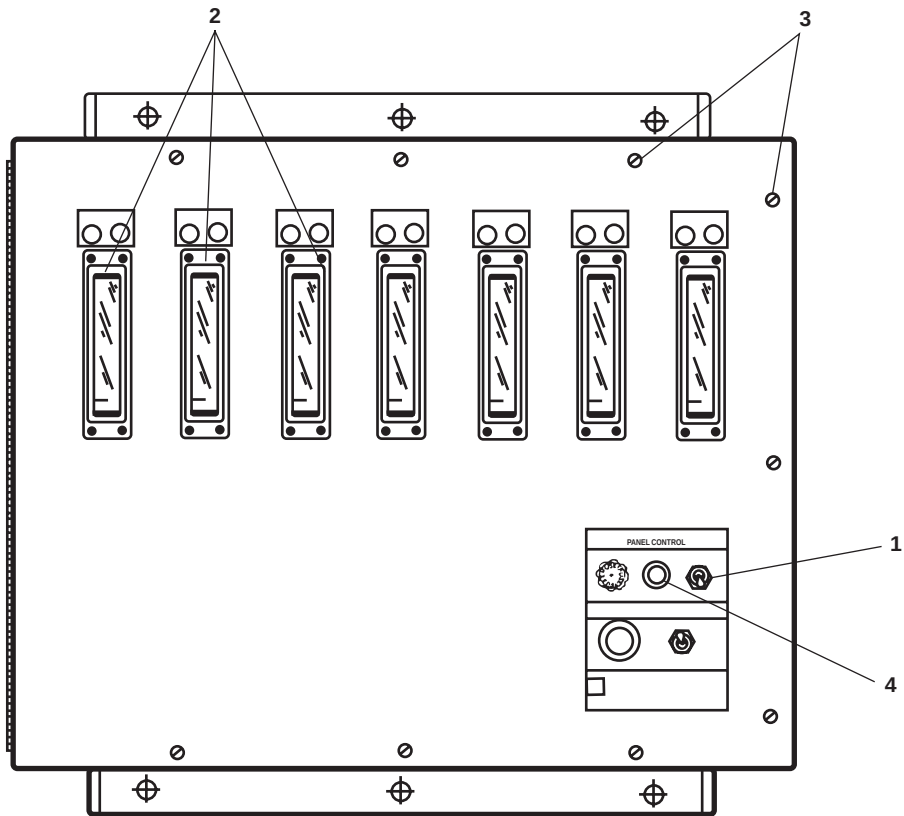


Figure 2. 7 Channel TLI Control Panel

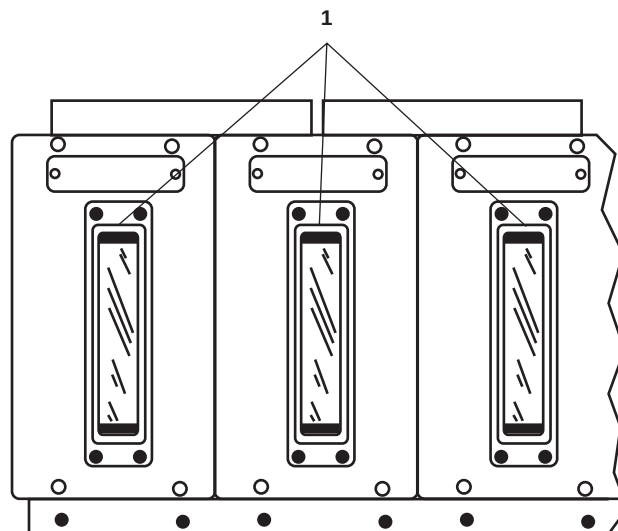


Figure 3. TLI Remote Indicator

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 can result in serious injury or death.

3. Loosen the captive screws (figure 1 or 2, item 3), and open the front panel of the TLI control panel.
4. Set the ON-OFF switch (figures 1 and 2, item 1) on the control panel to ON. Verify that the POWER lamp (figures 1 and 2, item 4) illuminates.
5. To test each level indicator circuit in turn, press and hold the CALIBRATE pushbutton switch (figure 4, item 1) on each control module in the TLI control panel one at a time.
6. While the CALIBRATE pushbutton switch (figure 4, item 1) is pressed, verify that the selected control panel fluid level meter (figures 1 and 2, item 2) and the associated remote indicator panel fluid level meter (figure 3, item 1) deflects to the full-scale position.

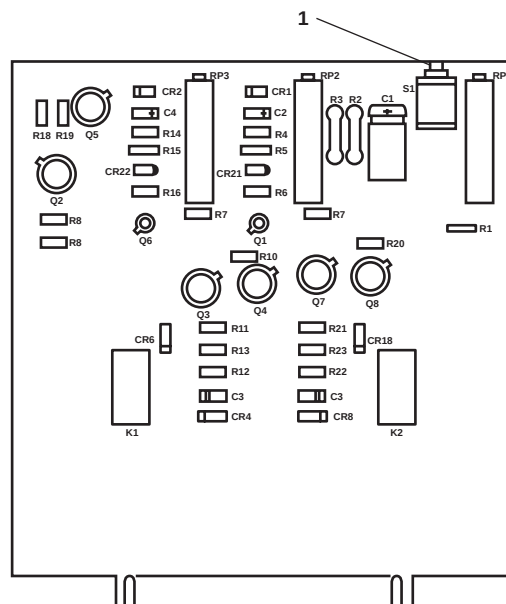


Figure 4. Control Module Circuit Card

7. If the fluid meters do not fully deflect, notify the maintenance supervisor.
8. Release the selected CALIBRATE pushbutton switch (figure 4, item 1).
9. At the TLI control panels, place the POWER ON/OFF switch (figure 1 or 2, item 1) to OFF.
10. Close the front panel and tighten the captive screws (figure 1 or 2, item 3) on the TLI control panel front cover.
11. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
TANK LEVEL INDICATORS, ADJUST

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0295 00 (volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

Equipment Conditions:

TLI system operating under usual conditions
(TM 55-1925-273-10).

SELF CALIBRATION

1. Set to OFF the ON/OFF switches (figures 1 and 2, item 1) on the Tank Level Indicator (TLI) control panels in the EOS, and verify that the POWER lamps (figures 1 and 2, item 2) are out.
2. Verify that all fluid meters on the control panels (figures 1 and 2, item 3) and remote indicator panels (figure 3, item 1) deflect to 0.

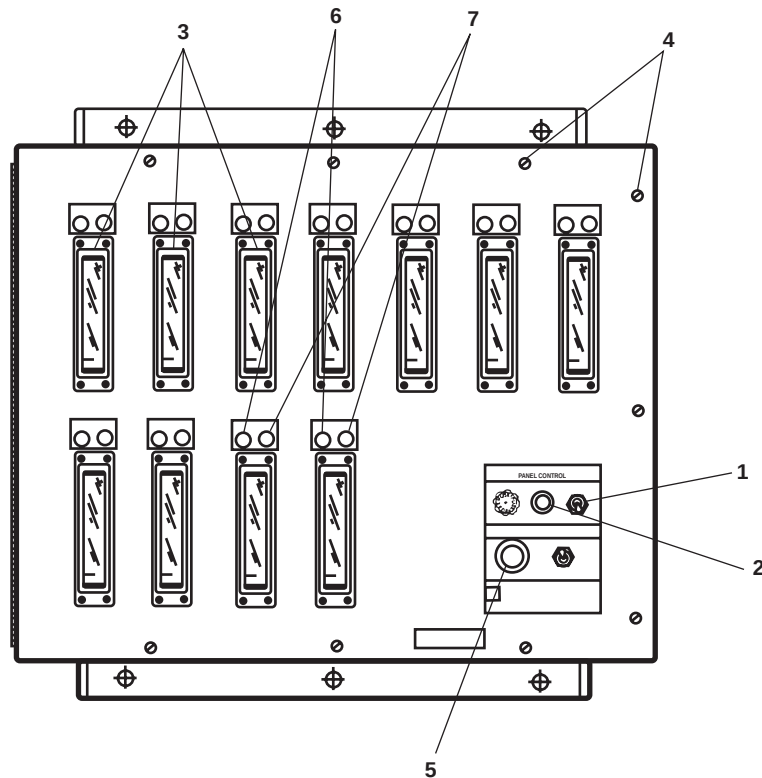


Figure 1. 11 Channel TLI Control Panel

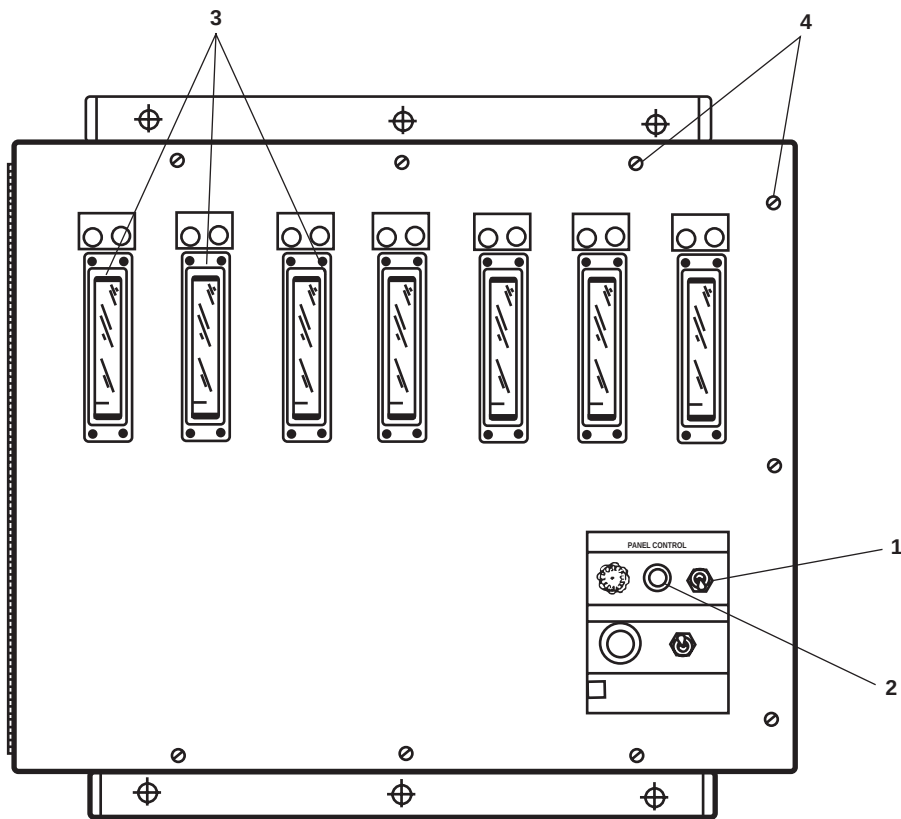


Figure 2. 7 Channel TLI Control Panel

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.

3. Loosen the captive screws (figure 1 or 2, item 4) and open the front panel of the TLI control panel.
4. Set to ON the ON-OFF switches (figures 1 and 2, item 1) on the control panel. Verify that the POWER lamp (figures 1 and 2, item 2) illuminates.

NOTE

Test only one fluid level indicator at a time.

5. To test each level indicator circuit in turn, press and hold the CALIBRATE pushbutton switch (figure 4, item 1) on each control module in the TLI.
6. While the CALIBRATE pushbutton switch (figure 4, item 1) is pressed, verify that the selected control panel fluid level meter (figures 1 and 2, item 3) and the associated remote indicator panel fluid level meter (figure 3, item 1) deflect to the full-scale position.

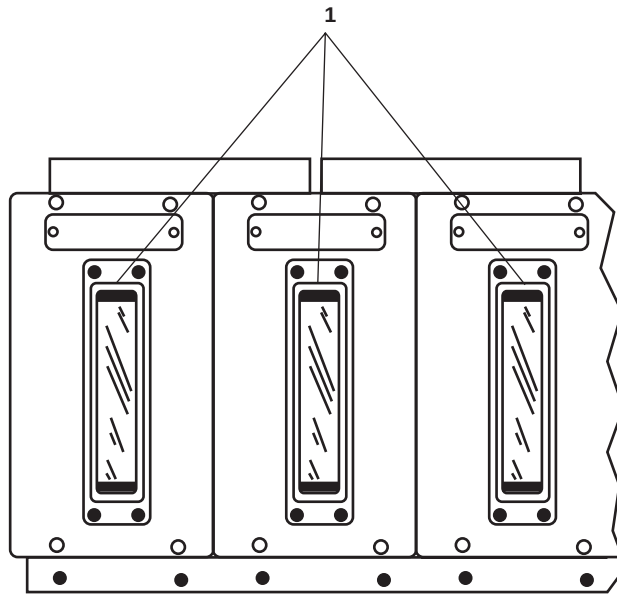


Figure 3. TLI Remote Indicator

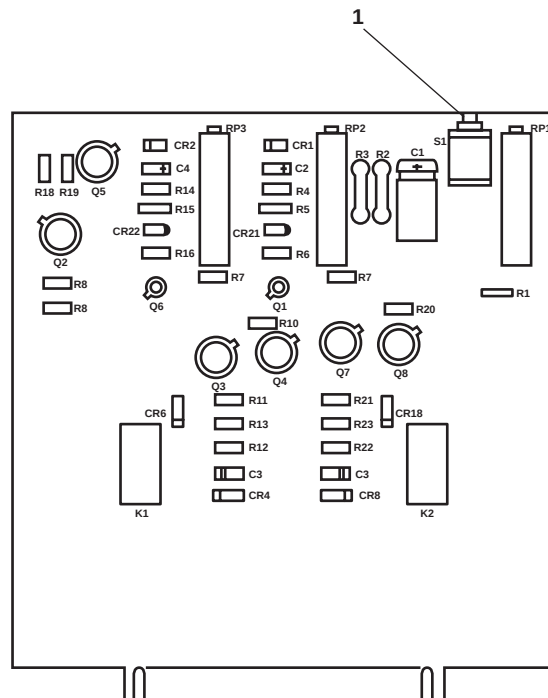


Figure 4. Control Module Circuit Card

NOTE

The port and starboard day tanks are the only tanks that contain functional high and low level alarm circuits on the TLI system.

7. If the control module containing the CALIBRATE pushbutton switch (figure 4, item 1) being pressed contains a high-alarm circuit, verify that the ALARM horn sounds (figure 1, item 5) and the associated HIGH ALARM lamp illuminates (figure 1, item 6) when the fluid level meter (figures 1, item 3) is at full defection.
8. Release the selected CALIBRATE pushbutton switch (figure 4, item 1).
9. At the TLI control panels, set to OFF the POWER ON/OFF switch (figure 1 or 2, item 1).
10. Close the front panel and tighten the captive screws (figure 1 or 2, item 4) on the TLI control panel front cover.
11. Return the TLI control panel to the desired readiness condition.

PERFORM FLOAT SIMULATOR TEST

1. Set to OFF the ON/OFF switches (figures 1 and 2, item 1) on the Tank Level Indicator (TLI) control panels in the EOS, and verify that the POWER lamps (figures 1 and 2, item 2) are out.
2. Verify that all fluid meters on the control panels (figures 1 and 2, item 3) and remote indicator panels (figure 3, item 1) deflect to 0.

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.

3. Loosen the captive screws (figure 1 or 2, item 4) and open the front panel of the TLI control panel.

NOTE

This test is designed to be performed on all fluid level indicators one at a time.

4. Label and remove the wiring from terminals 1, 2, and 3 (figure 5, item 1) of the selected TLI control module in the control panel.
5. Label and remove the float simulator cable from the FLOAT CONTROL INDICATOR simulator bracket (figure 5, item 2).
6. Connect the float simulator cable to the terminals (figure 5, item 1) associated with the selected control module as follows:
 - a. Red lead to terminal 1.
 - b. Black lead to terminal 2.
 - c. Green lead to terminal 3.

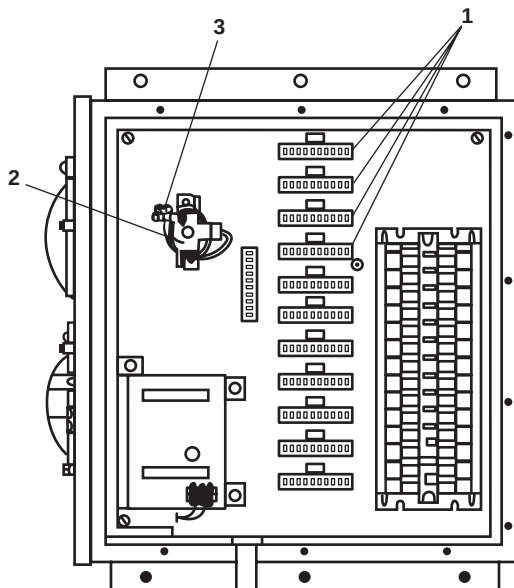


Figure 5. Float Simulator

7. Set to ON the ON-OFF switch (figures 1 and 2, item 1) on the control panel.
8. Observe fluid level meter deflection (figures 1 and 2, item 3) at the selected receiver module and verify that the deflection on the receiver module (figure 3, item 1) matches and follows the deflection on the control module.
9. Adjust the FLOAT SIMULATOR control (figure 5, item 3) to bring the deflection on the selected TLI control panel indicator (figures 1 and 2, item 3) to 25% of its rated capacity.

NOTE

The port and starboard day tanks are the only tanks that contain functional high and low level alarm circuits on the TLI system.

10. Verify that selected remote indicator panel indicator (figure 3, item 1) follows the control panel indicator (figures 1 and 2, item 3). For day tank meters, verify that the LOW ALARM lamp (figure 1, item 7) illuminates and the ALARM horn (figure 1, item 5) on the TLI control panel sounds.
11. Adjust the FLOAT SIMULATOR control (figure 5, item 3) to bring the deflection on the selected TLI control panel indicator (figures 1 and 2, item 3) to 50% of its rated capacity.
12. Verify that the selected remote indicator panel indicator (figure 3, item 1) follows the control panel indicator (figures 1 and 2, item 3). For day tank meters, verify that the LOW ALARM lamp (figure 1, item 7) goes out and the ALARM horn (figure 1, item 5) goes silent.
13. Adjust the FLOAT SIMULATOR control (figure 5, item 3) to bring the deflection on the selected TLI control panel indicator (figures 1 and 2, item 3) to 95% of its rated capacity. Verify that selected remote indicator panel indicator (figure 4, item 1) follows the control panel indicator.
14. For day tank meters, verify that the HIGH ALARM (figure 1, item 6) lamp illuminates steadily and the ALARM horn (figure 1, item 5) on the TLI control panel sounds.

-
15. Adjust the FLOAT SIMULATOR control (figure 5, item 3) to bring the deflection on the selected TLI control panel indicator (figures 1 and 2, item 3) to 50% of its rated capacity.
 16. Verify that selected remote indicator panel indicator (figure 4, item 1) follows the control panel indicator (figures 1 and 2, item 3). For day tank meters, verify that the HIGH ALARM (figure 1, item 6) lamp goes out and the ALARM horn (figure 1, item 5) goes silent.
 17. Set to OFF the ON-OFF switch (figures 1 and 2, item 1).
 18. Remove the float simulator cable from the control module terminals (figure 5, item 1).
 19. Connect the wiring to terminals 1, 2, and 3 (figure 5, item 1) using the labels from step 4 of Removal as a guide. Remove the labels.
 20. Connect the float simulator cable to the FLOAT CONTROL INDICATOR simulator bracket (figure 5, item 2) using the labels from step 5 of Removal as a guide. Remove the labels.
 21. Close the TLI control panel front cover and tighten the captive screws (figures 1 and 2, item 4).
 22. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
TANK LEVEL INDICATORS, CALIBRATE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)

References:

TM 55-1925-273-10
WP 0295 00 (volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

Equipment Conditions:

TLI system operating under usual conditions
(TM 55-1925-273-10).

1. Set to OFF the ON-OFF switch (figures 1 and 2, item 1) on the Tank Level Indicator (TLI) control panels in the EOS. Verify that the POWER lamp (figures 1 and 2, item 2) is out.
2. Verify that all fluid meters on the control panels (figure 1, item 3) and at the remote receiver modules (figure 3, item 1) deflect to 0.
3. Set to ON the ON-OFF switch (figures 1 and 2, item 1) on each control panel. Verify that the POWER lamp (figures 1 and 2, item 2) illuminates.

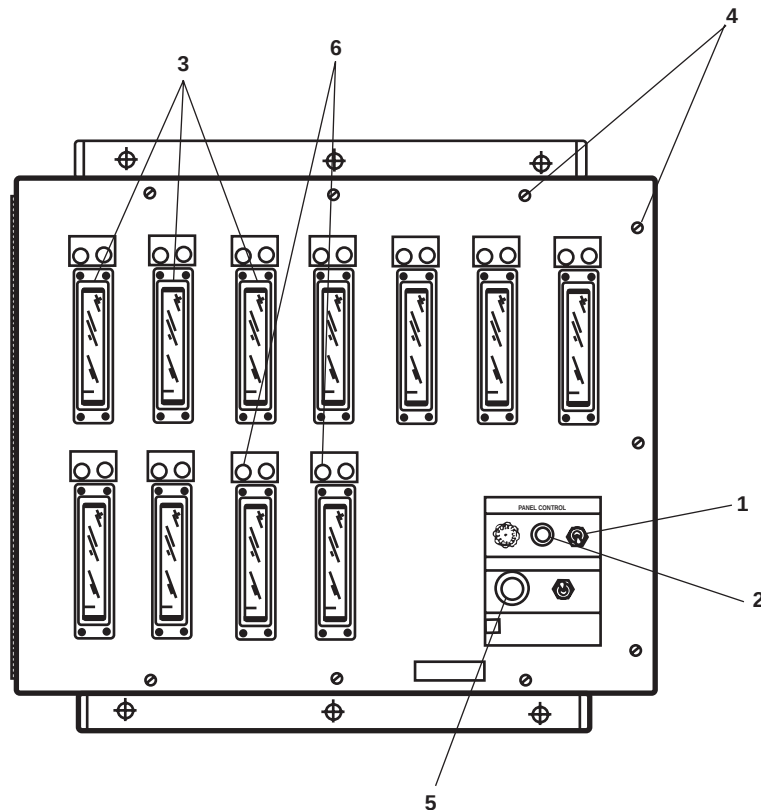


Figure 1. 11 Channel TLI Control Panel

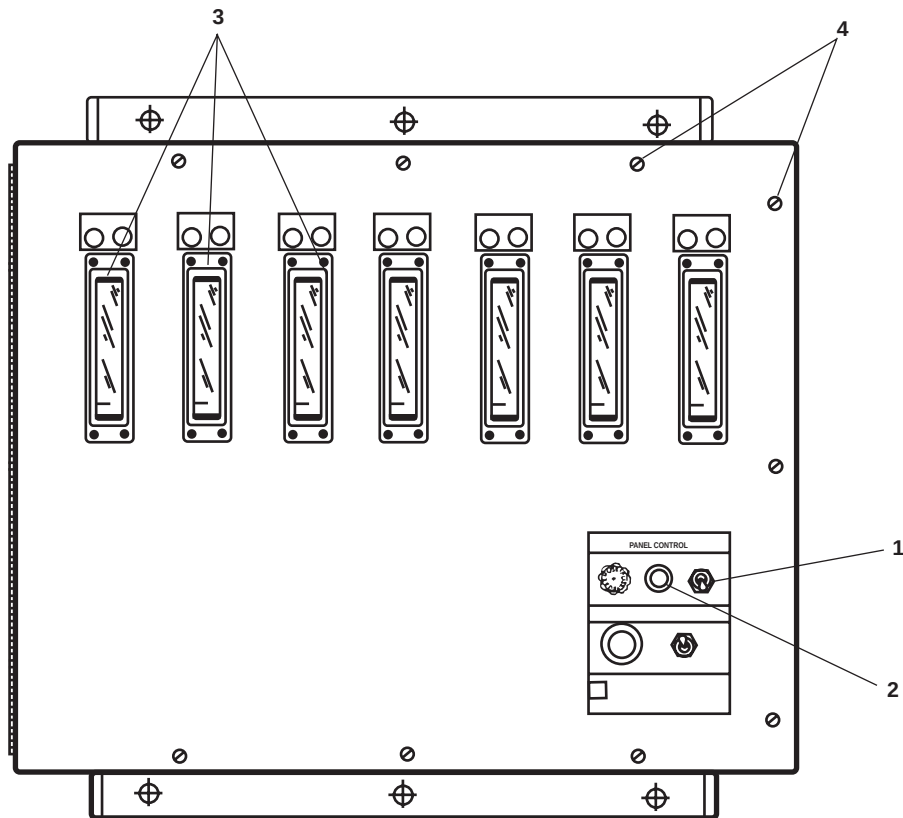


Figure 2. 7 Channel TLI Control Panel



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. Loosen the captive screws (figure 1 or 2, item 4) and open the front panel of the TLI control panel.
5. Locate, press, and hold the CALIBRATE pushbutton switch (figure 4, item 1) on each control module in the receiver panel, in turn.
6. While a CALIBRATE pushbutton switch (figure 4, item 1) is pressed, verify that the selected control panel fluid level meter (figures 1 and 2, item 3) and the associated remote fluid level meter (figure 3, item 1) deflect to the full-scale position.

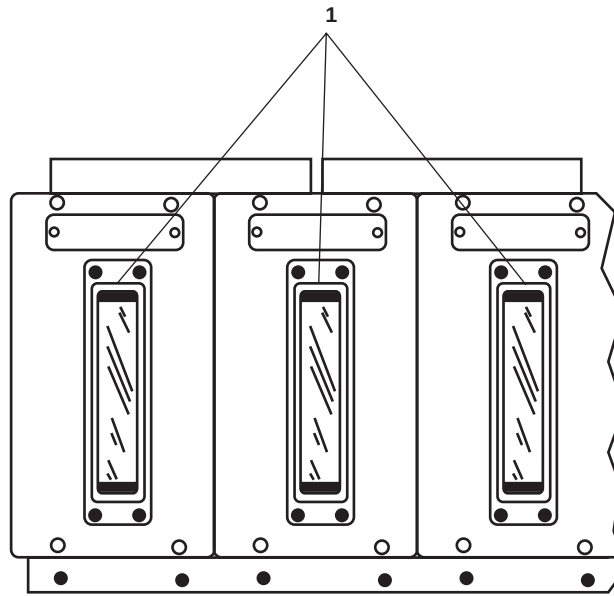


Figure 3. TLI Remote Receiver Module

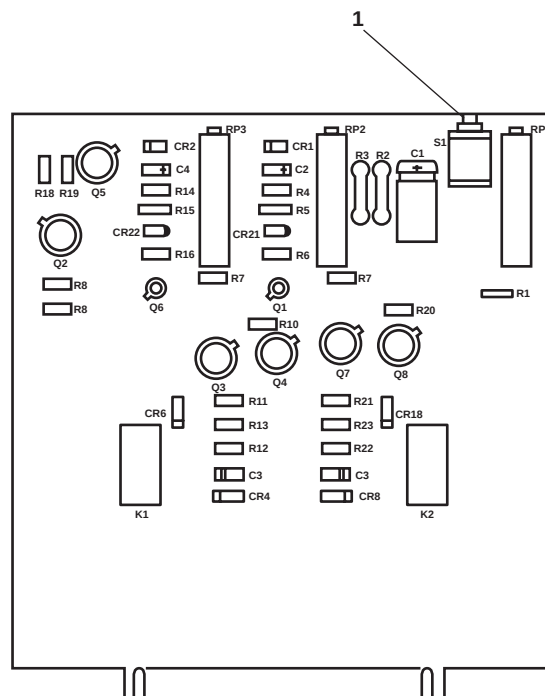


Figure 4. Control Module Circuit Card

NOTE

The port and starboard day tanks are the only tanks that contain functional high and low level alarm circuits on the TLI system.

7. If the control module containing the CALIBRATE pushbutton being pressed contains a high level alarm circuit, verify that the alarm horn (figure 1, item 5) sounds and the associated HIGH ALARM lamp (figure 1, item 6) illuminates when the CALIBRATE pushbutton switch (figure 4, item 1) is pressed.
8. Release the selected CALIBRATE pushbutton switch (figure 4, item 1).
9. Close the TLI control panel front cover and tighten the captive screws (figure 1 or 2, item 4).
10. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
TANK LEVEL INDICATORS, REPLACE**

INITIAL SETUP:**Personnel Required:**

Two Watercraft Engineers, 88L

Equipment Conditions:TLI system operating under usual conditions
(TM 55-1925-273-10).**References:**

TM 55-1925-273-10

POWER INDICATOR BULB REPLACEMENT**REMOVAL**

1. Remove the protective lens cover (figure 1, item 1).
2. Remove the bulb (figure 1, item 2).

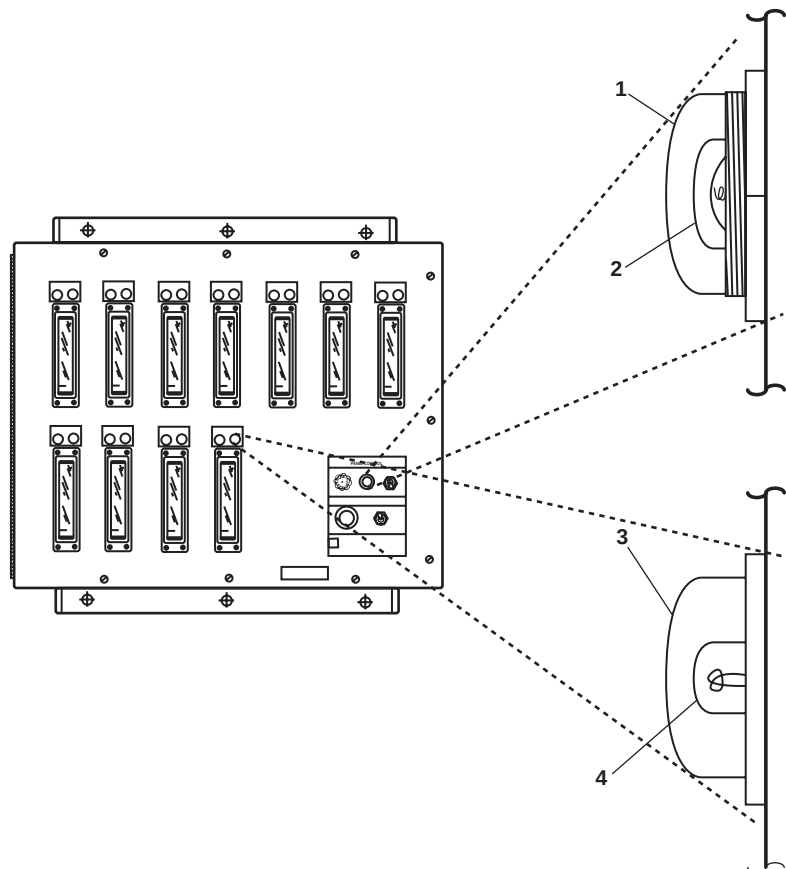


Figure 1. Tank Level Indicator Panel

INSTALLATION

1. Install the bulb (figure 1, item 2) finger tight.
2. Install the protective lens cover (figure 1, item 1) finger tight.

LOW ALARM AND HIGH ALARM INDICATOR BULBS REPLACEMENT**REMOVAL**

1. Remove the protective lens cover (figure 1, item 3).
2. Remove the bulb (figure 1, item 4).

INSTALLATION

1. Install the bulb (figure 1, item 4) finger tight.
2. Install the protective lens cover (figure 1, item 3) finger tight.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
TANK LEVEL INDICATORS AND DAY TANK HIGH LEVEL ALARM PANEL, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Tool Kit, Electrician's (Item 11, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

TLI POWER INDICATOR LAMP ASSEMBLY REPLACEMENT**REMOVAL**

1. Set to OFF the TLI SYSTEM. circuit breaker (figure 1, item 1) at 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502).

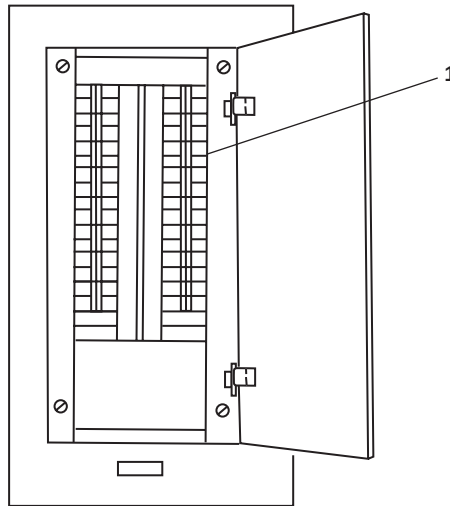


Figure 1. 120V Emergency Distribution Panel No. 1

2. Remove the protective lens cover (figure 2, item 1).
3. Remove the bulb (figure 2, item 2).
4. Loosen the nine captive screws (figure 2, item 3) and open the Tank Level Indicator (TLI) control panel (figure 2, item 4).

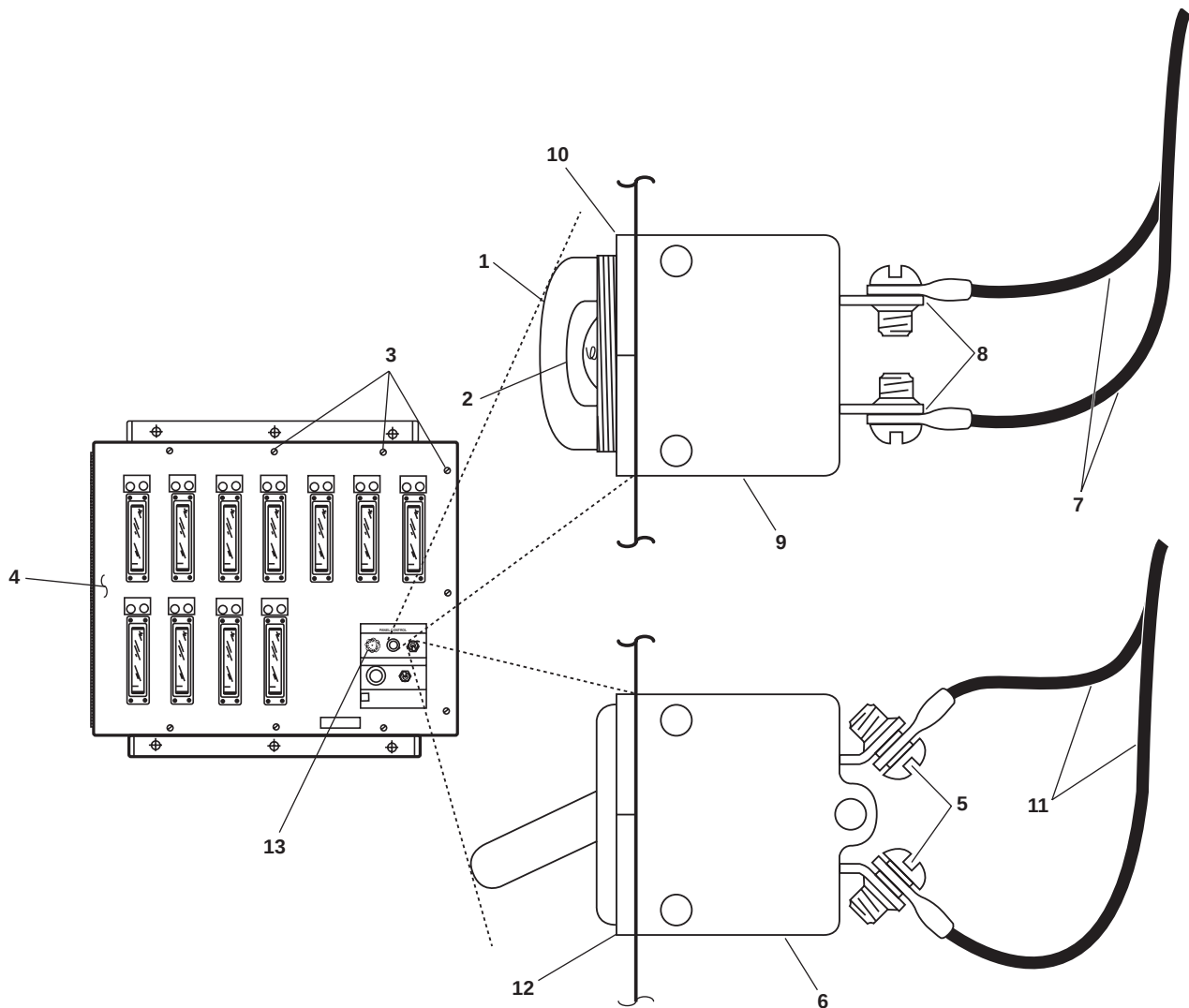


Figure 2. TLI Control Panel and Components

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

5. Use a multimeter to check for voltage at the terminals (figure 2, item 5) of the switch assembly (figure 2, item 6). If voltage is present, ensure that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

6. Label and remove the wires (figure 2, item 7) from the terminals (figure 2, item 8) of the lamp assembly (figure 2, item 9).
7. Remove the retaining nut (figure 2, item 10) and remove the lamp assembly (figure 2, item 9) from the TLI control panel (figure 2, item 4).

INSTALLATION

1. Install the lamp assembly (figure 2, item 9) in the TLI control panel (figure 2, item 4) and secure it with the retaining nut (figure 2, item 10).
2. Install the wires (figure 2, item 7) to the terminals (figure 2, item 8) of the lamp assembly (figure 2, item 9) using the labels from step 6 of Removal as a guide. Remove the labels.
3. Close the TLI control panel (figure 2, item 4) and secure it with the nine captive screws (figure 2, item 3).
4. Install the bulb (figure 2, item 2) finger tight.
5. Install the protective lens cover (figure 2, item 1) finger tight.
6. Remove the lockouts and tagouts (FM 55-502).
7. Set the circuit breaker to ON.
8. Operate the TLI system under usual conditions (TM 55-1925-273-10) and check for proper operation.
9. Return the equipment to the desired readiness condition.

TLI CONTROL PANEL SWITCH REPLACEMENT

REMOVAL

1. Set to OFF the TLI SYSTEM. circuit breaker (figure 1, item 1) at 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502).
2. Loosen the nine captive screws (figure 2, item 3) and open the TLI control panel (figure 2, item 4).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the terminals (figure 2, item 5) of the switch assembly (figure 2, item 6). If voltage is present, ensure that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and remove the wires (figure 2, item 11) from the terminals (figure 2, item 5) of the switch assembly (figure 2, item 6).
5. Remove the retaining nut (figure 2, item 12), and remove the switch assembly (figure 2, item 6) from the TLI control panel (figure 2, item 4).

INSTALLATION

1. Install the switch assembly (figure 2, item 6) in the TLI control panel (figure 2, item 4) and secure it with the retaining nut (figure 2, item 12).
2. Install the wires (figure 2, item 11) to the terminals (figure 2, item 5) of the switch assembly (figure 2, item 6) using the labels from step 4 of Removal as a guide. Remove the labels.
3. Close the TLI control panel (figure 2, item 4) and secure it with the nine captive screws (figure 2, item 3).
4. Remove the lockouts and tagouts (FM 55-502).
5. Set the circuit breaker to ON.
6. Operate the TLI system under usual conditions (TM 55-1925-273-10) and check for proper operation.
7. Return the equipment to the desired readiness condition.

