

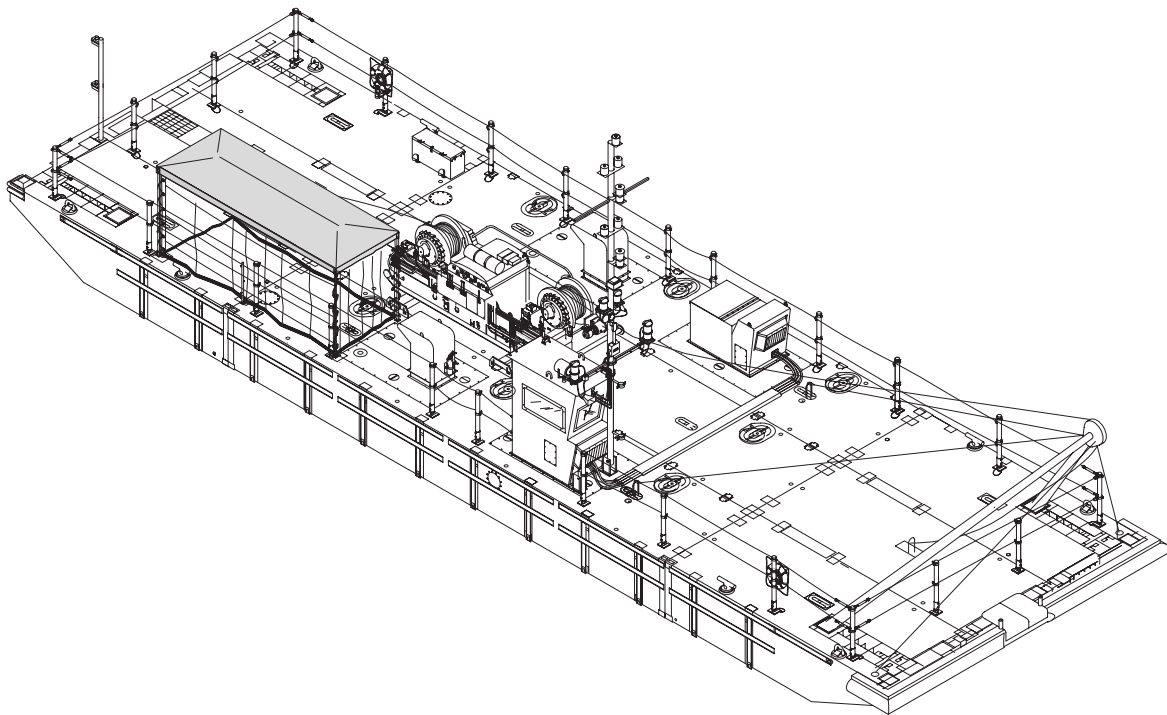
TM 55-1945-225-24

TECHNICAL MANUAL

UNIT, DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE MANUAL
FOR

MODULAR CAUSEWAY SYSTEM (MCS) WARPING TUG (WT) WT-2

NSN 1925-01-502-8772



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

HEADQUARTERS, DEPARTMENT OF THE ARMY
JUNE 2005

WARNING SUMMARY

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

NO SMOKING

Smoking is prohibited aboard this vessel.

JEWELRY

Remove rings, bracelets, wristwatches, and neck chains before working around or on a unit.

HEAVY OBJECTS

Handling heavily weighted objects can cause bodily injury. Do not lift materials or equipment over 50 lb without using appropriate material handling equipment.

BATTERIES

Do not smoke around batteries. Lead acid batteries contain sulfuric acid and if overcharged produce flammable hydrogen gas. Operating personnel must monitor the operators cab ammeter during operation, and if overcharging of batteries occurs, the machinery compartment must be properly vented.

HAZARD REPORTING

Report all hazards. It is your responsibility to report hazards through your chain-of-command.

HIGH VOLTAGE

Use extreme caution when checking energized circuits. Always place power off warning tags on power supply switches so that no one will apply power while performing maintenance.

HAZARDOUS FUMES IN CONFINED SPACES

The lazaret and 40 foot storage compartments are confined spaces and may contain hazardous fumes. Refer to FM 55-502 before entering a confined space. Never enter a confined space before checking the confined space with a gas free meter. Operate the exhaust plenum ventilation fan to remove fumes.

HAZARDOUS FUMES IN MANNED SPACES

The engine and fuel compartments are manned spaces and may contain hazardous fumes. Prior to entering these compartments, operate the exhaust plenum ventilation fan to remove fumes.

NUCLEAR, BIOLOGICAL OR CHEMICAL

In the event equipment has been exposed to nuclear, biological or chemical warfare, the equipment shall be handled with extreme caution and decontaminated in accordance with FM 3-5, instructions for immediate, operational and thorough decon procedures adapted for the marine environment. unprotected personnel can experience injury or death if residual toxic agents or radioactive material are present. If equipment is exposed to radioactive, biological or chemical agents, personnel must wear protective mask, hood, protective overgarments, chemical gloves and chemical boots in accordance with MOPP - level prescribed by the OIC or NCOIC.

WARNING SUMMARY - CONTINUED

ICE BUILDUP

Cold weather operations could create ice buildup on exposed surfaces producing hazardous footing conditions. Use extreme care when operating under icing conditions, death or serious injury to personnel could occur.

TORQUE VALUES

For torque not specified in an individual work package, refer to the torque limits work package located in the general maintenance section of this manual. Failure to tighten fasteners to specified torque may result in damage to equipment and death or injury to personnel.

WELDING OR GRINDING

Personnel must use a gas-free meter before performing module repair that requires welding or grinding.

ISOPAK LADDER SAFETY

Care must be taken when ascending or descending the ISOPAK ladder. ISOPAK ladder rungs become very slippery when wet. Failure to comply could result in injury or death to personnel.

BATTLE LANTERNS

Personnel must memorize the location and how to access the battle lanterns above and below deck in case of a power failure or crisis situation.

T-WRENCH LOCATION

Personnel must memorize the location and how to access the t-wrench used to open the escape hatch from the machinery compartment in a crisis situation.

HEARING PROTECTION

Personnel in the engine compartment, with the engine running, must wear double hearing protection in accordance with DA PAM 40-501. Personnel on deck with the engine idle above 1,200 RPM must wear single hearing protection. Single hearing protection shall be used when the deck winches are in use.

PAINTING OF MODULES

Prior to painting, personnel should apply barrier cream to exposed skin surfaces and ensure a safety shower and eye wash station are available.

ETHER HAZARD

Smoking, open flames and sparks are strictly prohibited around the ether cold start system. Ether is very toxic, can damage eyes or skin and is harmful or fatal if swallowed or inhaled. If swallowed, do not induce vomiting. Contact a physician immediately.

WARNING SUMMARY - CONTINUED

CARBON DIOXIDE HAZARD

If CO₂ has been discharged below deck, Gas Free Engineering personnel (per FM 55-502) must completely clear any CO₂, test the level of oxygen, and certify space is safe for personnel. After certification, the plunger on the fire suppression pressure switch, below deck, must be manually reset to operate the vent fan. Serious injury or death to personnel could result if CO₂ is inhaled.

OPERATOR CAB ROOF HAZARD

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall, utilize the mast/mast mounting bracket as grab handles. Failure to comply could result in injury or death to personnel.

ELECTRICAL WARNING

Electrical maintenance personnel should use care when troubleshooting the system and whenever possible maintenance should be performed with the Main Circuit Breaker in the OFF position and the batteries disconnected. Personnel must wear rubber gloves when performing electrical maintenance as personnel with open wounds will have a decreased resistance to electrical shock. Failure to comply could result in injury or death to personnel.

EXPLANATION OF SAFETY WARNING ICONS



EAR PROTECTION

EAR PROTECTION - Headphones over ears shows that noise level will harm ears.



ELECTRICAL

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



EYE PROTECTION

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



HEAVY OBJECTS

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



HEAVY PARTS

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



HEAVY PARTS

HEAVY PARTS 3 - Heavy object on human figure shows that heavy parts present a danger to life or limb.



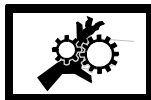
HELMET PROTECTION

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



HOT AREA

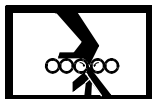
HOT AREA - Hand over object radiating heat shows that part is hot and can burn.



MOVING PARTS

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

EXPLANATION OF SAFETY WARNING ICONS - CONTINUED



MOVING PARTS

MOVING PARTS 2 - Hand with fingers caught between gears shows that the moving parts of the equipment present a danger to life or limb.



SLICK FLOOR

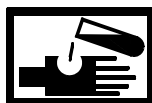
SLICK FLOOR - Wavy line on floor with legs prone shows that slick floor presents a danger for falling.



VEST

VEST - Life preserver on human figure shows life preserver must be worn to prevent drowning.

EXPLANATION OF HAZARDOUS MATERIAL WARNING ICONS



CHEMICAL

CHEMICALS - Drops of liquid on hand shows that the material will cause burns or irritation to human skin or tissue.



EXPLOSION

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



FIRE

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



POISON

POISON - Skull and crossbones shows that a material is poisonous or is a danger to life.



VAPOR

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

LIST OF EFFECTIVE PAGES / WORK PACKAGES

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HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 15 JUNE 2005

TECHNICAL MANUAL

**UNIT, DIRECT SUPPORT AND
GENERAL SUPPORT MAINTENANCE MANUAL
FOR**

**MODULAR CAUSEWAY SYSTEM (MCS)
WARPING TUG (WT)
WT-2
NSN 1925-01-502-8772**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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HOW TO USE THIS MANUAL

This manual contains certain features to improve the convenience of using this manual and increase the user's efficiency. These features include:

a. 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.

b. Illustrations

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

c. 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.

Prior to starting the procedures in this manual, the initial setup requirements are located directly above each procedure. 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.

Locating Major Components

Obtain the manual for the system to be worked on. Open to the Table of Contents located in the front of this manual. Find Chapter 1, *Description and Theory of Operation*. Under the chapter title you will find the work package titled *Location and Description of Major Components*. Turn to the work package indicated. This work package will give a brief description of the major components, and show an illustration of what the component looks like and its location.

The Alphabetical Index, located in the back of this manual, contains an alphabetical list of all sections of this manual. *Location and Description of Major Components* is found in section L. The work package 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.

Troubleshooting Procedures

The Table of Contents or Alphabetical Index may be used to locate sections within this manual. To locate a particular troubleshooting procedure, open the manual to the Table of Contents located in the front of this manual. Find Chapter 2, *Troubleshooting Procedures*. Under this section, find a work package titled *System/Subsystem Troubleshooting Index*. Turn to the work package indicated, which lists all of the troubleshooting procedures. Look down the list until you find the appropriate work package for the problem you are trying to solve. To the right side of the procedure will be a work package number. Turn to the work package indicated and follow the steps to complete the troubleshooting procedure. The procedures list the malfunction, symptom and the corrective action. The corrective action will indicate which maintenance procedure to go to for the repair of the symptom or what level of maintenance is capable of repair of the problem. Follow the procedures indicated to complete the task. At the top of the task you will have a section called INITIAL SETUP. There are five basic headings listed under INITIAL SETUP.

Test Equipment: Lists all test equipment (standard or special) required to troubleshoot, test and inspect the equipment covered in this manual. The test equipment is identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

Tools: Lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

Personnel Required: Lists all personnel necessary to perform the task.

Equipment Condition: 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.

References: Includes any other manuals 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 work package *References* in Chapter 4, *Supporting Information*.

Maintenance Instructions

To locate a maintenance procedure, open the manual to the Table of Contents located in the front of this manual. Find Chapter 3, *Maintenance Instructions*. Look down the list and find the maintenance procedure to be accomplished. On the right side of the maintenance procedure will be a work package number. Turn to the work package indicated. Before beginning the maintenance task, look through the procedure to familiarize yourself with the entire maintenance procedure. At the top of the task you will have a section called INITIAL SETUP. There are five basic headings listed under INITIAL SETUP.

Tools: Lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

Materials/Parts: Lists all parts or materials necessary to perform the task. Expendable and durables are identified with an item number and work package number from the Expendable and Durable Items List located in Chapter 4, *Supporting Information*.

Personnel Required: Lists all personnel necessary to perform the task.

References: Includes any other manuals 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 work package *References* in Chapter 4, *Supporting Information*.

Equipment Condition: 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.

Test Equipment: Lists all test equipment (standard or special) required to troubleshoot, test and inspect the equipment covered in this manual. The test equipment is identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

Repair Parts and Special Tools List

Refer to TM 55-1945-225-24P when requisitioning parts, special tools and equipment.

Identify the mandatory repair parts required to perform this task listed at the top of the work package in the INITIAL SET-UP. Using the part number provided, refer to the part number index work package in TM 55-1945-225-24P. Look up the part number in the part number column and identify the figure and item number where the part is located. Turn to the figure and locate the item number listed. Verify that the item is correct.

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
GENERAL INFORMATION**

SCOPE

This manual contains descriptions and instructions for the Warping Tug (WT).

Type of Manual: Unit, Direct Support and General Support Maintenance.

Purpose of Equipment: The purpose of the WT is for towing, anchor mooring and recovery, craft salvage during Logistics-Over-the-Shore (LOTS) deployment and handling of supplies between ship and beach.

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 User's Manual for the Army Maintenance Management System (TAMMS) and AR 700-138, Army Logistics Readiness and Sustainability.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If any component in your system needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368, Product Quality Deficiency Report. Mail it to the address specified in DA PAM 738-750, Functional User's Manual for the Army Maintenance Management System (TAMMS), or as specified by the acquiring activity. We will send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

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 the 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 Functional Users Manual for The Army Maintenance Management System (TAMMS).

OZONE DEPLETING SUBSTANCES (ODS)

The continued use of ODS has been prohibited by Executive Order 12856 of 3 August 1993.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

The procedures for destruction of Army materiel to prevent enemy use are contained in TM 750-244-6.

PREPARATION FOR STORAGE OR SHIPMENT

Reference TM 55-1945-225-10 for preparation for storage or shipment of the WT.

LIST OF ABBREVIATIONS/ACRONYMS

Abbreviation/Acronym	Name
A	Amps
AC	Alternating Current
ANS	Answer
ANT	Antenna
AOAP	Army Oil Analysis Program
AR	Army Regulation
ASSY	Assembly
AUX	Auxiliary
AWG	American Wire Gauge
BII	Basic Issue Items
C	Centigrade
CAGEC	Commercial and Government Entity Code
CCW	Counterclockwise
CLR	Clear
cm	Centimeters
CO ₂	Carbon Dioxide
COEI	Components of End Item
CPC	Corrosion Prevention Control
CS	Causeway Section
CTA	Common Table of Allowances
CW	Clockwise
DA PAM	Department of Army Pamphlet
dB	Decibels
DC	Direct Current
Deg	Degrees
DSC	Digital Selective Calling
ECM	Engine Control Module
EDIL	Expendable and Durable Items List
EIR	Equipment Improvement Recommendations
ESD	Electrostatic Discharge
F	Fahrenheit
FC	Floating Causeway
FCC	Federal Communications Commission
fl	Fluid
FM	Field Manual
FNC	Function
FSS	Fast Sealift Ship
ft	Feet
ft lbs	Foot Pounds
FWD	Forward
GAL	Gallon
GFI	Ground Fault Indicator
GND	Ground
GPH	Gallons Per Hour
GPS	Global Positioning System
H	Height
H/L	High/Low
HP	Horsepower
Hz	Hertz
IAW	In Accordance With
ICM	Intercommunication (short-form)

LIST OF ABBREVIATIONS/ACRONYMS (CONT'D)

Abbreviation/Acronym	Name
ID	Identification
in.	Inches
in. lbs	Inch Pounds
INTL	International
ISO	International Standards Organization
ISOPAK	International Standards Organization Package
kg	Kilograms
kHz	Kilohertz
kPa	Kilo pascal
kW	Kilowatt
L	Length
LASH	Lighter Aboard Ship
lb	Pounds
LCD	Liquid Crystal Display
LOTS	Logistics-Over-the-Shore
M	Meters
mA	Milliamperere
MCS	Modular Causeway System
MEM	Memory
mHz	Megahertz
MIM	Marine Interface Module
min	Minute
ML	Milliliters
MOPP	Mission Oriented Protective Posture
MTBE	Methyl Tertiary Butyl Ether
MTO&E	Modified Table of Organization and Equipment
NATO	North Atlantic Treaty Organization
NBC	Nuclear, Biological, or Chemical
NCOIC	Noncommissioned Officer in Charge
NEMA	National Electrical Manufacturers Association
Ni-Cd	Nickel Cadmium
NL	Navy Lighter
Nm	Newton Meters
NMEA	National Marine Electronic Association
NOAA	National Oceanic and Atmospheric Administration
NSA	National Security Agency
OD	Outside Diameter
ODS	Ozone Depleting Substance
OIC	Officer in Charge
oz	Ounces
PLGR	Precision Lightweight Global Positioning Receiver
PMCS	Preventive Maintenance Checks and Services
PN	Part Number
PSI	Pounds Per Square Inch
PTT	Push To Talk
PWR	Power
QTY	Quantity
rcv	Receive
RF	Radio Frequency
RPM	Revolutions Per Minute
RPSTL	Repair Parts and Special Tools List

LIST OF ABBREVIATIONS/ACRONYMS (CONT'D)

Abbreviation/Acronym	Name
RQD	Required
RRDF	Roll-On/Roll-Off discharge Facility
SC	Supply Catalog
SCR	Scrambler
SF	Standard Form
SINCGARS	Single Channel Ground and Airborne Radio
SRA	Specialized Repair Activity
SS	Sea State
STBD	Starboard
sw	Switch
TAMMS	The Army Maintenance Management System
TB	Technical Bulletin
TD	Technical Directive
TEL	Telephone
TEMP	Temperature
TM	Technical Manual
TO&E	Table of Organization and Equipment
Tx	Transmit
UTC	Coordinated Universal Time
uv	Ultra Violet
V	Volts
VAC	Voltage, Alternating Current
VDC	Voltage, Direct Current
VHF/FM	Very High Frequency/Frequency Modulation
W	Width
WP	Work Package
WT	Warping Tug
XMIT	Transmit
yd	Yard

CHAPTER 1

**DESCRIPTION AND THEORY OF OPERATION
FOR
MODULAR CAUSEWAY SYSTEM (MCS)
WARPING TUG (WT)**

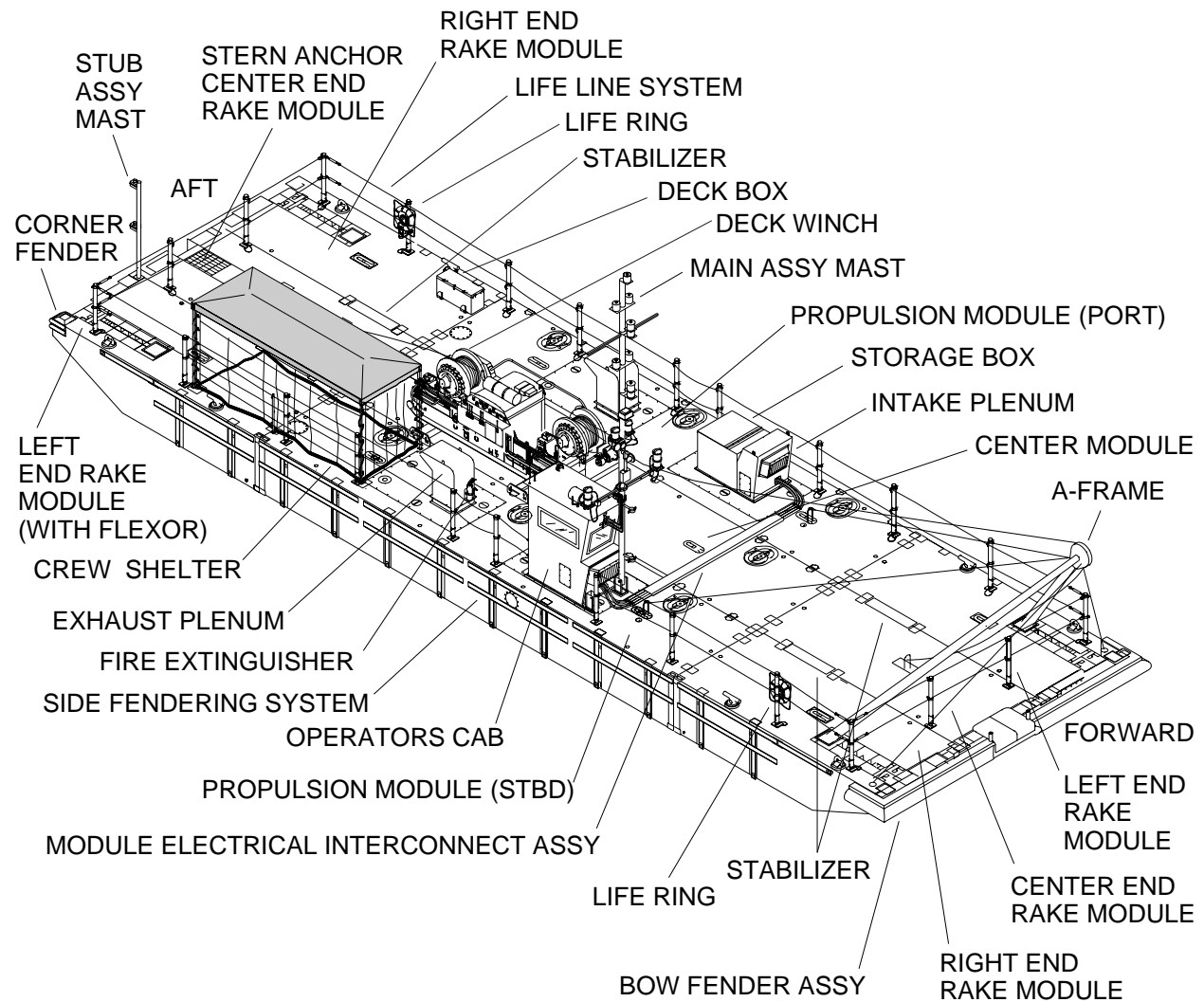
**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
EQUIPMENT DESCRIPTION AND DATA**

EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES

WARPING TUG

The WT consists of one powered section with the application of a WT conversion kit, consisting of a diesel-hydraulic deck winch and foundation adapter, a weight-handling A-frame forward, a self-deploying/retrievable stern anchor to assist in beach retraction/salvage and required above deck equipment. The above deck equipment includes the operators cab, intake and exhaust plenums, a main assembly mast, a stub assembly mast, an electrical interconnection assembly, storage boxes, life rings and stanchion mounted life lines.

The WT is used to assist in the assembly, movement and positioning of non-powered modules, strings, sections, Floating Causeways (FCs) and Roll-On/Roll-Off Discharge Facilities (RRDFs), to set and retrieve anchor moorings for the MCS, and for other weight handling and towing tasks.

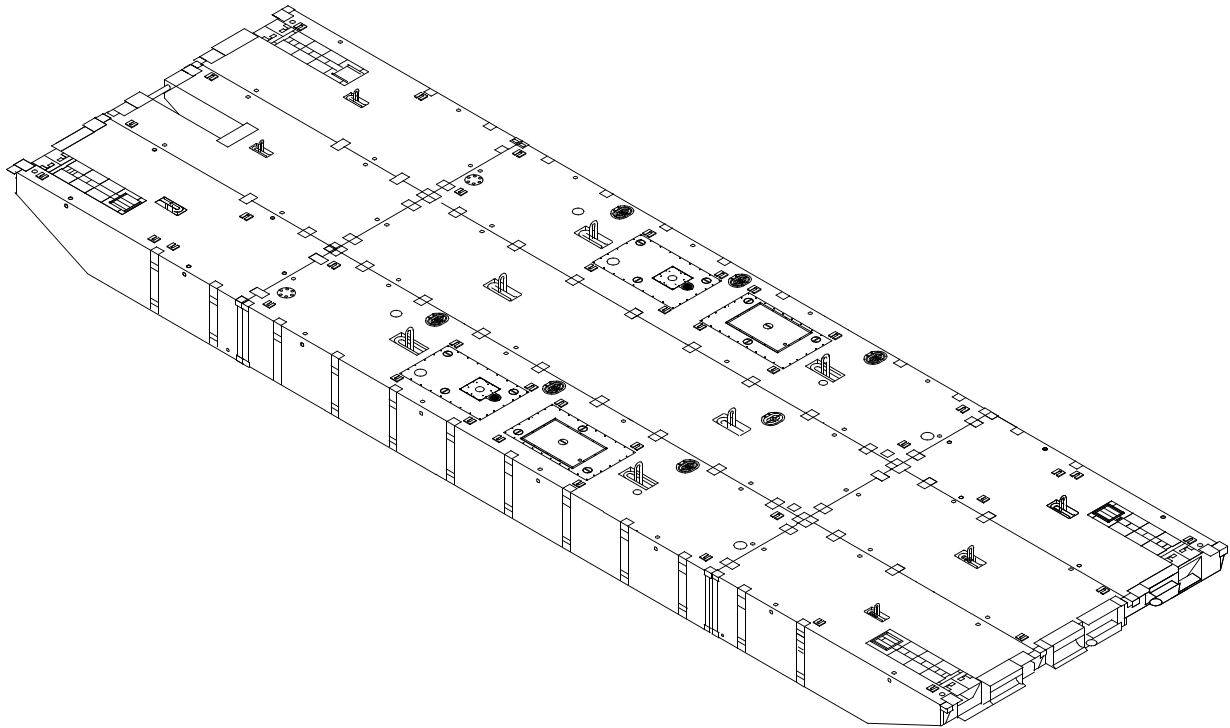


**OPERATOR MAINTENANCE
WARPING TUG
EQUIPMENT DESCRIPTION AND DATA**

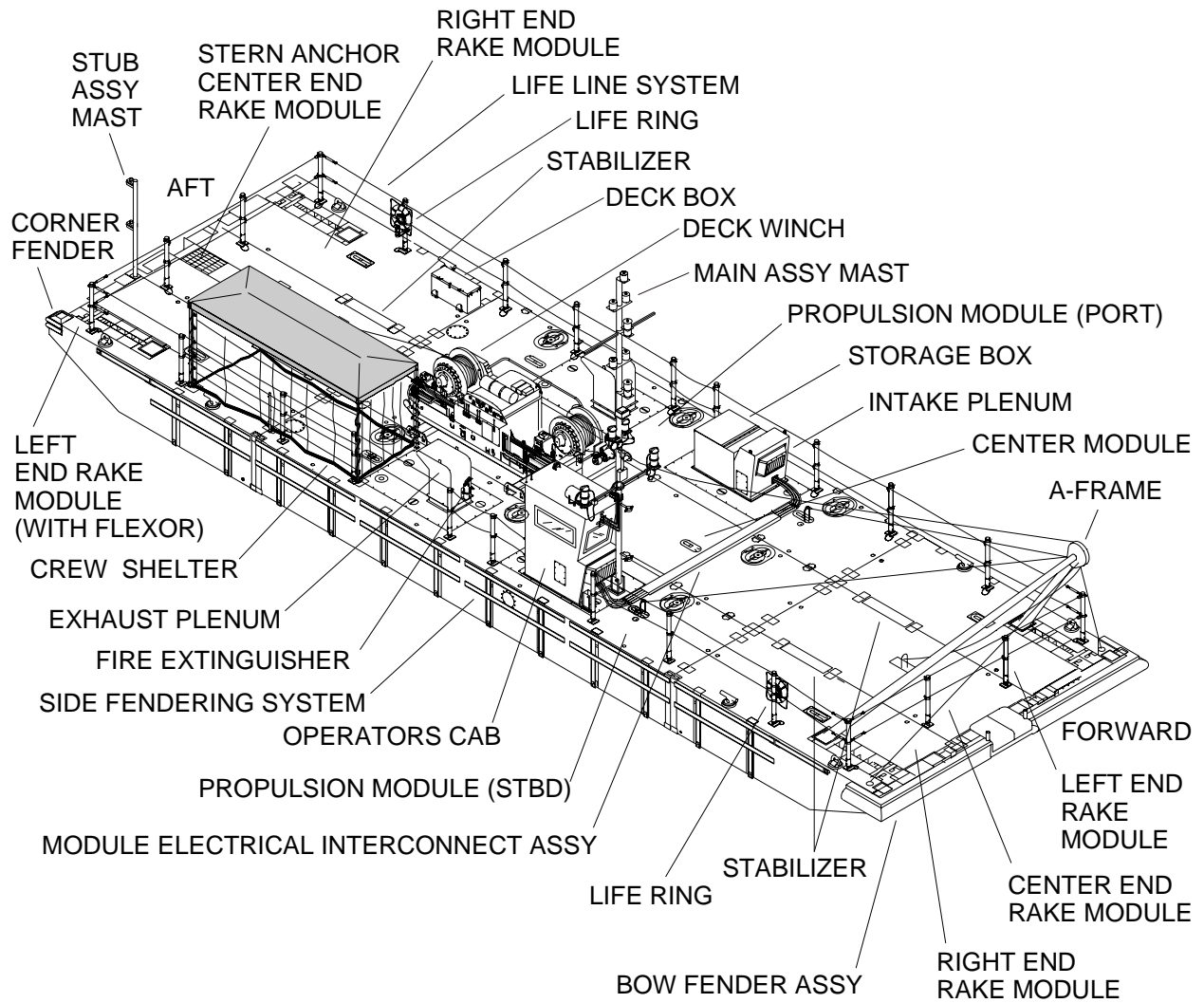
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

WARPING TUG POWERED SECTION

The WT powered section consists of two propulsion modules, one non-powered center module, two left and two right end rake modules, a center end rake module and a stern anchor center end rake module. All modules contain drainage systems to prevent water from accumulating in the lift shackle padeye locations.

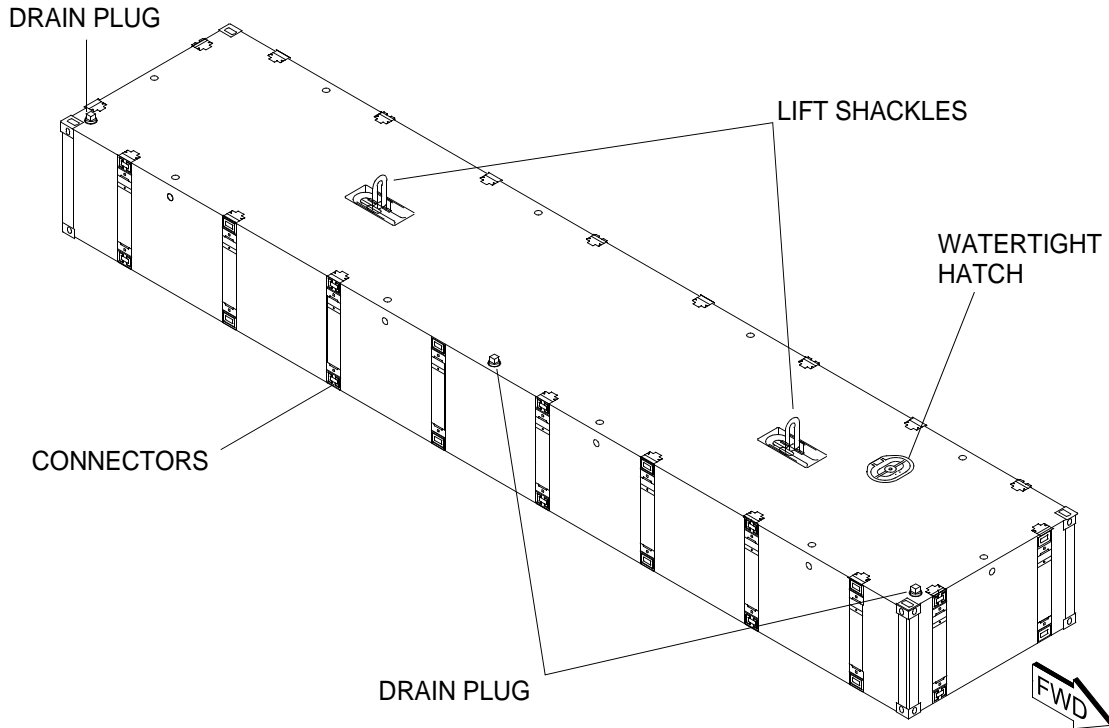


The following items complete the WT assembly. The operators cab, with controls, is a self-contained unit designed to be removed for transport and can be mounted on either port or starboard propulsion module. Plug-in type electrical connectors are provided to tie electrical control into the cab location. A module electrical interconnect assembly is the electrical control link between the cab to the propulsion module opposite the cab. Navigation lighting is provided by the main assembly mast mounted against the cab and a stub assembly mast that is installed on the aft end of the WT near the stern anchor. Both masts are removable for shipment. Air intake and exhaust plenums are installed on the propulsion modules to provide air flow through the machinery spaces. One air intake is integral to the cab. The deck equipment includes a deck winch, an A-frame and a stern anchor. The deck winch is a dual drum, diesel hydraulic reversible winch with capstan that provides pull for the A-frame and stern anchor. Four skag assemblies are installed, two forward and two aft, to provide some stability during operation at sea. A handheld portable fire extinguisher mounts to either exhaust plenum. A removable personnel safety railing system, made up of stanchions and life lines, is installed along the port and starboard sides and across the forward and aft ends of the WT. An equipment storage box is mounted to the air intake plenum, a deck box is mounted to the aft port side end rake and a crew shelter is mounted aft of the starboard side exhaust plenum. The WT is also equipped with side fenders, corner fenders and a bow bumper.



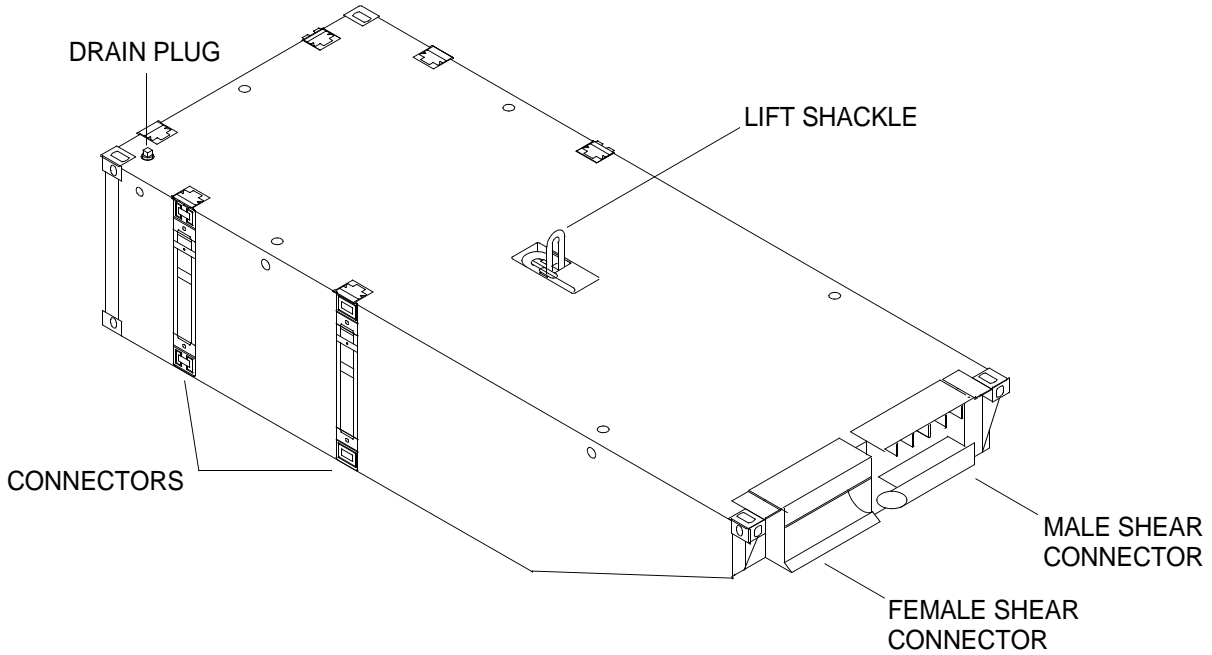
CENTER MODULE

The center module is located between the propulsion modules. The center module is a hollow structure with two 25 ton capacity lifting shackles, which are flush mounted in the deck. The textured deck and smooth bottom are free of any protrusions that might obstruct packing. Access for internal leak detection of each compartment is provided by three recessed threaded plugs located on the top of the module. Alternating male and female connectors are equally spaced along both sides and ends of the module. The lock assemblies are stowed flush with the surface and, when deployed, connect modules with minimum clearance. The center module contains a storage area below deck, which is accessible through a watertight hatch.



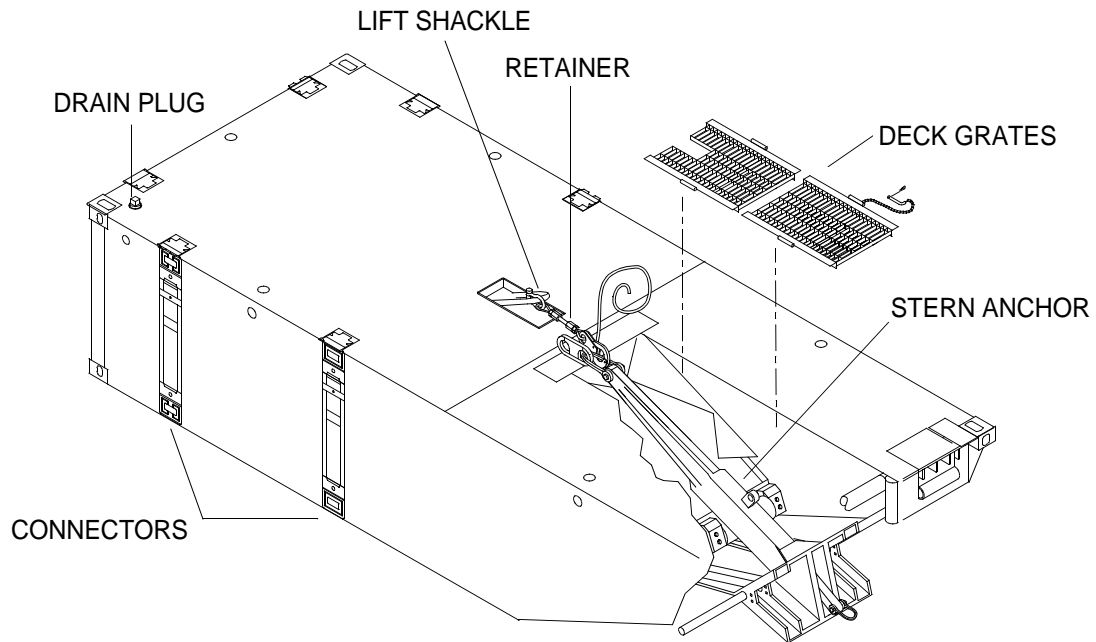
CENTER END RAKE MODULE

The center end rake module is attached on the forward end of the center module. The center end rake module is a hollow structure with one 25 ton capacity lifting shackle, which is flush mounted in the deck. The textured deck and smooth bottom are free of any protrusions that might obstruct packing. Access for internal leak detection of each compartment is provided by a recessed threaded plug located on the top of the module.



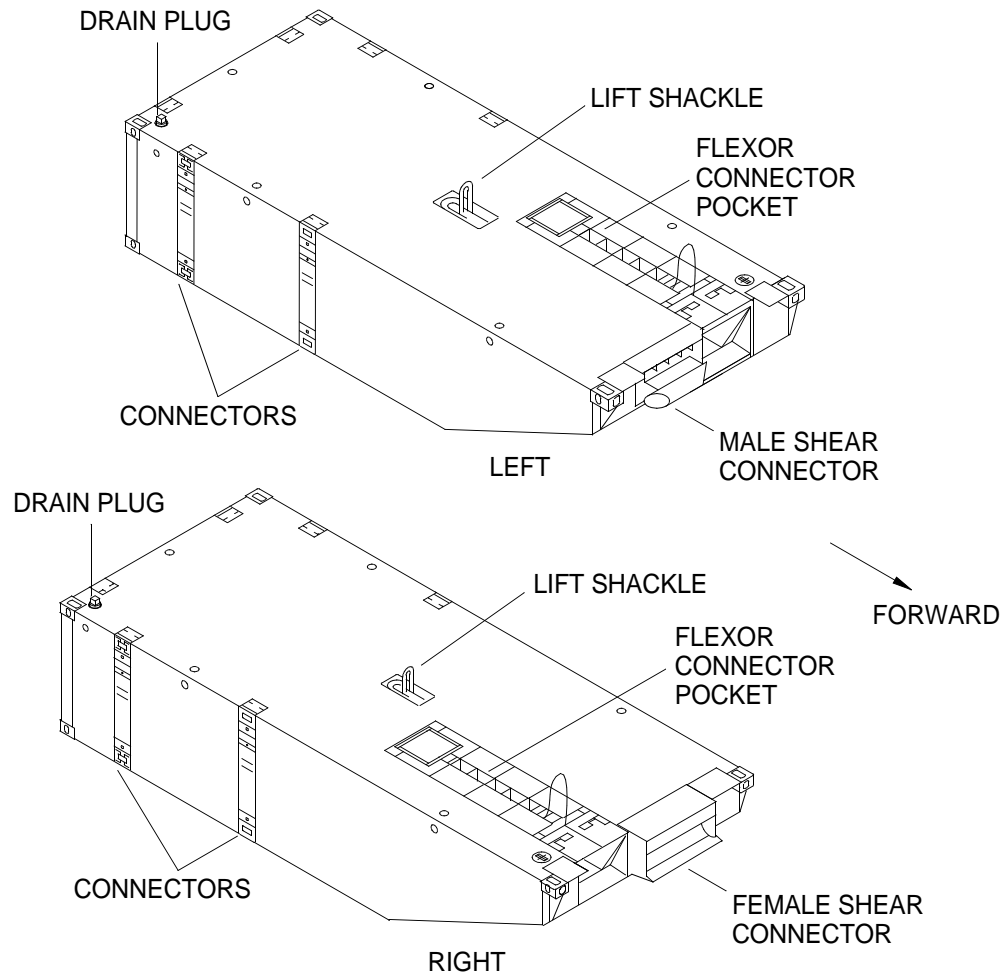
STERN ANCHOR CENTER END RAKE MODULE

The stern anchor center end rake module is attached to the aft end of the center module. The stern anchor center end rake module is a hollow structure with one 25 ton capacity lifting shackle, which is flush mounted in the deck. The textured deck and smooth bottom are free of any protrusions that might obstruct packing. Access for internal leak detection of each compartment is provided by a recessed threaded plug located on the top of the module. The module is designed with a channel for the housing, deployment and recovery of the stern anchor. The WT stern anchor is a NAVMOOR 1,000 lb anchor (dry weight = 1,120 lb). It is housed, deployed and recovered from within a channel located in the center of the module. The stern anchor is attached to the deck winch aft drum cable. Two removable grates are installed over the channel to protect personnel from stepping into the channel.



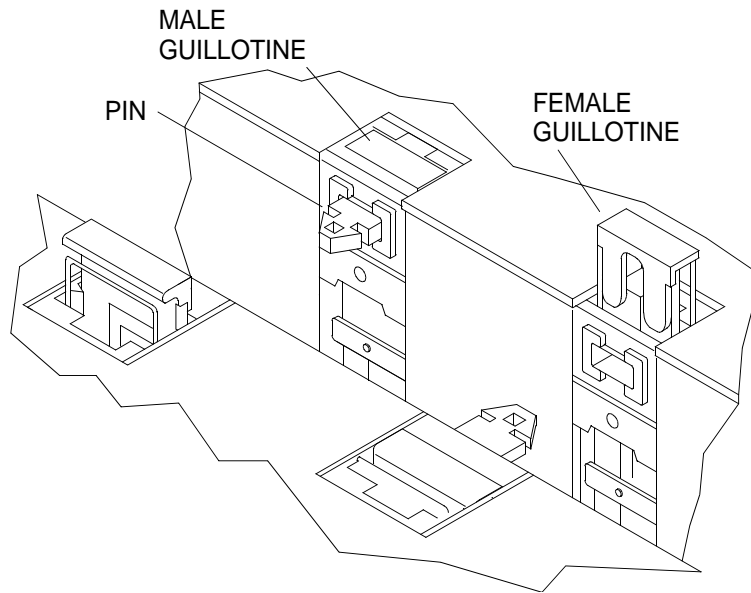
LEFT AND RIGHT END RAKE MODULES

The left and right end rake modules are attached to the end of the propulsion modules. The left and right end rake modules are hollow structures with one 25 ton capacity lifting shackle, which is flush mounted in the deck. The textured deck and smooth bottom are free of any protrusions that might obstruct packing. Access for internal leak detection of each compartment is provided by a recessed threaded plug located on the top of the module. The left and right end rake modules have flexor connector pockets for flexor connecting to other modules. The left end rake has a male shear connector and the right end rake has a female shear connector. These are used as a mating device during assembly and act as a hinge during operation.



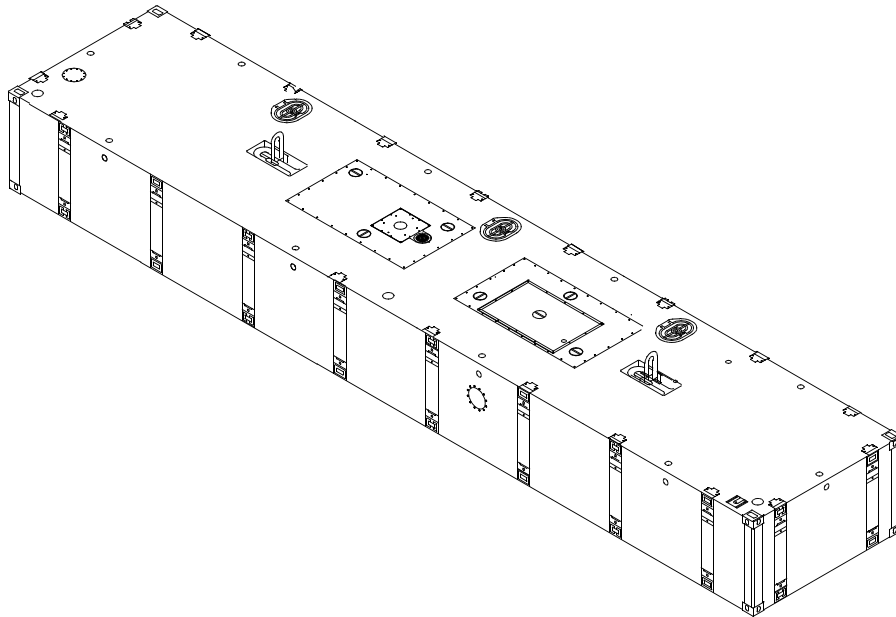
INTERCONNECT GUILLOTINES

The interconnect guillotines are mounted to the sides and ends of the modules and are used to secure the modules together during assembly of the WT. The female guillotine interlocks with the male guillotine connecting pin and lock when the guillotines are flush with the deck.



PROPULSION MODULE

The two propulsion modules are attached to the center module. The propulsion modules are the prime movers for the WT and each is propelled by an inline six cylinder, 625 HP, four cycle, water cooled, turbo charged, diesel marine engine driving a 360° steerable, 5,000 lb output pump-jet.



The propulsion module is divided into three compartments separated by watertight bulkheads with hatches. The center (machinery) compartment is the largest and contains engine cooling and exhaust components, the drive train, hydraulic system and all electrical components with the exception of one bilge pump, a single bilge pump control panel, a pressure operated switch, a light fixture and a switch that are located in the lazaret end compartment.

The drive train consists of a diesel engine, marine gear, transfer case and pump-jet. Guarded drive shafts connect the marine gear to the transfer case and the transfer case to the pump-jet.

The engine cooling and exhaust system consists of a seachest (raw water inlet integral with the structure of the module), a butterfly valve, a duplex strainer, engine raw water pump, fuel cooler, engine cooler heat exchanger, marine gear oil cooler, exhaust water shutoff valve, transfer case oil cooler, transfer case shutoff ball valve, water cooled muffler and exhaust flappers.

The hydraulic system consists of a hydraulic pump driven by the marine gear, a hydraulic motor that drives the primary steering planetary gearbox mounted on the pump-jet, a hydraulic brake which is integral to the auxiliary steering planetary gearbox mounted on the pump-jet, an electrically actuated way-valve with auxiliary manual control, manually operated ball valve, needle valve, braking valve unit, pressure filter and a hydraulic reservoir with return line filter. A manual hydraulic hand pump is also provided for manual release of the hydraulic brake in case of system malfunction.

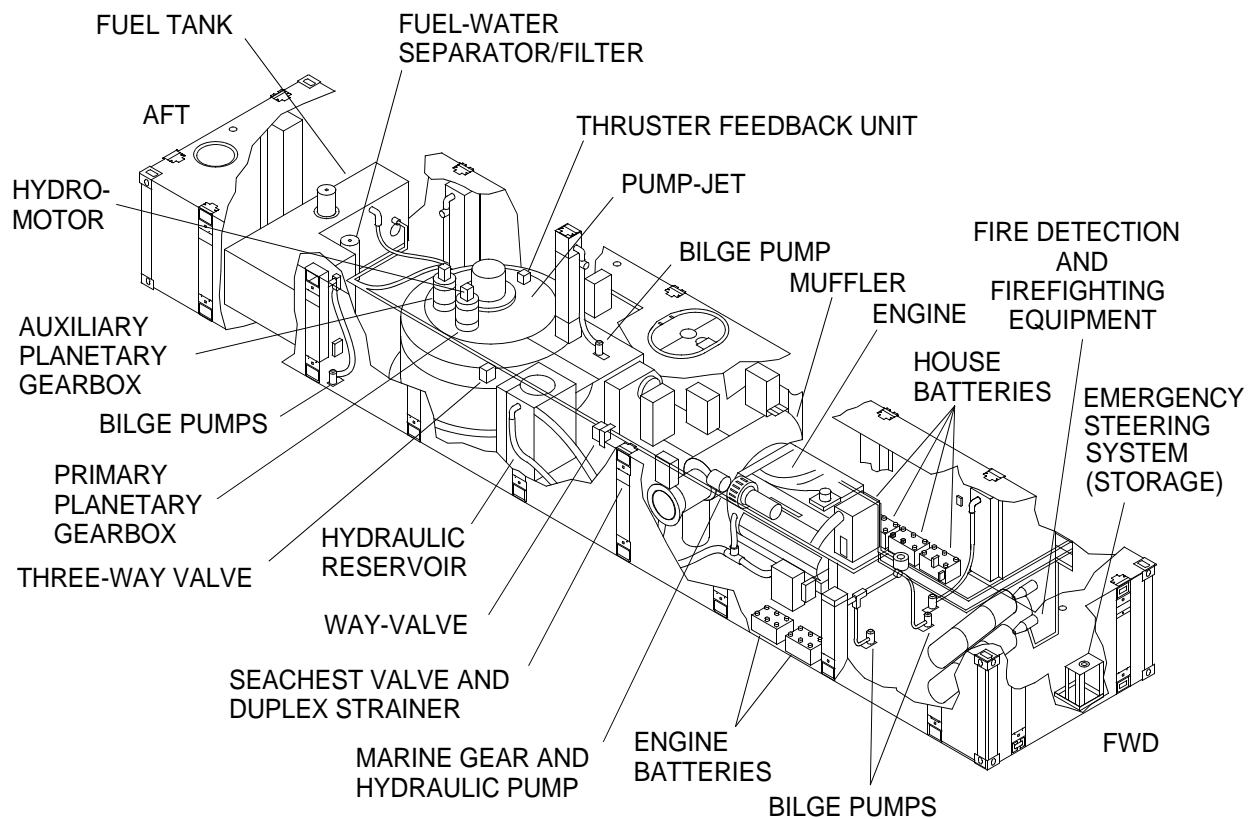
The propulsion module electrical system consists of an engine mounted alternator, six lead-acid storage batteries, propulsion module circuit breaker panel A6, bilge pump control panel A5, single bilge pump control panel A7, engine junction box with emergency stop control A4, engine mounted emergency stop push button, propulsion module junction box A3, pump-jet thruster junction box A2JB2, vent fan relay enclosure A8, thruster direction/auxiliary battery junction box assembly A9, isolator junction box assembly A12, fire detection system consisting of two thermal switches and a pressure switch electrically tied into the cab controls. If the temperature inside reaches 225°F, a fire alarm will sound in the cab. In the event of a fire, a manually activated fire suppression system will flood this compartment with CO₂ and the engine and machinery space ventilation fan will shut down. This compartment is also equipped with five electrically operated bilge pumps and float switches. Two NATO receptacles are also located in the propulsion module. One receives power from the house batteries and one receives power from the engine batteries.

The aft (fuel) compartment contains the fuel tank, fuel/water separator and fuel system shutoff valves. This compartment is also protected by the fire detection system. It is important to note that there are no electrical connections, controls or operating devices in this compartment. A bilge pump is not provided in this compartment. Fire detection is accomplished by means of a probe extending through the bulkhead that separates the fuel and machinery compartments with all electrical terminations made on the machinery compartment side. In the event of fire, this compartment is flooded with CO₂ upon activation of the fire suppression system.

Both the machinery compartment and the lazaret are equipped with lighting fixtures to provide personnel with an adequate light source when working below deck. Individual light switches control the lighting in each area. Lighting switchbox A10 controls power to the machinery compartment and lighting switchbox A11 controls power to the lazaret.

The forward compartment (lazaret) contains the fire suppression system control and agent storage components and provides stowage for the emergency steering assembly when not in use. This compartment is equipped with a bilge pump and float switch and is not protected by the fire suppression system.

Each propulsion module has six 3,700 GPH, submersible bilge pumps; five in the machinery compartment and one in the lazaret. The pumps are locally controlled from control stations mounted in the machinery compartment and lazaret or remotely controlled from the operators cab in conjunction with float switches. The pump-jet is driven by the diesel engine, which delivers 625 HP at 2,300 RPM on the output shaft. Weight of the propulsion module is approximately 41,100 lb. Listed below are detailed descriptions of the major components found in each propulsion module.



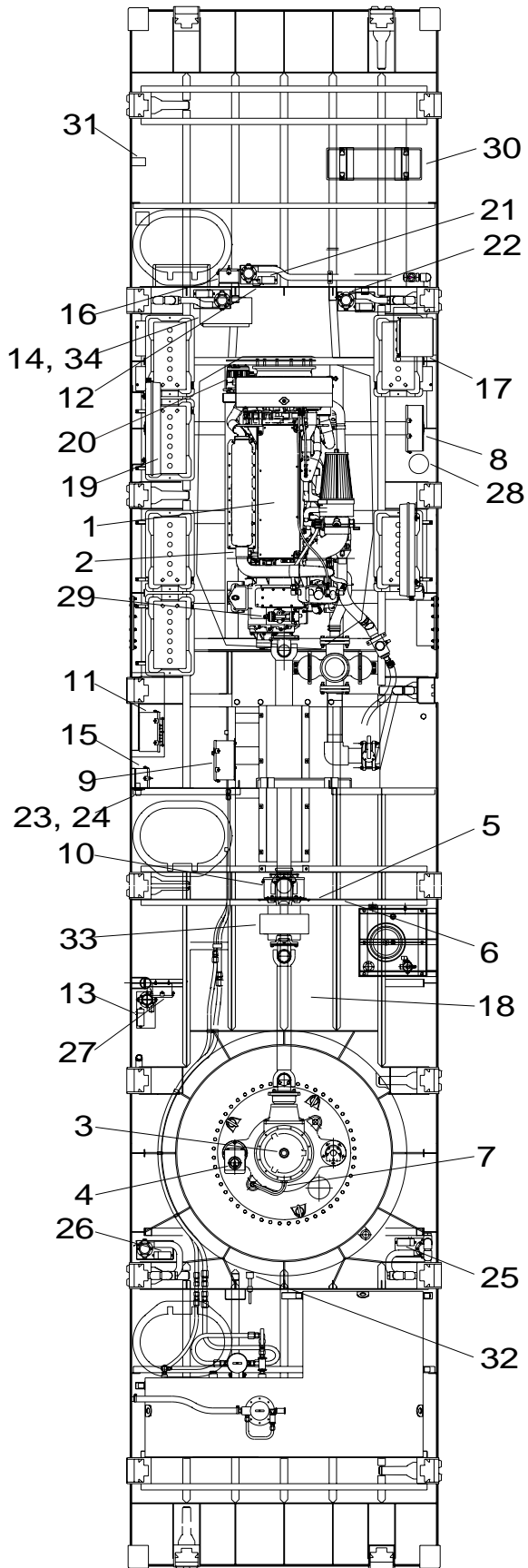


Table 1. Below Deck Equipment Locations.

KEY	DESIGNATOR	COMPONENT
1	A1	Engine and Components (Includes marine interface module, electric control module, temperature and pressure sending units. Components are wired to engine in harness KMB-1.)
2	A1B1	Engine Starter
3	A2	Thruster and Components
4	A2B1	Thruster Steering Position Synchro
5	A2JB2	Thruster Junction Box
6	A2JB1	Hydraulic Control (Note: Hydraulic control box connects to steering solenoids.)
7	A2S2	Thruster Gear Box Oil Level Switch
8	A3	Propulsion Module Junction Box
9	A4	Engine Junction Box (Contains emergency stop switch and three on/off toggle switches for the engine control module, marine interface module and engine controls.)
10	A5	Bilge Pump Control Panel (Contains five REMOTE/MANUAL toggles switches for bilge pump control in the machinery compartment.)
11	A6	Propulsion Module Circuit Breaker Panel (Contains the MAIN circuit breaker and 12 on/off toggle switches for power distribution.)
12	A7	Single Bilge Pump Control Panel (Contains one REMOTE/MANUAL toggle switch for bilge pump control in the lazaret.)
13	A8	Vent Fan Relay Enclosure for Vent Fan Motor (B1)
14	A9	Thruster DIR/AUX Battery Junction Box Assembly
15	A10	Engine Spaces Lights Switch Box Assembly
16	A11	Lazaret Lights Switch Box
17	A12	Isolator Junction Box Assembly
18	B1	Vent Fan Motor
19	BT	Batteries (total 6: 4 port and 2 starboard)
20	G1	Alternator
21	JB1	Junction Box for #1 Bilge Pump (B2)
22	JB2	Junction Box for #3 Bilge Pump (B4)
23	NR-1	NATO Receptacle (Engine)
24	NR-2	NATO Receptacle (NR2)
25	JB5	Junction Box for #5 Bilge Pump (B6)
26	JB6	Junction Box for #6 Bilge Pump (B7)

Table 1. Below Deck Equipment Locations. (Continued)

KEY	DESIGNATOR	COMPONENT
27	JB8	Junction Box for #4 Bilge Pump (B5)
28	L1	Cold Start Solenoid
29	L2/L3	Clutch Engage Forward/Backflush Solenoids
30	DS	Light (DS1 near pump-jet, DS2 near access hatch, DS3 over port batteries, DS4 over starboard batteries and DS5 in lazaret)
31	S2	CO ₂ Pressure Switch
32	S8	Aft Fire Thermal Detector
33	S9	Middle Fire Thermal Detector
34	VR1	Regulator for Alternator

Engine

The engine is an inline six cylinder, water cooled, turbo charged, after cooled, four cycle diesel marine engine delivering 625 HP at 2,300 RPM. All operator control of the engine is accomplished from the operators cab, with the exception of below deck emergency stop pushbuttons.

Exhaust System

The propulsion module exhaust system consists of a water cooled muffler assembly with an input directly coupled to the engine turbocharger exhaust port. The muffler is supplied with two exit ports. One is plugged and one is ported to the exhaust flapper for configuration as either a port or starboard exhaust system. The piping between the turbocharger, muffler and exhaust flapper is a flexible silicon hose to accommodate for thermal expansion in the system.

Fuel System

Each propulsion module is equipped with a 400 gallon stainless steel fuel tank permanently welded inside the fuel compartment. Fuel suction and return lines are fitted with shutoff ball valves to isolate fuel to the tank when not in use or during repairs to the fuel system. A filler neck/strainer basket, located on top of the fuel tank, is accessible through a deck hatch from outside the fuel compartment. A dual purpose fuel-water separator and filter is located near the fuel tank in the fuel tank compartment at the rear of the module to remove water and contaminants from the diesel fuel. A fuel level indicator is mounted directly to the fuel tank for indicating the amount of fuel remaining in the tank.

Fuel-Water Separator/Filter

A dual purpose fuel-water separator and filter is located near the fuel tank in the fuel tank compartment at the rear of the module. Its main function is to remove water and contaminants from the diesel fuel.

Marine Gear

The marine gear provides the capability to reverse the directional rotation of the other drive train components making it possible to backflush the pump-jet. It is mounted directly to the flywheel housing of the diesel engine. The transmission is equipped with an integral hydraulic system consisting of a pump, shifting valve and internal hydraulic cylinders. The pump utilizes the transmission lubricating oil to operate hydraulic cylinders, which shifts the gears to the backflush, neutral or engaged configurations. The shifting valve is solenoid actuated from a toggle control switch in the operators cab. In addition to powering the shifting cylinders, the pump also circulates case oil through an oil cooler that is plumbed into the engine raw water cooling system. In the event of electrical power loss to the marine gear shifting solenoids, an emergency engagement capability is provided for the marine gear by actuating a lever on the side of the valve body.

Transfer Case

The transfer case compensates for offset alignment between the output flange of the marine gear and the input flange of the pump-jet. It has a 1:1 gear ratio, utilizing spur gears throughout, and is equipped with an oil pump that circulates lubricating oil from its gear case through an oil cooler plumbed off of the engine raw water cooling system and back to the top of the transfer case to lubricate the upper gearing. The transfer case is connected to the marine gear and the pump-jet via drive shafts.

Machinery Guards

Removable metal machinery guards cover the drive shafts, engine flywheel and alternator belts to protect personnel from contact with rotating parts.

Pump-Jet

Each propulsion module is equipped with a 360° steerable pump-jet propulsion unit capable of delivering 6,000 lb of thrust. Both pump-jets are controlled electrically and hydraulically from the operators cab. The pump-jet works on the principal of a rotary pump and consists of a drive shaft that drives an upper gearbox assembly, which drives an impeller. Water is sucked into the pump-jet through a feeding funnel on the bottom of the module and fed into the enclosed pressure casing, whose bottom plate is provided with three systematically arranged outlet nozzles from which water is ejected at a 13° angle. A hydraulic steering motor drives a spur gear through a planetary gearbox to rotate the pressure casing and steering nozzles, located on the bottom, in both senses of rotation without limitation. A second planetary gearbox is provided to facilitate emergency steering. The emergency steering control stand is mounted abovedeck and interfaces with the through shaft of the planetary gearbox. The emergency steering gearbox contains a spring set, hydraulically released disc brake. The brake maintains the position of the steering nozzle until rotation is called for by the operator. In the event of hydraulic system failure, the brake can be released via the hydraulic hand pump to facilitate emergency steering.

An electromechanical feedback unit monitors relative steering position of the steering nozzle and transmits that position to a dial indicator in the operators cab. An electric sensor monitors the oil level in the upper gearbox and sends a signal to an indicating light in the operators cab when the oil level is below the required level.

Duplex Strainer

The duplex strainer is located by the diesel engine and is considered part of the raw water system. Its purpose is to collect debris from raw seawater and prevent it from entering the water pump.

Hydraulic System

The hydraulic system contained within each propulsion module provides the steering control for the pump-jet. The system includes an axial piston hydraulic pump mounted off the marine gear, a fixed displacement hydraulic motor mounted to the planetary gear drive off the pump-jet, hydraulic brake, control valves, filters and a 26 gallon hydraulic reservoir. The reservoir is fitted with an external sight level, in-tank suction strainer and in-tank return line filter. A pressure filter is located between the hydraulic pump and the way-valve control block. The interconnect piping between components includes a short section of hose to minimize the effects of vibration.

Hydraulic Pump

A flange mounted, axial piston hydraulic pump, driven by the marine gear, provides hydraulic pressure to operate the hydraulic steering motor and normal release of the hydraulic steering brake.

Hydraulic Motor

A fixed displacement, axial piston hydraulic motor (hydro-motor) is flange mounted on the input shaft of the pump-jet steering planetary gearbox. Hydraulic flow from the hydraulic pump is directed through the way-valve unit to drive the hydraulic motor in a clockwise or counterclockwise direction to rotate the steering nozzles.

Way-Valve Unit

The way-valve is controlled hydraulically by means of electrically operated pressure control valves or manually by means of a control lever mounted on the valve unit assembly. The way-valve directs hydraulic fluid via the load retaining valve to the hydraulic motor to control the direction in which the hydraulic motor rotates. A brake valve located on the pump-jet directs hydraulic pressure to the emergency steering planetary gearbox to release the hydraulic brake when rotation of the hydraulic motor is initiated.

Three-Way Valve

A manually operated control handle on the valve is positioned to select normal hydraulic operation or to isolate the normal hydraulics so that the emergency steering hydraulic hand pump can be used to release the hydraulic brake in the emergency steering mode.

Hydraulic Reservoir

The hydraulic reservoir is a 26 gallon holding tank for the system hydraulic fluid. The tank is equipped with a fill and drain port for replenishment of the fluid, a sight gauge to determine fluid level and a return line filter with dirt indicator to filter hydraulic fluid returning to the tank and outlet line strainer. The tank has a removable access panel to facilitate cleaning. A float switch monitors fluid level and lights an indicating light in the operators cab if the fluid level is below the required level.

Bilge Pumps

Each propulsion module is equipped with six bilge pumps, each capable of pumping 3,700 GPH in the event the propulsion module takes on water. Five are located in the machinery compartment and one in the lazaret. The pumps can be controlled remotely from the operators cab by illuminated pushbuttons when the corresponding float switch is actuated. The pumps can be tested locally at the bilge pump control panels without float switch actuation. Each pump is piped to a temporary 250 GAL holding tank, located forward of the lazaret, which receives all discharged oil/water. In an emergency, the discharged fluid can be redirected overboard.

Fire Detection and Fire Fighting Equipment

A fixed CO₂ fire suppression system is designed to flood the engine and pump-jet compartment and the fuel storage compartment with CO₂ in the propulsion module units if fire breaks out. Thermal detection probes activate an alarm in the operators cab if the temperature in the propulsion module reaches 225°F. One is mounted through the bulkhead behind the pump-jet to monitor the fuel compartment. The other one is mounted below the deck to monitor the machinery compartment. There is no thermal detector in the lazaret compartment. On the terminal strip A4, the fire alarm horn speaker will sound. The lower control panel in the operators cab has PORT FIRE ALARM and STARBOARD FIRE ALARM red indicator lights. Above deck manual activation is accomplished using a remote cable pull box recessed in the deck and located directly in front of the access hatch and forward of the operators cab. Pulling the handle activates the fire suppression system and floods the compartment with CO₂. A below deck manual release is located on the upper 50 lb bottle. When any of the fire suppression controls are manually pulled, four events occur:

- (1) Activates fixed time delayed CO₂ fire suppression system that, 30 seconds later, discharges into propulsion module to suffocate fire.
- (2) Disconnects cable from intake plenum inner vent cover causing it to close and shut off oxygen sources.
- (3) Cable action shuts off relay for exhaust fan in exhaust plenum.
- (4) Activates pressure trip mechanism to shut off diesel engine.

A portable CO₂ fire extinguisher is mounted on the front of either exhaust plenum.

Emergency Steering System

Each propulsion module is equipped with an emergency steering system consisting of a mounting stand, shaft with pillow block bearing support and hand crank. It is stored in the forward lazaret and is used to manually maneuver the WT in the event of a hydraulic system failure.

Pump-Jet Thruster Junction Box (A2JB2)

The pump-jet thruster junction box is mounted opposite the personnel access hatch approximately midway in the machinery compartment. The box contains relays and circuitry necessary to operate the way-valve steering solenoids and a circuit breaker for over-current protection.

Propulsion Module Junction Box (A3)

The propulsion module junction box is located on the forward starboard side of the machinery compartment. The box is the termination point for connection of three of the four main power cables that connect the propulsion module to the cab.

Engine Junction Box (A4)

The engine junction box is located inboard near the personnel access hatch. It is a steel enclosure that contains the diesel engine control interfaces, terminal strips and two relays controlling the emergency stop air flap solenoid and the emergency malfunction bell. An engine emergency stop pushbutton and circuit breakers for the engine control module, marine interface module and engine control circuits are mounted on the enclosure cover.

Bilge Pump Control Panel (A5)

The bilge pump control panel is mounted very near the center line of the propulsion module inboard of the personnel access hatch. The panel consists of a steel enclosure with five toggle switches, one for each bilge pump located in the machinery compartment, to provide remote (from operators cab) or manual (local) operation of the bilge pumps.

Propulsion Module Circuit Breaker Panel (A6)

The propulsion module circuit breaker panel is located in the machinery compartment, opposite the engine junction box, next to the personnel access hatch. The panel is a steel enclosure with 14 circuit breakers mounted to the enclosure cover. Thirteen circuit breakers are protected by a plastic guard plate mounted with stand-offs. Access slots permit operation of the circuit breakers while protecting them from accidental shut off or damage. The propulsion module main circuit breaker (A6CB1) and operators cab circuit breaker (A6CB11) must both be in the on position for the operators cab circuit breaker panel (A3) to receive power.

Single Bilge Pump Control Panel (A7)

The single bilge pump control panel is located in the lazaret and consists of a steel enclosure mounted to the bulkhead that separates the lazaret from the machinery compartment. A single toggle switch for the lazaret bilge pump operation is mounted to the enclosure cover and provides remote (from operators cab) or manual (local) operation of the bilge pump.

Vent Fan Relay Enclosure (A8)

The vent fan relay enclosure is located in the machinery compartment, just forward of the pump-jet on the same side as the personnel access hatch. The assembly consists of a steel enclosure with a plug-in type receptacle located on the bottom. The enclosure is the power source for vent fan operation and contains the relay for fan operation. Once the exhaust plenum is mounted, the power cord that is hard wired to the fan can be plugged into the receptacle to complete the installation. A screw-on cover protects the receptacle when not in use. The power cord from the fan is equipped with a screw cap that matches the receptacle thread to secure the cord to the enclosure.

Thruster Direction/Auxiliary Battery Junction Box Assembly (A9)

The pump-jet thruster direction/auxiliary battery junction box is mounted on the machinery compartment side of the bulkhead that separates the machinery compartment and the forward lazaret. The box contains a converter, voltage regulator/battery charging circuit, two 12 VDC batteries, a control relay and two terminal blocks. The enclosure is vented due to possible off-gassing of the batteries. The two auxiliary batteries provide emergency power to the thrust indicators mounted on the middle control panel A1 in the event of power failure.

Engine Space Lights Switch Box Assembly (A10)

The engine space lights switch box assembly is located near the personnel access hatch and provides power to all machinery compartment lighting.

Lazaret Light Switch Box (A11)

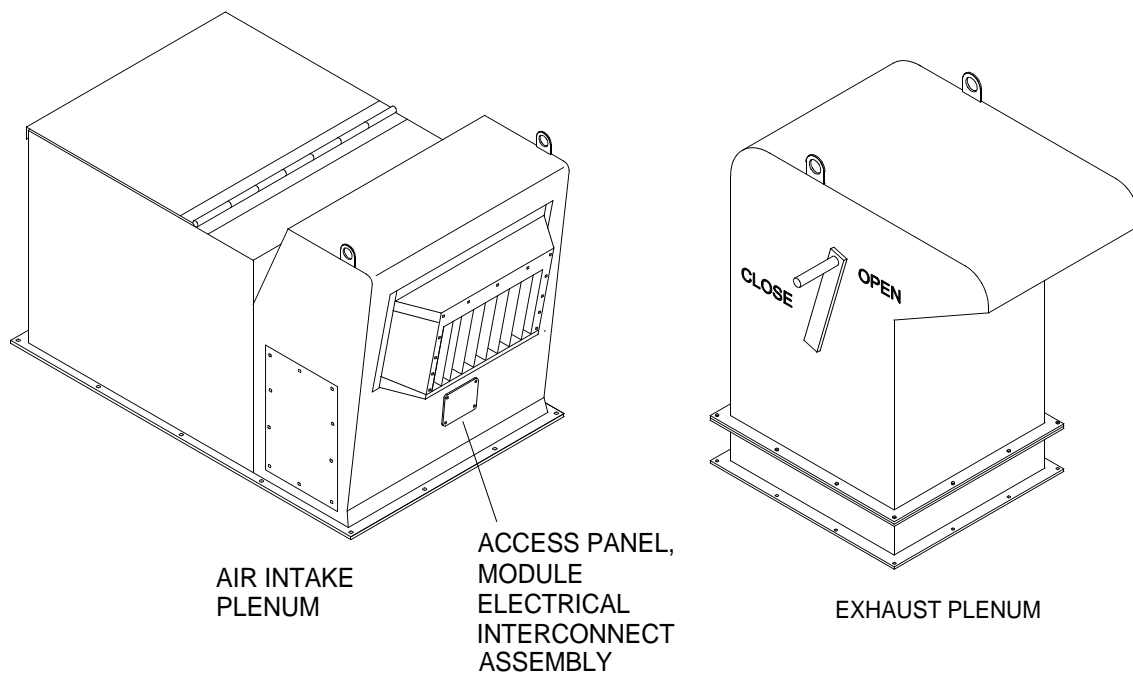
The lazaret light switch box is located near the personnel access hatch to the lazaret compartment and provides power to the below deck lighting in this area only.

Isolator Junction Box Assembly (A12)

The isolator junction box assembly is mounted on forward starboard side of the machinery compartment and contains a triple output isolator, the ammeter shunt and a power terminal block. The enclosure is vented to prevent overheating.

VENTILATION

Although not a part of the propulsion module itself, the port side intake plenum is mounted over the engine. The starboard side air intake is integral with the operators cab. The intake plenum access panel allows connection of the module electrical interconnect cable to the engine operating receptacles. The exhaust plenums are mounted over the pump-jet. The exhaust plenum fans are used to facilitate fresh air flow through the compartment and limit the engine compartment to a temperature rise of 20°F above ambient temperature. The exhaust plenum has a flapper door (damper) that is manually opened and closed. It is closed to eliminate a second source of air to any fire below deck. The port and starboard exhaust fans are controlled from the operators cab by toggle switches located on the lower control panel A2.



OPERATORS CAB

The operators cab is a portable steel fabricated unit, which can be mounted on either the port or starboard propulsion module. It houses the middle control panel A1, lower control panel A2, the operators cab circuit breaker panel A3, the terminal strip assembly A4 and the mast enclosure assembly A7 (navigation light switch box) that contains primary and spare main navigational light controls and indicators. A module electrical interconnect assembly is the electrical control link that allows control of both propulsion modules from the operators cab. The receptacles for the interconnect assembly are located within a operators cab access panel and air intake plenum access panel.

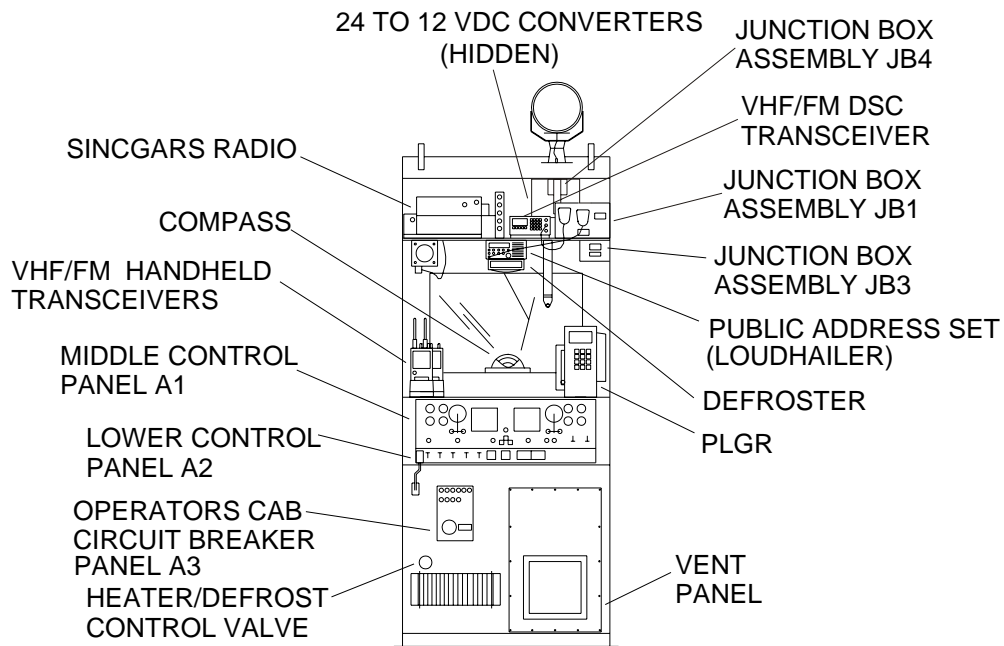
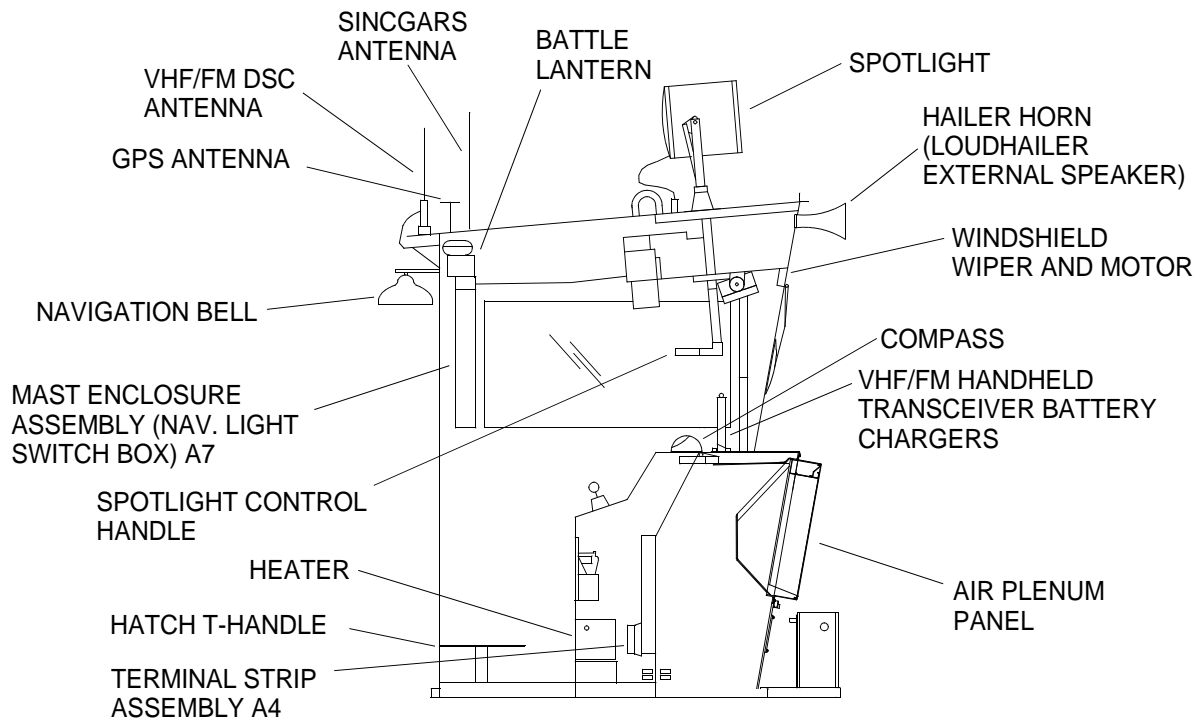
Communications and electronic equipment required to operate the WT include the VHF/FM DSC (Digital Selective Calling) transceiver programmable with weather channel, VHF/FM DSC 24 to 12 VDC converter VR1, AN/VRC-90A SINCGARS radio transmitter, two VHF/FM handheld transceivers with hands free capability and their associated battery chargers plus two additional batteries with charging buckets, public address set (loudhailer) with hailer horn (external loud speaker), AN/PSN-11(V)1 Precision Lightweight Global Positioning Receiver (PLGR) and a 24 to 12 VDC converter VR2 that supplies power to the VHF/FM handheld transceiver chargers, loudhailer and compass. The compass, located on the shelf above the middle control panel, has a remote sensor mounted on the main assembly mast. Junction box JB3 provides inline fuse protection for the PLGR, VHF/FM handheld transceiver chargers, loudhailer and compass.

Antennas for the VHF/FM DSC transceiver, AN/PSN-11(V)1 PLGR and AN/VRC-90A SINCGARS radio transmitter, along with a public address set (loudhailer), hailer horn (located forward) and a 12 inch diameter, 24 VDC marine duty spotlight are all located on the operators cab roof. The spotlight is controlled by a manual remote lever control that penetrates the operator cab roof and is activated by a toggle switch located on the middle control panel A1. The navigation horn signal is generated by depressing the "FOG" key on the loudhailer keying the loudhailer Push To Talk (PTT).

The operators cab contains a heater to maintain temperature at 65°F minimum in an ambient temperature of -10°F. Both the heater and the windshield defroster require hot water, which comes from the diesel engine glycol cooling system. There are hot water shutoff valves for the operators cab heating system which must be open for water to flow and the heating system on to provide heat. The defroster/heater control valve is used to determine the degree of heat which will be directed to the defroster or heater or simultaneously to both defroster and heater. With the valve fully closed, hot air will be directed only to the front window defroster. With the valve fully open, hot air will be directed to the heater. Any position of the valve between full open and full close will direct hot air to both defroster and heater. The defroster has inlet, outlet and bleeder valves. Toggle switches located on the lower control panel A2 activate the heater and defroster fans. An inline check valve on the hot water supply line and an electrically operated solenoid valve on the return line controlled by module selector switch A4S1 maintain fluid in the heating system when the engine power is not on or the operators cab is removed from the propulsion module. Module selector switch A4S1 toggle switch is mounted on the terminal strip assembly A4 and is set to either a starboard or port position. The position of the switch depends on the operators cab location on the powered section (starboard/port). Module selector switch A4S1 receives 24 VDC from the engine junction box A4 (CB3). The electrically operated solenoid valve on the return line is normally closed when the engine power is not on and the engine control circuits are not energized.

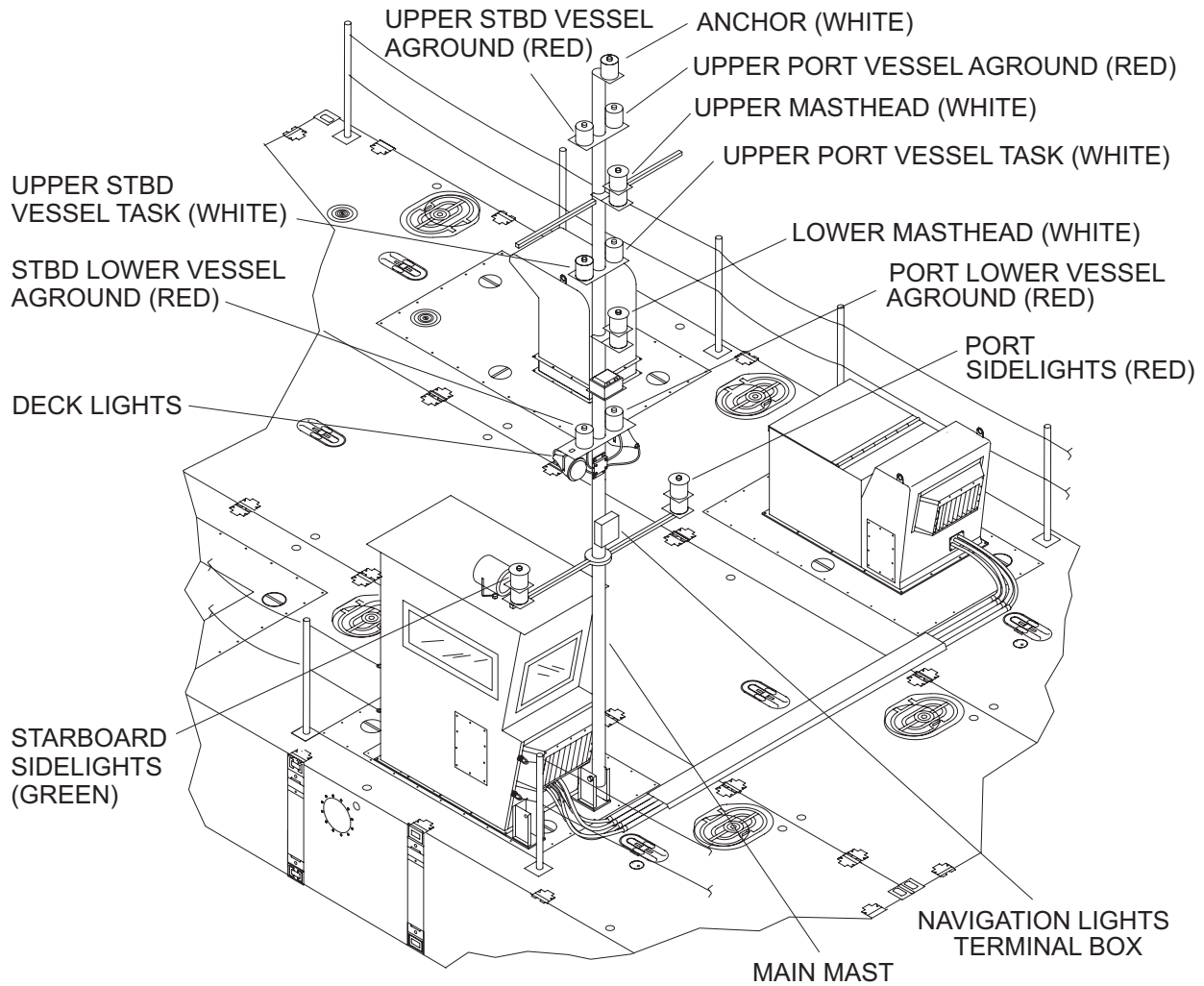
Miscellaneous operator cab equipment includes a windshield wiper that is activated by toggle switch located on the middle control panel, two handheld radios, a battery operated battle lantern and a navigation bell mounted on the rear of the operators cab.

Two deck lights attached to the main assembly mast provide abovedeck lighting for topside activity. These lights are controlled by a toggle switch/circuit breaker on the operators cab circuit breaker panel A3.

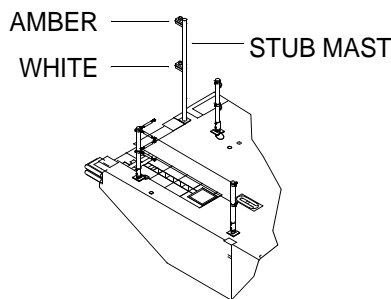


NAVIGATION LIGHTS

The main assembly mast is mounted on the front inboard side of the operators cab and the stub assembly mast is mounted on the aft starboard of the WT. These masts provide the necessary navigational running lights for signal and safety while the WT is in operation. The main assembly mast lights are activated by toggle switches located on the mast enclosure assembly A7 located inside the operators cab. The stub assembly mast contains two lights that are both battery powered and controlled by an on/off switch. Each light contains a light sensor that prevents the light from turning on when ambient light is present.



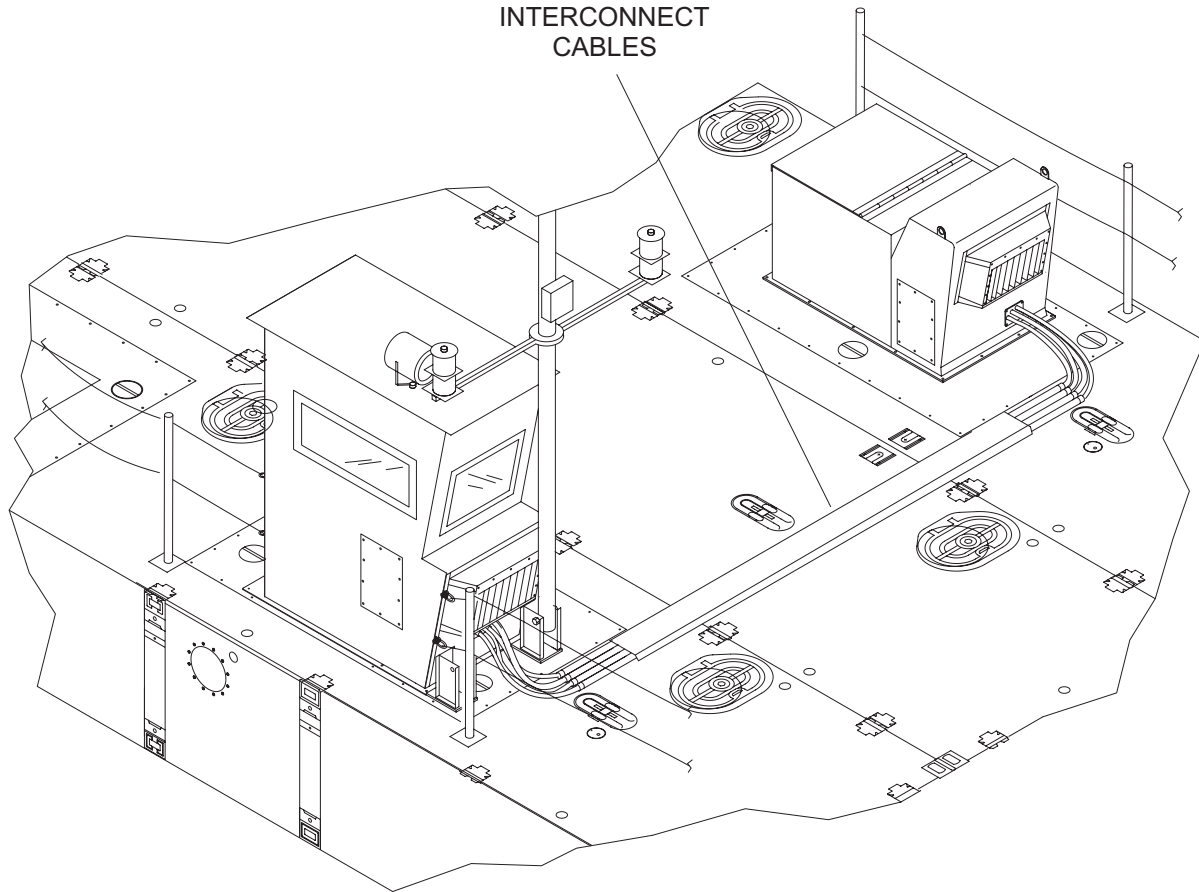
MAIN NAVIGATION MAST



STUB MAST

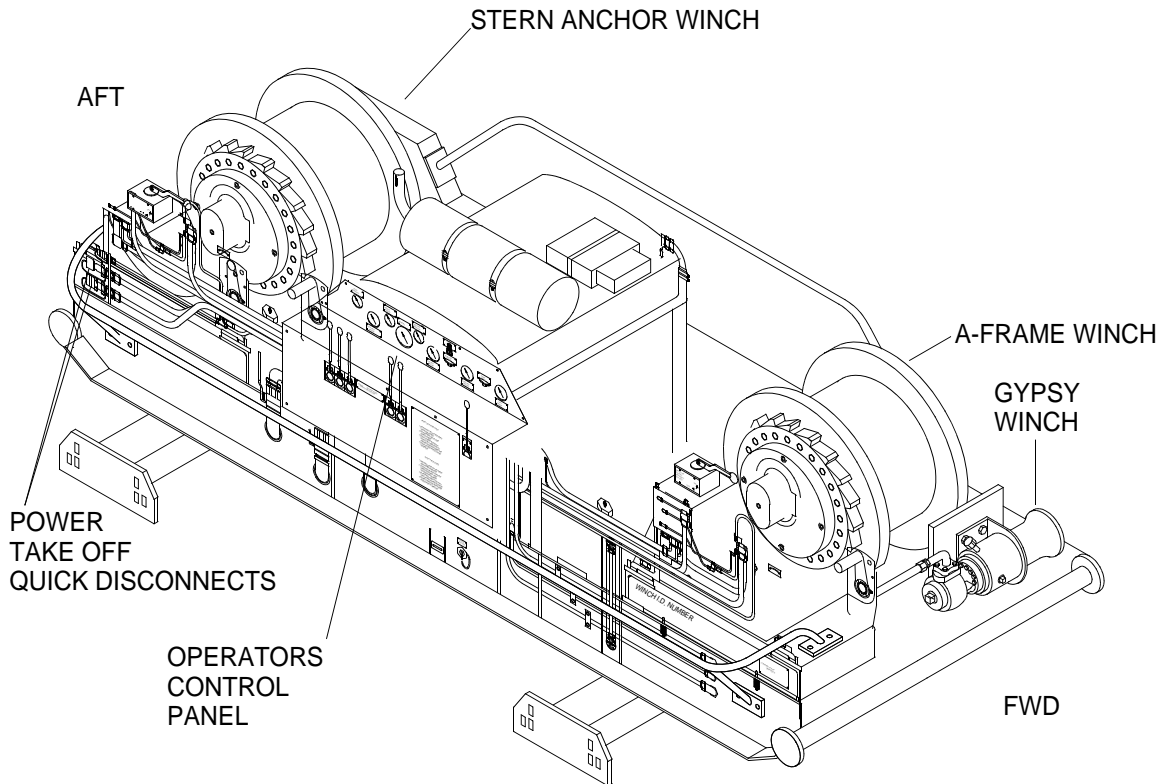
MODULE ELECTRICAL INTERCONNECT CABLES

The two propulsion modules are linked together with a reinforced set of interconnect cables that are mounted forward of the operators cab and the opposite side air intake plenum. The interconnect assembly allows operation commands to be transmitted from the operators cab to both propulsion module engines and pump-jet thrusters. The interconnect cable assembly is connected to receptacles located on front of the operators cab and the front of the intake plenum.



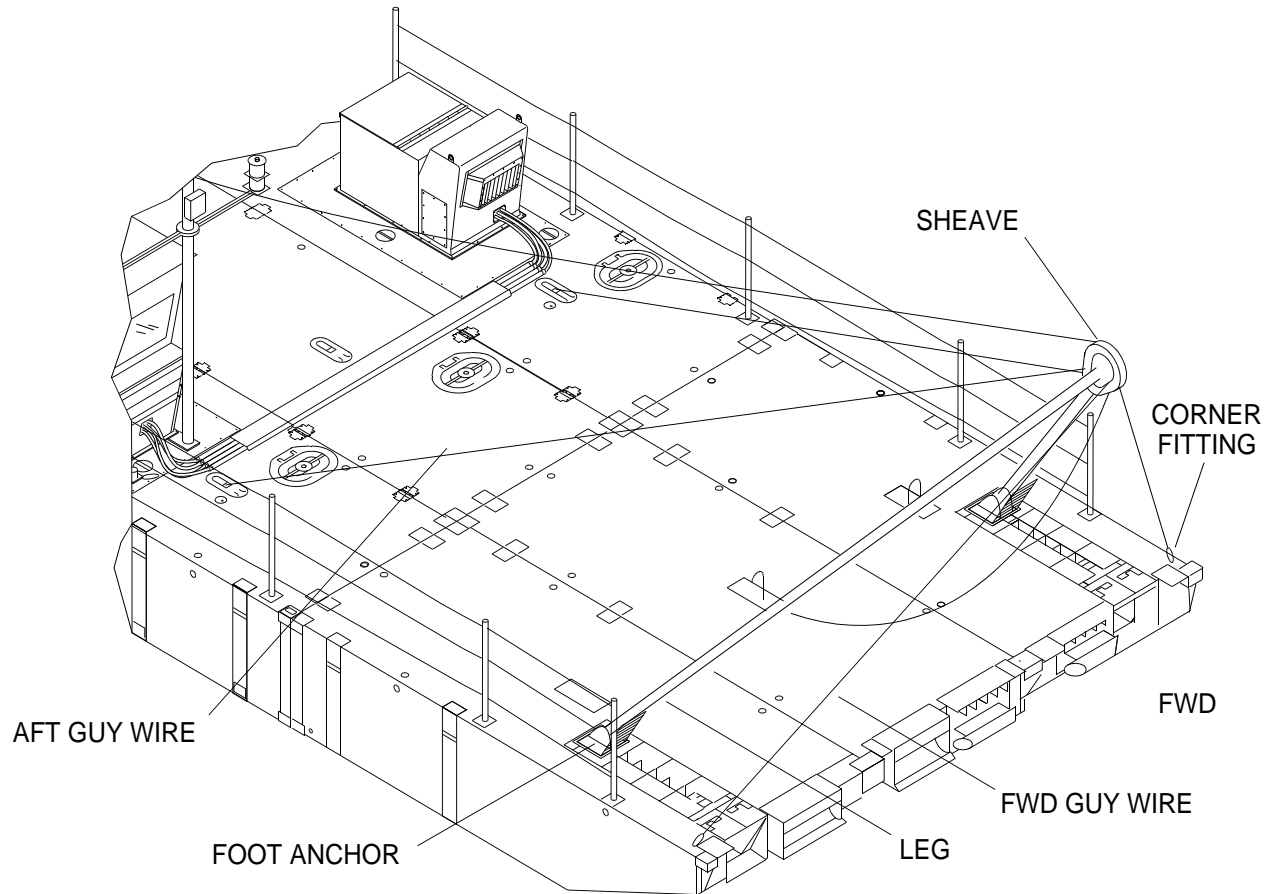
DECK WINCH

The WT primary working tool is a dual drum diesel-hydraulic reversible winch with a capstan. The winch is installed aft of the operators cab on the center module. It provides the line pull for the A-frame and the stern anchor. The forward drum is used with the A-frame and the aft drum is used with the stern anchor. The winch rated line pull is 27,000 lb bare drum and 19,500 lb full drum. Each drum carries 700 ft of 1 in. diameter wire rope. A 12 in. diameter gypsy (drum capstan) winch is located at the forward end, with a rated line pull of 5,000 lb. A power take-off is included with the winch to provide power to ancillary equipment and tools that are used on the WT.



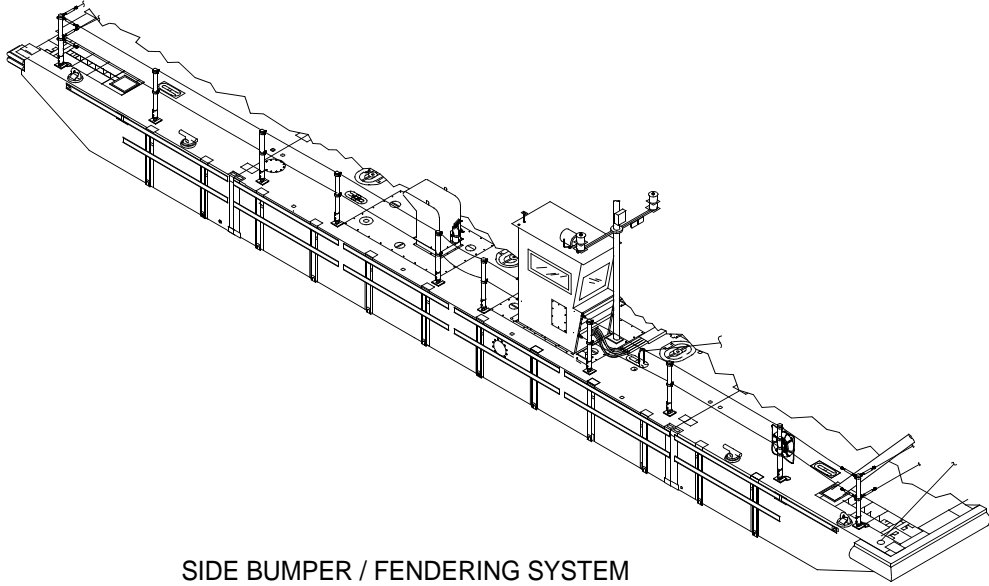
A-FRAME

The A-frame is located on the forward end of the powered section and has a lifting capacity of 27,000 lb when the load is forward of the plane of the A-frame legs. The safe working load for loads aft of the plane of the A-frame legs is 12,000 lb. The A-frame assembly includes two legs, a sheave, two foot anchors, two after guy assemblies, two forward guy assemblies and two corner fitting lugs. An elevating pole and an elevating pole guy assembly (not illustrated) are used with the deck winch to elevate the A-frame during assembly and disassembly. Guy wire tension is adjusted using turnbuckles.

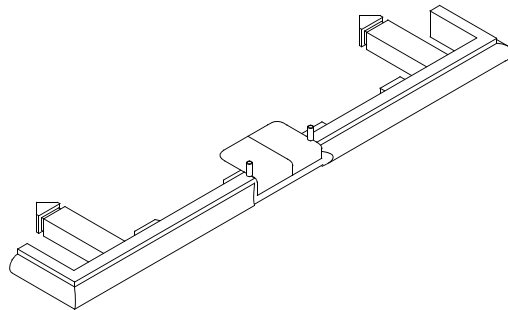


FENDERING SYSTEM

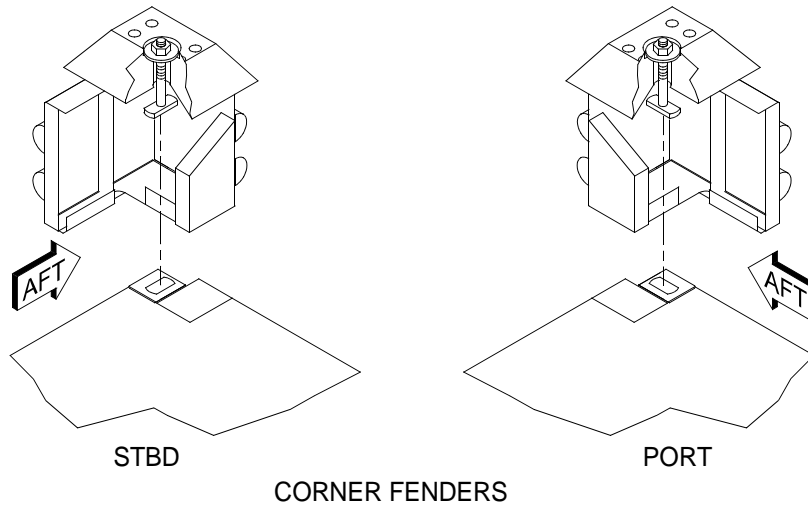
An eight piece side fendering system is attached to the guillotine fittings along each side of the WT to protect the sides from impact damage. The outboard ends of the fendering system are attached to a deck fitting on the end rake module. The bow fender assembly attaches to both end rake flexor receivers and protects the front from impact damage. The corner fenders attach to the ISO corners and protects the rear end rake corners from impact damage.



SIDE BUMPER / FENDERING SYSTEM



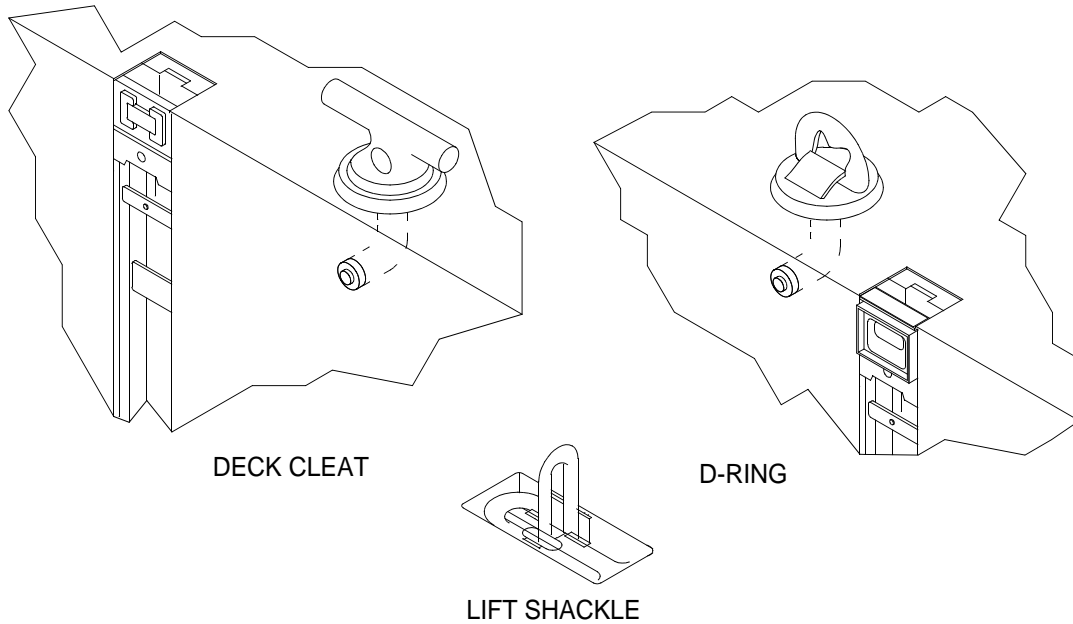
BOW FENDER ASSEMBLY



CORNER FENDERS

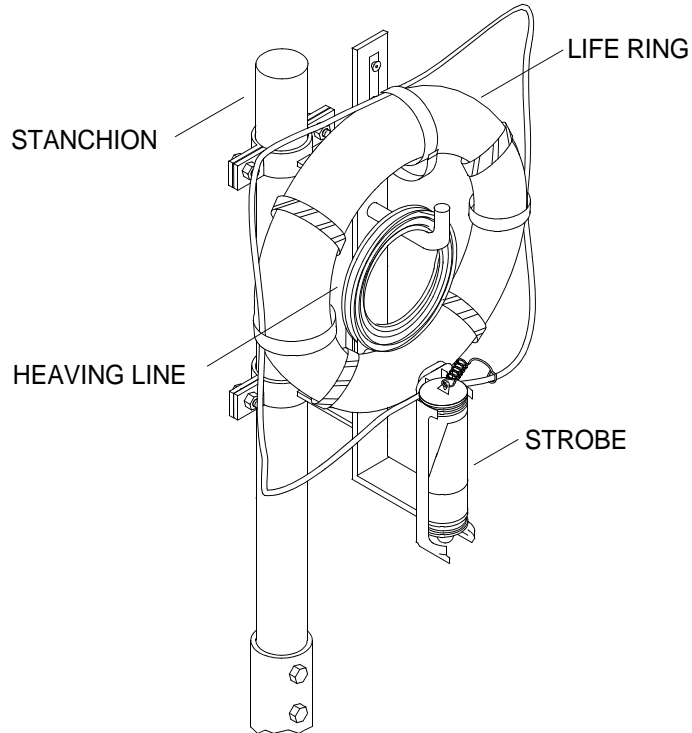
DECK FITTINGS

WT modules are provided with deck fittings to meet various operational needs. Available fittings include deck cleats and D-rings. These fittings are designed to have a working load that will exceed the breaking strength of a 5 in. (2 in 1 braid) nylon rope. There are 10 tube turns on each center and propulsion module and five on end rakes for mounting deck cleats and D-rings. The WT modules are provided with recessed lift shackles welded into the deck structure. The propulsion module lift shackles have a safe working load capacity of 35 tons. The center and end rake modules lift shackles have a safe working load capacity of 25 tons. There are two shackles on each center and propulsion module and one on the end rake. When stowed, the shackles fold down flush with the deck. Fittings are also available for the A-frame and deck winch.

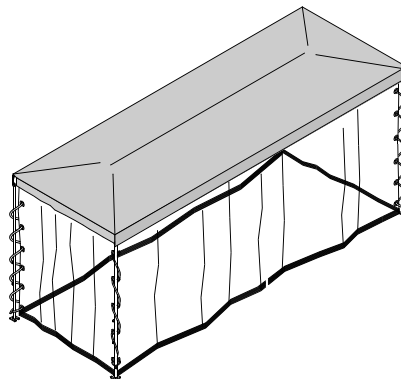


LIFE RING ASSEMBLIES

The two life ring assemblies are installed on life line stanchions of the WT and are used to assist in the rescue of personnel in the water. The life ring assemblies are mounted on the WT with one forward starboard side and one aft port side. The components of the life ring assembly consists of a donut shaped flotation device, a nylon heaving rope and strobe light mounted on a stanchion.

**CREW SHELTER**

The crew shelter is installed aft of the starboard side exhaust plenum on the WT. The crew shelter is composed of a canopy top and side panels stretched across an aluminum frame. The crew shelter provides overhead protection to personnel from the elements. Once assembled, the crew shelter is secured to the deck and attached to a life line stanchion for stability.



**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
EQUIPMENT DESCRIPTION AND DATA**

EQUIPMENT DATA

The following tables provides data applicable to major component levels.

Table 1. WT Equipment Data.

ITEM CHARACTERISTIC	DESCRIPTION
WARPING TUG	
Length	80 ft
Beam	24 ft
Depth	4 ft 6 in.
Freeboard (unloaded)	40 ± 2 in.
Freeboard (loaded)	12 ± 2 in.
Weight	@ 95.3 tons dry, 97.2 tons wet
Maximum Speed	6 knots, Sea State 2
Cargo Capacity	350 short tons
Fuel Tank Capacity (Maximum)	800 gallons (400 per tank; 340 usable)
Deck Winch	Model 27DH50DD5G (Reference TM 55-3950-204-14&P)
A-Frame	27,000 lb capacity
Stern Anchor	1,000 lb NAVMOOR anchor
PROPULSION MODULE	
Length	40 ft
Beam	8 ft
Depth	4 ft 6 in.
Weight	40,644 lb
Engine (2 per section)	DDC 60 Series, Model 6062-7404
Rated Horse Power (each)	625 HP at @ 2,300 RPM at output shaft
Cylinders	6 (inline)
Starting System	24 volt electric
Fuel Capacity	400 gallons
Average Operating Time Per Tank Of Fuel	10 hours
Marine Gear	Twin Disc, Model MG5114SC

Table 1. WT Equipment Data. (Continued)

ITEM CHARACTERISTIC	DESCRIPTION
Pump-Jet (2 Per Section)	Model SPJ-82-T
Pump-Jet Output (Each)	6,000 lb horizontal thrust at ship speed of 6 knots
Steering	360°
Electrical System	24 VDC 200 amps
Bilge Pumps	6 each at 3,700 GPH
Fire Suppression System	Manually Activated CO ₂
CENTER MODULES	
Length	40 ft
Beam	8 ft
Depth	4 ft 6 in.
Weight	21,263 lb
ISO Compatible	Yes
Sea State Operation	SS 2
END RAKE MODULES	
Length	20 ft
Beam	8 ft
Depth	4 ft 6 in.
Weights	
Left End Rake	11,568 lb
Left End Rake (Flexor Stowed)	12,968 lb
Right End Rake	11,566 lb
Center End Rake (Forward)	10,533 lb
Center Anchor Rake (Aft)	10,943 lb
Center Anchor Rake (With Stern Anchor Installed)	11,943 lb
ISO Comparable	Yes
Sea State Operation	SS 2
SKEG ASSEMBLIES	
Length	68 in.
Width	51 in.
Thickness	0.63 in.
Weight	1,105.19 lb

Table 1. WT Equipment Data. (Continued)

ITEM CHARACTERISTIC	DESCRIPTION
SHIPPING FRAMES	
One Intake and Two Exhaust Plenums	
Weight (includes shipping frame)	7,715.2 lb
Electrical Interconnect Assembly, Four Deck Cleats and Four D-Rings	
Weight (includes shipping frame)	7,791.72 lb
Main Assembly Mast, Stub Assembly Mast and Two A-Frame Legs	
Weight (includes shipping frame)	9,396.5 lb
Side Fendering System	
Weight (includes shipping frame)	13,189.88 lb
BOW FENDER ASSEMBLY	
Weight	3,740.8 lb
ISOPAK CONFIGURATIONS	
Intake and Exhaust Plenums Shipping Frame Mounted on Propulsion Module	
Weight	48,359.2 lb
Interconnect Assembly and Deck Fittings Shipping Frame Mounted on Propulsion Module	
Weight	48,435.72 lb
Side Fender Shipping Frame Mounted on Connected Left End Rake and Right End Rake	
Weight	36,323.88 lb
Mast and Stub Assembly Masts and A-Frame Legs Shipping Frame Mounted on Connected Left End Rake and Right End Rake	
Weight	32,530.5 lb
Center End Rake and Center Anchor Rake Mounted on Center Module	
Weight	42,739 lb

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
THEORY OF OPERATION

SYSTEM OPERATION

Operation of the WT revolves around the propulsion modules. Each contains a diesel engine (power) and a pump-jet for movement and direction. When the diesel engine is running, the marine gear (transmission) engages the transfer case into gear, which changes the engine speed to shaft speed. Seawater is brought into the pump-jet through the inlet grating at relatively low velocity in order to minimize ingesting debris. Seawater travels through the heliconic converter at high head and moderate velocity, thus reducing the losses due to turbulent flow. Seawater then flows through the discharge port, which contains a hydraulically actuated, specially designed steering nozzle. The accelerated water mass provides a reactive force acting on the hull of the vessel. Direction is controlled by rotation of the steering nozzle. Thrust is increased or decreased by varying the speed of the diesel engine. Controls and indicators necessary to operate the pump-jet are located in the operators cab. The following paragraphs provide the theory of operation of the WT subsystems.

DRIVE TRAIN

The drive train consists of the engine, marine gear, transfer case and pump-jet. Guarded drive shafts connect the marine gear to the transfer case and the transfer case to the pump-jet.

Engine

The engine is an inline six cylinder, water cooled, turbo charged, after cooled, four cycle, diesel marine engine, delivering 625 HP at 2,300 RPM. All operator control of the engine is accomplished from the operators cab.

Marine Gear

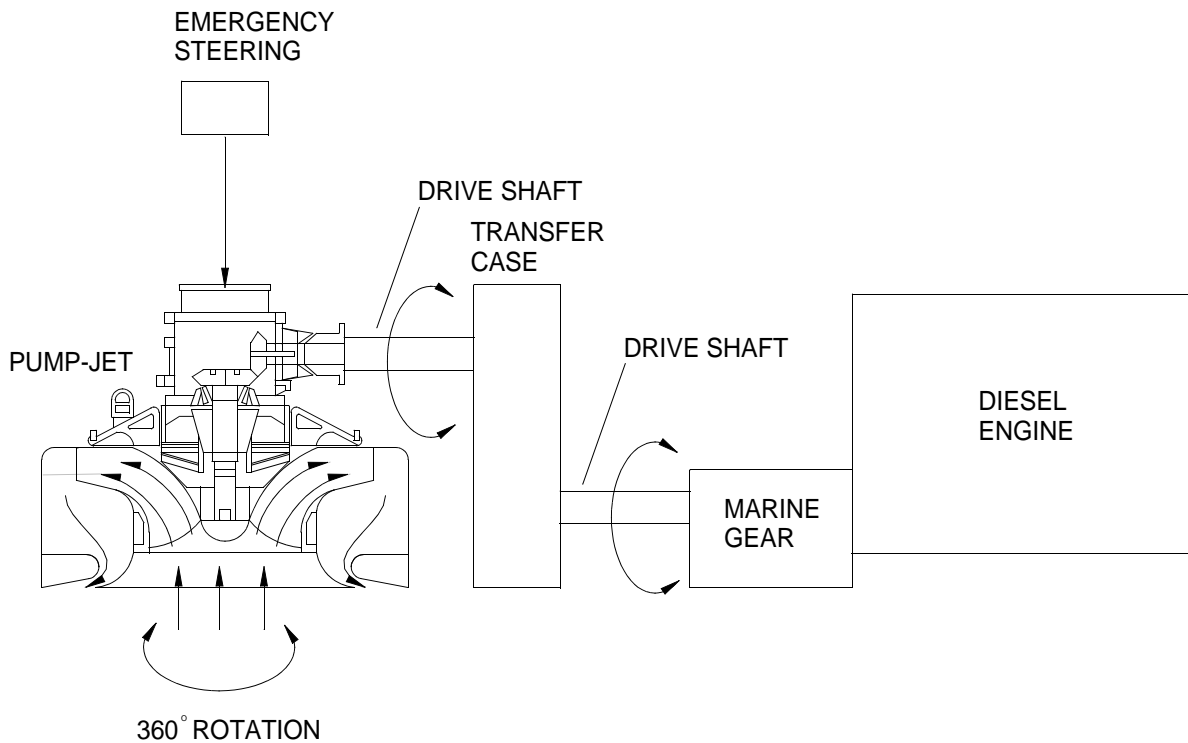
The marine gear is mounted directly to the flywheel housing of the diesel engine and provides the capability of reversing the directional rotation of the other drive train components, making it possible to backflush the pump-jet. The transmission is equipped with an integral hydraulic system consisting of a pump, shifting valve and internal hydraulic cylinders. The pump utilizes the transmission lubricating oil to operate hydraulic cylinders, which shifts the gears to the backflush, neutral or engaged configurations. The shifting valve is solenoid actuated from a toggle control switch in the operators cab. In addition to powering the shifting cylinders, the pump also circulates case oil through an oil cooler that is cooled by the engine raw water cooling system. In the event of electrical power loss to the marine gear shifting solenoids, an emergency engagement capability is provided for the marine gear by actuating a lever on the side of the valve body.

Transfer Case

The transfer case compensates for offset alignment between the output flange of the marine gear and the input flange of the pump-jet. It has a 1:1 gear ratio, utilizing spur gears throughout, and is equipped with an oil pump that circulates lubricating oil from its gearcase through an oil cooler that is cooled by the engine raw water cooling system and back to the top of the transfer case to lubricate the upper gearing. The transfer case is connected to the marine gear and the pump-jet via drive shafts.

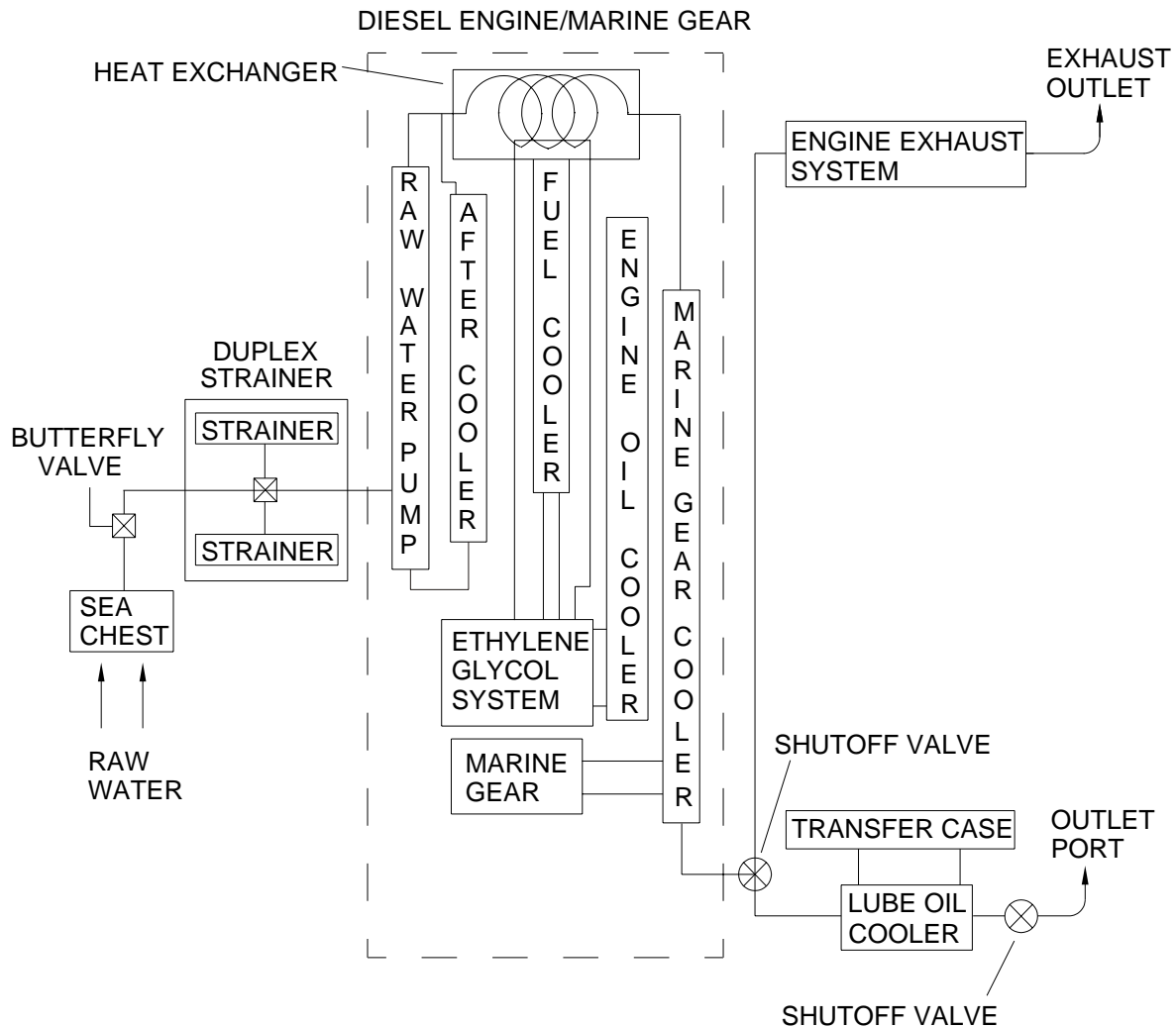
Pump-Jet

Each propulsion module is equipped with a 360° steerable pump-jet propulsion unit capable of delivering 6,000 lb of thrust. The pump-jet works on the principal of a rotary pump and consists of a drive shaft that drives an upper gearbox assembly that drives an impeller. Water is sucked into the pump-jet through a feeding funnel on the bottom of the module and fed into the enclosed pressure casing, whose bottom plate is provided with three systematically arranged outlet nozzles from which water is ejected at a 13° angle. A hydraulic steering motor drives a spur gear through a planetary gearbox to rotate the pressure casing and bottom plate (steering nozzles) in both senses of rotation without limitation. A second planetary gearbox is provided to facilitate emergency steering. The emergency steering control stand is mounted abovedeck and interfaces with the through shaft of the planetary gearbox. The emergency steering gearbox contains a spring set, hydraulically released disc brake. The brake maintains the position of the steering nozzle until rotation is called for by the operator. In the event of hydraulic system failure, the brake can be released via the hydraulic hand pump to facilitate emergency steering. An electromechanical feedback unit monitors relative steering position of the steering nozzle and transmits that position to a dial indicator in the operators cab. An electric sensor monitors the oil level in the upper gearbox and sends a signal to an indicating light in the operators cab when the oil level is below the required level.



COOLING AND EXHAUST (SEAWATER) SUBSYSTEM

The engine and exhaust system consists of the seachest (raw water inlet, integral with the structure of the module), butterfly valve, duplex strainer, engine raw water pump, aftercooler, engine coolant heat exchanger, marine gear oil cooler, exhaust water shutoff valve, transfer case oil cooler, transfer case shutoff ball valve, water cooled muffler and exhaust flappers. The water cooling system dissipates heat generated by the diesel engine, engine exhaust, marine gear and transfer case. This is accomplished by circulating raw (sea) water through the engine raw water pump, engine heat exchanger, marine gear oil cooler, transfer case oil cooler and muffler. The system is an open loop, drawing naturally cool seawater in one side and discharging heated seawater out of the other in a continuous cycle. The process requires the interaction of the following five subsystems.



Raw Water (Seawater) Subsystem

An engine driven raw water pump draws seawater from the seachest in the bottom of the hull through a duplex strainer to a heat exchanger at the front of the engine. Freshwater (ethylene glycol) cooling lines are passed through the heat exchanger. The raw water circulates around the engine coolant lines, lowering the temperature of the ethylene glycol coolant. Raw water exiting the heat exchanger is channeled through the marine gear oil cooler. Lubricating oil lines from the marine gear oil cooler is then channeled in two directions. A portion of the water is piped into the exhaust inlets to the muffler, cooling the muffler and exiting the module via the through hull assembly. The remaining water is piped through the transfer case lube oil cooler and exits the module via an outlet port.

Freshwater (Ethylene Glycol) Subsystem

Coolant is drawn by the engine water pump from the heat exchanger and is circulated through the engine lube oil cooler, cylinder block, cylinder heads and exhaust manifolds to the thermostat housings. A bypass from the thermostat housings to the inlet side of the water pump permits circulation of coolant through the engine when thermostats are closed. When the thermostats are open, the coolant flows through the heat exchanger where it is cooled. Thermostats control and regulate the flow of coolant within the freshwater cooling system to control engine temperature.

Marine Gear Oil Cooler

Raw water exiting the engine heat exchanger passes through the marine gear lube oil cooler. A gear pump, integral to the marine gear, circulates case oil from the marine gear through external lines to a heat exchanger type oil cooler and back to the transmission. Seawater passing through the oil cooler is circulated around the heat exchanger, lowering the temperature of the lube oil. The bearings, clutches and gears are lubricated and cooled by the returning lube oil.

Water Cooled Muffler

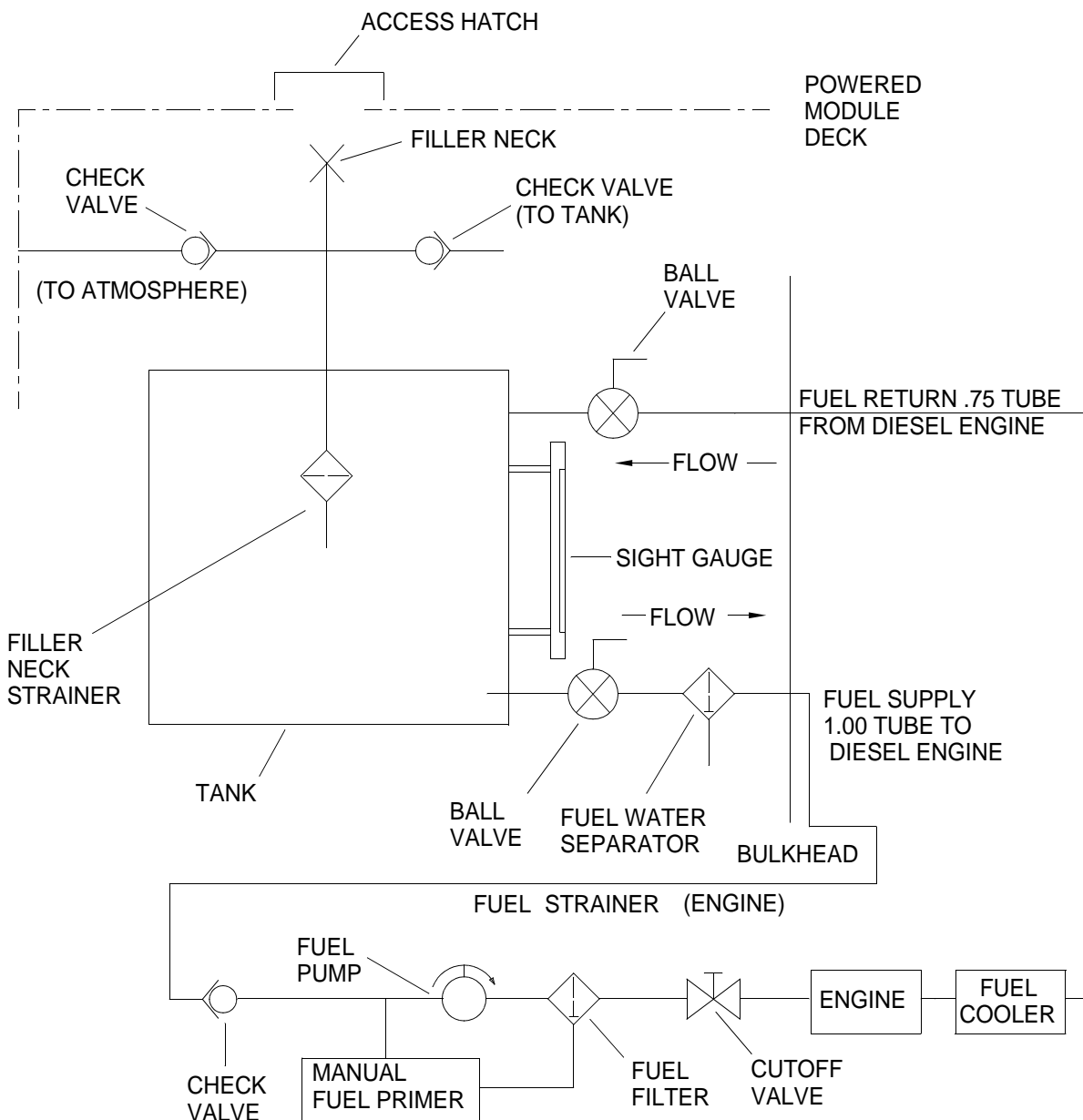
A normally open ball valve allows raw water exiting the marine gear oil cooler to be pumped into the exhaust system between the turbo charger and the muffler, filling the muffler with water and cooling prior to being expelled through the exhaust flapper port with the engine exhaust fumes. In addition to cooling the muffler, the water also acts as a noise dampening media within the muffler itself.

Transfer Case Lube Oil Cooler

A normally open ball valve allows raw water exiting the marine gear oil cooler to be pumped through the transfer case oil cooler. A gear driven pump, operated by rotation of the transfer case gearing, circulates lube oil from the transfer case through external lines to the heat exchanger type transfer case lube oil cooler and back to the transfer case. Seawater passing through the heat exchanger cools the lube oil. The cooled oil is returned to the top of the transfer case, lubricating the upper gears and bearings and cooling the unit simultaneously.

FUEL SYSTEM

The fuel system provides a filtered fuel supply to the diesel engine and is identical for port and starboard propulsion modules. A fabricated steel fuel tank stores 400 gallons of diesel fuel. The level of fuel in the tank can be viewed through a sight gauge located on the side of the tank. Fuel is added to the tank through a filler neck and filtered through a mesh strainer and plug, located on the top of the tank. The filler neck is accessible from the deck of the propulsion module through an 8 in. hatch. During refueling, air is vented from the tank through a check valve. Another check valve allows air to be drawn into the fuel tank as fuel is consumed. Fuel supply and return lines are sized to reduce fuel line pressures. During operation, fuel flows out of the tank through a one in. diameter fuel supply line to a fuel/water separator to remove water (condensation or other moisture) from the fuel. Fuel then travels through the supply line and is drawn through a secondary fuel filter mounted on the engine before entering the inlet fuel manifold, then through the fuel pipes to the inlet side of the fuel injectors. Surplus fuel returns from the outlet side of the fuel injectors to the fuel return manifold and then back to the fuel tank through a 0.75 in. diameter fuel return line. A fitting in the fuel outlet manifold in one of the cylinder heads maintains fuel system pressure. A check valve in the supply line prevents fuel from draining back to the tank when the engine is not running. Ball valves are provided on the supply and return lines to shut off the flow of fuel during maintenance and when the WT is not in operation.



VENTILATION SYSTEM

The ventilation system draws outside air and directs it below deck around the engine and other propulsion module components, removing heat and toxic fumes aft to be expelled to the atmosphere through the exhaust plenums. In addition, the intake plenum flapper door closes when the fire suppression system is activated, shutting off the supply of air to the machinery compartment. A secondary purpose of the system is to provide service access to the components below deck through large, removable deck covers. The WT ventilation system is comprised of the following components and operating mechanisms listed below.

Air Intake Plenum

The air intake plenum accepts outside air and directs it below deck to the machinery compartment. It is mounted on the engine hatch of the propulsion module facing forward. The plenum may be located on either the port or starboard side, depending on placement of the operators cab for that section. An air intake plenum is built into the front of the operators cab. The intake plenums also include the conduit entry plates for the electrical interconnect when the propulsion modules are assembled into a powered section.

Air Intake Plenum Flapper Door (Damper)

The intake plenum contains a flapper door which works in conjunction with the fire suppression system. A wire rope, attached to the flapper door within the intake plenum, is released when the fire suppression system is activated. This allows the flapper door to fall due to its own weight and rotate about 45° downward, closing the door and preventing oxygen from feeding a fire within the machinery compartment of the propulsion module.

Ventilation Fan (Exhaust Fan)

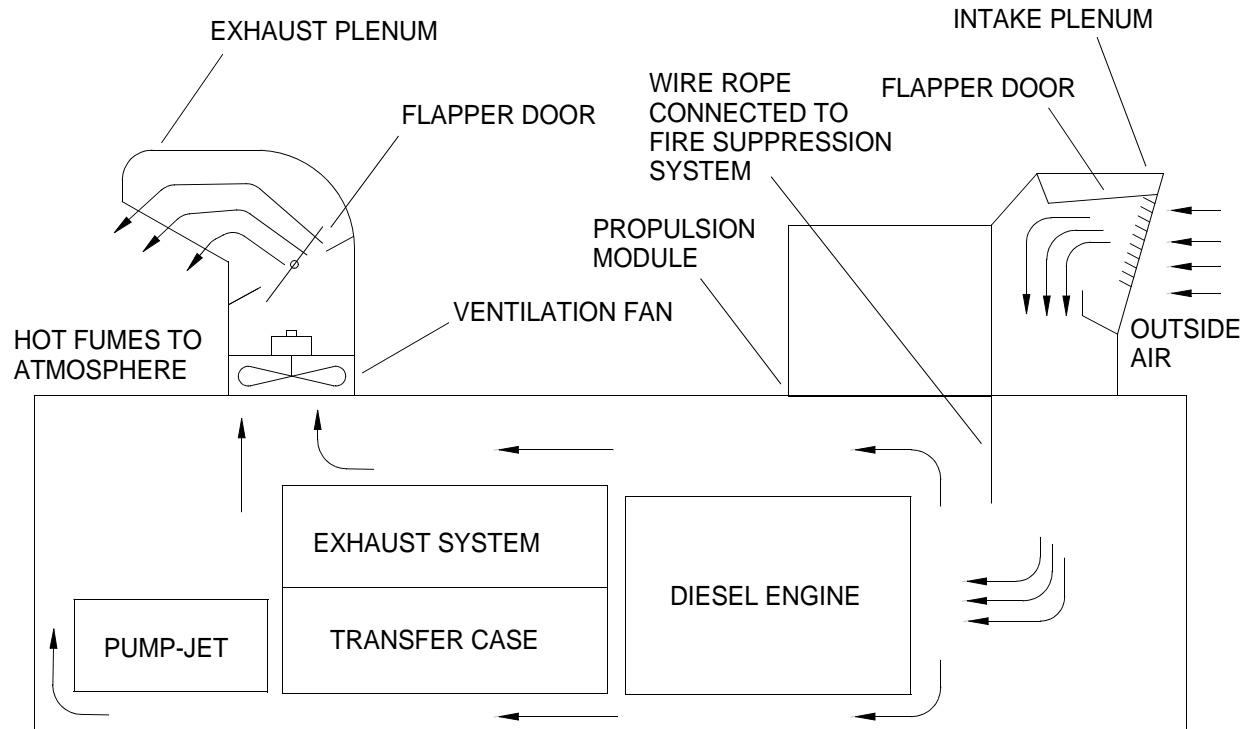
A ventilation fan draws hot fumes from below deck within the machinery compartment of the propulsion module. The blower moves air through the exhaust plenum at 3,075 cubic ft per minute. It removes heat from the engine, pump-jet and drive train components, forcing the hot fumes abovedeck and expelling them to the atmosphere. The marine duty 18 in. inner diameter ventilation fan has a cast aluminum alloy fan and is located at the intake side of the exhaust plenum. The blower has a ¾ HP, 24 VDC motor and runs at 1,750 RPM. Under normal operating conditions, the blower is controlled from a toggle switch located in the operators cab. If the fire suppression system is activated, power to the blower is disconnected automatically.

Exhaust Plenum

A welded metal structure, the exhaust plenum contains a ventilation fan and a flapper door. It is mounted on the thruster hatch of the propulsion module facing aft and provides ventilation for the machinery compartment of the propulsion module. A ventilation fan at the intake end of the plenum draws air from below deck, creating a vacuum which draws air through the intake plenum and expels hot, toxic fumes to the atmosphere.

Exhaust Plenum Flapper Door (Damper)

A hinged flapper is housed within the plenum. It is manually opened and closed. If the fire suppression system is activated, the flapper has to be closed manually, eliminating a second source of air to any fire below deck.



WT ELECTRICAL SYSTEM

The WT electrical system is provided with 24 VDC power from three separate power sources, identified as engine, house and auxiliary.

The engine power source consists of two 12 VDC batteries (BT7 and BT8), connected in series, which are located on the starboard side of the propulsion module. These provide power to the engine starting circuitry, through the engine junction box (A4), for engine related alarms and control functions, through the Engine Control Module (ECM) and Marine Interface Module (MIM), and to a NATO receptacle (NR-1 Engine).

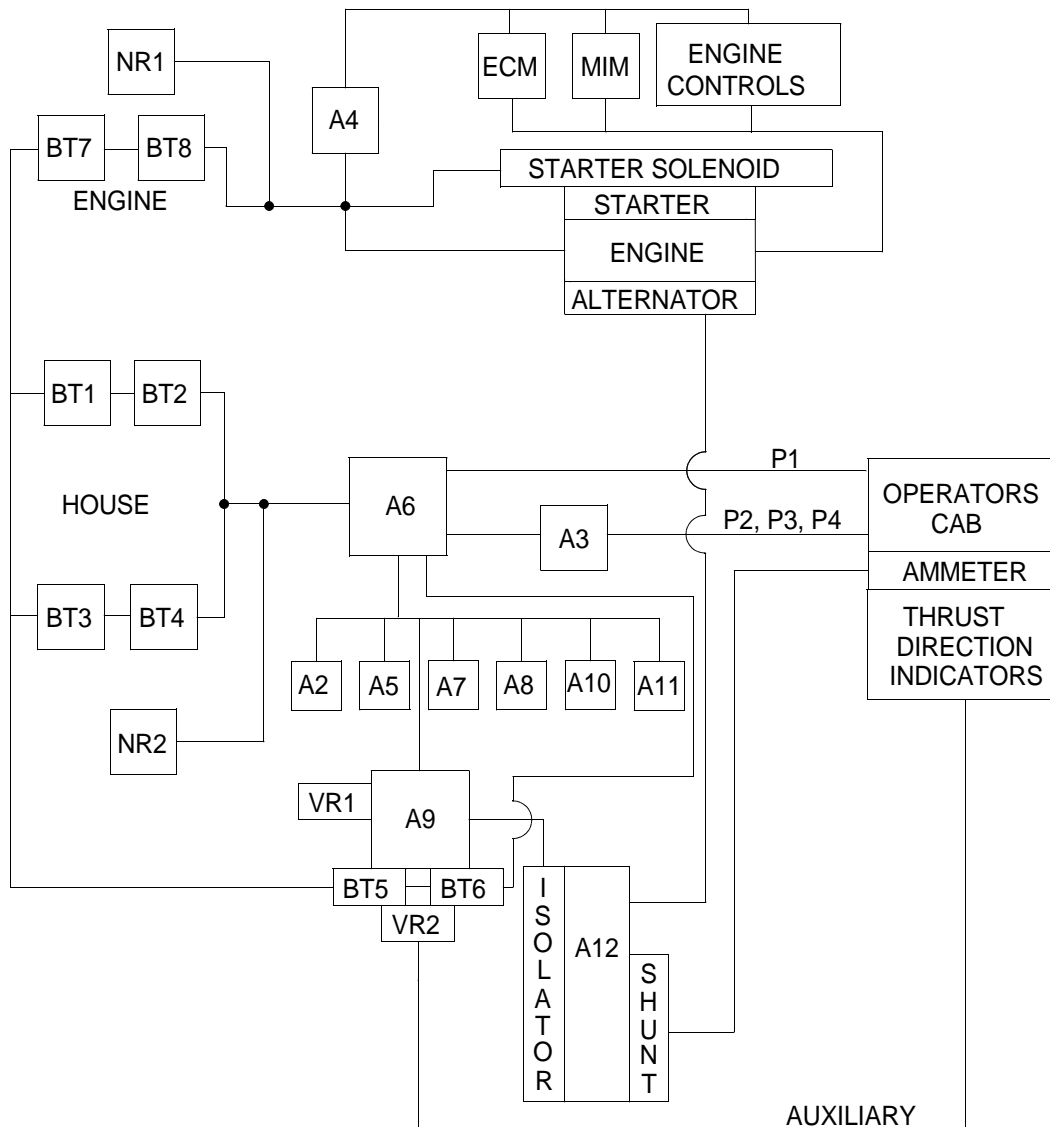
The house power source consists of four 12 VDC batteries (BT1, BT2, BT3 AND BT4), connected in series parallel, which are located on the port side of the propulsion module. These provide power to the propulsion module circuit breaker panel (A6) and a NATO receptacle (NR-2 House). From A6 and the propulsion module junction box (A3), power is distributed to the operators cab, the bilge pump control panel (A5), the single bilge pump control panel (A7), the pump jet (A2) control system, the vent fan relay enclosure (A8), the engine space light switch box (A 10) and the lazaret (lights) switch (A11).

The auxiliary power source consists of two 12 VDC batteries (BT5 and BT6), connected in series, and a voltage regulator (VR2) all located in the thruster direction/auxiliary battery junction box assembly (A9). These provide emergency power to the operator cab thrust direction indicators in the event of power loss from A6.

All three power sources are charged from the engine alternator via a triple output isolator located in the isolator junction box assembly (A12) and a voltage regulator (VR1) located in A9. The alternator output current is displayed on an ammeter that is shunt-driven and located on the middle control panel of the operators cab.

To interface both port and starboard propulsion modules with the operators cab, the port side control cabling from A3 (P2, P3, P4) and A6 (P1) are connected, through the air intake plenum, to the electrical interconnect assembly, which in turn is connected to the A6 receptacle on the front interior of the operators cab. The starboard side control cabling from A3 (P2, P3, P4) and A6 (P1) are connected to the A5 receptacle on the front interior of the operators cab. Both the A5 and A6 receptacles are accessible through side panels on the exterior of the operators cab.

In the event of a battery source loss, the 50 ft NATO slave cable can be connected from an exterior power source to NR-1 to start the engine and charge the batteries or NR-2 to power the house circuitry. The NATO receptacles can also work in the opposite direction, allowing a propulsion module, via the NATO slave cable, to provide battery power to another piece of equipment, such as the generator container on the WT.



- | | |
|--|--|
| A2 Pump-Jet | A8 Vent Fan Relay Enclosure |
| A3 Propulsion Module Junction Box | A9 Thruster Direction/Auxiliary Battery Junction Box |
| A4 Engine Junction Box | A10 Engine Space Lighting Switch |
| A5 Bilge Pump Control Panel | A11 Lazaret Light Switch |
| A6 Propulsion Module Circuit Breaker Panel | A12 Isolater Junction Box Assembly |
| A7 Single Bilge Pump Control Panel | BT1-8 Batteries |
| | NR-1&2 NATO Receptacles |

Ventilation

Both port and starboard units are equipped with a ventilation system. This system circulates outside air from the intake plenum through the engine compartment and out the exhaust plenum. The ventilation system is operated by a blower equipped with a $\frac{3}{4}$ HP, 24 VDC motor. The unit is powered by the 24 VDC house batteries, main circuit breaker, branch breaker, CO₂ pressure switch, operator switch and vent fan relay enclosure A8K1 relay.

Bilge Flood Warning and Control System (Port or Starboard)

The bilge system is powered by the 24 VDC house batteries. The power is fed through the propulsion module circuit breaker panel A6 to the bilge pump control panel A5 and single bilge pump control panel A7 up to the cab control. The float switches enable the pumps and provide a signal to the cab control that allows the operator to hear the alarm and check the red activated indicator(s) for location of flooding. The alarm silence switch should also be activated. The pump run switch provides remote operation from the operators cab to power the pump start relay contacts that start the pump and activates the green indicating lamp on the lower control panel A2. The pumps can be locally operated at the A5 and A7 control panels without having the float switches actuated.

Communications

AN/VRC-90A SINCGARS RADIO. The AN/VRC-90A SINCGARS radio receives 24 VDC power from the house batteries via the operators cab circuit breaker panel A3. The signal output of the transmitter is generated from the outdoor antenna.

VHF/FM DSC TRANSCEIVER. The VHF/FM DSC transceiver receives 12 VDC power from the house batteries via the VHF/FM DSC transceiver 24 to 12 VDC converter (VR1). This circuit is protected by a 10 amp fuse in JB1 and an inline ferrite line interference conditioner. The signal output of the transceiver is generated from the transceiver antenna.

VHF/FM HANDHELD TRANSCEIVER. Each VHF/FM handheld transceiver receive power from a self-contained, replaceable and rechargeable nickel-cadmium battery pack. The battery packs are recharged by battery chargers. The battery chargers receive 12 VDC power from the house batteries via a 24 to 12 VDC converter (VR2). The circuit is protected by a one amp fuse in JB3 and an inline ferrite line interference conditioner.

Public Address Set (Loudhailer). The loudhailer receives 12 VDC power from the house batteries via a 24 to 12 VDC converter (VR2). The circuit is protected by a six amp fuse in JB3.

VHF/FM DSC TRANSCEIVER 24 TO 12 VDC CONVERTER (VR1). The 24 VDC to 12 VDC voltage converter receives 24 VDC power from the house batteries and reduces the voltage to 12 VDC to power the VHF/FM DSC transceiver.

24 TO 12 VDC CONVERTER (VR2). The 24 VDC to 12 VDC voltage converter receives 24 VDC power from the house batteries and reduces the voltage to 12 VDC to power the loudhailer, VHF/FM handheld transceiver battery chargers and the compass.

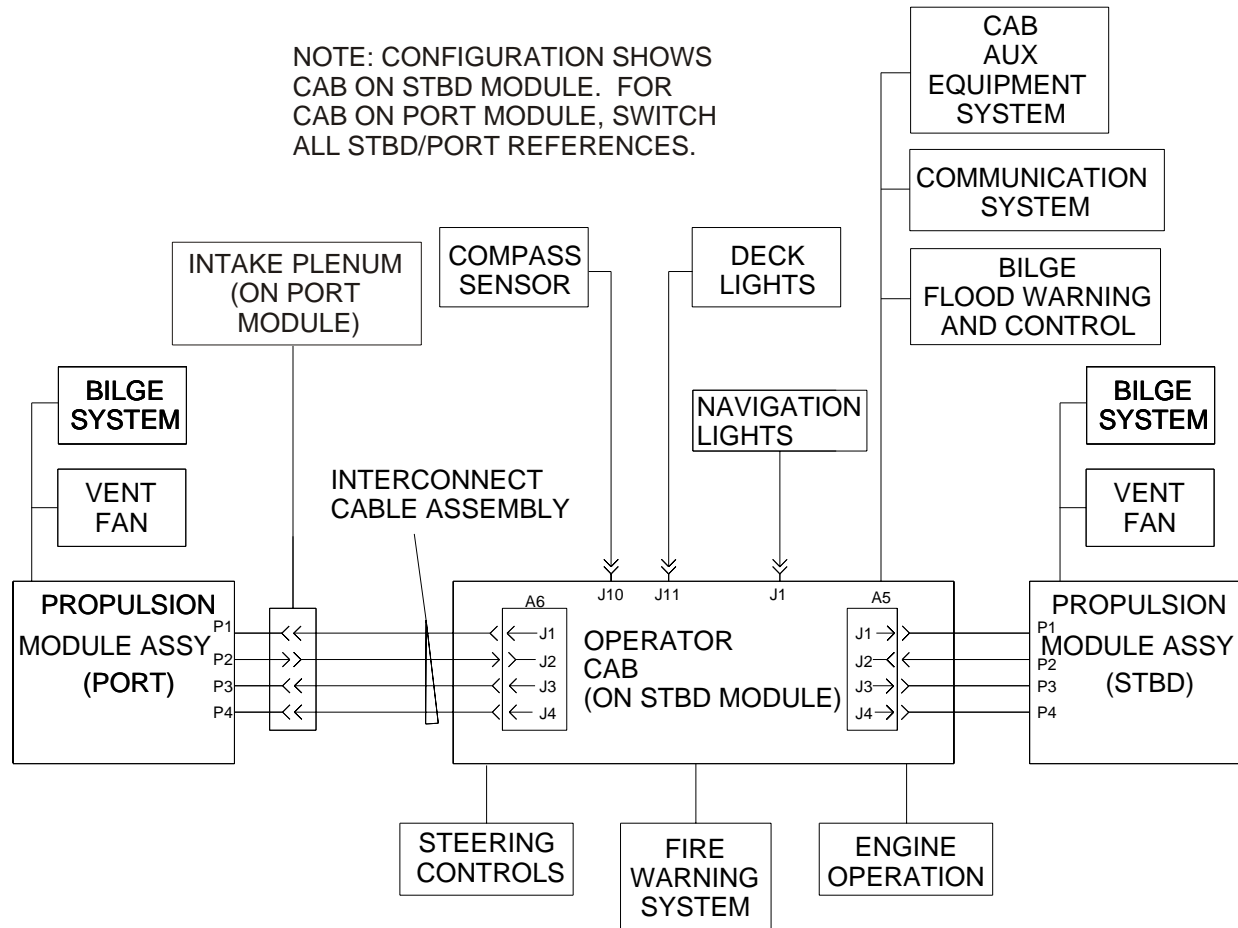
AN/PSN-11(V)1 PRECISION LIGHTWEIGHT GLOBAL POSITIONING RECEIVER (PLGR). The AN/PSN-11(V)1 PLGR receives 24 VDC power from the house batteries. The circuit is protected by a one amp fuse in JB3.

Navigation System

NAVIGATION LIGHTS. The main assembly mast lights receive 24 VDC power from the house batteries via the operators cab circuit breaker panel A3 through the mast enclosure assembly A7. The enclosure contains the switches, warning lights and alarm system for controlling the main assembly mast primary and spare lights. The stub assembly mast lights are each powered by four 6 VDC batteries.

COMPASS. The compass receives 12 VDC power from the house batteries via a 24 to 12 VDC converter (VR2). It contains a backlight that is powered from the panel dimmer switch fed by the operators cab circuit breaker panel A3. The compass also has a remote sensor mounted on the main assembly mast. The circuit is protected by a one amp fuse in JB3.

SPOTLIGHT. The spotlight receives 24 VDC power from the receive 24 VDC power from the house batteries via the operators cab circuit breaker panel A3 and the operator control switch on the middle control panel A1.



Diesel Engine

The Series 60 Diesel Engine used to power the WT is a four-stroke cycle, high speed, diesel engine. For complete operation of this diesel engine, refer to TM 55-1945-222-14&P.

Engine Operation (Port and Starboard)

The engine receives 24 VDC power from the engine batteries to operate the engine starter motor, starter contact B1, and engine starter solenoids L3. During cold weather conditions (+25°F or less), an engine cold pack starting aid automatically supplies ether into the air inlet housing of the blower. In case of extreme cold weather starting conditions, the engine power system is also equipped with a NATO receptacle. The engine contains the following operation switches and sending units that provide signals to the operator controls listed below.

Engine Control Module (ECM)

The engine control module receives electronic inputs from sensors mounted on the engine to control engine operation and also controls the solenoid operated valves in the fuel injection system. The engine sensors monitor water temperature, oil temperature and oil pressure.

WATER TEMP SENSOR. The water temperature sensor A1MT1 provides a signal to operators cab water temperature gauge. If the water temperature rises above 210°F (96°C), the engine malfunction relay A1K5 is energized via the ECM to activate the engine alarm bell and indicator.

OIL TEMP SENSOR. The oil temperature sensor A1MT2 provides a signal to operators cab oil temperature gauge. If the oil temperature rises above 240°F (116°C), the engine malfunction relay A1K5 is energized via the ECM to activate the engine alarm bell and indicator.

OIL PRESS SENSOR. The oil pressure sensor A1MT3 provides a signal via the ECM to operators cab oil pressure gauge. If the oil pressure drops below 20 PSI (138 kPa), the engine malfunction relay A1K5 is energized via the ECM to activate the engine alarm bell and indicator.

Marine Interface Module (MIM)

The marine interface module provides an interface between the ECM, engine control box and engine related sensors. During normal operation, the MIM ignition indicator will light green. When the engine ignition is initially activated, the orange and red indicators will flash momentarily then go out. A flashing orange light indicates an engine condition that requires maintenance personnel to perform an engine diagnostic test. The red indicator light represents a major engine malfunction requiring the operator to shutdown the engine to prevent damage. The MIM also provides maintenance personnel with a connection point for diagnosing engine malfunctions with test equipment.

Miscellaneous Engine Controls

ENGINE NORMAL STOP PUSHBUTTON. The engine normal stop pushbuttons, located in the operators cab and on the engine control box below deck, disconnects the 24 VDC signal to the ignition relay that will stop the engine under normal conditions.

ENGINE HOUR METER. The engine hour meter, located on the engine control box below deck, receives 24 VDC power from the engine batteries and is energized when the engine is running.

Engine Alternator

The engine alternator provides power to recharge the house, engine and auxiliary battery systems. It is controlled by the thruster direction/auxiliary junction box assembly A9VR1 voltage regulator and distributed through the A12S1 isolation diode. The operator's console ammeter(s) indicate the alternator output.

Operator Engine Control, Alarms and Indicator System

The following items extend the engine system for engine operation.

ENGINE GAUGES. The engine gauges in the operators cab receive their signals from the engine sensors and are powered from the 24 VDC engine batteries via the engine controls circuit breaker located on the engine junction box (A4).

ENGINE POWER SWITCHES. The engine power switches provide power from the engine batteries for gauge operation via the engine controls circuit breaker located on the engine junction box (A4) and enables the engine start pushbuttons.

ENGINE START SWITCHES. The engine start switches provide power to the engine start relay A1K1 from the engine batteries through the clutch deenergized normally closed relay (A4K2/A4K3). If the clutch switch is in either the forward or backflush positions, the engine will not start.

ENGINE ALARM WARNING/INDICATING SYSTEM. The engine alarm warning/indicating system, upon receiving an alarm from the ECM, will activate an indicating light and bell. At this point, the alarm/silence/test switch can be actuated.

ENGINE ALARM/SILENCE/TEST SWITCH. The alarm/silence/test switch, when moved from the alarm to the silence position, removes power from the alarm bell only. When the alarm condition is cleared, the indicating light will go out and the switch can be moved back to the alarm position. The test position provides power to the bell and the indicating light. This test position is a momentary contact.

ENGINE THROTTLE CONTROL. The engine throttle control provides a signal to the ECM/MIM that tells the engine to speed up or to slow down. The power source for this control comes from the MIM.

MARINE GEAR (FORWARD/DISENGAGED/BACKFLUSH). The marine gear (forward/disengaged/backflush) provides power to shift the gear solenoids. This power comes from the propulsion module circuit breaker panel A6 and activates the forward solenoid or backflush solenoid. The operator cab A4K2 port and A4K3 starboard relays activate an indicating light on the lower control panel A2. If the clutch switch is in the forward or backflush position, the engine starting system will not work because the clutch relay contacts in the starting circuit will be open and the engine will not start.

Lighting System

OPERATOR STATIONS. The operator station middle and lower control panel lights receive 24 VDC power from the house batteries via the cab circuit breaker panel A3. The lights are activated by their switch control source and controlled by a dimmer switch. Red indicator lights are used for alarm conditions and are not dimmable. Gauge backlights are dimmable from the dimmer switch.

CAB SPOTLIGHT. The cab spotlight receives 24 VDC power from the house batteries via the cab circuit breaker panel A3 and the operator control switch mounted on the middle control panel. The spotlight is used for deck night work and navigation buoy night identification.

ABOVEDECK LIGHTING. The deck lighting receives 24 VDC power from the house batteries via the cab circuit breaker panel A3. These lights are activated by a toggle switch on the operators cab circuit breaker panel A3.

BELOWDECK LIGHTING. The machinery and lazaret compartments lighting systems receive 24 VDC power from the house batteries via the propulsion module circuit breaker panel A6. Each compartment has a light switch to activate the area lighting, A10 in the machinery compartment and A11 in the lazaret.

BATTLE LANTERNS. The battle lanterns are powered by two six VDC batteries. The cab light has a red lens and below deck lights have white lenses.

Steering (Port and Starboard) Systems

PUMP-JET THRUSTER DIRECTIONAL CONTROL. The pump-jet thruster directional controls are manually controlled levers on the operator console, receiving 24 VDC power from the house batteries via the main circuit breaker panel A6 and the thruster junction box breaker to direct port and starboard pump-jet thrusters. The levers move forward and backward only, which energizes the clockwise and counterclockwise rotation relays and contacts K1 and K2 that operate the hydraulic power units thruster solenoids A2JB1-L4 and L5. The steering speed can be adjusted by variable resistors A2JB2-R1 and R2.

PUMP-JET THRUSTER DIRECTIONAL INDICATORS. The pump-jet thruster directional indicators receive 24 VDC power from the alternator and the auxiliary 24 VDC battery supply through the propulsion module circuit A6CB14 and are activated by the A9K1 relay contact, which is controlled by the engine starting system. The 24 VDC power to the pump-jet thruster directional signal and indicator has a line converter that stabilizes the 24 VDC power source. The pump-jet thruster directional signal comes from the feedback potentiometer.

FIRE ALARM SYSTEM (PORT AND STARBOARD). The fire alarm system (port and starboard) receives 24 VDC power from the propulsion module circuit breaker A6CB4. The circuit is activated by two temperature switches S8 and S9 that send signals up to the operator console and activate the fire alarm horn and warning light. The circuit also has an alarm/silence/test switch which, when moved from the alarm to the silence position, cuts power to the alarm horn and provides power to the indicating light. When the alarm condition has cleared, the indicating light will go out and the switch can be moved back to the alarm position. The test position will provide power to the horn and indicating light via the cab circuit breaker panel. This test position is a momentary contact.

Cab Auxiliary Systems

HYDRAULIC OIL LOW LEVEL INDICATOR (PORT AND STARBOARD) UNITS. The hydraulic oil low level indicators (port and starboard units) receive a signal from a float switch sending unit in the hydraulic tank, which provides a signal up to the operator console via the 24 VDC house batteries.

PUMP-JET GEARCASE LOW OIL LEVEL INDICATOR. The pump-jet gearcase low oil level indicator receives its signal from the oil level sending unit. The power comes from the 24 VDC house batteries through the sending unit and activates the low level indicator.

WINDSHIELD WIPER. The operator control switch provides power to the wiper motor from the cab circuit breaker panel A3 and 24 VDC house batteries.

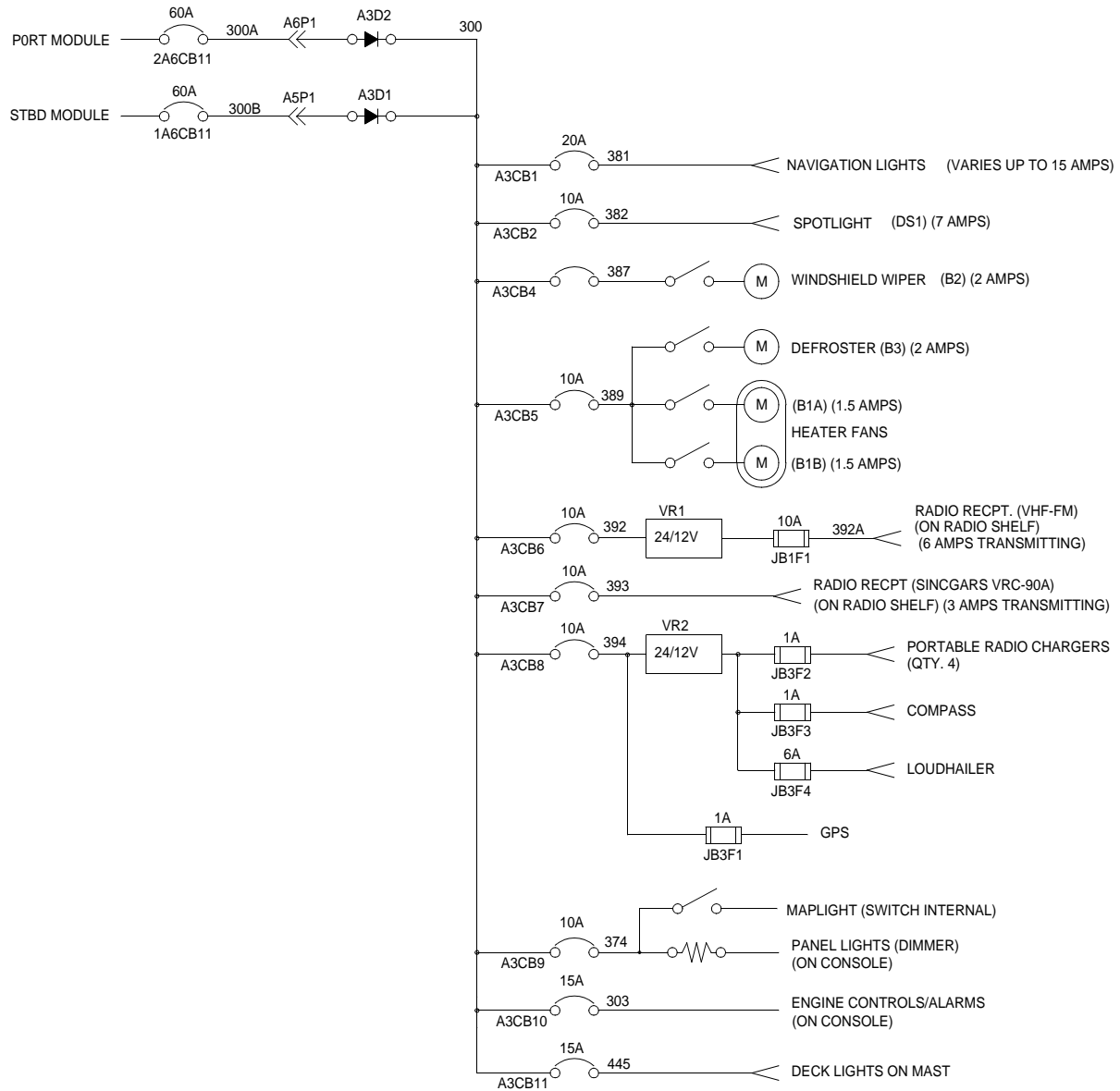
CAB HEATER. Water, heated by the engine cooling system, is circulated through the cab heater. The operator control switch low/off/high provides power to the heater blower motor from the 24 VDC house batteries through the cab breaker panel A3. The blower moves air around the heater coils, heats it and circulates the hot air through the cab. The heater supply line valve controls the amount of hot water dispersed between the heater and defroster.

WINDOW DEFROSTER. Water, heated by the engine cooling system, provides defrosted air. The operator control switch turns 24 VDC on or off to the blower motor from the cab breaker panel via the 24 VDC house batteries.

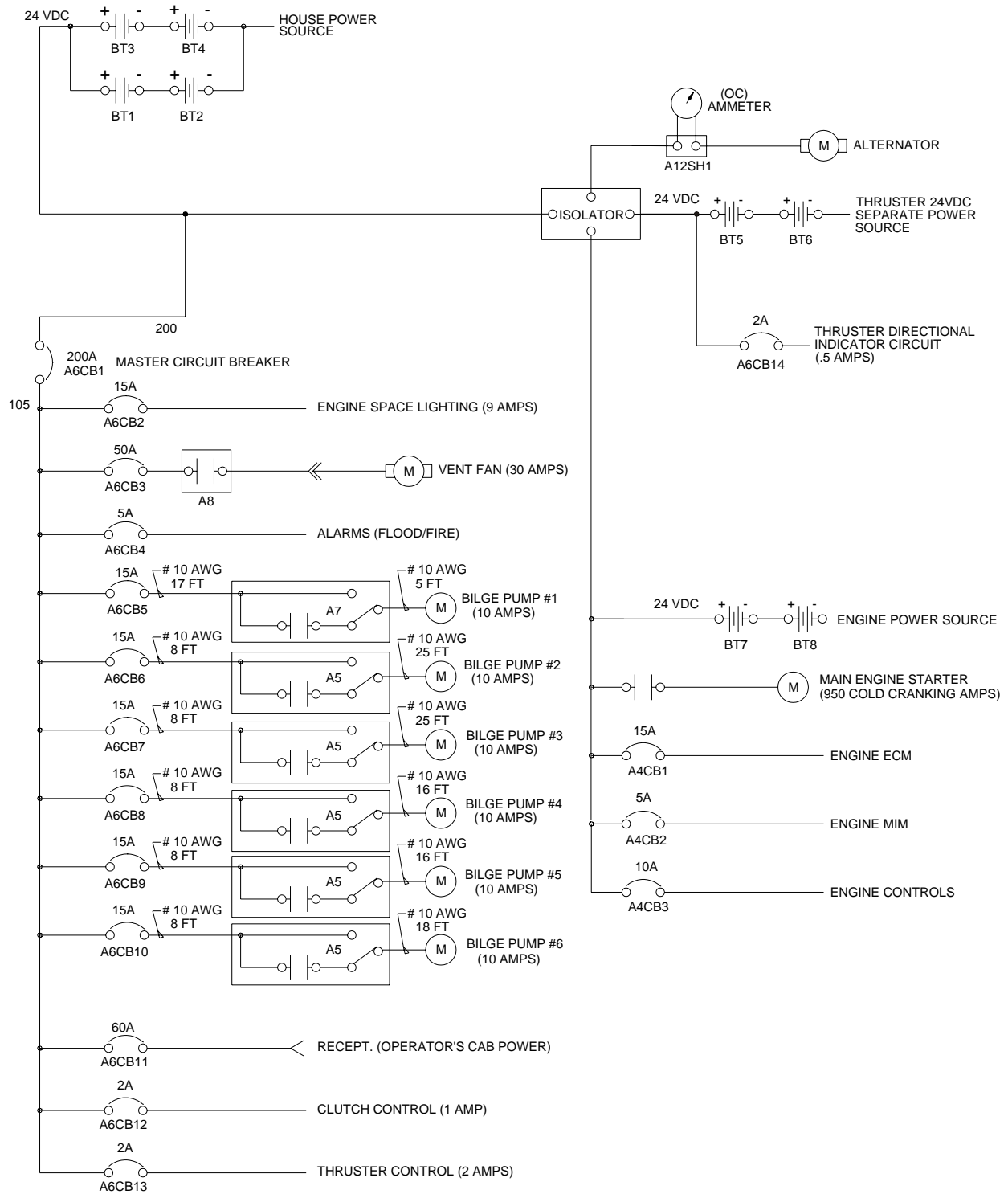
CAB CIRCUIT BREAKER TEST PANEL. The operators cab circuit breaker panel provides circuit protection for all electrical circuits in the operators cab. The panel also provides testing jacks and test point selector switch for testing the operators cab electrical circuits.

Electrical Interconnect System

The electrical interconnect assembly provides power and signal information between the cab twist lock plug/receptacles A5/A6 and the air intake plenum twist lock plug/receptacles A5/A6. Interconnection is determined by operators cab location port or starboard.



(SHEET 1 of 2)



(SHEET 2 of 2)

HYDRAULIC SYSTEM

Powered (Normal) Operation

The hydraulic system contained within each propulsion module provides the steering power and control for rotation of the pump-jet discharge nozzle. The four subsystems comprising this system include: 1) the reservoir system that stores, cools and filters the hydraulic fluid being pumped through the system; 2) the pump drive system, which provides the power to the steering motor; 3) the way-valve assembly, which protects the hydraulic system from overpressurization and controls the actuation of the hydraulic steering motor and; 4) the hydraulic steering motor drive system, which turns the discharge nozzle through 360° continuous rotation in both directions.

Emergency (Manual) Operation

In the event of loss of steering control at the cab due to an electrical failure, the steering system can be manually operated by one of two methods: 1) the use of a manual control lever on the way-valve unit and; 2) the fit-up of the emergency steering unit on the auxiliary planetary gearbox with manual release of the hydraulic brake.

Hydraulic Reservoir

In addition to storing the system hydraulic fluid, the hydraulic reservoir also cools 26 gallons of fluid with open air to all sides, including top and bottom. It also filters the oil through the suction line strainer, return line filter and filler neck screen. The reservoir is equipped with an external sight level gauge to determine actual fluid level and an in-tank float switch to monitor fluid level within and to notify the operator via an indicating light in the cab when it falls below the required level.

Hydraulic Pump

The axial piston hydraulic pump provides the power to drive the hydraulic motor. The pump is driven off the marine gear and is fitted with a flow control regulator. The drive shaft of the hydraulic pump drives a cylinder block causing the pistons within to move in an axial direction. The stroke of the pistons is limited by an internal swash plate, which adjusts around the vertical axis of the input shaft, varying the displacement of oil flow infinitely.

Way-Valve Unit

The proportional way-valve is controlled by means of the electrically operated proportional pressure valves or manually by means of the lever on the valve unit. The way-valve guides the hydraulic oil via the dual braking valve to the hydraulic motor.

Dual Braking Valve

The dual braking valve (load retaining valve) avoids uncontrolled rotation of the hydraulic motor caused by negative loads and locks the lines to the hydraulic motor tightly when the way-valve is in the rest position.

Hydraulic Motor

The hydraulic motor is mounted on the input shaft of the pump-jet steering planetary gearbox. The axial piston motor is a constant speed unit with fixed oblique discs supporting nine pistons configured as a rotor.

Three-Way Valve

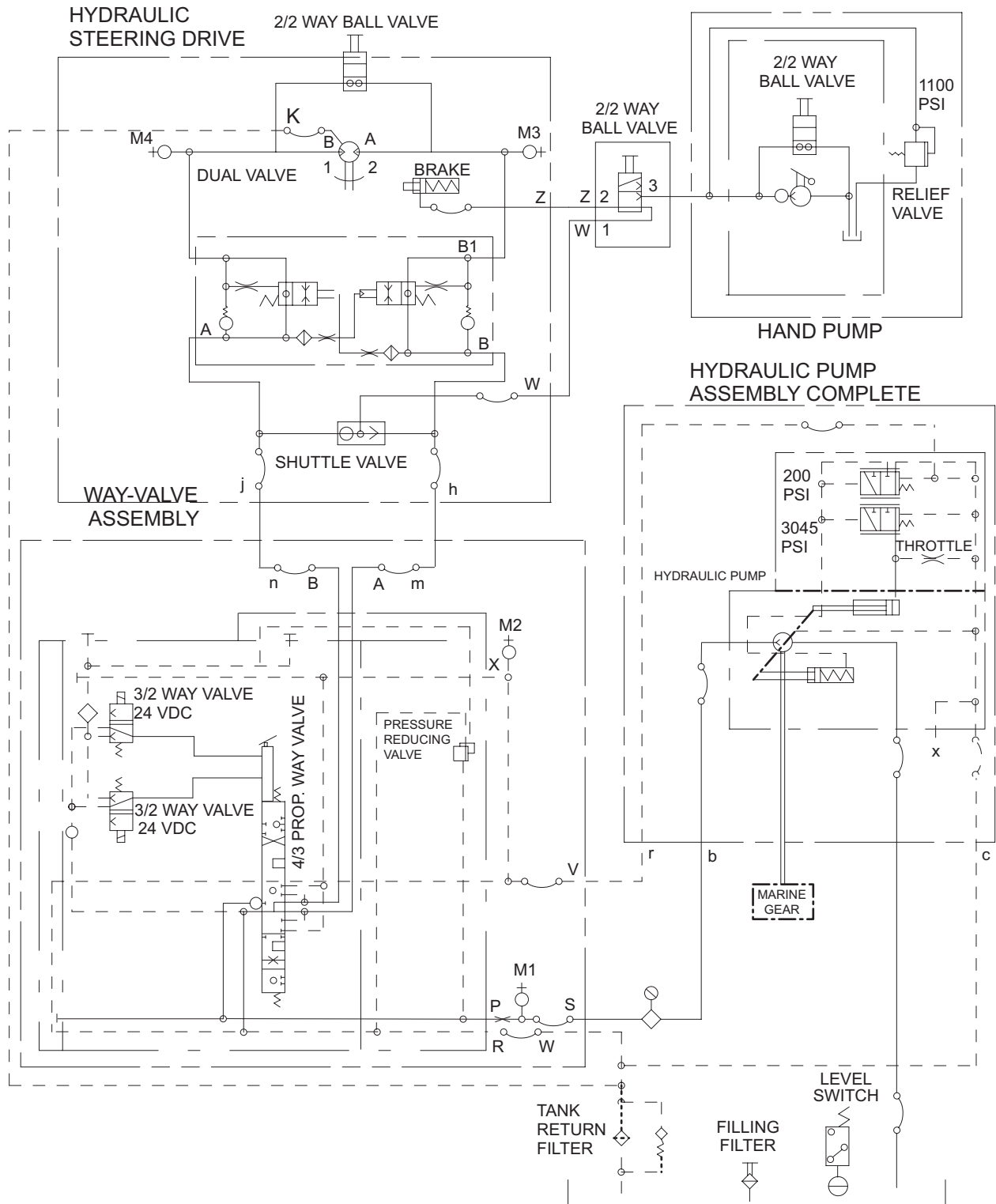
A manually operated, lever actuated, three-way valve is positioned to select normal hydraulic operation or to isolate the normal hydraulic system, so the manual hydraulic hand pump can be used to release the hydraulic brake for emergency steering operation.

Two-Way Valve

A two-way (needle) valve in the closed position during normal operation must be opened to allow for the manual releasing of the hydraulic brake via the hydraulic hand pump.

Manual Hydraulic Hand Pump

The hydraulic hand pump used to release the hydraulic brake for emergency steering operation is equipped with its own small hydraulic reservoir and pressure relief valve.



FIRE SUPPRESSION SYSTEM

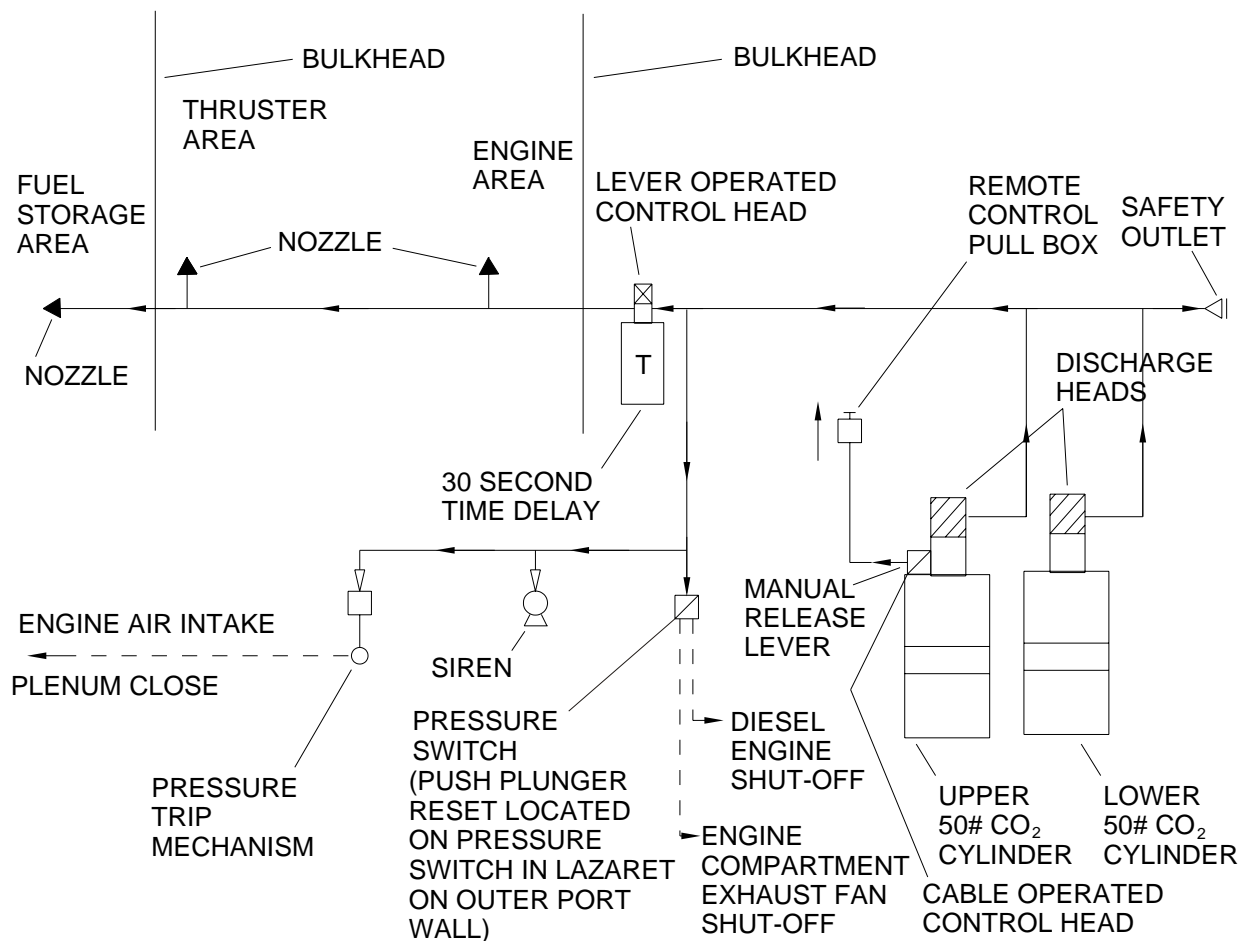
The fire suppression system is designed to flood the propulsion module machinery and fuel storage compartments with carbon dioxide (CO₂) if a fire occurs. System activation is accomplished manually using a remote control pull box recessed in the deck directly forward of the operators cab and air intake plenum.

WARNING

Do not activate fire suppression system if hatch between lazaret and machinery compartment is open. Failure to comply may result in death or injury to personnel.

Manual activation is also provided below deck in the lazaret, where the agent is stored, but not dispersed. The upper 50 lb CO₂ cylinder is equipped with a manual release lever, which initiates discharge the same way as the remote control pull box handle. The 30 second time delay device is also equipped with a manual release handle. However, actuation using this control will bypass the 30 second time delay. Upon activation, CO₂ is released into the system. The discharged CO₂ is directed down two circuit paths. One circuit directs the agent to a pressure operated switch, which immediately shuts off the diesel engine and machinery compartment exhaust fan. The flow of CO₂ also activates a warning siren and operates a pressure trip mechanism to close off the machinery compartment air intake plenum opening. The second circuit directs CO₂ to a 30 second time delay device to allow evacuation time for personnel prior to CO₂ discharge into the protected compartments via the three nozzles. It also provides the delay time needed for the other circuit to shut down the engine and close all air intake and exhaust systems.

After CO₂ has been discharged below deck, Gas Free Engineering personnel (per FM 55-502) must completely clear any CO₂, test the level of oxygen, and certify space is safe for personnel. Next, the CO₂ Pressure Switch push plunger must be depressed to reset the system. Once Pressure Switch is reset, the fire suppression system is fully operational.



DECK EQUIPMENT

Equipment onboard the deck of WTs include a diesel powered winch, A-frame, stern anchor and fittings for the assemblies.

Deck Winch

A WT primary working tool is a dual drum diesel-hydraulic reversible winch with a capstan. The winch is installed aft of the operators cab on the centerline. It provides the line pull for the A-frame and the stern anchor. The winch rated line pull is 27,000 lb bare drum and 19,500 lb full drum. Each drum carries 700 ft of 1 in. diameter wire rope. The deck winch also has a 12 in. diameter gypsy at the forward end. The gypsy rated line pull is 5,000 lb. A power take-off is included with the winch to provide power to ancillary equipment and tools that are used on the WT.

A-Frame

The WT A-frame has a lifting capacity of 27,000 lb when the load is forward of the plane of the A-frame legs. The safe working load for loads aft of the plane of the A-frame legs is 12,000 lb. The A-frame assembly includes two legs, a sheave, two foot anchors, two aft guy assemblies, two forward guy assemblies and two ISO corner lug fittings. An elevating pole and elevating pole guy assembly are used for lifting the A-frame during assembly and disassembly, then removed and stowed.

Stern Anchor

The WT stern anchor is a NAVMOOR 1,000 lb anchor (Dry weight = approximately 1,120 lb). It is housed, deployed and recovered from a channel located in the aft center rake module. Movement of the stern anchor is provided by the aft drum winch cable.

Deck Fittings

WT assemblies are provided with deck fittings to meet various operational needs. Available fittings include deck cleats and D-rings. These fittings have a 30,000 lb load capacity. There are 10 tube turns per non-propulsion nodule and five per end rake. The WT modules are provided with recessed lift shackles welded into the deck structure. Shackles have a safe working load capacity of 35 tons. There are two shackles per center and propulsion module and one per end rake. When stowed, the shackles fold down flush with the deck. Each lift shackle recess is provided with a drain system to limit water accumulation.

CHAPTER 2

**TROUBLESHOOTING PROCEDURES
FOR
MODULAR CAUSEWAY SYSTEM (MCS)
WARPING TUG (WT)**

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
SYSTEM/SUBSYSTEM TROUBLESHOOTING INDEX**

MALFUNCTION/SYMP TOM**TROUBLESHOOTING PROCEDURE****ABOVEDECK SYSTEMS**

Deck Lights Are Not Functioning	WP 0007 00
Exhaust Plenum Fan Will Not Operate	WP 0008 00
Interconnect Assembly Not Working Between Modules	WP 0009 00
Lamp Fixture On Main Assembly Mast Not Working	WP 0010 00
Lamp Indicator Light On Mast Enclosure Assembly A7 Not Working	WP 0011 00
Loss Of Power To Main Assembly Mast Navigation Lights	WP 0012 00
Navigation Lights Will Not Function	WP 0013 00
One or More Navigation Lights Are Not Functioning	WP 0014 00
Spotlight Not Functioning	WP 0015 00

DIESEL ENGINE

Malfunctions (Reference Only)	WP 0016 00
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HYDRAULIC SYSTEM

Hydraulic System Does Not Function	WP 0017 00
Hydraulic System Has High Pressure	WP 0018 00
Hydraulic System Has No Pressure	WP 0019 00
Hydraulic System Oil Foams	WP 0020 00
Hydraulic System Oil Milky	WP 0021 00
Hydraulic System Pump Makes Noise	WP 0022 00

MARINE GEAR

Malfunctions (Reference Only)	WP 0023 00
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MALFUNCTION/SYMPTOMTROUBLESHOOTING PROCEDURE**OPERATORS CAB**

Accessories Do Not Function	WP 0025 00
All Circuits Controlled By Operators Cab Circuit Breaker Panel A3 Are Not Functioning	WP 0026 00
Ammeter Indicates Zero Amps When System Is Running	WP 0027 00
Ammeter Indicates Discharging of System	WP 0028 00
Clutch Status Light Not Operational	WP 0029 00
Compass Has No Power	WP 0030 00
Defroster Fan Does Not Operate	WP 0031 00
Exhaust Plenum Fan Operating Status Light Does Not Illuminate	WP 0032 00
Fire Alarm Horn Does Not Operate	WP 0035 00
Fire Alarm Light Does Not Illuminate In Alarm Mode	WP 0036 00
Flood Alarm Sonalert Beeper Does Not Operate	WP 0037 00
Flood Alarm Light Indicator Does Not Illuminate In Alarm Mode	WP 0038 00
Gauge Lights Will Not Operate Or Vary In Brightness	WP 0039 00
Heater Fan Does Not Operate With Heater Fan Control On High	WP 0033 00
Heater Fan Does Not Operate With Heater Fan Control On Low	WP 0034 00
Low Engine Oil Pressure (Audible Alarm and Warning Light On)	WP 0040 00
Mast Enclosure Assembly A7 Sonalert Beeper Sounds	WP 0041 00
No Power to the Operators Cab Control Panels	WP 0042 00
No Steering Control Indication for the Pump-Jet	WP 0043 00
No Steering From Operators Cab	WP 0044 00
No Voltage At Test Jacks When Using Built-In Test Switch 3A3S1 In Any Position	WP 0045 00
Overheating (Audible Alarm And Warning Light On)	WP 0046 00
Pump-Jet Only Rotates In One Direction	WP 0047 00
Steering Reacts Sluggishly	WP 0048 00
Thruster Gearbox Oil Level Low Indicator Light Illuminates	WP 0049 00
Windshield Wiper Does Not Operate	WP 0024 00

MALFUNCTION/SYMPTOM**TROUBLESHOOTING PROCEDURE****PRECISION LIGHTWEIGHT GLOBAL POSITIONING RECEIVER (PLGR)**

PLGR Does Not Display Valid Position WP 0050 00

PLGR Has No Power WP 0051 00

PROPULSION MODULE

Alternator Is Not Charging Batteries WP 0052 00

Below Deck Lighting Does Not Function WP 0053 00

Bilge Pumps Do Not Function WP 0054 00

Bilge Pump Output Has Reduced Flow WP 0055 00

Bilge Pump Status Lights Are Not Functional WP 0056 00

Bilge Pump Will Not Function In Remote Mode From Operators Cab WP 0057 00

Bilge Pump Will Not Function In Test Mode (From Bilge Pump Control Panels
A5 or A7) WP 0058 00

Bilge Pump Will Not Shut Off WP 0059 00

Drive Train Does Not Operate Freely and Smoothly; Excessive Vibration Is
Experienced During Operation WP 0060 00

Marine Gear Clutch Will Not Engage In Engage/Backflush Directions WP 0061 00

Propulsion Module Becomes Hotter Than Normal Operating Temperature WP 0062 00

Water Entering Bilge From Pump Discharge Line When Pump Is Not Operating WP 0063 00

PUBLIC ADDRESS SET (LOUDHAILER)

Loudhailer Has No Power WP 0064 00

Loudhailer Will Not Transmit Sound to Hailer Horn (External Speaker) WP 0065 00

TRANSFER CASE

Malfunctions (Reference Only) WP 0066 00

VHF/FM HANDHELD TRANSCEIVER CHARGER

Charger Has No Power WP 0067 00

MALFUNCTION/SYMP TOMTROUBLESHOOTING PROCEDURE**VHF/FM TRANSCEIVER**

VHF/FM DSC Transceiver Does Not Display A Valid Position	WP 0068 00
VHF/FM DSC Transceiver Has No Power	WP 0069 00
VHF/FM DSC Transceiver Will Not Receive	WP 0070 00
VHF/FM DSC Transceiver Will Not Transmit	WP 0071 00

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

DECK LIGHTS ARE NOT FUNCTIONING

SYMPTOM

Deck lights do not illuminate.

MALFUNCTION

Disconnected power cable (P11) for main assembly mast.

CORRECTIVE ACTION

Unit Level Maintenance

Connect power cable (P11) for main assembly mast to receptacle on front of operators cab.

Perform operational check of deck lights. (TM 55-1945-225-10)

MALFUNCTION

Burned out main assembly mast incandescent floodlight lamp.

CORRECTIVE ACTION

Unit Level Maintenance

Replace main assembly mast incandescent floodlight lamp. (WP 0359 00)

Perform operational check of deck lights. (TM 55-1945-225-10)

MALFUNCTION

Faulty deck light fixture.

CORRECTIVE ACTION

Unit Level Maintenance

Position DECKLIGHTS toggle switch A3CB11 to on. Using multimeter, check for 24 VDC between the two compression terminals inside junction box JB5 on main assembly mast. If 24 VDC is present, replace floodlight fixture. (WP 0358 00)

Perform operational check of deck lights. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between main assembly mast JB5 and navigation lights terminal box.

CORRECTIVE ACTION

Unit Level Maintenance

Position DECKLIGHTS toggle switch A3CB11 to off. Disconnect P11 power cable from front of operators cab. Using multimeter, check for continuity between JB5 (wire 445) and navigation lights terminal box (TB2-9). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check for continuity between JB5 (wire 0) and navigation lights terminal box (TB2-7). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of deck lights. (TM 55-1945-225-10)

MALFUNCTION

Faulty P11 power cable.

CORRECTIVE ACTION

Unit Level Maintenance

Using a multimeter, check for continuity between P11 power cable and the navigation light terminal box (refer to navigation lights schematic and table on Figure 9 in foldouts). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

MALFUNCTION

Failed DECK LIGHTS circuit breaker A3CB11.

CORRECTIVE ACTION

Direct Support Level Maintenance

With DECK LIGHTS circuit breaker A3CB11 positioned to on, use multimeter to check for 24 VDC on input side A3CB11. If 24 VDC is present, use multimeter to check for 24 VDC on output side A3CB11. If 24 VDC is not present, replace DECK LIGHTS circuit breaker A3CB11. (WP 0294 00)

Perform operational check of deck lights. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between operators cab circuit breaker panel A3CB11 and J11 (located on front of operators cab).

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 24 VDC between A3TB2-1 and A3TB2-3. If 24 VDC is present, check for 24 VDC between J11-B and J11-A on front of cab with the P11 power cable removed. If 24 VDC is not present, repair/replace wiring in P24-23 cable as necessary. (WP 0397 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Tool Kit, General Mechanics (Item 2, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

EXHAUST PLENUM FAN WILL NOT OPERATE

NOTE

This task is typical for troubleshooting both port and starboard exhaust plenum vent fans.

SYMPTOM

Vent fan does not operate.

MALFUNCTION

Faulty vent fan.

CORRECTIVE ACTION

Unit Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Remove vent fan power cable from vent fan relay enclosure A8. Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to on. With VENT FAN toggle switch on lower control panel A2 to ON, use multimeter to verify 24 VDC at power cable receptacle on the vent fan relay enclosure A8. If 24 VDC is present, check resistance across the motor and cable at plug end of power cable. If resistance is greater than 0.6 ohms, perform continuity check of vent fan power cable and check motor connections (requires removal of heat shrink from motor end of power cable and separation of cable connections from motor). Terminal A is white wire and terminal B is black wire. If continuity is not present or wire connections are damaged, repair/replace wiring as necessary. Using multimeter, check resistance of vent fan motor across motor leads. If winding resistance is greater than zero, replace vent fan. (WP 0092 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

If 24 VDC is not present at power cable receptacle on A8, contact direct support maintenance.

MALFUNCTION

A8K1 relay in vent fan relay enclosure A8 not functioning.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 24 VDC across coil of A8K1 relay when VENT FANS toggle switch is positioned to ON. If 24 VDC is present, check for 24 VDC on field side contact terminal of A8K1 relay. If 24 VDC is not present, check for 24 VDC on input side of A8K1 relay. If 24 VDC is present, replace A8K1 relay. (WP 0217 00) If 24 VDC is not present, check wiring to A8K1 relay. If wiring is damage, repair/replace wiring as necessary. (WP 0397 00).

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Faulty VENT FANS toggle switch A2S21/S22 on lower control panel A2.

CORRECTIVE ACTION

Direct Support Level Maintenance

With VENT FANS toggle switch A2S21/S22 in ON position, use multimeter to check for 24 VDC on output side of VENT FANS toggle switch A2S21/S22. If 24 VDC is not present, check for 24 VDC on input side of VENT FANS toggle switch A2S21/S22. If 24 VDC is present, replace VENT FANS toggle switch A2S21/S22. (WP 0284 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Faulty VENT FANS circuit breaker A6CB3 on propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Direct Support Level Maintenance

With VENT FANS circuit breaker A6CB3 in the ON position, use multimeter to check for 24 VDC on output side of VENT FANS circuit breaker A6CB3. If 24 VDC is not present, check for 24 VDC on input side of VENT FANS circuit breaker A6CB3. If 24 VDC is present, replace VENT FANS circuit breaker A6CB3. (WP 0213 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

CO₂ pressure switch S2A in fire suppression system control box not functioning.

CORRECTIVE ACTION

Direct Support Level Maintenance

With CO₂ pressure switch S2A in the closed position, use multimeter to check for 24 VDC in engine junction box A4 at TB2-3. If 24 VDC is present, check for 24 VDC at TB2-4. If 24 VDC is not present, replace CO₂ pressure switch S2A. Contact Specialized Repair Facility (SRA).

MALFUNCTION

Open circuit between vent fan relay enclosure A8 and propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of cable P24-6 wiring between vent fan relay enclosure A8 (TB1) and propulsion module circuit breaker panel A6 (TB4). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of cable P24-6 wiring between vent fan relay enclosure A8 (K1-1) and propulsion module circuit breaker panel A6 (TB2-02). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between vent fan relay enclosure A8 and propulsion module junction box A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of cable VF-1 wiring between vent fan relay enclosure A8 (K1-1) and propulsion module junction box A3 (TB2-20). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of cable VF-1 wiring between vent fan relay enclosure A8 (K1-5) and propulsion module junction box A3 (TB1-15). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between engine junction box A4 and propulsion module junction box A3 (cable KMB-2).

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to on. Using multimeter, check for 24 VDC on wire 134 at TB1-14 in A3. If voltage is not present, check for 24 VDC on wire 134 at TB2-4 in A4. If voltage is present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

For port side propulsion module, an open circuit in propulsion module junction box A3 cable P2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of propulsion module junction box A3 cable P2 connector, wire 134 at pin 14 and inside A3 at TB1-14. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of propulsion module junction box A3 cable P2 connector, wire 135 at pin 15 and inside A3 at TB1-15. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between port/starboard receptacle assemblies A6/A5 and terminal strip assembly A4.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to on. Using multimeter, check for 24 VDC at TB01-13 on terminal strip assembly A4 for port vent fan and TB03-13 on terminal strip assembly A4 for starboard vent fan. If 24 VDC is not present, repair/replace wiring between TB01-13 and A6J2-14 or TB03-13 and A5 J2-14 as necessary. (WP 0397 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between terminal strip assembly A4 and VENT FANS toggle switch A2S21/S22 (port/starboard).

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter, check continuity of wiring between A2S21-2 on lower control panel A2 and TB01-13 on terminal strip assembly A4 or A2S22-2 on lower control panel A2 and TB03-13 on terminal strip assembly A4. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Use multimeter, check continuity of wiring between A2S21-3 on lower control panel A2 and TB01-14 on terminal strip assembly A4 or A2S22-3 on lower control panel A2 and TB03-14 on terminal strip assembly A4. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

For port side propulsion module, an open circuit in electrical interconnect assembly.

CORRECTIVE ACTION

General Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Disconnect electrical interconnect assembly from intake plenum and A6 receptacle on front of operators cab. (WP 0202 00) Using multimeter, check continuity of "P2" cabling through electrical interconnect assembly at pin 14 for wire 134 (end to end) and pin 15 for wire 135 (end to end). If continuity is not present on either wire, repair electrical interconnect cable. (WP 0203 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

INTERCONNECT ASSEMBLY NOT WORKING BETWEEN MODULES

SYMPTOM

Interconnect assembly does not work between modules.

MALFUNCTION

Interconnect assembly connectors loose on operators cab end receptacle A6 or on air intake plenum end connections with port propulsion module cables P1, P2, P3 and P4.

CORRECTIVE ACTION

Unit Level Maintenance

Tighten loose plugs. (TM 55-1945-225-10)

Perform operational check of interconnect assembly. (TM 55-1945-225-10)

Direct Support Level Maintenance

If plugs are damaged, repair interconnect cable. (WP 0203 00)

Perform operational check of interconnect assembly. (TM 55-1945-225-10)

MALFUNCTION

Bad or broken cables.

CORRECTIVE ACTION

Direct Support Level Maintenance

Disconnect interconnect assembly connectors on both ends. (TM 55-1945-225-10) Using multimeter, check continuity of wiring of interconnect assembly. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of interconnect assembly. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

NAVIGATION LIGHT FIXTURE ON MAIN ASSEMBLY MAST NOT WORKING

SYMPTOM

Main assembly mast navigation light fixture not working.

MALFUNCTION

Navigation light has failed bulb.

CORRECTIVE ACTION

Unit Level Maintenance

Replace light bulb. (WP 0353 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Mast enclosure assembly A7 has blown fuse.

CORRECTIVE ACTION

Unit Level Maintenance

Replace fuse. (WP 0343 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Mast enclosure assembly A7 has a defective toggle switch.

CORRECTIVE ACTION

Unit Level Maintenance

With toggle switch in the PRIMARY or SPARE position (as applicable), use multimeter to check for 24 VDC on output side of toggle switch. If 24 VDC is not present, replace toggle switch. (WP 0344 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Failed lamp fixture.

CORRECTIVE ACTION

Direct Support Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. With main assembly mast lowered (WP 0352 00), use a multimeter to check for continuity between applicable junction box receptacle and the navigation light terminal box (refer to navigation lights schematic and table on Figure 9 in foldouts). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) If continuity is present, repair appropriate lamp fixture. (WP 0354 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

LAMP INDICATOR LIGHT ON MAST ENCLOSURE ASSEMBLY A7 NOT WORKING

SYMPTOM

Lamp indicator light on mast enclosure assembly A7 not working.

MALFUNCTION

Loose or broken light bulb.

CORRECTIVE ACTION

Unit Level Maintenance

Tighten or replace light bulb. (WP 0348 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

MALFUNCTION

Faulty indicator light.

CORRECTIVE ACTION

Unit Level Maintenance

Using a multimeter, check for 24 VDC at input to indicator light. If 24 VDC is not present, replace indicator light. (WP 0348 00)

If main mast indicator light still does not operate properly, contact direct support maintenance.

MALFUNCTION

Open circuit in mast enclosure assembly A7.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of mast enclosure assembly A7 wiring. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

LOSS OF POWER TO MAIN ASSEMBLY MAST NAVIGATION LIGHTS

SYMPTOM

Main assembly mast navigation lights are not receiving power.

MALFUNCTION

Power cable (P1) for main assembly mast is not connected.

CORRECTIVE ACTION

Unit Level Maintenance

Connect main assembly mast power cable (P1) to connector on front of operators cab. (TM 55-1945-225-10)

If main assembly still does not operate properly, contact direct support maintenance.

MALFUNCTION

Faulty P1 power cable.

CORRECTIVE ACTION

Unit Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. With main assembly mast lowered (WP 0352 00), use a multimeter to check for continuity between P1 power cable and the navigation light terminal box (refer to navigation lights schematic and table on Figure 9 in foldouts). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

MALFUNCTION

Faulty NAV LIGHTS circuit breaker CB1 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

With NAV LIGHTS circuit breaker positioned to on, use multimeter to check for 24 VDC at input to NAV LIGHTS circuit breaker CB1. If 24 VDC is present, check for 24 VDC at output to NAV LIGHTS circuit breaker CB1. If 24 VDC is not present, replace NAV LIGHTS circuit breaker CB1. (WP 0294 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between operators cab circuit breaker panel A3 CB1 and operator cab terminal strip A4.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 381 between CB1-2 and A4TB9-10. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between operator cab terminal strip A4 and mast enclosure assembly A7.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 381 between A4TB9-10 to A7TB6-B12. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wire 0 between A4TB9-11 to A7TB6-B11. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between mast enclosure assembly A7 and J1 (located on front of operators cab).

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to on. With operators cab circuit breaker panel A3 CB1 and appropriate toggle switch on mast enclosure assembly A7 both positioned to on, use multimeter to check for 24 VDC at J1 (refer to navigation lights schematic and table on Figure 9 in foldouts). Note: pins 18 thru 21 are wire 0. If 24 VDC is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of mast lights. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

NAVIGATION LIGHTS WILL NOT FUNCTION

SYMPTOM

None of the navigation lights will function.

MALFUNCTION

Main assembly mast power cable is disconnected.

CORRECTIVE ACTION

Unit Level Maintenance

Connect main assembly mast power cable to receptacle on front of operators cab.

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Mast enclosure assembly A7 has blown fuse.

CORRECTIVE ACTION

Unit Level Maintenance

Replace fuse(s). (WP 0343 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Mast enclosure assembly A7 has defective toggle switch(s).

CORRECTIVE ACTION

Unit Level Maintenance

Using multimeter, check for 24 VDC on input side of toggle switch(s). If 24 VDC is not present, replace defective toggle switch(s). (WP 0344 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Defective reed switch assembly(s).

CORRECTIVE ACTION

Unit Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using multimeter, check for no continuity across reed switch. If no continuity is found, replace reed switch assembly(s). (WP 0346 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

If main mast navigation lights still do not operate properly, contact direct support maintenance.

MALFUNCTION

Open circuit in mast enclosure assembly A7 wiring.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring of mast enclosure assembly A7 wiring. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in main assembly mast wiring.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring of main assembly mast. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

ONE OR MORE NAVIGATION LIGHTS ARE NOT FUNCTIONING

NOTE

Red lights on mast enclosure assembly A7 indicate the navigation lights are active. When a navigation light burns out, an alarm sounds and its associated red light goes out. The alarm may be silenced using the ALARM/SILENCE switch.

SYMPTOM

One or more navigation lights are not functioning.

MALFUNCTION

Blown fuse(s) in the main mast enclosure assembly A7.

CORRECTIVE ACTION

Unit Level Maintenance

Replace the appropriate fuse(s). (WP 0343 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Bad indicator light.

CORRECTIVE ACTION

Unit Level Maintenance

Replace light. (WP 0348 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Mast enclosure assembly A7 has defective toggle switch.

CORRECTIVE ACTION

Unit Level Maintenance

Using a multimeter, check for 24 VDC at input side of toggle switch. If 24 VDC is present, replace toggle switch. (WP 0344 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between mast enclosure assembly A7 and operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using a multimeter, check for continuity of the wiring between mast enclosure assembly A7 and operators cab circuit breaker panel A3. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the main mast enclosure assembly and inoperative navigation light.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between the main mast enclosure A7 and the inoperative navigation light. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
ABOVEDECK SYSTEMS
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE**SPOTLIGHT NOT FUNCTIONING****SYMPTOM**

Spotlight does not function.

MALFUNCTION

Burned out light bulb.

CORRECTIVE ACTION

Unit Level Maintenance

Replace light bulb. (WP 0300 00)

Perform operational check of spotlight. (TM 55-1945-225-10)

If spotlight still does not operate properly, contact direct support maintenance.

MALFUNCTION

Failed SPOTLIGHT toggle switch A1S11.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 24 VDC on input side of SPOTLIGHT toggle switch A1S11.
If 24 VDC is present, replace SPOTLIGHT toggle switch A1A11. (WP 0267 00)

Perform operational check of spotlight. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between terminal strip assembly A4 and spotlight.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 24 VDC at terminals A4TB5-5/A4TB11-2 on terminal strip assembly A4.

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Disconnect spotlight power cable from receptacle on top of operators cab. Using multimeter, check continuity of wiring between terminal strip assembly A4TB11-2 and spotlight power cable connector receptacle. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of spotlight. (TM 55-1945-225-10)

MALFUNCTION

Faulty spotlight.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check continuity of wiring in the spotlight power cable. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00).

Perform operational check of spotlight. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
DIESEL ENGINE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:

Personnel Required

Engineer 88L

References

TM 55-1945-222-14&P

TROUBLESHOOTING PROCEDURE

DIESEL ENGINE MALFUNCTIONS

For troubleshooting procedures on the diesel engine, reference the diesel engine manual. (TM 55-1945-222-14&P)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-223-14&P

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

HYDRAULIC SYSTEM DOES NOT FUNCTION

SYMPTOM

Hydraulic system not functioning.

MALFUNCTION

Hydraulic system oil gummy.

CORRECTIVE ACTION

Unit Level Maintenance

Drain and clean hydraulic system reservoir tank strainer. (WP 0139 00)

Replace hydraulic system reservoir return filter element. (WP 0142 00)

Replace hydraulic system return filter assembly. (WP 0144 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

MALFUNCTION

Hydraulic pump solenoid electrical connections loose or damaged.

CORRECTIVE ACTION

Unit Level Maintenance

Check hydraulic pump solenoid electrical connections are tight.

Perform operational check of hydraulic system. (TM 55-1945-225-10)

If pump solenoid electrical connections appear to be damaged, repair hydraulic pump solenoid electrical connections. (TM 55-1945-223-14&P)

MALFUNCTION

Faulty hydraulic system pump.

CORRECTIVE ACTION

Unit Level Maintenance

Replace hydraulic system pump. (WP 0161 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

If hydraulic system still does not operate properly, contact direct support maintenance.

MALFUNCTION

Faulty hydro-motor on primary planetary gearbox.

CORRECTIVE ACTION

Direct Support Level Maintenance

Replace hydro-motor. (WP 0131 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

HYDRAULIC SYSTEM HAS HIGH PRESSURE

SYMPTOM

Hydraulic system has high pressure.

MALFUNCTION

Hydraulic pressure improperly adjusted.

CORRECTIVE ACTION

Adjust hydraulic system pressure. (WP 0135 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

MALFUNCTION

Dirt in return line and supply line filters.

CORRECTIVE ACTION

Drain and clean hydraulic system reservoir tank strainer. (WP 0139 00)

Replace hydraulic system reservoir filter element. (WP 0142 00)

Replace hydraulic system return filter assembly. (WP 0144 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

MALFUNCTION

Way-valve is not functioning properly.

CORRECTIVE ACTION

Replace way-valve. (WP 0165 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

HYDRAULIC SYSTEM HAS NO PRESSURE

SYMPTOM

No pressure in hydraulic system.

MALFUNCTION

Hydraulic system reservoir fluid level low.

CORRECTIVE ACTION

Service hydraulic system reservoir. (WP 0141 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

MALFUNCTION

Hydraulic filter system is dirty.

CORRECTIVE ACTION

Drain and clean hydraulic system reservoir tank strainer. (WP 0139 00)

Replace hydraulic system reservoir return filter element. (WP 0142 00)

Replace hydraulic system return filter assembly. (WP 0144 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

MALFUNCTION

Defective hydraulic pump emits unusual noise or excessive heat.

CORRECTIVE ACTION

Replace hydraulic system pump. (WP 0161 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE**HYDRAULIC SYSTEM OIL FOAMS****SYMPTOM**

Hydraulic system oil has foamy appearance.

MALFUNCTION

Air in hydraulic system.

CORRECTIVE ACTION

Check overall hydraulic system for damaged seals or loose joints. Repair as necessary.

Vent air from hydraulic system. (WP 0134 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

HYDRAULIC SYSTEM OIL MILKY

SYMPTOM

Hydraulic system oil appears milky.

MALFUNCTION

Water in hydraulic system.

CORRECTIVE ACTION

Check overall hydraulic system for source of water intrusion. Repair as necessary.

Drain and clean hydraulic system reservoir tank strainer. (WP 0139 00)

Replace hydraulic system reservoir return filter element. (WP 0142 00)

Replace hydraulic system return filter assembly. (WP 0144 00)

Service hydraulic system reservoir. (WP 0141 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

HYDRAULIC SYSTEM PUMP MAKES NOISE

SYMPTOM

Hydraulic pump emits noise.

MALFUNCTION

Hydraulic system oil level low.

CORRECTIVE ACTION

Service hydraulic system reservoir. (WP 0141 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

MALFUNCTION

Hydraulic filter system clogged.

CORRECTIVE ACTION

Drain and clean hydraulic system reservoir tank strainer. (WP 0139 00)

Replace hydraulic system reservoir return filter element. (WP 0142 00)

Replace hydraulic system return filter assembly. (WP 0144 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

MALFUNCTION

Faulty hydraulic pump.

CORRECTIVE ACTION

Replace hydraulic system pump. (WP 0161 00)

Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
MARINE GEAR
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:

Personnel Required

Engineer 88L

References

TM 55-1945-223-14&P

TROUBLESHOOTING PROCEDURE

MARINE GEAR MALFUNCTIONS

For troubleshooting procedures on the marine gear, reference the marine gear manual. (TM 55-1945-223-14&P)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

WINDSHIELD WIPER DOES NOT OPERATE

SYMPTOM

The windshield wiper is not functioning.

MALFUNCTION

Failed WSHLD WIPER toggle switch S12 on middle control panel A1.

CORRECTIVE ACTION

With WSHLD WIPER toggle switch S12 positioned to on, use a multimeter to check for 24 VDC on output of WSHLD WIPER toggle switch S12. If 24 VDC is not present, check for 24 VDC at input side of WSHLD WIPER toggle switch S12. If 24 VDC is present, replace WSHLD WIPER toggle switch S12. (WP 0268 00)

Perform operational check of windshield wiper. (TM 55-1945-225-10)

MALFUNCTION

Failed WSHLD WIPER circuit breaker CB4 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

With WSHLD WIPER circuit breaker CB4 positioned to on, use a multimeter to check for 24 VDC on output of WSHLD WIPER circuit breaker CB4. If 24 VDC is not present, check for 24 VDC at input side of WSHLD WIPER circuit breaker CB4. If 24 VDC is present, replace WSHLD WIPER circuit breaker CB4. (WP 0294 00)

Perform operational check of windshield wiper. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between WSHLD WIPER circuit breaker CB4 on operators cab circuit breaker panel A3 and WSHLD WIPER toggle switch S12 on middle control panel A1.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 387 between WSHLD WIPER circuit breaker CB4 on operators cab circuit breaker panel A3 and WSHLD WIPER toggle switch S12 on middle control panel A1. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of windshield wiper. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between WSHLD WIPER toggle switch S12 on middle control panel A1 and terminal strip assembly A4.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 388 between WSHLD WIPER toggle switch S12-3 and terminal strip assembly A4 (TB05-6). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of windshield wiper. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in cable P24-1 between terminal strip assembly A4 and JB1.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 388 between terminal strip assembly A4 (TB05-6) and JB1 (TB1-4). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wire 0 between terminal strip assembly A4 (TB11) and JB1 (TB1-5). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of windshield wiper. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in cable P24-4 between JB1 and windshield wiper.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 388 between JB1 (TB1-4) and windshield wiper motor lead (B2-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wire 0 between JB1 (TB1-3) and windshield wiper motor lead (B2-2). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of windshield wiper. (TM 55-1945-225-10)

MALFUNCTION

Faulty windshield wiper motor.

CORRECTIVE ACTION

If all previous troubleshooting corrective actions have been accomplished and windshield wiper still will not operate, replace windshield wiper motor. (WP 0310 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

ACCESSORIES DO NOT FUNCTION

SYMPTOM

The operators cab accessories are not functioning.

MALFUNCTION

Failed OPR CAB circuit breaker CB11 on the propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC on output side of OPR CAB circuit breaker CB11 on propulsion module circuit breaker panel A6. If 24 VDC is not present, check for 24 VDC on input side of OPR CAB circuit breaker CB11. If 24 VDC is present, replace OPR CAB circuit breaker CB11. (WP 0213 00)

Perform operational check of operators cab accessories. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the MAIN circuit breaker CB1 and the OPR CAB circuit breaker CB11 in propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using a multimeter, check continuity of wiring between MAIN breaker CB1 and OPR CAB circuit breaker CB11. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab accessories. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

ALL CIRCUITS CONTROLLED BY OPERATORS CAB CIRCUIT BREAKER PANEL A3 ARE NOT FUNCTIONING

SYMPTOM

All circuits controlled by operators cab circuit breaker panel A3 do not function.

MALFUNCTION

Failed OPR CAB circuit breaker CB11 on the propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC on input side of OPR CAB circuit breaker CB11. If 24 VDC is present, replace OPR CAB circuit breaker CB11. (WP 0213 00)

Perform operational check of operators cab accessories. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the MAIN circuit breaker CB1 and the OPR CAB circuit breaker CB11 in propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using a multimeter, check continuity of wiring between MAIN breaker CB1 and OPR CAB circuit breaker CB11. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab accessories. (TM 55-1945-225-10)

MALFUNCTION

Faulty diodes D1/D2 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Replace diodes D1/D2. (WP 0397 00)

Perform operational check of operators cab switches. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Tool Kit, General Mechanics (Item 2, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

AMMETER INDICATES ZERO AMPS WHEN SYSTEM IS RUNNING

SYMPTOM

Ammeter needle shows zero amps when engine is running.

MALFUNCTION

No alternator output.

CORRECTIVE ACTION

Unit Level Maintenance

Refer to alternator not charging system batteries troubleshooting. (WP 0052 00)

MALFUNCTION

Improper ammeter shunt signal to ammeter gauge.

CORRECTIVE ACTION

General Support Level Maintenance.

Position both MAIN circuit breaker on the propulsion module circuit breaker panel A6 and A4CB3 circuit breaker on engine junction box A4 to off. Lift A9FU1 fuse inside thruster DIR/AUX battery junction box assembly A9. Using multimeter, check continuity of cable P24-13 between Isolator Junction Box A12 (wire 220, SH1-B+) and propulsion module junction box A3 (TB4-10). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of cable P24-13 between

Isolator Junction Box A12 (wire 221, SH1-L+) and propulsion module junction box A3 (TB4-11). If continuity is not present, repair/replace wiring as necessary (WP 0397 00). If problem not corrected, proceed.

Using multimeter, check continuity of propulsion module junction box A3 cable P4 connector, wire 220 at pin 10 and inside A3 at TB4-10. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of propulsion module junction box A3 cable P2 connector, wire 221 at pin 11 and inside A3 at TB4-11. If continuity is not present, repair/replace wiring as necessary (WP 0397 00). If problem is not corrected, proceed.

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 and all circuit breakers on engine junction box A4 to off. Disconnect electrical interconnect assembly from intake plenum and A6 receptacle on front of operators cab. (WP 0202 00) Using multimeter, check continuity of "P4" cabling through electrical interconnect assembly at pin 10 for wire 220 (end to end) and pin 11 for wire 221 (end to end). If continuity is not present on either wire, repair electrical interconnect cable (WP 0203 00). If problem is not corrected, proceed.

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to on. For port ammeter, use multimeter to check continuity between A6 receptacle (wire 220 at J4 pin10 and wire 221 at J4 pin 11) and the terminal strip assembly A4 (wire 301A on TB05-18 and wire 301 on TB05-16) If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) For starboard ammeter, use multimeter to check continuity between A5 receptacle (wire 220 at J4 pin10 and wire 221 at J4 pin 11) and the terminal strip assembly A4 (wire 302A on TB09-9 and wire 302 on TB09-7). If continuity is not present, repair/replace wiring as necessary (WP 0397 00). If problem is not corrected, proceed.

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. For port ammeter, use multimeter to check continuity of wiring between terminal strip assembly A4 (wire 301A on TB05-18 and wire 301 on TB05-16) to A1M2 (shunt 1) and (shunt 2) respectively. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) For starboard ammeter, use multimeter to check continuity of wiring between terminal strip assembly A4 (wire 302A on TB09-9 and wire 302 on TB09-7) to A1M8 (shunt 1) and (shunt 2) respectively. If continuity is not present, repair/replace wiring as necessary (WP 0397 00).

Perform operational check of ammeter. (TM 55-1945-225-10)

MALFUNCTION

Failed ammeter gauge.

CORRECTIVE ACTION

If ammeter shunt signal is present and ammeter gauge still does not display running system amperage, replace ammeter gauge. (WP 0258 00)

Perform operational check of ammeter. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Tool Kit, General Mechanics (Item 2, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

AMMETER GAUGE DOES NOT RESPOND WHEN SYSTEM IS POWERED

SYMPTOM

Ammeter needle does not move during start-up.

MALFUNCTION

Failed voltage regulator VR3 on converter assembly A8.

CORRECTIVE ACTION

Using multimeter, check for 12 VDC across output side of voltage regulator VR3 (wire 376 and 377). If 12 VDC is not present, check for 24 VDC on input side of voltage regulator VR3 (wires 374 and 0). If 24 VDC is present, replace converter assembly A8. (WP 0296 00)

Perform operational check of ammeter. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between voltage regulator VR3 and ammeter gauge(s) A1M2/A1M8.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between voltage regulator VR3 (wire 376) and A1M2/A1M8 (+). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wiring between voltage regulator VR3 (wire 377) and A1M2/A1M8 (-). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of ammeter. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between voltage regulator VR3 and operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between voltage regulator VR3 (wire 374) and operators cab circuit breaker panel A3 (CB9-2). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wiring between voltage regulator VR3 (wire 0) and operators cab circuit breaker panel A3 (TB2-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of ammeter. (TM 55-1945-225-10)

MALFUNCTION

Failed ammeter gauge.

CORRECTIVE ACTION

If ammeter shunt signal has been confirmed (WP 0027 00) and power is present at ammeter gauge, and ammeter gauge still does not display running system amperage, replace ammeter gauge. (WP 0258 00)

Perform operational check of ammeter. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TM 55-1945-223-14&P

TROUBLESHOOTING PROCEDURE

CLUTCH INDICATOR NOT OPERATIONAL

SYMPTOM

Clutch indicator not operational.

MALFUNCTION

Failed indicator.

CORRECTIVE ACTION

Replace PORT/STARBOARD CLUTCH indicator A2DS4/5. (WP 0289 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Faulty PORT/STARBOARD CLUTCH indicator A2DS4/5.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC on input side of PORT/STARBOARD CLUTCH indicator A2DS4/5. If 24 VDC is present, replace PORT/STARBOARD CLUTCH indicator A2DS4/5. (WP 0289 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Faulty PORT/STARBOARD CLUTCH toggle switch(s) A2S5S6.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC on input side of PORT/STARBOARD CLUTCH indicator A2DS4/5. If 24 VDC is present, replace PORT/STARBOARD CLUTCH toggle switch(s) A2S5S6. (WP 0278 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between PORT/STARBOARD CLUTCH indicator A2DS4/5 and PORT/STARBOARD CLUTCH toggle switch(s) A2S5S6.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check for continuity of wiring between PORT/STARBOARD CLUTCH indicator A2DS4/5 and PORT/STARBOARD CLUTCH toggle switch(s) A2S5S6. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the terminal strip assembly A4 and the propulsion module junction box A3.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC at TB1-4/TB1-13 in the appropriate propulsion module junction box A3.

If 24 VDC is present, use multimeter to check for 24 VDC at terminal strip assembly A4TB2-16/A4TB10-3 and A4TB4-16/A4TB10-3 at the operators cab terminal board assembly.

If 24 VDC is not present at A4TB2-16/A4TB10-3 and A4TB4-16/A4TB10-3 on terminal strip assembly A4, refer to troubleshooting procedures for power take-off clutch and neutral switch in the marine gear manual. (TM 55-1945-223-14&P)

If 24 VDC is not present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between the terminal strip assembly A4 and the appropriate propulsion module junction box A3. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Failed diode A2D1/2 (port, starboard) on lower control panel A2.

CORRECTIVE ACTION

Replace diode A2D1/2. (WP 0397 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE**COMPASS NOT FUNCTIONING****SYMPTOM**

Compass not displaying direction.

MALFUNCTION

Disconnected sensor cable (P10) from main assembly mast.

CORRECTIVE ACTION

Unit Level Maintenance

Connect sensor cable (P10) for main assembly mast to receptacle on front of operators cab.

Perform operational check of compass. (TM 55-1945-225-10)

MALFUNCTION

COMPASS circuit breaker CB8 on operators cab circuit breaker panel A3 not on.

CORRECTIVE ACTION

Unit Level Maintenance

Position COMPASS circuit breaker CB8 on operators cab circuit breaker panel A3 to on.

Perform operational check of compass. (TM 55-1945-225-10)

MALFUNCTION

Failed fuse F3 in junction box assembly JB3.

CORRECTIVE ACTION

Unit Level Maintenance

Replace fuse F3 in junction box assembly JB3. (WP 0366 00)

Perform operational check of compass. (TM 55-1945-225-10)

If compass still does not operate properly, contact direct support level maintenance.

MALFUNCTION

Compass display is functioning, but no directional reading is being displayed.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position A3CB8 on operators cab circuit breaker panel to off. Remove compass sensor cable P10 from front of operators cab. Remove cable P12-12 from bottom of compass display. (WP 0329 00) Using multimeter, check for continuity between P12-12 connector and J10 on front of operators cab (pin2 - J10-B; pin4 - J10-D; pin5 - J10-E; pin6 - J10-F; pin7 - J10-G). If continuity is present, replace flux gate. (WP 0333 00)

Perform operational check of compass. (TM 55-1945-225-10)

MALFUNCTION

Faulty NAV COMPASS toggle switch A3CB8.

CORRECTIVE ACTION

Direct Support Level Maintenance

With NAV COMPASS toggle switch on operators cab circuit breaker panel A3 positioned to on, use multimeter to check for 24 VDC at output of A3CB8. If 24 VDC is not present, use multimeter to check for 24 VDC at input to A3CB8. If 24 VDC is present, replace NAV COMPASS circuit breaker A3CB8. (WP 0294 00)

Perform operational check of compass. (TM 55-1945-225-10)

If compass still does not operate properly, contact direct support maintenance.

MALFUNCTION

Faulty 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 12 VDC at output of 24 to 12 VDC converter VR2 (wire 440, +12). If 12 VDC is not present, use multimeter to check for 24 VDC at input to 24 to 12 VDC converter VR2 (wire 394, +24). If 24 VDC is present, replace 24 to 12 VDC converter VR2. (WP 0364 00)

Perform operational check of compass. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between operators cab circuit breaker panel A3 and terminal strip A4.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between operators cab circuit breaker panel A3 (A3CB8) and terminal strip A4 (A4TB5-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of compass. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on cable P24-20 between terminal strip A4 and junction box assembly JB3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 394 between terminal strip A4 (A4TB5-1) and junction box assembly JB3 (TB1-4). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wire 0 between terminal strip A4 (A4TB11) and junction box assembly JB3 (TB1-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

For compass display backlight, check continuity between terminal strip A4 (A4TB5-17) and junction box assembly JB3 TB1-9). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of compass. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on P24-21 between junction box assembly JB3 and 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity between junction box assembly JB3 (wire 394, JB3TB1-6) and 24 to 12 VDC converter VR2 (+24). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity between junction box assembly JB3 (wire 0, JB3TB1-3) and 24 to 12 VDC converter VR2 (-) input. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of compass. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on P12-10 between junction box assembly JB3 and 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity between junction box assembly JB3 (wire 440, JB3TB1-7) and 24 to 12 VDC converter VR2 (+12). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity between junction box assembly JB3 (wire 0, JB3TB1-3) and 24 to 12 VDC converter VR2 (-) output. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of compass. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on P12-12 between junction box assembly JB3 and compass display.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity between junction box assembly JB3 (wire 614, JB3F3-26) and compass display (+). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity between junction box assembly JB3 (wire 0, JB3TB1-5) and compass display (-). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

For compass display backlight, check continuity between junction box assembly JB3 (wire 375A, JB3TB1-9) and compass display light. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of compass. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

DEFROSTER FAN DOES NOT OPERATE

SYMPTOM

Defroster fan does not operate.

MALFUNCTION

Faulty DEFROSTER toggle switch A2S25 on lower control panel A2.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC at input side of DEFROSTER toggle switch A2S25. If 24 VDC is not present, replace DEFROSTER toggle switch A2S25. (WP 0285 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Faulty HEATER DEFROST circuit breaker A3CB5 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC at input side of HEATER DEFROST circuit breaker A3CB5. If 24 VDC is not present, replace HEATER DEFROST circuit breaker A3CB5. (WP 0294 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between DEFROSTER toggle switch A2S25 and HEATER DEFROST circuit breaker A3CB5.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between DEFROSTER toggle switch A2S25 and HEATER DEFROST circuit breaker A3CB5. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between CAB HEATER FAN A2S4 and heater fan B1A.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between CAB HEATER FAN A2S4 and heater fan B1A. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Defective defroster fan.

CORRECTIVE ACTION

Replace defroster. (WP 0306 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

EXHAUST PLENUM FAN OPERATING STATUS LIGHT DOES NOT ILLUMINATE

NOTE

This task is typical for troubleshooting both port and starboard vent fan indicator lamps.

SYMPTOM

Operating status light for the vent fan does not illuminate.

MALFUNCTION

Failed vent fan indicator.

CORRECTIVE ACTION

Replace vent fan indicator. (WP 0288 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Faulty vent fan indicator on lower control panel A2.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC on input of vent fan indicator. If 24 VDC is present, replace vent fan indicator. (WP 0288 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Faulty diode A2D15/16 lower control panel A2.

CORRECTIVE ACTION

With VENT FANS toggle switch A2S21/S22 in ON position, use multimeter to check for 24 VDC on output of diode A2D15/16. If 24 VDC is not present, replace diode 3A2D15/16. (WP 0397 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

MALFUNCTION

Open wiring between vent fan indicator A2S21/S22 and vent fan indicator A2DS6/7 on lower control panel A2.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between vent fan indicator A2S21/S22 and vent fan indicator A2DS6/7. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of vent fan. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

HEATER FAN DOES NOT OPERATE WITH HEATER FAN CONTROL ON HIGH

SYMPTOM

Fan does not operate with heater fan control on high.

MALFUNCTION

Faulty CAB HEATER FAN toggle switch A2S4 on lower control panel A2.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC at input side of CAB HEATER FAN toggle switch A2S4. If 24 VDC is not present, replace CAB HEATER FAN toggle switch A2S4. (WP 0274 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Faulty HEATER DEFROST circuit breaker A3CB5 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC at input side of HEATER DEFROST circuit breaker A3CB5. If 24 VDC is not present, replace HEATER DEFROST circuit breaker A3CB5. (WP 0294 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between CAB HEATER FAN toggle switch A2S4 and HEATER DEFROST circuit breaker A3CB5.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between CAB HEATER FAN toggle switch A2S4 and HEATER DEFROST circuit breaker A3CB5. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between CAB HEATER FAN toggle switch A2S4 and heater fan B1A.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between CAB HEATER FAN toggle switch A2S4 and heater fan B1A. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Defective heater fan.

CORRECTIVE ACTION

Replace heater. (WP 0307 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

HEATER FAN DOES NOT OPERATE WITH HEATER FAN CONTROL ON LOW

SYMPTOM

No operation from fan control while on low.

MALFUNCTION

Faulty CAB HEATER FAN toggle switch A2S4 on lower control panel A2.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC at input side of CAB HEATER FAN toggle switch A2S4. If 24 VDC is not present, replace CAB HEATER FAN toggle switch A2S4. (WP 0274 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Faulty HEATER DEFROST circuit breaker A3CB5 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC at input side of HEATER DEFROST circuit breaker A3CB5. If 24 VDC is not present, replace HEATER DEFROST circuit breaker A3CB5. (WP 0294 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between CAB HEATER FAN toggle switch A2S4 and HEATER DEFROST circuit breaker A3CB5.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between CAB HEATER FAN toggle switch A2S4 and HEATER DEFROST circuit breaker A3CB5. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between CAB HEATER FAN toggle switch A2S4 and heater fan B1A.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between CAB HEATER FAN toggle switch A2S4 and heater fan B1A. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab fan. (TM 55-1945-225-10)

MALFUNCTION

Defective heater fan.

CORRECTIVE ACTION

Replace heater. (WP 0307 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE**FIRE ALARM HORN DOES NOT OPERATE****SYMPTOM**

Fire alarm horn does not operate.

MALFUNCTION

Faulty fire alarm horn.

CORRECTIVE ACTION

While holding PORT/STARBOARD FIRE toggle switch(s) A2S1/3 (port, starboard) on lower control panel A2 to TEST, use multimeter to check for 24 VDC at output of fire alarm horn A4LS2 on terminal strip assembly A4. If 24 VDC is not present, check for 24 VDC at input of fire alarm horn A4LS2. If 24 VDC is present, replace fire alarm horn A4LS2 on terminal strip assembly A4. (WP 0297 00)

Perform operational check of fire alarm horn. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between A4LS2 on terminal strip assembly A4 and A2S1/3 (port, starboard) in lower control panel A2 and terminal strip assembly A4.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using a multimeter, check for continuity between A4LS2 on terminal strip assembly A4 and PORT/STARBOARD FIRE toggle switch(s) A2S1/3 (port, starboard) on lower control panel A2. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of fire alarm horn. (TM 55-1945-225-10)

MALFUNCTION

Faulty PORT/STARBOARD FIRE toggle switch(s) A2S1/3 (port, starboard) on lower control panel A2.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC at input to PORT/STARBOARD FIRE toggle switch(s) A2S1/3 on lower control panel A2. If voltage present, replace PORT/STARBOARD FIRE toggle switch(s) A2S1/3. (WP 0286 00)

Perform operational check of fire alarm horn. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in wiring between the operators cab lower control panel A2 and the appropriate propulsion module bilge pump control assembly A5 or A7.

CORRECTIVE ACTION

If 24 VDC is not present at PORT/STARBOARD FIRE toggle switch(s) A2S1/3, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring between PORT/STARBOARD FIRE toggle switch(s) A2S1/3 and the appropriate bilge pump control panel assembly A5 or A7. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of fire alarm horn. (TM 55-1945-225-10)

MALFUNCTION

Faulty diode A4D1 (starboard) or A4D2 (port) on terminal strip assembly A4.

CORRECTIVE ACTION

Replace diode. (WP 0396 00)

Perform operational check of fire alarm horn. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

FIRE ALARM INDICATOR LIGHT DOES NOT ILLUMINATE IN ALARM MODE

NOTE

This task is typical for troubleshooting both fire alarm indicator lights.

SYMPTOM

No illumination from FIRE alarm indicator light(s) while in alarm mode.

MALFUNCTION

Failed FIRE alarm indicator light.

CORRECTIVE ACTION

Replace FIRE alarm indicator light. (WP 0290 00)

Perform operational check of fire alarm indicator light. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between PORT/STARBOARD FIRE alarm toggle switch(s) A2DS1/2 and PORT/STARBOARD FIRE alarm indicator(s) A2DS1/2 on lower control panel A2.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC at input to PORT/STARBOARD FIRE alarm indicator(s) A2DS1/2. If 24 VDC is present, replace PORT/STARBOARD FIRE alarm indicator(s) A2DS1/2. (WP 0290 00)

Perform operational check of fire alarm indicator light. (TM 55-1945-225-10)

If 24 VDC is not present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring between PORT/STARBOARD FIRE alarm toggle switch(s) A2DS1/2 and PORT/STARBOARD FIRE alarm indicator(s) A2DS1/2. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of fire alarm light. (TM 55-1945-225-10)

MALFUNCTION

Faulty switch PORT/STARBOARD FIRE alarm toggle switch(s) A2DS1/2 on lower control panel A2.

CORRECTIVE ACTION

While holding PORT/STARBOARD FIRE alarm toggle switch(s) A2DS1/2 in TEST position, use multimeter to check for 24 VDC at input to PORT/STARBOARD FIRE alarm toggle switch(s) A2DS1/2. If 24 VDC is present, replace PORT/STARBOARD FIRE alarm toggle switch(s) A2DS1/2. (WP 0286 00)

Perform operational check of fire alarm light. (TM 55-1945-225-10)

MALFUNCTION

Failed diode A2D17 on lower control panel A2 or failed diode A4D1/D2/D4 on terminal strip assembly A4.

CORRECTIVE ACTION

Replace diode. (WP 0396 00)

Perform operational check of fire alarm light. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

FLOOD ALARM SONALERT BEEPER DOES NOT OPERATE

NOTE

This task is typical for troubleshooting the sonalert beeper.

SYMPTOM

Sonalert beeper will not sound.

MALFUNCTION

Faulty sonalert beeper A2SL1 on lower control panel A2.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC on input to A2LS1. If 24 VDC is present, replace sonalert beeper. (WP 0279 00)

Perform operational check of flood alarm. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between sonalert beeper A2LS1 and FLOODING toggle switch A2S2.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between sonalert beeper A2LS1 and FLOODING toggle switch A2S2. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of flood alarm. (TM 55-1945-225-10)

MALFUNCTION

Faulty FLOODING toggle switch A2S2 on lower control panel A2.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC at input of FLOODING toggle switch A2S2.
If 24 VDC is present, replace FLOODING toggle switch A2S2 on lower control panel A2. (WP 0287 00)

Perform operational check of flood alarm. (TM 55-1945-225-10)

MALFUNCTION

Open in wiring between operators cab lower control panel A2 and terminal strip A4.

CORRECTIVE ACTION

If 24 VDC was not present in the previous step, use multimeter to check for 24 VDC at A4TB4-18/3A4TB10-3 at the operators cab terminal strip A4.

If 24 VDC is present, use multimeter to check continuity of wiring. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of flood alarm. (TM 55-1945-225-10)

MALFUNCTION

Open in wiring between terminal strip assembly A4 and propulsion module junction box A3.

CORRECTIVE ACTION

If 24 VDC was not present in the previous step, use multimeter to check for 24 VDC at TB1-16/TB3-5 in the appropriate propulsion module junction box A3.

If 24 VDC is present, use multimeter to check continuity of wiring between terminal strip assembly A4 and propulsion module junction box A3. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of flood alarm. (TM 55-1945-225-10)

MALFUNCTION

Open in wiring between bilge pump control assembly A5 or A7 and propulsion module junction box A3.

CORRECTIVE ACTION

If 24 VDC was not present in the previous step, use multimeter to check for 24 VDC at TB1-3/TB3-2 in the appropriate bilge pump control assembly A5 or A7.

If 24 VDC is present, check continuity of wiring between bilge pump control assembly A5 or A7 and propulsion module junction box A3. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of flood alarm. (TM 55-1945-225-10)

MALFUNCTION

Failed diode A5D1/A5D1 (starboard, port).

CORRECTIVE ACTION

Replace diode. (WP 0396 00)

Perform operational check of flood alarm. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

FLOOD ALARM INDICATOR LAMP DOES NOT ILLUMINATE IN ALARM MODE

SYMPTOM

No illumination of FLOODING alarm indicator lamp while in alarm mode.

MALFUNCTION

Failed FLOODING alarm indicator lamp.

CORRECTIVE ACTION

Replace FLOODING alarm indicator lamp. (WP 0291 00)

Perform operational check of FLOODING alarm. (TM 55-1945-225-10)

MALFUNCTION

Faulty flood indicator A2DS2.

CORRECTIVE ACTION

With FLOODING alarm toggle switch A2S2 positioned to TEST, use multimeter to check for 24 VDC on output side of FLOODING alarm indicator A2DS2. If 24 VDC is not present, check for 24 VDC on input side of FLOODING alarm A2DS2. If 24 VDC is present, replace flood indicator A2DS2. (WP 0291 00)

Perform operational check of FLOODING alarm. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between FLOODING alarm indicator A2DS2 and FLOODING alarm toggle switch A2S2 on lower control panel A2.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using a multimeter, check continuity of wiring between FLOODING alarm A2DS2-2 and FLOODING alarm toggle switch A2S2-5. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00).

Perform operational check of FLOODING alarm. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

OPERATORS CAB GAUGE LIGHTS WILL NOT OPERATE OR VARY IN BRIGHTNESS

SYMPTOM

No operation or a variation in brightness from the operators cab gauge lights.

MALFUNCTION

Failed PANEL DIMMER A2R1 on lower control panel A2.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC on input side of PANEL DIMMER A2R1. If 24 VDC is present, replace PANEL DIMMER A2R1. (WP 0276 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Failed PANEL LIGHTS circuit breaker CB9 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC on input side of PANEL LIGHTS circuit breaker CB9. If 24 VDC is present, replace PANEL LIGHTS circuit breaker CB9. (WP 0294 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between PANEL DIMMER A2R1 and PANEL LIGHTS circuit breaker CB9 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using a multimeter, check continuity of wiring between PANEL DIMMER A2R1 and PANEL LIGHTS CB9. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TM 55-1945-222-14&P

TROUBLESHOOTING PROCEDURE

LOW ENGINE OIL PRESSURE (AUDIBLE ALARM AND WARNING LIGHT ON)

SYMPTOM

Audible engine alarm and ENG ALARM indicator is on.

MALFUNCTION

Oil pressure sending unit not transmitting correct reading.

CORRECTIVE ACTION

Check wiring harness for positive ground. Repair wiring harness. (WP 0397 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Oil pressure sending unit is transmitting correct reading, lubrication system malfunctioning.

CORRECTIVE ACTION

Diesel engine malfunctioning. (TM 55-1945-222-14&P)

Perform operational check of diesel engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

MAST ENCLOSURE ASSEMBLY A7 SONALERT BEEPER SOUNDS

SYMPTOM

Sonalert beeper on mast enclosure assembly A7 sounds.

MALFUNCTION

Navigation light has failed bulb.

CORRECTIVE ACTION

Unit Level Maintenance

Replace light bulb. (WP 0353 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Mast enclosure assembly A7 has blown fuse.

CORRECTIVE ACTION

Unit Level Maintenance

Replace fuse. (WP 0343 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Mast enclosure assembly A7 has a defective toggle switch.

CORRECTIVE ACTION

Unit Level Maintenance

Using multimeter, check for 24 VDC on input to toggle switch. If 24 VDC is present, replace toggle switch. (WP 0344 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

MALFUNCTION

Faulty sonalert beeper.

CORRECTIVE ACTION

Unit Level Maintenance

Position MAIN circuit breaker on the propulsion module circuit breaker panel A6 to off. Using multimeter, check for no continuity across sonalert beeper. If no continuity is found, replace sonalert beeper. (WP 0345 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

If navigation lights still do not operate properly, contact direct support maintenance.

MALFUNCTION

Open circuit in the mast enclosure assembly A7.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using a multimeter, perform a continuity test of the electrical wiring from the mast enclosure assembly A7 to the light bulb receptacle of the affected light. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of navigation lights. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE**NO POWER TO THE OPERATORS CAB CONTROL PANELS****SYMPTOM**

The operators cab control panels are not receiving power.

MALFUNCTION

Failed CONTROL PANELS circuit breaker on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC at input to CONTROL PANELS circuit breaker CB9. If 24 VDC is present, replace CONTROL PANELS circuit breaker CB9 on operators cab circuit breaker panel A3. (WP 0294 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Failed OPR CAB circuit breaker CB11 on propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Using a multimeter, check for 24 VDC at input to OPR CAB circuit breaker CB11. If 24 VDC is present, replace OPR CAB circuit breaker CB11 on propulsion module circuit breaker panel A6. (WP 0213 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Failed MAIN circuit breaker CB1 on propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC at input to MAIN circuit breaker CB1. If 24 VDC is present, replace MAIN circuit breaker CB1 on the propulsion module circuit breaker panel A6. (WP 0213 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the propulsion module circuit breaker panel A6 and the operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using a multimeter, check continuity of wiring between propulsion module circuit breaker panel A6 and operators cab circuit breaker panel A3. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab control panel. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

NO STEERING CONTROL INDICATION FOR THE PUMP-JET

SYMPTOM

The thrust direction dial is not indicating pump-jet position.

MALFUNCTION

Low voltage is being supplied by the thruster direction/auxiliary battery junction box assembly A9 batteries.

CORRECTIVE ACTION

Replace the thruster direction/auxiliary battery junction box assembly A9 batteries. (WP 0218 00)

Perform operational check of steering system. (TM 55-1945-225-10)

MALFUNCTION

The thrust indicating device is defective.

CORRECTIVE ACTION

Replace thrust indicating device. (WP 0264 00)

Perform operational check of steering system. (TM 55-1945-225-10)

MALFUNCTION

The pump-jet planetary gearing feedback unit is defective.

CORRECTIVE ACTION

Replace pump-jet planetary gearing feedback unit. (WP 0167 00)

Perform operational check of steering system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE**NO STEERING FROM OPERATORS CAB****SYMPTOM**

No steering from operators cab.

MALFUNCTION

Improper operation of valves in the way-valve assembly.

CORRECTIVE ACTION

Unit Level Maintenance

Replace hydraulic way-valve. (WP 0165 00)

Perform operational check of steering system. (TM 55-1945-225-10)

MALFUNCTION

Low hydraulic pressure.

CORRECTIVE ACTION

Unit Level Maintenance

Adjust hydraulic pump pressure. (WP 0135 00)

Perform operational check of hydraulic system (steering control lever).
(TM 55-1945-225-10)

If still no pressure, replace hydraulic pump. (WP 0161 00)

Perform operational check of hydraulic system (steering control lever).
(TM 55-1945-225-10)

If steering still does not operate properly, contact direct support maintenance.

MALFUNCTION

24 VDC not present at electric control valve connectors of way-valve.

CORRECTIVE ACTION

Direct Support Maintenance

Repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of steering system. (TM 55-1945-225-10)

MALFUNCTION

Hydraulic system solenoid valves are staying energized.

CORRECTIVE ACTION

Direct Support Level Maintenance

Isolate steering control A2S23 terminal 4/A2S24 terminal 4 (port/starboard) on the lower control panel A2. With the steering control held in either the clockwise or counterclockwise position, use multimeter to check for 24 VDC at appropriate steering control lever A2S23-4/3A2DS2-2 or 3A2S24-4/3A2DS2-2 on the lower control panel A2.

If 24 VDC is present, use multimeter to check continuity of steering control lever A2S23-4/A2DS2-2 and A2S24-4/A2DS2-2 wiring. If continuity is not present, replace steering control lever 3A2S23 or 3A2S24 as necessary. (WP 0275 00)

Perform operational check of hydraulic system (steering control lever).
(TM 55-1945-225-10)

If 24 VDC is not present, use multimeter to check continuity of wiring to the hydraulic system solenoid valves for short circuits. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of hydraulic system (steering control lever).
(TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

NO VOLTAGE AT TEST JACKS WHEN USING BUILT-IN TEST SWITCH 3A3S1
IN ANY POSITION

SYMPTOM

When using built in operators cab circuit breaker panel A3 test switch A3S1 in any position, there is no voltage at test jacks.

MALFUNCTION

Open circuit between A3S1 wiper and test jack J2 (+).

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off.
Using a multimeter, check continuity of wiring between A3S1 COMMON and
jack J2 (+). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab switches. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between TB2-1 and test jack J2 (-).

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off.
Using multimeter, check continuity of wiring between TB2-1 and test jack J2 (-).
If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of operators cab switches. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TM 55-1945-222-14&P

TROUBLESHOOTING PROCEDURE

ENGINE OVERHEATING (AUDIBLE ALARM AND WARNING LIGHT ON)

SYMPTOM

Audible engine alarm and ENG ALRM indicator is on.

MALFUNCTION

Freshwater hose(s) has a leak.

CORRECTIVE ACTION

Unit Level Maintenance

Replace the defective hose(s). (TM 55-1945-222-14&P)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Engine water temperature sending unit not transmitting correct reading.

CORRECTIVE ACTION

Unit Level Maintenance

Check wiring harness for positive ground. Repair wiring harness (WP 0397 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Raw water hose(s) has a leak.

CORRECTIVE ACTION

Unit Level Maintenance

Replace the defective hose(s). (WP 0108 00, WP 0110 00, WP 0112 00, WP 0113 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Engine raw water pump is not working.

CORRECTIVE ACTION

Unit Level Maintenance

Replace the raw water pump. (TM 55-1945-222-14&P)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Raw water system clogged.

CORRECTIVE ACTION

Unit Level Maintenance

Remove and clean raw water system components as necessary.

MALFUNCTION

Engine heat exchanger is clogged.

CORRECTIVE ACTION

Direct Support Level Maintenance

Clean or replace the heat exchanger core. (TM 55-1945-222-14&P)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Diesel engine cooling system malfunctioning.

CORRECTIVE ACTION

Direct Support Level Maintenance

Diesel engine malfunctioning. (WP 0016 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TM 55-1945-223-14&P

TROUBLESHOOTING PROCEDURE

PUMP-JET ONLY ROTATES ONE DIRECTION

SYMPTOM

No clockwise steering from operators cab.

MALFUNCTION

Failed clockwise steering solenoid.

CORRECTIVE ACTION

Unit Level Maintenance

Using a multimeter, check for 24 VDC at input to steering solenoid. If 24 VDC is present, replace hydraulic way-valve. (WP 0165 00)

Perform operational check of steering system. (TM 55-1945-225-10)

MALFUNCTION

Failed counterclockwise steering solenoid.

CORRECTIVE ACTION

Unit Level Maintenance

Using a multimeter, check for 24 VDC at input to steering solenoid. If 24 VDC is present, replace hydraulic way-valve. (WP 0165 00)

Perform operational check of steering system. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between steering control and clockwise steering solenoid.

CORRECTIVE ACTION

Direct Support Level Maintenance

Put steering control in the clockwise position. Using a multimeter, check for 24 VDC at terminals of the terminal strip assembly A4.

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring between the operators cab and the appropriate propulsion module steering solenoid. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of steering system. (TM 55-1945-225-10)

MALFUNCTION

No counterclockwise steering from operators cab.

CORRECTIVE ACTION

Direct Support Level Maintenance

Put steering control in the counterclockwise position. Using multimeter, check for 24 VDC at terminals at terminal strip assembly A4.

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use a multimeter to check continuity of wiring between the operators cab and the appropriate propulsion module steering solenoid. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of steering system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

STEERING REACTS SLUGGISHLY

SYMPTOM

Steering is reacting sluggishly.

MALFUNCTION

Air in hydraulic system.

CORRECTIVE ACTION

Bleed air from hydraulic system. (WP 0134 00)

Perform operational check of steering system. (TM 55-1945-225-10)

MALFUNCTION

Low hydraulic pressure.

CORRECTIVE ACTION

Adjust hydraulic pump pressure. (WP 0135 00)

Perform operational check of steering system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUMP-JET
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

THRUSTER GEARBOX LOW OIL INDICATOR LIGHT ILLUMINATES

SYMPTOM

Thruster gearbox low oil indicator(s) on lower control panel A2 illuminated.

MALFUNCTION

Low oil level in pump-jet gearbox.

CORRECTIVE ACTION

Service oil in pump-jet gearcase. (WP 0126 00)

Perform operational check of pump-jet. (TM 55-1945-225-10)

MALFUNCTION

Defective thruster gearbox low oil sensor.

CORRECTIVE ACTION

Replace thruster gearbox low oil sensor. Contact specialized repair activity.

Perform operational check of pump-jet. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PRECISION LIGHTWEIGHT GLOBAL POSITIONING RECEIVER (PLGR)
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

PLGR DOES NOT DISPLAY A VALID POSITION

SYMPTOM

No indication of valid position displayed in the PLGR display window.

MALFUNCTION

Faulty GPS antenna.

CORRECTIVE ACTION

Replace GPS antenna. (WP 0340 00)

Perform operational check of PLGR. (TM 55-1945-225-10)

MALFUNCTION

Failed PLGR.

CORRECTIVE ACTION

Replace PLGR. (WP 0336 00)

Perform operational check of PLGR. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
PRECISION LIGHTWEIGHT GLOBAL POSITIONING RECEIVER (PLGR)
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Tool Kit, General Mechanics (Item 2, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

PLGR WILL NOT TURN ON

SYMPTOM

No indication of power displayed in the PLGR display window.

MALFUNCTION

Failed fuse F1 in junction box assembly JB3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check for continuity across fuse F1 inside JB3. If continuity is not present, replace fuse F1 in junction box assembly JB3. (WP 0366 00)

Perform operational check of PLGR. (TM 55-1945-225-10)

MALFUNCTION

Faulty GPS circuit breaker CB8 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

With GPS circuit breaker CB8 positioned to on, use a multimeter to check for 24 VDC on output of GPS circuit breaker CB8. If 24 VDC is not present, use a multimeter to check for 24 VDC at input to GPS circuit breaker CB8. If 24 VDC is present, replace GPS circuit breaker CB8. (WP 0294 00)

Perform operational check of PLGR. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on cable P24-20 between junction box assembly JB3 and GPS circuit breaker CB8 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between junction box assembly JB3 (wire 394, JB3-TB1-4) and terminal strip assembly A4 (TB5-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wiring between junction box assembly JB3 (wire 0, JB3-TB1-1) and terminal strip assembly A4 (TB11). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of PLGR. (TM 55-1945-225-10)

MALFUNCTION

PLGR will not power up.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 24 VDC on the plug of P24-22 between wire 0 (RING) and wire 611 (CENTER). If 24 VDC is present, replace PLGR. (WP 0336 00)

Perform operational check of PLGR. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on cable P24-22 between junction box assembly JB3 and PLGR.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity between junction box assembly JB3 (wire 611, JB3-F1-2) and PLGR (CENTER, wire 611). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity between junction box assembly JB3 (TB1-4) and PLGR (RING, wire 0). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of PLGR. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Tool Kit, General Mechanics (Item 2, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-222-14&P

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

ALTERNATOR IS NOT CHARGING THE BATTERIES

SYMPTOM

Battery bank voltage shows less than 26 VDC while engines are running, after checking test points using the Built In Test Switch on operators cab circuit breaker panel A3.

MALFUNCTION

Alternator drive belts loose.

CORRECTIVE ACTION

Adjust alternator drive belt tension. (TM 55-1945-222-14&P)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Alternator drive belts worn or broken.

CORRECTIVE ACTION

Replace alternator drive belts. (TM 55-1945-222-14&P)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Alternator wiring loose or damaged.

CORRECTIVE ACTION

Inspect alternator wiring for connectivity or damage. If wiring requires retermination, refer to TM 55-1945-222-14&P. If wiring is damaged, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Alternator malfunctioning.

CORRECTIVE ACTION

Test alternator. (TM 55-1945-222-14&P)

If alternator fails test, replace alternator. (TM 55-1945-222-14&P)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Thruster direction/aux. battery junction box assembly A9 voltage regulator (VR1) malfunctioning.

CORRECTIVE ACTION

Test voltage regulator VR1. (TM 55-1945-222-14&P)

If voltage regulator VR1 fails test, replace voltage regulator VR1. (WP 0219 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Failed A9FU1 fuse in thruster direction/aux. battery junction box assembly A9.

CORRECTIVE ACTION

Using multimeter, check for 24 VDC on wire 607 in thruster direction/aux. battery junction box assembly A9. If 24 VDC is not present, replace fuse A9FU1. (WP 0219 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between alternator and thruster direction/aux. battery junction box assembly A9.

CORRECTIVE ACTION

Remove positive battery terminal from BT7. (WP 0197 00) Using multimeter, check continuity of cable P24-1 wiring between alternator (wire 130, G1-STATOR) and thruster direction/aux. battery junction box assembly A9 (TB1-2). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of cable P24-1 wiring between alternator (wire 0, G1-GND) and thruster direction/aux. battery junction box assembly A9 (TB1-3). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between alternator and isolator junction box A12.

CORRECTIVE ACTION

Remove positive battery terminal from BT1, BT3 and BT7. (WP 0197 00) Using multimeter, check for 24 VDC on cable P24-18 wiring between alternator (wire 220, G1 (+)) and isolator junction box A12 (SH1-B+). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between alternator and engine battery BT8.

CORRECTIVE ACTION

Remove positive battery terminal from BT1, BT3 and BT7. Using multimeter, check continuity of cable P24-16 wiring between alternator (wire 0, G1 (GND)) and BT8 negative terminal. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between thruster direction/aux. battery junction box assembly A9 and isolator junction box A12 in cable P24-18.

CORRECTIVE ACTION

Remove positive battery terminal from BT1, BT3 and BT7. Using multimeter, check for 24 VDC in isolator junction box A12 between (A12S1-3) and (TB1-2). If 24 VDC is not present, repair/replace wiring as necessary. (WP 0397 00)

Using multimeter, check for continuity between isolator junction box A12 (A12S1-2) and thruster direction/aux. battery junction box assembly A9 (TB1-5). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of diesel engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TB 9-6140-200-14

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

BELOW DECK LIGHTING DOES NOT FUNCTION

SYMPTOM

Below deck lighting does not illuminate.

MALFUNCTION

Defective fluorescent light bulb(s).

CORRECTIVE ACTION

Unit Level Maintenance

Replace defective fluorescent light bulb(s). (WP 0371 00)

Perform operational check on below deck lighting system. (TM 55-1945-225-10)

MALFUNCTION

Batteries do not have sufficient charge, are discharged or are defective.

CORRECTIVE ACTION

Unit Level Maintenance

Service batteries. (WP 0198 00)

Perform operational check on below deck lighting. (TM 55-1945-225-10)

If discharged, charge batteries. (TB 9-6140-200-14)

Perform operational check on below deck lighting. (TM 55-1945-225-10)

If charging does not correct battery condition, replace batteries. (WP 0199 00)

Perform operational check on below deck lighting. (TM 55-1945-225-10)

MALFUNCTION

Defective light fixture.

CORRECTIVE ACTION

Unit Level Maintenance

Using a multimeter, check for 24 VDC at light fixture input. If 24 VDC is present, check for continuity between fluorescent light bulb receptacles. If continuity is not present, replace light fixture. (WP 0372 00)

Perform operational check on below deck lighting system. (TM 55-1945-225-10)

If below deck lighting system still does not operate properly, contact direct support maintenance.

MALFUNCTION

Defective light switch.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using a multimeter, check for 24 VDC at light switch input. If 24 VDC is present, check for 24 VDC on output side with light switch in the ON position. If 24 VDC is not present, replace light switch. (WP 0374 00, WP 0375 00)

Perform operational check on below deck lighting system. (TM 55-1945-225-10)

MALFUNCTION

Defective ENGINE SPACE LIGHTS circuit breaker A6CB2 on propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using a multimeter, check for 24 VDC at ENGINE SPACE LIGHTS circuit breaker A6CB2 on propulsion module circuit breaker panel A6 input. If 24 VDC is present, check for 24 VDC on output side with ENGINE SPACE LIGHTS circuit breaker A6CB2 on propulsion module circuit breaker panel A6 in the on position. If 24 VDC is not present, replace ENGINE SPACE LIGHTS circuit breaker A6CB2. (WP 0213 00)

Perform operational check on below deck lighting system. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between light fixture and light switch.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using a multimeter, check for 24 VDC at light switch output. If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Check for continuity of wiring between light fixture and light switch. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check on below deck lighting system. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between light switch and ENGINE SPACE LIGHTS circuit breaker A6CB2 on propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using a multimeter, check for 24 VDC at light switch input. If 24 VDC is not present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Check for continuity of wiring between light switch and ENGINE SPACE LIGHTS circuit breaker A6CB2. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check on below deck lighting system. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between ENGINE SPACE LIGHTS circuit breaker A6CB2 and internal wiring of propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using a multimeter, check for continuity of wiring inside propulsion module circuit breaker panel A6. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check on below deck lighting system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

BILGE PUMP DOES DO NOT FUNCTION

SYMPTOM

Bilge pumps do not function.

MALFUNCTION

Float switch is clogged or defective.

CORRECTIVE ACTION

Unit Level Maintenance

Clean or replace float switch as necessary. (WP 0170 00, WP 0172 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Bilge pump check valve is defective.

CORRECTIVE ACTION

Unit Level Maintenance

Replace check valve. (WP 0173 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Bilge pump is defective.

CORRECTIVE ACTION

Unit Level Maintenance

Replace bilge pump. (WP 0174 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

If bilge pump still does not operate properly, contact direct support level maintenance.

MALFUNCTION

Open circuit between the bilge pump control panel assembly and the corresponding junction box located in the engine compartment.

CORRECTIVE ACTION

Direct Support Level Maintenance

If wiring to junction box is acceptable, use multimeter to check for 24 VDC at B2-2/B2-1 motor leads in the appropriate junction box.

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring from the junction box to the pump. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) If wiring is acceptable, replace bilge pump. (WP 0174 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in internal wiring of the appropriate switch XA5S1-XA5S5 or XA7S1 in bilge pump control assemblies A5 or A7.

CORRECTIVE ACTION

Direct Support Level Maintenance

If 24 VDC was not present at unit XA5 or XA7 terminals, use multimeter to check for 24 VDC at appropriate terminals as listed below in the bilge pump control assembly A5 or A7.

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring and connections at the appropriate switch XA5S1-XA5S5 or XA7S1 located on the cover of the bilge pump control panel A5 or A7. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Failed bilge pump toggle switch.

CORRECTIVE ACTION

Direct Support Level Maintenance

If 24 VDC was present and wiring is acceptable, replace bilge pump control panel A5 or A7 bilge pump toggle switch. (WP 0211 00, WP 0215 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in wiring from the power module circuit breaker panel A6 to the bilge pump control panel A5 or A7.

CORRECTIVE ACTION

Direct Support Level Maintenance

If 24 VDC was not present in previous step, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring between the power module circuit breaker panel A6 and the bilge pump control panel A5 or A7. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

BILGE PUMP OUTPUT HAS REDUCED FLOW

SYMPTOM

Output flow from bilge pump is reduced.

MALFUNCTION

Plugged bilge pump strainer.

CORRECTIVE ACTION

Replace bilge pump. (WP 0174 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Obstruction or kinking in discharge line.

CORRECTIVE ACTION

Remove debris from the discharge line. Adjust hose to avoid any kinks. (WP 0171 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Plugged bilge pump check valve.

CORRECTIVE ACTION

Clean bilge pump check valve. (WP 0171 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Defective bilge pump.

CORRECTIVE ACTION

Replace bilge pump. (WP 0174 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

BILGE PUMP STATUS LIGHTS ARE NOT FUNCTIONAL

SYMPTOM

Status lights for bilge pump are not functioning.

MALFUNCTION

Defective lamp.

CORRECTIVE ACTION

Replace bilge pump flood warning indicator lamp. (WP 0281 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

Replace bilge pump indicator/switch push button lamp. (WP 0283 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in wiring between the lower control panel assembly A2 and the propulsion module junction box A3.

CORRECTIVE ACTION

With pump running, use a multimeter to check for 24 VDC at terminals in the propulsion module junction box A3.

If 24 VDC is present, use multimeter to check for 24 VDC at terminal at the terminal strip assembly A4 with the appropriate pump running.

If 24 VDC is not present at the terminal strip assembly A4, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of interconnect wiring between terminal strip assembly A4 and the appropriate propulsion module junction box A3. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

If 24 VDC is present at terminal strip assembly A4, use multimeter to check continuity of wiring between terminal strip assembly A4 and the appropriate bilge pump indicator/switch push button. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

BILGE PUMPS WILL NOT FUNCTION IN REMOTE MODE FROM OPERATORS CAB

SYMPTOM

While in remote mode, bilge pumps will not function from the operators cab.

MALFUNCTION

Defective or clogged bilge float switch.

CORRECTIVE ACTION

Unit Level Maintenance

Clean or replace the float switch as necessary. (WP 0170 00, WP 0172 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

If bilge pump still does not operate properly, contact direct support maintenance.

MALFUNCTION

Open circuit from the pump run pushbutton.

CORRECTIVE ACTION

Direct Support Level Maintenance

While holding a pump run pushbutton, use a multimeter to check for 24 VDC at the appropriate terminals in the bilge pump control assembly A5 or A7.

Locations: Pump 1-A7K1 relay; Pump 2-A5K2 relay; Pump 3-A5K3 relay; Pump 4-A5K4 relay; Pump 5-A5K5 relay; Pump 6-A5K6 relay.

If 24 VDC is not present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring between the propulsion module junction box A3 and bilge pump control assembly A5 or A7.

Locations: Pump 1-between A3CFD-1 and A7CFD-1; Pump 2-between A3CFD-8 and A5CFD-4; Pump 3-between A3CFD-8 and A5CFD-3; Pump 4-between A3CFD-8 and A5CFD-7; Pump 5-A3CFD-8 and A5CFD-5; Pump 6-between A3CFD-8 and A5CFD-6.

If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

If wiring is acceptable, replace pump run switch. (WP 0282 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in bilge pump control assembly A5 or A7 internal wiring.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using a multimeter, check continuity of wiring bilge pump control assembly A5 or A7. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the bilge pump control assembly A5 or A7 and the corresponding junction box located in the engine compartment.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using a multimeter, check for 24 VDC at the appropriate terminals in the bilge pump junction box.

NOTE

Bilge Pump 2 is connected to the A9 Thruster Direction/Auxiliary Battery Junction Box Assembly.

Locations: Pump 1-JB1; Pump 3-JB2; Pump 4-JB8; Pump 5-JB5; Pump 6-JB6

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use a multimeter to check continuity of wiring between the bilge pump control assembly A5 or A7 to the corresponding junction box. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the junction box and the bilge pump motor.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 24 VDC at B motor leads in the appropriate junction box.

NOTE

Bilge Pump 2 is connected to the A9 Thruster Direction/Auxiliary Battery Junction Box Assembly. Bilge pump motor leads are designated B3.

Locations: Pump 1-JB1B2; Pump 3-JB2B4; Pump 4-JB8B5; Pump 5-JB5B6; Pump 6-JB6B7

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring from the junction box to the bilge pump motor. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

If wiring is acceptable, replace bilge pump. (WP 0174 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the junction box and the bilge pump float switch.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 24 VDC at S float switch leads in the appropriate junction box.

NOTE

Bilge Pump 2 is connected to the A9 Thruster Direction/Auxiliary Battery Junction Box Assembly. Bilge pump float switch leads are designated S11.

Locations: Pump 1-JB1S10; Pump 3-JB2S12; Pump 4-JB8S13; Pump 5-JB5S14;
Pump 6-JB6S15

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring from the junction box to the bilge pump float switch. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

If wiring is acceptable, replace bilge pump. (WP 0174 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

BILGE PUMPS WILL NOT FUNCTION IN TEST MODE (FROM BILGE JUNCTION BOXES A5 AND A7)

SYMPTOM

While in test mode, bilge pumps will not function.

MALFUNCTION

Defective bilge pump.

CORRECTIVE ACTION

Unit Level Maintenance

Replace bilge pump. (WP 0174 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

If bilge pump still does not operate properly, contact direct support maintenance.

MALFUNCTION

Open circuit between the bilge pump control assemblies A5 or A7 and the corresponding junction box located in the engine compartment.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using a multimeter, check for 24 VDC at the appropriate terminals in the bilge pump control panel A5 or A7.

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use a multimeter to check continuity of wiring between the bilge pump control panel A5 or A7 and the corresponding junction box located in the engine compartment. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the junction box and the pump.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using a multimeter, check for 24 VDC at B2-2/B2-1 motor leads in the appropriate junction box.

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring from the junction box to the pump. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in internal wiring of the appropriate BILGE PUMP switch XA5S1-XA5S5 or XA7S1 in control assembly A5 or A7.

CORRECTIVE ACTION

Direct Support Level Maintenance

If 24 VDC was not present at unit XA5 or XA7 terminals, use multimeter to check for 24 VDC at appropriate terminals in the bilge pump control assembly A5 or A7.

If 24 VDC is present, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring and terminations at the appropriate switch XA5S1-XA5S5 or XA7S1 located on the cover of the bilge pump control panel A5 or A7. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Failed bilge pump toggle switch.

CORRECTIVE ACTION

Direct Support Level Maintenance

If 24 VDC was present and wiring is acceptable, replace bilge pump switch.
(WP 0211 00, WP 0215 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Open circuit in wiring from the power module circuit breaker panel A6 to the bilge pump control assembly A5 or A7.

CORRECTIVE ACTION

Direct Support Level Maintenance

If 24 VDC was not present in previous step, position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Use multimeter to check continuity of wiring between the power module circuit breaker panel A6 and the bilge pump control assembly A5 or A7. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

ReferencesTM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

BILGE PUMP WILL NOT SHUT OFF

SYMPTOM

Bilge pump will not shut off.

MALFUNCTION

Float switch plugged with debris.

CORRECTIVE ACTION

Clean debris from around float switch. (WP 0171 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Obstruction or kinking in discharge line.

CORRECTIVE ACTION

Remove debris from the discharge line. Adjust hose to avoid any kinks. (WP 0171 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

MALFUNCTION

Defective bilge pump.

CORRECTIVE ACTION

Replace bilge pump. (WP 0174 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TM 55-1945-205-24-3-4

TROUBLESHOOTING PROCEDURE

DRIVE TRAIN DOES NOT OPERATE FREELY AND SMOOTHLY; EXCESSIVE VIBRATION IS EXPERIENCED DURING OPERATION

SYMPTOM

Excessive vibration is experienced during operation of the drive train.

MALFUNCTION

Foreign objects in pump-jet water inlet.

CORRECTIVE ACTION

Unit Level Maintenance

Backflush pump-jet to remove foreign objects. (TM 55-1945-225-10)

If excessive vibration continues, contact direct support maintenance.

MALFUNCTION

Drive shaft mounting bolts are loose on drive shafts between marine gear and transfer case and/or transfer case and pump-jet.

CORRECTIVE ACTION

Direct Support Level Maintenance

Tighten drive shaft mounting bolts as necessary. (WP 0117 00)

Perform operational check of drive train. (TM 55-1945-225-10)

MALFUNCTION

Failure of drive shaft universal joint bearing on drive shafts between marine gear and transfer case and/or transfer case and pump-jet

CORRECTIVE ACTION

Direct Support Level Maintenance

Replace drive shaft. (WP 0117 00)

Perform operational check of drive train. (TM 55-1945-225-10)

MALFUNCTION

Drive shaft balance weights missing from drive shafts.

CORRECTIVE ACTION

Direct Support Level Maintenance

Replace drive shaft. (WP 0117 00)

Perform operational check of drive train. (TM 55-1945-225-10)

MALFUNCTION

Marine gear mounting foundation bolts are loose.

CORRECTIVE ACTION

Direct Support Level Maintenance

Tighten marine gear mounting foundation bolts. (WP 0384 00)

Perform operational check of drive train. (TM 55-1945-225-10)

MALFUNCTION

Transfer case mounting bolts are loose.

CORRECTIVE ACTION

Direct Support Level Maintenance

Tighten transfer case mounting bolts. (TM 55-1945-205-24-3-4)

Perform operational check of drive train. (TM 55-1945-225-10)

MALFUNCTION

Engine mounting bolts are loose.

CORRECTIVE ACTION

Direct Support Level Maintenance

Tighten engine mounting bolts. (WP 0383 00)

Perform operational check of drive train. (TM 55-1945-225-10)

MALFUNCTION

Internal damage to marine gear.

CORRECTIVE ACTION

Direct Support Level Maintenance

Replace marine gear. (WP 0384 00)

Perform operational check of drive train. (TM 55-1945-225-10)

MALFUNCTION

Internal damage to transfer case.

CORRECTIVE ACTION

Direct Support Level Maintenance

Replace transfer case. (TM 55-1945-205-24-3-4)

Perform operational check of drive train. (TM 55-1945-225-10)

MALFUNCTION

Internal damage to engine.

CORRECTIVE ACTION

Direct Support Level Maintenance

Replace engine. (WP 0383 00)

Perform operational check of drive train. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TM 55-1945-223-14&P

TROUBLESHOOTING PROCEDURE

MARINE GEAR CLUTCH WILL NOT ENGAGE IN ENGAGE/BACKFLUSH DIRECTIONS

SYMPTOM

Clutch does not engage in engage/backflush directions.

MALFUNCTION

CLUTCH circuit breaker on propulsion module circuit breaker panel A6 is off.

CORRECTIVE ACTION

Unit Level Maintenance

Position CLUTCH circuit breaker on propulsion module circuit breaker panel A6 to on. (TM 55-1945-225-10)

Perform operational check of marine gear. (TM 55-1945-225-10)

If marine gear clutch still does not operate properly, contact direct support maintenance.

MALFUNCTION

Faulty CLUTCH toggle switch A2S5/6 (port/starboard).

CORRECTIVE ACTION

Direct Support Level Maintenance

Position CLUTCH toggle switch A2S5/6 to ENGAGED. Using a multimeter, check for 24 VDC at output side of CLUTCH toggle switch A2S5/6. Position CLUTCH toggle switch A2S5/6 to BACKFLUSH. Using a multimeter, check for 24 VDC at output side of CLUTCH toggle switch A2S5/6. If 24 VDC is not present in either position, use multimeter to check for 24 VDC at input side of CLUTCH toggle switch A2S5/6. If 24 VDC is present, replace CLUTCH toggle switch A2S5/6. (WP 0278 00)

Perform operational check of marine gear. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between CLUTCH toggle switch A2S5/6 and propulsion module circuit breaker panel A6.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between CLUTCH toggle switch A2S5/6 and the appropriate propulsion module circuit breaker panel A6. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of marine gear. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between CLUTCH toggle switch A2S5/6 and propulsion module junction box A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between CLUTCH toggle switch A2S5/6 and the appropriate propulsion module junction box A3. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of marine gear. (TM 55-1945-225-10)

MALFUNCTION

Clutch still will not engage in engage/backflush directions.

CORRECTIVE ACTION

Refer to marine gear troubleshooting procedures. (TM 55-1945-223-14&P)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TM 55-1945-222-14&P

TROUBLESHOOTING PROCEDURE

PROPULSION MODULE BECOMES HOTTER THAN NORMAL
OPERATING TEMPERATURE

NOTE

This task is typical for troubleshooting the propulsion module.

SYMPTOM

Operating temperature of propulsion module becomes hotter than normal.

MALFUNCTION

Flapper door contained within the intake plenum is closed.

CORRECTIVE ACTION

Connect wire rope from the fire suppression system to hold flapper door in the open position. (TM 55-1945-225-10)

Perform operational check of intake plenum. (TM 55-1945-225-10)

MALFUNCTION

Air intake plenum louver assembly is clogged.

CORRECTIVE ACTION

Clean air intake louver assembly. (TM 55-1945-225-10)

Perform operational check of intake plenum. (TM 55-1945-225-10)

MALFUNCTION

Exhaust vent fan is not operating.

CORRECTIVE ACTION

Turn on VENT FANS circuit breaker A2DS6/7 (port, starboard) on lower control panel A2. (TM 55-1945-225-10)

Perform operational check of intake plenum. (TM 55-1945-225-10)

MALFUNCTION

Diesel engine is overheating.

CORRECTIVE ACTION

Refer to diesel engine troubleshooting procedures. (TM 55-1945-222-14&P)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

WATER ENTERING BILGE FROM PUMP DISCHARGE LINE WHEN PUMP
IS NOT OPERATING

SYMPTOM

When pump is not operating, water is entering the bilge from the bilge pump discharge line.

MALFUNCTION

Defective check valve in discharge line.

CORRECTIVE ACTION

Replace check valve. (WP 0173 00)

Perform operational check of bilge pumps. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
PUBLIC ADDRESS SET (LOUDHAILER)
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Tool Kit, General Mechanics (Item 2, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

LOUDHAILER WILL NOT TURN ON

SYMPTOM

No indication of power displayed in the loudhailer display window.

MALFUNCTION

Failed fuse F4 in junction box assembly JB3.

CORRECTIVE ACTION

Unit Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check for continuity across fuse F4 inside JB3. If continuity is not present, replace fuse F4 in junction box assembly JB3. (WP 0366 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

MALFUNCTION

Faulty LOUDHAILER circuit breaker CB8 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

With LOUDHAILER circuit breaker CB8 positioned on, use multimeter to check for 24 VDC at output of RADIO CHARGER circuit breaker CB8-2. If 24 VDC is not present, use multimeter to check for 24 VDC on input to LOUDHAILER circuit breaker CB8-1. If 24 VDC is present, replace LOUDHAILER circuit breaker CB8. (WP 0294 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

MALFUNCTION

Faulty 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 12 VDC at output of 24 to 12 VDC converter VR2 (wire 440, +12). If 12 VDC is not present, use multimeter to check for 24 VDC at input to 24 to 12 VDC converter VR2 (wire 394, +24). If 24 VDC is present, replace 24 to 12 VDC converter VR2. (WP 0364 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on P24-21 between junction box assembly JB3 and 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity between junction box assembly JB3 (wire 394, TB1-6) and 24 to 12 VDC converter VR2 (+24). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity between junction box assembly JB3 (wire 0, TB1-3) and 24 to 12 VDC converter VR2 (-) input. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on P12-10 between junction box assembly JB3 and 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity between junction box assembly JB3 (wire 440, TB1-7) and 24 to 12 VDC converter VR2 (+12). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity between junction box assembly JB3 (wire 0, TB1-3) and 24 to 12 VDC converter VR2 (-) output. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

MALFUNCTION

Open circuit on cable P24-20 between terminal strip A4 and junction box assembly JB3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 394 between terminal strip A4 (TB5-1) and junction box assembly JB3 (TB1-4). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wire 0 between terminal strip A4 (TB11) and junction box assembly JB3 (TB1-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between operators cab circuit breaker panel A3 CB8 and terminal strip A4.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wiring between operators cab circuit breaker panel A3 (CB8) and terminal strip A4 (TB5-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

MALFUNCTION

Failed loudhailer.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 12 VDC on P12-13 at input on LOUDHAILER between wires 613 (13.6 +) and wire 0 (13.6 -). If 12 VDC is present and loud hailer still will not power up, replace loud hailer. (WP 0317 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
PUBLIC ADDRESS SET (LOUDHAILER)
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

LOUDHAILER WILL NOT TRANSMIT SOUND TO HAILER HORN (LOUDHAILER EXTERNAL SPEAKER)

SYMPTOM

Sound is not being transmitted from the loudhailer external speaker.

MALFUNCTION

Voltage not being supplied to external speaker.

CORRECTIVE ACTION

Unit Level Maintenance

Depress microphone key, use multimeter to check for 12 VDC at the speaker wire connector screws at the loud hailer. If 12 VDC is not present, troubleshoot loud hailer power circuitry. (WP 0064 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

MALFUNCTION

Failed external speaker.

CORRECTIVE ACTION

Unit Level Maintenance

Using multimeter, check for 12 VDC at the speaker wire connections on the external speaker. If 12 VDC is present, replace speaker. (WP 0319 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

If loudhailer still does not operate properly, contact direct support maintenance.

MALFUNCTION

Open circuit between loudhailer and external speaker.

CORRECTIVE ACTION

Direct Support Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off.
Using multimeter, check continuity of wiring between loud hailer and external speaker.
If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of loud hailer. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
TRANSFER CASE
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Personnel Required**

Engineer 88L

ReferencesTM 55-1945-205-24-3-4

TROUBLESHOOTING PROCEDURE

TRANSFER CASE MALFUNCTIONS

For troubleshooting procedures on the transfer case, reference the transfer case manual. (TM 55-1945-205-24-3-4)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
VHF/FM HANDHELD TRANSCEIVER CHARGER
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE**CHARGER HAS NO POWER****NOTE**

This task is typical for troubleshooting the VHF/FM handheld transceiver chargers.

SYMPTOM

No indication of power being supplied to VHF/FM handheld transceiver charger.

MALFUNCTION

Failed VHF/FM handheld transceiver charger.

CORRECTIVE ACTION**Unit Level Maintenance**

Using a multimeter, check for 12 VDC between ring and center of power cable plug. If 12 VDC is present, check for 12 VDC between tabs inside charger (with power cable connected). If 12 VDC is not present, replace VHF/FM handheld transceiver charger. (WP 0315 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

If VHF/FM handheld transceiver charger still does not operate properly, contact direct support maintenance.

MALFUNCTION

Failed fuse F2 in junction box assembly JB3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check for continuity across fuse F2 inside JB3. If continuity is not present, replace fuse F2 in junction box assembly JB3. (WP 0366 00)

Perform operational check of PLGR. (TM 55-1945-225-10)

MALFUNCTION

Faulty RADIO CHARGER circuit breaker CB8 on operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

With RADIO CHARGER circuit breaker CB8 positioned on, use multimeter to check for 24 VDC at output of RADIO CHARGER circuit breaker CB8-2. If 24 VDC is not present, use multimeter to check for 24 VDC on input to RADIO CHARGER circuit breaker CB8-1. If 24 VDC is present, replace RADIO CHARGER circuit breaker CB8. (WP 0294 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

MALFUNCTION

Faulty 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 12 VDC at output of 24 to 12 VDC converter VR2 (wire 440, +12). If 12 VDC is not present, use multimeter to check for 24 VDC at input to 24 to 12 VDC converter VR2 (wire 394, +24). If 24 VDC is present, replace 24 to 12 VDC converter VR2. (WP 0364 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

MALFUNCTION

Open circuit between VHF/FM handheld transceiver charger and JB5.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 612 between JB5 (TB1-3) and VHF/FM handheld transceiver charger positive tab. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wire 0 between JB5 (TB1-1) and VHF/FM handheld transceiver charger negative tab. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

MALFUNCTION

Open circuit on P12-11 between JB5 and JB3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 612 between JB5 (TB1-3) and JB3 (F2-2). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wire 0 between JB5 (TB1-1) and JB3 (TB1-4). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

MALFUNCTION

Faulty 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 12 VDC at output of 24 to 12 VDC converter VR2 (wire 440, +12). If 12 VDC is not present, use multimeter to check for 24 VDC at input to 24 to 12 VDC converter VR2 (wire 394, +24). If 24 VDC is present, replace 24 to 12 VDC converter VR2. (WP 0364 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

MALFUNCTION

Open circuit on P24-21 between junction box assembly JB3 and 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity between junction box assembly JB3 (wire 394, TB1-6) and 24 to 12 VDC converter VR2 (+24). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity between junction box assembly JB3 (wire 0, TB1-3) and 24 to 12 VDC converter VR2 (-) input. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

MALFUNCTION

Open circuit on P12-10 between junction box assembly JB3 and 24 to 12 VDC converter VR2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity between junction box assembly JB3 (wire 440, TB1-7) and 24 to 12 VDC converter VR2 (+12). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity between junction box assembly JB3 (wire 0, TB1-3) and 24 to 12 VDC converter VR2 (-) output. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

MALFUNCTION

Open circuit on cable P24-20 between terminal strip A4 and junction box assembly JB3.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 394 between terminal strip A4 (TB5-1) and junction box assembly JB3 (TB1-4). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check continuity of wire 0 between terminal strip A4 (TB11) and junction box assembly JB3 (TB1-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

MALFUNCTION

Open circuit between operators cab circuit breaker panel A3 CB8 and terminal strip A4.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off.
Using multimeter, check continuity of wiring between operators cab circuit breaker panel A3 (CB8) and terminal strip A4 (TB5-1). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM handheld transceiver charger.
(TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

VHF/FM DSC TRANSCEIVER DOES NOT DISPLAY A VALID POSITION

SYMPTOM

No indication of valid position displayed in the VHF/FM DSC transceiver display window.

MALFUNCTION

PLGR is not generating a NMEA signal.

CORRECTIVE ACTION

Turn PLGR on. (TM 55-1945-225-10)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

Check all cable connections between VHF/FM DSC transceiver and PLGR. (TM 55-1945-225-10)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

If VHF/FM DSC transceiver still does not display a valid position, troubleshoot PLGR. (WP 0050 00)

MALFUNCTION

Open circuit between in cable P5-2 between VHF/FM DSC transceiver and JB3.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check for continuity between JB3 (white wire 651, TB1-1) and VHF/FM DSC transceiver (pin 5 on P5-2 connector). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check for continuity between JB3 (green wire 0, TB1-4) and VHF/FM DSC transceiver (pin 6 on P5-2 connector). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between in cable P5-1 between JB3 and PLGR.

CORRECTIVE ACTION

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check for continuity between JB3 (grey wire 651, TB1-1) and PLGR (GPSJ2, pin 14 on J2 connector). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check for continuity between JB3 (SHIELD wire 0, TB1-3) and PLGR (GPSJ2, pin 2 on J2 connector). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check for continuity between JB3 (brown wire 650, TB1-2) and PLGR (GPSJ2, pin 3 on J2 connector). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Using multimeter, check for continuity between JB3 (jumper wire 650, TB1-2) and PLGR (GPSJ2, pin 13 on J2 connector). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of Using multimeter, check for continuity between JB3 (brown wire 650, TB1-2) and PLGR (GPSJ2, pin 3 on J2 connector). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00). (TM 55-1945-225-10)

MALFUNCTION

Failed VHF/FM DSC transceiver.

CORRECTIVE ACTION

If all previous malfunctions have been resolved and VHF/FM DSC transceiver still does not display a valid position, replace VHF/FM DSC transceiver. (WP 0324 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Tool Kit, General Mechanics (Item 2, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

VHF/FM DSC TRANSCEIVER WILL NOT RUN ON

SYMPTOM

No indication of power displayed in the transceiver display window.

MALFUNCTION

Failed fuse F1 in junction box JB1.

CORRECTIVE ACTION

Unit Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check for continuity across fuse JB1F1 inside junction box 1. If continuity is not present, replace fuse in junction box JB1. (WP 0201 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

If VHF/FM DSC transceiver still does not function properly, contact direct support maintenance.

MALFUNCTION

Faulty VHF/FM RADIO circuit breaker CB6 on the operators cab circuit breaker panel A3.

CORRECTIVE ACTION

Direct Support Level Maintenance

With VHF/FM RADIO circuit breaker CB6 position on, use multimeter to check for 24 VDC on output side of VHF/FM RADIO circuit breaker CB6. If 24 VDC is not present, check for 24 VDC on input side of VHF/FM RADIO circuit breaker CB6. If 24 VDC is present, replace VHF/FM RADIO circuit breaker CB6 on operators cab circuit breaker panel A3. (WP 0294 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Faulty 24 to 12 VDC converter VR1.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 12 VDC at output of 24 to 12 VDC converter VR1 (wire 392A, +12). If 12 VDC is not present, use multimeter to check for 24 VDC at input to 24 to 12 VDC converter VR1 (wire 392, +24). If 24 VDC is present, replace 24 to 12 VDC converter VR1. (WP 0363 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the 24 to 12 VDC converter VR1 and JB1 receptacle J2.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 392A between the 24 to 12 VDC converter VR1 output and JB1-J2 receptacle. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between junction box 1 receptacle J2 and VHF/FM DSC transceiver power cable plug.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of wire 392A between JB1-J2 and VHF/FM DSC transceiver power cable plug. If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Open circuit between the VHF/FM RADIO circuit breaker CB6 at the operators cab circuit breaker panel A3 and the 24 to 12 VDC converter VR1.

CORRECTIVE ACTION

Direct Support Level Maintenance

Position MAIN circuit breaker on propulsion module circuit breaker panel A6 to off. Using multimeter, check continuity of P24-1 (wire 392) between the VHF/FM RADIO circuit breaker A3CB6-2 and JB1 (TB1-8). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00) Check continuity of wire 0 between terminal strip assembly A4 (A4TB-11) and JB1 (TB1-9). If continuity is not present, repair/replace wiring as necessary. (WP 0397 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Failed VHF/FM DSC transceiver.

CORRECTIVE ACTION

Direct Support Level Maintenance

Using multimeter, check for 12 VDC at VHF/FM DSC transceiver receptacle J2 (power). If 12 VDC is present, replace VHF/FM DSC transceiver. (WP 0324 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

VHF/FM DSC TRANSCEIVER WILL NOT RECEIVE

SYMPTOM

No reception from the transceiver.

MALFUNCTION

Failed antenna cable.

CORRECTIVE ACTION

Disconnect antenna cable connector from receptacle on rear of operators cab. (WP 0326 00)

Using a multimeter, check for continuity of center conductor on antenna coaxial cable. If no continuity is present, replace antenna cable. (WP 0328 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Continuity between antenna center conductor and cable connector.

CORRECTIVE ACTION

Using a multimeter, check for continuity between antenna center conductor and cable connector. If continuity exists, replace antenna cable. (WP 0328 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Continuity between antenna center conductor and male connector threads.

CORRECTIVE ACTION

Using a multimeter, check for continuity between antenna center conductor and male connector threads. If continuity exists, replace antenna. (WP 0326 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Failed VHF/FM DSC transceiver.

CORRECTIVE ACTION

Replace VHF/FM DSC transceiver. (WP 0324 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER
TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Test Equipment**

Multimeter (Item 5, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

TROUBLESHOOTING PROCEDURE

VHF/FM DSC TRANSCEIVER WILL NOT TRANSMIT

SYMPTOM

No transmission from the transceiver.

MALFUNCTION

Failed antenna cable.

CORRECTIVE ACTION

Disconnect antenna cable connector from receptacle on rear of operators cab. (WP 0326 00)

Using a multimeter, check for continuity of center conductor on antenna coaxial cable. If no continuity is present, replace antenna cable. (WP 0328 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Continuity between antenna center conductor and cable connector.

CORRECTIVE ACTION

Using a multimeter, check for continuity between antenna center conductor and cable connector. If continuity exists, replace antenna cable. (WP 0328 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Continuity between antenna center conductor and male connector threads.

CORRECTIVE ACTION

Using a multimeter, check for continuity between antenna center conductor and male connector threads. If continuity exists, replace antenna. (WP 0326 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

MALFUNCTION

Failed VHF/FM DSC transceiver.

CORRECTIVE ACTION

Replace VHF/FM DSC transceiver. (WP 0324 00)

Perform operational check of VHF/FM DSC transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

CHAPTER 3

**MAINTENANCE INSTRUCTIONS
FOR
MODULAR CAUSEWAY SYSTEM (MCS)
WARPING TUG (WT)**

**UNIT AND DIRECT SUPPORT MAINTENANCE
WARPING TUG
SERVICE UPON RECEIPT OF MATERIEL**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L (2)

References

SF 361
DA PAM 738-750
TM 55-1945-205-24-3-4
TM 55-3950-204-14&P

GENERAL INFORMATION

This work package contains information for the unpacking, inspecting and processing of equipment on the WT when a new item is received from the supply system. This work package also contains information for the packaging and shipping of equipment being returned to the supply system.

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage on SF 361, Transportation Discrepancy Report.

Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with applicable service instructions (e.g., for Army instructions, see DA PAM 738-750).

UNPACK TRANSFER CASE

1. Using assistant, open transfer case shipping container.
2. Using assistant, remove transfer case. (TM 55-1945-205-24-3-4)
3. The removed transfer case shall be packaged in the container that the replacement transfer case was received. If required, instructions on how to package the unserviceable transfer case in the empty container in the same manner that the new transfer case was packaged will be attached to the container.
4. Two crew members are required to unpack the transfer case. Two total man hours required.

UNPACK FLEXOR CONNECTOR

1. Using assistant, open shipping container.
2. Using assistant, unpack flexor connector from shipping container.

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3. The removed flexor connector shall be packaged in the container that the replacement flexor connector was received. If required, instructions on how to package the unserviceable flexor connector in the empty container in the same manner that the new flexor connector was packaged, will be attached to the container.
 4. Two crew members are required to unpack the flexor connector. Four total man hours required.

UNPACK DUPLEX STRAINER

1. Open duplex strainer shipping container.
2. Unpack duplex strainer shipping container
3. The removed duplex strainer shall be packaged in the container that the replacement duplex strainer was received. If required, instructions on how to package the unserviceable duplex strainer in the empty container in the same manner that the new duplex strainer was packaged, will be attached to the container.
4. One crew member is required to unpack the duplex strainer. Two total man hours required.

UNPACK BILGE PUMP

1. Open bilge pump shipping container.
2. Remove bilge pump from shipping container.
3. The removed bilge pump shall be packaged in the container that the replacement bilge pump was received. If required, instructions on how to package the unserviceable bilge pump in the empty container in the same manner that the new bilge pump was packaged, will be attached to the container.
4. One crew member is required to unpack the bilge pump. One total man hour required.

UNPACK DECK WINCH

1. Using assistant, open deck winch shipping container.
2. Using assistant, unpack and remove deck winch from shipping container.
3. Remove the deck winch technical manual (TM 55-3950-204-14&P) and deck winch cover from inside shipping container.
4. The unserviceable deck winch shall be packaged in the container that the replacement deck winch was received. If required, instructions on how to package the unserviceable deck winch in the empty container in the same manner that the new deck winch was packaged, will be attached to the container.
5. Two crew members are required to unpack the deck winch. Two total man hours required.
6. Upon receipt of deck winch, the deck winch frame must be modified to allow connection of the deck winch to the transverse beams prior to mounting on the WT. Refer to foldout Figure 15 (FO-31) for modification requirements.

CHECK UNPACKED EQUIPMENT

Table 1. Equipment Inspection.

