

**TECHNICAL MANUAL**  
**OPERATOR, UNIT AND INTERMEDIATE**  
**(DIRECT AND GENERAL SUPPORT)**  
**MAINTENANCE MANUAL**

**LANDING CRAFT, MECHANIZED**  
**(LCM-8)**  
**(ROHR AND GUNDERSON MODELS)**  
**OPERATOR**  
**MAINTENANCE**  
**(1905-01-284-2647 AND 1905-01-284-2648)**

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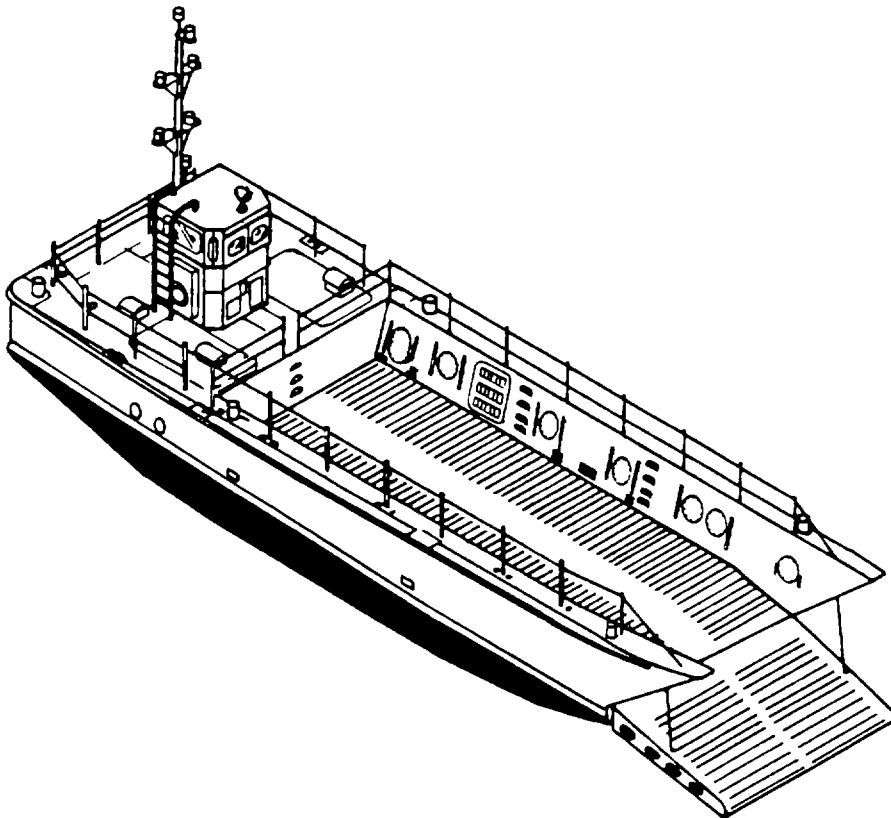
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Maintenance Manual

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(LCM-8)  
(ROHR AND GUNDERSON MODELS)  
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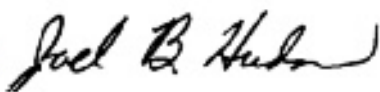
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This Technical Manual pertains only to ROHR and Gunderson model vessels which have undergone the Service Life Extension Program (SLEP). If your vessel is still awaiting SLEP application, you must use TM 55-1905-217-12, dated 15 August 1974 and TM 55-1905-217-34, dated 8 October 1974.

**WARNING****DANGEROUS CHEMICALS**

are used in this equipment.

**SERIOUS INJURY OR DEATH**

may result if personnel fail to observe these safety precautions:

· Be sure all cargo is secure, especially during rough seas.

· Corrosive battery electrolyte, and potassium hydroxide, are potentially dangerous to personnel and property. Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, start flushing the affected area immediately with clean water. Continue washing until medical assistance arrives.

· Wipe or flush any spillage. Volatile materials will not be brought aboard; electrical circuits will not be energized; fuel tanks will not be topped off, and engines will not be started before CO<sub>2</sub> firefighting equipment is available and operative.

· Observe NO SMOKING rules when refueling. Do not work on live circuits. Tag circuit and warn other personnel not to energize the circuits. Never use a blow torch or other similar means for heating fuel or oil lines.

· Dry cleaning solvent (Fed Spec. P-D-680), used to clean parts, is potentially dangerous to personnel and property. Clean parts in a well ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Wash exposed skin thoroughly. Wear eye protection when blowing solvent from parts. Compressed air used for cleaning purposes will not exceed 30 psi (2.1 kg/cm<sup>2</sup>).

· Noise: The engines and various other equipment are excessively noisy. Serious hearing loss or deafness could occur if this equipment is operated without professionally fitted hearing protection. Unprotected and unnecessary personnel must keep out of the immediate area.

**WARNING****ASPHYXIATION DANGER**

**BE SURE** engine room ventilators are open when operating the engine(s). The engine exhaust gases contain carbon monoxide, which is a colorless, odorless, and poisonous gas. Breathing air with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, a sleepy feeling, and coma. Brain damage or death can result from heavy exposure. Precautions must be followed to insure crew safety. **BE ALERT** at all times during vehicle operation for exhaust odors and exposure symptoms. If either is present **IMMEDIATELY VENTILATE** personnel compartment. If symptoms persist, remove affected person to fresh air, keep warm; **DO NOT PERMIT PHYSICAL EXERCISE**; if necessary, give artificial respiration.

**FOR ARTIFICIAL RESPIRATION, REFER TO FM 21-11**

**BE AWARE-** the field protective mask for nuclear-biological-chemical (NBC) protection will not protect you from carbon monoxide poisoning. **THE BEST DEFENSE AGAINST CARBON MONOXIDE POISONING IS GOOD VENTILATION.**

**WARNING****LOW VOLTAGE**

is used in the operation of this equipment.

**Do not be misled by the term "low voltage."** Potentials as low as 50 volts may cause death under adverse conditions. Never work on electrical equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas. Whenever possible, the input power supply to the equipment must be shut off before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it. Do not operate the equipment without all grilles, guards, louvers, and covers in place and tightly secured.

**WARNING****FIRE OR EXPLOSION HAZARD  
SERIOUS INJURY OR DEATH**

- **May result if personnel fail to observe these safety precautions. Hatches must be opened before energizing any electrical circuit or starting engines. Do not smoke or use open flame in the vicinity when servicing batteries as hydrogen gas, an explosive is generated. Use only distilled water to maintain battery electrolyte level. Do not fill fuel tank while engine is running. Provide metallic contact between the fuel container and fuel tank to prevent a static spark from igniting fuel.**
- **When cutting with a torch, or when welding, always station fire watches, ready with fire extinguishers, in the vicinity on both sides of the plate that is being cut or welded.**
- **Prior to cutting or welding on the ramp, remove drain plugs on both sides of the ramp and check if ramp interior is primer coated. If primer coated, flush thoroughly with steam, carbon dioxide, or water. Do not reinstall drain plugs until the cutting and/or welding operation is completed. Failure to take this precaution may result in explosion of accumulated primer vapors.**
- **When refueling, shut down the electrical system. Observe the no smoking rule. Do not permit anyone to operate tools or equipment which may produce sparks near the refueling operation. Sparks or fire may ignite the diesel fuel and produce an explosion.**
- **Fuel oil and other petroleum products are highly volatile in extreme heat. To minimize the possibility of explosion, wipe up all spills at once, see that fuel lines and valves are not leaking and pump bilges regularly.**
- **Before attempting to remove any compressed air system lines or components, relieve air pressure from system. Failure to do so may result in injury or possible death to maintenance personnel.**
- **Before disconnecting a line in the hydraulic system, bleed the pressure from that portion of the line. Failure to do so may result in injury or possible death to maintenance personnel.**

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Operator, Unit and Intermediate  
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Maintenance Manual

**LANDING CRAFT, MECHANIZED  
(LCM-8)  
(ROHR AND GUNDERSON MODELS)  
(NSN 1905-01-284-2647 and 1905-01-284-2648)**

**REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

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

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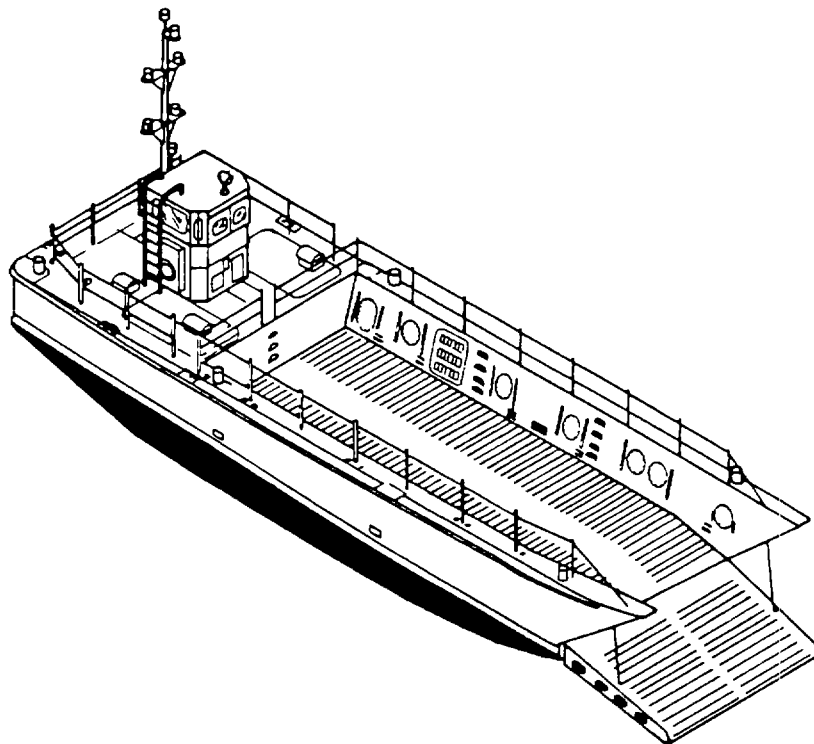
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## Section I. GENERAL INFORMATION

**1-1 SCOPE.**

- ⌚ **Type of Manual:** Operator, Unit, and Intermediate (Direct and General Support) Maintenance for Landing Craft, Mechanized (LCM-8).
- ⌚ **Model Numbers:** NSN 1905-01-284-2647 (ROHR), NSN 1905-01-284-2648 (GUNDERSON)
- ⌚ **Purpose of Equipment:** To transport cargo, troops, and vehicles from ship-to-shore, shore-to-shore or in retrograde movements. May be utilized for lighterage and utility work in harbors. Additionally, the LCM-8 can be used in diving operations, coastal survey, repair of other craft and to assist ships in salvage operations.

**1-2 MAINTENANCE FORMS AND RECORDS.**

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

**1-3 DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE.**

Procedures to be followed when capture or abandonment of the landing craft is imminent are covered in TM 750-244-3.



**1-4 REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRs).**

If your landing craft 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 (Quality Deficiency Report). Mail it direct to Commander, US Army Troop Support Command, ATTN. AMSTR - QX, 4300 Goodfellow Boulevard, St. Louis, MO 63120-1798. We will send you a reply.

**1-5 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC).**

The contents of this technical manual have been validated against engineering source data. Operator and maintenance instructions have been validated against the system/equipment by actual demonstration as required.

**1-6 LIST OF ABBREVIATIONS.**

The following is a list of abbreviations of components, maintenance terms and forms associated with the LCM-8:

- DPDT - Double Pole, Double Throw Switch
- DS/GS - Direct Support/General Support
- EIR - Equipment Improvement Recommendation
- FR - Frame
- HWT - High Water Temperature
- LCM - Landing Craft, Mechanized
- LOP - Low O11 Pressure
- MAC - Maintenance Allocation Chart
- MSD - Marine Sanitation Device
- MTOE - Modified Table of Organizational Equipment
- OWS - Oil/Water Separator
- PMCS - Preventive Maintenance Checks and Services
- QAI - Quality Assurance Inspections
- RAI - Rudder Angle Indicator
- RIL - Red Indicating Lamps

- RMHS - Remote Magnetic Heading System
- RPSTL - Repair Parts and Special Tools List
- TAMMS - The Army Maintenance Management System
- TMDE - Test, Measurement and Diagnostic Equipment
- TROSCOM - Troop Support Command

## 1-7 GLOSSARY.

The following defines technical, nautical and mission-related terms used in this training manual:

- Accumulators - Devices that receive, store, build-up and release hydraulic oil in the LCM-8 hydraulic starting system.
- Anaerobic Decomposition - Sewage decay occurring in absence of oxygen. A natural action accelerated by the addition of selected bacteria.
- Athwartship - Across the ship from side to side.
- Bilge - The lowest part of a ship's inner hull.
- Biochemical Oxygen Demand - The ratio of oxygen available to the oxygen required for stabilization of sewage.
- Coalesce - Action arising from combination of distinct elements, such as oil/water mixture and other oil in fuel system.
- Coaming - The raised frame (around the hatchway) that keeps out water.
- Effluent - The outflow of sewage.
- Hondu - A drum key, a device to hold ramp cable on winch drum to prevent cable from running out.
- Lazarette. - Compartment between decks used as a storeroom for repair parts, line and auxiliary equipment. On the LCM-8, a compartment aft of the engine room.
- Weir - Divider that controls or diverts flow of sewage in marine sanitation system.

Section II. EQUIPMENT DESCRIPTION AND DATA

1-8 EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES.

1-8.1. **General.** The LCM-8 is a type of watercraft intended for use in rough or exposed waters. It is capable of operating through breakers and grounding on a beach, remaining upright and tight, and retracting under its own power. It can be transported to overseas destinations as cargo aboard transport ships. This craft is all-weather operational in sea state 1, 2 and 3. Other capabilities and features are as follows:

MOBILITY DATA

Speed (light)	11 knots (20.4 km/hr)
(loaded)	9 knots (16.7 km/hr)
Cruising Range (light)	332 nautical miles (614.9 km)
(loaded)	271 nautical miles (501.9 km)

HULL AND ACCOMMODATIONS DATA

Length, overall	74 ft (22.55m)
Beam, extreme	21 ft 0 5/8 in (6.40m)
Beam, molded	20 ft 11 3/4 in (6.32m)
Depth, molded amid ships	9 ft 4 in (284.5cm)
Draft, loaded, mean	4 ft 6 in (137.16cm)
Freeboard, loaded, mean	4 ft 10 in (147.32cm)
Displacement (light)	58.81 long tons (59.8t)
(loaded)	116.07 long tons (117.9t)
Cargo Space (length)	42 ft. 9 in (13m)
(width)	14 ft 6 in (4.4m)
Anchor	
Number	1
Type	70 pounds, "Danforth" Mark 2
Line	75 fathoms, 3 inch nylon
Propellers	
Number	2
Type	Manganese bronze, 3-blade, 34-inch diameter, 22-inch pitch
Complement	
Crew	6
Troops	200 combat-equipped

**1-8.2 Hull Structural Features.** Refer to Foldout-1. The hull is an all steel welded structure. There are nine watertight bulkheads at frames 3, 7, 11, 15, 19, 23, 27, 31 and 39. The compartments forward of frame 31 below the cargo deck form seven sealed watertight buoyancy holds or voids. The cargo deck extends forward of frame 31 to the bow ramp. The main deck extends from the bow aft along the sides of the cargo well to the full main deck over the engine room and lazarette. The compartment below the main deck from frame 31 aft to frame 39 is the engine room. The compartment aft of frame 39 to the transom is the lazarette. The pilothouse superstructure is located on the main deck, centerline, at frame 35. Port and starboard skeg keels project from the underwater hull between frames 29 and 39. Tunnels in the keels aft of frame 39 provide clearance for the propellers. V- shaped struts are welded to each skeg keel and to the hull between frames 41 and 42. Seven zinc anodes are provided for underwater hull cathodic protection.

**1-8.2.1 Main Deck.** The main deck extends the entire length of the LCM-8. A full deck is provided from the transom forward to frame 31. Between the bow and frame 31, the main deck forms port and starboard walkways along the sides of the cargo well. Engine room cover plates with integral ventilators are bolted in the deck, port and starboard, between frames 31 and 38. A lazarette cover plate is bolted in the deck, port of the centerline aft of frame 39. Six 15-inch chocks are provided in pairs, port and starboard, on the bow, at frame 37, and on the transom. Six 12-inch mooring bitts are provided in pairs, port and starboard, at frames 3, 29 and 43. Four lifting eyes are provided in pairs, port and starboard, at frames 15 and 31.

a. Engine cooling system expansion tank fill deck plates are provided, port and starboard, in the deck aft of frame 31. Fuel tank sounding deck plates are provided, port and starboard, in the deck aft of frame 39. Port and starboard deck plates are provided on the transom for installing the emergency steering tiller. A fuel fill connection and fuel tank vent connection are located behind the pilothouse on the centerline at frame 39. Anchor brackets are welded to the deck, port side, between frames 41 and 42, for securing the anchor. Fourteen deck plates are provided in pairs, port and starboard, at frames 7, 11, 19, and 27 for venting the sealed watertight holds below the cargo deck. A single lifeline with 28 portable stanchions is provided for personnel safety. A double lifeline is provided aft of frame 31. Twelve fender lashing eyes are welded to the deck, six per side, at equal intervals, port and starboard.

b. Two watertight access hatches are located on the main deck. One 30 by 24- inch raised watertight hatch located port of the centerline aft of frame 33 provides access to the engine room. Another 30 by 24-inch raised watertight hatch located port of the centerline on the lazarette cover plate aft of frame 39 provides access to the lazarette compartment.

c. A telescoping, hinged mast is rigged on the main deck near centerline immediately aft of the pilothouse superstructure. The telescoping mast is the foundation for the masthead light, the anchor light, the upper and lower not-under-command lights, the remote magnetic heading transmitter, and the halyard for the ensign. The mast is designed to be manually extended to its full height for use in the vertical position, and to be completely lowered and hinged to starboard for horizontal stowage on deck. The mast hinged foundation is welded to the deck adjacent to centerline at frame 39. Mast support brackets and electrical connection boxes for the mast lights and remote magnetic heading transmitter are positioned on the rear of the pilothouse bulkhead. Securing staples with lashing material for stowing the mast in the horizontal position are welded to the deck starboard of the centerline at frame 43.

**1-8.2.2 Pilothouse.** The pilothouse is a 6-foot long by 7-foot high by 6-foot wide superstructure mounted on the main deck, centerline, between frames 35 and 39. The pilothouse superstructure is steel to a height of 5 feet above the main deck and topped by an aluminum removable canopy containing windows that allow the coxswain 360-degree visibility. The canopy is designed to be removed when the LCM-8 is engaged in operations requiring low profile configuration. Entrance to the pilothouse is through 42 by 15-inch open doorways in the superstructure, port and starboard. The port and starboard lights are mounted on welded brackets on the sides of the canopy at frame 39. The stern light is mounted on a welded bracket attached to the static isolator cabinet behind the pilothouse. Two 24-inch life rings are stowed, port and starboard, in brackets on the sides of the superstructure. The emergency steering tiller is stowed in brackets below the starboard life ring. The electric horn is on a bracket, forward of the pilothouse starboard superstructure. Seven rectangular peep holes are cut in the pilothouse superstructure to increase visibility for the coxswain. A search light is mounted on top of the canopy. The ship's bell is mounted on a bracket, forward of the pilothouse superstructure.

**1-8.2.3 Cargo Well.** The cargo well extends aft from the bow ramp to frame 31. The cargo well is entirely above the waterline. The cargo well deck slopes downward aft of frame 7 to the bulkhead at frame 31, and forward of frame 7 to the bow. Freeing ports are provided in the wing walls at frames 16 and 29, port and starboard, to drain accumulated water. Scuppers are provided at frame 3, port and starboard, to drain water from the forward section of the cargo well deck. Steel tread bars welded to the cargo well deck provide traction for heavy equipment carried as cargo on the LCM-8.

**a.** Cargo lashing rings and padeyes are provided along the port and starboard wing walls for securing cargo. Sixteen 18-inch diameter manholes are flush bolted in the wing walls, port and starboard. One 18 by 24-inch manhole is flush bolted in the starboard wing wall, aft. These manholes provide access to the normally sealed hold areas below the cargo well deck. Pipe guards welded to the cargo well wing walls protect the manholes and hatches from possible damage due to shifting cargo. Steps recessed in the wing walls at frames 10 and 20, port and starboard, and in the aft bulkhead at frame 31 provide personnel access to the cargo well from the main deck. Emergency ramp hosting padeyes are welded to the wing walls, port and starboard, at frame 0 just below the main deck.

**b.** Two 30 by 36-inch individually dogged flush watertight access hatches are provided in the cargo well. One 30 by 36-inch hatch located in the starboard wing wall at frame 5 provides access to the hydraulic ramp winch. The other 30 by 36-inch hatch, located in the port wing wall at frame 23, provides access to the dry stowage locker in buoyancy hold 5. Threaded bronze hoisting eyes with T-handle wrenches are provided adjacent to both 30 by 36-inch access hatches. The cargo well is illuminated by two lights, port and starboard, recessed into bulkhead 31. Two 8-foot boat hooks are provided with the LCM-8 and are stowed in brackets, port and starboard, along the cargo well wing walls between frames 7 and 15. A hand pump for manually actuating the hydraulic winch in case of hydraulic fluid pressure failure is located in a recess in the starboard wing wall at frame 9.

**1-8.2.4 Bow Ramp.** The bow ramp is a welded steel structure hinged at six locations on the bow just below the waterline at frame 3. The ramp hinges pivot on 2-inch diameter carbon steel hinge pins. The E hinge brackets are welded to the ramp and to the hull. Thirty-two steel tread bars welded to the ramp deck provide traction for heavy equipment carried as cargo on the LCM-8.

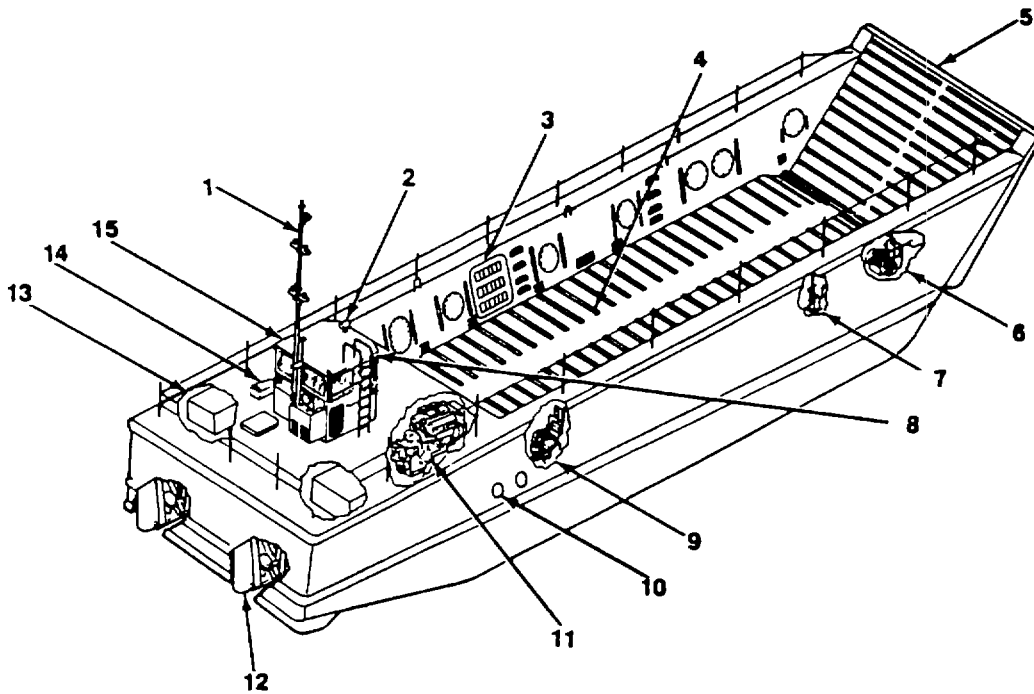
The bow ramp is raised and lowered by a hydraulic powered winch and cable system. A transverse pipe, which passes through the bow ramp interior forward of frame 0 with associated pivoting sheaves at each end, serves as a ramp hoisting cable guide. Ramp attachments for emergency mechanical hoist cables are provided in the bow ramp deck, port and starboard, at frame A. Port and starboard preventers are provided to secure the bow in full hoist position. The bow ramp preventers are shackled to the forward lifeline anchor fittings, port and starboard, on the main deck and attach to the bow ramp with eye slip hooks. Ratchet load binders are installed in the preventers to cinch the bow ramp into the full hoist position. A synthetic rubber gasket provides a watertight seal between the bow ramp and the cargo well when the bow ramp is at full hoist and cinched in position.

**1-9 LOCATION AND DESCRIPTION OF MAJOR COMPONENTS.**

**1-9.1 Major Components.**

MAST (1) Used to support navigation lights.

SEARCHLIGHT (2) Used for sighting objects at night as required.



**1-9 1 Major Components (continued).**

STOWAGE LOCKER (3) Used for storage of equipment.

CARGO WELL (4) Used to carry troops, vehicles and other cargo.

RAMP (5) Used to load and off-load troops, vehicles and other cargo.

WINCH (6) Used to reel in or reel out winch cable to raise or lower the ramp.

RAMP HAND PUMP (7) Used to manually lower the ramp in an emergency.

HORN (8) Used to give signals to other vessels.

MARINE SANITATION DEVICE (9) Used to treat sewage from the marine head.

EXHAUST PORTS (10) Used to expel engine exhaust fumes from the engine exhaust manifold.

PROPULSION ENGINE (11). Used primarily to propel the craft Also used to drive other engine accessories.

RUDDERS (12). Used to direct the thrust of the propellers in order to maneuver the vessel.

FUEL TANK (13). Used to store fuel oil for the engines.

ENGINE ROOM VENTILATORS (14). Used to bring fresh air into the engine room and ventilate the space.

PILOTHOUSE (15) Used as a station for operating the vessel.

**1-9.2 Location and Contents of Major Identification and Instruction Plates**

**1-9.2.1 LCM-8 Identification Plate.** Located in the pilothouse, starboard corner.

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LANDING CRAFT, MECHANIZED LCM (8) MOD-1  
REGISTRY NUMBER  
BUILT FOR THE UNITED STATES NAVY BY -  
ROHR CORP. INDUSTRIAL SYSTEMS GROUP  
MARINE DIVISION

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**1-9.2.2 Oily Waste Discharge Warning Plate .** Located on oil holding tank in engine room, port side.

---

DISCHARGE OF OIL PROHIBITED

THE FEDERAL WATER POLLUTION CONTROL ACT PROHIBITS  
THE DISCHARGE OF OIL OR OILY WASTE INTO OR UPON THE  
NAVIGABLE WATERS AND CONTIGUOUS ZONE OF THE UNITED STATES  
IF SUCH DISCHARGE CAUSES A FILM OR SHEEN UPON,  
OR DISCOLORATION OF, THE SURFACE OF THE WATER OR CAUSES  
A SLUDGE OR EMULSION BENEATH THE SURFACE OF WATER  
VIOLATORS ARE SUBJECT TO A PENALTY OF \$5,000

**1-9.2. Engine Starting Instruction Plate.** Located on the port side of the pilothouse control console.

---

STARTING INSTRUCTIONS

THE LOCAL START SWITCH IN ENGINE  
ROOM MUST BE PLACED IN THE REMOTE  
POSITION BEFORE THE ENGINE CAN BE  
STARTED BY THE REMOTE START  
PUSHBUTTON LOCATED IN THE PILOTHOUSE

---



**1-9.2.4 Ramp Operating Instruction Plate.** Located in pilothouse, starboard side.

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RAMP OPERATING INSTRUCTIONS

1. ENGINE(S) MUST BE RUNNING & P T O, ENGAGED TO SUPPLY PRESSURE
2. MOVE CONTROL LEVER TO RAMP DOWN POSITION
3. RETURN LEVER TO NEUTRAL WHEN DESIRED POSITION IS REACHED

**CAUTION**

**IF CONTROL LEVER IS NOT RETURNED TO NEUTRAL AFTER RAISING OR LOWERING, DAMAGE WILL RESULT.**

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**1-9.2.5 Ramp Emergency Lowering Instruction Plate.** Located above the ramp hand pump compartment on the starboard side of the cargo well.

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RAMP OPERATING INSTRUCTIONS

NORMAL OPERATION

1. CLOSE LOWER HAND PUMP SHUT-OFF VALVE
2. OPEN UPPER SHUT-OFF VALVE
3. OPEN HAND PUMP BYPASS VALVE

EMERGENCY OPERATION

1. DISENGAGE BOTH HYDRAULIC RAMP PUMPS
  2. CLOSE UPPER SHUT-OFF VALVE
  3. OPEN LOWER HAND PUMP SHUT-OFF VALVE
  4. CLOSE HAND PUMP BYPASS VALVE
  5. OPERATE HAND PUMP UNTIL WINCH BRAKE RELEASES AND RAMP STARTS LOWERING
  6. STOP RAMP LOWERING BY OPERATING HAND PUMP BYPASS VALVE
-

**1-9.2.6 Emergency Steering Instruction Placard.** Located in the lazarette.

---

**EMERGENCY STEERING**

1. IN CASE OF FAILURE OF HAND PUMP, PROCEED WITH MANUAL STEERING FROM WHEEL
  2. IN CASE OF FAILURE OF MANUAL STEERING FROM WHEEL, PROCEED TO USE EMERGENCY TILLER AS FOLLOWS:
    - (1) PULL OUT ACCESS PLATE IN DECK OVER ONE RUDDER STOCK
    - (2) UNSHIP AND INSERT EMERGENCY TILLER AT OPEN RUDDER STOCK
    - (3) ENTER LAZARETTE AND PULL OUT EYE PIN TO DISCONNECT HYD CYLINDERS
- 

**1-9.2.7 Oil/Water Separator and Bilge Pumping System Operating Instruction Placard.** Located on port side of engine room below the holding tank. The contents of this placard are shown on Foldout - 2.

**1-10 EQUIPMENT DATA.**

Refer to table below for a list of performance data including numerical and other specification - related data.

**Equipment Data**

**PROPULSION ENGINE**

Manufacturer	Detroit Diesel
Model	7122-7000
Shaft Horsepower	400
Full Load Speed	2100 rpm
Rotation	Right-Hand
Number of Cylinders	12
Bore	425 inches (108mm)
Stroke	5 inches (127mm)
Lube Oil Capacity	40 Quarts

**MARINE TRANSMISSION**

Manufacturer	Twin Disc, Inc.
Model	MG-514C
Minimum Oil Pressure (when cruising)	215 psi
Oil Capacity	6 gal

**PROPULSION CONTROL SYSTEM**

Manufacturer	Kobelt Manufacturing Co.
Model (Control Head)	2048 K
Throttle/Clutch Cables	Panish B-2260
Throttle Control Linkage	Panish A-1585
Clutch Control Linkage	Panish A-1585
Articulators	Panish Nos. C2175, C2190
Shutdown Cables	Panish C 1332 - T

**HYDRAULIC STARTING SYSTEM**

Recharging Pump w/Adapter Plate (2)	Bosch RPA 300412B
Cranking Motor (2)	Bosch CMD2A111
Accumulator (2)	Bosch ACB-30A-7109A
Accumulator (2)	Bosch ACB-30B-7110B
Charging Pump (Hand)	Bosch HPA 300118
Filter, High Pressure "T"	Bosch FRK 300382-3A
Filter, High Pressure In-Line	Bosch FRH 300116
Control Valve	Waterman 314LE-6-24
Level Indicator	Gems Sensors (Type M2) 87744
Relief Valve (2)	Fluid Controls 1A32-F4-60S

**HYDRAULIC STEERING SYSTEM**

Helm Unit  
 Pump, Power Steering (2)  
 Cylinder (2)  
 Return Filter  
 Flow Divider  
 Relief Valve  
 Suction Strainer (2)  
 Counterbalance Valve (2)  
 Check Valve  
 Ball Valve (8)  
 Temperature/Level Indicator  
 Ball Valve (3)

Char Lynn WK-11-SCC  
 Vickers VTM42-40-15-15-ME-R1-14  
 Ortman Miller 2TH - Style G  
 Gresen FSP107-1ED1A  
 Gresen CFD50-3  
 Gresen J-50  
 Hydrocraft HA-FS-5  
 Double A SAS-175-C-K144  
 Double A D-06-10A1  
 Worcester 444B  
 Hydrocraft HSG-88  
 Conbraco 73-104 (Apollo)

**ELECTRICAL SYSTEM**

Alternator (2)  
 Voltage Regulator (2)  
 Voltage Protector (2)  
 Resistor (2)  
 Batteries (2)

Motorola 8SA-3006P(28 5v/70amp)  
 Motorola 8RD-3025B (28 5volts)  
 Motorola 9-20 (24 volt,;)  
 Motorola 1744555A07 (150 ohm)  
 12v/120 AH each

**RAMP HYDRAULIC SYSTEM**

Winch  
 Pump (Starboard)  
 Pump (Port)  
 Control Valve  
 Suction Strainer (2)  
 Return Filter  
 Hand Pump  
 Check Valve (2)  
 Shuttle Valve  
 Level Indicator

Gearmatic 22-SEC  
 Vickers 35V25A-1C-10L-002  
 Vickers 35V25A-1C-10L-132  
 Vickers CM3N02R20-BL-30  
 Jelliff J75-600-100-2-1  
 Gresen FLR 415  
 Pine 160-8  
 Double A D4-185  
 Gearmatic 50835  
 Gems Sensors (Type M2) VLI-86210

**EMERGENCY BILGE SYSTEM**

Bilge Pump  
 Hydraulic Motor  
 Bypass Flow Regulator  
 Hydraulic Diverter Valve  
 (Directional Ball Valve)

MP Pump #27805  
 HPI M2-169  
 Fluids Controls 2FA86-R-12T-12T-12T-25-S  
 Worcester 1 1/2 - D44(6YBSEVI)

**ENGINE COOLING SYSTEM (FRESH WATER)**

Pump (2)  
 Keel Cooler (2)  
 Total Fresh Water Capacity

(Furnished with Engine)  
 Buships Dwg. No. C-3166915-D  
 21 gallons (each side)

**SEA (RAW) WATER COOLING SYSTEM**

Pump (2)	(Furnished with Engine)
Duplex Strainer (2)	Gross Mechanical Laboratory HD 2000A

**OIL/WATER SEPARATOR AND BILGE PUMPING SYSTEM**

Oil/Water Separator (2)	Separation and Recovery Systems Inc Type C (5 gpm).
Strainer (8)	MP Pump Co Model 2225A
Pump/Motor Unit	Sher-Water Model SI-251-24-VDC
Holding Tank Capacity	75 gallons

**NAVIGATIONAL AND COMMUNICATION EQUIPMENT**

Remote Magnetic Heading System (RMHS)	Sperry
Radio Set, AN/URC-80	GFE
Radio Set, AN/VRC-47	GFE
Radio Set, AN/URC-92	GFE
Radio Set, AN/VRC-46	GFE

**FUEL SYSTEM**

Primary Fuel Strainers (2)	Purolator 113JJ 18-3
Fuel Filter/Water Separator	Racor IOOOFG
Fuel Tanks (2), Capacity	432 gallons each
Fuel Pump	(Furnished with Engine)
Engine Fuel Filter	(Furnished with Engine)

**MARINE SANITATION DEVICE**

Marine Sanitation Device (MSD)	Marland SS-40 Type II
Rated Capacity	40 gallons per day
Marine Head	Wilcox-Crittenden 1550-C
Maximum Flush Water	1 gallon per flush
Disinfecting Agent	Calcium hypochlorite tablets (6 pounds)
Three-Way Ball Valve	Hayward TW10150T
Swing Check Valve	Techno 1-1/2-5002F-316
Seacock	Perko 805-No 5-3/4
Rotary Switch	Russell Stoll 1493N
(10A, double pole)	

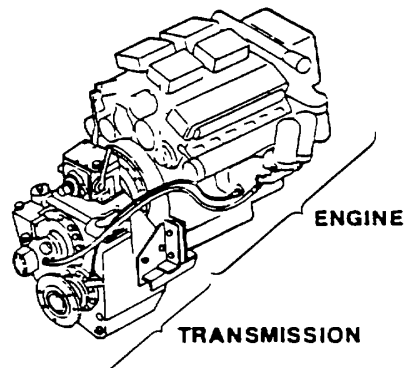
**1-11 SAFETY, CARE, AND HANDLING.**

Safety of personnel from injury and prevention of equipment from damage are of paramount importance. All operating personnel should be familiar with damage control procedures and safety regulations associated with inclement weather and fire hazards. Ensure that personnel in the vicinity of the ramp are cautioned before lowering or raising the ramp.

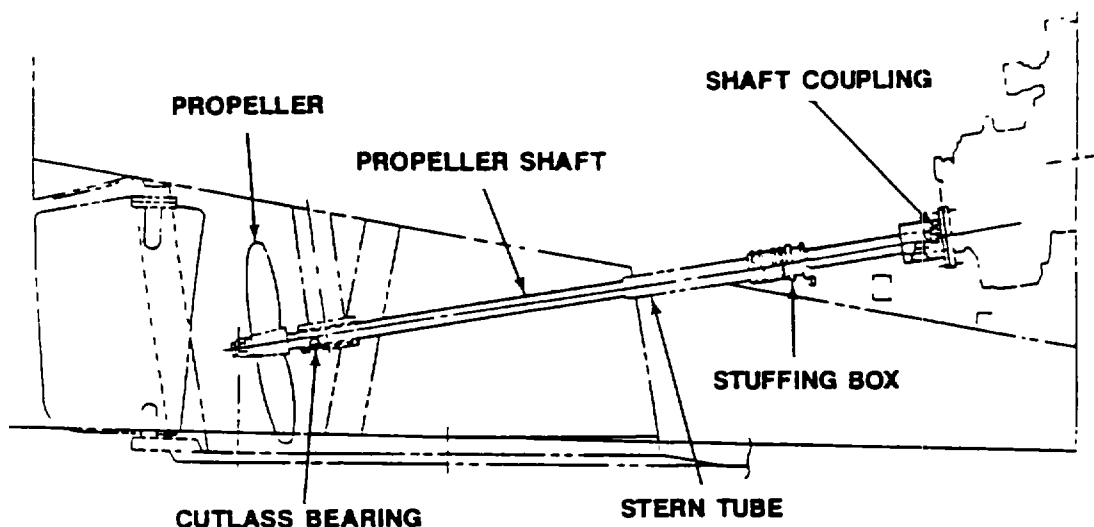
## Section III. TECHNICAL PRINCIPLES OF OPERATION

## 1-12 PROPULSION SYSTEM.

**1-12.1. Propulsion. Machinery.** The power for propulsion of the landing craft is provided by two V-12 Detroit Diesel Engines and two Twin Disc Marine Transmissions. Each engine and transmission form one propulsion unit as shown below. The propulsion units rotate the propeller shafts in opposite directions. The starboard propeller shaft rotates clockwise and the port propeller shaft rotates counterclockwise when viewed from the stern while moving ahead. The propulsion units are controlled remotely by a Kobelt dual function, single lever control head, mounted in the pilothouse control console. In addition, the propulsion units provide the power directly and indirectly to operate other systems. Refer to TM. 5-2815-231-14 for further information on the propulsion engines.

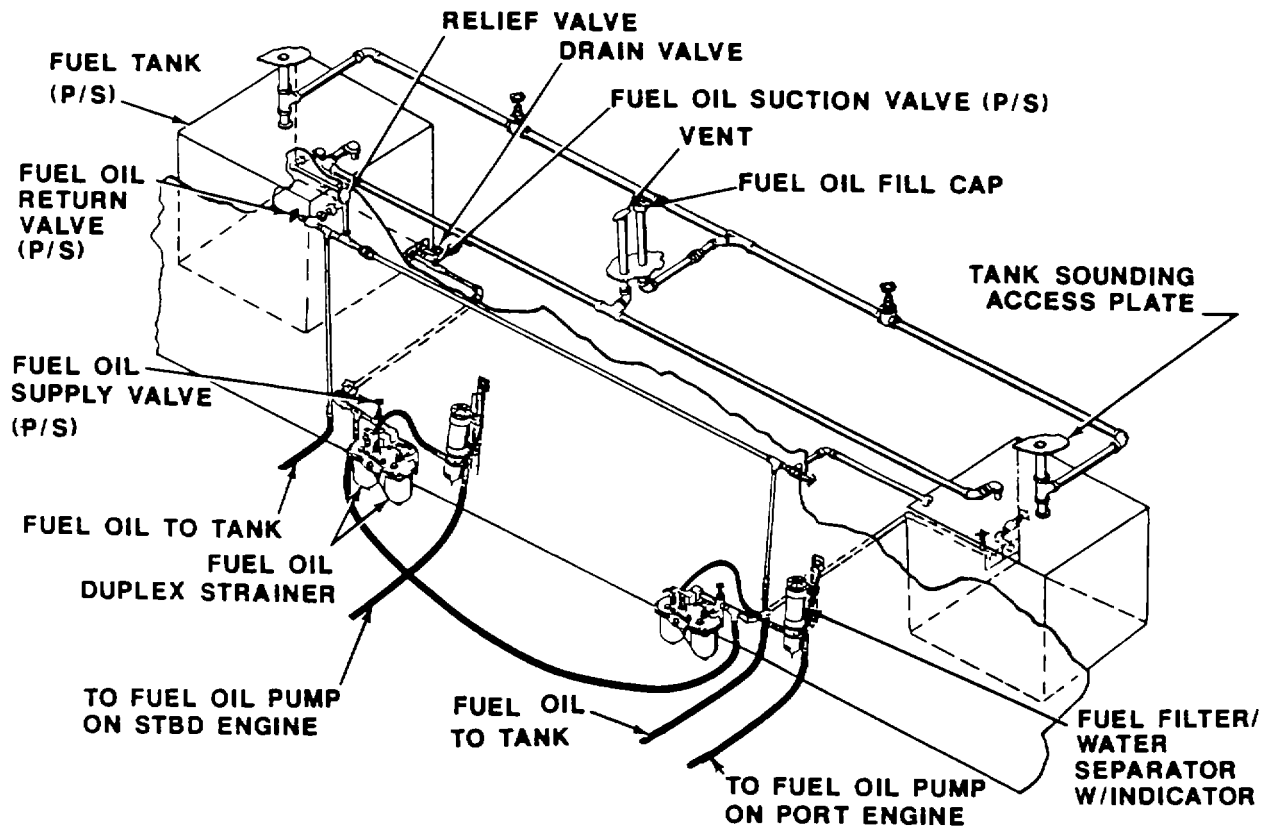


**1-12.2. Shafts and Propellers.** The propeller shafts are 2-1/2 inch diameter corrosion resistant steel. The transmission couplings are flange type with taper bore. Each shaft is supported by a cutlass bearing in a V-strut and shaft lug. The bearings are installed with light push fit and are secured with hex head cap screws. The stuffing boxes are rubber neck type with heavy duty hose and hose clamps. The propellers are keyed to the trailing tapered shaft end, and are secured to the shaft with a jam nut, plain nut and cotter pin.

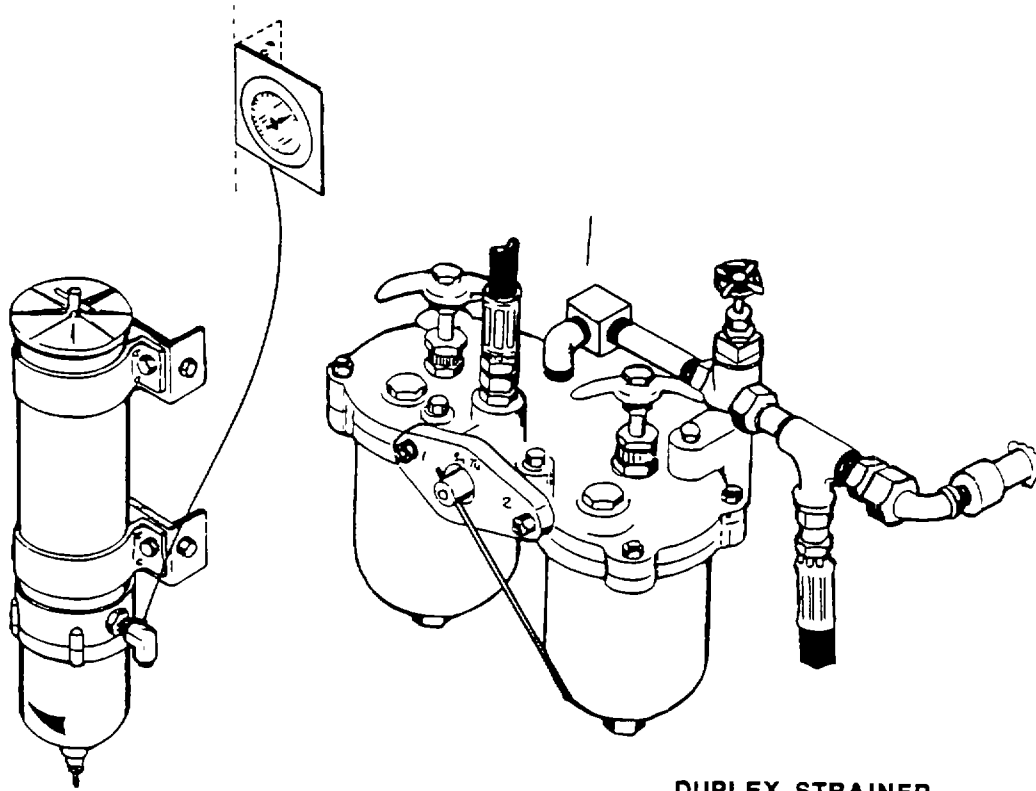


**1-13 FUEL SYSTEM.**

a.. Identical fuel systems are installed, port and starboard. The fuel system supplies fuel oil for operating the propulsion engines. When the system is lined up for operation, fuel oil flows from the fuel tanks through the suction valves in the lazarette into the engine room. Two supply valves located in the engine room near bulkhead 39 (on both sides of the ramp/starting system hydraulic tank) allow fuel oil to flow into the fuel strainers. The cross-over line located ahead of the supply valves permits fuel oil to flow from the port fuel tank through the starboard fuel oil strainer to the starboard engine, and vice versa. The fuel oil is further purified as it flows through the fuel filter/water separators before going to the engines. Fuel oil not injected into the engine is cooled in the fuel oil coolers before returning to tank. Fuel oil from either engine may be returned to either fuel oil tank through the return valves in the fuel oil return piping. The relief valve in the return piping relieves directly to the starboard fuel oil tank when the pressure in the return lines exceeds 2 psi. The engine mounted fuel filter, fuel pump, and fuel manifold which complement the system are covered in TM 5-2815-231-14.



b. Each case of the duplex strainer has a cleaning knife and a metal edge element with particle size retention of 0001. inch (25 microns). The cleaning knives are rotated around the elements by turning the ratchet handles. The head is equipped with a control valve so that flow can be directed to one element while the other is serviced.



**FUEL FILTER/WATER SEPARATOR**

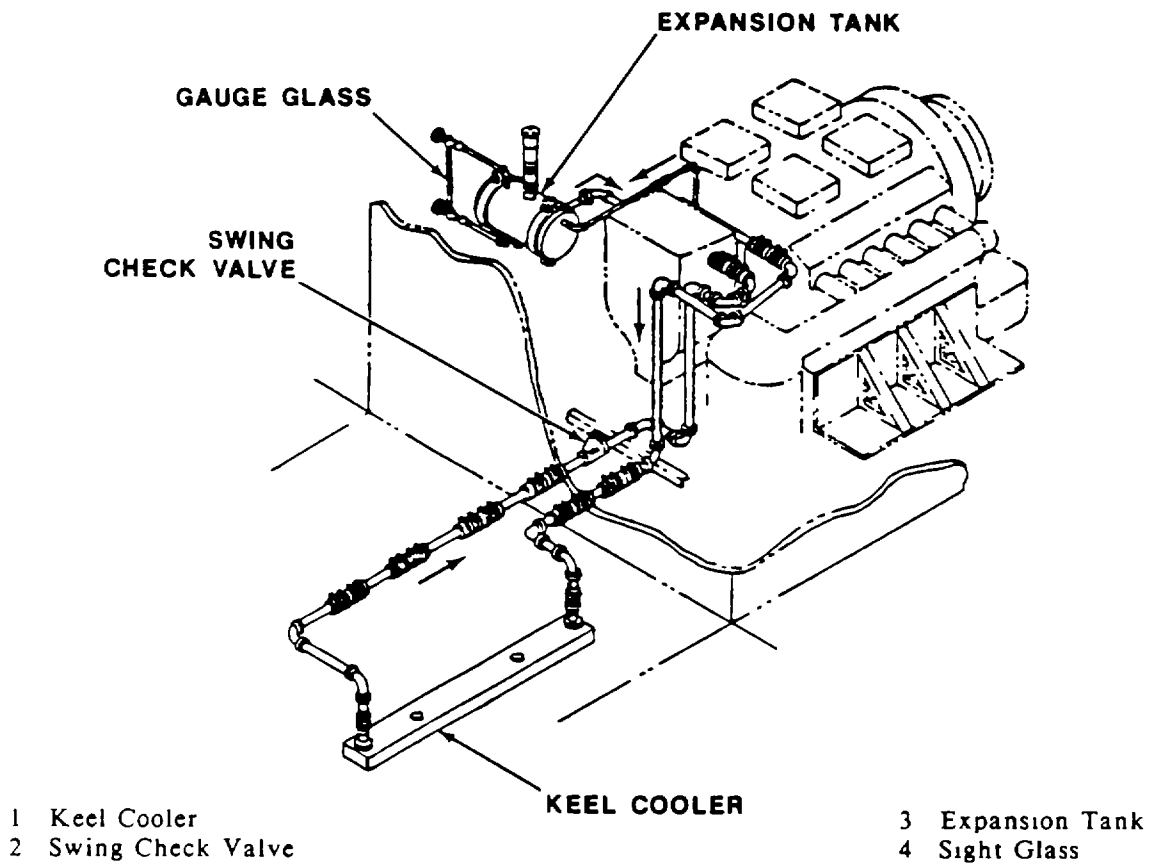
**DUPLEX STRAINER**

c. The fuel filter/water separator works in a series of three stages to progressively clean the diesel fuel. In the primary stage (separation), liquid and solid contamination down to 30 microns are separated out by centrifugal action. In the secondary stage (coalescing), minute particles of liquid contamination tend to bead on the lower inner wall of the shell, accumulating and eventually falling to the bottom of the bowl. In the final stage (filtration), fuel flows through the replacement element where the minute solids are removed.



**1-14 ENGINE COOLING SYSTEM.**

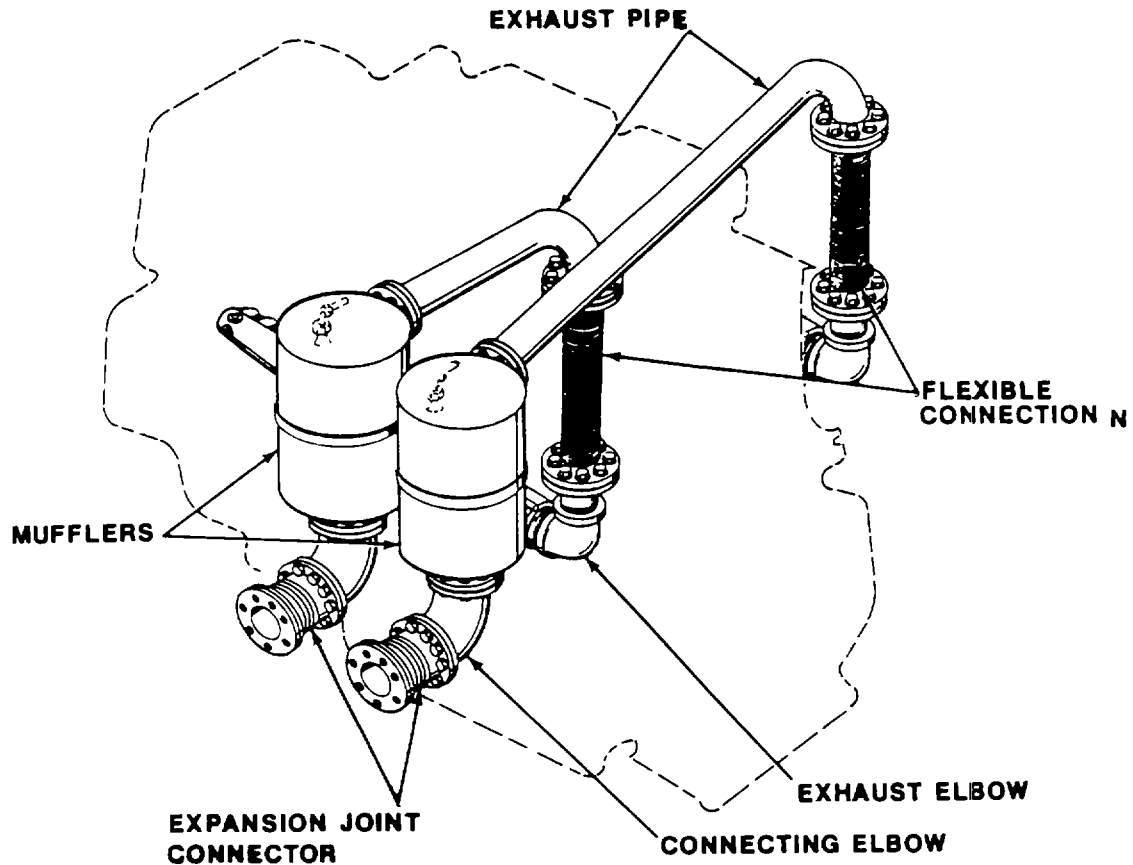
Identical engine cooling systems are installed, port and starboard. The engine cooling system uses fresh water for cooling the engine block. Coolant is circulated through the engine by a centrifugal type water pump. Heat is removed from the coolant by the keel coolers. The two keel coolers act as heat exchangers, utilizing the surrounding sea water to dissipate the heat of the engine coolant. Port and starboard keel coolers are longitudinally recessed in the underside of the hull between frames 25 and 31. The keel coolers employ a fin design to provide maximum surface area for heat transfer. Access to the keel cooler installations and piping is in the buoyancy holds 6 and 7. Upon leaving the keel coolers, the coolant passes through a swing check valve in the engine room and into the suction of the engine-driven water pump. The coolant is then pumped through the cooling passages in the engine. Control of the engine temperature is accomplished by thermostats that regulate the flow of the coolant within the cooling system. The expansion tanks, located in the upper reaches of the engine room, accommodate excess coolant and resupply the system when needed.



**(STARBOARD SYSTEM SHOWN)**

**1-15 EXHAUST SYSTEM.**

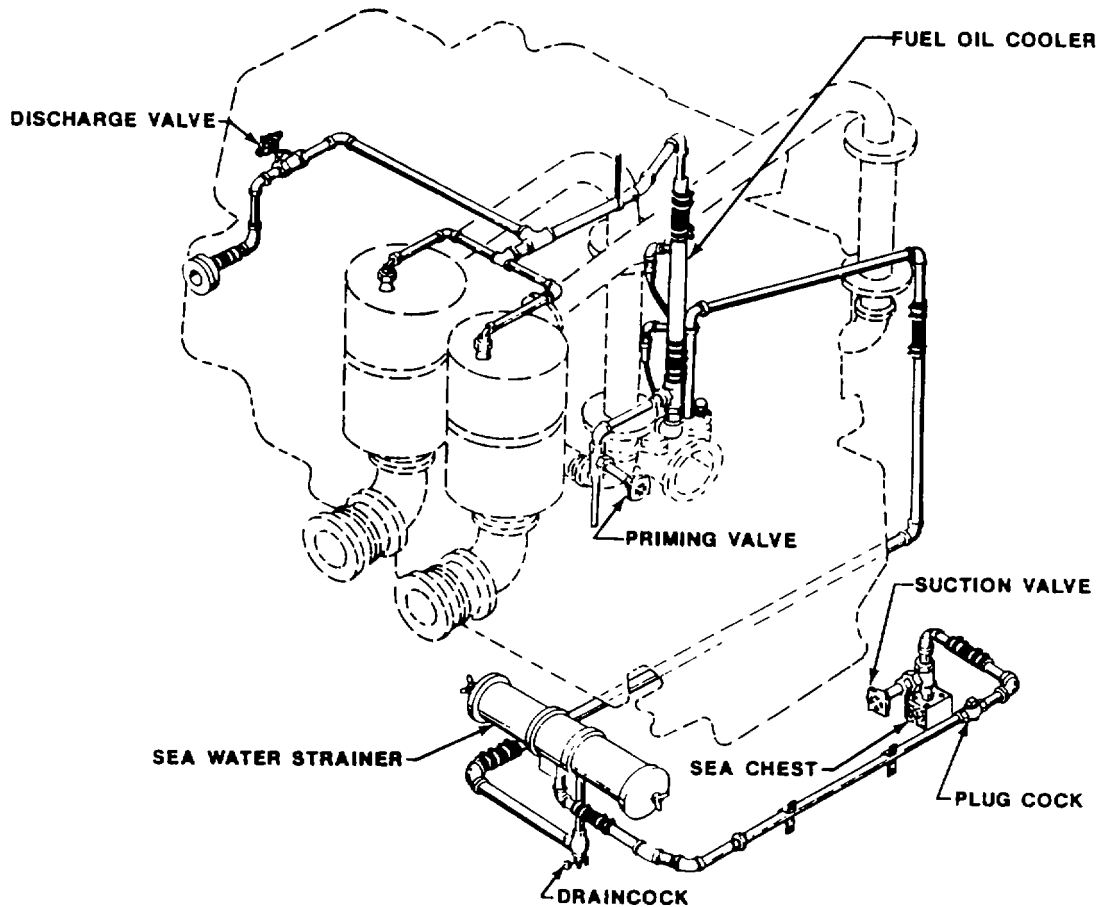
Identical exhaust systems are installed, port and starboard. The exhaust system removes the products of combustion from the engine exhaust manifold to the atmosphere. The mufflers in the system suppress noise and are cooled by sea water from the raw water system. Other major components of the system are the exhaust elbow, flexible connection, exhaust pipe, connecting elbow and expansion joint connector. The exhaust piping is insulated to a depth of 3 inches in one inch layers with thermal glass fiber insulation in accordance with military specification MIL-I-16411, Type II insulation over flanges is removable.



(STARBOARD SYSTEM SHOWN)

**1-16 RAW (SEA) WATER COOLING SYSTEM.**

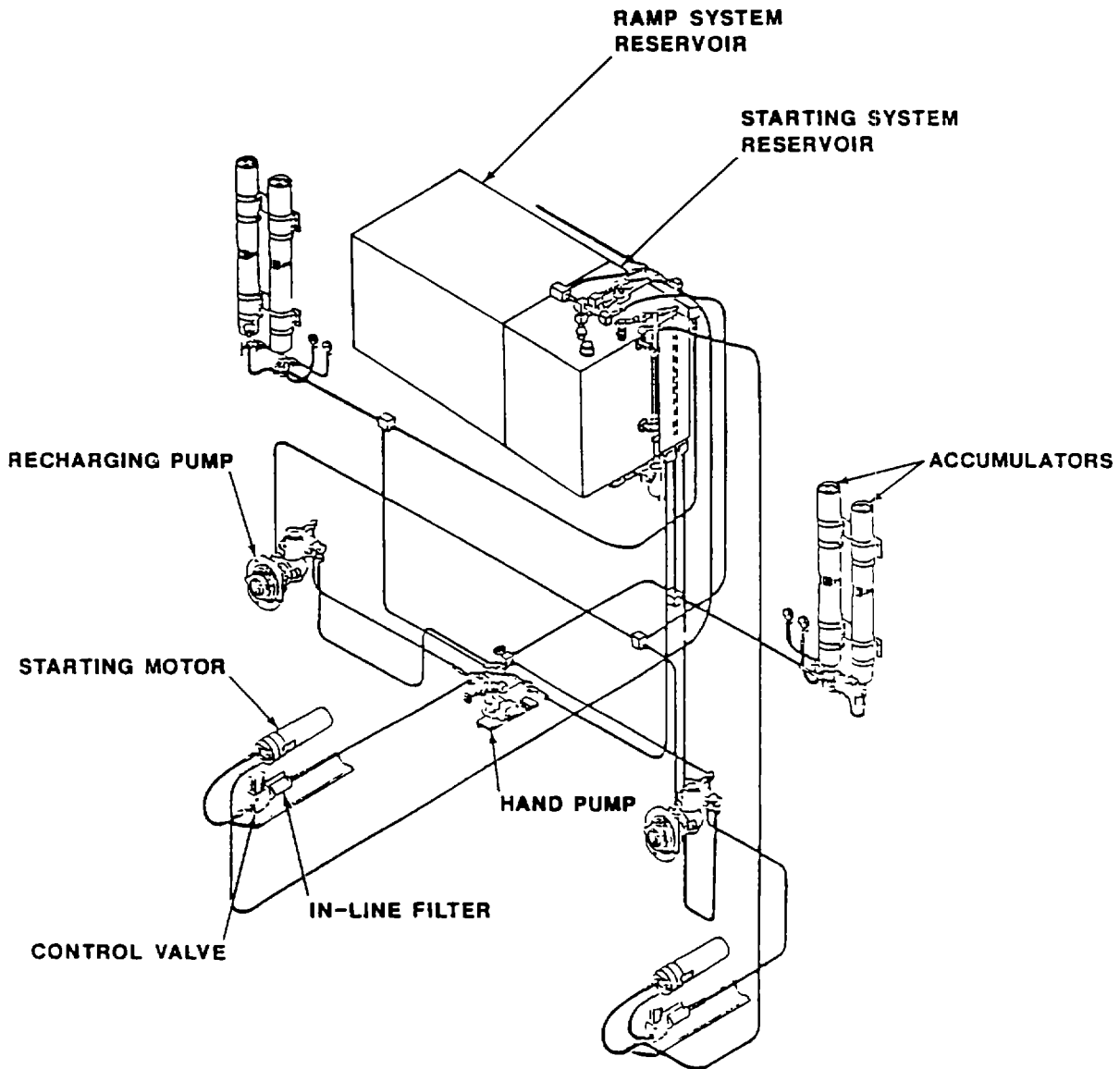
Identical raw water systems are installed, port and starboard. The function of the raw water cooling system is two-fold provide cooling for the mufflers and the return fuel oil, and priming for the bilge pumps. Sea water Intake is at the sea chest located aft of each marine transmission. The suction valves allow sea water to flow through the strainers mounted on each side of the engine room. The engine-mounted raw water pump pumps the sea water through the fuel oil coolers and the mufflers. The priming valve allows sea water priming of the bilge pump. Some sea water is discharged overboard through the discharge valve. The discharge valve is used to control the amount and rate at which sea water passes through the fuel oil coolers and mufflers. The sea water which is used to cool the mufflers is discharged through the exhaust ports with the exhaust gases



**(STARBOARD SYSTEM SHOWN)**

**1-17 HYDRAULIC STARTING SYSTEM.**

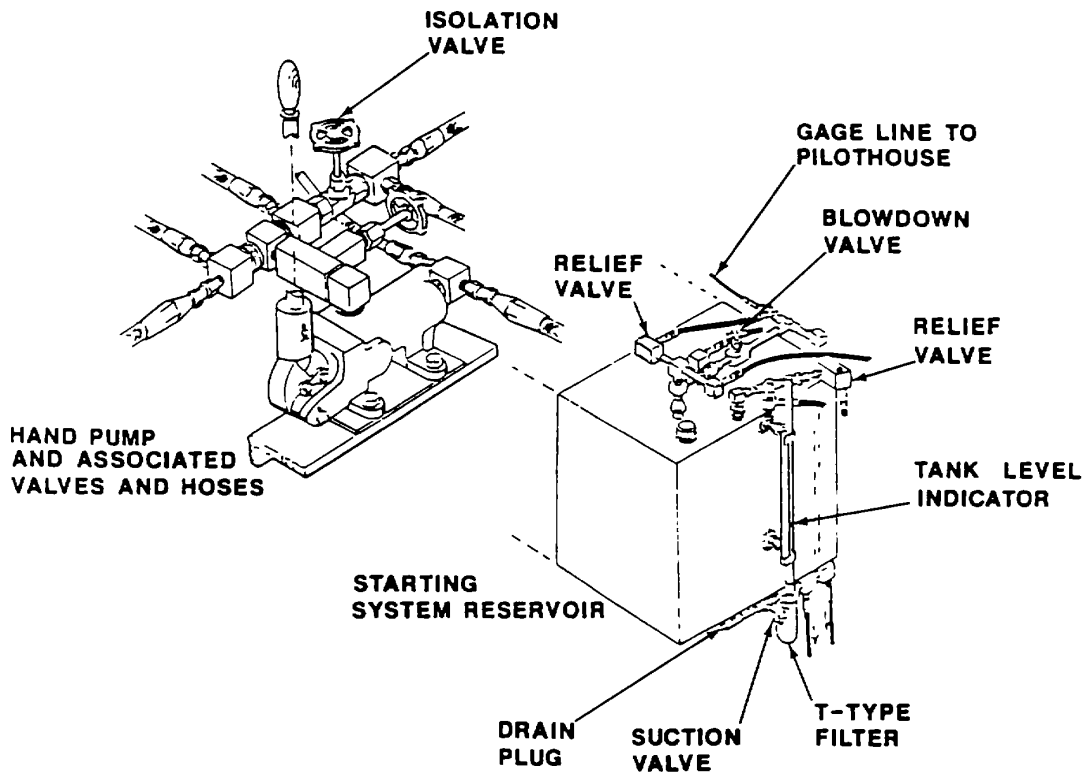
a. The function of the hydraulic starting system is to start the engines. The hand pump is used to supply the initial charge of hydraulic oil from the hydraulic reservoir into the two pairs of accumulators. The hand pump is a single piston, double-acting, positive displacement pump. The force required on the handle at 3000 psi is 48.5 pounds. The system is automatically recharged after each start, and can be manually recharged as necessary. The starting potential stored in the accumulators remains during long periods of inactivity



b. Hydraulic oil is stored at 3250 psi under the pressure of compressed nitrogen gas. When the engine start pushbutton is engaged, the control valve opens. Fluid under pressure is forced out of the accumulator, by the expanding nitrogen gas, and flows into the starting motor via the high pressure in-line filter and control valve. The starting motor accelerates the engine to a high cranking speed. The used hydraulic oil returns directly to the reservoir

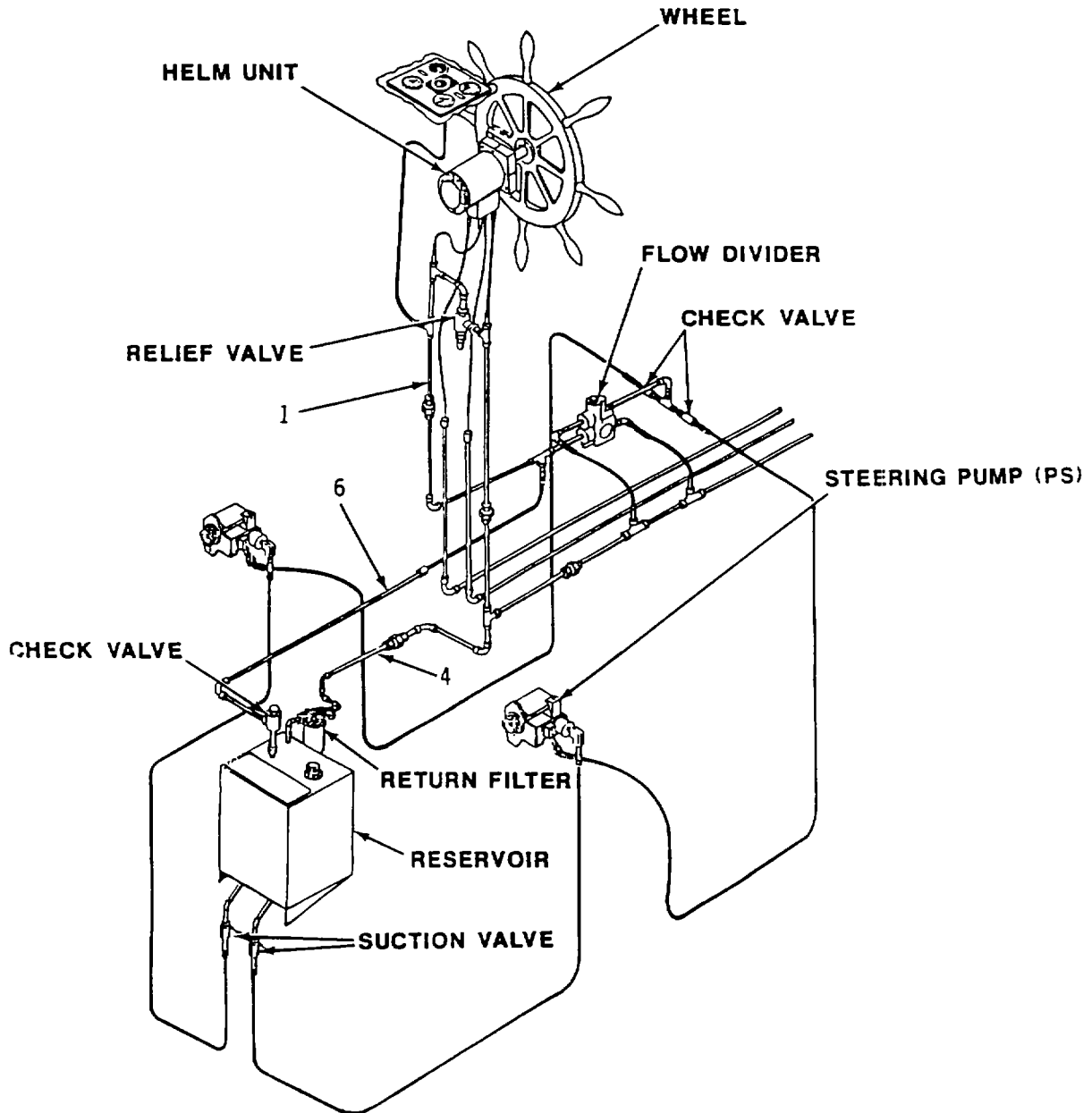
c. The engine-driven recharging pump runs continuously during engine operation and automatically recharges the accumulators. When the required pressure is attained in the accumulators, a valve within the pump body opens and the hydraulic oil discharged by the pump is by-passed to the reservoir

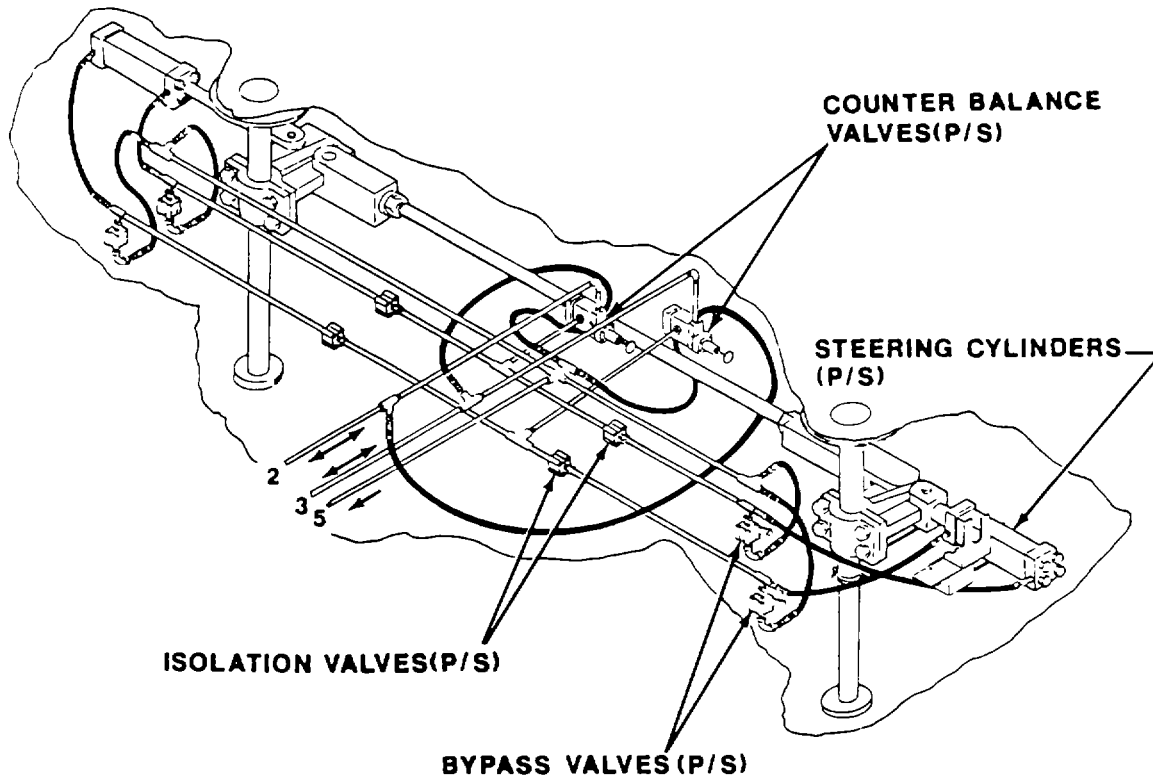
d. The accumulator blowdown valve is for blowing down the accumulators to relieve pressure before servicing the system (refer to instruction on the front of ramp/starting system reservoir). There are two relief valves set at 3400 psi to prevent the system from over-pressurization



**1-18 HYDRAULIC STEERING SYSTEM.**

a. The LCM-8 has a hydraulic steering gear. The engine driven power steering pumps have a total controlled flow rate of 3 gpm. The output of each pump passes through a check valve into a flow divider. The flow divider, which is set at 1050 psi, supplies 2 gpm of hydraulic oil to the helm unit through line (1). The remaining flow is returned to the hydraulic reservoir via return filter





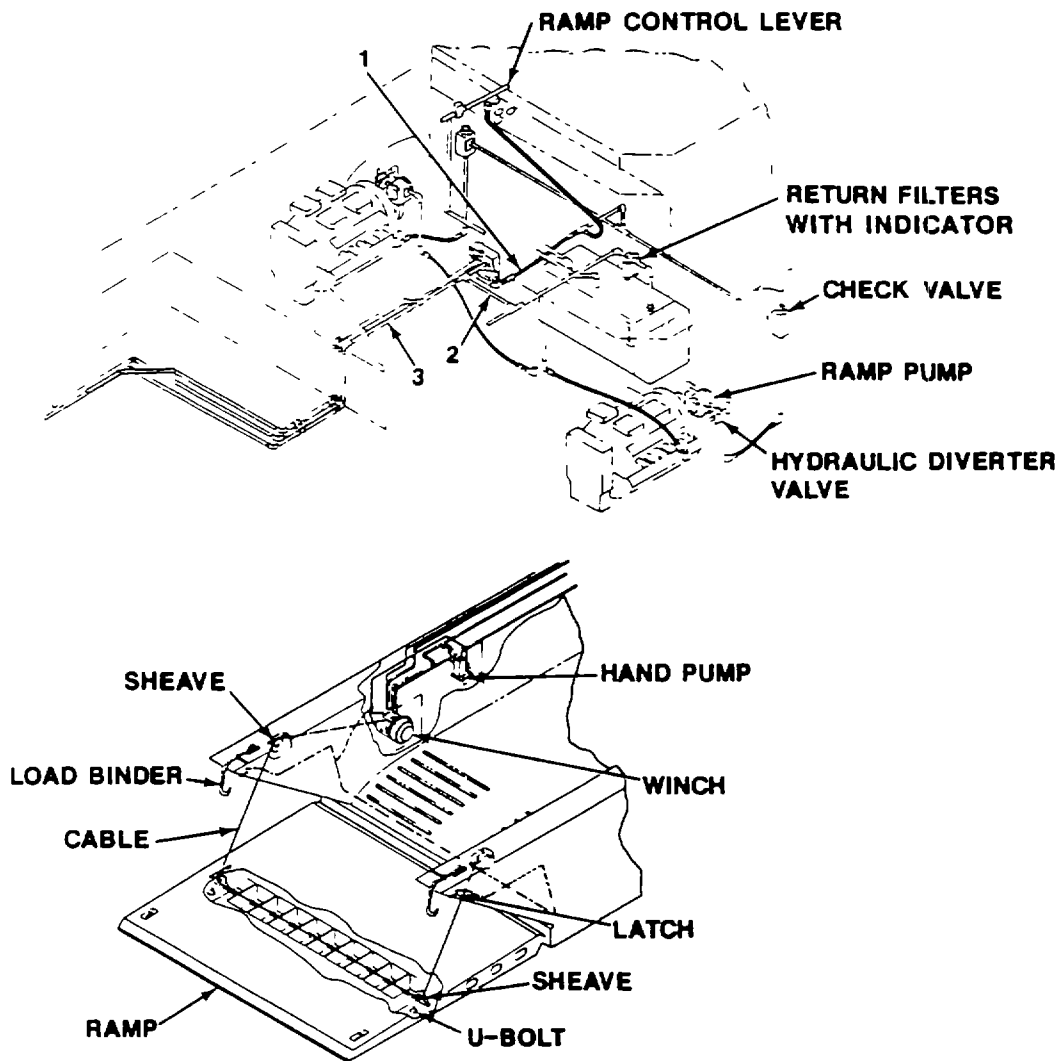
b. When the wheel is stationary, all the hydraulic oil supplied to the helm unit is returned to the hydraulic reservoir through line (4). When the helm is turned clockwise, the helm unit delivers hydraulic oil through line (3), the port counterbalance valve, and the lower Isolation valves, to the starboard side of each steering cylinder. The resultant clockwise torque positions the rudders. The hydraulic oil which is discharged from the port side of each steering cylinder passes through the upper isolation valves and the starboard counterbalance valve through line (2) to the helm unit before returning to reservoir via return filter. When the wheel is turned counterclockwise, line (2) supplies the cylinders and line (3) relieves the cylinders to put a counter-clockwise torque on the rudders.

c. The four bypass valves are normally closed but may be opened to drain the cylinders through line (5) to permit emergency steering. If a malfunction renders the engine driven pumps inoperative, the helm unit is capable of supplying itself with hydraulic oil from the reservoir as the wheel is turned. Under this condition the suction is through the check valve and line (6).

**1-19 RAMP HYDRAULIC SYSTEM.**

a. The function of the ramp hydraulic system. is to lower and raise the ramp as required. The ramp hydraulic pump is driven by the marine transmission top-mounted power take-off. When the hydraulic diverter valve is set for ramp operation, the pump discharges hydraulic oil through the check valve to the ramp control valve.

b. The ramp control valve is actuated by raising or lowering the ramp control lever located in the pilothouse. When the ramp control lever is raised, the control valve pipes the flow through line (1) to the hydraulic motor inside the winch. A cable and sheave mechanism raises the ramp as the wire rope winds onto the winch drum. Return oil flows through line (2) through the return filters into the ramp hydraulic reservoir. When it is desired to lower the ramp, the ramp control lever is lowered. The control valve pipes the flow through line (3) to the winch motor, returning to the reservoir through line (2).





c. Emergency lowering of the ramp is accomplished by the use of a hydraulic hand pump. The emergency ramp hoisting device consists of two 3-ton chain fall hoists. Each hoist consists of a reeving chain with swivel hook, selector lever, chain attachment, gear housing assembly and bottom hook.

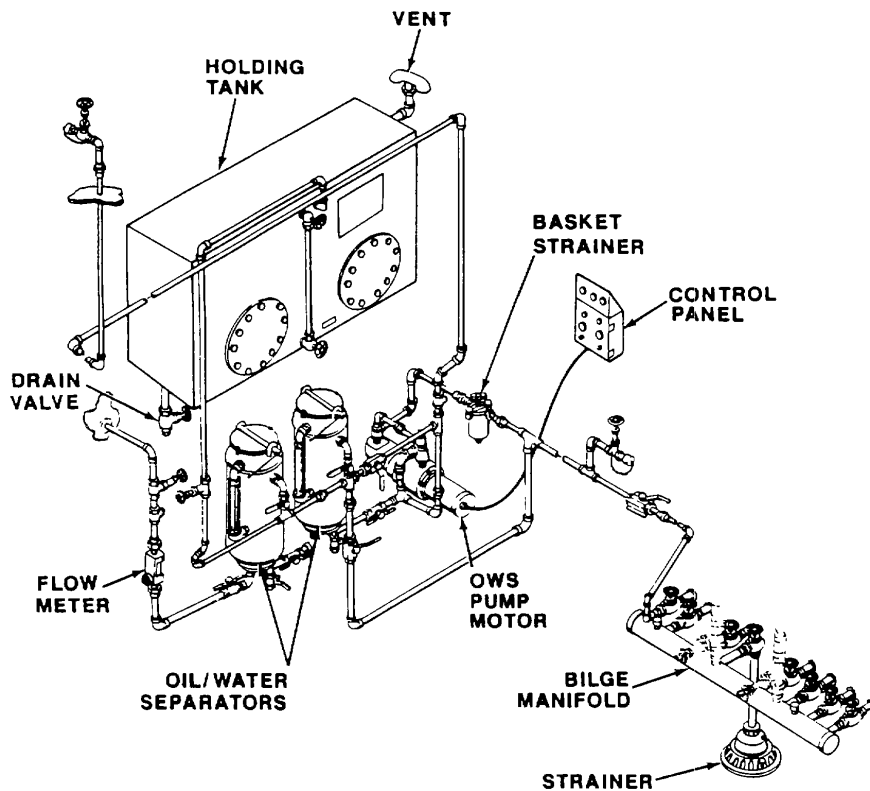
d. A hydraulically actuated mechanical latch is provided to secure the ramp in the fully raised position. The latch is unlocked by hydraulic pressure when the ramp control lever is placed in the RAMP DOWN position. The latch is automatically locked when the ramp is raised. The latch can be unlocked during emergency conditions (no pressure in the ramp hydraulic system, engines not operating, etc) by operating the hand pump.

e. The ramp winch incorporates an automatic winch reversing mechanism. The mechanism prevents cable overrun and coiling when the ramp lowering cycle is completed or interrupted. When the cable goes slack, the mechanism causes the hydraulic oil to bypass the winch and is returned to the reservoir.