TLI CONTROL PANEL FUSE REPLACEMENT

REMOVAL

1. Set to OFF the TLI SYSTEM. circuit breaker (figure 1, item 1) at 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502).
2. Remove the fuse holder (figure 2, item 13) from the TLI control panel (figure 2, item 4).
3. Remove the fuse (figure 3, item 1) from the fuse holder (figure 3, item 2).

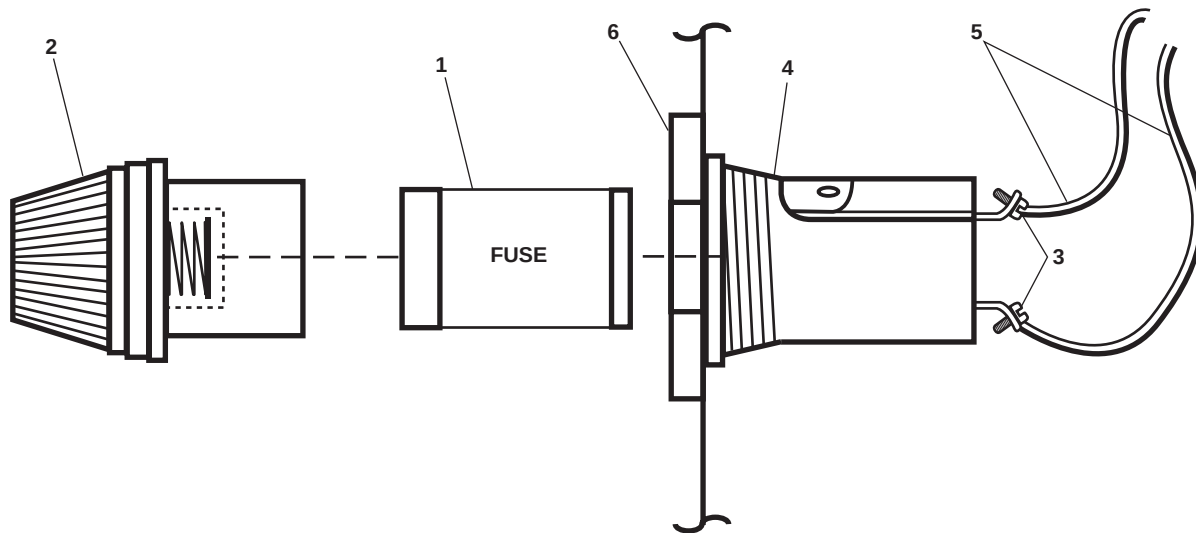


Figure 3. Control Panel Fuse Holder Assembly

INSTALLATION

1. Install the fuse (figure 3, item 1) in the fuse holder (figure 3, item 2).
2. Install the fuse holder (figure 2, item 13) with the new fuse (figure 3, item 1) in the TLI control panel (figure 2, item 4) finger tight.

3. Remove the lockouts and tagouts (FM 55-502).
4. Set the circuit breaker to ON.
5. Operate the TLI system under usual conditions (TM 55-1925-273-10) and check for proper operation.
6. Return the equipment to the desired readiness condition.

TLI CONTROL PANEL FUSE HOLDER ASSEMBLY REPLACEMENT

REMOVAL

1. Set to OFF the TLI SYSTEM. circuit breaker (figure 1, item 1) at 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502).
2. Perform the TLI Control Panel Fuse Replacement Removal procedure in this work package.
3. Loosen the nine captive screws (figure 2, item 3) and open the control panel (figure 2, item 4).



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

4. Use a multimeter to check for voltage at the terminals (figure 3, item 3) of the fuse holder assembly (figure 3, item 4). If voltage is present, ensure that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Label and remove the wires (figure 3, item 5) from the terminals (figure 3, item 3) of the fuse holder assembly (figure 3, item 4).
6. Remove the retaining nut (figure 3, item 6), and remove the fuse holder assembly (figure 3, item 4) from the TLI control panel (figure 2, item 4).

INSTALLATION

1. Install the fuse holder assembly (figure 3, item 4) in the TLI control panel (figure 2, item 4) and secure it with the retaining nut (figure 3, item 6).
2. Install the wires (figure 3, item 5) to the fuse holder assembly (figure 3, item 4) using the labels from step 5 of Removal as a guide. Remove the labels.
3. Close the TLI control panel (figure 2, item 4) and secure it with the nine captive screws (figure 2, item 3).
4. Perform the TLI Control Panel Fuse Replacement Installation procedure in this work package.

DAY TANK HIGH LEVEL ALARM INDICATOR BULB REPLACEMENT

REMOVAL

1. Set to OFF the FUEL OIL DAY TANKS (P&S) HIGH LEVEL ALARM circuit breaker (figure 4, item 1) at the machinery DC control distribution panel. Lock out and tag out (FM 55-502).
2. Remove the protective lens cover (figure 5, item 1).
3. Remove the bulb (figure 5, item 2).

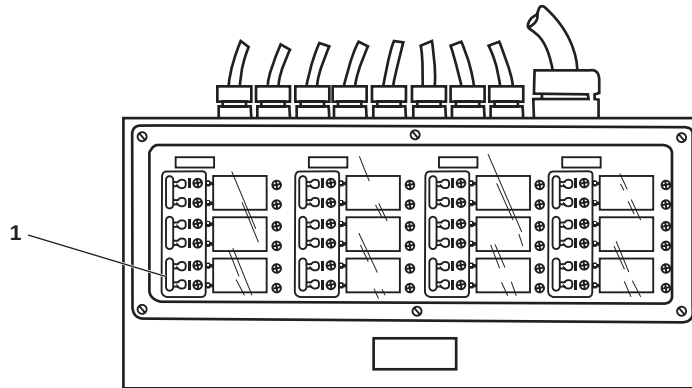


Figure 4. Machinery DC Control Distribution Panel

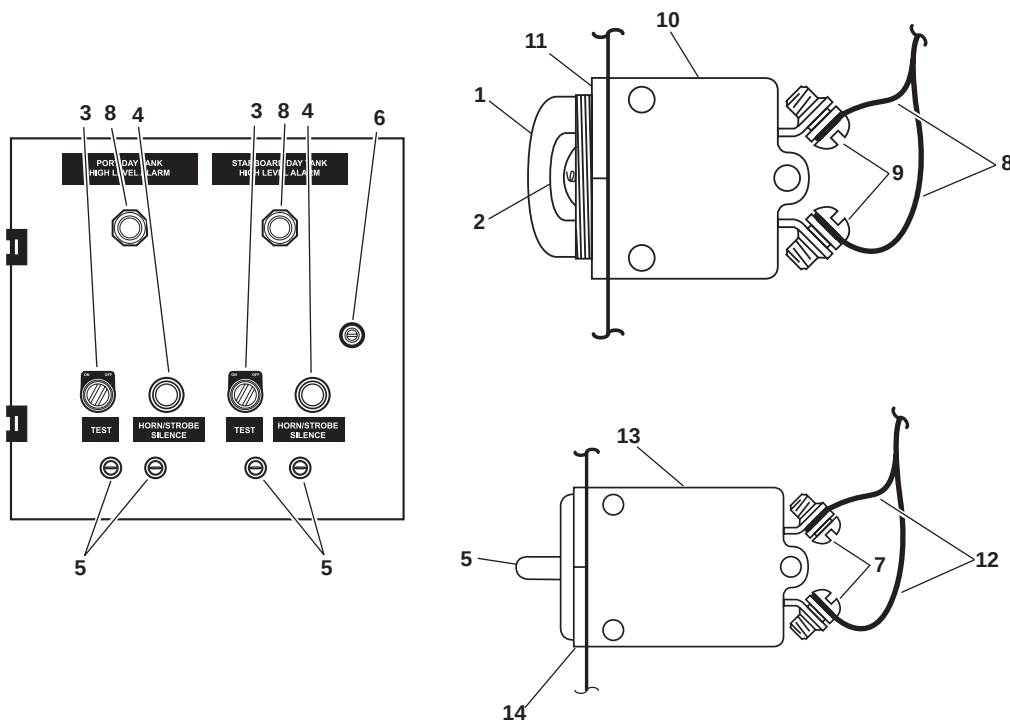


Figure 5. Day Tank High Level Alarm Panel

INSTALLATION

1. Install the bulb (figure 5, item 2) finger tight.
2. Install the protective lens cover (figure 5, item 1) finger tight.
3. Remove the lockouts and tagouts (FM 55-502).
4. Set the circuit breaker to ON.
5. Operate the day tank high level alarm under usual conditions (TM 55-1925-273-10).
6. Cycle the TEST switch (figure 5, item 3) from OFF to ON and back to OFF to test the alarm circuit function.
7. Press and release the HORN/STROBE SILENCE switch (figure 5, item 4) to silence the alarm.
8. Verify that the replaced bulb illuminates correctly.
9. Return the equipment to the desired readiness condition.

DAY TANK HIGH LEVEL ALARM FUSE REPLACEMENT**REMOVAL**

1. Set to OFF the FUEL OIL DAY TANKS (P&S) HIGH LEVEL ALARM circuit breaker (figure 4, item 1) at the machinery DC control distribution panel. Lock out and tag out (FM 55-502).
2. Remove the fuse holder (figure 5, item 5) from the panel.
3. Remove the fuse from the fuse holder (figure 5, item 5).

INSTALLATION

1. Install the fuse in the fuse holder (figure 5, item 5).
2. Install the fuse holder (figure 5, item 5) in the panel finger tight.
3. Remove the lockouts and tagouts (FM 55-502).
4. Set the circuit breaker to ON.
5. Operate the day tank high level alarm under usual conditions (TM 55-1925-273-10).
6. Cycle the TEST switch (figure 5, item 3) from OFF to ON and back to OFF to test the alarm circuit function.
7. Press and release the HORN/STROBE SILENCE switch (figure 5, item 4) to silence the alarm.
8. Return the equipment to the desired readiness condition.

DAY TANK HIGH LEVEL ALARM LAMP ASSEMBLY REPLACEMENT**REMOVAL**

1. Perform the Day Tank High Level Alarm Indicator Bulb Replacement Removal procedure in this work package.
2. Loosen the captive screw (figure 5, item 6) and open the alarm panel.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the terminals (figure 5, item 7) on the back of the fuse holders (figure 5, item 5). If voltage is present, ensure that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and remove the wires (figure 5, item 8) from the terminals (figure 5, item 9) of the lamp assembly (figure 5, item 10).
5. Remove the retaining nut (figure 5, item 11), and remove the lamp assembly (figure 5, item 10) from the alarm panel.

INSTALLATION

1. Install the lamp assembly (figure 5, item 10) in the alarm panel and secure it with the retaining nut (figure 5, item 11).
2. Install the wires (figure 5, item 8) to the lamp assembly (figure 5, item 11) using the labels from step 4 of Removal as a guide. Remove the labels.
3. Close the alarm panel and tighten the captive screw (figure 5, item 6).
4. Perform the Day Tank High Level Alarm Indicator Bulb Replacement Installation procedure in this work package.

DAY TANK HIGH LEVEL ALARM FUSE HOLDER REPLACEMENT**REMOVAL**

1. Perform the Day Tank High level Alarm Fuse Holder Replacement Removal procedure in this work package.
2. Loosen the captive screw (figure 5, item 6) and open the panel.

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Use a multimeter to check for voltage at the terminals (figure 5, item 7) on the back of the fuse holders (figure 5, item 5). If voltage is present, ensure that the correct circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

-
4. Label and remove the wires (figure 5, item 12) from the terminals (figure 5, item 7) of the fuse holder assembly (figure 5, item 13).
 5. Remove the retaining nut (figure 5, item 14) and remove the fuse holder assembly (figure 5, item 13) from the alarm panel.

INSTALLATION

1. Install the fuse holder assembly (figure 5, item 13) in the alarm panel and secure it with the retaining nut (figure 5, item 14).
2. Install the wires (figure 5, item 12) to the fuse holder assembly (figure 5, item 13) using the labels from step 4 of Removal as a guide. Remove the labels.
3. Close the alarm panel and secure it with the captive screw (figure 5, item 6).
4. Perform the Day Tank High level Alarm Fuse Holder Replacement Installation procedure in this work package.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
SEWAGE COLLECTION, HOLDING, AND TRANSFER (CHT) SYSTEM VALVES; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 1, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protective (Item 36, Table 1, WP 0295 00, Volume 2)
 Suitable Drain Pan

Materials/Parts:

Rag, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
 Tags, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
 Valve, Scupper, Gag (Item 11, Figure 81, WP 0304 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

FM 55-502
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0304 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the MSD DISCHARGE PUMP AND BLOWER circuit breaker at 440V power panel No. 4. Lock out and tag out (FM 55-502).
 Set to OFF the SEWAGE DISCHARGE PUMP No. 1. circuit breaker and the SEWAGE DISCHARGE PUMP No. 2. circuit breaker at 440V power panel No. 1. Lock out and tag out (FM 55-502).
 CLOSE all valves upstream and downstream of the affected valve. Lock out and tag out (FM 55-502).
 Ventilation fans operating under usual conditions (TM 55-1925-273-10).

SCUPPER GAG VALVE REPLACEMENT**REMOVAL**

1. Partially OPEN the valve (figure 1, item 1) to equalize any internal pressure before removing any bolts.
2. Place a suitable drain pan under the valve (figure 1, item 1).

WARNING

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source. Avoid open flames and prolonged breathing of fumes. Failure to comply with this warning could cause serious illness or death.

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

3. Slowly loosen the bolts (figure 1, item 2) and nuts (figure 1, item 3) on the inlet side of the valve (figure 1, item 1). Allow pressure to vent and any liquid to drain into the suitable drain pan.

4. Remove the bolts (figure 1, item 2) and nuts (figure 1, item 3) from the inlet side of the valve.
5. Remove the bolts (figure 1, item 4) and nuts (figure 1, item 5) from the outlet side of the valve (figure 1, item 1).
6. Remove the valve (figure 1, item 1) from the vessel piping.
7. Remove and discard the gaskets (figure 1, items 6 and 7).

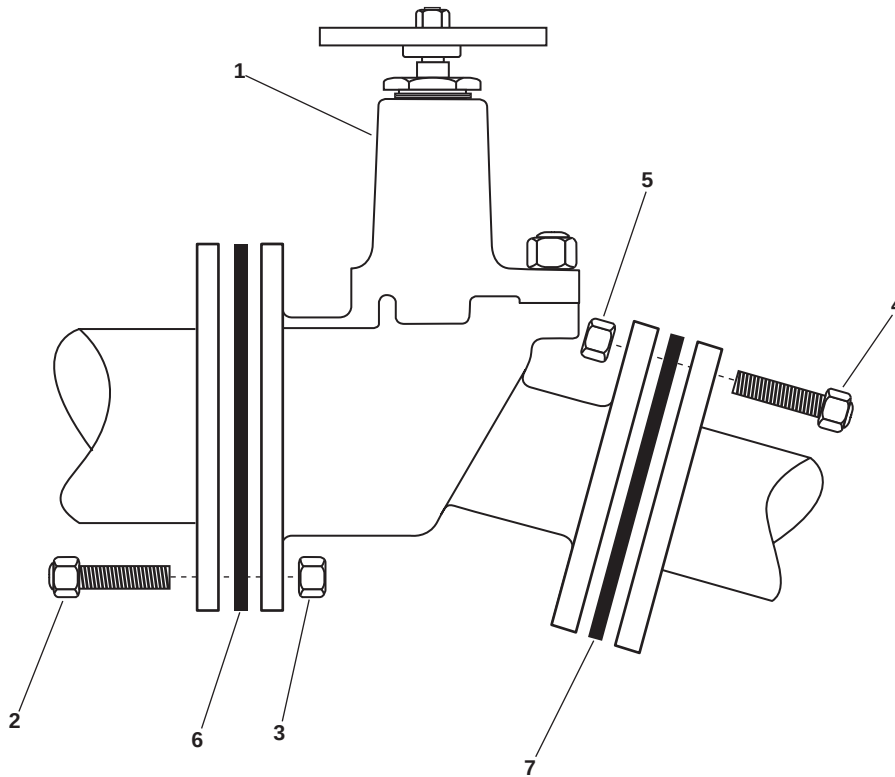
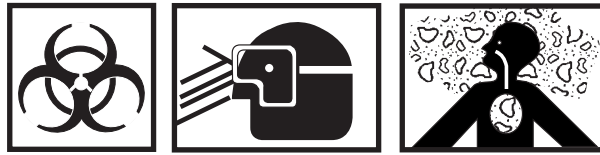


Figure 1. Flanged Scupper Gag Valve

INSTALLATION

Sewage is a common mode of transmission for parasitic organisms that may have the capability of causing communicable diseases. Chemical protective gloves and a protective apron should be worn to help prevent contact with sewage. After coming in contact with sewage or contaminated equipment, be sure to clean yourself with a disinfectant soap. Avoid sewage contact with skin abrasions, punctures, cuts, and other open wounds. Wipe up and clean any spills and/or contaminated equipment using a disinfectant soap. Failure to comply can result in death or serious illness.

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. Clean the flanges of valve (figure 1, item 1) and vessel piping using a wire brush, clean wiping rags, and water.
2. Install the valve (figure 1, item 1) and two new gaskets (figure 1, items 6 and 7) to the vessel piping. Secure it with the bolts (figure 1, items 2 and 4) and the nuts (figure 1, items 3 and 5).
3. Remove the lockouts and tagouts (FM 55-502).
4. Set the circuit breakers to ON.
5. Operate the marine sanitation device under usual conditions (TM 55-1925-273-10).
6. Check the valve and connections for leakage and proper operation.
7. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
SEWAGE COLLECTION, HOLDING, AND TRANSFER (CHT) SYSTEM, VALVES; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protection (Item 36, Table 1, WP 0295 00, Volume 2)

Materials/Parts:

Rag, Wiping (Item 139, Table 2, WP 0307 00, Volume 2)
 Gasket (Item 6, Figure 80, WP 0304 00, Volume 2)
 Packing (Item 4, Figure 80, WP 0304 00, Volume 2)
 Packing (Item 9, Figure 80, WP 0304 00, Volume 2)
 Seat, Valve (Item 7, Figure 80, WP 0304 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

TM 55-1925-273-10
 WP 0159 00
 WP 0295 00 (volume 2)
 WP 0304 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Ventilation fans operating Under Usual Conditions (TM 55-1925-273-10).
 Sewage system valve removed (WP 0159 00).

TYPICAL BALL VALVE (FLANGED) REPAIR**DISASSEMBLY****WARNING**

Toxic and flammable vapors are generated in the sewage system. Provide ventilation from outside source. Avoid open flames and prolonged breathing of fumes. Failure to comply with this warning could cause serious illness or death.

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

1. Remove the nut (figure 1, item 1) and the handle (figure 1, item 2) from the valve body (figure 1, item 3).
2. Remove the gland nut (figure 1, item 4) from the valve body (figure 1, item 3).
3. Remove the gland nut packing (figure 1, item 5) from the valve body (figure 1, item 3). Discard the gland nut packing.
4. Remove the valve stem (figure 1, item 6) from the valve body (figure 1, item 3).

5. Remove the valve stem packing (figure 1, item 7) from the valve body (figure 1, item 3). Discard the valve stem packing.
6. Remove the retainer (figure 1, item 8) from the valve body (figure 1, item 3).
7. Remove the gasket (figure 1, item 9) from the valve body (figure 1, item 3). Discard the gasket.
8. Remove the valve seat (figure 1, item 10), the ball (figure 1, item 11), and the valve seat (figure 1, item 12) from the valve body (figure 1, item 3).

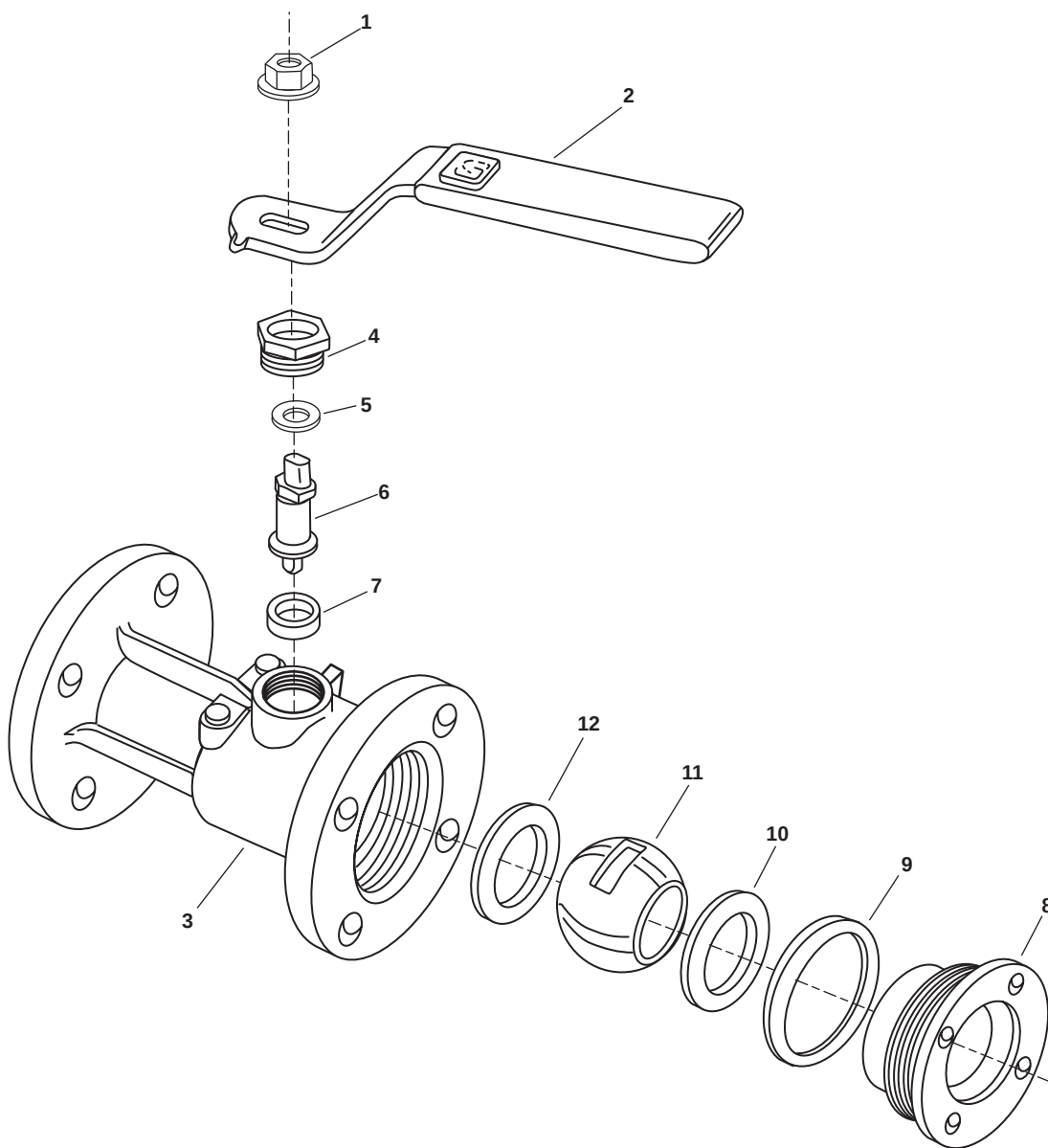


Figure 1. Ball Valve Repair

ASSEMBLY

1. Inspect all valve components for wear and damage.
2. Clean the parts of the valve using clean wiping rags and water.
3. Install the valve seat (figure 1, item 12), the ball (figure 1, item 11), the valve seat (figure 1, item 10), and a new gasket (figure 1, item 9) in valve body (figure 1, item 3). Secure them with the retainer (figure 1, item 8).
4. Install new valve stem packing (figure 1, item 7) in the valve body (figure 1, item 3).
5. Install the valve stem (figure 1, item 6) in the valve body (figure 1, item 3).
6. Install new gland nut packing (figure 1, item 5) in the valve body (figure 1, item 3). Secure it with gland nut (figure 1, item 4).
7. Install the handle (figure 1, item 2) and secure it with the nut (figure 1, item 1).
8. Perform the applicable installation procedure for the affected valve (WP 0159 00).

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
SEWAGE DISCHARGE PUMP, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

At 440V power panel No. 1, set the SEWAGE DIS-
CHARGE PUMP No. 1. or the SEWAGE DIS-
CHARGE PUMP No. 2. circuit breaker to OFF. 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.

FASTENER REPLACEMENT**REMOVAL**

Remove the four bolts (figure 1, item 1), four lockwashers (figure 1, item 2), and four flat washers (figure 1, item 3). Discard the lockwashers.

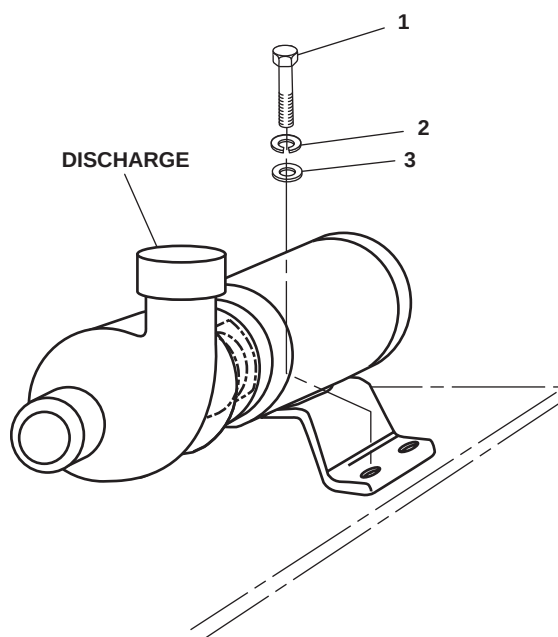


Figure 1. Sewage Pump Hardware Replacement

INSTALLATION

1. Install the four bolts (figure 1, item 1), four new lockwashers (figure 1, item 2), and the four flat washers (figure 1, item 3).
2. Remove the lockouts and tagouts (FM 55-502).
3. Set the circuit breaker to ON.
4. Operate the sewage discharge pump under usual conditions (TM 55-1925-273-10), and check for vibration and abnormal noise.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
SEWAGE DISCHARGE PUMP, ELECTRIC MOTOR; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Motor, Alternating C (Item 1, Figure 82, WP 0304 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0304 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the SEWAGE DISCHARGE PUMP No. 1.
circuit breaker or the SEWAGE DISCHARGE PUMP
No 2. circuit breaker at 440V power panel No. 1.
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**

1. Remove the screws (figure 1, item 1) and remove the cover (figure 1, item 2) from the junction box (figure 1, item 3).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the wiring terminals in the in the junction box (figure 1, item 3). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and remove the wiring (figure 1, item 4) from the junction box (figure 1, item 3).

4. Remove the two bolts (figure 2, item 1) four flat washers (figure 2, item 2), two lockwashers (figure 2, item 3), and two nuts (figure 2, item 4) from the coupling guard (figure 2, item 5). Discard the lockwashers.
5. Remove the coupling guard (figure 2, item 5).
6. Loosen the motor coupling flange setscrew (figure 3, item 1).

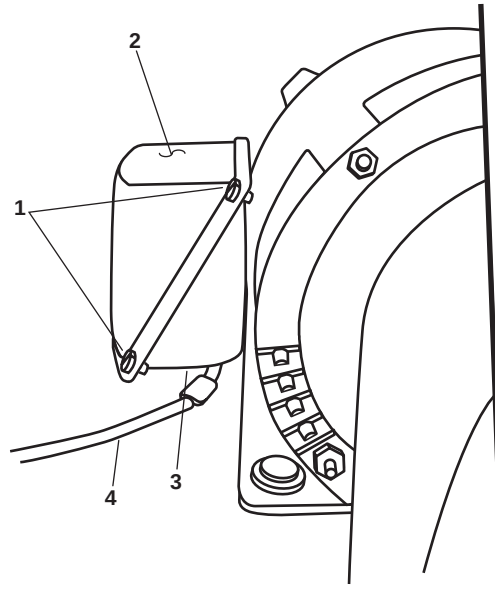


Figure 1. Electrical Junction Box

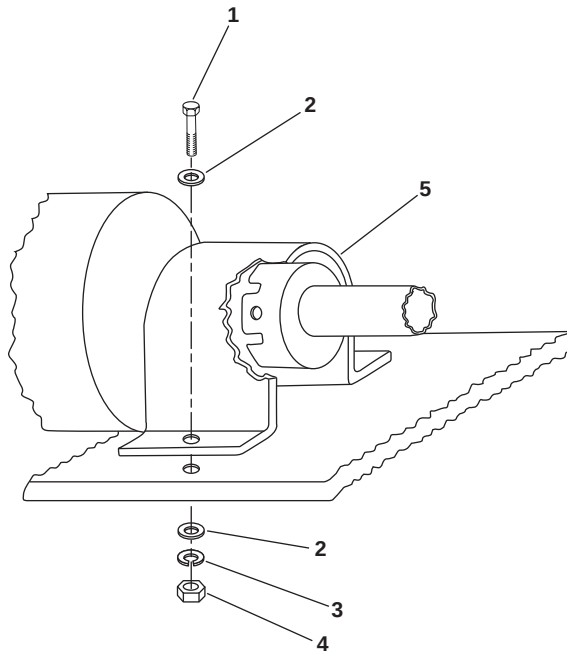


Figure 2. Coupling Guard

7. Slide the motor coupling flange (figure 3, item 2) towards the motor (figure 3, item 3).
8. Remove the four bolts (figure 3, item 4), four lockwashers (figure 3, item 5), and four flat washers (figure 3, item 6) that secure the motor (figure 3, item 3). Discard the lockwashers (figure 3, item 5).
9. Remove the motor (figure 3, item 3) from the foundation (figure 3, item 7).
10. Remove the motor coupling flange (figure 3, item 2) from the motor shaft (figure 3, item 8).

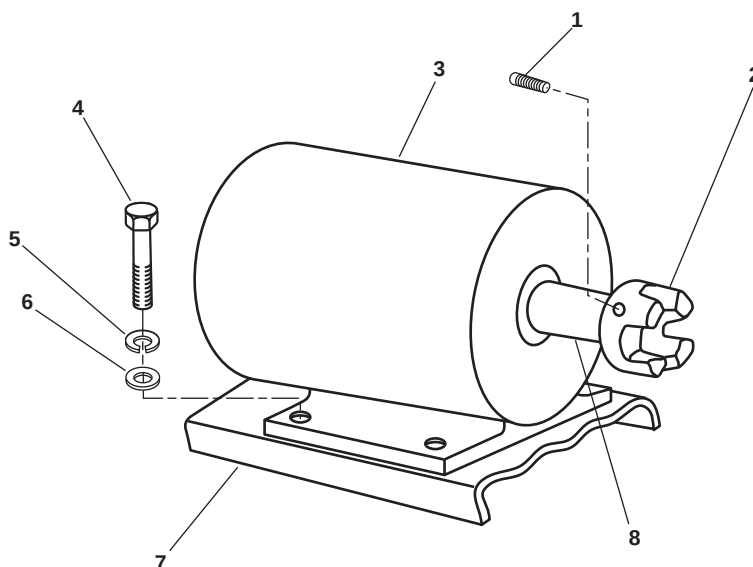


Figure 3. Electric Motor

INSTALLATION

1. Install the motor coupling flange (figure 3, item 2) on the motor shaft (figure 3, item 8) with the flat end towards the motor (figure 3, item 3).
2. Install the motor (figure 3, item 3) on the foundation and secure it with the four bolts (figure 3, item 4), four new lockwashers (figure 3, item 5), and four flat washers (figure 3, item 6). Do not tighten the nuts and bolts at this time.
3. Align the motor coupling flange (figure 4, item 1) and the pump coupling flange (figure 4, item 2), leaving approximately 0.016 inch (0.41 mm) space between the both flanges.
4. To check the alignment between the motor coupling flange (figure 4, item 1) and the pump coupling flange (figure 4, item 2):
 - a. The maximum angular offset shall be 1 degree, and maximum parallel offset shall be 0.015 inch (0.381 mm). Refer to figure 4.
 - b. Tighten the motor coupling flange setscrew (figure 3, item 1).
 - c. Tighten the four bolts (figure 3, item 4), four new lockwashers (figure 3, item 5), and four flat washers (figure 3, item 6).
 - d. Repeat steps a–c until the alignment is correct.

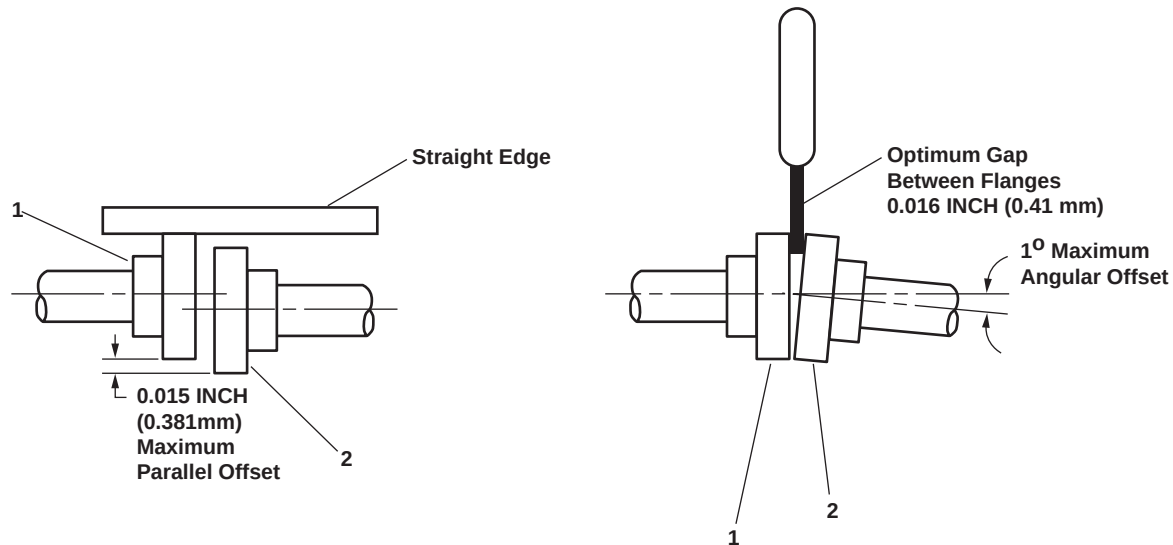


Figure 4. Alignment of Pump Coupling Flange and Motor Coupling Flange

5. Install the coupling guard (figure 2, item 5) and secure it with two bolts (figure 2, item 1), four flat washers (figure 2, item 2), two new lockwashers (figure 2, item 3) and two nuts (figure 2, item 4).
6. Install the wiring using the labels from step 3 of Removal as a guide. Remove the labels.
7. Install the cover (figure 1, item 2) on the junction box (figure 1, item 3), securing it with the screws (figure 1, item 1).
8. Remove the lockouts and tagouts (FM 55-502).
9. Set the circuit breaker to ON.
10. Operate the sewage discharge pump under usual conditions (TM 55-1926-273-10), checking for proper operation and unusual noises or vibration.
11. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
OILY BILGE SYSTEM, PIPING; SERVICE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00,
Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2,
WP 0295 00, Volume 2)
Suitable Drain Pan

Materials/Parts:

Gasket (Item 2, Figure 83, WP 0304 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0304 00 (volume 2)

SERVICE DUPLEX STRAINER

1. Position a suitable drain pan beneath the work area.
2. Position the selector lever (figure 1, item 1) over the in-service strainer element.
3. Loosen the T-handle (figure 1, item 2) and swing the bail (figure 1, item 3) clear of the cover (figure 1, item 4).

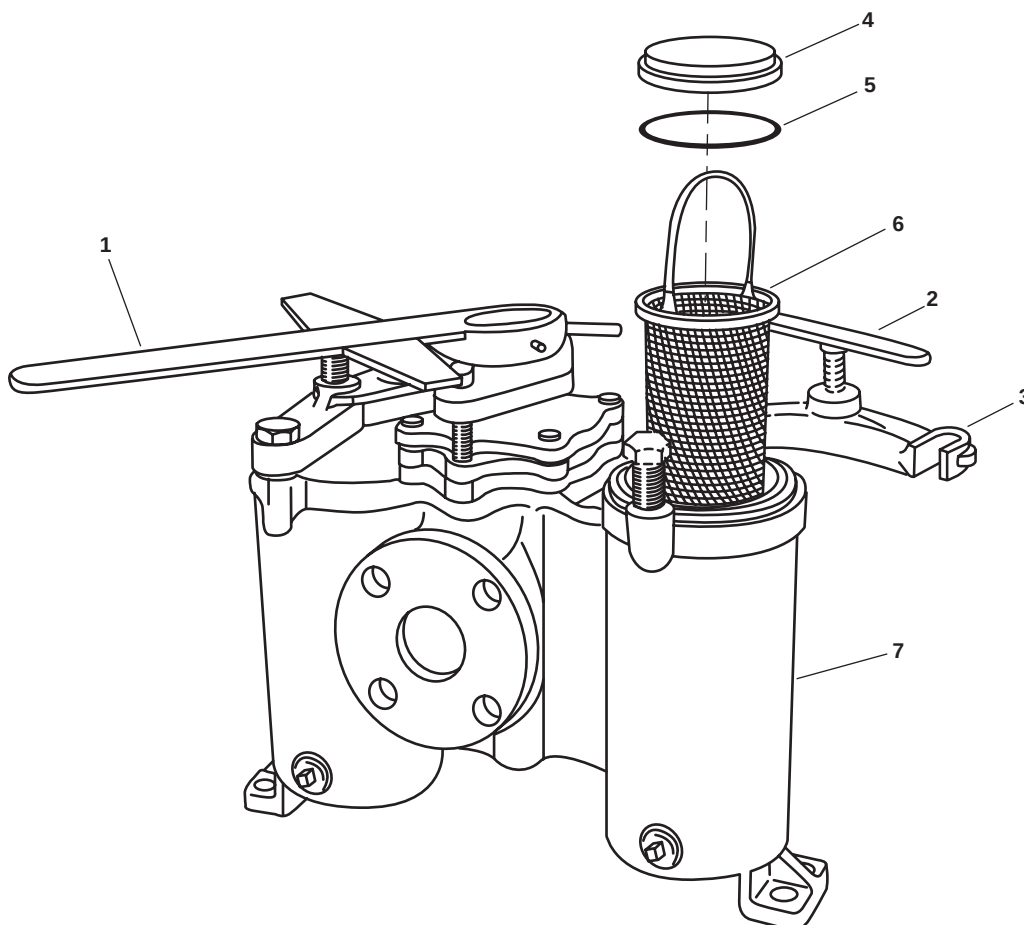
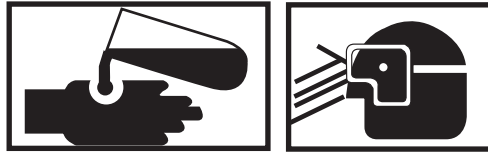


Figure 1. Duplex Strainer

WARNING

Used oil and other oily waste tank contents can cause personal injury if they come in contact with skin or eyes. Chemical protective gloves and goggles must be worn whenever the oily waste tank contents may come in contact with the skin or eyes. Failure to comply can result in death or serious injury to personnel.