COMPONENT	ACCEPTABLE	REPAIRABLE	NONREPARABLE
Transfer Case			
Transfer case	No physical damage to exterior of transfer case.	Missing hardware.	Cracks, holes or any structural damage to exterior of transfer case.
Container	Free from damage. Splits less than 3 in. long, no closer than 1 in. to edge of board or adjoining split. The board must be secured by at least 1 nail on each side of the split when it extends to the end.	Broken or missing handles. Splits more than 3 inches but no closer than 1 in. to edge of board or adjoining split or 1 in. wide, that can be repaired by use of corrugated fasteners.	None. Splits closer than 1 in. to edge of board or adjoining split or over 1 in. wide.
Flexor Connector			
Flexor Connector	Minor scratches or dents.	Separation of polyurethane material, cracks in the external lodgments. (Contact Specialized Repair Activity.)	None.
Container	Free from damage. Splits less than 3 in. long, no closer than 1 in. to edge of board or adjoining split. The board must be secured by at least 1 nail on each side of the split when it extends to the end.	Broken or missing handles. Splits more than 3 in. but no closer than 1 in. to edge of board or adjoining split or 1 in. wide, that can be repaired by use of corrugated fasteners.	None. Splits closer than 1 in. to edge of board or adjoining split or over one in. wide.
Bilge Pump			
Bilge Pump	Minor scratches or dents.	None.	Structural damage to bilge pump, wires cut or missing insulation.

Table 1. Equipment Inspection. (Continued)

COMPONENT	ACCEPTABLE	REPAIRABLE	NONREPARABLE
Duplex Strainer			
Duplex Strainer	Minor scratches or dents.	Loose, missing or broken yoke handles. Loose or missing hardware.	Cracks, holes or any structural damage that would cause the strainer to leak.
Container	Free from damage. Splits less than 3 in. long, no closer than 1 in. to edge of board or adjoining split. The board must be secured by at least 1 nail on each side of the split when it extends to the end.	None. Splits more than 3 in. but no closer than 1 in. to edge of board or adjoining split or 1 in. wide, that can be repaired by use of corrugated fasteners.	None. Splits closer than 1 in. to edge of board or adjoining split or over one in. wide.
Deck Winch			
Deck Winch	No physical damage to exterior of deck winch.	Missing hardware.	Cracks, holes or any structural damage to deck winch components.
Container	Free from damage. Splits less than 3 in. long, no closer than 1 in. to edge of board or adjoining split. The board must be secured by at least 1 nail on each side of the split when it extends to the end.	Broken or missing handles. Splits more than 3 inches but no closer than 1 in. to edge of board or adjoining split or 1 in. wide, that can be repaired by use of corrugated fasteners.	None. Splits closer than 1 in. to edge of board or adjoining split or over one in. wide.

PRELIMINARY SERVICING OF TRANSFER CASE

Service transfer case. (TM 55-1945-205-24-3-4)

PRELIMINARY SERVICING OF DECK WINCH

Service deck winch. (TM 55-3950-204-14&P)

**UNIT LEVEL MAINTENANCE
WARPING TUG
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)
PROCEDURES INTRODUCTION**

INTRODUCTION

General

Preventive Maintenance Checks and Services (PMCS) are performed to keep the warping tug equipment in operating condition. The checks are used to find, correct or report problems.

If you find something wrong when performing PMCS, fix it, if you can, using troubleshooting procedures and/or maintenance procedures.

The right-hand column of the PMCS table lists conditions that make the vessel not fully mission capable. Write up items not fixed on DA Form 2404. For further information on how to use this form, see DA PAM 738-750.

Leakage Definition

CAUTION

Equipment operation is allowed 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. Failure to maintain proper fluid levels could result in damage to equipment.

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 equipment. The following are definitions of the classes of leakage an operator or crew member needs to know to be able to determine the condition of the leak. Learn and then be familiar with them and **REMEMBER - WHEN IN DOUBT, ASK YOUR SUPERVISOR.**

CLASS I - Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

CLASS II - Leakage of fluid great enough to form drops, but not enough to cause drops to drip from being checked.

CLASS III - Leakage of fluid great enough to form drops that fall from the item being checked.

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 equipment.

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 your supervisor.

There are some common items to check all over the equipment. 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.
2. Welds: Many items on the equipment are welded. To check these welds, look for chipped paint, rust, corrosion or gaps. When these conditions exist, write them up on DA Form 2404.
3. Electrical wires, connectors and harnesses: Tighten loose connectors. Look for cracked or broken insulation, bare wires and broken connectors. When these conditions exist, write them up on DA Form 2404.
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 your supervisor.

Lubrication Service Intervals - Normal Conditions

For safer, more trouble free operations, make sure that your equipment is serviced when it needs it. For the proper lubrication and service intervals, see the PMCS section of this manual.

Lubrication Service Intervals - Unusual Conditions

Your equipment will require extra service and care when you operate under unusual conditions. High or low temperatures or long periods of hard use will break down the lubricant, requiring you to add or change lubricant more often.

Oil Filters

Oil filters shall be serviced/cleaned/changed, as applicable, when:

They are known to be contaminated or clogged.

Service is recommended by AOAP laboratory analysis.

At prescribed hard time intervals.

Army Oil Analysis Program (AOAP)

The WT engines, marine transmission gearcases, transfer cases, hydraulic systems and winch engine oil are enrolled in the AOAP. Refer to SF 368 for the AOAP. WT components will be sampled at the following intervals:

WT Engines - Sample crankcase oil every 90 days or 100 operating hours, whichever occurs first, as prescribed by DA PAM 738-750.

Marine Transmission Gearcases - Sample oil every 90 days or 100 operating hours, whichever occurs first, as prescribed by DA PAM 738-750.

Transfer Cases - Sample oil every 90 days or 100 operating hours, whichever occurs first, as prescribed by DA PAM 738-750.

Hydraulic Systems - Sample oil every 180 days, as prescribed by DA PAM 738-750.

Warranty Information

For equipment under manufacturer's warranty, hard time oil service intervals shall be followed. Intervals shall be shortened if lubricants are known to be contaminated or if operation is under adverse conditions, such as: longer than usual operating hours, extended idling periods or extreme dust.

CLEANING AND LUBRICATION

Proper cleaning and lubrication can aid in avoiding possible problems or trouble, so make it a habit to do the following:

CAUTION

Follow all cleaning and lubrication instructions carefully. Failure to do so can result in damage to equipment.

1. Thoroughly wash all equipment exposed to salt spray with clean, fresh water.
2. Clean grease fittings before lubrication.
3. Lubricate all equipment at conclusion of the operation before equipment storage.
4. Always use the PMCS lubrication instructions as a guide.
5. Never use too much lubricant.
6. Never use the wrong type or grade of lubricant.
7. Lubricate more during constant use and less during inactive periods.
8. Use the correct grade of lubricant for seasonal temperature expected.

CORROSION PREVENTION AND CONTROL (CPC)

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

Corrosion is typically associated with rusting of metals or galvanic corrosion, which produces a white powder. The category of corrosion also includes deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling or breaking of the 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.

**UNIT LEVEL MAINTENANCE
WARPING TUG
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)
AND LUBRICATION PROCEDURES**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Materials/Parts

Grease, Ball and Roller Bearing (Item 13, WP 0426 00)

Personnel Required

Seaman 88K

References

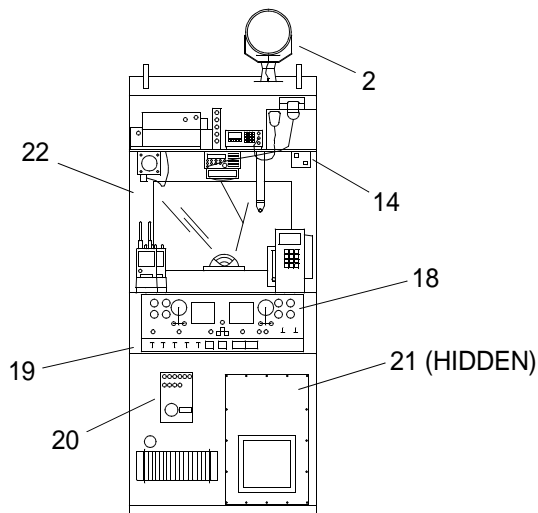
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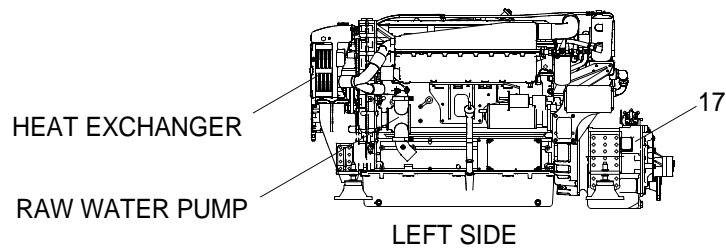
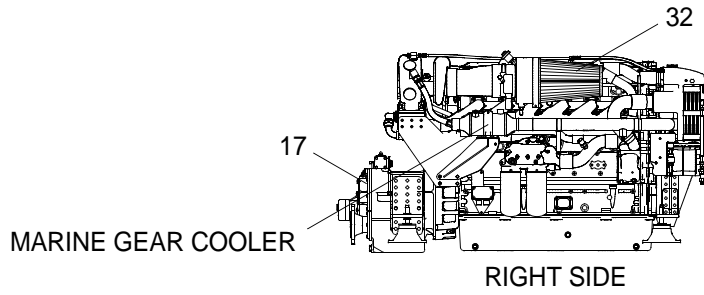
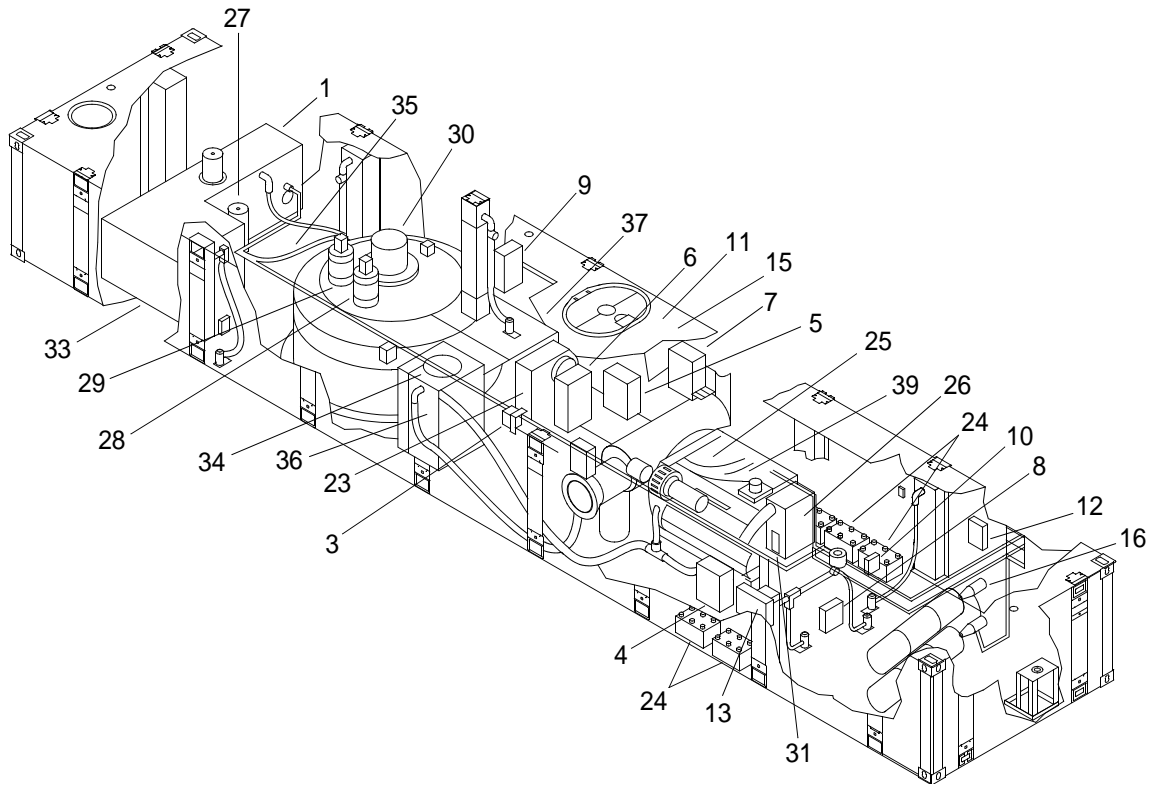
TM 55-1945-222-14&P

TM 55-1945-223-14&P

TM 55-1945-205-24-3-4

- | | |
|---|---|
| 1. Fuel System | 30. Pump-Jet Gearcase |
| 2. Spotlight | 31. Raw Water Cooling System |
| 3. Thruster Junction Box Assembly (A2JB2) | 32. Engine Air Filter Elements |
| 4. Propulsion Module Junction Box Assembly (A3) | 33. Fuel System Fuel Tank |
| 5. Engine Junction Box Assembly (A4) | 34. Hydraulic System Filters |
| 6. Bilge Pump Control Panel Assembly (A5) | 35. Engine Oil and Fuel Lines and Hoses |
| 7. Propulsion Module Circuit Breaker Panel (A6) | 36. Hydraulic System Reservoir |
| 8. Single Bilge Pump Control Panel Assembly (A7) | 37. Pump-Jet Hydro Hand Pump |
| 9. Vent Fan Relay Enclosure (A8) | 38. Non-Powered Modules |
| 10. Thruster Dir./Aux. Batt. Junction Box Assembly (A9) | 39. Diesel Engine |
| 11. Engine Space Lights Switch (A10) | 40. Portable CO2 Fire Extinguisher |
| 12. Lazaret Lights Switch (A11) | |
| 13. Isolator Junction Box Assembly (A12) | |
| 14. Junction Box Assembly (JB-3) | |
| 15. NATO Receptacles (NR-1 and NR-2) | |
| 16. Fire Suppression Pressure Switch | |
| 17. Marine Gear | |
| 18. Middle Control Panel (A1) | |
| 19. Lower Control Panel (A2) | |
| 20. Operators Cab Circuit Breaker Panel (A3) | |
| 21. Terminal Strip Assembly (A4) | |
| 22. Mast Enclosure Assembly (A7) | |
| 23. Transfer Case | |
| 24. Batteries | |
| 25. Cold-Pack Starting Aid | |
| 26. Diesel Engine Cooling System | |
| 27. Fuel System Fuel Water Separator | |
| 28. Planetary Gearbox, Primary | |
| 29. Planetary Gearbox, Auxiliary | |





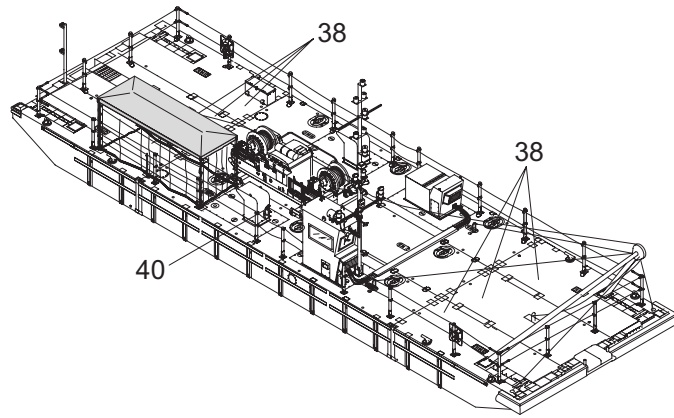


Table 1. Preventive Maintenance Checks and Services for the Warping Tug.

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	Weekly	1.0	Fuel System	Check for water in fuel tank using water detection paste. (WP 0178 00)	
2	Weekly	1.0	Spotlight	Clean lens and reflector. Inspect for cracked lens, broken seals and corrosion. (WP 0299 00)	
3	Monthly	1.0	Thruster Junction Box Assembly (A2JB2)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0205 00)	
4	Monthly	1.0	Engine Junction Box Assembly (A3)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0207 00)	
5	Monthly	1.0	Propulsion Module Junction Box (A4)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0209 00)	
6	Monthly	1.0	Bilge Pump Control Panel Assembly (A5)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0211 00)	
7	Monthly	1.0	Propulsion Module Circuit Breaker Panel (A6)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0213 00)	

Table 1. Preventive Maintenance Checks and Services for the Warping Tug. (Continued)

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
8	Monthly	1.0	Single Bilge Pump Control Panel Assembly (A7)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0215 00)	
9	Monthly	1.0	Vent Fan Relay Enclosure (A8)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0217 00)	
10	Monthly	1.0	Thruster Dir./Aux. Batt. Junction Box Assembly (A9)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0219 00)	
11	Monthly	1.0	Engine Space Lights Switch (A10)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0374 00)	
12	Monthly	1.0	Lazaret Lights Switch (A11)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0376 00)	
13	Monthly	1.0	Isolator Junction Box Assembly (A12)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0221 00)	
14	Monthly	1.0	Junction Box Assembly (JB-3)	Open box and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0366 00)	
15	Monthly	1.0	NATO Receptacles (NR-1 and NR-2)	Open receptacle and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0397 00)	
16	Monthly	0.5	Fire Suppression Pressure Switch	Test the fire suppression switch. If switch is inoperative, contact Specialized Repair Activity (SRA).	Switch is inoperative.
17	Monthly	0.5	Marine Gear	1. Remove emergency lock-up plug and inspect for corrosion and pitting. (TM 55-1945-223-14&P)	

Table 1. Preventive Maintenance Checks and Services for the Warping Tug. (Continued)

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
17	Monthly	0.5	Marine Gear (Cont'd)	<p>2. Inspect emergency lock-up plug preformed packings for dry rot or cracking. Replace as necessary. (TM 55-1945-223-14&P)</p> <p>3. Coat emergency lock-up plug with a thin layer of ball and roller grease and install emergency lock-up plug. (TM 55-1945-223-14&P)</p>	
18	Monthly	1.0	Middle Control Panel (A1)	Remove operators cab access panel (WP 0239 00) and inspect interior of panel A1 for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0397 00)	
19	Monthly	1.0	Lower Control Panel (A2)	Remove operators cab access panel (WP 0239 00) and inspect interior of panel A2 for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0397 00)	
20	Monthly	1.0	Operators Cab Circuit Breaker Panel (A3)	Remove operators cab access panel (WP 0239 00) and inspect interior of panel A3 for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0397 00)	
21	Monthly	1.0	Terminal Strip Assembly (A4)	Remove operators cab access panel (WP 0239 00) and inspect terminal board (A4) for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0397 00)	
22	Monthly	1.0	Mast Enclosure Assembly (A7)	Remove operators cab access panel (WP 0239 00) and inspect for corrosion, evidence of moisture and loose or damaged connections/components. Repair as necessary. (WP 0397 00)	

Table 1. Preventive Maintenance Checks and Services for the Warping Tug. (Continued)

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
23	Monthly	1.5	Transfer Case	Service transfer case after first 24 hours of operation and monthly thereafter or in accordance with AOAP. (TM 55-1945-205-24-3-4)	
24	Monthly	0.5	Batteries	Inspect charge on batteries. If charge level is low, charge batteries. (TB 9-6140-200-14)	
25	Monthly or 200 Hours	0.5	Cold-Pack Starting Aid	Weigh the cold pack starting aid fluid cylinder monthly or every 200 operating hours, whichever occurs first. Empty container weighs 16 oz (238 gr), full cylinder weighs 37 oz (510 gr). (TM 55-1945-222-14&P)	
26	Semi-annually or 100 Hours	1.0	Diesel Engine Cooling System	Inspect water pump drain hole for plugging. (TM 55-1945-222-14&P)	
27	Semi-annually or 300 Hours	3.0	Fuel System Fuel Water Separator	Replace fuel water separator filter element semi-annually or every 300 operating hours, whichever occurs first. (TM 55-1945-222-14&P)	
28	Semi-annually or 100 Hours or 2,500 Hours	2.0	Planetary Gearbox, Primary	Service gearbox after first 100 hours of operation and every 2,500 operating hours or semi-annually, whichever occurs first. (WP 0127 00)	
29	Semi-annually or 100 Hours or 2,500 Hours	2.0	Planetary Gearbox, Auxiliary	Service gearbox after first 100 hours of operation and every 2,500 operating hours or semi-annually, whichever occurs first. (WP 0129 00)	
30	Semi-annually or 250 Hours or 2,500 Hours	4.0	Pump-Jet Gearcase	Service gearcase after the first 250 hours of operation and every 2,500 operating hours or semi-annually, whichever occurs first. (WP 0126 00)	
31	Annually or 5,000 Hours	1.5	Raw Water Cooling System	Inspect and replace all zinc anodes. (TM 55-1945-222-14&P)	
32	Annually	1.0	Engine Air Filter Elements	1. Replace engine air filter elements. (TM 55-1945-222-14&P)	

Table 1. Preventive Maintenance Checks and Services for the Warping Tug. (Continued)

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
32	Annually	1.0	Engine Air Filter Elements (Cont'd)	2. Clean engine air inlet collector. (TM 55-1945-222-14&P) 3. Clean engine crankcase breather limiters. (TM 55-1945-222-14&P)	
33	Annually	10.0	Fuel System Fuel Tank	Drain fuel, remove inspection covers and inspect for corrosion and damage. (WP 0182 00)	
34	Annually or 250 Hours	2.0	Hydraulic System Filters	1. Replace the hydraulic reservoir filter every 250 operating hours or annually, whichever occurs first. (WP 0142 00) 2. Replace the hydraulic system pressure filter element every 250 operating hours or annually, whichever occurs first. (WP 0142 00)	
31	Annually or 5,000 Hours	20.0	Raw Water Cooling System	1. Remove heat exchanger and raw water pump anodes annually or 500 operating hours, whichever comes first. Clean anodes. Replace if worn excessively. (TM 55-1945-222-14&P) 2. Clean the exterior of the heat exchanger fins annually or 500 operating hours, whichever comes first. (TM 55-1945-222-14&P)	
26	Annually or 5,000 Hours	1.0	Diesel Engine Cooling System	Functionally test cooling system thermostat annually or 500 operating hours, whichever comes first. (TM 55-1945-222-14&P)	
35	Annually or 500 Hours	0.1	Engine Oil and Fuel Lines and Hoses	Check oil and fuel hoses for signs of deterioration. Replace hoses as necessary. (WP 0188 00)	Any Class I fuel leakage is found.
36	Annually or 500 Hours or 2,000 Hours	3.5	Hydraulic System Reservoir	Clean hydraulic reservoir strainer after first 500 operating hours and every 2,000 operating hours or annually, whichever comes first. (WP 0139 00)	

Table 1. Preventive Maintenance Checks and Services for the Warping Tug. (Continued)

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
37	Annually or 500 Hours or 2,000 Hours	0.5	Pump-Jet Hydro Hand Pump	Service pump-jet hydro hand pump reservoir after first 500 operating hours and every 2,000 operating hours or annually, whichever comes first. (WP 0162 00)	
38	Annually or 2,400 Hours	1.0	Non-Powered Modules	Pressure test modules and repair leaks, cracks and corrosion. (WP 0234 00)	Leaks present or structural damage which interferes with operation.
26	Biennially or 4,000 Hours	3.0	Diesel Engine Cooling System	Replace freshwater coolant biennially or 4,000 operating hours, whichever comes first. (TM 55-1945-222-14&P)	
39	After 4 Hours	0.5	Diesel Engine	After alternator belt replacement (TM 55-1945-222-14&P) and four hours of initial operation, alternator belt tension must be checked and adjusted as required. (TM 55-1945-222-14&P)	
32	150 Hours	0.5	Engine Air Filter Elements	Inspect, clean or replace air filter elements. (TM 55-1945-222-14&P)	
39	150 Hours	1.0	Diesel Engine	1. Change diesel engine crankcase lubricating oil every 150 operating hours or in accordance with AOAP. (TM 55-1945-222-14&P) 2. Replace engine oil filters. (TM 55-1945-222-14&P) 3. Replace secondary fuel filter. (TM 55-1945-222-14&P)	
39	Every 200 Hours	0.5	Diesel Engine	Check engine alternator belt tension. (TM 55-1945-222-14&P)	
39	250 Hours	0.5	Diesel Engine	1. Clean and re-oil air separator and vacuum limiter. (TM 55-1945-222-14&P) 2. Replace oil filters. (TM 55-1945-222-14&P)	

Table 1. Preventive Maintenance Checks and Services for the Warping Tug. (Continued)

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
17	300 Hours	2.0	Marine Gear	1. Change marine gear lubricating oil or in accordance with AOAP. (TM 55-1945-222-14&P) 2. Clean marine gear manifold filter screen. (TM 55-1945-222-14&P)	
31	400 Hours	2.0	Raw Water Cooling System	Remove, clean and inspect fuel cooler. (TM 55-1945-222-14&P)	
31	400 Hours or 2 Years	1.0	Raw Water Cooling System	Clean and flush heat exchanger. (TM 55-1945-222-14&P)	
35	500 Hours	2.0	Engine Oil, Fuel Lines and hoses	1. Inspect cooling system hoses. Replace as required. (TM 55-1945-222-14&P) 2. Inspect fuel system hoses, except fire-resistant. Replace as required. (TM 55-1945-222-14&P)	
35	1,000 Hours	2.0	Engine Oil and Fuel Lines and Hoses	Inspect fuel system fire-resistant hoses. Replace as required. (TM 55-1945-222-14&P)	
17	1,000 Hours	2.0	Marine Gear	1. Change marine gear lubricating oil or in accordance with AOAP. (TM 55-1945-223-14&P) 2. Check mounting bolts and pads. Tighten or replace as required. (TM 55-1945-223-14&P)	
39	1,000 Hours	1.5	Diesel Engine	1. With the engine running, check for flow of air from the air box drain tubes. Clean tubes as required. (TM 55-1945-222-14&P) 2. Remove crankcase breather and clean with steel mesh pad. (TM 55-1945-222-14&P) 3. Check and retighten engine mounts. (WP 0383 00)	
39	1,500 Hours	2.0	Diesel Engine	After first 1,500 hours of operation, check and reset valve lash and injector height. (TM 55-1945-222-14&P)	

Table 1. Preventive Maintenance Checks and Services for the Warping Tug. (Continued)

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
21	4,000 Hours or 2 Years	2.0	Diesel Engine Cooling System	Drain, flush and replace coolant. (TM 55-1945-222-14&P)	
39	5,000 Hours	10.0	Diesel Engine	Replace fuel injectors. (TM 55-1945-222-14&P)	
39	6,000 Hours	1.5	Diesel Engine	Replace fresh water pump seal. (TM 55-1945-222-14&P)	
26	8,000 Hours or 6 Years	2.0	Diesel Engine Cooling System	Drain, flush and replace coolant. (TM 55-1945-222-14&P)	
39	1,000 Hours, 10,000 Hours or Every Two Years	1.5	Diesel Engine	Replace air filter element and vacuum limiter. (TM 55-1945-222-14&P)	
26	10,000 Hours or 2 Years	2.0	Diesel Engine Cooling System	Replace thermostats and seals. (TM 55-1945-222-14&P)	
26	10,000 Hours or 4 Years	2.0	Diesel Engine Cooling System	Drain, flush and replace coolant. (TM 55-1945-222-14&P)	
17	10,000 Hours or 4 Years	2.0	Marine Gear	Replace marine gear oil cooler. (TM 55-1945-223-14&P)	
31	4 Years	2.0	Raw Water Cooling System	Replace fuel cooler. (TM 55-1945-222-14&P)	
35	5 Years	20.0	Engine Oil and Fuel Lines and Hoses	Replace all fuel and oil hoses in or out of engine during major engine overhaul or five years, whichever occurs first. (WP 0188 00)	
40	6 Years	1.0	Portable CO ₂ Fire Extinguisher	Hydrostatically test portable fire extinguisher and replace O-rings. Contact Specialized Repair Activity (SRA). Record completion in the deck logbook.	
26	Overhaul	2.0	Diesel Engine Cooling System	Drain, flush and replace coolant. (TM 55-1945-222-14&P)	
39	Overhaul	2.0	Diesel Engine	Replace vibration damper. (TM 55-1945-222-14&P)	

END OF WORK PACKAGE

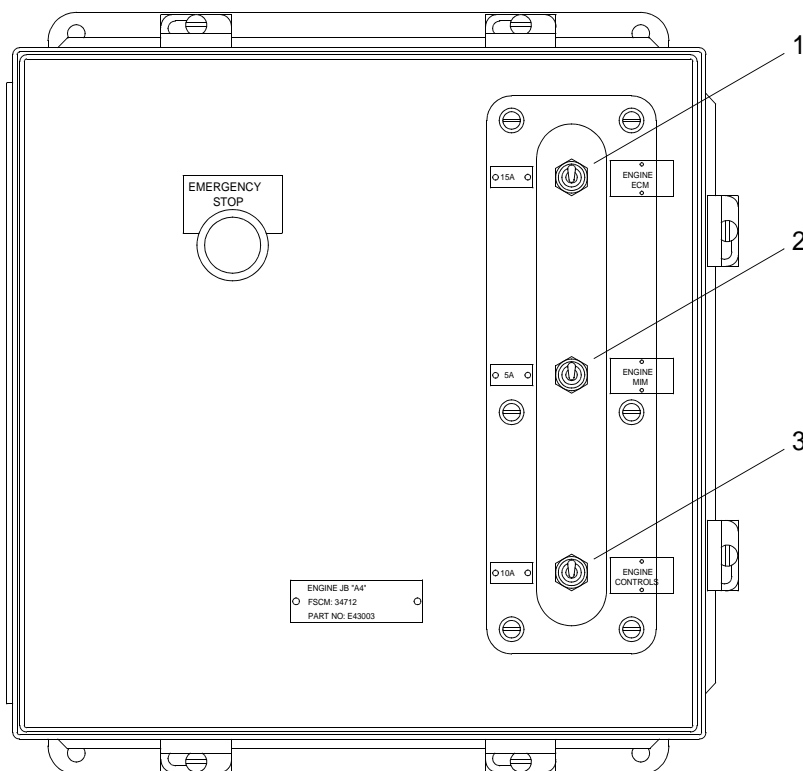
UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
PROPULSION MODULE
ENGINE POWER ISOLATION

INITIAL SETUP:**Personnel Required**

Engineer 88L

ISOLATE CONTROL POWER TO ENGINE

1. Position engine junction box assembly (A4) ENGINE ECM circuit breaker (1) to off (open).



2. Position engine junction box assembly (A4) ENGINE MIM circuit breaker (2) to off (open).
3. Position engine junction box assembly (A4) ENGINE CONTROLS circuit breaker (3) to off (open).

RESTORE CONTROL POWER TO ENGINE

1. Position engine junction box assembly (A4) ENGINE ECM circuit breaker (1) to on (closed).
2. Position engine junction box assembly (A4) ENGINE MIM circuit breaker (2) to on (closed).
3. Position engine junction box assembly (A4) ENGINE CONTROLS circuit breaker (3) to on (closed).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE
MARINE GROWTH REMOVAL**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Hose Assembly, Nonmetallic (Item 15, WP 0425 00)
 Blast Cleaning Machine (Item 7, WP 0425 00)
 Scraper, Ship (Copper Alloy) (Item 23, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Seaman 88K

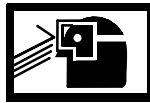
Equipment Condition

Powered Module Dry-docked.

REMOVE PROPULSION MODULE MARINE GROWTH

1. Connect hose to power washer.

WARNING



EYE PROTECTION

2. Remove marine growth using a brass scraper if required.

WARNING



EYE PROTECTION

3. Remove marine growth debris from the surface of the module using a hose with directed water spray.

WARNING



EYE PROTECTION

4. Remove marine growth from male and female connectors in both the extended and retracted position using a hose with directed water spray.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE
CLEANING AND PAINTING**

INITIAL SETUP:**Tools**

Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Scraper, Ship (Copper Alloy) (Item 23, WP 0425 00)
Drill, Electric, Portable, (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Brush, Paint (Item 4, WP 0426 00)
Roller Kit, Paint (Item 31, WP 0426 00)
Paint, Sherwin Williams (Item 26, WP 0426 00)
Paint, Sherwin Williams (Item 24, WP 0426 00)
Paint, Sherwin Williams (Item 25, WP 0426 00)
Reducer (Item 30, WP 0426 00)
Cleaner (Item 5, WP 0426 00)
Paper, Abrasive (Item 27, WP 0426 00)
Tape, Pressure Sensitive Adhesive (Item 45, WP 0426 00)
Cloth, Cleaning (Item 7, WP 0426 00)
Disk, Abrasive, 240 grit (Item 9, WP 0426 00)

Personnel Required

Seaman 88K

References

SSPC SP-10
DOD-PRF-24648
MIL-PRF-23236

Equipment Condition

Powered Modules Dry-docked.
Powered Module Marine Growth Removed. (WP 0076 00)

PREPARE AND CLEAN PROPULSION MODULE FOR PAINTING

 WARNING



EYE PROTECTION



VAPOR

NOTE

This task is typical for spot painting of module exteriors. Preparation procedures are in accordance with Steel Structures Painting Council, SP-10 Hand Tool Cleaning (SSPC SP-10). These coatings are approved in accordance with DOD-PRF-24648 and MIL-PRF-23236.

The following steps will be performed prior to module surface painting. Upon completion of rust and paint removal the surface finish shall be free of all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter.

1. Remove all oil, dust, grease, dirt, loose rust and other foreign matter by use of portable electric drill and sanding disks, hand scraping, hand sanding or a combination of these methods.
2. Using fresh water and clean lint-free cloth, wipe area clean and allow to air dry in preparation for painting.

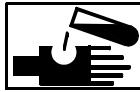
PAINT EXTERIOR PROPULSION MODULE STEEL SURFACES

1. Mask off areas to be painted.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

NOTE

Inorganic zinc-rich coating comes in two pre-measured containers which, when mixed with water, provides four gallons of ready-to-apply material.

Application temperature range limits are 40° - 100°F.

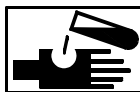
No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

2. Mix two part water based inorganic zinc-rich coating in accordance with manufacturers instructions.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

3. Using brush, apply mixed water based inorganic zinc-rich coating in accordance with manufacturers instructions.

- Clean up any spills and splatters immediately with cleaner and warm fresh water.

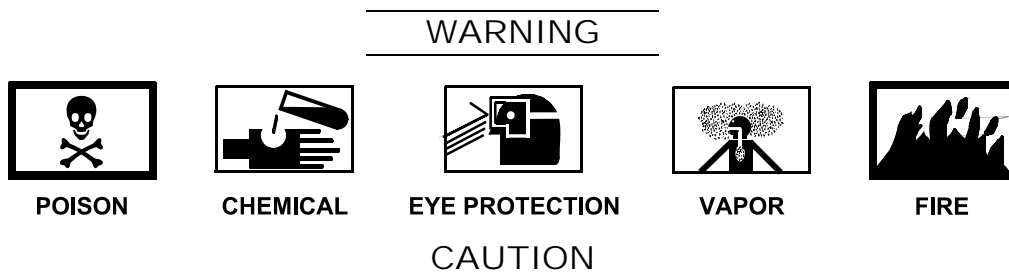
NOTE

Cold temperatures or high humidity will retard drying time.

- Allow coating to cure, approximately 2 hours at 77°F, prior to placing in service.
- Remove masking tape from masked off areas.

APPLY NON-SKID DECK COATING TO EXTERIOR STEEL PROPULSION MODULE SURFACES

- Mask off area to coated.



Do not apply anti-skid coating to air test plug ports, lift castings, shackles and connector castings.

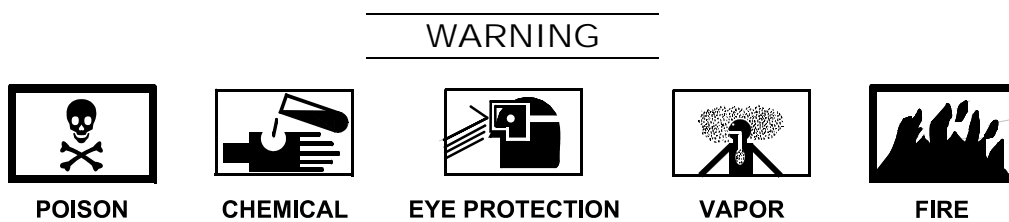
NOTE

Non-skid deck coating is a two part kit general purpose, polyamide epoxy coating that is mixed prior to application.

Application temperature range limits are 50° - 110°F.

No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

- Mix two part non-skid coating in accordance with manufacturers instructions.



- Using nylon roller and paint tray or brush, apply non-skid deck coating to deck surface.

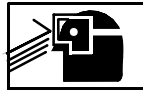
 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR



FIRE

4. Back roll or brush coating while wet at a 90° angle to evenly spread the texture.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR



FIRE

5. Clean up any spills and splatters immediately with reducer.

NOTE

Cold temperatures or high humidity will retard drying time.

6. Allow to cure, approximately 24 hours at 77°F, prior to use by light traffic.
7. Remove masking tape from masked off areas.

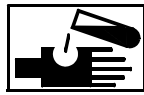
PAINT INTERIOR PROPULSION MODULE STEEL SURFACES

1. Mask off areas to be coated.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR



FIRE

NOTE

Multi-purpose epoxy coating is a modified epoxy phenalkamine, formulated specifically for immersion and atmospheric service for marine environments, which comes in a two part kit.

Application temperature range limits are 0° - 120°F.

No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

2. Mix two part epoxy coating in accordance with manufacturers instructions.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR



FIRE

- Using brush, apply mixed epoxy coating in accordance with manufacturers instructions.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR



FIRE

- Clean up any spills and splatters immediately with reducer.

NOTE

Cold temperatures or high humidity will retard drying time.

- Allow coating to cure, approximately 3.5 hours at 77° F, prior to handling.
- Remove masking tape from masked off areas.

PAINT PROPULSION MODULE OPERATORS CAB STEEL STRUCTURES

- Mask off any areas to be painted.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

NOTE

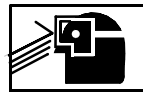
Inorganic zinc-rich coating comes in two pre-measured containers which, when mixed with water, provides four gallons of ready-to-apply material.

Application temperature range limits are 40° - 100°F.

No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

- Mix two part water based inorganic zinc-rich coating in accordance with manufacturers instructions.

WARNING

**POISON****CHEMICAL****EYE PROTECTION****VAPOR**

3. Using brush, apply mixed water based inorganic zinc-rich coating in accordance with manufacturers instructions to affected areas of operators cab, inside and out.
4. Using brush, apply mixed water based inorganic zinc-rich coating in accordance with manufacturers instructions to affected areas of operators cab insulation.
5. Clean up any spills and splatters immediately with cleaner and warm fresh water.

NOTE

Cold temperatures or high humidity will retard drying time.

6. Allow coating to cure, approximately 2 hours at 77°F, prior to placing in service.
7. Remove masking tape from masked off areas.

APPLY DECK GRIP COATING TO PROPULSION MODULE OPERATORS CAB EXTERIOR ROOF

1. Mask off a two inch border around outer edge of cab roof and around roof mounted equipment.

WARNING

**POISON****CHEMICAL****EYE PROTECTION****VAPOR****FIRE****NOTE**

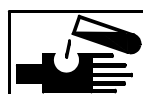
Non-skid deck coating is a two part kit general purpose, polyamide epoxy coating that is mixed prior to application.

Application temperature range limits are 50° - 110°F.

No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

2. Mix two part non-skid deck coating in accordance with manufacturers instructions.

WARNING

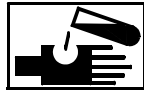
**POISON****CHEMICAL****EYE PROTECTION****VAPOR****FIRE**

3. Using nylon roller and paint tray or brush, apply non-skid deck coating to affected operator cab roof surface.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR



FIRE

4. Back roll or brush coating while wet at a 90° angle to evenly spread the texture.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR



FIRE

5. Clean up any spills and splatters immediately with reducer.

NOTE

Cold temperatures or high humidity will retard drying time.

6. Allow to cure, approximately 24 hours at 77°F, prior to use by light traffic.
7. Remove masking tape from masked off areas.

**PAINT PROPULSION MODULE MAIN ASSEMBLY MAST, DECK CLEATS, D-RINGS,
LIFE RAIL STANCHION BASES, INTAKE AND EXHAUST PLENUMS, GUILLOTINE
CONNECTORS AND FLEXOR ASSEMBLIES**

 CAUTION

Do not prime or paint rubber surfaces of flexor assemblies as damage to equipment could occur.

1. Mask off any areas to be painted.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

NOTE

Inorganic zinc-rich coating comes in two pre-measured containers which, when mixed with water, provides four gallons of ready-to-apply material.

Application temperature range limits are 40° - 100°F.

No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

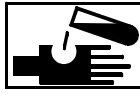
2. Mix two part water based inorganic zinc-rich coating in accordance with manufacturers instructions.

WARNING

**POISON****CHEMICAL****EYE PROTECTION****VAPOR**

- Using brush, apply mixed water based inorganic zinc-rich coating in accordance with manufacturers instructions.

WARNING

**POISON****CHEMICAL****EYE PROTECTION****VAPOR**

- Clean up any spills and splatters immediately with cleaner and warm fresh water.

NOTE

Cold temperatures or high humidity will retard drying time.

- Allow coating to cure, approximately 2 hours at 77°F, prior to placing in service.
- Remove masking tape from masked off areas.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION MALE AND FEMALE
GUILLOTINE CONNECTORS
INSPECTION, REPAIR, LUBRICATION AND ADJUSTMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Crowbar (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Sponge (Item 39, WP 0426 00)
Wedge, Wood (Item 49, WP 0426 00)
Grease, Ball and Roller Bearing (Item 13, WP 0426 00)

Personnel Required

Seaman 88K

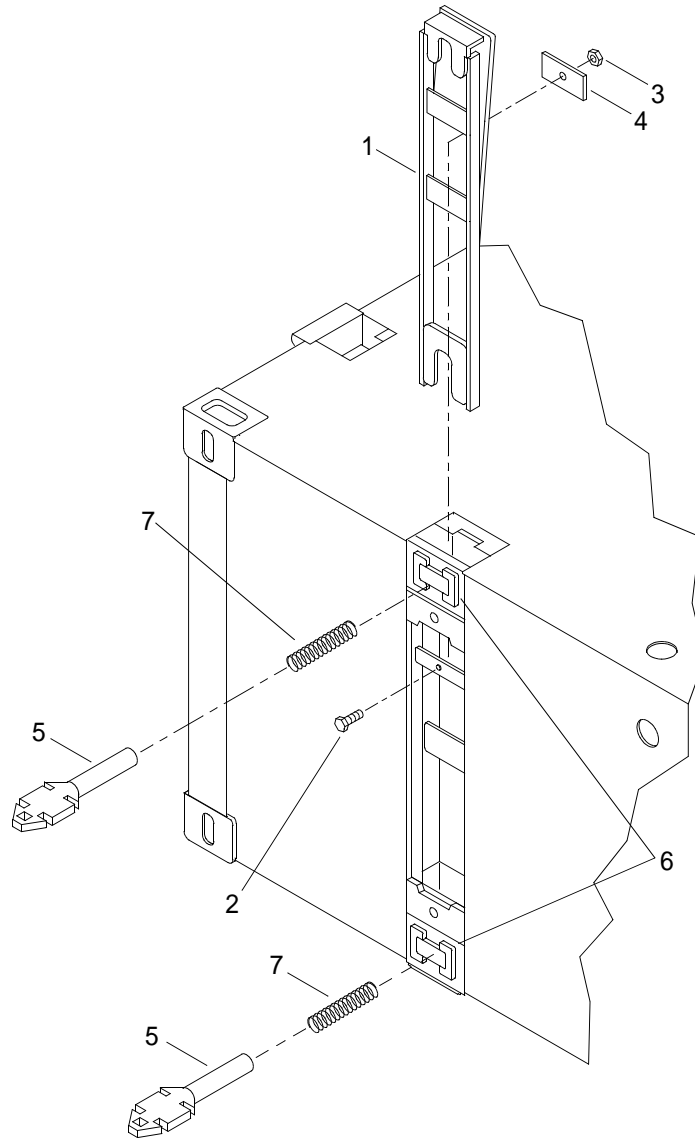
Equipment Condition

Warping Tug Dry-docked.

DISASSEMBLY OF POWERED SECTION GUILLOTINE CONNECTORS**NOTE**

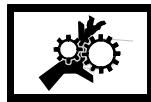
This task is typical for all male and female guillotine connector assemblies.

1. Disassemble male guillotine connector assembly (1).



- a. Remove bolt (2), nut (3) and friction plate (4).
- b. Pry up on guillotine connector bar (1) using a crowbar.

WARNING

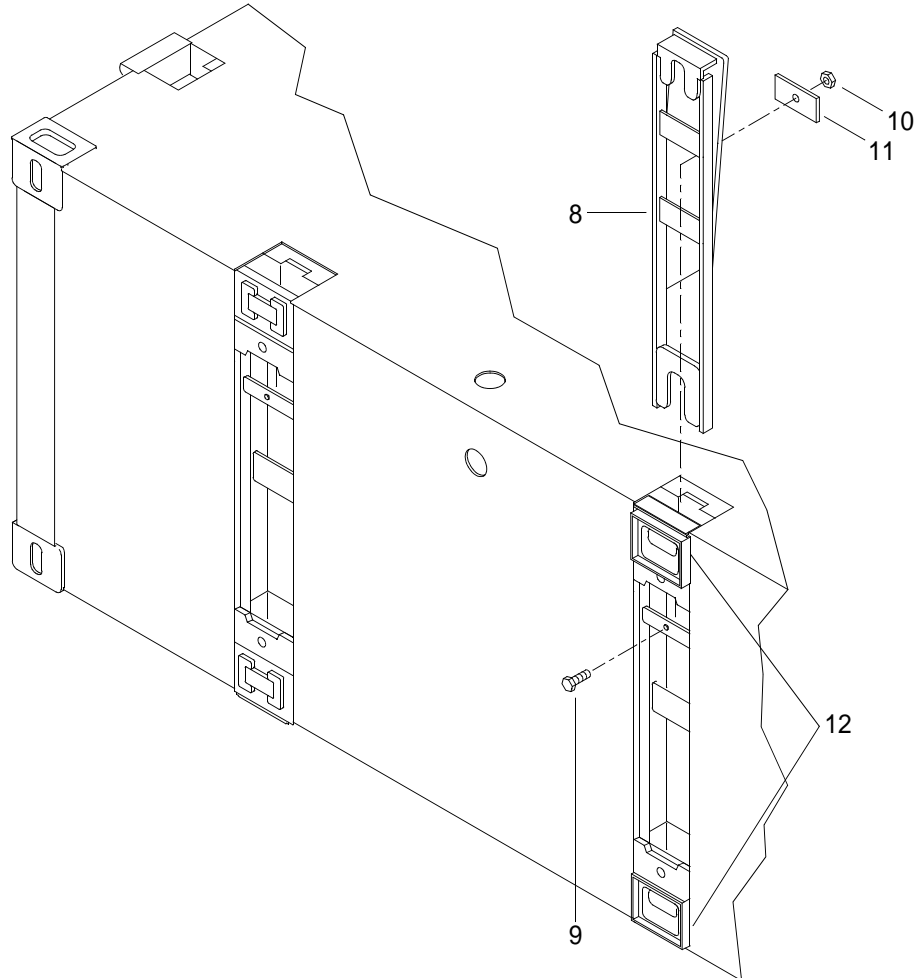


MOVING PARTS

Failure to block guillotine bar in up position when removing pins and springs could result in personal injury or death.

- c. Place a block of wood under upper “lip” of guillotine connector bar (1) after it is raised to hold it in up position.
- d. Push up on retainer located on underside of the male connector pin (5).

- e. Remove male connector pin (5) from guillotine connector lock housing (6).
 - f. Remove deployment spring (7).
 - g. Remove guillotine connector bar (1) from guillotine lock housing (6).
2. Disassemble female guillotine connector assembly (8).



- a. Remove bolt (9), nut (10) and friction plate (11).
- b. Pry up on guillotine connector bar (8) using a crowbar.
- c. Remove guillotine connector bar (8) from guillotine lock housing (12).

INSPECT AND REPAIR/REPLACE POWERED SECTION GUILLOTINE CONNECTORS

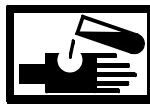
1. Inspect male connector pins (5) for cracks, cuts or corrosion. If damaged, replace connector pins.
2. Inspect deployment springs (7) for cracks, cuts or corrosion. If damaged, replace deployment springs.
3. Inspect guillotine connector bars (1, 8) for cracks, cuts or corrosion. If damaged, repair or replace guillotine connector bars (1, 8).

4. Inspect guillotine connector bar (1, 8) for rust or corrosion. Repair or replace damaged guillotine connector bar as necessary.
5. Inspect guillotine connector male and female lock housings (6, 12) for cracks, cuts or corrosion. If damaged, replace guillotine connector lock housings (6, 12).
6. Inspect guillotine connector assembly friction plates (4, 11) for cracks, cuts or corrosion. If damaged, replace friction plates (4, 11).

LUBRICATE POWERED SECTION GUILLOTINE CONNECTORS

1. Lubricate the guillotine connector assemblies.

WARNING



CHEMICAL



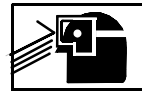
EYE PROTECTION

- a. Lubricate connector bar assemblies with a light coat of grease.

WARNING



CHEMICAL



EYE PROTECTION

- b. Lubricate deployment springs (7) with a light coat of grease.
2. Clean and/or paint exposed or rusty surfaces.

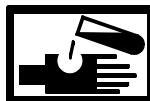
WARNING



EYE PROTECTION

- a. Use wire brush to clean exposed or rusting surfaces.

WARNING



CHEMICAL



EYE PROTECTION

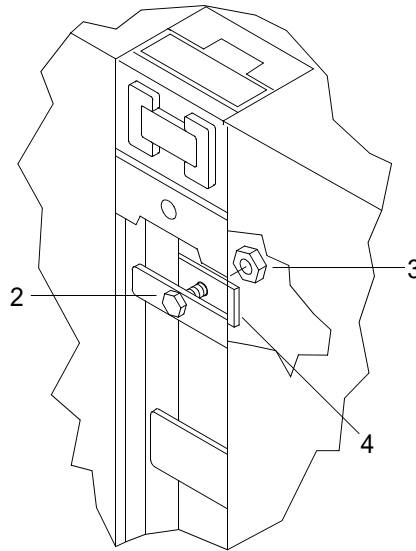
- b. Spot paint exposed surfaces. (WP 0077 00).
3. Remove standing water with a sponge from guillotine connector assemblies.

ASSEMBLE POWERED SECTION GUILLOTINE CONNECTORS

1. Assemble the female guillotine connector assembly.
 - a. Install guillotine connector bar (8) into guillotine lock housing (12).
 - b. Install bolt (9) through friction plate (10) and nut (11).
2. Assemble male guillotine connector assembly.
 - a. Install guillotine connector bar (1) into guillotine lock housing (6).
 - b. Install deployment spring (7) on male connector pin (5).
 - c. Install male connector pin (5) into guillotine connector lock housing (6) by pushing down on retainer located on underside of male connector pin (5) to lock pin in place.
 - d. Install bolt (2) through friction plate (4) and nut (3).

ADJUST POWERED SECTION GUILLOTINE CONNECTORS

1. Locate friction plate (4) on guillotine connector assembly.



2. Tighten bolt (2) and nut (3).
3. Remove block of wood.
4. Raise and lower male and female guillotine connectors and check for smooth operation and verify female connector remains in the raised position.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE ZINC ANODE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Seaman 88K

Equipment Condition

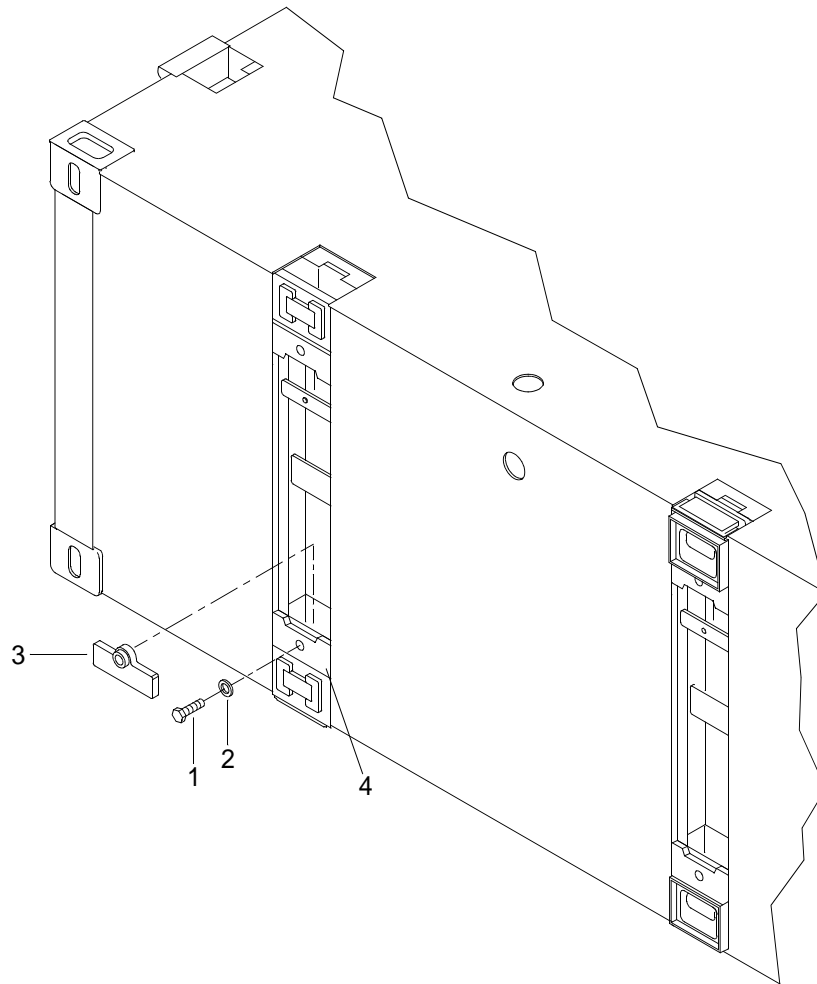
Powered Module Dry-docked.

Module Strings Disassembled. (TM 55-1945-225-10)

REMOVE PROPULSION MODULE ZINC ANODE**NOTE**

The zinc anodes are located at the base of each propulsion module guillotine interconnect.
This task is typical for the replacement of all propulsion module zinc anodes.

1. Remove hex head capscrew (1) and flat washer (2) from zinc anode threaded insert (3).



2. Remove zinc anode from guillotine interconnect (4).
3. Discard zinc anode (3).

INSTALL PROPULSION MODULE ZINC ANODES

1. Position new zinc anode (3) in guillotine interconnect (4).
2. Install washer (2) and hex head capscrew (1) to secure zinc anode (3) to guillotine interconnect (4).
3. Tighten hex head capscrew (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION INTAKE PLENUM ASSEMBLY
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Qty 3
 Shackle, 1/2 in. 2 Ton (Item 24, WP 0425 00)
 Qty 3

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 SST Bolt and SST Washer (Item 40, WP 0426 00)
 Sealant, Gasket (Item 33, WP 0426 00)
 Cleaning Compound, Solvent (Item 6 WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

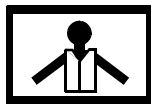
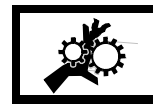
Engineer 88L

Equipment Condition

Module Interconnect Assembly Removed. (WP 0202 00)

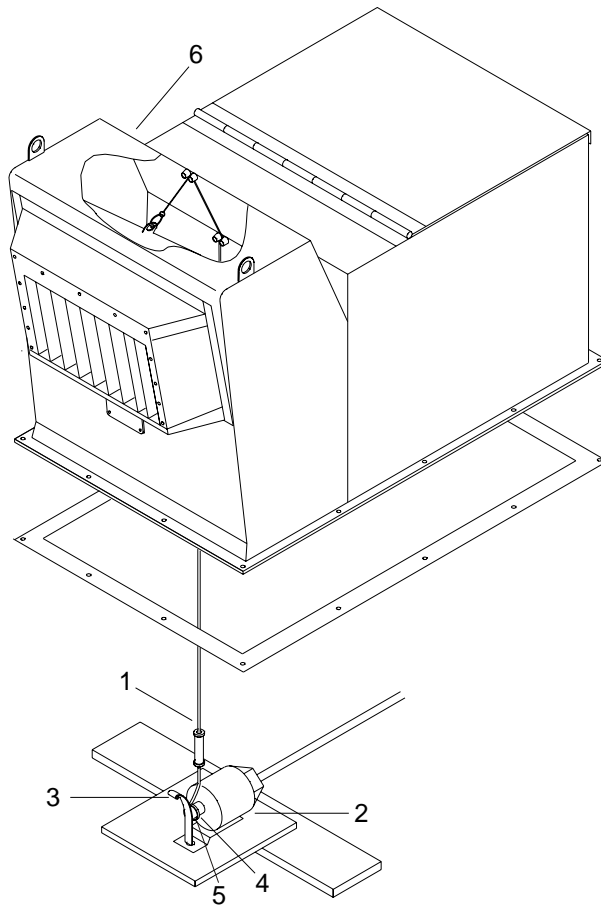
REMOVE INTAKE PLENUM ASSEMBLY

WARNING

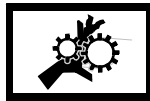
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Remove wire rope (1) from fire suppression trip mechanism (2).

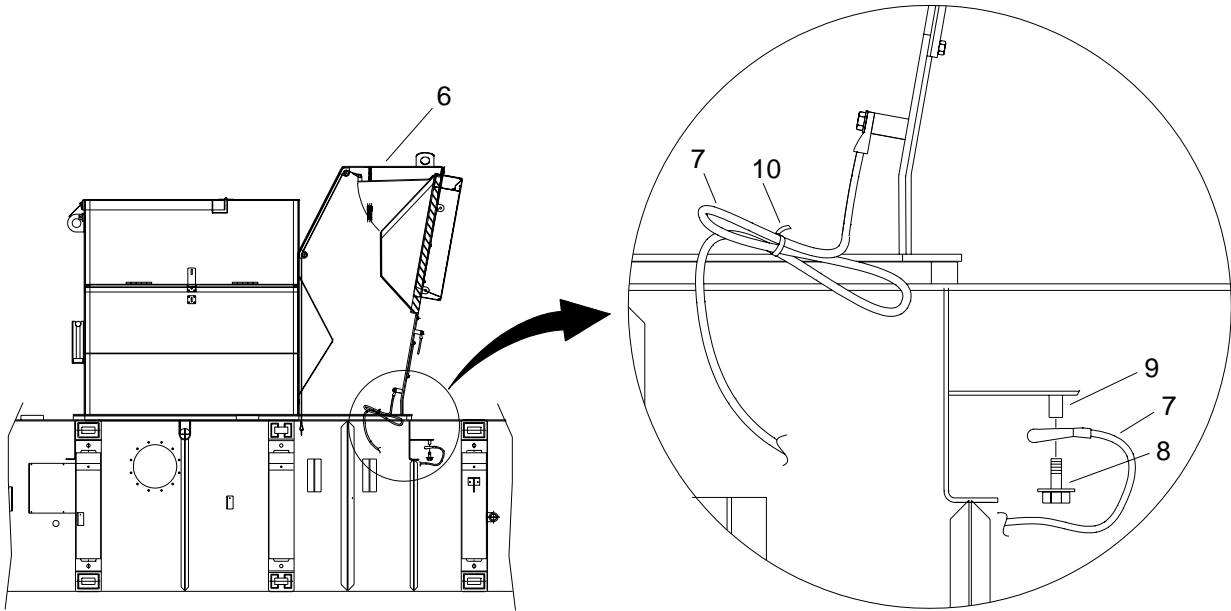


WARNING

**MOVING PARTS**

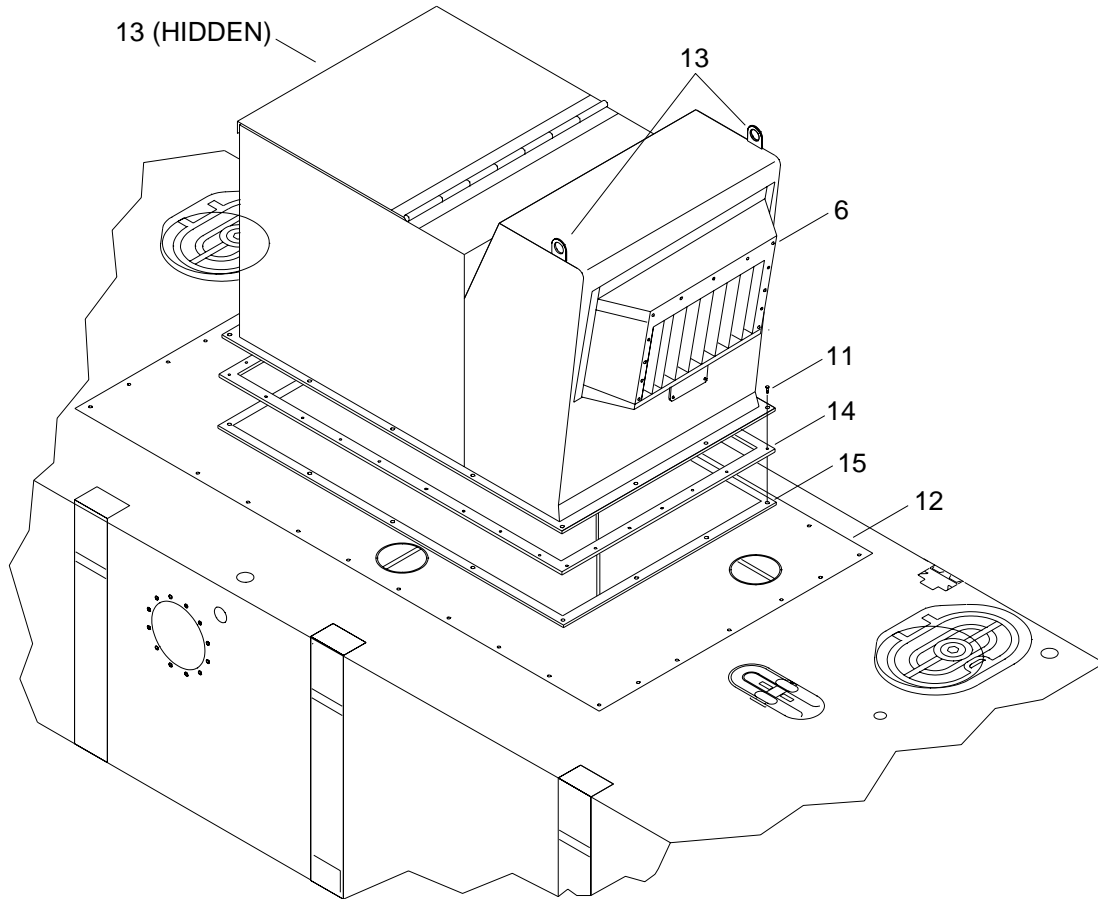
- a. Holding wire rope (1), pull fire suppression solenoid spring flange (3) away from solenoid shaft (4).
- b. Remove wire rope ring (5) from solenoid shaft (4).
- c. Slowly release tension on wire rope (1) until flapper inside intake plenum assembly (6) closes.
- d. Release spring flange (3).

3. Remove ground cable (7) from intake plenum assembly (6).



- a. Remove bolt and washer (8) securing ground cable (7) to propulsion module boss (9).
- b. Remove ground cable (7) from propulsion module boss (9).
- c. Coil ground cable (7) and secure inside of intake plenum assembly (6) with tie wrap (10).
- d. Install bolt and washer (8) in propulsion module boss (9).

4. Remove bolts (11) securing intake plenum assembly (6) to engine hatch (12).



5. Connect shackles and slings to intake plenum assembly lift points (13).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

6. Using crane, slings and shackles, remove intake plenum assembly (6) from engine hatch (12).
7. Remove slings and shackles from intake plenum assembly lift points (13).
8. Inspect gasket (14) on lip of opening (15) in engine hatch (12) for cuts, tears and deterioration. Replace if damaged. (WP 0081 00)

INSTALL INTAKE PLENUM ASSEMBLY

1. Connect shackles and slings to intake plenum assembly lift points (13). Apply adhesive to lip (15) of port propulsion module engine hatch (12) and install intake plenum (6) if gasket (14) was removed.

WARNING**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

2. Using crane, slings and shackles, position intake plenum assembly (6) over opening (15) in engine hatch (12).

WARNING**CHEMICAL****EYE PROTECTION**

3. Apply antiseize to bolts (11).

WARNING**CHEMICAL****EYE PROTECTION**

4. Using wiping rag, clean off excess antiseize compound.
5. Install bolts (11) to secure intake plenum assembly (6) to engine hatch (12). Tighten bolts (11).
6. Remove slings and shackles from intake plenum assembly lift points (13).
7. Ground intake plenum assembly (6).
 - a. Cut tie wrap (10) securing ground cable (7) to inside of intake plenum assembly (6)
 - b. Remove and discard bolt and washer (8) from propulsion module boss (9).

WARNING**EYE PROTECTION**

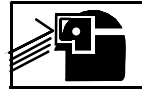
- c. Using a wire brush, remove all corrosion and paint from top of propulsion module boss (9).

WARNING

**CHEMICAL****EYE PROTECTION**

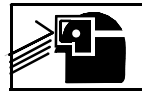
- d. Using cleaner, clean top and threads of propulsion module boss (9).

WARNING

**CHEMICAL****EYE PROTECTION**

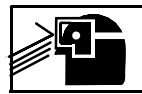
- e. Apply antiseize compound to mating surfaces of propulsion module boss (9), ground cable (7) and new bolt and washer (8).
- f. Position ground cable (7) on propulsion module boss (9).
- g. Install bolt and washer (8) to secure ground cable (7) to propulsion module boss (9) and tighten.

WARNING

**CHEMICAL****EYE PROTECTION**

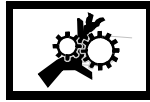
- h. Using wiping rag, clean off excess antiseize compound.

WARNING

**CHEMICAL****EYE PROTECTION**

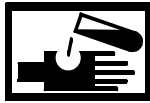
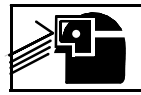
- i. Apply a thin bead of sealing compound no. 2 to terminating edges, sealing bolt and washer (8), ground cable (7) and propulsion module boss (9).
8. Install wire rope (1) on fire suppression trip mechanism (2).

WARNING

**MOVING PARTS**

- a. While pulling down on wire rope (1), pull fire suppression solenoid spring flange (3) away from solenoid shaft (4) and install end loop of wire rope (1) on solenoid shaft (4).
 - b. Release fire suppression solenoid spring flange (3).
9. Install module interconnect assembly. (WP 0202 00)

WARNING

**CHEMICAL****EYE PROTECTION**

10. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION INTAKE PLENUM ASSEMBLY GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gasket, Cab
 PN E20191
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Adhesive (Item 1, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

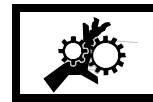
Engineer 88L

Equipment Condition

Module Interconnect Assembly Removed. (WP 0202 00)
 Powered Section Intake Plenum Removed. (WP 0080 00)

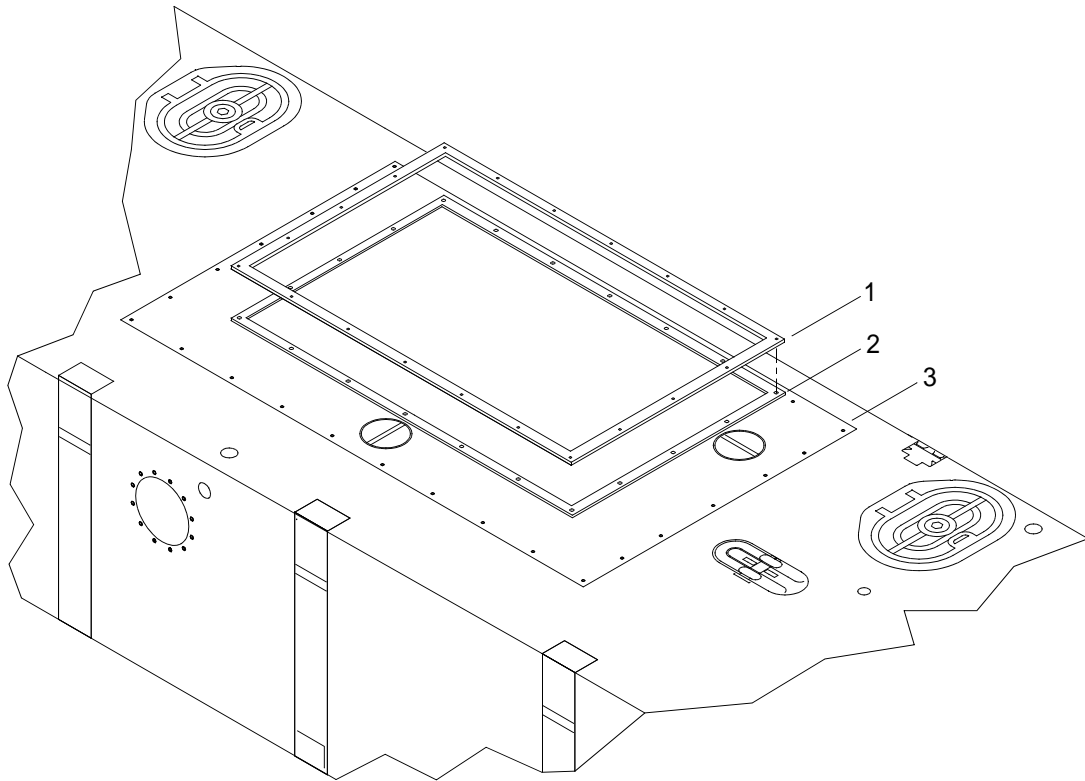
REMOVE POWERED SECTION INTAKE PLENUM ASSEMBLY GASKET

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Using putty knife, remove damaged gasket (1) from lip of opening (2) in engine hatch (3). Discard gasket (1).

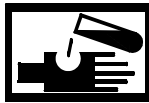
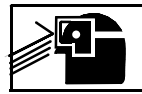


WARNING

**CHEMICAL****EYE PROTECTION**

2. Use cleaner and wiping rags to remove adhesive from mating surfaces.

WARNING

**CHEMICAL****EYE PROTECTION**

3. Dispose of contaminated wiping rags per local procedures.

INSTALL POWERED SECTION INTAKE PLENUM ASSEMBLY GASKET

WARNING

**CHEMICAL****EYE PROTECTION****NOTE**

The same gasket is used for mounting both the intake plenum assembly and the operators cab on the engine hatch.

1. Apply adhesive to gasket (1).
2. Install new gasket (1) on lip of opening (2) in engine hatch (3).
3. Install powered section intake plenum assembly. (WP 0080 00)
4. Install module interconnect assembly. (WP 0202 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION INTAKE PLENUM ASSEMBLY LOUVER
REPLACEMENT**

INITIAL SETUP:**Tools**

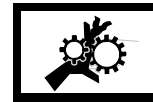
Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Louver
 PN E47278
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

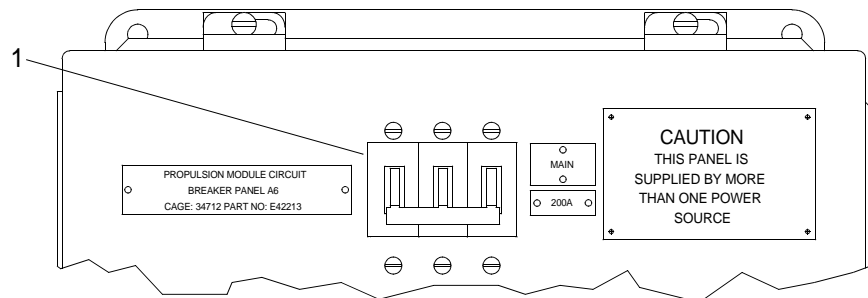
Personnel Required

Engineer 88L (2)

REMOVE POWERED SECTION INTAKE PLENUM ASSEMBLY LOUVER**WARNING****VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

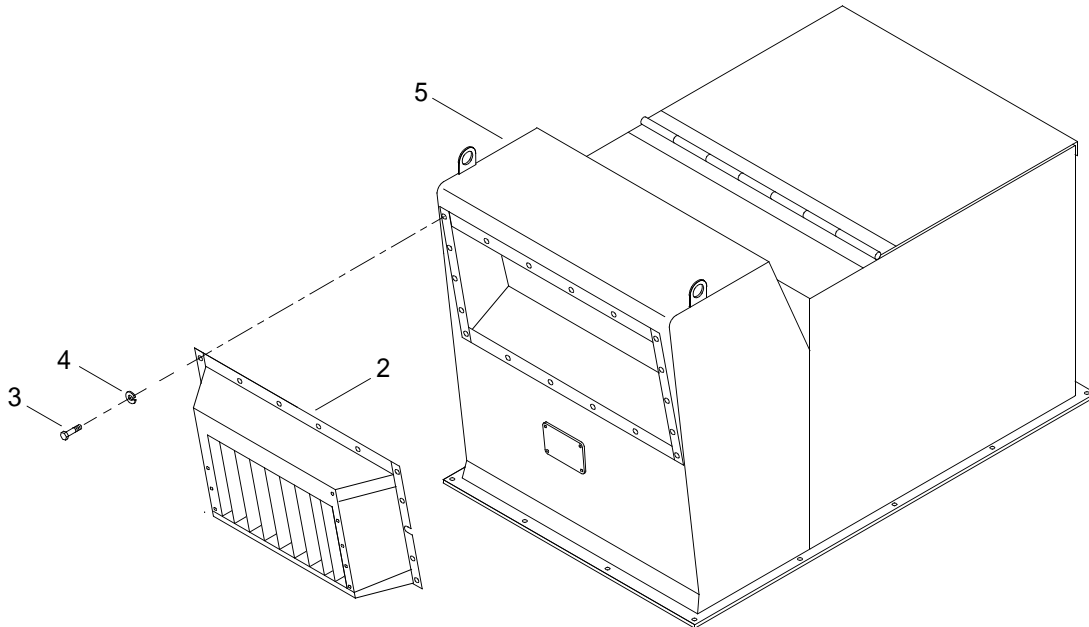
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



NOTE

The left and right center side screws are not removed during removal of the louver. Cutout slots in the center sides identify these locations. These two screws are used to hold the air intake weldment in place.

2. While assistant holds louver (2) in place, remove hex head capscrews (3) and lockwashers (4) securing louver (2) to front of intake plenum assembly (5).



3. Using assistant, remove louver (2) from intake plenum assembly (5).
4. Discard louver (2).

INSTALL POWERED SECTION INTAKE PLENUM ASSEMBLY LOUVER

1. Using assistant, position new louver (2) into opening on front of intake plenum assembly (5).
2. Install hex head capscrews (3) and lockwashers (4) to secure louver (2) to front of intake plenum assembly (5). Tighten hex head capscrews (3).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION INTAKE PLENUM ASSEMBLY
AIR INTAKE WELDMENT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Crimping Tool, Terminal Hand (Item 5, WP 0425 00)

Materials/Parts

Weldment, Air Intake
PN E07202
Wire Rope
PN E18738
Splicing Sleeve, Oval
PN E18728
Qty 2
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L (2)

Equipment Condition

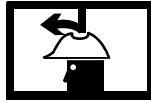
Powered Section Intake Plenum Assembly Louver Removed. (WP 0082 00)

**REMOVE POWERED SECTION INTAKE PLENUM ASSEMBLY AIR
INTAKE WELDMENT**

 WARNING



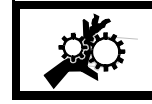
VEST



HELMET PROTECTION



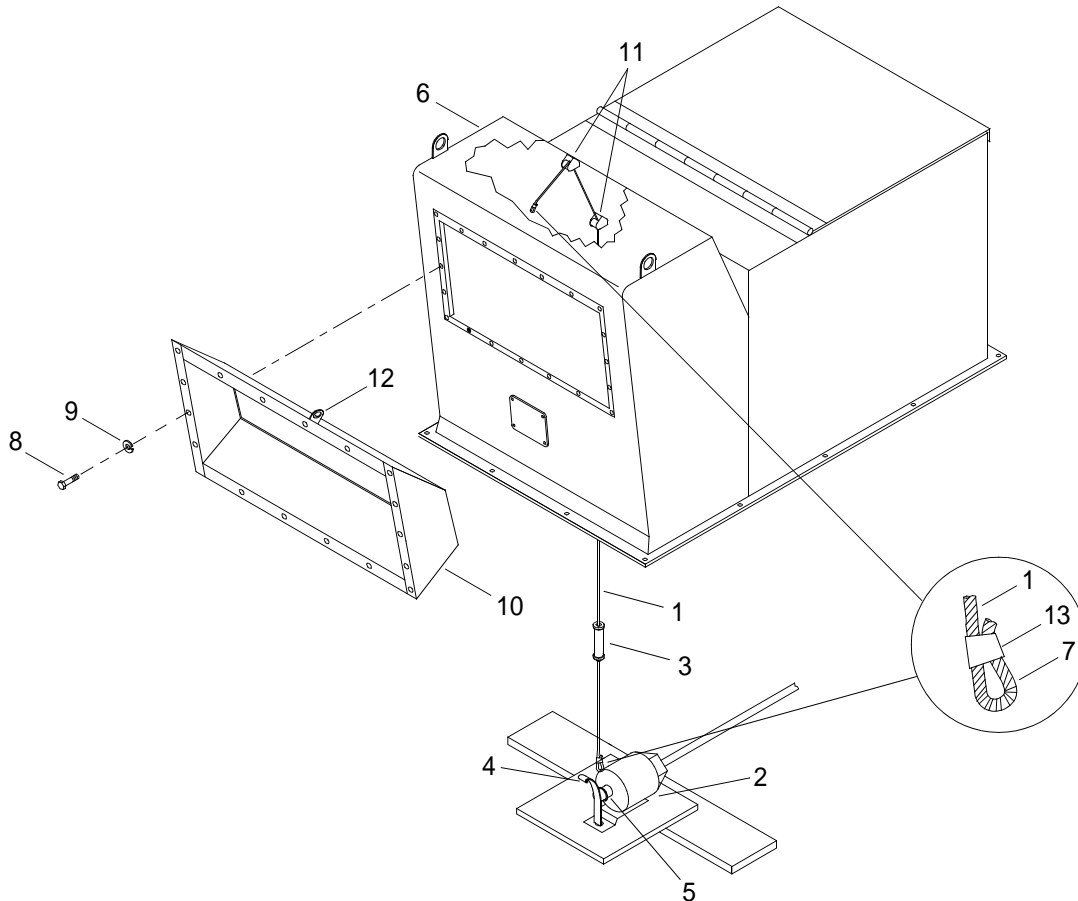
HEAVY PARTS



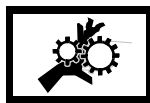
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove wire rope (1) from fire suppression trip mechanism (2).



 WARNING



MOVING PARTS

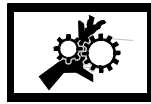
- a. Holding wire rope (1) by handle (3), pull fire suppression solenoid spring flange (4) away from solenoid shaft (5).
- b. Slowly release tension on wire rope (1) until flapper inside operators cab (6) closes.

-
- Using wire cutters, cut loop (7) off lower end of wire rope (1) and retain handle (3).
 - Remove two hex head capscrews (8) and lockwashers (9) securing air intake weldment (10) to front of intake plenum assembly (6).
 - Using assistant, remove air intake weldment (10) with attached wire rope (1) from front of intake plenum assembly (6), while guiding wire rope (1) over inside cable guides (11).
 - Discard air intake weldment (10) and wire rope (1).

INSTALL POWERED SECTION INTAKE PLENUM ASSEMBLY AIR INTAKE WELDMENT

- Using crimping tool, create loop (7) in new wire rope (1) over flapper bracket (12) on air intake weldment (10) and secure with new oval splicing sleeve (13).
- Using assistant, route wire rope (1) over cable guides (11) and position air intake weldment (10) into opening on front of intake plenum assembly (6).
- Install two hex head capscrews (8) and lockwashers (9) to secure air intake weldment (10) on front of intake plenum assembly (6). Tighten hex head capscrews (8).
- Slide handle (3) over lower end of wire rope (1).
- Using crimping tool, create a loop (7) on lower end of wire rope (1) and secure with new oval splicing sleeve (13).

WARNING



MOVING PARTS

- While pulling down on handle (3), pull fire suppression solenoid spring flange (4) away from solenoid shaft (5) and slip lower loop (7) over solenoid shaft (5).
- Release fire suppression solenoid spring flange (4) and tension on wire rope (1).
- Install powered section intake plenum assembly louver. (WP 0082 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION INTAKE PLENUM ASSEMBLY WIRE ROPE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Crimping Tool, Terminal Hand (Item 5, WP 0425 00)

Materials/Parts

Wire Rope
 PN E18738
 Splicing Sleeve, Oval
 PN E18728
 Qty 2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

Equipment Condition

Powered Section Intake Plenum Assembly Air Intake Weldment Removed. (WP 0083 00)

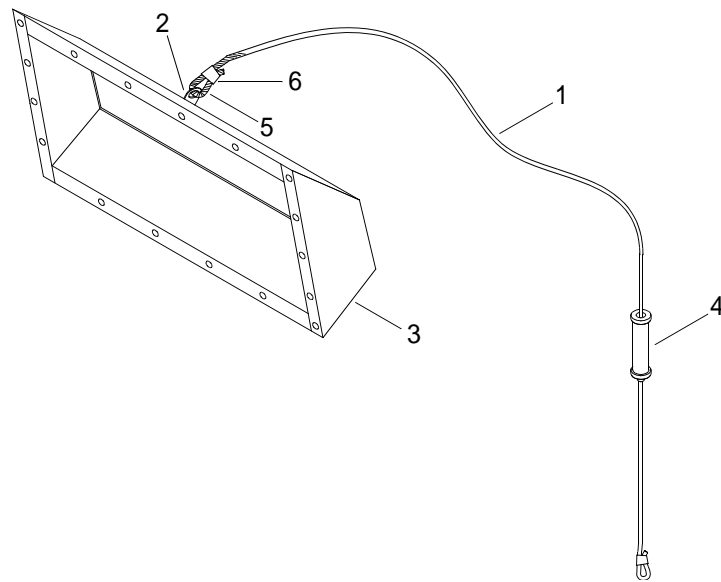
REMOVE POWERED SECTION INTAKE PLENUM ASSEMBLY WIRE ROPE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Using wire cutters, cut wire rope (1) on flapper bracket (2) on air intake weldment (3).



2. Using wire cutters, cut loop off lower end of wire rope (1) and retain handle (4).
3. Discard wire rope (1).

INSTALL POWERED SECTION INTAKE PLENUM ASSEMBLY WIRE ROPE

1. Using crimping tool, create loop (5) in new wire rope (1) over flapper bracket (2) on air intake weldment (3) and secure with new oval splicing sleeve (6).
2. Slide handle (4) over lower end of wire rope (1).
3. Using crimping tool, create loop (5) on lower end of wire rope (1) and secure with new oval splicing sleeve (6).
4. Install powered section intake plenum assembly air intake weldment. (WP 0083 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION INTAKE PLENUM INTERCONNECT COVER
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

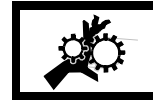
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

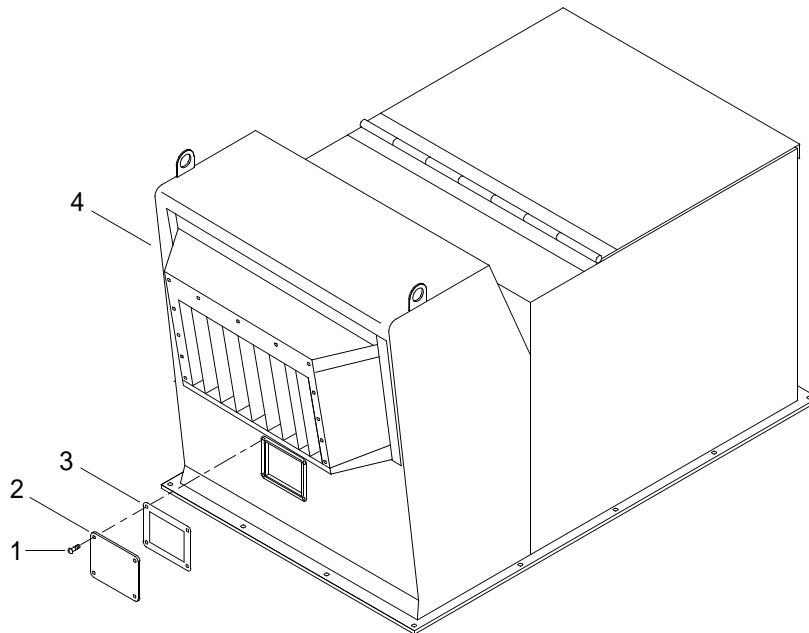
REMOVE POWERED SECTION INTAKE PLENUM INTERCONNECT COVER

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove screws (1) securing cover (2) and gasket (3) to front of intake plenum (4).



2. Remove cover (2) from gasket (3).

INSTALL POWERED SECTION INTAKE PLENUM INTERCONNECT COVER

1. Position cover (2) over gasket (3) in opening on front of intake plenum (4).
2. Install screws (1) to secure cover (2) on intake plenum (4). Tighten screws (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION INTAKE PLENUM
INTERCONNECT COVER GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

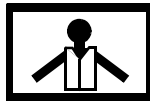
Gasket, Interconnect
PN E19161
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

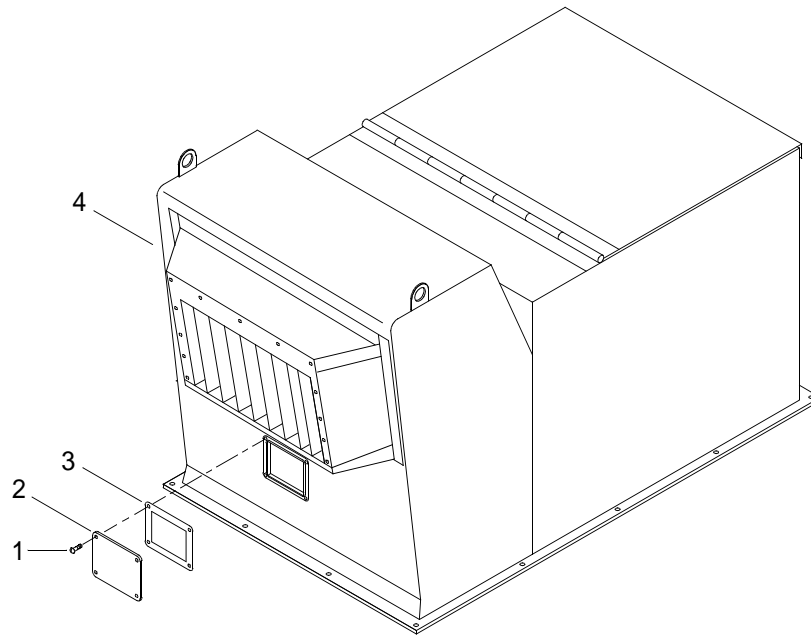
REMOVE POWERED SECTION INTAKE PLENUM INTERCONNECT COVER GASKET

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove screws (1) securing cover (2) and gasket (3) to front of intake plenum (4).



2. Remove cover (2) and gasket (3) from front of intake plenum (4)
3. Remove gasket (3) from cover (2) and discard.

INSTALL POWERED SECTION INTAKE PLENUM INTERCONNECT COVER GASKET

1. Position new gasket (3) and cover (2) over opening in front of intake plenum (4).
2. Install screws (1) to secure cover (2) and gasket (3) on intake plenum (4). Tighten screws (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION EXHAUST PLENUM ASSEMBLY
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Shackle, 1/2 in. 2 Ton (Item 24, WP 0425 00)
 Qty 2

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

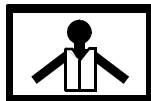
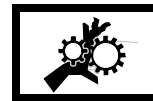
TM 55-1945-225-10

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE EXHAUST PLENUM ASSEMBLY

WARNING

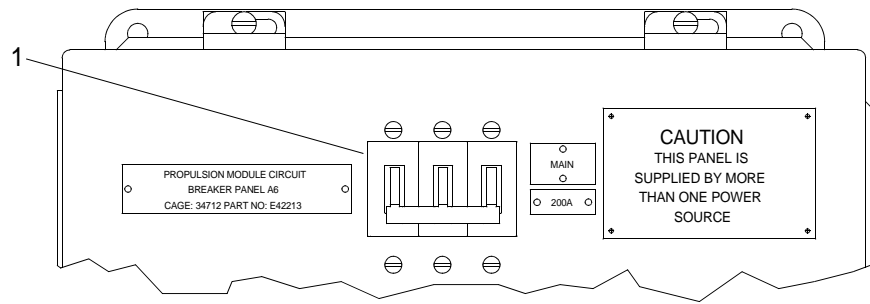
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

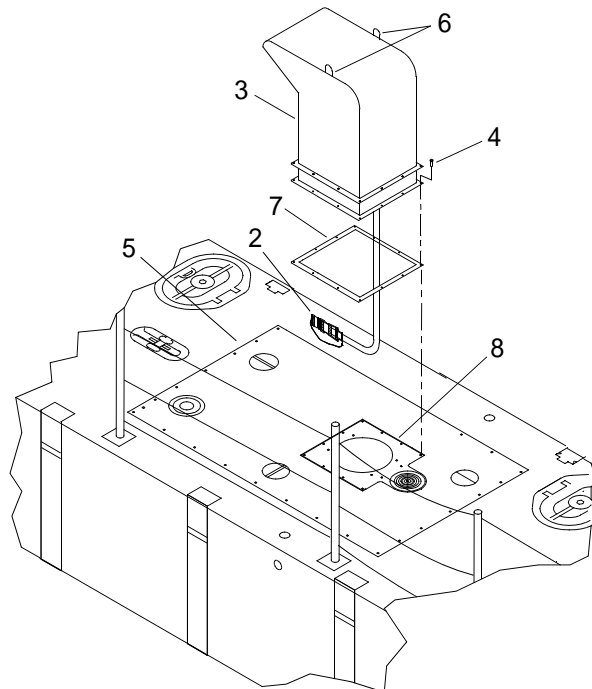
NOTE

This task is typical for the removal and installation of exhaust plenum assemblies.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



3. Disconnect power cable (2) of exhaust plenum assembly (3) from vent fan relay enclosure A8.
4. Remove bolts (4) securing exhaust plenum assembly (3) to thruster hatch (5).



5. Connect shackles and slings to exhaust plenum assembly lift points (6).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

6. Using crane, slings and shackles, remove exhaust plenum assembly (3) from thruster hatch (5).
7. Remove slings and shackles from exhaust plenum assembly lift points (6).
8. Inspect gasket (7) on lip of opening (8) in thruster hatch (5) for cuts, tears or deterioration. Replace if damaged. (WP 0088 00)

INSTALL EXHAUST PLENUM ASSEMBLY

1. Connect shackles and slings to exhaust plenum assembly lift points (6).

—————
WARNING
—————



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

2. Using crane, slings and shackles, position exhaust plenum assembly (3) over opening (8) in thruster hatch (5).

—————
WARNING
—————



CHEMICAL



EYE PROTECTION

3. Apply antiseize to bolts (4).
4. Install bolts (4) to secure exhaust plenum assembly (3) to thruster hatch (5). Tighten bolts (4).

—————
WARNING
—————



CHEMICAL



EYE PROTECTION

5. Using wiping rag, clean off excess antiseize compound.
6. Remove slings and shackles from exhaust plenum assembly lift points (6).
7. Connect power cable (2) of exhaust plenum assembly (3) to vent fan relay enclosure A8.
8. Perform operational check of exhaust plenum assembly (3). (TM 55-1945-225-10)

—————
WARNING
—————



CHEMICAL



EYE PROTECTION

9. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION EXHAUST PLENUM GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gasket, Fan Mount
 PN E18941
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Adhesive (Item 1, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

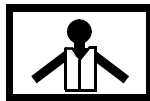
Engineer 88L

Equipment Condition

Powered Section Exhaust Plenum Removed. (WP 0087 00)

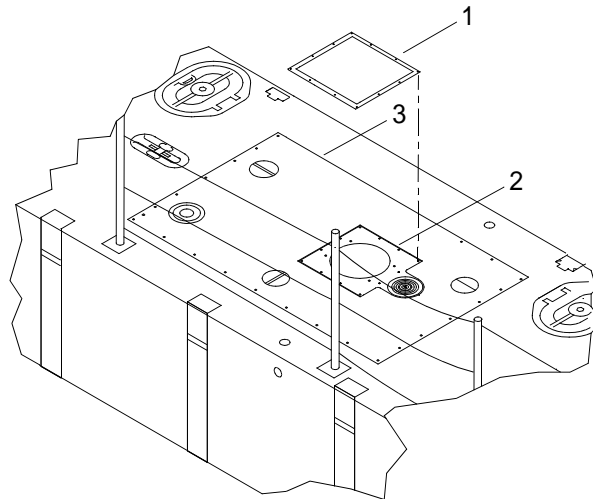
REMOVE POWERED SECTION EXHAUST PLENUM GASKET

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Using putty knife, remove damaged gasket (1) from lip of opening (2) in thruster hatch (3).



 WARNING



CHEMICAL



EYE PROTECTION

- Use cleaner and wiping rags to remove adhesive from mating surfaces.

 WARNING



CHEMICAL



EYE PROTECTION

- Dispose of contaminated wiping rags per local procedures.

INSTALL POWERED SECTION EXHAUST PLENUM GASKET

 WARNING



CHEMICAL



EYE PROTECTION

NOTE

The same gasket is used for mounting both the intake plenum assembly and the operators cab on the engine hatch.

- Apply adhesive on new gasket (1)
- Install gasket (1) on lip of opening (2) in thruster hatch (3).
- Install powered section exhaust plenum assembly. (WP 0087 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION EXHAUST PLENUM COVER
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

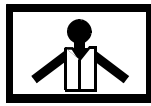
- Cover, Exhaust Plenum
PN E18772
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Engineer 88L
-

REMOVE POWERED SECTION EXHAUST PLENUM COVER

WARNING



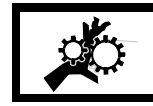
VEST



HELMET PROTECTION



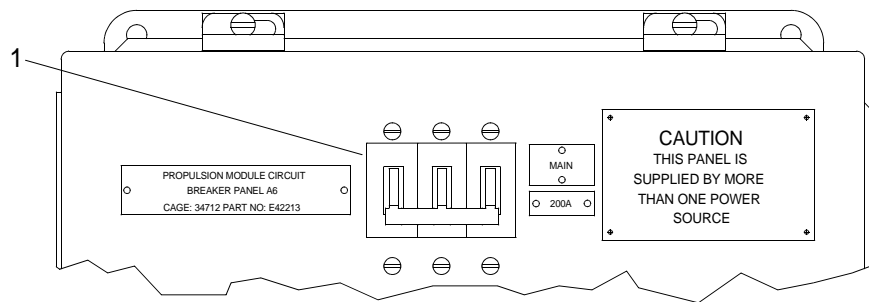
HEAVY PARTS



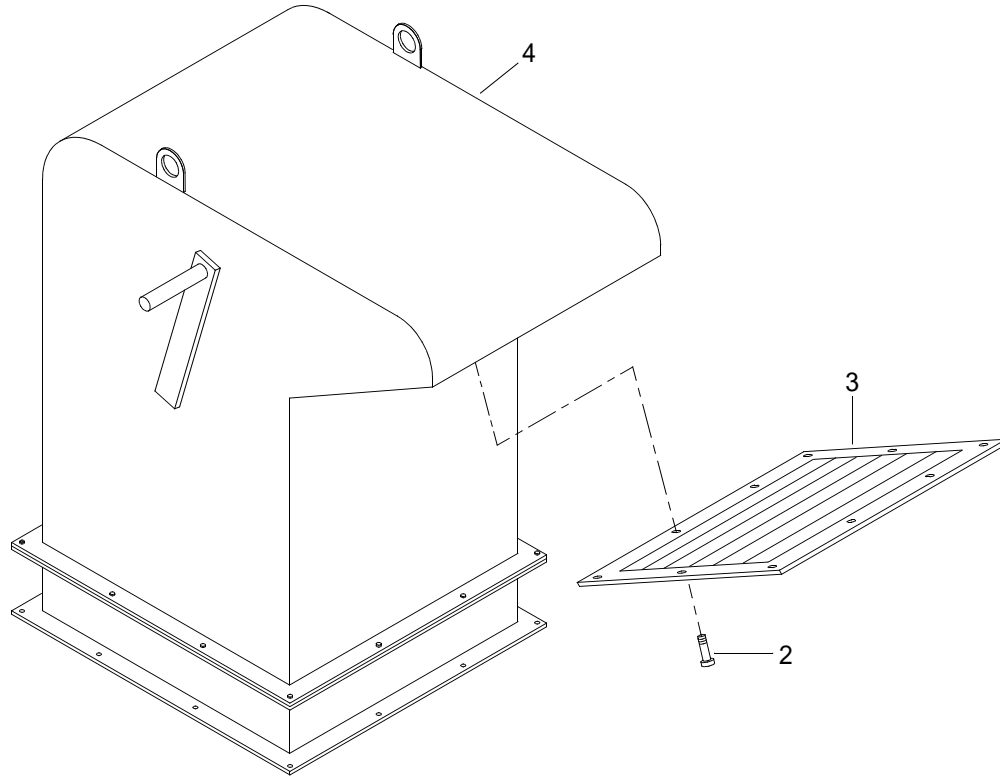
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Remove capscrews (2) securing cover (3) to exhaust plenum (4).



3. Remove cover (3) from exhaust plenum (4) and discard.

INSTALL POWERED SECTION EXHAUST PLENUM COVER

1. Position new cover (3) over opening on exhaust plenum (4).
2. Install capscrews (2) to secure cover (3) on exhaust plenum (4). Tighten capscrews (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION EXHAUST PLENUM DOOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Door, Exhaust Plenum
 PN E18762
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

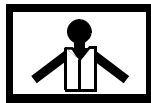
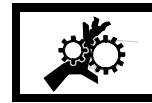
Engineer 88L

Equipment Condition

Exhaust Plenum Cover Removed. (WP 0089 00)

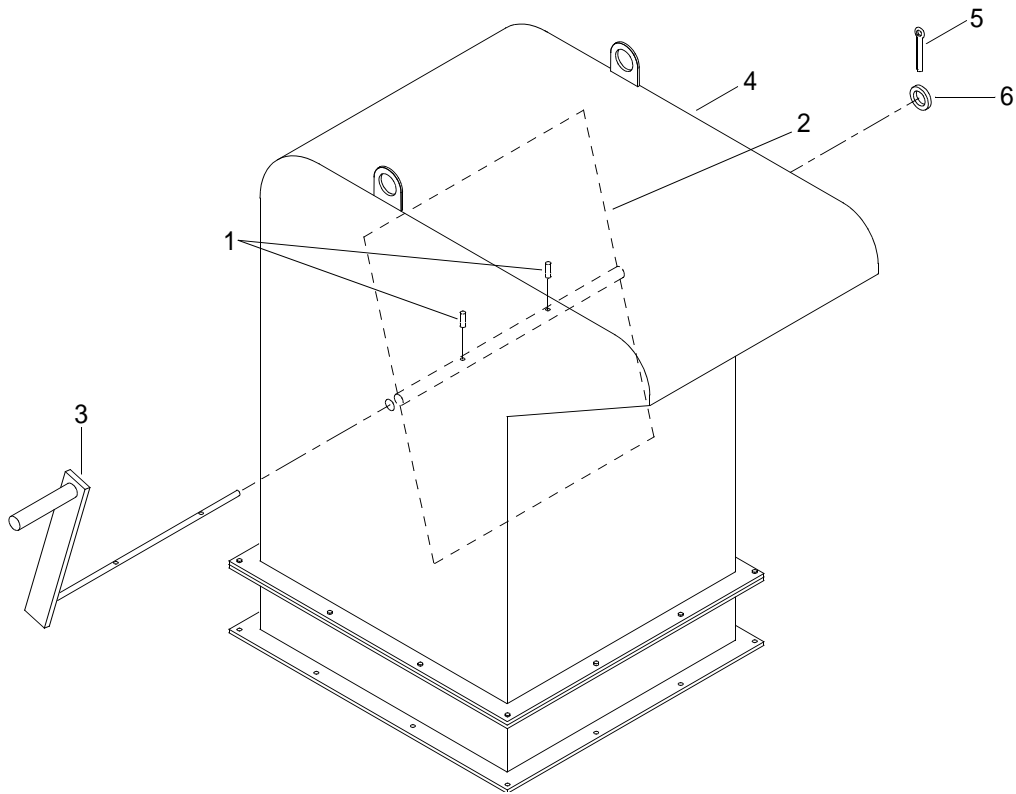
REMOVE POWERED SECTION EXHAUST PLENUM DOOR

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove drive pins (1) securing door (2) to locking handle (3) inside exhaust plenum (4).



2. Remove cotter pin (5) and flat washer (6) from locking handle (3).
3. Supporting door (2), remove locking handle (3) through side of exhaust plenum (4).
4. Remove door (2) from inside exhaust plenum (4) and discard.

INSTALL POWERED SECTION EXHAUST PLENUM DOOR

1. Holding new door (2) inside exhaust plenum (4), install locking handle (3) through exhaust plenum (4) and door (2).
2. Install flat washer (6) and cotter pin (5) in locking handle (3).
3. Install drive pins (1) in door (2) and locking handle (3).
4. Install exhaust plenum cover. (WP 0089 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION EXHAUST PLENUM LOCKING HANDLE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Handle, Locking
 PN E23892
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

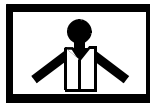
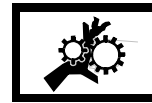
Engineer 88L

Equipment Condition

Exhaust Plenum Cover Removed. (WP 0089 00)

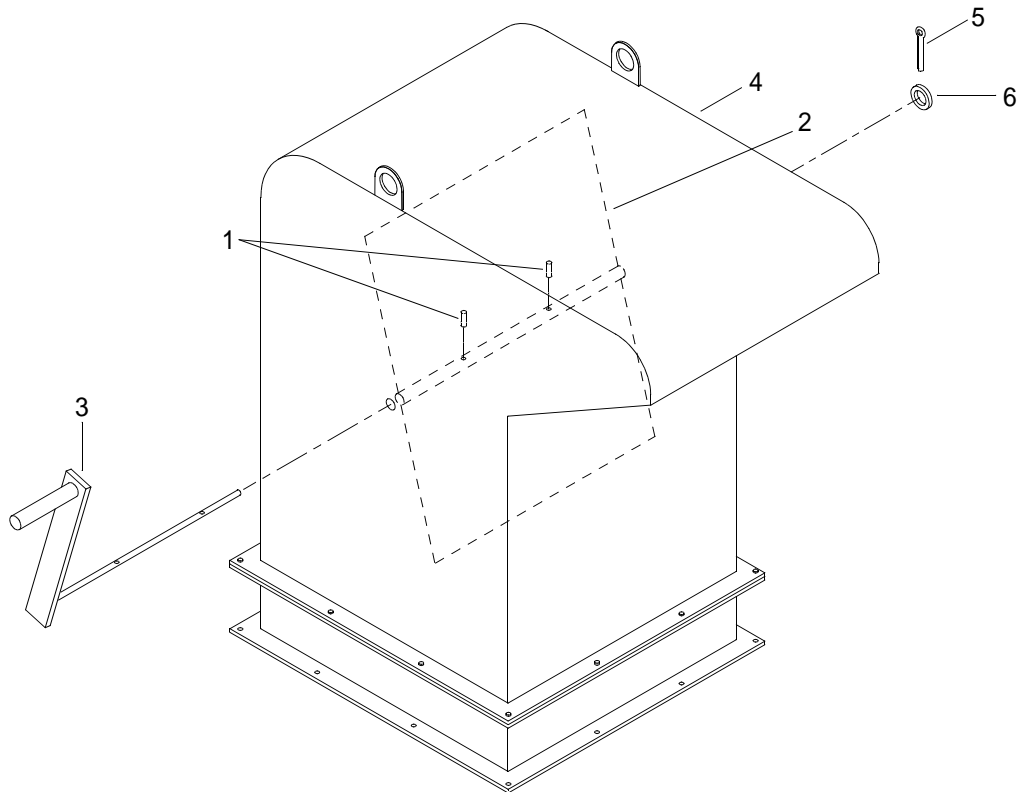
REMOVE POWERED SECTION EXHAUST PLENUM DOOR HANDLE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove drive pins (1) securing door (2) to locking handle (3) inside exhaust plenum (4).



2. Remove cotter pin (5) and flat washer (6) from locking handle (3).
3. Supporting door (2), remove locking handle (3) through side of exhaust plenum (4).
4. Remove door (2) from inside exhaust plenum (4).
5. Discard locking handle (3).

INSTALL POWERED SECTION EXHAUST PLENUM DOOR HANDLE

1. Holding door (2) inside exhaust plenum (4), install new locking handle (3) through exhaust plenum (4) and door (2).
2. Install flat washer (6) and cotter pin (5) in locking handle (3).
3. Install drive pins (1) in door (2) and locking handle (3).
4. Install exhaust plenum cover. (WP 0089 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION EXHAUST PLENUM VENT FAN
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Blower, Axial (Vent Fan)
 PN E08678
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

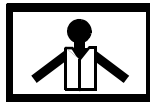
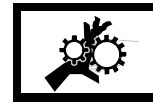
Engineer 88L

Equipment Condition

Powered Section Exhaust Plenum Removed. (WP 0087 00)

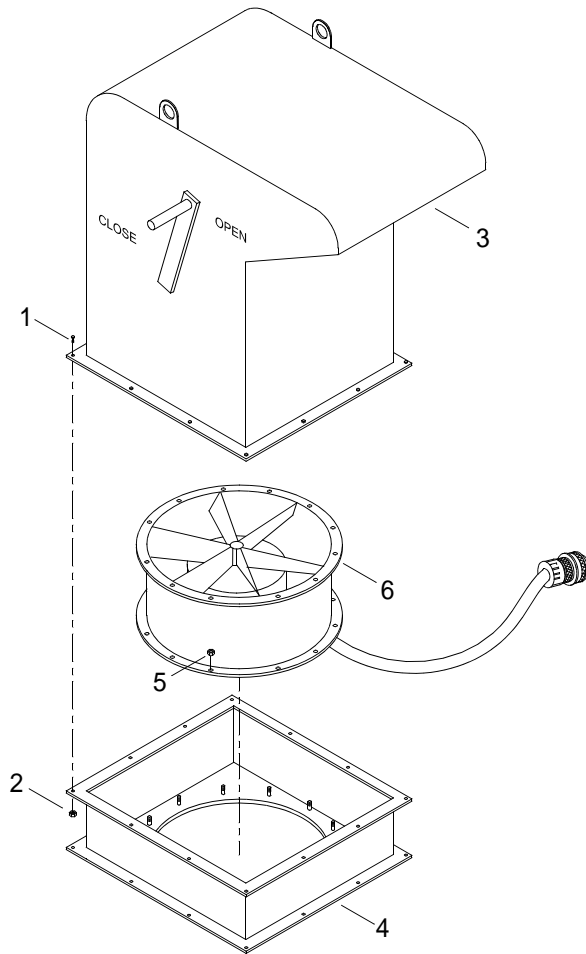
REMOVE POWERED SECTION VENT FAN

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove hex head capscrews (1) and hex nuts (2) securing exhaust plenum cowling (3) to exhaust blower mount (4).



2. Remove exhaust plenum cowling (3).
3. Remove hex nuts (5) securing vent fan (6) to exhaust blower mount (4).
4. Remove vent fan (6).

INSTALL POWERED SECTION VENT FAN

1. Position new vent fan (6) on exhaust blower mount (4).
2. Install hex nuts (5) to secure vent fan (6) to exhaust blower mount (4). Tighten hex nuts (5).
3. Position exhaust plenum cowling (3) on exhaust blower mount (4).
4. Install hex head capscrews (1) and hex nuts (2) to secure plenum cowling (3) to exhaust blower mount (4). Tighten hex nuts (2).
5. Install powered section exhaust plenum. (WP 0087 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION OPERATORS CAB/INTAKE PLENUM
SIDE ACCESS PANEL
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

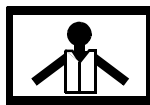
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Antiseize Compound (Item 3, WP 0426 00)
- Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

REMOVE POWERED SECTION OPERATORS CAB/INTAKE PLENUM SIDE ACCESS PANEL

WARNING



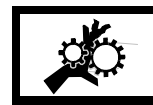
VEST



HELMET PROTECTION



HEAVY PARTS



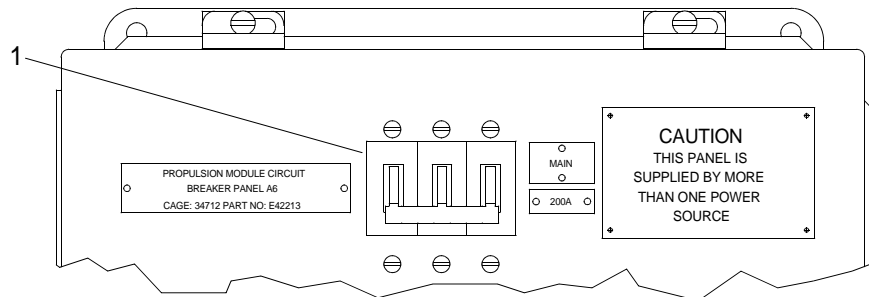
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

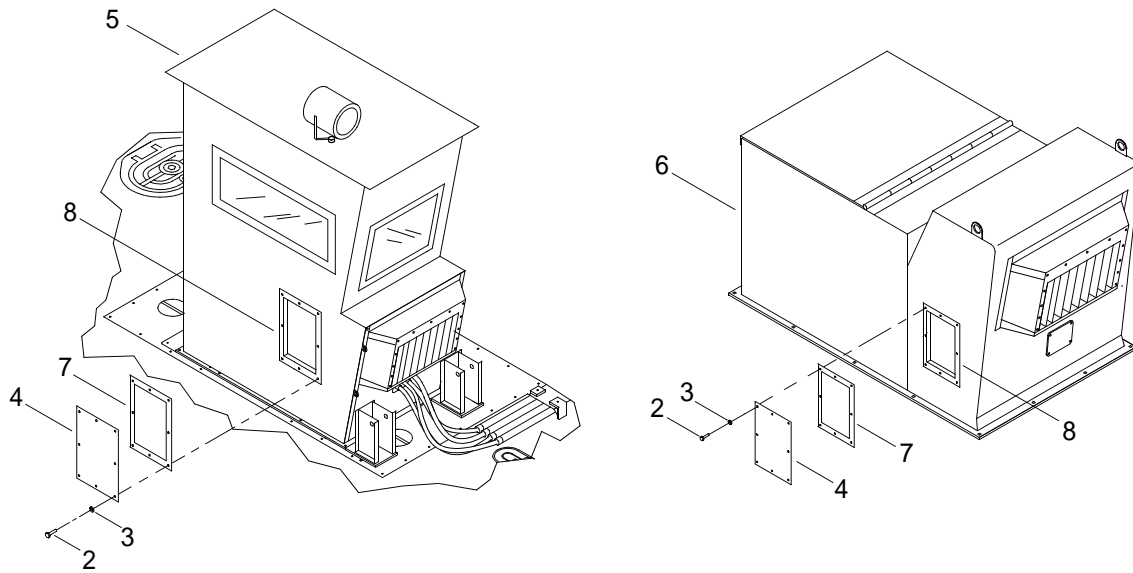
NOTE

This task is typical for removal and installation of both port and starboard side operator cab or intake plenum access panels.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove eight pan head capscrews (2) and lockwashers (3) attaching side access panel (4) to operators cab (5) or intake plenum (6).



- Remove side access panel (4).
- Inspect gasket (7) on lip of opening (8) in operators cab (5) or intake plenum (6) for cuts, tears or deterioration. Replace if damaged.

INSTALL POWERED SECTION OPERATORS CAB/INTAKE PLENUM SIDE ACCESS PANEL

WARNING



CHEMICAL



EYE PROTECTION

- Apply antiseize on pan head capscrews (2).
- Position side access panel (4) on operators cab (5) or intake plenum (6).
- Install eight pan head capscrews (2) and lockwashers (3) to secure access panel (4) to the operators cab (5) or intake plenum (6). Tighten pan head capscrews (2).

WARNING



CHEMICAL



EYE PROTECTION

- Using wiping rag, clean off excess antiseize compound.

WARNING

**CHEMICAL****EYE PROTECTION**

5. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION OPERATORS CAB/INTAKE PLENUM
SIDE ACCESS PANEL GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gasket, Access Cover
 PN E19451
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

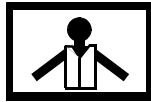
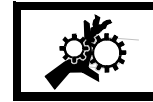
Engineer 88L

Equipment Condition

Powered Section Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)

**REMOVE POWERED SECTION OPERATORS CAB/INTAKE PLENUM SIDE ACCESS
PANEL GASKET**

WARNING

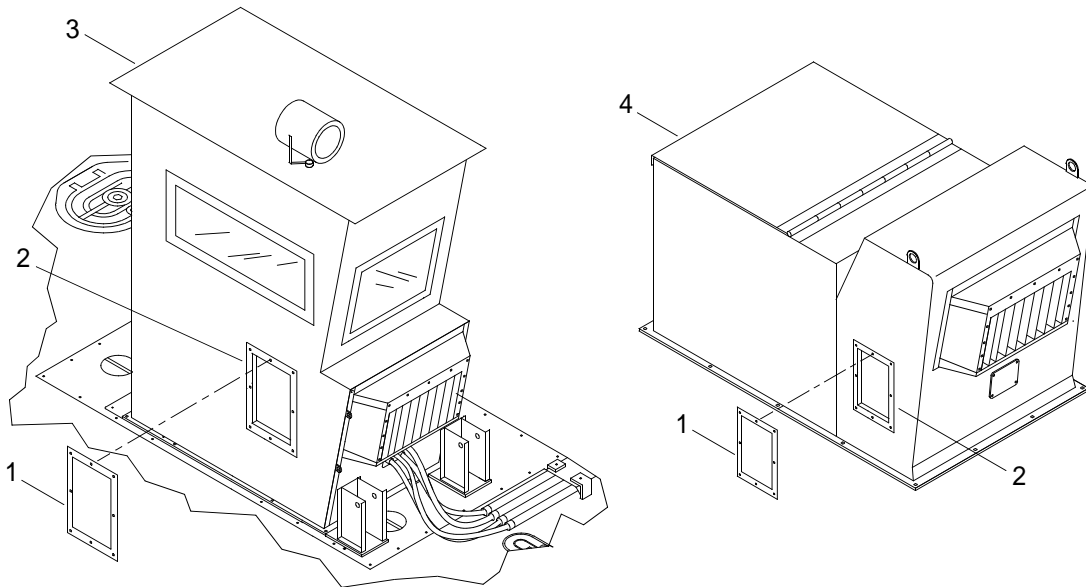
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for removal and installation of both the port or starboard side access panels on the operators cab and intake plenum.

1. Using putty knife, remove damaged gasket (1) from lip of opening (2) in operators cab (3) or intake plenum (4).



 WARNING



CHEMICAL



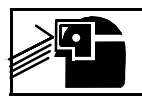
EYE PROTECTION

2. Use cleaner and wiping rags to remove adhesive from mating surfaces.

 WARNING



CHEMICAL



EYE PROTECTION

3. Dispose of contaminated wiping rags per local procedures.

INSTALL POWERED SECTION OPERATORS CAB/INTAKE PLENUM SIDE ACCESS PANEL GASKET

 WARNING



CHEMICAL



EYE PROTECTION

1. Apply adhesive to new gasket (1).
2. Install gasket (1) to lip of opening (2) in operators cab (3) or intake plenum (4).
3. Install powered section operators cab/intake plenum side access panel. (WP 0093 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION OPERATORS CAB
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Qty 3
 Shackle, 1/2 in. 2 Ton (Item 24, WP 0425 00)
 Qty 2

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 SST Bolt and SST Washer (Item 40, WP 0426 00)
 Sealant, Gasket (Item 33, WP 0426 00)
 Cleaning Compound, Solvent (Item 6, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)
 Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

Engineer 88L

References

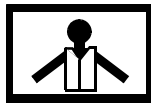
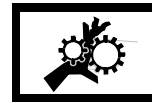
TM 55-1945-225-10

Equipment Condition

Life lines Removed. (TM 55-1945-225-10)
 Main Assembly Mast Removed. (WP 0350 00)
 Module Interconnect Assembly Removed. (WP 0202 00)

REMOVE OPERATORS CAB

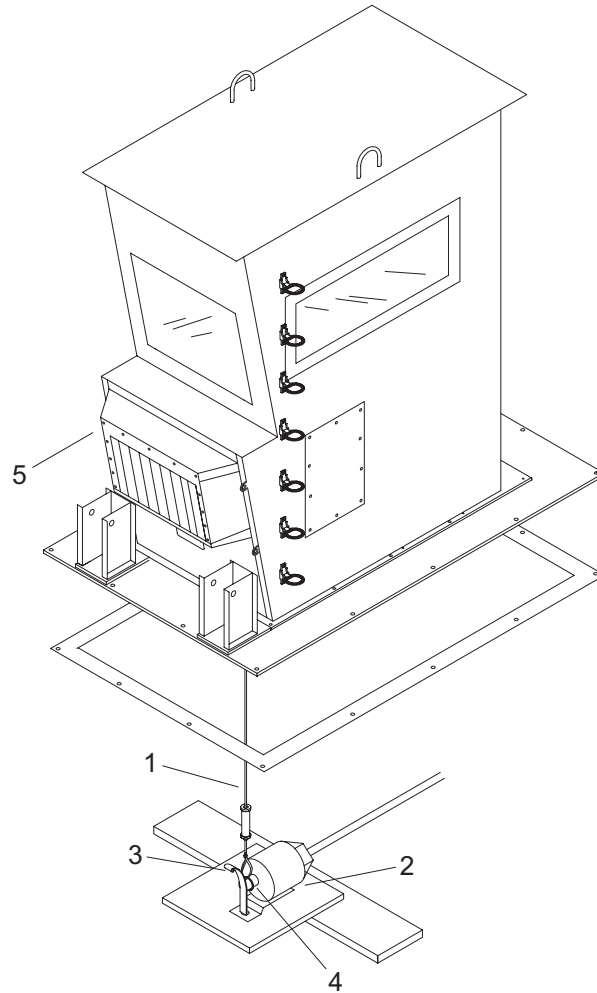
WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

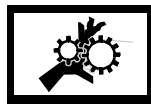
All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)

2. Remove wire rope (1) from fire suppression trip mechanism (2).

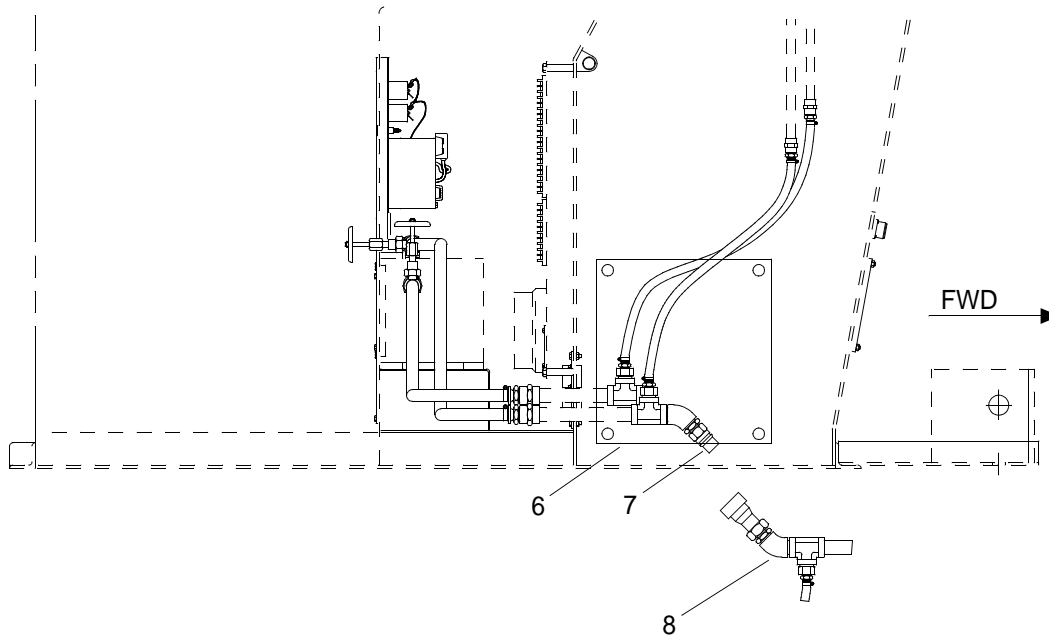


WARNING

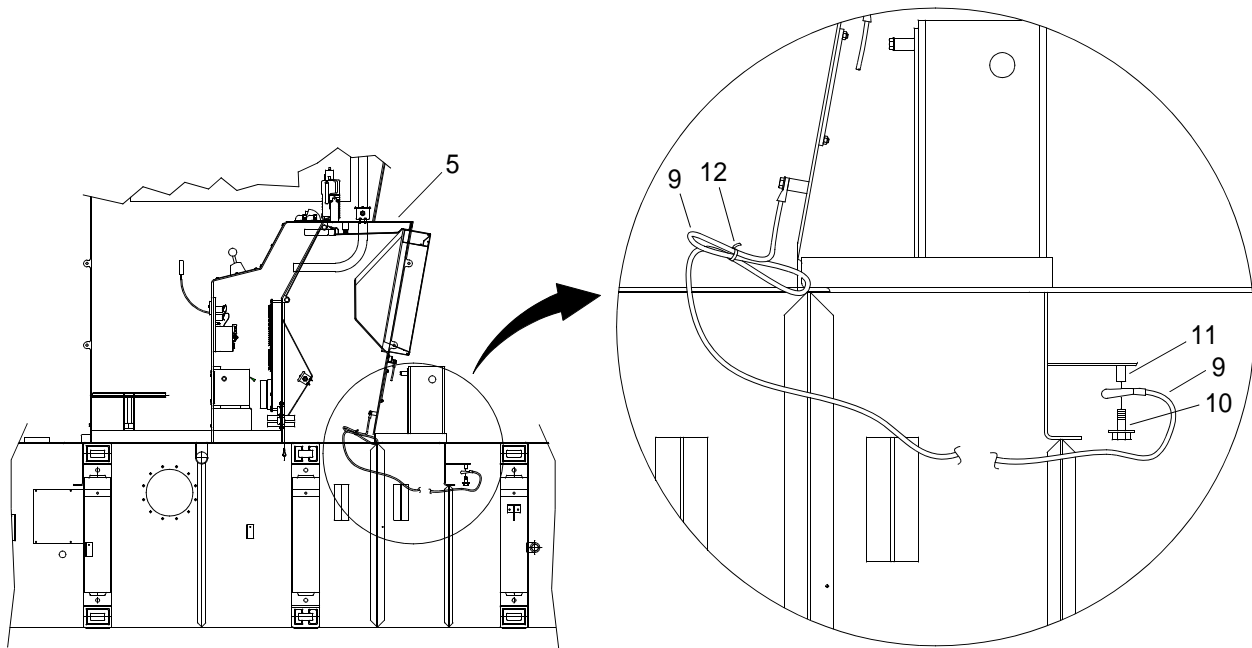
**MOVING PARTS**

- a. Holding wire rope (1), pull fire suppression solenoid spring flange (3) away from solenoid shaft (4).
- b. Slowly release tension on wire rope (1) until flapper inside operators cab (5) closes.

3. Through operators cab starboard access (6), disconnect heating system male (7) and female (8) quick disconnect water hoses.

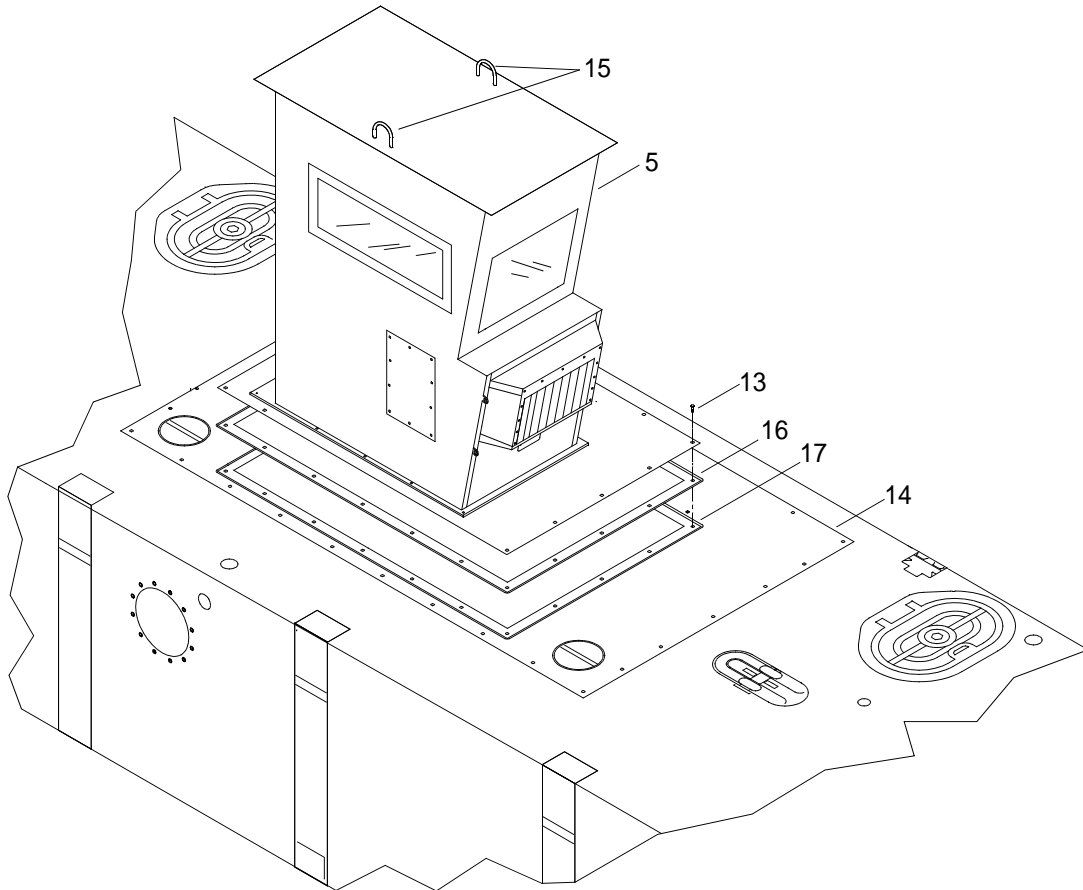


4. Remove operators cab ground cable (9).



- a. Remove steel bolt and washer (10) securing operators cab ground cable (9) to propulsion module boss (11).
- b. Remove operators cab ground cable (9) from propulsion module boss (11).
- c. Coil operators cab ground cable and secure inside of operators cab (5) with tie wrap (12).
- d. Install bolt and washer (10) in propulsion module boss (11).

5. Remove bolts (13) securing operators cab (5) to engine hatch (14).



6. Connect shackles and slings to operators cab lift points (15).

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

7. Using crane, slings and shackles, remove operators cab (5) from engine hatch (14).
8. Inspect gasket (16) on lip of opening (17) in engine hatch (14). Replace if damaged.
9. Remove slings and shackles from operators cab lift points (15).

INSTALL OPERATORS CAB

1. Connect shackles and slings to operators cab lift points (15).

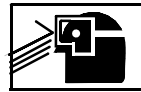
 WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

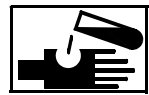
2. Using crane, slings and shackles, position operators cab (5) over opening (17) in engine hatch (14).

 WARNING

**CHEMICAL****EYE PROTECTION**

3. Apply antiseize to bolts (13).
4. Install bolts (13) to secure operators cab (5) to engine hatch (14). Tighten bolts (13).

 WARNING

**CHEMICAL****EYE PROTECTION**

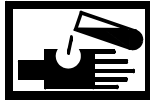
5. Using wiping rag, clean off excess antiseize compound.
6. Remove slings and shackles from operators cab lift points (15).
7. Ground operators cab assembly (5).
 - a. Cut tie wrap (12) securing ground cable (9) to inside of operators cab (5)
 - b. Remove and discard bolt and washer (10) from propulsion module boss (11).

 WARNING

**EYE PROTECTION**

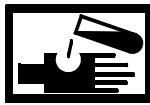
- c. Using a wire brush, remove all corrosion and paint from top of propulsion module boss (11).

 WARNING

**CHEMICAL****EYE PROTECTION**

- d. Apply antiseize compound to mating surfaces of propulsion module boss (11), ground cable (9) and new bolt and washer (10).
- e. Position ground cable (9) on propulsion module boss (11).
- f. Install bolt and washer (10) securing ground cable (9) to propulsion module boss (11) and tighten.

 WARNING

**CHEMICAL****EYE PROTECTION**

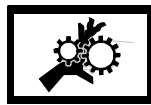
- g. Using wiping rag, clean off excess antiseize compound.

 WARNING

**CHEMICAL****EYE PROTECTION**

- h. Apply a thin bead of sealing compound no. 2 to terminating edges, sealing bolt and washer (10), ground cable (9) and propulsion module boss (11).
- 8. Through operators cab starboard access (6), connect heating system male (7) and female (8) quick disconnect water hoses.
 - 9. Install wire rope (1) on fire suppression trip mechanism (2).

 WARNING

**MOVING PARTS**

- a. While pulling down on wire rope (1), pull fire suppression solenoid spring flange (3) away from solenoid shaft (4) and install end loop of wire rope (1) on solenoid shaft (4).
 - b. Release fire suppression solenoid spring flange (3).
- 10. Install module interconnect assembly. (WP 0202 00)
 - 11. Install main assembly mast. (WP 0350 00)

12. Install life lines. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION

13. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION OPERATORS CAB JUMPER CABLES
INSTALLATION AND REMOVAL**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

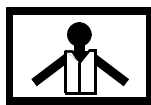
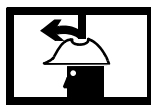
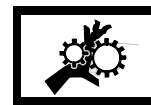
References

TM 55-1945-225-10

**POWERED SECTION OPERATORS CAB JUMPER CABLES INSTALLATION AND REMOVAL
PROCEDURES FOR PROPULSION MODULE OPERATIONAL CHECKS**

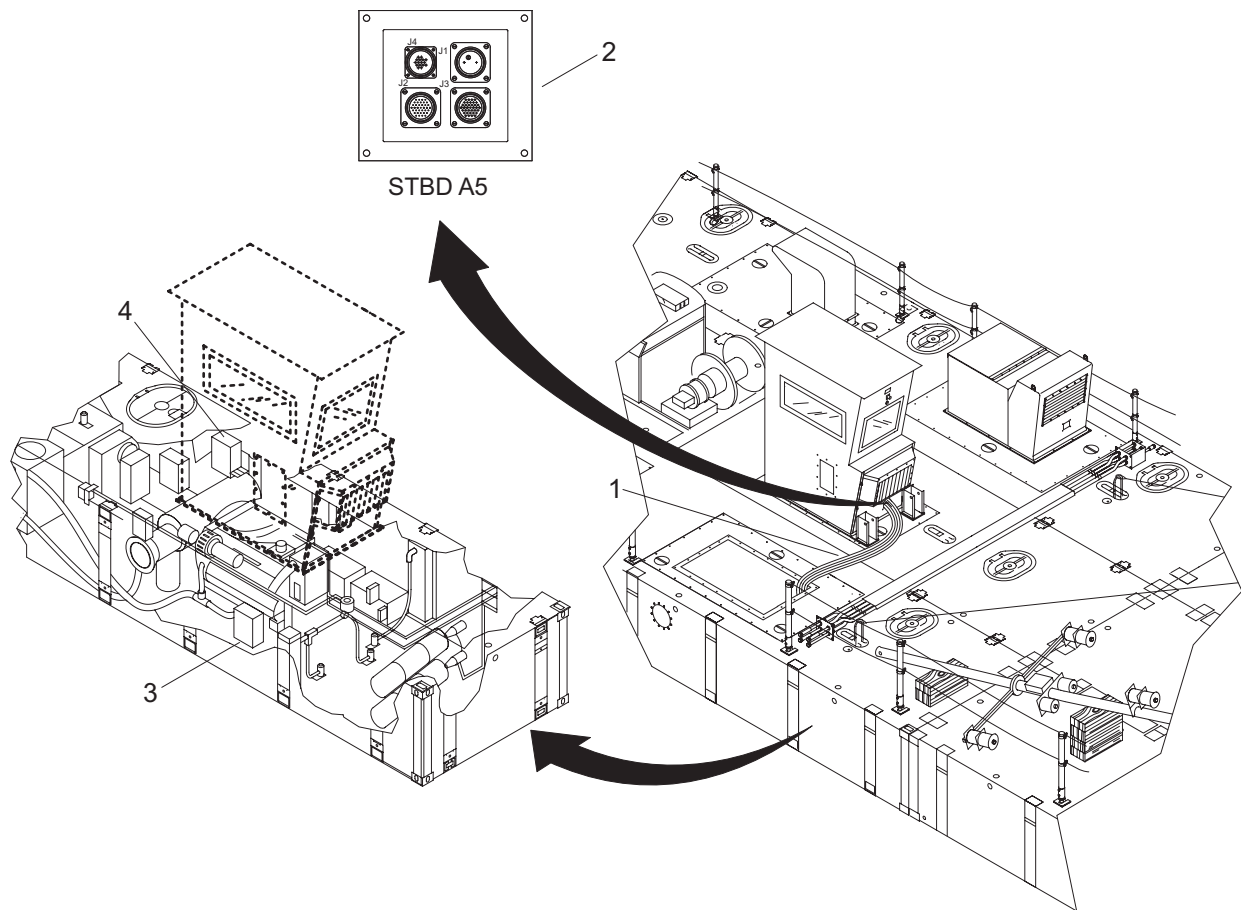
STARBOARD PROPULSION MODULE OPERATIONAL CHECKS

—————
 WARNING
 —————

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

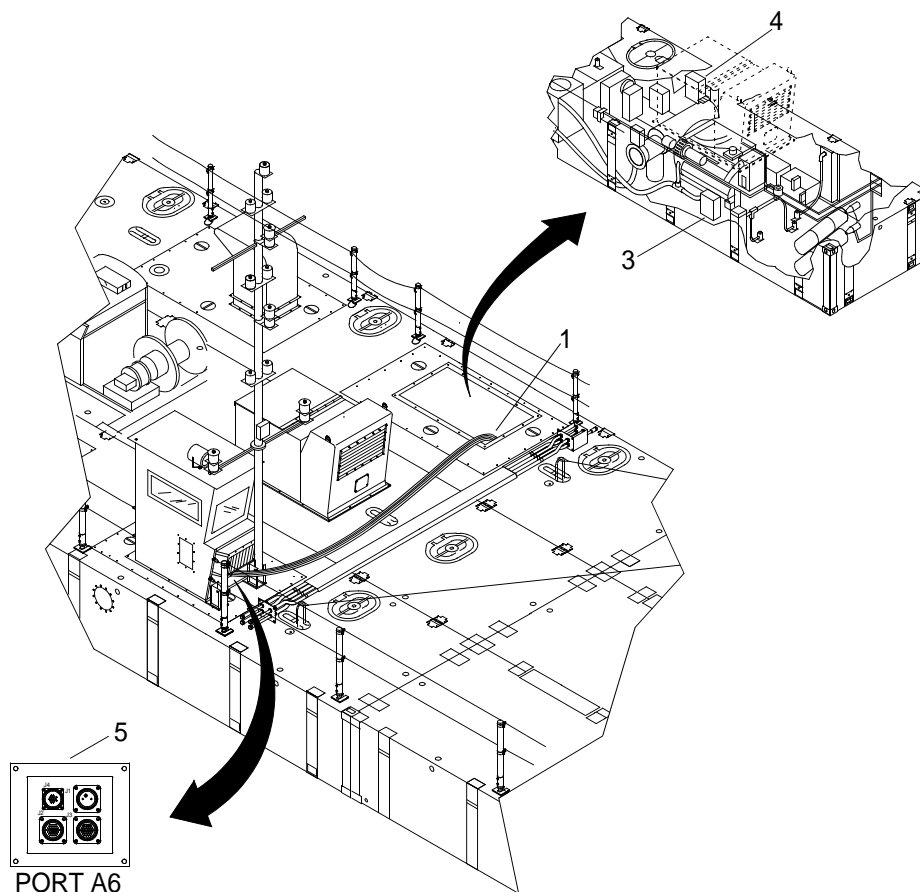
1. Remove jumper cables from BII container. (TM 55-1945-225-10)
2. Connect operators cab end of jumper cables (1) to operators cab starboard receptacle A5 (2).



3. Connect propulsion module end of jumper cables (1) to starboard propulsion module junction box A3 (3) power cables P2, P3, P4 and starboard propulsion module circuit breaker panel A6 (4) power cable P1.
4. Perform operational check, as required.
5. After operational check, remove jumper cables (1) from operators cab starboard receptacle A5 (2), starboard propulsion module junction box A3 (3) power cables P2, P3, P4 and starboard propulsion module circuit breaker panel A6 (4) power cable P1.
6. Stow jumper cables (1) in BII container. (TM 55-1945-225-10)

PORT PROPULSION MODULE OPERATIONAL CHECKS

1. Remove jumper cables from BII container. (TM 55-1945-225-10)
2. Connect operators cab end of jumper cables (1) to operators cab port receptacle A6 (5).



3. Connect propulsion module end of jumper cables (1) to port propulsion module junction box A3 (3) power cables P2, P3, P4 and port propulsion module circuit breaker panel A6 (4) power cable P1.
4. Perform operational check, as required.
5. After operational check, remove jumper cables (1) from operators cab starboard receptacle A5 (2), port propulsion module junction box A3 (3) power cables P2, P3, P4 and port propulsion module circuit breaker panel A6 (4) power cable P1.
6. Stow jumper cables (1) in BII container. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION OPERATORS CAB GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gasket, Cab
 PN E20191
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Cleaning Compound, Solvent (Item 6, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

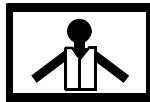
Engineer 88L

Equipment Condition

Module Interconnect Assembly Removed. (WP 0202 00)
 Main Assembly Mast Removed. (WP 0350 00)
 Powered Section Operators Cab Removed. (WP 0095 00)

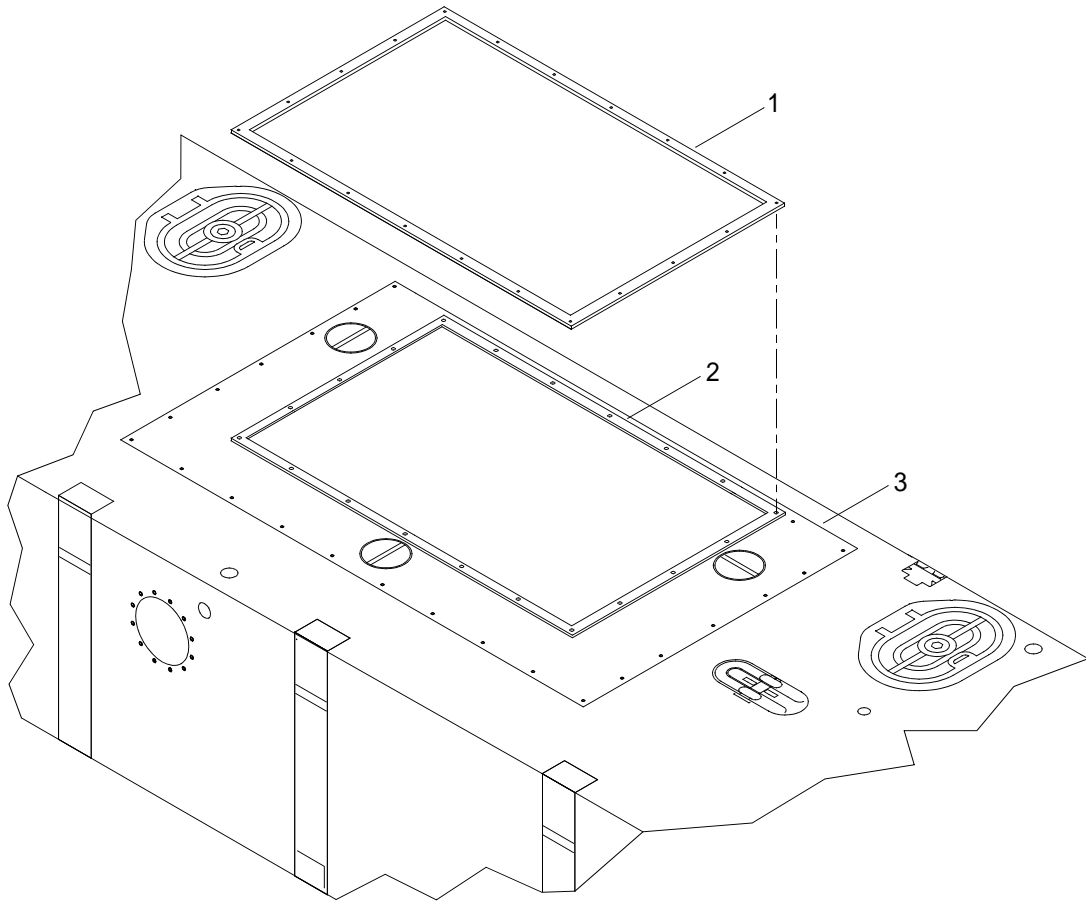
REMOVE POWERED SECTION OPERATORS CAB GASKET

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Using putty knife, remove damaged gasket (1) from lip of opening (2) in engine hatch (3). Discard gasket (1).



WARNING



CHEMICAL



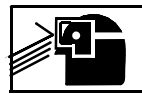
EYE PROTECTION

- 2. Use cleaner and wiping rags to remove adhesive from mating surfaces.

WARNING



CHEMICAL



EYE PROTECTION

- 3. Dispose of contaminated wiping rags per local procedures.

INSTALL POWERED SECTION OPERATORS CAB GASKET

WARNING

**CHEMICAL****EYE PROTECTION****NOTE**

The same gasket is used for mounting both the intake plenum assembly and the operators cab on the engine hatch.

1. Apply adhesive on new gasket (1).
2. Install gasket (1) on lip of opening (2) in engine hatch (3).
3. Install powered section operators cab assembly. (WP 0095 00)
4. Install main assembly mast. (WP 0350 00)
5. Install module interconnect assembly. (WP 0202 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION ENGINE HATCH
REMOVAL, INSTALLATION, RAISING AND LOWERING**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Shackle, 1/2 in. 2 Ton (Item 24, WP 0425 00)
 Qty 3
 Crowbar (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L
 Seaman 88K

References

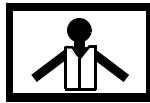
TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Removed. (WP 0350 00)
 SINCGARS Antenna Removed. (TM 55-1945-225-10)
 Operators Cab Removed. (WP 0095 00)
 Intake Plenum Assembly Removed. (WP 0080 00)

REMOVE POWERED SECTION ENGINE HATCH

WARNING



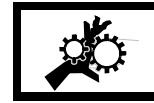
VEST



HELMET PROTECTION



HEAVY PARTS



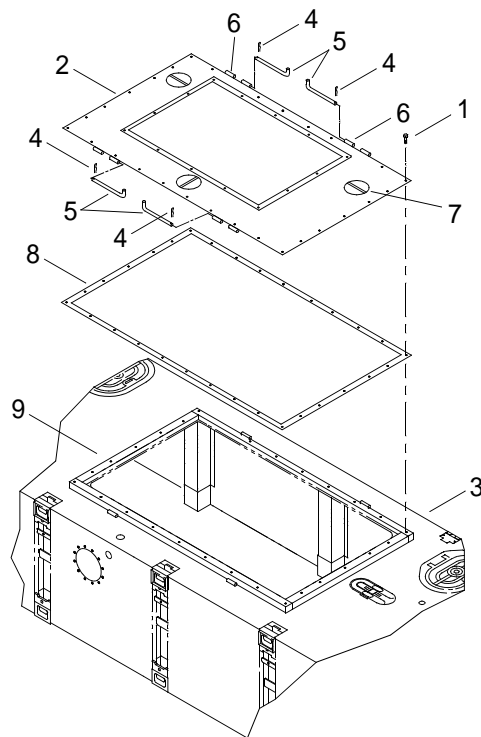
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for the removal and installation of engine hatches.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Remove capscrews (1) securing engine hatch (2) to propulsion module (3).



3. Remove hairpin-cotter pins (4) from hinge pins (5).
4. Remove hinge pins (5) from hinge tube (6).
5. Connect shackles and slings to engine hatch lift points (7).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

6. Using crane, slings and shackles, remove engine hatch (2).
7. Inspect gasket (8) on lip of opening (9) in propulsor module (3) for cuts, tears or deterioration. Replace if damaged. (WP 0099 00)
8. Remove slings and shackles from engine hatch lift points (7).

INSTALL POWERED SECTION ENGINE HATCH

1. Connect shackles and slings to engine hatch lift points (7).

 WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

NOTE

Verify the engine hatch is positioned on the propulsion module to facilitate proper installation of the operators cab or intake plenum.

2. Using crane, slings and shackles, position engine hatch (2) over opening (9) in propulsion module (3).
3. Install hinge pins (5) in hinge tube (6).
4. Install hairpin-cotter pins (4) in hinge pins (5).

 WARNING

**CHEMICAL****EYE PROTECTION**

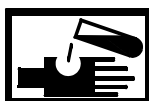
5. Apply antiseize to capscrews (1).
6. Install capscrews (1) to secure hatch (2) to propulsion module (3). Tighten capscrews (1).

 WARNING

**CHEMICAL****EYE PROTECTION**

7. Using wiping rag, clean off excess antiseize compound.

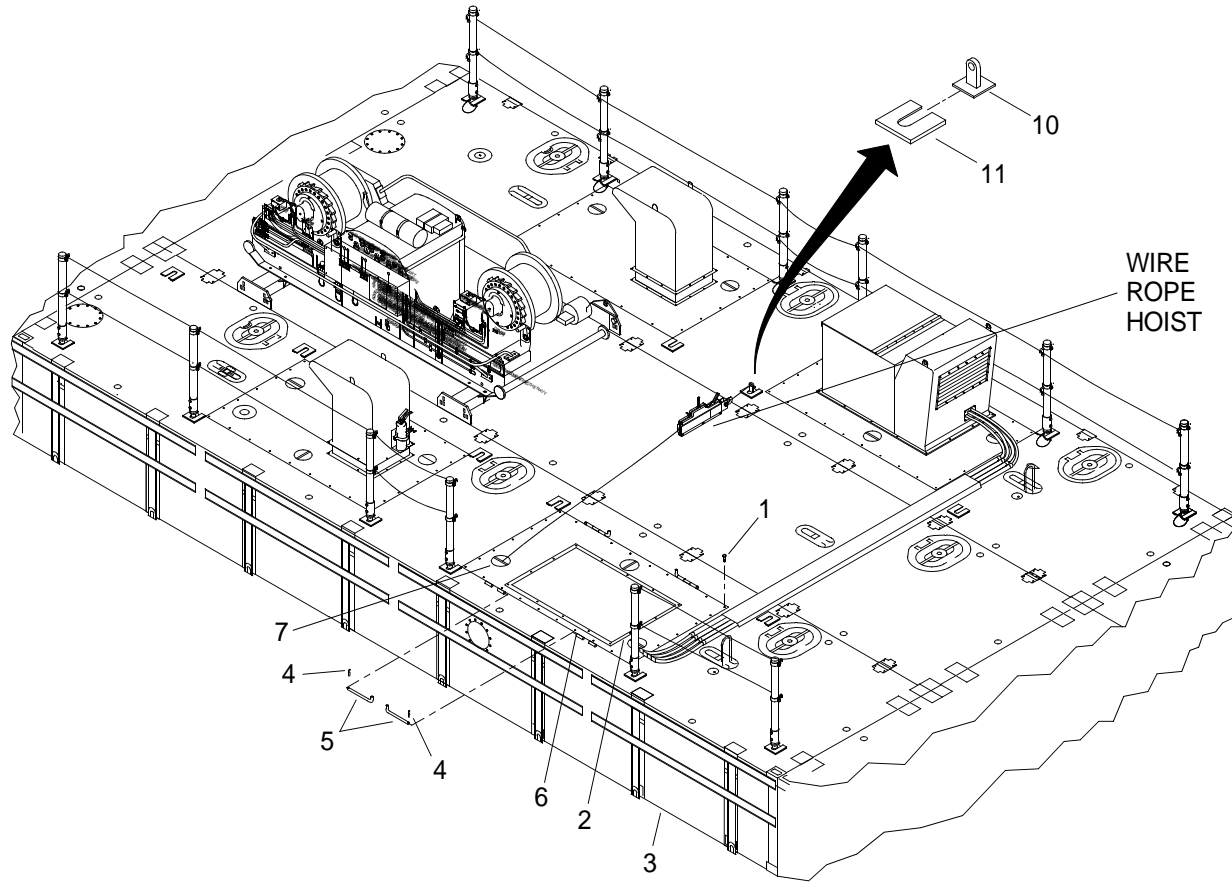
 WARNING

**CHEMICAL****EYE PROTECTION**

8. Dispose of contaminated wiping rags per local procedures.

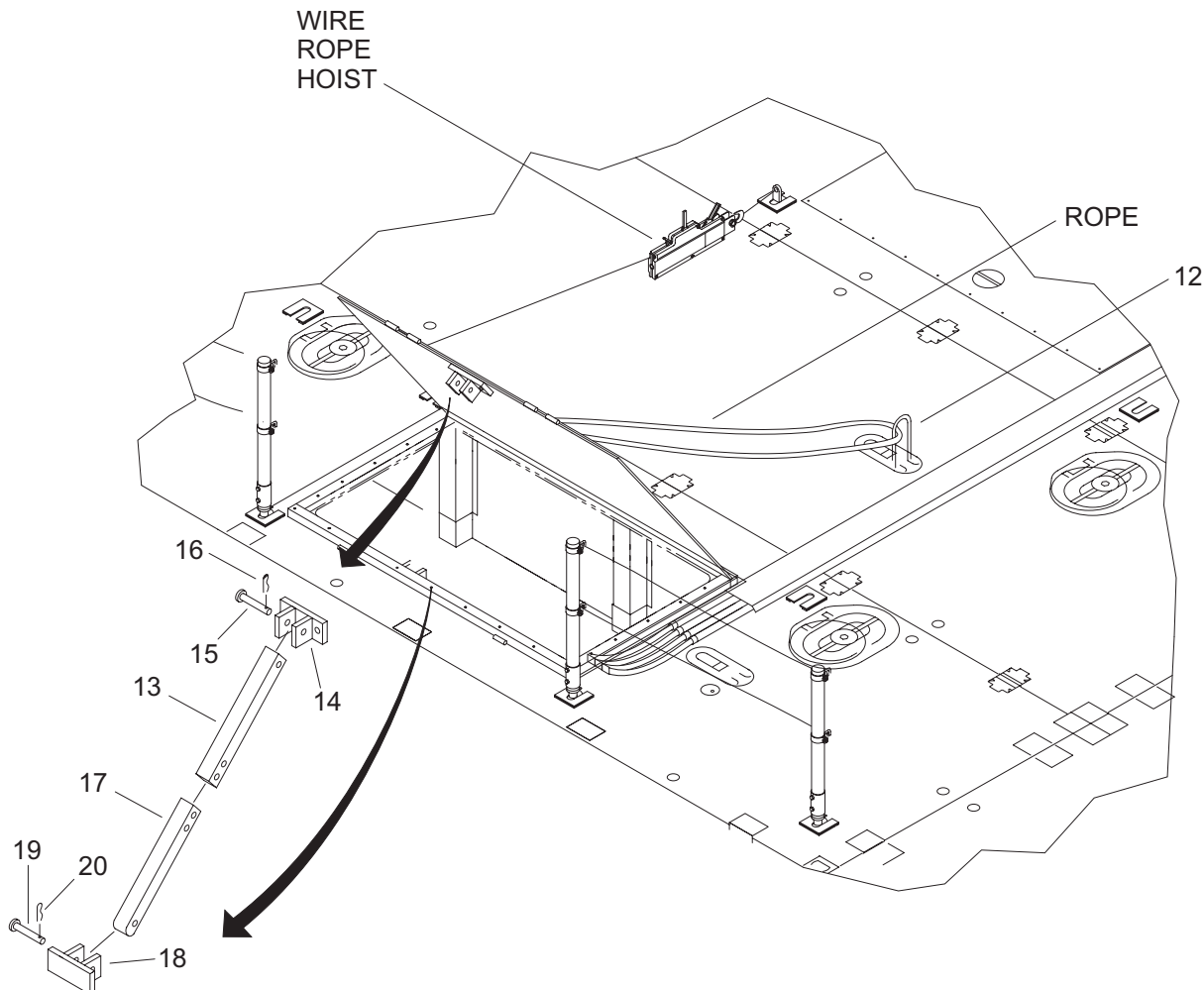
RAISE POWERED SECTION ENGINE HATCH

1. Remove rope, hatch handling assembly and wire rope hoist from the BII container.



2. Remove capscrews (1) securing engine hatch (2) to propulsion module (3).
3. Remove two hairpin-cotter pins (4) from hinge pins (5).
4. Remove hinge pins (5) from hinge tube (6).
5. Install base padeye (10) in deck fittings (11).
6. Install wire rope hoist between base padeye (10) and thruster hatch lift point (7)

7. Operate wire rope hoist until engine hatch (2) stands almost vertically, while assistant prys outboard edge of hatch until raised above horizontal plane.

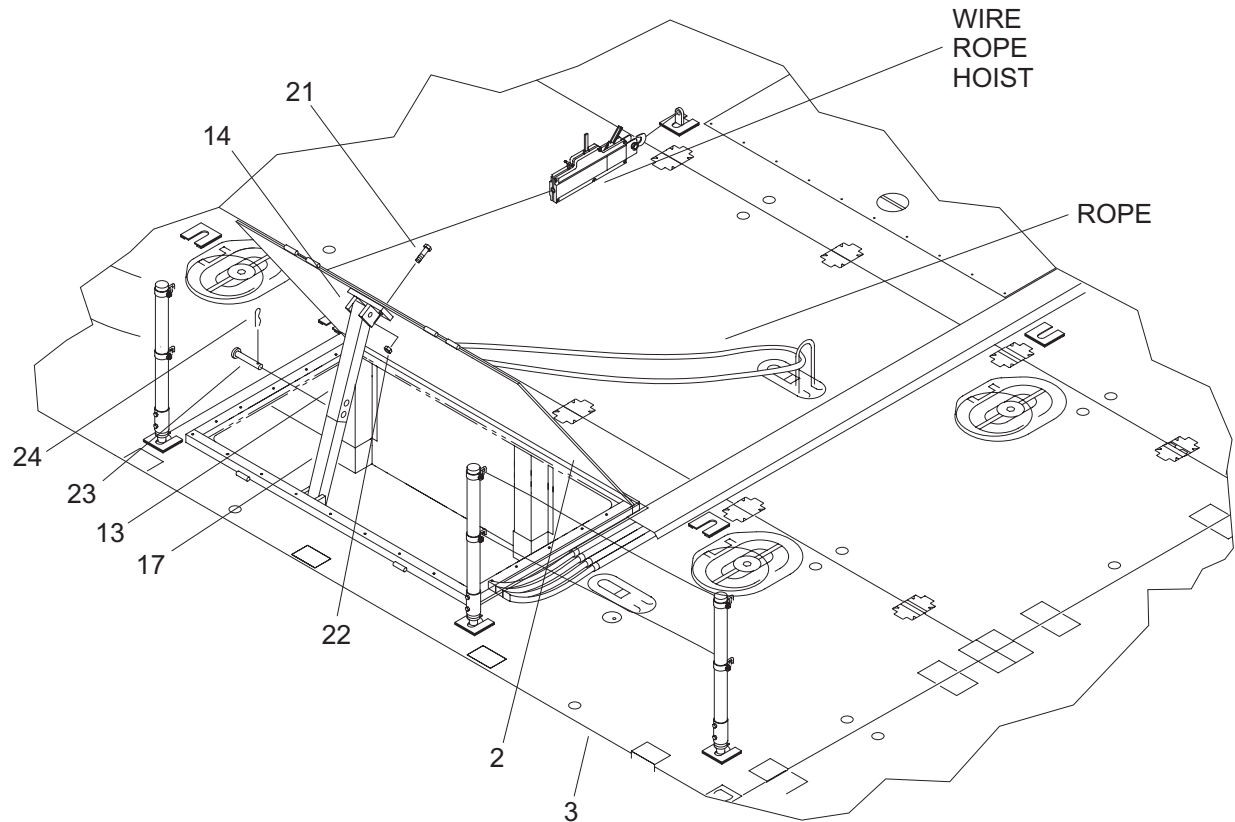


NOTE

Rope is used as a back-up safety device in the event a failure should occur to the wire rope hoist.

8. Using rope, temporarily secure engine hatch (2) to lifting padeye (12).
9. Position upper half of prop bar (13) to upper bracket weldment (14).
10. Install clevis pin (15) through upper half of prop bar (13) and bracket weldment (14).
11. Install hair pin cotter (16) in clevis pin (15).
12. Position lower half of prop bar (17) on bracket weldment (18).
13. Install clevis pin (19) through lower half of prop bar (17) and bracket weldment (18).
14. Install hair pin cotter (20) in clevis pin (19).
15. Slide upper half of prop bar (13) over lower half of prop bar (17).

16. Position bracket weldment (14) on engine hatch (2).



17. Install cap screw (21) and hex nut (22) securing bracket weldment (14) to engine hatch (2) and tighten hex nut (22).

18. Using wire rope hoist raise or lower engine hatch (2) until holes in lower half of prop bar (17) and upper half of prop bar (13) line up.

19. Install clevis pin (23) through lower half of prop bar (17) and upper half of prop bar (13).

20. Install hair pin cotter (24) in clevis pin (23).

LOWER POWERED SECTION ENGINE HATCH

1. Remove hair pin cotter (24) from clevis pin (23).

2. Remove clevis pin (23) securing lower half of prop bar (17) to upper half of prop bar (13).

3. Remove hair pin cotter (20) from clevis pin (19).

4. Remove clevis pin (19) securing lower half of prop bar (17) to bracket weldment (18).

5. Remove lower half of prop bar (17) from upper half of prop bar (13) and bracket weldment (18).

6. Remove hair pin cotter (16) from clevis pin (15).

7. Remove clevis pin (15) securing upper half of prop bar (13) to bracket weldment (14).

8. Remove upper half of prop bar (13) from bracket weldment (14).

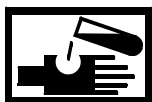
9. Remove capscrew (21) and hex nut (22) securing bracket weldment (14) to engine hatch (2).
10. Remove bracket weldment (14) from engine hatch (2).
11. Remove rope, temporarily securing engine hatch (2) to lifting padeye (12).
12. Operate wire rope hoist until engine hatch (2) is lowered completely.
13. Remove wire rope hoist from base padeye (10) and thruster hatch lift point (7).
14. Remove base padeye (10) from deck fittings (11).
15. Install hinge pins (5) in hinge tube (6).
16. Install two hairpin-cotter pins (4) in hinge pins (5).

WARNING

**CHEMICAL****EYE PROTECTION**

17. Apply antiseize to capscrews (1).
18. Install capscrews (1) securing engine hatch (2) to propulsion module (3) and tighten capscrews (1).
19. Remove slings and shackles from engine hatch lift points (4).
20. Install intake plenum assembly. (WP 0080 00)
21. Install operators cab. (WP 0095 00)
22. Install SINCGARS antenna. (TM 55-1945-225-10)
23. Install main assembly mast. (WP 0350 00)

WARNING

**CHEMICAL****EYE PROTECTION**

24. Using wiping rag, clean off excess antiseize compound.

WARNING

**CHEMICAL****EYE PROTECTION**

25. Dispose of contaminated wiping rags per local procedures.
26. Stow rope, hatch handling assembly and wire rope hoist in BII container.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION ENGINE HATCH GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gasket, Cab
 PN E20191
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Adhesive (Item 1, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

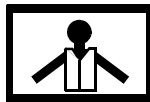
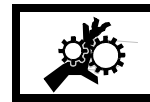
Engineer 88L

Equipment Condition

Main Assembly Mast Removed. (WP 0350 00)
 SINCGARS Antenna Removed. (TM 55-1945-225-10)
 Operators Cab Removed. (WP 0095 00)
 Intake Plenum Assembly Removed. (WP 0080 00)
 Powered Section Engine Hatch Removed. (WP 0098 00)

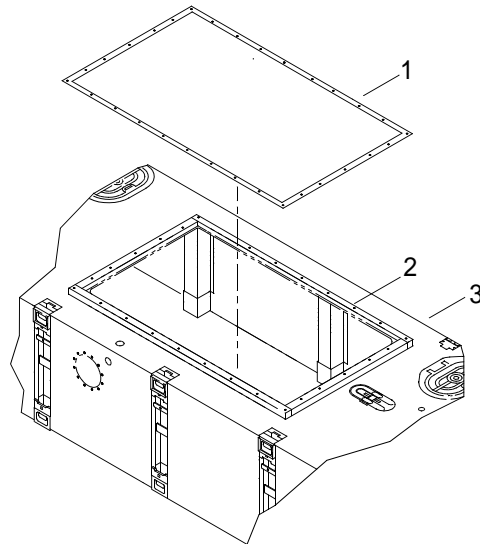
REMOVE POWERED SECTION INTAKE PLENUM ASSEMBLY GASKET

WARNING

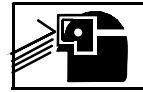
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Using putty knife, remove damaged gasket (1) from lip of opening (2) in propulsion module (3). Discard gasket (1).



WARNING

**CHEMICAL****EYE PROTECTION**

2. Use cleaner and wiping rags to remove adhesive from mating surfaces.

WARNING

**CHEMICAL****EYE PROTECTION**

3. Dispose of contaminated wiping rags per local procedures.

INSTALL POWERED ENGINE HATCH GASKET

WARNING

**CHEMICAL****EYE PROTECTION****NOTE**

The same gasket is used for mounting both the intake plenum assembly and the operators cab on the engine hatch.

1. Apply adhesive on new gasket (1).
2. Install gasket (1) on lip of opening (2) in propulsion module (3).
3. Install powered section engine hatch. (WP 0098 00)
4. Install intake plenum assembly. (WP 0080 00)
5. Install operators cab. (WP 0095 00)
6. Install SINGARS antenna. (TM 55-1945-225-10)
7. Install main assembly mast. (WP 0350 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION THRUSTER HATCH
REMOVAL, INSTALLATION, RAISING AND LOWERING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Crowbar (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Qty 3
 Shackle, 1/2 in. 2 Ton (Item 24, WP 0425 00)
 Qty 3

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L/88K

References

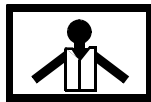
TM 55-1945-225-10

Equipment Condition

Exhaust Plenum Assembly Removed. (WP 0087 00)

REMOVE THRUSTER HATCH

WARNING

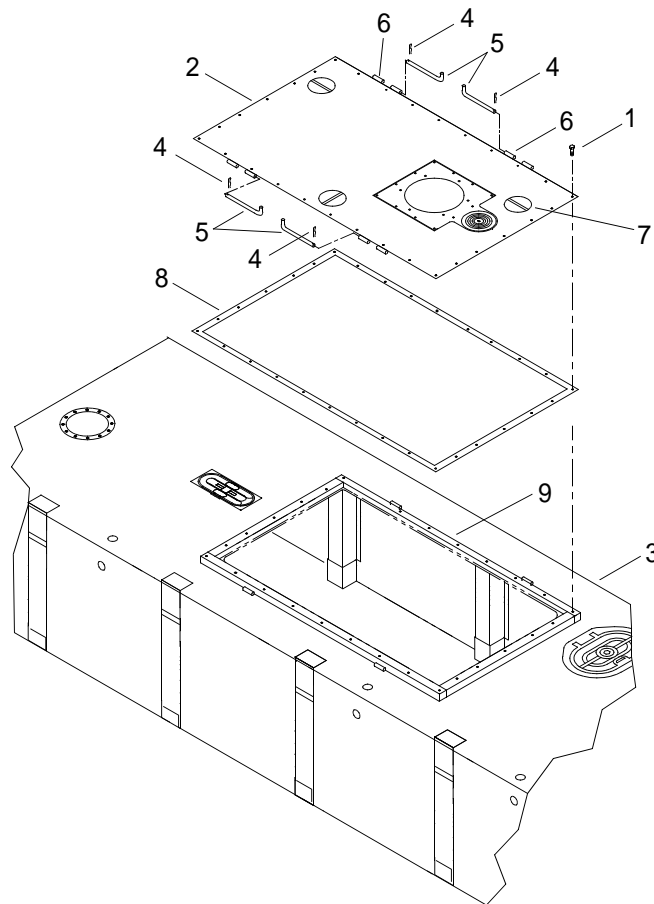
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for the removal and installation of thruster hatches.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Remove capscrews (1) securing thruster hatch (2) to propulsion module (3).



3. Remove hairpin-cotter pins (4) from hinge pins (5).
4. Remove hinge pins (5) from hinge tube (6).
5. Connect shackles and slings to thruster hatch lift points (7).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

6. Using crane, slings and shackles, remove thruster hatch (2).
7. Inspect gasket (8) on lip of opening (9) in propulsion module (3) for cuts, tears or deterioration. Replace if damaged. (WP 0101 00)
8. Remove slings and shackles from thruster hatch lift points (7).

INSTALL THRUSTER HATCH

1. Connect shackles and slings to thruster hatch lift points (7).

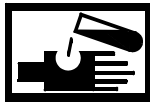
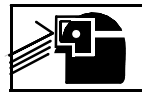
WARNING**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

NOTE

Verify thruster hatch is positioned on the propulsion module to facilitate proper installation of the exhaust plenums.

2. Using crane, slings and shackles, position thruster hatch (2) over opening (9) in propulsion module (3).
3. Install hinge pins (5) in hinge tube (6).
4. Install hairpin-cotter pins (4) in hinge pins (5).

WARNING**CHEMICAL****EYE PROTECTION**

5. Apply antiseize to capscrews (1).
6. Install capscrews (1) to secure hatch (2) to propulsion module (3). Tighten capscrews (1).

WARNING**CHEMICAL****EYE PROTECTION**

7. Using wiping rag, clean off excess antiseize compound.
8. Remove slings and shackles from thruster hatch lift points (7).

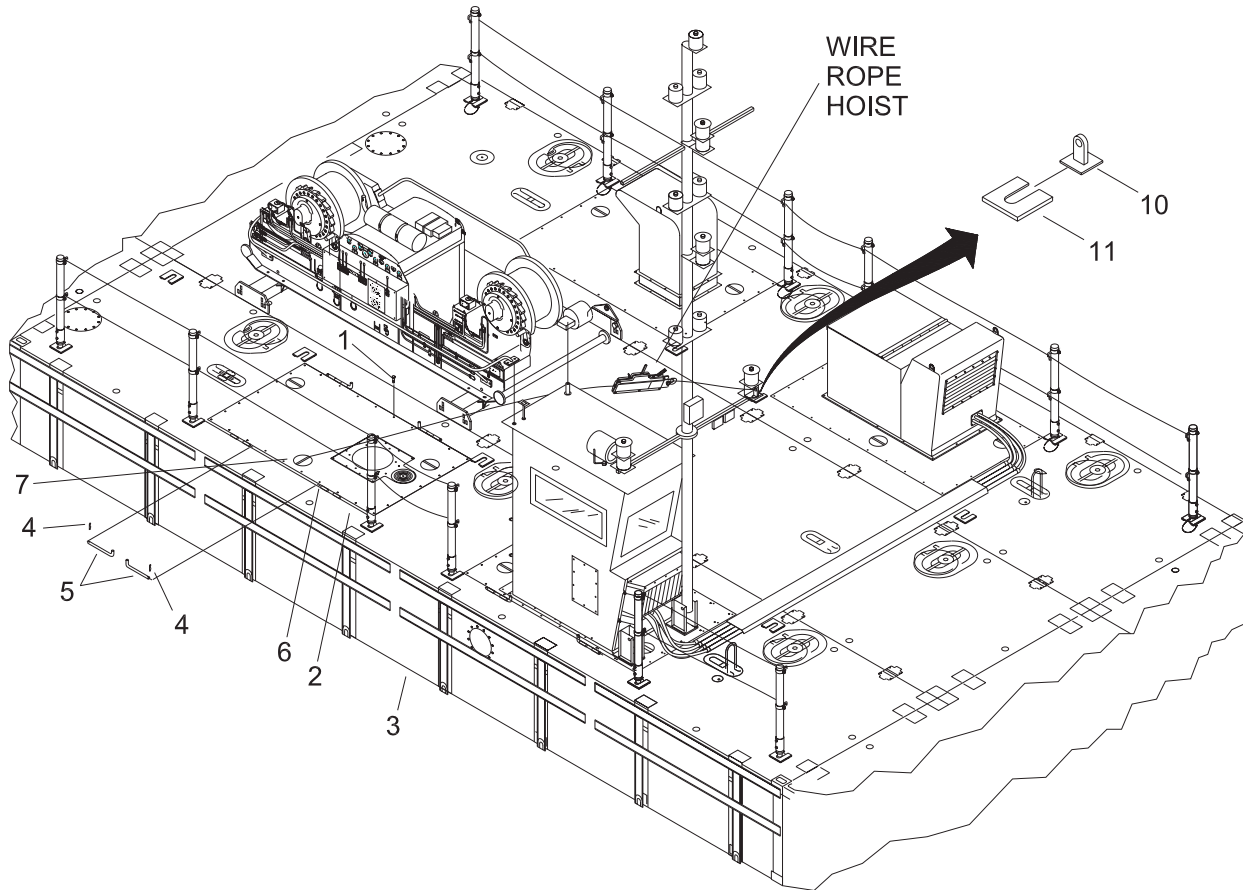
WARNING

**CHEMICAL****EYE PROTECTION**

- Dispose of contaminated wiping rags per local procedures.

RAISE POWERED SECTION THRUSTER HATCH

- Remove rope, hatch handling assembly and wire rope hoist from the BII container.



- Remove capscrews (1) securing thruster hatch (2) to propulsion module (3).
- Remove two hairpin-cotter pins (4) from hinge pins (5).
- Remove hinge pins (5) from hinge tube (6).

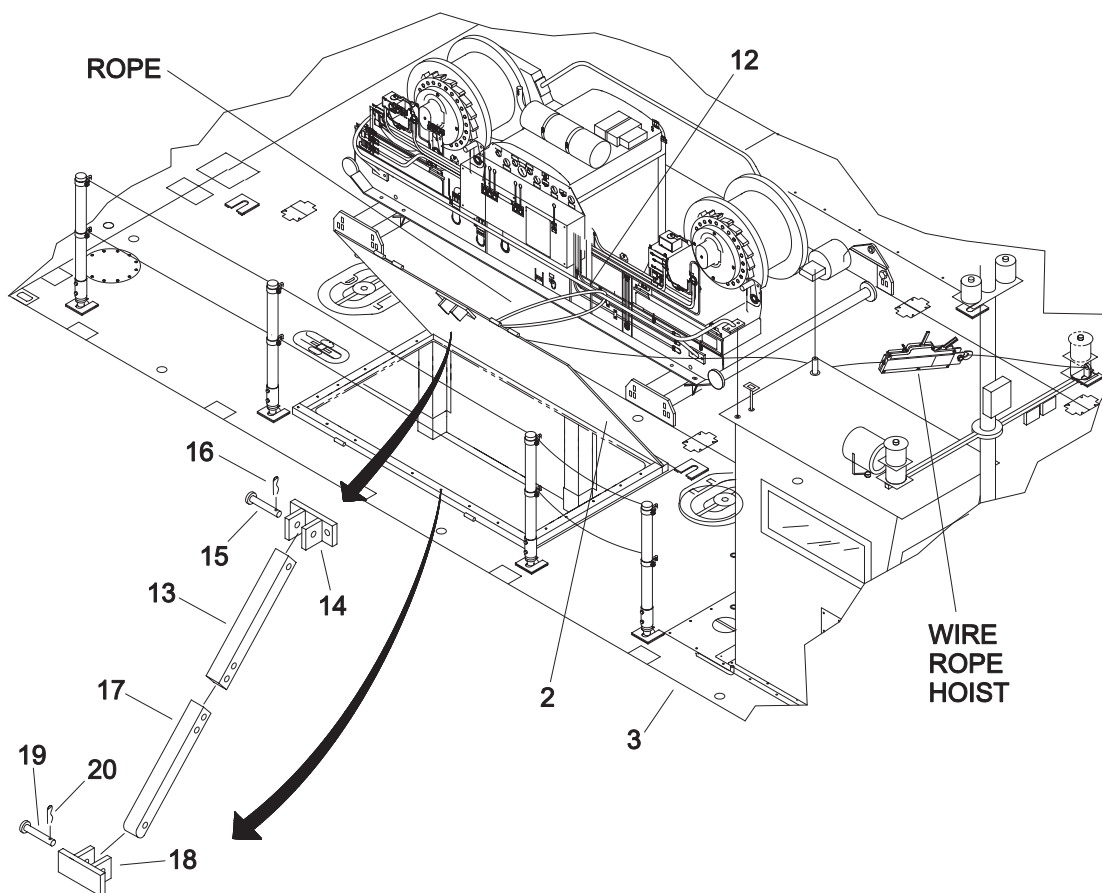
WARNING

Do not allow the griphoist cable to rub or wrap around anything in its path to the thruster hatch lift point. Failure to comply may cause grip hoist cable to break and may cause injury or death to personnel.

NOTE

Any of the deck fittings on the opposite propulsion module that allow an unobstructed line to the thruster hatch lift point may be used.

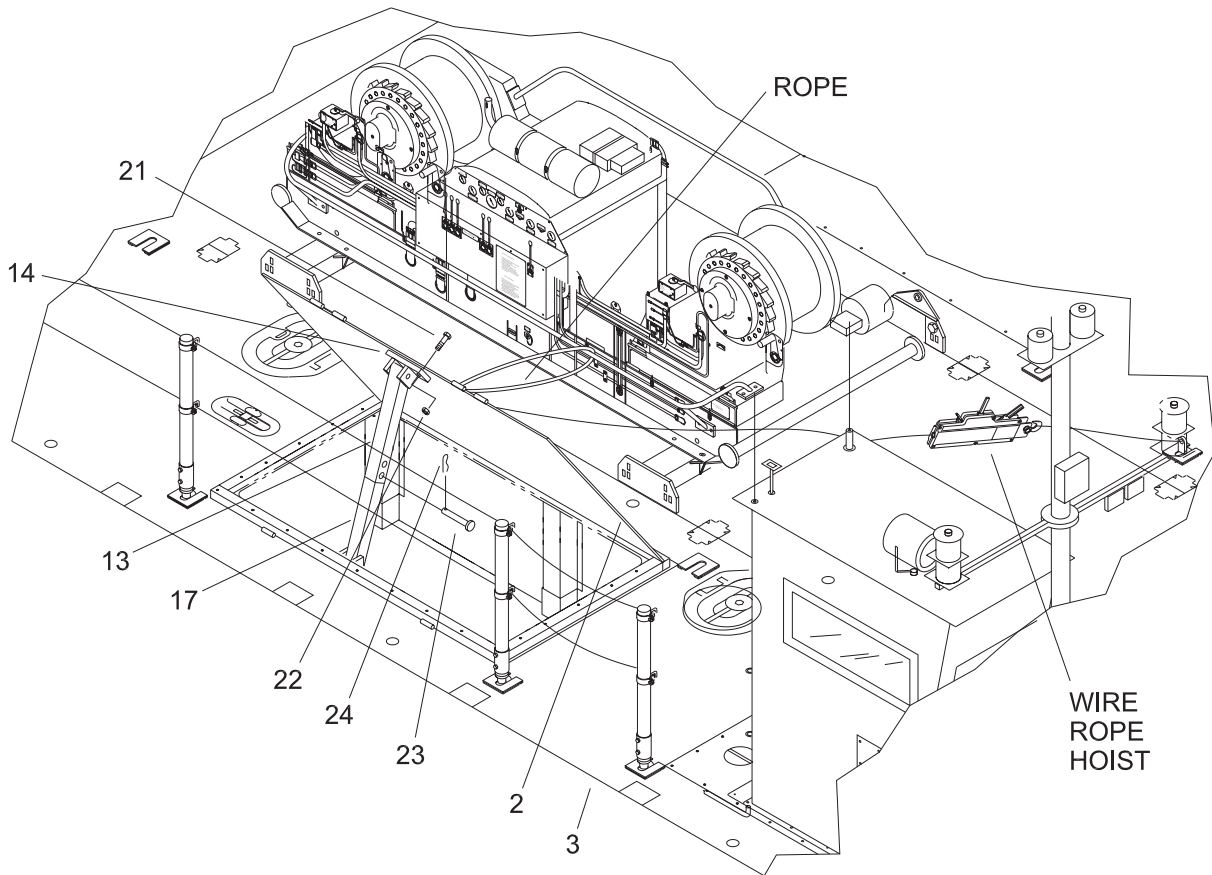
5. Install base padeye (10) in a deck fitting (11) that will allow the least amount of angle on the griphoist cable.
6. Install wire rope hoist between base padeye (10) and thruster hatch lift point (7).
7. Operate wire rope hoist until thruster hatch (2) stands almost vertically, while assistant prys outboard edge of hatch until raised above horizontal plane.

**NOTE**

Rope is used as a back-up safety device in the event a failure should occur to the wire rope hoist.

8. Using rope, temporarily secure thruster hatch (2) to hand rail (12) of deck winch.
9. Position upper half of prop bar (13) to upper bracket weldment (14).

10. Install clevis pin (15) through upper half of prop bar (13) and bracket weldment (14).
11. Install hair pin cotter (16) in clevis pin (15).
12. Position lower half of prop bar (17) on bracket weldment (18).
13. Install clevis pin (19) through lower half of prop bar (17) and bracket weldment (18).
14. Install hair pin cotter (20) in clevis pin (19).
15. Slide upper half of prop bar (13) over lower half of prop bar (17).
16. Position bracket weldment (14) on thruster hatch (2).



17. Install capscrew (21) and hex nut (22) securing bracket weldment (14) to thruster hatch (2) and tighten hex nut (22).
18. Using wire rope hoist raise or lower thruster hatch (2) until holes in lower half of prop bar (17) and upper half of prop bar (13) line up.
19. Install clevis pin (23) through lower half of prop bar (17) and upper half of prop bar (13).
20. Install hair pin cotter (24) in clevis pin (23).

LOWER POWERED SECTION THRUSTER HATCH

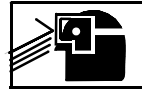
1. Remove hair pin cotter (24) from clevis pin (23).
2. Remove clevis pin (23) securing lower half of prop bar (17) to upper half of prop bar (13).
3. Remove hair pin cotter (20) from clevis pin (19).
4. Remove clevis pin (19) securing lower half of prop bar (17) to bracket weldment (18).
5. Remove lower half of prop bar (17) from upper half of prop bar (13) and bracket weldment (18).
6. Remove hair pin cotter (16) from clevis pin (15).
7. Remove clevis pin (15) securing upper half of prop bar (13) to bracket weldment (14).
8. Remove upper half of prop bar (13) from bracket weldment (14).
9. Remove capscrew (21) and hex nut (22) securing bracket weldment (14) to thruster hatch (2).
10. Remove bracket weldment (14) from thruster hatch (2).
11. Remove rope temporarily securing thruster hatch (2) to hand rail (12) of deck winch.
12. Operate wire rope hoist until thruster hatch (2) is lowered completely.
13. Remove wire rope hoist from base padeye (10) and thruster hatch lift point (7).
14. Remove base padeye (10) from deck fittings (11).
15. Install hinge pins (5) in hinge tube (6).
16. Install two hairpin-cotter pins (4) in hinge pins (5).

WARNING

**CHEMICAL****EYE PROTECTION**

17. Apply antiseize to capscrews (1).
18. Install capscrews (1) securing thruster hatch (2) to propulsion module (3) and tighten capscrews (1).
19. Install exhaust plenum assembly. (WP 0087 00)

WARNING

**CHEMICAL****EYE PROTECTION**

20. Using wiping rag, clean off excess antiseize compound.

WARNING

**CHEMICAL****EYE PROTECTION**

21. Dispose of contaminated wiping rags per local procedures.
22. Stow rope, hatch handling assembly and wire rope hoist in BII container.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION THRUSTER HATCH GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gasket, Hatch, Thruster
 PN E12111
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Adhesive (Item 1, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

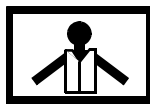
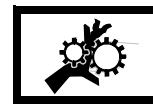
Engineer 88L

Equipment Condition

Main Assembly Mast Removed. (WP 0350 00)
 SINCGARS Antenna Removed. (TM 55-1945-225-10)
 Operators Cab Removed. (WP 0095 00)
 Intake Plenum Assembly Removed. (WP 0080 00)
 Powered Section Thruster Hatch Removed. (WP 0100 00)

REMOVE POWERED SECTION THRUSTER GASKET

WARNING

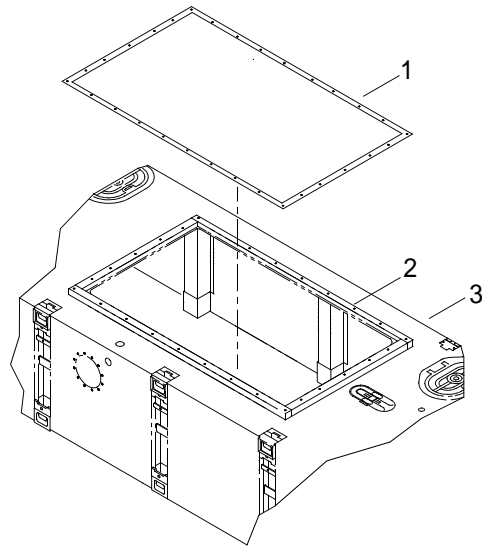
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the replacement of thruster hatch gaskets.

1. Using putty knife, remove damaged gasket (1) from lip of opening (2) in thruster hatch (3) and discard.



WARNING



CHEMICAL



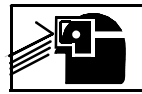
EYE PROTECTION

2. Use cleaner and wiping rags to remove adhesive from mating surfaces.

WARNING



CHEMICAL



EYE PROTECTION

3. Dispose of contaminated wiping rags per local procedures.

INSTALL POWERED SECTION THRUSTER GASKET

WARNING



CHEMICAL



EYE PROTECTION

1. Apply adhesive on new gasket (1).
2. Install gasket (1) to lip of opening (2) in thruster hatch (3).
3. Install powered section thruster hatch. (WP 0100 00)

-
4. Install intake plenum assembly. (WP 0080 00)
 5. Install operators cab. (WP 0095 00)
 6. Install SINCGARS antenna. (TM 55-1945-225-10)
 7. Install main assembly mast. (WP 0350 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM BUTTERFLY (SEACHEST) VALVE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Sling, 66,000 lb. 30 ft (Olive) (Item 29, WP 0425 00)
Shackle, 1 3/4 in. 40 Ton (Item 26, WP 0425 00)
Qty 2

Materials/Parts

Valve, Butterfly (Seachest)
PN 3245259
Gasket, Flange
PN E09151
Qty 2

Personnel Required

Engineer 88L (2)

References

TM 55-1945-225-10

Equipment Condition

Propulsion Module Dry-docked.

REMOVE RAW WATER COOLING SYSTEM BUTTERFLY (SEACHEST) VALVE

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)

WARNING



HEAVY PARTS

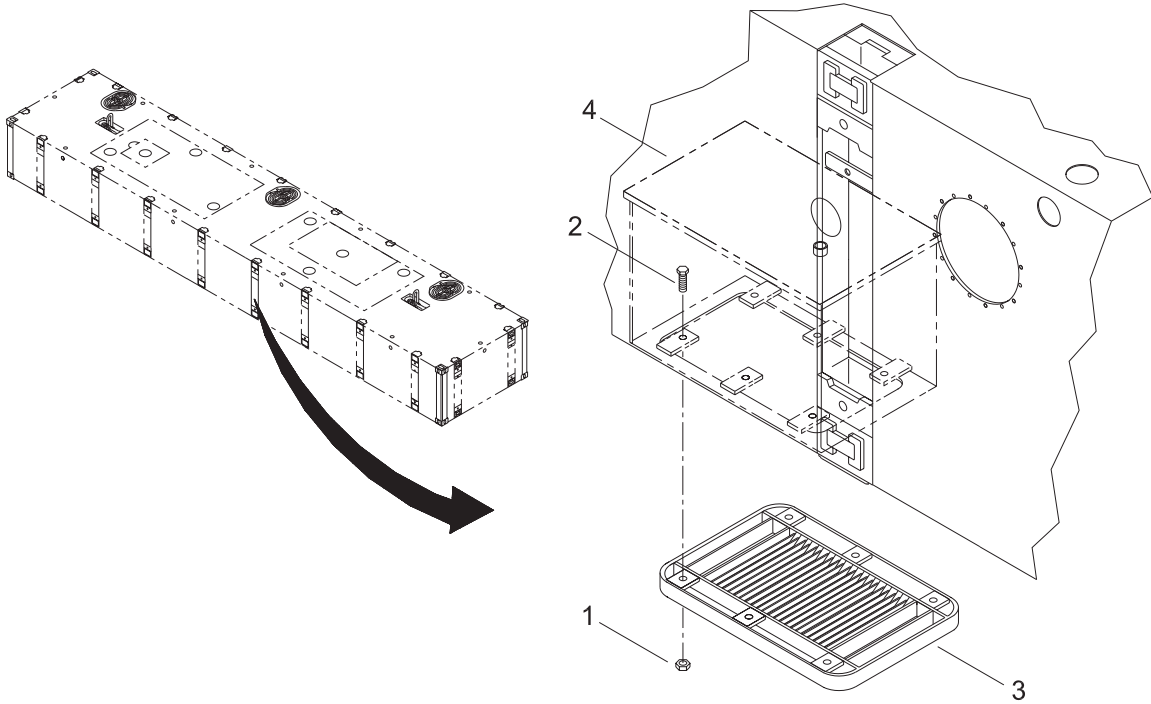
Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

NOTE

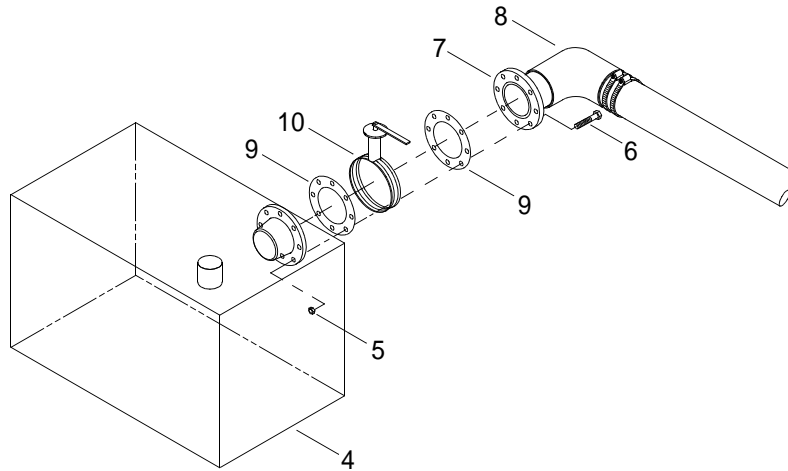
This task is typical for port or starboard propulsion modules.

2. Using crane, slings and shackles, place module on dunnage high enough off of the ground to easily access the bottom of the module.
3. Remove slings and shackles.
4. Remove six nuts (1) and bolts (2) from seachest grate (3) at bottom of seachest (4).

5. Remove seachest grate (3).



6. Remove eight nuts (5) inside seachest (4) from bolts (6).



7. Remove eight bolts (6) from threaded flange (7) and seachest (4).
8. Move threaded flange (7) and hose assembly (8) away from seachest (4).
9. Remove two flange gaskets (9) and seachest valve (10).
10. Discard two flange gaskets (9) and seachest valve (10).

INSTALL RAW WATER COOLING SYSTEM BUTTERFLY (SEACHEST) VALVE

1. Position first new flange gasket (9) against seachest (4).
2. Position new seachest valve (10) against seachest (4).
3. Position second new flange gasket (9) against seachest valve (10).
4. Position hose assembly (8) and threaded flange (7) against seachest valve (10).
5. Install eight bolts (6) through threaded flange (7) and seachest (4).
6. Install eight nuts (5) inside seachest (4) on bolts (6).
7. Tighten eight nuts (5).
8. Position seachest grate (3) under seachest (4).
9. Install six bolts (2) and nuts (1) through seachest grate (3) and seachest (4).
10. Tighten six nuts (1).
11. Perform operational check of engine cooling system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM SEACHEST ZINC ANODES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Materials/Parts

Anode, Zinc

PN E11308

Tape, Antiseize (Item 42, WP 0426 00)

Personnel Required

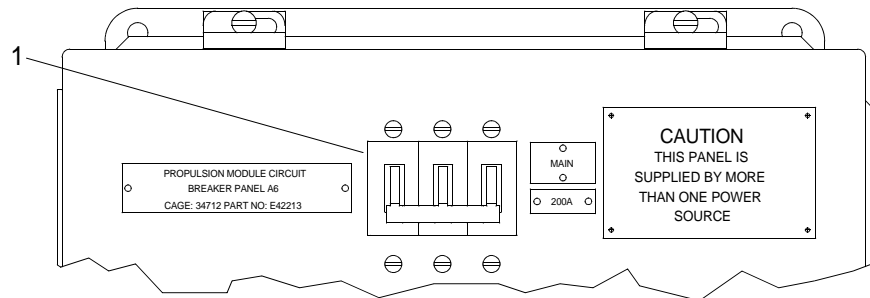
Engineer 88L

Equipment Condition

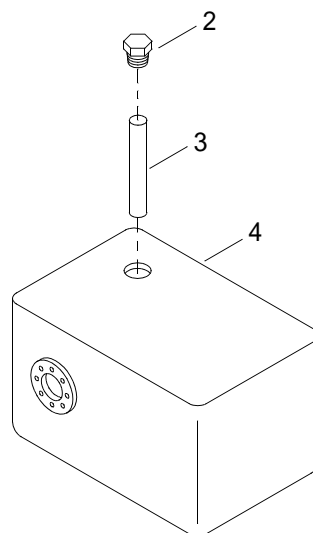
Propulsion Module Dry-docked.

REMOVE RAW WATER COOLING SYSTEM SEACHEST ZINC ANODES

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Remove support plug (2) with zinc anode (3) from seachest (4).



3. Separate old zinc anode (3) from support plug (2). Discard anode (3).

INSTALL RAW WATER COOLING SYSTEM SEACHEST ZINC ANODES

1. Install new zinc anode (3) into support plug (2).
2. Apply antiseize tape to threads of support plug (2).
3. Install support plug (2) with zinc anode (3) into seachest (4).
4. Tighten support plug (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM STRAINER BASKET
REMOVAL, CLEANING AND INSTALLATION**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Protector, Hearing (Item 20, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Engineer 88L

References

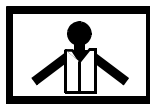
- TM 55-1945-225-10

Equipment Condition

- Engine Power Isolated. (WP 0075 00)
-

REMOVE RAW WATER COOLING SYSTEM STRAINER BASKET

WARNING



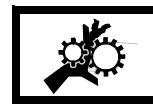
VEST



HELMET PROTECTION



HEAVY PARTS



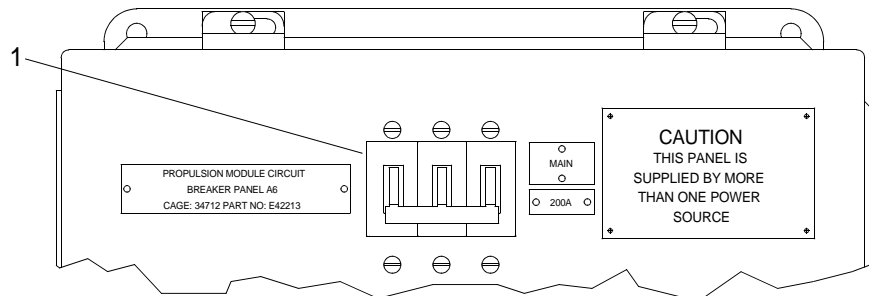
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

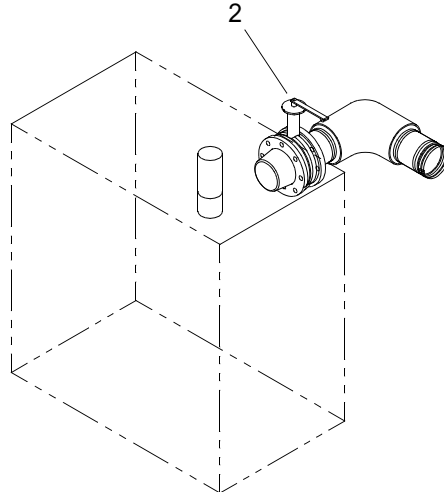
NOTE

The following procedure is typical for removal and installation of both port and starboard propulsion module duplex strainer baskets.

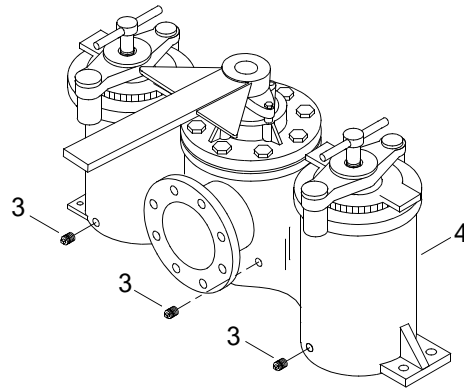
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



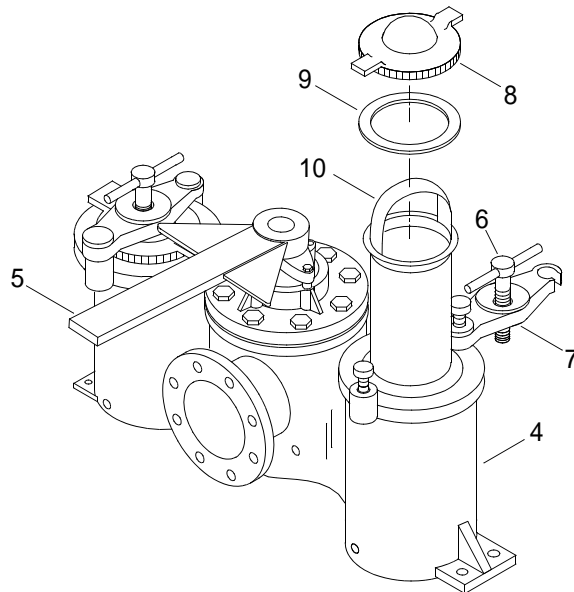
- Verify butterfly (seachest) valve (2) is closed.



- Remove three pipe plugs (3) from duplex strainer integral body (4). Allow water to drain into bilge.



- Verify duplex strainer valve (5) is closed.



- Loosen yoke handle (6).

-
6. Move yoke (7) off body cover (8).
 7. Remove body cover (8) and body cover gasket (9) from integral body (4).
 8. Remove duplex strainer basket (10) from integral body (4).

CLEAN RAW WATER COOLING SYSTEM STRAINER BASKET

1. Inspect duplex strainer basket (10) for debris and overall condition.
2. Remove debris as required.
3. Rinse duplex strainer basket (10) with clean water.

INSTALL RAW WATER COOLING SYSTEM STRAINER BASKET

1. Install duplex strainer basket (10) in integral body (4).
2. Position body cover gasket (9) on integral body (4).
3. Position body cover (8) on body cover gasket (9).
4. Position yoke (7) on body cover (8).
5. Tighten yoke handle (6).
6. Install three pipe plugs (3) in integral body (4).
7. Open butterfly (seachest) valve (2).
8. Open duplex strainer valve (5).
9. Start engine. (TM 55-1945-225-10)
10. Activate bilge pumps. (TM 55-1945-225-10)

WARNING



EAR PROTECTION

11. Check duplex strainer for leaks.
12. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM DUPLEX STRAINER
REPLACEMENT AND ADJUSTMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Protector, Hearing (Item 20, WP 0425 00)
 Crowbar (Item 4, WP 0425 00)
 Wrench, Torque (0-175 ft lbs) (Item 37, WP 0425 00)

Materials/Parts

Strainer, Duplex, 4 in.
 PN 72-48F
 Gasket, Flange
 PN E09151
 Qty 2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 1, WP 0426 00)

Personnel Required

Engineer 88L

References

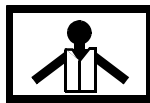
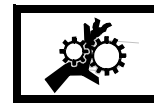
TM 55-1945-225-10

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE RAW WATER COOLING SYSTEM DUPLEX STRAINER

WARNING

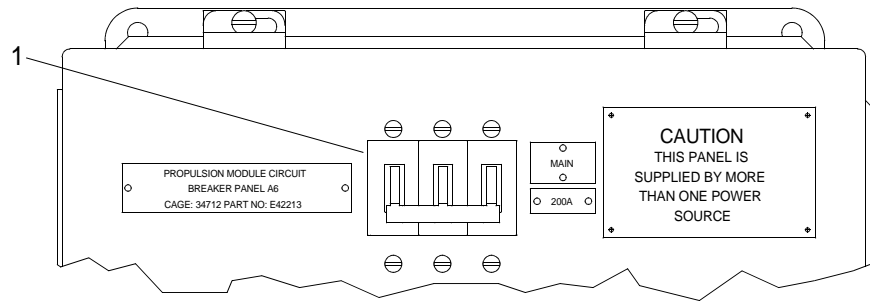
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

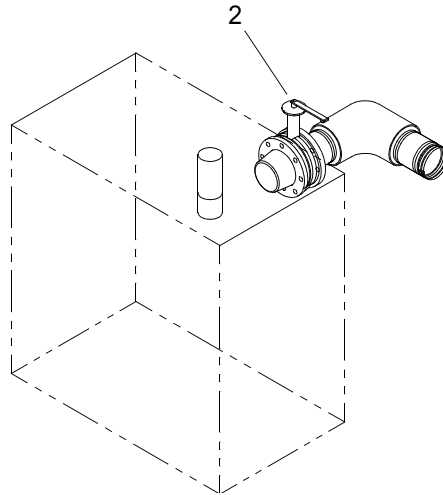
NOTE

This task is typical for both raw water duplex strainers.

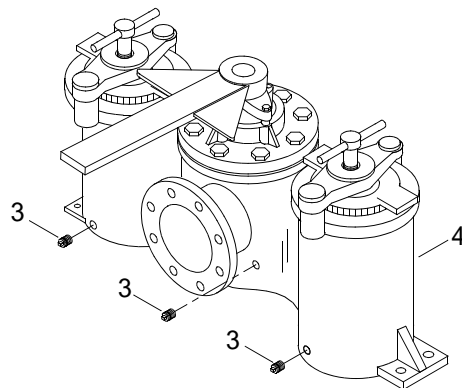
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



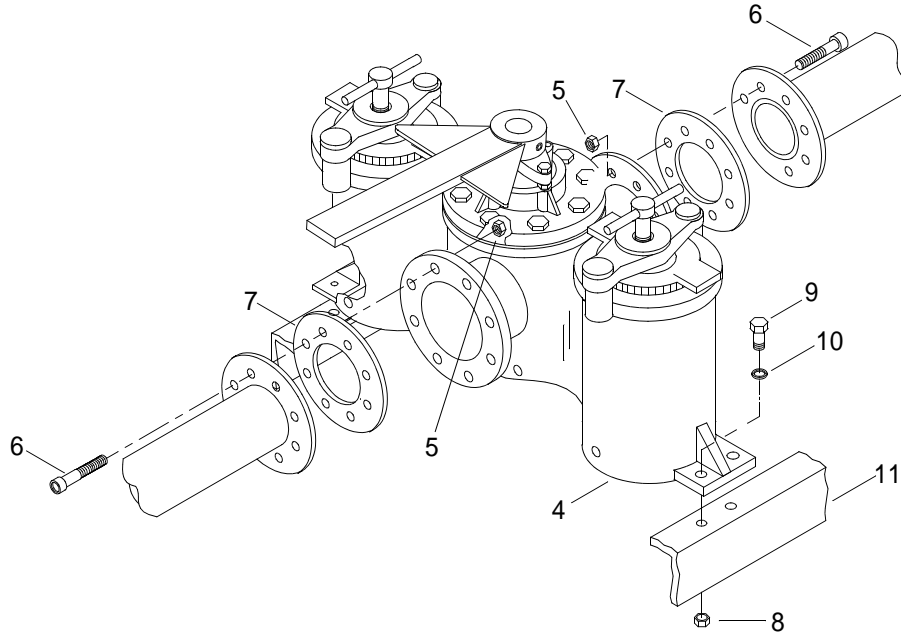
2. Verify butterfly (seachest) valve (2) is closed.



3. Remove three pipe plugs (3) from duplex strainer (4), allowing water to drain into bilge.



4. Remove 16 nuts (5) and capscrews (6) from duplex strainer (4).



5. Remove two gaskets (7) from duplex strainer (4) and discard.
6. Remove four nuts (8), capscrews (9) and washers (10) securing duplex strainer (4) to duplex strainer mounts (11).

WARNING

**HEAVY PARTS**

7. Remove duplex strainer (4) from duplex strainer mounts (11) and discard.

INSTALL RAW WATER COOLING SYSTEM DUPLEX STRAINER

WARNING

**HEAVY PARTS**

1. Position new duplex strainer (4) on duplex strainer mount (11).

WARNING

**CHEMICAL****EYE PROTECTION**

2. Apply adhesive to threads of four capscrews (9).
3. Install four washers (10), capscrews (9) and nuts (8) to secure duplex strainer (4) on duplex strainer mounts (11).
4. Using torque wrench, torque four capscrews (9) to 47 ft lbs (63.73 N-m).
5. Position two new gaskets (7) on duplex strainer (4).

WARNING

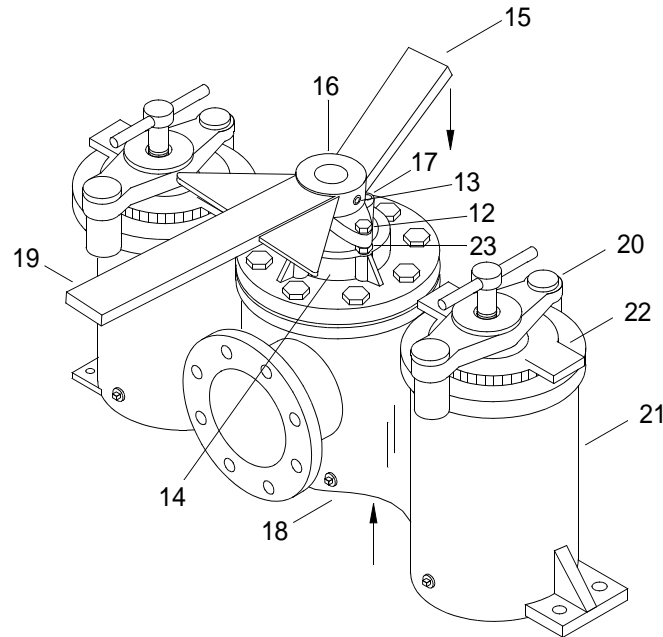
**CHEMICAL****EYE PROTECTION**

6. Apply adhesive to threads of 16 capscrews (6).
7. Install 16 capscrews (6) and nuts (5).
8. Using torque wrench, torque nuts (5) to 95 ft lbs (128.82 N-m).
9. Install three pipe plugs (3) in duplex strainer (4) and tighten.

ADJUST DUPLEX STRAINER**NOTE**

The following procedure shall be followed if valve plug requires adjustment.

1. Loosen two hex nuts (12).



2. Verify set screw (13) is tight.
3. Free valve plug (14).
 - a. Position crowbar (15) beneath valve handle hub (16) and resting on locking flange stub (17).
 - b. Apply firm downward pressure to lift valve plug (14).
 - c. Using hammer, tap the valve body (18) while lifting valve plug (14).

NOTE

If valve plug is not freed, the following step shall be performed.

- d. Using hammer, tap bottom of valve body (18) with an upward motion while lifting valve plug (14).

CAUTION

Do not force valve plug through operation cycle. Failure to comply could result in damage to equipment.

4. Adjust valve plug (14).
 - a. Evenly tighten two hex nuts (12).
 - b. Using valve handle (19), continually move valve plug (14) through cycle until resistance is felt.
 - c. Remove yoke (20) from chamber (21) not in use.
 - d. Remove chamber cover (22).
 - e. Verify that water level in chamber (21) does not rise.
 - f. Repeat steps 4a through 4e if water level in chamber (21) rises.
 - g. Install chamber cover (22).
 - h. Install yoke (20) on chamber (21) and tighten.
5. Tighten jam nuts (23).
6. Start engine. (TM 55-1945-225-10)
7. Activate bilge pumps. (TM 55-1945-225-10)

WARNING



EAR PROTECTION

8. Check duplex strainer (4) for leaks.
9. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM DUPLEX STRAINER
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gasket
 PN 72-48F-7
 Qty 2
 Gasket
 PN 72-48F-24
 Packing
 PN 72-48F-22
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

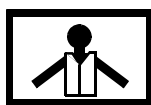
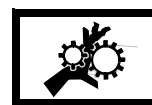
Engineer 88L

Equipment Condition

Raw Water Cooling System Duplex Strainer Removed. (WP 0105 00)

DISASSEMBLE RAW WATER COOLING SYSTEM DUPLEX STRAINER

WARNING

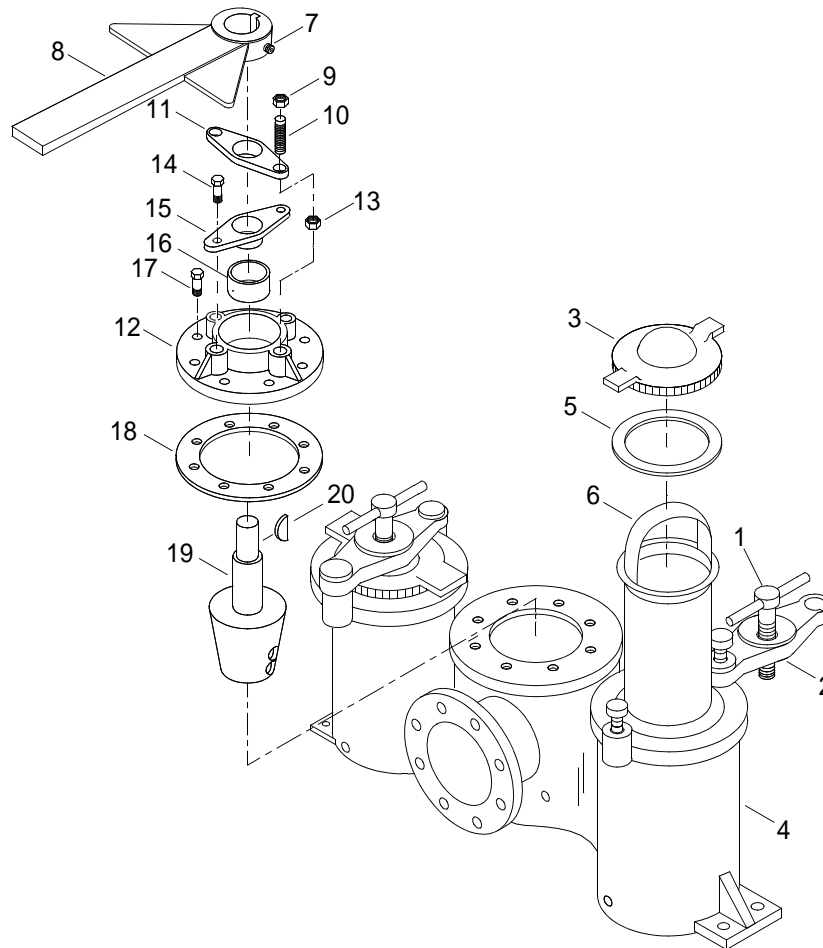
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

Repair is limited to the replacement of damaged components. The following steps are typical for repair of raw water system duplex strainers.

1. Loosen two yoke handles (1).



2. Move two yokes (2) from body covers (3).
3. Remove two body covers (3) from integral body (4).
4. Remove two gaskets (5) from integral body (4) and discard.
5. Remove two duplex strainer baskets (6) from integral body (4).
6. Loosen set screw (7) from valve handle (8).
7. Remove valve handle (8).
8. Remove two hex nuts (9) from studs (10).
9. Remove locking flange (11) from valve cover (12).
10. Remove two hex jam nuts (13) from studs (10).
11. Remove two studs (10) from valve cover (12).
12. Remove two gland cap screws (14) from valve cover (12).
13. Remove gland (15) from valve cover (12).

-
14. Remove packing (16) and discard.
 15. Remove eight valve cover capscrews (17) from valve cover (12).
 16. Remove valve cover (12) from integral body (4).
 17. Remove gasket (18) from integral body (4) and discard.
 18. Remove valve plug assembly (19) from integral body (4).
 19. Remove woodruff key (20) from valve plug assembly (19).

ASSEMBLE RAW WATER COOLING SYSTEM DUPLEX STRAINER

1. Install woodruff key (20) in valve plug assembly (19).
2. Install valve plug assembly (19) into integral body (4).
3. Position new cover gasket (18) on integral body (4).
4. Position valve cover (12) on integral body (4).
5. Install eight valve cover capscrews (17) in valve cover (12) and tighten.
6. Install new packing (16).
7. Position gland (15) on valve cover (12).
8. Install two gland capscrews (14) in valve cover (12) and tighten.
9. Install two studs (10) in valve cover (12).
10. Install two hex jam nuts (13) on studs (10).
11. Position locking flange (11) on valve cover (12).
12. Install two hex nuts (9) on studs (10).
13. Position valve handle (8).
14. Tighten set screw (7).
15. Install two duplex strainer baskets (6) in integral body (4).
16. Position two new gaskets (5) on integral body (4).
17. Position two body covers (3) on integral body (4).
18. Position two yokes (2) on body covers (3).
19. Tighten two yoke handles (1).
20. Install raw water cooling system duplex strainer. (WP 0105 00)

END OF WORK PACKAGE

UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM BUTTERFLY (SEACHEST) VALVE
TO DUPLEX STRAINER WATER HOSE
REPLACEMENT

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Protector, Hearing (Item 20, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Engineer 88L

References

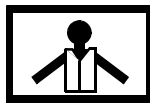
- TM 55-1945-225-10

Equipment Condition

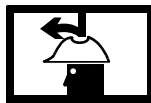
- Engine Power Isolated. (WP 0075 00)
-

REMOVE RAW WATER COOLING SYSTEM BUTTERFLY (SEACHEST) VALVE TO DUPLEX STRAINER WATER HOSE

WARNING



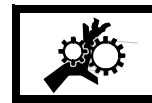
VEST



HELMET PROTECTION



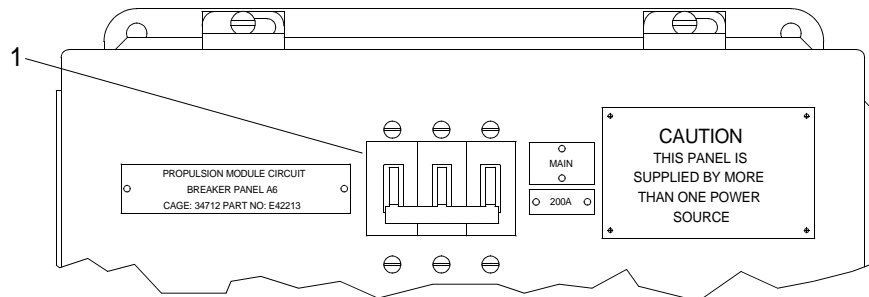
HEAVY PARTS



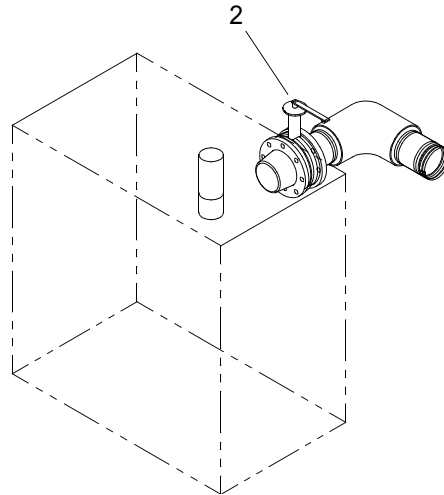
MOVING PARTS

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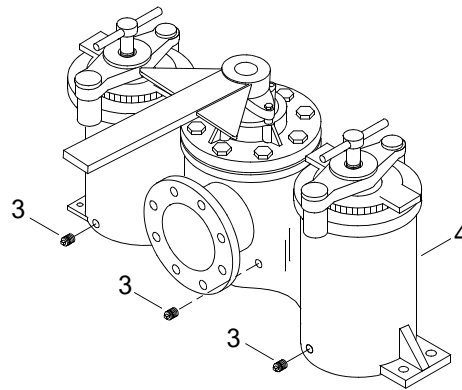
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



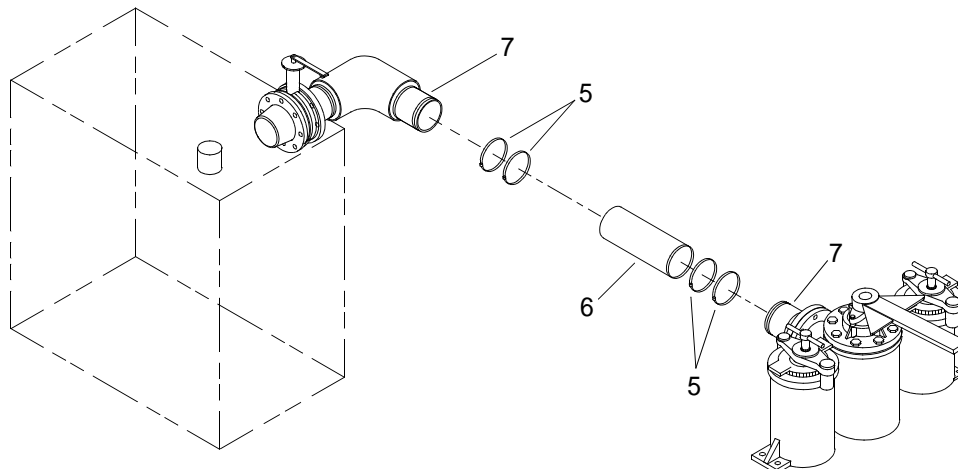
2. Verify seachest valve (2) is closed.



3. Remove three pipe plugs (3) from duplex strainer (4). Allow water to drain into bilge.



4. Remove four hose clamps (5).



5. Remove water hose (6) from two nipples (7).
6. Discard water hose (6).

INSTALL RAW WATER COOLING SYSTEM BUTTERFLY (SEACHEST) VALVE TO DUPLEX STRAINER WATER HOSE

1. Manufacture new hose (6). (WP 0413 00)
2. Install new water hose (6) onto two nipples (7).
3. Install four hose clamps (5) on water hose (6).
4. Tighten four hose clamps (5) around water hose (6).
5. Install three pipe plugs (3) into duplex strainer (4).
6. Open seachest valve (2).
7. Start engine to activate raw water pumps. (TM 55-1945-225-10)
8. Activate bilge pump. (TM 55-1945-225-10)

WARNING

**EAR PROTECTION**

9. Check water hose (6) and hose clamps (5) connections for leaks.
10. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM DUPLEX STRAINER TO
RAW WATER COOLING PUMP HOSES
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Protector, Hearing (Item 20, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Engineer 88L

References

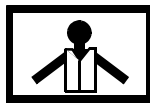
- TM 55-1945-225-10

Equipment Condition

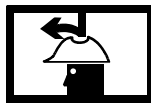
- Engine Power Isolated. (WP 0075 00)
-

REMOVE RAW WATER COOLING SYSTEM DUPLEX STRAINER TO RAW WATER COOLING PUMP HOSES

WARNING



VEST



HELMET PROTECTION



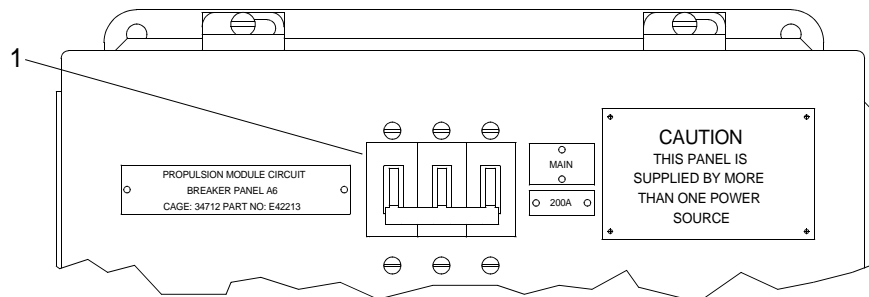
HEAVY PARTS



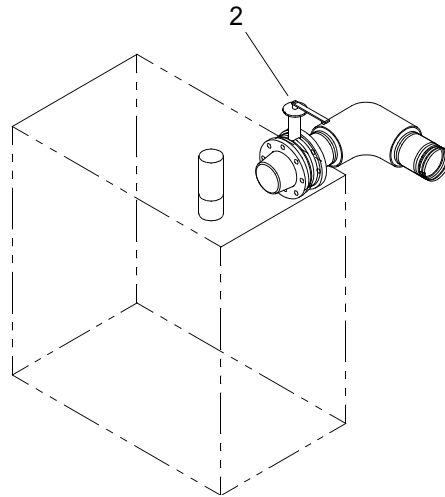
MOVING PARTS

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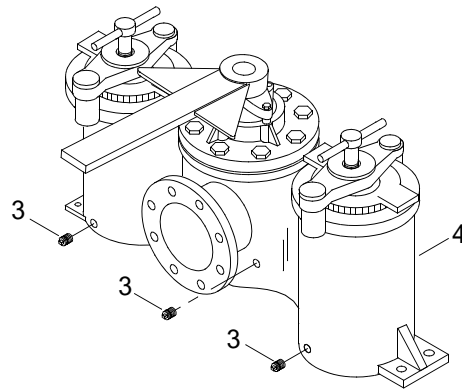
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



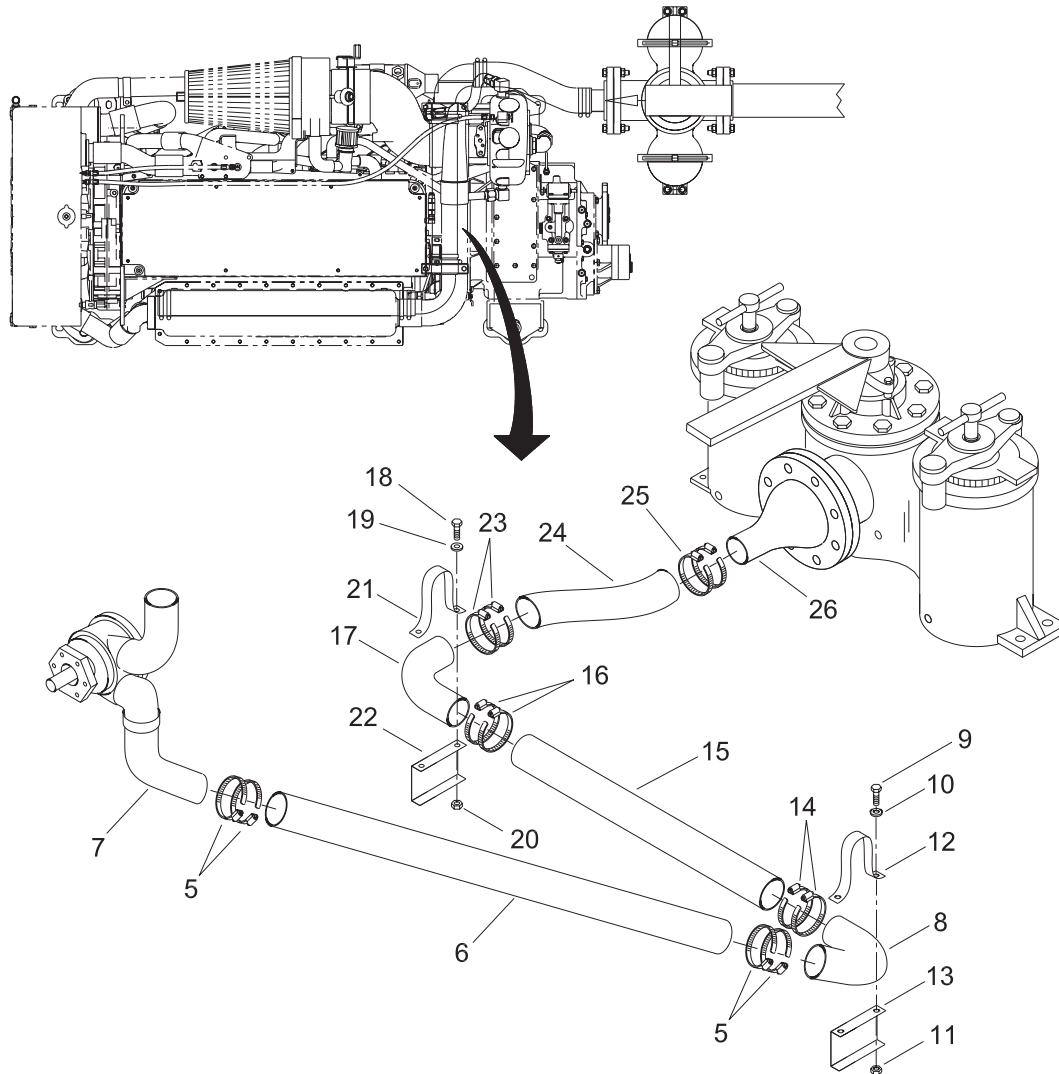
2. Verify butterfly (seachest) valve (2) is closed.



3. Remove three pipe plugs (3) from duplex strainer (4). Allow water to drain into bilge.



4. Remove four hose clamps (5) and retain.



5. Remove hose (6) from raw water pump (7) and elbow (8). Discard hose (6).
6. Remove two hex head bolts (9), lockwashers (10) and hex nuts (11) securing support clamp (12) to channel support (13).
7. Remove two hose clamps (14) from hose (15) and elbow (8) and retain hose clamps (14).
8. Remove elbow (8) from channel support (13) and retain.
9. Remove two hose clamps (16) from hose (15) and retain hose clamps (16).
10. Remove hose (15) from elbow (17). Discard hose (15).
11. Remove two hex head bolts (18), lockwashers (19) and hex nuts (20) securing support clamp (21) to channel support (22).
12. Remove two hose clamps (23) from hose (24) and retain.

-
13. Remove elbow (17) from channel support (22) and retain.
 14. Remove two hose clamps (25) from hose (24) and retain.
 15. Remove hose (24) from duplex strainer flange (26). Discard hose (24).

INSTALL RAW WATER COOLING SYSTEM DUPLEX STRAINER TO RAW WATER COOLING PUMP HOSES

1. Manufacture new hose (24). (WP 0410 00)
2. Install new hose (24) on duplex strainer flange (26).
3. Install two hose clamps (25) onto hose (24).
4. Tighten two hose clamps (25).
5. Install elbow (17) in hose (24) and on channel support (22).
6. Install two hose clamps (23) on hose (24).
7. Tighten two hose clamps (23).
8. Install two hex head bolts (18), lockwashers (19) and hex nuts (20) to secure support clamp (21) and elbow (17) to channel support (21).
9. Tighten two hex head bolts (18).
10. Manufacture new hose (15). (WP 0410 00)
11. Install new hose (15) on elbow (17).
12. Install two hose clamps (16) on hose (15).
13. Tighten two hose clamps (16).
14. Install elbow (8) in hose (15) and on channel support (13).
15. Install two hose clamps (14) on hose (15) and elbow (8).
16. Tighten two hose clamps (14).
17. Install two hex head bolts (9), lockwashers (10) and hex nuts (11) to secure support clamp (12) and elbow (8) to channel support (13).
18. Tighten two hex head bolts (9).
19. Manufacture new hose (6). (WP 0409 00)
20. Install four hose clamps (5) on hose (6).
21. Install new hose (6) between raw water pump (7) and elbow (8).
22. Tighten two hose clamps (5).

-
23. Install three pipe plugs (3) into duplex strainer (4).
 24. Open seachest valve (2).
 25. Start engine to activate raw water pump. (TM 55-1945-225-10)

WARNING



EAR PROTECTION

26. Check duplex strainer to raw water pump components for leaks.
27. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM EXHAUST/
TRANSFER CASE HEAT EXCHANGER TEE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Protector, Hearing (Item 20, WP 0425 00)

Materials/Parts

Tee, 2.5 NPT
 PN E09971
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)

Personnel Required

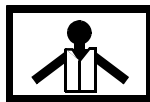
Engineer 88L

Equipment Condition

Raw Water Cooling System Exhaust Shutoff Valve Removed. (WP 0111 00)
 Engine Power Isolated. (WP 0075 00)

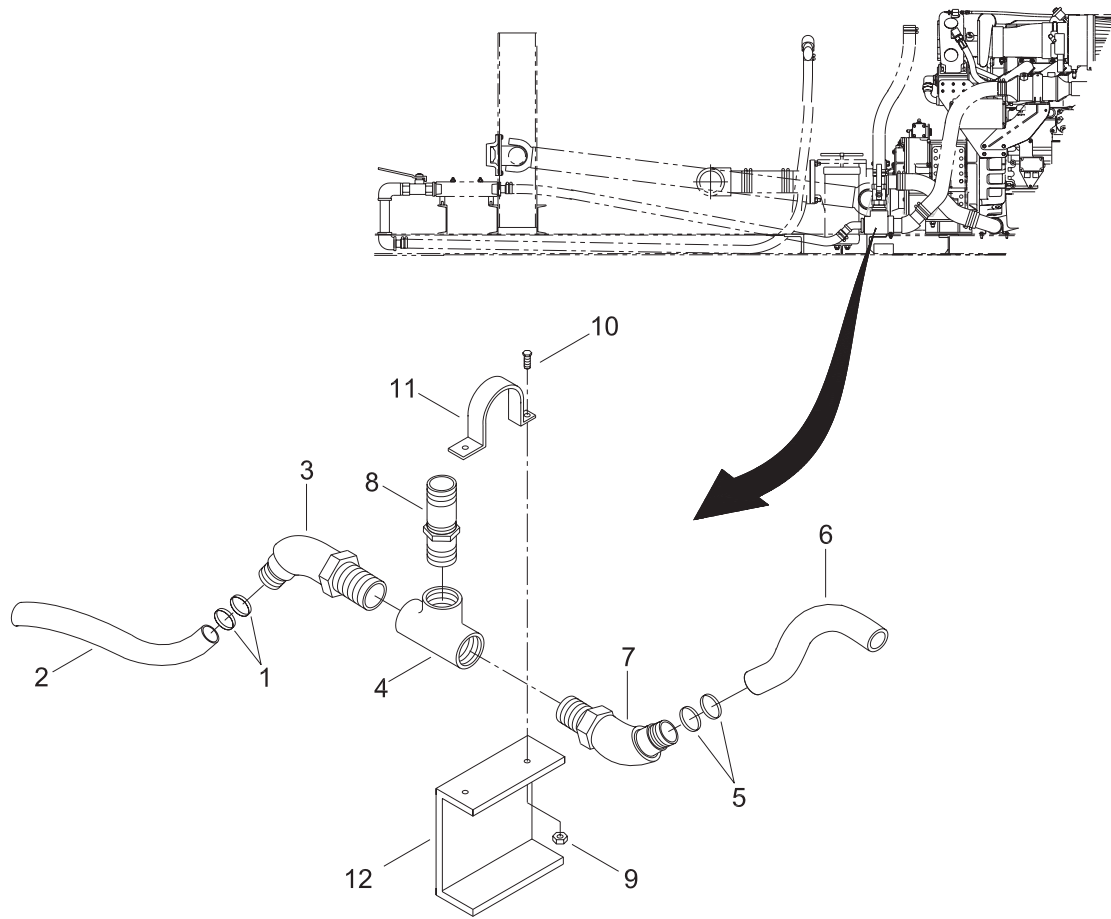
REMOVE RAW WATER COOLING SYSTEM EXHAUST/TRANSFER CASE HEAT EXCHANGER TEE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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1. Loosen two hose clamps (1) and slide over hose (2).



2. Remove hose (2) from nipple (3).
3. Remove nipple (3) from tee (4).
4. Loosen two hose clamps (5) and slide over hose (6).
5. Remove hose (6) from nipple (7).
6. Remove nipple (7) from tee (4).
7. Remove nipple (8) from tee (4).
8. Remove two hex head cap screws (9), hex nuts (10) and support clamp (11) securing tee (4) to channel support (12).
9. Discard tee (4).

INSTALL RAW WATER COOLING SYSTEM EXHAUST/TRANSFER CASE HEAT EXCHANGER TEE

1. Position new tee (4) on channel support (12).

WARNING

**CHEMICAL****EYE PROTECTION**

2. Apply adhesive to threads of two hex head capscrews (9).
3. Install two hex head capscrews (9), hex nuts (10) and support clamp (11) to secure tee (4) to channel support (12).
4. Tighten two hex head capscrews (9) and hex nuts (10).

WARNING

**CHEMICAL****EYE PROTECTION**

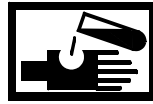
5. Apply sealing compound to threads on nipple (8).
6. Install nipple (8) in tee (4).

WARNING

**CHEMICAL****EYE PROTECTION**

7. Apply sealing compound to threads on nipple (7).
8. Install nipple (7) in tee (4).
9. Install hose (6) on nipple (8).
10. Slide two hose clamps (5) over hose (6).
11. Tighten hose clamps (5).

WARNING

**CHEMICAL****EYE PROTECTION**

12. Apply sealing compound to threads on nipple (3).
13. Install nipple (3) in tee (4).
14. Install hose (2) on nipple (3).
15. Slide two hose clamps (1) over hose (2).
16. Tighten hose clamps (1).
17. Install raw water exhaust shutoff valve. (WP 0111 00)
18. Start engine to activate raw water pump. (TM 55-1945-225-10)

WARNING

**EAR PROTECTION**

19. Check new tee (4) for leaks.
20. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING EXHAUST/TRANSFER CASE HEAT EXCHANGER TEE
TO MARINE GEAR HEAT EXCHANGER WATER HOSE
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Protector, Hearing (Item 20, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Engineer 88L

References

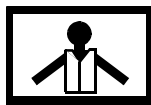
- TM 55-1945-225-10

Equipment Condition

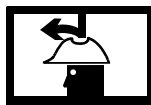
- Engine Power Isolated. (WP 0075 00)
-

REMOVE RAW WATER COOLING EXHAUST/TRANSFER CASE HEAT EXCHANGER TEE TO MARINE GEAR HEAT EXCHANGER WATER HOSE

WARNING



VEST



HELMET PROTECTION



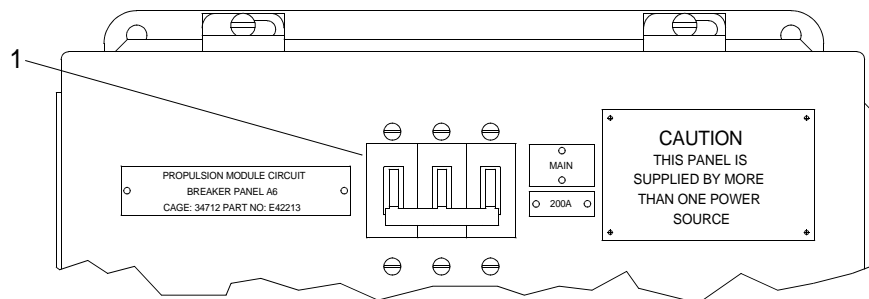
HEAVY PARTS



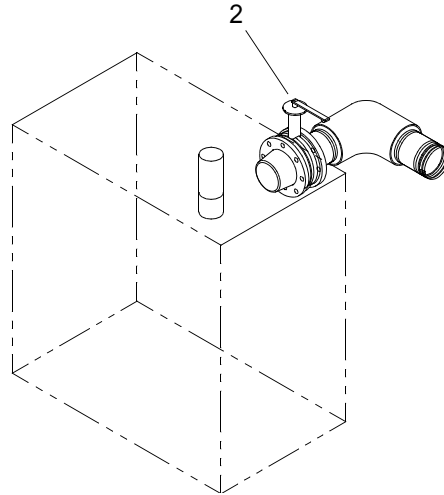
MOVING PARTS

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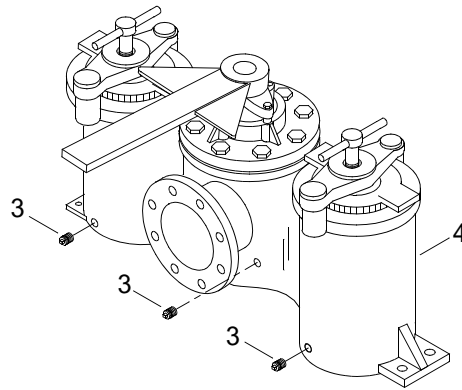
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



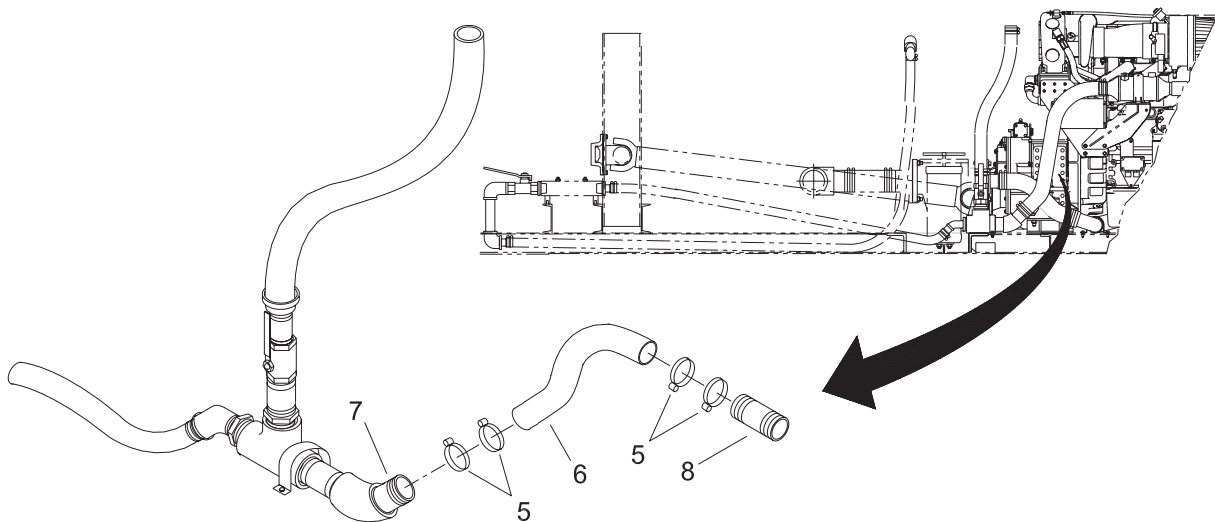
2. Verify butterfly (seachest) valve (2) is closed.



3. Remove three pipe plugs (3) from duplex strainer (4). Allow water to drain into bilge.



4. Remove four hose clamps (5) and retain.



5. Remove water hose (6) from nipple (7) and marine gear heat exchanger nipple (8).
6. Discard water hose (6).

INSTALL RAW WATER COOLING EXHAUST/TRANSFER CASE HEAT EXCHANGER TEE TO MARINE GEAR HEAT EXCHANGER WATER HOSE

1. Manufacture new hose (6). (WP 0408 00)
2. Install new hose (6) onto nipple (7) and marine gear heat exchanger nipple (8).
3. Install four hose clamps (5) on hose (6).
4. Tighten four hose clamps (5) on hose (6).
5. Install three pipe plugs (3) into duplex strainer (4).
6. Open butterfly (seachest) valve (2).
7. Start engine. (TM 55-1945-225-10)
8. Activate bilge pumps. (TM 55-1945-225-10)

WARNING

**EAR PROTECTION**

9. Check new hose (6) for leaks.
10. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM EXHAUST SHUTOFF BALL VALVE
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Protector, Hearing (Item 20, WP 0425 00)
- Wrench, Pipe (Item 4, WP 0425 00)

Materials/Parts

- Valve, Ball, 2 in.
PN E09528
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Sealing Compound (Item 34, WP 0426 00)

Personnel Required

- Engineer 88L

References

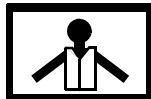
- TM 55-1945-225-10

Equipment Condition

- Engine Power Isolated. (WP 0075 00)

REMOVE RAW WATER COOLING SYSTEM EXHAUST SHUTOFF BALL VALVE

WARNING



VEST



HELMET PROTECTION



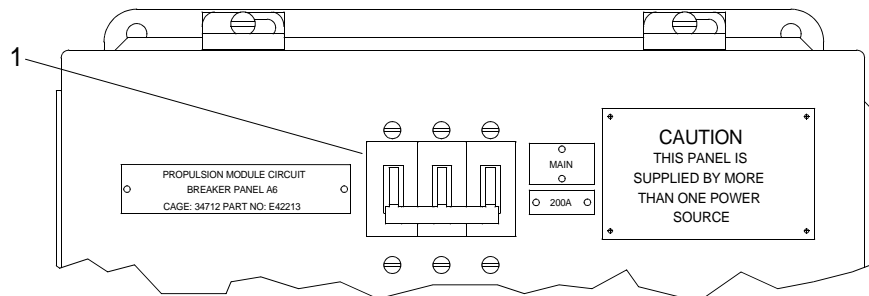
HEAVY PARTS



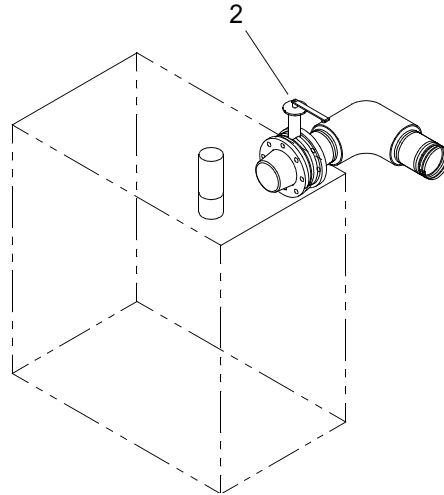
MOVING PARTS

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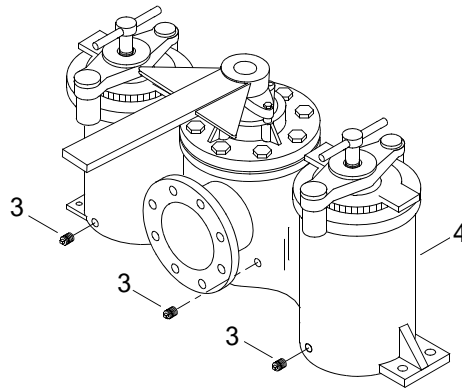
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



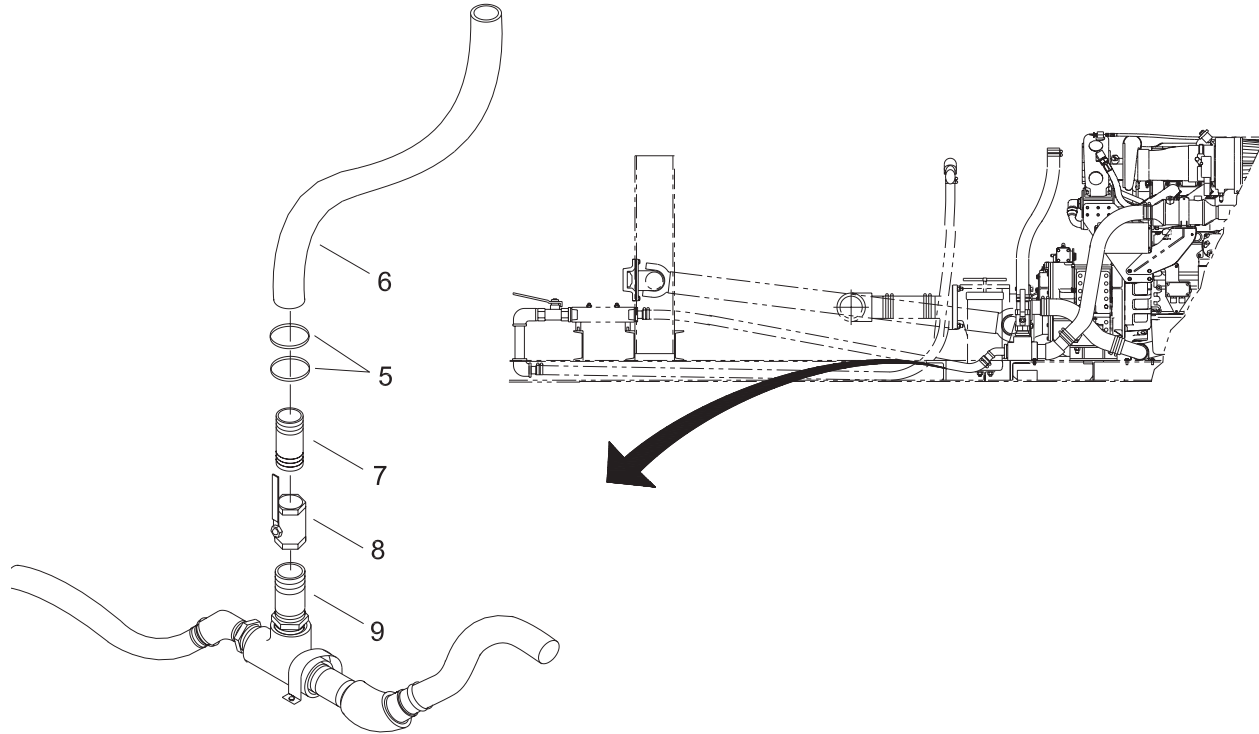
2. Verify butterfly (seachest) valve (2) is closed.



3. Remove three pipe plugs (3) from duplex strainer (4). Allow water to drain into bilge.



- Loosen two hose clamps (5) and slide over hose (6).



- Remove hose (6) from nipple (7).
- Using pipe wrench, remove nipple (7) from ball valve (8).
- Remove ball valve (8) from nipple (9).
- Discard ball valve (8).

INSTALL RAW WATER COOLING SYSTEM EXHAUST SHUTOFF BALL VALVE

WARNING



CHEMICAL



EYE PROTECTION

- Apply sealing compound to threads on ball valve (8).
- Using pipe wrench, install new ball valve (8) on nipple (9).
- Tighten ball valve (8) on nipple (9).

WARNING

**CHEMICAL****EYE PROTECTION**

4. Apply sealing compound to threads on nipple (7).
5. Using pipe wrench, install nipple (7) in ball valve (8).
6. Tighten nipple (7) on ball valve (8).
7. Install hose (6) on nipple (7).
8. Slide two hose clamps (5) over hose (6).
9. Tighten two hose clamps (5) on hose (6).
10. Install three pipe plugs (3) into duplex strainer (4).
11. Open butterfly (seachest) valve (2).
12. Start engine. (TM 55-1945-225-10)
13. Activate bilge pumps. (TM 55-1945-225-10)

WARNING

**EAR PROTECTION**

14. Check new ball valve (8) for leaks.
15. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM EXHAUST/TRANSFER CASE HEAT EXCHANGER
TEE TO TRANSFER CASE HEAT EXCHANGER WATER HOSE
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Protector, Hearing (Item 20, WP 0425 00)

Materials/Parts

- Hose, 1.50 I.D.
PN E13208-6
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Engineer 88L

References

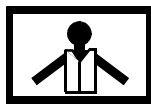
- TM 55-1945-225-10

Equipment Condition

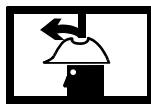
- Engine Power Isolated. (WP 0075 00)
-

REMOVE RAW WATER COOLING SYSTEM EXHAUST/TRANSFER CASE HEAT EXCHANGER TEE TO TRANSFER CASE HEAT EXCHANGER WATER HOSE

WARNING



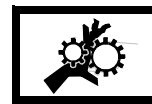
VEST



HELMET PROTECTION



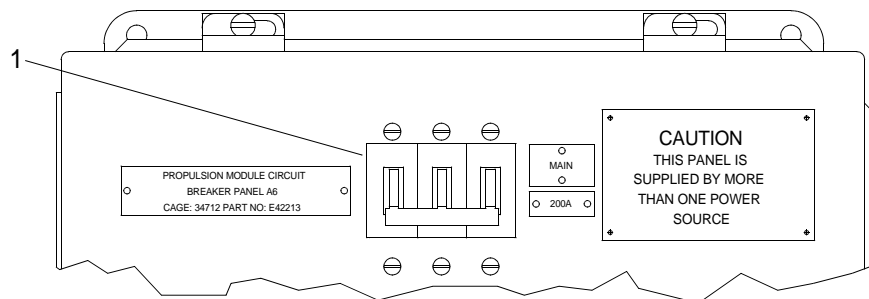
HEAVY PARTS



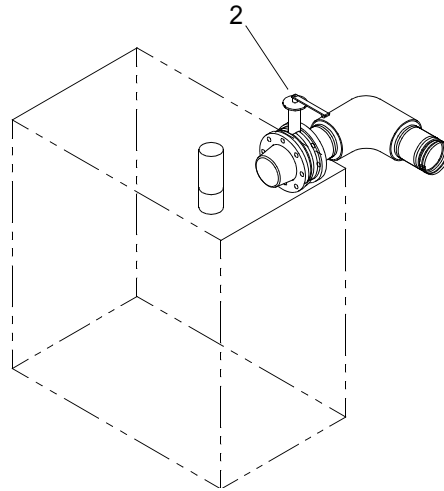
MOVING PARTS

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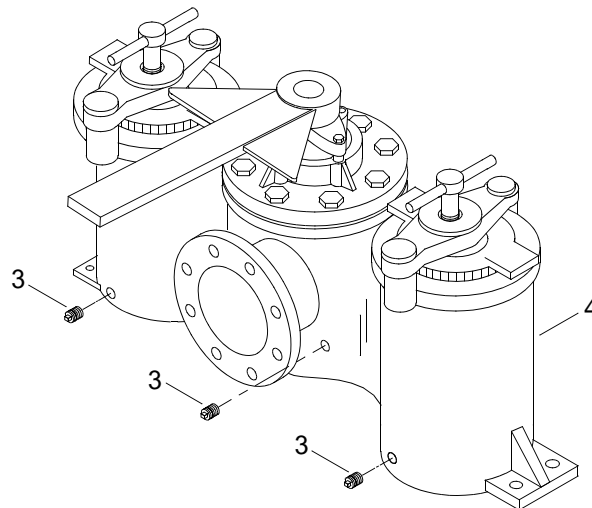
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



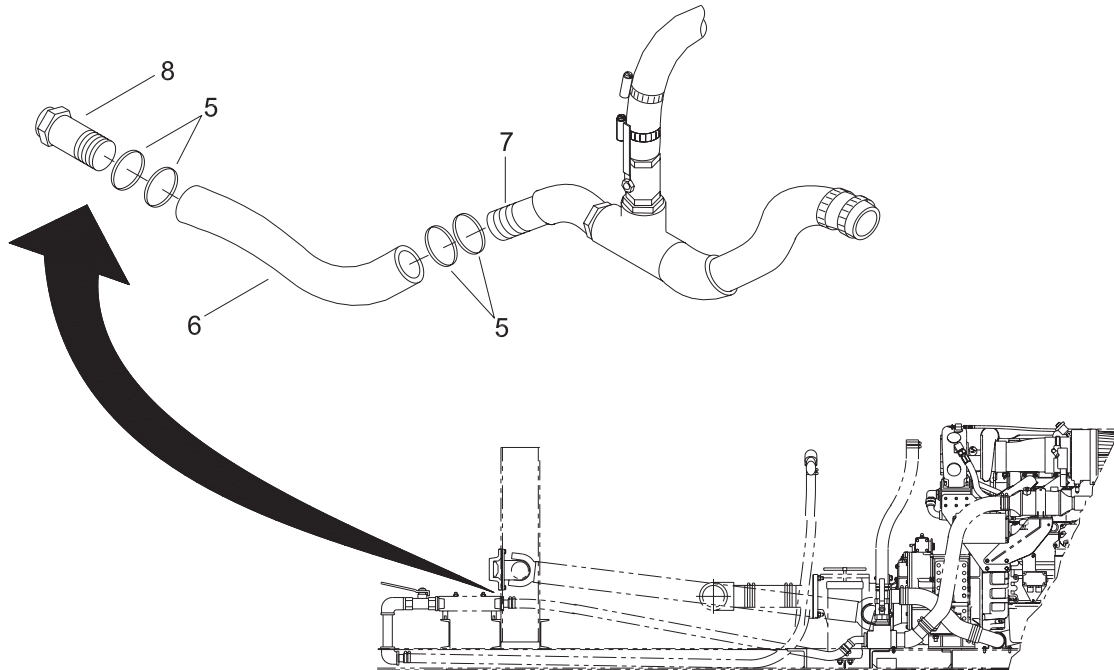
2. Verify butterfly (seachest) valve (2) is closed.



3. Remove three pipe plugs (3) from duplex strainer (4). Allow water to drain into bilge.



4. Remove four hose clamps (5).



5. Remove water hose (6) from nipple (7) and transfer heat exchanger nipple (8).
6. Discard water hose (6).

INSTALL RAW WATER COOLING SYSTEM EXHAUST/TRANSFER CASE HEAT EXCHANGER TEE TO TRANSFER CASE HEAT EXCHANGER WATER HOSE

1. Manufacture new hose (6). (WP 0411 00)
2. Install new water hose (6) onto nipple (7) and transfer case heat exchanger (8).
3. Install four hose clamps (5) on water hose (6).
4. Tighten four hose clamps (5) around water hose (6).
5. Install three pipe plugs (3) into duplex strainer (4).
6. Open butterfly (seachest) valve (2).
7. Start engine. (TM 55-1945-225-10)
8. Activate bilge pumps. (TM 55-1945-225-10)

WARNING



EAR PROTECTION

9. Check new water hose (6) for leaks.
10. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RAW WATER COOLING SYSTEM TRANSFER CASE HEAT
EXCHANGER TO OVERBOARD DISCHARGE WATER HOSE
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Protector, Hearing (Item 20, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Engineer 88L

References

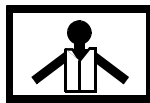
- TM 55-1945-225-10

Equipment Condition

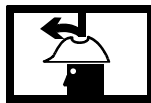
- Engine Power Isolated. (WP 0075 00)
-

REMOVE RAW WATER COOLING SYSTEM TRANSFER CASE HEAT EXCHANGER TO OVERBOARD DISCHARGE WATER HOSE

WARNING



VEST



HELMET PROTECTION



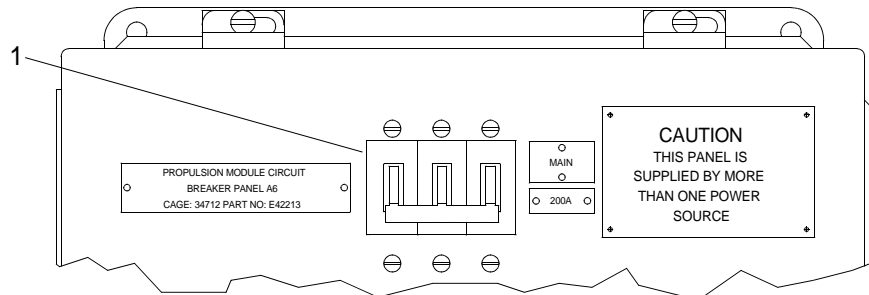
HEAVY PARTS



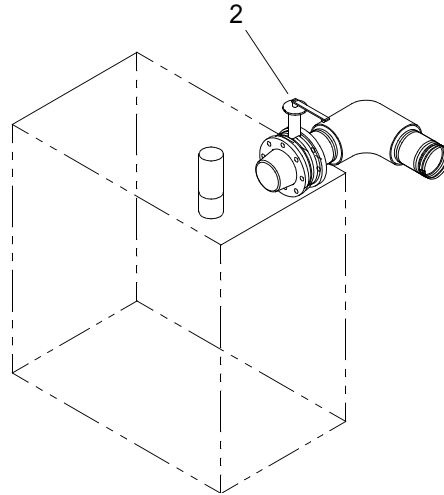
MOVING PARTS

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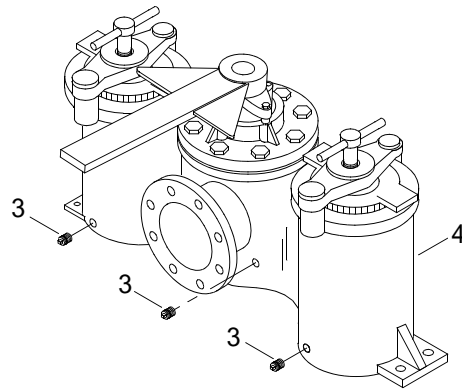
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



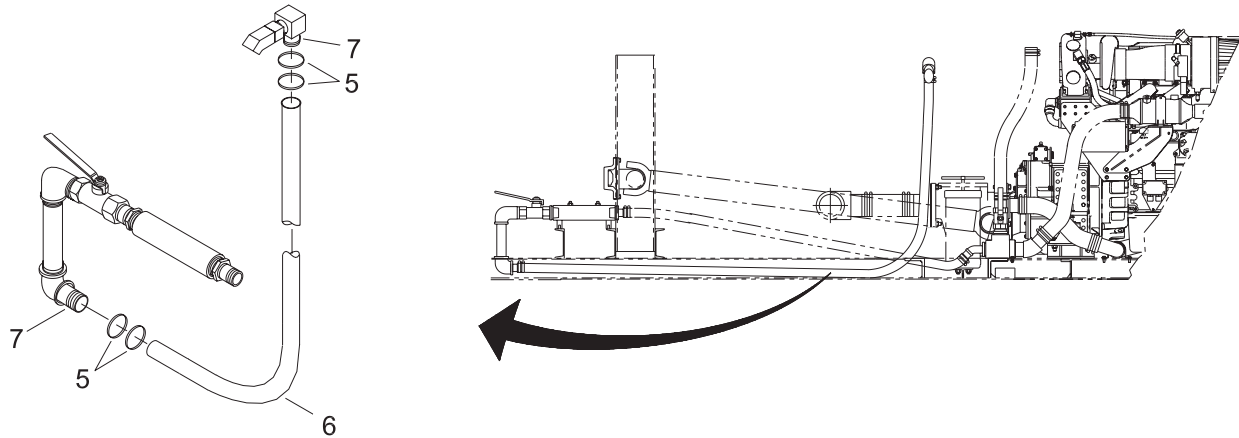
2. Verify the butterfly (seachest) valve (2) is closed.



3. Remove three pipe plugs (3) from duplex strainer (4). Allow water to drain into bilge.



4. Remove four hose clamps (5) and retain.



5. Remove water hose (6) from two nipples (7).
6. Discard water hose (6).

**INSTALL RAW WATER COOLING SYSTEM TRANSFER CASE HEAT EXCHANGER
TO OVERBOARD DISCHARGE WATER HOSE**

1. Manufacture hose (6). (WP 0411 00)
2. Install new water hose (6) onto two nipples (7).
3. Install four hose clamps (5) on water hose (6).
4. Tighten four hose clamps (5) on water hose (6).
5. Install three pipe plugs (3) into duplex strainer (4).
6. Open seachest valve (2).
7. Start engine to activate raw water pump. (TM 55-1945-225-10)
8. Activate bilge pump. (TM 55-1945-225-10)

WARNING

**EAR PROTECTION**

9. Check heat exchanger to overboard discharge water hose (6) and connections (5) for leaks.
10. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
DRIVE TRAIN TRANSFER CASE TO
PUMP-JET MACHINERY GUARD
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

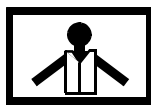
- Engineer 88L (2)

Equipment Condition

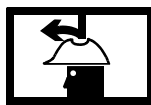
- Engine Power Isolated. (WP 0075 00)
-

REMOVE DRIVE TRAIN TRANSFER CASE TO PUMP-JET MACHINERY GUARD

WARNING



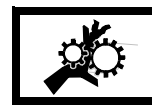
VEST



HELMET PROTECTION



HEAVY PARTS



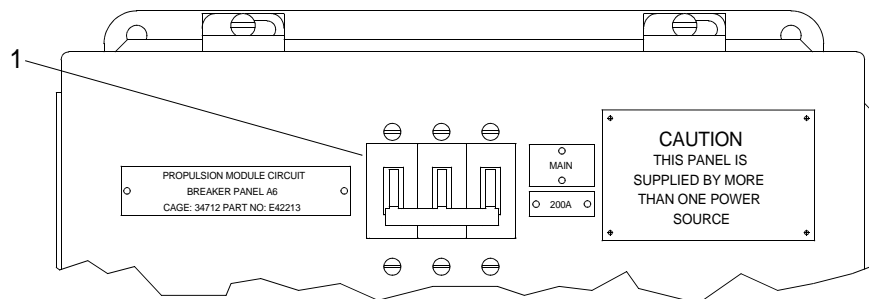
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

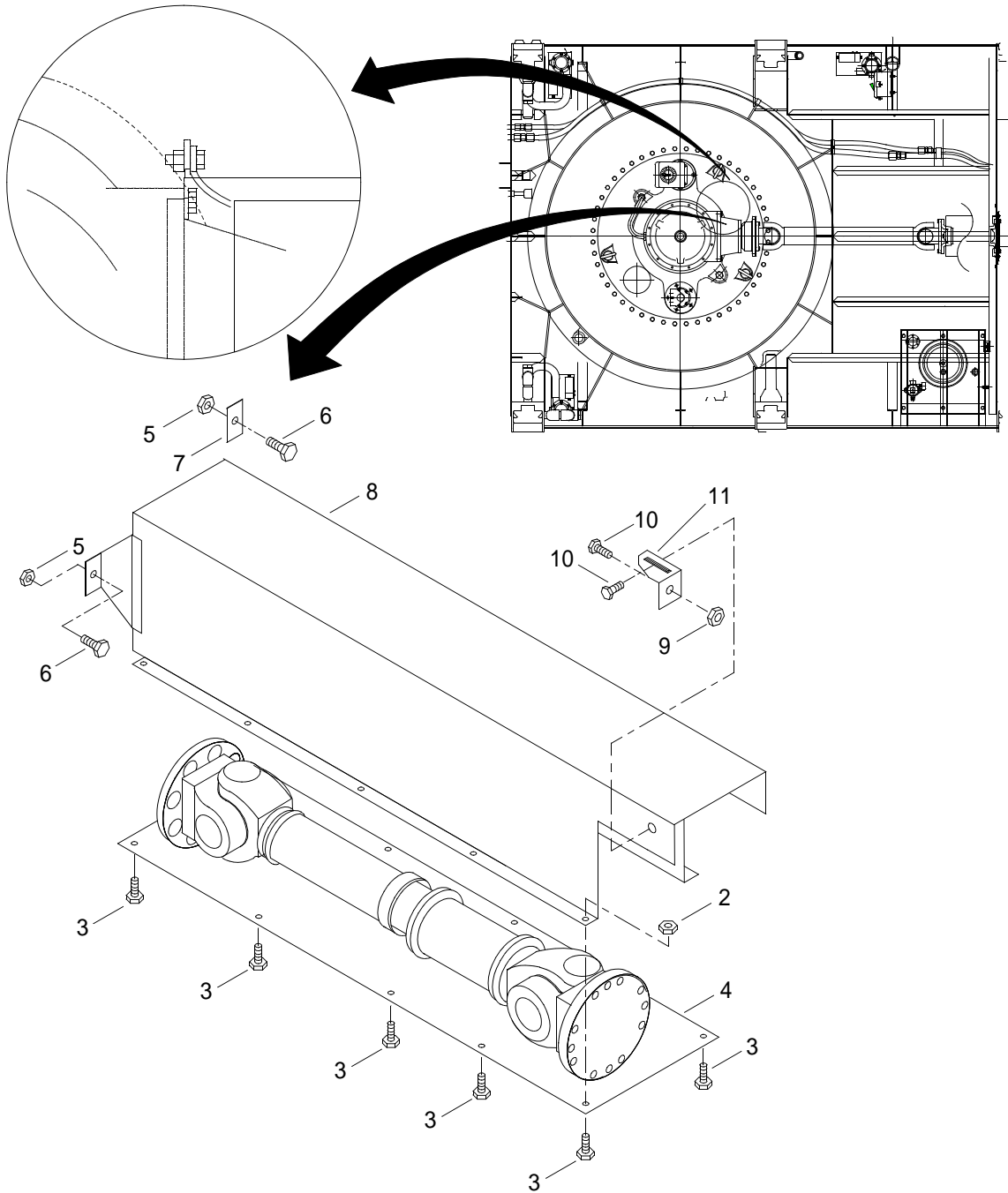
The following procedure is typical for removal and installation of transfer case to pump-jet machinery guard on both port and starboard propulsion modules.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Loosen and remove ten hex nuts (2) and hex head capscrews (3) to free cover guard (4).

3. Loosen and remove two self-locking hex nuts (5) and hex head capscrews (6) from mounting plate (7).



WARNING



HEAVY OBJECTS

4. With aid of assistant, support machinery guard (8).

-
5. Remove four self-locking hex nuts (9) and four hex head capscrews (10) from machine guard bracket (11).

WARNING



HEAVY OBJECTS

6. Remove machinery guard (8).

INSTALL DRIVE TRAIN TRANSFER CASE TO PUMP-JET MACHINERY GUARD

WARNING



HEAVY OBJECTS

1. With aid of assistant, position machinery guard (8) over drive shaft, between pump-jet and transfer case.
2. Secure machinery guard (8) to machine guard bracket (11) using four self-locking hex nuts (9) and hex head capscrews (10).
3. Secure machinery guard (8) to mount plate (7) using two self-locking hex nuts (5) and hex head capscrews (6).

WARNING



HEAVY OBJECTS

4. Position cover guard (4) and secure to machinery guard (8) using ten hex nuts (3) and hex head capscrews (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
DRIVE TRAIN MARINE GEAR TO
TRANSFER CASE MACHINERY GUARDS
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

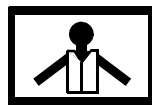
- Engineer 88L (2)

Equipment Condition

- Engine Power Isolated. (WP 0075 00)
-

REMOVE DRIVE TRAIN MARINE GEAR TO TRANSFER CASE MACHINERY GUARDS

WARNING



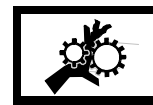
VEST



HELMET PROTECTION



HEAVY PARTS



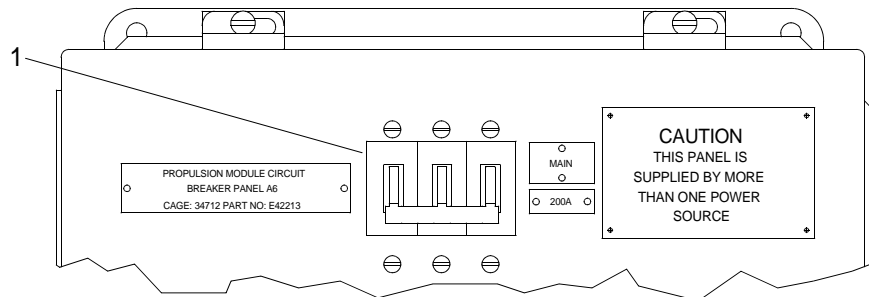
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of marine gear to transfer case machinery guards on both port and starboard propulsion modules.

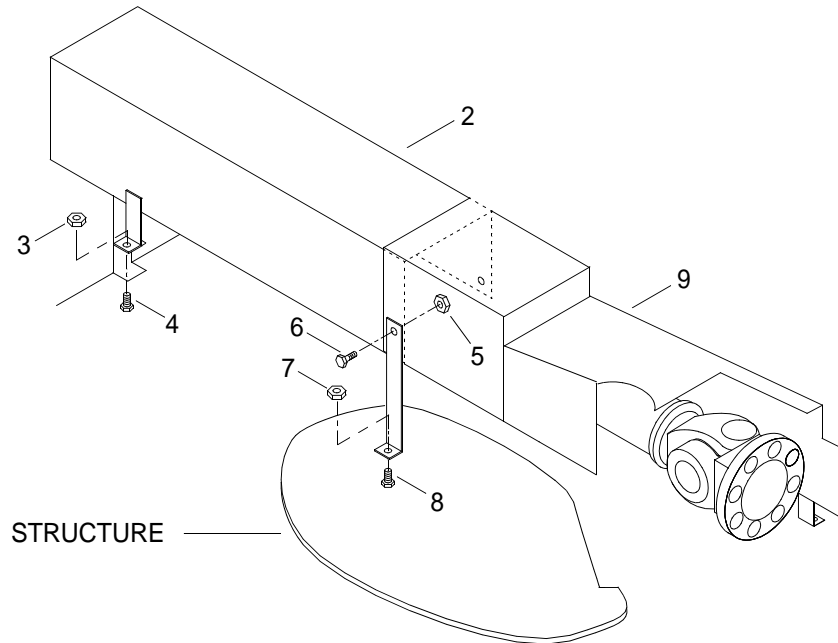
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

**HEAVY OBJECTS**

2. With assistant supporting upper machinery guard (2), remove two hex nuts (3) from tack-welded capscrews (4) at base of guard (2).



3. Remove two hex nuts (5) and two capscrews (6) to free upper machinery guard (2).

WARNING

**HEAVY OBJECTS**

4. Remove four hex nuts (7) from four tack-welded capscrews (8) to free lower machinery guard (9).

INSTALL DRIVE TRAIN MARINE GEAR TO TRANSFER CASE MACHINERY GUARDS

WARNING

**HEAVY OBJECTS**

1. Using tack-welded capscrews (8) as guides, lower machinery guard (9) down to deck.
2. Secure lower machinery guard (9) to deck with four hex nuts (7).

WARNING

**HEAVY OBJECTS**

3. With aid of assistant, position upper machinery guard (2) overlapping lower machinery guard (9), aligning two holes in engine side of upper guard with two holes in lower machinery guard (9).
4. Secure both upper and lower guards at location near middle of drive shaft using two capscrews (6) and two hex nuts (5).
5. Secure top of upper machinery guard (2) with two hex nuts (3) on tack-welded capscrews (4) at base of guard (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
DRIVE TRAIN DRIVE SHAFTS
INSPECTION AND SERVICING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Lubricating Gun, Hand (Item 18, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Grease, Automotive and Artillery (Item 12, WP 0426 00)

Personnel Required

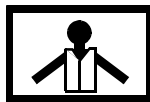
Engineer 88L

Equipment Condition

Drive Train Transfer Case To Pump-Jet Machinery Guard Removed. (WP 0114 00)
 Drive Train Marine Gear To Transfer Case Machinery Guard Removed. (WP 0115 00)

INSPECT DRIVE TRAIN DRIVE SHAFTS

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for both drive shafts in both port and starboard propulsion modules.

1. Check bolts and mating flanges (1) for tightness and correct seating.

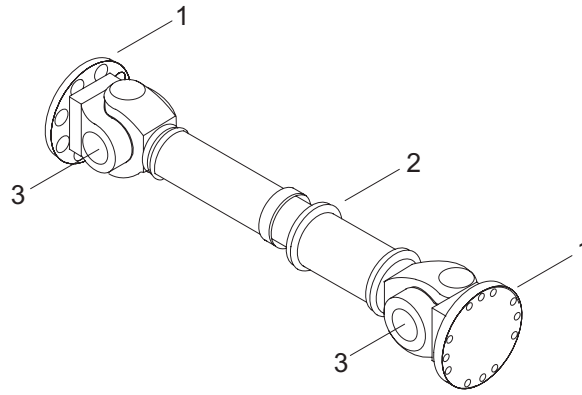


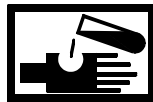
Table 1. Torque Values for Driveshafts

TORQUE	EQUIPMENT NOMENCLATURE
55 ft lb	Transfer Case Flanges
280 ft lb	Marine Gear Flange
330 ft lb	Pump-Jet Flange

2. Ensure even tightening of bolts; any loose bolts should be tightened in sequence, alternating sides and moving around flange in only one direction.
3. Check for play in slip spline (2) and cross and bearing (3) and before regreasing. If any looseness or play is felt, shaft must be replaced. (WP 0117 00, WP 0118 00)

SERVICE DRIVE TRAIN DRIVE SHAFTS

WARNING



CHEMICAL



EYE PROTECTION

1. Using lubricating gun and grease, lubricate bearing assemblies (3) until clean grease appears at all journal cross bearing seals.
2. If all journal cross bearing seals do not purge when being lubed, tap on yoke lugs with a soft faced hammer while applying pressure to lubrication fitting.
3. Install drive train marine gear to transfer case machinery guard. (WP 0115 00)
4. Install drive train transfer case to pump-jet machinery guard. (WP 0114 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MARINE GEAR TO TRANSFER CASE DRIVE TRAIN DRIVE SHAFT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Item 2, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Brush, Wire Scratch (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Wrench, Torque (0-175 ft lbs) (Item 37, WP 0425 00)

Materials/Parts

Drive Shaft
 PN 456795-73
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L (2)

References

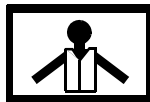
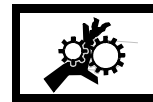
TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Removed. (WP 0350 00)
 Powered Section Operators Cab Removed. (WP 0095 00)
 Powered Section Intake Plenum Removed. (WP 0080 00)
 Powered Section Engine Hatch Removed. (WP 0098 00)
 Drive Train Marine Gear To Transfer Case Machinery Guard Removed. (WP 0115 00)
 Powered Section Engine Exhaust Muffler Removed. (WP 0168 00)

REMOVE MARINE GEAR TO TRANSFER CASE DRIVE TRAIN DRIVE SHAFT

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

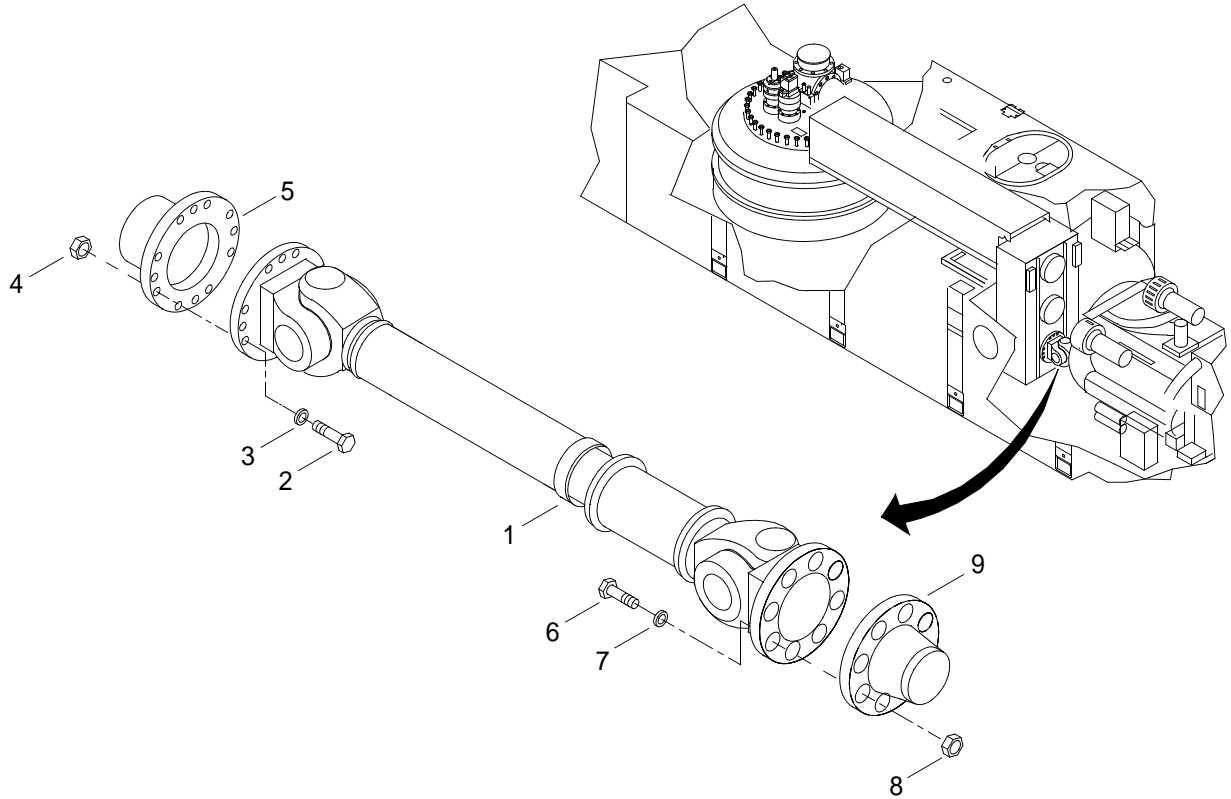
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for both port and starboard marine gear to transfer case drive train shafts.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)

2. Support marine gear to transfer case drive shaft (1) with a sling attached to crane.



WARNING

**HEAVY PARTS**

3. Remove capscrews (2), lockwashers (3) and hex nuts (4) securing shaft (1) to transfer case flange (5).

WARNING

**HEAVY PARTS**

4. Remove capscrews (6), lockwashers (7) and hex nuts (8) securing shaft (1) to marine gear flange (9).

 WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- Using crane and sling, lift marine gear to transfer case drive shaft (1) through engine hatch deck opening.

INSTALL MARINE GEAR TO TRANSFER CASE DRIVE TRAIN DRIVE SHAFT

 WARNING



EYE PROTECTION

- Clean all mounting surfaces with a wire brush to ensure residual adhesive, rust inhibitor, dirt or grease is removed.

 WARNING



HEAVY PARTS

- Support marine gear to transfer case drive shaft (1) with sling attached to crane.

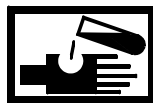
 WARNING



HEAVY PARTS

- Guide shaft (1) through engine hatch deck opening and lower below deck.
- Position shaft (1) against marine gear flange (9) so orientation arrows on shaft (1) and marine gear flange (9) face each other.

 WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to capscrews (6).

-
6. Install capscrews (6), lockwashers (7) and hex nuts (8) to secure shaft (1) to marine gear flange (9).
 7. Using torque wrench, torque capscrews (6) to 460 ft lb (623 N-m).
 8. Position shaft (1) against transfer case flange (5).

WARNING



CHEMICAL



EYE PROTECTION

9. Apply adhesive to capscrews (2).
10. Install capscrews (2), lockwashers (3) and hex nuts (4) to secure shaft (1) to transfer case flange (5).
11. Using torque wrench, torque capscrews (2) to 55 ft lb (74 N-m).
12. Remove sling.
13. Install powered section engine exhaust muffler. (WP 0168 00)
14. Install drive train marine gear to transfer case machinery guard machinery guard. (WP 0115 00)
15. Install powered section engine hatch. (WP 0098 00)
16. Install powered section intake plenum. (WP 0080 00)
17. Install powered section operators cab. (WP 0095 00)
18. Install main assembly mast. (WP 0350 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
TRANSFER CASE TO PUMP-JET DRIVE TRAIN DRIVE SHAFT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Item 2, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Brush, Wire Scratch (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Wrench, Torque (0-175 ft lbs) (Item 37, WP 0425 00)

Materials/Parts

Drive Shaft
 PN E26228
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L (2)

References

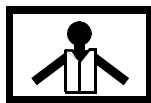
TM 55-1945-225-10

Equipment Condition

Powered Section Exhaust Plenum Removed. (WP 0087 00)
 Powered Section Thruster Hatch Removed. (WP 0100 00)
 Drive Train Transfer Case To Pump-Jet Machinery Guard Removed. (WP 0114 00)

REMOVE TRANSFER CASE TO PUMP-JET DRIVE TRAIN DRIVE SHAFT

WARNING

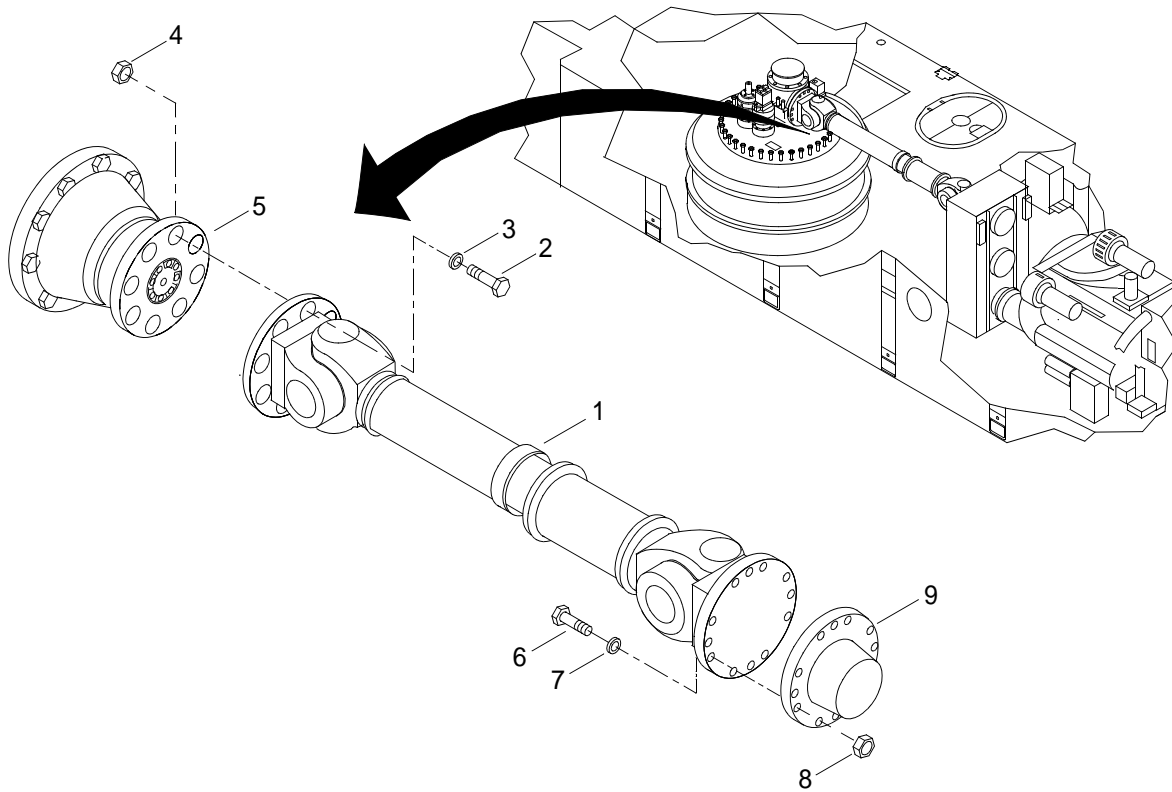
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for both port and starboard transfer case to pump-jet drive train shafts.

1. Inspect sling prior to use. (TM 55-1945-225-10)
2. Support transfer case to pump-jet drive shaft (1) with a sling attached to crane.



WARNING

**HEAVY PARTS**

3. Remove eight cap screws (2), lockwashers (3) and hex nuts (4) securing shaft (1) to pump-jet flange (5).

WARNING

**HEAVY PARTS**

4. Remove 12 cap screws (6), lockwashers (7) and hex nuts (8) securing shaft (1) to transfer case flange (9).

 WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- Using crane and sling, lift transfer case drive shaft (1) through thruster hatch deck opening.

INSTALL TRANSFER CASE TO PUMP-JET DRIVE TRAIN DRIVE SHAFT

 WARNING



EYE PROTECTION

- Clean all mounting surfaces with a wire brush to ensure residual adhesive, rust inhibitor, dirt or grease is removed.

 WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- Support transfer case to pump-jet drive shaft (1) with a sling attached to crane.

 WARNING



HEAVY PARTS

- Guide shaft (1) through thruster hatch deck opening and lower below deck.

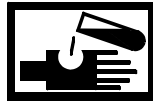
 WARNING



HEAVY PARTS

- Position shaft (1) against transfer case flange (9).

WARNING

**CHEMICAL****EYE PROTECTION**

5. Apply adhesive to capscrews (6).
6. Install capscrews (6), lockwashers (7) and hex nuts (8) to secure shaft (1) to transfer case flange (9).
7. Using torque wrench, torque capscrews (6) to 55 ft lb (74.58 N-m).

WARNING

**HEAVY OBJECTS**

8. Position shaft (1) against pump-jet flange (5) so that orientation arrows on shaft (1) and pump-jet flange (5) face each other.

WARNING

**CHEMICAL****EYE PROTECTION**

9. Apply adhesive to capscrews (2).
10. Install eight capscrews (2), lockwashers (3) and hex nuts (4) to secure shaft (1) to pump-jet flange (5).
11. Using torque wrench, torque capscrews (2) to 330 ft lb (447 N-m).
12. Remove sling.
13. Install drive train transfer case to pump-jet machinery guard machinery guard. (WP 0114 00)
14. Install powered section thruster hatch. (WP 0100 00)
15. Install powered section exhaust plenum. (WP 0087 00)

END OF WORK PACKAGE

DIRECT SUPPORT MAINTENANCE
WARPING TUG
DRIVE TRAIN
ALIGNMENT

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
Qty 4
Shackle, 3/4 in. 4.75 Ton (Item 25, WP 0425 00)
Qty 3
Hoist, Chain (Item 14, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-205-24-3-4
TM 55-1945-225-10

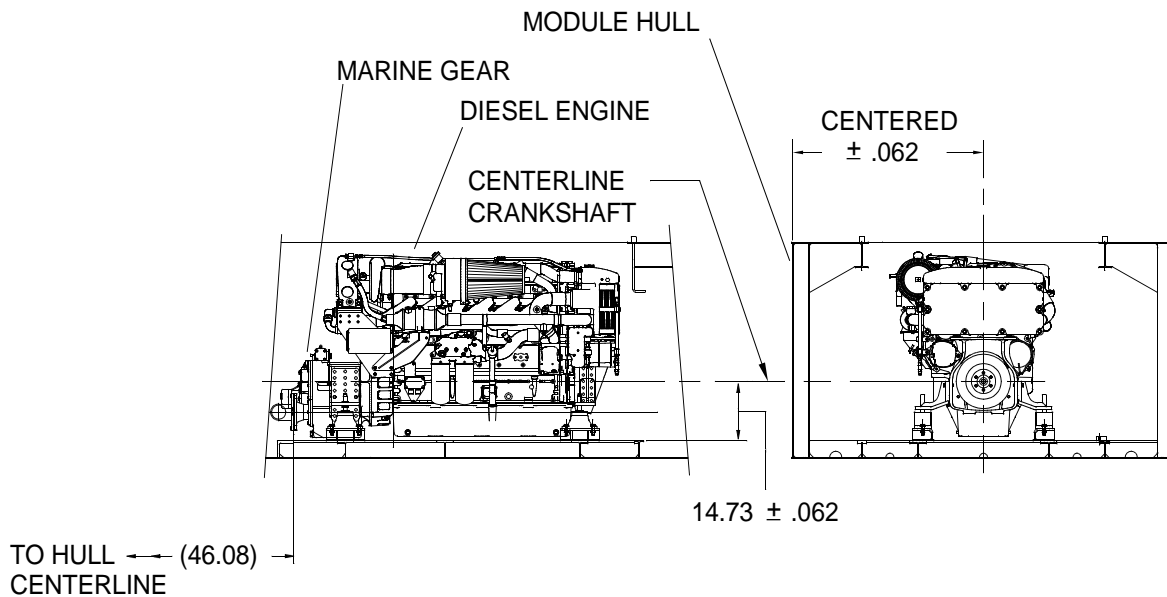
Equipment Condition

Main Assembly Mast Removed. (WP 0350 00)
SINCGARS Antenna Removed. (TM 11-5820-890-20-3)
Powered Section Operators Cab Removed. (WP 0095 00)
Powered Section Intake Plenum Assembly Removed. (WP 0080 00)
Powered Section Exhaust Plenum Removed. (WP 0087 00)
Powered Section Engine Hatch Removed. (WP 0098 00)
Powered Section Thruster Hatch Removed. (WP 0100 00)
Drive Train Transfer Case To Pump-Jet Machinery Guard Removed. (WP 0114 00)
Drive Train Marine Gear To Transfer Case Machinery Guard Removed. (WP 0115 00)

ALIGN DRIVE TRAIN**NOTE**

This task is typical for both port and starboard drive trains.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Using crane and appropriate slings and shackles, support weight of engine and marine gear by engine pedestal mounts to raise or lower elevation to measurements depicted below, prior to securing engine to deck.