**1-20 OIL/WATER SEPARATOR AND BILGE PUMPING SYSTEM.**

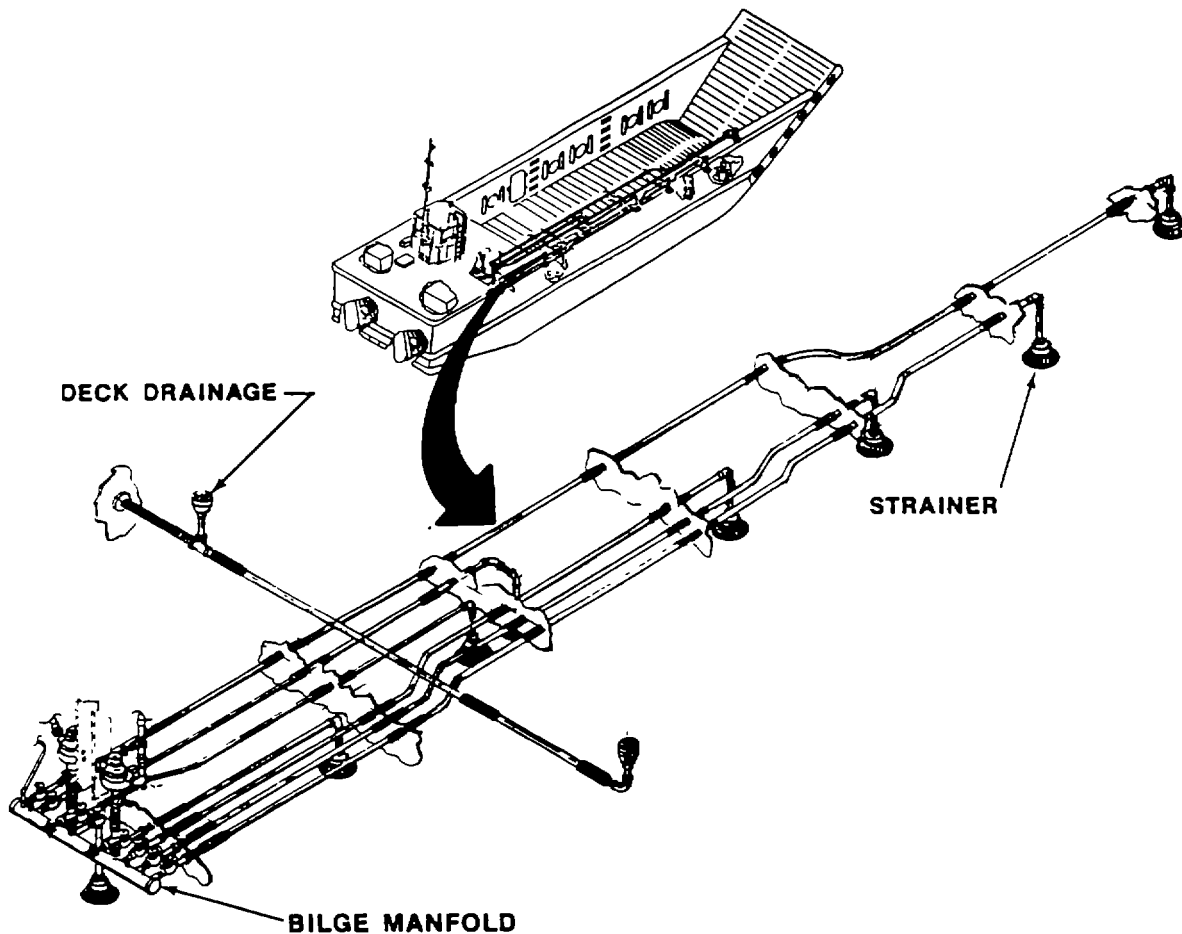
- a. The Oil/Water Separator (OWS) and Bilge Pumping System performs the following functions
  - (1) Pumps oily water from the bilges, discharges clean bilge water overboard and stores the waste oil.
  - (2). Drains engine crankcase lube oil from oil pans and pumps it into holding tank
  - (3) Picks up spills or empties buckets
  - (4) Pumps oil from primary and secondary stage separator to holding tank
  - (5) Pumps oil from holding tank through shore connection

b. The system consists of eight bilge strainers, a bilge manifold, basket strainer, electric motor-driven OWS pump, control panel, two oil-water separators, flow meter, holding tank and various valves. The holding tank has a 75-gallon capacity. The oil is stored while the vessel is operating in the contiguous zone until it can be discharged to a holding tank ashore.. The level of oil in the tank is determined by checking the sight glass on the front of the tank. After each use of the oil/water separator system, check the sight glass to see if the tank needs emptying. Over-filling the tank will force excess oil through the tank vent.



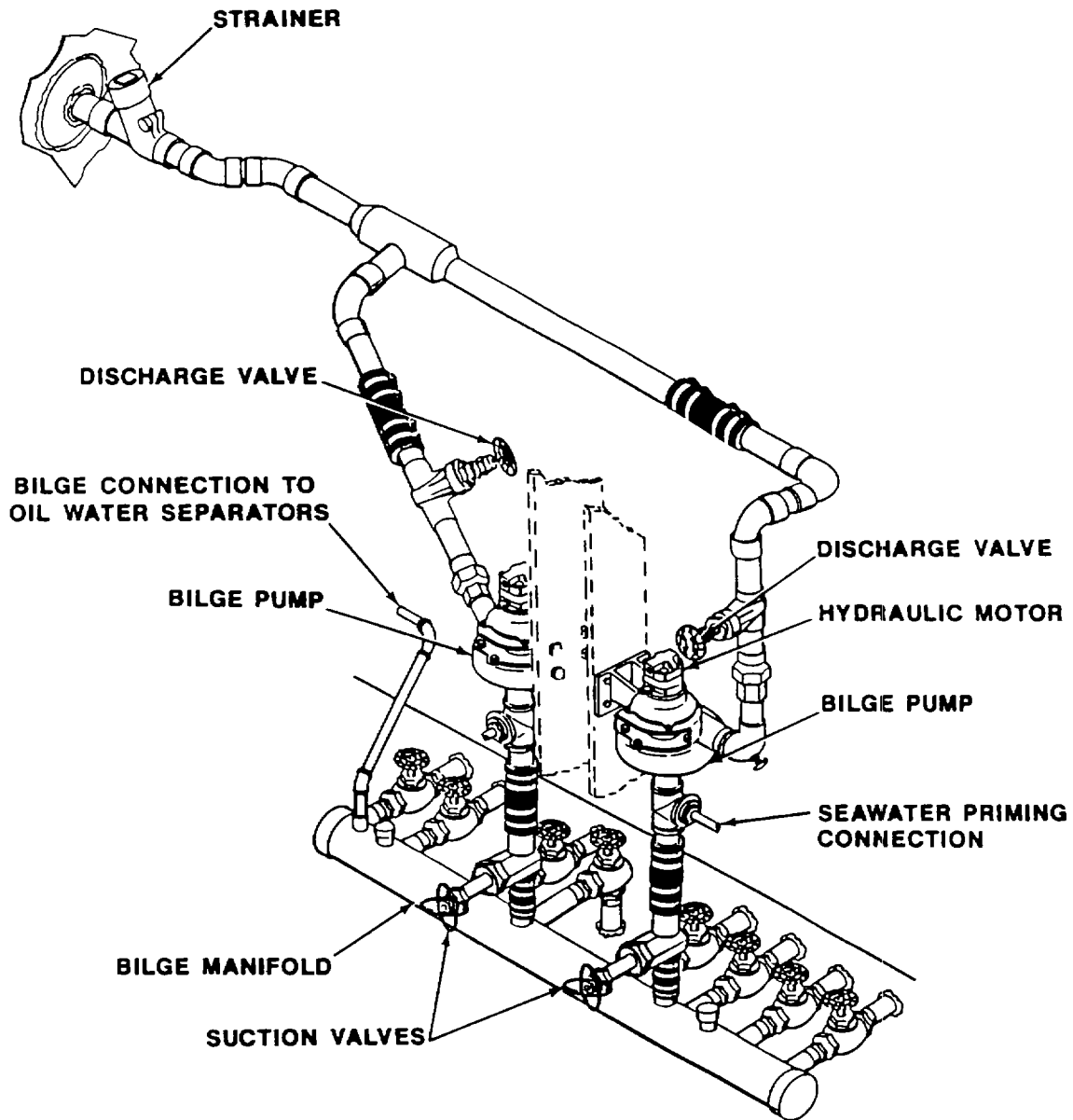
c. After the oil/water separator is started and applicable valves opened, liquid is sucked up either from the bilge, engine, or transmission crankcase by the oil/water separator pump. Larger particles are filtered out of the liquid by the basket strainer. The pump discharges the fluid from the crankcase directly to the holding tank and from the bilge to the oil/water separators where the oil is separated from the water. Clean water is discharged overboard. When the oil level is visible in the OWS sight glass, the oil is discharged to the holding tank by manually opening the oil discharge valve. When full, the holding tank can be emptied, by discharging to a shore oil receiving facility or drained by opening a tank drain valve. Refer to TM 55-2090-201- 14 & P for details of OWS operation.

d. The bilge manifold is located forward of the engine room on the centerline of the vessel. Seven bilge strainers are located in the void compartments below the cargo well and one in the engine room.. The drain valve located under the ramp/starting system hydraulic reservoir is used to drain the lazarette into the engine room. Deck drains are discharged directly overboard through deck drainage piping

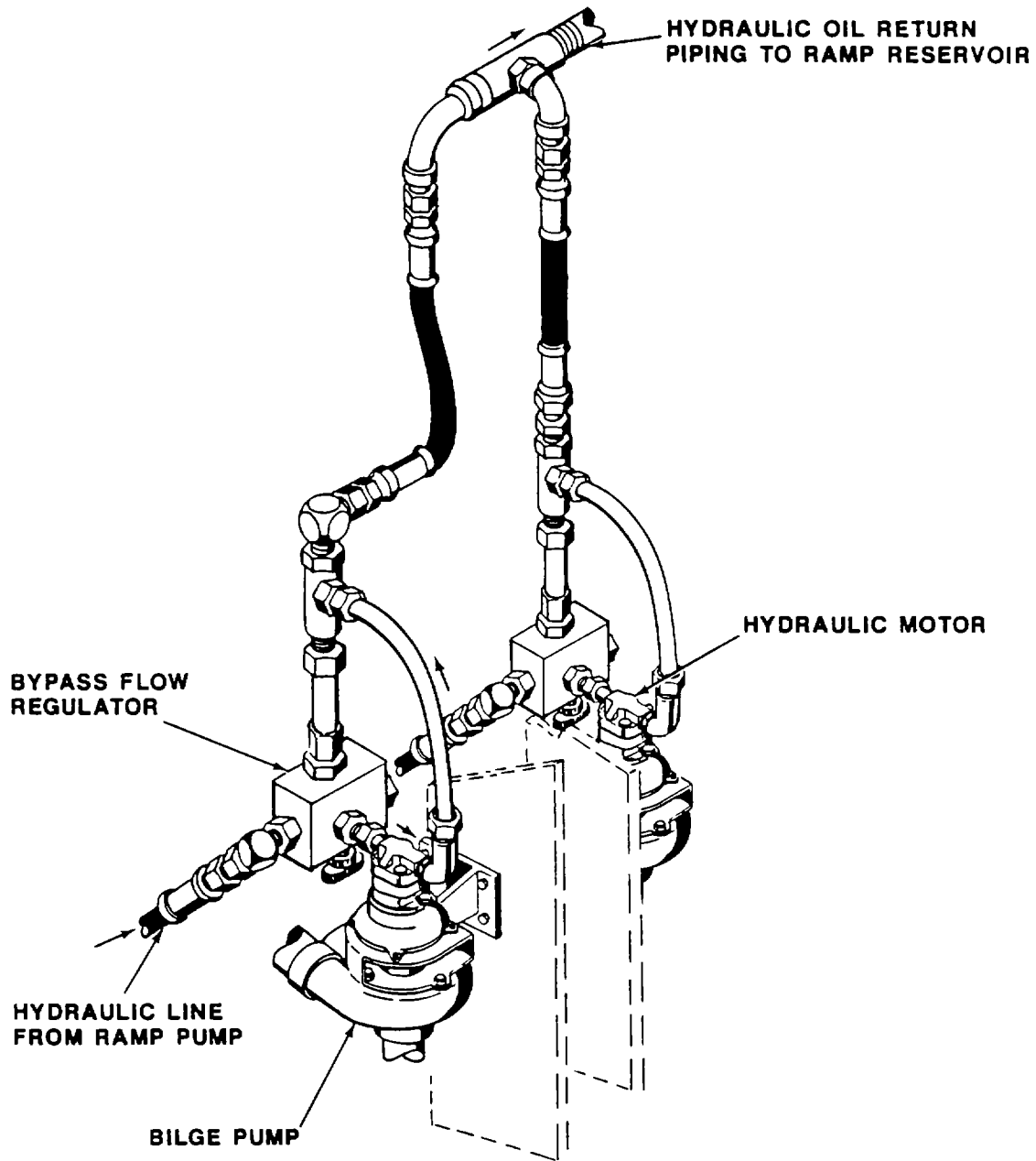


**1-21 EMERGENCY BILGE SYSTEM.**

a. The emergency bilge system is used to pump the bilges when flooding is imminent. The system consists of two motor driven centrifugal pumps and a bypass flow regulator. The bilge pump/hydraulic motor assemblies are mounted above the bilge manifold and take suction from it. Each pump has a suction valve and a discharge valve. The discharge piping runs athwartship through the port side of the hull and contains a strainer.



b. The hydraulic motors which drive the bilge pumps operate on a hydraulic circuit coming off the ramp hydraulic system. The hydraulic diverter valve located in the ramp hydraulic pump outlet is set to divert hydraulic fluid to the hydraulic motor suction line. The bypass flow regulator is factory preset to allow 10 gallons per minute regulated flow and to relieve at 1500 psi. The hydraulic motors discharge into a pipe which returns the ramp hydraulic oil into the ramp hydraulic reservoir



## 1-22 ELECTRICAL SYSTEM

a. The electrical system is a 24 VDC two-wire ungrounded system. Normal source of electrical distribution for power, lighting and IC (interior communication) systems circuits is supplied by two engine driven alternators. When the engines are shut down, electrical distribution for power, lighting and IC circuits is supplied from two 12 volt series connected storage batteries.

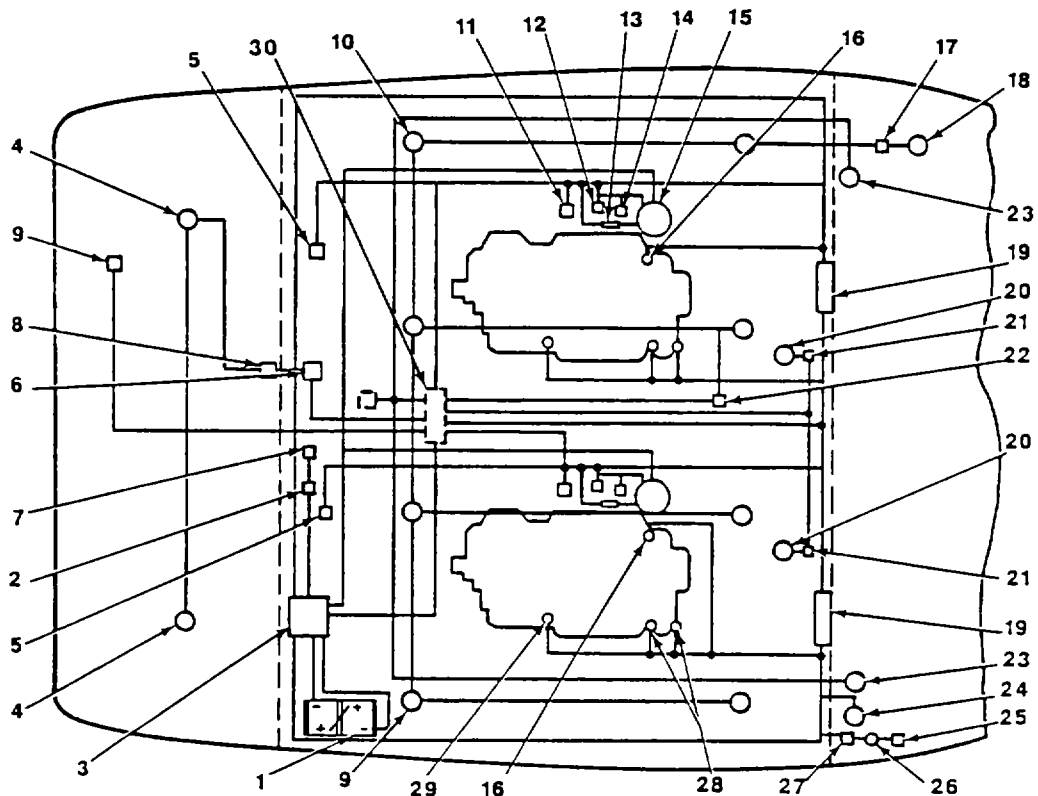
b. The prime purpose of the batteries in the vessel's electrical system is to provide a source of electrical power for starting the engines. (Note that the power is applied to the control valves for hydraulic starting and not directly to the starting motors). The batteries also act as a stabilizer to the voltage in the electrical system. They can, for a limited time, furnish current when the electrical demands of the LCM-8 exceed the output of the alternator. After the engines are running, the alternator is intended to supply all of the electrical requirements of the LCM-8, plus additional power to replace the charge taken from the batteries to start the engines.

c. The belt-driven alternators convert mechanical and magnetic energy to alternating current (ac) and voltage by the rotation of an electromagnetic field (rotor). The three phase, full wave rectifier system contained within the alternator converts the ac into direct current (dc). The six silicon rectifier diodes will pass current from the alternator to the batteries or load, but will not pass current from the batteries to the alternator. Hence, no cut-out relay is required. A fuel pressure switch, installed in each engine fuel system, disconnects the alternator field when the engine is shut down. Each alternator assembly includes a starting field resistor, a voltage regulator and a voltage protector. The function of the voltage regulator is to maintain constant system output voltage under all speeds and load conditions. This is necessary because excessive voltage will damage electrical components and instruments. The electronic voltage regulator functions like a solid state switch which constantly monitors system voltage. When the voltage tends to drop, the switch closes and energizes the alternator field winding to increase the output. When the system voltage tends to rise, the regulator switch opens and de-energizes the field circuit to decrease the voltage. The voltage protector protects the alternator from high voltages under certain conditions. For instance, if the batteries are inadvertently disconnected while the alternator is operating, unusually large output voltages could destroy the alternator.

d. A control and distribution panel is provided to supply groups of loads located in close proximity to each other. The control and distribution panel is located in the pilothouse. Junction boxes are provided in the pilothouse, and stuffing tubes are used where cables pass through watertight bulkheads. A circuit breaker enclosure is installed on the engine room aft bulkhead with a breaker designed to protect the battery or alternators against short circuit. A safety switch is also installed on the aft bulkhead to protect the IC circuits. Circuits supplied from the control and distribution panel are protected by 10A and 20A fuses. Refer to Foldout-3 for a schematic diagram of the electrical system.

e. Individual switches for fans, windshield wipers and engine room receptacles are located on the control and distribution panel. The receptacle circuits are fuse protected. Two overhead white lights and eight overhead white lights provide illumination in the lazarette and engine room respectively. The marine sanitation device compartment has one overhead white light. The stowage compartment has one overhead white light. Two bulkhead mounted red lights are installed in the cargo well, aft. Panel lighting is provided, port and starboard, for the pilothouse console instruments. The lights are controlled by a DPDT switch on the control and distribution panel, and protected with a 10A fuse. Each light group is controlled by a separate switch.

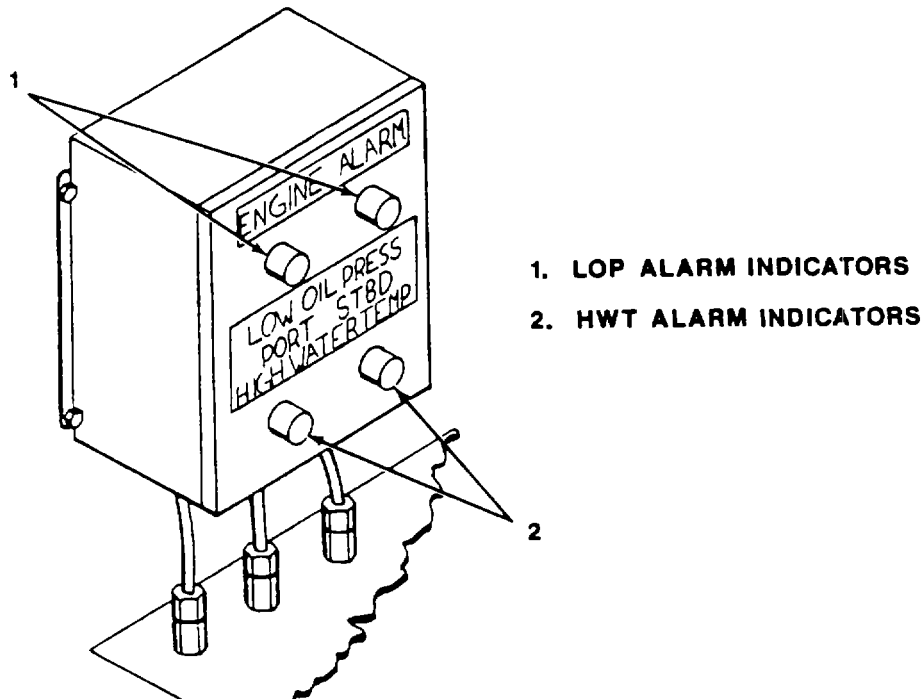
Illustration Showing Location of Electrical System Components (Sheet 1)



- |   |   |
|---|---|
| 1. Batteries                                  | 16 High Water Temperature Switch                |
| 2. Circuit Breaker                            | 17 Rotary Switch, Stowage Locker Lights         |
| 3. Terminal Board and Water-tight Enclosure   | 18 Interior Light, Stowage Locker               |
| 4. Interior lights, Lazarette (2)             | 19 Terminal Box, 12 - circuit                   |
| 5. Local Start Switch (2)                     | 20 Engine Room Fan                              |
| 6. Engine Room Receptacle                     | 21 Fan Receptacle                               |
| 7. Safety Switch                              | 22 Toggle Switch Engine Room Lights             |
| 8. Toggle Switch, Lazarette Interior Lights   | 23 Cargo Well Lights                            |
| 9. Rudder Angle, Transmitter                  | 24 Pump Motor (MSD)                             |
| 10. Interior lights, Engine Room (8)          | 25 Rotary Switch (MSD)                          |
| 11. Pushbutton, Starting System Control Valve | 26 MSD Compartment Light                        |
| 12. Voltage Regulator                         | 27 MSD Light Switch                             |
| 13. Resistor                                  | 28 Fuel Pressure Switches                       |
| 14. Voltage Protector                         | 29 Low Oil Pressure Switch                      |
| 15. Alternator                                | 30 Control and Distribution Panel (Pilot house) |

f. The navigation lights are controlled by a double pole, double throw switch (DPDT) located in the control and distribution panel. A stern light, two side lights (port and starboard), four not-under-command lights, an anchor light and masthead light comprise the navigation lights. These lighting circuits are protected by panel installed 10A fuses. The masthead, anchor and not-under-command light-; are mounted on a telescoping mast hinge-mounted on deck aft of the pilothouse. The mast lighting circuits are completed through plugs and receptacles Installed on the aft side of the pilothouse. An induction compass transmitter for the RMHS is located on top of the mast support (see illustration on facing page)

g. The engine alarm panel provides the helmsman with a visual alarm In the event of an engine malfunction. The engine alarm circuits are controlled by a DPST switch and protected by two 10A fuses on the control and distribution panel. The alarm circuits consist of engine warning red indicating lamps (RIL) which indicate low oil pressure (LOP) and high water temperature (HWT). The LOP alarm circuit contains a fuel pressure switch which prevents the LOP circuit from activating when the engines are shut down. A ground detector, located in the pilothouse, is used to detect grounds in the entire electrical system excluding the IC circuits.

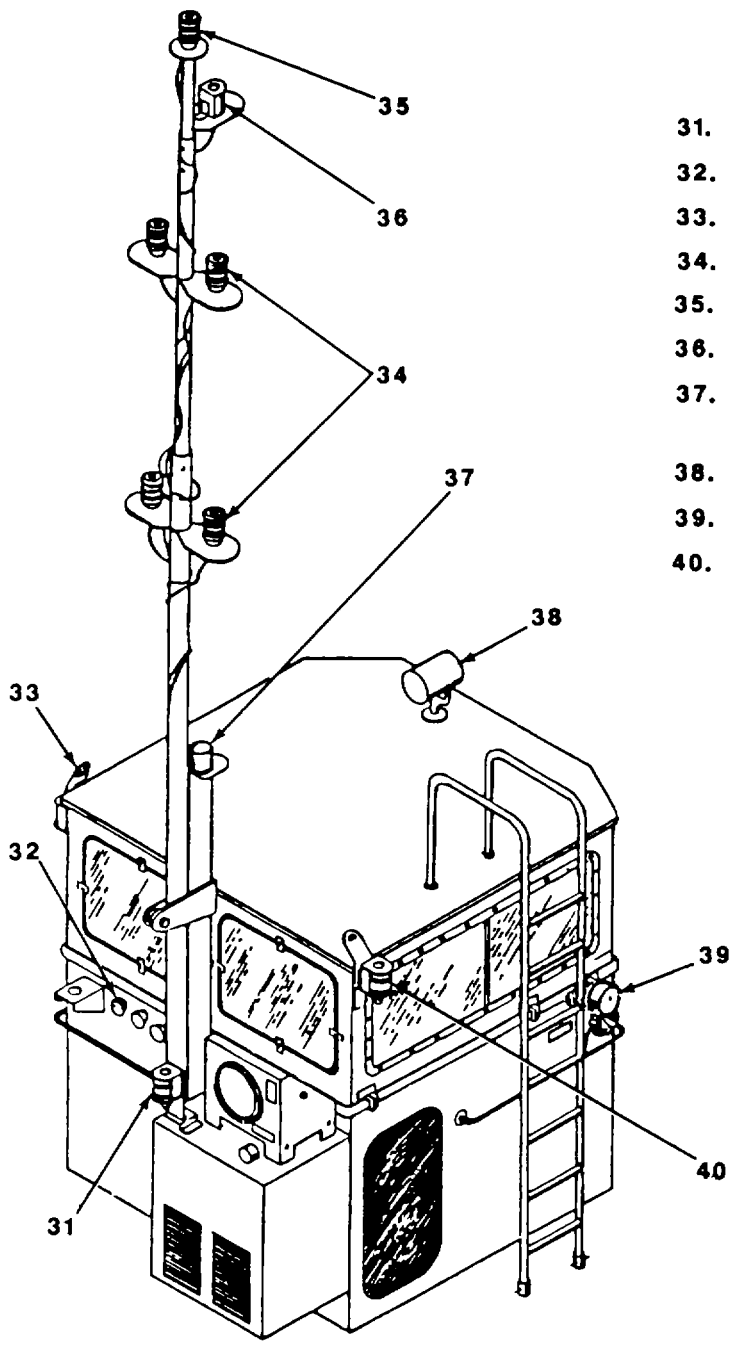


**NOTE**

The location of electrical components inside the pilothouse are shown and described in para. 2-1.



Illustration Showing Location of Electrical System Components (Sheet 2)



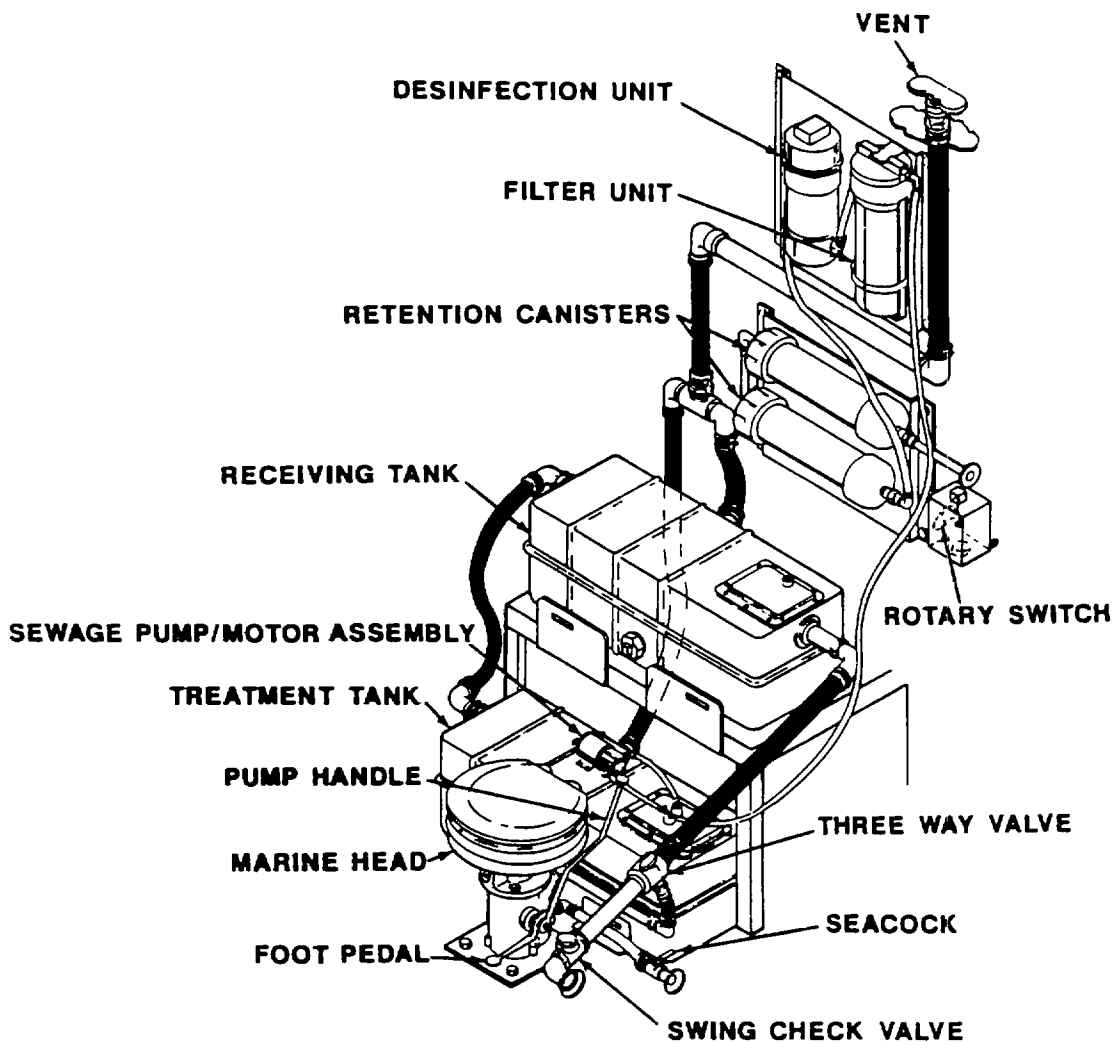
- 31. STERN LIGHT
- 32. RECEPTACLES (4)
- 33. PORT LIGHT
- 34. NOT-UNDER COMMAND LIGHTS (4)
- 35. ANCHOR LIGHT
- 36. MASTHEAD LIGHT
- 37. INDUCTION COMPASS TRANSMITTER (RMHS)
- 38. SEARCHLIGHT
- 39. HORN
- 40. STARBOARD LIGHT

**1-23 MARINE SANITATION DEVICE.**

**1-23.1 System Description.**

a. The Marine Sanitation Device (MSD) is a modular sewage system designed to accommodate eight people and is rated at forty gallons of sewage per day from toilets only. The system consists of four modules: Receiving Tank, Treatment Tank, Filter-Disinfecter, and Retention Canisters. The system is compatible with a low volume flush toilet using 1 gallon maximum per flush.

b. The marine head discharges sewage into the first of four compartments in the receiving tank. Directly above the first compartment is a bolted-on hatch cover which, when removed exposes a clean-out opening for periodic maintenance. Three more compartments (without clean-outs) are designed to provide residence time for anaerobic decomposition and low flow velocities for sedimentation. The compartments are separated by dividers which also serve as weirs to control flow. After entering the first compartment, the sewage flows up and over into the second compartment. The flow is then directed down and under the next divider into the third compartment, then up and over the last weir into the final chamber of the receiving tank.



c. The sewage flows by gravity from the receiving tank into the first of four compartments in the treatment tank. The sewage follows the same over and under flow path as in the receiving tank. The first three compartments provide for further sedimentation and anaerobic decomposition before entering the final chamber. An electric motor-pump installed on the treatment tank pumps the clarified effluent from the final chamber to the filter-disinfector at a rate of 0.21 gpm. The pump is controlled by a float switch which is attached to the suction pipe and suspended from the hatch cover on the final chamber of the treatment tank.

d. The filter assembly is a standard water filter. The filter housing can be unscrewed from the cap, permitting easy replacement of the 50 micron filter element. The element can be washed and reused several times. The sewage liquor is pumped through the filter element into the disinfection unit. The outlet of the filter has a built-in check valve to prevent backflow of liquid chlorine into the filter housing. The tablets of solid disinfecting agents inside the disinfector dissolve at a rate that provides for a three to six week period between recharge operations, depending on flow conditions. The maximum capacity is seven tablets.

e. The effluent flows by gravity from the disinfector into the retention canisters. The retention canisters provide the proper residence time for oxidation of solid matter and disinfection of the liquid effluent. The effluent is discharged overboard from the retention canisters.

f. The marine head or "skipper" features a foot pedal and a smooth working easily accessible vertical pump handle. The seacock allows sea water into the bowl when the foot pedal is engaged. The three-way valve permits flushing the toilet through the MSD or directly overboard when the vessel is in the open sea. The swing check valve in the sewage discharge line prevents backflow.

g. The rotary switch is used to furnish electrical power to the pump motor to operate the marine sanitation device.

### 1-23.2 Treatment Method.

a. The sewage system uses a combination of sewage treatment principles to achieve a safe acceptable effluent. The incoming sewage is subjected to sedimentation in the receiving and treatment tanks. While the sewage passes through these tanks it is subjected to a second treatment, natural decomposition by anaerobic action. This natural action is accelerated by the addition of selected bacteria for use in the digestion and liquification of sewage. These enzymes reduce the complex fats, proteins and carbohydrates in the sewage to stable sludge through a chain of reactions. The bacteria supplements the action of the enzymes as well as to attack and liquify the fibrous components of raw sewage. The temperature at which the enzyme-bacterial action is most effective is 86°F (30°C).

b. The third treatment is a filtration stage consisting of final removal of all particles above 50 microns that have passed through the preceding stages of treatment. If the recommended flush water is exceeded, solids will not be separated from the liquor and the filter will become clogged. The final stage of treatment consists of chlorination which disinfects the effluent. The residence time in the retention canisters is approximately 5 minutes. The oxidizing action of the chlorine solution not only results in elimination of pathogens but also reduces the biochemical oxygen demand (BOD) of the effluent.

**Section IV. SERVICE UPON RECEIPT****1-24 GENERAL.**

The services performed upon receipt of a new or used vessel are the responsibility of the receiving organization and will be performed by the crew and issuing activity.

**WARNING**

Before volatile materials are brought aboard, or the engines are started, ensure that firefighting equipment is immediately available for use in case of fire emergency. Failure to comply could endanger personnel and/equipment.

**1-25 INSPECTING AND SERVICING THE LCM-8.**

The crew and issuing activity will conduct a 100 percent inventory of the vessel and required components as per appendices 'C' and 'D'. Any shortages will be listed and reported to the proper authority for corrective action. The crew will perform all of the operator PMCS as listed in paragraph 2-2. All defects and shortages will be recorded on DA Form 2404 as per DA PAM 738-750. Upon inspection of vessel, all services up to and including those done annually, will be performed as listed in paragraph 4-4.

**1-26 USED EQUIPMENT.**

A vessel received from storage will be inspected as specified in paragraph 1-25 above. However, storage personnel will have performed the depreservation operation and outfitted and operated the vessel prior to the arrival of the crew.

**CHAPTER 2  
OPERATING INSTRUCTIONS**

	Paragraph
Cold Weather Operation .....	2-6
Controls and Indicators.....	2-1
Emergency Procedures .....	2-9
Foul Weather Operation.....	2-8
Hot Weather Operation .....	2-7
Operating Procedure .....	2-4
Operation of Auxiliary Equipment.....	2-5
Pre-operating Procedures.....	2-3
Preventive Maintenance.....	2-2

## Section I. DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

### 2-1 CONTROLS AND INDICATORS.

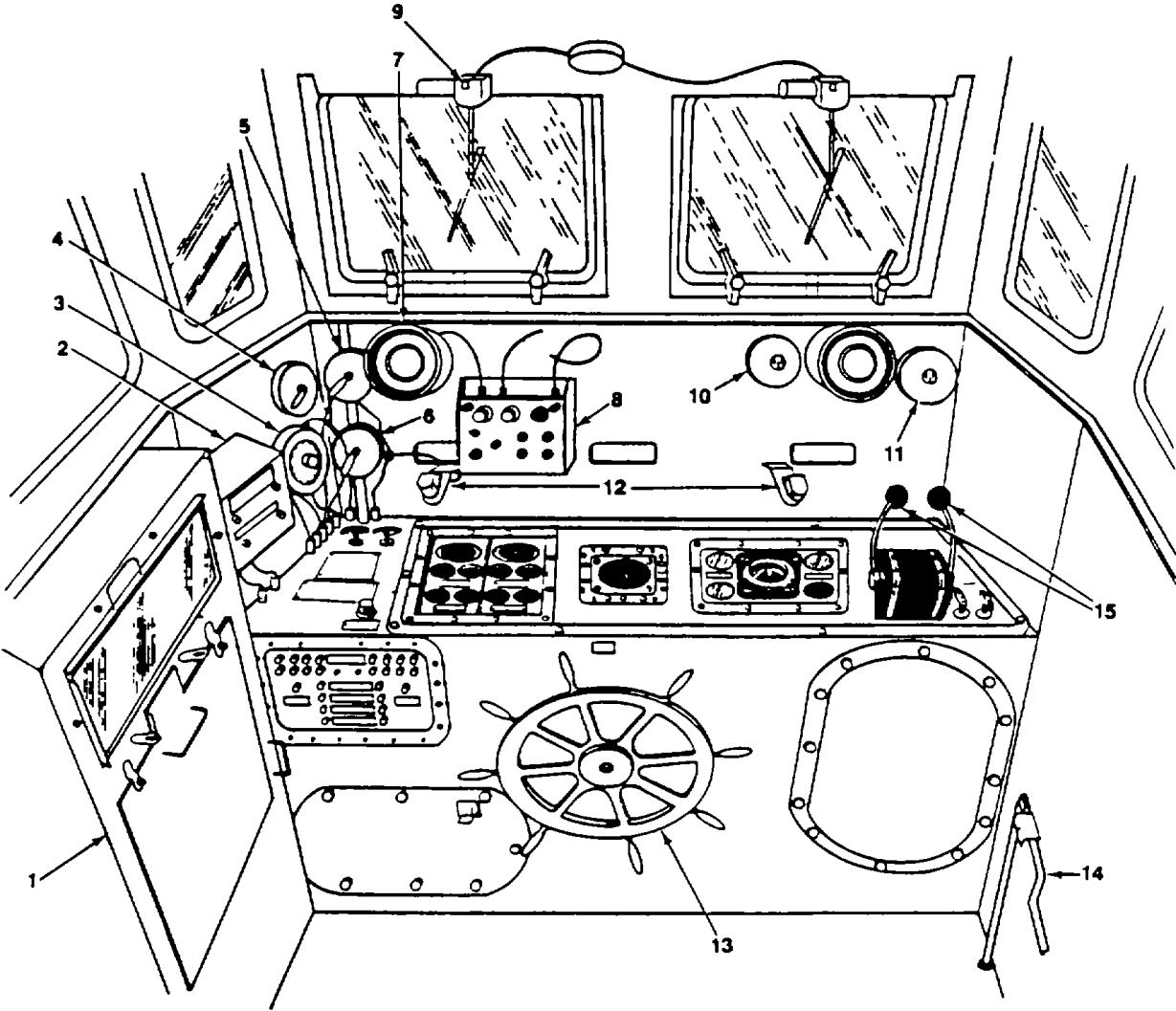
This paragraph contains a functional explanation of all operator controls and indicators (refer to table below).

#### Operator Controls and Indicators.

Key	Control or Indicator	Function
1.	Communication Cabinet	Contains three radio receiver - transmitters AN/VRC-47, AN/URC-92 and AN/URC-80.
2.	ENGINE ALARMS	Indicates when engine has low oil pressure and/high water temperature.
3.	RUNNING LIGHTS Switch	Turns the port, stern, starboard and not-under-command lights on and off.
4.	MASTHEAD/ANCHOR LIGHTS Switch	Turns masthead and anchor lights on and off.
5.	CARGO WELL LIGHTS Switch	Turns cargo well lights on and off.
6.	INSTRUMENT LIGHTS Switch	Turns the instrument panel lights on and off.
7.	Loudspeaker	Used for voice communication with the AN/URC-80 radio.
8.	Radio Control Box	Used to select channel on the AN/URC-80 Radio for ship to ship communication.
9.	Windshield Wiper Switch	Turns windshield wipers on and off.
10.	Searchlight Receptacle	Used to connect/disconnect power to the searchlight.
11.	Wiper Receptacle	Used to connect/disconnect power to the windshield wipers
12.	Control Console Lights	Illuminates the control console in the pilothouse.
13.	Steering Wheel	Used to change course of the craft.
14.	Ramp Control Lever	Used to raise or lower the ramp.

Operator Controls and Indicators (Continued).

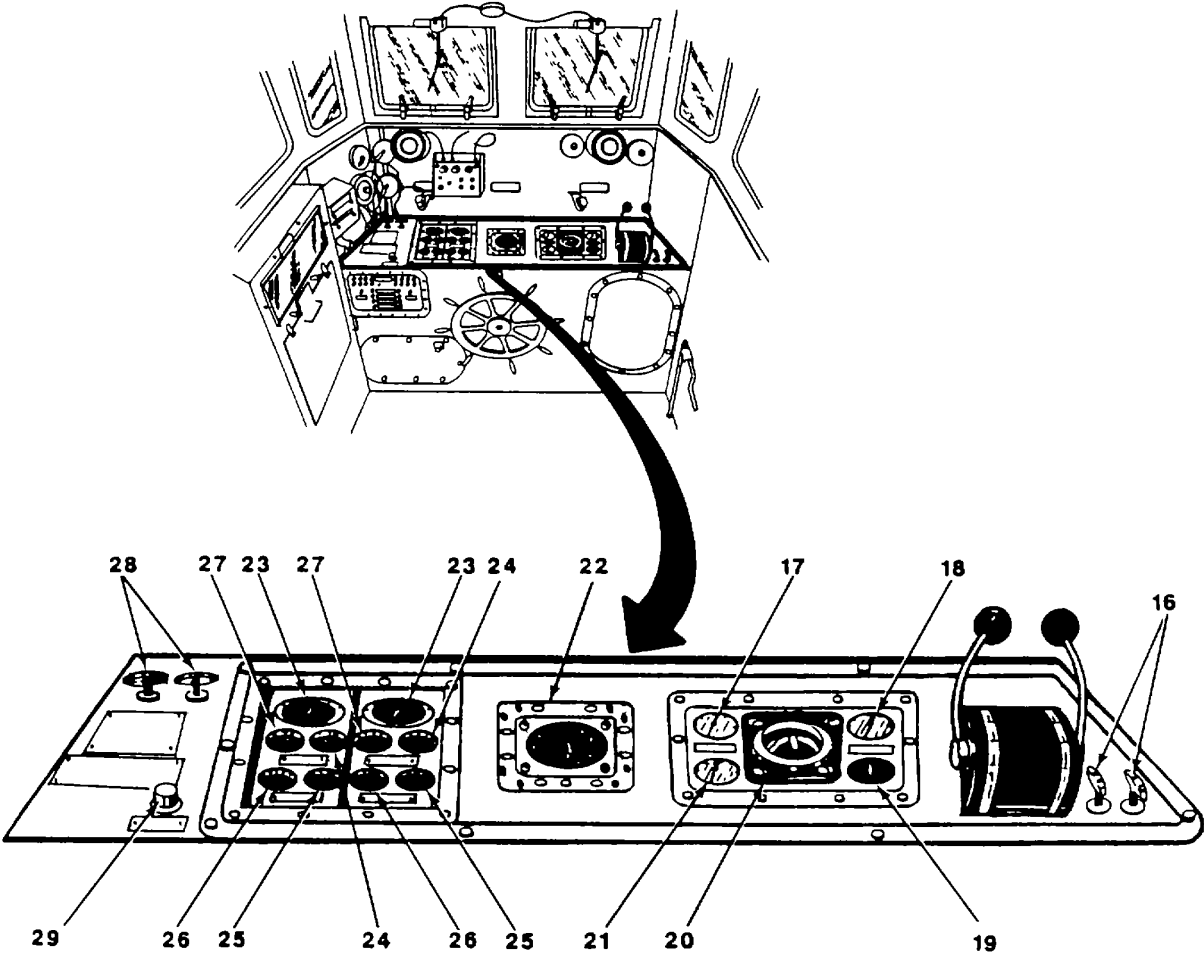
Key	Control or Indicator	Function
15	Propulsion Control Levers	Used to control the clutch and throttle of the propulsion units.



**Operator Controls and Indicators (Continued).**

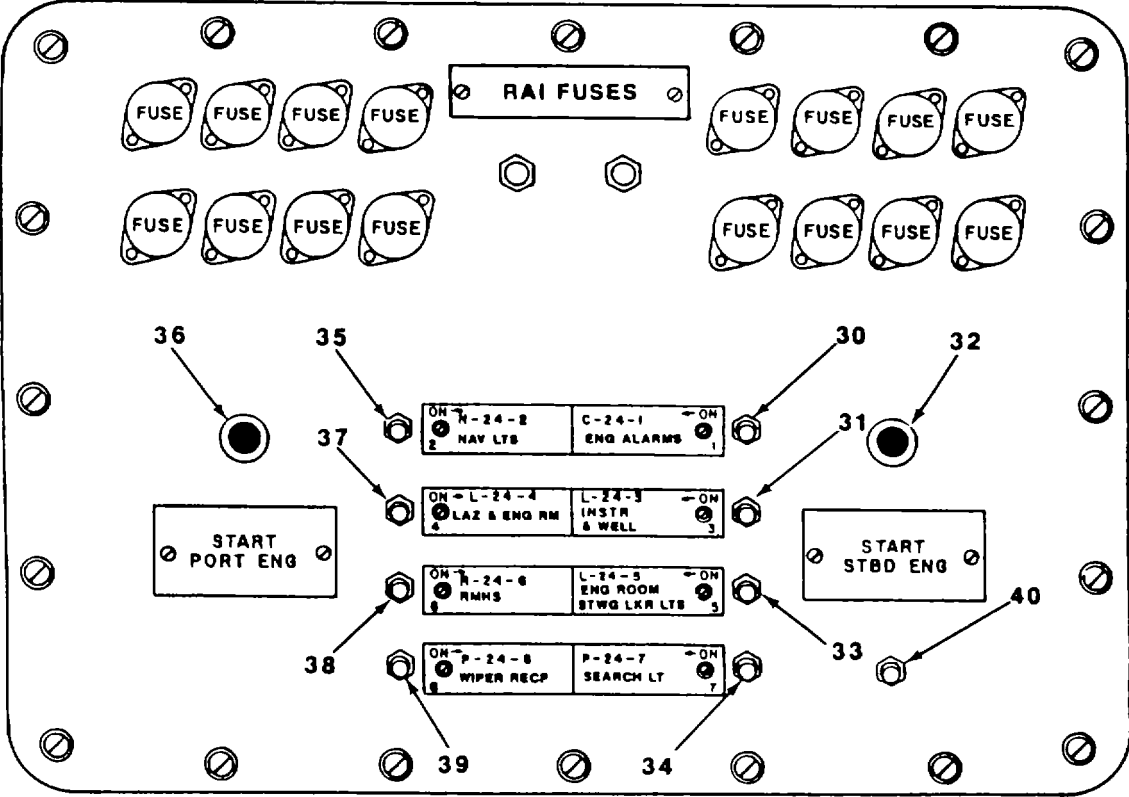
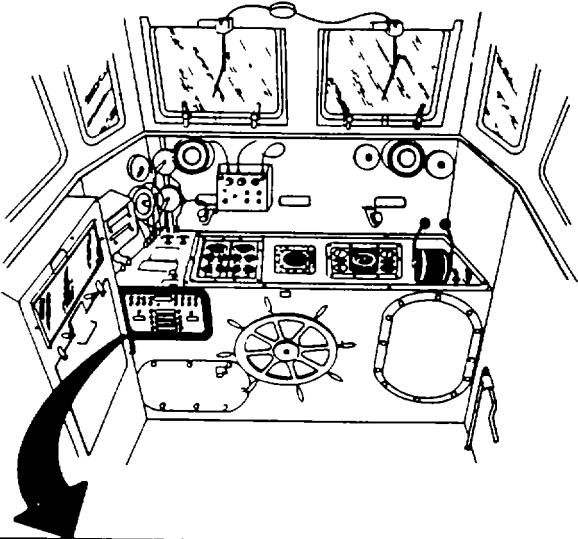
<b>Key</b>	<b>Control or Indicator</b>	<b>Function</b>
16.	ENG SHUTDOWN Controls	Used to stop the propulsion engines by cutting off fuel supply.
17.	HYD STEERING Pressure Gauge	Indicates the hydraulic pressure in the steering system.
18.	HYD RAMP Pressure Gauge	Indicates the hydraulic pressure in the ramp hydraulic system.
19.	BATT AMPS Indicator	Indicates the battery charge/discharge rate.
20.	RUDDER ANGLE Indicator	Indicates the position of the rudders.
21.	HYD START Pressure Gauge	Indicates the hydraulic pressure in the starting system.
22.	COMPASS (RMHS)	Indicates the heading of the vessel as determined by the induction compass transmitter.
23.	Tachometer	Indicates engine speed in revolutions per minute.
24.	Alternator Ammeter	Registers the current flow from the alternators.
25.	TRANS OIL PRESS Gauge	Registers the pressure of the lubricating oil feeding the transmission.
26.	ENG OIL PRESS Gauge	Registers the pressure of the lubricating oil in the engine.
27.	Water Temp Gauge	Registers the temperature of the fresh water used in the engine for cooling.
28.	EMERGENCY ENGINE SHUTDOWN Controls	Used to stop the propulsion engines in an emergency by cutting off the air supply.
29.	HORN Button	Used to sound the horn.





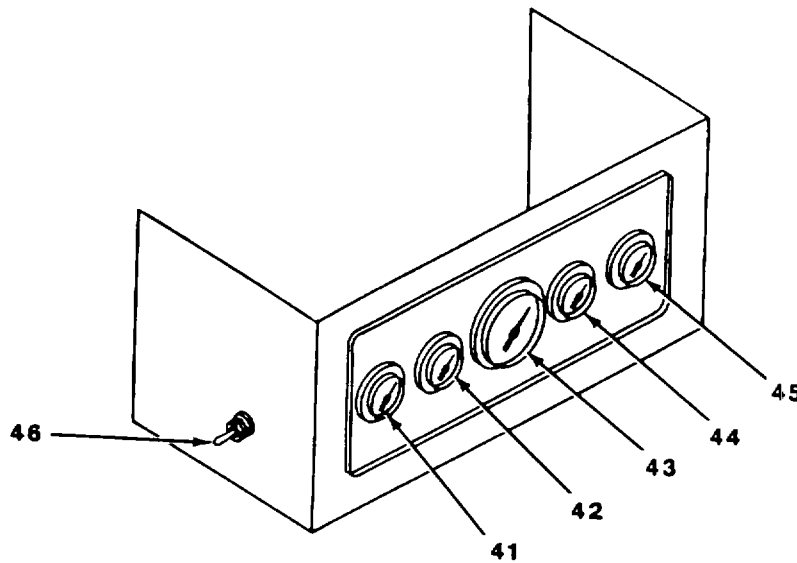
**Operator Controls and Indicators (Continued).**

<b>Key</b>	<b>Control or Indicator</b>	<b>Function</b>
30.	ENG ALARM Switch	Controls electrical power to the engine alarm panel.
31.	INSTR & WELL Switch	Controls electrical power to the instrument panel lights and cargo well lights
32.	START STBD ENG Button	Used to start the starboard propulsion engine by opening the starting system control valve.
33.	ENG ROOM/STWG	LKR Controls electrical power to the engine LTS Switch room and stowage locker lights.
34.	SEARCH LT Switch	Controls electrical power to the search-light.
35.	NAV LT Switch	Controls electrical power to the navigation lights.
36.	START PORT ENG Button	Used to start the port propulsion engine by opening the starting system control valve.
37.	LAZ & ENG RM Switch	Controls electrical power to lazarette lights and engine room fans.
38.	RMHS Switch	Controls electrical power to the Remote Magnetic Heading System.
39.	WIPER RECP Switch	Controls electrical power to the wiper receptacle.
40.	RAI Switch	Used to turn on/off power to the Rudder Angle Indicator.



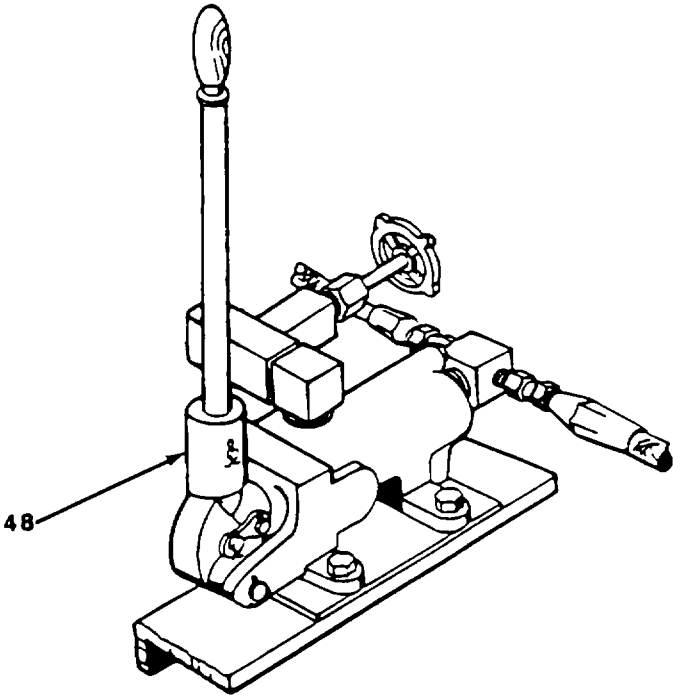
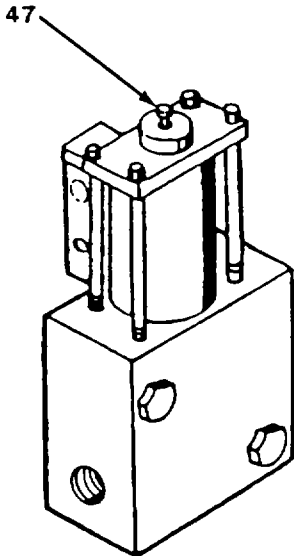
Operator Controls and Indicators (Continued).

Key	Control or Indicator	Function
41.	ENG WATER TEMP Gauge	Registers the temperature of the fresh water used in the engine for cooling.
42.	ENG OIL PRESS Gauge	Registers the pressure of the lubricating oil in the engine.
43.	Tachometer	Registers engine speed in revolutions per minute.
44.	TRANS OIL PRESS Gauge	Registers the pressure of the lubricating oil feeding the transmission.
45.	ALTERNATOR	Ammeter Registers the current flow from the alternator.
46	REMOTE/LOCAL ENGINE START Switch (MOM ON/OFF/ON)	Used to start the engines locally, or to provide remote start capability from the pilothouse.



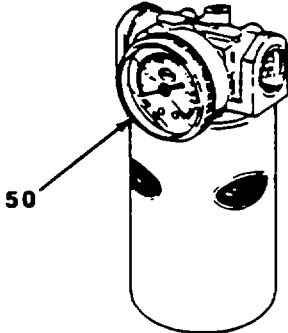
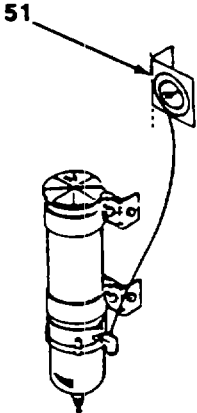
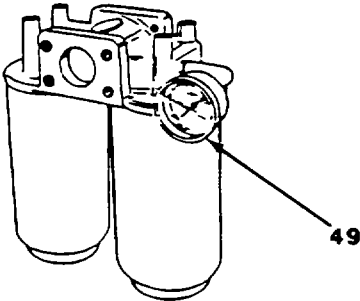
Operator Controls and Indicators (Continued).

Key	Control or Indicator	Function
47.	Control Valve Pushbutton	Used to start the engines as a manual override mode.
48.	Starting System Hand Pump	Used to provide initial charge to the accumulators for starting the engines.



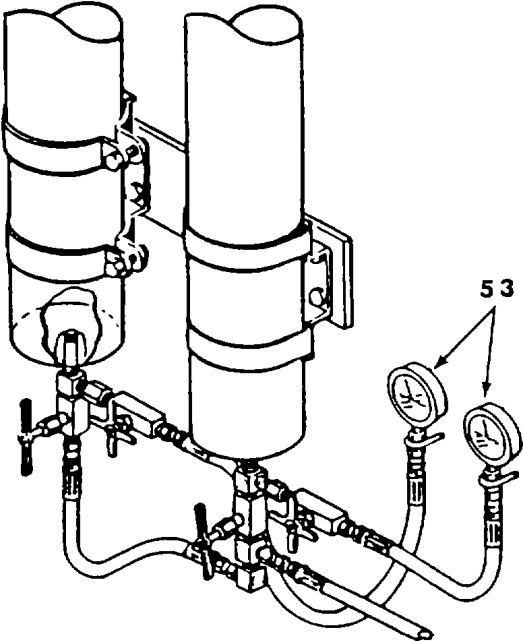
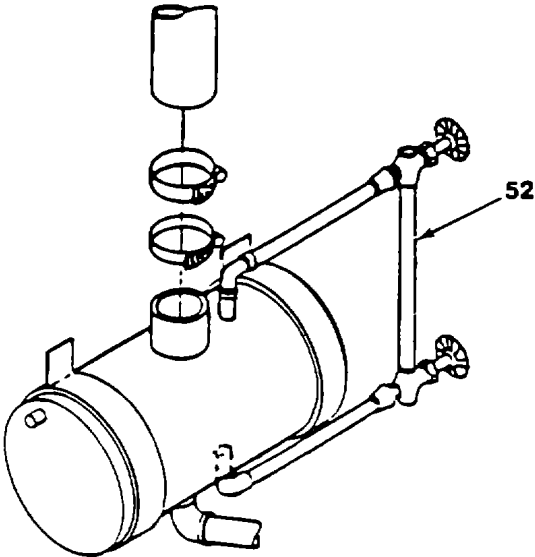
Operator Controls and Indicators (Continued).

Key	Control or Indicator	Function
49.	Ramp Hydr. Sighs Return Filter Indicator	Indicates filter element condition. green (clean), red (dirty).
50.	Steering Sys Return Filter Indicator	Indicates filter element condition.
51.	Fuel Filter/Water Separator indicator	Indicates filter element condition.



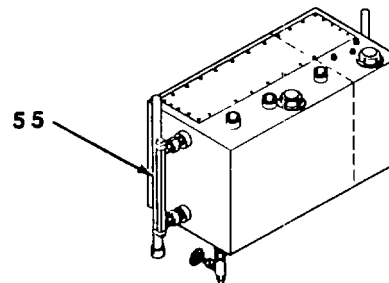
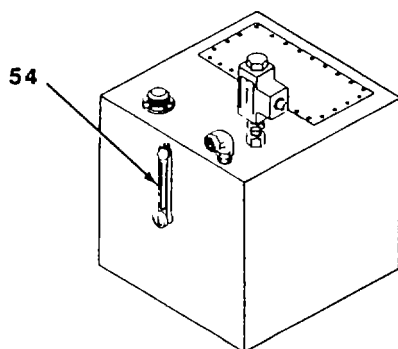
Operator Controls and Indicators (Continued).

Key	Control or Indicator	Function
52.	Expansion Tank Sight Glass	Provides visual indication of the amount of fresh water in the expansion tank.
53.	Accumulator Gauges	Indicates the hydraulic pressure available for starting the engines.



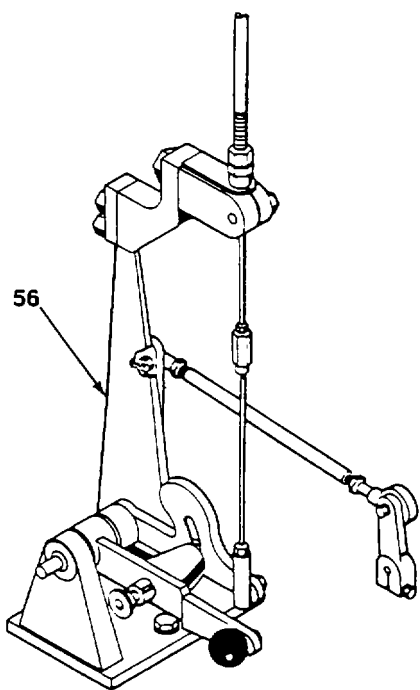
Operator Controls and Indicators (Continued).

Key	Control or Indicator	Function
54.	Steering Tank Temperature and Level Indicator	Indicates the temperature and level of the hydraulic oil in the tank.
55.	Ramp/Starting System Tank Level Indicator	Indicates the level of hydraulic oil in the ramp/starting system tanks.



56. Clutch Control Unit

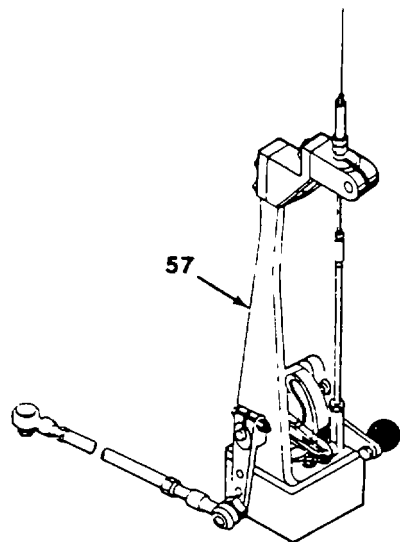
First, it is a control system disconnect so that the transmission can be operated from the engine room independently of the control system. Second, it provides a means of matching the stroke of the control system to the stroke required to operate the transmission control valve lever. Third, it acts as a convenient fastening point for the cables without having to use awkward brackets or extra cable bends.



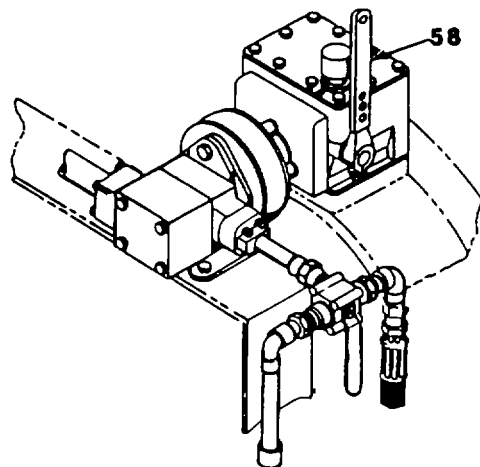


Operator Controls and Indicators (Continued).

Key	Control or Indicator	Function
57.	Throttle Control Unit	First, it is a control system disconnect so that the engine can be operated from the engine room independently of the control system. Second, it provides a means of matching the stroke required to operate the engine governor lever. Third, it acts as a convenient fastening point for the cables without having to use awkward brackets or extra cable bends



58.	PTO Clutch Lever	Used to engage/disengage the ramp hydraulic pump drive.
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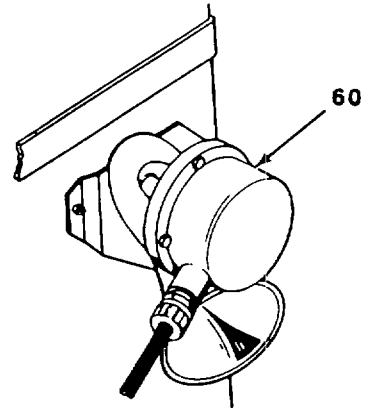
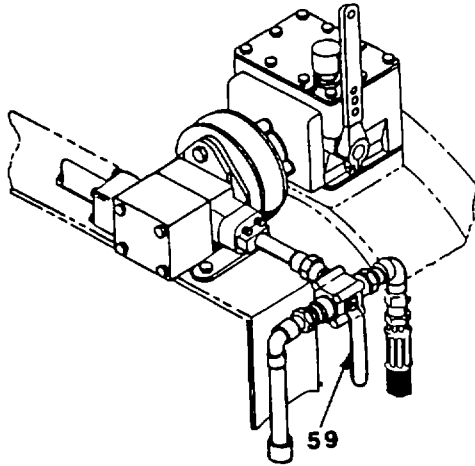


Operator Controls and Indicators (Continued).

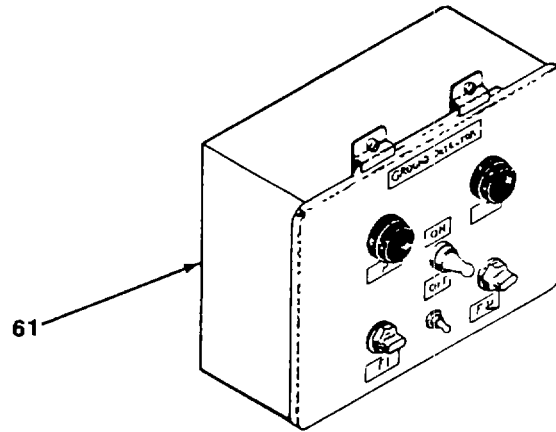
Key	Control or Indicator	Function
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59.	Hydr Diverter Valve	Used to direct hydraulic oil to winch hydraulic motor or bilge pump hydraulic motor.
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60.	Electric Horn	Used to give signals to other vessels.
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61.	Ground Detector	Used to detect a ground in the electrical system.
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## Section II. OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

### 2-2 PREVENTIVE MAINTENANCE.

**2-2.1 General.** Preventive Maintenance (PM) is the systematic care, servicing and inspection of equipment. The purpose of PM is to keep the LCM-8 in serviceable condition, and to prevent, find and repair conditions that could render the equipment inoperable. Deficiencies noted that are above the crew level of maintenance should be reported to Unit level utilizing DA Form 2404 (Material Inspection Report) in accordance with DA PAM 738-750.

- a. **Before you operate.** Always keep in mind the cautions and warnings. Perform your *before (B)* operation PMCS.
- b. **While you operate.** Always keep in mind the cautions and warnings. Perform your *during (D)* operation PMCS.
- c. **After you operate.** Be sure to perform your *after (A)* operation PMCS.
- d. **If your equipment fails to operate.** Troubleshoot with proper equipment. Report any deficiencies using the appropriate forms. See DA PAM 738-750.

### 2-2.2 PMCS Procedures.

- a. Your Preventive Maintenance Checks and Services table lists the inspections and care of your LCM-8 required to keep it in good operating condition.
- b. The Interval column of your PMCS table tells you when to do a certain check or service.
- c. Leakage definitions for operator/crew PMCS are classified as follows:

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

#### CAUTION

- **Equipment operation is allowable with minor leakages (Class I or II). Of course, you must consider the fluid capacity in the item/system being checked/inspected. When in doubt notify your supervisor.**
- **When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.**
- **Class III leaks should be reported to your supervisor or organizational maintenance.**

- d. "Before Operation" checks are limited to those required for consecutive application by an assigned operator/crew. The following instructions should be observed to obtain Increased inspections when the LCM-8 is first assigned to an operator/crew or when operation is resumed after a period of nonuse.

Perform weekly as well as *before operations* PMCS as listed in table if:

- a. You are the assigned operator and have not operated the LCM-8 since the last weekly inspection.
- b. You are operating the Item for the first time.
- e. The procedure column of your PMCS table tells you how to do the required checks and services. Carefully follow these instructions. If you do not have the tools, or if the procedure tells you to, have organizational maintenance do the work.
- f. If your equipment does not perform as required, refer to Chapter 3 under Troubleshooting for possible problems. Report any malfunctions or failures on DA Form 2404 or refer to DA PAM 738-750.
- g. If your equipment requires removal in order to perform PMCS, refer to Chapter 3 under Maintenance instructions or notify your supervisor.

**2-2 3 Equipment is not ready/available if: procedures.**

This column tells you when and why your equipment cannot be used.

**NOTE**

**The terms "ready/available" and "mission capable" refer to the same status: Equipment is on hand and is able to perform its combat missions (See DA PAM 738-750).**

Operator Preventive Maintenance Checks and Services

If your equipment must be kept in continuous operation, check and service only those items that can be checked and serviced without disturbing operation. Make the complete checks and services when the equipment can be shut down.

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
1	⌚					Hull above Waterline a. Hull	Inspect hull for cracks, punctures, rust or other deterioration which affect the watertight integrity or strength of the hull Inspect for excessive wear due to rubbing or chafing. Weld or chip as necessary, then prime and paint as per TB 43-0144	Damage is such as to hinder safe operation of vessel due to a loss in watertight integrity or loss in strength. Vessel takes on water Vessel will not support a deck load
	⌚				⌚	b. Bitts	Inspect bitts and surrounding deck plating for cracks or breaks. Inspect welds for deterioration (breaks or rust) Keep bitts free of rust or scale. Prime and paint as necessary	Cracks or breaks are present which could affect holding strength of bitt Bitt is loose or missing
					⌚	c. Chocks	Inspect chocks and surrounding deck plating for cracks or breaks Inspect welds for deterioration. Keep chocks free of rust or scale Prime and paint as necessary.	Cracks or breaks are present which could affect the holding strength of the chock.
⌚	⌚				⌚	d. Tiedowns	Inspect the downs for severe bending, cracks or heavy rust. Repair be downs by welding as necessary.	Tiedowns are damaged or missing
						e. Stanchions	Inspect stanchions and sockets for cracks and deterioration Ensure all stanchions are present and fit snugly In the sockets Ensure socket pin holds stanchions securely Check stanchions for lifeline retaining Rings and brace socket. Ensure safety chain is in good order	Stanchions and sockets are cracked or broken so as to render the lifeline useless.  Stanchions are bent to a 45 degree angle or great so as to render the lifeline useless or missing  Stanchions not secured In socket  Safety chains are missing or broken.

Operator Preventive Maintenance Checks and Services (Continued)

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
2	⌚			⌚		f. Lifelines	Inspect lifelines for wear (deformed cable, broken strands) Ensure lifelines are taut and able to support a man's weight Ensure lifelines are properly supported by the stanchions and that the turnbuckles are In good order	Lifelines are worn or missing  Lifelines are unsupported and unable to withstand a man's weight
				⌚		g. Hatches	Inspect hatch cover and coaming for physical defects. Ensure hatch cover and gasket provide a watertight seal. Inspect hinges and dogs for freedom of movement and securing capability Replace as necessary (para 5-13).	Hatch cover is missing or damaged where it will not form a watertight seal with the coaming
				⌚		h. Void Covers	Inspect covers for defects, damage or missing bolts that affect watertight Integrity. Inspect gasket for wear and sealing capability. Replace as necessary (para 5-13).	Void cover damaged or missing that would affect its watertight integrity
					⌚	Voids/ Compartments	Inspect voids for any damage or deterioration (hull pierced, rust, etc.) Check for water, oil, or other signs of leakage into compartments Check for any unusual signs of stress to the structure. Pump bilges and remove rust, pnme and paint as necessary.	Voids are not watertight
3		⌚		⌚		ForeDeck Ramp Hoist Hand Pump	Inspect pump for leaks or Improper functioning. Ensure pump provides pressure to system sufficient to lower the ramp Replace and repair (para 5-20 and 6-8) as necessary. Remove fill plug on top of hand pump and fill reservoir to approximately 2/3 full with hydraulic oil (MIL-H-17672). Item 12, Appendix E Clean hand pump and pump compartment	Hand pump is Inoperative.

Operator Preventive Maintenance Checks and Services (Continued)

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
4	⌚	⌚	⌚			Ramp Locking Hydraulic Cylinders	Inspect cylinders for leaks and tighten connection as necessary Wipe oil and dirt from cylinders using clean rags Replace and repair (para 5-21 and 6-9), as necessary	Cylinders do not release latch hooks.
5				⌚		Ramp Winch Hydraulic Motor	Fill primary drive assembly through port "Q" with hydraulic oil (MIL-H-17672) Item 12, Appendix E.	
6		⌚				Ramp Winch	Inspect winch to ensure it operates freely with no binding In either direction Check to see if winch vibrates during operation, tighten mounting bolts Apply two or three shots of grease to fittings on lever arm. Fill final drive assembly to the level of the filler plug (refer to L055-1905-222-12) Wipe winch clean with clean rag.	Winch is not capable of operating ramp
7					⌚	Ramp Assembly a. Ramp	Inspect ramp for dents, cracks, rust, or other damage that will inhibit safe functioning of the ramp Weld, scrape to remove rust, then prime and paint as necessary Replace ramp if necessary (para. 5-25)	Ramp does not provide watertight integrity while underway.
					⌚	b Cables and Sheaves	Inspect cables and sheaves for wear and serviceability Pay out cable and check for kinks, hockles, and broken wires Check sheaves for frictional wear and freedom to spin. Replace as necessary (para 5-27) Lubricate cables and sheaves (refer to L055-1905-222-12)	Cable has kinks, hockddes and broken wires  Sheaves will not rotate or hold cable to guide it

Operator Preventive Maintenance Checks and Services (Continued)

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
8					⌚	c. Chains	Inspect chain stops and load binders for cracks, rust and other damage Check chain for missing and weak links Ensure chains support ramp equally Ensure load binder operates properly Replace as necessary (para. 5-27)	One or both chains are defective or missing
		⌚				d. Latch Mechanism	Inspect latch mechanism for cracks, bends and rust. Check for proper engagement with U-bolt. Ensure latch hook moves freely on its hinge Replace or repair latch mechanism as necessary (para 5-26 and 6-11)	Latch mechanism will not engage to secure or release ramp.
					⌚	e. Hinge Assembly	Apply two or three shots of grease to the grease fittings on latch mechanism. Clean surroundings area as necessary Lower ramp to gain access to hinge assembly Inspect hinges for cracks, breaks, rust and wear Ensure hinges operate freely and are well lubricated Lubricate Hinge Assembly (refer to L055-1905-222-12) Inspect hinge pin for wear, signs that pin is loose or has shifted Check tightness of nuts and bolts on end of hinge pin	Damage to hinge assembly is such as will render operation dangerous
					⌚	f. Seal	Inspect seal for rips, tears or missing sections. Ensure seal maintains watertight Integrity with ramp In secured position Replace seal (para. 5-28) if necessary	Seal does not maintain watertight integrity.
					AFTDECK Navigational Aids Navigation Lights			



Operator Preventive Maintenance Checks and Services (Continued)

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
9	⌚					a. Bulbs	Turn on power at distribution panel. Turn switch to on position. Visually inspect all navigation lights for proper operation Replace burned out bulbs (para 3-4)	Light is inoperative
	⌚					b. Lenses	Inspect for cracks, watertight integrity and obstructions Replace lens housing if lens is cracked (para 3-4)	
				⌚		c. Fixtures and Switches	Check fixtures for secure mounting to mast and pilot-house Check switches for looseness or malfunction; replace fixtures and/switches as necessary (para.4-7)	
				⌚	⌚	d. Horn	Check operation of horn and watertight integrity Search Light	
		⌚				a. Bulb and Reflector Glass	Check search light for proper operation Inspect reflector glass for cracks, Replace burned out bulbs or cracked glass as necessary (para 4-8) Clean reflector glass if necessary	
10						b. Fixture	Check fixture for free movement and full range of motion Lubricate as necessary Ensure fixture is securely mounted; tighten mounting hardware as necessary Replace damaged search light (para 4-8)	Mast is cracked or dented to a degree that will affect its strength
					⌚	Mast	Inspect mast and mast support for cracks, dents and other major material defects Replace (para 4-20) as necessary Check mast for rust or evidence of paint deterioration. Remove paint and rust and spot paint as necessary Check locking pin for ease or removal. Lubricate hinge assembly and locking pin as necessary	

Operator Preventive Maintenance Checks and Services (Continued)

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
11	⌚			⌚		Windows	Check windows for cracks and scratches. Replace windows if cracked or hard to see through (para 4-19). Ensure both front windows open and close easily Adjust arms as necessary Clean windows at least weekly or more often when dirty with window cleaner and dean cloth squeegee	
12	⌚			⌚		a. Wipers	Check each windshield wiper arm to ensure arm is firmly attached to windshield wiper motor shaft If loose, tighten screw at the pivot point of the arm where It attaches to the motor shaft Check each windshield wiper blade for wear Replace blade if cracked or worn by pressing damp assembly on the windshield wiper arm to release old blade Install new blade into the damp assembly on the windshield wiper arm.	
						b. Wiper Motor	Check operation of motor at all speeds	
13					⌚	Rudder and Tiller	Make sure tiller assembly is in storage beside pilothouse Check tiller sockets for accumulation of foreign matter Remove foreign materials from sockets Check rudder through full range of motion (from hard port to hard starboard) Ensure rudder angle indicator operates accordingly Replace or repair rudder as necessary (para 5-37 and 5-38). Inspect rudder shaft packing	Rudders are not aligned
	⌚	⌚	⌚					

Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
14	⌚					<p><u>PILOTHOUSE</u> Distribution panel</p> <p>Inspect panel to insure three-way switches have full range of motion Ensure circuits are completed in both <u>on</u> positions</p> <p>Inspect to insure switches control the proper items as they are marked. Ensure all switches and fuses are present and function properly Replace switches and fuses as necessary (para 4-16)</p> <p>Inspect engine start buttons and ensure they function properly.</p>	<p>Switches will not move or complete the appropriate circuit in either of the <u>on</u> positions</p> <p>Switches or fuses are missing</p>	
15					⌚	<p>Canopy and exterior for damage to include rust, dents and cracks</p> <p>Ensure all fixtures connected to and passing through the canopy are watertight. Check nine clamps serving canopy to pilot house bulwark. Ensure clamps are secure</p> <p>Check canopy for rust or evidence of paint deterioration Remove paint and rust from area. Spot paint as necessary Check eye bolts and nuts for tightness</p>	<p>Visually inspect canopy interior</p> <p>Canopy has defects which hamper the normal operation of the vessel</p>	

Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
16	⌚					Propulsion Control Head	<p>Check propulsion controls for full range of motion and proper control of throttle and clutch linkages Replace control head (para 4-22) if necessary.</p> <p>Remove dome (cover) from control head and lubricate as necessary</p>	Controls do not effect the desired throttle/clutch change
17	⌚					Control Console, Instrument Lights, and Switch	<p>Inspect control console to ensure all gauges are present and functioning. Ensure switches are functioning properly and securely mounted. Ensure panel lights are operational. If light bulbs are burned out replace</p> <p>Dust control console to maintain a clean work environment.</p>	Gauges and controls are missing or malfunctioning. Switches are malfunctioning which control operational facets of the vessel
18 35#	⌚				⌚	Steering Helm Unit	<p>Inspect unit and connections for leaks or damage. Check that helm operates freely and controls rudder through its full range of motion</p> <p>Remove access plate in wheel house. Check and tighten hydraulic hose connections at helm unit as necessary Clean dirt and hydraulic oil from unit Replace or repair as necessary (para. 5-31 and 6-14).</p>	Helm unit cannot turn rudder freely through 35# port to starboard (hardover to hardover).

Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
19	⌚				⌚	LAZARETTE Steering System Valves, Piping, Hoses and Fittings.	Inspect valves, pipe joints and hose assemblies for leaks and other damage. Tighten joints and replace valves and hose assemblies as necessary (para. 4- 30)	Class III leaks exist.
20	⌚				⌚	Steering Cylinders	Inspect cylinders and hydraulic connections for leaks or damage Tighten and secure hydraulic and mechanical connections. Check both cylinders for proper functioning	Class III leaks exist
21						Steering System Counterbalance Valve	Inspect counterbalance and connections for leaks Adjust per para. 6-16.	
22	⌚				⌚	Fuel Tank, Piping, Valves, Hoses and Fittings	Inspect tanks valves, piping joints and hose assemblies for leaks or damage Remove rust from tanks, then prime and paint as necessary. Tighten piping joints; replace valves and hose assemblies as necessary.  Ensure filler cap, sounding tube cap, and vent cover are in place and seal the fuel oil system Check fuel tank for water contamination, using water indicator paste.  Sample fuel from each fuel tank bottom drain valve	Fuel tank contaminated with water.

Operator Preventive Maintenance Checks and Services (Continued)

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
23	⌚					ENGINE ROOM Electrical System Batteries and Cables	<p>Inspect batteries for leaks and corrosion Check electrolyte LEVEL and add distilled water as necessary Check battery cables and terminals for tight, dean connections Check battery mounting for secure fit Clean terminals and tighten as necessary. Test battery (para 4-10) and replace (para 4-11) if necessary</p> <p>Check battery voltage using a voltmeter. A voltage reading of between (1 8-26v) is acceptable. Replace (para 4-11) if batteries cannot maintain charge.</p>	Batteries cannot maintain charge
24	⌚	⌚				Alternator	<p>Check alternator for proper mounting Check bolts for tightness. Check belts for proper tension. Adjust belt tension as necessary (para 4-12).</p> <p>Inspect alternator terminals for rust, tag and remove leads, then clean corroded terminals Reinstall and secure leads.</p> <p>Monitor ammeters during operation Current reading should be between 1.0 and 2.0 amps Test (para. 3-5), replace (para 4-12) and/repair (para 5-6) alternator as necessary.</p> <p>Check alternator output (para 3-5)</p>	System is not charging properly

Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
25	⌚					Voltage Regulator	Inspect regulator to ensure it is mounted securely Check that electrical connections are clean and tight	
26	⌚					Voltage Protector	Inspect protector to ensure it is mounted securely Check that electrical connections are clean and tight	
27	⌚					Lighting Fixtures and Switches	Inspect fixtures and switches for proper operation of lights Inspect fixtures for secure mounting, cracked, broken or missing guards, globes and bulbs Inspect wiring connecting switches and fixtures for wear, fraying and proper routing Replace burned out bulbs, fixtures and switches as necessary(para 4- 17)	
28				⌚		<u>Propulsion Controls and Linkages</u> a Throttle Linkage	Inspect linkage from control head to governor for cable damage Ensure linkage is free to move and is not bound at any point AdJust (para 4-23) and/replace defective components of throttle linkage as necessary (para. 5-8)	Linkage is bent, kinked, severed or loose so as to affect proper control of the throttle
	⌚	⌚					Inspect shifting and throttle linkage ball joints	

Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
29				⊙		b. Clutch Linkage	Inspect linkage from control head to transmission. Ensure linkage is free to move and is not bound at any point. Adjust (para. 4-24) and/replace defective components of clutch linkage as necessary (para S9).	Linkage is bent, kinked, severed or loose so as to affect proper control of the clutch.
				⊙		<u>Sanitation System</u> a Marine Head	Add activator through the marine head and flush to insure adequate biological action to reduce sludge.	
				⊙		b Receiving/ Treatment Tank	Inspect tanks for leaks and cracks or other damage. Replace as necessary (para. 4-26).  Check tanks for dogging. Open dram plug and remove hatch cover. Use a water hose to rinse the tanks thoroughly, then replace drain plug and hatch cover.	
				⊙		c. Disaffection Unit	Check and keep disaffection unit a minimum of one-half full Add disinfectant tablets as necessary. A full unit takes seven tablets.	
					d. Filter	Clean or replace filter element after processing 400 gallons of sewage. The filter element can be rinsed clean and reused several times before replacement		



Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
30		⌚				<u>Ramp Hydraulic System</u>  Valves, Piping, Hoses and Fittings	Inspect pipe Joints and hose assemblies for leaks and other damage. Replace valves, tighten pipe Joints and replace hoses as necessary (para 4-30).	
31	⌚	⌚	.			Ramp Hoist Hydraulic Pump	Inspect pump for leaks and proper hydraulic connections Ensure pump operates and provides adequate hydraulic pressure to system. Replace (para. 5-16) or repair (para 6-6) as necessary	Pump does not supply sufficient pressure to operate the ramp
32	⌚	⌚				Ramp Hoist	Inspect valve for leaks or Control Valve function of valve in all positions (neutral, raise, and lower). Replace (para. 5-17) or repair (para 6-7) as necessary	Valve does not operate ramp Improper functioning Check
33		⌚				Ramp Hoist Check Valve	Inspect check valve for leaks Tighten piping connections to check valve; replace and repair check valve (para. 5-18 and 5-19)	
34	⌚	.				Ramp Reservoir, Strainers, Filters	Check level indicator to ensure proper hydraulic fluid level Add fluid as necessary. Inspect strainers and filters for cleanliness and serviceability. Check for leaks at filters. Replace strainers and filters as necessary (para 3-9).	Reservoir Is low or empty

Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
35	⊕				⊕	a Valves, Piping Hoses and Fitting	<p><u>Steering System</u></p> <p>Inspect valves, pipe joints and hose assemblies for leaks and other damage. Tighten joints and replace valves and hose assemblies as necessary (para 4-30).</p>	Class III leaks exist
	⊕					b. Steering Pump	<p>Inspect pump and connecting hose assemblies for leaks. Ensure pump is properly mounted, tighten pump connections as necessary. If pumps cannot supply the necessary system pressure, investigate and replace or repair (para. 5-29 and 6-12) as necessary.</p>	Both pumps do not function
					⊕	c. Relief Valve	<p>Inspect valve and connections for leaks. Tighten connections as necessary. Replace or repair as necessary (para. 5-32 and 5-33).</p>	
						d. Flow Divider	<p>Inspect divider and connections for leaks. Tighten connections as necessary. Replace or repair as necessary (para. 5-34 and 6-15).</p>	
						e. Check Valve	<p>Inspect valve and connections for leaks. Tighten connections as necessary. Replace or repair as necessary (para 4-33 and 5-36).</p>	

Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
36	⌚			⌚		f. Hydraulic	Check hydraulic fluid level Reservoir	Reservoir is low or empty through sight glass. Add oil as needed. Inspect tank connections for leaks and tighten as necessary.
				⌚		g. Filters and Strainers	Inspect strainers and filters for cleanliness and serviceability. Check for leaks at filters. Replace strainers and filters as necessary (para. 3-11)	
					⌚	<u>Bilge System</u> Piping, Valves, Hoses and Fittings.	Inspect all bilge piping joints, valves and hose assemblies for leaks. Inspect valves to ensure they open and close completely with no binding. In each void, check bellmouth strainer for debris and clean as necessary. Repair piping joints by brazing, replace hose assemblies as indicated in para. 4-30.	
37	⌚	⌚				Bilge Pump and Hydraulic Motor	Inspect bilge pump and hydraulic motor for secure mounting. Tighten mounting hardware as necessary. Ensure pump is primed during operation. Replace or repair as necessary (para. 5-40 and 5-41).  <b>Note</b> Do not tamper with bypass flow regulator setting of 10 gpm and 1500 psi relief.	Pumps fail to function.

Operator Preventive Maintenance Checks and Services - (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
38	⌚					<u>Sea Water System</u> Piping, Hoses and Valves	Inspect piping, especially connecting hoses for cracks, breaks and leaks. Tighten hose or clamps or replace hoses and valves as necessary.	
39	⌚				⌚	Duplex Strainer	Check strainer for sediment and other foreign matter Ensure plastic cylinder and screen are clean (para. 3-12). Replace or repair strainer as necessary (para. 5-42 and 5-43)	
40	⌚				⌚	<u>Hydraulic Starting System</u> Starting System' Valves, Piping,	Inspect valves, piping joints Hoses and Fittings ing joint leaks Replace valves, piping joints and hose assemblies (para. 4-30) as necessary.	Class III leaks exist and hose assemblies for pip-
41	⌚				⌚	Recharging Pump	Inspect pump for leaks or damage Check that pump is mounted to engine securely. If pump cannot recharge system, investigate and replace or repair pump as necessary (para. 5-44 and 6-17).	

Operator Preventive Maintenance Checks and Services (Continued)

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
42	⌚				⌚	Accumulator	Inspect accumulator and gauge connections for leaks or damage Replace accumulator as necessary (para 5-45) Make periodic checks to ensure that accumulator retains pressure.	
43	⌚				⌚	Reservoir and Filter	Check tank level indicator periodically Add oil as needed Check filter for leaks and dirty element condition, replace element as necessary (para 5-46)	Reservoir is low or empty
44	⌚				⌚	Control Valve	Check control valve and hydraulic connections for leaks or damage Ensure valve functions properly In local, remote and manual modes.	
45					⌚	Starting Motor	Inspect motor and connections for leaks or damage. Tighten hose connections and mounting hardware as necessary Replace or repair as necessary (para 5-48 and 6-19)	Starting motor cannot crank engine.
46				⌚		Hand Pump	Inspect hand pump and connections for leaks or damage. Check periodically to ensure that pump is capable of charging system Check to make sure that the Hand Pump is free of air Replace or repair pump as necessary (para 5-49 and 6-20)	Hand Pump will not operate
47	⌚				⌚	Strainer	Inspect strainer for leaks. Tighten drain plug and fuel connections Clean strainer monthly or every 500 hours (para. 3-14)	
48	⌚	⌚			⌚	Fuel Filter/ Water Separator	Inspect filter and connectons for leaks  Inspect the clear bowl for accumulation of filtered deposits Check gauge reading, 10-15 In Hg vacuum is an Indication that bowl is to be cleaned Clean as required (para 3-16)	Filter leaks Bowl is cracked or broken.  Filter Is not properly mounted/secured so as to put no additional strain on the fuel lines

Operator Preventive Maintenance Checks and Services (Continued)

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment is Not Ready/Available If:
	B	D	A	W	M			
49						Engine Cooling System	Inspect bracket for secure mounting Inspect bowl for cracks or defects Tighten leaky connections and/or replace filter (para 3-17) as necessary	
		⌚	⌚			Piping	Inspect pipe joints and hose connections for cracks or leaks tighten hose clamps or replace hoses as necessary Check Keel Cooler hose connection to ensure that hose is not long. Tighten as needed	
						Radios	Follow the procedure as outlined in the operators manual.	
					⌚	Life Jackets	Ensure that all ties and straps are serviceable and that there are no rips or tears in the jackets.	
					⌚	Life Rings	Ensure that the ring is in good shape and that light works on the ring.	
					⌚	Fire Extinguisher	Ensure that pins are in place and that extinguishers are weighed and label with the weight	
		⌚	⌚		⌚	Compass	Ensure that the compass is reading correct readings Check that there is no system error showing on the display.	
			⌚			Cutlass Bearing	Listen for any unusual noises during operations at all RPM ranges	
				⌚	Emergency Steering	Remove plug and ensure that the tiller arm turns from 35 degrees right and 35 degrees left rudder		

Operator Preventive Maintenance Checks and Services (Continued)

B-Before  
D-During

A-After  
W-Weekly

M-Monthly

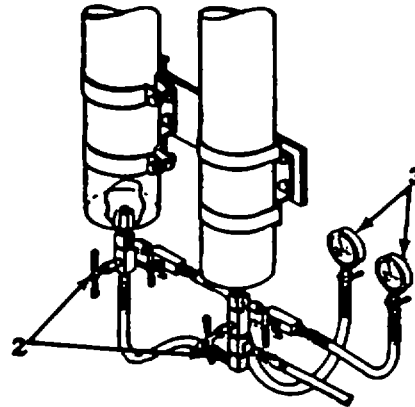
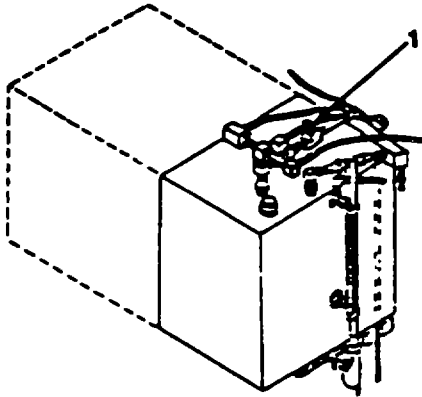
ITEM NO.	INTERVAL					Item To Be Inspected	PROCEDURES Check for and have repaired or adjusted as necessary	Equipment Is Not Ready/Available If:
	B	D	A	W	M			
					⌚	Tools/BII	Inventory all Bill tools to ensure accountability and serviceability of all items For BII, see Approx C. Use SB 5180-90-CL-N55-HR to inventory tools.	
50	⌚	⌚	⌚	.	.	Expansion Tank	Inspect sight glass for coolant level (1/2 full when cold) Add coolant as necessary Check antifreeze condition with hydrometer. Check tank for cracks, leaks or corrosion Weld cracks and repair valves as necessary (para 5-51)	
51	⌚	⌚	.		⌚	Exhaust System Piping and Lagging	Inspect exhaust piping for exhaust leaks, or other damage. Make sure adequate thermal protection is positioned for dangerously exposed areas Replace lagging if necessary.	
52		⌚		⌚	.	Mufflers	Inspect mufflers for exhaust leaks Check raw water connection for leaks Inspect muffler for signs of corrosion. Replace or repair as necessary (para 4-34)	Muffler leaks or otherwise damaged
53		⌚			⌚	Hull Below Waterline Stuffing Box	Inspect stuffing box for condition of packing and amount of leakage Ensure all bolts are present and snug Adjust stuffing box while underway as necessary. Check gland for excess heat by placing hand on gland after adjustment. Check flex hose & clamps for proper installation and deterioration	

### Section III. OPERATION UNDER USUAL CONDITIONS

#### 2-3 PRE-OPERATING PROCEDURES.

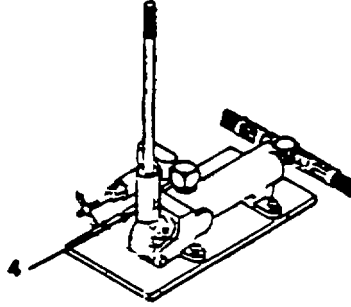
**2-3.1 Initial Engine Start.** The precharge pressure of the accumulators is the pressure of the nitrogen gas with which the accumulators are initially charged. This pressure must be checked before the system pressure is raised for the initial engine start. To check the precharge pressure, proceed as follows:

- a. Open the accumulator blowdown valve (1) on the ramp/starting system hydraulic tank.
- b. Open accumulator shut-off valve (2) and allow pressure gauge (3) to return to zero.





- c. Close the accumulator blowdown valve (1) and pump several strokes on the hand pump (4).



- d. Observe the accumulator pressure gauge (3). The gauge should show a rapid pressure rise from zero to the nitrogen precharge pressure, where it will remain without change for several additional strokes of the hand pump. Log the precharge pressure (1500 psi is normal).

#### NOTE

**An accumulator pressure of 1500 psi when the ambient temperature is above 40° F will provide adequate cranking to start the engine. Between 40° F and 0° F, 2500 psi should be sufficient. Below 0° F, the accumulators should be charged to 3250 psi. For ambient temperatures below 40° F, use a starting aid.**

- e. Use the hand pump (4) to raise the accumulator pressure.

#### 2-3.2 Routine Procedures.

- Ensure the local start toggle switch is in the LOCAL position.
- Perform the before-operation PMCS in paragraph 2-2.
- Lubricate the landing craft as specified in the Lube Order LO 55-1905-222- 12.
- Ensure that the expansion tank for each engine is at least one-half full. Check the gauge glass. Refer to para 2-1, item 52.
- Sound both fuel oil tanks to determine the level of fuel oil. The fuel tanks should be kept as full of fuel as possible to minimize condensation of water within the tanks. Replenish the fuel tanks according to the following procedure (refer to figure in para 1-1 3 for steps d through f):

#### **WARNING**

**Before fueling the tanks ensure that firefighting equipment is immediately available for use in case of fire emergency. Do not smoke or allow smoking, or any other open flame in the vicinity of the fueling operation. Wipe clean any fuel spillage and dispose of spilled fuel oil in accordance with current U.S. Coast Guard Regulations. A fueling watch supervisor shall be stationed by the coxswain to ensure compliance with fueling safety procedures. Failure to comply may endanger personnel and/equipment.**

- (1) Close the fuel oil return valves to ensure that the tanks will be fully replenished.
  - (2) Remove the cap on the fuel fill connection behind the pilothouse.
  - (3) Open the filling valve in the fuel fill piping to tank to be filled. (The valve is located in the lazarette ).
  - (4) Fill the fuel tank to about 95 percent capacity with clean diesel fuel.
  - (5) Close the fuel filling valve in the lazarette.
  - (6) Open the fuel oil return valves in the engine room.
  - (7) Secure the cap on the fuel fill connection and the deck plate for sounding the tanks (if not already closed).
  - (8) Repeat steps 1 through 8 for the other tank.
- f. Open both fuel oil suction valves in the lazarette.
  - g. Open both fuel oil supply valves and return valves in the engine room.
  - h. Open both sea water suction valves and discharge valves in the engine room. Ensure that sea water is discharging at the overboard and exhaust outlets. Refer to figure in para. 1- 16.
  - i. Ensure that both PTO clutch levers are disengaged. Refer to figure in para 2-1, item 58.
  - j. Open one accumulator shut-off valve for each engine. Refer to figure in para 1-17. Ensure that the other accumulator valves are closed for reserve stand-by.
  - k. Open steering reservoir suction valves. Refer to figure in para. 1- 18.
  - l. Open the suction line shut-off valve below the starting system hydraulic tank. Refer to figure in para 1-17.
  - m. Ensure that pins on the throttle control unit and clutch control unit are engaged for remote control. Refer to figures in para. 2-1, items 56 and 57.
  - n. Ensure that the local start toggle switches mounted on the inboard side of the engine room instrument panels are in REMOTE position. Refer to figure m para 2-1, item 46.

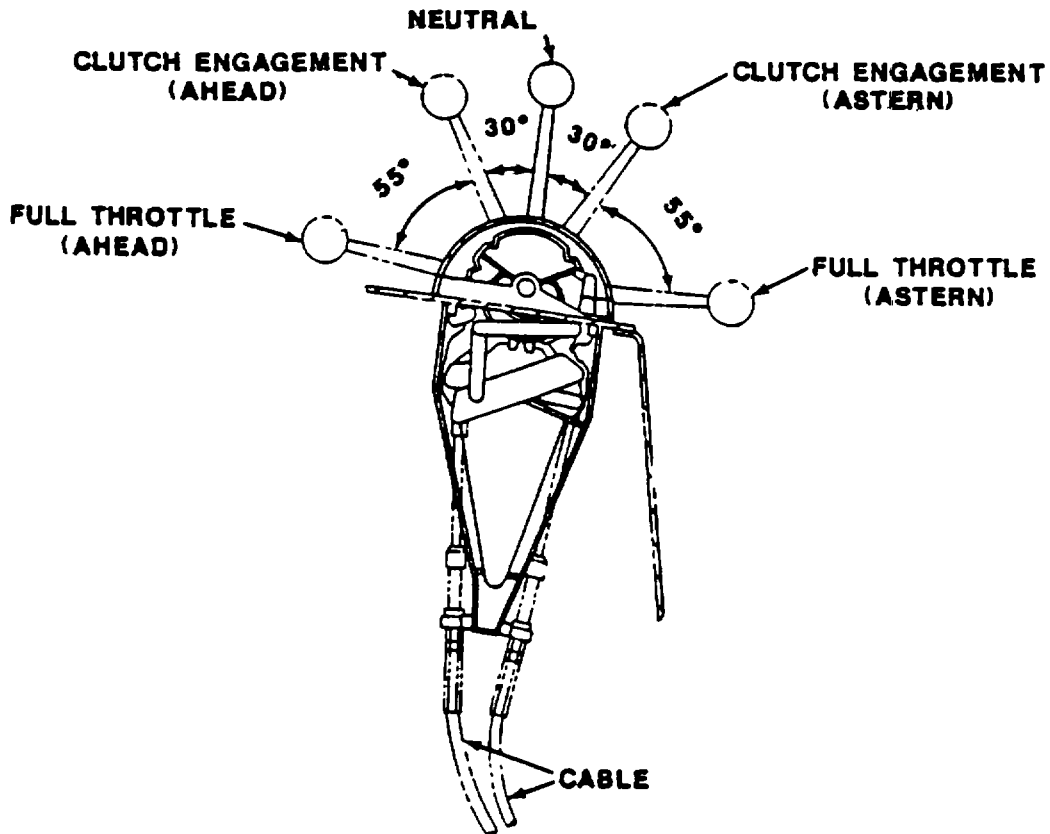


2-4 OPERATING PROCEDURE

**CAUTION**

Hearing protection must be worn in the engine room, in the pilothouse and on the pilothouse deck when the engines are running.

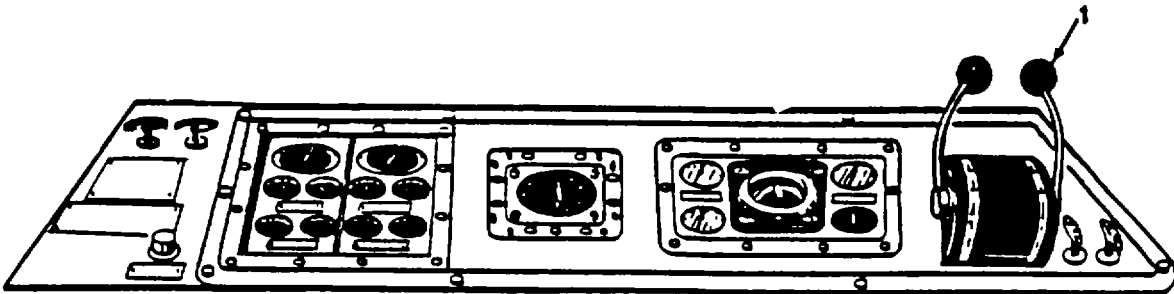
**2-4.1 LCM-8 Start-Up.** (Starboard system described, port system similar). Before starting the engines, the control system should be cycled from full speed ASTERN (REVERSE) to full speed AHEAD (FORWARD) to ensure unrestricted operation throughout the entire speed range, and then returned to NEUTRAL.



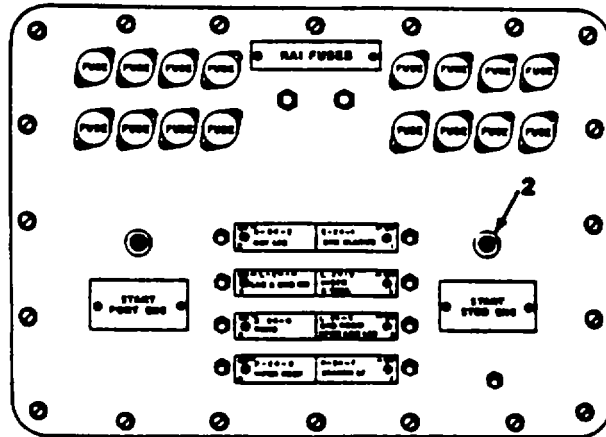
**WARNING**

Before starting the propulsion units, ensure all personnel are clear of moving components in the engine room, and that all divers are clear of the propellers. Failure to comply could result in injury or death.

- a. From the neutral position, pull the starboard propulsion control (1) away from the dome approximately 1/4 inch. Open throttle approximately 1/4 way by moving the starboard propulsion control forward. (The engine throttle is connected to the governor speed control shaft through linkage. Movement of the speed control shaft changes the speed setting of the governor and thus the engine speed.)



- b. Depress the pushbutton (2) labeled START STBD ENG on the control and distribution panel. Release button promptly when engine starts.

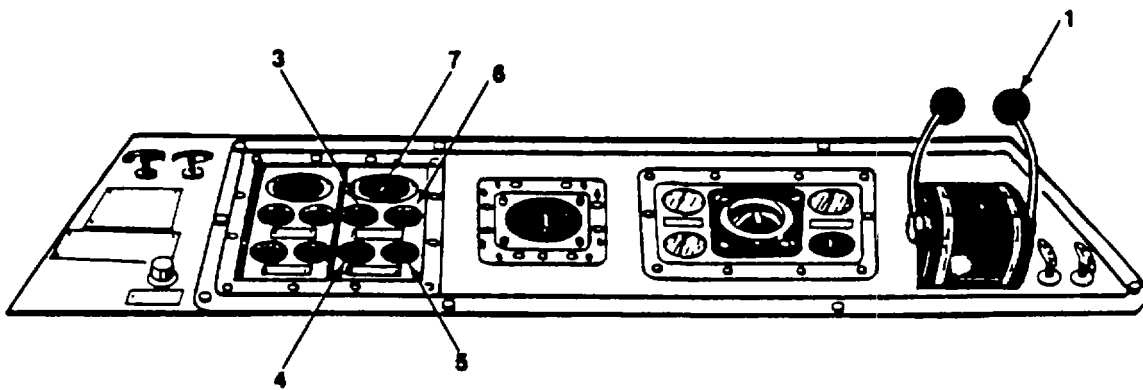


- c. Repeat steps a and b to start the port propulsion engine, making sure to use the appropriate port controls. (The order in which the starboard and port propulsion systems may be started is irrelevant.)

**NOTE**

**If either engine fails to start after four attempts, troubleshoot the starting system according to guidelines in section 11 of chapter 3. Refer also to engine troubleshooting procedures in TM 5-2815-231-14.**

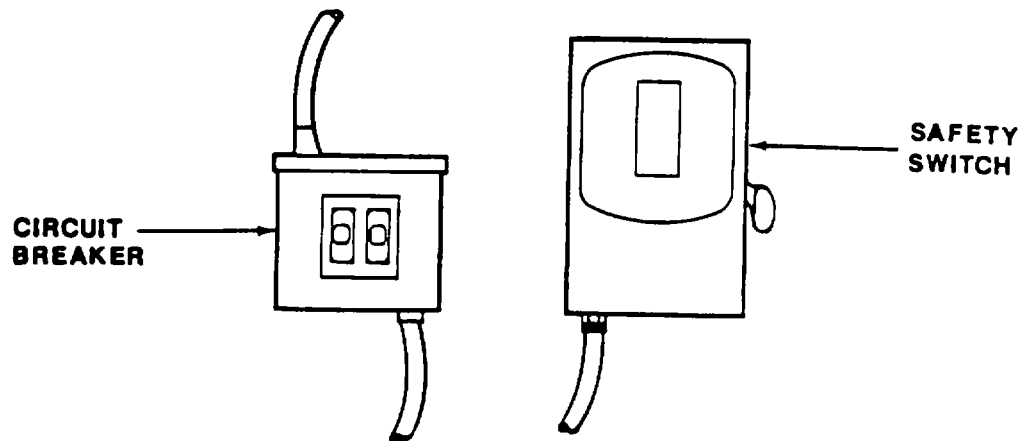
- d. Immediately after engine starts, observe the engine oil pressure gauge. If low or no oil pressure is indicated after 15 seconds of operation, stop the engine (refer to para 2-4 4 (f)). Check engine troubleshooting procedures in TM 5-2815-231-14.
- e. Let engines run at part throttle and no-load for 5 minutes, then return the propulsion control (1) of the operating engine(s) to the Neutral position.



- f. As engines warm up, check the following gauges:
  - (1) engine water temperature (3)-(160-185 degrees is normal).
  - (2) engine oil pressure (4)-(20-30 psi is normal).
  - (3) transmission oil pressure (5) (50 psi out of gear, 210-220 while running).
  - (4) ammeter (6) shows an up scale needle deflection (charging).
  - (5) tachometer (7) (550 RPM at idle).



- g. Turn ON safety switch in engine room to supply electric power to the radios.
- h. Turn ON the circuit breaker in the engine room to feed electric power to the control and distribution panel.

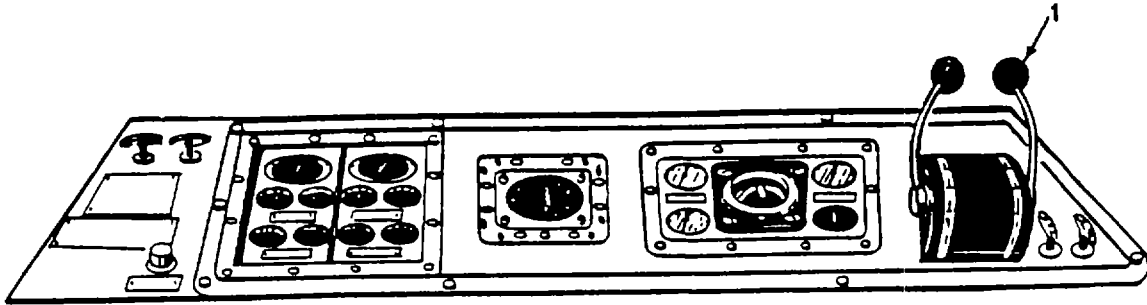


- i. Turn ON light and accessory switches on the control and distribution panel as necessary. Refer to figure in para. 2-4.1 (b).
- j. Turn ON instrument lights switch. Refer to para. 2-1, item 6.
- k. Turn ON navigation lights (running and masthead/anchor lights) switches as necessary. Refer to figure in para. 2-1, items 3 and 4.



**2.4.2 LCM-8 Operation.** Both propulsion engines are used during normal operation. After the engine warm-up and verification that all systems are operating normally, perform the following procedure:

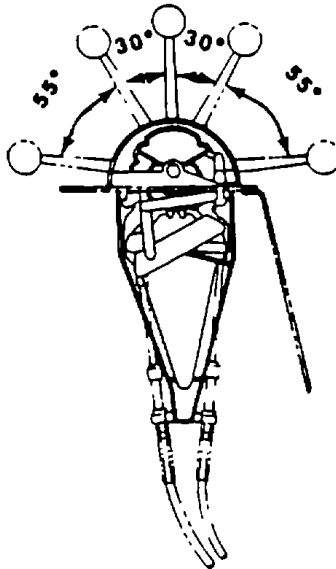
- a. RELEASE AND Cast off the mooring lines between LCM-8 and the dock. Stow mooring lines.
- b. Shift the propulsion controls (1) from NEUTRAL position into FWD or REV gear position which is identified by a detent feel at approximately 30 degrees from the vertical.



- c. Proceed with caution using the steering wheel and the propulsion controls to maneuver the LCM-8 away from the dock.

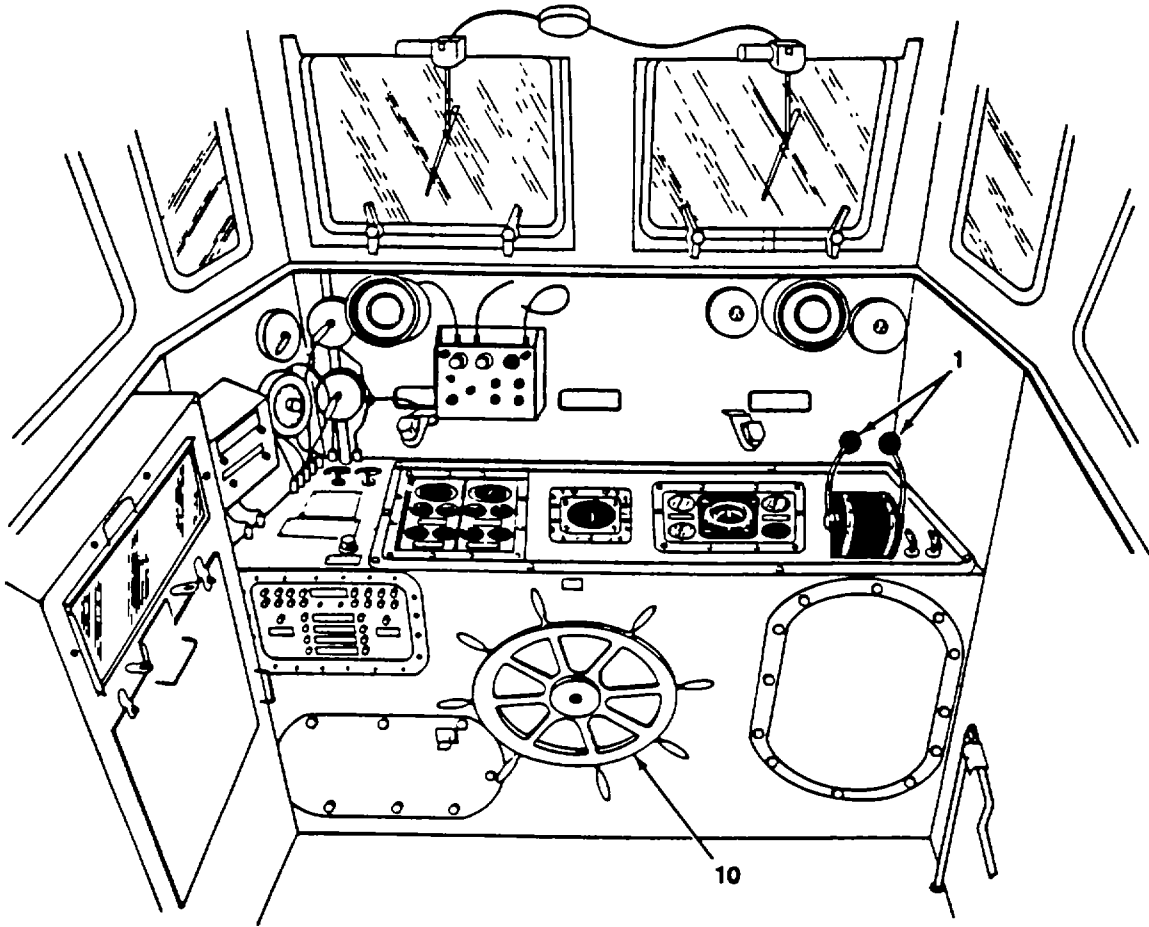
**CAUTION**

Do not shift the propulsion controls from AHEAD mode to the ASTERN mode or vice versa through the NEUTRAL position at engine speeds over 800 RPM. Shifting gear mode through NEUTRAL at high engine speeds will strain the marine transmission, cause excessive friction in the clutch mechanism, and produce a damaging shock load on the propulsion machinery. Reduce engine speed to IDLE (550 rpm) before shifting from one gear mode to another.



## NOTE

Full speed ahead or full speed astern is 85S degrees away from neutral position.



- d. To control engine speed, move the propulsion controls (1) further away from the clutch positions into the throttle range.
- e. Turn the wheel (10) to steer the landing craft.





**2-4.2.1 Mooring Procedure.** Ensure the LCM-8 mooring lines are in proper repair and secured to the mooring bitts at the appropriate deck stations before approaching a moorage. Perform the following mooring procedure:

**WARNING**

**Secure mooring lines only to mooring bitts. Never secure mooring lines to handrails or other deck hardware not intended for mooring purposes. Failure to comply may result in damage to the vessel and injury or death to personnel.**

- a. Cautiously maneuver the LCM-8 to the desired location alongside the pier or dock.
- b. Cast the LCM-8 mooring lines to assisting personnel on the pier or dock.
- c. Take up slack and secure the mooring lines to mooring cleats or bitts on the pier or dock.

**NOTE**

**Under normal conditions, one mooring line forward and one mooring line aft are sufficient to moor the LCM-8. In high wind or strong current conditions, additional lines will be required to moor the vessel.**

**2-4.2.2 Anchoring.** Observe the following guidelines when anchoring the LCM-8.

- a. Assemble the LCM-8 ground tackle by connecting the anchor to the anchor chain and line.
- b. Head the boat into the wind or seas at the location where the anchor is to be dropped.
- c. Run the vessel slow ahead until it is keeping station into the wind or seas.

**WARNING**

**An anchoring supervisor shall be stationed to ensure that personnel do not become entangled in the anchor line while it is paying out. Failure to comply may result in injury or death to personnel.**

- d. Lower the anchor from the bow to the water and pay out anchor line until the anchor reaches the bottom.
- e. Allow the vessel to drift astern with the wind or seas until a scope of line about six times the depth of water is paid out.
- f. Lay the anchor line in a bow chock and secure it to a mooring bit. When the line becomes taut, set the anchor by BACKING the vessel with the engines at IDLE speed.
- g. When a strain on the anchor line is achieved, indicating the anchor is set, return the propulsion control levers to NEUTRAL position. LCM-8 is anchored.

**2-4.2.3 Hoisting Anchor.**

- a. To hoist anchor, take-in anchor line while the vessel is moving slowly forward to the anchor location.
- b. When the anchor line is vertical, stop the vessel and hoist the anchor aboard the vessel.
- c. Disassemble the LCM-8 ground tackle and stow the anchor, anchor chain and line as directed by the coxswain.

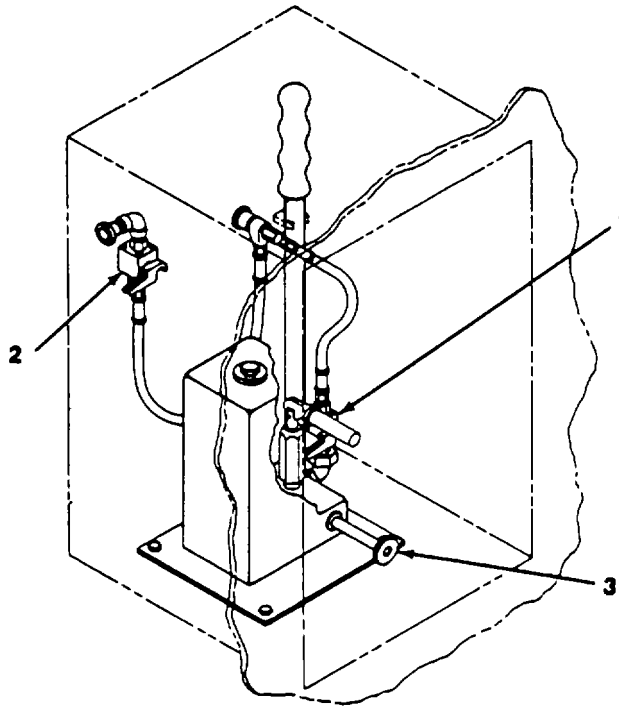
**2-4.3 Operation of Ramp System.** The ramp system may be operated with only one ramp pump in operation. However, if maximum ramp hoisting rate is required, both ramp pumps must be in operation.

**2-4.3.1 Lowering Ramp.** Normal ramp lowering is accomplished with the installed hydraulic ramp system, using the following procedure:

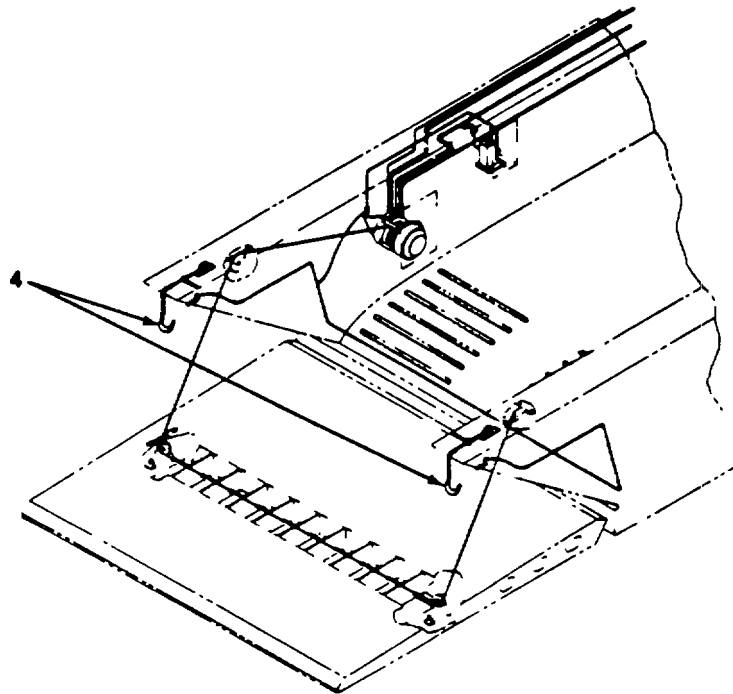
**WARNING**

**Do not lower the ramp when the LCM-8 is underway. The ramp should be operated only after the LCM-8 has been beached or docked. Failure to comply may sink the vessel and endanger personnel.**

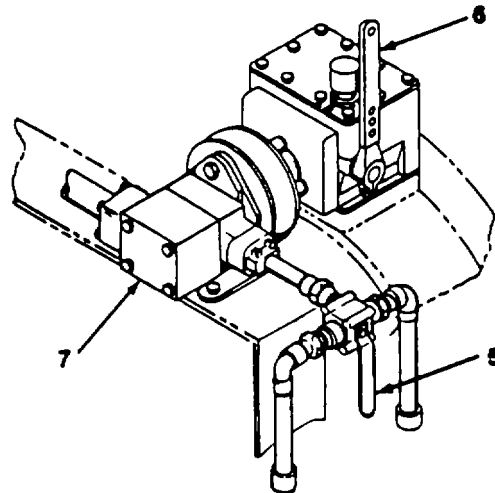
- a. Ensure that the lower hand pump shut-off valve (1) is closed.
- b. Ensure that the upper hand pump shut-off valve (2) is opened.
- c. Ensure that the hand pump by-pass valve (3) is opened.



- d. Remove the load binders (4), port and starboard, from the ramp.



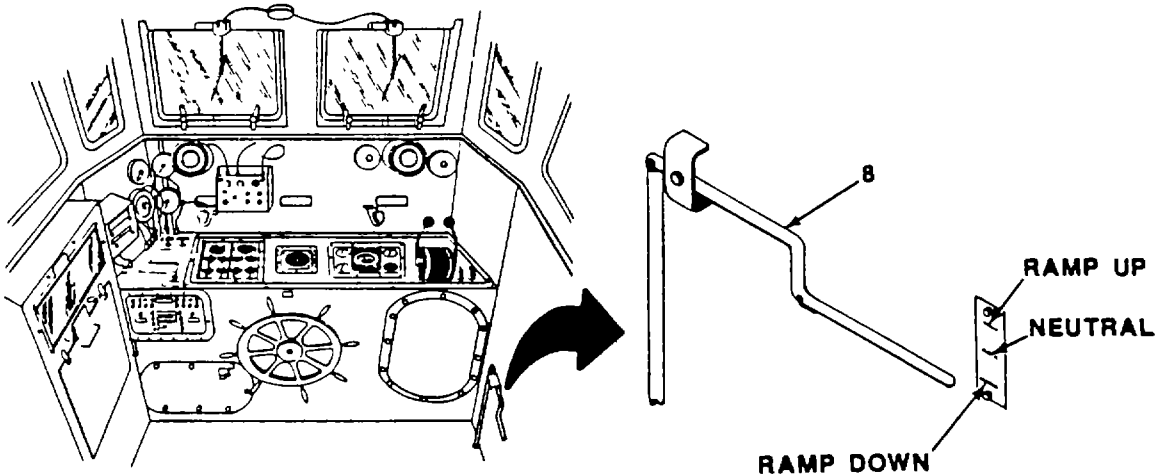
- e. Position the hydraulic diverter valve (5) for RAMP operation (check label plate near valve for correct position).  
 f. With engine running between 1200-1500 rpm, engage the PTO clutch lever (6) to start the ramp pump (7). Check label plate near lever for proper position.



**CAUTION**

If the control lever is not returned to neutral after operating the ramp, damage to the hydraulic ramp machinery will result.

- g. To lower the ramp, move the ramp control lever (8) to RAMP DOWN position. When the ramp is lowered, move the ramp control lever back to NEUTRAL position.



**2-4.3.2 Raising Ramp.** Normal ramp raising is accomplished with the following procedure:

- a. Perform procedural steps a through f in para. 2-4.3.1.

**CAUTION**

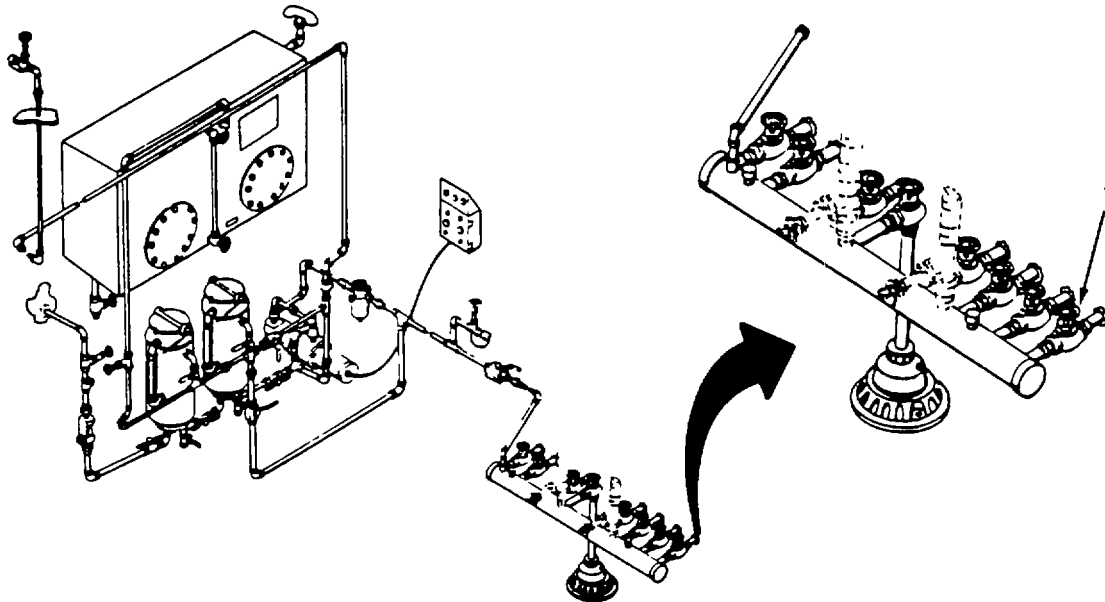
If the control lever is not returned to neutral after operating the ramp, damage to the hydraulic ramp machinery will result.

- b. To raise the ramp, move the ramp control lever (8) to RAMP UP position. When the ramp is raised, return the ramp control lever back to NEUTRAL position.  
 c. Secure the ramp with the load binders (4), port and starboard. Refer to figure in para. 2-4.3.1(d).  
 d. Disengage PTO clutch lever (6) after operation. Refer to figure in para. 2-4.3.1 (f).

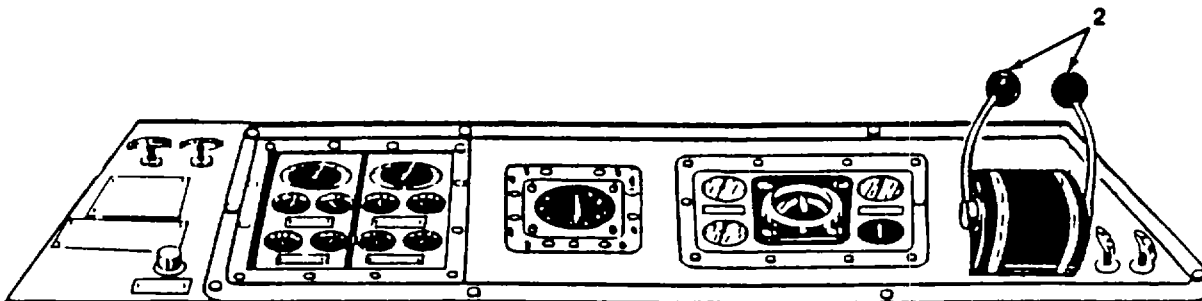


2-4.4 LCM-8 Shutdown.

- a. Selectively drain the bilges if necessary.
- b. Shut down the bilge system (refer to para. 2-5.4) and close the eight suction control valves (1) on the bilge manifold.



- c. Use the propulsion controls (2) to stop the landing craft. Place propulsion controls in neutral position after the LCM-8 stops.



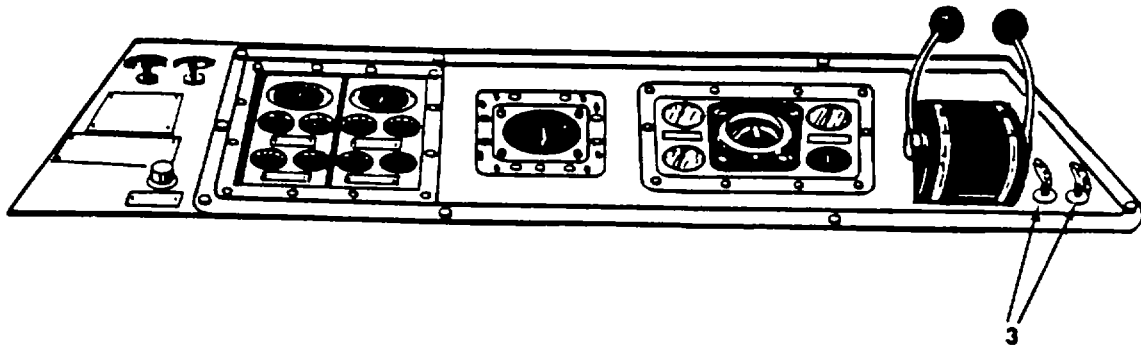
- d. Pull the propulsion controls (2) away from the dome approximately 1/4 inch, then forward to allow engines to run at half speed or lower for 5 minutes. This permits the coolant to reduce the temperature of the engine's moving parts.
- e. Place the propulsion controls (2) in NEUTRAL position and proceed to shut down the engines.



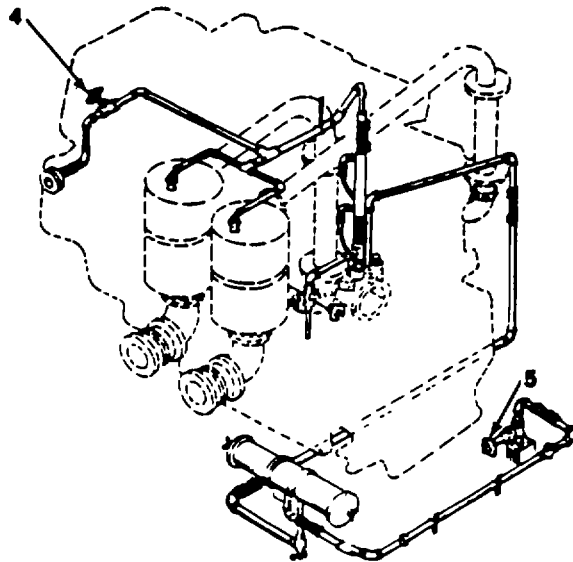
**CAUTION**

Using an emergency engine shutdown control to stop the engines may cause damage to engine oil seals. The emergency engine shutdown control should be used in the event of engine room fire or runaway engine emergencies only.

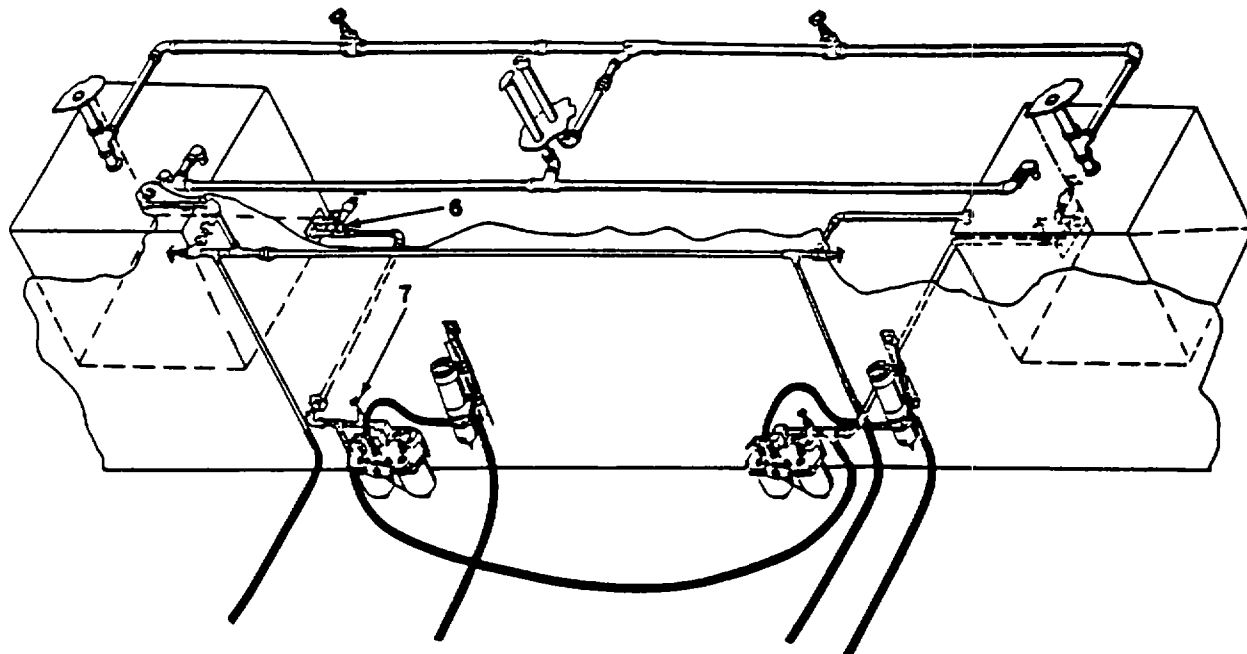
- f. Pull the engine shutdown controls (3) out the full length of travel and hold it out until engines stop. Pulling on the stop control handles manually places the injector racks in the 'no-fuel' position. Return the engine stop control handles to their original position after the engines stop.



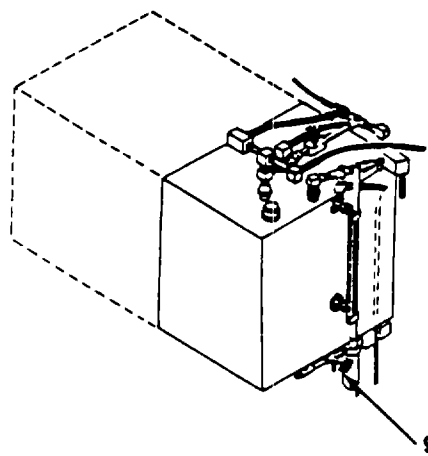
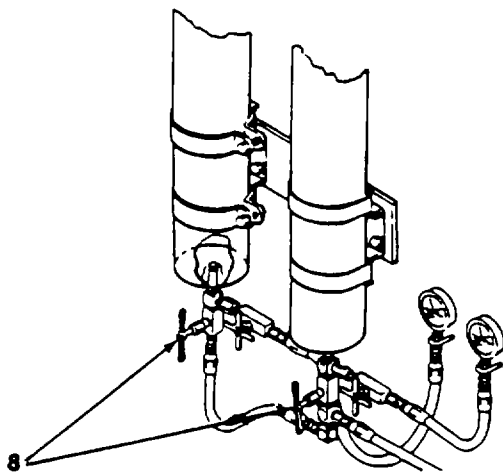
- g. Close the port and starboard sea water overboard discharge valves (4).  
h. Close the port and starboard sea water suction valves (5).



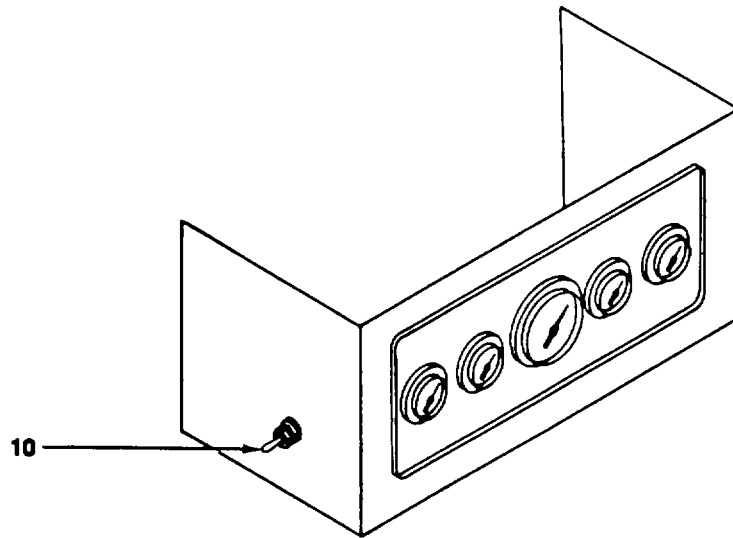
- i. Close both fuel oil suction valves (6) in the lazarette.
- j. Close both fuel oil supply valves (7) in the engine room.



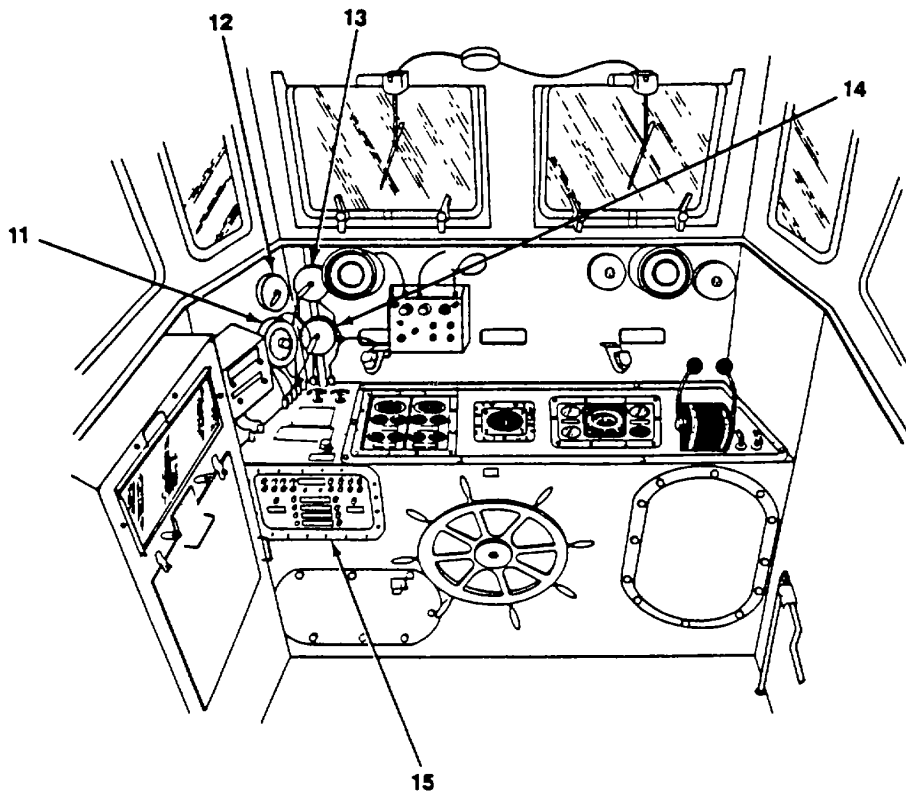
- k. Close the accumulator valves (8), port and starboard.
- l. Close starting system suction line shut-off valve (9).



- m. Place local start toggle switch (10) in NEUTRAL position.

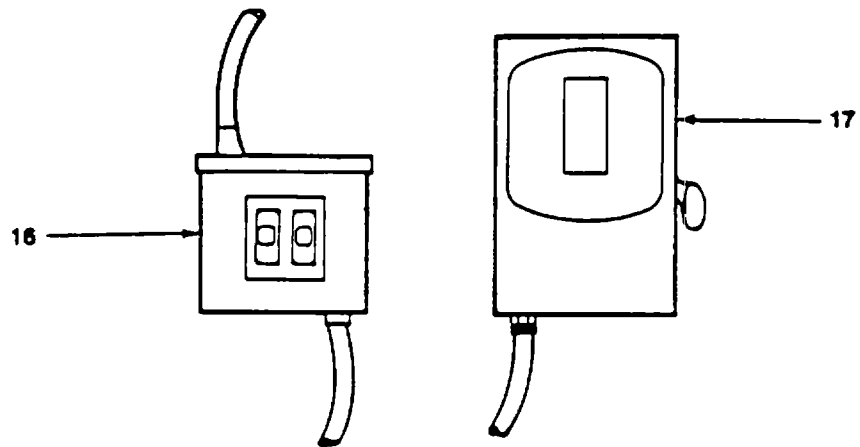


- n. Ensure that the following light switches are turned OFF, running lights switch (11), masthead/anchor lights switch (12), cargo well lights switch (13), and instrument lights switch (14).
- o. Turn OFF all switches on the control and distribution panel (15).



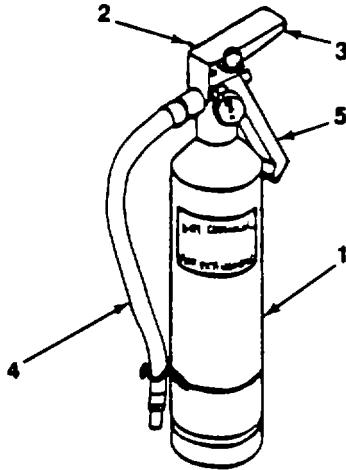


- p. Place the circuit breaker (16) on the engine room aft bulkhead in the OFF position.
- q. Place the safety switch (17) on the engine room aft bulkhead in the OFF position.



## 2-5 OPERATION OF AUXILIARY EQUIPMENT.

**2-5.1 Fire Extinguishers.** There are four fire extinguishers (three CO<sub>2</sub>, one dry chemical type) aboard the vessel. There is one in the lazarette, and two in the engine room. The dry chemical type is stored in the pilothouse. The operating procedure follows:



- a. Carry the extinguisher (1) in an upright position and approach the fire as closely as the heat permits.
- b. Remove the locking pin (2) from the valve (3).
- c. Grasp the hose (4).
- d. Squeeze the release lever (5) and at the same time direct the carbon dioxide/dry chemical flow toward the base of the fire with a sweeping motion.
- e. Fight the fire from the windward side so the wind will blow the heat away from the operator.
- f. In fighting fire in electrical equipment, or on a bulkhead, direct the discharge at the bottom of the flaming area. Move the horn slowly from side-to-side and follow the receding flames upward.

### NOTE

**The valve can be opened and closed repeatedly without loss from leakage.**

- g. Release the lever (5) to close the valve (3) as soon as conditions permit. Continue to open and close the valve as necessary.
- h. When continuous operation is desired, the D-yoke ring on the carrying handle may be slipped over the operating handle when the handle is depressed.



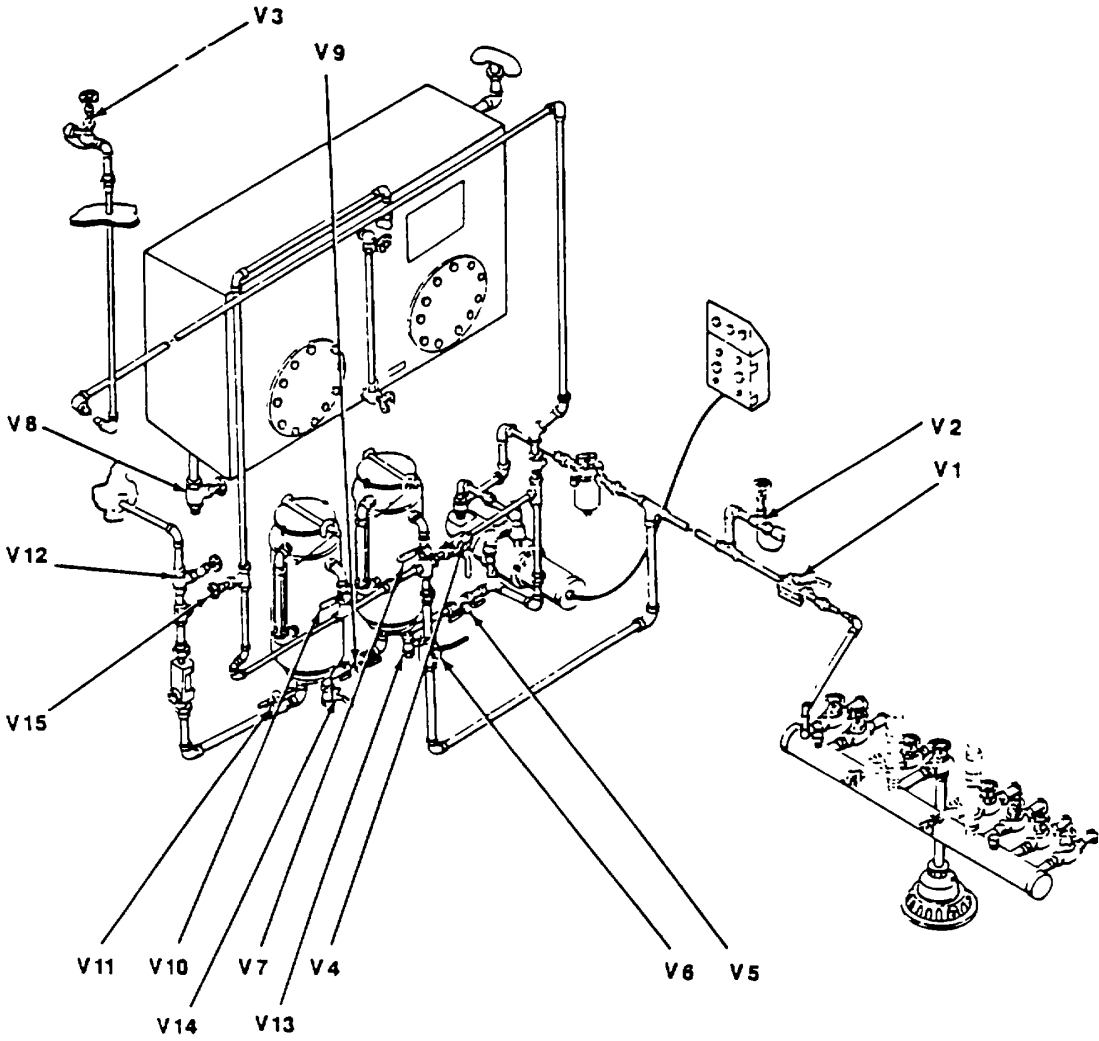
**2-5.2 Communication Equipment.** Operating instructions for the communication equipment are covered in the pertinent technical manual Refer to Appendix A.

**2-5.3 Navigation Equipment.** The Remote Magnetic Heading System (RMHS) consists of an induction compass transmitter and a heading indicator. The induction compass transmitter, which senses the vessel's heading relative to the magnetic NORTH, is located on the mast support. The heading indicator, which indicates the vessel's heading as determined by the induction compass transmitter, is located in the pilothouse control console. To engage the RMHS, place the RMHS switch (para 2-1, item 38) to the ON position.

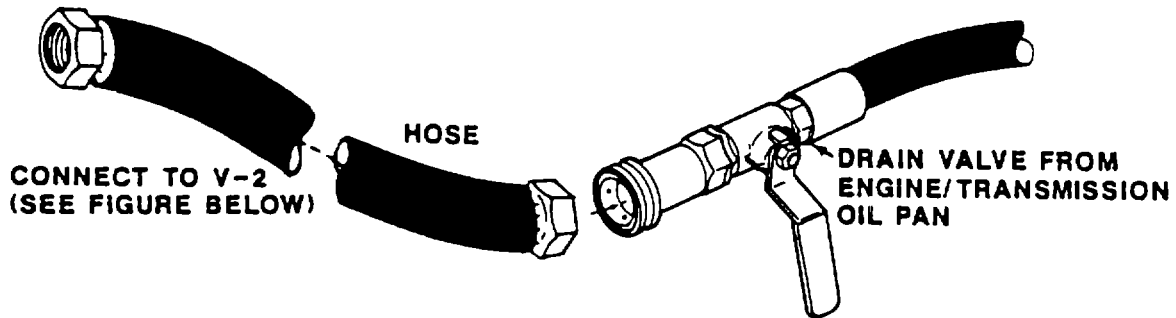
**2-5.4 Oil/Water Separator and Bilge Pumping System.** Normal operation of the bilge pumping system is through the Oil/Water Separators (OWS). The engines must be operating to provide electric power to the electric motor which drives the Oil/Water Separator (OWS) pump. Use the accompanying procedures to perform the following functions.

- a. Empty Bilges.
  - (1) Open bilge manifold valve of compartment that needs emptying.
  - (2) Open valves V-1, V-5, V-9, V-11 and V-12.
  - (3) Close valves V-2, V-3, V-4, V-6, V-7 and V-10.
  - (4) Turn on OWS pump at control panel (refer to TM 55-2090-201-14&P).
  - (5) Turn off OWS pump and close V-1 when the bilge compartment is empty.

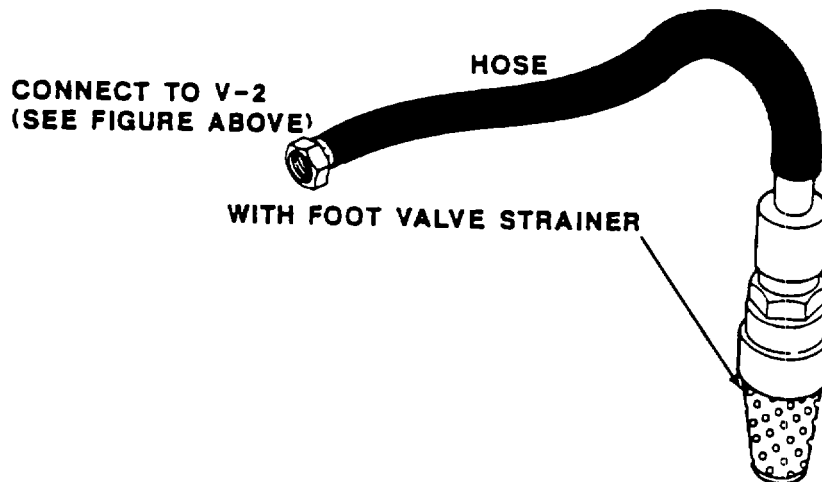




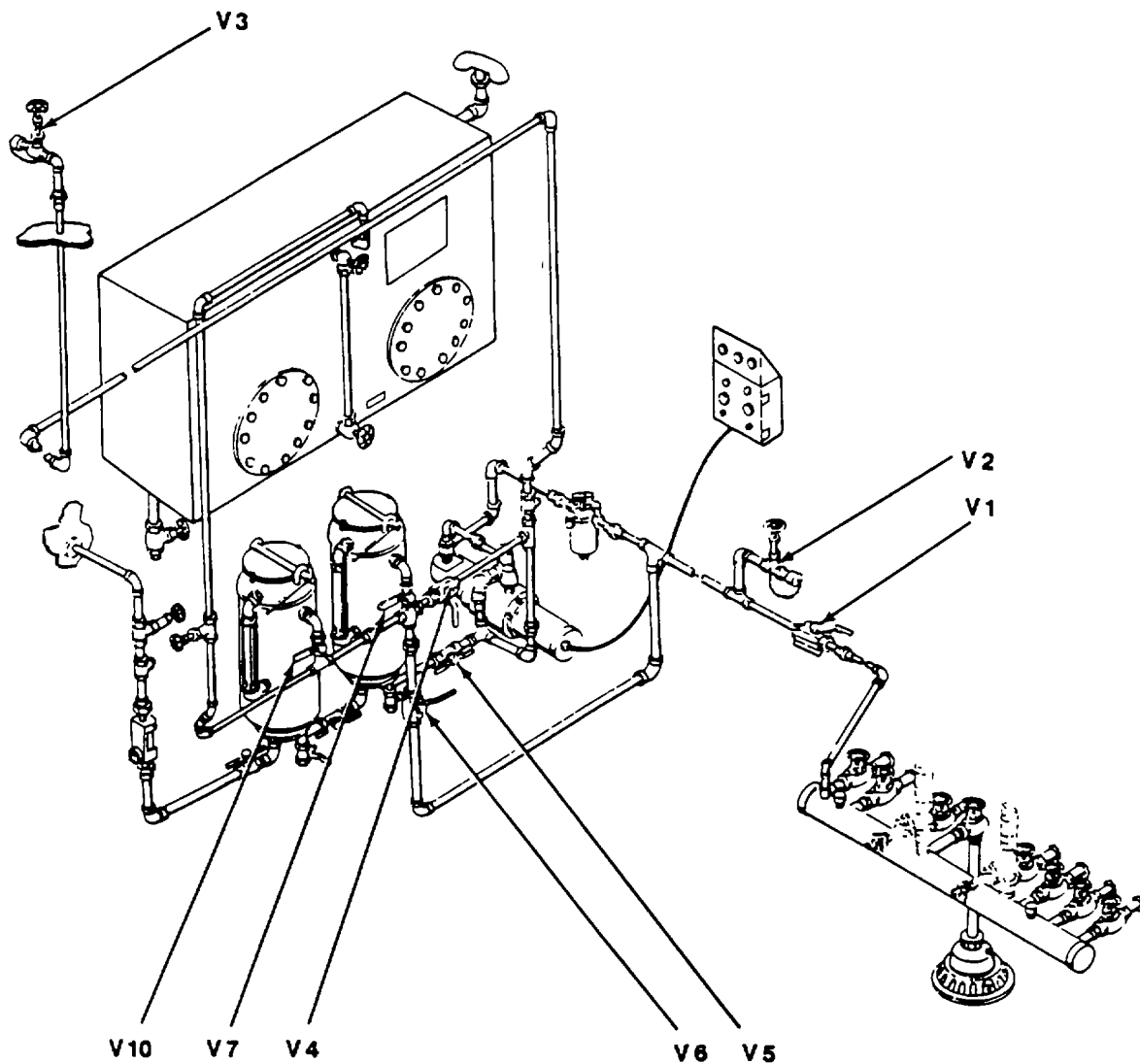
- b. Drain engine crankcase lube oil from oil pans and pump it into holding tank.
- (1) Connect one end of hose to engine oil pan drain pipe and the other end to the intake coupling at V-2.
  - (2) Open valves V-2 and V-4.
  - (3) Close valves V-1, V-3, V-5, V-6, V-7 and V-10.
  - (4) Turn on OWS pump at control panel (refer to TM 55-2090-201-14&P).
  - (5) Turn off OWS pump and close V-2 when oil pan is empty.



- c. Pick up spills or empty buckets.
- (1) Connect one end of hose to intake coupling at V-2..
  - (2) Attach foot valve/strainer to other end of hose.
  - (3) Open valves V-2, V-5, V-9, V-11 and V-12.
  - (4) Close valves V-1, V-3, V-4, V-6, V-7 and V-10.
  - (5) Submerge foot valve/strainer in spill or bucket..
  - (6) Turn on OWS pump at control panel (refer to TM 55-2090-201-14&P).
  - (7) Turn off OWS pump when you are done.



- d. Pump oil from primary and secondary stage separator to holding tank (refer to TM 55-2090-201-14&P).
- c. Pump oil from holding tank to another holding tank ashore.
  - (1) Attach one end of hose to coupling at V-3 and the other end to a used oil container at a shore installation.
  - (2) Open valves V-3 and V-6.
  - (3) Close valves V-1, V-2, V-4, V-5, V-7, and V-10.
  - (4) Turn on OWS pump at control panel (refer to TM 55-2090-201-14&P).
  - (5) Turn off OWS pump when you are done and close V-3 and V-6.

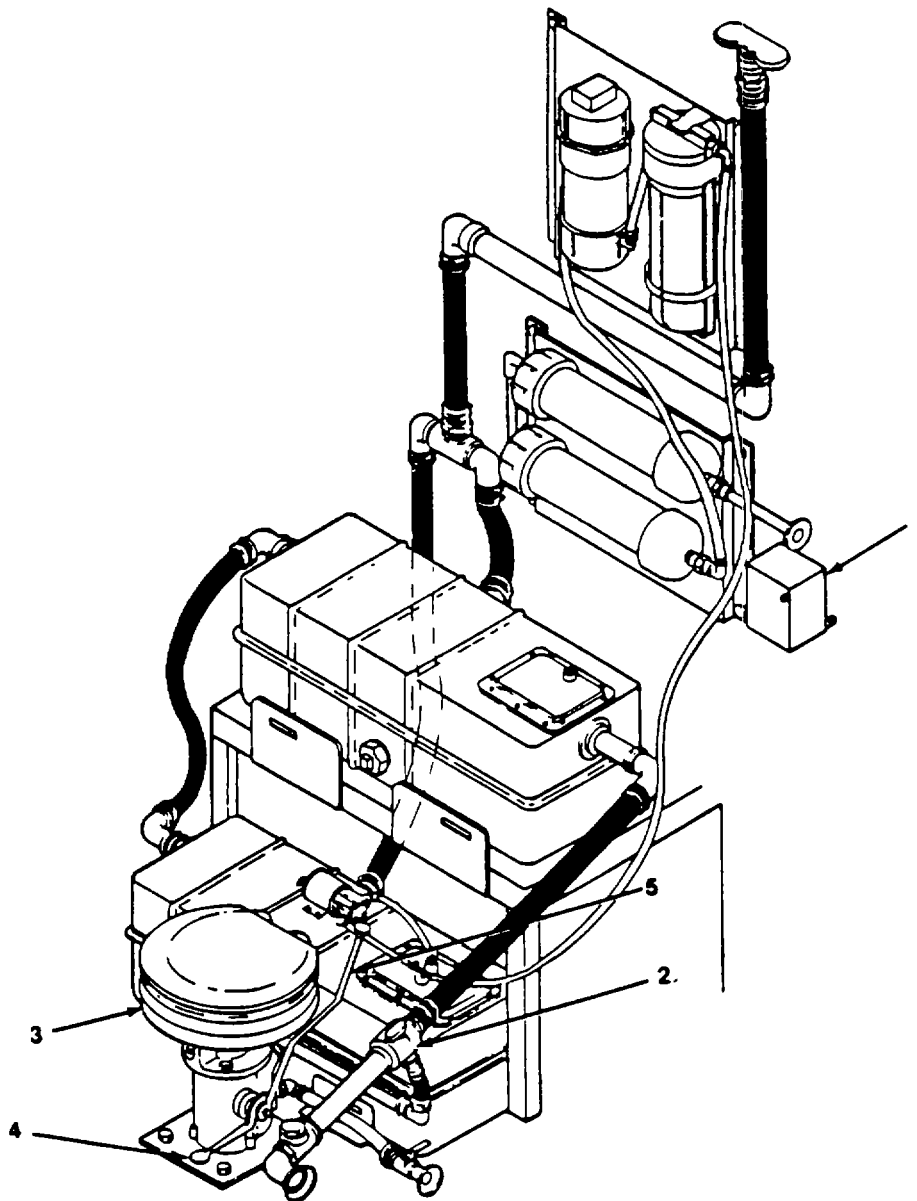


### 2-5.5 Marine Sanitation Device.

- a. Ensure that the rotary switch (1) located near the retention canisters is ON. (This switch should stay on during extended periods of usage).
- b. Ensure that the three-way valve (2) is set for MSD operation (arrow on valve pointing forward).
- c. After usage of the marine head (3), depress the foot pedal (4) and flush with a few strokes of the pump handle (5).

#### NOTE

The three-way valve may be set to bypass the MSD (arrow on valve pointing aft) to flush the toilet directly overboard when in the open sea.



**Section IV. OPERATING UNDER UNUSUAL CONDITIONS****2-6 COLD WEATHER OPERATION.****2-6.1 Starting Aid.****WARNING**

**Do not overuse starting aid. Overloading the engine air box with this highly volatile fluid may result in an explosion.**

- a. Spray starting aid from aerosol can into engine air box. Follow manufacturer's instructions
- b. Wait 3 seconds and then push ENG START button to start engine.

**2-6.2 Engines.** Keep engine compartment as warm as possible without shutting off ventilation completely.

**2-6.3 Batteries.**

- a. Keep batteries fully charged to prevent freezing.
- b. Check specific gravity and adjust to suit particular conditions (TM 9-6140-200-15).
- c. Check batteries for correct terminal voltage.

**2-6.4 Cooling System.** Add antifreeze to engine fresh water cooling system to prevent freezing (TB 750-651).

**2-6.5 Lubricating Oil.** Refer to LO 5-2815-231-12 for instructions concerning lubrication of engines during operation in cold weather.

**WARNING**

**Never use a blow torch or other similar means for heating fuel or lubricating lines.**

**2-6.6 Steering System.** Test steering system thoroughly by moving steering wheel from left to right. Turn steering wheel slowly at first to loosen any ice that may have formed between the hull and rudders at waterline.

**2-6.7 Hull and Fittings.**

- a. Keep caps installed on hose connections, except when filling.
- b. Remove Ice from ladders and passageways on main deck.

**2-6.8 Navigation Lights and Horn.** Ice may form on any of these units and prevent proper operation. Carefully remove ice from unit.



## 2-7 HOT WEATHER OPERATION.

### WARNING

Fuel oil and other similar materials are highly volatile In hot weather and these vapors increase the possibility of an explosion. Be sure all spilled petroleum products are wiped up. Inspect for leaks in fuel lines and fittings. Pump bilges regularly.