4. Remove the cover (figure 1, item 4) and gasket (figure 1, item 5). Discard the gasket.
5. Remove the strainer element (figure 1, item 6).
6. Clean the strainer element (figure 1, item 6) with clean water. A wire brush may be used as necessary to remove hardened deposits. If the strainer element cannot be satisfactorily cleaned, replace it.
7. Install the new or cleaned strainer element (figure 1, item 6) in the strainer body (figure 1, item 7).
8. Install the cover (figure 1, item 4) using a new gasket (figure 1, item 5).
9. Swing the bail (figure 1, item 3) in place over the cover (figure 1, item 4) and tighten the T-handle (figure 1, item 2).
10. Place the strainer element in service by positioning the selector lever (figure 1, item 1) over the strainer.
11. Operate the oily bilge pump (TM 55-1925-273-10) and check the strainer for leaks.
12. Return the oily bilge pump to the desired readiness condition (TM 55-1925-273-10).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
OILY BILGE SYSTEM, VALVES; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 1, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protection (Item 36, Table 1, WP 0295 00, Volume 2)
Suitable Drain Pan

Personnel Required:

One Watercraft Engineer, 88L

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

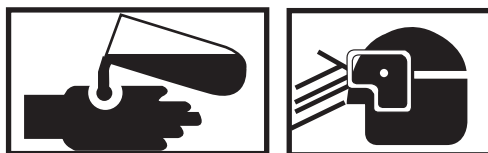
Rags, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)

Equipment Conditions:

CLOSE valve CA-56, COV – OILY BILGE PMP SUCT.
Lock out and tag out (FM 55-502).
CLOSE valves upstream and downstream of the affected valve. Lock out and tag out (FM 55-502).

FLANGED ANGLE VALVE REPLACEMENT**REMOVAL**

1. Partially open the valve (figure 1, item 1) to equalize any internal pressure before removing any bolts.
2. Place a suitable drain pan under the valve (figure 1, item 1).

WARNING

Used oil and other oily waste tank contents can cause personal injury if they come in contact with skin or eyes. Chemical protective gloves and goggles must be worn whenever the oily waste tank contents may come in contact with the skin or eyes. Failure to comply with this warning can cause serious personal injury or death.

3. Slowly loosen the bolts (figure 1, item 2) and nuts (figure 1, item 3) on the inlet side of the valve (figure 1, item 1), and allow the pressure to vent and any liquid to drain into the suitable drain pan.
4. Remove the bolts (figure 1, item 2) and nuts (figure 1, item 3) from the inlet side of the valve (figure 1, item 1).
5. Remove the bolts (figure 1, item 4) and nuts (figure 1, item 5) from the outlet side of the valve (figure 1, item 1).
6. Remove the valve (figure 1, item 1) from the vessel's piping (figure 1, item 6).
7. Remove and discard the gaskets (figure 1, items 7 and 8).

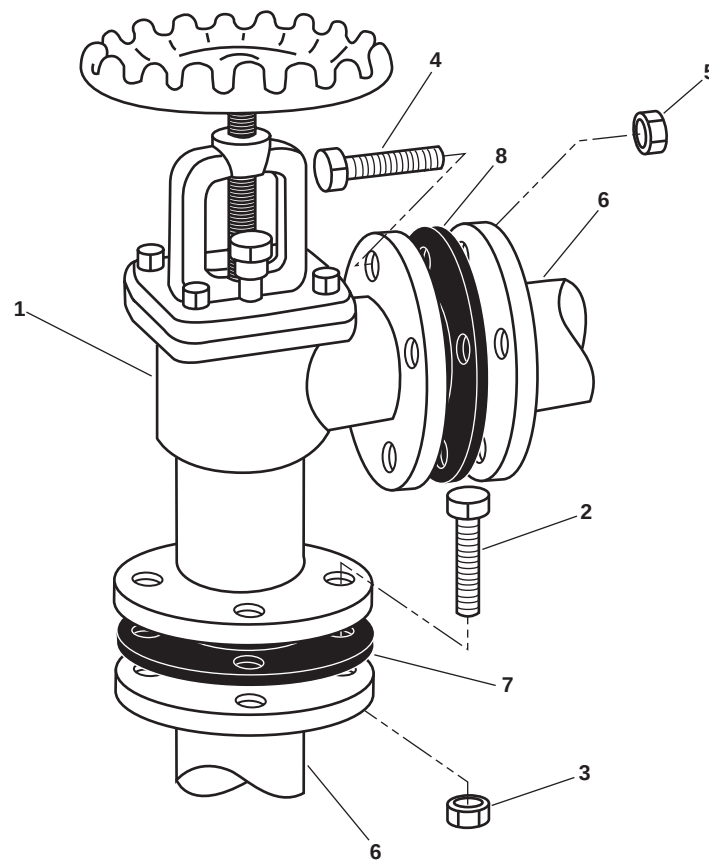
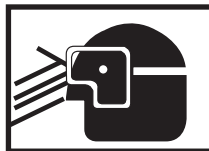


Figure 1. Flanged Angle Valve

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.

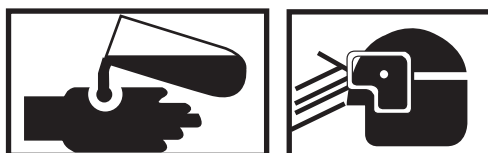
1. Clean the flanges of valve (figure 1, item 1) and vessel's piping (figure 1, item 6) using a wire brush, clean wiping rags, and water.
2. Install the valve (figure 1, item 1) and two new gaskets (figure 1, items 7 and 8) to the vessel's piping, and secure it with the bolts (figure 1, items 2 and 4) and the nuts (figure 1, items 3 and 5).
3. Perform the Follow-On Service procedure at the end of this work package.

FLANGED GLOBE VALVE REPLACEMENT

REMOVAL

1. Partially open the valve (figure 2, item 1) to equalize any internal pressure before removing any bolts.
2. Place a suitable drain pan under the valve (figure 2, item 1).

WARNING



Used oil and other oily waste tank contents can cause personal injury if they come in contact with skin or eyes. Chemical protective gloves and goggles must be worn whenever the oily waste tank contents may come in contact with the skin or eyes. Failure to comply with this warning can cause serious personal injury or death.

3. Slowly loosen the bolts (figure 2, item 2) and nuts (figure 2, item 3) on the inlet side of the valve (figure 2, item 1), and allow and pressure to vent and any liquid to drain into the drain pan.
4. Remove the bolts (figure 2, item 2) and nuts (figure 2, item 3) from the inlet side of the valve (figure 2, item 1).
5. Remove the bolts (figure 2, item 4) and nuts (figure 2, item 5) from the outlet side of the valve (figure 2, item 1).

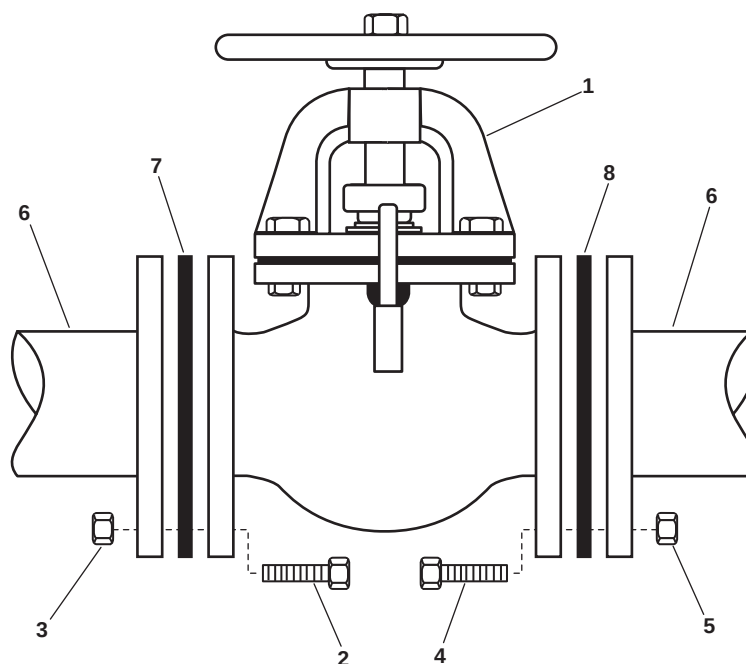
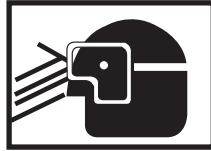


Figure 2. Flanged Globe Valve

6. Remove the valve (figure 2, item 1) from the vessel's piping (figure 2, item 6).
7. Remove and discard the gaskets (figure 2, items 7 and 8).

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.

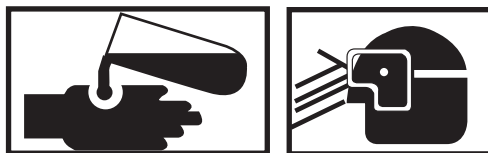
1. Clean the flanges of valve (figure 2, item 1) and vessel's piping (figure 2, item 6) using a wire brush, clean wiping rags, and water.
2. Install the valve (figure 2, item 1) and two new gaskets (figure 2, items 7 and 8) to the vessel's piping, and secure it with the bolts (figure 2, items 2 and 4) and the nuts (figure 2, items 3 and 5).
3. Perform the Follow-On Service procedure at the end of this work package.

THREADED VALVE (TYPICAL) REPLACEMENT

REMOVAL

1. Partially open the valve (figure 3, item 1) to equalize any internal pressure before removing any bolts.
2. Place a suitable drain pan under the union (figure 3, item 2) of the valve (figure 3, item 1) to be removed.

WARNING



Used oil and other oily waste tank contents can cause personal injury if they come in contact with skin or eyes. Chemical protective gloves and goggles must be worn whenever the oily waste tank contents may come in contact with the skin or eyes. Failure to comply with this warning can cause serious personal injury or death.

CAUTION

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

3. Using the two wrench method, loosen the union (figure 3, item 2), and allow any pressure to vent and any fluid to drain.

4. Using the two wrench method, remove the pipe (figure 3, item 3) from the valve (figure 3, item 1).
5. Using the two wrench method, remove the valve (figure 3, item 1) from the vessel piping (figure 3, item 4).

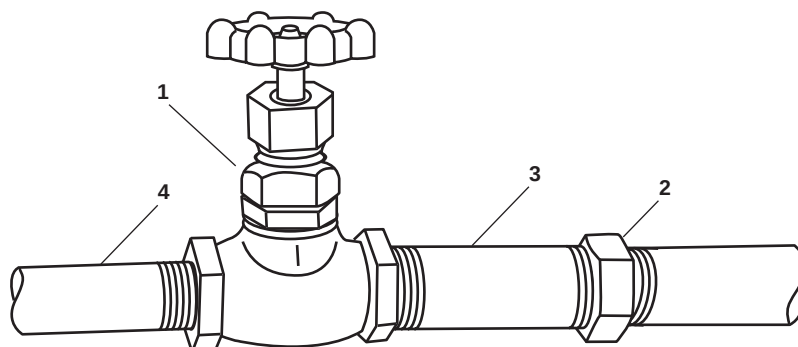
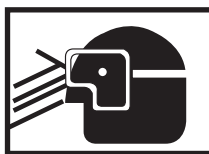


Figure 3. Threaded Valve (Typical)

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. Clean the threaded ends of the piping (figure 3, items 3 and 4) with a wire brush.
2. Apply antiseizing tape to the threaded ends of the piping (figure 3, items 3 and 4).

⚠ CAUTION

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

3. Using the two wrench method, install the valve (figure 3, item 1) onto the vessel piping (figure 3, item 4).
4. Using the two wrench method, install the pipe (figure 3, item 3) into the valve (figure 3, item 1).
5. Using the two wrench method, install the union (figure 3, item 2) to the pipe (figure 3, item 3).
6. 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. Set the circuit breakers to ON.
3. Operate the oily bilge system under usual conditions (TM 55-502-1925-273-10).
4. Check the valve and connections for leakage and proper operation.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
OILY BILGE SYSTEM, OILY BILGE PUMP, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Suitable Drain Pan

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Pump (Item 1, Figure 84, WP 0304 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0304 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

CLOSE valves OB-8 OILY BILGE PMP DISCH. TO
OILY WST.STOR. TK., OB-9 OILY BILGE PMP.
DISCH TO SHORE, OB-13 OILY WST. STOR. TK.
TO OILY BILGE PMP. SUCT., OB-14 C.O.V.-OILY
BILGE PMP. SUCT., and CA-56, COV – OILY
BILGE PMP SUCT. Lock out and tag out (FM 55-
502).

OILY BILGE PUMP REPLACEMENT**REMOVAL**

WARNING

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

 CAUTION

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

1. Slowly remove the air inlet line to release any air pressure.
2. Place a suitable drain pan under the inlet union (figure 1, item 1).

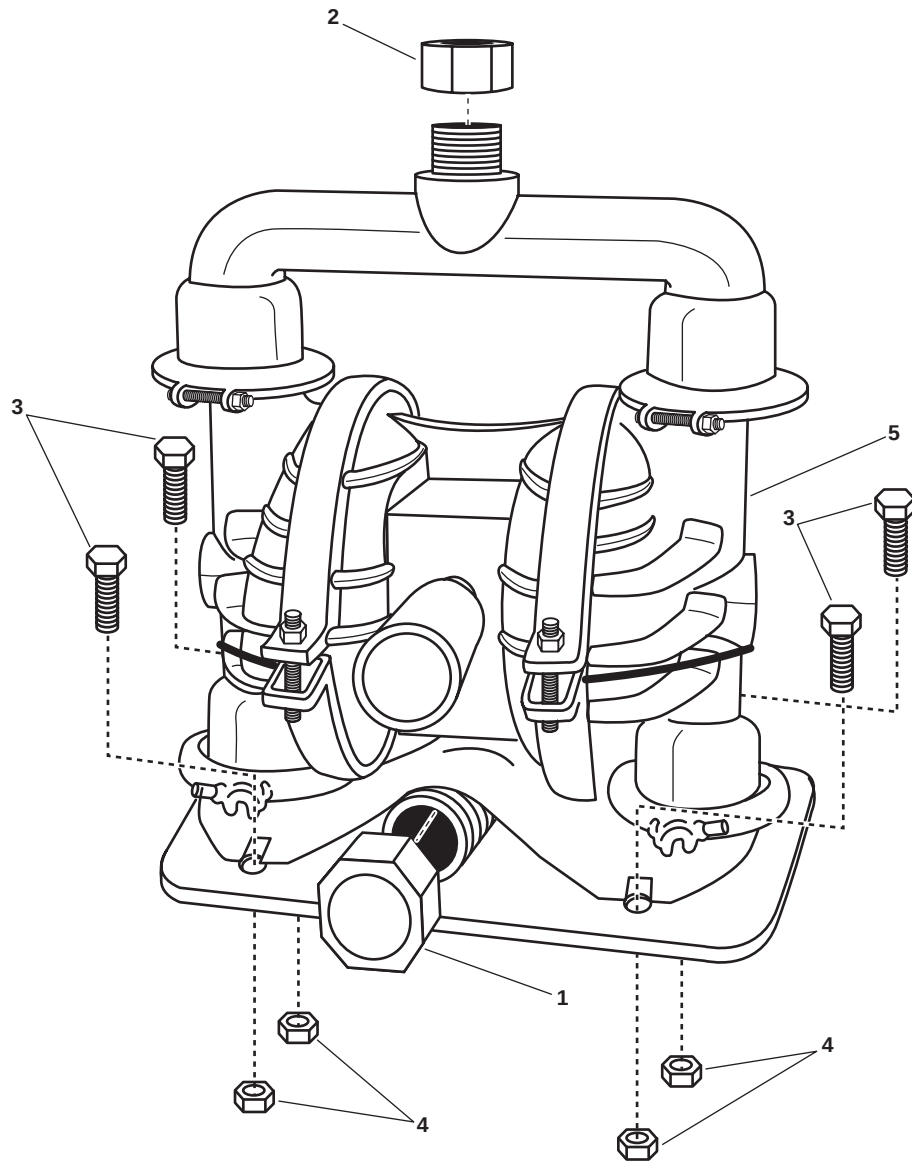


Figure 1. Oily Bilge Pump

WARNING

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

 CAUTION

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

3. Using two wrenches, loosen the inlet union (figure 1, item 1) and allow the oily water to drain.
4. Using two wrenches, loosen the outlet union (figure 1, item 2) and allow the oily water to drain.
5. Remove the inlet union (figure 1, item 1) and the outlet union (figure 1, item 2) from the vessel's piping.
6. Remove the four bolts (figure 1 item 3) and four nuts (figure 1, item 4) that secure the pump (figure 1, item 5) to the foundation.
7. Remove the pump (figure 1, item 5).

INSTALLATION

1. Install the pump (figure 1, item 5) to the foundation, securing it with the four bolts (figure 1 item 3) and four nuts (figure 1, item 4). Do not tighten the bolts and nuts at this time.

 CAUTION

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

2. Using two wrenches, install the inlet union (figure 1, item 1).
3. Using two wrenches, install the outlet union (figure 1, item 2).
4. Tighten the four bolts (figure 1 item 3) and four nuts (figure 1, item 4) that secure the pump (figure 1, item 5) to the foundation (figure 1, item 6).
5. Install the air line to the pump (figure 1, item 5).
6. Remove the lockouts and tagouts (FM 55-502).
7. OPEN the valves.
8. Operate the oily bilge pump under usual conditions (TM 55-1925-273-10), ensuring that the pump operates properly.
9. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
OILY BILGE SYSTEM, OILY BILGE PUMP; REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
 Tool Kit, Master Mechanic's (Item 23, Table 2, WP 0295 00, Volume 2)
 Wrench, Torque, 0-600 IN-LB (Item 24, Table 2, WP 0295 00, Volume 2)
 Suitable Drain Pan

Materials/Parts:

Dry Cleaning Solvent (Item 57, Table 1, WP 0307 00, Volume 2)
 Grease, General Purpose (Item 75, Table 1, WP 0307 00, Volume 2)
 Rags, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
 Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)
 Gasket (Item 8, Figure 84, WP 0304 00, Volume 2)

Materials/Parts (continued):

Gasket (Item 12, Figure 84, WP 0304 00, Volume 2)
 O-Ring (Item 7, Figure 84, WP 0304 00, Volume 2)
 O-Ring, Spring Guide (Item 3, Figure 84, WP 0304 00, Volume 2)
 Valve Seat (Item 4, Figure 83, WP 0304 00, Volume 2)

Personnel Required:

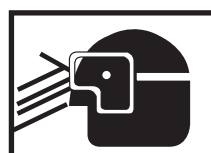
Two Watercraft Engineers, 88L

References:

TM 55-1925-273-10
 WP 0165 00
 WP 0295 00 (volume 2)
 WP 0304 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

Oily bilge pump removed (WP 0165 00).

PUMP DISASSEMBLY**WARNING**

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. Drain the pump by turning it upside down and allowing any fluid to flow into a suitable drain pan.
2. Mark a line (figure 1) from each liquid chamber to its corresponding air chamber to assist in the proper alignment during assembly.
3. Remove the four bolts (figure 2, item 1) and the four nuts (figure 2, item 2), and remove the two sets of discharge manifold clamp bands (figure 2, item 3).
4. Remove the discharge manifold (figure 2, item 4) from the liquid chambers (figure 2, items 5 and 6).

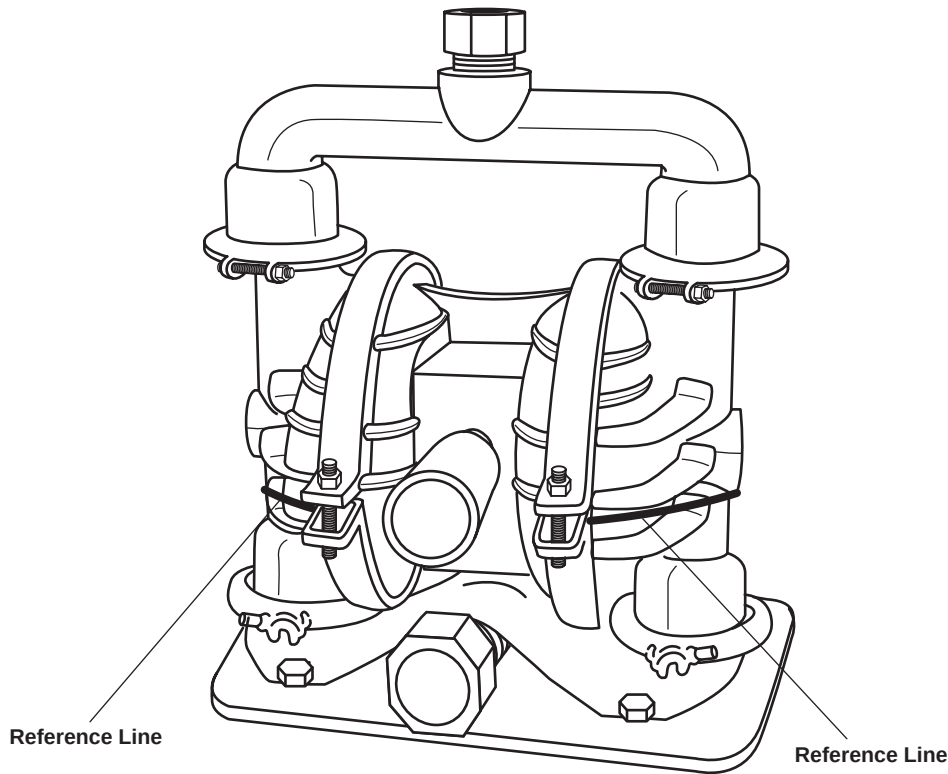


Figure 1. Alignment Marks

5. Remove the two discharge balls (figure 2, item 7), two valve seat O-rings (figure 2, item 8) and two valve seats (figure 2, item 9) from the discharge manifold (figure 2, item 4). Discard the valve seat O-rings.
6. Remove the four bolts (figure 2, item 10) and the four nuts (figure 2, item 11) and remove the two sets of intake manifold clamp bands (figure 2, item 12).
7. Remove the intake manifold (figure 2, item 13) from the liquid chambers (figure 2, items 5 and 6).
8. Remove the two intake balls (figure 2, item 14) two valve seat O-rings (figure 2, item 15) and two seats (figure 2, item 16) from the intake manifold (figure 2, item 13). Discard the valve seat O-rings.
9. Remove four nuts (figure 2, item 17) and four bolts (figure 2, item 18), and remove the two sets of liquid chamber clamps (figure 1, item 19).
10. Remove the liquid chambers (figure 2, item 5 and 6) from the center block (figure 2, item 20).
11. Remove the two outer pistons (figure 2, item 21) from the center block (figure 2, item 20).
12. Remove the two outer diaphragms (figure 2, item 22), the two inner diaphragms (figure 2, item 23), and the inner pistons (figure 2, item 24) from the center block (figure 2, item 20).
13. Remove the shaft stud (figure 2, item 25) and shaft (figure 2, item 26) from the center block (figure 2, item 20).
14. Remove the seven GlydTM rings (figure 2, item 27) from the shaft (figure 2, item 26). Discard the GlydTM rings.

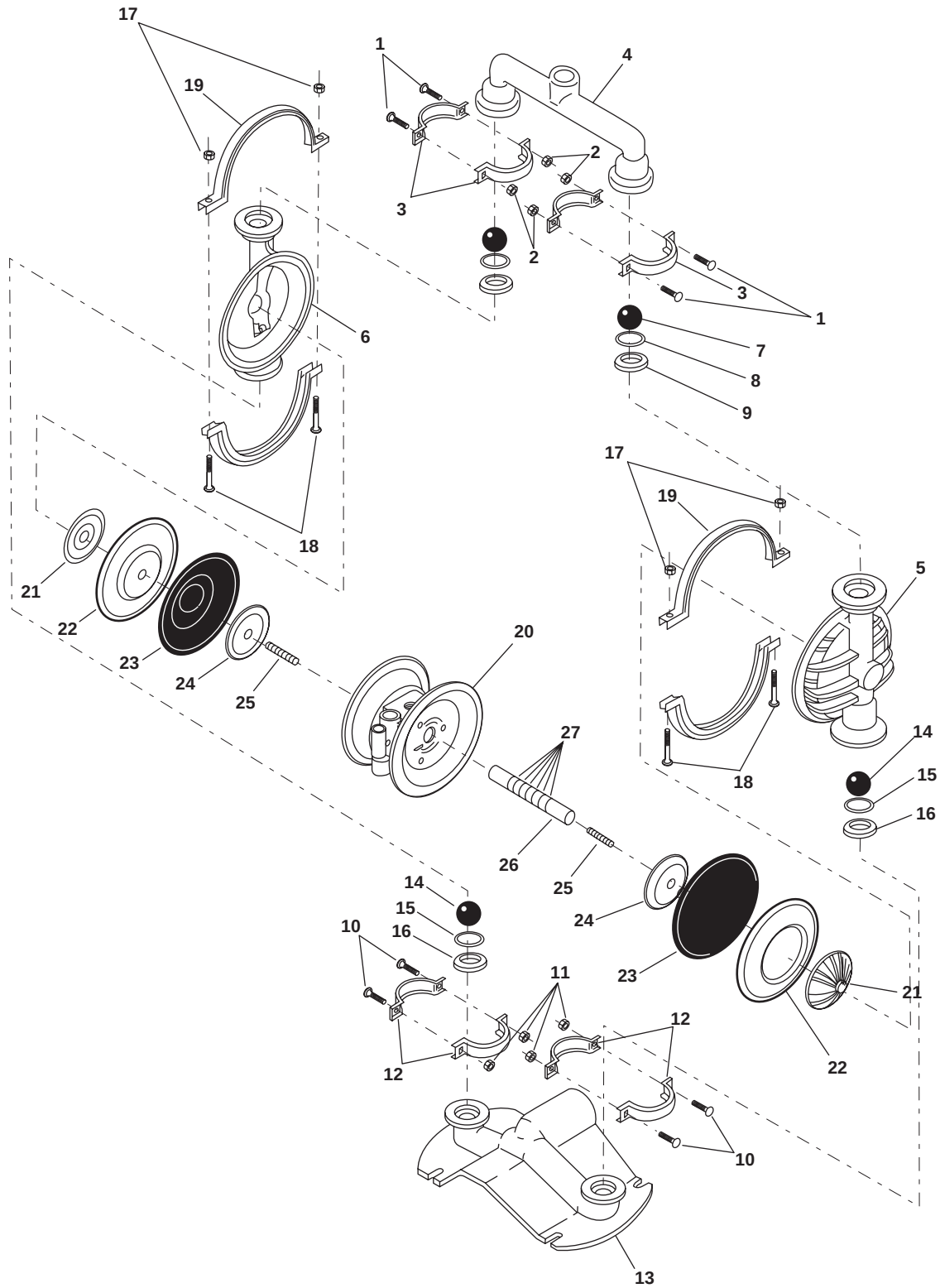
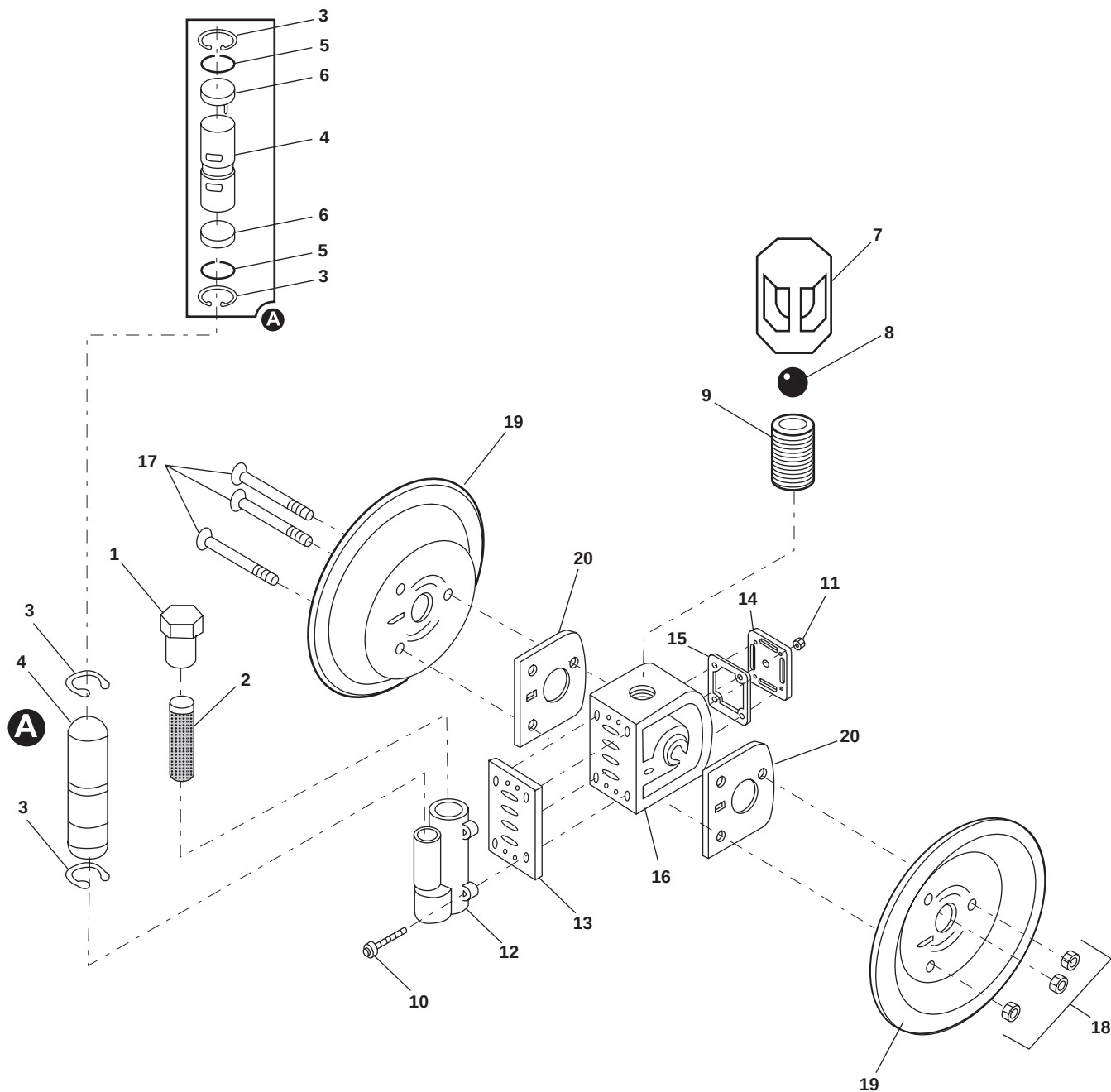


Figure 2. Oily Bilge Pump

CENTER BLOCK DISASSEMBLY

1. Remove the bolt (figure 3, item 1) and the air valve screen (figure 3, item 2).
2. Remove the snap rings (figure 3, item 3), and remove the air valve (figure 3, item 4).
3. Remove the O-rings (figure 3, item 5) from the air valve (figure 3, item 4). Discard the O-rings.
4. Remove the guide caps (figure 3, item 6) from the air valve (figure 3, item 4).
5. Remove the check body (figure 3, item 7), the check ball (figure 3, item 8), and the nipple (figure 3, item 9).

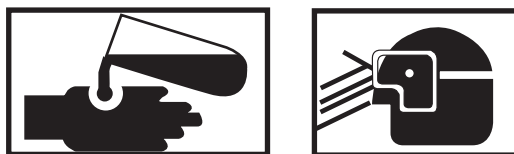
**Figure 3. Oily Bilge Pump**

6. Remove the four bolts (figure 3, item 10) and four nuts (figure 3, item 11) and remove the main valve body (figure 3, item 12), the air valve gasket (figure 3, item 13), the muffler (figure 3, item 14), and the muffler gasket (figure 3, item 15), from the center block (figure 3, item 16). Discard the muffler gasket.
7. Remove the three bolts (figure 3, item 17) and the three nuts (figure 3, item 18) and remove the two air cambers (figure 3, item 19) from the center block (figure 3, item 16).
8. Remove the two gaskets (figure 3, item 20) from the center block (figure 3, item 16). Discard the gaskets.

CLEANING AND INSPECTION

1. Remove the old antiseizing tape from the outer diaphragms (figure 2, item 22) and inner diaphragms (figure 3, item 23) and clean the sealing surfaces. Replace the old antiseizing tape with new.
2. Remove the old antiseizing tape from the air chambers (figure 3, item 19) and clean the sealing surfaces. Replace the old antiseizing tape with new.

WARNING



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.

3. Use cleaning solvent and clean wiping rags to clean all the removed parts. Check for any burrs on the sealing surfaces of all removed parts, and inspect all components for wear or damage.
4. Check that the ports in the air valve (figure 3, item 4) and the main valve assembly (figure 3, item 12), and the center block (figure 3, item 16) are free of debris and damage.
5. Clean the air valve screen (figure 3, item 2).
6. Inspect the main valve (figure 3, item 12) and center block (figure 3, item 16) for nicks and scoring.
7. Inspect the air valve (figure 3, item 4) for excessive wear. A shiny aluminum color indicates that the air valve assembly is worn beyond working tolerances.

CENTER BLOCK ASSEMBLY

1. Install seven new Glyd™ rings (figure 2, item 27) on the shaft (figure 2, item 26).
2. Install two new block gaskets (figure 3, item 20) on each side of the center block (figure 3, item 16).
3. Lubricate the shaft (figure 2, item 25) with general purpose grease and install it in the center block (figure 3, item 16).
4. Install the two air chambers (figure 3, item 19) on the center block (figure 3, item 16), and secure them with the three bolts (figure 3, item 17) and three nuts (figure 3, item 18) tightened to 75 lb-in. (8.5 Nm).

5. Install the main valve body (figure 3, item 12) the air valve gasket (figure 3, item 13) the muffler (figure 3, item 14) and a new muffler gasket (figure 3, item 15) on the from the center block (figure 3, item 16), and secure with the four bolts (figure 3, item 10) and four nuts (figure 3, item 11).
6. Apply antiseizing tape to the male threads of the nipple (figure 3, item 9), and install it about half way into the center block (figure 3, item 16).
7. Install the check ball (figure 3, item 8) in the check body (figure 3, item 7), and secure the check body to the exposed male threads of the nipple (figure 3, item 9) on the center block (figure 3, item 16).
8. Install the two air valve caps (figure 3, item 6), and two new O-rings (figure 3, item 5) on the air valve (figure 3, item 4).
9. Install the air valve (figure 3, item 4) in the main valve body (figure 3, item 12), and secure it with two new snap rings (figure 3, item 3).
10. Install the air valve screen (figure 3, item 2) in the main valve body (figure 3, item 12), and secure it with the bolt (figure 3, item 1).

PUMP ASSEMBLY

1. Install the two inner pistons (figure 2, item 24), the two inner diaphragms (figure 2, item 23), and the two outer diaphragms (figure 2, item 22) on the shaft (figure 2, item 25), and secure them with the two outer pistons (figure 2, item 21) tightened to a torque of 33 lb-ft (44 Nm).
2. Install the liquid chambers (figure 2, item 5 and 6) to the center block (figure 2, item 20) using the reference lines from figure 1, and secure them with the liquid chamber clamps (figure 1, item 19), the four nuts (figure 2, item 17), and the four bolts (figure 2, item 18) tightened to a torque the of 95 lb-in. (10.7 Nm).
3. Install the two seats (figure 2, item 16), two new valve seat O-rings (figure 2, item 15) , and the two intake balls (figure 2, item 14) in the intake manifold (figure 2, item 13).
4. Install the liquid chambers (figure 2, items 5 and 6) and the center block (figure 2, item 20) on the intake manifold (figure 2, item 13), and secure them with the two sets of intake manifold clamp bands (figure 2, item 12), the four bolts (figure 2, item 10) and the four nuts (figure 2, item 11) tightened to a torque of 30 lb-in. (3.4 Nm).
5. Install the two valve seats (figure 2, item 9), two new valve seat O-rings (figure 2, item 8), and the two discharge balls (figure 2, item 7) in the discharge manifold (figure 2, item 4).
6. Install the discharge manifold (figure 2, item 4) on the liquid chambers (figure 2, items 5 and 6), and secure it with the two sets of discharge manifold clamp bands (figure 2, item 3), the four bolts (figure 2, item 1) and the four nuts (figure 2, item 2) tightened to a torque of 30 lb-in. (3.4 Nm).
7. Perform the Oily Bilge Pump Replace Installation Procedure (WP 0165 00).

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BALLAST SYSTEM, VALVES; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 1, WP 0295 00), Volume 2)
 Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
 Gloves, Chemical and Oil Protection (Item 36, Table 1, WP 0295 00, Volume 2)
 Suitable Drain Pan

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Materials/Parts:

Rag, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
 Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
 Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)

Equipment Conditions:

Set to OFF the BILGE PUMP No. 1 circuit breaker on the emergency switchboard. Lock out and tag out (FM 55-502).
 Set to OFF the BILGE PUMP No. 2 circuit breaker on the main switchboard. Lock out and tag out (FM 55-502).
 CLOSE valves upstream and downstream of the affected valve. Lock out and tag out (FM 55-502).

THREADED VERTICAL CHECK VALVE REPLACEMENT**REMOVAL**

1. Place a suitable drain pan under the union (figure 1, item 1) of the valve (figure 1, item 2) to be removed.

! CAUTION

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

2. Using the two wrench method, slowly loosen the union (figure 1, item 1) and allow any pressure to vent and any fluid to drain into the suitable drain pan.
3. Using the two wrench method, remove the pipe (figure 1, item 3) from the valve (figure 1, item 2).
4. Using the two wrench method, remove the valve (figure 1, item 2) from the vessel piping (figure 1, item 4).

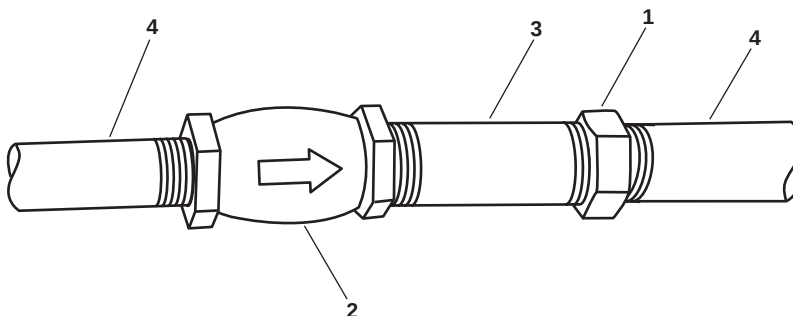
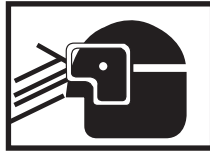


Figure 1. Threaded Vertical Check Valve (Typical)

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 or death.

1. Clean the threaded ends of the piping (figure 1, items 3 and 4) with a wire brush.
2. Apply antiseizing tape to the threaded ends of the piping (figure 1, items 3 and 4).

⚠ CAUTION

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

3. Using the two wrench method, install the valve (figure 1, item 2) on the vessel piping (figure 1, item 4).
4. Using the two wrench method, install the pipe (figure 1, item 3) in the valve (figure 1, item 2).
5. Using the two wrench method, install the union (figure 1, item 1) to the pipe (figure 1, item 3).
6. Perform the Follow-On Service procedure at the end of this work package.