3. Verify diesel engine crankshaft centerline is parallel, level and square to within 0.062 in. to hull longitudinal centerline.
4. If engine crankshaft centerline is not parallel to within 0.062 in. to hull longitudinal centerline, shim engine to correct elevation. (WP 0383 00)
5. Align marine gear in same manner as engine to elevation shown above.
6. Align transfer case in same manner as engine to elevation shown above. (TM 55-1945-205-24-3-4)
7. Verify transfer case input and output flanges are in line with marine gear and pump-jet. (TM 55-1945-205-24-3-4)
8. Install drive train transfer case to pump-jet machinery guard. (WP 0114 00)
9. Install drive train marine gear to transfer case machinery guard. (WP 0115 00)
10. Install the powered section engine hatch. (WP 0098 00)
11. Install the powered section thruster hatch. (WP 0100 00)
12. Install the powered section exhaust plenum. (WP 0087 00)
13. Install the powered section intake plenum assembly. (WP 0080 00)
14. Install the powered section operators cab. (WP 0095 00)
15. Install SINCGARS antenna. (TM 11-5820-890-20-3)
16. Install main assembly mast. (WP 0350 00)
17. Perform operational check of drive train. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FRESHWATER COOLING SYSTEM HEATER HOSES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Life Preserver, Vest (Item 17, WP 0425 00)

Helmet, Safety (Blue) (Item 13, WP 0425 00)

Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

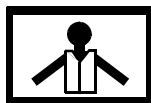
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE FRESHWATER COOLING SYSTEM HEATER HOSES

WARNING



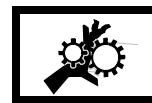
VEST



HELMET PROTECTION



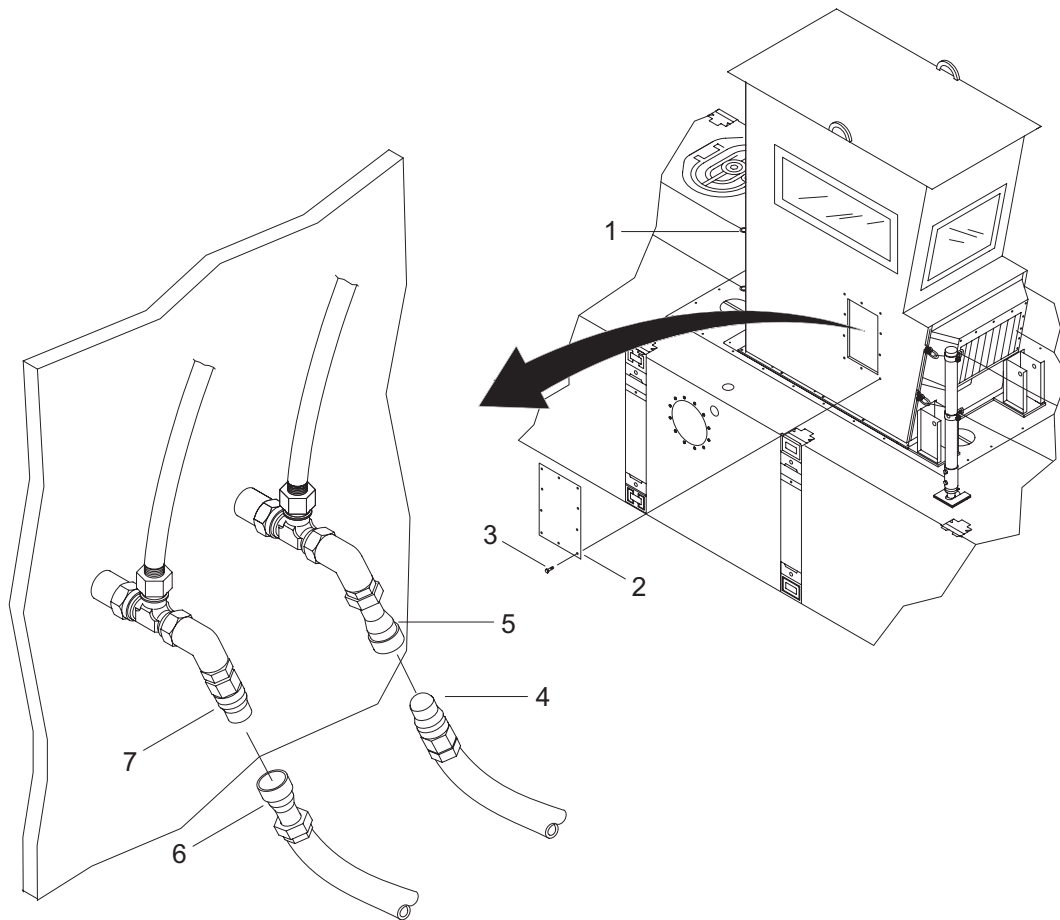
HEAVY PARTS



MOVING PARTS

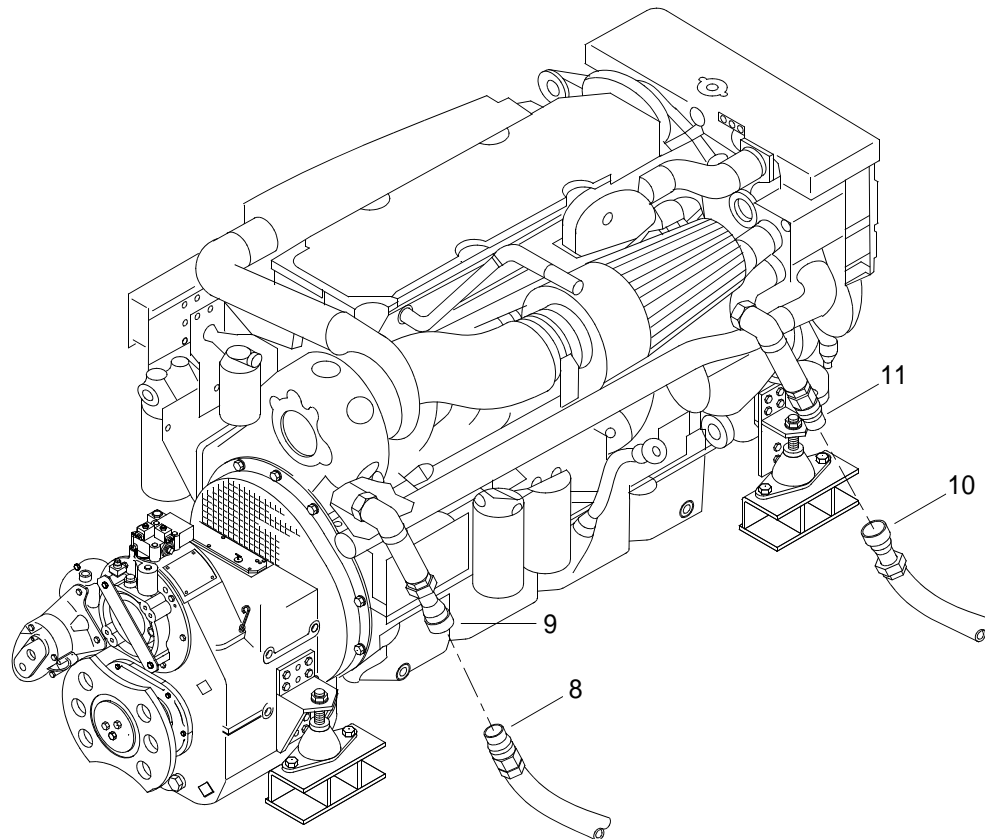
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove operators cab (1) side access panel (2).

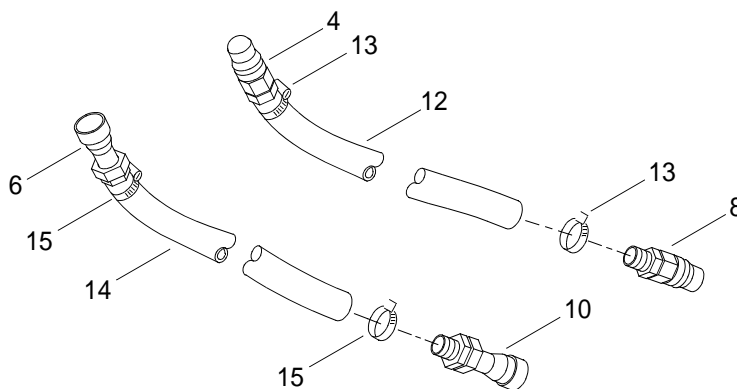


- a. Remove capscrews (3).
 - b. Remove access panel (2).
2. Disconnect heating system hose male quick disconnect (4) from operators cab female quick disconnect (5).
 3. Disconnect heating system hose female quick disconnect (6) from operators cab male quick disconnect (7).

4. Disconnect heating system hose male quick disconnect (8) from engine female quick disconnect (9).



5. Disconnect heating system hose female quick disconnect (10) from engine male quick disconnect (11).
6. Remove two heating system hose male quick disconnects (4 and 8) from hose (12).



- a. Remove two hose clamps (13) from hose (12).
- b. Remove remove male quick disconnects (4 and 8) from hose (12) and discard hose.
7. Remove two heating system hose female quick disconnects (6 and 10) from hose (14).

 - a. Remove two hose clamps (15) from hose (14).
 - b. Remove remove female quick disconnects (6 and 10) from hose (14) and discard hose.

INSTALL FRESHWATER COOLING SYSTEM HEATER HOSES

1. Manufacture new heater hoses. (WP 0419 00)
2. Install two heating system hose female quick disconnects (6 and 10) on new hose (14).
 - a. Slide two hose clamps (15) on new hose (14).
 - b. Install female quick disconnects (6 and 10) on new hose (14).
 - c. Tighten two hose clamps (15).
3. Install two heating system hose male quick disconnects (4 and 8) on hose (12).
 - a. Slide two hose clamps (13) on new hose (12).
 - b. Install male quick disconnects (4 and 8) on new hose (12).
 - c. Tighten two hose clamps (13).
4. Connect heating system hose female quick disconnect (10) to engine male quick disconnect (11).
5. Connect heating system hose male quick disconnect (8) to engine female quick disconnect (9).
6. Connect heating system hose female quick disconnect (6) to operators cab male quick disconnect (7).
7. Connect heating system hose male quick disconnect (4) to operators cab female quick disconnect (5).
8. Install operators cab (1) side access panel (2).
 - a. Position access panel (2) on operators cab (1).
 - b. Install capscrews (3) and tighten.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
DRIVE TRAIN ENGINE CRANKCASE
SERVICING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Lubricating Oil, Engine (Item 19, WP 0426 00)
Qty 38
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-222-14&P
TM 55-1945-225-10

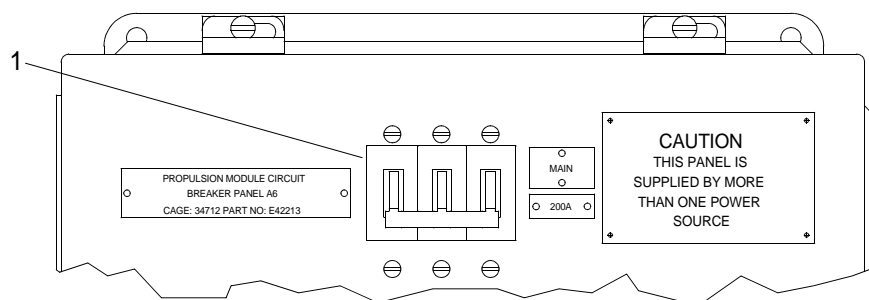
Equipment Condition

Engine Cool To Touch.
Engine Power Isolated. (WP 0075 00)
Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)

SERVICE DRIVE TRAIN ENGINE CRANKCASE**NOTE**

This task is typical for port and starboard engines.

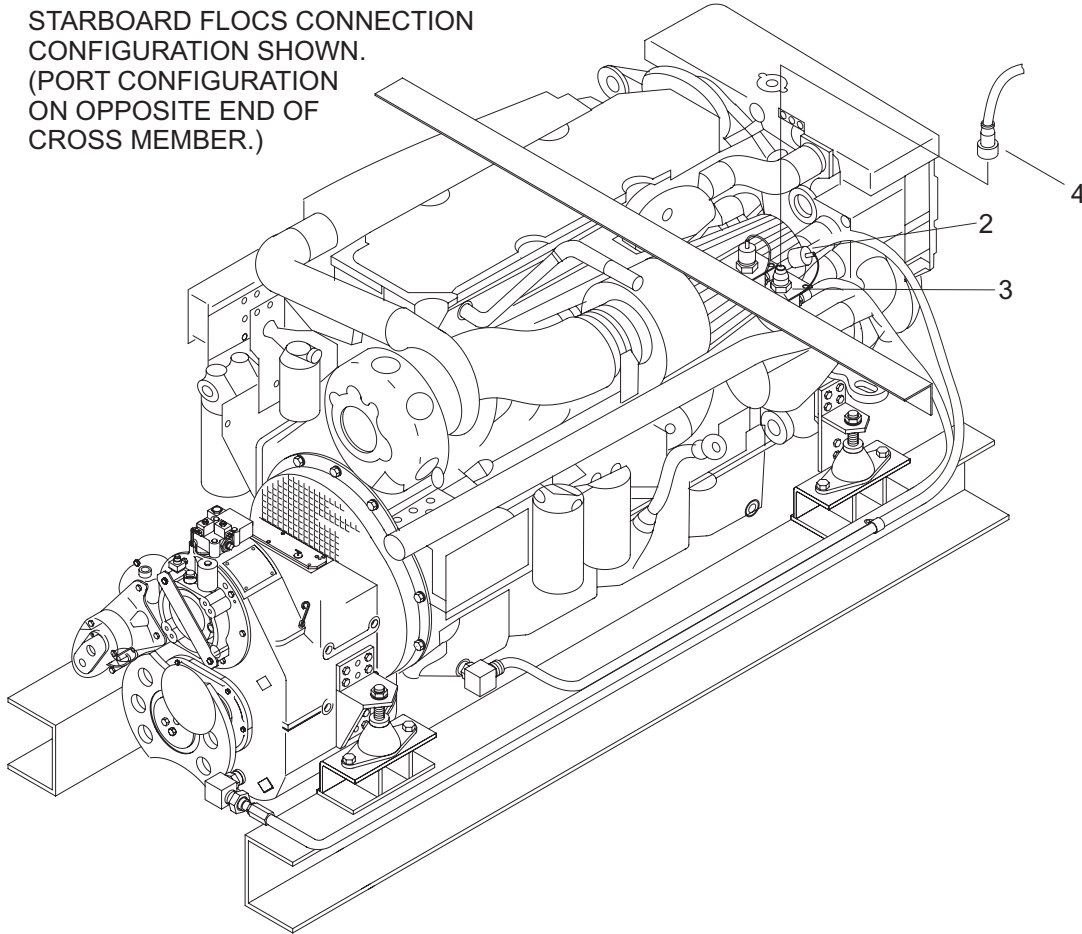
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Remove Fast Lube Oil Change System (FLOCS) from BII container. (TM 55-1945-225-10)
3. Position FLOCS close enough to diesel engine to reach diesel engine FLOCS connections with FLOCS hose.

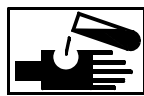
4. Remove dust cap (2) from diesel engine FLOCS connection (3).

STARBOARD FLOCS CONNECTION
CONFIGURATION SHOWN.
(PORT CONFIGURATION
ON OPPOSITE END OF
CROSS MEMBER.)



5. Connect FLOCS hose connection (4) to diesel engine FLOCS connection (3).

WARNING



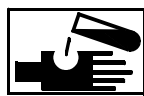
CHEMICAL



EYE PROTECTION

6. Using FLOCS, remove oil from diesel engine crankcase and pump into disposal container.
7. Replace engine oil filters. (TM 55-1945-222-14&P)

WARNING



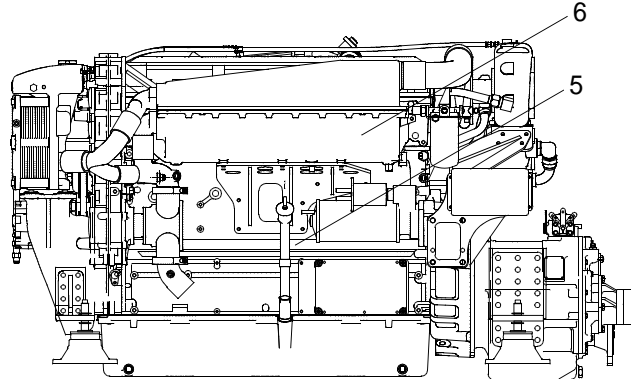
CHEMICAL



EYE PROTECTION

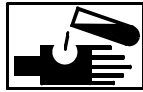
8. Using FLOCS, fill diesel engine crankcase with 38 quarts of oil.

9. Check oil level on dipstick (5) on port side of diesel engine (6). Adjust oil level as required.



10. Disconnect FLOCS hose connection (4) from diesel engine FLOCS connection (3).
 11. Install dust cap (2) on diesel engine FLOCS connection (3).

WARNING



CHEMICAL



EYE PROTECTION



SLICK FLOOR

12. Clean up spilled fluid with spill kit and dispose of spill kit waste and disposal container contents per local procedures.
13. Stow FLOCS in BII container. (TM 55-1945-225-10)
14. Perform operational check of diesel engine. (TM 55-1945-225-10)
15. Install operators cab/intake plenum access panel. (WP 0093 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
DRIVE TRAIN ENGINE FAST LUBE SYSTEM HOSES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanic's (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Fast Lube System Hose Assembly
PN E47413
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

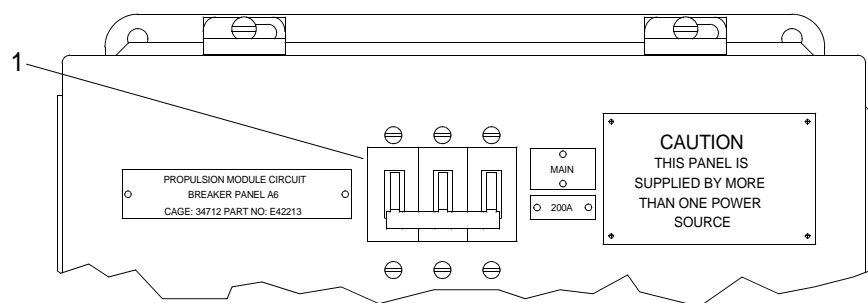
Equipment Condition

Propulsion Module Ventilated. (TM 55-1945-225-10)
Diesel Engine Oil Drained. (WP 0121 00)
Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)

REMOVE DRIVE TRAIN FAST LUBE SYSTEM HOSES**NOTE**

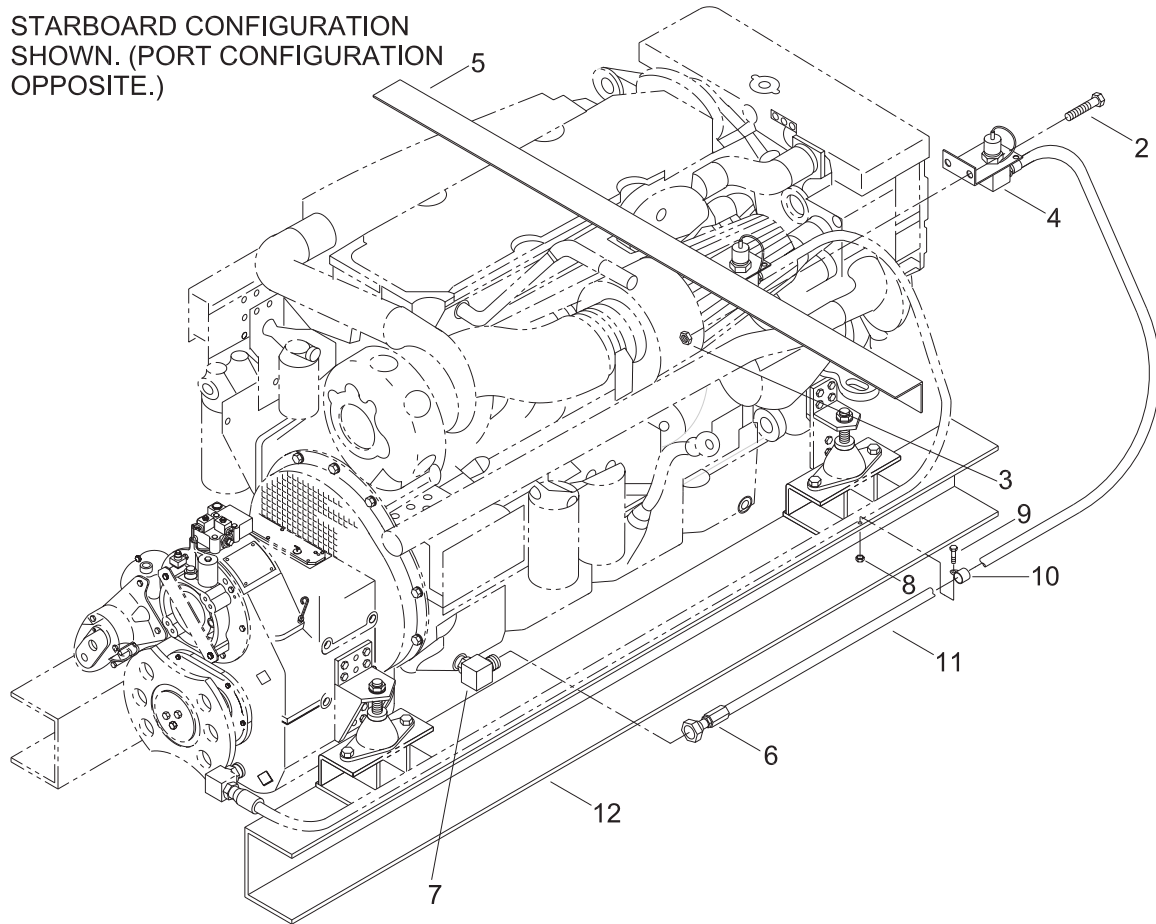
The following procedure is typical for the removal and installation of fast lube systems.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove two hex head capscrews (2) and hex nuts (3) securing hose assembly bracket (4) to cross member (5).

STARBOARD CONFIGURATION
SHOWN. (PORT CONFIGURATION
OPPOSITE.)

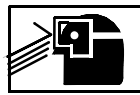


- Position drain pan beneath hose assembly female fitting (6) hose assembly female fitting (6).
- Remove hose assembly female fitting (6) from 90° swivel fitting (7).
- Remove hex nut (8) and hex head capscrew (9) securing hose clamp (10) and hose assembly (11) to support beam (12).
- Remove hose clamp (10) from hose assembly (11).

WARNING



CHEMICAL



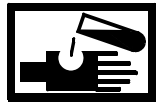
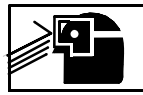
EYE PROTECTION

- Remove drain pan and dispose of contents per local procedures.

INSTALL DRIVE TRAIN FAST LUBE SYSTEM HOSES

1. Position hose clamp (10) on hose assembly (11) on support beam (12).
2. Install hex nut (8) and hex head capscrew (9) to secure hose clamp (10) and hose assembly (11) to support beam (12).
3. Tighten hex head nut (8).
4. Connect hose assembly female fitting (6) from 90° swivel fitting (7).
5. Install two hex head capscrews (2) and hex nuts (3) to secure hose assembly bracket (4) to cross member (5).
6. Tighten hex nuts (3).
7. Service engine crankcase oil. (WP 0121 00)
8. Start engine and check for leaks. (TM 55-1945-225-10)
9. Install operators cab/intake plenum side access panel. (WP 0093 00)
10. Shut down engine. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

11. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
DRIVE TRAIN MARINE GEAR
SERVICING**

INITIAL SETUP:**Tools**

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Lubricating Oil, Engine (Item 19, WP 0426 00)
- Qty 2.8
- Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

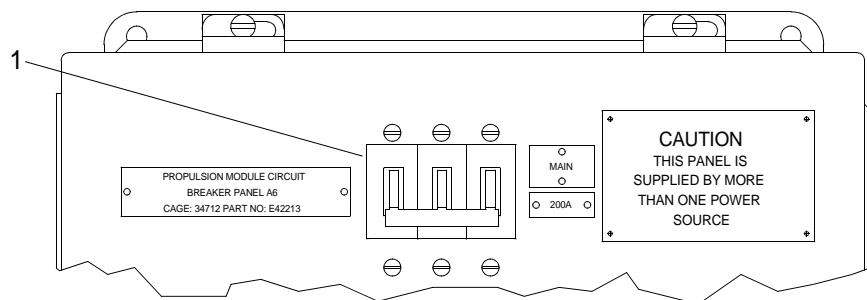
Equipment Condition

- Engine Cool To Touch.
 - Engine Power Isolated. (WP 0075 00)
 - Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
-

SERVICE DRIVE TRAIN MARINE GEAR**NOTE**

This task is typical for port and starboard engines.

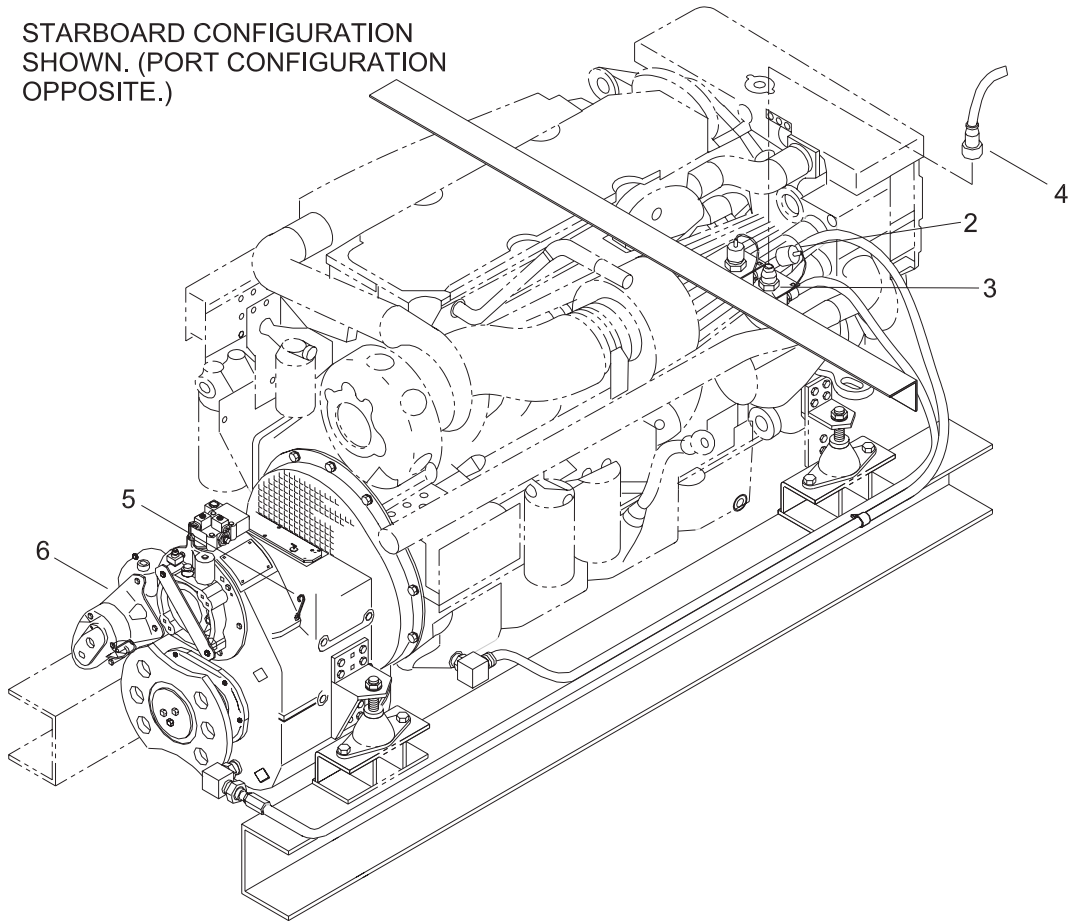
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Remove Fast Lube Oil Change System (FLOCS) from BII container. (TM 55-1945-225-10)
3. Position FLOCS close enough to diesel engine to reach diesel engine FLOCS connections with FLOCS hose.

- Remove dust cap (2) from marine gear FLOCS connection (3).

STARBOARD CONFIGURATION
SHOWN. (PORT CONFIGURATION
OPPOSITE.)



- Connect FLOCS hose connection (4) to marine gear FLOCS connection (3).

WARNING



CHEMICAL



EYE PROTECTION

- Using FLOCS, remove oil from marine gear and pump into disposal container.

WARNING



CHEMICAL



EYE PROTECTION

- Using FLOCS, fill marine gear with 2.8 gallons. (10.6 liters) of oil.
- Check oil level on dipstick (5) on starboard side of marine gear (6). Adjust oil level as required.

-
9. Disconnect FLOCS hose connection (4) from marine gear FLOCS connection (3).
 10. Install dust cap (2) on marine gear FLOCS connection (3).

WARNING



CHEMICAL



EYE PROTECTION



SLICK FLOOR

11. Clean up spilled fluid with spill kit and dispose of spill kit waste and disposal container contents per local procedures.
12. Stow FLOCS in BII container. (TM 55-1945-225-10)
13. Perform operational check of marine gear. (TM 55-1945-225-10)
14. Install operators cab/intake plenum access panel. (WP 0093 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
DRIVE TRAIN MARINE GEAR FAST LUBE SYSTEM HOSES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanic's (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Fast Lube System Hose Assembly
PN E47413
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

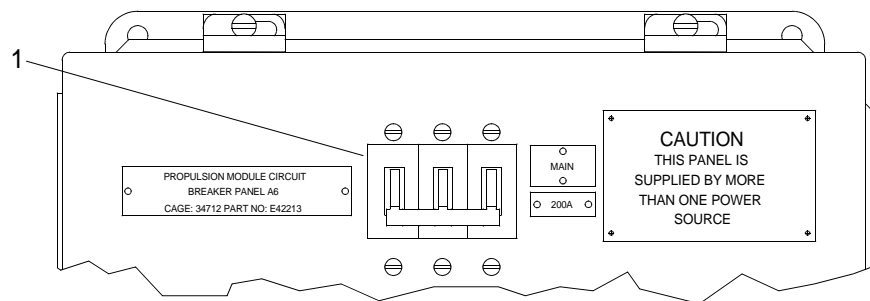
Equipment Condition

Propulsion Module Ventilated. (TM 55-1945-225-10)
Marine Gear Oil Drained. (WP 0123 00)
Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)

REMOVE DRIVE TRAIN FAST LUBE SYSTEM HOSES**NOTE**

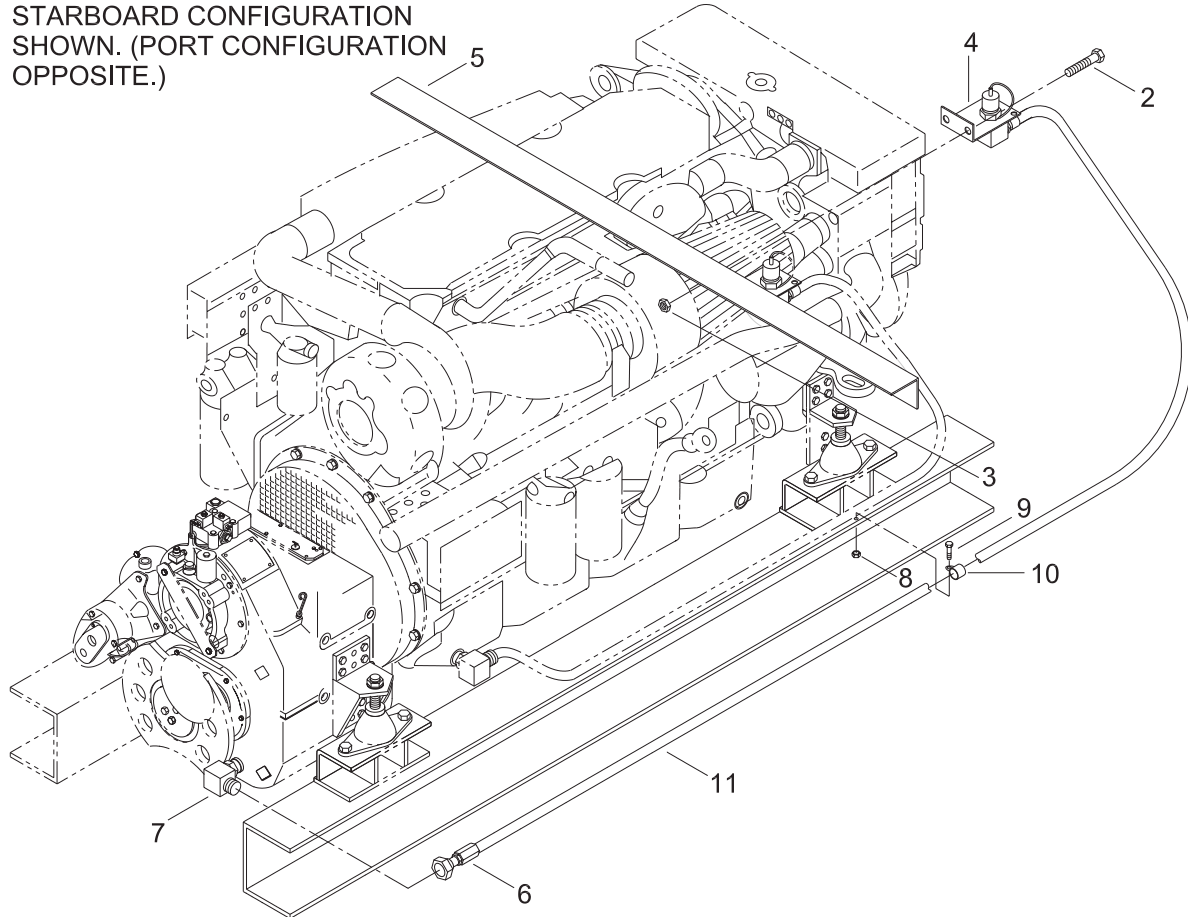
The following procedure is typical for the removal and installation of fast lube systems.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove two hex head capscrews (2) and hex nuts (3) securing hose assembly bracket (4) to cross member (5).

STARBOARD CONFIGURATION
SHOWN. (PORT CONFIGURATION
OPPOSITE.)



- Position drain pan beneath engine oil pan.
- Remove hose assembly female fitting (6) from 90° swivel fitting (7).
- Remove hex nut (8) and hex head capscrew (9) securing hose clamp (10) and hose assembly (11) to support beam (12).
- Remove hose clamp (10) from hose assembly (11).

WARNING



CHEMICAL



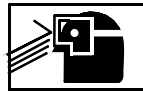
EYE PROTECTION

- Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL DRIVE TRAIN FAST LUBE SYSTEM HOSES

1. Position hose clamp (10) on hose assembly (11) on support beam (12).
2. Install hex nut (8) and hex head capscrew (9) to secure hose clamp (10) and hose assembly (11) to support beam (12).
3. Tighten hex head nut (8).
4. Connect hose assembly female fitting (6) from 90° swivel fitting (7).
5. Install two hex head capscrews (2) and hex nuts (3) to secure hose assembly bracket (4) to cross member (5).
6. Tighten hex nuts (3).
7. Service marine gear oil. (WP 0123 00)
8. Start engine and check for leaks. (TM 55-1945-225-10)
9. Shut down engine. (TM 55-1945-225-10)
10. Install operators cab/intake plenum side access panel. (WP 0093 00)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

11. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUMP-JET BRAKING VALVE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Respirator, Air Filtering ((Item 3, WP 0425 00)

Materials/Parts

Braking Valve Unit
 PN 1101910
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

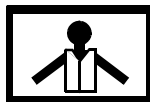
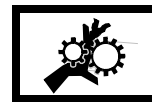
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

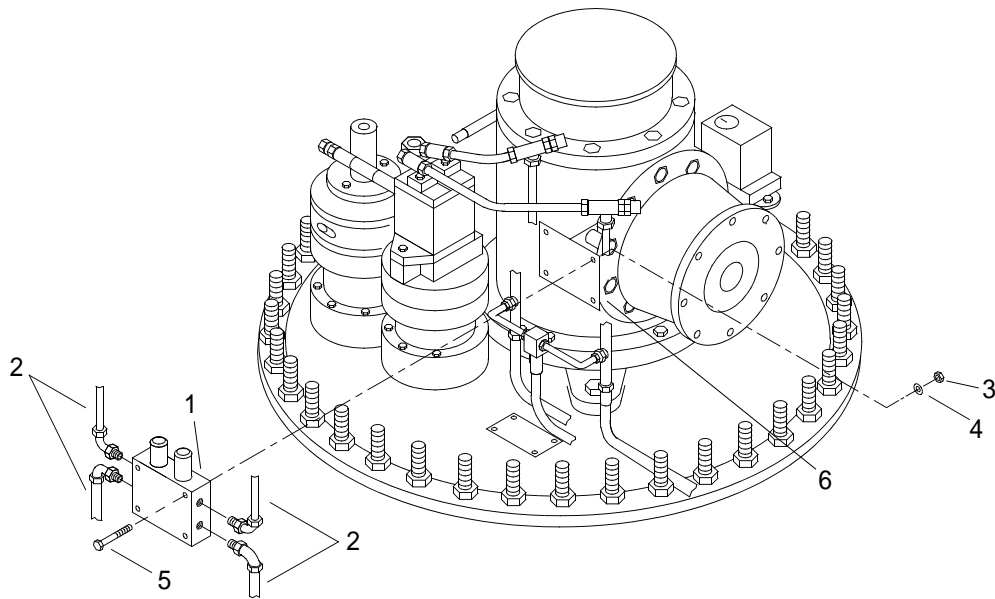
REMOVE PUMP-JET BRAKING VALVE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

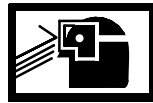
1. Position drain pan under braking valve unit (1).



 WARNING



CHEMICAL



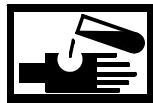
EYE PROTECTION



VAPOR

- Remove four hydraulic lines (2) from sides of braking valve unit (1).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

- Drain hydraulic system fluid from braking valve unit (1) into drain pan.
- Remove four hex nuts (3), plain washers (4) and hex bolts (5) securing braking valve unit (1) to braking valve unit console (6).
- Remove braking valve unit (1) and discard.

 WARNING



CHEMICAL



EYE PROTECTION



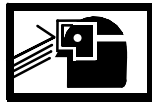
VAPOR

- Remove drain pan and dispose of contents per local procedures.

INSTALL PUMP-JET BRAKING VALVE

1. Position new braking valve unit (1) on braking valve unit console (6).
2. Install four hex bolts (5) through braking valve unit (1) and braking valve unit console (6).
3. Install plain washers (4) and hex nuts (3) to secure braking valve unit (1) to braking valve unit console (6).
4. Tighten hex nuts (3).
5. Install hydraulic lines (2) on braking valve unit (1).
6. Tighten all hydraulic line fittings.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.
8. Service hydraulic system reservoir. (WP 0141 00)
9. Perform operational check of pump-jet. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUMP-JET GEARCASE
SERVICING**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Apron, Utility (Item 6, WP 0425 00)
- Pump, Oil Suction (Item 22, WP 0425 00)
- Wrench, Torque (150-750 in lbs) (Item 39, WP 0425 00)

Materials/Parts

- Preformed Packing
PN 1020506
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Lubricating Oil, Gear (Item 20, WP 0426 00)
- Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

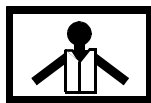
- Engineer 88L

Equipment Condition

- Powered Section Exhaust Plenum Removed. (WP 0087 00)

SERVICE PUMP-JET GEARCASE

WARNING



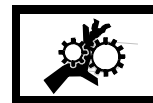
VEST



HELMET PROTECTION



HEAVY PARTS



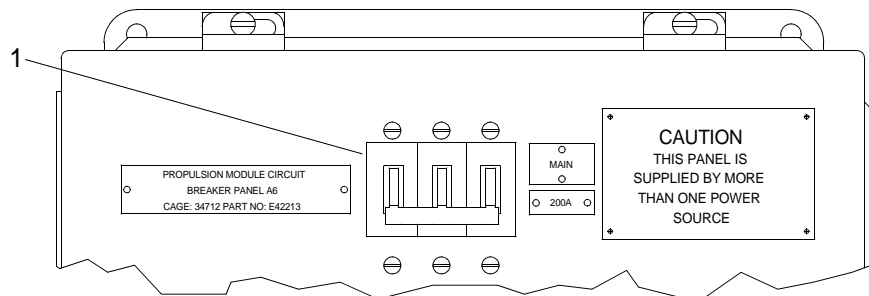
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

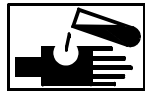
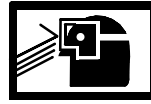
NOTE

The following procedure is typical for port and starboard pump-jets.

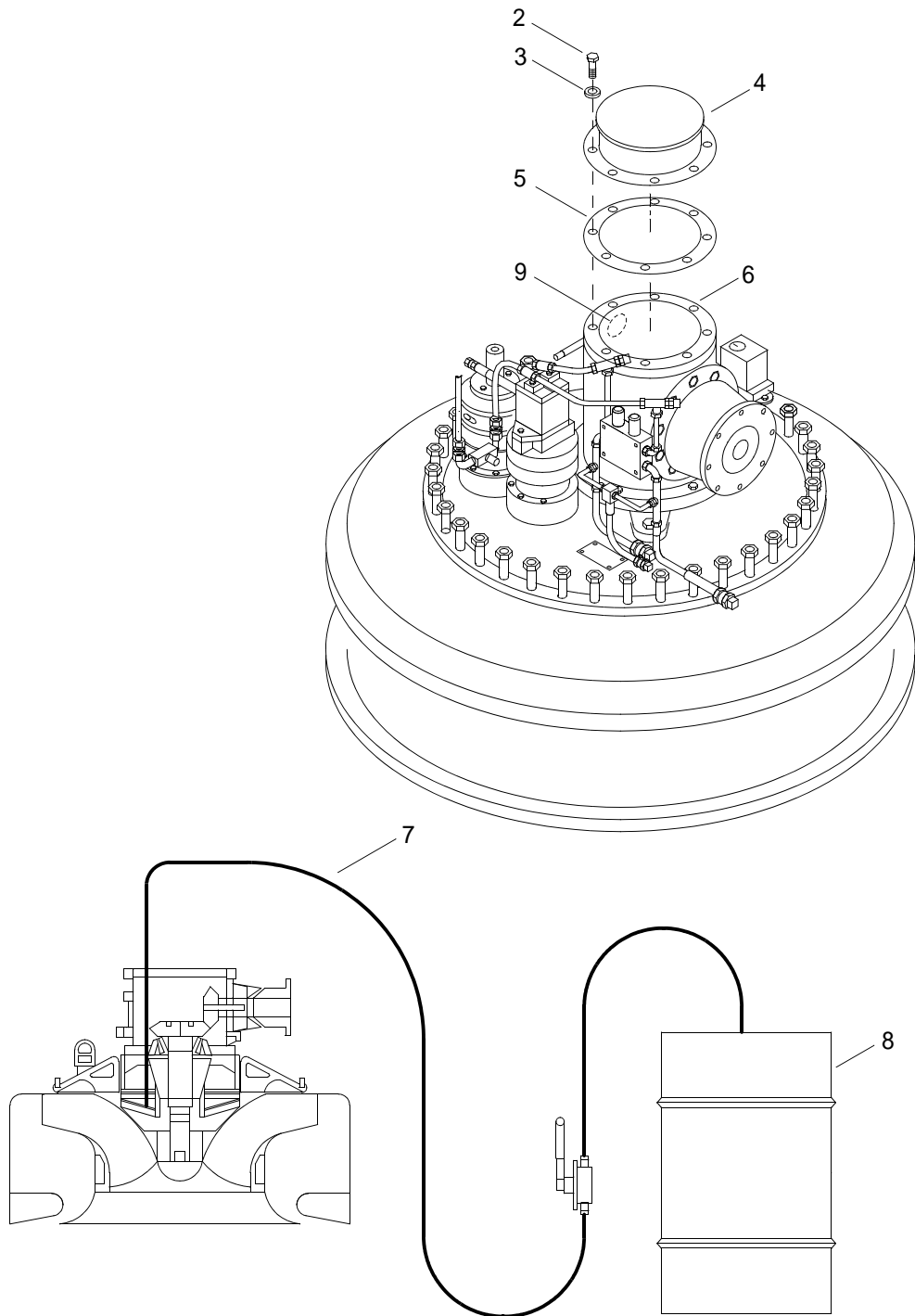
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

**CHEMICAL****EYE PROTECTION**

2. Remove capscrews (2), washers (3), cover (4) and preformed packing (5) from top of pump-jet (6). Discard preformed packing (5).



3. Insert tube of oil suction pump (7) through opening in top of pump-jet (6) as deep as possible.

 WARNING



CHEMICAL



EYE PROTECTION

4. Pump old oil into container (8).
5. Remove suction pump (7).

 WARNING



CHEMICAL



EYE PROTECTION

6. Remove container and dispose of contents per local procedures.

 WARNING



CHEMICAL



EYE PROTECTION

7. Fill pump-jet (6) gearcase with approximately 20 gallons (76 liters) of clean lubricating oil.
8. Check oil level through oil level glass (9). Adjust level as required.
9. Position new preformed packing (5) on top of pump-jet (6) opening.
10. Secure cover (4) with capscrews (2) and washers (3).
11. Torque capscrews (2) using cross-method to 305 in. lbs (34.5 N-m).

 WARNING



CHEMICAL



EYE PROTECTION



SLICK FLOOR

12. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.
13. Install powered section exhaust plenum. (WP 0087 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUMP-JET PRIMARY PLANETARY GEARBOX
SERVICING**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Lubricating Oil, Gear (Item 20, WP 0426 00)
- Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

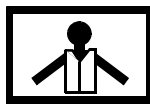
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

SERVICE PUMP-JET PRIMARY PLANETARY GEARBOX

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



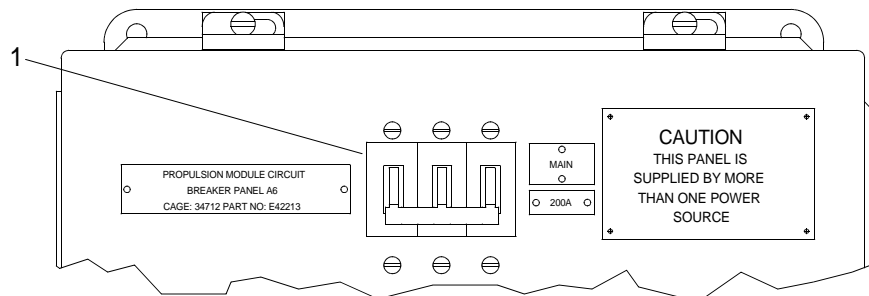
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

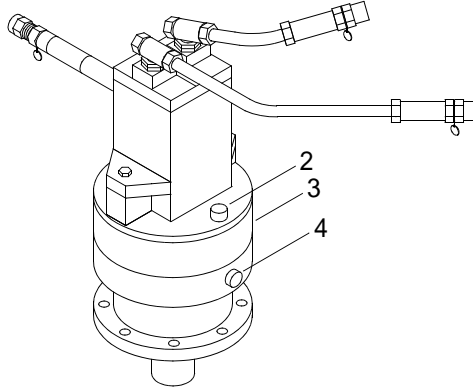
NOTE

The following procedure is typical for port and starboard pump-jet primary planetary gearboxes.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Place a drain pan under filler/breather plug (2).
3. Remove filler/breather plug (2) from primary planetary gearbox (3).



WARNING



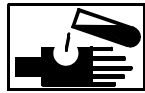
CHEMICAL



EYE PROTECTION

4. Remove drain plug (4) and drain oil into drain pan.
5. Inspect outside of primary planetary gearbox (3) for structural damage, corrosion or cracks.

WARNING



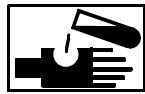
CHEMICAL



EYE PROTECTION

6. Install drain plug (4) in primary planetary gearbox (3).

WARNING



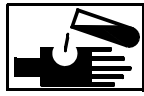
CHEMICAL



EYE PROTECTION

7. Remove drain pan and dispose of contents per local procedures.

WARNING

**CHEMICAL****EYE PROTECTION**

8. Fill primary planetary gearbox (3) with clean lubricating oil through filler/breather plug (2) opening until oil level reaches top of primary planetary gearbox (3).
9. Install filler/breather plug (2) in primary planetary gearbox (3).

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

10. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
PUMP-JET PRIMARY PLANETARY GEARBOX
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Brush, Stencil (Soft Bristle) (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Planetary Gearbox, Primary
 PN 1106760
 Packing, Preformed
 PN 1001400
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Grease, Automotive and Artillery (Item 12, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

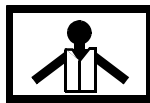
Engineer 88L

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Pump-Jet Gearcase Drained. (WP 0126 00)
 Pump-Jet Hydro-Motor Removed. (WP 0131 00)

REMOVE PUMP-JET PRIMARY PLANETARY GEARBOX

WARNING

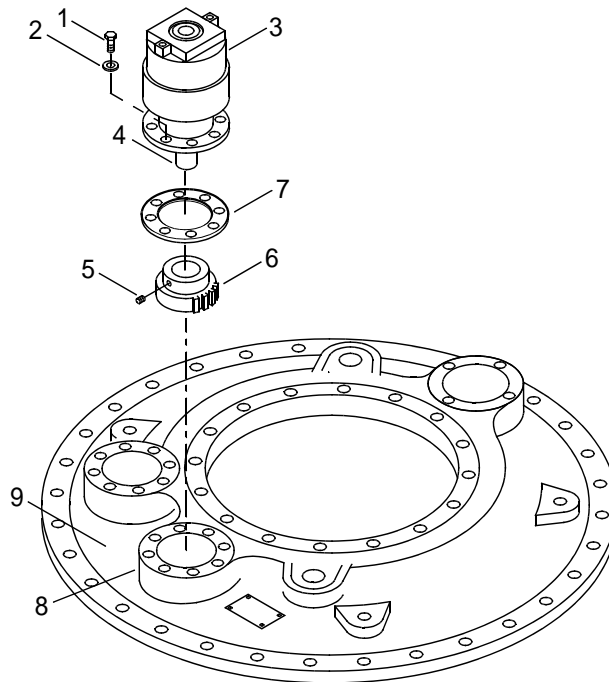
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

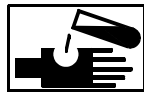
The following procedure is typical for removal and installation of port and starboard primary planetary gearboxes.

1. Remove eight socket head capscrews (1) and lockwashers (2).



2. Position drain pan under all fittings prior to removing planetary gearbox (3).

WARNING



CHEMICAL



EYE PROTECTION



HEAVY OBJECTS

3. Lift planetary gearbox (3) from pump-jet (4).
4. Loosen set screw (5) and remove gear (6) and retain for reuse.
5. Remove preformed packing (7) and discard.

WARNING



CHEMICAL



EYE PROTECTION

6. Remove drain pan and dispose of contents per local procedures.

INSTALL PUMP-JET PRIMARY PLANETARY GEARBOX**WARNING****CHEMICAL****EYE PROTECTION**

1. Clean gear (6) and mounting surfaces with cleaner and brush.
2. Ensure all surfaces are free of dirt or rust preventatives.
3. Install gear (6) on gearbox mount opening (8) and secure with set screw (5).
4. Tighten set screw (5).

WARNING**CHEMICAL****EYE PROTECTION**

5. Apply automotive and artillery grease to preformed packing groove and install new preformed packing (7) on planetary gearbox mounting base (9).

WARNING**HEAVY OBJECTS**

6. Position new gearbox (3) on pump-jet (4) to facilitate reconnection of all lines.
7. Install eight lockwashers (2) and socket head capscrews (1) to secure planetary gearbox (3) to pump-jet (4).
8. Tighten socket head capscrews (1).

WARNING**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.
10. Install pump-jet hydro-motor. (WP 0131 00)
11. Service pump-jet gearcase. (WP 0126 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUMP-JET AUXILIARY PLANETARY GEARBOX
SERVICING**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Lubricating Oil, Gear (Item 20, WP 0426 00)
- Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

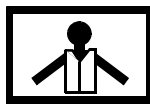
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

SERVICE PUMP-JET AUXILIARY GEARBOX

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



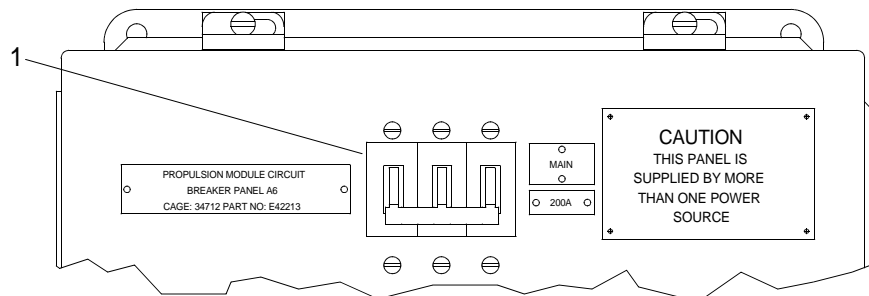
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

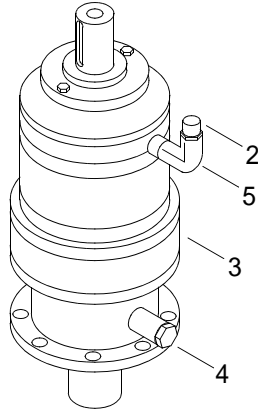
NOTE

The following procedure is typical for servicing Sport and starboard pump-jet auxiliary gearboxes.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Remove filler/breather plug (2) from auxiliary planetary gearbox (3).



3. Place drain pan under drain plug (4).

WARNING



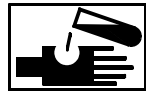
CHEMICAL



EYE PROTECTION

4. Remove drain plug (4) and drain oil into drain pan.
 5. Inspect outside of gearbox (3) for structural damage, corrosion or cracks.

WARNING



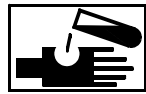
CHEMICAL



EYE PROTECTION

6. Install drain plug (4) in gearbox (3).

WARNING



CHEMICAL



EYE PROTECTION

7. Remove drain pan and dispose of contents per local procedures.

WARNING

**CHEMICAL****EYE PROTECTION**

8. Fill gearbox (3) with clean lubricating oil through filler/breather plug (2) opening until oil level reaches horizontal part of elbow tube (5).
9. Install filler/breather plug (2).

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

10. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
PUMP-JET AUXILIARY PLANETARY GEARBOX
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Brush, Stencil (Soft Bristle) (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Planetary Gearbox, Auxiliary
 PN 1109428
 Packing, Preformed
 PN 712770170
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Grease, Automotive and Artillery (Item 12, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

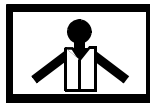
Engineer 88L

Equipment Condition

Pump-Jet Gearcase Drained. (WP 0126 00)

REMOVE PUMP-JET AUXILIARY PLANETARY GEARBOX

WARNING

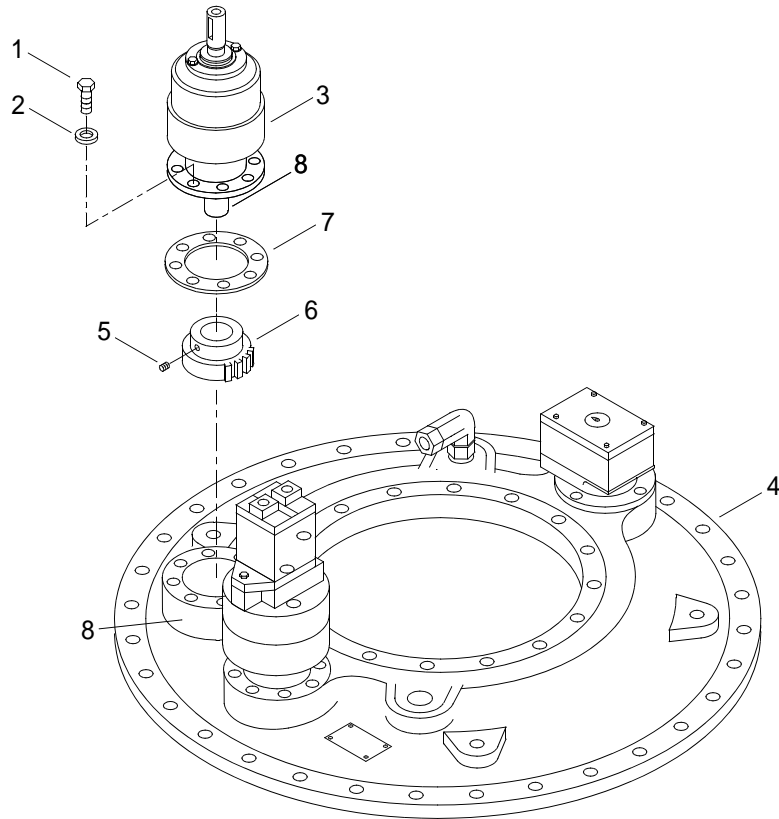
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

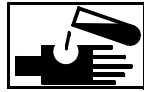
The following procedure is typical for removal and installation of port and starboard pump-jet auxiliary gearboxes.

1. Remove eight capscrews (1) and lockwashers (2).



2. Position drain pan under all fittings before removing gearbox (3).

WARNING



CHEMICAL



EYE PROTECTION



HEAVY OBJECTS

3. Lift gearbox (3) from pump-jet (4).
4. Loosen set screw (5) and remove gear (6).
5. Remove preformed packing (7) and discard.

WARNING



CHEMICAL

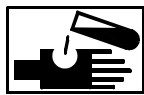


EYE PROTECTION



VAPOR

6. Remove drain pan and dispose of contents per local procedures.

INSTALL PUMP-JET AUXILIARY PLANETARY GEARBOX**WARNING****CHEMICAL****EYE PROTECTION**

1. Clean gear (6) and mounting area with cleaner and brush.
2. Ensure all surfaces are free of dirt or rust.
3. Install gear (6) on gearbox mounting base (8) and secure with set screw (5).
4. Tighten set screw (5).

WARNING**CHEMICAL****EYE PROTECTION**

5. Apply grease to preformed packing groove and install new preformed packing (7) on gearbox mounting base (8).

WARNING**CHEMICAL****EYE PROTECTION****HEAVY OBJECTS**

6. Position new gearbox (3) on gearbox mounting base (8).
7. Install eight capscrews (1) and lockwashers (2) to secure gearbox (3) to pump-jet (4).
8. Tighten capscrews (1).

WARNING**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.
10. Service pump-jet gearcase. (WP 0126 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
PUMP-JET HYDRO-MOTOR
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

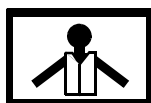
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE PUMP-JET HYDRO-MOTOR

WARNING



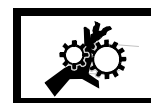
VEST



HELMET PROTECTION



HEAVY PARTS



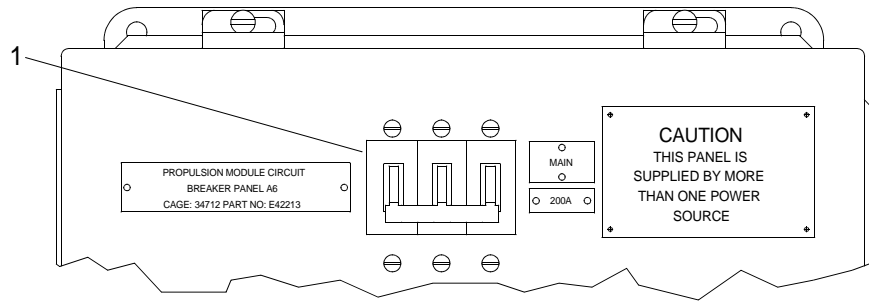
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of port and starboard pump-jet hydro-motors.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING



CHEMICAL

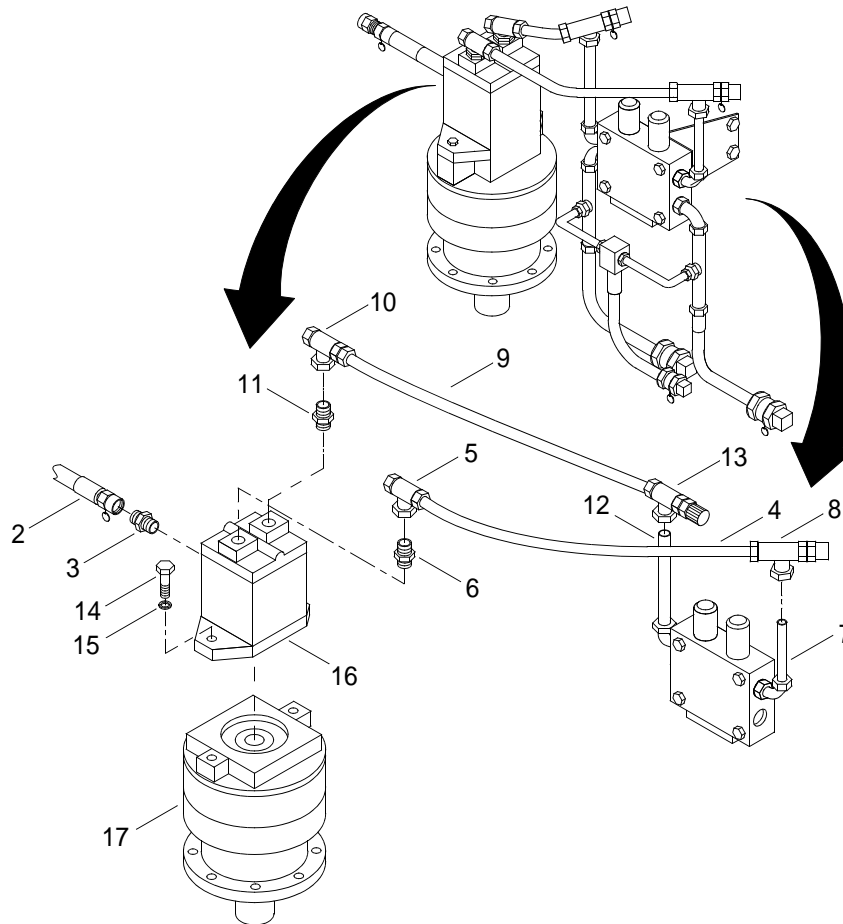


EYE PROTECTION

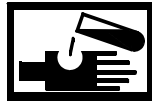


VAPOR

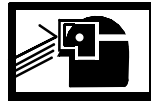
2. Position drain pan under all fittings before removing hydraulic line maximum pressure hose (2).



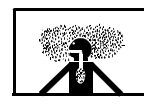
 WARNING



CHEMICAL



EYE PROTECTION



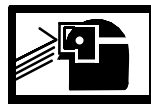
VAPOR

3. Disconnect hydraulic line maximum pressure hose (2) from straight male stud fitting (3).
4. Remove straight male stud fitting (3).
5. Disconnect hydraulic pipe (4).
 - a. Disconnect adjustable tee fitting (5) from straight male stud fitting (6).
 - b. Disconnect tube (7) from equal tee (8).
 - c. Remove hydraulic pipe (4), adjustable tee fitting (5) and equal tee (8) as an assembly.
6. Remove straight male stud fitting (6).
7. Disconnect hydraulic pipe (9).
 - a. Disconnect adjustable tee fitting (10) from straight male stud fitting (11).
 - b. Disconnect tube (12) from equal tee (13).
 - c. Remove hydraulic pipe (9), adjustable tee fitting (10) and equal tee (13) as an assembly.
8. Remove straight male stud fitting (11).
9. Remove two hex screws (14) and lockwashers (15).
10. Remove hydro-motor (16) from planetary gearbox (17).

 WARNING



CHEMICAL



EYE PROTECTION



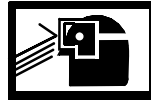
VAPOR

11. Remove drain pan and dispose of contents per local procedures.

INSTALL PUMP-JET HYDRO-MOTOR

1. Position hydro-motor (16) on planetary gearbox (17).
2. Secure hydro-motor (16) with two hex screws (14) and lockwashers (15).
3. Tighten hex screws (14).

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

4. Install straight male fitting (11).
5. Connect hydraulic pipe (9).
 - a. Position hydraulic pipe (9), adjustable tee fitting (10) and equal tee (13) as an assembly.
 - b. Connect tube (12) to equal tee (13).
 - c. Connect adjustable tee fitting (10) to straight male stud fitting (11).
6. Install straight male fitting (6).
7. Connect hydraulic pipe (4).
 - a. Position hydraulic pipe (4), adjustable tee fitting (5) and equal tee (8) as an assembly.
 - b. Connect tube (7) to equal tee (8).
 - c. Connect adjustable tee fitting (5) to straight male stud fitting (6).
8. Connect hydraulic line maximum pressure hose (2) to male stud fitting (3).
9. Tighten all fittings.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

10. Clean up any spilled fluid with a spill kit and dispose of spill kit waste per local procedures.
11. Service hydraulic system reservoir. (WP 0141 00)
12. Perform operational check of pump-jet. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUMP-JET EXPANSION TANK
CLEANING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Preformed Gasket
 PN E27141
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cloth, Cleaning (Item 7, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

CLEAN PUMP-JET EXPANSION TANK

WARNING

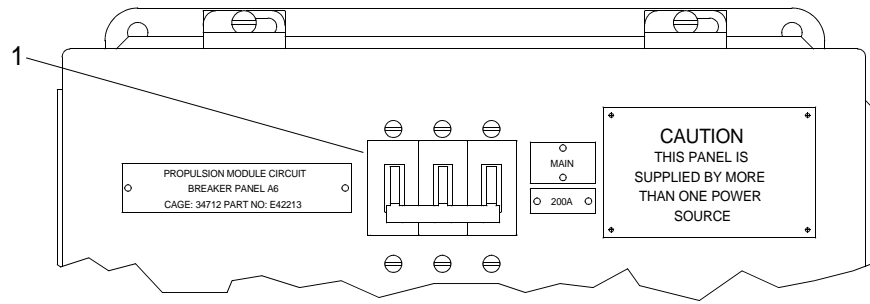
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

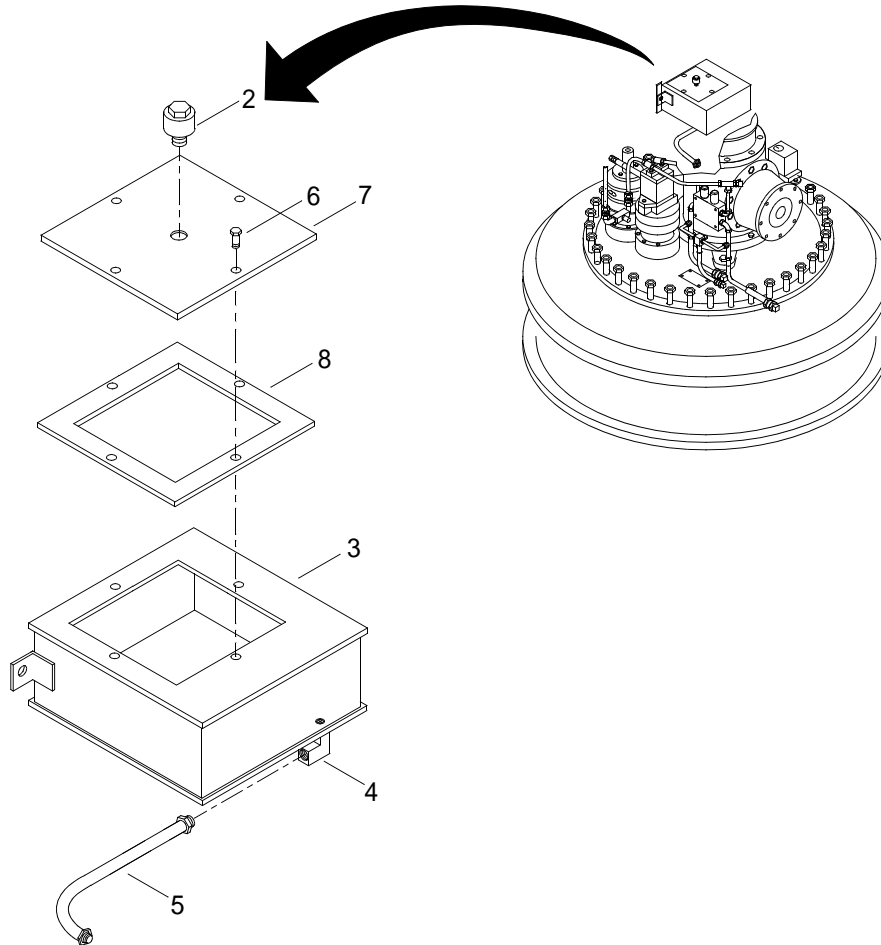
NOTE

The following procedure is typical for port and starboard pump-jet expansion tanks.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove air vent plug (2) from top of pump-jet expansion tank (3).



- Position drain pan beneath expansion tank elbow (4).

WARNING



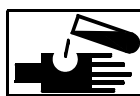
EYE PROTECTION



CHEMICAL

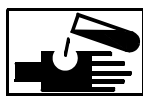
- Remove hose (5) from elbow (4) under expansion tank (3) and drain oil into drain pan.

WARNING

**EYE PROTECTION****CHEMICAL**

5. Remove drain pan and dispose of contents per local procedures.
6. Remove four hex head capscrews (6) securing cover (7) to top of expansion tank (3).
7. Remove cover (7) and preformed gasket (8).
8. Discard gasket (8).
9. Clean interior of expansion tank (3) with lint-free cloth.
10. Replace hose (5) on elbow (4).
11. Position new preformed gasket (8) on top of expansion tank (3).
12. Position cover (7) on expansion tank (3).
13. Install four hex head capscrews (6) to secure cover (7) on expansion tank (3).
14. Tighten four hex head capscrews (6).
15. Install air vent plug (2).

WARNING

**EYE PROTECTION****CHEMICAL****SLICK FLOOR**

16. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUMP-JET EXPANSION TANK
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Expansion Tank Assembly
 PN E27113
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L (2)

References

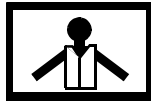
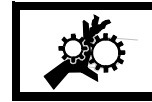
TM 55-1945-225-10

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE PUMP-JET EXPANSION TANK

WARNING

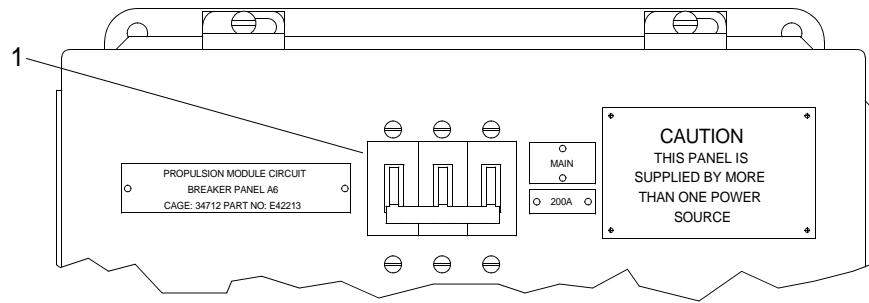
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

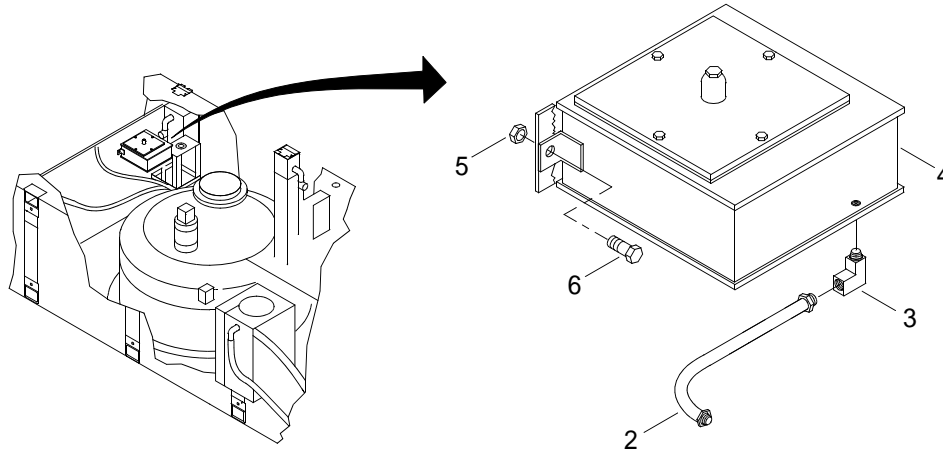
NOTE

The following procedure is typical for removal and installation of pump-jet expansion tanks.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Position drain pan beneath hydraulic hose (2).



WARNING



EYE PROTECTION



CHEMICAL

- Disconnect hydraulic hose (2) and elbow (3) from underside of tank (4).
- Drain oil from hose (2) and tank (4) into drain pan.
- Using assistant, support tank (4) and remove two hex nuts (5) and capscrews (6).
- Remove expansion tank (4).

WARNING



EYE PROTECTION



CHEMICAL

- Remove drain pan and dispose of contents per local procedures.

INSTALL PUMP-JET EXPANSION TANK

1. Using assistant, position new expansion tank (4) on mounts and attach with two capscrews (6) and hex nuts (5).
2. Tighten hex nuts (5).
3. Install elbow (3) on underside of tank (4).
4. Tighten elbow (3).
5. Install hose (2) on elbow (3).
6. Tighten hose (2).

WARNING

**EYE PROTECTION****CHEMICAL****SLICK FLOOR**

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.
8. Perform operational check of pump-jet. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM
BLEED**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Respirator, Air Filtering (Item 3, WP 0425 00)
- Protector, Hearing (Item 20, WP 0425 00)
- Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

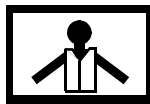
- Engineer 88L

References

- TM 55-1945-225-10

BLEED AIR FROM HYDRAULIC SYSTEM

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



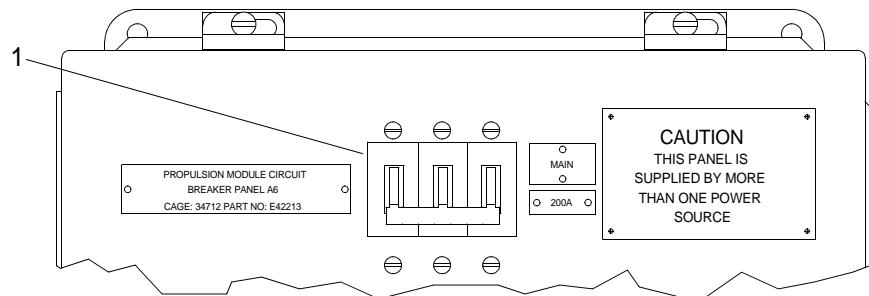
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

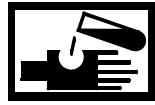
The following procedure is typical for venting air and pressure from both port and starboard hydraulic systems.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

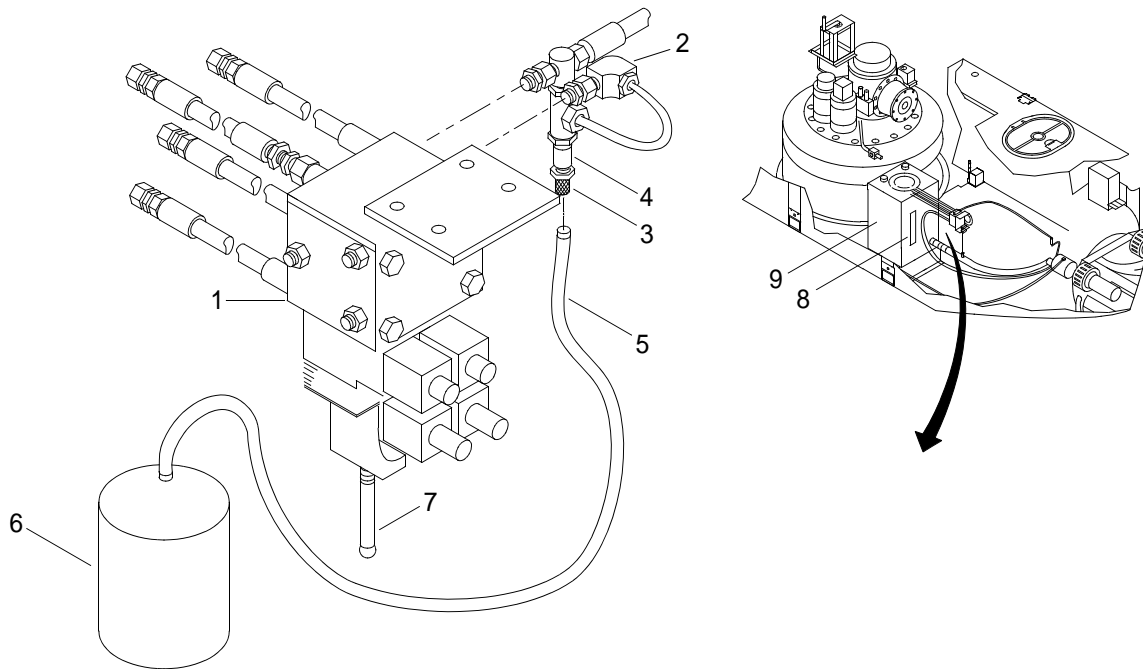


2. Place drain pan under way-valve (2).

WARNING

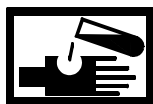
**CHEMICAL****EYE PROTECTION****VAPOR**

3. On way-valve (2), remove test port cap (3) from test port (4).



4. Connect one end of hose (5) to test port (4).
5. Place other end of hose (5) in drain pan (6).
6. Start engine. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****EAR PROTECTION**

7. Slowly loosen test ports connection (4) to allow oil to drain.
8. Manually operate way-valve handle (7) and monitor oil flowing out of hose.
9. When air bubbles are no longer visible in oil, release way-valve handle (7).
10. Tighten test port connection (4).

11. Remove test hose (5).
12. Install test port cap (3).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

13. Remove drain pan and dispose of contents in accordance with local procedures.
14. Check oil level on level gauge (8) on reservoir (9).
15. Shut engine off. (TM 55-1945-225-10)
16. Service hydraulic reservoir. (WP 0141 00)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



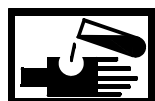
SLICK FLOOR

17. Clean up any spilled fluid with spill kit and dispose of spill kit waste per local procedures.

BLEED PRESSURE FROM HYDRAULIC SYSTEM

1. Place drain pan under way-valve (2).
2. On way-valve (2), remove test port cap (3) from test port (4).
3. Connect one end of test hose (5) to test port (4).
4. Place other end of test hose (5) in drain pan (6).

 WARNING



CHEMICAL



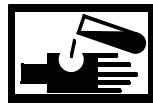
EYE PROTECTION



VAPOR

5. Slowly loosen test ports connection (4) to allow oil to drain under pressure.
6. When oil pressure is relieved, close test port (4).
7. Remove test hose (5).
8. Install test port cap (3).

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

9. Remove drain pan and dispose of contents in accordance with local procedures.
10. Check oil level gauge (8) on reservoir (9).
11. Service hydraulic reservoir. (WP 0141 00)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

12. Clean up any spilled fluid with spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM
ADJUSTMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)
Protector, Hearing (Item 20, WP 0425 00)
Wrench, Torque (10-250 in lbs) (Item 38, WP 0425 00)

Materials/Parts

Packing, Preformed
PN BH00114774
Qty 2
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Cloth, Cleaning (Item 7, WP 0426 00)

Personnel Required

Engineer 88L

References

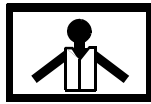
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Has Been Bled. (WP 0134 00)

SET PRESSURE REGULATION

 WARNING



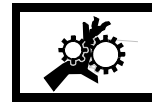
VEST



HELMET PROTECTION



HEAVY PARTS



MOVING PARTS

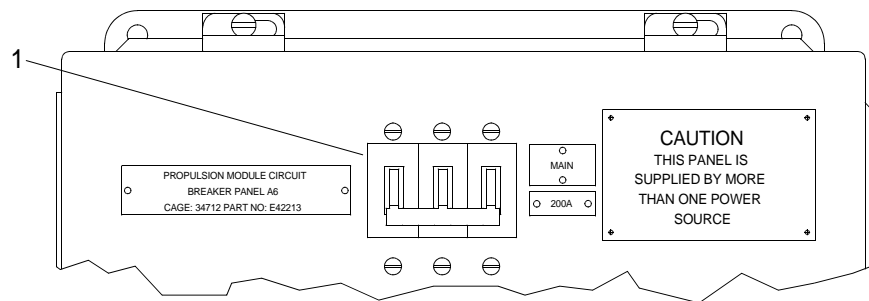
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

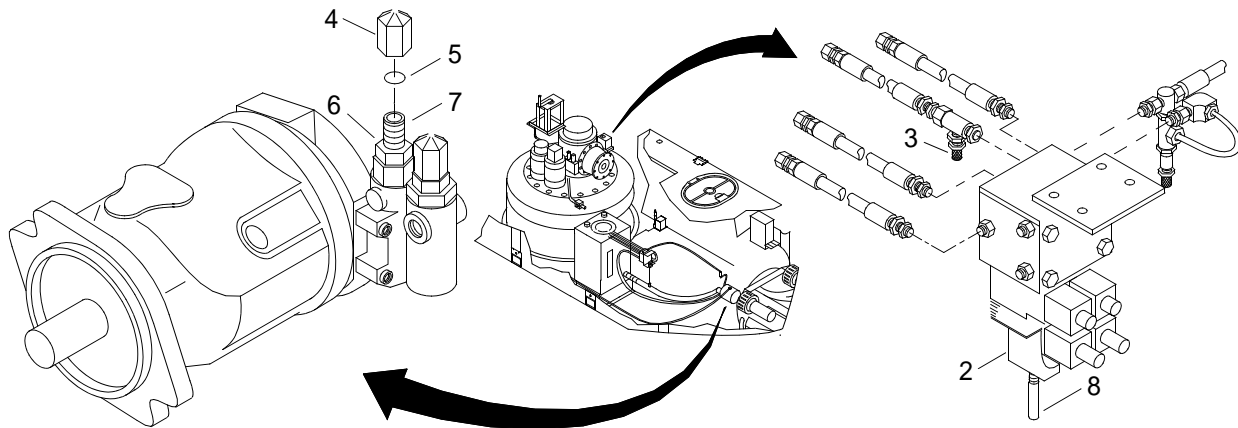
The following procedure is typical for adjusting pressure on both port and starboard hydraulic systems.

Test gauge assembly is stowed in operators cab.

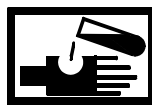
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Tag and disconnect wiring to solenoids on way-valve (2).



 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Open test port (3) of way-valve (2) and connect test gauge.

WARNING

**EAR PROTECTION**

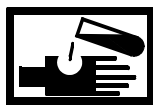
4. Remove acorn nut (4) and preformed packing (5). Discard preformed packing (5).
5. Loosen hex nut (6).
6. Start engine. (TM 55-1945-225-10)
7. Turn set screw (7) by turning with hex socket head wrench.
8. Set pressure to 3,046 PSI (210 bar).
9. Fully open way-valve (2) by moving handle (8) as far aft as possible to obtain proper reading on test gauge.

NOTE

One turn of set screw corresponds to 725 PSI (50 bar) within a pressure range of 290-3,625 PSI (20-250 bar).

10. Increase pressure by turning set screw (7) clockwise and decrease pressure by turning set screw (7) counterclockwise.
11. Holding set screw (7) in position with socket head wrench, secure set screw (7) in position using hex nut (6).
12. Install new preformed packing (5) and acorn nut (4) removed in step 4.
13. Using torque wrench, tighten acorn nut (4) to 15.4 ft lbs (20.34 N-m).
14. Stop engine. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

15. Remove test gauge and close test port (3).
16. Connect wiring to solenoids on way-valve (2).
17. Remove tags on wiring.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM FLOW
ADJUSTMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Protector, Hearing (Item 20, WP 0425 00)
 Wrench, Torque (10-250 in lbs) (Item 38, WP 0425 00)

Materials/Parts

Ring
 PN BH00114774
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

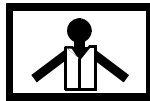
Engineer 88L

References

TM 55-1945-225-10

SET FLOW REGULATION

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

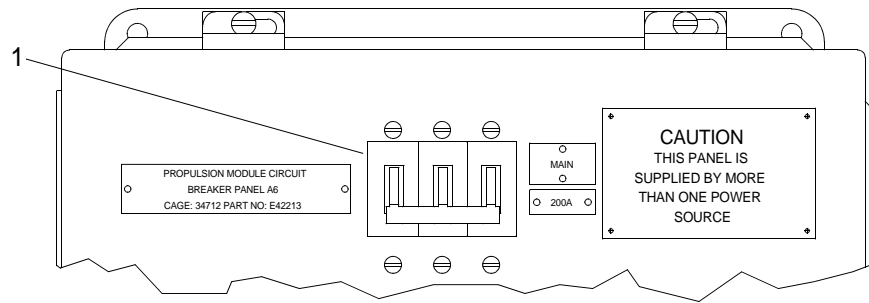
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for adjusting flow in both port and starboard hydraulic systems.

Test gauge assembly is stowed in operators cab.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING



CHEMICAL

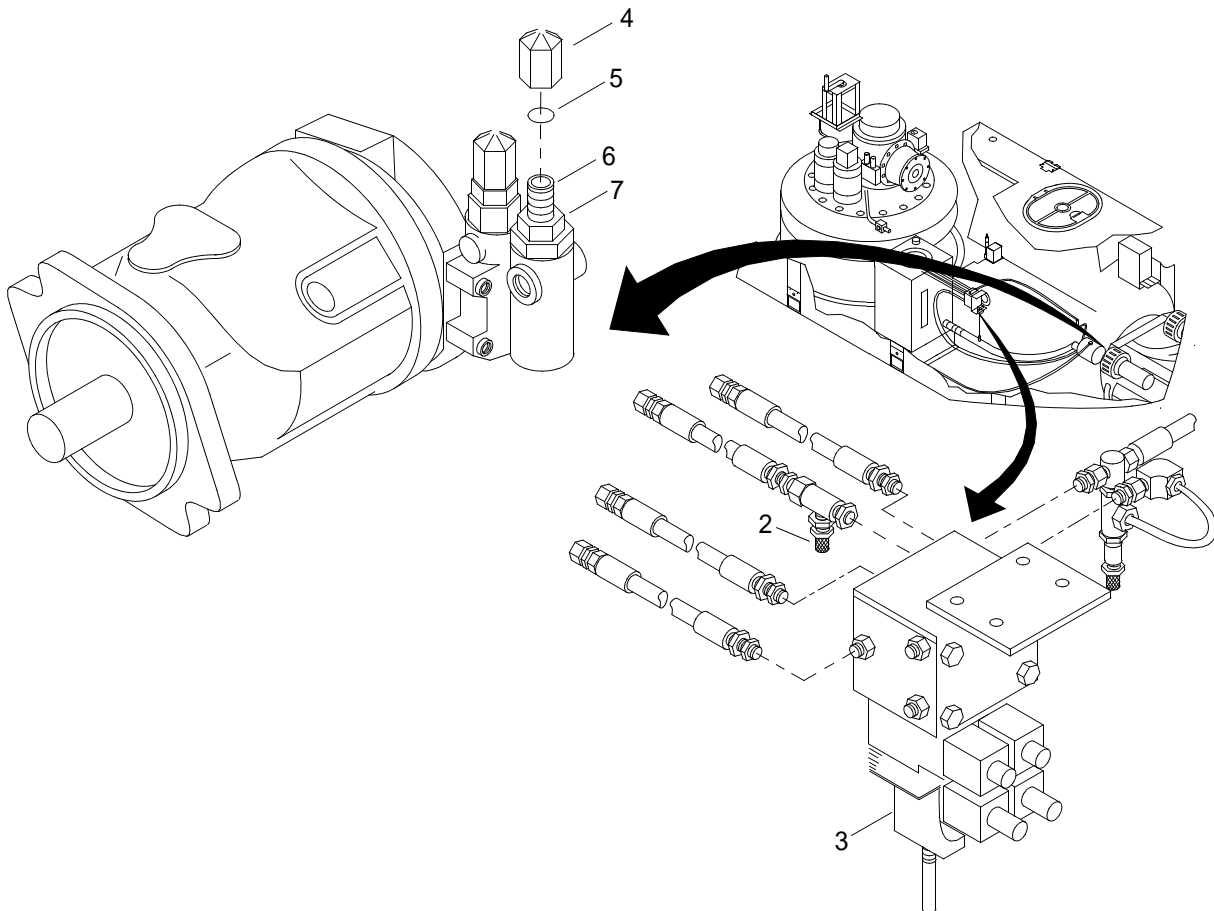


EYE PROTECTION



VAPOR

- Open test port (2) of way-valve (3) and connect test gauge.



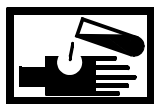
- Start engine. (TM 55-1945-225-10)

WARNING

**EAR PROTECTION**

4. Ensure hydraulic pressure reading on test gauge is 275 PSI (19 bar). If necessary, adjust flow rate as follows:
 - a. Remove acorn nut (4) and ring (5). Discard ring (5).
 - b. Loosen hex nut (6).
 - c. Set flow range by turning flow set screw (7) with socket wrench. Proper reading should be 275 PSI (19 bar). Increase flow by turning screw clockwise. Decrease flow by turning screw counterclockwise.
 - d. Holding set screw (7) in position with socket head wrench, secure set screw (7) in position using hex nut (6).
 - e. Install new ring (5) and acorn nut (4).
 - f. Using torque wrench, tighten acorn nut (4) to 15.4 ft lbs (20.34 N-m).
5. Stop engine. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

6. Remove test gauge and close test port (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC STEERING SYSTEM
ADJUSTMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L (2)

References

TM 55-1945-225-10

Equipment Condition

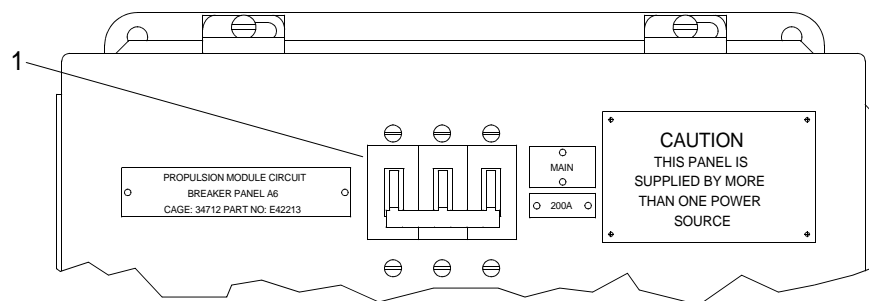
Engine Power Isolated. (WP 0075 00)

ADJUST HYDRAULIC STEERING SYSTEM**NOTE**

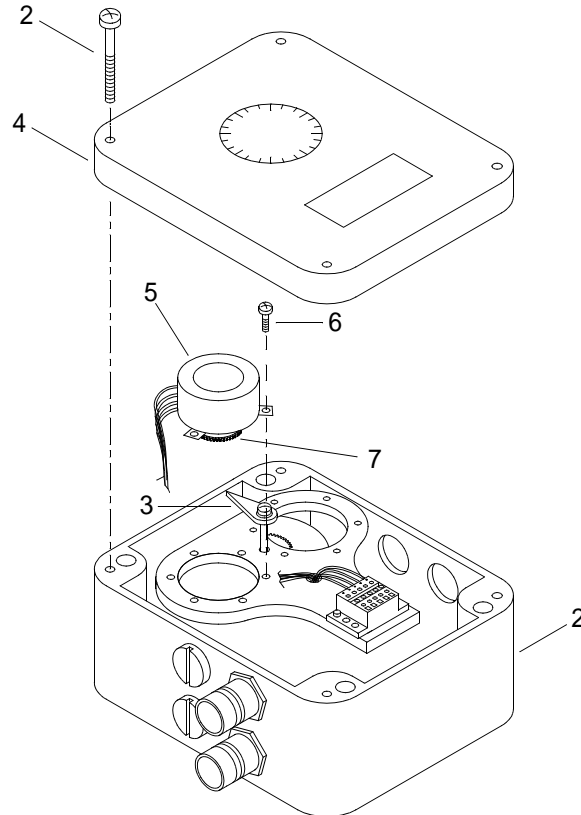
This task is typical for adjusting steering in both propulsion modules.

The pump-jet thrust nozzle should be verified as pointing aft prior to placing the propulsion module in the water to perform this adjustment.

1. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to on.



2. Verify position of feedback unit (2) dial indicator (3) is pointing forward.

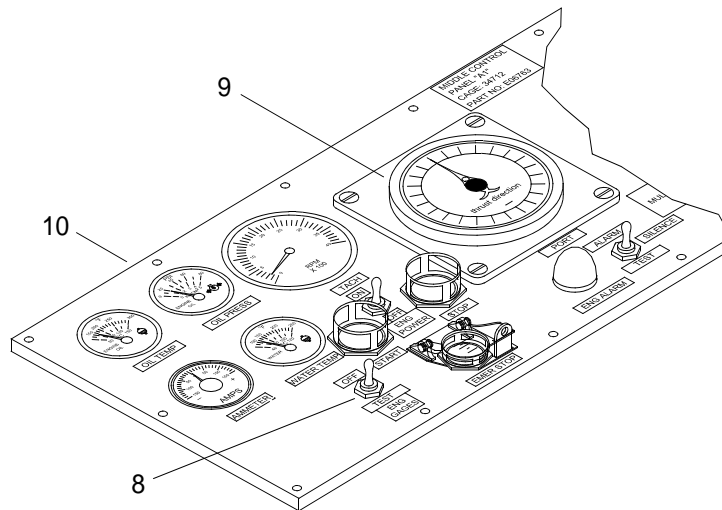


3. Remove screws (3) securing cover (4) on feedback unit (2).
4. Remove cover (4) from feedback unit (2) to gain access to position potentiometer (5).
5. Remove screws (6) securing body of position potentiometer (5) inside feedback unit (2).

CAUTION

Care must be given to prevent damage to electrical wiring attached to position potentiometer when lifting component out of feedback unit. Failure to comply will result in damage to equipment.

6. Lift position potentiometer (5) from feedback unit (2) to access gear (7) on bottom of position potentiometer (5).
7. With assistant in operators cab to hold ENG GAGES toggle switch (8) in TEST position ((provides power to thrust indicators (9) on middle control panel A1 (10)) and to verify thrust indicator (9) movement, rotate gear (7) on bottom of position potentiometer (5) clockwise or counterclockwise until thrust indicator pointer (10) direction agrees with dial indicator (3) position on feedback unit (2). When adjustment is complete, release engine alarm switch (8).



8. Install position potentiometer (5) inside feedback unit (2) ensuring position of dial indicator (3) does not change.
9. Install screws (6) to secure body of position potentiometer (5) inside feedback unit (2). Tighten screws (6).
10. Position cover (4) on feedback unit (2).
11. Install screws (3) to secure cover (4) on feedback unit (2). Tighten screws (3).
12. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to off.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR FLUID LEVEL
SENSOR SUBASSEMBLY
REMOVAL, TESTING AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

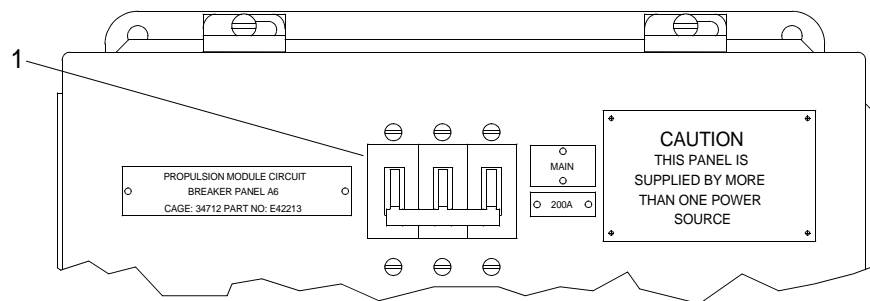
Equipment Condition

Engine Power Isolated. (WP 0075 00)

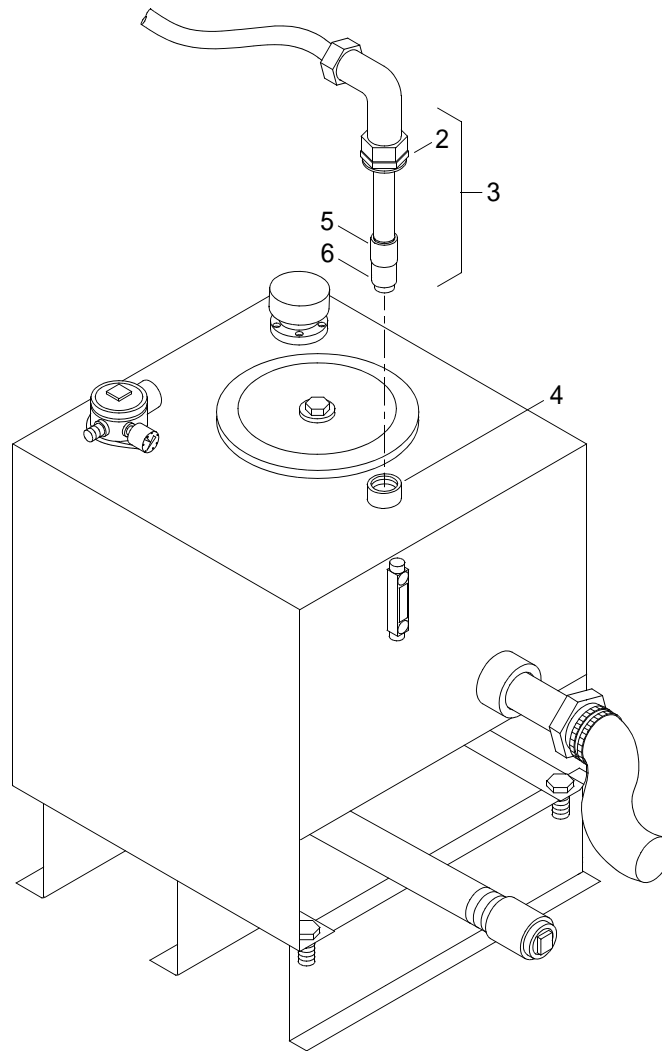
REMOVE HYDRAULIC SYSTEM RESERVOIR FLUID LEVEL SENSOR SUBASSEMBLY**NOTE**

The following procedure is typical for the removal, testing and installation of sensor subassemblies.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Turn adaptor (2) of fluid level sensor subassembly (3) counterclockwise on top of hydraulic reservoir (4).



WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Carefully remove the fluid level sensor subassembly (3) from the hydraulic reservoir (4).

TEST HYDRAULIC SYSTEM RESERVOIR FLUID LEVEL SENSOR SUBASSEMBLY

1. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to on.
2. Move sensor float (5) to lower limit of travel.
3. On lower control panel A2 in operators cab, check that HPU OIL LEVEL LOW red indicator illuminates.
4. If indicator does not illuminate, replace fluid level sensor (6).
5. Move sensor float (5) to upper limit of travel.

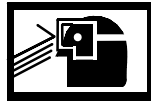
6. On lower control panel A2 in operators cab, check that HPU OIL LEVEL LOW red indicator is not illuminated.
7. If indicator illuminates, replace fluid level sensor (6).
8. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to off.

INSTALL HYDRAULIC SYSTEM RESERVOIR FLUID LEVEL SENSOR SUBASSEMBLY

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

1. Install fluid level sensor subassembly (3) into the top of the reservoir (4).
2. Turn adaptor (2) clockwise and tighten.
3. Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR TANK STRAINER
REMOVAL, CLEANING AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Brush, Stencil (Soft Bristle) (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cloth, Cleaning (Item 7, WP 0426 00)
 Hydraulic Fluid, Petroleum Base (Item 15, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

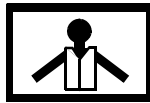
TM 55-1945-225-10

Equipment Condition

Hydraulic System Reservoir Drained. (WP 0140 00)

REMOVE HYDRAULIC SYSTEM RESERVOIR TANK STRAINER

WARNING



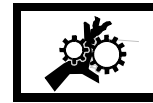
VEST



HELMET PROTECTION



HEAVY PARTS



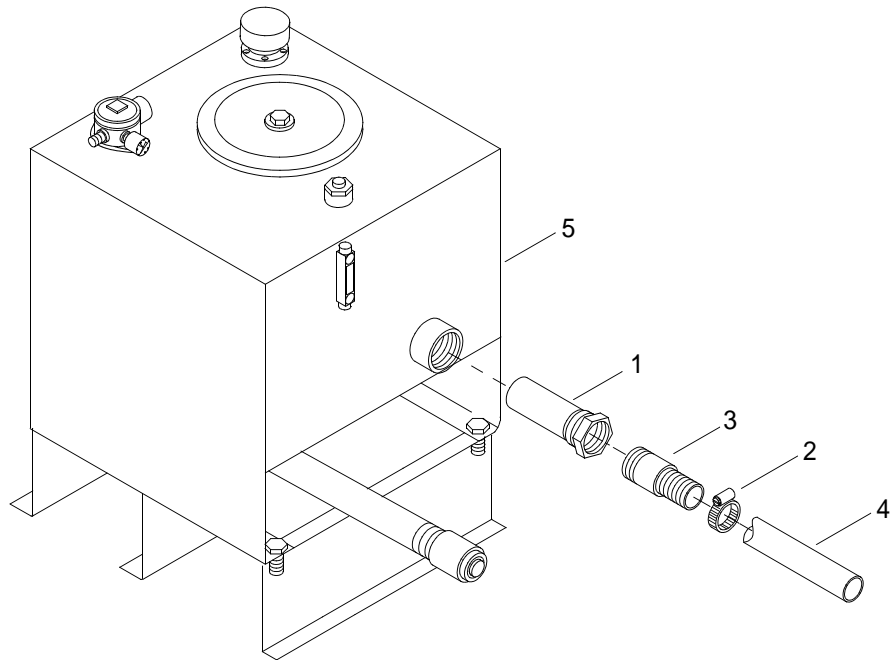
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

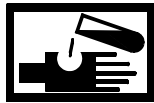
The following procedure is typical for both port and starboard hydraulic reservoirs.

1. Position drain pan beneath strainer (1).



2. Remove hose clamp (2) from strainer nipple (3).

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Remove hose (4) from strainer nipple (3).

WARNING



CHEMICAL



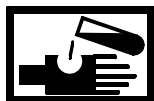
EYE PROTECTION



VAPOR

4. Remove strainer nipple (3) from strainer (1).

WARNING



CHEMICAL



EYE PROTECTION



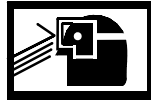
VAPOR

5. Remove strainer (1) from reservoir (5) by turning counterclockwise.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

6. Remove drain pan and dispose of contents per local procedures.

CLEAN HYDRAULIC SYSTEM RESERVOIR TANK STRAINER

1. Using cleaning cloth and brush, clean strainer (1) of all accumulations of dirt and debris.

 WARNING



CHEMICAL



EYE PROTECTION

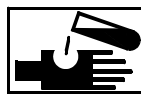


VAPOR

2. Rinse strainer (1) in clean oil.

INSTALL HYDRAULIC SYSTEM RESERVOIR TANK STRAINER

 WARNING



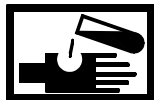
CHEMICAL



EYE PROTECTION

1. Apply antiseize compound to threads of strainer (1).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

2. Install strainer (1) into reservoir (5).
3. Tighten strainer (1).
4. Install strainer nipple (3) in strainer (1).
5. Tighten strainer nipple (3).
6. Position hose (4) over strainer nipple (3).
7. Position hose clamp (2) on hose (4).
8. Tighten hose clamp (2).

9. Service hydraulic system reservoir. (WP 0141 00)

WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

10. Clean up spilled fluid with spill kit and dispose of spill kit waste per local procedures.

11. Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR
DRAINING AND CLEANING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Brush, Stencil (Soft Bristle) (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cloth, Cleaning (Item 7, WP 0426 00)
 Lubricating Oil, General Purpose (Item 21, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

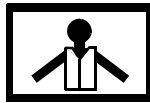
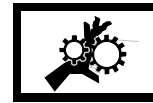
TM 55-1945-225-10

Equipment Condition

Engine Power Isolated. (WP 0075 00)

DRAIN HYDRAULIC SYSTEM RESERVOIR

WARNING

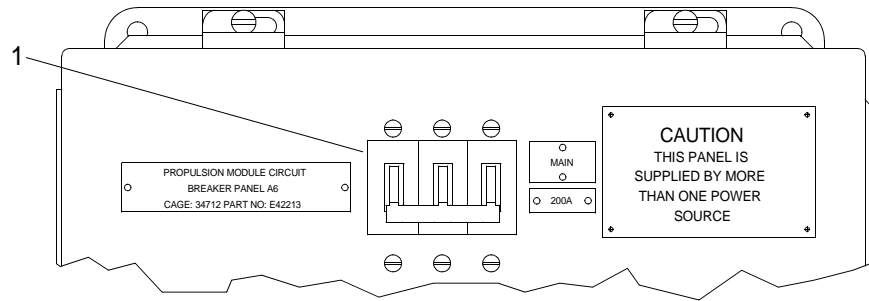
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for servicing both port and starboard hydraulic reservoirs.

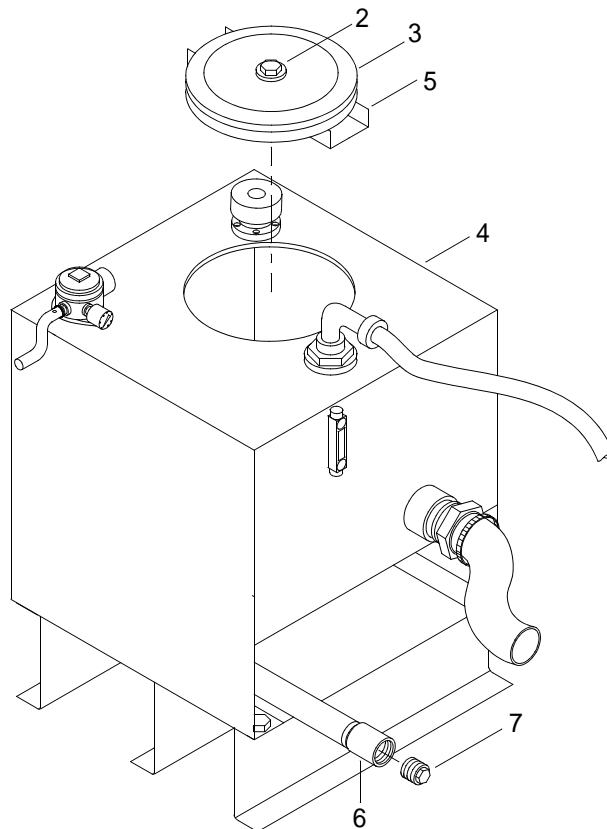
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



NOTE

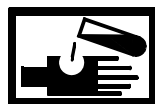
Do not loosen hex head capscrew too much or inspection cover bar will fall into reservoir.

- Loosen hex head capscrew (2) securing inspection cover (3) to reservoir (4).



- Slide inspection cover (3) to one side of reservoir opening until bar (5) is freed from edge.

WARNING



CHEMICAL



EYE PROTECTION



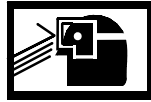
VAPOR

- Remove inspection cover (3).
- Position drain pan beneath drain pipe (6).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

6. Remove drain plug (7) from end of drain pipe (6).

 WARNING



CHEMICAL



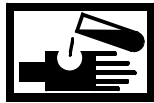
EYE PROTECTION



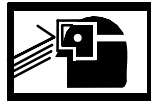
VAPOR

7. Drain oil out of reservoir (4) into drain pan.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

8. Remove drain pan and dispose of contents per local procedures.

CLEAN HYDRAULIC SYSTEM RESERVOIR

1. Using cleaning cloth and a soft bristle brush, clean hydraulic reservoir (4) interior to loosen sludge.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

2. Rinse reservoir (4) with clean lubricating oil.
3. Clean underside of inspection cover (3) using cleaning cloth.

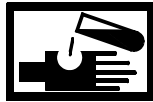
FILL HYDRAULIC SYSTEM RESERVOIR

WARNING

**EYE PROTECTION****VAPOR**

1. Apply sealing compound to drain plug (7).
2. Install drain plug (7) in drain pipe (6).
3. Service hydraulic system reservoir. (WP 0141 00)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

4. Position inspection cover (3) in top of reservoir (4).
5. Tighten capscrew (2).

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

6. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.
7. Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR
SERVICING**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Lubricating Oil, General Purpose (Item 21, WP 0426 00)

Personnel Required

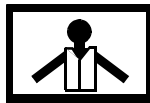
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

SERVICE HYDRAULIC SYSTEM RESERVOIR

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



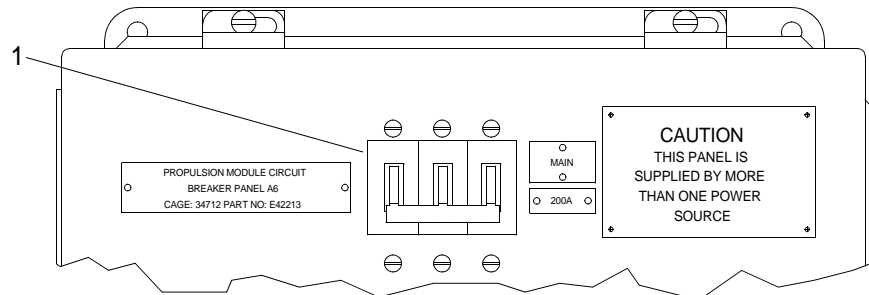
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for servicing both port and starboard hydraulic reservoirs.

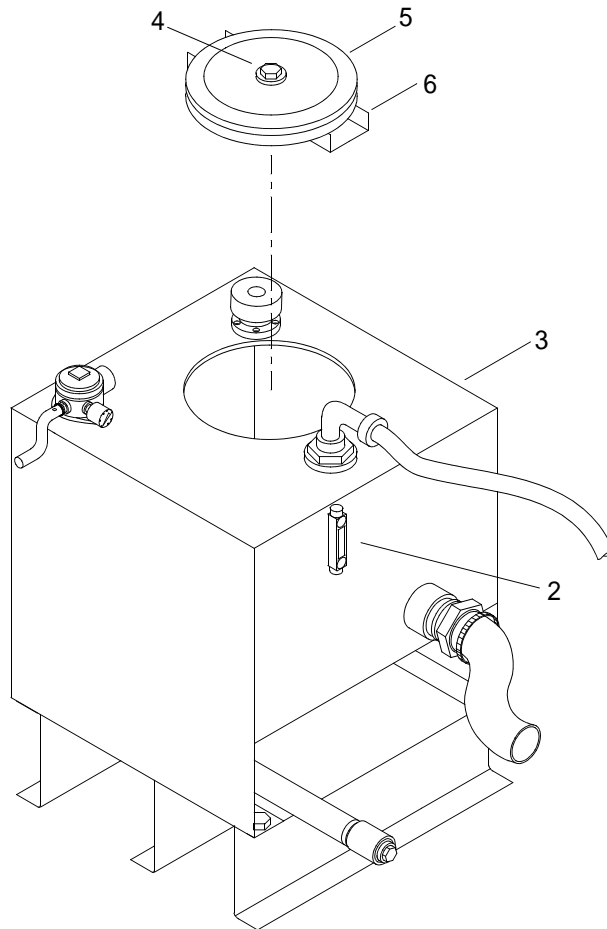
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



NOTE

If fluid level in the sight glass does not indicate full, the reservoir must be serviced.

- Inspect the lubricating oil level through the sight glass (2) on the side of the reservoir (3).

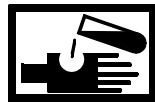


NOTE

Do not loosen hex head capscrew too much or the inspection cover bar will fall into reservoir.

- Loosen hex head capscrew (4) securing the inspection cover (5) to reservoir (3).
- Slide inspection cover (5) to one side of reservoir (3) until bar (6) is free from the edge.

WARNING



CHEMICAL



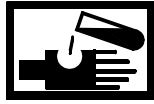
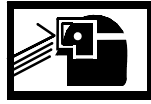
EYE PROTECTION



VAPOR

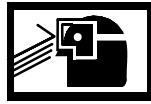
- Remove inspection cover (5).

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

6. Fill the reservoir (3) with lubricating oil.
7. Verify fluid level in sight gauge (2) indicates full.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

8. Position the inspection cover (5) on top of the reservoir (3).
9. Tighten hex head capscrew (4).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM FILTER ELEMENTS
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Element, Return Filter
 PN GT4G10Y6
 Element, Pressure Filter
 PN N10
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Lubricating Oil, General Purpose (Item 21, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

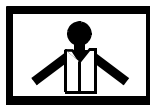
TM 55-1945-225-10

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM RESERVOIR RETURN FILTER ELEMENT

WARNING

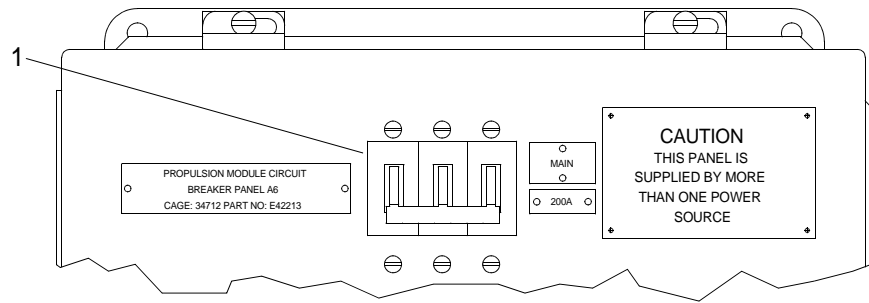
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of hydraulic filter elements.

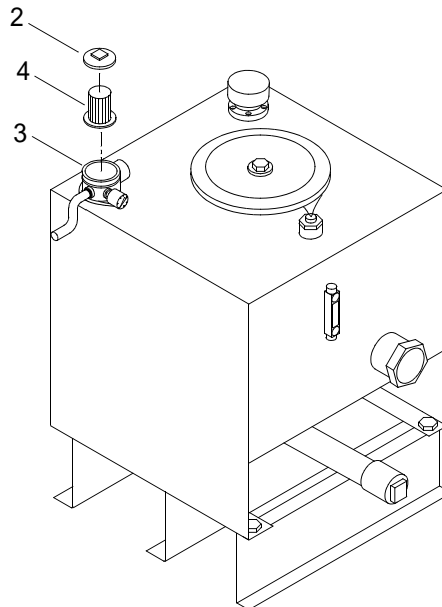
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



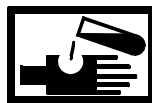
WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

2. Turn cap (2) counterclockwise and remove from return filter housing (3).



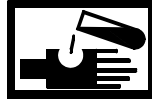
WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

3. Remove element (4) from return filter housing (3) and discard.

INSTALL HYDRAULIC SYSTEM RESERVOIR RETURN FILTER ELEMENT

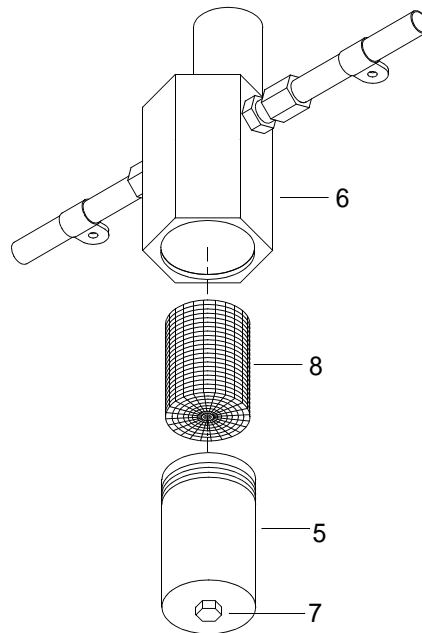
WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

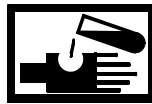
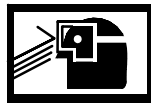
1. Insert new return filter element (4) into return filter housing (3).
2. Install cap (2), turn clockwise to tighten.

REMOVE HYDRAULIC SYSTEM HYDRAULIC PRESSURE FILTER

1. Position drain pan beneath hydraulic pressure filter (5).

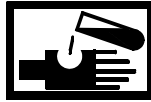


WARNING

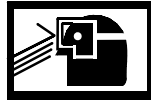
**CHEMICAL****EYE PROTECTION****VAPOR**

2. Remove hydraulic pressure filter (5) from hydraulic manifold (6) by turning nut (7) on bottom of hydraulic pressure filter (5) counterclockwise.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Remove hydraulic pressure filter element (8) from inside hydraulic pressure filter (5).

 WARNING



CHEMICAL



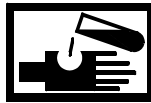
EYE PROTECTION



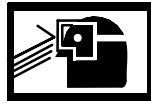
VAPOR

4. Discard hydraulic pressure filter element (8).

 WARNING



CHEMICAL



EYE PROTECTION

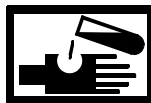


VAPOR

5. Remove drain pan and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM HYDRAULIC PRESSURE FILTER

 WARNING



CHEMICAL



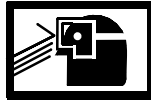
EYE PROTECTION



VAPOR

1. Lubricate integral seal of new hydraulic pressure filter element (8) with hydraulic oil.
2. Install new hydraulic pressure filter element (8) into hydraulic pressure filter (5).
3. Position hydraulic pressure filter (5) on hydraulic manifold (6).
4. Tighten hydraulic pressure filter (5) on hydraulic manifold (6) using nut (7) on bottom of hydraulic pressure filter (5) and turning clockwise.
5. Service hydraulic system reservoir. (WP 0141 00)
6. Vent air from hydraulic system. (WP 0134 00)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 8,400 lb. 20 ft (Yellow) (Item 30, WP 0425 00)
 Qty 2

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

References

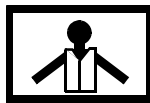
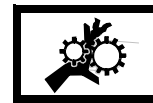
TM 55-1945-225-10

Equipment Condition

Powered Section Exhaust Plenum Removed. (WP 0087 00)
 Powered Section Thruster Hatch Removed. (WP 0100 00)
 Hydraulic System Pressure Vented. (WP 0134 00)
 Hydraulic System Reservoir Fluid Level Sensor Subassembly Removed. (WP 0138 00)
 Hydraulic System Reservoir Tank Strainer Removed. (WP 0139 00)
 Hydraulic System Reservoir Drained. (WP 0140 00)
 Hydraulic System Reservoir Filter Element Removed. (WP 0142 00)
 Hydraulic System Reservoir Breather/Filler Removed. (WP 0145 00)
 Hydraulic System Reservoir Sight Gauge Removed. (WP 0146 00)

REMOVE HYDRAULIC SYSTEM RESERVOIR

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

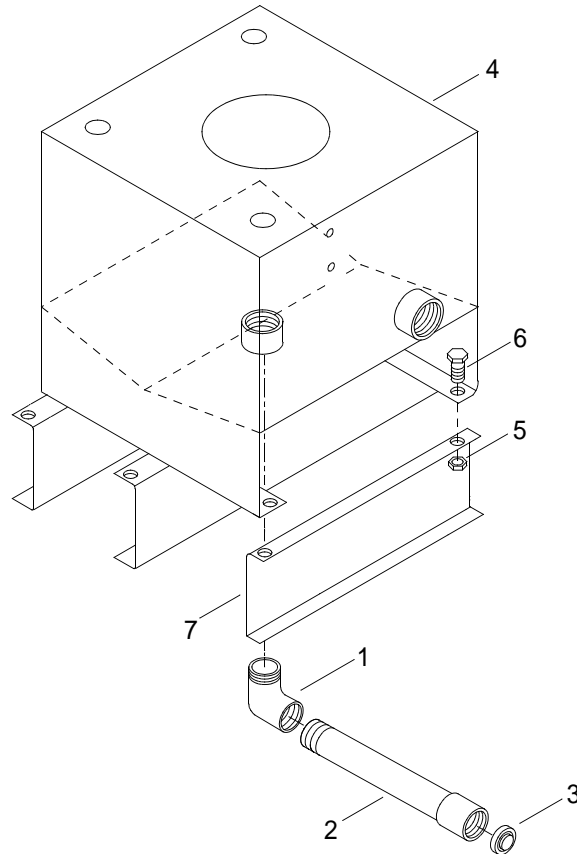
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of port or starboard hydraulic reservoirs.

1. Inspect slings prior to use. (TM 55-1945-225-10)

2. Remove elbow (1), drain pipe (2) and drain plug (3) from beneath hydraulic reservoir (4).



3. Remove six hex nuts (5) and hex head capscrews (6) securing hydraulic reservoir (4) to base supports (7).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

4. Using crane and sling, remove hydraulic reservoir (4).

INSTALL HYDRAULIC SYSTEM RESERVOIR

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

1. Using crane and sling, position hydraulic reservoir (4) on base supports (7).
2. Install six hex head capscrews (6) and hex nuts (5) to secure reservoir (3) on base supports (7).
3. Tighten hex head nuts (5).
4. Install elbow (1), drain pipe (2) and drain plug (3) on bottom of reservoir (4).
5. Install hydraulic system reservoir sight gauge. (WP 0146 00)
6. Install hydraulic system reservoir breather/filler. (WP 0145 00)
7. Install hydraulic system reservoir filter element. (WP 0142 00)
8. Service hydraulic reservoir. (WP 0141 00)
9. Install hydraulic system reservoir tank strainer. (WP 0139 00)
10. Install hydraulic system reservoir fluid level sensor subassembly. (WP 0138 00)
11. Vent air from hydraulic system. (WP 0134 00)
12. Install powered section thruster hatch. (WP 0100 00)
13. Install powered section exhaust plenum assembly. (WP 0087 00)
14. Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RETURN FILTER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pump, Oil Suction (Item 22, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Filter, Return
 PN GT4G10Y6
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

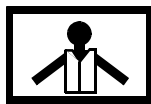
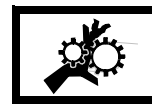
TM 55-1945-225-10

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM HYDRAULIC RETURN FILTER ASSEMBLY

WARNING

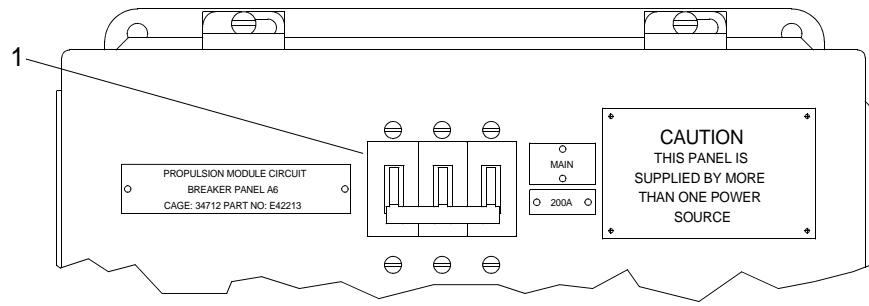
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for replacement of both port and starboard hydraulic filters.

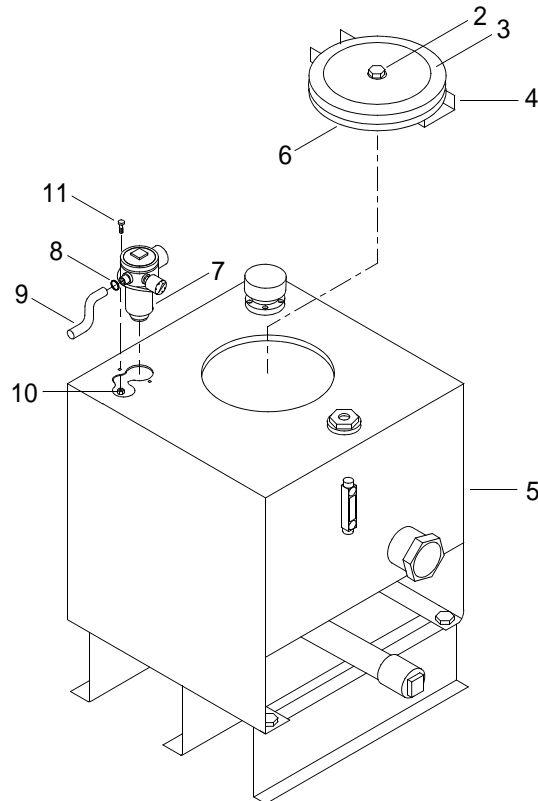
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



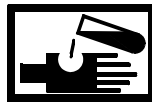
NOTE

Complete removal of capscrew will result in inspection cover bar falling into reservoir.

- Loosen hex head capscrew (2).



WARNING



CHEMICAL



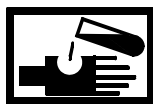
EYE PROTECTION



VAPOR

- Slide inspection cover (3) to one side of reservoir opening until inspection cover bar (4) is free from edge of opening of reservoir (5).

 WARNING



CHEMICAL



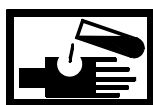
EYE PROTECTION



VAPOR

4. Remove inspection cover (3), gasket (6) and bar (4) as a unit.
5. Position drain pan in proximity of return filter assembly (7).
6. Loosen hose clamp (8).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

7. Remove hose (9) from return filter assembly (7).

 WARNING



CHEMICAL



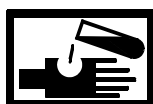
EYE PROTECTION



VAPOR

8. Drain hydraulic fluid from hose (9) into drain pan.

 WARNING



CHEMICAL



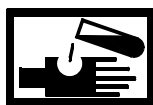
EYE PROTECTION



VAPOR

9. Using oil suction pump, remove sufficient hydraulic fluid from reservoir (5) into drain pan to permit access to nuts (10).
10. Remove two nuts (10) and capscrews (11) from return filter assembly (7).

 WARNING



CHEMICAL



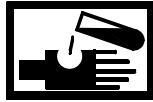
EYE PROTECTION



VAPOR

11. Remove return filter assembly (7) from reservoir (5) and discard.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

12. Remove drain pan and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM HYDRAULIC RETURN FILTER ASSEMBLY

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

1. Position new return filter assembly (7) on reservoir (5).
2. Install two capscrews (11) and nuts (10) on return filter assembly (7) and tighten.
3. Position hose (9) on return filter assembly (7).
4. Tighten hose clamp (8).
5. Service hydraulic reservoir. (WP 0141 00)
6. Position bar (4), gasket (6) and inspection cover (3) on reservoir (5).
7. Tighten capscrew (2).
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

9. Clean up spilled fluid with spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR BREATHER/FILLER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Breather/Filler
 PN Nab-1010-4
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

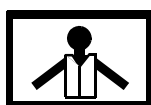
TM 55-1945-225-10

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM RESERVOIR BREATHER/FILLER

WARNING



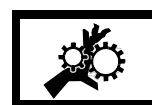
VEST



HELMET PROTECTION



HEAVY PARTS



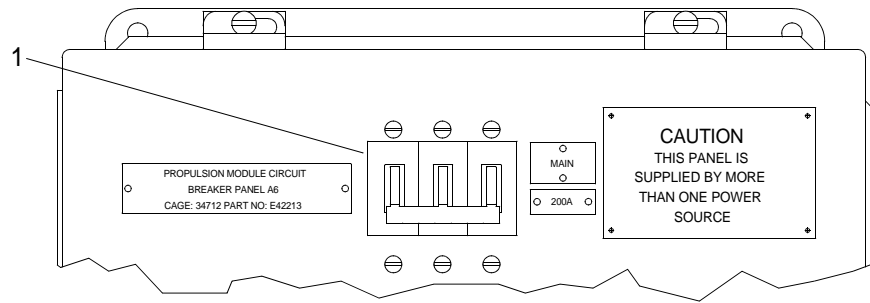
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

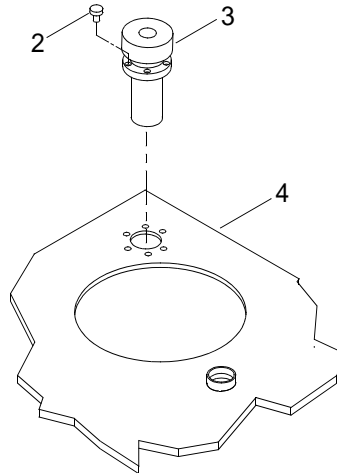
NOTE

The following procedure is typical for removal and installation of hydraulic reservoir breather/fillers.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove six capscrews (2) securing breather/filler (3) to top of hydraulic reservoir (4).



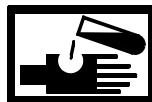
WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

- Remove breather/filler (3) from hydraulic reservoir (4) and discard.

INSTALL HYDRAULIC SYSTEM RESERVOIR BREATHING/FILLER

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

- Position new breather/filler (3) on top of hydraulic reservoir (4).
- Secure breather/filler (3) to hydraulic reservoir (4) with six capscrews (2).
- Tighten capscrews (2).
- Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR SIGHT GAUGE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gauge, Level
 PN G605-06-Y-1
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

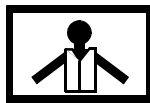
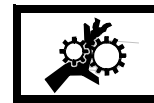
TM 55-1945-225-10

Equipment Condition

Hydraulic System Reservoir Drained. (WP 0140 00)

REMOVE HYDRAULIC SYSTEM RESERVOIR SIGHT GAUGE

WARNING

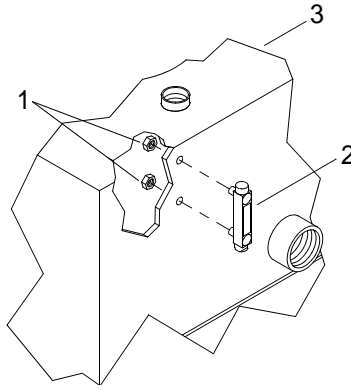
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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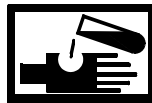
NOTE

The following procedure is typical for the removal and installation of hydraulic reservoir sight gauges.

1. Remove two hex nuts (1) securing sight gauge (2) to the side of hydraulic reservoir (3).



 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

2. Remove sight gauge (2) from hydraulic reservoir (3) and discard.

INSTALL HYDRAULIC SYSTEM RESERVOIR SIGHT GAUGE

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

1. Position new sight gauge (2) on the top of the hydraulic reservoir (3).
2. Secure the sight gauge (2) to hydraulic reservoir (3) with two hex nuts (1).
3. Tighten hex nuts (1).
4. Service hydraulic reservoir. (WP 0141 00)
5. Perform operational check of hydraulic system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR TO
HYDRAULIC PUMP SUCTION HOSE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pump, Oil Suction (Item 22, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Hose, 1 1/4 ID
 PN 18FT-881-20
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

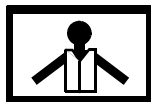
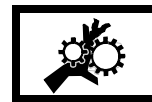
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

HYDRAULIC SYSTEM RESERVOIR TO HYDRAULIC PUMP SUCTION HOSE

WARNING

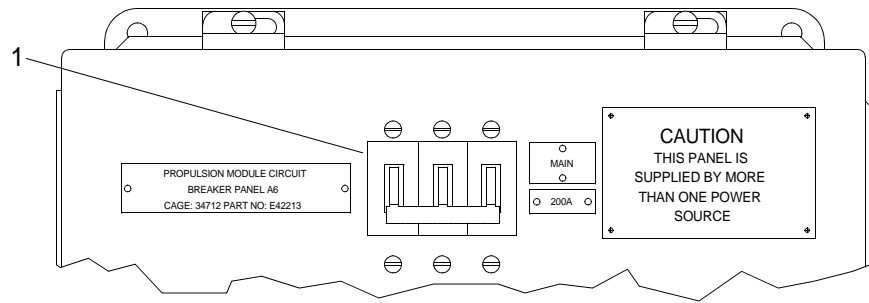
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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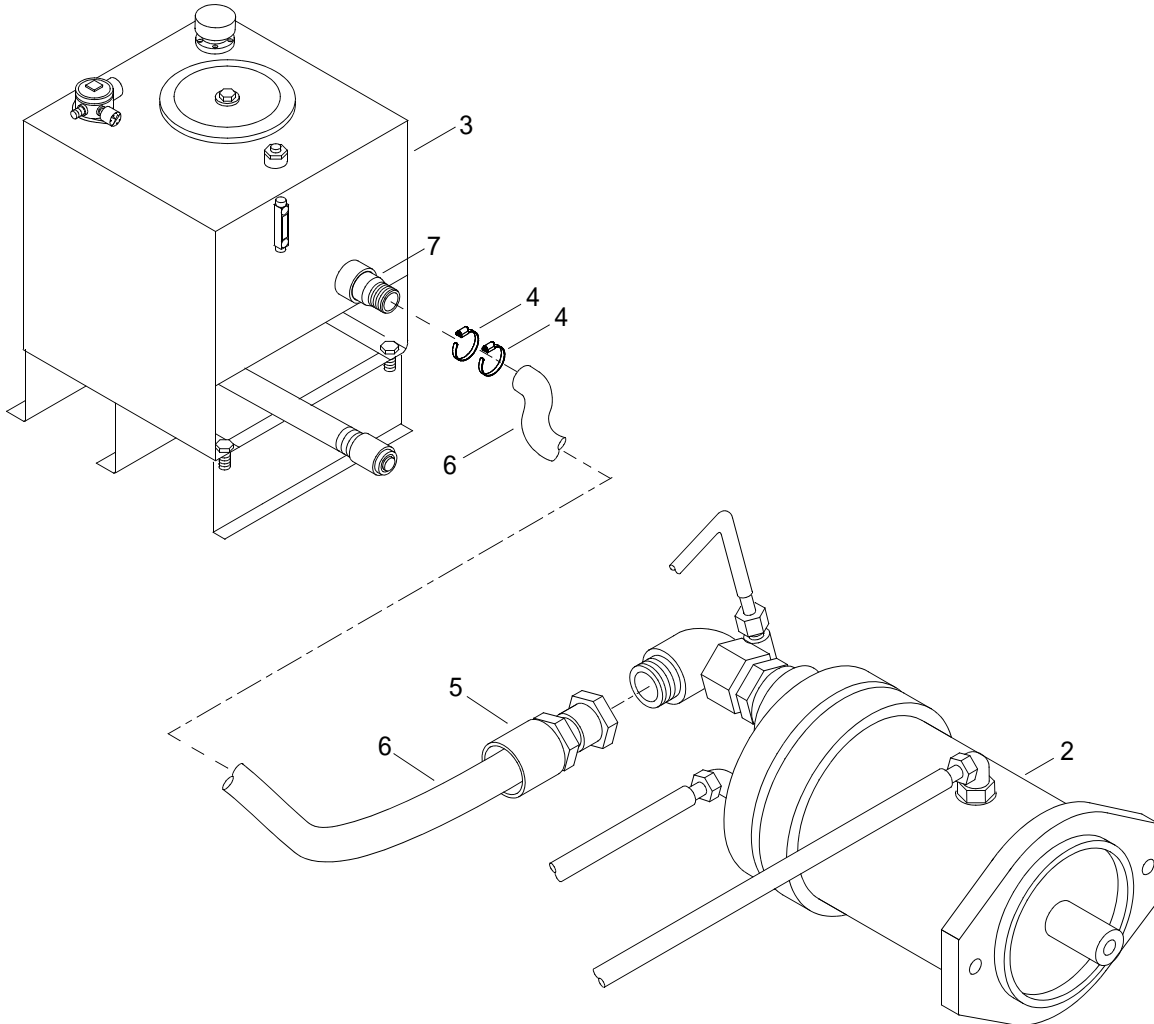
NOTE

The following procedure is typical for replacing both port and starboard hydraulic reservoir to hydraulic pump section hoses.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Place drain pans beneath hydraulic pump (2) and hydraulic reservoir (3).

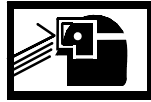


3. Loosen hose clamps (4).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

4. Remove hose adaptor (5) from hydraulic pump (2).

 WARNING



CHEMICAL



EYE PROTECTION



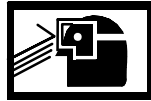
VAPOR

5. Remove hose (6) from filter tank adaptor (7).
6. Remove hose clamps (4) from hose (6).
7. Discard hose (6).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

8. Remove drain pans and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM RESERVOIR TO HYDRAULIC PUMP SUCTION HOSE

1. Position hose clamps (4) on new hose (6).
2. Install hose (6) on filter tank adaptor (7).
3. Tighten hose clamps (4).
4. Install hose adaptor (5) on hydraulic pump (2) and tighten.
5. Service hydraulic reservoir. (WP 0141 00)
6. Vent air from hydraulic system. (WP 0134 00)
7. Perform operational check of hydraulic system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

8. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM PUMP TO PRESSURE FILTER TUBE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pump, Oil Suction (Item 22, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Assembly, Tube
 PN 1008088
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

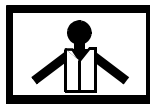
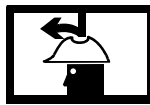
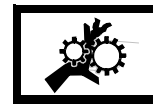
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM PUMP TO PRESSURE FILTER TUBE

WARNING

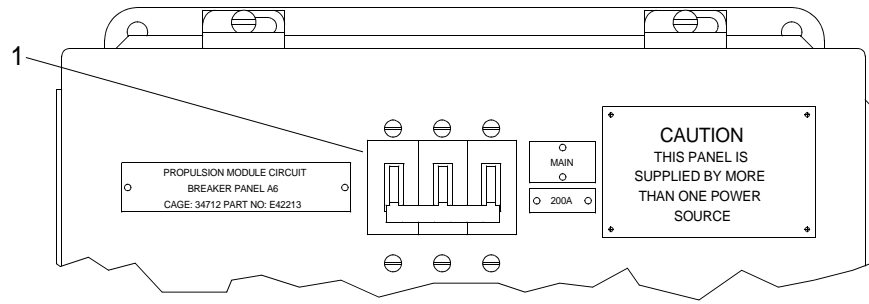
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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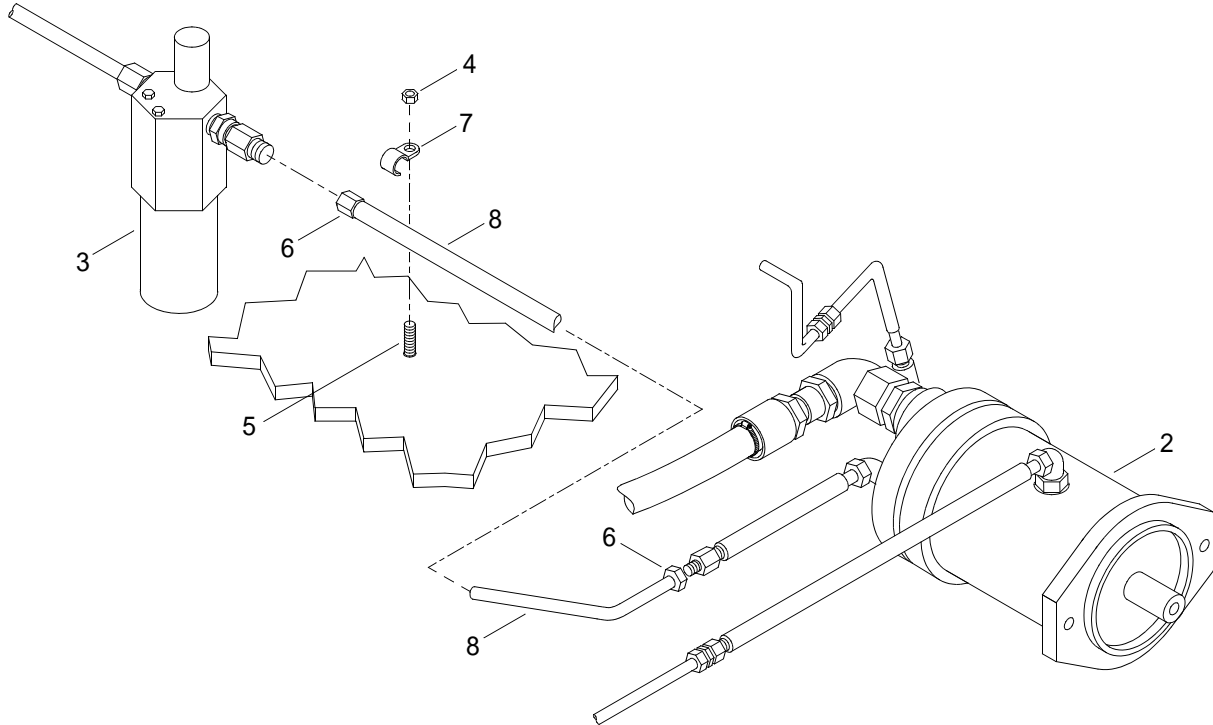
NOTE

The following procedure is typical for replacing both port and starboard hydraulic pump to pressure filter tubes.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

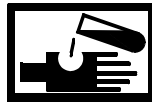


2. Position drain pans beneath hydraulic pump (2) and pressure filter (3).



3. Remove self-locking nut (4) from stud (5).

WARNING



CHEMICAL



EYE PROTECTION



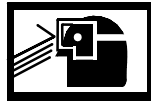
VAPOR

4. Disconnect fittings (6) from hydraulic pump (2) and pressure filter (3).
5. Remove clamp (7) from stud (5) and tube (8).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

6. Tilt tube (8) and drain hydraulic fluid into drain pan.
7. Discard tube (8).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

8. Remove drain pans and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM PUMP TO PRESSURE FILTER TUBE

 WARNING



CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads of hydraulic pump (2) and pressure filter (3).
2. Position new tube (8) between hydraulic pump (2) and pressure filter (3).
3. Connect fittings (6) to hydraulic pump (2) and pressure filter (3) and tighten.
4. Position clamp (7) on tube (8) and stud (5).
5. Install self-locking nut (4) on stud (5) and tighten.
6. Service hydraulic reservoir. (WP 0141 00)
7. Vent air from hydraulic system. (WP 0134 00)
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM WAY-VALVE PORT M TO PUMP-JET
MANIFOLD PORT H HYDRAULIC LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Assembly, Tube
 PN 1008088
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

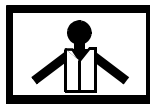
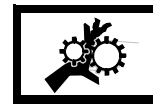
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

**REMOVE HYDRAULIC SYSTEM WAY-VALVE PORT M TO PUMP-JET MANIFOLD
PORT H HYDRAULIC LINE**

WARNING

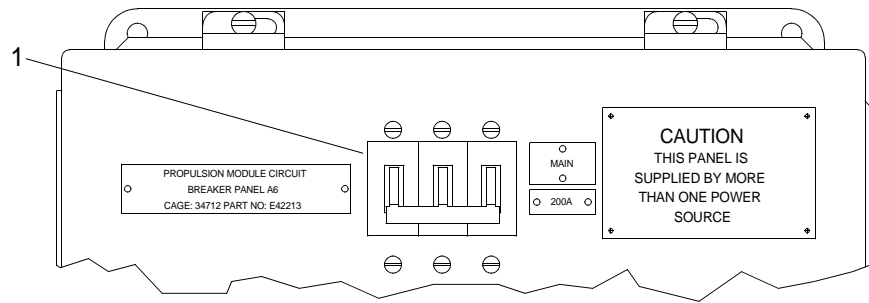
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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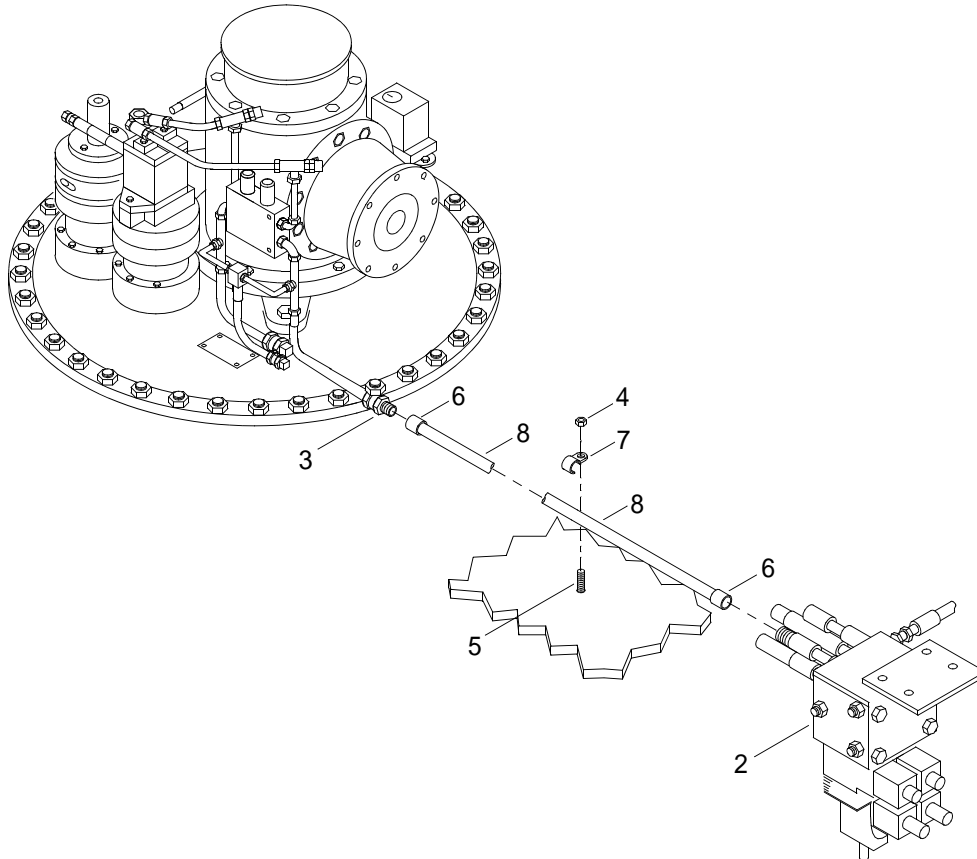
NOTE

The following procedure is typical for replacing both port and starboard way-valve port M to pump-jet manifold port H hydraulic line.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

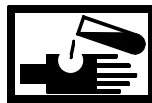


- Position drain pans beneath way-valve (2) and pump-jet manifold port H (3).



- Remove self-locking nut (4) from stud (5).

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

- Disconnect fittings (6) from way-valve (2) and pump-jet manifold (3).
- Remove clamp (7) from stud (5) and tube (8).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

6. Tilt tube (8) and drain hydraulic fluid into drain pan.
7. Discard tube (8).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

8. Remove drain pan and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM WAY-VALVE PORT M TO PUMP-JET MANIFOLD PORT H HYDRAULIC LINE

 WARNING



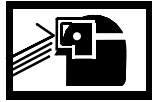
CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads on way-valve (2) and pump-jet manifold (3).
2. Position new tube (8) between way-valve (2) and pump-jet manifold (3).
3. Connect fittings (6) to way-valve (2) and pump-jet manifold (3) and tighten.
4. Position clamp (7) on tube (8) and stud (5).
5. Install self-locking nut (4) on stud (5) and tighten.
6. Service hydraulic reservoir. (WP 0141 00)
7. Vent air from hydraulic system. (WP 0134 00)
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM WAY-VALVE PORT N TO PUMP-JET
MANIFOLD PORT J HYDRAULIC LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)
Qty 2

Materials/Parts

Tube Assembly
PN 1008088
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Sealing Compound (Item 35, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

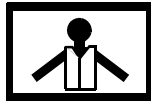
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
Engine Power Isolated. (WP 0075 00)

**REMOVE HYDRAULIC SYSTEM WAY-VALVE PORT N TO PUMP-JET MANIFOLD PORT J
HYDRAULIC LINE**

WARNING



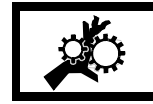
VEST



HELMET PROTECTION



HEAVY PARTS



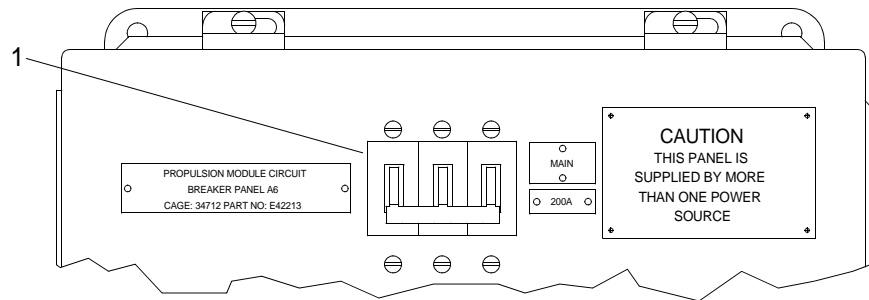
MOVING PARTS

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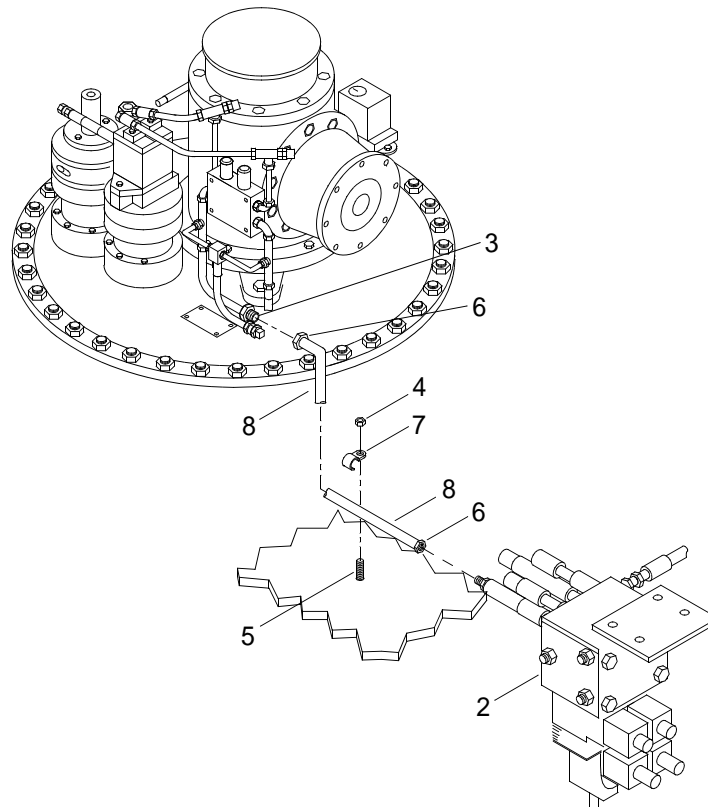
NOTE

The following procedure is typical for replacing both port and starboard way-valve port N to pump-jet manifold port J hydraulic line.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

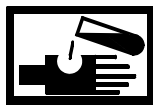


2. Position drain pans beneath way-valve (2) and pump-jet manifold port N (3).



- Remove self-locking nuts (4) from stud (5).

 WARNING



CHEMICAL



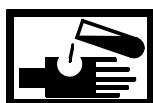
EYE PROTECTION



VAPOR

- Disconnect fittings (6) from way-valve (2) and pump-jet manifold (3).
- Remove clamps (7) from studs (5) and tube (8).

 WARNING



CHEMICAL



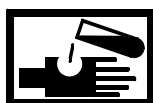
EYE PROTECTION



VAPOR

- Tilt tube (8) and drain hydraulic fluid into drain pan.
- Discard tube (8).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

- Remove drain pans and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM WAY-VALVE PORT N TO PUMP-JET MANIFOLD PORT J HYDRAULIC LINE

 WARNING



CHEMICAL



EYE PROTECTION

- Apply sealing compound to male threads on way-valve (2) and pump-jet manifold (3).
- Position new tube (8) between way-valve (2) and pump-jet manifold (3).
- Connect fittings (6) on way-valve (2) and pump-jet manifold (3).
- Position clamps (7) on tube (8) and studs (5).
- Install self-locking nuts (4) on studs (5) and tighten.

6. Service hydraulic reservoir. (WP 0141 00)
7. Vent air from hydraulic system. (WP 0134 00)
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM PUMP-JET MANIFOLD
TO 3/2 BALL VALVE LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Tube Assembly
 PN 1008082
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

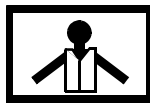
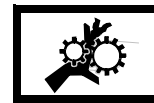
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM PUMP-JET MANIFOLD TO 3/2 BALL VALVE LINE

WARNING

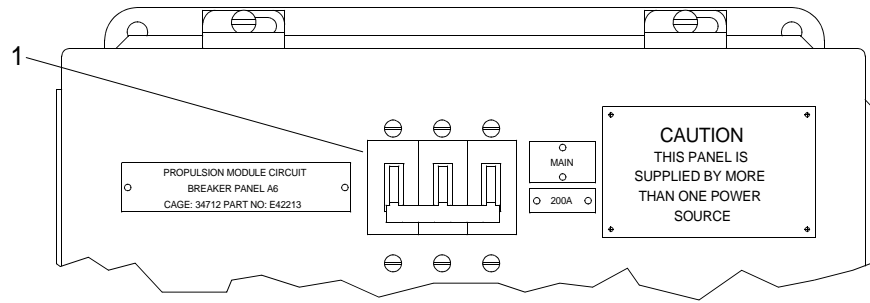
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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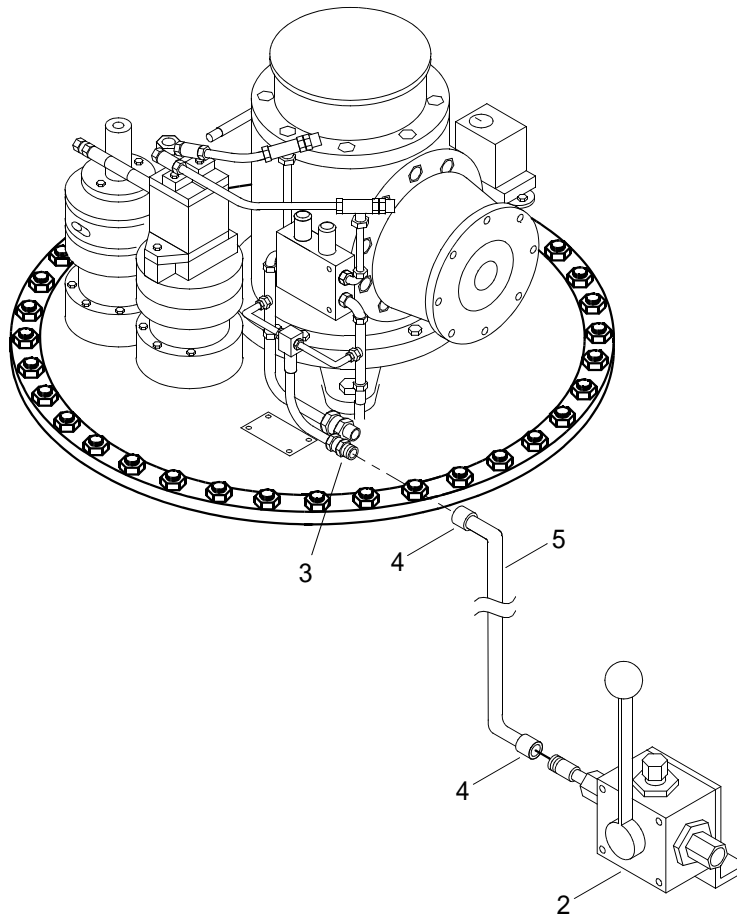
NOTE

The following procedure is typical for replacing both port and starboard hydraulic pump-jet to 3/2 ball valve hoses.

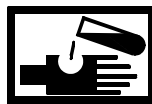
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pans beneath ball valve (2) and pump-jet manifold (3).



WARNING



CHEMICAL



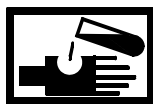
EYE PROTECTION



VAPOR

3. Disconnect fittings (4) from ball valve (2) and pump-jet manifold (3).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

4. Tilt end of tube (5) and drain hydraulic fluid into drain pan.
5. Discard tube (5).

 WARNING



CHEMICAL



EYE PROTECTION

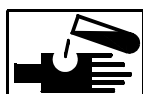


VAPOR

6. Remove drain pans and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM PUMP-JET MANIFOLD TO 3/2 BALL VALVE LINE

 WARNING



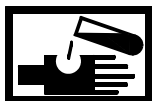
CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads on ball valve (2) and pump-jet manifold (3).
2. Position new tube (5) between ball valve (2) and pump-jet manifold (3).
3. Connect fittings (4) to ball valve (2) and pump-jet manifold (3) and tighten.
4. Service hydraulic reservoir. (WP 0141 00)
5. Vent air from hydraulic system. (WP 0134 00)
6. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM 3/2 BALL VALVE TO HAND
PUMP HYDRAULIC LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Tube Assembly
 PN 007211
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

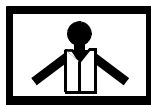
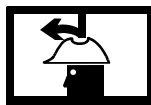
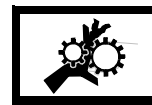
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM 3/2 BALL VALVE TO HAND PUMP HYDRAULIC LINE

WARNING

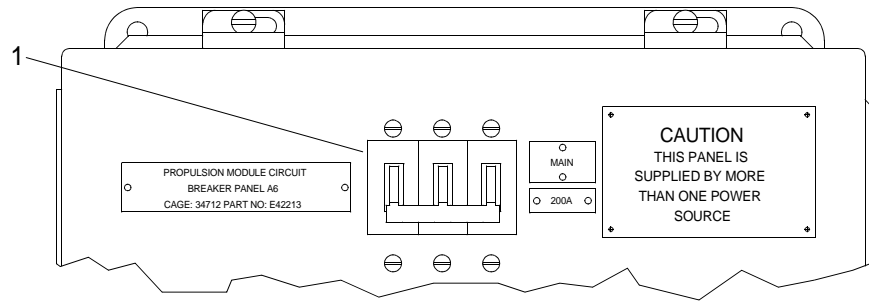
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

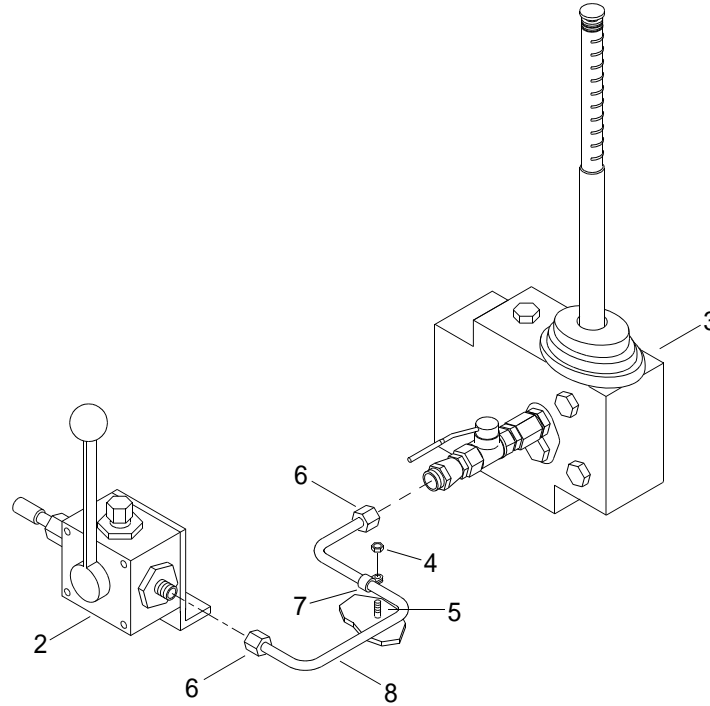
NOTE

The following procedure is typical for replacing both port and starboard 3/2 ball valve to hand pump hydraulic lines.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

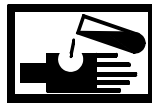


- Position drain pans beneath ball valve (2) and hand pump (3).



- Remove self-locking nut (4) from stud (5).

WARNING



CHEMICAL



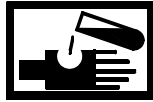
EYE PROTECTION



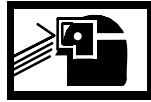
VAPOR

- Disconnect fittings (6) from ball valve (2) and hand pump (3).
- Remove clamp (7) from stud (5) and tube (8).

 WARNING



CHEMICAL



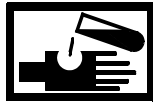
EYE PROTECTION



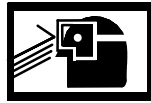
VAPOR

6. Discard tube (8).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

7. Remove drain pans and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM 3/2 BALL VALVE TO HAND PUMP HYDRAULIC LINE

 WARNING



CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male fitting threads of ball valve (2) and hand pump (3).
2. Position new tube (8) between ball valve (2) and hand pump (3).
3. Install fittings (6) on ball valve (2) and hand pump (3) and tighten.
4. Install clamp (7) on tube (8) and stud (5).
5. Install self-locking nut (4) on stud (5) and tighten.
6. Service hydraulic reservoir. (WP 0141 00)
7. Vent air from hydraulic system. (WP 0134 00)
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM 3/2 BALL VALVE
TO PUMP-JET BRAKE HYDRAULIC LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Tube Assembly
 PN 1008084
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

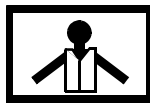
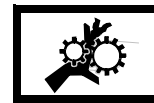
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM 3/2 BALL VALVE TO PUMP-JET BRAKE HYDRAULIC LINE

WARNING

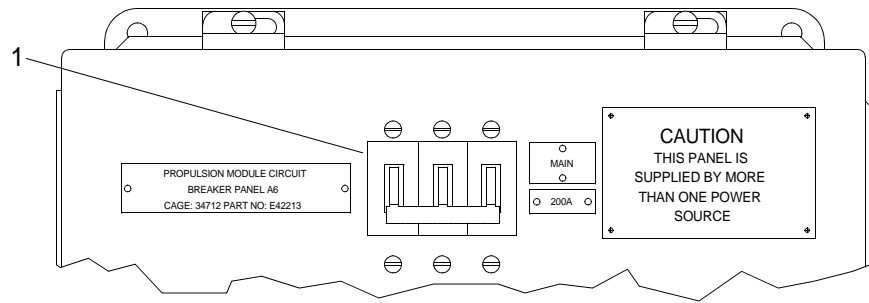
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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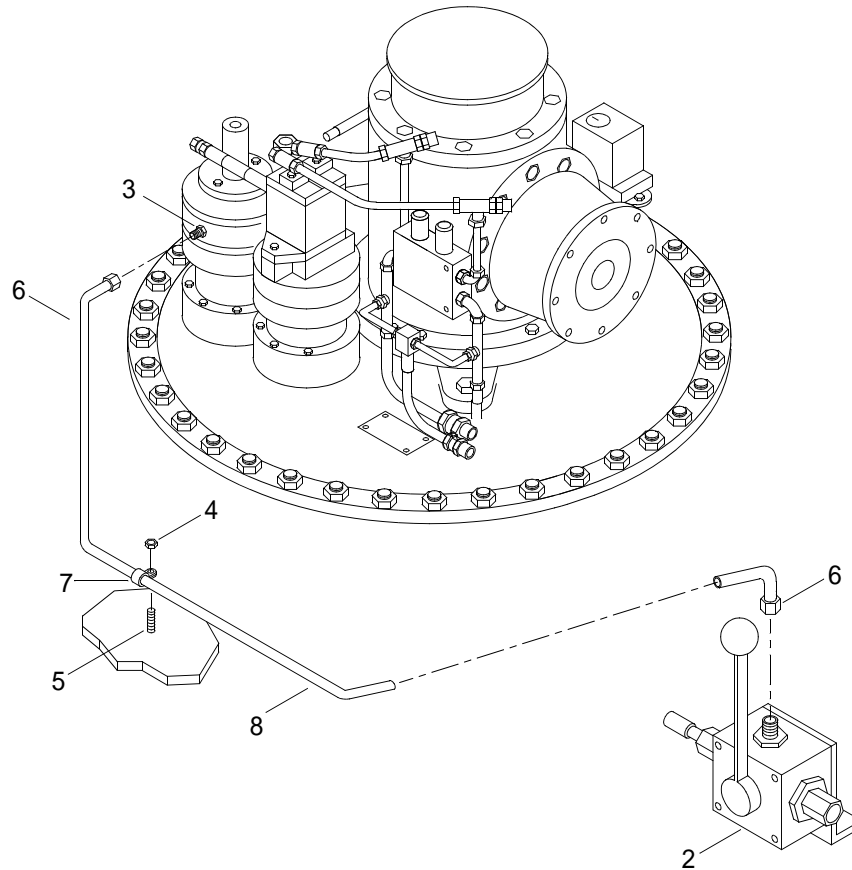
NOTE

The following procedure is typical for replacing both port and starboard 3/2 ball valve to pump-jet brake hydraulic line.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

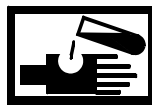


- Position drain pans beneath ball valve (2) and pump-jet planetary gear nipple (3).



- Remove self-locking nut (4) from stud (5).

WARNING



CHEMICAL



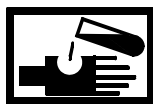
EYE PROTECTION



VAPOR

- Disconnect fittings (6) from ball valve (2) and pump-jet planetary gear nipple (3).
- Remove clamp (7) from stud (5) and tube (8).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

6. Tilt tube (8) and drain hydraulic fluid into drain pan.
7. Discard tube (8).

 WARNING



CHEMICAL



EYE PROTECTION

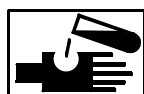


VAPOR

8. Remove drain pans and dispose of contents per local procedures.

INSTALL 3/2 BALL VALVE TO PUMP-JET BRAKE HYDRAULIC LINE

 WARNING



CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads of ball valve (2) and pump-jet planetary gear nipple (3).
2. Position new tube (8) between ball valve (2) and pump-jet planetary gear nipple (3).
3. Connect fittings (6) on ball valve (2) and pump-jet planetary gear nipple (3) and tighten.
4. Install clamp (7) on tube (8) and stud (5).
5. Install self-locking nut (4) on stud (5) and tighten.
6. Service hydraulic reservoir. (WP 0141 00)
7. Vent air from hydraulic system. (WP 0134 00)
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM PUMP-JET HYDRAULIC MOTOR TO
RESERVOIR RETURN LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Tube, Assembly
 PN 0007212
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

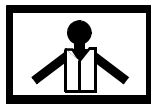
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

**REMOVE HYDRAULIC SYSTEM PUMP-JET HYDRAULIC MOTOR TO RESERVOIR
RETURN LINE**

WARNING

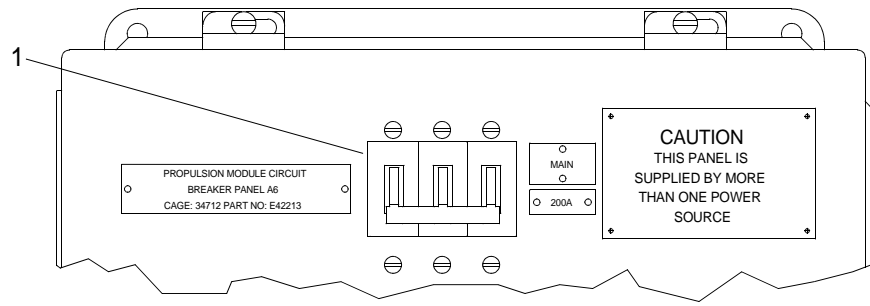
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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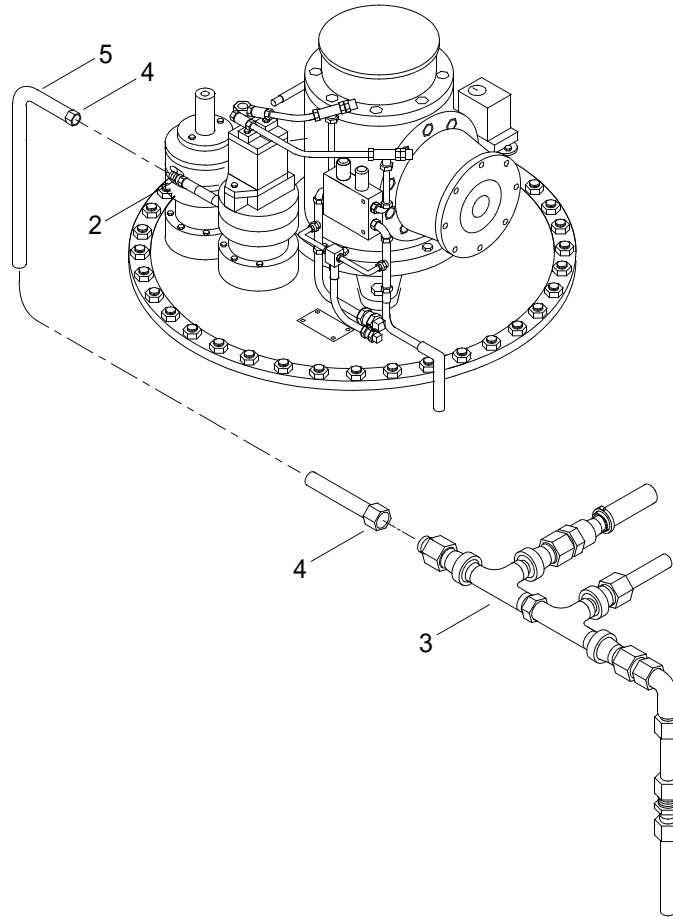
NOTE

The following procedure is typical for replacing both port and starboard pump-jet hydraulic motor to reservoir return lines.

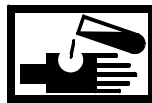
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pans beneath pump-jet hydraulic motor (2) and return line (3).



WARNING



CHEMICAL



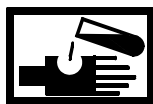
EYE PROTECTION



VAPOR

3. Disconnect fittings (4) from pump-jet hydraulic motor (2) and return line (3).

 WARNING



CHEMICAL



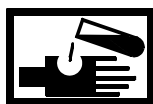
EYE PROTECTION



VAPOR

4. Tilt tube (5) and drain hydraulic fluid into drain pans.
5. Discard tube (5).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

6. Remove drain pans and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM PUMP-JET HYDRAULIC MOTOR TO RESERVOIR RETURN LINE

 WARNING



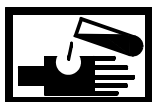
CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads of pump-jet hydraulic motor (2) and return line (3).
2. Position new tube (5) between pump-jet hydraulic motor (2) and return line (3).
3. Connect fittings (4) to pump-jet hydraulic motor (2) and return line (3) and tighten.
4. Service hydraulic reservoir. (WP 0141 00)
5. Vent air from hydraulic system. (WP 0134 00)
6. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM WAY-VALVE TO RESERVOIR RETURN LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Assembly, Tube
 PN 0007212
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

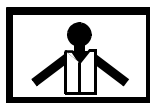
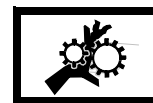
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC WAY-VALVE TO RESERVOIR RETURN LINE

WARNING

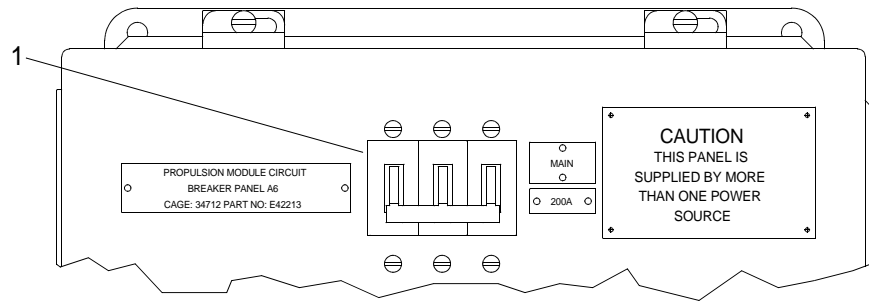
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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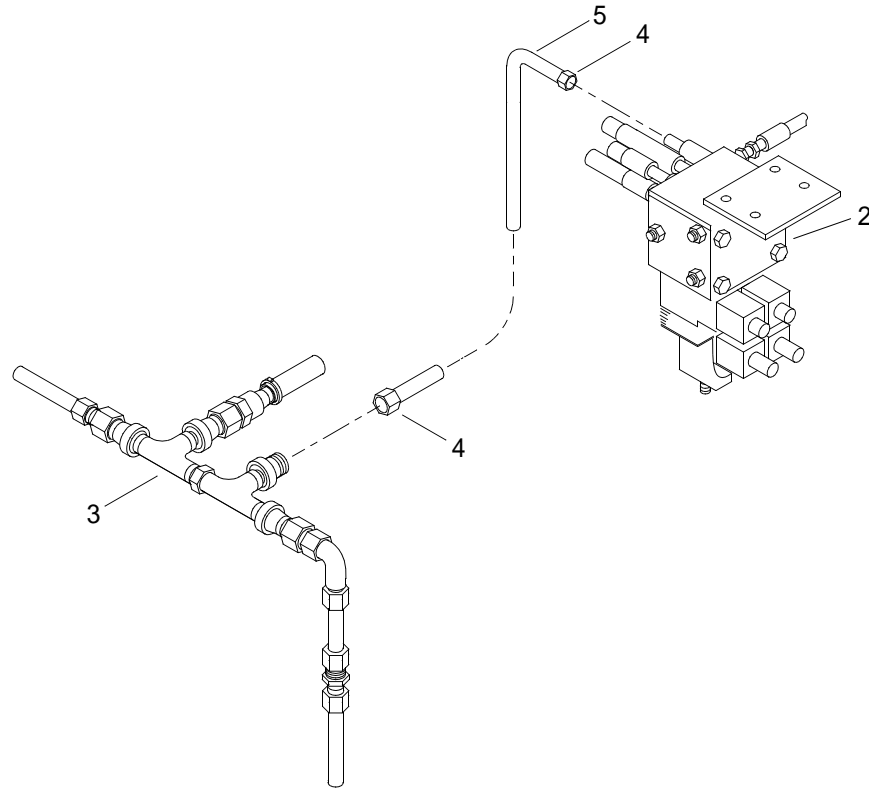
NOTE

The following procedure is typical for replacing both port and starboard way-valve to reservoir return lines.

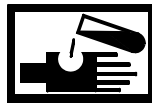
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



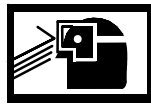
2. Position drain pans beneath way-valve (2) and return line (3).



WARNING



CHEMICAL



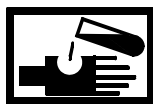
EYE PROTECTION



VAPOR

3. Disconnect fittings (4) from way-valve (2) and return line (3).

 WARNING



CHEMICAL



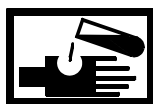
EYE PROTECTION



VAPOR

4. Tilt tube (5) and drain hydraulic fluid into drain pan.
5. Discard tube (5).

 WARNING



CHEMICAL



EYE PROTECTION

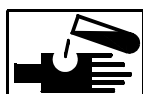


VAPOR

6. Remove drain pans and dispose of contents per local procedures.

INSTALL WAY-VALVE TO RESERVOIR RETURN LINE

 WARNING



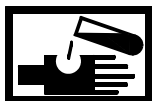
CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads of way-valve (2) and return line (3).
2. Position new tube (5) between way-valve (2) and return line (3).
3. Install fittings (4) on way-valve (2) and return line (3) and tighten.
4. Service hydraulic reservoir. (WP 0141 00)
5. Vent air from hydraulic system. (WP 0134 00)
6. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM PUMP TO RESERVOIR RETURN LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Assembly, Tube
 PN 0007213
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

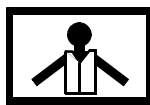
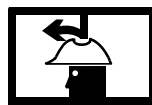
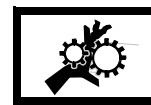
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM PUMP TO RESERVOIR RETURN LINE

WARNING

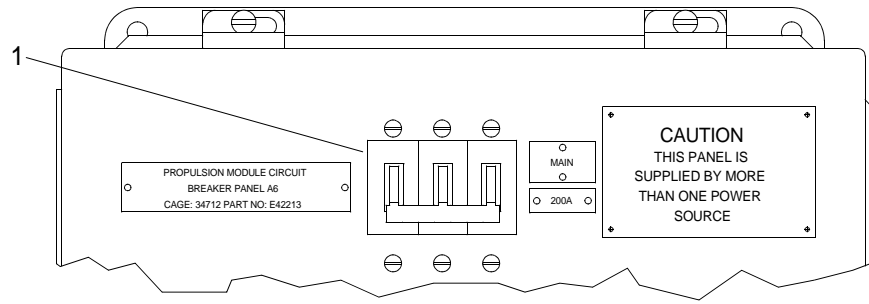
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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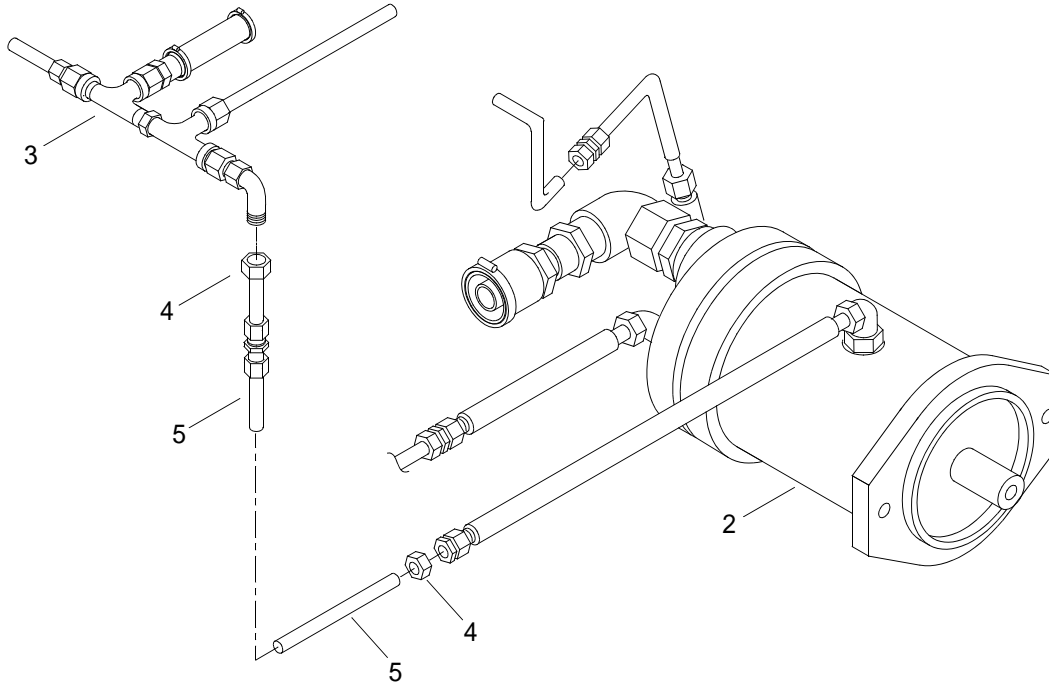
NOTE

The following procedure is typical for replacing both port and starboard way valve to reservoir return lines.

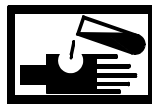
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pans beneath hydraulic pump (2) and return line (3).



WARNING



CHEMICAL



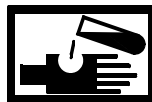
EYE PROTECTION



VAPOR

3. Disconnect fittings (4) from hydraulic pump (2) and return line (3).

WARNING



CHEMICAL



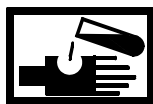
EYE PROTECTION



VAPOR

4. Tilt tube (5) and drain hydraulic fluid into drain pan.
5. Discard tube (5).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

6. Remove drain pans and dispose of contents per local procedures.

INSTALL HYDRAULIC PUMP TO RESERVOIR RETURN LINE

 WARNING



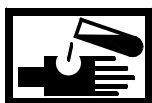
CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads of hydraulic pump (3) and return line (3).
2. Position new tube (5) between hydraulic pump (2) and return line (3).
3. Install fittings (4) on hydraulic pump (2) and return line (3) and tighten.
4. Service hydraulic reservoir. (WP 0141 00)
5. Vent air from hydraulic system. (WP 0134 00)
6. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM WAY-VALVE TO HYDRAULIC PUMP LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Assembly, Tube
 PN 0007212
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

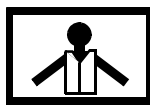
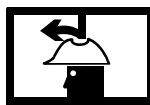
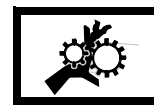
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM WAY-VALVE TO HYDRAULIC PUMP LINE

WARNING

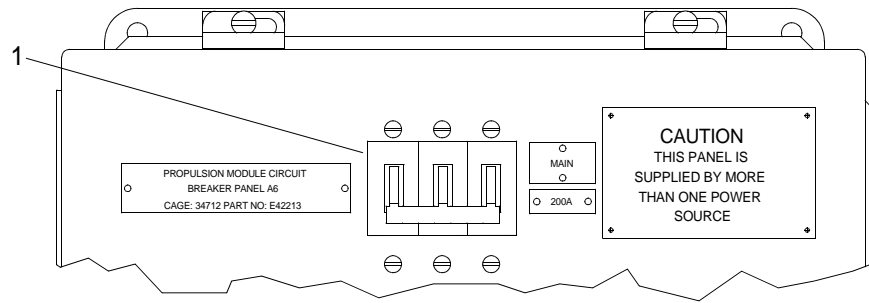
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

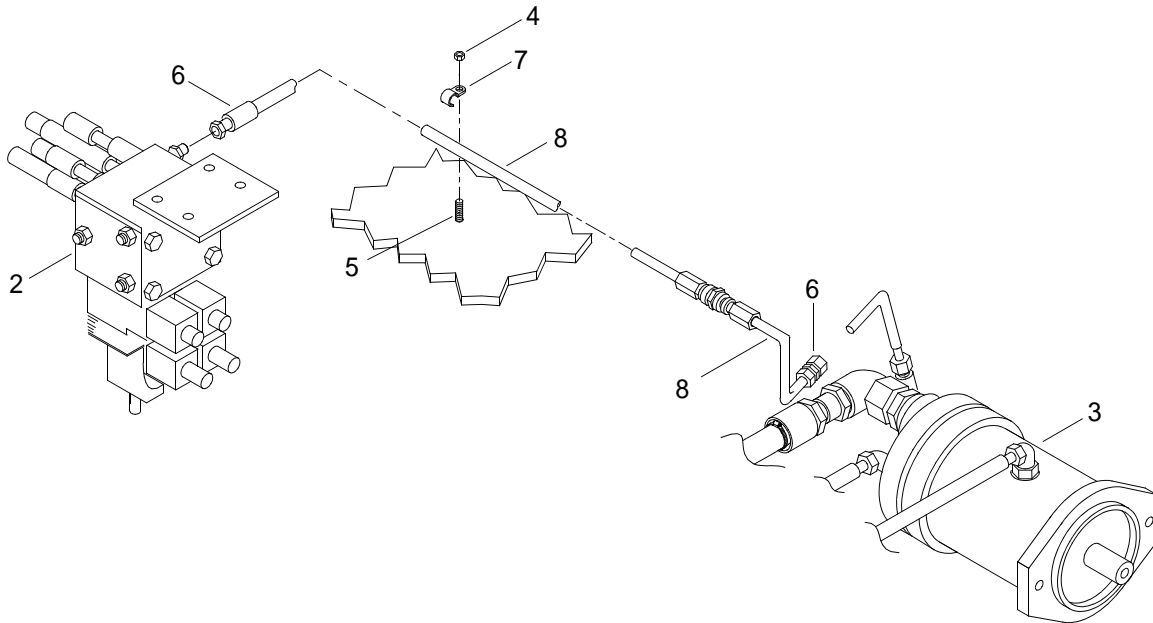
NOTE

The following procedure is typical for replacing both port and starboard way-valves to hydraulic pump lines.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

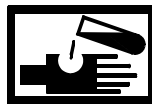


2. Position drain pans beneath way-valve (2) and hydraulic pump (3).



3. Remove self-locking nut (4) from stud (5).

WARNING



CHEMICAL



EYE PROTECTION

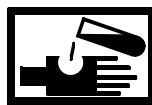


VAPOR

4. Disconnect fittings (6) from way-valve (2) and hydraulic pump (3).

5. Remove clamp (7) from stud (5) and tube (8).

WARNING



CHEMICAL



EYE PROTECTION

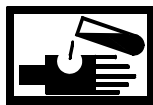


VAPOR

6. Tilt tube (8) and drain hydraulic fluid into drain pan.

7. Discard tube (8).

WARNING



CHEMICAL



EYE PROTECTION

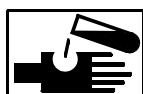


VAPOR

8. Remove drain pans and dispose of contents per local procedures.

INSTALL WAY-VALVE TO HYDRAULIC PUMP LINE

WARNING



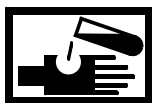
CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads of way-valve (2) and hydraulic pump (3).
2. Position new tube (8) between way-valve (2) and hydraulic pump (3).
3. Install fittings (6) on way-valve (2) and hydraulic pump (3) and tighten.
4. Install clamp (7) on tube (8) and stud (5).
5. Install self-locking nut (4) on stud (5) and tighten.
6. Service hydraulic reservoir. (WP 0141 00)
7. Vent air from hydraulic system. (WP 0134 00)
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM PRESSURE FILTER TO WAY-VALVE LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Qty 2

Materials/Parts

Assembly, Tube
 PN 1007322
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

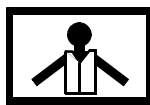
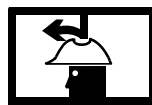
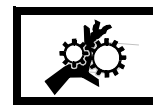
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM PRESSURE FILTER TO WAY-VALVE LINE

WARNING

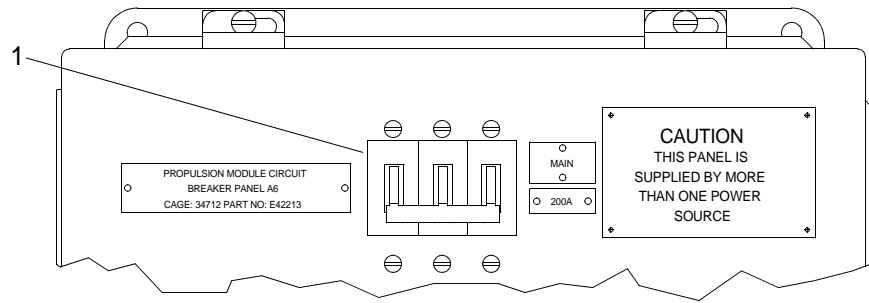
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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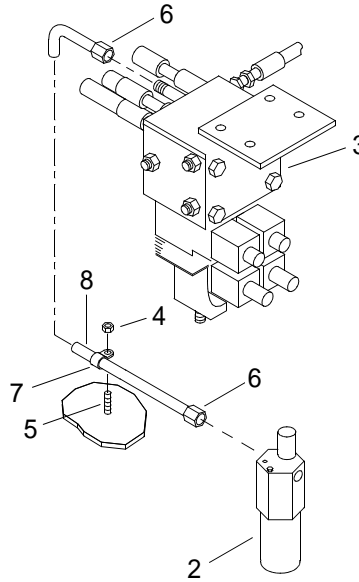
NOTE

The following procedure is typical for replacing both port and starboard pressure filter to way-valve hydraulic lines.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

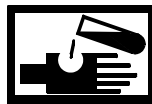


2. Position drain pans beneath pressure filter (2) and way-valve (3).



3. Remove self-locking nut (4) from stud (5).

WARNING



CHEMICAL



EYE PROTECTION

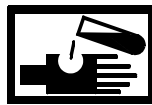


VAPOR

4. Disconnect fittings (6) from pressure filter (2) and way-valve (3).

5. Remove clamp (7) from stud (5) and tube (8).

WARNING



CHEMICAL



EYE PROTECTION

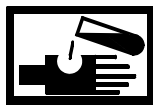


VAPOR

6. Tilt tube (8) and drain hydraulic fluid into drain pan.

7. Discard tube (8).

WARNING



CHEMICAL



EYE PROTECTION

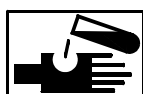


VAPOR

8. Remove drain pans and dispose of contents in accordance with local procedures.

INSTALL HYDRAULIC SYSTEM PRESSURE FILTER TO WAY-VALVE LINE

WARNING



CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads of pressure filter (2) and way-valve (3).
2. Position new tube (8) between pressure filter (2) and way-valve (3).
3. Install fittings (6) on pressure filter (2) and way-valve (3) and tighten.
4. Install clamp (7) on tube (8) and stud (5).
5. Install self-locking nut (4) on stud (5) and tighten.
6. Service hydraulic reservoir. (WP 0141 00)
7. Vent air from hydraulic system. (WP 0134 00)
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM NEEDLE VALVE TO
PUMP-JET MOTOR HYDRAULIC LINE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Assembly, Tube
 PN 1012396
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 35, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

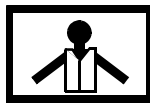
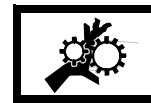
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM NEEDLE VALVE TO PUMP-JET MOTOR HYDRAULIC LINE

WARNING

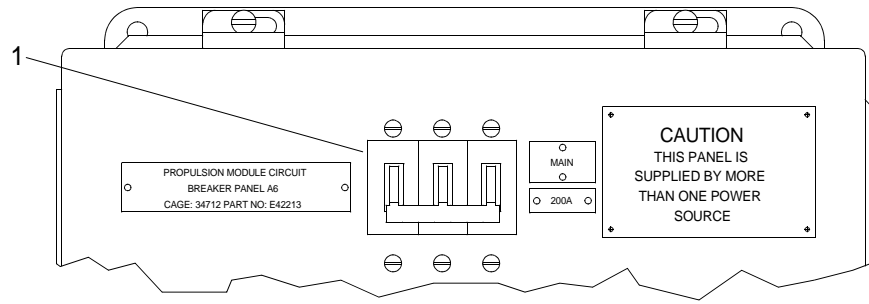
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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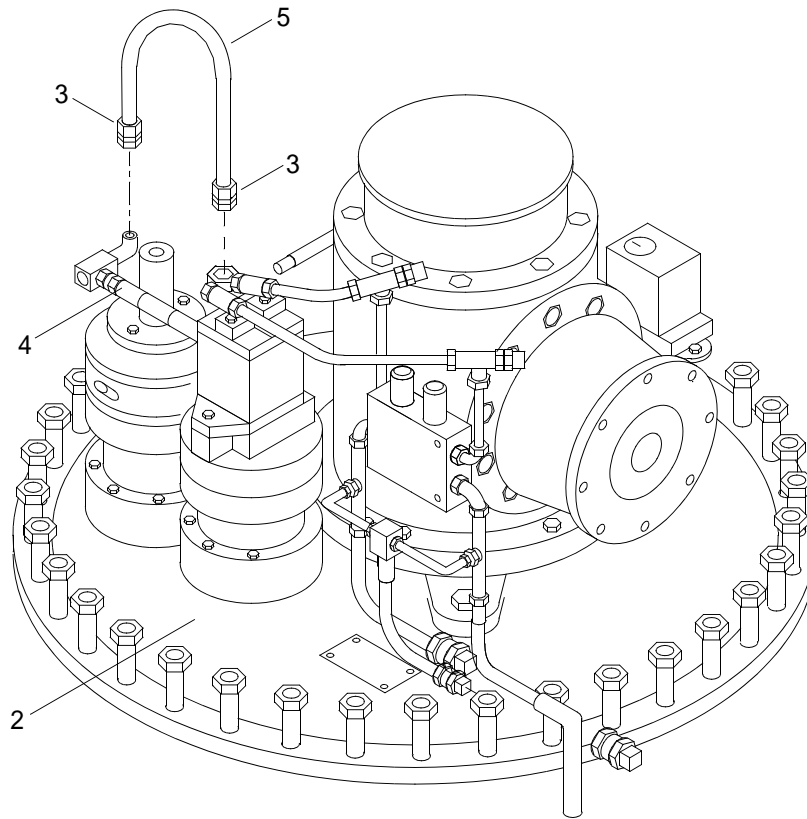
NOTE

The following procedure is typical for replacing both port and starboard pump-jet installations.

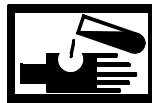
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pan in proximity of pump-jet motor (2).
3. Position rags beneath jet-pump motor (2).



WARNING



CHEMICAL



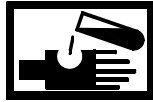
EYE PROTECTION



VAPOR

4. Disconnect fittings (3) from needle valve (4) and pump-jet motor (2).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

5. Tilt tube (5) and drain hydraulic fluid into drain pan.
6. Discard tube (5).

 WARNING



CHEMICAL



EYE PROTECTION

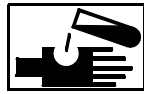


VAPOR

7. Remove drain pan and oily rags and dispose of per local procedures.

**INSTALL HYDRAULIC SYSTEM NEEDLE VALVE TO PUMP-JET MOTOR
HYDRAULIC LINE**

 WARNING



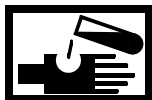
CHEMICAL



EYE PROTECTION

1. Apply sealing compound to male threads of needle valve (4) and pump-jet motor (2).
2. Position new tube (5) between needle valve (4) and pump-jet motor (2).
3. Install fittings (4) on needle valve (4) and pump-jet motor (2) and tighten.
4. Service hydraulic reservoir. (WP 0141 00)
5. Vent air from hydraulic system. (WP 0134 00)
6. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM RESERVOIR RETURN LINE FILTER HOSE
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Respirator, Air Filtering (Item 3, WP 0425 00)
- Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

- Hose, 5/8 IN. ID
PN 801-10
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

- Engineer 88L

References

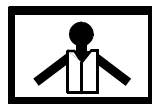
- TM 55-1945-225-10

Equipment Condition

- Hydraulic System Pressure Vented. (WP 0134 00)
 - Engine Power Isolated. (WP 0075 00)
-

REMOVE HYDRAULIC SYSTEM RESERVOIR RETURN LINE FILTER HOSE

WARNING



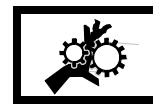
VEST



HELMET PROTECTION



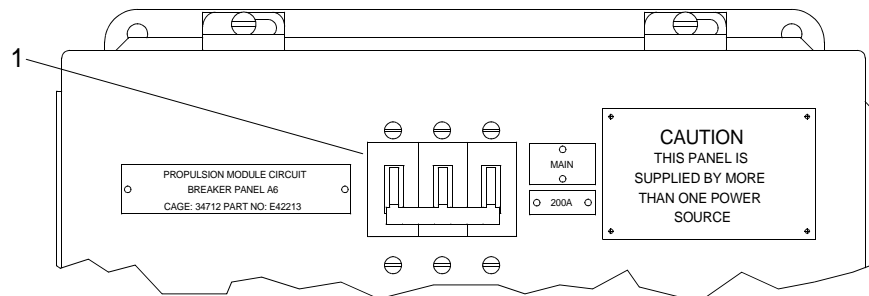
HEAVY PARTS



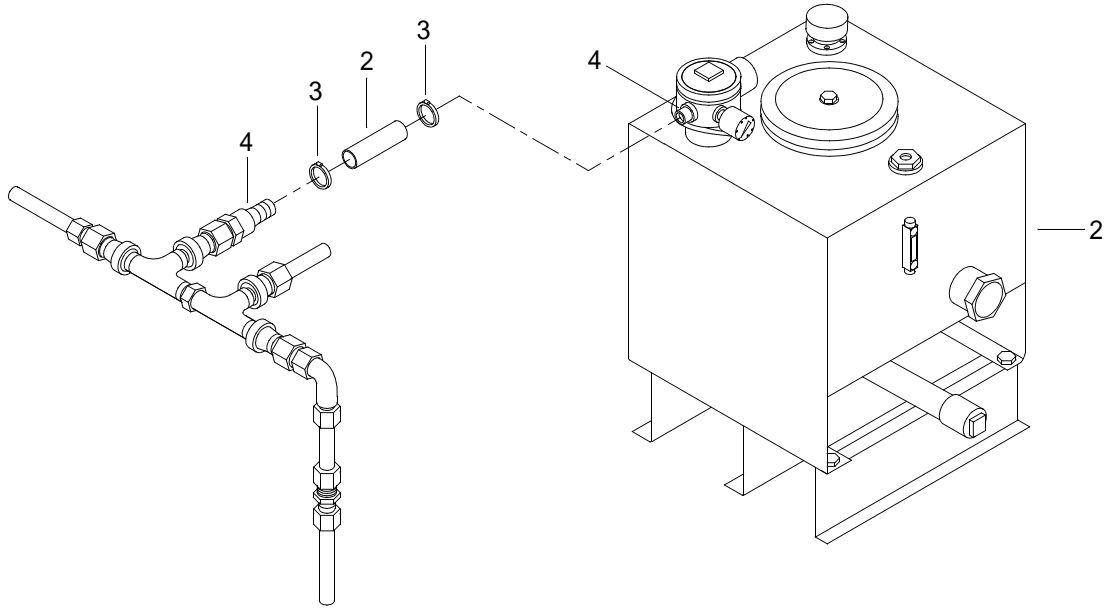
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pan beneath return hose (2).



WARNING



CHEMICAL



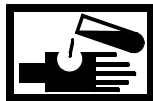
EYE PROTECTION



VAPOR

3. Loosen two hose clamps (3) and slide over nipples (4).

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

4. Remove hose (2) from nipples (4).

WARNING



CHEMICAL



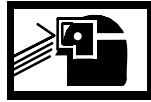
EYE PROTECTION



VAPOR

5. Discard hose (2).

WARNING

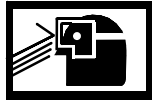
**CHEMICAL****EYE PROTECTION****VAPOR**

6. Remove drain pan and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM RESERVOIR RETURN LINE FILTER HOSE

1. Position new hose (2) on nipples (4).
2. Position hose clamps (3) on hose (2).
3. Tighten hose clamps (3).
4. Service hydraulic reservoir. (WP 0141 00)
5. Vent air from hydraulic system. (WP 0134 00)
6. Perform operational check of hydraulic system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

7. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM PUMP
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Hydraulic Pump
 PN 1085331
 Gasket
 PN E28301
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

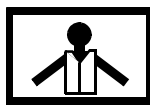
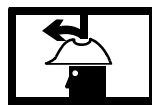
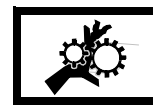
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

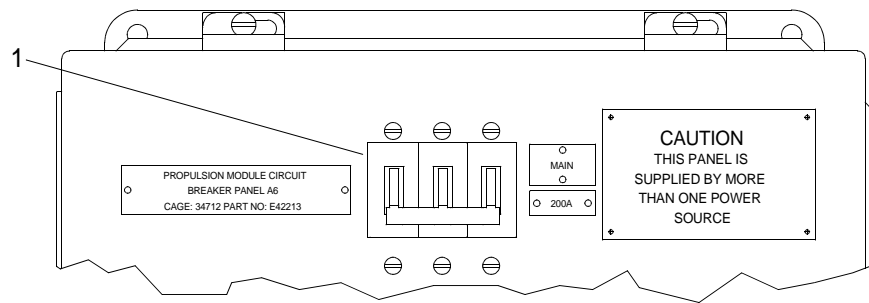
REMOVE HYDRAULIC SYSTEM PUMP

WARNING

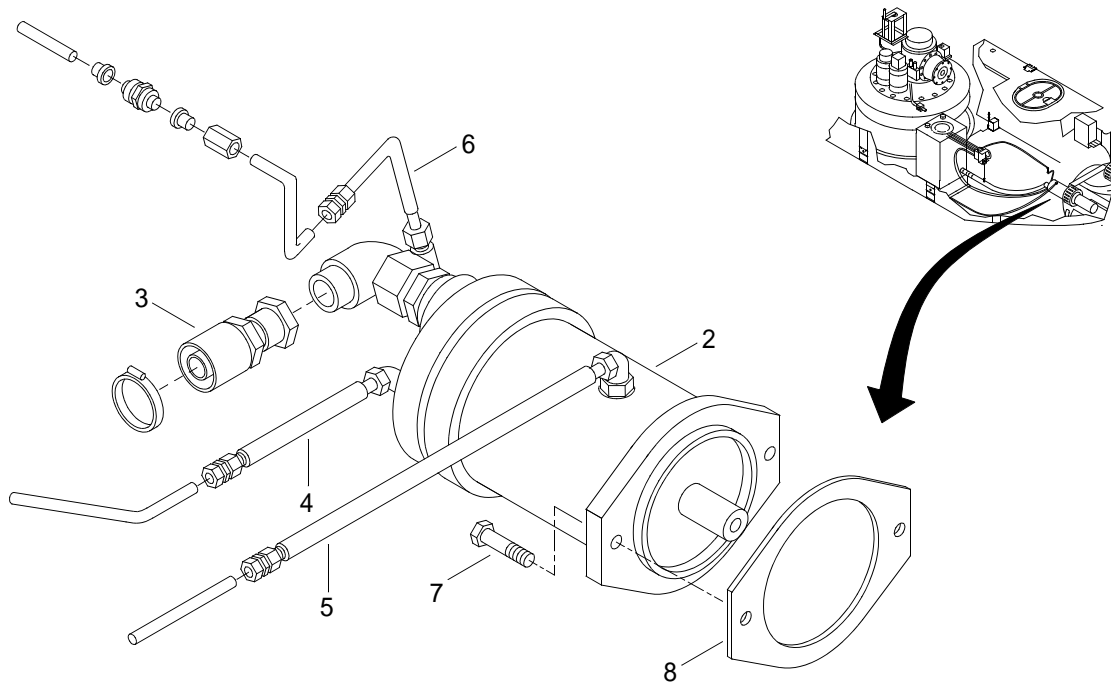
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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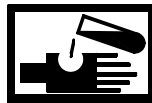
1. Verify that MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pan below hydraulic pump (2) to catch excess oil drained from hoses.



WARNING



CHEMICAL



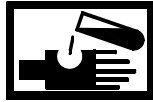
EYE PROTECTION



VAPOR

3. Disconnect hose L1 (3), from hydraulic pump (2) suction to reservoir suction.
4. Disconnect tube L2 (4), from hydraulic pump (2) pressure to pressure filter.
5. Disconnect tube L8B (5), from hydraulic pump (2) return line to reservoir return line.
6. Disconnect tube L9 (6), from hydraulic pump (2) to way-valve.
7. Remove two capscrews (7) securing the hydraulic pump (2) to the marine gear.
8. Remove hydraulic pump (2) and gasket (8).
9. Discard hydraulic pump (2) and gasket (8).

 WARNING



CHEMICAL



EYE PROTECTION



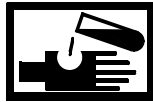
VAPOR

10. Remove drain pan and dispose of contents per local procedures.

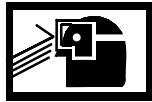
INSTALL HYDRAULIC SYSTEM PUMP

1. Install new gasket (8) onto new hydraulic pump (2).
2. Position and secure hydraulic pump (2) to the marine gear with two capscrews (7). Tighten capscrews.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Connect tube L9 (6), from hydraulic pump (2) to way-valve.
4. Connect tube L8B (5), from hydraulic pump (2) return line to reservoir return line.
5. Connect tube L2 (4), from hydraulic pump (2) pressure to pressure filter.
6. Connect hose L1 (3), from the hydraulic pump (2) suction to reservoir suction.
7. Service hydraulic reservoir. (WP 0141 00)
8. Vent air from hydraulic system. (WP 0134 00)
9. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

10. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM HAND PUMP
SERVICING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Lubricating Oil, General Purpose (Item 21, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

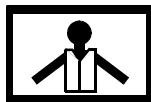
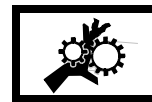
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

SERVICE HYDRAULIC SYSTEM HAND PUMP

WARNING

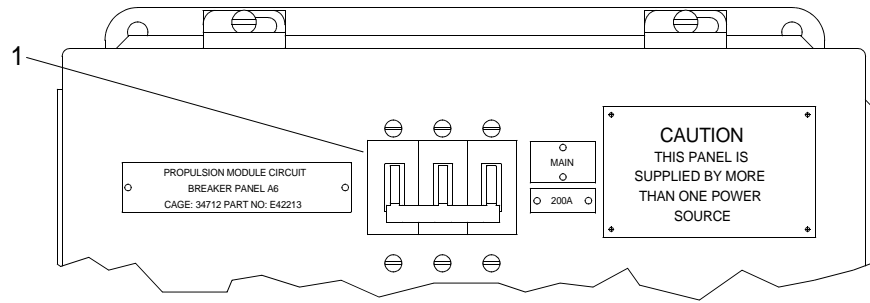
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

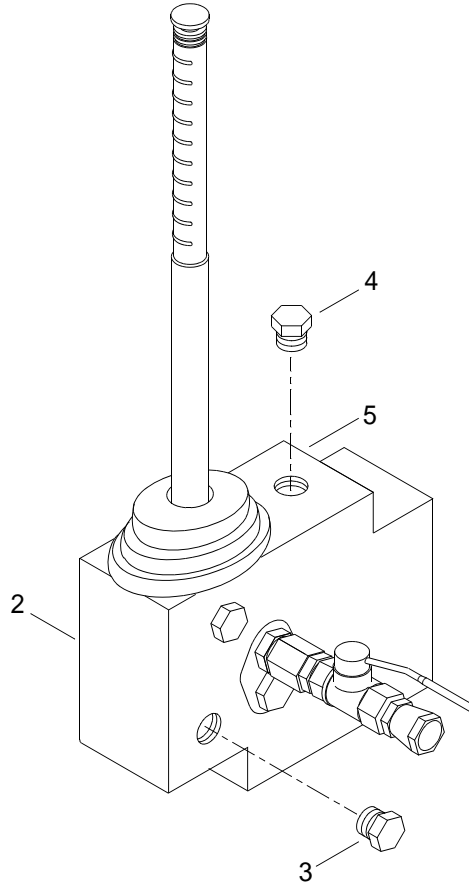
NOTE

The following procedure is typical for servicing both port and starboard hydraulic hand pumps.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pan under hydraulic hand pump (2).



WARNING



CHEMICAL



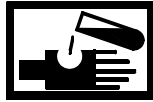
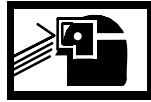
EYE PROTECTION



VAPOR

3. Remove drain plug (3) from hydraulic hand pump (2) and allow oil to drain into drain pan.
4. Remove fill plug (4) from cover (5).
5. Install drain plug (3) in hydraulic hand pump (2) and tighten.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

6. Fill hydraulic hand pump with lubricating oil, through hole in cover (5).
7. Install new air filter (5) in cover (6) and tighten.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

8. Remove drain pan and dispose of contents per local procedures.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM HAND PUMP
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Hydraulic Hand Pump
 PN 1114579
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)
 Lubricating Oil, General Purpose (Item 21, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

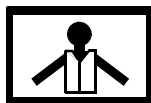
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM HAND PUMP

WARNING



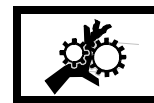
VEST



HELMET PROTECTION



HEAVY PARTS



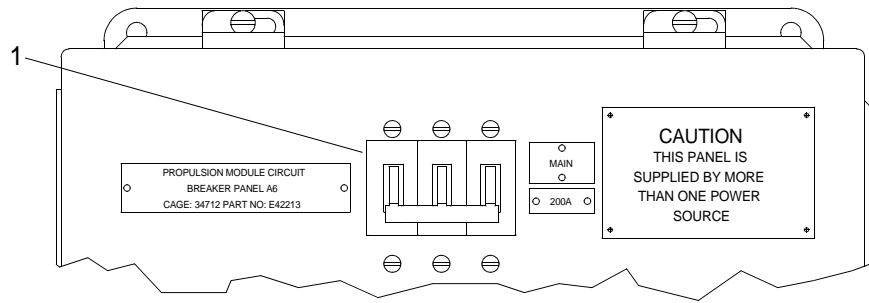
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

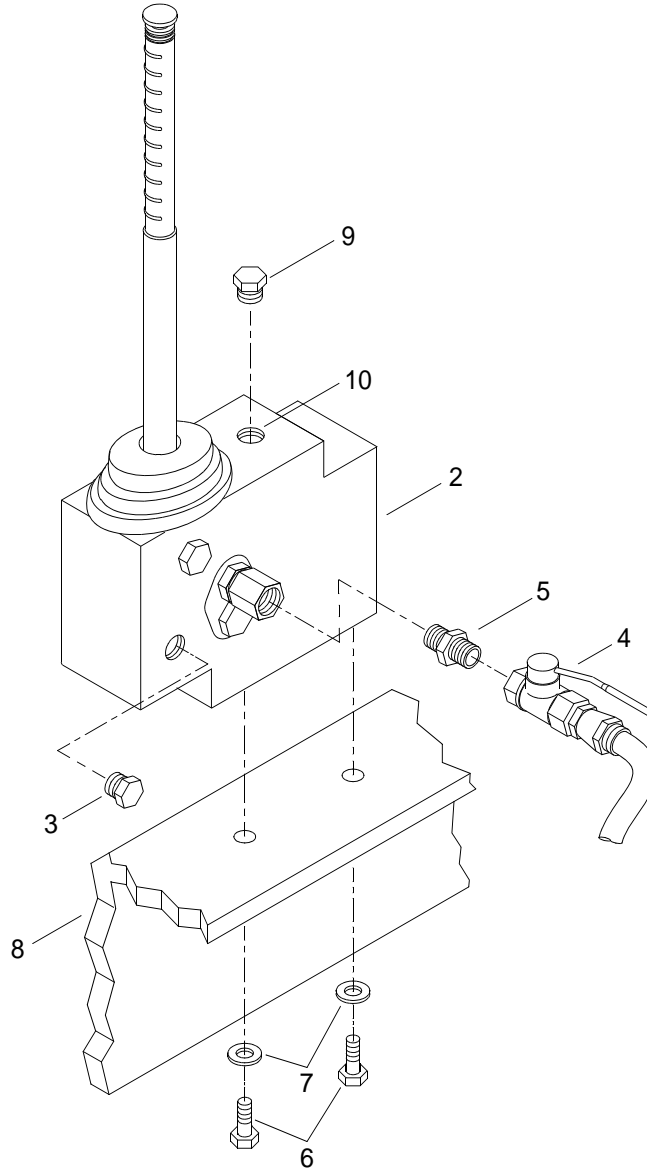
NOTE

The following procedure is typical for removal and installation of port and starboard hydraulic hand pumps.

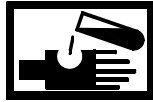
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Place drain pan under hydraulic hand pump assembly (2).



 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Remove drain plug (3) from hydraulic hand pump (2).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

4. Allow lubricating oil to drain into drain pan.
5. Remove shut off valve (4) from straight stud standpipe fitting (5).
6. Remove straight stud standpipe fitting (5) from hydraulic hand pump (2).
7. Retain straight stud standpipe fitting (5).
8. Remove two mounting bolts (6) and washers (7) securing hydraulic hand pump (2) to compartment structure support beam (8).
9. Remove hydraulic hand pump (2) from compartment structure support beam (8).

 WARNING



CHEMICAL



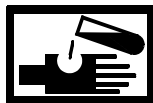
EYE PROTECTION



VAPOR

10. Drain residual lubricating oil into drain pan.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

11. Remove drain pan and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM HAND PUMP

1. Position new hydraulic hand pump (2) on compartment structure support beam (8).

 WARNING



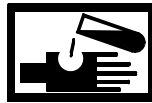
EYE PROTECTION



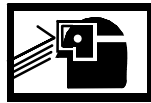
CHEMICAL

2. Apply adhesive to threads of two mounting bolts (6).
3. Install two mounting bolts (6) and washers (7) to secure new hydraulic hand pump (2) to compartment structure support beam (8) and tighten.
4. Install straight stud standpipe fitting (5) on new hydraulic hand pump (2) and tighten.
5. Connect adjustable tee fitting (4) to straight stud standpipe fitting (5).
6. Turn fill plug (9) counterclockwise and remove from hydraulic hand pump cover (10).

 WARNING



CHEMICAL



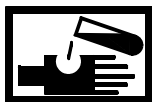
EYE PROTECTION



VAPOR

7. Fill hydraulic hand pump with lubricating oil.
8. Install fill (9) on hydraulic hand pump cover (10) by inserting in hydraulic hand pump cover (10) and turning in a clockwise direction.
9. Perform operation of hydraulic hand pump and check for leaks.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

10. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM HAND PUMP
BLEEDING**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Respirator, Air Filtering (Item 3, WP 0425 00)
- Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

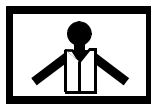
- Engineer 88L (2)

Equipment Condition

- Engine Power Isolated. (WP 0075 00)

BLEED HYDRAULIC SYSTEM HAND PUMP

WARNING



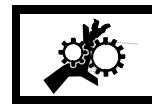
VEST



HELMET PROTECTION



HEAVY PARTS



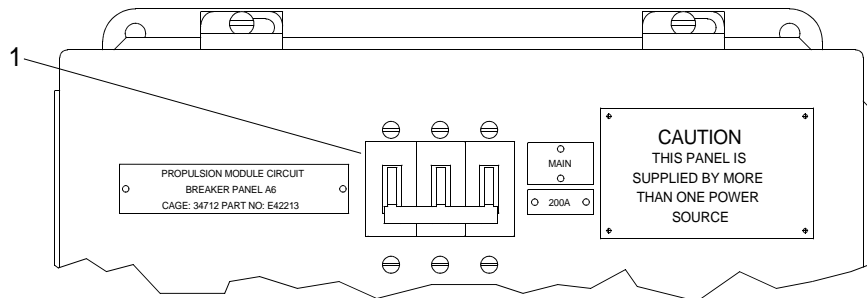
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

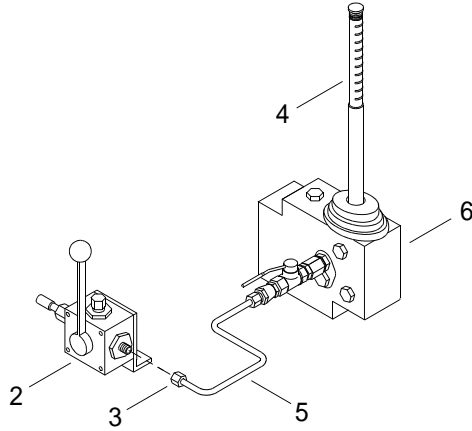
NOTE

The following procedure is typical for bleeding both port and starboard hydraulic hand pumps.

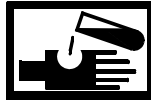
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



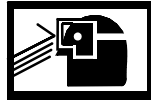
2. Position drain pan below 3/2 ball valve (2).



WARNING



CHEMICAL



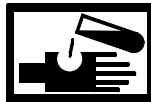
EYE PROTECTION



VAPOR

3. Disconnect fitting (3) from 3/2 ball valve (2).
4. Begin pumping hydraulic hand pump handle (4).

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

5. When fluid coming out of line (5) is free of air bubbles, connect fitting (3) to 3/2 ball valve (2) and tighten.
6. Service hydraulic hand pump (6). (WP 0162 00)

WARNING



CHEMICAL



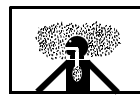
EYE PROTECTION



VAPOR

7. Remove drain pan and dispose of contents per local procedures.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

8. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM WAY-VALVE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Way-Valve
 PN 1088210
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

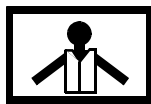
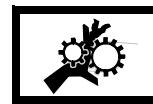
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM WAY-VALVE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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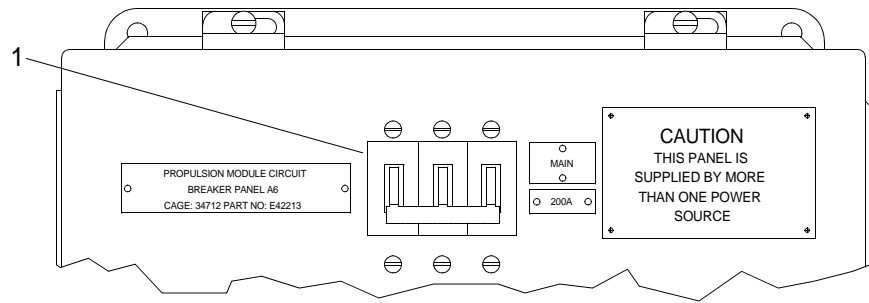
CAUTION

Before removing any hydraulic piping, tag all connections to way-valve. Failure to comply could result in damage to system.

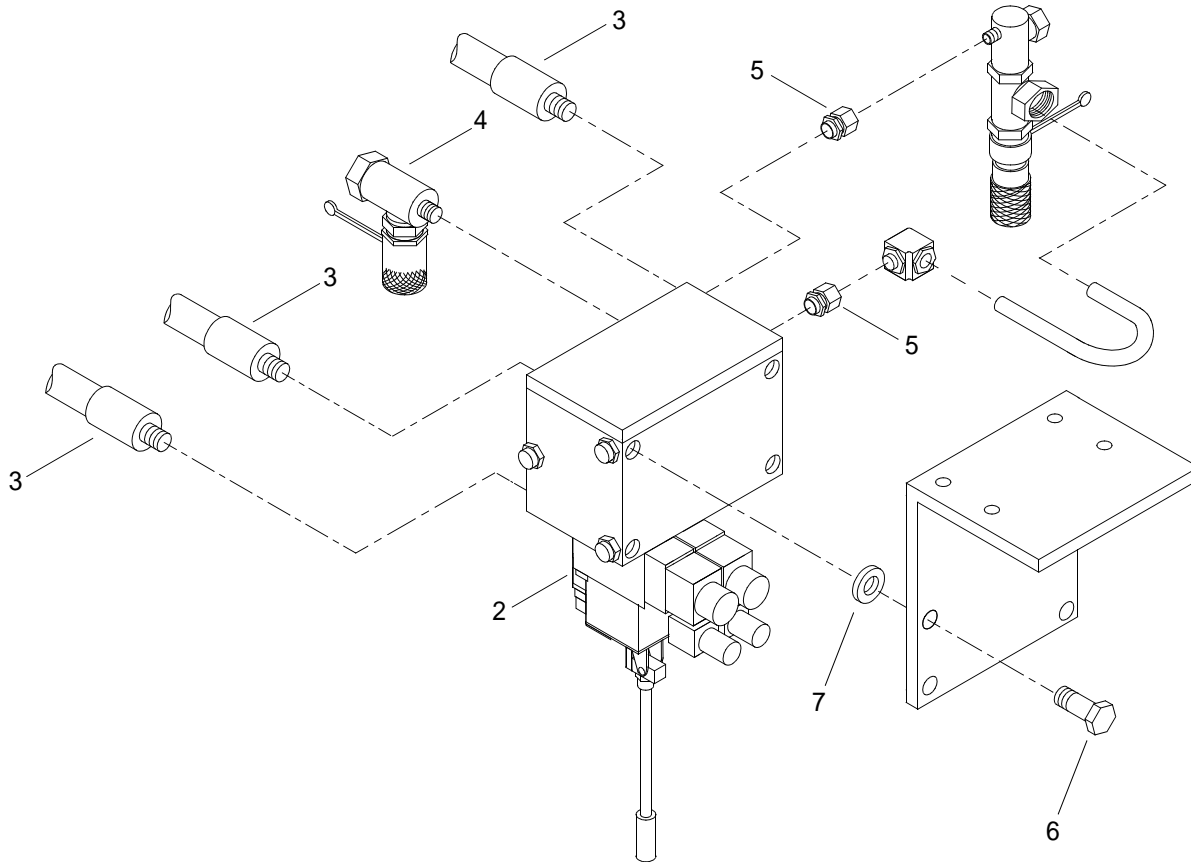
NOTE

The following procedure is typical for removal and installation of way-valves.

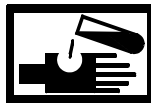
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position a drain pan beneath way-valve (2).



WARNING



CHEMICAL



EYE PROTECTION



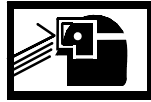
VAPOR

3. Remove three straight thread connectors (3), one nut run swivel tee (4) and two tube end reducers (5) from way-valve (2).
4. Remove four capscrews (6), four washers (7) and way-valve (2). Discard way-valve (2).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

5. Remove drain pan and dispose of contents per local procedures.

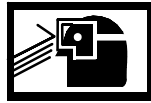
INSTALL HYDRAULIC SYSTEM WAY-VALVE

1. Align new way-valve (2) with mounting holes and install four capscrews (6) and four washers (7).

 WARNING



CHEMICAL



EYE PROTECTION



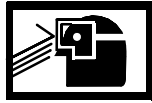
VAPOR

2. Connect two tube end reducers (5), one nut run swivel tee (4) and three straight connectors (3) to way-valve (2).
3. Service hydraulic reservoir. (WP 0141 00)
4. Vent air from hydraulic system. (WP 0134 00)
5. Perform operational check of hydraulic system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



SLICK FLOOR

6. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HYDRAULIC SYSTEM 3/2 BALL VALVE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Protector, Hearing (Item 20, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

3/2 Ball Valve
 PN 386245
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Lubricating Oil, General Purpose (Item 21, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

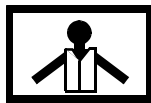
TM 55-1945-225-10

Equipment Condition

Hydraulic System Pressure Vented. (WP 0134 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE HYDRAULIC SYSTEM 3/2 BALL VALVE

WARNING

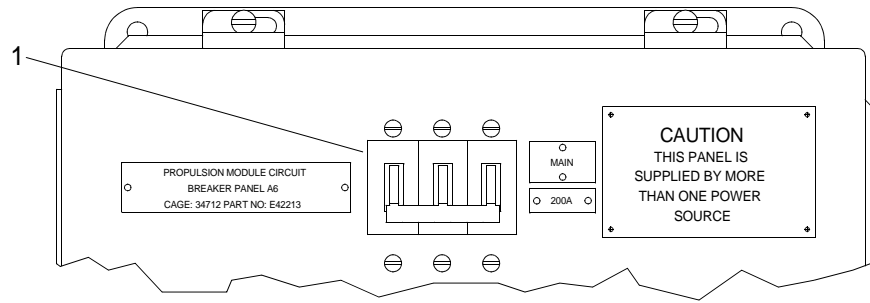
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

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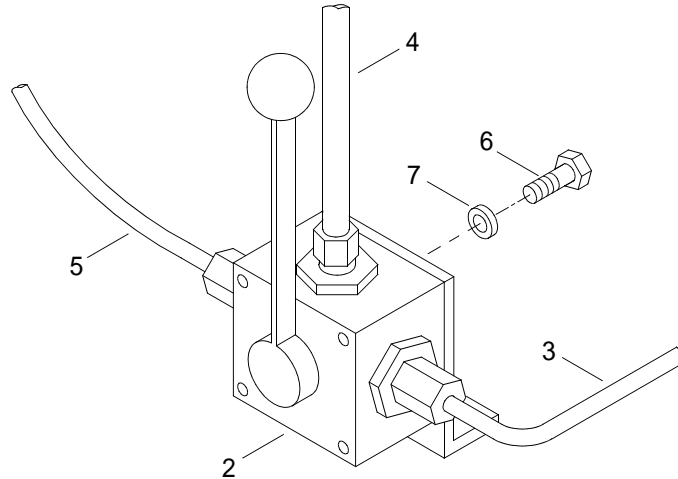
NOTE

The following procedure is typical for removal and installation of 3/2 ball valves.

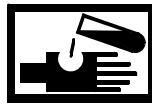
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pan beneath ball valve (2).



WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Disconnect tube (3) from ball valve (2).

WARNING



CHEMICAL



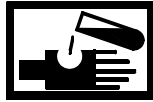
EYE PROTECTION



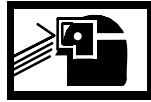
VAPOR

4. Disconnect tube (4) from ball valve (2).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

5. Disconnect hose (5) from ball valve (2).
6. Remove capscrews (6) and washers (7) attaching ball valve to bulkhead.
7. Remove ball valve (2) from bulkhead.

 WARNING



CHEMICAL



EYE PROTECTION



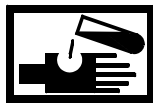
VAPOR

8. Remove drain pan and dispose of contents per local procedures.

INSTALL HYDRAULIC SYSTEM 3/2 BALL VALVE

1. Position new ball valve (2) on bulkhead.
2. Install capscrews (6) and washers (7).
3. Tighten capscrews (6).

 WARNING



CHEMICAL



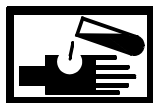
EYE PROTECTION



VAPOR

4. Connect tube (3) to ball valve (2).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

5. Connect tube (4) to ball valve (2).

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

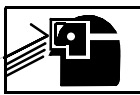
6. Connect hose (5) to ball valve (2).
7. Service hydraulic reservoir. (WP 0141 00)
8. Vent air from hydraulic system. (WP 0134 00)
9. Start engine. (TM 55-1945-225-10)

WARNING

**EAR PROTECTION**

10. Energize hydraulic system and functionally test ball valve (2).
11. Shut engine down. (TM 55-1945-225-10)
12. Service hydraulic hand pump. (WP 0162 00)

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR****SLICK FLOOR**

13. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
PUMP-JET PLANETARY GEARING FEEDBACK UNIT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Brush, Stencil (Soft Bristle) (Item 3, WP 0425 00)

Materials/Parts

Feedback Unit
PN 1109134
Preformed Packing
PN 1001402
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Cleaner (Item 5, WP 0426 00)
Grease, Automotive and Artillery (Item 12, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

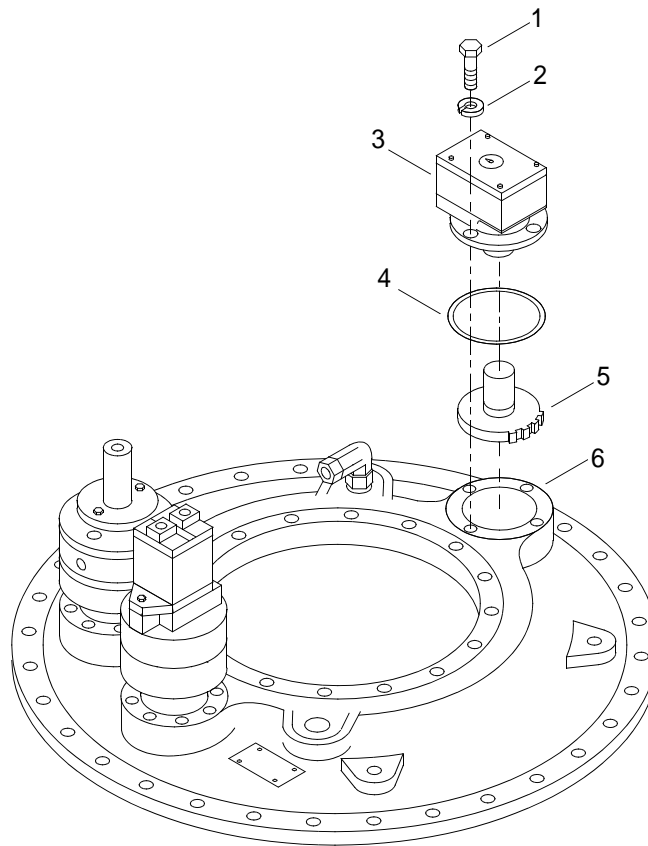
Equipment Condition

Pump-Jet Gearcase Drained. (WP 0126 00)

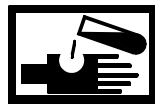
REMOVE PUMP-JET PLANETARY GEARING FEEDBACK UNIT**NOTE**

The following procedure is typical for both port and starboard feedback units.

1. Remove capscrews (1) and spring washers (2) from feedback unit (3).

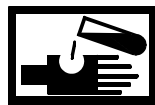


WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

2. Remove feedback unit (3) and preformed packing (4). Discard feedback unit and preformed packing.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

3. Lift feedback unit gear (5) out of pump-jet mounting base (6).

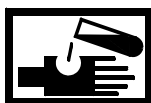
INSTALL PUMP-JET PLANETARY GEARING FEEDBACK UNIT

WARNING

**CHEMICAL****EYE PROTECTION**

1. Clean feedback unit gear (5) and mounting base (5) with cleaner and brush.
2. Install feedback unit gear (5) in pump-jet mounting base (6).

WARNING

**CHEMICAL****EYE PROTECTION**

3. Apply grease to preformed packing groove and install new preformed gasket (4) on gearbox mounting base (6).
4. Position new feedback unit (5) on pump-jet mounting base (6).
5. Install capscrews (1) and spring washers (2) to secure feedback unit (3) to pump-jet (7).
6. Service pump-jet gearcase. (WP 0126 00)
7. Adjust hydraulic system steering as required. (WP 0137 00)
8. Perform operational check of hydraulic system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

9. Clean up spilled fluid with a spill kit and dispose of per local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ENGINE EXHAUST SYSTEM MUFFLER
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Protector, Hearing (Item 20, WP 0425 00)
Sling, 8,400 lb. 20 ft (Yellow) (Item 30, WP 0425 00)
Qty 2

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Twine, Fibrous (Item 46, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

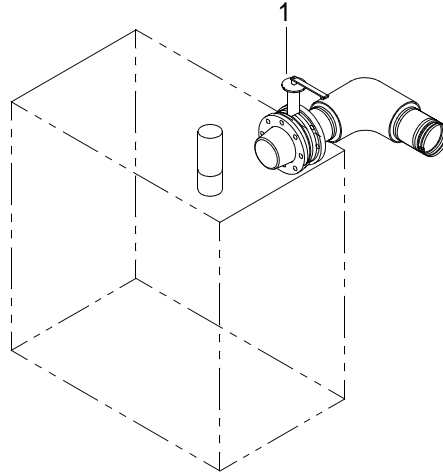
Exhaust System Cool To Touch.
Main Assembly Mast Removed. (WP 0350 00)
Powered Section Operators Cab Removed. (WP 0095 00)
Powered Section Intake Plenum Removed. (WP 0080 00)
Powered Section Engine Hatch Removed. (WP 0098 00)

REMOVE ENGINE EXHAUST SYSTEM MUFFLER**NOTE**

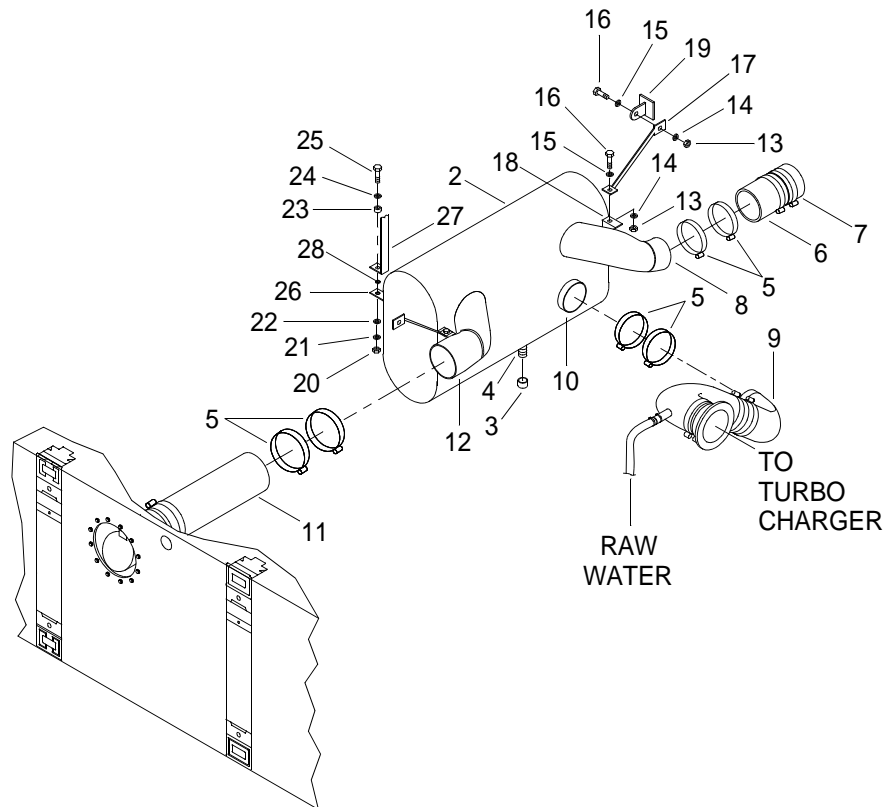
This task is typical for removal and installation of both port and starboard engine exhaust mufflers.

1. Inspect slings prior to use. (TM 55-1945-225-10)

- Verify the butterfly (seachest) valve (1) is closed.



- On bottom of muffler (2), remove cap (3) from drain pipe (4) and drain raw water from muffler (2) into bilge.



- When muffler (2) is drained, install cap (3) on drain pipe (4). Tighten cap (3).
- Loosen hose clamps (5) and remove hose (6) with plug (7) from muffler exhaust outlet elbow (8).
- Loosen hose clamps (5) and remove elbow (9) from muffler exhaust intake (10).
- Secure elbow (9) to engine with twine.
- Loosen hose clamps (5) and remove hose (11) from muffler exhaust outlet elbow (12).

9. Remove muffler (2) from propulsion module.
 - a. Use crane and sling to support weight of muffler (2).
 - b. Remove nylock hex nuts (13), lockwashers (14), flat washers (15) and hex bolts (16) securing stanchions (17) to muffler brackets (18) and stanchion support brackets (19).
 - c. Remove nylock hex nuts (20), lockwashers (21), flat washers (22), male ISO bushings (23), fender washers (24) and hex bolts (25) securing muffler brackets (26) to mounting structure support brackets (27).

 WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- d. Using crane and slings, remove muffler (2) from propulsion module.
- e. Remove female ring isolators (28) resting on muffler brackets (26).
- f. Remove sling from muffler (2).

INSTALL ENGINE EXHAUST SYSTEM MUFFLER

1. Install muffler (2) in propulsion module.

 WARNING



HEAVY PARTS



MOVING PARTS

The female ring isolators are positioned between the muffler brackets and the mounting structure support brackets. Placement must allow the hex head bolts to connect the brackets together. Keep fingers clear. Failure to comply could result in injury to personnel.

- a. Position female ring isolators (28) on muffler brackets (26).

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- b. Using crane and slings, position muffler (2) on mounting structure support brackets (27).
 - c. Install nylock hex nuts (20), lockwashers (21), flat washers (22), male ISO bushings (23), fender washers (24) and hex bolts (25) to secure muffler brackets (26) to mounting structure support brackets (27). Tighten nylock hex nuts (20).
 - d. Position stanchions (17) between muffler brackets (18) and stanchion support brackets (19).
 - e. Install nylock hex nuts (13), lockwashers (14), flat washers (15) and hex bolts (16) to secure stanchions (17) to muffler brackets (18) and stanchion support brackets (19). Tighten nylock hex nuts (13).
 - f. Remove sling from muffler (2).
2. Install hose (11) on muffler exhaust outlet elbow (12) and tighten hose clamps (5).
 3. Remove and discard twine securing elbow (9) to engine.
 4. Install elbow (11) on muffler exhaust intake (10) and tighten hose clamps (5).
 5. Install hose (6) with plug (7) on muffler exhaust outlet elbow (8) and tighten hose clamps (5).
 6. Install powered section engine hatch. (WP 0098 00)
 7. Install powered section intake plenum assembly. (WP 0080 00)
 8. Install powered section operators cab. (WP 0095 00)
 9. Install main assembly mast. (WP 0350 00)
 10. Open butterfly (seachest) valve (1).

WARNING

**EAR PROTECTION**

11. Start engine to activate bilge pumps and perform operational check of exhaust system. (TM 55-1945-225-10)
12. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ENGINE EXHAUST SYSTEM
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Protector, Hearing (Item 20, WP 0425 00)
Hose Assembly, Nonmetallic (Item 15, WP 0425 00)
Sling, 8,400 lb. 20 ft (Yellow) (Item 30, WP 0425 00)
Qty 2

Materials/Parts

Gasket, Flapper Flange
PN C95-1234G
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Cleaner (Item 5, WP 0426 00)
Twine, Fibrous (Item 46, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L (2)

References

TM 55-1945-225-10

Equipment Condition

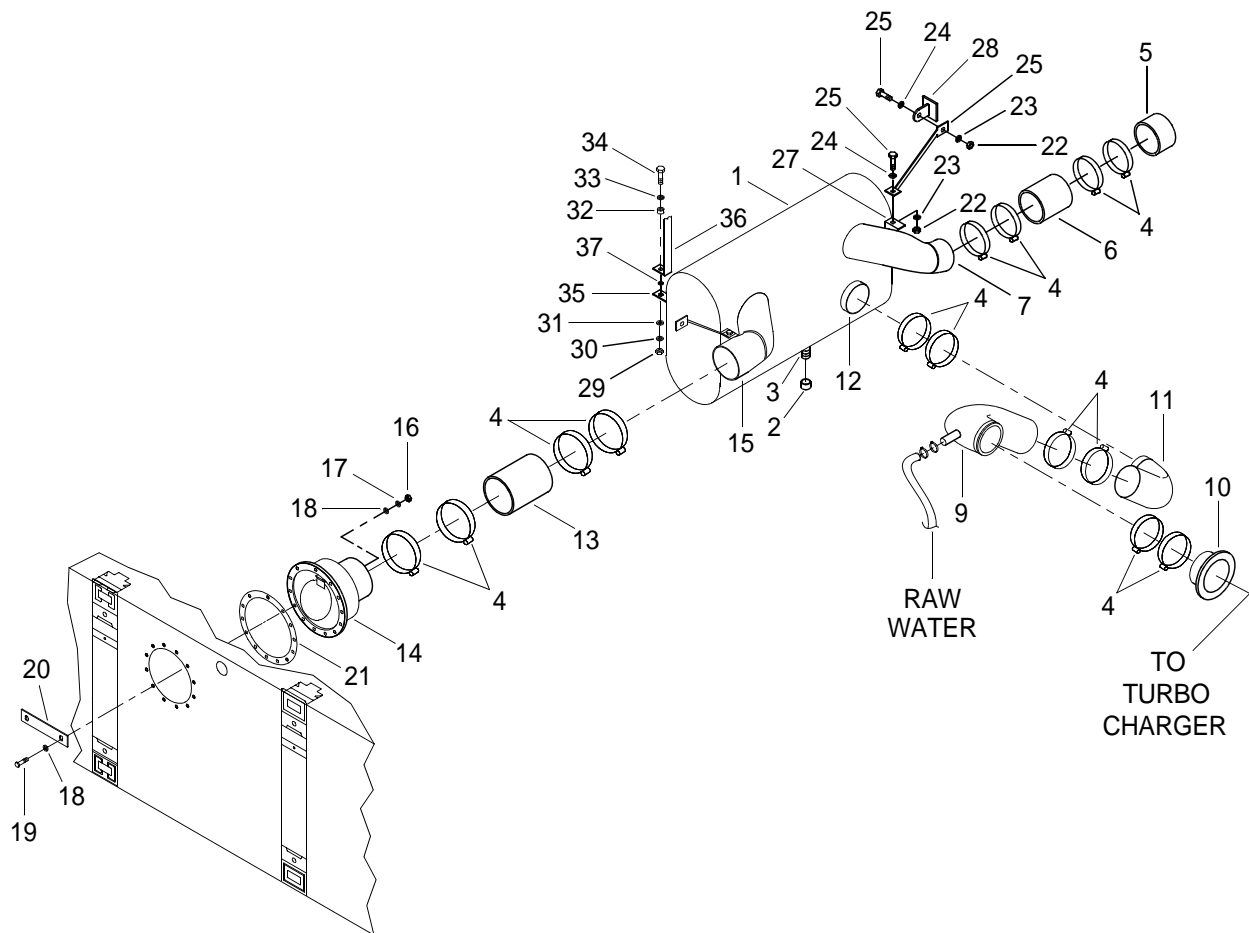
Engine And Exhaust System Cool To Touch.
Exhaust System Cool To Touch.
Main Assembly Mast Removed. (WP 0350 00)
Powered Section Operators Cab Removed. (WP 0095 00)
Powered Section Intake Plenum Removed. (WP 0080 00)
Powered Section Engine Hatch Removed. (WP 0098 00)

DISASSEMBLE ENGINE EXHAUST SYSTEM**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the engine exhaust system.

Repair is limited to the replacement of damaged parts.

1. Inspect slings prior to use. (TM 55-1945-225-10)
2. On bottom of muffler (1), remove cap (2) from drain pipe (3) and drain raw water from muffler (1) into bilge.



3. When muffler (1) is drained, install cap (2) on drain pipe (3). Tighten cap (2).
4. Loosen hose clamps (4) and disassemble exhaust assembly components.
 - a. Remove plug (5) from hose (6).
 - b. Remove hose (6) from muffler exhaust outlet elbow (7).
 - c. Remove raw water hose (8) from riser assembly (9) and secure raw water hose (8) to bulkhead with twine.
 - d. Remove riser assembly (9) from turbo install kit (10).
 - e. Remove riser assembly (9) from elbow (11).
 - f. Remove elbow (11) from muffler exhaust intake (12).
 - g. Remove hose (13) from through-hull housing (14).
 - h. Remove hose (13) from muffler exhaust outlet elbow (15).
5. Using assistant, remove nylock hex nuts (16), lockwashers (17), flat washers (18) and hex bolts (19) securing through-hull housing (14) and flat bar (20) to side of propulsion module.
6. Remove through-hull housing (14) and flapper flange gasket (21) from side of propulsion module. Discard flapper flange gasket (21).

-
7. Remove muffler (1) from propulsion module.

NOTE

Use crane and sling to support weight of muffler.

- a. Remove nylock hex nuts (22), lockwashers (23), flat washers (24) and hex bolts (25) securing stanchions (26) to muffler brackets (27) and stanchion support brackets (28).
- b. Remove nylock hex nuts (29), lockwashers (30), flat washers (31), male ISO bushings (32), fender washers (33) and hex bolts (34) securing muffler brackets (35) to mounting structure support brackets (36).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- c. Using crane and slings, remove muffler (1) from propulsion module.
- d. Remove female ring isolators (37) resting on muffler brackets (35).
- e. Remove sling from muffler (1).

CLEAN ENGINE EXHAUST SYSTEM

1. Clean engine exhaust system component interior surfaces with water and a clean wiping rag.

WARNING



CHEMICAL



EYE PROTECTION

2. Remove foreign substances from engine exhaust system component exterior surfaces with cleaner and a clean wiping rag. Allow to air dry prior to installation.

WARNING



CHEMICAL



EYE PROTECTION

3. Dispose of contaminated wiping rags per local procedures.

INSPECT ENGINE EXHAUST SYSTEM

1. Inspect exhaust assembly components for corrosion, cracks or other damage. Replace if damaged.
2. Inspect hoses (6, 14) for punctures, cracks or deterioration. Replace if damaged.

ASSEMBLE ENGINE EXHAUST SYSTEM

1. Install muffler (1) in propulsion module.

WARNING

**HEAVY PARTS****MOVING PARTS**

The female ring isolators are positioned between the muffler brackets and the mounting structure support brackets. Placement must allow the hex head bolts to connect the brackets together. Keep fingers clear. Failure to comply could result in injury to personnel.

- a. Position female ring isolators (37) on muffler brackets (35).

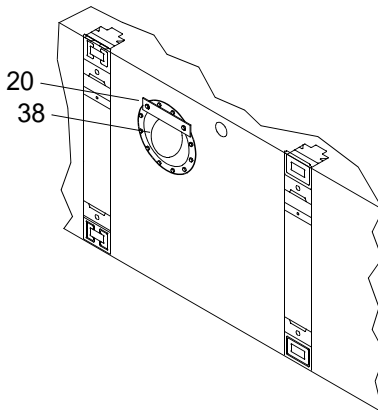
WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- b. Using crane and slings, position muffler (1) on mounting structure support brackets (36).
 - c. Install nylock hex nuts (29), lockwashers (30), flat washers (31), male ISO bushings (32), fender washers (33) and hex bolts (34) to secure muffler brackets (35) to mounting structure support brackets (36). Tighten nylock hex nuts (29).
 - d. Position stanchions (26) between muffler brackets (27) and stanchion support brackets (28).
 - e. Install nylock hex nuts (22), lockwashers (23), flat washers (24) and hex bolts (25) to secure stanchions (26) to muffler brackets (27) and stanchion support brackets (28). Tighten remaining two nylock hex nuts (22)
2. Position new flapper flange gasket (21), through-hull housing (14) and flat bar (20) on side of propulsion module.
 3. Using assistant, install nylock hex nuts (16), lockwashers (17), flat washers (18) and hex bolts (19) to secure through-hull housing (14) and flat bar (20) to side of propulsion module.
 4. Tighten nylock hex nuts (16) except for nylock hex nuts securing flat bar (20) to side of propulsion module.

5. Adjust flat bar (20) so that flapper (38) only reaches 90° when raised.



6. Tighten remaining two nylock hex nuts (16) securing flat bar (20).
7. Remove sling from muffler (1).
8. Assemble exhaust assembly components.
 - a. Install hose (13) on muffler exhaust outlet elbow (15) and tighten hose clamps (4).
 - b. Install hose (13) on through-hull housing (14) and tighten hose clamps (4).
 - c. Install elbow (11) on muffler exhaust intake (12) and tighten hose clamps (4).
 - d. Install riser assembly (9) on elbow (11) and tighten hose clamps (4).
 - e. Install riser assembly (9) on turbo install kit (10) and tighten hose clamps (4).
 - f. Remove and discard twine securing raw water hose (8) to bulkhead.
 - g. Install raw water hose (8) on riser assembly (9) and tighten hose clamps (4).
 - h. Install hose (6) on muffler exhaust outlet elbow (7) and tighten hose clamps (4).
 - i. Install plug (5) on hose (6) and tighten hose clamps (4).
9. Install powered section engine hatch. (WP 0098 00)
10. Install powered section intake plenum assembly. (WP 0080 00)
11. Install powered section operators cab. (WP 0095 00)
12. Install main assembly mast. (WP 0350 00)

WARNING

**EAR PROTECTION**

13. Start engine to activate bilge pumps and perform operational check of exhaust system. (TM 55-1945-225-10)
14. Shut down engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BILGE PUMP FLOAT SWITCH
CLEANING AND TESTING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Materials/Parts

Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

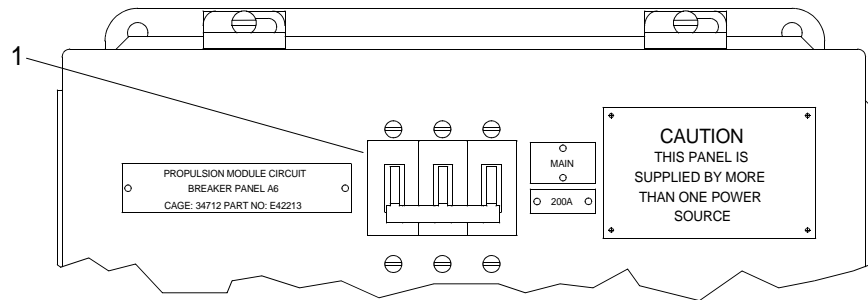
Equipment Condition

Engine Power Isolated. (WP 0075 00)

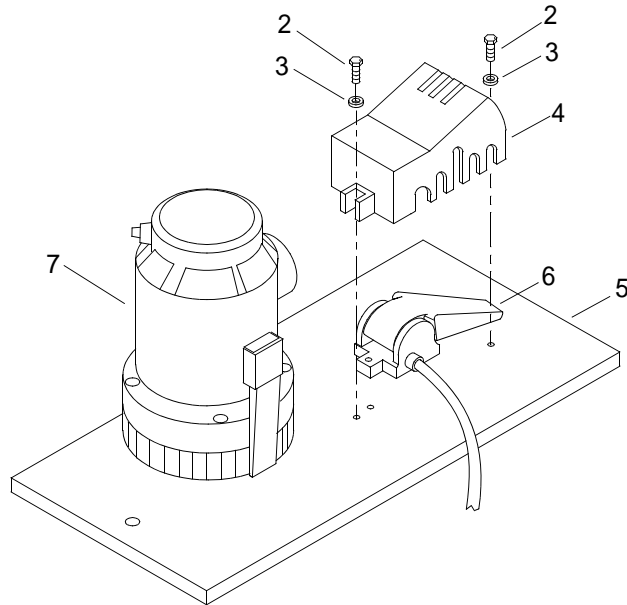
CLEAN BILGE PUMP FLOAT SWITCH**NOTE**

This task is typical for all bilge pump float switches.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Remove screws (2) and washers (3) securing float switch cover (4) to bilge pump mounting plate (5).



3. Remove float switch cover (4).
4. Using wiping rag, clean debris and obstructions from float switch (6).

TEST BILGE PUMP FLOAT SWITCH

1. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to on.

CAUTION

Do not operate the pump for an excessive amount of time if no water is present in the bilge. Failure to comply could cause damage to equipment.

2. Lift float switch (6) and verify bilge pump (7) turns on.
3. Release float switch (6) to verify bilge pump (7) shuts off.
4. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to off.
5. Position float switch cover (4) over float switch (6).
6. Install two screws (2) and two washers (3) to secure float switch cover (4) to bilge pump mounting plate (5). Tighten screws (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BILGE PUMP CHECK VALVE AND DISCHARGE HOSE
REMOVAL, CLEANING, INSPECTION AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Wrench, Pipe (10 in.) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Sealing Compound (Item 34, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

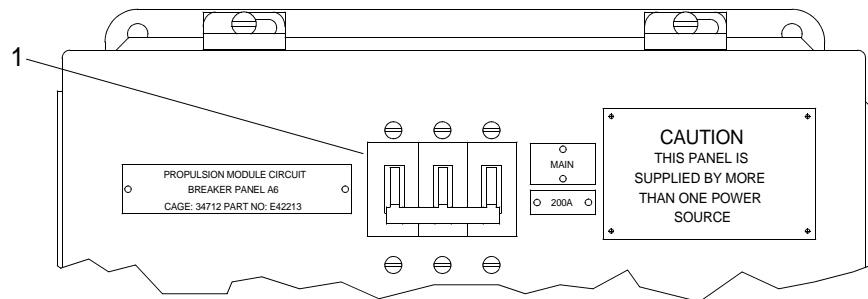
Equipment Condition

Engine Power Isolated. (WP 0075 00)

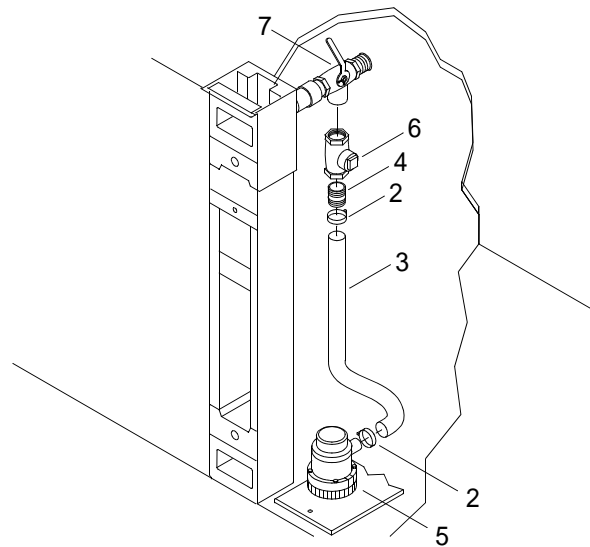
REMOVE BILGE PUMP CHECK VALVE AND DISCHARGE HOSE**NOTE**

This task is typical for all bilge pump check valves and discharge hoses.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Loosen hose clamps (2) securing discharge hose (3) between check valve nipple (4) and bilge pump (5).



3. Remove discharge hose (3) from check valve nipple (4) and bilge pump (5).
4. Remove check valve nipple (4) from check valve (6).
5. Remove check valve (6) from two-way valve (7).

CLEAN BILGE PUMP CHECK VALVE AND DISCHARGE HOSE

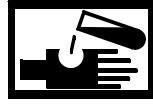
1. Using water, rinse debris from discharge hose (3), check valve nipple (4) and check valve (6).
2. Using wiping rag, clean discharge hose (3), check valve nipple (4) and check valve (6).

INSPECT CHECK VALVE AND DISCHARGE HOSE

1. Inspect discharge hose (3) for deterioration. Replace if damaged.
2. Inspect check valve nipple (4) and check valve (6) for rust or decay. Replace if damaged. (WP 0172 00)

INSTALL BILGE PUMP CHECK VALVE AND DISCHARGE HOSE

WARNING

**CHEMICAL****EYE PROTECTION**

1. Apply sealant to pipe threads of check valve nipple (4), check valve (6) and two-way valve (7).

CAUTION

Failure to install the check valve properly will result in pump malfunctioning and could cause damage to equipment.

2. Install check valve (6) on two-way valve (7). Verify check valve arrows are correctly oriented to prevent malfunction of bilge pump (5).
3. Install check valve nipple (4) on check valve (6).
4. Install hose clamps (2) on discharge hose (3).
5. Install discharge hose (3) between bilge pump (5) and check valve nipple (4) and secure with hose clamps (2). Tighten hose clamps (2).
6. Perform operational check of bilge pump. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BILGE PUMP FLOAT SWITCH WITH GUARD
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Float Switch with Guard
PN 35WG
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

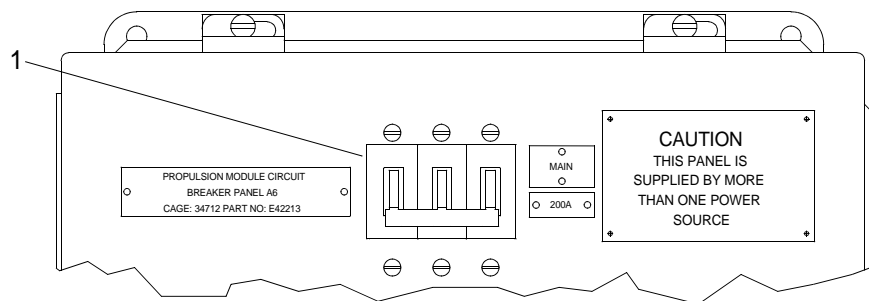
Equipment Condition

Engine Power Isolated. (WP 0075 00)

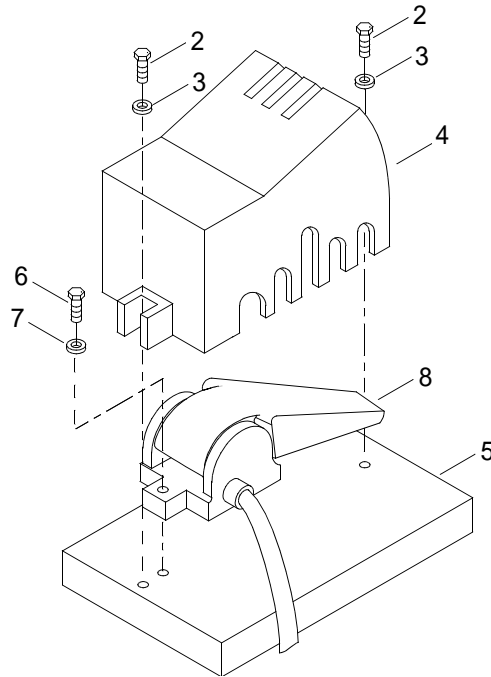
REMOVE BILGE PUMP FLOAT SWITCH AND GUARD**NOTE**

This task is typical for removal and installation of bilge pump float switches.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove screws (2) and washers (3) securing float switch cover (4) to bilge pump mounting plate (5).



- Remove float switch cover (4).
- Remove screw (6) and washer (7) securing float switch (8) to bilge pump mounting plate (5).
- Tag and disconnect electrical wiring to float switch (8).
- Remove float switch (8) and discard.

INSTALL BILGE PUMP FLOAT SWITCH AND GUARD

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to threads of screws (2, 6).
- Connect electrical wiring to new float switch (8) and remove tags.
- Position float switch (8) on bilge pump mounting plate (5).
- Install screw (6) and washer (7) to secure float switch (8) to bilge pump mounting plate (5). Tighten screw (6).

-
5. Position new float switch cover (4) over float switch (8).
 6. Install screws (2) and washers (3) to secure float switch cover (4) to bilge pump mounting plate (5). Tighten screws (2).
 7. Perform operational check of bilge pump. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BILGE PUMP CHECK VALVE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Valve, Check
PN 2144
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Sealing Compound (Item 34, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

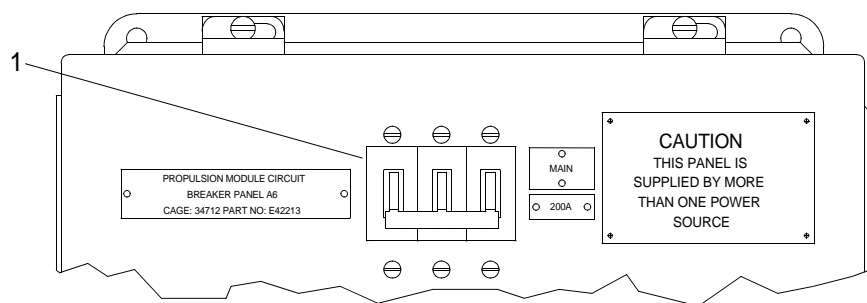
Equipment Condition

Engine Power Isolated. (WP 0075 00)

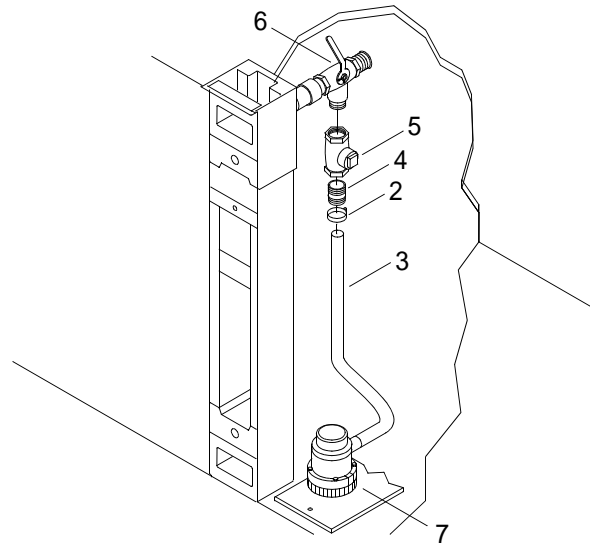
REMOVE BILGE PUMP CHECK VALVE**NOTE**

This task is typical for the removal and installation of bilge check valves.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Loosen hose clamp (2) securing discharge hose (3) to check valve nipple (4).



3. Remove discharge hose (3) from check valve nipple (4).
4. Remove check valve nipple (4) from check valve (5).
5. Remove check valve (5) from two-way valve (6) and discard check valve (5).

INSTALL BILGE PUMP CHECK VALVE

WARNING



CHEMICAL



EYE PROTECTION

CAUTION

Failure to install the check valve properly will result in the pump malfunctioning and can result in damage to equipment.

1. Apply sealing compound to pipe threads on new check valve (5), two-way valve (6) and check valve nipple (4).

CAUTION

Failure to install the check valve properly will result in pump malfunctioning and could cause damage to equipment. Normal flow alignment allows water to travel from the bilge pump to the bilge system holding tank.

2. Install check valve (5) on two-way valve (6). Verify check valve arrows are correctly oriented to prevent malfunction of bilge pump (7).
3. Install check valve nipple (4) on check valve (5).
4. Install discharge hose (3) on check valve nipple (4) and secure with hose clamp (2). Tighten hose clamp (2).
5. Perform operational check of bilge pump. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BILGE PUMP
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Pump, Bilge
PN 16A
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Sealing Compound (Item 34, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

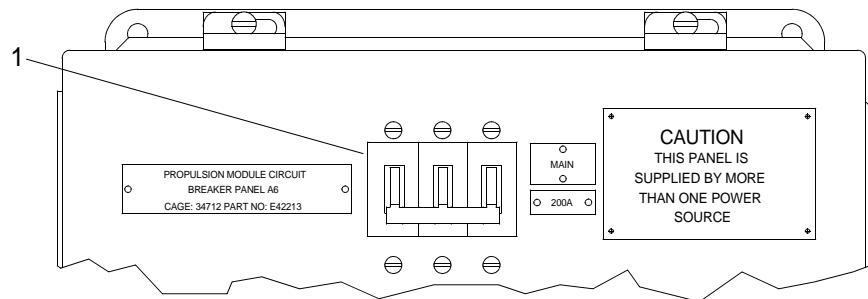
Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE BILGE PUMP**NOTE**

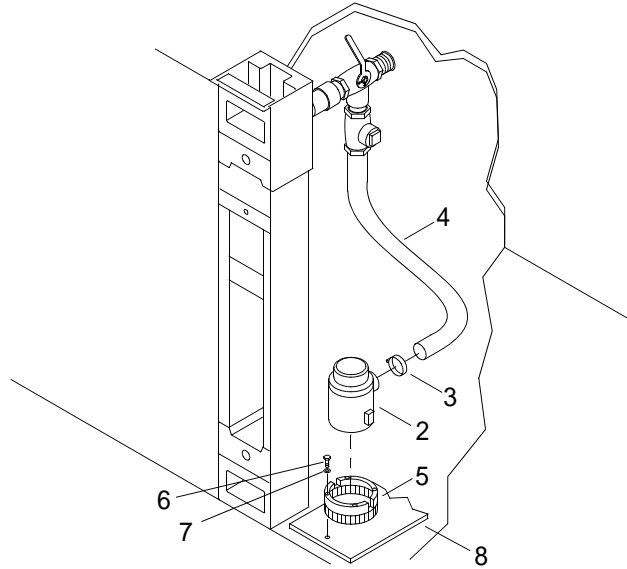
This task is typical for the removal and installation of bilge pumps.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Tag and disconnect electrical wires from bilge pump (2).

- Loosen hose clamp (3) connecting discharge hose (4) to bilge pump (2).



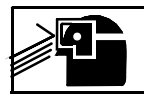
- Remove discharge hose (4) from bilge pump (2).
- Remove bilge pump (2) from strainer (5) by depressing lock tabs on either side of bilge pump (2).
- Remove screws (6) and washers (7) securing strainer (5) to bilge pump mounting plate (8).
- Remove bilge pump (2) and strainer (5) and discard.

INSTALL BILGE PUMPS

WARNING



CHEMICAL



EYE PROTECTION

- Apply sealant to threads of screws (6).

NOTE

The strainer is part of the bilge pump assembly.

- Position new strainer (5) on bilge pump mounting plate (8).
- Install screws (6) and washers (7) to secure strainer (5) to bilge pump mounting plate (8). Tighten screws (6).
- Install new bilge pump (2) on strainer (5) and lock in place with lock tabs.
- Install discharge hose (4) on bilge pump (2) and secure with hose clamp (3). Tighten hose clamp (3).
- Connect electrical wiring to bilge pump (2) and remove tags.
- Perform operational check of bilge pump. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BILGE PUMP HOSES 2 IN. I.D.
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

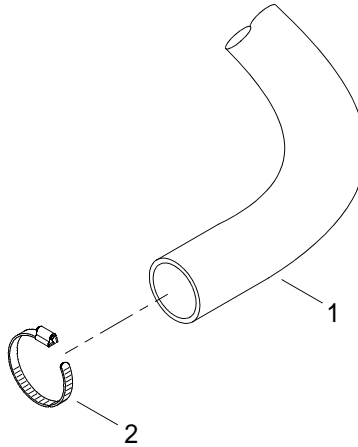
Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE BILGE PUMP HOSES**NOTE**

The following procedure is typical for removal of bilge pump hoses.

1. Remove bilge pump hose (1).



2. Loosen worm gear clamps (2).
3. Move worm gear clamps (2) back onto bilge pump hose (1).
4. Remove bilge pump hose (1) from connection.
5. Remove worm gear clamps (2) from bilge pump hose (1) and discard hose. Retain worm gear clamp (2).

INSTALL BILGE PUMP HOSES**NOTE**

The following procedure is typical for installation of bilge pump hoses.

1. Manufacture bilge pump hose. (WP 0414 00)
2. Place worm gear clamps (2) on bilge pump hose (1).
3. Install bilge pump hose (1) on connecting point.
4. Move worm gear clamps (2) to end of bilge pump hose (1).
5. Tighten worm gear clamps (2).
6. Perform operational check of bilge pump system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BILGE PUMP HOSES 1.5 IN. I.D.
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

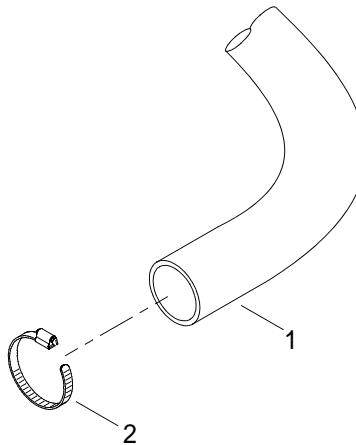
Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE BILGE PUMP HOSES**NOTE**

The following procedure is typical for removal of bilge pump hoses.

1. Remove bilge pump hose (1).



2. Loosen worm gear clamps (2).
3. Move worm gear clamps (2) back onto bilge pump hose (1).
4. Remove bilge pump hose (1) from connection.
5. Remove worm gear clamps (2) from bilge pump hose (1) and discard hose. Retain worm gear clamp (2).

INSTALL BILGE PUMP HOSES**NOTE**

The following procedure is typical for installation of bilge pump hoses.

1. Manufacture bilge pump hose. (WP 0411 00)
2. Place worm gear clamps (2) on bilge pump hose (1).
3. Install bilge pump hose (1) on connecting point.
4. Move worm gear clamps (2) to ends of bilge pump hose (1).
5. Tighten worm gear clamps (2).
6. Perform operational check of bilge pump system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM FILLER NECK STRAINER
REMOVAL, CLEANING AND INSTALLATION**

INITIAL SETUP:

Tools

- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Diesel Fuel (Item 8, WP 0426 00)
- Cloth, Cleaning (Item 7, WP 0426 00)

Personnel Required

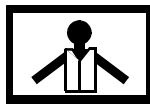
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE FUEL SYSTEM FILLER NECK STRAINER

WARNING



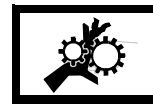
VEST



HELMET PROTECTION



HEAVY PARTS



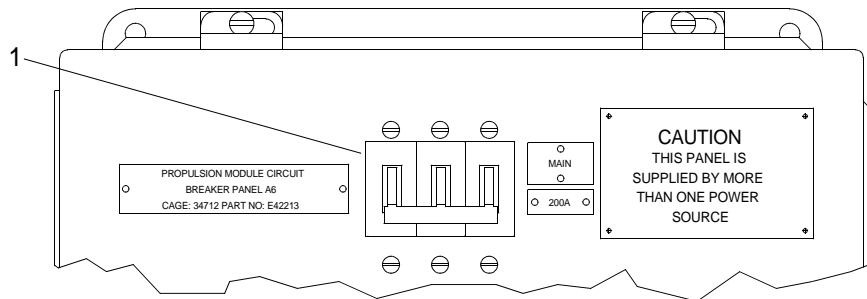
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for all fuel system filler neck strainers.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



 WARNING

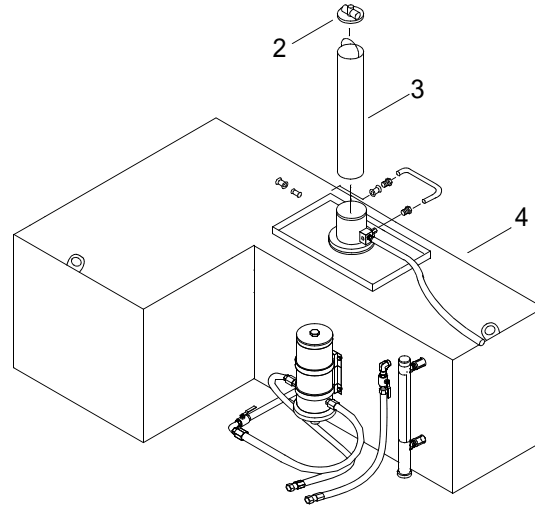


CHEMICAL



EYE PROTECTION

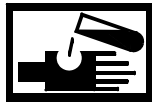
- Remove cover (2) from deck access by turning T-bar counterclockwise.



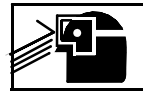
- Lift filler neck strainer (3) out of fuel tank (4) filler neck using bail bar.

CLEAN FUEL SYSTEM FILLER NECK STRAINER

 WARNING



CHEMICAL



EYE PROTECTION

- Clean strainer (3) using clean, lint-free cloth to free contaminants from screen.

 WARNING



CHEMICAL



EYE PROTECTION

- Rinse strainer (3) with clean diesel fuel.

INSTALL FUEL SYSTEM FILLER NECK STRAINER

WARNING

**CHEMICAL****EYE PROTECTION**

1. Install filler neck strainer (3) into tank (4) filler neck.
2. Install cover (2) by turning T-bar clockwise.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM TANK
INSPECTION**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Gage, Stick, Petroleum (Item 10, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Water Indicating Paste (Item 47, WP 0426 00)

Personnel Required

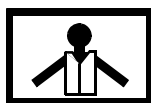
Engineer 88L

Equipment Condition

Fuel System Filler Neck Strainer Removed. (WP 0177 00)

INSPECT FUEL SYSTEM TANK FOR WATER

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS****CHEMICAL****EYE PROTECTION**

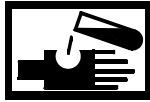
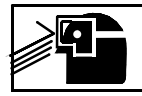
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for inspecting for water in fuel tanks.

1. Apply water indicating paste to end of measuring stick.

WARNING

**CHEMICAL****EYE PROTECTION**

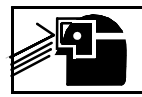
2. Insert gage stick into fuel tank until it reaches the bottom of the tank.

WARNING

**CHEMICAL****EYE PROTECTION**

3. Remove gage stick from fuel tank.

WARNING

**CHEMICAL****EYE PROTECTION**

4. Inspect water indicating paste on end of gage stick for color change.

NOTE

No change in color indicates water is not present in fuel tank. A change in color to pink indicates water is present in fuel tank.

5. If water indicating paste changes color to pink, clean the fuel system tank. (WP 0183 00)
6. Install fuel system filler neck strainer. (WP 0177 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM TANK
DRAINING**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Siphon Assembly, Fuel (Item 27, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

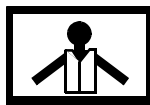
Engineer 88L

Equipment Condition

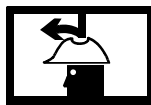
Engine Power Isolated. (WP 0075 00)

DRAIN FUEL TANK

WARNING



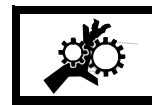
VEST



HELMET PROTECTION



HEAVY PARTS



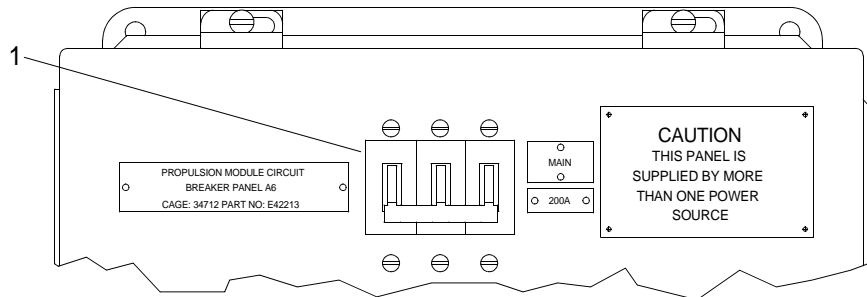
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

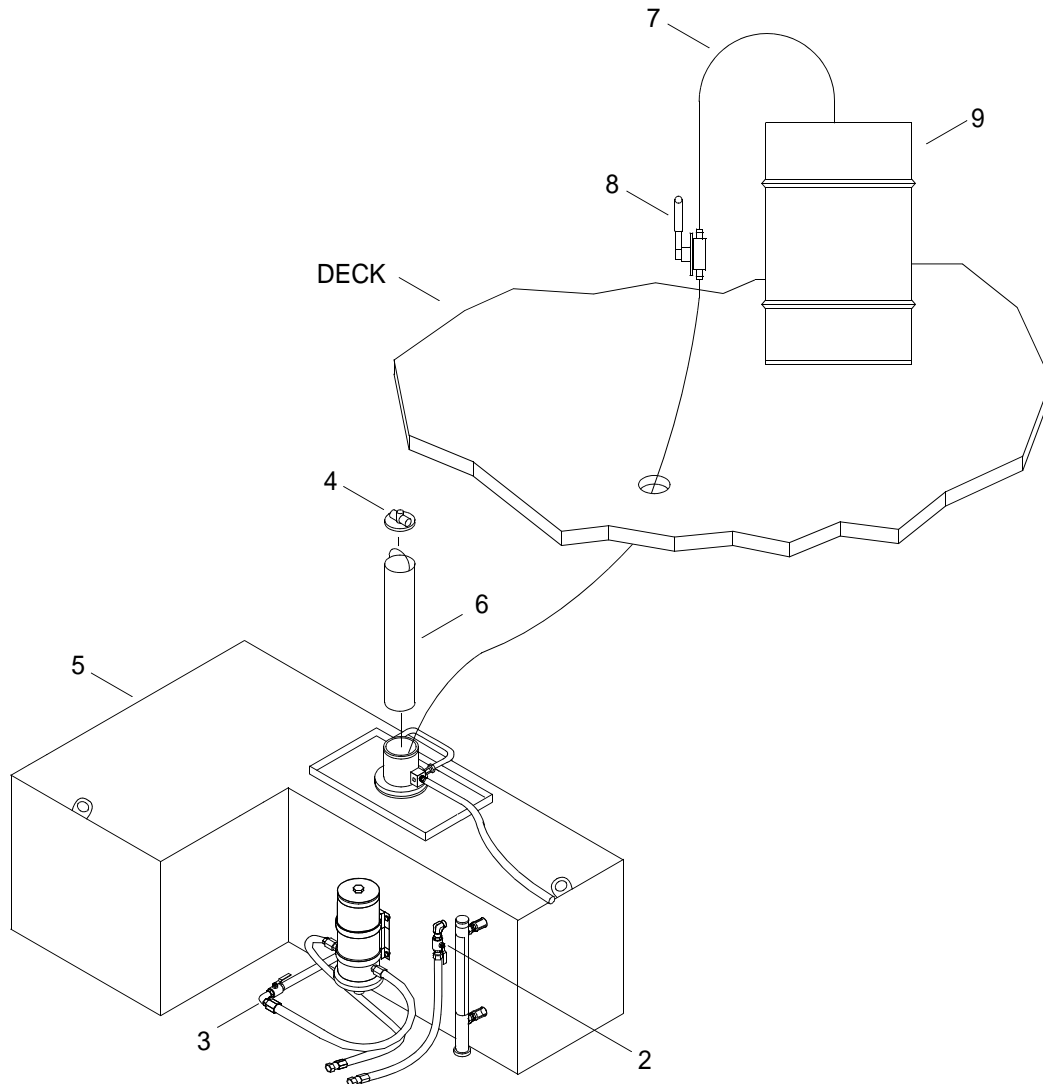
NOTE

The following procedure is typical for defueling both port and starboard fuel tanks.

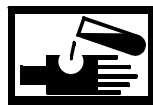
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Close fuel supply line (2) and fuel return line (3) valves.



WARNING



CHEMICAL



EYE PROTECTION

3. Remove cover (4) from tank (5).
4. Lift out filler neck strainer (6).
5. Insert fuel siphon hose (7) into filler neck opening until hose reaches bottom of tank (5).

WARNING

**CHEMICAL****EYE PROTECTION**

6. Remove fuel from tank using fuel siphon (8) and store fuel in approved container (9).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL OIL COMPARTMENT HATCH COVER PLATE
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Antiseize Compound (Item 3, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

REMOVE FUEL OIL COMPARTMENT HATCH COVER PLATE GASKET

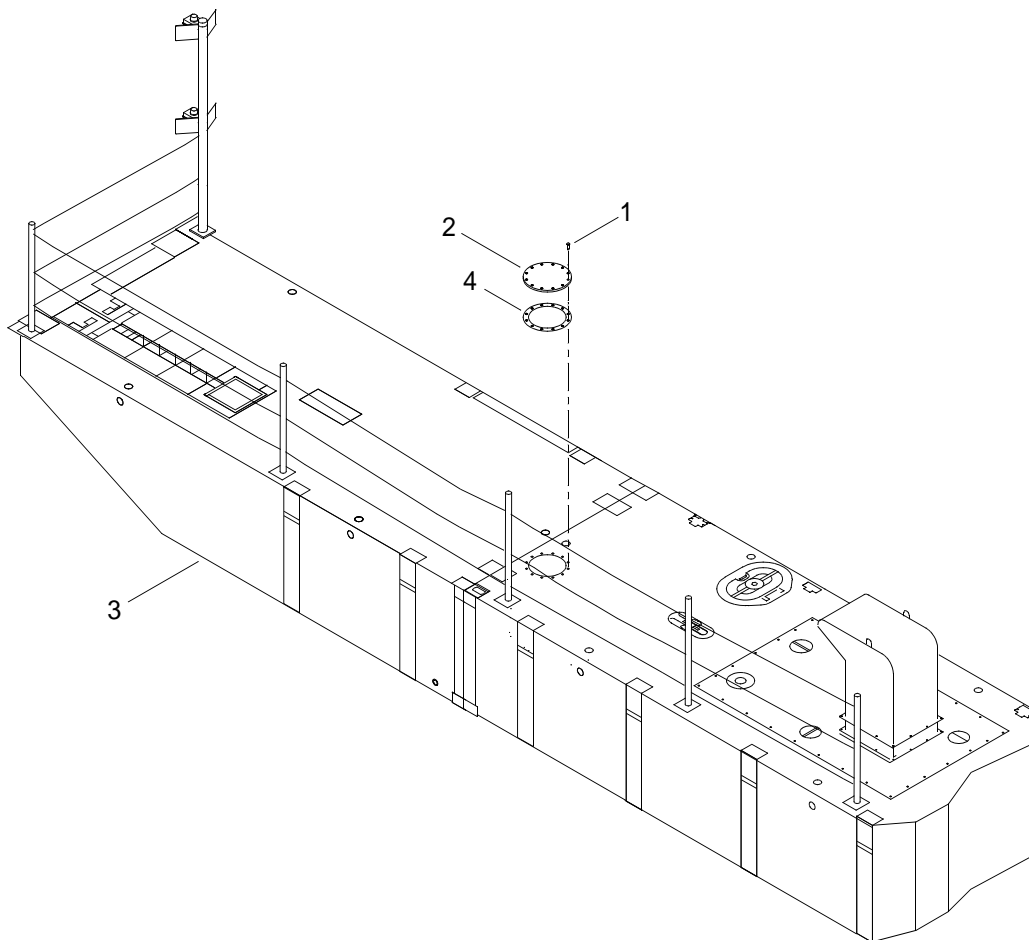
WARNING



VEST

All personnel must wear a personal flotation device WT operations and maintenance. Failure to observe this precaution could result in serious injury or death.

1. Remove capscrews (1) securing fuel oil compartment hatch cover plate (2) to propulsion module (3).



2. Remove fuel oil compartment hatch cover plate (2) from propulsion module (3).
3. Remove fuel oil compartment hatch cover plate gasket (4) from propulsion module (3).
4. Inspect fuel oil compartment hatch cover plate gasket (4) for cut, tears or deterioration. Replace damaged gasket as required. (WP 0229 00)

INSTALL FUEL OIL COMPARTMENT HATCH COVER PLATE GASKET

1. Position fuel oil compartment hatch cover plate gasket (4) on propulsion module (3).
2. Position fuel oil compartment hatch cover plate (2) on propulsion module (3).

WARNING



CHEMICAL



EYE PROTECTION

3. Apply antiseize to capscrews (1).
4. Install capscrews (1) to secure fuel oil compartment hatch cover plate (2) to propulsion module (3). Tighten capscrews (1).

WARNING

**CHEMICAL****EYE PROTECTION**

5. Using wiping rag, clean off excess antiseize compound.

WARNING

**CHEMICAL****EYE PROTECTION**

6. Dispose of wiping rag per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM INSPECTION COVERS
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Wrench, Torque (150-750 in lbs) (Item 39, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gasket
 PN HC-EC-S-18
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

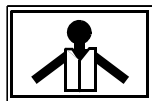
TM 55-1945-225-10

Equipment Condition

Fuel System Tank Drained. (WP 0179 00)
 Fuel Oil Compartment Hatch Cover Plate Removed. (WP 0180 00)

REMOVE FUEL SYSTEM INSPECTION COVERS

WARNING

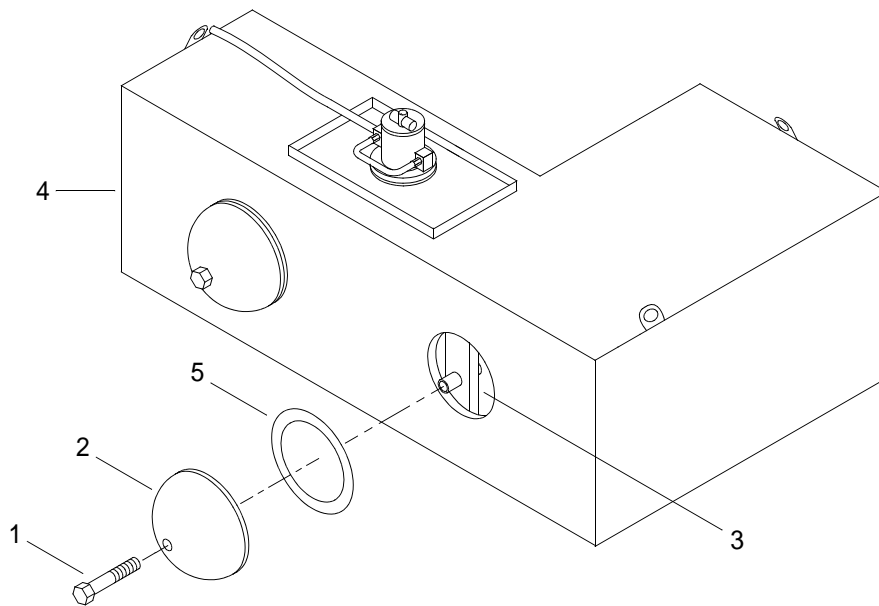
**VEST****CHEMICAL****EYE PROTECTION**

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of fuel tank inspection covers.

1. Remove capscrew (1) securing inspection cover (2) to welded bar (3) on fuel tank (4).



2. Remove cover (2) and gasket (5) from fuel tank (4).
3. Discard gasket (5).

INSTALL FUEL SYSTEM INSPECTION COVERS

1. Position new gasket (5) on cover (2).

WARNING



CHEMICAL



EYE PROTECTION

2. Position inspection cover (2) and gasket (5) on fuel tank (4).
3. Install capscrew (1) through inspection cover (2) and into welded bar (3) in fuel tank (4).
4. Using torque wrench, torque capscrew (1) to 240 to 300 in. lb (27.12 to 33.9 N-m).
5. Fill fuel system tank. (TM 55-1945-225-10)
6. Install fuel oil compartment hatch cover plate. (WP 0180 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM TANK
INSPECTION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

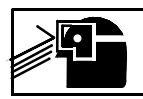
TM 55-1945-225-10

Equipment Condition

Fuel System Tank Drained. (WP 0179 00)
 Fuel System Inspection Covers Removed. (WP 0181 00)

INSPECT FUEL SYSTEM TANK INTERNALLY

WARNING

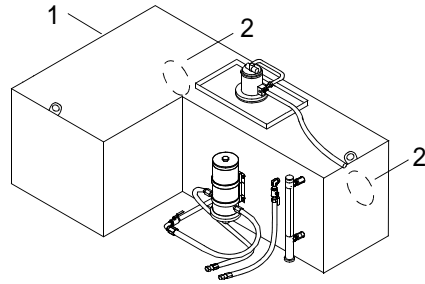
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS****CHEMICAL****EYE PROTECTION**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for port and starboard fuel tanks.

1. Inspect interior of drained fuel tank (1) through two inspection ports (2) for signs of debris and loose or broken components.



2. Remove any debris, loose or broken components from fuel tank.
3. Install fuel system inspection covers. (WP 0181 00)
4. Fill fuel system tank. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM TANK
CLEANING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Diesel Fuel (Item 8, WP 0426 00)
 Cloth, Cleaning (Item 7, WP 0426 00)

Personnel Required

Engineer 88L

References

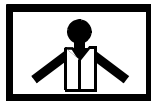
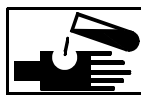
TM 55-1945-225-10

Equipment Condition

Fuel System Filler Neck Strainer Removed. (WP 0177 00)
 Fuel System Tank Sight Level Removed. (WP 0186 00)
 Fuel System Tank Drained. (WP 0179 00)
 Fuel System Inspection Covers Removed. (WP 0181 00)

CLEAN FUEL SYSTEM TANK

WARNING

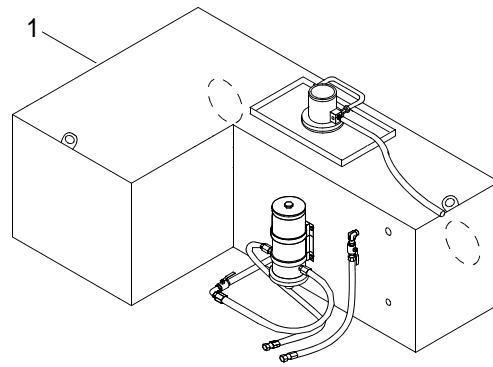
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS****CHEMICAL****EYE PROTECTION**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for port and starboard fuel tanks.

1. Remove any residual fuel from the interior of the fuel tank (1) using lint-free cloth.



WARNING

**CHEMICAL****EYE PROTECTION**

2. Clean the entire interior of the tank (1) using lint-free cloth dampened with diesel fuel.
3. Install fuel system inspection covers. (WP 0181 00)
4. Install fuel system tank sight level. (WP 0186 00)
5. Install fuel system filler neck strainer. (WP 0177 00)
6. Fill fuel system tank with fuel. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM FILLER NECK CHECK VALVE
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Check Valve
PN 232T1-4PP
Qty 2
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Sealing Compound (Item 34, WP 0426 00)

Personnel Required

- Engineer 88L

Equipment Condition

- Engine Power Isolated. (WP 0075 00)
-

REMOVE FUEL SYSTEM FILLER NECK CHECK VALVE

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



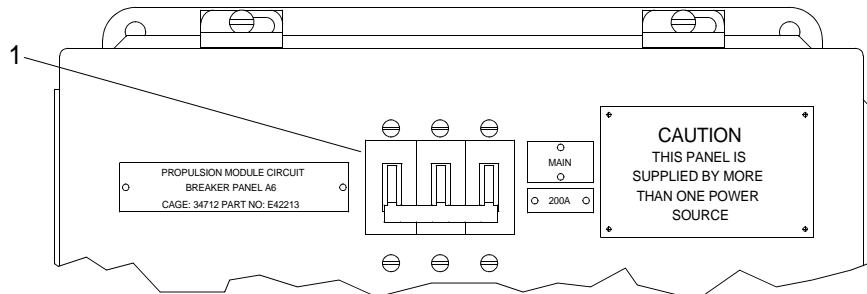
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

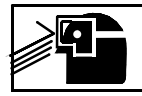
NOTE

The following procedure is typical for both port and starboard fuel tanks.

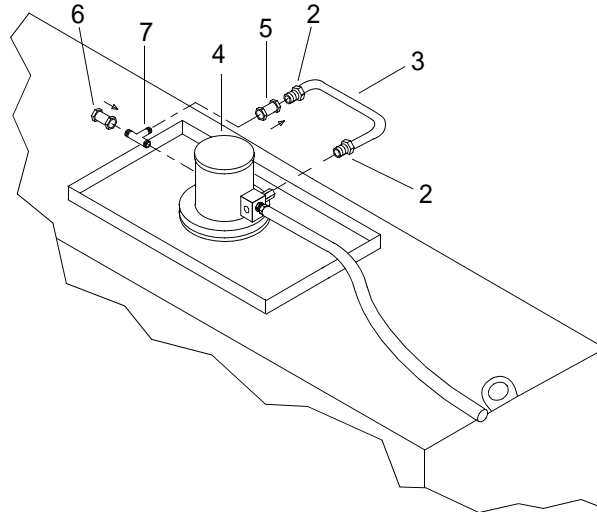
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

**CHEMICAL****EYE PROTECTION**

2. Loosen male connectors (2) of rigid fuel line (3) at filler neck (4) and check valve (5).



3. Remove rigid fuel line (3) from check valve (5) and filler neck (4).
4. Retain rigid fuel line (3).
5. Remove two check valves (5 and 6) from male pipe tee (7).
6. Discard check valves (5 and 6).