**2-7.1 Engines.** Keep engine compartment as cool as possible by use of ventilation fans.

#### **2-7.2 Batteries.**

- a. Check electrolyte level often and fill as necessary.
- b. Keep terminals free of corrosion.
- c. Reduce specific gravity (TM 9-6140-200-14)

**2-7.3 Cooling System.** Check water temperature gauge often. Temperature should not rise above 185°F (74°C). If this temperature is exceeded, check for the following:

- a. Insufficient supply of fresh water in the engine cooling system. If so, fill expansion tank and check for leakage.
- b. Engine coolant thermostat faulty. Refer to TM 5-2815-231-14.
- c. Sea water (raw water) inlet clogged at sea chest. Blow out sea chest with compressed air.
- d. Engine fresh water pump faulty. Refer to TM 5-2815-231-14.

#### **2-7.4 Lubricating Oil.**

- a. Check lubricating oil pressure gauge often. Pressure will drop slightly as water temperature rises.
- b. Refer to LO 55-2815-231-14 for instructions concerning lubrication of engines during operation in hot weather.

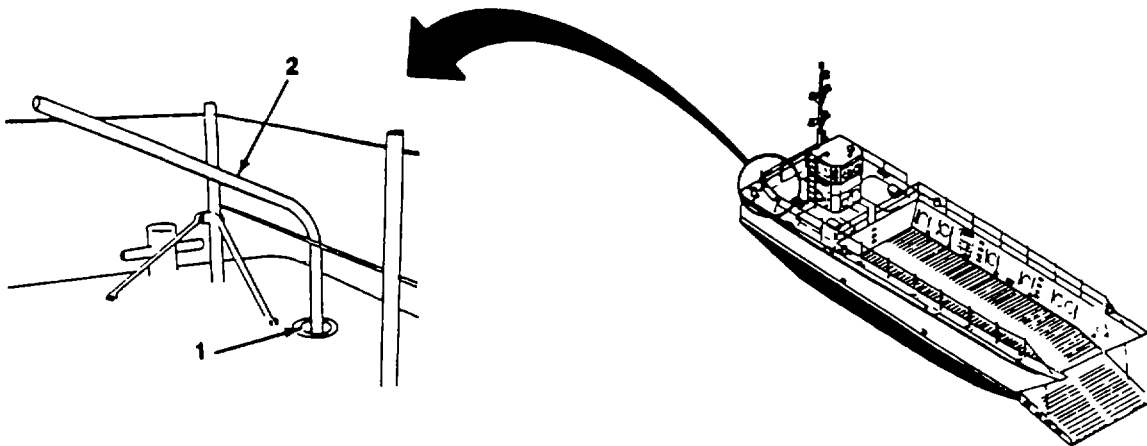
## 2-8 FOUL WEATHER OPERATION.

- a. Check to see that all gear and equipment are properly stowed and secured.
- b. Should the engines be operated at high speed in rough water, the engines will surge when the propellers leave the water, causing excessive vibration. The governor may be overworked under these conditions, and it will be necessary for the protection of the engines and safety of the vessel to reduce the speed of the engines until a safe operating speed is attained, as determined by the state of the sea.

## 2-9 EMERGENCY PROCEDURES.

**2-9.1 Emergency Steering.** If one steering pump or one engine should fail, the steering system will continue to operate. If both steering pumps should fail, steering can be accomplished by turning the wheel. The helm unit will act as a pump to actuate the steering cylinders. In case of failure of the hydraulic steering capability, use the emergency' tiller as follows:

- a. Open the normally closed by-pass valves - two port, two starboard - in the lazarette to drain the steering cylinders. Refer to figure in para. 1-18(c).
- b. Remove the deck plate (1) over the port or starboard rudder stock on the main deck.
- c. Remove the emergency tiller (2) from the stowage brackets on the starboard side of the pilothouse.
- d. From the main deck, insert the emergency tiller socket over the upper square rudder stock.



### CAUTION

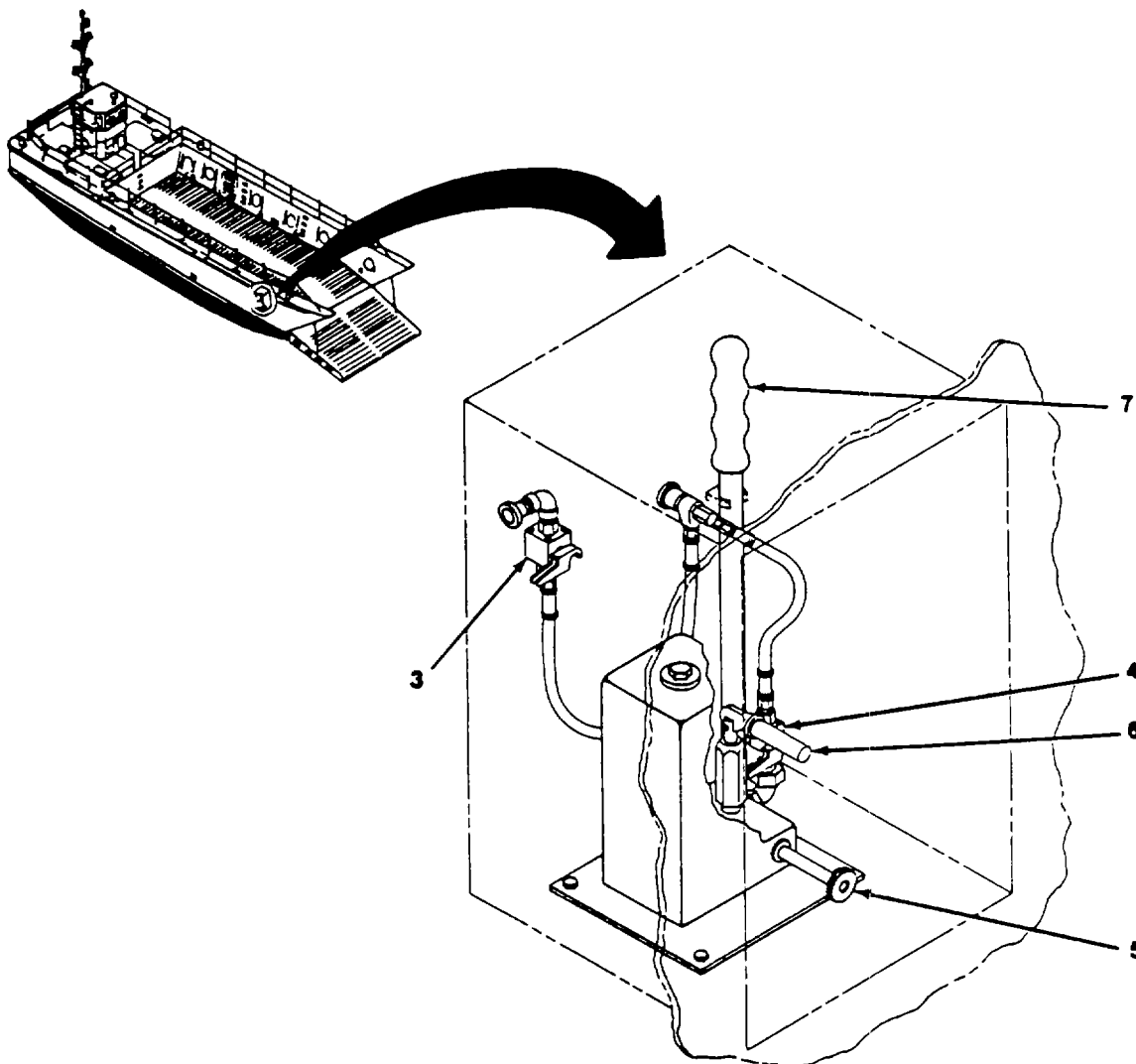
Steering the LCM-8 with the emergency tiller must be accomplished at engine speeds below 1500 RPM. Steering by tiller at engine speeds over 1500 RPM may endanger the tiller operator and cause loss of steering control.

- e. Steer the LCM-8 by operating the tiller (2).

### NOTE

If the steering cylinder is jammed and restricting rudder movement, remove the cotter pin from the connecting rod pin; remove the connecting rod pin from both the cylinder piston and the port tiller crank arm. Then resume steering by tiller.

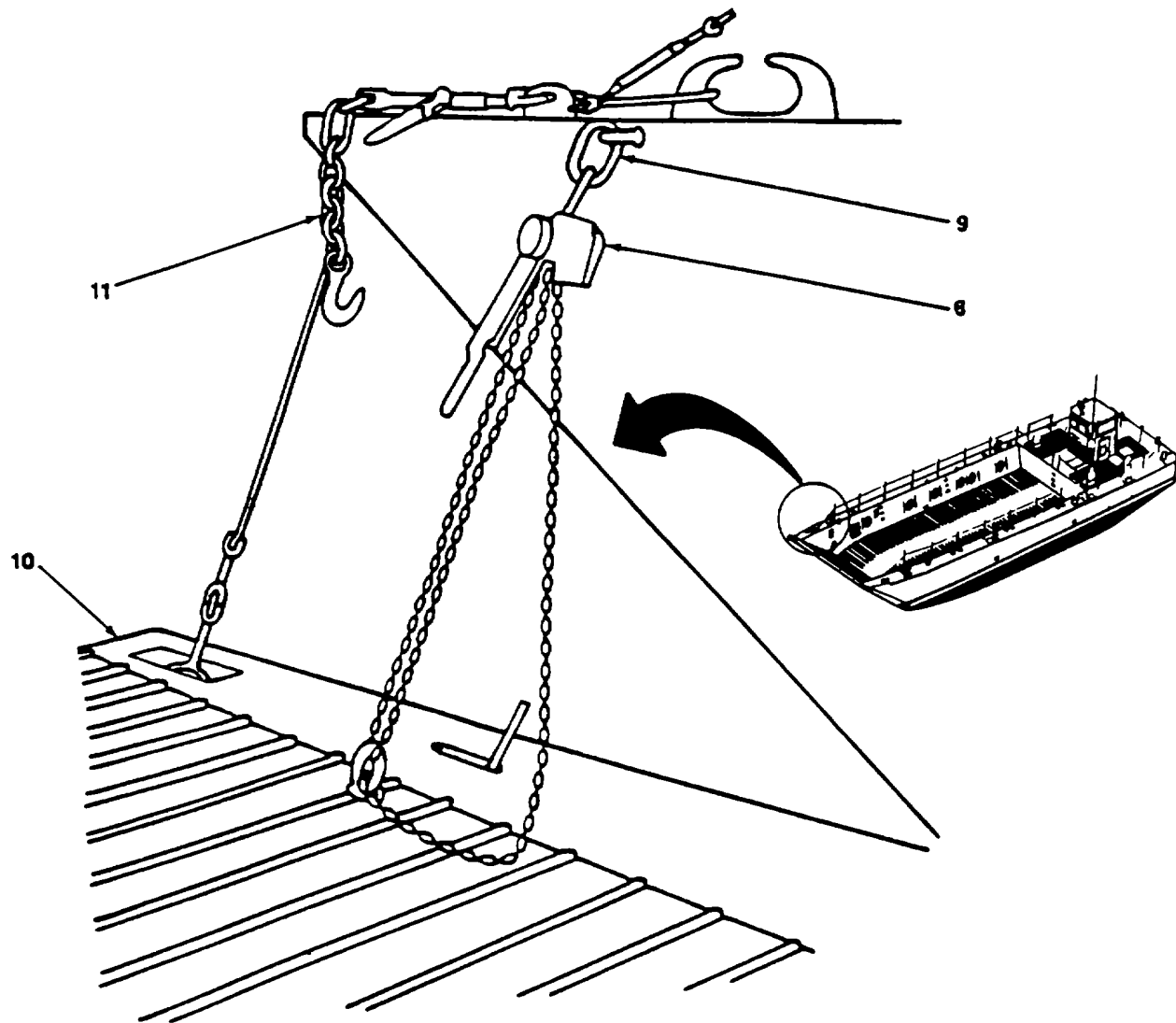
**2-9.2 Emergency Operation to Lower Ramp.** When the propulsion units cannot be operated, or a malfunction in the hydraulic ramp system is encountered, the ramp can be lowered according to the following procedure:



- a. Disengage both PTO clutch levers to stop ramp hydraulic pumps. Refer to figure in para. 2-1, item 58.
- b. Close upper shut-off valve (3) in the hand pump compartment.
- c. Open lower shut-off valve (4) in the hand pump compartment.
- d. Close hand pump bypass valve (5).
- e. Remove port and starboard load binders. Refer to figure in para. 2-4.3.1(d).
- f. Operate hand pump (6) with handle (7) until winch brake releases and ramp starts lowering.
- g. Stop ramp lowering by opening the hand pump bypass valve (5).

**2-9.3 Emergency Operation to Raise Ramp.** The chain falls are operated in unison to raise or lower the ramp in emergencies. When the propulsion units cannot be operated, or a malfunction in the hydraulic ramp system is encountered, the ramp can be hoisted according to the following procedure:

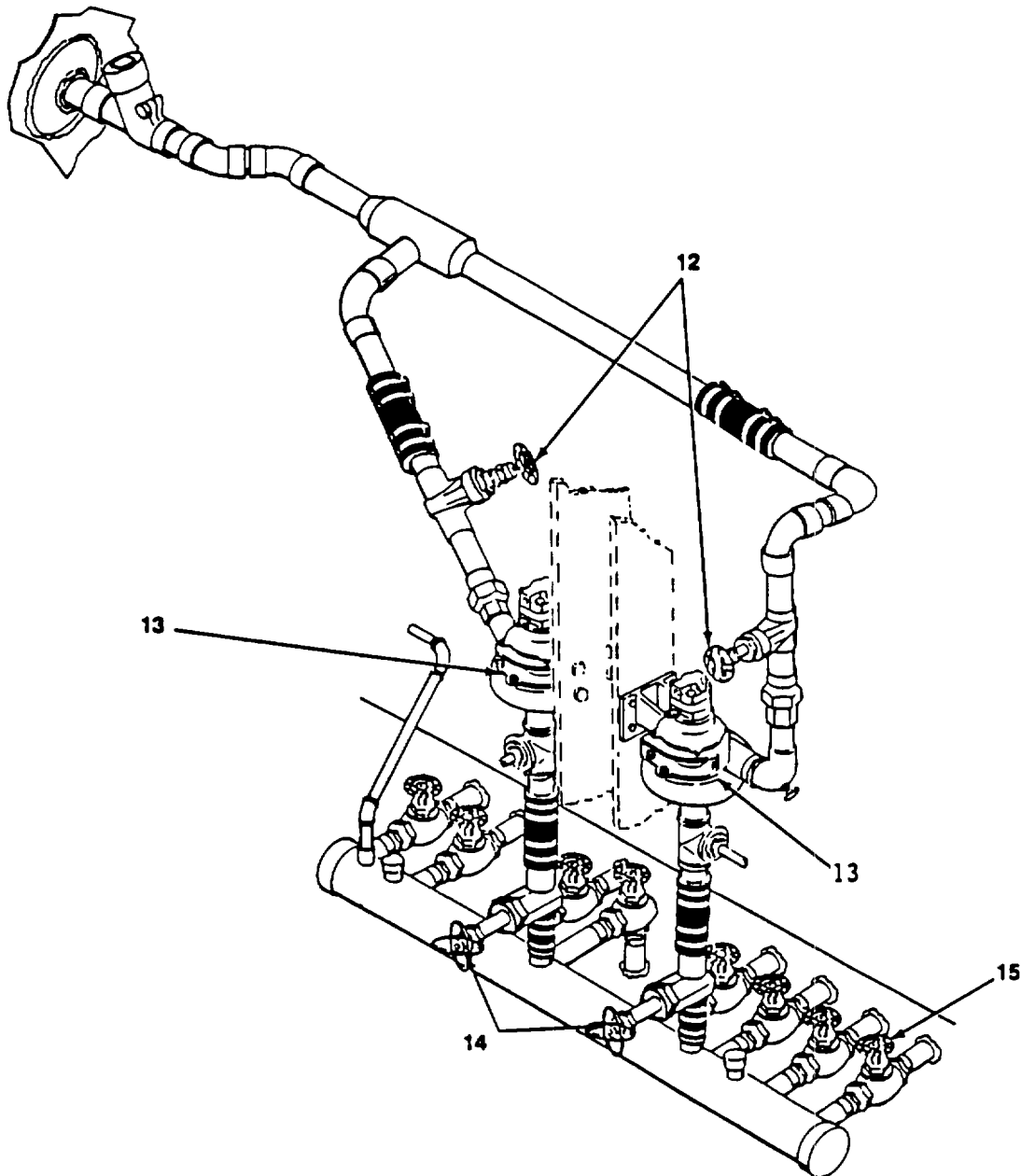
- a. Perform procedural steps a through d in para. 2-9.2.
- b. Hook up the 3-ton chain fall hoists (8) to the port and starboard ramp hoisting padeyes (9) on the wing walls, and to the attachment points in the ramp deck.



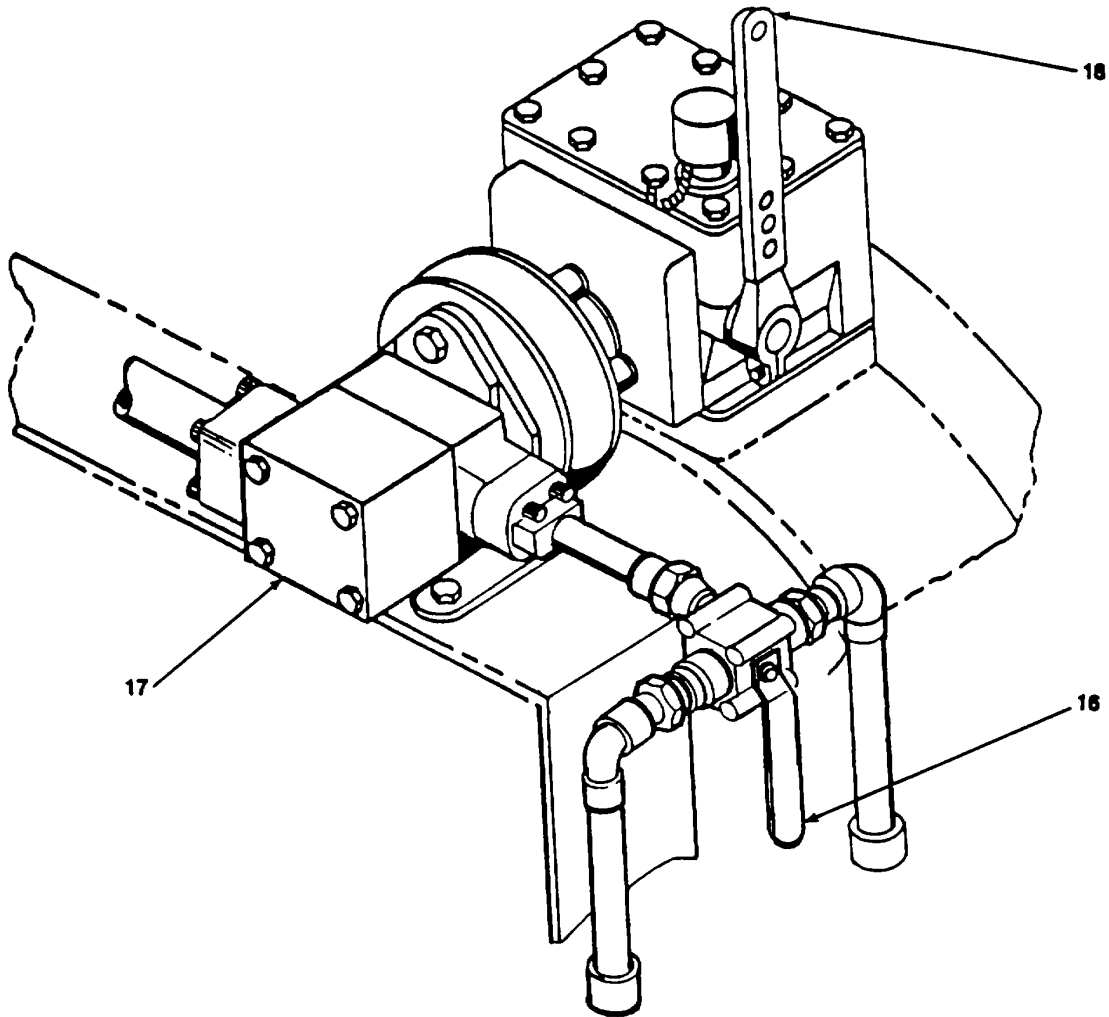
- c. Operate the chain fall hoists (8) simultaneously until the ramp (10) is fully hoisted.
- d. Secure ramp (10) with load binders (11) on both sides.
- e. Remove the chain fall hoists (8) and stow them in brackets provided in the lazarette.

**2-9.4 Emergency Bilge Pumping.** In the event of flooding, the two hydraulic motor-driven bilge pumps are used to remove water from the vessel. Perform the following instructions:

- a. With engines in operation and sea water system lined up, open the priming valve in both sea water priming lines.
- b. Open the overboard discharge valve (12) for both bilge pumps (13).
- c. Open the suction valve (14) for both bilge pumps.
- d. Open the bilge manifold valves (15) to the bilge compartments that need emptying.



- c. Set the handle on the hydraulic diverter valve (16) in the BILGE position (HANDLE UP on port engine; HANDLE DOWN on starboard engine).
- f. Start the ramp hydraulic pump (17) by engaging the PTO clutch lever (18) forward.



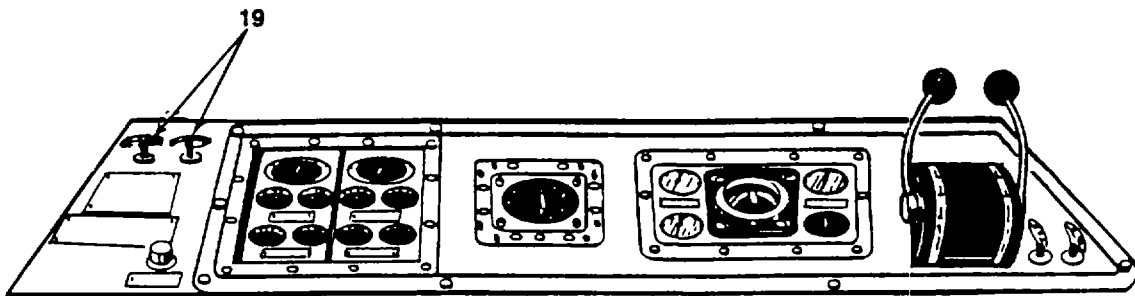
- g. After operation, follow the above steps in reverse order to shut down the system.



**2-9.5 Emergency Engine Shutdown.** The emergency engine shutdown control, when pulled, will trip the air shut-down valve located between the air inlet housing and the blower to shut off the air supply to the engine. Lack of air will prevent further combustion of the fuel and stop the engine. The emergency engine shutdown control must be pushed back-in after the engine stops so the air shutdown valve can be opened for restarting after the malfunction has been corrected. Use the procedure below to shut down the engines in an emergency.

**CAUTION**

**Using an emergency engine air shutdown control to stop an engine may cause damage to engine oil seals. The emergency engine shutdown control should be used in engine room fire or runaway engine emergencies only.**



- a. Pull the applicable emergency engine shutdown control (19) (T-handle) on the control console, port side, and hold it there until engine stops.
- b. Push in the emergency engine shutdown control after engine stops.

**2-9.6 Inoperable Rudders.** If the rudders become fouled or unusable, the LCM-8 can be steered by varying engine speed as follows.

**2-9.6.1 Steering By Engine Speed.**

- a. To turn the LCM-8 to port while underway, decrease the port engine speed while maintaining the starboard engine speed. The turning rate to port is predicated on the difference in speeds of the port and starboard engines. Set the port engine throttle to the appropriate engine speed for the desired turning rate. When the turn is completed, increase the port engine speed to that of the starboard engine.

- b. To turn the LCM-8 to starboard while underway, decrease the starboard engine speed while maintaining the port engine speed. The turning rate to starboard is predicated on the difference in speeds of the port and starboard engines. Set the starboard engine throttle to the appropriate engine speed for the desired turning rate. When the turn is completed, increase the starboard engine speed to that of the port engine.

**2-9.6.2 Steering By Engine-Direction.** At IDLE engine speeds, the LCM-8 can be turned by manipulating the marine transmission control levers as follows:

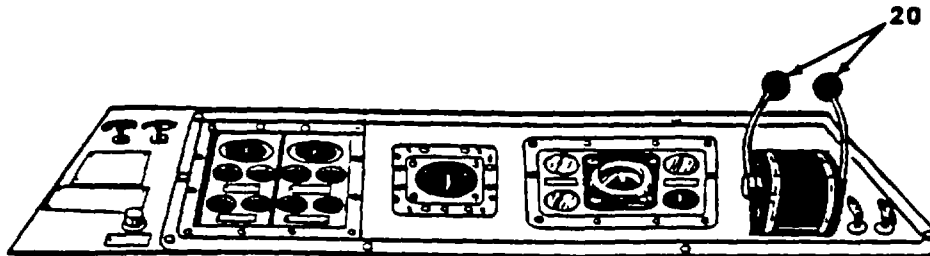
**CAUTION**

**An engine speed of 550 RPM should be maintained when steering with the engine controls. Shifting marine transmission modes (FWD to REV or vice versa) at high engine speeds will strain the marine transmission assembly, cause excessive friction in the clutch mechanism, and produce a damaging shock load on the propulsion machinery.**

**NOTE**

**The rudders should be positioned amidships when steering with the engine controls.**

- a. To turn the LCM-8 to port using the propulsion control levers (20), place the starboard propulsion control lever in the FWD position and the port propulsion control lever in the REV position. When the turn to port is completed, return both propulsion control levers to the NEUTRAL position and proceed with underway operations.



- b. To turn the LCM-8 to starboard using the propulsion control levers (20), place the port propulsion control lever in the FWD position and the starboard propulsion control lever in the REV position. When the turn to starboard is completed, return both propulsion control levers to the NEUTRAL position and proceed with underway operations.

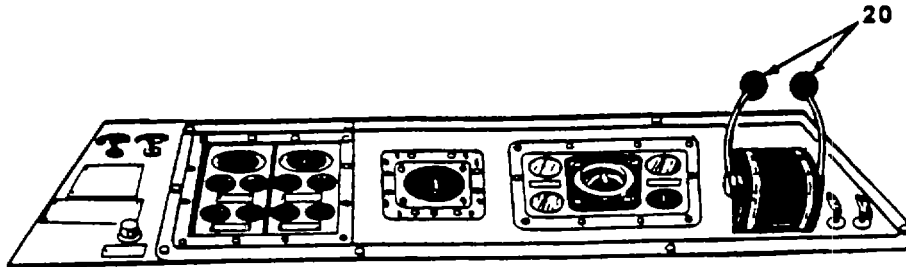




**2-9.7 Emergency Boat Stopping.** If the LCM-8 is traveling forward at cruising speed in the AHEAD mode, emergency stopping can be accomplished with the propeller shafts as follows:

**WARNING**

**Warn the crew as early as possible before initiating the EMERGENCY STOP procedure. Failure to comply could result in injury to personnel due to shifting cargo.**



- a. Place both propulsion control levers in the NEUTRAL position until engine speeds fall below 800 RPM.
- b. Shift both propulsion control levers into REV gear position.
- c. Increase both engine speeds to maximum speed in the ASTERN mode.
- d. When the LCM-8 stops, return both propulsion control levers to NEUTRAL.
- e. Proceed with underway operations.

**2-9.8 Propulsion Engine Failure.**

**2-9.8.1 One Engine Breakdown.** In the event of breakdown of either propulsion engine, proceed to moorage under power of the second engine as follows:

- a. Shut down the malfunctioning propulsion unit (refer to para 2-4.4).
- b. Steer the LCM-8 so as to compensate for the drag of the inoperable propeller and shaft.

**2-9.8.2 Two Engine Breakdown.** In the event of breakdown of both propulsion engines, the LCM-8 will have to be towed. Towing arrangements shall be at the discretion of the coxswain.

**WARNING**

Secure towing lines only to mooring bits. Never secure towing lines to lifelines, handrails or other deck hardware not intended for mooring purposes. Failure to comply may result in damage to the vessel and injury or death to personnel.

**2-9.9 Transmission Backdriving.** All current twin disc production marine transmissions can be backdriven (propeller windmilling with dead engine) for the following conditions, provided that the vessel speed, when backdriving the marine transmission does not exceed the normal propulsion speed of the vessel- towing to deliver a boat, towing home a boat with engine trouble, sailboat auxiliary and multiple screw vessel with engine(s) shutdown.

**2-9.9.1 Selective Methods Required for Backdriving.**

- a. Start the engine and operate the marine transmission in neutral at normal fluid pressures for a minimum of five minutes, doing this once every eight hours. Maintain the backdriven marine transmission's oil level at the full mark on the dipstick.
- b. In the case of an inoperable engine where pressure lubing the transmission is not possible, plug the dipstick tube and fill the unit with oil. Then, before backdriving, drain the oil down to full oil level. Repeat this process every eight hours.



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**CHAPTER 3**  
**OPERATOR MAINTENANCE**

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Functional Test of Alternator .....	3-5
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Inspect Steering System Reservoir, Strainers and Filter .....	3-10
Replace Fuel Filter/Water Separator .....	3-17
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## Section I. LUBRICATION INSTRUCTIONS

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### 3-1 GENERAL LUBRICATION INSTRUCTIONS.

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This section contains general lubrication instructions that are not covered in the lubrication orders. Refer to LO 55-1905-222-12 and LO 5-2815-231-12 for detailed lubrication information applicable to the LCM-8. The LCM-8 crew should be familiar with and adhere to the following lubrication instructions:

- a. Keep all lubricant containers closed and stored in a clean, dry place. Allow no dust, dirt, or other foreign material to mix with the lubricants.
- b. Keep all lubrication equipment, such as grease gun, clean and ready for use.
- c. Wipe all lubrication points free of dirt and old grease before lubricating equipment. Clean all lubrication points after lubricating equipment to prevent accumulation of Foreign matter.
- d. Lubricate equipment periodically as shown on lubrication orders.

## Section II. TROUBLESHOOTING PROCEDURES

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### 3-2 TROUBLESHOOTING PROCEDURES.

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This paragraph provides information useful in diagnosing and correcting unsatisfactory operation or failure of LCM-8 systems and equipment. Troubleshooting procedures in this manual are limited to the basic craft. Refer to TM 5-2815-231-14 for engine and transmission troubleshooting procedures. Before using the troubleshooting procedures, ensure that all applicable operating procedures have been performed.

#### NOTE

- **The table lists the common malfunctions which you may find during operation or maintenance of the equipment. You should perform tests/inspections and corrective actions in the order listed.**
- **This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by the listed corrective actions, notify your supervisor.**

## Troubleshooting

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**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**NAVIGATIONAL AIDS**

## 1. LIGHT(S) DO NOT LIGHT UP

Step 1. Check to see if main switch is off on the control and distribution panel.

Turn switch on.

Step 2. Check to see if bulb is defective.

Replace bulb.

Step 3. Check for blown fuses

Notify unit maintenance.

Step 4. Check to see if wiring/fixtures/switches are faulty

Notify unit maintenance.

## 2. HORN WILL NOT SOUND.

Step 1. Check to see if ice has formed in the horn

Remove ice.

Step 2. Check to see if wiring/horn/switch is faulty

Notify unit maintenance.

## Troubleshooting - Continued

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**ELECTRICAL SYSTEM**

## 1. ALTERNATOR NOT CHARGING

Step 1. Check to see if drive belts are loose or broken

Tighten alternator drive belts or replace as necessary

Step 2. Check to see if alternator leads are secure

Secure alternator leads

Step 3. Test to see if voltage regulator/voltage protector is defective (para. 3-5)

Notify unit maintenance

Step 4. Test to see if alternator is defective (para. 3-5)

Notify unit maintenance.

## 2. ALTERNATOR OUTPUT LOW OR UNSTEADY

Step 1. Check to see if drive belts are loose

Tighten alternator drive belts

Step 2. Test to see if voltage regulator/voltage protector is defective.

Notify unit maintenance

Step 3. Check to see if alternator brushes are worn or loose.

Notify unit maintenance

## 3. NOISY ALTERNATOR

Step 1. Check to see if drive belts or pulley are loose

Tighten drive belts and pulley

Step 2. Check for misaligned belts or pulley

Correct alignment

---

**Troubleshooting - Continued**


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**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**


---

**ELECTRICAL SYSTEM - Continued**

Step 3. Check for cracked or damaged housing

Notify unit maintenance

Step 4. Check to see if drive belts are worn or defective

Notify unit maintenance

Step 5. Check to see if alternator bearings are worn

Notify unit maintenance

**4. BATTERIES WILL NOT HOLD CHARGE**

Step 1. Check to see if battery cables are loose or terminals are corroded

Clean and tighten as necessary

Step 2. Check to see if battery water level is low

Add water

Step 3. Test to see if batteries are defective

Notify unit maintenance

**5. ELECTRICAL SWITCHES FAIL TO START ENGINE**

Step 1. Check to see if batteries are dead

Notify unit maintenance.

Step 2. Check to see if wiring/switches are defective

Notify unit maintenance

Step 3. Check to see if control valve solenoid is defective

Notify direct support maintenance

Step 4. Check hydrostart accumulators for proper pressure

Step 5. Check hydrostart valve alignment

Step 6 To isolate the problem to either the electrical or the hydraulic system, prepare to start the diesel and depress the control valve solenoid manual release button If the engine starts It is an electrical problem If no start, It is a hydraulic related problem



**Troubleshooting - Continued**

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**ELECTRICAL SYSTEM - Continued****6. ENGINE ROOM/LAZARETTE/CARGO WELL LIGHTS DO NOT LIGHT UP**

Step 1. Check to see if light bulb is defective

Replace bulb.

Step 2. Check to see if wiring/fixture/switch is defective

Notify unit maintenance.

**PROPULSION CONTROL SYSTEM****1. PROPULSION CONTROLS DO NOT EFFECT A CLUTCH OR THROTTLE CHANGE**

Step 1. Check to see if clutch or throttle cables are disconnected Trace entire cable length from control head in pilothouse to the governor or transmission control valve lever

Notify unit maintenance

Step 2. Check to see if control head is defedive.

Notify unit maintenance.

**2. ENGINE SHUTDOWN CONTROLS INOPERATIVE.**

Step 1. Check to see if shutdown cable is disconnected from T-handle.

Notify unit maintenance

Step 2. Check to see if shutdown cable is defective.

Notify unit maintenance.

**Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**SANITATION SYSTEM**

**1. WATERCLOSET (SKIPPER) DOES NOT REFILL WHEN FOOT PEDAL IS DEPRESSED**

Check to see if seacock is closed

Open seacock.

**2. WATERCLOSET DOES NOT DISCHARGE PROPERLY INTO SANITATION DEVICE**

Step 1. Check to see if there is electrical power to the pump motor.

Turn the rotary switch to ON.

Step 2. Check the filter cartridge to be see if it is blocked.

Rinse and re-install or replace the filter element (para 3-7).

Step 3. Check for blockage within the receiving or treatment tank.

Drain the tanks, remove hatch cover and any material that may cause blockage (para 3-7).

**3. SEWAGE PUMP DOES NOT RUN**

Step 1. Check to see if float switch is defective.

Notify direct support maintenance

Step 2. Check to see if wiring/switch/pump-motor is defective

Notify direct support maintenance

**Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**RAMP SYSTEM**

**1. CONTROL VALVE LEVER MOVES BUT WINCH DOES NOT TURN (CABLE IS FREE TO MOVE)**

Step 1. Check to see if power-take-off (PTO) is disengaged

Engage PTO.

Step 2. Check to see if hydraulic diverter valve is set for BILGE PUMP operation.

Set hydraulic diverter valve for RAMP operation.

Step 3. Check to see if oil level in reservoir is low.

Replenish as necessary.

Step 4. Check to see if any hydraulic line has burst.

Notify direct support maintenance.

**2. CONTROL VALVE LEVER DOES NOT MOVE.**

Check to see if control valve is seized.

Notify direct support maintenance.

**3. RAMP CONTINUES TO LOWER WITH CONTROL VALVE IN NEUTRAL.**

Check to see if lower hand pump shutoff valve is open.

Close lower hand pump shutoff valve.

**4. UNUSUALLY SLOW RAMP OPERATION.**

Step 1. Check to see if lower hand pump shutoff valve is open.

Close lower hand pump shutoff valve.

Step 2. Check to see if engines are not up to speed.

Increase engine speed.

---

**Troubleshooting - Continued**

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**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**RAMP SYSTEM - Continued**

Step 3. Check to see if only one pump is engaged.

Engage both pumps for quicker operation.

**5. BRAKE DOES NOT RELEASE.**

Check for foreign material in system.

Flush system completely and clean strainers and filters (para 3-9).

**6. HAND PUMP DOES NOT DEVELOP PRESSURE.**

Check to see if hand pump bypass valve is open.

Close hand pump bypass valve.

**7. LOSS OF OIL FROM RAMP WINCH HYDRAULIC MOTOR.**

Check to see if motor is defective.

Notify direct support maintenance.

**8. NOISY OPERATION OF PUMPS.**

Step 1. Check for air in system.

Tighten leaky connections and purge system.

Step 2. Check pump coupling for misalignment.

Notify direct support maintenance.

Step 3. Check to see if pump is defective.

Notify direct support maintenance.

**9. ERRATIC ACTION OF WINCH.**

Step 1. Check for air in system.

Tighten leaky connections and purge system.

**Troubleshooting - Continued****MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION****RAMP SYSTEM - Continued**

Step 2. Check to see if winch is defective.

Notify general support.

**STEERING SYSTEM.****1. STEERING WHEEL DIFFICULT TO TURN.**

Step 1. Check to see if Isolation valves In lazarette are closed.

Open isolation valves (refer to figure In para 5-30).

Step 2. Check to see if counterbalance valve is set improperly.

Notify unit maintenance.

Step 3. Check to see if relief valve is stuck open.

Notify unit maintenance.

Step 4. Check to see if there is binding In helm unit.

Notify direct support maintenance.

Step 5. Check to see if rudder is jammed or fouled.

Notify general support maintenance.

**2. STEERING IS SLOW.**

Check to see if foreign material is in flow divider.

Notify direct support maintenance.

**3. WHEEL TURNS BUT RUDDER DOES NOT.**

Step 1. Check for air In system.

Tighten leaky connections and purge system.

---

**Troubleshooting - Continued**


---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**


---

**STEERING SYSTEM - Continued**

Step 2. Check for ruptured line.

Notify direct support maintenance

Step 3. Check for helm unit failure.

Notify direct support maintenance

**4. NOISY OPERATION OF PUMP**

Step 1. Check to see if oil level is low in reservoir

Refill reservoir

Step 2. Check for air in system

Purge system

Step 3. Check for a loose external connection

Tighten connection.

Step 4. Check to see if pump is defective

Notify direct support maintenance

**5. HYDRAULIC PUMP DISCHARGE PRESSURE LOW**

Step 1. Check to see if suction valves are partially closed

Open suction valves fully

Step 2. Check to see if oil level in reservoir is low

Replenish reservoir

Step 3. Check to see if suction strainers are clogged

Clean strainers (para 3-11).

Step 4. Check to see if pump is defective

Notify direct support maintenance

**Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**STEERING SYSTEM - Continued**

**6. RUDDER ANGLE INDICATOR DOES NOT RESPOND.**

Step 1. Check to see if RAI switch is OFF.

Turn RAI switch to ON.

Step 2. Check to see if transmitter connecting linkage is obstructed.

Remove obstruction.

Step 3. Check to see if RAI fuses are blown.

Notify unit maintenance.

Step 4. Check to see if RAI switch is defective.

Notify unit maintenance.

Step 5. Check to see if transmitter connecting linkage is damaged.

Notify direct support maintenance.

**7. RUDDER ANGLE INDICATOR READING INCORRECT.**

Step 1. Check to see if transmitter (follow-up unit) potentiometer is maladjusted.

Notify direct support maintenance.

Step 2. Check to see if transmitter is defective.

Notify direct support maintenance

**BILGE SYSTEM**

**1. OIL WATER SEPARATOR (OWS) PUMP FAILS TO DELIVER WATER**

Step 1. Check to see if OWS pump motor control is OFF at the control panel

Turn on pump motor control

**Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**BILGE SYSTEM - Continued**

Step 2. Check to see if OWS system valves are lined up improperly for operation.

Line up system valves (para 2-5. 4).

Step 3. Check to see whether suction strainers are clogged.

Clean suction strainers.

Step 4. Check to see if OWS pump/motor assembly is defective.

Refer to TM 55-2090-201-14 & 14P.

**2. BILGE AREAS DRAIN SLOWLY, VERY LITTLE OVERBOARD DISCHARGE.**

Step 1. Check to see if any system valve is partially closed.

Open valve.

Step 2. Check to see if suction strainers are clogged.

Clean suction strainers.

Step 3. Check to see if basket strainer is clogged.

Clean basket strainer.

**3. EMERGENCY BILGE PUMP FAILS TO DELIVER WATER.**

Step 1. Check to see if ramp hydraulic pump is not operating.

Engage PTO clutch lever while engine is operating.

Step 2. Check to see if hydraulic diverter valve is improperly set for RAMP operation.

Set hydraulic diverter valve for BILGE operation.

Step 3. Check to see if bilge pump priming valve is closed.

Open bilge pump priming valve.



**Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**BILGE SYSTEM - Continued**

Step 4. Check to see if bilge pump system valves are lined up improperly.

Open valves.

Step 5. Check to see if suction strainers are clogged.

Clean suction strainers.

Step 6. Check to see if bilge pump/motor assembly is inoperative.

Notify direct support maintenance.

**STARTING SYSTEM**

**1. ENGINE DRIVEN RECHARGING PUMP FAILS TO RAISE ACCUMULATOR PRESSURE.**

Step 1. Check to see if oil level in reservoir is low.

Replenish reservoir.

Step 2. Check for air in the system.

Purge system.

Step 3. Check to see if suction filter is clogged.

Clean filter element or replace (para 3-13).

Step 4. Check to see if the hose has burst.

Notify direct support maintenance.

Step 5. Check to see if engine driven pump is defective.

Notify direct support maintenance.

---

**Troubleshooting - Continued**

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**STARTING SYSTEM - Continued****2. CRANKING SPEED TOO SLOW.**

Step 1. Check to see if engine oil or system oil is too heavy.

Replace oil with proper grade oil.

Step 2. Check for inlet line restriction (from accumulator to starting motor).

Ensure that hoses are not collapsed and are free of obstructions.

Step 3. Check to see if hydraulic oil pressure is Insufficient.

Charge accumulators with hydraulic oil, using hand pump.

Step 4. Check to see If starting motor is defective.

Notify direct support maintenance.

**3. HAND PUMP FAILS TO CHARGE SYSTEM.**

Step 1. Check to see if accumulator valves are closed.

Open accumulator valves.

Step 2. Check to see if isolation valve is closed (when trying to charge port accumulators).

Open isolation valve.

Step 3. Check to see if oil level in reservoir is low.

Replenish reservoir.

Step 4. Check to see if suction filter is clogged.

Clean filter element or replace (para. 3-13).

Step 5. Check to see If accumulator blowdown valve is open (when trying to charge port accumulators).

Close accumulator blowdown valve.

**Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**STARTING SYSTEM - Continued**

Step 6. Check to see if the hose has burst.  
 Notify direct support maintenance.

Step 7. Check to see if hand pump is defective.  
 Notify direct support maintenance

**4. LOW ACCUMULATOR PRESSURE.**

Step 1. Check to see if accumulator is charged to proper nitrogen precharge pressure.  
 Charge with nitrogen to correct pressure (para. 6-13e).

Step 2. Check to see if there is excessive oil leaks.  
 Tighten connections and replace hoses and fittings.

Step 3. Check to see if accumulator is defective.  
 Notify direct support maintenance.

**5. HIGH PRESSURE IN SYSTEM (ABOVE 3500 PSI).**

Step 1. Check to see if relief valve is stuck in the closed position.  
 Notify direct support maintenance.

Step 2. Check to see if unloading valve in recharging pump is operating Improperly.  
 Notify direct support maintenance.

**6. ENGINE FAILS TO START IN ALL STARTING MODES.**

Step 1. Check to see if control valve is defective.  
 Notify direct support maintenance.

Step 2. Check to see if starting motor is defective.  
 Notify direct support maintenance.

**Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**ENGINE COOLING SYSTEM**

**HIGH COOLANT TEMPERATURE**

- Step 1. Inspect cooling system for dirt and scale.  
 Notify unit maintenance.
- Step 2. Inspect and test the thermostat for faulty operation.  
 Refer to TM 5-2815-231-14.

**FUEL SYSTEM**

**1. SUFFICIENT FUEL NOT AVAILABLE TO ENGINES.**

- Step 1. Check to see if fuel tanks are empty.  
 Fill tanks (para. 2-3. 2).
- Step 2. Check to see if fuel system is not properly lined up.  
 Open all valves fully.
- Step 3. Check to see if fuel strainers are clogged.  
 Clean fuel strainers (para. 3-14).
- Step 4. Check to see the fuel hoses and fittings leak.  
 Notify direct support maintenance.

**2. WATER IN FUEL.**

- Step 1. Check to see if the fuel in the tanks is contaminated with water.  
 Drain tanks completely and re-fuel with uncontaminated fuel.

**Troubleshooting - Continued**

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**FUEL SYSTEM - Continued**

Step 2. Check to see if leaky hoses are immersed in bilge water

Notify direct support maintenance

---

**EXHAUST SYSTEM**

**1. EXHAUST SYSTEM TOO NOISY**

Check to see if mufflers are defective.

Notify unit maintenance.

**2. EXHAUST SYSTEM TOO HOT.**

Check to see If there is leakage of exhaust gas or cooling water in the exhaust system.

Notify unit maintenance.

---

**PROPELLER, PROPELLER SHAFT AND STUFFING BOX**

**1. EXCESSIVE LEAKAGE FROM STUFFING BOX.**

Check for loose or worn packing.

Adjust or replace packing (para. 6-25).

**2. EXCESSIVELY HOT STUFFING BOX.**

Check to see if packing gland is too tight.

Adjust packing (para 6-25).

**Troubleshooting - Continued**

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**PROPELLER, PROPELLER SHAFT AND STUFFING BOX - Continued****3. EXCESSIVE VIBRATION IN PROPELLER SHAFT**

Step 1. Check for misalignment of propeller coupling.

Notify general support maintenance.

Step 2. Check for bent or broken propeller.

Notify general support maintenance.

**Section III. MAINTENANCE PROCEDURES**

---

**3-3 GENERAL MAINTENANCE PROCEDURES.**

---

This section contains maintenance procedures that are the responsibility of the operator, as authorized by the Maintenance Allocation Chart (MAC). Refer to the operator PMCS for all INSPECT and SERVICE maintenance functions on the MAC that are not addressed in the following maintenance procedures.

**NOTE**

**Due to the mission and crew capabilities of the vessel, maintenance normally assigned to organizational level or higher may be assigned to operator crew.**

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**MAINTENANCE OF NAVIGATION LIGHTS**

---

**3-4 REPLACE NAVIGATION LIGHT BULB AND LENS HOUSING.**

---

This task covers

- a. Removal
- b. Installation

---

INITIAL SETUP

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Navigation Lights off.

Materials/Parts

Bulb  
P/N 904-00003  
Bulb  
P/N 904-00006  
Lens Housing  
P/N 33506  
Lens Housing  
P/N 33501, 33502, 33504, 33505  
Locking Ring  
P/N 8-3514-011

General Safety Instructions

Energized electrical equipment is dangerous. Never work on energized equipment unless authorized to do so by responsible authority.

**3-4 REPLACE NAVIGATION LIGHT BULB AND LENS HOUSING (Continued).**

**REMOVAL**

1. REMOVE LENS HOUSING AND BULB FROM MASTHEAD/PORT/STERN/STARBOARD LIGHT

**WARNING**

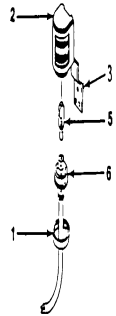
**De-energize all navigation lights at the control and distribution panel in the pilothouse. Energized circuits during replacement may result in injury or damage to personnel and equipment.**

- a. Remove retainer (1) from lens housing (2) Lens housing (2) will remain attached to mounting bracket (3)

**NOTE**

**Do not remove lens housing unless replacement is necessary.**

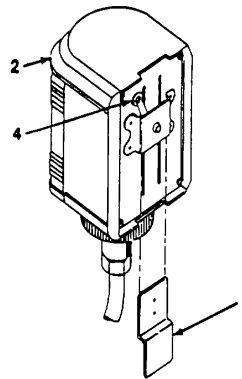
- b. Remove bulb (5) from bulb holder (6).



**INSTALLATION**

1. INSTALL LENS HOUSING AND BULB IN MASTHEAD/PORT/STERN/STARBOARD LIGHT

- a. Install new bulb (5) in bulb holder (6).
- b. Install retainer (1) and bulb holder (6) to lens housing (2).
- c. Install new lens housing (2) on bracket (3).
- d. Throw lever (4) on rear of lens housing (2) In direction to tighten the fixture.





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**3-4 REPLACE NAVIGATION LIGHT BULB AND LENS HOUSING (Continued).**

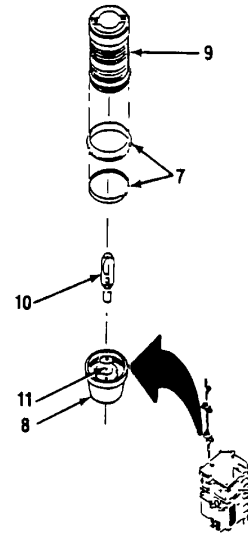
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**REMOVAL**

1. REMOVE LENS HOUSING AND BULB IN ANCHOR/NOT-UNDER-COMMAND LIGHT:
  - a. Unlock locking ring assembly (7) from base (8).
  - b. Remove lens housing (9) from base (8) Do not lose locking ring assembly (7).
  - c. Remove bulb (10) from bulb holder (11)

**INSTALLATION**

1. INSTALL LENS HOUSING AND BULB IN ANCHOR/NOT-UNDER-COMMAND LIGHT
  - a. Install new bulb (10) in bulb holder.
  - b. With the locking ring assembly (7) in position, install lens housing (9).
  - c. Secure new lens housing (9) in base (8).
  - d. Secure locking ring assembly (7).



**MAINTENANCE OF ALTERNATOR**  
**3-5 FUNCTIONAL TEST OF ALTERNATOR**

---

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rall  
 and Marine  
 5 180-00-629-9783  
 Multimeter (TS-352B/U or equiv)  
 6625-00-553-0142  
 Multimeter Jumper leads 2, 4, 6, and 10  
 feet in length with alligator clips  
 Tester, Battery  
 6630-00-171-5126

General Safety Instructions:

Do NOT under any circumstances, short FIELD  
 terminal of alternator to ground.  
 Do NOT disconnect voltage regulator while alter-  
 nator is operating.  
 Do NOT disconnect alternator output lead from  
 alternator while the alternator is operating

Equipment Conditions

Refer to NOTES in procedure.

Do NOT remove alternator without first discon-  
 necting the negative battery cable from the bat-  
 tery.

---

**NOTE**

- o Before actual in-vessel testing begins, check the battery to be sure it is fully charged (Normal 1.260 - 1.285 Sp. Gr.), if not, charge the battery first.
- o Check that wires and cables are free of corrosion.
- o The alternator drive belt must be properly adjusted, in good condition, and free of grease or oils that may induce slipping under load.

**1. SETUP MULTIMETER**

- a. Hold multimeter in hand. Switch to 0-40 volts dc range
- b. Connect negative multimeter lead to negative battery terminal.

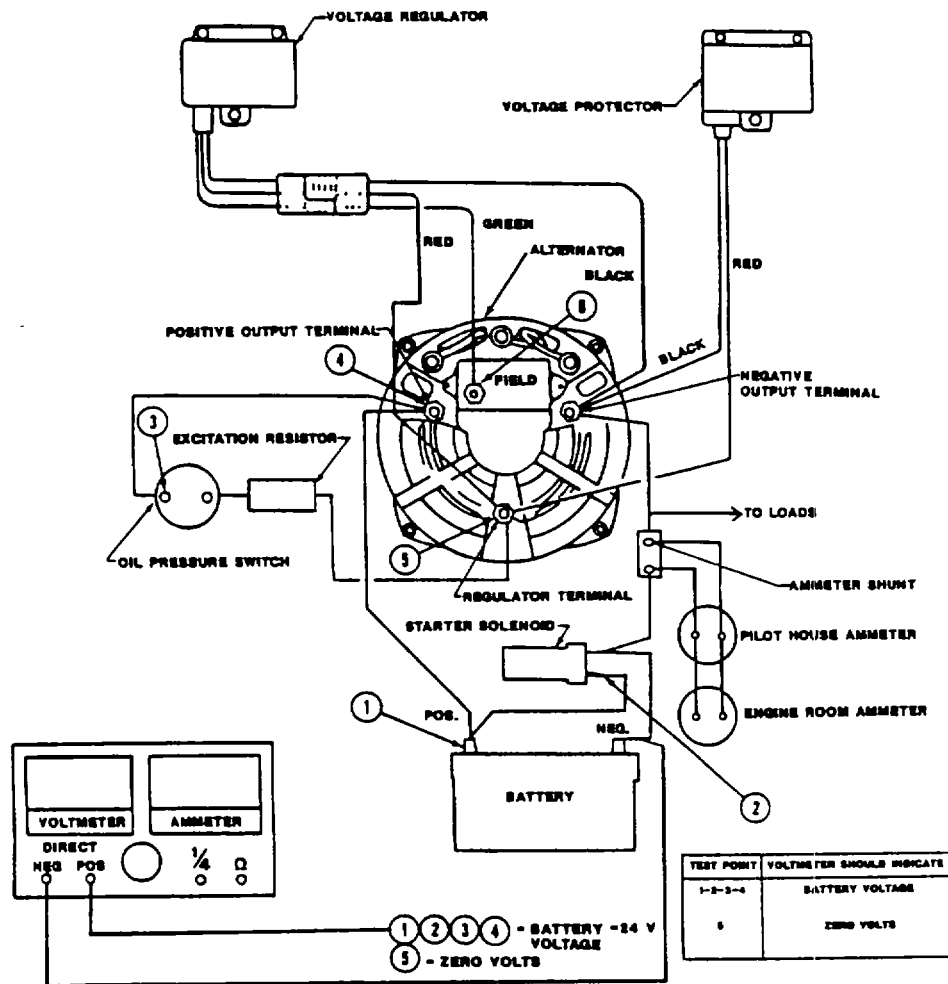
**2. BATTERY VOLTAGE AND SHORTED POSITIVE DIODE TEST**

**NOTE**

The engine should not be running when performing this test.

**3-5 FUNCTIONAL TEST OF ALTERNATOR (Continued).**

- a. Test points 1, 2, 3, and 4 using multimeter positive lead; all test points should read battery voltage.
- b. Test point 5 should read zero. If any voltage is noted, go to step c.
- c. Remove one lead from excitation resistor and repeat step b, above. A voltage reading other than zero indicates a shorted positive rectifier diode. Repair as necessary (refer to para. 6-5).



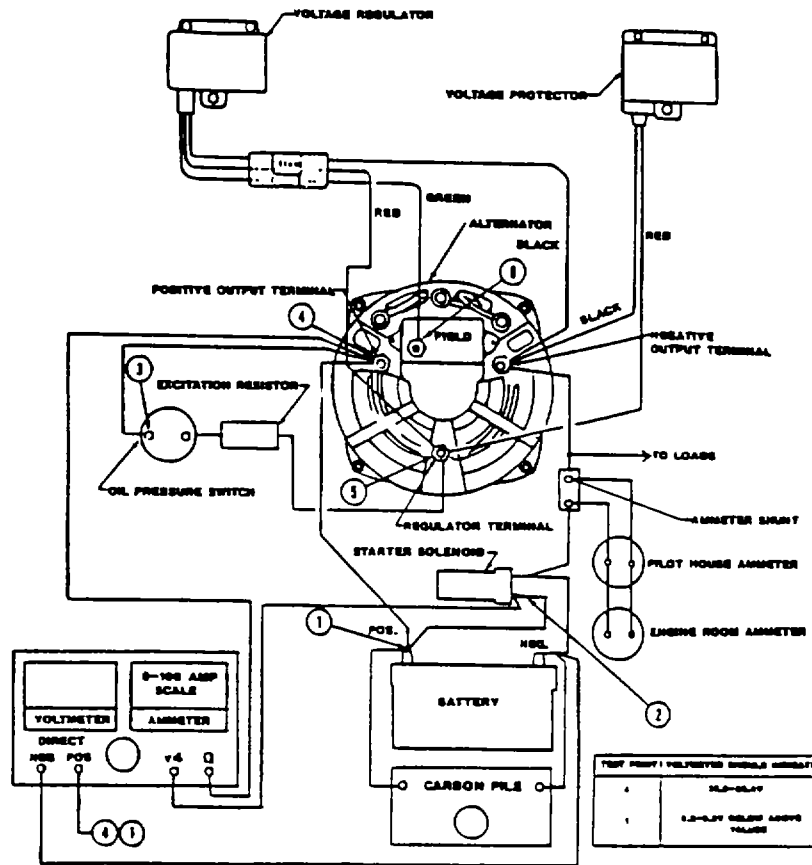
**3-5 FUNCTIONAL TEST OF ALTERNATOR (Continued).**

**3. ALTERNATOR BRUSH AND FIELD ASSEMBLY TEST**

**NOTE**

The engine should be running when performing this test.

- a Place ammeter on 100 ampere scale
- b Connect ammeter leads across test point 1 and 4 Disconnect field wire from test point 6 and place temporary jumper between test point 5 and 6 If ammeter indicates maximum rated amperage, the regulator is defective If ammeter indicates less than maximum rated amperage, the alternator, brushes, or field assembly is defective (refer to para 4- 12 and retest)



---

**3-5 FUNCTIONAL TEST OF ALTERNATOR (Continued).**

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4. ALTERNATOR OUTPUT TEST. This paragraph is deleted

**MAINTENANCE OF SANITATION SYSTEM**

**3-6 INSPECT SANITATION SYSTEM.**

**INITIAL SETUP**

Tools:

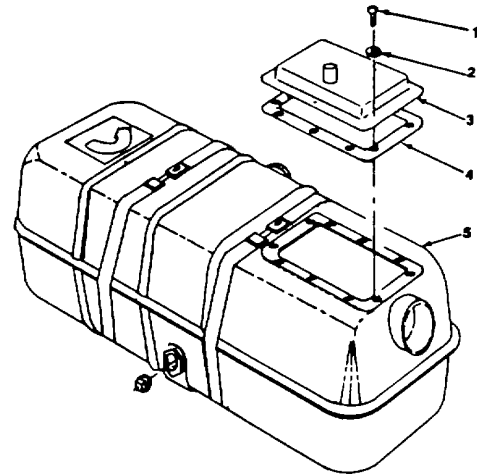
Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

De-energize sanitation system  
rotary switch.

**1. INSPECT RECEIVING AND TREATMENT TANKS.**

- a. Remove ten screws (1) and washers (2) from hatch cover (3)
- b. Remove hatch cover (3) and gasket (4) from receiving tank (5)
- c. Inspect gasket (4) for tear and wear. Get a new gasket if necessary
- d. Inspect the interior of the receiving tank (5) for clogging.

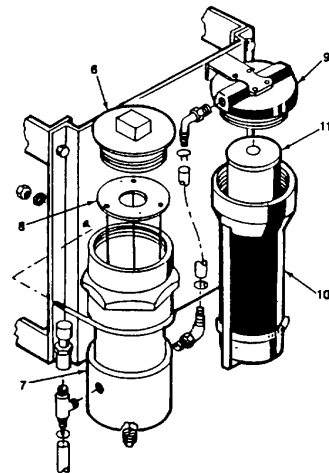


**NOTE**

**Inspection procedures for treatment tank are similar to the above.**

**2. INSPECT DISINFECTATION UNIT.**

- a. Remove cap (6) from disinfection unit (7).
- b. Check cage (8) to see if unit needs a supply of disinfection tablets. (Keep disinfection unit (7) a minimum of one half full).



**3-6 INSPECT SANITATION SYSTEM (Continued).****3. INSPECT FILTER ELEMENT.**

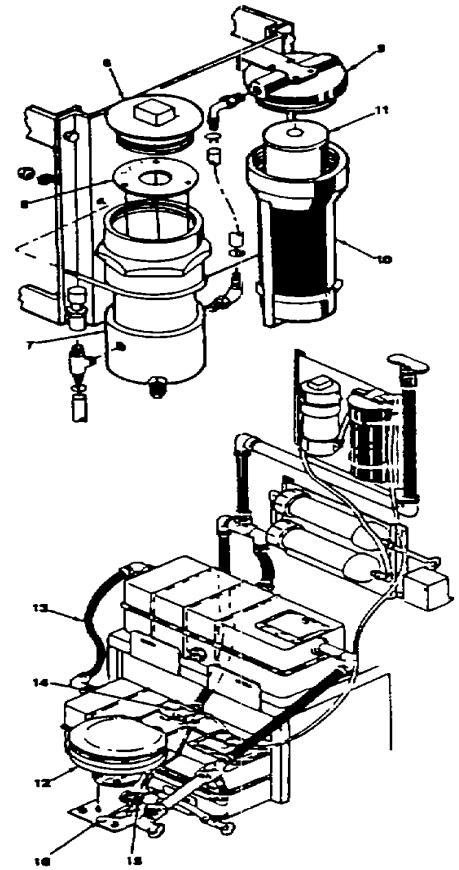
- a. Remove cap (9) from filter (10), remove filter element (11).
- b. Inspect filter element (11) for clogging. Check to see if filter element (11) needs to be replaced or cleaned and re-used.

**4 INSPECT THE HEAD, PIPING AND HOSES**

- a. Inspect the marine head (12) and hoses (13) for blockage and leakage
- b. Inspect hoses for leakage, and hose clamps for tightness.
- c. Inspect pipe joints for leakage and loose connections.
- d. Inspect pump (14) for leakage.
- e. Check marine head pump handle (15) and foot pedal (16) for ease of operation.

**NOTE**

**FOLLOW-ON MAINTENANCE:**  
Service sanitation system (para. 3-7).



---

### 3-7 SERVICE SANITATION SYSTEM.

---

#### INITIAL SETUP

##### Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Water Hose

##### Materials/Parts

Filter Element  
P/N 31749  
Gasket  
P/N 31740  
Sani-Start Activator  
Item 16, Appendix E  
Disinfection Tablets  
Item 15, Appendix E

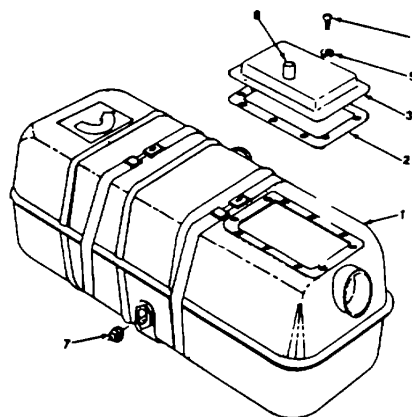
##### Equipment Conditions

Reference  
Para. 3-6. Hatch covers removed  
from receiving and treatment tanks,  
filter cap and disinfection unit  
cap removed.

---

#### CLEAN RECEIVING AND TREATMENT TANKS

- a. Remove clogging material from the interior of the receiving tank (1).
- b. Install gasket (2) and hatch cover (3) on receiving tank (1), and secure with screws (4) and washers (5).
- c. Attach a water hose to rinse fitting (6) on hatch cover (3).
- d. Open drain plug (7) and rinse the receiving tank (1) thoroughly to remove sludge.
- e. Remove water hose from rinse fitting (6) and install drain plug (7).
- f. Clean exterior of receiving tank (1).



#### NOTE

Cleaning procedures for treatment tank are similar to the above.



**3-7 SERVICE SANITATION SYSTEM (Continued).**

**REPLENISH DISINFECTION UNIT.**

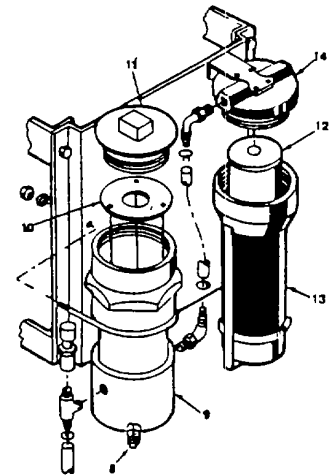
- a. Remove drain plug (8) and drain disinfection unit (9). Re-install drain plug.

**NOTE**

**Under full loading (8 people), a full (7 tablets) disinfection unit will provide 21 days service.**

- b. Lift cage (10) out of disinfection unit Insert tablets by slightly springing the vertical rods outward and inserting the tablets
- c. Insert cage (10) in disinfection unit (9).
- d. Install cap (11) on disinfection unit (9).

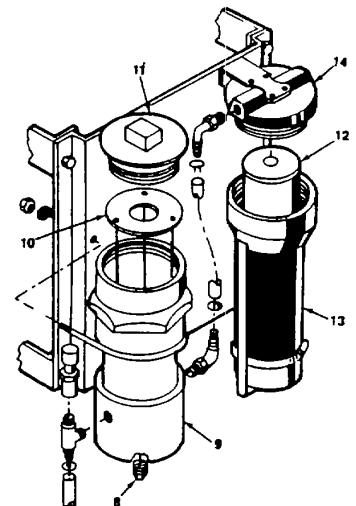
**CLEAN FILTER ELEMENT**



**NOTE**

**Under maximum usage, the filter should be cleaned or replaced after processing 400 gallons of sewage.**

- a. Rinse the filter element (12); clean and re-use several times before replacement.
- b. Install filter element (12) in filter (13), install cap (14).



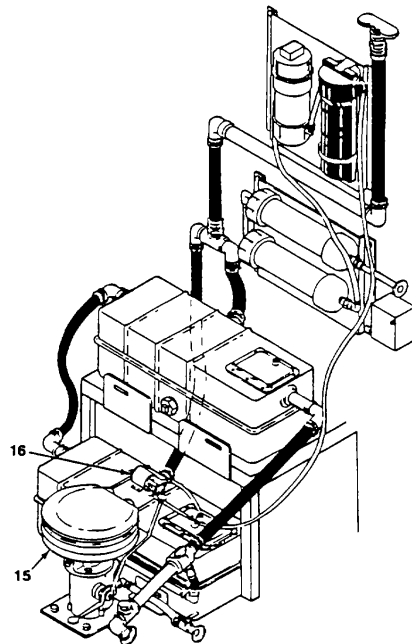
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**3-7 SERVICE SANITATION SYSTEM (Continued).**

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**SERVICE THE HEAD, PIPING AND HOSES**

- a. Loosen hose clamps and remove hose sections. Remove clogging materials
- b. Install hoses and tighten hose clamps and pipe joints
- c. Add 5 ounces of Sani-Start activator through the marine head (15) by flushing. Check operator PMCS for frequency of addition.
- d. Clean pump-motor (16) assembly



**MAINTENANCE OF RAMP SYSTEM**

**3-8 INSPECT RAMP SYSTEM RESERVOIR, STRAINERS AND FILTERS.**

**INITIAL SETUP**

Tools.

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

General Safety Instructions:

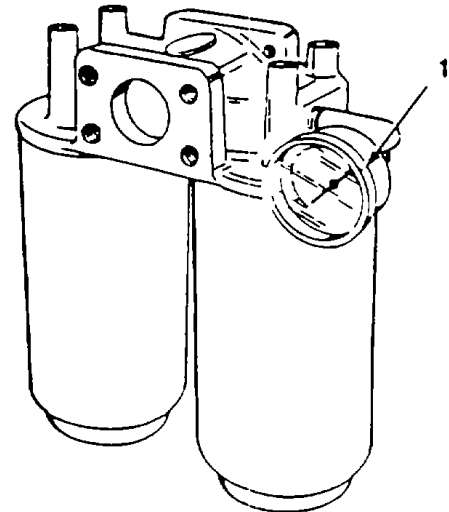
Observe warning stenciled on  
Ramp/Starting System reservoir

Equipment Conditions:

Engine running, ramp  
pump In operation.

**1. INSPECT FILTER INDICATOR**

- a. With ramp pump in operation, check ramp return filter indicator (I) The maximum allowable pressure drop across the filters is 15 psi (Excessive pressure drop across the filters could indicate dirty oil condition)
- b. Shut down LCM-8 prior to inspection of reservoir and strainers

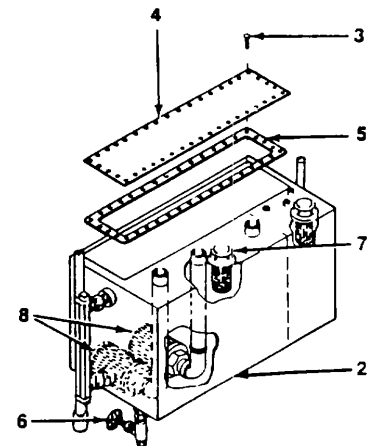


**2. INSPECT RESERVOIR AND STRAINERS**

**WARNING**

**The engine should not be running when performing this inspection. Injury to personnel may result.**

- a. Visually inspect the exterior of the reservoir (2) for leaks.
- b. Clean tank top with a clean lint-free cloth
- c. With the engine and all systems shut down, remove thirty-two capscrews (3), remove tank inspection cover (4) and gasket (5). Inspect gasket (5) for breaks or any defects Get a new gasket If necessary

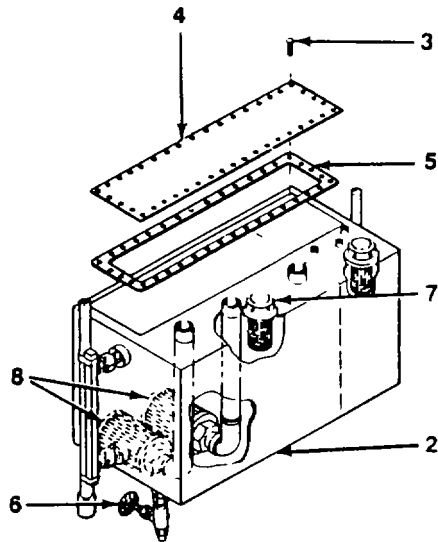


**3-8 INSPECT RAMP SYSTEM RESERVOIR, STRAINERS AND FILTERS (Continued).**

- d. Check for dirt inside reservoir (2) scum on tank sides and oil surface, and sludge on tank bottom.
- e. If oil is found to be dirty, open drain valve (6) and drain into suitable container. Inspect reservoir for corrosion and other defects.
- f. Remove filler/breather-filter (7) and inspect the wire mesh screen for clogging and other defects.
- g. Remove and inspect strainers (8) for clogging and any defects.
- h. Get new strainers (8) if there is extensive damage.

**NOTE**

**FOLLOW-ON MAINTENANCE:** Service filters, strainers and reservoir (para. 3-9).



**MAINTENANCE OF RAMP SYSTEM**

---

**3-9 SERVICE RAMP SYSTEM RESERVOIR, STRAINERS AND FILTERS.**

---

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rall  
and Marine  
5180-00-629-9783  
reservoir.

Equipment Conditions:

Reference  
Para. 3-8. Reservoir inspection  
cover and strainers removed from

Materials/Parts:

Cleaning Solvent  
Item 17, Appendix E  
Filter Element  
P/N 3293-001  
Center Post Gasket  
P/N 1575-001  
Filter Element Seal  
P/N 3274-001  
Housing Seal 'O' Ring  
P/N 1576-001  
Hydraulic Oil  
Item 12, Appendix E  
Flushing Compound  
Item 13, Appendix E

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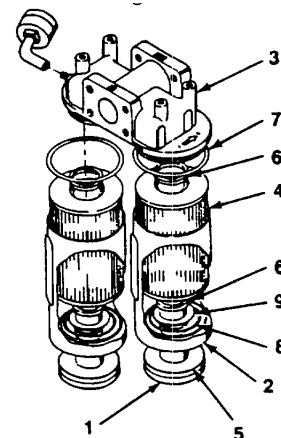
**SERVICE**

1. REMOVE 10 MICRON PAPER FILTER ELEMENTS

**NOTE**

**Have a container ready to catch oil from the filter head casting.**

- a. Loosen center post (1). Remove center post (1) and filter housing (2) together from the filter head (3).
- b. Remove and discard filter element (4), center post gasket (5), two filter element seals (6), housing seal 'O' ring (7), conical spring (8) and backup washer (9).



---

**3-9 SERVICE RAMP SYSTEM RESERVOIR, STRAINERS AND FILTERS (Continued).**


---

**2. CLEAN FILTER HOUSING****WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 1000 - 1380F (38° - 59°C).

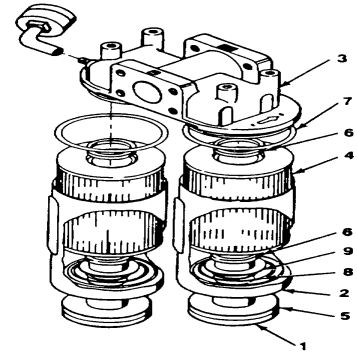
- a. Discard any oil from filter housing (2)
- b. Clean filter housing (2), conical spring (8), backup washer (9), and center post (1) in solvent

**3. INSPECT SPRING AND WASHER.**

- a. Inspect conical spring (8) for bends and loss of tension. Inspect backup washer (9) for wear and tear.
- b. Get new conical spring (8) and backup washer (9) if above conditions are found.

**4. ASSEMBLE AND INSTALL FILTER.**

- a. Assemble new center post gasket (5) and filter housing (2) on center post (1).
- b. Install conical spring (8), backup washer (9), and new filter element seal (6), in filter housing (2).
- c. Install new filter element (4), new filter element seal (6) and housing seal 'O' ring (7).
- d. Fill filter housing with clean hydraulic oil MIL-L-17672 to displace air.
- e. Install the filter assembly onto the filler head (3).



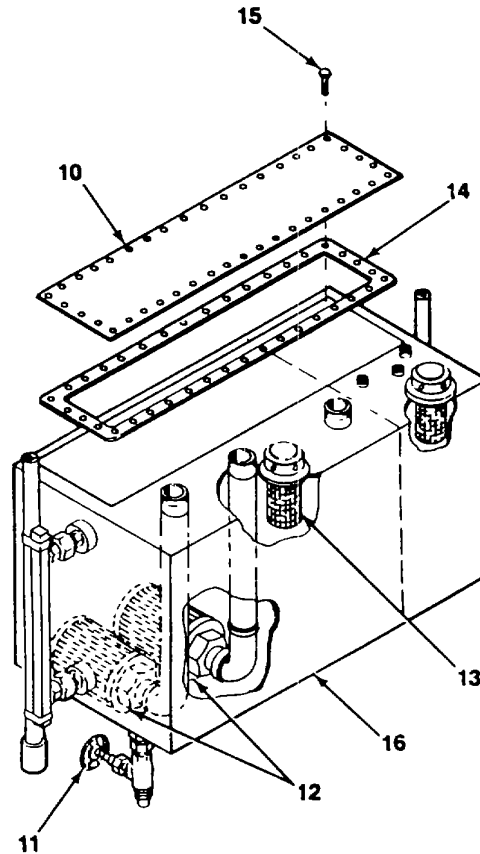
**3-9 SERVICE RAMP SYSTEM RESERVOIR, STRAINERS AND FILTERS (Continued).**

**5. CLEAN RESERVOIR AND STRAINERS**

- a. Clean tank Inspection cover (10) with a scraper
- b. Close drain valve (11), temporarily install cover (10) and use flushing compound No 8509 (Spec AF-3595) to flush the reservoir.
- c. Drain flushing compound, remove tank inspection cover (10) and let dry for one hour
- d. Clean suction strainers (12) with wire brush.
- e. Clean the wire mesh screen on the filler/breather-filter (13).

**6. INSTALL STRAINERS, RESERVOIR INSPECTION COVER AND FILLER/BREATHER-FILTER**

- a. Install cleaned suction strainers or replacement strainers in reservoir (12).
- b. Install filler/breather-filter (13).
- c. Install gasket (14) if in good condition or Install a replacement gasket.
- d. Install tank inspection cover (10) and secure with capscrews (15).
- e. Close drain valve (11) and fill ramp reservoir (16) with hydraulic oil MIL-L-17672.



**MAINTENANCE OF STEERING SYSTEM**

**3-10 INSPECT STEERING SYSTEM RESERVOIR, STRAINERS AND FILTERS.**

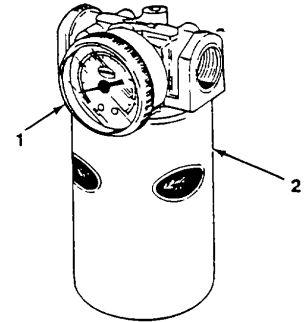
**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rall  
and Marine  
5180-00-629-9783

Equipment Conditions:

Reference  
Engine running, steering pump In operation.



**1. INSPECT FILTER INDICATOR**

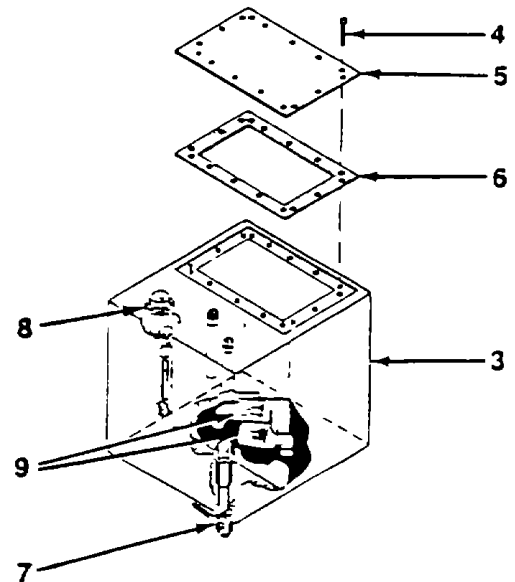
- a. With steering system in operation, check indicator (1) on return filter (2). The maximum allowable pressure drop across the filters is 15 psi. Excessive pressure drop across the filter could indicate dirty oil condition.
- b. Shut down LCM-8 prior to inspection of reservoir and strainers.

**2. INSPECT RESERVOIR AND STRAINERS.**

**WARNING**

**The engine should not be running when performing this inspection. Injury to personnel may result.**

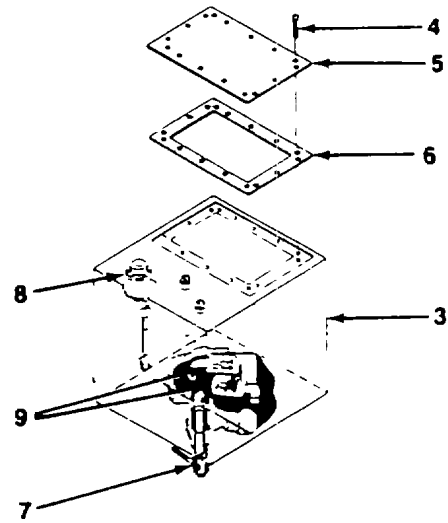
- a. Visually inspect the exterior of the steering reservoir (3) for leaks
- b. Clean reservoir top with a clean lint-free cloth
- c. With engine and all systems shut- down, remove sixteen capscrews (4), remove tank inspection cover (5) and gasket (6) Inspect gasket (6) for damage Get a new gasket if necessary.





**3-10 INSPECT STEERING SYSTEM RESERVOIR, STRAINERS AND FILTERS (Continued).**

- d. Check for dirt inside tank, scum on tank sides and oil surface, and sludge on tank bottom.
- e. If oil is found to be dirty, open tank drain valve (7) and drain into suitable container. Inspect tank for corrosion and other defects.
- f. Remove filler/breather-filter (8) and inspect wire mesh screen for clogging and other defects.
- g. Remove and inspect strainers (9) for clogging and any defects.
- h. Get new strainers (9) if there is extensive damage.