FLANGED ANGLE/STOP CHECK VALVE REPLACEMENT

REMOVAL

1. Partially OPEN the valve (figure 2, item 1) to equalize any internal pressure before removing any bolts.
2. Place a suitable drain pan under the valve (figure 2, item 1).
3. Slowly loosen the bolts (figure 2, item 2) and nuts (figure 2, item 3) on the inlet side of the valve (figure 2, item 1), and allow and pressure to vent and any liquid to drain into the suitable drain pan.
4. Remove the bolts (figure 2, item 2) and nuts (figure 2, item 3) from the inlet side of the valve (figure 2, item 1).
5. Remove the bolts (figure 2, item 4) and nuts (figure 2, item 5) from the outlet side of the valve (figure 2, item 1).
6. Remove the valve (figure 2, item 1) from the vessel piping (figure 2, item 6).
7. Remove and discard the gaskets (figure 2, items 7 and 8).

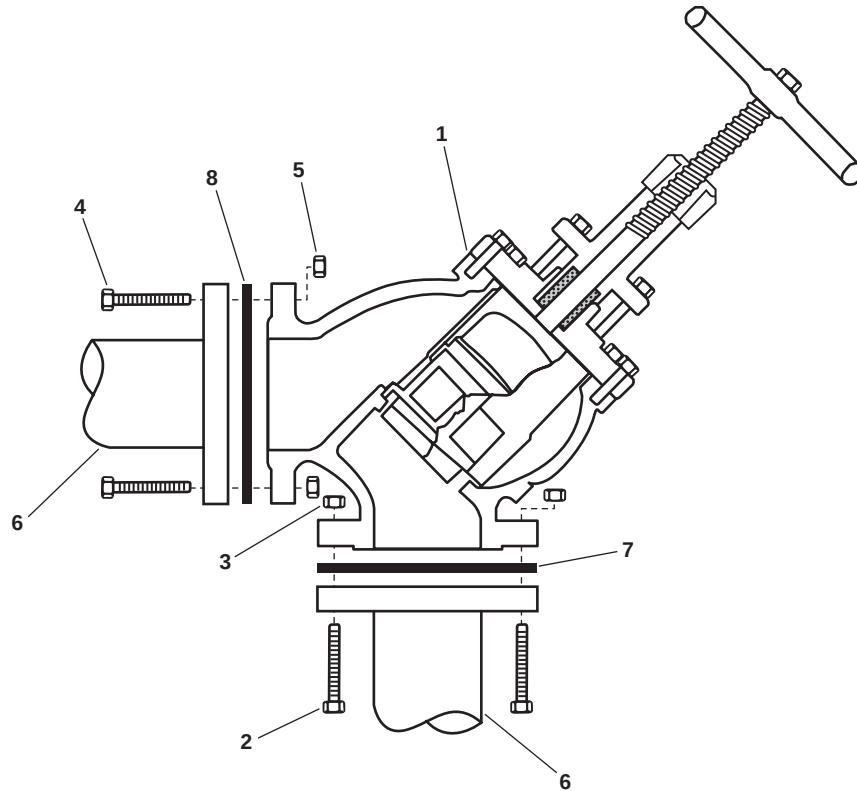
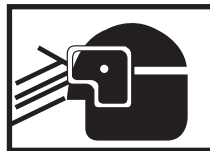


Figure 2. Flanged Angle/Stop Check Valve

INSTALLATION

WARNING

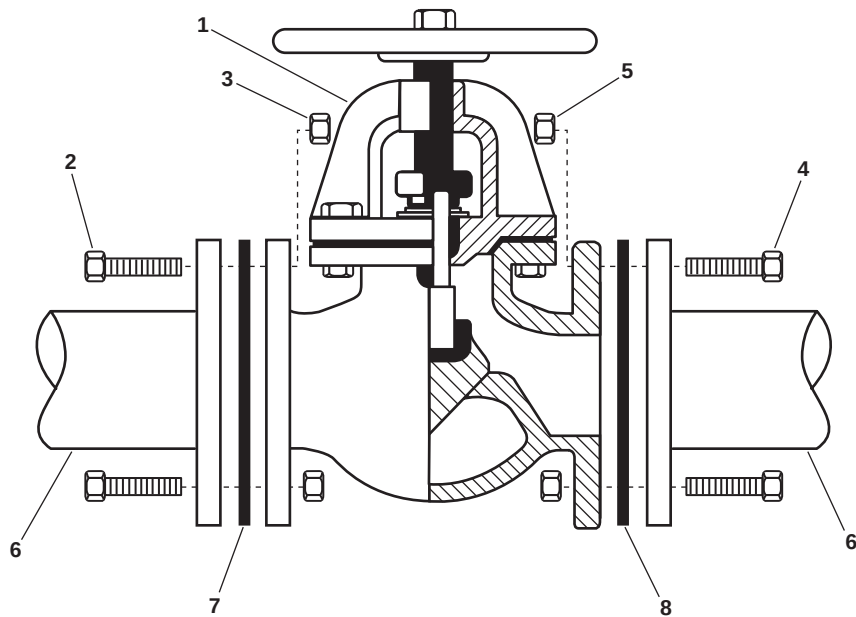


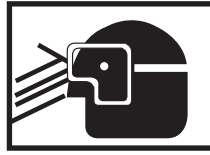
Removing components by means of wire brushing produces flying particles. These particles can cause serious injury to personnel. Protective goggles, gloves, and long sleeves must be worn at all times during wire brushing operations. Failure to comply with this warning can result in serious injury or death.

1. Clean the flanges of valve (figure 2, item 1) and vessel piping (figure 2, item 6) using a wire brush, clean wiping rags, and water.
2. Install the valve (figure 2, item 1) and two new gaskets (figure 2, items 7 and 8) to the vessel's piping, and secure it with the bolts (figure 2, items 2 and 4) and the nuts (figure 2, items 3 and 5).
3. Perform the Follow-On Service procedure at the end of this work package.

FLANGED GLOBE/GATE VALVE REPLACEMENT**REMOVAL**

1. Partially open the valve (figure 3, item 1) to equalize any internal pressure before removing any bolts.
2. Place a suitable drain pan under the valve (figure 3, item 1).
3. Slowly loosen the bolts (figure 3, item 2) and nuts (figure 3, item 3) on the inlet side of the valve (figure 3, item 1), and allow any pressure to vent and any liquid to drain into the suitable drain pan.
4. Remove the bolts (figure 3, item 2) and nuts (figure 3, item 3) from the inlet side of the valve (figure 3, item 1).
5. Remove the bolts (figure 3, item 4) and nuts (figure 3, item 5) from the outlet side of the valve (figure 3, item 1).
6. Remove the valve (figure 3, item 1) from the vessel piping (figure 3, item 6).
7. Remove and discard the gaskets (figure 3, items 7 and 8).

**Figure 3. Flanged Globe/Gate Valve**

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 or death.

1. Clean the flanges of valve (figure 3, item 1) and vessel piping (figure 3, item 6) using a wire brush, clean wiping rags, and water.
2. Install the valve (figure 3, item 1) and two new gaskets (figure 3, items 7 and 8) to the vessel piping, and secure it with the bolts (figure 3, items 2 and 4) and the nuts (figure 3, items 3 and 5).
3. 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. Set the circuit breakers to ON.
3. Operate the oily bilge system under usual conditions (TM 55-1925-273-10).
4. Check the valve and connections for leakage and proper operation.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BALLAST SYSTEM, VALVES; REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References:

WP 0167 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Rag, Wiping (Item 139, Table 2, WP 0307 00,
Volume 2)

Equipment Conditions:

Ballast system valve removed (WP 0167 00).

Personnel Required:

One Watercraft Engineer, 88L

THREADED BALL VALVE REPAIR**DISASSEMBLY**

1. Remove the nut (figure 1, item 1), the lockwasher (figure 1, item 2), the flat washer (figure 1, item 3), and the handle (figure 1, item 4) from the valve body (figure 1, item 5).
2. Remove the retainer (figure 1, item 6), the valve stem (figure 1, item 7), and the retainer packing (figure 1, item 8) from the valve body (figure 1, item 5). Discard the retainer packing.
3. Remove the packing (figure 1, item 9) from the valve body (figure 1, item 5). Discard the packing.
4. Remove the four bolts (figure 1, item 10) and flat washers (figure 1, item 11), and separate the end fittings (figure 1, item 12) from the valve body (figure 1, item 5).
5. Remove the packing (figure 1, item 13), the valve seats (figure 1, item 14), and the ball (figure 1, item 15) from the valve body (figure 1, item 5). Discard the packing and valve seats.

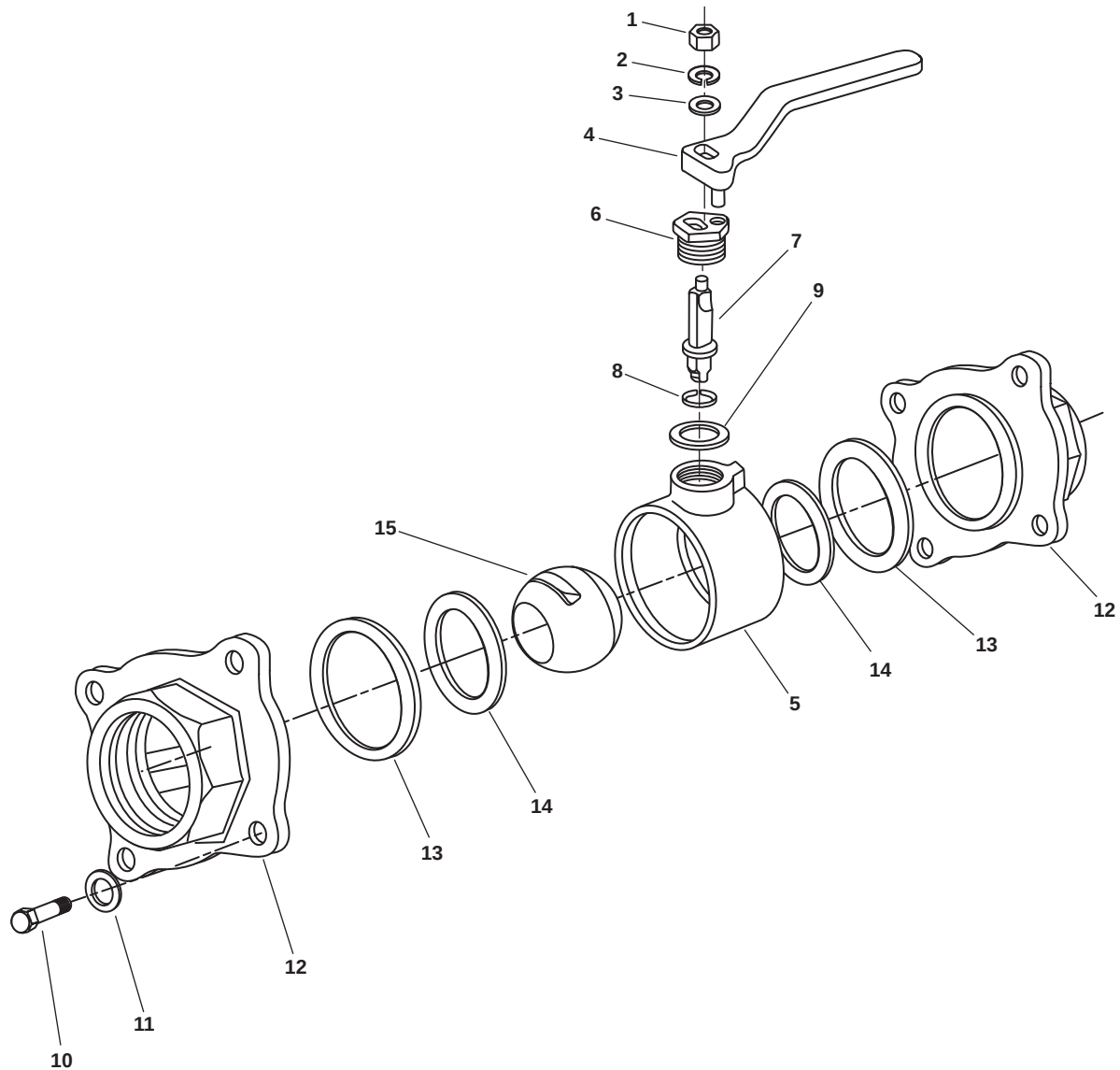


Figure 1. Threaded Ball Valve

ASSEMBLY

1. Inspect all valve components for wear and damage.
2. Clean the parts of the valve using clean wiping rags and water.
3. Install new packing (figure 1, item 13), new valve seats (figure 1, item 14), and the ball (figure 1, item 15) in the valve body (figure 1, item 5), and secure them with the four bolts (figure 1, item 10), flat washers (figure 1, item 11), and the end fittings (figure 1, item 12).
4. Install new packing (figure 1, item 9) in the valve body (figure 1, item 5).
5. Install the valve stem (figure 1, item 7) and new retainer packing (figure 1, item 8) in the valve body (figure 1, item 5), and secure them with the retainer (figure 1, item 6).

6. Install the handle (figure 1, item 4) on the valve body (figure 1, item 5) and secure it with the nut (figure 1, item 1), a new lockwasher (figure 1, item 2), and the flat washer (figure 1, item 3).
7. Perform the applicable installation procedure for the affected valve (WP 0167 00).

FLANGED STOP CHECK VALVE REPAIR

DISASSEMBLY

1. Remove the nut (figure 2, item 1) and the handle (figure 2, item 2) from the valve body (figure 2, item 3).
2. Remove the retainer nut (figure 2, item 4) and the packing gland (figure 2, item 5) from the valve body (figure 2, item 3). Discard the packing gland.
3. Remove the bolts (figure 2, item 6), the stem (figure 2, item 7), and the stem packing (figure 2, item 8) from the valve body (figure 2, item 3). Discard the stem packing.
4. Remove the bolts (figure 2, item 9), and remove the access cover (figure 2, item 10), and the packing gland (figure 2, item 11) from the valve body (figure 2, item 3).
5. Remove the valve disk (figure 2, item 12) and the valve seat (figure 2, item 13) from the valve body (figure 2, item 3). Discard the valve disk and valve seat.

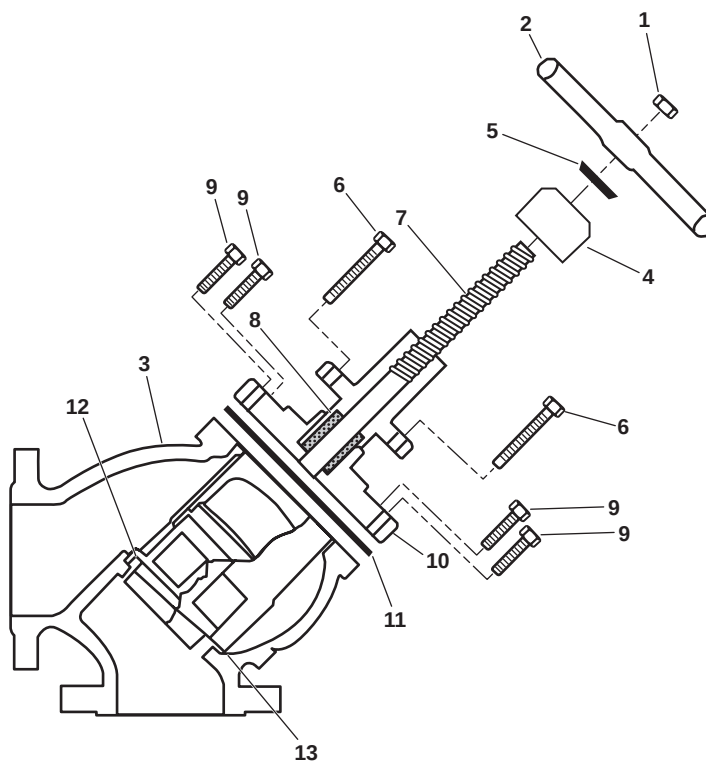


Figure 2. Flanged Stop Check Valve

ASSEMBLY

1. Inspect all valve components for wear and damage.
2. Clean the parts of the valve (figure 2, item 1) using clean wiping rags and water.
3. Install a new valve seat (figure 2, item 13) and a new valve disk (figure 2, item 12) in the valve body (figure 2, item 3).
4. Install a new packing gland (figure 2, item 11) on the access cover (figure 2, item 10) and secure the access cover to the valve body (figure 2, item 3) with the bolts (figure 2, item 9).
5. Install the stem (figure 2, item 7) and new stem packing (figure 2, item 8) on the valve body (figure 2, item 3) and secure it with the bolts (figure 2, item 6).
6. Install a new packing gland (figure 2, item 5) in the retainer nut (figure 2, item 4) and install the retainer nut on the valve body (figure 2, item 3).
7. Install the handle (figure 2, item 2) on the valve body (figure 2, item 3) and secure it with the nut (figure 2, item 1).
8. Perform the applicable installation procedure for the affected valve (WP 0167 00).

FLANGED CHECK VALVE REPAIR

DISASSEMBLY

1. Remove the nuts (figure 3, item 1) and bolts (figure 3, item 2), and remove the cover (figure 3, item 3) from the valve body (figure 3, item 4).
2. Remove the gasket (figure 3, item 5) from the cover (figure 3, item 3). Discard the gasket.
3. Remove the valve hinge pin (figure 3, item 6) and valve seat (figure 3, item 7). Discard the valve seat.
4. Remove the plug (figure 3, item 8) from the valve body (figure 3, item 4).

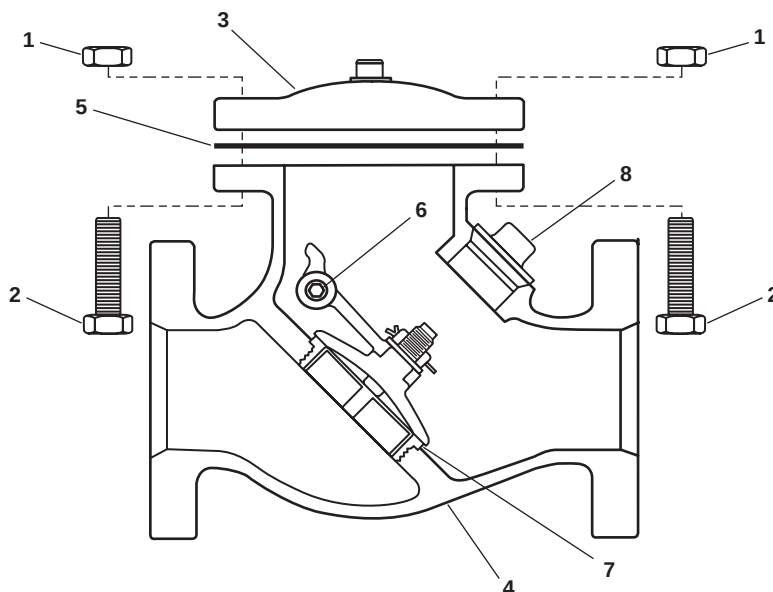


Figure 3. Flanged Check Valve

ASSEMBLY

1. Inspect all valve components for wear and damage.
2. Clean the parts of the valve (figure 3, item 1) using clean wiping rags and water.
3. Install a new valve seat (figure 3, item 7) and secure it inside the valve body (figure 3, item 4) with the valve hinge pin (figure 3, item 6).
4. Install a new gasket (figure 3, item 5) on the cover (figure 3, item 3) and secure it to the valve body (figure 3, item 4) with the nuts (figure 3, item 1) and bolts (figure 3, item 2).
5. Install the plug (figure 3, item 8) in the valve body (figure 3, item 4).
6. Perform the applicable installation procedure for the affected valve (WP 0167 00).

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BALLAST PUMP, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the BILGE PUMP No. 1 circuit breaker at the emergency switchboard or the BILGE PUMP No. 2 circuit breaker at the main switchboard. 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.

BALLAST PUMP HARDWARE REPLACEMENT**REMOVAL**

1. Inspect for any damaged, corroded or missing fasteners at the flanges and at the foundation.
2. Remove the nuts (figure 1, item 1), lockwashers (figure 1, item 2), flat washers (figure 1, items 3 and 4), and bolts (figure 1, item 5). Discard the lockwashers and any damaged or corroded fasteners.
3. Remove the bolts (figure 1, item 6) and nuts (figure 1, item 7). Discard any damaged or corroded fasteners.
4. Remove the bolts (figure 1, item 8) and nuts (figure 1, item 9). Discard any damaged or corroded fasteners.

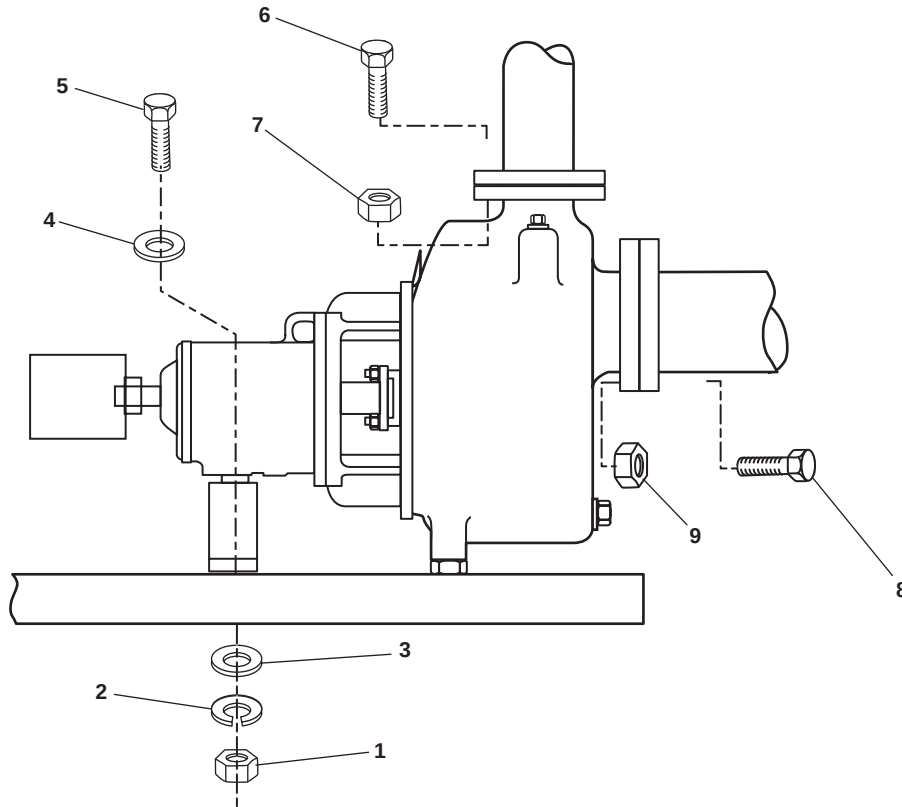


Figure 1. Ballast Pump Hardware Replacement

INSTALLATION

1. Install the bolts (figure 1, item 5), flat washers (figure 1, items 3 and 4), new lockwashers (figure 1, item 2), and nuts (figure 1, item 1).
2. Install bolts (figure 1, item 6 or 8) and nuts (figure 1, item 7 or 9).
3. Perform the Follow-On Service procedure at the end of this work package.

STRAINER HARDWARE REPLACEMENT

REMOVAL

1. Inspect for any damage, corroded or missing fasteners at the flanges and at the foundation.
2. Remove the nuts (figure 2, item 1), lockwashers (figure 2, item 2), flat washers (figure 2, items 3 and 4), and bolts (figure 2, item 5). Discard the lockwashers and any damaged or corroded fasteners.
3. Remove the nuts (figure 2, item 6) and bolts (figure 2, item 7). Discard any damaged or corroded fasteners.
4. Remove the bolts (figure 2, item 8) and nuts (figure 2, item 9). Discard any damaged or corroded fasteners.

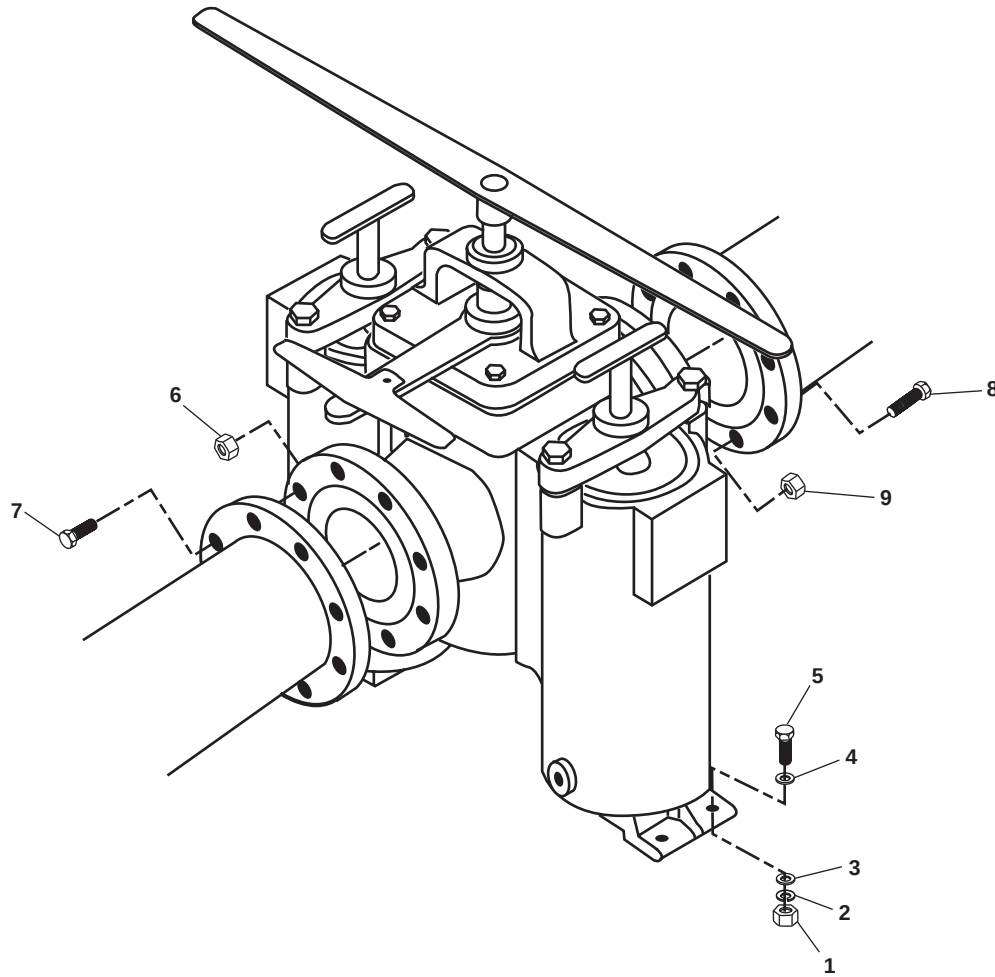


Figure 2. Strainer Hardware Replacement

INSTALLATION

1. Install the bolts (figure 2, item 5), and flat washers (figure 2, items 3 and 4), new lockwashers (figure 2, item 2), and nuts (figure 2, item 1).
2. Install the bolts (figure 2, item 7) and nuts (figure 2, item 6).
3. Install the bolts (figure 2, item 8) and nuts (figure 2, item 9).
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. Set the applicable circuit breaker to ON.
3. Operate the bilge/ballast pump under usual conditions (TM-55-1925-273-10).

4. Check for leaks and proper operation of the bilge/ballast system.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BALLAST PUMP, PUMP END; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Chain Hoist (Item 7, Table 2, WP 0295 00, Volume 2)
Sling, Endless (Item 10, Table 2, WP 0295 00, Volume 2)
Suitable Drain Pan

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0171 00
WP 0295 00
WP 0307 00

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)

Equipment Conditions:

Electric motor removed (WP 0171 00).
For ballast pump No. 1, CLOSE valves BB-26 B/B PMP No. 1 BLST. SUCT, BB-29 B/B PMP No. 1 BILGE SUCT., and BB-34 B/B PMP No. 1 OVBD DISCH. Lock out and tag out (FM 55-502).
For ballast pump No. 2, CLOSE valves BB-27 B/B PMP No. 2 BLST. SUCT, BB-30 B/B PMP No. 2 BILGE SUCT, and BB-32 B/B PMP No. 2 OVBD DISCH. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

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.

REMOVAL

1. Place a suitable drain pan under the ballast pump (figure 1, item 1).

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.

2. Slowly open the pressure gauge fitting (figure 1, item 2) to relieve pressure from the ballast pump (figure 1, item 1).
3. After all pressure has been released, completely disconnect the pressure gauge piping (figure 1, item 2) from the ballast pump's piping.
4. Remove the four nuts (figure 1, item 3), four lockwashers (figure 1, item 4), four flat washers (figure 1, item 5), four bolts (figure 1, item 6), and four flat washers (figure 1, item 7) securing the ballast pump (figure 1, item 1) to its foundation (figure 1, item 8). Discard the lockwashers.

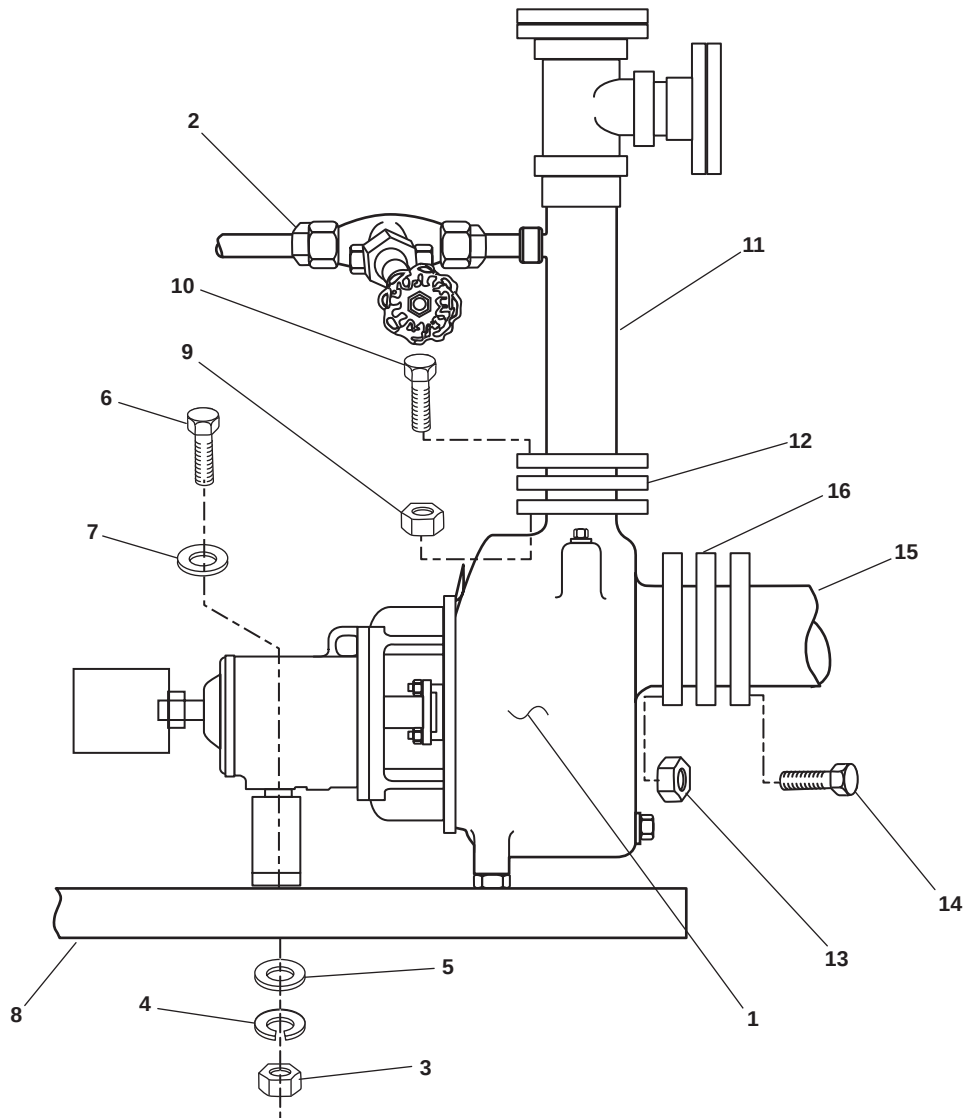


Figure 1. Ballast Pump

5. Remove the four nuts (figure 1, item 9) and four bolts (figure 1, item 10) securing the ballast pump to the discharge piping (figure 1, item 11).
6. Remove the gasket (figure 1, item 12) from the discharge piping (figure 1, item 11). Discard the gasket.
7. Remove the four nuts (figure 1, item 13) and four bolts (figure 1, item 14) securing the ballast pump (figure 1, item 2) to the suction piping (figure 1, item 15).
8. Remove the gasket (figure 1, item 16) from the suction piping (figure 1, item 15). Discard the gasket.

WARNING

All personnel in the vicinity of lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in serious injury or death.

9. Using the endless sling and chain hoist, remove the ballast pump (figure 1, item 1) from the foundation (figure 1, item 8).

INSTALLATION**WARNING**

All personnel in the vicinity of lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in serious injury or death.

1. Using the endless sling and chain hoist, install the ballast pump (figure 1, item 1) on its foundation (figure 1, item 8).
2. Install the four bolts (figure 1, item 6), eight flat washers (figure 1, items 5 and 7), four new lockwashers (figure 1, item 4), and four nuts (figure 1, item 3) securing the ballast pump (figure 1, item 1) to its foundation (figure 1, item 8). Do not tighten the bolts at this time.
3. Install a new gasket (figure 1, item 12) between the ballast pump (figure 1, item 1) and the discharge piping (figure 1, item 11) and install the four bolts (figure 1, item 10) and four nuts (figure 1, item 9). Do not tighten bolts at this time.
4. Install a new gasket (figure 1, item 16) between the ballast pump (figure 1, item 1) and the suction piping (figure 1, item 15) and install the four bolts (figure 1, item 14) and four nuts (figure 1, item 13). Do not tighten bolts at this time.
5. Tighten the four bolts (figure 1, item 6), securing the ballast pump (figure 1, item 1) to its foundation (figure 1, item 8).
6. Tighten the four bolts (figure 1, item 10) and the four nuts (figure 1, item 9).
7. Tighten the four bolts (figure 1, item 14) and the four nuts (figure 1, item 13).
8. Apply antiseizing tape on the male threads of the pressure gauge piping (figure 1, item 2). Connect the pressure gauge piping to the ballast pump's piping connection.
9. Install the electric motor (WP 0171 00).
10. Operate the ballast pump under usual conditions (TM 55-1925-273-10), checking for leaks and proper operation.
11. Return the ballast pump to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BALLAST PUMP, ELECTRIC MOTOR; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Sling, Endless (Item 5, Table 2, WP 0295 00, Volume 2)
Chain Hoist (Item 7, Table 2, WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

For ballast Pump No.1, set to OFF the BILGE PUMP circuit breaker on the emergency switchboard. Lock out and tag out (FM 55-502).
For Ballast Pump No.2, set to OFF the BILGE PUMP No.2 circuit breaker on the main switchboard. 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.

REMOVAL**NOTE**

Electrical junction boxes may vary in size, shape, and mounting position of the box on the motor frame. Electrical junction box covers may vary in number and placement of screws holding the cover in place.

1. Remove the four screws (figure 1, item 1) from the electrical junction box cover (figure 1, item 2).
2. Remove the junction box cover (figure 1, item 2).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized can result in serious injury or death.

3. Using a multimeter, check for available voltage at the wiring terminals. If voltage is present, ensure that the proper circuit breaker is secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

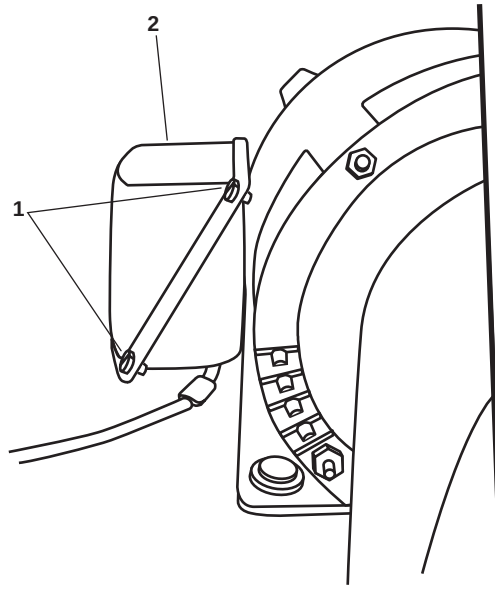


Figure 1. Electrical Junction Box

4. Label and disconnect the electrical wiring.
5. Remove the two bolts (figure 2, item 1), the two lockwashers (figure 2, item 2), and the two flat washers (figure 2, item 3) from the coupling guard (figure 2, item 4). Discard the lockwashers.

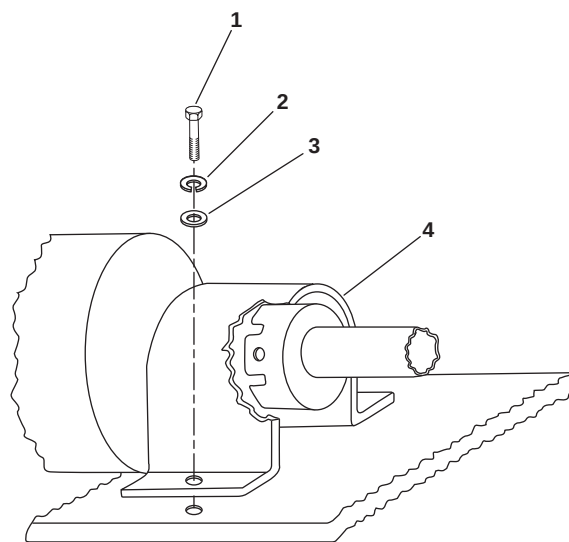


Figure 2. Coupling Guard

6. Remove the coupling guard (figure 2, item 4).
7. Loosen the motor coupling flange setscrew (figure 3, item 1).
8. Slide the motor coupling flange (figure 3, item 2) towards the motor (figure 3, item 3).
9. Remove the four bolts (figure 3, item 4), four lockwashers (figure 3, item 5), and four flat washers (figure 3, item 6). Discard the four lockwashers.

WARNING

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.

10. Using an endless sling and chain hoist to remove the motor (figure 3, item 3) from its foundation.
11. Slide the motor coupling flange (figure 3, item 2) off the motor shaft.

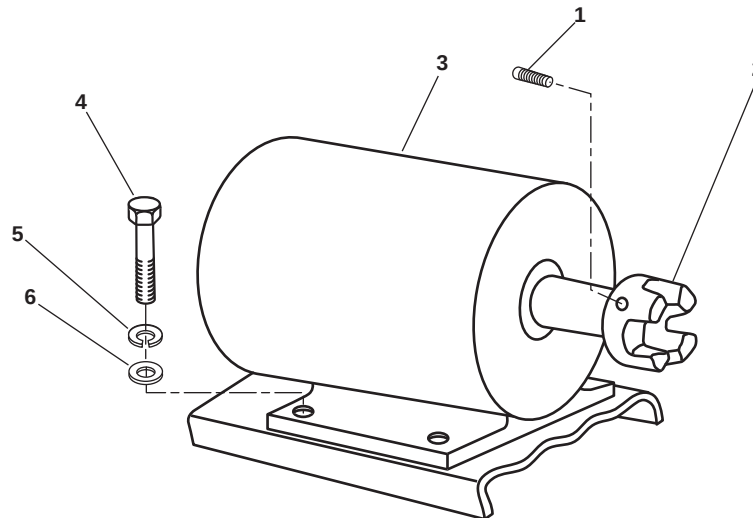


Figure 3. Electric Motor

INSTALLATION

1. Slide the motor coupling flange (figure 3, item 2) onto the motor shaft (refer to figure 3) with the flat end towards the motor (figure 3, item 3) housing.