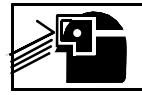
INSTALL FUEL SYSTEM FILLER NECK CHECK VALVE

WARNING

**CHEMICAL****EYE PROTECTION**

1. Using a wire brush, remove old sealing compound from pipe threads on male connectors (2) of rigid fuel line (3) and male pipe tee (7).

WARNING

**CHEMICAL****EYE PROTECTION**

2. Apply sealing compound to pipe threads on male connectors (3) and male pipe tee (7).
3. Install new check valve (6) on male pipe tee (7) with direction of flow toward filler neck and tighten.
4. Install new check valve (5) on male pipe tee (7) with direction of flow away from tee and tighten.
5. Install male connectors (2) of rigid fuel line (3) on check valve (5) and the filler neck (4).
6. Tighten both connectors (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM BALL VALVE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Ball Valve, Supply
PN 1-A-3600-TT
Ball Valve, Return
PN ¾-A-3600-TT
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Sealing Compound (Item 34, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Fuel System Tank Drained. (WP 0179 00)
Fuel System Fuel Water Separator Drained. (WP 0194 00)

REMOVE FUEL SYSTEM SUPPLY LINE BALL VALVE

 WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



MOVING PARTS

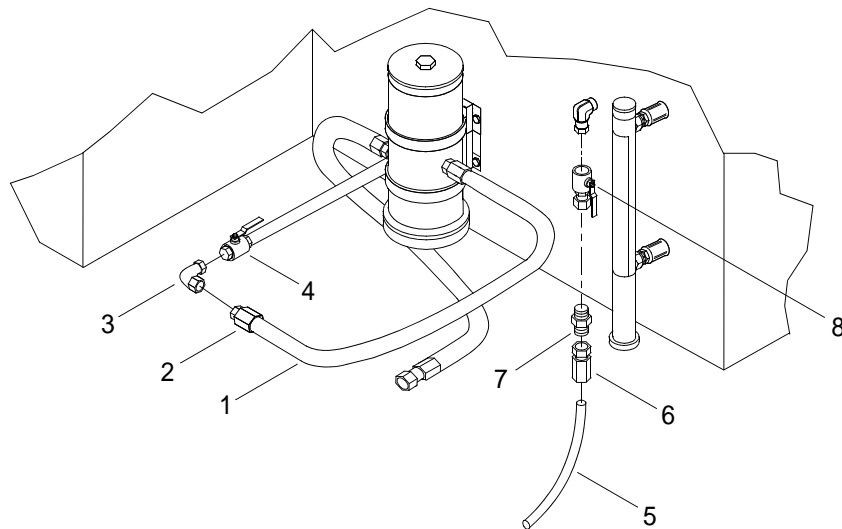
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

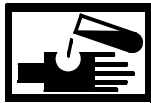
The following procedure is typical for removal and installation of fuel systems supply and return ball valves.

After draining fuel tank, residual fuel will be in both supply and return lines.

1. Position drain pan beneath fuel tank supply hose (1).



 WARNING



CHEMICAL



EYE PROTECTION

2. Remove supply hose (1), hose fitting (2) and 90° elbow (3).

WARNING

**CHEMICAL****EYE PROTECTION**

3. Remove fuel supply line ball valve (4).

WARNING

**CHEMICAL****EYE PROTECTION**

4. Remove drain pan and dispose of contents in accordance with local procedures.

REMOVE FUEL SYSTEM RETURN LINE BALL VALVE

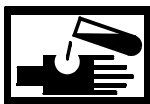
1. Position drain pan beneath fuel return hose (5).

WARNING

**CHEMICAL****EYE PROTECTION**

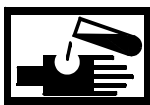
2. Remove hose (5), hose fitting (6) and straight adaptor (7).

WARNING

**CHEMICAL****EYE PROTECTION**

3. Remove fuel return line ball valve (8).

WARNING

**CHEMICAL****EYE PROTECTION**

4. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL FUEL SYSTEM SUPPLY LINE BALL VALVE**WARNING****CHEMICAL****EYE PROTECTION**

1. Apply sealing compound to pipe threads on 90° elbow (3) and fuel supply line ball valve (4).
2. Install new fuel supply line ball valve (4), 90° elbow (3), hose fitting (2) and hose (1).
3. Tighten fittings.

WARNING**CHEMICAL****EYE PROTECTION**

4. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

INSTALL FUEL SYSTEM RETURN LINE BALL VALVE**WARNING****CHEMICAL****EYE PROTECTION**

1. Apply sealing compound to pipe threads on straight adaptor (7) and return line ball valve (8).
2. Install new return line ball valve (8), straight adaptor (7), hose fitting (6) and hose (5).
3. Tighten fittings.
4. Fill fuel system tank. (TM 55-1945-225-10)
5. Perform operational check on fuel system. (TM 55-1945-225-10)

WARNING**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

6. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM TANK SIGHT LEVEL
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Level, Sight
 PN E0208
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

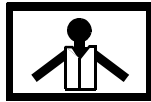
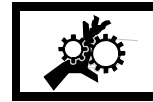
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE FUEL SYSTEM TANK SIGHT LEVEL

WARNING

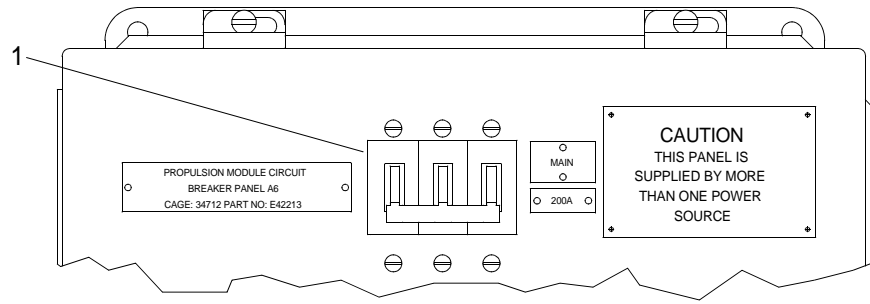
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

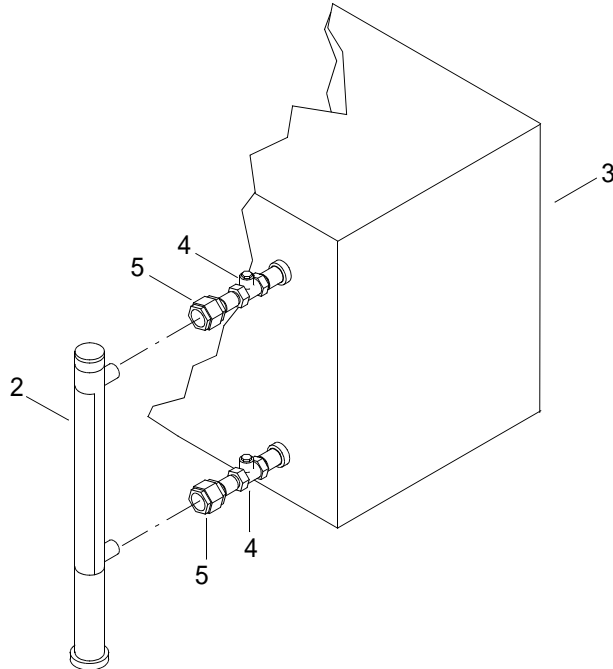
NOTE

The following procedure is typical for removal of both port and starboard fuel tank sight levels.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pan below sight level (2) on fuel tank (3).



3. Close top and bottom shutoff cocks (4) by turning clockwise.

WARNING



CHEMICAL



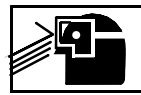
EYE PROTECTION

4. Loosen top and bottom close nipples (5) until sight level (2) is free.

WARNING



CHEMICAL



EYE PROTECTION

5. Remove sight level (2), and drain residual fuel into drain pan.

-
- Discard sight level (2).

WARNING



CHEMICAL



EYE PROTECTION

- Remove drain pan and dispose of contents per local procedures.

INSTALL FUEL SYSTEM TANK SIGHT LEVEL

- Position new sight level (2) on top and bottom close nipples (5).
- Tighten top and bottom close nipples (5).
- Open top and bottom shutoff cocks (4) by turning counterclockwise.

WARNING



CHEMICAL



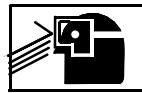
EYE PROTECTION

- Check sight level top and bottom close nipples (5) for leaks.

WARNING



CHEMICAL



EYE PROTECTION



SLICK FLOOR

- Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM TANK SIGHT LEVEL SHUTOFF COCK
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Shutoff, Cock
 PN 48535k75
 Qty 2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

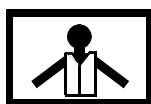
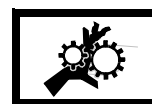
TM 55-1945-225-10

Equipment Condition

Fuel System Tank Drained. (WP 0179 00)

REMOVE FUEL SYSTEM TANK SIGHT LEVEL SHUTOFF COCK

WARNING

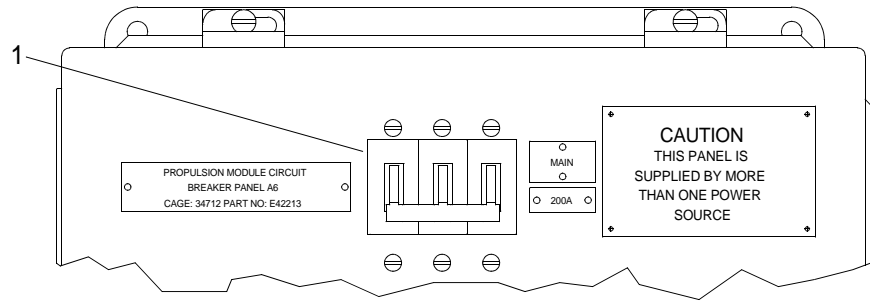
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

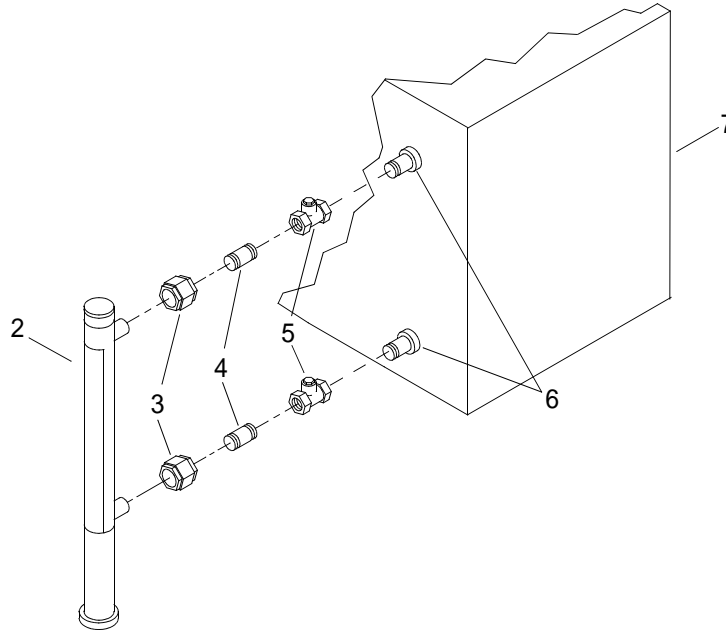
NOTE

The following procedure is typical for both port and starboard fuel tanks.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pan below sight level (2).



WARNING



CHEMICAL



EYE PROTECTION

3. Loosen top and bottom close nipples (3) until sight level (2) is free.

WARNING



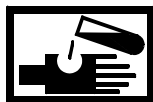
CHEMICAL



EYE PROTECTION

4. Remove sight level (2).

 WARNING



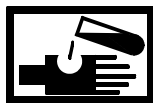
CHEMICAL



EYE PROTECTION

5. Drain residual fuel into drain pan.
6. Retain sight level (2).
7. Remove top and bottom close nipples (3) and retain.
8. Remove pipes (4) and retain.
9. Remove shutoff cocks (5) from pipes (6).
10. Discard shutoff cocks (5).

 WARNING



CHEMICAL



EYE PROTECTION

11. Remove drain pan and dispose of contents per local procedures.

INSTALL FUEL SYSTEM SIGHT LEVEL SHUTOFF COCK

 WARNING



CHEMICAL



EYE PROTECTION

1. Using a wire brush, remove old adhesive from pipes (4) and exposed end of pipe (6) attached to tank (7).

 WARNING



CHEMICAL



EYE PROTECTION

2. Apply adhesive to threads of pipes (4) and on exposed end of pipes (6).
3. Install new shutoff cocks (5) on pipes (6) and tighten.
4. Install pipes (4), retained for installation, on shutoff cocks (5) and tighten.
5. Install close nipples (3) on union pipes (4) and tighten.

-
6. Install retained site level (2) on top and bottom close nipples (3).
 7. Fill fuel system tank. (TM 55-1945-225-10)
 8. Open both shutoff cocks (5) by turning counterclockwise.
 9. Check for leaks.

WARNING



CHEMICAL



EYE PROTECTION



SLICK FLOOR

10. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM RUBBER HOSES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Hose, Fuel
PN E11488
Hose, Fuel
PN E11508-1
Hose, Fuel
PN E11508-2
Hose, Fuel
PN E11508-3
Hose, Fuel
PN E11518-1
Hose, Fuel
PN E11518-2
Hose, Fuel
PN E11518-3
Hose, Fuel
PN E11518-4
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

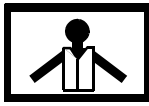
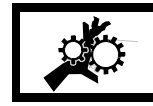
TM 55-1945-225-10

Equipment Condition

Fuel System Tank Drained. (WP 0179 00)

REMOVE FUEL SYSTEM RUBBER HOSES

WARNING

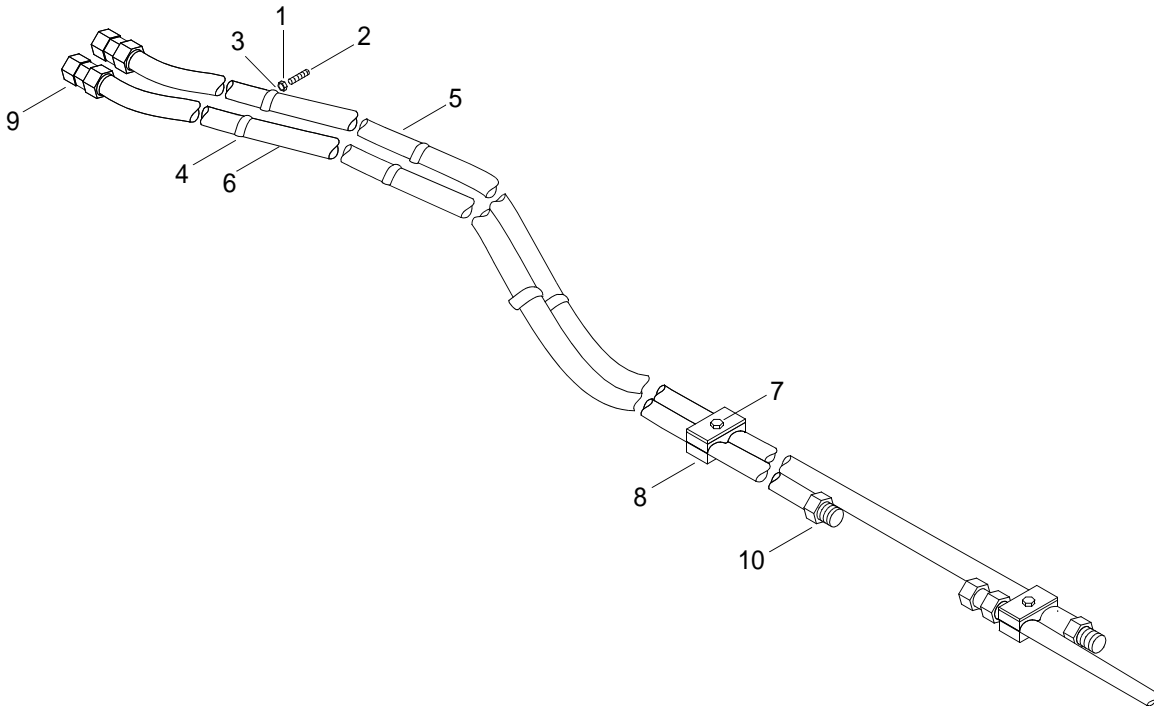
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for all fuel system rubber hoses for port and starboard fuel systems.

1. Place drain pan under hose being removed for draining residual fuel from hose.
2. Remove nut (1) from stud (2) connecting clamps (3 and 4).



3. Separate clamp (3) from clamp (4).
4. Replace nut (1) on stud (2) of clamp (3), leaving attached to hose (5).
5. Remove clamp (4) from hose (6) and retain clamp (4).
6. Loosen screw (7) from clamp (8) enough to remove hose (6).
7. Loosen adaptor (9) and male fitting (10).
8. Remove hose (6).

 WARNING



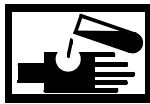
CHEMICAL



EYE PROTECTION

9. Drain residual fuel into drain pan.
10. Discard hose (6).

 WARNING



CHEMICAL



EYE PROTECTION

11. Remove drain pan and dispose of contents per local procedures.

INSTALL FUEL SYSTEM RUBBER HOSES

 WARNING



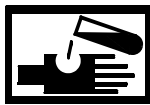
CHEMICAL



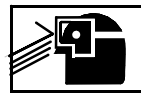
EYE PROTECTION

1. Apply adhesive to threads of male fitting (10) of new hose (6).
2. Install male fitting (10) and tighten.
3. Install adaptor (9) and tighten.

 WARNING



CHEMICAL



EYE PROTECTION

4. Remove screw (7) from clamp (8) and apply sealing compound to screw threads.
5. Position hose (6) in clamp (8).
6. Install screw (7) and tighten.
7. Install retained clamp (4) on new hose (6).
8. Remove nut (1) from stud (2) on clamp (3) attached to hose (5).
9. Install clamp (4) on stud (2) with clamp (3).

WARNING

**CHEMICAL****EYE PROTECTION**

10. Apply adhesive to threads of stud (2).
11. Install nut (1) on stud (2) and tighten.
12. Fill fuel system tank. (TM 55-1945-225-10)
13. Perform operational check on fuel system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

14. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM RIGID FUEL LINE PN E12798-3
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

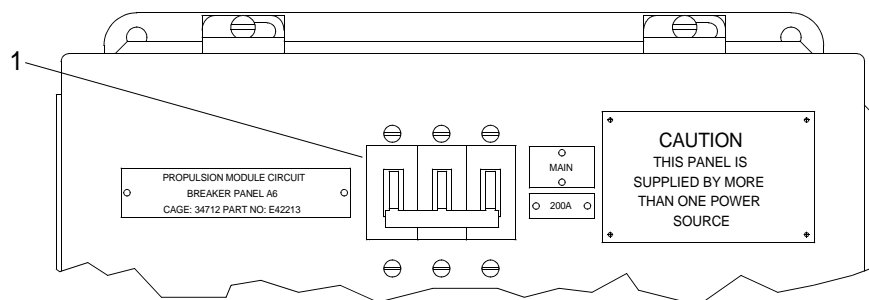
Equipment Condition

Engine Power Isolated. (WP 0075 00)

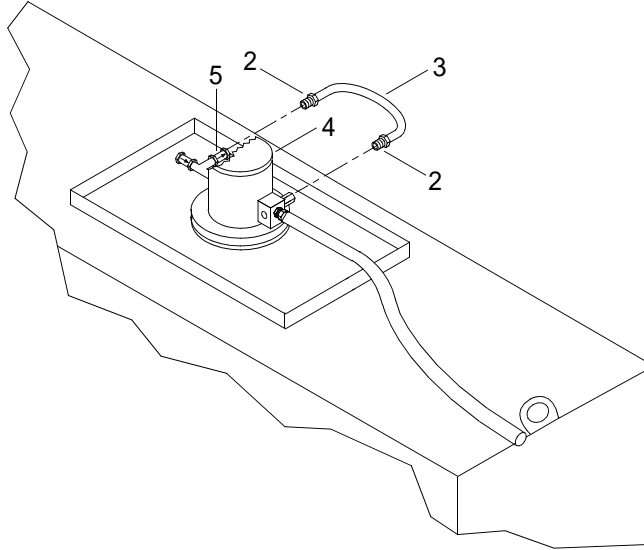
REMOVE FUEL SYSTEM RIGID FUEL LINE PN E12798-3**NOTE**

This task is typical for both port and starboard propulsion modules.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen male connectors (2) of rigid fuel line (3) at filler neck (4) and check valve (5).



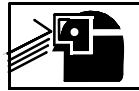
- Remove rigid fuel line (3) from check valve (5) and filler neck (4).

WARNING

**CHEMICAL****EYE PROTECTION**

- Drain any residual fuel from rigid fuel line (3) into drain pan.
- Discard rigid fuel line (3).

WARNING

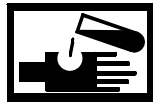
**CHEMICAL****EYE PROTECTION**

- Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL FUEL SYSTEM RIGID FUEL LINE PN E12798-3

1. Manufacture new rigid fuel line (3). (WP 0418 00)
2. Position rigid fuel line (3) where installation will occur to determine required final bends and length. Use tube bender and tube cutter as required.
3. Install new male connectors (2) on rigid fuel line (3). (WP 0400 00)

WARNING

**CHEMICAL****EYE PROTECTION**

4. Apply adhesive to pipe threads on male connectors (2) of rigid fuel line (3).
5. Install male connectors (2) of rigid fuel line (3) on check valve (5) and the filler neck (4).
6. Tighten both male connectors (2).
7. Perform operational check on fuel system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

8. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM RIGID FUEL LINE PN E12798-4
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Bender, Tube (Item 4, WP 0425 00)
Cutter, Tube (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

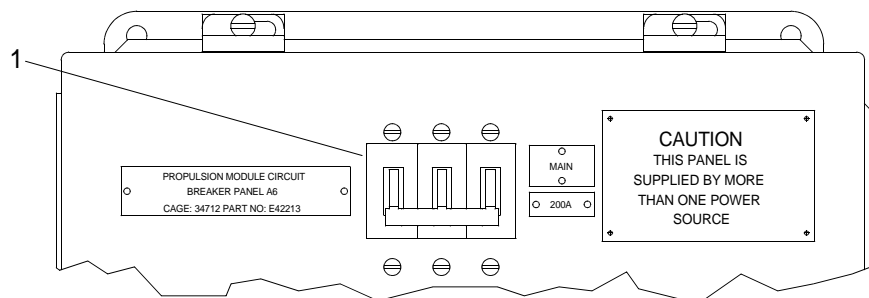
Equipment Condition

Engine Power Isolated. (WP 0075 00)

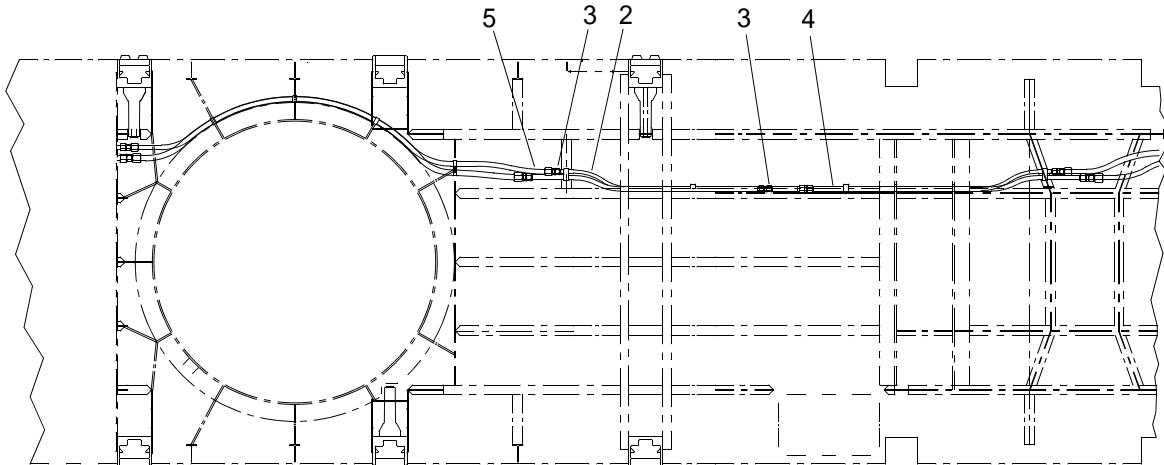
REMOVE FUEL SYSTEM RIGID FUEL LINE PN E12798-4**NOTE**

This task is typical for both port and starboard propulsion modules.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Position drain pan near rigid fuel line (2).



WARNING



CHEMICAL



EYE PROTECTION

- Disconnect fittings (3) on both ends of rigid fuel line (2) from forward (4) and aft (5) fuel lines.

WARNING



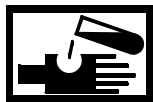
CHEMICAL



EYE PROTECTION

- Remove rigid fuel line (2).

WARNING



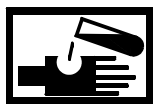
CHEMICAL



EYE PROTECTION

- Drain any residual fuel from rigid fuel line (2) into drain pan.
- Discard rigid fuel line (2).

WARNING

**CHEMICAL****EYE PROTECTION**

7. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL FUEL SYSTEM RIGID FUEL LINE PN E12798-4

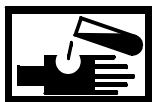
1. Manufacture new rigid fuel line (2). (WP 0418 00)
2. Position rigid fuel line (2) where installation will occur to determine required final bends and length. Use tube bender and tube cutter as required.
3. Install new fittings (3) on rigid fuel line (2). (WP 0400 00)

WARNING

**CHEMICAL****EYE PROTECTION**

4. Apply adhesive to pipe threads on fittings (3) of rigid fuel line (2).
5. Connect fittings (3) on both ends of rigid fuel line (2) to forward (4) and aft (5) fuel lines.
6. Tighten both end fittings (3).
7. Perform operational check on fuel system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

8. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM RIGID FUEL LINE PN E12788-2
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Bender, Tube (Item 4, WP 0425 00)
Cutter, Tube (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

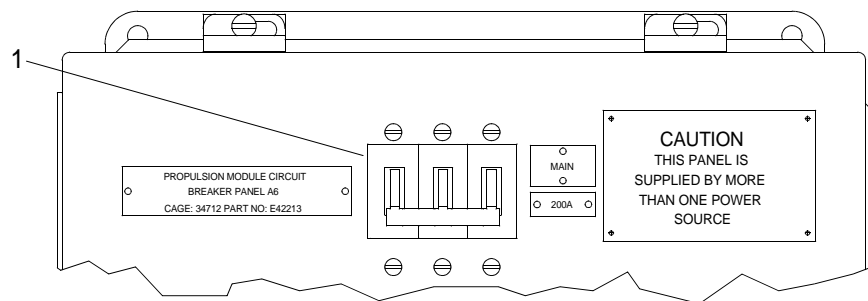
Equipment Condition

Engine Power Isolated. (WP 0075 00)

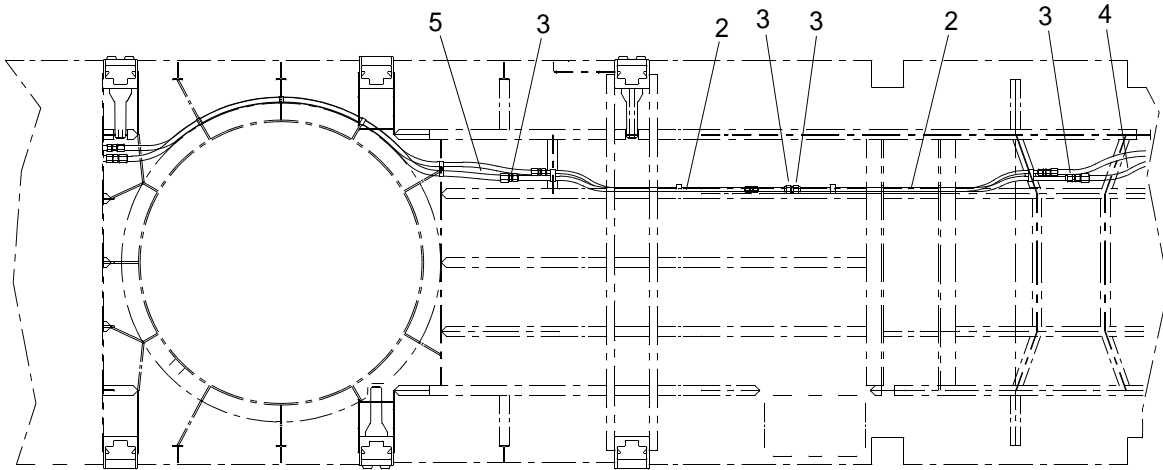
REMOVE FUEL SYSTEM RIGID FUEL LINE PN E12788-2**NOTE**

This task is typical for both forward and aft E12788-2 rigid fuel lines in both port and starboard propulsion modules.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



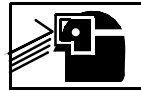
2. Position drain pan near rigid fuel line (2).



WARNING



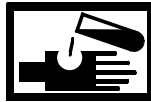
CHEMICAL



EYE PROTECTION

3. Disconnect fittings (3) on both ends of rigid fuel line (2) from forward (4) and aft (5) fuel lines.

WARNING



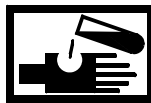
CHEMICAL



EYE PROTECTION

4. Remove rigid fuel line (2).

WARNING



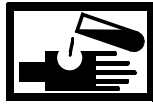
CHEMICAL



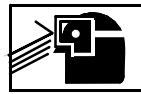
EYE PROTECTION

5. Drain any residual fuel from rigid fuel line (2) into drain pan.
6. Discard rigid fuel line (2).

 WARNING



CHEMICAL



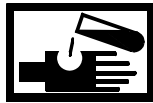
EYE PROTECTION

7. Remove drain pan and dispose of contents in accordance with local procedures.

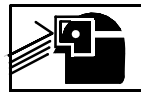
INSTALL FUEL SYSTEM RIGID FUEL LINE PN E12788-2

1. Manufacture new rigid fuel line (2). (WP 0417 00)
2. Position rigid fuel line (2) where installation will occur to determine required final bends and length. Use tube bender and tube cutter as required.
3. Install new fittings (3) on rigid fuel line (2). (WP 0399 00)

 WARNING



CHEMICAL



EYE PROTECTION

4. Apply adhesive to pipe threads on fittings (3) of rigid fuel line (2).
5. Connect fittings (3) on both ends of rigid fuel line (2) to forward (4) and aft (5) fuel lines.
6. Tighten both end fittings (3).
7. Perform operational check on fuel system. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



SLICK FLOOR

8. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM RIGID FUEL LINE PN E12798-1
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Bender, Tube (Item 4, WP 0425 00)
Cutter, Tube (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

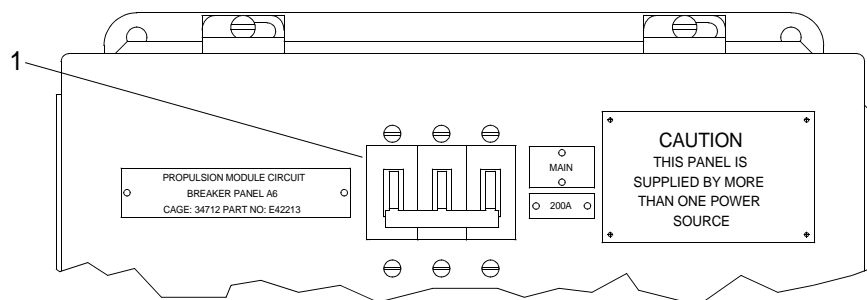
Equipment Condition

Engine Power Isolated. (WP 0075 00)

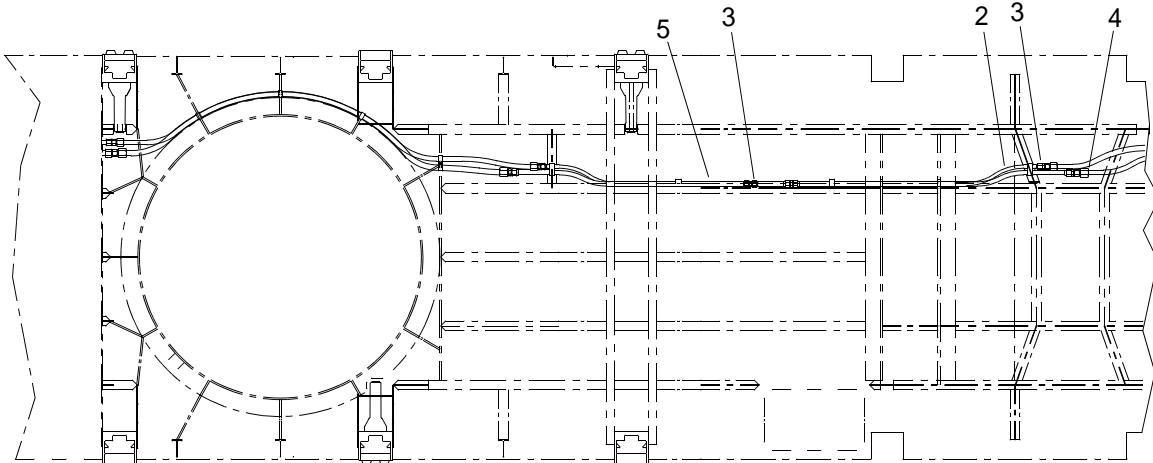
REMOVE FUEL SYSTEM RIGID FUEL LINE PN E12798-1**NOTE**

This task is typical for both port and starboard propulsion modules.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Position drain pan near rigid fuel line (2).



WARNING



CHEMICAL



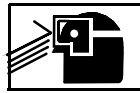
EYE PROTECTION

- Disconnect fittings (3) on both ends of rigid fuel line (2) from forward (4) and aft (5) fuel lines.

WARNING



CHEMICAL



EYE PROTECTION

- Remove rigid fuel line (2).

WARNING



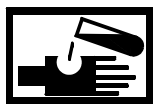
CHEMICAL



EYE PROTECTION

- Drain any residual fuel from rigid fuel line (2) into drain pan.
- Discard rigid fuel line (2).

WARNING

**CHEMICAL****EYE PROTECTION**

7. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL FUEL SYSTEM RIGID FUEL LINE PN E12798-1

1. Manufacture new rigid fuel line (2). (WP 0419 00)
2. Position rigid fuel line (2) where installation will occur to determine required final bends and length. Use tube bender and tube cutter as required.
3. Install new fittings (3) on rigid fuel line (2). (WP 0399 00)

WARNING

**CHEMICAL****EYE PROTECTION**

4. Apply adhesive to pipe threads on fittings (3) of rigid fuel line (2).
5. Connect fittings (3) on both ends of rigid fuel line (2) to forward (4) and aft (5) fuel lines.
6. Tighten both end fittings (3).
7. Perform operational check on fuel system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

8. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM REINFORCED FUEL HOSE PN E11488
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Hose
E11488
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)
Lubricating Oil, General Purpose (Item 21, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

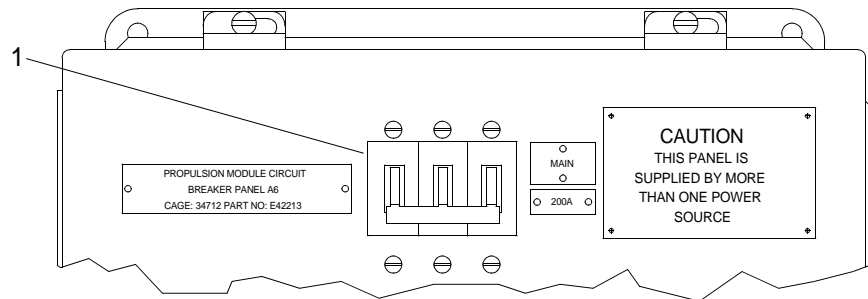
Equipment Condition

Engine Power Isolated. (WP 0075 00)

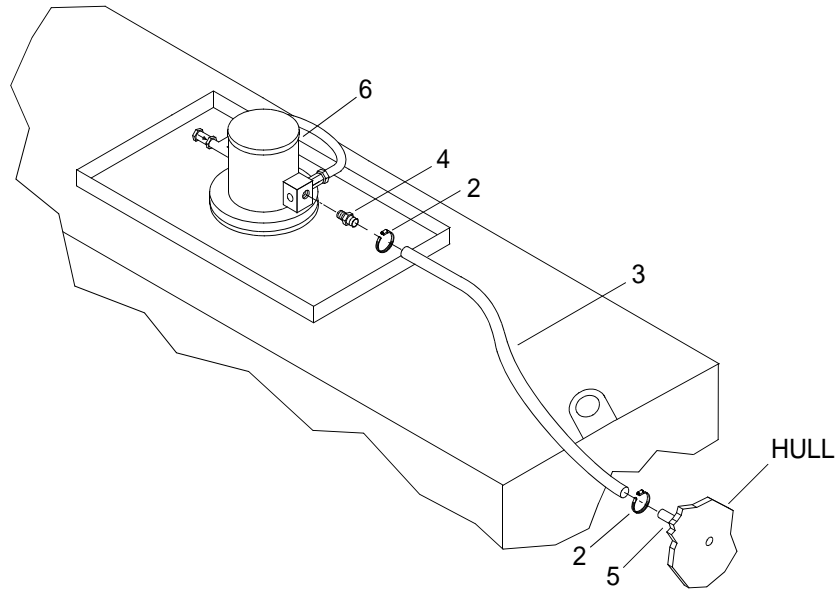
REMOVE FUEL SYSTEM REINFORCED FUEL HOSE PN E11488**NOTE**

This task is typical for both port and starboard propulsion modules.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Loosen hose clamps (2) on both ends of reinforced fuel hose (3).



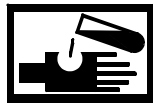
3. Remove reinforced fuel hose (3) from hose adapter (4) and bulkhead fitting (5).

NOTE

The reinforced fuel hose attaches to the barbed end of the hose adapter. If removal of the reinforced fuel hose cannot be done by hand, the hose adapter must be removed from the filler neck prior to removing the reinforced fuel hose from the hose adapter.

4. If removal of reinforced fuel hose (3) from hose adapter (4) is difficult, proceed as follows.
 - a. Remove hose adapter (4) with attached reinforced fuel hose (3) from filler neck (6).
 - b. Remove reinforced fuel hose (3) from hose adapter (4).

WARNING



CHEMICAL



EYE PROTECTION

5. Drain any residual fuel from reinforced fuel hose (3) into drain pan.
6. Discard reinforced fuel hose (3).

WARNING



CHEMICAL



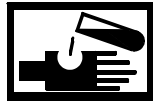
EYE PROTECTION

7. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL FUEL SYSTEM REINFORCED FUEL HOSE PN E11488

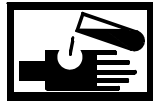
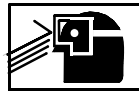
1. Install new reinforced fuel hose (3).

WARNING

**CHEMICAL****EYE PROTECTION**

2. If hose adapter (4) was removed, apply adhesive to pipe threads.
3. Install hose adapter (4) on filler neck (6). Tighten hose adapter (4).

WARNING

**CHEMICAL****EYE PROTECTION**

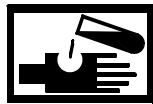
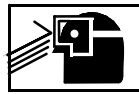
4. Lubricate barbed end of hose adaptor (4).
5. Place hose clamps (2) loosely on both ends of reinforced fuel hose (3).
6. Install reinforced fuel hose (3) between hose adapter (4) and bulkhead fitting (5).

WARNING

**CHEMICAL****EYE PROTECTION**

7. Remove excess oil from hose adaptor (4) and reinforced fuel hose (3) with wiping rag.

WARNING

**CHEMICAL****EYE PROTECTION**

8. Dispose of contaminated wiping rags per local procedures.
9. Tighten both hose clamps (2).
10. Perform operational check on fuel system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

11. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM FUEL/WATER SEPARATOR
DRAINING**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
- Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

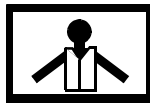
Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

DRAIN FUEL SYSTEM FUEL/WATER SEPARATOR

WARNING



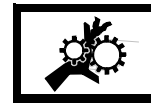
VEST



HELMET PROTECTION



HEAVY PARTS



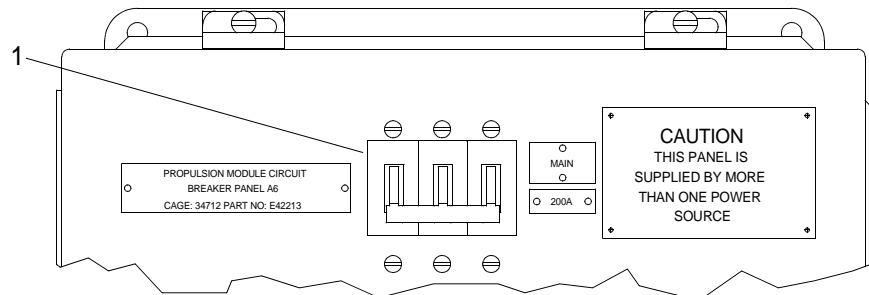
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

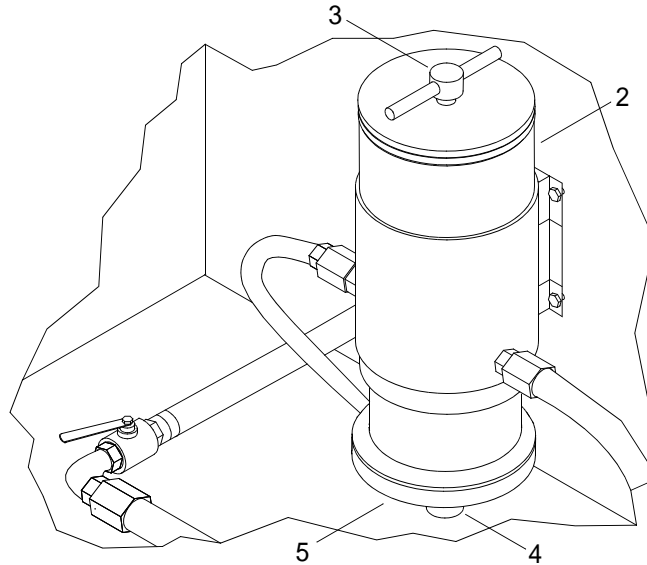
NOTE

This task is typical for port and starboard fuel systems.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Position drain pan under fuel/water separator (2).



3. Loosen handle (3) to break vacuum within fuel/water separator (2).

WARNING



CHEMICAL



EYE PROTECTION

4. Remove drain plug (4) to drain water and contaminants from collection bowl (5).

WARNING



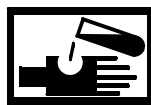
CHEMICAL



EYE PROTECTION

5. Remove drain pan and dispose of contents in accordance with local procedures.
6. Install drain plug (4).
7. Tighten drain plug (4).
8. Tighten handle (3) on fuel/water separator (2).

WARNING



CHEMICAL



EYE PROTECTION



SLICK FLOOR

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL SYSTEM FUEL/WATER SEPARATOR FILTER ELEMENT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Filter Element
 PN 2020TMOR
 Gasket
 PN 11007
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Diesel Fuel (Item 8, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

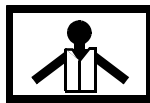
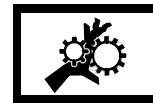
Engineer 88L

Equipment Condition

Engine Shut Down. (TM 55-1945-225-10)
 Fuel System Fuel/Water Separator Drained. (WP 0194 00)

REMOVE FUEL SYSTEM FUEL/WATER SEPARATOR FILTER ELEMENT

WARNING

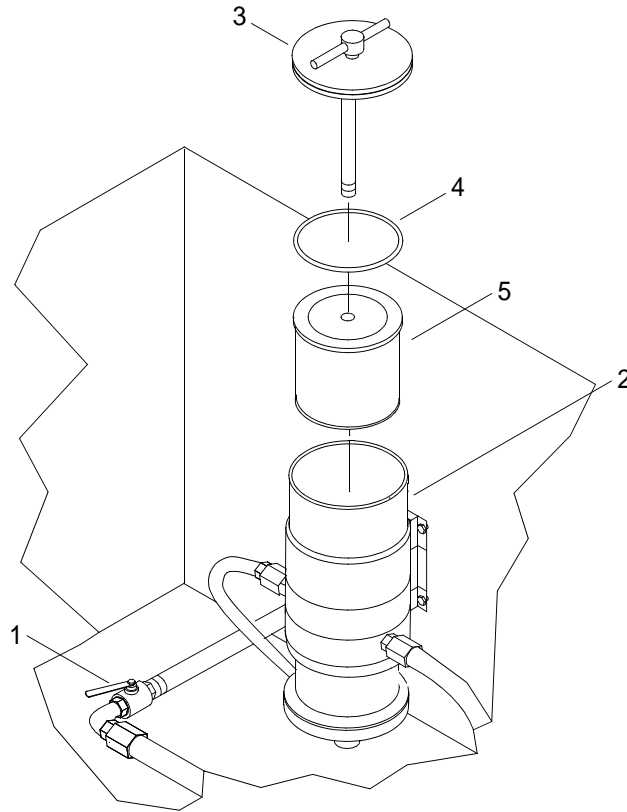
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS****CHEMICAL****EYE PROTECTION**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for port and starboard fuel systems.

1. Close ball valve (1) in fuel supply line to fuel/water separator (2).



2. Remove cover (3) and lid gasket (4) from fuel/water separator (2) by turning T-bar counterclockwise.
3. Discard gasket (4).
4. Remove filter element (5) by slowly pulling upwards with a twisting motion.
5. Discard filter element (5) per local procedures.

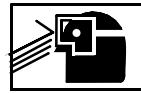
INSTALL FUEL SYSTEM FUEL/WATER SEPARATOR FILTER ELEMENT

1. Install new filter element (5) in fuel/water separator (2).

WARNING



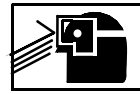
CHEMICAL



EYE PROTECTION

2. Fill fuel/water separator with clean fuel.

WARNING

**CHEMICAL****EYE PROTECTION**

3. Apply a coating of clean fuel to seal of new lid gasket (4).
4. Install lid gasket (4) and cover (3) on fuel/water separator (2).
5. Tighten cover (3) by turning T-bar clockwise.
6. Open ball valve (1) in fuel supply line to fuel/water separator (2).
7. Perform operational check of fuel system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

8. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
FUEL SYSTEM FUEL/WATER SEPARATOR ASSEMBLY
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Fuel/Water Separator
 PN 1000 MA
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

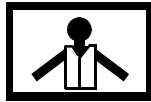
Engineer 88L

Equipment Condition

Engine Shut Down. (TM 55-1945-225-10)
 Fuel System Fuel/Water Separator Drained. (WP 0194 00)

REMOVE FUEL SYSTEM FUEL/WATER SEPARATOR

WARNING



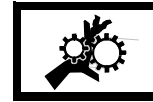
VEST



HELMET PROTECTION



HEAVY PARTS



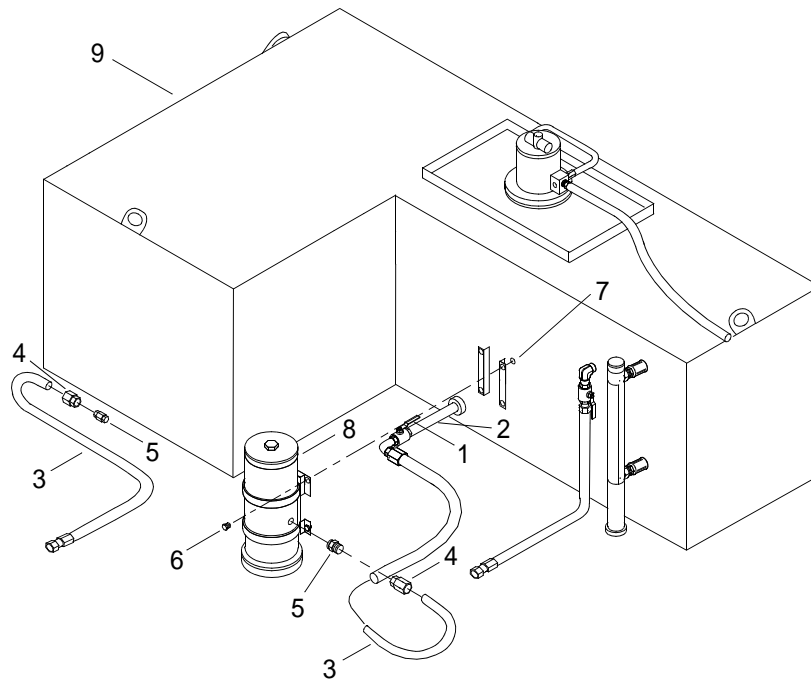
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of fuel water separators.

1. Close ball valve (1) in fuel inlet line (2).



WARNING

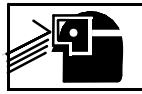
**CHEMICAL****EYE PROTECTION****EXPLOSION**

2. Remove two hoses (3), two hose fittings (4) and two external thread reducers (5).
3. Remove four hex head capscrews (6) and four hex nuts (7) securing fuel/water separator (8) to fuel tank (9).
4. Remove fuel/water separator (8) and discard.

INSTALL FUEL/WATER SEPARATOR

1. Position new fuel/water separator (8) on side of fuel tank (9).
2. Secure fuel/water separator (8) with four hex head capscrews (6) and four hex nuts (7).
3. Tighten nuts (7).
4. Install two external thread reducers (5), two hose fittings (4) and two hoses (3).
5. Tighten fittings (4).
6. Open ball valve (1) in fuel inlet line to fuel/water separator (8) and check for leaks.
7. Perform operational check of fuel system. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

8. Clean up spilled fluid with a spill kit and dispose of spill kit waste per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
POWERED SECTION BATTERIES POSITIVE LEAD TERMINALS
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Puller, Battery Terminal (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Grease, Automotive and Artillery (Item 12, WP 0426 00)

Personnel Required

Engineer 88L

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE POWERED SECTION BATTERIES POSITIVE LEAD TERMINALS

WARNING



VEST



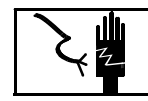
HELMET PROTECTION



HEAVY PARTS



MOVING PARTS



ELECTRICAL

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

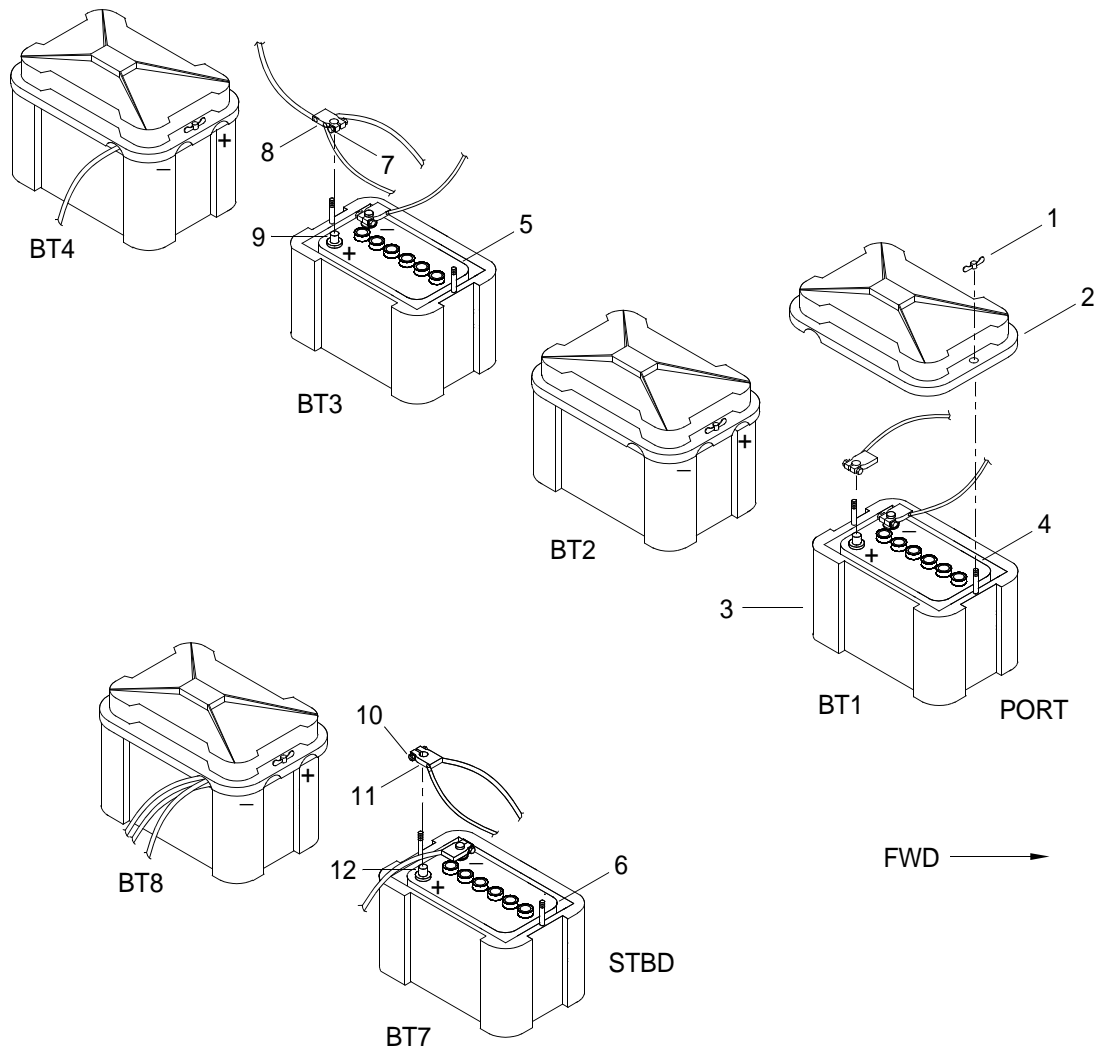
NOTE

Battery posts are identified by a raised positive and negative signs stamped on battery top.

Batteries BT1 through BT4 (House) are located on port side of diesel engine.

Batteries BT7 and BT8 (Engine) are located on starboard side of diesel engine.

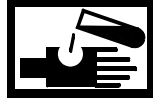
1. Remove wing nuts (1) securing battery box covers (2) to battery boxes (3) of BT1 (4) and BT3 (5) and/or BT7 (6).



2. Remove battery box covers (2) from battery boxes (3).
3. Isolate power to house battery system.
 - a. Loosen hex nuts (7) on positive lead terminals (8) of batteries BT1 (4) and BT3 (5).
 - b. Using battery terminal puller, remove positive lead terminals (8) from positive posts (9) of batteries BT1 (4) and BT3 (5).
 - c. Position positive lead terminals (8) out of way to prevent contact between positive lead terminals (8) and positive posts (9) of batteries BT1 (4) and BT3 (5).
4. Isolate power to engine battery system.
 - a. Loosen hex nut (10) on positive lead terminal (11) of battery BT7 (6).
 - b. Using battery terminal puller, remove positive lead terminal (11) from positive post (12) of battery BT7 (6).
 - c. Position positive lead terminal (11) out of way to prevent contact between positive lead terminal (11) and positive post (12) of battery BT7 (6).

INSTALL POWERED SECTION BATTERIES POSITIVE LEAD TERMINALS

WARNING

**CHEMICAL****EYE PROTECTION**

1. Apply a thin coat of grease on battery terminals (8, 11) and positive posts (9, 12) as applicable.
2. Position positive lead terminals (8) over positive posts (9) of batteries BT1 (4) and BT3 (5) or positive lead terminal (11) over positive post (12) BT7 (6).
3. Carefully press positive lead terminals (8, 11) down on positive posts (9, 12).
4. Tighten positive lead terminal hex nuts (7, 10).
5. Position battery box covers (2) on battery boxes (3).
6. Install wing nuts (1) to secure battery box covers (2) on battery boxes (3). Tighten wing nuts (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM BATTERIES
TESTING AND SERVICING**

INITIAL SETUP:**Test Equipment**

Tester, Antifreeze Solutions (Hydrometer) (Item 3, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Life Preserver, Vest (Item 17, WP 0425 00)

Helmet, Safety (Blue) (Item 13, WP 0425 00)

Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Respirator, Air Filtering (Item 3, WP 0425 00)

Apron, Utility (Item 6, WP 0425 00)

Charger, Battery (Item 4, WP 0425 00)

Puller, Battery Terminal (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Grease, Automotive and Artillery (Item 12, WP 0426 00)

Sodium Bicarbonate Injection (Item 37, WP 0426 00)

Water, Reagent Distilled (Item 48, WP 0426 00)

Personnel Required

Engineer 88L

References

TB 9-6140-200-14

Equipment Condition

Engine Power Isolated. (WP 0075 00)

TEST ELECTRICAL SYSTEM BATTERIES

WARNING



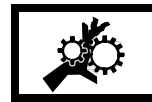
VEST



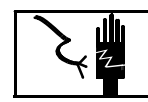
HELMET PROTECTION



HEAVY PARTS



MOVING PARTS



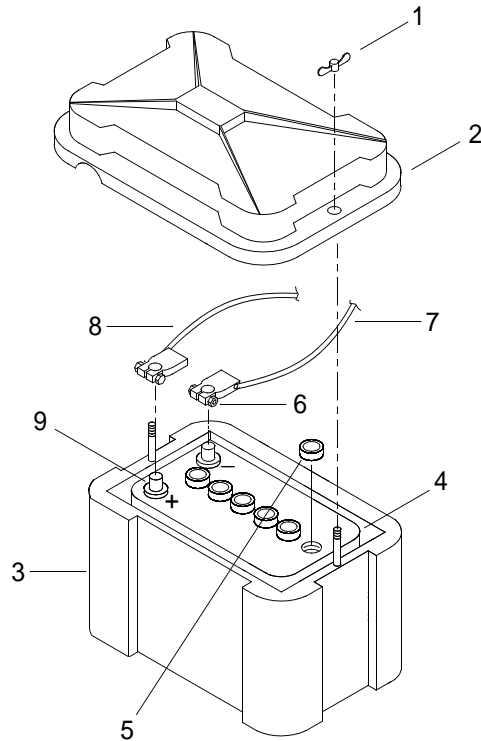
ELECTRICAL

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for testing and servicing batteries.

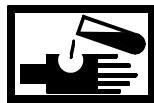
1. Remove wing nuts (1) securing battery box cover (2) on battery box (3).



2. Remove battery box cover (2) from battery box (3) for access to battery (4).
3. Remove battery cell caps (5) from battery (4).
4. Perform hydrometer test on all cells of battery (4). (TB 9-6140-200-14)
5. Install battery cell caps (5) on battery (4).
6. Log results in vessel logbook.

SERVICE ELECTRICAL SYSTEM BATTERIES

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

1. Loosen hex nuts (6) and remove negative (7) and positive (8) leads from battery terminals (9).

WARNING



CHEMICAL



EYE PROTECTION

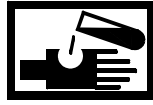


VAPOR

2. Using wire brush, clean negative (7) and positive (8) leads from battery terminals (9) with baking soda and water to remove any corrosion.

-
- Carefully push down negative (7) and positive (8) leads on battery terminals (9) and tighten hex nuts (6).

WARNING



CHEMICAL



EYE PROTECTION

- Apply a coat of grease on battery terminals (9) and negative (7) and positive (8) leads.
- Remove battery cell caps (5).

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

- Using distilled water, fill each cell of battery (4) so level of electrolyte covers the tops of plates inside battery (4).
- Install battery cell caps (5) on battery (4). Tighten battery cell caps (5).
- Test and charge batteries (5). (TB 9-6140-200-14)
- Position top cover (2) on battery box (3).
- Install wing nuts (1) to secure top cover (2) on battery box (3). Tighten wing nuts (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM BATTERIES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Shackle, 1/2 in. 2 Ton (Item 24, WP 0425 00)
 Slings, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)

Materials/Parts

Battery
 PN E40858
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Grease, Automotive and Artillery (Item 12, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Powered Section Engine Hatch Removed. (WP 0098 00)

REMOVE ELECTRICAL SYSTEM BATTERIES

WARNING



VEST



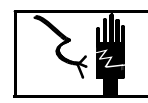
HELMET PROTECTION



HEAVY PARTS



MOVING PARTS



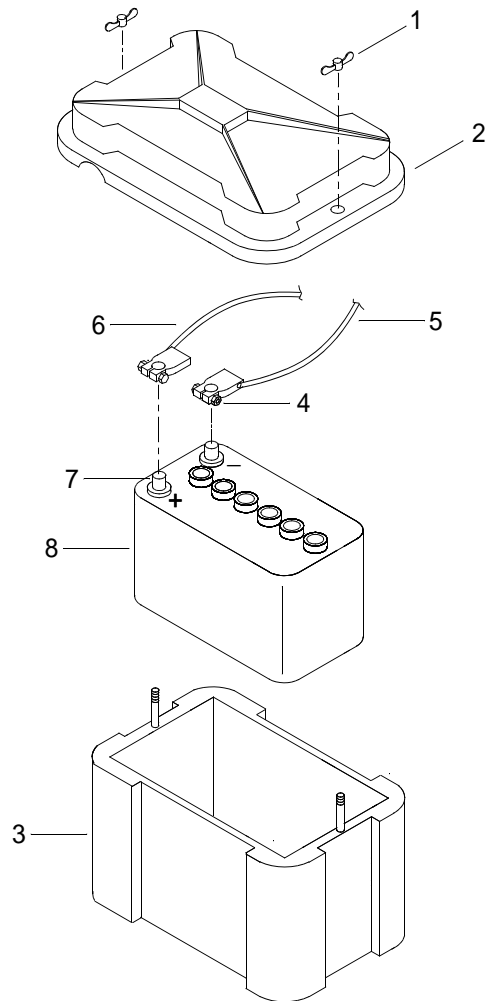
ELECTRICAL

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for removal and installation of batteries.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Remove wing nuts (1) securing battery cover (2) to battery box (3).



3. Remove battery cover (2) from battery box (3).
4. Loosen hex nuts (4) and remove negative (5) and positive leads (6) from battery terminals (7) on battery (8).

WARNING



CHEMICAL



EYE PROTECTION



VAPOR



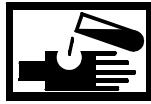
HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

Ensure electrolyte caps are tight prior to removing battery.

5. Using crane, sling and shackle, remove battery (8) from battery box (3).

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- Using crane, sling and shackle, remove battery (8) through engine hatch opening.

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR

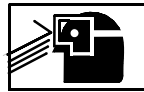
- Dispose of battery (8) in accordance with local procedures.

INSTALL ELECTRICAL SYSTEM BATTERIES

 WARNING



CHEMICAL



EYE PROTECTION



VAPOR



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- Using crane, sling and shackle, lower new battery (8) through engine hatch opening into battery box (3).
- Carefully push down negative (5) and positive leads (6) on battery terminals (7). Tighten hex nuts (4).

 WARNING



CHEMICAL



EYE PROTECTION

- Apply a coat of grease on battery terminals (7) and negative (5) and positive leads (6).
- Position battery cover (2) on battery box (3).
- Install wing nuts (1) to secure battery cover (2) on battery box (3). Tighten wing nuts (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM BATTERY BOX
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Box, Battery
PN 90-2138
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

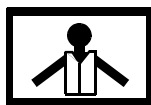
Engineer 88L

Equipment Condition

Electrical System Batteries Removed. (WP 0199 00)

REMOVE ELECTRICAL SYSTEM BATTERY BOX

WARNING



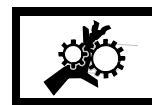
VEST



HELMET PROTECTION



HEAVY PARTS



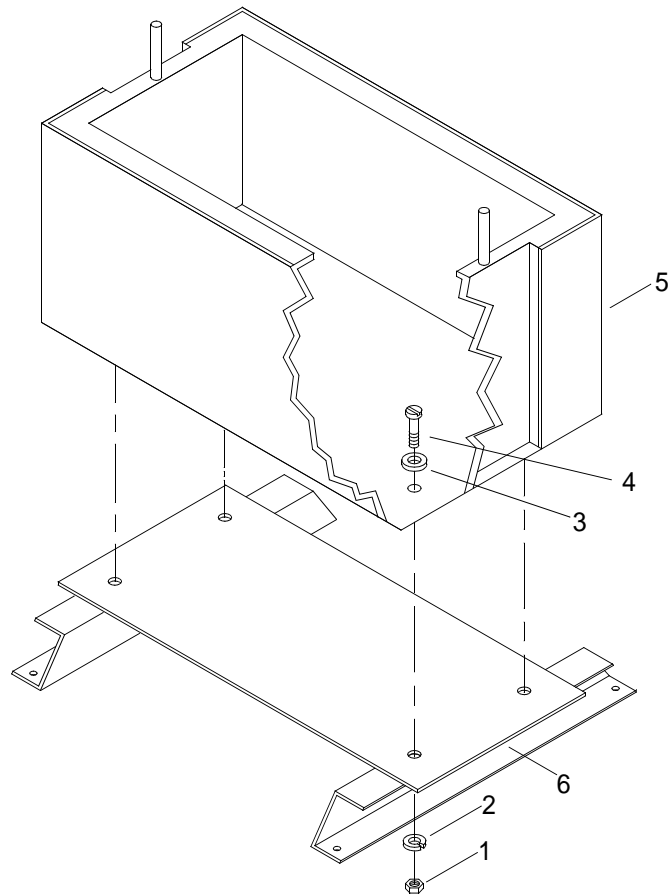
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for removal and installation of battery boxes.

1. Remove hex nuts (1), flat washers (2), lockwashers (3) and hex head capscrews (4) securing battery box (5) to mounting plate (6).



2. Remove battery box (5) from mounting plate (6).
3. Discard battery box (5).

INSTALL ELECTRICAL SYSTEM BATTERY BOX

1. Position new battery box (5) on mounting plate (6).
2. Install hex nuts (1), flat washers (2), lockwashers (3) and hex head capscrews (4) to secure battery box (5) to mounting plate (6). Tighten hex nuts (1).
3. Install electrical system batteries. (WP 0199 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM JUNCTION BOX JB1 FUSE
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Fuse
PN AGC-10 JB1F1
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Engineer 88L

References

- TM 55-1945-225-10
-

REMOVE ELECTRICAL SYSTEM JUNCTION BOX JB1 FUSE

WARNING



VEST



HELMET PROTECTION



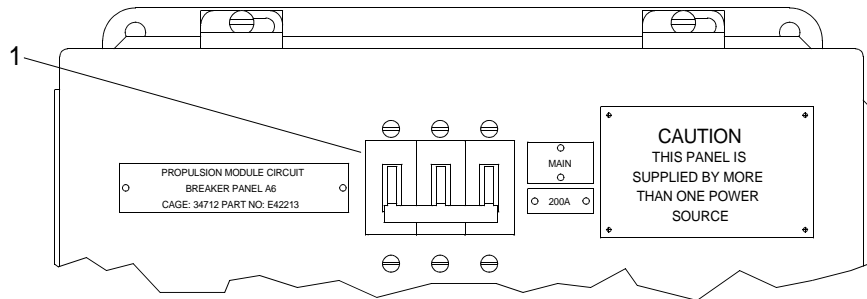
HEAVY PARTS



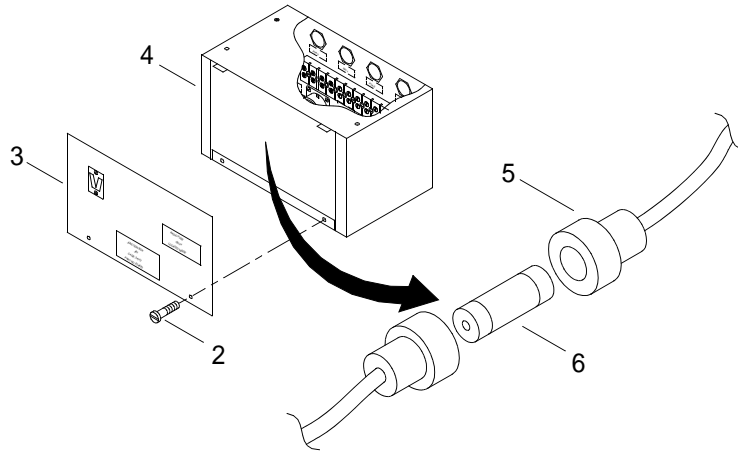
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Loosen two door screws (2) securing junction box cover (3) to junction box JB1 (4).



3. Remove junction box cover (3).
4. Locate fuse holder (5) inside of junction box JB1 (4).
5. Push together and twist two parts of fuse holder (5) in opposite directions and slide apart.
6. Remove and discard fuse (6).

INSTALL ELECTRICAL SYSTEM JUNCTION BOX JB1 FUSE

1. Position new fuse (6) in fuse holder (5).
2. Push together and twist two parts of fuse holder (5) to secure.
3. Position junction box cover (3) on front of junction box JB1 (4).
4. Install two screws (2) to secure junction box cover (3) to junction box JB1 (4). Tighten screws (2).
5. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM MODULE INTERCONNECT ASSEMBLY
REMOVAL, INSPECTION AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 8,400 lb. 20 ft (Yellow) (Item 30, WP 0425 00)
 Qty 2

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 SST Bolt and SST Washer (Item 40, WP 0426 00)
 Sealant, Gasket (Item 33, WP 0426 00)
 Cleaning Compound, Solvent (Item 6, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

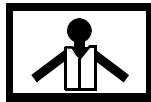
Engineer 88L

References

TM 55-1945-225-10

REMOVE ELECTRICAL SYSTEM MODULE INTERCONNECT ASSEMBLY

WARNING

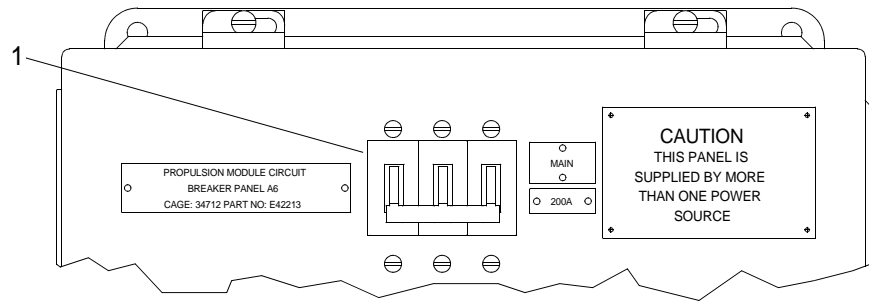
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

The following procedure provides for removal of interconnect assembly when operators cab is installed on starboard propulsion module. When operators cab is mounted on port side propulsion module, starboard side operators cab side access panel is removed.

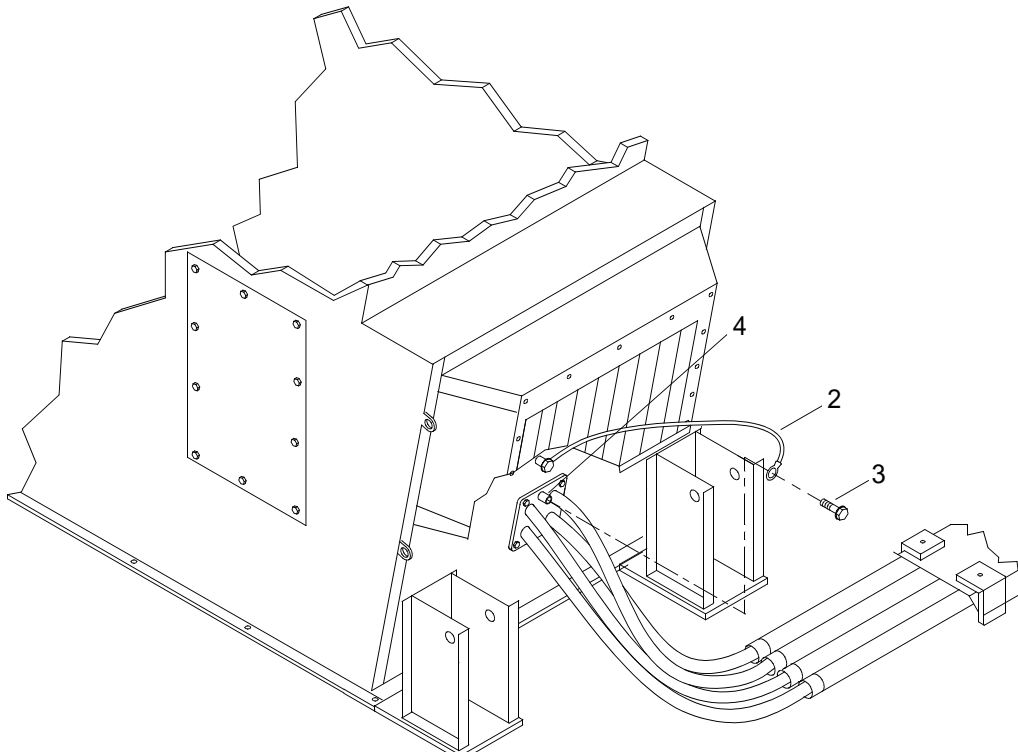
1. Inspect slings prior to use. (TM 55-1945-225-10)
2. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



NOTE

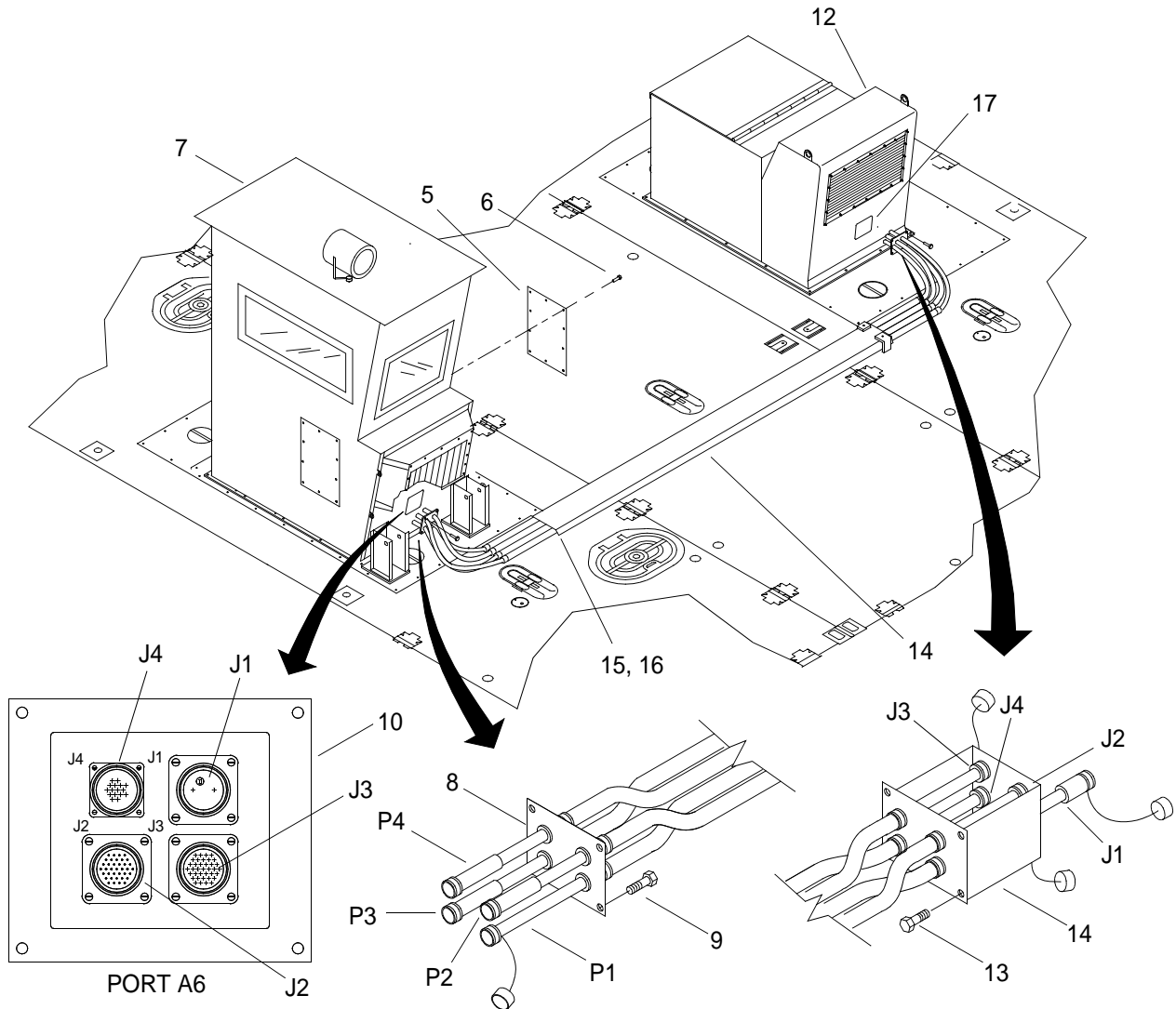
Removing of interconnect assembly ground is typical for both ends of interconnect assembly.

3. Remove interconnect assembly ground cables (2).



- a. Remove bolt and washer (3) securing ground cable (2) to interconnect assembly boss (4).
- b. Remove ground cable (2) from interconnect assembly boss (4).
- c. Install bolt and washer (3) in interconnect assembly boss (4).

4. Remove operators cab port side access panel (5).



a. Remove ten bolts (6) securing port side access panel (5) to operators cab (7).

b. Remove port side access panel (5).

5. Remove electrical interconnect assembly conduit plate (8) from operators cab (7).

a. Remove four bolts (9) attaching electrical interconnect assembly conduit plate (8) to operators cab (7).

b. Remove electrical interconnect assembly conduit plate (8).

6. Remove power cables from operators cab (7) PORT receptacle A6 (10).
 - a. Remove P4 from J4.
 - b. Remove P3 from J3.
 - c. Remove P2 from J2.
 - d. Remove P1 from J1 and install dust cap.
7. Remove electrical interconnect assembly conduit plate (11) from air intake plenum (12).
 - a. Remove four bolts (13) attaching electrical interconnect assembly conduit plate (11) to air intake plenum (12).
 - b. Remove electrical interconnect assembly conduit plate (11).
8. From below deck, remove power module cable from interconnect cable receptacles.
 - a. Remove power module A6, P1 from interconnect cable, J1 and install dust cap.
 - b. Remove power module junction box A3, P2 from interconnect cable, J2 and install dust cap.
 - c. Remove power module junction box A3, P3 from interconnect cable, J3 and install dust cap.
 - d. Remove power module junction box A3, P4 from interconnect cable, J4 and install dust cap.
9. Remove electrical interconnect assembly (14).
 - a. Loosen four allen head bolts (15) and pivot hold down clamps (16) securing electrical interconnect assembly (14) to deck.

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

NOTE

Care should be given to protect connectors on both ends of electrical interconnect assembly from damage.

- b. Using crane and sling, remove interconnect assembly (14) from deck.

INSPECT ELECTRICAL SYSTEM MODULE INTERCONNECT ASSEMBLY

1. Inspect for broken or bent pins. Contact general support maintenance for repair as needed.
2. Inspect for broken contact sockets or corrosion on sockets. Contact general support maintenance for repair as needed.

INSTALL ELECTRICAL SYSTEM MODULE INTERCONNECT ASSEMBLY

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

1. Using crane and sling, install interconnect assembly (14) on deck.
2. Rotate four hold down clamps (16) into position over electrical interconnect assembly and secure with four allen head bolts (15).
3. Tight allen head bolts (15).
4. Position interconnect assembly conduit entry plate (11) in intake plenum front access (17).
5. From below deck, connect power module cables to interconnect cable receptacles.
 - a. Remove dust cap and connect power module junction box A3, P2 to interconnect cable, J2.
 - b. Remove dust cap and connect power module junction box A3, P4 to interconnect cable, J4.
 - c. Remove dust cap and connect power module junction box A3, P3 to interconnect cable, J3.
 - d. Remove dust cap and connect power module A6, P1 to interconnect cable, J1.
6. Install four bolts (13) into electrical interconnect assembly conduit plate (11) to air intake plenum (12).
7. Tighten bolts (13).
8. Install power cables on operators cab (7) PORT receptacle A6 (10).
 - a. Install P4 on J4.
 - b. Install P3 on J3.
 - c. Install P2 on J2.
 - d. Remove dust cap and install P1 on J1.

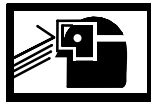
-
9. Install electrical interconnect assembly conduit plate (8) on operators cab (7).
 - a. Install four bolts (9) attaching electrical interconnect assembly conduit plate (5) to operators cab (4).
 - b. Tighten bolts (9).

NOTE

Grounding of interconnect assembly is typical for both ends of interconnect assembly.

10. Ground interconnect assembly (2).
 - a. Remove and discard bolt and washer (3) from interconnect assembly boss (4).

—————
WARNING
—————



EYE PROTECTION

- b. Using a wire brush, remove all corrosion and paint from top of interconnect assembly boss (4).

—————
WARNING
—————



CHEMICAL



EYE PROTECTION

- c. Using cleaner, clean top and threads of interconnect assembly boss (4).

—————
WARNING
—————



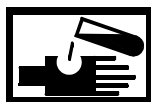
CHEMICAL



EYE PROTECTION

- d. Apply antiseize compound to mating surfaces of interconnect assembly boss (4), ground cable (2) and new bolt and washer (3).
 - e. Position ground cable (2) on interconnect assembly boss (4).
 - f. Install bolt and washer (3) securing ground cable (2) to interconnect assembly boss (4) and tighten.

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WARNING
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CHEMICAL



EYE PROTECTION

- g. Using wiping rag, clean off excess antiseize compound.

WARNING

**CHEMICAL****EYE PROTECTION**

- h. Apply a thin bead of sealant to terminating edges, sealing bolt and washer (3), ground cable (2) and interconnect assembly boss (4).
11. Install operators cab port side access panel.
 - a. Position operators cab port side access panel (5) on side of operators cab (7) and secure with bolts (6).
 - b. Tighten bolts (6).
 12. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**GENERAL SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM MODULE INTERCONNECT CABLE
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Tool Kit, Electricians (Item 33, WP 0425 00)
 Crimping Tool, Terminal Hand (Item 5, WP 0425 00)
 Soldering Iron, Electric (Item 5, WP 0425 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

REPAIR ELECTRICAL SYSTEM MODULE INTERCONNECT CABLECAUTION

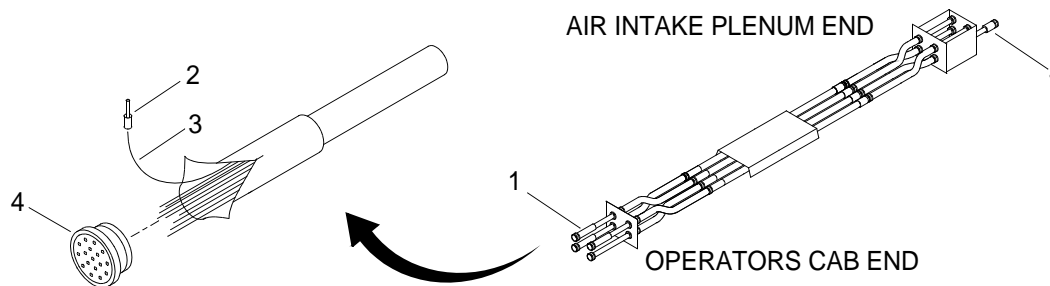
Care should be given to protect electrical connectors on both ends of electrical interconnect assembly. Failure to comply may cause damage to exposed pins.

NOTE

Repair is typical for all connectors.

Repair is limited to replacement of pins and connectors.

1. Inspect connectors (1) for bent or broken pins (2). Replace damaged parts.



- a. Using an extraction tool, remove damaged pin (2) by pushing pin (2) and wire (3) back through plug body (4).
 - b. Cut pin (2) from wire (3).
 - c. Strip 3/8 in. of insulation from wire (3).
 - d. Position new pin (2) on wire (3).
 - e. Using soldering iron or crimping tool, attach pin (2) to wire (3).
 - f. Using an insertion tool, install new pin (2) in plug body (4) from back side of plug body (4).
2. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM THRUSTER JUNCTION BOX A2JB2
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

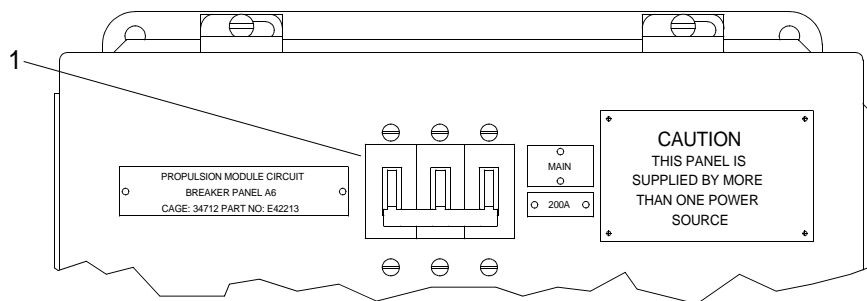
Equipment Condition

Engine Power Isolated. (WP 0075 00)

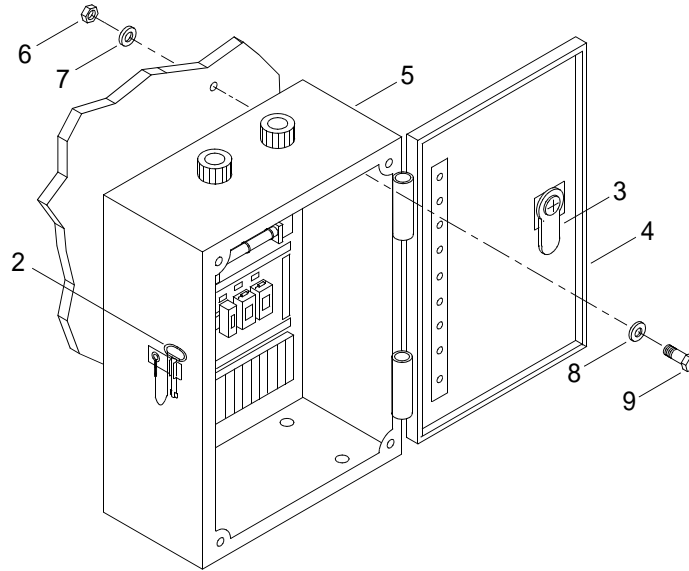
REMOVE THRUSTER JUNCTION BOX A2JB2**NOTE**

This task is typical for removal and installation of the thruster junction box A2JB2.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Using key (2), rotate door latch (3) 90° clockwise and open enclosure cover (4).



- Tag, disconnect and remove all external wiring to the thruster junction box A2JB2 (5).
- Remove hex nuts (6), lockwashers (7), flat washers (8), and hex head capscrews (9) securing thruster junction box A2JB2 (4) to mounting structure.
- Remove thruster junction box A2JB2 (5).

INSTALL THRUSTER JUNCTION BOX A2JB2

WARNING



CHEMICAL



EYE PROTECTION

- Apply antiseize compound to hex head capscrews (9).
- Position thruster junction box A2JB2 (5) on mounting structure.
- Install hex head capscrews (9), flat washers (8), lockwashers (7) and hex nuts (6) to secure thruster junction box A2JB2 (5) to mounting structure. Tighten hex nuts (6).
- Connect all external wiring to thruster junction box A2JB2 (5) and remove tags.
- Close enclosure cover (4) and rotate door latch (3) 90° counterclockwise with key (2) to lock.
- Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM THRUSTER JUNCTION BOX A2JB2
REPAIR

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

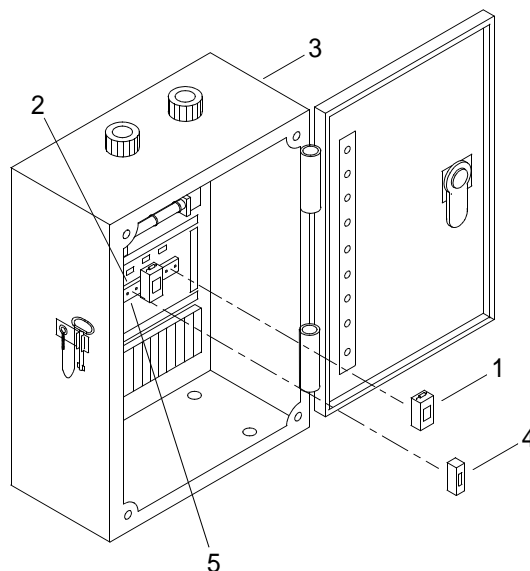
Thruster Junction Box A2JB2 Removed. (WP 0204 00)

DISASSEMBLE THRUSTER JUNCTION BOX A2JB2**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the thruster junction box A2JB2.

Repair is limited to the replacement of damaged parts.

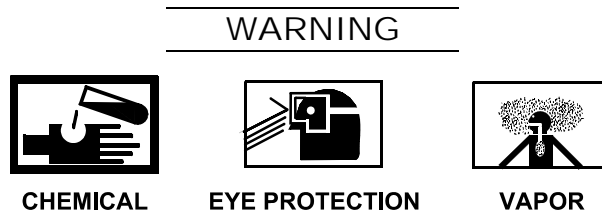
1. Remove relay (1) from relay socket (2) of thruster junction box A2JB2 (3) by pulling straight out.



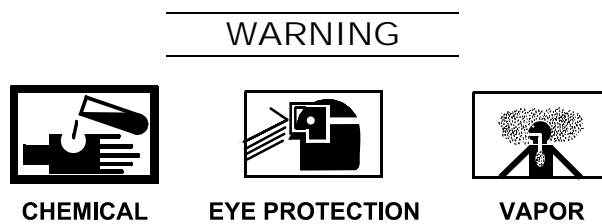
-
- Remove circuit breaker (4) from panel (5) by pulling straight out.

CLEAN THRUSTER JUNCTION BOX A2JB2

- Clean thruster junction box A2JB2 interior and exterior surfaces with a clean wiping rag.



- Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.



- Dispose of contaminated wiping rags per local procedures.

INSPECT THRUSTER JUNCTION BOX A2JB2

- Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
- Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE THRUSTER JUNCTION BOX A2JB2

- Install circuit breaker (4) in panel (5) by pushing straight in.
- Install relay (1) in relay socket (2) of thruster junction box A2JB2 (3) by pushing straight in.
- Install thruster junction box A2JB2. (WP 0204 00)
- Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM PROPULSION MODULE JUNCTION BOX A3
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

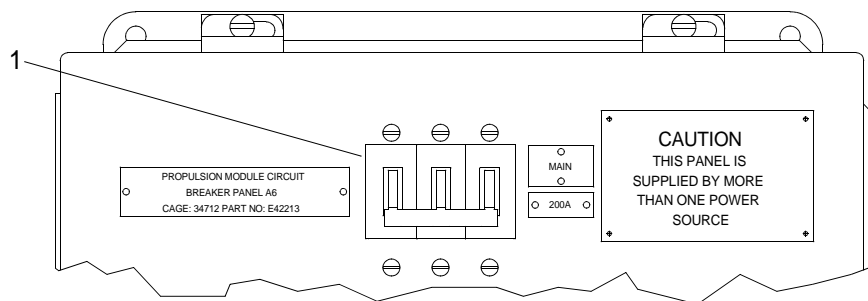
Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE PROPULSION MODULE JUNCTION BOX A3**NOTE**

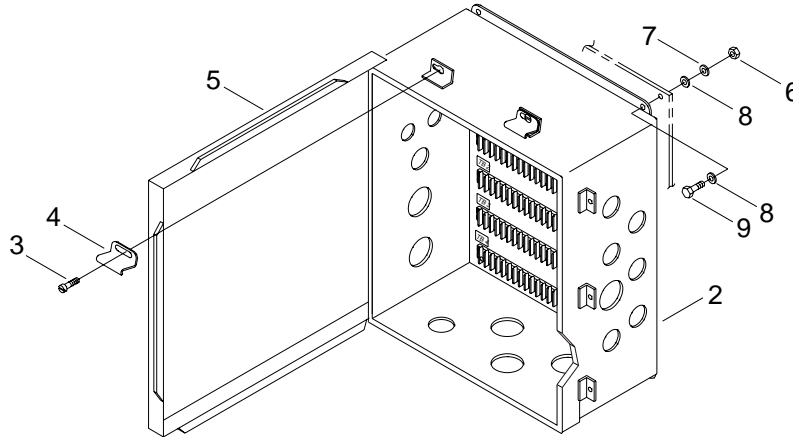
This task is typical for the removal and installation of the propulsion module junction box A3.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Disconnect power cables to module interconnect assembly from propulsion module junction box A3 (2).

- Loosen screws (3) to pivot cover clamps (4) free.



- Open enclosure cover (5).
- Tag and disconnect all external electrical wiring to propulsion module junction box A3 (2).
- Remove hex nuts (6), lockwashers (7), washers (8) and hex head capscrews (9) securing propulsion module junction box A3 (2) to mounting structure.
- Remove propulsion module junction box A3 (2).

INSTALL PROPULSION MODULE JUNCTION BOX A3

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to hex head capscrews (9).
- Position propulsion module junction box A3 (2) on mounting structure.
- Install hex head capscrews (9), flat washers (8), lockwashers (7) and hex nuts (6) to secure propulsion module junction box A3 (5) to mounting structure. Tighten hex nuts (6).
- Connect all external wiring to propulsion module junction box A3 (2) and remove tags.
- Close enclosure cover (5), pivot clamps (4) over lip of enclosure cover (5) and tighten screws (3).
- Connect power cables to module interconnect assembly from propulsion module junction box A3 (2).
- Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM PROPULSION MODULE JUNCTION BOX A3
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

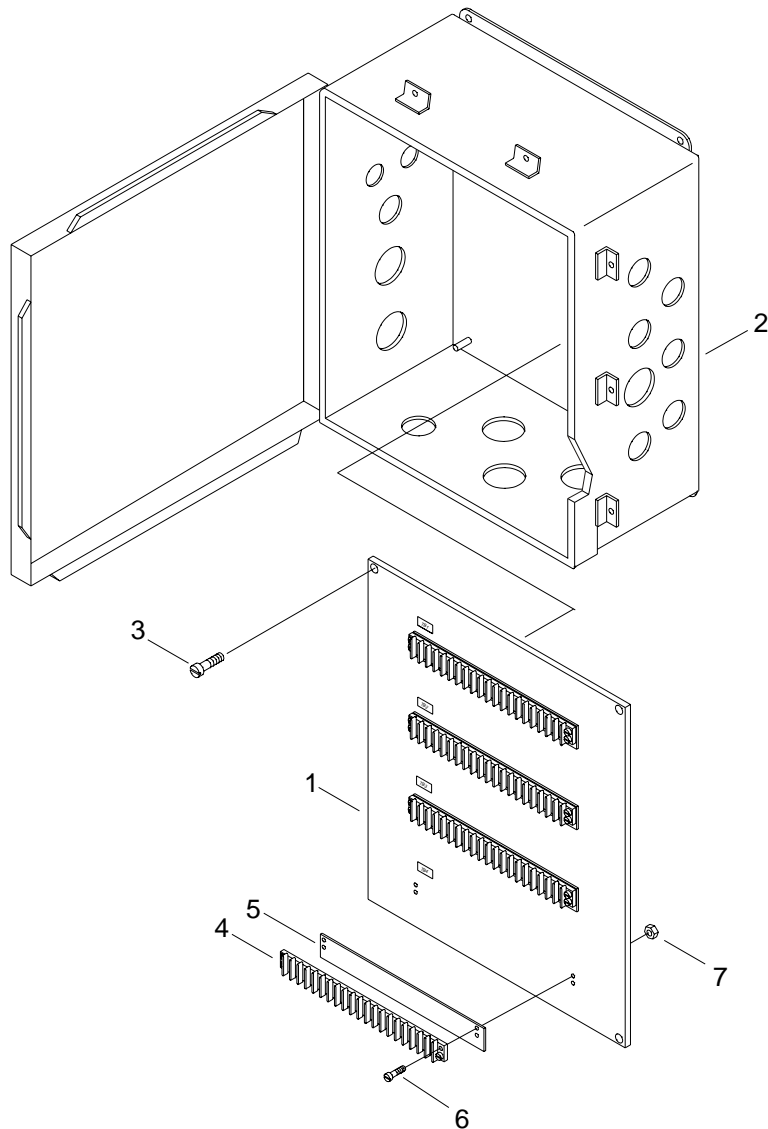
Propulsion Module Junction Box A3 Removed. (WP 0206 00)

DISASSEMBLE PROPULSION MODULE JUNCTION BOX A3**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the propulsion module junction box A3.

Repair is limited to the replacement of damaged components.

1. Remove panel (1) from propulsion module junction box A3 (2).



- a. Tag and disconnect wiring from panel (1).
- b. Remove pan head screws (3) securing panel (1) to propulsion module junction box A3 (2).
- c. Remove panel (1).

NOTE

The following step is typical for the removal of TB1, TB2 and TB3 terminal blocks.

2. Remove terminal block (4) and marker strip (5) from panel (1).
 - a. Tag and disconnect wiring from terminal block (4).
 - b. Remove pan head screws (6) and insert nuts (7) securing terminal block (4) and marker strip (5) to panel (1).
 - c. Remove terminal block (4) and marker strip (5).

CLEAN PROPULSION MODULE JUNCTION BOX A3

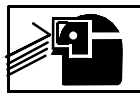
1. Clean propulsion module junction box A3 interior and exterior surfaces with a clean wiping rag.

 WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

 WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

3. Dispose of contaminated wiping rags per local procedures.

INSPECT PROPULSION MODULE JUNCTION BOX A3

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE PROPULSION MODULE JUNCTION BOX A3**NOTE**

The following step is typical for the installation of TB1, TB2 and TB3 terminal blocks.

1. Install terminal block (4) and marker strip (5) on panel (1).
 - a. Position terminal block (4) and marker strip (5) on panel (1).
 - b. Install pan head screws (6) and insert nuts (7) to secure terminal block (4) and marker strip (5) on panel (1). Tighten insert nuts (7).
 - c. Connect wiring to terminal board (4) and remove tags.

2. Install panel (1) in propulsion module junction box A3 (2).
 - a. Position panel (1) in propulsion module junction box A3 (2).
 - b. Install pan head screws (3) to secure panel (1) to propulsion module junction box A3 (2). Tighten pan head screws (3).
 - c. Connect wiring to panel (1) and remove tags.
3. Install propulsion module junction box A3. (WP 0206 00)
4. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM ENGINE JUNCTION BOX ASSEMBLY A4
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

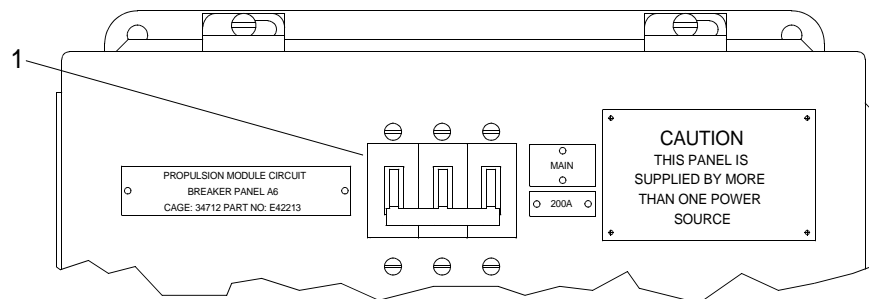
Equipment Condition

Powered Section Batteries Positive Lead Terminals (Engine) Removed. (WP 0197 00)

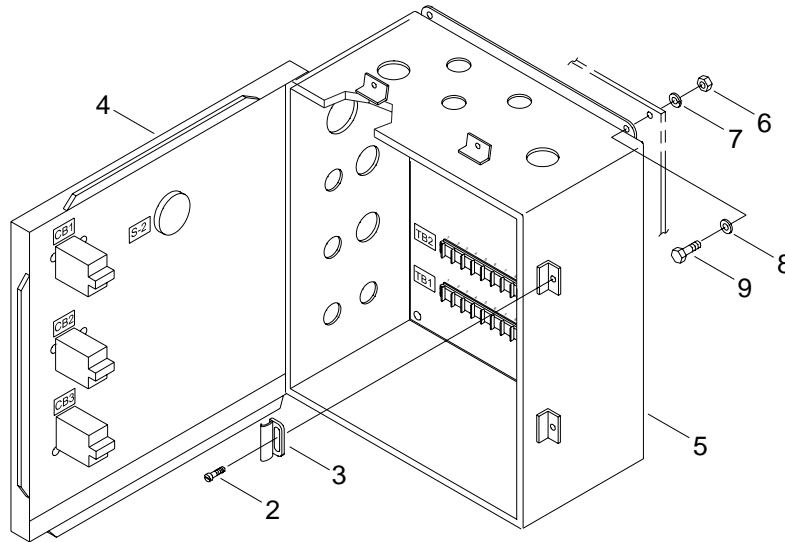
REMOVE ENGINE JUNCTION BOX ASSEMBLY A4**NOTE**

This task is typical for the removal and installation of the engine junction box assembly A4.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



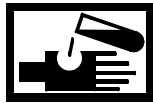
- Loosen screws (2) to pivot cover clamps (3) free.



- Open enclosure cover (4).
- Tag and disconnect all external electrical wiring to engine junction box assembly A4 (5).
- Remove hex head nuts (6), lockwashers (7), washers (8) and hex head capscrews (9) securing engine junction box assembly A4 (5) to mounting structure.
- Remove engine junction box assembly A4 (5).

INSTALL ENGINE JUNCTION BOX ASSEMBLY A4

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to hex head capscrews (9).
- Position engine junction box assembly A4 (5) on mounting structure.
- Install hex head capscrews (9), washers (8), lockwashers (7) and hex nuts (6) to secure engine junction box assembly A4 (5) to mounting structure. Tighten hex nuts (6).
- Connect all external electrical wiring to engine junction box assembly A4 (5) and remove tags.
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
- Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM ENGINE JUNCTION BOX ASSEMBLY A4
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

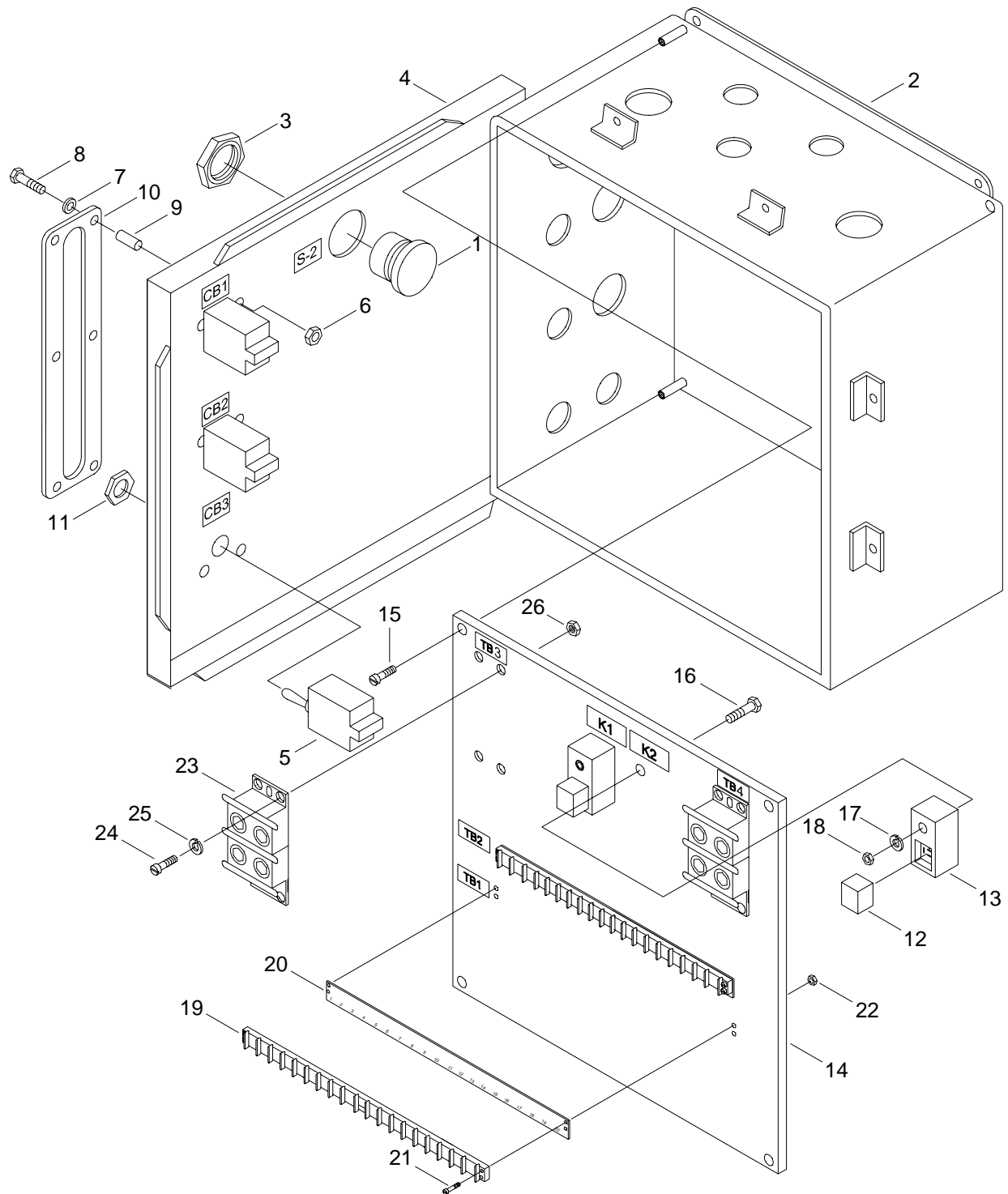
Engine Junction Box Assembly A4 Removed. (WP 0208 00)

DISASSEMBLE ENGINE JUNCTION BOX ASSEMBLY A4**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the engine junction box assembly A4.

Repair is limited to the replacement of damaged parts.

1. Remove EMERGENCY STOP pushbutton (1) from engine junction box assembly A4 (2).



- a. Tag and disconnect wiring from EMERGENCY STOP pushbutton (1).
- b. Remove large hex nut (3) securing EMERGENCY STOP pushbutton (1) to enclosure cover (4).
- c. Remove EMERGENCY STOP pushbutton (1) from enclosure cover (4).

NOTE

The circuit breaker guard must be removed prior to removal of the circuit breakers.

The following step is typical for the removal of circuit breakers.

2. Remove circuit breaker (5) from enclosure cover (4).
 - a. Remove self-lock hex nuts (6), flat washers (7), pan head screws (8), standoffs (9) and circuit breaker guard (10) from enclosure cover (4).
 - b. Tag and disconnect wiring from circuit breaker (5).
 - c. Remove small hex nut (11) securing circuit breaker (5) to enclosure cover (4).
 - d. Remove circuit breaker (5) from enclosure cover (4).
3. Separately remove relays (12) from relay sockets (13) on panel (14) by pulling straight out.
4. Remove panel (14) from engine junction box assembly A4 (2).
 - a. Tag and disconnect wiring from panel (14).
 - b. Remove pan head screws (15) securing panel (14) to engine junction box assembly A4 (2).
 - c. Remove panel (14) from engine junction box assembly A4 (2).

NOTE

The following step is typical for the removal of relay sockets.

5. Remove relay socket (13) from panel (14).
 - a. Tag and disconnect wiring from relay socket (13).
 - b. Remove pan head screw (16), lockwashers (17) and insert nut (18) securing relay socket (13) to panel (14).
 - c. Remove relay socket (13) from panel (14).

NOTE

The following step is typical for the removal of terminal blocks.

6. Remove terminal block (19) and marker strip (20) from panel (14).
 - a. Tag and disconnect wiring from terminal block (19).
 - b. Remove pan head screws (21) and nutserts (22) securing terminal block (19) and marker strip (20) to panel (14).
 - c. Remove terminal block (19) and marker strip (20) from panel (14).

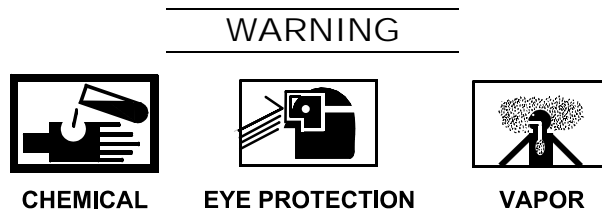
NOTE

The following step is typical for the removal of power blocks.

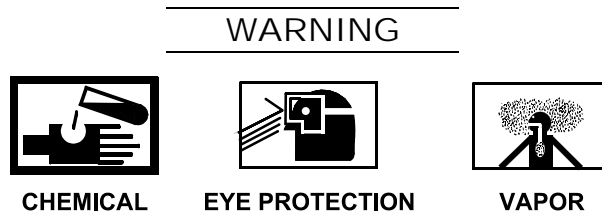
7. Remove power block (23) from panel (14).
 - a. Remove pan head screws (24), lockwashers (25) and insert nuts (26) securing power block (23) to panel (14).
 - b. Remove power block (23) from panel (14).

CLEAN ENGINE JUNCTION BOX A4

1. Clean engine junction box A4 interior and exterior surfaces with a clean wiping rag.



2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.



3. Dispose of contaminated wiping rags per local procedures.

INSPECT ENGINE JUNCTION BOX ASSEMBLY A4

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE ENGINE JUNCTION BOX ASSEMBLY A4
NOTE

The following step is typical for the installation of power blocks.

1. Install power block (23) on panel (14).
 - a. Position power block (23) on panel (14).
 - b. Install pan head screws (24), lockwashers (25) and insert nuts (26) to secure power block (19) to panel (14). Tighten insert nuts (26).

NOTE

The following step is typical for the installation of terminal blocks.

2. Install terminal block (19) and marker strip (20) on panel (14).
 - a. Position terminal block (19) and marker strip (20) on panel (14).
 - b. Install pan head screws (21) and nutserts (22) to secure terminal block (19) and marker strip (20) to panel (14). Tighten nutserts (22).
 - c. Connect wiring to terminal block (19) and remove tags.

NOTE

The following step is typical for the installation of relay sockets.

3. Install relay socket (13) on panel (14).
 - a. Position relay socket (13) on panel (14).
 - b. Install pan head screw (16), lockwashers (17) and insert nut (18) to secure relay socket (13) to panel (14). Tighten insert nut (18).
 - c. Connect wiring to relay socket (13) and remove tags.
4. Install panel (14) in engine junction box assembly A4 (2).
 - a. Position panel (14) in engine junction box assembly A4 (2).
 - b. Install pan head screws (15) to secure panel (14) to engine junction box assembly A4 (2). Tighten pan head screws (15).
 - c. Connect wiring to panel (14) and remove tags.
5. Separately install relays (12) into relay sockets (13) on panel (14) by pushing straight in.

NOTE

The following step is typical for the installation of circuit breakers

6. Install circuit breaker (5) in enclosure cover (4).
 - a. Position circuit breaker (5) in enclosure cover (4).
 - b. Install small hex nut (11) to secure circuit breaker (5) to enclosure cover (4). Tighten small hex nut (11).
 - c. Connect wiring to circuit breaker (5) and remove tags.
 - d. Install circuit breaker guard (10), standoffs (9), pan head screws (8), flat washers (7) and self-lock hex nuts (6) to secure circuit breaker guard (10) to enclosure cover (4). Tighten self-lock hex nuts (6).

7. Install EMERGENCY STOP pushbutton (1) in engine junction box assembly A4 (2).
 - a. Position EMERGENCY STOP pushbutton (1) on enclosure cover (4).
 - b. Install large hex nut (3) to secure EMERGENCY STOP pushbutton (1) to enclosure cover (4). Tighten large hex nut (3).
 - c. Connect wiring to EMERGENCY STOP pushbutton (1) and remove tags.
8. Install engine junction box assembly A4. (WP 0208 00)
9. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM BILGE PUMP CONTROL PANEL A5
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

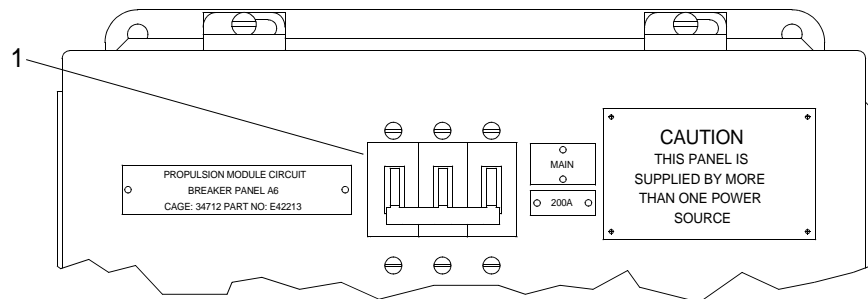
Equipment Condition

Engine Power Isolated. (WP 0075 00)

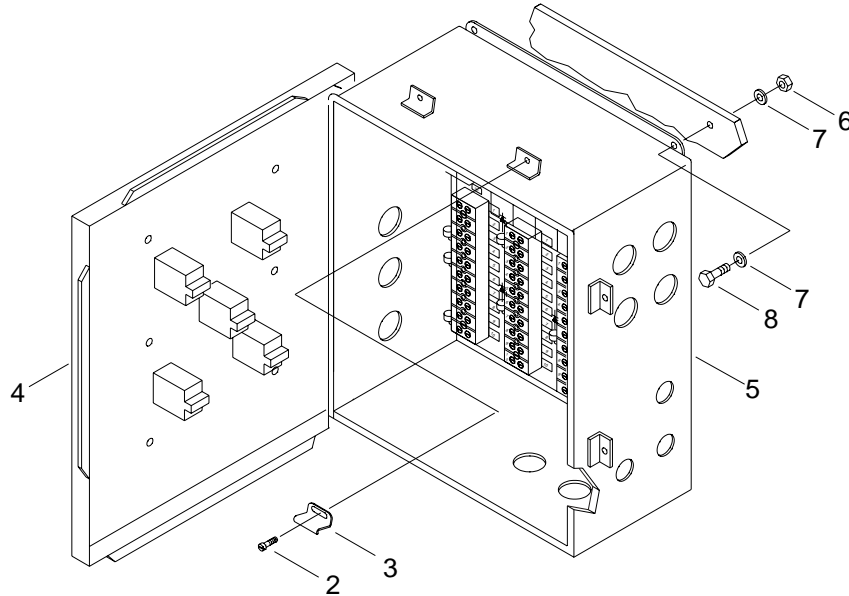
REMOVE BILGE PUMP CONTROL PANEL A5**NOTE**

This task is typical for the removal and installation of the bilge pump control panel A5.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



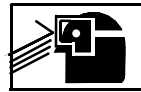
- Open enclosure cover (4).
- Tag and disconnect all external wiring to bilge pump control panel A5 (5).
- Remove hex nuts (6), flat washers (7) and hex head capscrews (8) securing bilge pump control panel A5 (5) to mounting structure.
- Remove bilge pump control panel A5 (5).

INSTALL ELECTRICAL SYSTEM BILGE PUMP CONTROL PANEL A5

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to hex head capscrews (8).
- Position the bilge pump control panel A5 (5) on mounting structure.
- Install hex head capscrews (8), flat washers (7) and hex nuts (6) to secure bilge pump control panel A5 (5) to mounting structure. Tighten hex nuts (6).
- Connect all external wiring to bilge pump control panel A5 (5) and remove tags.
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (5) and tighten screws (2).
- Perform operational check of bilge pumps. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM BILGE PUMP CONTROL PANEL A5
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Bilge Pump Control Panel A5 Removed. (WP 0210 00)

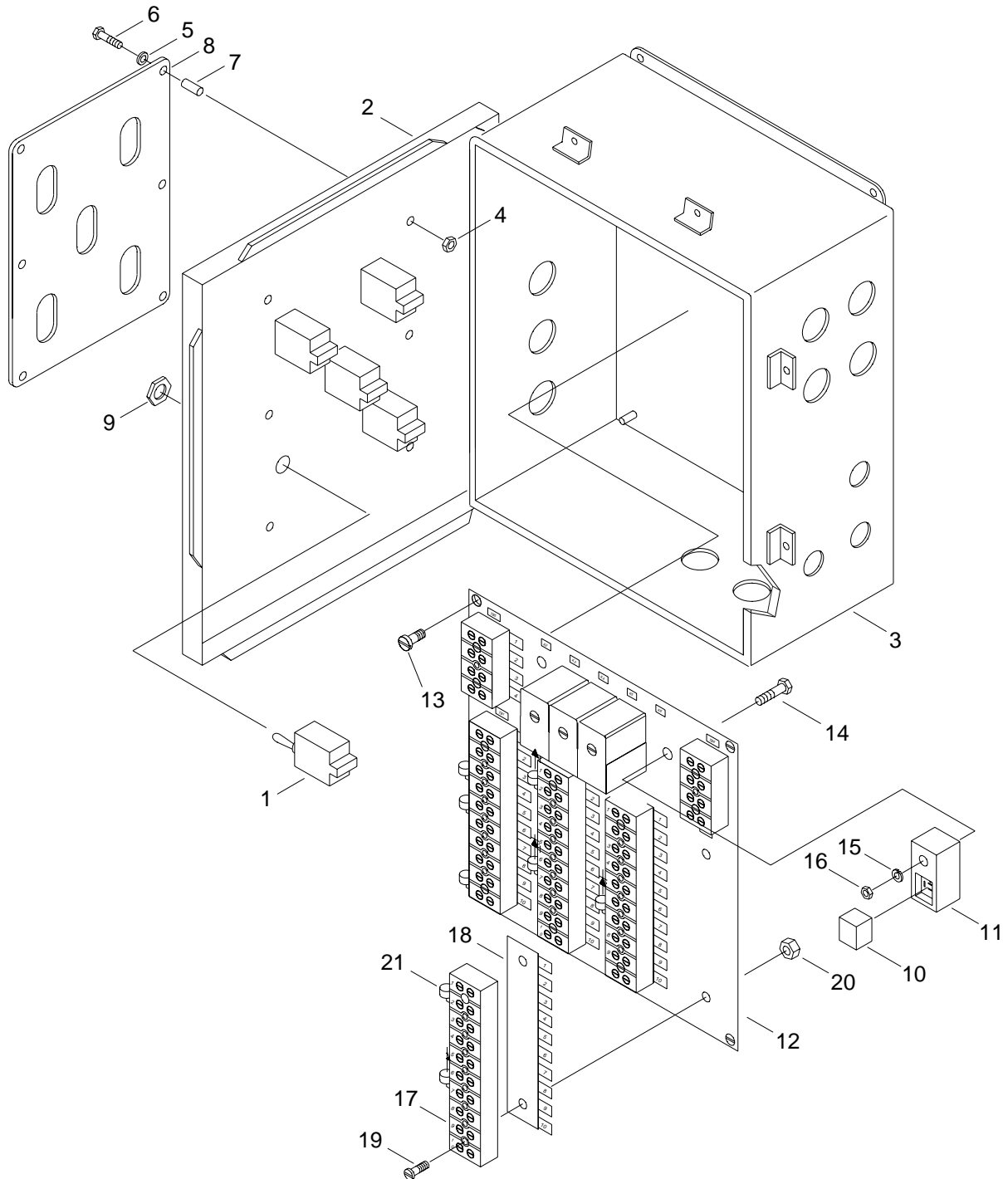
DISASSEMBLE BILGE PUMP CONTROL PANEL A5**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the bilge pump control panel A5.

Repair is limited to the replacement of damaged parts.

The following step is typical for the removal of circuit breakers.

1. Remove circuit breaker (1) from enclosure cover (2) on bilge pump control panel A5 (3).



- a. Remove self-lock hex nuts (4), flat washers (5), pan head screws (6), standoffs (7) and circuit breaker guard (8) from enclosure cover (2).
- b. Tag and disconnect wiring from circuit breaker (1).
- c. Remove hex nut (9) securing circuit breaker (1) to enclosure cover (2).
- d. Remove circuit breaker (1) from enclosure cover (2).

2. Separately remove relays (10) from relay sockets (11) on panel (12) by pulling straight out.
3. Remove panel (12) from bilge pump control panel A5 (3).
 - a. Tag and disconnect wiring from panel (12).
 - b. Remove pan head screws (13) securing panel (12) to bilge pump control panel A5 (3).
 - c. Remove panel (12) from bilge pump control panel A5 (3).

NOTE

The following step is typical for the removal of relay sockets.

4. Remove relay socket (11) from panel (12).
 - a. Tag and disconnect wiring from relay socket (11).
 - b. Remove pan head screw (14), lockwashers (15) and insert nut (16) securing relay socket (11) to panel (12).
 - c. Remove relay socket (11) from panel (12).

NOTE

The following step is typical for the removal of terminal blocks.

5. Remove terminal block (17) and marker strip (18) from panel (12).
 - a. Remove pan head screws (19) and insert nuts (20) securing terminal block (17) and marker strip (18) to panel (12).
 - b. Remove terminal block (17) and marker strip (18) from panel (12).
 - c. Remove diodes (21) from terminal block (17). (WP 0396 00)

CLEAN BILGE PUMP CONTROL PANEL A5

1. Clean bilge pump control panel A5 interior and exterior surfaces with a clean wiping rag.

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

3. Dispose of contaminated wiping rags per local procedures.

INSPECT BILGE PUMP CONTROL PANEL A5

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE BILGE PUMP CONTROL PANEL A5**NOTE**

The following step is typical for the installation of terminal blocks.

1. Install terminal block (17) and marker strip (18) on panel (12).
 - a. Install diodes (21) on terminal block (17). (WP 0396 00)
 - b. Position terminal block (17) and marker strip (18) on panel (12).
 - c. Install pan head screws (19) and insert nuts (20) to secure terminal block (17) and marker strip (18) to panel (12). Tighten insert nuts (20).

NOTE

The following step is typical for the installation of relay sockets.

2. Install relay socket (11) on panel (12).
 - a. Position relay socket (11) on panel (12).
 - b. Install pan head screw (14), lockwashers (15) and insert nut (16) to secure relay socket (11) to panel (12).
 - c. Connect wiring to relay socket (11) and remove tags.
3. Install panel (12) in bilge pump control panel A5 (3).
 - a. Position panel (12) in bilge pump control panel A5 (3).
 - b. Install pan head screws (13) to secure panel (12) in bilge pump control panel A5 (3).
 - c. Connect wiring to panel (12) and remove tags.

-
4. Separately install relays (10) into relay sockets (11) on panel (12) by pushing straight in.

NOTE

The following step is typical for the installation of circuit breakers.

5. Install circuit breaker (1) in enclosure cover (2).
 - a. Position circuit breaker (1) in enclosure cover (2).
 - b. Install hex nut (9) to secure circuit breaker (1) to enclosure cover (2). Tighten hex nut (9).
 - c. Connect wiring to circuit breaker (1) and remove tags.
 - d. Install self-lock hex nuts (4), flat washers (5), pan head screws (6), standoffs (7) and circuit breaker guard (8) on enclosure cover (2). Tighten self-lock hex nuts (4).
6. Install bilge pump control panel A5. (WP 0210 00)
7. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM PROPULSION MODULE
CIRCUIT BREAKER PANEL A6
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

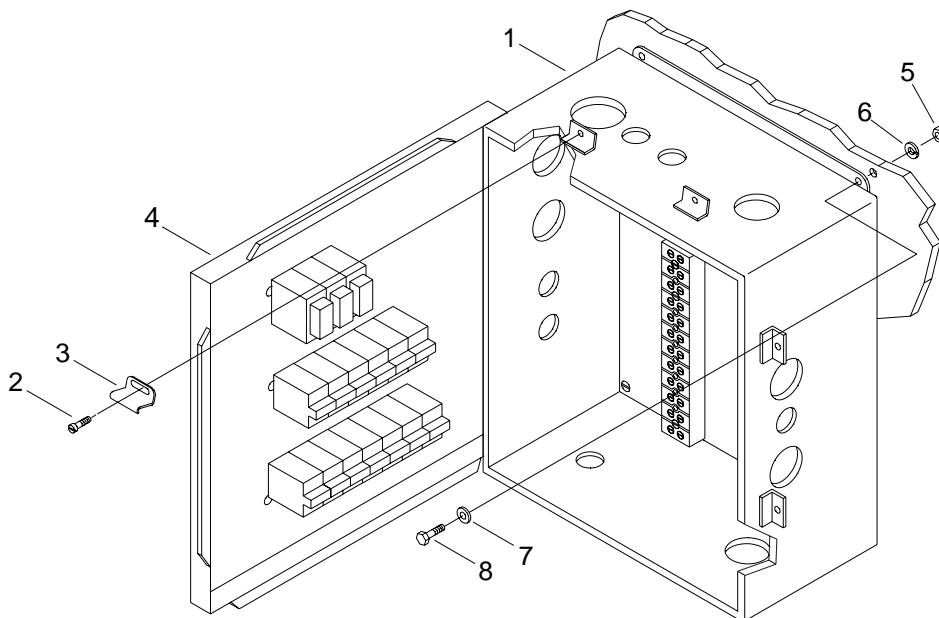
Equipment Condition

Powered Section Batteries Positive Lead Terminals Removed. (WP 0197 00)
Thruster Direction/Auxiliary Battery Junction Box Assembly A9 Batteries Removed. (WP 0218 00)

REMOVE PROPULSION MODULE CIRCUIT BREAKER PANEL A6**NOTE**

This task is typical for the removal and installation of the propulsion module circuit breaker panel A6.

1. Disconnect power cable to module interconnect assembly from propulsion module circuit breaker panel A6 (1).



2. Loosen screws (2) to pivot cover clamps (3) free.

3. Open enclosure cover (4).
4. Tag and disconnect all external electrical wiring to propulsion module circuit breaker panel A6 (1).
5. Remove hex nuts (5), lockwashers (6), flat washers (7) and hex head capscrews (8) securing propulsion module circuit breaker panel A6 (1) to mounting structure.
6. Remove propulsion module circuit breaker panel A6 (1).

INSTALL PROPULSION MODULE CIRCUIT BREAKER PANEL A6

WARNING



CHEMICAL



EYE PROTECTION

1. Apply adhesive to hex head capscrews (8).
2. Position propulsion circuit breaker panel A6 (1) on mounting structure.
3. Install hex head capscrews (8), flat washers (7), lockwashers (6) and hex nuts (5) to secure propulsion circuit breaker panel A6 (1) to mounting structure. Tighten hex nuts (6).
4. Connect all external wiring to propulsion circuit breaker panel A6 (1) and remove tags.
5. Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
6. Connect power cable to module interconnect assembly from propulsion module circuit breaker panel A6 (1).
7. Install thruster direction/auxiliary battery junction box assembly A9 batteries. (WP 0218 00)
8. Install powered section main batteries negative lead terminals. (WP 0197 00)
9. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM PROPULSION MODULE
CIRCUIT BREAKER PANEL A6
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

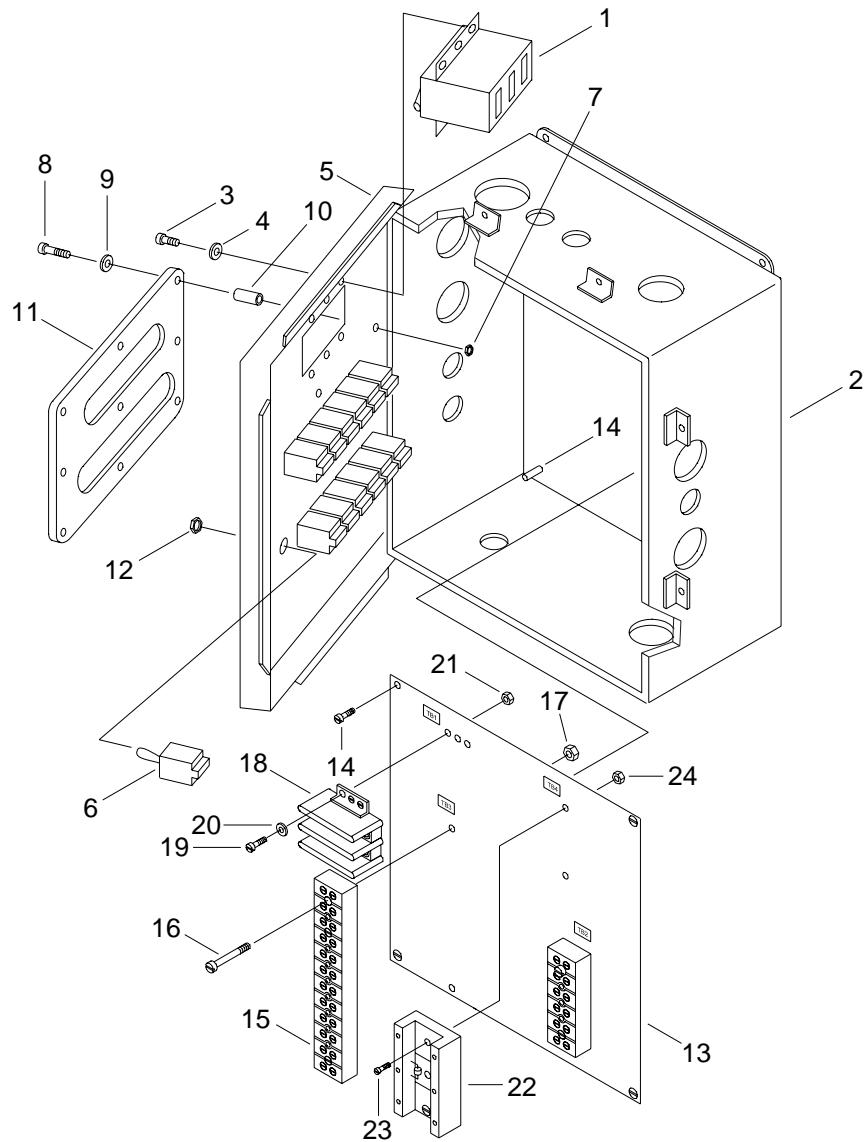
Propulsion Module Circuit Breaker Panel A6 Removed. (WP 0212 00)

DISASSEMBLE PROPULSION MODULE CIRCUIT BREAKER PANEL A6**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the propulsion module circuit breaker panel A6.

Repair is limited to the replacement of damaged parts.

1. Remove MAIN circuit breaker (1) from propulsion module circuit breaker panel A6 (2).



- a. Tag and disconnect wiring from MAIN circuit breaker (1).
- b. Remove round head screws (3) and lockwashers (4) securing MAIN circuit breaker (1) to enclosure cover (5).
- c. Remove MAIN circuit breaker (1) from enclosure cover (5).

NOTE

The following step is typical for the removal of circuit breakers.

2. Remove circuit breaker (6) from enclosure cover (5).
 - a. Remove self-lock hex nuts (7), pan head screws (8), washers (9), standoffs (10) and circuit breaker guard (11) from enclosure cover (5).
 - b. Tag and disconnect wiring from circuit breaker (6).

-
- c. Remove hex nut (12) securing circuit breaker (6) to enclosure cover (5).
 - d. Remove circuit breaker (6) from enclosure cover (5).
3. Remove panel (13) from propulsion module circuit breaker panel A6 (2).
 - a. Tag and disconnect wiring to panel (13).
 - b. Remove pan head screws (14) securing panel (13) in propulsion module circuit breaker panel A6 (2).
 - c. Remove panel (13).

NOTE

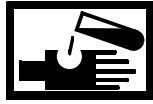
The following step is typical for the removal of terminal blocks.

4. Remove terminal block (15) from panel (13).
 - a. Tag and disconnect wiring to terminal block (15).
 - b. Remove round head screws (16) and insert nuts (17) securing terminal block (15) to panel (13).
 - c. Remove terminal block (15).
5. Remove power block (18) from panel (13).
 - a. Tag and disconnect wiring to power block (18).
 - b. Remove round head screws (19), flat washers (20) and insert nuts (21) securing power block (18) to panel (13).
 - c. Remove power block (18).
6. Remove power distribution block (22) from panel (13).
 - a. Tag and disconnect wiring to power distribution block (22).
 - b. Remove round head screws (23) and insert nuts (24) securing power distribution block (22) to panel (13).
 - c. Remove power distribution block (22).

CLEAN PROPULSION MODULE CIRCUIT BREAKER PANEL A6

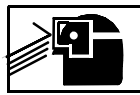
1. Clean propulsion module circuit breaker panel A6 interior and exterior surfaces with a clean wiping rag.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

3. Dispose of contaminated wiping rags per local procedures.

INSPECT PROPULSION MODULE CIRCUIT BREAKER PANEL A6

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE PROPULSION MODULE CIRCUIT BREAKER PANEL A6

1. Install power distribution block (22) on panel (13).
 - a. Position power distribution block (22) on panel (13).
 - b. Install round head screws (23) and insert nuts (24) to secure power distribution block (22) to panel (13). Tighten insert nuts (24).
 - c. Connect wiring to power distribution block (22) and remove tags.
2. Install power block (18) on panel (13).
 - a. Position power block (18) on panel (13).
 - b. Install round head screws (19), flat washers (20) and insert nuts (21) to secure power block (18) to panel (13). Tighten insert nuts (21).
 - c. Connect wiring to power block (18) and remove tags.

NOTE

The following step is typical for the installation of terminal blocks.

3. Install terminal block (15) on panel (13).

-
- a. Position terminal block (15) on panel (13).
 - b. Install round head screws (16) and insert nuts (17) to secure terminal block (15) to panel (13). Tighten insert nut (17).
 - c. Connect wiring to terminal block (15) and remove tags.
4. Install panel (13) in propulsion module circuit breaker panel A6 (2).
 - a. Position panel (13) in propulsion module circuit breaker panel A6 (2).
 - b. Install pan head screws (14) to secure panel (13) in propulsion module circuit breaker panel A6 (2).
 - c. Connect wiring to panel (13) and remove tags.

NOTE

The following step is typical for the installation of circuit breakers.

5. Install circuit breaker (6) on enclosure cover (5).
 - a. Position circuit breaker (6) on enclosure cover (5).
 - b. Install hex nut (12) to secure circuit breaker (6) to enclosure cover (5).
 - c. Connect wiring to circuit breaker (6) and remove tags.
 - d. Install self-lock hex nuts (7), pan head screws (8), washers (9), standoffs (10) and circuit breaker guard (11) on enclosure cover (5). Tighten self-lock hex nuts (7).
6. Install MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 (2).
 - a. Position MAIN circuit breaker (1) on enclosure cover (5).
 - b. Install round head screws (3) and lockwashers (4) to secure MAIN circuit breaker (1) to enclosure cover (5).
 - c. Connect wiring to MAIN circuit breaker (1) and remove tags.
7. Install propulsion module circuit breaker panel A6. (WP 0212 00)
8. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM SINGLE BILGE PUMP
CONTROL PANEL A7
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

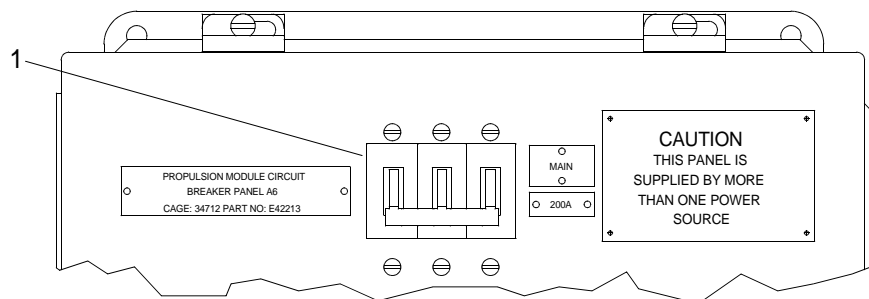
Equipment Condition

Engine Power Isolated. (WP 0075 00)

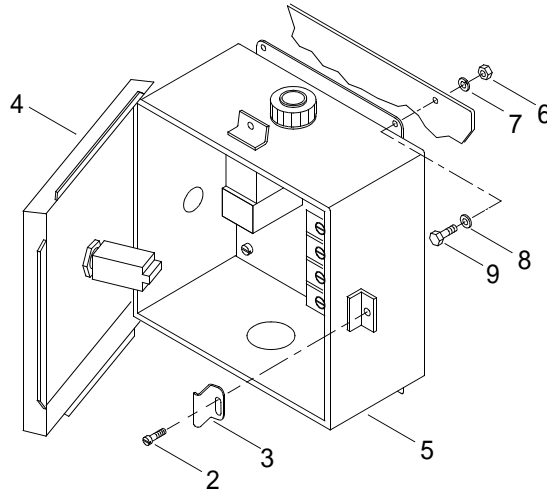
REMOVE SINGLE BILGE PUMP CONTROL PANEL A7**NOTE**

This task is typical for the removal and installation of the single bilge pump panel A7.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



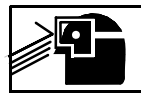
- Open enclosure cover (4).
- Tag and disconnect all external electrical wiring to single bilge pump control panel A7 (5).
- Remove hex head nuts (6), lockwashers (7), washers (8) and hex head capscrews (9) securing single bilge pump control panel A7 (5) to mounting structure.
- Remove single bilge pump control panel A7 (5).

INSTALL SINGLE BILGE PUMP CONTROL PANEL A7

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to capscrews (9).
- Position single bilge pump control panel A7 (5) on mounting structure.
- Install hex head nuts (6), lockwashers (7), washers (8) and hex head capscrews (9) to secure single bilge pump control panel A7 (5) to mounting structure. Tighten hex head nuts (6).
- Connect all external wiring to single bilge pump control panel A7 (5) and remove tags.
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
- Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM SINGLE BILGE PUMP
CONTROL PANEL A7
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Single Bilge Pump Control Panel A7 Removed. (WP 0214 00)

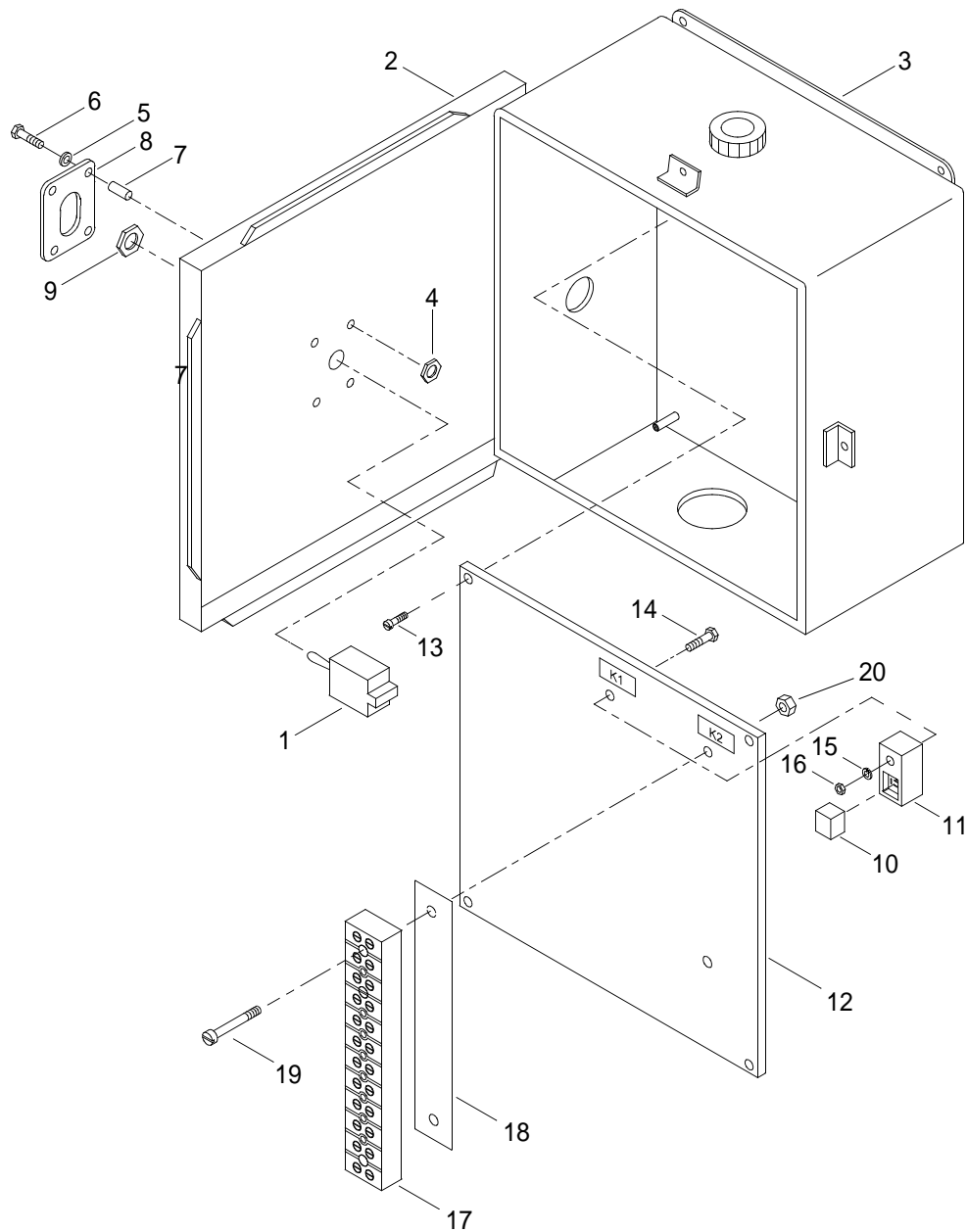
DISASSEMBLE SINGLE BILGE PUMP CONTROL PANEL A7**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the single bilge pump control panel A7.

Repair is limited to the replacement of damaged parts.

The circuit breaker guard must be removed prior to removal of the circuit breakers.

1. Remove circuit breaker (1) from enclosure cover (2) on single bilge pump control panel A7 (3).



- a. Remove self-lock hex nuts (4), flat washers (5), pan head screws (6), standoffs (7) and circuit breaker guard (8) from enclosure cover (2).
 - b. Remove hex nut (9) securing circuit breaker (1) to enclosure cover (2).
 - c. Remove circuit breaker (1) from enclosure cover (2).
2. Remove relay (10) from relay socket (11) on panel (12) by pulling straight out.

3. Remove panel (12) from single bilge pump control panel A7 (3).
 - a. Remove pan head screws (13) securing panel (12) to single bilge pump control panel A7 (3).
 - b. Remove panel (12) from single bilge pump control panel A7 (3).
4. Remove relay socket (11) from panel (12).
 - a. Remove pan head screw (14), lockwashers (15) and insert nut (16) securing relay socket (11) to panel (12).
 - b. Remove relay socket (11) from panel (12).
5. Remove terminal block (17) and marker strip (18) from panel (12).
 - a. Remove pan head screws (19) and insert nuts (20) securing terminal block (17) and marker strip (18) to panel (12).
 - b. Remove terminal block (17) and marker strip (18) from panel (12).

CLEAN SINGLE BILGE PUMP CONTROL PANEL A7

1. Clean single bilge pump control panel A7 interior and exterior surfaces with a clean wiping rag.

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Dispose of contaminated wiping rags per local procedures.

INSPECT SINGLE BILGE PUMP CONTROL PANEL A7

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE SINGLE BILGE PUMP CONTROL PANEL A7**NOTE**

The following step is typical for the installation of terminal blocks.

1. Install terminal block (17) and marker strip (18) on panel (12).
 - a. Position terminal block (17) and marker strip (18) on panel (12).
 - b. Install pan head screws (19) and insert nuts (20) to secure terminal block (17) and marker strip (18) to panel (12). Tighten insert nuts (20).

NOTE

The following step is typical for the installation of relay sockets.

2. Install relay socket (11) on panel (12).
 - a. Position relay socket (11) on panel (12).
 - b. Install pan head screw (14), lockwashers (15) and insert nut (16) to secure relay socket (11) to panel (12).
3. Install panel (12) in single bilge pump control panel A7 (3).
 - a. Position panel (12) in single bilge pump control panel A7 (3).
 - b. Install pan head screws (13) to secure panel (12) in single bilge pump control panel A7 (3).
4. Separately install relays (10) into relay sockets (11) on panel (12) by pushing straight in.

NOTE

The following step is typical for the installation of circuit breakers.

5. Install circuit breaker (1) in enclosure cover (2).
 - a. Position circuit breaker (1) in enclosure cover (2).
 - b. Install hex nut (9) to secure circuit breaker (1) to enclosure cover (2). Tighten hex nut (9).
 - c. Install self-lock hex nuts (4), flat washers (5), pan head screws (6), standoffs (7) and circuit breaker guard (8) on enclosure cover (2). Tighten self-lock hex nuts (4).
6. Install single bilge pump control panel A7. (WP 0214 00)
7. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM VENT FAN RELAY ENCLOSURE A8
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

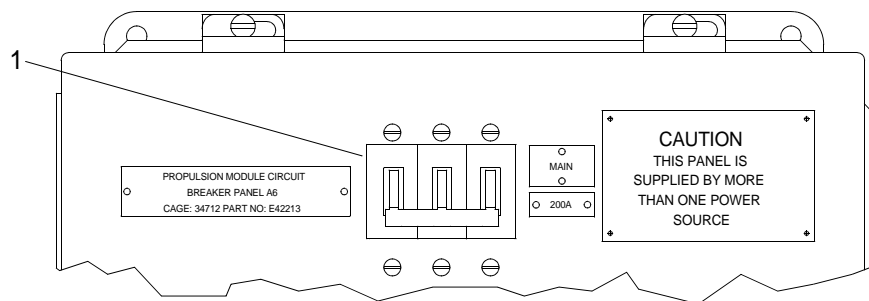
Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE VENT FAN RELAY ENCLOSURE A8**NOTE**

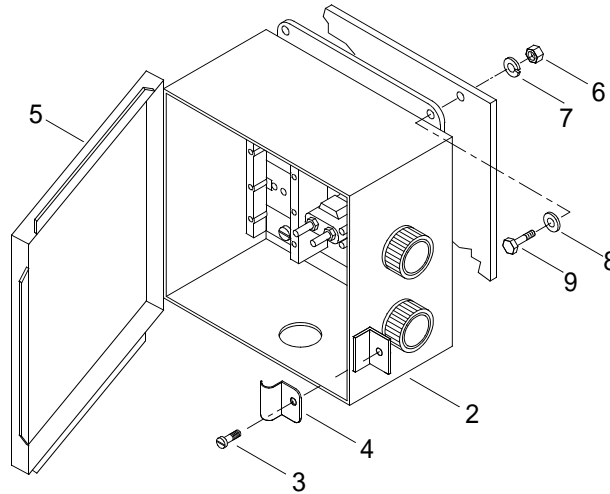
This task is typical for the removal and installation of the vent fan relay enclosure A8.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Disconnect power cable to exhaust plenum from vent fan relay enclosure A8 (2).

- Loosen two screws (3) to pivot clamps (4) free.



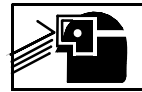
- Open enclosure cover (5).
- Tag and disconnect all external electrical wiring to vent fan relay enclosure A8 (2).
- Remove hex nuts (6), lockwashers (7), washers (8) and hex head capscrews (9) securing vent fan relay enclosure A8 (2) to mounting structure.
- Remove vent fan relay enclosure A8 (2).

INSTALL VENT FAN RELAY ENCLOSURE A8

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to capscrews (9).
- Position vent fan relay enclosure A8 (2) on mounting structure.
- Install hex head capscrews (9), washers (8), lockwashers (7) and hex nuts (6) to secure vent fan relay enclosure A8 (2) to mounting structure. Tighten hex nuts (6).
- Connect all external wiring to vent fan relay enclosure A8 (2) and remove tags.
- Close enclosure cover (5), pivot clamps (4) over lip of enclosure cover (5) and screws (3).
- Connect power cable to exhaust plenum from vent fan relay enclosure A8 (2).
- Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM VENT FAN RELAY ENCLOSURE A8
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

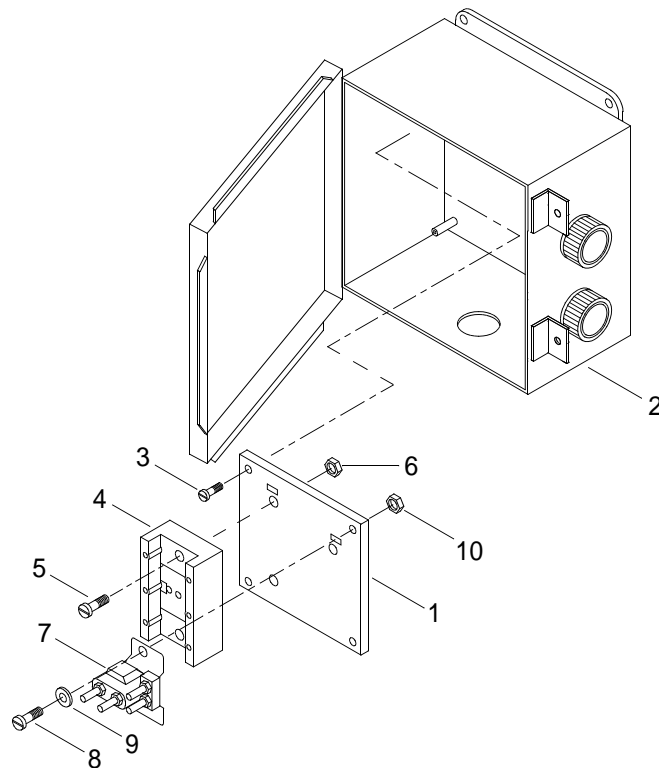
Vent Fan Relay Enclosure A8 Removed. (WP 0216 00)

DISASSEMBLE VENT FAN RELAY ENCLOSURE A8**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the vent fan relay enclosure A8.

Repair is limited to the replacement of damaged parts.

1. Remove panel (1) from vent fan relay enclosure A8 (2).



- a. Remove pan head screws (3) securing panel (1) to vent fan relay enclosure A8 (2).
 - b. Remove panel (1) from vent fan relay enclosure A8 (2).
3. Remove terminal block (4) from panel (1).
 - a. Remove pan head screws (5) and insert nuts (6) securing terminal block (4) to panel (1).
 - b. Remove terminal block (4) from panel (1).
4. Remove relay (7) from panel (1).
 - a. Remove pan head screws (8), flat washers (9) and insert nuts (10) securing relay (7) to panel (1).
 - b. Remove relay (7).

CLEAN VENT FAN RELAY ENCLOSURE A8

1. Clean vent fan relay enclosure A8 interior and exterior surfaces with a clean wiping rag.

 WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

 WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

3. Dispose of contaminated wiping rags per local procedures.

INSPECT VENT FAN RELAY ENCLOSURE A8

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE VENT FAN RELAY ENCLOSURE A8

1. Install relay (7) on panel (1).
 - a. Position relay (7) on panel (1).
 - b. Install pan head screws (8), flat washers (9) and insert nuts (10) to secure relay (7) to panel (1).
2. Install terminal block (4) on panel (1).
 - a. Position terminal block (4) on panel (1).
 - b. Install pan head screws (5) and insert nuts (6) to secure terminal block (4) to panel (1).
3. Install panel (1) in vent fan relay enclosure A8 (2).
 - a. Position panel (1) in vent fan relay enclosure A8 (2).
 - b. Install pan head screws (3) to secure panel (1) to vent fan relay enclosure A8 (2).
4. Install vent fan relay enclosure A8. (WP 0216 00)
5. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM THRUSTER DIRECTION/AUXILIARY
BATTERY JUNCTION BOX ASSEMBLY A9
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

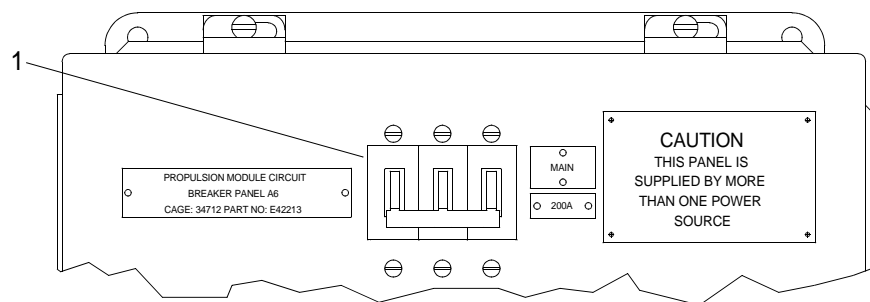
Engine Power Isolated. (WP 0075 00)

REMOVE THRUSTER DIRECTION/AUXILIARY BATTERY JUNCTION BOX ASSEMBLY A9

NOTE

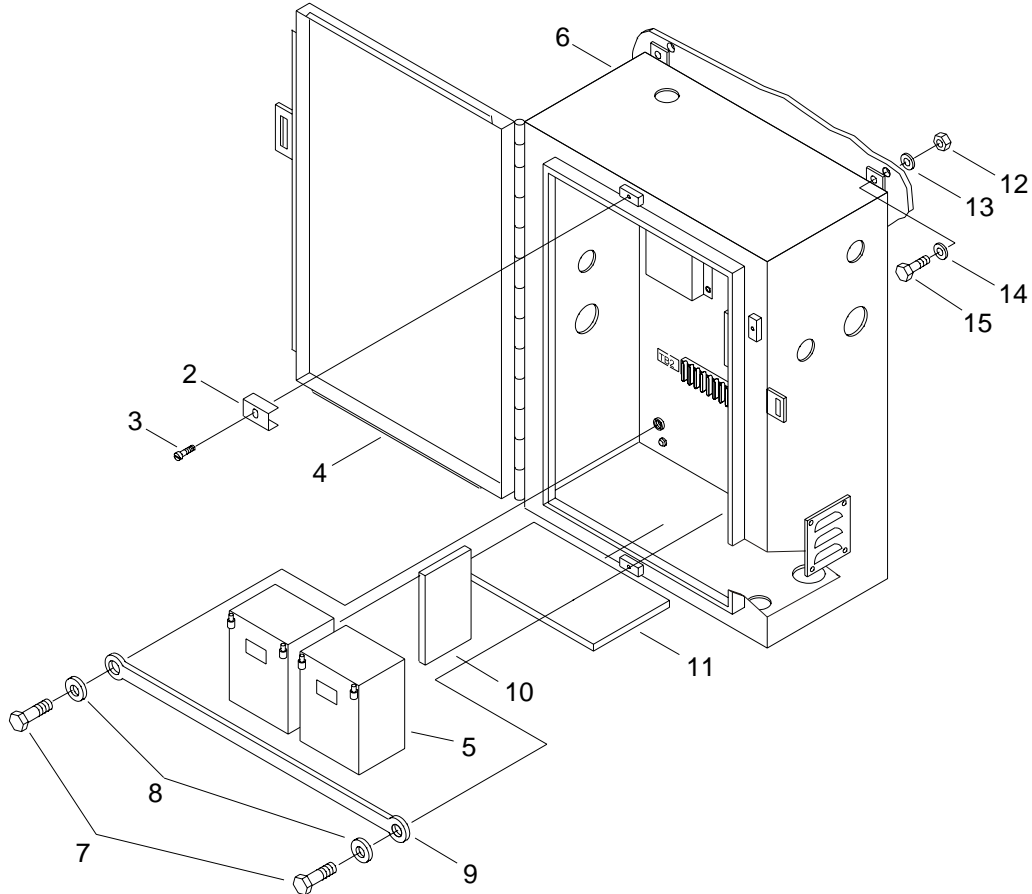
This task is typical for the removal and installation of the thruster direction/auxiliary battery junction box assembly A9.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Remove powered section main batteries positive lead terminals. (WP 0197 00)

3. Loosen screws (2) to pivot clamps (3) free.



4. Open enclosure cover (4).
5. Remove auxiliary batteries (5) from thruster direction/auxiliary battery junction box assembly A9 (6).
 - a. Remove hex nuts (7), flat washers (8) and battery strap (9) securing auxiliary batteries (5) in thruster direction/auxiliary battery junction box assembly A9 (6).
 - b. Disconnect and remove auxiliary batteries (5), battery cushions (10) and battery pad (11) from thruster direction/auxiliary battery junction box assembly A9 (6).
6. Tag and disconnect all external electrical wiring to thruster direction/auxiliary battery junction box assembly A9 (6).
7. Remove hex head nuts (12), lockwashers (13), flat washers (14) and hex head cap screws (15) securing thruster direction/auxiliary battery junction box assembly A9 (6) to mounting structure.
8. Remove thruster direction/auxiliary battery junction box assembly A9 (6).

**INSTALL THRUSTER DIRECTION/AUXILIARY BATTERY JUNCTION BOX
ASSEMBLY A9**

WARNING

**CHEMICAL****EYE PROTECTION**

1. Apply adhesive to hex head capscrews (15).
2. Position thruster direction/auxiliary battery junction box assembly A9 (6) on mounting structure.
3. Install hex head nuts (12), lockwashers (13), flat washers (14) and hex head capscrews (15) to secure thruster direction/auxiliary battery junction box assembly A9 (6) to mounting structure.
4. Connect all external electrical wiring to thruster direction/auxiliary battery junction box assembly A9 (6) and remove tags.
5. Install auxiliary batteries (5) in thruster direction/auxiliary battery junction box assembly A9 (6).
 - a. Position battery pad (11), battery cushions (10) and connect auxiliary batteries (5) in thruster direction/auxiliary battery junction box assembly A9 (6).
 - b. Install battery strap (9), flat washers (8) and hex nuts (7) to secure auxiliary batteries (5) in thruster direction/auxiliary battery junction box assembly A9 (6).
6. Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
7. Install powered section main batteries positive lead terminals. (WP 0197 00)
8. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM THRUSTER DIRECTION/AUXILIARY
BATTERY JUNCTION BOX ASSEMBLY A9
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Thruster Direction/Auxiliary Battery Junction Box Assembly A9 Removed. (WP 0218 00)

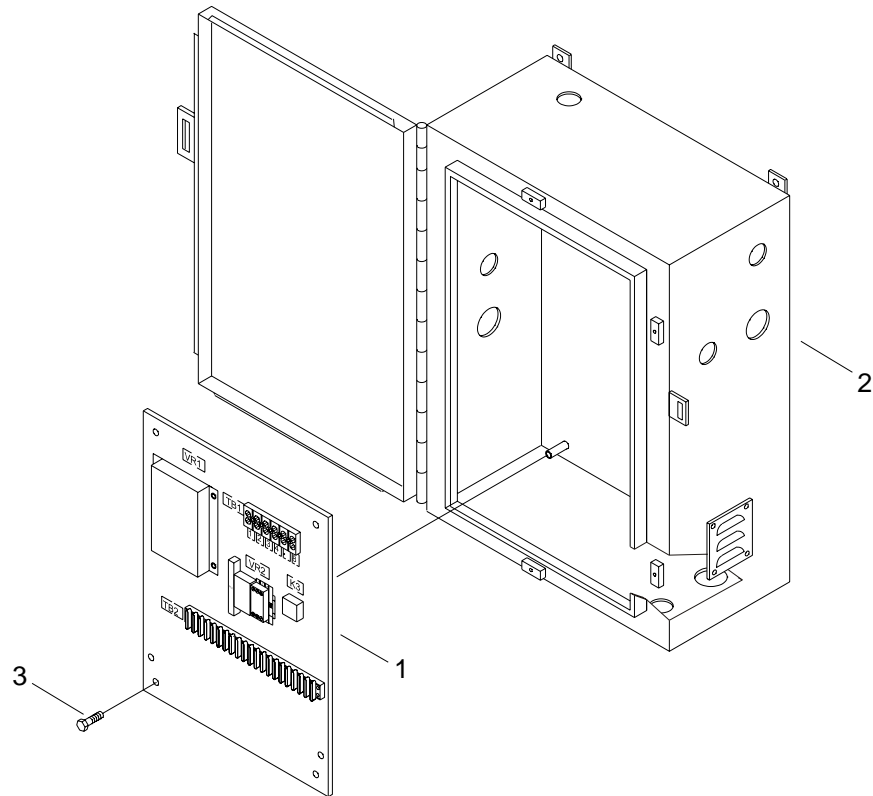
**DISASSEMBLE THRUSTER DIRECTION/AUXILIARY BATTERY JUNCTION BOX
ASSEMBLY A9**

NOTE

This task is typical for the removal, inspection, repair and installation of the thruster direction/auxiliary battery junction box assembly A9.

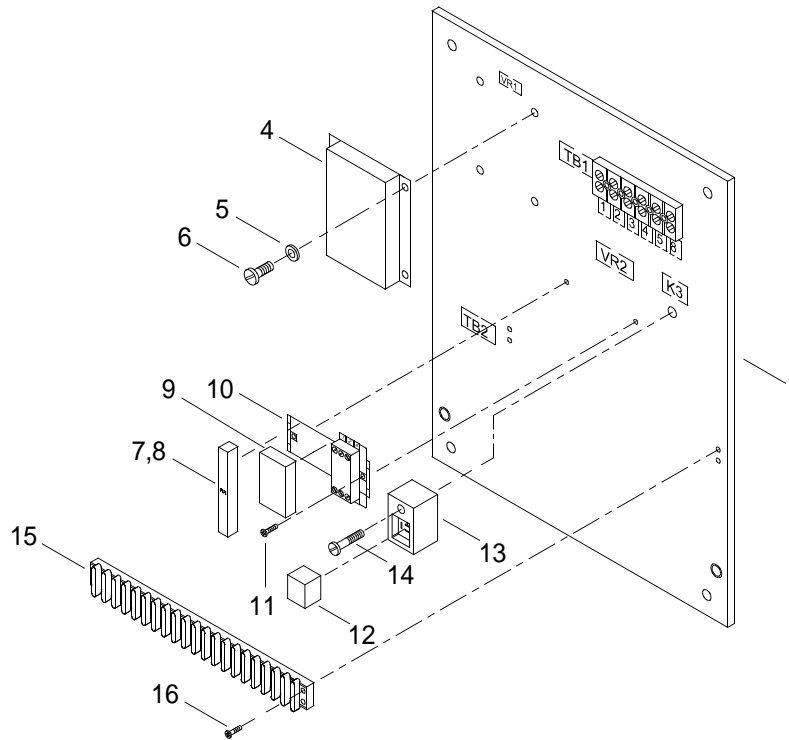
Repair is limited to the replacement of damaged components.

1. Remove panel (1) from thruster direction/auxiliary battery junction box assembly A9 (2).



- a. Tag and disconnect wiring from panel (1).
- b. Remove pan head screws (3) securing panel (1) to thruster direction/auxiliary battery junction box assembly A9 (2).
- c. Remove panel (1) from thruster direction/auxiliary battery junction box assembly A9 (2).

2. Remove voltage regulator (4) from panel (1).



- a. Tag and disconnect wiring from voltage regulator VR1 (4).
 - b. Remove pan head screws (5) and flat washers (6) securing voltage regulator (4) to panel (1).
 - c. Remove voltage regulator (4) from panel (1).
3. Remove fuse holder (7) with fuse (8) from on top of transformer (9).
4. Remove transformer (9) and din rail (10) from panel (1).
- a. Tag and disconnect wiring from transformer (9).
 - b. Remove pan head screws (11) securing transformer (9) and din rail (10) to panel (1).
 - c. Remove transformer (9) and din rail (10) from panel (1).
5. Remove relay (12) from relay socket (13) on panel (1) by pulling straight out.
6. Remove relay socket (13) from panel (1).
- a. Tag and disconnect wiring from relay socket (13).
 - b. Remove pan head screw (14) securing relay socket (13) to panel (1).
 - c. Remove relay socket (13) from panel (1).

NOTE

The following steps are typical for removal of terminal blocks.

7. Remove terminal block (15) from panel (1).
 - a. Tag and disconnect wiring from terminal block (15).
 - b. Remove pan head screws (16) securing terminal block (15) to panel (1).
 - c. Remove terminal block (15) from panel (1).

CLEAN THRUSTER DIRECTION/AUXILIARY BATTERY JUNCTION BOX ASSEMBLY A9

1. Clean engine junction box A4 interior and exterior surfaces with a clean wiping rag.

WARNING



CHEMICAL



EYE PROTECTION



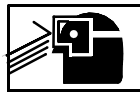
VAPOR

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Dispose of contaminated wiping rags per local procedures.

INSPECT THRUSTER DIRECTION/AUXILIARY BATTERY JUNCTION BOX ASSEMBLY A9

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

**ASSEMBLE THRUSTER DIRECTION/AUXILIARY BATTERY JUNCTION BOX
ASSEMBLY A9****NOTE**

The following steps are typical for installation of terminal blocks.

1. Install terminal block (15) on panel (1).
 - a. Position terminal block (15) on panel (1).
 - b. Install pan head screws (16) to secure terminal block (15) to panel (1). Tighten pan head screws (16).
 - c. Connect wiring to terminal block (15) and remove tags.
2. Install relay socket (13) on panel (1).
 - a. Position relay socket (13) on panel (1).
 - b. Install pan head screw (14) to secure relay socket (13) to panel (1). Tighten pan head screw (14).
 - c. Connect wiring to relay socket (13) and remove tags.
3. Install relay (12) in relay socket (13) on panel (1) by pushing straight in.
4. Install transformer (9) and din rail (10) on panel (1).
 - a. Position transformer (9) and din rail (10) on panel (1).
 - b. Install pan head screws (11) to secure transformer (9) and din rail (10) to panel (1).
 - c. Connect wiring to transformer (9) and remove tags.
5. Install fuse holder (7) with fuse (8) on top of transformer (9).
6. Install voltage regulator (4) on panel (1).
 - a. Position voltage regulator (4) on panel (1).
 - b. Install pan head screws (5) and flat washers (6) to secure voltage regulator (4) to panel (1).
 - c. Connect wiring to voltage regulator (4) and remove tags.
7. Install panel (1) in thruster direction/auxiliary battery junction box assembly A9 (2).
 - a. Position panel (1) in thruster direction/auxiliary battery junction box assembly A9 (2).
 - b. Install pan head screws (3) to secure panel (1) in thruster direction/auxiliary battery junction box assembly A9 (2).
 - c. Connect wiring to panel (1) and remove tags.
8. Install thruster direction/auxiliary battery junction box assembly A9. (WP 0218 00)
9. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM ISOLATOR JUNCTION BOX ASSEMBLY A12
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

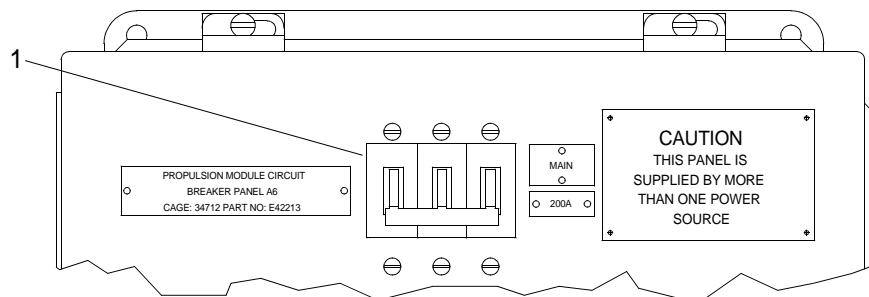
Equipment Condition

Engine Power Isolated. (WP 0075 00)

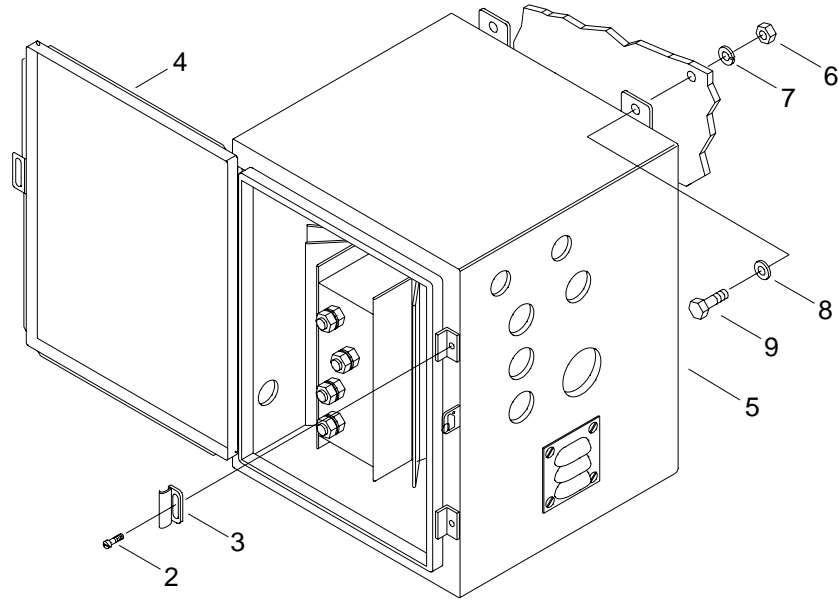
REMOVE ISOLATOR JUNCTION BOX ASSEMBLY A12**NOTE**

This task is typical for the removal and installation of the isolator junction box assembly A12.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



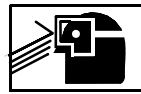
- Open enclosure cover (4).
- Tag and disconnect all external electrical wiring to isolator junction box assembly A12 (5).
- Remove hex head nuts (6), lockwashers (7), washers (8) and hex head capscrews (9) securing isolator junction box assembly A12 (5) to mounting structure.
- Remove isolator junction box assembly A12 (5).

INSTALL ISOLATOR JUNCTION BOX ASSEMBLY A12

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to hex head capscrews (9).
- Position isolator junction box assembly A12 (5) on mounting structure.
- Install hex head nuts (6), lockwashers (7), washers (8) and hex head capscrews (9) to secure isolator junction box assembly A12 (5) to mounting structure. Tighten hex head nuts (6).
- Connect all external wiring to isolator junction box assembly A12 (5) and remove tags.
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
- Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM ISOLATOR JUNCTION BOX ASSEMBLY A12
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

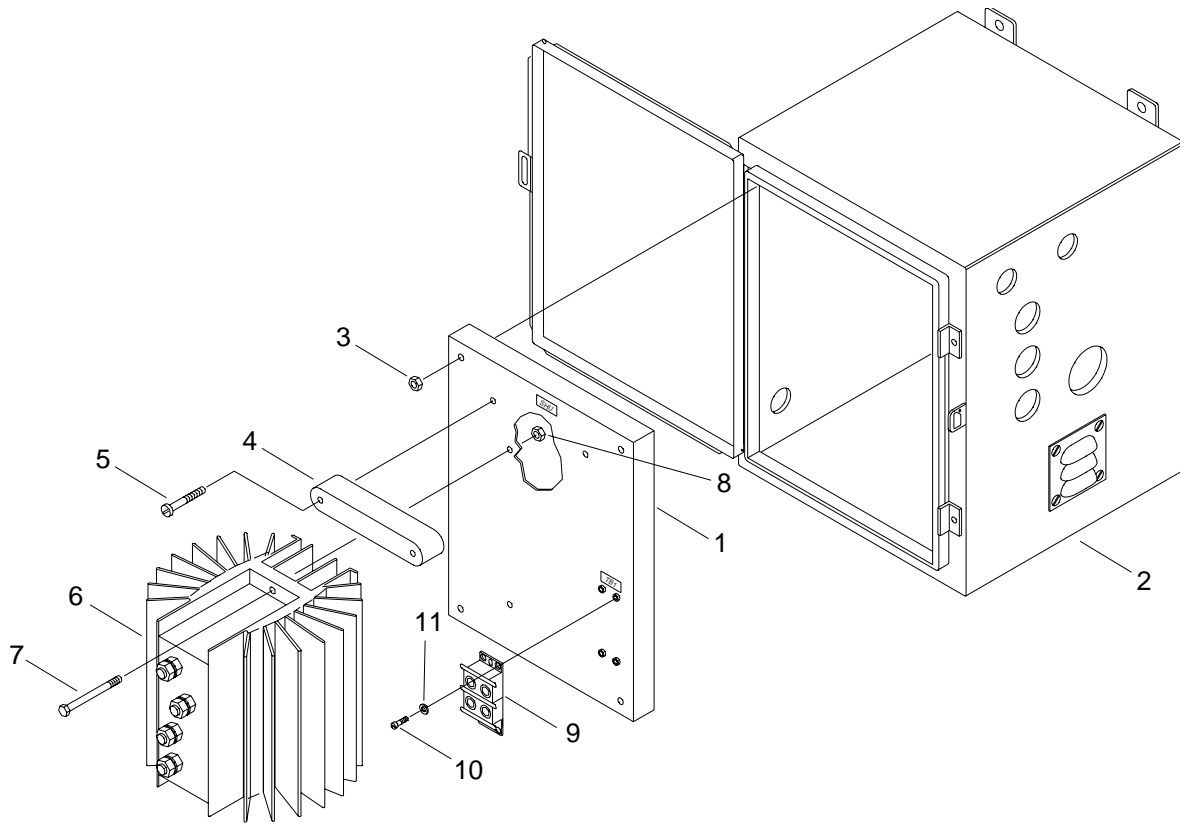
Isolator Junction Box Assembly A12 Removed. (WP 0220 00)

DISASSEMBLE ISOLATOR JUNCTION BOX ASSEMBLY A12**NOTE**

This task is typical for the removal, inspection, repair and installation of components on the isolator junction box assembly A12.

Repair is limited to the replacement of damaged parts.

1. Remove panel (1) from isolator junction box assembly A12 (2).

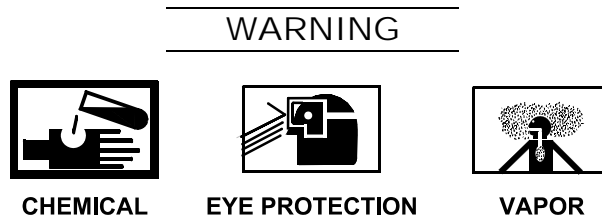


- a. Tag and disconnect wiring from panel (1).
 - b. Remove self-lock hex nuts (3) securing panel (1) to isolator junction box assembly A12 (2).
 - c. Remove panel (1) from isolator junction box assembly A12 (2).
2. Remove ammeter shunt (4) from panel (1).
 - a. Tag and disconnect wiring from ammeter shunt (4).
 - b. Remove pan head screws (5) securing ammeter shunt to panel (1).
 - c. Remove ammeter shunt (4) from panel (1).
 3. Remove isolator (6) from panel (1).
 - a. Tag and disconnect wiring from isolator (6).
 - b. Remove hex head capscrews (7) and rivet nut (8) securing isolator (6) to panel (1).
 - c. Remove isolator (6) from panel (1).
 4. Remove power block (9) from panel (1).
 - a. Tag and disconnect wiring from power block (9).
 - b. Remove round head screws (10) and flat washers (11) securing power block (9) to panel (1).

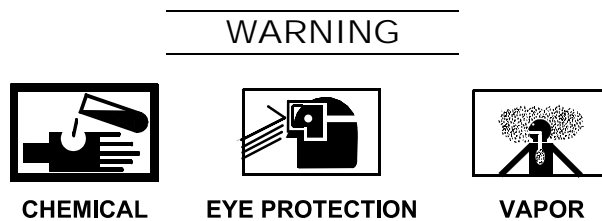
-
- c. Remove power block (9) from panel (1).

CLEAN ISOLATOR JUNCTION BOX ASSEMBLY A12

1. Clean isolator junction box assembly A12 interior and exterior surfaces with a clean wiping rag.



2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.



3. Dispose of contaminated wiping rags per local procedures.

INSPECT ISOLATOR JUNCTION BOX ASSEMBLY A12

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE ISOLATOR JUNCTION BOX ASSEMBLY A12

1. Install isolator (6) on panel (1).
- a. Position isolator (6) on panel (1).
 - b. Install hex head capscrews (7) and rivet nut (8) to secure isolator (6) on panel (1). Tighten hex head capscrews (7).
 - c. Connect wiring to isolator (6) and remove tags.
2. Install ammeter shunt (4) on panel (1).
- a. Position ammeter shunt (4) on panel (1).
 - b. Install pan head screws (5) to secure ammeter shunt on panel (1). Tighten pan head screws (5).
 - c. Connect wiring to ammeter shunt (4) and remove tags.
3. Install power block (9) on panel (1).
- a. Position power block (9) on panel (1).

-
- b. Install round head screws (10) and flat washers (11) to secure power block (9) on panel (1). Tighten pan head screws (10).
 - c. Connect wiring to power block (9) and removed tags.
4. Install panel (1) in isolator junction box assembly A12 (2).
 - a. Position panel (1) in isolator junction box assembly A12 (2).
 - b. Install self-lock hex nuts (3) to secure panel (1) in isolator junction box assembly A12 (2). Tighten self-lock hex nuts (3).
 - c. Connect wiring to panel (1) and remove tags.
 5. Install isolator junction box assembly A12. (WP 0220 00)
 6. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM A5 STARBOARD RECEPTACLE ASSEMBLY/
A6 PORT RECEPTACLE ASSEMBLY
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Adhesive (Item 2, WP 0426 00)

Personnel Required

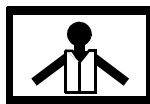
Engineer 88L

References

TM 55-1945-225-10

REMOVE A5 STARBOARD RECEPTACLE ASSEMBLY/A6 PORT RECEPTACLE ASSEMBLY

WARNING



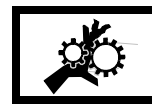
VEST



HELMET PROTECTION



HEAVY PARTS



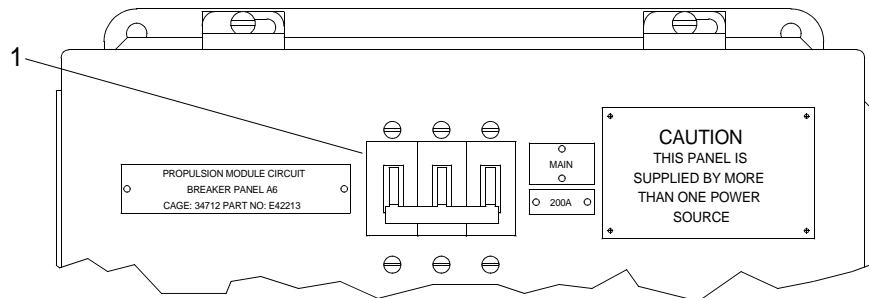
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

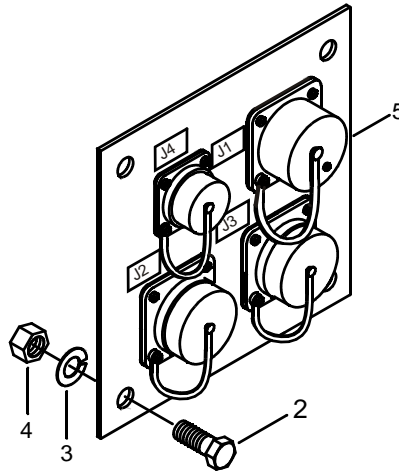
NOTE

This task is typical for the removal and installation of starboard and port receptacle assemblies A5/A6.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove hex head capscrews (2), lockwashers (3) and hex nuts (4) securing receptacle assembly (5) to mounting surface.



- Remove receptacle assembly (5).

INSTALL A5 STARBOARD RECEPTACLE/A6 PORT RECEPTACLE ASSEMBLIES

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to hex head capscrews (2).
- Position receptacle assembly (5) on mounting surface.
- Install hex head capscrews (2), lockwashers (3) and hex nuts (4) to secure receptacle assembly (5) on mounting surface. Tighten hex nuts (4).
- Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM A5 STARBOARD RECEPTACLE ASSEMBLY
3A5J1 RECEPTACLE/A6 PORT RECEPTACLE
ASSEMBLY 3A6J1 RECEPTACLE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Receptacle 3A5J1
 PN GTC020R28-7P
 Receptacle 3A6J1
 PN GTC020R28-7P
 Gasket
 PN E26978-2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)

Personnel Required

Engineer 88L

References

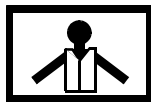
TM 55-1945-225-10

Equipment Condition

A5 Starboard Receptacle Assembly/A6 Port Receptacle Assembly Removed. (WP 0222 00)

REMOVE 3A5J1 RECEPTACLE/3A6J1 RECEPTACLE

WARNING

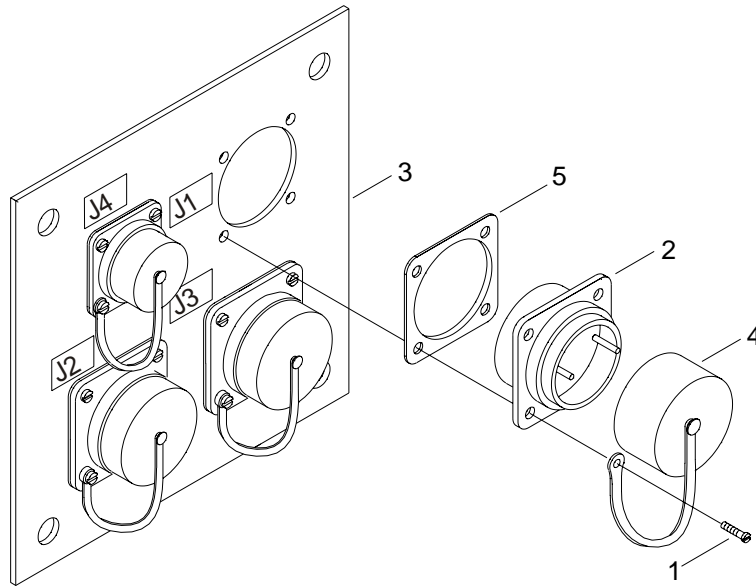
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for the replacement of the 3A5J1 and 3A6J1 receptacles.

1. Remove pan head screws (1) securing receptacle (2) to mounting plate (3).

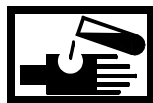


2. Tag and disconnect electrical wiring to receptacle (2).
3. Remove receptacle (2) with cap (4) and gasket (5).
4. Discard receptacle (2) and gasket (5).

INSTALL 3A5J1 RECEPTACLE/3A6J1 RECEPTACLE

1. Connect electrical wiring to new receptacle (2) and remove tags.
2. Position receptacle (2), cap (4) and new gasket (5) on the mounting plate (3).

WARNING



CHEMICAL



EYE PROTECTION

3. Apply sealing compound to pan head screws (1).
4. Install pan head screws (1) and tighten.
5. Install A5 starboard receptacle assembly/A6 port receptacle assembly. (WP 0222 00)
6. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM A5 STARBOARD RECEPTACLE ASSEMBLY
3A5J4 RECEPTACLE/A6 PORT RECEPTACLE
ASSEMBLY 3A6J4 RECEPTACLE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Receptacle 3A5J4
 PN 208489-1
 Receptacle 3A6J4
 PN 208489-1
 Gasket
 PN E26978-1
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)

Personnel Required

Engineer 88L

References

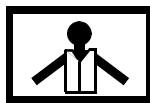
TM 55-1945-225-10

Equipment Condition

A5 Starboard Receptacle Assembly/A6 Port Receptacle Assembly Removed. (WP 0222 00)

REMOVE 3A5J4 RECEPTACLE/3A6J4 RECEPTACLE

WARNING

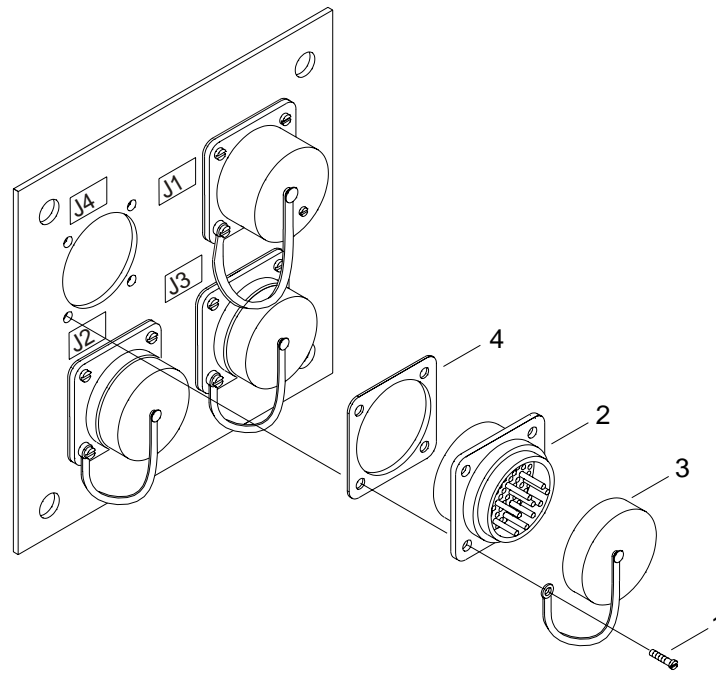
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for the replacement of the 3A5J4 and 3A6J4 receptacles.

1. Remove pan head screws (1).



2. Tag and disconnect electrical wiring from receptacle (2).
3. Remove receptacle (2) with cap (3) and gasket (4).
4. Discard receptacle (2) and gasket (4).

INSTALL 3A5J4 RECEPTACLE/3A6J4 RECEPTACLE

1. Connect electrical wiring to new receptacle (2) and remove tags.
2. Position new receptacle (2), cap (3) and new gasket (4) on the mounting surface.

WARNING



CHEMICAL



EYE PROTECTION

3. Apply sealing compound to pan head screws (1).
4. Install pan head screws (1). Tighten pan head screws (1).
5. Install A5 starboard receptacle assembly/A6 port receptacle assembly. (WP 0222 00)
6. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM A5 STARBOARD RECEPTACLE ASSEMBLY
3A5J2 RECEPTACLE/A6 PORT RECEPTACLE
ASSEMBLY 3A6J2 RECEPTACLE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Receptacle 3A5J2
 PN 208473-1
 Receptacle 3A6J2
 PN 208473-1
 Gasket
 PN E26978-2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)

Personnel Required

Engineer 88L

References

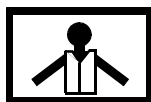
TM 55-1945-225-10

Equipment Condition

A5 Starboard Receptacle Assembly/A6 Port Receptacle Assembly Removed. (WP 0222 00)

REMOVE 3A5J2 RECEPTACLE/3A6J2 RECEPTACLE

WARNING

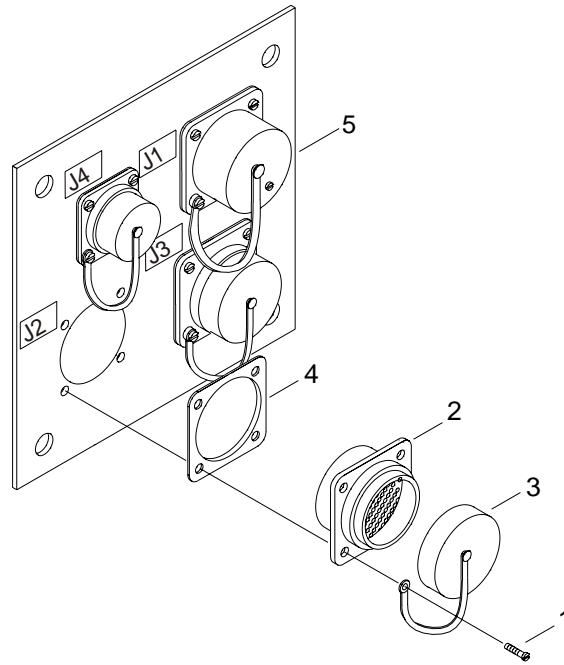
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for the replacement of the 3A5J2 and 3A6J2 receptacles.

1. Remove pan head screws (1).



2. Tag and disconnect electrical wiring from receptacle (2).
3. Remove receptacle (2) with cap (3) and gasket (4).
4. Discard receptacle (2) and gasket (4).

INSTALL 3A5J2 RECEPTACLE/3A6J2 RECEPTACLE

1. Connect electrical wiring to new receptacle (2) and remove tags.
2. Position new receptacle (2), cap (3) and new gasket (4) on the mounting surface.

WARNING



CHEMICAL



EYE PROTECTION

3. Apply sealing compound to pan head screws (1).
4. Install pan head screws (1). Tighten pan head screws (1).
5. Install A5 starboard receptacle assembly/A6 port receptacle assembly. (WP 0222 00)
6. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM A5 STARBOARD RECEPTACLE ASSEMBLY
3A5J3 RECEPTACLE/A6 PORT RECEPTACLE
ASSEMBLY 3A6J3 RECEPTACLE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Receptacle 3A5J3
 PN 208471-1
 Receptacle 3A6J3
 PN 208471-1
 Gasket
 PN E26978-2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)

Personnel Required

Engineer 88L

References

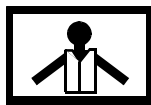
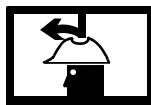
TM 55-1945-225-10

Equipment Condition

A5 Starboard Receptacle Assembly/A6 Port Receptacle Assembly Removed. (WP 0222 00)

REMOVE 3A5J3 RECEPTACLE/3A6J3 RECEPTACLE

WARNING

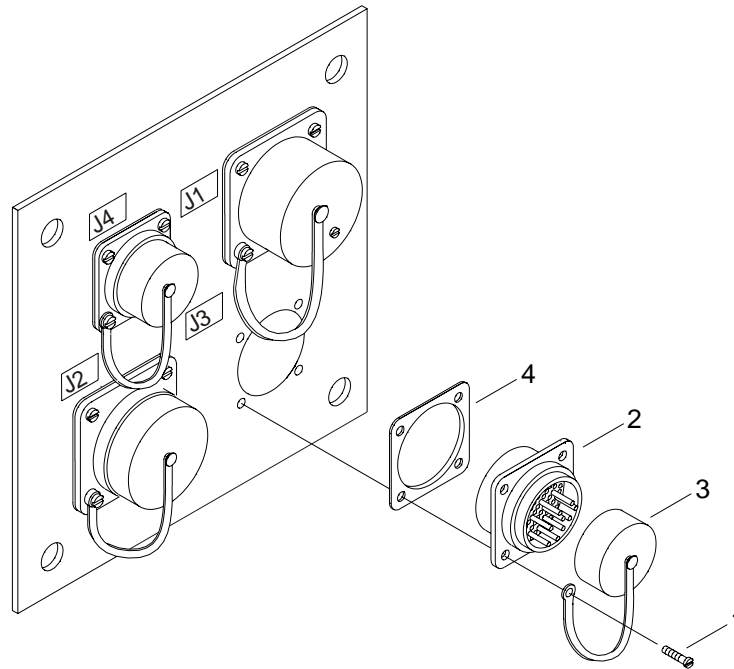
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for the replacement of the 3A5J3 and 3A6J3 receptacles.

1. Remove pan head screws (1).

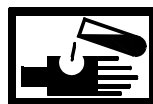


2. Tag and disconnect electrical wiring from receptacle (2).
3. Remove receptacle (2) with cap (3) and gasket (4).
4. Discard receptacle (2) and gasket (4).

INSTALL 3A5J3 RECEPTACLE/3A6J3 RECEPTACLE

1. Connect electrical wiring to new receptacle (2) and remove tags.
2. Position new receptacle (2), cap (3) and new gasket (4) on the mounting surface.

WARNING



CHEMICAL



EYE PROTECTION

3. Apply sealing compound to pan head screws (1).
4. Install pan head screws (1). Tighten pan head screws (1).
5. Install A5 starboard receptacle assembly/A6 port receptacle assembly. (WP 0222 00)
6. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
EMERGENCY STEERING UNIT
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Life Preserver, Vest (Item 17, WP 0425 00)

Helmet, Safety (Blue) (Item 13, WP 0425 00)

Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

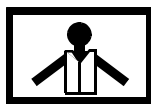
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

DISASSEMBLE EMERGENCY STEERING UNIT

WARNING



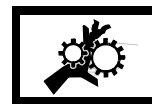
VEST



HELMET PROTECTION



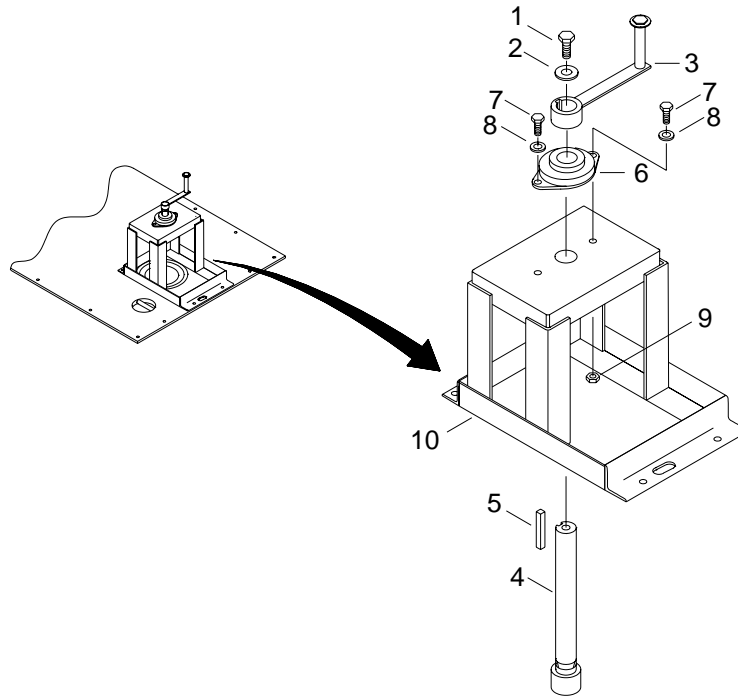
HEAVY PARTS



MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

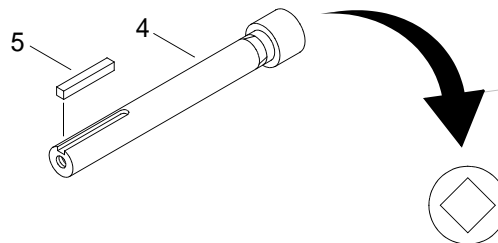
1. Remove hex head bolt (1) and washer (2) from handle assembly (3).



2. Remove handle assembly (3) from shaft (4).
3. Remove woodruff key (5) from shaft (4).
4. Slide shaft (4) from flange bearing (6).
5. Remove two hex head bolts (7), flat washers (8) and hex nuts (9) securing flange bearing (6) to support (10).
6. Remove flange bearing (6) from support (10).

INSPECT EMERGENCY STEERING UNIT

1. Inspect flange bearing (6) for looseness or wear. Replace as necessary.
2. Inspect handle assembly (3) for wear and serviceability. Replace as necessary.
3. Inspect shaft (4) for cracks and wear on either end that could cause slipping. Replace as necessary.



4. Inspect woodruff key (5) for wear. Replace as necessary.

ASSEMBLE EMERGENCY STEERING UNIT

1. Install flange bearing (6) on support (10).
2. Install two hex head bolts (7), flat washers (8) and hex nuts (9) to secure flange bearing (6) to support (10).
3. Tighten nuts (9).
4. Slide shaft (4) through flange bearing (6).
5. Install woodruff key (5) on shaft (4).
6. Install handle assembly (3) on shaft (4).
7. Install hex head bolt (1) and washer (2) on handle assembly (3).
8. Tighten bolt (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
EMERGENCY STEERING ADAPTOR
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

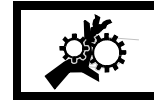
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

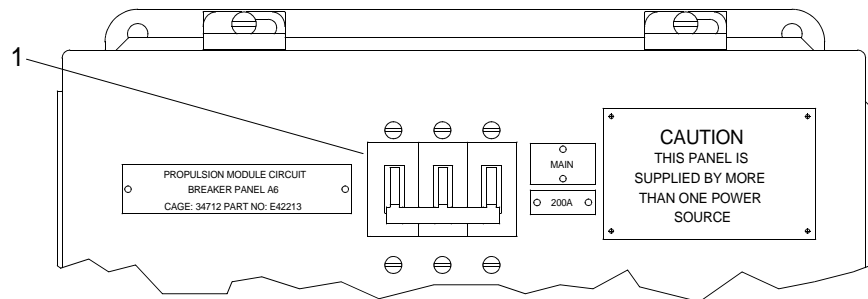
REMOVE EMERGENCY STEERING ADAPTOR

WARNING

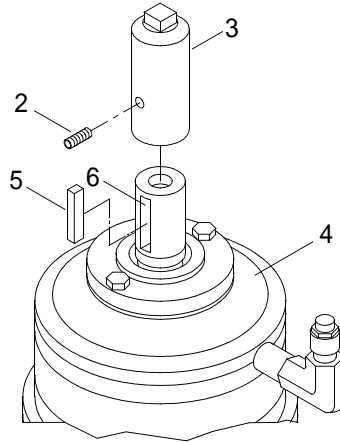
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



-
2. Remove and retain set screw (2) securing slide adaptor (3) to auxiliary planetary gearbox (4).



3. Remove slide adaptor (3) from auxiliary planetary gearbox (4).
4. Remove and retain key (5).

INSTALL EMERGENCY STEERING ADAPTOR

1. Position key (5) into auxiliary planetary gearbox reducer shaft (6).
2. Install slide adaptor (3) onto shaft (6).
3. Secure slide adaptor (3) with set screw (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PROPULSION MODULE FUEL/OIL COMPARTMENT GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Scraper, Ship (Copper Alloy) (Item 23, WP 0425 00)

Materials/Parts

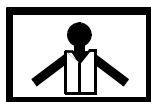
Gasket
 PN E13728
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

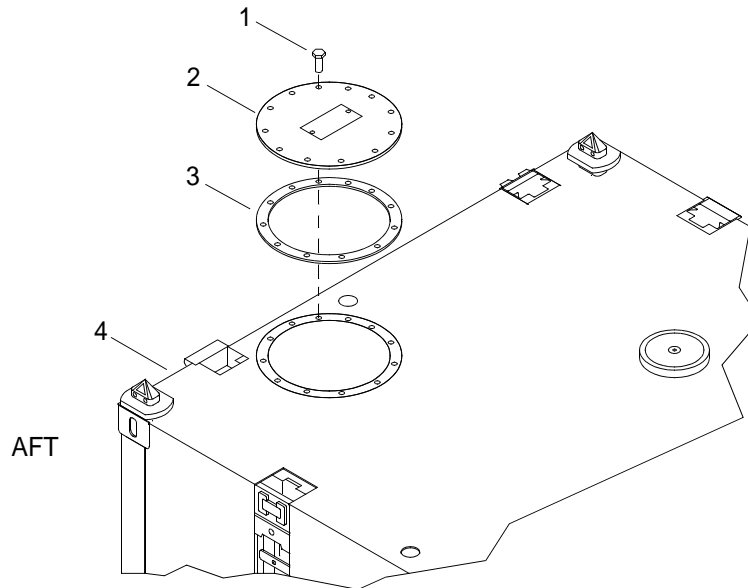
REMOVE PROPULSION MODULE FUEL/OIL COMPARTMENT GASKET

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove hex head capscrews (1).



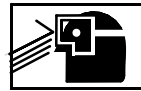
2. Remove hatch cover plate (2).
3. Remove gasket (3) from module (4).
4. Discard gasket (3).

INSTALL PROPULSION MODULE FUEL/OIL COMPARTMENT GASKET

WARNING



CHEMICAL



EYE PROTECTION

1. Using scraper and cleaner, remove gasket residue from module (4) and hatch cover plate (2).

WARNING



CHEMICAL



EYE PROTECTION

2. Using rag and cleaner, wipe all cover plate surfaces clean.
3. Position new gasket (3) on module (4).
4. Position hatch cover plate (2) over gasket (3) on module (4).
5. Install hex head capscrews (1) through cover plate (2) and gasket (3) into module (4).
6. Tighten hex head capscrews (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
NON-POWERED MODULE
MARINE GROWTH REMOVAL**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Hose Assembly, Nonmetallic (Item 15, WP 0425 00)
 Blast Cleaning Machine (Item 7, WP 0425 00)
 Scraper, Ship (Copper Alloy) (Item 23, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Seaman 88K

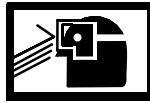
Equipment Condition

Non-Powered Module Dry-docked.

REMOVE NON-POWERED MODULE MARINE GROWTH

1. Connect hose to power washer.

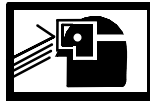
WARNING



EYE PROTECTION

2. Remove marine growth using a scraper.

WARNING



EYE PROTECTION

3. Remove marine growth debris from the surface of the module using a hose with directed water spray.

WARNING



EYE PROTECTION

4. Remove marine growth from male and female connectors in both the extended and retracted position using a hose with directed water spray.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
NON-POWERED MODULE
CLEANING AND PAINTING**

INITIAL SETUP:**Tools**

Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Scraper, Ship (Copper Alloy) (Item 23, WP 0425 00)
Drill, Electric, Portable, (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Brush, Paint (Item 4, WP 0426 00)
Roller Kit, Paint (Item 31, WP 0426 00)
Paint, Sherwin Williams (Item 26, WP 0426 00)
Paint, Sherwin Williams (Item 25, WP 0426 00)
Reducer (Item 30, WP 0426 00)
Paper, Abrasive (Item 27, WP 0426 00)
Tape, Pressure Sensitive Adhesive (Item 45, WP 0426 00)
Cloth, Cleaning (Item 7, WP 0426 00)
Disk, Abrasive, 240 grit (Item 9, WP 0426 00)

Personnel Required

Seaman 88K

References

SSPC SP-10
DOD-PRF-24648
MIL-PRF-23236

Equipment Condition

Non-Powered Module Dry-docked.
Non-Powered Module Marine Growth Removed. (WP 0230 00)

PREPARE AND CLEAN NON-POWERED MODULE FOR PAINTING

 WARNING



EYE PROTECTION



VAPOR

NOTE

This task is typical for spot painting of module exteriors. Preparation procedures are in accordance with Steel Structures Painting Council, SP-10 Hand Tool Cleaning (SSPC SP-10). These coatings are approved in accordance with DOD-PRF-24648 and MIL-PRF-23236.

The following steps will be performed prior to module surface painting. Upon completion of rust and paint removal the surface finish shall be free of all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter.

1. Remove all oil, dust, grease, dirt, loose rust and other foreign matter by use of portable electric drill and sanding disks, hand scraping, hand sanding or a combination of these methods.
2. Using fresh water and clean lint-free cloth, wipe area clean and allow to air dry in preparation for painting.

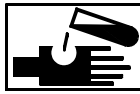
PAINT EXTERIOR NON-POWERED MODULE STEEL SURFACES

1. Mask off areas to be painted.

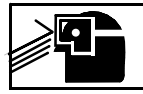
 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

NOTE

Inorganic zinc-rich coating comes in two pre-measured containers which, when mixed with water, provides four gallons of ready-to-apply material.

Application temperature range limits are 40° - 100°F.

No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

2. Mix two-part water based inorganic zinc-rich coating in accordance with manufacturers instructions.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

3. Using brush, apply mixed water based inorganic zinc-rich coating in accordance with manufacturers instructions.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

- Clean up any spills and splatters immediately with reducer and warm fresh water.

NOTE

Cold temperatures or high humidity will retard drying time.

- Allow coating to cure, approximately 2 hours at 77°F, prior to placing in service.
- Remove masking tape from masked off areas.

**APPLY NON-SKID DECK COATING TO EXTERIOR STEEL NON-POWERED
MODULE SURFACES**

- Mask off area to coated.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

 CAUTION

Do not apply anti-skid coating to air test plug ports, lift castings and shackles and connector castings, damage to equipment will occur.

NOTE

Application temperature range limits are 40° - 120°F.

No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

- Using nylon roller, paint tray and brush, apply one coat of Amercoat 385 AS anti-skid coating to deck surface.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



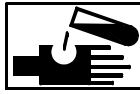
VAPOR

- Back roll each coat while wet at a 90° angle to evenly spread the texture.

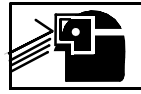
 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

4. Clean up any spills and splatters immediately with reducer and warm fresh water.

NOTE

Cold temperatures or high humidity will retard drying time.

5. Allow to dry tack free, approximately 3 hours at 70°F.

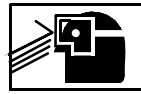
 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

 CAUTION

Do not apply anti-skid coating to air test plug ports, lift castings, shackles and connector castings, damage to equipment will occur.

NOTE

Application temperature range limits are 40° - 120°F. No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

6. Apply a second coat of anti-skid coating, after the first coat is completely tack free.

NOTE

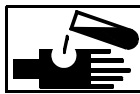
Cold temperatures or high humidity will retard drying time.

7. Allow anti-skid coating to dry 96 hours before heavy traffic or equipment is used on it.

 WARNING



POISON



CHEMICAL



EYE PROTECTION



VAPOR

8. Clean up any spills and splatters immediately with reducer and warm fresh water.

PAINT NON-POWERED MODULE DECK CLEATS, D-RINGS, GUILLOTINE CONNECTORS AND FLEXOR ASSEMBLIES

CAUTION

Do not prime or paint rubber surfaces of flexor assemblies. Failure to comply will result in damage to equipment.

1. Mask off areas to be painted.

WARNING

**POISON****CHEMICAL****EYE PROTECTION****VAPOR****NOTE**

Inorganic zinc-rich coating comes in two pre-measured containers which, when mixed with water, provides four gallons of ready-to-apply material.

Application temperature range limits are 40° - 100°F.

No coating should be done if the surface is likely to be damaged by rain, fog, dew or dust, etc., during the drying period.

2. Mix water based inorganic zinc-rich coating in accordance with manufacturers instructions.

WARNING

**POISON****CHEMICAL****EYE PROTECTION****VAPOR**

3. Using brush, apply water based inorganic zinc-rich coating in accordance with manufacturers instructions.

WARNING

**POISON****CHEMICAL****EYE PROTECTION****VAPOR**

4. Clean up any spills and splatters immediately with soap and warm fresh water.

NOTE

Cold temperatures or high humidity will retard drying time.

5. Allow coating to cure, approximately 2 hours at 77°F, prior to placing in service.
6. Remove masking tape from masked off areas.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
NON-POWERED MODULE ZINC ANODE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Seaman 88K

Equipment Condition

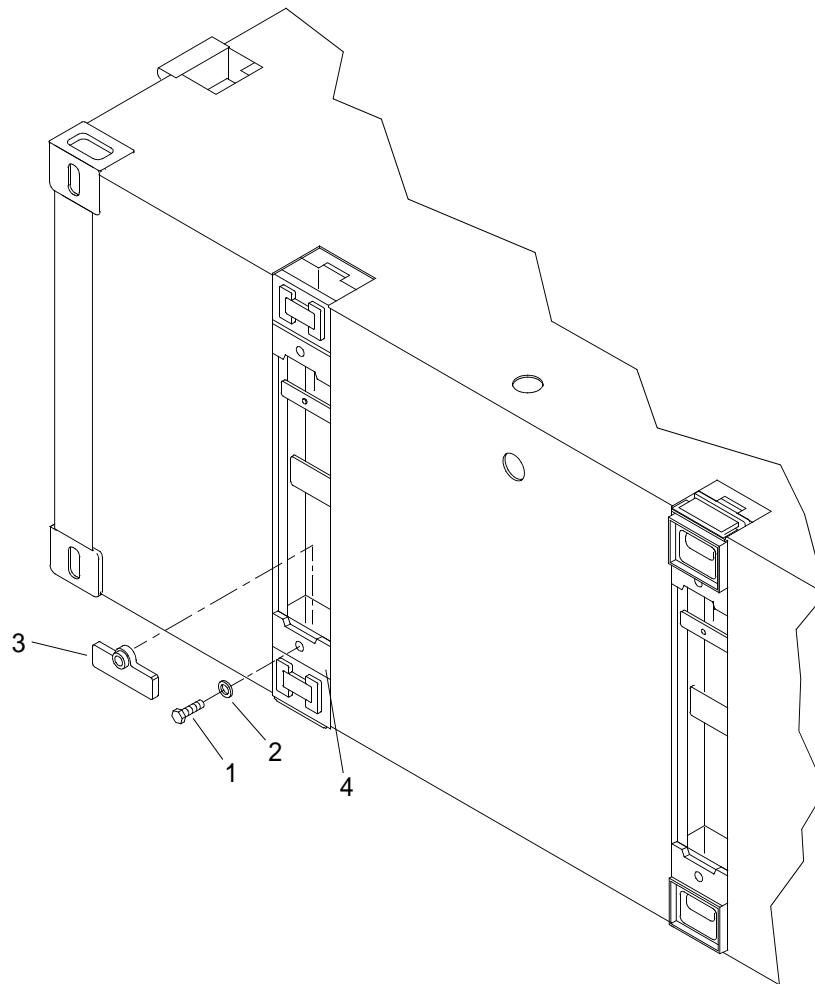
Non-Powered Module Dry-docked.

Module Strings Disassembled. (TM 55-1945-225-10)

REMOVE NON-POWERED MODULE ZINC ANODE**NOTE**

The zinc anodes are located at the base of each non-powered guillotine interconnect. This task is typical for the replacement of all non-powered module zinc anodes.

1. Remove hex head capscrew (1) and flat washer (2) from zinc anode threaded insert (3).



2. Remove zinc anode from guillotine interconnect (4).
3. Discard zinc anode (3).

INSTALL NON-POWERED MODULE ZINC ANODES

1. Position new zinc anode (3) in guillotine interconnect (4).
2. Install washer (2) and hex head capscrew (1) to secure zinc anode (3) to guillotine interconnect (4).
3. Tighten hex head capscrew (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
NON-POWERED MODULE
INSPECTION FOR WATER**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Dispensing Pump, Hand Driven (Item 4, WP 0425 00)
Socket Wrench Set (3/4 sq dr) (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Antiseize Compound (Item 3, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

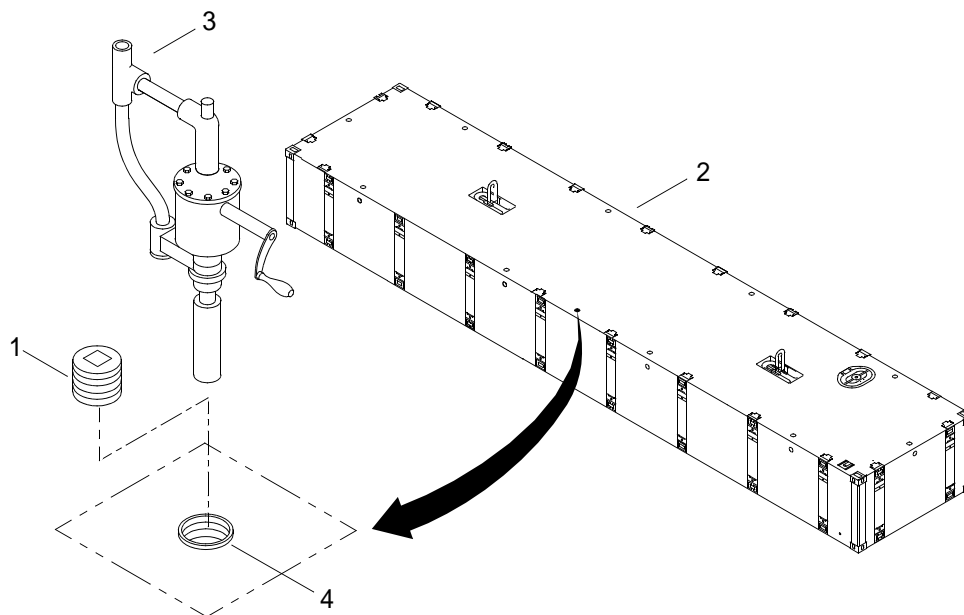
Seaman 88K

Equipment Condition

Non-Powered Modules Dry-docked.

INSPECT NON-POWERED MODULE FOR WATER**INSPECT AND DRAIN 40 FT CENTER MODULE**

1. Using 3/4 in. socket wrench, remove two machine plugs (1) from top of 40 ft module (2).



2. Open scuttle in forward lazaret.

-
3. Determine if water is present in 40 ft module (2).
 - a. If water is not present, perform step 3 through 5.
 - b. If water is present, proceed to step 6.

WARNING



CHEMICAL



EYE PROTECTION

4. Apply antiseize compound to threads of machine plugs (1).
5. Using 3/4 in. socket wrench, install plugs (1) into 40 ft module (2). Tighten machine plugs (1).

WARNING



CHEMICAL



EYE PROTECTION

6. Using wiping rag, clean off excess antiseize compound.
7. Drain 40 ft module (2) of water.
 - a. Lower telescoping siphon of hand pump (3) through hole (4) in top of 40 ft module (2).
 - b. Operate hand pump (3) to remove water.
 - c. Pressure test 40 ft module (2). (WP 0234 00)

WARNING



CHEMICAL

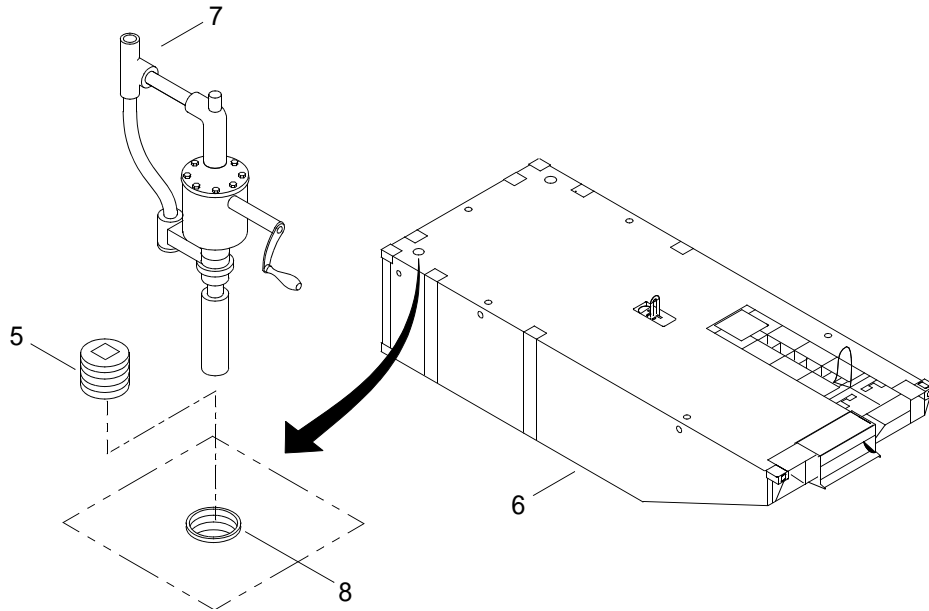


EYE PROTECTION

8. Dispose of contaminated wiping rags per local procedures.

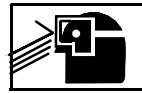
INSPECT AND DRAIN 20 FT LEFT AND RIGHT END RAKE MODULES

1. Using 3/4 in. socket wrench, remove machine plug (5) from top of left/right end rake module (6).



2. Determine if water is present in left/right end rake module (6).
 - a. If water is not present, perform step 3 through 5.
 - b. If water is present, proceed to step 6.

WARNING

**CHEMICAL****EYE PROTECTION**

3. Apply antiseize compound to threads of machine plug (5).
4. Using 3/4 in. socket wrench, install plug (5) into left/right end rake module (6). Tighten machine plugs (5).

WARNING

**CHEMICAL****EYE PROTECTION**

5. Using wiping rag, clean off excess antiseize compound.

6. Drain left/right end rake module (6) of water.
 - a. Lower telescoping siphon of hand pump (7) through hole (8) in top of left/right end rake module (6).
 - b. Operate hand pump (7) to remove water.
 - c. Pressure test left/right end rake module (6). (WP 0234 00)

WARNING



CHEMICAL

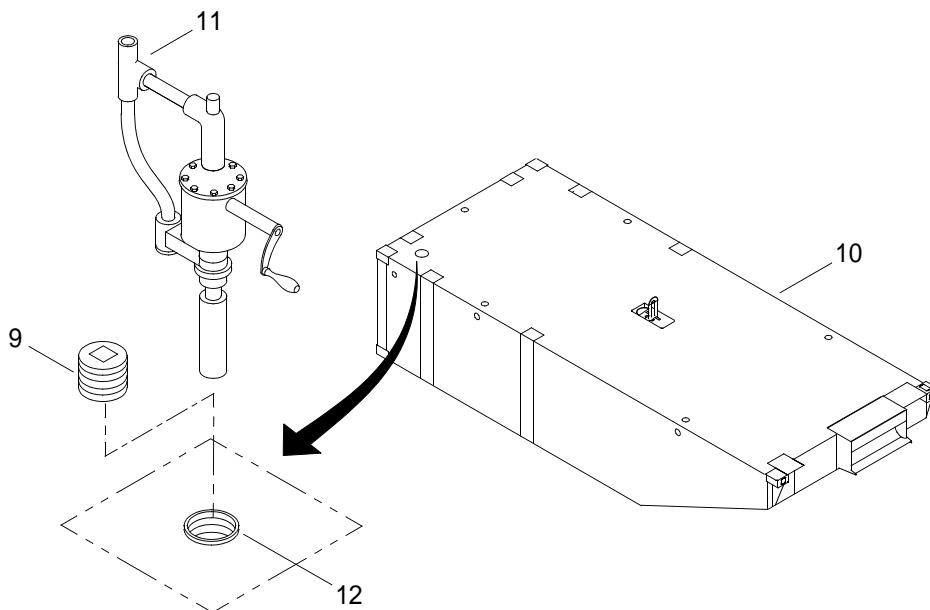


EYE PROTECTION

7. Dispose of contaminated wiping rags per local procedures.

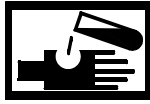
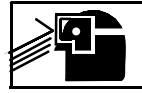
INSPECT AND DRAIN 20 FT CENTER END RAKE MODULE AND 20 FT CENTER END RAKE MODULE WITH STERN ANCHOR

1. Using 3/4 in. socket wrench, remove machine plug (9) from center end rake module (10).



2. Determine if water is present in center end rake module (10).
 - a. If water is not present, perform step 3 through 5.
 - b. If water is present, proceed to step 6.

WARNING

**CHEMICAL****EYE PROTECTION**

3. Apply antiseize compound to threads of machine plug (9).
4. Using 3/4 in. socket wrench, install plugs (9) into center end rake module (10). Tighten machine plug (9).

WARNING

**CHEMICAL****EYE PROTECTION**

5. Using wiping rag, clean off excess antiseize compound.
6. Drain center end rake module (10) of water.
 - a. Lower telescoping siphon of hand pump (11) through hole (12) in top of center end rake module (10).
 - b. Operate hand pump (11) to remove water.
 - c. Pressure test center end rake section (10). (WP 0234 00)

WARNING

**CHEMICAL****EYE PROTECTION**

7. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
NON-POWERED MODULE
PRESSURE TEST**

INITIAL SETUP:**Test Equipment**

Test Set, Compartment Air (Item 32, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Wrench Set, Socket ($\frac{3}{4}$ sqdr) (Item 4, WP 0425 00)

Compressor, Unit, Reciprocating, Power Drive (Item 8, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Antiseize Compound (Item 3, WP 0426 00)

Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 5-805-7

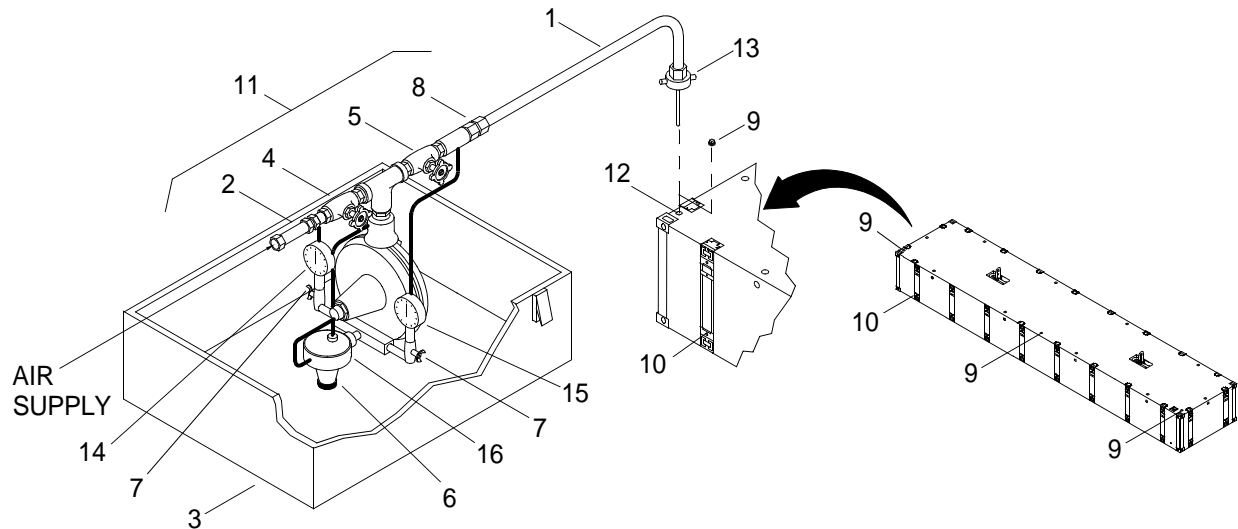
Equipment Condition

Warping Tug Modules Dry-docked.

PRESSURE TEST NON-POWERED MODULE**PRESSURE TEST 40 FT CENTER MODULE****NOTE**

The center module is divided into two airtight sections and the watertight stowage area.
Pressure test must be performed at all three drain plug locations.

1. Remove sensing line (1) and charging line extension hose (2) from storage box (3).



2. Verify inlet and outlet valves (4, 5), pressure knob (6) and both gage petcocks (7) are closed.
3. Connect sensing line (1) to outlet coupling fitting (8).
4. Using breaker bar, remove pipe plug (9) from one of three locations at side of center module (10).
5. Position test set (11) on center module (10).
6. Install test set sensing line (1) into center module (10) through chosen pipe plug opening (12).
7. Using pipe to hose adaptors (13), as required, connect sensing line (1) to pipe plug opening (12).

WARNING



EYE PROTECTION

Do not operate air compressor without first reading operating manual. Failure to comply may result in injury or death to personnel.

8. Connect 100 PSI air supply to charging line extension hose (2) connector.
9. Rotate pressure knob (6) counterclockwise eight turns.
10. Open both gage petcocks (7).
11. Open air supply valve, applying input pressure.
12. Open inlet valve (4).

WARNING

**EXPLOSION**

Module pressure must be regulated to 2 PSI pressure. Higher pressures may cause explosion. Failure to comply may result in serious injury or death to personnel.

13. Observe input pressure gage (14) and rotate pressure knob (6) clockwise until gage reads 2 PSI.
14. When input pressure gage (14) is stable at 2 PSI, open outlet valve (5).
15. When output pressure gage (15) reads 2 PSI, close outlet valve (5).
16. Observe any pressure drop on output pressure gage (15).

CAUTION

Leaky joints must be sealed or welded before use. Water leaking into module structure may cause corrosion and metal deterioration.

17. Inspect all seams for evidence of leakage and mark observed leakage areas. Report any leakage to next higher maintenance level.
18. Seams must be welded watertight before proceeding with assembly for mission. (TM 5-805-7)
19. To hold pressure while isolating a leak, open outlet valve (5) to allow regulator (16) to control air loss at a rate dependent upon volume of module and rate of leakage.
20. To shut down test set (11), close air supply valve and remove charging line extension hose (2).
21. Remove sensing line (1) from pipe plug opening (12) and remove test set (11).

WARNING

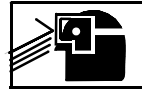
**CHEMICAL****EYE PROTECTION**

22. Apply antiseize compound on pipe plug (9) threads.
23. Using breaker bar, install pipe plug (9) in center module (10) and tighten.

 WARNING



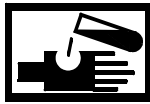
CHEMICAL



EYE PROTECTION

24. Using wiping rag, clean off excess antiseize compound.
25. Close inlet and outlet valves (4, 5), both gage petcocks (7) and rotate pressure knob (6) clockwise to end of travel.
26. Remove adaptor (13), if used, and stow in storage box (3).
27. Coil sensing line (1) and charging line extension hose (2) in storage box (3).

 WARNING



CHEMICAL



EYE PROTECTION

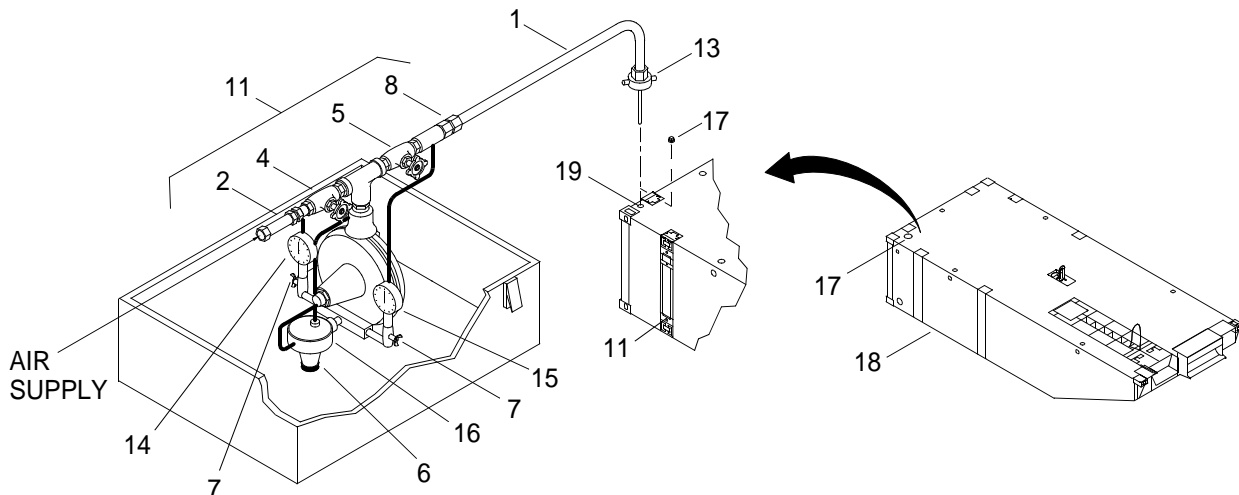
28. Dispose of contaminated wiping rags per local procedures.

PRESSURE TEST 20 FT RIGHT AND LEFT END RAKE MODULE

NOTE

The following procedure is typical for pressure testing all right and left end rake modules and for pipe plug location.

1. Remove sensing line (1) and charging line extension hose (2) from storage box (3).



2. Verify inlet and outlet valves (4, 5), pressure knob (6) and both gage petcocks (7) are closed.
3. Connect sensing line (1) to outlet coupling fitting (8).
4. Using breaker bar, remove pipe plug (17) from end rake module (18).

5. Position test set (11) on end rake module (18).
6. Install test set sensing line (1) into end rake module (18) through chosen pipe plug opening (19).
7. Using pipe to hose adaptors (13), as required, connect sensing line (1) to pipe plug opening (19).

WARNING



EYE PROTECTION

Do not operate air compressor without first reading operating manual. Failure to comply may result in injury or death to personnel.

8. Connect 100 PSI air supply to charging line extension hose (2).
9. Rotate set pressure knob (6) counterclockwise eight turns.
10. Open both gage petcocks (7).
11. Open air supply valve, applying input pressure.
12. Open inlet valve (4).

WARNING



EXPLOSION

Module pressure must be regulated to 2 PSI pressure. Higher pressures may cause explosion. Failure to comply may result in serious injury or death to personnel.

13. Observe input pressure gage (14) and rotate pressure knob (6) clockwise until gage reads 2 PSI.
14. When input pressure gage (14) is stable at 2 PSI, open outlet valve (5).
15. When output pressure gage (15) reads 2 PSI, close outlet valve (5).
16. Observe any pressure drop on output pressure gage (15).

CAUTION

Leaky joints must be sealed or welded before use. Water leaking into module structure may cause corrosion and metal deterioration.

17. Inspect all seams for evidence of leakage and mark observed leakage areas. Report any leakage to next higher maintenance level.
18. Seams must be welded watertight before proceeding with assembly for mission. (TM 5-805-7)

19. To hold pressure while isolating a leak, open outlet valve (5) to allow regulator (16) to control air loss at a rate dependent upon volume of module and rate of leakage.
20. To shut down test set (11), close air supply valve and remove charging line extension hose (2).
21. Remove sensing line (1) from pipe plug (19) opening and remove test set (11).

WARNING

**CHEMICAL****EYE PROTECTION**

22. Apply antiseize compound on plug (17) threads.
23. Using breaker bar, install plug (17) in end rake module (18) test location and tighten.

WARNING

**CHEMICAL****EYE PROTECTION**

24. Using wiping rag, clean off excess antiseize compound.
25. Close inlet and outlet (4, 5) valves, both gage petcocks (7) and rotate pressure knob (6) clockwise to end of travel.
26. Remove adaptor (13), if used, and stow in storage box (3).
27. Coil sensing line (1) and charging line extension hose (2) in storage box (3).

WARNING

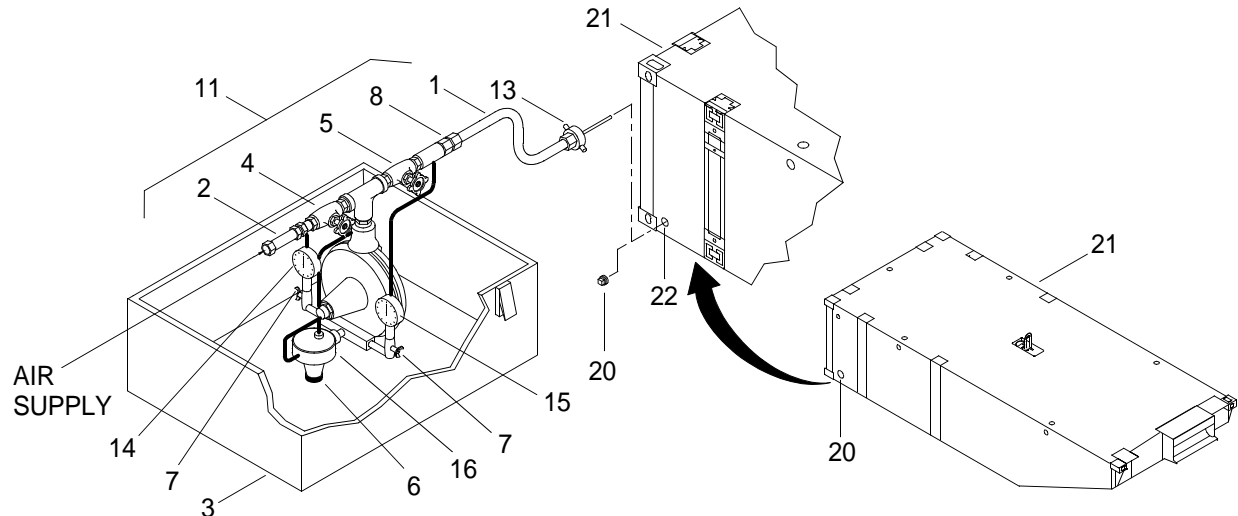
**CHEMICAL****EYE PROTECTION**

28. Dispose of contaminated wiping rags per local procedures.

PRESSURE TEST 20 FT CENTER END RAKE MODULE**NOTE**

The following procedure is typical for pressure testing all center end rake modules and for pipe plug location.

1. Remove sensing line (1) and charging line extension hose (2) from storage box (3).



2. Verify inlet and outlet valves (4, 5), pressure knob (6) and both gage petcocks (7) are closed.
3. Connect sensing line (1) to outlet coupling fitting (8).
4. Using breaker bar, remove pipe plug (20) from center end rake module (21).
5. Position test set (11) on center end rake module (21).
6. Install sensing line (1) into module (21) through chosen pipe plug (22) opening.
7. Using pipe to hose adaptors (13), as required, connect sensing line (1) to pipe plug (22) opening.

WARNING**EYE PROTECTION**

Do not operate air compressor without first reading operating manual. Failure to comply may result in injury or death to personnel.

8. Connect 100 PSI air supply to charging line extension hose (2) connector.
9. Rotate set pressure knob (6) counterclockwise eight turns.
10. Open both gage petcocks (7).
11. Open air supply valve, applying input pressure.

-
12. Open inlet valve (4).

WARNING



EXPLOSION

Module pressure must be regulated to 2 PSI pressure. Higher pressures may cause explosion. Failure to comply may result in serious injury or death to personnel.

13. Observe input pressure gage (14) and rotate pressure knob (6) clockwise until gage reads 2 PSI.
14. When input pressure gage (14) is stable at 2 PSI, open outlet valve (5).
15. When output pressure gage (15) reads 2 PSI, close outlet valve (5).
16. Observe any pressure drop on output pressure gage (15).

CAUTION

Leaky joints must be sealed or welded before use. Water leaking into module structure may cause corrosion and metal deterioration.

17. Inspect all seams for evidence of leakage and mark observed leakage areas. Report any leakage to next higher maintenance level.
18. Seams must be welded watertight before proceeding with assembly for mission. (TM 5-805-7)
19. To hold pressure while isolating a leak, open outlet valve (5) to allow regulator (16) to control air loss at a rate dependent upon volume of module and rate of leakage.
20. To shut down test set (11), close air supply valve and remove charging line extension hose (3).
21. Remove sensing line (1) from pipe plug (22) opening and remove test set (11).

WARNING



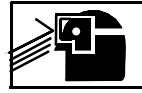
CHEMICAL



EYE PROTECTION

22. Apply antiseize compound on plug (20) threads.
23. Using breaker bar, install plug (21) in center end rake module (21) test location and tighten.

WARNING

**CHEMICAL****EYE PROTECTION**

24. Using wiping rag, clean off excess antiseize compound.
25. Close inlet and outlet (4, 5) valves, both gage petcocks (7) and rotate pressure knob (6) clockwise to end of travel.
26. Remove adaptor (13), if used, and stow in storage box (3).
27. Coil sensing line (1) and charging line extension hose (2) in storage box (3).

WARNING

**CHEMICAL****EYE PROTECTION**

28. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FLEXOR
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Shackle, 1 3/4 in. 40 Ton (Item 26, WP 0425 00)
 Crowbar (Item 4, WP 0425 00)
 Hammer, Hand, (10 lb Sledge) (Item 12, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Rope, Fibrous (Item 32, WP 0426 00)

Personnel Required

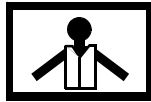
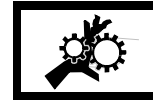
Seaman 88K (2)

References

TM 55-1945-225-10

REMOVE FLEXOR

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

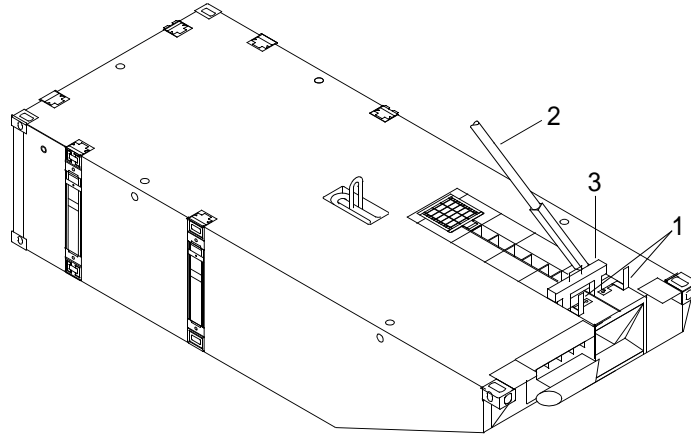
All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

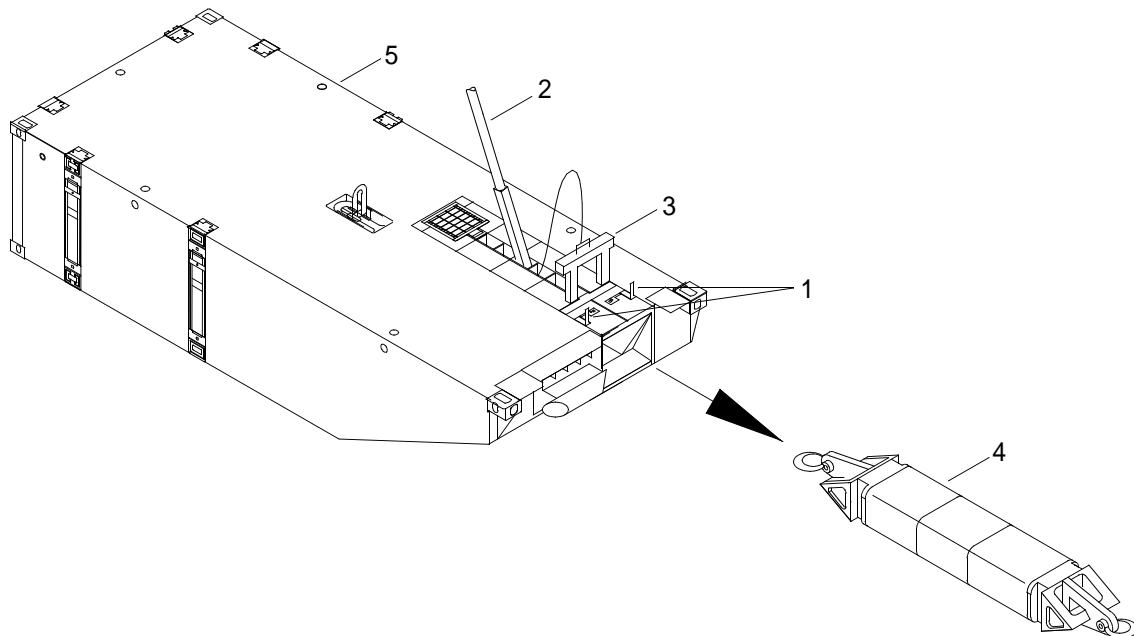
The flexor is stored in the aft left end rake module.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)

2. Rotate chute bolt handles (1) and pull chute bolts (1) to unlocked position.



3. Using a crowbar (2), lift guillotine plate (3) up from flexor connector slots.
4. Move flexor (4) forward using a crowbar (2).



WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

5. Using crane, sling and shackle, remove flexor (4) from end rake module (5).

INSTALL FLEXOR

1. Tie rope to inboard shackle of new flexor (4) and route rope through flexor well to assist with installing flexor (4) in left end rake module (5).

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

2. While assistant pulls on rope, use crane, sling and shackle to install flexor (4) from end rake module (5).
3. Push flexor (4) backward completely using a crowbar (2).
4. Using sledgehammer, drive down guillotine (3) and rotate chute bolt handles (1) to locked position.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FLEXOR WELL CHUTE BOLT COVER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Cover, Bolt, Right
PN E38052
Cover, Bolt, Left
PN E38082
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

REMOVE FLEXOR WELL CHUTE BOLT COVER

WARNING



VEST

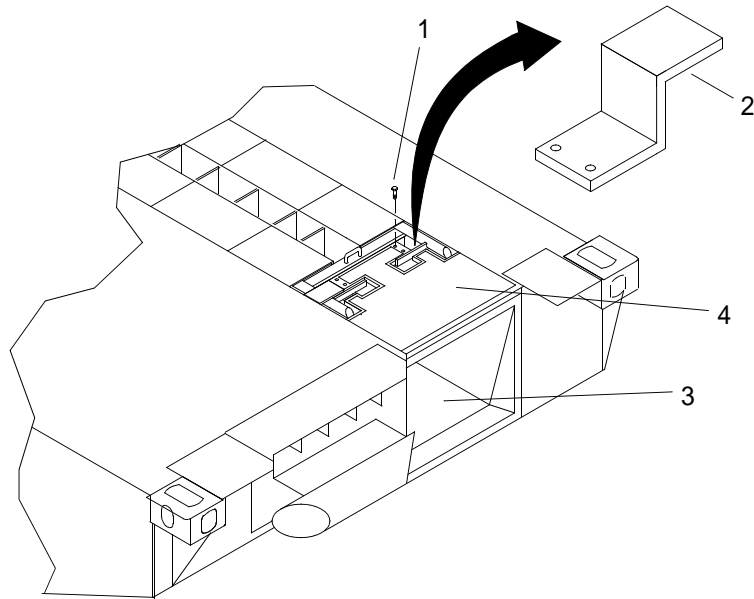
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death.

NOTE

This task is typical for the removal and installation of flexor well chute bolt covers.

The bolts securing the chute bolt cover to the flexor well are accessed through holes in the flexor well top plate.

1. Remove bolts (1) securing flexor well chute bolt cover (2) to flexor well (3).



2. Remove and discard flexor well chute bolt cover (2).

INSTALL FLEXOR WELL CHUTE BOLT COVER

1. Position new flexor well chute bolt cover (2) through opening in flexor well top plate (4).

WARNING



CHEMICAL



EYE PROTECTION

2. Apply coat of adhesive to threads of bolts (1).
3. Install bolts (1) to secure flexor well chute bolt cover (2) in flexor well (3). Tighten bolts (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FLEXOR WELL CHUTE BOLT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Receiver, Chute Bolt
PN E04842
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

REMOVE FLEXOR WELL CHUTE BOLT

WARNING



VEST

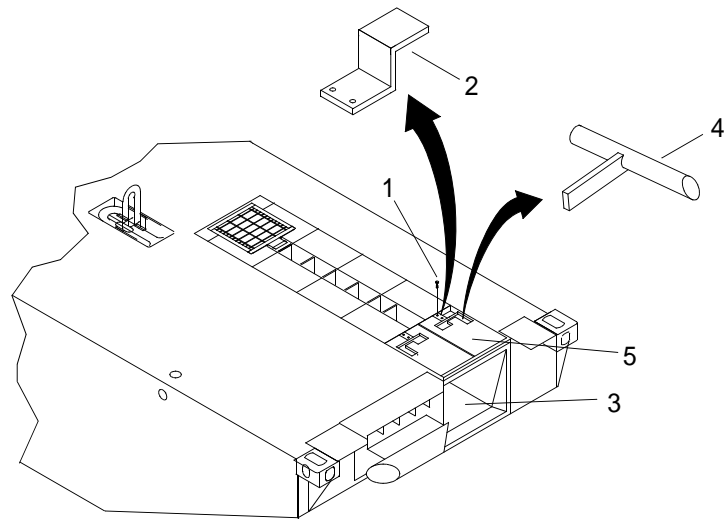
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death.

NOTE

This task is typical for the removal and installation of flexor well chute bolts.

The bolts securing the chute bolt cover are accessed through holes in the flexor well top plate.

1. Remove bolts (1) securing flexor well chute bolt cover (2) to flexor well (3).



2. Remove flexor well chute bolt cover (2) from flexor well (3).
3. Remove flexor well chute bolt (4) from inside flexor well (3) and discard.

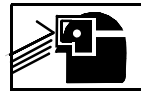
INSTALL FLEXOR WELL CHUTE BOLT

1. Position new flexor well chute bolt (4) into flexor well (3).

WARNING



CHEMICAL



EYE PROTECTION

2. Apply coat of adhesive to threads of bolts (1).
3. Position flexor well chute bolt cover (2) through opening of flexor well top cover (5).
4. Install bolts (1) to secure flexor well chute bolt cover (2) in flexor well (3). Tighten bolts (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FLEXOR WELL HATCH ASSEMBLY
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Assembly, Hatch
 PN E26433
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

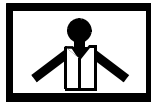
Engineer 88L

Equipment Condition

A-Frame Disassembled (If Required). (WP 0370 00)

REMOVE FLEXOR WELL HATCH ASSEMBLY

WARNING



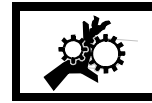
VEST



HELMET PROTECTION



HEAVY PARTS



MOVING PARTS

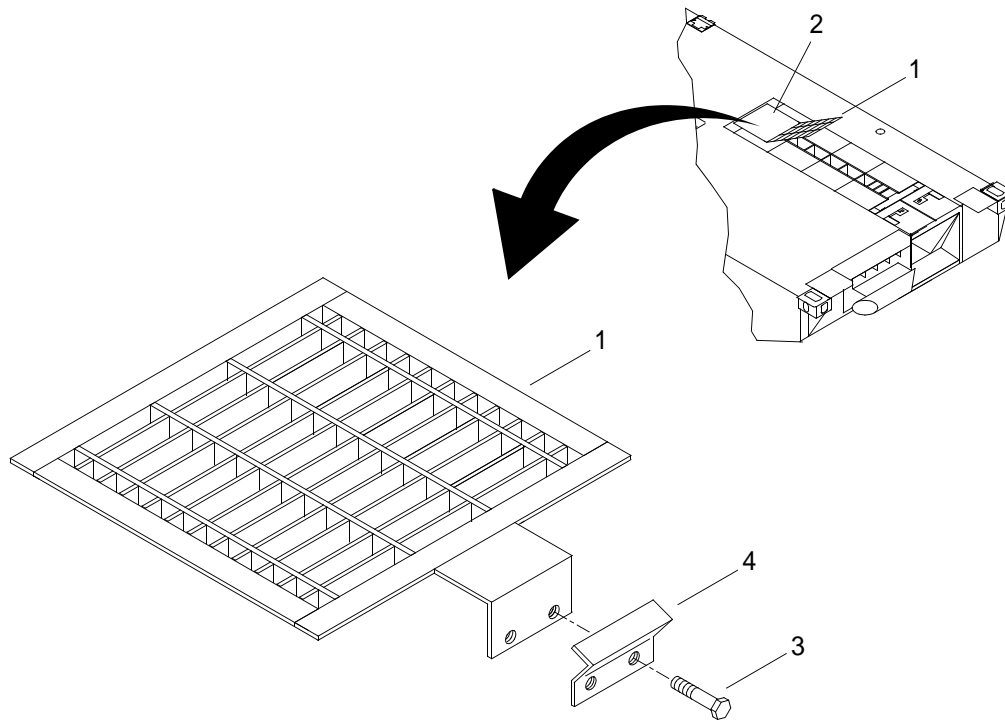
All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for the removal and installation of flexor well hatch assemblies.

The nuts on the hatch assembly are welded in place.

1. Pivot hatch assembly (1) off flexor well (2).



2. Remove bolts (3) securing hinge (4) to hatch assembly (1) inside flexor well (2).
3. Remove hatch assembly (1) and hinge (4) from flexor well (2) and discard.

INSTALL FLEXOR WELL HATCH ASSEMBLY

1. Position new hinge (4) and hatch assembly (1) on flexor well (2).
2. Install bolts (3) to secure hinge (4) to hatch assembly (1) on flexor well (2). Tighten bolts (3).
3. Close hatch assembly (1) on flexor well (2).
4. Assemble A-frame. (WP 0370 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB ACCESS PANEL
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Seaman 88K

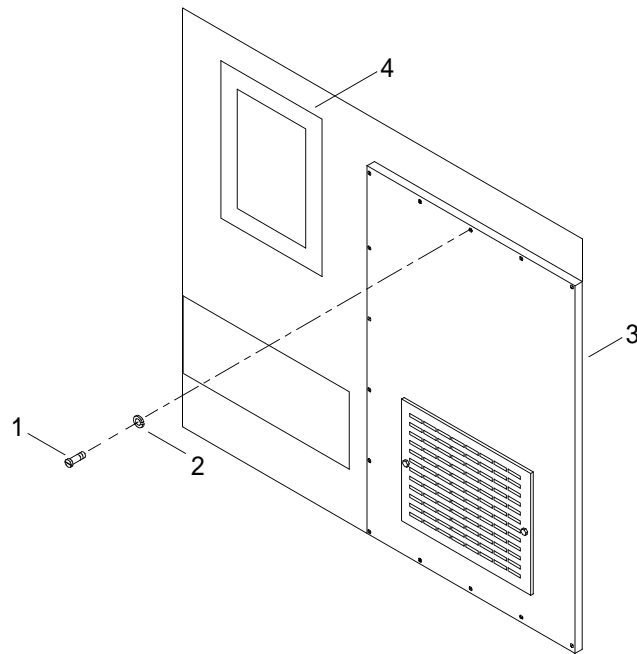
REMOVE OPERATORS CAB ACCESS PANEL

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove pan head capscrews (1) and lockwashers (2) securing access panel (3) to front of operators cab control console (4).



2. Remove access panel (3) from front of operators cab control console (4).

INSTALL OPERATORS CAB ACCESS PANEL

1. Position access panel (3) over opening on front of operators cab control console (4).
2. Install pan head capscrews (1) and lockwashers (2) to secure access panel (3) to front of operators cab control console (4). Tighten pan head capscrews (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB AIR INTAKE LOUVER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

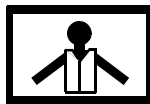
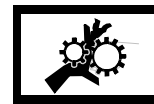
Louver
 PN E47278
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L (2)

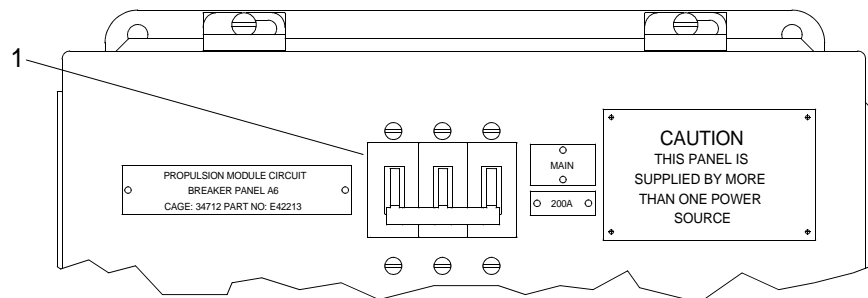
REMOVE OPERATORS CAB AIR INTAKE LOUVER

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

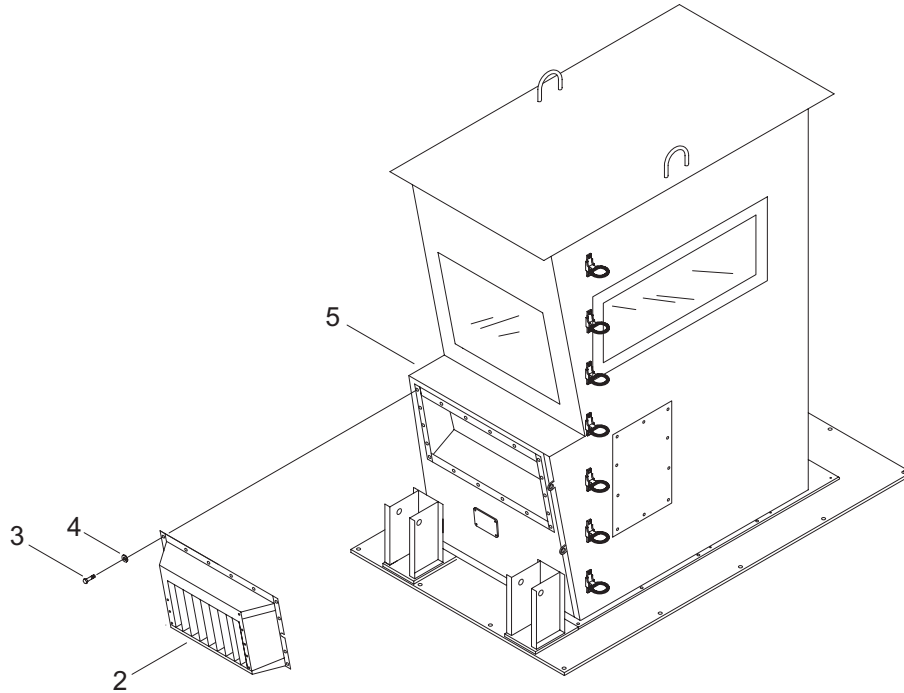
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



NOTE

The left and right center side screws are not removed during removal of the louver. Cutout slots in the center sides identify these locations. These two screws are used to hold the air intake weldment in place.

2. While assistant holds louver (2) in place, remove hex head capscrews (3) and lockwashers (4) securing louver (2) to front of operators cab (5).



3. Using assistant, remove louver (2) from operators cab (5).
4. Discard louver (2).

INSTALL OPERATORS CAB AIR INTAKE LOUVER

1. Using assistant, position new louver (2) into opening on front of operators cab (5).
2. Install hex head capscrews (3) and lockwashers (4) to secure louver (2) to front of operators cab (5). Tighten hex head capscrews (3).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB AIR INTAKE WELDMENT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Weldment, Air Intake
 PN E07202
 Splicing Sleeve, Oval
 PN E18728
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L (2)

References

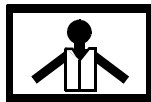
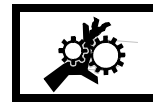
TM 55-1945-225-10

Equipment Condition

Operators Cab Air Intake Louver Removed. (WP 0240 00)

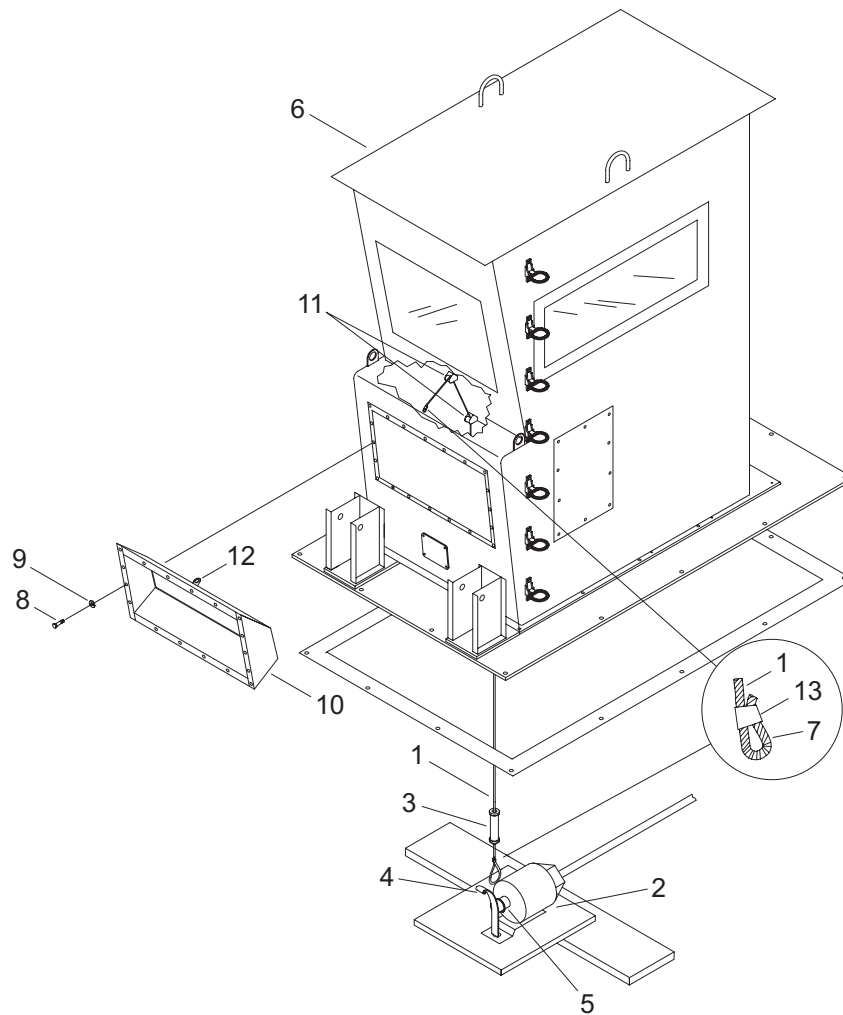
REMOVE OPERATORS CAB AIR INTAKE WELDMENT

WARNING

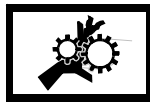
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove wire rope (1) from fire suppression trip mechanism (2).



WARNING

**MOVING PARTS**

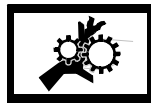
- a. Holding wire rope (1) by handle (3), pull fire suppression solenoid spring flange (4) away from solenoid shaft (5).
 - b. Slowly release tension on wire rope (1) until flapper inside operators cab (6) closes.
2. Using wire cutters, cut loop (7) off lower end of wire rope (1) and retain handle (3).
 3. Remove two hex head capscrews (8) and lockwashers (9) securing air intake weldment (10) to front of operators cab (6).
 4. Using assistant, remove air intake weldment (10) with attached wire rope (1) from front of operators cab (6), while guiding wire rope (1) over inside cable guides (11).

5. Using wire cutters, cut loop (7) off flapper bracket (12) near oval splicing sleeve (13) on air intake weldment (1).
6. Discard air intake weldment (10) and wire rope (1).

INSTALL OPERATORS CAB AIR INTAKE WELDMENT

1. Using crimping tool, create loop (7) in new wire rope (1) over flapper bracket (12) on air intake weldment (10) and secure with new oval splicing sleeve (13).
2. Using assistant, route wire rope (1) over cable guides (11) and position air intake weldment (10) into opening on front of operators cab (6).
3. Install two hex head capscrews (8) and lockwashers (9) to secure air intake weldment (10) on front of operators cab (6). Tighten hex head capscrews (8).
4. Slide handle (3) over lower end of wire rope (1).
5. Using crimping tool, create loop (7) on lower end of wire rope (1) and secure with new oval splicing sleeve (13).

WARNING



MOVING PARTS

6. While pulling down on handle (3), pull fire suppression solenoid spring flange (4) away from solenoid shaft (5) and slip lower loop (7) over solenoid shaft (5).
7. Release fire suppression solenoid spring flange (4) and tension on wire rope (1).
8. Install operators cab air intake louver. (WP 0240 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB AIR INTAKE WIRE ROPE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Crimping Tool, Terminal Hand (Item 5, WP 0425 00)

Materials/Parts

Splicing Sleeve, Oval
 PN E18728
 Qty 2
 Wire Rope
 PN E18738
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

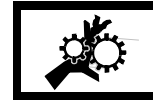
Engineer 88L

Equipment Condition

Operators Cab Air Intake Weldment Removed. (WP 0241 00)

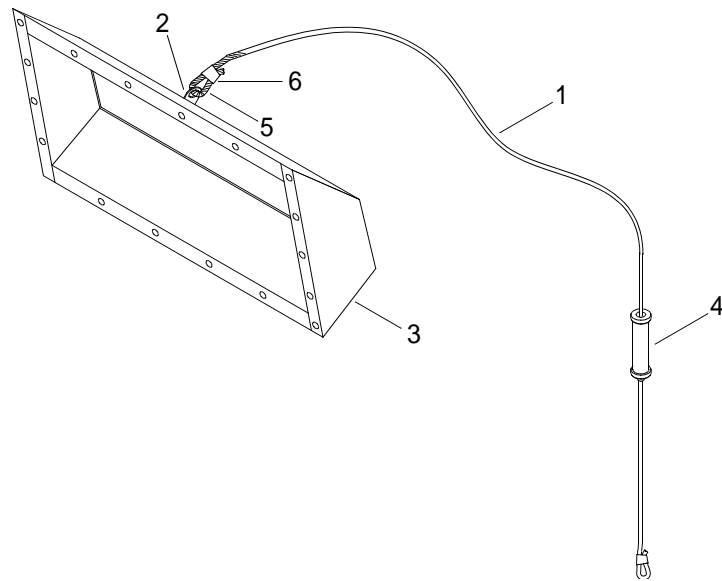
REMOVE OPERATORS CAB AIR INTAKE WIRE ROPE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Using wire cutters, cut wire rope (1) on flapper bracket (2) on air intake weldment (3).



2. Using wire cutters, cut loop off lower end of wire rope (1) and retain handle (4).
3. Discard wire rope (1).

INSTALL OPERATORS CAB INTAKE WIRE ROPE

1. Using crimping tool, create loop (5) in new wire rope (1) over flapper bracket (2) on air intake weldment (3) and secure with new oval splicing sleeve (6).
2. Slide handle (4) over lower end of wire rope (1).
3. Using crimping tool, create loop (5) on lower end of wire rope (1) and secure with new oval splicing sleeve (6).
4. Install operators cab air intake weldment. (WP 0241 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB DEFROSTER VALVES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Valve, Needle
 PN E19018-2 (0.38 NPT)
 Qty 2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

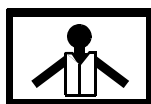
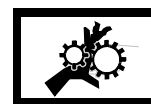
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Operators Cab Defroster Outlet Water Hose Removed. (WP 0245 00)
 Operators Cab Defroster Inlet Water Hose Removed. (WP 0246 00)

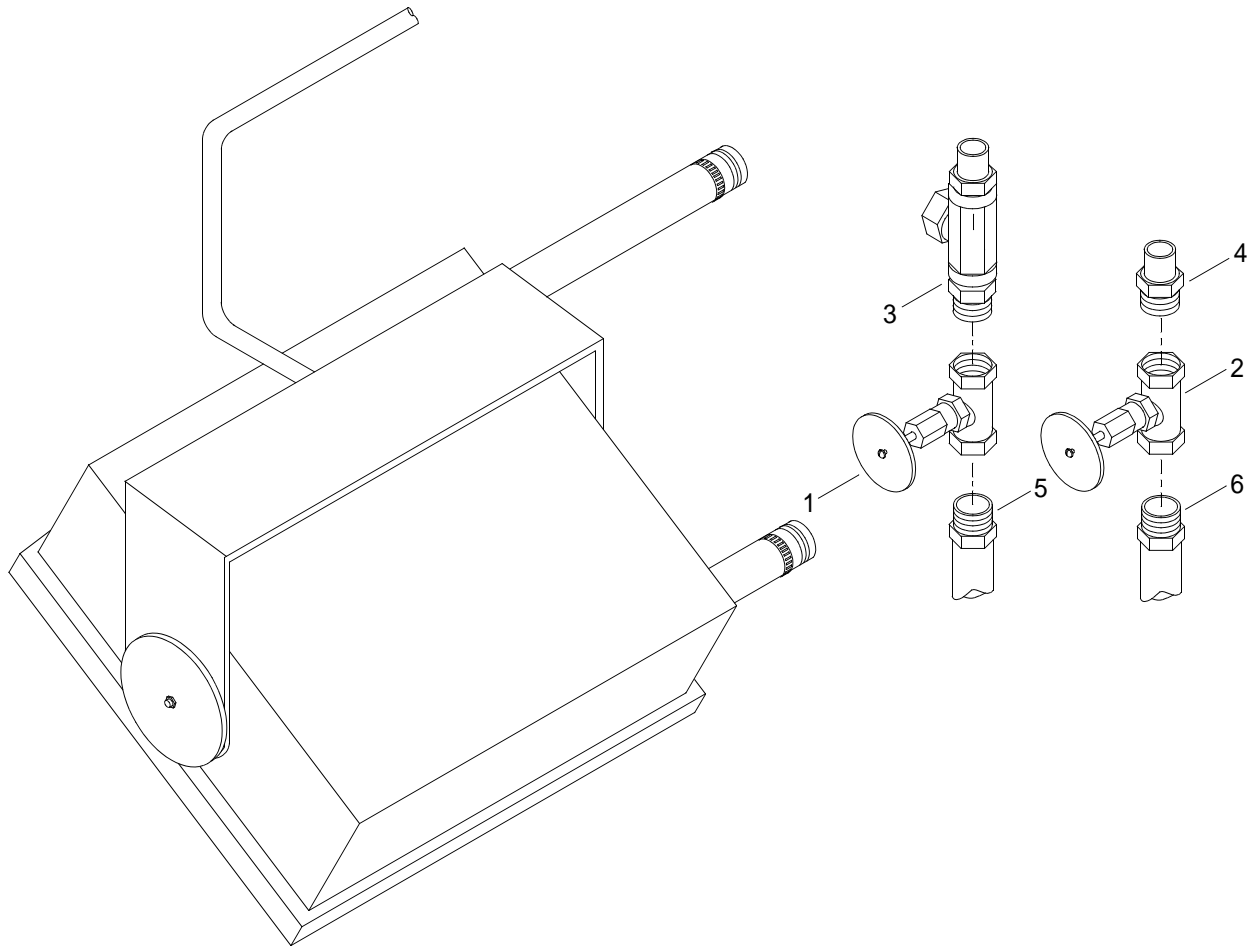
REMOVE OPERATORS CAB DEFROSTER VALVES

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Place drain pan under defrost valves (1 and 2) to collect coolant.



 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

2. Open defrost valves (1 and 2) and drain residual fluid into drain pan.
3. Remove tee and nipple (3) as an assembly from valve (1).
4. Remove nipple (4) from valve (2).
5. Remove valves (1 and 2) from pipe nipples (5 and 6) and discard.

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

6. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB DEFROSTER VALVES

WARNING

**CHEMICAL****EYE PROTECTION**

1. Apply sealing compound to threads on pipe nipple (6).
2. Install new valve (2) on pipe nipple (6) and tighten.

WARNING

**CHEMICAL****EYE PROTECTION**

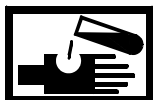
3. Apply sealing compound to threads on hose nipple (5).
4. Install new valve (1) on pipe nipple (5) and tighten.

WARNING

**CHEMICAL****EYE PROTECTION**

5. Apply sealing compound to threads on hose nipple (4).
6. Install nipple (4) on valve (2).

WARNING

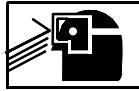
**CHEMICAL****EYE PROTECTION**

7. Apply sealing compound to threads on hose nipple (3).
8. Install tee and nipple (3) as an assembly on valve (1).
9. Install operators cab inlet defroster water hoses. (WP 0246 00)
10. Install operators cab outlet defroster water hoses. (WP 0245 00)
11. Install operators cab/intake plenum side access panel. (WP 0093 00)
12. Start the starboard engine. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

13. Place drain pan under tee (5) and loosen plug to bleed air from defroster coolant system.
14. Tighten plug on tee (5) when all trapped air has escaped.

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

15. Remove drain pan and dispose of contents in accordance with local procedures.
16. Shut down the starboard engine. (TM 55-1945-225-10)
17. Service heat exchanger. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR



SLICK FLOOR

18. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB HEATER VALVES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Valve, Needle
 PN E19018-1 (0.75 NPT)
 Qty 2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

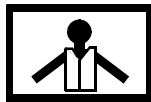
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Operators Cab Heater Outlet Water Hose Removed. (WP 0247 00)
 Operators Cab Heater Inlet Water Hose Removed. (WP 0248 00)

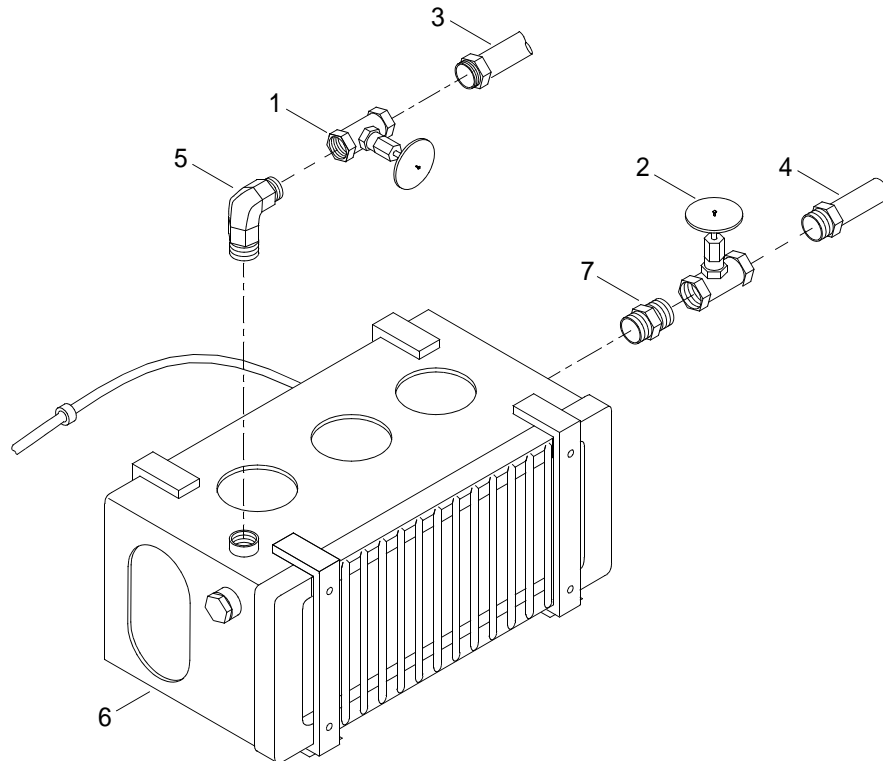
REMOVE OPERATORS CAB HEATER VALVES

WARNING

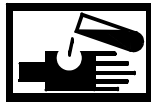
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Place drain pan under heater valves (1 and 2) to collect coolant.



 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

2. Remove hose fittings (3 and 4) from heater valves (1 and 2).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

3. Remove elbow (5) and heater valve (1) from heater (6).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

4. Remove nipple (7) and heater valve (2) from heater (6).

 WARNING



CHEMICAL



EYE PROTECTION



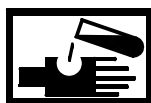
POISON



VAPOR

- Remove heater valve (1) from elbow (5) and discard heater valve (1).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

- Remove heater valve (2) from nipple (7) and discard heater valve (2).

 WARNING



CHEMICAL



EYE PROTECTION



POISON

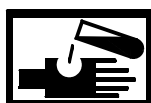


VAPOR

- Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB HEATER VALVES

 WARNING



CHEMICAL



EYE PROTECTION

- Apply sealing compound to threads on nipple (7), elbow (5) and threads of hose fittings (3 and 4).
- Install new heater valve (2) on nipple (7). Tighten heater valve (2).
- Install new heater valve (1) on elbow (5). Tighten heater valve (1).
- Install nipple (7) and heater valve (1) into heater (6). Tighten nipple (7).
- Install elbow (5) and heater valve (2) into heater (6). Tighten elbow (5).
- Install hose fitting (4) into heater valve (2). Tighten hose fitting (4).
- Install hose fitting (3) into heater valve (1). Tighten hose fitting (3).
- Install operators cab outlet heater hose. (WP 0247 00)
- Install operators cab inlet heater hose. (WP 0248 00)

-
10. Install operators cab/intake plenum side access panel. (WP 0093 00)
 11. Service heat exchanger. (TM 55-1945-225-10)
 12. Perform operational check of heater. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR



SLICK FLOOR

13. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB DEFROSTER OUTLET WATER HOSE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Hose
 PN E19108-5
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

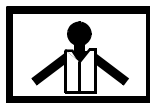
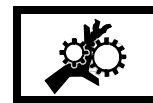
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Engine Power Isolated. (WP 0075 00)

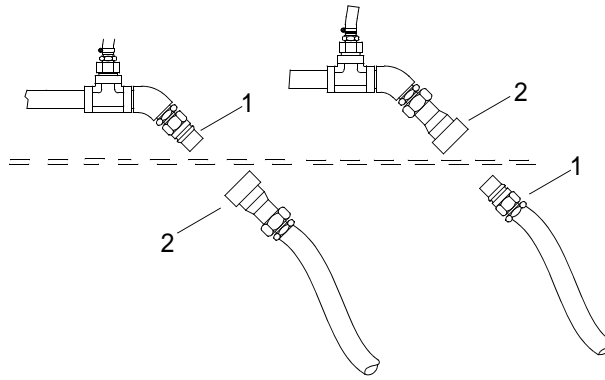
REMOVE OPERATORS CAB OUTLET WATER DEFROSTER HOSE

WARNING

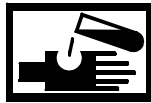
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

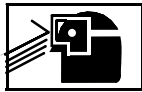
1. Position drain pan under male (1) and female (2) quick disconnects.



WARNING



CHEMICAL



EYE PROTECTION

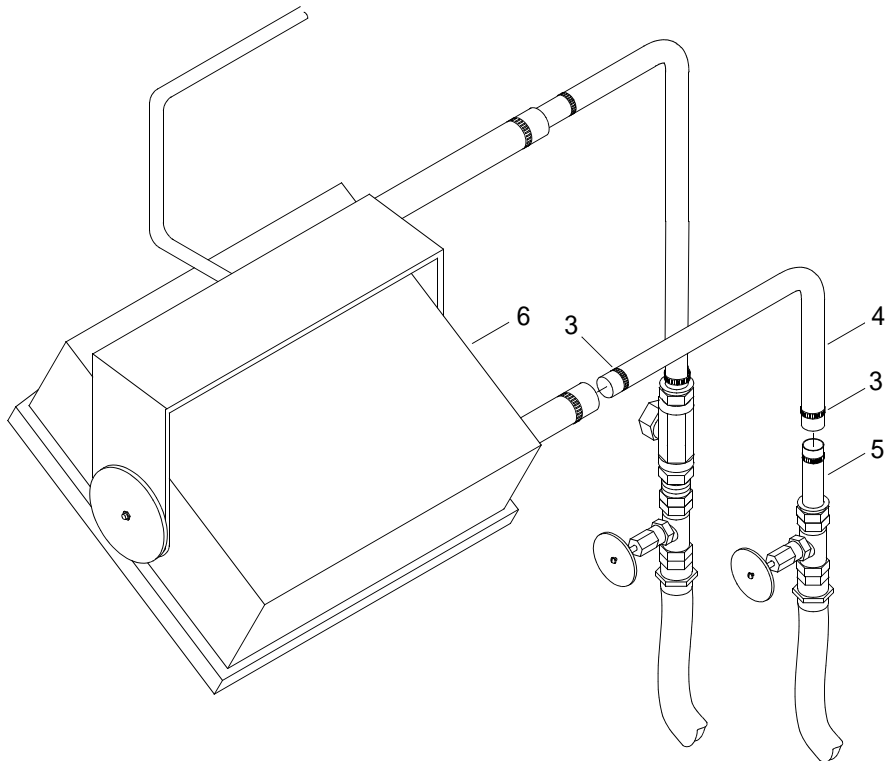


POISON

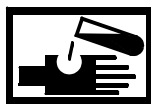


VAPOR

2. Disconnect male (1) and female (2) quick disconnects.
3. Loosen hose clamps (3) securing hose (4) at hose nipple (5) and defroster (6).



 WARNING



CHEMICAL



EYE PROTECTION



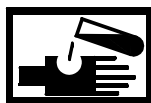
POISON



VAPOR

- Remove hose (4) from hose nipple (5) and defroster (6) and discard hose (4).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

- Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB OUTLET WATER DEFROSTER HOSE

- Manufacture new outlet water defroster hose. (WP 0420 00)

 WARNING



CHEMICAL



EYE PROTECTION



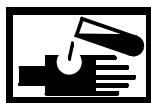
POISON



VAPOR

- Install new hose (4) on hose nipple (5) and defroster (6).
- Secure hose (4) to hose nipple (5) and heater (6) with hose clamps (3). Tighten hose clamps (3).
- Connect male (1) and female (2) quick disconnects.
- Install operators cab/intake plenum side access panel. (WP 0093 00)
- Start the starboard engine. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



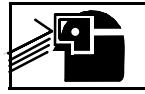
POISON



VAPOR

- Place drain pan under tee (5) and loosen plug to bleed air from defroster coolant system.
- Tighten plug on tee (5) when all trapped air has escaped.
- Shut down the starboard engine. (TM 55-1945-225-10)
- Service heat exchanger. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****POISON****VAPOR****SLICK FLOOR**

11. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB DEFROSTER INLET WATER HOSE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Hose
 PN E19108-6
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Engine Power Isolated. (WP 0075 00)

REMOVE OPERATORS CAB INLET WATER DEFROSTER HOSE

WARNING



VEST



HELMET PROTECTION



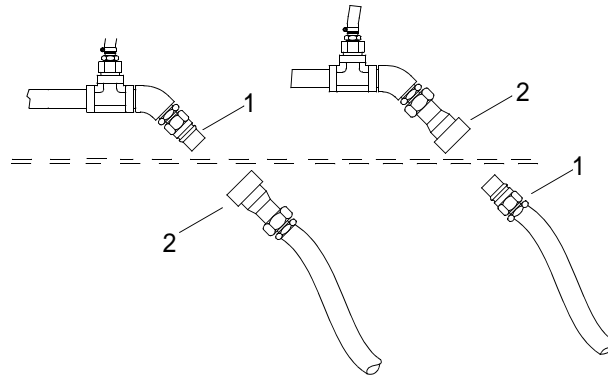
HEAVY PARTS



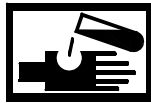
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

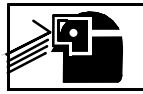
1. Position drain pan under male (1) and female (2) quick disconnects.



WARNING



CHEMICAL



EYE PROTECTION

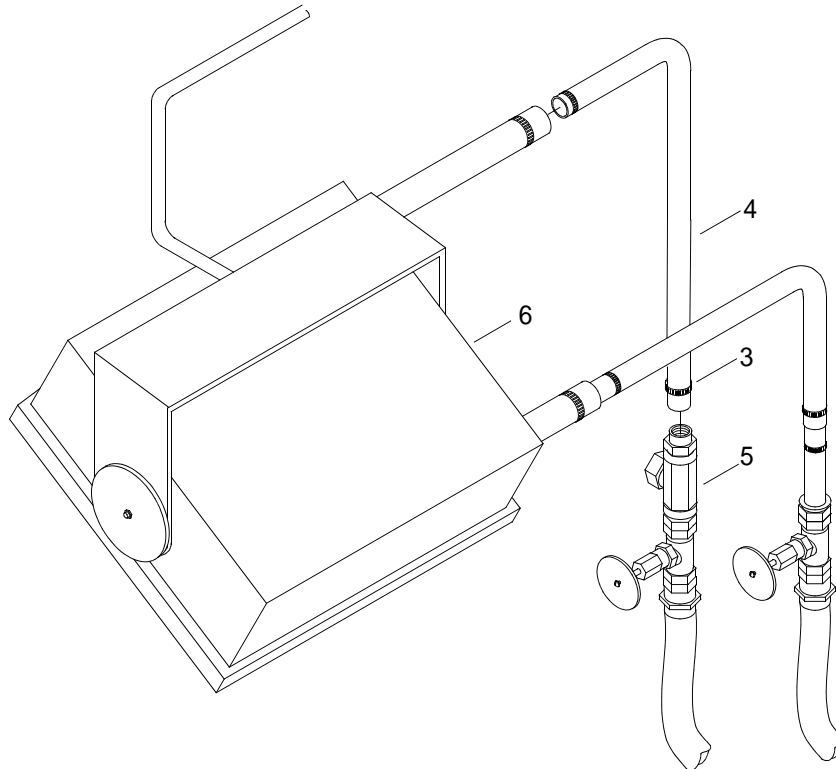


POISON



VAPOR

2. Disconnect male (1) and female (2) quick disconnects.
3. Loosen hose clamps (3) securing hose (4) at hose nipple (5) and defroster (6).



 WARNING



CHEMICAL



EYE PROTECTION



POISON



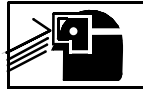
VAPOR

- Remove hose (4) from hose nipple (5) and defroster (6) and discard hose (4).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

- Remove drain pan and dispose of contents in accordance with local procedures.

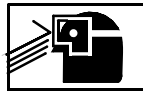
INSTALL OPERATORS CAB INLET WATER DEFROSTER HOSE

- Manufacture new inlet water defroster hose. (WP 0420 00)

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

- Install new hose (4) on hose nipple (5) and defroster (6).
- Secure hose (4) to hose nipple (5) and heater (6) with hose clamps (3). Tighten hose clamps (3).
- Connect male (1) and female (2) quick disconnects.
- Install operators cab/intake plenum side access panel. (WP 0093 00)
- Start the starboard engine. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

- Place drain pan under tee (5) and loosen plug to bleed air from defroster coolant system.
- Tighten plug on tee (5) when all trapped air has escaped.
- Shut down the starboard engine. (TM 55-1945-225-10)
- Service heat exchanger. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****POISON****VAPOR****SLICK FLOOR**

11. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB OUTLET HEATER WATER HOSE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Hose
 PN E19108-2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

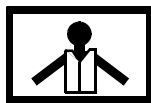
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Engine Power Isolated. (WP 0075 00)

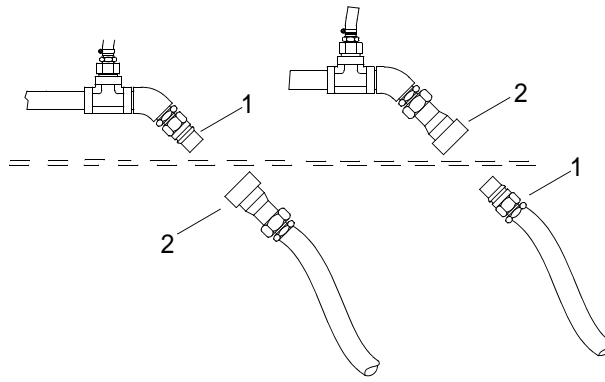
REMOVE OPERATORS CAB OUTLET HEATER HOSE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Position drain pan under male (1) and female (2) quick disconnects.



WARNING



CHEMICAL



EYE PROTECTION

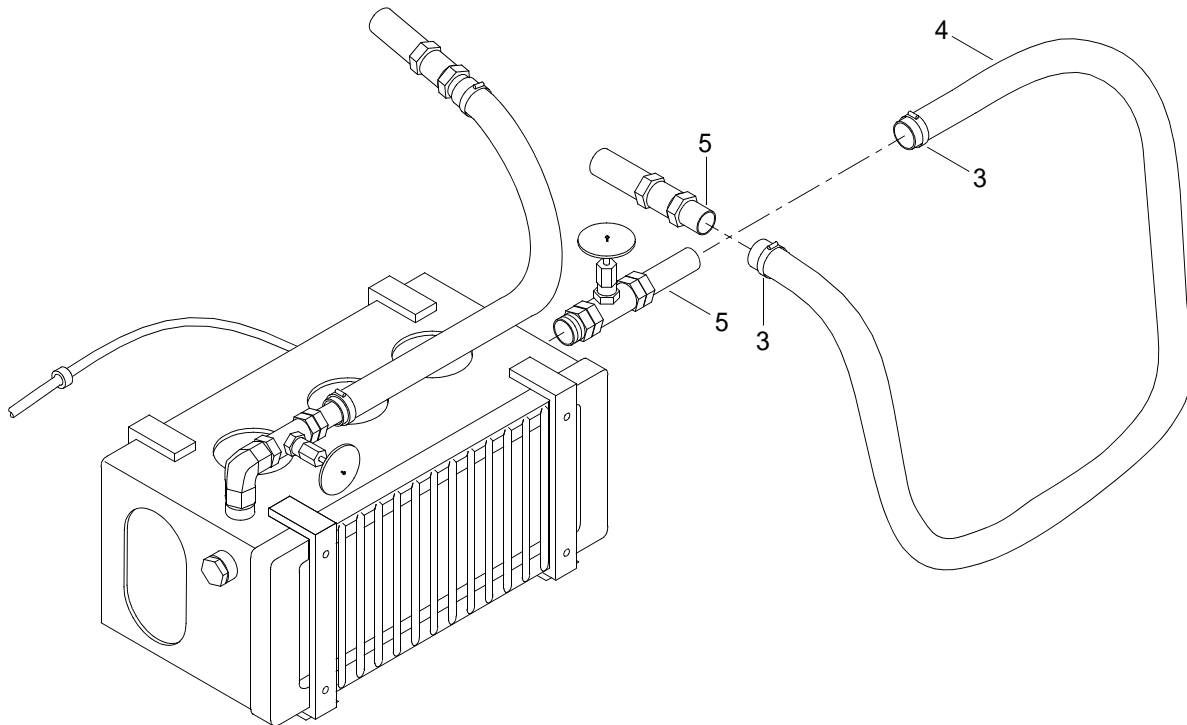


POISON



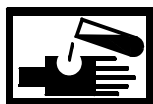
VAPOR

2. Disconnect male (1) and female (2) quick disconnects.
3. Loosen hose clamps (3) securing hose (4) to hose nipples (5).



4. Remove hose (4) from hose nipples (5) and discard hose (4).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

5. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB OUTLET HEATER HOSE

1. Manufacture new outlet water defroster hose. (WP 0419 00)
2. Install new hose (4) on hose nipples (5).
3. Secure hose (4) to hose nipples (5) with hose clamps (3).
4. Connect male (1) and female (2) quick disconnects.
5. Install operators cab/intake plenum side access panel. (WP 0093 00)
6. Start the starboard engine to purge air from heater hose. (TM 55-1945-225-10)
7. Shut down the starboard engine. (TM 55-1945-225-10)
8. Service heat exchanger. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR



SLICK FLOOR

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB INLET HEATER WATER HOSE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Hose
 PN E19108-3
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

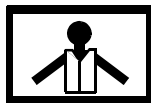
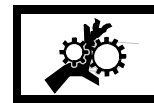
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Engine Power Isolated. (WP 0075 00)

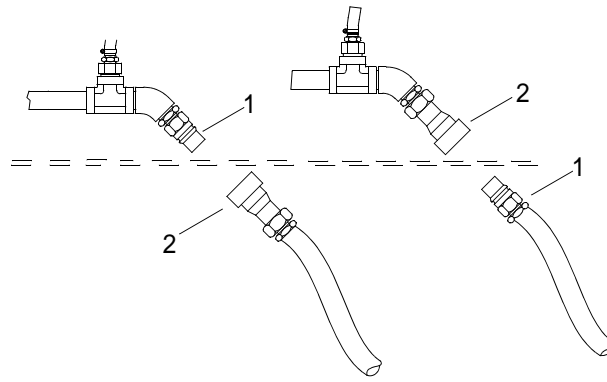
REMOVE OPERATORS CAB INLET HEATER HOSE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

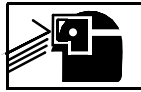
1. Position drain pan under male (1) and female (2) quick disconnects.