**NOTE**

**FOLLOW ON MAINTENANCE: Service filters, strainers and reservoir (para. 3-11).**

**MAINTENANCE OF STEERING SYSTEM**

**3-11 SERVICE STEERING SYSTEM RESERVOIR, STRAINERS AND FILTERS.**

**INITIAL SETUP**

Tools:-

Tool Kit, Mechanic's, Rall  
and Marine  
5180-00-629-9783

Equipment Conditions:

Reference  
Para 3-10 Reservoir  
inspection cover and  
strainers removed from  
reservoir

Materials/Parts:

Cleaning Solvent  
Item 17, Appendix E  
Hydraulic Oil  
Item 12, Appendix E  
Flushing Compound  
Item 13, Appendix E  
Filter  
P/N K-22001  
Strainer  
HA-FS-5

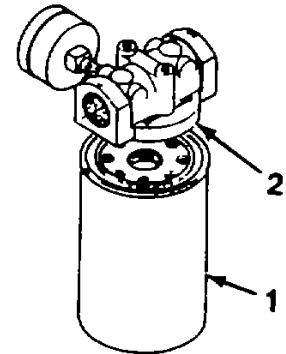
**1. REMOVE 10 MICRON PAPER  
FILTER ELEMENT**

**NOTE**

**Have a container ready to catch oil from the  
filter head casting.**

- a. Unscrew filter (1) from head (2). Discard filter.
- b. Get a new filter

**2. CLEAN FILTER HEAD.**



**WARNING**

**Dry cleaning solvent, P-D-680, used to clean parts, is  
potentially dangerous to personnel and property. Avoid  
repeated or prolonged skin contact. Do not use near  
open flame or excessive heat. Flash point of solvent is  
1000 ° 1380F (38° -59°C):**

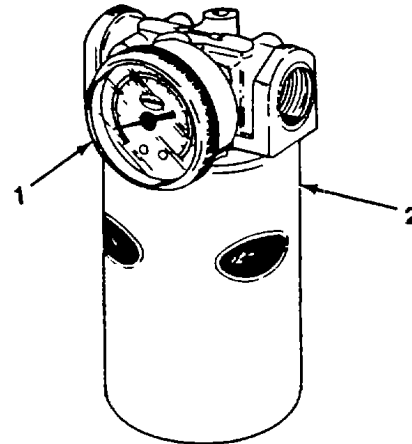
Clean the filter head (2) with a  
lint-free cloth dampened with  
cleaning solvent

**3-11 SERVICE STEERING SYSTEM RESERVOIR, STRAINERS AND FILTERS (Continued).****3. INSTALL FILTER**

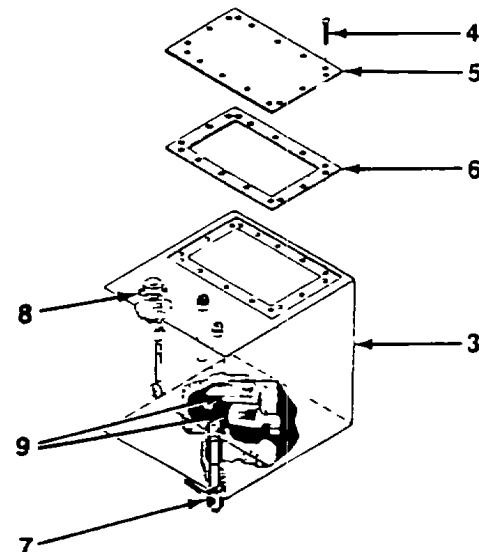
- a. Fill filter (1) with clean hydraulic oil MIL-L-17672 to displace air.
- b. Install filter (1) onto the head casting (2).

**4. CLEAN RESERVOIR AND STRAINERS**

- a. Clean tank inspection cover (5) with a scraper.
- b. Close drain valve (7), temporarily install cover (5) and use flushing compound No 8509 (Spec AF-3595) to flush the tank (3).
- c. Drain flushing compound, remove tank inspection cover (5) and let dry for one hour.
- d. Clean suction strainers (9) with wire brush.
- e. Clean the wire mesh screen on the filler/breather-filter (8).

**5. INSTALL STRAINERS, RESERVOIR INSPECTION COVER AND FILLER/BREATHER-FILTER.**

- a. Install cleaned strainers (9) or replacement strainers in the tank (3).
- b. Install filler/breather-filter (8).
- c. Install gasket (6) if in good condition or install a replacement gasket.
- d. Install tank inspection cover (5) and secure with capscrews (4).
- e. Close drain valve (7) and fill steering reservoir (3) with hydraulic oil MIL-L-17672.



**MAINTENANCE OF SEA WATER SYSTEM**

---

**3-12 SERVICE SEA WATER STRAINERS.**

---

**INITIAL SETUP**

**Tools:**

Tool Kit, Mechanic's, Rall  
and Marine  
5180-00-629-9783

**Equipment Conditions:**

Engine shut down.

**Materials/Parts.**

Screen  
P/N HD99A  
Gasket  
P/N 10

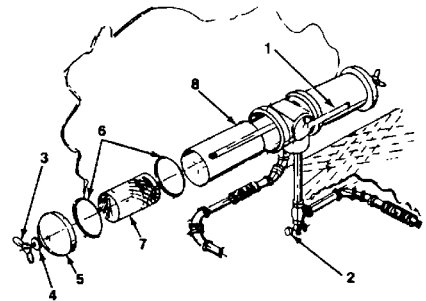
---

**REMOVE AND CLEAN STRAINER**

**CAUTION**

**Failure to properly maintain strainers may restrict water flow, causing the fuel and exhaust systems to overheat and the bilge pumps to lose prime.**

- a. Set strainer handle (1) towards strainer In use and away from strainer to be cleaned. Open draincock (2) to drain strainers.
- b. Remove wing nut (3), washer (4), end cap (5) and gasket (6) from strainer not in use.
- c. Remove screen (7) and cylinder (8) and clean. Use a wire brush to dislodge particles from screen (7) or replace with a new one.
- d. Reassemble strainer parts as shown.
- e. Set handle (1) in direction of cleaned strainer and repeat steps b through d for other strainer.



**MAINTENANCE OF STARTING SYSTEM**

**3-13 SERVICE STARTING SYSTEM RESERVOIR AND FILTERS.**

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down

Materials/Parts:

Hydraulic Fluid  
Item 24, Appendix E  
Cleaning Solvent  
Item 17, Appendix E  
Filter Element  
P/N FE 200575  
'O' Ring  
P/N GA 100201

General Safety Instructions

Observe warning stenciled on ramp/  
starting system reservoir

**NOTE**

**Maintenance Instructions for starting system reservoir are similar to that of the ramp system reservoir (para. 3-9).**

**1. REMOVE 40 MICRON T-TYPE FILTER HOUSING**

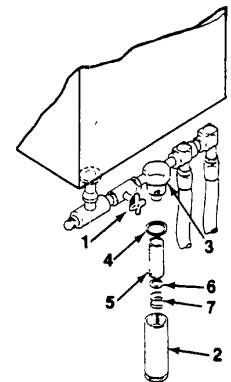
**WARNING**

**The starting system is a high pressure hydraulic system. Relieve pressure in system by opening the accumulator blowdown valve before servicing. Failure to comply may result in injury to personnel.**

**NOTE**

**Have a container ready to catch oil from the filter.**

- a Close suction line shutoff valve (1).
- b Unscrew filter housing (2) from filter cap (3).
- c Remove gasket (4), filter element (5), seat guide (6) and spring (7) from filter housing.



**3-13 SERVICE STARTING SYSTEM RESERVOIR AND FILTERS (Continued).**

2. CLEAN FILTER

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38°-59° C).

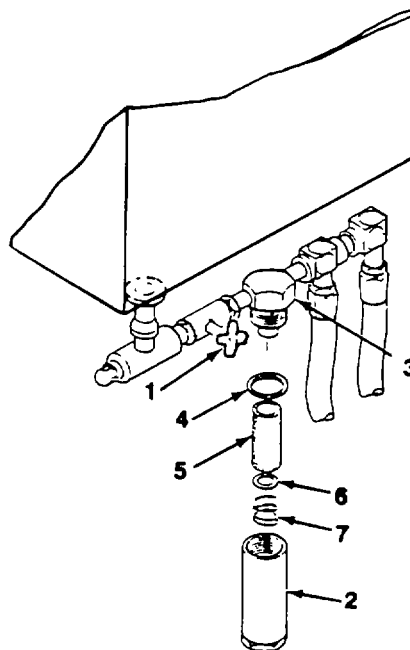
Clean gasket (4), filter element (5), seat guide (6), spring (7) and filter housing (2).

3. INSPECT FILTER ELEMENT AND GASKET.

- a. Visually inspect filter element (5) and gasket (4) for any defects.
- b. Get new filter element and gasket if necessary; reuse if in good condition.

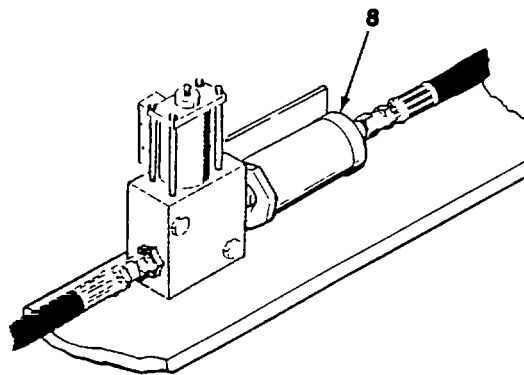
4. ASSEMBLE AND INSTALL FILTER.

- a. Assemble spring (7), seat guide (6), filter element (5) and gasket (4) in filter housing (2).
- b. Fill filter housing (2) with clean hydraulic fluid MIL-H-5606 to displace air.
- c. Install filter assembly onto filter cap (3).



5. SERVICE 40 MICRON IN-LINE FILTER.

Service the in-line filter (8) using the procedures outlined above. Refer to para 5-46 for removal procedure.



**MAINTENANCE OF FUEL SYSTEM**

**3-14 SERVICE FUEL STRAINER.**

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions

Engine shut down

**CLEAN FUEL STRAINER**

**NOTE**

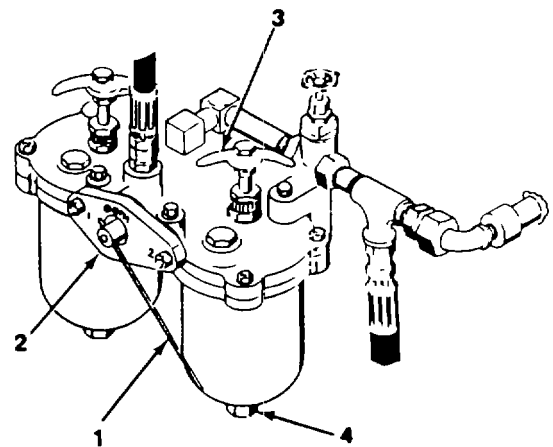
**Clean the filter elements after every 500 hours of operation.**

- a. To clean filter element number 2, set control valve pointer (1) so that it is over indicated number 1 on the valve gland (2). This shows that element number 2 is shut off.
- b. Turn cleaning handle (3) on top of element number 2 one or more complete revolutions (clockwise).
- c. Remove drain plug (4) and drain side of strainer body into suitable container. Replace drain plug (4).

**NOTE**

**Step d is to be used when it is imperative to clean the strainers while underway.**

- d. Set control valve pointer (1) at arrow marked **BOTH** on valve gland (2). This will permit strainer body on number 2 element side to fill while number 1 element side is still operating so that at no time will there be any stoppage of oil flow to the engine.
- e. Set control valve pointer (1) so that it is over indicated number 2 on valve gland (2) and repeat steps b, c, and d to clean element number 1.



## MAINTENANCE OF FUEL SYSTEM

### 3-15 REPLACE FUEL STRAINER.

This task covers:                      a. Removal                      b. Installation

#### INITIAL SETUP

##### Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

##### Equipment Conditions:

Engine shut down

##### Materials/Parts:

Fuel Strainer  
113JJ18-3

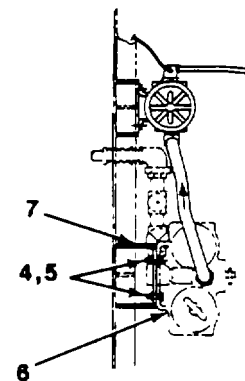
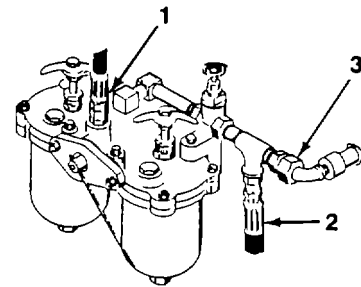
##### General Safety Instructions:

Ensure that the fuel suction valve in lazarette is closed before replacing the strainers. Failure to comply may result in flooding the engine room with fuel oil and damage to equipment.

#### REMOVAL

1. REMOVE HOSE AND PIPING CONNECTION.
  - a. With engine shut down, close fuel suction valve in lazarette.
  - b. Remove hose connections (1 and 2).
  - c. Remove locknut (3) from the union elbow.
2. REMOVE STRAINER FROM BULKHEAD MOUNTING PLATE.

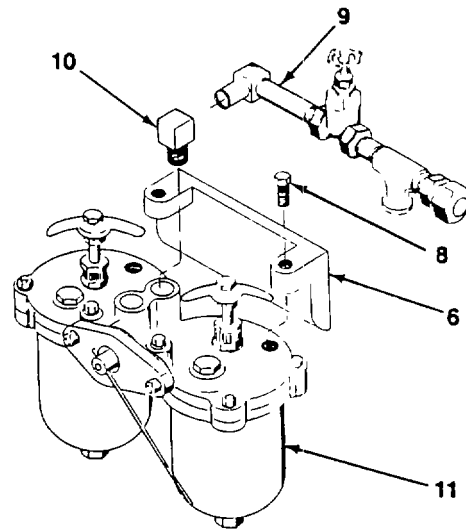
Remove two capscrews (4) and self-locking hex nuts (5) from strainer bracket (6) and bulkhead mounting plate (7).





**3-15 REPLACE FUEL STRAINER (Continued).****3. REMOVE BRACKET AND PIPING FROM STRAINER BODY.**

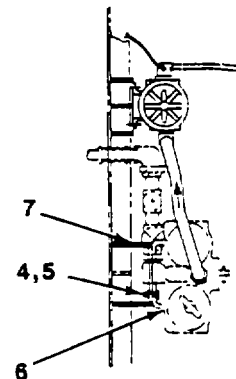
- a. Remove capscrews (8) in two places, and remove bracket (6) from strainer.
- b. Rotate pipe section (9) from adapter (10) to remove pipe section.
- c. Remove adapter (10) from strainer inlet port.
- d. Replace strainer (11).

**INSTALLATION****1. INSTALL BRACKET AND PIPING ON STRAINER BODY.**

- a. Install adapter (10) on new strainer. (11).
- b. Install pipe section (9) onto adapter (10).
- c. Install bracket (6) on strainer (11) and secure with capscrews (8).

**2. INSTALL STRAINER ON BULKHEAD MOUNTING PLATE.**

- a. Align mounting holes in strainer bracket (6) and the holes in the bulkhead mounting plate (7).
- b. Secure strainer (11) with two capscrews (4) and two self-locking hex nuts (5).



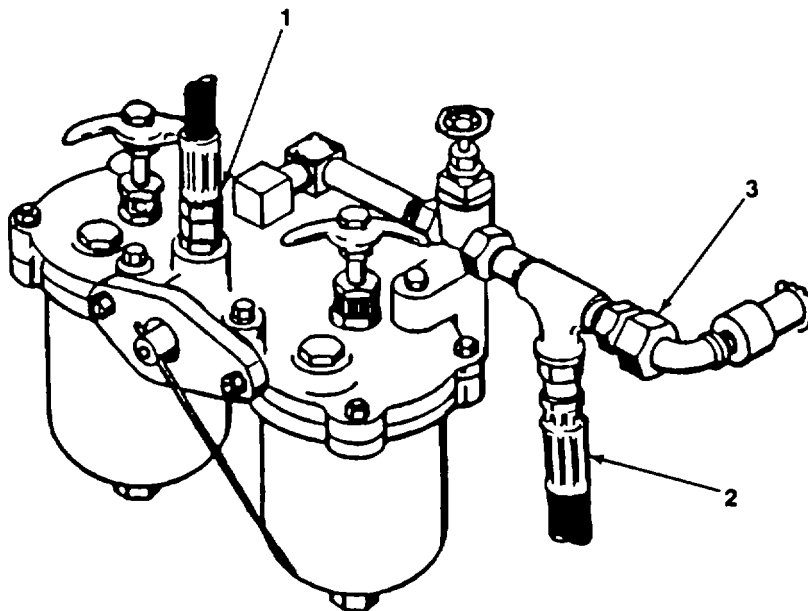
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**3-15 REPLACE FUEL STRAINER (Continued).**

---

**3. RE-CONNECT HOSES AND PIPING**

- a. Complete the piping connection by screwing the locknut (3) onto the elbow union.
- b. Re-connect hoses (1 and 2).
- c. Open fuel suction valve in lazarette.



**MAINTENANCE OF FUEL SYSTEM**

**3-16 SERVICE FUEL FILTER/WATER SEPARATOR.**

Service the fuel filter/water separator when the gauge indicates a pressure drop of 10-15 Inches of mercury (red zone) or when the bowl shows water and sediment contamination.

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Reference  
Engine shut down

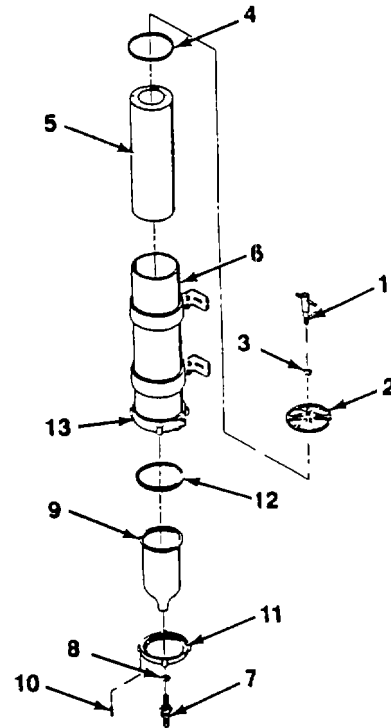
Materials/Parts:

Element  
P/N 2020 SM-30  
Gasket  
P/N 11007  
'O' Ring  
P/N 11350

**SERVICE**

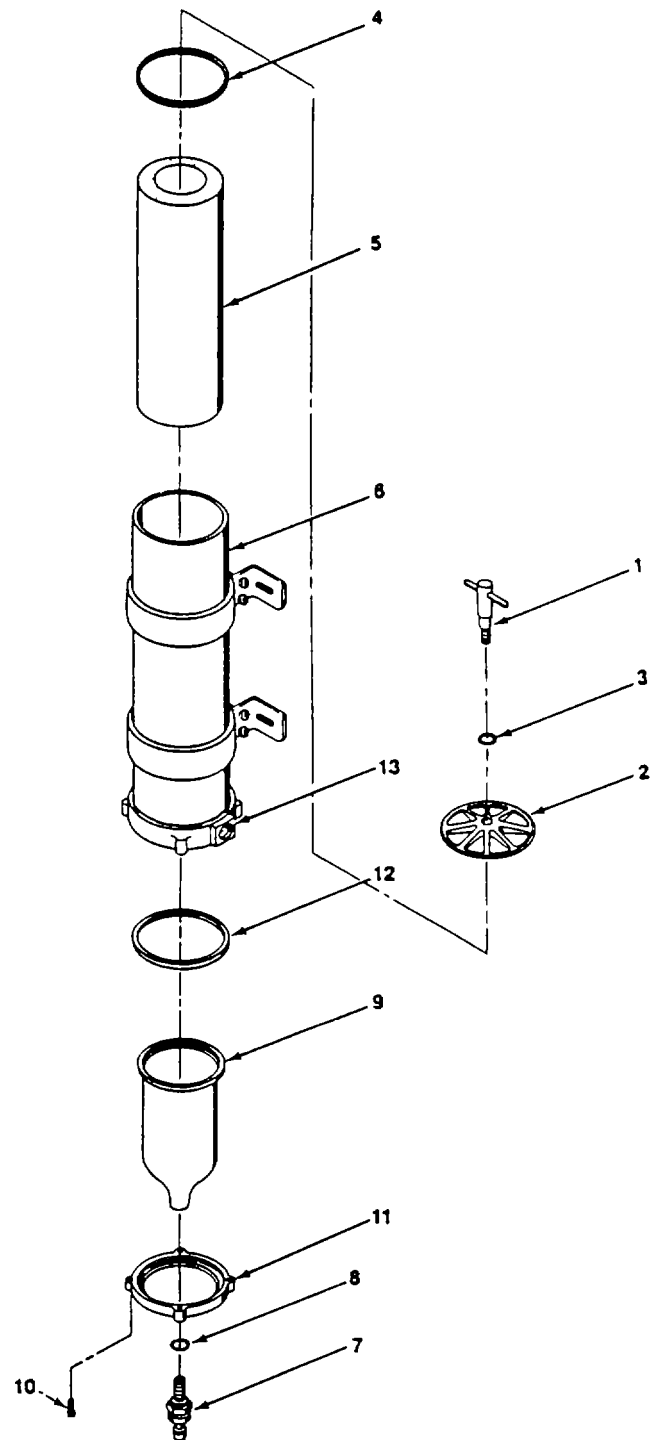
**REMOVE FILTER ELEMENT FOR CLEANING.**

- a. Ensure that engine is not running. Close fuel supply valve near fuel strainer. Drain filter unit completely.
- b. Remove 'T' handle (1) and lid (2). Inspect 'O' ring (3) and gasket (4) and replace if necessary.
- c. Remove element (5) by slowly pulling upward with a turning motion from cylinder (6).
- d. Remove drain valve (7) and 'O' ring (8). Flush with clean diesel fuel.



**3-16 SERVICE FUEL FILTER/WATER SEPARATOR (Continued).**

- e. If contamination is present in the bowl (9), remove bowl retainer screws (10) and lift retaining ring (11) and gasket (12) off over bowl.
- f. Remove bowl (9) and clean with clean diesel fuel.
- g. Replace bowl gasket (12), attach bowl (9) to base (13), put bowl retaining ring (11) over bowl (9) and tighten retainer screws (10).
- h. Replace drain valve (7) and 'O' ring (8). Insert replacement element (5) with downward turning motion.
- i. Prime the system by pouring clean diesel fuel into the unit until full.
- j. Replace gasket (4), lid (2), and 'O' ring (3), and tighten 'T' handle (1).



**MAINTENANCE OF FUEL SYSTEM**

**3-17 REPLACE FUEL FILTER/WATER SEPARATOR.**

This task covers:                      a. Removal                      b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down.

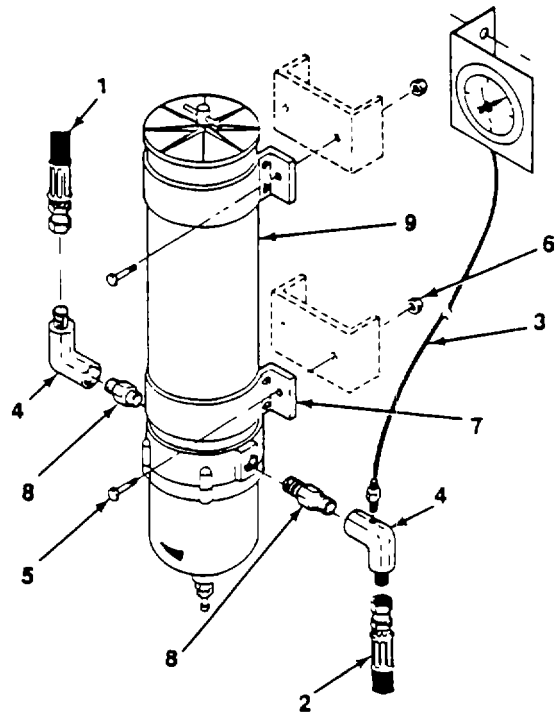
Materials/Parts:

Fuel Filter/Water Separator  
1000 FG

**REMOVAL**

**REMOVE FUEL FILTER/WATER SEPARATOR**

- a. Ensure that engine is not operating. Close fuel supply valve near fuel strainer.
- b. Remove inlet and outlet hose fittings (1 and 2). Have container ready to catch oil.
- c. Remove hose (3) for the indicator from elbow (4) on discharge side.
- d. Remove four capscrews (5) and self-locking hex nuts (6) from the bracket clamps (7).



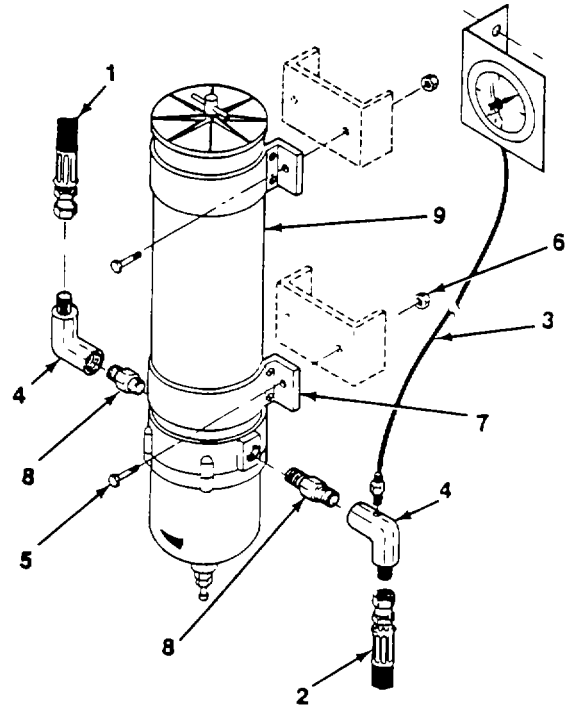
**3-17 REPLACE FUEL FILTER/WATER SEPARATOR (Continued).**

- e. Remove elbows (4) and bushings (8) from fuel filter/water separator (9).
- f. Get a new fuel filter/water separator (9).

**INSTALLATION**

**INSTALL FUEL FILTER/WATER SEPARATOR.**

- a. Install two bushings (8) in the inlet and outlet ports of the new fuel/water separator (9).
- b. Install elbows (4) into the two ports.
- c. Align mounting holes and secure bracket clamps (7) with capscrews (5) and self-locking hex nuts (6).
- d. Install Inlet and outlet hose fittings (1 and 2) onto the elbows (4).
- e. Re-connect hose (3) on elbow (4) on the discharge side.
- f. Open fuel supply valve near fuel strainer.



**MAINTENANCE OF STUFFING BOX****3-18 ADJUST STUFFING BOX.**

---

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

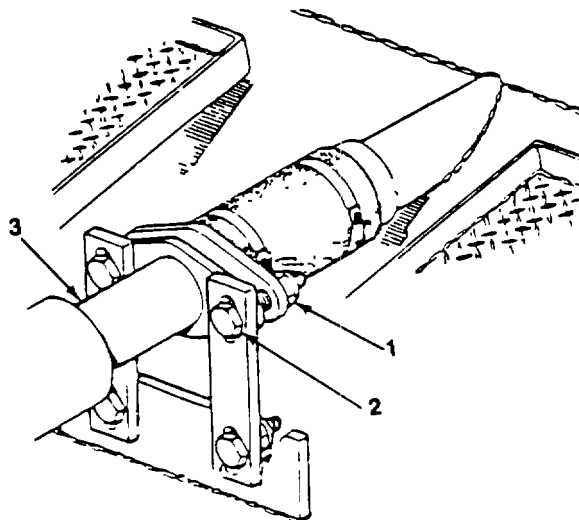
Equipment Conditions:

Engine running at idle,  
propeller turning ahead

---

**ADJUST STUFFING BOX**

- a. Adjust nuts (1) on bolts (2) alternately while the propeller shaft (3) is rotating.
- b. Tighten locknuts against adjusting nuts.
- c. Tighten nuts (1) evenly until seepage reaches a minimum.
- d. If adjustment fails to stop excessive see page, replace packing in stuffing box (refer to para 6-25).



**CHAPTER 4**  
**UNIT MAINTENANCE**

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Adjust Clutch Linkage.....	4-24
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Preventive Maintenance Checks and Services Procedures.....	4-4
Repair Control and Distribution Panel.....	4-16
Repair MSD Pump/Motor Assembly.....	4-29
Repair Parts .....	4-3
Replace Alternator.....	4-12
Replace Batteries and Cables.....	4-11
Replace Canopy.....	4-18
Replace Check Valve (Steering System) .....	4-33
Replace Electric Horn.....	4-9
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Replace Filter, Disinfection Unit and Retention Canisters .....	4-27
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CHAPTER 4

UNIT MAINTENANCE - Continued

	Paragraph
Replace Searchlight Bulb, Reflector Glass and Fixture.....	4-8
Replace Voltage Protector.....	4-15
Replace Treatment Tank .....	4-26
Replace Voltage Regulator.....	4-14
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Service of Rudder and Tiller .....	4-35
Special Tools, TMDE and Support Equipment.....	4-2
Test Batteries .....	4-10
Troubleshooting Procedures.....	4-5

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

---

**4-1 COMMON TOOLS AND EQUIPMENT.**

---

For authorized common tools and equipment, refer to the Modified Table of Organizational Equipment (MTOE) applicable to your unit.

---

**4-2 SPECIAL TOOLS, TMDE AND SUPPORT EQUIPMENT.**

---

Any special tools or equipment required by organizational maintenance personnel to perform maintenance on the landing craft is listed in Appendix B of this manual.

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**4-3 REPAIR PARTS.**

---

Repair parts are listed and illustrated in the repair parts and special tools list (TM 55-1905-222-24P) covering organizational maintenance of this equipment.

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**Section II. UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES**

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**4-4 PREVENTIVE MAINTENANCE CHECKS AND SERVICES PROCEDURES.**

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- a. Your PMCS table lists the inspections and care required to keep the LCM-8 in good operating condition.
- b. The interval column of your PMCS table tells you when to do a certain check or service.
- c. The procedure column of your PMCS table tells you how to do the required checks and services. Carefully follow these procedures. If you do not have the equipment to perform these procedures, seek assistance from the next higher maintenance level.
- d. If your equipment requires removal in order to perform PMCS, refer to chapter 4 under maintenance instructions and notify your supervisor.

Unit Preventive Maintenance Checks and Services

Item No.	Interval						Item To Be Inspected	Procedures
	W	M	Q	A	B	H		
1			●				Horn	Test horn for operation. With engines running and circuits energized, depress horn push-button momentarily and listen for sound. Replace horn if necessary (para 4-9). Ensure that is secured properly on pilothouse super-structure, tighten mounting hardware as necessary.
2						300	<u>Sanitation System</u> Motor and Pump	Clean pump and motor and secure mounting as necessary. Check to see if motor is running hot, during periods of operation.  Inspect pump impeller every 300 hours of operation by removing pump covet. Replace Impeller if necessary (para 4-29).
3			●				<u>Ramp System</u> Ramp Winch Hydraulic Motor	Inspect connections for leaks and lighten as necessary. Tighten mounting bolts as necessary.
4			●				<u>Hydraulic Steering System</u> Rudder and Tiller	Lubricate all hinge and pin assemblies Lubricate rudder post through grease filings. Check and tighten nuts and bolts as necessary.
5			●				Rudder Angle Transmitter	Inspect transmitter for proper functioning Ensure rudder moves freely through its full range of motion. Make checks while observing rudder angle indicator. Replace (para 5-39) as necessary.

Unit Preventive Maintenance Checks and Services

Item No.	Interval						Item To Be Inspected	Procedures
	W	M	Q	A	B	H		
6			●				<u>Seawater System</u> Piping	Check and tighten piping connections as necessary. Repair or replace defective piping as needed.
7		●					<u>Hydraulic Starting System</u> Accumulator	Check accumulator for minimum nitrogen pressure as per para 2-3.1. Charge accumulators with nitrogen as necessary (para 6-18).

**Section III. UNIT TROUBLESHOOTING**

---

**4-5 TROUBLESHOOTING PROCEDURES.**

---

This paragraph provides information useful in diagnosing and correcting unsatisfactory operation or failure of LCM-8 systems and equipment. Troubleshooting procedures in this manual are limited to the basic craft. Refer to TM 5-2815-231-14 for engine and transmission troubleshooting procedures. Before using the troubleshooting procedures, ensure that all applicable operating procedures have been performed.

**NOTE**

- **The table lists the common malfunctions which you may find during operation or maintenance of the equipment. You should perform tests/inspections and corrective actions in the order listed.**
- **This manual cannot list all malfunctions that may occur, nor all tests or inspections and corrective actions. If a malfunction is not listed or is not corrected by the listed corrective actions, notify your supervisor.**

**Troubleshooting**

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**NAVIGATIONAL AIDS**

1. LIGHT(S) DO NOT LIGHT UP.

Step 1. Check for blown fuses.

Replace fuses (para 4-17).

Step 2. Check to see if wiring is faulty.

Check connections at connection boxes, control and distribution panel and at lights. Secure connections.

Step 3. Check to see if fixtures or switches are defective.

Replace fixtures and switches (para 4-7 and para 4-17).

## Troubleshooting - Continued

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**NAVIGATIONAL AIDS - Continued**

## 2. HORN WILL NOT SOUND.

Step 1. Check to see if wiring connections are loose.

Tighten wiring connections.

Step 2. Check to see if push-button switch is faulty.

Replace horn switch (para 4-9).

Step 3. Check to see if horn is defective.

Replace horn (para 4-9).

## Troubleshooting - Continued

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**ELECTRICAL SYSTEM**

## 1. ALTERNATOR NOT CHARGING.

Step 1. Test to see if voltage regulator/voltage protector is defective (para 3-5).

Replace voltage regulator/voltage protector (para 4-14).

Step 2. Test to see if alternator is defective (para 3-5).

Replace alternator (para 4-12) Send defective alternator to direct support maintenance for repairs.

## 2. ALTERNATOR OUTPUT LOW OR UNSTEADY.

Step 1. Test to see if voltage regulator/voltage protector is defective (para 3-5).

Replace voltage regulator/voltage protector (para 4-12/4-14).

Step 2. Test to see if alternator brushes are loose.

Replace alternator (para. 4-12). Send defective alternator to direct support maintenance for repairs.

## Troubleshooting - Continued

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**ELECTRICAL SYSTEM - Continued**

## 3. NOISY ALTERNATOR.

Step 1. Check to see if alternator drive belts are worn or defective.

Replace alternator drive belts.

Step 2. Check to see if alternator bearings are worn.

Replace alternator (para 4-12). Send defective alternator to direct support maintenance for repair.

## 4. BATTERIES WILL NOT HOLD CHARGE.

Test to see if batteries are defective.

Replace batteries (para 4-11.)

## 5. ELECTRICAL SWITCHES FAIL TO START ENGINE.

Step 1. Check to see if batteries are dead.

Replace batteries (para 4-7).

Step 2. Check to see if wiring is defective.

Replace/repair wiring (para 4-7).

Step 3. Check to see if switches are defective.

Replace switches (para 4-7).

## 6. ENGINE ROOM/LAZARETTE/CARGO WELL LIGHTS DO NOT LIGHT UP.

Step 1. Check to see if wiring is defective.

Replace/repair wiring (para. 4-17).



**Troubleshooting - Continued**

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**ELECTRICAL SYSTEMS - Continued**

Step 2. Check to see if fixture is defective.

Check connections at connection box.

Repair connections or replace fixture (para 4-17).

Step 3. Check to see if switch is defective.

Replace switch (para 4-7/4-17).

---

**PROPULSION CONTROL SYSTEM**

**1. PROPULSION CONTROLS DO NOT AFFECT A CLUTCH OR THROTTLE CHANGE**

Step 1. Check to see if clutch or throttle cables are disconnected. Trace entire cable length from control head in pilothouse to governor or transmission control valve lever in engine room.

Re-connect cables and adjust (para 4-22/4-23).

Step 2. Check to see if control head is defective.

Replace control head (para 4-22).

Step 3. Check to see if throttle and/or clutch control unit s5 defective.

Replace throttle/clutch control unit (para 4-23).

## Troubleshooting - Continued

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**PROPULSION CONTROL SYSTEM - Continued**

2. ENGINE SHUTDOWN CONTROLS INOPERATIVE.
  - Step 1. Check to see if shutdown cable is disconnected from T-handle.  
Re-connect cables.
  - Step 2. Check to see if shutdown cable is defective.  
Replace shutdown cable (para. 4-25).

---

**STEERING SYSTEM**

1. STEERING WHEEL DIFFICULT TO TURN.
  - Step 1. Check to see if counterbalance valve is set improperly.  
Adjust counterbalance valve (para. 4-32).
  - Step 2. Check to see if check valve is stuck open.  
Replace/re-adjust check valve (para 4-31).
2. (Deleted).

## Troubleshooting - Continued

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**ENGINE COOLING SYSTEM****HIGH COOLANT TEMPERATURE.**

Inspect cooling system for dirt and scale.

Clean cooling system by flushing to remove dirt.

---

**EXHAUST SYSTEM**

1. **EXHAUST SYSTEM TOO NOISY.**
  - Check to see if mufflers are defective.
  - Replace/repair mufflers (para. 4-34).
2. **EXHAUST SYSTEM TOO HOT.**
  - Check to see if there is leakage of exhaust gas or cooling water in the exhaust system.
  - Replace/repair piping (para 4-34).

**Section IV. UNIT MAINTENANCE PROCEDURES**

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**4-6 GENERAL MAINTENANCE PROCEDURES.**

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This section contains maintenance procedures that are the responsibility of unit maintenance personnel as authorized by the Maintenance Allocation Chart (MAC).

**MAINTENANCE OF NAVIGATION LIGHTS**

---

**4-7 REPLACE NAVIGATION LIGHT FIXTURES AND SWITCHES.**

---

This task covers:                      a. Removal                      b. Installation

---

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

All power off

Materials/Parts:

Light, 3600, White w/24v Bulb  
P/N 33506-033  
Light, 3600, Red w/24v Bulb  
P/N 33506-233  
Light, Masthead w/24v Bulb  
P/N 33501-003  
Light, Port, w/24v Bulb  
P/N 33504-203  
Light, Stern w/24v Bulb  
P/N 33502-003  
Light, Starboard w/24v Bulb  
P/N 33505-103

General Safety Instructions:

Energized electrical equipment is dangerous. Never work on energized equipment unless authorized to do so by a responsible authority.

**REMOVAL**

**WARNING**

**De-energize all navigation lights at the control and distribution panel in the pilothouse. Energized circuits during replacement may result in injury or damage to personnel and equipment**

**4-7 REPLACE NAVIGATION LIGHT FIXTURES AND SWITCHES (Continued).**

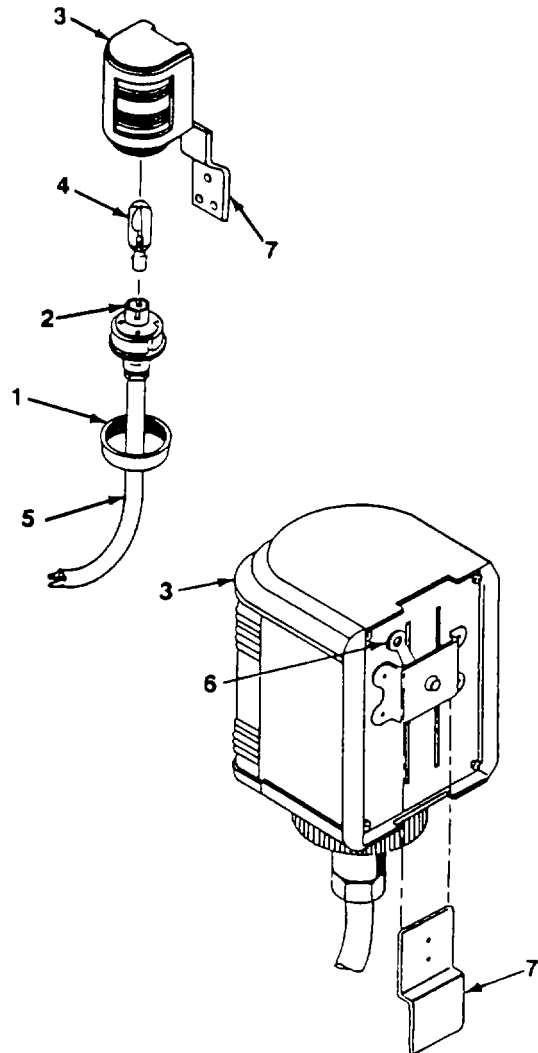
**REMOVE MASTHEAD/PORT/  
STARBOARD/STERN LIGHT FIXTURE**

- a. Remove retainer (1) and bulb holder (2) from lens housing (3). Remove bulb (4) from bulb holder (2).
- b. Remove wiring (5) from bulb holder (2).
- c. Throw lever (6) on rear of lens housing (3) in opposite direction. (This releases fixture from bracket (7)).
- d. Remove lens housing (3).

**INSTALLATION**

**INSTALL MASTHEAD/PORT/STAR-  
BOARD/STERN LIGHT FIXTURE.**

- a. Install lens housing (3) over bracket (7).
- b. Throw lever (6) in the direction to secure the housing.
- c. Install wiring (5) to bulb holder (2). Install bulb (4) in bulb holder (2).
- d. Place bulb holder (2) in lens housing (3) and secure with retainer.

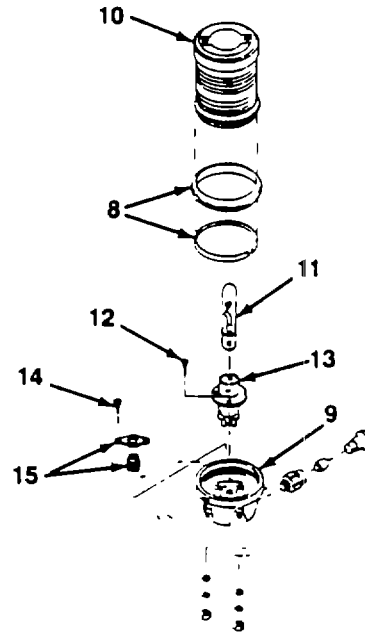


**4-7 REPLACE NAVIGATION LIGHT FIXTURES AND SWITCHES (Continued).**

**REMOVAL**

**REMOVE ANCHOR/NOT-UNDER-COMMAND LIGHT FIXTURE**

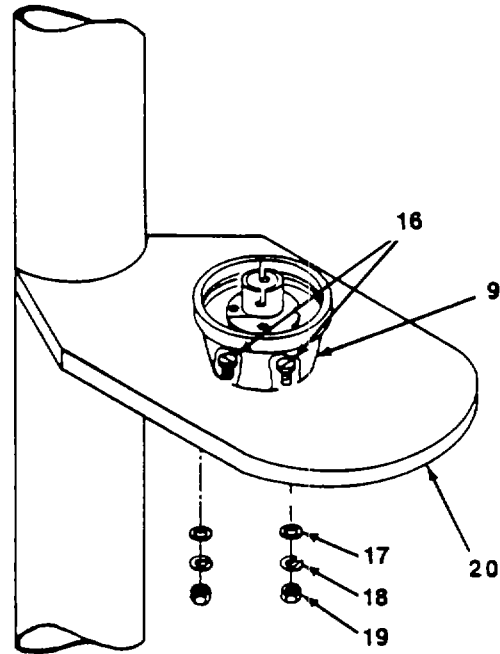
- a. Unlock locking ring assembly (8) from the base (9). Lift off lens housing (10), and locking ring assembly (8).
- b. Remove bulb (11). Remove two screws (12) securing the bulb holder (13) to the base (9).
- c. Remove wiring from bulb holder (13).
- d. Remove two screws (14) holding cable clamp assembly (15) to base (13), and remove wiring.
- e. Remove three screws (16), flat washers (17), lockwashers (18) and nuts (19) from the base (9).
- f. Remove base (9) from the support plate (20).



**INSTALLATION**

**INSTALL ANCHOR/NOT-UNDER-COMMAND LIGHT FIXTURE**

- a. Secure base (9) to support plate (20) with screws (16), flat washers (17), lockwashers (18) and nuts (19).
- b. Pull wiring through base (9) and cable assembly (15). Connect wiring to bulb holder (13) and secure cable clamp with screws (14).
- c. Install bulb holder (13) on base (9) and secure with screws (12).
- d. Install bulb (11).
- e. Install lens housing (10) and locking ring assembly (8).



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**4-7 REPLACE NAVIGATION LIGHT FIXTURES AND SWITCHES (Continued).**

---

**REMOVAL**

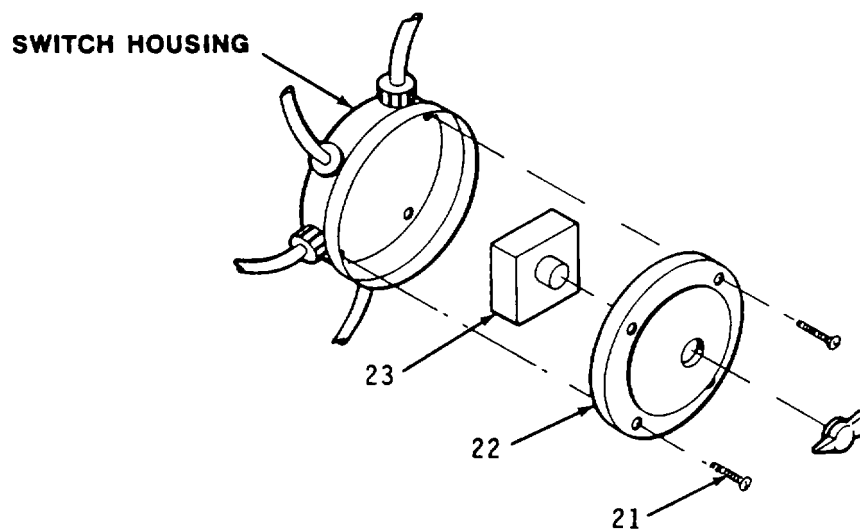
REMOVE SWITCH.

- a. Loosen screws (21) on face-plate (22) switch (23).
- b. Pull off switch face-plate (22) and disconnect wiring from switch (23).
- c. Replace switch.

**INSTALLATION**

INSTALL SWITCH.

- a. Re-connect wiring to appropriate terminal of switch (23).
- b. Mount face-plate (22) and secure with screws (21).





**MAINTENANCE OF SEARCHLIGHT**

**4-8 REPLACE SEARCHLIGHT BULB, REFLECTOR, GLASS AND FIXTURE.**

This task covers:                    a. Removal                    b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail and  
Marine  
5180-00-629-9783

Materials/Parts:

Bulb  
P/N Figure 433-3  
Lens Glass  
P/N Figure 354, Item 3

Equipment Conditions:

All power off

General Safety Instructions:

Energized searchlight is dangerous  
Never work on energized equipment  
unless authorized to do so by a  
responsible authority.

**REMOVAL**

**NOTE**

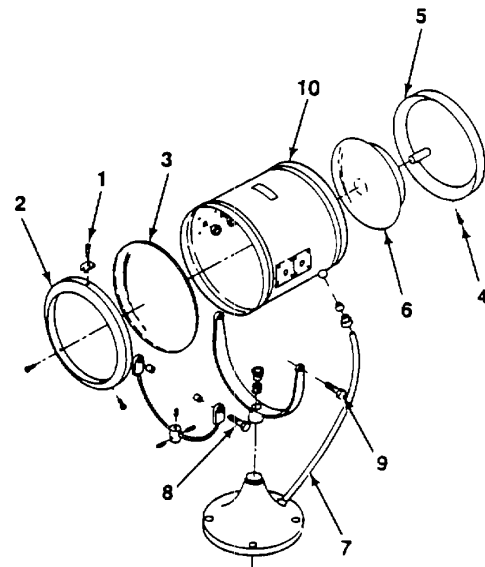
The searchlight is mounted on top pilothouse canopy.

REMOVE SEARCHLIGHT.

**WARNING**

De-energize the searchlight at the control and distribution panel in the pilothouse. Energized circuits during replacement may result in injury or damage to personnel and equipment.

- a. Loosen three screws (1), remove retaining ring (2) and lens glass (3) at front of light.
- b. Loosen three screws (4), remove retaining ring (5) and sealed beam light (6) at rear.

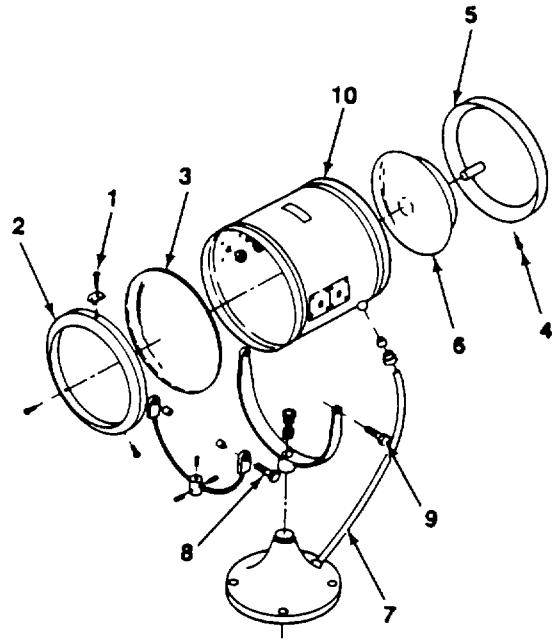


**4-8 REPLACE SEARCHLIGHT BULB, REFLECTOR, GLASS AND FIXTURE (Continued).**

- c. Disconnect power cable (7) at rear of light assembly.
- d. Remove screws (8) from the control yoke assembly.
- e. Remove screws (9) from main yoke assembly.
- f. Remove searchlight (10).

**INSTALLATION****INSTALL SEARCHLIGHT.**

- a. Install searchlight (10).
- b. Install screws (9) to main yoke assembly.
- c. Install screws (8) to control yoke assembly.
- d. Connect power cable (7) at rear of light assembly.
- e. Install sealed beam light (6), install retaining ring (5), and tighten three screws (4).
- f. Install lens glass (3), install retaining ring (2), and tighten three screws (1).



## MAINTENANCE OF ELECTRICAL HORN

### 4-9 REPLACE ELECTRIC HORN.

This task covers:                    a. Removal                    b. Installation

#### INITIAL SETUP

##### Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

##### Materials/Parts:

Horn  
P/N 1CH3D3

##### Equipment Conditions:

All power off

##### General Safety Instructions:

Energized electrical equipment is dangerous. Never work on energized equipment unless authorized to do so by a responsible authority.

#### REMOVAL

REMOVE HORN.

#### WARNING

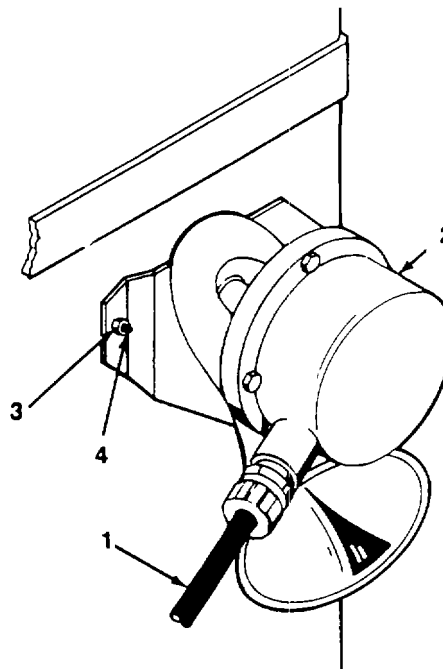
**De-energize the horn at the control and distribution panel in the pilothouse. Energized circuits during replacement may result in injury or damage to personnel and equipment.**

- a. Disconnect electrical lead (1) to horn (2).
- b. Remove three nuts (3) from studs (4) and remove horn (2).

#### INSTALLATION

INSTALL HORN

- a. Install horn (2) and secure with three nuts (3) on studs (4).
- b. Connect electrical lead (1) to horn (2).



## MAINTENANCE OF BATTERIES AND CABLES

### 4-10 TEST BATTERIES.

#### INITIAL SETUP

##### Test Equipment.

Tester, Battery GG-T-258 (Hydrometer)

##### Equipment Conditions:

##### References

Engine shut down.

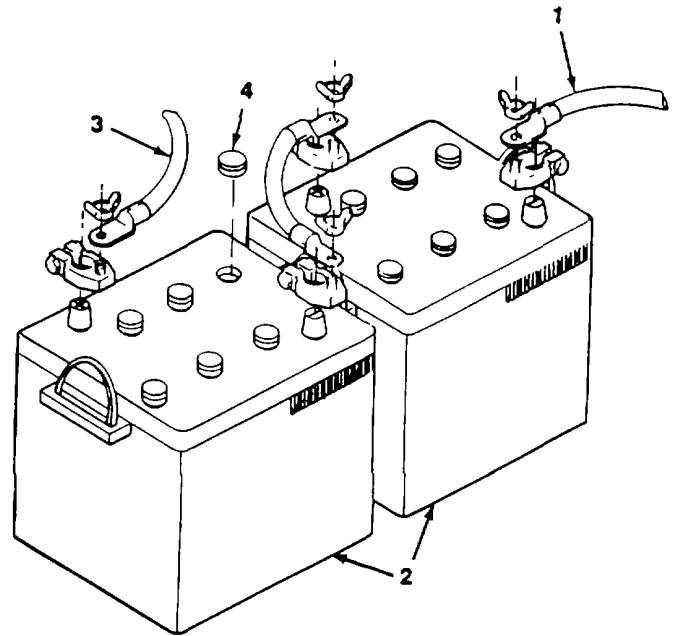
TM 9-6140-200-14 (see Appendix A)

##### General Safety Instructions:

Disconnect all leads from battery  
Terminals before testing.

#### TEST

1. REMOVE LEADS FROM BATTERY TERMINALS.
  - a. With engine shut down, remove battery box cover.
  - b. First disconnect negative battery lead (1) from negative terminal of battery (2). Then disconnect positive battery lead (3) from positive terminal of battery (2).
2. TEST BATTERY.
  - a. Remove cell cover (4).
  - b. Test the specific gravity of each cell with a hydrometer, and compare reading to chart in TM 9-6140-200-14. If the specific gravity reading is below 1225 on the hydrometer, charge the battery. Specific gravity readings of 1.260-to-1270 on the hydrometer indicate a fully charged battery.
  - c. Install cell cover (4).



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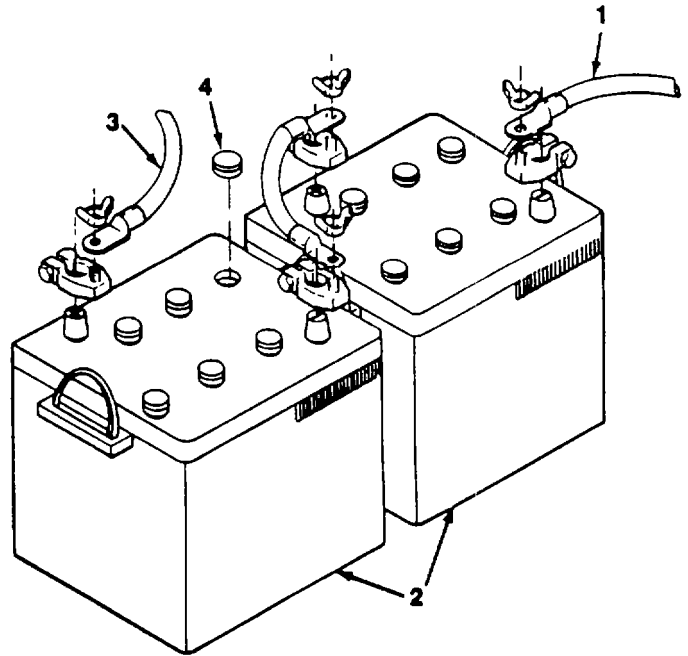
**4-10 TEST BATTERIES (Continued).**

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**3. RE-CONNECT LEADS TO BATTERY TERMINALS.****CAUTION**

**Always observe polarity with direct current systems. Ensure that negative terminals of both the battery and alternator are the same. Reversing battery terminal connections will destroy rectifier diodes in the alternator.**

- a. First connect positive battery lead (3) to positive terminal of battery (2). Then connect negative battery lead (1) to negative terminal of battery (2).
- b. Install battery cover.



**MAINTENANCE OF BATTERIES AND CABLES**

**4-11 REPLACE BATTERIES AND CABLES.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down

Reference:

TM 9-6140-200-14

General Safety Instructions:

Disconnect all leads from battery terminals before replacing

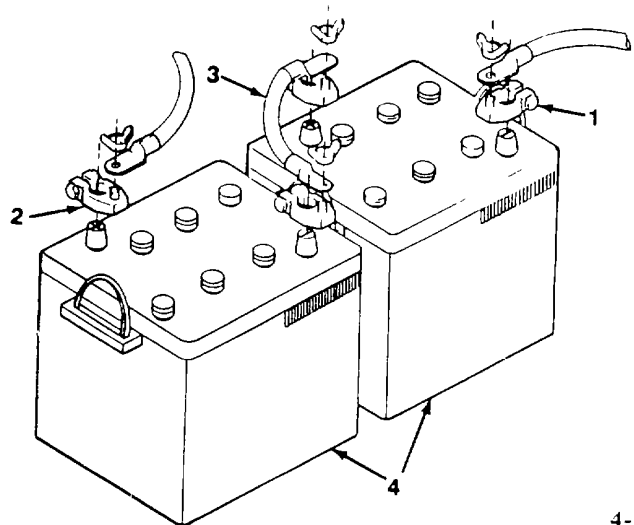
**REMOVAL**

**WARNING**

Corrosive battery electrolyte contains potassium hydroxide. Wear rubber gloves, apron, and face shield when handling leaking batteries. If potassium hydroxide is spilled on clothing or other material, wash immediately with clean water. If spilled on personnel, immediately flush the affected area with clean water. Seek medical assistance. Continue flushing until medical assistance arrives.

**REMOVE BATTERIES AND CABLES.**

- a. Remove battery box cover.
- b. Disconnect and remove the negative lead (1), then disconnect and remove the positive lead (2) at the batteries. Disconnect interconnecting cable (3).
- c. Remove batteries (4) from rack.



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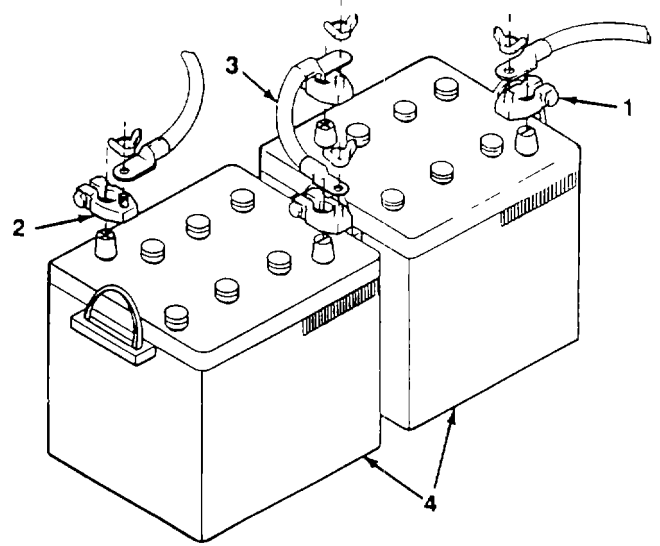
**4-11 REPLACE BATTERIES AND CABLES (Continued).**

---

**INSTALLATION**

INSTALL BATTERIES AND CABLES.

- a. Install batteries (4) into rack.
- b. Install interconnecting cable (3). Connect positive lead (2) and negative lead (1) at batteries.
- c. Install battery box cover.



**MAINTENANCE OF ALTERNATORS****4-12 REPLACE ALTERNATOR.**

This task covers:            a. Removal            b. Installation    c. Adjustment

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

General Safety Instructions:

Disconnect all leads from  
battery terminals before  
replacing electrical equipment.

Equipment Conditions:

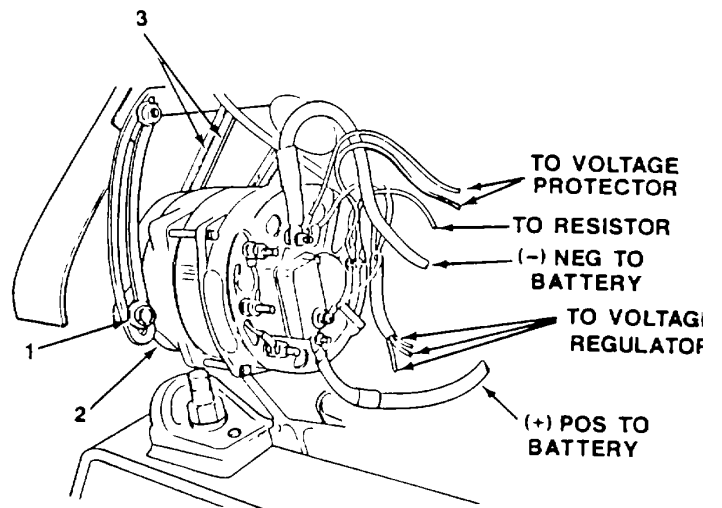
Engine not operating.  
Battery disconnected.

**REMOVAL****WARNING**

**Disconnect battery cables when working on the alternator. Failure to do so may result in serious injury or damage to personnel and equipment.**

## REMOVE ALTERNATOR

- a. Tag all electrical leads to and from the alternator before disconnecting.
- b. Disconnect all electrical leads.
- c. Loosen adjustment strap bolt (1).
- d. Move alternator (2) as necessary and remove drive belts (3).





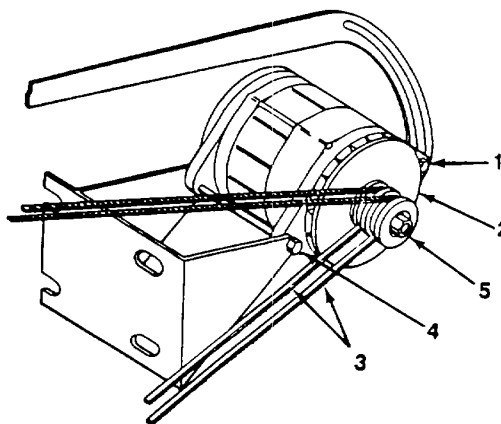
**4-12 REPLACE ALTERNATOR (Continued).**

- e. Remove adjustment strap bolt (1).
- f. Remove mounting bolts (4), and alternator (2).

**INSTALLATION**

**INSTALL ALTERNATOR**

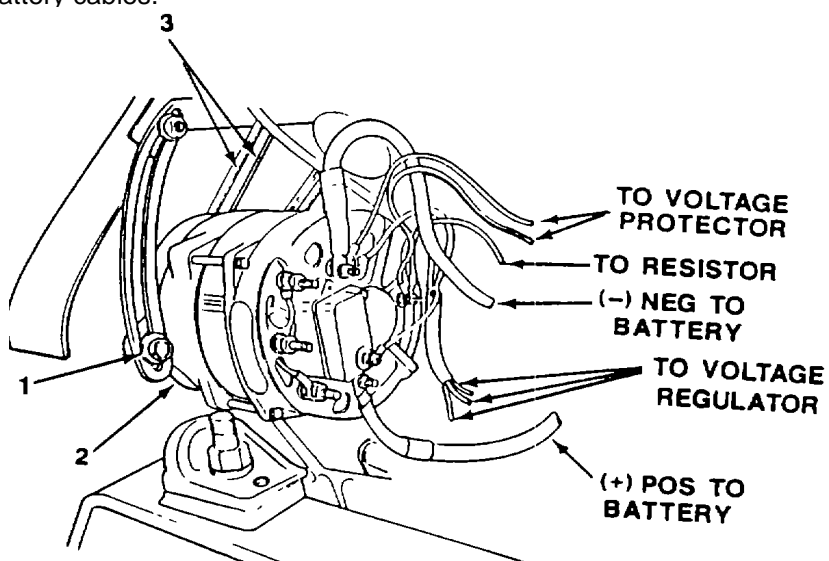
- a. Position alternator (2) in place and secure with mounting bolt (4) and adjustment strap bolt (1). Do not tighten.
- b. Install drive belts (3).



**ADJUSTMENT**

**ADJUST ALTERNATOR BELT'S TENSION.**

- a. Move alternator (2) to adjust belt until there is a deflection of approximately 1/2 inch midway between the alternator drive pulley (5) and the crankshaft pulley.
- b. Tighten adjustment strap bolt (1) and mounting bolt (4).
- c. Re-connect electrical leads tagged.
- d. Re-connect battery cables.



**4-13 ADJUST VOLTAGE REGULATOR**

The voltage regulator setting can be changed from the factory established value in order to accommodate a special operating situation. The most desirable setting is the one that allows the alternator to maintain a fully charged battery with minimum water usage.

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Multimeter  
P/N 2500-553-0142

Equipment Conditions:

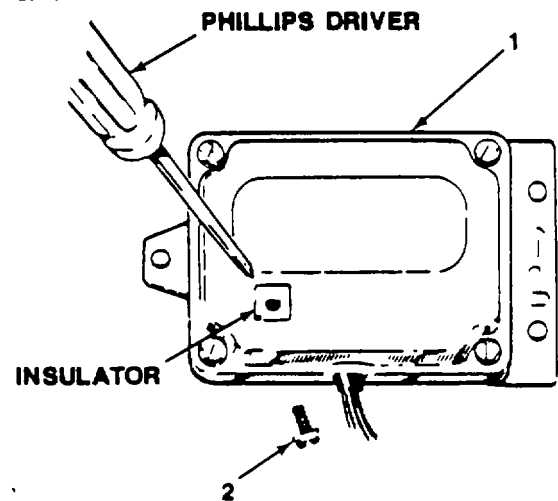
All power off.

General Safety Instructions

Carefully check all circuit connections to eliminate loose wires prior to adjusting the voltage regulator.

**ADJUSTMENT**

1. SET UP VOLTAGE REGULATOR FOR ADJUSTMENT.
  - a. Remove voltage regulator ( 1 ) to gain access to its rear(refer to para 4-14).
  - b. Remove voltage adjustment access screw (2) from rear of voltage regulator (1).
  - c. Set up multimeter (0-50 v, 0-100 amp scales) and vessel electrical system as shown.
  - d. Start up the engine served by the voltage regulator requiring adjustment. Operate at 800 rpm for one-half-hour.



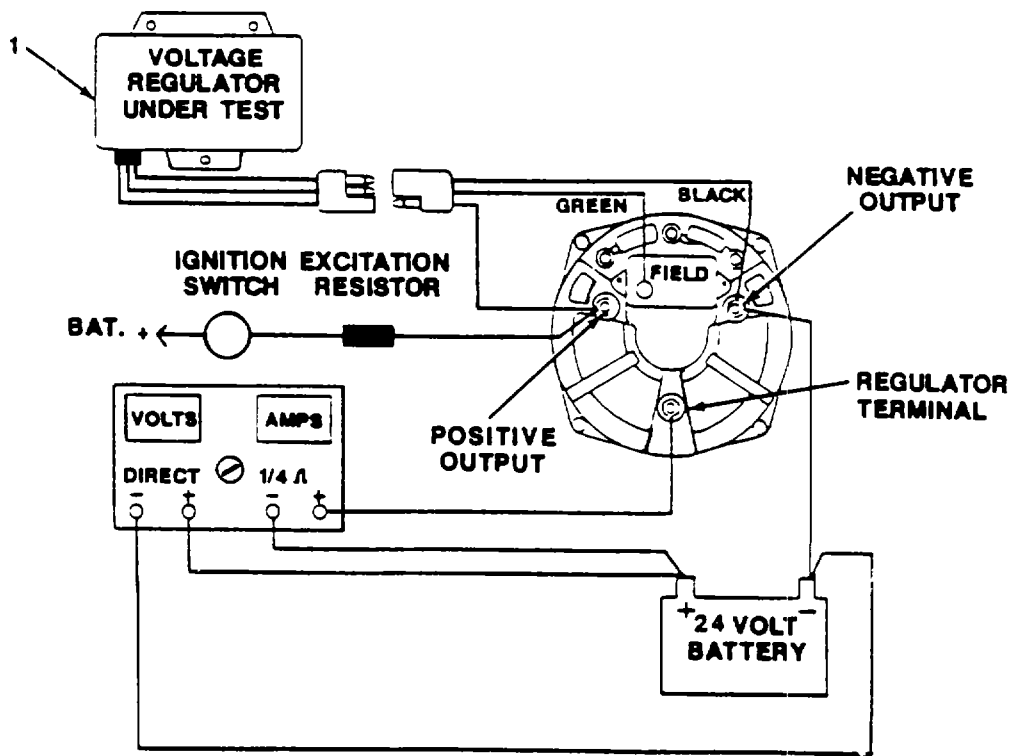
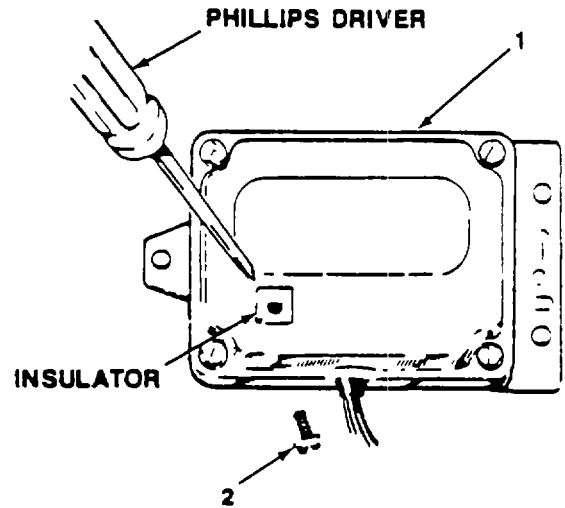
**NOTE**

The voltage regulator incorporates temperature compensating circuitry that automatically provides a slightly higher charging voltage in cold weather and a lower charging voltage in hot weather. The regulator should be brought to operating temperature prior to final adjustment.

4-13 ADJUST VOLTAGE REGULATOR (Continued)

2. ADJUST VOLTAGE REGULATOR.

- a. Use a number 0 Phillips screwdriver to change the rheostat setting.
- b. Adjust one turn at a time and observe multimeter for desired voltage. Turn clockwise to increase voltage, and counterclockwise to decrease voltage.
- c. Install voltage adjustment access screw (2) on rear of voltage regulator (1).



**MAINTENANCE OF VOLTAGE REGULATORS****4-14 REPLACE VOLTAGE REGULATOR.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Material/Parts:

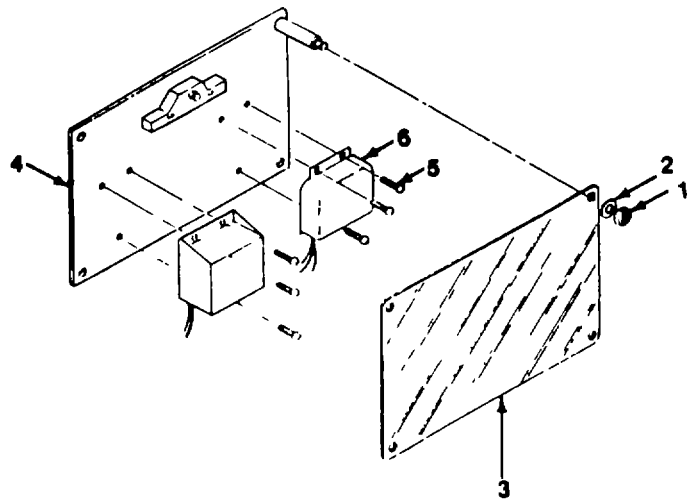
Voltage Regulator  
P/N 8RD-3025B

Equipment Conditions:

Engine shut down

Material/Parts:**REMOVAL****REMOVE VOLTAGE REGULATOR**

- a. Remove four nuts (1) and washers (2) and remove cover glass (3) from mounting plate (4).
- b. Remove three mounting screws (5) from voltage regulator (6) and remove voltage regulator.
- c. Tag all electrical leads to and from the voltage regulator (6) before disconnecting.
- d. Disconnect all electrical leads.

**INSTALLATION****INSTALL VOLTAGE REGULATOR**

- a. Connect electrical leads to , voltage regulator (6).
- b. Install voltage regulator (6) on mounting plate (4) and secure with screws (5).
- c. Install cover glass (3) and secure with nuts (1) and washers (2).

**MAINTENANCE OF VOLTAGE PROTECTOR****4-15 REPLACE VOLTAGE PROTECTOR.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

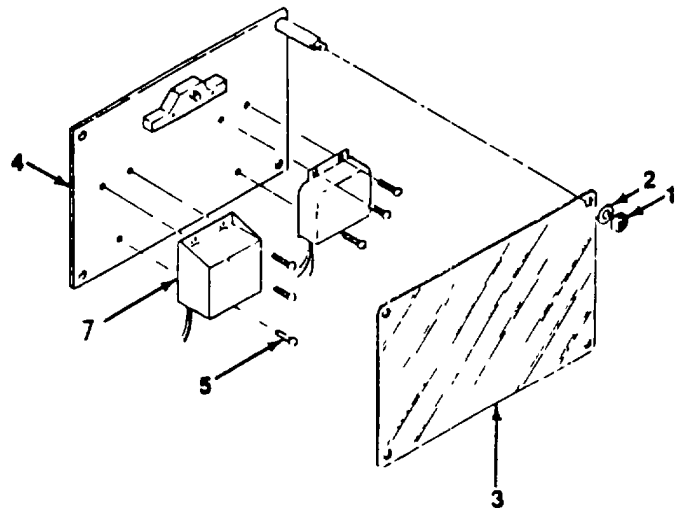
Engine shut down.

Material/Parts:

Voltage Protector  
P/N Model 9-20

**REMOVAL****REMOVE VOLTAGE PROTECTOR**

- a. Remove four nuts (1) and washers (2) and remove cover glass (3) from mounting plate (4).
- b. Remove three mounting screws (5) from voltage protector (7) and remove voltage protector.
- c. Tag all electrical leads to and from the voltage protector (1) before disconnecting.
- d. Disconnect all electrical leads.

**INSTALLATION****INSTALL VOLTAGE PROTECTOR**

- a. Connect electrical leads to voltage protector (7).
- b. Install voltage protector (7) on mounting plate (4) and secure with screws (5).
- c. Install cover glass (3) and secure with nuts (1) and washers (2).

**4-16 REPAIR CONTROL AND DISTRIBUTION PANEL.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Material/Parts:

Fuse, 10 amp

Switch,  
MS-35053-04

Equipment Conditions:

All power off.

General Safety Instructions:

Disconnect all leads from battery  
terminals before replacing  
electrical equipment.

**REMOVAL**

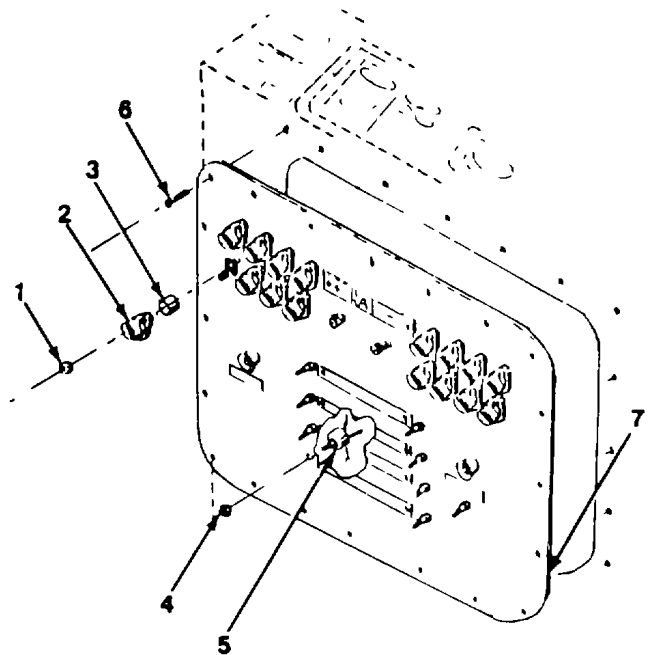
## REMOVE FUSE

- a. Remove two nuts (1) from studs.
- b. Remove fuse holder (2) and fuse (3).

**INSTALLATION**

## INSTALL FUSE.

- a. Install fuse (3) and fuse holder (2).
- b. Secure fuse holder (2) with nuts (1).



**4-16 REPAIR CONTROL AND DISTRIBUTION PANEL (Continued).****REMOVAL**

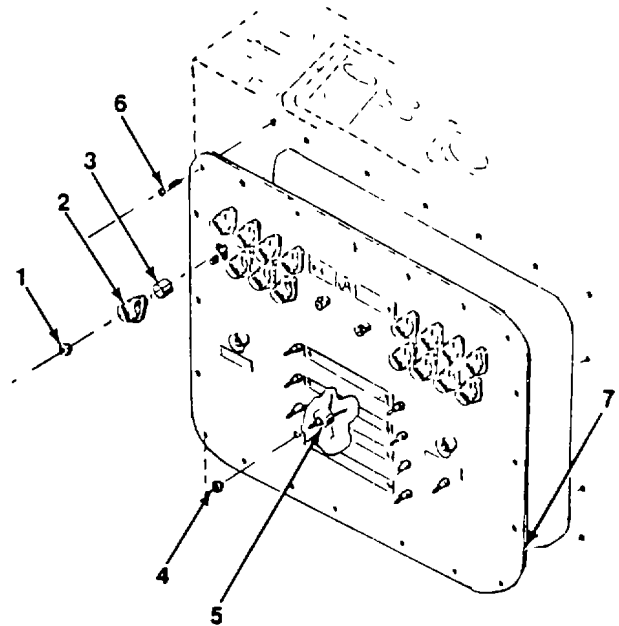
## REMOVE SWITCH

- a. Loosen boot (4) from front of switch (5).
- b. Remove screws (6) from control and distribution panel (7).
- c. Remove switch (5) and disconnect wiring. Tag wiring to facilitate reconnection.

**INSTALLATION**

## INSTALL SWITCH

- a. Re-connect wiring to new switch (5).
- b. Install switch in control and distribution panel (7) and secure with boot (4).
- c. Install control and distribution panel (7) and secure with screws (6).



**MAINTENANCE OF LIGHTING FIXTURES AND SWITCHES**

**4-17 REPLACE/REPAIR LIGHTING FIXTURES AND SWITCHES.**

This task covers:      a. Removal    c. Installation  
                                  b. Repair

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Materials/Parts:

Lamp, Incandescent 32v DC, 50 Watt  
 P/N Item 27, Appendix E

Equipment Conditions:

All power off

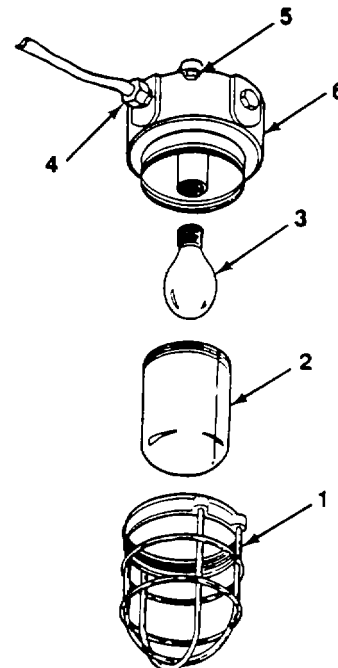
General Safety Instructions:

Energized electrical equipment is dangerous. Never work on energized equipment unless authorized to do so by a responsible authority

**REMOVAL**

REMOVE LIGHTING FIXTURES.

- a. Ensure power is off for the circuit being serviced.
- b. Unscrew and remove light guard (1).  
 Unscrew and remove glass globe (2).
- c. Unscrew and remove Incandescent lamp (3).
- d. Disconnect wiring (4) entering and leaving fixture.
- e. Remove mounting bolts (5) and take down fixture (6).



**REPAIR**

REPAIR LIGHT FIXTURES

- a. Check to ensure all wiring connections are solid, clean (free of corrosion) and intact. Repair as necessary.



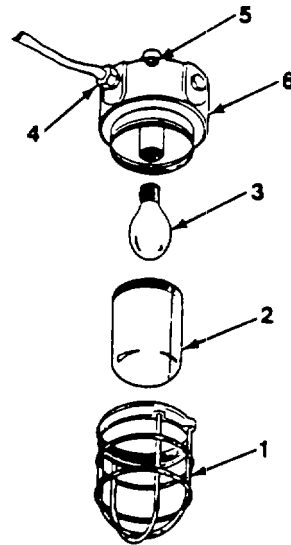
**4-17 REPLACE/REPAIR LIGHTING FIXTURES AND SWITCHES (Continued).**

- b. Replace lamp (3) and ensure that the threads are not crossed and the bulb seats securely and completely in the fixture (6).

**INSTALLATION**

INSTALL LIGHT FIXTURES.

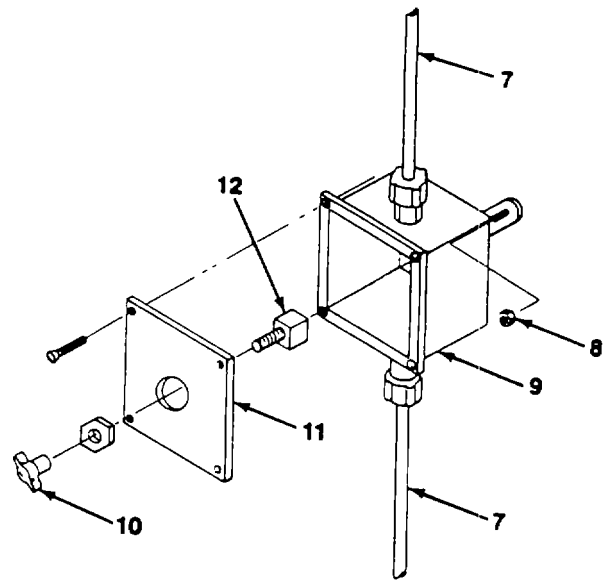
- a. Mount fixture with bolts (5) to the appropriate structure.
- b. Connect wiring (4) entering and leaving fixture.
- c. Screw in lamp (3), glass globe (2) and guard (1).
- d. Energize circuit and test light.



**REMOVAL**

REMOVE ROTARY SWITCH.

- a. Ensure power is off for the circuit being serviced.
- b. Disconnect wiring (7) entering and leaving the switch.
- c. Remove mounting nut (8) and switch box (9).