WARNING



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.

2. Using an endless sling and chain hoist, position the motor (figure 3, item 3) on its foundation with the mounting holes aligned.
3. Install four bolts (figure 3, item 4), four new lockwashers (figure 3, item 5), and four flat washers (figure 3, item 6). Do not tighten at this time.
4. Align the pump coupling flange (figure 4, item 1) and the motor coupling flange (figure 4, item 2) together leaving approximately 0.016-inch (0.41 mm) space between the ends of both flanges. Refer to figure 4.
5. Check the alignment between the pump coupling flange (figure 4, item 1) and the motor coupling flange (figure 4, item 2).
6. The maximum angular offset shall be 1 degree and maximum parallel offset shall be 0.015 inch (0.381 mm). Refer to figure 4.

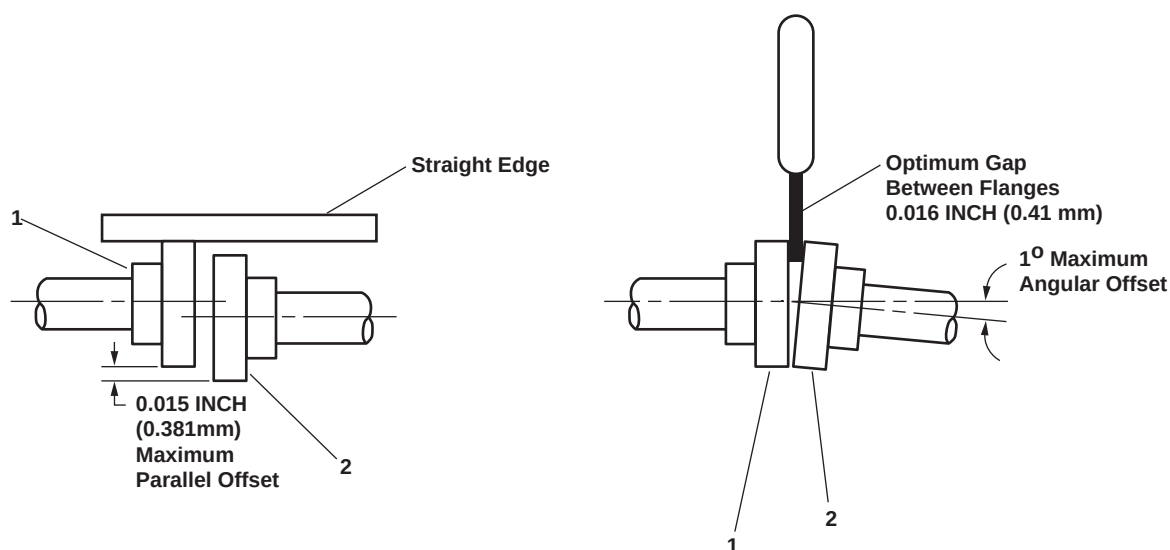


Figure 4. Alignment of Pump Coupling Flange and Motor Coupling Flange

7. Tighten the motor coupling flange setscrew (figure 3, item 1).
8. Tighten the four bolts (figure 3, item 4).
9. Install the coupling guard (figure 2, item 4) and secure it with two bolts (figure 2, item 1), two new lockwashers (figure 2, item 2), and two flat washers (figure 2, items 3). Tighten the bolts.
10. Connect the electrical wiring using the labels from step 4 of Removal as a guide. Remove the labels.
11. Install the electrical junction box cover (figure 1, item 2) and secure it with the four screws (figure 1, item 1).
12. Remove the lockouts and tagouts (FM 55-502).
13. Operate the Ballast pump under usual conditions (TM 55-1925-273-10) and check for proper operation.
14. Return the ballast pump to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
POTABLE WATER SYSTEM, VALVES; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Goggles, Industrial (Item 35, Table 2, WP 0295 00, Volume 2)
Gloves, Chemical and Oil Protective (Item 36, Table 2, WP 0295 00, Volume 2)
Suitable Drain Pan

Materials/Parts:

Rag, Wiping (Item 139, Table 1, WP 0307 00, Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)
Tape, Antiseizing (Item 175, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the HOT POTABLE WATER HEATER No. 1 and HOT POTABLE WATER HEATER No. 2 circuit breakers at the main switchboard. Lock out and tag out (FM 55-502).
Set to OFF the POTABLE WATER PUMP No. 1 and POTABLE WATER PUMP No. 2 circuit breakers at the 440V power panel No. 5. Lock out and tag out (FM 55-502).
Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP circuit breaker at the 440V power panel No. 4. Lock out and tag out (FM 55-502).
CLOSE valves upstream and downstream of the affected valve. Lock out and tag out (FM 55-502).

THREADED HOSE CONNECTION VALVE REPLACEMENT**Removal**

1. Place a suitable drain pan under the valve (figure 1, item 1) to be removed.
2. Slowly OPEN the valve (figure 1, item 1) and allow any pressure to vent and any fluid to drain into the suitable drain pan.

 CAUTION

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

3. Using the two wrench method, loosen the valve (figure 1, item 1) from the vessel piping (figure 1, item 2), and allow any remaining fluid to drain.
4. Using the two wrench method, remove the valve (figure 1, item 1) from the vessel piping (figure 1, item 2).

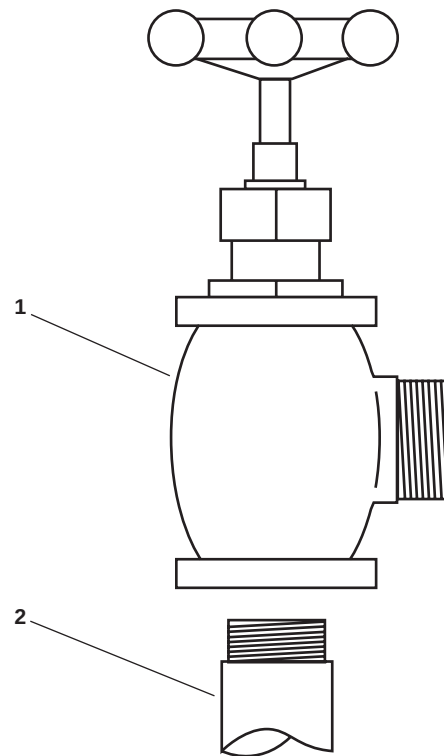
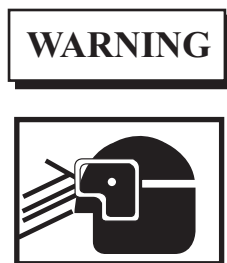


Figure 1. Threaded Hose Connection Valve

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 with this warning can result in serious injury or death to personnel.

1. Clean the threaded ends of the piping (figure 1, items 2) with a wire brush.
2. Apply antiseizing tape to the threaded ends of the piping (figure 1, items 2).

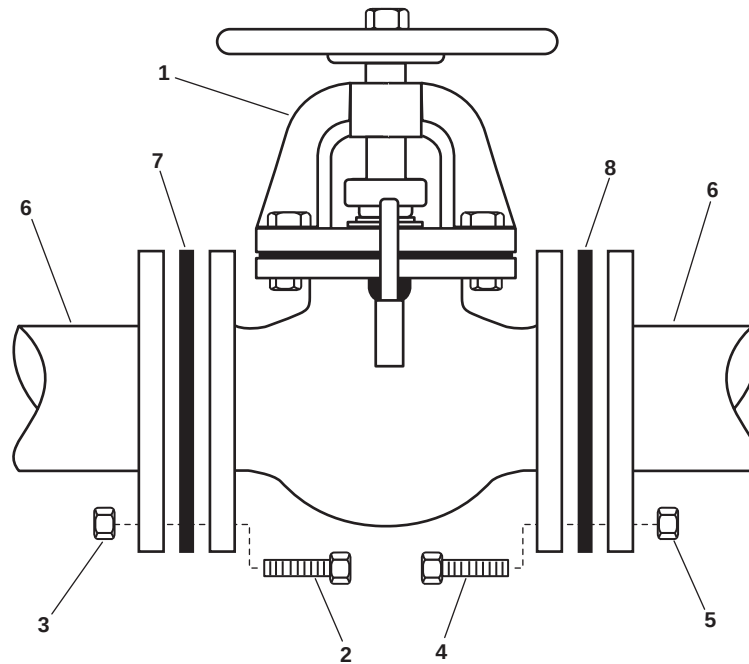
CAUTION

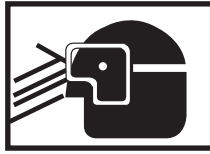
Failure to use two wrenches while tightening pipe fittings, couplings, and valves may cause damage to the valves, fittings, couplings, and piping.

3. Using the two wrench method, install the valve (figure 1, item 1) on the vessel piping (figure 1, item 2).
4. Perform the Follow-On Service procedure at the end of this work package.

FLANGED GLOBE VALVE REPLACEMENT**REMOVAL**

1. Partially OPEN the valve (figure 2, item 1) to equalize any internal pressure before removing any bolts.
2. Place a suitable drain pan under the valve (figure 2, item 1).
3. Slowly loosen the bolts (figure 2, item 2) and nuts (figure 2, item 3) on the inlet side of the valve (figure 2, item 1), and allow any pressure to vent and any liquid to drain into the suitable drain pan.
4. Remove the bolts (figure 2, item 2) and nuts (figure 2, item 3) from the inlet side of the valve (figure 2, item 1).
5. Remove the bolts (figure 2, item 4) and nuts (figure 2, item 5) from the outlet side of the valve (figure 2, item 1).
6. Remove the valve (figure 2, item 1) from the vessel piping (figure 2, item 6).
7. Remove and discard the gaskets (figure 2, items 7 and 8).

**Figure 2. Flanged Globe Valve**

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 or death to personnel.

1. Clean the flanges of the valve (figure 2, item 1) and vessel piping (figure 2, item 6) using a wire brush, clean wiping rags, and water.
2. Install the valve (figure 2, item 1) and two new gaskets (figure 2, items 7 and 8) to the vessel piping, and secure it with the bolts (figure 2, items 2 and 4) and the nuts (figure 2, items 3 and 5).
3. Perform the Follow-On Service procedure at the end of this work package.

THREADED VALVE (TYPICAL) REPLACEMENT**REMOVAL**

1. Partially OPEN the valve (figure 3, item 1) to equalize any internal pressure.
2. Place a suitable drain pan under the union (figure 3, item 2) of the valve (figure 3, item 1) to be removed.

⚠ CAUTION

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

3. Using the two wrench method, loosen the union (figure 3, item 2), and allow any pressure to vent and any fluid to drain into the suitable drain pan.

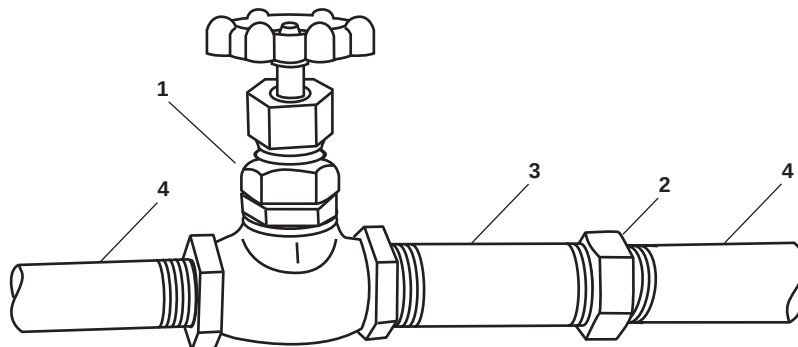
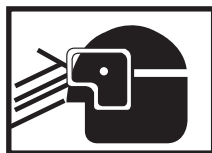


Figure 3. Threaded Valve (Typical)

4. Using the two wrench method, remove the pipe (figure 3, item 3) from the valve (figure 3, item 1).
5. Using the two wrench method, remove the valve (figure 3, item 1) from the vessel piping (figure 3, item 4).

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 or death to personnel.

1. Clean the threaded ends of the piping (figure 3, items 3 and 4) with a wire brush.
2. Apply antiseizing tape to the threaded ends of the piping (figure 3, items 3 and 4).

! CAUTION

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

3. Using the two wrench method, install the valve (figure 3, item 1) on the vessel piping (figure 3, item 4).
4. Using the two wrench method, install the pipe (figure 3, item 3) in the valve (figure 3, item 1).
5. Using the two wrench method, install the union (figure 3, item 2) to the pipe (figure 3, item 3).
6. 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. Set the circuit breakers to ON.
3. Operate the oily bilge system Under Usual Conditions (TM 55-1925-273-10).
4. Check the valve and connections for leakage and proper operation.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
POTABLE WATER SYSTEM, VALVES; REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References:

WP 0172 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Rag, Wiping (Item 139, Table 2, WP 0307 00,
Volume 2)

Equipment Conditions:

Potable water system threaded valve removed
(WP 0172 00).

Personnel Required:

One Watercraft Engineer, 88L

THREADED BALL VALVE REPAIR**DISASSEMBLY**

1. Remove the nut (figure 1, item 1), the lockwasher (figure 1, item 2), the flat washer (figure 1, item 3) and the handle (figure 1, item 4) from the valve body (figure 1, item 5).
2. Remove the retainer (figure 1, item 6) the valve stem (figure 1, item 7) and the retainer packing (figure 1, item 8) from the valve body (figure 1, item 5). Discard the retainer packing.
3. Remove the packing (figure 1, item 9) from the valve body (figure 1, item 5). Discard the packing.
4. Remove the four bolts (figure 1, item 10) and flat washers (figure 1, item 11), and separate the end fittings (figure 1, item 12) from the valve body (figure 1, item 5).
5. Remove the packing (figure 1, item 13), the valve seats (figure 1, item 14) and the ball (figure 1, item 15) from the valve body (figure 1, item 5). Discard the packing and valve seats.

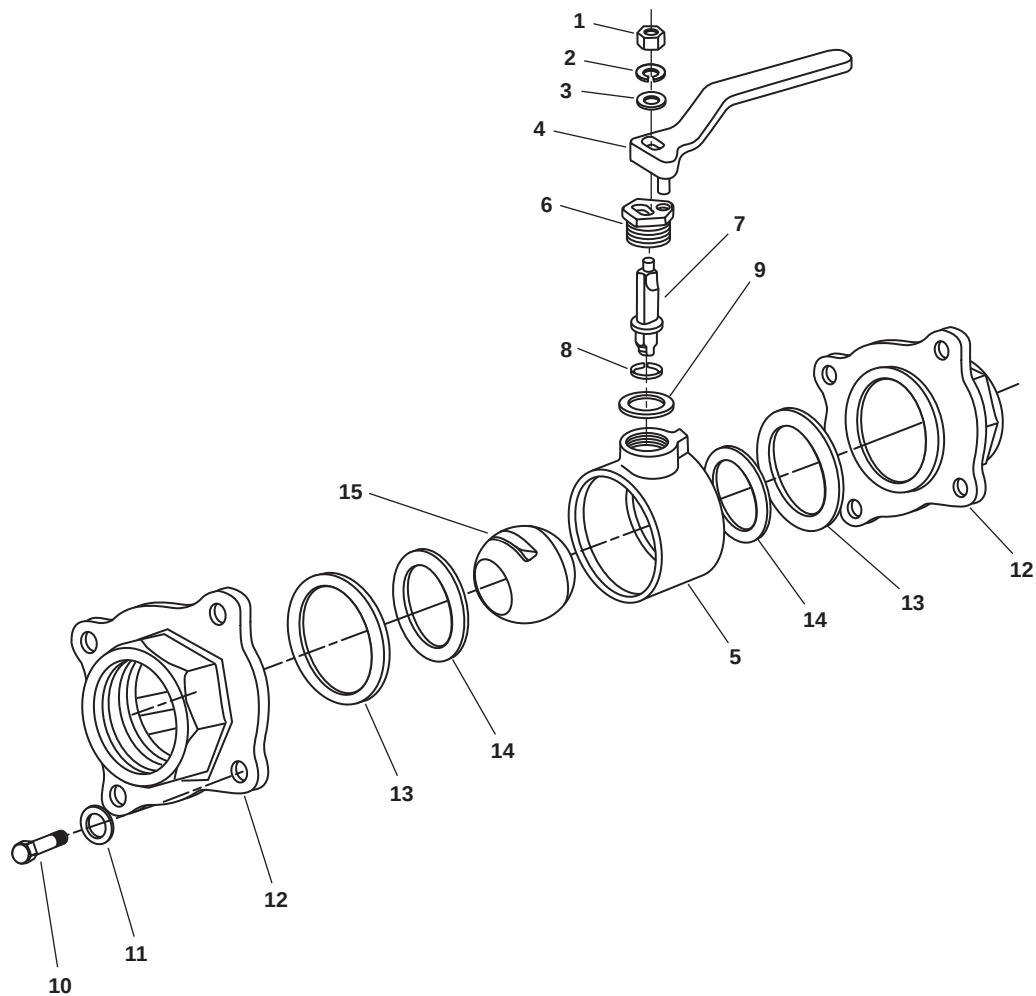


Figure 1. Threaded Ball Valve

ASSEMBLY

1. Inspect all valve components for wear and damage.
2. Clean the parts of the valve using clean wiping rags and water.
3. Install new packing (figure 1, item 13), new valve seats (figure 1, item 14) and the ball (figure 1, item 15) in the valve body (figure 1, item 5), and secure them with the four bolts (figure 1, item 10), flat washers (figure 1, item 11), and the end fittings (figure 1, item 12).
4. Install new packing (figure 1, item 9) in the valve body (figure 1, item 5).
5. Install the valve stem (figure 1, item 7) and new retainer packing (figure 1, item 8) in the valve body (figure 1, item 5), and secure them with the retainer (figure 1, item 6).
6. Install the handle (figure 1, item 4) on the valve body (figure 1, item 5), and secure it with the nut (figure 1, item 1), a new lockwasher (figure 1, item 2) and the flat washer (figure 1, item 3).
7. Perform the applicable installation procedure for the affected threaded valve (WP 0172 00).

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
POTABLE WATER PUMP, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

References (continued):

TB 43-0218
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

For potable water pump No. 1, set to OFF the POTABLE
WATER PUMP No. 1 circuit breaker in 440V power
panel No. 5. Lock out and tag out (FM 55-502).
For potable water pump No. 2, set to OFF the POTABLE
WATER PUMP No. 2 circuit breaker in 440V power
panel No. 5. Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lock wire 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

1. If questionable mounting hardware is observed, remove the four nuts (figure 1, item 1), four lockwashers (figure 1, item 2), eight flat washers (figure 1, item 3), and four bolts (figure 1, item 4). Discard the lockwashers.

NOTE

Replace only the questionable or missing mounting hardware with new hardware.

2. Install the four bolts (figure 1, item 4), eight flat washers (figure 1, item 3), four new lockwashers (figure 1, item 2), and four nuts (figure 1, item 1).
3. Remove the lockouts and tagouts (FM 55-502).
4. Return the potable water pump to the desired readiness condition.

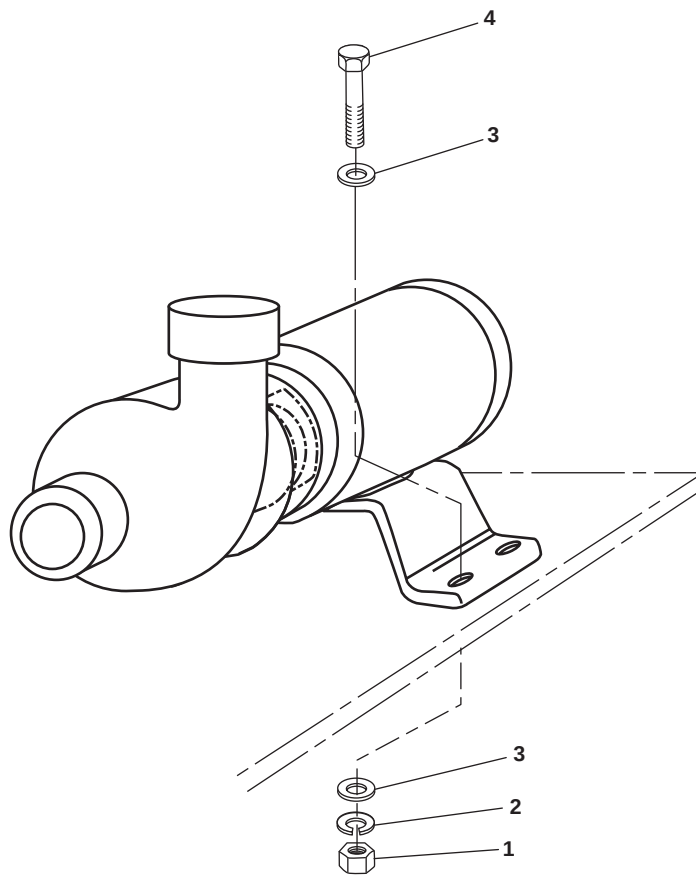


Figure 1. Potable Water Pump Hardware Replacement

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
POTABLE WATER PUMP, PUMP END; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

Materials/Parts:

Pump, Centrifugal (Item 1, Figure 88, WP 0305 00,
Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

TB 43-0218
TM 55-1925-273-10
WP 0176 00
WP 0295 00 (volume 2)
WP 0305 00 (volume 2)

Equipment Conditions:

Potable water pump and motor removed (WP 0176 00).

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.

DISASSEMBLY**NOTE**

It may be necessary to rotate the motor shaft by hand to gain access to the capscrews.

1. Loosen, but do not remove, the two exposed capscrews (figure 1, item 1).
2. Remove the four bolts (figure 1, item 2) and four lockwashers (figure 1, item 3) that secure the pump (figure 1, item 4) to the motor (figure 1, item 5). Discard the lockwashers.
3. Remove the pump (figure 1, item 4) from the motor (figure 1, item 5).

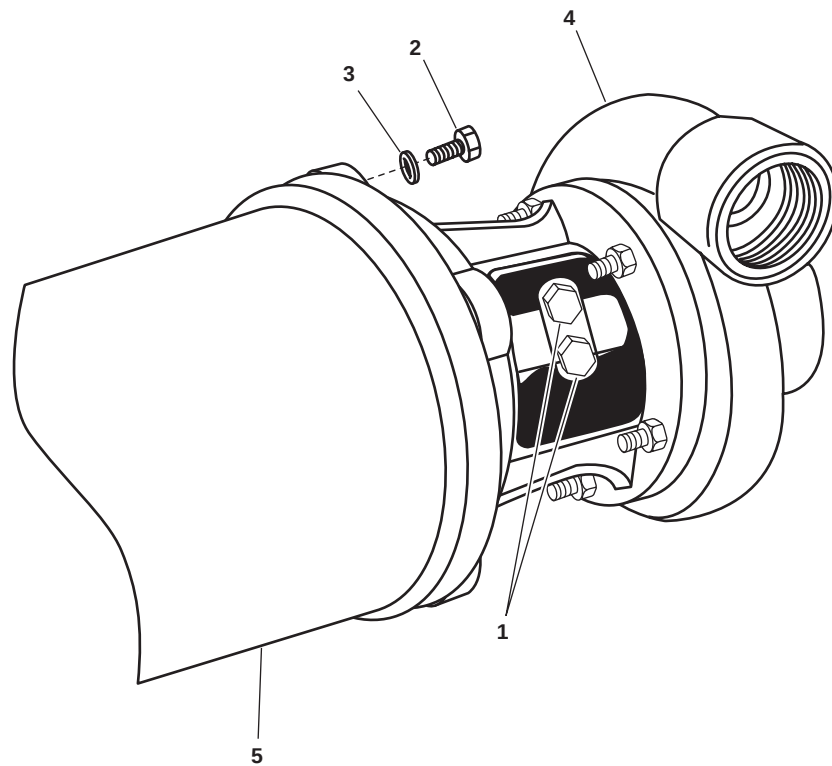


Figure 1. Potable Water Pump Assembly

ASSEMBLY

1. Install the pump (figure 1, item 4) on the motor (figure 1, item 5) using four bolts (figure 1, item 2) and four new lockwashers (figure 1, item 3).
2. Tighten the two exposed capscrews (figure 1, item 1).
3. Install the potable water pump and motor (WP 0176 00).
4. Operate the potable water pump under usual conditions (TM 55-1925-273-10).
5. Return the potable water pump to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
POTABLE WATER PUMP, ELECTRIC MOTOR; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
 WP 0295 00, Volume 2)
 Tool Kit, Electrician's (Item 11, Table 2,
 WP 0295 00, Volume 2)
 Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
 Volume 2)
 Tape, Antiseizing (Item 175, Table 1, WP 0307 00,
 Volume 2)
 Motor, Alternating C (Item 10, Figure 88,
 WP 0305 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 TB 43-0218
 TM 55-1925-273-10

References (continued):

WP 0175 00
 WP 0295 00 (volume 2)
 WP 0305 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

For potable water pump No. 1, set to OFF the POTABLE WATER PUMP No. 1. circuit breaker in 440V power panel No. 5. Lock out and tag out (FM 55-502).
 For potable water pump No. 2, set to OFF the POTABLE WATER PUMP No. 2. circuit breaker in 440V power panel No. 5. Lock out and tag out (FM 55-502).
 For potable water pump No. 1, CLOSE valves PW-16 C.O.V. -POT. WTR. PMP. No. 1 SUCT and PW-76 C.O.V. POT. WTR. PMP. No. 1 DISCH. Lock out and tag out (FM 55-502).
 For potable water pump No. 2, CLOSE valves PW-17 C.O.V. -POT. WTR. PMP. No. 2 SUCT and PW-77 C.O.V. POT. WTR. PMP. No. 2 DISCH. 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.

POTABLE WATER PUMP AND MOTOR ASSEMBLY REPLACEMENT**REMOVAL**

1. Remove the four screws (figure 1, item 1) and remove the junction box cover (figure 1, item 2) from the junction box (figure 1, item 3).

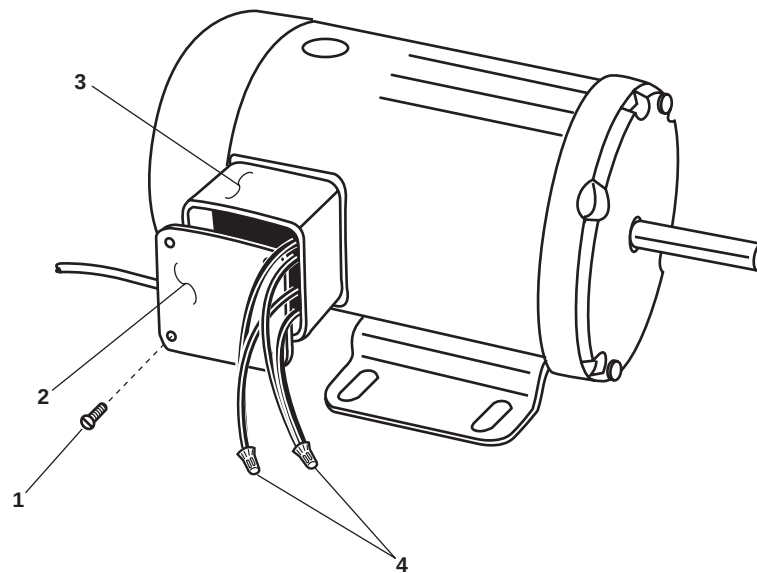


Figure 1. Potable Water Pump Motor and Junction Box

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in injury or death.

2. Use a multimeter to check for voltage at the wiring (figure 1, item 4). If voltage is present, ensure that the proper circuit breaker is secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label, disconnect, and remove the wiring (figure 1, item 4) from the junction box (figure 1, item 3).

⚠ CAUTION

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

4. Disconnect the inlet union (figure 2, item 1) and outlet union (figure 2, item 2) from the potable water pump (figure 2, item 3) using the two wrench method.
5. Remove the four bolts (figure 2, item 4), four nuts (figure 2, item 5), and four lockwashers (figure 2, item 6) that secure the motor (figure 2, item 7) to the mounting plate (figure 2, item 8). Discard the lockwashers.

6. Remove the entire potable water pump (figure 2, item 3) and attached motor (figure 2, item 7) to a suitable work area.
7. Disconnect the inlet fitting (figure 2, item 9) and outlet fitting (figure 2, item 10) from the potable water pump (figure 2, item 3).
8. Remove the potable water pump (figure 2, item 3) from the motor (figure 2, item 7) (WP 0175 00).

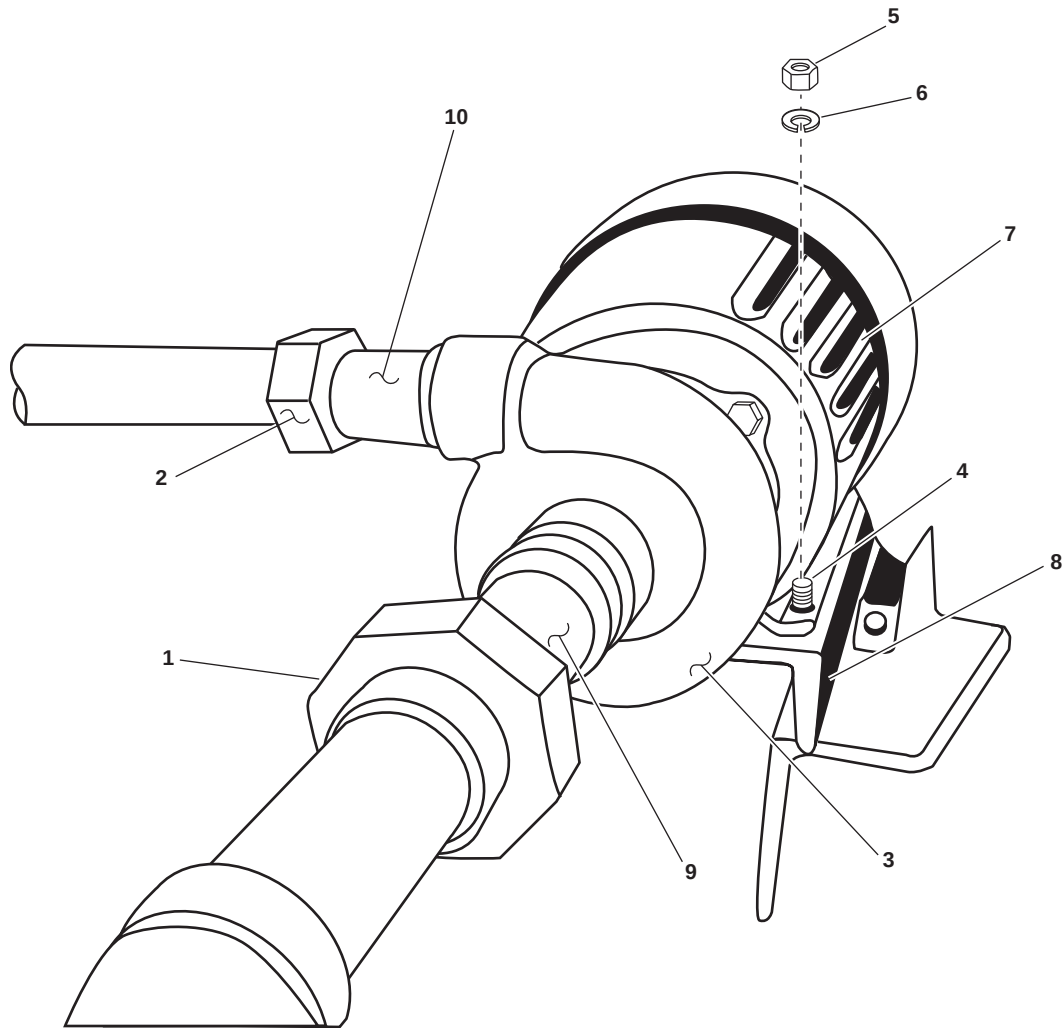
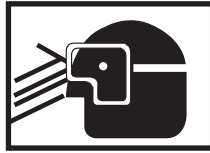


Figure 2. Potable Water Pump, Fittings, and Fasteners

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. Clean the male pipe threads of the inlet fitting (figure 2, item 9) and outlet fitting (figure 2, item 10) with a wire brush.
2. Wrap the male pipe threads with of the inlet fitting (figure 2, item 9) and outlet fitting (figure 2, item 10) with antiseizing tape.
3. Install the inlet fitting (figure 2, item 9) and outlet fitting (figure 2, item 10) on the potable water pump (figure 2, item 3).
4. Install the potable water pump (figure 2, item 3) on the motor (figure 2, item 7) (WP 0175 00).
5. Position the potable water pump (figure 2, item 3) and attached motor (figure 2, item 7) on the mounting plate (figure 2, item 8).

! CAUTION

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

6. Tighten the inlet union (figure 2, item 1) and outlet union (figure 2, item 2) on the pump (figure 2, item 3) using the two wrench method.
7. Secure the potable water pump (figure 2, item 3) and attached motor (figure 2, item 7) to the mounting plate (figure 2, item 8) with the four bolts (figure 2, item 4), four nuts (figure 2, item 5), and four new lockwashers (figure 2, item 6).
8. Install and connect the wiring (figure 1, item 4) in the junction box (figure 1, item 3), using the labels from step 3 of Removal as a guide. Remove the labels.
9. Install the junction box cover (figure 1, item 2) on the junction box (figure 1, item 3) using the four screws (figure 1, item 1).
10. Remove the lockouts and tagouts (FM 55-502).
11. Operate the potable water pump under usual conditions (TM 55-1925-273-10).
12. Check for leaks and proper operation.
13. Return the potable water pump to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HYDROPNEUMATIC TANK, REPLACE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Suitable Drain Pan

Personnel Required:

One Watercraft Engineer, 88L

References:

TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Rag, Wiping (Item 139, Table 1, WP 0307 00,
Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Tape, Antiseizing (Item 175, Table 1, WP 0307 00,
Volume 2)

PRESSURE GAUGE REPLACEMENT**REMOVAL**

1. CLOSE the gauge shutoff valve (figure 1, item 1).
2. Remove the pressure gauge (figure 1, item 2) from the fitting (figure 1, item 3).

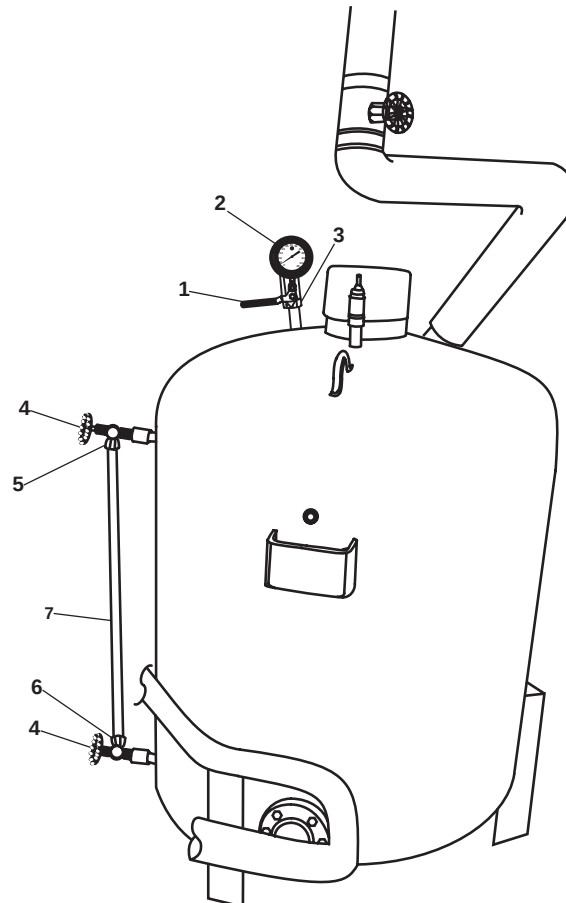


Figure 1. Hydropneumatic Tank

INSTALLATION

1. Apply antiseizing tape to the male pipe threads of the new pressure gauge (figure 1, item 3).
2. Install the new pressure gauge (figure 1, item 2) into the fitting (figure 1, item 3).
3. OPEN the gauge shutoff valve (figure 1, item 1), checking for proper operation and leakage.

SIGHT GLASS REPLACEMENT**REMOVAL**

1. CLOSE the sight glass shutoff valves (figure 1, item 4).
2. Loosen the top compression nut (figure 1, item 5).
3. Loosen the bottom compression nut (figure 1, item 6) and remove the sight glass (figure 1, item 7). Discard the sight glass and the two compression sleeves. Retain the compression nuts.

INSTALLATION

1. Install the compression nuts (figure 1, items 5 and 6) and the new compression sleeve on the top and bottom of the new sight glass (figure 1, item 7).
2. Install the new sight glass (figure 1, item 7) in the shutoff valves (figure 1, item 4) and tighten the compression nuts (figure 1, items 5 and 6).
3. OPEN the sight glass shutoff valve (figure 1, item 4) and check the sight glass (figure 1, item 7) for leaks and proper operation.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HYDROPNEUMATIC TANK, PRESSURE SWITCH; REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Materials/Parts:

Rag, Wiping (Item 139, Table 1, WP 0307 00,
Volume 2)
Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Tape, Antiseizing (Item 175, Table 1, WP 0307 00,
Volume 2)
Switch, Pressure (Item 2, Figure 89, WP 0305 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0305 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the POTABLE WATER PUMP No. 2. and POTABLE WATER PUMP No. 1. circuit breakers in 440V power panel No. 5. Lock out and tag out (FM 55-502). Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker in 440V power panel No. 4. Lock out and tag out (FM 55-502). Close valve PW-18, HYDRO. PNEU TK INLET and PW-78, C.O.V. HYDR. PNEU TK. OUTLET. Lock out and tag out (FM 55-502).

REMOVAL

1. OPEN the hydropneumatic tank air charging connection valve (figure 1, item 1) to relieve the pressure in the hydropneumatic tank (figure 1, item 2).
2. Remove the four screws (figure 1, item 3) from the pressure switch cover (figure 1, item 4).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

3. Using a multimeter, check for voltage at the pressure switch terminals (figure 1, item 5). 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.
4. Label and disconnect the wiring (figure 1, item 6) from the pressure switch (figure 1, item 7).
5. Remove the pressure switch (figure 1, item 7) from the hydropneumatic tank (figure 1, item 2).