WARNING



CHEMICAL



EYE PROTECTION

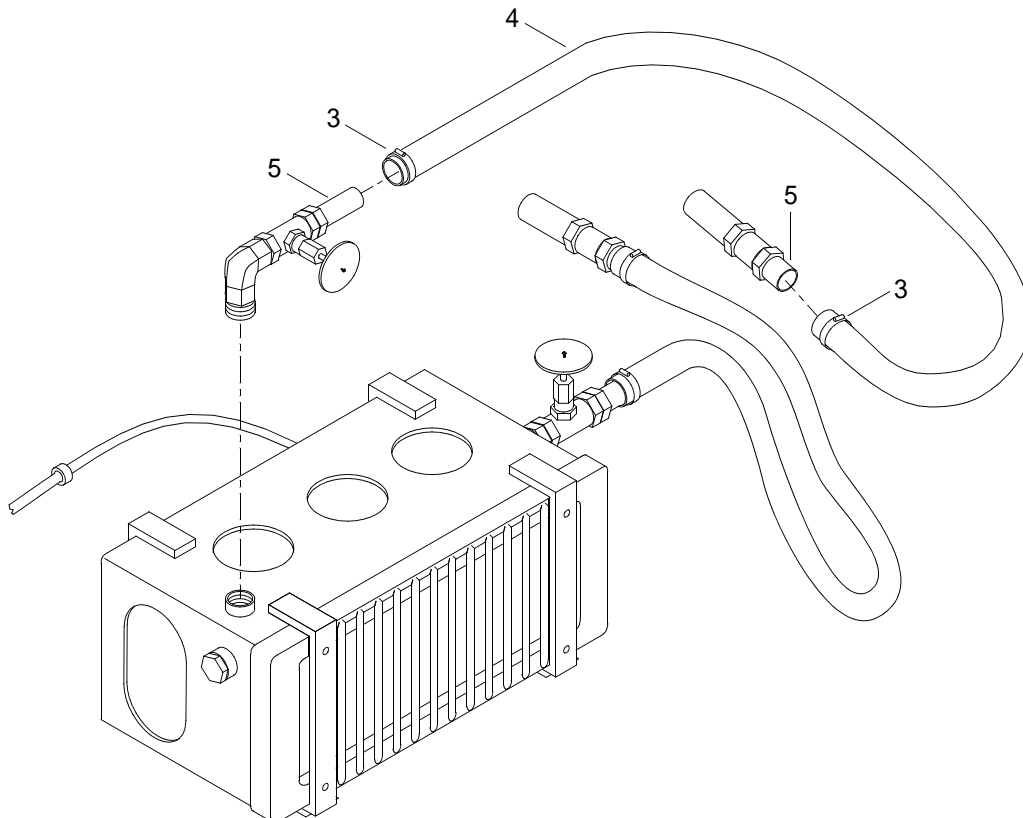


POISON



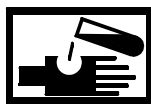
VAPOR

2. Disconnect male (1) and female (2) quick disconnects.
3. Loosen hose clamps (3) securing hose (4) to hose nipple (5).



4. Remove hose (4) from hose nipple (5) and discard hose (4).

WARNING

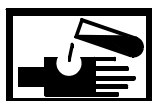
**CHEMICAL****EYE PROTECTION****POISON****VAPOR**

5. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB INLET HEATER HOSE

1. Manufacture new inlet water defroster hose. (WP 0419 00)
2. Install new hose (4) on hose nipple (5).
3. Secure hose (4) to hose nipple (5) with hose clamps (3).
4. Connect male (1) and female (2) quick disconnects.
5. Install operators cab/intake plenum side access panel. (WP 0093 00)
6. Start the starboard engine to purge air from heater hose. (TM 55-1945-225-10)
7. Shut down the starboard engine. (TM 55-1945-225-10)
8. Service heat exchanger. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION****POISON****VAPOR****SLICK FLOOR**

9. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB HEATER HOSE MALE QUICK DISCONNECT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Wrench, Pipe (Item 4, WP 0425 00)

Materials/Parts

Quick Disconnect, Male
 PN E19128-1
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

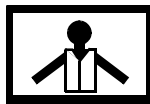
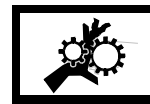
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Engine Power Isolated. (WP 0075 00)

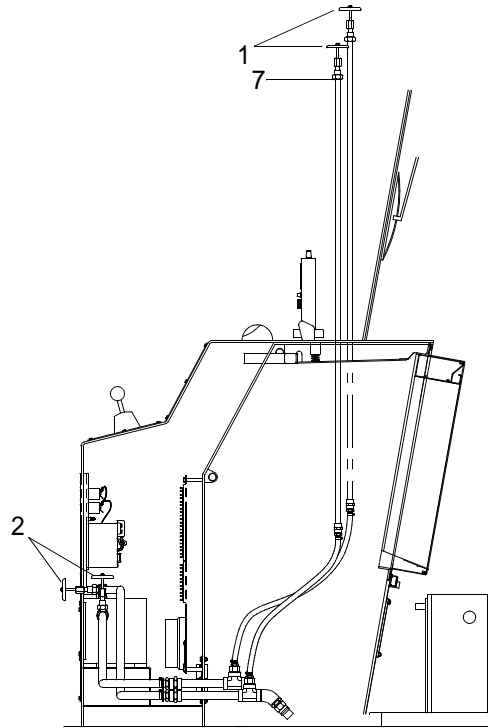
REMOVE OPERATORS CAB HEATER HOSE MALE QUICK DISCONNECT

WARNING

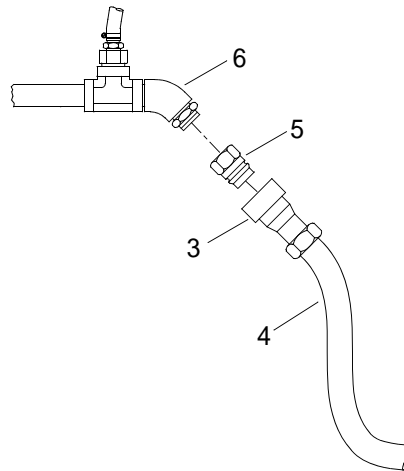
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Close the inlet/outlet defrost needle valves (1).



2. Close the inlet/outlet heater needle valves (2).
3. Place a drain pan under female quick disconnect (3) on return water hose (4) and male quick disconnect (5) on elbow (6).



WARNING



CHEMICAL



EYE PROTECTION



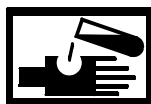
POISON



VAPOR

4. Separate female quick disconnect (3) on return water hose (4) from male quick disconnect (5) on elbow (6).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

5. Using pipe wrench, remove male quick disconnect (5) from elbow (6).
6. Discard male quick disconnect (5).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

7. Remove spill pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB HEATER HOSE MALE QUICK DISCONNECT

 WARNING



CHEMICAL



EYE PROTECTION

1. Apply sealing compound to threads on male quick disconnect (5).
2. Install new male quick disconnect (5) on elbow (6). Tighten male quick disconnect (3).
3. Connect female quick disconnect (3) on return water hose (4) to male quick disconnect (5) on elbow (6).
4. Open the inlet/outlet heater needle valves (2).
5. Open the inlet/outlet defrost needle valves (1).
6. Install operators cab/intake plenum side access panel. (WP 0093 00)
7. Start the starboard engine. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

8. Place drain pan under tee (7) and loosen plug to bleed air from defroster coolant system.
9. Tighten plug on tee (7) when all trapped air has escaped.

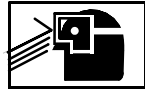
10. Shut down the starboard engine. (TM 55-1945-225-10)

11. Service heat exchanger. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR



SLICK FLOOR

12. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB HEATER CHECK VALVE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Wrench, Pipe (Item 4, WP 0425 00)

Materials/Parts

Valve, Check
 PN E46208
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

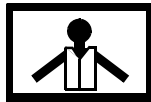
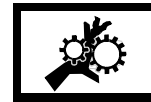
Engineer 88L

Equipment Condition

Operators Cab Heater Hose Male Quick Disconnect Removed. (WP 0249 00)

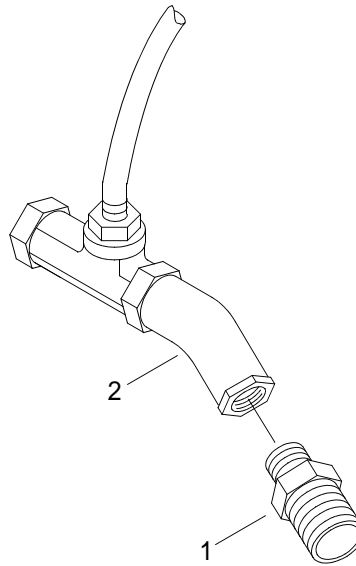
REMOVE OPERATORS CAB HEATER CHECK VALVE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Using pipe wrench, remove check valve (1) from elbow (2).



2. Discard check valve (1).

INSTALL OPERATORS CAB HEATER CHECK VALVE

WARNING



CHEMICAL



EYE PROTECTION

1. Apply sealing compound to threads of new check valve (1).
2. Install new check valve (1) on elbow (2).
3. Using pipe wrench, tighten check valve (1).

WARNING



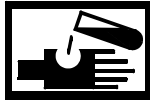
CHEMICAL



EYE PROTECTION

4. Using wiping rag, wipe off excess sealing compound.
5. Install operators cab heater hose male quick disconnect. (WP 0249 00)

WARNING

**CHEMICAL****EYE PROTECTION**

6. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB HEATER SOLENOID VALVE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Wrench, Pipe (Item 4, WP 0425 00)
 Brush, Wire, Scratch (Item 4, WP 0425 00)

Materials/Parts

Valve, Solenoid
 PN E46228
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

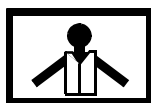
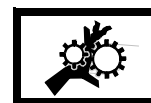
Engineer 88L

Equipment Condition

Operators Cab Heater Hose Female Quick Disconnect Removed. (WP 0252 00)

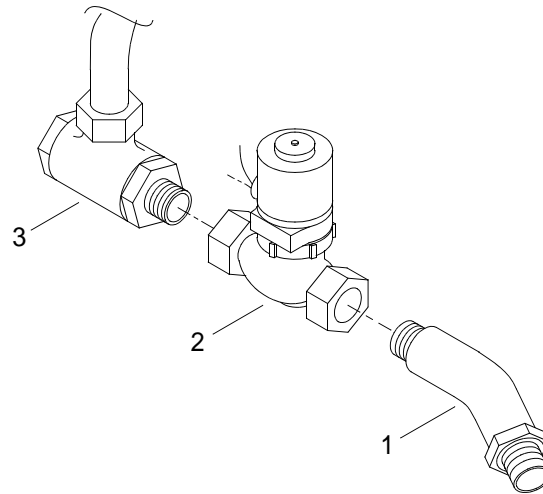
REMOVE OPERATORS CAB HEATER SOLENOID VALVE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Using pipe wrench, remove elbow and nipple (1) from solenoid valve (2) as an assembly.



2. Tag and disconnect wiring harness.
3. Using pipe wrench, remove solenoid valve (2) from nipple (3) and discard.

INSTALL OPERATORS CAB HEATER SOLENOID VALVE

WARNING



EYE PROTECTION

1. Using wire brush, clean old pipe sealing compound from nipple (3).

WARNING



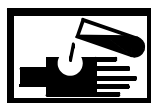
CHEMICAL



EYE PROTECTION

2. Apply sealing compound to threads of nipple (3).
3. Install new solenoid valve (2) on nipple (3).
4. Using pipe wrench, tighten solenoid valve (2).

WARNING



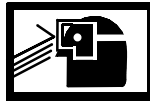
CHEMICAL



EYE PROTECTION

5. Using wiping rag, wipe off excess sealing compound.

WARNING

**EYE PROTECTION**

- Using wire brush, clean old pipe sealing compound from threads of elbow and nipple (1).

WARNING

**CHEMICAL****EYE PROTECTION**

- Apply sealing compound to threads of elbow and nipple (1).
- Install elbow and nipple (1) on solenoid valve (2).
- Using pipe wrench, tighten elbow and nipple (1).

WARNING

**CHEMICAL****EYE PROTECTION**

- Using wiping rag, wipe off excess sealing compound.
- Install operators cab heater hose female quick disconnect. (WP 0252 00)
- Connect wiring harness and remove tags.

WARNING

**CHEMICAL****EYE PROTECTION**

- Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB HEATER HOSE FEMALE QUICK DISCONNECT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)
 Wrench, Pipe (Item 4, WP 0425 00)

Materials/Parts

Quick Disconnect, Female
 PN E19138-1
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

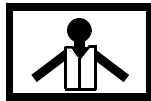
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Engine Power Isolated. (WP 0075 00)

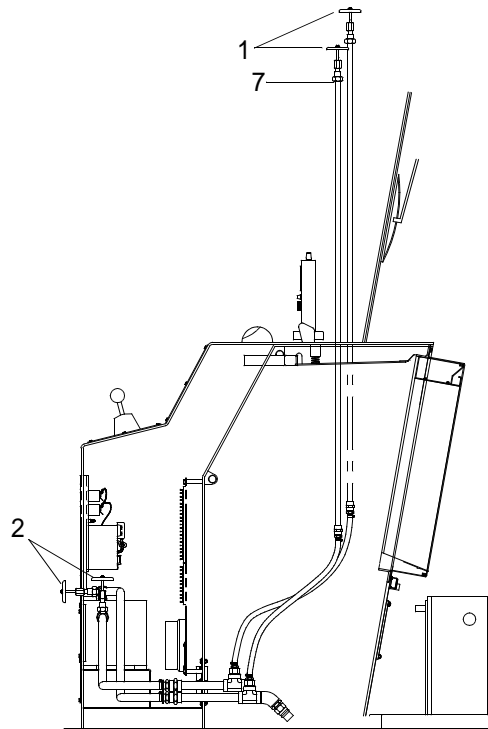
REMOVE OPERATORS CAB HEATER HOSE FEMALE QUICK DISCONNECT

WARNING

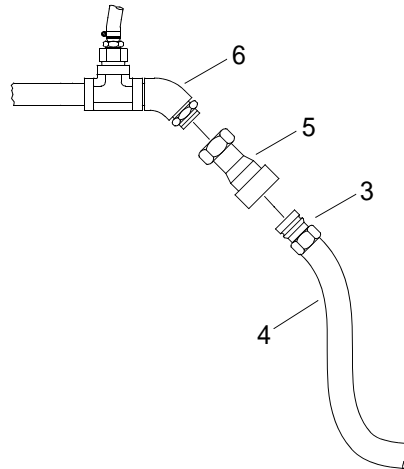
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

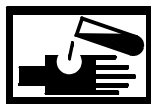
1. Close the inlet/outlet defrost needle valves (1).



2. Close the inlet/outlet heater needle valves (2).
3. Place a drain pan under male quick disconnect (3) on supply water hose (4) and female quick disconnect (5) on elbow (6).



WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

4. Separate male quick disconnect (3) on supply water hose (4) from female quick disconnect (5) on elbow (6).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

5. Using pipe wrench, remove female quick disconnect (5) from elbow (6).
6. Discard female quick disconnect (5).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

7. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB HEATER HOSE FEMALE QUICK DISCONNECT

 WARNING



CHEMICAL



EYE PROTECTION

1. Apply sealing compound to threads on female quick disconnect (5).
2. Install new female quick disconnect (5) on elbow (6). Tighten female quick disconnect (3).
3. Connect male quick disconnect (3) on supply water hose (4) to female quick disconnect (5) on elbow (6).
4. Open the inlet/outlet heater needle valves (2).
5. Open the inlet/outlet defrost needle valves (1).
6. Install operators cab/intake plenum side access panel. (WP 0093 00)
7. Start the starboard engine. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

8. Place drain pan under tee (7) and loosen plug to bleed air from defroster coolant system.
9. Tighten plug on tee (7) when all trapped air has escaped.

10. Shut down the starboard engine. (TM 55-1945-225-10)

11. Service heat exchanger. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR



SLICK FLOOR

12. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB WINDOW
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

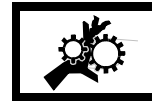
Window, Slide, S-1
 PN E12058
 Window, Fixed
 PN E12068
 Window, Slide, P-1
 PN E12048
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)

Personnel Required

Engineer 88L

REMOVE OPERATORS CAB WINDOW

WARNING

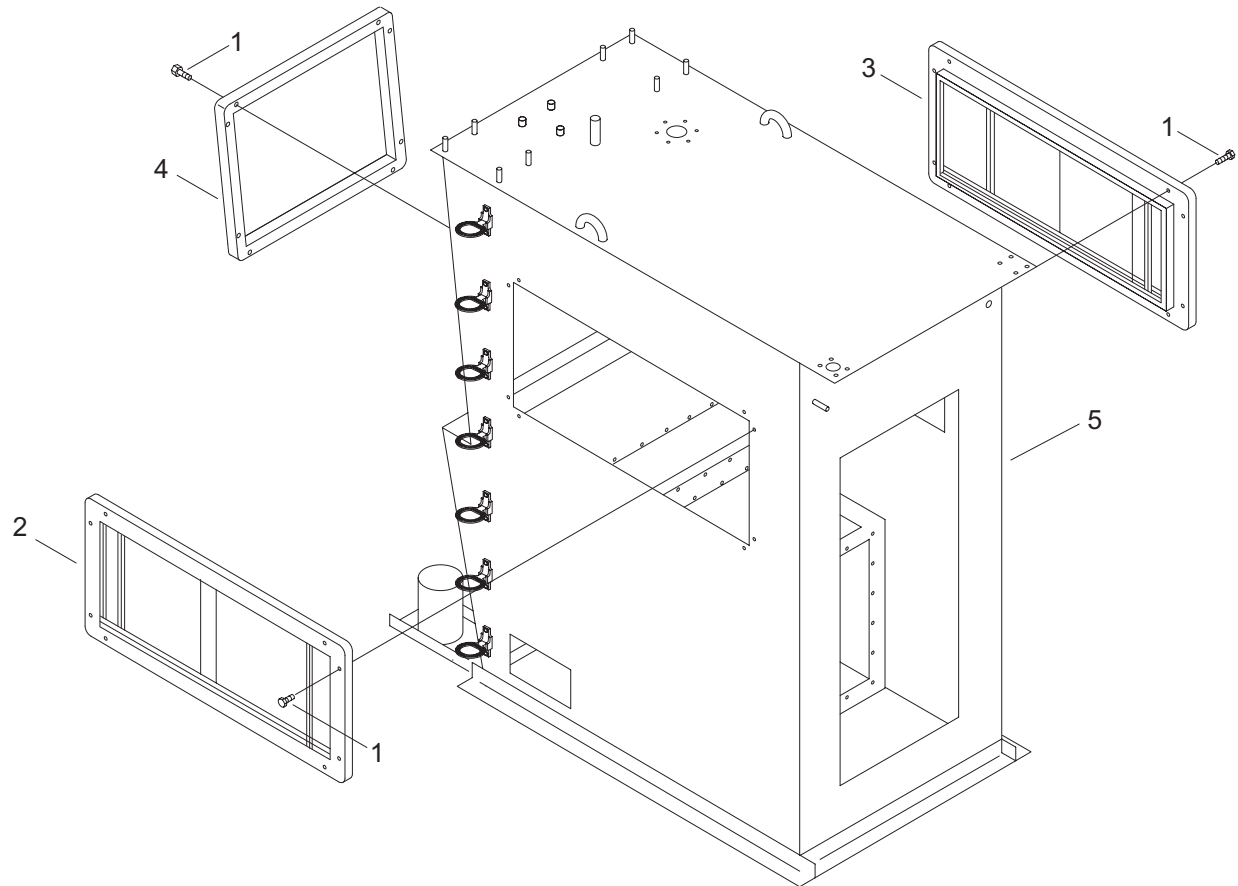
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

The following procedure is typical for operators cab forward fixed, port and starboard windows.

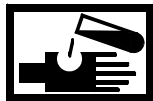
1. Remove eight flat head screws (1) from window (2, 3 or 4) and operators cab (5).



2. Remove slide window (2, 3) or fixed window (4).

INSTALL OPERATORS CAB WINDOW

WARNING



CHEMICAL



EYE PROTECTION

1. Apply a sufficient bead of sealant around entire window frame to achieve a continuous water tight seal.
2. Position new window (2, 3 or 4) on operators cab (5).
3. Install eight flat head screws (1) through windows (2, 3 or 4) and into operators cab.
4. Tighten eight flat head screws (1).

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Adhesive (Item 2, WP 0426 00)
- Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

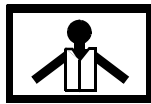
Engineer 88L

References

TM 55-1945-225-10

REMOVE MIDDLE CONTROL PANEL A1

WARNING



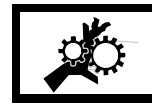
VEST



HELMET PROTECTION



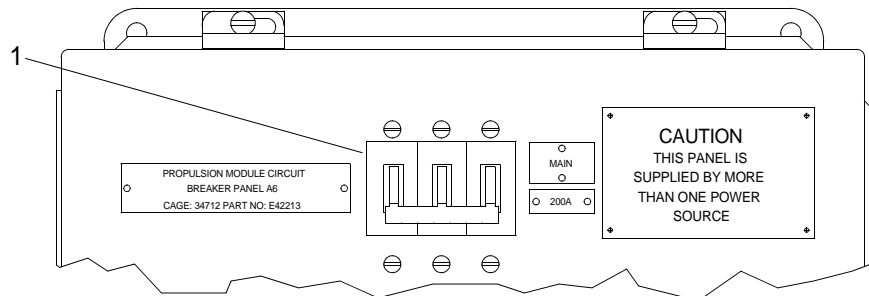
HEAVY PARTS



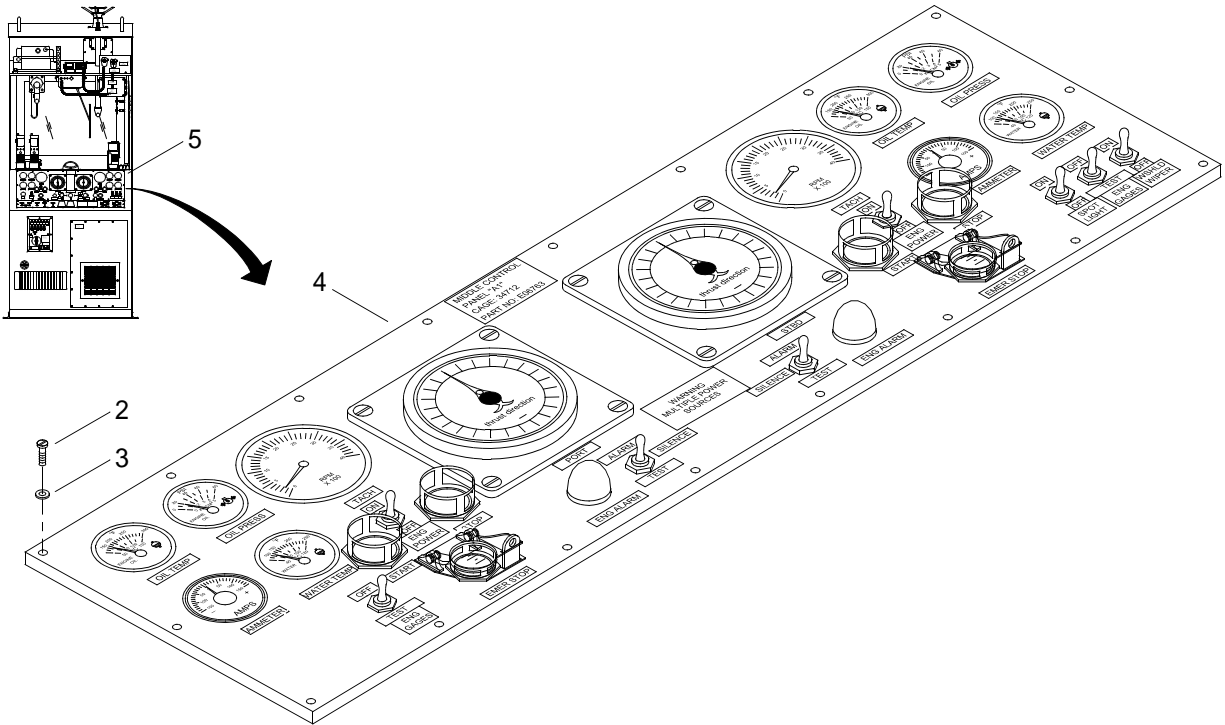
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove pan head capscrews (2) and lockwashers (3) securing middle control panel A1 (4) to operators cab control console (5).



- Lift and tilt middle control panel A1 (4) from operators cab control console (5) to access electrical wiring.
- Remove tiedown straps securing wires.
- Tag and disconnect all electrical wiring to middle control panel A1 (4).
- Remove middle control panel A1 (4) from operators cab control console (5).

INSTALL MIDDLE CONTROL PANEL A1

- Connect all electrical wiring to middle control panel A1 (4) and remove tags.
- Use tiedown straps to secure wires.

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to pan head capscrews (2).

-
4. Position middle control panel A1 (4) on operators cab control console (5).
 5. Install pan head capscrews (2) and lockwashers (3) to secure middle control panel A1 (4) to operators cab control console (5). Tighten pan head capscrews (2).
 6. Perform operational check of middle control panel A1. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 ENGINE ALARM INDICATOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator, Watertight
 PN E46428-2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

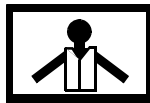
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE ENGINE ALARM INDICATOR

WARNING

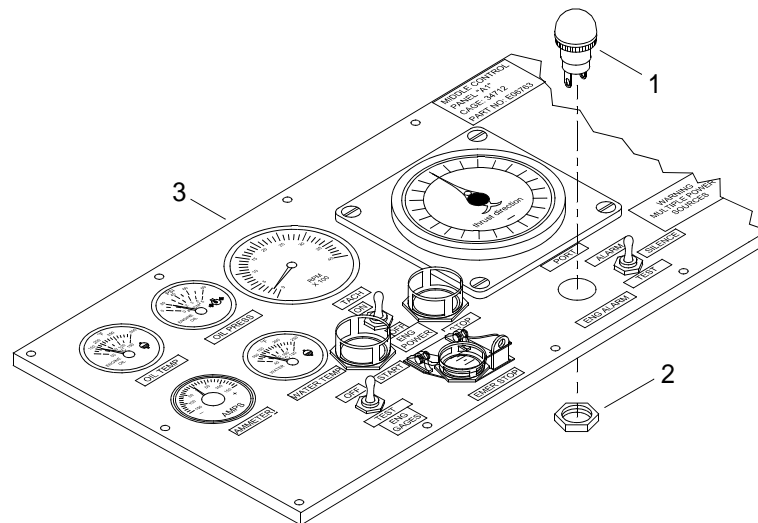
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the red engine alarm indicators on the middle control panel A1.

1. Tag and disconnect electrical wiring to indicator (1).



2. Remove indicator retainer (2) from indicator (1).
3. Remove indicator (1) from front of middle control panel A1 (3) and discard.

INSTALL ENGINE ALARM INDICATOR

1. Position new indicator (1) through hole in front of middle control panel A1 (3).
2. Install indicator retainer (2) to secure indicator (1) to middle control panel A1 (3). Tighten indicator retainer (2).
3. Connect electrical wiring to indicator (1) and remove tags.
4. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 TACHOMETER GAUGE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Tachometer
PN E46769
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

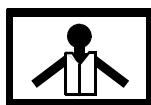
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE TACHOMETER GAUGE

WARNING



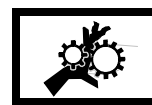
VEST



HELMET PROTECTION



HEAVY PARTS



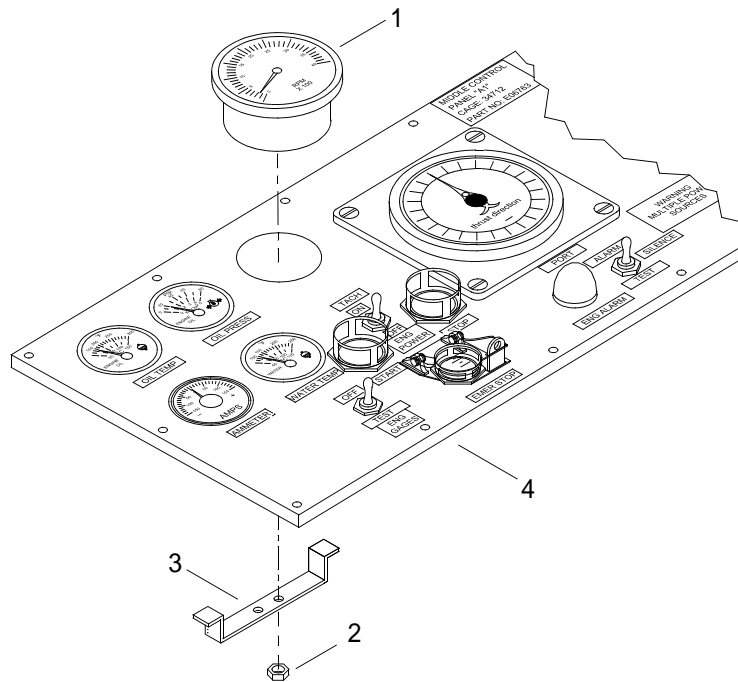
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of tachometer gauges on the middle control panel A1.

1. Tag and disconnect electrical wiring to tachometer gauge (1). Do not remove inline dropping resistor.



2. Remove hex nuts (2) and bracket (3) securing tachometer gauge (1) to middle control panel A1 (4).
3. Remove tachometer gauge (1) from middle control panel A1 (4) and discard.

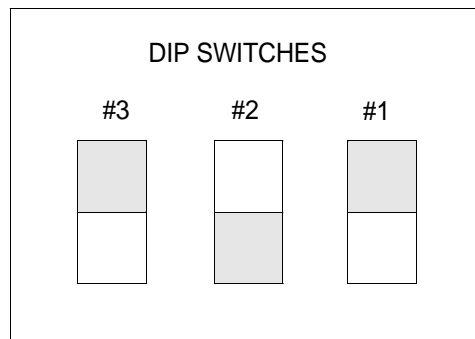
INSTALL TACHOMETER GAUGE

1. Install red filters on 24 VDC bulbs from resistor kit.
2. Replace original bulbs in new tachometer gauge (1) with new red filtered 24 VDC bulbs.

NOTE

The off position of a dip switch is up and down is on.

3. Verify/set dip switch positions (#1-OFF; #2-ON; #3-OFF) on rear of tachometer gauge (1).



4. Position tachometer gauge (1) on middle control panel A1, secure with bracket (3) and hex nut (2).

-
5. Install bracket (3) and hex nuts (2) to secure tachometer gauge (1) to middle control panel A1 (4). Tighten hex nuts (2).
 6. Connect electrical wiring to tachometer gauge (1) and remove tags.
 7. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 OIL PRESSURE GAUGE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gauge, Pressure, 80 PSI
 PN E46819
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

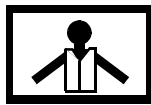
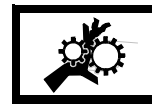
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE OIL PRESSURE GAUGE

WARNING

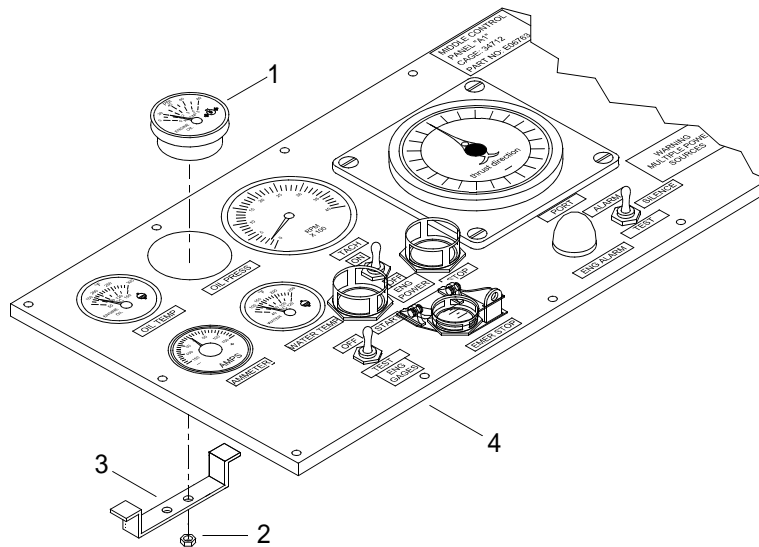
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of oil pressure gauges on the middle control panel A1.

1. Tag and disconnect electrical wiring to oil pressure gauge (1).



2. Remove hex nuts (2) and bracket (3) securing oil pressure gauge to middle control panel A1 (4).
3. Remove oil pressure gauge from middle control panel A1 (4) and discard.

INSTALL OIL PRESSURE GAUGE

1. Install red filter on 24 VDC bulb from resistor kit.
2. Replace original bulb in new oil pressure gauge (1) with new red filtered 24 VDC bulb.
3. Position oil pressure gauge (1) on middle control panel A1 (4).
4. Install bracket (3) and hex nuts (2) to secure oil pressure gauge (1) to middle control panel A1 (4). Tighten hex nuts (2).
5. Connect electrical wiring to oil pressure gauge (1) and remove tags.
6. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 AMMETER GAUGE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Ammeter
 PN E46779
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

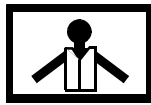
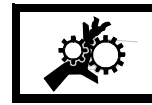
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE AMMETER GAUGE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of ammeter gauges on the middle control panel A1.

1. Tag and disconnect electrical wiring to ammeter gauge (1).

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 WATER TEMPERATURE GAUGE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gauge, Temperature, 120°C
 PN 46799
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

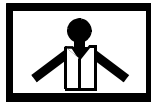
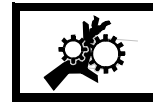
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE WATER TEMPERATURE GAUGE

WARNING

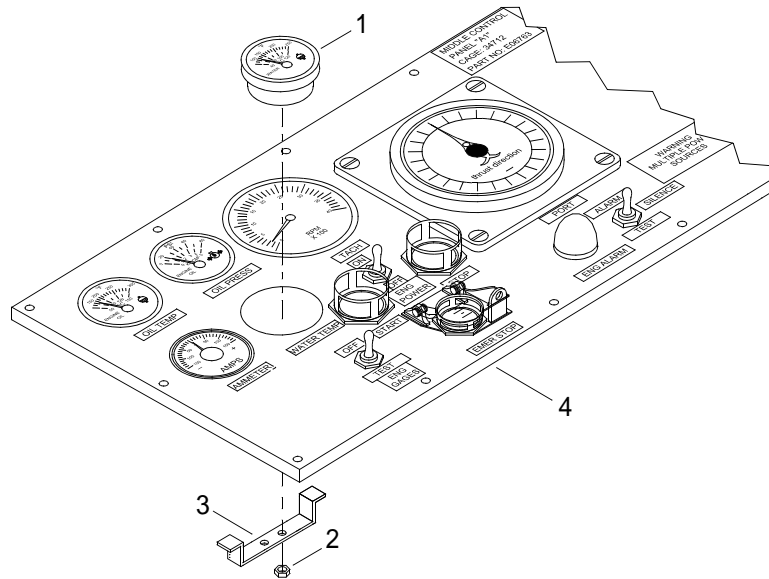
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of water temperature gauges on the middle control panel A1.

1. Tag and disconnect electrical wiring to water temperature gauge (1).



2. Remove hex nuts (2) and bracket (3) securing water temperature gauge (1) to middle control panel A1 (4).
3. Remove water temperature gauge (1) from middle control panel A1 (4) and discard.

INSTALL WATER TEMPERATURE GAUGE

1. Install red filter on 24 VDC bulb from resistor kit.
2. Replace original bulb in new water temperature gauge (1) with new red filtered 24 VDC bulb.
3. Position water temperature gauge (1) on middle control panel A1 (4).
4. Install bracket (3) and hex nuts (2) to secure water temperature gauge (1) on middle control panel A1 (4). Tighten hex nuts (2).
5. Connect electrical wiring to water temperature gauge (1) and remove tags.
6. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 OIL TEMPERATURE GAUGE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gauge, Oil Temperature (150°C FS, Elect.)
 PN E46809
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

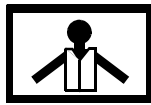
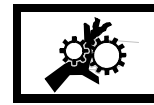
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE OIL TEMPERATURE GAUGE

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of oil temperature gauges on the middle control panel A1.

1. Tag and disconnect electrical wiring to oil temperature gauge (1).

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 ENGINE GAGE TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch (28 VDC, 7 AMP)
PN E09678-3
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

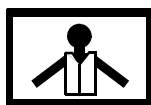
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE ENGINE GAGE TOGGLE SWITCH

WARNING



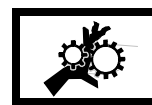
VEST



HELMET PROTECTION



HEAVY PARTS



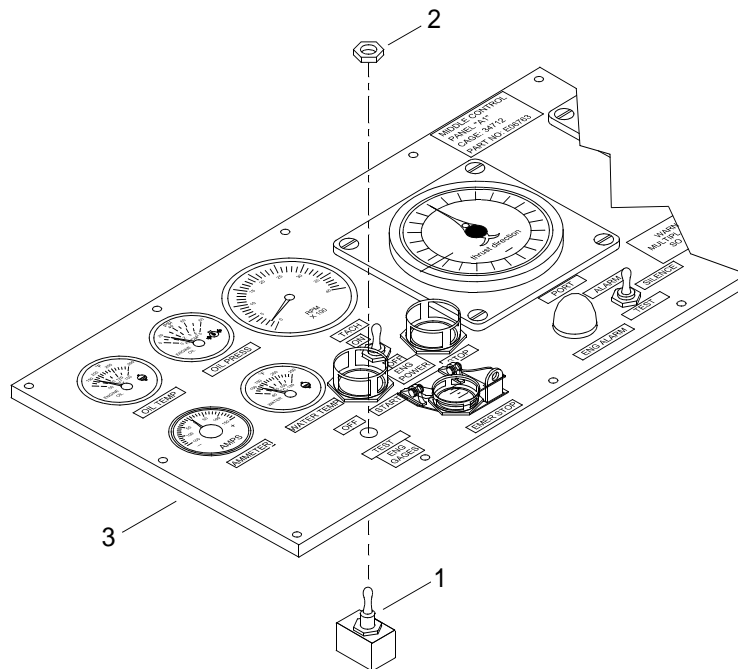
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of engine gage toggle switch(s) on the middle control panel A1.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from middle control panel A1 (3) and discard.

INSTALL ENGINE GAGE TOGGLE SWITCH

1. Position new toggle switch (1) on middle control panel A1 (3).
2. Install hex nut (2) to secure toggle switch (1) to middle control panel A1 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 ENGINE START PUSHBUTTON
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Pushbutton, Contact (Black W/Type A Contact)
 PN E30299
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

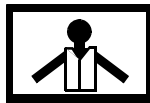
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE ENGINE START PUSHBUTTON

WARNING

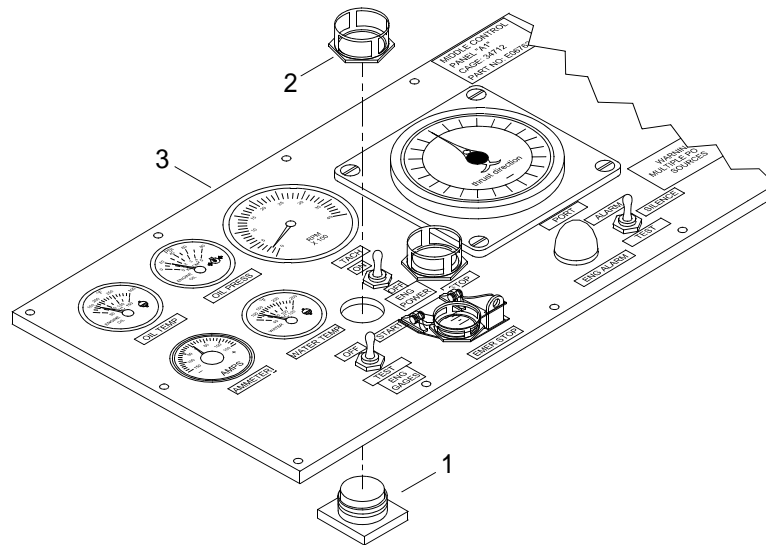
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of engine pushbuttons on the middle control panel A1.

1. Tag and disconnect electrical wiring to engine start pushbutton (1).



2. Remove hex nut (2) securing engine start pushbutton (1) to middle control panel A1 (3).
3. Remove engine start pushbutton (1) from middle control panel A1 (3) and discard.

INSTALL ENGINE START PUSHBUTTON

1. Position new engine start pushbutton (1) on middle control panel A1 (3).
2. Install hex nut (2) to secure engine start pushbutton (1) to middle control panel A1 (3). Tighten hex nut (2).
3. Connect electrical wiring to engine start pushbutton (1) and remove tags.
4. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 ENGINE ALARM TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch (28 VDC, 7 AMP)
 PN E09678-4
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

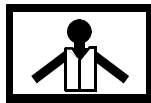
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE ENGINE ALARM TOGGLE SWITCH

WARNING

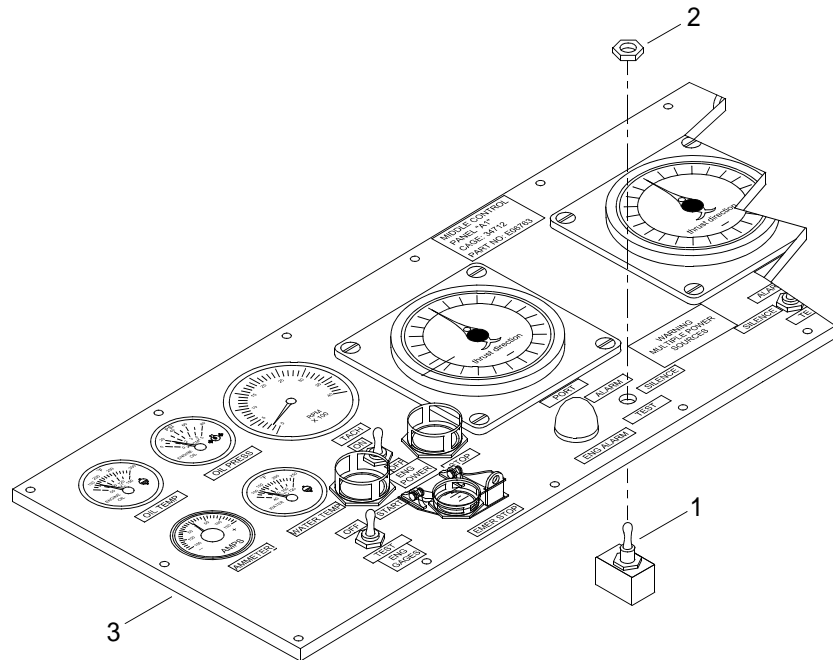
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of engine alarm toggle switches on the middle control panel A1.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from middle control panel A1 (3) and discard.

INSTALL ENGINE ALARM TOGGLE SWITCH

1. Position new toggle switch (1) on middle control panel A1 (3).
2. Install hex nut (2) to secure toggle switch (1) to middle control panel A1 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 THRUST INDICATING DEVICE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Display, Control
 PN 1037484 (Supplied with Thruster)
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

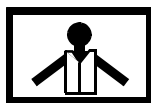
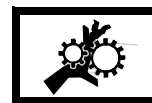
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE THRUST INDICATING DEVICE

WARNING

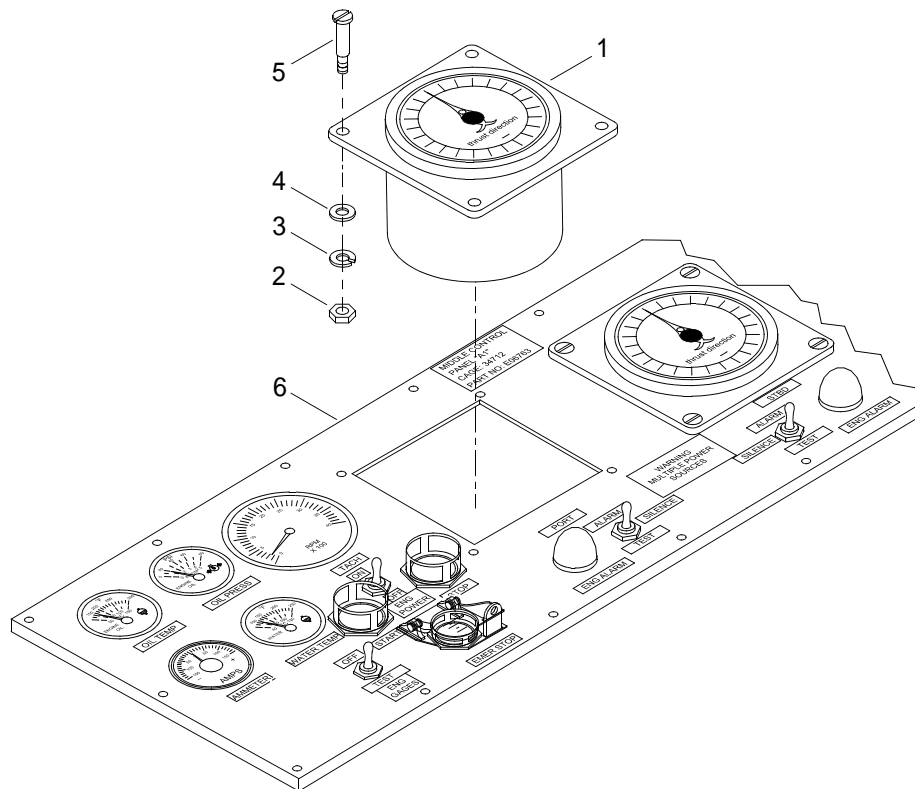
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of thrust indicating devices on the middle control panel A1.

1. Tag and disconnect electrical wiring from thrust indicating device (1).



2. Remove hex nuts (2), lockwashers (3), flat washers (4) and pan head machine screws (5) securing thrust indicating device (1) to middle control panel A1 (5).
3. Remove thrust indicating device (1) from middle control panel A1 (5).

INSTALL MIDDLE CONTROL PANEL A1 THRUST INDICATING DEVICE

1. Position new thrust direction device (1) on top of middle control panel A1 (6).
2. Install pan head machine screws (5), flat washers (4), lockwashers (3) and hex nuts (2) to secure thrust indicating device (1) on middle control panel A1 (6). Tighten hex nuts (2).
3. Connect electrical wiring to thrust indicating device (1) and remove tags.
4. Initialize thrust direction device by performing hydraulic system steering adjustment. (WP 0137 00)
5. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 THRUST INDICATING
DEVICE LIGHT BULB
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

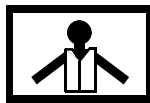
- Engineer 88L

Equipment Condition

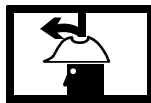
- Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE THRUST INDICATING DEVICE LIGHT BULB

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



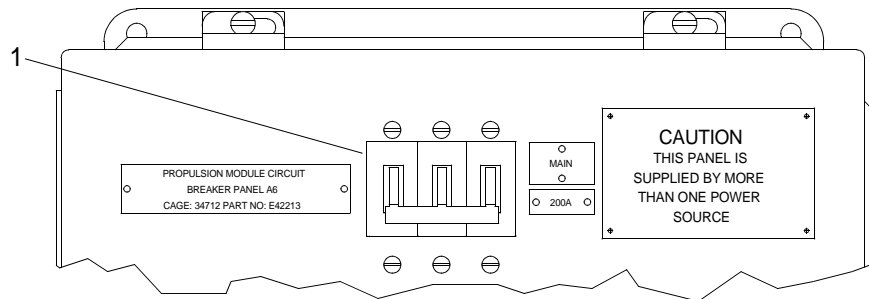
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

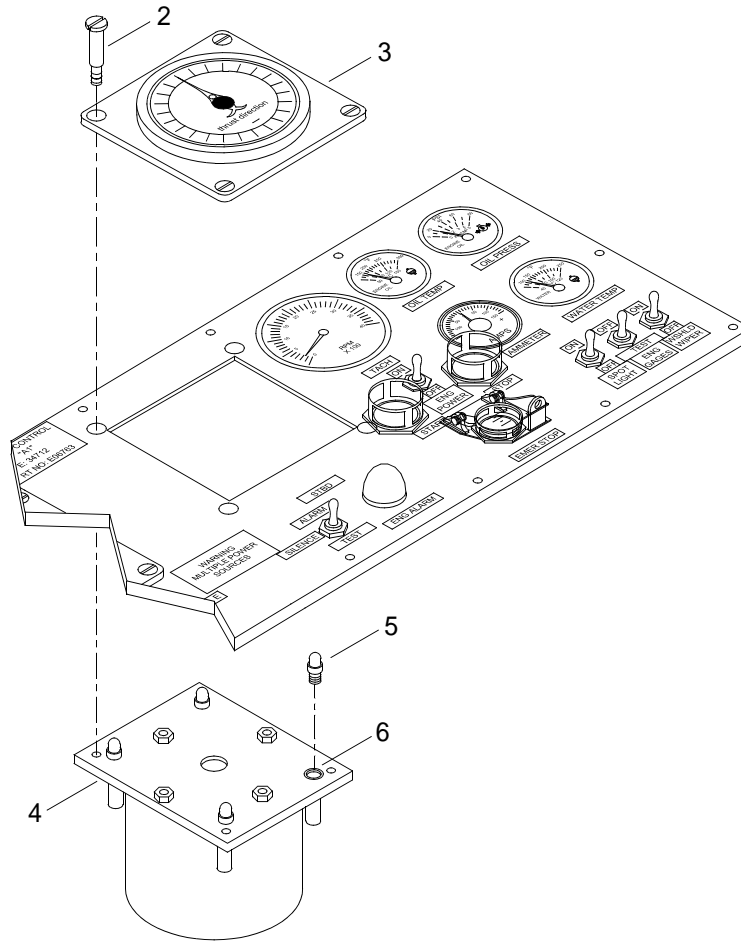
NOTE

The following procedure is typical for the removal and installation of thrust indicating device light bulbs.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove pan head screws (2) securing cover plate (3) to thrust indicating device (4).



- Remove cover plate (3) from thrust indicating device (4).
- Unscrew bulb (5) from lamp socket (6) and discard.

INSTALL THRUST INDICATING DEVICE LIGHT BULB

- Position new bulb (5) in lamp socket (6).
- Screw bulb (5) into lamp socket (6) to tighten.
- Position cover plate (3) on thrust indicating device (4).
- Install pan head screws (2) to secure cover plate to thrust indicating device (4). Tighten pan head screws (2).
- Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 ENGINE POWER TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch
 PN E08318-2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

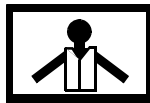
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE ENGINE POWER TOGGLE SWITCH

WARNING

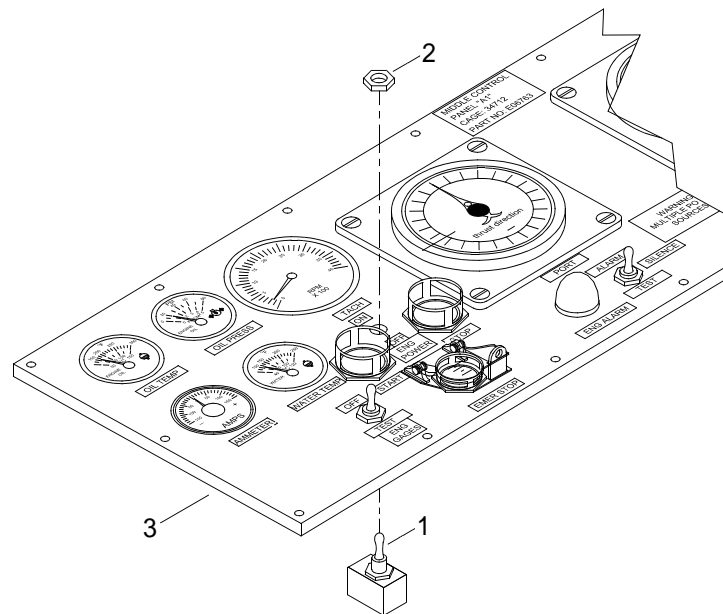
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of engine power toggle switch(s) on the middle control panel A1.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from middle control panel A1 (3) and discard.

INSTALL ENGINE POWER TOGGLE SWITCH

1. Position new toggle switch (1) on middle control panel A1 (3).
2. Install hex nut (2) to secure toggle switch (1) to middle control panel A1 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 SPOTLIGHT TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch
PN E08318-2
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

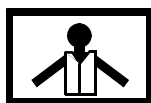
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE SPOTLIGHT TOGGLE SWITCH

WARNING



VEST



HELMET PROTECTION



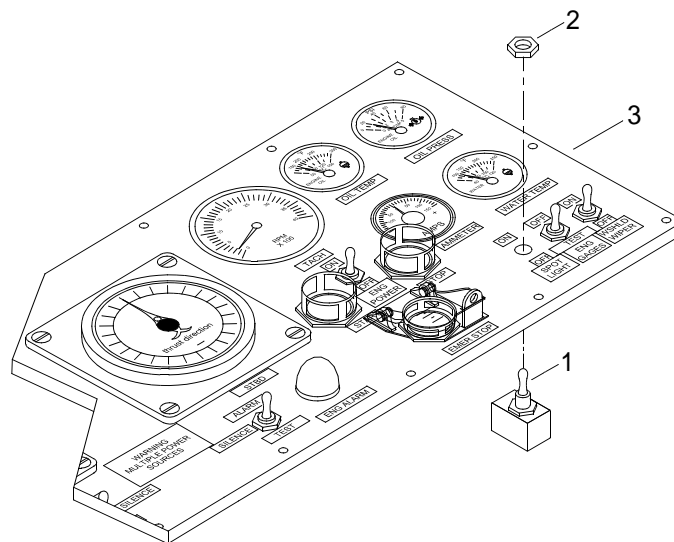
HEAVY PARTS



MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from middle control panel A1 (3) and discard.

INSTALL SPOTLIGHT TOGGLE SWITCH

1. Position new toggle switch (1) on middle control panel A1 (3).
2. Install hex nut (2) to secure toggle switch (1) to middle control panel A1 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1
WINDSHIELD WIPER TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch
PN E08318-2
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

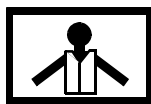
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE WINDSHIELD WIPER TOGGLE SWITCH

WARNING



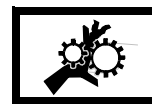
VEST



HELMET PROTECTION



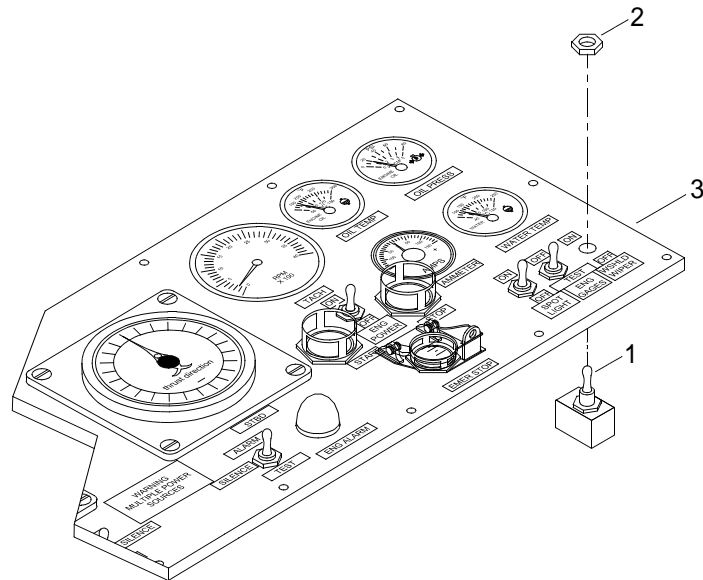
HEAVY PARTS



MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from middle control panel A1 (3) and discard.

INSTALL WINDSHIELD WIPER TOGGLE SWITCH

1. Position new toggle switch (1) on middle control panel A1 (3).
2. Install hex nut (2) to secure toggle switch (1) to middle control panel A1 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1
EMERGENCY STOP PUSHBUTTON
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Pushbutton, Contact (Emergency Stop Red)
 PN E30289
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

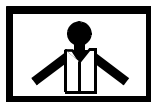
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE EMERGENCY STOP PUSHBUTTON

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



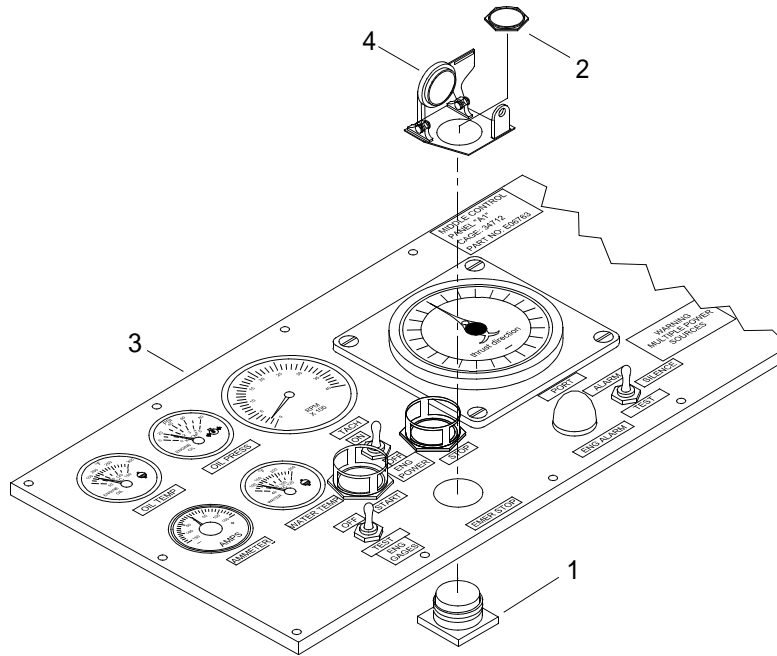
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of emergency stop pushbuttons on the middle control panel A1.

1. Tag and disconnect electrical wiring to emergency stop pushbutton (1).



2. Remove hex nut (2) securing emergency stop pushbutton (1) to middle control panel A1 (3).
3. Remove pushbutton cover (4) from emergency stop pushbutton (1).
4. Remove emergency stop pushbutton (1) from middle control panel A1 (3) and discard.

INSTALL EMERGENCY STOP PUSHBUTTON

1. Position new emergency stop pushbutton (1) on middle control panel A1 (3).
2. Position pushbutton cover (4) over emergency stop pushbutton (1).
3. Install hex nut (2) to secure pushbutton cover (4) and emergency stop pushbutton (1) to middle control panel A1 (3). Tighten hex nut (2).
4. Connect electrical wiring to emergency stop pushbutton (1) and remove tags.
5. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1
EMERGENCY STOP PUSHBUTTON COVER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Attachment, Padlock
 PN E45958
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88K

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE MIDDLE CONTROL PANEL A1 EMERGENCY STOP PUSHBUTTON COVER

WARNING

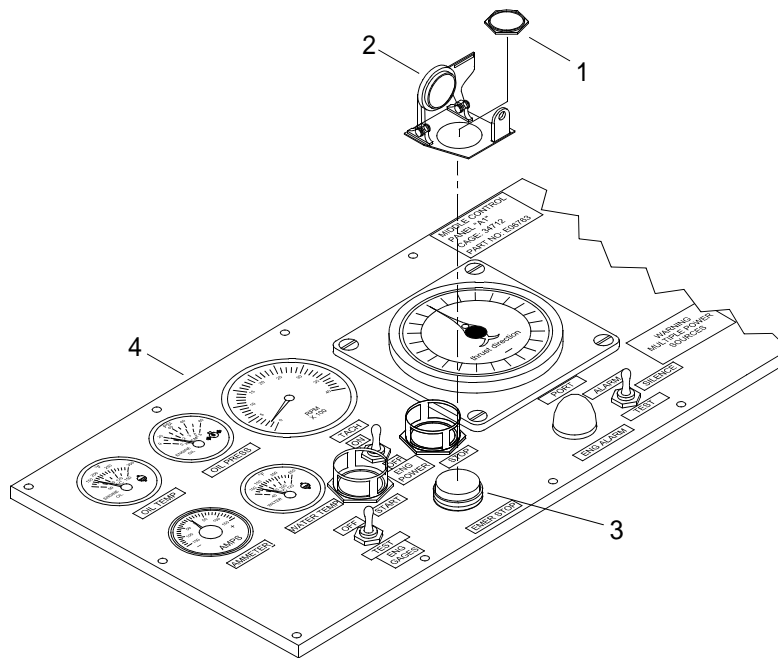
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of both emergency stop pushbutton covers.

1. Remove hex nut (1) securing pushbutton cover (2) and emergency stop pushbutton (3) to middle control panel A1 (4).



2. Supporting emergency stop pushbutton (3) from beneath middle control panel A1 (4), remove pushbutton cover (2) from emergency stop pushbutton (3).
3. Discard pushbutton cover (2).

INSTALL MIDDLE CONTROL PANEL A1 EMERGENCY STOP PUSHBUTTON COVER

1. Position new pushbutton cover (2) on emergency stop pushbutton (3) while supporting emergency stop pushbutton (3) from beneath middle control panel A1 (4).
2. Install hex nut (1) to secure pushbutton cover (2) and emergency stop pushbutton (3) to middle control panel A1 (4). Tighten hex nut (1).
3. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MIDDLE CONTROL PANEL A1 ENGINE STOP PUSHBUTTON
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Pushbutton, Contact (Black W/Type B Contact)
 PN E30309
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

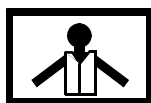
Engineer 88L

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE ENGINE STOP PUSHBUTTON

WARNING

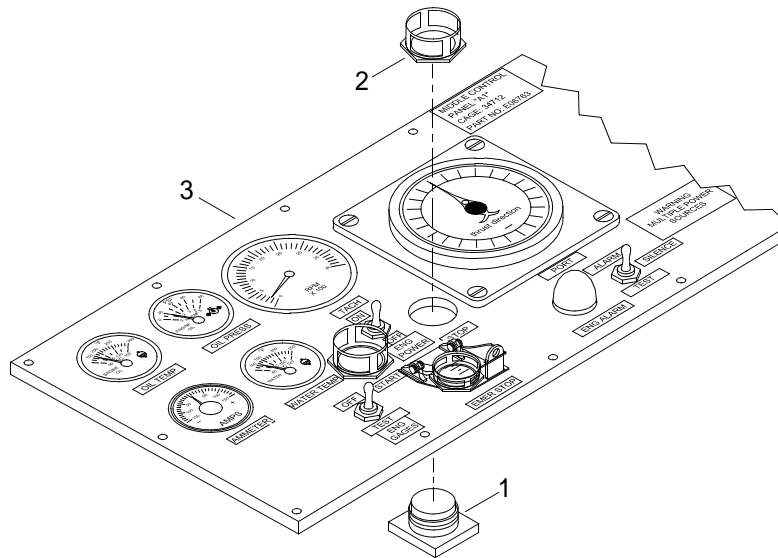
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of engine stop pushbuttons on the middle control panel A1.

1. Tag and disconnect electrical wiring to engine stop pushbutton (1).



2. Remove hex nut (2) securing engine stop pushbutton to middle control panel A1 (3).
3. Remove engine stop pushbutton (1) from middle control panel A1 (3) and discard.

INSTALL ENGINE STOP PUSHBUTTON

1. Position new engine stop pushbutton (1) on middle control panel A1 (3).
2. Instal hex nut (2) to secure engine stop pushbutton to middle control panel A1 (3). Tighten hex nut (2).
3. Connect electrical wiring to engine stop pushbutton (1) and remove tags.
4. Install middle control panel A1. (WP 0254 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)
 Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

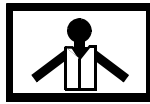
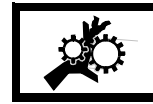
Engineer 88L

References

TM 55-1945-225-10

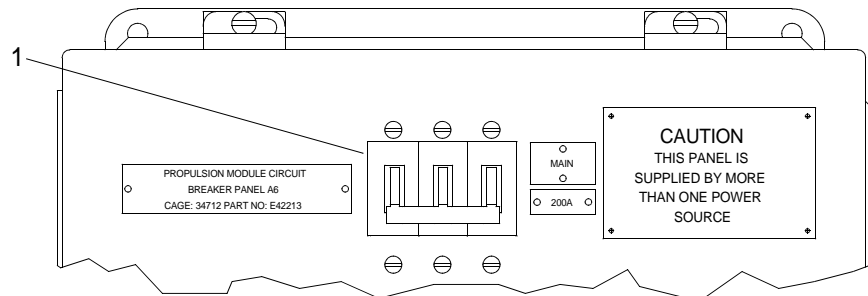
REMOVE LOWER CONTROL PANEL A2

WARNING

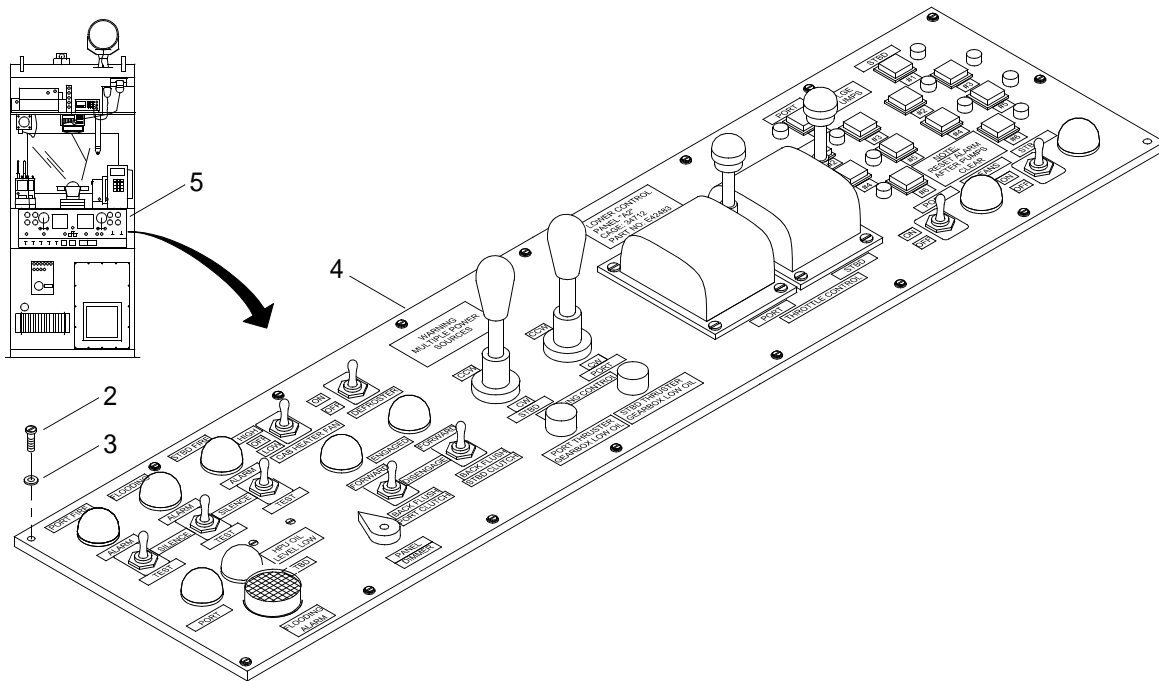
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove pan head capscrews (2) and lockwashers (3) securing lower control panel A2 (4) to operators cab control console (5).

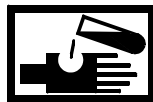


- Lift and tilt lower control panel A2 (4) from operators cab control console (5), being careful not to bend or chafe the wiring, to access electrical wiring.
- Remove tiedown straps securing loose wires.
- Tag and disconnect all electrical wiring to lower control panel A2 (4).
- Remove lower control panel A2 (4) from operators cab control console (5).

INSTALL LOWER CONTROL PANEL A2

- Connect all electrical wiring to lower control panel A2 (4) and remove tags.
- Use tiedown straps to secure loose wires.

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to pan head capscrews (2).
- Position lower control panel A2 (4) on operators cab control console (5).
- Install pan head capscrews (2) and lockwashers (3) to secure lower control panel A2 (4) to operators cab control console (5). Tighten pan head capscrews (2).
- Perform operational check of lower control panel A2. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 THROTTLE CONTROL
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Control, Throttle (5K Ohm)
 PN E06528
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

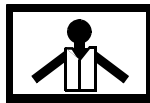
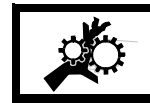
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE THROTTLE CONTROL

WARNING

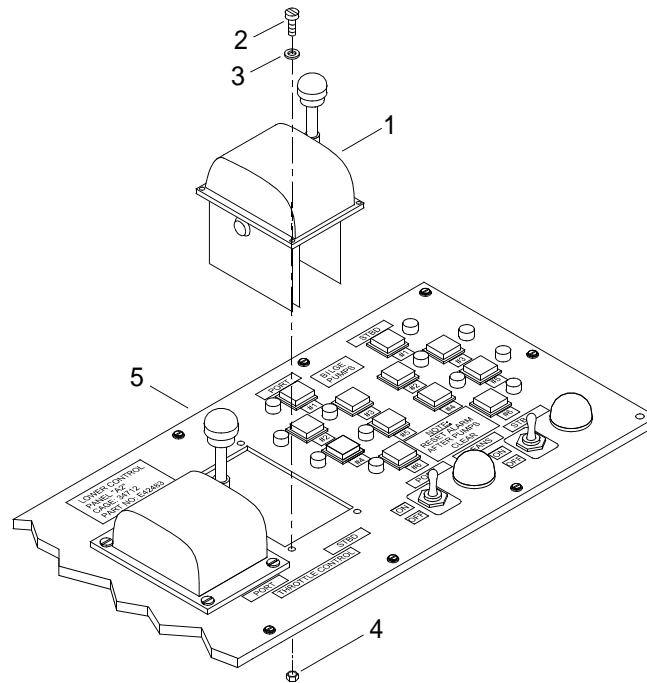
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of both throttle controls on the lower control panel A2.

1. Tag and disconnect electrical wiring to throttle control (1).



2. Remove pan head screws (2), flat washers (3) and hex nuts (4) securing throttle control (1) to lower control panel A2 (5).
3. Remove throttle control (1) from lower control panel A2 (5) and discard.

INSTALL THROTTLE CONTROL

1. Position new throttle control (1) on lower control panel A2 (5).
2. Install pan head screws (2), flat washers (3) and hex nuts (4) to secure throttle control (1) to lower control panel A2 (5). Tighten hex nuts (4).
3. Connect electrical wiring to throttle control (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 CAB HEATER FAN TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch (28 VDC)
PN E08318-5
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

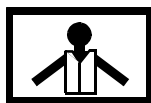
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE CAB HEATER FAN TOGGLE SWITCH

WARNING



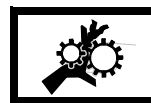
VEST



HELMET PROTECTION



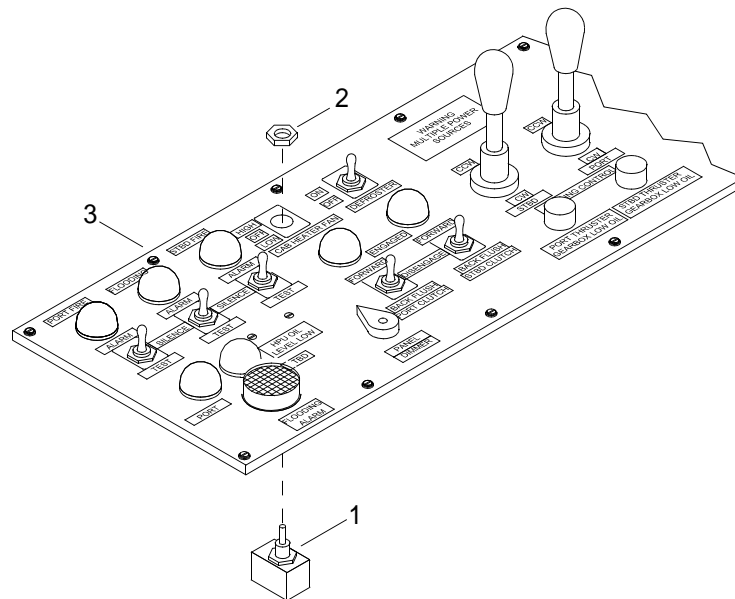
HEAVY PARTS



MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from lower control panel A2 (3) and discard.

INSTALL CAB HEATER FAN TOGGLE SWITCH

1. Position new toggle switch (1) on lower control panel A2 (3).
2. Install hex nut (2) to secure toggle switch (1) to lower control panel A2 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 STEERING CONTROL LEVERS
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Toggle Switch, Steering Control
 PN E28798
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

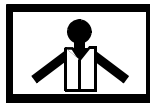
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE STEERING CONTROL LEVER

WARNING



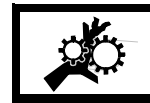
VEST



HELMET PROTECTION



HEAVY PARTS



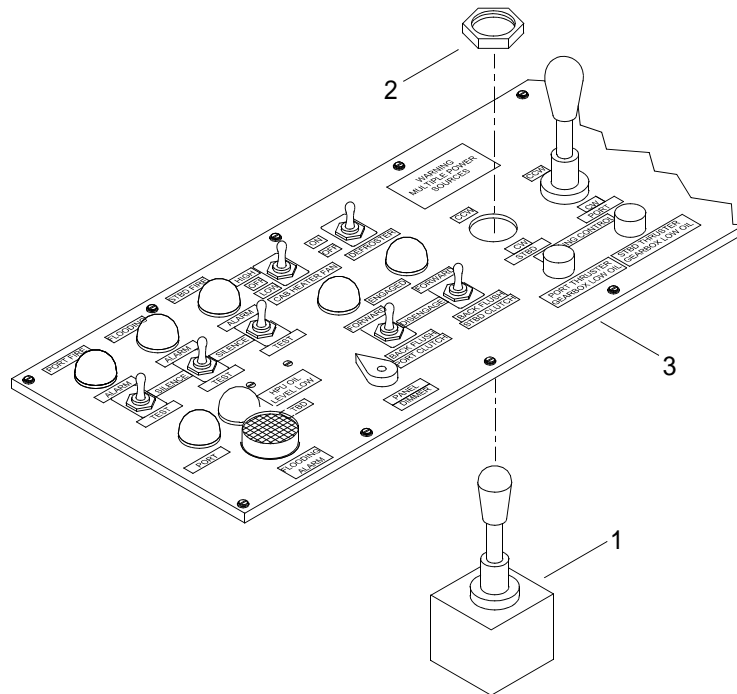
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the steering control levers on the lower control panel A2.

1. Tag and disconnect electrical wiring to steering control lever (1).



2. Remove hex nut (2) securing steering control lever (1) to lower control panel A2 (3).
3. Remove steering control lever (1) from lower control panel A2 (3) and discard.

INSTALL STEERING CONTROL LEVER

1. Position new steering control lever (1) on lower control panel A2 (3).
2. Install hex nut (2) to secure steering control lever (1) to lower control panel A2 (3). Tighten hex nut (2).
3. Connect electrical wiring to steering control lever (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 DIMMER SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Dimmer, Alarm and Gauge Light
PN E09408
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

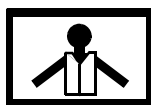
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE DIMMER SWITCH

WARNING



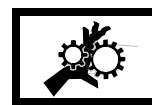
VEST



HELMET PROTECTION



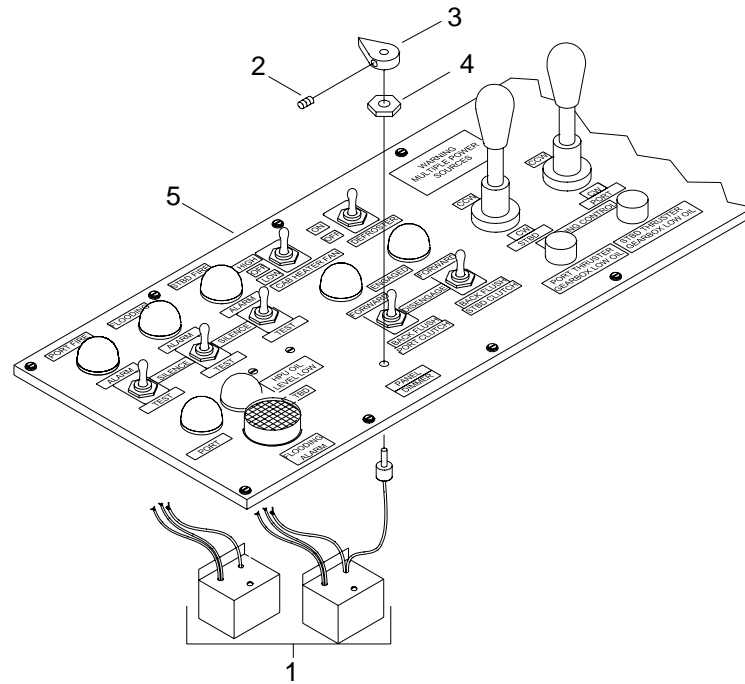
HEAVY PARTS



MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Tag and disconnect electrical wiring to components of two piece dimmer switch (1).



2. Remove set screw (2) securing knob (3) to post of dimmer switch (1).
3. Remove knob (3) from post of dimmer switch (1).
4. Remove hex nut (4) securing dimmer switch (1) to lower control panel A2 (5).
5. Remove dimmer switch (1) from lower control panel A2 (5) and discard.

INSTALL DIMMER SWITCH

1. Position new dimmer switch (1) on lower control panel A2 (5).
2. Install hex nut (4) to secure dimmer switch (1) to the lower control panel A2 (5). Tighten hex nut (4).
3. Install knob (3) on post of dimmer switch (1) and secure with set screw (2). Tighten set screw (2).
4. Connect electrical wiring to components of two piece dimmer switch (1) and remove tags.
5. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 THRUSTER GEARBOX
LOW OIL INDICATOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator, Assembly
 PN E46433
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

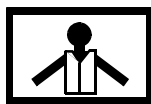
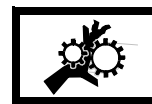
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE THRUSTER GEARBOX LOW OIL INDICATOR

WARNING

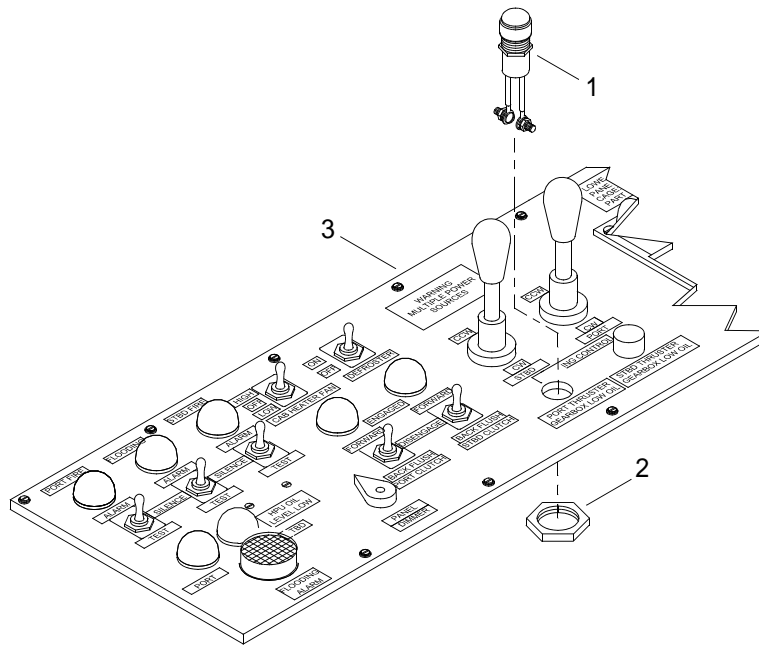
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the red thruster gearbox low oil indicators on the lower control panel A2.

1. Tag and disconnect electrical wiring to indicator (1).



2. Remove indicator retainer (2) from indicator (1).
3. Remove indicator (1) from front of lower control panel A2 (3) and discard.

INSTALL THRUSTER GEARBOX LOW OIL INDICATOR

1. Position new indicator (1) through hole in front of lower control panel A2 (3).
2. Install indicator retainer (2) to secure indicator (1) to lower control panel A2 (3). Tighten indicator retainer (2).
3. Connect electrical wiring to indicator (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 CLUTCH TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch (Lock-Out Type)
 PN E08318-7
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

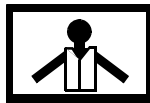
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE CLUTCH TOGGLE SWITCH

WARNING

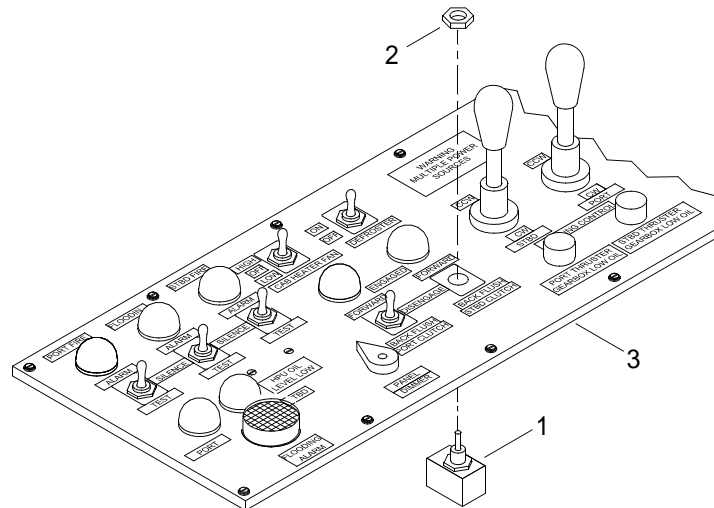
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the clutch toggle switch(s) on the lower control panel A2.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from lower control panel A2 (3) and discard.

INSTALL CLUTCH TOGGLE SWITCH

1. Position new toggle switch (1) on lower control panel A2 (3).
2. Install hex nut (2) to secure toggle switch (1) to lower control panel A2 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 SONALERT BEEPER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Beeper, Sonalert
 PN 08088
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

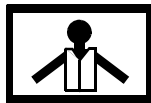
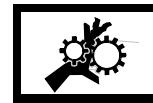
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

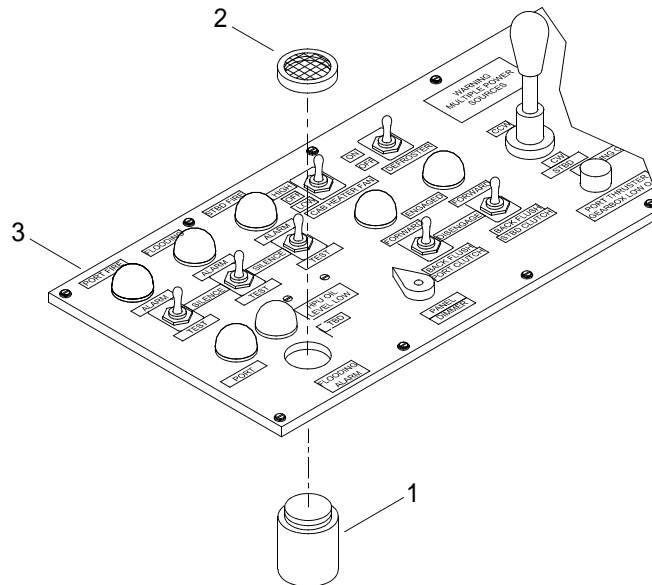
REMOVE SONALERT BEEPER

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Tag and disconnect electrical wiring to sonalert beeper (1).



2. Unscrew and remove speaker cap (2) securing sonalert beeper (1) to lower control panel A2 (3).
3. Remove sonalert beeper (1) from lower control panel A2 (3) and discard.

INSTALL SONALERT BEEPER

1. Position new sonalert beeper (1) on lower control panel A2 (3).
2. Install speaker cap (2) to secure sonalert beeper (1) to lower control panel (3). Tighten speaker cap (2).
3. Connect electrical wiring to sonalert beeper (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 BILGE PUMP FLOOD WARNING
INDICATOR LIGHT ASSEMBLY
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator Light Assembly
 PN E26848
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

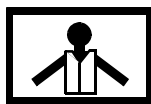
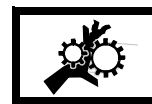
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE FLOOD WARNING INDICATOR BASE

WARNING

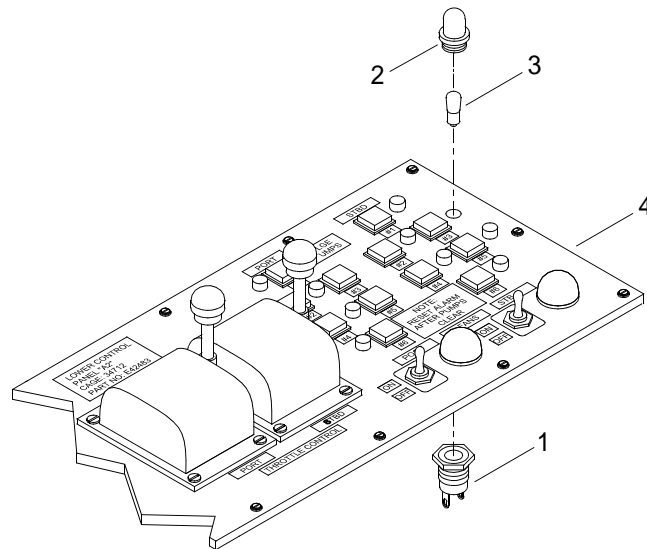
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for removal and installation of the bilge pump flood warning indicator light assemblies on the lower control panel A2.

1. Tag and disconnect electrical wiring to indicator base (1).



2. Unscrew red cap (2) from indicator base (1) and discard.
3. Remove bulb (3) from indicator base (1).
4. Remove indicator base (1) from lower control panel A2 (4) and discard.

INSTALL FLOOD WARNING INDICATOR

1. Position new indicator base (1) on lower control panel A2 (4).
2. Position and install bulb (3) in indicator base (1).
3. Screw new red cap (2) on indicator base (1) to secure indicator base (1) to lower control panel A2 (4). Tighten red cap (2).
4. Connect electrical wiring to indicator base (1) and remove tags.
5. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 BILGE PUMP FLOOD
WARNING INDICATOR LAMP
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Lamp
 PN E30688-1
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

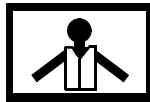
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE FLOOD WARNING INDICATOR LAMP

WARNING



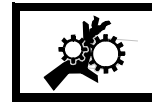
VEST



HELMET PROTECTION



HEAVY PARTS



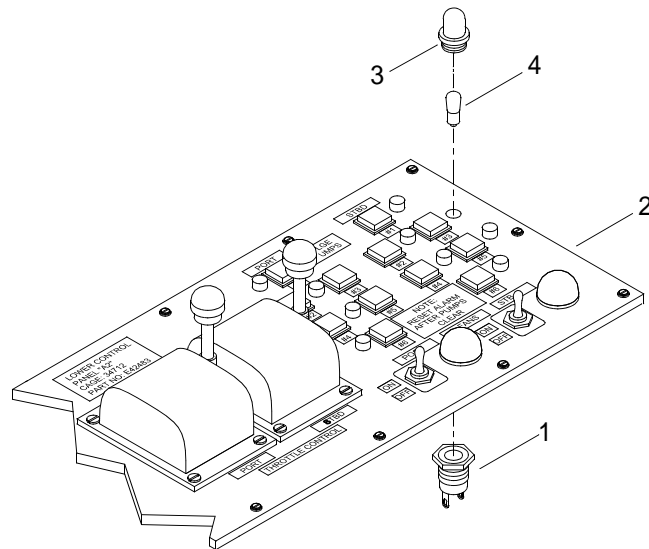
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for removal and installation of the bilge pump flood warning indicator lamps on the lower control panel A2.

1. Support indicator base (1) from beneath lower control panel A2 (2).



2. Unscrew red cap (3) from indicator base (1).
3. Remove lamp (4) from indicator base (1) and discard.

INSTALL FLOOD WARNING INDICATORS LAMP

1. Support indicator base (1) from beneath lower control panel A2 (2).
2. Position and install new lamp (4) in indicator base (1).
3. Screw red cap (3) on indicator base (1) to secure indicator base (1) to lower control panel A2 (2). Tighten red cap (3).
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 BILGE PUMP
INDICATOR/SWITCH PUSHBUTTON
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator/Switch
 PN E11258
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

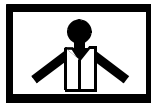
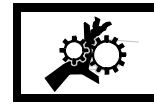
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE BILGE PUMP INDICATOR/SWITCH PUSHBUTTON

WARNING

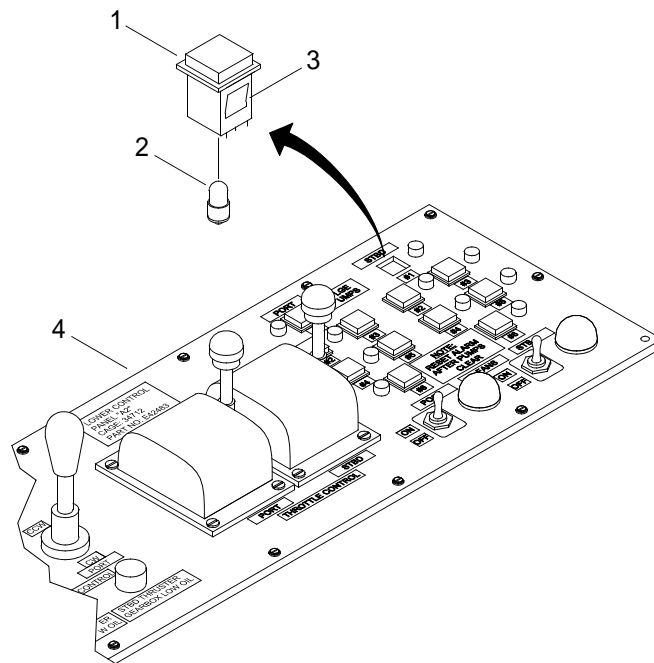
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for removal and installation of the bilge pump indicator/switch pushbuttons on the lower control panel A2.

1. Tag and disconnect electrical wiring to indicator/switch (1).



2. Remove bulb (2) from bottom of indicator/switch (1).
3. Depress tabs (3) on sides of indicator/switch (1) securing indicator/switch (1) to lower control panel A2 (4).
4. Remove indicator/switch (1) from lower control panel A2 (4) and discard.

INSTALL LOWER CONTROL PANEL A2 BILGE PUMP SYSTEM INDICATOR LIGHT BULB

1. Position new indicator/switch (1) on lower control panel A2 (4), adjust tabs (3) to lower control panel A2 (4) thickness and snap in place to secure to lower control panel A2 (4).
2. Position and install bulb (2) into base of indicator/switch (1).
3. Connect electrical wiring to indicator/switch (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 BILGE PUMP
INDICATOR/SWITCH PUSHBUTTON LAMP
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Lamp
PN E43208
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

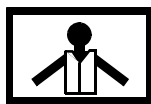
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE BILGE PUMP INDICATOR/SWITCH PUSHBUTTON LAMP

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



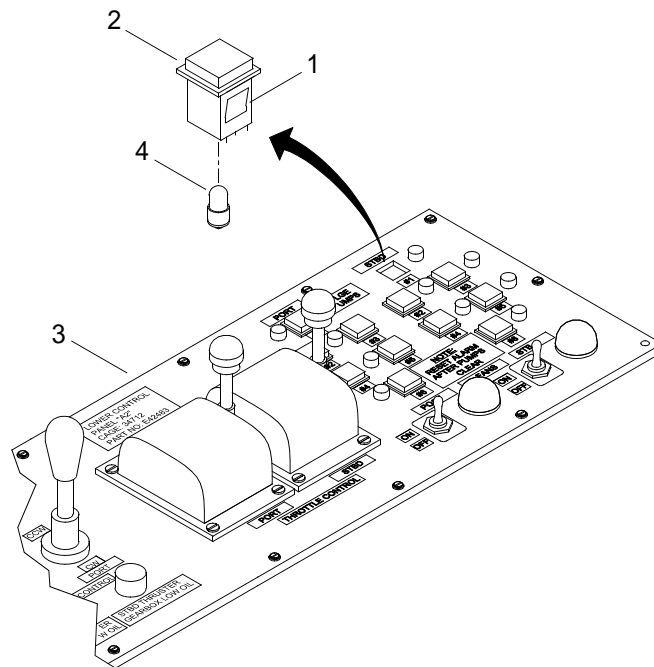
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for removal and installation of the bilge pump indicator/switch pushbutton lamps on the lower control panel A2.

1. Depress tabs (1) on sides of indicator/switch (2) securing indicator/switch (2) to lower control panel A2 (3).



2. Remove lamp (4) from bottom of indicator/switch (2) and discard.

INSTALL BILGE PUMP INDICATOR/SWITCH PUSHBUTTON LAMP

1. Install new lamp (4) into base of indicator/switch (2).
2. Install indicator/switch (2) on lower control panel A2 (3) and snap in place to secure to lower control panel A2 (3).
3. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 VENT FANS TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch (28 VDC)
 PN E08318-6
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

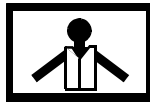
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE VENT FANS TOGGLE SWITCH

WARNING



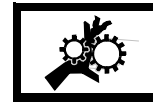
VEST



HELMET PROTECTION



HEAVY PARTS



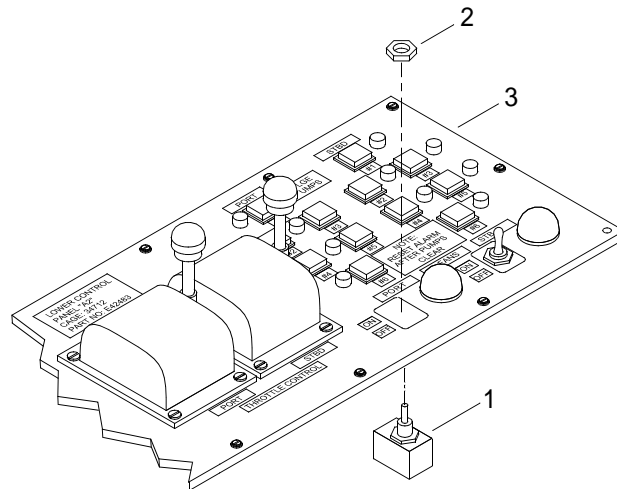
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the vent fans toggle switch(s) on the lower control panel A2.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from lower control panel A2 (3) and discard.

INSTALL VENT FANS TOGGLE SWITCH

1. Position new toggle switch (1) on lower control panel A2 (3).
2. Install hex nut (2) to secure toggle switch (1) to lower control panel A2 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 DEFROSTER TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch (28 VDC)
PN E08318-6
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

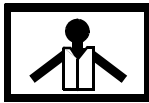
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE DEFROSTER TOGGLE SWITCH

WARNING



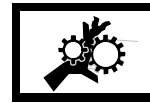
VEST



HELMET PROTECTION



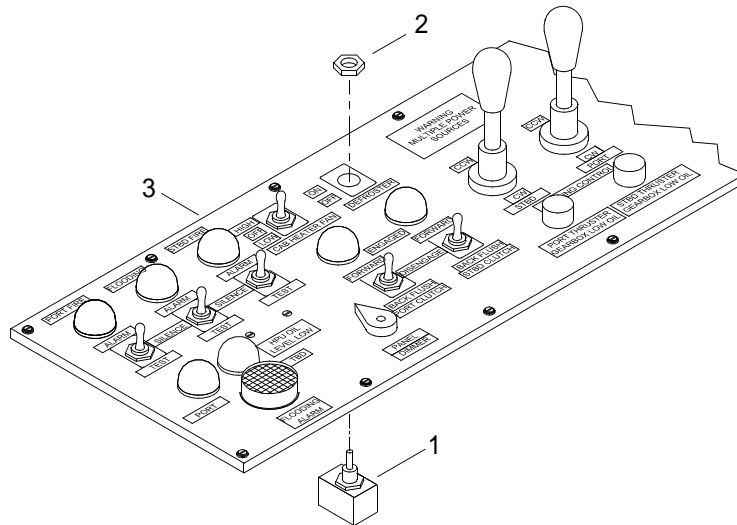
HEAVY PARTS



MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from lower control panel A2 (3) and discard.

INSTALL DEFROSTER TOGGLE SWITCH

1. Position new toggle switch (1) on lower control panel A2 (3).
2. Install hex nut (2) to secure toggle switch (1) to lower control panel A2 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 FIRE TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch (28 VDC)
 PN E09678-4
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

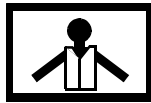
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE FIRE TOGGLE SWITCH

WARNING



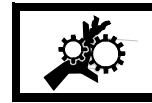
VEST



HELMET PROTECTION



HEAVY PARTS



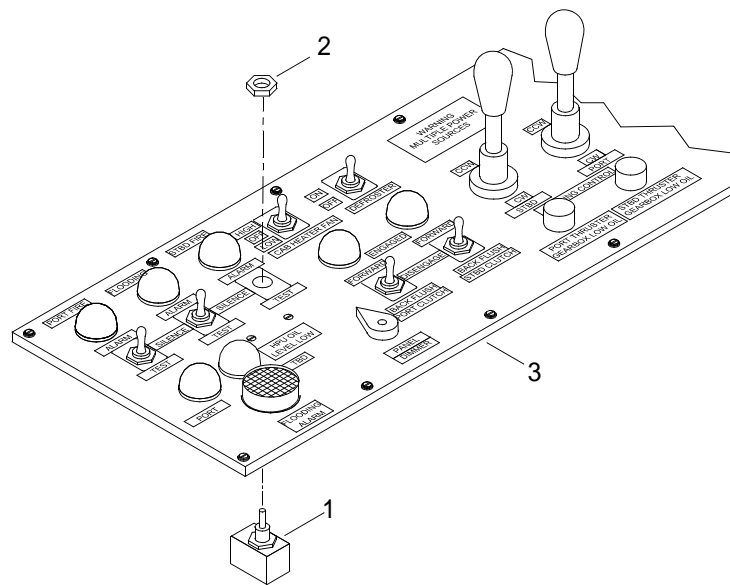
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the fire toggle switch(s) on the lower control panel A2.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from lower control panel A2 (3) and discard.

INSTALL FIRE TOGGLE SWITCH

1. Position new toggle switch (1) on lower control panel A2 (3).
2. Install hex nut (2) to secure toggle switch (1) to lower control panel A2 (3). Tighten hex nuts (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 FLOODING TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Switch (28 VDC)
 PN E09678-4
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

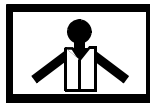
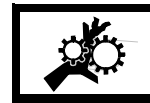
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

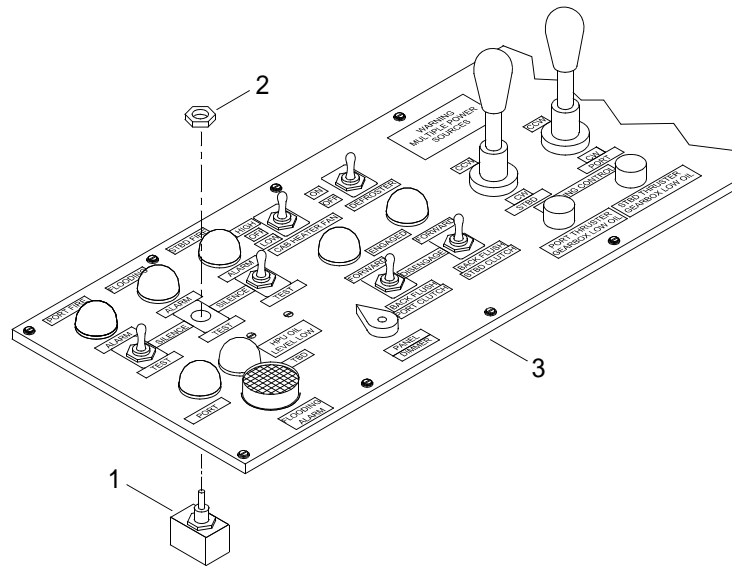
REMOVE FLOODING TOGGLE SWITCH

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Tag and disconnect electrical wiring to toggle switch (1).



2. Remove hex nut (2) from toggle switch (1).
3. Remove toggle switch (1) from lower control panel A2 (3) and discard.

INSTALL FLOODING TOGGLE SWITCH

1. Position new toggle switch (1) on lower control panel A2 (3).
2. Install hex nut (2) to secure toggle switch (1) to lower control panel A2 (3). Tighten hex nut (2).
3. Connect electrical wiring to toggle switch (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 VENT FAN INDICATOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator, Watertight
 PN E46428-3
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

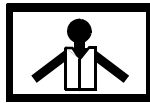
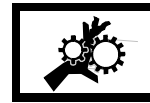
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE VENT FAN INDICATOR

WARNING

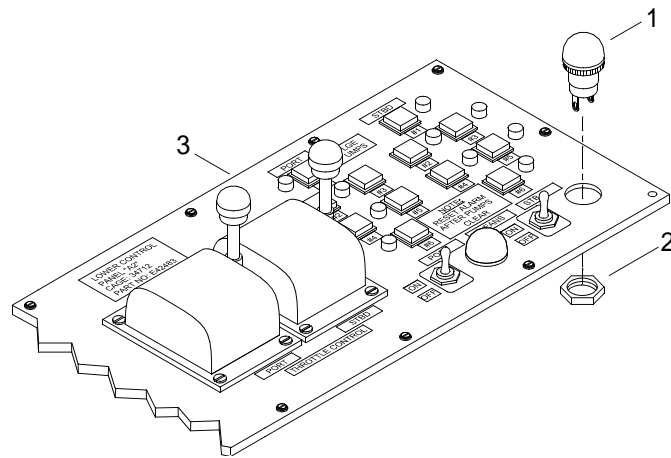
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the green vent fan indicators on the lower control panel A2.

1. Tag and disconnect electrical wiring to indicator (1).



2. Remove indicator retainer (2) from indicator (1).
3. Remove indicator (1) from front of lower control panel A2 (3) and discard.

INSTALL VENT FAN INDICATOR

1. Position new indicator (1) through hole in front of lower control panel A2 (3).
2. Install indicator retainer (2) to secure indicator (1) to lower control panel A2 (3). Tighten indicator retainer (2).
3. Connect electrical wiring to indicator (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 CLUTCH INDICATOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator, Watertight
 PN E46428-4
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

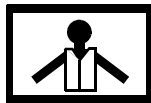
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE CLUTCH INDICATOR

WARNING



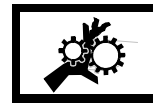
VEST



HELMET PROTECTION



HEAVY PARTS



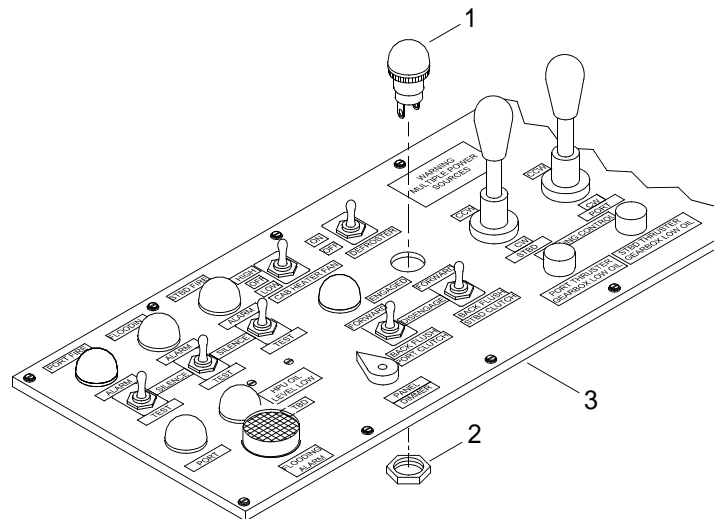
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the amber (yellow) clutch indicator bases on the lower control panel A2.

1. Tag and disconnect electrical wiring to indicator (1).



2. Remove indicator retainer (2) from indicator (1).
3. Remove indicator (1) from front of lower control panel A2 (3) and discard.

INSTALL CLUTCH INDICATOR

1. Position new indicator (1) through hole in front of lower control panel A2 (3).
2. Install indicator retainer (2) to secure indicator (1) to lower control panel A2 (3). Tighten indicator retainer (2).
3. Connect electrical wiring to indicator (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 FIRE INDICATOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator, Watertight
PN E46428-2
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

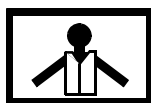
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE FIRE INDICATOR

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the red fire indicators on the lower control panel A2.

1. Tag and disconnect electrical wiring to indicator (1).

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 FLOODING INDICATOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator, Watertight
 PN E46428-2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

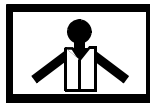
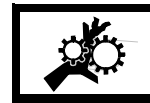
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE FLOODING INDICATOR

WARNING

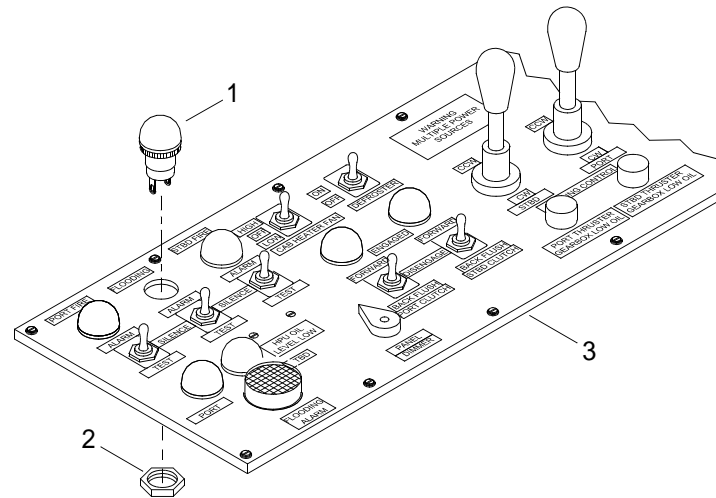
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the red flooding indicators on the lower control panel A2.

1. Tag and disconnect electrical wiring to indicator (1).



2. Remove indicator retainer (2) from indicator (1).
3. Remove indicator (1) from front of lower control panel A2 (3) and discard.

INSTALL FLOODING INDICATOR

1. Position new indicator (1) through hole in front of lower control panel A2 (3).
2. Install indicator retainer (2) to secure indicator (1) to lower control panel A2 (3). Tighten indicator retainer (2).
3. Connect electrical wiring to indicator (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LOWER CONTROL PANEL A2 HPU OIL LEVEL
LOW INDICATOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Indicator, Watertight
 PN E46428-2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

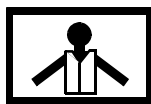
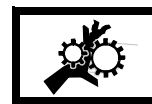
Engineer 88L

Equipment Condition

Lower Control Panel A2 Removed. (WP 0272 00)

REMOVE HPU OIL LEVEL LOW INDICATOR

WARNING

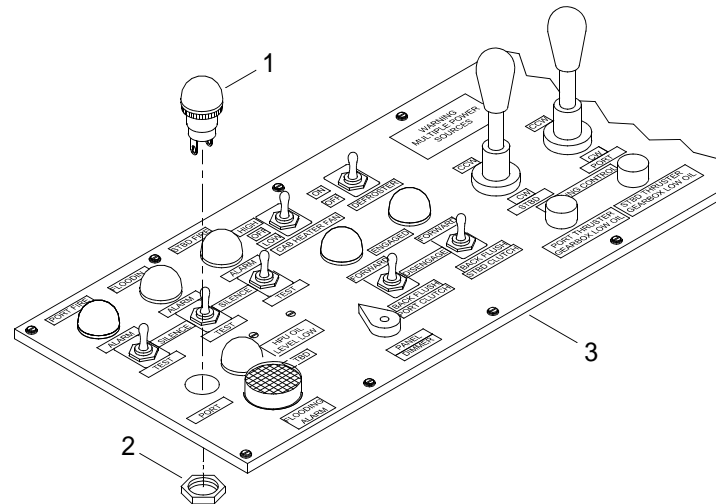
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of the red HPU oil level low indicators on the lower control panel A2.

1. Tag and disconnect electrical wiring to indicator (1).



2. Remove indicator retainer (2) from indicator (1).
3. Remove indicator (1) from front of lower control panel A2 (3) and discard.

INSTALL HPU OIL LEVEL LOW INDICATOR

1. Position new indicator (1) through hole in front of lower control panel A2 (3).
2. Install indicator retainer (2) to secure indicator (1) to lower control panel A2 (3). Tighten indicator retainer (2).
3. Connect electrical wiring to indicator (1) and remove tags.
4. Install lower control panel A2. (WP 0272 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB CIRCUIT BREAKER PANEL A3
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

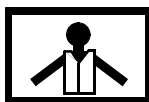
TM 55-1945-225-10

Equipment Condition

Operators Cab Access Panel Removed. (WP 0239 00)

REMOVE OPERATORS CAB CIRCUIT BREAKER PANEL A3

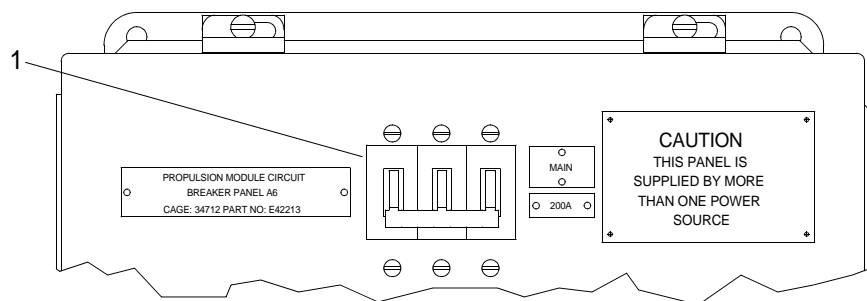
WARNING



VEST

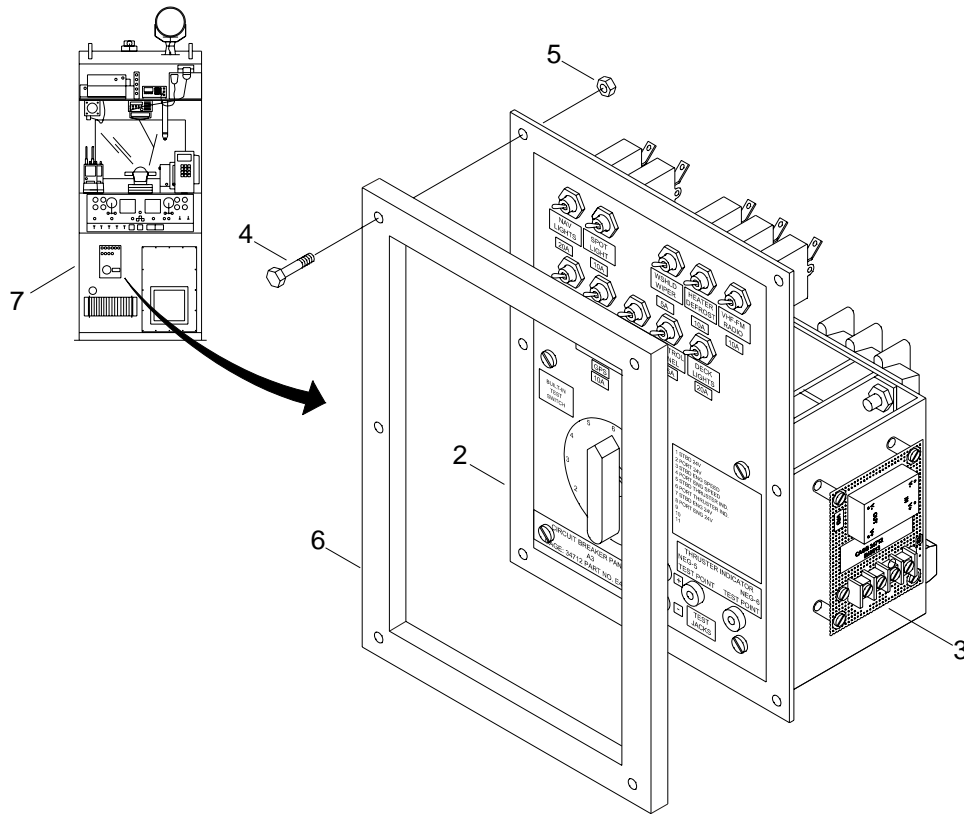
All personnel must wear a personal flotation device during WT maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Tag and disconnect electrical wiring to operators cab circuit breaker panel A3 (2).
3. Tag and disconnect electrical wiring to converter assembly A8 (3).

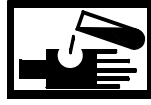
4. Remove pan head capscrews (4) and hex nuts (5) securing operators cab circuit breaker panel A3 (2) and spacer plate (6) to front of operators cab control console (7).



5. Remove operators cab circuit breaker panel A3 (2) and spacer plate (6) from front of operators cab control console (7).

INSTALL OPERATORS CAB CIRCUIT BREAKER PANEL A3

WARNING

**CHEMICAL****EYE PROTECTION**

1. Apply adhesive to pan head capscrews (4).
2. From behind control console, position spacer plate (6) and operators cab circuit breaker panel A3 (2) over opening in operators cab control console (7).
3. Install pan head capscrews (4) and hex nuts (5) to secure spacer plate (6) and operators cab circuit breaker panel A3 (2) to front of operators cab control console (7). Tighten hex nuts (5).
4. Connect electrical wiring to operators cab converter assembly A8 (3) and remove tags.
5. Connect electrical wiring to operators cab circuit breaker panel A3 (2) and remove tags.
6. Perform operational check of operators cab circuit breaker panel A3. (TM 55-1945-225-10)
7. Install operators cab access panel. (WP 0239 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB CIRCUIT BREAKER PANEL A3
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

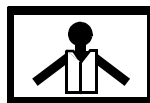
TM 55-1945-225-10

Equipment Condition

Operators Cab Access Panel Removed. (WP 0239 00)
Operators Cab Circuit Breaker Panel A3 Removed. (WP 0293 00)

DISASSEMBLE OPERATORS CAB CIRCUIT BREAKER PANEL A3

WARNING



VEST

All personnel must wear a personal flotation device during WT maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

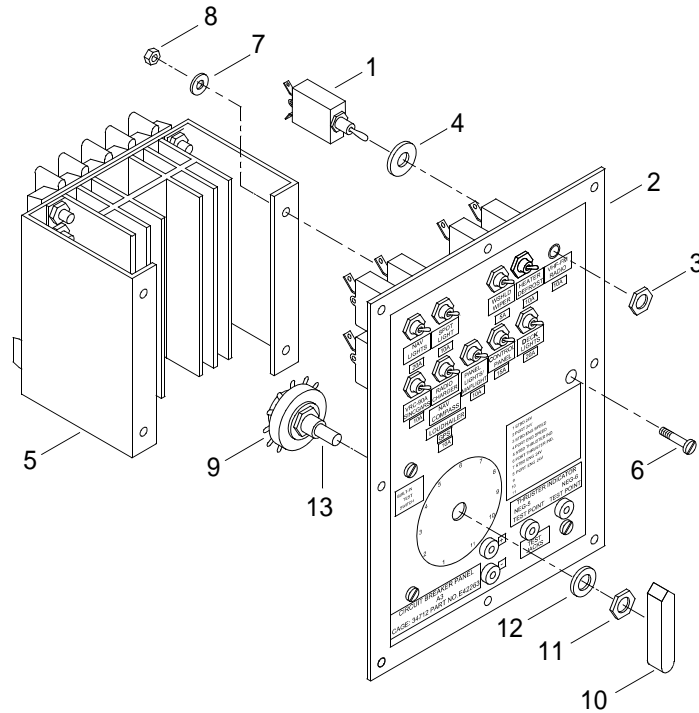
NOTE

This task is typical for the removal, inspection, repair and installation of components on the operators cab circuit breaker panel A3.

Repair is limited to the replacement of damaged parts.

The following step is typical for the removal of circuit breakers.

1. Remove circuit breaker (1) from operators cab circuit breaker panel A3 (2).

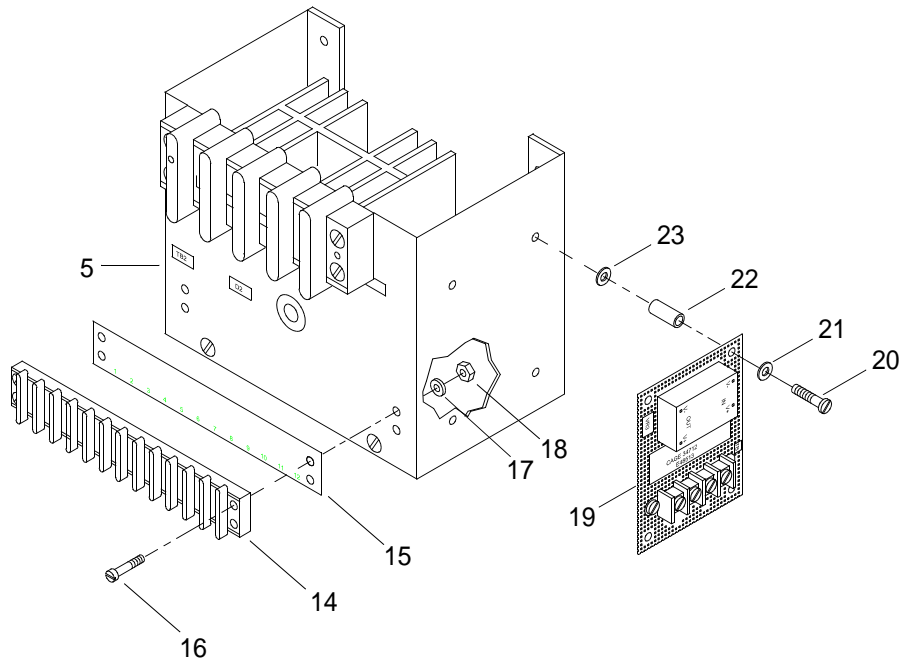


- a. Tag and disconnect wiring from circuit breaker (1).
 - b. Remove hex nut (3) securing circuit breaker (1) to operators cab circuit breaker panel A3 (2).
 - c. Remove circuit breaker (1) and washer (4) from operators cab circuit breaker panel A3 (2).
2. Remove heat sink bracket (5) from operators cab circuit breaker panel A3 (2).
 - a. Remove pan head screws (6), lockwashers (7) and hex nuts (8) securing heat sink bracket (5) to operators cab circuit breaker panel A3 (2).
 - b. Remove heat sink bracket (5) from operators cab circuit breaker panel A3 (2).
 3. Remove rotary switch (9) from operators cab circuit breaker panel A3 (2).
 - a. Tag and disconnect electrical wiring from rotary switch (9).
 - b. Remove bar pointer knob (10), hex nut (11) and washer (12) from rotary switch shaft (13) on front of operator cab circuit breaker panel A3 (2).
 - c. Remove rotary switch (9) from operator cab circuit breaker panel A3 (2).

NOTE

The following step is typical for the removal of terminal blocks.

4. Remove terminal block (14) and marker strip (15) from rear of heat sink bracket (5).



- a. Remove pan head screws (16), lockwashers (17) and hex nuts (18) securing terminal block (14) and marker strip (15) to heat sink bracket (5).
 - b. Remove terminal block (14) and marker strip (15) from heat sink bracket (5).
5. Remove converter assembly A8 (19).
- a. Remove pan head machine screws (20) and flat washers (21) securing converter assembly A8 (19) to heat sink bracket (5).
 - b. Remove converter assembly A8 (19)
 - c. Remove spacers (22) and plastic washers (23) from heat sink bracket (5).

NOTE

The following step is typical for the removal of terminal blocks.

CLEAN OPERATORS CAB CIRCUIT BREAKER PANEL A3

1. Clean operators cab circuit breaker panel A3 surfaces with a clean wiping rag.

WARNING


CHEMICAL

EYE PROTECTION

VAPOR

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING


CHEMICAL

EYE PROTECTION

VAPOR

3. Dispose of contaminated wiping rags per local procedures.

INSPECT OPERATORS CAB CIRCUIT BREAKER PANEL A3

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE OPERATORS CAB CIRCUIT BREAKER PANEL A3

1. Install converter assembly A8 (19).
 - a. Install spacers (22) and plastic washers (23) on heat sink bracket (5).
 - b. Position converter assembly A8 (19) on spacers (22).
 - c. Install pan head machine screws (20) and flat washers (21) to secure converter assembly A8 (19) to heat sink bracket (5).
 - d. Tighten pan head machine screws (20).

NOTE

The following step is typical for the installation of terminal blocks.

2. Install terminal block (14) and marker strip (15) on rear of heat sink bracket (5).
 - a. Position terminal block (14) and marker strip (15) on heat sink bracket (5).
 - b. Install pan head screws (16), lockwashers (17) and hex nuts (18) to secure terminal block (14) and marker strip (15) to heat sink bracket (5). Tighten hex nuts (18).
3. Install rotary switch (9) on operators cab circuit breaker panel A3 (2).
 - a. Position rotary switch (9) on operator cab circuit breaker panel A3 (2).
 - b. Install bar pointer knob (10), hex nut (11) and washer (12) on rotary switch shaft (13) to secure rotary switch (9) on front of operator cab circuit breaker panel A3 (2). Tighten hex nut (11).
 - c. Connect electrical wiring to rotary switch (9) and remove tags.
4. Install heat sink bracket (5) on operators cab circuit breaker panel A3 (2).
 - a. Position heat sink bracket (5) on operators cab circuit breaker panel A3 (2).
 - b. Install pan head screws (6), lockwashers (7) and hex nuts (8) to secure heat sink bracket (5) on operators cab circuit breaker panel A3 (2). Tighten hex nuts (8).

NOTE

The following step is typical for the installation of circuit breakers.

5. Install circuit breaker (1) on operators cab circuit breaker panel A3 (2).
 - a. Position circuit breaker (1) and washer (4) on operators cab circuit breaker panel A3 (2).
 - b. Install hex nut (3) to secure circuit breaker (1) on operators cab circuit breaker panel A3 (2). Tighten hex nut (3).
 - c. Connect wiring from circuit breaker (1) and remove tags.
6. Install operators cab circuit breaker panel A3. (WP 0293 00)
7. Perform operational check of operators cab circuit breaker panel A3. (TM 55-1945-225-10)
8. Install operators cab access panel. (WP 0239 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB CIRCUIT BREAKER PANEL A3
TESTING**

INITIAL SETUP:

Test Equipment

Multimeter (Item 5, WP 0425 00)

Tools

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Life Preserver, Vest (Item 17, WP 0425 00)

Helmet, Safety (Blue) (Item 13, WP 0425 00)

Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

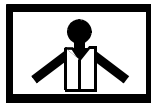
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

TEST CIRCUITS ON OPERATORS CAB CIRCUIT BREAKER PANEL A3

WARNING



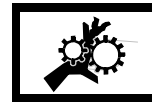
VEST



HELMET PROTECTION



HEAVY PARTS



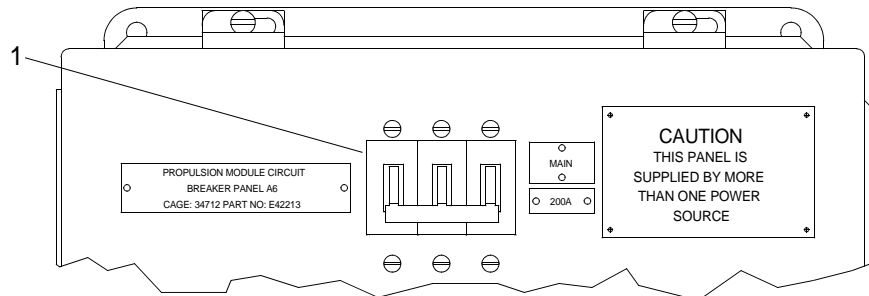
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

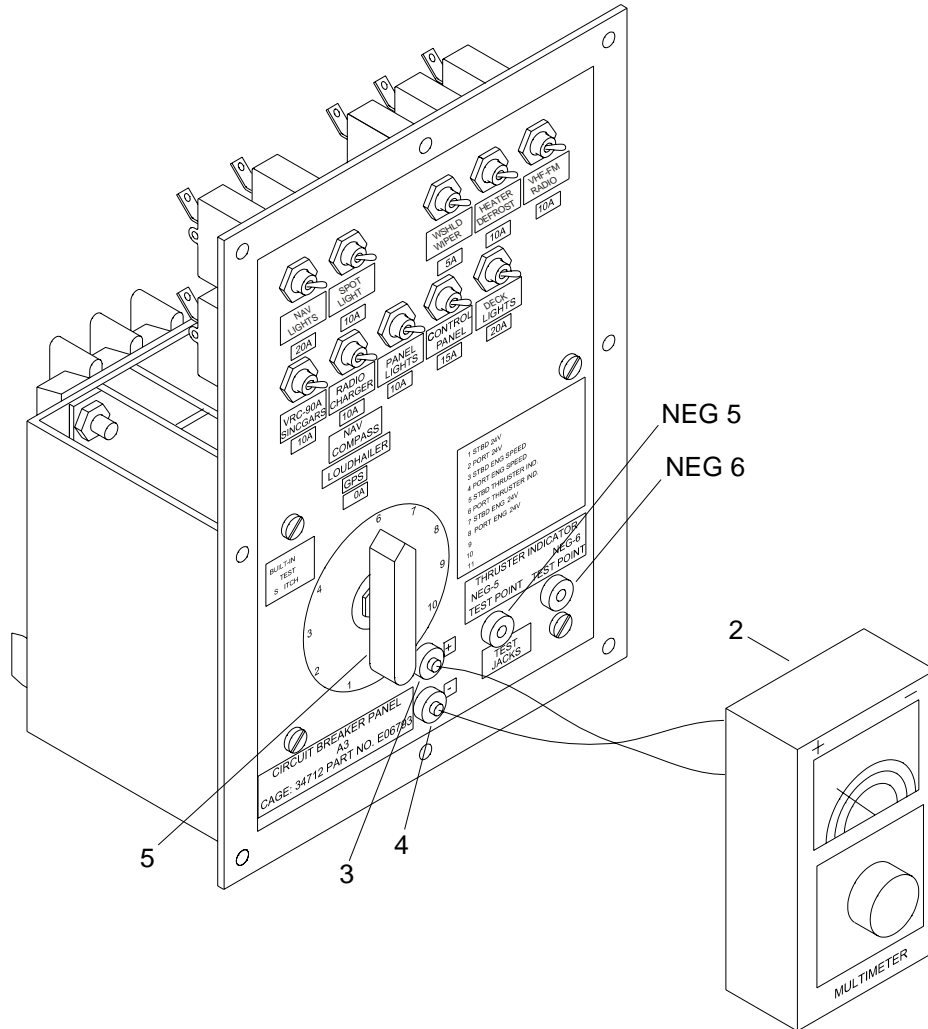
NOTE

The following test indicates only that power exists to the various units described.

1. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to on.



2. Insert positive (+) and negative (-) leads of multimeter (2) into positive test jack (3) and negative test jack (4), respectively. Verify polarity of multimeter leads matches polarity of test jacks.



3. Perform voltage measurements as follows.
 - a. If measurement of voltage to STARBOARD THRUST INDICATORS is desired, insert negative (-) multimeter (2) lead into either NEG 5 or NEG 6 jack, depending upon which is to be tested.
 - b. Turn BUILT IN TEST rotary switch (5) to select circuit to be tested. Use label on front right side of panel as a guide.
 - c. Select appropriate scale on multimeter (2) to read approximately 24 VDC.
 - d. If reading on multimeter (2) is not approximately 24 VDC, proceed to applicable troubleshooting work package.
4. Remove multimeter (2) leads when testing is completed.
5. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to off.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
CONVERTER ASSEMBLY A8
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Assembly, Converter
PN E48513

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Operators Cab Access Panel Removed. (WP 0239 00)
Operators Cab Circuit Breaker Panel A3 Removed. (WP 0293 00)

REMOVE CONVERTER ASSEMBLY A8

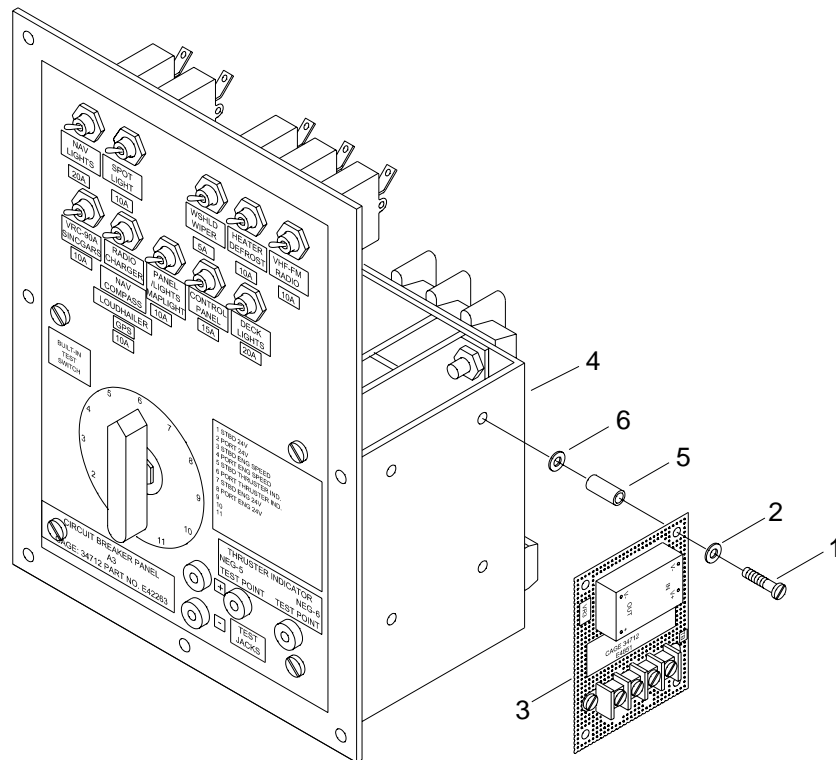
WARNING



VEST

All personnel must wear a personal flotation device during WT maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Remove pan head machine screws (1) and flat washers (2) securing converter assembly A8 (3) to heat sink bracket (4) and discard.



2. Remove converter assembly A8 (3) and discard.
3. Remove spacers (5) and plastic washers (6) from heat sink bracket (4) and discard.

INSTALL CONVERTER ASSEMBLY A8

1. Install new spacers (5) and plastic washers (6) on heat sink bracket (4).
2. Position new converter assembly A8 (3) on spacers (5).
3. Install new pan head machine screws (1) and flat washers (2) to secure converter assembly A8 (3) to heat sink bracket (4).
4. Tighten pan head machine screws (1).
5. Install operators cab circuit breaker panel A3. (WP 0293 00)
6. Perform operational check of operators cab converter assembly A8. (TM 55-1945-225-10)
7. Install operators cab access panel. (WP 0239 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
TERMINAL STRIP A4 ASSEMBLY
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)
 Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)
 Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

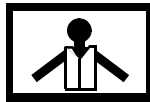
Engineer 88L

Equipment Condition

Operators Cab Access Panel Removed. (WP 0239 00)
 Terminal Strip A4 Assembly Removed. (WP 0298 00)

DISASSEMBLE TERMINAL STRIP A4 ASSEMBLY

WARNING



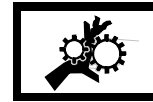
VEST



HELMET PROTECTION



HEAVY PARTS



MOVING PARTS

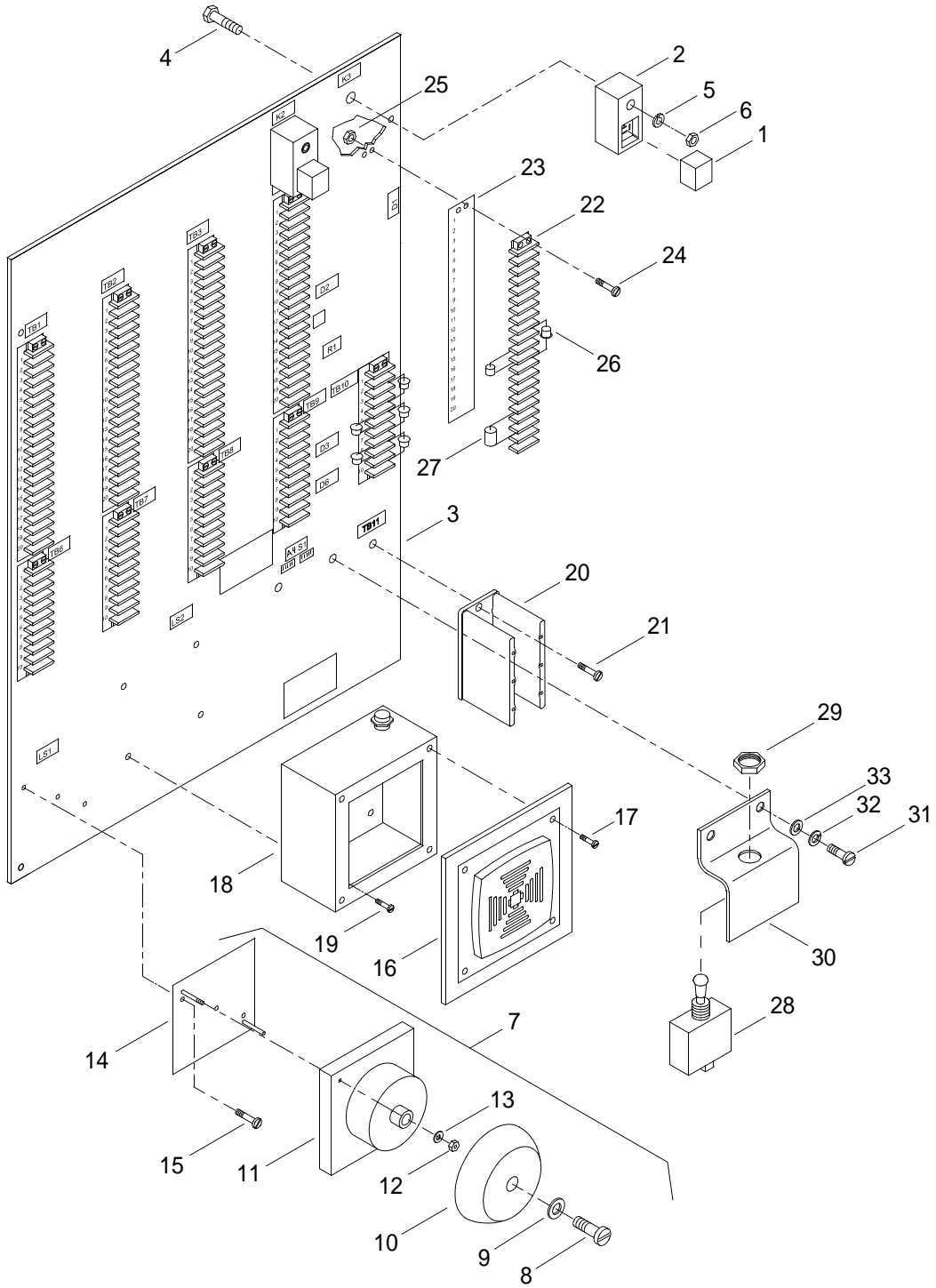
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal, inspection, repair and installation of components on the terminal strip A4 assembly.

Repair is limited to the replacement of damaged parts.

1. Separately remove relays (1) from relay sockets (2) on terminal strip A4 assembly (3) by pulling straight out.



NOTE

The following step is typical for the removal of relay sockets.

2. Remove relay socket (2) from terminal strip A4 assembly (3).
 - a. Remove pan head screw (4), lockwashers (5) and insert nut (6) securing relay socket (2) to terminal strip A4 assembly (3).
 - b. Remove relay socket (2) from terminal strip A4 assembly (3).
3. Remove alarm bell (7) from terminal strip A4 assembly (3).
 - a. Remove capscrew (8) and washer (9) from bell (10).
 - b. Remove bell (10) to expose bell solenoid (11).
 - c. Cut tiedown straps as required.
 - d. Remove nut (12) and washer (13).
 - e. Remove bell solenoid (11) from base (14).
 - f. Remove round head screws (15) securing base (14) to terminal strip A4 assembly (3).
 - g. Remove base (14) from terminal strip A4 assembly (3).
4. Remove alarm horn (16) from terminal strip A4 assembly (3).
 - a. Remove round head screws (17) securing alarm horn (16) to junction box (18).
 - b. Cut tiedown straps as required.
 - c. Remove alarm horn (16) from junction box (18).
 - d. Remove round head screws (19) securing junction box (18) to terminal strip A4 assembly (3).
 - e. Remove junction box (18) from terminal strip A4 assembly (3).
5. Remove power distribution block (20) from terminal strip A4 assembly (3).
 - a. Cut tiedown straps as required.
 - b. Remove pan head screws (21) securing power distribution block (20) to terminal strip A4 assembly (3).
 - c. Remove power distribution block (20) from terminal strip A4 assembly (3).

NOTE

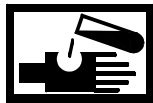
The following step is typical for the removal of terminal blocks.

6. Remove terminal block (22) and marker strip (23) from terminal strip A4 assembly (3).
 - a. Cut tiedown straps as required.
 - b. Remove pan head screws (24) and insert nuts (25) securing terminal block (22) and marker strip (23) to terminal strip A4 assembly (3).
 - c. Remove terminal block (22) and marker strip (23) from terminal strip A4 assembly (3).
 - d. Remove diodes (26) and/or resistors (27) from terminal block (22), as required.
7. Remove heater switch assembly (28) from terminal strip A4 assembly (3).
 - a. Remove large hex nut (29) securing heater switch assembly (28) to mounting bracket (30).
 - b. Remove heater switch assembly (28) from mounting bracket (30).
 - c. Remove pan head screws (31), lockwashers (32) and flat washers (33) securing mounting bracket (30) to terminal strip A4 assembly (3).
 - d. Remove mounting bracket (30) from terminal strip A4 assembly (3).

CLEAN TERMINAL STRIP A4 ASSEMBLY

1. Clean terminal strip A4 assembly (3) surfaces with a clean wiping rag.

WARNING


CHEMICAL

EYE PROTECTION

VAPOR

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING


CHEMICAL

EYE PROTECTION

VAPOR

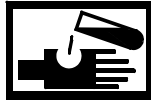
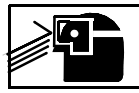
3. Dispose of contaminated wiping rags per local procedures.

INSPECT TERMINAL STRIP A4 ASSEMBLY

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE TERMINAL STRIP A4 ASSEMBLY

WARNING

**CHEMICAL****EYE PROTECTION**

1. Apply adhesive to all screws (4, 8, 15, 17, 19, 21, 24, 31).
2. Install heater switch assembly (28) on terminal strip A4 assembly (3).
 - a. Position mounting bracket (30) on terminal strip A4 assembly (3).
 - b. Install pan head screws (31), lockwashers (32) and flat washers (33) to secure mounting bracket (30) on terminal strip A4 assembly (3). Tighten pan head screws (31).
 - c. Position heater switch assembly (28) on mounting bracket (30).
 - d. Install large hex nut (29) to secure heater switch assembly (28) to mounting bracket (30). Tighten large hex nut (29).

NOTE

The following step is typical for the installation of terminal blocks.

3. Install terminal block (22) and marker strip (23) on terminal strip A4 assembly (3).
 - a. Install diodes (26) and/or resistors (27) on terminal block (22), as required.
 - b. Position terminal block (22) and marker strip (23) on terminal strip A4 assembly (3).
 - c. Install pan head screws (24) and insert nuts (25) to secure terminal block (22) and marker strip (23) to terminal strip A4 assembly (3).
 - d. Install tiedown straps as required.
4. Install power distribution block (20) on terminal strip A4 assembly (3).
 - a. Position power distribution block (20) on terminal strip A4 assembly (3).
 - b. Install pan head screws (21) to secure power distribution block (20) to terminal strip A4 assembly (3).
 - c. Install tiedown straps as required.

5. Install alarm horn (16) on terminal strip A4 assembly (3).
 - a. Position junction box (18) on terminal strip A4 assembly (3).
 - b. Install round head screws (19) to secure junction box (18) to terminal strip A4 assembly (3). Tighten round head screws (19).
 - c. Position alarm horn (16) on junction box (18).
 - d. Install tiedown straps as required.
 - e. Install round head screws (17) to secure alarm horn (16) to junction box (18). Tighten round head screws (17).
6. Install alarm bell (7) on terminal strip A4 assembly (3).
 - a. Position base (14) on terminal strip A4 assembly (3).
 - b. Install round head screws (15) to secure base (14) to terminal strip A4 assembly (3). Tighten round head screws (15).
 - c. Position bell solenoid (11) on base (14).
 - d. Install nut (12) and washer (13). Tighten nut (12).
 - e. Install tiedown straps as required.
 - f. Install bell (10) over exposed bell solenoid (11).
 - g. Install capscrew (8) and washer (9) to secure bell (10) to bell solenoid (11). Tighten capscrew (8).

NOTE

The following step is typical for the installation of relay sockets.

7. Install relay socket (2) on terminal strip A4 assembly (3).
 - a. Position relay socket (2) on terminal strip A4 assembly (3).
 - b. Install pan head screw (4), lockwashers (5) and insert nut (6) to secure relay socket (2) to terminal strip A4 assembly (3). Tighten insert nut (6).
8. Separately install relays (1) into relay sockets (2) by pushing straight in.
9. Install terminal strip A4 assembly. (WP 0298 00)
10. Install operators cab access panel. (WP 0239 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
TERMINAL STRIP A4 ASSEMBLY
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Adhesive (Item 2, WP 0426 00)

Personnel Required

- Engineer 88L

References

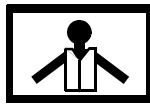
- TM 55-1945-225-10

Equipment Condition

- Operators Cab Access Panel Removed. (WP 0239 00)
-

REMOVE TERMINAL STRIP A4 ASSEMBLY

WARNING



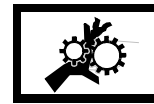
VEST



HELMET PROTECTION



HEAVY PARTS



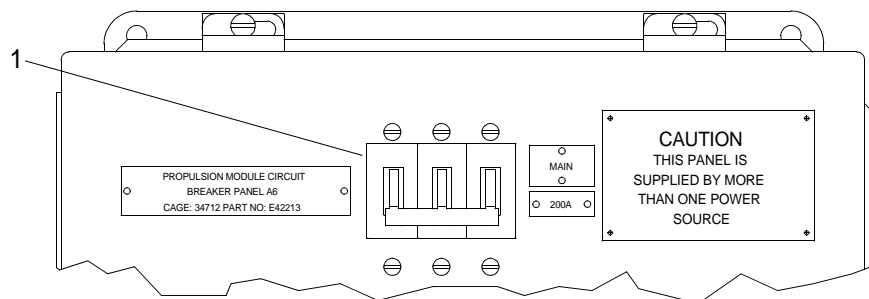
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

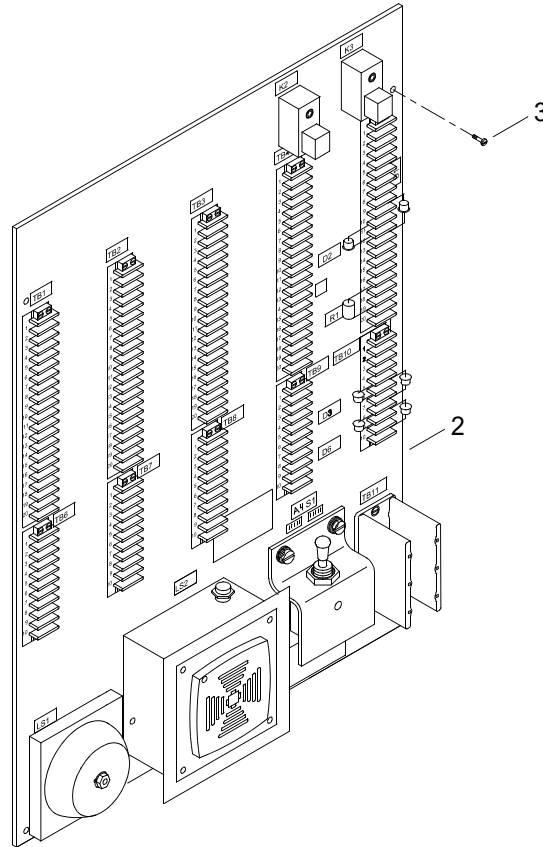
NOTE

This task is typical for the removal and installation of the terminal strip A4 assembly.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Tag and disconnect all wiring to terminal strip A4 assembly (2).



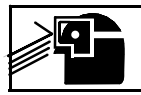
3. Remove pan head screws (3) securing terminal strip A4 assembly (2) to mounting structure.
4. Remove terminal strip A4 assembly (2).

INSTALL TERMINAL STRIP A4 ASSEMBLY

WARNING



CHEMICAL



EYE PROTECTION

1. Apply adhesive to four pan head screws (3).
2. Position terminal strip A4 assembly (2) on mounting structure.
3. Install pan head screws (3) to secure terminal strip A4 assembly (2) to mounting structure. Tighten pan head screws (3).
4. Connect all wiring to terminal strip A4 assembly (2) and remove tags.
5. Install operators cab access panel. (WP 0239 00)
6. Perform operational check of terminal strip A4 assembly. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SPOTLIGHT
CLEANING AND ADJUSTMENT**

INITIAL SETUP:**Tools**

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Gloves, Rubber, Industrial (Item 11, WP 0426 00)
- Cleaner (Item 5, WP 0426 00)
- Paper, Lens (Item 28, WP 0426 00)

Personnel Required

Seaman 88K

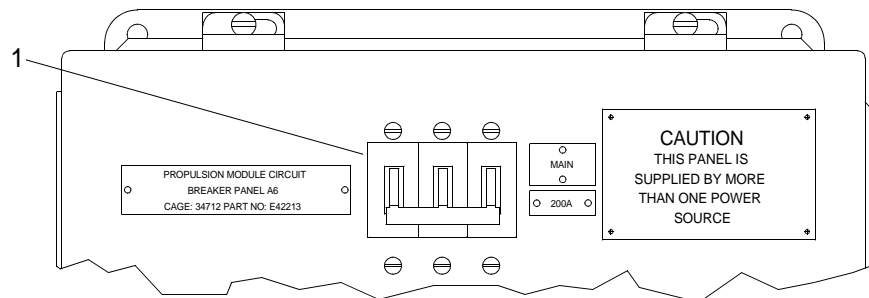
CLEAN SPOTLIGHT

WARNING

**VEST**

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

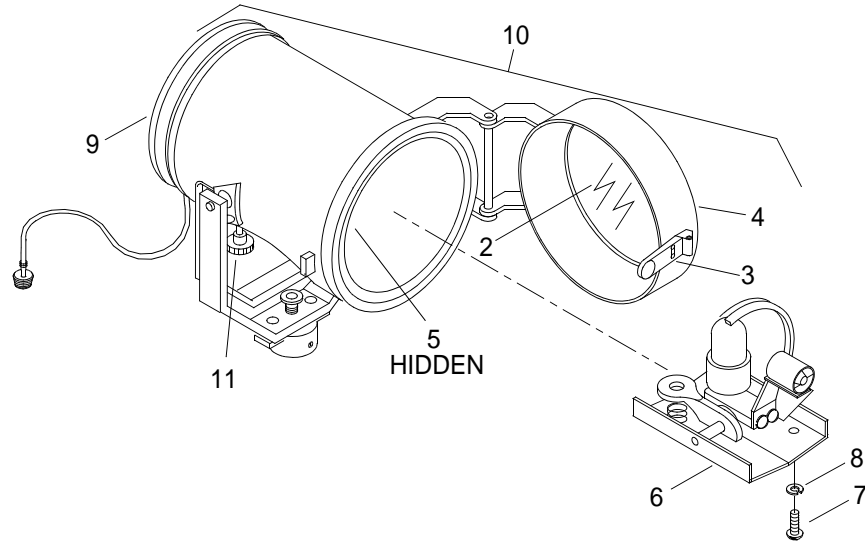
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

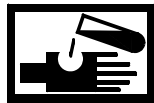
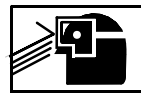
When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

2. Gain access to top of operators cab.

 3. Clean light lens (2).


- a. Operate latch (3) and open door (4).
 - b. Clean light lens (2) inside and out with lens paper and cleaner.
4. Clean light reflector (5).
- a. Tag and disconnect wiring harness from lamp holder (6).
 - b. Remove four machine screws (7) and lockwashers (8) securing lamp holder (6) to shell assembly (9).
 - c. Remove lamp holder (6).

 WARNING

**CHEMICAL****EYE PROTECTION**

- d. Clean light reflector (5) with lens paper and cleaner.
- e. Position lamp holder (6) in shell assembly (9).
- f. Install four machine screws (7) and lockwashers (8) to secure lamp holder (6) to shell assembly (9).
- g. Remove tags and connect wiring harness to lamp holder (6).
- h. Close door (4) and operate latch (3) to secure spotlight cover door (4).

ADJUST SPOTLIGHT

1. Project spotlight (10) beam on flat surface approximately 50 feet away.

WARNING

**HOT AREA**

2. Use knob (11) at bottom of spotlight (10) to focus until beam pattern is adjusted to desired intensity.

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

3. Descend from top of operators cab.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SPOTLIGHT BULB
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Gloves, Cotton (Item 11, WP 0425 00)

Materials/Parts

Lamp
 PN 4212400
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

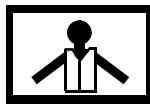
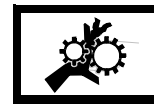
Seaman 88K

References

TM 55-1945-225-10

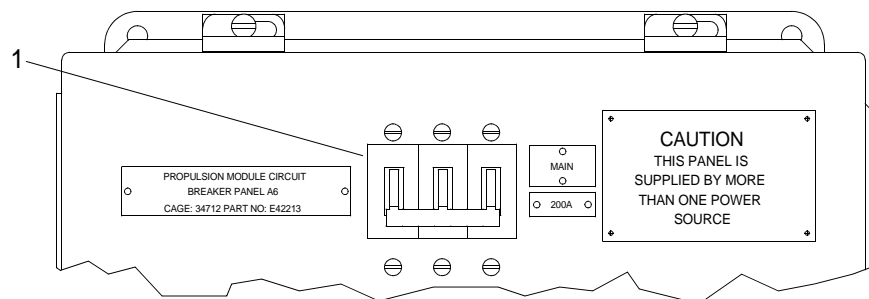
REMOVE SPOTLIGHT BULB

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

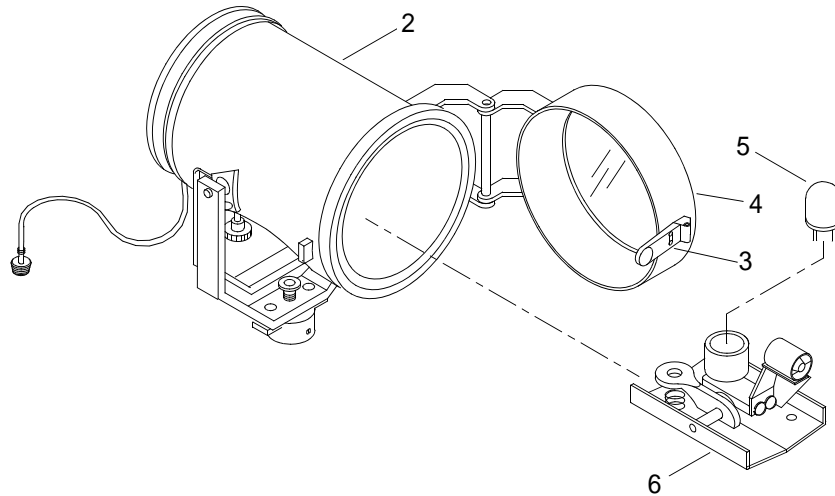
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

2. Gain access to top of operators cab.
3. On spotlight (2), operate latch (3) and open spotlight cover door (4).



WARNING



HOT AREA

4. Wearing a pair of cotton gloves, remove lamp (5) from lamp holder (6).
5. Discard lamp (5).

INSTALL SPOTLIGHT BULB

CAUTION

Do not touch new halogen light bulb with bare hands. Failure to comply will cause damage to equipment.

1. Wearing a pair of cotton gloves, install new lamp (5) in lamp holder (6).
2. Close door (4) and operate latch (3) to secure.

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

3. Descend from top of operators cab.
4. Perform operational check of spotlight (2). (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SPOTLIGHT
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)

Materials/Parts

Pin, Cotter
 PN 65108
 Qty 2
 Gasket, Spotlight Base
 PN E24701
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Seaman 88K

References

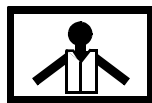
TM 55-1945-225-10

Equipment Condition

SINGGARS Radio Removed. (WP 0320 00)

REMOVE SPOTLIGHT INSIDE CAB COMPONENTS (FIXTURE ASSEMBLY)

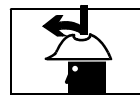
WARNING



VEST



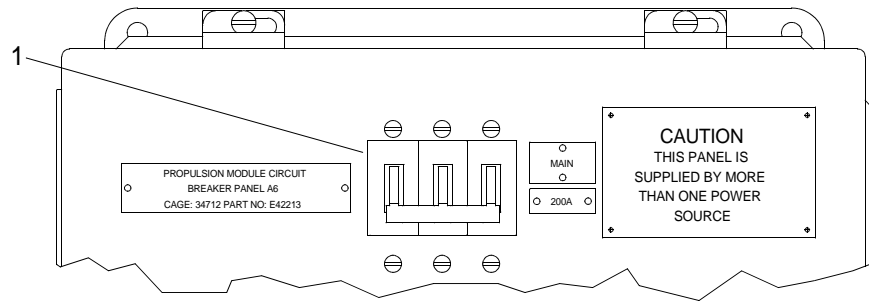
HEAVY PARTS



HELMET PROTECTION

All personnel must wear personal flotation device, hard hat and safety shoes during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

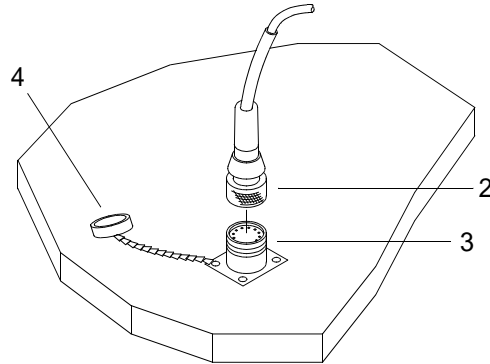
1. Inspect sling prior to use. (TM 55-1945-225-10)
2. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

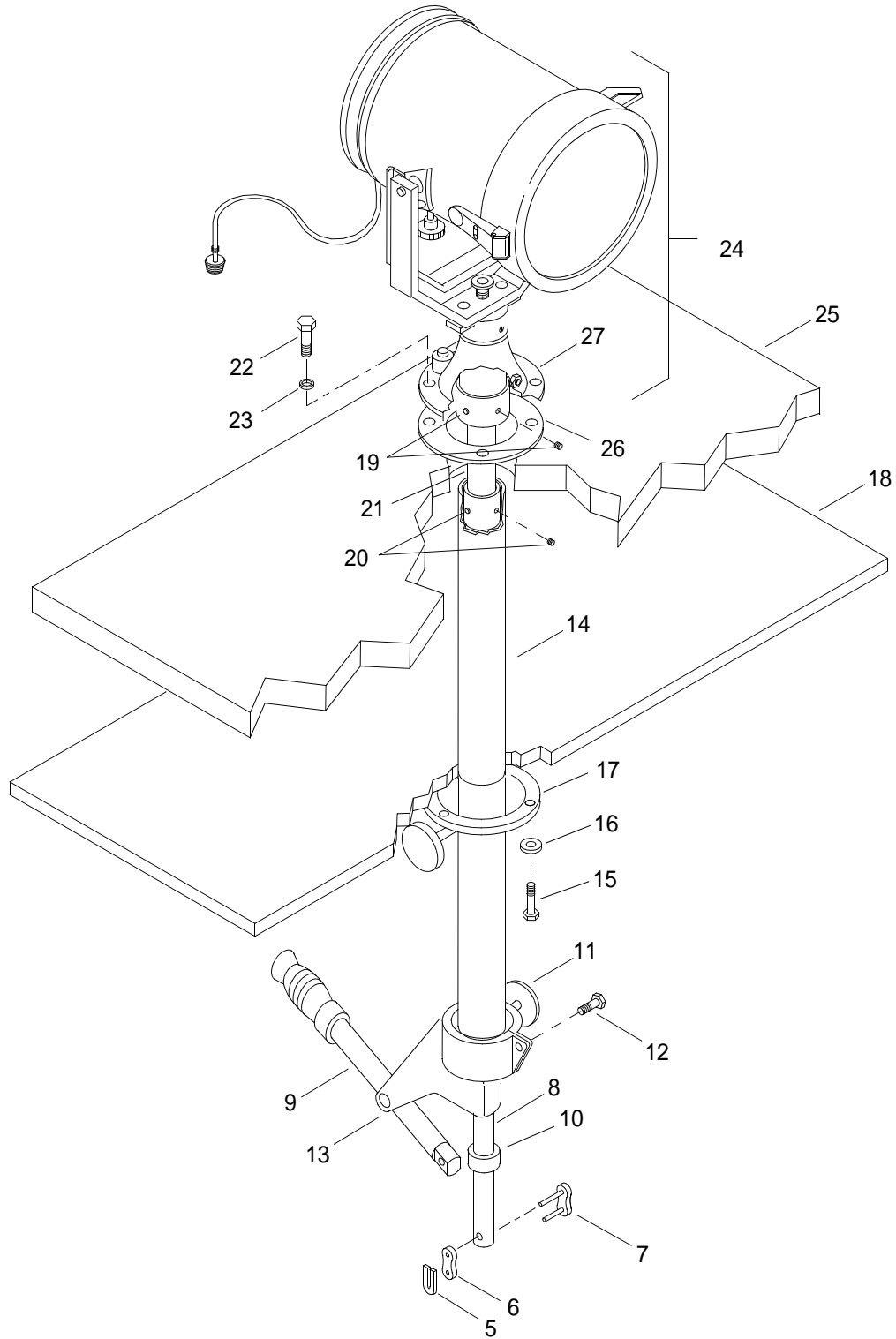
When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

3. Gain access to top of operators cab.
4. Disconnect spotlight power supply plug (2) from roof electrical receptacle (3).



5. Install receptacle dust cap (4) on electrical receptacle (3).

6. Remove retaining clip (5) and keeper plate (6) from connecting link (7).



7. Remove connecting link (7) from lower push rod (8) and lever (9).
8. Slide bearing (10) off lower push rod (8).
9. Loosen ceiling flange knob (11).
10. Loosen socket head capscrew (12).
11. Slide lever bracket assembly (13) off lower push rod (8) and torque tube (14).
12. Remove three panhead machine screws (15) and lock push rod washers (16) securing ceiling flange (17) to bottom of radio mount (18).
13. Loosen two set screws (19).
14. Slide torque tube (14) off of lower push rod (8).
15. Loosen two set screws (20).
16. Remove lower push rod (8) from upper push rod (21).

REMOVE SPOTLIGHT ABOVE CAB COMPONENTS (LIGHT HEAD)

1. Remove four hex head capscrews (22) and lockwashers (23) securing light head assembly (24) to operators cab roof (25).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

2. Using crane and sling, lift light head assembly (24) off operators cab roof (25).

WARNING



EYE PROTECTION

3. Using putty knife, remove gasket (26) from operators cab roof (25) and roof flange (27).

INSTALL SPOTLIGHT ABOVE CAB COMPONENTS (LIGHT HEAD)

WARNING

**CHEMICAL****EYE PROTECTION**

- Using rags and cleaner, clean surface area of operators cab roof (25).

WARNING

**EYE PROTECTION**

- Using wire brush, remove old sealing compound from four hex head capscrews (22).

WARNING

**CHEMICAL****EYE PROTECTION**

- Apply sealing compound to threads of four hex head capscrews (22).
- Position new gasket (26) on operators cab roof (25), aligning screws holes.

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

- Using crane and sling, position spotlight head assembly (24) roof flange (27) over gasket (26), aligning capscrew holes in roof flange (27) with holes in gasket (26).
- Install lockwashers (23) on hex head capscrews (22).
- Install hex head capscrews (22) and lockwashers (23) to secure roof flange assembly (27) to roof of operators cab (25).
- Tighten capscrews (22).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

9. Descend from top of operators cab.

INSTALL SPOTLIGHT INSIDE CAB COMPONENTS (FIXTURE ASSEMBLY)

1. Install lower push rod (8) on upper push rod (21).
2. Tighten two set screws (20).
3. Slide torque tube (14) up over lower push rod (8).
4. Tighten two set screws (19).
5. Install three pan head machine screws (15) and lock push rod washers (16) securing ceiling flange (17) to bottom of radio mount (18).
6. Slide lever bracket assembly (13) over lower push rod (8) and torque tube (14).
7. Tighten socket head capscrew (12).
8. Tighten ceiling flange knob (11).
9. Slide bearing (10) over lower push rod (8).
10. Install connecting link (7) in lower push rod (8) and lever (9).
11. Install retaining clip (5) and keeper plate (6) on connecting link (7).
12. Remove receptacle dust cap (4).
13. Connect spotlight power supply plug (2) to electric receptacle (3) located on top of operators cab roof (25).
14. Install SINGARS radio. (WP 0320 00)
15. Perform operational check of spotlight. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SPOTLIGHT PUSH ROD PACKING
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)

Materials/Parts

Packing, Preformed
 PN 51012
 Pin, Cotter
 PN 65108
 Qty 2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

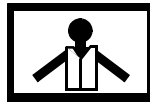
Engineer 88L

References

TM 55-1945-225-10

REMOVE SPOTLIGHT PUSH ROD PACKING

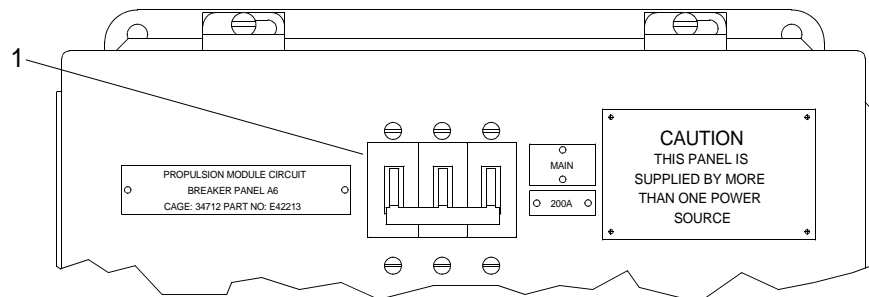
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

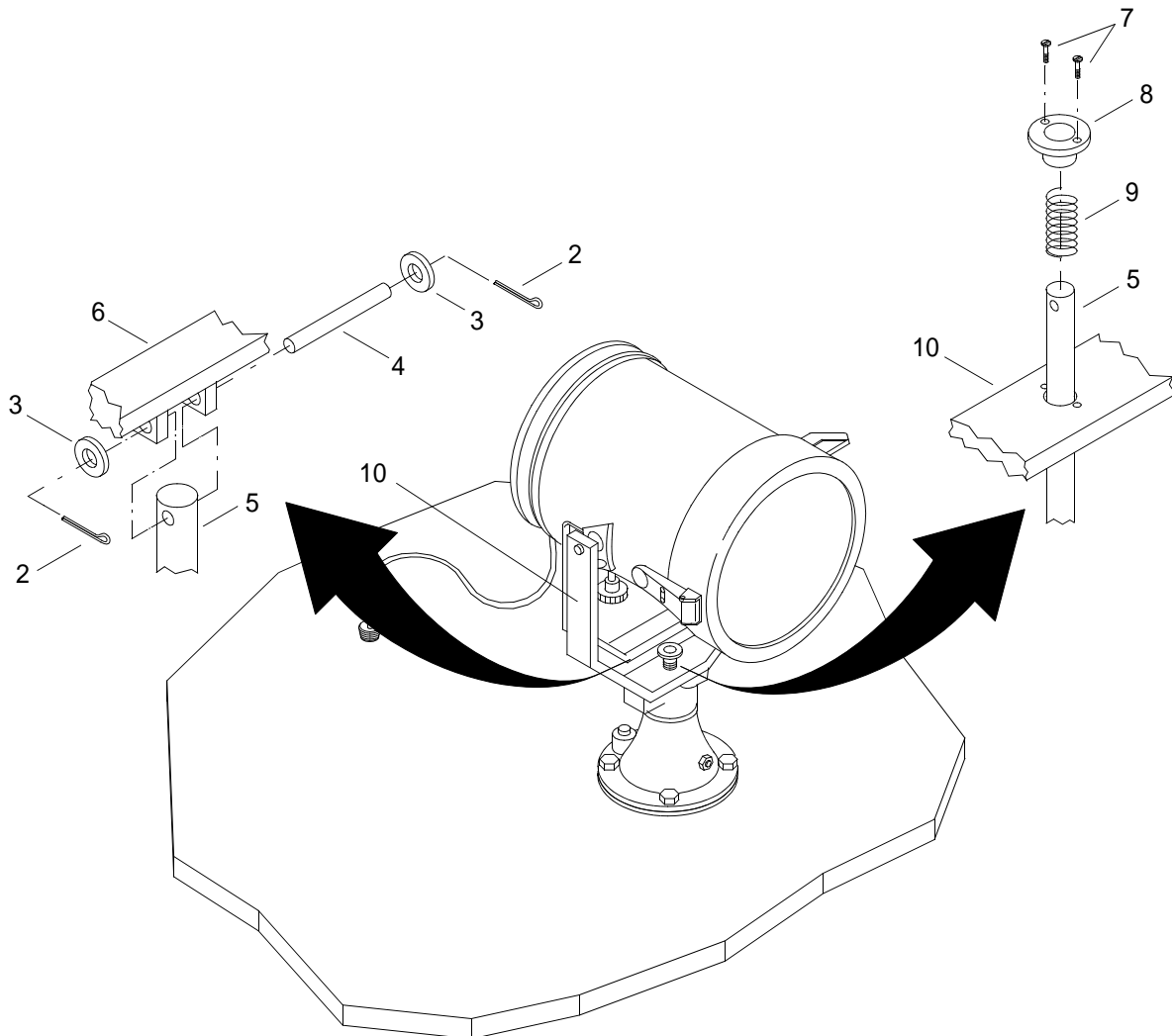
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

2. Gain access to top of operators cab.
3. Remove two cotter pins (2) and two flat washers (3) from clevis pin (4) in spotlight push rod (5) at base of yoke (6).



4. Retain washers (3).
5. Discard cotter pins (2).
6. Remove and retain clevis pin (4).
7. Remove two machine screws (7) on packing flange (8).

-
8. Slide packing flange (8) up push rod (5).
 9. Remove and discard preformed packing (9).

INSTALL SPOTLIGHT PUSH ROD PACKING

1. Wind new preformed packing (9) around push rod (5) and work it tightly into pocket on harp (10).
2. Slide packing flange (8) down push rod (5).
3. Install two machine screws (7) in packing flange (8).
4. Tighten machine screws (7) to compress preformed packing (9).
5. Position spotlight so base of yolk (6) aligns with push rod (5).
6. Install clevis pin (4) through yolk (6) and push rod (5).
7. Install flat washers (3) and new cotter pins (2) on ends of clevis pin (4).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

8. Descend from top of operators cab.
9. Perform operational check of spotlight. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SPOTLIGHT MOUNTING GASKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Scraper, Ship (Copper Alloy) (Item 23, WP 0425 00)

Materials/Parts

Gasket
PN E24701
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Cleaner (Item 5, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

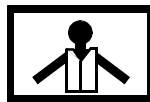
TM 55-1945-225-10

Equipment Condition

Spotlight Above Cab Components (Light Head) Removed. (WP 0301 00)

REMOVE SPOTLIGHT MOUNTING GASKET

WARNING

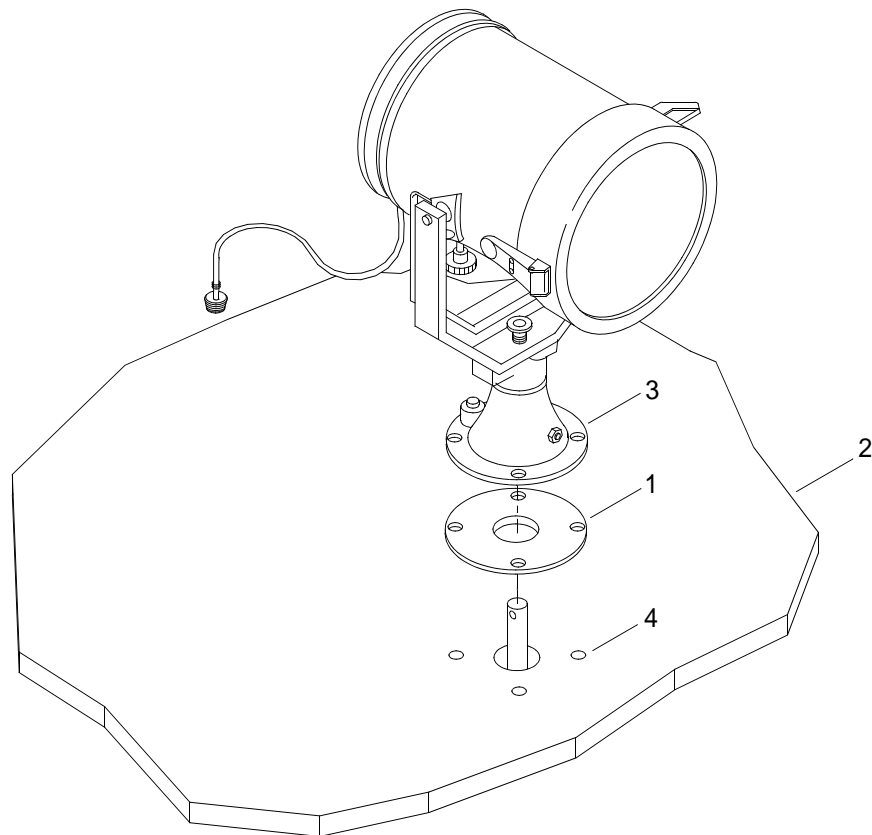


VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

1. Gain access to top of operators cab.
2. Using scraper, remove spotlight gasket (1) from roof (2) and any particles remaining on roof flange (3).



3. Discard old gasket (1).

INSTALL SPOTLIGHT MOUNTING GASKET

WARNING



CHEMICAL



EYE PROTECTION

1. Using rags and cleaner, clean surface area of operators cab roof (2) and roof flange (3).
2. Position new gasket (1) on operators cab roof (2), aligning screw holes (4).
3. Install spotlight above cab components (light head). (WP 0301 00)

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

4. Descend from top of operators cab.
5. Perform operational check of spotlight. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SPOTLIGHT GLASS COVER DOOR LATCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Latch, Tension
PN 72021
Screw, Machine
PN 60027

Personnel Required

Engineer 88L

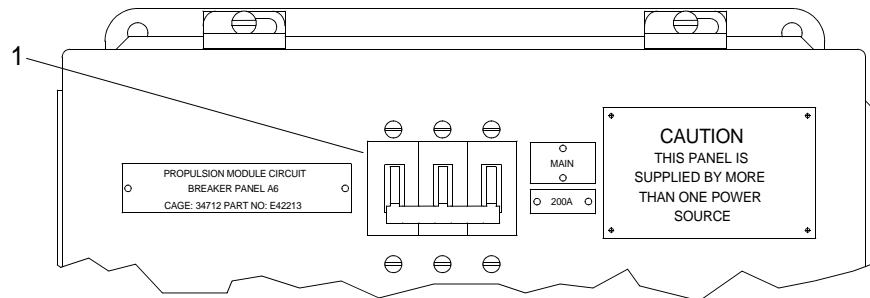
REMOVE SPOTLIGHT GLASS COVER DOOR LATCH

WARNING

**VEST**

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

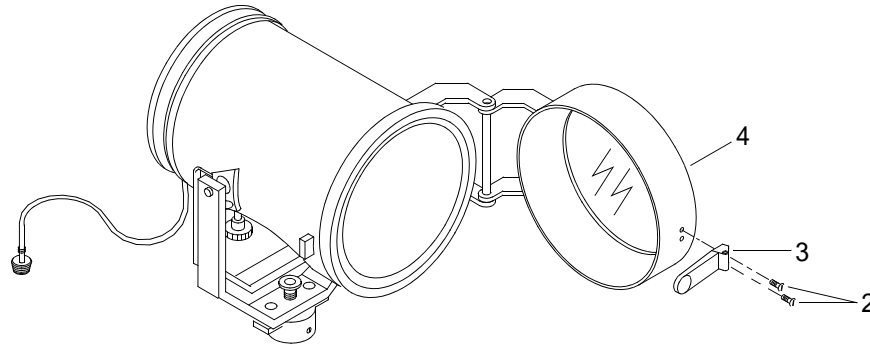


WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

2. Gain access to top of operators cab.

-
3. Remove and discard two machine screws (2) securing tension latch (3) to door (4).



4. Remove and discard tension latch (3).

INSTALL SPOTLIGHT GLASS COVER DOOR LATCH

1. Position new tension latch (3) on door (4).
2. Install two new machine screws (2). Tighten screws (2).
3. Operate tension latch (3) to secure door (4) in closed position.

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

4. Descend from top of operators cab.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SPOTLIGHT
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)

Materials/Parts

Packing, Push Rod
 PN 51012
 Pin, Cotter
 (81493)
 Qty 2
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

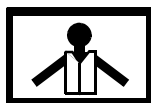
Engineer 88L

References

TM 55-1945-225-10

DISASSEMBLE SPOTLIGHT

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS

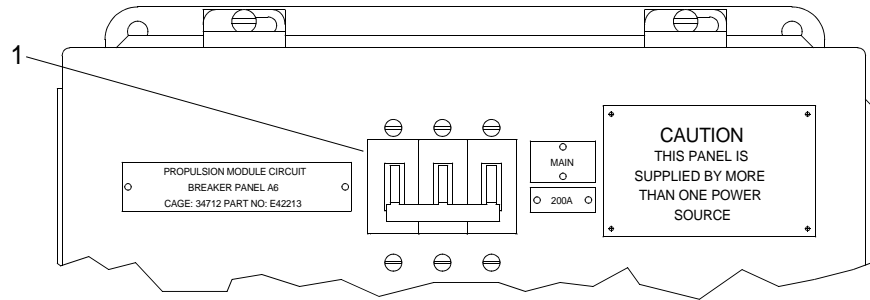


MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Inspect sling prior to use. (TM 55-1945-225-10)

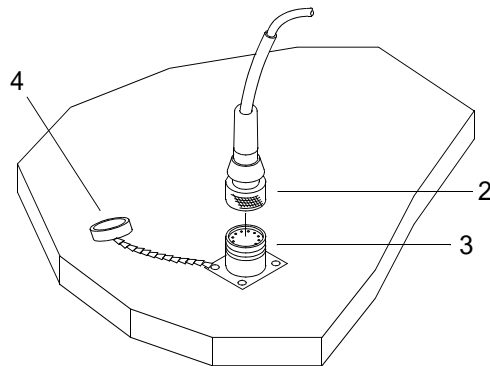
- Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

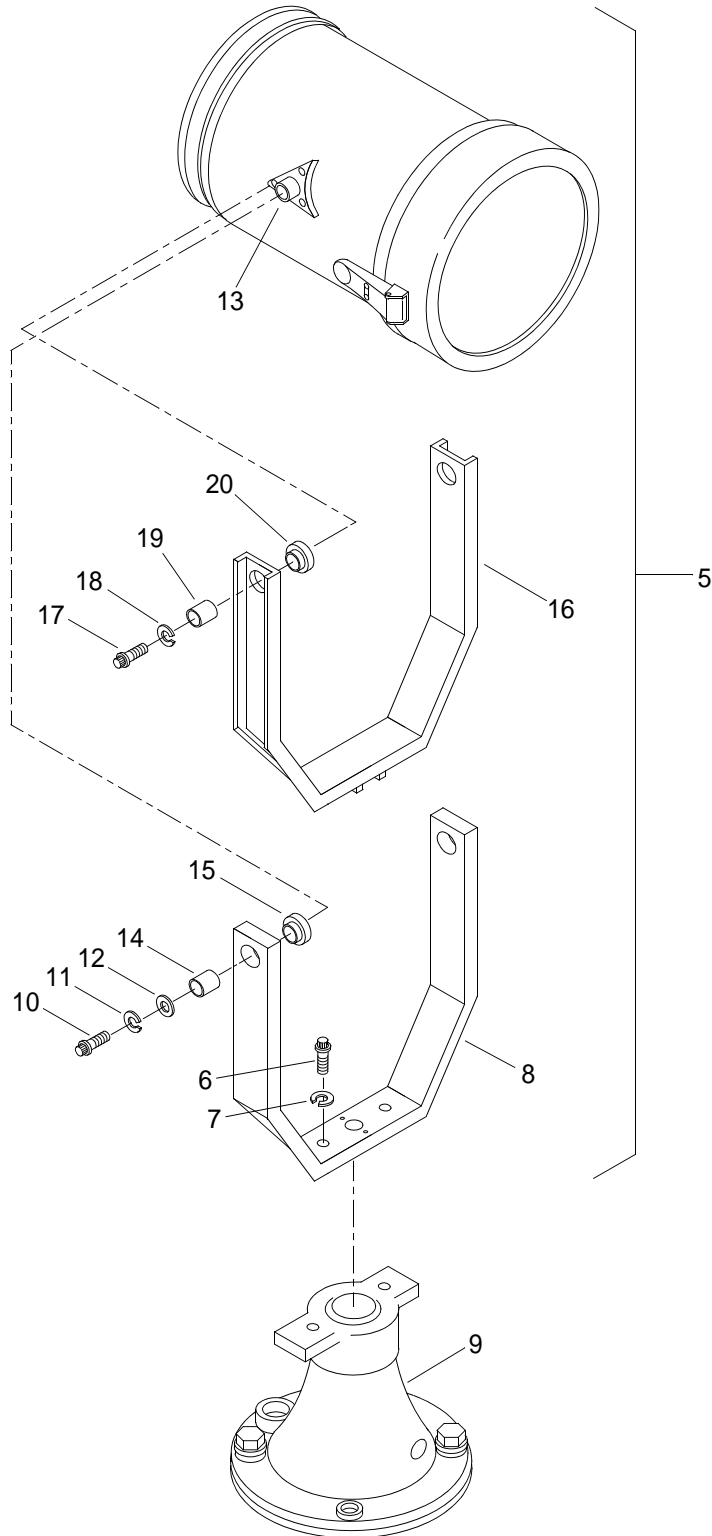
When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

- Gain access to top of operators cab.
- Disconnect spotlight power supply connector plug (2) from operators cab roof electrical receptacle (3).



- Install receptacle dust cap (4) on electrical receptacle (3).
- Remove push rod packing. (WP 0302 00)

7. Attach sling to spotlight, yolk and harp assembly (5).



8. Remove two capscrews (6) and lockwashers (7) securing harp (8) to spotlight head base assembly (9).

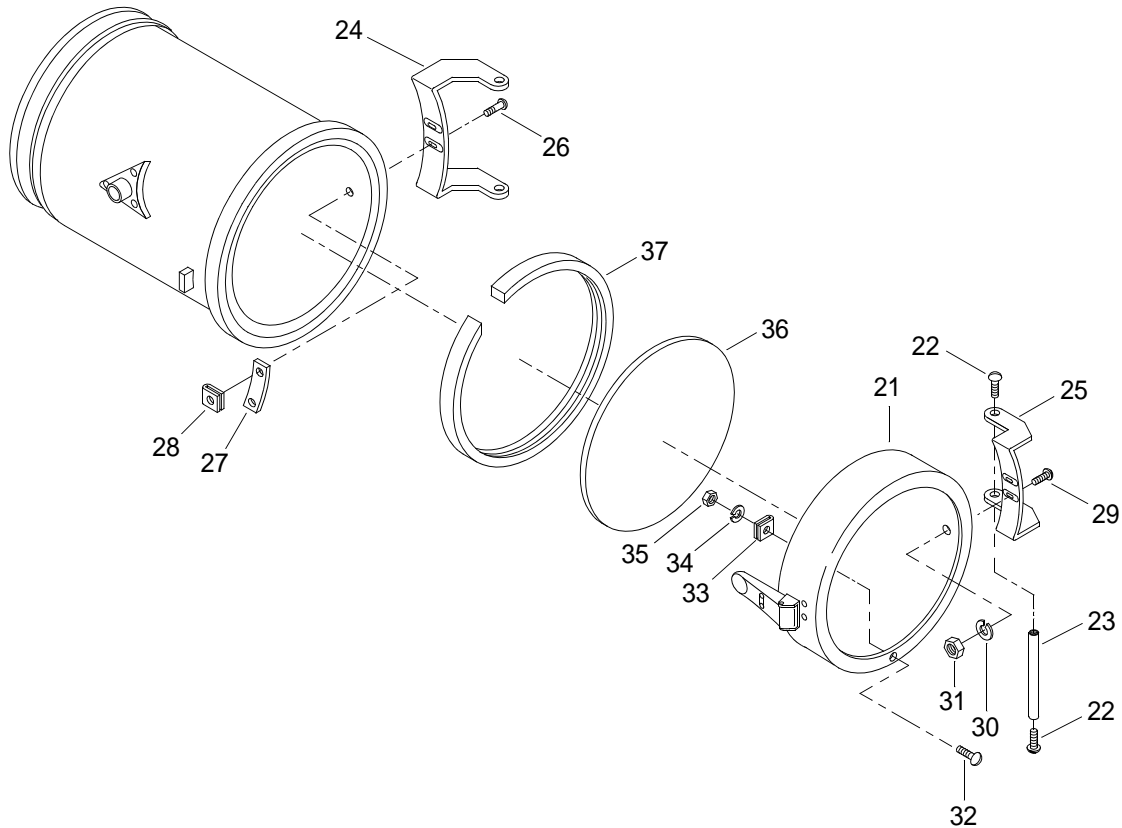
WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

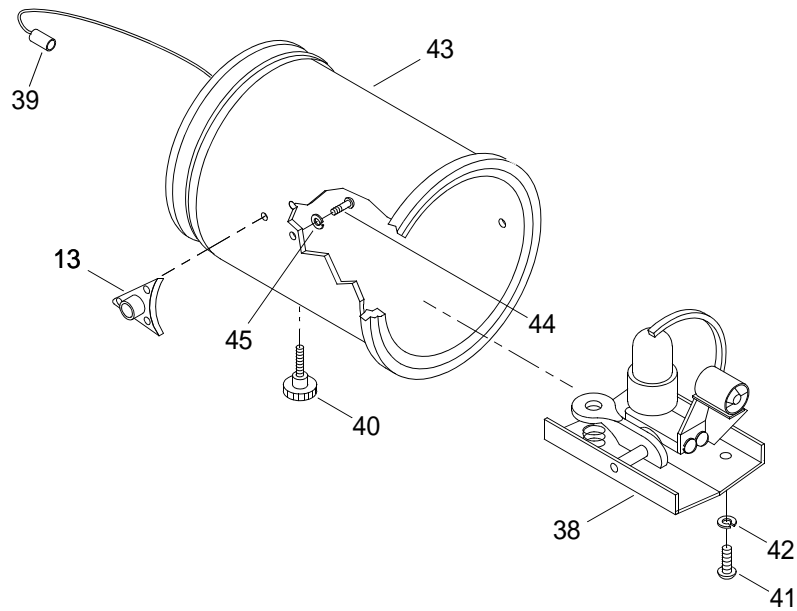
9. Using crane and sling, remove spot light, yolk and harp assembly (5) and place on deck of warping tug.
10. Remove and disassemble harp (8).
 - a. Remove two capscrews (10), lockwashers (11) and flat washers (12) securing harp (8) to support bracket (13).
 - b. Remove two sleeve bushings (14) from inside of sleeve bearings (15).
 - c. Remove two sleeve bearings (15) from harp (8).
11. Remove and disassemble yolk (16).
 - a. Remove two capscrews (17) and lockwashers (18) securing yolk (16) to support bracket (13).
 - b. Remove two sleeve bushings (19) from inside of sleeve bearings (20).
 - c. Remove two sleeve bearings (20) from yolk (16).

12. Remove and disassemble door (21).



- a. Remove two screws (22) from hinge pin (23).
- b. Remove hinge pin (23) connecting shell hinge (24) to door hinge (25).
- c. Separate shell hinge (24) from door hinge (25).
- d. Remove two machine screws (26) from nut plate (27) and push on nut (28).
- e. Remove shell hinge (24).
- f. Remove two machine screws (29), lockwashers (30) and hex nuts (31) securing door hinge (25) to door (21).
- g. Remove door hinge (25) from door (21).
- h. Remove six machine screws (32), window retaining clips (33), lockwashers (34) and nuts (35) securing light lens (36) to door (21).
- i. Remove light lens (36) from door (21).
- j. Remove gasket (37) from light lens (36).

13. Remove lamp holder (38).



- a. Remove spotlight bulb. (WP 0303 00)
 - b. Tag and disconnect wiring harness (39).
 - c. Remove knob assembly (40).
 - d. Remove four machine screw (41) and lockwashers (42) securing lamp holder (38) to shell assembly (43).
 - e. Remove lamp holder (38) from shell assembly (43).
14. Remove support brackets (13).
- a. Remove four machine screws (44), lockwashers (45) support bracket (13) from shell assembly (43).
 - b. Remove support bracket (13) from shell assembly (43).

INSPECT SPOTLIGHT

1. Inspect harp (8) for cracks, dents or damage. Replace damaged parts.
2. Inspect yolk (16) for cracks, dents or damage. Replace damaged parts.
3. Inspect sleeve bushings (13 and 18) and sleeve bearings (14 and 19) for cracks, wear or damage. Replace damaged parts.
4. Inspect door hinge pieces (22, 23 and 24) for cracks, bends, damage or wear. Replace damaged parts.
5. Inspect light lens (36) for cracks or cloudiness. Replace damaged parts.
6. Inspect gasket (37) for dry rot, cracks, leaks, tears or any damage that will cause leaks. Replace damaged parts.
7. Inspect wiring harness (39) for damaged insulation or cracked connectors. Replace damaged parts.
8. Inspect support bracket (13) for cracks, wear or damage. Replace damaged parts.
9. Inspect lamp holder (38) for damage or corrosion. Replace damaged parts.
10. Inspect all machine screws, capscrews and nuts for damaged threads and distorted heads. Replace damaged parts.

ASSEMBLE SPOTLIGHT

1. Install support brackets (13).
 - a. Position support bracket (13) on shell assembly (43).
 - b. Install four capscrews (44) and lockwashers (45) to secure support bracket (13) on shell assembly (43).
 - c. Tighten capscrews (44).
2. Install lamp holder (38).
 - a. Position lamp holder (38) in shell assembly (43).
 - b. Install four machine screws (41) and lockwashers (42) to secure lamp holder (38) to shell assembly (43).
 - c. Tighten machine screws (41).
 - d. Install knob assembly (40).
 - e. Connect wiring harness (39) as previously tagged.
 - f. Install spotlight bulb. (WP 0303 00)
3. Assemble and install door (21).
 - a. Position shell hinge (24) on shell assembly (43).
 - b. Install two machine screws (26), nut plate (27) and push on nut (28) securing shell hinge (24) on shell assembly (43).
 - c. Tighten machine screws (26).

- d. Install gasket (37) on light lens (36).
 - e. Install light lens (36) in door (21).
 - f. Install six machine screws (32), window retaining clips (33), lockwashers (34) and nuts (35) to secure light lens (36) to door (21).
 - g. Tighten machine screws (32).
 - h. Position door hinge (25) on door (21).
 - i. Install two machine screws (29), lockwashers (30) and hex nuts (31) to secure door hinge (25) to door (21).
 - j. Tighten machine screws (29).
 - k. Position shell hinge (24) and door hinge (25) together.
 - l. Install hinge pin (23) connecting shell hinge (24) to door hinge (25).
 - m. Install two machine screws (22) in hinge pin (23).
 - n. Tighten machine screws (22).
4. Assemble and install yolk assembly (16).
 - a. Install two sleeve bearings (20) on yolk (16).
 - b. Install two sleeve bushings (19) inside sleeve bearings (20).
 - c. Install two capscrews (17) and lockwashers (18) to secure yolk (16) to support bracket (13).
 - d. Tighten capscrews (17).
 5. Assemble and install harp (8).
 - a. Install two sleeve bearings (15) on harp (8).
 - b. Install two sleeve bushings (14) inside sleeve bearings (15).
 - c. Install two capscrews (10), lockwashers (11) and flat washers (12) to secure harp (8) to support bracket (13).
 - d. Tighten capscrews (10).

WARNING

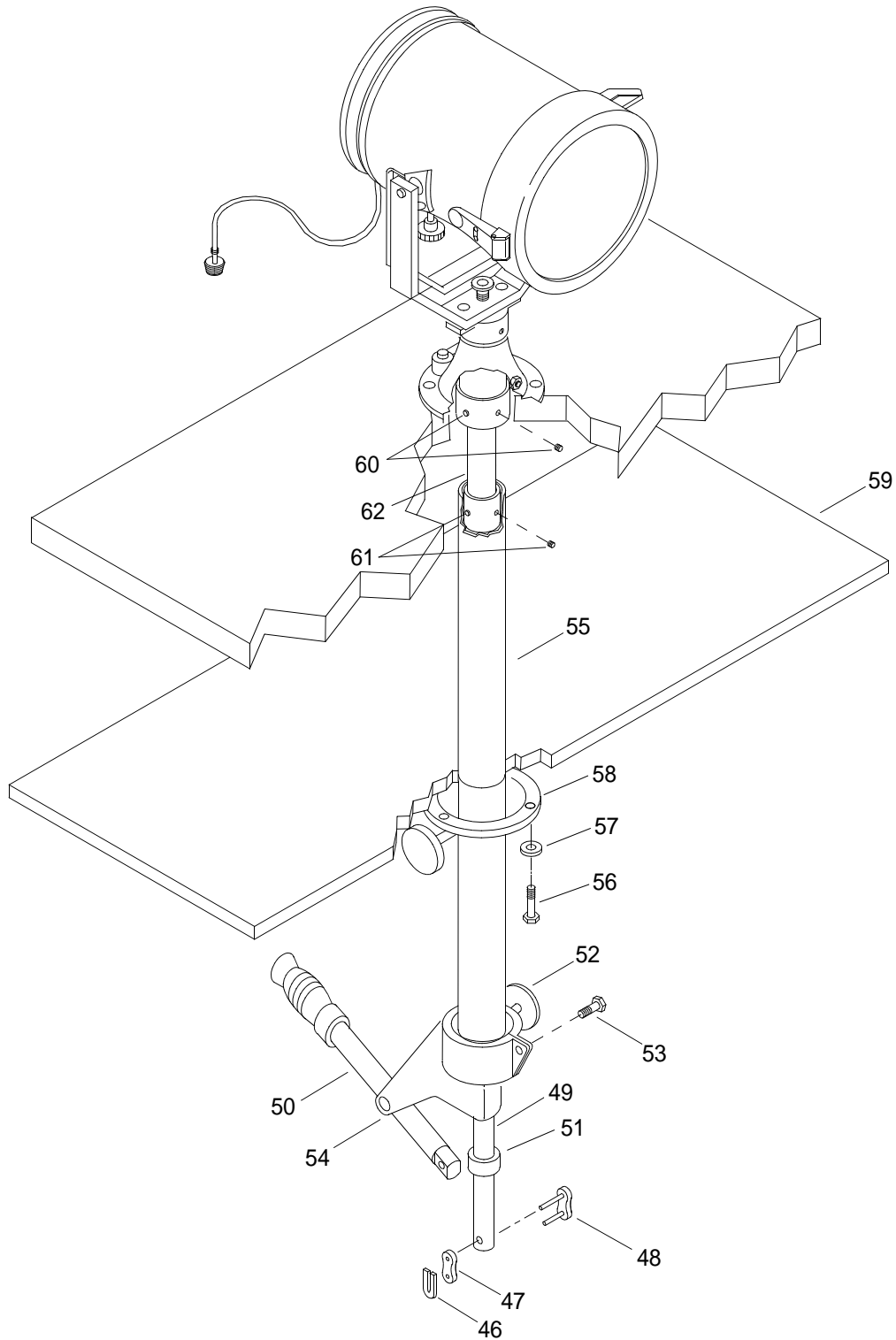
**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

6. Using crane and slings, lift spot light, yolk and harp assembly (5) and position harp (8) on spotlight head base assembly (9).
7. Install two capscrews (6) and lockwashers (7) securing harp (8) to spotlight head base assembly (9).
8. Remove crane and slings, from spot light, yolk and harp assembly (5).
9. Install push rod packing. (WP 0302 00)
10. Remove receptacle dust cap (4).
11. Connect spotlight power supply plug (2) to operators cab roof electric receptacle (3).

DISASSEMBLE LOWER SPOTLIGHT FIXTURE ASSEMBLY

1. Remove SINCGARS radio. (WP 0320 00)
2. Remove retaining clip (46) and keeper plate (47) from connecting link (48).



-
3. Remove connecting link (48) from push rod (49) and lever (50).
 4. Slide bearing (51) off of push rod (49).
 5. Loosen ceiling flange knob (52).
 6. Loosen socket head capscrew (53).
 7. Slide lever bracket assembly (54) off of push rod (49) and torque tube (55).
 8. Remove three pan head machine screws (56) and lockwashers (57) securing ceiling flange (58) to bottom of radio mount (59).
 9. Remove ceiling flange (58).
 10. Loosen two set screws (60).
 11. Slide torque tube (55) off of push rod (49).
 12. Loosen two set screws (61).
 13. Remove push rod (49) from push rod (62).

INSPECT LOWER SPOTLIGHT FIXTURE ASSEMBLY

1. Inspect retaining clip (46), keeper plate (47) and connecting link (48) for damage or wear. Replace damaged parts.
2. Inspect push rod (49) for bends, cracks, wear, galling or damage. Replace damaged parts.
3. Inspect bearing (51) for wear or damage. Replace damaged parts.
4. Inspect lever bracket assembly (54) for cracks or damage. Replace damaged parts.
5. Inspect torque tube (55) for cracks, dents or damage. Replace damaged parts.
6. Inspect all machine screws and capscrews for damaged threads and distorted heads. Replace damaged parts.

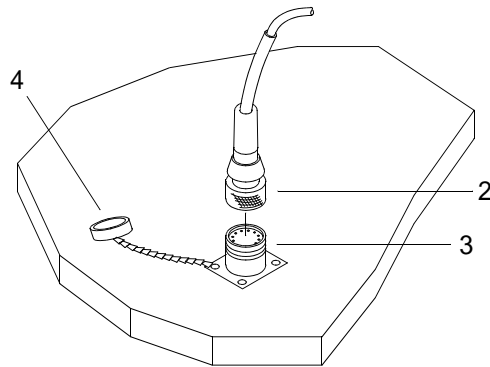
ASSEMBLE LOWER SPOTLIGHT FIXTURE ASSEMBLY

1. Install push rod (49) on push rod (62).
2. Tighten two set screws (61).
3. Slide torque tube (55) up over push rod (49).
4. Tighten two set screws (60).
5. Position ceiling flange (58) over torque tube (55).
6. Install three pan head machine screws (56) and lockwashers (57) securing ceiling flange (58) to bottom of radio mount (59).
7. Slide lever bracket assembly (54) over push rod (49) and onto torque tube (55).
8. Tighten socket head capscrew (53).

9. Tighten ceiling flange knob (52).
10. Slide bearing (51) over push rod (49).
11. Install connecting link (48) in push rod (49) and lever (50).
12. Install retaining clip (46) and keeper plate (47) on connecting link (48).
13. Install SINCGARS radio. (WP 0320 00)

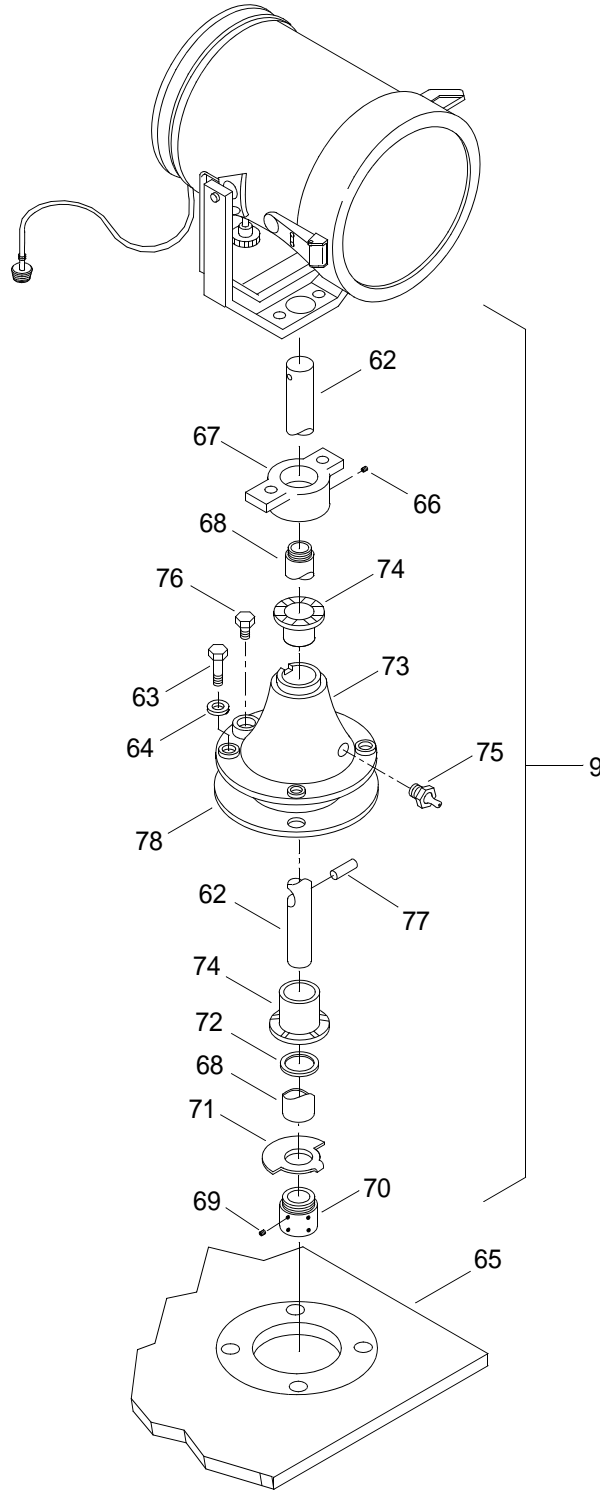
DISASSEMBLE UPPER LIGHT HEAD BASE ASSEMBLY

1. Disconnect spotlight power supply connector plug (2) from roof electrical receptacle (3).



2. Install receptacle dust cap (4) on electrical receptacle (3).
3. Remove push rod packing. (WP 0302 00)

4. Remove two capscrews (6) and lockwashers (7) securing harp (8) to spotlight head base assembly (9).



5. Remove harp (8) and set aside.
6. Remove four hex head screws (63) and lockwashers (64) securing spotlight head base assembly (9) to operators cab roof (65).
7. Loosen set screw (66) from tube flange (67).

8. Remove tube flange (67) from torque tube (68).
9. Loosen two set screws (69) on tube coupling (70).
10. Remove tube coupling (70) from torque tube (68).
11. Remove stop ring (71) from torque tube (68).
12. Remove preformed packing (72) from torque tube (68).
13. Remove torque tube (68) from roof flange (73).
14. Remove two ball bearings (74) from roof flange (73).
15. Remove lube fitting (75) from roof flange (73).
16. Remove hex head plug (76) from roof flange (73).
17. Slide push rod (62) out through bottom of roof flange (73).
18. Remove pin (77) from push rod (62).
19. Using putty knife, remove old gasket (78) from roof (65) and roof flange (73).

INSPECT UPPER LIGHT HEAD BASE ASSEMBLY

1. Inspect upper torque tube (68) for cracks, dents or damage. Replace damaged parts.
2. Inspect tube coupling (70) for cracks or damage. Replace damaged parts.
3. Inspect stop ring (71) for cracks or wear. Replace damaged parts.
4. Inspect two ball bearings (74) for wear or damage. Replace damaged parts.
5. Inspect push rod (62) for bends, cracks, wear, galling or damage. Replace damaged parts.
6. Inspect pin (77) for bends, cracks, wear, galling or damage. Replace damaged parts.
7. Inspect roof flange (73) for cracks or damage. Replace damaged parts.
8. Inspect all capscrews and hex head plugs for damaged threads and distorted heads. Replace damaged parts.

ASSEMBLE UPPER LIGHT HEAD BASE ASSEMBLY

1. Install pin (77) in push rod (62).
2. Slide push rod (62) in through bottom of roof flange (73).
3. Install new preformed packing (72) on torque tube (68).
4. Position torque tube (68) over push rod (62) in roof flange (73).
5. Install two ball bearings (74) in roof flange (73).
6. Install stop ring (71) on torque tube (68).

-
7. Install tube coupling (70) on torque tube (68).
 8. Tighten two set screws (69).
 9. Install tube flange (67) on torque tube (68).
 10. Tighten set screw (66).
 11. Install hex head plug (76) in roof flange (73).
 12. Install lube fitting (75) on roof flange (73).
 13. Position new gasket (78) on roof (65).
 14. Position spotlight head base assembly (9) over gasket (78).
 15. Install four hex head screws (63) and lockwashers (64) securing spotlight head base assembly (9) to operators cab roof (65).
 16. Tighten four hex head screws (63).
 17. Position light harp (8) on tube flange (67).
 18. Install two capscrews (6) and lockwashers (7) securing harp (8) to spotlight head base assembly (9).
 19. Tighten two capscrews (6).
 20. Install push rod packing. (WP 0302 00)
 21. Remove receptacle dust cap (4).
 22. Connect spotlight power supply plug (2) to electric receptacle (3) located on top of operators cab roof (65).
 23. Perform operational check of spotlight. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB DEFROSTER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Defroster
 PN E18278
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Sealing Compound (Item 34, WP 0426 00)
 Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

References

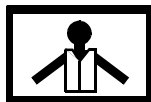
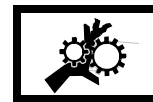
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.

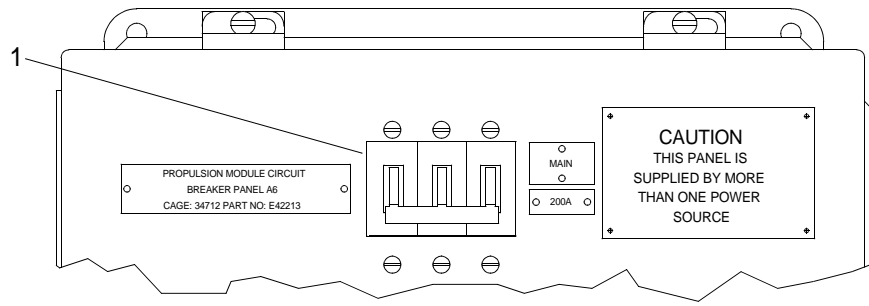
REMOVE OPERATORS CAB DEFROSTER

WARNING

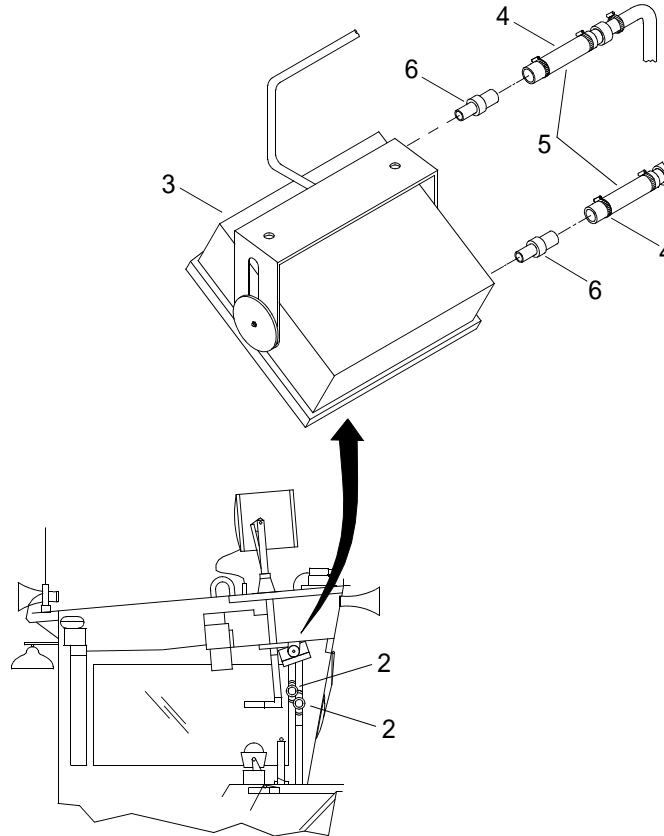
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

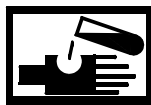


2. Close inlet and outlet defrost needle valves (2).



3. Position drain pan under operators cab enclosure defroster (3).

WARNING



CHEMICAL



EYE PROTECTION



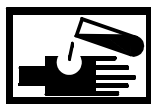
POISON



VAPOR

4. Loosen hose clamps (4) and remove hoses (5) from union connectors (6).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

5. Remove union connectors (6) from defroster (3).

 WARNING



CHEMICAL



EYE PROTECTION

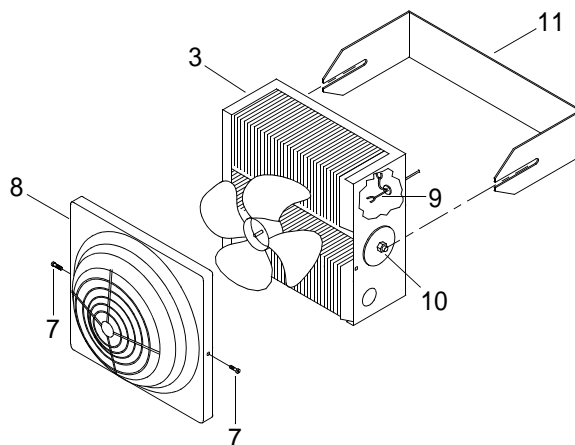


POISON



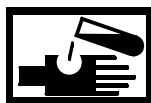
VAPOR

6. Drain hoses (5) of coolant into drain pan.
7. Remove screws (7) securing defroster cover (8) on defroster (3).



8. Remove defroster cover (8) from defroster (3).
9. Tag and disconnect electrical wiring (9) to defroster (3).
10. Loosen nuts (10) and remove defroster (3) from mounting bracket (11).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



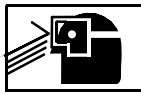
VAPOR

11. Remove defroster (3) and drain coolant into drain pan.
12. Discard defroster (3).

 WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

13. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB ENCLOSURE DEFROSTER

 WARNING



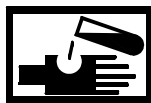
CHEMICAL



EYE PROTECTION

1. Apply sealing compound to threads on union connectors (6).
2. Install union connectors (6) on new defroster (3) and tighten union connectors (6).
3. Position defroster (3) on mounting bracket (11) and tighten nuts (10) to secure defroster (3) on mounting bracket (11).
4. Connect electrical wiring (9) to defroster (3) and remove tags.
5. Position defroster cover (8) on defroster (3).
6. Install screws (7) to secure defroster cover (8) on defroster (3). Tighten screws (7).
7. Position hoses (5) on union connectors (6) and tighten hose clamps (4).
8. Open inlet and outlet defrost needle valves (2).
9. Service cooling system. (TM 55-1945-225-10)
10. Start starboard engine. (TM 55-1945-225-10)

 WARNING



CHEMICAL



EYE PROTECTION

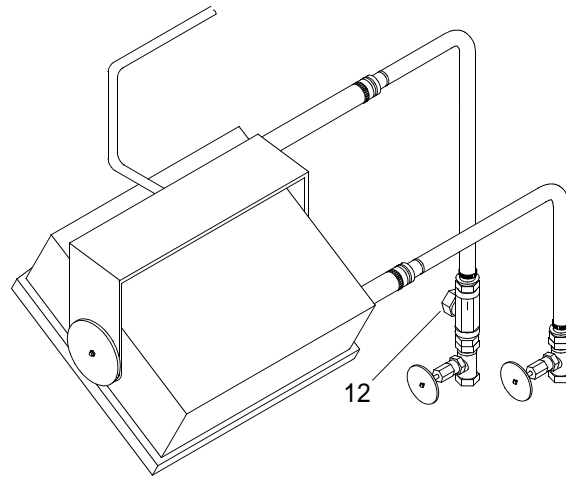


POISON



VAPOR

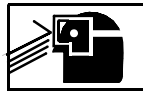
11. Place drain pan under defrost bleed plug (12).



WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

12. Loosen bleed plug (12) to bleed air from coolant system of defroster (3).

WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

13. Tighten plug (12) when all trapped air has escaped.

WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

14. Remove drain pan and dispose of contents in accordance with local procedures.

15. Shut down starboard engine. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR



SLICK FLOOR

16. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB ENCLOSURE HEATER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)
 Respirator, Air Filtering (Item 3, WP 0425 00)
 Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Heater
 PN E08288
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Personnel Required

Engineer 88L

References

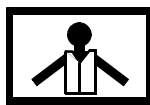
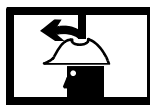
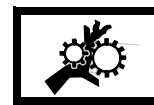
TM 55-1945-225-10

Equipment Condition

Cooling System Cool To Touch.
 Operators Cab/Intake Plenum Side Access Panel Removed. (WP 0093 00)
 Operators Cab Access Panel Removed. (WP 0239 00)
 Heater Water Hoses Removed. (WP 0247 00)

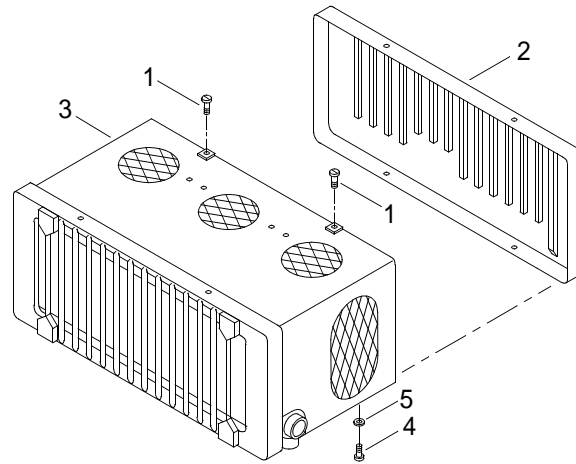
REMOVE OPERATORS CAB ENCLOSURE HEATER

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

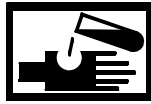
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

1. Remove screws (1) securing rear grille (2) to heater (3).



2. Tag and disconnect electrical wiring to heater (3).
3. Remove capscrews (4) and lockwashers (5) securing heater (3) to mounting structure.
4. Remove heater (3).

WARNING



CHEMICAL



EYE PROTECTION



POISON



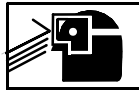
VAPOR

5. Drain coolant from heater (3) into drain pan.
6. Discard heater (3).

WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR

7. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL OPERATORS CAB ENCLOSURE HEATER

1. Position new heater (3) on mounting structure.
2. Connect electrical wiring to heater (3) and remove tags.
3. Install screws (1) to secure grille (2) on heater (3). Tighten screws (1).
4. Install capscrews (4) and lockwashers (5) to secure heater (3) on mounting structure. Tighten capscrews (4).
5. Install heater outlet water hoses. (WP 0247 00)
6. Install operators cab access panel. (WP 0239 00)

-
7. Install operators cab/intake plenum side access panel. (WP 0093 00)
 8. Service cooling system. (TM 55-1945-225-10)
 9. Perform operational check of heater. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION



POISON



VAPOR



SLICK FLOOR

10. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB WINDSHIELD WIPER BLADE
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Wiper Blade
 PN BD721020-10
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

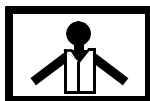
Seaman 88K

References

TM 55-1945-225-10

REMOVE OPERATORS CAB WINDSHIELD WIPER BLADE

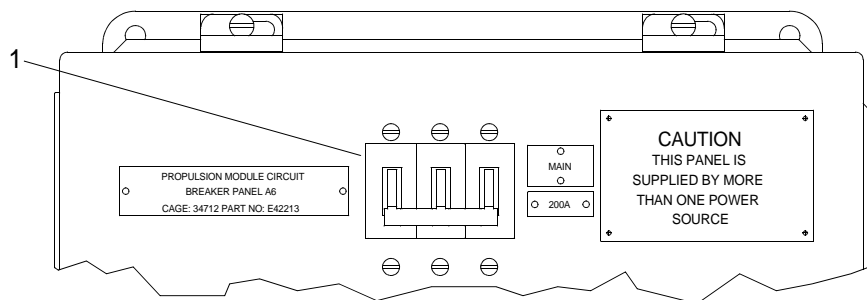
WARNING



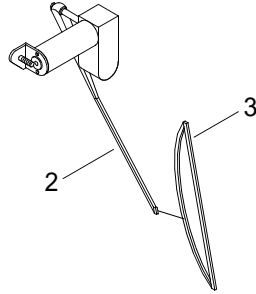
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



-
2. Pull wiper arm (2) away from window.



3. Squeeze clip and slide out wiper blade (3).
4. Discard wiper blade (3).

INSTALL OPERATORS CAB WINDSHIELD WIPER BLADE

1. Slide new wiper blade (3) into groove on wiper arm (2).
2. Push wiper arm (2) back against window.
3. Perform operational check of windshield wiper. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB WINDSHIELD WIPER ARM
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Wiper Arm
PN LE721156
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

References

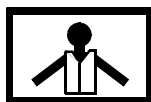
TM 55-1945-225-10

Equipment Condition

Windshield Wiper Blade Removed. (WP 0308 00)

REMOVE OPERATORS CAB WINDSHIELD WIPER ARM

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS

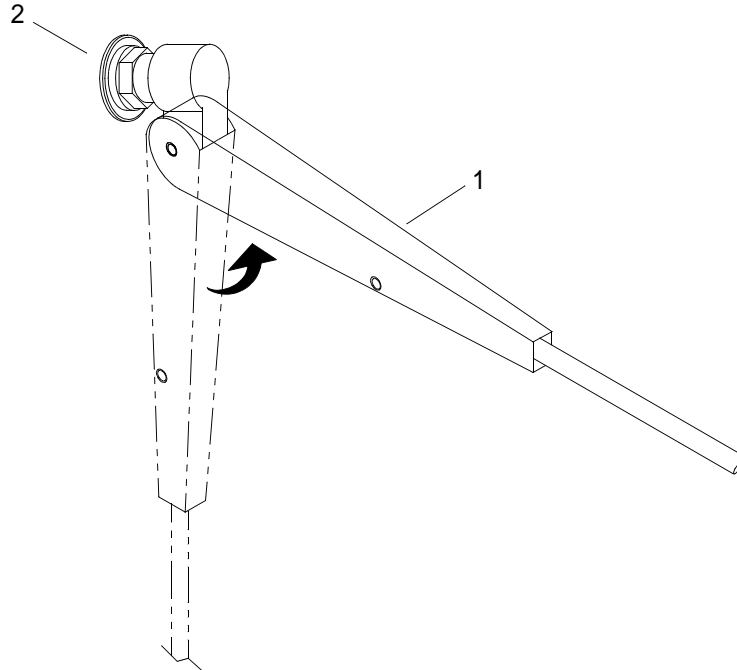


MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Fold wiper arm (1) back to its completely retracted position.

-
2. Grasp wiper arm (1) at wiper motor shaft (2).



3. Remove wiper arm (1) from windshield wiper motor shaft (2).
4. Discard wiper arm (1).

INSTALL OPERATORS CAB WINDSHIELD WIPER MOTOR

1. Press new wiper arm (1) on windshield wiper motor shaft (2).
2. Install windshield wiper blade. (WP 0308 00)
3. Perform operational check of windshield wiper. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB WINDSHIELD WIPER MOTOR
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Windshield Wiper Motor
PN WWF-24-C-17105
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Antiseize Compound (Item 3, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

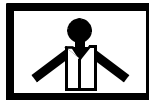
TM 55-1945-225-10

Equipment Condition

Windshield Wiper Blade Removed. (WP 0308 00)
Windshield Wiper Arm Removed. (WP 0309 00)

REMOVE OPERATORS CAB WINDSHIELD WIPER MOTOR

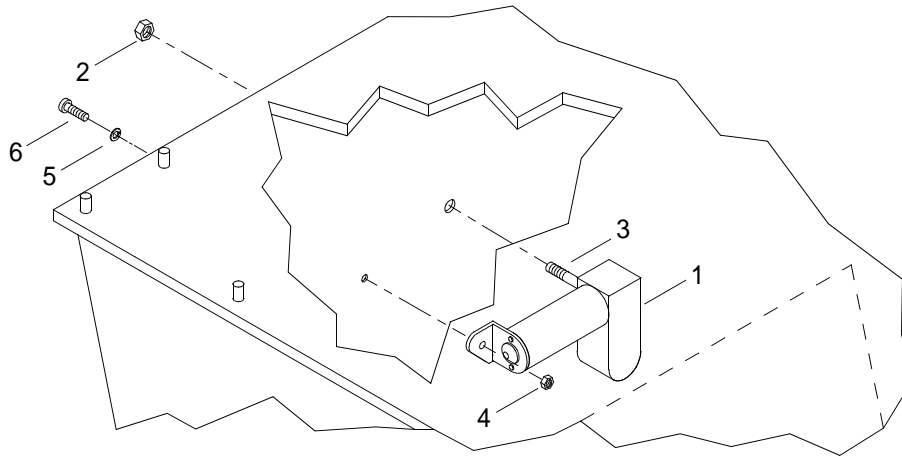
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

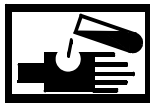
1. Disconnect and tag electrical wires to windshield wiper motor (1).



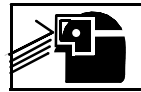
2. Remove lock nut (2) from motor output shaft (3).
3. Remove nut (4), lockwasher (5) and pan head screw (6).
4. Remove windshield wiper motor (1) from interior of cab front wall.
5. Discard windshield wiper motor (1).

INSTALL OPERATORS CAB WINDSHIELD WIPER MOTOR

WARNING



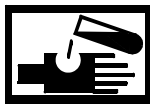
CHEMICAL



EYE PROTECTION

1. Apply antiseize compound to pan head screw (6).
2. Position new windshield wiper motor (1) on interior of cab front wall.
3. Install pan head screw (6), lockwasher (5) and nut (4). Tighten nut (4).

WARNING



CHEMICAL



EYE PROTECTION

4. Using wiping rag, clean off excess antiseize compound.
5. Install lock nut (2) on wiper motor output shaft (3).
6. Tighten lock nut (2).
7. Connect electrical wires to windshield wiper motor (1). Remove tags.

-
8. Install windshield wiper arm. (WP 0309 00)
 9. Install windshield wiper blade. (WP 0308 00)
 10. Perform operational check of windshield wiper. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION

11. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM HANDHELD TRANSCEIVER ANTENNA
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Flexible Antenna
PN 21-20006

Personnel Required

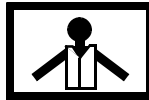
Seaman 88K

References

TM 55-1945-225-10

REMOVE VHF/FM HANDHELD TRANSCEIVER ANTENNA

WARNING



VEST

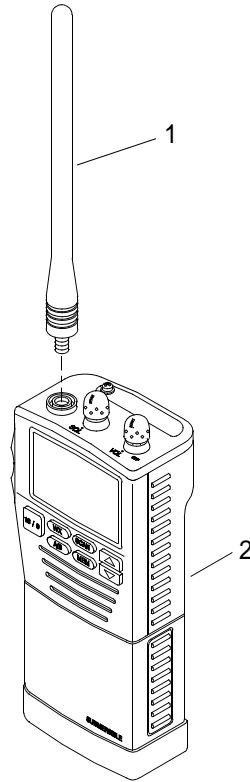
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of VHF/FM handheld transceiver antennas.

1. Turn VHF/FM handheld transceiver power off. (TM 55-1945-225-10)

2. Turn antenna (1) in a counterclockwise direction.



3. Remove antenna (1) from transceiver (2).
4. Discard antenna (1).

INSTALL VHF/FM HANDHELD TRANSCEIVER ANTENNA

1. Align new antenna (1) with antenna connector.
2. Turn antenna (1) in a clockwise direction until hand tight.
3. Perform operational check on handheld transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM HANDHELD TRANSCEIVER CONTROL KNOBS
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Knob
PN 21-200010

Personnel Required

Seaman 88K

References

TM 55-1945-225-10

REMOVE VHF/FM HANDHELD TRANSCEIVER CONTROL KNOBS

WARNING



VEST

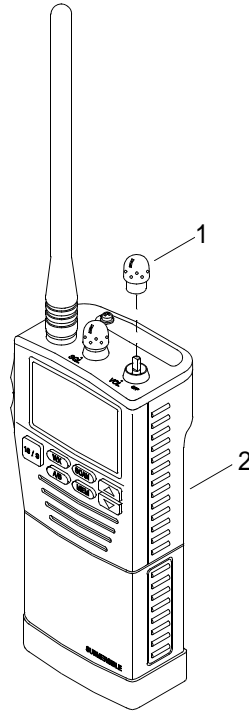
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of VHF/FM handheld transceiver control knobs.

1. Turn VHF/FM handheld transceiver power off. (TM 55-1945-225-10)

2. Grasp knob (1) and pull straight up.



3. Remove knob (1) from transceiver (2).
4. Discard knob (1).

INSTALL VHF/FM HANDHELD TRANSCEIVER CONTROL KNOBS

1. Align new control knob (1) with half-moon shaped control knob shaft on top of transceiver (2).
2. Position and gently push knob onto shaft until seated.
3. Perform operational check on handheld transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM HANDHELD TRANSCEIVER
RECHARGEABLE BATTERY PACK
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Battery Pack, Rechargeable
PN 21-200015

Personnel Required

Seaman 88K

References

TM 55-1945-225-10

REMOVE VHF/FM HANDHELD TRANSCEIVER RECHARGEABLE BATTERY PACK

WARNING



VEST

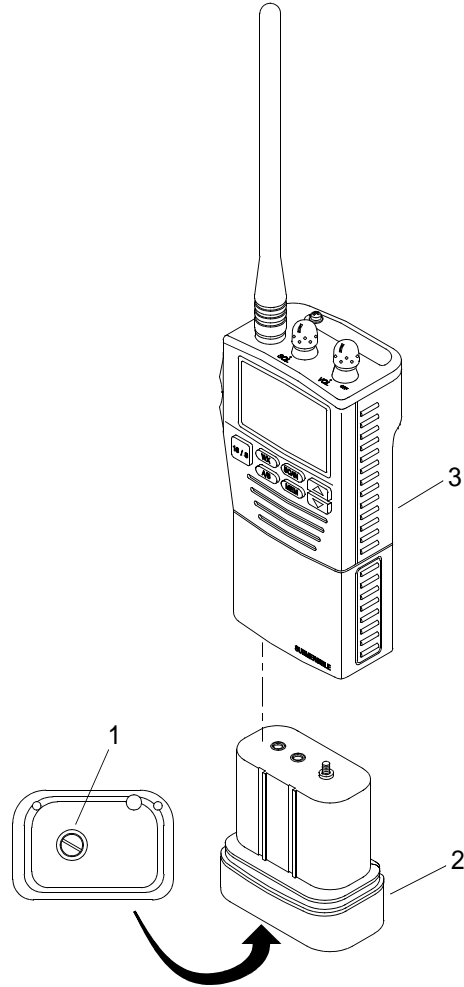
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of VHF/FM handheld transceiver rechargeable battery packs.

1. Turn VHF/FM handheld transceiver power off. (TM 55-1945-225-10)

2. Turn battery lock screw (1) counterclockwise 8 or 9 complete turns.



3. Grasp battery pack (2), pull out from transceiver (3).
4. Discard old battery pack (2) per local procedures.

INSTALL VHF/FM HANDHELD TRANSCEIVER RECHARGEABLE BATTERY PACK

1. Align new battery pack (2) with slots in battery cavity.
2. Slide battery pack (2) into battery cavity of transceiver (3) until fully inserted.
3. Turn battery lock screw (1) clockwise until hand-tightened.
4. Charge new battery pack (2). (TM 55-1945-225-10)
5. Perform operational check on handheld transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM HANDHELD TRANSCEIVER ALKALINE BATTERY PACK
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Battery, Non recharge
PN 20-0571-1988-NEDA 15A
Qty 6

Personnel Required

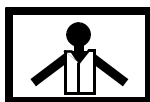
Seaman 88K

References

TM 55-1945-225-10

REMOVE VHF/FM HANDHELD TRANSCEIVER ALKALINE BATTERY PACK

WARNING



VEST

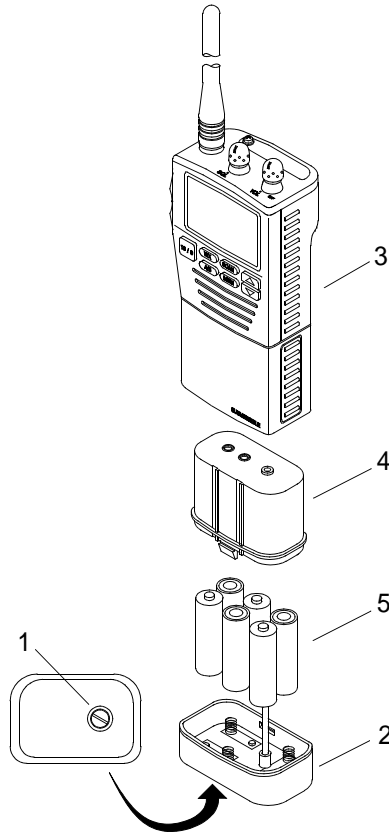
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

The following procedure is typical for removal and installation of VHF/FM handheld transceiver alkaline batteries.

1. Turn VHF/FM handheld transceiver power off. (TM 55-1945-225-10)

- Turn battery lock screw (1) counterclockwise 8 or 9 complete turns.



- Grasp battery pack base (2) and pull out from transceiver (3).
- Squeeze sides of battery pack cover (4) and separate from battery pack base (2).
- Remove six batteries (5) from battery pack cover (4) and discard per local procedures.

INSTALL VHF/FM HANDHELD TRANSCEIVER ALKALINE BATTERY PACK

- Install six new batteries (5) in battery pack cover (4).
- Press battery pack base (2) on battery pack cover (4).

NOTE

Assembled battery pack base and battery pack cover can only be inserted into transceiver cavity one way.

- Align battery pack base (2) and battery pack cover (4) with slots in transceiver (3) cavity. Slide assembled battery pack base (2) and cover into cavity of transceiver (3).
- Turn battery lock screw (1) clockwise until hand-tightened.
- Perform operational check on handheld transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM HANDHELD TRANSCEIVER BATTERY CHARGER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Battery Charger
PN 21-200016

Personnel Required

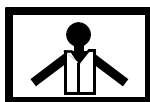
Engineer 88L

References

TM 55-1945-225-10

REMOVE VHF/FM HANDHELD TRANSCEIVER BATTERY CHARGER

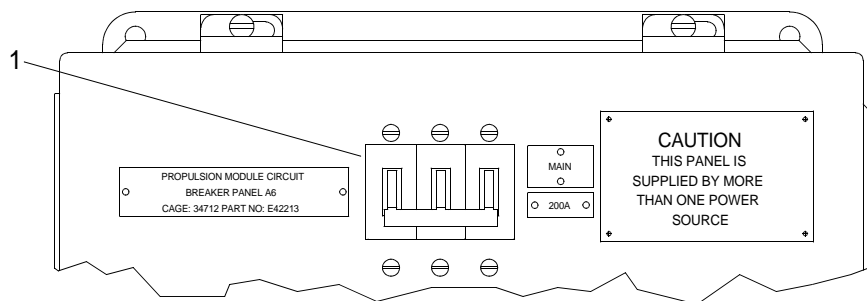
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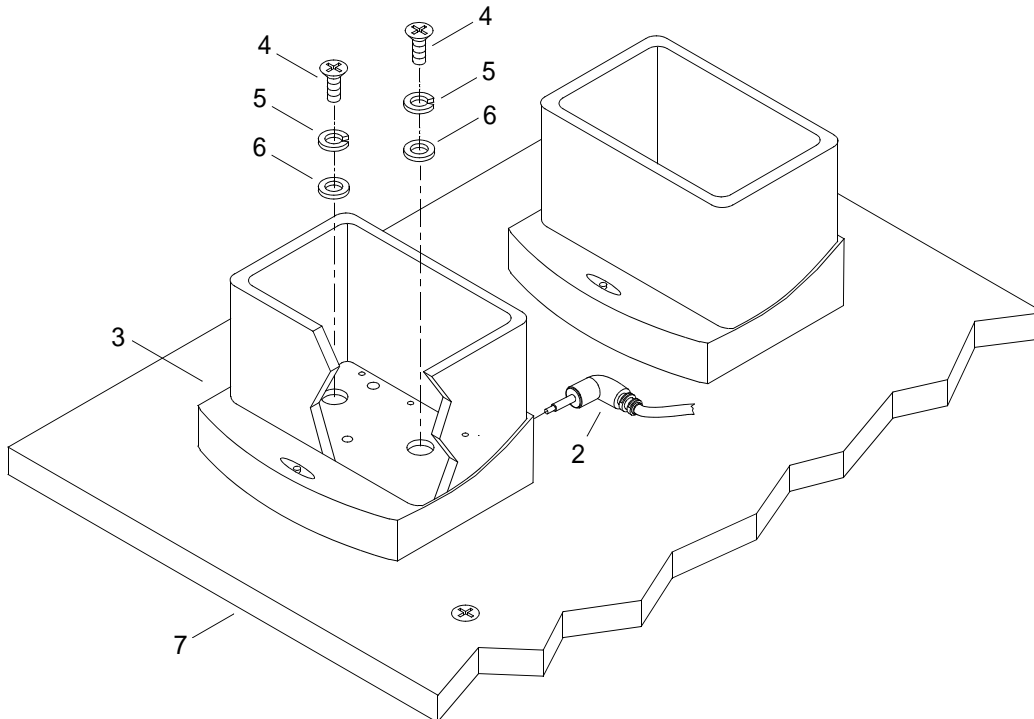
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove battery charger power cord (2) from rear of charger (3).



- Remove two screws (4), lockwashers (5) and washers (6) holding charger onto console (7).
- Remove and discard charger (3).

INSTALL VHF/FM HANDHELD TRANSCEIVER BATTERY CHARGER

- Position new charger (3) on console (7).
- Install two screws (4), lockwashers (5) and washers (6) through charger (3) into console (7).
- Tighten screws (4).
- Plug battery charger power cord (2) into back of charger (3).
- Perform operational check on handheld transceiver battery charger. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUBLIC ADDRESS SET (LOUDHAILER) MICROPHONE
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Microphone
PN G263596-2

Personnel Required

Seaman 88K

References

TM 55-1945-225-10

REMOVE PUBLIC ADDRESS SET (LOUDHAILER) MICROPHONE

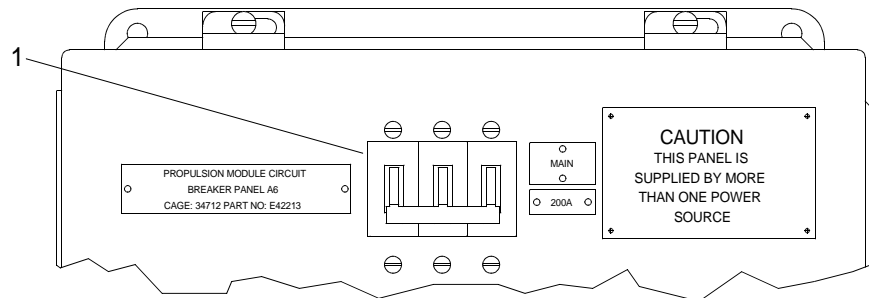
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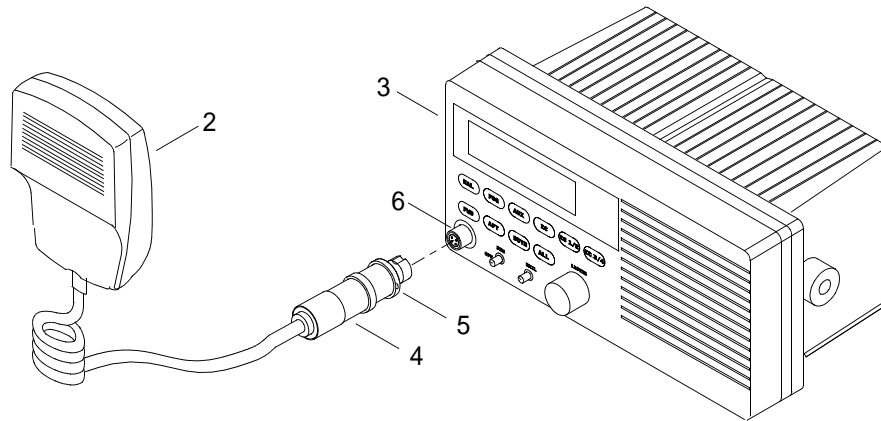
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Remove microphone (2) from loudhailer (3).



3. Grasp microphone connector (4) and turn knurled nut (5) counterclockwise to remove.
4. Discard microphone (2).

INSTALL PUBLIC ADDRESS SET (LOUDHAILER) MICROPHONE

1. Install new microphone (2) on loudhailer (3).
 - a. Line up keyway on microphone connector (4) with keyway on loudhailer connector (6).
 - b. Insert microphone connector (4) into loud hailer connector (6) and turn knurled nut (5) clockwise until hand tight.
2. Perform operational check on loud hailer. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUBLIC ADDRESS SET (LOUDHAILER)
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Public Address Set
PN RAY430

Personnel Required

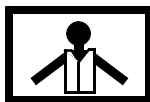
Engineer 88L

References

TM 55-1945-225-10

REMOVE PUBLIC ADDRESS SET (LOUDHAILER)

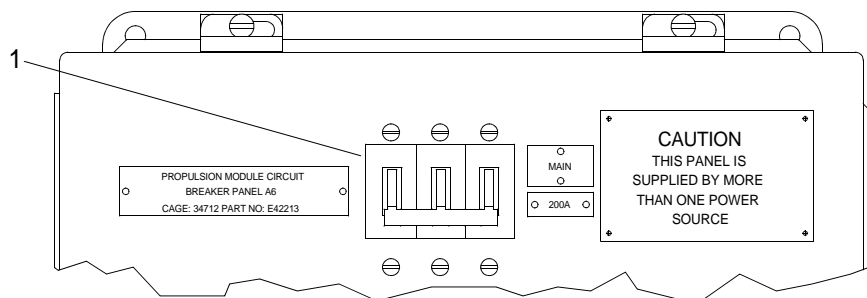
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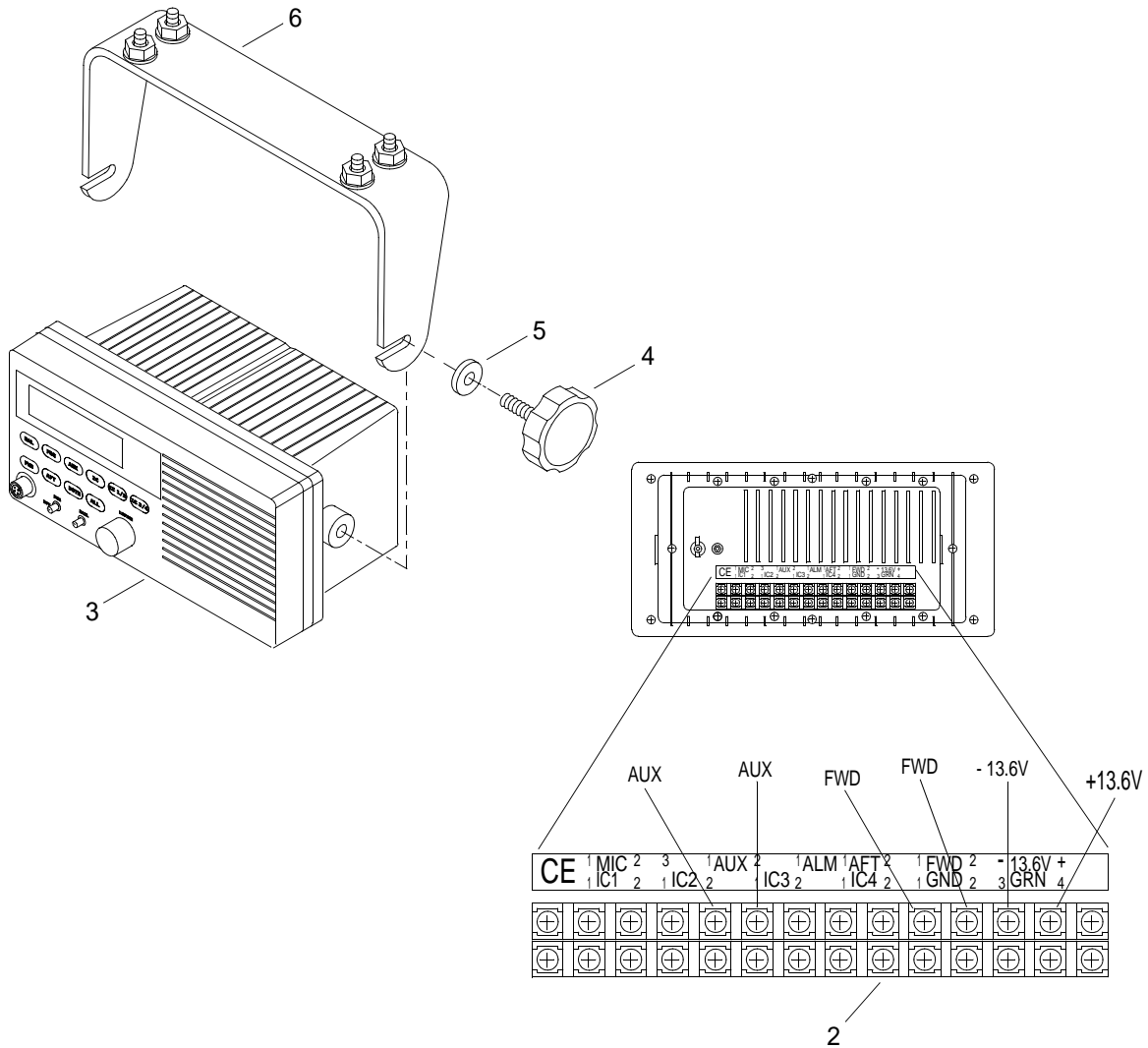
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Tag and disconnect wiring from terminal strip (2) on rear of loudhailer (3).



3. Remove two knobs (4) and washers (5) from loudhailer (3).
4. Remove loudhailer (3) from mount (6).

INSTALL PUBLIC ADDRESS SET (LOUDHAILER)

1. Position new loudhailer (3) in mount (6).
2. Install two knobs (4) through washers (5) and into loudhailer (3).
3. Tighten knobs (4) hand tight.
4. Connect wiring to terminal strip (2) on rear of loudhailer (3).
5. Remove tags.
6. Perform operational check on loud hailer. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUBLIC ADDRESS SET (LOUDHAILER) MOUNT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Mount
PN G263596-4

Personnel Required

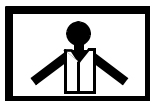
Seaman 88K

Equipment Condition

Public Address Set (Loud hailer) Removed. (WP 0317 00)
VHF/FM DSC Transceiver Microphone Removed. (WP 0323 00)
VHF/FM DSC Transceiver Removed. (WP 0324 00)

REMOVE PUBLIC ADDRESS SET (LOUDHAILER) MOUNT

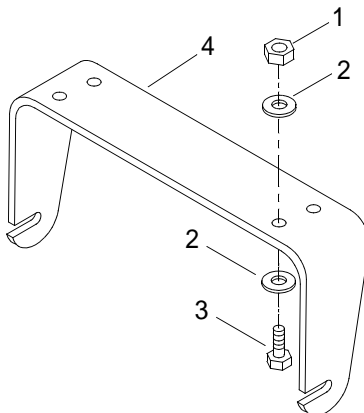
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Remove two self-locking nuts (1), four flat washers (2) and two bolts (3) from mounting bracket (4).



2. Remove mounting bracket (4) from beneath shelf.
3. Discard mounting bracket (4).

INSTALL PUBLIC ADDRESS SET (LOUDHAILER) MOUNT

1. Position new mounting bracket (4) beneath shelf.
2. Install two bolts (3) with washers (2) through bracket holes and through holes in shelf.
3. Install second washers (2) and self-locking nuts (1) on bolts (3).
4. Tighten nuts (1).
5. Install VHF/FM DSC transceiver. (WP 0324 00)
6. Install VHF/FM DSC transceiver microphone. (WP 0323 00)
7. Install public address set (loud hailer). (WP 0317 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PUBLIC ADDRESS SET (LOUDHAILER)
HAILER HORN (EXTERNAL SPEAKER)
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Crimping Tool, Terminal Hand (Item 5, WP 0425 00)

Materials/Parts

Hailer Horn
PN M95435
Splice Electrical, Butt
PN CWT3809W1
Qty 2

Personnel Required

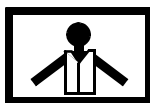
Engineer 88L

References

TM 55-1945-225-10

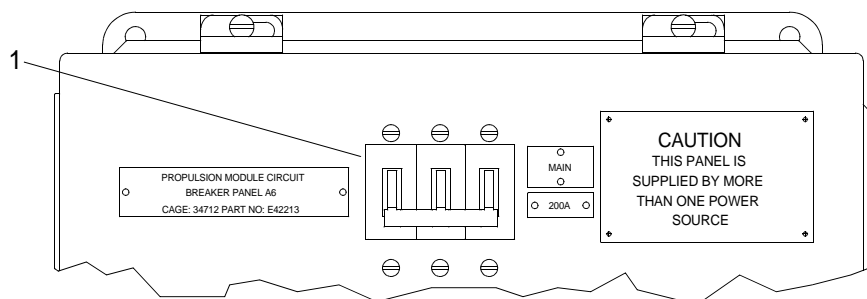
**REMOVE PUBLIC ADDRESS SET (LOUDHAILER) HAILER HORN
(EXTERNAL SPEAKER)**

WARNING

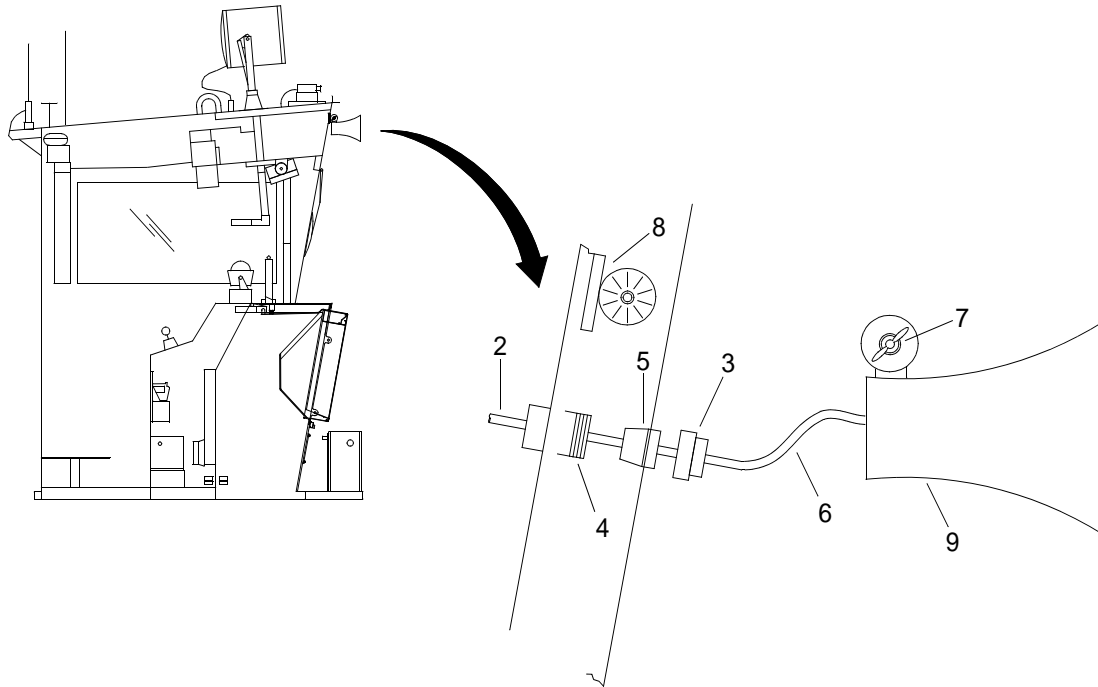
**VEST**

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- From inside operators cab, locate speaker wire (2) and cut it with wire cutters.



- Remove nylon stuffing tube packing retaining cap (3) from nylon stuffing tube (4) by turning retaining cap (3) counterclockwise.
- Remove stuffing tube packing (5) from nylon stuffing tube (4).
- Outside operators cab, pull speaker wire (6) completely through nylon stuffing tube (4).
- Remove wing bolt (7) securing speaker to bracket (8) and remove speaker (9).
- Discard speaker (9).

INSTALL PUBLIC ADDRESS SET (LOUDHAILER) HAILER HORN (EXTERNAL SPEAKER)

- Position new loudhailer speaker (9) onto its bracket (8) and secure it with wing bolt (7).
- Tighten wing bolt (7).
- Feed new speaker wire (6) through nylon stuffing tube retaining cap (3), stuffing tube packing (5) and nylon stuffing tube (4) into interior of operators cab.
- Connect new speaker wire (2) to old wire inside cab using electrical splices and electrical splice crimping tool.
- Insert stuffing tube packing (5) into nylon stuffing tube (4).
- Install nylon stuffing tube packing retaining cap (3) on nylon stuffing tube (4) by turning retaining cap (3) clockwise.
- Tighten retaining cap (3).
- Perform operational check on public address set (loud hailer). (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SINGGARS RADIO
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Personnel Required

Seaman 88K

References

TM 11-5820-890-20-3

REMOVE AND INSTALL SINGGARS RADIO

Refer to TM 11-5820-890-20-3 for removal and installation of the AN/VRC-88D SINGGARS radio.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SINGGARS RADIO REMOTE AND MICROPHONE
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Personnel Required

Seaman 88K

References

TM 11-5820-890-20-3

REMOVE AND INSTALL SINGGARS RADIO REMOTE AND MICROPHONE

Refer to TM 11-5820-890-20-3 for removal and installation of the AN/VRC-88D SINGGARS radio remote and microphone.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SINGGARS RADIO ANTENNA
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Personnel Required**

Seaman 88K

References

TM 11-5820-890-20-3

REMOVE AND INSTALL SINGGARS RADIO ANTENNA

Refer to TM 11-5820-890-20-3 for removal and installation of the AN/VRC-88D SINGGARS radio antenna.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER MICROPHONE
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

VHF/FM DSC Transceiver Microphone
PN 21-200001

Personnel Required

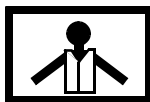
Seaman 88K

References

TM 55-1945-225-10

REMOVE VHF/FM DSC TRANSCEIVER MICROPHONE

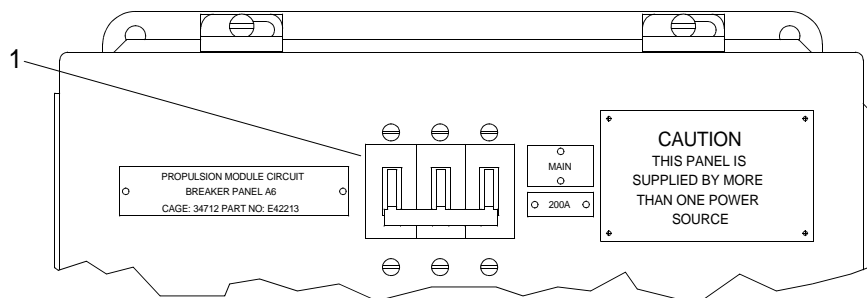
WARNING



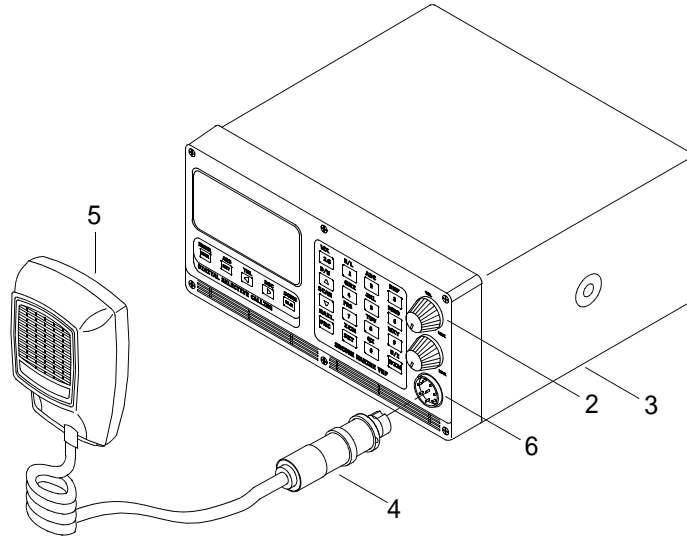
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Rotate volume knob (2) on transceiver (3) to OFF position.



3. Grasp microphone connector (4), turn knurled nut counterclockwise and remove microphone (5) from transceiver connector port (6).
4. Discard microphone (5).

INSTALL VHF/FM DSC TRANSCEIVER MICROPHONE

1. Line up keyway on new microphone connector (4) with keyway on transceiver connector port (6).
2. Insert microphone connector (4) and tighten knurled nut clockwise to install.
3. Perform initial setup and operational check on DSC transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

VHF/FM DSC Transceiver
PN DSC-500

Personnel Required

Seaman 88K

References

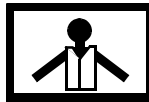
TM 55-1945-225-10

Equipment Condition

VHF/FM DSC Transceiver Microphone Removed. (WP 0323 00)

REMOVE VHF/FM DSC TRANSCEIVER

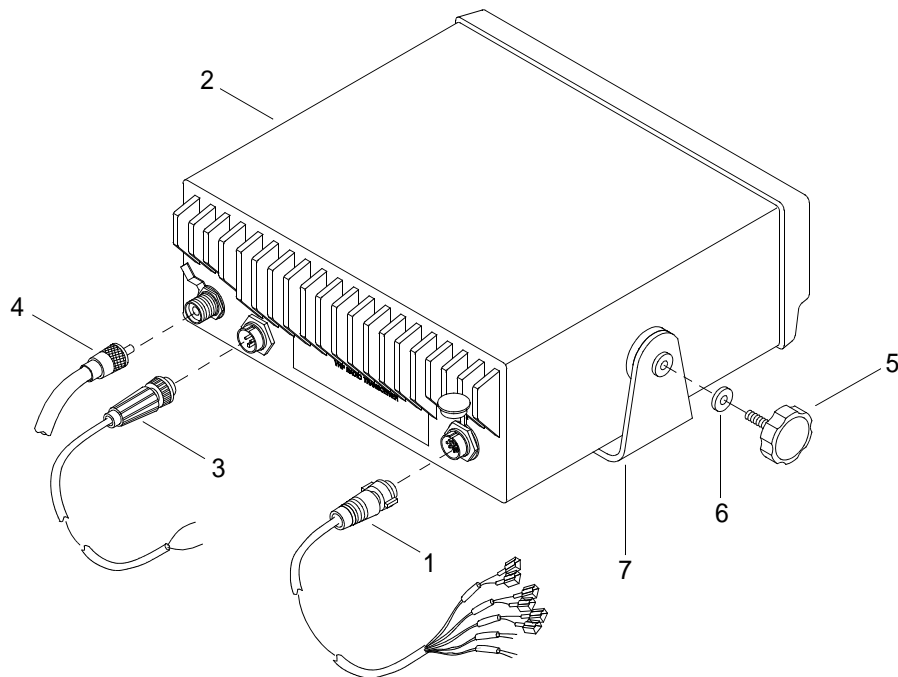
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Detach interface cable (1) from back of transceiver (2) by turning connector counterclockwise to remove.



2. Detach power cable (3) from back of transceiver (2) by turning connector counterclockwise to remove.
3. Detach antenna coaxial cable (4) from back of transceiver (2) by turning connector counterclockwise to remove.
4. Remove two knobs (5) and washers (6) from mount (7) by turning knobs counterclockwise.
5. Remove transceiver (2) from mount (7).

INSTALL VHF/FM DSC TRANSCEIVER

1. Position transceiver (2) in mount (7) and align mount holes.
2. Install two washers (6) and knobs (5) through mount (7) into transceiver (2). Tighten knobs (5).
3. Attach antenna coaxial cable (4) to back of transceiver (2) by turning connector clockwise and hand tighten.
4. Attach power cable (3) to back of transceiver (2) by aligning keyways, then turning connector clockwise and hand tighten.
5. Attach interface cable (1) to back of transceiver (2) by aligning keyways then turning connector clockwise and hand tighten.
6. Install VHF/FM DSC transceiver microphone. (WP 0323 00)
7. Perform initial setup of DSC transceiver. (TM 55-1945-225-10)
8. Perform operational check on DSC transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER MOUNT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

VHF/FM DSC Transceiver Mount
PN 21-200003

Personnel Required

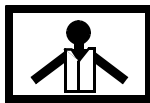
Seaman 88K

Equipment Condition

VHF/FM DSC Transceiver Microphone Removed. (WP 0323 00)
VHF/FM DSC Transceiver Removed. (WP 0324 00)

REMOVE VHF/FM TRANSCEIVER MOUNT

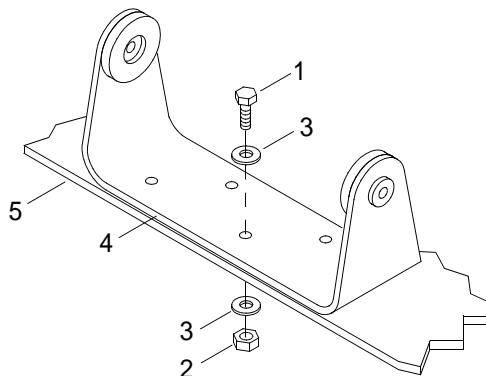
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Remove four hex head bolts (1), four self-locking nuts (2) and eight flat washers (3) attaching mount (4) to shelf (5).



2. Remove and discard mount (4).

INSTALL VHF/FM DSC TRANSCEIVER MOUNT

1. Align new mount (4) with holes in shelf (5).
2. Install four hex head bolts (1), eight flat washers (3) and four self-locking nuts (2) through mount (4) and shelf (5) and tighten.
3. Install VHF/FM DSC transceiver. (WP 0324 00)
4. Install VHF/FM DSC transceiver microphone. (WP 0323 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER ANTENNA
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Antenna
PN 5240

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

REMOVE VHF/FM DSC TRANSCEIVER ANTENNA

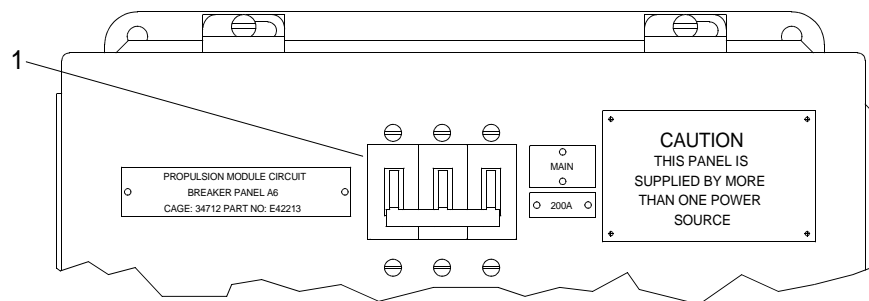
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.

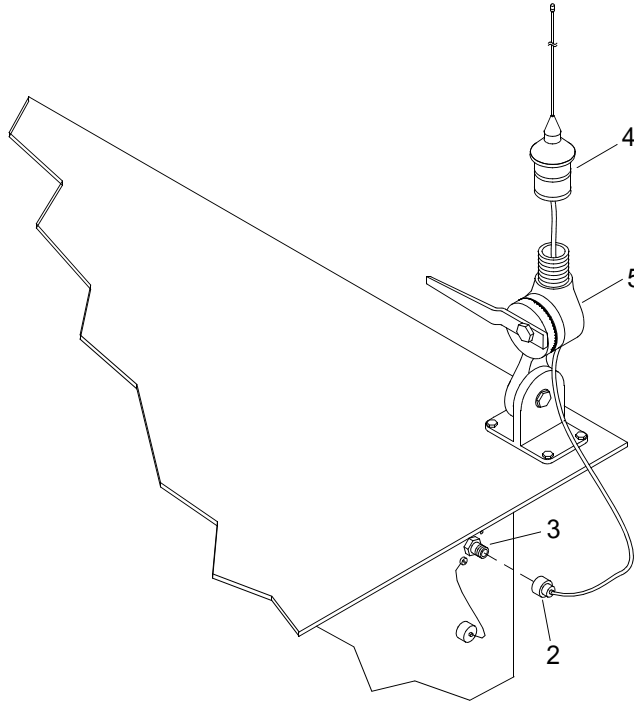


WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

2. Use operators cab ladder to gain access to top of operators cab.

3. Disconnect VHF connector (2) from bulkhead adaptor (3).



4. Unscrew VHF/FM DSC transceiver antenna (4) from VHF/FM DSC transceiver mount (5).
5. Discard antenna (4).

INSTALL VHF/FM DSC TRANSCEIVER ANTENNA

1. Screw new VHF/FM DSC transceiver antenna (4) onto VHF/FM DSC transceiver mount (5).
2. Install VHF connector (2) on bulkhead adaptor (3).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

3. Descend from top of operators cab.
4. Perform operational check on DSC transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER ANTENNA MOUNT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Mount, Antenna
PN 366-H
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Antiseize Compound (Item 3, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

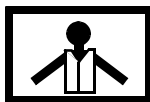
Engineer 88L

Equipment Condition

VHF/FM DSC Transceiver Antenna Removed. (WP 0326 00)

REMOVE VHF/FM DSC TRANSCEIVER ANTENNA MOUNT

WARNING



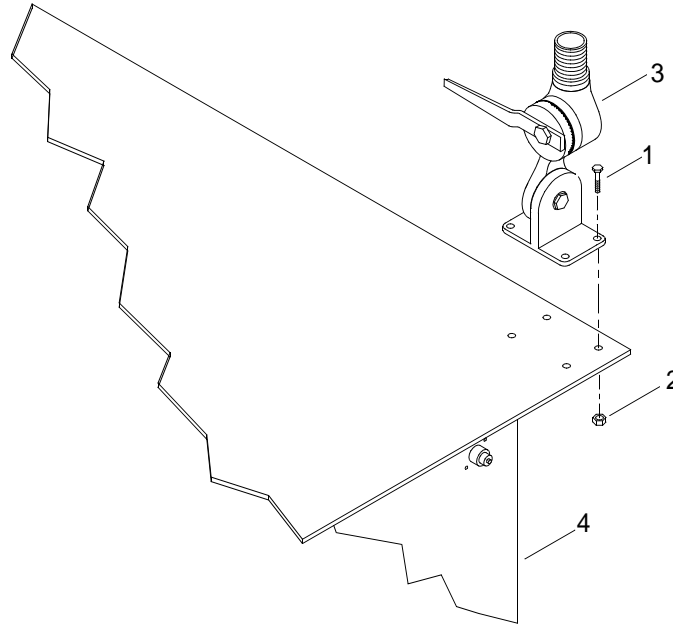
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

1. Use operators cab ladder to gain access to top of operators cab.

- Remove four capscrews (1) and four hex nuts (2) securing VHF/FM DSC antenna mount (3) to operators cab (4).



- Remove and discard VHF/FM DSC transceiver antenna mount (3).

INSTALL VHF/FM DSC TRANSCEIVER ANTENNA MOUNT

WARNING



CHEMICAL



EYE PROTECTION

- Apply antiseize compound to threads on capscrews (1).
- Align new antenna mount (3) on operators cab (4) and secure with capscrews (1) and nuts (2). Tighten nuts (2).

WARNING



CHEMICAL



EYE PROTECTION

- Using wiping rag, clean off excess antiseize compound.

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

- Descend from top of operators cab.

-
5. Install VHF/FM DSC transceiver antenna. (WP 0326 00)

WARNING



CHEMICAL



EYE PROTECTION

6. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
VHF/FM DSC TRANSCEIVER ANTENNA CABLE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Antenna Cable
PN E06508-5
Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

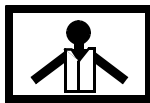
Engineer 88L

References

TM 55-1945-225-10

REMOVE VHF/FM DSC TRANSCEIVER ANTENNA CABLE

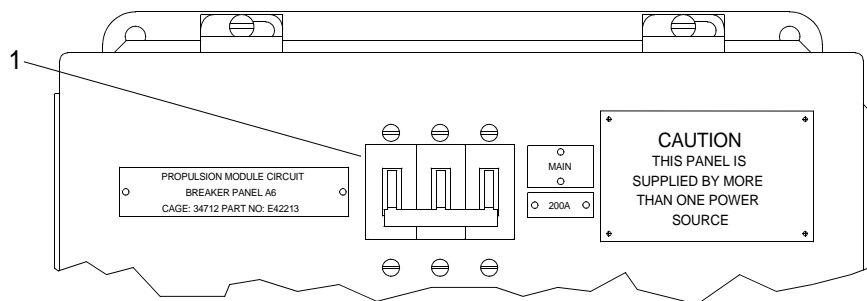
WARNING



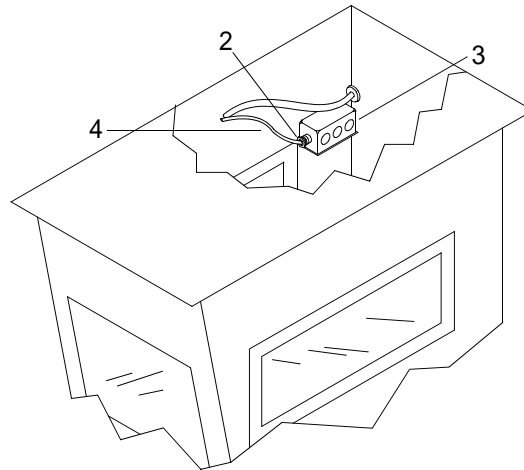
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

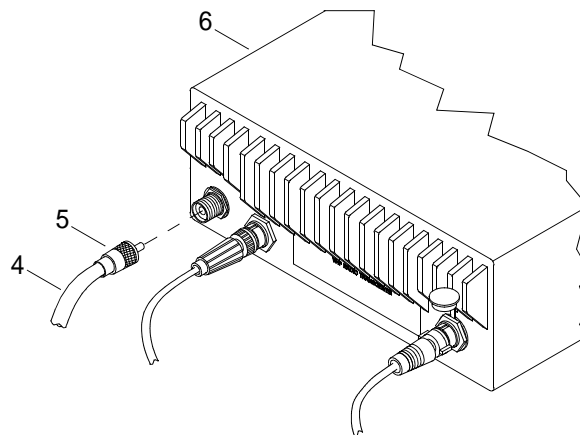
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove antenna connector (2) from male-to-male interface (3) on rear inside wall of operators cab by turning counterclockwise.



- Cut all tiedown straps holding antenna cable (4) in place.
- Remove antenna connector (5) from rear of VHF/FM DSC transceiver (6) by turning counterclockwise.



- Remove and discard antenna cable (4).

INSTALL VHF/FM DSC TRANSCEIVER ANTENNA CABLE

- Attach new antenna cable connector (5) to rear of VHF/FM DSC transceiver (6).
- Run new antenna cable (4) along inside top of operators cab starboard side wall.
- Replace tiedown straps to hold antenna cable (4) in place in all locations.
- Attach antenna cable connector (2) to male-to-male interface (3) on rear inside wall of operators cab by turning clockwise.
- Perform operational check on DSC transceiver. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB COMPASS
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Compass
PN E41608

Personnel Required

Engineer 88L

References

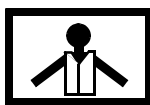
TM 55-1945-225-10

Equipment Condition

Middle Control Panel A1 Removed. (WP 0254 00)

REMOVE OPERATORS CAB COMPASS

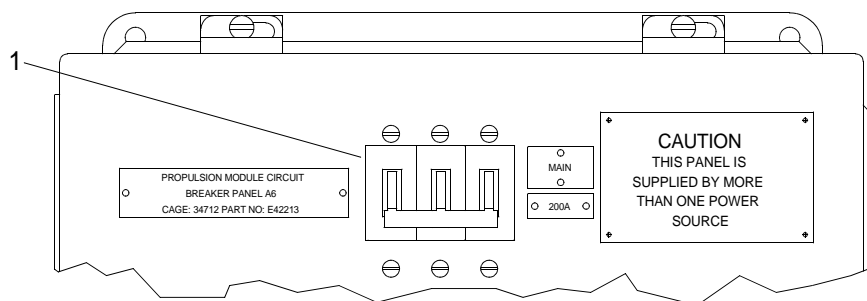
WARNING



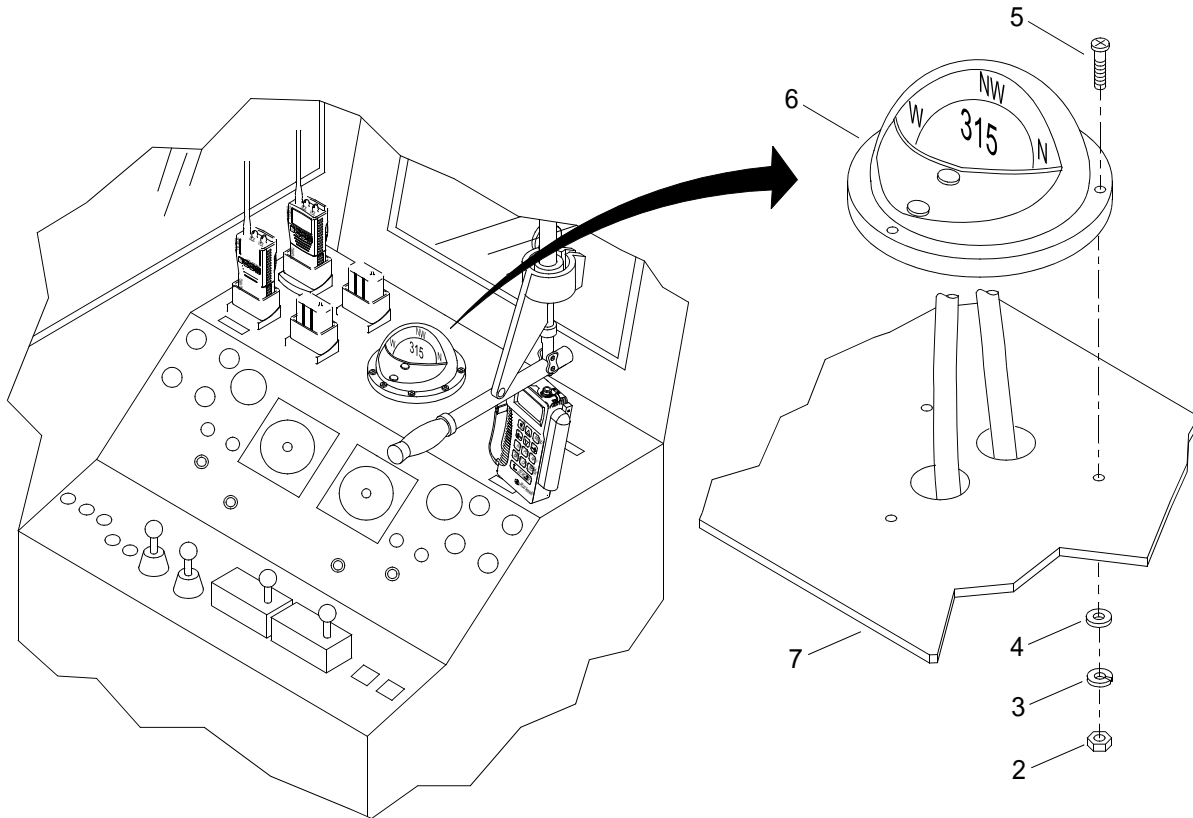
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove nuts (2), lockwashers (3), washers (4) and bolts (5) securing compass (6) to operators cab console (7).



- Lift compass (6) off operators cab console (7).
- Tag and disconnect electrical wiring from bottom of compass (6).
- Remove and discard compass (6).

INSTALL OPERATORS CAB COMPASS

- Connect electrical wiring to bottom of new compass (6) and remove tags.
- Position compass (6) on operators cab console (7).
- Install nuts (2), lockwashers (3), washers (4) and bolts (5) to secure compass (6) to operators cab console (7). Tighten nuts (2).
- Install middle control panel A1. (WP 0254 00)
- Perform operational check of compass. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB MAPLIGHT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Maplight
 PN E46319
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

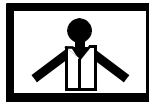
TM 55-1945-225-10

Equipment Condition

Operators Cab Access Panel Removed. (WP 0239 00)
 Operators Cab Circuit Breaker Panel A3 Removed. (WP 0293 00)

REMOVE OPERATORS CAB MAPLIGHT

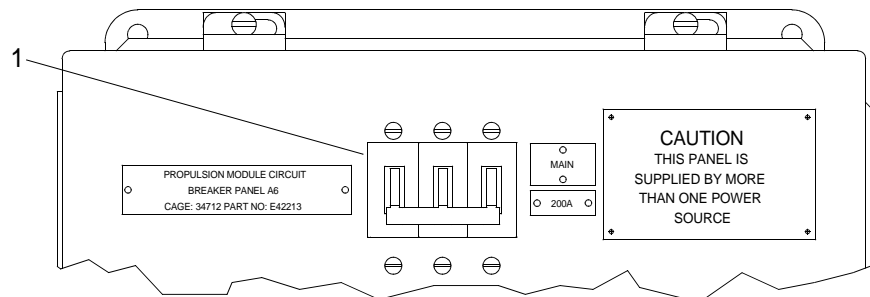
WARNING



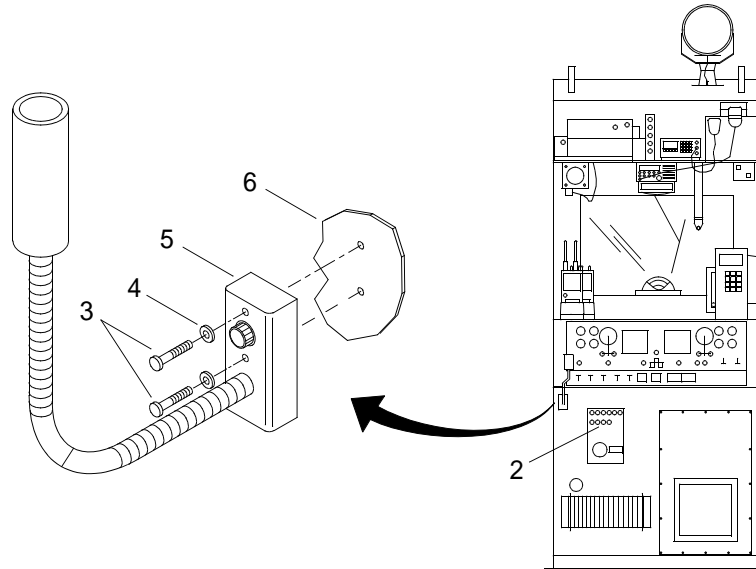
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Tag and disconnect maplight electrical wiring from rear of operators cab circuit breaker panel A3 (2).



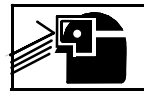
3. Remove capscrews (3) and lockwashers (4) securing maplight (5) to front of operators console (6).
4. Remove and discard maplight (5).

INSTALL OPERATORS CAB MAPLIGHT

WARNING



CHEMICAL



EYE PROTECTION

1. Apply thin bead of adhesive to mating surface of new maplight (5).
2. Position maplight (5) on front of operators cab console (6).
3. Install capscrews (3) and lockwashers (4) to secure maplight (5) to operators cab console (6). Tighten capscrews (3).
4. Connect maplight electrical wiring from rear of operators cab circuit breaker panel A3 (2) and remove tags.
5. Install operators cab circuit breaker panel A3. (WP 0293 00)
6. Install operators cab access panel. (WP 0239 00)
7. Perform operational check of maplight. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB MAPLIGHT BULB
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Lamp
PN E46308

Personnel Required

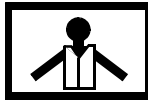
Engineer 88L

References

TM 55-1945-225-10

REMOVE OPERATORS CAB MAPLIGHT BULB

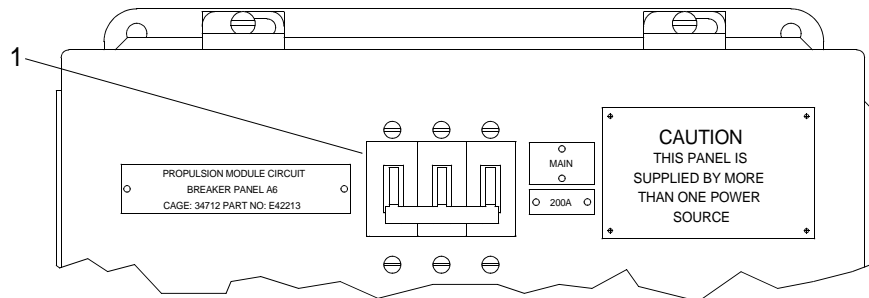
WARNING



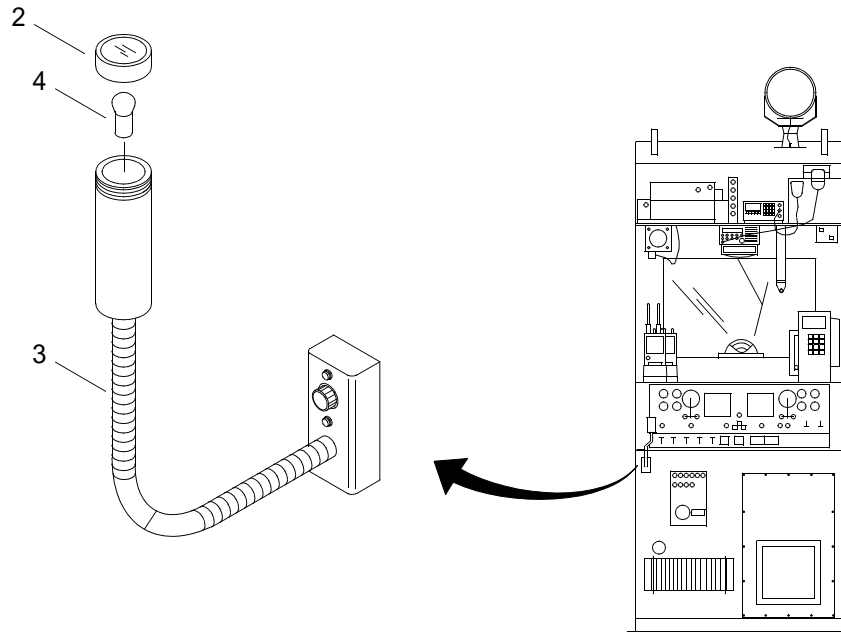
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove cap (2) by turning counterclockwise on end of maplight (3).



- Push in, twist counterclockwise, remove and discard bulb (4) from maplight (3).

INSTALL OPERATORS CAB MAPLIGHT BULB

- Position new bulb (4) in maplight (3).
- Push in and twist bulb (4) clockwise to secure in maplight (3).
- Install cap (2) on maplight (3) by turning clockwise. Tighten cap (2).
- Perform operational check of maplight. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB FOLDING STEP
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

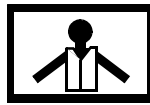
Folding Step
PN E36868

Personnel Required

Engineer 88L (2)

REMOVE OPERATORS CAB FOLDING STEP

WARNING



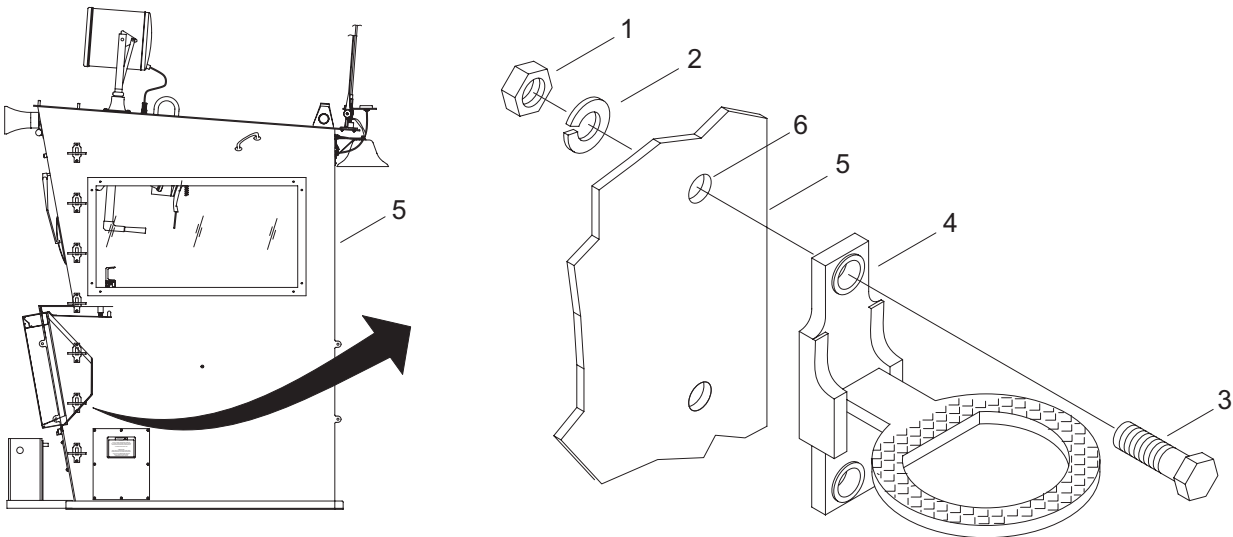
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

This procedure is typical for replacement of folding steps.

- Using assistant, remove hex nuts (1), lockwashers (2) and hex head capscrews (3) securing folding step (4) to side of operators cab (5).



2. Remove and discard folding step (4).

INSTALL OPERATORS CAB FOLDING STEP

1. Position new folding step (4) over holes (6) on side of operators cab (5).
2. Using assistant, install hex head capscrews (3), lock-washers (2) and hex nuts (1) to secure folding step (4) on side of operators cab (5). Tighten hex nuts (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST FLUX GATE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Flux Gate Heading Sensor
PN 01-0118-001

Personnel Required

Seaman 88K

References

TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Lowered. (WP 0350 00)

REMOVE MAIN ASSEMBLY MAST FLUX GATE

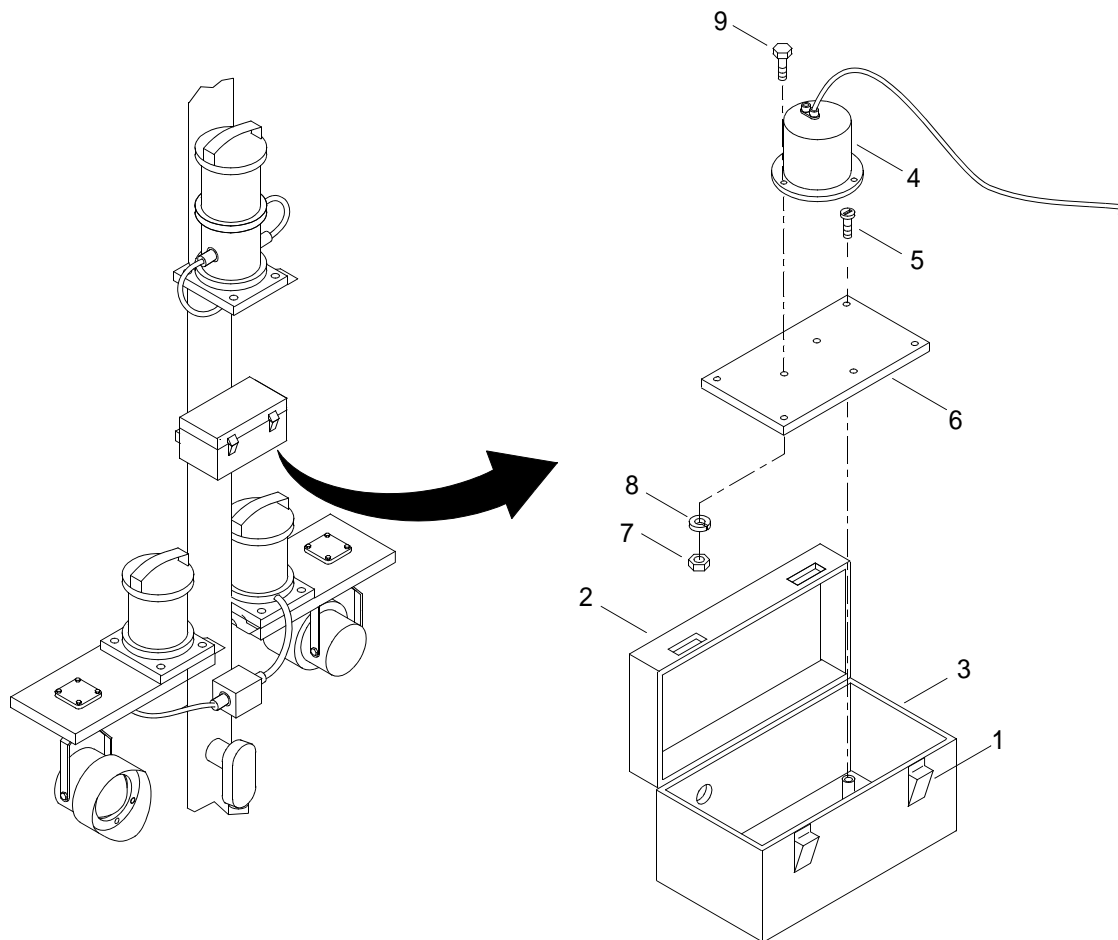
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Open latches (1) securing cover (2) to enclosure (3).



2. Tag and disconnect electrical wiring to main assembly mast flux gate (4).
3. Remove screws (5) securing mounting plate (6) inside enclosure (3).
4. Remove mounting plate (6) from enclosure (3).
5. Remove nuts (7), lockwashers (8) and bolts (9) securing main assembly mast flux gate (4) to mounting plate (6).
6. Remove main assembly mast flux gate (4) from mounting plate (6).
7. Discard main assembly mast flux gate (4).

INSTALL MAIN ASSEMBLY MAST FLUX GATE

1. Position new main assembly mast flux gate (4) on mounting plate (6). Direction of arrow is critical, arrow must point forward.
2. Install nuts (7), lockwashers (8) and bolts (9) to secure flux gate (4) to mounting plate (6). Tighten nuts (7).
3. Position mounting plate (6) inside enclosure (3).
4. Install screws (5) to secure mounting plate (6) inside enclosure (3). Tighten screws (5).
5. Connect electrical wiring to main assembly mast flux gate (4) and remove tags.
6. Close cover (2) on enclosure (3) and secure latches (1).
7. Raise main assembly mast. (WP 0350 00)
8. Perform operational check of compass. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PRECISION LIGHTWEIGHT GLOBAL POSITIONING RECEIVER
(PLGR) MEMORY BATTERY
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Battery, Non-rechargeable
PN VE461-5013-0001

Personnel Required

Seaman 88K

References

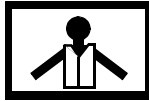
TM 55-1945-225-10

Equipment Condition

PLGR Removed. (WP 0336 00)

REMOVE PLGR MEMORY BATTERY

WARNING



VEST

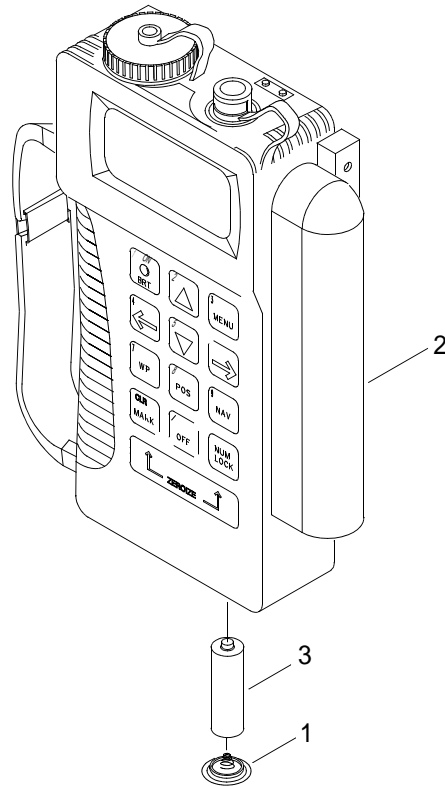
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

The PLGR must have a live main power source (battery or external) connected while replacing memory battery or all memory will be lost.

1. Remove memory battery cover (1) (bottom of unit) by turning it counterclockwise with a flat-tip screwdriver.
2. Tilt unit (2) right side up to slide battery (3) out.
3. Dispose of old battery in accordance with local procedures.

4. Inspect gasket on battery cover (1) for damage and dirt. Clean if necessary.



INSTALL PLGR MEMORY BATTERY

1. Install new battery (3) positive (+) end first.
2. Tighten memory battery cover (1) by turning it in a clockwise direction until snug, using a flat tip screwdriver.
3. Install PLGR. (WP 0336 00)
4. Check display. If WARNING message PLGR HAS CLEARED MEMORY appears, perform initial setup of PLGR. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PRECISION LIGHTWEIGHT GLOBAL POSITIONING
RECEIVER (PLGR) BATTERY
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Battery, Non-rechargeable
PN 2E/416-027

Personnel Required

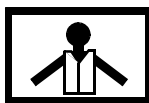
Seaman 88K

Equipment Condition

PLGR Removed. (WP 0336 00)

REMOVE PLGR BATTERY

WARNING



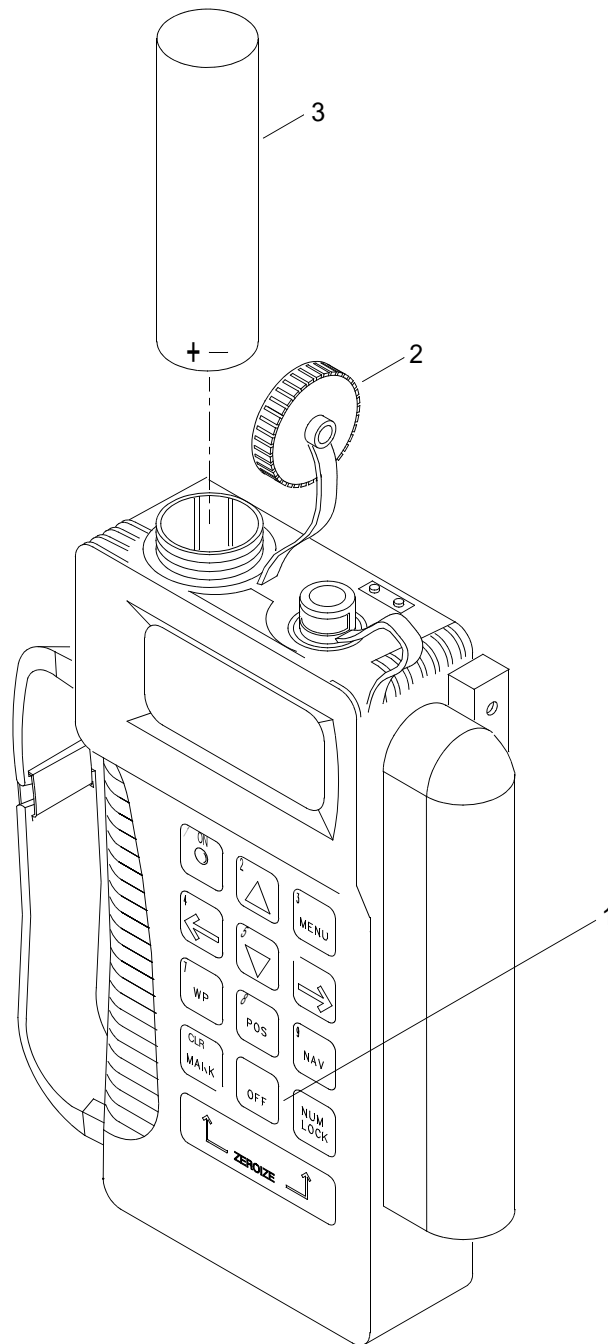
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

To ensure proper PLGR operation when installing or replacing both power and memory batteries, ensure power battery is installed or ships power is connected to PLGR prior to memory battery replacement.