**4-17 REPLACE/REPAIR LIGHTING FIXTURES AND SWITCHES (Continued).****REPAIR**

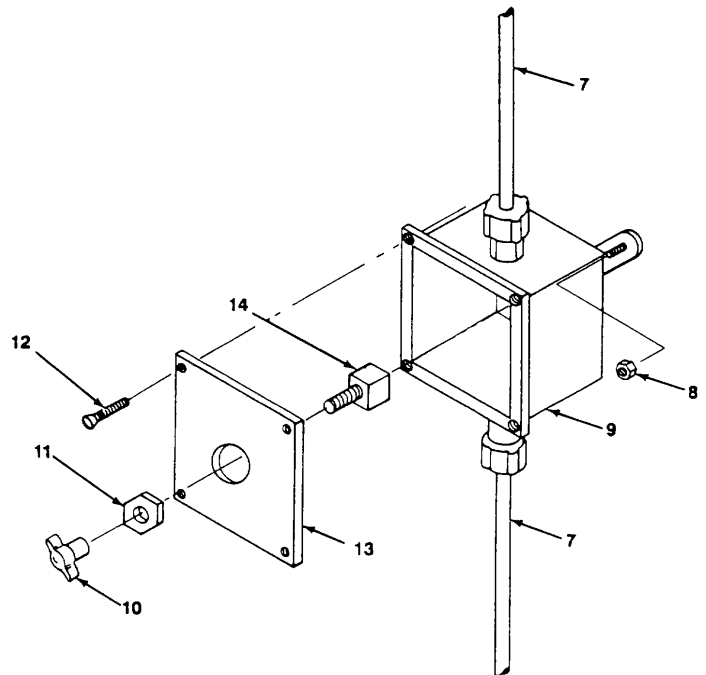
## REPAIR ROTARY SWITCH.

- a. Check to ensure all wiring connections are solid, clean (free of corrosion) and intact.
- b. Remove switch knob (10), nut (11) and unscrew screws (12) holding face plate (13) on switch box.
- c. Remove switch (14) from box (9) and replace switch (14).
- d. Re-assemble switch.

**INSTALLATION**

## INSTALL ROTARY SWITCH.

- a. Place switch in appropriate location and mount, using mounting nuts (8).
- b. Re-connect wiring (7) entering and leaving the switch.
- c. Energize circuit and test switch.



**MAINTENANCE OF CANOPY, MAST, WINDOW AND WIPERS****4-18 REPLACE CANOPY.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Materials/Parts:

Gasket  
P/N 2230 Gray

Equipment Conditions:

All power off. All accessories  
connected to canopy are disconnected  
(ladder, searchlight, wiper assembly).

General Safety Instructions:

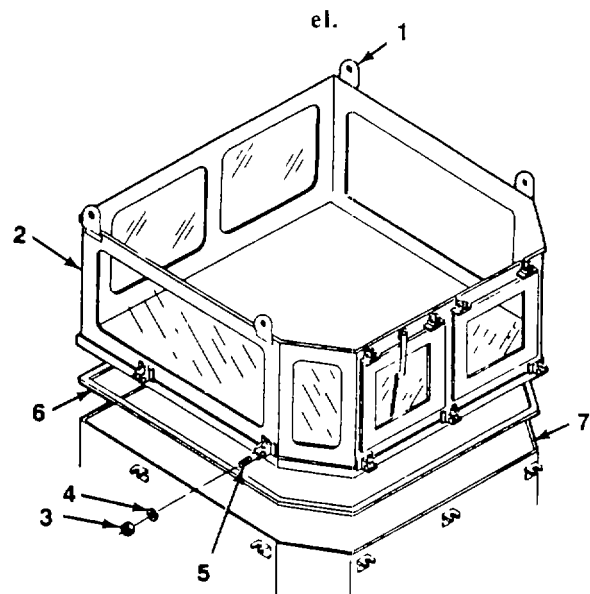
Inspect lifting eyes before removal  
Do not attempt to remove canopy  
manually. Ensure lifting device  
is of sufficient capacity.

**REMOVAL****WARNING**

**Ensure all accessories mounted on canopy are removed prior to canopy removal. Use an appropriate lifting device when removing canopy. Failure to do so may result in death or serious injury to personnel.**

## REMOVE CANOPY

- a. Remove all accessories connected to canopy.
- b. Attach lifting device to lifting bracket (1) on pilothouse canopy (2).
- c. Loosen seven nuts (3) and washers (4) to release eye bolts (5).
- d. Lift canopy and lower it to the deck. Remove gasket (6).



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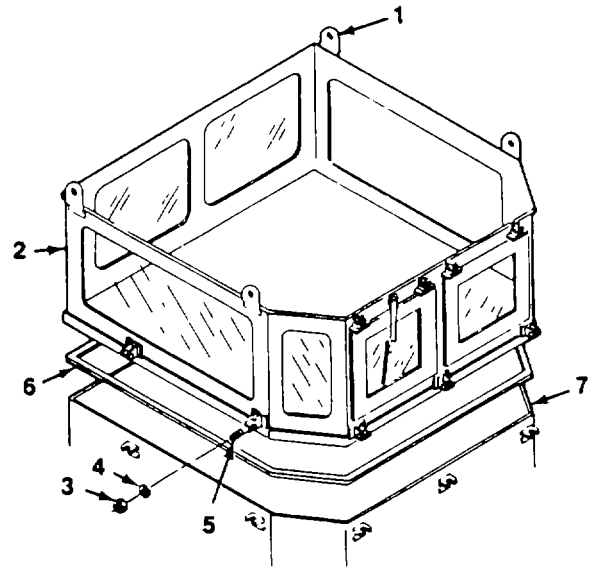
**4-18 REPLACE CANOPY (Continued).**

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**INSTALLATION**

INSTALL CANOPY.

- a. Install new gasket (6).
- b. Lift canopy and place it on the pilothouse base (7).
- c. Check gasket for proper alignment.
- d. Secure canopy with eyebolts (5), washers (4), and nuts (3). Torque nuts to 71-75 foot-pounds (96 26- 101 69 nm).
- e. Re-attach accessories to canopy.



**MAINTENANCE OF CANOPY, MAST, WINDOWS AND WIPERS****4-19 REPLACE WINDOW.**

This task covers:      a. Removal    b. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Personnel Required:**

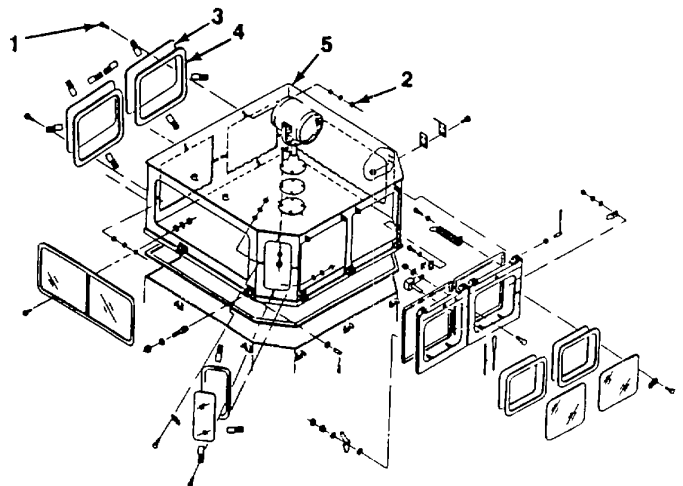
Two (2)

**General Safety Instructions:**

This is a two-person operation. Do not attempt to remove or install windows alone. Wear gloves when handling glass edges.

**REMOVAL****REMOVE WINDOW**

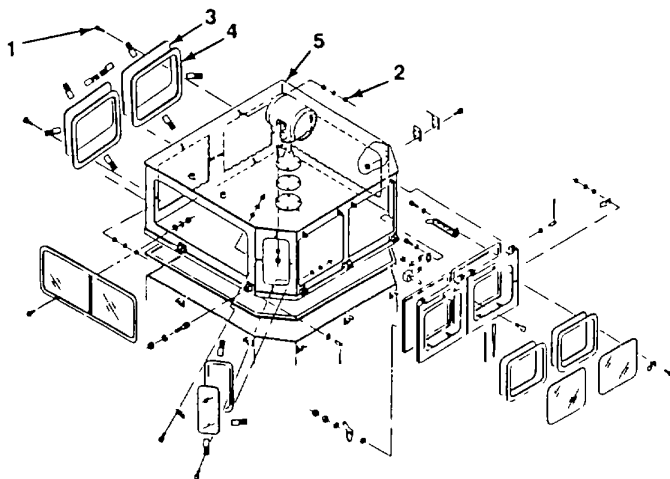
- a. Remove bolts (1) and nuts (2) holding window in place in canopy.
- b. Gently push glass (3) and gasket (4) out of canopy.
- c. Check glass (3) and gasket (4) for defects and replace as necessary.



**4-19 REPLACE WINDOW (Continued).****INSTALL**

## INSTALL WINDOW

- a. Ensure gasket (4) fits snugly around glass before mounting.
- b. Gently mount glass (3) and gasket (4) into canopy (5).
- c. Re-install bolts (1) and nuts (2) holding window in place.



**MAINTENANCE OF CANOPY, MAST, WINDOWS AND WIPERS**

**4-20 REPLACE MAST**

This mast covers: a. Removal b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail and Marine  
5180-00-629-9783

Equipment Conditions:

All power off Mast to be lowered to its lowest configuration

Personnel Required:

Two (2)

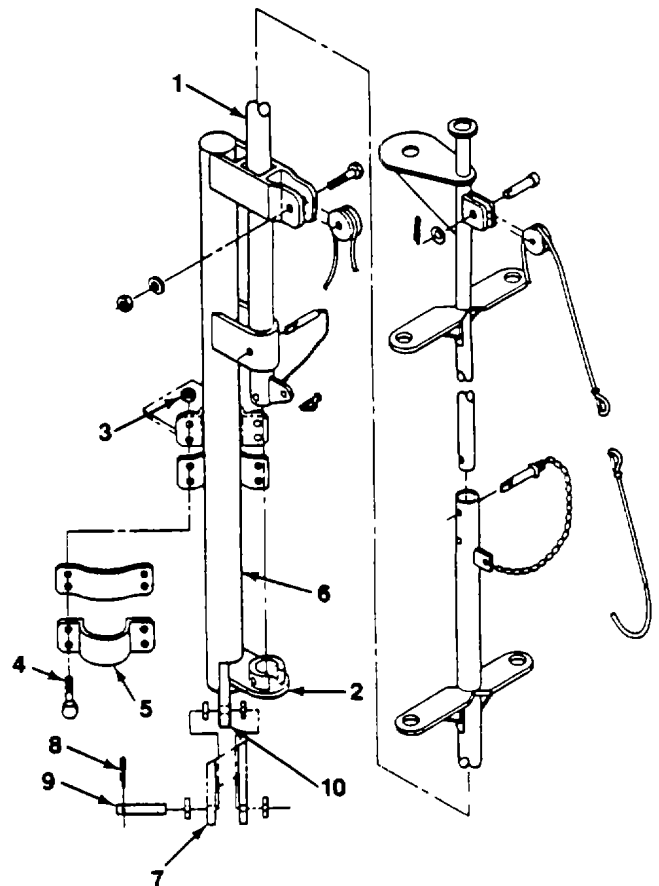
General Safety Instructions:

This is a two-person operation. Do not attempt to lower and replace mast by yourself (alone). Ensure mast is lowered gently so as not to damage the navigation lights and compass.

**REMOVAL**

REMOVE THE MAST.

- a. Lower mast (1) to its lowest configuration while still in the upright position. Ensure the butt of the mast is secured properly in the seat (2).
- b. Disconnect and tag all wiring to navigation lights mounted on the mast at the socket source at the rear of the pilothouse. All cables connected to the mast should dangle freely.
- c. Remove the four nuts (3) and bolts (4) of mast bracket (5) holding mast in upright position. Gently lower mast assembly (6) to the deck, pivoting around the base hinge (7).
- d. Remove all navigation lights and connecting wiring as per para 4-7. Remove compass as per TB 55-6605-262-24.

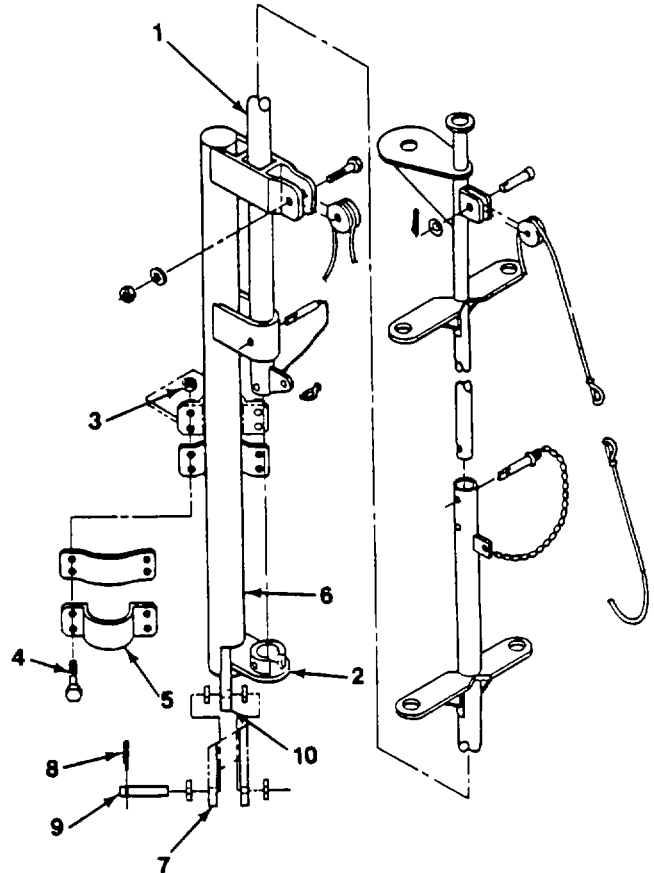


**4-20 REPLACE MAST (Continued).**

- e. Remove cotter pins (8) and hinge pin (9) at the base of the mast.

**INSTALLATION****INSTALL THE MAST.**

- a. Place the base of the mast (10) in the hinge (7) and install the hinge pin (9) and cotter pins (8).
- b. Re-install navigation lights and connecting wiring as per para. 4-7. Re-install compass as per TB 55- 6605-262-24.
- c. Carefully rotate mast (6) into its upright position. Re-install the mast bracket (5) and four nuts (3) and bolts (4).
- d. Re-connect all wiring from navigation lights to the appropriate power socket at the rear of the pilothouse.
- e. Inspect navigation lights as per para 4-7. Re-calibrate and adjust compass as per TB 55- 6605-262-24.





**MAINTENANCE OF CANOPY, MAST, WINDOWS AND WIPERS****4-21 REPLACE WINDSHIELD WIPERS AND WIPER MOTOR.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

Materials/Parts:

Wiper Motor  
P/N WWF-24C-19-10305  
Wiper Blades  
P/N LE 721156

Equipment Conditions:

All power off

General Safety Instructions:

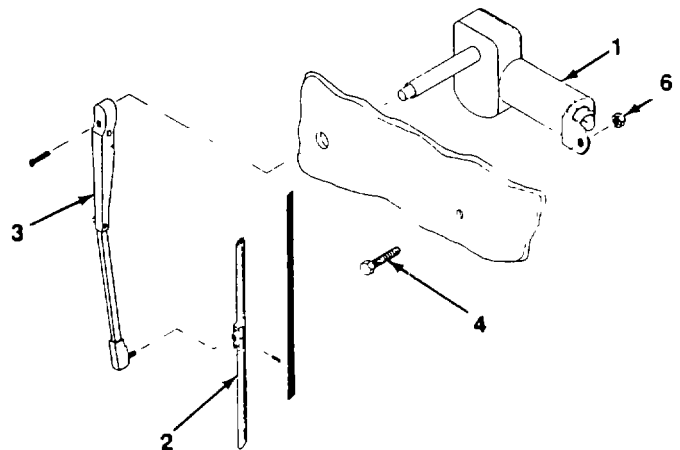
Energized electrical equipment is dangerous. Never work on energized equipment unless authorized to do so by a responsible authority

**REMOVAL****REMOVE WINDSHIELD WIPERS**

- a. Remove wiring from wiper motor (1).
- b. Remove wiper blade (2) and arm assembly (3).
- c. Remove bolt (4) connecting wiper motor (1) to the window frame (5). Remove nut (6), wiper motor from inside pilothouse.

**INSTALLATION****INSTALL WINDSHIELD WIPERS**

- a. Install wiper motor (1) and secure it to windshield by nut (6) and bolt (4).
- b. Re-install wiper arm (3) and blade (2).
- c. Re-connect wiring to wiper motor (1).
- d. Test wipers for proper functioning.



**MAINTENANCE OF PROPULSION CONTROL AND LINKAGE****4-22 REPLACE PROPULSION CONTROL HEAD.**

This task covers:      a. Removal    c. Test  
                                  b. Installation

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

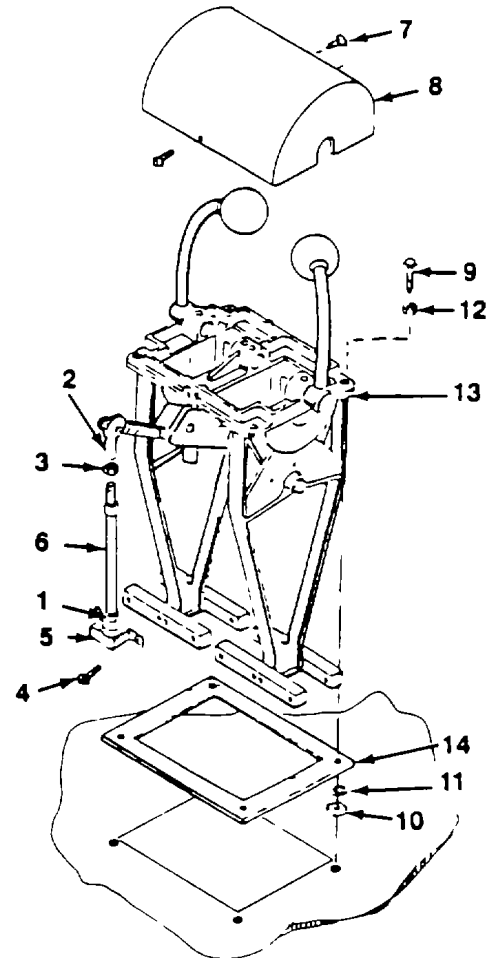
Control Head  
 P/N 2048-M

Equipment Conditions:

Engine shut down

Materials/Parts:**REMOVAL****REMOVE PROPULSION CONTROLS**

- a. Remove access plate in pilothouse control console.
- b. Disconnect four cables (1) from clevis (2) by loosening jam nut (3). Remove screws (4), clamps (5) and cable connector (6).
- c. Remove two screws (7) from dome (8) and remove dome.
- d. Remove four screws (9), nuts (10), lockwashers (11) and washers (12) from the frame (13).
- e. Pull propulsion control head assembly through the top of the control console.
- f. Remove gasket (14).
- g. Remove three Phillips screws (15) from retainer (16). Remove retainer (16).



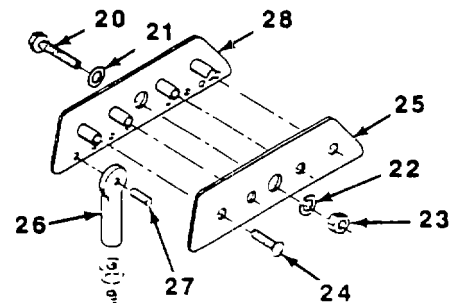
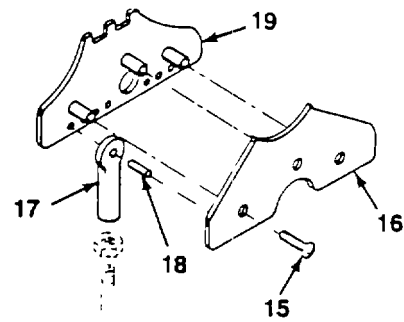
**4-22 REPLACE PROPULSION CONTROL HEAD (Continued).**

- h. Remove clevis (17) and pin (18) from clutch pivot plate (19).
- i. Remove capscrew (20), flat washer (21), lockwasher (22), and locknut (23).
- j. Remove four capscrews (24) from end plate (25). Remove end plate (25).
- k. Remove clevis (26) and pin (27) from throttle cam (28).
- l. Discard old control head.

**INSTALLATION**

INSTALL PROPULSION CONTROLS.

- a. Install clevis (17) on clutch pivot plate (19) and secure with pin (18).
- b. Install retainer (16) and secure with Phillips screws (15).
- c. Install clevis (26) on throttle cam (28) and secure with pin (27).
- d. Install end plate (25) and secure with capscrews (24).
- e. Install capscrews (20), flat washers (21), lockwashers (22) and locknuts (23).
- f. Install gasket (14), making sure to align the gasket holes with the mounting holes in the plate cutout.
- g. Install propulsion control head assembly.
- h. Secure the frame (13) with four screws (9), nuts (10), lockwashers (11) and washers (12).
- i. Install the dome (8).
- j. Secure dome (8) with two screws (7).



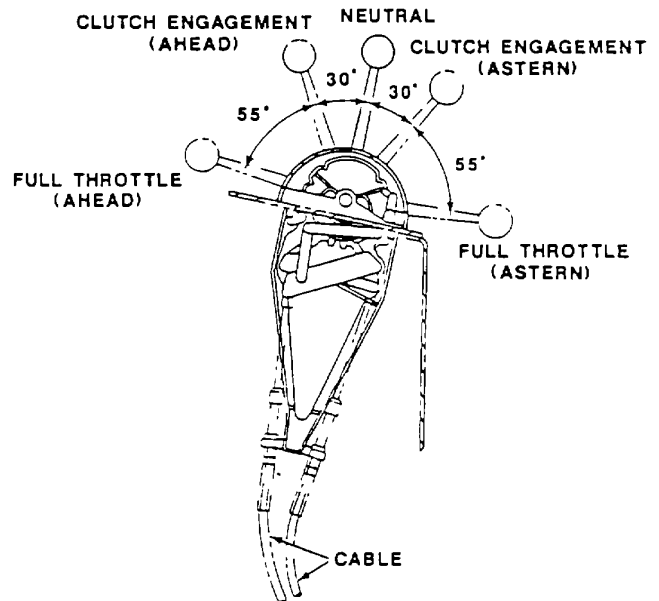
**4-22 REPLACE PROPULSION CONTROL HEAD (Continued).**

- k. Install cable connector (6) into clevis (2) and tighten jam nut (3).
- l. Secure cable with clamps (5) and screws (4).

**TEST**

## TEST PROPULSION CONTROLS

- a. Check clutch angle from NEUTRAL to AHEAD and NEUTRAL to ASTERN. Angle should be 30°.
- b. Check throttle angle from zero throttle to full throttle. Angle should be 55°.
- c. Pull out propulsion control handle approximately 1/4 inch from control housing. Check throttle angle, (in neutral clutch), from zero to full throttle. Angle should be 85°.
- d. Should adjustment be necessary, see para 4-23 and 4-24 for adjustment of throttle and clutch linkages respectively.



**MAINTENANCE OF THROTTLE CONTROL LINKAGE**

**4-23 ADJUST THROTTLE LINKAGE.**

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engines shut down

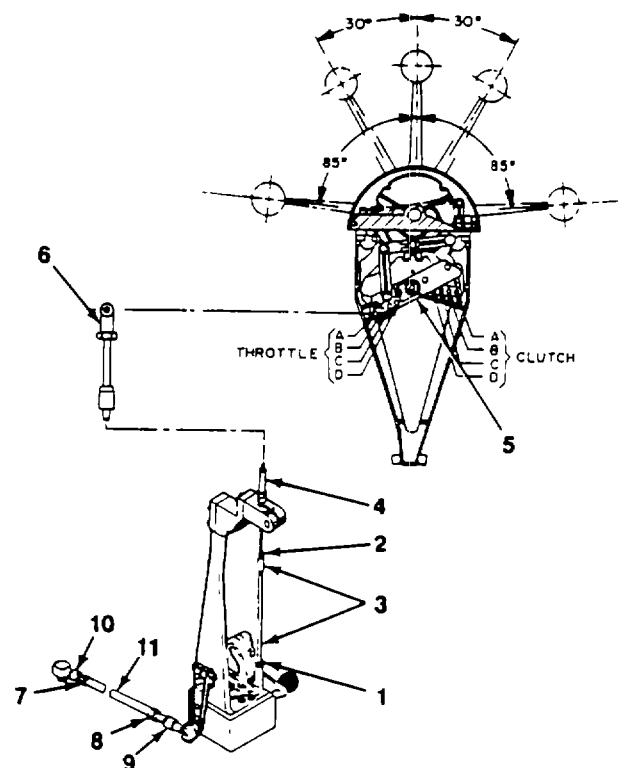
**ADJUSTMENT**

ADJUST THROTTLE LINKAGE

**NOTE**

**The throttle cable attached to the throttle-actuating cam must operate within the available stroke of the cable (3 inches).**

- a. Loosen locknut (1) and hex nut (2). Rotate rod and socket assembly (3) to lengthen or shorten the cable (4).
- b. Select appropriate connection point (A, B, C, D) for the adapter kit on the throttle cam (5). In order to obtain full handle travel in the speed range.
- c. Adjust adapter kit cable end (6) in such a manner to avoid bottoming of the control cable (4) in either direction.
  - (1) Loosen hex nuts (7 and 8) on rod ends (9 and 10).
  - (2) Rotate connecting rod (11) in such a manner to avoid bottoming of the control cable (4) in either direction.



**MAINTENANCE OF CLUTCH LINKAGE****4-24 ADJUST CLUTCH LINKAGE.**

The aim of this adjustment is to ensure that the output motion generated by the transmission control unit is compatible with the required stroke for the clutch control valve lever. It is also important that the clutch control valve lever goes from neutral to both "gear engage" positions without bottoming. A slight amount of end play is essential.

**INITIAL SETUP**Tools:

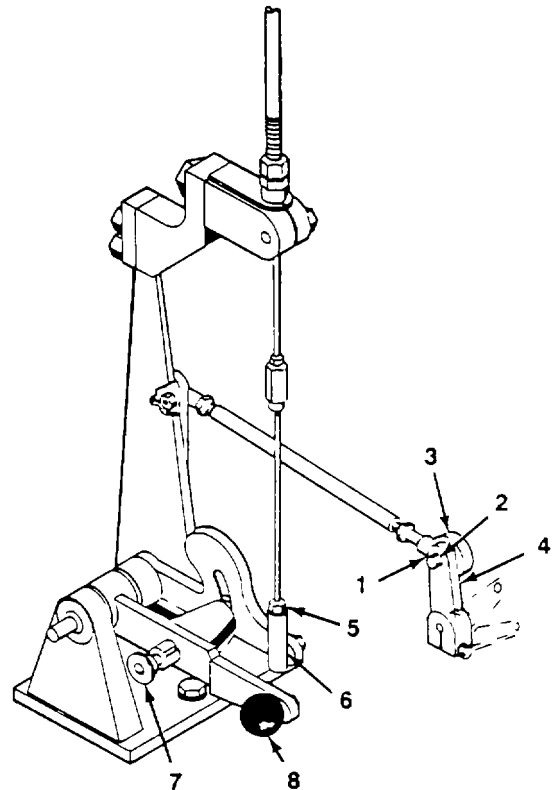
Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Reference  
Para. 2-4, Engine shut down

**ADJUST CLUTCH LINKAGE.**

- a. Remove hex nut (1), lockwasher (2), and rod end (3) from the clutch control valve lever (4).
- b. Move the clutch control valve lever (4) into the FWD and REVERSE positions. Scribe marks to denote the gear positions.
- c. Take measurement between the FWD and REV gear positions. Clutch travel should be 3 inches.
- d. Re-connect rod end (3) to clutch control valve lever (4) using hex nut (1) and lockwasher (2).
- e. Observe position of clutch control valve lever (4) as propulsion control lever in pilot house is cycled into FWD and REV gear positions. The clutch control valve lever (4) should go from NEUTRAL to both "gear engage" positions without bottoming.



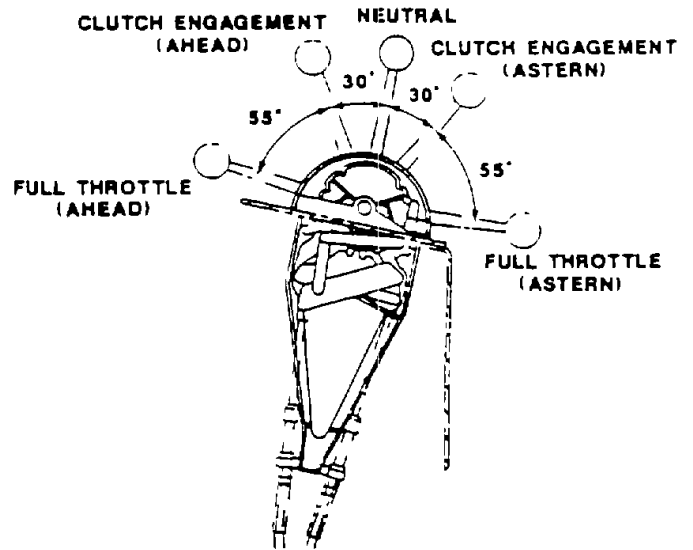
**4-24 ADJUST CLUTCH LINKAGE (Continued).**

- f. Check the clutch control valve lever (4) for slight end play in both "gear engage" positions
- g. If no play is felt, loosen locknut (5) and adjust rod end (6) for NEUTRAL position. Then re-tighten

**CAUTION**

**It is important that the clutch control valve lever is not trying to push or pull beyond a solid stop. Damage to the control system (and possible failure of the control system) can result if the clutch control valve lever is trying to exert too much pressure against any solid stops.**

- h. Cycle propulsion control lever to check for full 60° travel of the propulsion control lever, and 3 inches travel of the clutch control valve lever (4).
- i. Double-check adjustments by pulling out pin (7) and cycling the clutch control valve lever (4) using knobs (8) on transmission control unit.



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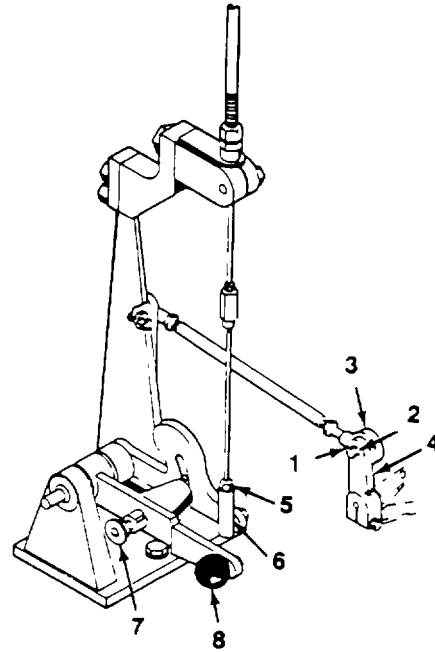
**4-24 ADJUST CLUTCH LINKAGE (Continued).**

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**CAUTION**

**Do not use thread-locking adhesive or self-locking nuts on cable threads, or damage to the cable may result.**

- j. After all adjustments are made, apply a heat-resistant crease to all ball joint sockets, and a light film on all rod ends (3 and 6).
- k. Double-check fasteners for tightness, but do not overtighten.





**MAINTENANCE OF ENGINE SHUTDOWN AND EMERGENCY ENGINE SHUTDOWN CONTROLS**

**4-25 REPLACE ENGINE SHUTDOWN CONTROLS (AIR AND FUEL).**

This task covers: a. Removal b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down.

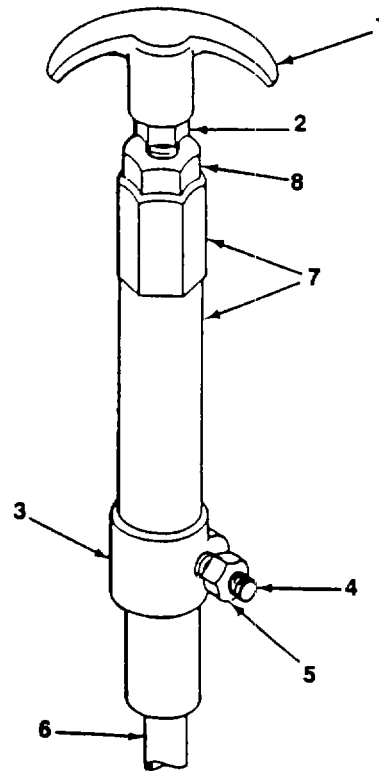
**REMOVAL**

**NOTE**

The procedure for replacing the engine stop control is the same for both the air and fuel shut-off in the pilothouse (four T-handles, 2 port and 2 starboard). The air shut-off is the emergency engine shutdown; the fuel shut-off is the engine shutdown.

**REMOVE ENGINE STOP CONTROLS (AIR AND FUEL)**

- a. Unscrew 'T' handle (1) from control. Do not remove lock nut (2).
- b. Remove access plate in pilothouse.
- c. Remove cable clamp (3) by first removing clamp screw (4) and clamp nut (5).
- d. Secure cable (6) to prevent it from dropping into the engine room.
- e. Remove tube assembly (7). Be careful not to lose mounting nut (8).



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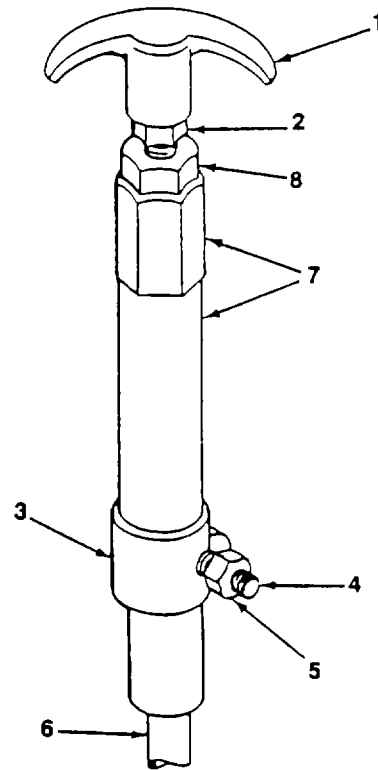
**4-25 REPLACE ENGINE SHUTDOWN CONTROLS (AIR AND FUEL) (Continued).**

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**INSTALLATION**

INSTALL ENGINE STOP CONTROLS (AIR AND FUEL).

- a. Secure cable (6) and new tube assembly (7) with cable clamp (3), clamp screw (4), and clamp nut (5)
- b. Place mounting nut (8) over mounting hole and insert the 'T' handle (1). Ensure that lock nut (2) is in place
- c. Tighten mounting nut (8) until 'T' handle (1) is secured.



**MAINTENANCE OF SANITATION SYSTEM**

**4-26 REPLACE TREATMENT TANK.**

This task covers a Removal b Installation

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions

Reference  
Engine shut down

Materials/Parts

Treatment Tank  
P/N 31754

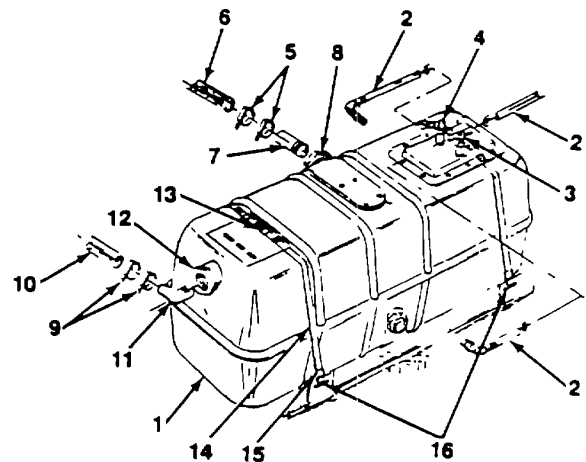
**REMOVAL**

1. REMOVE MAINTENANCE SANITATION SYSTEM (MSD) PUMP/MOTOR ASSEMBLY.

Remove MSD pump/motor assembly from treatment tank (1) Refer to para 4-29.

2. REMOVE TREATMENT TANK.

- a. Remove tubing assemblies (2) from tee (3) and elbow (4).
- b. Loosen hose clamps (5) and disconnect hose (6). Remove hose to male pipe adapter (7) from treatment tank vent fitting (8).
- c. Loosen hose clamps (9) and disconnect hose (10). Remove hose to male pipe combination elbow (11) from treatment tank inlet fitting (12).
- d. Loosen and remove clamps (13) from band (14) securing treatment tank (1).



**NOTE**

**Do not undo buckle (15) or remove bands from mounting brackets (16) unless replacement is necessary.**

**4-26 REPLACE TREATMENT TANK (Continued).**

- e. Remove treatment tank (1) from foundation.  
Replace treatment tank.

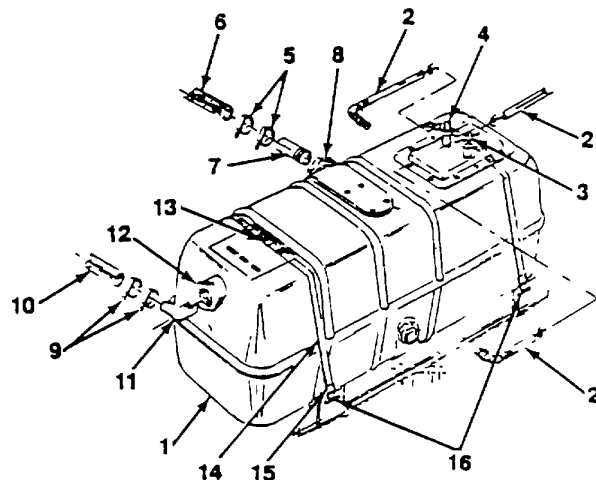
**NOTE**

There are three connections to the receiving tank; remove in similar fashion.

**INSTALLATION**

1. INSTALL TREATMENT TANK.
  - a. Install new treatment tank (1) on foundation.
  - b. Secure treatment tank (1) with band (14) and clamps (13)
  - c. Install hose to male pipe combination elbow (11) into treatment tank inlet fitting (12). Install hose (10) and secure with hose clamps (9).
  - d. Install hose to male pipe adapter (7) into treatment tank vent fitting (8). Install hose (6) and secure with hose clamps (5).
  - e. Install tubing assemblies (2) to tee (3) and elbow (4).
2. INSTALL PUMP MOTOR ASSEMBLY.

Install MSD pump/motor assembly to treatment tank (1). Refer to para 4-28



**4-27 REPLACE FILTER, DISINFECTION UNIT AND RETENTION CANISTERS.**

This task covers                      a. Removal                      b. Installation

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions

Engine shut down

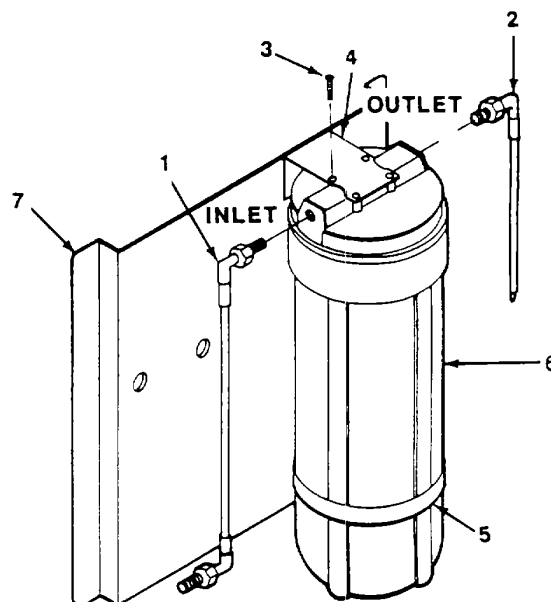
Materials/Parts

Filter  
P/N 31749  
Disinfection Unit  
P/N 31690  
Retention Canisters  
P/N 31842

**REMOVAL**

REMOVE FILTER

- a. Remove tubing assemblies (1 and 2) from filter inlet and outlet ports.
- b. Remove four screws (3) from filter bracket (4).
- c. Remove filter clamp (5) and filter (6) from mounting base (7). Replace filter.



**INSTALLATION**

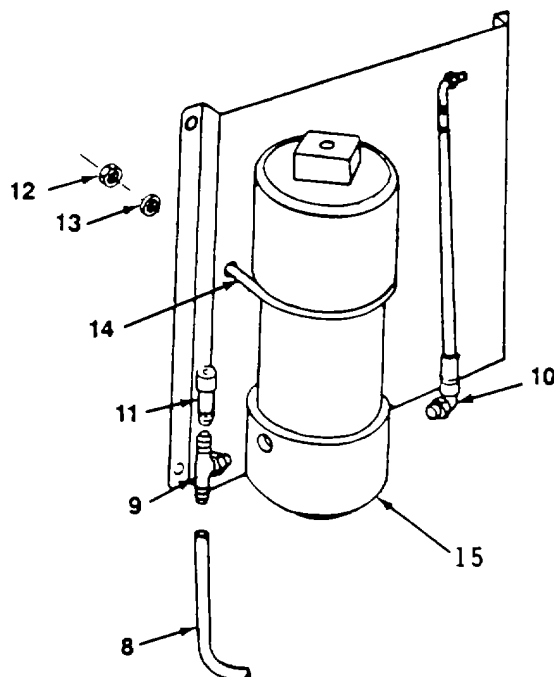
INSTALL FILTER

- a. Install filter (6) in correct position on mounting base (7).
- b. Secure filter (6) to bracket (4) with screws (3), secure clamp (5).
- c. Re-connect tubing assemblies (1 and 2) to filter inlet and outlet ports.

**4-27 REPLACE FILTER, DISINFECTION UNIT AND RETENTION CANISTERS (Continued).****REMOVAL**

## REMOVE DISINFECTION UNIT

- a. Remove tubing assembly (8) from tee (9)  
Remove tubing assembly (10) from  
disinfection unit outlet port.
- b. Remove breather (11) from tee (9).
- c. Remove two nuts (12) and lockwashers (13)  
from U-bolt (14).
- d. Remove disinfection unit (15) from mounting  
base (7) and remove tee (9) from inlet port of  
disinfection unit. Replace disinfection unit.

**INSTALLATION**

## INSTALL DISINFECTION UNIT

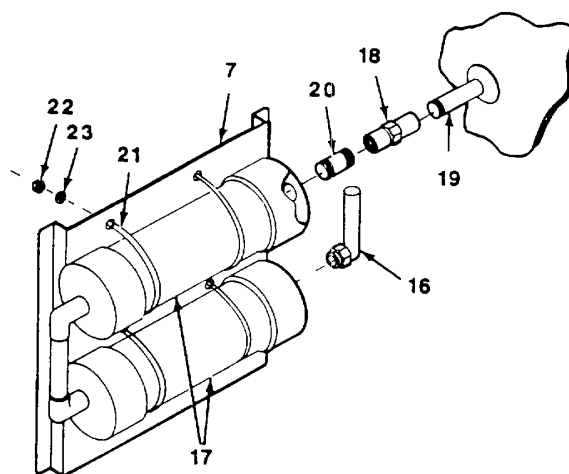
- a. Install tee (9) In inlet port of disinfection unit  
(15).
- b. Install disinfection unit (15) on mounting  
base (7) and secure with U-bolt (14),  
lockwashers (13) and nuts (12)
- c. Install breather (11) and tubing assembly  
(8) on tee (9).
- d. Install tubing assembly (10) in disinfection  
unit outlet port.

**4-27 REPLACE FILTER, DISINFECTION UNIT AND RETENTION CANISTERS (Continued).****REMOVAL****REMOVE RETENTION CANISTERS**

- a. Remove tubing assembly (16) from inlet port of canisters (17).
- b. Remove union (18) from overboard discharge piping (19) and close nipple (20), remove close nipple (20) from outlet port of canisters (17)
- c. Remove four U-bolts (21) and their mounting nuts (22) and lockwashers (23) from mounting base (7), remove both canisters (17) and replace

**INSTALLATION****INSTALL RETENTION CANISTERS**

- a. Install close nipple (20) in outlet port of canisters (17).
- b. Install canister (17) on mounting base (7) and secure with U-bolts (21), lockwashers (23) and nuts (22).
- c. Install union (18) between close nipple (20) and overboard discharge piping (19), tighten connection to prevent leaks.
- d. Install tubing assembly (16) In inlet port of retention canisters (17)



**4-28 REPLACE MSD PUMP AND MOTOR ASSEMBLY.**

This task covers a. Removal b Installation

INITIAL SETUP

Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions

Engine shut down

**REMOVAL**

1. REMOVE TUBING ASSEMBLIES AND WIRING.

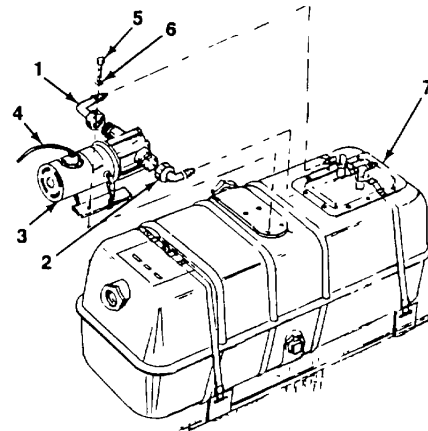
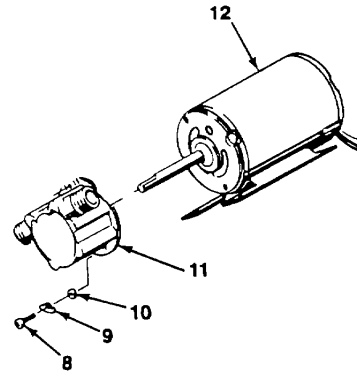
- a. Remove elbows (1 and 2) from inlet and outlet ports of pump/motor assembly (3).
- b. Disconnect electrical wiring (4) from pump/motor assembly (3).

2. REMOVE PUMP/MOTOR ASSEMBLY

- a. Remove four screws (5) and washers(6) securing pump/motor assembly (3) to treatment tank (7).
- b. Lift pump/motor assembly (3) from treatment tank (7).

3. SEPARATE PUMP FROM MOTOR

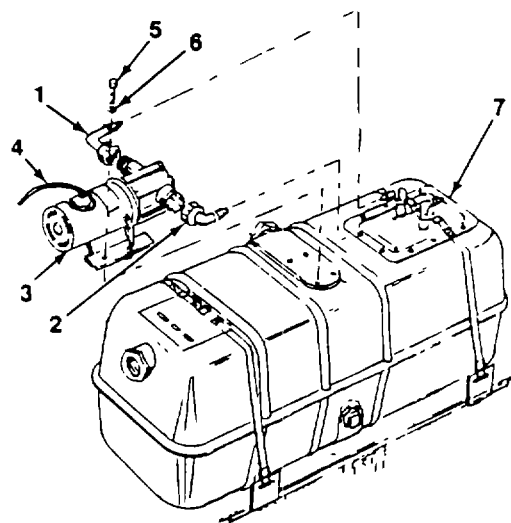
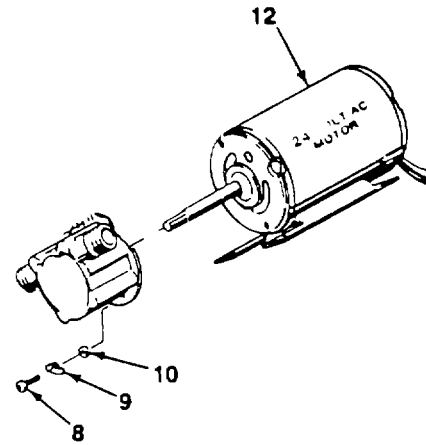
- a. Remove two stainless steel screws (8), spacers (9) and washers (10) from pump (11).
- b. Remove pump (11) from motor (12) Replace pump or motor as necessary.





**4-28 REPLACE MSD PUMP AND MOTOR ASSEMBLY (Continued).****INSTALLATION**

1. ASSEMBLE PUMP AND MOTOR.
  - a. Attach pump (11) to motor (12). Ensure that motor shaft engages pump impeller.
  - b. Secure pump to motor with two stainless steel screws (8), spacers (9) and washers (10).
2. INSTALL PUMP/MOTOR ASSEMBLY.
  - a. Install pump/motor assembly (3) on treatment tank (7). Ensure mounting holes are aligned.
  - b. Secure pump/motor assembly (3) with four screws (5) and washers (6).
3. RE-CONNECT TUBING ASSEMBLIES AND WIRING.
  - a. Re-connect electrical wiring (4) to source of power.
  - b. Install elbows (1 and 2) on inlet and outlet ports of pump/motor assembly (3).



**4-29 REPAIR MSD PUMP/MOTOR ASSEMBLY.**

This task covers

a. Disassembly	c. Inspection
b. Cleaning	d. Assembly

**INITIAL SETUP**Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions

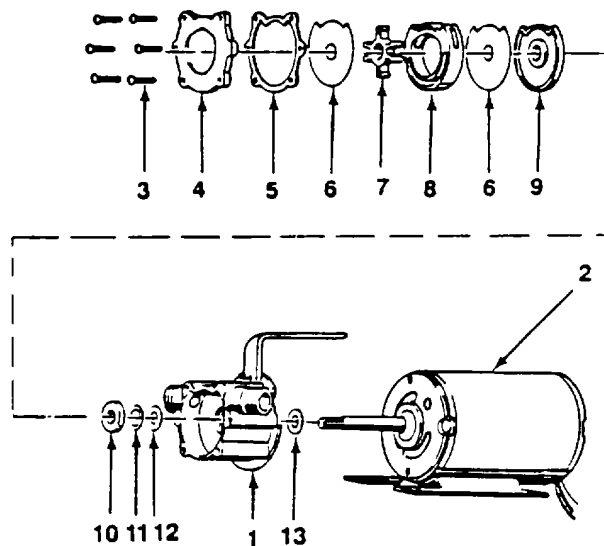
Reference  
Para 4-28, Pump/motor assembly  
removed and separated

Materials/Parts

Cleaning Solvent  
Item 17, Appendix E  
Impeller Kit  
P/N 31837  
Seal Kit  
P/N 31838

**DISASSEMBLY****DISASSEMBLE PUMP**

- a. Separate pump housing (1) from motor (2) (refer to para 4-28).
- b. Remove six screws (3) from pump cover (4), remove cover (4) and gasket (5).
- c. Remove wear plates (6), impeller (7), cam ring (8) and pump spacer (9).
- d. Remove lip seal (10), retaining ring (11), felt oiler (12) and shaft flinger (13) from pump housing (1).



---

**4-29 REPAIR MSD PUMP/MOTOR ASSEMBLY (Continued).**

---

**CLEANING**

## CLEAN PUMP PARTS

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100°- 138°F (38°C - 59°C).

- a. Clean all pump parts in cleaning solvent, Fed. Spec. P-D-680.
  - b. Allow parts to air dry
- 

**INSPECTION**

INSPECT IMPELLER, CAM RING, WEAR PLATES AND SHAFT SEALS

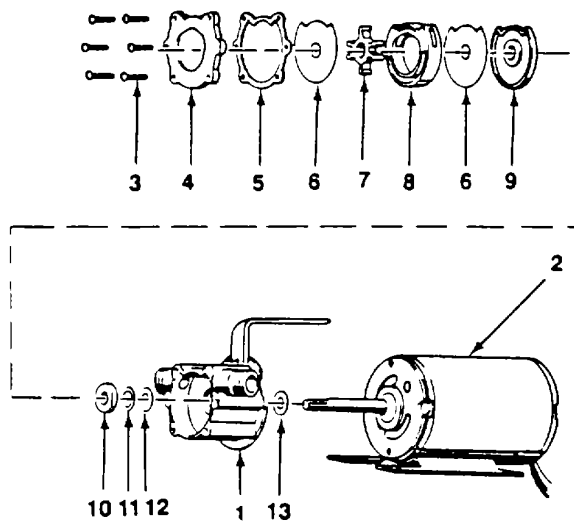
- a. Inspect impeller for wear or other damage.
- b. Inspect cam ring for wear and scoring.
- c. Check to see if wear plates are badly grooved or worn.
- d. Inspect shaft seals (lip seal, retaining ring, felt oiler and shaft flinger) for deterioration.
- e. Get replacement parts as necessary

4-29 REPAIR MSD PUMP/MOTOR ASSEMBLY (Continued).

**ASSEMBLY**

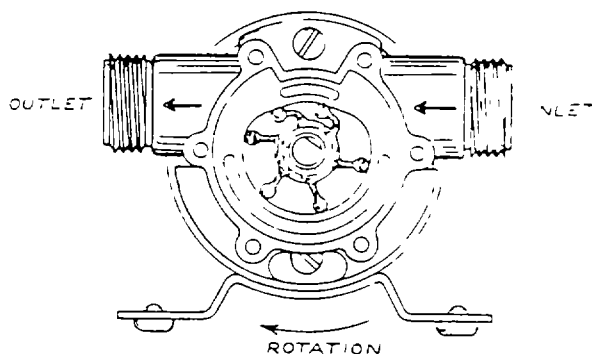
ASSEMBLE PUMP.

- a. Install shaft flinger (13), felt oiler (12), retaining ring (11) and lip seal (10) in pump housing (1).
- b. Lubricate cam ring (8) and wear plate (6) with grease.
- c. Install pump spacer (9) and wear plate (6) in pump housing (1).
- d. Position impeller (7) in cam ring (8) and as it goes into place, twist in a clockwise direction to bend the blades as shown, install cam ring in pump housing (1).
- e. Install a second wear plate (6), gasket (5) and cover (4). Secure cover (4) with six screws (3).



**NOTE**

**FOLLOW-ON MAINTENANCE:**  
 Assemble and install pump motor assembly (para. 4-28).



**MAINTENANCE OF RAMP HOISTING ASSEMBLY**

**4-30 REPLACE HOSES AND FITTINGS.**

This task covers                      a. Removal                                      b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Reference:

RPSTL TM 55-1905-222-24P

Equipment Conditions:

Engine shut down  
Ramp hydraulic system  
drained of oil at point  
of repairs.

**REMOVAL**

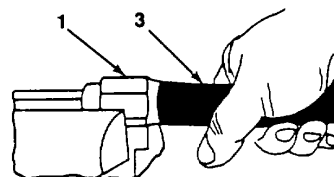
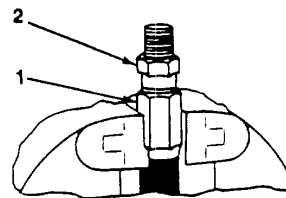
1. REMOVE VALVES AND PIPING.

**WARNING**

**The oil pressure in the system must be released prior to servicing hoses, fittings and other parts to prevent possible injury or damage to personnel or equipment.**

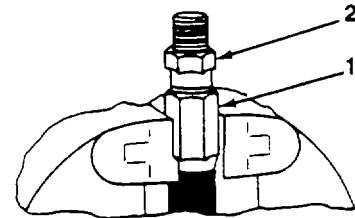
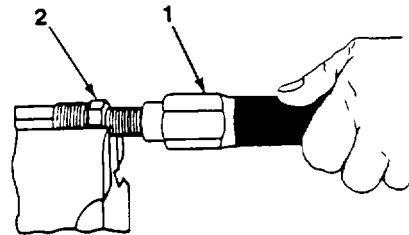
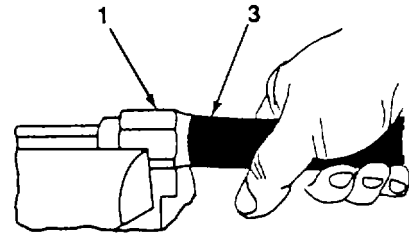
2. REMOVE HOSES AND FITTINGS.

- a. Disconnect fitting at its connection to the accessory item.
- b. Place socket (1) in vise. Unscrew nipple (2) counter-clockwise from socket (1). Place nipple in a safe place.
- c. Position socket (1) in vice and unscrew hose (3) clockwise from socket (1). Place socket in safe place.
- d. Disconnect hose (3) from fitting at other end of hose in the same manner.
- e. Replace hose and fittings as necessary.



**4-30 REPLACE HOSES AND FITTINGS (Continued).****INSTALLATION**

1. INSTALL VALVES AND PIPING
2. INSTALL HOSES AND FITTINGS.
  - a. Ensure hose and fittings are the proper size and length required.
  - b. Place socket (1) in vise as shown.
  - c. Dip cut end of hose (3) into hydraulic oil for adequate lubrication.
  - d. Thread hose (3) counter-clockwise into socket (1) until hose bottoms. Back hose off 1/2 turn.
  - e. Lubricate insert thread on nipple
  - f. Place nipple hex (2) in vise. Screw hose and socket (1) clockwise onto nipple until large threads engage.
  - g. Position socket in vise as shown and tighten assembly with a wrench
  - h. Connect other end of hose to a fitting in the same manner.
  - i. Re-connect hoses and fittings to their proper connections.
  - j. Bleed system for air before putting it into operation.



**MAINTENANCE OF RAMP HOISTING ASSEMBLY****4-31 SERVICE LEVEL INDICATOR.**

Float assembly contains a magnet. Float should be inspected after tank cleaning or flushing to clean any metal particles that may have attracted to magnet.

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Materials/Parts**

'O' Ring  
P/N 2-218

**Equipment Conditions:**

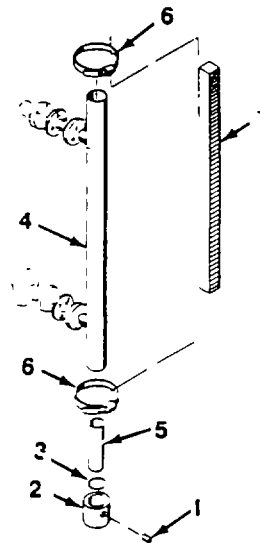
Engine shut down

**General Safety Instructions**

Ensure that the reservoir is drained completely before removing float for cleaning

**SERVICE**

1. REMOVE AND CLEAN FLOAT
  - a. Remove set screw (1) from end cap (2). Have a container ready to catch oil.
  - b. Remove end cap (2) and 'O' ring (3) from housing assembly (4). Discard 'O' ring if in bad condition and replace.
  - c. Remove float (5) and clean thoroughly with a clean lint-free cloth.

**NOTE**

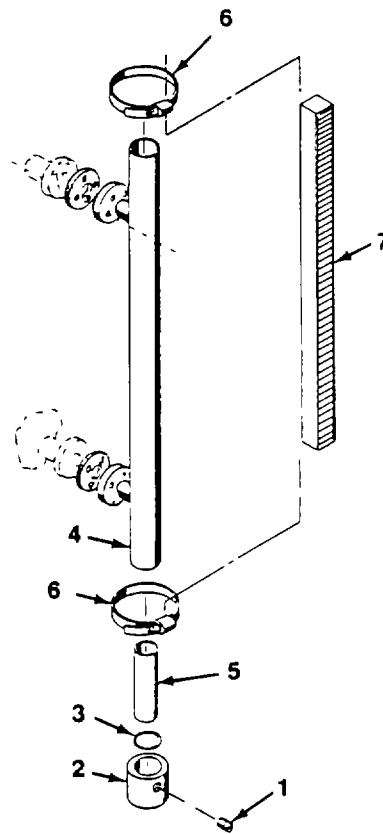
**Do not remove flag channel or clamps if replacement is not required. Observe and mark flag channel position in relation to housing assembly and reservoir before removing.**

**4-31 SERVICE LEVEL INDICATOR (Continued).**

- d. Loosen clamps (6) or flag channel (7). Replace clamps (6) or flag channel (7) if necessary.

**2 REPLACE FLOAT AND FLAG CHANNEL**

- a. Install float (5) into housing assembly (4).
- b. Install end cap (2) with a new 'O' ring (3) onto the bottom end of housing assembly (4).
- c. Secure end cap (2) to housing assembly (4) with set screw (1). Tighten set screw (1) to 14-16 in./lbs.
- d. Install flag channel (7) in the exact location on housing assembly (4) as noted during removal.
- e. Secure flag channel (7) with two clamps (6) and tighten to 6-10 in./lbs. torque.





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**MAINTENANCE OF HYDRAULIC STEERING SYSTEM**


---

**4-32 ADJUST COUNTERBALANCE VALVE.**


---

The counterbalance valves induce artificial pressure on the low pressure side of the steering cylinders to prevent the rudder from running ahead of the pumps.

---

**INITIAL SETUP**
Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions

Engines running.

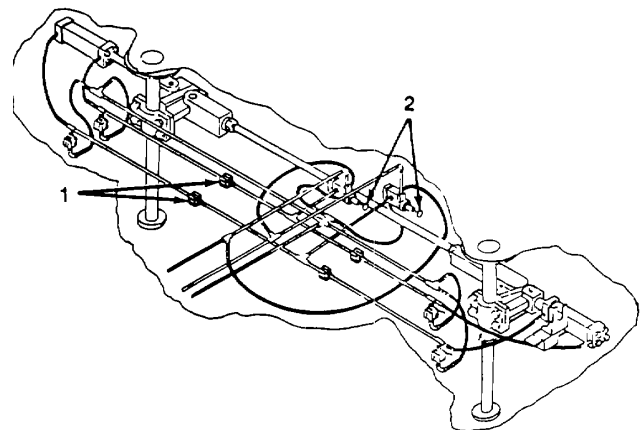
---

**ADJUSTMENT**
**NOTE**

Observe the steering system hydraulic pressure gauge (0-2000 PSI) located on the pilothouse console, while adjusting the valves. There are two counterbalance valves, one port and one starboard. One cannot be adjusted without the other being adjusted.

**ADJUST COUNTERBALANCE VALVE**

- a. Isolate one steering cylinder by closing both isolation valves (1) on the opposite side.
- b. Turn knob (2) to adjust counter-balance valve to bring the hydraulic pressure gauge reading to 1000 psi.
- c. Repeat procedure in b and c for second valve.



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM****4-33 REPLACE CHECK VALVE (STEERING SYSTEM)**

This task covers

a. Removal

b. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Equipment Conditions:**

Engine shut down

**Materials/Parts:**

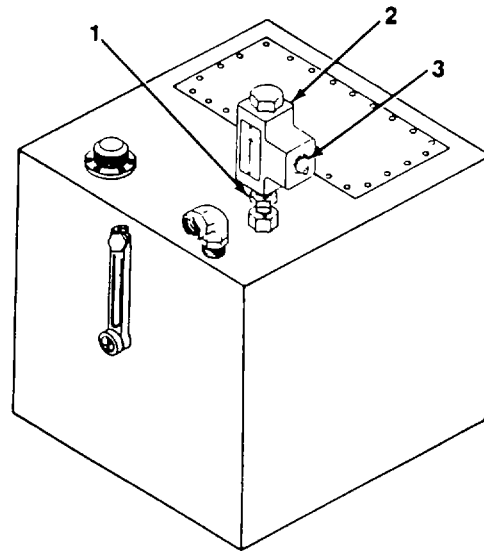
Check Valve  
P/N D0610A1

**REMOVAL****REMOVE CHECK VALVE**

- a. Remove union (1).
- b. Unscrew check valve (2) from piping (3). Have a container ready to catch oil.
- c. Replace check valve (2).

**INSTALLATION****INSTALL CHECK VALVE**

- a. Clean threads on pipe (3) and install check valve (2).
- b. Connect union (1).
- c. Ensure connections are tight and reservoir is up to the proper level.



**MAINTENANCE OF EXHAUST SYSTEM****4-34 REPLACE/REPAIR EXHAUST PIPING AND MUFFLER.**

This task covers

- a. Removal
- b. Repair

c. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Machine, Welding

**Equipment Conditions:**

Reference  
Engines shut down  
Exhaust system cool

**Materials/Parts:**

Gasket (MIL-G-14243 Class 1)  
Item 29, Appendix E

**General Safety Instructions:**

Prior to removing exhaust system, ensure the manifold and piping are cool. If this is not possible, ensure personnel wear gloves when handling hot engine pieces.

**References:**

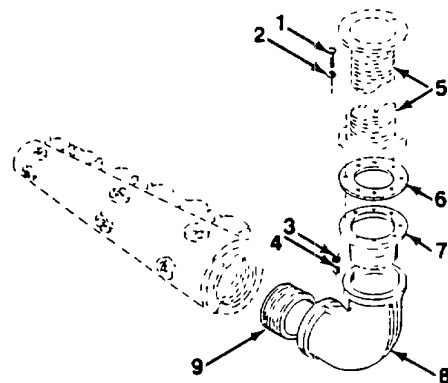
Thermo-Insulation Requirements  
(MIL-STD-769G)

**REMOVAL****CAUTION**

**Ensure personnel wear gloves when handling hot engine pieces. Handling hot engine pieces with bare hands or skin may result in severe burns.**

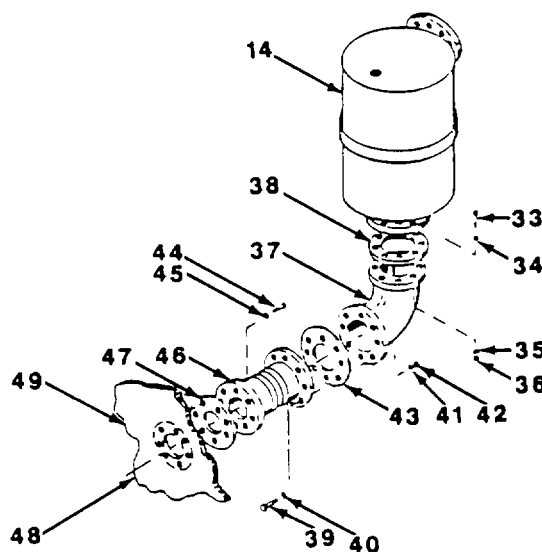
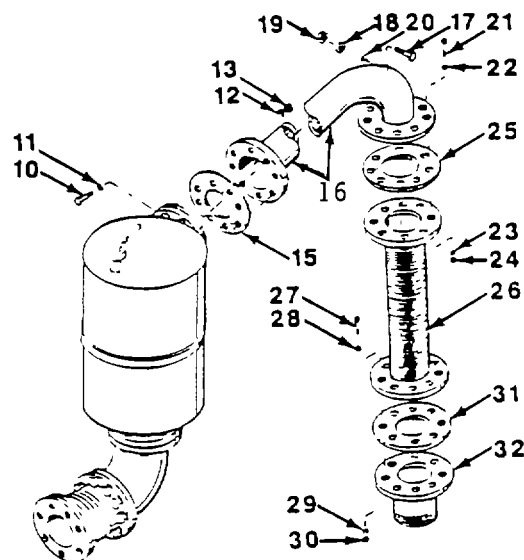
**REMOVE EXHAUST PIPING AND MUFFLER**

- a. Remove thermal covering from muffler and exhaust piping.
- b. Remove screws (1), flat washers (2), lockwashers (3) and nuts (4) from flexible connection (5). Remove and discard gasket (6).



4-34 REPLACE/REPAIR EXHAUST PIPING AND MUFFLER (Continued).

- c. Remove pipe flange (7), elbow (8) and pipe nipple (9) from engine exhaust manifold
- d. Remove screws (10), flat washers (11), lockwashers (12) and nuts (13) from muffler (14). Remove gasket (15).
- e. On the Inboard exhaust pipe (16) remove screw (17), lockwasher (18) and nut (19) attaching the hanger (20) to the bracket.
- f. Remove screws (21), flat washers (22), lockwashers (23), nuts (24) and exhaust pipe (16).
- g. Remove and discard gasket (25) on the top flange of flexible connection (26).
- h. Remove screws (27), flat washers (28), lockwashers (29) and nuts (30) from pipe flange (32). Remove flexible connection (26) and gasket (31).
- i. Remove screws (33), flat washers (34), lockwashers (35) and nuts (36) connecting elbow (37) to muffler (14). Remove muffler (14) and gasket (38).
- j. Remove screws (39), flat washers (40), lockwashers (41) and nuts (42). Remove elbow (37) and gasket (43).
- k. Remove screws (44) and lockwashers (45) from expansion joint connector (46) and plate (48). Plate (48) is welded to hull (49) of craft. Remove expansion joint connector (46) and gasket (47).



**4-34 REPLACE/REPAIR EXHAUST PIPING AND MUFFLER (Continued).****REPAIR****REPAIR EXHAUST PIPING MUFFLER****NOTE**

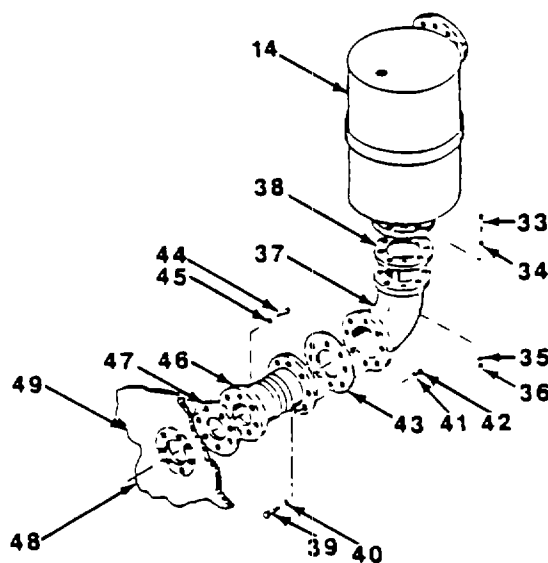
**Welding must be done by a qualified welder only.**

- a. Inspect muffler, hard piping and flanges for cracks.
- b. Weld cracks and re-fabricate piping between flanges as necessary.
- c. Grind all welds smooth.

**INSTALLATION****INSTALL EXHAUST PIPING AND MUFFLER****NOTE**

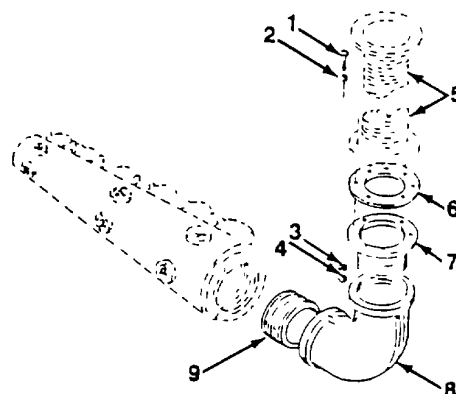
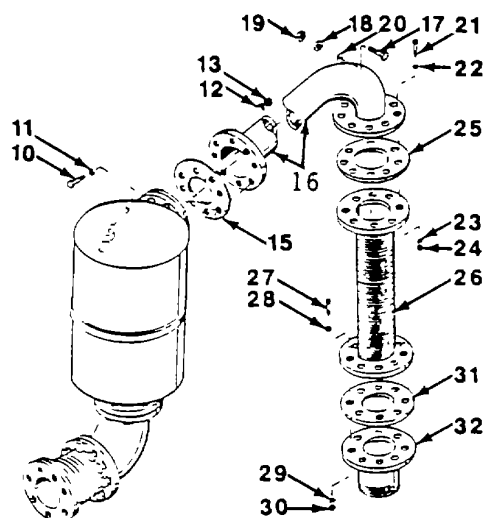
**Replace all gaskets removed during removal procedures.**

- a. Align mounting holes in gasket (47), expansion joint connector (46) and plate (48). Tighten with screws (44) and lockwashers (45).
- b. Install gasket (43) and elbow (37). Tighten with screws (39), flat washers (40), lockwashers (41) and nuts (42).



4-34 REPLACE/REPAIR EXHAUST PIPING AND MUFFLER (Continued).

- c. Install gasket (38) and muffler (14) and tighten with screws (33), flat washers (34), lockwashers (35) and nuts (36).
- d. Install gasket (15) and pipe (16) and secure with screws (10), flat washers (11), lockwashers (12) and nuts (13) On inboard exhaust pipe (16) secure hanger (20) with screws (17), lockwashers (18) and nut (19).
- e. Install gasket (25) and flexible connection (26) and tighten with screws (21), flat washers (22), lockwashers (23) and nuts (24).
- f. Install pipe nipple (9) on exhaust manifold install elbow (8).
- g. Install pipe flange (7) and gasket (6) and secure flexible connection (5) with screws (1), flat washers (2), lockwashers (3) and nuts (4).
- h. Insulate exhaust piping and muffler



**4-35 SERVICE OF RUDDER AND TILLER.****INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Equipment Conditions:**

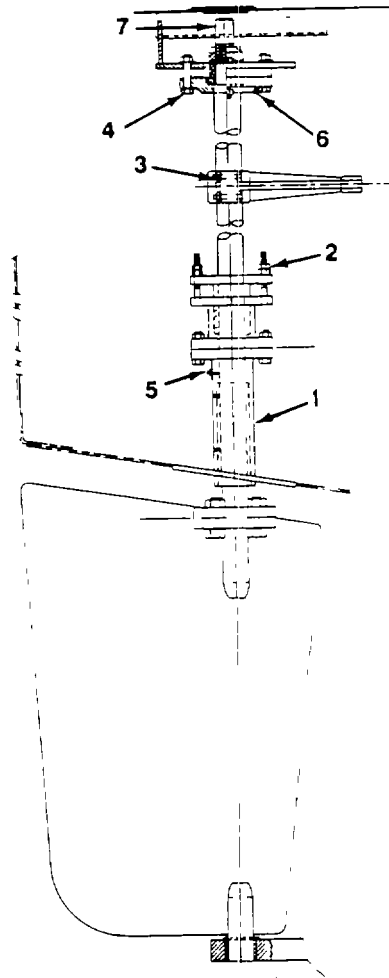
Engine shut down

**Materials/Parts:**

Grease  
Item 22, Appendix E  
Grease Gun

**SERVICE****SERVICE RUDDER AND TILLER**

- a. Check welds at base of rudder port (1) for breaks, cracks or leaks Refer to Direct Support for repair action.
- b. Tighten bolts at stuffing box (2) if loose. Replace stuffing material as necessary.
- c. Tighten nuts and bolts (3) connecting tiller arm to rudder stock as necessary.
- d. Tighten nuts and bolts connecting upper and lower thrust flanges (4) if loose.
- e. Lubricate rudder stock at grease fitting (5). Refer to LO 55-1905-222-12.
- f. Lubricate thrust bearing at grease fitting located at (6).
- g. Check serviceability of emergency tiller connection (7).
- h. Ensure emergency tiller is clean, free of rust and serviceable.



**Section V. PREPARATION FOR STORAGE AND SHIPMENT**

The procedure for operation for the storage and shipment of the LCM-8 is referred to in Shipment and Storage Technical Bulletins TB 740-97-2 and TB 730-97-4.



CHAPTER 5

INTERMEDIATE DIRECT SUPPORT MAINTENANCE

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CHAPTER 5

INTERMEDIATE DIRECT SUPPORT MAINTENANCE - Continued

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CHAPTER 5

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

---

**5-1 COMMON TOOLS AND EQUIPMENT.**

---

For authorized common tools and equipment, refer to the Modified Table of Organizational Equipment (MTOE) applicable to your unit.

---

**5-2 SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.**

---

Any special tools or equipment required by direct support maintenance personnel to perform maintenance on the landing craft is listed in Appendix B of this manual.

---

**5-3 REPAIR PARTS.**

---

Repair parts are listed and illustrated in the repair parts and special tools list (TM 55-1905-222-24P) covering direct support maintenance of this equipment.

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**Section II. TROUBLESHOOTING**

---

**5-4 TROUBLESHOOTING PROCEDURES.**

This paragraph provides information useful in diagnosing and correcting unsatisfactory operation or failure of LCM-8 systems and equipment. Troubleshooting procedures in this manual are limited to the basic craft. Refer to TM 5-2815-231-14 for engine and transmission troubleshooting procedures. Before using the troubleshooting procedures, ensure that all applicable operating procedures have been performed.

**NOTE**

**The table lists the malfunctions which may occur during the service life of the equipment. Replace all defective parts when repairing an equipment unless machining or other repair process can return the part to reusable condition.**

## Troubleshooting

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

## 1. ALTERNATOR FAILS TO CHARGE.

Step 1. Check for excessively worn, sticky or intermittent brushes.

Replace brushes (para 5-6).

Step 2. Test for defective rectifier diodes.

Disassemble alternator and replace diodes (para 6-5).

Step 3. Test for open rotor winding.

Disassemble alternator and verify rotor winding continuity.

Replace rotor if open (para. 6-5).

## 2. LOW OR UNSTEADY CHARGING RATE

Step 1. Check for open, grounded or shorted turns in stator coils.

Disassemble alternator and replace stator (para 6-5).

Step 2. Check for grounded or shorted turns in rotor winding.

Disassemble alternator and replace rotor (para 6-5).

Step 3. Check for open or shorted rectifier diodes.

Disassemble alternator and replace diodes (para 6-5).

## 3. NOISY ALTERNATOR

Check to see if alternator bearings are worn.

Disassemble alternator and replace worn or defective bearings (para 6-5).

**Troubleshooting - Continued**

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**PROPULSION CONTROL SYSTEM**

PROPULSION CONTROLS DO NOT EFFECT CLUTCH OR THROTTLE CHANGE

Check to see if control head is defective

Replace control head (para 5-6)

---

**SANITATION SYSTEM**

SEWAGE PUMP DOES NOT RUN

- Step 1. Check to see if float switch is defective.  
           Replace float assembly.
- Step 2. Check to see If wiring is faulty.  
           Repair as necessary.
- Step 3. Check to see if rotary switch is defective.  
           Replace rotary switch (para 4-17).
- Step 4. Check to see if pump-motor is defective.  
           Replace pump-motor assembly (para 4-28).

## Troubleshooting - Continued

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**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**RAMP SYSTEM**

## 1. CONTROL VALVE LEVER MOVES BUT WINCH DOES NOT TURN (CABLE IS FREE TO MOVE)

Check to see if any hydraulic line has burst.

Replace hoses and fittings (para 4-30).

## 2. CONTROL VALVE LEVER DOES NOT MOVE

Check to see if control valve is seized.

Replace control valve (para 5-22). Send defective control valve to general support maintenance for repairs

## 3. LOSS OF OIL FROM RAMP WINCH HYDRAULIC MOTOR

Check to see if motor seal is defective.

Repair motor (para 5-23).

## 4. NOISY OPERATION OF PUMP.

Step 1. Check for pump coupling misalignment.

Align pump coupling.

Step 2. Check to see if pump is defective.

Replace pump (para 5-16). Send defective pump to general support maintenance for repairs.

## Troubleshooting - Continued

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**STEERING SYSTEM**

## 1. STEERING WHEEL DIFFICULT TO TURN.

Check to see if dirt has been trapped in helm unit.

Disassemble helm unit, clean thoroughly and repair as necessary (para 5-31).

## 2. STEERING IS SLOW.

Check to see if foreign material is trapped in flow divider.

Replace/repair (para 5-34).

## 3. WHEEL TURNS BUT RUDDER DOES NOT MOVE.

Step 1. Check for ruptured line.

Replace hoses and fittings (para 4-30).

Step 2. Check for helm unit failure.

Replace/repair helm unit (para 5-31).

## 4. NOISY PUMP OPERATION.

Check to see if pump is defective.

Replace/repair pump (para 5-29).

## 5. HYDRAULIC PUMP DISCHARGE PRESSURE LOW.

Check to see if pump is defective.

Replace/repair pump (para 5-29).

## 6. RUDDER ANGLE INDICATOR READS BACKWARDS.

Step 1. Check to see if transmitter terminal wires are reversed.

Reverse wire to terminals 6 and 8 from the transmitter.



**Troubleshooting - Continued**

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

**STEERING SYSTEM - Continued**

Step 2. Check to see if transmitter is defective.

Replace transmitter (para 5-39).

**BILGE SYSTEM**

EMERGENCY BILGE PUMP FAILS TO DELIVER WATER.

Check to see if bilge pump/motor assembly is defective.

Replace/repair bilge pump/motor assembly (para 5-40).

**STARTING SYSTEM**

1. ENGINE DRIVEN RECHARGING PUMP FAILS TO RAISE ACCUMULATOR PRESSURE.

Step 1. Check to see if hose has burst.

Replace hoses and fittings (para 4-30).

Step 2. Check to see if engine driven pump is defective.

Replace pump (para 5-44) Send defective pump to general support maintenance for repairs.

2. CRANKING SPEED SLOW.

Check to see if there is excessive internal leakage in starting motor.

Replace starting motor (para 5-48). Send defective motor to general support maintenance for repairs.

## Troubleshooting - Continued

---

**MALFUNCTION****TEST OR INSPECTION****CORRECTIVE ACTION**

---

**STARTING SYSTEM - Continued**

## 3. HAND PUMP FAILS TO CHARGE SYSTEM.

Step 1. Check to see if hose has burst.

Replace hoses and fittings (para 4-30).

Step 2. Check to see if piston seal rings are damaged.

Replace hand pump (para. 5-49). Send defective hand pump to general support maintenance for repairs.

## 4. LOW/LOSS OF ACCUMULATOR PRECHARGE..

Check for damaged seal ring.

Replace accumulator (para 5-45). Send defective accumulator to general support maintenance for repairs.

## 5. HIGH PRESSURE IN SYSTEM (ABOVE 3500 PSI).

Step 1. Check to see if relief valve is defective.

Replace and adjust relief valve.

Step 2. Check to see if unloading valve in recharging pump is operating improperly.

Replace pump (para 5-44). Send defective pump to general support maintenance for repairs.

## 6. ENGINE FAILS TO START IN ALL STARTING MODES.

Step 1. Check to see if control valve is defective.

Replace control valve (para. 5-47).

Step 2. Check to see if starting motor is defective.