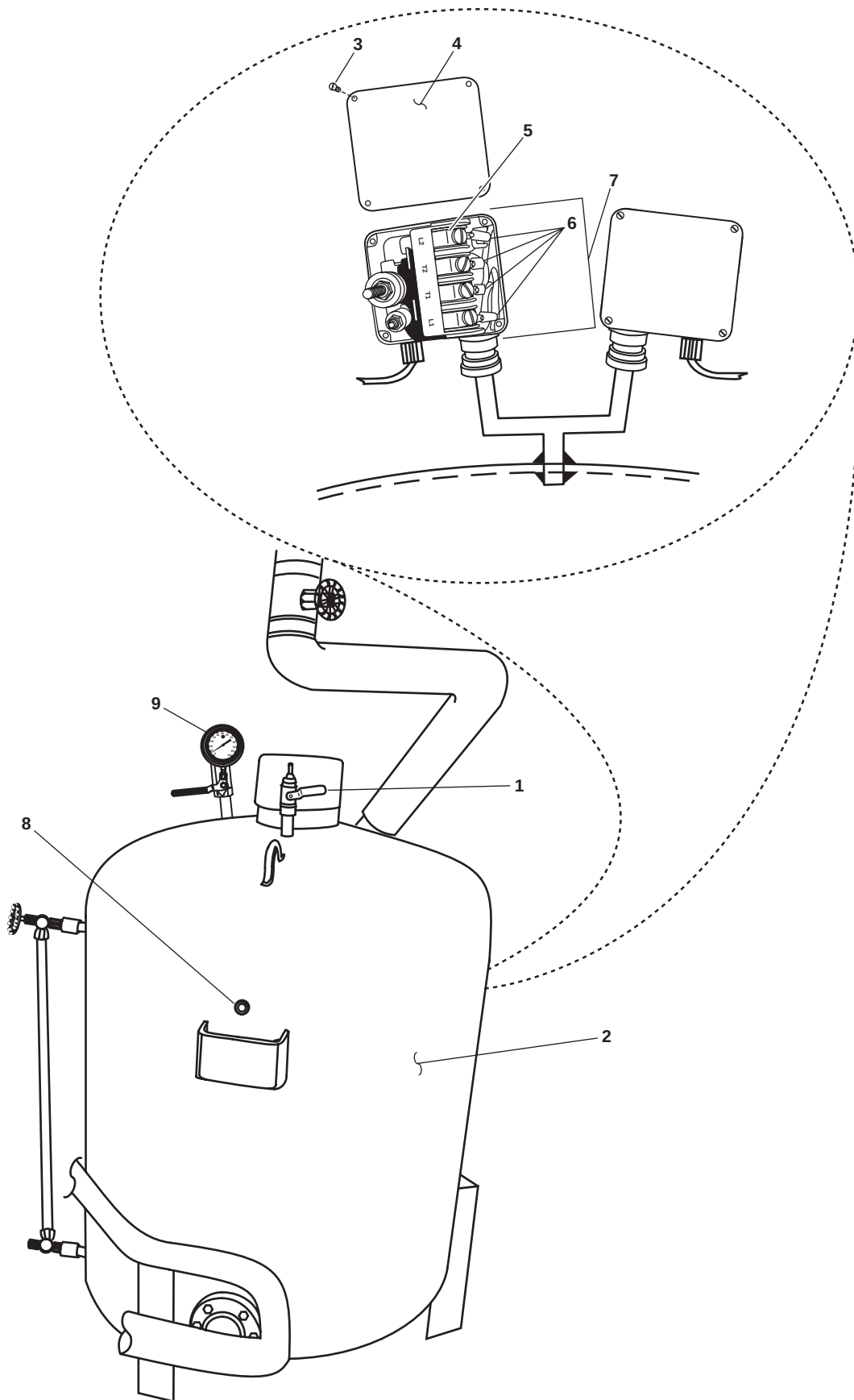


Figure 1. The Hydropneumatic Tank Pressure Switch

INSTALLATION

1. Place antiseizing tape on the male threads of the hydropneumatic tank (figure 1, item 2) pressure switch connection.
2. Install the pressure switch (figure 1, item 7) on the hydropneumatic tank (figure 1, item 2).
3. Connect the wiring (figure 1, item 6) to the pressure switch (figure 1, item 7) using the labels from step 4 of Removal as a guide. Remove the labels.
4. Pressurize the hydropneumatic tank by performing the following actions:
 - a. Verify that the hydropneumatic tank vent valve (figure 1, item 8) is CLOSED.
 - b. Connect the end of the charging air hose to the air charging connection valve (figure 1, item 1) on the hydropneumatic tank.
 - c. OPEN the air tool connection valve to supply compressed air to the pressure hose.
 - d. OPEN the air charging connection valve (figure 1, item 1) and pressurize the hydropneumatic tank (figure 1, item 2).
 - e. When the hydropneumatic pressure gauge (figure 1, item 9) indicates approximately 60 PSI (4.14 bar), CLOSE the air charging connection valve (figure 1, item 1).
 - f. CLOSE the air tool connection valve and disconnect the air hose from the hydropneumatic tank (figure 1, item 8).
5. Remove the lockouts and tagouts (FM 55-502).
6. Operate the potable water system under usual conditions (TM 55-1925-273-10) and check that the potable water pumps cycle on and off in response to the system demands.
7. Return the hydropneumatic tank to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
PROPORTIONING BROMIDE FEEDER SYSTEM, TEST

INITIAL SETUP:**Tools and Special Tools:**

Test Kit, Sanitizer (Item 30, Table 2, WP 0295 00,
Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

TM 55-1925-273-10
WP 0180 00
WP 0181 00
WP 0295 00 (volume 2)

TEST**NOTE**

Conduct this test routinely, and in conjunction with WP 0180 00, after the bromide feed cartridge is replaced.

1. Press the air-bleeder button (figure 1, item 1) to bleed all air out of the canister.
2. Operate the potable water system under usual conditions (TM 55-1925-273-10).

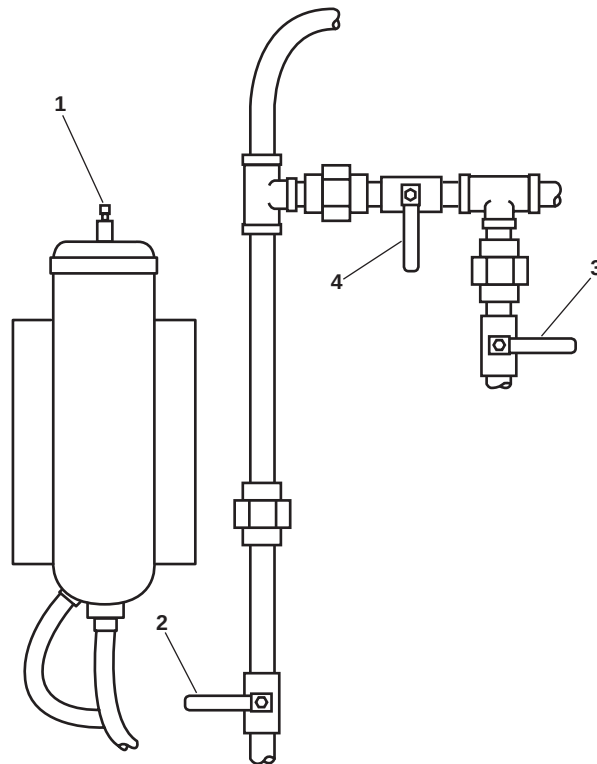


Figure 1. Brominator

3. OPEN the following valves:
 - a. PW-38, BROMINATOR OUTLET (figure 1, item 2)
 - b. PW-37, BROMINATOR INLET (figure 1, item 3)
4. Verify that valve PW-36, BYPASS-BROMINATOR (figure 1, item 4) is CLOSED.
5. Check that the CARTRIDGE CHANGE indicator light (figure 2, item 1) is not illuminated, and that the cartridge change indicator meter (figure 2, item 2) is operating.
6. Draw a sample of water from the test tap (figure 2, item 3).
7. Insert a strip of test paper into the water sample.
8. Remove the strip of test paper from the water sample and compare its color against the chart contained in the test kit.
9. If the bromine level is below acceptable limits, as determined by the chief engineer, repair the brominator (WP 0181 00). If the bromine level is above acceptable limits, notify the chief engineer, who will determine the proper course for corrective action.

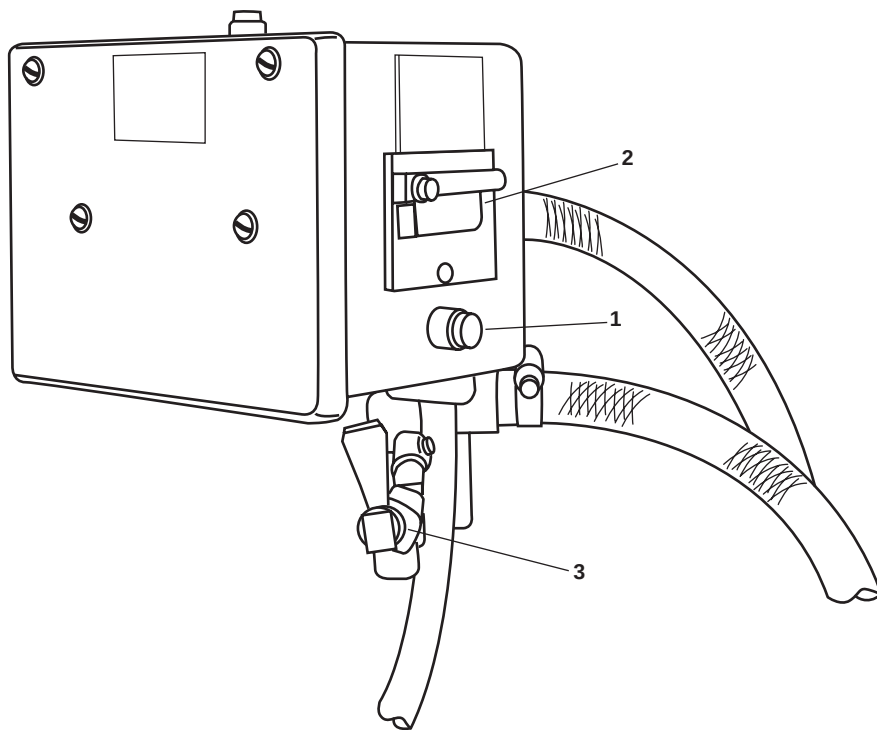


Figure 2. Brominator Cartridge Change Indicator

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
PROPORTIONING BROMIDE FEEDER SYSTEM; SERVICE, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)
Suitable Drain Pan

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Rag, Wiping (Item 139, Table 1, WP 0307 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0179 00
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the BROMINATOR. circuit breaker in 120V
emergency distribution panel No. 1. Lock out and
tag out (FM 55-502).
OPEN valve PW-36, BYPASS-BROMINATOR.
CLOSE valves PW-37, BROMINATOR INLET and PW-
38, BROMINATOR OUTLET. Lock out and tagout
(FM 55-502).

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lock wire 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.

BROMINE FEEDER CARTRIDGE REPLACEMENT**REMOVAL**

1. Place the suitable drain pan under the test tap (figure 1, item 1), and OPEN the test tap.
2. Press the AIR-BLEEDER button (figure 2, item 1) on the feeder vessel (figure 2, item 2) and allow the water to drain.
3. Loosen the T-nut (figure 2, item 3) and remove the lid retaining clamp (figure 2, item 4).
4. Remove the lid (figure 2, item 5) and discard the gasket (figure 2, item 6).
5. Remove the bromine feeder cartridge (figure 2, item 7) and allow the water to drain from the cartridge.

 CAUTION

Do not press the TIME TOTALIZER button to reset the number dials unless a new cartridge is being installed, or damage could occur to the brominator.

6. Place the bromine feeder cartridge (figure 2, item 7) in a suitable container, mark the container "PARTIALLY EX-HAUSTED CARTRIDGE," and record the date.

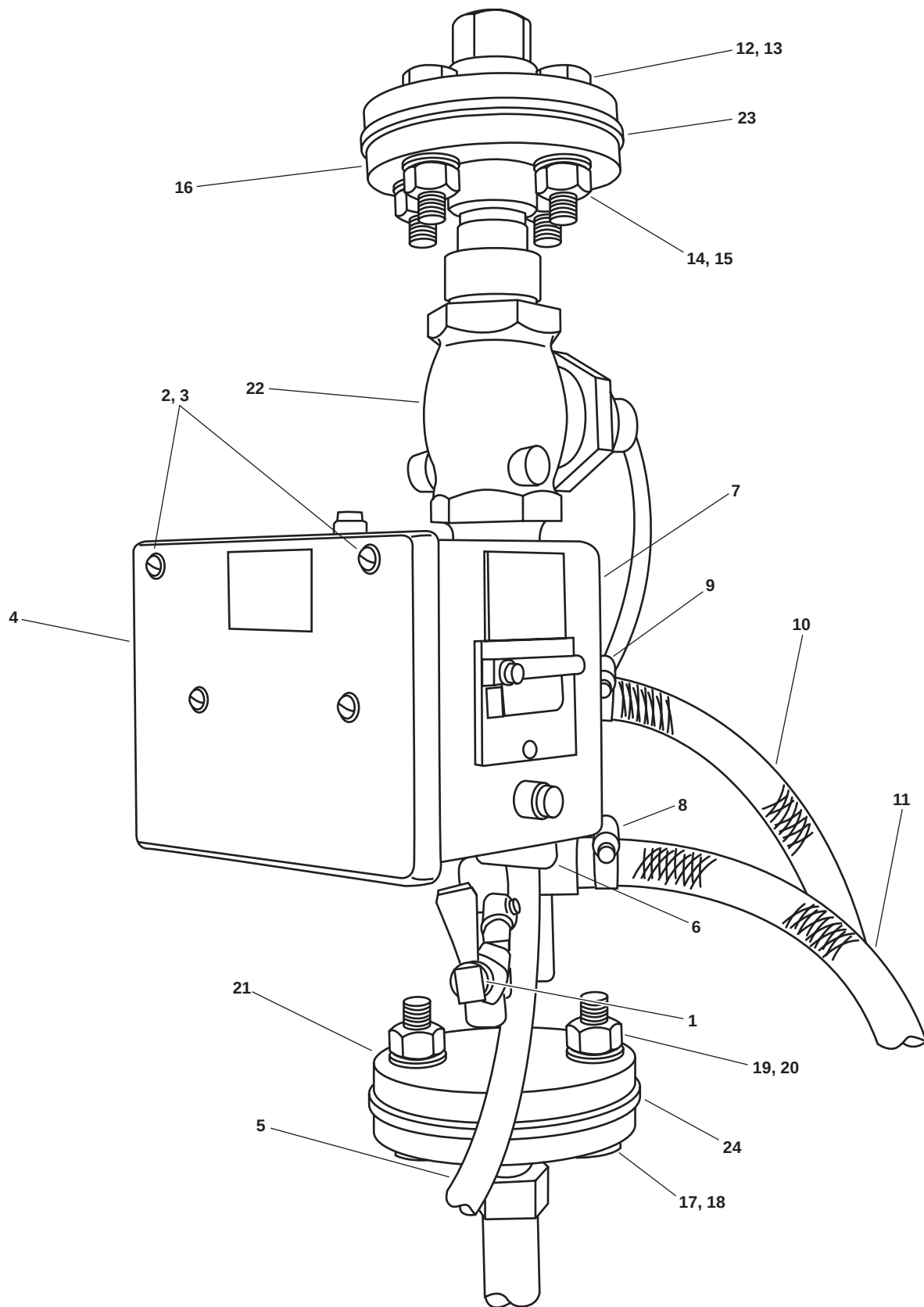


Figure 1. Cartridge Change Indicator/Brominator

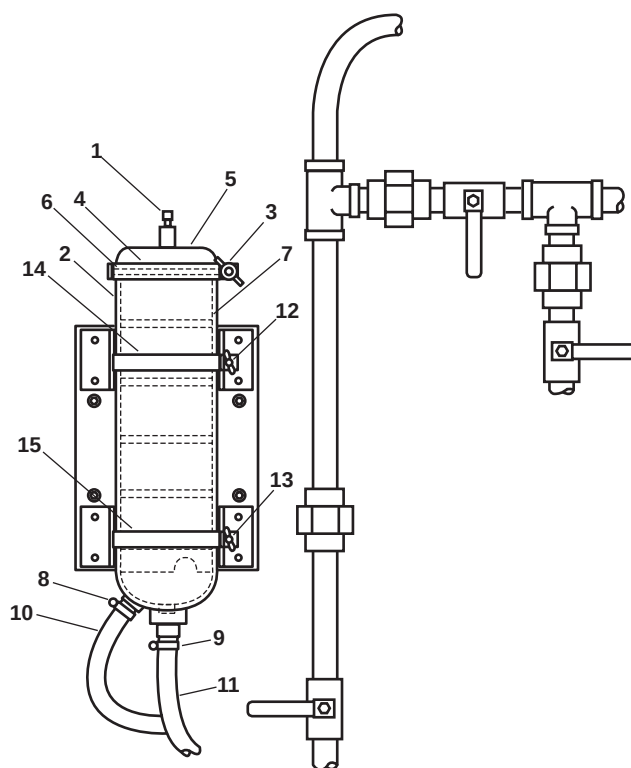


Figure 2. Brominator Feeder Assembly

7. Using clean potable water, clean all the removed metal parts. Inspect all component parts for unusual wear or damage, and replace as required.

INSTALLATION

⚠ CAUTION

Press the TIME TOTALIZER button to reset the time dial to zero only if a new bromine feeder cartridge is being installed, or damage could occur to the brominator.

1. Install the bromine feeder cartridge (figure 2, item 7) in feeder vessel (figure 2, item 2).
2. Install a new gasket (figure 2, item 6) on the lid (figure 2, item 5) and install the lid.
3. Install the lid retaining clamp (figure 2, item 4) and secure it with the T-nut (figure 2, item 3).
4. Perform the Follow-On Service procedure at the end of this work package.

CARTRIDGE CHANGE INDICATOR/BROMINATOR ASSEMBLY REPLACEMENT

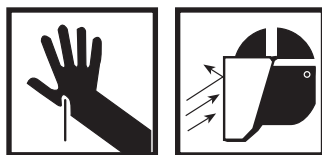
REMOVAL

1. Place the suitable drain pan under the test tap (figure 1, item 1), and OPEN the test tap.
2. Press the AIR-BLEEDER button (figure 2, item 1) on the feeder vessel (figure 2, item 2) and allow the water to drain.
3. Remove the two screws (figure 1, item 2) and two washers (figure 1, item 3), and OPEN the cartridge change indicator cover (figure 1, item 4).

WARNING

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

4. Using a multimeter, check for voltage at the wiring terminals. If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Label and disconnect the electrical wiring (figure 1, item 5).
6. Loosen the screw on the strain relief (figure 1, item 6) and remove the wiring from the cartridge change indicator (figure 1, item 7).
7. Loosen the two hose clamps (figure 1, items 8 and 9) and disconnect the hoses (figure 1, items 10 and 11). Drain the fluid from the hoses into the suitable drain pan.
8. Remove the four bolts (figure 1, item 12), four flat washers (figure 1, item 13), four lockwashers (figure 1, item 14), and four nuts (figure 1, item 15) from the brominator inlet flange (figure 1, item 16). Discard the lockwashers.
9. Remove the four bolts (figure 1, item 17), four flat washers (figure 1, item 18), four lockwashers (figure 1, item 19), and four nuts (figure 1, item 20) from the brominator outlet flange (figure 1, item 21). Discard the lockwashers.
10. Remove the brominator assembly (figure 1, item 22) from the vessel's piping and discard the gaskets (figure 1, items 23 and 24).

INSTALLATION**WARNING**

Wire brushing operations produce high velocity flying debris that can become lodged in the skin or in the eyes. Wear protective eyewear, gloves, and long sleeves when performing wire brushing operations. Failure to comply can result in serious injury to personnel.

1. Use a wire brush and clean potable water to clean the inlet flange (figure 1, item 16) and the outlet flange (figure 1, item 21) flat surfaces.
2. Install the brominator (figure 1, item 22) and new gaskets (figure 1, items 23 and 24) and secure it with the eight bolts (figure 1, items 12 and 17), eight flat washers (figure 1, items 13 and 18), eight new lockwashers (figure 1, items 14 and 19), and eight nuts (figure 1, items 15 and 20).

3. Install the hoses (figure 1, items 10 and 11) on the brominator (figure 1, item 22), and secure in place with the hose clamps (figure 1, items 8 and 9)
4. Install the wiring (figure 1, item 5) through the strain relief (figure 1, item 6) and into the cartridge change indicator (figure 1, item 7) using the labels from step 5 of Removal as a guide. Remove the labels.
5. Tighten the screw on the strain relief (figure 1, item 6).
6. Install the cartridge change indicator cover (figure 1, item 4) and secure it with the two screws (figure 1, item 2) and the two washers (figure 1, item 3).
7. Perform the Follow-On Service procedure at the end of this work package.

FEEDER ASSEMBLY REPLACEMENT

REMOVAL

1. Place the suitable drain pan under the test tap (figure 1, item 1) and OPEN the test tap.
2. Press the AIR-BLEEDER button (figure 2, item 1) on the feeder assembly (figure 2, item 2) and allow the water to drain into the suitable drain pan.
3. Loosen the clamps (figure 2, items 8 and 9) and disconnect the hoses (figure 2, items 10, and 11) from the bottom of the feeder assembly (figure 1, item 2) into the suitable drain pan.
4. Perform the Bromine Feeder Cartridge Replacement Removal procedure in this work package.
5. Loosen the upper and lower wing nuts (figure 2, items 12 and 13) and open the upper and lower retaining clamps (figure 2, items 14 and 15).
6. Remove the feeder assembly (figure 2, item 2) from the retaining clamps (figure 2, items 14 and 15).

INSTALLATION

1. Position the feeder assembly (figure 2, item 2) between the retaining clamps (figure 2, items 14 and 15) and secure it by tightening the wing nuts (figure 2, items 12 and 13).
2. Connect the hoses (figure 2, items 10 and 11) to the feeder assembly (figure 2, item 2) and secure it with the clamps (figure 2, items 8 and 9).
3. Perform the Bromine Feeder Cartridge Replacement Installation procedure in this work package.
4. Perform the Follow-On Service procedure at the end of this work package.

DUAL FEED VALVE ASSEMBLY REPLACEMENT

REMOVAL

1. Place the suitable drain pan under the test tap (figure 1, item 1) and OPEN the test tap.
2. Press the AIR-BLEEDER button (figure 2, item 1) on the feeder top assembly (figure 2, item 2) and allow the water to drain into the suitable drain pan.
3. Loosen the clamps (figure 3, items 1 and 2) that secure the hoses (figure 3, item 3 and 4) to the dual feed valve (figure 3, item 5).
4. Remove the hoses (figure 3, item 3 and 4) from the dual feed valve (figure 3, item 5) and drain the fluid into the suitable drain pan.

5. Remove the two screws (figure 3, item 6), the two locknuts (figure 3, item 7), and the two flat washers (figure 3, item 8), and remove the dual feed valve. Discard the locknuts.

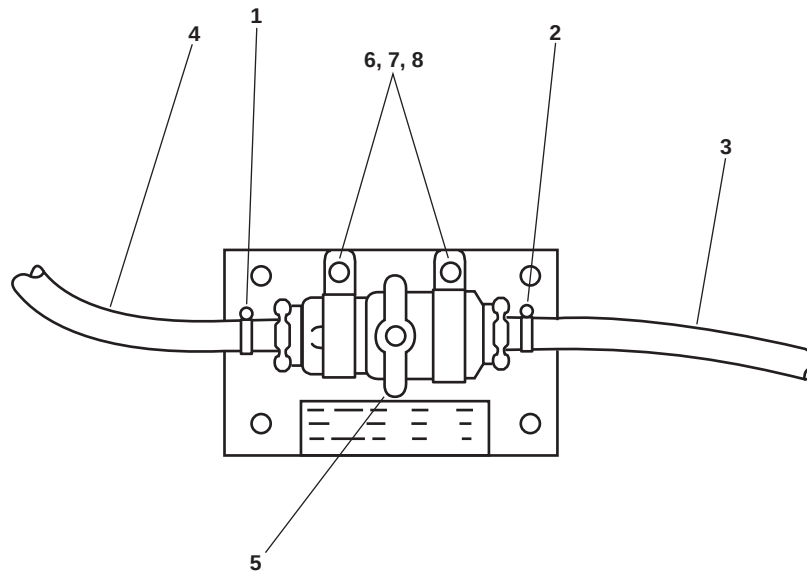


Figure 3. Dual Feed Valve Assembly

INSTALLATION

1. Install the dual feed valve (figure 3, item 5) using the two screws (figure 3, item 6), two new locknuts (figure 3, item 7), and the two flat washers (figure 3, item 8).
2. Install the hoses (figure 3, items 3 and 4) on the dual feed valve (figure 3, item 5) and secure the hoses with the two clamps (figure 3, items 1 and 2).
3. Perform the Follow-On Service procedure at the end of this work package.

FOLLOW-ON SERVICE

1. CLOSE the test tap (figure 1, item 1).
2. Remove the lockouts and tagouts (FM 55-502).
3. OPEN valves PW-37, BROMINATOR INLET and PW-38, BROMINATOR OUTLET.
4. CLOSE valve PW-36, BYPASS-BROMINATOR.
5. Operate the potable water system under usual conditions (TM 55-1925-273-10).
6. Test the brominator (WP 00 0179 00).
7. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
PROPORTIONING BROMIDE FEEDER SYSTEM, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)
Soldering Iron, Electrical (Item 21, Table 2,
WP 0295 00, Volume 2)

References:

TB 43-0218
TM 55-1925-273-10
WP 0180 00
WP 0295 00 (volume 2)
WP 0305 00 (volume 2)
WP 0307 00 (volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

Equipment Conditions:

Affected proportioning bromide feeder component removed
(WP 0180 00).

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.

LAMPS**DISASSEMBLY**

1. Unscrew and remove the light indicator lens cap (figure 1, item 1) and lamp (figure 1, item 2) from the indicator light housing (figure 1, item 3).
2. Remove the indicator light housing (figure 1, item 3) from the electrical box (figure 1, item 4).
3. Remove the two screws (figure 1, item 5) and two washers (figure 1, item 6) securing the cover (figure 1, item 7) of the electrical box (figure 1, item 4). Open the cover.
4. Remove the indicator light housing (figure 1, item 3) wires (figure 1, item 8) using a soldering iron.
5. Unscrew and remove the light indicator lens cap (figure 1, item 9) and lamp (figure 1, item 10) from the indicator light housing (figure 1, item 11).
6. Remove the indicator light housing (figure 1, item 11) wires (figure 1, item 12) using a soldering iron. Remove the indicator light housing from the time totalizer meter (figure 1, item 13).

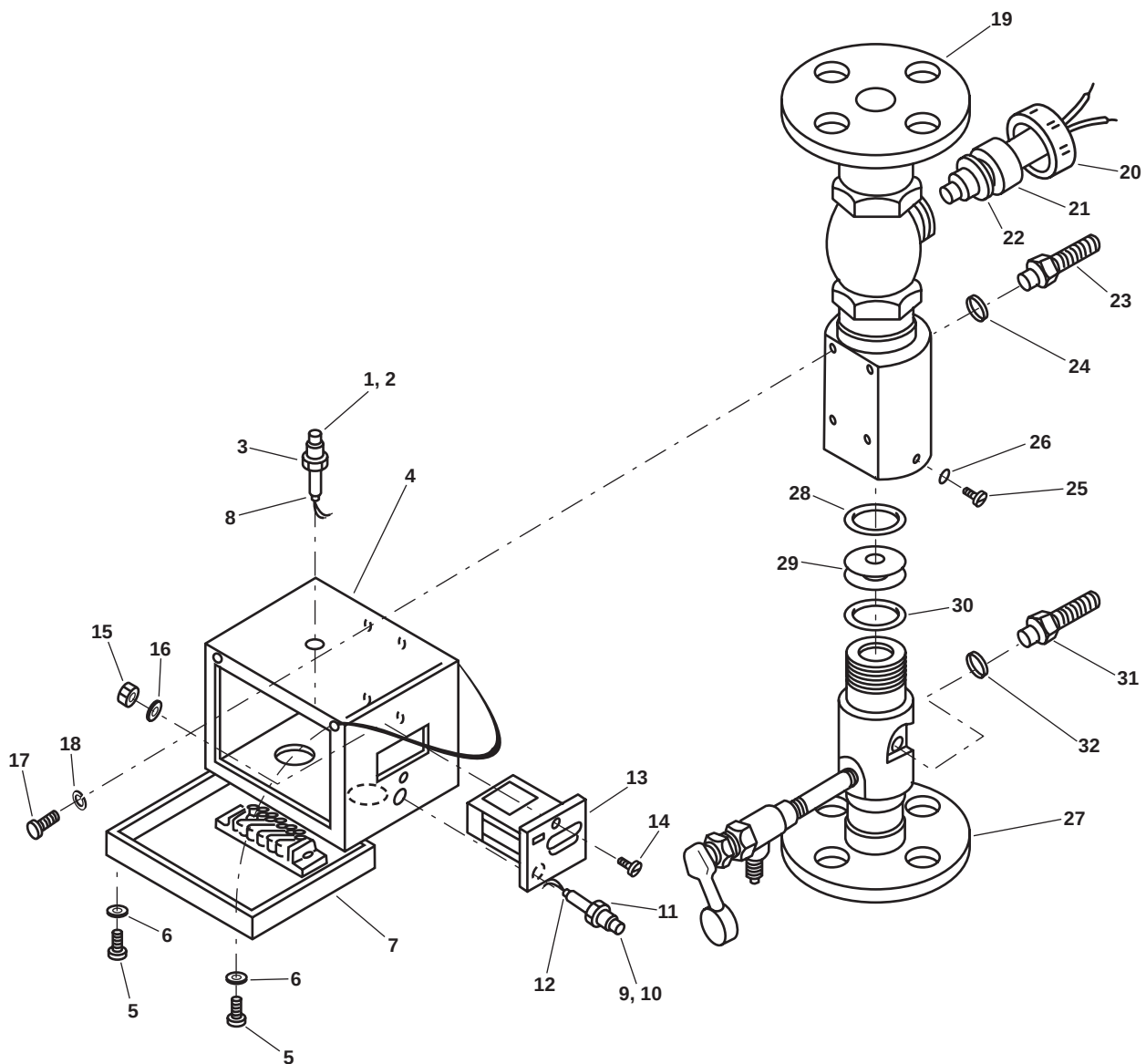


Figure 1. Bypass Header Assembly

ASSEMBLY

1. Connect the indicator light housing (figure 1, item 11) wires (figure 1, item 12) using a soldering iron. Install the indicator light housing into the time totalizer meter (figure 1, item 13).
2. Install the lamp (figure 1, item 10) into the indicator light housing (figure 1, item 11).
3. Thread the lens cap (figure 1, item 9) into the indicator light housing (figure 1, item 11) until it is finger tight.
4. Connect the indicator light housing (figure 1, item 3) wires (figure 1, item 8) using a soldering iron.
5. Install the indicator light housing (figure 1, item 3) into the electrical box (figure 1, item 4).
6. Install the lamp (figure 1, item 2) into the indicator light housing (figure 1, item 3).
7. Thread the lens cap (figure 1, item 1) onto the indicator light housing (figure 1, item 3) until it is finger tight.

8. Close the cover (figure 1, item 7) of the electrical box (figure 1, item 4) and install the two screws (figure 1, item 5) and two washers (figure 1, item 6) securing the cover of the electrical box.

TIME TOTALIZING METER

DISASSEMBLY

1. Remove the two screws (figure 1, item 14), the two nuts (figure 1, item 15), and the two flat washers (figure 1, item 16) securing the time totalizer meter (figure 1, item 13) to the electrical box (figure 1, item 4).
2. Remove the time totalizer meter (figure 1, item 13) from the electrical box (figure 1, item 4).

ASSEMBLY

1. Install the time totalizer meter (figure 1, item 13) in the electrical box (figure 1, item 4).
2. Install two screws (figure 1, item 14), two nuts (figure 1, item 15), and two flat washers (figure 1, item 16) securing the time totalizer meter (figure 1, item 13) to the electrical box (figure 1, item 4). Tighten the two screws.

ELECTRICAL BOX

DISASSEMBLY

1. Remove the four screws (figure 1, item 17) and four lockwashers (figure 1, item 18) securing the electrical box (figure 1, item 4) to the inlet plumbing assembly (figure 1, item 19). Discard the lockwasher.
2. Remove the electrical box (figure 1, item 4) from the inlet plumbing assembly (figure 1, item 19).

ASSEMBLY

1. Place the electrical box (figure 1, item 4) onto the inlet plumbing assembly (figure 1, item 19).
2. Install four screws (figure 1, item 17) and four new lockwashers (figure 1, item 18) securing the electrical box (figure 1, item 4) to the inlet plumbing assembly (figure 1, item 19). Tighten the four screws.

FLOW SENSOR

DISASSEMBLY

1. Loosen and remove the retaining nut (figure 1, item 20) securing the flow sensor (figure 1, item 21).
2. Remove the flow sensor (figure 1, item 21) from the inlet plumbing assembly (figure 1, item 19).
3. Remove the packing (figure 1, item 22) from the flow sensor (figure 1, item 21). Discard the packing.

ASSEMBLY

1. Install new packing (figure 1, item 22) on the flow sensor (figure 1, item 21).
2. Install the flow sensor (figure 1, item 21) in the inlet plumbing assembly (figure 1, item 19).
3. Thread the retaining nut (figure 1, item 20) on the inlet plumbing assembly (figure 1, item 19) securing the flow sensor (figure 1, item 21).

ADAPTERS**DISASSEMBLY**

1. Remove the adapter (figure 1, item 23) from the inlet plumbing assembly (figure 1, item 19).
2. Remove the packing (figure 1, item 24) from the adapter (figure 1, item 23). Discard the packing.

ASSEMBLY

1. Install new packing (figure 1, item 24) onto the adapter (figure 1, item 23).
2. Install the adapter (figure 1, item 23) into the inlet plumbing assembly (figure 1, item 19).

OUTLET ASSEMBLY

1. Remove the set screw (figure 1, item 25) and the lockwasher (figure 1, item 26), and separate the inlet plumbing assembly (figure 1, item 19) from the outlet plumbing assembly (figure 1, item 27). Discard the lockwasher.
2. Remove the packing (figure 1, item 28), the fixed orifice (figure 1, item 29), and the packing (figure 1, item 30) from the outlet plumbing assembly (figure 1, item 27).
3. Remove the adapter (figure 1, item 31) from the outlet plumbing assembly (figure 1, item 27).
4. Remove the packing (figure 1, item 32) from the adapter (figure 1, item 31). Discard the packing.

ASSEMBLY

1. Install new packing (figure 1, item 32) on the adapter (figure 1, item 31).
2. Install the adapter (figure 1, item 31) into the outlet plumbing assembly (figure 1, item 27).
3. Install new packing (figure 1, item 28), the fixed orifice (figure 1, item 29), and new packing (figure 1, item 30) onto the outlet plumbing assembly (figure 1, item 27).
4. Place together the inlet plumbing assembly (figure 1, item 19) and the outlet plumbing assembly (figure 1, item 27) and install the set screw (figure 1, item 25) and a new lockwasher (figure 1, item 26). Tighten the set screw.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HOT WATER HEATER, ADJUST**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

References:

WP 0295 00 (volume 2)

ADJUSTMENT**WARNING**

Take great care when working around 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 access cover (figure 1, item 1).
2. Adjust the cutout thermostat control (figure 2, item 1) to the desired temperature.

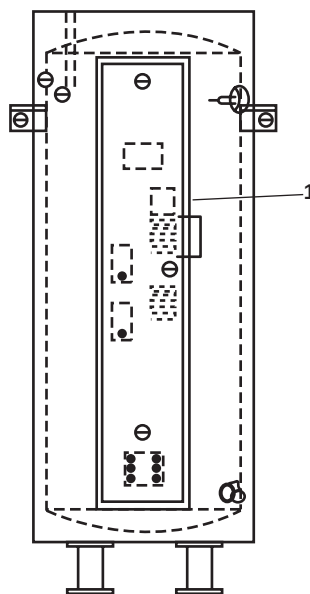


Figure 1. Hot Water Heater

3. Adjust the cutin thermostat controls (figure 2, item 2) to the desired temperature.
4. Close the access cover (figure 1, item 1).
5. Allow the water heater to operate for 60 to 90 minutes and observe the temperature reading.
6. Repeat steps 1-5 as necessary obtain the desired temperature.

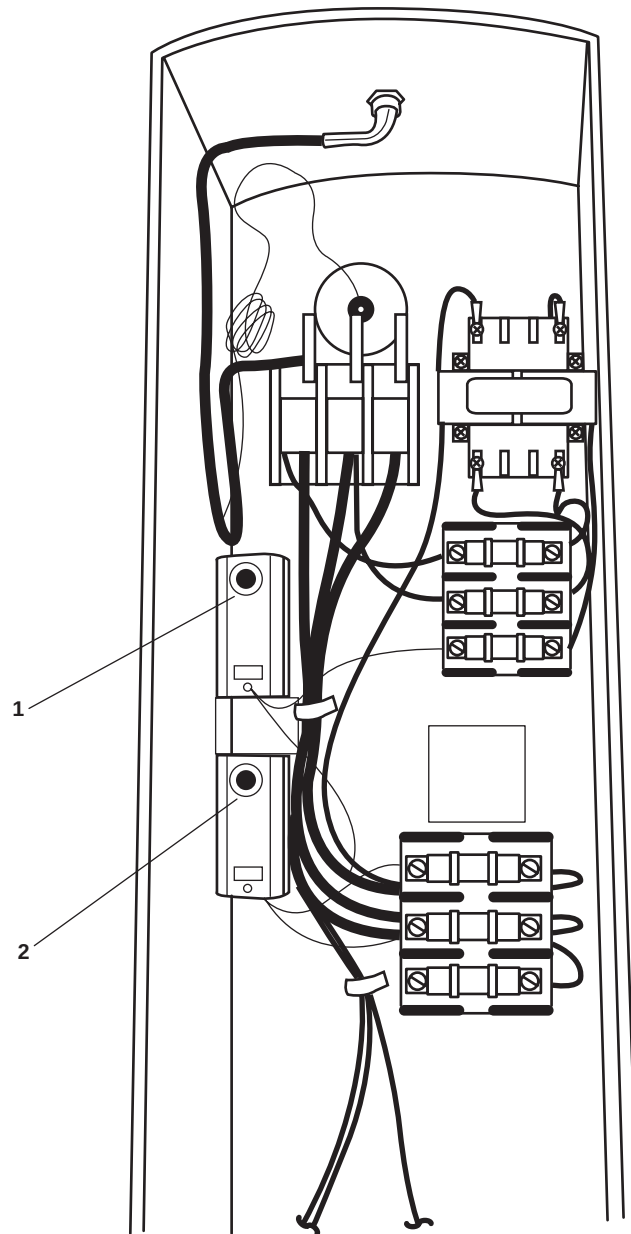


Figure 2. Water Heater Temperature Controls

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HOT WATER HEATER, REPLACE

INITIAL SETUP:**Materials/Parts:**

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

References:

FM 55-502
 WP 0182 00
 WP 0307 00 (volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

REMOVAL**NOTE**

Unit replacement consists of readying the hot water heater for removal by securing, locking out, and tagging out (FM 55-502) the applicable valves and circuit breakers. Direct support maintenance will remove and install the water heater. After installation is complete, unit maintenance must fill, test, and adjust the new hot water heater.

1. At the main switchboard in the EOS, set to OFF, lock out, and tag out (FM 55-502) the circuit breaker for the applicable hot water heater being removed. Refer to table 1 for the applicable hot water heater circuit breaker.
2. Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP, circuit breaker in 440V power panel No. 4. Lock out and tag out (FM 55-502).

Table 1. Hot Water Heater Lockout and Tagout Guide

Water Heater	Main Switchboard Circuit Breaker	Inlet Valve	Outlet Valve	Recirculating Hot Water Valve
1	HOT POTABLE WTR HTR No. 1	PW-80, POT. WTR. TO H.W. HTR	PW-82, H.W. HTR OUT	PW-44, RECIRC TO H.W. HEATER
2	HOT POTABLE WTR HTR No. 2	PW-79, POT. WTR. TO H.W. HTR.	PW-81, H.W. HTR. OUT	PW-43, RECIRC TO H.W. HEATER

3. CLOSE, lock out, and tag out (FM 55-502) the inlet, outlet, and recirculating hot water valves for the applicable hot water heater being removed. Refer to table 1 for the applicable hot water heater hot water valves.
4. Inform the unit maintenance supervisor that the hot water heater is ready for removal.