1. Press PLGR power OFF key (1).



2. Remove power battery cover (2) (top of unit) by twisting it counterclockwise. Tilt PLGR upside down to slide battery (3) out into your hand.

NOTE

The BA-5800/U lithium sulphur dioxide (LISO₂) battery is secondary power source for PLGR and contains a feature called Complete Discharge Device (CDD). CDD is a small switch located under a removable seal at top of BA-5800/U. Its purpose is to consume remaining lithium in battery after use and before disposal.

3. Press CDD button and place BA-5800 in a ventilated non-occupied area for five days.

4. Dispose of old battery in accordance with local procedures.

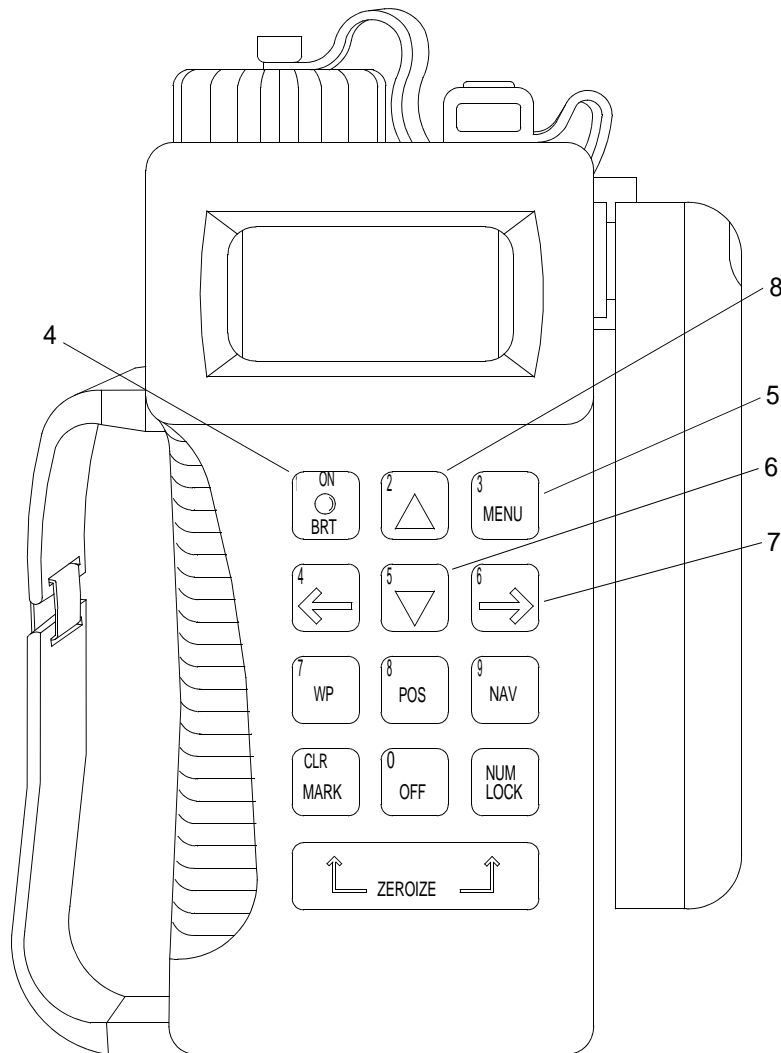
INSTALL PLGR BATTERY

1. Inspect gasket on battery cover (2) for damage and dirt. Clean or replace battery cover (2) as necessary.

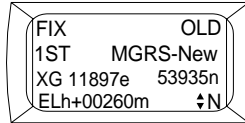
NOTE

If a nickel cadmium (rechargeable) battery is installed, check to be sure it is fully charged and observe correct polarity.

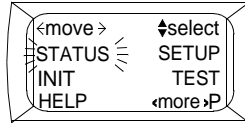
2. Install new battery (3) marked (+ -) end first.
3. Install power battery cover (2) (top of unit) by twisting it clockwise.
4. Install PLGR. (WP 0336 00)
5. Press ON key (4) to turn PLGR on.



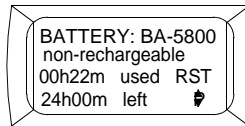
6. When screen below is displayed, press MENU key (5).



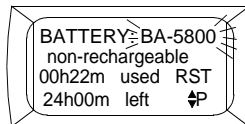
7. When STATUS flashes on screen, press DOWN ARROW key (6) twice.



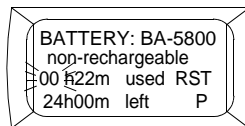
8. Press RIGHT ARROW key (7) to check type of battery.



9. Press RIGHT ARROW key (7) to select battery type, either BA-5800 lithium, AA-Lithium or AA-Alkaline.



10. Press RIGHT ARROW key (7) to move to hour/minute display then using UP/DOWN ARROW keys (6, 8), enter amount of time battery has been used. For example, if a used battery is installed with 1.5 hours of use, enter 0130 (hours and minutes). If a new battery is installed, enter 0000 (or activate RST (reset) field). This time is to be updated each time a different battery is installed.



END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PRECISION LIGHTWEIGHT GLOBAL POSITIONING RECEIVER (PLGR)
REPLACEMENT**

INITIAL SETUP:**Tools**

Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

PLGR
PN 822-0077-103

Personnel Required

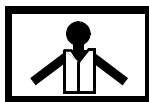
Seaman 88K

References

TM 55-1945-225-10

REMOVE PRECISION LIGHTWEIGHT GLOBAL POSITIONING RECEIVER (PLGR)

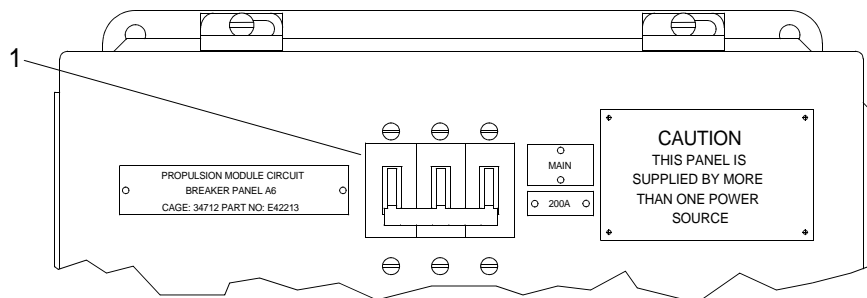
WARNING



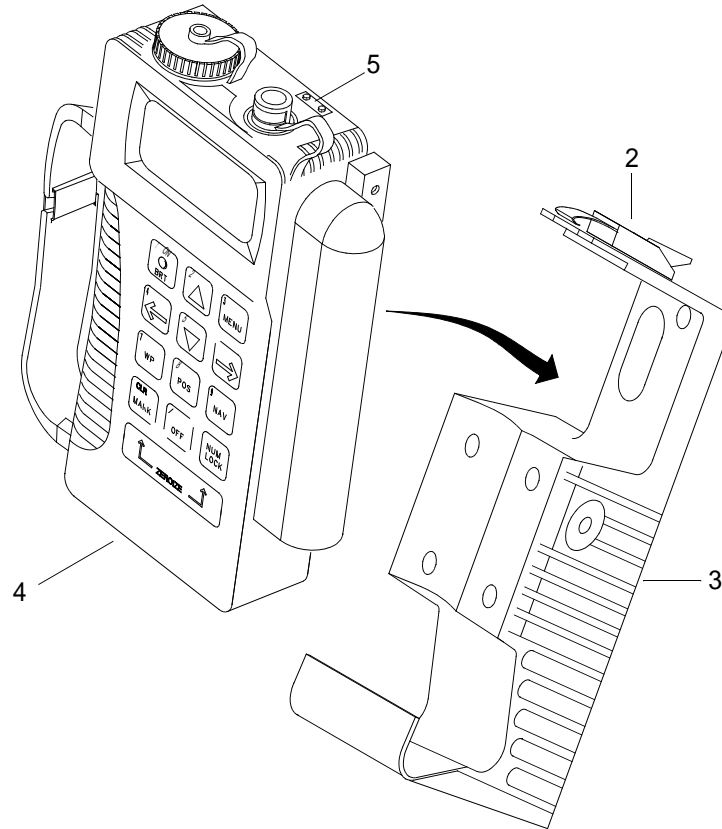
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Lift up and release clip (2) on top of PLGR mounting base (3).



3. Remove PLGR (4) from mounting base (3).
4. Disconnect cabling from rear of PLGR (4).
5. Remove PLGR memory battery. (WP 0334 00)

INSTALL PRECISION LIGHTWEIGHT GLOBAL POSITIONING RECEIVER (PLGR)

1. Install PLGR memory battery. (WP 0334 00)
2. Install cabling on rear of PLGR (4).
3. Position PLGR (4) on mounting base (3), base first.
4. Align mounting base retaining clip (2) with clip retainer (5) and snap shut.
5. Position MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 to on.
6. Perform initial setup of PLGR. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PRECISION LIGHTWEIGHT GLOBAL POSITIONING
RECEIVER (PLGR) MOUNTING BASE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

PLGR Mounting Base
PN 12967998

Personnel Required

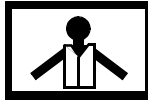
Engineer 88L

Equipment Condition

PLGR Removed. (WP 0336 00)

REMOVE PLGR MOUNTING BASE

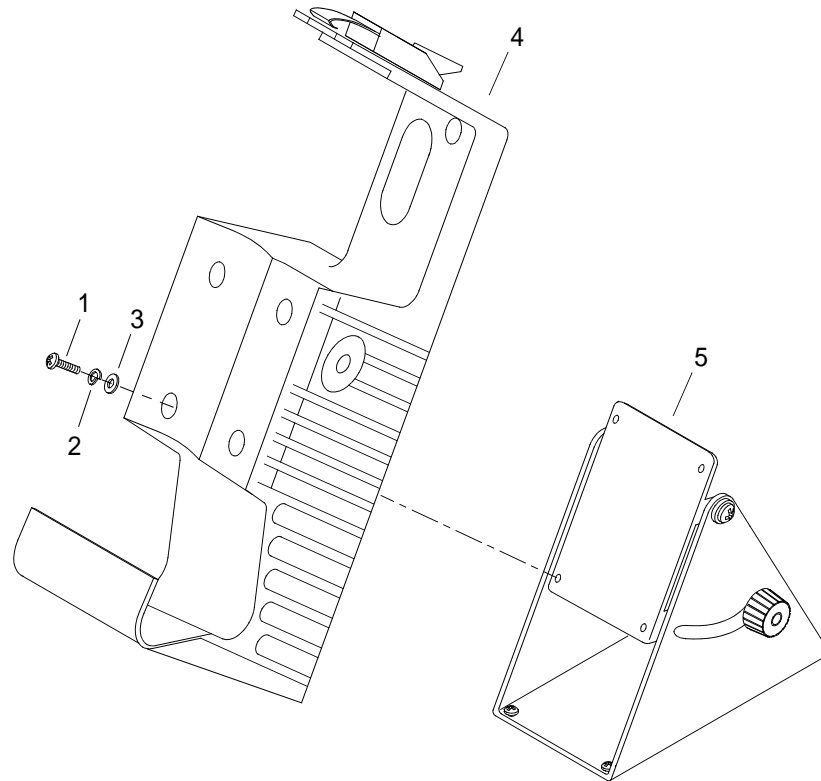
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Remove four screws (1), lockwashers (2) and flat washers (3).



2. Remove mounting bracket (4) from PLGR mounting base (5).
3. Discard mounting base (5).

INSTALL PLGR MOUNTING BASE

1. Position mounting bracket (4) on new PLGR mounting base (5).
2. Install four screws (1), lockwashers (2) and flat washers (3) through mounting bracket (4) and PLGR mounting base (5).
3. Tighten screws (1).
4. Install PLGR. (WP 0336 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PRECISION LIGHTWEIGHT GLOBAL POSITIONING
RECEIVER (PLGR) PIVOT MOUNT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

PLGR Pivot Mount
PN 50-200022

Personnel Required

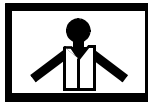
Engineer 88L

Equipment Condition

PLGR Removed. (WP 0336 00)

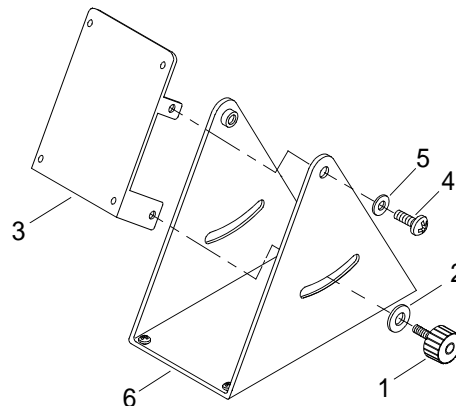
REMOVE PLGR PIVOT MOUNT

WARNING

**VEST**

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Remove two friction knobs (1) and washers (2) from PLGR pivot mount (3).



2. Remove two screws (4) and nylon washers (5) from PLGR pivot mount (3).

3. Remove PLGR pivot mount (3) from PLGR pivot base (6).
4. Discard pivot mount (3).

INSTALL NAVIGATION PLGR PIVOT MOUNT

1. Position new PLGR pivot mount (3) on PLGR pivot base (6).
2. Install two screws (4) and nylon washers (5) through pivot base (6) and into PLGR pivot mount (3).
3. Install two friction knobs (1) and washers (2) through PLGR pivot base (6) and into pivot mount (3).
4. Tighten knobs (1).
5. Install PLGR. (WP 0336 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PRECISION LIGHTWEIGHT GLOBAL POSITIONING
RECEIVER (PLGR) PIVOT BASE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

PLGR Pivot Base
PN 50-200023

Personnel Required

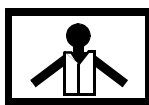
Engineer 88L

Equipment Condition

PLGR Removed. (WP 0336 00)
PLGR Pivot Mount Removed. (WP 0338 00)
PLGR Mounting Base Removed. (WP 0337 00)

REMOVE PLGR PIVOT BASE

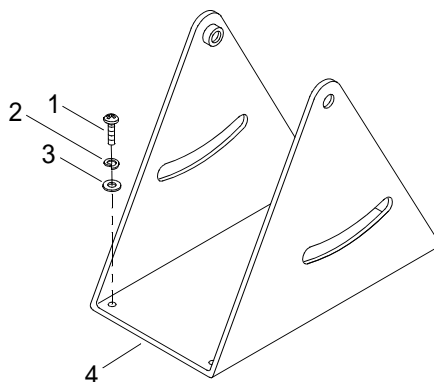
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Remove screw (1), lockwasher (2) and flat washers (3) from each corner of PLGR pivot base (4).



2. Remove PLGR pivot base (4) from mounting surface.
3. Discard PLGR pivot base (4).

INSTALL PLGR PIVOT BASE

1. Position new PLGR pivot base (4) on mounting surface.
2. Install screw (1), lockwasher (2) and flat washers (3) in each corner of PLGR pivot base (4).
3. Tighten screw (1).
4. Install PLGR mounting base. (WP 0337 00)
5. Install PLGR pivot mount. (WP 0338 00)
6. Install PLGR. (WP 0336 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
GLOBAL POSITIONING SYSTEM (GPS) ANTENNA
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

GPS Antenna
 PN 50-200021
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Tape, Insulation, Electrical (Item 44, WP 0426 00)
 Tape, Electrical (Item 43, WP 0426 00)
 Insulating Varnish, Electrical (Item 16, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

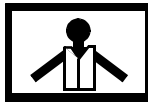
Engineer 88L

References

TM 55-1945-225-10

REMOVE GPS ANTENNA

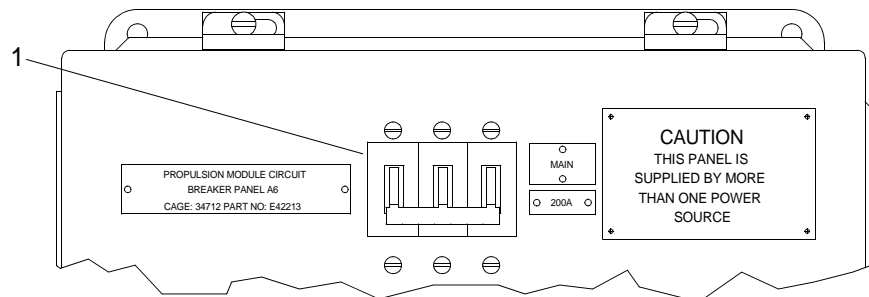
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

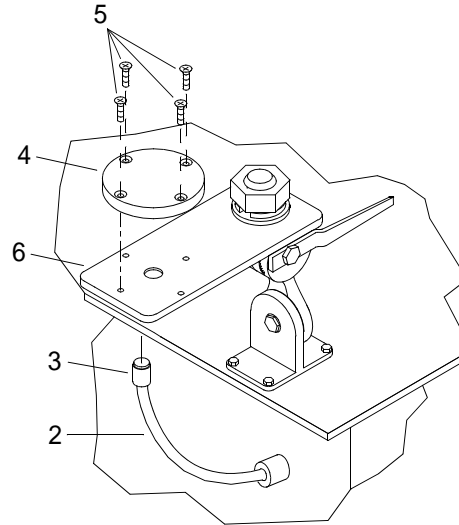
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

2. Use operators cab ladder to gain access to top of operators cab.
3. Peel off electrical tape from outer insulation of antenna cable (2).



CAUTION

When cutting tape, care should be taken to avoid cutting cable. Cutting cable could cause damage to equipment.

- a. Remove electrical tape.
- b. Repeat if necessary, to expose antiseize tape (rubber tape).
4. Peel off rubber tape from antenna cable (2).
 - a. Score any remaining rubber tape with sharp utility knife.
 - b. Remove rubber tape.
 - c. Repeat if necessary to expose connector.
5. Disconnect GPS antenna cable connector (3) from GPS antenna (4).
6. Remove four capscrews (5) securing GPS antenna (4) to antenna mount plate (6).
7. Remove GPS antenna (4) from antenna mount plate (6).
8. Discard GPS antenna (4).

INSTALL GPS ANTENNA

1. Position and install new GPS antenna (4) on antenna mount plate (6).

WARNING

**CHEMICAL****EYE PROTECTION**

2. Apply antiseize compound to threads of capscrews (5).
3. Install four capscrews (5) through GPS antenna (4) into antenna mount plate (6). Tighten screws (5).

WARNING

**CHEMICAL****EYE PROTECTION**

4. Using wiping rag, clean off excess antiseize compound.
5. Connect GPS antenna cable connector (3) to GPS antenna (4).

NOTE

Ensure that connection is secured and that cable is secured in connector.

6. Wrap rubber tape around antenna cable (2) approximately 1 in. below edge of GPS antenna cable connector (3), stretching tape tightly.
7. Wrap rubber tape around antenna cable (2), toward antenna (4), stretching tightly to make a tight seal.
8. Cut rubber tape with knife when GPS antenna cable connector (3) is completely covered with tape.
9. Apply a second layer of rubber tape, overlapping previous layer by approximately 75%.
10. Apply electrical tape around antenna cable (2) approximately 1 in. below edge of rubber tape stretching tape slightly.
11. Continue wrapping electrical tape around antenna cable (2) and GPS antenna cable connector (3), stretching slightly, and overlapping previous layer by approximately 50%.
12. Apply a second layer of electrical tape starting at GPS antenna cable connector (3) and working towards antenna cable (2).
13. Continue past first layer approximately 1 in. Ensure final three wraps are not stretched in order to prevent unravelling.
14. Cut tape with knife.

WARNING

**CHEMICAL****EYE PROTECTION**

15. Apply electrical insulating varnish on electrical tape, covering completely, and extending onto antenna cable (2) and GPS antenna (4) 1/2 in. Allow electrical insulating varnish to dry.

WARNING

**CHEMICAL****EYE PROTECTION**

16. Apply a second coat of electrical insulating varnish on electrical tape, covering completely, and extending onto antenna cable (2) and GPS antenna (4) 1/2 in.

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

17. Descend from top of operators cab.
18. Perform operational check on PLGR. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION**

19. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
GLOBAL POSITIONING SYSTEM (GPS) ANTENNA MOUNT PLATE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Drill, Electric, Portable (Item 4, WP 0425 00)
Drill, Set, Twist (Item 4, WP 0425 00)
Die and Tap Set (Item 4, WP 0425 00)

Materials/Parts

Mount Plate
PN 50-200079

Personnel Required

Engineer 88L

Equipment Condition

GPS Antenna Removed. (WP 0340 00)

REMOVE GPS ANTENNA MOUNT PLATE

WARNING



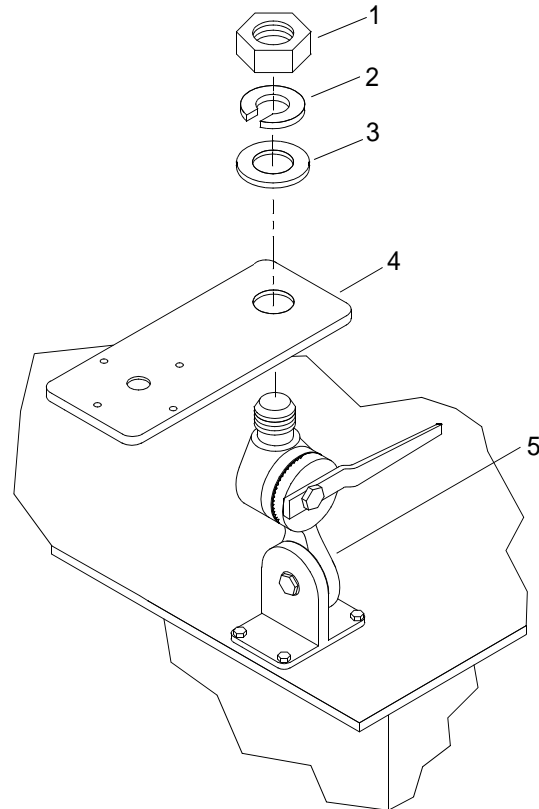
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

1. Using ladder, gain access to top of operators cab.

2. Remove nut (1), lockwasher (2) and washer (3) from stud on top of antenna mount (5).

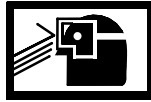


3. Remove mount plate (4) from antenna mount (5).
4. Discard mount plate (4).

INSTALL GPS ANTENNA MOUNT PLATE

1. Position new mount plate (4) on antenna mount (5).
2. Install washer (3), lockwasher (2) and nut (1) on stud atop antenna mount (5).
3. Tighten nut (1).
4. Position GPS antenna on new mounting plate (4).
5. Using GPS antenna as a template, mark three holes on new mounting plate (4).
6. Remove GPS antenna from mounting plate (4).

WARNING

**EYE PROTECTION**

7. Using an electric drill and a #36 (0.1065 in.) drill bit, drill four holes in mounting plate (4).
8. Using a #6-32 UNC tap, tap three holes previously drilled.
9. Install GPS antenna (WP 0340 00)

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

10. Descend from top of operators cab.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
GLOBAL POSITIONING SYSTEM (GPS) ANTENNA MOUNT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

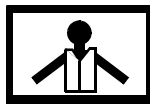
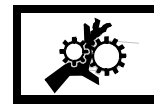
Mount
 PN 4187
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

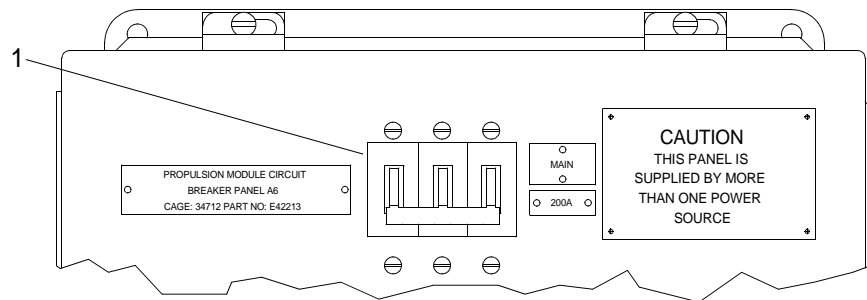
REMOVE GPS ANTENNA MOUNT

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

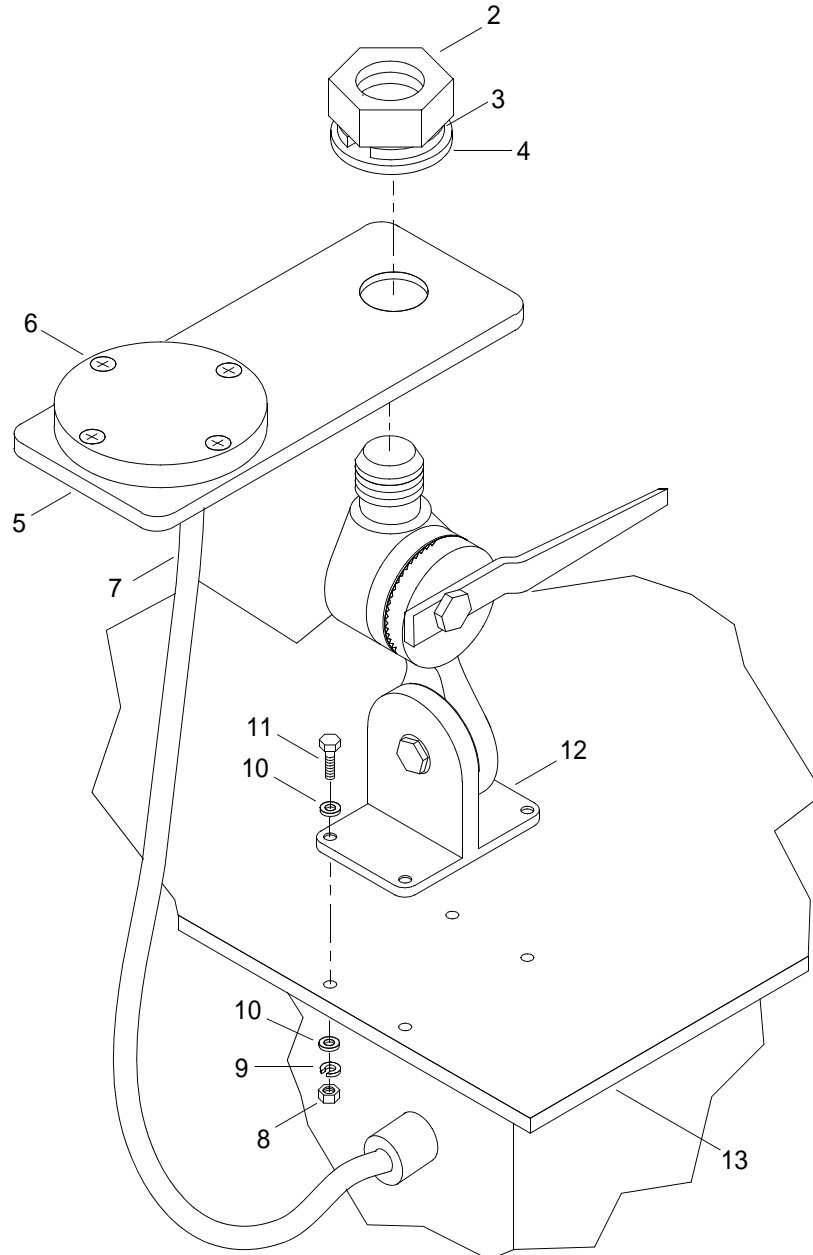
1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

- Gain access to top of operators cab.
- Remove nut (2) and lockwasher (3) and washer (4) from antenna mount plate (5).



CAUTION

Care should be given in placement of removed antenna and antenna cable to prevent damage to equipment. Failure to comply could result in damage to equipment.

4. Remove antenna mount plate (5) with attached antenna (6) and antenna cable (7).
5. Remove four nuts (8), four lockwashers (9), eight washers (10) and four bolts (11) from antenna mount (12).
6. Remove antenna mount (12) from top of operators cab (13).
7. Discard antenna mount (12).

INSTALL GPS ANTENNA MOUNT

1. Install new antenna mount (12) on top of operators cab (13).

WARNING


CHEMICAL

EYE PROTECTION

2. Apply antiseize compound to threads of bolts (11).
3. Install four bolts (11), eight washers (10), four lockwashers (9) and four nuts (8) securing antenna mount (12) to operators cab (13). Tighten nuts (8).
4. Position antenna mount plate (5) with attached antenna (6) and antenna cable (7) on antenna mount (12).

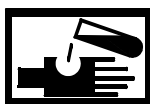
WARNING


CHEMICAL

EYE PROTECTION

5. Apply antiseize compound to threads of antenna mount (12).
6. Install antenna mount plate (5), washer (4), lockwasher (3) and nut (2) on antenna mount (12). Tighten nut (2).

WARNING


CHEMICAL

EYE PROTECTION

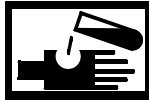
7. Using wiping rag, clean off excess antiseize compound.

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

8. Descend from top of operators cab.

WARNING



CHEMICAL



EYE PROTECTION

9. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAST ENCLOSURE ASSEMBLY A7 FUSES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Puller, Fuse (Item 21, WP 0425 00)

Materials/Parts

Fuse (250 Volt, 5 Amp)
PN AGC-5

Personnel Required

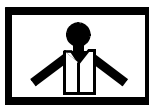
Engineer 88L

References

TM 55-1945-225-10

REMOVE FUSES

WARNING



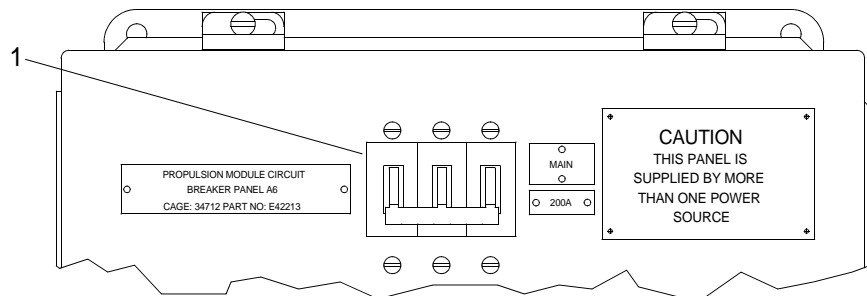
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

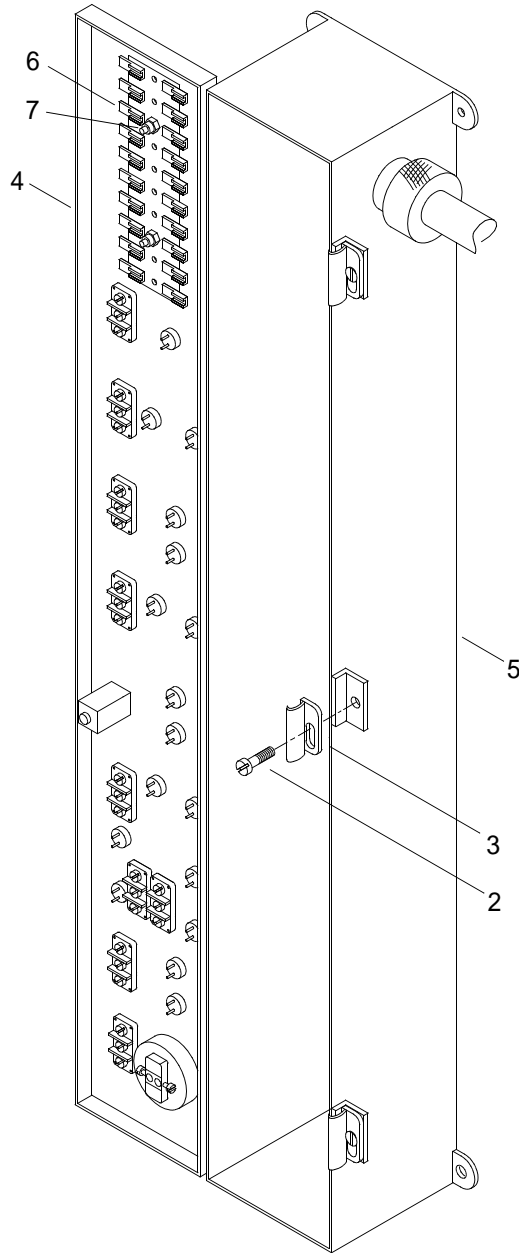
NOTE

This task is typical for the replacement of fuses in the mast enclosure assembly A7.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



- Open enclosure cover (4) of mast enclosure assembly A7 (5).
- Using fuse puller, remove fuse (6) from fuse holder (7) and discard.

INSTALL FUSES

- Using fuse puller, install new fuse (6) into fuse holder (7).
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
- Perform operational check of mast enclosure assembly A7. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAST ENCLOSURE ASSEMBLY A7 TOGGLE SWITCH
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Toggle Switch, Three Position
PN MS24523-21
Toggle Switch, Two Position
PN MS24523-22
Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

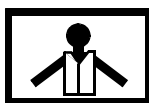
Engineer 88L

References

TM 55-1945-225-10

REMOVE TOGGLE SWITCH

WARNING



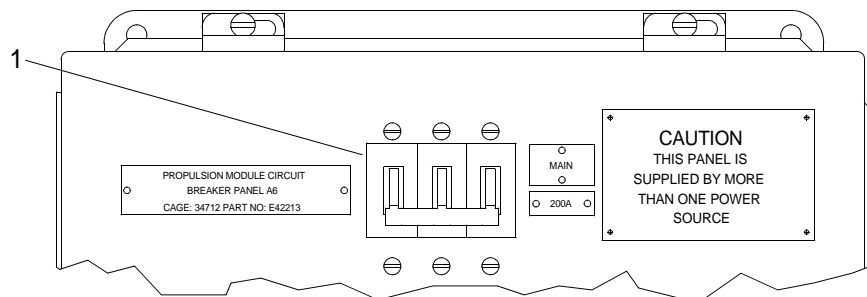
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

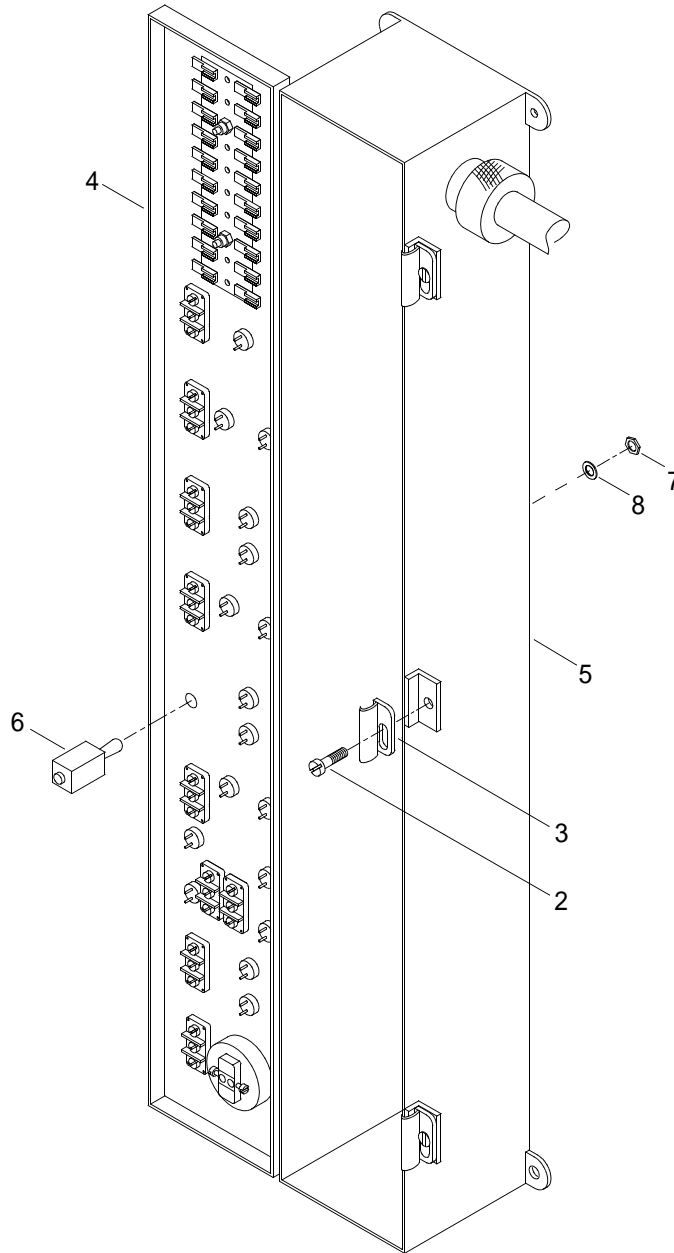
NOTE

This task is typical for the replacement of toggle switches in the mast enclosure assembly A7.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



- Open enclosure cover (4) of mast enclosure assembly A7 (5).
- Tag and disconnect electrical wiring from toggle switch (6).
- Remove tiedown straps securing wires.
- Remove hex nut (7) and lockwasher (8) securing toggle switch (6) to enclosure cover (4).
- Remove toggle switch (6) from enclosure cover (4) and discard.

INSTALL MAST ENCLOSURE A7 TOGGLE SWITCH

1. Install new toggle switch (6) into hole in enclosure cover (4).
2. Install lockwasher (8) and hex nut (7) to secure toggle switch (6) to enclosure cover (4). Tighten hex nut (7).
3. Connect electrical wiring to toggle switch (6) and remove tags.
4. Use tiedown straps to secure loose wires.
5. Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
6. Perform operational check of mast enclosure assembly A7. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAST ENCLOSURE ASSEMBLY A7 SONALERT BEEPER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Sonalert Beeper
PN SC628AJ
Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

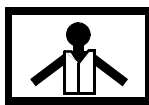
Engineer 88L

References

TM 55-1945-225-10

REMOVE SONALERT BEEPER

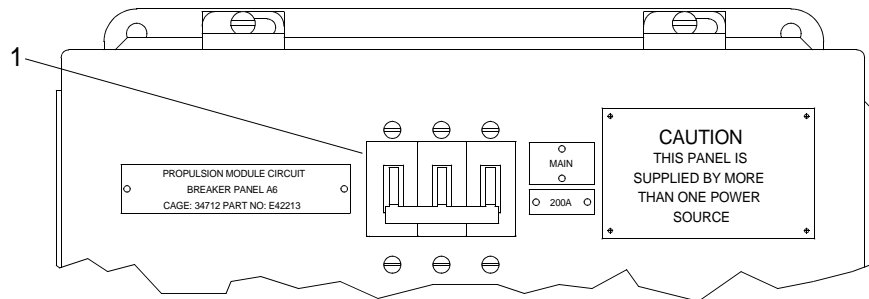
WARNING



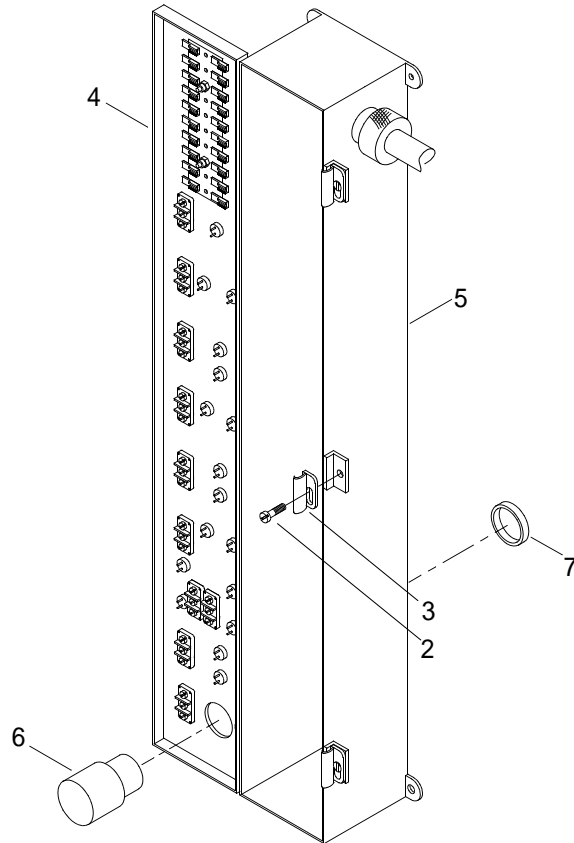
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



- Open enclosure cover (4) of mast enclosure assembly A7 (5).
- Remove tiedown straps securing loose wires.
- Remove hex nut (7) securing sonalert beeper (6) to enclosure cover (4).
- Remove sonalert beeper (6) from enclosure cover (4) and discard.

INSTALL MAST ENCLOSURE A7 SONALERT BEEPER

- Install new sonalert beeper (6) into hole in enclosure cover (4).
- Install hex nut (7) to secure sonalert beeper (6) on enclosure cover (4). Tighten knurled nut (7).
- Connect electrical wiring to sonalert beeper (6) and remove tags.
- Use tiedown straps to secure loose wires.
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
- Perform operational check of mast enclosure assembly A7. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAST ENCLOSURE ASSEMBLY A7 REED SWITCH ASSEMBLY
REPLACEMENT**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

- Reed Switch Assembly
PN E27623
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
- Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

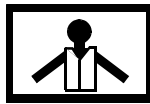
- Engineer 88L

References

- TM 55-1945-225-10
-

REMOVE REED SWITCH ASSEMBLY

WARNING



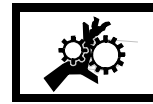
VEST



HELMET PROTECTION



HEAVY PARTS



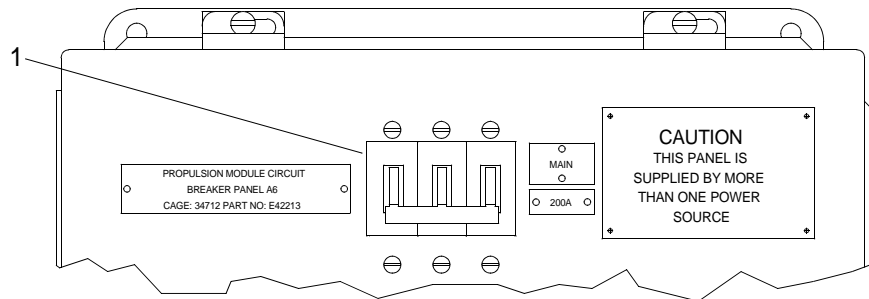
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

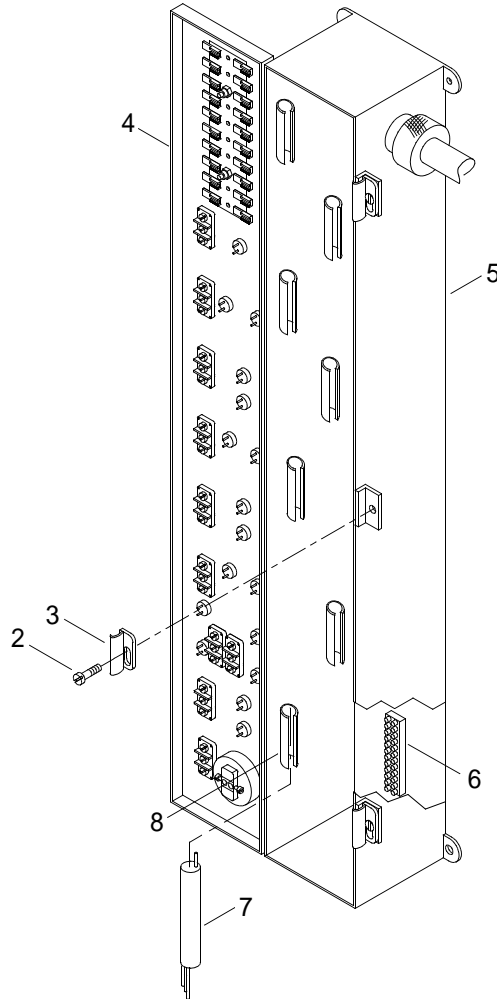
NOTE

This task is typical for the replacement of reed switch assemblies in the mast enclosure assembly A7.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



- Open enclosure cover (4) of mast enclosure assembly A7 (5).
- Tag and disconnect electrical wiring from terminal block (6).
- Remove tiedown straps securing wires.
- Remove reed switch assembly (7) from clip (8).
- Discard reed switch assembly (7).

INSTALL REED SWITCH ASSEMBLY

- Install new reed switch assembly (7) into clip (8).
- Connect electrical wiring to terminal block (6) and remove tags.
- Use tiedown straps to secure loose wires.
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
- Perform operational check of mast enclosure assembly A7. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAST ENCLOSURE ASSEMBLY A7 TERMINAL BLOCK
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Terminal Block, 12 Terminal
 PN 29.401.1253
 Terminal Blocks, 20 Terminal
 PN 29.401.2053
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Strap, Tiedown (Item 41, WP 0426 00)

Personnel Required

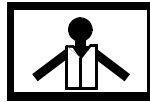
Engineer 88L

References

TM 55-1945-225-10

REMOVE TERMINAL BLOCK

WARNING



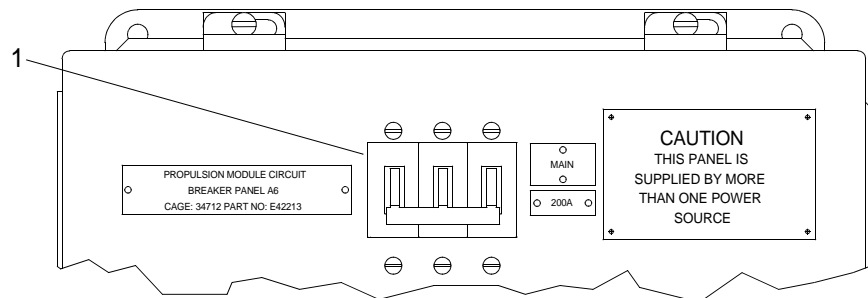
VEST

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

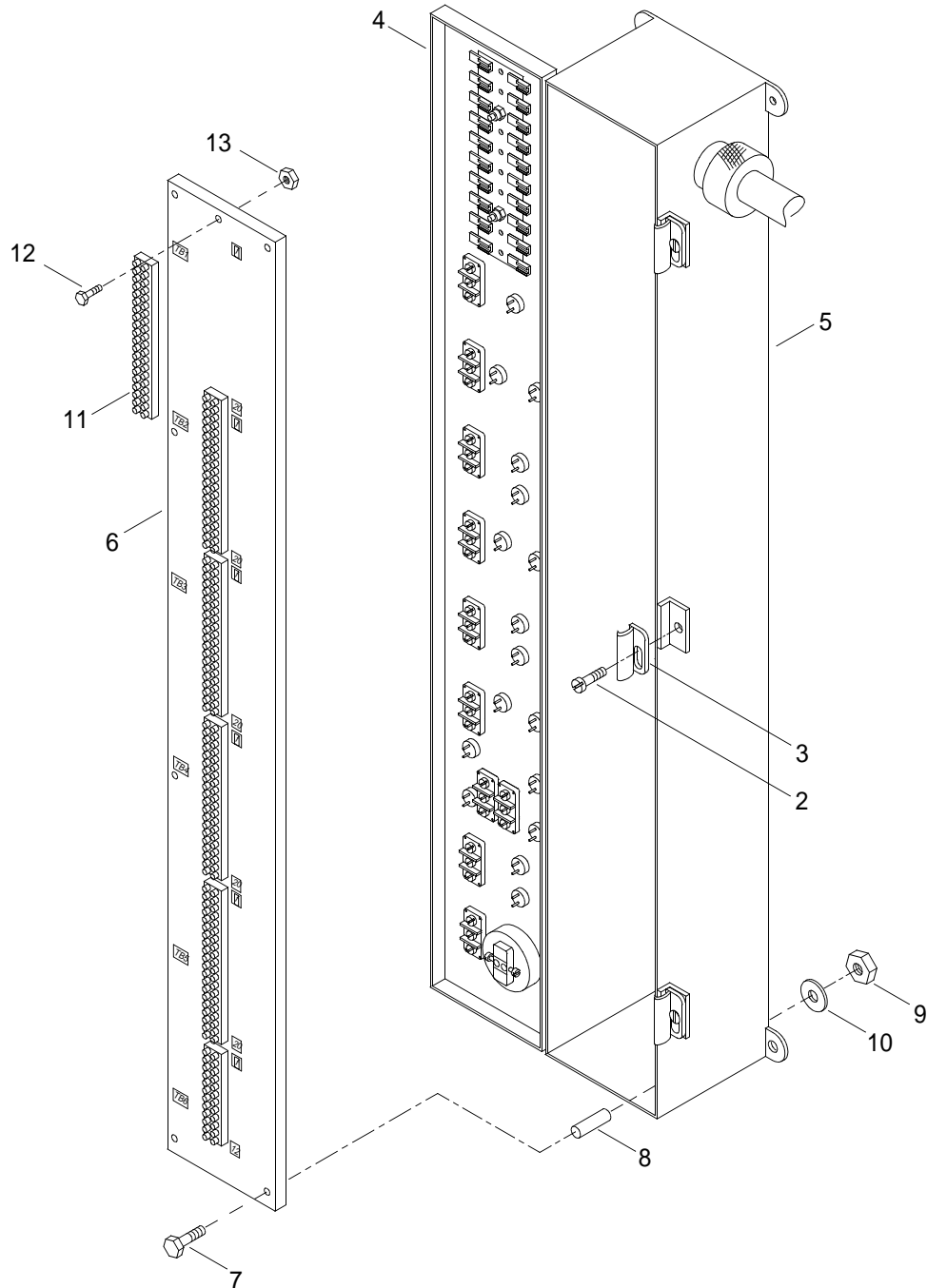
NOTE

This task is typical for the replacement of terminal blocks in the mast enclosure assembly A7.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Loosen screws (2) to pivot cover clamps (3) free.



3. Open enclosure cover (4) of mast enclosure assembly A7 (5).
4. Remove tiedown straps securing wires.
5. Remove back plate (6) from mast enclosure assembly A7 (5).
 - a. Tag and disconnect electrical wiring to back plate (6).
 - b. Remove pan head screws (7), standoffs (8), hex nuts (9) and lockwashers (10) securing back plate (6) to mast enclosure assembly A7 (5).

-
- c. Remove back plate (6) from mast enclosure assembly A7 (5).

NOTE

This step is typical for the removal of terminal blocks.

6. Remove terminal block (11) from back plate (6).
 - a. Tag and disconnect wiring from terminal block (11).
 - b. Remove pan head screws (12) and insert nuts (13) securing terminal block (11) to back plate (6).
 - c. Remove terminal block (11) from back plate (6) and discard.

INSTALL TERMINAL BLOCK

NOTE

This step is typical for the installation of terminal blocks.

1. Install new terminal block (11) on back plate (6).
 - a. Position terminal block (11) on back plate (6).
 - b. Install pan head screws (12) and insert nuts (13) to secure terminal block (11) to back plate (6). Tighten insert nuts (13).
 - c. Connect wiring to terminal block (11) and remove tags.
2. Install back plate (6) into mast enclosure assembly A7 (5).
 - a. Position back plate (6) into mast enclosure assembly A7 (5).
 - b. Install pan head screws (7), standoffs (8), lockwashers (10) and hex nuts (9) to secure back plate (6) in mast enclosure assembly A7 (5). Tighten hex nuts (9).
 - c. Connect electrical wiring to back plate (6) and remove tags.
3. Use tiedown straps to secure loose wires.
4. Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
5. Perform operational check of mast enclosure assembly A7. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAST ENCLOSURE ASSEMBLY A7 INDICATOR LIGHT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Indicator Light
PN 249-7872-3731504

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

REMOVE INDICATOR LIGHT

WARNING



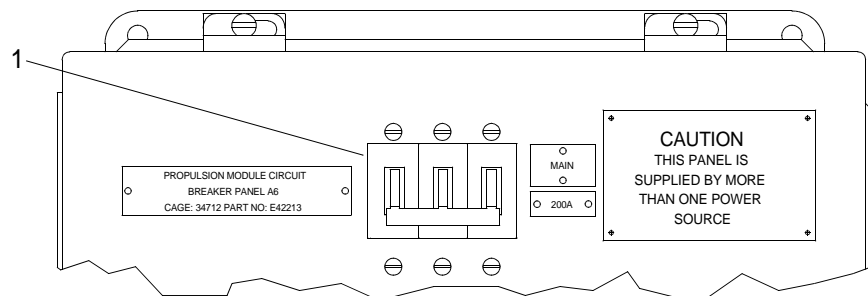
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

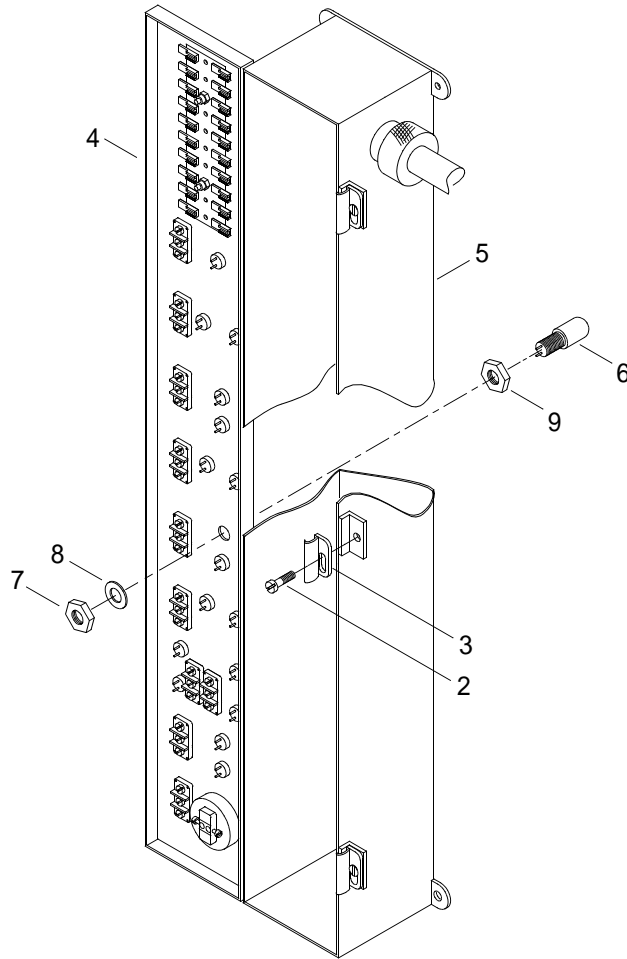
NOTE

This task is typical for the replacement of indicator lights in the mast enclosure assembly A7.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



- Open enclosure cover (4) of mast enclosure assembly A7 (5).
- Tag and disconnect electrical wiring to indicator light (6).
- Remove hex nut (7), lockwasher (8) and knurled flange nut (9) securing indicator light (6) to enclosure cover (4).
- Remove indicator light (6) from enclosure cover (4) and discard.

INSTALL INDICATOR LIGHT

- Position new indicator light (6) into hole in enclosure cover (4).
- Install knurled flange nut (9), lockwasher (8) and hex nut (7) to secure indicator light (6) on enclosure cover (4). Tighten knurled flange nut (9) and hex nut (7).
- Connect electrical wiring to indicator light (6) and remove tags.
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
- Perform operational check of mast enclosure assembly A7. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAST ENCLOSURE ASSEMBLY A7
REMOVAL, INSPECTION AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

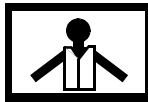
Engineer 88L

References

TM 55-1945-225-10

REMOVE MAST ENCLOSURE ASSEMBLY A7

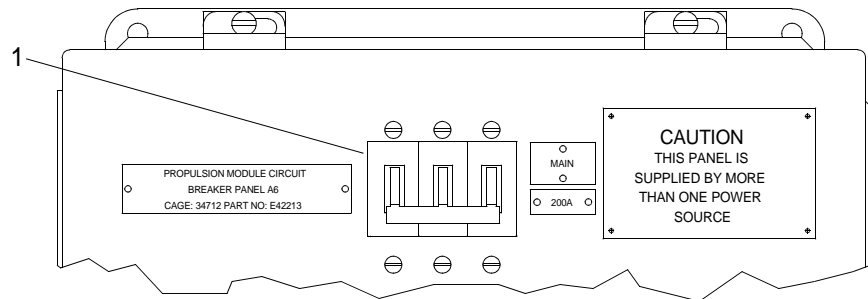
WARNING



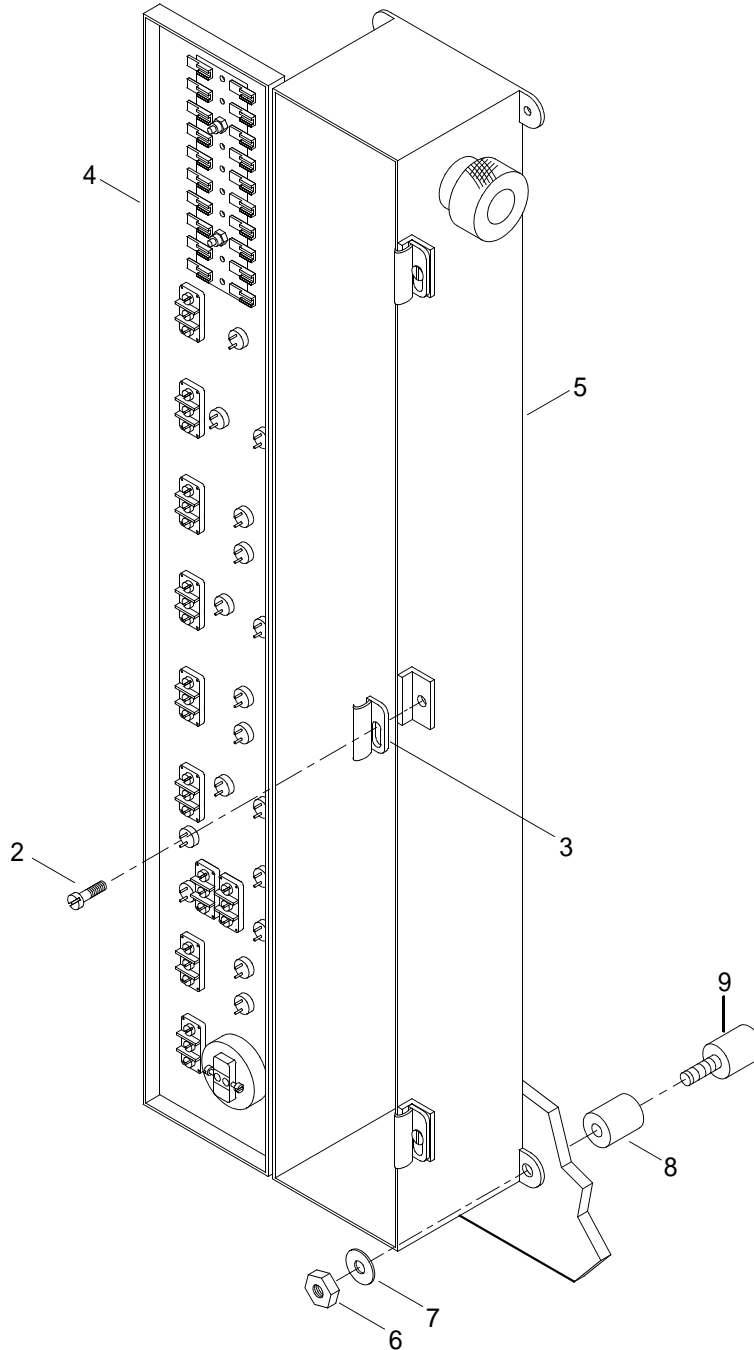
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) to pivot cover clamps (3) free.



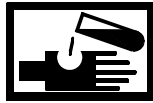
- Open enclosure cover (4) of mast enclosure assembly A7 (5).
- Tag and disconnect all external wiring to mast enclosure assembly A7 (5).
- Remove hex nuts (6), washers (7) and spacers (8) securing mast enclosure assembly A7 (5) to mounting structure studs (9).
- Remove mast enclosure assembly A7 (5).

INSPECT MAST ENCLOSURE ASSEMBLY A7

1. Inspect components for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

INSTALL MAST ENCLOSURE ASSEMBLY A7

WARNING

**CHEMICAL****EYE PROTECTION**

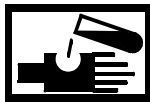
1. Apply adhesive to threads of mounting structure studs (9).
2. Position mast enclosure assembly A7 (5) on mounting structure studs (9).
3. Install hex nuts (6), washers (7) and spacers (8) to secure mast enclosure assembly A7 (5) to mounting structure studs (9). Tighten hex nuts (6).

WARNING

**CHEMICAL****EYE PROTECTION**

4. Using wiping rag, clean off excess antiseize compound.
5. Connect all external electrical wiring to mast enclosure assembly A7 (5) and remove tags.
6. Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
7. Perform operational check of mast enclosure assembly A7. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION**

8. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST
REMOVAL, INSPECTION, REPAIR AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Shackle, 3/4 in. 4.75 Ton (Item 25, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Shoring Block (Item 36, WP 0426 00)
 Qty 4
 Strap, Tiedown (Item 41, WP 0426 00)
 Neoprene Rubber Strip (Item 23, WP 0426 00)
 Sealant, Gasket (Item 33, WP 0426 00)
 Cleaning Compound, Solvent (Item 6, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

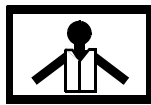
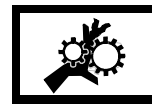
Engineer 88L

References

TM 55-1945-225-10
 TB 43-0144

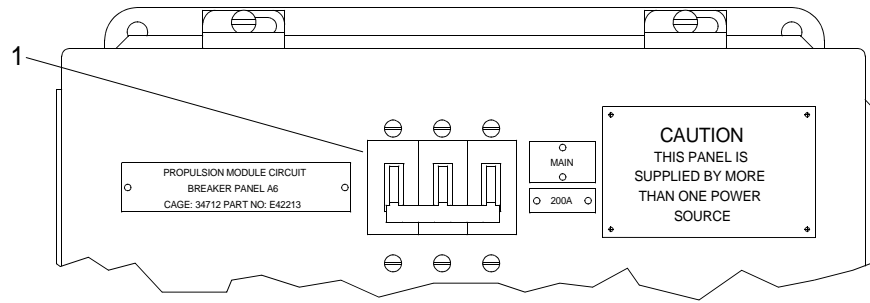
REMOVE MAIN ASSEMBLY MAST

WARNING

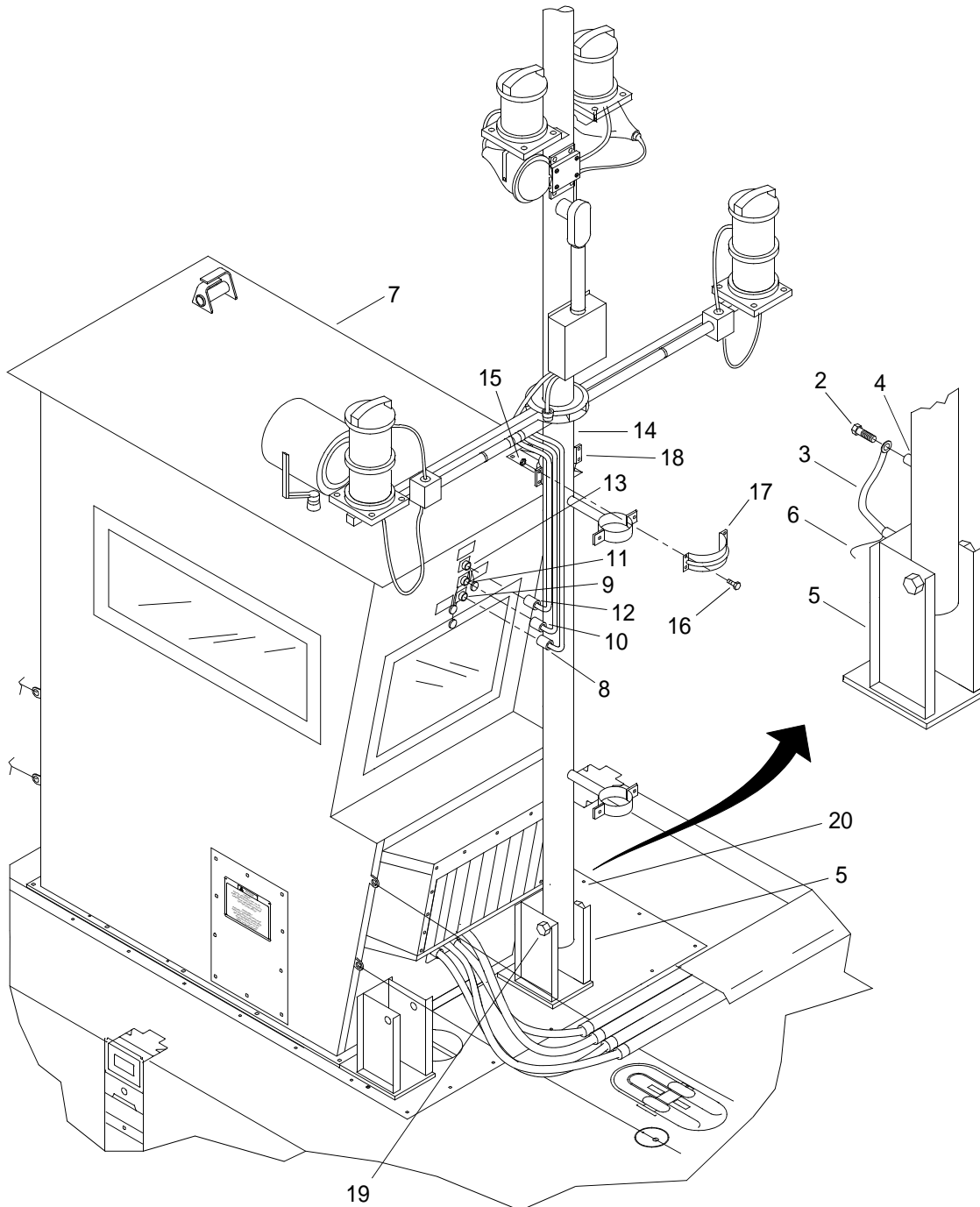
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



3. Remove bolt and washer (2) securing ground cable (3) to main assembly mast boss (4).



-
4. Secure ground cable (3) to deck holder (5) with tie wrap (6).
 5. Install bolt and washer (2) in main assembly mast boss (4). Tighten bolt and washer (2).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

6. Gain access to top of operators cab (7).
7. Remove navigation compass connector (8) from operator cab connector J11 (9).
8. Remove deck lights connector (10) from operator cab connector J10 (11).
9. Remove navigation lights connector (12) from operator cab connector J1 (13).
10. Attach crane, sling and shackle to main assembly mast (14) and make taut.
11. Remove hex nuts (15), capscrews (16) and outer clamp half (17) from operators cab assembly mast clamp half (18).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

12. Descend from top of operators cab.
13. Loosen hex nut (19) on bolt (20).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

NOTE

For manual lowering and raising of main assembly mast, refer to WP 0352 00.

14. Using crane, slings and shackles, lower main assembly mast (14) onto a shoring blocks on deck.
15. Install hex nuts (15), capscrews (16) and outer clamp half (17) on operators cab assembly mast clamp half (18). Tighten hex nuts (15).
16. Remove hex nut (19) and bolt (20) securing main assembly mast (14) to deck holder (5).

17. Install hex nut (19) and bolt (20) on deck holder (5). Tighten hex nut (19).

18. Remove sling and shackle.

INSPECT MAIN ASSEMBLY MAST

1. Inspect electrical cables for cuts, cracks, deterioration and fraying.
2. Inspect electrical connectors for bent, broken or missing pins, cracked or broken backshells, corrosion and dirt.
3. Inspect main assembly mast clamps neoprene strips for damage.
4. Inspect main assembly mast (2) for chipped or damaged paint and corrosion.

REPAIR MAIN ASSEMBLY MAST

1. Prepare and paint main assembly mast (14) as required in accordance with procedures contained in TB 43-0144.

NOTE

Repair is limited to replacement of damaged parts.

2. Replace damaged cables, connectors or corroded attaching hardware and neoprene strips as required.

INSTALL MAIN ASSEMBLY MAST

1. Remove hex nut (19) and bolt (20) from deck holder (5).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

2. Using crane, sling and shackle, position main assembly mast (14) into deck holder (5).
3. Install bolt (20) and hex nut (19). Do not tighten hex nut (19).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

4. Using crane, sling and shackle, raise main assembly mast (14) until assembly mast contacts operators cab assembly mast clamp half (18).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

5. Gain access to top of operators cab (7).
6. Install outer clamp half (17) on operators cab assembly mast clamp half (18) using capscrews (16) and hex nuts (15). Tighten hex nuts (15).
7. Tighten hex nut (20) on bolt (19).
8. Remove sling and shackle.
9. Connect navigation lights connector (12) to operators cab connector J1 (13).
10. Connect deck lights connector (10) to operators cab connector J10 (11).
11. Connect navigation compass connector (8) to operators cab connector J11 (9).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

12. Descend from top of operators cab (7).
13. Ground main assembly mast (14).
 - a. Cut tie wrap (6) securing ground cable (3) to deck holder (5).

WARNING



EYE PROTECTION

- b. Using a wire brush, remove all corrosion and paint from main assembly mast boss (4).

WARNING



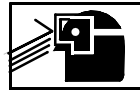
CHEMICAL



EYE PROTECTION

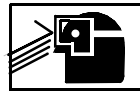
- c. Using cleaning compound, clean top and threads of main assembly mast boss (4).

WARNING

**CHEMICAL****EYE PROTECTION**

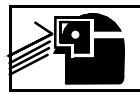
- d. Apply antiseize compound to mating surfaces of main assembly mast boss (4), ground cable (3) and bolt and washer (2).
- e. Position ground cable (3) on main assembly mast boss (4).
- f. Install bolt and washer (2) to secure ground cable (3) to main assembly mast boss (9). Tighten bolt and washer (2).

WARNING

**CHEMICAL****EYE PROTECTION**

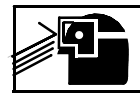
- g. Using wiping rag, clean off excess antiseize compound.

WARNING

**CHEMICAL****EYE PROTECTION**

- h. Apply a thin bead of sealant to terminating edges, sealing bolt and washer (2), ground cable (3) and main assembly mast boss (4).
14. Perform operational check on main assembly mast. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION**

- 15. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST YARDARMS
REMOVAL, INSPECTION, REPAIR AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)
 Cloth, Cleaning (Item 7, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10
 DOD-PRF-24648
 MIL-PRF-23236

Equipment Condition

Main Assembly Mast Lowered. (WP 0352 00)
 Main Assembly Mast Navigation Lights Removed. (WP 0354 00)
 Main Assembly Mast Incandescent Floodlights Removed. (WP 0358 00)
 Main Assembly Mast Navigation Light Junction Box Removed. (WP 0355 00)

REMOVE MAIN ASSEMBLY MAST PORT AND STARBOARD LOWER YARDARM

WARNING

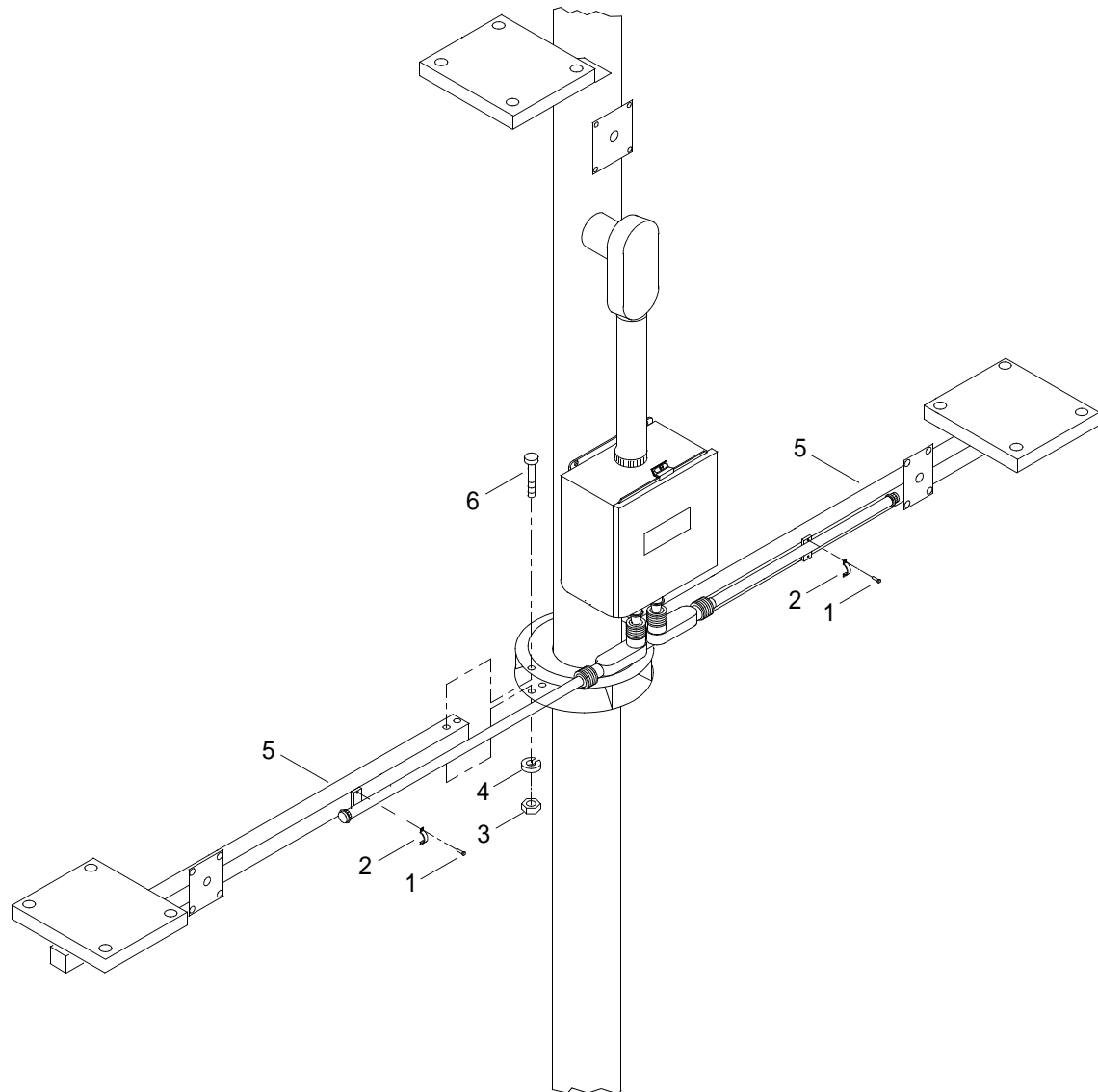
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This procedure is typical for removal of port and starboard lower yardarms.

1. Remove capscrew (1) and clamp (2).

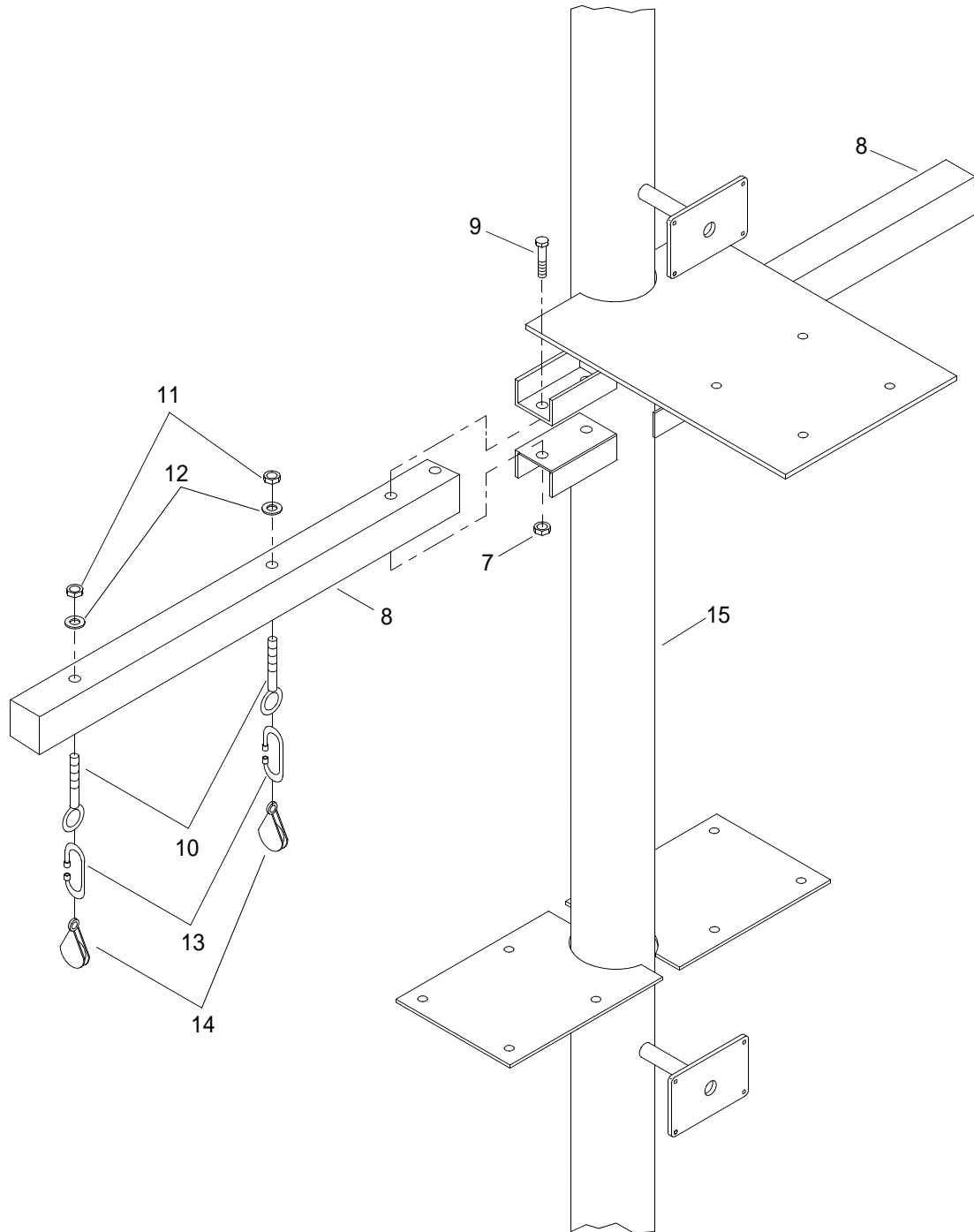


2. Remove two hex nuts (3) and lockwashers (4).
3. Hold yardarm (5) and remove two capscrews (6).
4. Remove yardarm (5).

REMOVE MAIN ASSEMBLY MAST PORT AND STARBOARD UPPER YARDARMS**NOTE**

This procedure is typical for removal of port and starboard upper yardarms.

1. Remove two hex nuts (7).



2. While supporting yardarm (8), remove two capscrews (9).

3. Remove yardarm (8).
4. While holding eye bolt (10), remove nuts (11) and flat washers (12).

INSPECT MAIN ASSEMBLY MAST YARDARMS AND ATTACHING HARDWARE

1. Inspect yardarms (8) for chipped or damaged paint and corrosion.
2. Inspect eye bolts (10), connector chains (13) and rope pulleys (14) for cracks and corrosion.

REPAIR MAIN ASSEMBLY MAST YARDARMS AND ATTACHING HARDWARE

NOTE

Repair of main assembly mast yardarms is limited to replacement of damaged parts.

1. Prepare and paint main assembly mast (15) in accordance with procedures contained in DOD-PRF-24648 and MIL-PRF-23236.
2. Replace damaged cables, connectors or corroded attaching hardware as required.

INSTALL MAIN ASSEMBLY MAST PORT AND STARBOARD LOWER YARDARMS

WARNING



CHEMICAL



EYE PROTECTION

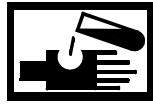
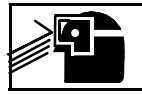
NOTE

This procedure is typical for installation of port and starboard lower yardarms.

1. Apply adhesive to two capscrews (6).
2. Hold yardarm (5) in position and install two capscrews (6).
3. Install two hex nuts (3) with lockwashers (4).
4. Install clamp (2) using capscrew (1).

INSTALL MAIN ASSEMBLY MAST PORT AND STARBOARD UPPER YARDARMS

WARNING

**CHEMICAL****EYE PROTECTION****NOTE**

This procedure is typical for installation of port and starboard upper yardarms.

Discard hex nut supplied with eyebolt and assemble using jam hex nut.

1. Apply adhesive to eye bolt (10).
2. While holding eye bolt (10), install flat washers (12) and nut (11).
3. Tighten nut (11).

WARNING

**CHEMICAL****EYE PROTECTION**

4. Apply threadlock compound to two capscrews (9).
5. Holding yardarm (8) in position, install two capscrews (9) and hex nuts (7).
6. Tighten two hex nuts (7).
7. Install main assembly mast navigation light junction box. (WP 0355 00)
8. Install main assembly mast navigation lights. (WP 0354 00)
9. Install main assembly mast incandescent floodlights. (WP 0358 00)
10. Raise main assembly mast. (WP 0352 00)
11. Perform operational check on main assembly mast. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST
LOWERING AND RAISING**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Shackle, 3/4 in. 4.75 Ton (Item 25, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Shoring Block (Item 36, WP 0426 00)

Personnel Required

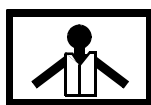
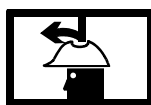
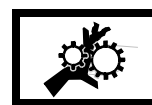
Engineer 88L (2)

References

TM 55-1945-225-10

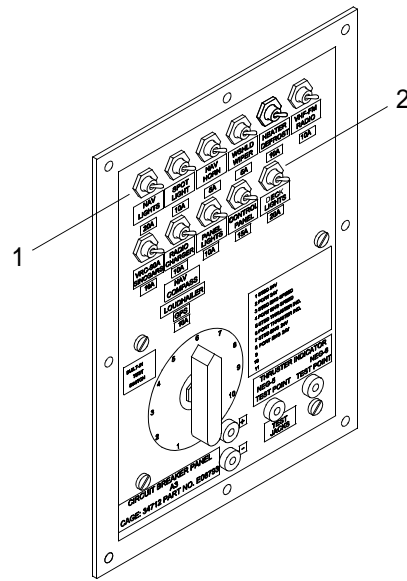
MANUALLY LOWER MAIN ASSEMBLY MAST

WARNING

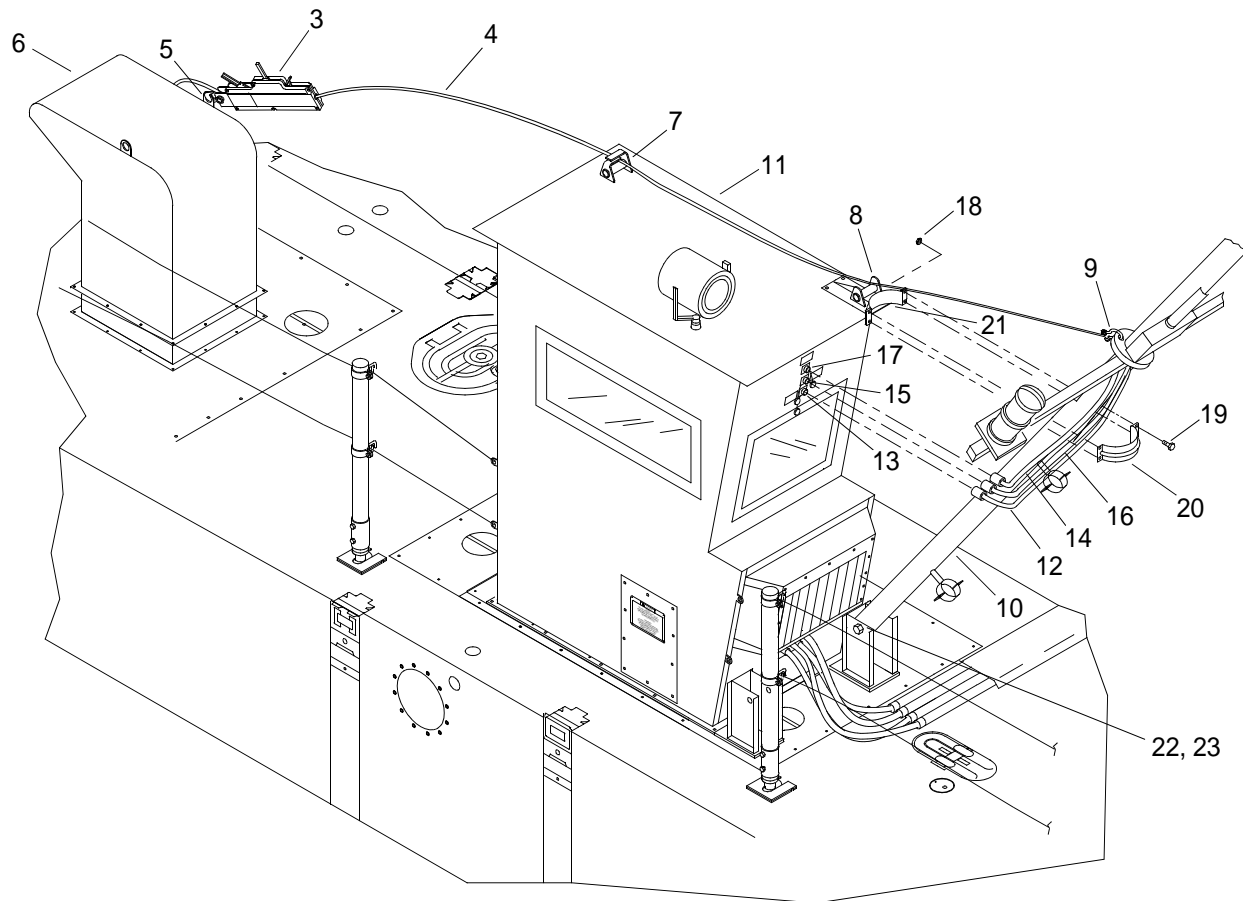
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Verify NAV LIGHTS (1) and DECK LIGHTS (2) circuit breakers on operators cab circuit breaker panel A3 are off.



2. Install cable hoist (3) and cable (4).



- a. Attach cable hoist (3) on inboard lifting bracket (5) of starboard exhaust plenum (6).
- b. Route cable (4) through flanges on aft guide (7) and over forward guide (8).

 WARNING



HEAVY PARTS

Ensure shackle is attached to mast with threaded pin bottomed out on shackle and safety catch on wire rope cable hook is fully engaged around shackle. Failure to comply could result in death or injury to personnel.

- c. Connect cable (4) to shackle (9) on main assembly mast (10).
- d. Operate cable hoist (3) until tension is on cable (4).

 WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

- 3. Gain access to top of operators cab (11).
- 4. Remove navigation compass connector (12) from operator cab connector J10 (13).
- 5. Remove deck lights connector (14) from operator cab connector J10 (15).
- 6. Remove navigation lights connector (16) from operator cab connector J1 (17).
- 7. Remove nuts (18), bolts (19) and outer clamp half (20) securing main assembly mast (10) to operator cab mounted clamp half (21).

 WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

- 8. Descend from top of operators cab (11).
- 9. Loosen hex nut (22) on bolt (23).

 WARNING



HEAVY PARTS

- 10. Using cable hoist (3), cable (4) and shackle (9), slowly lower main assembly mast (10) onto shoring block on deck of WT.
- 11. Remove all tension on cable (4) with cable hoist (3).

12. Disconnect cable (4) from shackle (9) on main assembly mast (10).
13. Remove cable (4) from top operators cab (11).
14. Remove cable hoist (3) from inboard lifting bracket (5) of starboard exhaust plenum (6).

MANUALLY RAISE MAIN ASSEMBLY MAST

1. Install cable hoist (3) and cable (4).
 - a. Attach cable hoist (3) on inboard lifting bracket (5) of starboard exhaust plenum (6).
 - b. Route cable (4) through flanges on aft guide (7) and over forward guide (8).

WARNING



HEAVY PARTS

Ensure shackle is attached to mast with threaded pin bottomed out on shackle and safety catch on wire rope cable hook is fully engaged around shackle. Failure to comply could result in death or injury to personnel.

- c. Connect cable (4) to shackle (9) on main assembly mast (10).
- d. Operate cable hoist (3) until tension is on cable (4).

WARNING



HEAVY PARTS

2. Using cable hoist (3), cable (4) and shackle (9), slowly raise main assembly mast (10) until contact is made with operators cab mounted clamp half (21).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

3. Gain access to top of operators cab (7)
4. Install outer clamp half (20), bolts (19) and nuts (18) to operator cab mounted clamp half (21) to secure main assembly mast (9) to operators cab (7). Tighten nuts (18).
5. Tighten hex nut (22) on bolt (23).
6. Install navigation compass connector (12) from operator cab connector J10 (13).

-
7. Install deck lights connector (14) from operator cab connector J10 (15).
 8. Install navigation lights connector (16) from operator cab connector J1 (17).
 9. Remove all tension on cable (4).
 10. Remove cable (4) from shackle (9) on main assembly mast (10).

WARNING

When ascending or descending from the operator cab roof using the six folding steps, care should be taken not to slip or fall as the operator cab roof has no grab handles. Failure to comply could result in death or injury to personnel.

11. Descend from top of operators cab (11).
12. Remove cable (4) from atop operators cab (11).
13. Remove cable hoist (3) from inboard lifting bracket (5) of starboard exhaust plenum (6).
14. Perform operational check of main assembly mast. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST NAVIGATION LIGHT BULBS
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Bulb, Light
PN 90400171

Personnel Required

Seaman 88K

References

TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Lowered. (WP 0352 00)

**REMOVE MAIN ASSEMBLY MAST NAVIGATION LIGHT BULBS
(SINGLE LAMP FIXTURES)**

WARNING



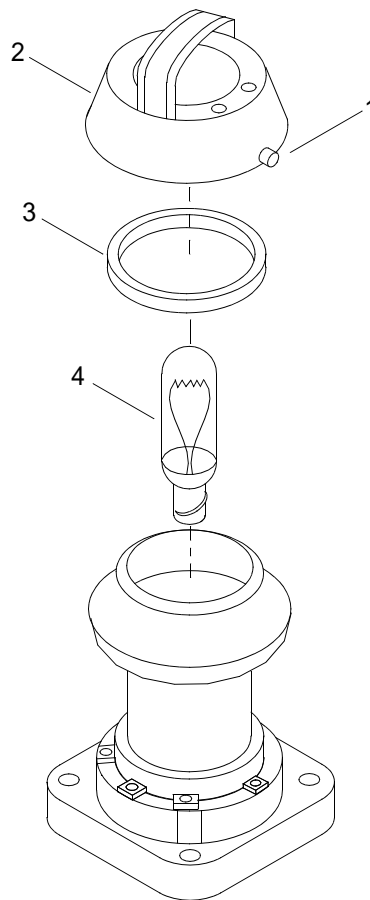
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

This task is typical for removal of single anchor, single vessel aground and single task navigation light bulbs.

1. Loosen safety knob screw (1).



2. Turn cover (2) by its handle counterclockwise and remove.
3. Remove gasket (3).
4. Rotate bulb (4) 1/4 turn counterclockwise, remove and discard.

INSTALL MAIN ASSEMBLY MAST NAVIGATION LIGHT BULBS (SINGLE LAMP FIXTURES)

NOTE

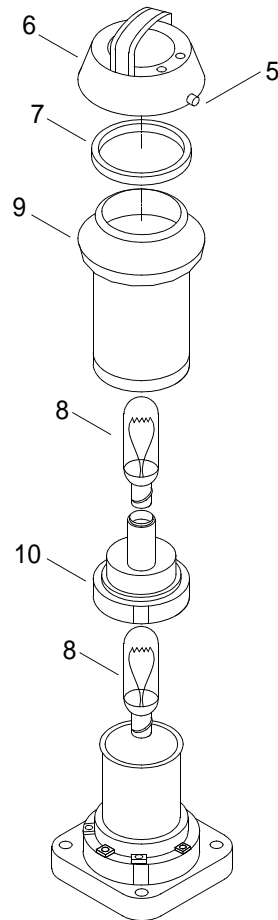
This task is typical for installation of single anchor, single vessel aground and single task navigation light bulbs.

1. Align new bulb (4) and rotate a clockwise 1/4 turn.
2. Position gasket (3) and install cover (2).
3. Tighten safety knob screw (1).
4. Raise main assembly mast. (WP 0352 00)
5. Perform operational check on main mast. (TM 55-1945-225-10)

**REMOVE MAIN ASSEMBLY MAST NAVIGATION LIGHT BULBS
(DUAL LAMP FIXTURES)****NOTE**

This task is typical for removal of double sidelight (port and starboard) and double masthead light bulbs.

1. Loosen safety knob screw (5).



2. Turn cover (6) by its handle counterclockwise and remove.
3. Remove gasket (7).
4. Rotate bulb (8) counterclockwise 1/4 turn, remove and discard.
5. To reach bottom bulb (8), remove lens (9) and mounting plate (10).
6. Turn bottom bulb (8) counterclockwise 1/4 turn, remove and discard.

**INSTALL MAIN ASSEMBLY MAST NAVIGATION LIGHT BULBS
(DUAL LAMP FIXTURES)****NOTE**

This task is typical for installation of single anchor, single vessel aground and single task navigation light bulbs.

1. Align new bottom bulb (8) and rotate clockwise 1/4 turn.
2. Install mounting plate (10) and lens (9).
3. Align new top bulb (8) and rotate clockwise 1/4 turn.
4. Position gasket (7) and install cover (6).
5. Tighten safety knob screw (5).
6. Raise main assembly mast. (WP 0352 00)
7. Perform operational check on main mast. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST NAVIGATION LIGHT
REMOVAL, INSPECTION, REPAIR AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Wrench, Torque (0-175 ft lbs) (Item 37, WP 0425 00)

Materials/Parts

Cloth, Cleaning (Item 7, WP 0426 00)

Personnel Required

Engineer 88L

References

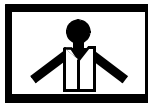
TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Lowered. (WP 0352 00)

REMOVE MAIN ASSEMBLY MAST NAVIGATION LIGHTS

WARNING



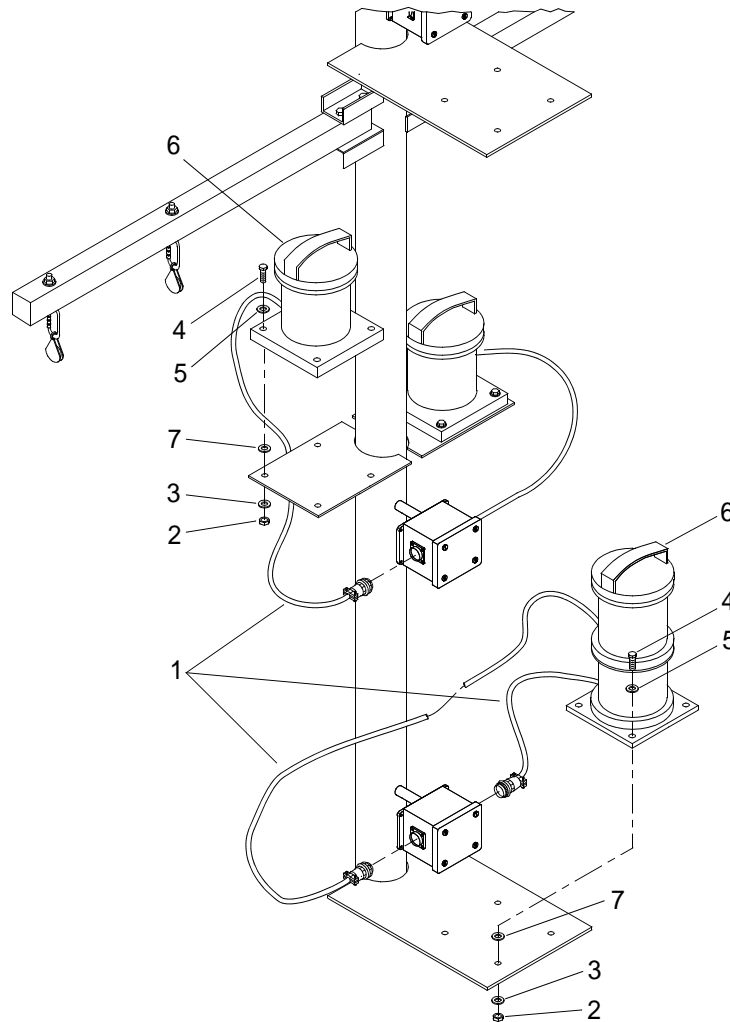
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

This task is typical for removal of main assembly mast navigation lights.

1. Disconnect electrical connectors (1).



2. Remove four hex nuts (2), lockwashers (3), cap screws (4) and flat washers (5) from light (6).
3. Carefully remove light (6) and four plastic washers (7) under light (6).

INSPECT MAIN ASSEMBLY MAST NAVIGATION LIGHTS

1. Inspect cables for cuts, cracks, deterioration and fraying.
2. Inspect connector for bent, broken or missing pins, cracked or broken backshells, corrosion and dirt.

REPAIR MAIN ASSEMBLY MAST NAVIGATION LIGHTS

1. Replace cut, cracked, frayed or deteriorated cables.
2. Straighten bent connector pins.
3. Replace broken or missing pins.
4. Replace cracked backshells.
5. Remove corrosion and dirt from interior of connectors using lint-free cloth.

INSTALL MAIN ASSMBLY MAST NAVIGATION LIGHTS**NOTE**

This task is typical for installation of main assembly mast navigation lights.

When installing port or starboard double sidelight, screen must be oriented to aft and inboard position. With double masthead lights, screen must be oriented to the aft position.

1. Place four plastic washers (7) on light base and position light (6) on washers (7).
2. Install four bolts (4) with flat washers (5) through holes in light (6) and base.
3. Install four lockwashers (3) and nuts (2) on bolts (4).
4. Torque nuts (2) to 35 ft lbs (47.46 N-m).
5. Install electrical connectors (1).
6. Raise main assembly mast. (WP 0352 00)
7. Perform operational check on main assembly mast. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST NAVIGATION LIGHT JUNCTION BOX
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Lowered. (WP 0352 00)

REMOVE MAIN ASSEMBLY MAST NAVIGATION LIGHT JUNCTION BOX

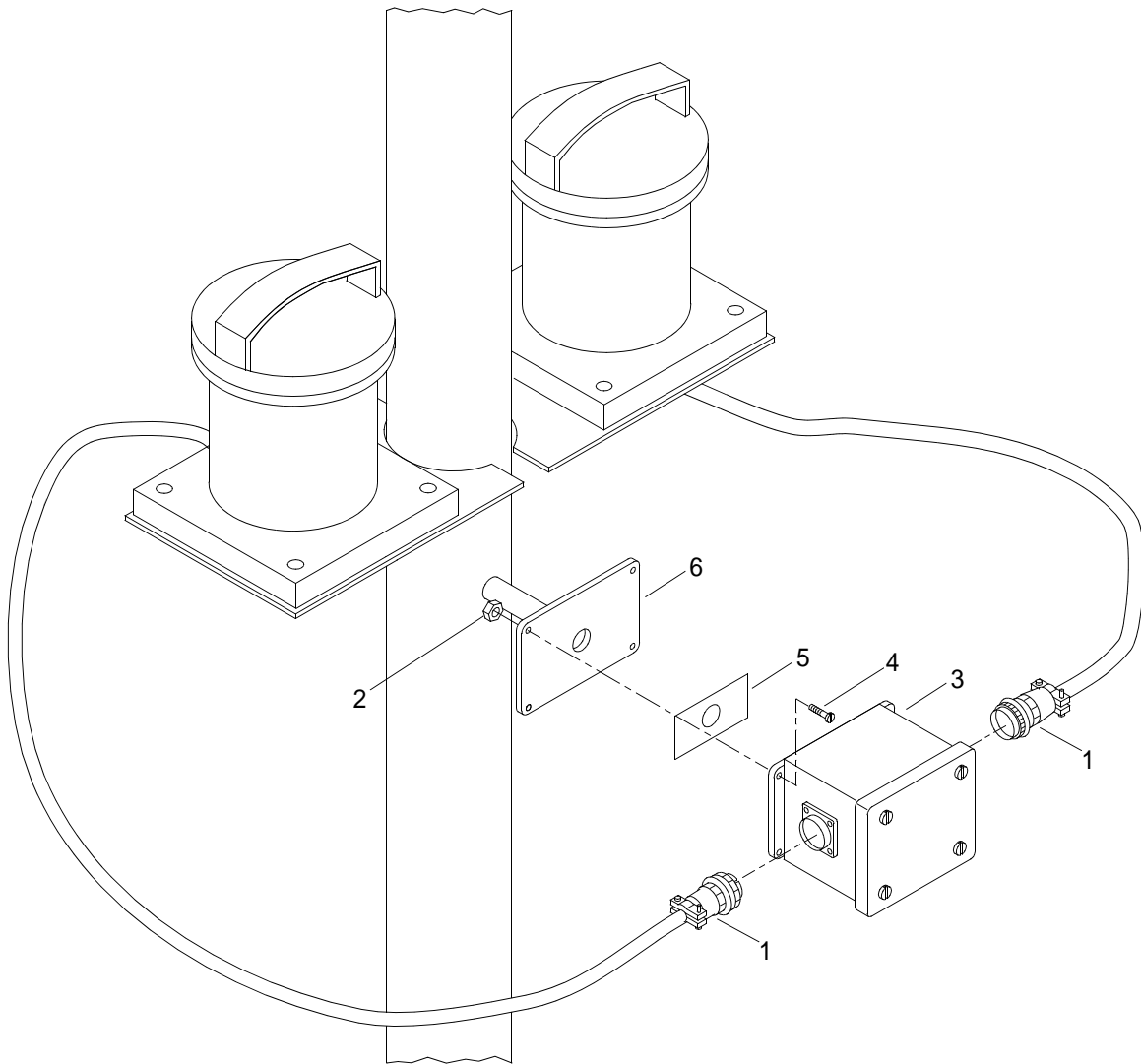
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Disconnect two or three light pigtail connectors (1), as required.



2. Remove four hex nuts (2).
3. While supporting junction box (3), remove four capscrews (4).
4. Remove gasket (5).

INSTALL MAIN ASSEMBLY MAST NAVIGATION LIGHT JUNCTION BOX

1. Position gasket (5) between junction box (3) and mast base (6).
2. Install four capscrews (4) and hex nuts (2).
3. Tighten four hex nuts (2).
4. Connect two or three light pigtails connectors (1), as required.
5. Raise main assembly mast. (WP 0352 00)
6. Perform operational check on main assembly mast. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST NAVIGATION LIGHT TERMINAL BOX
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Lowered. (WP 0352 00)

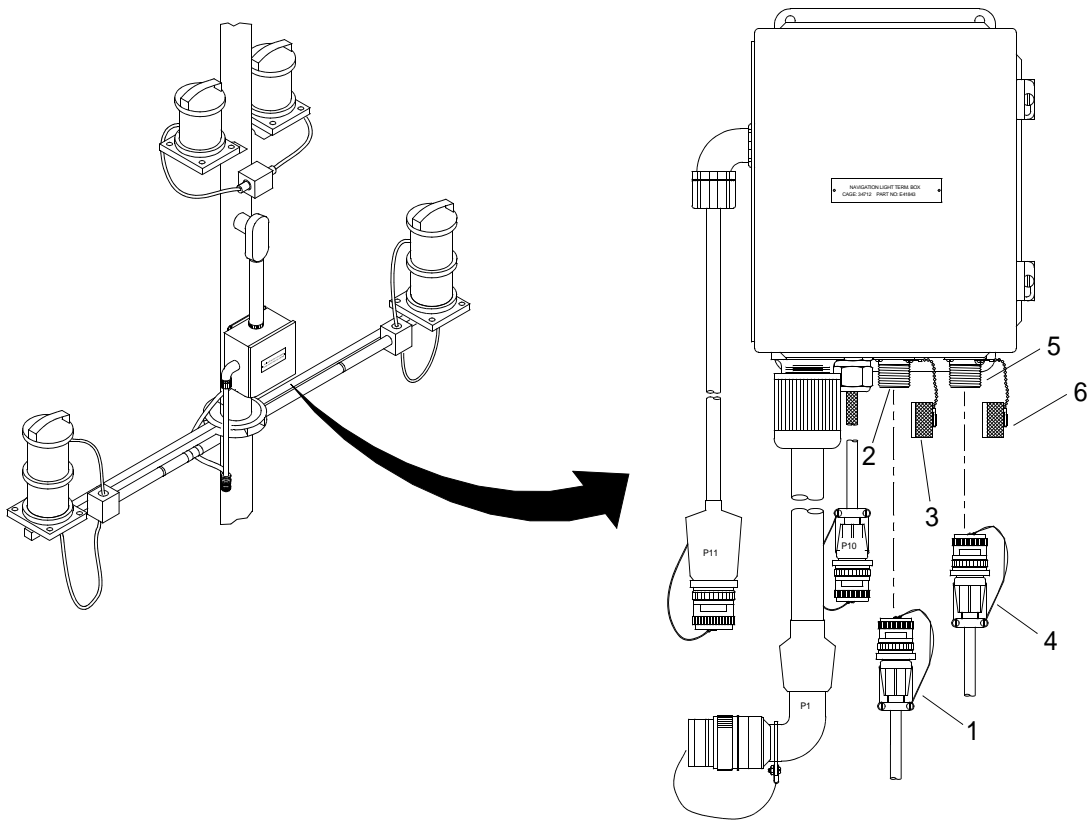
REMOVE MAIN ASSEMBLY MAST NAVIGATION LIGHT TERMINAL BOX

WARNING

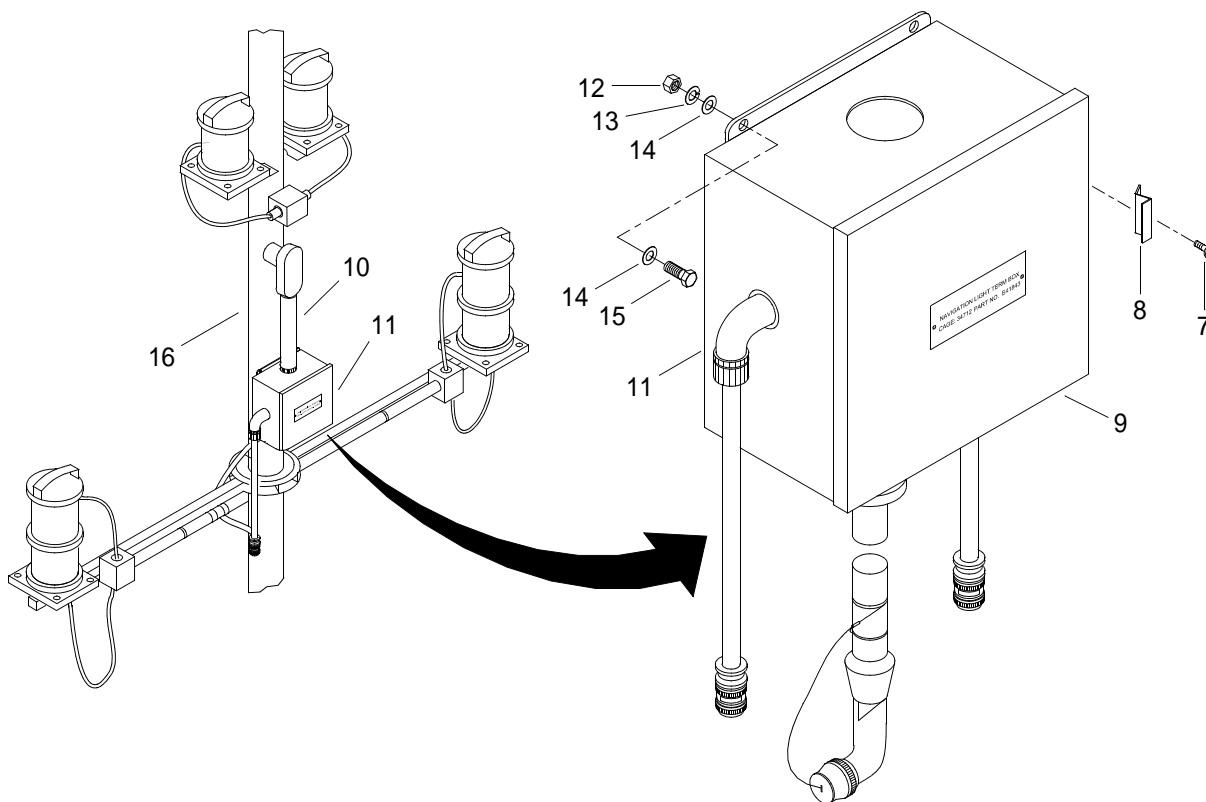
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Disconnect port yardarm wiring harness connector (1) from mast navigation light terminal box receptacle (2).



2. Install receptacle cap (3) on mast navigation light terminal box receptacle (2).
3. Disconnect starboard yardarm wiring harness connector (4) from mast navigation light terminal box receptacle (5).
4. Install receptacle cap (6) on mast navigation light terminal box receptacle (5).
5. Remove screws (7) and clamps (8) securing cover (9).



6. Open cover (9).
7. Disconnect and tag internal electrical wiring.
8. Disconnect conduit (10) from navigation light terminal box (11).
9. Remove hex nuts (12), lockwashers (13), flat washers (14), and hex head capscrews (15).
10. Remove main assembly mast navigation light terminal box (11) from main assembly mast (16).

INSTALL MAIN ASSEMBLY MAST NAVIGATION LIGHT TERMINAL BOX

WARNING



CHEMICAL



EYE PROTECTION

1. Apply antiseize compound to capscrews (15) and screws (7).
2. Position main assembly mast navigation light terminal box (11) on main assembly mast (16).
3. Secure main mast navigation assembly terminal box (11) with hex head capscrews (15), flat washers (14), lockwashers (13) and hex nuts (12). Tighten hex nuts (12).

WARNING

**CHEMICAL****EYE PROTECTION**

4. Using wiping rag, clean off excess antiseize compound.
5. Connect conduit (10) to navigation light terminal box (11).
6. Connect internal electrical wiring, as tagged, to terminal box (14).
7. Remove tags from electrical wiring.
8. Close cover (9).
9. Position clamps (8) on cover (9).
10. Install screws (7) and tighten.
11. Remove receptacle cap (6) from starboard mast navigation light terminal box receptacle (5).
12. Connect starboard yardarm wiring harness connector (4) to starboard mast navigation light terminal box receptacle (5).
13. Remove receptacle cap (3) from mast port navigation light terminal box receptacle (2).
14. Connect port yardarm wiring harness connector (1) on port mast navigation light terminal box receptacle (2).
15. Raise main assembly mast. (WP 0352 00)
16. Perform operational check on main assembly mast. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION**

17. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST NAVIGATION LIGHT
TERMINAL BOX TERMINAL BLOCK
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Personnel Required

Engineer 88L

References

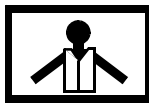
TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Navigation Light Terminal Box Removed. (WP 0356 00)

**REMOVE MAIN ASSEMBLY MAST NAVIGATION LIGHT TERMINAL BOX
TERMINAL BLOCK**

WARNING



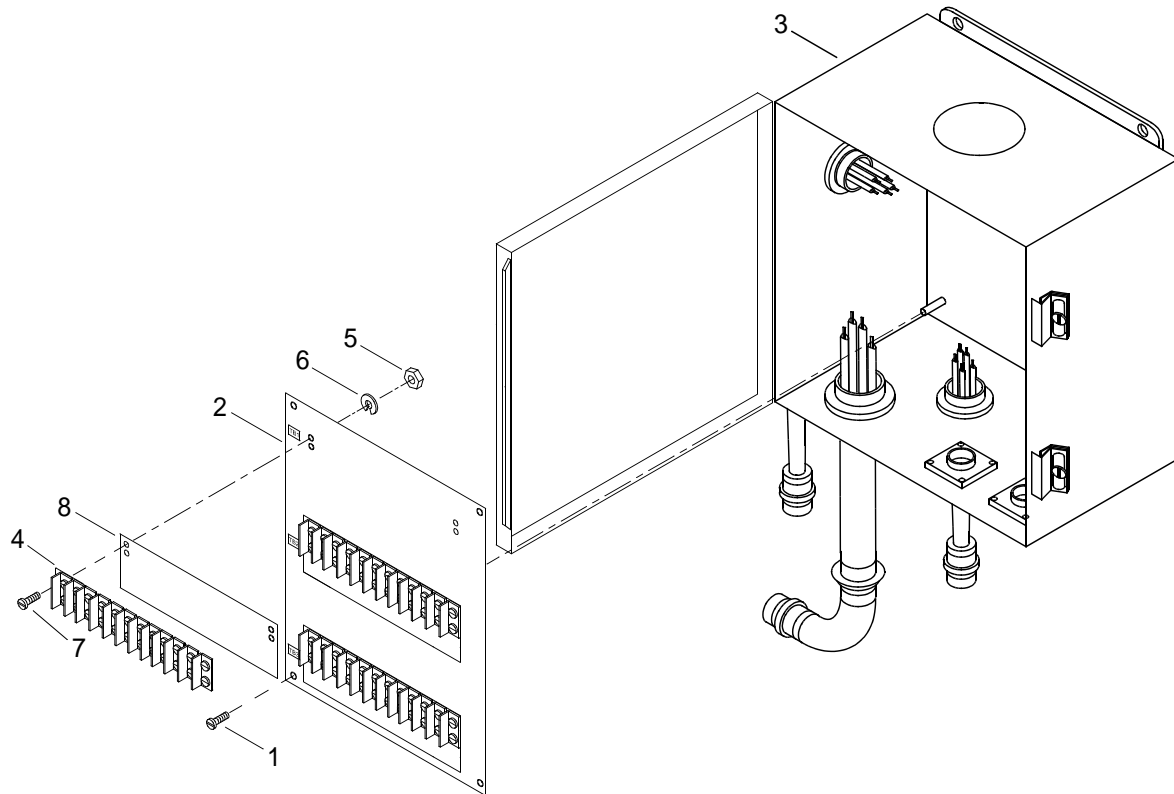
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death.

NOTE

This task is typical for removal and installation of terminal blocks.

1. Remove pan head screws (1) securing terminal board (2) to main assembly mast navigation light terminal box (3).



2. Remove terminal board (2) from main assembly mast navigation light terminal box (3).
3. Tag and disconnect electrical wiring to terminal block (4).
4. Remove nuts (5), lockwashers (6) and pan head screws (7) securing terminal block (4) and marker strip (8) to terminal board (2).
5. Remove terminal block (4) and marker strip (8) from terminal board (2).

INSTALL MAIN ASSEMBLY MAST NAVIGATION LIGHT TERMINAL BOX TERMINAL BLOCK

1. Position marker strip (8) and terminal block (4) on terminal board (2).
2. Install panhead screws (7), lockwashers (6) and nuts (5) to secure terminal block (4) and marker strip (8) on terminal board (2). Tighten nuts (5).
3. Connect electrical wiring to terminal block (4) and remove tags.
4. Position terminal board (2) inside main assembly mast navigation light terminal box (3).
5. Install panhead screws (1) to secure terminal board (2) to main assembly mast navigation light terminal box (5). Tighten panhead screws (1).
6. Install main assembly mast navigation light terminal box. (WP 0356 00)
7. Perform operational check on main assembly mast. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST INCANDESCENT FLOODLIGHT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)

Materials/Parts

Floodlight, Incandescent
PN E44138

Personnel Required

Seaman 88K (2)

References

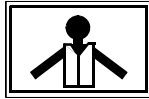
TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Lowered. (WP 0352 00)

REMOVE MAIN ASSEMBLY MAST INCANDESCENT FLOODLIGHT

WARNING



VEST



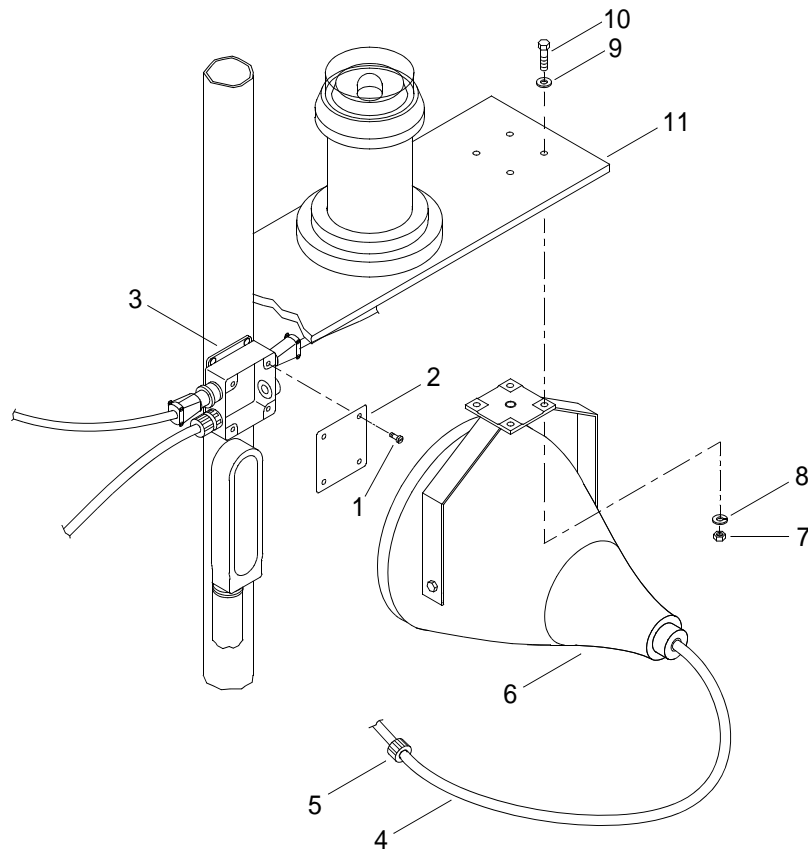
HELMET PROTECTION

All personnel must wear personal flotation device, and hard hat during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for removal of the main assembly mast incandescent floodlights.

1. Remove hex head capscrews (1) securing cover (2) on junction box (3).



2. Remove cover (2) from junction box (3).
3. Tag and disconnect main assembly mast incandescent floodlight wiring (4) inside junction box (3).
4. Remove main assembly mast incandescent floodlight wiring (4) from stuffing tube (5).

WARNING



HEAVY OBJECTS

5. Using assistant to support weight of main assembly mast incandescent floodlight (6), remove hex nuts (7), lockwashers (8), flat washers (9) and hex head cap screws (10) securing main assembly mast incandescent floodlight (6) to main assembly mast mounting plate (11).
6. Discard main assembly mast incandescent floodlight (6).

INSTALL MAIN ASSEMBLY MAST INCANDESCENT FLOODLIGHT

WARNING

**HEAVY OBJECTS****NOTE**

This task is typical for installation of the main assembly mast incandescent floodlights.

1. Using assistant to support weight of main assembly mast incandescent floodlight (6), position new main assembly mast incandescent floodlight (6) on main assembly mast mounting plate (11).
2. Install hex nuts (7), lockwashers (8), flat washers (9) and hex head capscrews (10) to secure main assembly mast incandescent floodlight (6) to main assembly mast mounting plate (11). Tighten hex nuts (7).
3. Route main assembly mast incandescent floodlight wiring (4) through stuffing tube (5) to inside junction box (3).
4. Connect main assembly mast incandescent floodlight wiring (4) inside junction box (3) and remove tags.
5. Position cover (2) on junction box (3).
6. Install hex head capscrews (1) to secure cover (2) on junction box (3). Tighten hex head capscrews (1).
7. Raise main assembly mast. (WP 0352 00)
8. Perform operational check on main assembly mast incandescent floodlight. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MAIN ASSEMBLY MAST INCANDESCENT FLOODLIGHT LAMP
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Lamp (150W)
PN E44138-21

Personnel Required

Seaman 88K

References

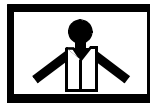
TM 55-1945-225-10

Equipment Condition

Main Assembly Mast Lowered. (WP 0352 00)

REMOVE MAIN ASSEMBLY MAST INCANDESCENT FLOODLIGHT LAMP

WARNING



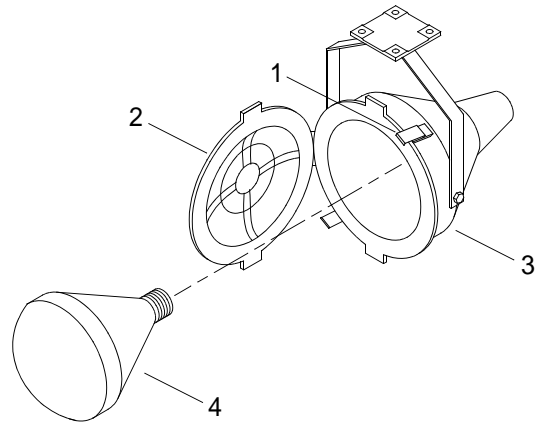
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

This task is typical for removal and installation of main assembly mast incandescent floodlight lamps.

1. Release door latches (1) securing door (2) to floodlight housing (3).



2. Open door (2) to access lamp (4).
3. Unscrew lamp (4) by turning counterclockwise. Remove lamp and discard.

INSTALL MAIN ASSEMBLY MAST INCANDESCENT FLOODLIGHT LAMP

1. Position new lamp (4) inside floodlight housing (3) and install by turning clockwise to tighten.
2. Close door (2) and secure with door latches (1).
3. Raise main assembly mast. (WP 0352 00)
4. Perform operational check on main mast. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB ELECTRICAL
SYSTEM JUNCTION BOX ASSEMBLY JB1
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Life Preserver, Vest (Item 17, WP 0425 00)

Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)

Antiseize Compound (Item 3, WP 0426 00)

Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

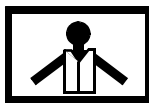
Engineer 88L

References

TM 55-1945-225-10

REMOVE OPERATORS CAB ELECTRICAL SYSTEM JUNCTION BOX

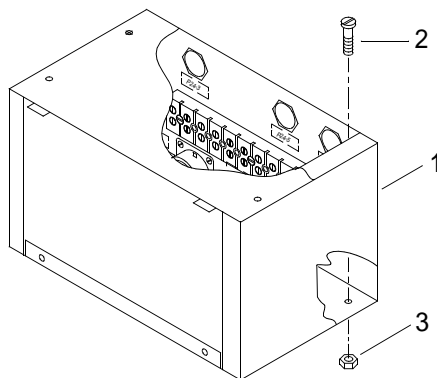
WARNING



VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Tag and disconnect all electrical wiring to junction box assembly JB1 (1).



2. Remove four pan head capscrews (2) and hex nuts (3).
3. Remove junction box assembly JB1 (1).

INSTALL OPERATORS CAB ELECTRICAL SYSTEM JUNCTION BOX

1. Position junction box assembly JB1 (1) on operators cab upper shelf.

WARNING



CHEMICAL



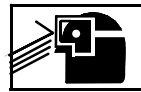
EYE PROTECTION

2. Apply antiseize compound to four pan head capscrews (2).
3. Secure junction box (1) with four pan head capscrews (2) and four hex nuts (3). Tighten hex nuts (3).

WARNING



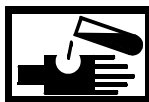
CHEMICAL



EYE PROTECTION

4. Using wiping rag, clean off excess antiseize compound.
5. Connect all wiring to junction box (1) as previously tagged and remove tags.
6. Perform operational check on VHF/FM DSC voltage converter. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION

7. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB ELECTRICAL SYSTEM JUNCTION BOX
ASSEMBLY JB1 TERMINAL BOARD
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Terminal Board
 PN 985-12
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Antiseize Compound (Item 3, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

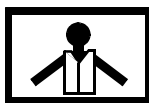
Engineer 88L

References

TM 55-1945-225-10

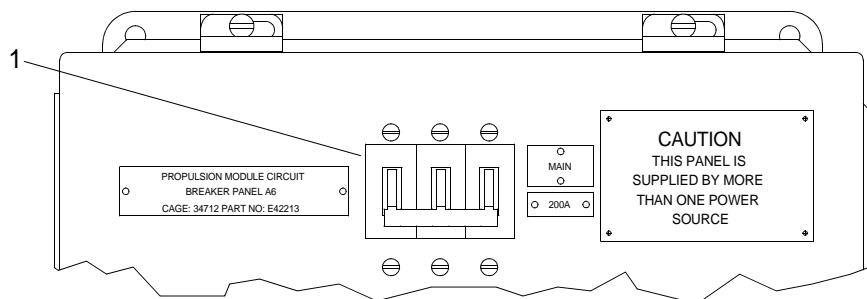
**REMOVE OPERATORS CAB ELECTRICAL SYSTEM JUNCTION BOX ASSEMBLY
JB1 TERMINAL BOARD**

WARNING

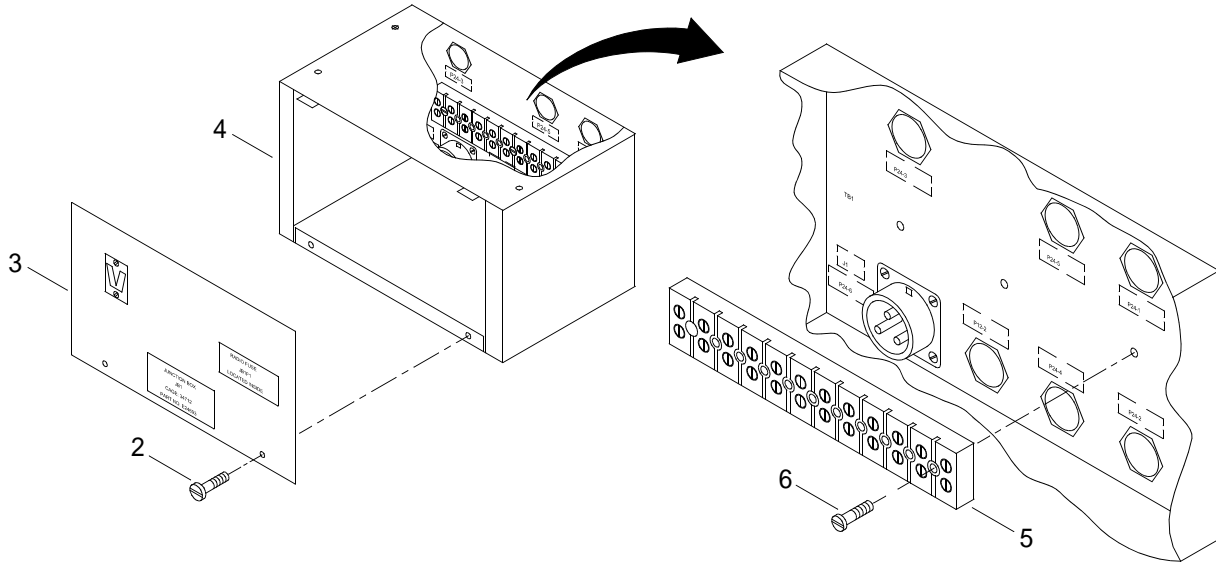
**VEST**

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen two door screws (2) securing junction box cover (3) to junction box (4).



- Remove junction box cover (3).
- Tag and disconnect electrical wiring to terminal board (5).
- Remove three round head screws (6) securing terminal board (5) to junction box (4).
- Remove and discard JB1 terminal board (5).

INSTALL OPERATORS CAB ELECTRICAL SYSTEM JUNCTION BOX ASSEMBLY JB1 TERMINAL BOARD

WARNING



CHEMICAL



EYE PROTECTION

- Apply antiseize compound to three round head screws (6).
- Position new JB1 terminal board (5) on junction box JB1 (4).
- Install and secure terminal board (5) with three round head screws (6). Tighten screws (6).

WARNING



CHEMICAL



EYE PROTECTION

- Using wiping rag, clean off excess antiseize compound.
- Connect wiring to terminal board (5) as previously tagged and remove tags.

-
6. Position junction box cover (3) on front of junction box (4) and secure with two door screws (2).
 7. Tighten screws (2).
 8. Perform operational check on junction box assembly JB1. (TM 55-1945-225-10)

WARNING



CHEMICAL



EYE PROTECTION

9. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB ELECTRICAL SYSTEM JUNCTION BOX
ASSEMBLY JB1 RECEPTACLE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Receptacle
PN MS3102A22-2S
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Antiseize Compound (Item 3, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

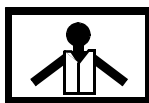
Engineer 88L

References

TM 55-1945-225-10

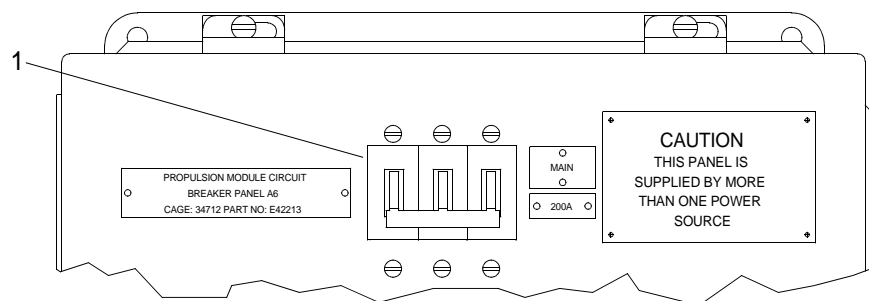
**REMOVE OPERATORS CAB ELECTRICAL SYSTEM JUNCTION BOX ASSEMBLY
JB1 RECEPTACLE**

WARNING

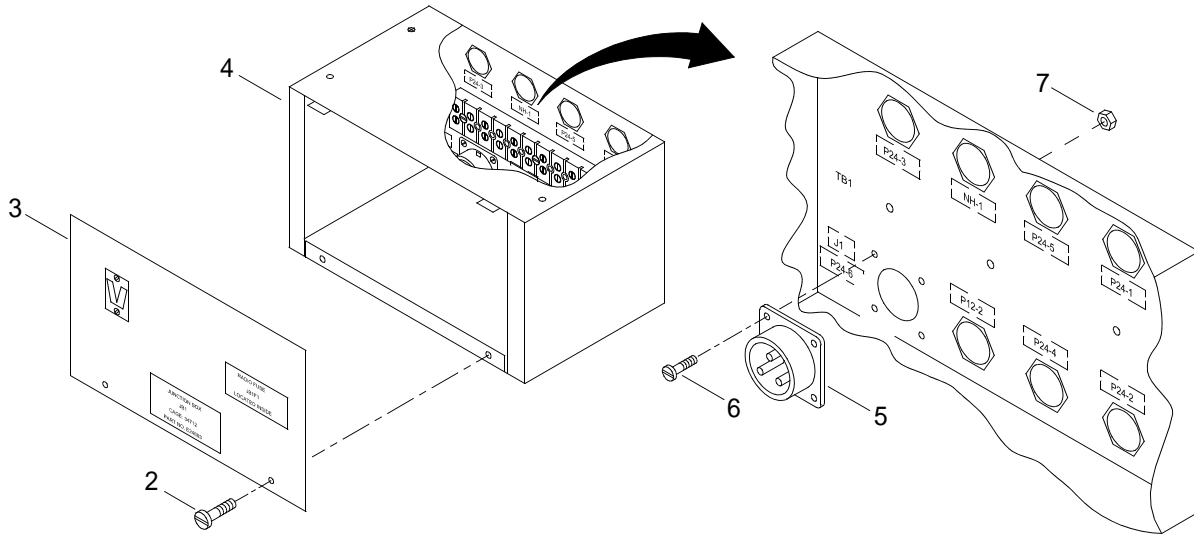
**VEST**

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen two screws (2) securing junction box cover (3) to junction box (4).

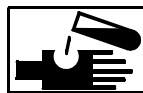


- Remove junction box cover (3).
- Tag and disconnect wiring from receptacle (5).
- Remove four pan head capscrews (6) and four hex nuts (7) securing receptacle (5) to junction box (4).
- Pull receptacle (5) from junction box (4).
- Remove and discard receptacle (5).

INSTALL OPERATORS CAB ELECTRICAL SYSTEM JUNCTION BOX ASSEMBLY JB1 RECEPTACLE

- Connect wiring to new receptacle (5) as previously tagged and remove tags.

WARNING



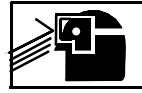
CHEMICAL



EYE PROTECTION

- Apply antiseize compound to four pan head capscrews (6).
- Position receptacle (5) on junction box (4).
- Secure receptacle (5) with four pan head capscrews (6) and four hex nuts (7).
- Tighten hex nuts (7).
- Position junction box cover (3) on front of junction box (4) and secure with two screws (2). Tighten screws (2).

WARNING

**CHEMICAL****EYE PROTECTION**

7. Using wiping rag, clean off excess antiseize compound.
8. Perform operational check on junction box assembly JB1. (TM 55-1945-225-10)

WARNING

**CHEMICAL****EYE PROTECTION**

9. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB ELECTRICAL SYSTEM VHF/FM
DSC 24 TO 12 VDC CONVERTER VR1
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Converter, 24 to 12 VDC
PN E41148

Personnel Required

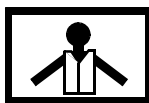
Engineer 88L

References

TM 55-1945-225-10

REMOVE 24 TO 12 VDC CONVERTER VR1

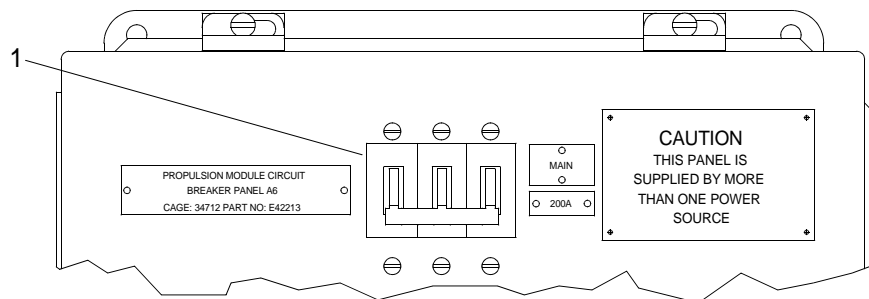
WARNING



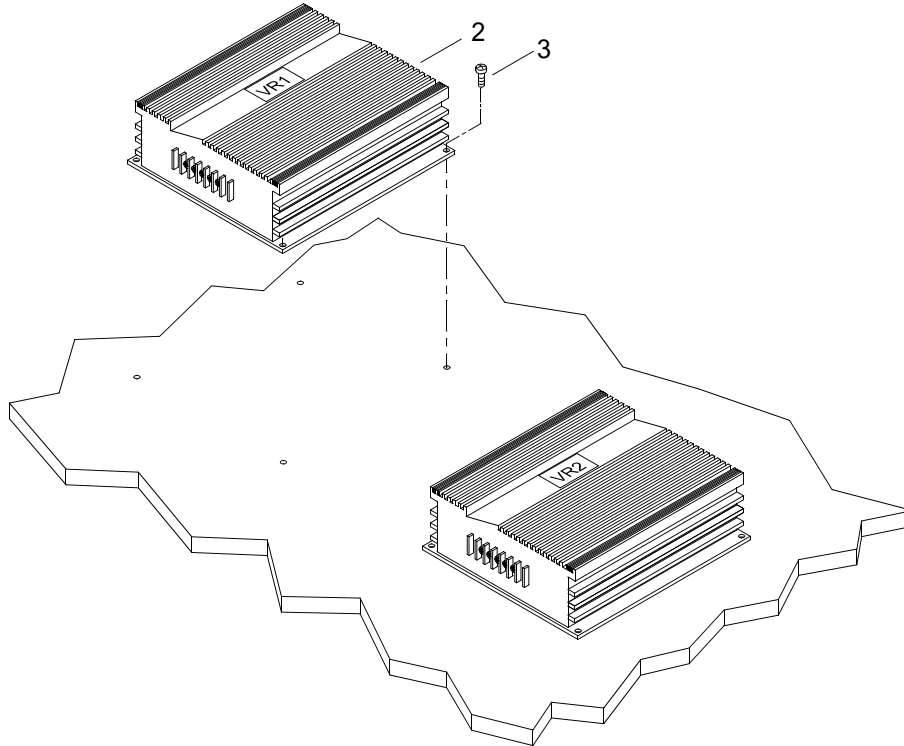
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Tag and disconnect wiring from converter (2).



3. Remove pan head screws (3) securing converter (2) to mounting surface.
4. Remove converter (2) and discard.

INSTALL 24 TO 12 VDC CONVERTER VR1

1. Position new converter (2) on mounting surface.
2. Install pan head screws (13) to secure converter (2) to mounting surface. Tighten screws (2).
3. Connect wiring to converter (2) and remove tags.
4. Perform operational check on the 24 to 12 VDC converter VR1. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB ELECTRICAL SYSTEM
24 TO 12 VDC CONVERTER VR2
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Converter, 24 to 12 VDC
PN E41148

Personnel Required

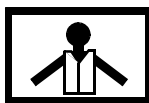
Engineer 88L

References

TM 55-1945-225-10

REMOVE 24 TO 12 VDC CONVERTER VR2

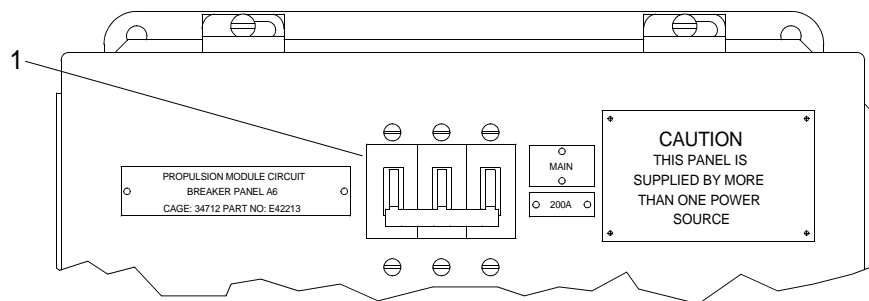
WARNING



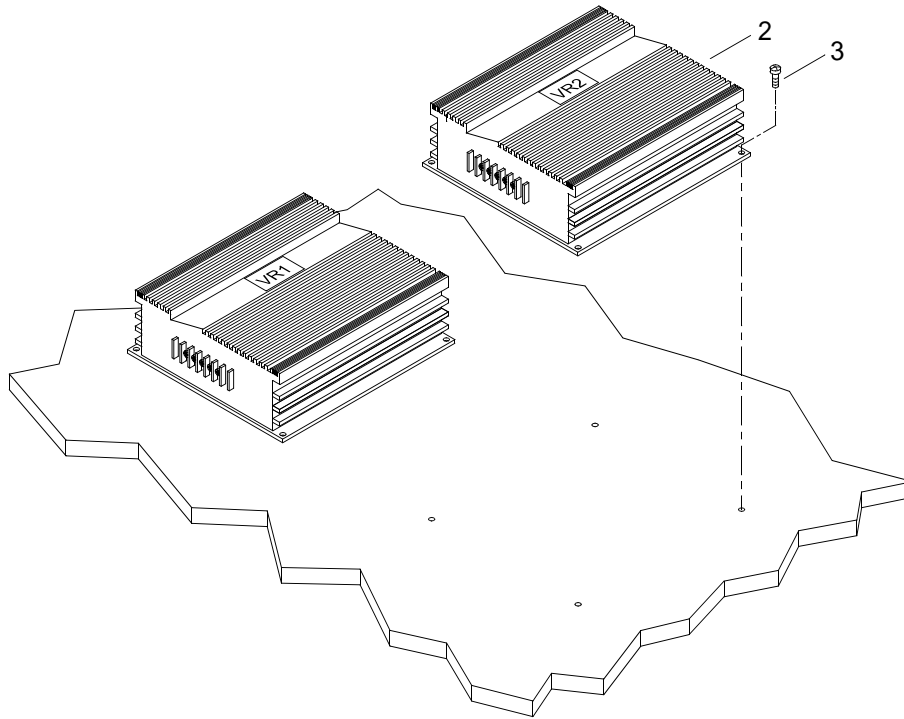
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Tag and disconnect wiring from converter (2).



3. Remove pan head screws (3) securing converter (2) to mounting surface.
4. Remove converter (2) and discard.

INSTALL 24 TO 12 VDC CONVERTER VR2

1. Position new converter (2) on mounting surface.
2. Install pan head screws (3) to secure converter (2) to mounting surface. Tighten screws (2).
3. Connect wiring to converter (2) and remove tags.
4. Perform operational check on the 24 to 12 VDC converter VR2. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB JUNCTION BOX JB3
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)

Personnel Required

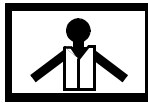
Engineer 88L

References

TM 55-1945-225-10

REMOVE OPERATORS CAB JUNCTION BOX JB3

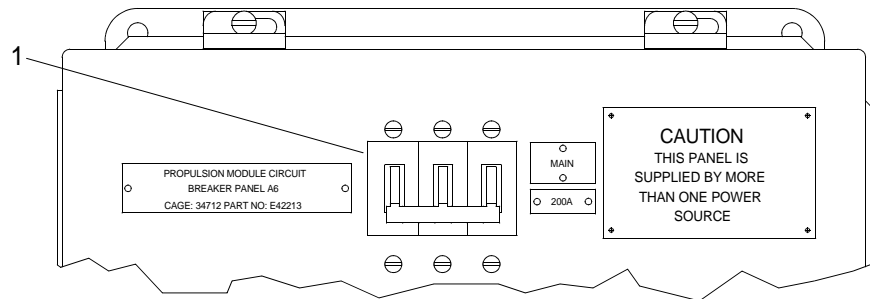
WARNING



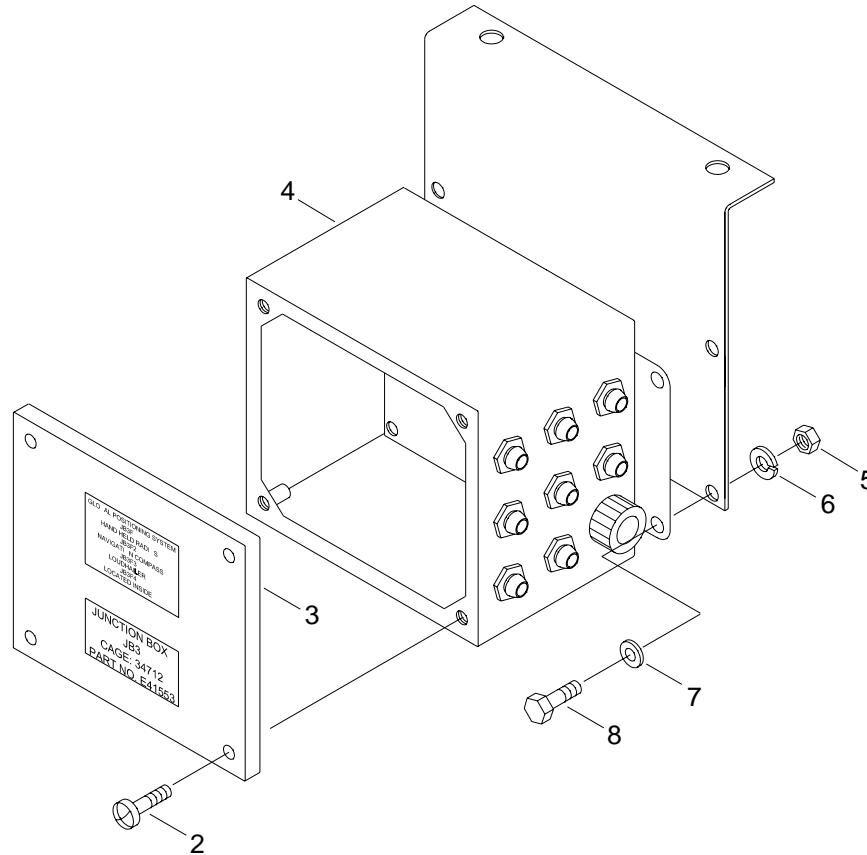
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Remove screws (2) securing enclosure cover (3) to junction box assembly JB3 (4).



- Remove enclosure cover (3).
- Tag and disconnect all external electrical wiring to junction box assembly JB3 (4).
- Remove hex head nuts (5), lockwashers (6), washers (7) and hex head capscrews (8) securing junction box assembly JB3 (3) to mounting structure.
- Remove junction box assembly JB3 (4).

INSTALL OPERATORS CAB JUNCTION BOX JB3

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to hex head capscrews (8).
- Position junction box assembly JB3 (4) on mounting structure.
- Install hex head nuts (5), lockwashers (6), washers (7) and hex head capscrews (8) to secure junction box assembly JB3 (4) to mounting structure. Tighten hex head nuts (5).

-
4. Connect all external wiring to junction box assembly JB3 (4) and remove tags.
 5. Position enclosure cover (3) on junction box assembly JB3 (4).
 6. Install screws (2) to secure enclosure cover (3) on junction box assembly JB3 (4). Tighten screws (2).
 7. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
OPERATORS CAB JUNCTION BOX JB3
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

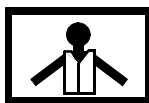
TM 55-1945-225-10

Equipment Condition

Operators Cab Junction Box Assembly JB3 Removed. (WP 0365 00)

DISASSEMBLE OPERATORS CAB JUNCTION BOX JB3

WARNING



VEST

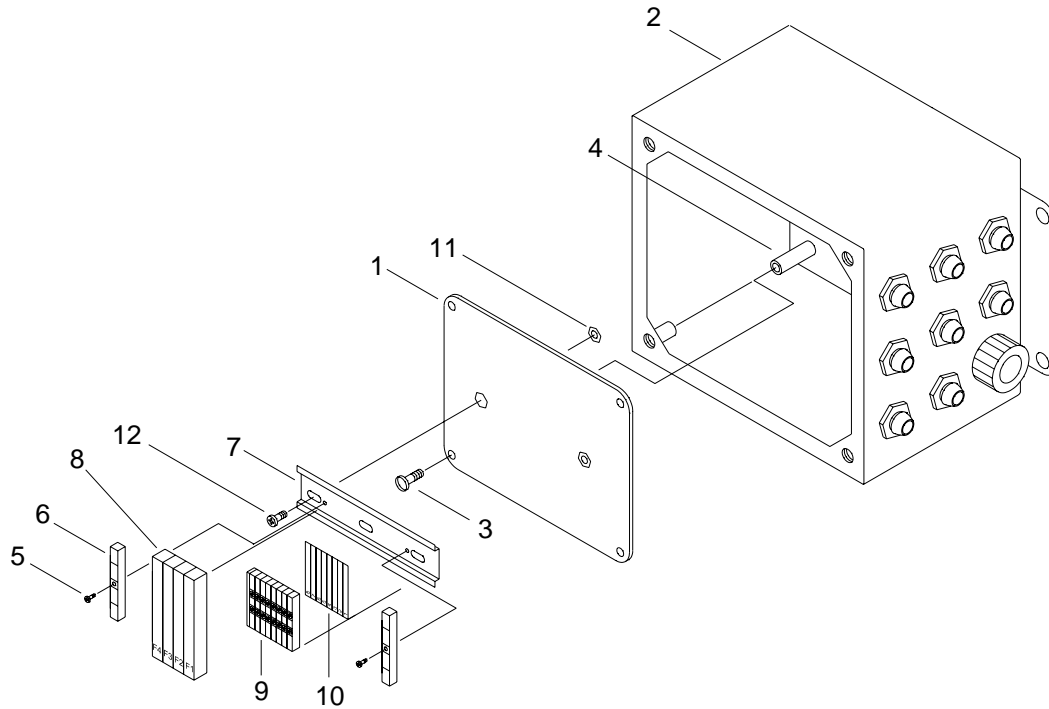
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

This task is typical for the removal, inspection, repair and installation of components on the junction box assembly JB3.

Repair is limited to the replacement of damaged parts.

1. Remove panel (1) from junction box assembly JB3 (2).



- a. Tag and disconnect wiring from panel (1).
- b. Remove capscrews (3) securing panel (1) to standoffs (4) inside junction box assembly JB3 (2).
- c. Remove panel (1) from junction box assembly JB3 (2).

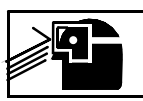
NOTE

The end anchors hold the subcomponents in place on the din rail.

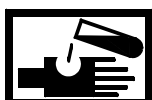
2. Remove screws (5) securing end anchors (6) to din rail (7).
3. Remove fuses with holders (8) from din rail (7).
4. Remove terminal block (9) and terminal block label (10) from din rail (7).
5. Remove din rail (7) from panel (1).
 - a. Remove insert nuts (11) and pan head screws (12) securing din rail (7) to panel (1).
 - b. Remove din rail (7) from panel (1).

CLEAN OPERATORS CAB JUNCTION BOX JB3

1. Clean junction box assembly JB3 interior and exterior surfaces with a clean wiping rag.

WARNING**CHEMICAL****EYE PROTECTION****VAPOR**

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING**CHEMICAL****EYE PROTECTION****VAPOR**

3. Dispose of contaminated wiping rags per local procedures.

INSPECT OPERATORS CAB JUNCTION BOX JB3

1. Inspect fuses and terminal blocks for loose or broken contacts. Replace damaged parts.
2. Inspect mechanical components for stripped threads or rounded heads. Replace damaged parts.

ASSEMBLE OPERATORS CAB JUNCTION BOX JB3

1. Install din rail (7) on panel (1).
 - a. Position din rail (7) on panel (1).
 - b. Install insert nuts (11) and pan head screws (12) to secure din rail (7) on panel (1). Tighten insert nuts (11).
2. Install terminal block (9) and terminal block label (10) on din rail (7).
3. Install fuses with holders (8) on din rail (7).
4. Position end anchors (6) on din rail (7) and secure with screws (5). Tighten screws (5).
5. Install panel (1) in junction box assembly JB3 (2).
 - a. Position panel (1) in junction box assembly JB3 (2).
 - b. Install capscrews (3) to secure panel (1) to standoffs (4) inside junction box assembly JB3 (2).
 - c. Connect wiring to panel (1) and remove tags.
6. Install operators cab junction box assembly JB3. (WP 0365 00)
7. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
OPERATORS CAB JUNCTION BOX JB4
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Junction Box, Loudhailer JB4
 PN E42043
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)

Personnel Required

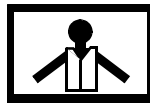
Engineer 88L

References

TM 55-1945-225-10

REMOVE LOUDHAILER JUNCTION BOX JB4

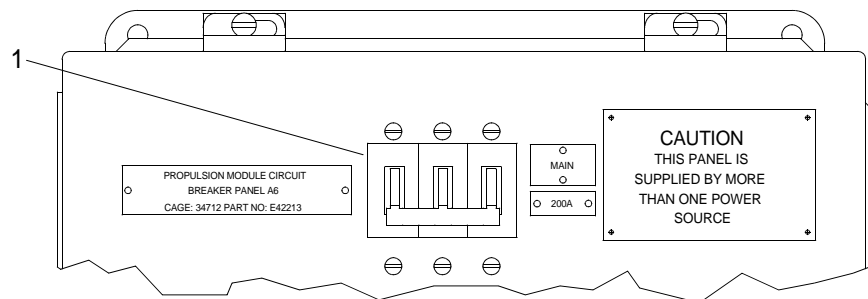
WARNING



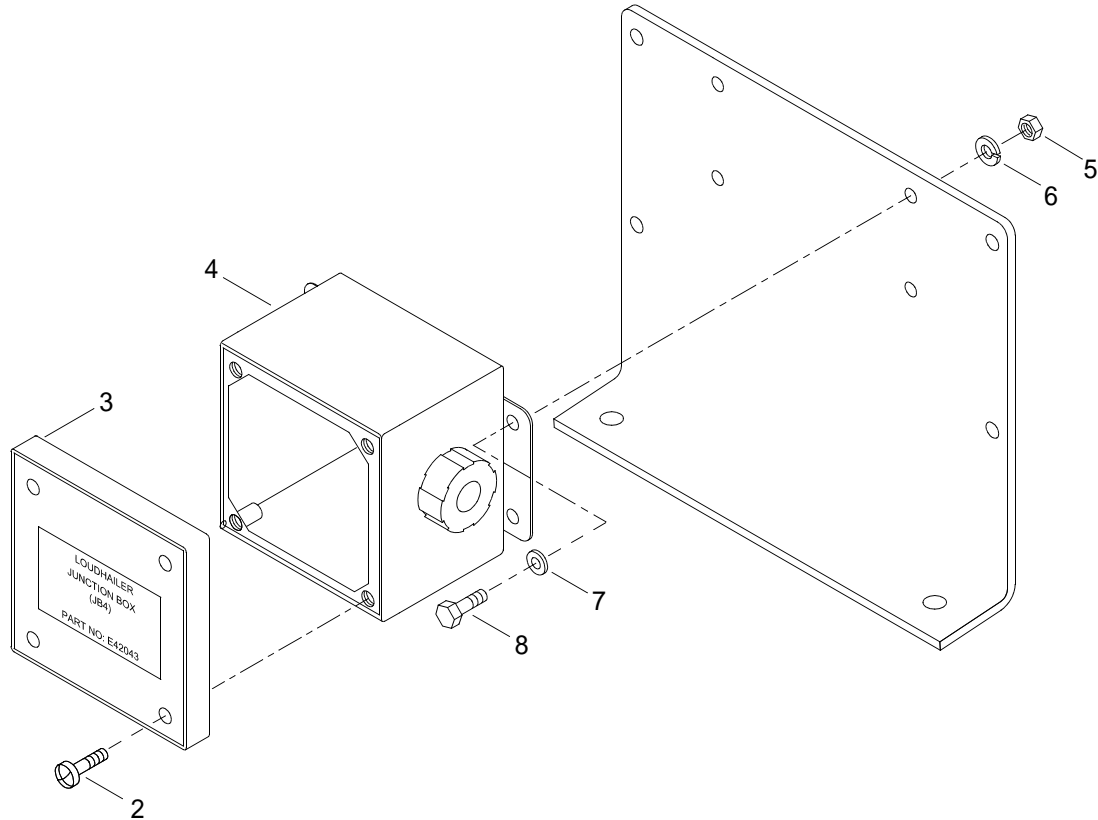
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



- Loosen screws (2) securing junction box cover (3) to junction box JB4 (4).



- Remove junction box cover (3).
- Tag and disconnect all external electrical wiring to junction box assembly JB4 (4).
- Remove hex head nuts (5), lockwashers (6), washers (7) and hex head capscrews (8) securing junction box assembly JB4 (3) to mounting structure.
- Remove junction box JB4 and discard.

INSTALL LOUDHAILER JUNCTION BOX JB4

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to hex head capscrews (8).
- Position new junction box JB4 on mounting surface.
- Install hex head nuts (5), lockwashers (6), washers (7) and hex head capscrews (8) to secure junction box assembly JB4 (3) to mounting structure.

-
4. Connect all external wiring to junction box JB4 (4) and remove tags.
 5. Position enclosure cover (3) on junction box JB4 (4).
 6. Install screws (2) to secure enclosure cover (3) on junction box JB4 (4). Tighten screws (2).
 7. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
STERN ANCHOR
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)

Materials/Parts

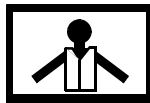
Cotter Pin
 Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

DISASSEMBLE STERN ANCHOR

WARNING

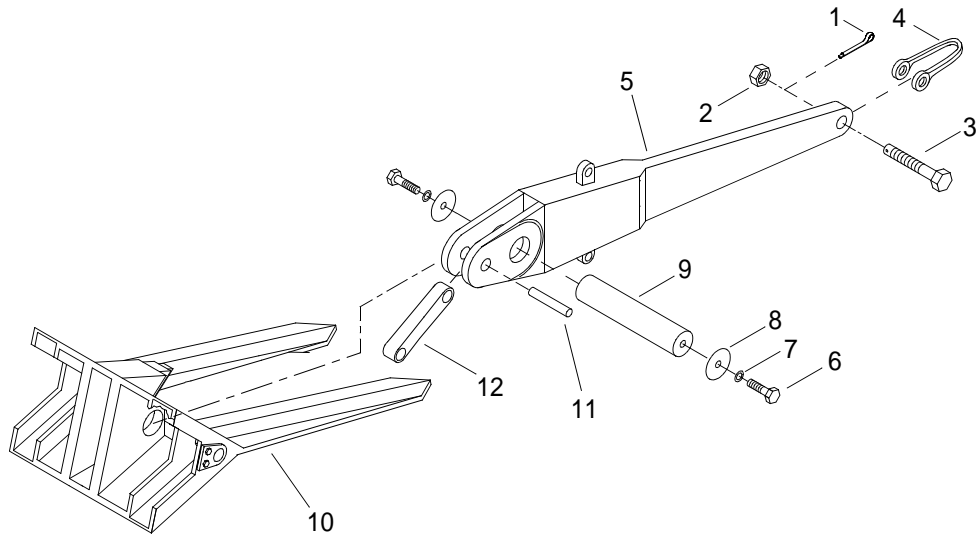
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

Repair is limited to replacement of defective items.

1. Remove cotter pin (1), nut (2) and bolt (3) from shackle (4). Discard cotter pin (1).



2. Remove shackle (4) from anchor shank (5).
3. Remove two capscrews (6), lockwashers (7) and washers (8) from trunnion pin (9).
4. Remove trunnion pin (9) from fluke assembly (10).

WARNING

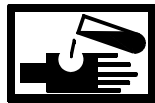


HEAVY PARTS

5. Remove fluke assembly (10) from anchor shank (5).
6. Remove pin (11) from anchor shank (5).
7. Remove link (12) from anchor shank (5).

CLEAN STERN ANCHOR

WARNING



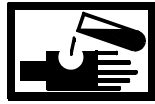
CHEMICAL



EYE PROTECTION

1. Using wiping rags soaked with cleaner, remove debris from all components.

 WARNING



CHEMICAL



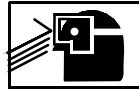
EYE PROTECTION

2. Using clean water, remove cleaner residue from all components.
3. Air dry all components.

 WARNING



CHEMICAL



EYE PROTECTION

4. Dispose of contaminated rags in accordance with local procedures.

INSPECT STERN ANCHOR

1. Inspect all components for cracks and breaks. Replace damaged items as necessary.
2. Inspect threaded components for damaged threads. Replace damaged items as necessary.

ASSEMBLE STERN ANCHOR

1. Position link (12) on anchor shank (5).
2. Install pin (11) in anchor shank (5).

 WARNING



HEAVY PARTS

3. Position fluke assembly (10) on anchor shank (5).
4. Install trunnion pin (9) in fluke assembly (10).
5. Install two washers (8), lockwashers (7) and capscrews (6) in trunnion pin (9).
6. Position shackle (4) on anchor shank (5).
7. Install bolt (3), nut (2) and new cotter pin (1) in shackle (4).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
STERN ANCHOR ROLLER
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Grease, Automotive and Artillery (Item 12, WP 0426 00)

Personnel Required

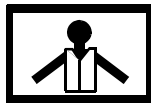
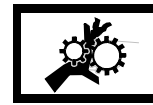
Engineer 88L

Equipment Condition

Stern Anchor Removed. (TM 55-1945-225-10)

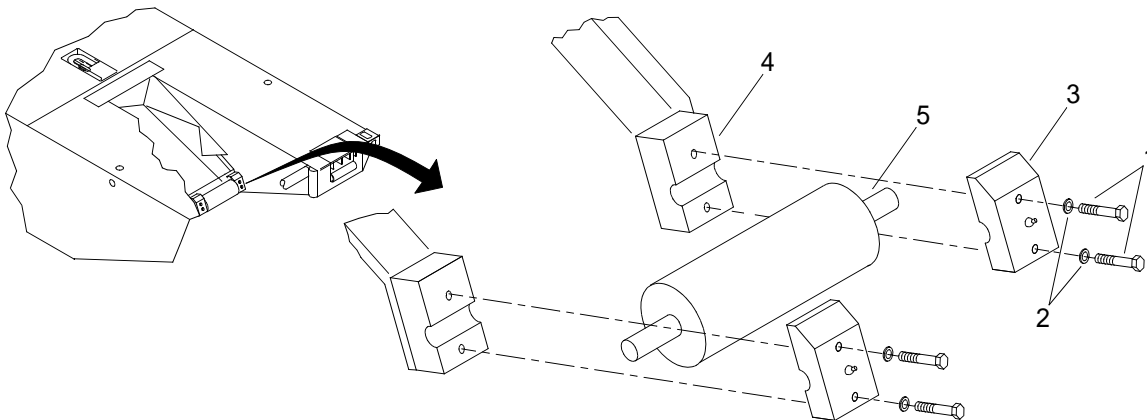
REMOVE STERN ANCHOR ROLLER

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Remove four bolts (1) and washers (2) securing upper pillow block halves (3) to lower pillow block halves (4).



2. Remove two upper pillow block halves (3).
3. Inspect upper pillow block halves (3) and bolts (1) and washers (2) for damage or wear that allows movement in roller (5). Replace damaged parts.

 WARNING



HEAVY OBJECTS

4. Remove anchor roller (5) and discard.

 WARNING



CHEMICAL



EYE PROTECTION

5. Clean old grease from upper pillow block halves (3) and lower pillow block halves (4).

INSTALL STERN ANCHOR ROLLER

 WARNING



CHEMICAL



EYE PROTECTION

1. Apply grease on upper pillow block halves (3) and lower pillow block halves (4).

 WARNING



HEAVY OBJECTS

2. Install new anchor roller (5) in lower pillow block halves (4).
3. Install upper pillow block halves (3) on lower pillow block halves (4).
4. Install four bolts (1) and washers (2) securing upper pillow block halves (3) to lower pillow block halves (4).
5. Tighten four bolts (1).
6. Install stern anchor. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
A-FRAME
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Plug, Ear (Item 181, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Qty 2
 Shackle, 3/4 in. 4.75 Ton (Item 25, WP 0425 00)
 Qty 2

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Rope, Fibrous (Item 32, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)
 Wedge, Wood (Item 49, WP 0426 00)
 Qty 2

Personnel Required

Seaman 88K (4)

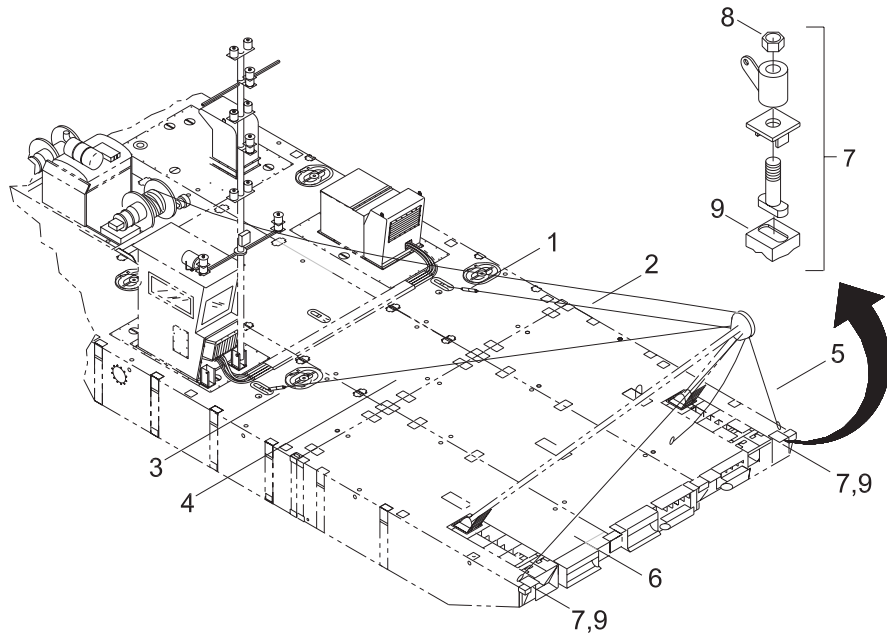
LOWER A-FRAME

WARNING

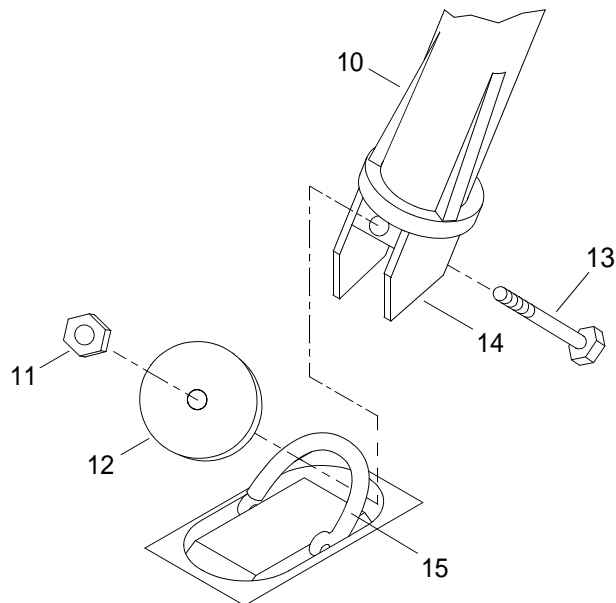
**EAR PROTECTION****VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Single hearing protection shall be used when the deck winches are in use. Failure to observe these precautions could result in serious injury or death.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Loosen turnbuckle (1) on port aft guy cable (2) and turnbuckle (3) on starboard aft guy cable (4) until enough slack is established to remove port forward guy cable (5) and starboard forward guy cable (6) from corner lug fittings (7).



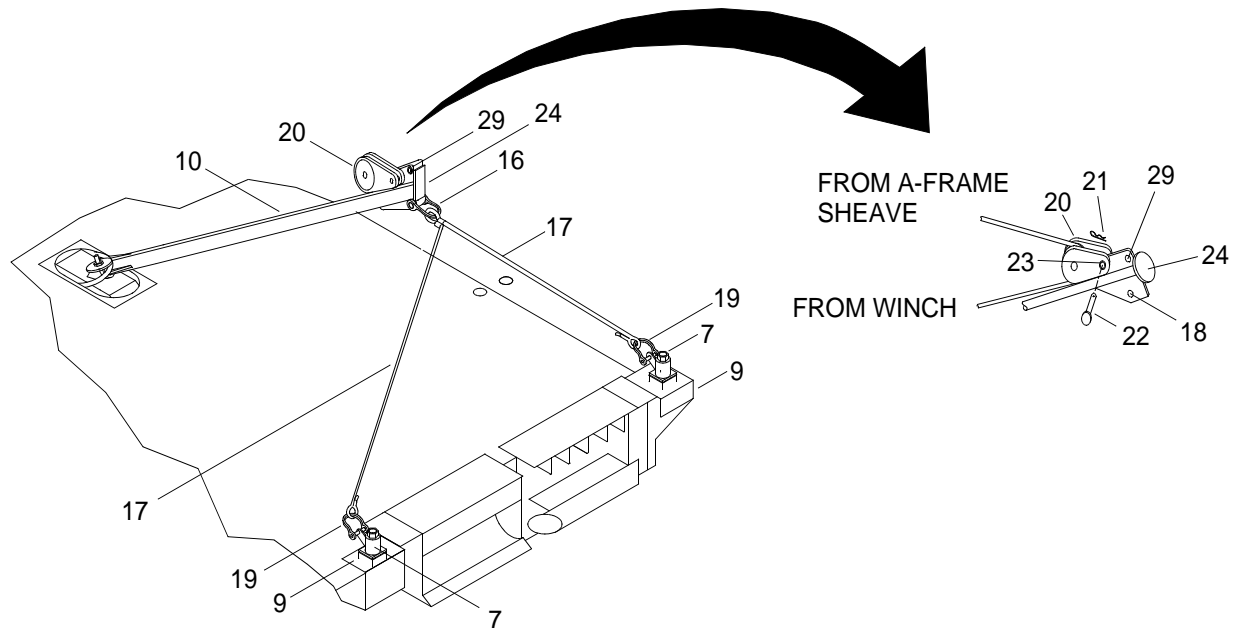
3. Loosen nuts (8) on corner fitting lug assemblies (7) enough to rotate corner fitting lug assemblies (7) 90° in outboard end rake ISO corners (9).
4. Remove two corner fitting lug assemblies (7) from two outboard end rake ISO corners (9).
5. Install elevating pole (10).
 - a. Remove nut (11), large washer plate (12) and bolt (13) from foot (14) of elevating pole (10).



WARNING

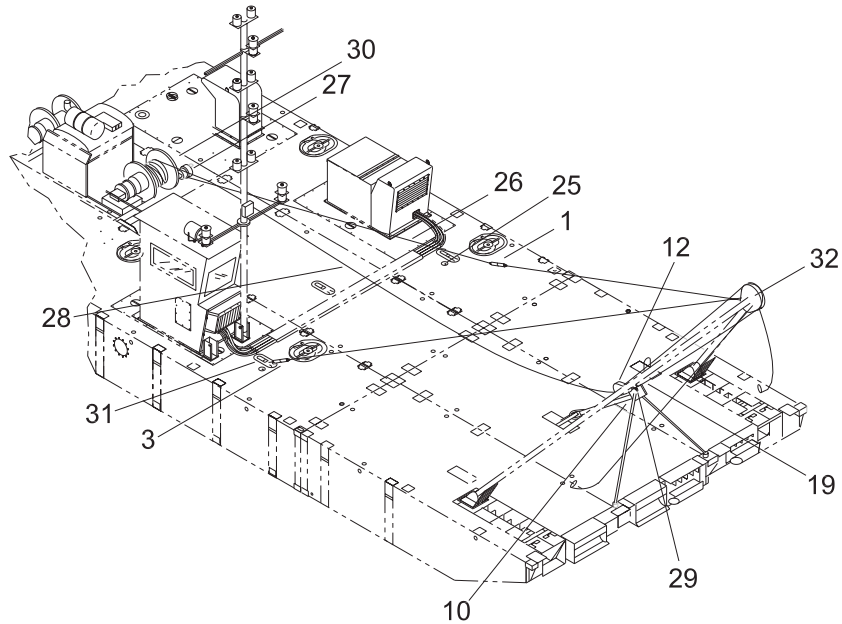
**HEAVY OBJECTS**

- b. Position elevating pole (10) into center rake module lifting lug shackle (15).
- c. Install bolt (13) through elevating pole foot (14) and shackle (15) and secure with washer plate (12) and nut (11). Tighten nut (11).
- d. Install two corner fitting lug assemblies (7) in center rake ISO corners (9), rotate assembly 90° and tighten nuts (8).
- e. Using shackle (16), attach top of elevating pole guy wire assembly (17) to forward shackle hole (18) of elevating pole (10).



- f. Using two shackles (19), attach legs of elevating pole guy wire assembly (17) to corner fitting lug assemblies (7).
6. Install 8 in. snatch block (20) on elevating pole (10).
 - a. Remove cotter pin (21) from retaining pin (22).
 - b. Position snatch block (20) in lower aft hole (23) of elevating pole head (24).
 - c. Install retaining pin (22) through snatch block (20) and elevating pole head (24).
 - d. Install cotter pin (21) in retaining pin (22).

7. Remove turnbuckle (1) from portside forward lifting lug (25).



8. Secure a 1 in. diameter nylon rope (26) between turnbuckle (1) and gypsy winch (27).
9. Secure forward winch drum wire (28) to upper eye (29) on top of elevating pole (10).
10. With slack in forward winch drum wire (28), capture it in snatch block (20) on elevating pole (10), entering snatch block (20) from bottom.
- Remove cotter pin (21) from retaining pin (22).
 - Remove retaining pin (22) from snatch block (20).
 - Open snatch block (20) and install forward drum wire (28).
 - Close snatch block (20).
 - Install retaining pin (22) in snatch block (20).
 - Install cotter pin (21) in retaining pin (22).

WARNING



HEAVY PARTS

Tension must be maintained on both gypsy winch nylon rope and forward drum winch wire to prevent A-frame from falling forward. Failure to comply will result in personnel injury and damage to equipment.

 WARNING



EAR PROTECTION

Single hearing protection shall be used when the deck winches are in use.

11. Using forward winch (30) and gypsy winch, draw up on both forward winch drum wire (28) and nylon rope (26) until both wire and rope are tight.
12. Remove turnbuckle (3) from starboard side forward lifting lug (31).

 WARNING

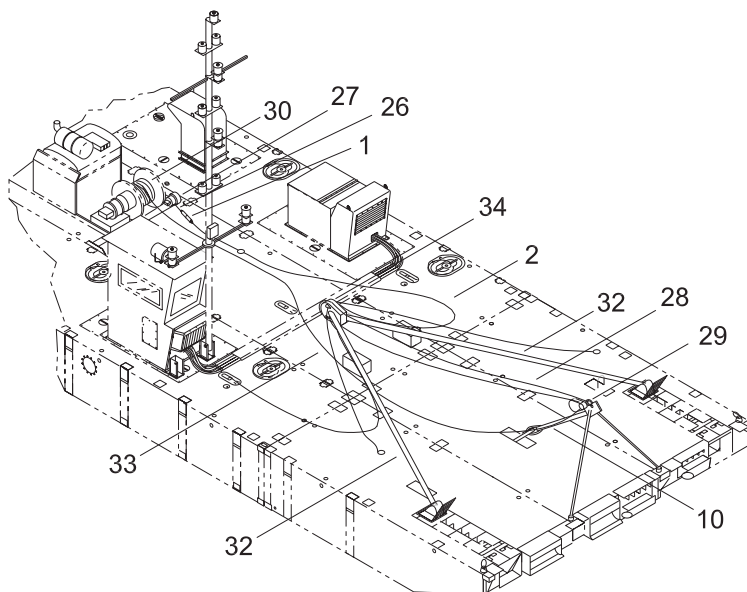


HEAVY PARTS

NOTE

The nylon rope and portside guy cable are primarily used to pull A-frame back past vertical. Once achieved, forward winch wire attached to elevating pole supports weight of A-frame until it is lowered to deck.

13. Using both winches (27, 30), slowly take in nylon rope (26) while letting out winch drum wire (28) until A-frame (32) is levered backwards and lowered towards deck.



14. Place large wooden blocks (33) beneath A-frame (32) to protect sheave (34).

 WARNING



HEAVY PARTS

15. Finish lowering A-frame (32) until legs of A-frame (32) rest on wooden blocks (33).
16. Back off on gypsy winch (27) to remove nylon rope (26) from turnbuckle (1).
17. Stow nylon rope (26) on gypsy winch (27).

 WARNING

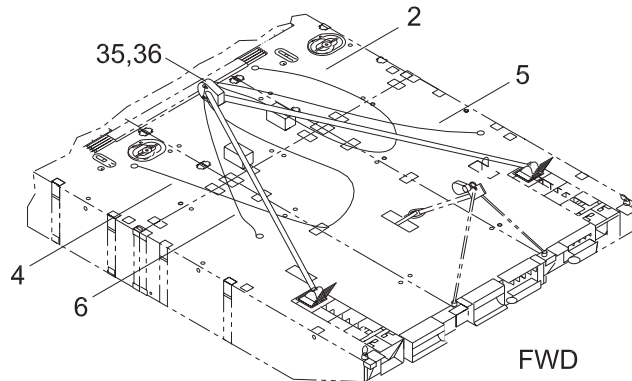


HEAVY PARTS

18. Back off on forward winch (30) to remove forward winch drum wire (28) from end to upper eye (29) on top of elevating pole (10).
19. Stow drum wire (28) on forward winch (30).

DISASSEMBLE A-FRAME

1. Remove four shackles (35) securing guy cables (2, 4, 5 and 6) to eyes on A-frame heads (36).



 WARNING

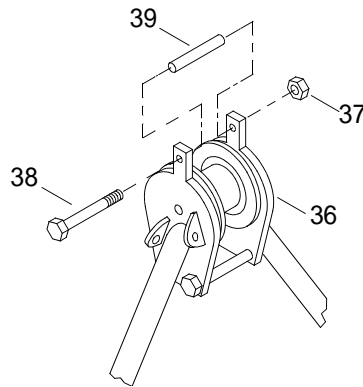


HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

2. Using crane, sling and shackles, separately remove four guy cables (2, 4, 5 and 6).

3. Remove slings and shackles.
4. Remove nut (37), bolt (38) and upper spacer (39) from between A-frame heads (36).

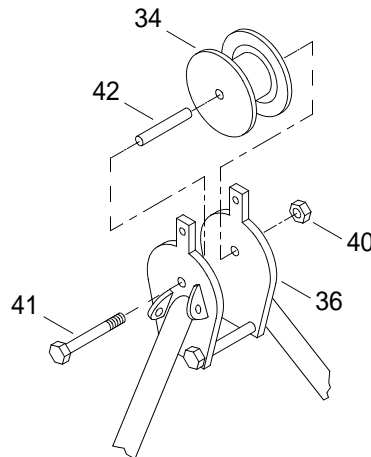


WARNING



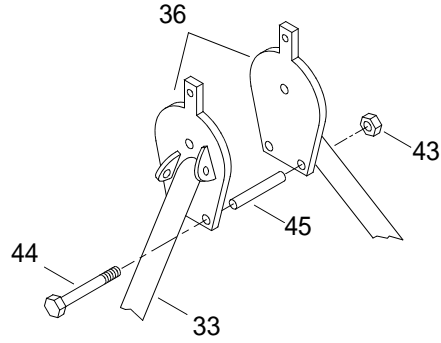
HEAVY PARTS

5. Supporting weight of sheave (34) with crane and sling, remove nut (40) and bolt (41).

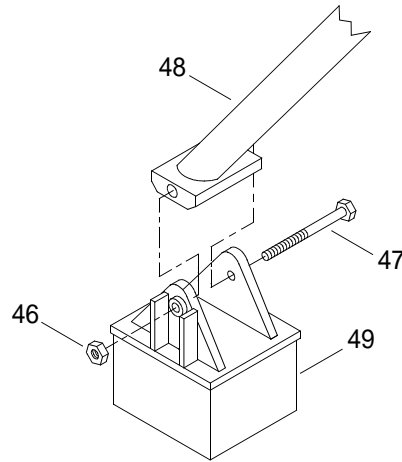


6. Remove sheave (34) with bushing (42) from between A-frame heads (36).
7. Remove bushing (42) from sheave (34).
8. Remove sling from sheave (34).

9. Remove two nuts (43), bolts (44) and lower spacers (45) from between A-frame heads (36).



10. Remove two nuts (46) and bolts (47) securing two A-frame legs (48) to two foot assemblies (49).



WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

11. Using crane, slings and shackles, separately remove two A-frame legs (48).
12. Remove slings and shackles.

 WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

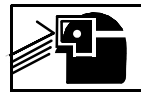
13. Using crane, sling and shackle, separately remove foot assemblies (49).
14. Remove sling and shackle.

CLEAN A-FRAME COMPONENTS

 WARNING



CHEMICAL



EYE PROTECTION

1. Using cleaner and wiping rags, remove debris from all components.

 WARNING



EYE PROTECTION

2. Use a wire brush to remove any surface corrosion as required.

 WARNING



CHEMICAL



EYE PROTECTION

3. Use clean water to rinse cleaner residue from components.

 WARNING



CHEMICAL



EYE PROTECTION

4. Dispose of contaminated wiping rags in accordance with local procedures.

INSPECT A-FRAME COMPONENTS**NOTE**

Repair is limited to replacement of damaged components.

1. Inspect all assembly nuts and bolts, shackles and turnbuckles for thread damage. Replace as necessary.
2. Inspect guys for frayed or damaged wires. Replace as necessary. (WP 0394 00)
3. Inspect spacers, sheave, foot assemblies and leg assemblies for bent or damaged areas. Replace as necessary.

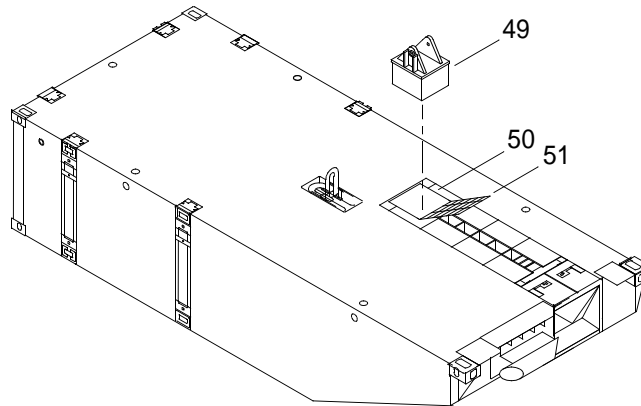
ASSEMBLE A-FRAME

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

1. Using crane, sling and shackle, separately install two A-frame foot assemblies (49) in forward flexor wells (50).



- a. Lift grate coverings (51) over forward outboard flexor wells (50).
- b. Install foot assembly (49) into flexor well (50).
- c. Remove slings and shackles.

 WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

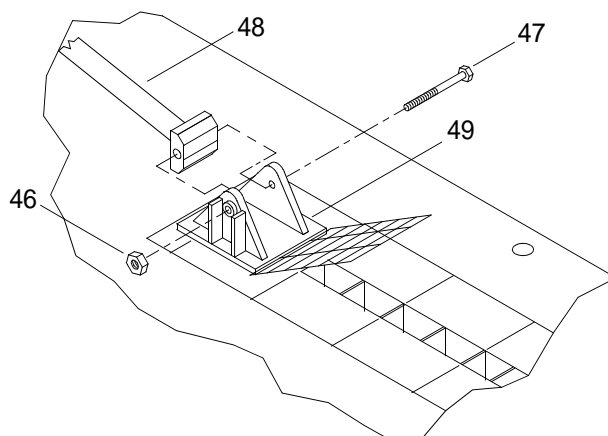
- Using crane, slings and shackles, separately place A-frame legs (48) on WT deck, supporting A-frame heads (36) on wooden blocks (33).

 WARNING

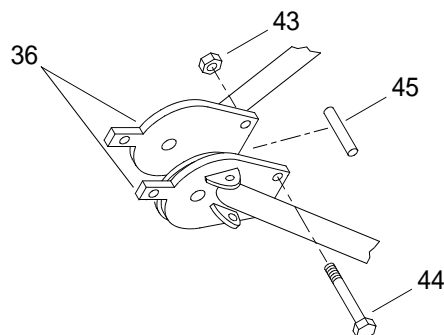


HEAVY PARTS

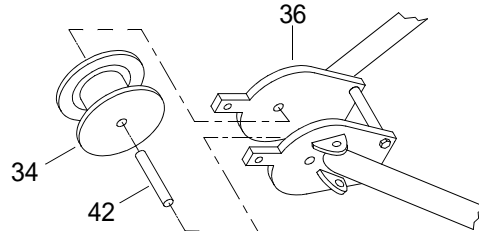
- Finish lowering A-frame leg (48) until lower end is positioned in A-frame foot assembly (49).



- Install bolt (47) into foot assembly (49) and A-frame leg (48).
- Install nut (46) on bolt (47) and finger tighten.
- Remove slings and shackles.
- Position two lower spacers (45) between A-frame heads (36) and install bolt (44) and nut (33) finger tight.



8. Install sheave bushing (42) into sheave (34).



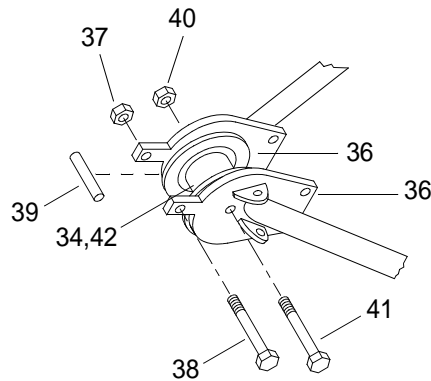
WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

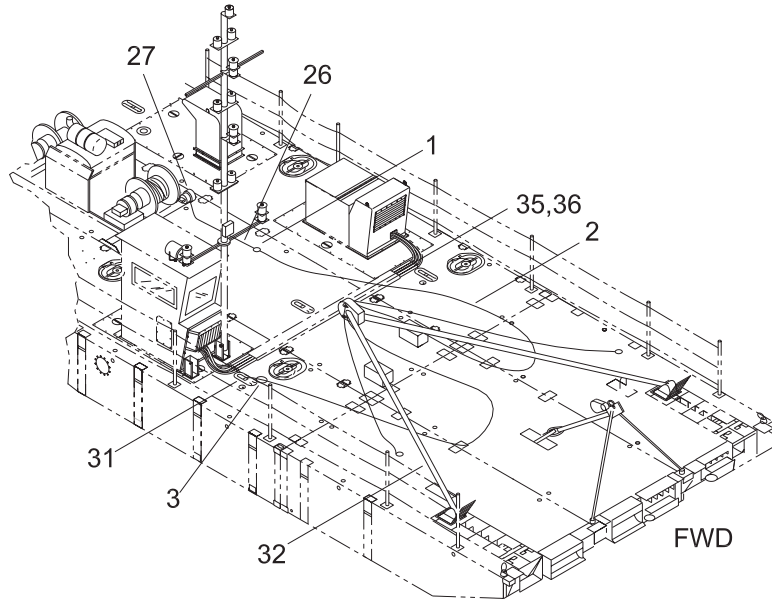
9. Using crane and sling, position sheave (34) with bushing (42) between A-frame heads (36) and install bolt (41) and nut (40) finger tight.



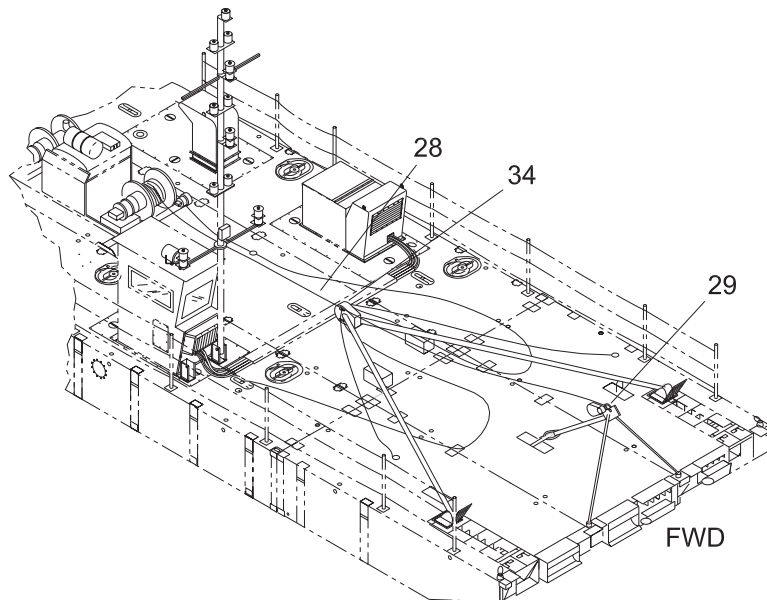
10. Position upper spacer (43) between A-frame heads (36) and install bolt (38) and nut (37) finger tight.
11. Tighten A-frame leg nuts (46) and A-frame head nuts (37, 40 and 43), then tighten each an additional 1/3 turn (120°).
12. Remove sling from sheave (34).

ELEVATE A-FRAME

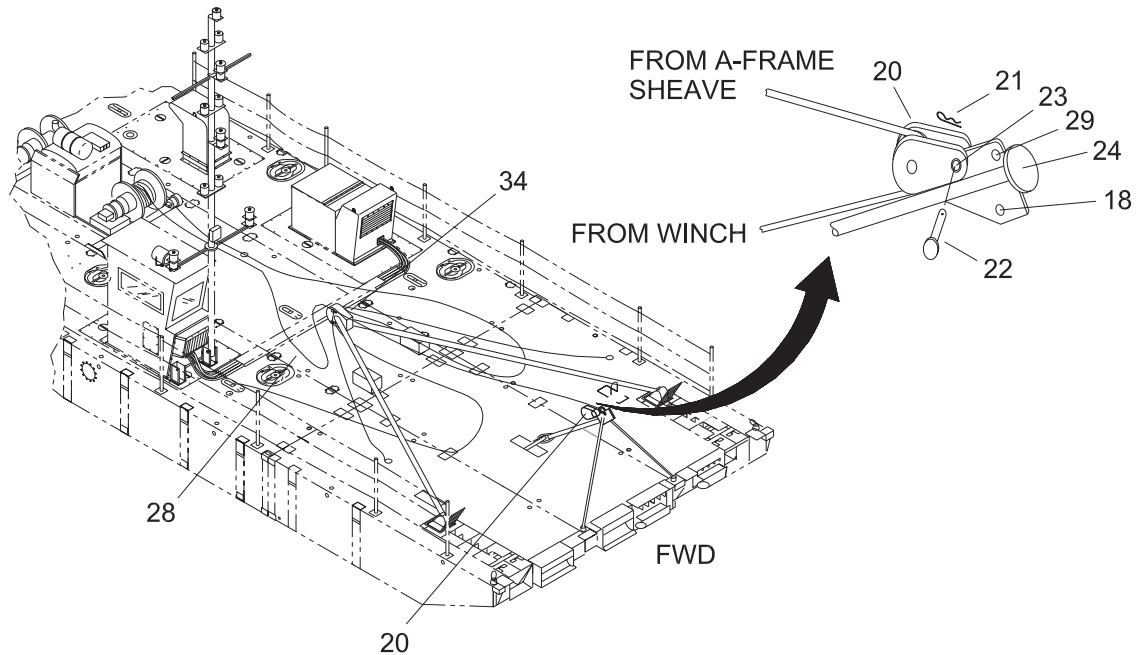
1. Install four shackles (35) to secure four guy cables (2, 4, 5 and 6) to eyes on A-frame heads (36).
2. Secure turnbuckle (3) and starboard guy cable (4) to starboard propulsion module forward lifting lug (31).
3. Secure a 1 in. diameter nylon rope (26) to turnbuckle (1) of port after guy assembly (2) and route to gypsy winch (27) to be tended as a preventer line while elevating A-frame (32).



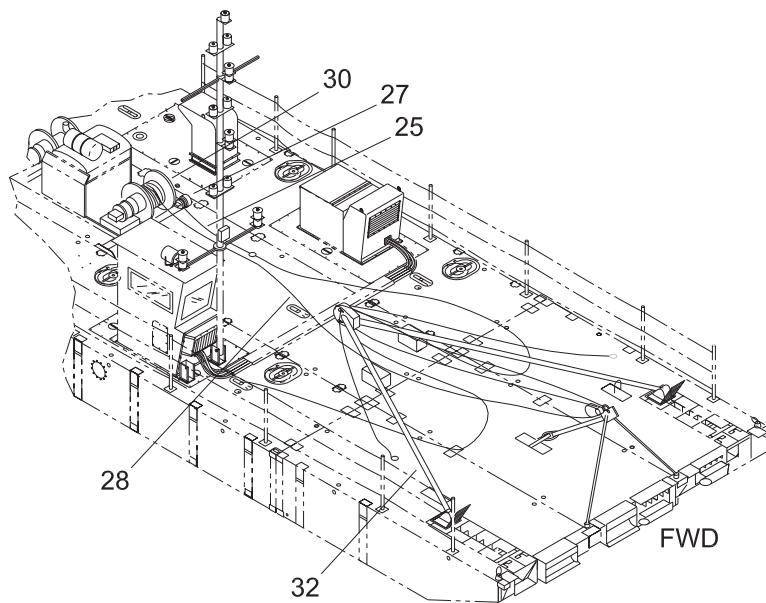
4. Lead forward winch drum cable (28) over A-frame sheave (34) to elevating pole upper eye (29) and secure it.



5. Take a bight of forward winch drum (28) under A-frame sheave (34) and capture it in 8 in. elevating pole snatch block (20).



- a. Remove cotter pin (21) from retaining pin (22).
- b. Holding snatch block (20), remove retaining pin (22).
- c. Loop forward winch drum wire (28) on snatch block (20) with end from forward winch (30) entering snatch block (20) from bottom.



- d. Close snatch block (20) and install retaining pin (22).
- e. Install cotter pin (21).

 WARNING



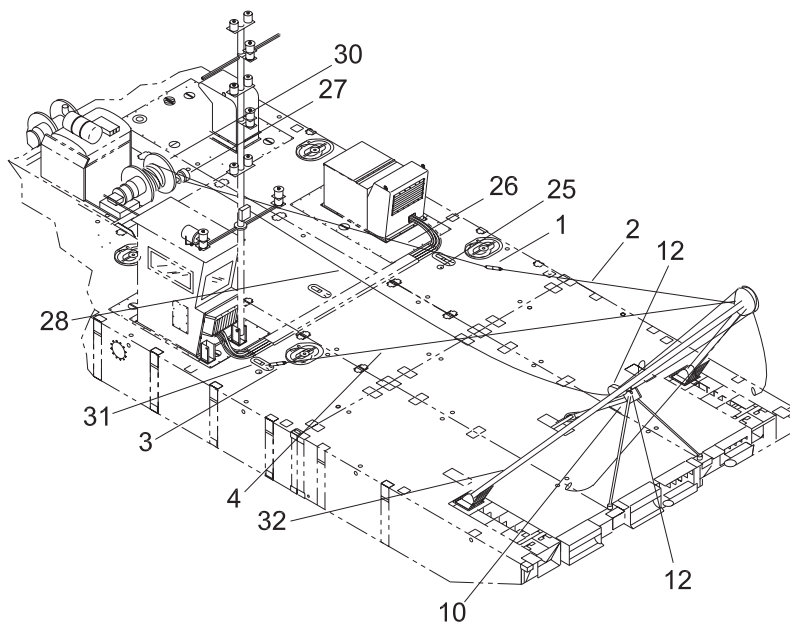
HEAVY PARTS



EAR PROTECTION

Single hearing protection shall be used when the deck winches are in use.

6. Using forward winch (30), haul on forward winch drum wire (28) to raise A-frame (32).



7. Tend preventer rope (26) on gypsy winch (27) as A-frame (32) is raised and passes through vertical position.

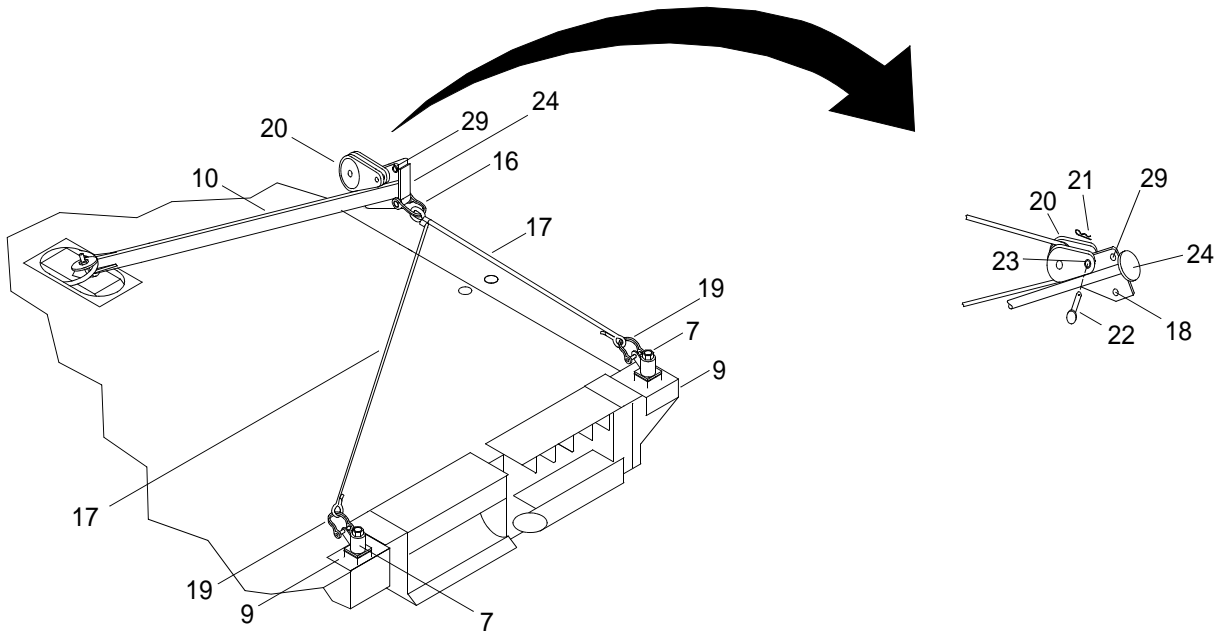
 WARNING



HEAVY PARTS

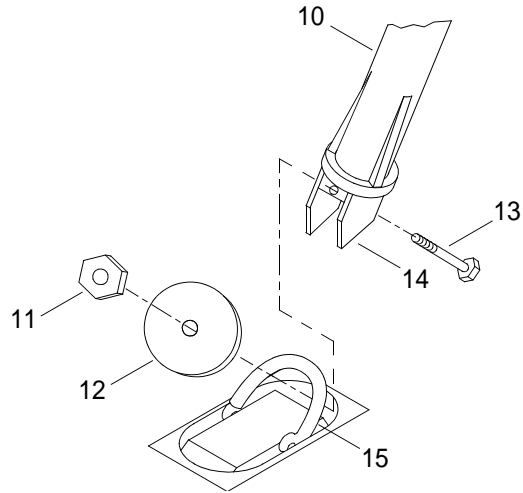
8. Lower A-frame (32) into operating position (approximately 60° past vertical) until it is supported by starboard aft guy cable (4).
9. Remove preventer rope (26) from port aft guy cable (2).
10. Install turnbuckle (1) and port aft guy cable (2) to port propulsion module forward lifting lug (25).

11. Remove elevating pole (10) and snatch block (20).



- a. Remove 8 in. snatch block (20) from elevating pole (10).
 - {1} Remove cotter pin (21) from retaining pin (22).
 - {2} Remove retaining pin (22) from snatch block (20) and elevating pole head (24).
 - {3} Open snatch block (20) and remove forward winch drum wire (28).
 - {4} Remove snatch block (20) from elevating pole head (24).
 - {5} Install retaining pin (22) in snatch block (20).
 - {6} Install cotter pin (21) in retaining pin (22).
 - {7} Stow snatch block (20).
- b. Remove guy wire assembly (17) shackles (16, 19) from elevating pole (10) and two corner fitting lug assemblies (7).
- c. Stow guy wire assembly (17) and shackles (16, 19).
- d. Loosen two nuts (8) enough to rotate corner fitting lug assemblies (7) 90° in center rake ISO corners (9).
- e. Remove corner fitting lug assemblies (7) from center rake ISO corners (9).

- f. Remove nut (11), large washer plate (12) and bolt (13) from foot (14) of elevating pole (10).



WARNING



HEAVY OBJECTS

- g. Remove elevating pole (10) from center rake module lifting lug shackle (15).
- h. Install bolt (13), washer plate (12) and nut (11) into elevating pole foot (14). Tighten nut (11)

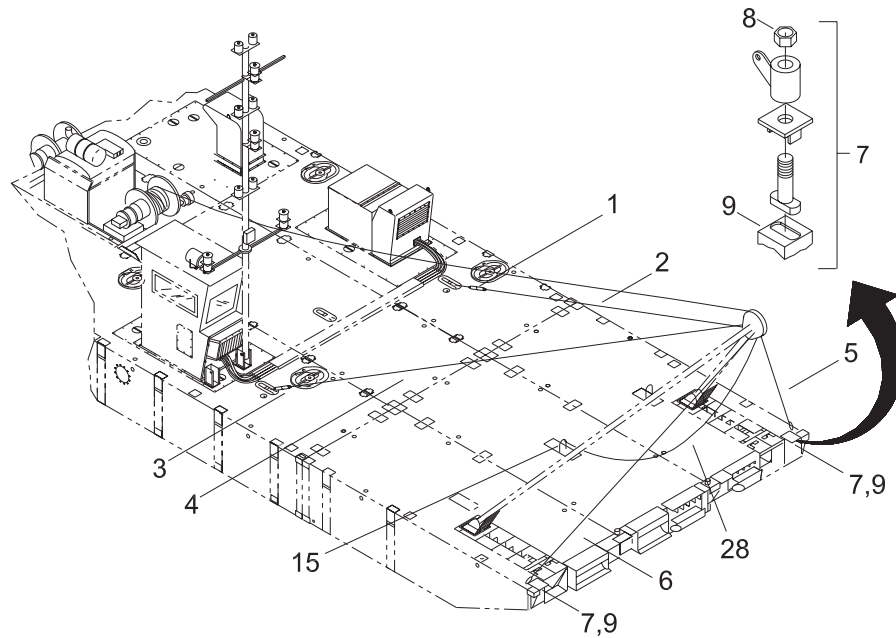
WARNING



HEAVY OBJECTS

- i. Remove elevating pole (10) and stow it.

12. Install two corner fitting lug assemblies (7) in two outboard end rake ISO corners (9), rotate them 90° and tighten nuts (8).



13. Secure A-frame forward guy wires (2, 4) to corner fitting lug assemblies (7).
14. Remove slack from A-frame guy wires (2, 4) by tightening turnbuckles (1, 3) until taut. Balance tension between port and starboard, until no slack is present.
15. Attach forward winch drum wire (28) to end rake center module lifting shackle (15).

WARNING



HEAVY PARTS



EAR PROTECTION

Single hearing protection shall be used when the deck winches are in use.

16. Using forward winch (30), remove slack on A-wire (28) and make taut.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BELOW DECK LIGHTING FLUORESCENT BULBS
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Bulb, Fluorescent

Personnel Required

Engineer 88L

References

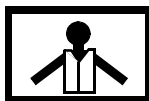
TM 55-1945-225-10

Equipment Condition

Engine Power Isolated. (WP 0075 00)

REMOVE FLUORESCENT BULB

WARNING



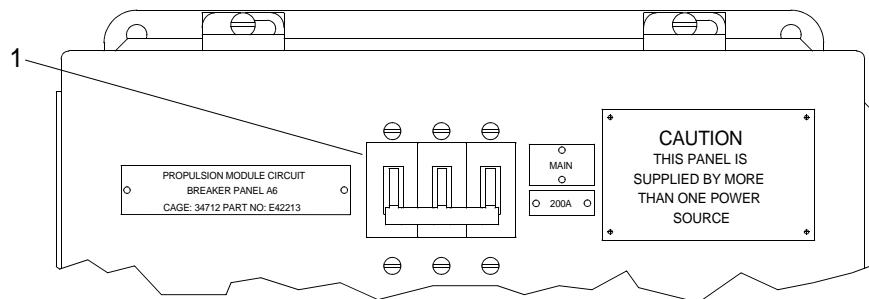
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

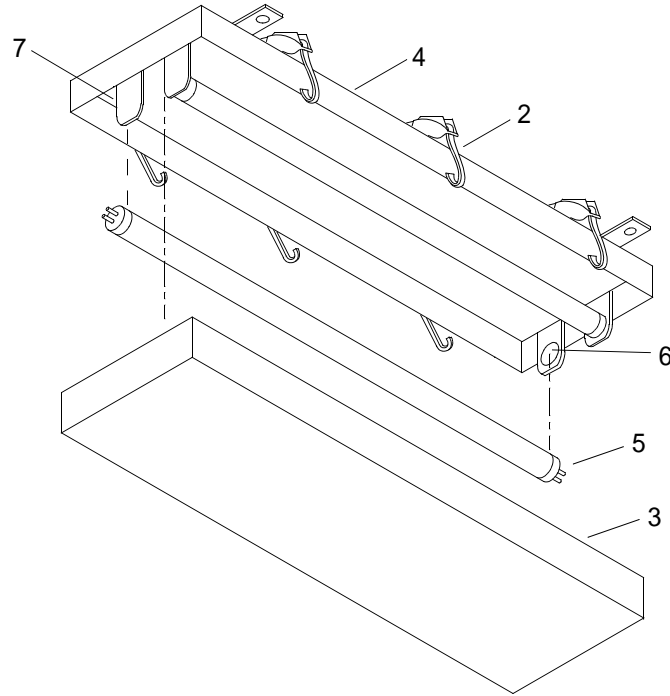
NOTE

This task is typical for removal and installation of below deck lighting fluorescent bulbs.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



2. Unlatch clamps (2) securing light fixture lens (3) to light fixture (4).



3. Remove light fixture lens (3) from light fixture (4).
4. Holding fluorescent bulb (5) near both ends, slowly push in on fluorescent bulb (5) towards spring-loaded receptacle (6) to free opposite contacts of fluorescent bulb (5) from fixed receptacle (7).
5. Remove fluorescent bulb (5) from spring-loaded receptacle (6).
6. Discard fluorescent bulb (5).

INSTALL FLUORESCENT BULB

1. Holding new fluorescent bulb (5) near both ends, position contacts of fluorescent bulb (5) into spring-loaded receptacle (6).
2. Slowly push in on fluorescent bulb (5) towards spring-loaded receptacle (6) until spring-loaded receptacle (6) is depressed.
3. Align opposite contacts of fluorescent bulb (4) with fixed receptacle (7) and allow spring-loaded receptacle (6) to push fluorescent bulb (5) into fixed receptacle (7).
4. Position light fixture lens (3) on light fixture (4) and secure with clamps (2).
5. Perform operational check of below deck lighting. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BELOW DECK LIGHTING FLUORESCENT LIGHT FIXTURE
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)

Materials/Parts

Light Fixture, Fluorescent
PN E42028

Personnel Required

Engineer 88L

References

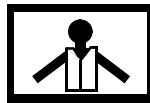
TM 55-1945-225-10

Equipment Condition

Below Deck Lighting Fluorescent Bulbs Removed. (WP 0371 00)

REMOVE FLUORESCENT LIGHT FIXTURE

WARNING



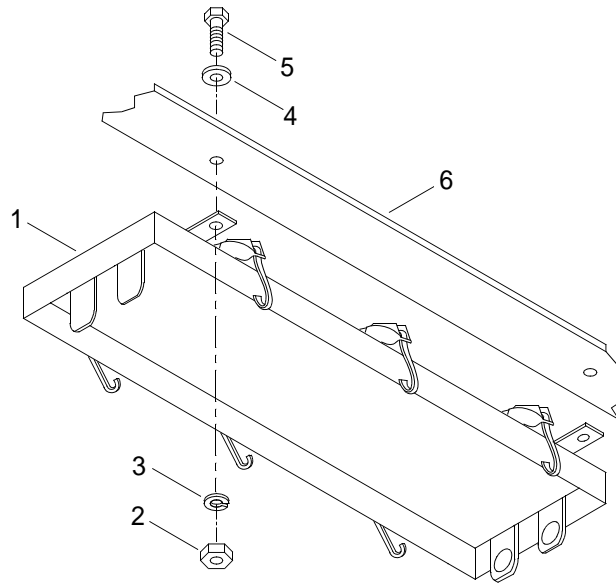
VEST

All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death to personnel.

NOTE

This task is typical for removal and installation of below deck lighting fluorescent light fixtures.

1. Tag and disconnect electrical wiring from fluorescent light fixture (1).



2. Remove hex head nuts (2), lockwashers (3), flat washers (4) and hex head capscrews (5) securing fluorescent light fixture (1) to mounting structure (6).
3. Discard fluorescent light fixture (1).

INSTALL FLUORESCENT LIGHT FIXTURE

1. Position new fluorescent light fixture (1) on mounting structure (6).
2. Install hex head capscrews (5), flat washers (4), lockwashers (3) and hex head nuts (2) to secure fluorescent light fixture (1) on mounting structure (6). Tighten hex head nuts (2).
3. Connect electrical wiring to fluorescent light fixture (1) and remove tags.
4. Install below deck lighting fluorescent bulbs. (WP 0371 00)
5. Perform operational check of below deck lighting. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ENGINE SPACES LIGHTS SWITCHBOX ASSEMBLY A10
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

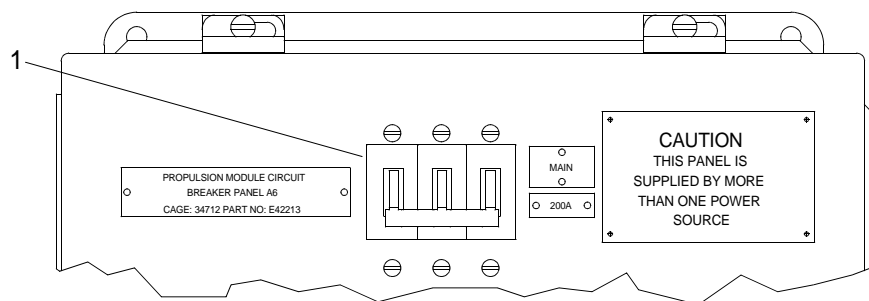
Equipment Condition

Engine Power Isolated. (WP 0075 00)

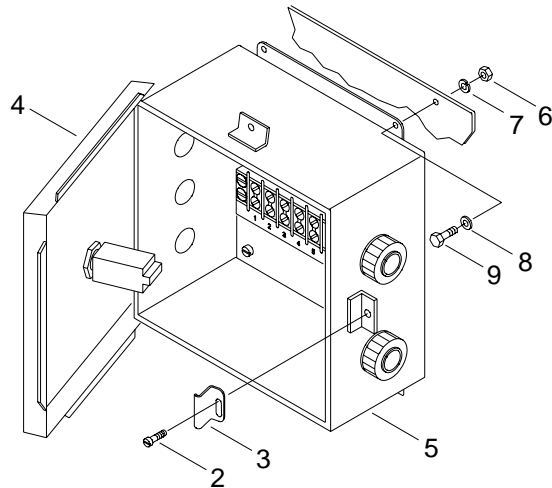
REMOVE ENGINE SPACES LIGHTS SWITCHBOX ASSEMBLY A10**NOTE**

This task is typical for the removal and installation of the lights switchbox assembly A10.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



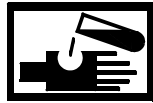
- Loosen screws (2) to pivot cover clamps (3) free.



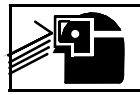
- Open enclosure cover (4).
- Tag and disconnect all external electrical wiring to lights switchbox assembly A10 (5).
- Remove hex head nuts (6), lockwashers (7), flat washers (8) and hex head capscrews (9) lights securing switchbox assembly A10 (5) to mounting structure.
- Remove lights switchbox assembly A10 (5).

INSTALL ENGINE SPACES LIGHTS SWITCHBOX ASSEMBLY A10

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to capscrews (9).
- Position lights switchbox assembly A10 (5) on mounting structure.
- Install hex head nuts (6), lockwashers (7), washers (8) and hex head capscrews (9) to secure lights switchbox assembly A10 (5) to mounting structure. Tighten hex head nuts (6).
- Connect all external wiring to lights switchbox assembly A10 (5) and remove tags.
- Close enclosure cover (4), pivot clamps (3) over lip of enclosure cover (4) and tighten screws (2).
- Perform operational check of below deck lighting. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ENGINE SPACE LIGHTS SWITCHBOX ASSEMBLY A10
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

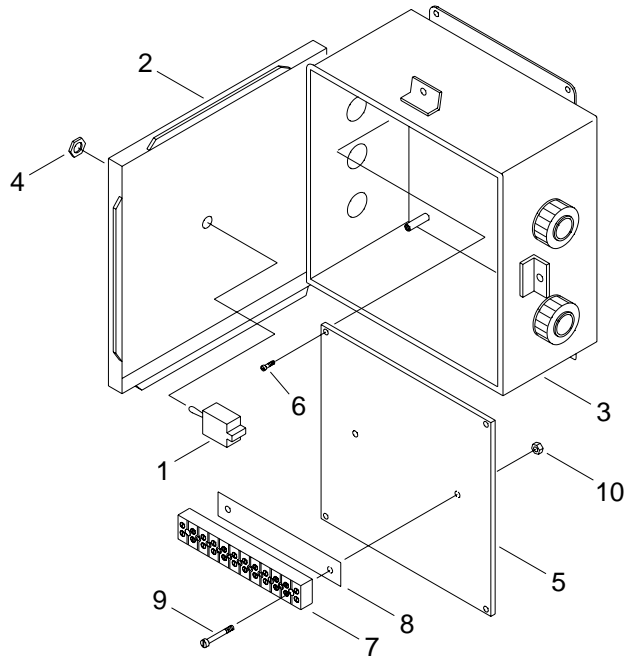
Engine Space Lights Switchbox Assembly Removed. (WP 0373 00)

DISASSEMBLE ENGINE SPACES LIGHTS SWITCHBOX ASSEMBLY A10**NOTE**

This task is typical for the removal, cleaning, inspection, repair and installation of components on the lights switchbox assembly A10.

Repair is limited to the replacement of damaged parts.

1. Remove toggle switch (1) from enclosure cover (2) of lights switchbox assembly A10 (3).



- a. Remove hex nut (4) securing toggle switch (1) to enclosure cover (2).
 - b. Remove toggle switch (1) from enclosure cover (2).
2. Remove panel (5) from lights switchbox assembly A10 (3).
 - a. Remove pan head screws (6) securing panel (5) to lights switchbox assembly A10 (3).
 - b. Remove panel (5) from lights switchbox assembly A10 (3).
 3. Remove terminal block (7) and marker strip (8) from panel (5).
 - a. Remove pan head screws (9) and insert nuts (10) securing terminal block (7) and marker strip (8) to panel (5).
 - b. Remove terminal block (7) and marker strip (8) from panel (5).

CLEAN ENGINE SPACES LIGHTS SWITCHBOX ASSEMBLY A10

1. Clean lights switchbox assembly A10 interior and exterior surfaces with a clean wiping rag.

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING

**CHEMICAL****EYE PROTECTION****VAPOR**

3. Dispose of contaminated wiping rags per local procedures.

INSPECT ENGINE SPACES LIGHTS SWITCHBOX ASSEMBLY A10

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE ENGINE SPACES LIGHTS SWITCHBOX ASSEMBLY A10

1. Install terminal block (7) and marker strip (8) on panel (5).
 - a. Position terminal block (7) and marker strip (8) on panel (5).
 - b. Install pan head screws (9) and insert nuts (10) to secure terminal block (7) and marker strip (8) to panel (5). Tighten insert nuts (10).
2. Install panel (5) in lights switchbox assembly A10 (3).
 - a. Position panel (5) in lights switchbox assembly A10 (3).
 - b. Install pan head screws (6) to secure panel (5) in lights switchbox assembly A10 (3).
3. Install toggle switch (1) in enclosure cover (2).
 - a. Position toggle switch (1) in enclosure cover (2).
 - b. Install hex nut (4) to secure toggle switch (1) to enclosure cover (2). Tighten hex nut (4).
4. Install engine space lights switchbox assembly. (WP 0373 00)
5. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LAZARET LIGHTS SWITCHBOX ASSEMBLY A11
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Adhesive (Item 2, WP 0426 00)

Personnel Required

Engineer 88L

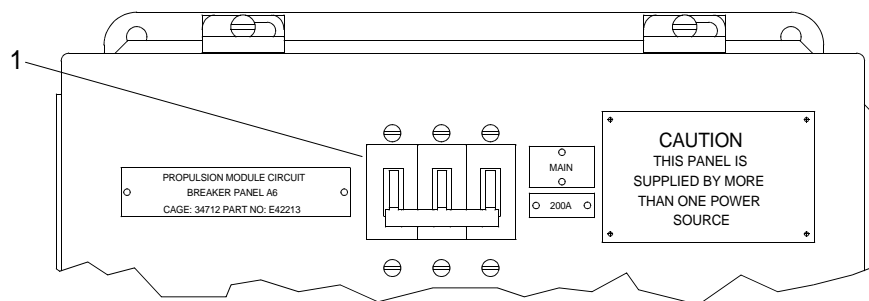
References

TM 55-1945-225-10

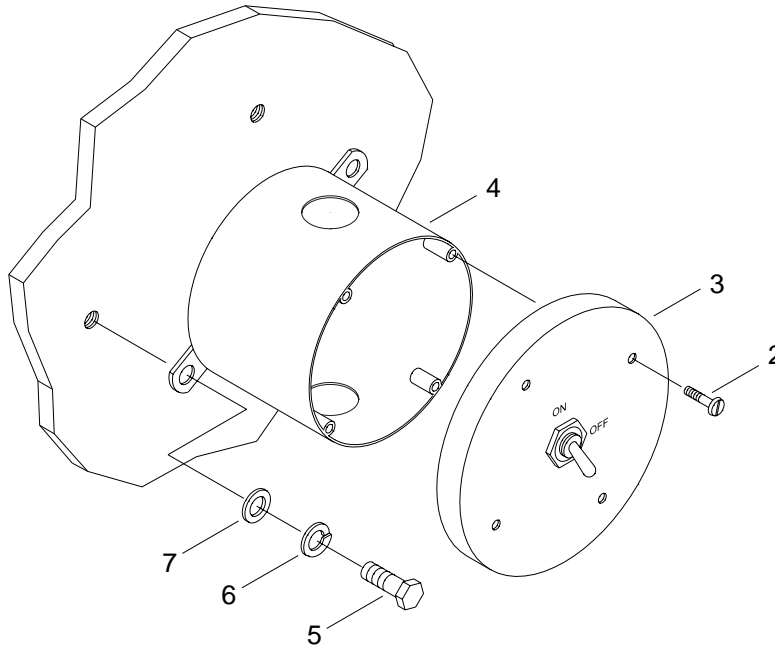
REMOVE LIGHTS SWITCHBOX ASSEMBLY A11**NOTE**

This task is typical for the removal and installation of the lights switchbox assembly A11.

1. Verify MAIN circuit breaker (1) on propulsion module circuit breaker panel A6 is off.



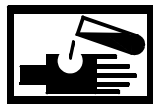
- Remove screws (2) securing cover (3) to lights switchbox assembly A11 (4).



- Remove cover (3).
- Tag and disconnect all external electrical wiring to lights switchbox assembly A11 (4).
- Remove hex head capscrews (5), lockwashers (6), flat washers (7) securing lights switchbox assembly A11 (4) to mounting structure.
- Remove lights switchbox assembly A11 (4).

INSTALL LIGHTS SWITCHBOX ASSEMBLY A11

WARNING



CHEMICAL



EYE PROTECTION

- Apply adhesive to hex head capscrews (5).
- Position lights switchbox assembly A11 (4) on mounting structure.
- Install hex head capscrews (5), lockwashers (6), and flat washers (7) to secure lights switchbox assembly A11 (4) to mounting structure. Tighten hex head capscrews (5).
- Connect all external wiring to lights switchbox assembly A11 (4) and remove tags.
- Position cover (3) on lights switchbox assembly A11 (4).
- Install screws (2) to secure cover (3) to lights switchbox assembly A11 (4). Tighten screws (2).
- Perform operational check of below deck lighting. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
LAZARET LIGHTS SWITCHBOX ASSEMBLY A11
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Isopropyl Alcohol, Technical (Item 17, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

References

TM 55-1945-225-10

Equipment Condition

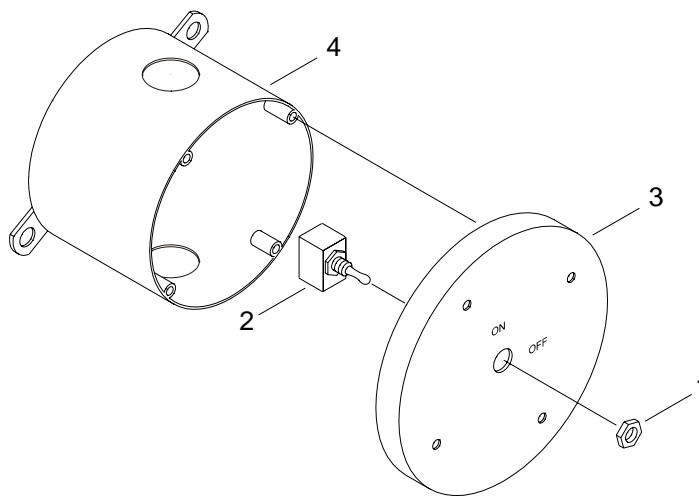
Lazaret Lights Switchbox Assembly A11 Removed. (WP 0375 00)

DISASSEMBLE LIGHTS SWITCHBOX ASSEMBLY A11**NOTE**

This task is typical for the removal, cleaning, inspection, repair and installation of components on the lights switchbox assembly A11.

Repair is limited to the replacement of damaged parts.

1. Remove hex nut (1) securing toggle switch (2) to cover (3) of lights switchbox assembly A11 (4).



-
2. Remove toggle switch (2) from cover (3).
 3. Remove toggle switch (1) from enclosure cover (2).

CLEAN LIGHTS SWITCH BOX ASSEMBLY A11

1. Clean lights switchbox assembly A11 interior and exterior surfaces with a clean wiping rag.

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

2. Remove foreign substances from electrical components with isopropyl alcohol and a clean wiping rag. Allow to air dry prior to installation.

WARNING



CHEMICAL



EYE PROTECTION



VAPOR

3. Dispose of contaminated wiping rags per local procedures.

INSPECT LIGHTS SWITCHBOX ASSEMBLY A11

1. Inspect for bent, loose or broken contacts, stripped threads or damaged parts. Replace damaged parts.
2. Inspect wiring for damage. Repair/replace as required. (WP 0397 00)

ASSEMBLE LIGHTS SWITCHBOX ASSEMBLY A11

1. Position toggle switch (2) on cover (3).
2. Install hex nut (1) to secure toggle switch (2) on cover (3) of lights switchbox assembly A11 (4).
3. Install lazaret lights switchbox assembly A11. (WP 0375 00)
4. Perform operational check of electrical system. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SIDE FENDER ASSEMBLY
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
 Qty 2
 Crowbar (Item 4, WP 0425 00)
 Hammer, Hand, (10 lb Sledge) (Item 12, WP 0425 00)
 Shackle, 1/2 in. 2 Ton (Item 24, WP 0425 00)
 Qty 2

Materials/Parts

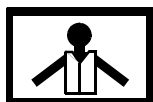
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Adhesive (Item 2, WP 0426 00)

Personnel Required

Seaman 88K (2)

REMOVE SIDE FENDER ASSEMBLY

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS



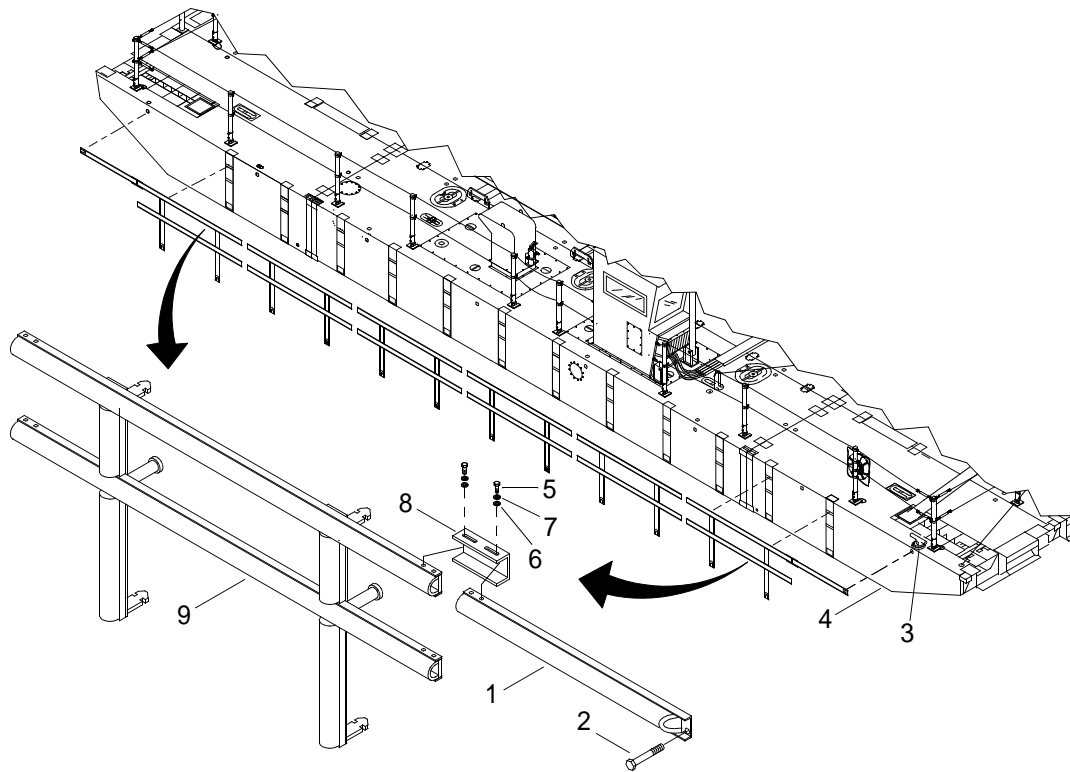
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for removal and installation of side fender assemblies.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Using crane, sling and shackles, support forward side fender (1) during removal.



NOTE

Turn tube stanchions, deck cleats or D-ring fittings may be used to secure outboard end of side fenders.

3. Remove bolt (2) securing forward end of forward side fender (1) to turn tube fitting (3) in side of end rake (4).
4. Remove four capscrews (5), four washers (6), four lockwashers (7) and connector (8) securing forward side fender (1) to forward most side fender assembly (9).

WARNING



HEAVY PARTS

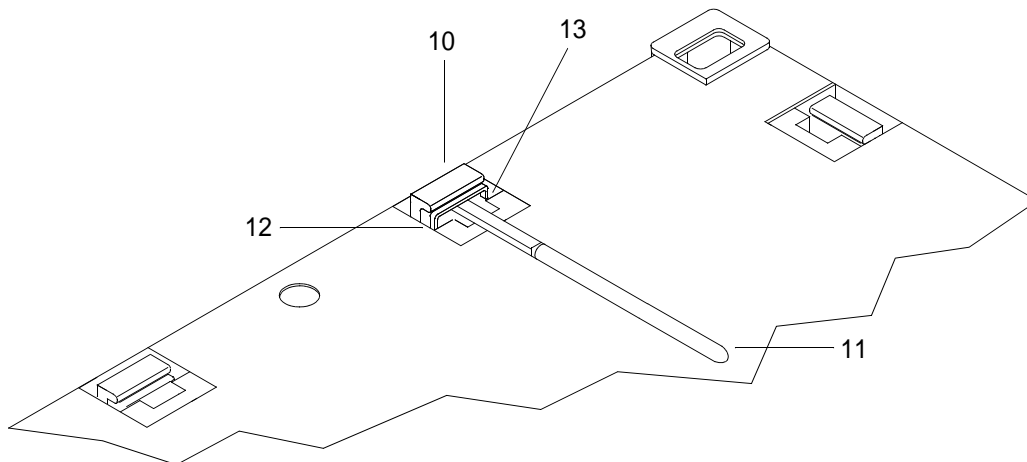
Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

5. Using crane, slings and shackles, remove forward side fender (1).
6. Remove slings and shackles from forward side fender (1).
7. Install bolt (2) in turn tube fitting (3).
8. Repeat steps 1 through 6 for aft side fender.
9. Using crane, slings and shackles, support side fender assembly (9) during removal.
10. Raise guillotine connectors (10).

NOTE

These steps are typical for raising guillotine connectors.

- a. Insert crowbar (11) behind spring bar (12) under guillotine connector (10).



- b. Rotate crowbar (11) downward to clear spring bar (12) from deck overhangs (13) and allow guillotine connectors (10) to move upward.
- c. Raise guillotine connector (10) approximately 6 in. until it stops.
- d. Remove crowbar (11).

WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

11. Using crane, slings and shackles, remove side fender assembly (9) on side of WT.
12. Using a sledge hammer, drive guillotine connectors (10) down.
13. Remove slings and shackles from side fender assembly (9).
14. Repeat steps 8 through 13 for remaining side fender assemblies (9).

INSTALL SIDE FENDER ASSEMBLY

1. Raise guillotine connectors (10).

NOTE

These steps are typical for raising guillotine connectors.

- a. Insert crowbar (11) behind spring bar (12) under guillotine connector (10).

- b. Rotate crowbar (11) downward to clear spring bar (12) from deck overhangs (13) and allow guillotine connector (10) to move upward.
- c. Raise guillotine connector (10) approximately 6 in. until it stops.
- d. Remove crowbar (11).

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

2. Using crane, slings and shackles, position side fender assembly (9) on side of WT and align with top and bottom guillotine connectors (10).
3. Using a sledge hammer, drive guillotine connectors (10) down to connect side fender assembly (9) on side of WT.
4. Remove slings and shackles from side fender assemblies (9).
5. Repeat steps 1 thru 4 for remaining side fender assemblies (9).

WARNING

**HEAVY PARTS**

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

6. Using crane, slings and shackles, separately position forward/aft side fenders (1) on side of WT.
7. Connect forward/aft side fender (1) to side fender assembly (9) using connector (8), four capscrews (5), four washers (6) and four lockwashers (7). Tighten capscrews (5).

NOTE

Turn tube stanchions, deck cleats or D-ring fittings may be used to secure outboard end of side fenders.

8. Connect end of forward/aft side fender (1) to turn tube fitting (3) in side of end rake (4) using bolt (2). Tighten bolt (2).
9. Remove slings and shackles from forward/aft side fender (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SIDE FENDER
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber, Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

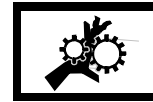
Engineer 88L

Equipment Condition

Side Fender Removed. (WP 0377 00)

DISASSEMBLE SIDE FENDER

WARNING

**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

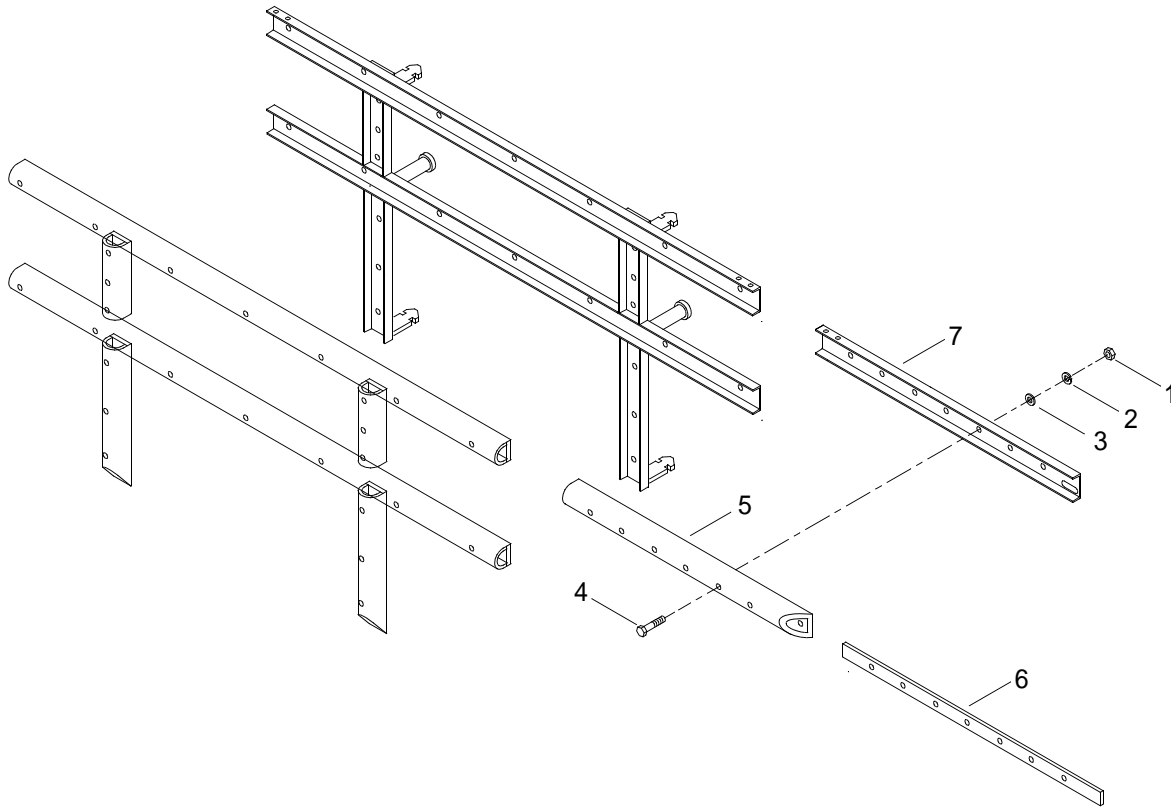
All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal, inspection, repair and installation of components on the side fenders.

Repair is limited to replacement of defective items.

1. Remove nuts (1), lockwashers (2), washers (3) and bolts (4) securing D-shaped rubber fender (5) and backing bar (6) to side fender frame (7).



2. Remove D-shaped rubber fender (5) and backing bar (6) from side fender frame (7).
3. Remove backing bar (6) from D-shaped rubber fender (5).

CLEAN SIDE FENDER

WARNING



CHEMICAL



EYE PROTECTION

1. Using wiping rags soaked with cleaner, remove debris from all components.

WARNING



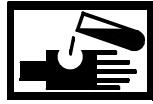
CHEMICAL



EYE PROTECTION

2. Using clean water, remove cleaner residue from all components.
3. Air dry all components.

WARNING

**CHEMICAL****EYE PROTECTION**

4. Dispose of contaminated rags in accordance with local procedures.

INSPECT SIDE FENDER

1. Inspect D-shaped rubber fender for wear and tear. Replace as required.
2. Inspect side fender frame and backing bar for corrosion, rust, wear and tear or damage to nuts, bolts and washers. Replace as required.

ASSEMBLE SIDE FENDER

1. Position backing bar (6) inside D-shaped rubber fender (5).
2. Position D-shaped rubber fender (6) and backing bar (6) on side fender frame (7).
3. Install nuts (1), lockwashers (2), washers (3) and bolts (4) to secure D-shaped rubber fender (5) and backing bar (6) to side fender frame (7). Tighten nuts (1).
4. Install side fender. (WP 0377 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BOW FENDER ASSEMBLY
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Sun, Wind and Dust (Safety) (Item 4, WP 0425 00)
Sling, 8,400 lb. 20 ft (Yellow) (Item 30, WP 0425 00)
Qty 2
Crowbar (Item 4, WP 0425 00)
Qty 2
Hammer, Hand (10 lb Sledge) (Item 12, WP 0425 00)
Shackle, 1/2 in. 2 Ton (Item 24, WP 0425 00)
Qty 2

Personnel Required

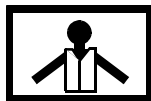
Seaman 88K (2)

Equipment Condition

A-frame Removed. (TM 55-1945-225-10)

REMOVE BOW FENDER ASSEMBLY

WARNING



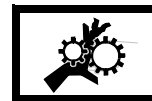
VEST



HELMET PROTECTION



HEAVY PARTS

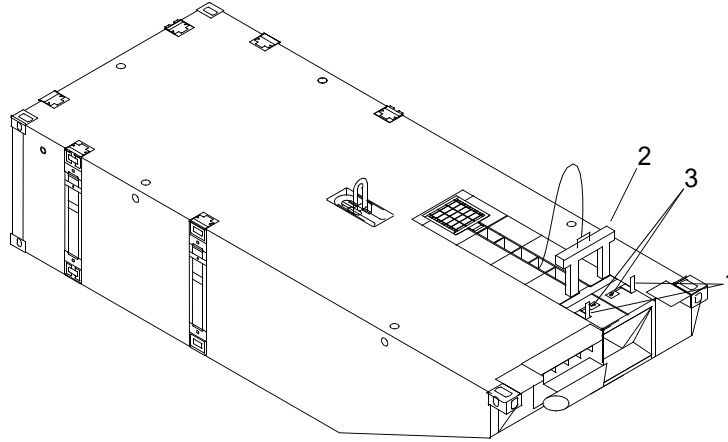


MOVING PARTS

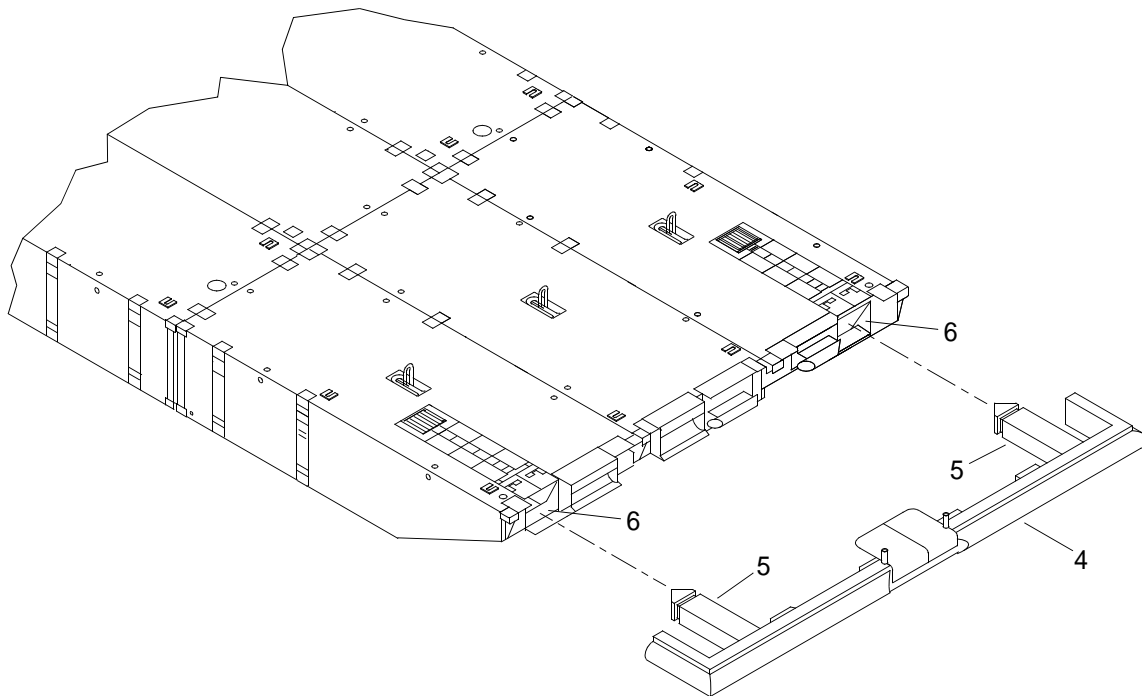
All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)

2. Rotate and pull the chute bolts (1) to unlocked position on left and right end rakes.



3. Lift guillotine (2) from flexor slots (3) on left and right end rakes.
4. Using crane, slings and shackles, support bow fender assembly (4) during removal.



5. Using assistant and crowbars, push outwards on flexor receiver insert subassemblies (5) until clear of both left and right end rake flexor receivers (6).
6. Remove bow fender assembly (4) from WT.
7. Insert guillotine (2) into flexor slots (3) on left and right end rakes.
8. Using sledgehammer, drive guillotines (2) into flexor slots (3) on left and right end rakes.
9. Push chute bolts (1) to locked position and rotate to closed position.
10. Remove slings and shackles from bow fender assembly (4).

INSTALL BOW FENDER ASSEMBLY

1. Rotate and pull the chute bolts (1) to unlocked position on left and right end rakes.
2. Lift guillotines (2) from flexor slots (3) on left and right end rakes.
3. Using crane, slings and shackles, position bow fender assembly (4) flexor receiver insert subassemblies (5) into both left and right end rake flexor receivers (6).
4. Using tag lines, pull inward on bow fender assembly (4) until flexor receiver insert subassemblies (5) are fully stowed in left and right end rake flexor receivers (6).
5. Insert guillotines (2) into flexor slots (3) on left and right end rakes.
6. Using sledge hammer, drive guillotines (2) into flexor slots (3) on left and right end rakes.
7. Push chute bolts (1) to locked position and rotate to closed position on left and right end rakes.
8. Remove tag lines, slings and shackles from bow fender assembly (4).
9. Install A-frame. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
BOW FENDER ASSEMBLY
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Sun, Wind and Dust (Safety) (Item 4, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

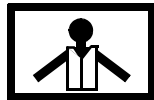
Engineer 88L

Equipment Condition

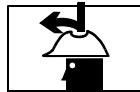
Bow Fender Assembly Removed. (WP 0379 00)

DISASSEMBLE BOW FENDER ASSEMBLY

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS

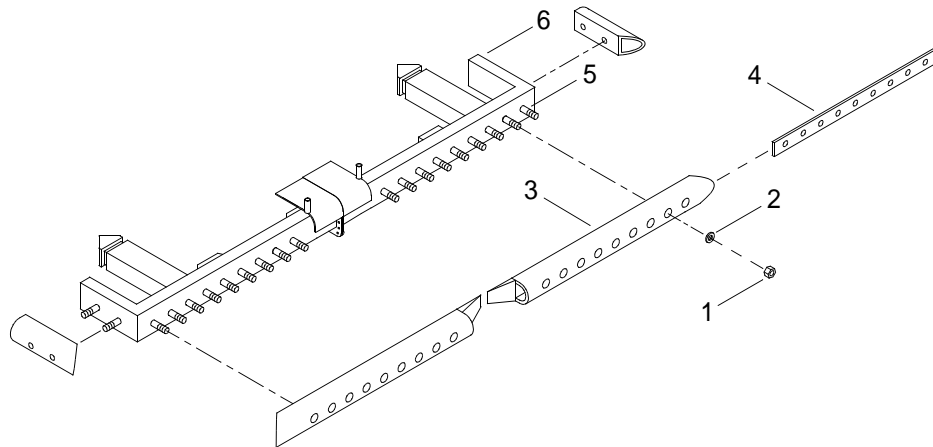
All personnel must wear a personal flotation device, hard hat and safety shoes during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal, inspection, repair and installation of components on the bow fender assembly.

Repair is limited to replacement of defective items.

1. Remove nuts (1) and washers (2) securing D-shaped rubber fender (3) and backing bar (4) to studs (5) on bow fender frame (6).



2. Remove backing bar (4) from D-shaped rubber fender (3).
3. Remove D-shaped rubber fender (3) backing bar (4) from bow fender frame (6).

CLEAN BOW FENDER ASSEMBLY

WARNING



CHEMICAL



EYE PROTECTION

1. Using wiping rags soaked with cleaner, remove debris from all components.

WARNING



CHEMICAL



EYE PROTECTION

2. Using clean water, remove cleaner residue from all components.
3. Air dry all components.

WARNING



CHEMICAL



EYE PROTECTION

4. Dispose of contaminated rags in accordance with local procedures.

INSPECT BOW FENDER ASSEMBLY

1. Inspect D-shaped rubber fender for wear and tear. Replace as required.
2. Inspect bow fender frame and backing bar for corrosion, rust, wear and tear or damaged to studs, nuts and washers. Replace as required.

ASSEMBLE BOW FENDER ASSEMBLY

1. Position backing bar (4) inside D-shaped rubber fender (3).
2. Position D-shaped rubber fender (3) and backing bar (4) over studs (5) on bow fender frame (6).
3. Install nuts (1) and washers (2) to secure D-shaped rubber fender (3) and backing bar (4) to studs (5) on bow fender frame (6). Tighten nuts (1).
4. Install bow fender assembly. (WP 0379 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
CORNER FENDER
REMOVAL AND INSTALLATION**

INITIAL SETUP:

Tools

- Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
- Helmet, Safety (Blue) (Item 13, WP 0425 00)
- Goggles, Sun, Wind and Dust (Safety) (Item 4, WP 0425 00)
- Life Preserver, Vest (Item 17, WP 0425 00)
- Socket, Socket Wrench, 3/4" Sq. Dr. 6 Pt. Size 2 3/4
- Adapter, Socket Wrench, 1/2" Sq. Female - 3/4" Sq. Male

Materials/Parts

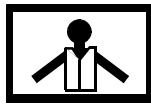
- Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

- Seaman 88K (2)

REMOVE CORNER FENDER

WARNING



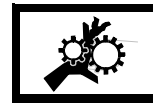
VEST



HELMET PROTECTION



HEAVY PARTS



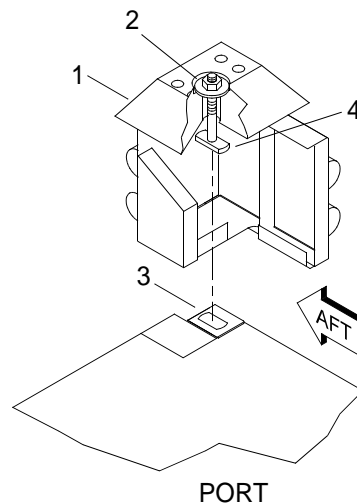
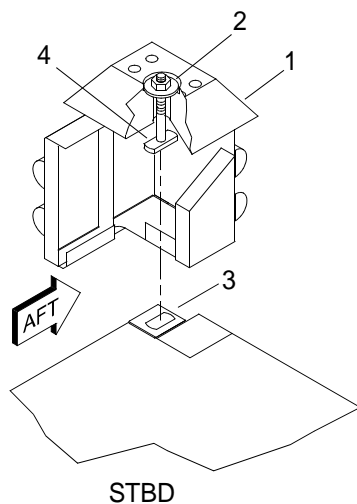
MOVING PARTS

All personnel must wear personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death.

NOTE

This task is typical for removal and installation of corner fenders.

1. Secure a tagline between corner fender (1) and any deck fitting to prevent accidental loss of equipment overboard.



2. Using socket wrench and adapter (both located inside the BII storage room), loosen nut (2) securing corner fender (1) to ISO corner (3).
3. Holding tee bolt (4) end threads, turn tee bolt (4) 1/4 turn to free tee bolt (4) from ISO corner (3).

WARNING

**HEAVY OBJECTS**

4. Using assistant, remove corner fender (1) from ISO corner (3).
5. Finger tighten nut (2) on tee bolt (4).

INSTALL CORNER FENDER

1. Using socket wrench and adapter (both located inside the BII storage room), loosen nut (2) on tee bolt (4).
2. Secure a tagline between corner fender (1) and any deck fitting.

WARNING

**HEAVY OBJECTS**

3. Using assistant, position corner fender (1) over ISO corner (3) until tee bolt (4) enters slot in ISO corner (3).
4. Holding tee bolt (4) end threads, turn tee bolt (4) 1/4 turn.
5. While holding tee bolt (4) up against bottom upper surface of ISO corner (3), finger tighten the nut (2).

NOTE

Use of pry bar may be required to bind tee bolt up against bottom upper surface of ISO corner while turning nut.

6. Using socket wrench and adapter (both located inside the BII storage room), tighten nut (2) to secure corner fender (1) to ISO corner (3).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
CORNER FENDER
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Sun, Wind and Dust (Safety) (Item 4, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
 Apron, Utility (Item 6, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
 Gloves, Rubber Industrial (Item 11, WP 0426 00)
 Cleaner (Item 5, WP 0426 00)
 Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

Equipment Condition

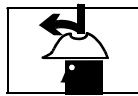
Corner Fender Removed. (WP 0381 00)

DISASSEMBLE CORNER FENDER

WARNING



VEST



HELMET PROTECTION



HEAVY PARTS

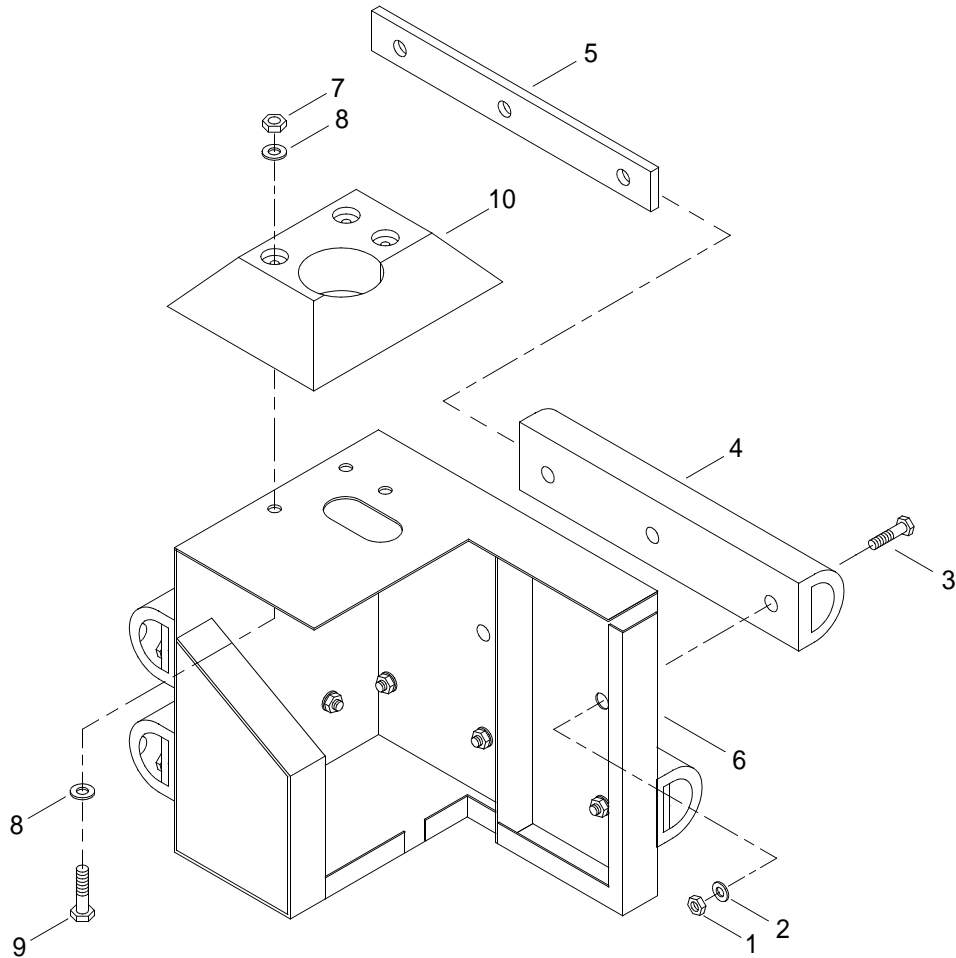
All personnel must wear a personal flotation device, hard hat and safety shoes during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal, inspection, repair and installation of components on the corner fender.

Repair is limited to replacement of defective items.

1. Remove nuts (1), washers (2) and bolts (3) securing D-shaped rubber fender (4) and backing bar (5) to corner fender frame (6).



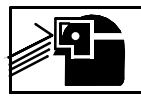
2. Remove D-shaped rubber fender (4) and backing bar (5) from corner fender frame (6).
3. Remove nuts (7), washers (8) and bolts (9) securing top sheet (10) to corner fender frame (6).
4. Remove top sheet (10) from corner fender frame (6).

CLEAN CORNER FENDER

WARNING



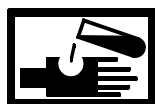
CHEMICAL



EYE PROTECTION

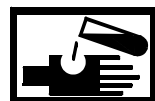
1. Using wiping rags soaked with cleaner, remove debris from all components.

WARNING

**CHEMICAL****EYE PROTECTION**

2. Using clean water, remove cleaner residue from all components.
3. Air dry all components.

WARNING

**CHEMICAL****EYE PROTECTION**

4. Dispose of contaminated rags in accordance with local procedures.

INSPECT CORNER FENDER

1. Inspect D-shaped rubber fender and top sheet for wear and tear. Replace as required.
2. Inspect corner fender frame for corrosion, rust, wear and tear or damage to nuts, bolts and washers. Replace as required.

ASSEMBLE CORNER FENDER

1. Position backing bar (5) inside D-shaped rubber fender (4).
2. Position D-shaped rubber fender (4) and backing bar (5) on corner fender frame (6).
3. Install nuts (1), washers (2) and bolts (3) to secure D-shaped rubber fender (4) and backing bar (5) to corner fender frame (6). Tighten nuts (1).
4. Position top sheet (10) on corner fender frame (6).
5. Install nuts (7), washers (8) and bolts (9) to secure top sheet (10) to corner fender frame (6). Tighten nuts (7).
6. Install corner fender. (WP 0381 00)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ENGINE
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)
Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
Qty 4
Shackle, 3/4 in. 4.75 Ton (Item 25, WP 0425 00)
Qty 3
Hoist, Chain (Item 14, WP 0425 00)
Wrench, Pipe (Item 4, WP 0425 00)
Wrench, Torque (0-175 ft lbs) (Item 37, WP 0425 00)
Stand, Maintenance, Automotive Engine (Item 31, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Twine, Fibrous (Item 46, WP 0426 00)
Strap, Tiedown (Item 41, WP 0426 00)
Lumber, Softwood, Dimension (Item 22, WP 0426 00)
Qty 2

Personnel Required

Engineer 88L (2)

References

TM 55-1945-225-10
TM 55-1945-222-14&P

Equipment Condition

Engine Cool To Touch.
Powered Section Main Batteries Positive Leads Removed. (WP 0197 00)
Main Assembly Mast Removed. (WP 0350 00)
SINCGARS Antenna Removed. (TM 11-5820-890-20-3)
Electrical System Module Interconnect Assembly Removed. (WP 0202 00)
Heater Hoses Removed. (WP 0120 00)
Powered Section Operators Cab Removed. (WP 0095 00)
Powered Section Intake Plenum Removed. (WP 0080 00)
Powered Section Engine Hatch Removed. (WP 0098 00)
Engine Muffler Removed. (WP 0168 00)
Drive Train Marine Gear To Transfer Case Machinery Guard Removed. (WP 0115 00)
Marine Gear To Transfer Case Drive Shaft Removed. (WP 0117 00)
Crankcase Oil Drained. (TM 55-1945-222-14&P)
Freshwater Cooling System Drained. (TM 55-1945-222-14&P)
Hydraulic System Pressure Vented. (WP 0134 00)

REMOVE ENGINE

WARNING



VAPOR



VEST



HELMET PROTECTION



HEAVY PARTS



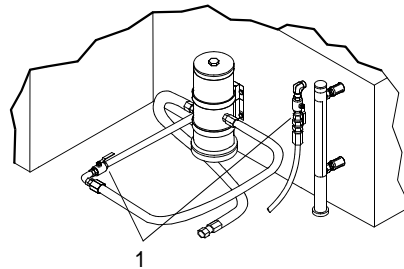
MOVING PARTS

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

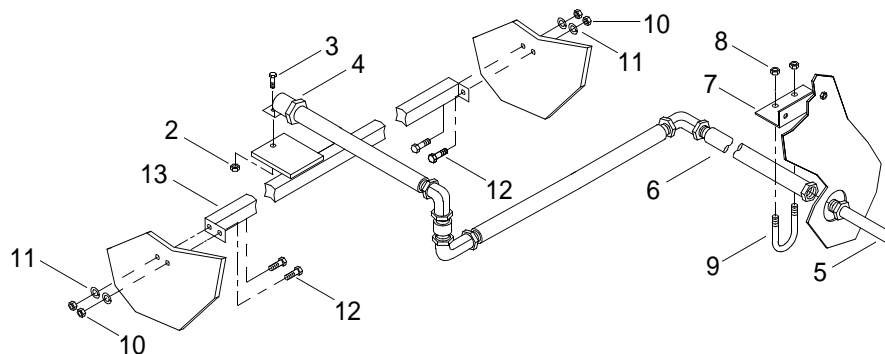
NOTE

This task is typical for removal and installation of both port and starboard diesel engines.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Verify fuel supply and return valves (1) are closed.



3. Remove nut (2) and capscrew (3) securing fire suppression trip mechanism solenoid (4) to its mount, located above engine.

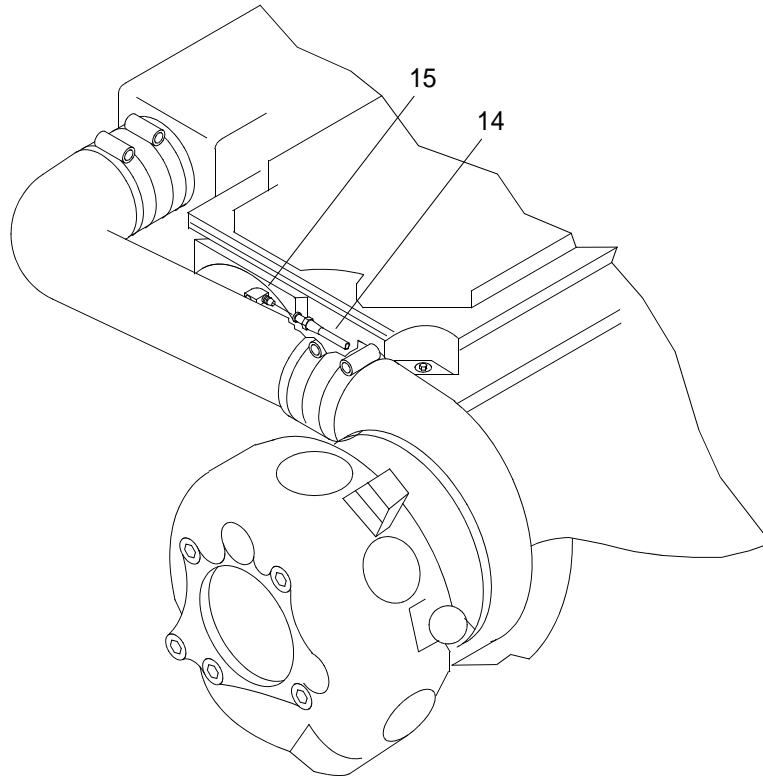


4. Using a pipe wrench, disconnect pipe coupling (5) from fire suppression CO₂ supply line (6) near propulsion module frame cross-member support bracket (7).
5. Remove two nuts (8) and U-bolt (9) supporting CO₂ supply line (6) to propulsion module frame cross-member support bracket (7).
6. Remove CO₂ line (6) with attached trip mechanism solenoid (4).
7. Remove self-locking hex nuts (10), lockwashers (11) and capscrews (12) securing fire suppression trip mechanism solenoid cross-module bracket (13) to propulsion module longitudinal frame.
8. Remove cross-module bracket (13).

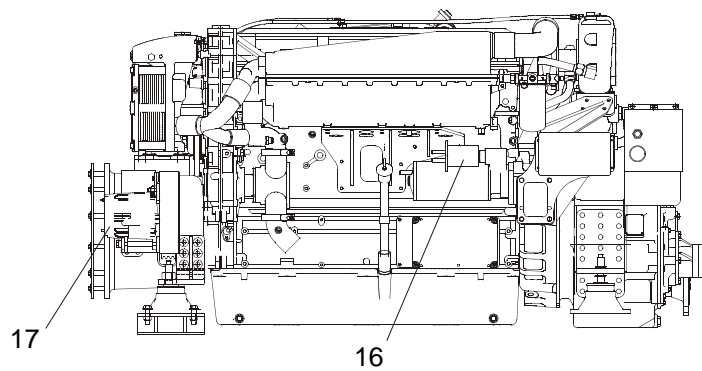
WARNING

**EXPLOSION****VAPOR**

9. Disconnect cold start supply line (14) from air inlet tube (15) and secure outboard with twine.

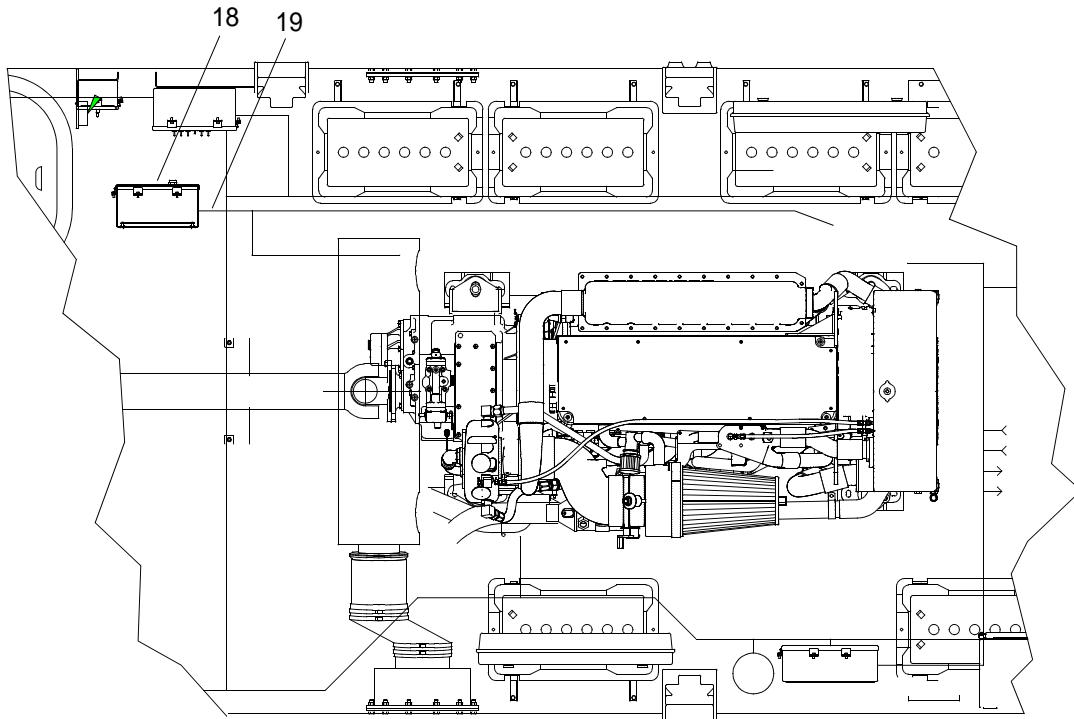


10. Tag and disconnect red and black battery leads from starter solenoid (16).



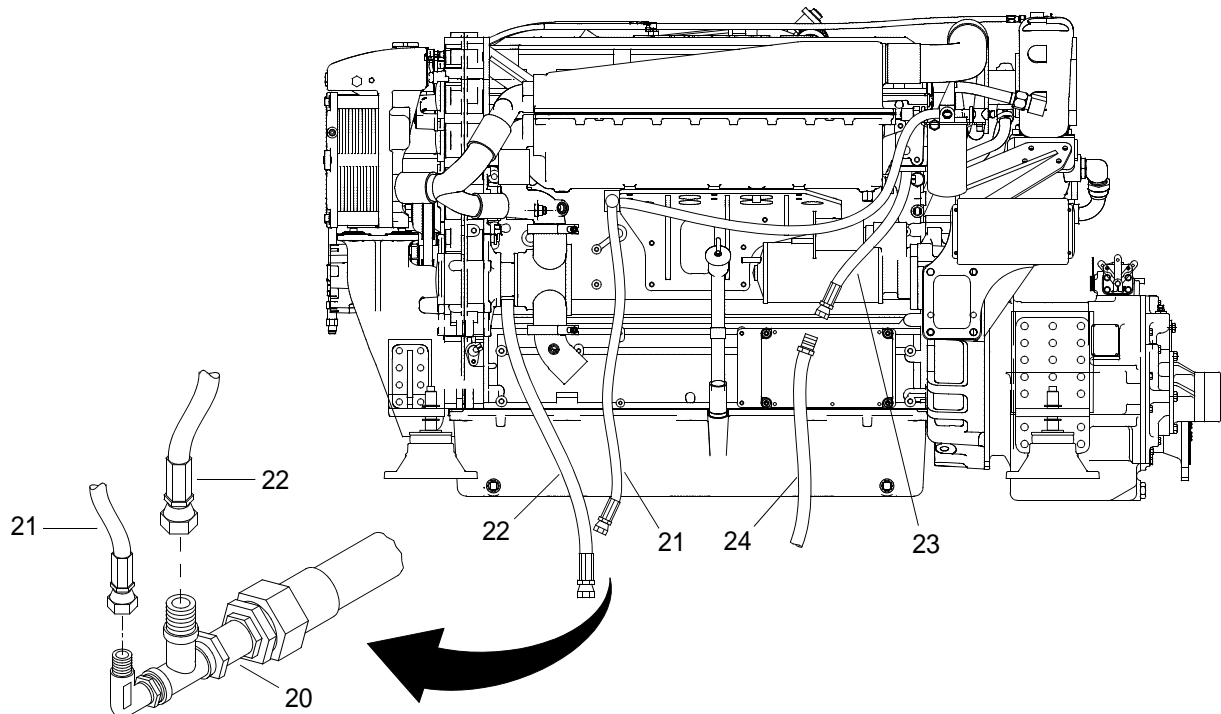
11. Tag and disconnect red and black battery leads from alternator (17).
12. Remove inline tiedown straps, pull leads off engine and secure leads outboard with twine.

13. Inside engine junction box A4 (18), tag and disconnect KMB-1 main engine electrical wiring harness (19).

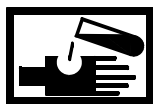


14. Once KMB-1 main engine electrical wiring harness (19) is isolated from engine junction box A4 (18), remove tiedown straps and coil and secure wire bundle on top of engine with twine.

15. Position drain pan beneath fuel supply line check valve (20) located near forward starboard end of the engine.

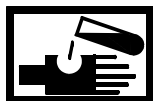


WARNING

**CHEMICAL****EYE PROTECTION**

16. Remove fuel primer pump supply line (21) from fuel supply line check valve (20).

WARNING

**CHEMICAL****EYE PROTECTION**

17. Remove fuel pump supply line (22) from fuel supply line check valve (20).

NOTE

Main fuel supply line with attached check valve will remain in bilge and will not interfere with engine removal.

18. Secure two fuel supply lines (21 and 22) to engine with twine.
19. Position drain pan beneath fuel pump return line (23) coupling, located on forward port side of engine.

WARNING

**CHEMICAL****EYE PROTECTION**

20. Remove fuel pump return line (23) from main fuel return line (24).

NOTE

Main fuel return line will remain in bilge and will not interfere with engine removal.

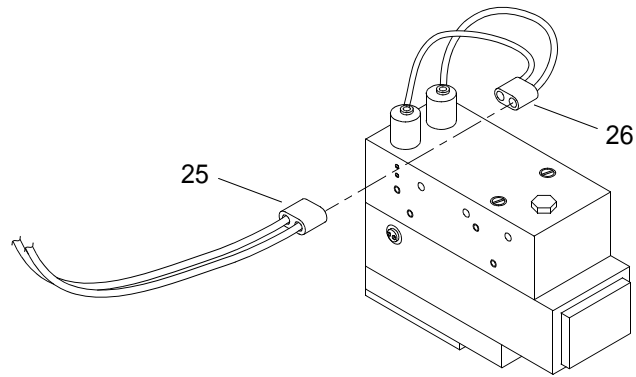
21. Secure fuel pump return line (23) to engine with twine.

WARNING

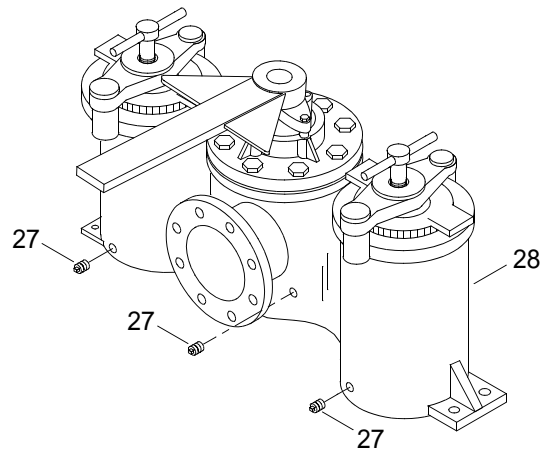
**CHEMICAL****EYE PROTECTION**

22. Remove drain pan and dispose of contents in accordance with local procedures.

23. Tag and disconnect marine gear shifting solenoid electrical connector (25) from two marine gear shifting solenoid harnesses (26) and secure to engine with twine.

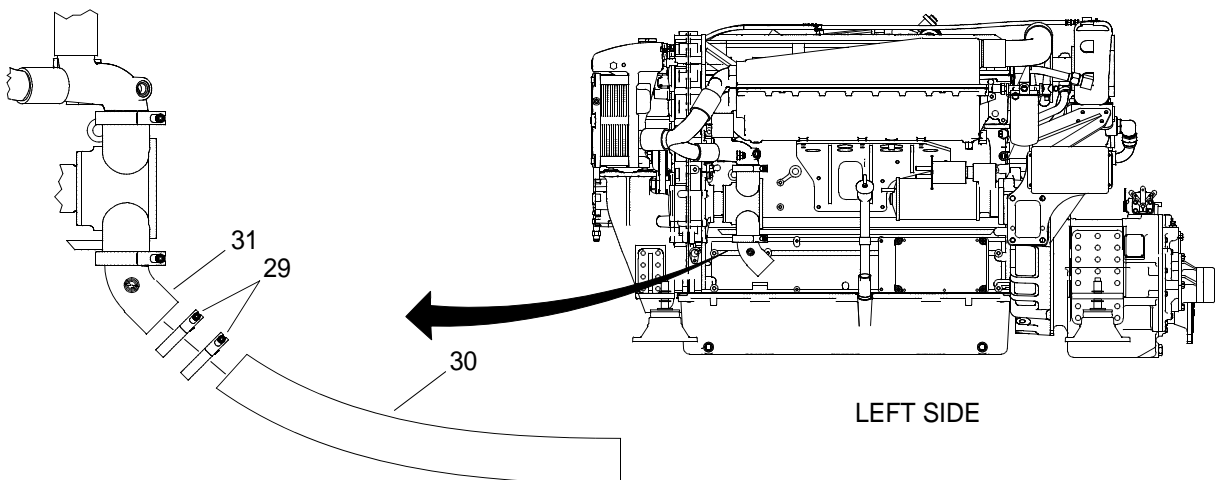


24. Remove three pipe plugs (27) from duplex strainer (28) and allow raw water system to drain into bilge.



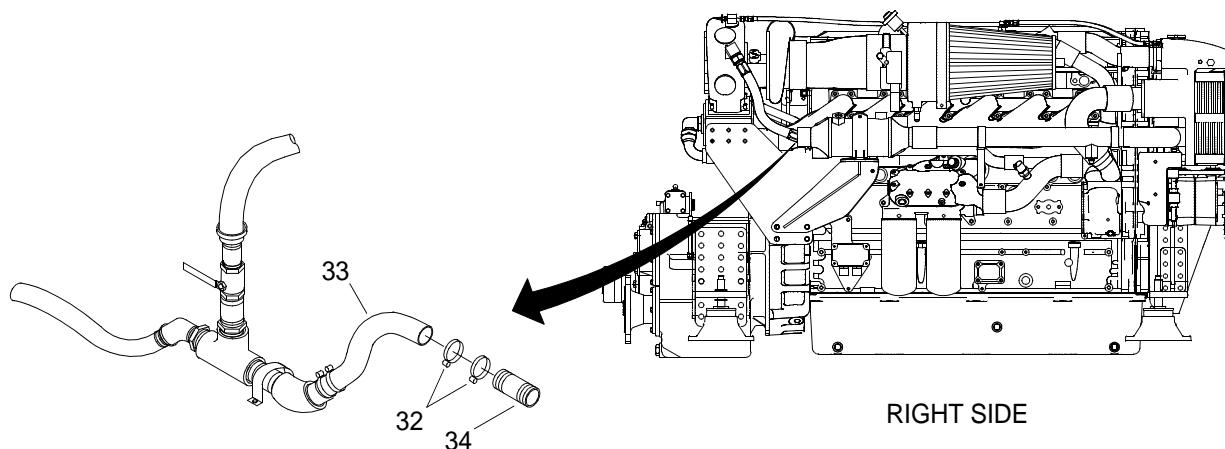
25. When raw water system is drained, install three pipe plugs (27) in duplex strainer (28).

26. Loosen two hose clamps (29) and remove raw water supply hose (30) from raw water pump coupling (31).



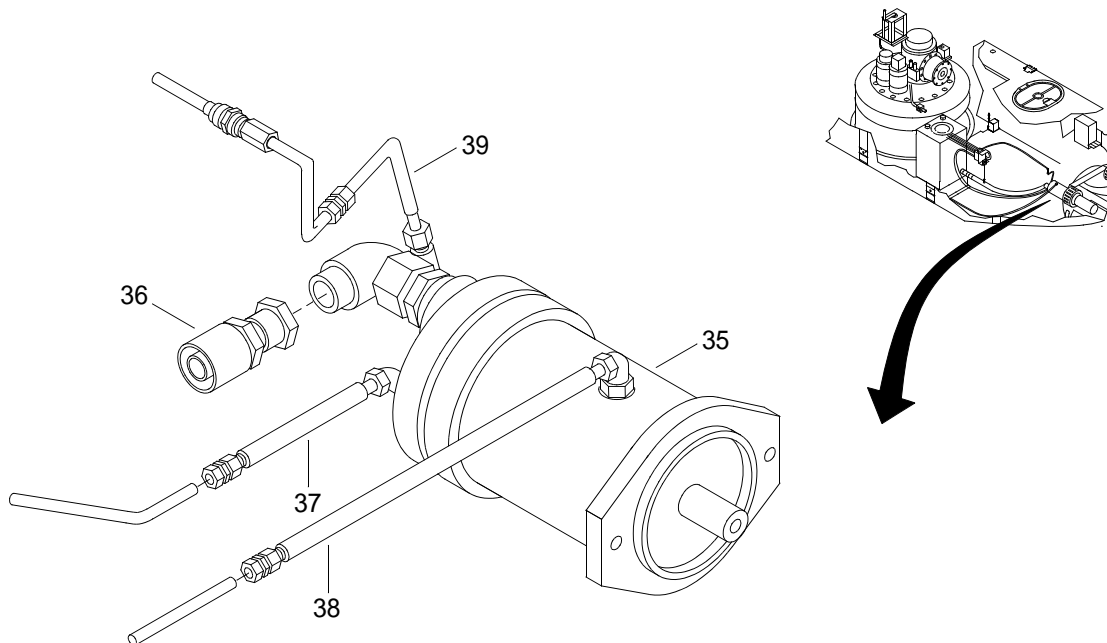
27. Secure raw water supply hose (30) outboard with twine.

28. Loosen two hose clamps (32) and remove raw water return hose (33) from marine gear cooler coupling (34), located aft and starboard of marine gear.



29. Secure raw water return hose (33) outboard with twine.

30. Position drain pan below hydraulic pump (35) to catch excess oil drained from hoses.



WARNING



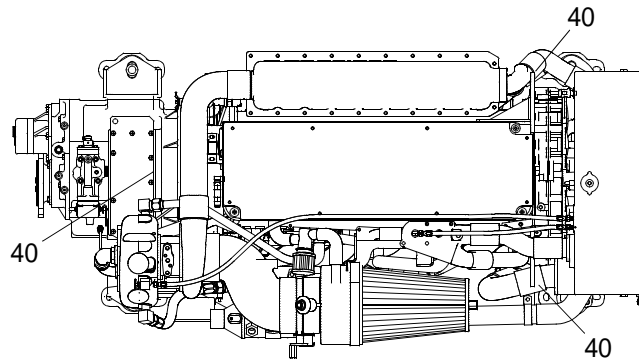
EYE PROTECTION



VAPOR

31. Disconnect hose L1 (36) from hydraulic pump (35) suction to reservoir suction.
32. Disconnect tube L2 (37) from hydraulic pump (35) pressure to pressure filter.
33. Disconnect tube L8B (38) from hydraulic pump (35) return line to reservoir return line.

34. Disconnect tube L9 (39) from hydraulic pump (35) to way-valve.
35. Secure hose L1 (36), tube L2 (37), tube L8B (38) and tube L9 (39) out board with twine.
36. Attach three slings and shackles to three lifting brackets (40) on top of engine.



WARNING

**HEAVY PARTS**

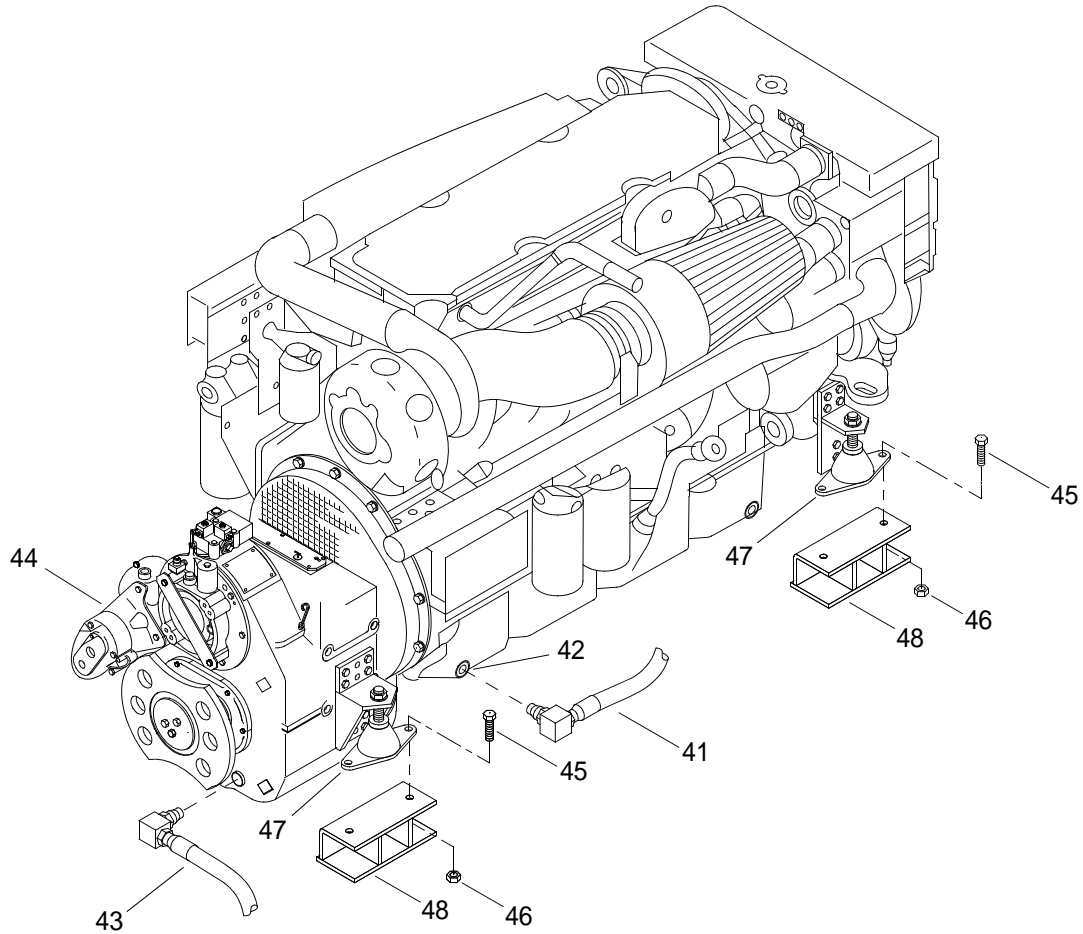
Do not attempt to lift engine with any less than a three point hook-up. Failure to comply could result in injury to personnel and damage to equipment.

NOTE

Use a sling and chain hoist to support marine gear and keep engine and marine gear level during removal.

37. Using crane, place tension on slings to prevent engine from shifting off mounts during removal of mounting capscrews.

38. Remove engine fast lube oil hose (41) from engine oil drain hole (42).



39. Remove marine gear fast lube oil hose (43) from marine gear (44).

40. Remove capscrews (45) and nuts (46) securing engine and marine gear mounting brackets (47) to hull mounts (48).

 WARNING



HEAVY PARTS

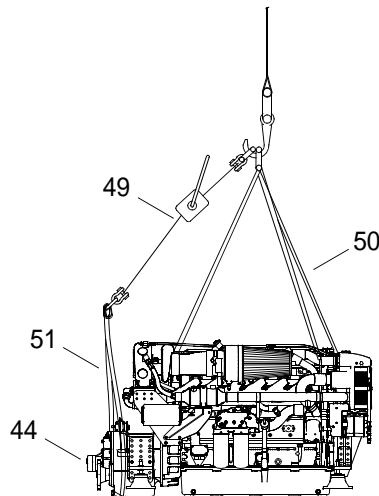
Do not attempt to lift engine with any less than a three point hook-up. Failure to comply could result in injury to personnel and damage to equipment.

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

NOTE

Use a sling and chain hoist to support marine gear and keep engine and marine gear level during removal.

41. Using crane, chain hoist (49), three slings (50) on engine and a sling (51) on marine gear (44), remove engine with marine gear (52) from propulsion module.



 WARNING



HEAVY PARTS

42. Place engine with marine gear (52) on wooden blocks or suitable engine stand to facilitate equipment separation.

43. Remove marine gear from rear of engine. (WP 0384 00)

INSTALL ENGINE

1. Install marine gear on rear of engine. (WP 0384 00)

WARNING

**HEAVY PARTS**

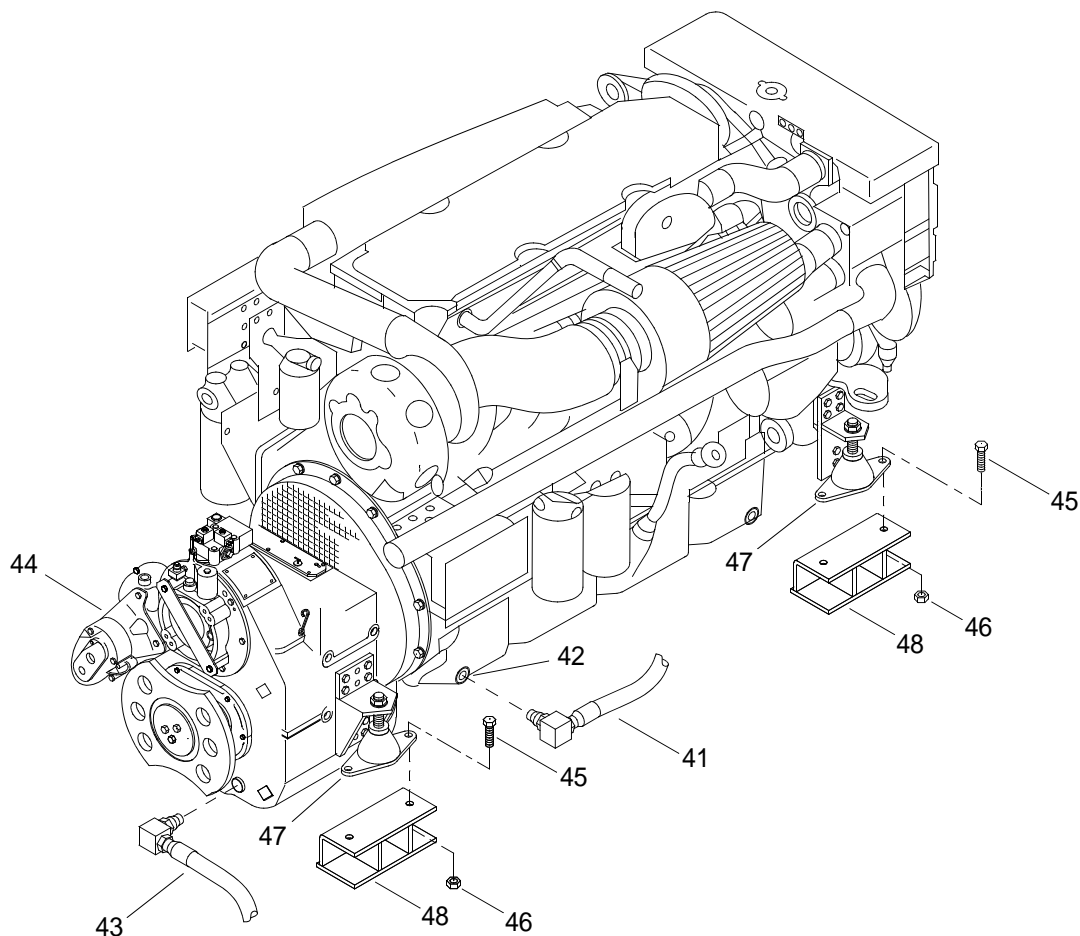
Do not attempt to lift engine with any less than a three point hook-up. Failure to comply could result in injury to personnel and damage to equipment.

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

NOTE

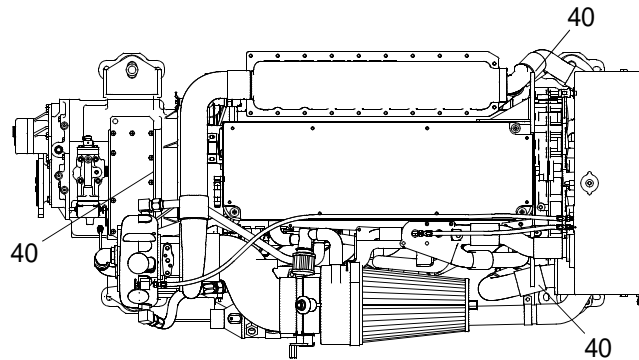
Use a sling and chain hoist to support marine gear and keep engine and marine gear level during removal.

- Using crane, chain hoist (49), three slings (50) on engine and a sling (51) on marine gear (44), install engine with marine gear (52) in propulsion module.
- Install eight capscrews (45) and nuts (46) to secure engine and marine gear mounting brackets (47) to hull mounts (48).

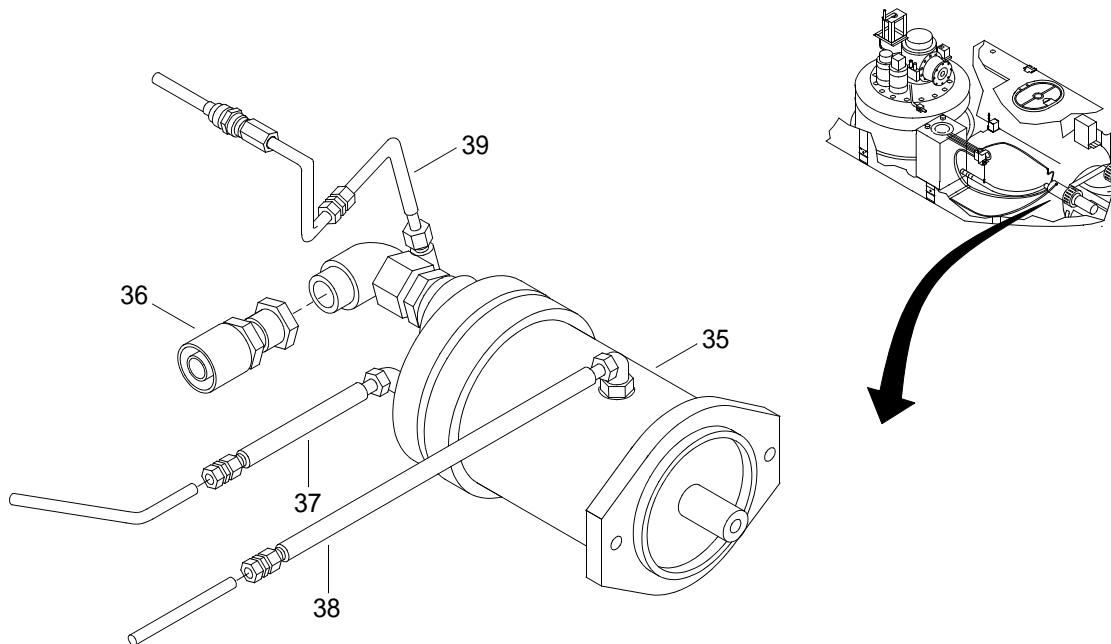


- Using torque wrench, torque eight capscrews (45) and nuts (46) to 90 ft lbs (122 N-m).