Replace starting motor (para 5-48). Send starting motor to general support maintenance for repairs

Troubleshooting - Continued

---

**MALFUNCTION**

**TEST OR INSPECTION**

**CORRECTIVE ACTION**

---

**FUEL SYSTEM**

SUFFICIENT FUEL NOT AVAILABLE TO ENGINES

Check to see if there is a break in the fuel hose.

Replace hoses and fittings (para 4-30).

**SECTION III. MAINTENANCE PROCEDURES**

---

**5-5 GENERAL MAINTENANCE PROCEDURES.**

---

This chapter contains maintenance procedures that are the responsibility of direct support maintenance, as authorized by the Maintenance Allocation Chart (MAC).

**MAINTENANCE OF ELECTRICAL SYSTEM****5-6 REPAIR ALTERNATOR.****INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Vise  
Multimeter

Materials/Parts:

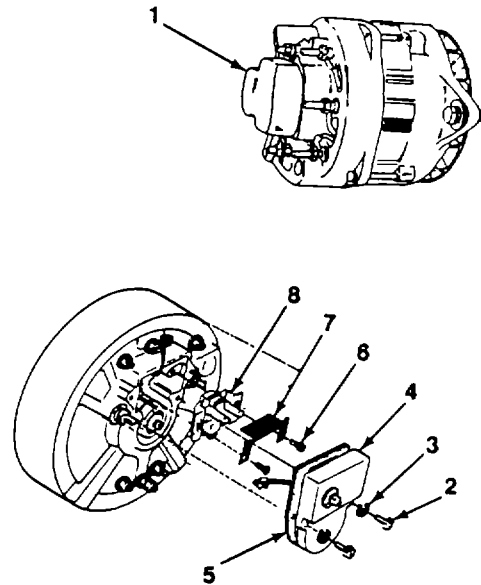
Brush  
P/N 3-12  
Felt Gasket  
P/N 3-14

Equipment Conditions:

Reference  
Para. 4-12. Alternator  
removed from engine.

**DISASSEMBLY****REMOVE BRUSH ASSEMBLY.**

- a. Clamp alternator (1) in a vise.
- b. Remove tapping hex screws (2) and lockwashers (3).
- c. Disconnect negative lead and remove brush cover plat (4) and felt gasket (5).
- d. Remove tapping hex screws (6), shunt lead insulator (7), and lift brush assembly (8) out of brush cavity.



**5-6 REPAIR ALTERNATOR (Continued).**

**CLEANING**

CLEAN BRUSH ASSEMBLY

- a. Dust off brush assembly with a soft brush.
- b. Clean brush cover plate with a clean lint-free cloth.
- c. Clean brush assembly cavity with a clean lint-free cloth.

**INSPECTION**

INSPECT BRUSH ASSEMBLY

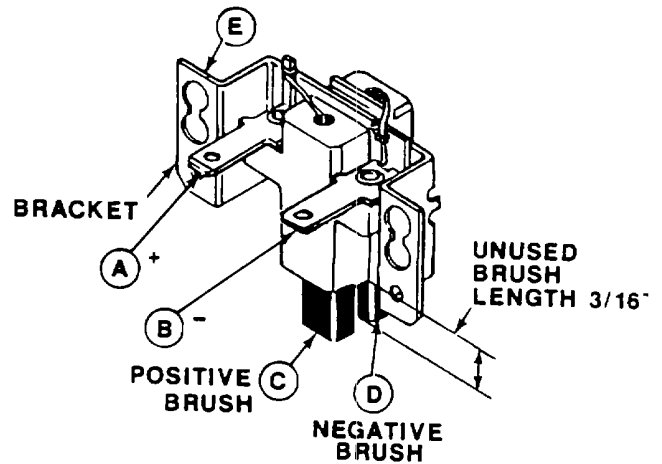
- a. Visually inspect brush for cracks, excessive wear and other defects.
- b. Get a new brush assembly if above conditions are found. If brushes are not oil soaked or cracked, and the rotor contacting surfaces are smooth, and the unused brush length is 3/16 inch or longer, they may be reused.

**TESTING**

TEST BRUSH ASSEMBLY

Test brush assembly for continuity and no circuit using a multimeter.

TEST
CONTINUITY FROM A TO C FROM B TO D
NO CIRCUIT FROM A TO B, D, OR E FROM B TO A, C, OR E



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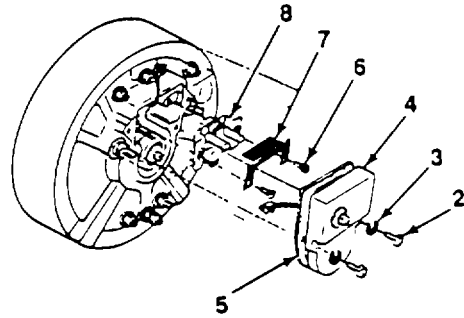
**5-6 REPAIR ALTERNATOR (Continued).**

---

**ASSEMBLY**

## INSTALL BRUSH ASSEMBLY

- a. Install brush assembly (8) in the brush cavity.
- b. Install shunt lead Insulator (7) and secure with tapping hex screws (6).
- c. Install felt gasket (5) and reconnect negative lead.
- d. Install brush cover plate (4) and secure with lockwashers (3) and tapping hex screws (2).



**MAINTENANCE OF CANOPY, MAST, WINDOWS AND WIPERS**

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**5-7 REPAIR CANOPY AND MAST.**

---

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Machine, Welding

Equipment Conditions:

All power off. All accessories connected to canopy are disconnected (ladder, searchlight, wipers assembly). Mast to be lowered to its lowest configuration

Personnel required:

(1) Certified welder.

General Safety Instructions:

Ensure area is safe for "HOT WORK." Post fire watch as necessary.

---

**REPAIR**

REPAIR CANOPY.

- a. Strip paint from canopy around area to be repaired. Ensure area is down to bare metal and free of rust.
- b. Weld damaged area so as to make it watertight and retain its original strength.
- c. Prime and paint area so it is restored to its original condition.
- d. Reinstall accessories.



---

**5-7 REPAIR CANOPY AND MAST (Continued).**

---

## REPAIR MAST.

- a. Lower mast to the deck as per para 4-20.
- b. Strip paint from mast around area to be repaired. Ensure area is down to bare metal and free of rust.
- c. Weld damaged area so as to make it watertight and retain its original strength.
- d. Prime and paint area so it is restored to its original condition. Refer to TB 43-0114.
- e. Raise mast to its upright and locked position as per para 4-20.

**MAINTENANCE OF PROPULSION CONTROLS AND LINKAGES**

**5-8 REPLACE THROTTLE LINKAGE.**

The throttle linkage consists of the throttle cable extending from the pilothouse control head to the articulator and the red knob control unit as well as the control rod assembly connecting the governor.

This task covers:                      a. Removal                      c. Installation  
     b. Lubrication

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Equipment Conditions:

Engine shut down.

Materials/Parts:

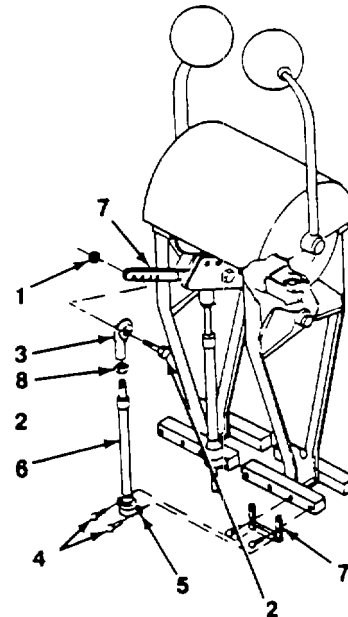
Control Unit, Red Knob  
 P/NA-1585  
 Throttle Cable (Part-13', Stbd-9')  
 P/N B-2260  
 Articulator  
 P/N C-2190

General Safety Instructions:

The throttle cable is heavy.  
 Therefore, caution should be  
 exercised when dropping it  
 from the pilothouse.

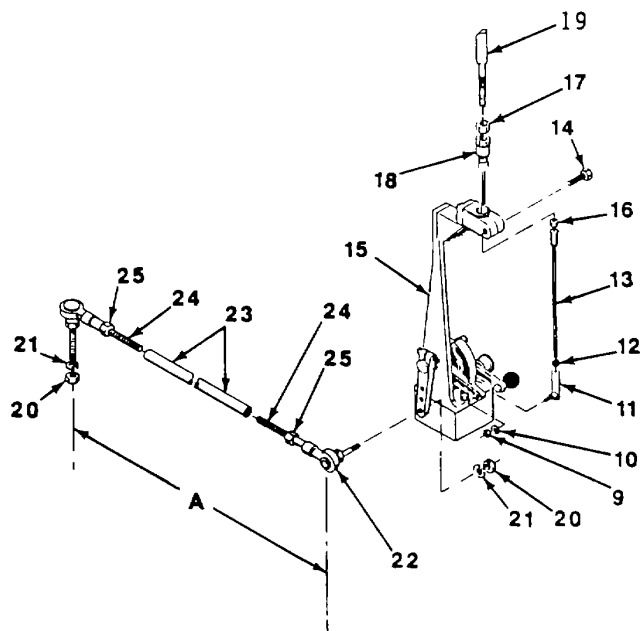
**REMOVAL**

1. DISCONNECT THROTTLE CABLE FROM CONTROL HEAD IN PILOTHOUSE.
  - a. Remove access plate in pilothouse control console.
  - b. Unscrew nut (1) and bolt (2) from cable connector (3), unscrew screws (4) from cable clamp (5).
  - c. Remove throttle cable (6) from throttle extension kit (7).
  - d. Loosen jam nut (8) and remove cable connector (3).



**5-8 REPLACE THROTTLE LINKAGE (Continued).****2. DISCONNECT THROTTLE CABLE AND ARTICULATOR FROM THE RED KNOB CONTROL UNIT IN ENGINE ROOM.**

- a. Remove nut (9) and washer (10), remove cable connector (11).
- b. Loosen locknut (12) and remove cable connector (11) from articulator (13).
- c. Remove screw (14) from control unit (15).
- d. Loosen locknuts (16 and 17), remove cable adapter bushing (18) from articulator (13) and throttle cable (19).
- e. Observe cable route from pilothouse to engine room. Pull throttle cable (19) down.

**3. DISCONNECT GOVERNOR CONTROL ROD ASSEMBLY FROM CONTROL UNIT.**

- a. Measure and record the length "A" from center to center of rod ends (22) before removing.
- b. Remove hex nuts (20) and lock-washers (21); remove rod ends (22) from coupling tube (23).

**NOTE**

**Hex nuts (25) may be loosened to disconnect rod end (22) from connecting rod (24). Do not disconnect unless adjustment is necessary.**

**5-8 REPLACE THROTTLE LINKAGE (Continued).**

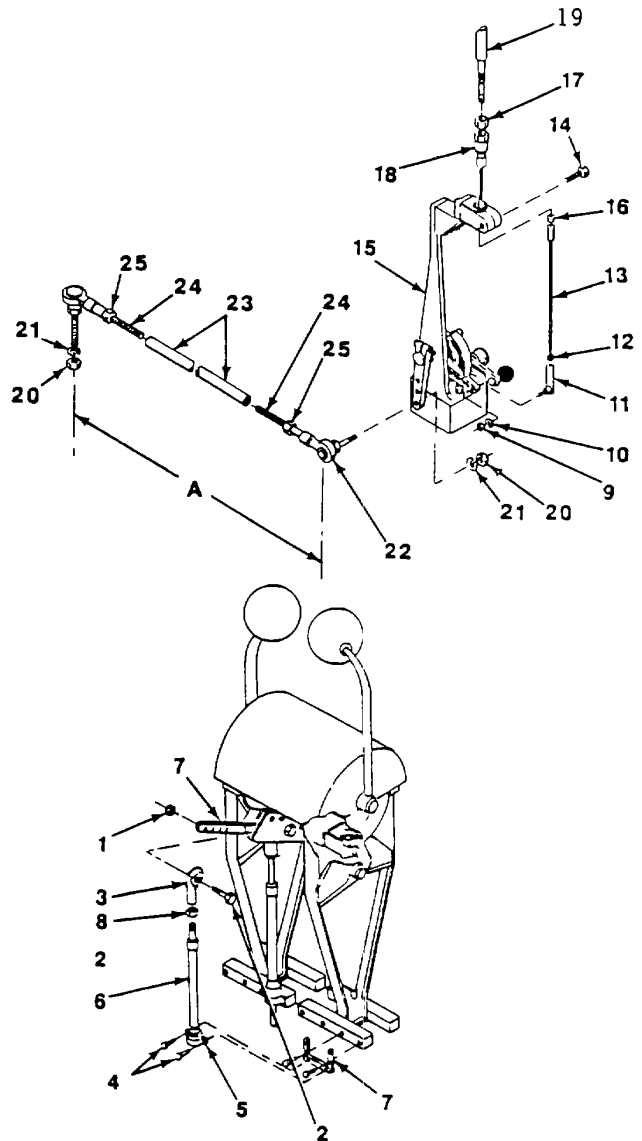
**LUBRICATION**

LUBRICATE RED KNOB CONTROL UNIT

Apply two or three shots of grease from a grease gun to the grease fitting on the lever of the red knob control unit (15).

**INSTALLATION**

1. ASSEMBLE AND INSTALL GOVERNOR CONTROL ROD ASSEMBLY
  - a. Install coupling tube (23) on rod ends (22). Adjust to length "A" recorded above.
  - b. Install rod ends (22) and secure with lockwashers (21) and hex nuts (20).
2. CONNECT THROTTLE CABLE TO CONTROL HEAD IN PILOTHOUSE.
  - a. Drop engine end of throttle cable into engine room through access in pilothouse.
  - b. Install cable connector (3) and jam nut (8) to throttle cable (6).
  - c. Install cable clamp (5) and secure with screws (4).
  - d. Install cable connector (3) onto throttle extension kit (7) and secure with bolt (2) and nut (1).
3. CONNECT THROTTLE CABLE AND ARTICULATOR TO RED KNOB CONTROL UNIT IN ENGINE ROOM.
  - a. Ensure that throttle cable is routed to engine room as required..
  - b. Install throttle cable (19) onto cable adapter bushing (18) and secure with locknut (17).



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**5-8 REPLACE THROTTLE LINKAGE (Continued).**

---

- c. Pass cable adapter bushing (18) through hole in control unit (15). Hand tighten screw (14). (Make sure only the bottom end of the bushing is clamped in control unit.)
- d. Install locknut (16) and articulator (13) onto threaded rod end of cable adapter bushing (18).
- e. Install locknut (12) and cable connector (11) on articulator (13).
- f. Install cable connector (11) and secure with washer (10) and nut (9).
- g. Adjust throttle linkage as necessary.

**MAINTENANCE OF PROPULSION CONTROLS AND LINKAGES**

**5-9 REPLACE CLUTCH LINKAGE.**

The clutch linkage consists of the clutch cable extending from the pilothouse control head to the articulator and the black knob control unit as well as the control rod assembly connecting the transmission control valve.

- This task covers:
- a. Removal
  - b. Lubrication
  - c. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

Equipment conditions:

Engine shut down.

Materials/Parts:

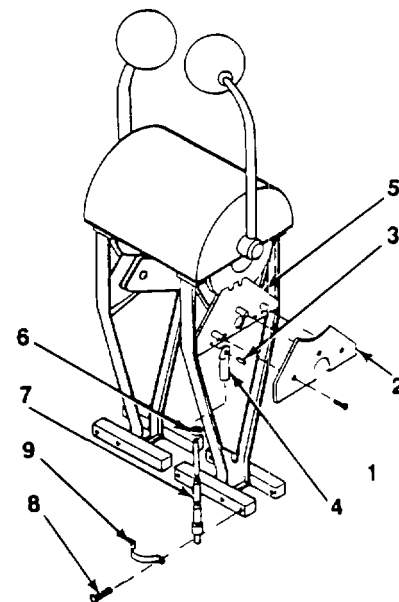
Control Unit, Black Knobs  
P/N A-1585  
Clutch Cable (Port-15', Stbd-12')  
P/N B-2260  
Articulator  
P/N C-2190

General Safety Instructions:

The clutch cable is heavy. Therefore, caution should be exercised when dropping it from the pilothouse.

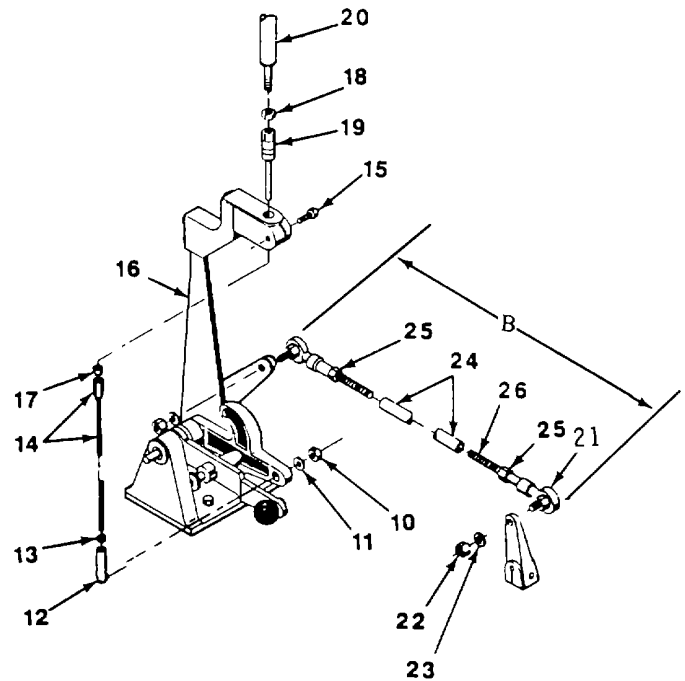
**REMOVAL**

1. DISCONNECT CLUTCH CABLE FROM CONTROL HEAD IN PILOTHOUSE.
  - a. Remove access plate in pilothouse control console.
  - b. Loosen three screws (1) and remove retainer (2).
  - c. Remove pin (3) from cable connector (4) and retainer plate (5).
  - d. Loosen jam nut (6) and remove clutch cable (7) from cable connector (4).
  - e. Loosen two screws (8) and remove cable clamp (9).



**5-9 REPLACE CLUTCH LINKAGE (Continued).**

2. DISCONNECT CLUTCH CABLE AND ARTICULATOR FROM THE BLACK KNOB CONTROL UNIT IN ENGINE ROOM.
  - a. Remove nut (10) and washer (11), remove cable connector (12).
  - b. Loosen locknut (13) and remove cable connector (12) from articulator (14).
  - c. Remove screw (15) from control unit (16).
  - d. Loosen locknuts (17 and 18) and remove cable adapter bushing (19) from articulator (14) and clutch cable (20).
  - e. Observe cable route from pilothouse to engine room. Pull clutch cable (20) down.
3. DISCONNECT TRANSMISSION CONTROL ROD ASSEMBLY FROM CONTROL UNIT.
  - a. Measure and record the length "B" from center to center of the rod ends (21) before removing.
  - b. Remove hex nuts (22) and lock-washers (23), remove rod ends (21) from coupling tube (24).

**NOTE**

**Hex nuts (25) may be loosened to disconnect rod end (21) from connecting rod (22). Do not disconnect unless adjustment is necessary.**

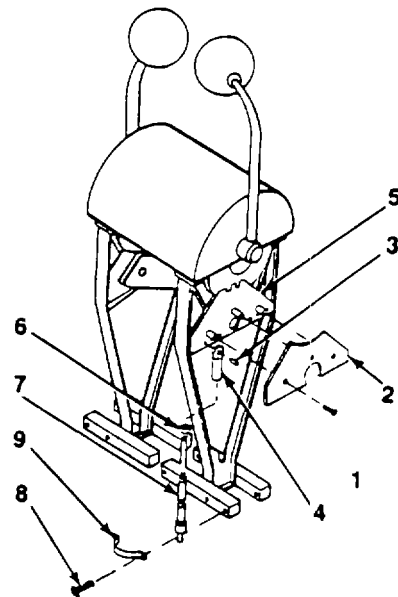
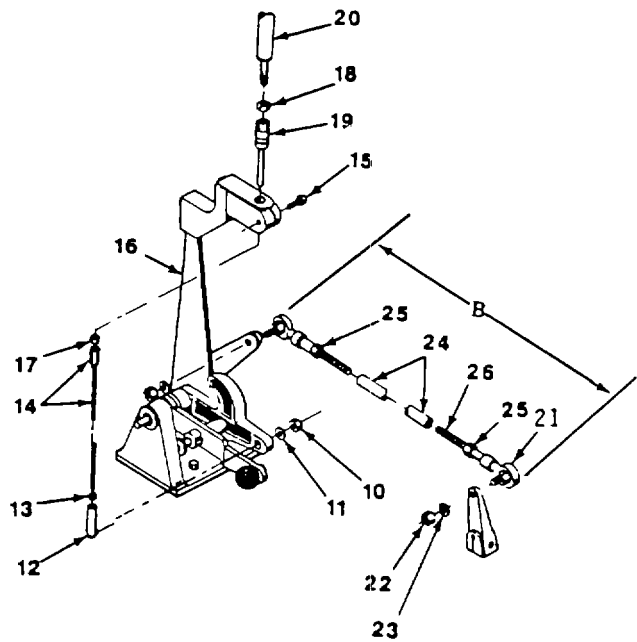
**LUBRICATION****LUBRICATE BLACK KNOB CONTROL UNIT**

Apply two or three shots of grease from a grease gun to the grease fitting on the lever of the black knob control unit.

**5-9 REPLACE CLUTCH LINKAGE (Continued).**

**INSTALLATION**

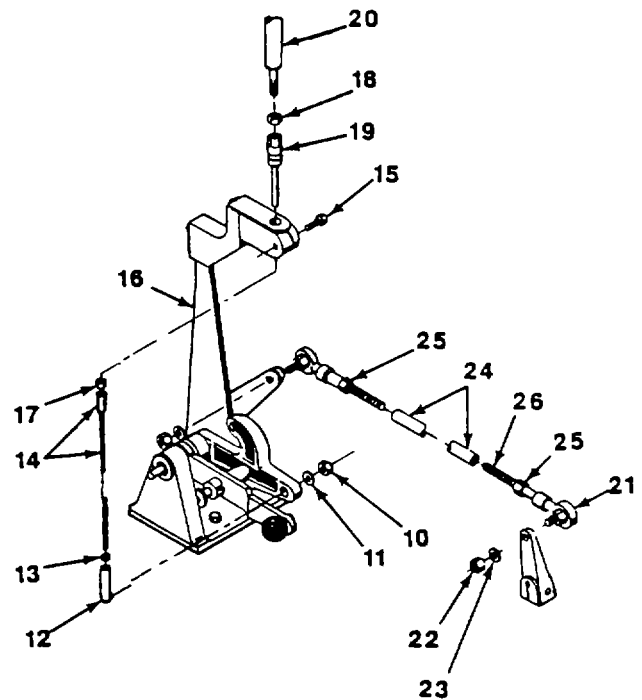
1. ASSEMBLE AND INSTALL TRANSMISSION CONTROL ROD ASSEMBLY.
  - a. Install coupling tube (24) on rod ends (21). Adjust to length "B" recorded above.
  - b. Install rod ends (21) and secure with lockwashers (23) and hex nuts (22).
2. CONNECT CLUTCH CABLE TO CONTROL HEAD IN PILOTHOUSE.
  - a. Drop transmission end of clutch cable into engine room through access in pilothouse.
  - b. Install cable connector (4) and jam nut (6) to clutch cable (7).
  - c. Install cable clamp (9) and secure with screws (8).
  - d. Install cable connector (4) into retainer plate (5) and secure with pin (3).
  - e. Install retainer (2) and secure with these screws (1).
3. CONNECT CLUTCH CABLE AND ARTICULATOR TO BLACK KNOB CONTROL UNIT IN ENGINE ROOM.
  - a. Ensure that clutch cable is routed to engine room as required.
  - b. Install clutch cable (20) onto cable adapter bushing (19) and secure with lock nut (18).
  - c. Pass cable adapter bushing (19) through hole in control unit (16). Hand tighten screw (15). (Make sure only the bottom end of the bushing is clamped in the control unit).





**5-9 REPLACE CLUTCH LINKAGE (Continued).**

- d. Install locknut (17) and articulator (14) onto threaded rod end of cable adapter bushing (19).
- e. Install locknut (13) and cable connector (12) on articulator (14).
- f. Install cable connector (12) and secure with washer (11) and nut (10).
- g. Adjust clutch linkage as necessary.



**MAINTENANCE OF ENGINE/TRANSMISSION INSTRUMENTS**

**5-10 REPLACE ENGINE/TRANSMISSION INSTRUMENTS.**

This task covers:                    a. Removal                    b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engines shut down All power off  
Remove all oil pressure from lines  
to gauges.

General Safety Instructions:

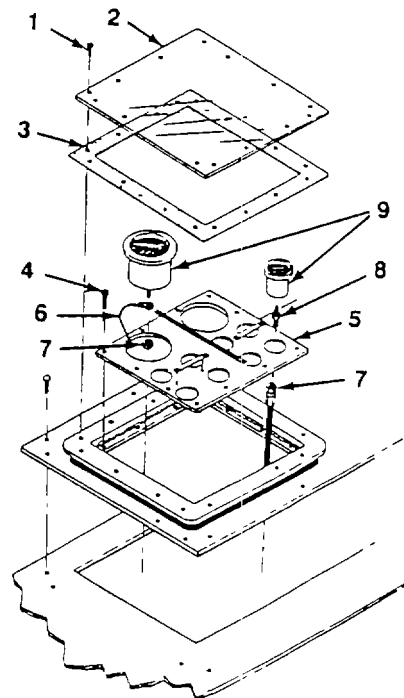
Energized electrical equipment is  
dangerous. Never work on energized  
equipment unless authorized to do so  
by a responsible authority.

**NOTE**

**Removal and installation is same for hydraulic gauges, rudder, angle  
indicator and ammeter.**

**REMOVE ENGINE/TRANSMISSION  
INSTRUMENTS**

- a. Remove screws (1), clear cover (2) and gasket (3).
- b. Remove screws (4) and lift instrument panel (5) to gain access to instruments.
- c. Disconnect tube or wires (6) by removing flare nut (7).
- d. Remove male connector (8) (if applicable) and replace gauge (9).



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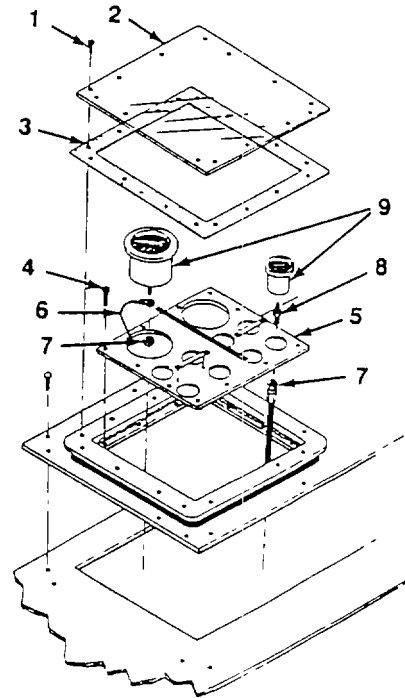
**5-10 REPLACE ENGINE/TRANSMISSION INSTRUMENTS (Continued).**

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**INSTALLATION**

INSTALL ENGINE/TRANSMISSION INSTRUMENTS.

- a. Screw male connector (8) into gauge (9) and reconnect tube/wire (6) and flare nut (7).
- b. Install gauge (9) into panel. Install panel (5) and secure it with screws (4).
- c. Replace gasket (3) (if necessary), cover (2) and secure with screws (1).



**5-11 REPLACE HYDRAULIC GAUGES, RUDDER ANGLE INDICATOR AND ANINIETER.**

This task covers:                    a. Removal                    c. Adjustment  
    b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Equipment Conditions:

All power off

Materials/Parts:

Hydraulic Steering Gauge  
 P/N 5DFMI-4CBM3000  
 Hydraulic Ramp Gauge  
 P/N5DFM1-4CBM5000  
 Hydraulic Start Gauge  
 P/N 5DFMI-4CBM5000  
 Battery Ammeter  
 P/N 377GH10  
 Rudder Angle Indicator  
 P/N MDL150,520-012  
 Adhesive (RTV)  
 Item 18, Appendix E

General Safety Instructions:

Ensure that hydraulic pressure in the system is relieved before removing gauges.

Use a tester to ensure that all power is off before touching bare wires.

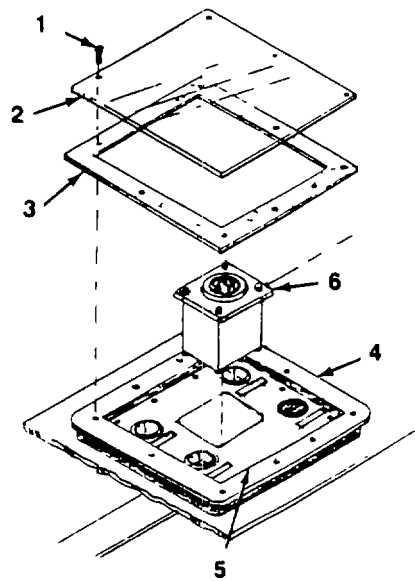
**REMOVAL**

**1. REMOVE COVER GLASS AND GASKET.**

Loosen fourteen tapping screws (1) and remove cover glass (2) and gasket (3) from the angle plate (4).

**2. REMOVE RUDDER ANGLE INDICATOR.**

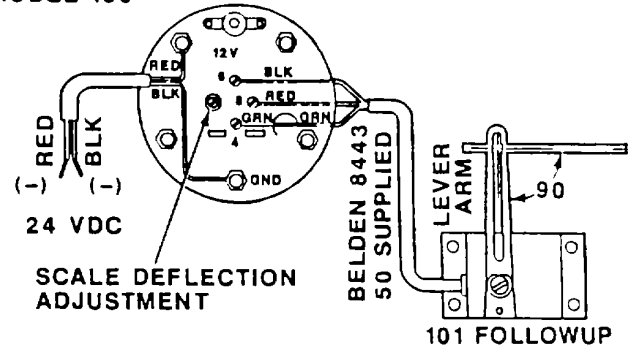
- a. The rudder angle indicator is attached to the instrument panel by adhesive. Use a small flathead screwdriver to detach rudder angle indicator from the instrument panel (5). Lift indicator only enough to obtain enough clearance to the rear of indicator (6).



**5-11 REPLACE HYDRAULIC GAUGES, RUDDER ANGLE INDICATOR AND AMMETER (Continued).**

- b. Tag and disconnect wires (BLACK, RED, & GREEN) from terminals 6, 8 and 4 respectively at the rear of the indicator.
- c. Tag and disconnect positive and negative terminals (RED AND BLACK) of the 24V supply from the rear of the indicator.

**MASTER STATION  
MODEL 150**



**INSTALLATION**

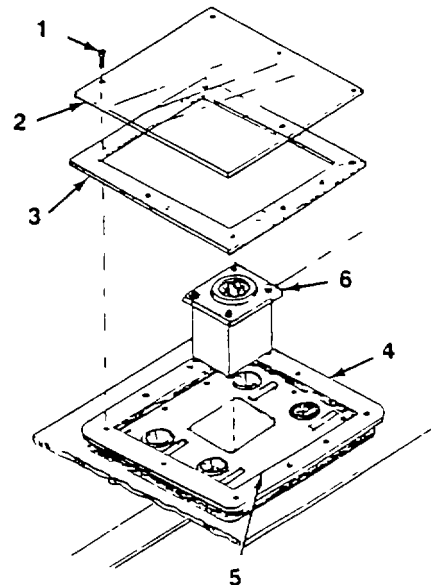
INSTALL NEW RUDDER ANGLE INDICATOR.

- a. Connect three wires to terminals 6, 8 and 4 at the rear of the indicator.
- b. Connect positive and negative terminals of the 24V supply to the indicator.
- c. Set new rudder angle transmitter into place on the instrument panel (5).

**NOTE**

**Align and adjust rudder angle indicator before proceeding with the following steps..**

- d. Seal rudder angle indicator to the instrument panel with good grade adhesive.
- e. Install gasket (3) and cover glass (2) and secure with fourteen tapping screws (1).



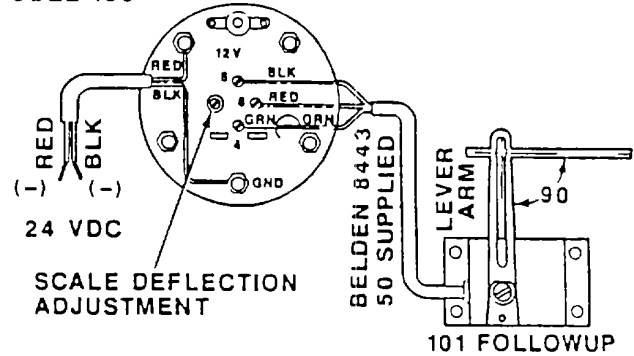
**5-11 REPLACE HYDRAULIC GAUGES, RUDDER ANGLE INDICATOR AND AMMETER (Continued)**

**ALIGNMENT**

**ADJUST RUDDER ANGLE INDICATOR**

- a. Turn rudders from hardover to hardover using the emergency tiller
- b. Observe rudder angle Indicator move from 35 degrees port to 35 degrees starboard or vice versa.
- c. Adjust scale deflection if readings in step b are different. (Scale deflection adjustment is located at rear of rudder angle indicator.) Continue to adjust until reading on indicator is 35° with rudders in hardover and 0° at midships.

**MASTER STATION  
MODEL 150**



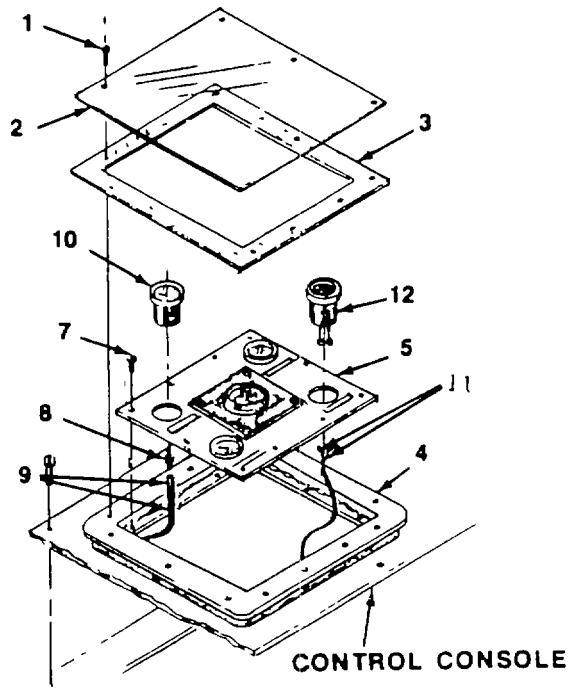
**REMOVAL**

1. REMOVE COVER GLASS GASKET AND INSTRUMENT PANEL.

Loosen fourteen tapping screws (1) and remove cover (2) and gasket (3) from the angle plate (4).

2. REMOVE HYDRAULIC GAUGES AND AMMETER.

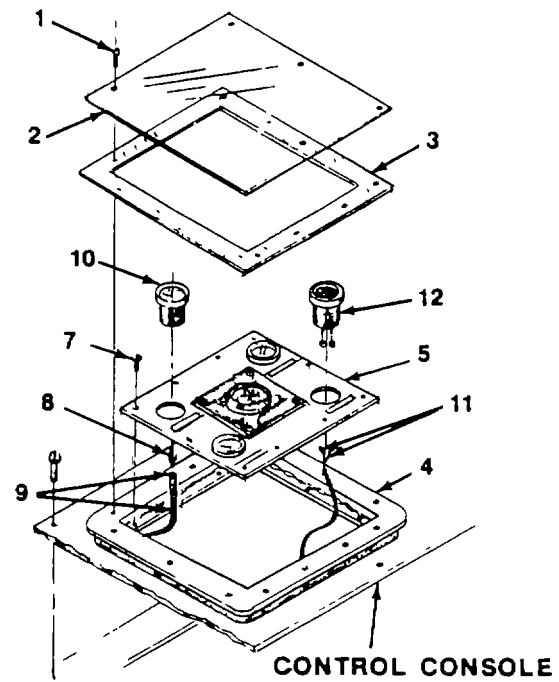
- a. Remove ten tapping screws (7) from instrument panel (5).
- b. Lift instrument panel only enough to gain access to the rear of the gauges.
- c. Remove male connector (8) from flare nut and tube assembly (9) and from gauge (10), remove gauge.
- d. Tag and disconnect two electrical wires (11) from rear of ammeter (12) and remove ammeter (12).



**5-11 REPLACE HYDRAULIC GAUGES, RUDDER ANGLE INDICATOR AND AMMETER (Continued).****INSTALLATION**

INSTALL HYDRAULIC GAUGES AND AMMETER.

- a. Set new hydraulic gauge and ammeter in place on instrument panel (5).
- b. Connect two electrical wires (11) to the terminals on rear of new ammeter (12).
- c. Install male connector (8) on new hydraulic gauge (10) and connect to flare nut and tube assembly (9).
- d. Set instrument panel (5) in place and secure with ten tapping screws (7).
- e. Install gasket (3) and cover glass (2) and secure with fourteen tapping screws (1).



**MAINTENANCE OF HULL, BITTS, CHOCKS, TIEDOWNS, STANCHIONS, LIFELINES, HATCHES, AND VOID COVERS**

**5-12 REPLACE/REPAIR HULL, BITTS, CHOCKS AND TIEDOWNS.**

This task covers:                      a. Removal                      b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Machine, Welding

Personnel Required:

(1) Certified Welder

Equipment Conditions:

Vessel is to be certified safe for  
"HOT WORK".

General Safety Instructions:

Ensure area is safe for "HOT WORK"  
Post fire watch as necessary.

**REMOVAL**

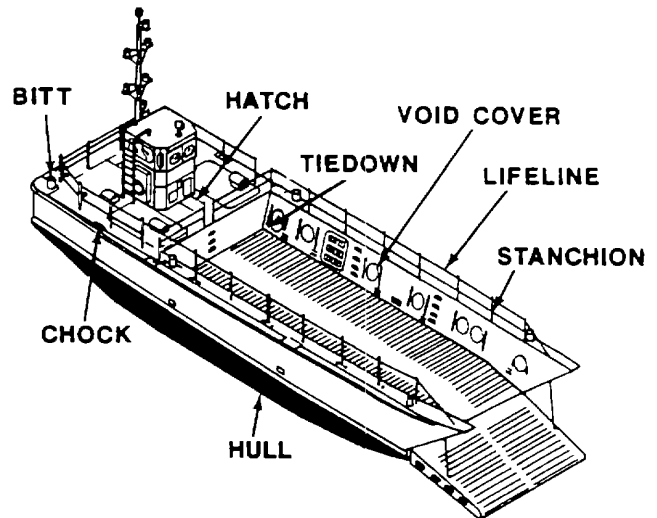
REMOVE HULL, BITTS, CHOCKS AND TIEDOWNS.

- a. Break welds at seams around item to be removed. Ensure item is secured so as not to fall in water or through deck when welds are broken.
- b. Remove item to be replaced.

**INSTALLATION**

INSTALL HULL, BITTS, CHOCKS AND TIEDOWNS.

- a. Prepare area for installation of deck fitting by welding.
- b. Weld item in place.
- c. Grind welds smooth. Prime and paint repaired area.





**MAINTENANCE OF HULL, BITTS, CHOCKS, TIEDOWNS, STANCHIONS, LIFELINES, HATCHES AND VOID COVERS**

**5-13 REPLACE/REPAIR HATCHES AND VOID COVERS.**

This task covers:                      a. Removal                      b. Installation

**INITIAL SETUP**

Tools:

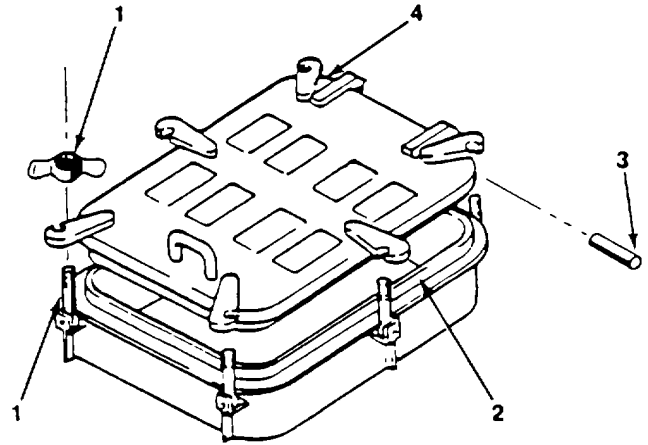
Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

General Safety Instructions:

Hatches and void covers are heavy and awkward to handle. Exercise care when handling these items by your yourself.

**REMOVAL**

1. REMOVE HATCHES
  - a. Unlatch hatch dog assembly (1) from coaming (2).
  - b. Remove hinge pins (3) and lift off hatch (4).



**INSTALLATION**

1. INSTALL HATCHES.
  - a. Place hatch (4) on coaming (2) and align hinge openings.
  - b. Re-insert hinge pins (3).
  - c. Secure hatch with dogs (1).

---

**5-13 REPLACE/REPAIR HATCHES AND VOID COVERS (Continued).**

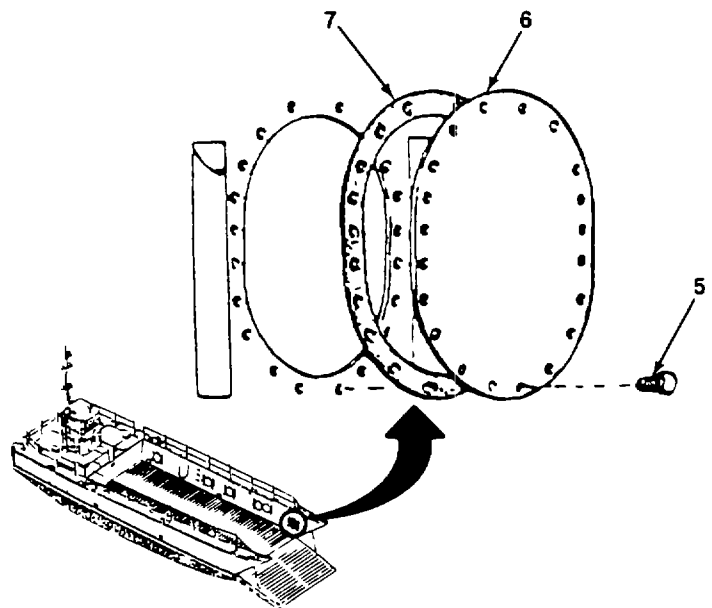
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**REMOVAL**

2. REMOVE VOID COVERS
  - a. Remove screws (5) from around void cover (6).
  - b. Remove void cover (6) and gasket (7).

**INSTALLATION**

2. INSTALL VOID COVERS
  - a. Install gasket (7) and void cover (6). Secure with screws (5).



## MAINTENANCE OF HULL, BITTS, CHOCKS, TIEDOWNS, STANCHIONS, LIFELINES, HATCHES AND VOID COVERS

### 5-14 REPLACE/REPAIR STANCHIONS AND LIFELINES.

This task covers:                    a. Removal                    b. Installation

#### INITIAL SETUP

##### Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

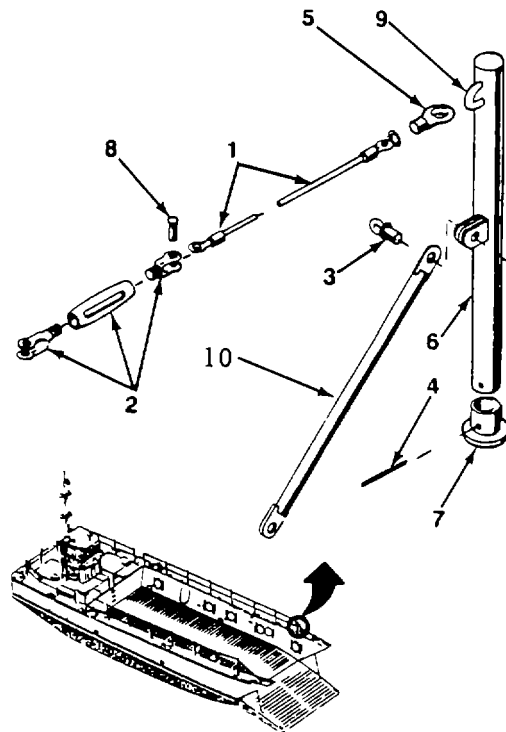
##### General Safety Instructions:

Personnel working on deck are to wear a work vest life preserver when lifelines are disassembled.

#### REMOVAL

##### REMOVE LIFELINES AND STANCHIONS

- a. Relieve tension from lifeline (1) with turnbuckle (2).
- b. Remove pin (3) from brace (10), and pin (4) from socket (7).
- c. Disconnect hook (5) and lift stanchion (6) from the socket (7).
- d. Remove pin (8) and disconnect lifeline (1) from turnbuckle (2).
- e. Pull lifeline through each stanchion eye (9) until lifeline is free of each stanchion. Disconnect lifeline at the end.

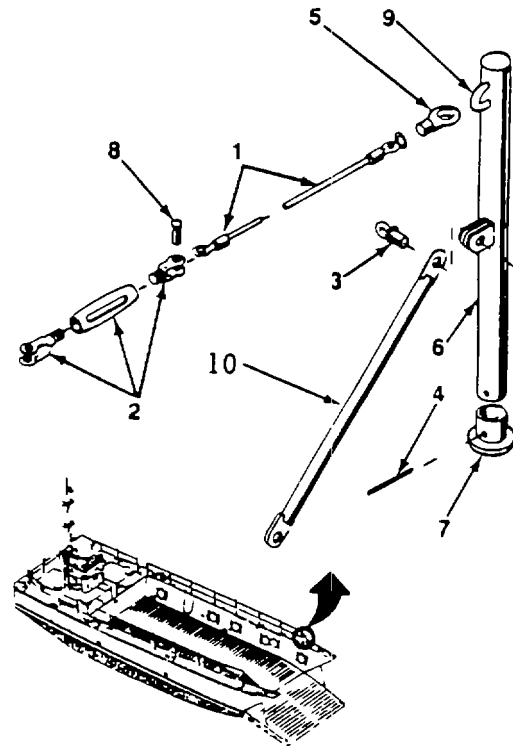


**5-14 REPLACE/REPAIR STANCHIONS AND LIFELINES (Continued).**

**INSTALLATION**

INSTALL LIFELINES AND STANCHIONS.

- a. Place stanchion (6) into socket (7).
- b. Install pin (3) to connect brace (10) to stanchion (6), and pin (4) into socket (7) and stanchion (6).
- c. Re-connect lifeline at one end and run it through each stanchion eye (9)
- d. Re-connect lifeline (1) to turnbuckle (2) with pin (8).
- e. Re-connect hook (5) to stanchion eye (9).
- f. Tighten lifeline (1) with turnbuckle (2).



**MAINTENANCE OF VOIDS AND COMPARTMENTS**

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**5-15 REPAIR VOIDS AND COMPARTMENTS.**

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**INITIAL SETUP**Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783  
Machine, Welding

Personnel Required:

(1) Certified Welder

Equipment Conditions:

Vessel and compartment  
certified safe for "HOT WORK".  
In certain instances vessel  
should be drydocked when damage  
is below waterline.

General Safety Instructions:

Ensure void or compartment is gas free  
from explosive vapors and is safe for  
entry. Post a fire watch during "HOT  
WORK".

---

**REPAIR****REPAIR VOIDS AND COMPARTMENTS.**

- a. Remove all water and contamination from voids to ascertain where the damage is.
- b. Prepare area for repair by removing paint and rust.
- c. Repair damage by welding and/or patching area. Replace damaged areas as necessary.
- d. Grind welds smooth. Prime and paint area upon completion of repairs.
- e. If voids are damaged due to heavy rust, the entire void should be sandblasted to bare metal, primed and painted

**MAINTENANCE OF RAMP HOIST HYDRAULIC PUMP**

**5-16 REPLACE RAMP HOIST HYDRAULIC PUMP.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Materials/Parts:

Sealant  
Item 14, Appendix E

Equipment Conditions:

Engine shut down  
Ramp hydraulic system drained  
of oil at pump

General Safety Instructions:

Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

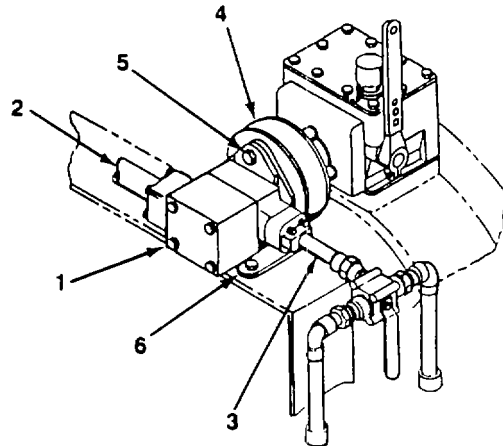
**REMOVAL**

**WARNING**

**The oil pressure in the system must be released prior to servicing the engine-driven pump, or other parts to prevent possible injury to personnel or equipment.**

**REMOVE RAMP HOIST HYDRAULIC PUMP.**

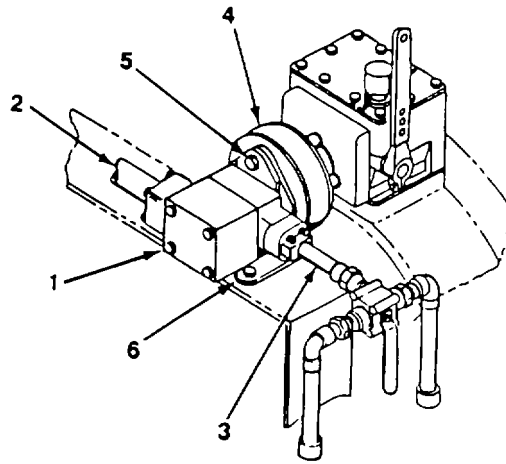
- a. Relieve the oil pressure in the hydraulic starting system.
- b. Clean all of the exterior dirt from the pump (1) and the hydraulic lines (2 and 3).
- c. Disconnect the hydraulic lines (2 and 3) from the pump (1). Cap lines.
- d. Remove coupling (4).
- e. Loosen bolts (5) holding the pump (1) to mounting bracket (6) and remove pump (1).



**5-16 REPLACE RAMP HOIST HYDRAULIC PUMP (Continued).****INSTALLATION**

INSTALL RAMP HOIST HYDRAULIC PUMP.

- a. Position pump (1) in place on mounting bracket (6).
- b. Install coupling (4).
- c. Secure pump (1) with bolts (5).

**CAUTION**

**Do not force the pump into place. Use of force, or tightening the bolts when the mounting flange is not against the flywheel housing, will force the drive arm against the pump body and result in damage to the pump when the engine is started.**

- d. Apply sealant sparingly to all MALE PIPE THREADS only and work it into the threads.

**CAUTION**

**Do not apply sealant to the last thread (that nearest the open end), or the female fittings, as it may wash into the system.**

- e. Remove caps from lines, and connect the hydraulic lines (2 and 3) to the pump (1).

**MAINTENANCE OF RAMP HOIST CONTROL VALVE**

**5-17 REPLACE RAMP HOIST CONTROL VALVE.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down  
Ramp hydraulic system drained  
of oil at the control valve

General Safety Instructions:

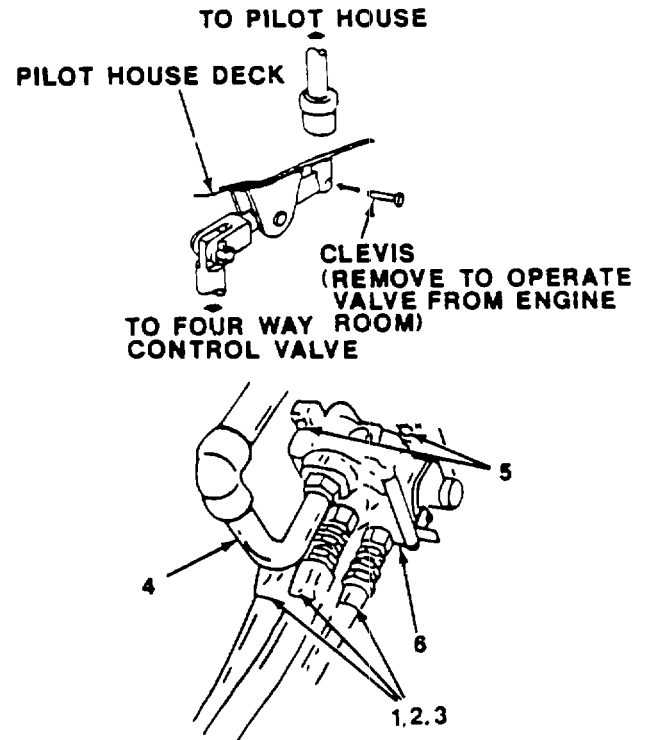
Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

**REMOVAL**

**WARNING**

The oil pressure in the system must be released prior to servicing the pump or other parts to prevent possible injury to personnel or equipment.

1. REMOVE CONTROL VALVE LINK LEVER.  
Disconnect operating lever link.
2. REMOVE RAMP HOIST CONTROL VALVE.
  - a. Clean hose connections (1, 2, and 3), disconnect, and cap open ends. Tag hoses to assure proper reconnection.
  - b. Disconnect return line (4).
  - c. Remove mounting bolts (5), and remove control valve (6).



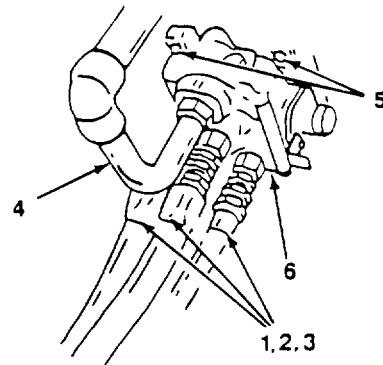


**5-17 REPLACE RAMP HOIST CONTROL VALVE (Continued).**

**INSTALLATION**

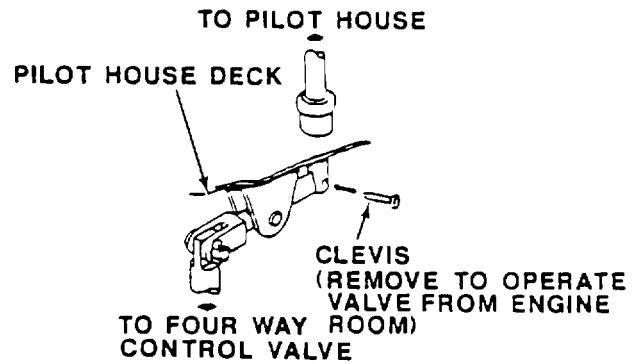
1. INSTALL RAMP HOIST CONTROL VALVE

- a. Position control valve (6) in place, and install mounting bolts (5).
- b. Re-connect return line (4). Remove cap.
- c. Re-connect hose connections (3, 2, and 1). Remove caps.



2. INSTALL CONTROL VALVE LINK LEVER.

- a. Re-connect operating link levers.
- b. Bleed hydraulic lines of air before putting system into operation.



**MAINTENANCE OF RAMP HOIST HYDRAULIC CHECK VALVE****5-18 REPLACE RAMP HOIST HYDRAULIC CHECK VALVE.**

This task covers: a. Removal b. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Equipment Conditions:**

Engine shut down  
Ramp hydraulic system drained  
of oil at the control valve.

**General Safety Instructions:**

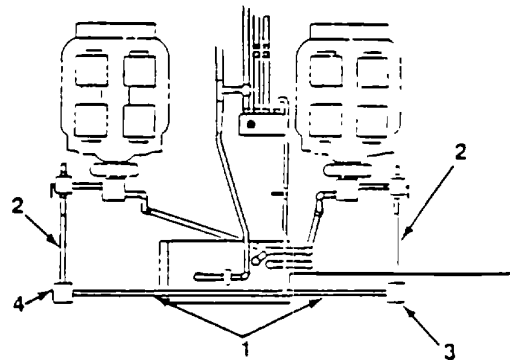
Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

**REMOVAL****WARNING**

**The oil pressure in the system must be released prior to servicing the pump or other parts to prevent possible injury to personnel or damage to equipment.**

**REMOVE RAMP HOIST HYDRAULIC CHECK VALVE.**

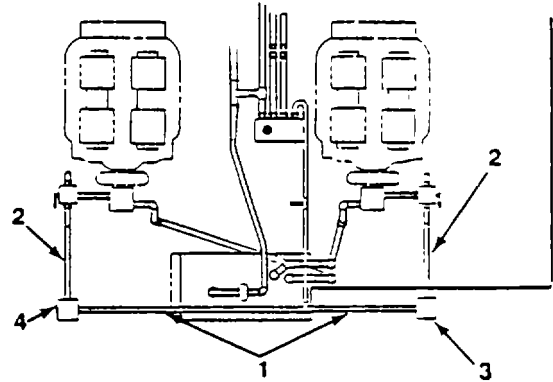
- a. Clean line connections.
- b. Remove outlet line (1) and inlet line (2) from check valve (3). Cap open end of inlet line.
- c. Remove check valve (3) from outlet line (1). Cap open end of outlet line.
- d. Remove other check valve (4) in the same manner.



**5-18 REPLACE RAMP HOIST HYDRAULIC CHECK VALVE (Continued).****INSTALLATION**

INSTALL RAMP HOIST HYDRAULIC CHECK VALVE.

- a. Position check valve (3) in place and install onto outlet line (1).
- b. Install inlet line (2).
- c. Install other check valve (4) in the same manner.
- d. Bleed hydraulic lines of air before putting system into operation.



**MAINTENANCE OF RAMP HOIST HYDRAULIC CHECK VALVE**

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**5-19 REPAIR RAMP HOIST HYDRAULIC CHECK VALVE.**

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- This task covers:
- |                |             |
|----------------|-------------|
| a. Disassembly | d. Repair   |
| b. Cleaning    | e. Assembly |
| c. Inspection  |             |
- 

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Check valve removed Refer  
to para 5-18

Materials/Parts:

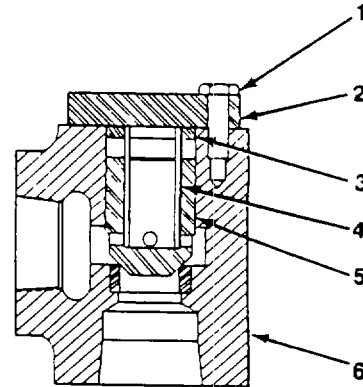
Packing  
P/N 82-20220-01  
Cleaning Solvent  
Item 17, Appendix E

---

**DISASSEMBLY**

DISASSEMBLE CHECK VALVE.

- Remove screws (1) from cap (2) and remove cap.
- Remove preformed packing (3). Discard packing.
- Remove spool spring (4) and oil control spool (5) from valve body (6).



**CLEANING**

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 1380F (38° - 59° C).

**5-19 REPAIR RAMP HOIST HYDRAULIC CHECK VALVE (Continued).**

**CLEAN CHECK VALVE**

Clean all metal parts in solvent and dry thoroughly.

**INSPECTION**

INSPECT CHECK VALVE.

- a. Inspect spring for distortion, loss of tension, or broken coils.
- b. Inspect spool for nicks or burrs.
- c. Inspect body for cracks.

**REPAIR**

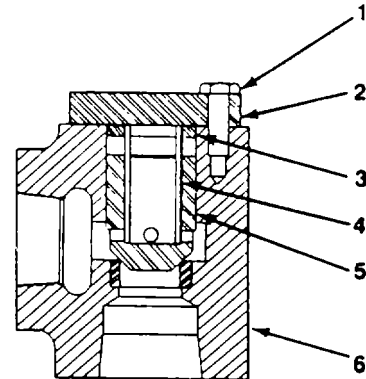
REPAIR CHECK VALVE.

- a. Replace packing.
- b. Remove burrs or nicks from spool with crocus cloth.
- c. If other parts are defective or damaged, replace valve.

**ASSEMBLY**

ASSEMBLE CHECK VALVE

- a. Install oil control spool (5) and spool spring (4) in valve body (6).
- b. Install preformed packing (3). Use new packing.
- c. Secure cap (2) to body using screws (1), and tighten.



**NOTE**

**FOLLOW-ON MAINTENANCE:**  
Install all check valve (para. 5-18).

**MAINTENANCE OF RAMP HOIST HAND PUMP**

**5-20 REPLACE RAMP HOIST HAND PUMP.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down.  
Ramp hydraulic system drained  
of oil at the hand pump.

General Safety Instructions:

Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

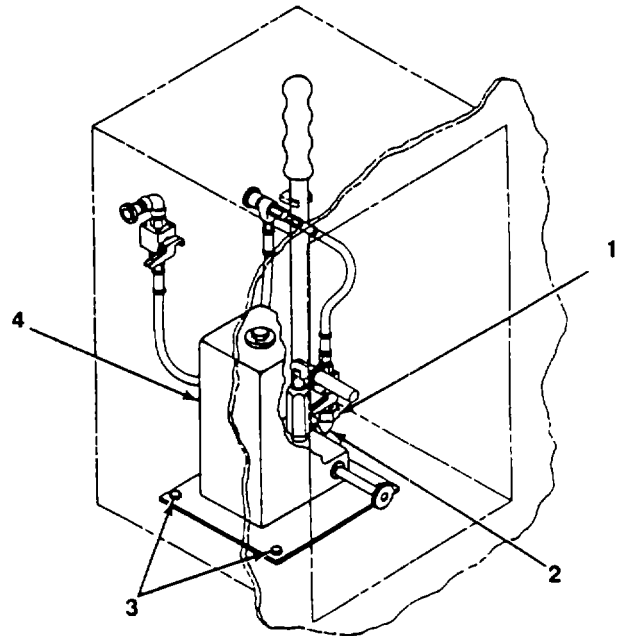
**REMOVAL**

**WARNING**

**The oil pressure in the system must be released prior to servicing the pump or other parts to prevent possible injury to personnel or damage to equipment.**

REMOVE HAND PUMP.

- a. Clean connections.
- b. Disconnect union (1). Cap ends.
- c. Remove line and fitting (2).
- d. Remove mounting bolts (3).
- e. Remove hydraulic tank and hand pump assembly (4).



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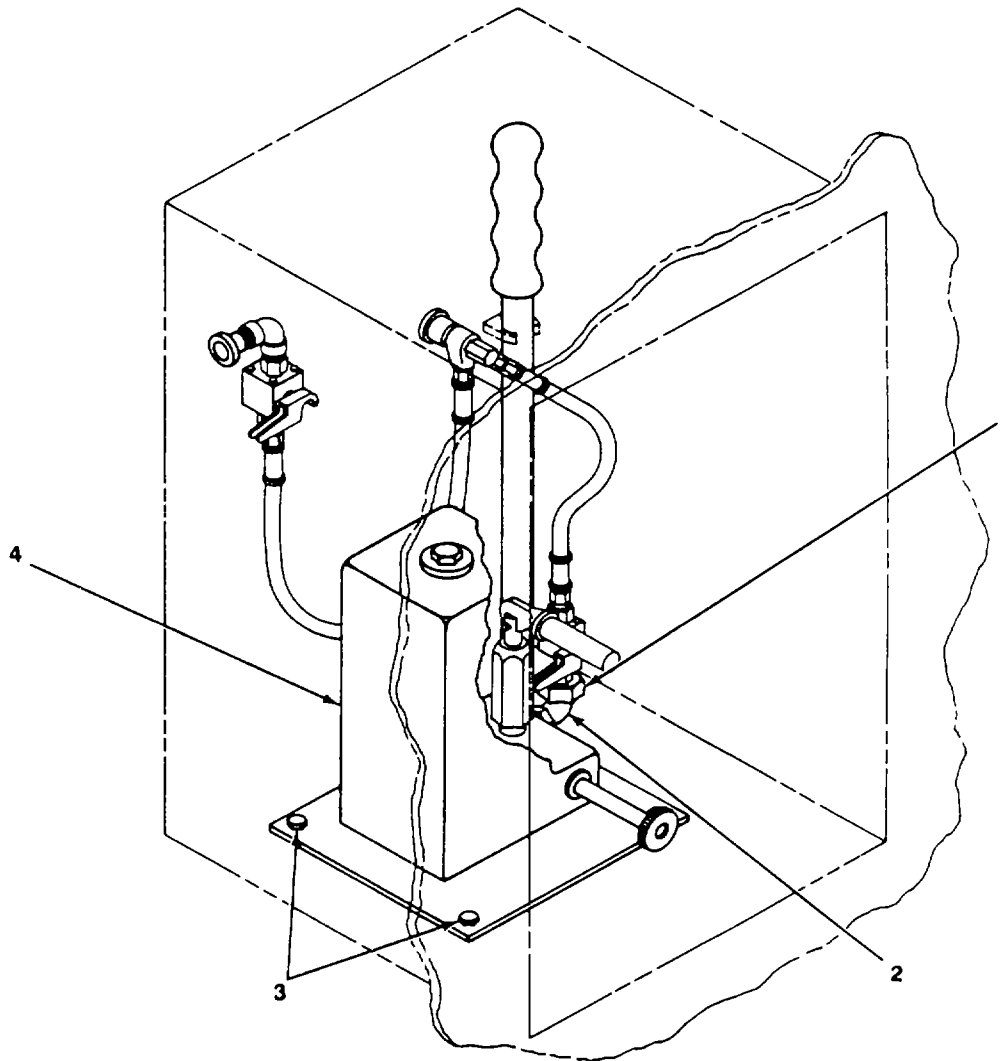
**5-20 REPLACE RAMP HOIST HAND PUMP (Continued).**

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**INSTALLATION**

## INSTALL HAND PUMP.

- a. Position hydraulic tank and pump assembly (4) in place, and install mounting bolts (3).
- b. Install line and fitting (2) and connect to union (1). Remove caps.
- c. Bleed hydraulic lines and pump of air before putting pump into operation.



**MAINTENANCE OF RAMP LOCKING HYDRAULIC CYLINDERS**

**5-21 REPLACE RAMP LOCKING HYDRAULIC CYLINDERS.**

This task covers: a. Removal b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down.  
Ramp hydraulic system drained  
at the locking cylinders.

General Safety Instructions:

Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

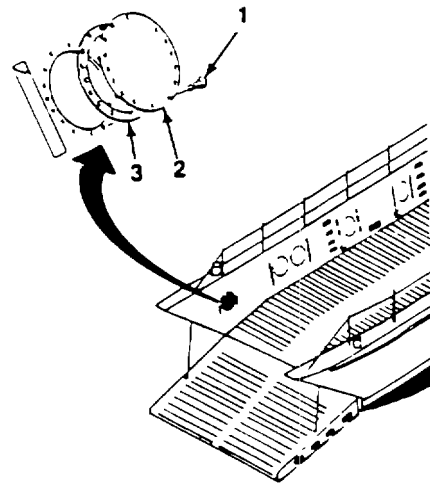
**REMOVAL**

**WARNING**

**The oil pressure in the system must be released prior to servicing the pump or other parts to prevent possible injury to personnel or damage to equipment.**

**REMOVE RAMP LOCKING CYLINDERS**

- a. Relieve pressure in ramp hydraulic system. Ensure that ramp load cylinders are in place.
- b. Place ramp hoist control valve lever in neutral position.
- c. Remove twenty screws (1) cover plate (2), and gasket (3) from hull. Discard gasket.





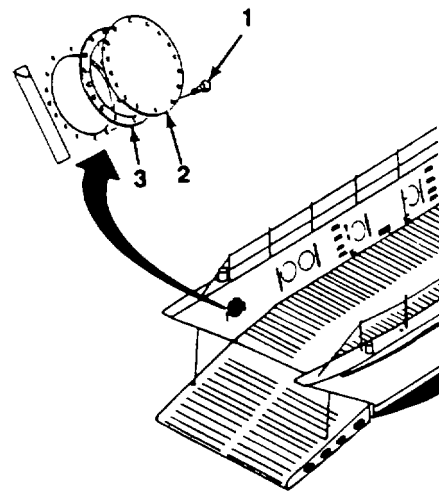
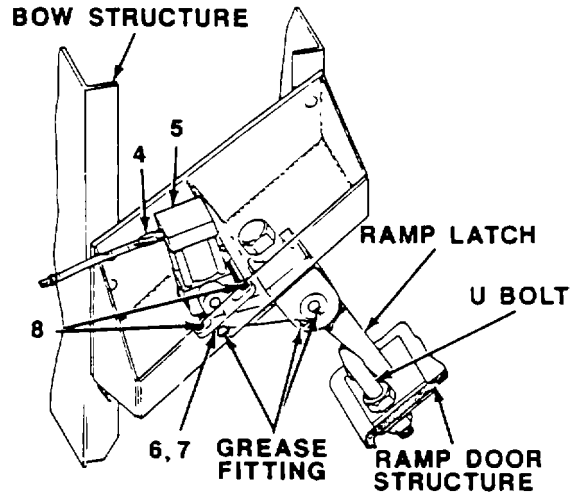
**5-21 REPLACE RAMP LOCKING HYDRAULIC CYLINDERS (Continued).**

- d. Remove access cover plate from other side of hull in a similar manner, if necessary.
- e. Disconnect hydraulic line (4) from cylinder (5)  
Cap hydraulic line.
- f. Remove clevis pin (6) and clevis (7).
- g. Remove mounting bolts (8) and hydraulic cylinder (5).

**INSTALLATION**

**INSTALL RAMP LOCKING CYLINDER.**

- a. Position hydraulic cylinder (5) in place, and install mounting bolts (8).
- b. Install clevis (7) and clevis pin (6).
- c. Re-connect hydraulic line (4). Remove end caps.
- d. Position new gasket (3) in place on cover plate (2).
- e. Install cover plate (2) to hull, using twenty screws (1).
- f. Install other cover plate if removed in a similar manner.
- g. Bleed hydraulic lines and cylinder of air before putting ramp into operation.



**MAINTENANCE OF RAMP SYSTEM**

**5-22 REPLACE RAMP WINCH HYDRAULIC MOTOR.**

This task covers:      a. Removal      c. Installation  
                                  b. Inspection

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Equipment Conditions:

Reference  
 Para 5-24. Winch removed.

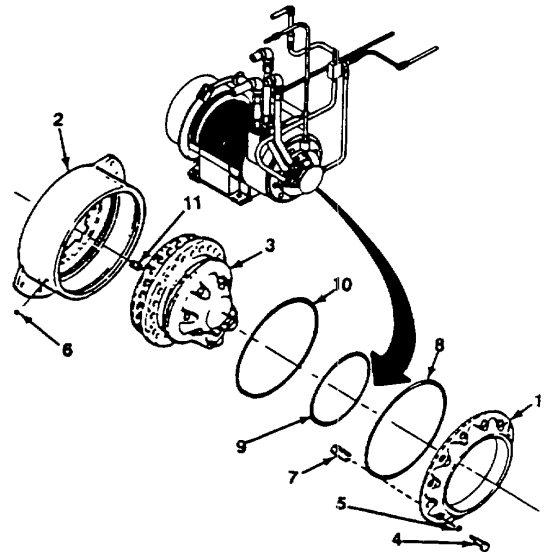
Materials/Parts:

Winch Motor  
 3950-121-5927  
 Preformed Packing  
 5330-457-6916  
 Preformed Packing  
 5330-457-6917  
 Cleaning Solvent  
 Item 17, Appendix E  
 Grease  
 Item 2, Appendix E

**REMOVAL**

**REMOVE HYDRAULIC MOTOR**

- a. Clean all dust and dirt away from the motor ports and vent port.
- b. Mark location of spring cover (1) with respect to primary housing (2) and location of spring cover (1) with respect to motor assembly (3). This will ensure that the motor ports and vent port are located correctly on reassembly.
- c. Drain the oil from the primary housing (2) by removing one capscrew (4) with its seal washer (5).



**5-22 REPLACE RAMP WINCH HYDRAULIC MOTOR (Continued).**

- d. Remove one pipe plug (6) from the top of the primary housing (2) to allow air to enter.

**WARNING**

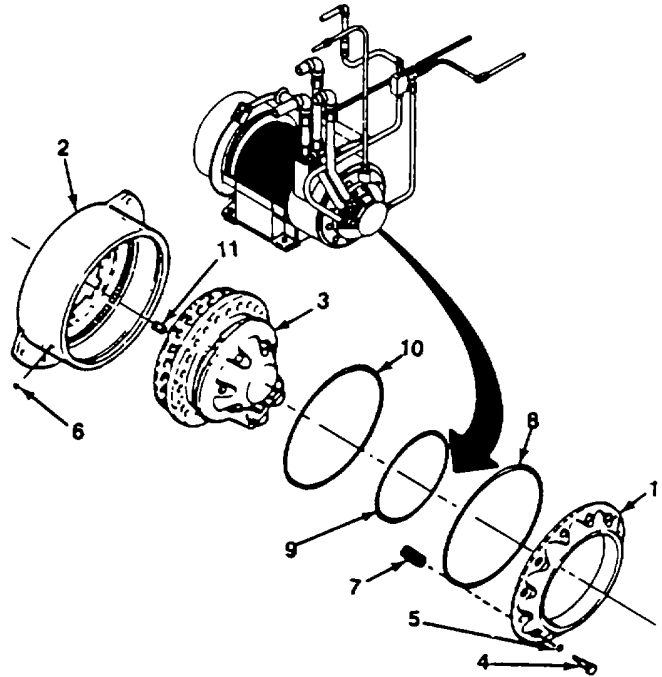
**Care must be taken to insure that spring cover is removed evenly as it carries the full spring load for the winch brake. Failure to remove cover evenly could result in personnel injury.**

- e. Remove remaining capscrews (4) and seal washers (5) by slackening each capscrew (4) half a turn at a time.
- f. Withdraw the spring cover (1) when all the spring load has been removed.

**NOTE**

**In most cases there will be a spring in every hole, but in certain applications fewer springs are required and it is important that they be located symmetrically when they are replaced. Note and mark any hole that does not contain a spring.**

- g. Remove springs (7) from spring cover (1).
- h. Remove and discard preformed packing (8) from spring cover (1).
- i. Remove and discard preformed packing (9) from the motor assembly (3).
- j. Remove snap ring (10) and motor assembly (3).
- k. Remove primary sun gear (11) if it has remained on the motor shaft.



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**5-22 REPLACE RAMP WINCH HYDRAULIC MOTOR (Continued).**

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**CLEANING**

CLEAN ALL REMOVED PARTS.

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59° C).

- a. Wash all parts in cleaning solvent P-D-680.
  - b. Dry thoroughly with compressed air or clean with lint-free cloths.
- 

**INSPECTION**

INSPECT ALL REMOVED PARTS

- a. Inspect and discard all preformed packings. Get replacement packings.
- b. Inspect the base in the spring cover for scores or bruises. Smooth out defects with a scraper and extra fine emery cloth in order that preformed packing will seal effectively.
- c. Check snap ring for flatness and that it forms a true circle. Replace if bent or damaged.

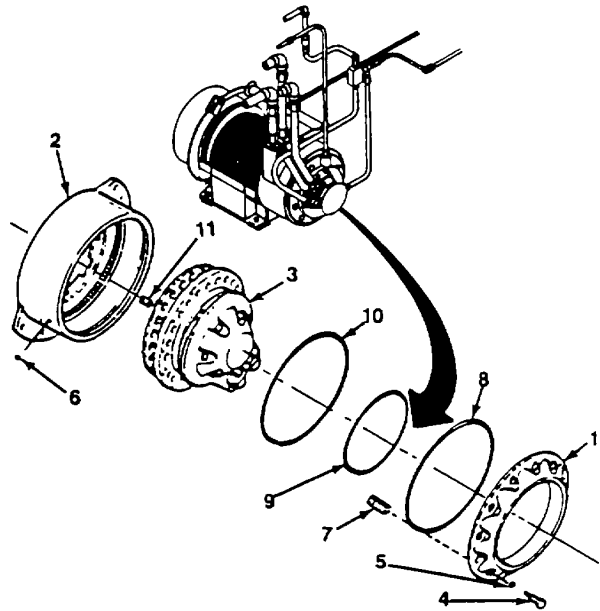
**5-22 REPLACE RAMP WINCH HYDRAULIC MOTOR (Continued).****INSTALLATION**

INSTALL HYDRAULIC MOTOR.

**NOTE**

**It may be necessary to rotate the motor assembly slightly so that the spline at the end of the motor shaft will engage with the gear in the primary planet assembly.**

- a. Set the winch assembly in a vertical position, install a new motor (3) and primary run gear (11) assembly in the primary housing (2) by holding it square with the end of the primary housing as it enters the housing. The spline at the end of the motor shaft will engage with the gear in the primary planet assembly and the motor will pilot into the planet hub bushing.
- b. Install snap ring (10) and make sure that it is properly seated in the bottom of the snap ring groove all the way around the housing.
- c. Rotate the motor assembly (3) in the primary housing to locate the motor ports and vent port as required.
- d. Lubricate new preformed packing (9) with grease and install in its groove on the motor assembly (3). Lubricate it again with grease.
- e. Install brake springs (7) in the same symmetrical pattern as they were before disassembly.
- f. Lubricate new preformed packing (8) with grease and install in its groove in the spring cover (1). Lubricate it again.



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**5-22 REPLACE RAMP WINCH HYDRAULIC MOTOR (Continued).**

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- g. Install spring cover (1) over the motor assembly (3) so that the vent port is located in the correct position as required.
- h. Install capscrews (4) and seal washers (5). Tighten evenly making sure that the spring cover (1) remains parallel to the end of the primary housing as it is tightened into place. Torque the capscrews to 50 pounds foot.

---

**5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR.**

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This task covers:      a. Disassembly      c. Inspection  
                                  b. Cleaning              d. Assembly

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**INITIAL SETUP**Tools:

Tool Kit, Mechanic's Rail  
 and Marine  
 5180-00-629-9783  
 Bearing Puller

Materials/Parts:

Cleaning Solvent  
 Item 17, Appendix E  
 Grease  
 Item 2, Appendix E  
 'O' Ring  
 P/N 50306 (2)  
 'O' Ring  
 P/N 50488 (2)  
 'O' Ring  
 P/N 50332 (2)  
 'O' Ring  
 P/N 50339  
 'O' Ring  
 P/N 50337

Equipment Conditions:

References  
 Para 5-24 Winch removed  
 Para 5-22 Winch motor removed

Materials/Parts:

Backup Washer  
 P/N 50362 (2)  
 Backup Washer  
 P/N 50487 (4)  
 Backup Washer  
 P/N 50368  
 Backup Washer  
 P/N 50367  
 Medium Pocket Seal  
 P/N 50485 (4)  
 Large Pocket Seal  
 P/N 50486 (8)  
 Small Pocket Seal  
 P/N 50484 (8)

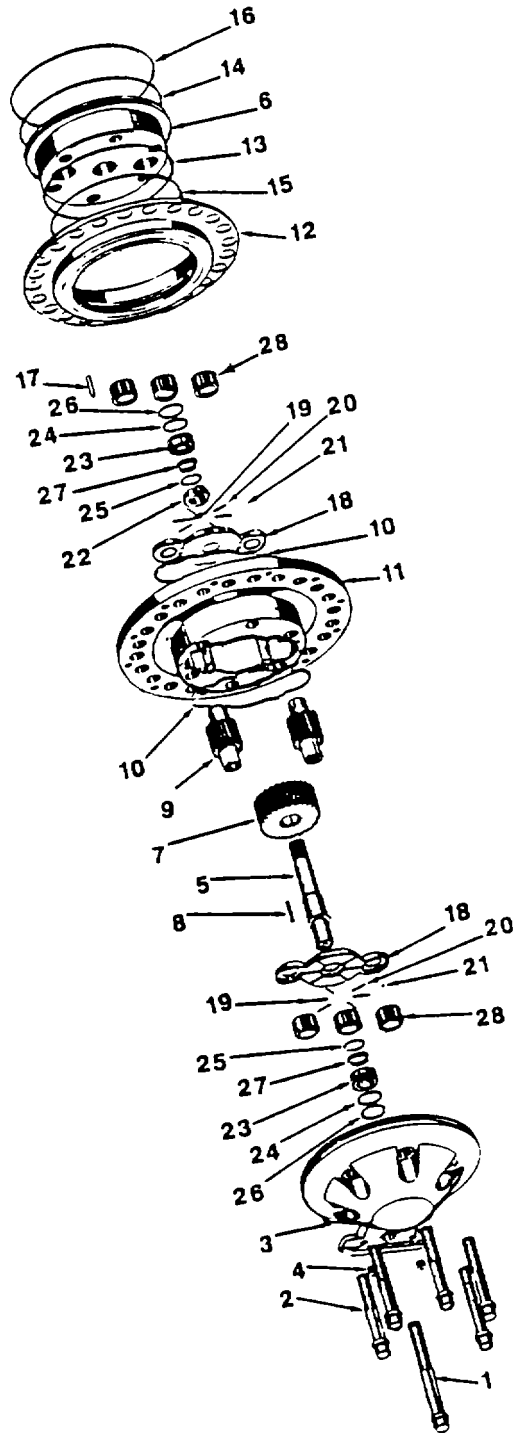
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5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR (Continued).