INSTALLATION

1. Verify that direct support maintenance completes the water heater installation procedure.

 CAUTION

Do not turn the hot water circuit breaker ON until the water heater tank is full of water, or damage to heater elements could occur.

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

3. Verify that the drain valve for the new hot water heater is CLOSED.
4. OPEN the vent valve (figure 1, item 1) on the applicable hot water heater to allow air to escape the tank while filling.
5. OPEN the inlet valve (table 1) on the applicable hot water heater and observe the vent valve (figure 1, item 1).
6. Allow the water heater tank to fill until a solid stream of water flows from the vent valve (figure 1, item 1).
7. CLOSE the vent valve (figure 1, item 1).
8. OPEN the applicable water heater outlet and recirculating hot water valves (table 1). Listen for any air that may pass through the hot water recirculating pump. Purge any air in the hot water piping by cycling the hot water tank vent valves (figure 1, item 1). Air may also be purged by OPENING a hot water valve in the heads or the galley.
9. Set the applicable circuit breaker (table 1) to ON.
10. Set to ON the HOT POTABLE WATER RECIRCULATING PUMP circuit breaker in 440V power panel No. 4.
11. Adjust the hot water heater cutin and cutout temperature controls (WP 0182 00).
12. Return the equipment to the desired readiness condition.

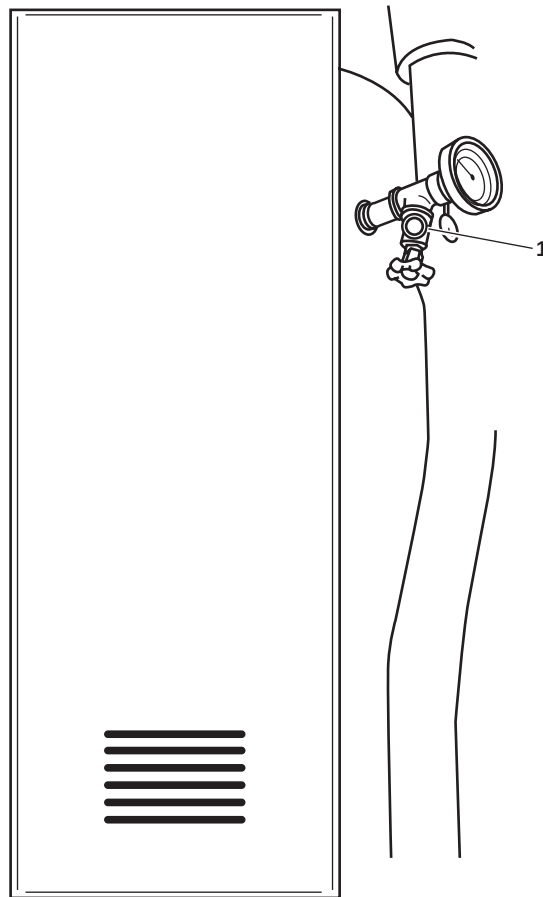


Figure 1. Water Heater Vent Valve

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HOT WATER HEATER, REPAIR

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, Electrician's (Item 11, Table 2,
 WP 0295 00 00, Volume 2)
 Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 WP 0182 00
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
 Volume 2)
 Tape, Antiseizing (Item 175, Table 1, WP 0307 00,
 Volume 2)

REPLACE FUSES**REMOVAL**

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker in 440V power panel No. 4. Lock out and tag out (FM 55-502).
2. At the main switchboard in the EOS, set to OFF, lock out, and tag out (FM 55-502) the circuit breaker for the applicable hot water heater. Refer to table 1 for the applicable circuit breaker.

Table 1. Hot Water Heater Lockout and Tagout Guide

Water Heater	Main Switchboard Circuit Breaker	Inlet Valve	Outlet Valve	Recirculating Hot Water Valve
1	HOT POTABLE WTR HTR NO. 1	PW-80, POT. WTR. TO H.W. HTR.	PW-82, H.W. HTR OUT	PW-44, RECIRC TO H.W. HEATER
2	HOT POTABLE WTR HTR NO. 2	PW-79, POT. WTR. TO H.W. HTR.	PW-81, H.W. HTR OUT	PW-43, RECIRC TO H.W. HEATER

3. Open the access door (figure 1, item 1).
4. Using a multimeter, check for voltage at the fuse (figure 1, item 2). If voltage is present, check that the proper circuit breaker (table 1) is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Using a fuse puller, remove the fuse (figure 1, item 2) from the fuse holder.



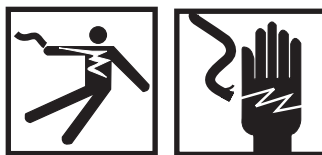
INSTALLATION

1. Using a fuse puller, install the new fuse (figure 1, item 2) in the fuse holder.
2. Close and secure the access door (figure 1, item 1).
3. Perform the Follow-On Service procedure at the end of this work package.

REPLACE HEATING ELEMENT

REMOVAL

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker in 440V power panel No. 4. Lock out and tag out (FM 55-502).
2. At the main switchboard in the EOS, set to OFF, lock out and tag out (FM 55-502) the circuit breaker for the applicable hot water heater. Refer to table 1 for the applicable circuit breaker.
3. CLOSE, lock out and tag out (FM 55-502) the inlet, outlet, and recirculating hot water valves for the applicable hot water heater. Refer to table 1 for the applicable inlet, outlet, and recirculating hot water valves.
4. Open the access door (figure 1, item 1).
5. Using a multimeter, check for voltage at the fuse (figure 1, item 2). If voltage is present, check that the proper circuit breaker (table 1) is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
6. Attach a hose to the drain valve (figure 1, item 3).
7. Lift the manual relief lever (figure 1, item 4) on the relief valve (figure 1, item 5) to let air into the tank.
8. OPEN the drain valve (figure 1, item 3) and allow the water to drain from the tank.
9. Label and disconnect the wiring from the heating element terminals (figure 1, item 6).
10. Remove the four nuts (figure 1, item 7), the heating element (figure 1, item 8), and the gasket (figure 1, item 9) from the water heater. Discard the gasket.

INSTALLATION

1. Verify that the jumper configuration on the new heating element matches the diagram in figure 2.
2. Position a new gasket (figure 1, item 9) and the heating element (figure 1, item 8) over the studs (figure 1, item 10).
3. Install the new heating element (figure 1, item 8), and secure it with the four nuts (figure 1, item 7).

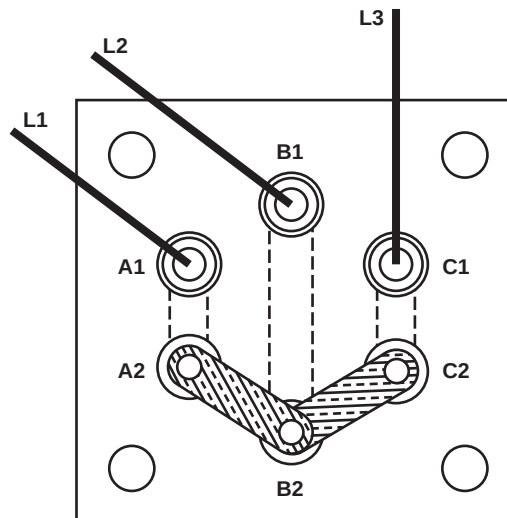


Figure 2. Heating Element Jumper Configuration

4. Connect the wiring to the new heating element terminals (figure 1, item 6) using the labels from step 9 of Removal as guide. Remove the labels.
5. Close and secure the access door (figure 1, item 1).
6. CLOSE the drain valve (figure 1, item 3) and remove the hose.
7. Remove the lockouts and tagouts (FM 55-502) from the applicable inlet valve (table 1) and OPEN the valve.
8. Fill the tank with water with the manual relief lever (figure 1, item 4) on the relief valve (figure 1, item 5) lifted.
9. When water escapes from the relief valve (figure 1, item 5), CLOSE the relief valve.
10. Perform the Follow-On Service procedure at the end of this work package.

REPLACE THERMOSTAT

REMOVAL



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker in 440V power panel No. 4. Lock out and tag out (FM 55-502).

2. At the main switchboard in the EOS, set to OFF, lock out, and tag out (FM 55-502) the circuit breaker for the applicable hot water heater. Refer to table 1 for the applicable circuit breaker.
3. Open the access door (figure 1, item 1).
4. Using a multimeter, check for voltage at the fuses (figure 1, item 2). If voltage is present, check that the proper circuit breaker (table 1) is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Remove the screw (figure 1, item 11) and remove the thermostat access cover (figure 1, item 12).
6. Remove the screws (figure 1, item 13) and label and disconnect the wire terminals (figure 1, item 14).
7. Remove the capillary tube (figure 1, item 15) from the thermo well.
8. Remove the two mounting screws (figure 1, item 16) and remove the thermostat (figure 1, item 17).

INSTALLATION

1. Install the thermostat (figure 1, item 17) and secure it with the mounting screws (figure 1, item 16).
2. Install the capillary tube (figure 1, item 15) into the thermo well.
3. Connect the wire terminals (figure 1, item 14) using the labels from step 6 of Removal as a guide. Remove the labels.
4. Install the screws (figure 1, item 13).
5. Install the thermostat access cover (figure 1, item 12), and secure it with the screw (figure 1, item 11).
6. Close and secure the access door (figure 1, item 1).
7. Perform the Follow-On Service procedure at the end of this work package.

REPLACE MAGNETIC CONTACTOR

REMOVAL



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker in 440V power panel No. 4. Lock out and tag out (FM 55-502).
2. At the main switchboard in the EOS, set to OFF, lock out, and tag out (FM 55-502) the circuit breaker for the applicable hot water heater. Refer to table 1 for the applicable circuit breaker.
3. Open the access door (figure 1, item 1).

4. Using a multimeter, check for voltage at the fuses (figure 3, item 1). If voltage is present, check that the proper circuit breaker (table 1) is locked out and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
5. Remove the fuses (figure 3, item 1) from the fuse holder (figure 3, item 2).
6. Label and disconnect the wiring (figure 3, item 3) from the fuse holder (figure 3, item 2).
7. Remove the two screws (figure 3, item 4) that secure the fuse holder (figure 3, item 2) to the magnetic contactor (figure 3, item 5) and remove the fuse holder.
8. Label and disconnect the control wiring (figure 3, item 6) from the magnetic contactor (figure 3, item 5).
9. Remove the two mounting screws (figure 3, item 7) and remove the magnetic contactor (figure 3, item 5).

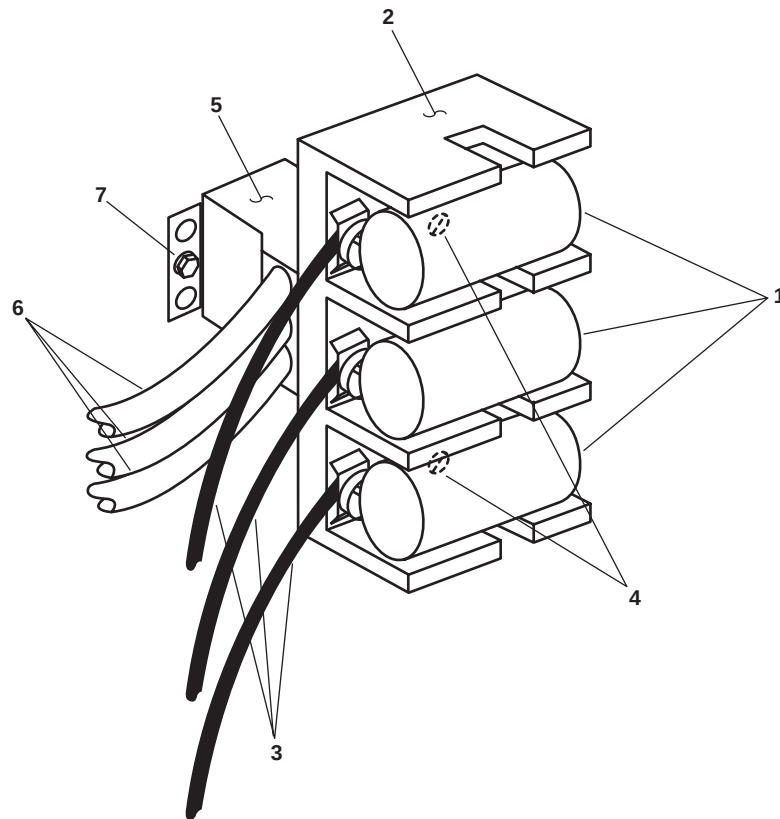


Figure 3. Magnetic Contactor/Fuse Holder

INSTALLATION

1. Install the new magnetic contractor (figure 3, item 5) and secure it with the two mounting screws (figure 3, item 7).
2. Connect the control wiring (figure 3, item 6) to the magnetic contactor (figure 3, item 5) using the labels from step 8 of Removal as a guide. Remove the labels.
3. Install the fuse holder (figure 3, item 2) and secure it to the magnetic contactor (figure 3, item 5) with the two screws (figure 3, item 4).

4. Connect the wiring (figure 3, item 3) to the fuse holder (figure 3, item 2) using the labels from step 6 of Removal as a guide. Remove the labels.
5. Close and secure the access door (figure 1, item 1).
6. Perform the Follow-On Service procedure at the end of this work package.

REPLACE THERMOMETER

REMOVAL

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

⚠ CAUTION

The elements for the hot water heaters are designed to be submerged in water when energized. Applying power to an empty hot water heater could cause damage.

1. Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker in 440V power panel No. 4. Lock out and tag out (FM 55-502).
2. At the main switchboard in the EOS, set to OFF, lock out and tag out (FM 55-502) the circuit breaker for the applicable hot water heater. Refer to table 1 for the applicable circuit breaker.
3. CLOSE, lock out and tag out (FM 55-502) the inlet, outlet, and recirculating hot water valves for the applicable hot water heater. Refer to table 1 for the applicable inlet, outlet, and recirculating hot water valves.
4. Attach a hose to the drain valve (figure 1, item 3).
5. Lift the manual relief lever (figure 1, item 4) on the relief valve (figure 1, item 5) to let air into the tank.
6. OPEN the drain valve (figure 1, item 3), and allow the water to drain from the tank.
7. Drain the water from the heater tank to a level that is below the thermometer (figure 1, item 18).
8. Unscrew the thermometer (figure 1, item 18) and remove it from the tank.

INSTALLATION

1. Apply antiseizing tape to the male threads of the new thermometer (figure 1, item 18), and install the thermometer in the tank.
2. CLOSE the drain valve (figure 1, item 3) and remove the hose.
3. Remove the lockout and tagout (FM 55-502) from the applicable inlet valve (table 1), and OPEN the valve.

4. Fill the tank with water with the manual relief lever (figure 1, item 4) on the relief valve (figure 1, item 5) lifted.
5. When water escapes from the relief valve (figure 1, item 5), CLOSE the relief valve.
6. 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. OPEN the applicable water heater outlet and recirculating hot water valves (table 1), listen for any air that may pass through the hot water recirculating pump. Purge any air in the hot water piping by cycling the hot water tank manual relief lever (figure 1, item 4). Air may also be purged by OPENING a hot water valve in the water closets or the galley.
3. Set to ON the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker in 440V power panel No. 4.
4. Set the applicable circuit breaker (table 1) to ON.
5. Adjust the hot water heater temperature (WP 0182 00).
6. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
HOT POTABLE WATER RECIRCULATION PUMP, REPLACE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)
Suitable Drain Pan

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)
Tape, Antiseizing (Item 175, Table 1, WP 0307 00,
Volume 2)
Pump, Centrifugal (Item 2, Figure 92, WP 0305 00,
Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0305 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the HOT POTABLE WATER RECIRCULATING PUMP. circuit breaker in 440V power panel No. 4. Lock out and tag out (FM 55-502). CLOSE valves PW-42, HW RECIRC. PMP. SUCT., PW-43, RECIRC TO H.W. HEATER, and PW-44, RECIRC TO H.W. HEATER. 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.

REMOVAL

1. Allow time for the water in the piping to cool.
2. Remove the two screws (figure 1, item 1) securing the junction box cover (figure 1, item 2).
3. Remove the junction box cover (figure 1, item 2).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

4. Use a multimeter to check for voltage at the wiring terminals (figure 1, item 3) in the junction box. If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

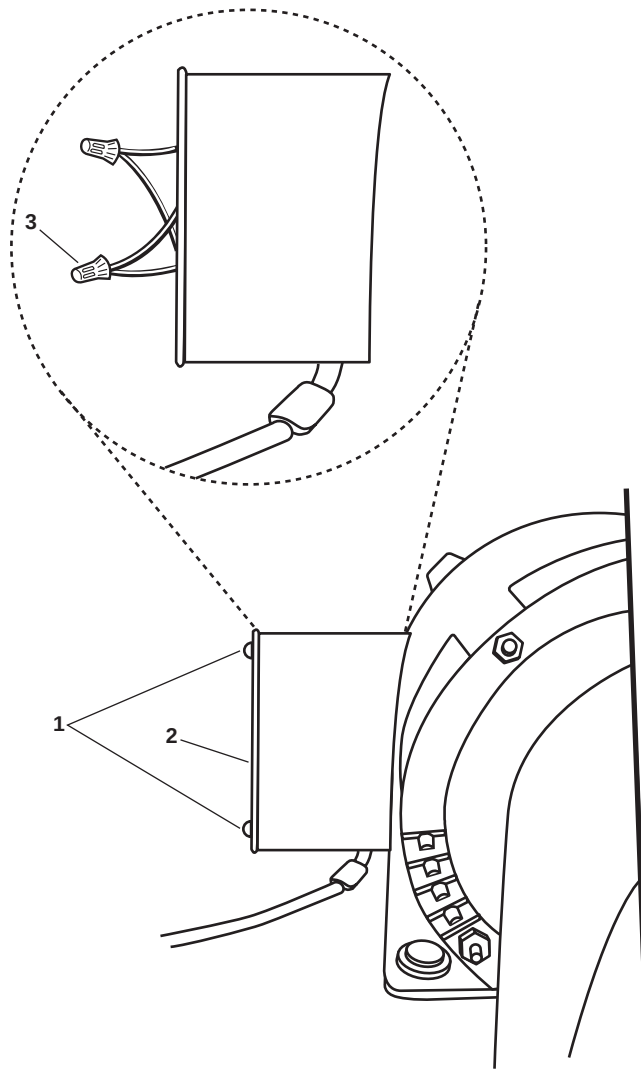


Figure 1. Electrical Junction Box

5. Label and disconnect the electrical wiring (figure 1, item 3).
6. Place a suitable drain pan under the hot potable water recirculating pump.
7. Loosen the pressure gauge piping (figure 2, item 1) to relieve any pressure that may be in the hot potable water recirculation pump (figure 2, item 2) piping.

⚠ CAUTION

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

8. Disconnect the potable water piping at the hot potable water recirculation pump (figure 2, item 2) inlet and outlet unions (figure 2, item 3 and 4).

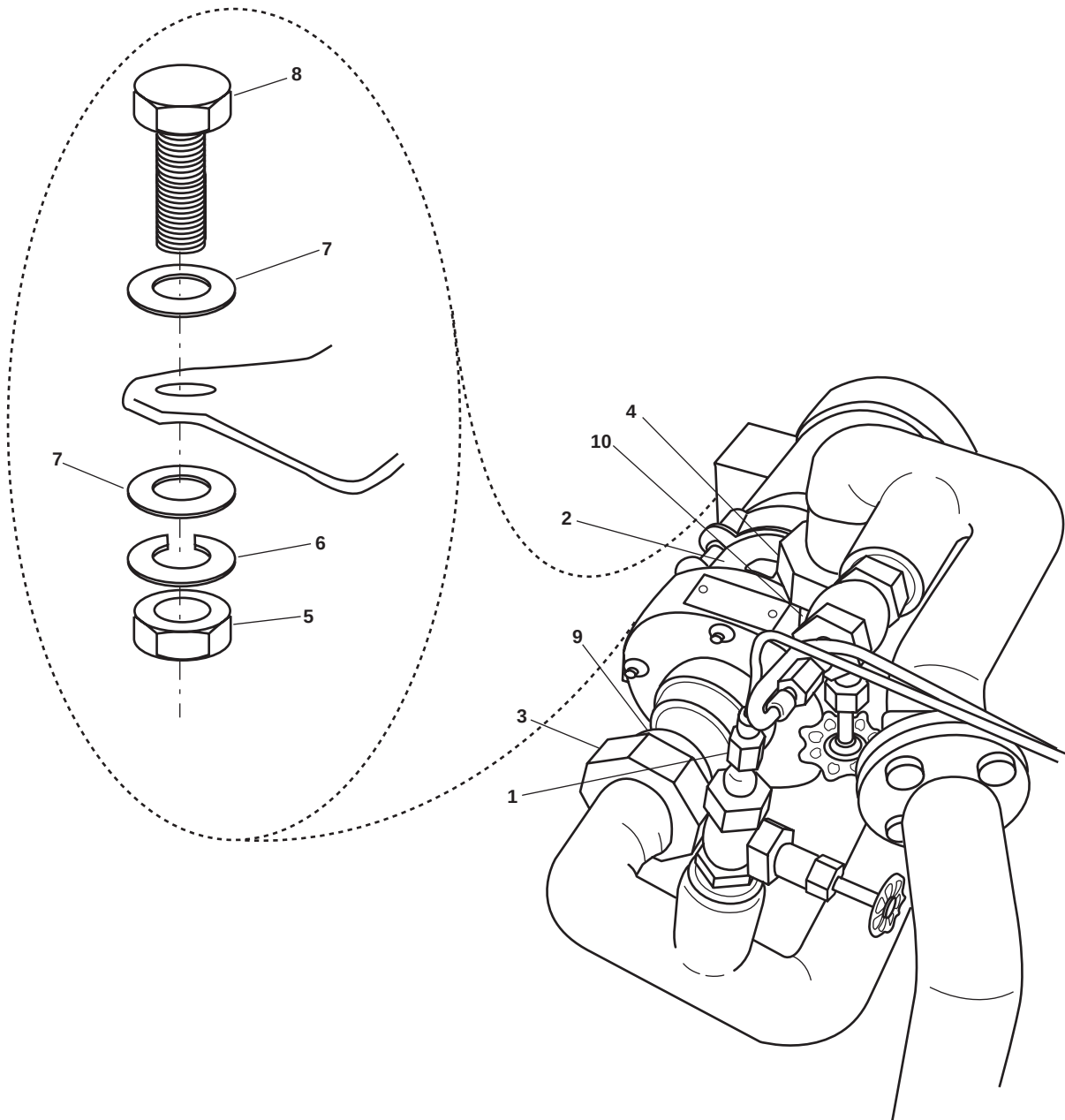


Figure 2. Hot Potable Water Recirculation Pump

9. Remove the four nuts (figure 2, item 5), four lockwashers (figure 2, item 6), eight flat washers (figure 2, item 7), and four bolts (figure 2, item 8) that secure the hot potable water recirculation pump (figure 2, item 2) to the foundation. Discard the lockwashers.
10. Remove the hot potable water recirculation pump (figure 2, item 2) from the foundation.
11. Remove the inlet fitting (figure 2, item 9) and the outlet fitting (figure 2, item 10) from the hot potable water recirculation pump (figure 2, item 2).

INSTALLATION

1. Apply antiseizing tape on the male threads of the inlet fitting (figure 2, item 9) and outlet fitting (figure 2, item 10) and install the fittings on the hot potable water recirculation pump (figure 2, item 2).
2. Install the hot potable water recirculation pump (figure 2, item 2) on its foundation and secure it with the four nuts (figure 2, item 5), four new lockwashers (figure 2, item 6), eight flat washers (figure 2, item 7), and four bolts (figure 2, item 8).

 CAUTION

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

3. Connect and tighten the inlet and outlet unions (figure 2, item 3 and 4) to the hot potable water recirculation pump (figure 2, item 2).
4. Install the discharge pressure gauge piping (figure 2, item 1) to hot potable water recirculation pump (figure 2, item 2) and tighten the piping connection.
5. Connect the electrical wiring (figure 1, item 3) using the labels from step 5 of Removal as a guide. Remove the labels.
6. Install the junction box cover (figure 1, item 2) and secure it with the two screws (figure 1, item 1).
7. Remove the lockouts and tagouts (FM 55-502).
8. Operate the potable water system under usual conditions (TM 55-1925-273-10) checking for leaks and proper operation.
9. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FIRE AND GENERAL SERVICE PUMP, PUMP END; REPLACE

INITIAL SETUP:**Materials/Parts:**

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502

TM 55-1925-273-10

WP 0307 00 (volume 2)

Equipment Conditions:

For fire and general service pump No. 1, set to OFF the FIRE PUMP #1 circuit breaker on the emergency switchboard. Lock out and tag out (FM 55-502). CLOSE valves FM-6 FIRE/G.S. PMP No. 1 SUCT, FM-16 FIRE/G.S. PMP No. 1 DISCH TO FM, and FM-17 FIRE/G.S. PMP No. 1 DISCH TO GS. Lock out and tag out (FM 55-502).

For fire and general service pump No. 2, set to OFF the FIRE PUMP No. 2 circuit breaker on the main switchboard. Lock out and tag out (FM 55-502). CLOSE valves FM-7 FIRE/G.S. PMP No. 2 SUCT, FM-14 FIRE/G.S. PMP. No. 2 DISCH. TO FM, and FM-15 FIRE/G.S. PMP. No. 2 DISCH. TO GS. Lock out and tag out (FM 55-502).

REMOVAL

1. Notify the pilothouse that the fire and general service pump will be secured for maintenance.
2. Align the fire main to be pressurized by the engine-driven firefighting pump (TM 55-1925-273-10).
3. Notify direct support maintenance that the fire and general service pump is ready for maintenance.

INSTALLATION

1. Verify that direct support maintenance has completed pump installation.
2. Remove the lockouts and tagouts (FM 55-502).
3. Operate the fire and general service pump under usual conditions (TM 55-1925-273-10) checking for proper operation and leaks.
4. Notify the pilothouse that the fire and general service pump is back online.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FIRE AND GENERAL SERVICE PUMP, ELECTRIC MOTOR; REPLACE, REPAIR

INITIAL SETUP:**Personnel Required:**

Two Watercraft Engineers, 88L

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0307 00 (volume 2)

Equipment Conditions:

For fire and general service pump No. 1, set to OFF the FIRE PUMP #1 circuit breaker on the emergency switchboard. Lock out and tag out (FM 55-502). CLOSE valves FM-6 FIRE/G.S. PMP No. 1 SUCT, FM-16 FIRE/G.S. PMP No. 1 DISCH TO FM, and FM-17 FIRE/G.S. PMP No. 1 DISCH TO GS. Lock out and tag out (FM 55-502).

For fire and general service pump No. 2, set to OFF the FIRE PUMP No. 2 circuit breaker on the main switchboard. Lock out and tag out (FM 55-502). CLOSE valves FM-7 FIRE/G.S. PMP No. 2 SUCT, FM-14 FIRE/G.S. PMP No. 2 DISCH. TO FM, and FM-15 FIRE/G.S. PMP No. 2 DISCH. TO GS. Lock out and tag out (FM 55-502).

REMOVAL

1. Notify the pilothouse that the fire and general service pump will be secured for maintenance.
2. Align the fire main to be pressurized by the engine-driven firefighting pump (TM 55-1925-273-10).
3. Ensure that the engine-driven firefighting pump is operational and can be used to supply the fire main in case the remaining fire and general service pump fails.
4. Notify direct support maintenance that the fire and general service pump motor is ready for maintenance.

INSTALLATION

1. Verify that direct support maintenance has completed fire general service pump installation.
2. Remove the lockouts and tagouts (FM 55-502).
3. Operate the fire and general service pump under usual conditions (TM 55-1925-273-10) and ensure that the pump operates normally and without unusual noise or vibration.
4. Notify the pilothouse that the fire and general service pump is back online.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
FIRE AND GENERAL SERVICE PUMP, ELECTRIC MOTOR; SERVICE

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
 WP 0295 00, Volume 2)
 Torque Wrench (0-250 FT-LB) (Item 4, Table 2,
 WP 0295 00, Volume 2)
 Lubricating Gun, Hand (Item 25, Table 2,
 WP 0295 00, Volume 2)

Materials/Parts:

Rag, Wiping (Item 139, Table 1, WP 0307 00,
 Volume 2)
 Sealing Compound, Loctite 242 (Item 155, Table 1,
 WP 0307 00, Volume 2)
 Grease, General Purpose (Item 75, Table 1,
 WP 0307 00, Volume 2)
 Tag, Danger (Item 174, Table 1, WP 0307 00,
 Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

References:

FM 55-502
 TM 55-1925-273-10
 WP 0295 00 (volume 2)
 WP 0307 00 (volume 2)

Equipment Conditions:

For fire and general service pump No. 1, set to OFF the FIRE PUMP #1 circuit breaker on the emergency switchboard. Lock out and tag out (FM 55-502). CLOSE valves FM-6 FIRE/G.S. PMP No. 1 SUCT, FM-16 FIRE/G.S. PMP No. 1 DISCH TO FM, and FM-17 FIRE/G.S. PMP No. 1 DISCH TO GS. Lock out and tag out (FM 55-502).

For fire and general service pump No. 2, set to OFF the FIRE PUMP No. 2 circuit breaker on the main switchboard. Lock out and tag out (FM 55-502). CLOSE valves FM-7 FIRE/G.S. PMP No. 2 PMP SUCT, FM-14 FIRE/G.S. PMP No. 2 DISCH. TO FM, and FM-15 FIRE/G.S. PMP No. 2 DISCH. TO GS. Lock out and tag out (FM 55-502).

FIRE AND GENERAL SERVICE PUMP
SERVICE PUMP

1. Align the on-service fire and general service pump to the general service system (TM 55-1925-273-10).
2. Ensure that the engine-driven firefighting pump is standing by to pressurize the firefighting system (TM 55-1925-273-10).

NOTE

Adequate lubrication is assured if the amount of the grease is maintained at 0.25 ounce (7.5 cc) to 0.5 ounce (15 cc) of the capacity of the bearing and adjacent space surrounding it.

3. Remove the drain plug (figure 1, item 1) from the upper bearing cartridge (figure 1, item 2).
4. Inject new general purpose grease into the upper grease fitting (figure 1, item 3) using a lubricating gun until the old grease is seen coming from the drain opening. Wipe any excess grease from the grease fitting using a wiping rag.
5. Remove the drain plug (figure 1, item 4) from the lower bearing cartridge (figure 1, item 5).
6. Inject new general purpose grease into the lower grease fitting (figure 1, items 6) using a lubricating gun until the old grease is seen coming from the drain opening. Wipe any excess grease from the grease fitting using a wiping rag.
7. Leave out the upper and lower drain plugs (figure 1, items 1 and 4) and perform the Follow-On Service procedure at the end of this work package.

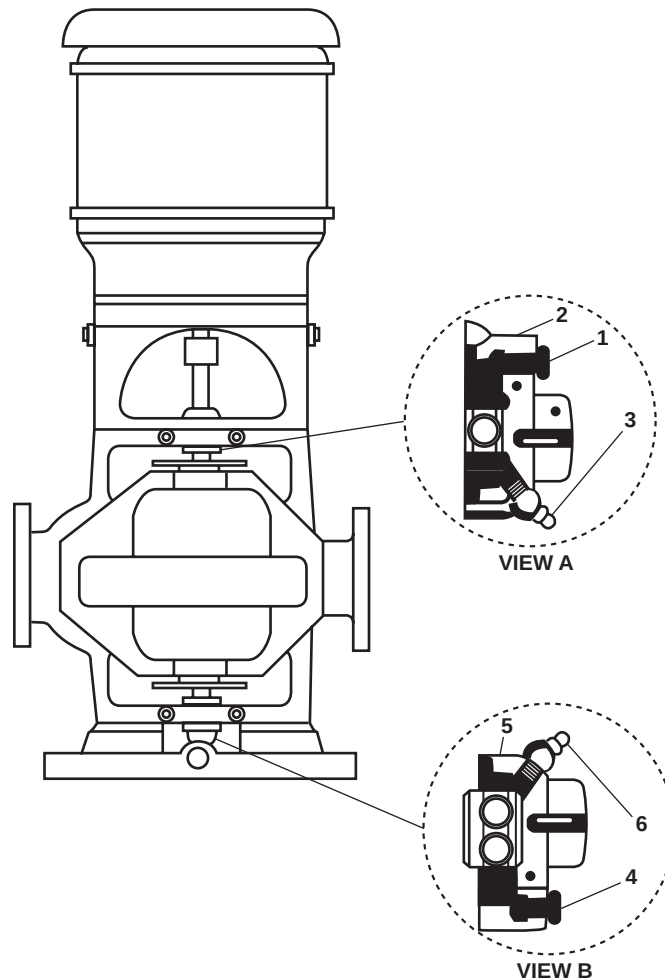


Figure 1. Fire and General Service Pump

SERVICE ELECTRIC MOTOR

1. Align the on-service fire and general service pump to the general service system (TM 55-1925-273-10).
2. Ensure that the engine-driven firefighting pump is standing by to pressurize the firefighting system (TM 55-1925-273-10).
3. Remove the grease drains (figure 2, items 1 and 2).

⚠ CAUTION

Do not apply grease through the upper or the lower grease fittings with the upper or the lower grease drains closed.

4. Add 0.4 ounce (12 cc) of new general purpose grease into the upper grease fitting (figure 2, items 3) using a lubricating gun. Wipe any excess grease from the grease fitting using a wiping rag.

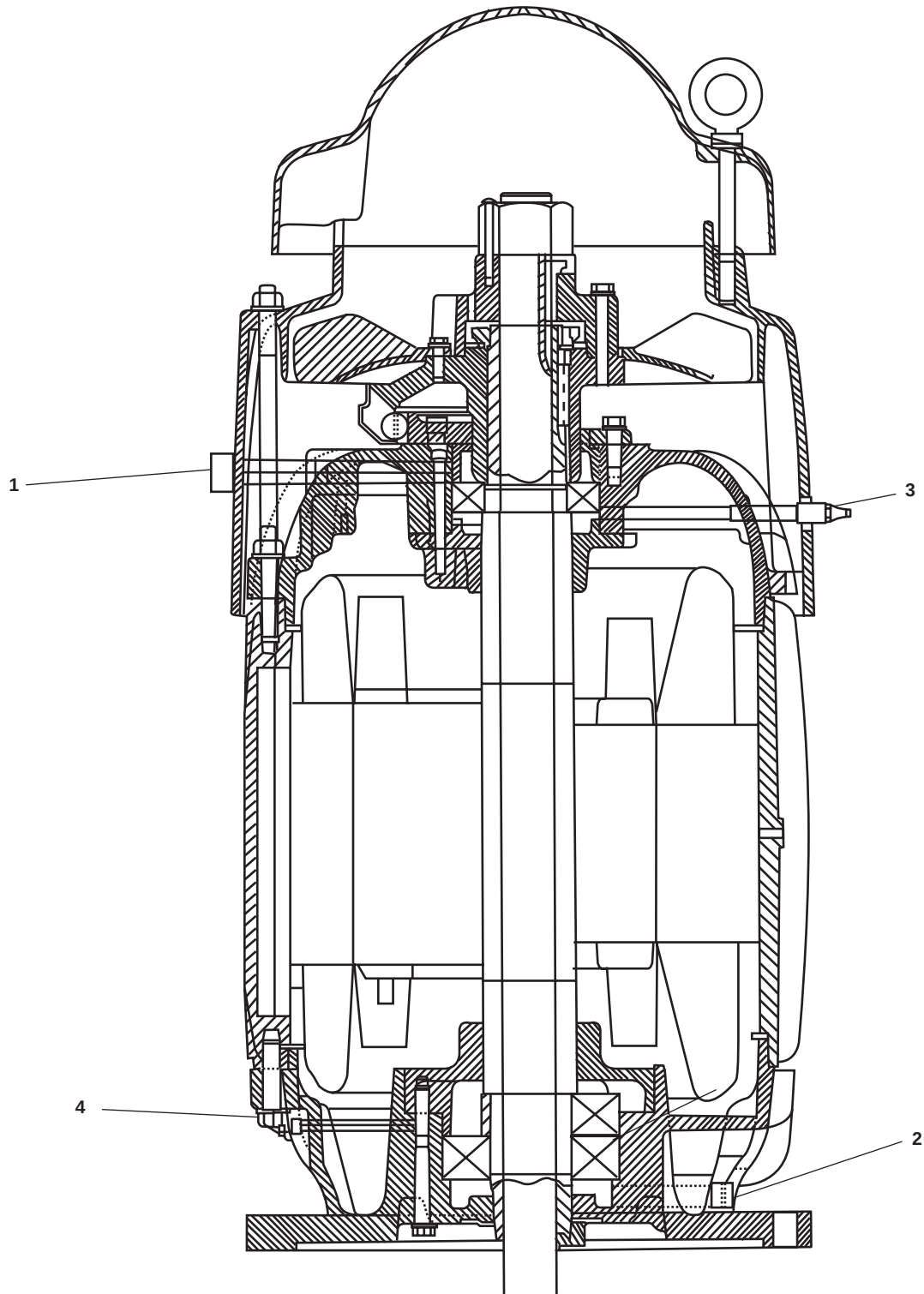


Figure 2. Electric Motor

5. Add 0.6 ounce (18 cc) of new general purpose grease into the lower grease fitting (figure 2, items 4) using a lubricating gun. Wipe any excess grease from the grease fitting using a wiping rag.
6. Leave out the grease drains (figure 2, items 1 and 2) and perform the Follow-On Service procedure at the end of this work package.

STRAINER SERVICE

DISASSEMBLY

WARNING

The strainer may be under pressure. Loosen the fasteners slowly and allow water to run around threads of fitting to release any pressure before opening the strainer cover. Releasing pressurized water suddenly may cause severe personal injury or death.

1. Place the clean side of the duplex strainer online using the strainer selector handle (figure 3, item 1).
2. Slowly loosen, but do not remove, the two bolts (figure 3, item 2) securing the cover (figure 3, item 3) to the strainer (figure 3, item 4) being serviced.
3. Allow any pressure to vent and any fluid to drain.
4. Loosen the T-handle (figure 3, item 5) and remove the locking bar (figure 3, item 6) and the cover (figure 3, item 3).