5. Install engine fast lube oil hose (41) in engine oil drain hole (42).
6. Install marine gear fast lube oil hose (43) on marine gear (44).
7. Remove three slings and shackles from three lifting brackets (40) from top of engine.



8. Remove twine securing hose L1 (36), tube L2 (37), tube L8B (38) and tube L9 (39).



WARNING



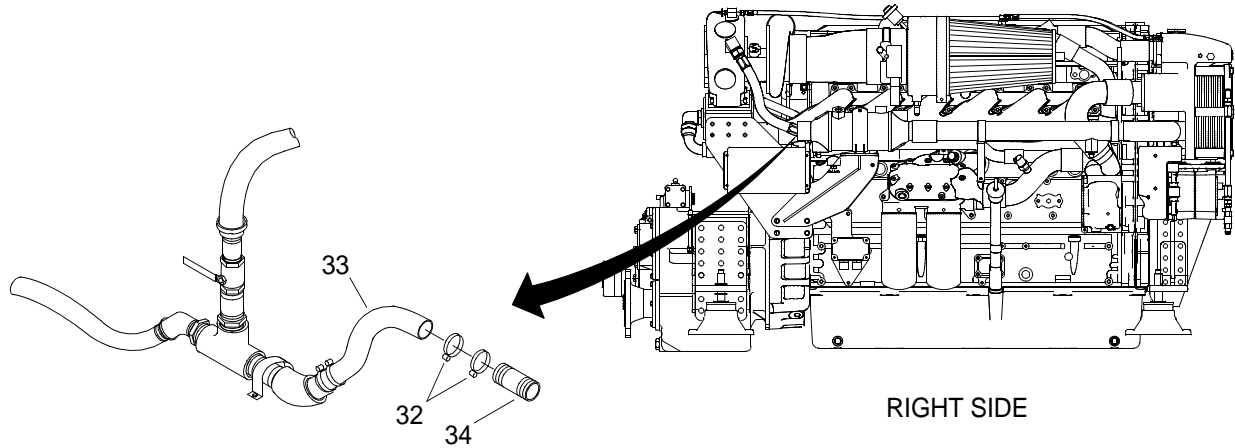
EYE PROTECTION



VAPOR

9. Connect tube L9 (39) to hydraulic pump (35) to way-valve.
10. Connect tube L8B (38) to hydraulic pump (35) return line to reservoir return line.
11. Connect tube L2 (37) to hydraulic pump (35) pressure to pressure filter.
12. Connect hose L1 (36) to hydraulic pump (35) suction to reservoir suction.

13. Remove twine securing raw water return hose (33) outboard.

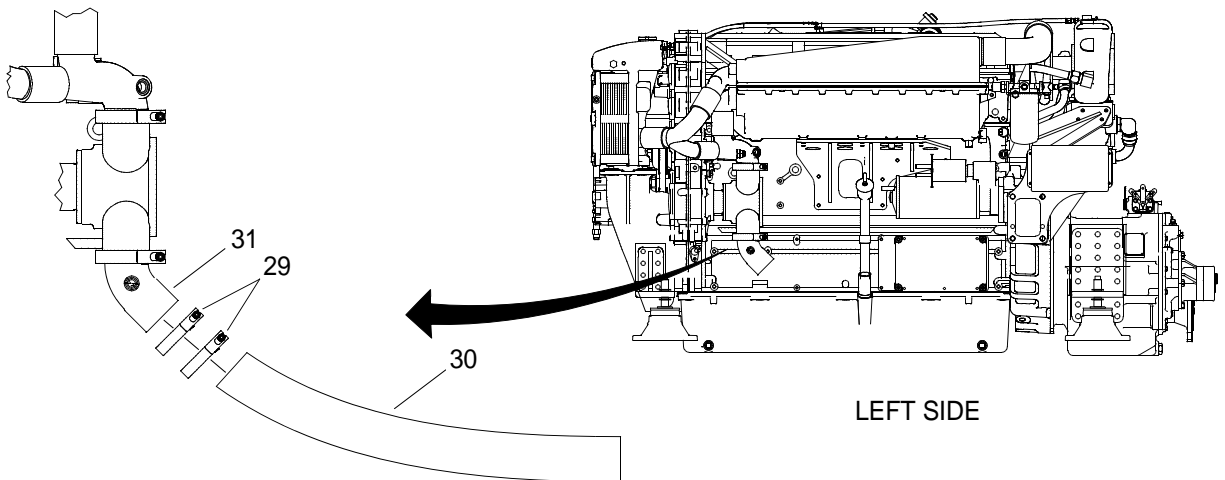


14. Install raw water return hose (33) on marine gear cooler coupling (34).

15. Install two hose clamps (32) on marine gear cooler coupling (34).

16. Tighten two hose clamps (32).

17. Remove twine securing raw water supply hose (30) outboard.

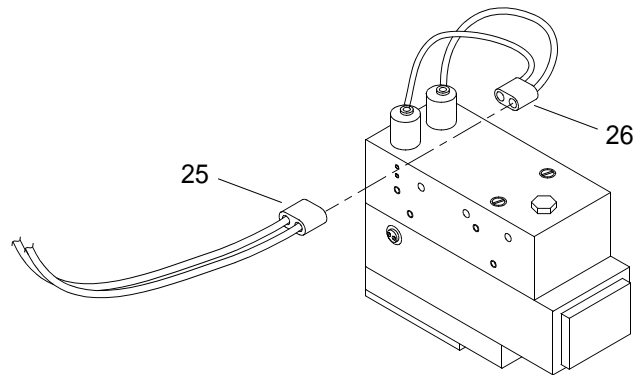


18. Install raw water supply hose (30) on raw water pump coupling (31).

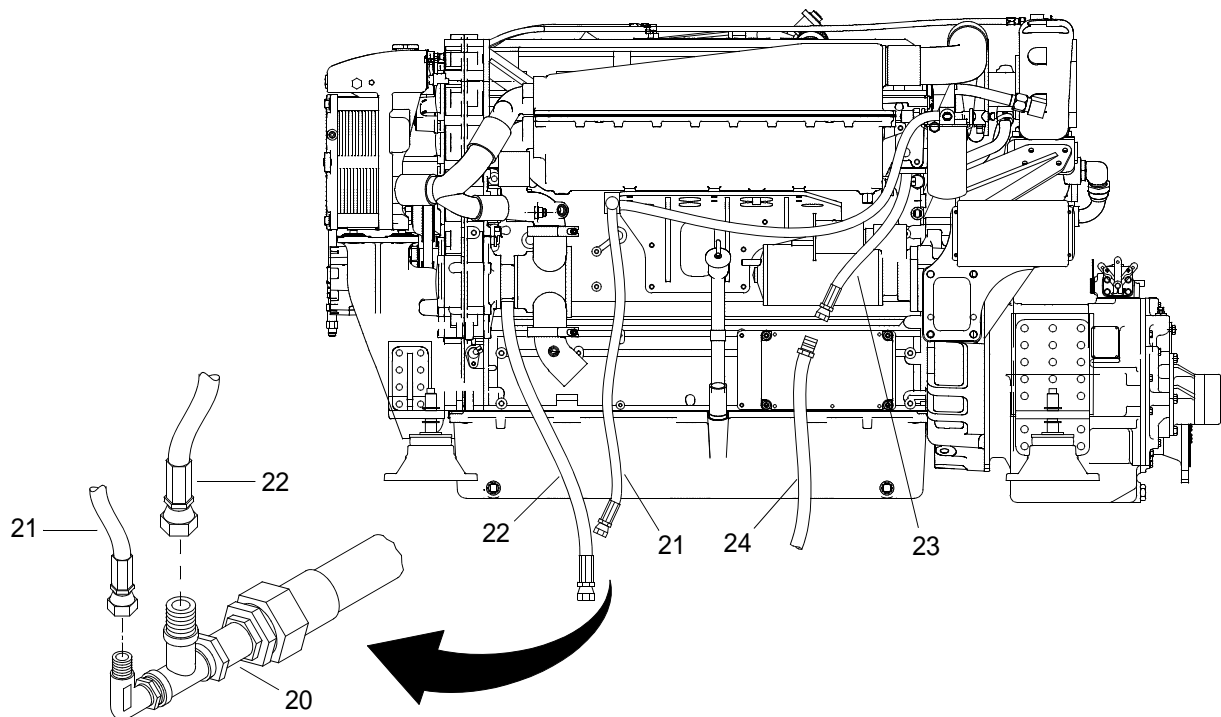
19. Install two hose clamps (29) on raw water pump coupling (31).

20. Tighten two hose clamps (29).

21. Remove tags and connect marine gear shifting solenoid electrical connector (25) to marine gear shifting solenoid harnesses (26).



22. Remove twine securing fuel pump return line (23) to engine.



WARNING



CHEMICAL



EYE PROTECTION

23. Install fuel pump return line (23) on main fuel return line (24).
24. Remove twine securing two fuel supply lines (21 and 22).

WARNING

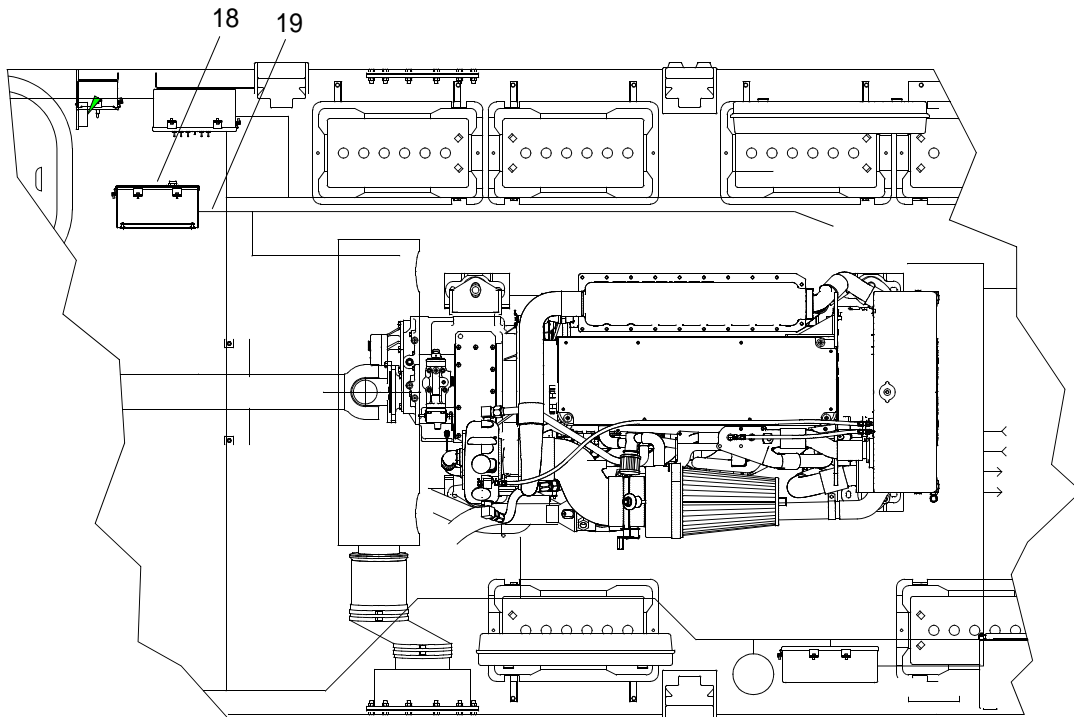
**CHEMICAL****EYE PROTECTION**

25. Install fuel pump supply line (22) on fuel supply line check valve (20).

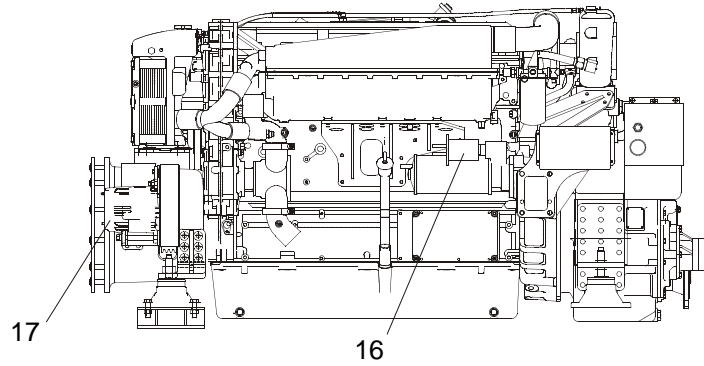
WARNING

**CHEMICAL****EYE PROTECTION**

26. Install fuel primer pump supply line (21) on fuel supply line check valve (20).
27. Inside engine junction box A4 (18), remove tags and connect KMB-1 main engine electrical wiring harness (19).



28. Remove twine securing red and black battery leads.



29. Remove tags and connect red and black battery leads to alternator (17).

30. Install in line tiedown straps.

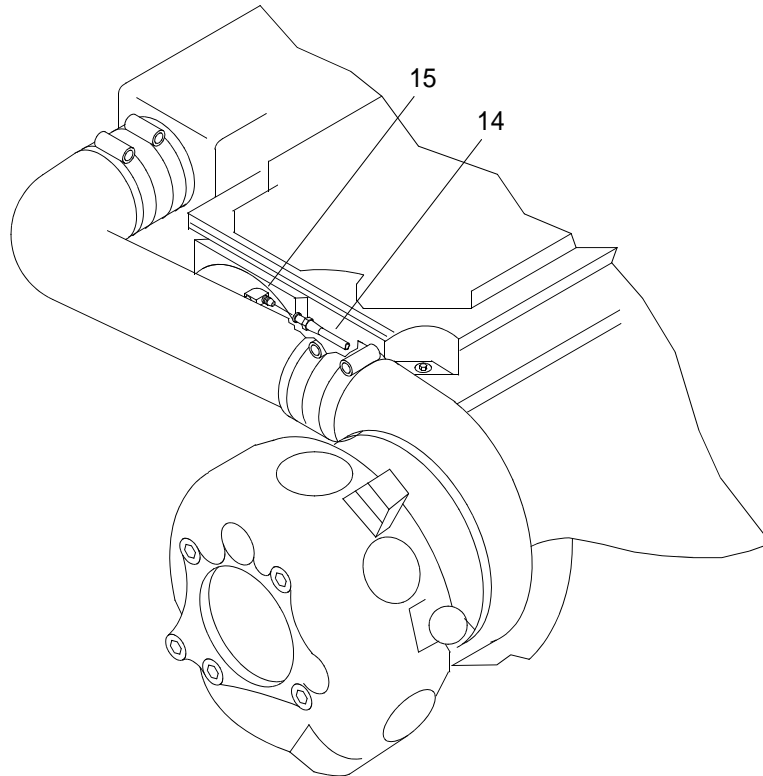
31. Remove tags and connect red and black battery leads to starter solenoid (16).

32. Install self-locking hex nuts (10), lockwashers (11) and capscrews (12) to secure fire suppression trip mechanism solenoid's cross-module bracket (13) to propulsion module longitudinal frame.

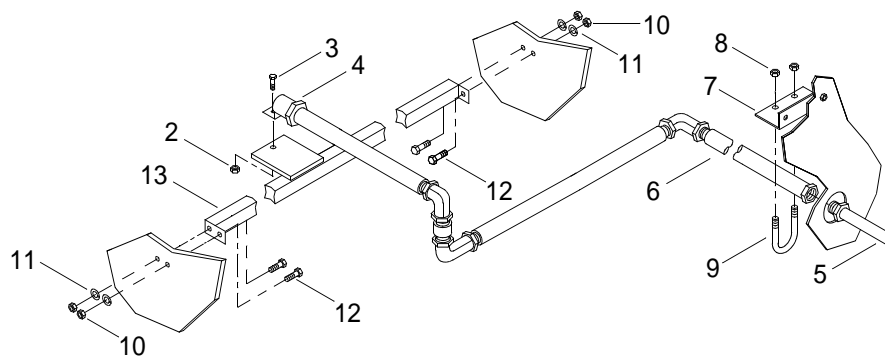
WARNING

**EXPLOSION****VAPOR**

33. Remove twine and connect cold start supply line (14) to air inlet tube (15).



34. Install cross-module bracket (13).



35. Install CO₂ line (6) on attached trip mechanism solenoid (4).
36. Install two nuts (8) and U-bolt (9) to support CO₂ line (6) on propulsion module frame cross-member support bracket (7).
37. Using a pipe wrench, connect pipe coupling (5) to fire suppression CO₂ supply line (6) near propulsion module frame cross-member support bracket (7).

38. Install nut (2) and capscrew (3) to secure fire suppression trip mechanism solenoid (4) to its mount, located above engine.
39. Service hydraulic system reservoir. (WP 0141 00)
40. Vent hydraulic system. (WP 0134 00)
41. Service fresh water cooling system. (TM 55-1945-222-14&P)
42. Service crankcase oil. (TM 55-1945-222-14&P)
43. Install marine gear to transfer case drive shaft. (WP 0117 00)
44. Install marine gear to transfer case machinery guard. (WP 0115 00)
45. Install muffler. (WP 0168 00)
46. Install engine hatch. (WP 0098 00)
47. Install intake plenum (WP 0080 00)
48. Install operators cab. (WP 0095 00)
49. Install heater hoses. (WP 0120 00)
50. Install electrical system module interconnect assembly. (WP 0202 00)
51. Install SINCGARS antenna. (TM 11-5820-890-20-3)
52. Install main assembly mast. (WP 0350 00)
53. Install main battery positive leads. (WP 0197 00)
54. Perform operational check of diesel engine. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
MARINE GEAR
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)
Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
Wrench, Torque (0-175 ft lbs) (Item 37, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Twine, Fibrous (Item 46, WP 0426 00)
Cleaner (Item 5, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)
Lumber, Softwood, Dimension (Item 22, WP 0426 00)
Qty 2

Personnel Required

Engineer 88L (2)

References

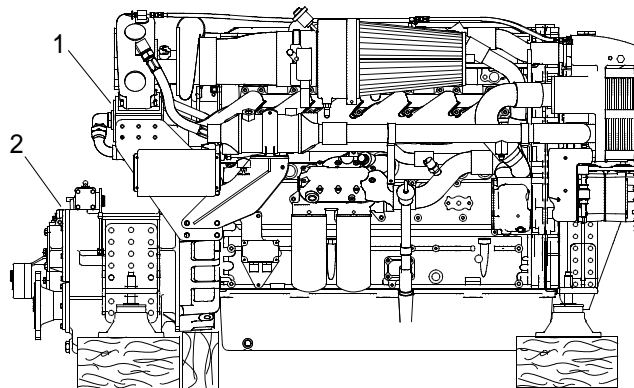
TM 55-1945-225-10
TM 55-1945-223-14&P

Equipment Condition

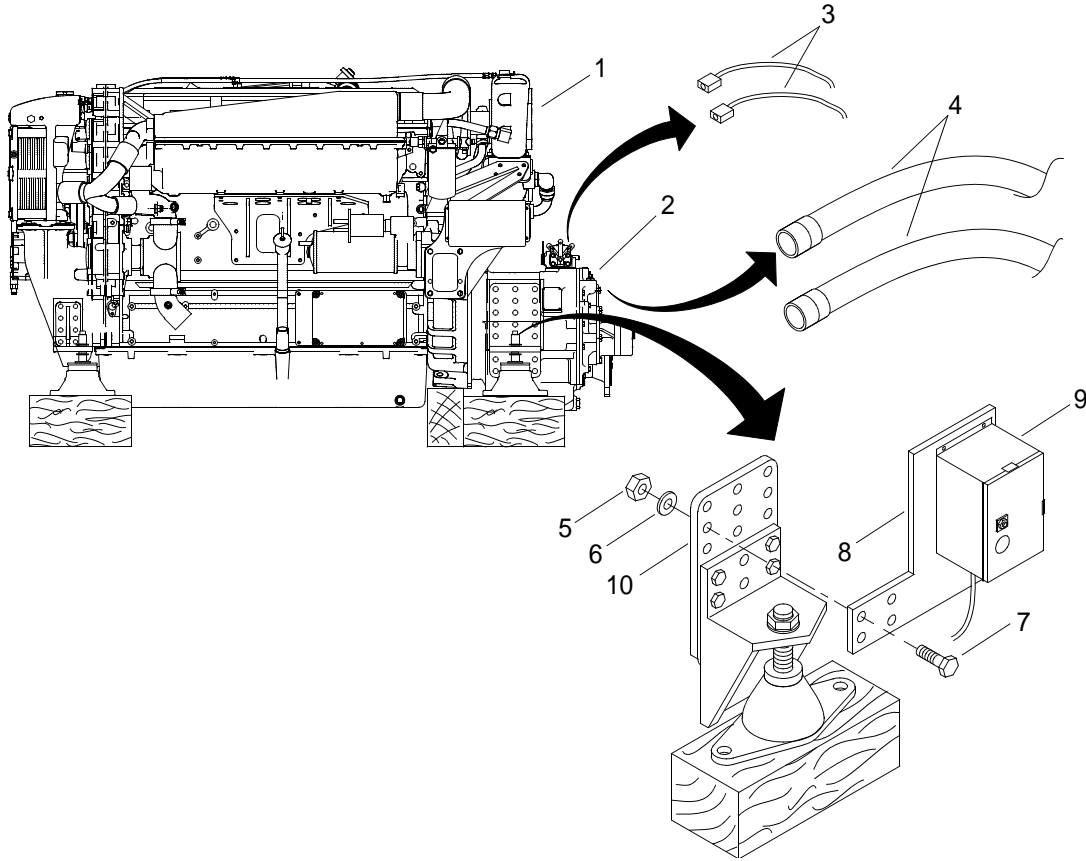
Diesel Engine Removed. (WP 0383 00)

REMOVE MARINE GEAR

1. Inspect sling prior to use. (TM 55-1945-225-10)
2. Verify rear (under flywheel housing) of diesel engine (1) is supported on dunnage prior to marine gear (2) removal.



3. Tag and disconnect marine gear solenoid electrical cables (3).



4. Using twine, secure marine gear solenoid electrical cables (3) to diesel engine (1).
5. Position drain pan near marine gear (2).

WARNING



CHEMICAL



EYE PROTECTION

6. Tag and disconnect marine gear oil hoses (4). Allow residual oil to drain into drain pan.
7. Using twine, secure marine gear oil hoses (4) to diesel engine (1).

WARNING



CHEMICAL



EYE PROTECTION

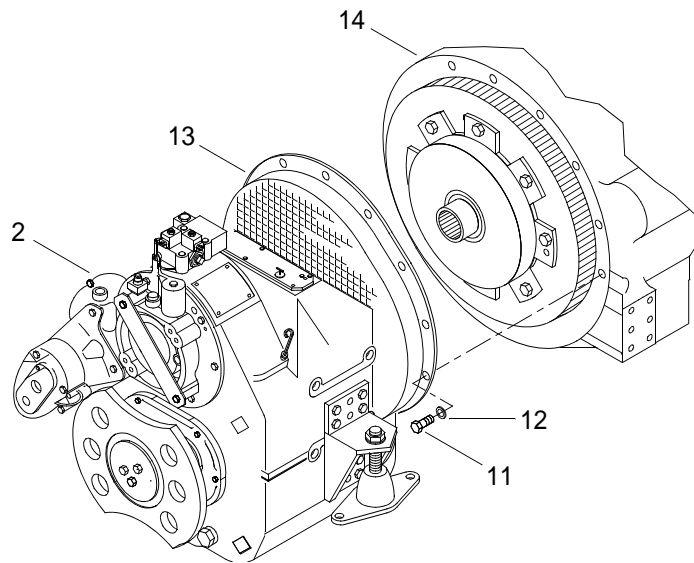
8. Remove drain pan and dispose of contents per local procedures.

9. Remove hex head nuts (5), lockwashers (6) and hex head capscrews (7) securing mount panel (8) for control interface box (9) to upper portion of support mount (10).
10. Using twine, secure mount panel (8) with attached control interface box (9) to diesel engine (1).

WARNING

**HEAVY PARTS**

11. Using crane and sling, support weight of marine gear (2) prior to removal of attaching hardware.
12. Remove hex head capscrews (11) and washers (12) securing marine gear housing (13) to engine flywheel housing (14).

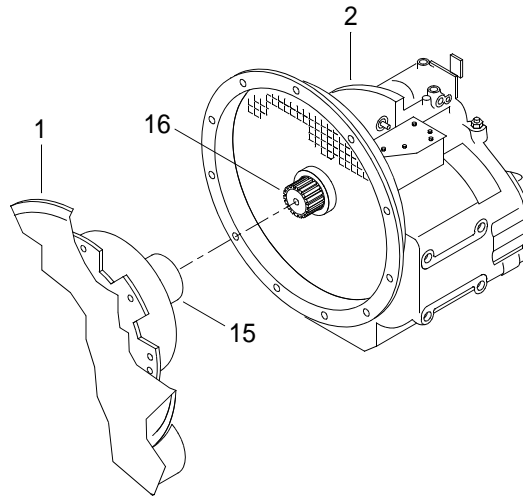


 WARNING



HEAVY PARTS

13. Using crane and sling for support and assistant to steady marine gear (2), slowly slide marine gear (2) aft until marine gear input shaft (15) is clear of engine torsional coupling hub (16).



 WARNING



HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

14. Using crane and sling and assistant to steady marine gear (2), remove marine gear (2) from rear of diesel engine (1).

INSTALL MARINE GEAR

 WARNING

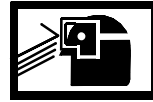


HEAVY PARTS

Do not stand beneath suspended loads. Failure to comply could result in death or injury to personnel.

1. Using crane and sling and assistant to steady marine gear (2), position marine gear (2) near engine flywheel housing (14).

WARNING

**CHEMICAL****EYE PROTECTION**

2. Use cleaner and wiping rags to remove any debris on mounting surfaces of marine gear housing (13) and engine flywheel housing (14).

WARNING

**HEAVY PARTS**

3. Using crane and sling for support and assistant to steady marine gear (2), slowly slide marine gear (2) forward until marine gear input shaft (15) is positioned inside engine torsional coupling hub (16).
4. Install hex head capscrews (11) and washers (12) to secure marine gear housing (13) to engine flywheel housing (14).
5. Using torque wrench, torque hex head capscrews (3) to 55 ft lbs (74.58 N-m).
6. Remove twine securing mount panel (8) with attached control interface box (9) to diesel engine (1).
7. Install hex head nuts (5), lockwashers (6) and hex head capscrews (7) to secure mount panel (8) for control interface box (9) to upper portion of support mount (10). Tighten hex head nuts (4).
8. Remove twine securing marine gear solenoid electrical cables (3) to diesel engine (1).
9. Connect marine gear solenoid electrical cables (3) to marine gear (2) and remove tags.
10. Remove twine securing marine gear oil hoses (4) to diesel engine (1).

WARNING

**CHEMICAL****EYE PROTECTION**

11. Connect marine gear oil hoses (4) to marine gear (2) and remove tags.

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

12. Clean up spilled fluid with a spill kit and dispose of contaminated wiping rags and spill kit waste per local procedures.
13. Install diesel engine. (WP 0383 00)
14. Perform operational check of marine gear. (TM 55-1945-225-10)

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
POWER PLANT MOUNTS
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Hoist, Chain (Item 14, WP 0425 00)
Sling, 5,300 lb 6 ft (Green) (Item 28, WP 0425 00)
Qty 4
Shackle, 3/4 in. 4.75 Ton (Item 25, WP 0425 00)
Qty 3

Materials/Parts

Assembly, Mounting, Center Bonded
PN CB-2204-127

Personnel Required

Engineer 88L

Equipment Condition

Diesel Engine Removed. (WP 0383 00)

REMOVE POWER PLANT MOUNT

WARNING



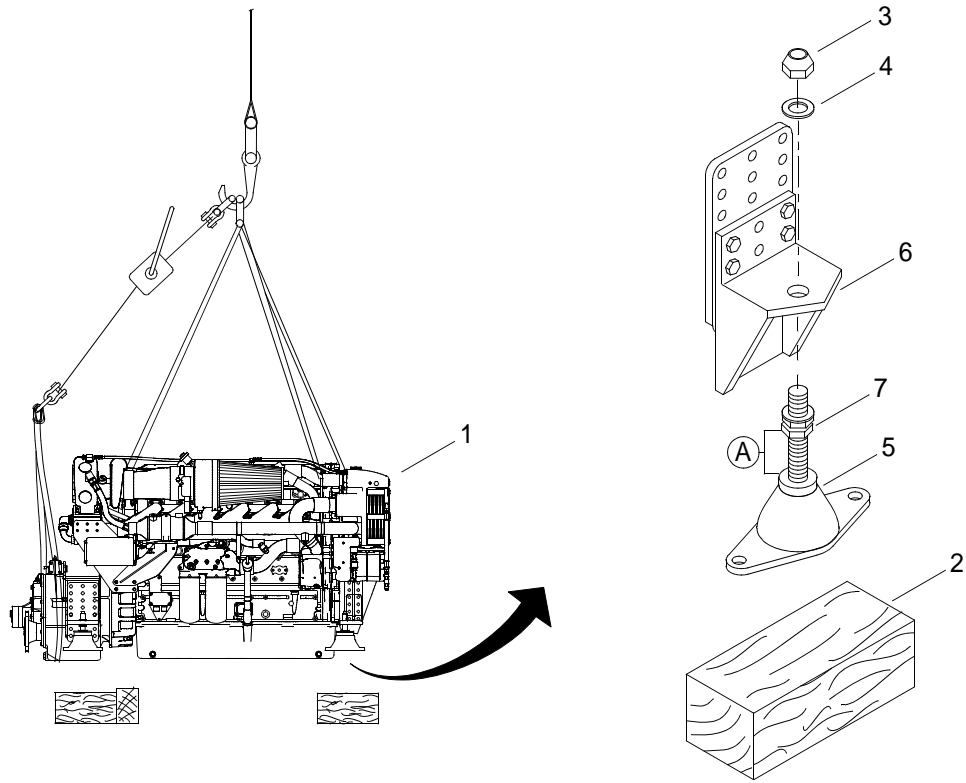
HEAVY PARTS

Do not attempt to lift power plant with any less than a three point hook-up on the diesel engine and a sling/chain hoist combination around marine gear for support. Failure to comply could result in injury to personnel and damage to equipment.

NOTE

This task is typical for removal and installation of the power plant (diesel engine with attached marine gear) supporting mounts.

1. Inspect slings and shackles prior to use. (TM 55-1945-225-10)
2. Using crane, chain hoist, slings and shackles, raise power plant (1) off supporting dunnage (2).



3. Remove nut (3) and washer (4) securing mount (5) to power plant support bracket (6).
4. Remove mount (5) from power plant support bracket (6).

NOTE

The height differences between the forward and rear support mounts will vary, depending upon amount of weight being supported on each mount. Retain information of the old height settings established during drive train alignment prior to discarding old mounts.

5. Using a ruler, measure distance between top of mount (5) and lower locking nut (7) and record reading (A).
6. Discard mount (5).

INSTALL POWER PLANT MOUNT

1. Using rule, preset height of lower locking nut (7) from top of new mount (5) to measurement (A) recorded during removal.
2. Install washer (4) and nut (3) to secure mount (5) to power plant support bracket (6). Tighten nut (3).

WARNING

**HEAVY PARTS**

3. Using crane, chain hoist, slings and shackles, lower power plant (1) onto supporting dunnage (2).
4. Install diesel engine. (WP 0383 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
LIFE LINE STANCHION
REMOVAL AND INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
 Life Preserver, Vest (Item 17, WP 0425 00)
 Helmet, Safety (Blue) (Item 13, WP 0425 00)
 Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

Engineer 88L

REMOVE LIFE LINE STANCHION

WARNING

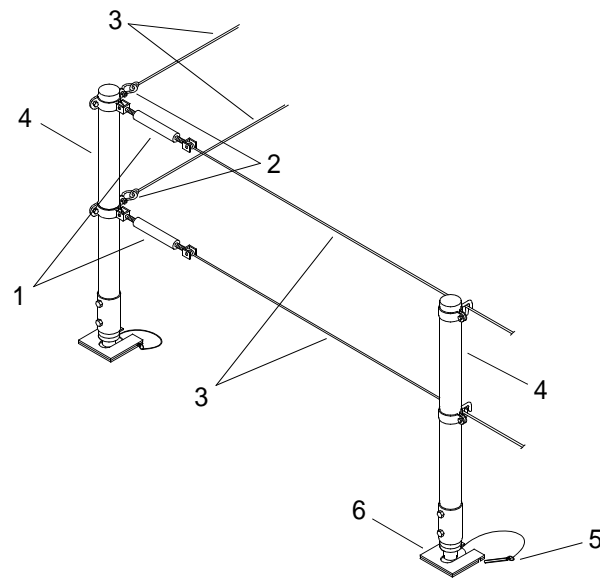
**VEST****HELMET PROTECTION****HEAVY PARTS****MOVING PARTS**

All personnel must wear a personal flotation device, hard hat, safety shoes and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal and installation of life line stanchions.

1. Loosen and remove turnbuckles (1) or shackles (2) securing ends of life lines (3) to life line stanchions (4).



2. Remove life lines (3) from life line stanchions (4).
3. Remove pin (5) securing life line stanchion (4) to deck fitting (6).
4. Remove life line stanchion (4) from deck fitting (6).

INSTALL LIFE LINE STANCHION

1. Position life line stanchion (4) into deck fitting (6).
2. Install pin (5) to secure life line stanchion (4) in deck fitting (6).
3. Position life lines (3) on life line stanchions (4) and secure with turnbuckles (1) or shackles (2). Tighten turnbuckles (1) or shackles (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
LIFE LINE STANCHION
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

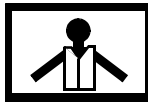
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Equipment Condition

Life Line Stanchion Removed. (WP 0386 00)

DISASSEMBLE LIFE LINE STANCHION

WARNING



VEST

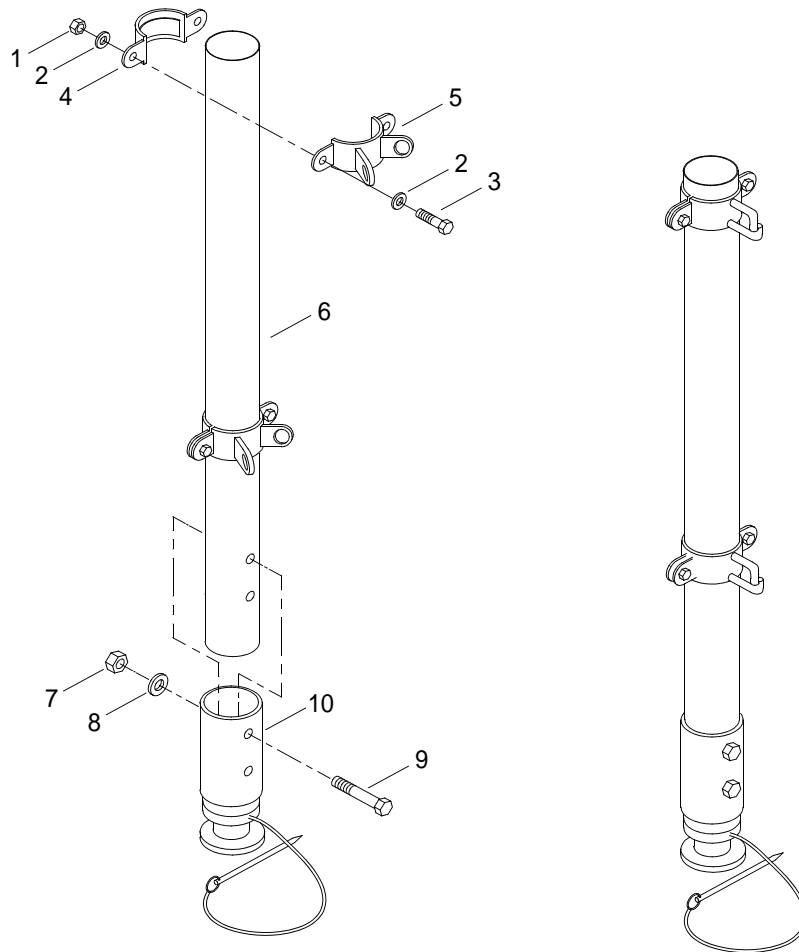
All personnel must wear a personal flotation device and gloves during WT operations and maintenance. Failure to observe these precautions could result in serious injury or death to personnel.

NOTE

This task is typical for the removal, inspection, repair and installation of components on both corner and side/end life line stanchions.

Repair is limited to replacement of defective items.

1. Remove self-locking nuts (1), washers (2) and hex head capscrews (3) securing outer (4) and inner (5) hanger brackets to life line stanchion (6).



CORNER STANCHION

SIDE/END STANCHION

2. Remove outer (4) and inner (5) hanger brackets from life line stanchion (6).
3. Remove self-locking nuts (7), washers (8), and hex head capscrews (9) securing life line stanchion (6) to life line stanchion base (10).
4. Remove life line stanchion (6) from life line stanchion base (10).

INSPECT LIFE LINE STANCHION

1. Inspect rubber strips on hanger brackets for wear and tear. Replace as required.
2. Inspect self-locking nuts, washers and hex head capscrews for damage. Replace as required.
3. Inspect stanchion for cracks or deterioration. Replace as required.

ASSEMBLE LIFE LINE STANCHION

1. Position life line stanchion (6) in life line stanchion base (10).
2. Install self-locking nuts (7), washers (8), and hex head capscrews (9) to secure life line stanchion (6) to life line stanchion base (10). Tighten self-locking nuts (7).
3. Position outer (4) and inner (5) hanger brackets on life line stanchion (6).
4. Install self-locking nuts (1), washers (2), and hex head capscrews (3) to securing outer (4) and inner (5) hanger brackets to life line stanchion (6). Tighten self-locking nuts (1).
5. Install life line stanchion. (WP 0386 00)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
RING BUOY AND HANGER BRACKET ASSEMBLY
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Brush, Wire Scratch (Item 4, WP 0425 00)

Materials/Parts

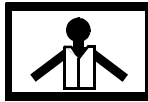
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Cleaner (Item 5, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

DISASSEMBLE RING BUOY AND HANGER BRACKET ASSEMBLY

WARNING



VEST

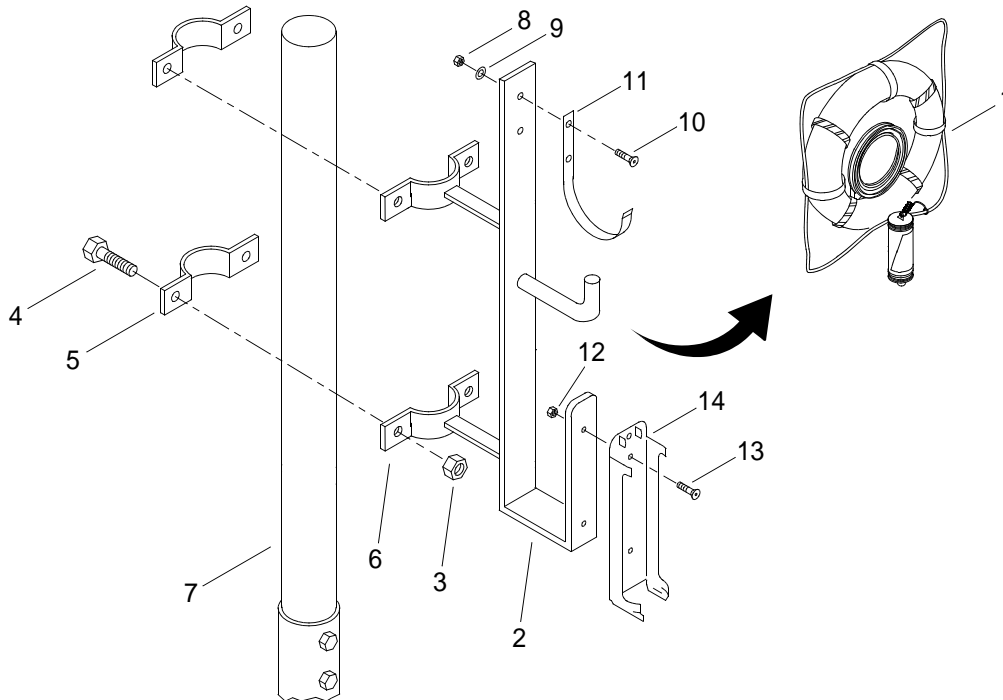
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death.

NOTE

Repair is limited to the replacement of damaged components.

1. Remove ring buoy with rope and strobe light (1) from hanger bracket assembly (2).

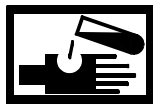
Revised May 1984 and 1985. TM 55-1945-225-24 (2)



2. Remove nuts (3), hex head capscrews (4) and outer clamp half (5) securing inner clamp half (6) to stanchion (7).
3. Remove hanger bracket assembly (2) from stanchion (7).
4. Remove nuts (8), washers (9), capscrews (10) and ring buoy bracket (11) from hanger bracket assembly (2).
5. Remove nuts (12), capscrews (13) and strobe light bracket (14) from hanger bracket assembly (2).

CLEAN QUICK RELEASE AND MOORING ASSEMBLY

WARNING



CHEMICAL



EYE PROTECTION

1. Clean hanger bracket assembly components with cleaner and wire brush.
2. Use fresh water to thoroughly wash all equipment after cleaning.
3. Wipe all parts clean with wiping rags.

WARNING



CHEMICAL



EYE PROTECTION

4. Dispose of contaminated wiping rags in accordance with local procedures.

INSPECT RING BUOY AND HANGER BRACKET ASSEMBLY

1. Inspect clamps (5, 6) and brackets (11, 14) for corrosion, cracks or other damage. Replace if damaged.
2. Inspect capscrews (4, 10, 13) and nuts (3, 8, 12) for damaged threads. Replace if damaged.

ASSEMBLE RING BUOY AND HANGER BRACKET ASSEMBLY

1. Install strobe light bracket (14), capscrews (13) and nuts (12) on hanger bracket assembly (2).
Tighten nuts (12).
2. Install ring buoy bracket (11), capscrews (10), washers (9) and nuts (8) on hanger bracket assembly (2).
Tighten nuts (8).
3. Position hanger bracket assembly (2) inner clamp half (6) on stanchion (7).
4. Install outer clamp half (5), hex head capscrews (4) and nuts (3) to secure hanger bracket assembly inner clamp half (6) to stanchion (6). Tighten nuts (3).
5. Install ring buoy with rope and strobe light (1) on hanger bracket assembly (2).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SKEG ASSEMBLY
REPAIR**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Apron, Utility (Item 6, WP 0425 00)
Brush, Wire Scratch (Item 4, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

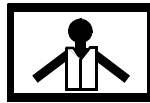
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Cleaner (Item 5, WP 0426 00)
Antiseize Compound (Item 3, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

DISASSEMBLE SKEG ASSEMBLY

WARNING



VEST

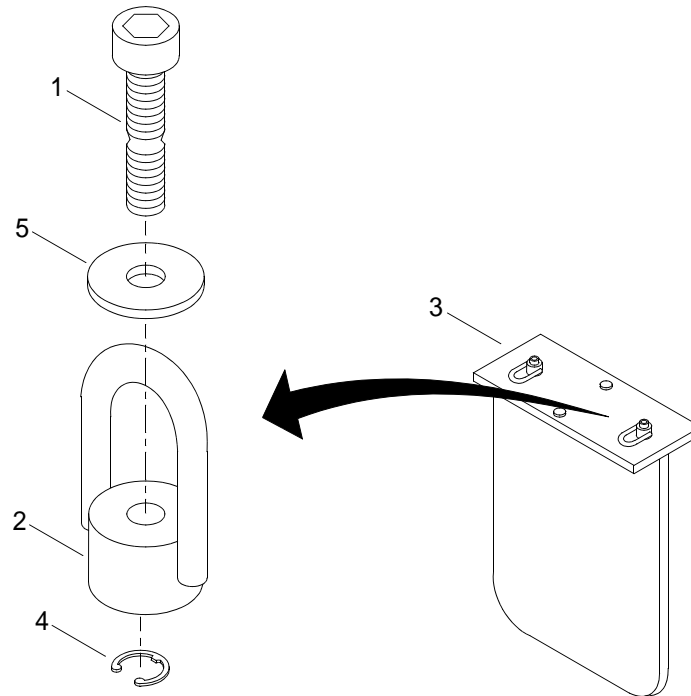
All personnel must wear a personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death.

NOTE

Repair is limited to the replacement of damaged components.

This task is typical for removal and installation of all hoist ring swivels.

1. Using key socket head wrench, remove bolt (1) securing hoist ring swivel (2) to top of skeg assembly (3).



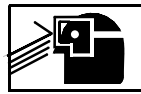
2. Remove E-clip (4) securing bolt to hoist ring swivel (2).
3. Remove bolt (1) and washer (5) from hoist ring swivel (2).

CLEAN SKEG ASSEMBLY

WARNING



CHEMICAL



EYE PROTECTION

1. Clean components of hoist ring swivel (2) with cleaner and wire brush.
2. Use fresh water to thoroughly wash all equipment after cleaning.
3. Wipe all parts clean with wiping rags.

WARNING



CHEMICAL



EYE PROTECTION

4. Dispose of contaminated wiping rags in accordance with local procedures.

INSPECT SKEG ASSEMBLY

1. Inspect components of hoist ring swivel (2) for corrosion, cracks or other damage. Replace if damaged.
2. Inspect bolt (1) for damaged threads. Replace if damaged.

ASSEMBLE SKEG ASSEMBLY

WARNING

**CHEMICAL****EYE PROTECTION**

1. Apply antiseize compound to threads of bolt (1).
2. Install washer (5) on bolt (1).
3. Install bolt (1) with washer (5) through hole in hoist ring swivel (2).
4. Install E-clip (4) over notch in bolt (1) to secure bolt (1) on hoist ring swivel (2).
5. Install hoist ring swivel (2) into hole on top of skeg assembly (3) and tighten bolt (1).

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HAND LANTERN INCANDESCENT BULB
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Materials/Parts

Lamp, Incandescent
PN MS16524-2

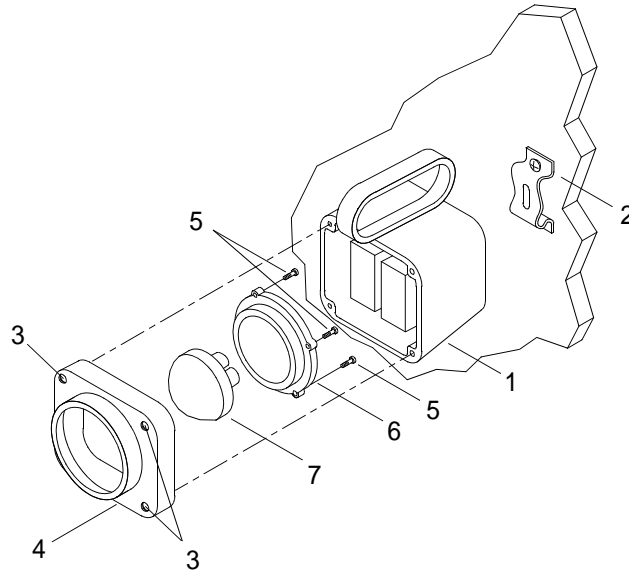
Personnel Required

Engineer 88L

REMOVE HAND LANTERN INCANDESCENT BULB**NOTE**

This task is typical for removal and installation of all hand lantern bulbs.

1. Rotate hand lantern (1) 90° and remove from mounting bracket (2).



2. Loosen four captive screws (3) on cover (4).
3. Remove cover (4).
4. Place cover (4) face down on work bench.
5. Remove four retaining screws (5) securing retaining ring (6) over bulb (7).
6. Remove retaining ring (6) and bulb (7).
7. Discard bulb (7).

INSTALL HAND LANTERN INCANDESCENT BULB

1. Position new bulb (7) into cover (4).
2. Position retaining ring (6) over bulb (7).
3. Install four retaining screws (5) to secure retaining ring (6) over bulb (7). Tighten screws (5).
4. Position cover (4) on hand lantern (1).
5. Tighten four captive screws (3) to secure cover (4) to hand lantern (1).
6. Position hand lantern (1) on mounting bracket (2) and rotate 90°.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HAND LANTERN BATTERIES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Materials/Parts

Battery, Non recharge
PN BA200U
Qty 2

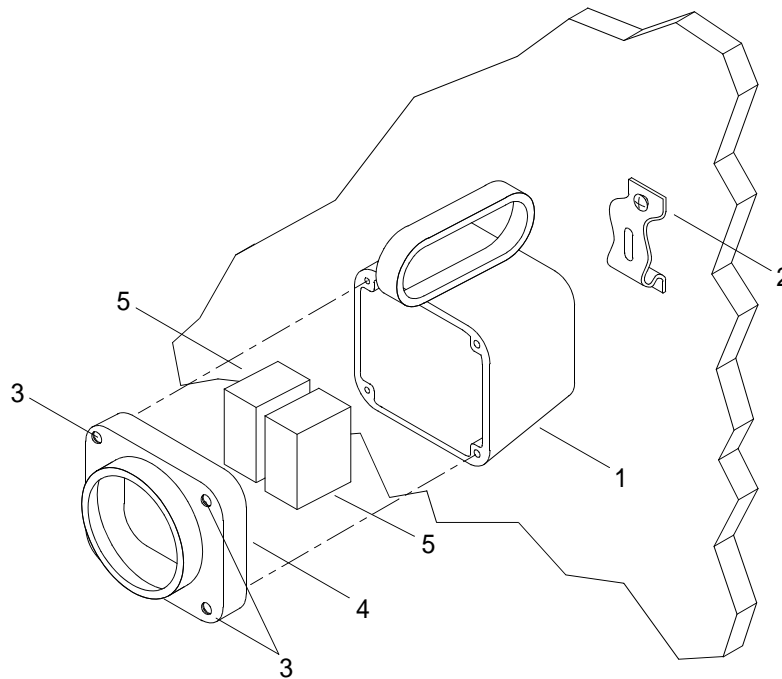
Personnel Required

Engineer 88L

REMOVE HAND LANTERN BATTERIES**NOTE**

This task is typical for removal and installation of all hand lantern batteries.

1. Rotate hand lantern (1) 90° and remove from mounting bracket (2).



2. Loosen four captive screws (3) on cover (4).
3. Remove cover (4).
4. Place hand lantern (1) face up on work bench.
5. Remove batteries (5) and dispose of in accordance with local procedures.

INSTALL HAND LANTERN BATTERIES

1. Install new batteries (5) in hand lantern (1).
2. Position cover (4) on hand lantern (1).
3. Install four captive screws (3) through cover (4) and into hand lantern (1).
4. Tighten four captive screws (3).
5. Position hand lantern (1) on mounting bracket (2) and rotate 90°.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HAND LANTERN MOUNTING BRACKET
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Materials/Parts

Assembly, Bracket

PN M16377-53-003

Holder, Light

PN M16377/54-2438

O-Ring

PN MS28775-001

Qty 2

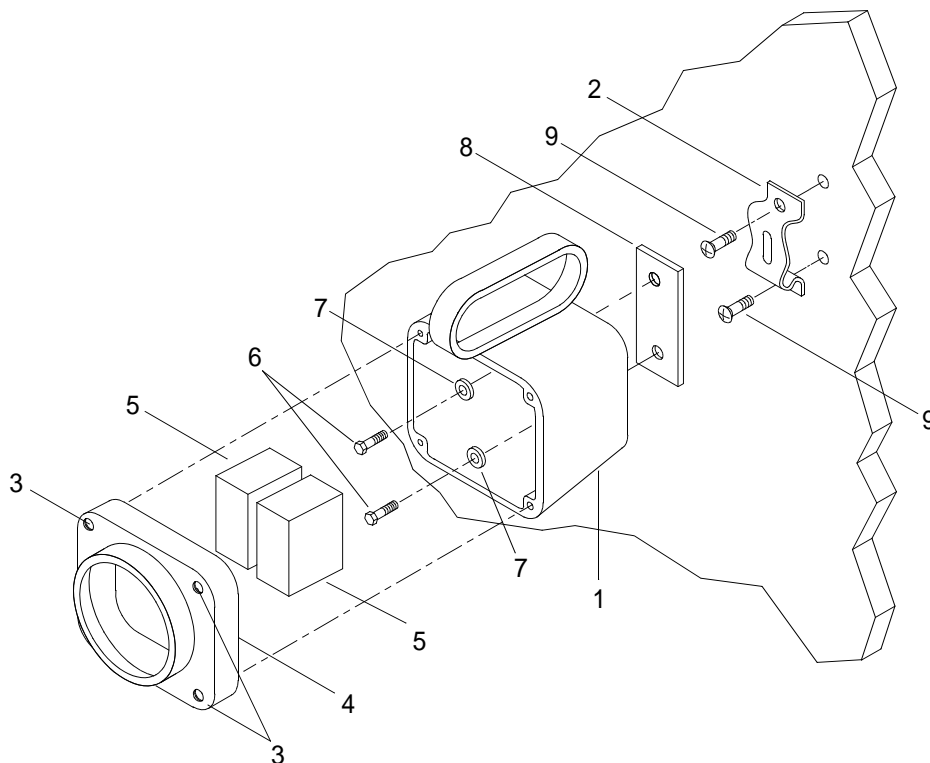
Personnel Required

Engineer 88L

REMOVE HAND LANTERN MOUNTING BRACKET**NOTE**

This task is typical for removal and installation of all hand lantern mounting brackets.

1. Rotate hand lantern (1) 90° and remove from mounting bracket (2).



2. Loosen four captive screws (3) on cover (4).
3. Remove cover (4).
4. Place hand lantern (1) face up on work bench.
5. Remove batteries (5).
6. Remove two hex head bolts (6) and o-rings (7) from bracket (8).
7. Discard o-rings (7) and bracket (8).
8. Remove two screws (9) to secure mounting bracket (2) to bulkhead.
9. Discard mounting bracket (2).

INSTALL HAND LANTERN MOUNTING BRACKET

1. Position new mounting bracket (2) on bulkhead.
2. Install two screws (9) securing mounting bracket (2) to wall.
3. Tighten screws (9).
4. Position new bracket (8) on back of hand lantern (1).
5. Install two hex head bolts (6) and new o-rings (7) through hand lantern (1) into bracket (8).
6. Tighten hex head bolts (6).
7. Install batteries (5).
8. Position cover (4) on hand lantern (1).
9. Install four screws (3) through cover (4) and into hand lantern (1).
10. Tighten four captive screws (3).
11. Position hand lantern (1) on mounting bracket (2) and rotate 90°.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
STUB ASSEMBLY MAST LIGHT
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Life Preserver, Vest (Item 17, WP 0425 00)
Helmet, Safety (Blue) (Item 13, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Light, Navigation
PN E36578
Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)

Personnel Required

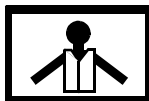
Seaman 88K

Equipment Condition

Stub Assembly Mast Removed. (TM 55-1945-225-10)
Stub Assembly Mast Light Batteries Removed. (TM 55-1945-225-10)

REMOVE STUB ASSEMBLY MAST LIGHT

WARNING



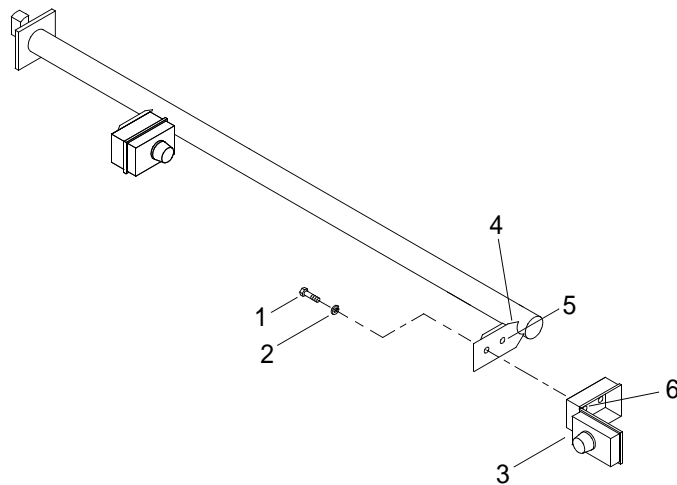
VEST

All personnel must wear personal flotation device during WT operations and maintenance. Failure to observe this precaution could result in serious injury or death.

NOTE

This task is typical for removal and installation of both stub assembly mast lights.

1. Remove hex head capscrews (1) and lockwashers (2) securing stub assembly mast light (3) to stub assembly mast light mounting plate (4).



2. Remove stub assembly mast light (3) from stub assembly mast light mounting plate (4) and discard.

INSTALL STUB ASSEMBLY MAST LIGHT

1. Position new stub assembly mast light (3) on stub assembly mast light mounting plate (4).
2. Install hex head capscrews (1) and lockwashers (2) through holes (5) in stub assembly mast light mounting plate (4) into inserts (6) inside assembly mast light (3) to secure assembly mast light (3) to stub assembly mast light mounting plate (4). Tighten hex head capscrews (1).
3. Install stub assembly mast light batteries. (TM 55-1945-225-10)
4. Install stub assembly mast. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
WEIGHT LIFTING DEVICES
INSPECTION**

INITIAL SETUP:**Personnel Required**Seaman 88K

CHAIN SLINGS

WARNING

The existence of any of the following conditions will require that chain slings be immediately removed from service. Failure to observe these precautions could result in serious injury or death to personnel.

1. Inspect chain for excessive wear or stretching.
2. Inspect chain for bent or twisted links.
3. Inspect chain for defective welds.
4. Inspect chain for nicks and gouges.
5. Inspect all attaching shackles and hardware for corrosion, nicks, cuts, scratches or breaks.
6. Inspect hoist attachment or terminal ring for distortion.

ROPE (NATURAL AND SYNTHETIC)

WARNING

The existence of any of the following conditions will require that rope be immediately removed from service. Failure to observe these precautions could result in serious injury or death to personnel.

1. Inspect rope for abnormal wear.
2. Inspect rope for powdered fiber between strands.
3. Inspect rope for broken or cut fibers.
4. Inspect rope for variation in the size or roundness of strands.
5. Inspect rope for discoloration or rotting.

SYNTHETIC WEB SLINGS

WARNING

The existence of any of the following conditions will require that web slings be immediately removed from service. Failure to observe these precautions could result in serious injury or death to personnel.

1. Inspect web slings for marks or codes that show rated capacities and type of synthetic web material.
2. Inspect web slings for uniform thickness and width.
3. Inspect web slings for selvage edges splitting from webbings width.
4. Inspect web slings for snags, punctures, tears or cuts.
5. Inspect web slings for broken or worn stitches.
6. Inspect web slings for distortion of fittings.
7. Inspect web sling fittings for sharp edges that could damage webbing.
8. Inspect web sling surface for evidence of melting, charring from acid or burns.

HOOKS AND SHACKLES

1. Inspect hooks and shackles for proper position and function of safety closure latch.
2. Inspect hooks and shackles for cracks or corrosion.
3. Inspect hooks and shackles for a throat opening of more than 15° original dimensions.
4. Inspect hooks and shackles for wear exceeding 10° of original dimensions.
5. Inspect hooks for more than a 10° twist from plane of unbent hook.
6. Inspect shackle pin for cracks, corrosion or excessive wear.

NOTE

New hooks should have all paint removed prior to being placed in service.

7. Inspect hooks for paint that covers small stress cracks from metal fatigue.

END OF WORK PACKAGE

**GENERAL SUPPORT MAINTENANCE
WARPING TUG
WEIGHT LIFTING DEVICES
TESTING**

INITIAL SETUP:

Personnel Required

Engineer 88L

References

29 CFR

TEST WEIGHT LIFTING DEVICES

Refer to 29 CFR, Sections 1919.6, 1919.15, 1919.28, 1919.30 and 1919.31.

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM DIODES
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Soldering Iron, Electric (Item 5, WP 0425 00)
Respirator, Air Filtering (Item 3, WP 0425 00)

Materials/Parts

Gloves, Men's and Women's (Leather Palm) (Item 10, WP 0426 00)
Kit Solder, Aluminum (Item 18, WP 0426 00)

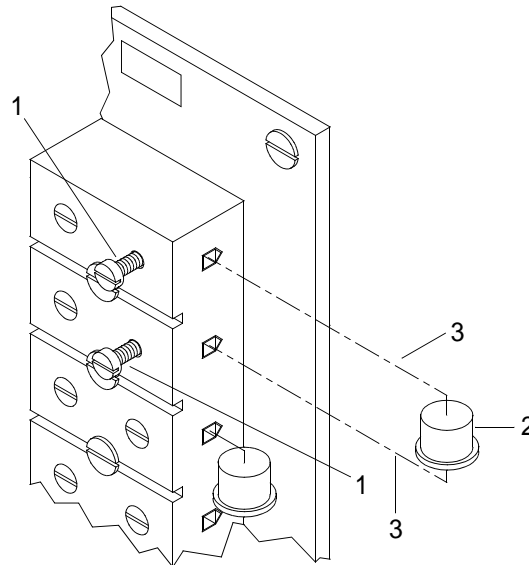
Personnel Required

Engineer 88L

REMOVE SCREW DOWN MOUNT ELECTRICAL SYSTEM DIODES**NOTE**

The following procedure is typical for removal of screw down mount diodes.

1. Loosen two screws (1).

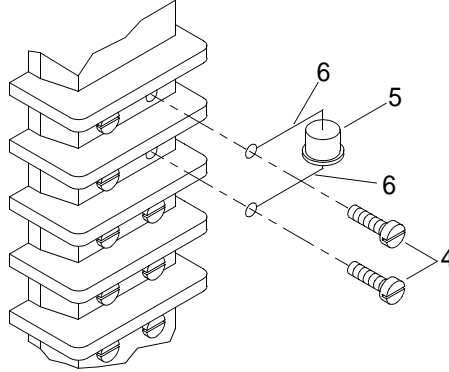


2. Remove diode (2) with attached leads (3).
3. Discard diode (2) with attached leads.

REMOVE LUG MOUNT ELECTRICAL SYSTEM DIODES**NOTE**

The following procedure is typical for removal of lug mount diodes.

1. Remove two screws (4).

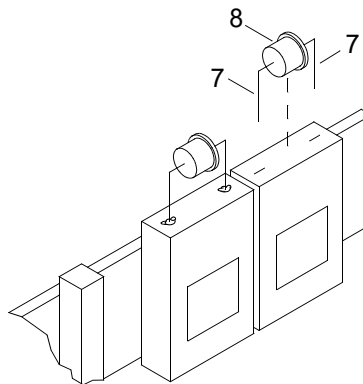


2. Remove diode (5) with attached leads (6).
3. Discard diode (5) with attached leads (6).

REMOVE SOLDER MOUNT ELECTRICAL SYSTEM DIODES**WARNING****HOT AREA****EYE PROTECTION****VAPOR****NOTE**

The following procedure is typical for removal of solder mount diodes.

1. Using soldering iron, heat and loosen two diode leads (7).



2. Remove diode (8) with attached leads (7) and discard.

INSTALL SCREW DOWN MOUNT ELECTRICAL SYSTEM DIODES**NOTE**

The following procedure is typical for installation of screw down mount diodes.

1. Position new diode (3) with attached leads (2).
2. Tighten two screws (1).

INSTALL LUG MOUNT ELECTRICAL SYSTEM DIODES**NOTE**

The following procedure is typical for installation of lug mount diodes.

1. Position new diode (5) with attached leads (6).
2. Install two screws (4) and tighten.

INSTALL SOLDER MOUNT ELECTRICAL SYSTEM DIODES

WARNING

**HOT AREA****EYE PROTECTION****VAPOR****NOTE**

The following procedure is typical for installation of solder mount diodes.

1. Position diode (8) with attached leads (7).
2. Using soldering iron, solder and flux attach two leads (7).

END OF WORK PACKAGE

**DIRECT SUPPORT MAINTENANCE
WARPING TUG
ELECTRICAL SYSTEM WIRING
REPAIR**

INITIAL SETUP:

Personnel Required

Engineer 88L

References

46 CFR 129.340

REPAIR ELECTRICAL SYSTEM WIRING

For electrical wiring repair procedures, refer to 46 CFR 129.340.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
PIPE NIPPLES, ELBOWS, TEES, ADAPTORS AND PLUGS
REPLACEMENT**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Materials/Parts

Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Tape, Antiseize (Item 42, WP 0426 00)
Sealing Compound (Item 34, WP 0426 00)
Spill Clean-Up Kit, Hazardous Material (Item 38, WP 0426 00)

Personnel Required

Engineer 88L

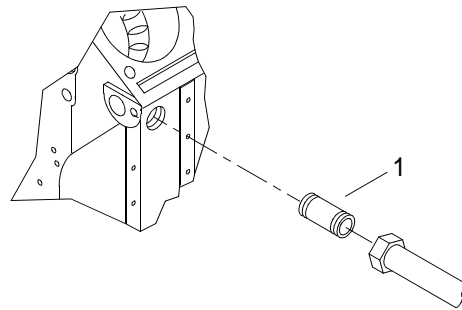
References

TM 55-1945-225-10

REMOVE PIPE NIPPLES, ELBOWS, TEES, ADAPTORS AND PLUGS**NOTE**

The following steps are typical for removal of pipe nipples.

1. Remove pipe nipple (1).



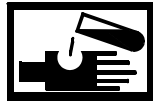
- a. Place drain pan under pipe nipple (1).

WARNING

**CHEMICAL****EYE PROTECTION**

- b. Disconnect associated hardware attached to pipe nipple (1).
- c. Remove pipe nipple (1) and discard.

 WARNING



CHEMICAL



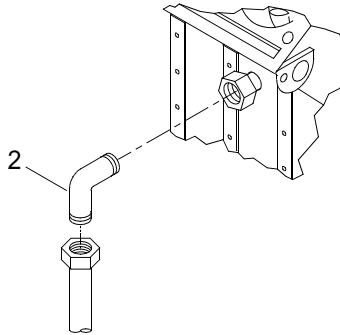
EYE PROTECTION

- d. Remove drain pan and dispose of contents in accordance with local procedures.

NOTE

The following steps are typical for removal of elbows.

2. Remove elbow (2).



- a. Place drain pan under elbow (2).

 WARNING



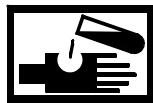
CHEMICAL



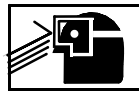
EYE PROTECTION

- b. Disconnect associated hardware attached to elbow (2).
 c. Remove elbow (2) and discard.

 WARNING



CHEMICAL



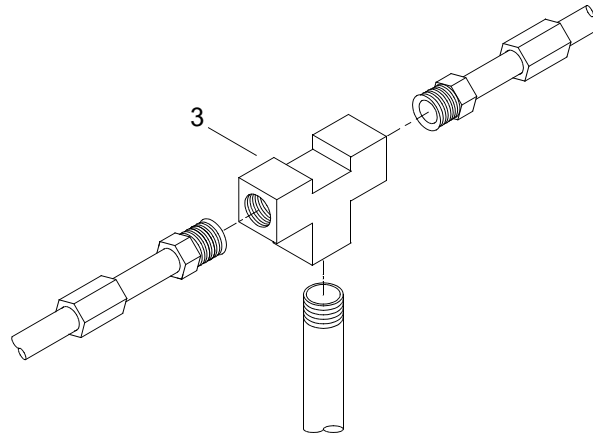
EYE PROTECTION

- d. Remove drain pan and dispose of contents in accordance with local procedures.

NOTE

The following steps are typical for removal of tees.

3. Remove tee (3).



- a. Place drain pan under tee (3).

WARNING

**CHEMICAL****EYE PROTECTION**

- b. Disconnect associated hardware attached to tee (3).
c. Remove tee (3) and discard.

WARNING

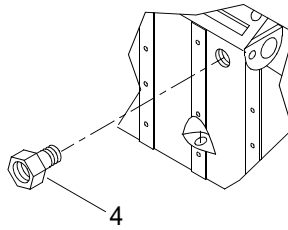
**CHEMICAL****EYE PROTECTION**

- d. Remove drain pan and dispose of contents in accordance with local procedures.

NOTE

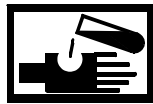
The following steps are typical for removal of adaptors.

4. Remove adaptor (4).



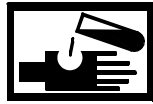
- a. Place drain pan under adaptor (4).

WARNING

**CHEMICAL****EYE PROTECTION**

- b. Disconnect associated hardware attached to adaptor (4).
c. Remove adaptor (4) and discard.

WARNING

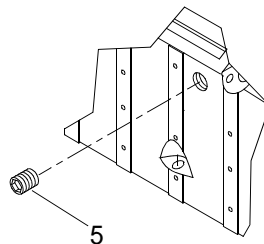
**CHEMICAL****EYE PROTECTION**

- d. Remove drain pan and dispose of contents in accordance with local procedures.

NOTE

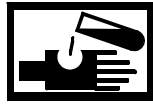
The following steps are typical for removal of plugs.

5. Remove plug (5).



- a. Place drain pan under plug (5).

 WARNING



CHEMICAL



EYE PROTECTION

- b. Remove plug (5) and discard.

 WARNING



CHEMICAL



EYE PROTECTION

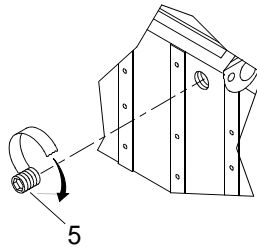
- c. Remove drain pan and dispose of contents in accordance with local procedures.

INSTALL PIPE NIPPLES, ELBOWS, TEES, ADAPTORS AND PLUGS

NOTE

The following steps are typical for installation of plugs.

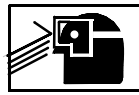
1. Install plug (5).



 WARNING



CHEMICAL



EYE PROTECTION

- a. Apply sealing compound on new plug (5) threads.
 b. Install new plug (5).

 WARNING



CHEMICAL



EYE PROTECTION



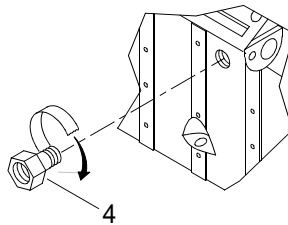
SLICK FLOOR

- c. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.
- d. Perform operational checks. (TM 55-1945-225-10)

NOTE

The following steps are typical for installation of adaptors.

- 2. Install adaptor (4).



 WARNING



CHEMICAL



EYE PROTECTION

- a. Apply sealing compound to new adaptor (4) threads and associated hardware.
- b. Install new adaptor (4) between associated hardware.
- c. Connect associated hardware to adaptor (4).

 WARNING



CHEMICAL



EYE PROTECTION



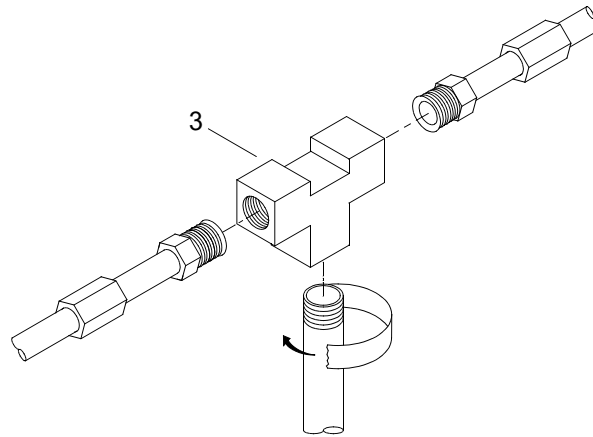
SLICK FLOOR

- d. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.
- e. Perform operational checks. (TM 55-1945-225-10)

NOTE

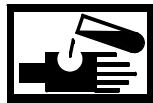
The following steps are typical for installation of tees.

3. Install tee (3).

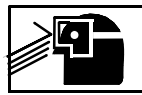


- a. Wrap associated hardware threads with antiseize tape.
- b. Position new tee (3) between associated hardware.
- c. Connect associated hardware to tee (3).

WARNING



CHEMICAL



EYE PROTECTION



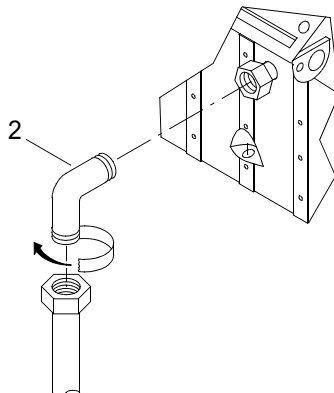
SLICK FLOOR

- d. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.
- e. Perform operational checks. (TM 55-1945-225-10)

NOTE

The following steps are typical for installation of elbows.

4. Install elbow (2).



- a. Wrap both ends of new elbow (2) threads with antiseize tape.
- b. Position new elbow (2) between associated hardware.
- c. Connect associated hardware to elbow (2).

WARNING

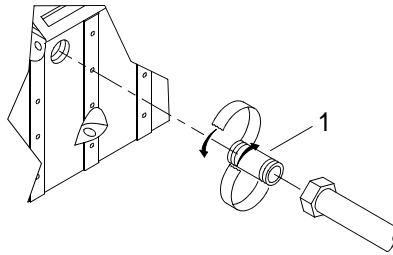
**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

- d. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.
- e. Perform operational checks. (TM 55-1945-225-10)

NOTE

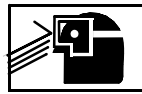
The following steps are typical for installation of pipe nipples.

5. Install pipe nipple (1).



- a. Wrap both ends of new pipe nipple (1) threads with antiseize tape.
- b. Position new pipe nipple (1) between associated hardware.
- c. Connect associated hardware to pipe nipple (1).

WARNING

**CHEMICAL****EYE PROTECTION****SLICK FLOOR**

- d. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.
- e. Perform operational checks. (TM 55-1945-225-10)

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SLEEVE PN E12978-1 AND NUT PN E12958-1
INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Tool, Tube Presetting (Item 34, WP 0425 00)

Materials/Parts

Sleeve
PN E12978-1
Nut
PN E12958-1
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Lubricating Oil, General Purpose (Item 21, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

Equipment Condition

E12798-1 and E12798-4 Tubes Manufactured. (WP 0418 00)

INSTALL SLEEVE AND NUT

WARNING



CHEMICAL



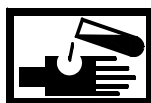
EYE PROTECTION

NOTE

This procedure is typical for installation of sleeves and nuts on manufactured tube
PN's E12798-1 and E12798-4.

1. Lubricate thread and cone of ferrule tool and thread of nut.
2. Slip nut over tube with threads pointing toward tube end.
3. Slip ferrule over tube with long, straight end pointing toward tube end.

WARNING



CHEMICAL

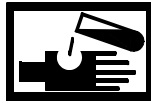


EYE PROTECTION

4. Lubricate ferrule.

5. Place ferrule tool in vise.
6. Bottom tube end firmly on internal shoulder of ferrule tool.
7. Manually screw nut onto ferrule tool until finger tight and make reference mark on tube and nut.
8. Hold tube steady against internal shoulder of ferrule tool and tighten nut an additional 1 3/4 turns.

WARNING

**CHEMICAL****EYE PROTECTION**

9. Remove excess oil from ferrule with wiping rag.
10. Loosen nut and inspect for proper pre-set.

NOTE

All fittings must be disassembled and inspected for proper ferrule pre-set before final assembly for service.

- a. Inspect for a ridge of metal that has been raised above the tube surface, to a height of at least 50% of the thickness of the ferrule's leading edge, completely around the tube.
 - b. Inspect the tail or back end of the ferrule is snug against the tube.
 - c. Inspect for a slight indentation around the end of the tube.
 - d. Check that ferrule does not move back and forth on tube.
11. Place tube end on internal shoulder of ferrule tool.
 12. Manually screw nut onto ferrule tool until finger tight.
 13. Make reference mark on nut and tube.
 14. Wrench tighten nut another 1/3 to 1/2 turn.
 15. Remove tube, ferrule and nut from ferrule tool.

WARNING

**CHEMICAL****EYE PROTECTION**

16. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
MALE CONNECTOR PN E11468
INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Vise Block With Flaring Pin (Item 36, WP 0425 00)

Materials/Parts

Male Connector
PN E11468

Personnel Required

Engineer 88L

Equipment Condition

E12798-3 Tube Manufactured. (WP 0418 00)

INSTALL MALE CONNECTOR

1. Slip nut over tube with threads pointing toward tube end.
2. Slip sleeve over tube with long, straight end pointing away from tube end.
3. Loosen screws on vise block.
4. Place tube end in vise block and tighten screws.
5. Place vise block in vise.
6. Position flaring pin on tube end.
7. Using hammer, strike flaring pin a few sharp blows to form flare on tube end.
8. Remove vise block from vise.
9. Loosen screws on vise block and remove tube.
10. Place male connector fitting body in vise.
11. Manually screw nut onto fitting body until hand tight.
12. Make reference mark on nut and tube.
13. Wrench tighten nut another 1 1/4 flats from reference mark.
14. Remove tube, nut, sleeve and body from vise.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
SLEEVE PN E12978-2 AND NUT PN E12958-2
INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)
Tool, Tube Presetting (Item 35, WP 0425 00)

Materials/Parts

Sleeve
PN E12978-2
Nut
PN E12958-2
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Lubricating Oil, General Purpose (Item 21, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

Engineer 88L

Equipment Condition

E12788-2 Tube Manufactured. (WP 0417 00)

INSTALL SLEEVE AND NUT

WARNING

**CHEMICAL****EYE PROTECTION**

1. Lubricate thread and cone of ferrule tool and thread of nut.
2. Slip nut over tube with threads pointing toward tube end.
3. Slip ferrule over tube with long, straight end pointing toward tube end.

WARNING

**CHEMICAL****EYE PROTECTION**

4. Lubricate ferrule.
5. Place ferrule tool in vise.
6. Bottom tube end firmly on internal shoulder of ferrule tool.

-
7. Manually screw nut onto ferrule tool until finger tight and make reference mark on tube and nut.
 8. Hold tube steady against internal shoulder of ferrule tool and tighten nut an additional 1 3/4 turns.

WARNING



CHEMICAL



EYE PROTECTION

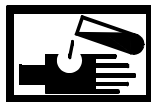
9. Remove excess oil from ferrule with wiping rag.
10. Loosen nut and inspect for proper pre-set.

NOTE

All fittings must be disassembled and inspected for proper ferrule pre-set before final assembly for service.

- a. Inspect for a ridge of metal that has been raised above the tube surface, to a height of at least 50% of the thickness of the ferrule's leading edge, completely around the tube.
 - b. Inspect the tail or back end of the ferrule is snug against the tube.
 - c. Inspect for a slight indentation around the end of the tube.
 - d. Check that ferrule does not move back and forth on tube.
11. Place tube end on internal shoulder of ferrule tool.
 12. Manually screw nut onto ferrule tool until finger tight.
 13. Make reference mark on nut and tube.
 14. Wrench tighten nut another 1/3 to 1/2 turn.
 15. Remove tube, ferrule and nut from ferrule tool.

WARNING



CHEMICAL



EYE PROTECTION

16. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HOSE FITTING PN E11528
INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Mini-Crimp Machine (Item 19, WP 0425 00)

Materials/Parts

Hose Fitting
E11528

Personnel Required

Engineer 88L

Equipment Condition

E11518-1, -2, -3 and -4 Hoses Manufactured. (WP 0416 00)

INSTALL MALE CONNECTOR

1. Mark hose at the end of hose fitting socket.
2. Push the hose fitting all the way onto the hose until the end of hose fitting socket is aligned with mark on hose.
3. Select the proper dies for fitting selected and install in crimp machine.
4. Insert hose and fitting until dies touch the fitting.
5. Place the pressure plate on top of dies.
6. Install pusher onto the cylinder of crimp machine.
7. Activate crimp machine pump to extend the cylinder.
8. Relieve pump pressure and allow cylinder to retract.
9. Remove pusher, pressure plate and dies.
10. Remove hose and fitting from crimp machine.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
FEMALE CONNECTOR PN E12858
INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Mini-Crimp Machine (Item 19, WP 0425 00)

Materials/Parts

Female Connector
PN E12858

Personnel Required

Engineer 88L

Equipment Condition

E11508-1, E11508-2 and E11508-3 Hoses Manufactured. (WP 0415 00)

INSTALL MALE CONNECTOR

1. Mark hose at the end of hose fitting socket.
2. Push the hose fitting all the way onto the hose until the end of hose fitting socket is aligned with mark on hose.
3. Select the proper dies for fitting selected and install in crimp machine.
4. Insert hose and fitting until dies touch the fitting.
5. Place the pressure plate on top of dies.
6. Install pusher onto the cylinder of crimp machine.
7. Activate crimp machine pump to extend the cylinder.
8. Relieve pump pressure and allow cylinder to retract.
9. Remove pusher, pressure plate and dies.
10. Remove hose and fitting from crimp machine.

END OF WORK PACKAGE

**UNIT LEVEL MAINTENANCE
WARPING TUG
HOSE NIPPLE PN E19028 AND CLAMP PN E19038
INSTALLATION**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Goggles, Industrial (Chipping, Chemical) (Item 4, WP 0425 00)

Materials/Parts

Hose Nipple
E19028
Hose Clamp
E19038
Gloves, Rubber, Industrial (Item 11, WP 0426 00)
Lubricating Oil, General Purpose (Item 21, WP 0426 00)
Rag, Wiping (Item 29, WP 0426 00)

Personnel Required

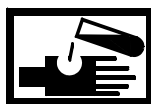
Engineer 88L

Equipment Condition

E19108-1 Hose Manufactured. (WP 0419 00)

INSTALL HOSE NIPPLE AND CLAMP

WARNING



CHEMICAL



EYE PROTECTION

1. Lubricate barbed end of hose nipple.
2. Push barbed end of hose nipple into hose until hose bottoms against hex.
3. Slip clamp over hose and nipple.
4. Tighten clamp.

WARNING



CHEMICAL



EYE PROTECTION

5. Using wiping rag, remove excess oil from adaptor and hose.

WARNING



CHEMICAL



EYE PROTECTION

6. Dispose of contaminated wiping rags per local procedures.

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
ILLUSTRATED LIST OF MANUFACTURED ITEMS**

INTRODUCTION**Scope**

This work package includes complete instructions for making items authorized to be manufactured or fabricated at Unit, Direct Support and General Support Maintenance Level that is applicable.

How to Use Index of Manufactured Items

A part number index in alphanumeric order is provided for cross-referencing part number of item to be manufactured to page which covers fabrication criteria.

Explanation of Illustrations of Manufactured Items

All instructions needed by maintenance personnel to manufacture item are included on illustrations.
All bulk materials needed for manufacture of an item are listed by part number or specification number in a tabular list on the illustrations.

LIST OF ILLUSTRATED MANUFACTURED ITEMS

Part Number	Name	Work Package
PN E09818-2	Raw Water Hose	WP 0413 00
PN E09858-4	Raw Water Hose	WP 0410 00
PN E09998-2	Raw Water Hose	WP 0408 00
PN E11508-1	Fuel Hose	WP 0415 00
PN E11508-2	Fuel Hose	
PN E11508-3	Fuel Hose	
PN E11518-1	Fuel Hose	WP 0416 00
PN E11518-2	Fuel Hose	
PN E11518-3	Fuel Hose	
PN E11518-4	Fuel Hose	
PN E12788-2	Fuel Tube	WP 0417 00
PN E12798-1	Fuel Tube	WP 0418 00
PN E12798-3	Fuel Tube	
PN E12798-4	Fuel Tube	

LIST OF ILLUSTRATED MANUFACTURED ITEMS (CONT'D)

Part Number	Name	Work Package	
PN E13208-2	Raw Water Hose	WP 0411 00	
PN E13208-3	Raw Water Hose		
PN E13208-4	Raw Water Hose		
PN E13208-8	Raw Water Hose		
PN E13208-10	Raw Water Hose		
PN E13208-11	Raw Water Hose		
PN E13208-12	Raw Water Hose		
PN E13208-13	Raw Water Hose		
PN E13208-14	Raw Water Hose		
PN E13208-15	Raw Water Hose		
PN E13208-16	Raw Water Hose		
PN E13208-6	Raw Water Hose		WP 0412 00
PN E13208-7	Raw Water Hose		
PN E13208-17	Raw Water Hose		
PN E19108-1	Heater Hose		WP 0419 00
PN E19108-2	Heater Hose		
PN E19108-3	Heater Hose		
PN E19108-4	Heater Hose	WP 0420 00	
PN E19108-5	Heater Hose		
PN E19108-6	Heater Hose		
PN E28481	Battery Cushion	WP 0406 00	
PN E28491	Battery Pad	WP 0407 00	
PN E31138-1	Suction and Return Hose	WP 0414 00	
PN E31138-2	Suction and Return Hose		
PN E31138-3	Suction and Return Hose		
PN E31138-4	Suction and Return Hose		
PN E31138-5	Suction and Return Hose		
PN E38928	Raw Water Hose	WP 0409 00	

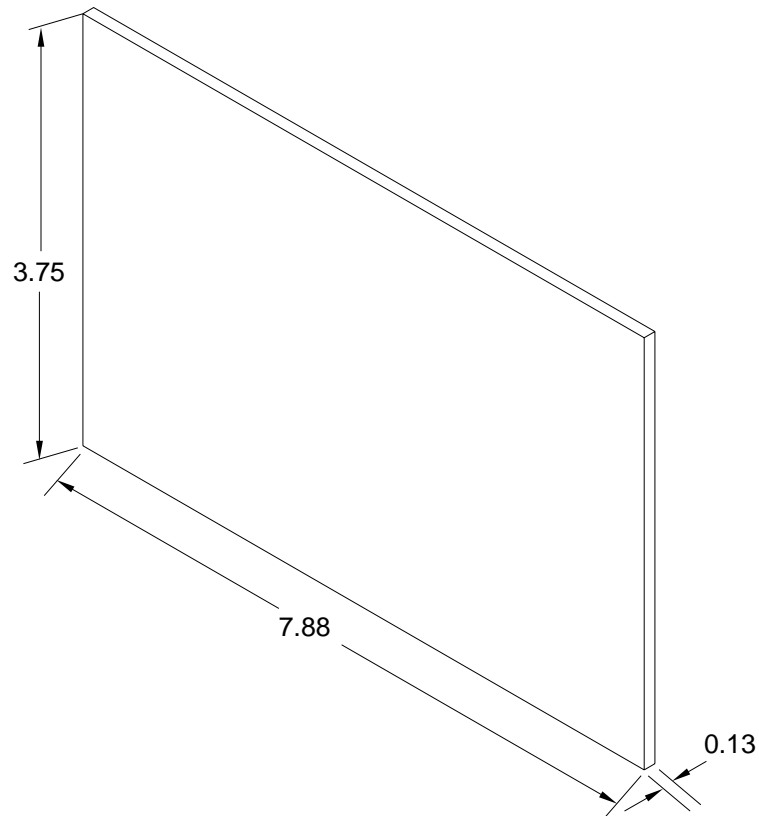
**UNIT LEVEL MAINTENANCE
WARPING TUG
BATTERY CUSHION
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

BATTERY CUSHION PN E28481**NOTES:**

BATTERY CUSHION - MAKE FROM NEOPRENE RUBBER, ASTM D1418 DESIGNATION CR, 70 DUROMETER.

CUT TO SIZE.

ALL DIMENSIONS ARE IN INCHES.

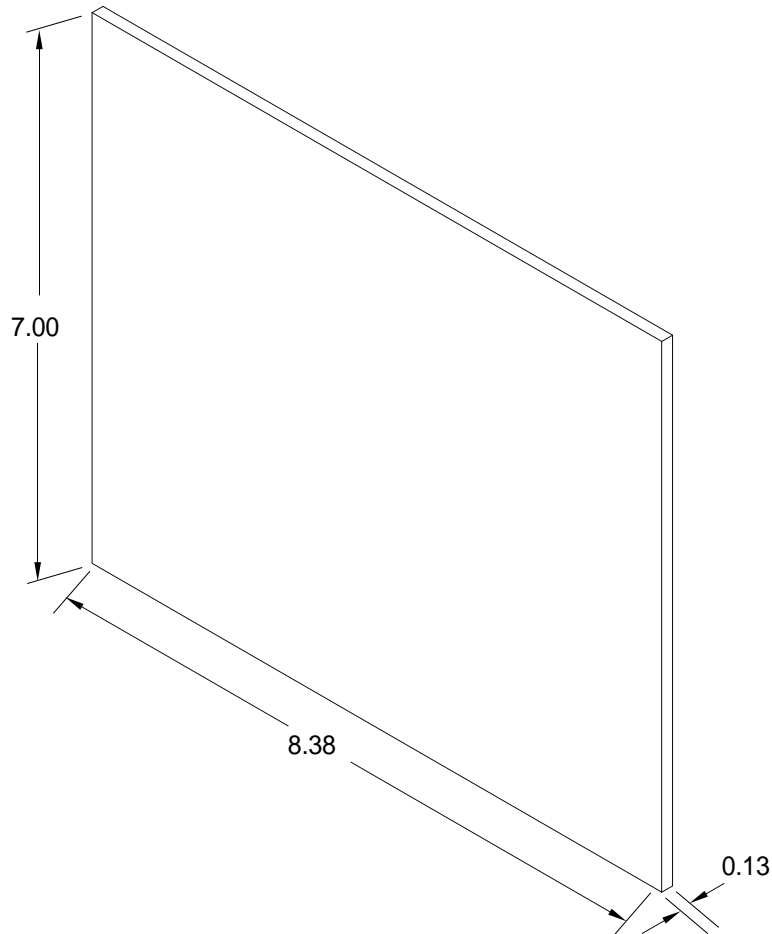
**UNIT LEVEL MAINTENANCE
WARPING TUG
BATTERY PAD
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

BATTERY PAD PN E28491**NOTES:**

BATTERY PAD - MAKE FROM NEOPRENE RUBBER, ASTM D1418 DESIGNATION CR, 70 DUROMETER.

CUT TO SIZE.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
HOSE, RAW WATER PN E09998-2
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

HOSE PN E09998-2**NOTES:**

RAW WATER HOSE-MAKE FROM 2.5 IN. I.D. X 3.05 IN. O.D., 2 PLY WIRE REINFORCED DISCHARGED HOSE, PN 305602.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
HOSE, RAW WATER PN E38928-1
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

HOSE PN E38928-1**NOTES:**

RAW WATER HOSE-MAKE FROM 3.0 IN. I.D. X 3.504 IN. O.D., WATER SUCTION HOSE, MULTIPLE PLY WITH HELIX WIRE, PN 7392-3000.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
HOSE, RAW WATER PN E09858-4
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

HOSE PN E09858-4**NOTES:**

RAW WATER HOSE-MAKE FROM 2.88 IN. I.D. X 3.44 IN. O.D., WATER SUCTION HOSE, MULTIPLE PLY WITH HELIX WIRE PN SW-369.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
HOSE, BILGE SYSTEM PN E13208-2, E13208-3, E13208-4 E13208-8, E13208-10,
E13208-11, E13208-12, E13208-13, E13208-14, E13208-15, E13208-16
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

**HOSE PN E13208-2, E13208-3, E13208-4 E13208-8, E13208-10, E13208-11, E13208-12,
E13208-13, E13208-14, E13208-15, E13208-16**

PART NUMBER	LENGTH
E13208-2	42 in.
E13208-3	96 in.
E13208-4	72 in.
E13208-8	52 in.
E13208-10	10 in.
E13208-11	12 in.
E13208-12	24 in.
E13208-13	15 in.
E13208-14	47 in.
E13208-15	16 in.
E13208-16	6 in.

NOTES:

RAW WATER HOSE-MAKE FROM 1.5 IN. I.D. X 1.85 IN. O.D., 2 PLY, WATER DISCHARGE HOSE,
PN 320010.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
HOSE, RAW WATER PN E13208-6, E13208-7, E13208-17
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

HOSE PN E13208-6, PN E13208-7, PN E13208-17

PART NUMBER	LENGTH
E13208-6	108 in.
E13208-7	132 in.
E13208-17	8 in.

NOTES:

RAW WATER HOSE-MAKE FROM 1.5 IN. I.D. X 1.85 IN. O.D., 2 PLY, WATER DISCHARGE HOSE, PN 320010.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
HOSE, RAW WATER PN E47219-1
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

HOSE PN E47219-2**NOTES:**

RAW WATER HOSE-MAKE FROM 4.5 IN. I.D. X 4.6 IN. O.D., 2 PLY WATER SUCTION HOSE, PN E47208.

CUT TO 6 IN.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
SUCTION AND RETURN HOSE PN E31138-1, E31138-2,
E31138-3, E31138-4, E31138-5
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

SUCTION AND RETURN HOSE PN E31138-1, E31138-2, E31138-3, E31138-4, E31138-5

PART NUMBER	LENGTH
E31138-1	232 in.
E31138-2	58 in.
E31138-3	15 in.
E31138-4	54 in.
E31138-5	5 in.

NOTES:

SUCTION AND RETURN HOSE-MANUFACTURE FROM 2.0 IN. I.D. X 2.50 IN. O.D., WEATHER AND OIL RESISTANT, WIRE REINFORCED, FLEXIBLE HYDRAULIC HOSE, VACUUM 25 IN OF HG, PN U332 OR EQUIVALENT.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL HOSE PN E11508-1, E11508-2, E11508-3
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

FUEL HOSE PN E11508-1, E11508-2, E11508-3

PART NUMBER	LENGTH
E11508-1	8 ft
E11508-2	4 ft
E11508-3	10 ft

NOTES:

FUEL HOSE-MAKE FROM .63 IN. I.D. X 1.08 IN. O.D., FIRE RESISTANT, WIRE REINFORCED FUEL AND OIL HOSE, WITH BLUE AQP ELASTOMER COVER, PN FC234-12.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN FEET.

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL HOSE PN E11518-1, E11518-2, E11518-3, E11518-4
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

FUEL HOSE PN E11518-1, E11518-2, E11518-3, E11518-4

PART NUMBER	LENGTH
E11518-1	12 ft
E11518-2	8 ft
E11518-3	6 ft
E11518-4	10 ft

NOTES:

FUEL HOSE-MAKE FROM .88 IN. I.D. X 1.27 IN. O.D., FIRE RESISTANT, WIRE REINFORCED FUEL AND OIL HOSE, WITH BLUE AQP ELASTOMER COVER, PN FC234-16.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN FEET.

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL TUBE PN E12788-2
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Cutter, Tube (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Personnel Required

Engineer 88L

FUEL HOSE PN E12788-2**NOTES:**

FUEL TUBE-MAKE FROM .951 IN. I.D. X 1.00 IN. O.D., STAINLESS STEEL TUBING.

CUT TO 64.81 IN.

CUT TO LENGTH UPON INSTALLATION.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
FUEL TUBE PN E12798-1,E12798-3, E12798-4
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)
Cutter, Tube (Item 4, WP 0425 00)
Pan, Drain (Item 4, WP 0425 00)

Personnel Required

Engineer 88L

FUEL TUBE PN E12798-1, E12798-3, E12798-4,

PART NUMBER	LENGTH
E12798-1	66.75 in.
E12798-3	14.50 in.
E12798-4	47.63 in.

NOTES:

FUEL TUBE-MAKE FROM .701 IN. I.D. X.75 IN. O.D., STAINLESS STEEL TUBING.

CUT TO LENGTH UPON INSTALLATION.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
HEATER HOSE PN E19108-1, E19108-2, E19108-3
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

HEATER HOSE PN E19108-1, E19108-2, E19108-3

PART NUMBER	LENGTH
E19108-1	120 in.
E19108-2	33 in.
E19108-3	46 in.

NOTES:

HEATER HOSE-MAKE FROM .75 IN. I.D. POLYESTER REINFORCED, PN 80-075.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT LEVEL MAINTENANCE
WARPING TUG
HEATER HOSE PN E19108-4, E19108-5, E19108-6
MANUFACTURE**

INITIAL SETUP:**Tools**

Tool Kit, General Mechanics (Rail and Marine) (Item 1, WP 0425 00)

Personnel Required

Engineer 88L

HEATER HOSE PN E19108-4, E19108-5, E19108-6

PART NUMBER	LENGTH
E19108-4	30 in.
E19108-5	21 in.
E11508-6	23 in.

NOTES:

HEATER HOSE-MAKE FROM .38 IN. I.D. POLYESTER REINFORCED, PN 80-038.

CUT TO LENGTH.

ALL DIMENSIONS ARE IN INCHES.

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
TORQUE LIMITS**

INTRODUCTION

When To Use Torque Limits

When a torque is not specified in an individual work package, use the procedures in this work package to determine proper torque limits and use of adapters with torque wrenches.

How To Use Adapters With Torque Wrenches

When an adaptor is necessary due to space or type of fitting being torqued, it must be determined how the adaptor changes the amount of force applied. If the adaptor increases or decreases the distance from the drive of the torque wrench to the fitting being torqued, an equation must be used to compensate for the difference.

NOTE

The following abbreviations apply to the below procedures:

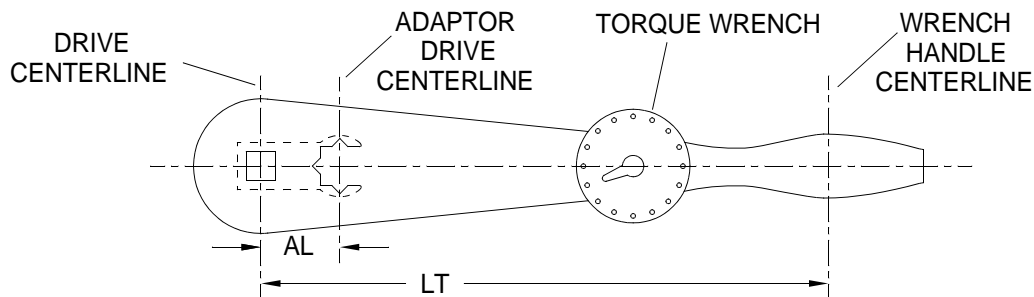
DT = Desired Torque

LT = Length of Torque Wrench

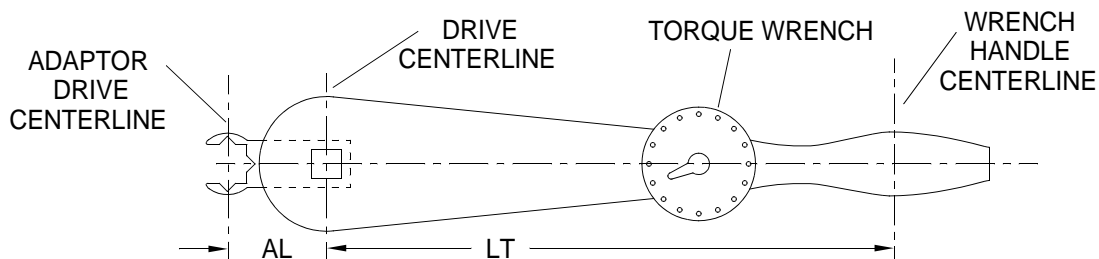
AL = Adaptor Length

AT = Applied Torque

1. If the adaptor used decreases the distance between the center of the torque wrench handle and the center of the drive, first find the desired torque for the fitting, then calculate as follows:



- a. Multiply DT by LT.
 - b. Subtract AL from LT.
 - c. Divide the first answer by the second answer to find AT.
2. If the adaptor used increases the distance between the center of the torque wrench handle and the center of the drive, first find the desired torque for the fitting, then calculate as follows:

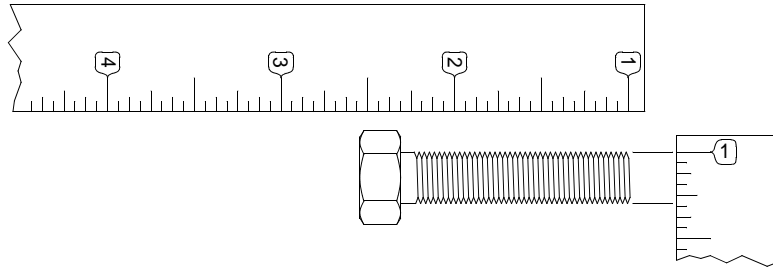


- a. Multiply DT by LT.
- b. Add AL and LT.
- c. Divide the first answer by the second answer to find AT.

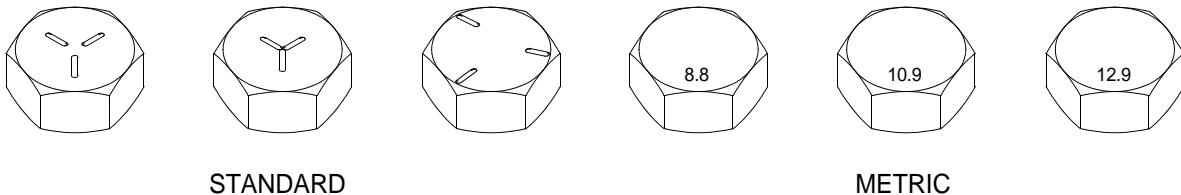
TORQUE TABLES

How To Use Torque Tables

1. Measure the diameter of the bolt to be torqued.



2. For SAE fasteners, determine the threads per inch by counting the threads. For metric fasteners, determine the thread pitch using a thread pitch gage.
3. Determine the type of markings on the bolt you are torquing by comparing the markings on the head of the bolt with the chart below.



4. Determine if this will be a wet or dry torque.
 - a. Wet torque is any bolt that is lubricated or coated with an antiseize compound.
 - b. Dry torque is any bolt that is not lubricated or coated with an antiseize compound.
5. On the table below, locate the bolt to be torqued.
 - a. Locate the diameter of the bolt.
 - b. Determine the threads per inch for the SAE fastener or the thread pitch for the metric fastener.
 - c. Slide across the table to the proper grade.
 - d. Choose wet or dry.
 - e. Slide down the proper column and across the proper row until they intersect, this is the proper torque value.

Table 1. SAE Standard Torque Table.

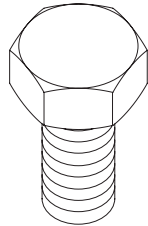
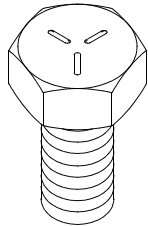
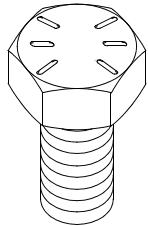
		SAE GRADE NO. 2				SAE GRADE NO. 5				SAE GRADE NO. 8			
													
		DRY		WET		DRY		WET		DRY		WET	
DIA IN.	THREADS PER INCH	IN. LBS	N-m	IN. LBS	N-m	IN. LBS	N-m	IN. LBS	N-m	IN. LBS	N-m	IN. LBS	N-m
1/4	20	66	7.46	49	5.54	101	11.41	76	8.58	143	16.15	107	12.09
1/4	28	75	8.47	56	6.33	116	13.10	87	9.83	164	18.53	123	13.89
5/16	18	135	15.25	101	11.41	209	23.61	157	17.73	295	33.32	221	24.96
5/16	24	150	17.17	112	12.65	230	25.98	173	19.54	327	36.94	245	27.68
3/8	16	240	27.11	180	20.33	370	41.80	278	31.40	523	59.08	392	44.28
3/8	24	272	30.73	204	23.04	420	47.44	315	35.58	593	66.99	445	50.27
7/16	14	384	43.38	288	32.53	593	66.99	445	50.27	837	94.55	628	70.94
7/16	20	428	48.35	321	36.26	662	74.78	496	56.03	935	105.62	700	79.07
1/2	13	585	66.08	439	49.59	904	102.12	678	76.59	1277	144.25	958	108.22
1/2	20	660	74.55	495	55.92	1020	115.22	764	86.30	1440	162.66	1080	122.00

Table 2. SAE Standard Torque Table.

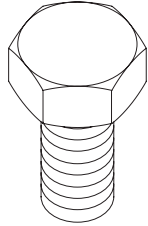
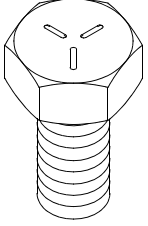
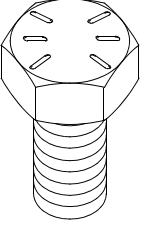
		SAE GRADE NO. 2				SAE GRADE NO. 5				SAE GRADE NO. 8			
													
		DRY		WET		DRY		WET		DRY		WET	
DIA IN.	THREADS PER INCH	FT LBS	N-m	FT LBS	N-m	FT LBS	N-m	FT LBS	N-m	FT LBS	N-m	FT LBS	N-m
9/16	12	70	94.92	53	71.87	109	147.80	82	111.19	154	208.82	115	155.94
9/16	18	78	105.77	59	80.00	121	164.08	91	123.40	171	231.88	128	173.57
5/8	11	97	131.53	73	98.99	150	203.40	113	153.23	212	287.47	159	215.60
5/8	18	110	149.16	82	111.19	170	230.52	127	172.21	240	325.44	180	244.08
3/4	10	172	233.23	129	174.92	269	364.76	201	272.56	376	509.86	282	382.39
3/4	16	192	260.35	144	195.26	297	402.73	223	302.29	420	569.52	315	427.14
1	8	-	-	-	-	644	873.26	483	654.95	909	1232.60	683	926.15
1	12	-	-	-	-	704	954.62	528	715.97	995	1349.22	746	1011.58

Table 3. Metric Standard Torque Table.

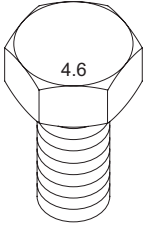
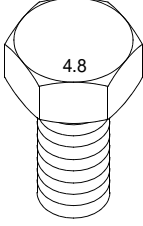
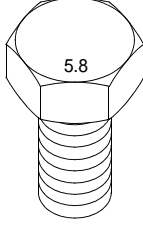
		CLASS 4.6				CLASS 4.8				CLASS 5.8			
													
		DRY		WET		DRY		WET		DRY		WET	
DIA MM	THREAD PITCH	N-m	IN. LBS	N-m	IN. LBS	N-m	IN. LBS	N-m	IN. LBS	N-m	IN. LBS	N-m	IN. LBS
3.0	0.5	.50	4	.40	4	.70	6	.50	4	-	-	-	-
3.5	0.6	.80	7	.60	5	1.10	10	.80	7	-	-	-	-
4.0	0.7	1.20	11	.90	8	1.60	14	1.20	11	-	-	-	-
5.0	0.8	2.40	21	1.80	16	3.30	29	2.50	22	4.00	35	3.00	27
6.0	1.0	4.00	35	3.00	27	5.66	50	4.20	37	6.90	61	5.20	26
8.0	1.25	9.90	88	7.40	66	13.60	120	10.20	90	16.70	148	12.50	111
10.0	1.50	19.60	174	14.70	130	27.00	239	20.00	177	33.10	293	24.80	220
12.0	1.75	34.10	302	25.60	227	47.00	416	35.00	310	58.00	51	43.00	381
14.0	2.0	54.30	481	40.80	361	75.00	664	56.00	496	92.00	814	69.00	611

Table 4. Metric Standard Torque Table.

DIA MM	THREAD PITCH	CLASS 8.8				CLASS 9.8				CLASS 10.9			
		DRY		WET		DRY		WET		DRY		WET	
		N-m	FT LBS	N-m	FT LBS	N-m	FT LBS	N-m	FT LBS	N-m	FT LBS	N-m	FT LBS
8.0	1.25	26.40	19	19.80	15	28.50	21	21.40	16	36.50	27	27.30	20
10.0	1.50	52.20	38	39.20	29	56.60	42	42.40	31	72.20	53	54.20	40
12.0	1.75	91.00	67	68.00	50	99.00	73	74.00	55	126.00	93	94.00	69
14.0	2.00	145.00	107	109.00	80	157.00	116	118.00	87	200.00	147	150.00	111
16.0	2.00	226.00	167	170.00	125	245.00	181	184.00	136	313.00	231	235.00	173
20.0	2.50	441.00	325	331.00	244	478.00	353	358.00	264	610.00	450	458.00	338
24.0	3.00	762.00	562	572.00	422	826.00	609	620.00	457	1055.00	778	791.00	583
30.0	3.50	1515.00	1117	1136.00	838	1641.00	1210	1231.00	908	2095.00	1545	1572.00	1159
36.0	4.00	2647.00	1952	1985.00	1464	2868.00	2115	2151.00	1586	3662.00	2701	2746.00	2025

END OF WORK PACKAGE

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
WIRING DIAGRAMS**

INITIAL SETUP:

Personnel Required

Engineer 88L

CABLE AND WIRING DIAGRAMS INTRODUCTION

Scope

This work package provides the cable lists, wiring lists and illustrations necessary for maintenance, troubleshooting and repair of the WT. Diagrams provide the identification of each wire to be connected by color code or wire number, as applicable. The diagrams show the location of each pertinent terminal and/or position.

The same diagram may be referenced at different times as it applies to instructions within the appropriate maintenance chapter (Unit Level, Direct Support or General Support).

The one line diagram, schematic and wiring diagram fold out illustrations can be located after the alphabetical index in this manual.

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LIST OF ABBREVIATIONS/ACRONYMS

The abbreviations used in this work package are in accordance with ASME Y14.38-1999, except when the abbreviation stands for a marking actually found in the equipment.

OPERATORS CAB CABLE LIST

LEGEND			
CABLE LIST	TYPE	CABLE LIST	TYPE
P24-1	LSMHOF-14	P12-4	SWE FURNISHED
P24-2	16-2S0 (SHIELD)	P12-5	SWE FURNISHED
P24-3	LS2SJ-16	P12-6	SWE FURNISHED
P24-4	16-2S0 (SHIELD)	P12-10	LS2SJ-16
P24-5	SWE FURNISHED	P12-11	LS2SJ-16
P24-6	GFE	P12-12	SWE WITH COMPASS
P24-8	LSDHOF-4	P12-13	LS2SJ-16
P24-9	LSTHOF-3	P5-1	SWE FURNISHED
P24-10	LSMSCS-24	P5-2	SWE FURNISHED
P24-11	LS3SJ-16	LH-1	LSDSGU-3
P24-20	LS2SJ-16	LH-2	SWE FURNISHED
P24-21	LS2SJ-16	C24-1	LS2SJ-16
P24-22	SWE WITH GPS	C24-2	SWE FURNISHED
P24-23	LSDSU-4	COM-1	SWE FURNISHED
P24-25	SWE FURNISHED	GPS-A1	SWE FURNISHED
R-RA1	RG-58/U FURNISHED		
R-RA1/1	RG-58/U FURNISHED		
R-RA2	RG-58/U FURNISHED		
R-LS1	GFE		
P12-2	SWE FURNISHED		
P12-3	SWE FURNISHED		

*Figure 1. Operators Cab Cable List
(Sheet 1 of 38)*

LEGEND (Continued)
UNIT 3 = OPERATORS CAB
ASSEMBLY A1 = MIDDLE CONTROL PANEL (ITEM 2 ON E39213)
ASSEMBLY A2 = LOWER CONTROL PANEL (ITEM 3 ON E30213)
ASSEMBLY A3 = OPERATORS CAB CIRCUIT BREAKER PANEL (ITEM 4 ON E39213)
ASSEMBLY A4 = TERMINAL BOARD ASSEMBLY (ITEM 8 ON E39213)
ASSEMBLY A5 = STARBOARD RECEPTACLE ASSEMBLY (ITEM 9 ON E39213)
ASSEMBLY A6 = PORT RECEPTACLE ASSEMBLY (ITEM 10 ON E39213)
ASSEMBLY A7 = MAST ENCLOSURE ASSEMBLY (NAVIGATION LIGHT SWITCH BOX) (ITEM 174 ON E39213)
JB1 = JUNCTION BOX #1 ON RADIO SHELF (ITEM 133 ON E39213)
JB2 = JUNCTION BOX #2 ON BACK OF CAB (ITEM 43 ON E39213)
JB3 = JUNCTION BOX #3 ON RADIO SHELF (ITEM 58 ON E39213)
JB4 = JUNCTION BOX #4 ON RADIO SHELF (ITEM 80 ON E39213)
JB5 = JUNCTION BOX #5 ON DASH BOARD (ITEM 51 ON E39213)
JB6 = JUNCTION BOX #6 UNDER DASH BOARD FORWARD OF BULKHEAD (ITEM 224 ON E39213)

*Figure 1. Operators Cab Cable List
(Sheet 2 of 38)*

CABLE LIST						
CABLE NUMBER: P24-1						
CABLE TYPE: LSMHOF-14, ITEM 91						
O.D.: .635 INCH						
CABLE LENGTH: 17 FEET						
CABLE ENTRY FROM: A4/A3			FROM: CONTROL CONSOLE - A4/A3			
CABLE ENTRY TO: JB1 (ITEM 133)			TO: RADIO SHELF JUNCTION BOX - JB1			
BULKHEAD FITTINGS: T & B			NOTES: CABLE CONNECTS TO BRANCH CABLES IN JB1/TB1.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	SPARE	BLACK				
2	SPARE	WHITE				
3	0	RED	COMPRESSION	A4TB11	COMPRESSION	TB1-3
4	388	GREEN	ITEM 92	A4TB05-6	COMPRESSION	TB1-4
5	0	ORG	COMPRESSION	A4TB11	COMPRESSION	TB1-5
6	383	BLUE	ITEM 92	A4TB05-5	COMPRESSION	TB1-6
7	0	WH/BK	COMPRESSION	A4TB11	COMPRESSION	TB1-7
8	392	RD/BK	ITEM 92	A3CB6-2	COMPRESSION	TB1-8
9	0	GN/BK	COMPRESSION	A4TB11	COMPRESSION	TB1-9
10	393	OR/BK	ITEM 92	A3CB7-2	COMPRESSION	TB1-10
11	0	BU/BK	COMPRESSION	A4TB11	COMPRESSION	TB1-11
12	442	BK/WH	ITEM 92	A4TB05-15	COMPRESSION	TB1-12
13	SPARE	RD/WH				
14	SPARE	GN/WH				

Figure 1. Operators Cab Cable List
(Sheet 3 of 38)

CABLE LIST						
CABLE NUMBER: P24-2						
CABLE TYPE: 16-2S0 (SHIELD), ITEM 94						
O.D.: .360 INCH						
CABLE LENGTH: 6 FEET						
CABLE ENTRY FROM: JB1 (IT.133)				FROM: RADIO SHELF - JB1		
CABLE ENTRY TO: B3 (ITEM 50)				TO: DEFROSTER FAN MOTOR - B3		
BULKHEAD FITTINGS: SIZE B STUFFING TUBE @ SHELF T & B LIQUIDTIGHT AT JB1				NOTES: 1. CABLE SHIELD GROUNDED AT STUFFING TUBE IN SHELF. REFER TO LSI DWG. E13441, DETAIL A-7. 2. CONNECTIONS TO DEFROSTER PIGTAILS SHALL BE SECURED TO PREVENT VIBRATION. DISCONNECT MOTOR GROUND LEAD FROM CASE AND TERMINATE TO LEAD (0) OF THIS CABLE. 3. BLUE MOTOR LEAD IS NOT USED - TAPE AND TIE BACK. BLUE LEAD IS FOR LOW SPEED OPERATION.		
				TERMINATION DATA		
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB1-11	ITEM 93	BLACK
2	442	WHITE	COMPRESSION	TB1-12	ITEM 93	RED
-	-	SHLD	-	SEE NOTE 1	-	-

Figure 1. Operators Cab Cable List
(Sheet 4 of 38)

CABLE LIST						
CABLE NUMBER: P24-3						
CABLE TYPE: LS2SJ-16 (ITEM 198)						
O.D.: .310 INCH						
CABLE LENGTH: 6 FEET						
CABLE ENTRY FROM: JB1			FROM: RADIO SHELF - JB1			
CABLE ENTRY TO: J5			TO: SPOTLIGHT, RECEPTACLE ON TOP OF OPERATORS CAB			
BULKHEAD FITTINGS: ROOF RECEPTACLE AND T & B LIQUIDTIGHT AT JB-1			NOTES: USE SOLDER SLEEVE (IT. 261), DRAIN WIRE (IT. 264) AND TERMINAL (IT. 262) FOR SHLD TERMINATION TO BACKSHELL.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB1-5	SOLDER	J5-B
2	383	WHITE	COMPRESSION	TB1-6	SOLDER	J5-A
3	SHIELD	SHIELD			SHIELD TO	BACKSHELL

Figure 1. Operators Cab Cable List
(Sheet 5 of 38)

CABLE LIST						
CABLE NUMBER: P24-4						
CABLE TYPE: 16-2S0 (SHIELD) ITEM 94						
O.D.: .360 INCH						
CABLE LENGTH: 7 FEET						
CABLE ENTRY FROM: JB 1			FROM: RADIO SHELF - JB-1			
CABLE ENTRY TO: B2			TO: WINDSHIELD WIPER MOTOR			
BULKHEAD FITTINGS: T & B LIQUIDTIGHT AT JB-1 SIZE B STUFFING TUBE AT SHELF			NOTES: GROUND SHIELD AT STUFFING TUBE IN SHELF. REF. E13441 DETAIL A-7.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	O	BLACK	COMPRESSION	TB1-3	E11028-10	B2-2
2	388	WHITE	COMPRESSION	TB1-4	E11028-5	B2-1
-	-	SHLD	-	SEE NOTE 1	-	B2-2

Figure 1. Operators Cab Cable List
(Sheet 6 of 38)

CABLE LIST						
CABLE NUMBER: P24-5						
CABLE TYPE: LSTHOF-3						
O.D.: .450 INCH						
CABLE LENGTH: 8 INCHES						
CABLE ENTRY FROM: VR 1			FROM: DC/DC CONVERTER, RADIO SHELF			
CABLE ENTRY TO: JB1, J2			TO: RADIO SHELF JUNCTION BOX, RADIO RECEPT. - JB1			
BULKHEAD FITTINGS: T & B LIQUIDTIGHT AT JB-1			NOTES: 1. DC/DC CONVERTER ITEM 29, MOUNTED ON RADIO SHELF BEHIND JB1. 2. JUMPER INPUT AND OUTPUT COMMONS (0) TOGETHER ON THE CONVERTER.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	(0)	BLACK	WIRE	COMMON SEE NOTE 2	ITEM 93	TB1-7
2	392	WHITE	WIRE	+24 VDC INPUT	ITEM 93	TB1-8
3	392A	RED	WIRE	+12 VDC OUTPUT	ITEM 93	NOTE BELOW
			NOTE: THE TRANSCEIVER IS PROVIDED WITH A #16 AVG GROUND WIRE. TERMINATE GROUND WIRE TO TRANSCEIVER MOUNTING SCREW USING TERMINAL, ITEM 175.			
			RED WIRE FROM CONVERTER (W/N 392A) IS CONNECTED TO RED WIRE GOING TO VHF/FM DSC RADIO PLUG WITH A WIRE COMPRESSION NUT IN JB1. RELOCATE RADIO IN-LINE FUSE AND HOLDER TO INSIDE OF JB1. USE BUTT SPLICE TO ADD LENGTH OF WIRE AS NECESSARY. LOOP WIRE 392A TWICE THROUGH FERRITE CORE INSIDE JB1. SECURE WITH TIEDOWN WRAPS (ITEM 156). REF: JB1 WIRING DIAGRAM, E45833.			

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P24-6						
CABLE TYPE: GFE (CX-13306)						
O.D.: N/A						
CABLE LENGTH: 8 FEET						
CABLE ENTRY FROM: JB1			FROM: RADIO SHELF - JB1			
CABLE ENTRY TO: A4J1			TO: SINCGARS MOUNTING BASE, MT-6352/VRC			
BULKHEAD FITTINGS:			NOTES: CONNECT GFE CABLE, IT. 269 TO J1 ON JB1 AND TO A4J1 ON SINCGARS MOUNTING BASE.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	(0)	N/A	CONNECTOR	J1-B	CONNECTOR	A4J1
2	393	N/A	CONNECTOR	J1-A	CONNECTOR	A4J1

Figure 1. Operators Cab Cable List
(Sheet 8 of 38)

CABLE LIST						
CABLE NUMBER: P24-8						
CABLE TYPE: LSDHOF-4 ITEM 99						
O.D.: .460 INCHES						
CABLE LENGTH: 18 FEET						
CABLE ENTRY FROM: A3/A4			FROM: CONSOLE INTERIOR, CB PANEL & TERM. BD. ASSY			
CABLE ENTRY TO: A7			TO: MAST ENCL. ASSY "A7" (NAV. LIGHT SW. BOX)			
BULKHEAD FITTINGS:			NOTES: W/N 381 FROM A3 CB1-2 TO A4TB9-10			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	(0)	BLACK	WIRE	A4TB-11	TERM LUG	TB6-B11
2	381	WHITE	ITEM 92	A4TB-10	TERM LEG	TB6-B12

Figure 1. Operators Cab Cable List
(Sheet 9 of 38)

CABLE LIST						
CABLE NUMBER: P24-9						
CABLE TYPE: LSHTOF-3 ITEM 98						
O.D.: .450 INCHES						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: A4TB05				FROM: CONSOLE, TERMINAL BOARD ASSY.		
CABLE ENTRY TO: B1A/B1B				TO: CONTROL CONSOLE INTERIOR, HEATER FAN MOTORS		
BULKHEAD FITTINGS: ENLARGE HOLE IN HEATER TO 5/8 INCH DIA FOR GROMMET				NOTES: TERMINATE CABLE DIRECTLY TO MOTOR LEADS. DISCONNECT MOTOR LEADS TO (INTERNAL) CASE OF HEATER. CONNECT THESE LEADS TO (0) OF CABLE P24-9, USE GROMMET, E46838, FOR CABLE ENTRY.		
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	(0)	BLACK	COMPRESSION	A4TB-11	ITEM 93	B1A/B BLACK
2	390	WHITE	ITEM 92	A4TB05-07	ITEM 93	B1A RED
3	391	RED	ITEM 92	A4TB05-08	ITEM 93	B1A RED
			NOTE: PLACE A CABLE TIE ON BOTH SIDES OF GROMMET TO PREVENT CABLE SLIPPAGE.			

Figure 1. Operators Cab Cable List
(Sheet 10 of 38)

CABLE LIST						
CABLE NUMBER: P24-10						
CABLE TYPE: LSMSCS-24 ITEM 200						
O.D.: .915 INCH						
CABLE LENGTH: 15 FEET						
CABLE ENTRY FROM: A7			FROM: MAST ENCL ASSY A7 (NAV LIGHT SW. BOX)			
CABLE ENTRY TO: J1			TO: OPERATORS CAB RECEPTACLE J1			
BULKHEAD FITTINGS:			NOTES: 1. * COMPRESSION TYPE FITTINGS			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	501	BLACK		TB1-B11	PINS	J1-1A
2	503	WHITE		TB1-A14	PINS	J1-2B
3	504	RED		TB2-B3	PINS	J1-3C
4	506	GREEN		TB2-A6	PINS	J1-4D
5	507	ORANGE		TB2-B14	PINS	J1-5E
6	509	BLUE		TB2-A17	PINS	J1-6F
7	510	WHT/BLK		TB3-B4	PINS	J1-7G
8	512	RED/BLK		TB3-A7	PINS	J1-8H
9	513	GRN/BLK		TB3-B15	PINS	J1-9J
10	518	OR/BLK		TB4-A8	PINS	J1-10K
11	518B	BLU/BLK		TB4-B16	PINS	J1-11L
12	520	BLK/WHT		TB4-A19	PINS	J1-12M
13	520B	RED/WHT		TB5-B7	PINS	J1-13N
14	522	GRN/WHT		TB5-A10	PINS	J1-14P
15	522B	BLU-WHT		TB5-B18	PINS	J1-15Q
(Continued on next page)						

Figure 1. Operators Cab Cable List
(Sheet 11 of 38)

CABLE LIST						
CABLE NUMBER: P24-10 (Cont'd)						
CABLE TYPE: LSMSCS-24 ITEM 200						
O.D.: .915 INCH						
CABLE LENGTH: 15 FEET						
CABLE ENTRY FROM: A7			FROM: MAST ENCL ASSY A7 (NAV LIGHT SW. BOX)			
CABLE ENTRY TO: J1			TO: OPERATORS CAB RECEPTACLE J1			
BULKHEAD FITTINGS:			NOTES (CONTINUED): 2. DOUBLE SHLD CABLE-USE SOLDER SLEEVE (IT. 261), DRAIN WIRE (IT. 264), AND TERMINAL (IT. 263) FOR TERMINATING EACH SHLD. TERMINATE DRAIN WIRES TO BULKHEAD USING HDINR ITS. 265 AND 266.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
16	SPARE	BLK/RED	SEE NOTE		PINS	J1-16R
17	SPARE	WHT/RED	SEE NOTE		PINS	J1-17S
18	0	ORG/RED	COMPRESSION	TB6-B8	PINS	J1-18T
19	0	BLU/RED	COMPRESSION	TB6-B8	PINS	J1-19U
20	0	RED/GRN	COMPRESSION	TB6-B9	PINS	J1-20V
21	0	ORG/GRN	COMPRESSION	TB6-B10	PINS	J1-21V
22	SPARE	BLK/WHT/ RED	SEE NOTE		PINS	J1-21X
23	SPARE	WHT/BLK/ RED	SEE NOTE		PINS	J1-23Y
24	SPARE	RED/BLK/ WHT	SEE NOTE		PINS	J1-24Z
25	SHLD	SHLD			SHIELD TO BULKHEAD	

Figure 1. Operators Cab Cable List (Cont'd)
(Sheet 11 of 38)

CABLE LIST						
CABLE NUMBER: P24-11						
CABLE TYPE: LS3SJ-16						
O.D.: .340 INCHES						
CABLE LENGTH: 21 FEET						
CABLE ENTRY FROM: LT. SW. BOX A7			FROM: MAST ENCL ASSY A7 (NAV LIGHT SW. BOX)			
CABLE ENTRY TO: J2			TO: AFT MAST RECEPTACLE J2			
BULKHEAD FITTINGS:			NOTES: USE SOLDER SLEEVE (IT. 261), DRAIN WIRE (IT. 264), AND TERMINAL (IT. 262) TO TERMINATE THE SHLD. TERMINATE DRAIN WIRE TO BULKHEAD USING HDUIR ITS. 204 AND 267.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB6-B7	PINS	3J2-B
2	515	WHITE	COMPRESSION	TB3-A18	PINS	3J2-A
3	516	RED OR GREEN	COMPRESSION	TB4-B5	PINS	3J2-C
4	SHLD	SHLD	-	-	SHIELD TO BULKHEAD	

Figure 1. Operators Cab Cable List
(Sheet 12 of 38)

CABLE LIST						
CABLE NUMBER: P24-20						
CABLE TYPE: LSTHOF-3						
O.D.: .450 INCH						
CABLE LENGTH: 15 FEET						
CABLE ENTRY FROM: A4TB			FROM: A4 (E43043)			
CABLE ENTRY TO: E41598-1			TO: JB-3 (E41553)			
BULKHEAD FITTINGS: 90 FT NYLON STUFFING TUBE, SIZE 2 (E18308-2). PACKING ASSEMBLY SIZE 2E (E18338-2E)			NOTES: RUNS FROM "A4" THROUGH THE DASHBOARD USING A STUFFING TUBE, INTO STARBOARD CONDUIT, THROUGH THE HOLE IN THE RADIO SHELF AND INTO JB3 THROUGH A STRAIN RELIEF.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	A4TB11	COMPRESSION	JB3TB1-1
2	394	WHITE	ITEM 92	A4TB5-1	COMPRESSION	JB3TB1-4
3	375A	RED	ITEM 92	A4TB5-17	COMPRESSION	JB3TB1-9
			INSTALL RESISTOR A4R1, E43043 ITEM 34, BETWEEN A4TB5-19 AND A4TB5-17			

Figure 1. Operators Cab Cable List
(Sheet 13 of 38)

CABLE LIST						
CABLE NUMBER: P24-22						
CABLE TYPE: SWE WITH GPS (ITEM 107)						
O.D.: .25 INCHES						
CABLE LENGTH: 16 FEET						
CABLE ENTRY FROM:				FROM: J4 ON GPS		
CABLE ENTRY TO: E41598-1				TO: JB3		
BULKHEAD FITTINGS:				NOTES: CABLE RUNS FROM GPS WITH PIGTAIL END ALONG THE DASHBOARD, UP THE STARBOARD CONDUIT, THROUGH THE HOLE IN THE RADIO SHELF, AND INTO JB3 THROUGH A STRAIN RELIEF.		
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	RING	SWE PLUG	GPS	COMPRESSION	JB3TB1-4
2	611	CENTER	SWE PLUG	GPS	COMPRESSION	JB3F1-2

Figure 1. Operators Cab Cable List
(Sheet 15 of 38)

CABLE LIST						
CABLE NUMBER: P24-23						
CABLE TYPE: LSDSU-4						
O.D.: .427 INCHES						
CABLE LENGTH: 14 FEET						
CABLE ENTRY FROM: A3			FROM: A3			
CABLE ENTRY TO: J11			TO: J11			
BULKHEAD FITTINGS:			NOTES: CABLE RUNS FROM A3 THROUGH THE PORT SIDE CONDUIT ALONG THE TOP OF THE RADIO SHELF, THROUGH THE CONVOLUTED TUBING AND INTO J11.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	A3TB2-1	SOLDER	J11-B
2	445	WHITE	COMPRESSION	A3TB2-3	SOLDER	J11-A

Figure 1. Operators Cab Cable List
(Sheet 16 of 38)

CABLE LIST						
CABLE NUMBER: P24-25						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH:						
CABLE ENTRY FROM:			FROM: A3			
CABLE ENTRY TO:			TO: MAP LIGHT DS2			
BULKHEAD FITTINGS:			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	IT. 230	TB2-1		SWE
2	374	WHITE	IT. 231	CB9-2		SWE

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: R-RA1						
CABLE TYPE: RG-58/U						
O.D.: .195 INCHES						
CABLE LENGTH: 6 FEET						
CABLE ENTRY FROM: VHF/FM			FROM: RADIO SHELF, VHF/FM TRANSCEIVER - ANTENNA CABLE			
CABLE ENTRY TO: JB2			TO: OP CAB INTERIOR, AFT STARBOARD UPPER CORNER - JB2			
BULKHEAD FITTINGS: TERMINAL TUBE ON JB-2			NOTES: 1. CABLE FURNISHED WITH ANTENNA. 2. GROUND CABLE SHIELD AT TERMINAL TUBE ENTRANCE TO JB-2 IAW LSI DWG E13441. 3. COAXIAL CONNECTORS ITEMS 46 AND 253 TO BE INSTALLED BY EXPERIENCED TECHNICIAN.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
-	R-RA1	BLACK	PL-259 COAXIAL PLUG WITH UG-176 ADAPTER	VHF/FM TRANSCEIVER (ANT)	PL-259 COAXIAL PLUG WITH UG-176 ADAPTER	J-1 (INSIDE JB-2)

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: R-RA1/1						
CABLE TYPE: RG-58/U						
O.D.: .195 INCHES						
CABLE LENGTH: 18 INCHES						
CABLE ENTRY FROM: JB-2 J-1				FROM: OP CAB EXTERIOR UPPER AFT STARBOARD CORNER, J-1 OF JB-2		
CABLE ENTRY TO: RA-1				TO: OP CAB ROOF AFT STARBOARD CORNER, VHF/FM ANTENNA		
BULKHEAD FITTINGS:				NOTES: 1. CABLE FURNISHED AND CONNECTED TO ANTENNA. 2. CUT EXCESS LENGTH FROM CABLE AND USE FOR R-RA1. 3. COAXIAL CONNECTORS ITEMS 46 AND 214 TO BE INSTALLED BY EXPERIENCED TECHNICIAN.		
				TERMINATION DATA		
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
-	R-RA1/1	BLACK	PL-259 COAXIAL PLUG WITH UG-176 ADAPTER	JB-2 J-1	COAXIAL CABLE	ANTENNA

Figure 1. Operators Cab Cable List (Sheet 19 of 38)

CABLE LIST						
CABLE NUMBER: R-RA2						
CABLE TYPE: GFE (CG-3855/VRC)						
O.D.: .195 INCHES						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: J-1			FROM: RADIO SHELF, SINGGARS MOUNTING BASE, MT-6352/VRC			
CABLE ENTRY TO: J-1			TO: AFT LEFT CORNER OF CAB ROOF, AS-3900A/VRC ANTENNA			
BULKHEAD FITTINGS: SIZE C STUFFING TUBE ON AFT OP. CAB BULKHEAD			NOTES: 1. CABLE AND CONNECTORS FURNISHED (GFE), ITEM 268. 2. CONNECTOR INSTALLATION AND REMOVAL SHALL BE DONE BY EXPERIENCED TECHNICIAN. 3. CONNECTION TO JB1 ON THE SINGGARS POWER AMPLIFIER WILL BE MADE IN THE FIELD BY THE USER. 4. GROUND CABLE SHIELD AT BULKHEAD PENETRATION.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
	R-RA2	BLACK	BNC (RT ANG)	PWR. AMP J-1 SEE NOTE 3	BNC STRAIGHT	AS-3900 J-1

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: R-LS1						
CABLE TYPE: GFE (CX-13292)						
O.D.:						
CABLE LENGTH: 3 FEET						
CABLE ENTRY FROM: J-1				FROM: RADIO SHELF, SINCGARS MOUNTING BASE, MT-6352/VRC		
CABLE ENTRY TO: J-1				TO: SINCGARS LOUDSPEAKER, LS-671		
BULKHEAD FITTINGS: SIZE C STUFFING TUBE ON AFT OP. CAB BULKHEAD				NOTES: GFE CABLE, IT. 270, IS PROVIDED WITH CONNECTORS AT BOTH ENDS.		
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
			CONNECTOR	A4JB	CONNECTOR	J1

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P12-2						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH: 3 FEET						
CABLE ENTRY FROM: JB1			FROM: RADIO SHELF, JUNCTION BOX - JB1			
CABLE ENTRY TO: VHF/FM			TO: RADIO SHELF, VHF/FM TRANSCEIVER, CONNECTOR J2			
BULKHEAD FITTINGS: T & B LIQUIDTIGHT AT JB1			NOTES: 1. CABLE AND CONNECTOR FURNISHED WITH RADIO. 2. REFER TO OWNER/OPERATOR MANUAL FOR DETAILED INSTALLATION INSTRUCTIONS. 3. W/N 392A RED CONNECTS WITH WIRE COMPRESSION NUT TO RED WIRE FROM DC-DC CONVERTER, P24-5.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
(-)	0		COMPRESSION	TB1-7	SWE	(-) OUT (J2-COM)
(+)	392A		ITEM 93	SEE NOTE 3	SWE	(+) OUT (J2-+)

Figure 1. Operators Cab Cable List (Sheet 22 of 38)

CABLE LIST						
CABLE NUMBER: P12-3						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: E43218-39			FROM: JB5			
CABLE ENTRY TO: PLUG, SWE			TO: J-6			
BULKHEAD FITTINGS:			NOTES: CABLE RUNS FROM JB5 THROUGH MULTI-HOLE CORD GRIP ALONG THE DASHBOARD TO J-6.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	612	BLACK	-	JB5TB1-3	SWE PLUG	OUTSIDE RING
2	0	WHITE	-	JB5TB1-1	SWE PLUG	CENTER PIN

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P12-4						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: E43218-39				FROM: JB5		
CABLE ENTRY TO: PLUG, SWE				TO: J-7		
BULKHEAD FITTINGS:				NOTES: CABLE RUNS FROM JB5 THROUGH MULTI-HOLE CORD GRIP ALONG THE DASHBOARD TO J-7.		
				TERMINATION DATA		
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	612	BLACK	-	JB5TB1-3	SWE PLUG	OUTSIDE RING
2	0	WHITE	-	JB5TB1-1	SWE PLUG	CENTER PIN

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P12-5						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: E43218-39			FROM: JB5			
CABLE ENTRY TO: PLUG, SWE			TO: J-8			
BULKHEAD FITTINGS:			NOTES: CABLE RUNS FROM JB-5 THROUGH MULTI-HOLE CORD GRIP ALONG THE DASHBOARD.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	612	BLACK	-	JB5TB1-4	SWE PLUG	OUTSIDE RING
2	0	WHITE	-	JB5TB1-2	SWE PLUG	CENTER PIN

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P12-6						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: E43218-39			FROM: JB5			
CABLE ENTRY TO: PLUG, SWE			TO: J-9			
BULKHEAD FITTINGS:			NOTES: CABLE RUNS FROM JB5 THROUGH MULTI-HOLE CORD GRIP ALONG DASHBOARD TO J-9.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	612	BLACK	-	JB5TB1-4	SWE PLUG	OUTSIDE RING
2	0	WHITE	-	JB5TB1-2	SWE PLUG	CENTER PIN

Figure 1. Operators Cab Cable List (Sheet 26 of 38)

CABLE LIST						
CABLE NUMBER: P12-10						
CABLE TYPE: LS2SJ-16						
O.D.: .265 INCHES						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: VR2			FROM: VR2			
CABLE ENTRY TO: E41598-1			TO: JB-3			
BULKHEAD FITTINGS:			NOTES: RUNS FROM CONVERTER VR2 THROUGH THE HOLE IN THE RADIO SHELF, THROUGH A STRAIN RELIEF TO JB-3.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	VR2-2 (-)	COMPRESSION	JB3TB3
2	440	WHITE	COMPRESSION	VR2-1 (+12)	COMPRESSION	JB3TB7

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P12-11						
CABLE TYPE: LS2SJ-16						
O.D.: .265 INCHES						
CABLE LENGTH: 15 FEET						
CABLE ENTRY FROM: E41598-3				FROM: JB5		
CABLE ENTRY TO: E41598-3				TO: JB3		
BULKHEAD FITTINGS:				NOTES: RUNS FROM JB-5 ALONG THE DASHBOARD, UP THROUGH THE STARBOARD SIDE CONDUIT, THROUGH THE HOLE IN THE RADIO SHELF AND INTO JB-3 THROUGH A STRAIN RELIEF.		
				TERMINATION DATA		
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	JB5TB1-1	COMPRESSION	JB3TB1-4
2	612	WHITE	COMPRESSION	JB5TB1-3	COMPRESSION	JB3F2-2

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P12-12						
CABLE TYPE: SWE WITH COMPASS						
O.D.: .260 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: E41608-3			FROM: COMPASS DISPLAY ON DASHBOARD			
CABLE ENTRY TO: E41598-3			TO: JB3			
BULKHEAD FITTINGS:			NOTES: CABLE LEAVES THE DISPLAY, PASSES THROUGH THE DASHBOARD, PASSES BLACK THROUGH THE DASHBOARD THROUGH A STUFFING TUBE, UP THE STARBOARD SIDE CONDUIT, THROUGH THE HOLE IN THE RADIO SHELF AND INTO JB3 THROUGH A STRAIN RELIEF.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	SWE	COMPASS (-)	COMPRESSION	JB3TB1-5
2	614	RED	SWE	COMPASS (+)	COMPRESSION	JB3F3-2
3	375A	WHITE	SWE	COMPASS LIGHT	COMPRESSION	JB3TB1-9
			FEED PIGTAIL END THROUGH DASHBOARD TO TERMINAL POINTS IN JB3			

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P12-13						
CABLE TYPE: LS2SJ-16						
O.D.: .265 INCHES						
CABLE LENGTH: 4 FEET						
CABLE ENTRY FROM: E41598-1				FROM: JB3		
CABLE ENTRY TO:				TO: LOUDHAILER		
BULKHEAD FITTINGS:				NOTES: CABLE RUNS FROM JB3 THROUGH A STRAIN RELIEF, TO BACK OF THE LOUDHAILER.		
				TERMINATION DATA		
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	JB3TB1-5	ITEM 165	13.6 (-)
2	613	WHITE	COMPRESSION	JB3F4-2	ITEM 165	13.6 (+)
SHIELD	-	-	COMPRESSION	JB3TB1-8	ITEM 165	GND
			LOOP WIRE 613 TWICE THROUGH FERRITE CORE (ITEM 160) INSIDE JB3. SECURE WITH TIE WRAPS (ITEM 156).			

Figure 1. Operators Cab Cable List
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CABLE LIST						
CABLE NUMBER: P5-1						
CABLE TYPE: SWE (ITEM 106)						
O.D.:						
CABLE LENGTH: 16 FEET						
CABLE ENTRY FROM: GPS			FROM: J2 ON GPS			
CABLE ENTRY TO:			TO: JB3			
BULKHEAD FITTINGS:			NOTES: FROM J2 ON GPS, ALONG THE DASHBOARD, UP THE STARBOARD CONDUIT, THROUGH THE HOLE IN THE RADIO SHELF, AND INTO JB3 THROUGH A STRAIN RELIEF.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
-	0	COAX SHLD	SWE PLUG	GPSJ2 PIN2	COMPRESSION	JB3TB1-1
-	650	BROWN	SWE PLUG	GPSJ2 PIN3	COMPRESSION	JB3TB1-2
-	650	SEE NOTE	SWE PLUG	GPSJ2 PIN13	COMPRESSION	JB3TB1-2
-	651	GRAY	SWE PLUG	GPSJ2 PIN14	COMPRESSION	JB3TB1-3
			NOTE: PIN3 AND PIN 13 ARE CONNECTED TOGETHER IN CABLE ASSEMBLY			

Figure 1. Operators Cab Cable List
(Sheet 31 of 38)

CABLE LIST						
CABLE NUMBER: P5-2						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH:						
CABLE ENTRY FROM:			FROM: ROSS RADIO			
CABLE ENTRY TO:			TO: JB3			
BULKHEAD FITTINGS:			NOTES: FROM ROSS RADIO EXTERNAL SPEAKER PLUG TO STRAIN RELIEF ON JB3. NMEA INPUT.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
	650	GREEN	SWE	PIN 6	COMPRESSION	JB3TB1-2
	651	WHITE	SWE	PIN 5	COMPRESSION	JB3TB1-1

Figure 1. Operators Cab Cable List
(Sheet 32 of 38)

CABLE LIST						
CABLE NUMBER: LH-1						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 7 FEET						
CABLE ENTRY FROM:			FROM: JB4			
CABLE ENTRY TO:			TO: RAY 430 LOUDHAILER			
BULKHEAD FITTINGS:			NOTES: RUNS FROM JB4 THROUGH HOLE IN RADIO SHELF TO LOUDHAILER.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	630	BLACK	ITEM 163	JB4	ITEM 259	FWD 1
2	631	WHITE	ITEM 163	JB4	ITEM 259	FWD 2
-	-	-	-	-	-	-

Figure 1. Operators Cab Cable List
(Sheet 33 of 38)

CABLE LIST						
CABLE NUMBER: LH-2						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH:						
CABLE ENTRY FROM:			FROM: LOUDHAILER EXTERNAL HORN			
CABLE ENTRY TO:			TO: JB4			
BULKHEAD FITTINGS: STUFFING TUBE (ITEM 153)			NOTES: RUNS FROM EXTERNAL HORN THROUGH STUFFING TUBE TO JB4 STRAIN RELIEF.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	630	BLACK	SWE	EXTERNAL HORN	ITEM 163	JB4
2	631	WHITE	SWE	EXTERNAL HORN	ITEM 163	JB4

Figure 1. Operators Cab Cable List
(Sheet 34 of 38)

CABLE LIST						
CABLE NUMBER: C24-1						
CABLE TYPE: LS2SJ-16						
O.D.: .265 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: E41598-3			FROM: JB6			
CABLE ENTRY TO: TERM. BOARD			TO: A4			
BULKHEAD FITTINGS: 1 STUFFING TUBE SIZE 1			NOTES: CABLE RUNS FROM JB6 THROUGH BULKHEAD TO TERMINAL STRIP A4 TERMINATE TO CABLE C24-2 IN JB6. USE SOLDER SLEEVE (IT. 261), DRAIN WIRE (IT. 264), AND TERMINAL (IT. 262) TO TERMINATE SHLD.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	ITEM 163	JB6	ITEM 92	A4TB06-9
2	450	WHITE	ITEM 163	JB6	ITEM 92	A4S1-2
-	SHLD	SHLD	-	-	SEE NOTES	A4TB6-9

Figure 1. Operators Cab Cable List
(Sheet 35 of 38)

CABLE LIST						
CABLE NUMBER: C24-2						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH: 18 INCHES						
CABLE ENTRY FROM: E46468-6				FROM: JB6		
CABLE ENTRY TO: SWE				TO: L1-HEATER LINE SOLENOID		
BULKHEAD FITTINGS:				NOTES: 1. TERMINATE TO CABLE C24-1. 2. L1 NOT POLARITY SENSITIVE.		
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	-	ITEM 163	JB6	SWE	SEE NOTE 2
2	450	-	ITEM 163	JB6	SWE	SEE NOTE 2

Figure 1. Operators Cab Cable List
(Sheet 36 of 38)

CABLE LIST						
CABLE NUMBER: COM-1						
CABLE TYPE: SWE						
O.D.:						
CABLE LENGTH: 25 FEET						
CABLE ENTRY FROM:			FROM: COMPASS			
CABLE ENTRY TO:			TO: J10			
BULKHEAD FITTINGS:			NOTES: ROUTED FROM COMPASS ACROSS CONSOLE TO TUBE, UP TUBE TO RADIO SHELF AND OVER TO J10. BEFORE CUTTING CABLE, VERIFY REMAINING LENGTH IS SUFFICIENT TO REACH FROM MATING CONNECTOR TO THE COMPASS SENSOR LOCATED ON THE MAST.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
-	-	BRN	-	NO CONNECTION	-	J10-A
-	-	RED	-	COMPASS PLUG PIN 2	-	J10-B
-	-	SHLD	-	NO CONNECTION	-	J10-C
-	-	WHITE	-	COMPASS PLUG PIN 4	-	J10-D
-	-	BLACK	-	COMPASS PLUG PIN 5	-	J10-E
-	-	GREEN	-	COMPASS PLUG PIN 6	-	J10-F
-	-	BLUE	-	COMPASS PLUG PIN 7	-	J10-G

Figure 1. Operators Cab Cable List
(Sheet 37 of 38)

CABLE LIST						
CABLE NUMBER: GPS-A1						
CABLE TYPE: SWE (ITEM 108)						
O.D.:						
CABLE LENGTH:						
CABLE ENTRY FROM:			FROM: GPS J3			
CABLE ENTRY TO:			TO: GPS ANTENNA			
BULKHEAD FITTINGS:			NOTES: FROM BACK OF GPS, ACROSS DASHBOARD, TO STARBOARD WINDOW. THEN AFT UNDER WINDOW TO AFT BULKHEAD, UP ALONG STARBOARD CORNER AND OVER ON AFT BULKHEAD TO STUFFING TUBE, THROUGH TUBE AND OUT TO ANTENNA.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
-	GPS-A1	-	SWE	GPS-J3	TNC	GPS-ANT.

Figure 1. Operators Cab Cable List
(Sheet 38 of 38)

PROPULSION MODULE WIRING LIST

LEGEND			
CABLE LIST	TYPE	CABLE LIST	TYPE
P24-1	LSNFW-9	CF-1	LSTHOF-3
P24-2	LSDHOF-4	CF-2	LSTHOF-3
P24-3	3/0	CF-5	LSTHOF-3
P24-4-1	E20828-3 3/0	CBP-1	LSMHOF-14
P24-4-2	E20828-4 3/0	CFD-1	LSDHOF-3
P24-5	LSDHOF-4	CFD-2	LSTNW-9
P24-6	LSDHOF-30	CFD-3	LSTNW-9
P24-7-1	LSFNW-9	CFD-4	LSTNW-9
P24-7-2	LSFNW-9	CFD-5	LSTNW-9
P24-8	LSDHOF-4	CFD-6	LSTNW-9
P24-9	LSTHOF-4	CFD-7	LSTNW-9
P24-10	LSDNW-9	CFD-8	LSMHOF-14
P24-11	LS2SJ-18	CFR-1	LSNNW-4
P24-12	3/0	KEH-1	LS2SJ-18
P24-13	LSDSGU-3	KEH-2	LS2SJ-18
P24-14	3/0	KL-2	LS4SJ-20
P24-15	3/0	KL-3	LS2SJ-18
P24-16	3/0 (G20838-3)	KL-4	LS2SJ-18
P24-17	3/0	KL-5	LS2SJ-18
P24-18	LSDNW-9	KL-6	LS2SJ-18
P24-19	LSDHOF-30	KL-7	LSDHOF-3
P24-20	GSXL-0601-0	KL-8	LS2SJ-18
B3-B7	3/0	HPU-1	LSDHOF-3
KMB-1	SWE	VF-1	LSDHOF-3
KMB-2	LSMHOF-14	P-1	2S0-6
KMB-3	LS3SJ-18	P-2	LSMHOF-37
KMB-4	SWE	P-3	LS3SU-7
KMB-5	SWE	P-4	LSMHOF-19

Figure 2. Propulsion Module Wiring List
(Sheet 1 of 72)

LEGEND (Continued)			
CABLE LIST	TYPE	CABLE LIST	TYPE
P-5	LSDHOF-30		
CL-1	LSDSGU-3		
CL-2	LSDSGU-3		
CL-3	LSDSGU-3		
CL-4	LSDSGU-3		
CL-5	LSDSGU-3		
CL-6	LSDSGU-3		
CL-7	LSDSGU-3		
P24-21	3/0 RED		
TS-1	SWE		

Figure 2. Propulsion Module Wiring List
(Sheet 2 of 72)

CABLE LIST						
CABLE NUMBER: P24-1						
CABLE TYPE: LSFNW-9						
O.D.: .630 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: G1			FROM: ALTERNATOR			
CABLE ENTRY TO: A9			TO: A9 JUNCTION BOX			
BULKHEAD FITTINGS: #4 NYLON TUBE 4E PACKING			NOTES: SECURE/SUPPORT CABLE AT ALTERNATOR TO PREVENT STRAIN ON ALTERNATOR TERMINATIONS.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
-	-	-	-	-	-	-
-	-	-	-	-	-	-
1	131	GREEN	E11028-12	G1-F	COMPRESSION	TB1-1
2	130	WHITE	E11028-12	G1-STATOR	COMPRESSION	TB1-2
3	0	BLACK	E11028-12	G1-GND	COMPRESSION	TB1-3
4	-	RED	-	SPARE	-	SPARE

Figure 2. Propulsion Module Wiring List
(Sheet 3 of 72)

CABLE LIST						
CABLE NUMBER: P24-2						
CABLE TYPE: LSDHOF-4						
O.D.: .460 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A9			FROM: A9 JUNCTION BOX			
CABLE ENTRY TO: A4			TO: ENGINE JUNCTION BOX			
BULKHEAD FITTINGS: #2 NYLON TUBE 2E PACKING			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	124	BLACK	E11028-21	TB1-4 (BRN)	E11028-21	TBE-13
2	SPARE	WHITE	-	-	-	-

Figure 2. Propulsion Module Wiring List
(Sheet 4 of 72)

CABLE LIST						
CABLE NUMBER: P24-3						
CABLE TYPE: 3/0						
O.D.: .660 INCHES						
CABLE LENGTH: SEE BELOW						
CABLE ENTRY FROM: BT7, BT8			FROM: ENGINE BATTERIES (2 BATT)			
CABLE ENTRY TO: A1B1			TO: ENG. STARTER, A1B1			
BULKHEAD FITTINGS:			NOTES: E20828-3 BLK, E20828-4 RED, POWER FOR STARTER. ROUTE CABLES IN 30 INCH LONG PIECE OF CONDUIT HOSE, IT. 211 (E53448).			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	E20838-3	BT8 (-)	E20908-4	STARTER NEG. POST
2	625	RED	E20838-3	BT7 (+)	E20908-4	STARTER POS. POST
			NOTE: RED = 15 FEET BLACK = 7 FEET			

Figure 2. Propulsion Module Wiring List
(Sheet 5 of 72)

CABLE LIST						
CABLE NUMBER: P24-4-1						
CABLE TYPE: E20828-3 3/0						
O.D.: .660 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: BT4			FROM: HOUSE BATTERIES (4 BATT)			
CABLE ENTRY TO: A6			TO: PROPULSION MODULE CIRCUIT BREAKER BOX			
BULKHEAD FITTINGS: #4 STUFFING TUBE WITH 4E PACKING ON A6			NOTES: CONDUCTORS ARE CLAMPED IN TERMINAL BLOCKS AT A6.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	E20838-3	BT4 (-)	COMPRESSION	TB4-(*)
			NOTE: (*) TB4 TERMINAL BLOCK CONNECTOR TO (0) CONNECT TO AN OPEN TERMINAL POINT.			

Figure 2. Propulsion Module Wiring List
(Sheet 6 of 72)

CABLE LIST						
CABLE NUMBER: P24-4-2						
CABLE TYPE: E20828-4 3/0						
O.D.: .660 INCHES						
CABLE LENGTH: 26 FEET						
CABLE ENTRY FROM: A12			FROM: A12 JUNCTION BOX			
CABLE ENTRY TO: A6			TO: PROPULSION MODULE CIRCUIT BREAKER BOX			
BULKHEAD FITTINGS: #4 STUFFING TUBE WITH 4E PACKING USED ON A6 AND A9 JUNCTION BOXES.			NOTES: CONDUCTORS ARE CLAMPED IN TERMINAL BLOCKS AT A6.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	200	RED	E20908-4	A12IS1-1	COMPRESSION	TB1-1

Figure 2. Propulsion Module Wiring List
(Sheet 7 of 72)

CABLE LIST						
CABLE NUMBER: P24-5						
CABLE TYPE: LSDHOF-4						
O.D.: .460 INCHES						
CABLE LENGTH: 7 FEET						
CABLE ENTRY FROM: A6			FROM: POWER MODULE CIRCUIT BREAKER BOX			
CABLE ENTRY TO: A4			TO: ENGINE JUNCTION BOX			
BULKHEAD FITTINGS: 2 NYLON STUFFING TUBE 2E PACKING ASSY-BOTH ENDS			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB4	E11028-1	TB1-20
2	132	WHITE	COMPRESSION	TB3-12	E11028-1	TB1-9

Figure 2. Propulsion Module Wiring List (Sheet 8 of 72)

CABLE LIST						
CABLE NUMBER: P24-6						
CABLE TYPE: LSDHOF-30						
O.D.: .960 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A8			FROM: VENT FAN RELAY, A8			
CABLE ENTRY TO: A6			TO: CIRCUIT BREAKER PANEL, A6			
BULKHEAD FITTINGS: #5 NYLON TUBE 5E PACKING ASSEMBLY-BOTH ENDS			NOTES: FEED FOR VENT FAN MOTOR CIRCUIT.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB1	COMPRESSION	TB4
2	133	WHITE	E11028-29	K1-1	COMPRESSION	TB2-02
			NOTE: USE TB1 LARGE LUG IN A8 FOR "0" WIRE FOR THIS CABLE. SEE CABLE VF-1.			

Figure 2. Propulsion Module Wiring List
(Sheet 9 of 72)

CABLE LIST						
CABLE NUMBER: P24-7-1						
CABLE TYPE: LSFNW-9						
O.D.: .630 INCHES						
CABLE LENGTH: 16 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL			
CABLE ENTRY TO: A6			TO: PM CIRCUIT BREAKER PANEL			
BULKHEAD FITTINGS: #4 NYLON TUBE 4E INSERT-BOTH ENDS			NOTES: TWO CABLES RUN TO SAME LOCATIONS. POWER FEED TO ENGINE COMPARTMENT BILGE PUMP CIRCUIT AND FLOOD ALARM.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB3-1	COMPRESSION	TB4
2	0	WHITE	COMPRESSION	TB3-1	COMPRESSION	TB4
3	137	RED	COMPRESSION	TB1-8	COMPRESSION	TB3-3
4	147	GREEN	COMPRESSION	TB2-3	COMPRESSION	TB3-5

Figure 2. Propulsion Module Wiring List
(Sheet 10 of 72)

CABLE LIST						
CABLE NUMBER: P24-7-2						
CABLE TYPE: LSFNW-9						
O.D.: .630 INCHES						
CABLE LENGTH: 16 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL			
CABLE ENTRY TO: A6			TO: PM CIRCUIT BREAKER PANEL			
BULKHEAD FITTINGS: #4 NYLON TUBE 4E INSERT-BOTH ENDS			NOTES: TWO CABLES RUN TO SAME LOCATIONS. POWER FEED TO ENGINE COMPARTMENT BILGE PUMP CIRCUIT AND FLOOD ALARM.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	152	BLACK	COMPRESSION	TB2-8	COMPRESSION	TB3-6
2	157	WHITE	COMPRESSION	TB4-3	COMPRESSION	TB3-7
3	162	RED	COMPRESSION	TB4-8	COMPRESSION	TB3-8
4	167	GREEN	COMPRESSION	TB3-8	COMPRESSION	TB3-9

*Figure 2. Propulsion Module Wiring List
(Sheet 11 of 72)*

CABLE LIST						
CABLE NUMBER: P24-8						
CABLE TYPE: LSDHOF-4						
O.D.: .460 INCHES						
CABLE LENGTH: 22 FEET						
CABLE ENTRY FROM: A9			FROM: A9 JUNCTION BOX			
CABLE ENTRY TO: A6			TO: PM CIRCUIT BREAKER PANEL			
BULKHEAD FITTINGS: 2E			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	202	BLACK	E11028-30	TB2-3	COMPRESSION	TB2-4
2	203	WHITE	E11028-30	TB2-4	COMPRESSION	TB2-5

Figure 2. Propulsion Module Wiring List
(Sheet 12 of 72)

CABLE LIST						
CABLE NUMBER: P24-9						
CABLE TYPE: LSTHOF-4						
O.D.: .480 INCHES						
CABLE LENGTH: 25 FEET						
CABLE ENTRY FROM: A6				FROM: POWER MODULE CIRCUIT BREAKER PANEL		
CABLE ENTRY TO: A3				TO: PM JUNCTION BOX		
BULKHEAD FITTINGS: 4 NYLON STUFFING TUBE 4B PACKING ASSEMBLY-BOTH ENDS				NOTES:		
						TERMINATION DATA
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB4	E11028-21	TB2-13
2	132	WHITE	COMPRESSION	TB3-12	E11028-21	TB3-17
3	173	RED	COMPRESSION	TB3-10	E11028-21	TB1-10

Figure 2. Propulsion Module Wiring List
(Sheet 13 of 72)

CABLE LIST						
CABLE NUMBER: P24-10						
CABLE TYPE: LSDNW-9						
O.D.: .545 INCHES						
CABLE LENGTH: 22 FEET						
CABLE ENTRY FROM: A6			FROM: POWER MODULE CIRCUIT BREAKER PANEL			
CABLE ENTRY TO: A7			TO: FWD BILGE PUMP CONTROL			
BULKHEAD FITTINGS: 4 NYLON TUBE 4B PACKING ASSEMBLY-BOTH ENDS			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB4	COMPRESSION	TB1-6
2	142	WHITE	COMPRESSION	TB3-4	COMPRESSION	TB1-3

Figure 2. Propulsion Module Wiring List
(Sheet 14 of 72)

CABLE LIST						
CABLE NUMBER: P24-11						
CABLE TYPE: LS2SJ-18						
O.D.: .310 INCHES						
CABLE LENGTH: 25 FEET						
CABLE ENTRY FROM: A2JB2			FROM: THRUSTER CONTROL JUNCTION BOX			
CABLE ENTRY TO: A6			TO: PM CIRCUIT BREAKER PANEL			
BULKHEAD FITTINGS: 2A			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB1-2	COMPRESSION	TB4-(*)
2	176	WHITE	COMPRESSION	TB1-1	COMPRESSION	TB3-11
3	SH	SHIELD	COMPRESSION	TB1-SH		NONE
			NOTE: (*)TB4 TERMINAL BLOCK ALL CONNECTIONS (0) CONNECT TO AN OPEN TERMINAL POINT.			

Figure 2. Propulsion Module Wiring List
(Sheet 15 of 72)

CABLE LIST						
CABLE NUMBER: P24-12						
CABLE TYPE: 3/0						
O.D.: .660 INCHES						
CABLE LENGTH: 15 FEET						
CABLE ENTRY FROM: ALT/G1			FROM: ALTERNATOR			
CABLE ENTRY TO: A12			TO: A12 ISOLATOR JUNCTION BOX			
BULKHEAD FITTINGS: A9 BOX NO. 4 STUFFING TUBE NO. 4E PACKING			NOTES: ROUTE CABLE IN 30 INCH LONG PIECE OF CONDUIT HOSE, IT. 211 (E53448) WITH CABLES KMB-1, KMB-4, AND KMB-5.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	220	RED	E20838-3	G1 (+)	E20838-3	SH1-B+

Figure 2. Propulsion Module Wiring List
(Sheet 16 of 72)

CABLE LIST						
CABLE NUMBER: P24-13						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A12			FROM: A12 ISOLATOR JUNCTION BOX			
CABLE ENTRY TO: A3			TO: POWER MODULE JUNCTION BOX A3			
BULKHEAD FITTINGS: #2 TUBE #2E PACKING			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	220	BLACK	E11028-21	SH1-B+	E11028-21	TB4-10
2	221	WHITE	E11028-21	SH1-L+	E11028-21	TB4-11

Figure 2. Propulsion Module Wiring List
(Sheet 17 of 72)

CABLE LIST						
CABLE NUMBER: P24-14						
CABLE TYPE: 3/0						
O.D.: .660 INCHES						
CABLE LENGTH: 15 FEET EACH						
CABLE ENTRY FROM: BT1-BT-4			FROM: HOUSE BATTERIES			
CABLE ENTRY TO: NR-2			TO: NATO RECEPICAL			
BULKHEAD FITTINGS:			NOTES: E20828-3 BLACK, E20828-4 RED			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	E20838-3	BT4 (-)	E20838-3	(-)
2	200	RED	E20838-3	BT3 (+)	E20838-3	(+)
			NOTE: RED CABLE = 15 FEET BLACK CABLE = 15 FEET			

Figure 2. Propulsion Module Wiring List
(Sheet 18 of 72)

CABLE LIST						
CABLE NUMBER: P24-15						
CABLE TYPE: 3/0						
O.D.: .660 INCHES						
CABLE LENGTH: SEE NOTE						
CABLE ENTRY FROM: BT7, BT8			FROM: ENGINE BATTERIES			
CABLE ENTRY TO: NR-1			TO: NATO RECEPTACLE (ENGINE)			
BULKHEAD FITTINGS:			NOTES: E20828-3 BLK, E20828-4 RED			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	E20838-3	BT8 (-)	E20838-3	(-)
2	625	RED	E20838-3	BT7 (+)	E20838-3	(+)
			NOTE: RED CABLE = 31 FEET BLACK CABLE = 18 FEET			

Figure 2. Propulsion Module Wiring List
(Sheet 19 of 72)

CABLE LIST						
CABLE NUMBER: P24-16						
CABLE TYPE: 3/0 (G20838-3)						
O.D.: .660 INCHES						
CABLE LENGTH: 17 FEET						
CABLE ENTRY FROM: BT8			FROM: BT8 (NEG)			
CABLE ENTRY TO: G1			TO: G1 GND			
BULKHEAD FITTINGS:			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	E20838-3	BT8 (-)	E20838-3	G1 (GND)

Figure 2. Propulsion Module Wiring List
(Sheet 20 of 72)

CABLE LIST						
CABLE NUMBER: P24-17						
CABLE TYPE: 3/0						
O.D.: .660 INCHES						
CABLE LENGTH: 15 FEET						
CABLE ENTRY FROM: A12			FROM: A12 ISOLATOR JUNCTION BOX			
CABLE ENTRY TO: BT7			TO: BT7 (+)			
BULKHEAD FITTINGS: #4 TUBE #4E PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	625	RED	E20908-4	A12S1-2	E20838-3	BT7 (+)

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P24-18						
CABLE TYPE: LSDNW-9						
O.D.: .545 INCHES						
CABLE LENGTH: 12 FEET						
CABLE ENTRY FROM: A12			FROM: ISOLATOR JUNCTION BOX			
CABLE ENTRY TO: A9			TO: THRUSTER DIR/AUX BATT. JUNCTION BOX			
BULKHEAD FITTINGS: #4 TUBE #4B PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	202	BLACK	E11028-35	A12S1-3	E11028-30	TB2-3
2	625	WHITE	E11028-35	A12A1-2	COMPRESSION	TB1-5

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P24-19						
CABLE TYPE: LSDHOF-30						
O.D.: .960 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A12			FROM: A12 JUNCTION BOX			
CABLE ENTRY TO: A4			TO: A4 ENGINE JUNCTION BOX			
BULKHEAD FITTINGS: #5 TUBE #5E PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	202	BLACK	COMPRESSION	A12TB1-2	COMPRESSION	A4TB4-2
2	625	WHITE	COMPRESSION	A12TB1-1	COMPRESSION	A4TB4-1

Figure 2. Propulsion Module Wiring List
(Sheet 23 of 72)

CABLE LIST						
CABLE NUMBER: P24-20						
CABLE TYPE: 6SXL-0601-0, #6AWG, E46278						
O.D.: .310 INCHES						
CABLE LENGTH: 15 FEET						
CABLE ENTRY FROM: BT8			FROM: ENGINE BATTERIES			
CABLE ENTRY TO: A12			TO: A12 JUNCTION BOX			
BULKHEAD FITTINGS: #2 TUBE #2A PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLK	E11028-38	BT8 (-)	COMPRESSION	A12TB1-2

Figure 2. Propulsion Module Wiring List
(Sheet 24 of 72)

CABLE LIST						
CABLE NUMBER: B3 THROUGH B7						
CABLE TYPE: 3/0						
O.D.: .660 INCHES						
CABLE LENGTH: AS NEEDED						
CABLE ENTRY FROM: SEE NOTES			FROM: SEE NOTES			
CABLE ENTRY TO: SEE NOTES			TO: SEE NOTES			
BULKHEAD FITTINGS:			NOTES: INTERNAL CABLING ON BATTERY BANK SEE BELOW. REFERENCE E41293 SHT 8. LABEL ENDS OF CABLES WITH TERMINATION POINT.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
B3	SEE NOTE	RED	E20838-3	BT1-POS.	E20838-3	BT3-POS.
B4	SEE NOTE	BLACK	E20838-3	BT4-NEG.	E20908-4	STARTER POST A1B1-NEG.
B5	SEE NOTE	RED	E20838-3	BT3-NEG.	E20838-3	BT4-POS.
B6	SEE NOTE	BLACK	E20838-3	BT2-NEG.	E20838-3	BT4-NEG.
B7	SEE NOTE	RED	E20838-3	BT7-NEG.	E20838-3	BT8-POS.
			NOTE: B3 7 FEET LONG E20828-3 BLACK B4 2 FEET LONG E20828-3 RED B5 2 FEET LONG B6 7 FEET LONG B7 7 FEET LONG			

Figure 2. Propulsion Module Wiring List
(Sheet 25 of 72)

CABLE LIST						
CABLE NUMBER: KMB-1						
CABLE TYPE: SWE						
O.D.: .640 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A1			FROM: MAIN ENGINE			
CABLE ENTRY TO: A4			TO: ENGINE JUNCTION BOX			
BULKHEAD FITTINGS: #4 TUBE #4E PACKING			NOTES: KMB-1 IS WIRING HARNESS FURNISHED ON ENGINE. CONNECT SHIELD ON WIRE NOS. 119, 120, & 121 TO TB1-8. ROUTE CABLE IN 30 INCH LNG PIECE OF CONDUIT HOSE, IT. 211 (E53448) WITH CABLES P24-12, KMB-4 AND KMB-5.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
0	0	WHITE	-	SWE	E11028-17	A4TB1-20
103	103	GREEN	-	SWE	E11028-9	A4TB1-10
106	106	GREEN	-	SWE	E11028-9	A4TB1-18
111	111	ORANGE		SWE	E11028-9	A4TB2-1
113	113	ORANGE	-	SWE	E11028-9	A4TB2-2
115	115	ORANGE	-	SWE	E11028-9	A4TB2-6
119	119	RED	-	SWE	E11028-9	A4TB1-4
120	120	GREEN	-	SWE	E11028-9	A4TB1-6
121	121	BLACK		SWE	E11028-9	A4TB1-7
	SHLD	SHIELD	SEE NOTE	SWE	E11028-9	A4TB1-8
132	132	ORANGE		SWE	E11028-9	A4TB1-9
124	124	ORANGE		SWE	E11028-9	A4TB1-12
125	125	GREEN		SWE	E11028-9	A4TB2-7
126	126	GREEN		SWE	E11028-9	A4TB2-8
127	127	GREEN		SWE	E11028-9	A4TB2-9
128	128	ORANGE		SWE	E11028-9	A4TB1-14

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: KMB-2						
CABLE TYPE: LSMHOF-14						
O.D.: .635 INCHES						
CABLE LENGTH: 22 FEET						
CABLE ENTRY FROM: A4			FROM: ENGINE JUNCTION BOX, A4			
CABLE ENTRY TO: A3			TO: POWER MODULE JUNCTION BOX, A3			
BULKHEAD FITTINGS: #4 NYLON TUBE #4E INSERT-BOTH ENDS			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	104	BLACK	E11028-1	TB1-16	E11028-1	TB1-8
2	111	WHITE	E11028-1	TB2-1	E11028-1	TB1-4
3	113	RED	E11028-1	TB2-2	E11028-1	TB1-2
4	115	GREEN	E11028-1	TB2-6	E11028-1	TB1-6
5	124	ORANGE	E11028-1	TB1-13	E11028-1	TB1-7
6	125	BLUE	E11028-1	TB2-7	E11028-1	TB3-14
7	126	WH/BK	E11028-1	TB2-8	E11028-1	TB3-15
8	127	RD/BK	E11028-1	TB2-9	E11028-1	TB3-16
9	129	GN/BK	E11028-1	TB1-15	E11028-1	TB1-9
10	110	OR/BK	E11028-1	TB2-10	E11028-1	TB1-3
11	134	BLU/BK	E11028-1	TB2-4	E11028-1	TB1-14
12	133	BK/WHT	E11028-1	TB2-3	E11028-1	TB2-20
13	180	RD/WHT	E11028-1	TB2-5	E11028-1	TB2-11
14	178	GN/WHT	E11028-1	TB1-11	E11028-1	TB2-15

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: KMB-3						
CABLE TYPE: LS3SJ-18						
O.D.: .325 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A4			FROM: ENGINE JUNCTION BOX			
CABLE ENTRY TO: A3			TO: POWER MODULE JUNCTION BOX			
BULKHEAD FITTINGS: #2 NYLON TUBE #2 BINSERT BOTH ENDS			NOTES: THROTTLE CONTROL			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	119	BLACK	E11028-9	TB1-4	E11028-9	TB3-2
2	121	WHITE	E11028-9	TB1-7	E11028-9	TB3-3
3	120	RED	E11028-9	TB1-6	E11028-9	TB3-4
4	SHIELD	SHIELD	E11028-9	TB1-8	-	-

Figure 2. Propulsion Module Wiring List
(Sheet 28 of 72)

CABLE LIST						
CABLE NUMBER: KMB-4						
CABLE TYPE: SWE						
O.D.: .470 INCHES						
CABLE LENGTH: 23 FEET						
CABLE ENTRY FROM: A1			FROM: A1 ENGINE			
CABLE ENTRY TO: A4			TO: A4 ENGINE JUNCTION BOX			
BULKHEAD FITTINGS: #2 NYLON TUBE #2E PACKING			NOTES: ROUTE CABLE IN 30 INCH LONG CONDUIT HOSE, IT 21 (E53448) WITH CABLES P24-12, KMB-1 AND KMB-5.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	625	RED	-	-	COMPRESSION	A4TB4-1
2	605	RED	-	ECM POWER	COMPRESSION	A4TB2-12
3	0	WHITE	-	GND	COMPRESSION	A4TB3-2
4	0	WHITE	-	GND	COMPRESSION	A4TB3-2
5	0	WHITE	-	GND	COMPRESSION	A4TB3-2
6	0	WHITE	-	GND	COMPRESSION	A4TB3-2

Figure 2. Propulsion Module Wiring List
(Sheet 29 of 72)

CABLE LIST						
CABLE NUMBER: KMB-5						
CABLE TYPE: SWE						
O.D.: .780 (.390 EACH) INCHES						
CABLE LENGTH: -						
CABLE ENTRY FROM: A1				FROM: A1 ENGINE		
CABLE ENTRY TO: A4				TO: A4 ENGINE JUNCTION BOX		
BULKHEAD FITTINGS: #4 TUBE				NOTES: ROUTE CABLE IN 30 INCH PIECE OF CONDUIT HOSE, IT. 211 (E53448) WITH CABLES P24-12, KMB-1 AND KMB-4.		
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	SWE	PLUG A	COMPRESSION	A4TB3-2
2	603	RED	SWE	PLUG B,C,D	COMPRESSION	A4TB3-1

Figure 2. Propulsion Module Wiring List
(Sheet 30 of 72)

CABLE LIST						
CABLE NUMBER: CF-1						
CABLE TYPE: LSTHOF-3						
O.D.: .450 INCHES						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL			
CABLE ENTRY TO: S9			TO: ENGINE ROOM FIRE DETECTOR			
BULKHEAD FITTINGS: #2 NYLON TUBE 2E PACKING TWO SCREW CONN AT S9			NOTES: 1. CABLE CF-1 CONNECTS IN S9 TO THE SWITCH. 2. REMOVE INSULATORS AND INSTALL HEAT SHRINK TUBING FOR WATERPROOF CONNECTIONS.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	140	BLACK	COMPRESSION	TB1-5	E23808-1	S9-2 (BLK)
2	137	WHITE	COMPRESSION	TB1-9	E23808-1	S9-1 (WHT)
3	SPARE	RED	-	-	-	-

Figure 2. Propulsion Module Wiring List
(Sheet 31 of 72)

CABLE LIST						
CABLE NUMBER: CF-2						
CABLE TYPE: LSTHOF-3						
O.D.: .450 INCHES						
CABLE LENGTH: 29 FEET						
CABLE ENTRY FROM: A7			FROM: FORWARD COMPARTMENT BILGE PUMP CONTROL			
CABLE ENTRY TO: A5			TO: BILGE PUMP CONTROL PANEL			
BULKHEAD FITTINGS: # 2 STUFFING TUBE #2E PACKING BOTH ENDS			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	138	BLACK	COMPRESSION	TB1-7	COMPRESSION	TB1-2
2	SPARE	WHITE	-	-	-	-
3	146	RED	COMPRESSION	TB1-4	COMPRESSION	TB1-7

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CF-5						
CABLE TYPE: LSTHOF-3						
O.D.: .450 INCHES						
CABLE LENGTH: 30 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL			
CABLE ENTRY TO: S8			TO: AFT COMPARTMENT FIRE DETECTOR S8			
BULKHEAD FITTINGS: #2 NYLON TUBE, 2E PACKING AT A5. TWO SCREW CONNECTOR AT JB7.			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	140	BLACK	COMPRESSION	TB1-5	E23808-1	S8-2 (BLK)
2	137	WHITE	COMPRESSION	TB1-9	E23808-1	S8-1 (WHT)
3	SPARE	RED	-	-	-	-

Figure 2. Propulsion Module Wiring List
(Sheet 33 of 72)

CABLE LIST						
CABLE NUMBER: CBP-1						
CABLE TYPE: LSMHOF-14						
O.D.: .635 INCHES						
CABLE LENGTH: 31 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL A5			
CABLE ENTRY TO: A3			TO: POWER MODULE JUNCTION BOX A3			
BULKHEAD FITTINGS: #4 NYLON STUFFING TUBE 4E PACKING BOTH ENDS			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	SPARE	BLACK	-	-	-	-
2	SPARE	WHITE	-	-	-	-
3	139	RED	COMPRESSION	TB1-10	E11028-1	TB1-16
4	141	GREEN	COMPRESSION	TB1-6	E11028-1	TB1-17
5	148	ORANGE	COMPRESSION	TB2-5	E11028-1	TB1-20
6	150	BLUE	COMPRESSION	TB2-1	E11028-1	TB2-1
7	153	WH/BLK	COMPRESSION	TB2-10	E11028-1	TB2-2
8	155	RD/BLK	COMPRESSION	TB2-6	E11028-1	TB2-3
9	158	GN/BLK	COMPRESSION	TB4-5	E11028-1	TB2-4
10	160	OR/BLK	COMPRESSION	TB4-1	E11028-1	TB2-5
11	163	BU/BLK	COMPRESSION	TB4-10	E11028-1	TB2-6
12	165	BK/WH	COMPRESSION	TB4-6	E11028-1	TB2-7
13	168	RD/WH	COMPRESSION	TB3-10	E11028-1	TB2-8
14	170	GN/WH	COMPRESSION	TB3-6	E11028-1	TB2-9

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFD-1						
CABLE TYPE: LSDHOF-3						
O.D.: .425 INCHES						
CABLE LENGTH: 12 FEET						
CABLE ENTRY FROM: A3			FROM: P.M. JUNCTION BOX			
CABLE ENTRY TO: A7			TO: FORWARD COMPARTMENT BILGE PUMP CONTROL			
BULKHEAD FITTINGS: #2 NYLON STUFFING TUBE 2E PACKING AT BOTH ENDS			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	143	BLACK	E11028-1	TB1-18	COMPRESSION	TB1-5
2	145	WHITE	E11028-1	TB1-19	COMPRESSION	TB1-1

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFD-2						
CABLE TYPE: LSTNW-9						
O.D.: .625 INCHES						
CABLE LENGTH: 5 FEET						
CABLE ENTRY FROM: A7				FROM: FORWARD COMPARTMENT BILGE PUMP CONTROL		
CABLE ENTRY TO: JB1				TO: FWD. COMPARTMENT JUNCTION BOX, BILGE PUMP, SWITCH		
BULKHEAD FITTINGS: #4 NYLON TUBE, 4E PACKING				NOTES: IN JB1, CFD-2 CONNECTS TO WIRES FROM BILGE PUMP B2, & FLOAT SWITCH S10. OBSERVE POLARITY OF B2, S10 IS NON-POLARIZED.		
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB1-6	E23808-2	B2-1 (BLACK) S10-2
2	143	WHITE	COMPRESSION	TB1-5	E23808-2	B2-2 (BROWN)
3	146	RED	COMPRESSION	TB1-4	E23808-2	S10-1

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFD-3						
CABLE TYPE: LSTNW-9						
O.D.: .625 INCHES						
CABLE LENGTH: 35 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL, A5			
CABLE ENTRY TO: JB2			TO: FWD. STARBOARD. ENG. RM. JUNCTION BOX 2, B4, S12			
BULKHEAD FITTINGS: #4 NYLON TUBE, 4E PACKING AT A5. TWO SCREW CONNECTOR AT JB2.			NOTES: IN JB2, CFD-3 CONNECTS TO WIRES FROM BILGE PUMP B4, & BILGE SW S12. OBSERVE POLARITY OF B4, S12 IS NON-POLARIZED.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB3-4	E23808-2	B4-1 (BLACK) S12-2
2	153	WHITE	COMPRESSION	TB2-10	E23808-2	B4-2 (BROWN)
3	156	RED	COMPRESSION	TB2-9	E23808-2	S12-1

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFD-4						
CABLE TYPE: LSTNW-9						
O.D.: .625 INCHES						
CABLE LENGTH: 29 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL			
CABLE ENTRY TO: A9			TO: FWD PORT ENG. RM. THRUSTER JUNCTION BOX, A9, B3, S11			
BULKHEAD FITTINGS: #4 NYLON TUBE, 4E PACKING BOTH ENDS. #1 NYLON TUBE, 1B PACKING ON PUMP/FLOAT SWITCH.			NOTES: A9 JUNCTION BOX IS USED AS A PASS THROUGH FOR B3-S11 PUMP/FLOAT SWITCH.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB3-2	E23808-2	TB2-18
2	148	WHITE	COMPRESSION	TB2-5	E23808-2	TB2-19
3	151	RED	COMPRESSION	TB2-4	E23808-2	TB2-20
			NOTE: FROM A9 TO PUMP/PUMP FLOAT SWITCH. THE FOLLOWING CONNECTIONS SHALL BE USED.			
1	0		COMPRESSION	TB2-18	E11028-19	B3-1 (BLACK) S11-2
2	148		COMPRESSION	TB2-19	E11028-19	B3-2 (BROWN)
3	151		COMPRESSION	TB2-20	E11028-19	S11-1

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFD-5						
CABLE TYPE: LSTNW-9						
O.D.: .625 INCHES						
CABLE LENGTH: 30 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL			
CABLE ENTRY TO: JB5			TO: AFT STARBOARD. ENG. RM. JUNCTION BOX, B6, S14			
BULKHEAD FITTINGS: #4 NYLON TUBE, 4E PACKING AT A5. TWO SCREW CONNECTOR AT JB5.			NOTES: IN JB5 CFD-5 CONNECTS TO WIRES FROM BILGE PUMP B6, & BILGE SW S14. OBSERVE POLARITY OF B6, S14 IS NON-POLARIZED.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB3-2	E23808-2	B6-1 (BLACK) S14-2
2	163	WHITE	COMPRESSION	TB4-10	E23808-2	B6-2 (BROWN)
3	166	RED	COMPRESSION	TB4-9	E23808-2	S14-1

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFD-6						
CABLE TYPE: LSTNW-9						
O.D.: .625 INCHES						
CABLE LENGTH: 30 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL, A5			
CABLE ENTRY TO: JB6			TO: AFT COMPARTMENT, JUNCTION BOX, JB6			
BULKHEAD FITTINGS: #4 NYLON TUBE, 4E PACKING AT A5. TWO SCREW CONNECTOR AT JB6.			NOTES: IN JB6 CFD-6 CONNECTS TO WIRE FROM BILGE PUMP B7 & BILGE SW S15. OBSERVE POLARITY OF B7, S15 IS NON-POLARIZED.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB3-5	E23808-2	B7-1 (BLACK) S15-2
2	168	WHITE	COMPRESSION	TB3-10	E23808-2	B7-2 (BROWN)
3	171	RED	COMPRESSION	TB3-9	E23808-2	S15-1

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFD-7						
CABLE TYPE: LSTNW-9						
O.D.: .625 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL			
CABLE ENTRY TO: JB8			TO: AFT PORT ENGINE RM. JUNCTION BOX, B5, S13			
BULKHEAD FITTINGS: #4 NYLON TUBE, 4E PACKING AT A5. TWO SCREEN CONNECTORS AT JB8.			NOTES: IN JB8, CFD-7 CONNECTS TO WIRES FROM BILGE PUMP B5, & BILGE SW S13. OBSERVE POLARITY OF B5, S13 IS NON-POLARIZED.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	COMPRESSION	TB3-3	E23808-2	B5-1 (BLACK) S13-2
2	158	WHITE	COMPRESSION	TB4-5	E23808-2	B5-2 (BROWN)
3	161	RED	COMPRESSION	TB4-4	E23808-2	S13-1

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFD-8						
CABLE TYPE: LSMHOF-14						
O.D.: .635 INCHES						
CABLE LENGTH: 30 FEET						
CABLE ENTRY FROM: A5			FROM: BILGE PUMP CONTROL PANEL			
CABLE ENTRY TO: A3			TO: PM JUNCTION BOX			
BULKHEAD FITTINGS: #4 STUFFING TUBE #4E PACKING BOTH ENDS			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	146	BLACK	COMPRESSION	TB1-7	E11028-21	TB4-1
2	151	WHITE	COMPRESSION	TB2-4	E11028-21	TB4-2
3	156	RED	COMPRESSION	TB2-9	E11028-21	TB4-3
4	161	GREEN	COMPRESSION	TB4-4	E11028-21	TB4-4
5	166	ORANGE	COMPRESSION	TB4-9	E11028-21	TB4-5
6	171	BLUE	COMPRESSION	TB3-9	E11028-21	TB4-6
7	138	WH/BLK	COMPRESSION	TB1-2	E11028-21	TB4-7
8	SPARE	RED/BLK	-	-	-	-
9	SPARE	GRN/BLK	-	-	-	-
10	SPARE	ORG/BLK	-	-	-	-
11	SPARE	BLU/BLK	-	-	-	-
12	SPARE	BLK/WHT	-	-	-	-
13	SPARE	RED/WHT	-	-	-	-
14	SPARE	GRN/WHT	-	-	-	-

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: CFR-1						
CABLE TYPE: LSNNW-4						
O.D.: .513 INCHES						
CABLE LENGTH: 33 FEET						
CABLE ENTRY FROM: A4			FROM: ENGINE JUNCTION BOX			
CABLE ENTRY TO: S2			TO: CO ₂ RELEASE SWITCH, FWD. COMPARTMENT			
BULKHEAD FITTINGS: #4 TUBE, 4B PACKING			NOTES: THIS CABLE IS CONNECTED TO ONE POLE OF THE CO ₂ RELEASE SWITCH.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	133	BLACK	E11028-21	TB2-3	E11028-21	S2A COM
2	134	WHITE	E11028-21	TB2-4	E11028-21	S2A N/C
3	104	RED	E11028-21	TB1-16	E11028-21	S2B-COM
4	124	GREEN	E11028-21	TB1-12	E11028-21	S2B-N/0

Figure 2. Propulsion Module Wiring List
(Sheet 43 of 72)

CABLE LIST						
CABLE NUMBER: KEH-1						
CABLE TYPE: LS2SJ-18						
O.D.: .310 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A3				FROM: POWER MODULE JUNCTION BOX		
CABLE ENTRY TO: L2				TO: CLUTCH SOLENOID (L2)		
BULKHEAD FITTINGS: 2A PACKING, #2 NYLON TUBE @ A3				NOTES: COORDINATOR WITH HYDRAULIC SYSTEM MECHANICS TO IDENTIFY ENGAGE CONNECTIONS.		
				TERMINATION DATA		
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	E11028-1	TB1-13	PLUG	C
2	174	WHITE	E11028-1	TB1-11	PLUG	D
3	SHIELD	-	E11028-1 E25028-1	TB3-9	-	-

Figure 2. Propulsion Module Wiring List
(Sheet 44 of 72)

CABLE LIST						
CABLE NUMBER: KEH-2						
CABLE TYPE: LS2SJ-18						
O.D.: .31 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A3			FROM: POWER MODULE JUNCTION BOX			
CABLE ENTRY TO: L3			TO: CLUTCH SOLENOID (L3)			
BULKHEAD FITTINGS: 2A PACKING, #2 NYLON TUBE @ A3			NOTES: COORDINATE WITH HYDRAULIC SYSTEM MECHANICS TO IDENTIFY ENGAGE CONNECTIONS.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	E11028-1	TB1-13	PLUG	A
2	175	WHITE	E11028-1	TB1-12	PLUG	B
3	SHLD	-	E11028-1 E25028-1	TB3-9	-	-

Figure 2. Propulsion Module Wiring List
(Sheet 45 of 72)

CABLE LIST						
CABLE NUMBER: KL-2						
CABLE TYPE: LS4SJ-20						
O.D.: .360 INCHES						
CABLE LENGTH: 45 FEET						
CABLE ENTRY FROM: A3			FROM: POWER MODULE J BOX			
CABLE ENTRY TO: A2B1			TO: ON THRUSTER - SYNCHRO, A2B1			
BULKHEAD FITTINGS: #2 TUBE, 2A PACKING			NOTES: EQUIPMENT FURNISHED AS PART OF THRUSTER. CONSULT MANUFACTURER'S DATA TO CONFIRM CONNECTIONS.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	182	BLACK	E11028-1	TB3-10	COMPRESSION	1
2	183	WHITE	E11028-1	TB3-11	COMPRESSION	2
3	185	RED	E11028-1	TB3-6	COMPRESSION	3
4	186	GREEN	E11028-1	TB3-7	COMPRESSION	4
5	SHIELD	SHIELD	E11028-1	TB3-13	-	-

Figure 2. Propulsion Module Wiring List
(Sheet 46 of 72)

CABLE LIST						
CABLE NUMBER: KL-3						
CABLE TYPE: LS2SJ-18						
O.D.: .310 INCHES						
CABLE LENGTH: 23 FEET						
CABLE ENTRY FROM: A9			FROM: THRUSTER DIR/AUX. BATT./VOLTAGE REG.			
CABLE ENTRY TO: A3			TO: POWER MODULE JUNCTION BOX			
BULKHEAD FITTINGS: STUFFING TUBE #2 PACKING #2A BOTH ENDS			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	205	BLACK	E11028-21	TB2-6	E11028-21	TB2-18
2	206	WHITE	E11028-21	TB2-7	E11028-21	TB2-19
3	SHIELD	-	-	-	-	-

Figure 2. Propulsion Module Wiring List
(Sheet 47 of 72)

CABLE LIST						
CABLE NUMBER: KL-4						
CABLE TYPE: LS2SJ-18						
O.D.: .325 INCHES						
CABLE LENGTH: 30 FEET						
CABLE ENTRY FROM: A2JB2				FROM: THRUSTER/JUNCTION BOX (A2JB2)		
CABLE ENTRY TO: A3				TO: POWER MODULE JUNCTION BOX A3		
BULKHEAD FITTINGS: NO. 2 STUFFING TUBE, NO. 2B PACKING, BOTH ENDS				NOTES: INTERFACE CABLING TO CAB FOR THRUSTER CONTROL.		
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	210	BLACK	COMPRESSION	TB1-3	E11028-21	TB3-12
2	211	WHITE	COMPRESSION	TB1-4	E11028-21	TB3-19
3	212	RED	COMPRESSION	TB1-5	E11028-21	TB3-18
4	SHLD	SHLD	COMPRESSION	SHLD	E11028-21	TB3-13

Figure 2. Propulsion Module Wiring List
(Sheet 48 of 72)

CABLE LIST						
CABLE NUMBER: KL-5						
CABLE TYPE: LS2SJ-18						
O.D.: .310 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A2JB1			FROM: HYD. CONTROL/SOL. A			
CABLE ENTRY TO: A2JB2			TO: THRUSTER CONTROL			
BULKHEAD FITTINGS: HYD. CONTROL PLUG SOL. A THRUSTER CONTROL NO. 2 STUFFING TUBE NO. 2A PACKING			NOTES: CCW THRUSTER ROTATION.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	PLUG	L5-2	COMPRESSION	TN1-9
2	177	WHITE	PLUG	L5-1	COMPRESSION	TB1-8
3	SHLD	SHLD	-	-	COMPRESSION	TB1-9/SH

Figure 2. Propulsion Module Wiring List
(Sheet 49 of 72)

CABLE LIST						
CABLE NUMBER: KL-6						
CABLE TYPE: LS2SJ-18						
O.D.: .310 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A2JB1			FROM: HYD. CONTROL/SOL. B			
CABLE ENTRY TO: A2JB2			TO: THRUSTER CONTROL			
BULKHEAD FITTINGS: HYD. CONTROL SOL. B, A2JB2, NO.2 STUFFING TUBE, NO.2A PACKING			NOTES: CW THRUSTER ROTATION.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLACK	PLUG	L4-2	COMPRESSION	TB1-7
2	179	WHITE	PLUG	L4-1	COMPRESSION	TB1-6
3	SHLD	SHLD	-	-	COMPRESSION	TB1-9/SH

Figure 2. Propulsion Module Wiring List (Sheet 50 of 72)

CABLE LIST						
CABLE NUMBER: KL-7						
CABLE TYPE: LSDHOF-3						
O.D.: .425 INCHES						
CABLE LENGTH: 30 FEET						
CABLE ENTRY FROM: A4			FROM: ENGINE JUNCTION BOX, A4			
CABLE ENTRY TO: L1			TO: COLD START SOLENOID, L1			
BULKHEAD FITTINGS: #2 NYLON TUBE, 2E PACKING AT A4			NOTES: AFTER BUTTSPLICES USE HEAT SHRINK TO COVER WIRE AND BUTTSPLICE.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	103	BLACK	E11028-1	TB1-10	BUTTSPLICE	BLUE SOL. POS
2	0	WHITE	E11028-1	TB1-19	BUTTSPLICE	BLACK SOL. NEG

Figure 2. Propulsion Module Wiring List
(Sheet 51 of 72)

CABLE LIST						
CABLE NUMBER: KL-8						
CABLE TYPE: LS35J-18						
O.D.: .370 INCHES						
CABLE LENGTH: 30 FEET						
CABLE ENTRY FROM: A4			FROM: ENGINE BOX A4			
CABLE ENTRY TO: A2S2			TO: THRUSTER GEARCASE OIL LEVEL			
BULKHEAD FITTINGS: #2 TUBE 2A PACKING			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	180	RED	E11028-1	TB2-5	PLUG	C
2	0	BLACK	E11028-1	TB1-19	PLUG	B
3	625	WHITE	E11028-1	TB1-17	PLUG	A
4	SHIELD	-	-	-	-	-

Figure 2. Propulsion Module Wiring List (Sheet 52 of 72)

CABLE LIST						
CABLE NUMBER: HPU-1						
CABLE TYPE: LSDHOF-3						
O.D.: .425 INCHES						
CABLE LENGTH: 37 FEET						
CABLE ENTRY FROM: A2JB1-S1			FROM: HYD. TANK A2JB1-S1			
CABLE ENTRY TO: A4			TO: ENGINE BOX A4			
BULKHEAD FITTINGS: #2 STUFFING TUBE #2E PACKING @ A4 #1 PACKING #1C PACKING @ HPU CONN.			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	178	BLACK	SPlice	RED WIRE	E11028-21	TB1-11
2	625	WHITE	SPlice	RED WIRE	E11028-21	TB1-17

Figure 2. Propulsion Module Wiring List
(Sheet 53 of 72)

CABLE LIST						
CABLE NUMBER: VF-1						
CABLE TYPE: LSDHOF-3						
O.D.: .425 INCHES						
CABLE LENGTH: 37 FEET						
CABLE ENTRY FROM: A3			FROM: A3-PWR MOD JUNC BOX - LOCATED FWD (STARBOARD)			
CABLE ENTRY TO: A8			TO: A8-VENT FAN RELAY ENCL. LOCATED AFT (PORT)			
BULKHEAD FITTINGS: #2 TUBE #2E PACKING			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	135	BLK	E11028-21	TB1-15	E11028-10	K1-5
2	133	WHT	E11028-21	TB2-20	E11028-27	K1-1

Figure 2. Propulsion Module Wiring List
(Sheet 54 of 72)

CABLE LIST						
CABLE NUMBER: P-1						
CABLE TYPE: 2S0-6 (CABLE ASSEMBLY: E13033-1)						
O.D.: .825 INCHES						
CABLE LENGTH: 22 FEET						
CABLE ENTRY FROM: A6			FROM: PM CIRCUIT BREAKER PANEL			
CABLE ENTRY TO: PLUG			TO: CAB A5/A6 OR INTERCONNECT CABLE ASSEMBLY			
BULKHEAD FITTINGS: #5 TUBE 5B PACKING			NOTES: "TO" CONNECTION POINT IS EITHER 3A5-J1, 3A6-J1 OR INTERCONNECT CABLE ASSEMBLY J-1 DEPENDING ON CAB AND MODULE LOCATIONS. REFERENCE DRAWING E36194.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLK	COMPRESSION	TB4-ALL	SOLDER	P1-B
2	172	WHT	COMPRESSION	TB2-3	SOLDER	P1-A

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P-2						
CABLE TYPE: LSMHOF-37 (CABLE ASSEMBLY: E13033-2)						
O.D.: .925 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A3			FROM: PM JUNCTION BOX A3			
CABLE ENTRY TO: SIZE 5 TUBE, 5D PACKING			TO: CAB A5/A6 OR INTERCONNECT CABLE ASSEMBLY			
BULKHEAD FITTINGS: SIZE 5 TUBE 5D PACKING			NOTES: "TO" CONNECTION POINT IS EITHER 3A5-J2, 3A6-J2 OR INTERCONNECT CABLE ASSEMBLY J-2 DEPENDING ON CAB AND MODULE LOCATIONS. REFERENCE DRAWING E36194.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	112		E11028-21	TB1-1	CRIMP	P2-1
2	113		E11028-21	TB1-2	CRIMP	P2-2
3	110		E11028-21	TB1-3	CRIMP	P2-3
4	111		E11028-21	TB1-4	CRIMP	P2-4
5	114		E11028-21	TB1-5	CRIMP	P2-5
6	115		E11028-21	TB1-6	CRIMP	P2-6
7	124		E11028-21	TB1-7	CRIMP	P2-7
8	104		E11028-21	TB1-8	CRIMP	P2-8
9	129		E11028-21	TB1-9	CRIMP	P2-9
10	173		E11028-21	TB1-10	CRIMP	P2-10
11	174		E11028-21	TB1-11	CRIMP	P2-11
12	175		E11028-21	TB1-12	CRIMP	P2-12
13	SPARE		E11028-21	TB1-13	CRIMP	P2-13
14	134		E11028-21	TB1-14	CRIMP	P2-14
15	135		E11028-21	TB1-15	CRIMP	P2-15
16	139		E11028-21	TB1-16	CRIMP	P2-16

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P-2 (CONT.)						
CABLE TYPE: LSMHOF-37 (CABLE ASSEMBLY: E13033-2)						
O.D.: .925 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A3			FROM: PM JUNCTION BOX A3			
CABLE ENTRY TO: SIZE 5 TUBE, 5 D PACKING			TO: CAB A5/A6 OR INTERCONNECT CABLE ASSEMBLY			
BULKHEAD FITTINGS: SIZE 5 TUBE 5D PACKING			NOTES: “TO” CONNECTION POINT IS EITHER 3A5-J2, 3A6-J2 OR INTERCONNECT CABLE ASSEMBLY J-2 DEPENDING ON CAB AND MODULE LOCATIONS. REFERENCE DRAWING E36194.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
17	141		E11028-21	TB1-17	CRIMP	P2-17
18	143		E11028-21	TB1-18	CRIMP	P2-18
19	145		E11028-21	TB1-19	CRIMP	P2-19
20	148		E11028-21	TB1-20	CRIMP	P2-20
21	150		E11028-21	TB2-1	CRIMP	P2-21
22	153		E11028-21	TB2-2	CRIMP	P2-22
23	155		E11028-21	TB2-3	CRIMP	P2-23
24	158		E11028-21	TB2-4	CRIMP	P2-24
25	160		E11028-21	TB2-5	CRIMP	P2-25
26	163		E11028-21	TB2-6	CRIMP	P2-26
27	165		E11028-21	TB2-7	CRIMP	P2-27
28	168		E11028-21	TB2-8	CRIMP	P2-28
29	170		E11028-21	TB2-9	CRIMP	P2-29
30	181		E11028-21	TB2-10	CRIMP	P2-30
31	180		E11028-21	TB2-11	CRIMP	P2-31
32	SPARE		E11028-21	TB2-12	CRIMP	P2-32

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P-2 (CONT.)						
CABLE TYPE: LSMHOF-37 (CABLE ASSEMBLY: E13033-2)						
O.D.: .925 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A3			FROM: PM JUNCTION BOX A3			
CABLE ENTRY TO: SIZE 5 TUBE, 5D PACKING			TO: CAB A5/A6 OR INTERCONNECT CABLE ASSEMBLY			
BULKHEAD FITTINGS: SIZE 5 TUBE 5D PACKING			NOTES: "TO" CONNECTION POINT IS EITHER 3A5-J2, 3A6-J2 OR INTERCONNECT CABLE ASSEMBLY J-2 DEPENDING ON CAB AND MODULE LOCATIONS. REFERENCE DRAWING E36194.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
33	0		E11028-21	TB2-13	CRIMP	P2-33
34	190		E11028-21	TB2-14	CRIMP	P2-34
35	178		E11028-21	TB2-15	CRIMP	P2-35
36	187		E11028-21	TB2-16	CRIMP	P2-36
37	SPARE		E11028-21	TB2-17	CRIMP	P2-37

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P-3						
CABLE TYPE: LS3SU-7 (CABLE ASSEMBLY: E13033-3)						
O.D.: .910 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A3			FROM: PM JUNCTION BOX A3			
CABLE ENTRY TO: PLUG			TO: CAB A5/A6 OR INTERCONNECT CABLE ASSEMBLY			
BULKHEAD FITTINGS:			NOTES: “TO” CONNECTION POINT IS EITHER 3A5-J3, 3A6-J3 OR INTERCONNECT CABLE ASSEMBLY J-3 DEPENDING ON CAB AND MODULE LOCATIONS. REFERENCE DRAWING E36194.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	119	1-BLK	E11028-21	TB-3-2	CRIMP	P3-2
2	121	1-WH	E11028-21	TB3-3	CRIMP	P3-3
3	120	1-RD	E11028-21	TB3-4	CRIMP	P3-4
4	0	1-SHD	E11028-21	TB3-1	CRIMP	P3-1
5	185	2-BK	E11028-21	TB3-6	CRIMP	P3-5
6	186	2-WH	E11028-21	TB3-7	CRIMP	P3-6
7	SPARE	2-RD	E11028-21	TB3-8	CRIMP	P3-8
8	0	2-SHD	E11028-21	TB3-5	CRIMP	P3-7
9	182	2-BK	E11028-21	TB3-10	CRIMP	P3-9
10	183	3-WH	E11028-21	TB3-11	CRIMP	P3-14
11	SPARE	3-RD	-	-	CRIMP	P3-15
12	0	2-SHD	E11028-21	TB3-9	CRIMP	P3-13
13	125	4-BK	E11028-21	TB3-14	CRIMP	P3-10
14	126	4-WH	E11028-21	TB3-15	CRIMP	P3-11
15	127	4-RD	E11028-21	TB3-16	CRIMP	P3-12
16	0	4-SHD	E11028-21	TB3-13	CRIMP	P3-16

Figure 2. Propulsion Module Wiring List
(Sheet 59 of 72)

CABLE LIST						
CABLE NUMBER: P-3 (CONT.)						
CABLE TYPE: LS3SU-7 (CABLE ASSEMBLY: E13033-3)						
O.D.: .910 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A3			FROM: PM JUNCTION BOX A3			
CABLE ENTRY TO: PLUG			TO: CAB A5/A6 OR INTERCONNECT CABLE ASSEMBLY			
BULKHEAD FITTINGS:			NOTES: “TO” CONNECTION POINT IS EITHER 3A5-J3, 3A6-J3 OR INTERCONNECT CABLE ASSEMBLY J-3 DEPENDING ON CAB AND MODULE LOCATIONS. REFERENCE DRAWING E36194.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
17	132	5-BK	E11028-21	TB3-17	CRIMP	P3-17
18	212	5-WH	E11028-21	TB3-18	CRIMP	P3-18
19	211	5-RD	E11028-21	TB3-19	CRIMP	P3-19
20	SPARE	5-SHD	E11028-21	-	CRIMP	P3-20
21	205	6-BK	E11028-21	TB2-18	CRIMP	P3-21
22	206	6WH	E11028-21	TB2-19	CRIMP	P3-22
23	210	6-RD	E11028-21	TB3-12	CRIMP	P3-27
24	0	6-SHD	E11028-21	TB3-20	CRIMP	P3-28
25	SPARE	7-BK	-	-	CRIMP	P3-23
26	SPARE	7-WH	-	-	CRIMP	P3-24
27	SPARE	7-RD	-	-	CRIMP	P3-25
28	SPARE	7-SHD	-	-	CRIMP	P3-26

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P-4						
CABLE TYPE: LSMHOF-19 (CABLE ASSEMBLY: E13033-4)						
O.D.: .705 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A3			FROM: PM JUNCTION BOX A3			
CABLE ENTRY TO: PLUG			TO: CAB A5/A6 OR INTERCONNECT CABLE ASSEMBLY			
BULKHEAD FITTINGS:			NOTES: "TO" CONNECTION POINT IS EITHER 3A5-J4, 3A6-J4 OR INTERCONNECT CABLE ASSEMBLY J-4 DEPENDING ON CAB AND MODULE LOCATIONS. REFERENCE DRAWING E36194.			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	146	6-BK	E11028-21	TB4-1	CRIMP	P4-1
2	151	6-WH	E11028-21	TB4-2	CRIMP	P4-2
3	156	6-RD	E11028-21	TB4-3	CRIMP	P4-3
4	161	7-BK	E11028-21	TB4-4	CRIMP	P4-4
5	166	7-WH	E11028-21	TB4-5	CRIMP	P4-5
6	171	7-RD	E11028-21	TB4-6	CRIMP	P4-6
7	138	7-SHD	E11028-21	TB4-7	CRIMP	P4-7
8	SPARE	-	E11028-21	TB4-8	CRIMP	P4-8
9	SPARE	-	E11028-21	TB4-9	CRIMP	P4-9
10	220	-	E11028-21	TB4-10	CRIMP	P4-10
11	221	-	E11028-21	TB4-11	CRIMP	P4-11
12	SPARE	-	E11028-21	TB4-12	CRIMP	P4-12
13	SPARE	-	E11028-21	TB4-13	CRIMP	P4-13
14	SPARE	-	E11028-21	TB4-14	CRIMP	P4-14
15	SPARE	-	E11028-21	NO CONN.	CRIMP	P4-15
16	SPARE	-	E11028-21	NO CONN.	CRIMP	P4-16

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P-4 (CONT.)						
CABLE TYPE: LSMHOF-19 (CABLE ASSEMBLY: E13033-4)						
O.D.: .705 INCHES						
CABLE LENGTH: 10 FEET						
CABLE ENTRY FROM: A3			FROM: PM JUNCTION BOX A3			
CABLE ENTRY TO: PLUG			TO: CAB A5/A6 OR INTERCONNECT CABLE ASSEMBLY			
BULKHEAD FITTINGS:			NOTES: “TO” CONNECTION POINT IS EITHER 3A5-J4, 3A6-J4 OR INTERCONNECT CABLE ASSEMBLY J-4 DEPENDING ON CAB AND MODULE LOCATIONS. REFERENCE DRAWING E36194.			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
17	SPARE	-	E11028-21	NO CONN.	CRIMP	NO CONN.
18	SPARE	-	E11028-21	NO CONN.	CRIMP	NO CONN.
19	SPARE	-	E11028-21	NO CONN.	CRIMP	NO CONN.

Figure 2. Propulsion Module Wiring List
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CABLE LIST						
CABLE NUMBER: P-5						
CABLE TYPE: LSMHOF-30 (CABLE ASSEMBLY: E13033-5)						
O.D.: .960 INCHES						
CABLE LENGTH: 13 FEET						
CABLE ENTRY FROM: REFERENCE E44693			FROM: EXHAUST PLENUM VENT FAN MOTOR (B1)			
CABLE ENTRY TO: PLUG			TO: VENT FAN RELAY ENCLOSURE A8			
BULKHEAD FITTINGS:			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLK	REF. E44693	-	SOLDER	P5-B
2	136	WH	TERMINATION DETAILS	-	SOLDER	P5-A

Figure 2. Propulsion Module Wiring List
(Sheet 63 of 72)

CABLE LIST						
CABLE NUMBER: CL-1						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 6 FEET						
CABLE ENTRY FROM: A6				FROM: PM CIRCUIT BREAKER PANEL		
CABLE ENTRY TO: A10				TO: ENGINE SPACE LIGHTS SWITCH BOX ASSEMBLY		
BULKHEAD FITTINGS: #2 STRAIGHT NYLON STUFFING TUBE 2C PACKING ASSEMBLY BOTH ENDS				NOTES:		
				TERMINATION DATA		
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLK	COMPRESSION	TB4	E11028-21	TB1-2
2	609	WHT	COMPRESSION	TB3-1	E11028-21	TB1-1

Figure 2. Propulsion Module Wiring List
(Sheet 64 of 72)

CABLE LIST						
CABLE NUMBER: CL-2						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 12 FEET						
CABLE ENTRY FROM: A10			FROM: ENGINE SPACE LIGHTS SWITCH BOX ASSEMBLY			
CABLE ENTRY TO: DS1			TO: DS1			
BULKHEAD FITTINGS: #2 TUBE #2C PACKING			NOTES:			
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	611	BLACK	E11028-21	TB1-6	E11028-21	DS1 (-)
2	610	WHITE	E11028-21	TB1-3	E11028-21	DS1 (+)

Figure 2. Propulsion Module Wiring List
(Sheet 65 of 72)

CABLE LIST						
CABLE NUMBER: CL-3						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A10			FROM: ENGINE SPACE LIGHTS SWITCH BOX ASSEMBLY			
CABLE ENTRY TO: DS2			TO: DS2			
BULKHEAD FITTINGS: #2 TUBE #2C PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	611	BLACK	E11028-21	TB1-6	E11028-21	DS2 (-)
2	610	WHITE	E11028-21	TB1-3	E11028-21	DS2 (+)

Figure 2. Propulsion Module Wiring List
(Sheet 66 of 72)

CABLE LIST						
CABLE NUMBER: CL-4						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A10			FROM: ENGINE SPACE LIGHTS SWITCH BOX ASSEMBLY			
CABLE ENTRY TO: DS3			TO: DS3			
BULKHEAD FITTINGS: #2 TUBE #2C PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	611	BLK	E11028-21	TB1-7	E11028-21	DS3 (-)
2	610	WHT	E11028-21	TB1-4	E11028-21	DS3 (+)

Figure 2. Propulsion Module Wiring List
(Sheet 67 of 72)

CABLE LIST						
CABLE NUMBER: CL-5						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 15 FEET						
CABLE ENTRY FROM: A10			FROM: ENGINE SPACE LIGHTS SWITCH BOX ASSEMBLY			
CABLE ENTRY TO: DS4			TO: DS4			
BULKHEAD FITTINGS: #2 TUBE #2C PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	611	BLK	E11028-21	TB1-7	E11028-21	DS4 (-)
2	610	WHT	E11028-21	TB1-4	E11028-21	DS4 (+)

Figure 2. Propulsion Module Wiring List
(Sheet 68 of 72)

CABLE LIST						
CABLE NUMBER: CL-6						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: A6			FROM: PM CIRCUIT BREAKER PANEL			
CABLE ENTRY TO: A11			TO: A11			
BULKHEAD FITTINGS: #2 TUBE #2C PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	0	BLK	COMPRESSION	TB4	E11028-21	S1-6
2	609	WHT	COMPRESSION	TB3-1	E11028-21	S1-3

Figure 2. Propulsion Module Wiring List
(Sheet 69 of 72)

CABLE LIST						
CABLE NUMBER: CL-7						
CABLE TYPE: LSDSGU-3						
O.D.: .391 INCHES						
CABLE LENGTH: 13 FEET						
CABLE ENTRY FROM: A11			FROM: LAZARET SWITCH			
CABLE ENTRY TO: D55			TO: LAZARET LIGHT			
BULKHEAD FITTINGS: #2 NYLON TUBE #2C PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	642	BLK	COMPRESSION	S1-5	E11028-21	DS5 (-)
2	641	WHT	COMPRESSION	S1-2	E11028-21	DS5 (+)

Figure 2. Propulsion Module Wiring List
(Sheet 70 of 72)

CABLE LIST						
CABLE NUMBER: P24-21						
CABLE TYPE: 3/0 RED						
O.D.: .660 INCHES						
CABLE LENGTH: 20 FEET						
CABLE ENTRY FROM: BT3 (+)			FROM: BT3 (+)			
CABLE ENTRY TO: A12			TO: A12			
BULKHEAD FITTINGS: #4 NYLON TUBE #4E PACKING			NOTES:			
			TERMINATION DATA			
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
1	200	RED	E20838-3	BT3 (+)	E20838-3	A12IS1-1

Figure 2. Propulsion Module Wiring List
(Sheet 71 of 72)

CABLE LIST						
CABLE NUMBER: TS-1						
CABLE TYPE: SWE (AWG 20)						
O.D.: .19 INCHES						
CABLE LENGTH: 18 FEET						
CABLE ENTRY FROM: G1				FROM: ALTERNATOR		
CABLE ENTRY TO: A9				TO: A9 JUNCTION BOX		
BULKHEAD FITTINGS: #1 NYLON TUBE 1B PACKING				NOTES: MOUNT SENSOR TERMINAL TO SIDE OF ALTERNATOR IN THE HOLE PROVIDED WITH SHEET METAL SCREW AND WASHER, ITEMS 207-208 DRAWING E41293.		
TERMINATION DATA						
WIRE NO.	WIRE LABEL	COLOR	FROM TERM METHOD	FROM TERM POINT	TO TERM METHOD	TO TERM POINT
-	-	-	-	-	-	-
-	-	-	-	-	-	-
1	616	BLACK	FURNISHED	G1	E11028-31	TB2-11
2	615	RED	FURNISHED	G1	E11028-31	TB2-10

Figure 2. Propulsion Module Wiring List
(Sheet 72 of 72)

Table 1. Propulsion Module Junction Box A3, Internal Wiring List and Rear View.

TO	TERM	ITEM #	CABLE COND #	WIRE #	CONN	PIN	NOTES
TB1	01	10	1	112	P2	01	-
TB1	02	10	2	113	P2	02	-
TB1	03	10	3	110	P2	03	-
TB1	04	10	4	111	P2	04	-
TB1	05	10	5	114	P2	05	-
TB1	06	10	6	115	P2	06	-
TB1	07	10	7	124	P2	07	-
TB1	08	10	8	104	P2	08	-
TB1	09	10	9	129	P2	09	-
TB1	10	10	10	173	P2	10	-
TB1	11	10	11	174	P2	11	-
TB1	12	10	12	175	P2	12	-
TB1	13	-	13	-	-	-	-
TB1	14	10	14	134	P2	14	-
TB1	15	10	15	135	P2	15	-
TB1	16	10	16	139	P2	16	-
TB1	17	10	17	141	P2	17	-
TB1	18	10	18	143	P2	18	-
TB1	19	10	19	145	P2	19	-
TB1	20	10	20	148	P2	20	-
TB2	01	10	21	150	P2	21	-
TB2	02	10	22	153	P2	22	-
TB2	03	10	23	155	P2	23	-
TB2	04	10	24	158	P2	24	-
TB2	05	10	25	160	P2	25	-
TB2	06	10	26	163	P2	26	-
TB2	07	10	27	165	P2	27	-
TB2	08	10	28	168	P2	28	-
TB2	09	10	29	170	P2	29	-
TB2	10	10	30	181	P2	30	-
TB2	11	10	31	180	P2	31	-
TB2	12	10	32	-	P2	32	SPARE

Table 1. Propulsion Module Junction Box A3, Internal Wiring List and Rear View. (Continued)

TO	TERM	ITEM #	CABLE COND #	WIRE #	CONN	PIN	NOTES
TB2	13	10	33	0	P2	33	-
TB2	14	10	34	190	P2	34	-
TB2	15	10	35	178	P2	35	-
TB2	16	10	36	187	P2	36	-
TB2	17	10	37	-	P2	37	SPARE
TB2	18	10	6-BK	205	P3	21	-
TB2	19	10	6-WH	206	P3	22	-
TB2	20	-	-	133	-	-	TB2-20 is used as a tie point for wire #133 when making interconnections in propulsion module (E26573).
TB3	01	10	1-SHD	0	P3	01	SHIELD
TB3	02	10	1-BK	119	P3	02	-
TB3	03	10	1-WH	121	P3	03	-
TB3	04	10	1-RD	120	P3	04	-
TB3	06	10	2-BK	185	P3	05	-
TB3	07	10	2-WH	186	P3	06	-
TB3	05	10	2-SHD	0	P3	07	SHIELD
TB3	08	10	2-RD		P3	08	SPARE
TB3	10	10	3-BK	182	P3	09	-
TB3	14	10	4-BK	125	P3	10	-
TB3	15	10	4-WH	126	P3	11	-
TB3	16	10	4-RD	127	P3	12	-
TB3	09	10	3-SHD	0	P3	13	SHIELD
TB3	11	10	3-WH	183	P3	14	-
TB3	12	10	6-RD	210	P3	27	-
TB3	13	10	4-SHD	0	P3	16	SHIELD
TB3	17	10	5-BK	132	P3	17	-
TB3	18	10	5-WH	212	P3	18	-
TB3	19	10	5-RD	211	P3	19	-
TB3	20	10	6-SHD	0	P3	28	SHIELD
			5-SHD	-	P3	20	SPARE
			3-RED	-	P3	15	SPARE

Table 1. Propulsion Module Junction Box A3, Internal Wiring List and Rear View. (Continued)

TO	TERM	ITEM #	CABLE COND #	WIRE #	CONN	PIN	NOTES
			7-BLK	-	P3	23	SPARE
			7-WHT	-	P3	24	SPARE
			7-RED	-	P3	25	SPARE
			7-SHD	-	P3	26	SPARE
TB4	01	10	1	146	P4	01	-
TB4	02	10	2	151	P4	02	-
TB4	03	10	3	156	P4	03	-
TB4	04	10	4	161	P4	04	-
TB4	05	10	5	166	P4	05	-
TB4	06	10	6	171	P4	06	-
TB4	07	10	7	138	P4	07	-
TB4	08	10	8	SPARE	P4	08	-
TB4	09	10	9	SPARE	P4	09	-
TB4	10	10	10	220	P4	10	-
TB4	11	10	11	221	P4	11	-
TB4	12	10	12	SPARE	P4	12	-
TB4	13	10	13	SPARE	P4	13	-
TB4	14	10	14	SPARE	P4	14	-

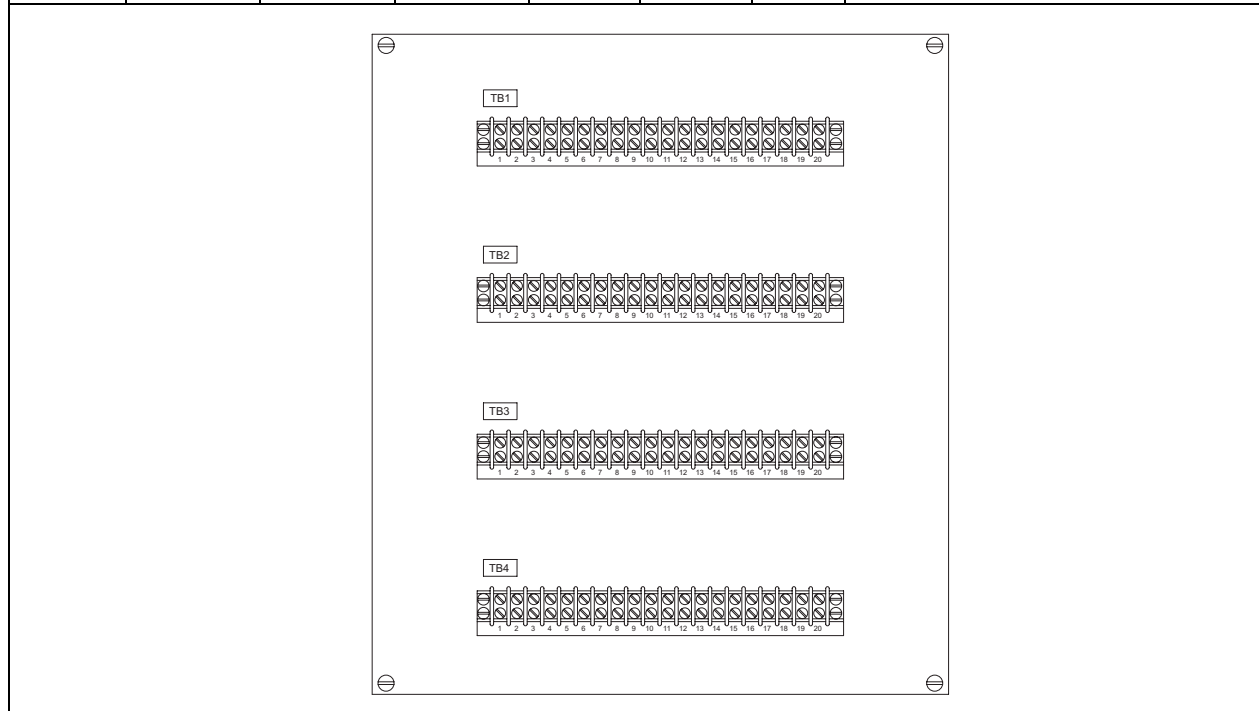
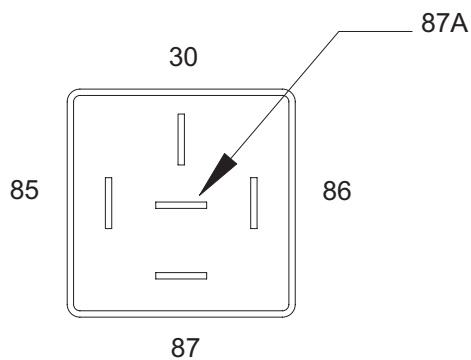


Table 2. Engine Junction Box Assembly A4, Internal Wiring List and Rear View.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
K1	85	6	0	16	TB1	19	17	-
K2	85	6	0	16	TB1	19	17	-
TB1	19	18	0	16	TB1	20	18	JUMPER
K1	86	6	104	16	TB1	16	17	-
K1	87	6	106	14	TB1	18	17	-
S2	4	-	106	16	TB1	18	17	-
CB3	2	22	110	14	TB2	10	17	-
TB1	12	18	124	-	TB1	13	18	JUMPER
K2	30	6	124	16	TB1	13	17	-
K2	86	6	128	16	TB1	14	17	-
K2	87	6	129	16	TB1	15	17	-
CB1	2	22	603	14	TB3	1	-	-
CB2	2	22	605	14	TB2	12	17	-
K1	30	6	625	14	TB4	1	-	-
S2	3	-	625	16	TB4	1	-	-
TB4	1	-	625	16	TB1	17	-	-
TB4	1	-	625	14	CB1	1	22	-
TB4	1	-	625	14	CB2	1	22	-
CB2	1	22	625	14	CB3	1	22	-
TB3	2	-	0	14	TB4	2	-	JUMPER



TERMINAL IDENTIFICATION FOR K1 & K2

Table 2. Engine Junction Box Assembly A4, Internal Wiring List and Rear View. (Continued)

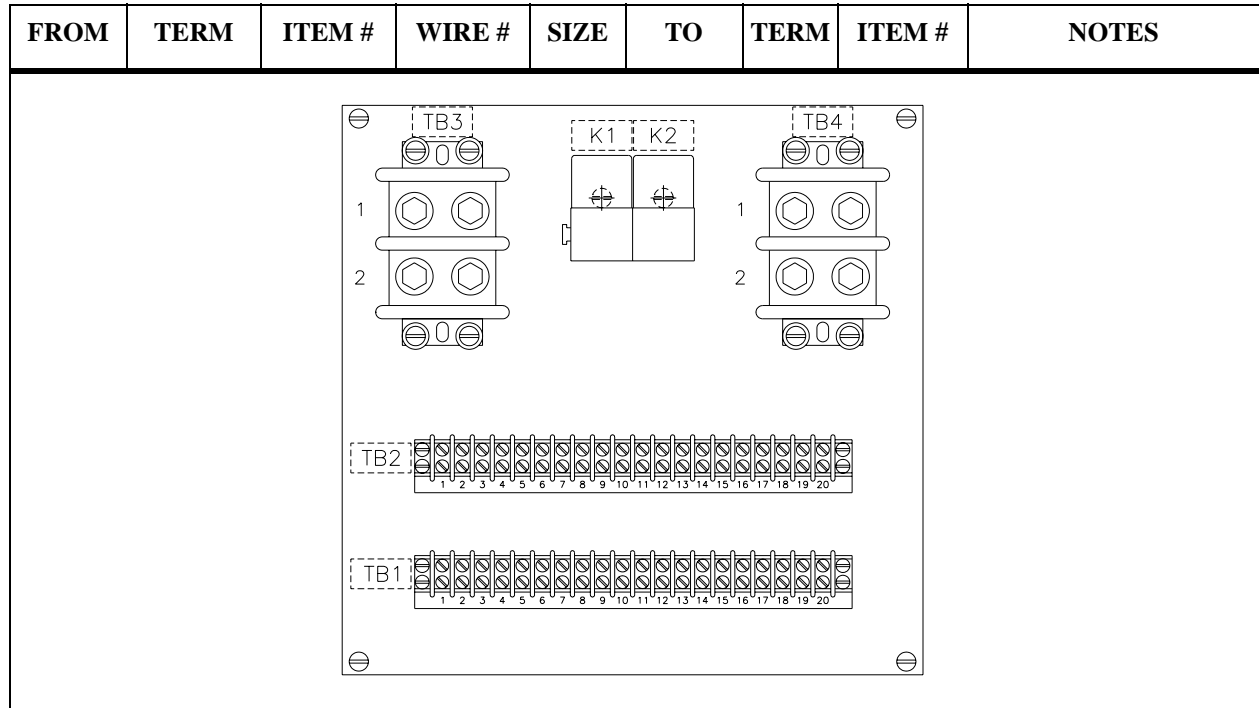


Table 3. Engine Junction Box Assembly A4, External Wiring List.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
-	-	-	0	-	TB1	20	-	-
-	-	-	0	-	TB1	19	-	-
-	-	-	103	-	TB1	10	-	-
-	-	-	104	-	TB1	16	-	-
-	-	-	105	-	TB1	17	-	-
-	-	-	106	-	TB1	18	-	-
-	-	-	111	-	TB2	1	-	-
-	-	-	113	-	TB2	2	-	-
-	-	-	115	-	TB2	06	-	-
-	-	-	116	-	TB1	01	-	-
-	-	-	117	-	TB1	02	-	-
-	-	-	118	-	TB1	03	-	-
-	-	-	119	-	TB1	04	-	-
-	-	-	120	-	TB1	06	-	-
-	-	-	121	-	TB1	07	-	-

Table 3. Engine Junction Box Assembly A4, External Wiring List. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
-	-	-	122	-	TB1	08	-	-
-	-	-	123	-	TB1	09	-	-
-	-	-	124	-	TB1	12	-	-
-	-	-	124	-	TB1	13	-	-
-	-	-	125	-	TB2	07	-	-
-	-	-	126	-	TB2	08	-	-
-	-	-	127	-	TB2	09	-	-
-	-	-	128	-	TB1	14	-	-
-	-	-	129	-	TB1	15	-	-
-	-	-	133	-	TB2	3	-	-
-	-	-	134	-	TB2	4	-	-
-	-	-	178	-	TB1	11	-	-
-	-	-	180	-	TB2	5	-	-
-	-	-	605	-	TB2	12	-	-
-	-	-	132 (TACH+)	-	TB1	9	-	-
-	-	-	SHIELDS	-	TB1	8	-	-
-	-	-	0	-	TB3	2	-	-
-	-	-	603	-	TB3	1	-	-
-	-	-	0	-	TB4	2	-	-
-	-	-	625	-	TB4	1	-	-

Table 4. Bilge Pump Control Assembly A5, Internal Wiring List and Rear View.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
TB6	3	-	138	16	TB6	1	-	JUMPER
TB6	1	-	138	16	TB5	1	-	JUMPER
TB5	1	-	138	16	TB5	3	-	JUMPER
TB5	3	-	138	16	TB1	2	-	JUMPER
TB1	2	-	138	16	TB1	3	-	JUMPER
TB1	3	-	138	-	D12	A	29	D12-A

Table 4. Bilge Pump Control Assembly A5, Internal Wiring List and Rear View. (Continued)

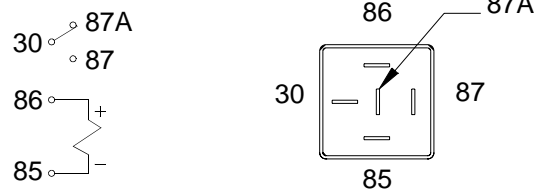
FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
TB1	4	-	171	-	D12	K	29	D12-K
TB1	5	-	140	-	D2	A	29	D2-A
TB1	6	-	141	-	D2	K	29	D2-K
TB1	9	-	137	-	D1	A	29	D1-A
TB1	10	-	139	-	D1	K	29	D1-K
K2	30	8	147	16	TB2	3	-	-
K2	87	8	149	16	TB2	2	-	-
K2	86	8	150	16	TB2	1	-	-
K2	85	8	151	16	TB2	4	-	-
S1	1	32	147	16	TB2	3	-	-
S1	2	32	148	16	TB2	5	-	-
S1	3	32	149	16	TB2	2	-	-
K3	30	8	152	16	TB2	8	-	-
K3	87	8	154	16	TB2	7	-	-
K3	86	8	155	16	TB2	6	-	-
K3	85	8	156	16	TB2	9	-	-
S2	1	32	152	16	TB2	8	-	-
S2	2	32	153	16	TB2	10	-	-
S2	3	32	154	16	TB2	7	-	-
K4	30	8	157	16	TB4	3	-	-
K4	87	8	159	16	TB4	2	-	-
K4	86	8	160	16	TB4	1	-	-
K4	85	8	161	16	TB4	4	-	-
S3	1	32	157	16	TB4	3	-	-
S3	2	32	258	16	TB4	5	-	-
S3	3	32	159	16	TB4	2	-	-
K5	30	8	162	16	TB4	8	-	-
K5	87	8	164	16	TB4	7	-	-
K5	86	8	165	16	TB4	6	-	-

Table 4. Bilge Pump Control Assembly A5, Internal Wiring List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
K5	85	8	166	16	TB4	9	-	-
S4	1	32	162	16	TB4	8	-	-
S4	2	32	163	16	TB4	10	-	-
S4	3	32	164	16	TB4	7	-	-
TB1	8	-	137	16	TB1	9	-	JUMPER
TB3	1	-	0	16	TB3	2	-	JUMPER
TB3	2	-	0	16	TB4	3	-	JUMPER
TB3	3	-	0	16	TB4	4	-	JUMPER
TB3	4	-	0	16	TB4	5	-	JUMPER
K6	30	8	167	16	TB3	8	-	-
K6	87	8	169	16	TB3	7	-	-
K6	86	8	170	16	TB3	6	-	-
K6	85	8	171	16	TB3	9	-	-
S5	1	32	167	16	TB3	8	-	-
S5	2	32	168	16	TB3	10	-	-
S5	3	32	169	16	TB3	7	-	-
TB5	1	-	138	-	D8	A	29	D8-A
TB5	2	-	151	-	D8	K	29	D8-K
TB5	3	-	138	-	D9	A	29	D9-A
TB5	4	-	156	-	D9	K	29	D9-K
TB6	1	-	138	-	D10	A	29	D10-A
TB6	2	-	161	-	D10	K	29	D10-K
TB6	3	-	138	-	D11	A	29	D11-A
TB6	4	-	166	-	D11	K	29	D11-K
TB2	4	-	151	16	TB5	2	-	JUMPER
TB2	9	-	156	16	TB5	4	-	JUMPER
TB4	4	-	161	16	TB6	2	-	JUMPER
TB4	9	-	166	16	TB6	4	-	JUMPER
TB3	9	-	171	16	TB1	4	-	JUMPER

Table 4. Bilge Pump Control Assembly A5, Internal Wiring List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
TB2	2	-	149	-	D3	A	29	D3-A
TB2	1	-	150	-	D3	K	29	D3-K
TB2	7	-	154	-	D4	A	29	D4-A
TB2	6	-	155	-	D4	K	29	D4-K
TB4	2	-	159	-	D5	A	29	D5-A
TB4	1	-	160	-	D5	K	29	D5-K
TB4	7	-	164	-	D6	A	29	D6-A
TB4	6	-	165	-	D6	K	29	D6-K
TB3	7	-	169	-	D7	A	29	D7-A
TB3	6	-	170	-	D7	K	29	A7-K



NOTES:

- POLARITY OF DIODES, TERMINAL BLOCK DESIGNATIONS, TERMINAL NUMBERS, AND COMPONENT DESIGNATORS AS INDICATED BY □ SHALL BE PERMANENTLY STAMPED IN INK OR MARKED USING VINYL ADHESIVE LABELS, LOCATED APPROXIMATELY AS SHOWN. SPRAY WITH KRYLON CLEAR COAT (1301) TO SEAL.
- THE BILGE PUMP CONTROL PANEL ASSY IS UNIT A5.
- AFFIX LABEL PLATES, ITEMS 11-17 AND 41 WITH ITEM 53.
- MARK ENDS OF INTERNAL WIRES WITH WIRE NUMBERS USING HEAT SHRINK TUBING. COVER TERMINAL LUG BARREL WITH HEAT SHRINK TUBING.
- USE LOCKTITE 242 ON ALL MOUNTING SCREWS FOR TERMINAL BOARDS, RELAYS AND STAND-OFFS FOR GUARDS.
- RELAY DESIGNATION K1 IS NOT USED IN THIS ASSEMBLY.
- USE TIE WRAPS AND CABLE TIE MOUNTS TO SECURE WIRE BUNDLES.
- LABEL CABLE ENTRY HOLES WITH CABLE NO.S (REF. E41314) AS SHOWN USING VINYL ADHESIVE LABELS. SPRAY WITH KRYLON CLEAR COAT (1301) TO SEAL.
- CONNECT DIODES AS LISTED IN NOTES COLUMN. FOR EXAMPLE
D1-A IS THE DIODE WHICH CONNECTS TO DB1-9
D1-K IS THE DIODE CATHODE WHICH CONNECTS TO TB1-10.

Table 5. Propulsion Module Circuit Breaker Panel A6, Internal Wiring List.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
CB1	2A	55	105	4	CB3	1	48	-
CB1	2B	55	105	4	CB11	1	55	-
CB1	2C	53	105	14	TB2	1	-	-
CB3	1	34	105	8	CB2	1	34	JUMPER
CB2	1	34	105	8	CB4	1	34	JUMPER
CB4	1	34	105	8	CB5	1	34	JUMPER
CB5	1	34	105	8	CB6	1	34	JUMPER
CB6	1	34	105	8	CB7	1	34	JUMPER
CB11	1	62	105	8	CB13	1	34	JUMPER
CB13	1	34	105	8	CB12	1	34	JUMPER
CB12	1	34	105	8	CB10	1	34	JUMPER
CB10	1	34	105	8	CB9	1	34	JUMPER
CB9	1	34	105	8	CB8	1	34	JUMPER
CB3	2	34	133	8	TB2	2	-	-
CB4	2	33	137	14	TB3	3	-	-
CB5	2	33	142	14	TB3	4	-	-
CB6	2	33	147	14	TB3	5	-	-
CB7	2	33	152	14	TB3	6	-	-
CB8	2	33	157	14	TB3	7	-	-
CB9	2	33	162	14	TB3	8	-	-
CB10	2	33	167	14	TB3	9	-	-
CB11	2	62	172	8	TB2	3	-	-
CB12	2	33	173	14	TB3	10	-	-
CB13	2	33	176	14	TB3	11	-	-
CB14	1	33	202	14	TB2	4	-	-
CB14	2	33	203	14	TB2	5	-	-
TB1	1	-	221	3/0	CB1	1	59	-
CB2	2	33	609	14	TB3	1	-	-

**Table 6. Propulsion Module Circuit Breaker Panel A6,
External Connections and Rear View.**

WIRE #	FROM	TERM	EQUIPMENT	NOTES
0	TB4	ALL	NEGATIVE	ALL GROUNDS TIE HERE
105	TB2	1	OIL LEVEL	HPU OIL AND GEARCASE OIL
133	TB2	2	VENT FAN	-
137	TB3	3	ALARMS	-
142	TB3	4	BILGE PUMP 1	-
147	TB3	5	BILGE PUMP 2	-
152	TB3	6	BILGE PUMP 3	-
157	TB3	7	BILGE PUMP 4	-
162	TB3	8	BILGE PUMP 5	-
167	TB3	9	BILGE PUMP 6	-
172	TB2	3	OPERATORS CAB	(P1-WHITE)
173	TB3	10	CLUTCH CONTROL	-
176	TB3	11	THRUSTER	-
202	TB2	4	THRUSTER INDICATOR	-
203	TB2	5	THRUSTER INDICATOR	-
221	TB1	1	+24 IN	-
609	TB3	1	ENG. SPACE LIGHTS	-
132	TB3	12	TACH +	-

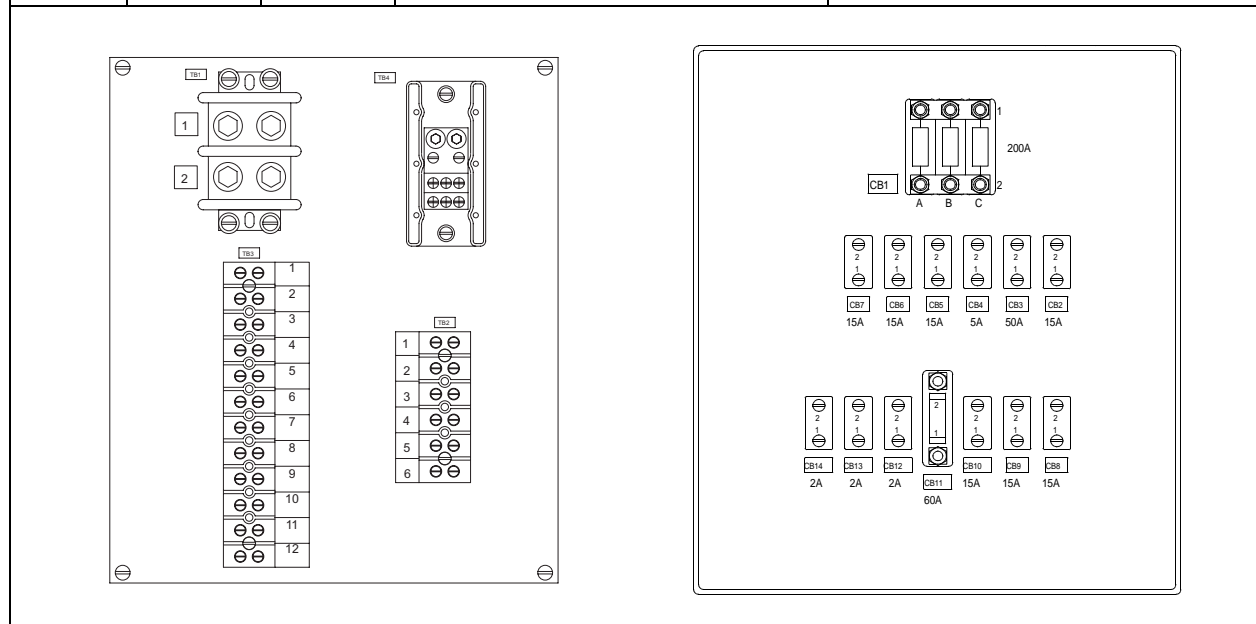


Table 7. Single Bilge Pump Control A7, Internal Wiring List and Rear View.

FROM	TERM #	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
K1	30	6	142	16	TB1	3	-	-
K1	87	6	144	16	TB1	2	-	-
K1	86	6	145	16	TB1	1	-	-
K1	85	6	146	16	TB1	8	-	-
K1	85	6	146	16	TB1	4	-	-
TB1-8	-	6	146	16	TB1	4	-	JUMPER
S1	1	22	142	16	TB1	3	-	-
S1	2	22	143	16	TB1	5	-	-
S1	3	22	144	16	TB1	2	-	-
D1	A	-	144	16	TB1	2	-	DIODE ANODE
D1	K	-	145	16	TB1	1	-	DIODE CATHODE
-	-	-	0	-	TB1	6	-	TIE POINT (EXTERNAL WIRES)
D2	A	-	138	-	TB1	7	-	DIODE ANODE
D2	K	-	146	16	TB1	8	-	DIODE CATHODE

Table 7. Single Bilge Pump Control A7, Internal Wiring List and Rear View. (Continued)

FROM	TERM #	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
<p style="text-align: center;">TERMINAL LAYOUT</p>								
<p style="text-align: center;">TERMINAL IDENTIFICATION FOR K1</p>								
<p>NOTES:</p> <p>1 POLARITY OF DIODES, TERMINAL NUMBERS AND COMPONENT DESIGNATORS AS INDICATED BY [] SHALL BE PERMANENTLY STAMPED IN INK, LOCATED APPROXIMATELY AS SHOWN.</p> <p>2 THE SINGLE BILGE PUMP CONTROL ASSY' IS UNIT A7 LOCATED IN THE FORWARD COMPARTMENT. UNIT PREFIX IS "1" FOR THE STBD POWER MODULE, "2" FOR THE PORT POWER MODULE. BILGE PUMP ASSY' FOR STBD POWERED MODULE IS "1A7" AND FOR PORT POWOWERED MODULE "2A7".</p> <p>4 LABEL ALL INTERNAL WIRE ENDS WITH WIRE NUMBERS USING HEAT SHRINK TUBING, ITEM 24. COVER TERMINAL LUG BARREL WITH HEAT SHRINK TUBING.</p>								

Table 8. Vent Fan Relay Assembly A8, Wire Internal Connections and Rear View.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM #	ITEM #	NOTES
P5	A	21	0	5AWG		LARGE SCREW	8	NO. 4
P5	A	21	136	5AWG	K1	3	4	NO. 4
K1	4	4	0	1AWG	TB1	SMALL SCREW	8	NO. 4

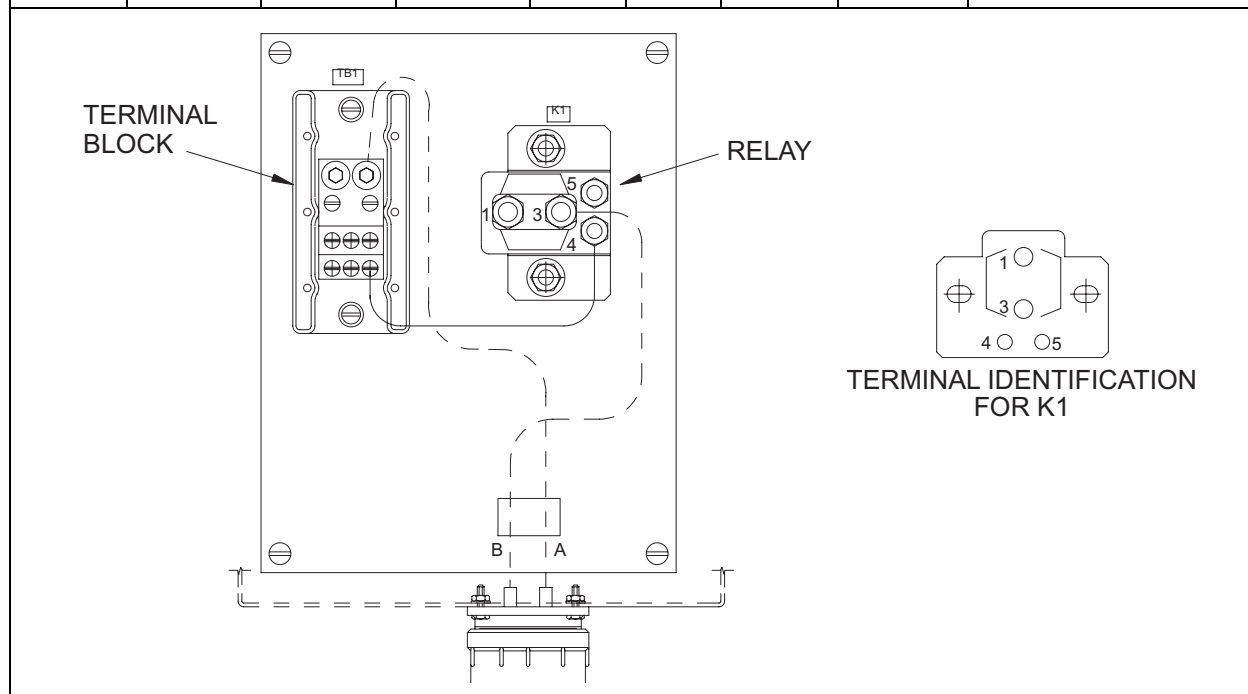


Table 9. Thruster Direction/Auxiliary Battery Junction Box A9, Pass Through Terminations.

WIRE SIZE	FROM	WIRE #	TERM	TO	WIRE #	TERM
10	B3-1	0	ITEM-33	TB2-18	0	E23808-2
10	S11-2	0	ITEM-33	TB2-18	0	E23808-2
10	B3-2	148	ITEM-33	TB2-19	148	E23808-2
10	S11-1	151	ITEM-33	TB2-20	151	E23808-2

**Table 10. Thruster Direction/Auxiliary Battery Junction Box A9, Electrical
Internal Wire Connections and Rear View.**

WIRE SIZE	FROM	WIRE #	TERM	TO	WIRE #	TERM
FURNISHED	VR1 BLUE	131	PLUG	TB1-1	131	COMPRESSION
FURNISHED	VR1 ORANGE	130	PLUG	TB1-2	130	COMPRESSION
FURNISHED	VR1 BLACK	0	PLUG	TB1-3	0	COMPRESSION
FURNISHED	VR1 BROWN	124	PLUG	TB1-4	124	COMPRESSION
FURNISHED	VR1 RED	607	PLUG	FU-1	607	COMPRESSION
14 "RED"	FU1-2	625	COMPRESSION	TB1-5	625	COMPRESSION
16	TB1-4	124	COMPRESSION	K1-85	124	ITEM-10
14 "WHITE"	TB2-1	0	ITEM-18	K1-86	0	ITEM-10
14 "WHITE"	TB2-1	0	ITEM-18	TB2-2	0	ITEM-18
14 "WHITE"	TB2-2	0	ITEM-18	TB1-3	0	COMPRESSION
FURNISHED	SEE NOTE 7	615		TB2-10	615	ITEM 49
FURNISHED	SEE NOTE 7	616		TB2-11	616	ITEM 49
14 "RED"	TB2-3	202	ITEM-18	BT5 +	202	ITEM-20
14 "RED"	BT5 -	201	ITEM-20	BT6 +	201	ITEM-20
14 "RED"	K1-30	203	ITEM-10	TB2-4	203	ITEM-18
16	K1-87	204	ITEM-10	VR2-5	204	COMPRESSION
14 "WHITE"	VR2-1	0	COMPRESSION	TB2-1	0	ITEM-18
16	VR2-6	205	COMPRESSION	TB2-6	205	ITEM-18
16	VR2-2	206	COMPRESSION	TB2-7	206	ITEM-18
14 "WHITE"	BT6 -	0	ITEM-20	TB2-2	0	ITEM-18

Table 10. Thruster Direction/Auxiliary Battery Junction Box A9, Electrical Internal Wire Connections and Rear View. (Continued)

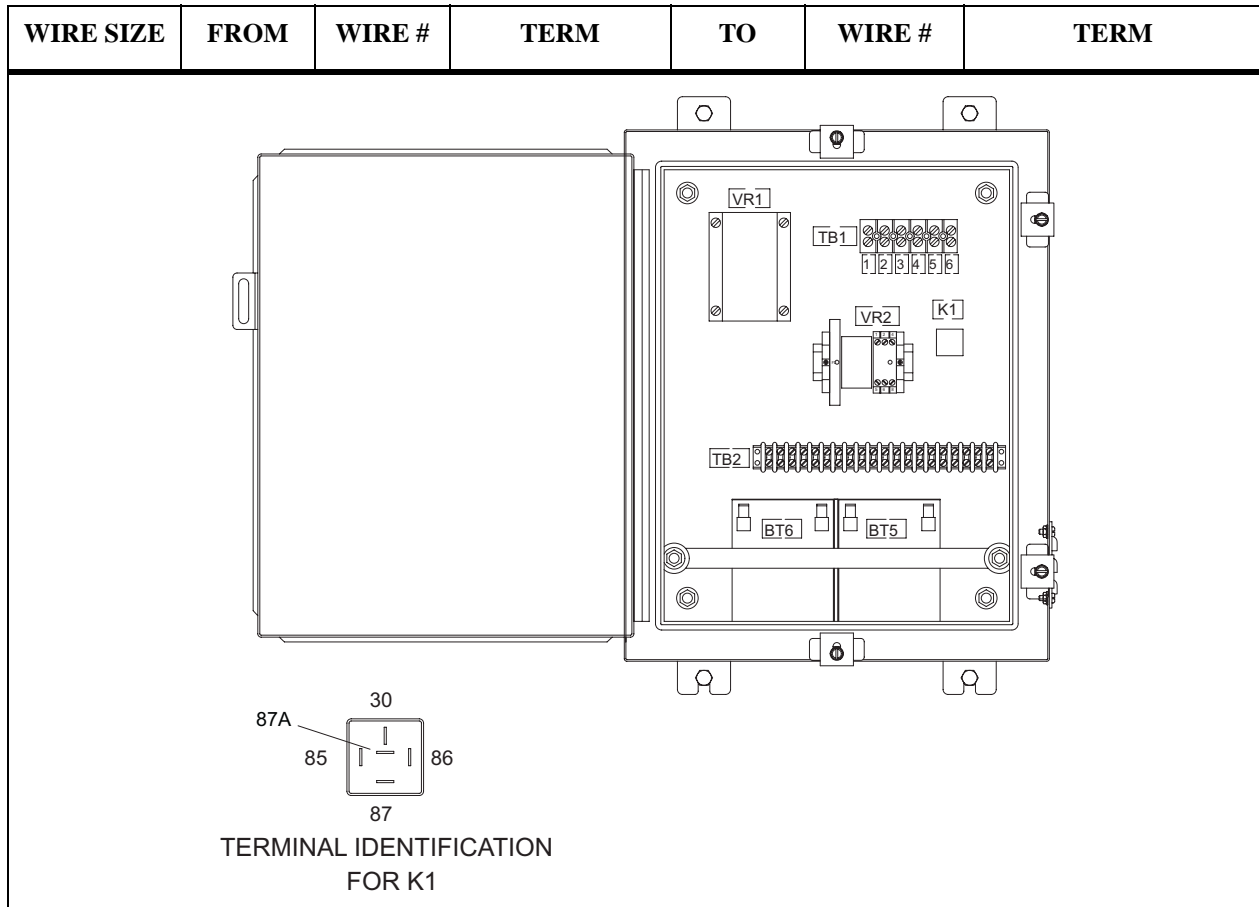


Table 11. Middle Control Panel A1, Wiring Diagram, List and Rear View.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
TAP	0	-	0	16	A4TB10	4	-	-
M1	(-)	35	0	16	(0)	TAP	34	-
M1	2	35	0	16	(0)	TAP	34	-
M10	(-)	35	0	16	(0)	TAP	34	-
M10	2	35	0	16	(0)	TAP	34	-
-	-	-	-	-	-	-	-	-
M2	LAMP (-)	35	0	16	(0)	TAP	34	-
M3	(-)	35	0	16	(0)	TAP	34	-
M3		35	0	16	(0)	TAP	34	-
M4	(-)	35	0	16	(0)	TAP	34	-
M4	2	35	0	16	(0)	TAP	34	-

Table 11. Middle Control Panel A1, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
M5	(-)	35	0	16	(0)	TAP	34	-
M5	LAMP 1 (2)	35	0	16	(0)	TAP	34	-
M6	LAMP 1 (2)	35	0	16	(0)	TAP	34	-
M6	(-)	35	0	16	(0)	TAP	34	-
M7	2	35	0	16	(0)	TAP	34	-
M7	(-)	35	0	16	(0)	TAP	34	-
-	-	-	-	-	-	-	-	-
M8	LAMP (-)	35	0	16	(0)	TAP	34	-
M9	(-)	35	0	16	(0)	TAP	34	-
M9	2	35	0	16	(0)	TAP	34	-
M5	LAMP 1 (2)	35	0	16	(0)	TAP	34	-
M6	LAMP 1 (2)	35	0	16	(0)	TAP	34	-
-	-	-	-	-	-	-	-	-
M2	SHUNT 2	35	301	16	A4TB5	16	-	-
M2	SHUNT 1	35	301A	16	A4TB5	18	-	-
M8	SHUNT 2	35	302	16	A4TB9	7	-	-
M8	SHUNT 1	35	302A	16	A4TB9	9	-	-
S8	3	-	303	16	(303)	TAP	34	-
S8	3	-	303	14	A4TB5	14	-	-
S5	11	55	303	16	(303)	TAP	34	-
S5	1	55	303	16	(303)	TAP	34	-
S4	3	-	303	16	(303)	TAP	34	-
S14	11	55	303	16	(303)	TAP	34	-
S14	1	55	303	16	S4	1	34	-
S14	10	55	303e	16	S14	4	55	-
S5	10	55	303D	16	S5	4	55	-
S4	4	-	304	14	A4TB1	6	34	-

Table 11. Middle Control Panel A1, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
S8	4	-	305	16	A4TB3	6	-	-
S3	2	-	306	16	A4TB1	7	-	-
S1	2	55	308	16	A4TB1	10	-	-
S15	1	55	308	16	S1	2	55	-
S1	3	55	309	16	A4TB1	11	-	-
S3	1	-	309	16	S1	3	55	-
S2	1	-	310	16	A4TB1	8	-	-
S2	2	-	312	16	A4TB1	9	-	-
M1	S	35	313	16	A4TB1	2	-	-
M4	S	35	314	16	A4TB1	3	-	-
M3	S	35	315	16	A4TB1	1	-	-
S15	2	55	316	16	(316)	TAP	34	-
M1	R1/+	35	316	16	(316)	TAP	34	-
M3	R2/+	35	316	16	(316)	TAP	34	-
M4	R3/+	35	316	16	(316)	TAP	34	-
M5	R4/+	35	316	16	S15	2	-	-
S15	2	55	316	16	A4TB1	5	55	-
M5	S	35	317	16	A4TB1	4	-	-
S6	2	-	320	16	A4TB3	10	-	-
S13	1	55	320	16	S6	2	55	-
S7	3	-	321	16	A4TB3	8	-	-
S7	4	-	322	16	A4TB3	9	-	-
S13	2	55	324	16	(324)	TAP	34	-
M10	R8/+	35	324	16	(324)	TAP	34	-
M6	R5/+	35	324	16	(324)	TAP	34	-
M7	R6/+	35	324	16	(324)	TAP	34	-
M9	R7/+	35	324	16	(324)	TAP	34	-
S13	2	55	324	16	A4TB3	5	55	-
M7	S	35	325	16	A4TB3	2	-	-

Table 11. Middle Control Panel A1, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
M10	S	35	326	16	A4TB3	3	-	-
M9	S	35	327	16	A4TB3	4	-	-
M6	S	35	328	16	A4TB3	4	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
S5	6	55	365A	16	S5	3	55	-
S5	3	55	365A	16	A4TB3	12		-
S14	3	55	365	16	S14	6	34	-
S14	6	55	365	16	A4TB1	12	-	-
S9	2	-	366	16	A4TB1	7	-	-
S6	3	55	367	16	A4TB3	11	-	-
S9	1	-	367	16	S6	3	55	-
-	-	-	-	-	-	-	-	-
S5	5	55	368	16	A4TB10	10	-	-
S14	5	55	368A	16	A4TB10	9	-	-
DS1	1	55	369	16	S5	2	55	-
DS2	1	55	369A	16	S14	2	55	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
TAP	375	-	375	16	A4TB5	19	-	-
M1	1	35	375	16	(375)	TAP	34	-
M10	1	35	375	16	(375)	TAP	34	-
M2	LAMP (+)	35	375	16	(375)	TAP	34	-
M3	1	35	375	16	(375)	TAP	34	-
M5	LAMP 2 (1)	35	375	16	(375)	TAP	34	-
M6	LAMP 2 (1)	35	375	16	(375)	TAP	34	-
M4	1	35	375	16	(375)	TAP	34	-

Table 11. Middle Control Panel A1, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
M5	LAMP 1 (1)	35	375	16	(375)	TAP	34	-
M6	LAMP 1 (1)	35	375	16	(375)	TAP	34	-
M7	1	35	375	16	(375)	TAP	34	-
M8	LAMP (+)	35	375	16	(375)	TAP	34	-
M9	1	35	375	16	(375)	TAP	34	-
-	-	-	-	-	-	-	-	-
M2	(+)	35	376	16	A8TB	1	34	-
M8	(+)	35	376	16	A8TB	1	34	-
-	-	-	-	-	-	-	-	-
M2	(-)	35	377	16	A8TB	2	34	-
M8	(-)	35	377	16	A8TB	2	34	-
S11	2	55	382	14	A3CB2	2	-	-
S11	3	55	383	14	A4TB5	5	-	-
S12	2	55	387	16	A3CB4	2	-	-
S12	3	55	388	16	A4TB5	6	-	-
P12	TBB-4	42	409	20	A4TB6	1	-	GRN
P12	TBB-3	42	410	20	A4TB6	2	-	RED
P12	TBB-1	42	411	20	A4TB6	4	-	BLK
P12	TBB-2	42	412	20	A4TB6	5	-	WHT
-	-	-	SHLD	-	A4TB6	10	-	-
P12	TBA-1 (+)	42	407	20	A4TB7	3	-	WHT
P12	TBA-2 (-)	42	408	20	A45B7	6	-	BLK
-	-	-	SHLD	-	A4TB7	5	-	-
P12	LT-1	42	375	16	(RED)	TAP	34	-
P12	LT-2	42	0	16	(BLU)	TAP	34	-
P11	TBB-4	42	423	16	A4TB8	1	-	GRN
P11	TBB-3	42	424	16	A4TB8	2	-	RED
P11	TBB-1	42	427	16	A4TB8	4	-	BLK

Table 11. Middle Control Panel A1, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
P11	TBB-2	42	428	16	A4TB8	5	-	WHT
-	-	-	SHLD	-	A4TB10	2	-	-
P11	TBA-1 (+)	42	422	16	A4TB9	3	-	WHT
P11	TBA-2 (-)	42	434	16	A4TB9	6	-	BLK
-	-	-	SHLD	-	A4TB9	5	-	-
P11	LT-1	42	375	16	(RED)	TAP	34	-
P11	LT-2	42	0	16	(BLU)	TAP	34	-
DS1	2	36	461	16	A4TB10	6		-
DS2	2	-	461A	16	A4TB10	7		-

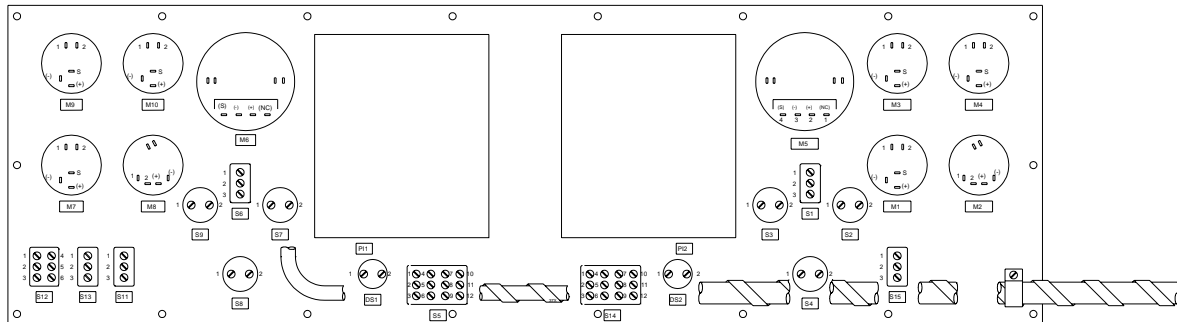
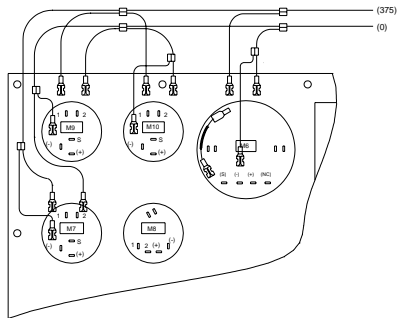


Table 12. Lower Control Panel, Wiring Diagram, List and Rear View.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
S2	1	47	0	16	S2	11	47	-
S2	11	47	-	16	DS9	2	47	-
R1	BLACK	50	0	16	(0)	TAP	50	-
D17	2	SOLDER	0	14	A4TB10	3	47	-
DS8	2	47	0	16	D17	2	47	-
DS8	2	47	0	16	DS9	2	47	-
S2	3	47	138	16	S2	6	47	-
S2	6	47	138	16	A4TB5	10	47	-
S13	1	SOLDER	303	16	(303)	TAP	50	-
S18	1	SOLDER	303	16	(303)	TAP	50	-
S1	1	47	303	16	(303)	TAP	50	-
S20	1	SOLDER	303	16	(303)	TAP	50	-
S1	11	47	303	16	A4TB5	13	47	-
S17	1	44	303	16	(303)	TAP	50	-
S12	1	SOLDER	303	16	(303)	TAP	50	-
S15	1	SOLDER	303	16	(303)	TAP	50	-
S16	1	SOLDER	303	16	(303)	TAP	50	-
S19	1	SOLDER	303	16	(303)	TAP	50	-
S3	11	47	303	16	(303)	TAP	50	-
S14	1	SOLDER	303	16	(303)	TAP	50	-
S11	1	SOLDER	303	16	(303)	TAP	50	-
S10	1	SOLDER	303	16	(303)	TAP	50	-
S9	1	SOLDER	303	16	(303)	TAP	50	-
DS10	1	89	303	16	S1	1	47	-
DS10	1	89	303	16	DS11	1	89	-
DS11	1	89	303	20	DS20	(+)	SOLDER	-
DS20	(+)	SOLDER	303	20	DS19	(+)	SOLDER	-
DS19	(+)	SOLDER	303	20	DS17	(+)	SOLDER	-
DS17	(+)	SOLDER	303	20	DS15	(+)	SOLDER	-

Table 12. Lower Control Panel, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
DS15	(+)	SOLDER	303	20	DS16	(+)	SOLDER	-
DS16	(+)	SOLDER	303	20	DS18	(+)	SOLDER	-
DS18	(+)	SOLDER	303	20	DS26	(+)	SOLDER	-
DS26	(+)	SOLDER	303	20	DS25	(+)	SOLDER	-
DS25	(+)	SOLDER	303	20	DS23	(+)	SOLDER	-
DS23	(+)	SOLDER	303	20	DS21	(+)	SOLDER	-
DS21	(+)	SOLDER	303	20	DS22	(+)	SOLDER	-
DS22	(+)	SOLDER	303	20	DS24	(+)	SOLDER	-
S1	11	47	303	16	(303)	TAP	50	-
S3	11	44	303	16	S3	1	47	-
S3	10	44	303A	16	S3	4	47	-
S1	10	44	303B	16	S1	4	47	-
S2	10	44	303C	16	S2	4	47	-
DS4	1	47	311	16	A4TB2	16	47	-
DS5	1	47	323	16	A4TB4	16	47	-
R1	PURPLE	52	329	16	D16	2	SOLDER	-
D16	2	52	329	16	D15	2	SOLDER	JUMPER
D15	2	52	329	16	D14	2	SOLDER	JUMPER
D14	2	52	329	16	D13	2	SOLDER	JUMPER
D13	2	-	329	16	D12	2	SOLDER	JUMPER
D12	2	52	329	16	D11	2	SOLDER	JUMPER
D11	2	52	329	16	D10	2	SOLDER	JUMPER
D10	2	-	329	16	D9	2	SOLDER	JUMPER
D9	2	52	329	16	D8	2	SOLDER	JUMPER
D8	2	52	329	16	D7	2	SOLDER	JUMPER
D7	2	-	329	16	D6	2	SOLDER	JUMPER
D6	2	52	329	16	D5	2	SOLDER	JUMPER
D5	2	52	329	16	D4	2	SOLDER	JUMPER
D4	2	-	329	16	D3	2	SOLDER	JUMPER

Table 12. Lower Control Panel, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
D3	2	52	329	16	D2	2	SOLDER	JUMPER
D2	2	52	329	16	D1	2	SOLDER	JUMPER
S9	2	SOLDER	330	16	A4TB2	1	47	-
S9	A	SOLDER	331	16	A4TB2	2	47	-
S10	2	SOLDER	332	16	A4TB2	3	47	-
S10	A	SOLDER	333	16	A4TB2	4	47	-
S11	2	SOLDER	334	16	A4TB2	5	47	-
S11	A	SOLDER	335	16	A4TB2	6	47	-
S12	2	SOLDER	336	16	A4TB2	7	47	-
S12	A	SOLDER	337	16	A4TB2	8	47	-
S13	2	SOLDER	338	16	A4TB2	9	47	-
S13	A	SOLDER	339	16	A4TB2	10	47	-
S14	2	SOLDER	340	16	A4TB2	11	47	-
S14	A	SOLDER	341	16	A4TB2	12	47	-
S15	2	SOLDER	342	16	A4TB2	1	47	-
S15	A	SOLDER	343	16	A4TB2	2	47	-
S16	2	SOLDER	344	16	A4TB2	3	47	-
S16	A	SOLDER	345	16	A4TB2	4	47	-
S17	2	SOLDER	346	16	A4TB2	5	47	-
S17	A	SOLDER	347	16	A4TB2	6	47	-
S18	2	SOLDER	348	16	A4TB2	7	47	-
S18	A	SOLDER	349	16	A4TB2	8	47	-
S19	2	SOLDER	350	16	A4TB2	9	47	-
S19	A	SOLDER	351	16	A4TB2	10	47	-
S20	2	SOLDER	352	16	A4TB2	11	47	-
S20	A	SOLDER	353	16	A4TB2	12	47	-
DS2	2	47	354	16	LS1	(+)	47	-
LS1	(+)	476	354	16	A4TB4	18	47	-
-	-	-	-	-	-	-	-	-

Table 12. Lower Control Panel, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
S2	5	47	355	16	LS1	(-)	47	-
DS2	1	47	356	16	S2	2	47	-
S3	3	47	357	16	A4TB4	17	47	-
S3	6	47	357	16	S3	3	47	-
S3	5	47	358	16	A4TB5	9	47	-
DS3	1	47	360	16	S3	2	47	-
DS3	2	52	360A	16	A4TB10	1	47	-
S1	6	47	361	16	S1	3	47	-
S1	3	47	361	16	A4TB2	17	47	-
S1	5	47	3621	16	A4TB5	11	47	-
DS1	1	37	363	16	S1	2	47	-
S21	2	47	370	16	A4TB1	13	47	-
S21	3	47	371	16	A4TB1	14	47	-
S21	3	47	371	16	DS6	1	47	-
S22	2	47	372	16	A4TB3	13	47	-
S22	3	47	373	16	A4TB3	14	47	-
S22	3	47	272	16	DS7	1	47	-
R1	RED	50	374	16	A8TB	4	45	-
R1	BLUE	50	375	16	A4TB5	19	47	-
S4	5	47	389	16	S4	2	47	-
S4	2	47	389	16	A3CB5	2	45	-
S25	2	47	389	16	S4	5	47	-
S4	1	47	390	16	S4	3	47	-
S4	3	47	390	16	A4TB5	7	47	-
S4	6	47	391	A6	A4TB5	8	47	-
R2	L	47	395	A6	A4TB1	15	47	-
R2	R	47	396	A6	A4TB1	A6	47	-
R2	C	47	397	16	A4TB1	17	47	WIPER
R3	L	47	398	16	A4TB3	A5	47	-

Table 12. Lower Control Panel, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
R3	R	47	399	16	A4TB3	A6	47	-
R3	C	47	400	16	A4TB3	17	47	-WIPER
S5	2	47	401	16	S5	5	47	-
S5	2	47	401	16	A4TB2	14	47	-
S5	3	47	402	16	A4TB2	15	47	-
S5	1	47	403	16	A4TB2	13	47	-
S6	2	47	403	16	A4TB2	14	47	-
S6	2	47	404	16	S6	5	47	-
S6	3	47	404	16	A4TB4	14	47	-
S6	3	47	405	16	A4TB4	15	47	-
S6	1	47	406	16	A4TB4	13	47	-
DS10	2	89	416	16	A4TB7	8	47	-
S23	23	47	417	16	A4TB7	8	47	-
DS8	1	47	418	16	4TB7	1	47	-
S23	14	47	419	16	A4TB7	2	47	-
S23	3	47	420	16	A4TB6	7	47	-
S23	3	47	420	16	S23	24	47	-
S5	6	47	425	16	A4TB2	19	47	-
S5	4	47	425	16	S5	6	47	JUMPER
S6	6	47	426	16	A4TB2	20	47	-
S6	4	47	426	16	S6	6	47	JUMPER
DS11	2	89	433	16	A4TB9	8	47	-
S24	23	47	435	16	A4TB9	1	47	-
DS9	1	47	436	16	A4TB9	4	47	-
S24	14	47	437	16	A4TB9	2	47	-
S24	13	47	438	16	A4TB8	8	47	-
S24	13	47	438	16	S24	24	47	-
S25	3	47	442	16	A4TB5	15	47	-
DS1	2	51	460	16	D17	1	SOLDER	-

Table 12. Lower Control Panel, Wiring Diagram, List and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
DS7	2	51	462	16	D16	1	SOLDER	-
DS6	2	51	463	16	D15	1	SOLDER	-
S20	B	SOLDER	464	16	D14	1	SOLDER	-
S19	B	SOLDER	465	16	D13	1	SOLDER	-
S18	B	SOLDER	466	16	D12	1	SOLDER	-
S17	B	SOLDER	467	16	D11	1	SOLDER	-
S16	B	SOLDER	468	16	D10	1	SOLDER	-
S15	B	SOLDER	469	16	D9	1	SOLDER	-
S14	B	SOLDER	470	16	D8	1	SOLDER	-
S13	B	SOLDER	471	16	D7	1	SOLDER	-
S12	B	SOLDER	472	16	D6	1	SOLDER	-
S11	B	SOLDER	473	16	D5	1	SOLDER	-
S10	B	SOLDER	474	16	D4	1	SOLDER	-
S9	B	SOLDER	475	16	D3	1	SOLDER	-
DS5	2	47	476	16	D2	1	SOLDER	-
DS4	2	47	477	16	D1	1	SOLDER	-
DS15	(-)	SOLDER	500	20	A4TB1	19	97	-
DS16	(-)	SOLDER	501	20	A4TB1	20	97	-
DS17	(-)	SOLDER	502	20	A4TB3	19	97	-
DS18	(-)	SOLDER	503	20	A4TB3	20	97	-
DS19	(-)	SOLDER	504	20	A4TB4	19	97	-
DS20	(-)	SOLDER	505	20	A4TB4	20	97	-
DS21	(-)	SOLDER	506	20	A4TB6	6	97	-
DS22	(-)	SOLDER	507	20	A4TB7	7	97	-
DS23	(-)	SOLDER	508	20	A4TB7	9	97	-
DS24	(-)	SOLDER	509	20	A4TB7	10	97	-
DS25	(-)	SOLDER	510	20	A4TB8	6	97	-
DS26	(-)	SOLDER	511	20	A4TB8	7	97	-

Table 12. Lower Control Panel, Wiring Diagram, List and Rear View. (Continued)

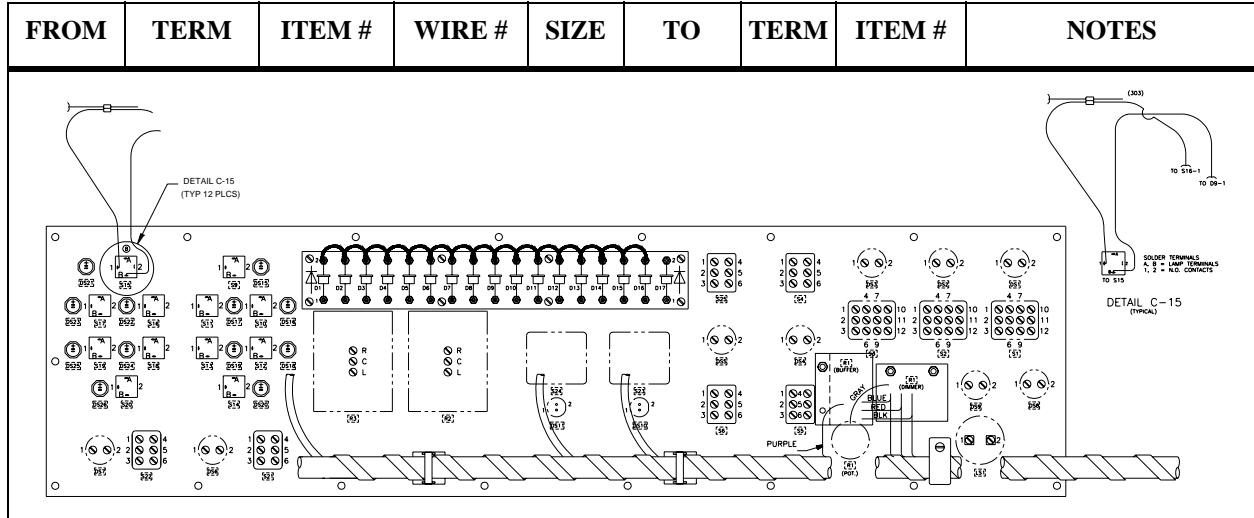


Table 13. Operators Cab Circuit Breaker Panel A3, Internal Connections.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
J1(-)	1	SOLDER	0	16	TB2	1	63	-
TB2	1	-	0	-	TB2	2	82	JUMPER (IT. 82)
TB1	3	-	300A	-	D2	A	-	DIODE LEAD
-	-	-	-	-	-	-	-	-
TB1	2	-	300B	-	D1	A	-	DIODE LEAD
D1	K	50	300	10	D2	K	50	ISOLATE FROM HEAT SINK
D2	K	50	300	10	CB7	1	51	-
CB7	1	51	300	10	CB8	1	51	-
CB7	1	51	300	10	CB1	1	51	-
CB1	1	51	300	10	CB2	1	51	-
CB2	1	51	300	10	CB4	1	51	-
-	-	-	-	-	-	-	-	-
CB4	1	51	300	10	CB5	1	51	-
CB5	1	51	300	10	CB6	1	51	-
CB8	1	51	300	10	CB9	1	51	-
CB9	1	51	300	10	CB10	1	51	-
CB10	1	51	300	10	CB11	1	51	-
CB11	2	81	445	14	TB2	3	63	-

Table 13. Operators Cab Circuit Breaker Panel A3, Internal Connections. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-
S1	COMMON	SOLDER	+	LEAD	R1 [12]	1	SOLDER	SWITCH TO R1
R1	2	SOLDER	+	LEAD	J2(+)	1	SOLDER	R1 TO JACK (+)
S1	POS 1	SOLDER	300B	16	TB1	2	56	-
S1	POS 2	SOLDER	300A	16	TB1	3	56	-
S1	POS 3	SOLDER	400	16	TB2	4	63	-
S1	POS 4	SOLDER	397	16	TB2	5	63	-
S1	POS 5	SOLDER	422	16	TB2	6	63	-
S1	POS 6	SOLDER	407	16	TB2	7	63	-
S1	POS 7	SOLDER	320	16	TB2	8	63	-
S1	POS 8	SOLDER	308	16	TB2	9	63	-
S1	POS 9	SOLDER	N/A [13]	16	TB2	10	63	-
J3	1	SOLDER	408	16	TB2	11	63	-
J4	1	SOLDER	434	16	TB2	12	63	-

Table 14. Operators Cab Circuit Breaker Panel A3, External Connections and Rear View.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
TB2	1	63	0	16	A4TB11	-	NOT REQ'D	COMMON FOR TEST SW
TB2	1	63	0	14	J11	B	SOLDER	COM. FOR DECK LIGHTS
TB2	1	63	0	SWE	DS2	SWE	-	MAPLIGHT
TB2	2	63	0	16	A8TB	3	63	VR3
TB1	3	80	300A	8	A6J1	A	CRIMP PINS	PORT+24 VDC POWER
TB1	2	80	300B	8	A5J1	A	CRIMP PINS	STARBOARD +24 VDC POWER
CB10	2	81	303	14	A4TB5	13	63	CONTROL PANEL ALARMS
TB2	9	63	308	16	A4TB01	10	63	PORT ENG 24 V
TB2	8	63	320	16	A4TB03	10	63	STARBOARD ENG 24 V

Table 14. Operators Cab Circuit Breaker Panel A3, External Connections and Rear View. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
-	-	-	-	-	-	-	-	-
CB9	2	REF	374	SWE	DS2	SWE	-	MAPLIGHT
CB9	2	REF	374	16	A8TB	4	63	VR3
CB1	2	81	381	14	A4TB9	10	63	NAVIGATION LIGHTS
CB2	2	REF	382	14	A1S11	2	REF	SPOTLIGHT-NOTE [15]
-	-	-	-	-	-	-	-	-
CB4	2	REF	387	16	A1S12	2	REF	WSHLD WIPER- NOTE [15]
CB5	2	REF	389	16	A2S4	2	REF	HTR/DEFROSTER- NOTE [14]
CB6	2	81	392	16	3JB1TB1	8	63	VHF/FM RADIO
CB7	2	81	393	16	3JB1TB1	10	63	SINGARS
CB8	2	81	394	16	A4TB5	1	63	CONVERTER AND GPS
TB2	5	63	397	16	A4TB1	17	63	THROTTLE CONTROL (P)
TB2	4	63	400	16	A4TB3	17	63	THROTTLE CONTROL (S)
TB2	7	63	407	16	A4TB7	3	63	THRUST INDICATOR (P)
TB2	11	63	408	16	A4TB7	6	63	THRUST INDICATOR (P)
TB2	6	63	422	16	A4TB9	3	63	THRUST INDICATOR (S)
TB2	12	63	434	16	A4TB9	6	63	THRUST INDICATOR (S)
TB2	3	63	445	14	J11	A	SOLDER	DECK LIGHTS TO A7

Table 14. Operators Cab Circuit Breaker Panel A3, External Connections and Rear View. (Continued)

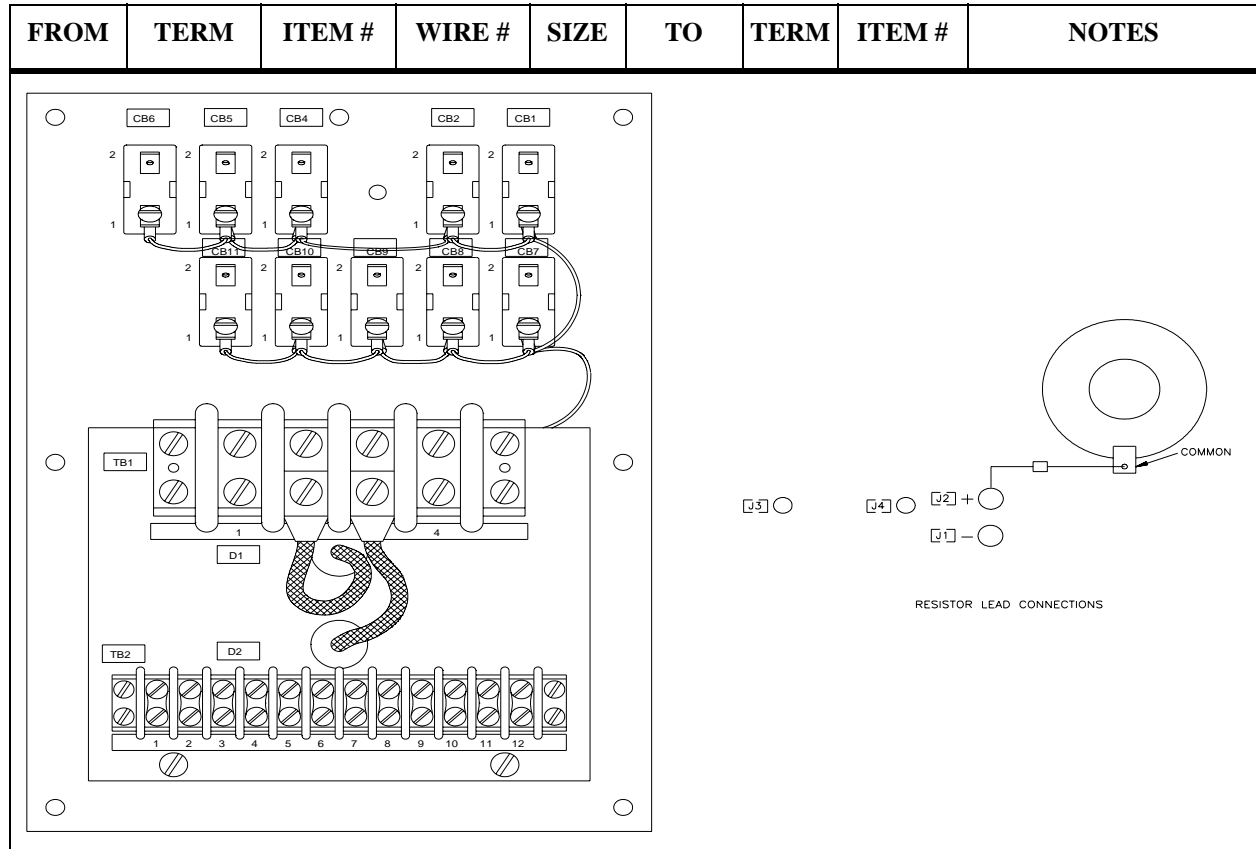


Table 15. Terminal Strip A4 Assembly, External Wiring List.