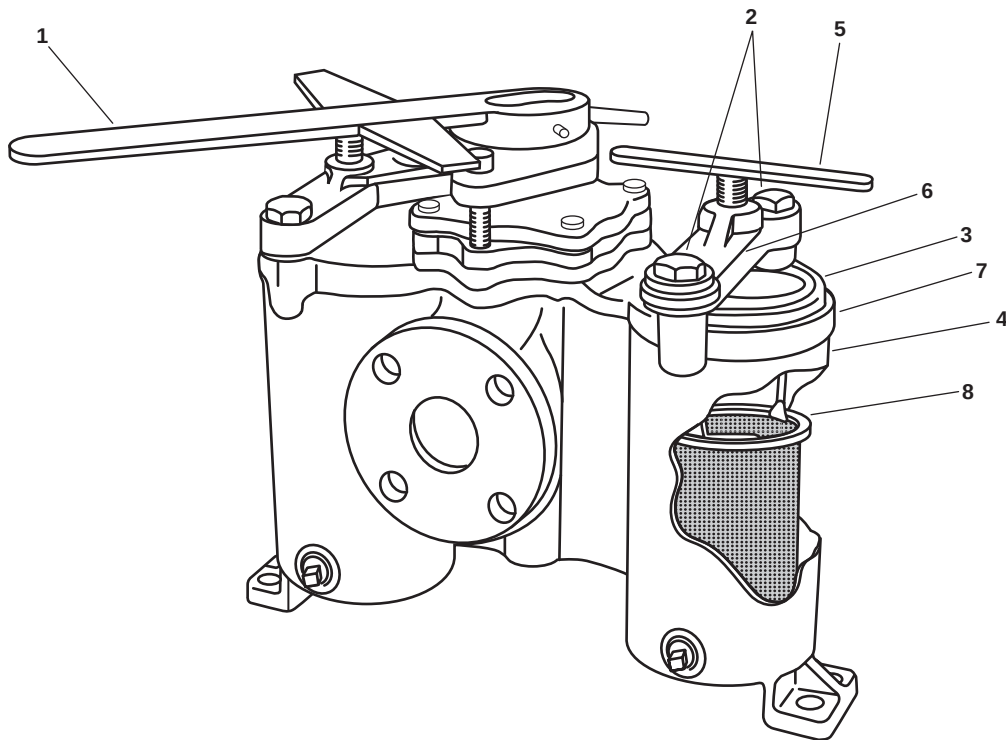


Figure 3. Duplex Strainer

5. Remove the gasket (figure 3, item 7) from the cover (figure 3, item 3). Discard the gasket.
6. Remove the basket (figure 3, item 8) from the strainer (figure 3, item 4). Discard the contents of the basket.
7. Using clean fresh water, clean all the removed parts.
8. Remove any sediment from the basket (figure 3, item 8).
9. Remove any debris from the interior of the strainer (figure 3, item 4) and wipe the inside of the strainer with a clean wiping rag.
10. Inspect the basket (figure 3, item 8) and strainer (figure 3, item 4) for excessive rust or deterioration. Replace any worn parts.

ASSEMBLY

1. Install the basket (figure 3, item 8) into the strainer (figure 3, item 4).
2. Install a new gasket (figure 3, item 7) on the cover (figure 3, item 2).
3. Install the cover (figure 3, item 2) on the strainer (figure 3, item 4), securing it in place with the locking bar (figure 3, item 6).
4. Tighten the two bolts (figure 3, item 2) and the T-handle (figure 3, item 5).

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Align the piping for the serviced fire and general service pump to the general service system (TM 55-1925-273-10).
3. Operate the serviced fire and general service pump (TM 55-1925-273-10) checking for leaks and proper operation.
4. If the pump was serviced:
 - a. Run the pump for 15 minutes to purge excess grease.
 - b. Install the upper drain plug (figure 1, item 1) and remove any excess grease.
 - c. Install the lower drain plug (figure 1, item 4) and remove any excess grease.
5. If the electric motor was serviced:
 - a. Run the pump for 15 minutes to purge excess grease.
 - b. Apply sealing compound Loctite 242 to the threads of the upper grease drain (figure 2, item 1). Install and tighten the grease drain to a torque of 20 lb-ft (27 Nm).
 - c. Apply sealing compound Loctite 242 to the threads of the lower grease drain (figure 2, item 2). Install and tighten the grease drain to a torque of 20 lb-ft (27 Nm).
 - d. Remove any excess grease from the drain's plugs.
6. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
PORTABLE ELECTRIC PUMP, REPAIR**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

Personnel Required:

One Watercraft Engineer, 88L

Materials/Parts:

Grease, General Purpose (Item 75, Table 1,
WP 0307 00, Volume 2)
Sealing Compound, Loctite 242 (Item 155, Table 1,
WP 0307 00, Volume 2)
Impeller (Item 3, Figure 94, WP 0306 00, Volume 2)
Gasket (Item 2, Figure 94, WP 0306 00, Volume 2)
Seal, Plain (Item 4, Figure 94, WP 0306 00, Volume 2)

References:

WP 0295 00 (volume 2)
WP 0306 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Pump unplugged.

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

DISASSEMBLY--JABSCO MODEL 11810-SERIES

1. Remove the six screws (figure 1, item 1) from the end cover (figure 1, item 2). Remove the cover and the gasket (figure 1, item 3). Discard the gasket.
2. Remove the impeller (figure 1, item and 4) from the pump's shaft.

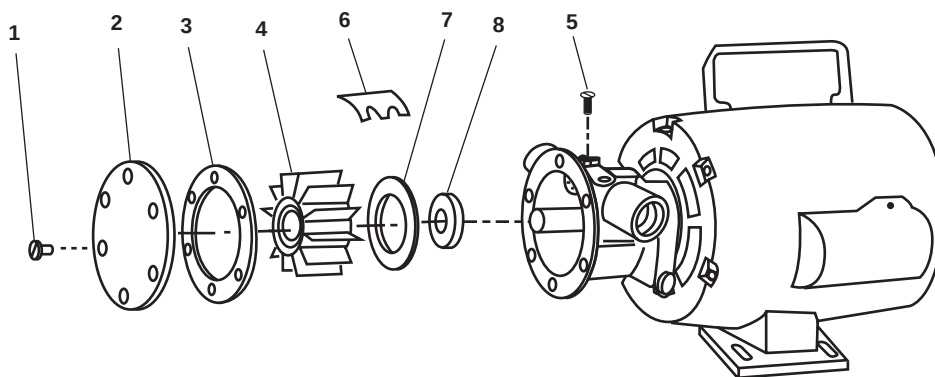


Figure 1. Portable Pump (JABSCO Model 11810-Series)

3. Loosen the cam screw (figure 1, item 5) and remove the cam (figure 1, item 6).
4. Remove the wear plate (figure 1, item 7) and the shaft seal (figure 1, item 8).

INSPECTION--JABSCO MODEL 11810-SERIES

1. Inspect the cover for damage or signs of wear. Replace a worn or damaged cover.
2. Inspect the impeller for wear, bent/missing blades, or other obvious damage. Replace a worn or damaged cover.
3. Inspect the wear plate for damage or signs of excessive wear. Replace a worn or damaged wear plate.

ASSEMBLY--JABSCO MODEL 11810-SERIES

NOTE

The shaft seal's lip should face the back of the impeller.

1. Install a new shaft seal (figure 1, item 8) in the seal's bore with the seal facing the back of the impeller (figure 1, item 4). Apply general purpose grease to the back of the shaft seal's lip.
2. Install the wear plate (figure 1, item 7), aligning its slot with the dowel pin.
3. Apply sealing compound Locktite 242 to the top of the cam (figure 1, item 6) and the cam screw threads (figure 1, item 5). Install the cam and cam screw.
4. Lubricate the pump shaft's outer diameter with a light coat of general purpose grease.
5. Align the impeller (figure 1, item 4) with the flat side on the shaft, and install the impeller.
6. Install a new gasket (figure 1, item 3) and cover (figure 1, item 2) on the pump.
7. Install and tighten the six screws (figure 1, item 1).
8. Connect a suction and discharge hose to the pump and submerge the end of the suction hose.
9. Plug the portable pump into a 120 Vac outlet and check that the pump has good discharge flow.
10. Return the portable pump to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
DRILL PRESS; REPLACE, SERVICE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00,
Volume 2)

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set to OFF the MACHINE SHOP EQUIPMENT JUNC-
TION BOX. (LATHE/GRINDER/DRILL PRESS).
circuit breaker in the load center distribution panel.
Lock out and tag out (FM 55-502).

Personnel Required:

Two Watercraft Engineers, 88L

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lock wire 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.

DRILL PRESS REPLACEMENT**REMOVAL**

1. Remove the two screws (figure 1, item 1) and the junction box cover (figure 1, item 2).

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

2. Use a multimeter to check for voltage at the terminals in the junction box (figure 1, item 2). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the drill press wiring (figure 1, item 3).

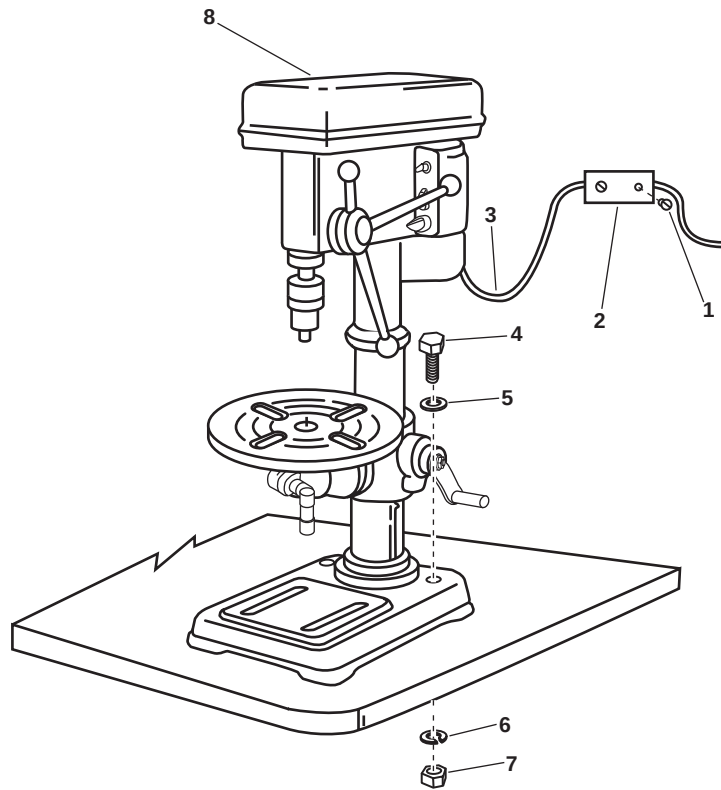


Figure 1. Drill Press

4. Remove the four bolts (figure 1, item 4), four flat washers (figure 1, item 5), four lockwashers (figure 1, item 6), and four nuts (figure 1, item 7). Discard the lockwashers.
5. Remove the drill press (figure 1, item 8) from the workbench.

INSTALLATION

1. Place the drill press (figure 1, item 8) on the workbench, and secure it with the four bolts (figure 1, item 4), four flat washers (figure 1, item 5), four new lockwashers (figure 1, item 6), and four nuts (figure 1, item 7).
2. Connect the drill press wiring (figure 1, item 3) using the labels from step 3 of Removal as a guide. Remove the labels.
3. Perform the Follow-On Service procedure at the end of this work package.

SERVICE

DISASSEMBLY

1. Open the pulley cover (figure 2, item 1) to gain access to the top V-belt (figure 2, items 2) and the bottom V-belt (figure 2, item 3).
2. Move the center pulley shaft (figure 2, item 4), toward the spindle pulley (figure 2, item 5) and pull the bottom V-belt (figure 2, item 3) upward and remove it from the center pulley (figure 2, item 6) and the spindle pulley.

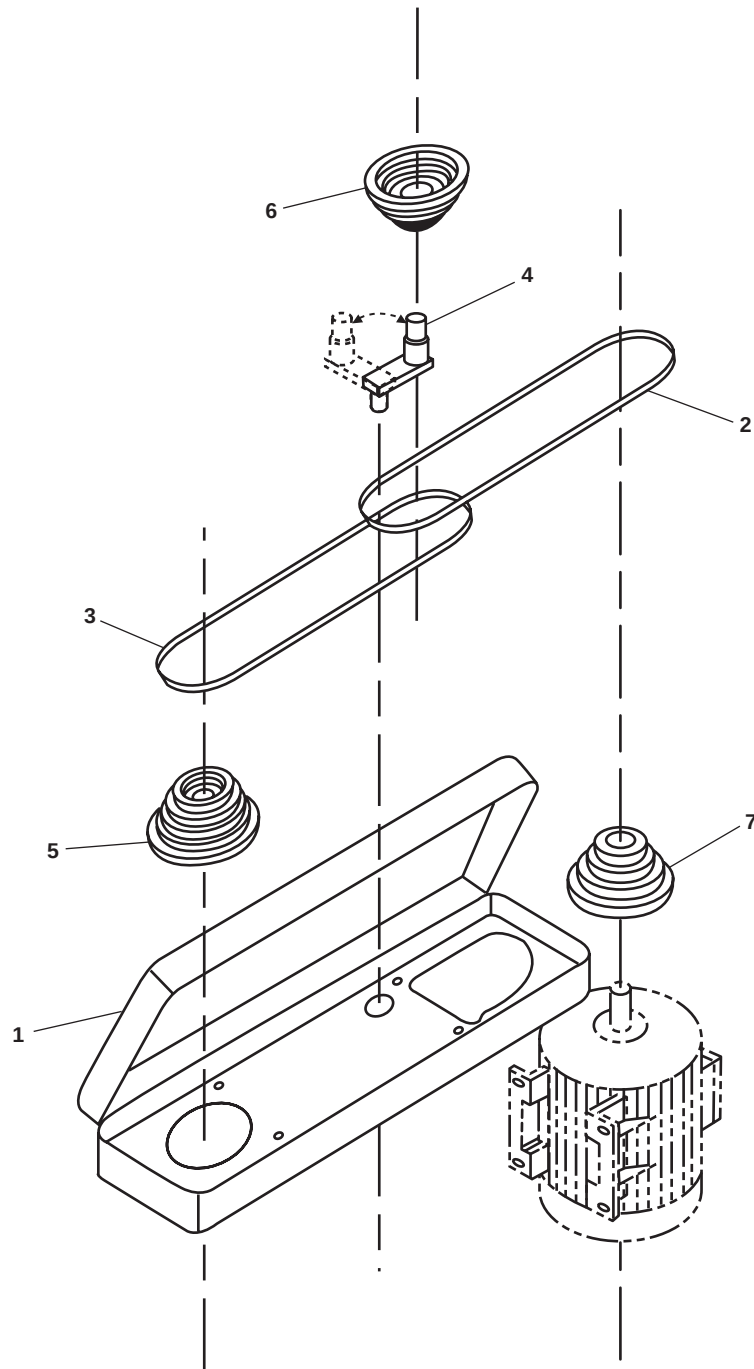


Figure 2. Drill Press Components

3. Move the center pulley shaft (figure 2, item 4) toward the motor pulley (figure 2, item 7) and pull the top V-belt (figure 2, item 2) upward and remove it from the motor pulley and the center pulley.

ASSEMBLY

NOTE

Ensure that the new V-belt is in alignment with the spindle, center, and motor pulley channels grooves.

1. Move the center pulley shaft (figure 2, item 4) toward the spindle pulley (figure 2, item 5) and install the new bottom V-belt (figure 2, item 3).
2. Move the center pulley shaft (figure 2, item 4) toward the motor pulley (figure 2, item 7), and push the top V belt (figure 2, item 2) down onto the center pulley (figure 2, item 6) and the spindle pulley (figure 2, item 5).
3. Close the cover (figure 2, item 1).
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. Operate the workshop equipment under usual conditions (TM 55-1925-273-10) and check for proper operation of the drill press.
3. Return the drill press to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
BENCH GRINDER; REPLACE, SERVICE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)

References:

FM 55-502
TB 43-0218
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00,
Volume 2)

Equipment Conditions:

Set to OFF the MACHINE SHOP EQUIPMENT JUNCTION BOX. (LATHE/GRINDER/DRILL PRESS). circuit breaker in the load center distribution panel. 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 lock wire 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.

BENCH GRINDER REPLACEMENT**REMOVAL**

WARNING



Replace or repair components only after the affected circuit has been secured, locked out, and tagged out (FM 55-502). Performing replacement or repair with the circuit energized may result in serious injury or death.

1. Remove the four screws (figure 1, item 1) and the junction box cover (figure 1, item 2).
2. Use a multimeter to check for voltage at the terminals in the junction box (figure 1, item 2). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
3. Label and disconnect the bench grinder wiring (figure 1, item 3).

INSTALLATION

1. Position the bench grinder (figure 2, item 5) over its mounting holes in the workbench.
2. Install the two nuts (figure 2, item 1), two new lockwashers (figure 2, item 2), four flat washers (figure 2, item 3), and two bolts (figure 2, item 4), and secure the bench grinder (figure 2, item 5) to the workbench.
3. Connect the bench grinder wiring (figure 1, item 3) using the labels from step 3 of Removal as a guide. Remove the labels.
4. Install the junction box cover (figure 1, item 2) and secure it in place with the four screws (figure 1, item 1).
5. Perform the Follow-On Service procedure at the end of this work package.

SERVICE**DISASSEMBLY**

1. Remove the three screws (figure 2, item 6) securing the guard cover (figure 2, item 7) to the bench grinder (figure 2, item 5).
2. Remove the left hand nut (figure 2, item 8) and the wheel flange (figure 2, item 9) securing the wheel (figure 2, item 10) to the bench grinder (figure 2, item 5).
3. Remove the wheel (figure 2, item 10) from the bench grinder (figure 2, item 5).

ASSEMBLY

1. Install the wheel (figure 2, item 10) onto the bench grinder (figure 2, item 5).
2. Install the wheel flange (figure 2, item 9) onto the bench grinder (figure 2, item 5) and secure it with the left hand nut (figure 2, item 8).
3. Install the guard cover (figure 2, item 7) onto the bench grinder (figure 2, item 5) and secure in place with the three screws (figure 2, item 6).
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. Operate the workshop equipment under usual conditions (TM 55-1925-273-10) and check for proper operation of the bench grinder.
3. Return the bench grinder to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
WELDER, REPLACE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0295 00, Volume 2)
Multimeter (Item 16, Table 2, WP 0295 00, Volume 2)
Chain Hoist, Hand Operated (Item 7, Table 2, WP 0295 00, Volume 2)
Sling, Endless (Item 5, Table 2, WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Engineers, 88L

Materials/Parts:

Tag, Danger (Item 174, Table 1, WP 0307 00, Volume 2)

References:

FM 55-502
TM 55-1925-273-10
WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Set to OFF the WELDING MACHINE. circuit breaker in 440V power panel No. 5. Lock out and tag out (FM 55-502).

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 can cause serious injury or death.

NOTE

Electrical junction boxes may vary in size, shape, and mounting position of the box on the motor frame. Electrical junction box covers may vary in number and placement of screws holding the cover in place.

1. Remove the screws (figure 1, item 1) holding the electrical junction box cover (figure 1, item 2).
2. Remove the junction box cover (figure 1, item 2).
3. Using a multimeter, check for voltage at the wiring terminals. If voltage is present, ensure that the proper circuit breaker is secured, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.
4. Label and disconnect the electrical wiring.
5. Remove the bolts (figure 1, item 3) and flat washers (figure 1, item 4) securing the welder (figure 1, item 5) to the deck.
6. Attach an endless sling through the welder (figure 1, item 5) lifting eye (figure 1, item 6) and use the hand operated chain hoist to lift the welder off the deck for removal.

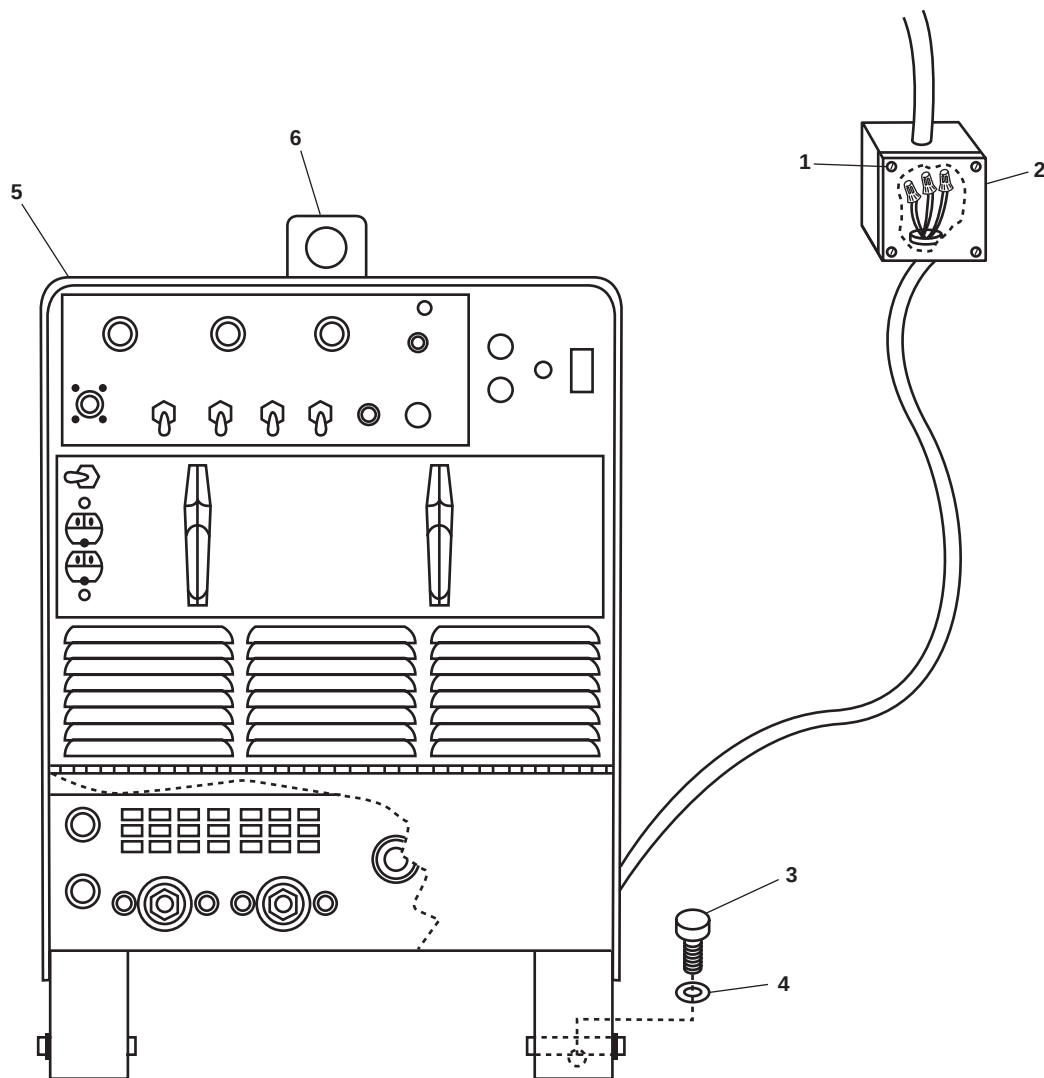


Figure 1. Arc Welder Removal

INSTALLATION

1. Slowly lower the welder (figure 1, item 5) to the deck and position the arc welder over the mounting holes in the deck.
2. Install the flat washers (figure 1, item 4) and bolts (figure 1, item 3). Tighten the bolts.
3. Connect the welder (figure 1, item 5) wires inside the junction box using the labels from step 4 of Removal as a guide. Remove the labels.
4. Remove the lockouts and tagouts (FM 55-502).
5. Operate the workshop equipment under usual conditions (TM 55-1925-273-10) and check for proper operating of the welder.
6. Return the welder to the desired readiness condition.

END OF WORK PACKAGE

**UNIT MAINTENANCE
INLAND AND COASTAL LARGE TUG (LT)
GUN MOUNTS, SERVICE**

INITIAL SETUP:**Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2,
WP 0295 00, Volume 2)

Personnel Required:

Two Watercraft Operators, 88K

Materials/Parts:

Cleaner, Lubricant and Preservative (Item 34,
Table 1, WP 0307 00, Volume 2)
Cloth, Abrasive (Crocus Cloth) (Item 39, Table 1,
WP 0307 00, Volume 2)
Lubricating Oil, General Purpose (Item 108,
Table 1, WP 0307 00, Volume 2)
Rag, Wiping (Item 139, Table 1, WP 0307 00,
Volume 2)
Grease, Aircraft (Item 68, Table 1, WP 0307 00,
Volume 2)

References:

WP 0295 00 (volume 2)
WP 0307 00 (volume 2)

Equipment Conditions:

Gun cover removed.
Cradle locked at 0° elevation.
Gun removed from cradle.

INSPECT**CRADLE SLIDING BOLTS****NOTE**

This task replenishes grease and oil on joints and pins ensuring free movement.

1. Inspect the upper cradle's (figure 1, item 1) two upper bolts (figure 1, item 2) located in the cradle's sliding channels to ensure the proper tightness of the bolts.
2. If the bolts (figure 1, item 2) are shoulder bolts, tighten each bolt until the self-locking nut is snug against the shoulder of the bolt. If the bolts are full-threaded bolts, tighten each bolt until the bolt can no longer be rotated by hand; then back off the self-locking nut 1/8 turn. The bolt should rotate if turned by hand, but should not rotate freely.
3. Inspect the lower cradle's (figure 1, item 3) four lower bolts (figure 1, item 4) located in the cradle's sliding channels to ensure the proper tightness of the bolts.
4. If the bolts (figure 1, item 4) are shoulder bolts, tighten each bolt until the self-locking nut is snug against the shoulder of the bolt. If the bolts are full-threaded bolts, tighten each bolt until the bolt can no longer be rotated by hand; then back off the self-locking nut 1/8 turn. The bolt should rotate if turned by hand, but should not rotate freely.
5. If either of the two upper (figure 1, item 2) or the four lower bolts (figure 1, item 4) are corroded, rusted, or show obvious damage, replace new bolts and self-locking nuts.

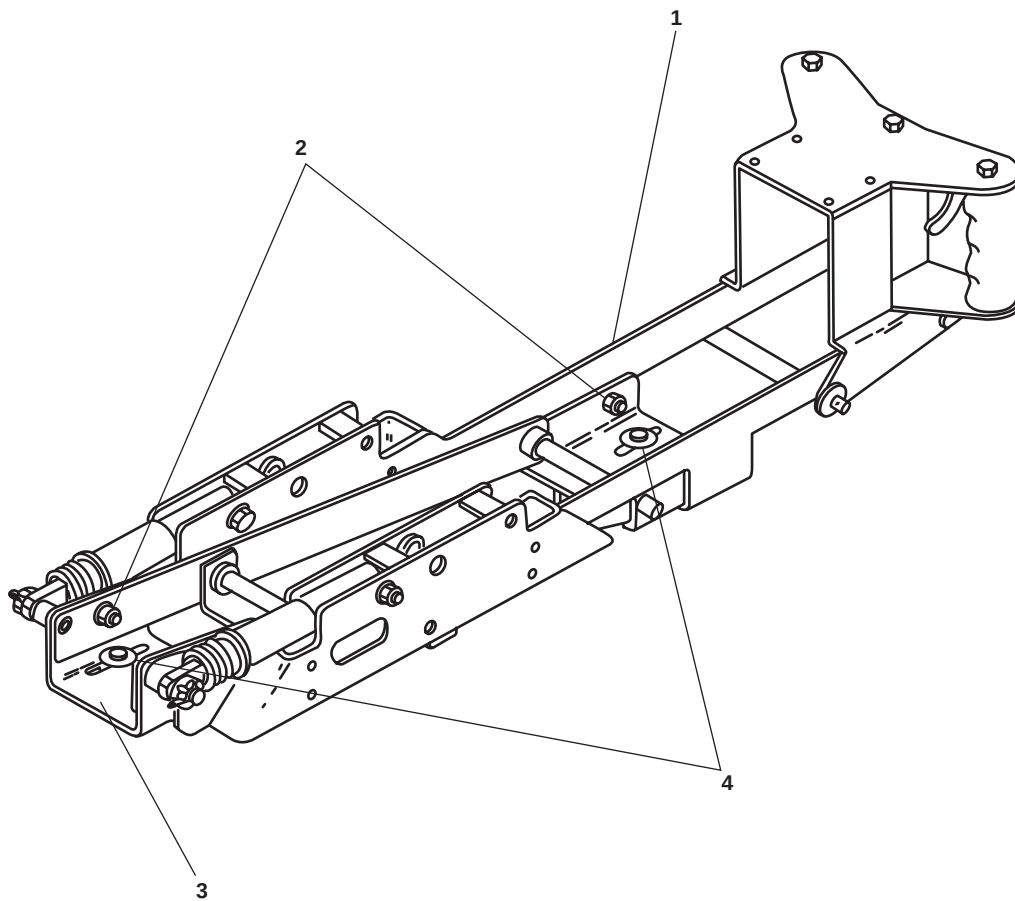
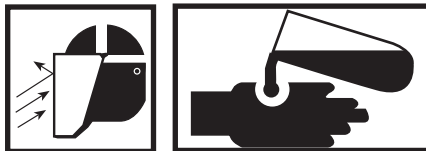


Figure 1. Machine Gun Mount Upper Cradle

SERVICE

WARNING



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 comply can result in illness, serious injury, or death.

1. Clean any foreign matter from the lubrication points and exposed metal surfaces using a wiping rag before lubricating.
2. Remove any surface rust using crocus cloth.
3. Loosen the pintle clamp (figure 2, item 1) and remove the carriage (figure 2, item 2) and cradle (figure 2, item 3) from the stand (figure 2, item 4).

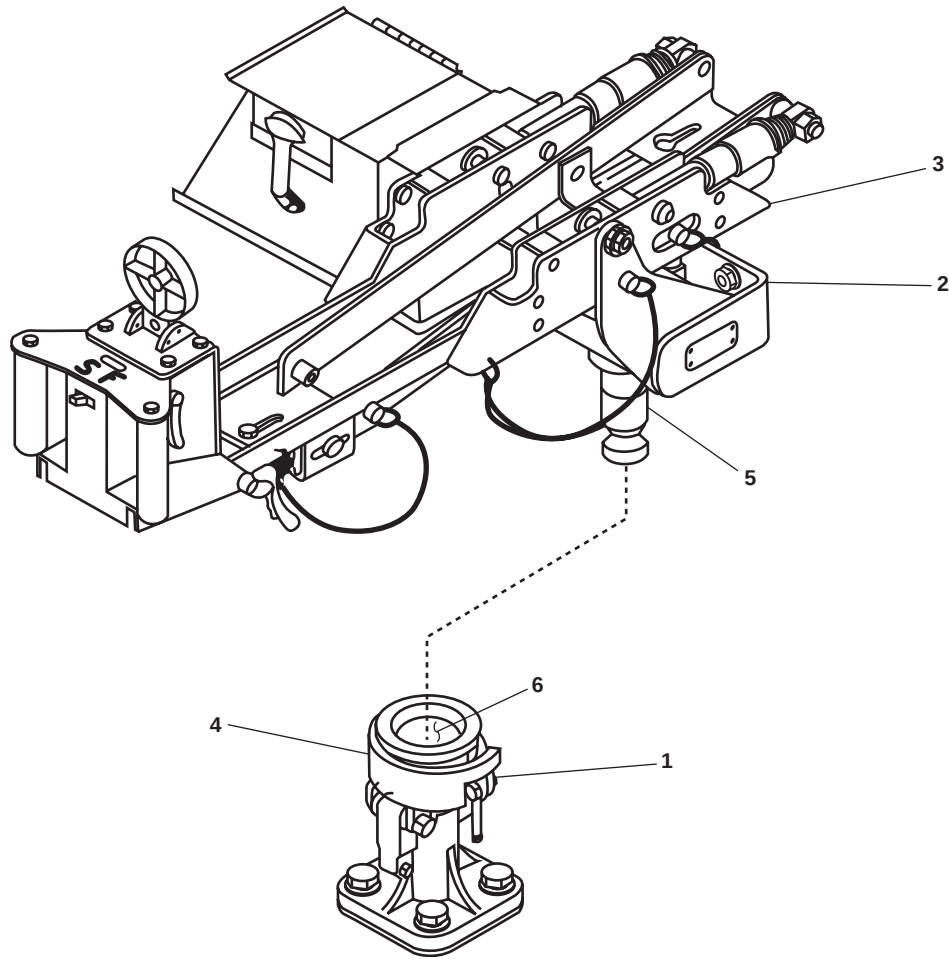


Figure 2. Machine Gun Mount

4. Apply a heavy coat of aircraft grease to the carriage pintle (figure 2, item 5; figure 3, item 1).
5. Apply a heavy coat of aircraft grease to the stand socket (figure 2, item 6; figure 3, item 2)
6. Install the carriage (figure 2, item 2) and the cradle (figure 2, item 3) onto the stand (figure 2, item 4).
7. Apply a light coat of aircraft grease to the threads of the pintle clamp (figure 2, item 1; figure 3, item 3). Tighten the pintle clamp.
8. Apply five drops of aircraft grease to the gun mount pins and bearings (figure 3, item 4) and the locking bearings (figure 3, item 5).
9. Apply cleaner, lubricant and preservative to the cradle lock bearing (figure 3, item 6).
10. Apply a light coat of cleaner, lubricant and preservative to the rear sight hinge area (figure 3, item 7).
11. Apply a light coat of cleaner, lubricant and preservative to to the ammunition box securing lock (2 points) and hinge (figure 3, item 8).

12. Apply a light coat of cleaner, lubricant and preservative to the depression stop bolt (figure 3, item 9).
13. Apply a light coat of cleaner, lubricant and preservative to the safety and return spring (figure 3, item 10).
14. Apply a light coat of grease to all exposed contact metal surfaces.

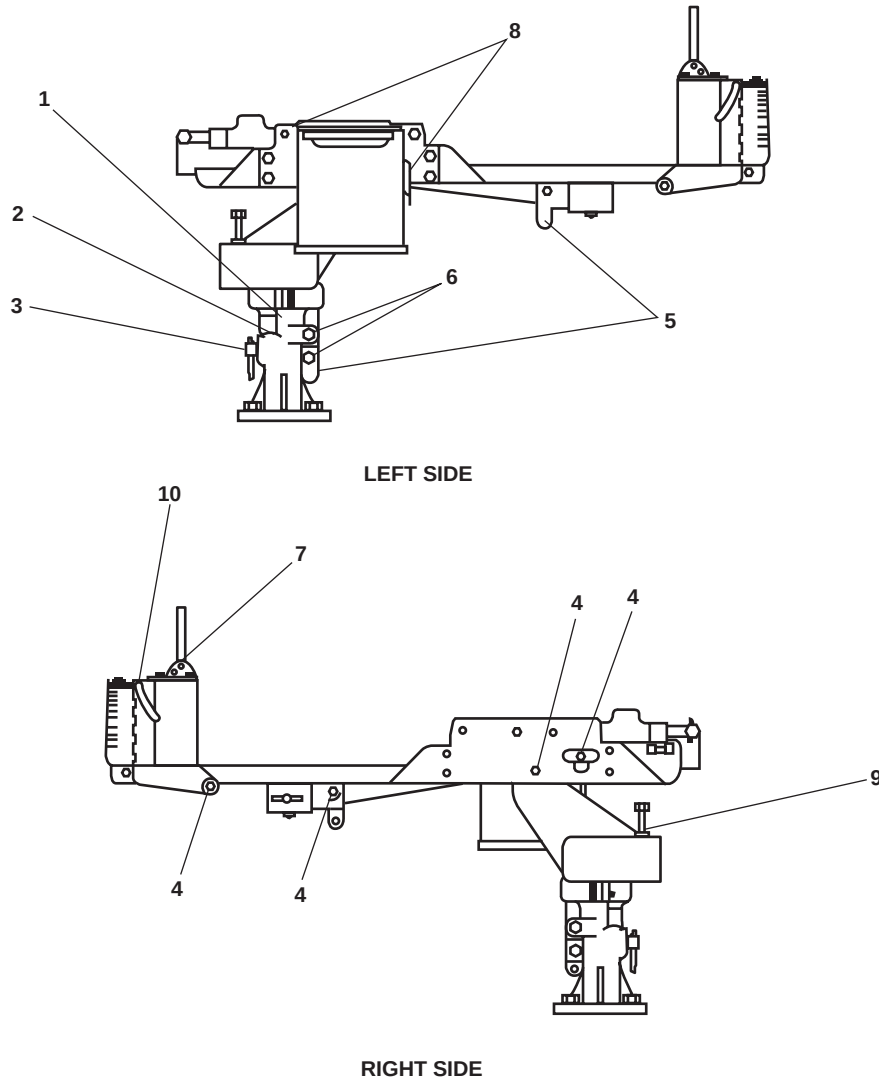


Figure 3. Machine Gun Mount Lubrication Points

END OF WORK PACKAGE

By Order of the Secretary of the Army:

Official:



SANDRA R. RILEY

*Administrative Assistant to the
Secretary of the Army*

PETER J. SCHOOMAKER
*General, United States Army
Chief of Staff*

0529212

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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: "Whoever" whoever@avma27.army.mil
To: whoever@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: TM X-XXXX-XXX-XXX						DATE: Date of the TM.	TITLE: Title of TM.
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Exact wording of recommended change must be given)	
	0019 00 1	3	1	1		Step No. 2 says to secure doors open with locking bar or hooks from where to what? The bars or hooks are not identified.	
	0019 00 4	4	1	1		Step No. 19 states to remove locking bars, pins or hooks from where to what? The bars, pins or hooks are not identified. Where are they stored?	
SAMPLE							
* Reference to line numbers within the paragraph or subparagraph.							
TYPED NAME, GRADE OR TITLE Doe, John, CPL				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION 755-1313		SIGNATURE <i>CPL John Doe</i>	

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: TM X-XXXX-XXX-XXX					DATE: Date of the TM.		TITLE: Title of TM.		
PAGE NO.	COLM NO.	LINE NO.	FEDERAL STOCK NUMBER	REFERENCE NO.		FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION
SAMPLE									
PART III - REMARKS (Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)									
* Reference to line numbers within the paragraph or subparagraph.									
TYPED NAME, GRADE OR TITLE Doe, John, CPL				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION 755-1313			SIGNATURE CPL John Doe		

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
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PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS							
PUBLICATION/FORM NUMBER TM 55-1925-273-24&P-1						DATE	TITLE Unit, Direct Support, and General Support Maintenance Manual Including Repair Parts and Special Tools List for 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: <i>(Forward direct to addressee listed in publication)</i>			FROM: <i>(Activity and location) (Include ZIP Code)</i>			DATE		
PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS								
PUBLICATION NUMBER TM 55-1925-273-24&P-1				DATE		TITLE Unit, Direct Support, and General Support Maintenance Manual Including Repair Parts and Special Tools List for 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 <i>(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.)</i>								
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION			SIGNATURE	

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PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS									
PUBLICATION NUMBER TM 55-1925-273-24&P-1				DATE		TITLE Unit, Direct Support, and General Support Maintenance Manual Including Repair Parts and Special Tools List for 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 <i>(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.)</i>									
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION			SIGNATURE		

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA						Use Part II (<i>reverse</i>) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: (<i>Forward to proponent of publication or form</i>) (<i>Include ZIP Code</i>)						FROM: (<i>Activity and location</i>) (<i>Include ZIP Code</i>)	
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS							
PUBLICATION/FORM NUMBER TM 55-1925-273-24&P-1						DATE	TITLE Unit, Direct Support, and General Support Maintenance Manual Including Repair Parts and Special Tools List for Inland and Coastal Large Tug (LT) NSN 1925-01-509-7013 (EIC XAG)
ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON	
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TO: <i>(Forward direct to addressee listed in publication)</i>			FROM: <i>(Activity and location) (Include ZIP Code)</i>				DATE	
PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS								
PUBLICATION NUMBER TM 55-1925-273-24&P-1			DATE		TITLE Unit, Direct Support, and General Support Maintenance Manual Including Repair Parts and Special Tools List for Inland and Coastal Large Tug (LT) NSN 1925-01-509-7013 (EIC XAG)			
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PART III - REMARKS <i>(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.)</i>								
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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: 082852-000