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB01	1	315	A1M3	S	-
TB01	1	315	A6J3	12	-
TB01	2	313	A1M1	S	-
TB01	2	313	A6J3	10	-
TB01	3	314	A1M4	S	-
TB01	3	314	A6J3	11	-
TB01	4	317	A1M5	S	-
TB01	4	317	A6J3	17	-
TB01	5	316	A1S15	2	-
TB01	5	316	A6J2	7	-
TB01	6	304	A1S4	2	-
TB01	6	304	A6J2	8	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB01	7	306	A1S3	2	-
TB01	7	306	A6J2	6	-
TB01	8	310	A1S2	1	-
TB01	8	310	K2	87A	-
TB01	9	312	A1S2	2	-
TB01	9	312	A6J2	2	-
TB01	10	308	A1S1	2	-
TB01	10	308	A3TB2	9	-
TB01	10	308	A6J2	3	-
TB01	11	309	A1S1	3	-
TB01	11	309	A6J2	4	-
TB01	11	309	K2	30	-
TB01	11	309	A4S1	3	-
TB01	12	365	A6J2	9	-
TB01	12	365	A1S14	6	-
TB01	13	370	A2S21	2	-
TB01	13	370	A6J2	14	-
TB01	14	371	A2S21	3	-
TB01	14	371	A6J2	15	-
TB01	15	395	A2R2	L	-
TB01	15	395	A6J3	2	-
TB01	16	396	A2R2	R	-
TB01	16	396	A6J3	3	-
TB01	17	397	A2R2	C	-
TB01	17	397	A3TB2	5	-
TB01	17	397	A6J3	4	-
TB01	18	0	A2R2		SHIELD
TB01	18	0	TB11	-	-
TB01	19	500	A2DS15	(-)	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB01	19	500	A6J4	1	-
TB01	20	501	A2DS16	(-)	-
TB01	20	501	A6J4	2	-
TB02	1	330	A2S9	2	-
TB02	1	330	A6J2	19	-
TB02	2	331	A2S9	A	-
TB02	2	331	A6J2	18	-
TB02	3	332	A2S10	2	-
TB02	3	332	A6J2	21	-
TB02	4	333	A2S10	A	-
TB02	4	333	A6J2	20	-
TB02	5	334	A2S11	2	-
TB02	5	334	A6J2	23	-
TB02	6	335	A2S11	A	-
TB02	6	335	A6J2	22	-
TB02	7	336	A2S12	2	-
TB02	7	336	A6J2	25	-
TB02	8	337	A2S12	A	-
TB02	8	337	A6J2	24	-
TB02	9	338	A2S13	2	-
TB02	9	338	A6J2	27	-
TB02	10	339	A2S13	A	-
TB02	10	339	A6J2	26	-
TB02	11	340	A2S14	2	-
TB02	11	340	A6J2	29	-
TB02	12	341	A2S14	A	-
TB02	12	341	A6J2	28	-
TB02	13	403	A2S5	1	-
TB02	13	403	A6J2	12	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB02	14	401	A2S5	2	-
TB02	14	401	A6J2	10	-
TB02	15	402	A2S5	3	-
TB02	15	402	A6J2	11	-
TB02	16	311	A2DS4	1	-
TB02	16	311	K2	87	-
TB02	17	361	A2S1	3	-
TB02	17	361	A6J2	17	-
TB02	18	354	A6J2	16	-
TB02	18	354	TB04	18	14 GA. WIRE
-	-		-	-	-
TB02	19	425	A2S5	6	-
TB02	19	425	K2	85	-
TB02	20	426	K3	85	-
TB02	20	426	A2S6	6	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
TB03	1	327	A1M9	5	-
TB03	1	327	A5J3	12	-
TB03	2	325	A1M7	S	-
TB03	2	325	A5J3	10	-
TB03	3	326	A1M10	S	-
TB03	3	326	A5J3	11	-
TB03	4	328	A1M6	S	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB03	4	328	A5J3	17	-
TB03	5	324	A1S13	2	-
TB03	5	324	A5J2	7	-
TB03	6	305	A1S8	2	-
TB03	6	305	A5J2	8	-
TB03	7	366	A1S9	2	-
TB03	7	366	A5J2	6	-
TB03	8	321	A1S7	1	-
TB03	8	321	K3	87A	-
TB03	9	322	A1S7	2	-
TB03	9	322	A5J2	2	-
-	-	-	-	-	-
TB03	10	320	A3TB2	8	-
TB03	10	320	A1S6	2	-
TB03	10	320	A5J2	3	-
TB03	11	367	A1S6	3	-
TB03	11	367	A5J2	4	-
TB03	11	367	K3	30	-
TB03	11	367	A4S1	1	-
TB03	12	365A	A1S5	3	-
TB03	12	365A	A5J2	9	-
TB03	13	372	A2S22	2	-
TB03	13	372	A5J2	14	-
TB03	14	373	A2S22	3	-
TB03	14	373	A5J2	15	-
TB03	15	398	A2R3	L	-
TB03	15	398	A5J3	2	-
TB03	16	399	A2R3	R	-
TB03	16	399	A5J3	3	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB03	17	400	A2R3	C	-
TB03	17	400	A3TB2	4	-
TB03	17	400	A5J3	4	-
TB03	18	0	A2R3	-	SHIELD
TB03	18	0	TB11	-	-
TB03	19	502	A2DS17	(-)	-
TB03	19	502	A6J4	3	-
TB03	20	503	A2DS18	(-)	-
TB03	20	503	A6J4	4	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
TB04	1	342	A2S15	2	-
TB04	1	342	A5J2	19	-
TB04	2	343	A2S15	A	-
TB04	2	343	A5J2	18	-
TB04	3	344	A2S16	2	-
TB04	3	344	A5J2	21	-
TB04	4	345	A2S16	A	-
TB04	4	345	A5J2	20	-
TB04	5	346	A2S17	2	-
TB04	5	346	A5J2	23	-
TB04	6	347	A2S17	A	-
TB04	6	347	A5J2	22	-
TB04	7	348	A2S18	2	-
TB04	7	348	A5J2	25	-
TB04	8	349	A2S18	A	-
TB04	8	349	A5J2	24	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
-	-		-	-	-
TB04	9	350	A2S19	2	-
TB04	9	350	A5J2	27	-
TB04	10	351	A2S19	A	-
TB04	10	351	A5J2	26	-
TB04	11	352	A2S20	2	-
TB04	11	352	A5J2	29	-
TB04	12	353	A2S20	A	-
TB04	12	353	A5J2	28	-
TB04	13	406	A2S6	1	-
TB04	13	406	A5J2	12	-
TB04	14	404	A2S6	2	-
TB04	14	404	A5J2	10	-
TB04	15	405	A2S6	3	-
TB04	15	405	A5J2	11	-
TB04	16	323	A2DS5	1	-
TB04	16	323	K3	87	-
TB04	17	357	A2S3	3	-
TB04	17	357	A5J2	17	-
TB04	18	354	A2LS1	(+)	-
TB04	18	354	A5J2	16	-
TB04	18	354	TB02	18	-
TB04	19	504	A2DS19	(-)	-
TB04	19	504	A6J4	5	-
TB04	20	505	A2DS20	(-)	-
TB04	20	505	A6J4	6	-
-	-	-	-	-	-
TB05	1	394	A3CB8	2	-
TB05	1	394	JB3TB1	6	+24 V JB3

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB05	2	384	A3CB3	2	SPARE
TB05	2	-	-	-	-
TB05	2	-	-	-	-
TB05	3	-	JB1TB1	2	SPARE
TB05	3	-	-	-	-
TB05	4	-	-	-	-
TB05	4	-	-	-	-
TB05	5	383	A1S11	3	-
TB05	5	383	JB1TB1	6	SPOTLIGHT
TB05	6	388	A1S12	3	-
TB05	6	388	JB1TB1	4	WINDSHIELD WIPER
TB05	7	390	A2S4	3	-
TB05	7	390	B1A	1	HEATER
TB05	8	391	A2S4	6	-
TB05	8	391	B1B	1	HEATER
TB05	9	358	A2S3	5	-
TB05	9	358	D1	A	CONNECT DIODE LEAD TO TERM
TB05	10	138	A2S2	6	-
TB05	10	138	A5J4	7	-
TB05	10	138	A6J4	7	-
TB05	11	362	A2S1	5	-
TB05	11	362	D2	A	CONNECT DIODE LEAD TO TERM
TB05	12	359	D1	K	CONNECT DIODE LEAD TO TERM
TB05	12	359	D2	K	CONNECT DIODE LEAD TO TERM
TB05	12	359	LS2	1	-
TB05	13	303	A2S1	11	-
TB05	13	303	A3CB10	2	-
TB05	13	303	TB05	14	JUMPER (IT. 26)
TB05	14	303	A1S8	1	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB05	14	303	TB05	13	-
TB05	15	442	A2S25	3	-
TB05	15	442	JB1TB1	12	DEFROSTER
TB05	16	301	A1M2	SHUNT 2	-
TB05	16	301	A6J4	11	-
-	-	-	-	-	-
TB05	17	375A	A4R1	2	COMPASS BACKLIGHT
TB05	18	301A	A6J4	10	-
TB05	18	301A	A1M2	SHUNT 1	-
TB05	19	375	A1M10	1	-
TB05	19	375	A2R1	BLUE	-
TB05	19	375	A2R1	1	SEE RESISTOR ITEM 34
TB05	20	-	JB1TB1	1	SPARE
TB05	20	0	A1M10	2	-
TB05	20	0	TB11	-	-
TB05	20	0	K1	85	-
-	-	-	-	-	-
-	-	-	-	-	-
TB06	1	409	A1P12	TBB-4	GRN
TB06	1	409	A6J3	5	-
TB06	2	410	A1P12	TBB-3	RED
TB06	2	410	A6J3	6	-
-	-	-	-	-	-
TB06	3	0	A6J3	7	-
TB06	3	0	A6J3	13	-
TB06	3	0	A6J3	1	-
TB06	3	0	TB11	-	-
TB06	4	411	A1P12	TBB-1	BLK
TB06	4	411	A6J3	9	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB06	5	412	A1P12	TBB-2	WH
TB06	5	412	A6J3	14	-
TB06	6	506	A2DS21	(-)	-
TB06	6	506	A5J4	1	-
TB06	7	420	A2S23	13	-
TB06	7	420	A6J3	27	-
TB06	8	0	A6J3	20	SHIELD
TB06	8	0	TB07	5	-
TB06	8	0	TB06	9	JUMPER (IT. 43)
TB06	9	0	TB06	10	-
TB06	9	0	A5J3	16	SHIELD
TB06	9	0	JB6	-	-
TB06	10	0	A5J3	20	SHIELD
TB06	10	0	TB11	-	-
TB06	10	0	JB6	(-)	L1
TB06	10	0	A1P12	-	SHIELD
TB07	1	417	A2S23	23	-
TB07	1	417	A6J3	18	-
TB07	2	419	A2S23	14	-
TB07	2	419	A6J3	19	-
TB07	3	407	A1P12	TB (+)	-
TB07	3	407	A3TB2	7	-
TB07	3	407	A6J3	21	-
TB07	4	418	A2DS8	1	-
TB07	4	418	A6J2	35	-
TB07	5	0	A1P12	SHLD	-
TB07	5	0	TB06	8	-
TB07	5	0	A6J3	28	SHIELD
TB07	6	408	A1P12	TB (-)	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB07	6	408	A6J3	22	-
TB07	6	408	A3TB2	11	-
TB07	7	507	A2DS22	(-)	-
TB07	7	507	A5J4	2	-
TB07	8	416	A2DS10	2	-
TB07	8	416	A6J2	31	-
TB07	9	508	A2DS23	(-)	-
TB07	9	508	A5J4	3	-
TB07	10	509	A2DS24	(-)	-
TB07	10	509	A5J4	4	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
TB08	1	423	A1P11	TB03	-
TB08	1	423	A5J3	5	-
TB08	2	424	A1P11	TB05	-
TB08	2	424	A5J3	6	-
-	-		-	-	-
TB08	3	0	A5J3	1	-
TB08	3	0	A5J3	7	-
TB08	3	0	A5J3	13	-
TB08	3	0	TB11	-	-
TB08	4	427	A1P11	TB-1	-
TB08	4	427	A5J3	9	-
TB08	5	428	A1P11	TB-2	-
TB08	5	428	A5J3	14	-
TB08	6	510	A2DS25	(-)	-
TB08	6	510	A5J4	5	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB08	7	511	A2DS26	(-)	-
TB08	7	511	A5J4	6	-
TB08	8	438	A2S24	13	-
TB080	8	438	A5J3	27	-
TB08	9	0	TB08	10	JUMPER (IT. 26)
TB08	9	0	-	-	SHIELD
TB08	10	0	A4K2	86	-
TB08	10	0	A4K3	86	-
TB08	10	0	TB11	-	-
-	-		-	-	-
-	-		-	-	-
TB09	1	435	A2S24	23	-
TB09	1	435	A5J3	18	-
TB09	2	437	A2S24	14	-
TB09	2	437	A5J3	19	-
TB09	3	422	A1P11	TB (+)	-
TB09	3	422	A3TB2	6	-
TB09	3	422	AA5J3	21	-
TB09	4	436	A2DS9	1	-
TB09	4	436	A5J2	35	-
TB09	5	0	A5J3	28	SHIELD
TB09	5	0	A1P11	SHLD	-
TB09	5	0	TB11	-	-
TB09	6	434	A1P11	TB (-)	-
TB09	6	4334	A5J3	22	-
TB09	6	434	A3TB2	12	-
TB09	7	302	A5J4	11	-
TB09	7	302	A1M8	SHUNT 2	-
TB09	8	433	A2DS11	2	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB09	8	433	A5J2	31	-
TB09	9	302A	A5J4	10	-
TB09	9	302A	A1M8	SHUNT 1	-
TB09	10	381	A7TB6	A12	NAV LIGHT SWITCHBOX
TB09	10	381	A3CB1	2	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
TB10	1	360A	A2DS3	2	-
TB10	1	360A	D4	A	-
TB10	2	0	TB10	3	JUMPER (IT. 44)
TB10	2	0	D4	K	-
TB10	2	0	A1P12	-	SHIELD
TB10	3	0	A2D17	2	-
TB10	3	0	TB10	4	JUMPER (IT. 44)
-	-	-	-	-	-
TB10	3	0	LS2	2	-
TB10	4	0	A1MA0	(-)	-
TB10	4	0	TB10	5	JUMPER (IT. 44)
TB10	4	0	LS1	2	-
TB10	5	0	TB11	-	-
TB10	5	0	D3	K	CONNECT DIODE LEAD TO TERM
TB10	5	0	D7	K	-
TB10	6	461	A1DS1	2	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB10	6	461	D3	2	CONNECT DIODE LEAD TO TERM
TB10	7	461A	A1DS2	2	-
TB10	7	461A	D7	A	-
TB10	8	368B	LS1	1	-
TB10	8	368B	D5	K	-
TB10	8	368B	D6	K	-
TB10	9	368A	A1S14	5	-
TB10	9	368A	D6	A	-
TB10	10	368	D5	A	-
TB10	10	368	A1S5	5	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
-	-		-	-	-
TB11	-	0	A5J1	B	-
TB11	-	0	A6J1	B	-
TB11	-	0	B1A/B	2	HEATER
TB11	-	0	B2	2	WINDSHIELD WIPER
TB11	-	0	B3	2	DEFROSTER
TB11	-	0	DS1	2	SPOTLIGHT
TB11	-	0	JB1TB1	3	-
TB11	-	0	JB1TB1	5	-
TB11	-	0	JB1TB1	11	SINCGARS
TB11	-	0	A7TB6	A11	NAV. LT. SW. BOX 14 GA. WIRE
TB11	-	0	A3TB2	A	COMMON FOR TEST SW.
TB11	-	0	JB1TB1	9	-

Table 15. Terminal Strip A4 Assembly, External Wiring List. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB11	-	0	JB1TB1	7	VHF/FM
TB11	-	0	A5J2	33	-
TB11	-	0	A5J3	16	-
TB11	-	0	A5J3	20	-
TB11	-	0	A6J3	16	-
TB11	-	0	A6J3	20	-
TB11	-	0	VR1	(-)	DUPLICATE
TB11	-	0	TB01	18	DUPLICATE
TB11	-	0	TB03	18	DUPLICATE
TB11	-	0	TB05	20	DUPLICATE
TB11	-	0	TB06	3	DUPLICATE
TB11	-	0	TB06	10	DUPLICATE
TB11	-	0	TB08	3	DUPLICATE
TB11	-	0	TB08	10	DUPLICATE
TB11	-	0	TB09	5	DUPLICATE
TB11	-	0	TB10	5	14 GA. WIRE
TB11	-	0	JB3TB1	5	VR2 AND GPS
-	-	-	-	-	-
S1	2	450	JB6	(+)	L1

Table 16. Terminal Strip A4 Assembly, Internal Wiring List and Rear View.

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB01	8	310	K2	87A	-
TB01	11	309	K2	30	-
TB01	11	309	A4S1	3	-
TB01	18	0	TB11	-	-
TB02	16	311	K2	87	-
TB02	18	354	TB04	18	14 GA. WIRE
TB02	19	425	K2	85	-

Table 16. Terminal Strip A4 Assembly, Internal Wiring List and Rear View. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB02	20	426	K3	85	-
TB03	8	321	K3	87A	-
TB03	11	367	K3	30	-
TB03	11	367	A4S1	1	-
TB03	18	0	TB11	-	-
TB04	16	323	K3	87	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
TB05	9	358	D1	A	CONNECT DIODE LEAD TO TERM
TB05	11	362	D2	A	CONNECT DIODE LEAD TO TERM
TB05	12	359	D1	K	CONNECT DIODE LEAD TO TERM
TB05	12	359	D2	K	CONNECT DIODE LEAD TO TERM
TB05	12	359	LS2	1	-
TB05	13	303	TB05	14	JUMPER (IT. 26)
-	-	-	-	-	-
TB05	17	375A	R1	2	-
TB05	19	375	R1	1	-
TB05	20	0	TB11	-	-
TB05	20	0	K1	85	-
TB06	3	0	TB11	-	-
TB06	8	0	TB07	5	-
TB06	8	0	TB06	9	JUMPER (IT. 43)
TB06	9	0	TB06	10	JUMPER (IT. 43)
TB06	10	0	TB11	-	-
-	-	-	-	-	-
TB08	3	0	TB11	-	-
TB08	9	0	TB08	10	JUMPER (IT. 26)

Table 16. Terminal Strip A4 Assembly, Internal Wiring List and Rear View. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB08	10	0	A4K2	86	-
TB08	10	0	A4K3	86	-
TB08	10	0	TB11	-	-
TB09	5	0	TB11	-	-
TB10	1	360A	D4	A	-
TB10	2	0	TB10	3	JUMPER (IT. 44)
TB10	2	0	D4	K	-
TB10	3	0	TB10	4	JUMPER (IT. 44)
TB10	3	0	LS2	2	-
TB10	4	0	TB10	5	JUMPER (IT. 44)
TB10	4	0	LS1	2	-
TB10	5	0	TB11	-	-
TB10	5	0	D3	K	CONNECT DIODE LEAD TO TERM
TB10	5	0	D7	K	-
TB10	6	461	D3	A	CONNECT DIODE LEAD TO TERM
TB10	7	461A	D7	A	-
TB10	8	368B	LS1	1	-
TB10	8	368B	D5	K	-
TB10	8	368B	D6	K	-
TB10	9	368A	D6	A	-
TB10	10	368	D5	A	-
-	-	-	-	-	-
TB11	-	0	TB01	18	DUPLICATE
TB11	-	0	TB03	18	DUPLICATE
TB11	-	0	TB05	20	DUPLICATE
TB11	-	0	TB06	3	DUPLICATE
TB11	-	0	TB06	10	DUPLICATE
TB11	-	0	TB08	3	DUPLICATE
TB11	-	0	TB08	10	DUPLICATE

Table 16. Terminal Strip A4 Assembly, Internal Wiring List and Rear View. (Continued)

CONNECTION	TERM	WIRE #	FROM	TERM	NOTES
TB11	-	0	TB09	5	DUPLICATE
TB11	-	0	TB10	5	DUPLICATE

Diagram illustrating the internal wiring and rear view of the Terminal Strip A4 Assembly. The assembly includes terminal blocks TB1 through TB11, relays K1, K2, K3, LS1, LS2, and diodes D2, D3, D4, D5, D6, D7. A callout shows a detail of a terminal block with pins 30, 31, 85, 86, 87, and 87A.

Table 17. Starboard Receptacle A5 Assembly, Wire List, Rear View and Pin Connections.

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPERATOR CAB WIRE #	TO	TERM	LUG	NOTES
J1	A	S	-	8	300B	A3TB1	2	-	+24 VDC
J1	B	S	-	8	0	A4TB11	1	-	24 VDC RET
J2	01	C	-	16	-	-	-	-	SPARE
J2	02	C	-	16	322	A4TB3	9	B133	-
J2	03	C	-	16	320	A4TB3	10	B133	-
J2	04	C	-	16	367	A4TB3	11	B133	-
J2	05	C	-	16	-	-	-	-	SPARE
J2	06	C	-	16	366	A4TB3	7	B133	-
J2	07	C	-	16	324	A4TB3	5	B133	-

Table 17. Starboard Receptacle A5 Assembly, Wire List, Rear View and Pin Connections. (Continued)

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPERATOR CAB WIRE #	TO	TERM	LUG	NOTES
J2	08	C	-	16	305	A4TB3	6	B133	-
J2	09	C	-	16	365A	A4TB3	12	B133	-
J2	10	C	-	16	404	A4TB4	14	B133	-
J2	11	C	-	16	405	A4TB4	15	B133	-
J2	12	C	-	16	406	A4TB4	13	B133	-
J2	13	C	-	16	-	-	-	-	SPARE
J2	14	C	-	16	372	A4TB3	13	B133	-
J2	15	C	-	16	373	A4TB3	14	B133	-
J2	16	C	-	16	354	A4TB4	18	B133	-
J2	17	C	-	16	357	A4TB4	17	B133	-
J2	18	C	-	16	343	A4TB4	2	B133	-
J2	19	C	-	16	342	A4TB4	1	B133	-
J2	20	C	-	16	345	A4TB4	4	B133	-
J2	21	C	-	16	344	A4TB4	3	B133	-
J2	22	C	-	16	347	A4TB4	6	B133	-
J2	23	C	-	16	346	A4TB4	5	B133	-
J2	24	C	-	16	349	A4TB4	8	B133	-
J2	25	C	-	16	348	A4TB4	7	B133	-
J2	26	C	-	16	351	A4TB4	10	B133	-
J2	27	C	-	16	350	A4TB4	9	B133	-
J2	28	C	-	16	353	A4TB4	12	B133	-
J2	29	C	-	16	352	A4TB4	11	B133	-
J2	30	C	-	-	-	-	-	-	SPARE
J2	31	C	-	16	433	A4TB9	8	B133	-
J2	32	-	-	-	-	-	-	-	SPARE
J2	33	C	-	-	0	A4TB11	2	B133	-
J2	34	C	-	-	-	-	-	-	SPARE
J2	35	C	-	16	436	A4TB9	4	B133	-

Table 17. Starboard Receptacle A5 Assembly, Wire List, Rear View and Pin Connections. (Continued)

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPERATOR CAB WIRE #	TO	TERM	LUG	NOTES
J2	36	C	-	-	-	-	-	-	SPARE
J2	37	C	-	-	-	-	-	-	SPARE
J3	1	C	1-SHD	16	0	A4TB8	3	B133	-
J3	2	C	1-BK	16	398	A4TB3	15	B133	-
J3	3	C	1-WH	16	399	A4TB3	16	B133	-
J3	4	C	1-RD	16	400	A4TB3	17	B133	-
J3	5	C	2-BK	16	423	A4TB8	1	B133	-
J3	6	C	2-WH	16	424	A4TB8	2	B133	-
J3	7	C	2-SHD	16	0	A4TB8	3	B133	-
J3	8	C	2-RD	16	-	-			SPARE
J3	9	C	3-BK	16	427	A4TB8	4	B133	-
J3	10	C	4-BK	16	325	A4TB3	2	B133	-
J3	11	C	4-WH	16	326	A4TB3	3	B133	-
J3	12	C	4-RD	16	327	A4TB3	1	B133	-
J3	13	C	3-SHD	16	0	A4TB8	3	B133	-
J3	14	C	3-WH	16	428	A4TB8	5	B133	-
J3	15	C	3-RD	-	-	-	-	-	SPARE
-	-	-	-	-	-	-	-	-	-
J3	16	C	4-SHD	16	0	A4TB11	-	B133	-
J3	17	C	5-BK	16	328	A4TB3	4	B133	
J3	18	C	5-WH	16	435	A4TB9	1	B133	
J3	19	C	5-RD	16	437	A4TB9	2	B133	
J3	20	C	5-SHD	16	0	A4TB11	-		-
J3	21	C	6-BK	16	422	A4TB9	3	B133	SPARE
J3	22	C	6-WH	16	434	A4TB9	6	B133	SPARE
J3	23	C	7-BK	16	-	-	-	-	SPARE
J3	24	C	7-WH	16	-	-	-	-	SPARE
J3	25	C	7-RD	16	-	-	-	-	SPARE

Table 17. Starboard Receptacle A5 Assembly, Wire List, Rear View and Pin Connections. (Continued)

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPERATOR CAB WIRE #	TO	TERM	LUG	NOTES
J3	26	C	7-SHD	16	-	-	-	-	SPARE
J3	27	C	6-RD	16	438	A4TB8	8	B133	-
J3	28	C	6-SHD	16	0	A4TB9	5	B133	-
J3	29	C	N/C	-	-	-	-	-	-
J3	30	C	N/C	-	-	-	-	-	-
J3	31	C	N/C	-	-	-	-	-	-
J3	32	C	N/C	-	-	-	-	-	-
J3	33	C	N/C	-	-	-	-	-	-
J3	34	C	N/C	-	-	-	-	-	-
J3	35	C	N/C	-	-	-	-	-	-
J3	36	C	N/C	-	-	-	-	-	-
J3	37	C	N/C	-	-	-	-	-	-
J4	1	C	-	16	506	A4TB6	6	B133	-
J4	2	C	-	16	507	A4TB7	7	B133	-
J4	3	C	-	16	508	A4TB7	9	B133	-
J4	4	C	-	16	509	A4TB7	10	B133	-
J4	5	C	-	16	510	A4TB8	6	B133	-
J4	6	C	-	16	511	A4TB8	7	B133	-
J4	7	C	-	16	138	A4TB5	10	B133	-
J4	8	C	-	-	-	-	-	-	SPARE
J4	9	C	-	-	-	-	-	-	SPARE
J4	10	C	-	16	302A	A4TB9	9	B133	-
J4	11	C	-	16	302	A4TB9	7	B133	-
J4	12	C	-	-	-	-	-	-	SPARE
J4	13	C	-	-	-	-	-	-	SPARE
J4	14	C	-	-	-	-	-	-	SPARE
J4	15	C	-	-	-	-	-	-	SPARE
J4	16	C	-	-	-	-	-	-	SPARE

Table 17. Starboard Receptacle A5 Assembly, Wire List, Rear View and Pin Connections. (Continued)

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPERATOR CAB WIRE #	TO	TERM	LUG	NOTES
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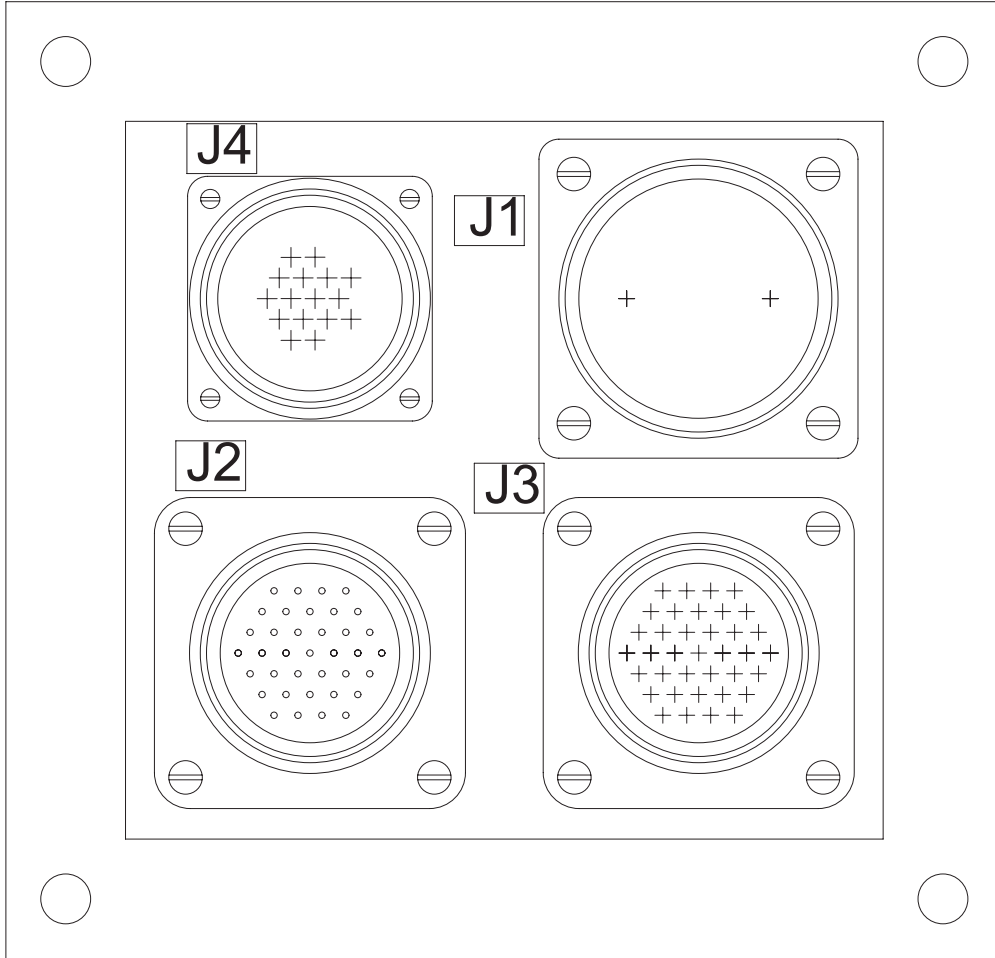


Table 17. Starboard Receptacle A5 Assembly, Wire List, Rear View and Pin Connections. (Continued)

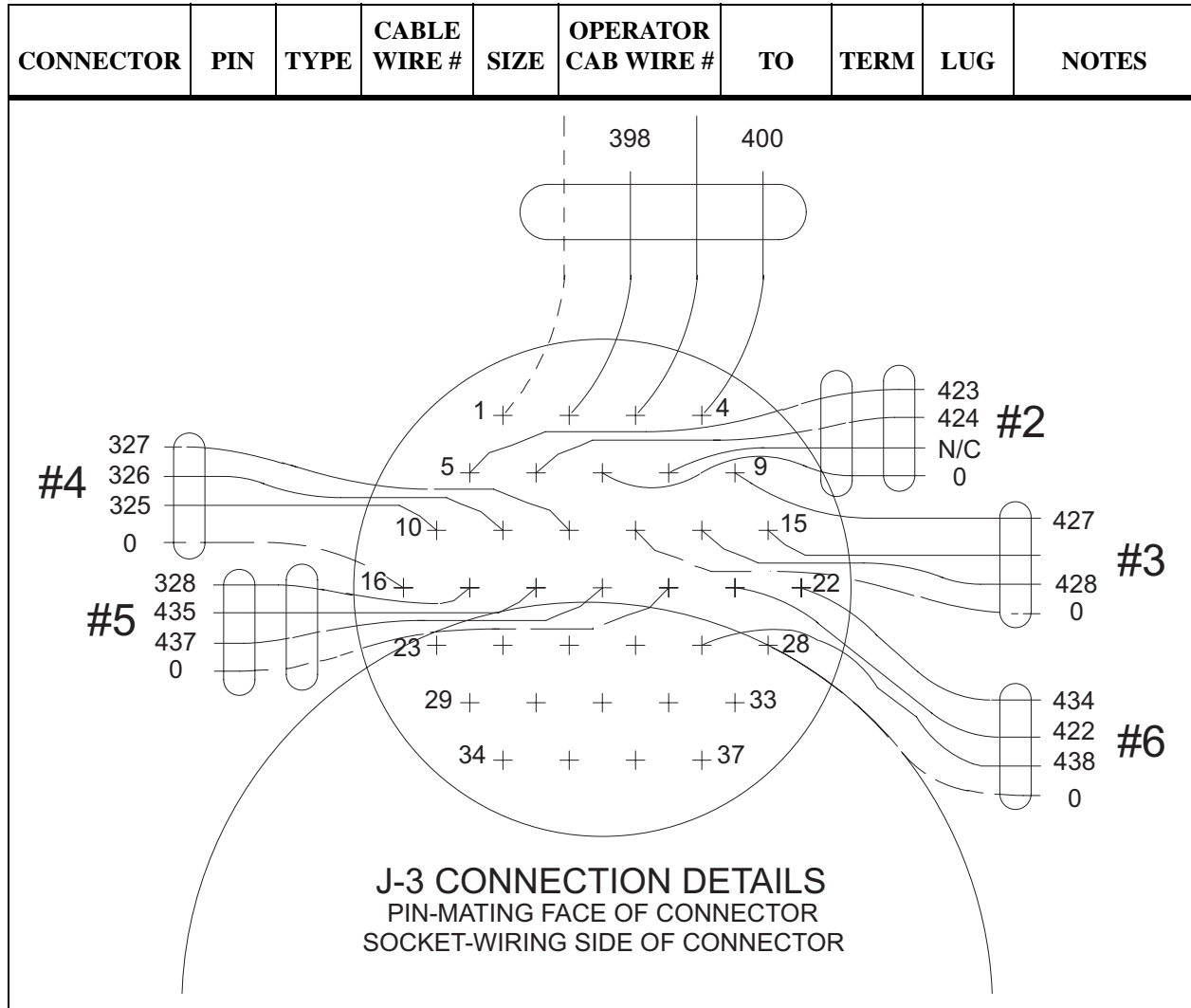


Table 18. Port Receptacle A6 Assembly, Wire List, Rear View and Pin Connections.

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPER CAB WIRE #	TO	TERM	LUG	NOTES
J1	A	S		8	300A	A3TB1	3	-	+24 VDC
J1	B	S		8	0	A4TB11	1	-	24 VDC RET
J2	01	C		16	-	-	-	-	SPARE
J2	02	C		16	312	A4TB1	9	B133	-
J2	03	C		16	308	A4TB1	10	B133	-
J2	04	C		16	309	A4TB1	11	B133	-
J2	05	C		16	-	-	-	-	SPARE
J2	06	C		16	306	A4TB1	7	B133	-

Table 18. Port Receptacle A6 Assembly, Wire List, Rear View and Pin Connections. (Continued)

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPER CAB WIRE #	TO	TERM	LUG	NOTES
J2	07	C	-	16	316	A4TB1	5	B133	-
J2	08	C	-	16	304	A4TB1	6	B133	-
J2	09	C	-	16	365	A4TB1	12	B133	-
J2	10	C	-	16	401	A4TB2	14	B133	-
J2	11	C	-	16	402	A4TB2	15	B133	-
J2	12	C	-	16	403	A4TB2	13	B133	-
J2	13	C	-	16	-	-	-	-	-
J2	14	C	-	16	370	A4TB2	13	B133	-
J2	15	C	-	16	371	A4TB2	14	B133	-
J2	16	C	-	16	354	A4TB4	18	B133	-
J2	17	C	-	16	361	A4TB2	17	B133	-
J2	18	C	-	16	331	A4TB2	2	B133	-
J2	19	C	-	16	330	A4TB2	1	B133	-
J2	20	C	-	16	333	A4TB2	4	B133	-
J2	21	C	-	16	332	A4TB2	3	B133	-
J2	22	C	-	16	335	A4TB2	6	B133	-
J2	23	C	-	16	334	A4TB2	5	B133	-
J2	24	C	-	16	337	A4TB2	8	B133	-
J2	25	C	-	16	336	A4TB2	7	B133	-
J2	26	C	-	16	339	A4TB2	10	B133	-
J2	27	C	-	16	338	A4TB2	9	B133	-
J2	28	C	-	16	341	A4TB2	12	B133	-
J2	29	C	-	16	340	A4TB2	11	B133	-
J2	30	C	-	-	-	-	-	-	SPARE
J2	31	C	-	16	416	A4TB7	8	B133	-
J2	32	-	-	-	-	-	-	-	SPARE
J2	33	C	-	16	0	A4TB11	2	B133	-
J2	34	C	-	-	-	-	-	-	SPARE

Table 18. Port Receptacle A6 Assembly, Wire List, Rear View and Pin Connections. (Continued)

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPER CAB WIRE #	TO	TERM	LUG	NOTES
J2	35	C		16	418	A4TB7	4	B133	-
J2	36	C	-	-	-	-	-	-	SPARE
J2	37	C	-	-	-	-	-	-	SPARE
J3	1	C	1-SHD	16	0	A4TB6	3	B133	-
J3	2	C	1-BK	16	395	A4TB1	15	B133	-
J3	3	C	1-WH	16	396	A4TB1	16	B133	-
J3	4	C	1-RD	16	397	A4TB1	17	B133	-
J3	5	C	2-BK	16	409	A4TB6	1	B133	-
J3	6	C	2-WH	16	410	A4TB6	2	B133	-
J3	7	C	2-SHD	16	0	A4TB6	3	B133	-
J3	8	C	2-RD	16	-	-	-	-	SPARE
J3	9	C	3-BK	16	411	A4TB6	4	B133	-
J3	10	C	4-BK	16	313	A4TB1	2	B133	-
J3	11	C	4-WH	16	314	A4TB1	3	B133	-
J3	12	C	4-RD	16	315	A4TB1	1	B133	-
J3	13	C	3-SHD	16	0	A4TB6	3	B133	-
J3	14	C	3-WH	16	412	A4TB6	5	B133	-
J3	15	C	3-RD	-	-	-	-	-	SPARE
J3	16	C	4-SHD	16	0	A4TB11	-		-
J3	17	C	5-BK	16	317	A4TB1	4	B133	-
J3	18	C	5-WH	16	417	A4TB7	1	B133	-
J3	19	C	5-RD	16	419	A4TB7	2	B133	-
J3	20	C	5-SHD	16	0	A4TB11	-	-	-
J3	21	C	6-BK	16	407	A4TB7	3	B133	SPARE
J3	22	C	6-WH	16	408	A4TB7	6	B133	SPARE
J3	23	C	7-BK	16	-	-	-	-	SPARE
J3	24	C	7-WH	16	-	-	-	-	SPARE
J3	25	C	7-RD	16	-	-	-	-	SPARE

Table 18. Port Receptacle A6 Assembly, Wire List, Rear View and Pin Connections. (Continued)

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPER CAB WIRE #	TO	TERM	LUG	NOTES
J3	26	C	7-SHD	16	0	-	-	-	SPARE
J3	27	C	6-RD	16	420	A4TB6	7	B133	-
J3	28	C	6-SHD	16	0	A4TB7	5		-
J3	29	C	N/C	-	-	-	-	-	-
J3	30	C	N/C	-	-	-	-	-	-
J3	31	C	N/C	-	-	-	-	-	-
J3	32	C	N/C	-	-	-	-	-	-
J3	33	C	N/C	-	-	-	-	-	-
J3	34	C	N/C	-	-	-	-	-	-
J3	35	C	N/C	-	-	-	-	-	-
J3	36	C	N/C	-	-	-	-	-	-
J3	37	C	N/C	-	-	-	-	-	-
J4	1	C	-	16	500	A4TB1	19	B133	-
J4	2	C	-	16	501	A4TB1	20	B133	-
J4	4	C	-	16	503	A4TB3	20	B133	-
J4	3	C	-	16	502	A4TB3	19	B133	-
J4	5	C	-	16	504	A4TB4	19	B133	-
J4	6	C	-	16	505	A4TB4	20	B133	-
J4	7	C	-	16	138	A4TB5	10	B133	-
J4	8	C	-	-	-	-	-	-	SPARE
J4	9	C	-	-	-	-	-	-	SPARE
J4	10	C	-	16	301A	A4TB5	18	B133	-
J4	11	C	-	16	301	A4TB5	16	B133	-
J4	12	C	-	-	-	-	-	-	SPARE
J4	13	C	-	-	-	-	-	-	SPARE
J4	14	C	-	-	-	-	-	-	SPARE
J4	15	C	-	-	-	-	-	-	SPARE
J4	16	C	-	-	-	-	-	-	SPARE

Table 18. Port Receptacle A6 Assembly, Wire List, Rear View and Pin Connections. (Continued)

CONNECTOR	PIN	TYPE	CABLE WIRE #	SIZE	OPER CAB WIRE #	TO	TERM	LUG	NOTES
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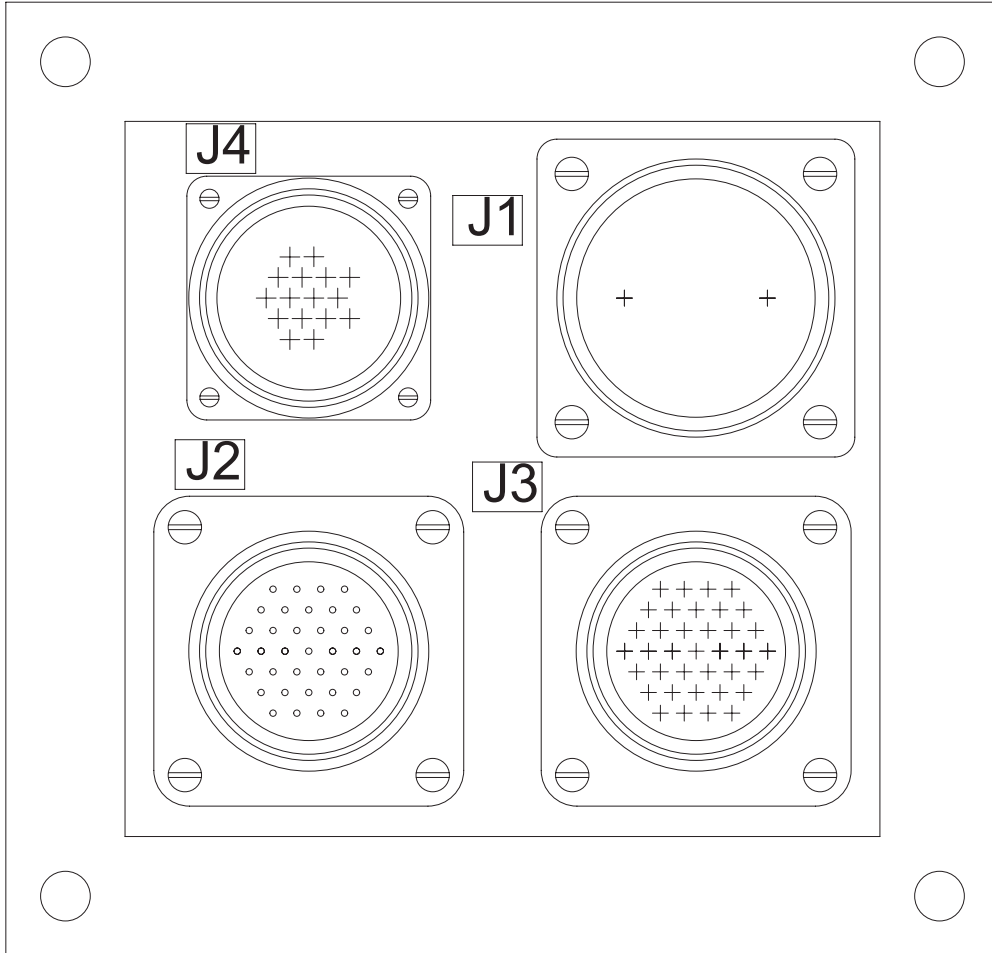


Table 18. Port Receptacle A6 Assembly, Wire List, Rear View and Pin Connections. (Continued)

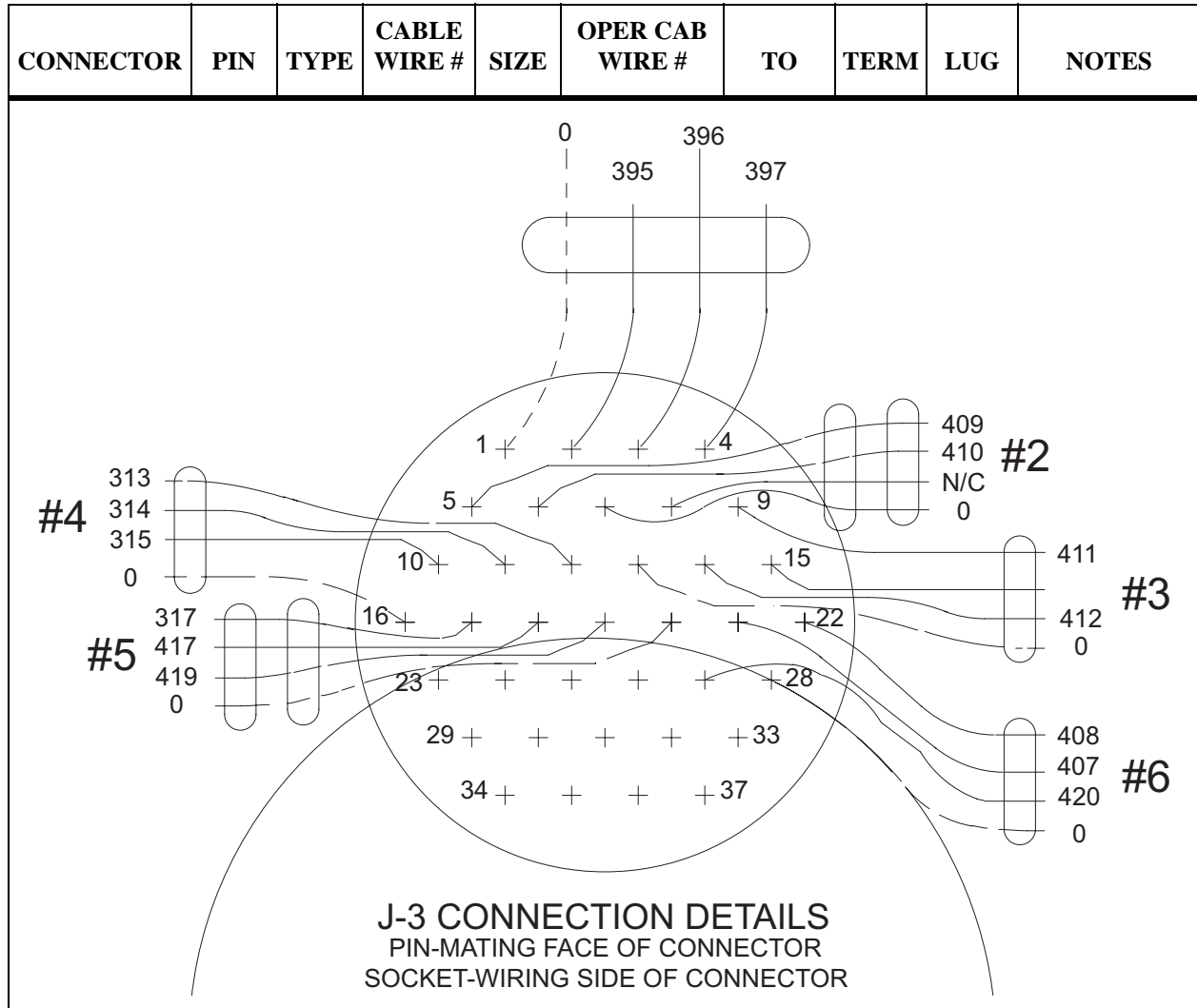


Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views.

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
TB6	A5	-	0	16	TB6	A6	-	JUMPERS
TB6	A6	-	0	16	TB6	A7	-	JUMPERS
TB6	A7	-	0	16	TB6	A8	-	JUMPERS
TB6	A8	-	0	16	TB6	A9	-	JUMPERS
TB6	A9	-	0	16	TB6	A10	-	JUMPERS
TB6	A10	-	0	16	TB6	A11	-	JUMPERS
TB6	B5	-	0	20	DS1	(-)	-	JUMPERS
DS1	(-)	-	0	20	DS11	(-)	-	JUMPERS
DS11	(-)	-	0	20	DS10	(-)	-	JUMPERS

Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
DS10	(-)	-	0	20	DS2-A	(-)	-	JUMPERS
DS2-A	(-)	-	0	20	DS2-B	(-)	-	JUMPERS
DS2-B	(-)	-	0	20	DS7	(-)	-	JUMPERS
DS7	(-)	-	0	20	DS6	(-)	-	JUMPERS
DS6	(-)	-	0	20	DS3-A	(-)	-	JUMPERS
DS3-A	(-)	-	0	20	DS3-B	(-)	-	JUMPERS
DS3-B	(-)	-	0	20	DS9	(-)	-	JUMPERS
DS9	(-)	-	0	20	DS8	(-)	-	JUMPERS
TB6	B6	-	0	20	DS5-A	(-)	-	JUMPERS
DS5-A	(-)	-	0	20	DS5-B	(-)	-	JUMPERS
DS5-B	(-)	-	0	20	DS4-A	(-)	-	JUMPERS
DS4-A	(-)	-	0	20	DS4-B	(-)	-	JUMPERS
DS4-B	(-)	-	0	20	DS12-A	(-)	-	JUMPERS
DS12-A	(-)	-	0	20	DS12-B	(-)	-	JUMPERS
DS12-B	(-)	-	0	20	LS1	(-)	-	JUMPERS
TB6	B2	-	532	20	TB5	B17	-	JUMPERS
TB5	B17	-	532	20	TB5	B6	-	JUMPERS
TB5	B6	-	532	20	TB4	B15	-	JUMPERS
TB4	B15	-	532	20	TB4	B4	-	JUMPERS
TB4	B4	-	532	20	TB3	B14	-	JUMPERS
TB3	B14	-	532	20	TB3	B3	-	JUMPERS
TB3	B3	-	532	20	TB2	B13	-	JUMPERS
TB2	B13	-	532	20	TB2	B2	-	JUMPERS
TB2	B2	-	532	20	TB1	B10	-	JUMPERS
TB1	B10	-	532	20	TB1	A13	-	JUMPERS
TB1	A13	-	532	20	TB2	A5	-	JUMPERS
TB2	A5	-	532	20	TB2	A16	-	JUMPERS
TB2	A16	-	532	20	TB3	A6	-	JUMPERS
TB3	A6	-	532	20	TB3	A17	-	JUMPERS

Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
TB3	A17	-	532	20	TB4	A7	-	JUMPERS
TB4	A7	-	532	20	TB4	A18	-	JUMPERS
TB4	A18	-	532	20	TB5	A9	-	JUMPERS
TB6	A12	-	381	20	F1	1	-	#8
F1	1	-	381	14	F2	1	-	#8
F2	1	-	381	14	F3	1	-	#8
F3	1	-	381	14	F4	1	-	#8
F4	1	-	381	14	F5	1	-	#8
F5	1	-	381	14	F6	1	-	#8
F6	1	-	381	14	F7	1	-	#8
F7	1	-	381	14	F8	1	-	#8
F8	1	-	381	14	F9	1	-	#8
F1	2	-	500	18	S1	2	44	-
F2	2	-	502	18	S2	2	44	-
F3	2	-	505	18	S3	2	44	-
F4	2	-	508	18	S4	2	44	-
F5	2	-	511	18	S5	2	44	-
F6	2	-	517	18	S6	2	44	-
F7	2	-	519	18	S7	2	44	-
F8	2	-	514	18	S8	2	44	-
F9	2	-	521	18	S9	2	44	-
S1	3	44	501A	18	TB1	B9	-	-
K1	2	-	501A	-	TB1	A9	-	#9
K1	4	-	501	-	TB1	A11	-	#9
K1	1	-	531	-	TB1	A16	-	#9
TB1	A16	-	531	-	D1	1	-	#10
D1	2	-	532	-	TB1	A10	-	#10
K1	3	-	530	-	TB1	A15	-	#9
TB1	B15	-	530	20	DS1	(+)	-	-

Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
S2	3	44	503A	18	TB1	A12	-	-
K2	2	-	503A	-	TB1	B12	-	#9
K2	4	-	503	-	TB1	B14	-	#9
K2	1	-	533	-	TB1	B19	-	#9
TB1	B19	-	533	-	D2	1	-	#10
D2	2	-	532	-	TB1	B13	-	#10
K2	3	-	534	-	TB1	B18	-	#9
TB1	A18	-	534	20	DS2-A	(+)	-	-
S2	1	44	504A	18	TB2	B1	-	-
K3	2	-	504A	-	TB2	A1	-	#9
K3	4	-	504	-	TB2	A3	-	#9
K3	1	-	536	-	TB2	A8	-	#9
TB2	A8	-	536	-	D3	1	-	#10
D3	2	-	532	-	TB2	A2	-	#10
K3	3	-	535	-	TB2	A7	-	#9
TB2	B7	-	535	20	DS2-B	(+)	-	-
S3	3	44	506A	18	TB2	A4	-	-
K4	2	-	506A	-	TB2	B4	-	#9
K4	4	-	506	-	TB2	B6	-	#9
K4	1	-	537	-	TB2	B11	-	#9
TB2	B11	-	537	-	D4	1	-	#10
D4	3	-	532	-	TB2	B5	-	#10
K4	3	-	538	-	TB2	B10	-	#9
TB2	A10	-	538	20	DS3-A	(+)	-	-
S3	1	44	507A	18	TB2	B12	-	-
K5	2	-	507A	-	TB2	A12	0	#9
K5	4	-	507	-	TB2	A14	-	#9
K5	1	-	540	-	TB2	A19	-	#9
TB2	A19	-	540	-	D5	1	-	#10

Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
D5	2	-	532	-	TB2	A13	-	#10
K5	3	-	539	-	TB2	A18	-	#9
TB2	B18	-	539	20	DS3-B	(+)	-	-
S4	3	44	509A	18	TB2	A15	-	-
K6	2	-	509A	-	TB2	B15	-	#9
K6	4	-	509	-	TB2	B17	-	#9
K6	1	-	541	-	TB3	B1	-	#9
TB3	B1	-	541	-	D6	1	-	#10
D6	2	-	532	-	TB2	B16	-	#10
K6	3	-	542	-	TB2	B20	-	#9
TB2	A20	-	542	20	DS4-A	(+)	-	-
S4	1	44	510A	18	TB3	B2	-	-
K7	2	-	510A	-	TB3	A2	-	#9
K7	4	-	510	-	TB3	A4	-	#9
K7	1	-	544	-	TB3	A9	-	#9
TB3	A9	-	544	-	D7	1	-	#10
D7	2	-	532	-	TB3	A3	-	#10
K7	3	-	543	-	TB3	A8	-	#9
TB3	B8	-	543	20	DS4-B	(+)	-	-
S5	3	44	512A	18	TB3	A5	-	-
K8	2	-	512A	-	TB3	B5	-	#9
K8	4	-	512	-	TB3	B7	-	#9
K8	1	-	545	-	TB3	B12	-	#9
TB3	B12	-	545	-	D8	1	-	#10
D8	2	-	532	-	TB3	B6	-	#10
K8	3	-	546	-	TB3	B11	-	#9
TB3	A11	-	546	20	DS5-A	(+)	-	-
S5	1	44	513A	18	TB3	B13	-	-
K9	2	-	513A	-	TB3	A13	-	#9

Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
K9	4	-	513	-	TB3	A15	-	#9
K9	1	-	548	-	TB3	A20	-	#9
TB3	A20	-	548	-	D9	1	-	#10
D9	2	-	532	-	TB3	A14	-	#10
K9	3	-	547	-	TB3	A19	-	#9
TB3	B19	-	547	20	DS5-B	(+)	-	-
S8	3	44	515A	18	TB3	A16	-	-
K10	2	0	515A	-	TB3	B16	-	#9
K10	4	-	515	-	TB3	B18	-	#9
K10	1	-	549	-	TB4	B2	-	#9
TB4	B2	-	549	-	D10	1	-	#10
D10	2	-	532	-	TB3	B17	-	#10
K10	3	-	550	-	TB4	B1	-	#9
TB4	A1	-	550	20	DS12-A	(+)	-	-
S8	1	44	516A	18	TB4	B3	-	-
K11	2	-	516A	-	TB4	A3	-	#9
K11	4	-	516	-	TB4	A5	-	#9
K11	1	-	552	-	TB4	A10	-	#9
TB4	A10	-	552	-	D11	1	-	#10
D11	2	-	532	-	TB4	A4	-	#10
K11	3	-	551	-	TB4	A9	-	#9
TB4	B9	-	551	20	DS12-B	(+)	-	-
S6	3	44	518A	18	TB4	A6	-	-
TB4	A6	-	518A	18	TB4	A14	-	-
K12	2	-	518A	-	TB4	A14	-	-
K12	4	-	518	-	TB4	B8	-	#9
K12	1	-	553	-	TB4	B13	-	#9
TB4	B13	-	553	-	D12	1	-	#10
D12	2	-	532	-	TB4	B7	-	#10

Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
K12	3	-	554	-	TB4	B12	-	#9
TB4	A12	-	554	20	DS6	(+)	-	-
K13	2	-	518A	-	TB4	A14	-	#9
K13	4	-	518B	-	TB4	A16	-	#9
K13	1	-	556	-	TB5	A1	-	#9
TB5	A1	-	556	-	D13	1	-	#10
D13	2	-	532	-	TB4	A15	-	#10
K13	3	-	555	-	TB4	A20	0	#9
TB4	B20	-	555	20	DS7	(+)	-	-
S7	3	44	520A	18	TB4	A17	-	-
TB4	A17	-	520A	18	TB5	A5	-	-
K14	2	-	520A	-	TB4	B17	-	#9
K14	4	-	520	-	TB4	B19	-	#9
K14	1	-	557	-	TB5	B3	-	#9
TB5	B3	-	557	-	D14	1	-	#10
D14	2	-	532	-	TB4	B18	-	#10
K14	3	-	558	-	TB5	B2	-	#9
TB5	A2	-	558	20	DS8	(+)	-	-
K15	2	-	520A	-	TB5	A5	-	#9
K15	4	-	520B	-	TB5	A7	-	#9
K15	1	-	560	-	TB5	A12	-	#9
TB5	A12	-	560	-	D15	1	-	#10
D15	2	-	532	-	TB5	A6	-	#10
K15	3	-	559	-	TB5	A11	-	#9
TB5	B11	-	559	20	DS9	(+)	-	-
S9	3	44	522A	18	TB5	A8	-	-
TB5	A8	-	522A	18	TB5	A16	-	-
K16	2	-	522A	-	TB5	B8	-	#9
K16	4	-	522	-	TB5	B10	-	#9

Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
K16	1	-	561	-	TB5	B15	-	#9
TB5	B15	-	561	-	D16	1	-	#10
D16	2	-	532	-	TB5	B9	-	#10
K16	3	-	562	-	TB5	B14	-	#9
TB5	A14	-	562	20	DS10	(+)	-	-
K17	2	-	522A	-	TB5	A16	-	#9
K17	4	-	522B	-	TB5	A18	-	#9
K17	1	-	564	-	TB6	A1	-	#9
TB6	A1	-	564	-	D17	1	-	#10
D17	2	-	532	-	TB5	A17	-	#10
K17	3	-	563	-	TB5	A20	-	#9
TB5	B20	-	563	20	DS11	(+)	-	-
TB6	A2	-	532	20	S10	2	-	-
S10	3	-	565	20	LS1	(+)	-	-

Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

FROM	TERM	ITEM #	WIRE #	SIZE	TO	TERM	ITEM #	NOTES
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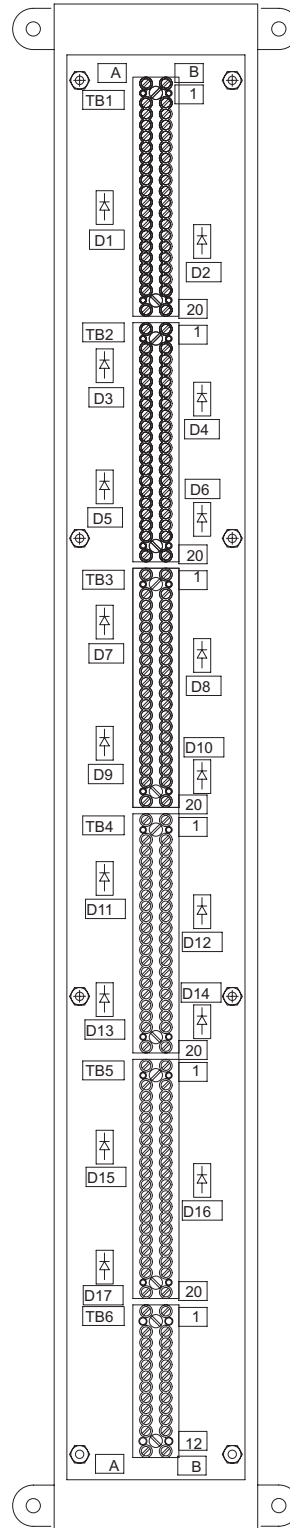
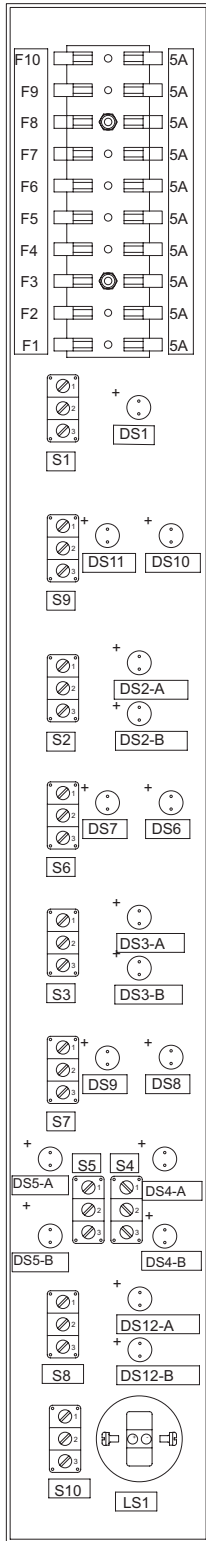


Table 19. Mast Enclosure Assembly A7, Wiring List and Rear Views. (Continued)

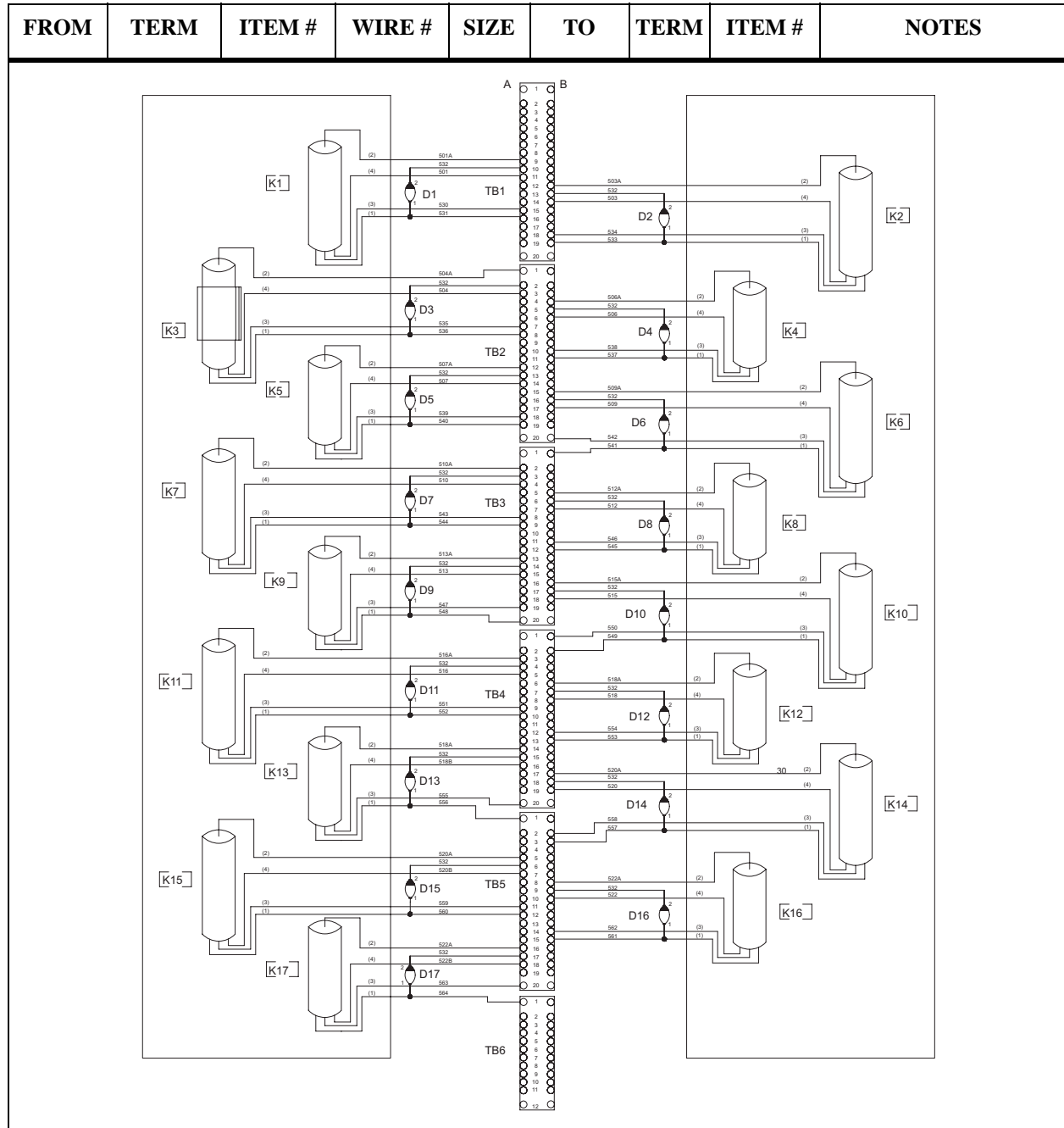


Table 20. Module Electrical Interconnect Assembly.

CONN ITEM #	PIN/ITEM #	TYPE	CABLE COND #	WIRE #	SIZE/AWG
12	A	S	1 WHITE	172	6
12	B	S	2 BLACK	0	6
11	01	17	1	112	16
11	02	17	2	113	16

Table 20. Module Electrical Interconnect Assembly. (Continued)

CONN ITEM #	PIN/ITEM #	TYPE	CABLE COND #	WIRE #	SIZE/AWG
11	03	17	3	110	16
11	04	17	4	111	16
11	05	17	5	114	16
11	06	17	6	115	16
11	07	17	7	124	16
11	08	17	8	104	16
11	09	17	9	129	16
11	10	17	10	173	16
11	11	17	11	174	16
11	12	17	12	175	16
11	13	17	13	SPARE	16
11	14	17	14	134	16
11	15	17	15	135	16
11	16	17	16	139	17
11	17	17	17	141	16
11	18	17	18	143	16
11	19	17	19	145	16
11	20	17	20	148	16
11	21	17	21	150	16
11	22	17	22	153	16
11	23	17	23	155	16
11	24	17	24	158	16
11	25	17	25	160	16
11	26	17	26	163	16
11	27	17	27	165	16
11	28	17	28	168	16
11	29	17	29	170	16
11	30	17	30	181	16
11	31	17	31	180	16

Table 20. Module Electrical Interconnect Assembly. (Continued)

CONN ITEM #	PIN/ITEM #	TYPE	CABLE COND #	WIRE #	SIZE/AWG
11	32	17	32	SPARE	16
11	33	17	33	0	16
11	34	17	34	190	16
11	35	17	35	178	16
11	36	17	36	187	16
11	37	17	37	SPARE	16
13	01	18	1-SHD	0	18
13	02	18	1-BK	119	18
13	03	18	1-WH	121	18
13	04	18	1-RD	120	18
13	05	18	2-BK	185	18
13	06	18	2-WH	186	18
13	07	18	2-SHD	0	18
13	08	18	2-RD	SPARE	18
13	09	18	3-BK	182	18
13	10	18	4-BK	125	18
13	11	18	4-WH	126	18
13	12	18	4-RD	127	18
13	13	18	3-SHD	0	18
13	14	18	3-WH	183	18
13	15	18	3-RD	SPARE	18
13	16	18	R-SHD	0	18
13	17	18	5-BK	132	18
13	18	18	5-WH	212	18
18	19	18	5-RD	211	18
13	20	18	5-SHD	0	18
13	21	18	6-BK	205	18
13	22	18	6-WH	206	18
13	23	18	7-BK	SPARE	18

Table 20. Module Electrical Interconnect Assembly. (Continued)

CONN ITEM #	PIN/ITEM #	TYPE	CABLE COND #	WIRE #	SIZE/AWG
13	24	18	7-WH	SPARE	18
13	25	18	7-RD	SPARE	18
13	26	18	7-SHD	SPARE	18
13	27	18	6-RD	210	18
13	28	18	6-SHD	0	18
13	29	18	N/C	-	16
13	30	18	N/C	-	16
13	31	18	N/C	-	16
13	32	18	N/C	-	16
13	33	18	N/C	-	16
13	34	18	N/C	-	16
13	35	18	N/C	-	16
13	36	18	N/C	-	16
13	37	18	N/C	-	16
15	A	S	1 WHITE	172	6
15	B	S	2 BLACK	0	6
14	01	18	1	112	16
14	02	18	2	113	16
14	03	18	3	110	16
14	04	18	4	111	16
14	05	18	5	114	16
14	06	18	6	115	16
14	07	18	7	124	16
14	08	18	8	104	16
14	09	18	9	129	16
14	10	18	10	173	16
14	11	18	11	174	16
14	12	18	12	175	16
14	13	18	13	SPARE	16

Table 20. Module Electrical Interconnect Assembly. (Continued)

CONN ITEM #	PIN/ITEM #	TYPE	CABLE COND #	WIRE #	SIZE/AWG
14	14	18	14	134	16
14	15	18	15	135	16
14	16	18	16	139	16
14	17	18	16	141	16
14	18	18	18	143	16
14	19	18	19	145	16
14	20	18	20	148	16
14	21	18	21	150	16
14	22	18	22	153	16
14	23	18	23	155	16
14	24	18	24	158	16
14	25	18	25	160	16
14	26	18	26	163	16
14	27	18	27	165	16
14	28	18	28	168	16
14	29	18	29	170	16
14	30	18	30	181	16
14	31	18	31	180	16
14	32	18	32	SPARE	16
14	33	18	33	0	16
14	34	18	34	190	16
14	35	18	35	178	16
14	36	18	36	187	16
14	37	18	37	SPARE	16
16	01	17	1-SHD	0	18
16	02	17	1-BK	119	18
16	03	17	1-WH	121	18
16	04	17	1-RD	120	18
16	05	17	2-BK	185	18

Table 20. Module Electrical Interconnect Assembly. (Continued)

CONN ITEM #	PIN/ITEM #	TYPE	CABLE COND #	WIRE #	SIZE/AWG
16	06	17	2-WH	186	18
16	07	17	2-SHD	0	18
16	08	17	2-RD	SPARE	18
16	09	17	3-BK	182	18
16	10	17	4-BK	125	18
16	11	17	4-WH	126	18
16	12	17	4-RD	127	18
16	13	17	3-SHD	0	18
16	14	17	3-WH	183	18
16	15	17	3-RD	SPARE	18
16	16	17	4-SHD	0	18
16	17	17	5-BK	132	18
16	18	17	5-WH	212	18
16	19	17	5-RD	211	18
16	20	17	5-SHD	0	18
16	21	17	6-BK	205	18
16	22	17	6-WH	206	18
16	23	17	7-BK	SPARE	18
16	24	17	7-WH	SPARE	18
16	25	17	7-RD	SPARE	18
16	26	17	7-SHD	SPARE	18
16	27	17	6-RD	210	18
16	28	17	6-SHD	0	18
16	29	17	N/C	-	16
16	30	17	N/C	-	16
16	31	17	N/C	-	16
16	32	17	N/C	-	16
16	33	17	N/C	-	16
16	34	17	N/C	-	16

Table 20. Module Electrical Interconnect Assembly. (Continued)

CONN ITEM #	PIN/ITEM #	TYPE	CABLE COND #	WIRE #	SIZE/AWG
16	35	17	N/C	-	16
16	36	17	N/C	-	16
16	37	17	N/C	-	17
23	01	18	1	146	16
23	02	18	2	151	16
23	03	18	3	156	16
23	04	18	4	161	16
23	05	18	5	166	16
23	06	18	6	171	16
23	07	18	7	138	16
23	08	18	8	NOTE 2	16
23	09	18	9	NOTE 2	16
23	10	18	10	220	16
23	11	18	11	221	16
23	12	18	12	SPARE	16
23	13	18	13	SPARE	16
23	14	18	14	SPARE	16
23	15	18	15	SPARE	16
23	16	18	16	SPARE	16
23	N/C	-	17	SPARE	16
23	N/C	-	18	SPARE	16
23	N/C	-	19	SPARE	16
26	01	17	1	146	16
26	02	17	2	151	16
26	03	17	3	156	16
26	04	17	4	161	16
26	05	17	5	166	16
26	06	17	6	171	16
26	07	17	7	138	16

Table 20. Module Electrical Interconnect Assembly. (Continued)

CONN ITEM #	PIN/ITEM #	TYPE	CABLE COND #	WIRE #	SIZE/AWG
26	08	17	8	-	16
26	09	17	9	-	16
26	10	17	10	220	16
26	11	17	11	221	16
26	12	17	12	-	16
26	13	17	13	-	16
26	14	17	14	SPARE	16
26	15	17	15	SPARE	16
26	16	17	16	SPARE	16
26	N/C	-	17	SPARE	16
26	N/C	-	18	SPARE	16
26	N/C	-	19	SPARE	16

CHAPTER 4

**SUPPORTING INFORMATION
FOR
MODULAR CAUSEWAY SYSTEM (MCS)
WARPING TUG (WT)**

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
REFERENCES**

SCOPE

This work package lists all field manuals, forms, technical manuals and miscellaneous publications referenced in this manual.

ARMY REGULATIONS

AR 700-138 Army Logistics Readiness and Sustainability

CODE OF FEDERAL REGULATIONS

29 CFR Labor, Parts 1911 to 1925

46 CFR Shipping, Parts 90 to 139

DA PAMPHLETS

DA PAM 40-501 Hearing Conservation Program

DA PAM 738-750 Functional User's Manual For The Army Maintenance Management System (TAMMS)

FIELD MANUALS

FM 3-5 NBC, Decontamination

FM 55-502 Army Watercraft Safety

FORMS

DA Form 2028 Recommended Changes to Publications and Blank Forms

DA Form 2404 Equipment Inspection and Maintenance Worksheet

SF 361 Transportation Discrepancy Report

SF 368 Product Quality Deficiency Report

MISCELLANEOUS

ASME Y14.38-1999 The American Society of Mechanical Engineers Abbreviations and Acronyms

CTA 8-100 Common Table of Allowances, Army Medical Department Expendable/Durable Items

CTA 50-970 Common Table of Allowances, Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items)

DOD-PRF-24648 Primer Coating, Zinc Dust Pigmented for Exterior Steel Surfaces

MIL-PRF-23236 Paint Coating Systems, Fuel and Salt Water Ballast Tanks (Metric)

SSPC SP-10 Steel Structures Painting Council, SP-10 Near-White Blast Cleaning

SUPPLY CATALOG

SC 4910-95-A68 Shop Equipment, Automotive Maintenance and Repair: Field Maintenance, Wheeled Vehicle, Post, Camp and Station, Set C. Less Power

SC 4910-95-A72 Shop Equipment, Automotive Equipment and Repair, Organizational Maintenance

SC 4920-99-A16 Sets, Kits and Outfits, Shop Set, Aircraft Maintenance, Fixed Base: Electrical

SC 5180-95-N26 Tool Kit, General Mechanics

SC 5180-90-N55 Sets, Kits and Outfits for Tool Kit, General Mechanics, Diesel Engine

TECHNICAL BULLETIN

TB 9-6140-200-14 Operator's, Unit, Direct Support and General Support Maintenance Manual for Lead-Acid Storage Batteries

TB 43-0144 Painting of Watercraft

TB 55-1900-207-24 Treatment of Cooling Water in Marine Diesel Engines

TECHNICAL MANUALS

TM 5-805-7 Welding: Design, Procedures and Inspection, for Minor Weld Repairs

TM 11-5820-890-20-3 Unit Level Maintenance Handbook for SINCGARS ICOM Ground Radios

TM 11-5825-291-13 Operations and Maintenance Manual, Satellite Signals Navigation Sets

TM 55-1945-205-24-3-4 Unit, Direct Support and General Maintenance, Warping Tug Transfer Case

TM 55-1945-222-14&P Unit, Direct Support and General Maintenance, Warping Tug Diesel Engine

TM 55-1945-223-14&P Unit, Direct Support and General Maintenance, Warping Tug Marine Gear

TM 55-1945-225-10 Operators Manual for the Modular Causeway System, Warping Tug

TM 55-1945-225-24P Unit, Direct Support and General Maintenance, Repair Parts and Special Tools List, Warping Tug

TM 55-3950-204-14&P Operation and Maintenance Instructions With Parts List for Winch, Side-Loadable Warping Tug

TM 750-244-6 Procedures for Destruction of Tank-Automotive Equipment

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
MAINTENANCE ALLOCATION CHART (MAC)**

INTRODUCTION

The Army Maintenance System MAC

This introduction provides a general explanation of all maintenance and repair functions authorized at various levels under the standard Army Maintenance System concept.

The MAC (immediately following the introduction) designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities of the designated maintenance levels, which are shown on the MAC in column (4) as:

Unit - includes two subcolumns, C (operator/crew) and O (unit) maintenance.

Direct Support - includes an F subcolumn.

General Support - includes an H subcolumn.

Depot - includes a D subcolumn.

The tools and test equipment requirements (immediately following the MAC) list the tools and test equipment, both special tools and common tool sets, required for each maintenance function as referenced from the MAC.

The remarks (immediately following the tools and test equipment requirements) contain supplemental instructions and explanatory notes for a particular maintenance function.

Maintenance Functions

Maintenance functions are limited to and defined as follows:

1. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical and/or electrical characteristics with established standards through examination, e.g., by sight, sound or feel. This includes scheduled inspection and gaugings and evaluation of cannon tubes.
2. **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.
3. **Service.** Operations required periodically to keep an item in proper operating conditions; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint or to replenish fuel, lubricants, chemical fluids or gases. This includes scheduled exercising and purging of recoil mechanisms.
4. **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.
5. **Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.

6. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.
7. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating or fixing into position a spare, repair part or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.
8. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.
9. Repair. The application of the maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction or failure in a part, subassembly, module (component or assembly), end item or system.

NOTE

The following definitions are applicable to the "repair" maintenance function:

Services - inspect, test, service, adjust, align, calibrate and/or replace.

Fault location/troubleshooting - the process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).

Disassembly/assembly - the step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

Actions - welding, grinding, riveting, straightening, facing, machining and/or resurfacing.

10. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.
11. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

Explanation of Columns in the MAC

Column (1) - Group Number. Column (1) lists FGC numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

Column (2) - Component/Assembly. Column (2) contains the item names of components, assemblies, subassemblies and modules for which maintenance is authorized.

Column (3) - Maintenance Function. Column (3) lists the functions to be performed on the item listed in column (2). For a detailed explanation of these functions refer to "Maintenance Functions" outlined above.

Column (4) - Maintenance Level. Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level. The work time figures represent the average time required to restore an item (assembly, subassembly, component, module, end item or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

C - Operator or crew maintenance

O - Unit maintenance

F - Direct support maintenance

L - Specialized Repair Activity (SRA)

H - General support maintenance

D - Depot maintenance

NOTE

The "L" maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by a work time figure in the "H" column of column (4) and an associated reference code is used in the remarks column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

Column (5) - Tools and Equipment Reference Code. Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

Column (6) - Remarks Code. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

Explanation of Columns in the Tools and Test Equipment Requirements

Column (1) - Tool or Test Equipment Reference Code. The tool or test equipment reference code correlates with a code used in column (5) of the MAC.

Column (2) - Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

Column (3) - Nomenclature. Name or identification of the tool or test equipment.

Column (4) - National Stock Number (NSN). The NSN of the tool or test equipment.

Column (5) - Tool Number. The manufacturer's part number, model number or type number.

Explanation of the Columns in the Remarks

Column (1) - Remarks Code. The code recorded in column (6) of the MAC.

Column (2) - Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
MAINTENANCE ALLOCATION CHART**

MAINTENANCE ALLOCATION CHART

Table 1. Maintenance Allocation Chart. (MAC)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
00	MODULAR CAUSEWAY SYSTEM (MCS)								
02	ROLL-ON/ROLL-OFF DISCHARGE FACILITY (RRDF)								
03	WARPING TUG (WT)								
0301	POWERED SECTION	Inspect	2.0	6.0	2.0	4.0		1	P
		Test	0.5						
		Service	2.0	6.0	2.0				
		Replace		1.0					
		Repair				6.0		1, 24, 28, 15	D
030101	PROPULSION MODULE	Inspect	4.0					1, 15, 7, 23, 4, 25	P
		Test	0.5						
		Service	4.0						
		Repair	2.0			4.0			D
03010101	ENGINE COOLING SYSTEM	Inspect	0.5						P
		Test	0.5						
		Service	4.0						
		Replace		2.0				1, 4	
		Repair		0.5	1.5			1, 26, 29	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
0301010101	DUPLEX STRAINER	Service		1.5				1	
		Adjust		0.5					
		Replace		1.0				1, 4, 37	
		Repair			1.0			1	
03010102	DRIVE TRAIN INSTALLATION	Inspect	1.0	1.5				1	P
		Service	0.5	0.5				1	
		Align			2.0			1	
		Replace	0.5		1.0			1, 28, 37, 3	
		Repair				2.0			

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL				(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE	
			UNIT		DS	GS			DEPOT
			C	O	F	H			D
0301010201	DIESEL ENGINE	Replace			2.0			1,14,4,25, 28,31,37	A
		Repair			8.0			1,14,25, 28,49,50, 51,52,53, 54,55,56, 57,58,59, 60,61,62, 63,64,65, 66,67,68, 69,70,71, 72,73,74, 75,76,77, 78,79,80, 81,82,83, 84,85,86, 87,88,89, 90,91,92, 93,94,95, 96,97, 98,99, 100,101, 102,103, 104,105, 106,107, 108,109, 110,111, 112,113, 114,115, 116,117, 118,119, 120,121, 122,123, 124,125, 126,127, 128,129, 130,131, 132,133, 134,135, 136,137, 138,139, 140,141, 142,143, 144,145, 146,147,	A

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
0301010201	DIESEL ENGINE (CONT'D)	Repair			8.0			148,149, 150,151, 152,153, 154,155, 156,157, 158,159, 160,161, 162,163, 164,165, 166,167, 168,169, 170,171, 172,173, 174,175, 176,177, 178,179, 180	
0301010202	MARINE GEAR	Replace			2.0				B
		Repair				4.0		42, 43, 44, 45, 46, 47, 48	
0301010203	TRANSFER CASE	Replace				1.0			C
		Repair				4.0		1	
0301010204	THRUSTER (PUMP-JET)	Inspect	0.5	0.5				1, 3, 4, 40, 41	P
		Service	1.0	1.5				1, 4, 22	
		Replace				0.5			
		Repair				10.0		1, 4	D
030101020401	UPPER GEAR BOX	Replace			3.0				
030101020402	HYDRO-MOTOR	Replace			2.0			1, 4	
030101020403	PLANETARY GEARING	Replace			2.0			1, 4	
030101020404	FEEDBACK UNIT	Adjust		0.5				1	
		Replace			0.5			1, 4	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
030101020405	PLANETARY GEARING	Replace			2.0			1, 4	
0301010205	FAST LUBE OIL CHG SYS	Replace		0.5					
		Repair		0.5					
0301010206	TANK ASSEMBLY	Replace		0.5					
		Repair		0.5				1, 23	
03010103	MACHINERY GUARD INSTALLATION	Replace		0.5				1	
		Repair		0.5					
03010104	ENGINE EXHAUST SYSTEM INSTALATION	Replace			4.0				
		Repair			2.0			1, 15, 30	
0301010401	MUFFLER ASSEMBLY	Replace			4.0			1, 23, 30	
		Repair		0.5					
0301010402	THRU-HULL ASSEMBLY	Replace			0.5				
0301010403	RETAINER ASSEMBLY	Replace			0.5				
03010105	HYDRAULIC SYSTEM INSTALLATION	Inspect	1.0	3.0				1	P
		Service	6.0						
		Adjust		1.0				1, 9, 38	
		Replace			4.0			1, 2, 19, 34, 35, 36	
		Repair			1.0			1, 2, 19, 34, 35, 36	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
0301010501	HYDRO-PUMP INSTALLATION	Adjust		1.0					
		Replace		1.0				1, 4, 22	
		Repair			1.0				
030101050101	PUMP	Replace		1.0				1, 4	
		Repair				4.0		1	
0301010502	VALVE UNIT	Replace		1.0					
		Repair				1.0			
030101050201	VALVE	Replace		1.0				1, 4	
		Repair				2.5		1	
0301010503	HYDRO-HAND PUMP INSTALLATION	Inspect	0.2						
		Service		0.2				1, 4	
		Replace		1.0				1	
030101050301	HAND PUMP	Replace		1.0				1, 4	
0301010504	BALL VALVE	Replace		0.5				1, 4	
		Repair		0.5				1	
0301010505	HYDRAULIC RESERVIOR ASSEMBLY	Replace		2.0				1, 30	
		Repair		2.0				1, 4	
030101050501	RETURN FILTER	Replace		0.5				1, 4, 22	
030101050502	INSPECTION COVER	Replace		0.5				1	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
03010106	BILGE SYSTEM INSTALLATION	Inspect	1.0						P
		Test	0.1						
		Replace		2.0				1	
		Repair		3.0				1, 4	
0301010601	BILGE PUMP	Replace		1.0				1	
03010107	FIRE SUPPRESSION SYSTEM	Inspect	0.25						
		Test				0.5			P
		Service				1.0			
		Install				1.0			
		Replace				1.0			
		Repair				1.0		4	D
03010108	FUEL SYSTEM	Inspect	0.5						P
		Service	0.5	1.0				1, 10	
		Replace		1.0				1, 4	
		Repair		2.5				1, 4, 27	
03010109	PROPULSION MODULE ELECTRICAL ASSEMBLY	Inspect	0.5						P
		Test	0.5						
		Replace		0.5	2.0			1	
		Repair			2.0			1, 4	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
0301010901	BILGE PUMP CONTROL ASSEMBLY	Inspect	0.25						P
		Replace			2.0			1	
		Repair			1.5			1, 4	
0301010902	SINGLE BILGE PUMP CONTROL ASSEMBLY	Inspect	0.25	0.25				1	P
		Replace			2.0			1	
		Repair			1.5			1, 4	
0301010903	ENGINE JUNCTION BOX ASSEMBLY	Inspect	0.25						P
		Replace			2.0			1	
		Repair			1.5			1, 4	
0301010904	PROPULSION MODULE JUNCTION BOX ASSEMBLY	Inspect	0.25	0.25				1	P
		Replace			2.0			1	
		Repair			1.5			4	
0301010905	CIRCUIT BREAKER PANEL ASSEMBLY	Inspect	0.25	0.25					P
		Replace			2.0			1	
		Repair			1.5			4	
0301010906	BATTERY INSTALLATION	Inspect	0.5						P
		Service	1.5	0.5				1, 4	
		Replace			0.5			1, 4	
		Repair			1.5			1, 2	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
0301010907	VENT FAN RELAY ENCLOSURE ASSEMBLY	Inspect	0.25	0.25				1	P
		Replace			2.0			1	
		Repair			1.5			1, 4	
0301010908	PUMP-JET JUNCTION BOX	Inspect	0.25						P
		Replace			2.0			1	
		Repair			1.5			1	
0301010909	PUMP-JET DIRECTION/AUX BATTERY JUNCTION BOX	Inspect	0.25	0.25					P
		Replace			2.0			1	
		Repair			1.5			1	
03010110	EMERGENCY STEERING SYSTEM	Inspect	0.5						P
		Service	0.5						
		Replace		0.5					1
		Repair		2.5					1
030102	NON-POWERED MODULES EXTERIOR	Inspect	1.0					1, 3	P
		Test		6.0				1, 8, 32	
		Service	1.5	4.0				1, 23	
		Repair		4.0				1	
		Overhaul				24.0			

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
03010201	GUILLOTINE	Inspect	0.5						P
		Service		1.0				1, 4	
		Replace		1.0					
		Repair		3.0				1, 4	
03010202	CONNECTOR	Inspect	0.5						P
		Replace		1.0					
03010203	SPRING PIN	Inspect	0.5						P
		Replace		1.0					
03010204	LOCK PLATE	Inspect	0.5						P
		Replace		1.0					
03010205	HATCH ASSEMBLY (P20LRP & RRP)	Inspect	0.5						P
		Service	0.5						
		Replace			3.0				
		Repair			1.0				
030103	FLEXOR ASSEMBLY	Inspect	1.0						P
		Replace	1.0						
		Repair				8.0			
030104	OPERATORS CAB ASSEMBLY	Replace		1.0				1, 24, 28	
		Repair			1.0			1	
03010401	MIDDLE CONTROL PANEL	Inspect			2.0				
		Test			2.0				
		Replace			16.0			1	
		Repair			3.0			1, 2, 4	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
03010402	LOWER CONTROL PANEL	Inspect			2.0				
		Test			2.0				
		Replace			16.0			1	
		Repair			3.0			1, 2, 4	
03010403	CIRCUIT BREAKER PANEL	Inspect			1.0				
		Test			1.0			4	
		Replace			12.0			1	
		Repair			2.0			1, 2, 4	
03010404	TERMINAL BOARD ASSEMBLY	Inspect			1.0				
		Test			1.0				
		Replace			10.0			1	
		Repair			2.0			1, 2, 4	
03010405	RECEPTICAL ASSEMBLY (PORT & STARBOARD)	Inspect			0.5				P
		Replace			1.0			1	
		Repair			2.0			1, 2, 4	
03010406	NAVIGATION HORN	Test	0.5						P
		Replace		0.5				1	
03010407	BATTLE LANTERN	Inspect	0.5						P
		Replace		0.5				1	
		Repair		1.0				1	
03010408	COMPASS	Inspect	2.0						P
		Replace		2.0				1, 4	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
03010409	WINDSHIELD WIPER	Replace		2.0					
		Repair		1.0				1	
03010410	VHF/FM PORTABLE RADIO SYSTEM	Replace	1.0						
0301041001		Replace		0.5				1, 4	
03010411	HEATER	Inspect	2.0						P
		Replace			6.0			1, 4	
03010412	NAVIGATIONAL BELL	Test	0.5						P
		Replace		0.5					
03010413	LOUDHAILER	Test	0.5						P
		Replace		0.5				1, 8	
		Repair				8.0		1, 2, 4	
03010414	VHF/FM RADIO SYSTEM	Replace	1.0					1	
03010415	SPOTLIGHT	Adjust		1.0				1, 28	
		Replace		1.0				1, 23, 4, 28	
03010416	SINGARS RADIO								E
03010417	DEFROSTER	Inspect	1.0						P
		Replace			4.0			1, 4	
03010418	GPS (INCLUDING PLGR)	Replace		0.5				1, 8	
		Repair			2.0			1, 23	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
03010419	MAST ENCLOSURE ASSEMBLY	Inspect	1.0						P
		Test			1.0				
		Replace			12.0			1, 21	
		Repair			2.0			1, 4, 37	
03010420	OPERATORS CAB ELECTRICAL SYSTEM	Inspect			4.0			1	P
		Test			4.0				
		Replace			10.0			1	
		Repair			6.0			1, 4	
030105	INTAKE PLENUM ASSEMBLY	Inspect	0.5						P
		Replace		0.5				1, 24, 28	
		Repair		0.5				1, 8	
030106	D-RING ASSEMBLY	Inspect	0.5						P
		Replace	1.0						
030107	CLEAT MOORING ASSEMBLY	Inspect	0.5						P
		Replace	1.0						
030108	EXHAUST PLENUM ASSEMBLY	Inspect	0.5						P
		Service		0.5					
		Replace		1.0				1, 24, 28	
		Repair		0.5				1, 8	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
030109	MAIN MAST ASSEMBLY	Inspect	3.0						P
		Replace		1.0				1, 30	
		Repair		3.0				4	
030110	STUB MAST ASSEMBLY	Inspect	1.0						P
		Replace		1.0				4	
		Repair	0.5	1.0				4	
030111	INTERCONNECT ELECTRICAL ASSEMBLY	Inspect		0.5					P
		Replace		0.5				1, 28	
		Repair	1.5					1, 8, 31, 33	
030112	LIFE LINE ASSEMBLY	Adjust	1.0						
		Replace		1.0					
		Repair		1.0					
030113	SIDE FENDER ASSEMBLY	Inspect	2.0						P
		Replace		1.0				1, 4, 12, 24, 28	
		Repair		2.0				1	
030114	BOW FENDER	Inspect	2.0						
		Replace		1.0				1, 4, 12, 24, 28	
		Repair		2.0				1	

Table 1. Maintenance Allocation Chart. (MAC) (Continued)

(1) GROUP NO.	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP REF CODE	(6) REMARKS CODE
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
030115	CORNER FENDER	Inspect	2.0						
		Replace		1.0				1	
		Repair		2.0				1	
0302	CONVERSION KIT, MODULAR WARPING TUG								
030201	A-FRAME ASSEMBLY	Inspect	0.5						P
		Replace	0.5						
		Repair			1.0			1, 25, 28	
030202	ANCHOR ASSEMBLY	Inspect	1.0						P
		Replace		1.0				1	
		Repair		1.0				1	
030203	SKEG ASSEMBLIES	Inspect	0.5						P
		Service	1.5						
		Replace		1.0					
0303	SHIPPING RACK ARRANGMENTS								
0304	CONVERSION KIT								
030401	CONTAINER, 20 FT, OPEN END	Inspect	2.0						P
		Service	1.0						
		Repair			4.0				

Table 2. Tools and Test Equipment for Modular Warping Tug.

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
1	O	Tool Kit, General Mechanics (Rail and Marine)	5180-00-629-9783	SC 5180-90-N55
2	O	Tool Kit, General Mechanics	5180-00-177-7033	SC 5180-95-N26
3	O	Shop Equipment, Automotive Vehicle (Set C)	4910-00-348-7698	SC 4910-95-A68
4	O	Shop Equipment, Automotive Vehicle (CM 2)	4910-00-754-0650	SC 4910-95-A72
5	O	Shop Set C, Electric	4920-00-944-0757	SC 4920-99-A16
6	O	Apron, Utility	8415-00-082-6108	A-A-55063
7	O	Blast Cleaning Machine	4940-00-168-2173	MILH81324AS
8	O	Compressor, Unit, Reciprocating, Power Drive	4310-00-861-9820	MILC13874
9	O	Gage, Pressure, Dial Indicating	6685-01-249-1147	MS17856-6
10	O	Gage, Stick, Petroleum	5210-00-092-8051	MW4008
11	O	Gloves, Cotton	8415-00-268-8330	112
12	O	Hammer, Hand, (10 lb Sledge)	5120-00-243-2957	75H-01116
13	O	Helmet, Safety (Blue)	8415-00-279-2205	ISEA/ANSI Z89.1
14	O	Hoist, Chain	3950-00-965-0098	MILH904
15	O	Hose Assembly, Nonmetallic	4720-00-203-3912	A-A-59270
16	O	Indicator, Dial	5120-00-277-8840	196A
17	O	Life Preserver, Vest	4220-00-555-9006	MIL-L-17653
18	O	Lubricating Gun, Hand	4930-00-965-0288	30415
19	O	Mini-Crimp Machine		FT1310
20	O	Protector, Hearing	4240-00-022-2946	A-A-58084
21	O	Puller, Fuse	5120-00-224-9453	34-001
22	O	Pump, Oil Suction	4320-00-049-7564	D15-619-A-47
23	O	Scraper, Ship (Copper Alloy)	5110-00-224-9929	PD5110-00-224-9929
24	O	Shackle, 1/2 in. 2 Ton	4030-01-499-9284	1019472

Table 2. Tools and Test Equipment for Modular Warping Tug. (Continued)

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
25	O	Shackle, 3/4 in. 4.75 Ton	4030-00-343-5433	1019515
26	O	Shackle, 1 3/4 in. 40 Ton		1021138
27	O	Siphon Assembly, Fuel	4520-00-874-0429	13208E6234
28		Sling, 5,300 lb 6 ft (Green)	3940-01-501-0972	EN60X6FT
29	O	Sling, 66,000 lb. 30 ft (Olive)		EN800X30FT
30	O	Sling, 8,400 lb. 20 ft (Yellow)	3940-01-501-1216	EN90X20FT
31	O	Stand, Maintenance, Automotive Engine	4910-00-529-8387	MILS45004
32	O	Test Set, Compartment Air	6685-00-327-2957	805-1749233
33	O	Tool Kit, Electricians	5180-01-107-3976	WK-7
34	O	Tool, Tube Presetting	5120-01-490-5471	560583
35	O	Tool, Tube Presetting	5120-01-331-6159	560585
36	O	Vise Block With Flaring Pin		12-2866
37	O	Wrench, Torque (0-175 ft lbs)	5120-01-396-5751	1753LDF
38	O	Wrench, Torque (10-250 in lbs)	5120-01-356-0743	J24405
39	O	Wrench, Torque (150-750 in lbs)	5120-01-374-1931	GGG-W-2843
40	O	Bushing Driver Set	5120-01-311-2041	A157C
41	O	Hammer, Hand	5120-00-357-6077	GGG-H-33
42	H	Output Gear Press Sleeve		TD300427
43	H	Release Spring Compressor		T18502
44	H	Output Bearing Support		TD300328
45	H	Pinion Clamp		TD300429
46	H	End Play Adjustment (Fwd)		TD300430
47	H	End Play Adjustment (Rev)		TD300431
48	H	Clutch Lifting Tool		TD300432
49	H	Accessory Drive Tool Set		J 36024-C

Table 2. Tools and Test Equipment for Modular Warping Tug. (Continued)

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
50	H	Adapter, Dial Indicator	4910-01-353-8518	J-39164
51	H	Adapter, Oil Seal		J 34158
52	H	Adapter, Engine Stand		J 35635-A
53	H	Adjuster, Lash, Cam-Idler Gear	5120-01-322-8885	J35596
54	H	Accessory Drive Tool Set		J 36024-C
55	H	Air Chisel		CP 715
56	H	Air Compressor Fan Drive Service Tool Set		J 36310-A
57	H	Alignment Stud Set	5120-01-322-3503	J35785
58	H	Barring Tool, Engine	5120-01-322-3498	J36237
59	H	Bearing Tool Set (Part Of)		J 35517
60	H	Bearing Tool Set (Part Of)		J 35988-18
61	H	Bearing Tool Set (Part Of)		J 35988-1A
62	H	Bearing Tool Set (Part Of) Adapter		J 35988-5
63	H	Belt Tensioning Tool		7401-0076
64	H	Bolt, Eye	5306-01-319-1987	J35595
65	H	Bracket, Lifting, Cylinder Head		J 35641-A
66	H	Brush, Cleaning, Valve Guide	5120-00-766-2141	J-5437
67	H	Camshaft Socket Tool		J 36003-A
68	H	Checker, Gear Lash	5120-01-353-2520	J 38662
69	H	Collect, Machine		J 23479-100A
70	H	Collect, Machine	3460-01-355-3553	J23479-29
71	H	Compressor, Valve Spring	5120-01-322-1127	J35580
72	H	Compressor, Valve Spring	5120-01-254-5049	J8062
73	H	Connecting Rod Bolt Protectors		J 43661
74	H	Connecting Rod Bolt Protectors		J 35317

Table 2. Tools and Test Equipment for Modular Warping Tug. (Continued)

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
75	H	Connecting Rod Guide (Cast Iron)		J 43661
76	H	Connecting Rod Guide (Forged Steel)		J 43661
77	H	Crankshaft Oil Sleeve Remover		J 37075-A
78	H	Cup Plug Tool		J 36326
79	H	Cylinder Head Engine Stand Adapter		J 39652
80	H	Cylinder Kit Removal Tool		J 43396
81	H	Diagnostic Data Recorder Kit		J 38500-D
82	H	Dial Indicator Bore & Concentricity Set	5120-00-937-7284	J-9737-C
83	H	Fixture, Holding	5120-01-353-8514	J 35988-2
84	H	Fixture, Holding, Fuel Pump		J 38767-1
85	H	Flaring Tool, Tube, Hand	5120-00-711-1920	J5286-6
86	H	Flywheel Lock		J 36375-A
87	H	Fuel Pump Tool Set		J 38767-A
88	H	Gage Block	5120-00-353-2535	J 33880-20
89	H	Gage, 2.5MM Step		J 35884-A
90	H	Gage, Cylinder	5120-01-070-4543	J 5347-B
91	H	Gage, Cylinder	5120-00-023-4798	J22273-01
92	H	Gage, Dial, Valve Sea	4910-00-779-7103	J8165-2
93	H	Gage, Height	5120-01-355-6424	J 33880-7
94	H	Gage, Profile	5120-01-337-4412	J38609
95	H	Gage, Profile	5220-01-319-6604	J35637
96	H	Gage, Profile	5220-01-440-0686	J39697
97	H	Grinder, Valve Seat	4910-00-254-5048	J7040A
98	H	Guide Stud Set	5120-01-322-3502	J35784

Table 2. Tools and Test Equipment for Modular Warping Tug. (Continued)

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
99	H	Guide Stud Set	5120-01-322-3505	J36107
100	H	Guide, Connect Rod	5120-01-322-3508	J 35945
101	H	Handle, Drive	5120-00-977-5578	J7079-2
102	H	Handle, Oil Seal Installer	5120-00-970-9030	J1508-8
103	H	Head Bolt Counterbore Resurface Tool		J 38189
104	H	Holding Fixture, Piston Connecting Rod	5120-01-322-3497	J36211
105	H	Hooked Pick		J 39227
106	H	Hose Clamp Installer Tool		J 41454
107	H	Hydraulic Ram		J 35951-1
108	H	Indicator Dial	5120-00-023-4798	J 7872
109	H	Impeller, Installer	5120-01-354-2771	J-35988-14
110	H	Insertor, Seal	5120-01-353-8568	J-35686-1
111	H	Insertor, Seal	5120-01-365-4079	J38858
112	H	Insertor, Stud	5120-01-354-2944	J-35686-2
113	H	Installation Tool, Seal	5120-01-354-0470	J 36310-2
114	H	Installer Set, Cup Plug	5120-01-322-2359	J35653
115	H	Installer, Bearing		J 33854
116	H	Installer, Bearing Kit		J 36310-A
117	H	Installer, Cup Plug		J 36236
118	H	Installer, Dowel	5120-01-354-2775	J-36224-1
119	H	Installer, Dowel	5120-01-354-2776	J-36224-2
120	H	Installer, Needle Bearing		J 38767-B
121	H	Installer, Pilot, Injection	4940-00-711-1919	J5286-5
122	H	Installer, Seal	5120-00-977-5579	J8550
123	H	Installer, Valve Stem Seal		J 39109

Table 2. Tools and Test Equipment for Modular Warping Tug. (Continued)

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
124	H	Installing Tool, Tube Packing Ring	5120-01-354-0426	J 33880-4
125	H	Lifting Sling, Flywheel	5120-01-132-5447	J-25026
126	H	Magnetic Clamp, Indicator	4910-01-158-3976	J7872-2
127	H	Main Bearing Shell Remover		J 36187
128	H	Needle Bearing Remover		J 33853
129	H	Oil Seal Removal Tool		J 41329
130	H	Pilot		J 35623-A
131	H	Pilot, Camshaft Gear		J35906
132	H	Pilot, Seat Reamer	5120-00-353-7039	J 33880-3
133	H	Pilot, Tip Reamer	5120-00-353-7040	J 33880-10
134	H	Pin, Shoulder, Headless	5315-01-333-2771	J36235
135	H	Pin, Straight, Threaded	5315-01-475-5229	J43431
136	H	Piston Ring Compression Tool		J 35598-A
137	H	Piston Ring Compressor		J 43397
138	H	Plate, Indexing Fixture	3460-01-319-5533	J35651
139	H	Plate, Retaining Shaft	3040-01-319-0848	J35652
140	H	Pliers, Piston Ring	5120-01-142-2459	J22405-02
141	H	Pliers, Retaining Ring		J 22380
142	H	Pliers, Retaining Ring		J 23432
143	H	Pliers, Retaining Ring	5120-01-322-6888	J36347
144	H	Pliers, Retaining Ring	5120-00-293-2513	J4880
145	H	Post, Base	5120-01-356-1649	J 35642-1
146	H	Press, Cylinder Liner	3449-02-319-5599	J35597
147	H	Protector, Crankshaft	2815-01-321-9248	J35994
148	H	Puller, Mechanical	5120-01-322-1128	J35791

Table 2. Tools and Test Equipment for Modular Warping Tug. (Continued)

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
149	H	Pump, Hydraulic Ram, Hand Driven	4320-01-320-4618	J35951-175
150	H	Reamer, Hand	5110-01-355-0637	J 33880-1
151	H	Reamer, Hand	5120-01-355-0636	J 33880-5
152	H	Reconditioning Set, Injector Tube	5120-01-322-3507	J33880
153	H	Remover, Seal	5120-01-048-1385	J1508-13
154	H	Remover, Seal	5120-01-363-7572	J-1930
155	H	Remover, Seal	5120-01-322-1131	J35993
156	H	Remover, Valve Guide	5120-01-322-3506	J34696
157	H	Remover, Valve Seat Insert		J 23479-460A
158	H	Remover, Valve Seat Insert	5120-00-494-1836	J 23479-271
159	H	Replacing Tool, Engine Valve Seat Insert	5120-01-322-1133	J33190
160	H	Replacing Tool, Engine Valve Seat Insert	5120-01-322-2995	J34983
161	H	Rocker Arm Shaft Removal Tool		J 35996-A
162	H	Screwdriver Attachment Set, Socket Wrench	5130-01-486-8484	J-25359-C
163	H	Seal Protector		J 33021-A
164	H	Service Kit, Water Pump	5120-01-322-6115	J35988-B
165	H	Spacer, Straight	5365-01-465-2572	J35686-11
166	H	Stand, Maintenance, Automotive Engine	4910-00-808-3372	J29109
167	H	Surface Conditioning Set		J 36571
168	H	Test Kit, Radiator-R	4910-00-728-8227	J24460-01
169	H	Tester, Cylinder Compression	4910-01-319-6990	J36223-D
170	H	Tester, Diesel Fuel Injector Nozzle	4910-01-332-7051	J34760

Table 2. Tools and Test Equipment for Modular Warping Tug. (Continued)

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
171	H	Tester, Spring	4940-01-138-8259	J-22738-02
172	H	Tester, Valve Spring		J 25076-13
173	H	Tester, Water Pump Impeller Slip		J 35687-1
174	H	Timing Gear Lash Adjusting Tool Pedestal		J 35996-15
175	H	Tool Set, Oil Seal Installation		J 35686-A
176	H	Tube Tip Refinisher Assembly	5120-00-785-1017	J5286-8
177	H	Valve Guide Limiting Sleeve		J 33191-A
178	H	Valve Spring Compressor Jaws		J 8062-3
179	H	Washer, Seal	5310-01-474-8888	J35686-10
180	H	Water Pump Gear Lash Tool		J 38977
181	O	Plug, Ear	6515-00-137-6345	4-375

Table 3. Remarks for Modular Warping Tug. (MCS)

REMARKS CODE	REMARKS
A	Refer to Commercial Off the Shelf (COTS) Diesel Engine Manual. (TM 55-1945-222-14&P)
B	Refer to Commercial Off the Shelf (COTS) Marine Gear manual. (TM 55-1945-223-14&P)
C	Refer to Commercial Off the Shelf (COTS) Transfer Case manual. (TM 55-1945-205-24-3-4)
D	Disposition at Specialized Repair Activity (SRA) (for Repair/Non-repair Disposition).
E	Government Furnished Equipment Refer to TM 11-5820-890-20-3.
F	Repair is limited to bulb replacement and battery.
G	Refer to TM 5-805-7, Welding: Design, Procedures and Inspection, for Minor Weld Repairs.
H	Preventive Maintenance Checks and Services (PMCS).

**UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
WARPING TUG
EXPENDABLE AND DURABLE ITEMS LIST (EDIL)**

INTRODUCTION**Scope**

This work package lists expendable and durable items to help you will need to operate and maintain the Warping Tug. This list is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

Explanation of Columns in the Expendable/Durable Items List

Column (1) - Item Number. This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., Use antiseize compound (Item 3, WP 0106 00)).

Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed item. (C = Operator/Crew, O = Unit/AVUM, F = Direct Support/AVIM, H = General Support, D = Depot)

Column (3) - National Stock Number (NSN). This is the NSN assigned to the item which you can use to requisition it.

Column (4) - Item Name, Description, Commercial and Government Entity Code (CAGEC), and Part Number (PN). This column provides the other information you need to identify the item.

Column (5) - Unit of Measure (U/M). This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

EXPENDABLE AND DURABLE ITEMS LIST**Table 1. Expendable and Durable Items List. (EDIL)**

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGE AND PART NUMBER	(5) U/M
1	O	8040-00-843-0802	Adhesive, general purpose silicone rubber RTV (71984) RTV732	TU
2	O	8040-01-250-3969	Adhesive, general purpose, medium strength threadlocker (05972) 242	EA
3	O	8030-00-251-3980	Antiseize Compound, 1 lb can thread compound (81349) MIL-A-907	LB
4	O	8020-00-200-3487	Brush, Paint, multipurpose, 4 in. brush (80244) PD8020-00-245-4517	EA
5	O	6850-01-431-9025	Cleaner, Type II, 50 lb container (81349) MIL-C-29602	CO
6	O	6850-00-285-6056	Cleaning Compound, Solvent (81348) PC444	BX

Table 1. Expendable and Durable Items List. (EDIL) (Continued)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGE AND PART NUMBER	(5) U/M
7	O	7920-00-044-9281	Cloth, Cleaning, contains 10 lbs, white, 12 in. X 16 in. (58536) A-A-59323	BX
8	O	9140-01-412-1311	Diesel Fuel, winter grade, DF1, low sulphur (81348) A-A-52557	GL
9	C	5350-00-103-2054	Disk, Abrasive, 240 grit (09410) 30-5144-240	SH
10	O	8415-00-634-4658	Gloves, Men's and Women's (Leather Palm) (58563) A-A-50021	PR
11	O	8415-00-266-8677	Gloves, Rubber, Industrial (81349) MIL-DTL-32066	PR
12	O	9150-01-197-7689	Grease, Automotive and Artillery, 6.5 lb can, conforms to PPP-C-96, Type V Class 2 (81349) MIL-G-10924D	CN
13	C	9150-01-095-5512	Grease, Ball and Roller Bearing, lithium soap, temperature range -35° to 325°F (-54° to 163°C) (White Lithium Grease) (73219) L0189.001	CN
14	C	9150-00-929-7946	Grease, General Purpose, 14 oz cartridge, oxidation, corrosion, water, salt water, wear and extreme pressure resistant (76736) DURA-LITH GREASE EP 2	CA
15	O	9150-00-252-6383	Hydraulic Fluid, Petroleum Base, 1 qt can, conforms to PPP-C-96, Type 1 Class 3 (81349) MIL-H-5606	QT
16	O	5970-00-962-3335	Insulating Varnish, Electrical, 15 oz brush top can, rubber-textured electrical coating (0T769) 7268	CN
17	O	6810-00-753-4993	Isopropyl Alcohol, Technical (89264) 2200200	CN
18	F	3439-01-298-1121	Kit Solder, Aluminum, consists of solder and flux (70334) 29245	KT
19	C	9150-00-189-6730	Lubricating Oil, Engine, 1 qt can, internal combustion engine, MIL-L-2104, 40 Grade (81349) MILL2104	QT
20	O	9150-01-422-9340	Lubricating Oil, Gear, 55 gal dr, 80W90 Grade (81349) Mil-1-2105-1-80W90	GAL

Table 1. Expendable and Durable Items List. (EDIL) (Continued)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGE AND PART NUMBER	(5) U/M
21	O	9150-00-993-6621	Lubricating Oil, General Purpose, 55 gallon drum, conforms to PPP-D-729, Type 2 (19135) DTE-25	DR
22	O	5510-00-220-6178	Lumber, Softwood, Dimension, 4 in. X 4 in. X 8 ft min. (81348) MM-L-751	EA
23	O		Neoprene Rubber Strip, blended rubber sponge strip with pressure sensitive backing (39428) 8694K89	RL
24	O		Paint, Sherwin Williams, Dura-plate 235 (09869)	GL
25	O		Paint, Sherwin Williams, Dura-skid 460 (09869) 372-130	GL
26	O		Paint, Sherwin Williams, Zinc-Clad XI (09869) 373-930	GL
27	O	5350-01-043-2278	Paper, Abrasive, 320 grit, 9 in. X 11 in., for metal, wood, plastic, paint, enamel and lacquer (80204) ANSI B74.18	SH
28	O	6640-00-559-1385	Paper, Lens, unit of issue contains 100 each, type 1 class1, 7 in, W X 11 in, L (81348) NNN-P-40	GL
29	O	7920-00-205-1711	Rag, Wiping, cotton, contains 50 lbs, mixed colors (80244) 7920002051711	BE
30	O		Reducer (09869) R7K15	
31	O	8020-00-597-4759	Roller Kit, Paint, consists of paint tray and roller (80244) 8020-00-597-4759	KT
32	O	4020-00-240-2161	Rope, Fibrous (81349) MIL-H-226	RL
33	O	8030-01-440-5121	Sealant, Gasket (MIL-S-45180, 3 oz tube, gasket sealant #2 black paste) (05972) 101B	TU
34	O	8030-00-204-9149	Sealing Compound, 250 cc collapsible tube paste, pipe thread sealant with teflon (05972) 592-41	TU
35	O	8030-00-339-0310	Sealing Compound, 50 cc bottle, brown liquid, hydraulic sealant (05972) 56931	BX

Table 1. Expendable and Durable Items List. (EDIL) (Continued)

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, CAGE AND PART NUMBER	(5) U/M
36	C	5510-01-470-5122	Shoring Block, wood, 6 in. W X 30 in. L X 6 in. H, pressure treated pine (0F6V7) 551-032-001	EA
37	O	6505-01-053-2634	Sodium Bicarbonate Injection, USP, baking soda (32288) NDC00517-0639-25	BX
38	O	4235-01-416-8465	Spill Clean-Up Kit, Hazardous Material, sorbent pads with disposal bags used for petroleum spills (50378) P-SKFL31	KT
39	O	7920-00-057-2087	Sponge, rectangular sponge 6 in. X 4 in. X2 in. (18873) 8AF	EA
40	O		SST Bolt and SST Washer (34712) E45588-4	EA
41	F	5975-00-156-3253	Strap, Tiedown, plastic 13.350 in. Comp A, Type 1 (56501) TY-28M	HD
42	O	8030-00-889-3535	Tape, Antiseize (58536) AA50892-2-2	RL
43	O	5970-01-290-1623	Tape, Electrical, black linerless rubber splicing tape (75037) 130C1INX30FT	RL
44	O	5970-00-240-0617	Tape, Insulation, Electrical (75037) SCOTCH 23 3/4 IN. BLACK	RL
45	O	7510-00-266-6710	Tape, Pressure Sensitive Adhesive, 60 yard roll (81346) ASTM D-6123	RL
46	C	4020-00-231-5886	Twine, Fibrous (81349) MIL-T-713	EA
47	O	6850-00-001-4194	Water Indicating Paste, 1 oz metal coated tube (81349) MILW83779	PG
48	O	6550-01-310-1677	Water, Reagent Distilled, four 1 gallon per package (07TA6) C4350-1A	PK
49	O	5510-00-268-3476	Wedge, Wood, shoring wedge, Type B1, 3 in. X 1.5 in. X 12 in. (80064) S8800-461043	EA

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- A1B1 ENGINE STARTER
- A2 THRUSTER & COMPONENTS
- A2B1 THRUSTER STEERING POSITION SYNCHRO
- A2JB2 THRUSTER JUNCTION BOX E26929
- A2JB1 HYDRAULIC CONTROL NOTE 2.
- A2S2 THRUSTER GEAR BOX OIL LEVEL SW
- A3 PROPULSION MODULE JUNCTION BOX, E28803
- A4 ENGINE JUNCTION BOX & E STOP SW, E43003
- A5 BILGE PUMP CONTROL PANEL, E08893
- A6 CIRCUIT BREAKER PANEL, E42213
- A7 SINGLE BILGE PUMP CONTROL PANEL, E08903
- A8 VENT FAN RELAY ENCLOSURE, E23703, FOR MOTOR B1
- A9 THRUSTER DIR./ AUX. BATT. JUNCTION BOX ASSY. ENCLOSURE E41423.
- A10 ENGINE SPACE LIGHT SWITCH BOX ASSY., E42123
- A11 SWITCH, LAZARET E43328

- A12 ISOLATOR J-BOX ASS'Y, E44313
- B1 VENT FAN MOTOR (B1)
- BT BATTERY
- G1 ALTERNATOR
- JB1 JUNCTION BOX FOR #1 BILGE PUMP (B2)
- JB2 JUNCTION BOX FOR #3 BILGE PUMP (B4)
- NR-2 NATO RECEPTACLE (HOUSE)
- NR-1 NATO RECEPTACLE (ENGINE)
- JB5 JUNCTION BOX FOR #5 BILGE PUMP (B6)
- JB6 JUNCTION BOX FOR #6 BILGE PUMP (B7)
- JB8 JUNCTION BOX FOR #4 BILGE PUMP (B5)
- L1 COLD START SOLENOID
- L2/L3 CLUTCH ENGAGE FORWARD/ENGAGE BACKFLUSH SOLENOIDS
- DS LIGHT

- S2 CO2 PRESSURE SWITCH
 - S8 FIRE THERMAL DETECTOR LOCATED AFT
 - S9 FIRE THERMAL DETECTOR LOCATED MIDDLE
 - VR1 REGULATOR FOR ALTERNATOR
- LEGEND NOTES: 1. ENGINE COMPONENTS INCLUDE MARINE INTERFACE MODULE, ELECTRIC CONTROL MODULE, TEMPERATURE AND PRESSURE SENDING UNITS ETC. SEE SCHEMATIC E41324, THESE ARE WIRED TO ENGINE IN HARNESS KMB-1
2. HYD CONTROL BOX CONNECTS TO STEERING SOLENOIDS.
3. THIS LEGEND LISTS ONLY THOSE COMPONENTS CONNECTED IN PROPULSION MODULE & DOES NOT ADDRESS COMPONENTS WIRED ON SUBASSEMBLIES.

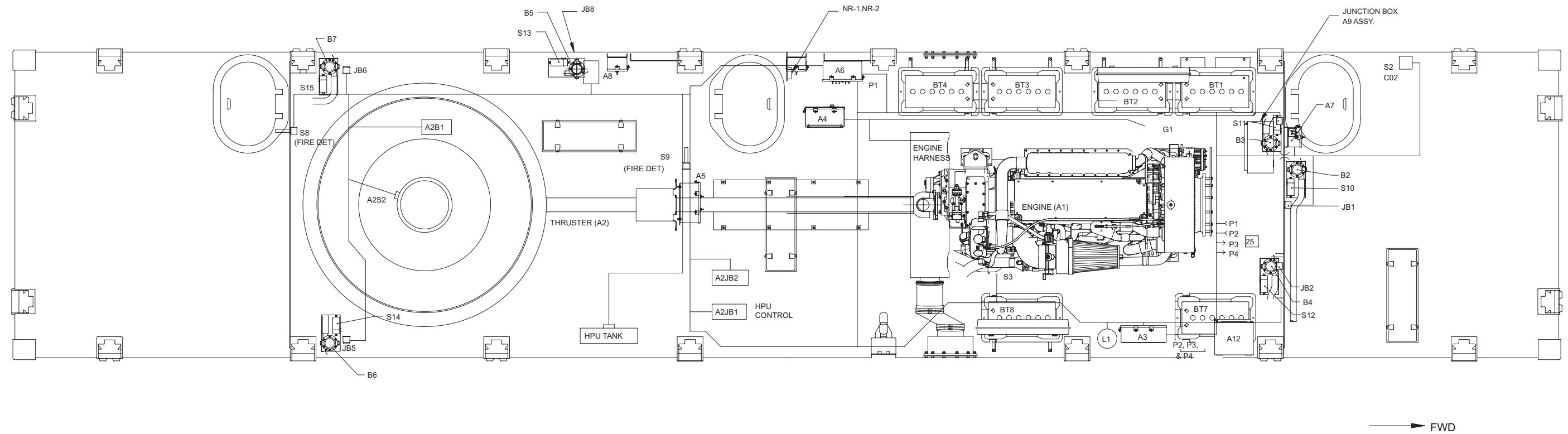


Figure 1. MCS Propulsion Module Electrical Assembly Wiring Diagram (Sheet 1 of 3).

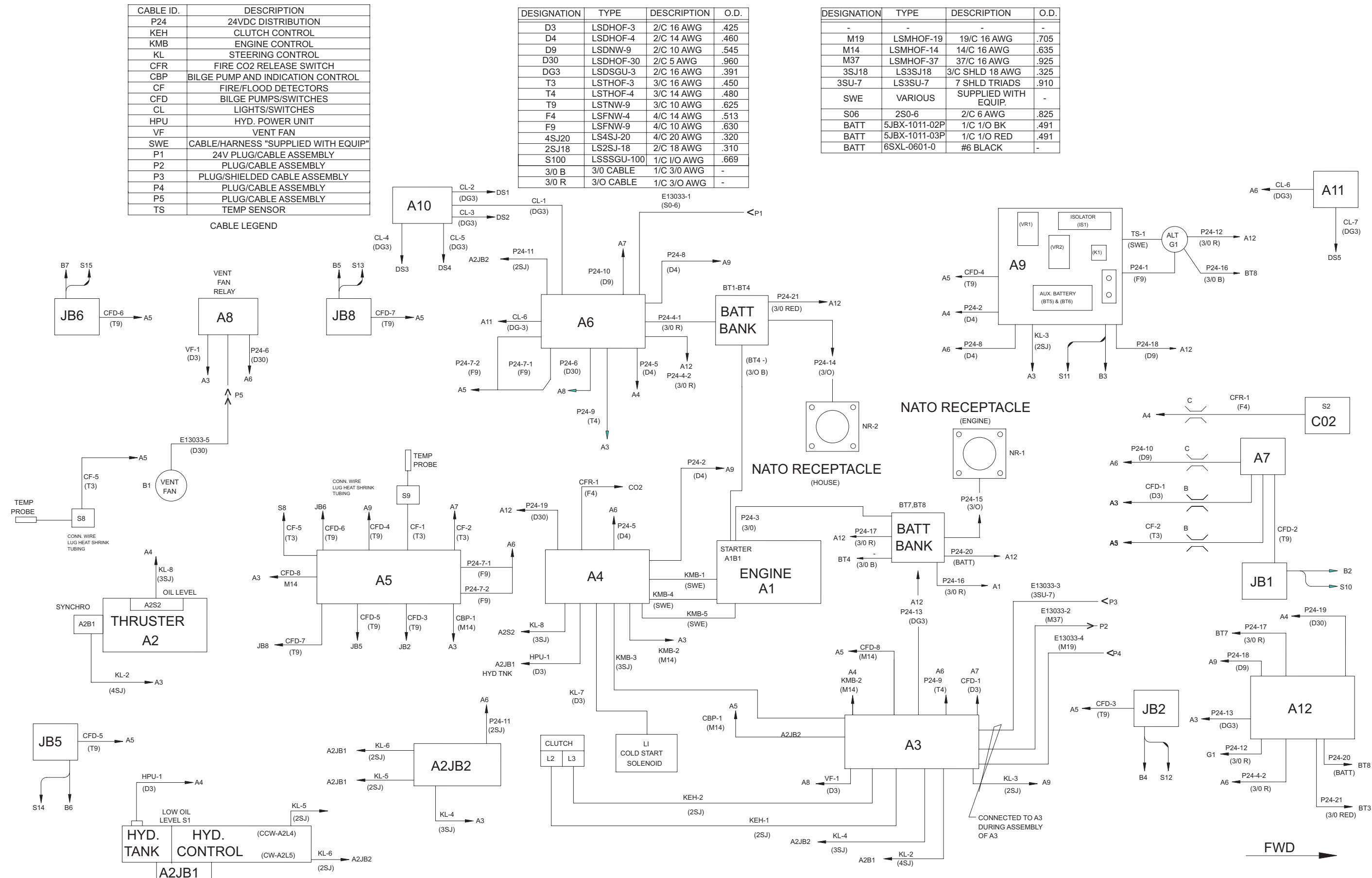


Figure 1. MCS Propulsion Module Electrical Assembly Wiring Diagram (Sheet 2 of 3).

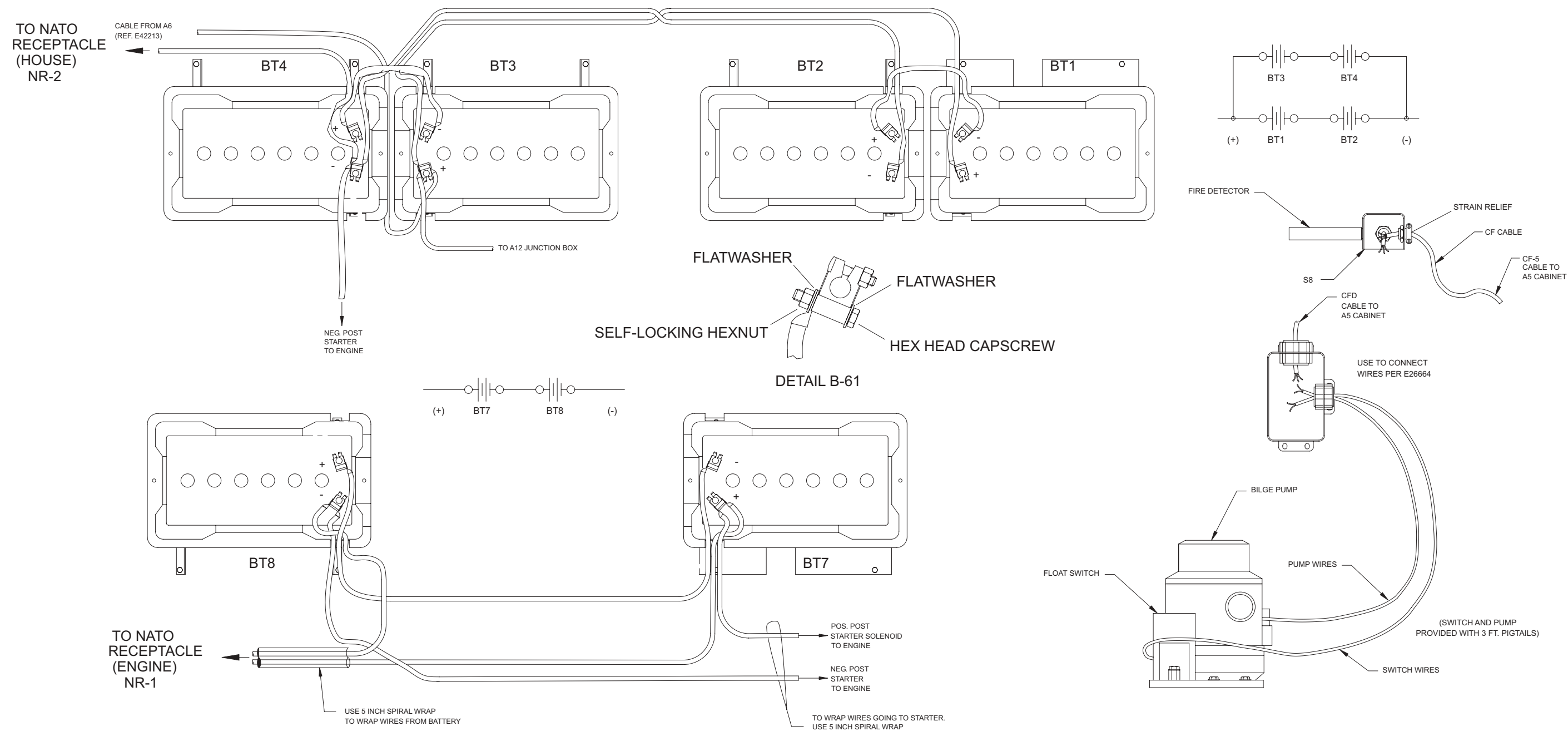


Figure 1. MCS Propulsion Module Electrical Assembly Wiring Diagram (Sheet 3 of 3).

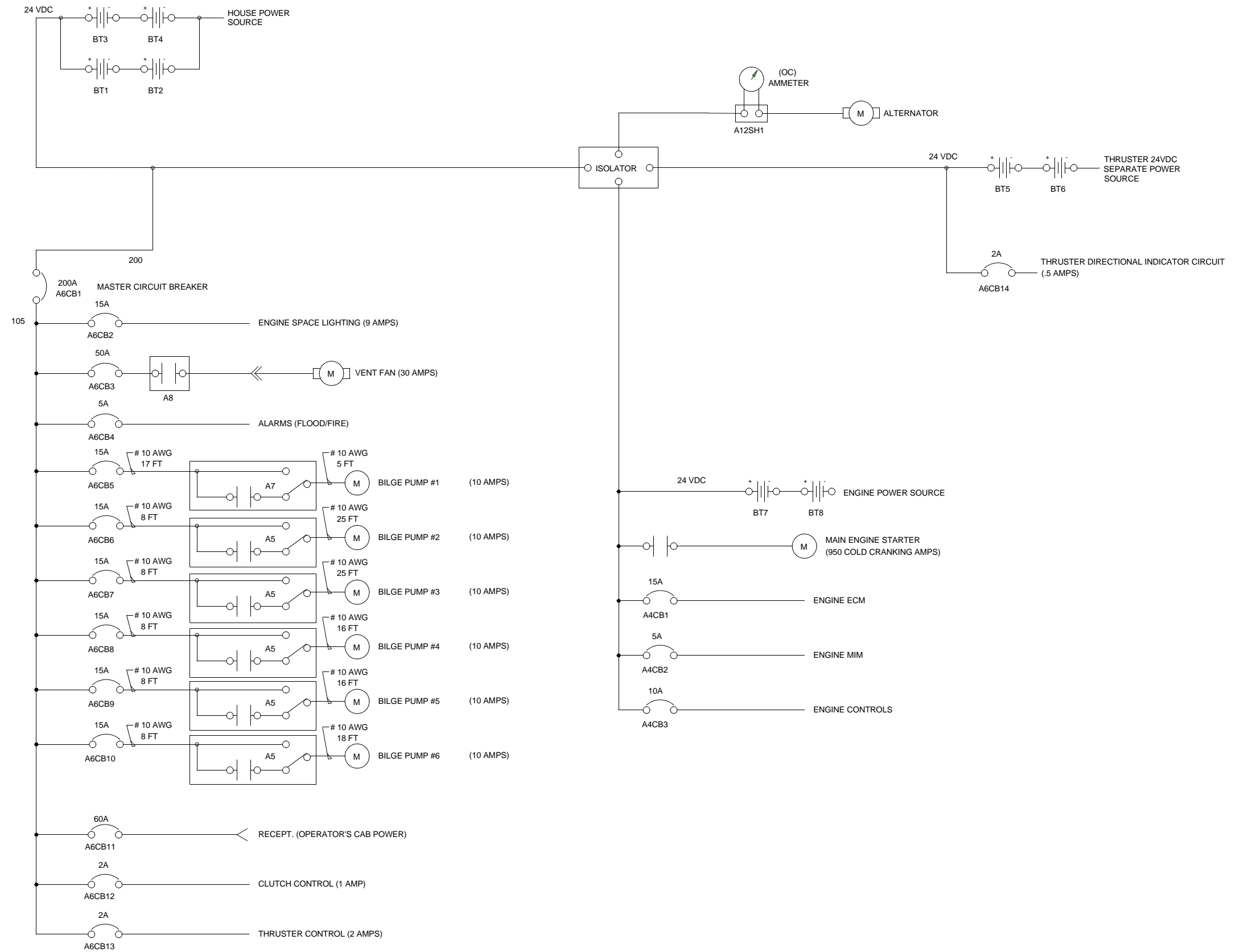


Figure 2. MCS Propulsion Module One Line Diagram.

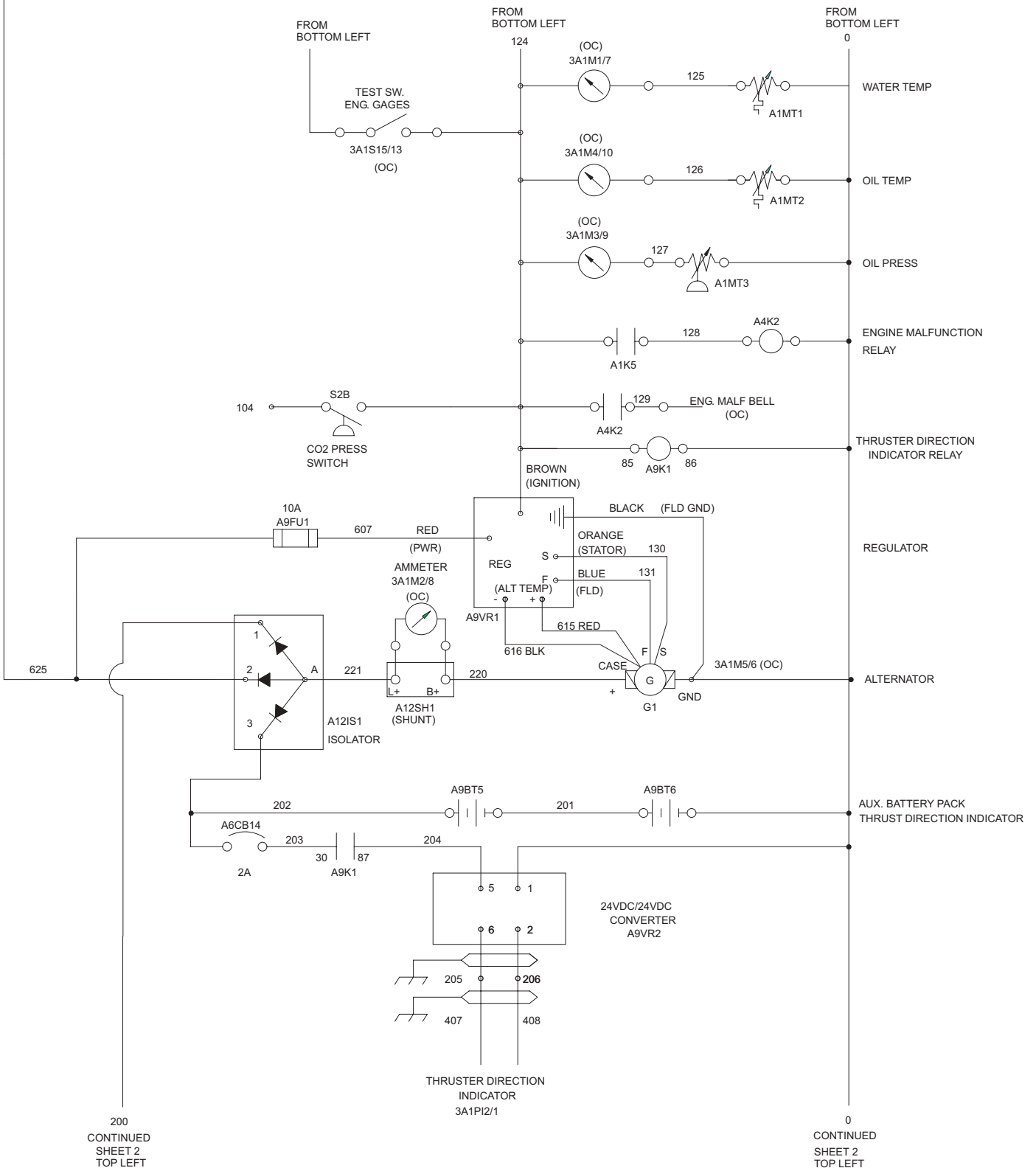
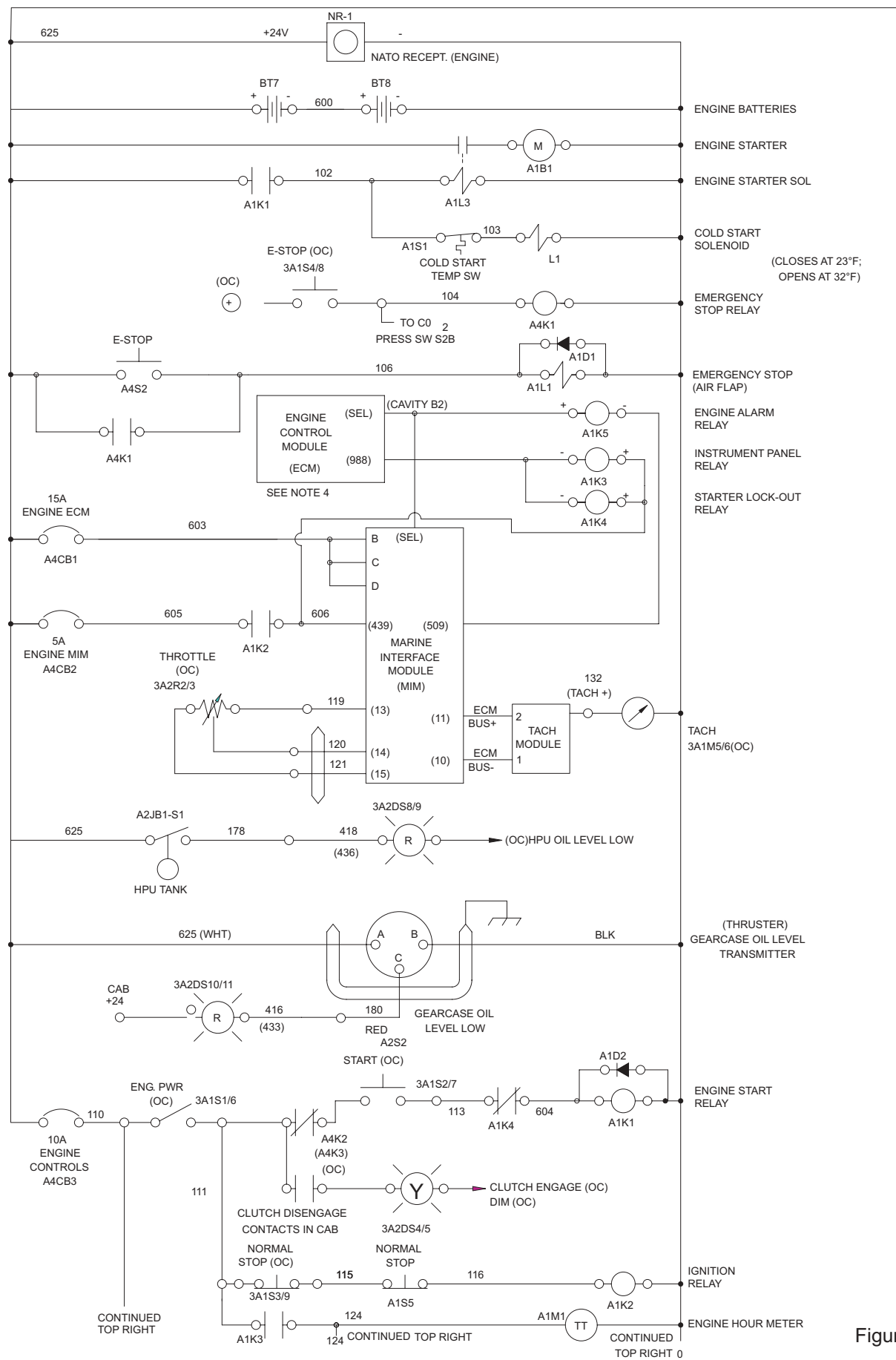


Figure 3. MCS Propulsion Module Schematic (Sheet 1 of 4).

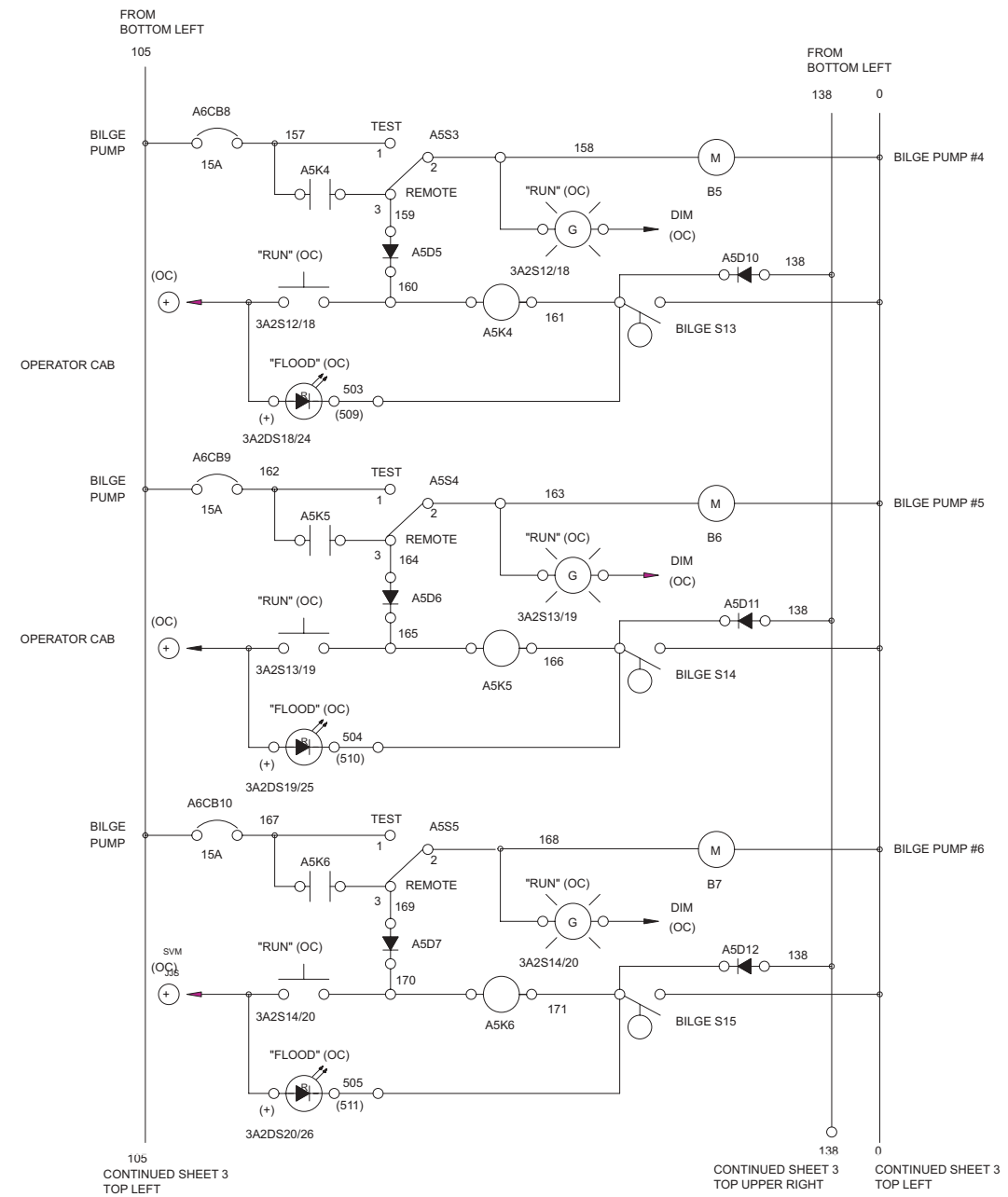
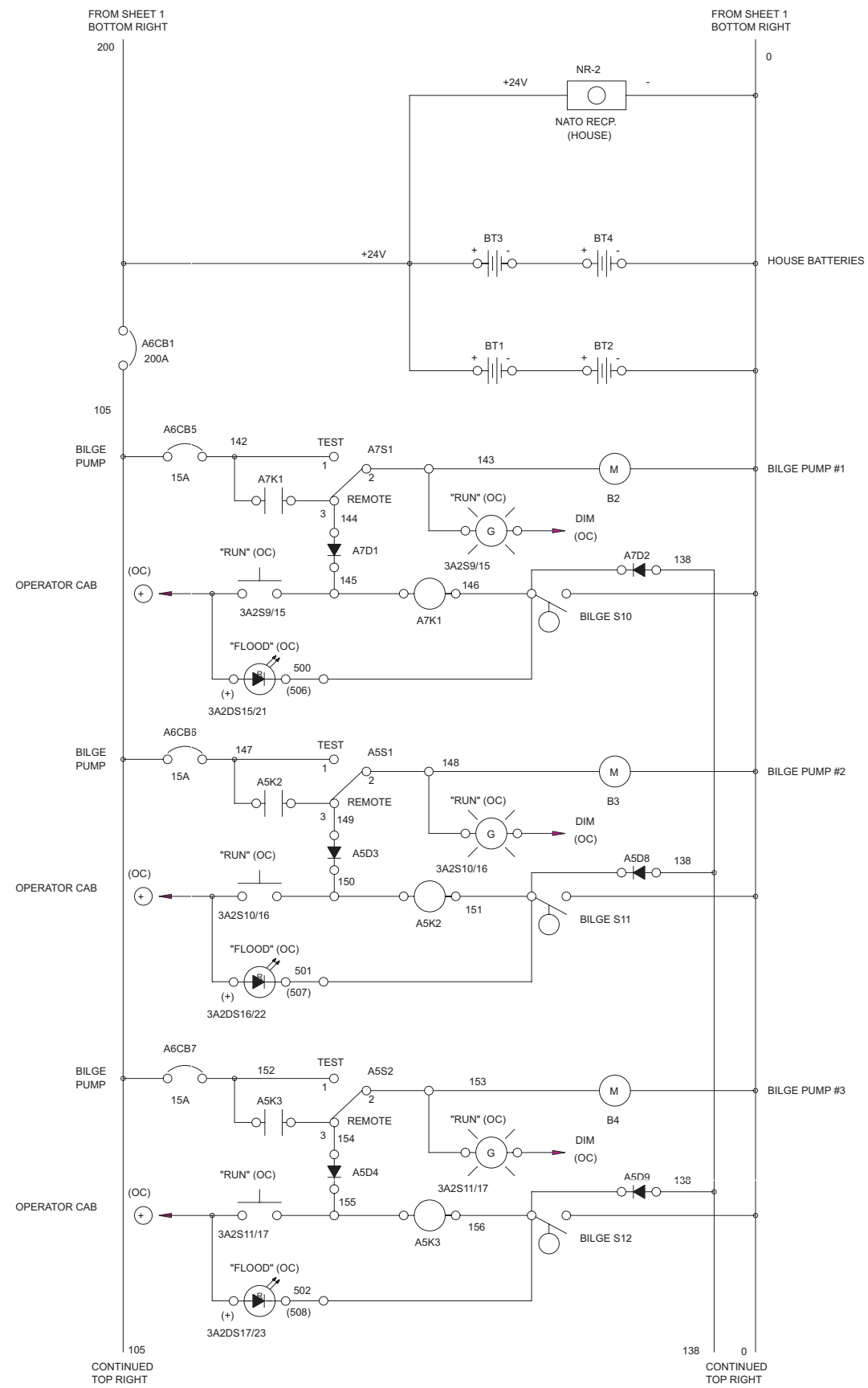


Figure 3. MCS Propulsion Module Schematic (Sheet 2 of 4).

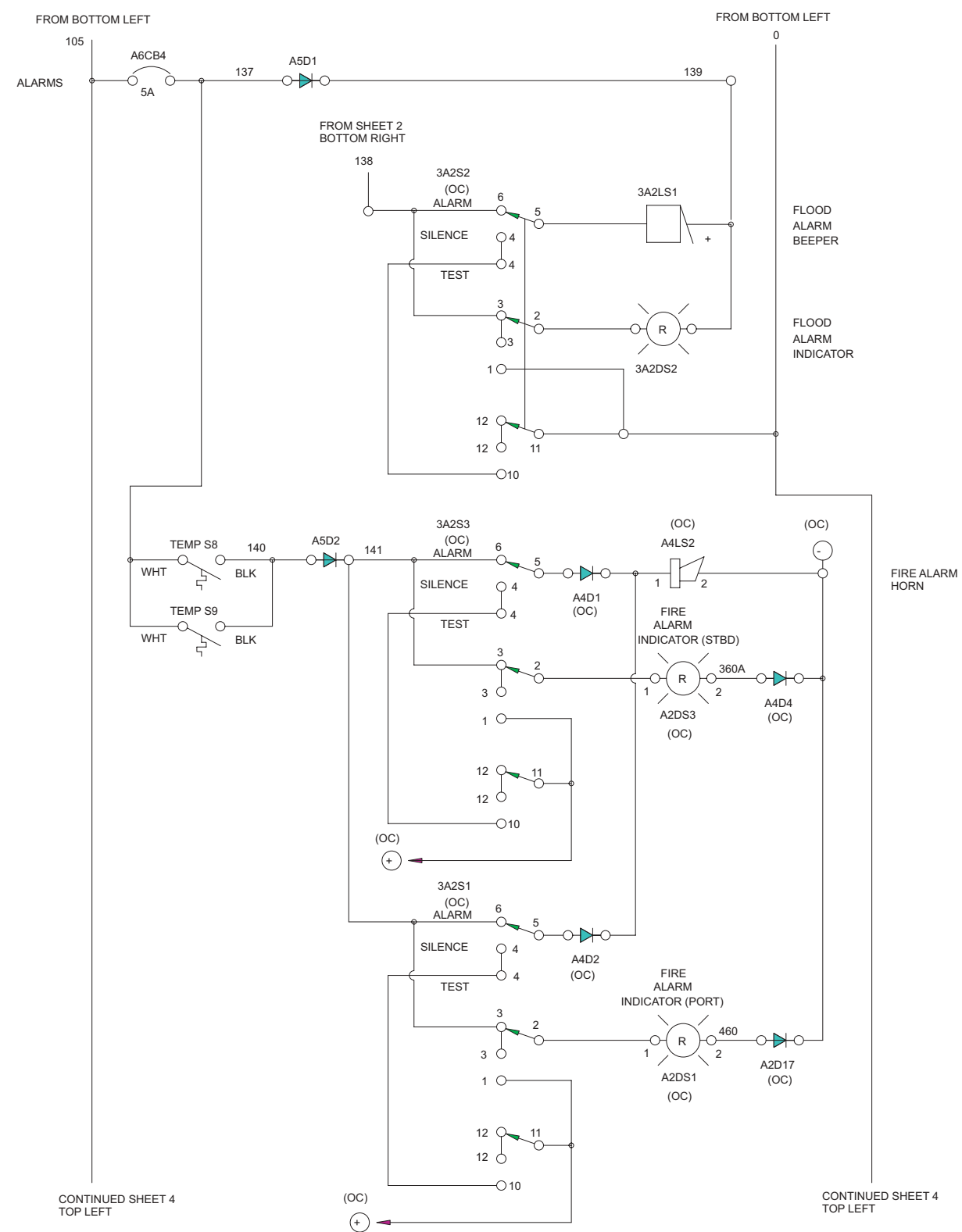
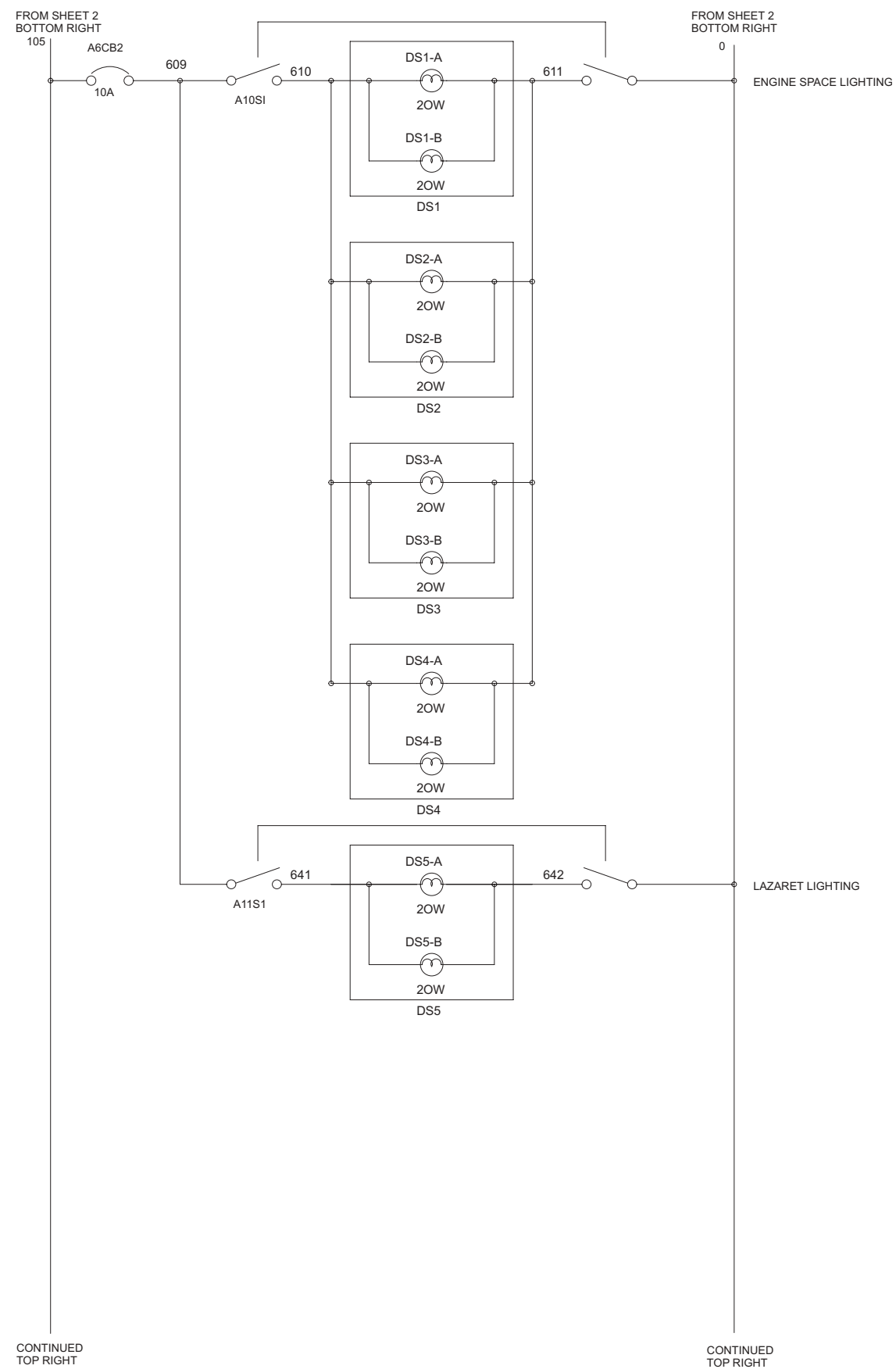
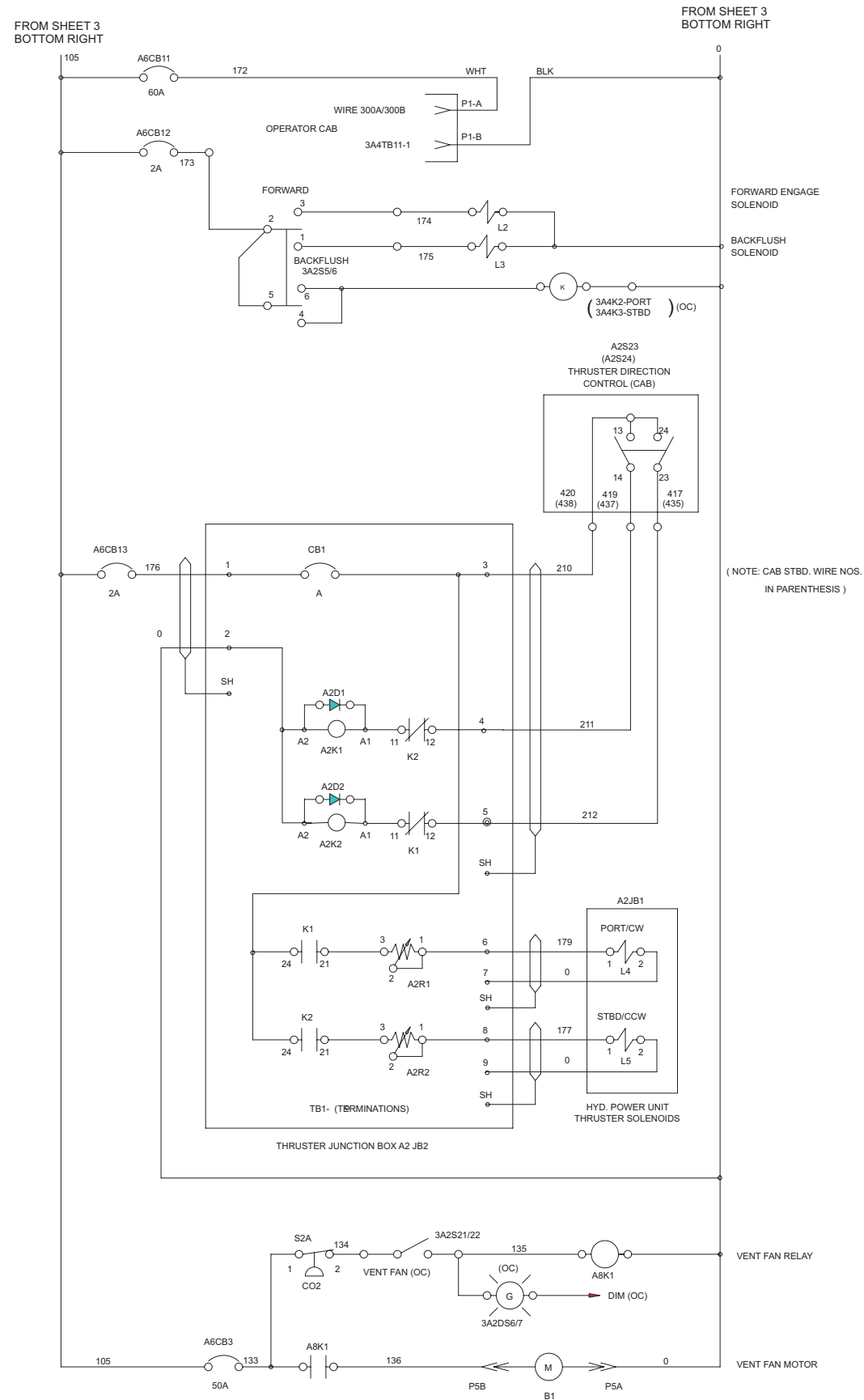


Figure 3. MCS Propulsion Module Schematic (Sheet 3 of 4).



LEGEND

ABBREVIATION	EXPLANATION
CO2	CARBON DIOXIDE/FIRE EXTINGUISHING SYSTEM
E-STOP	ENGINE EMERGENCY STOP/AIR SHUT-OFF
ECM	ENGINE CONTROL MODULE
ENG PWR	ENGINE POWER
ENG MALF	ENGINE MALFUNCTION, INDICATES LOW OIL PRESSURE OR HIGH WATER (COOLANT) TEMPERATURE
FLD	ALTERNATOR FIELD
FO PRESS	FUEL OIL PRESSURE
HIGH W TEMP	HIGH ENGINE WATER (COOLANT) TEMPERATURE
LOW O PRESS	LOW ENGINE OIL PRESSURE
MIM	MARINE INTERFACE MODULE
OC	OPERATOR CAB/ALSO DESIGNATED AS UNIT 3
TACH	TACHOMETER FOR ENGINE SPEED IN RPM

NOTE: ALL DESIGNATORS ARE PREFIXED WITH UNIT OR ASSEMBLY NUMBERS AND FOLLOWED BY AN ASSIGNED NUMBER FOR IDENTIFICATION. SEE NOTE 4 FOR A DESCRIPTION OF UNIT DESIGNATORS.

DESIGNATOR	DEVICE
A1	DIESEL ENGINE & ELECTRICAL COMPONENTS INSTALLED ON ENGINE
A2	THRUSTER & ASSOCIATED ELECTRICAL COMPONENTS, E26929
A3	POWER MODULE JUNCTION BOX, E09683
A4	ENGINE JUNCTION BOX, E43003
A5	BILGE PUMP CONTROL PANEL, E08893
A6	PROPULSION MODULE CIRCUIT BREAKER PANEL, E42213
A7	SINGLE BILGE PUMP CONTROL PANEL, E08903
A8	VENT FAN RELAY ENCLOSURE, E23703
A9	THRUSTER DIRECTION / AUX. BATT. JUNCTION BOX ASS'Y, E41423
A10	SWITCH BOX ASS'Y, ENGINE SPACE LIGHTS, E42123
A11	SWITCH, LAZARET, E43328
A12	ISOLATOR, JUNCTION BOX, E44313
B	MOTOR, STARTER or SYNCHRO
BT	BATTERY
CB	CIRCUIT BREAKER
D	DIODE, SEMICONDUCTOR
DS	INDICATING LAMP; LIGHT SOURCE
K	RELAY
L	SOLENOID
LS	AUDIBLE DEVICE, BEEPER etc.
M	METER, GAGE or PICK-UP
MT	TRANSDUCER FOR METER/GAGE
S	SWITCH or GOVERNOR
VR	REGULATOR
SH	SHUNT
IS	ISOLATOR
NR	NATO RECEIPT.

EXAMPLES: 1) A1M1, THIS IS METER NUMBER 1 (ENGINE HOUR METER) INSTALLED ON DIESEL ENGINE (A1)
 2) S3. THIS IS SWITCH NUMBER 3 (NEUTRAL LIMIT SWITCH) IN POWER MODULE. THIS SWITCH IS THE ONLY ELECTRICAL COMPONENT INSTALLED ON THE POWER TAKE OFF CLUTCH ENGAGEMENT CYLINDER.
 3) 3A2DS13/19, THIS IS INDICATING LAMP (DS) NUMBER 13 FOR PORT AND NUMBER 19 FOR STBD LOCATED IN ASSEMBLY A2 IN THE OPERATOR CAB (UNIT 3). SEE OPERATOR CAB SCHEMATIC E41354 AND ASSEMBLY E39213 FOR DESCRIPTION OF THE A2 ASSEMBLY WHICH IS THE LOWER CONTROL PANEL ASSEMBLY "A2" DRAWING E42483.

- NOTES:
- CONDUCTORS GOING TO OPERATOR CAB ARE SHOWN AS DASHED. DEVICES IN OPERATOR CAB HAVE DESIGNATIONS THAT START WITH "3". LAST DIGIT OF OPERATOR CAB DEVICES IF SEPARATED FOR PORT/STBD ARE SHOWN WITH A SLASH BETWEEN THE PORT AND STBD DEVICE NUMBERS.
 - THIS SCHEMATIC DOES NOT SHOW ALL TERMINAL OR CONNECTOR PIN NUMBERS.
 - SYSTEM DESIGNATORS (ALL DESIGNATORS NOT USED ON THIS SCHEMATIC)
 UNIT 1 : STBD PROPULSION MODULE. THIS IS MODULE E36133 (P40P) INSTALLED IN STBD LOCATION.
 UNIT 2 : PORT PROPULSION MODULE. THIS IS MODULE E36133 (P40P) INSTALLED IN PORT LOCATION.
 UNIT 3 : OPERATOR CAB
 UNIT 4 : MAIN MAST
 UNIT 5 : STUB MAST
 - FOR CLARITY, ENGINE WIRING IS NOT SHOWN IN ITS ENTIRETY. ONLY WIRING FOR MODULE CONTROL AND POWER INTERFACES IS SHOWN

Figure 3. MCS Propulsion Module Schematic (Sheet 4 of 4).

OPERATOR CAB UNIT 3

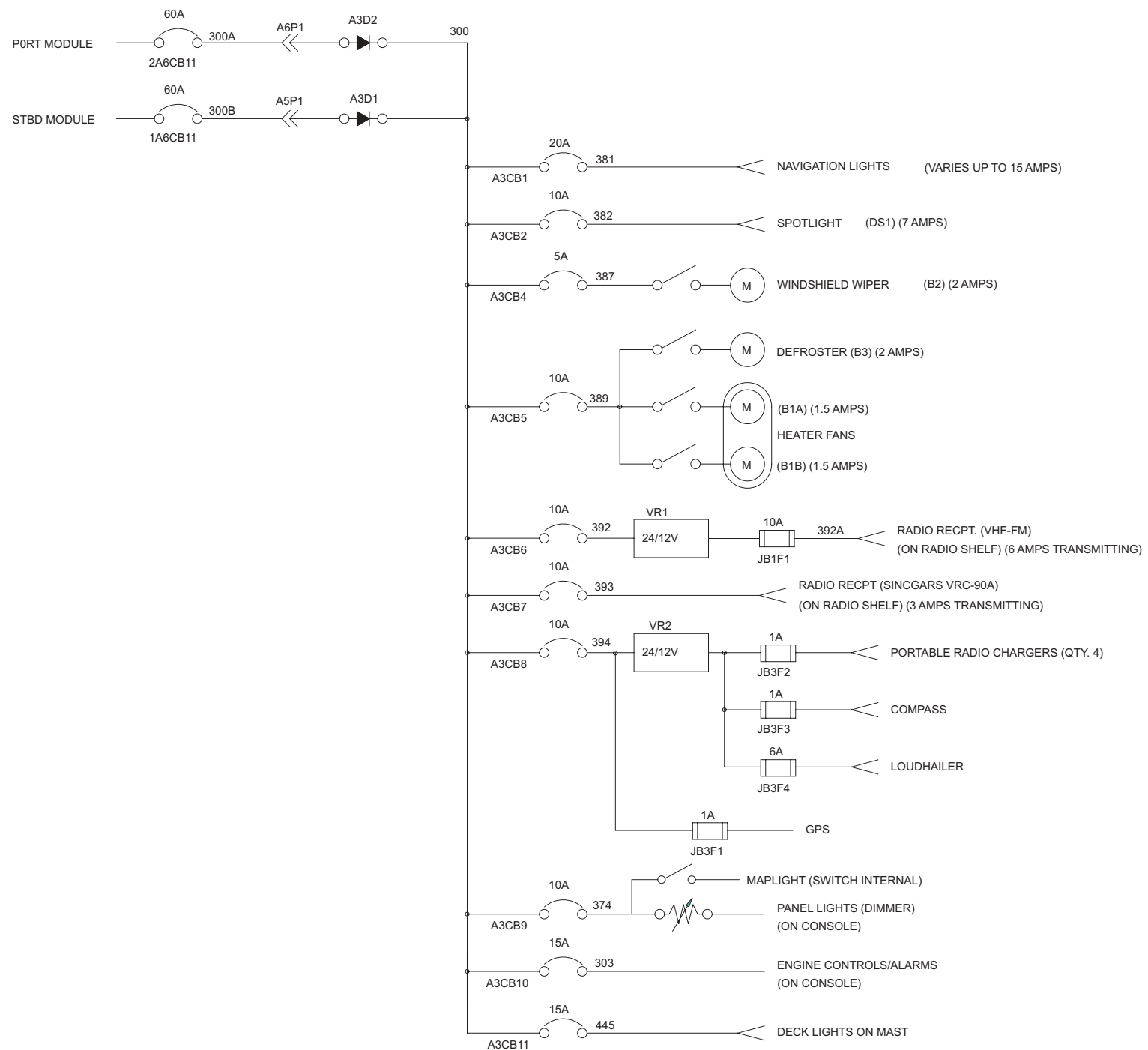
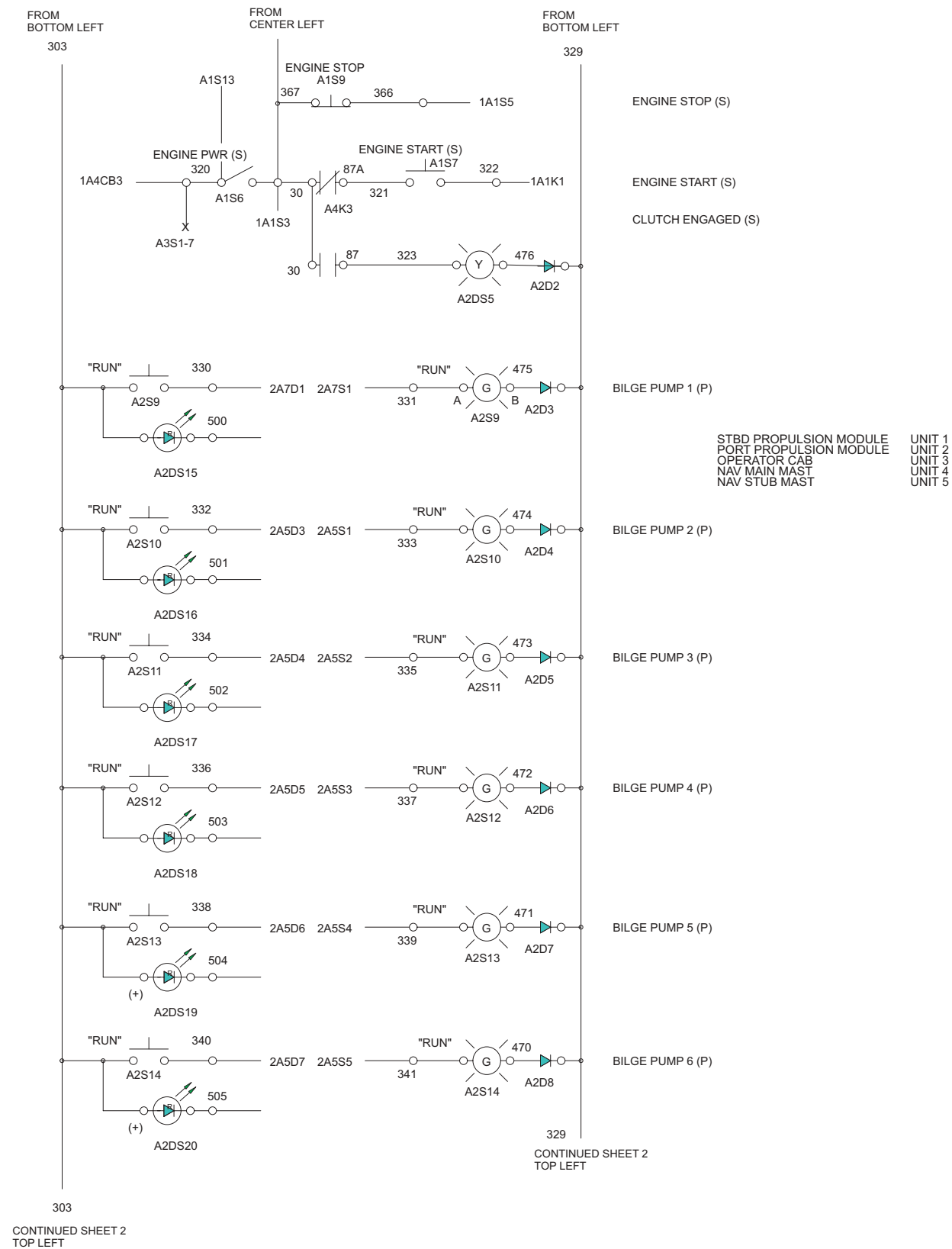
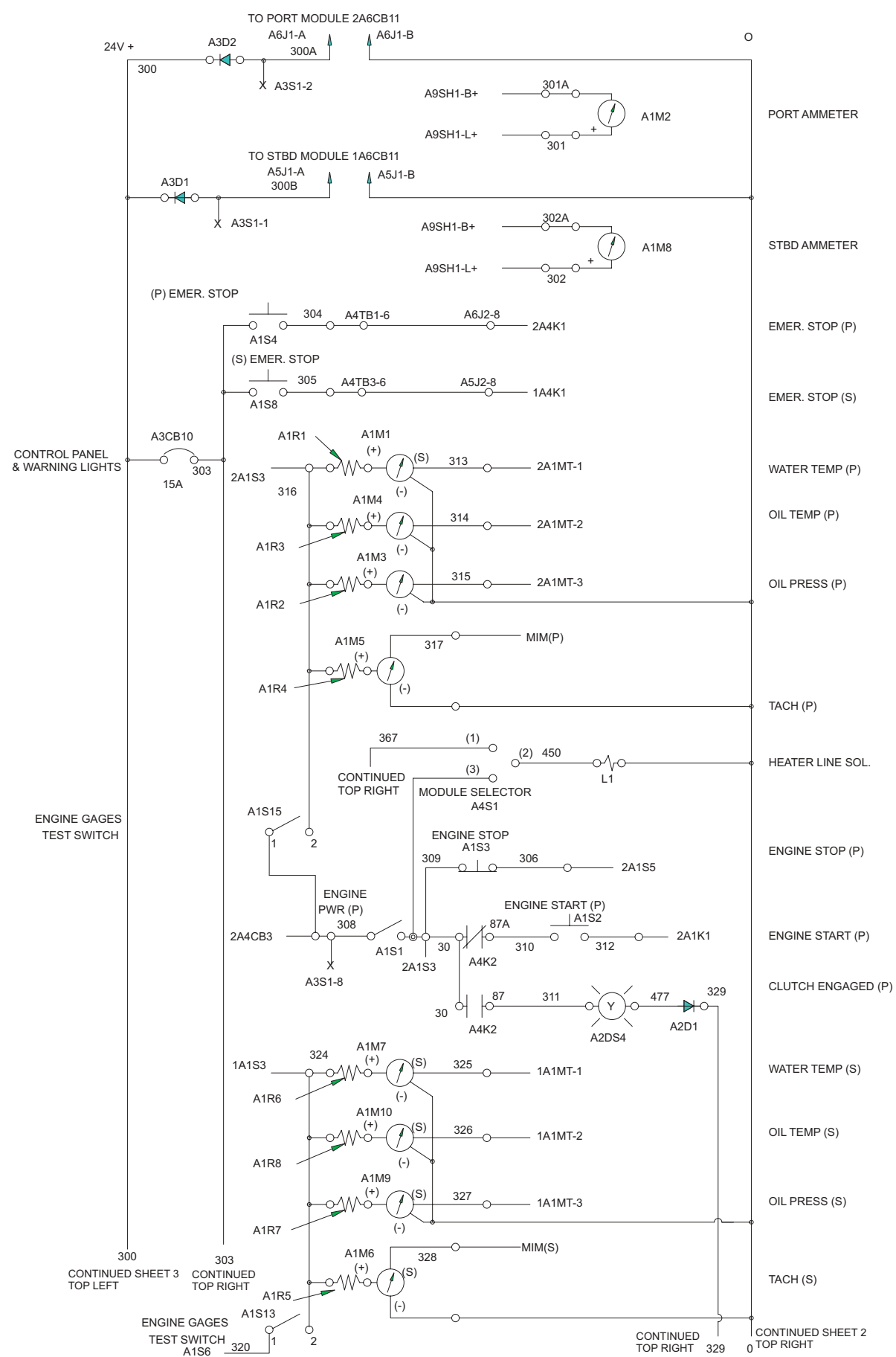


Figure 4. MCS Operator Cab One Line Diagram.



STBD PROPULSION MODULE
PORT PROPULSION MODULE
OPERATOR CAB
NAV MAIN MAST
NAV STUB MAST

UNIT 1
UNIT 2
UNIT 3
UNIT 4
UNIT 5

Figure 5. MCS Operator Cab Schematic (Sheet 1 of 6).

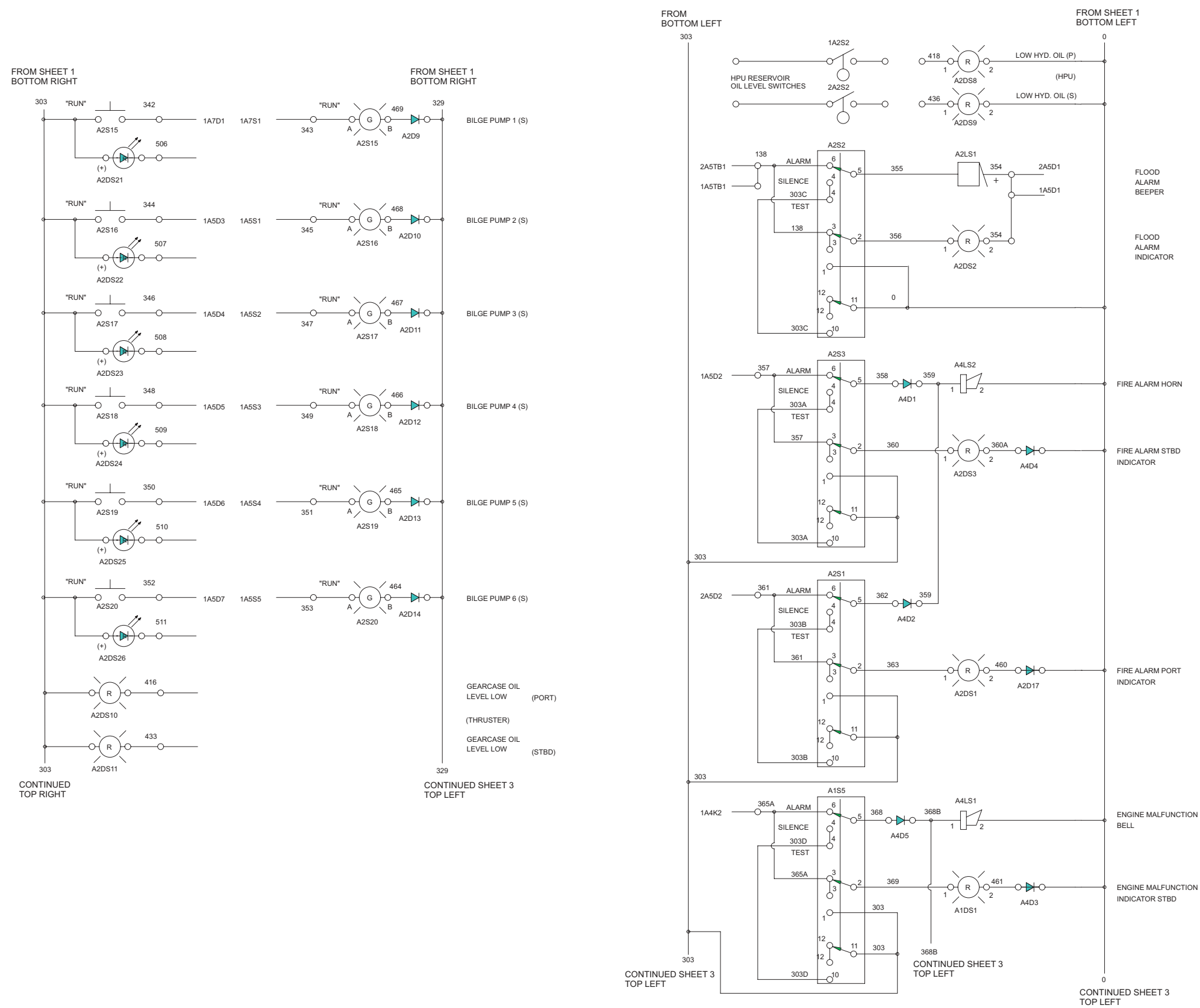
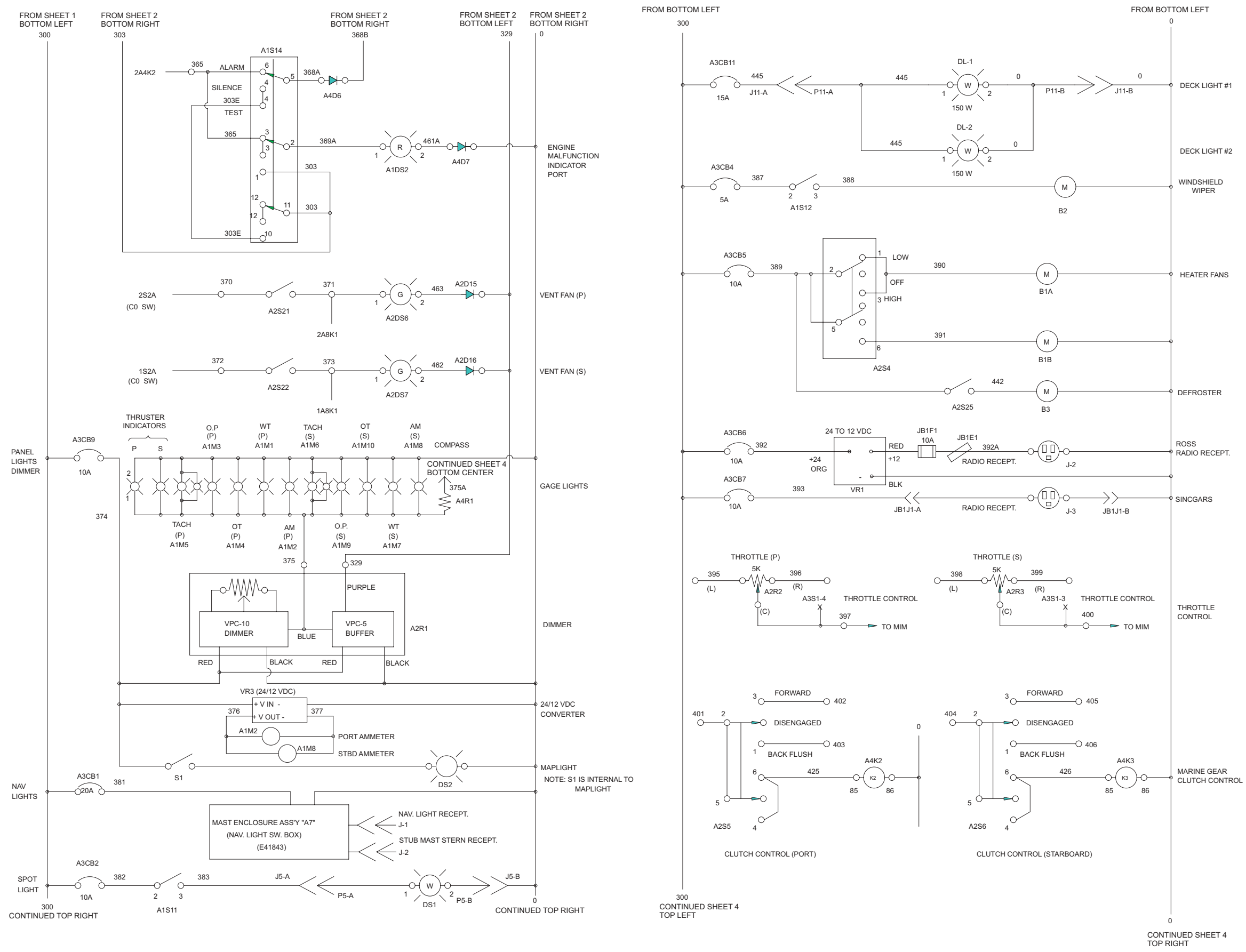
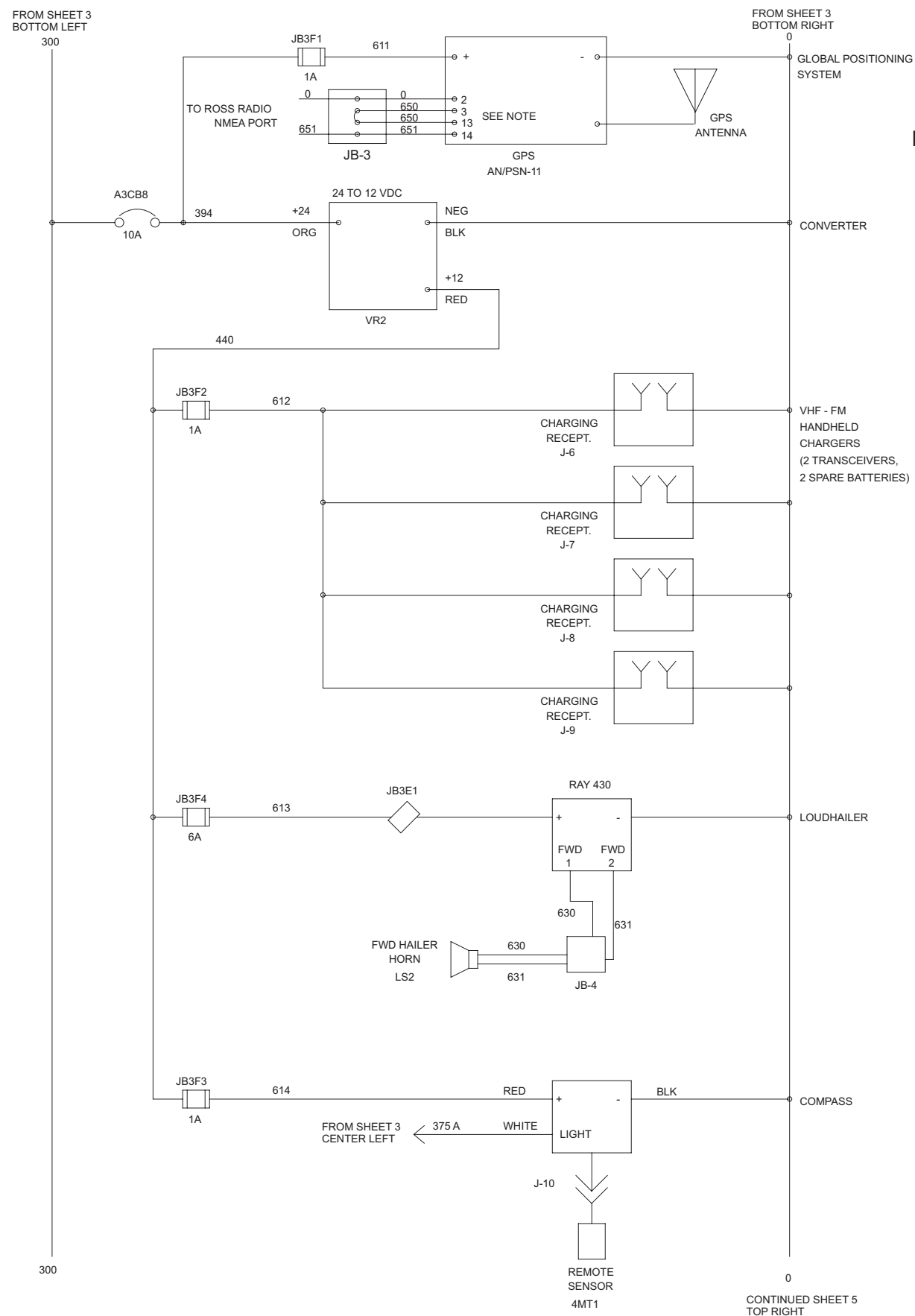


Figure 5. MCS Operator Cab Schematic (Sheet 2 of 6).



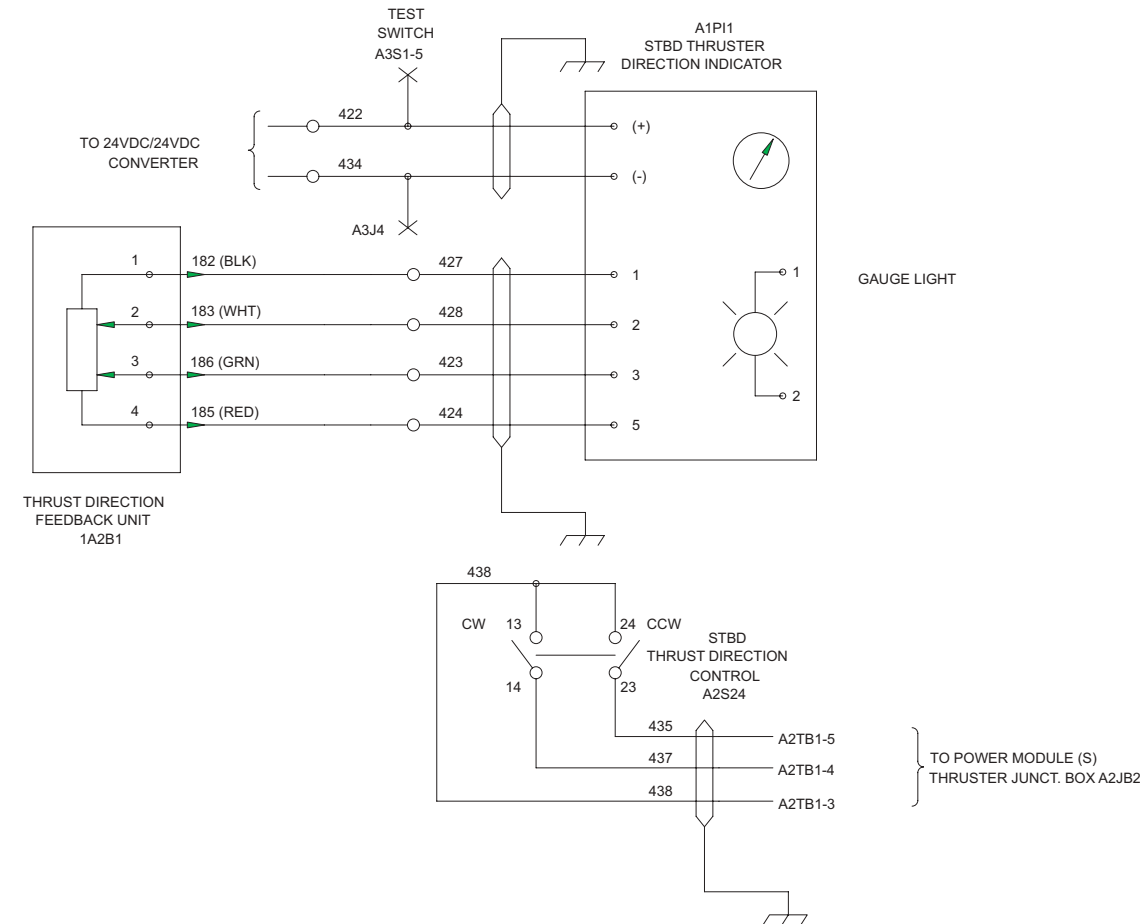
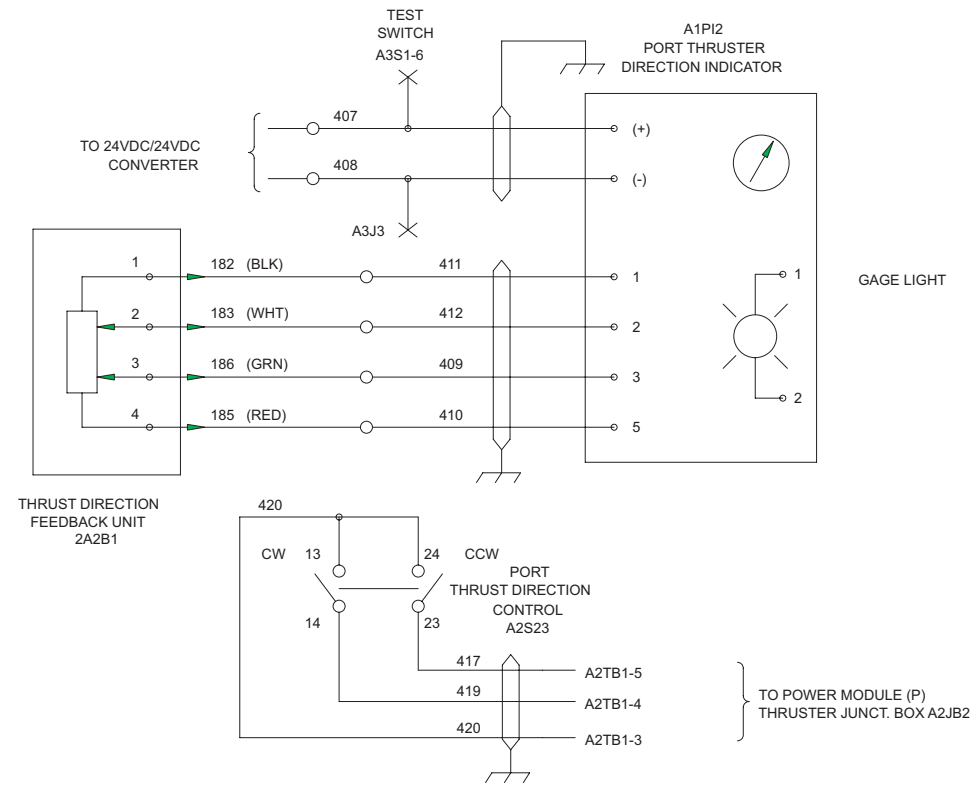
NOTE: CB11 TOGGLE ACTS AS A SWITCH FOR DECK LIGHTS

Figure 5. MCS Operator Cab Schematic (Sheet 3 of 6).

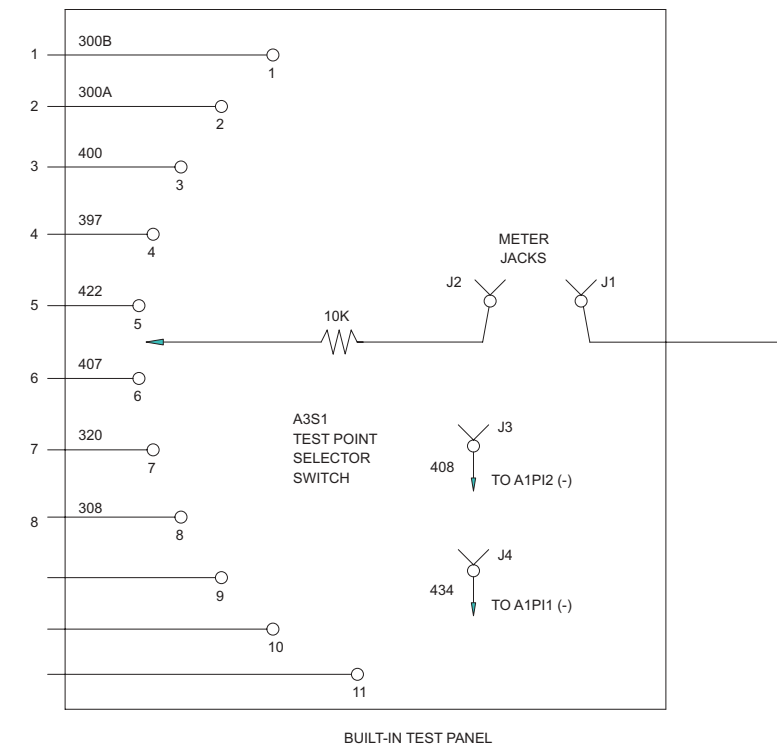


NOTE:
 CONNECTING PINS 3 AND 13 ENABLES COMMUNICATION THROUGH NMEA PORT. PINS 3 AND 13 ARE CONNECTED INTERNALLY BY THE GPS/ROSS RADIO INTERFACE CABLE AS WELL AS BY A JUMPER INSTALLED IN JB-3.

Figure 5. MCS Operator Cab Schematic (Sheet 4 of 6).



- STBD 24V BUS
- PORT 24V BUS
- STBD SPEED COM.
- PORT SPEED COM.
- STBD THRUSTER +24V
- PORT THRUSTER +24V
- STBD ENG 24
- PORT ENG 24
- NOT USED
- NOT USED
- NOT USED



FROM SHEET 4
BOTTOM RIGHT

0

Figure 5. MCS Operator Cab Schematic (Sheet 5 of 6).

DESIGNATORS

NOTE: ALL DESIGNATORS ARE PREFIXED WITH UNIT OR ASSEMBLY NUMBERS AND FOLLOWED BY AN ASSIGNED NUMBER FOR IDENTIFICATION.

DESIGNATOR	DEVICE
A1	MIDDLE CONTROL PANEL ASSEMBLY, E42493
A2	LOWER CONTROL PANEL ASSEMBLY, E42483
A3	OPERATOR CAB CIRCUIT BREAKER PANEL, E42263
A4	TERMINAL STRIP ASSEMBLY, E43043
A5	STBD RECEPTACLE ASSEMBLY, E08873
A6	PORT RECEPTACLE ASSEMBLY, E08883
A7	MAST ENCLOSURE ASSEMBLY, E49513
A8	24/12 VDC CONVERTER ASSEMBLY,E48513
B	MOTOR, STARTER or SYNCHRO
BT	BATTERY
CB	CIRCUIT BREAKER
D	DIODE, SEMICONDUCTOR
DS	INDICATING LAMP
E	EMI/RFI SUPPRESSOR
G	ALTERNATOR
J	RECEPTACLE
JB	JUNCTION BOX
K	RELAY
L	SOLENOID
LS	AUDIBLE DEVICE, BEEPER, HAILER HORN, etc.
M	METER, GAGE or PICK-UP
MT	TRANSDUCER FOR METER/GAGE; COMPASS SENSOR
PI	PANEL INDICATOR
R	RESISTOR OR POTENTIOMETER
S	SWITCH INCLUDING ILLUMINATED PUSHBUTTON SWITCHES
VR	VOLTAGE CONVERTER, 24VDC TO 12 VDC

- EXAMPLES: 1) A1M1, THIS IS METER NUMBER 1 (PORT ENGINE WATER TEMP METER) INSTALLED ON MIDDLE CONTROL PANEL ASSEMBLY "A1"
- 2) A1S6, THIS IS SWITCH NUMBER 6 (STBD ENGINE POWER SWITCH) INSTALLED ON MIDDLE CONTROL PANEL ASSEMBLY "A1"
- 3) A2S13, THIS IS SWITCH NUMBER 13 (ILLUMINATED PUSHBUTTON SWITCH FOR PORT BILGE PUMP NUMBER 5 INSTALLED ON LOWER CONTROL PANEL ASSEMBLY "A2"

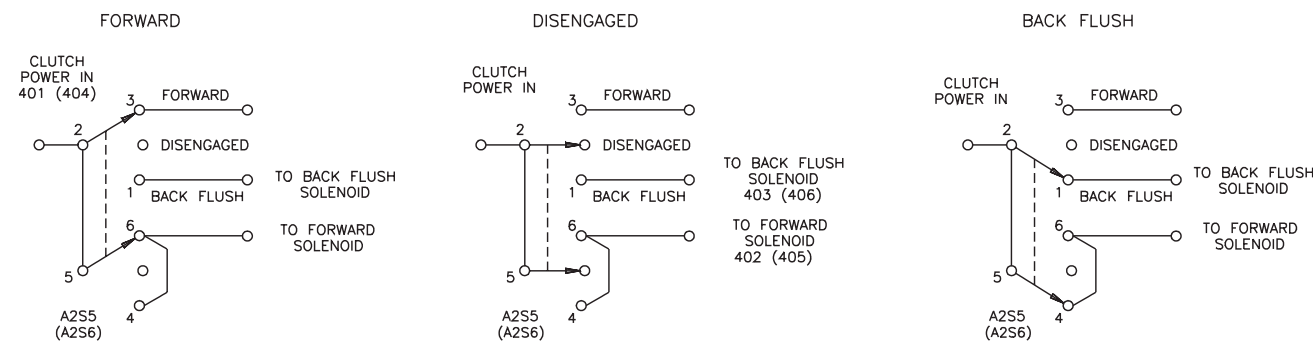
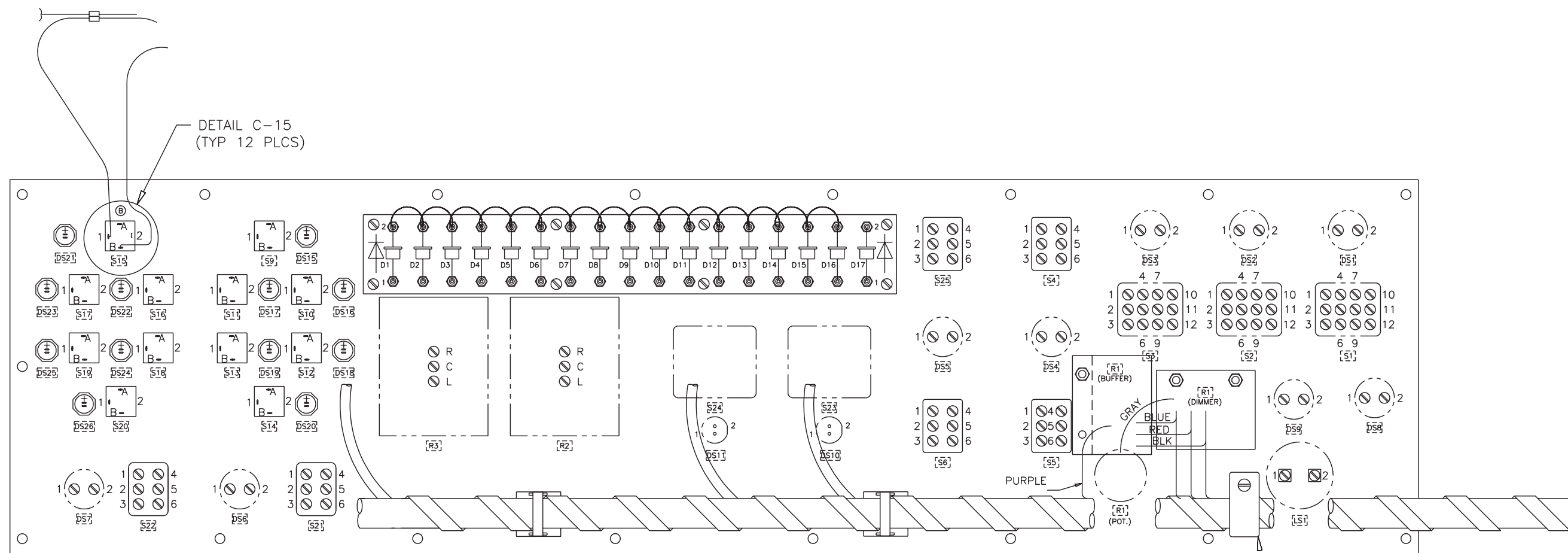
NOTES:

1. CONDUCTORS SHOWN AS DASHED CONTINUE TO PROPULSION MODULES THROUGH CONNECTORS. DEVICES IN PROPULSION MODULES ARE DESIGNATED BY NUMERICAL PREFIX, TYPE DESIGNATION, AND PART NUMBER. PORT (2) OR STBD (1) MODULE DESIGNATIONS PREFIX PART DESIGNATOR.
2. THIS SCHEMATIC DOES NOT SHOW ALL TERMINALS OR CONNECTOR PIN NUMBERS.
3. TERMINAL MARKINGS ON GAGES OR OTHER DEVICES MAY DIFFER DUE TO ALTERNATE SOURCES.
4. "RUN" LIGHTS A2S9 THROUGH A2S20 (SHEET 1) ARE PART OF ILLUMINATED PUSHBUTTON SWITCHES A2S9 THROUGH A2S20. FOR SCHEMATIC PURPOSES THESE LIGHTS HAVE "S" DESIGNATIONS INSTEAD OF "DS" DESIGNATION FOR OTHER LIGHTS IN THE SYSTEM.

LEGEND

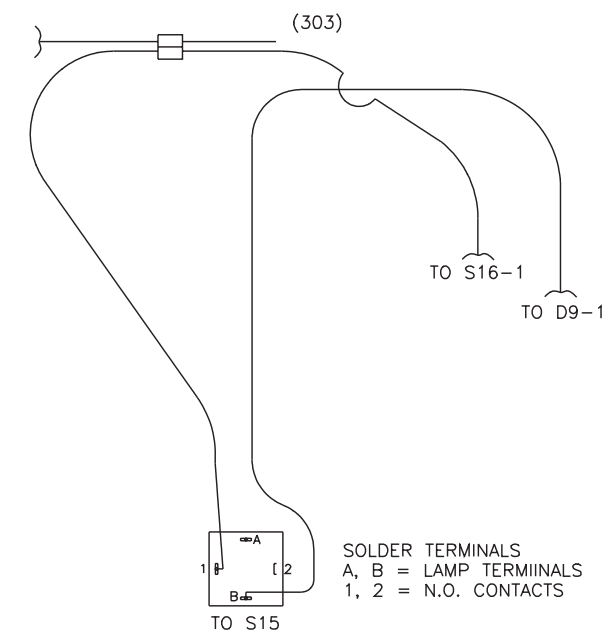
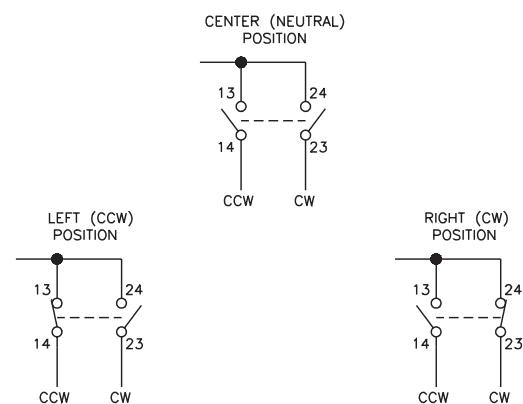
ABBREVIATION	EXPLANATION
AM	AMMETER
DISENGAGED	CLUTCH IN NEUTRAL POSITION
ENG PWR	ENGINE POWER
ENG MALF	ENGINE MALFUNCTION, INDICATES LOW OIL PRESSURE OR HIGH COOLANT TEMPERATURE
E-STOP	ENGINE EMERGENCY STOP/AIR SHUT-OFF
GPS	GLOBAL POSITIONING SYSTEM
MIM	MARINE INTERFACE MODULE
(P)	PORT
RAY 430	LOUDHAILER
RECEPT	RECEPTACLE, CONNECTOR
(S)	STBD
SINGGARS	GOVERNMENT FURNISHED RADIO, SINGLE CHANNEL GROUND & AIRBORNE RADIO SYSTEM
SW	SWITCH
TACH	TACHOMETER FOR ENGINE SPEED IN RPM
TEMP	TEMPERATURE

Figure 5. MCS Operator Cab Schematic (Sheet 6 of 6).



S5 PORT / S6(STBD) MARINE GEAR CLUTCH CONTROL WIRING DIAGRAM

STEERING CONTROL WIRING DIAGRAM



DETAIL C-15 (TYPICAL)

Figure 6. Lower Control Panel "A2" Assembly Wiring.

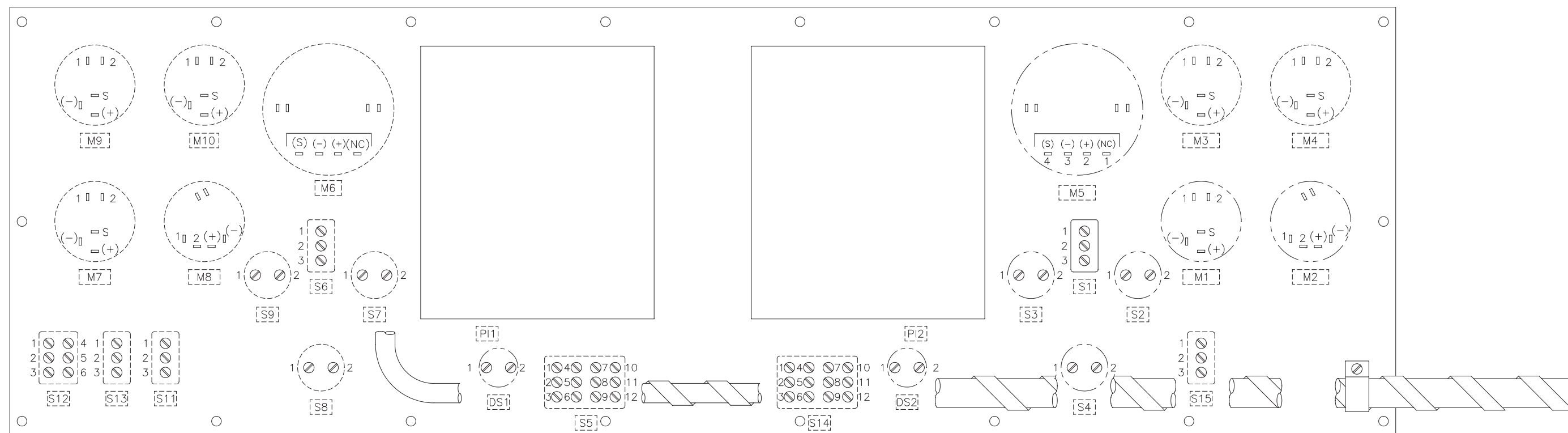
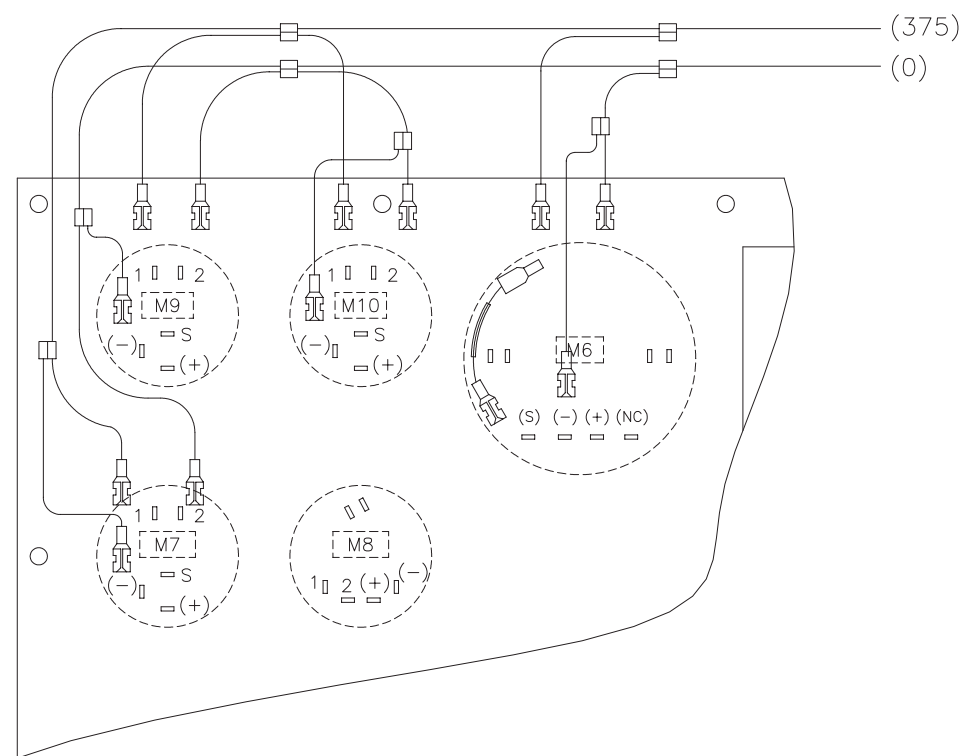
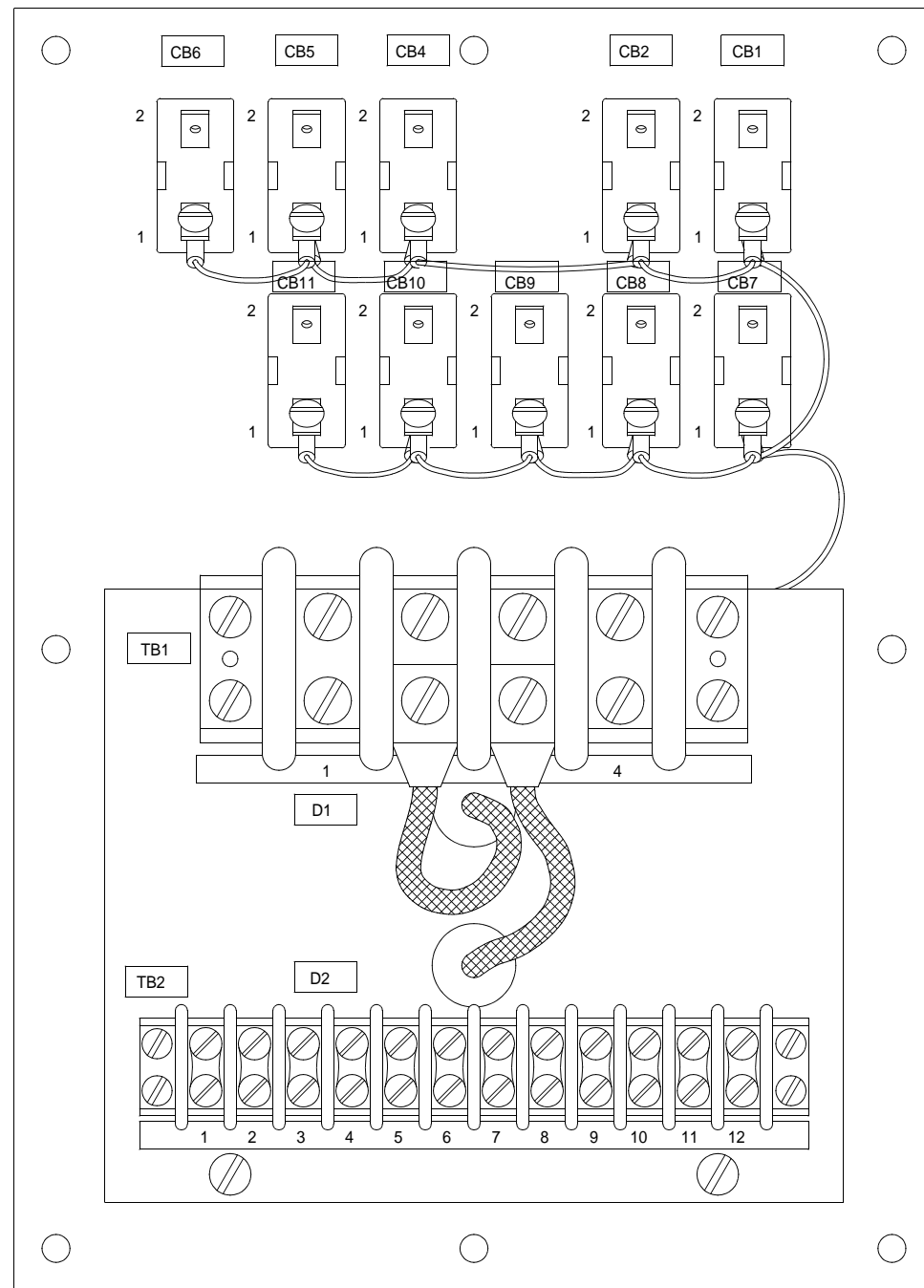


Figure 7. Middle Control Panel "A1" Assembly Wiring.



VIEW B-15

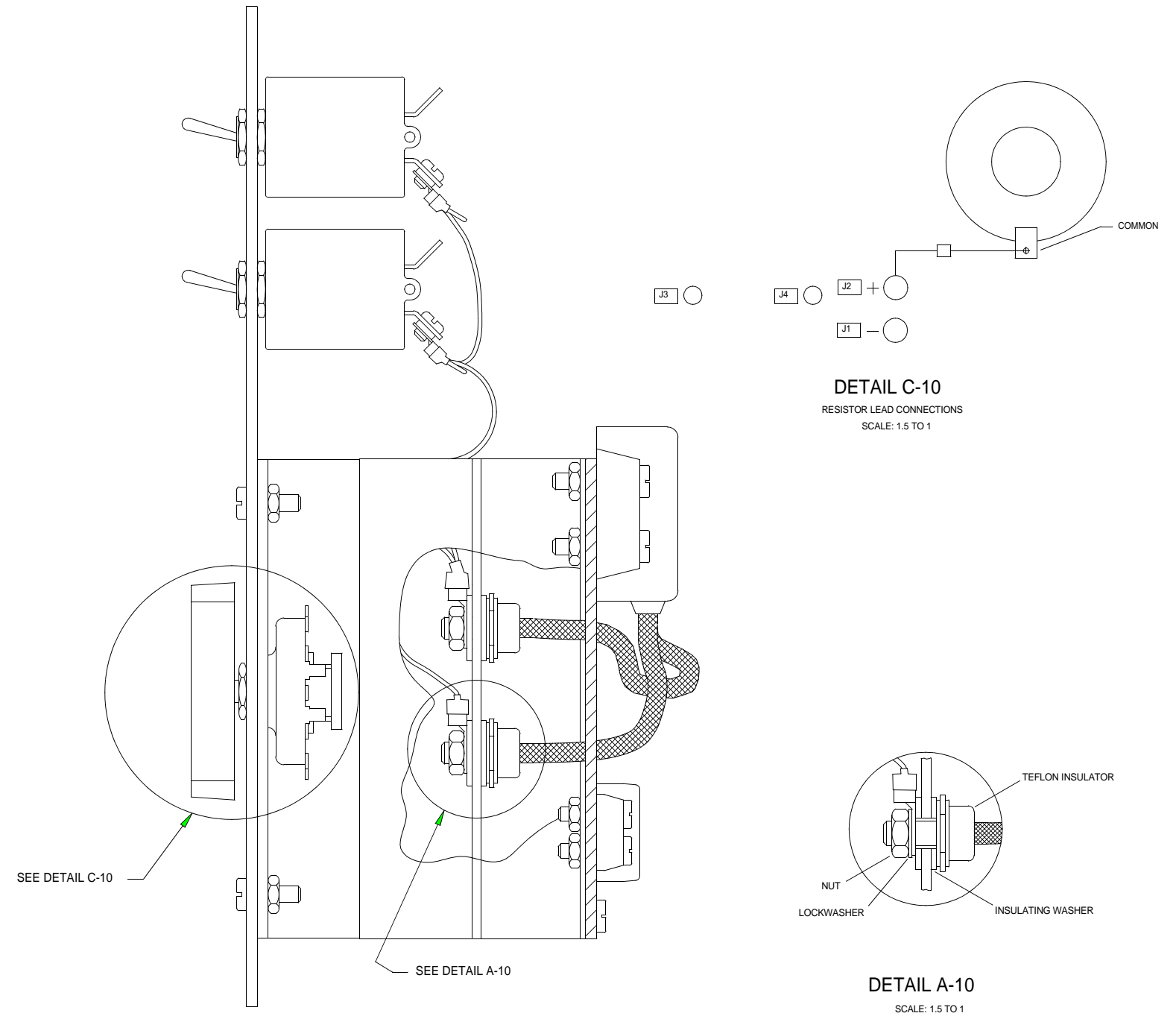
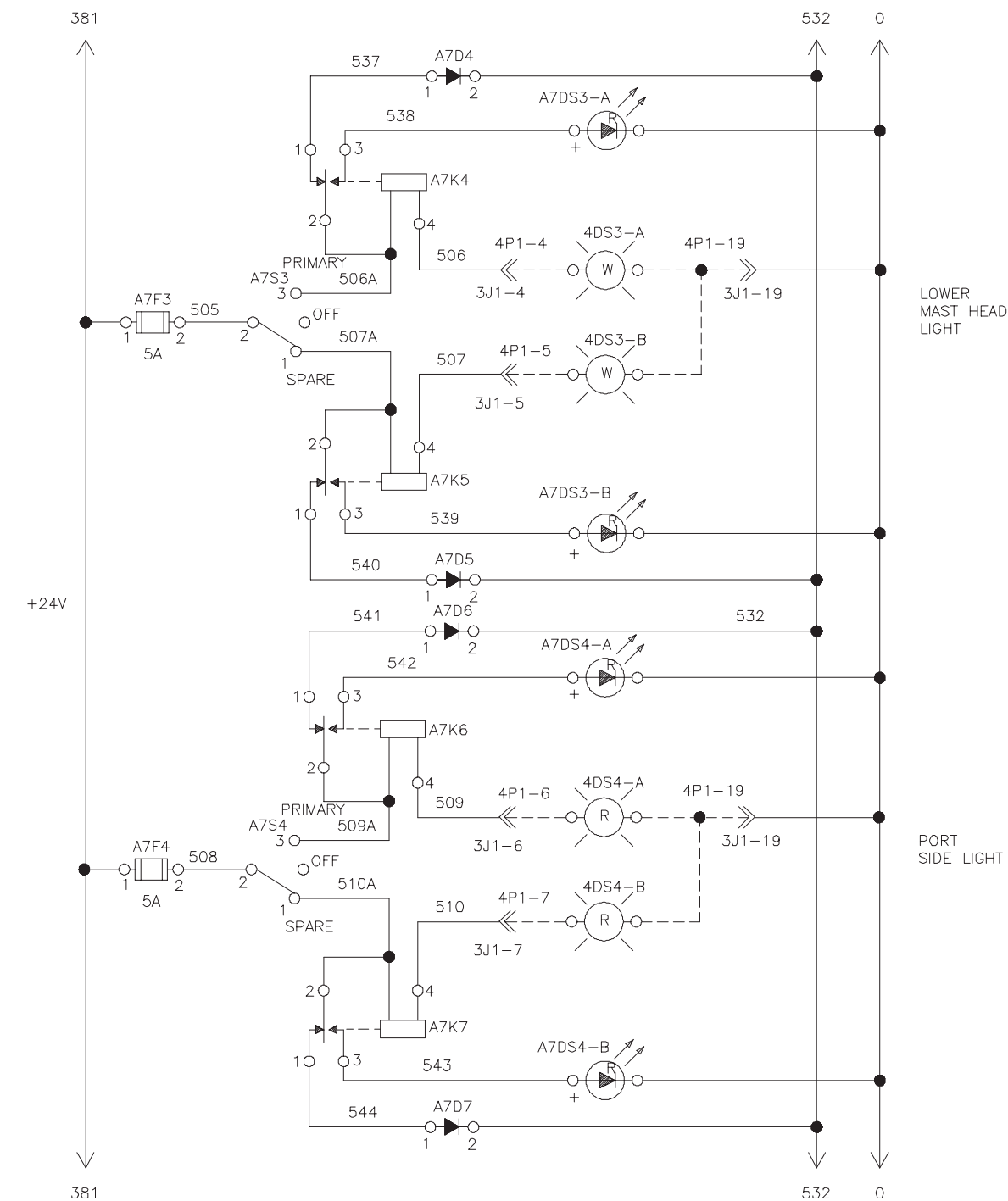
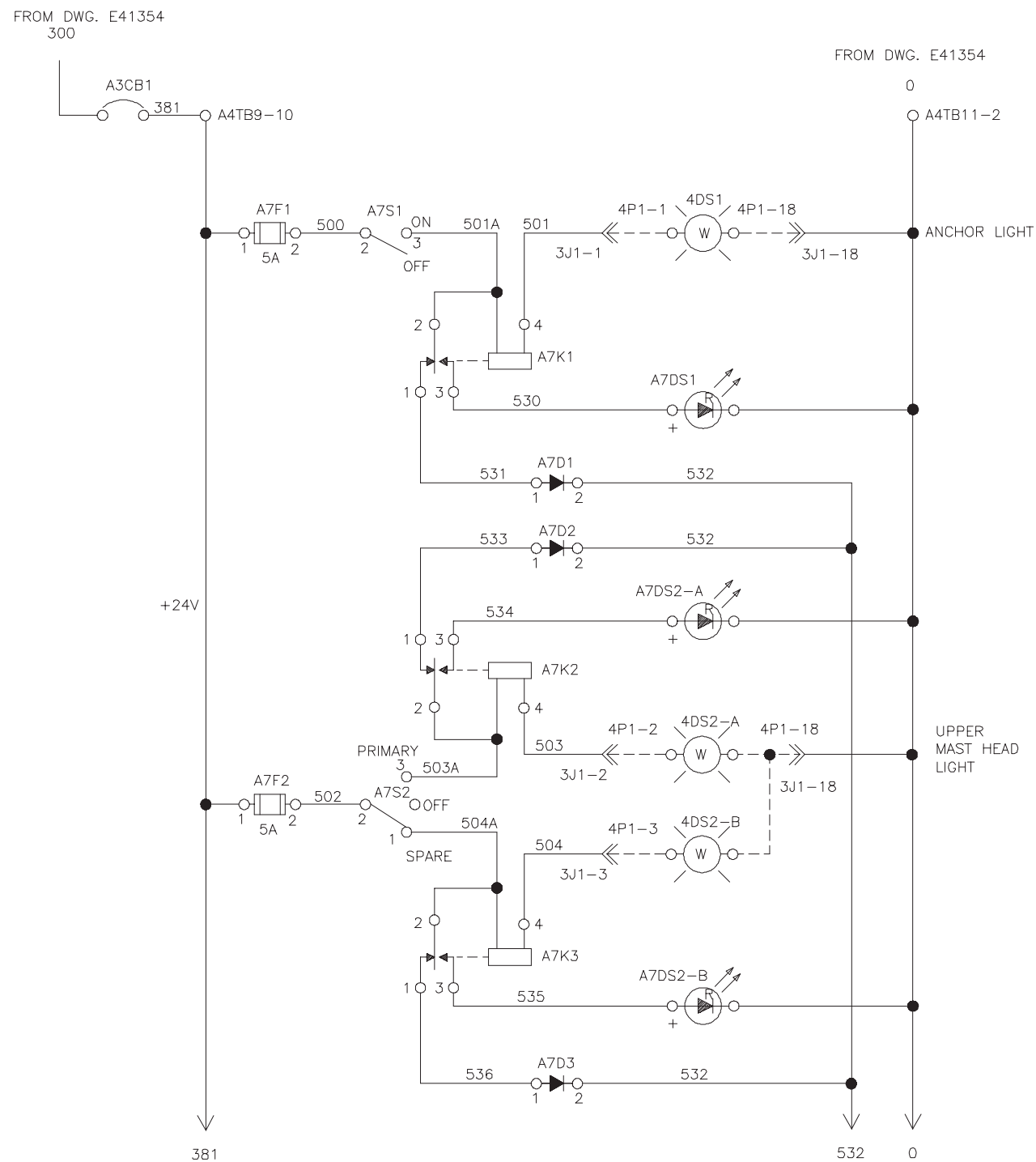


Figure 8. Operator Cab Circuit Breaker Panel "A3" Wiring.



CONTINUED SHEET 2

CONTINUED SHEET 2

Figure 9. Navigation Lights Schematic (Sheet 1 of 3).

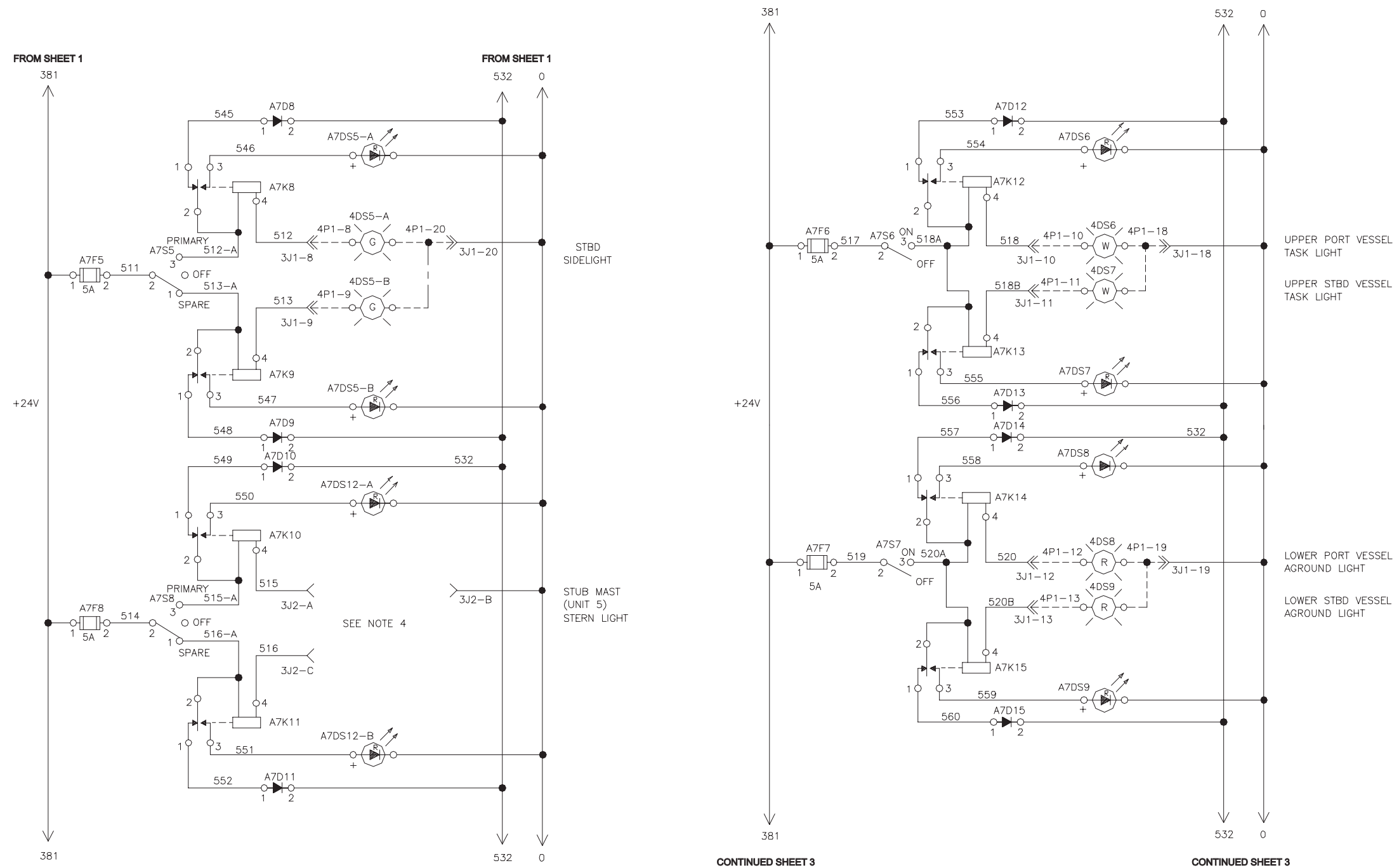


Figure 9. Navigation Lights Schematic (Sheet 2 of 3).

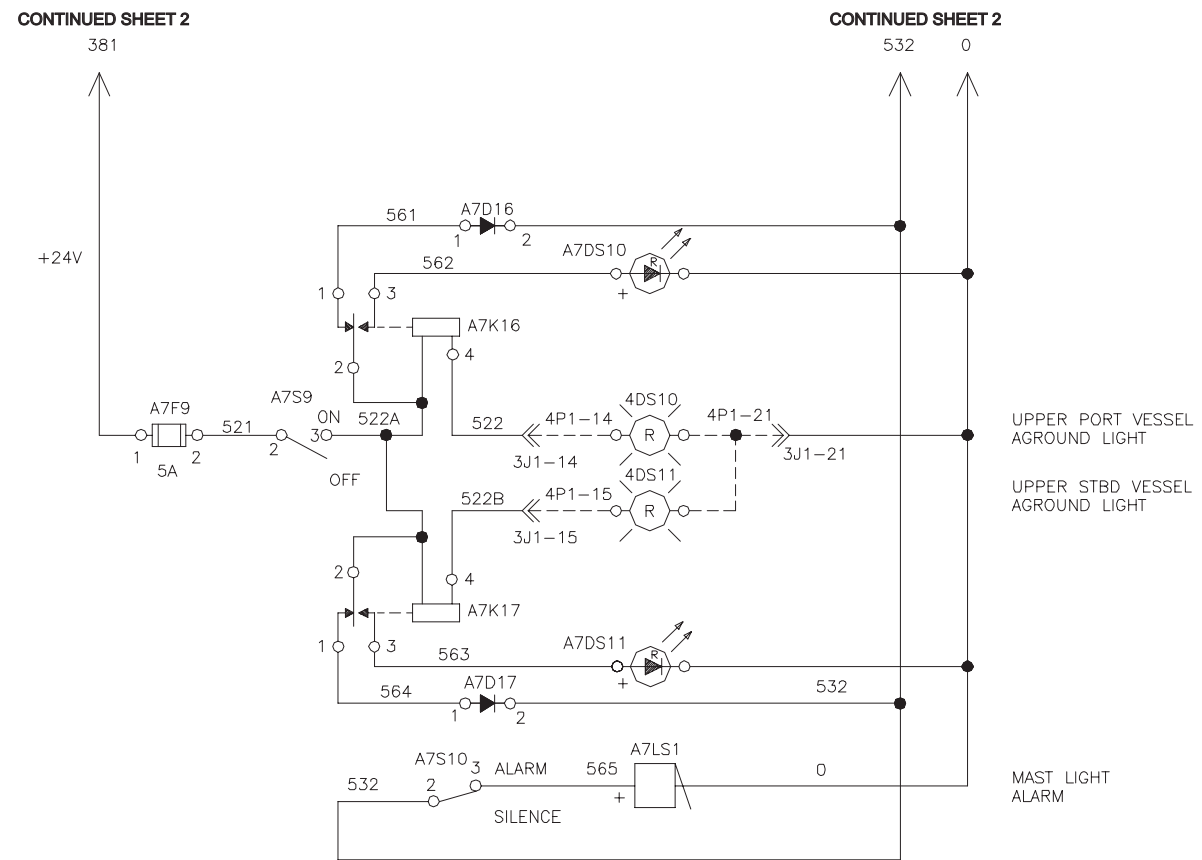
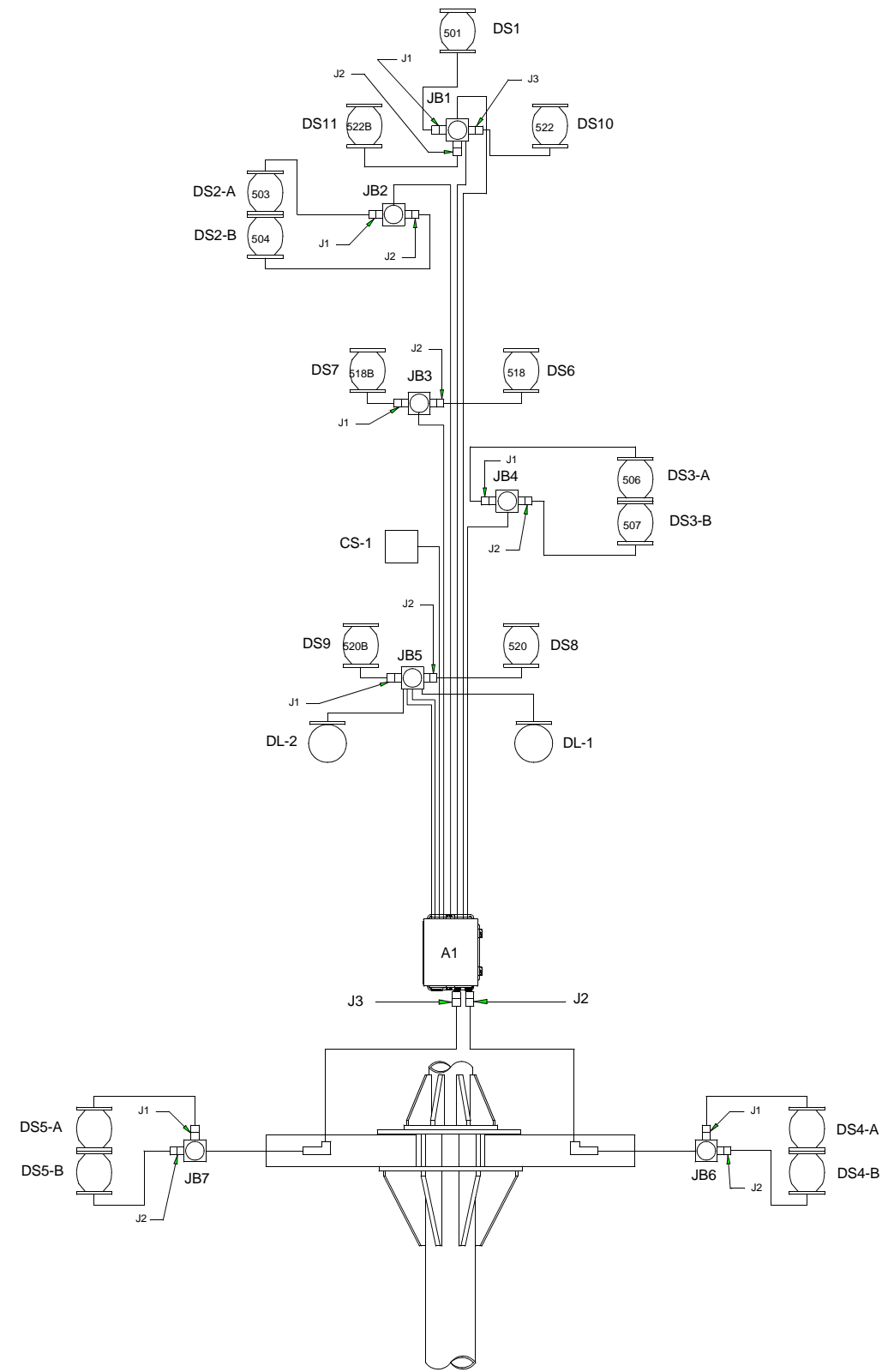


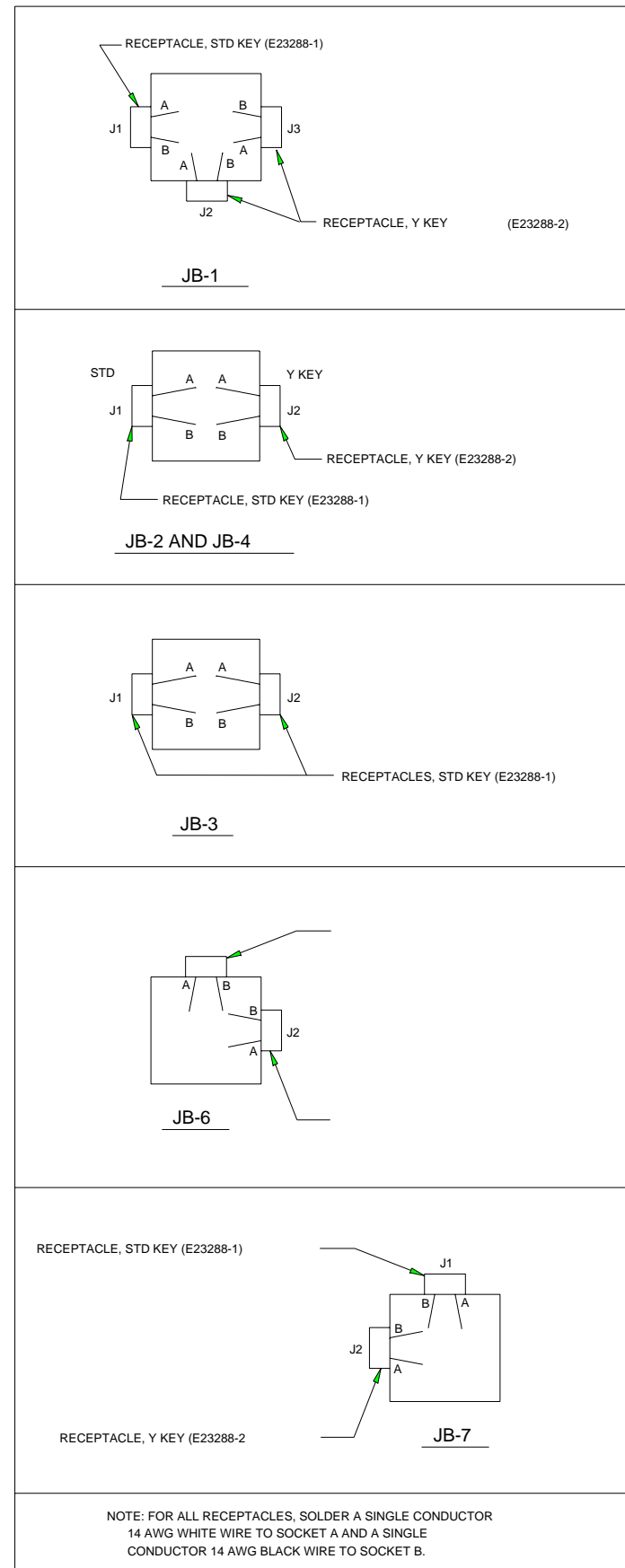
Figure 9. Navigation Lights Schematic (Sheet 3 of 3).



LEGEND

ANCHOR WHITE, ALL AROUND SINGLE	DS1
UPPER PORT VESSEL AGROUND RED, ALL AROUND SINGLE	DS10
UPPER STBD VESSEL AGROUND RED, ALL AROUND SINGLE	DS11
UPPER MASTHEAD WHITE, SCREENED DOUBLE	DS2-A DS2-B
UPPER PORT VESSEL TASK WHITE, ALL AROUND SINGLE	DS6
UPPER STBD VESSEL TASK WHITE, ALL AROUND SINGLE	DS7
LOWER MASTHEAD WHITE, SCREENED DOUBLE	DS3-A DS3-B
LOWER PORT VESSEL AGROUND RED, ALL AROUND SINGLE	DS8
LOWER STBD VESSEL AGROUND RED, ALL AROUND SINGLE	DS9
PORT SIDELIGHT RED, SCREENED DOUBLE	DS4-A DS4-B
STBD SIDELIGHT GREEN, SCREENED DOUBLE	DS5-A DS5-B
NAVIGATION LIGHT TERM BOX	A1
DECK LIGHTS	DL-1 DL-2
COMPASS SENSOR	CS-1

Figure 10. Main Mast Cable Diagram (Sheet 1 of 2).



JUNCTION BOXES (LOOKING AFT) RECEPTACLE WIRING

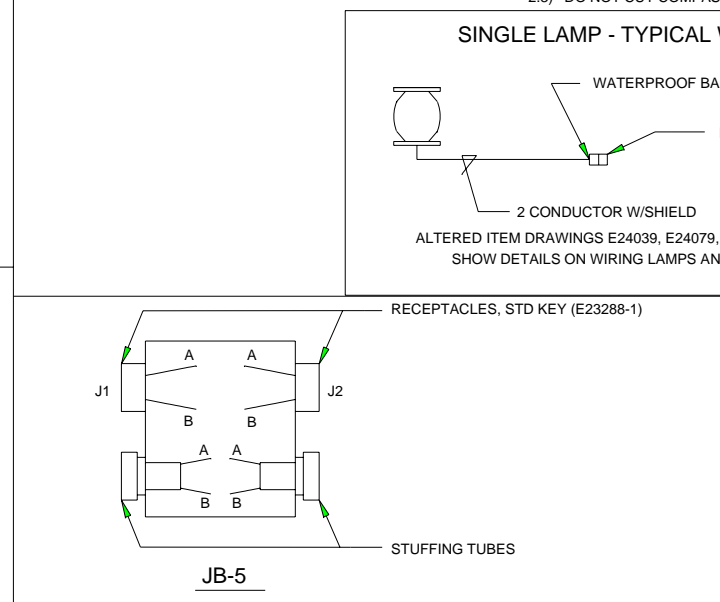


TABLE I

CABLE NUMBER	CABLE TYPE	CONDUCTOR NUMBER	CONDUCTOR COLOR	FROM	FROM METHOD	TO	TO METHOD	NOTES
1	14/2	501	WHT	A1TB1-1	A	JB1/J1-A	B	
	14/2	0	BLK	A1TB3-1	A	JB1/J1-B	B	
2	14/3	518	WHT	A1TB1-10	A	JB3/J2-A	B	
	14/3	518B	GRN	A1TB2-1	A	JB3/J1-A	B	
3	14/3	0	BLK	A1TB3-2	A	JB3/J1&J2-B	C	
	14/3	503	WHT	A1TB1-2	A	JB2/J1-A	B	
4	14/3	504	GRN	A1TB1-3	A	JB2/J2-A	B	
	14/3	0	BLK	A1TB3-3	A	JB2/J1&J2-B	C	
5	14/3	520	WHT	A1TB2-2	A	JB5/J2-A	B	
	14/3	520B	GRN	A1TB2-3	A	JB5/J1-A	B	
6	14/3	0	BLK	A1TB3-4	A	JB5/J1&J2-B	C	
	14/3	506	WHT	A1TB1-4	A	JB4/J1-A	B	
7	14/3	507	GRN	A1TB1-5	A	JB4/J2-A	B	
	14/3	0	BLK	A1TB3-5	A	JB4/J1&J2-B	C	
8	16/3	509	WHT	J2-A	D	JB6/J1-A	B	
	16/3	510	RED	J2-C	D	JB6/J2-A	B	
9	16/3	0	BLK	J2-B	D	JB6/J1 & J2-B	C	
	16/3	512	WHT	J3-A	D	JB7/J1-A	B	
10	16/3	513	RED	J3-C	D	JB7/J2-A	B	
	16/3	0	BLK	J3-B	D	JB7/J1 & J2-B	C	
11	16/3	522	WHT	A1TB2-4	A	JB1/J3-A	B	
	16/3	522B	RED	A1TB2-5	A	JB1/J2-A	B	
12	16/3	0	BLK	A1TB3-8	A	JB1/J2&J3-B	C	
	14/2	445	WHT	A1TB2-9	A	JB5/DL-A	C	
13	14/2	0	BLK	A1TB2-7	A	JB5/DL-B	C	
	SWE	-	-	N/C	-	P10 N/C	-	NOTE 2.3
14	SWE	-	RED	CS-1 PIN 2	-	P10 PIN B	-	
	SWE	-	-	N/C	-	P10 N/C	-	
15	SWE	-	WHT	CS-1 PIN 4	-	P10 PIN D	-	
	SWE	-	BLK	CS-1 PIN 5	-	P10 PIN E	-	
16	SWE	-	GRN	CS-1 PIN 6	-	P10 PIN F	-	
	SWE	-	BLUE	CS-1 PIN 7	-	P10 PIN G	-	

NOTES:

- 2.1) ALL INTERNAL CABLES ARE SJOW-A TYPE.
- 2.2) TERMINATION METHODS: TERMINATE WIRES AS SHOWN IN TABLE I. ASSEMBLY A1, ALL LAMPS AND JB'S WITH RECEPTACLES SHALL BE INSTALLED PRIOR TO USING TABLE I.
 - A - TERMINAL LUG, RING TONGUE, #6 FLANGED FORK FOR 14AWG WIRE IN A1 ASSEMBLY.
 - B - SETSCREW WIRE CONNECTOR FOR 2-14AWG WIRES IN JUNCTION BOXES.
 - C - SETSCREW WIRE CONNECTOR FOR 3-14AWG WIRES IN JUNCTION BOXES.
 - D - SOLDER CONNECTION
- 2.2) CONDUCTOR LABELS:
ALL WIRES ARE TO BE LABELED ON BOTH ENDS WITH CONDUCTOR NUMBER ON HEAT SHRINK TUBING IDENTIFIED ON ASSEMBLY DRAWING E03123.
- 2.3) DO NOT CUT COMPASS SENSOR CABLE UNTIL PROPER LENGTH IS DETERMINED AT INSTALLATION OF MAST TO CAB.

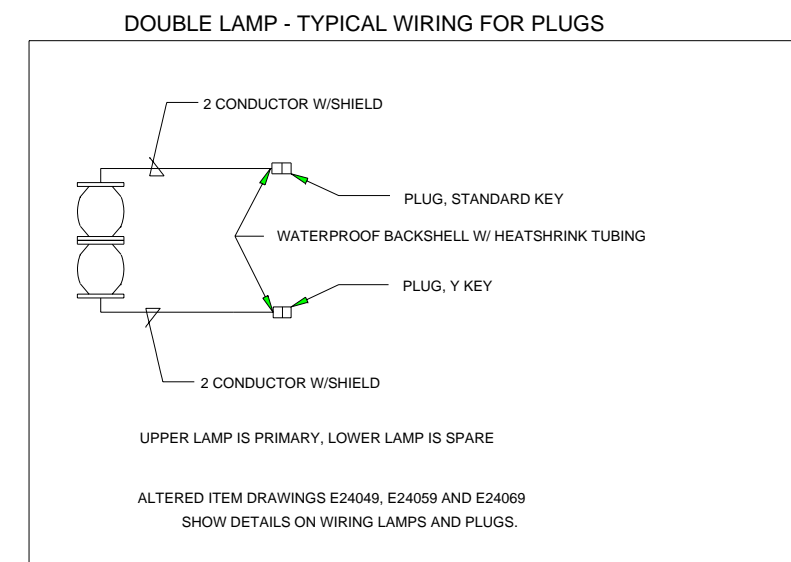
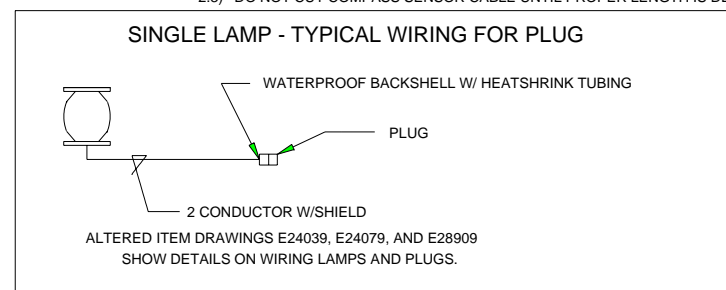


Figure 10. Main Mast Cable Diagram (Sheet 2 of 2).

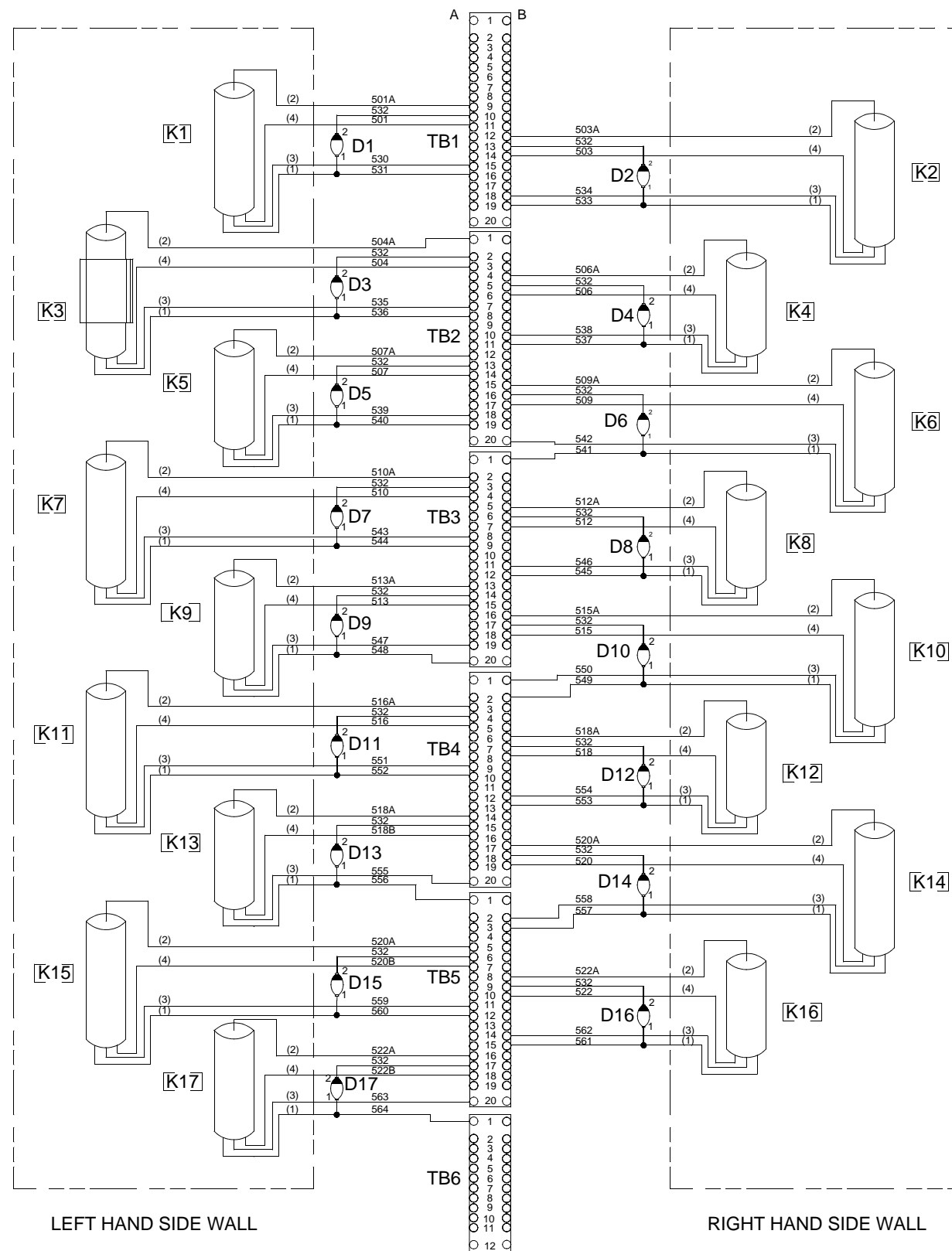


Figure 11. Mast Enclosure Assembly "A7".

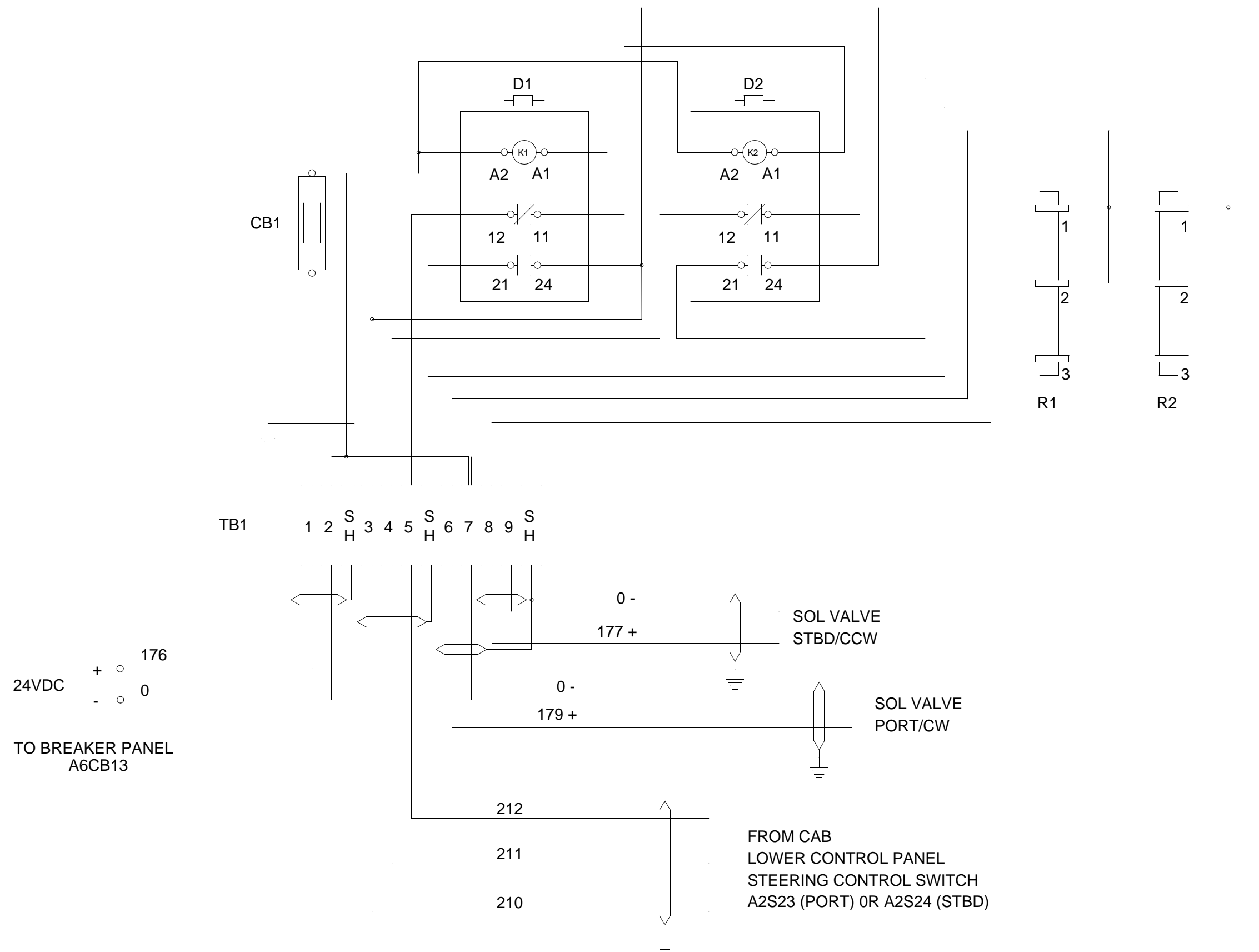


Figure 12. Thruster Junction Box Assembly A2JB2.

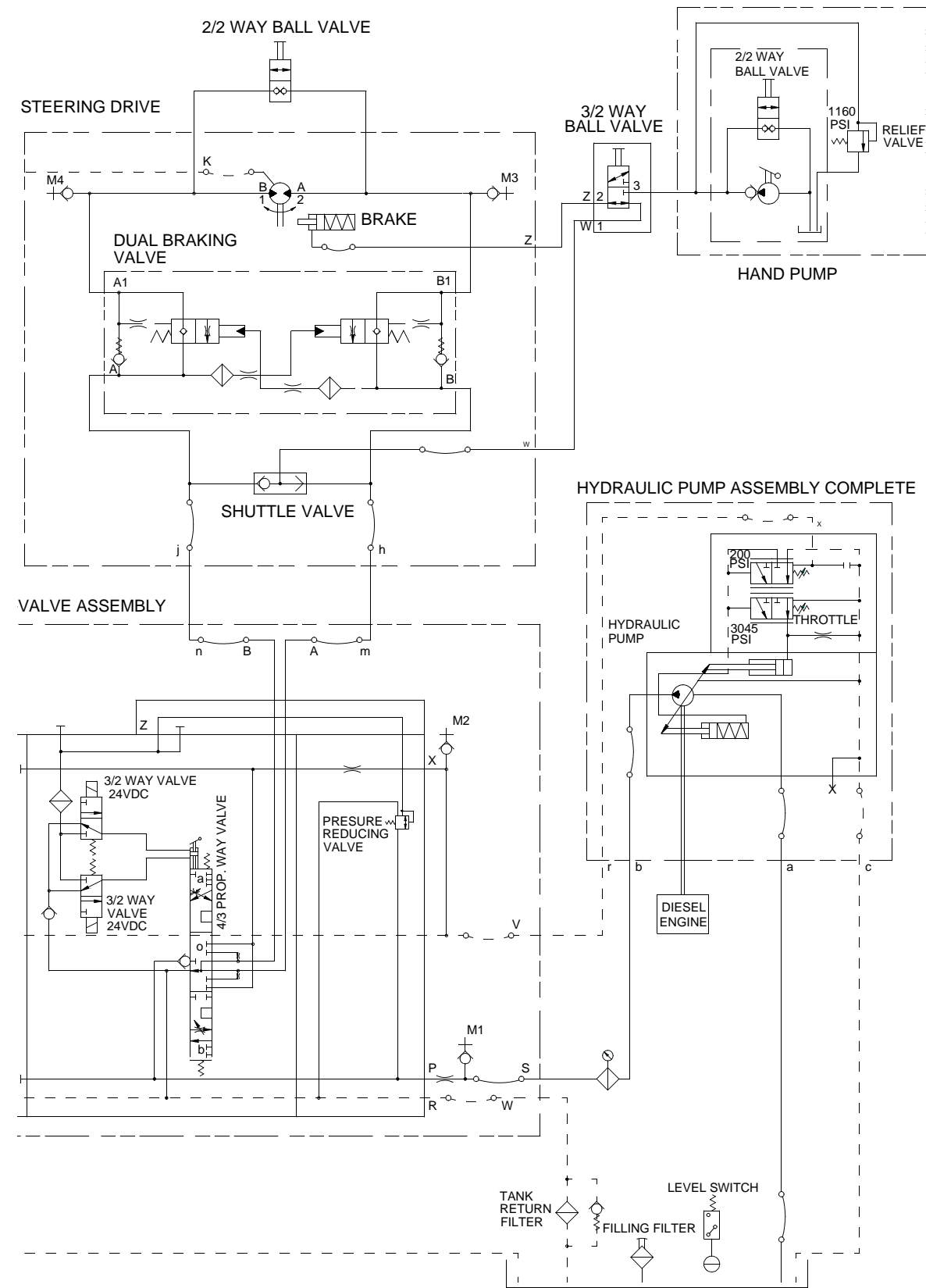
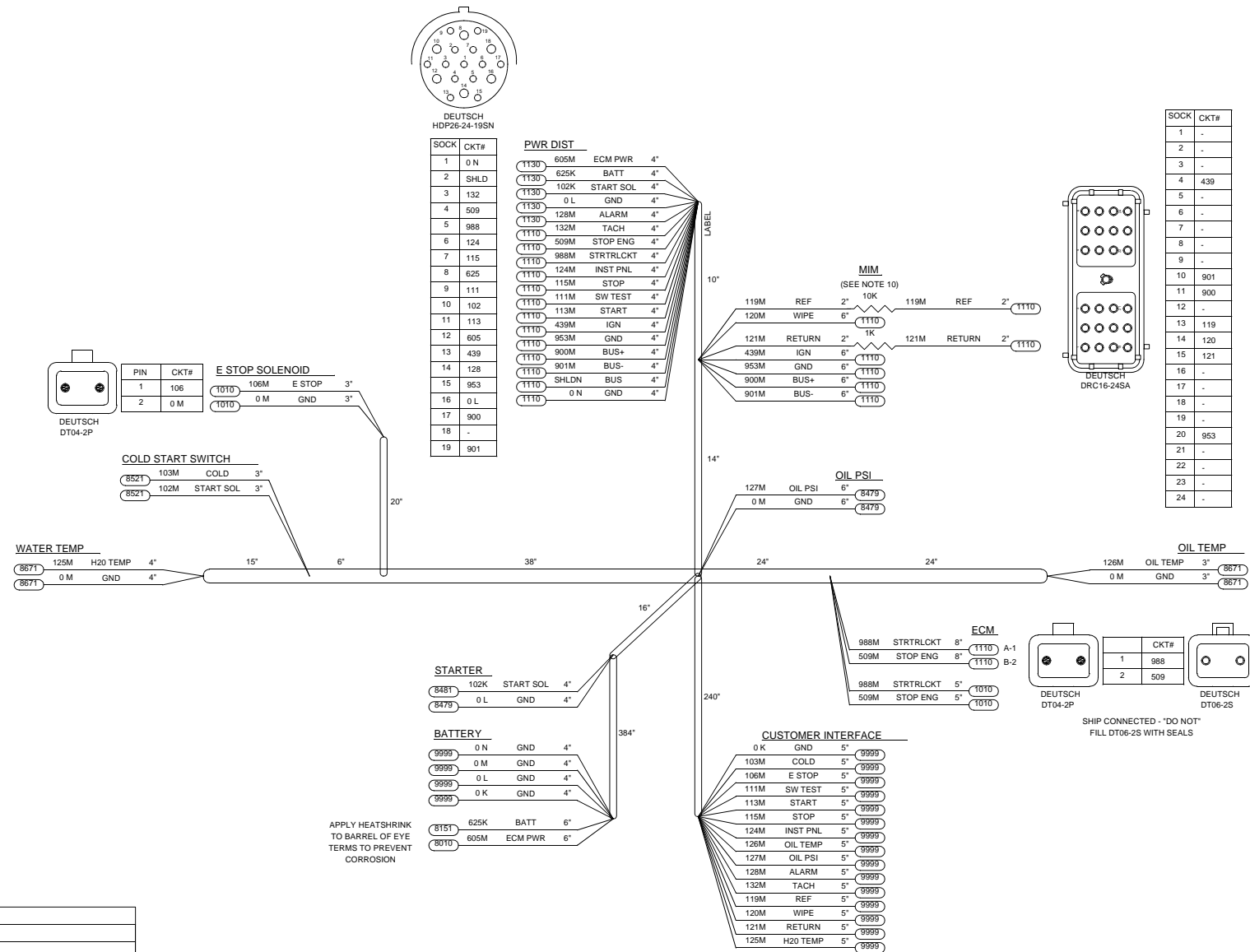


Figure 13. Hydraulic Schematic Diagram.



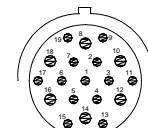
CIRCUIT DIRECTORY				
CKT#	COLOR	FUNCOD	QTY	DESCRIPTION
0	WHT	GND	12	GROUND
102	RED	START SOL	3	START SOLENOID POWER FROM START RELAY
103	GRN	COLD	2	COLD START SIGNAL TO PILOT STATION
106	GRN	E STOP	2	EMERGENCY STOP SIGNAL TO PILOT STATION
111	ORN	SW TEST	2	SWITCH TEST SIGNAL FROM PILOT STATION
113	ORN	START	2	START SIGNAL TO POWER DISTRIBUTION BOX
115	ORN	STOP	2	STOP SIGNAL TO POWER DISTRIBUTION BOX
119	RED	REF	3	THROTTLE REFERENCE SIGNAL
120	GRN	WIPE	2	THROTTLE WIPE SIGNAL
121	BLK	RETURN	3	THROTTLE RETURN SIGNAL
124	ORN	INST PNL	2	PILOT STATION SIGNAL TO POWER DISTRIBUTION BOX
125	GRN	H2O TEMP	2	ENGINE WATER TEMP SIGNAL TO PILOT STATION
126	GRN	OIL TEMP	2	ENGINE OIL TEMP SIGNAL TO PILOT STATION
127	GRN	OIL PSI	2	ENGINE OIL PSI SIGNAL TO PILOT STATION
128	ORN	ALARM	2	ALARM SIGNAL TO PILOT STATION
132	ORN	TACH	2	TACHOMETER SIGNAL TO PILOT STATION
439	RED	IGN	2	IGNITION SIGNAL TO ECM
509	PUR	STOP ENG	3	STOP ENGINE SIGNAL FROM ECM
605	RED	ECM PWR	2	BATTERY POWER TO IGNITION RELAY
625	RED	BATT	3	BATTERY POWER +24V DC
900	RED	BUS+	2	J1587 BUS+
901	BLK	BUS-	2	J1587 BUS-
953	WHT	GND	2	GROUND
988	GRY	STRTRLCKT	3	ECM SIGNAL TO INSTRUMENT PANEL & LOCKOUT RELAY

TERMINAL DIRECTORY			
TRM#	QTY	SIZE	DESCRIPTION
1010	4	16-18GA	PIN, #16, NICKEL, DEUTSCH, 0460-202-16141
1110	22	16-18GA	SOCKET, #16, NICKEL, DEUTSCH, 0462-201-16141
1130	5	12-16GA	SOCKET, #12, NICKEL, DEUTSCH, 0462-203-12141
8010	1	14-16GA	EYE, INSL, #6, SEALED, AMP 55850-1
8479	3	14-16GA	SPADE, SEALED, #8, AMP, 55870-1
8481	1	10-12GA	SPADE, SEALED, #8, AMP, 55872-1
8151	2	10-12GA	EYE, INSL, #6, AMP, 35149
8521	2	14-16GA	BUTTSPLICE, SEALED, AMP, 55825-1
8671	4	14-16GA	SLIDE, FEMALE, FULLY INSL, AMP, 3-350819-2
9999	19	ALL	NO STRIP, NO TERM

SUFFIX LETTER	WIRE SIZE	LOAD RANGE
A	4/0	300-350
B	3/0	250-299
C	2/0	200-249
D	0	150-199
E	1	100-149
F	2	75-99
G	4	50-74
H	6	40-49
I	8	30-39
J	10	20-29
K	12	15-19
L	14	10-14
M	16	5-9
N	18	3-4
O	20	1-2
P	22	0-1

- NOTES:
- ALL SECONDARY LOCKS & SEALS REQUIRED WHERE APPLICABLE.
 - HARNES ASSY TO BE PROTECTED W/40MIL BLACK NYLON YARN, 12 PIX PER INCH.
 - HARNES LABEL TO INCLUDE PART NUMBER, DATE & REVISION LEVEL.
 - TERMINAL MANUFACTURER MAY BE SUBSTITUTED WITH ANOTHER MANUFACTURER IF EQUIVALENT. DEUTSCH TERMINALS "MAY NOT" BE SUBSTITUTED.
 - WIRE TYPE TO BE GXL UNLESS OTHERWISE NOTED.
 - CIRCUITS 119, 120, 121 TO BE A SHIELDED CABLE. BELDEN 85241 OR EQUIVALENT. SHIELD DRAIN TO BE GROUNDED AT PILOT STATION DURING INSTALLATION.
 - CIRCUITS 900 & 901 TO BE A SHIELDED CABLE. BELDEN 85231 OR EQUIVALENT. SHIELD DRAIN TO BE GROUNDED TO "0" CIRCUIT IN POWER DISTRIBUTION BOX LOCATION. DRAIN WIRE TO HAVE HEATSHRINK SO DEUTSCH CONNECTOR WILL SEAL.
 - ALL CONNECTOR VIEWS ARE SHOWN WIRE INSERTION SIDE UNLESS OTHERWISE NOTED.
 - "CIRCUIT 0" DIFFERENT WIRE GAUGE SIZES NOT TO BE SPLICED INSIDE HARNES.
 - RESISTORS TO BE COVERED WITH NON-ADHESIVE LINED HEATSHRINK. RESISTOR VALUES ARE TO BE +/- 1, 1/4 WATT.
 - NON-PREINSULATED EYE TERMS TO HAVE HEATSHRINK APPLIED TO TERM BARREL.
 - ATTACH TO PIGTAIL AS LOOSE TERMS (2) .250 FULLY INSL SLIDES. AMP 3-520106-2 OR EQUIVALENT.

Figure 14. Engine Electrical System Schematic (Sheet 1 of 4).



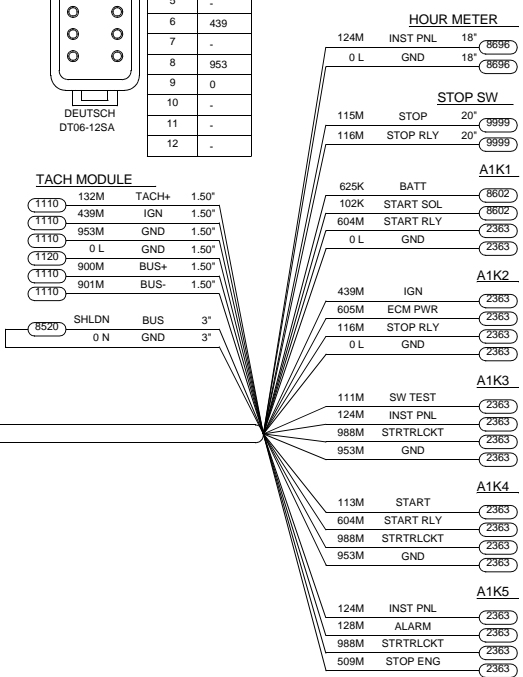
DEUTSCH
HDP24-24-19PN
NUT 2411-001-2405
SEAL MCL-0000-0012

PIN	CKT#
1	0 N
2	SHLD
3	132
4	509
5	988
6	124
7	115
8	625
9	111
10	102
11	113
12	605
13	439
14	128
15	953
16	0 L
17	900
18	-
19	901

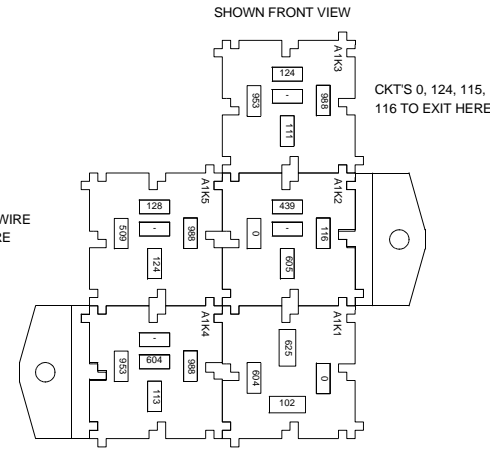
TRM#	QTY	SIZE	DESCRIPTION
1030	605M	ECM PWR	5"
1030	625K	BATT	5"
1030	102K	START SOL	5"
1030	0 L	GND	5"
1030	128M	ALARM	5"
1030	132M	TACH	5"
1010	509M	STOP ENG	5"
1010	988M	STRTRLCKT	5"
1010	124M	INST PNL	5"
1010	115M	STOP	5"
1010	111M	SW TEST	5"
1010	113M	START	5"
1010	439M	IGN	5"
1010	953M	GND	5"
1010	900M	BUS+	5"
1010	901M	BUS-	5"
1010	SHLDN	BUS	5"
1010	0 N	GND	5"

SOCK	CKT#
1	901
2	900
3	132
4	-
5	-
6	439
7	-
8	953
9	0
10	-
11	-
12	-

TRM#	QTY	SIZE	DESCRIPTION
1110	132M	TACH+	1.50"
1110	439M	IGN	1.50"
1110	953M	GND	1.50"
1120	0 L	GND	1.50"
1120	900M	BUS+	1.50"
1110	901M	BUS-	1.50"
8520	SHLDN	BUS	3"
0 N	GND	3"	



FARGO POWER DISTRIBUTION PANEL B/M		
QTY	PART#	DESCRIPTION
7	59011	LOCKING WEDGE
2	59113	2.50" STANDOFF
4	59022	ISO RELAY BLOCK
1	59184	POWER RELAY BLOCK
18	59056	SECONDARY LOCK



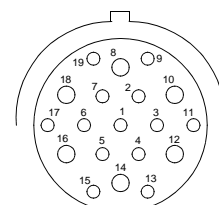
CKT#	COLOR	FUNCOD	QTY	DESCRIPTION
0	WHT	GND	7	GROUND
102	RED	START SOL	2	START SOLENOID POWER FROM START RELAY
111	ORN	SW TEST	2	SWITCH TEST SIGNAL FROM PILOT STATION
113	ORN	START	2	START SIGNAL TO POWER DISTRIBUTION BOX
115	ORN	STOP	2	STOP SIGNAL TO POWER DISTRIBUTION BOX
116	PUR	STOP SW	2	STOP SW TO A1K2 RELAY
124	ORN	INST PNL	4	PILOT STATION SIGNAL TO POWER DISTRIBUTION BOX
128	ORN	ALARM	2	ALARM SIGNAL TO PILOT STATION
132	ORN	TACH	2	TACHOMETER SIGNAL TO PILOT STATION
439	RED	IGN	3	IGNITION SIGNAL TO ECM
509	PUR	STOP ENG	2	STOP STRTRLCKT SIGNAL FROM ECM
604	ORN	JUMPER	2	A1K1 RELAY JUMPER TO A1K4 RELAY
605	RED	ECM PWR	2	BATTERY POWER TO IGNITION RELAY
625	RED	BATT	2	BATTERY POWER +24V DC
900	RED	BUS+	2	J1587 BUS+
901	BLK	BUS-	2	J1587 BUS-
953	WHT	GND	4	GROUND
988	GRY	STRTRLCKT	4	ECM SIGNAL TO INSTRUMENT PANEL & LOCKOUT RELAY

TRM#	QTY	SIZE	DESCRIPTION
1010	13	16-18GA	PIN, #16, NICKEL, DEUTSCH, 0460-202-16141
1030	5	12-16GA	PIN, #12, NICKEL, DEUTSCH, 0460-204-12141
1110	5	16-18GA	SOCKET, #16, NICKEL, DEUTSCH, 0462-201-16141
1120	1	14-16GA	SOCKET, #14, NICKEL, DEUTSCH, 0462-209-16141
2363	18	14-16GA	SOCKET, 630, TIN, METRI-PACK, 12015870
8520	1	18-22GA	BUTTSPLICE, SEALED, AMP, 55824-1
8602	2	10GA	FEMALE, SLIDE, .380 UN-INSL, AMP, 962834-2
8696	2	14-16GA	FEMALE, SLIDE, .250 FUL INSL 90, AMP, 3-520132-2
9999	2	ALL	NO STRIP, NO TERM

SUFFIX LETTER	WIRE SIZE	LOAD RANGE
A	40	300-350
B	30	250-299
C	20	200-249
D	0	150-199
E	1	100-149
F	2	75-99
G	4	50-74
H	6	40-49
I	8	30-39
J	10	20-29
K	12	15-19
L	14	10-14
M	16	5-9
N	18	3-4
O	20	1-2
P	22	0-1

- NOTES:
1. ALL SECONDARY LOCKS & SEALS REQUIRED WHERE APPLICABLE.
 2. TERMINAL MANUFACTURER MAYBE SUBSTITUTED WITH ANOTHER MANUFACTURER IF EQUIVALENT. DEUTSCH TERMINAL "MAY NOT" BE SUBSTITUTED.
 3. WIRE TYPE TO BE GXL UNLESS OTHERWISE NOTED.
 4. HARNESS TO BE TAPED.
 5. CIRCUITS 900 & 901 TO BE A SHIELDED CABLE. BELDEN 85231 OR EQUIVALENT. SHIELD DRAIN TO BE GROUNDED TO "0" CIRCUIT IN POWER DISTRIBUTION BOX LOCATION. DRAIN WIRE TO HAVE HEATSHRINK SO DEUTSCH CONNECTOR WILL SEAL.
 6. ALL CONNECTOR VIEWS ARE SHOWN WIRE INSERTION SIDE UNLESS OTHERWISE NOTED.
 7. CIRCUIT "0" DIFFERENT WIRE GAUGE SIZES NOT TO BE SPLICED INSIDE HARNESS.

Figure 14. Engine Electrical System Schematic (Sheet 2 of 4).



DEUTSCH
HDP24-24-19PN
NUT 2411-001-2405
SEAL MCL-0000-0012

PIN	CKT#
1	0 N
2	SHLD
3	132
4	509
5	988
6	124
7	115
8	625
9	111
10	102
11	113
12	605
13	439
14	128
15	953
16	0 L
17	900
18	-
19	901

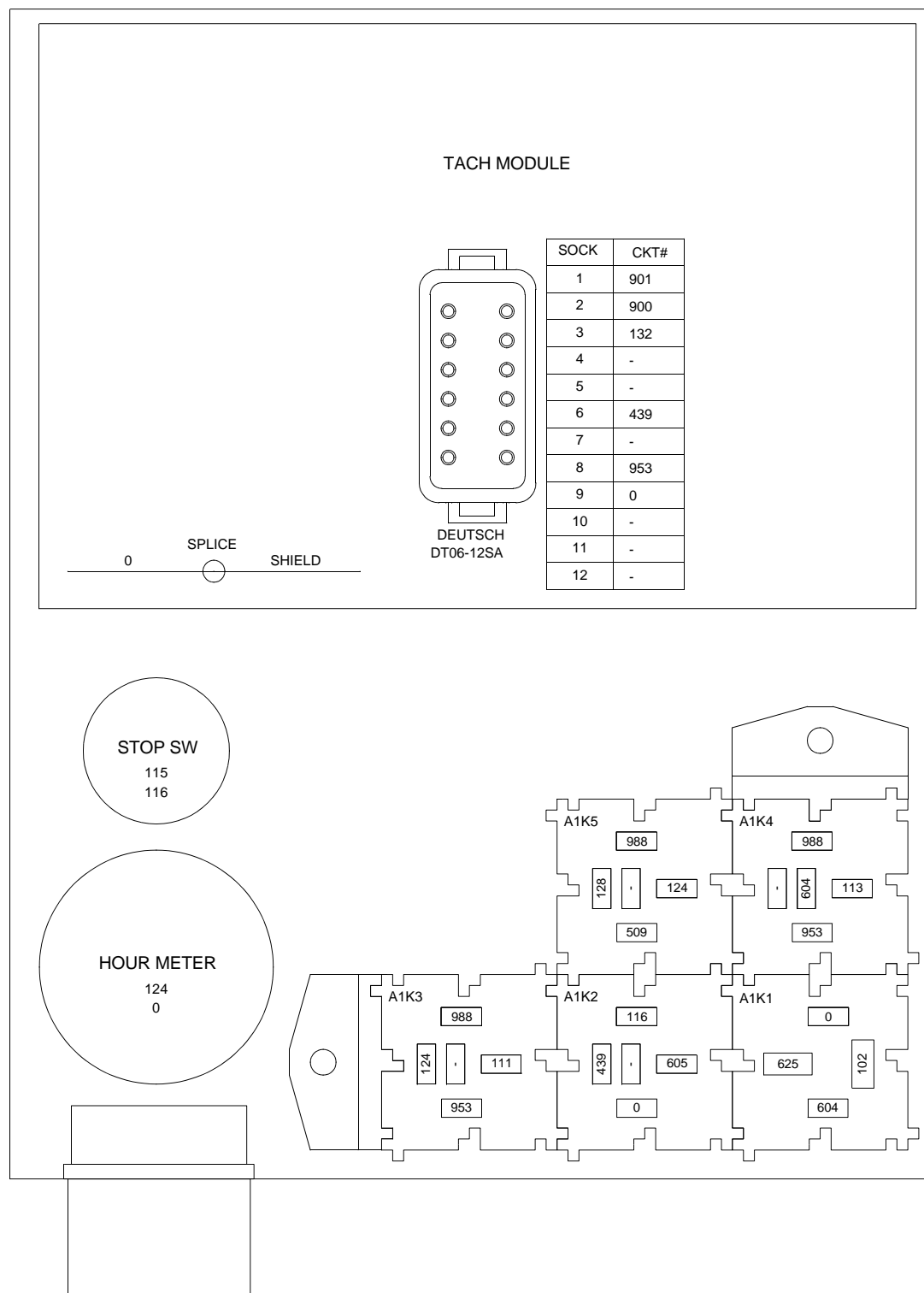
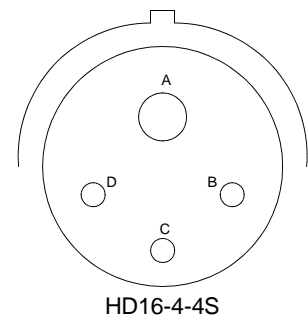
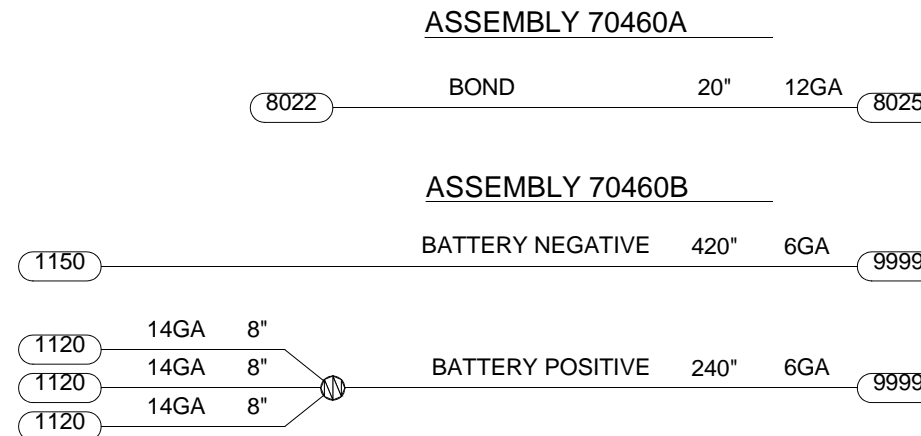


Figure 14. Engine Electrical System Schematic (Sheet 3 of 4).



SOCK	CKT#
A	BAT NEG
B	BAT POS
C	BAT POS
D	BAT POS



CIRCUIT DIRECTORY				
QTY	COLOR	FUNCOD	SIZE	DESCRIPTION
1	BLACK	BOND	12GA	GROUND, BOND
1	BLACK	BATT NEG	6GA	BATTERY NEGATIVE
1	RED	BATT POS	6GA	BATTERY POSITIVE
3	RED	BATT POS	14GA	BATTERY POSITIVE

TERMINAL DIRECTORY			
TRM#	QTY	SIZE	DESCRIPTION
1120	3	14-16GA	SOCKET, #14, NICKEL, DEUTSCH, 0462-209-16141
1150	1	6GA	SOCKET, #4, NICKEL, DEUTSCH, 0462-203-0431
8022	1	10-12GA	EYE, INSL, SEALED, 1/4, AMP 55858-1
8025	1	10-12GA	EYE, INSL, SEALED, 1/2, AMP 55861-1
9999	2	ALL	NO STRIP, NO TERM

NOTES:

1. ALL WIRE TO BE TYPE SXL.
2. ALL SECONDARY LOCKS & SEALS REQUIRED WHERE APPLICABLE.
3. SUBASSEMBLY 70460A NOT TO BE COVERED. LABEL WIRE AS BOND.
4. BATTERY NEGATIVE TO BE COVERED WITH 410" OF SPLIT CONDUIT 3/8".
5. BATTERY POSITIVE TO BE COVERED WITH 230" OF SPLIT CONDUIT 1/2".
6. CONDUIT TYPE COLE-FLEX 492 OR EQUIVALENT.
7. CONDUIT TO HAVE TIE WRAP AT EACH END & TAPE APPROX. EVERY 7" BETWEEN TIE WRAPS.

Figure 14. Engine Electrical System Schematic (Sheet 4 of 4).

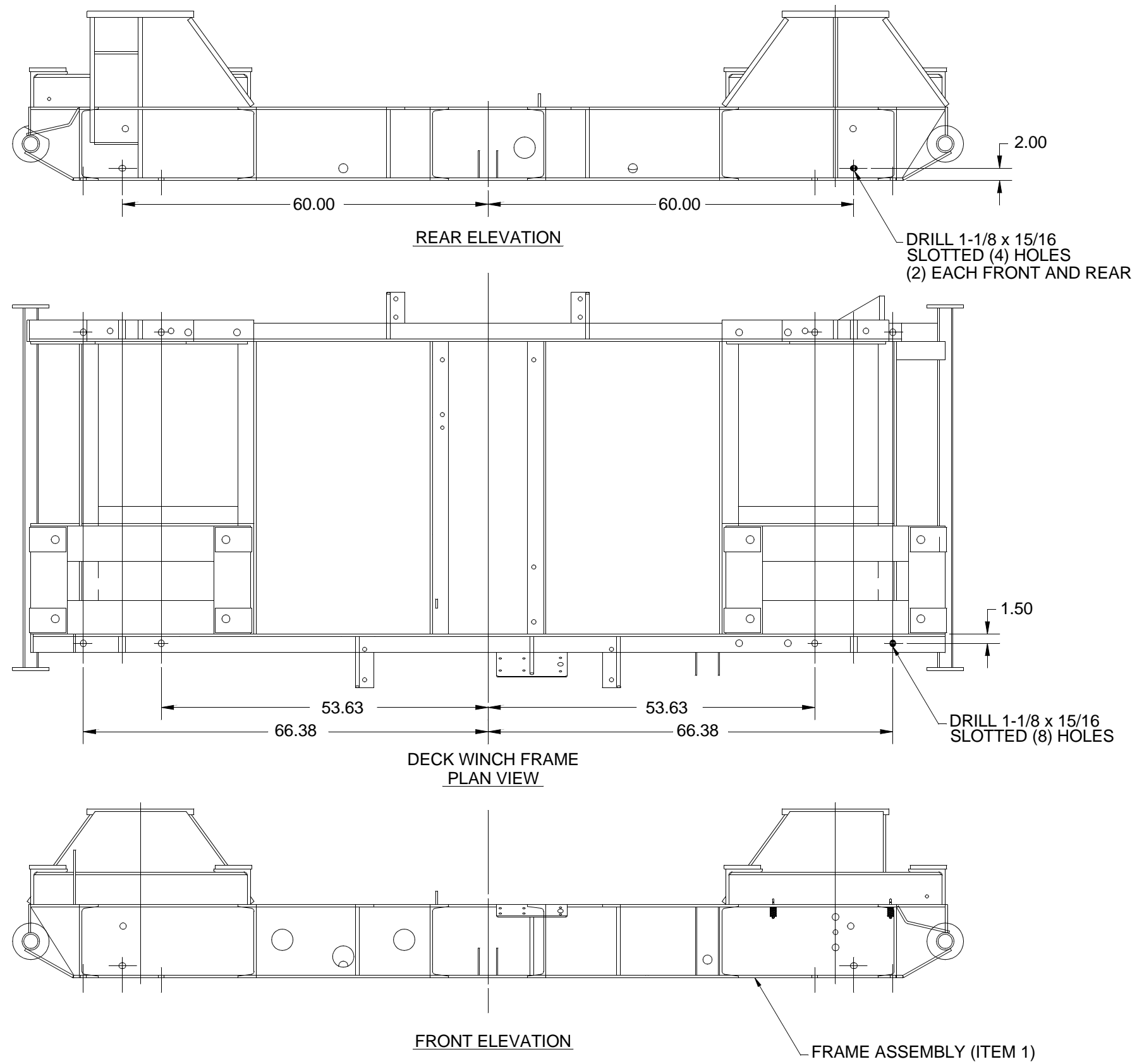


Figure 15. Modifications to Deck Winch Frame.

These are the instructions for sending an electronic 2028.

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17 and 27.

From: "Whomever" whomever@avma27.army.mil
To: whomever@avma27.army.mil
To: TACOM-TECH-PUBS@ria.army.mil

Subject:DA Form 2028

1. **From:** Joe Smith
2. **Unit:** home
3. **Address:** 4300 Park
4. **City:** Hometown
5. **St:** MO
6. **Zip:** 77777
7. **Date Sent:** 19-OCT-93
8. **Pub no:** 55-1915-200-10
9. **Pub Title:** TM
10. **Publication Date:** 11-APR-88
11. **Change Number:** 12
12. **Submitter Rank:** MSG
13. **Submitter Fname:** Joe
14. **Submitter Mname:** T
15. **Submitter Lname:** Smith
16. **Submitter Phone:** 123-123-1234
17. **Problem:** 1
18. **Page:** 1
19. **Paragraph:** 3
20. **Line:** 4
21. **NSN:** 5
22. **Reference:** 6
23. **Figure:** 7
24. **Table:** 8
25. **Item:** 9
26. **Total:** 123
27. **Text:**

This is the text for the problem below line 27.

TM 55-1945-225-24

<p>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.</p>						Use Part II (<i>reverse</i>) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE: Date form is filled out.
TO: (<i>Forward to proponent of publication or form</i>) (<i>Include ZIP Code</i>) Mailing address found on title block page.						FROM: (<i>Activity and location</i>) (<i>Include ZIP Code</i>) 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 CPL John Doe	

TM 55-1945-225-24

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		

TM 55-1945-225-24

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS						Use Part II (<i>reverse</i>) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE:
For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.							
To: AMSTA-LC-CI / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630						FROM:	
PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS							
PUBLICATION/FORM NUMBER: TM 55-1945-225-24						DATE: 15 AUGUST 2002	TITLE: Unit, Direct Support and General Support Maintenance Manual for Modular Causeway System (MCS) Warping Tug (WT)
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Exact wording of recommended change must be given)	
* Reference to line numbers within the paragraph or subparagraph.							
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

TM 55-1945-225-24

TO: <i>(Forward to proponent of publication or form) (Include ZIP Code)</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/FORM NUMBER:					DATE:		TITLE:	
PAGE NO.	COLM NO.	LINE NO.	FEDERAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION
<p align="center">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></p>								
* Reference to line numbers within the paragraph or subparagraph.								
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION			SIGNATURE	

TM 55-1945-225-24

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS						Use Part II (<i>reverse</i>) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE:
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* Reference to line numbers within the paragraph or subparagraph.							
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

TM 55-1945-225-24

TO: (Forward to proponent of publication or form) (Include ZIP Code)				FROM: (Activity and location) (Include ZIP Code)			DATE:	
PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS								
PUBLICATION/FORM NUMBER:				DATE:		TITLE:		
PAGE NO.	COLM NO.	LINE NO.	FEDERAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION
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PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS							
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* Reference to line numbers within the paragraph or subparagraph.							
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION		SIGNATURE	

TM 55-1945-225-24

TO: <i>(Forward to proponent of publication or form) (Include ZIP Code)</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/FORM NUMBER:					DATE:		TITLE:	
PAGE NO.	COLM NO.	LINE NO.	FEDERAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION
PART III - REMARKS <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>								
* Reference to line numbers within the paragraph or subparagraph.								
TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION			SIGNATURE	

By Order of the Secretary of the Army:

Official:



SANDRA R. RILEY

*Administrative Assistant to the
Secretary of the Army*

0410302

PETER J. SCHOOMAKER
*General, United States Army
Chief of Staff*

DISTRIBUTION: To be distributed in accordance with the Initial Distribution Number (IDN) 256791, requirements for TM 55-1945-225-24.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
 1 decimeter = 10 centimeters = 3.94 inches
 1 meter = 10 decimeters = 39.37 inches
 1 dekameter = 10 meters = 32.8 feet
 1 hectometer = 10 dekameters = 328.08 feet
 1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
 1 decigram = 10 centigrams = 1.54 grains
 1 gram = 10 decigrams = .035 ounce
 1 dekagram = 10 grams = .35 ounce
 1 hectogram = 10 dekagrams = 3.52 ounces
 1 kilogram = 10 hectograms = 2.2 pounds
 1 quintal = 100 kilograms = 220.46 pounds
 1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce
 1 deciliter = 10 centiliters = 3.38 fl. ounces
 1 liter = 10 deciliters = 33.81 fl. ounces
 1 dekaliter = 10 liters = 2.64 gallons
 1 hectoliter = 10 dekaliters = 26.42 gallons
 1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
----	------------------------	----------------------------	---------------------	----