**DISASSEMBLY**

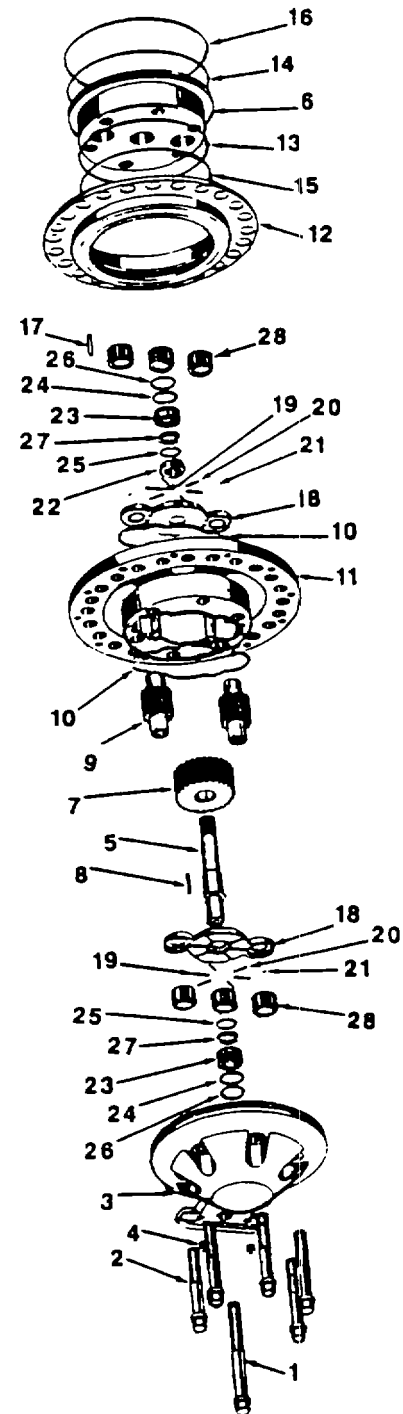
DISASSEMBLE MOTOR.

- a. Remove capscrew (1) and the five capscrews (2) from the port end cover (3).
- b. Remove the two pipe plugs (4).
- c. Lift off the port end cover (3), Items 18 through 28 will be removed with the port end cover (3). For disassembly of these parts see steps i thru r.
- d. Remove motor shaft (5) from shaft end covers (6). The large gear (7) and key (8) will be removed with the motor shaft (5).
- e. Press the large gear (7) off the motor shaft (5) and remove key (8). Note which end of the gear was next to the port end cover (3) for reassembly the same way.



**5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR (Continued).**

- f. Remove the small gears (9) and keep together with the large gear (7) as they are a matched gear set. Note which end of each gear was next to port end cover (3) for reassembly the same way.
- g. Remove and discard 'O' ring (10).
- h. Remove gear housing (11), remove and discard second 'O' ring (10) from the other side of the gear housing (11).
- i. Remove brake piston (12) from shaft end cover (6).
- j. Remove and discard 'O' rings (13 and 14) and backup washers (15 and 16).
- k. Remove pin (17) from brake piston (12) only if replacement is required because of damage or wear.
- l. Turn the port end cover (3) and the shaft end cover (6) over so that the thrust plates (18) are up. Pry off thrust plates (18) with a knife blade or thin screw driver. Take care not to mark the face next to the end covers (3 and 6).
- m. Remove and discard pocket seals (19, 20 and 21).
- n. Remove spacer (22) and bushing (23) from shaft end cover (6).
- o. Remove and discard 'O' rings (24 and 25); remove backup washers (26 and 27) from the bushing (23).
- p. Pull bearings (28) with a bearing puller from the end covers (3 and 6) only if they are being replaced.
- q. Remove and discard 'O' rings (24) and backup washer (26) from bushing (23) in the port end cover (3).





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**5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR (Continued).**

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- r. If bearings (28) have been removed, remove bushing (23) from the port end cover (3).
- 

**CLEANING**

## CLEAN MOTOR PARTS

- a. Clean thrust plates with a clean lint-free cloth. Never wash the thrust plates.

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59° C).

- b. Clean all other motor parts in solvent P-D-680. Dry thoroughly with compressed air or clean with lint-free cloths.
- c. Allow bearings to air dry after cleaning in solvent P-D-680. Do not dry with compressed air.
- 

**INSPECTION**

## INSPECT MOTOR PARTS

- a. Inspect and discard all 'O' rings, backup washers and pocket seals and get replacements.
- b. Inspect needle bearings for freeness of rollers. Check for pits, broken rollers or excessive wear and replace if any of these conditions exist.
- c. Inspect gears, check the edges of the gear teeth and faces for scoring or roughness. Remove roughness or scoring with a fine hone.

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**5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR (Continued).**

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- d. Inspect the gear hubs for excessive wear at bearing points. If wear exceeds 0.001 inch on the hub diameter, the gears should be replaced. Replace gears in sets since they are matched at the time of manufacture.
- e. Inspect the machined surfaces of the port end cover, shaft end cover and gear housing for roughness. Stone to remove roughness. Replace if roughness is excessive.
- f. Measure the gear housing bore and replace if the radial wear is in excess of 0.006. A new gear housing measures 2.0025 inch in the small bores and 3.7525 inch in the large bore.
- g. Inspect thrust plates for erosion or excessive wear on the running surfaces. Replace if necessary.
- h. Rewash all parts that have been stoned and dry thoroughly.
- i. Inspect shaft for distortion. Repair/replace as necessary.

**NOTE**

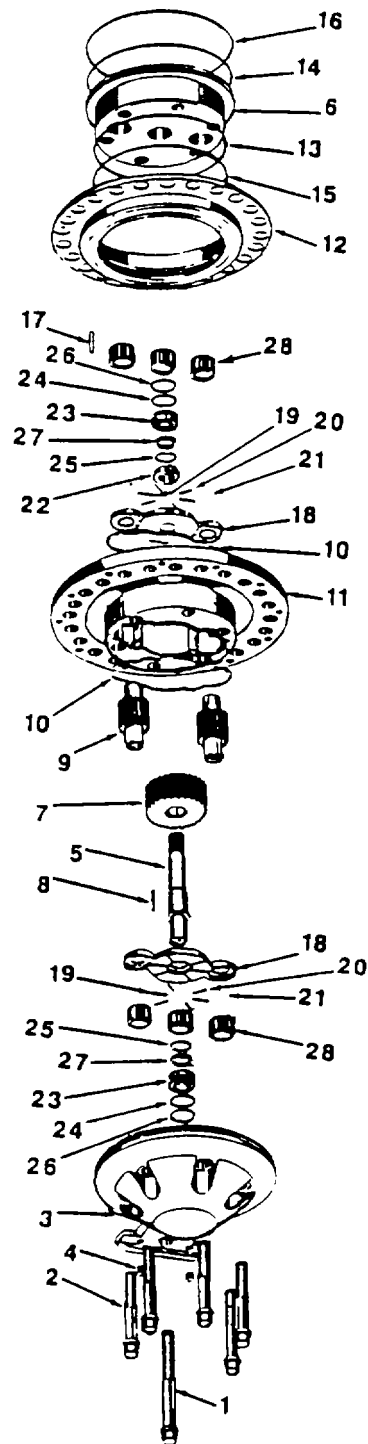
**If either the gears (13) or needle bearings (27) are replaced because of excessive wear, it is good practice to replace both the gears and bearings. Replacement of one part and not the other will cause premature wear of the new part because of its attempt to conform to the wear pattern of the old part. Also if the gears and bearings are replaced due to excessive wear, carefully check the side of the gear housing bore which has most wear. In most cases the gear housing will also have to be replaced along with the gears and bearings.**

5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR (Continued).

**ASSEMBLY**

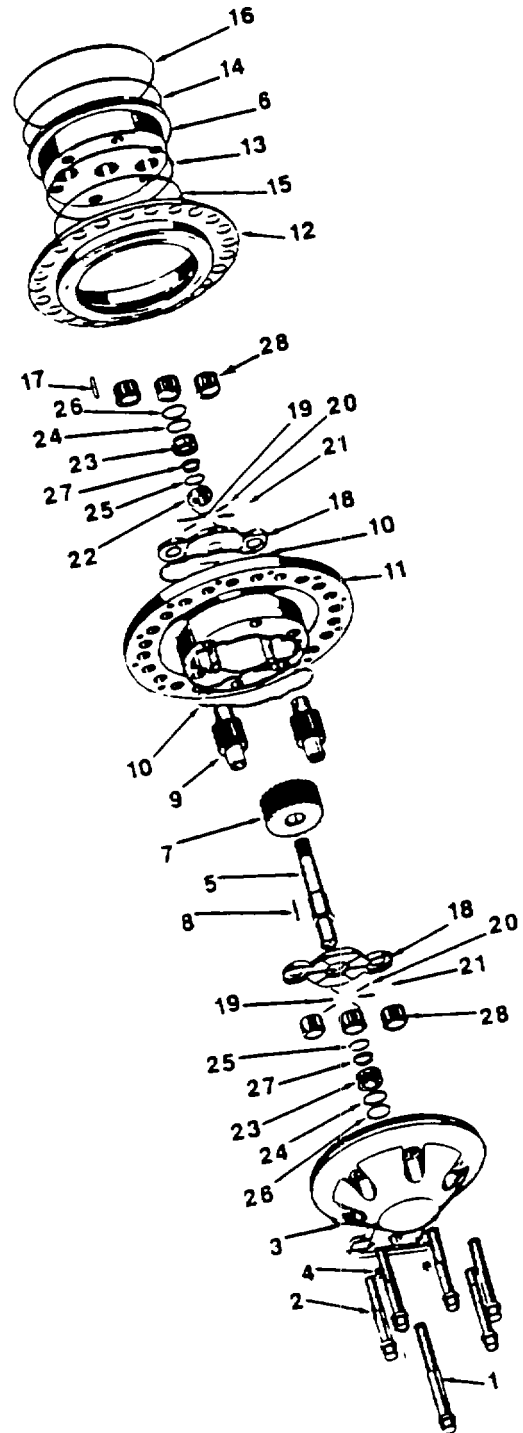
ASSEMBLE MOTOR.

- a. Install two backup washers (27) in the inside groove in the seal bushings (23), install one backup washer (26) in the outside groove.
- b. Lubricate 'O' rings (24 and 25) with grease and install one 'O' ring (25) in the inside groove of each seal bushing (23) so that both backup washers (27) are together at the thick wall side of the groove.
- c. Install 'O' ring (24) in the outside groove so that it is at the same end of the bushing as 'O' ring (25). Give all 'O' rings additional coat of grease.
- d. Place the port end cover (3) and the shaft end cover (6) on work bench with bearing bores facing up.
- e. Install the seal bushing (23) in the center bore in the port end cover (3) so that the backup washers (26 and 27) enter before the 'O' rings (24 and 25).
- f. Install bearing (28) in the outer bore of the port end cover (3) and the shaft end cover (6) so that they bottom at the end of the bearing bore.
- g. Install remaining seal bushing (23) in the shaft end cover (6) so that backup washers (26 and 27) enter the bore before 'O' rings (24 and 25); locate against bearing (28).



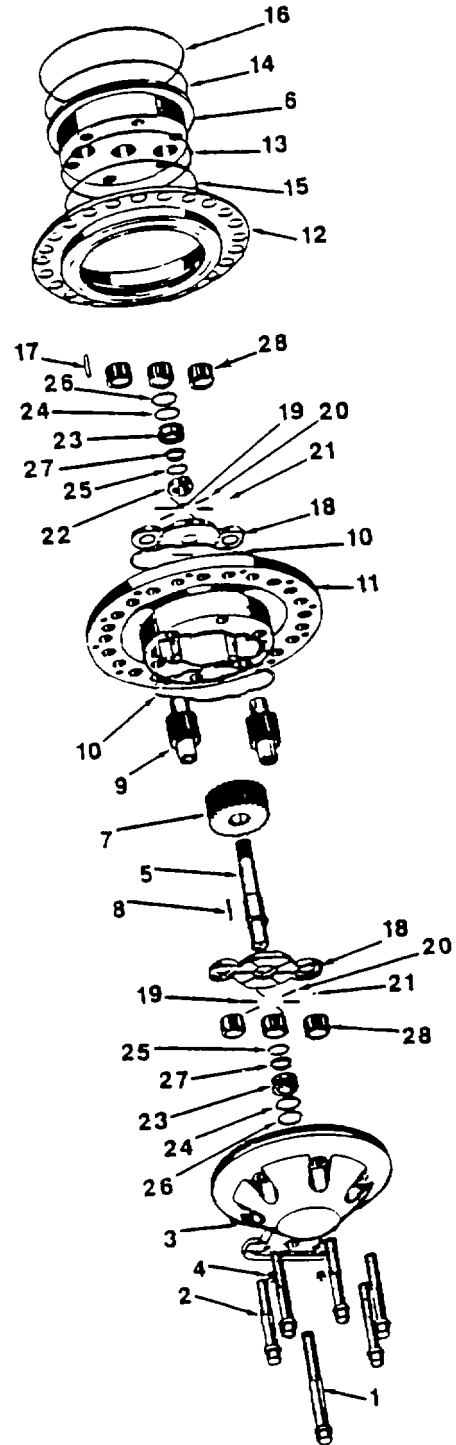
**5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR (Continued).**

- h. Place the spacer (22) in the center bore next to the seal bushing (23) in the shaft end cover (6). Press both bushings in until they seal on the end of each bore. Be sure that all 'O' rings (24 and 25) are installed toward the gear side of the end covers (3 and 6).
- i. Check that the outside bores are clean and install needle bearings (28) so that they bottom at the end of the bearing bores.
- j. Place a small amount of heavy grease into the middle slots in the open face of each thrust plate (18) and insert two medium pocket seals (19) in each thrust plate (18).
- k. Place the thrust plate (18) with the pocket seal slots towards the end cover (3) or (6) and install over bearings.
- l. Check to see that the pocket seal (19) in the center slots are still in place and tap the thrust plate into position with a soft hammer until approximately 1/32 inch clearance is left between thrust plate (18) and end cover (3) or (6).
- m. Insert a large pocket seal (20) into each of the four center radial slots in the thrust plate (18). insert a small pocket seal (21) into each of the four outside slots in the thrust plate (18). Be sure to push each seal all the way into the slots so that the hidden end is always in contact with the needle bearing race.
- n. Tap the assembled thrust plate (18) into position against the face of the end cover (3) or (6). Trim the exposed ends of the small pocket seals (21) square and flush with thrust plate (18).



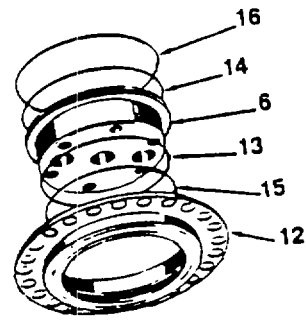
**5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR (Continued).**

- o. Install backup washer (16) in the outside groove of the shaft end cover (6).
- p. Lubricate 'O' ring (14) and install it next to the backup washer (16) so that it is on the side of the backup washer nearest to the thrust plate (18) end of the shaft end cover (6). Give the 'O' ring and backup washer an additional coat of grease.
- q. Install backup washer (15) in the inside groove in the brake piston (12). Lubricate 'O' ring (13) and install it next to the backup washer (15) so that it is on the side as the backup washer nearest to the large bore of the brake piston (12). Give 'O' ring and backup washer an additional coat of grease.
- r. Check that pin (17) is installed in the brake piston (12) to the shaft and cover (6). Make sure that backup washers (15 and 16) do not extrude and get pinched between the mating diameters of the brake piston (12) and the shaft end cover (6).
- s. Place key (8) in keyway of motor shaft (5), then press the larger gear (7) over the motor shaft (5). Check that the gear bottoms against the shaft shoulder.
- t. Place the shaft end cover (6) and the thrust plate (18) up and install the motor shaft assembly through the seal bushing (23). Take care not to extrude backup washer (26).
- u. Lubricate 'O' ring (10) and install one on each side of the gear housing (11). Give the 'O' rings an additional coat of grease.



5-23 REPAIR RAMP WINCH HYDRAULIC MOTOR (Continued).

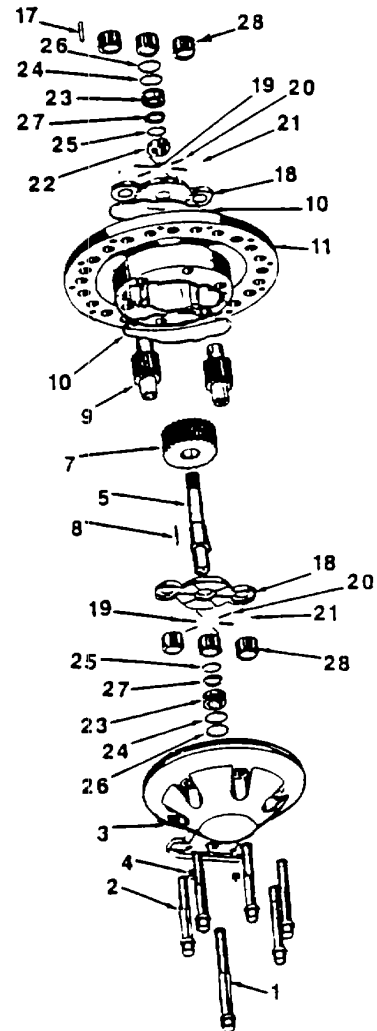
- v. Assemble the gear housing (11) over the thrust plate (18) on the shaft end cover (6) so that the gear housing (11) and the shaft end cover are concentric. Ensure that pin (17) locates in the gear housing. Tap the gear housing (11) into place.



NOTE

If the gears are not being replaced with new parts, reassemble the gears with respect to the port end shaft as noted during disassembly.

- w. Take the matched small gears (9) and install them so that they pilot into the bearings in the shaft end cover and mate with the large gear (7).
- x. Install the port end cover (3) onto the gear housing (11) so that the hubs of the gears (7 and 9) pilot into the needle bearings (28); the thrust plate (18) should also pilot into the gear housing (11). Use a soft hammer to seat the port end cover taking care that 'O' ring (10) does not get pinched during the assembly.
- y. Install pipe plugs (4) in port end cover (3).
- z. Install the five capscrews (2) and one capscrew (1). Tighten evenly in stages to a torque of 200 pounds- foot. After tightening the capscrews, ensure that the motor shaft can be rotated by hand.



**5-24 REPLACE RAMP WINCH.**

This task covers:      a. Removal              c. Installation  
                                  b. Lubrication        d. Alignment

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Materials/Parts:

Cleaning Solvent  
 Item 17, Appendix E  
 Grease  
 Item 2, Appendix E  
 Transmission oil  
 Item 19, Appendix E  
 Hydraulic Oil  
 Item 12, Appendix E

Equipment Condition:

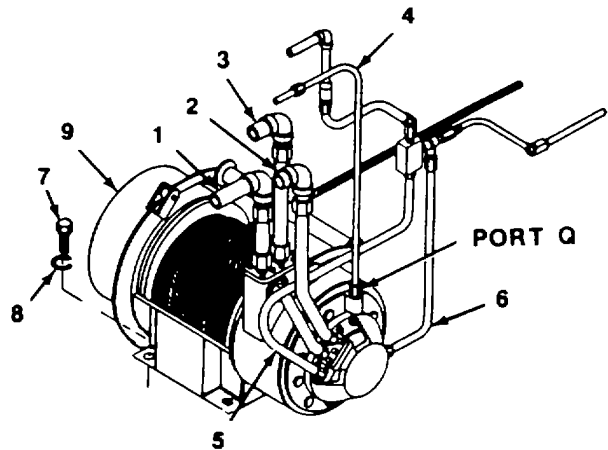
Ramp in lowered position

General Safety Instructions:

Exercise caution when removing  
 or installing winch with the  
 use of a lifting device (crane  
 or wrecker).

**REMOVAL**

1. REMOVE WINCH CABLE.
  - a. Line up the ramp system for operation (refer to para 2-4.3 1).
  - b. With the ramp control lever in the RAMP DOWN position, have one personnel keep the winch cable taut while the other fakes the cable onto the ramp.
  - c. Continue to pay out cable and remove cable end from winch drum.
2. REMOVE CONNECTING HOSE SECTIONS AND TUBING.
  - a. Remove hose sections (1, 2, and 3) from the winch and connecting elbows.



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**5-24 REPLACE RAMP WINCH (Continued).**

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- b. Remove tubing (4) - (drain line to reservoir) from the winch port Q.
  - c. Remove hose sections (5 and 6) from motor port and brake port respectively.
3. REMOVE WINCH FROM FOUNDATION.

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**WARNING**

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**Total weight of winch is 1,070 lbs (484.710 kg). Be sure that a suitable lifting device is available prior to removing winch from hull. Failure to use a lifting device could result in injury to personnel.**

- a. Remove mounting bolts (7) and lockwashers (8) in four places.
- b. Use suitable lifting device to remove winch (9) from foundation.

---

**LUBRICATION**

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**LUBRICATE REPLACEMENT WINCH.**

- a. Remove filler plug on final drive assembly and fill with SAE 90 transmission oil to the level of the filler plug. Install filler plug.
- b. Fill primary drive assembly with hydraulic oil MIL-L-17672 through port Q.
- c. Apply two or three shots of grease to the grease fittings on the end of auto-reverse mechanism lever arm.



**5-24 REPLACE RAMP WINCH (Continued).****INSTALLATION**

## 1. INSTALL WINCH

**WARNING**

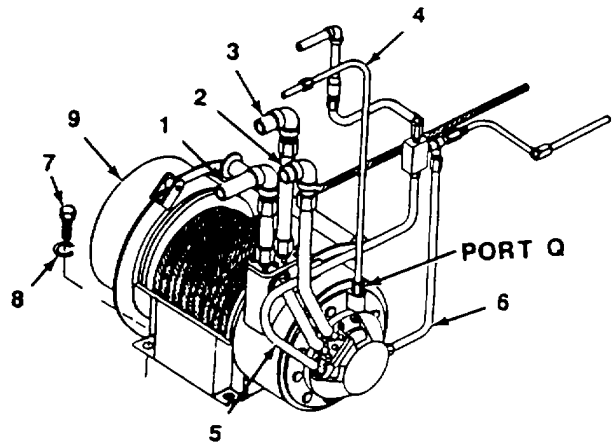
**Total weight of winch is 1,070 lbs (484.710 kg). Be sure that a suitable lifting device is available prior to removing winch from hull. Failure to use a lifting device could result in injury to personnel.**

- a. Use a suitable lifting device to set the winch on its foundation.
  - b. Install four mounting bolts (7) and lockwashers (8).
2. INSTALL CONNECTING HOSE SECTIONS AND TUBING.

- a. Connect hose sections (5 and 6) to motor port and brake port respectively.
- b. Connect tubing (4) to the winch port Q.
- c. Connect hose sections (1, 2, and 3) to the winch and elbows. Tighten to eliminate leakage.

## 3. INSTALL WINCH CABLE.

- a. Install the bitter end of the cable onto the winch drum.
- b. Line up the ramp system for operation (refer to para. 2-4.3.1).



**5-24 REPLACE RAMP WINCH (Continued).**

- c. With the ramp control lever in RAMP UP position, have one personnel keep the winch cable taut while the other ensures that the cable reels perfectly into the winch drum.

**WARNING**

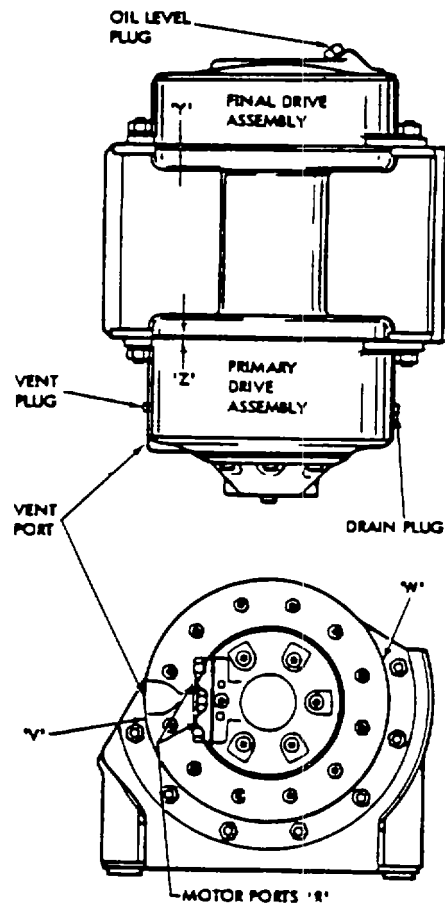
**Keep clear of the ramp when all the slack is taken from the cable. Failure to comply could result in injury to personnel.**

- d. Continue to raise the ramp, if necessary, and secure it with load binders.

**ALIGNMENT**

CHECK THE ALIGNMENT OF THE WINCH.

- a. Measure clearance 'Y' with feeler gauges at points 'V' and 'W' as indicated. Measure clearance 'Z' at points 'V' and 'W'. For good alignment clearance 'Y' should be equal when measured at Points 'V' and 'W' within 005". Clearance 'Z' should also be equal when measured at 'V' and 'W' within 005". Clearance 'Y' does not require to be equal to clearance 'Z'.
- b. If the clearances measured at 'V' and 'W' are not within 005", install shims under corner of the winch base until clearances 'V' and 'W' are within 005" when the winch is bolted solidly to its mounting.



**MAINTENANCE OF RAMP, RAMP CABLES, CHAINS, SHEAVES, LATCH MECHANISMS, SEAL AND HINGE PINS**

**5-25 REPLACE RAMP AND HINGE PINS.**

This task covers:            a. Removal            b. Installation

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783  
Hoisting Device (Crane)  
Sledge Hammer

Equipment Conditions:

Reference  
Para 5-21. Latch cylinders  
removed. Vessel in drydock.  
Engine shut down

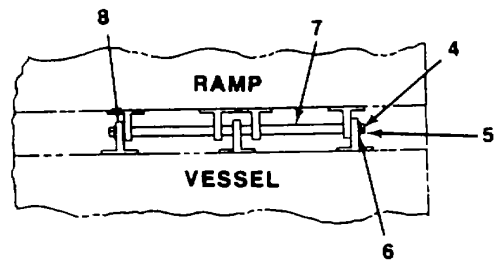
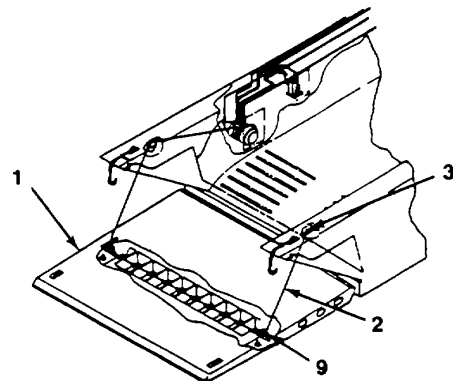
General Safety Instructions

Ensure hoisting device is capable of lifting  
the ramp when disconnected from vessel.

**REMOVAL**

**REMOVE RAMP AND HINGE PINS.**

- a. Remove access plates as required to gain entry into the various components for removal of ramp.
- b. Attach a suitable lifting device to ramp assembly (1).
- c. Lower ramp by hand far enough to permit access to the hinges and pins.
- d. Detach winch wire rope (2) from hull superstructure (3). Remove cable (2) from ramp cable system.
- e. Remove locking pin (4), locking nut (5) and hinge washer (6) from both ends of each hinge pin (7).
- f. Drive hinge pins (7) out of hinges (8) and carefully remove pins (7) and ramp (1) from vessel



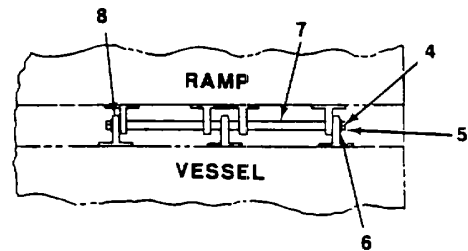
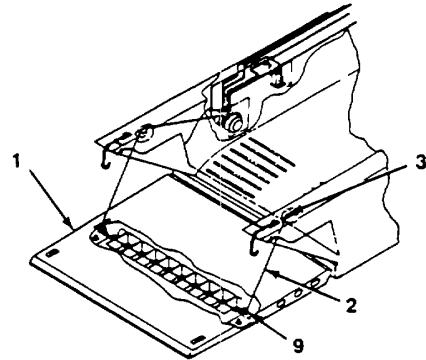
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**5-25 REPLACE RAMP AND HINGE PINS (Continued).**

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**INSTALLATION****INSTALL RAMP AND HINGE PINS.**

- a. Attach suitable lifting device to ramp assembly (1).
- b. Place ramp assembly (1) in position on bow.
- c. Run wire rope (2) through cable sheaves (9) and secure to superstructure (3).
- d. Align ramp (1) with holes in hinges (8) and drive in hinge pins (7) to secure ramp (1).
- e. Re-install hinge washer (6), locking nut (5) and locking pin (4) to both ends of each hinge pin (7).
- f. Raise ramp assembly by hand to locking place.



**MAINTENANCE OF RAMP, RAMP CABLES, CHAINS, SHEAVES, LATCH MECHANISMS, SEALS AND PINS**

**5-26 REPLACE LATCH MECHANISM.**

This task covers:      a. Removal                      b. Installation

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

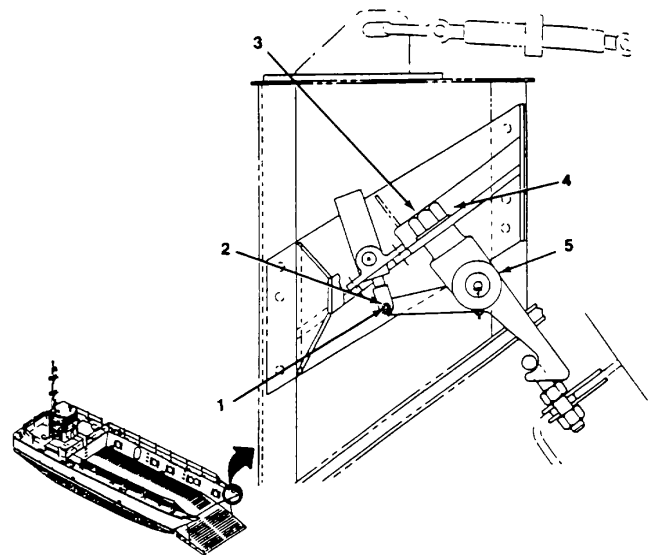
Equipment Conditions

Reference  
Para 5-21 Latch cylinders  
removed. Vessel In drydock  
Ramp In lowered position

**REMOVAL**

**REMOVE LATCH MECHANISM**

- a. Remove access plate to locking cylinder/latch mechanism.
- b. Remove cotter pins (1) and clevis pin (2).
- c. Remove nut (3) and washer (4) securing latch assembly (5).
- d. Remove latch assembly (5) from vessel.
- e. Remove other latch assembly In the same manner.



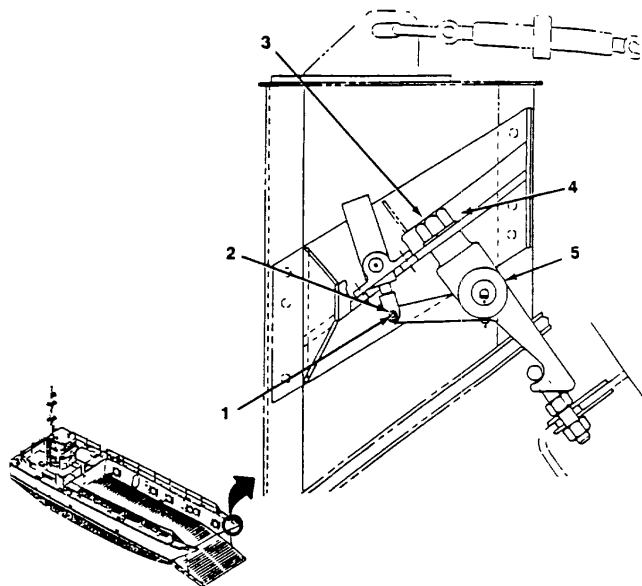
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**5-26 REPLACE LATCH MECHANISM (Continued).**

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**INSTALLATION****INSTALL LATCH MECHANISM**

- a. Position latch assembly (5) in place and install nut (3) and flat washer (4).
- b. Install clevis pin (2) and cotter pin (1).
- c. Install other latch in the same manner.



**MAINTENANCE OF RAMP, RAMP CABLES, CHAINS, SHEAVES, LATCH MECHANISMS, SEAL AND HINGE PINS**

**5-27 REPLACE RAMP CABLES, SHEAVES AND CHAINS.**

This task covers:      a. Removal                      b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Reference  
Para 5-21 Latch cylinder  
removed Vessel in drydock  
Ramp Is in lowered position

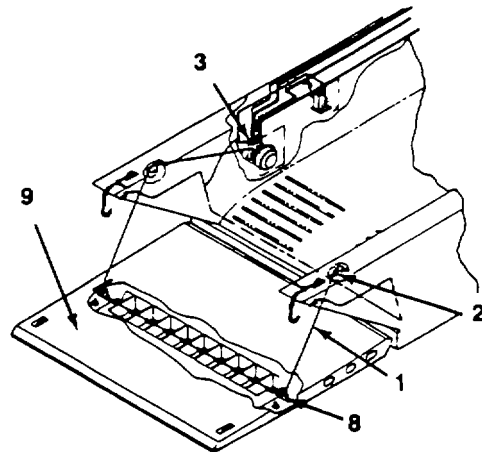
General Safety Instructions

Ensure ramp is secured in lowered position  
whereas it does not move when being  
serviced.

**REMOVAL**

**1. REMOVE RAMP CABLE**

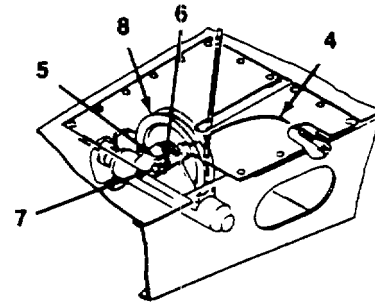
- a. Remove access plates to winch cable connections and sheaves
- b. Detach winch cable (1) from hull superstructure  
(2) Remove cable (1) from ramp cable system.
- c. Run out cable off of winch drum (3) onto the deck  
Disconnect end of cable from winch drum (3).



**5-27 REPLACE RAMP CABLES, SHEAVES AND CHAINS (Continued).**

**2. REMOVE SHEAVES**

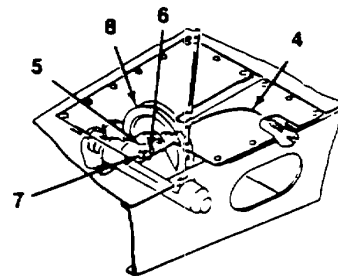
- a. Disconnect and remove hose assembly (4) used to lubricate sheave
- b. Remove cotter pin (5)
- c. Remove castellated nut (6) from sheave pin (7)
- d. Remove sheave pin (7) from sheave (8).
- e. Remove sheave (8).
- f. Remove remaining sheave in the same manner.



**INSTALLATION**

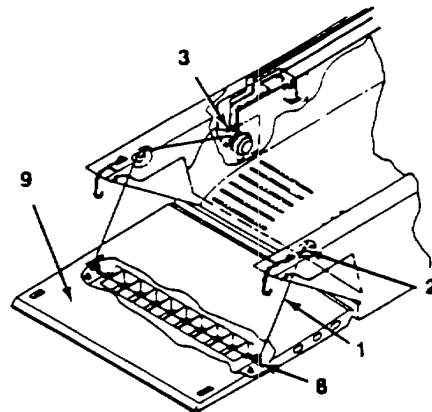
**1. INSTALL SHEAVES**

- a. Position sheave (8) in place.
- b. Install sheave pin (7) in sheave (8)
- c. Secure sheave pin (7) with castellated nut (6).
- d. Align holes in nut (6) with holes in sheave pin (7), then secure with cotter pin (5).
- e. Re-connect lubricating hose (4) to sheave.



**2. INSTALL RAMP CABLE.**

- a. Connect end of ramp cable to winch drum (3). Wind cable onto drum.
- b. Run cable through sheaves (8) and ramp (9) and re-connect end of cable to hull superstructure (2).
- c. Install access plates.
- d. Test system for operation.





**MAINTENANCE OF RAMP, RAMP CABLES, CHAINS, SHEAVES, LATCH MECHANISMS, SEALS AND PINS**

**5-28 REPLACE RAMP SEAL.**

This task covers      a. Removal      b. Installation

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions

Vessel in drydock  
Ramp is in lowered position

**REMOVAL**

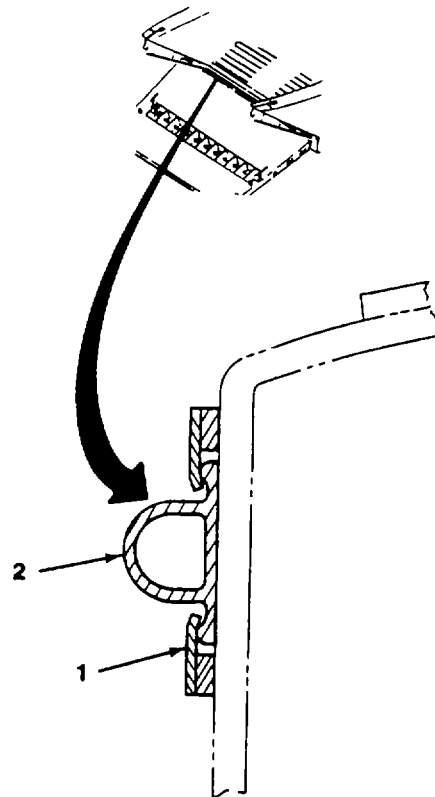
**REMOVE RAMP SEAL**

- a. Expand metal tube (1) securing seal (2) in place Use suitable pry bars to expand tube securing seal.
- b. Remove seal (2) from superstructure

**INSTALLATION**

**INSTALL RAMP SEAL**

- a. Expand metal tube (1) far enough to accommodate seal. Use suitable pry bars to expand tube.
- b. Install seal (2).



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM**

**5-29 REPLACE STEERING PUMP.**

This task covers      a. Removal                      b. Installation

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions

Engine shut down  
Hydraulic system to be drained  
at pump All hydraulic pressure  
relieved.

General Safety Instructions

Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

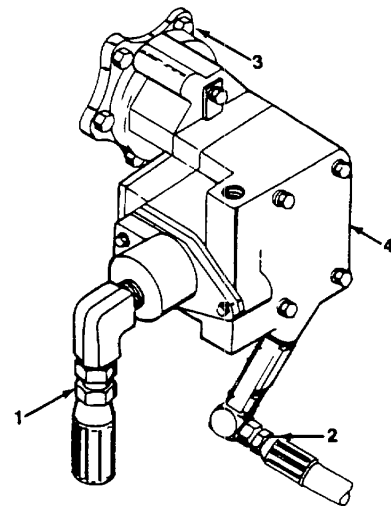
**REMOVAL**

**WARNING**

**The oil pressure in the system must be released prior to servicing the pump or other parts to prevent possible injury to personnel or damage to equipment.**

**REMOVE STEERING PUMP.**

- a. Relieve of pressure In steering system
- b. Disconnect intake (1) and discharge (2) lines. Cap ends of hydraulic lines
- c. Loosen mounting bolts (3) to engine. Remove pump (4).



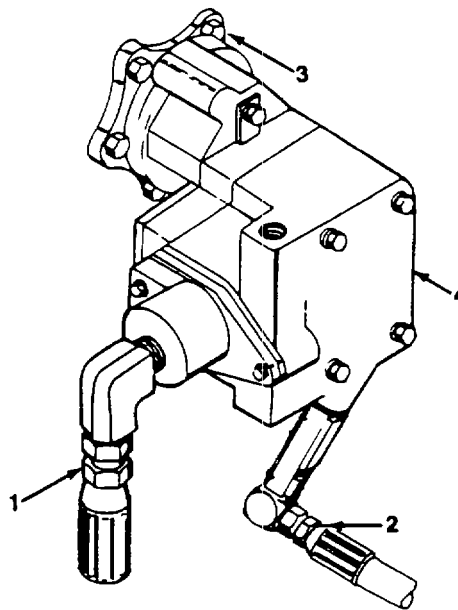
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**5-29 REPLACE STEERING PUMP (Continued).**

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**INSTALLATION****INSTALL STEERING PUMP**

- a. Mount steering pump (4) onto engine. Tighten mounting bolts (3).
- b. Remove caps from hydraulic lines. Re-connect intake (1) and discharge (2) hydraulic lines.
- c. Bleed air from lines at pump before putting it into operation.



## MAINTENANCE OF HYDRAULIC STEERING SYSTEM

---

### 5-30 REPLACE STEERING CYLINDERS.

This task covers:      a. Removal                      b. Installation

---

#### INITIAL SETUP

##### Tools

Tool Kit, Mechanic's, Rall  
and Marine  
5180-00-629-9783

##### Equipment Conditions

Engine shut down.  
Hydraulic steering system  
drained of oil at steering cylinder.

##### General Safety Instructions:

Ensure that hydraulic pressure  
in the system is relieved before  
working on system

---

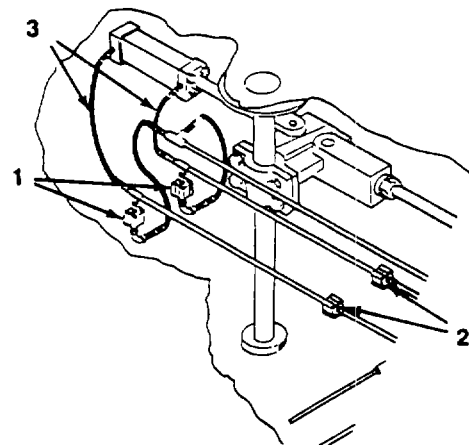
#### REMOVAL

#### WARNING

The fluid pressure in the system must be released prior to servicing the pump or other parts to prevent possible injury to personnel or damage to equipment.

#### 1. REMOVE CYLINDER HOSES.

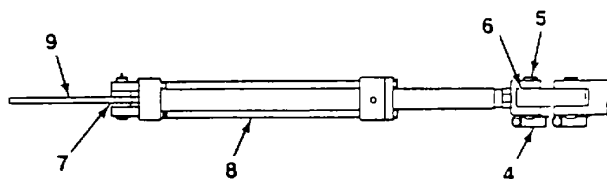
- a. Open the normally closed bypass valves (1) to drain the cylinders being replaced. Close the normally open isolation valves (2) to isolate the cylinders being replaced.
- b. Disconnect cylinder hoses (3). Cap open ends.



## 5-30 REPLACE STEERING CYLINDERS (Continued).

### 2. REMOVE STEERING CYLINDER

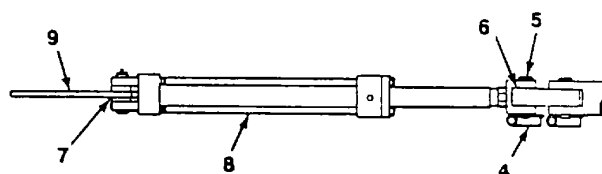
- a. Remove safety pin (4) from clevis pin (5), remove clevis pin (5) and spacer (6).
- b. Remove spacer block (7) and remove cylinder (8) from support plate (9)



## INSTALLATION

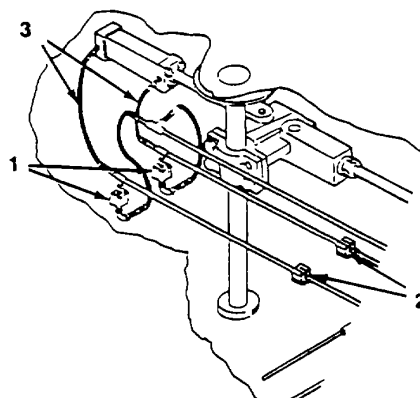
### 1. INSTALL STEERING CYLINDER

- a. Position steering cylinder (8) in place
- b. Install spacer (6), clevis pin (5) and spacer block (7).
- c. Secure clevis pin with safety pin (4).



### 2 RE-CONNECT CYLINDER HOSES.

- a. Remove caps from hose ends and re-connect hoses (3).
- b. Open isolation valves (2) for cylinder being installed. Close bypass valves (1).



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM**

---

**5-31 REPLACE HELM UNIT.**

This task covers.      a. Removal                      b. Installation

---

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's Rall  
and Marine  
5180-00-629-9783  
Torque Wrench

Equipment Conditions

Engine shut down  
Hydraulic steering system  
drained of oil at helm unit

General Safety Instructions

Ensure that hydraulic pressure in  
the system is relieved before  
working on system

---

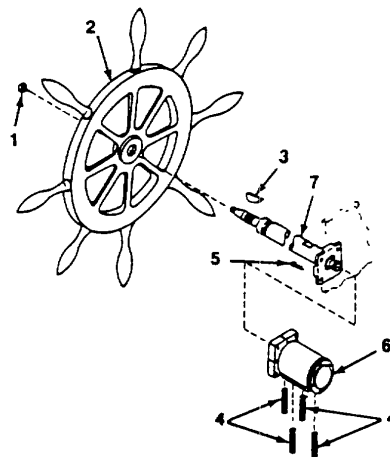
**REMOVAL**

**WARNING**

**The fluid pressure In the system must be released prior to servicing the pump or other parts to prevent possible injury to personnel or damage to equipment.**

**REMOVE HELM UNIT**

- a. Remove capnut (1).
- b. Remove steering wheel (2) and key (3).
- c. Remove bolts securing access cover.
- d. Remove access cover and cover gasket.
- e. Disconnect the four hoses (4) from helm unit Cap open ends.
- f. Remove four mounting bolts (5).
- g. Remove helm unit (6).
- h. Remove control unit (7).



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**5-31 REPLACE HELM UNIT (Continued).**

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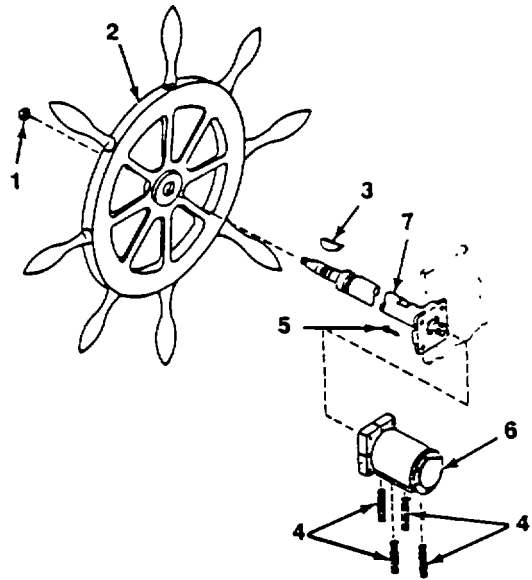
**INSTALLATION**

INSTALL HELM UNIT.

**NOTE**

**Rotate control unit shaft while bringing surfaces into contact.  
This will allow splines on control unit and helm unit to engage.**

- a Install control unit (7) and helm unit (6) using bolts (5) Torque bolts to 280 lb In. (316 Nm).
- b Install hoses (4).
- c Install key (3) and steering wheel (2).
- d Install capnut (1).
- e Replace access cover and gasket.



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM**

---

**5-32 REPLACE RELIEF VALVE (STEERING SYSTEM).**

This task covers      a. Disassembly      b. Installation

---

**INITIAL SETUP**

Tools.

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down.

General Safety Instructions

Ensure that hydraulic pressure  
in the system is relieved before  
working on system

---

**REMOVAL**

**WARNING**

The oil pressure in the system must be released prior to servicing the valve or other parts to prevent possible injury to personnel or damage to equipment.

**REMOVE RELIEF VALVE**

- a. Remove nipple (1) from relief valve (2).
- b. Unscrew relief valve (2) from nipple (3).



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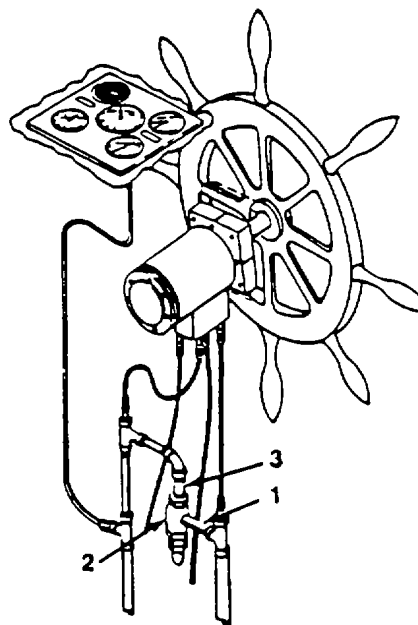
**5-32 REPLACE RELIEF VALVE (STEERING SYSTEM) (Continued).**

---

**INSTALLATION**

## INSTALL RELIEF VALVE

- a. Ensure that replacement relief valve is adjusted to specifications (1500 psi in the LCM-8 steering system).
- b. Screw relief valve (2) into nipple (3).
- c. Install nipple (1) and tighten all connections.



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM**

---

**5-33 REPAIR RELIEF VALVE.**

---

This task covers:            a. Disassembly                    c. Inspection  
                                       b. Cleaning                        d. Assembly

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's Rall  
 and Marine  
 5180-00-629-9783

Equipment Conditions:

Reference  
 Para 5-32. Relief valve removed

Materials/Parts.

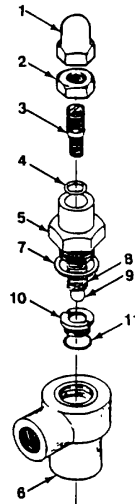
Cleaning Solvent  
 Item 17, Appendix E  
 Seal Kit (Seat 'O' Ring,  
 Body Gasket, Adjustment  
 Screw 'O' Ring)  
 P/N K-20003

**DISASSEMBLY**

---

**DISASSEMBLE RELIEF VALVE**

- a. Remove acorn cap (1), loosen jam nut (2) and remove adjusting screw (3).
- b. Remove and discard 'O' ring (4) from adjusting screw (3).
- c. Unscrew and remove valve body (5) from housing (6); remove and discard gasket (7).
- d. Remove spring (8), relief ball (9) and relief seat (10); remove and discard seat 'O' ring (11).



**5-33 REPAIR RELIEF VALVE (Continued).****CLEANING****CLEAN ALL PARTS**

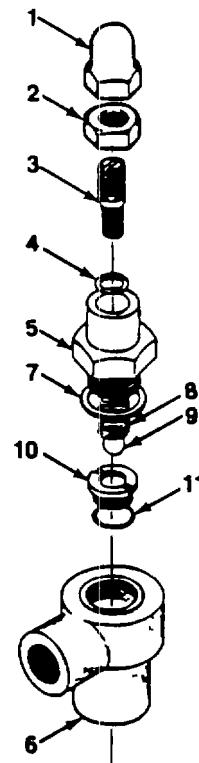
Clean all parts in cleaning solvent  
Fed. Spec. P-D-680 Blow dry with  
compressed air.

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 1000-1380F (38°- 59°C).

**INSPECTION**

1. INSPECT RELIEF SEAT, RELIEF BALL AND SPRING.
  - a. Inspect relief seat (10) for wear or thread damage. Get a new part if above conditions are found.
  - b. Inspect relief ball (9) for scuff marks. Get a new part if above conditions are found.
  - c. Check spring (8) for distortion or loss of tension. Get a new spring if there is little or no tension in the spring.
2. INSPECT HOUSING, VALVE BODY AND ADJUSTING SCREW.
  - a. Inspect housing (6), valve body (5) and adjusting screw (3) for cracks or thread damage.
  - b. Get new parts if above conditions are found on any item.



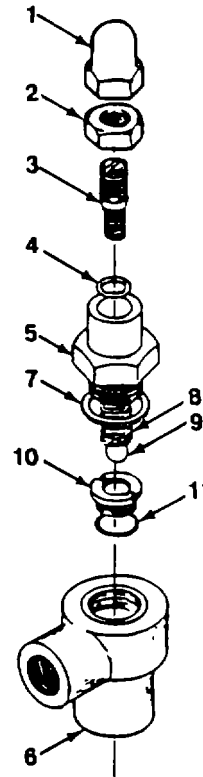
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**5-33 REPAIR RELIEF VALVE (Continued).**

---

**ASSEMBLY****ASSEMBLE RELIEF VALVE.**

- a. Place 'O' ring (11) over end of relief seat (10)  
Install relief seat (10) in housing (b).
- b. Place relief ball (9) In relief seat (10) and install  
spring (8).
- c. Place gasket (7) over end of valve body (5).
- d. Secure spring (8) and relief ball (9) In relief seat  
(10) by installing valve body (5).
- e. Install 'O' ring (4) on adjusting screw (3).
- f. Install adjusting screw (3) and tighten jam nut (2).
- g. Install acorn cap (1) on adjusting screw (3).



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM**

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**5-34 REPLACE FLOW DIVIDER.**

---

This task covers:            a. Removal                    b. Installation

---

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rall  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down  
Hydraulic steering system drained  
of oil at flow divider

General Safety Instructions:

Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

---

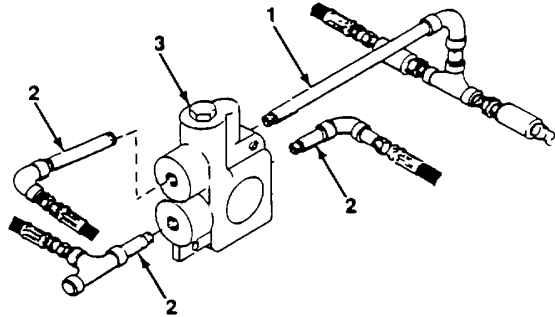
**REMOVAL**

**REMOVE FLOW DIVIDER**

**WARNING**

**The fluid pressure in the system must be released prior to servicing the flow divider or other parts to prevent possible injury to personnel or damage to equipment.**

- a. Disconnect pipe section (1) and nipples (2). Have a container ready to catch oil.
- b. Remove flow divider (3), and cap open ports and pipe ends.



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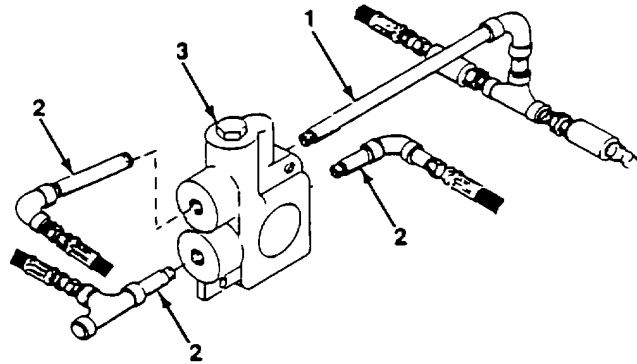
**5-34 REPLACE FLOW DIVIDER (Continued).**

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**INSTALLATION**

INSTALL FLOW DIVIDER.

- a. Ensure that replacement flow divider is set for 1050 psi and 2 gpm regulated flow.
- b. Remove caps from pipe ends and flow divider ports.
- c. Install flow divider (3) by reconnecting pipe sections (1) and nipples (2).
- d. Tighten all connections.



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM**

**5-35 REPLACE COUNTERBALANCE VALVE.**

This task covers.            a. Removal            b Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engines shut down

General Safety Instructions:

Ensure that hydraulic pressure  
In the system is relieved before  
working on system

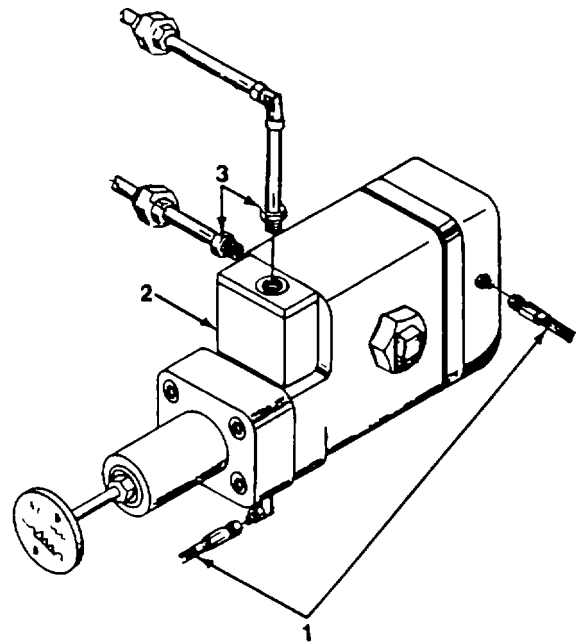
**REMOVAL**

REMOVE COUNTERBALANCE VALVE

**WARNING**

**The fluid pressure in the system must be released prior to servicing the pump or other parts to prevent possible injury to personnel or damage to equipment.**

- a. Remove hose assemblies (1) from counterbalance valve (2) Have a container ready to catch oil
- b. Remove bushings (3) In the piping from the counterbalance valve (2) Remove counterbalance valve
- c. Cap the open ports of valve and piping.



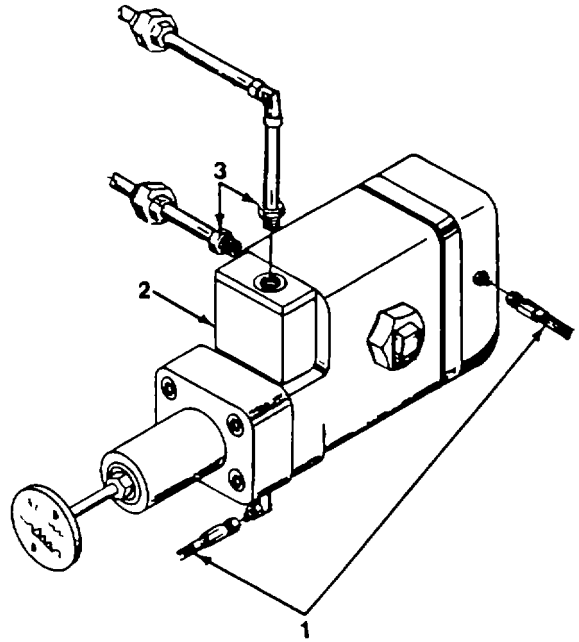
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**5-35 REPLACE COUNTERBALANCE VALVE (Continued).**

---

**INSTALLATION****INSTALL COUNTERBALANCE VALVE**

- a. Remove caps from pipe ends and counterbalance valve ports
- b. Re-connect bushings (3) into counterbalance valve (2)
- c. Re-connect hose assemblies (1).
- d. Tighten all connections





**MAINTENANCE OF HYDRAULIC STEERING SYSTEM****5-36 REPAIR CHECK VALVE (STEERING SYSTEM).**

This task covers:      a. Disassembly      c. Inspection  
                                  b. Cleaning            d. Assembly

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

**Equipment Conditions:**

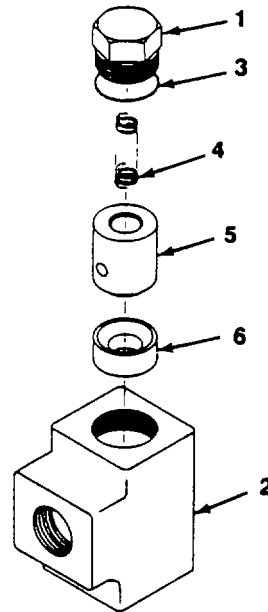
Reference  
 Para 4-33 Check valve removed

**Materials/Parts:**

Cleaning Solvent  
 Item 17, Appendix E  
 Spring  
 P/N 10-00159-02  
 Preformed Packing  
 P/N 82-20216-01

**DISASSEMBLY****DISASSEMBLE CHECK VALVE**

- a. Remove plug (1) from body (2).
- b. Remove and discard preformed packing (3) from plug (1).
- c. Remove spring (4) and poppet (5) from body (2).
- d. Press poppet seat (6) from body (2).



**5-36 REPAIR CHECK VALVE (STEERING SYSTEM) (Continued).**

**CLEANING**

**CLEAN ALL PARTS**

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38°-59° C).

Clean all parts in cleaning solvent  
 Fed Spec P-D-680 Blow dry with  
 compressed air.

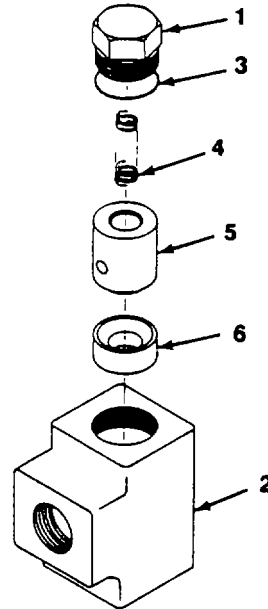
**INSPECTION**

**1. INSPECT POPPET SEAT SPRING.**

- a. Inspect poppet seat (6) for wear.
- b. Inspect spring (4) for distortion and loss of tension.
- c. Get replacement parts as necessary.

**2. INSPECT PLUG AND VALVE BODY.**

- a. Inspect valve body (2) for cracks or thread damage.
- b. Inspect plug (1) for thread damage Replace as necessary.



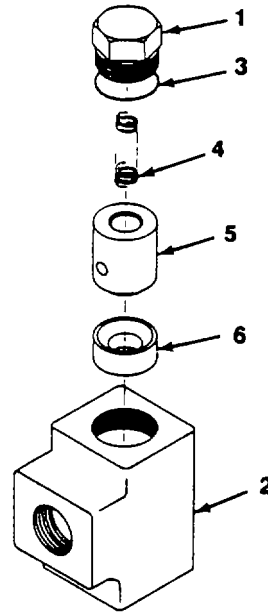
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**5-36 REPAIR CHECK VALVE (STEERING SYSTEM) (Continued).**

---

**ASSEMBLY****ASSEMBLE CHECK VALVE.**

- a. Install poppet seat (6) in valve body (2).
- b. Insert poppet (5) and spring (4) in valve body (2).
- c. Install a new preformed packing (3) on plug (1).
- d. Install plug (1) in valve body (2).



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM****5-37 REPLACE RUDDER.**

This task covers:            a. Removal                    b. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Equipment Conditions:**

Vessel In drydock

**General Safety Instructions:**

Rudder stock and rudder are  
too heavy for one person to  
lift Get help during  
replacement

**Personnel Required:**

Four (4)

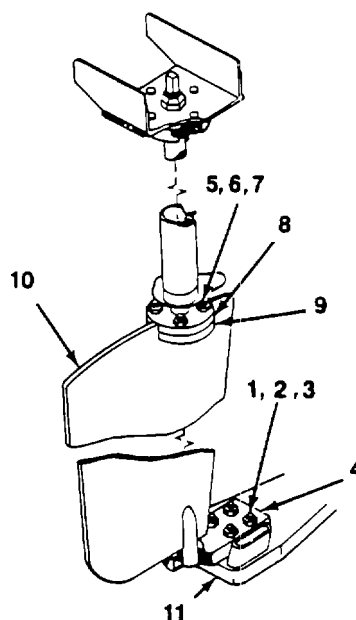
**REMOVAL**

## 1. REMOVE RUDDER

**WARNING**

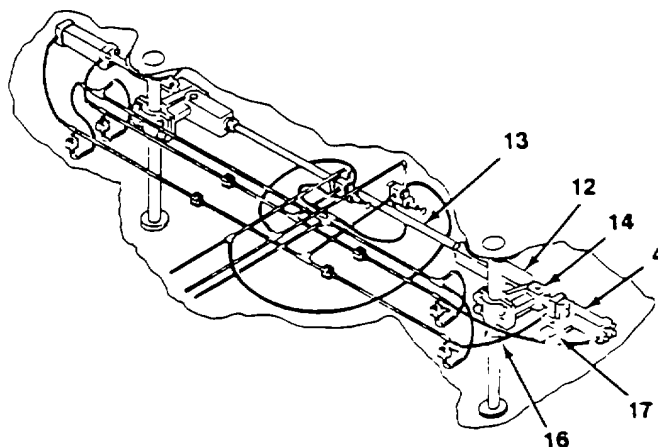
**At least four (4) personnel are required to remove rudder assembly from the craft to avoid the possibility of injury. This assembly weight is approximately 200 pounds (90.7 kg).**

- a. Remove four cotter pins (1), nuts (2), and bolts (3) from rudder shoe casting (4).
- b. Remove four nuts (5), washers (6), and bolts (7) from upper flange (8) and lower flange (9).
- c. Allow rudder assembly (10) to drop approximately 1/4 inch (6.35 mm) to separate the flanges.
- d. Slide rudder assembly (10) aft to clear skeg bar (11) and remove from craft.

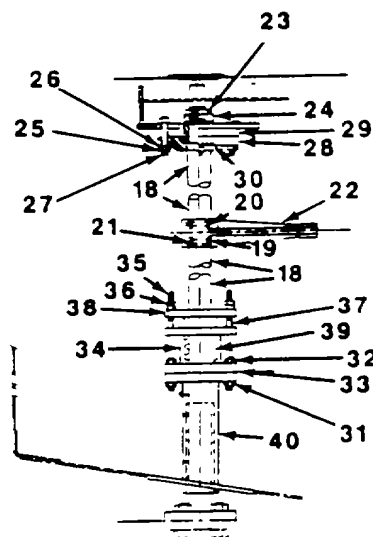


**5-37 REPLACE RUDDER (Continued).****2. REMOVE TIE ROD AND CYLINDER ASSEMBLY**

- a. Remove clevis pin and disconnect clevis (12) from end of tie rod (13)
- b. Remove tie rod (13)
- c. Remove clevis pin and disconnect clevis (14) from end of hydraulic cylinder. Remove cylinder assembly (15)
- d. Disconnect the universal rudder clamp (16) of rudder angle transmitter (7) from the rudder stock (18).

**3. REMOVE RUDDER STOCK**

- a. Remove nuts (19), washers (20), and bolts (21) from crank assembly.
- b. Remove crank assembly (22) from upper rudder stock (18).
- c. Remove cotter pin (23) and nut (24), from upper rudder stock.
- d. Remove flange mounting nuts (25), lockwashers (26), and capscrews (27).
- e. Separate lower thrust flange (28), upper thrust flange (29), and thrust bearing (30).
- f. Remove stuffing box mounting nuts (31), capscrews (32), gasket (33), from stuffing box (34).
- g. Remove packing gland jam nuts (35), hex nuts (36), studs (37) from packing gland (38).
- h. Remove packing gland (38) and stuffing box (34).
- i. Remove flax packing (39) from stuffing box (34). Discard packing.



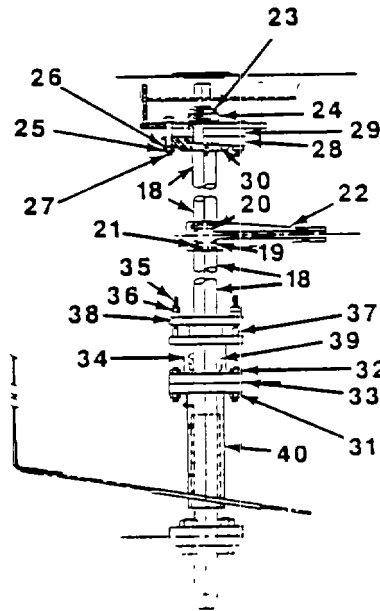
**5-37 REPLACE RUDDER (Continued).**

- j. Remove lower thrust flange (28), upper thrust flange (29), and thrust bearing (30)
- k. Remove sleeve bearing (40) from stuffing box. Discard if damaged
- l. Remove upper rudder stock (18)

**INSTALLATION**

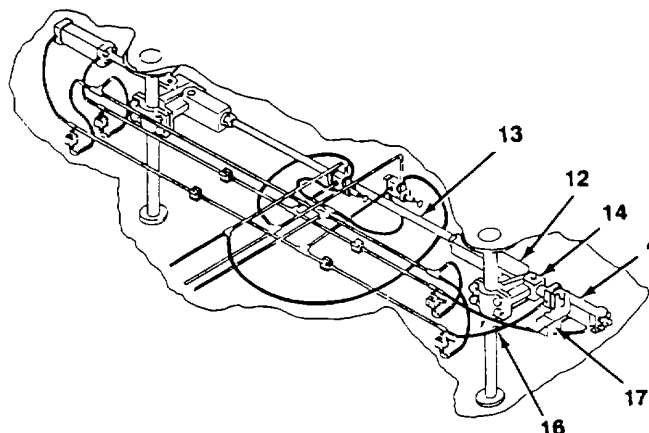
**1. INSTALL RUDDER AND TILLER**

- a. Install upper rudder stock (18).
- b. Install sleeve bearing (40) In stuffing box (34) Replace if damaged.
- c. Install flax packing (39) In stuffing box (34) Use new packing.
- d. Place packing gland (38) over end of rudder stock
- e. Install studs (37), nuts (36), and jam nuts (35) to secure. Do not tighten.
- f. Position stuffing box (34) and gasket (33) in place.
- g. Secure with capscrews (32) and nuts (31) Do not tighten.
- h. Position thrust bearing (30) in place, then place upper thrust flange (20) and lower thrust flange (28) over bearing.
- i. Place assembled tiller in place in vessel and secure flange assembly with capscrews (27), lockwashers (26), and flange mounting nuts (25).
- J. Secure rudder stock assembly to vessel with nut (24).



**5-37 REPLACE RUDDER (Continued).**

- k. Align holes in nut (24) with hole in rudder stock and install cotter pin (23).
- l. Tighten nuts (31 and 36).
- m. Install crank assembly (22) onto upper rudder stock (18) with bolts (21), washers (20), and nuts (19).

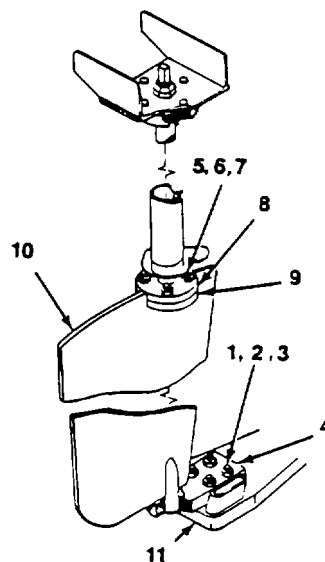
**2. INSTALL TIE ROD AND CYLINDER ASSEMBLY**

- a. Place tie rod (13) in position.
- b. Re-connect clevis (12) to end of tie rod (13).
- c. Re-connect clevis (14) on end of hydraulic cylinder (15), Install clevis pin.
- d. Re-connect universal rudder clamp (16) of rudder angle transmitter (17) to the rudder stock (18).

**3. INSTALL RUDDER.****WARNING**

**At least four (4) personnel are required to install the rudder assembly in the craft to avoid the possibility of injury. This assembly weighs approximately 200 lbs (90.718 kg).**

- a. Slide rudder assembly (10) into position on skeg bar (11).
- b. Lift up on rudder assembly (10) until lower rudder flange (9) and upper rudder flange (8) join together. Ensure that rudder assembly aligns with bolt holes in skeg bar.
- c. Secure upper and lower flange with bolts (7), washers (6), and bolts (5).



---

**5-37 REPLACE RUDDER (Continued).**

---

- d. Secure rudder shoe casting (4) to skeg bar (11) with bolts (3), nuts (2) and cotter pin (1).



**MAINTENANCE OF RUDDER**

---

**5-38 REPAIR RUDDER.**

---

This task covers                    a. Disassembly                    c. Assembly  
    b. Repair

---

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783  
 Welding Machine

**Equipment conditions:**

Reference  
 Para 5-37 Rudder removed from vessel  
 Vessel in drydock.

**Personnel Required:**

(1) Certified Welder

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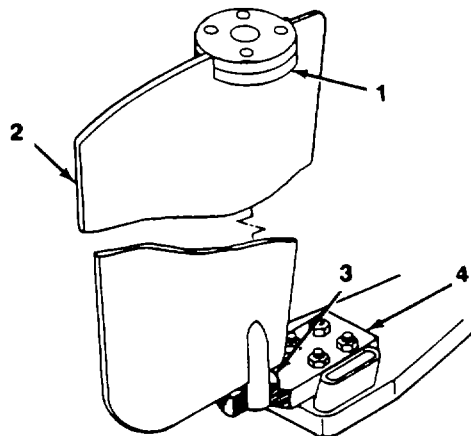
**DISASSEMBLY**

DISASSEMBLE RUDDER.

**NOTE**

**Replace rudder assembly if bronze gudgeon bearing is worn or the rudder is damaged beyond repair.**

- a. Remove lower rudder flange (1) from rudder (2) if damaged.
- b. Remove bronze gudgeon bearing (3) from rudder shoe casting (4).



---

**5-38 REPAIR RUDDER (Continued).**

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**REPAIR**

## REPAIR RUDDER

**WARNING**

**Welding must be done by a qualified welder in accordance with standard welding procedures.**

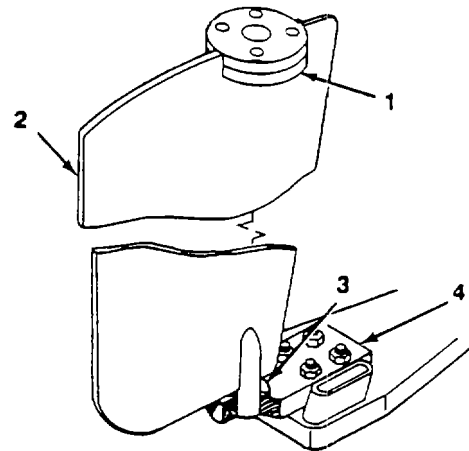
- a. Weld crack and breaks using standard welding procedures and grind smooth.
- b. Straighten any bends in rudder.
- c. Remove corrosion by wire brushing.
- d. Replace damaged or defective hardware.
- e. Prime and paint repaired areas.

---

**ASSEMBLY**

## ASSEMBLE RUDDER.

- a. Install bronze gudgeon bearing (3) in rudder shoe casting (4).
- b. Install rudder shoe casting (4) on rudder (2).
- c. Install lower rudder flange (1) on rudder assembly (2).



**MAINTENANCE OF RUDDER ANGLE INDICATOR**

**5-39 REPLACE RUDDER ANGLE TRANSMITTER (RAI).**

This task covers a. Removal b. Installation

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's, Rail and Marine  
5180-00-629-9783  
panel.

Equipment Conditions:

Engine shut down Rudder amidship. Power to RAI disconnected at the distribution.

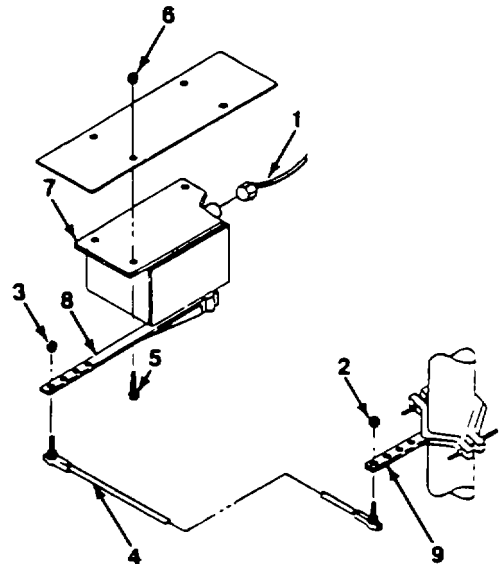
General Safety Instructions:

Energized equipment is dangerous. Never work on energized equipment unless authorized to do so by a responsible authority.

**REMOVAL**

REMOVE RUDDER ANGLE TRANSMITTER.

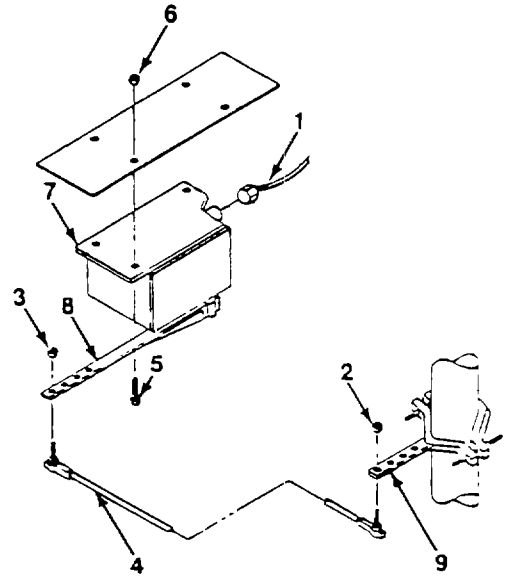
- a. Disconnect power/transmitter cable (l) at the follow-up unit.
- b. Loosen nuts (2 and 3) on both ends of the transmitter linkage (4) at rudder post and follow-up unit, and remove.
- c. Loosen mounting bolts (5) and nuts (6) and remove transmitter (7).



**5-39 REPLACE RUDDER ANGLE TRANSMITTER (RAI) (Continued).****INSTALLATION**

INSTALL RUDDER ANGLE TRANSMITTER.

- a. Mount transmitter (7) with actuating arm (8) in the same direction as the tiller activating arm (9). Secure transmitter with bolts (5) and nuts (6).
- b. Install transmitter linkage (4) to the same connecting points as when it was removed. Secure with nuts (2 and 3).
- c. Re-connect power/transmitter cable (1) at the follow-up unit.
- d. Energize circuit and check indicator for proper functioning.



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**MAINTENANCE OF BILGE SYSTEM**

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**5-40 REPLACE BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY.**

---

This task covers                      a. Removal                      b. Installation

---

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

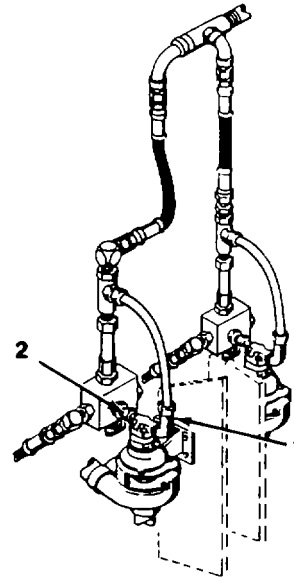
**Equipment Conditions:**

Engines shut down  
Hydraulic lines drained of  
oil at pump motor  
Bilge piping system drained  
of liquid.

---

**REMOVAL**

1. REMOVE HYDRAULIC MOTOR CONNECTION.
  - a. Remove elbow (1) from hydraulic motor discharge line.
  - b. Remove union (2) from hydraulic motor inlet line.



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**5-40 REPLACE BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY (Continued)**

---

**2. REMOVE BILGE PUMP**

- a. Remove union (3) from bilge pump discharge piping.
- b. Remove the four mounting bolts (4) and nuts (5) from the pedestal.
- c. Remove bilge pump/hydraulic motor assembly (6) from close nipple (7) in suction line.

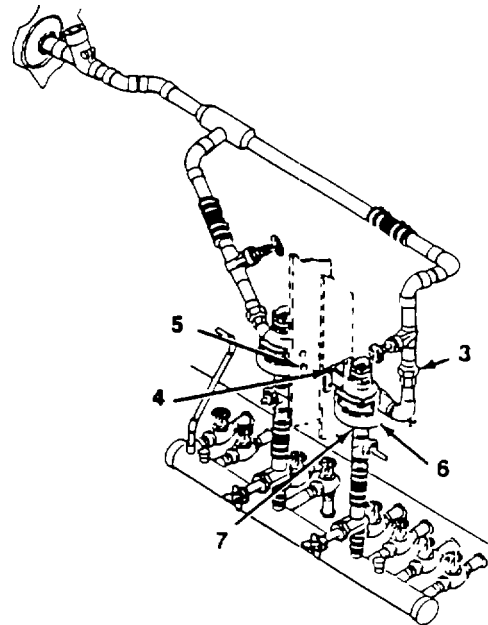
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**INSTALLATION****1. INSTALL BILGE PUMP**

- a. Install bilge pump/hydraulic motor assembly (6) onto the close nipple (7) in the suction piping.
- b. Secure pump pedestal with mounting bolts (4) and nuts (5).
- c. Re-connect bilge pump discharge piping with union (3).

**2. INSTALL HYDRAULIC MOTOR CONNECTIONS**

- a. Re-connect hydraulic motor. Inlet piping with union (2).
- b. Re-connect hydraulic motor discharge piping with elbow (1).



**MAINTENANCE OF BILGE SYSTEM****5-41 REPAIR BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY.**

This task covers-

a. Disassembly	c. Assembly
b. Repair	

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-0-629-9783

**Equipment Conditions:**

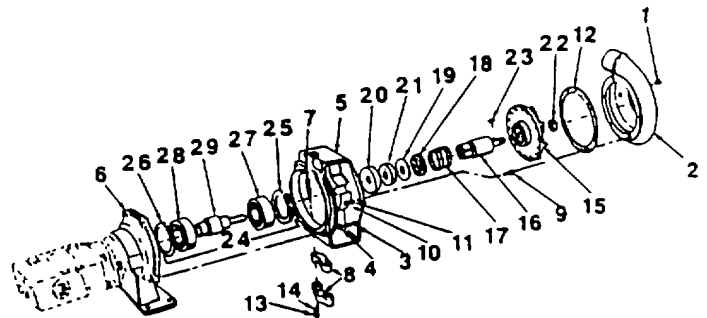
Reference  
Para. 5-40 Bilge pump removed

**Materials/Parts:**

Cleaning Solvent  
Item 17, Appendix E  
Gasket  
P/N 21216  
Seal  
P/N 22640  
'O' Ring  
P/N 25009-20  
'O' Ring  
P/N 25001-31  
'O' Ring  
P/N 25000-38  
Seal Kit  
P/N 80005-16

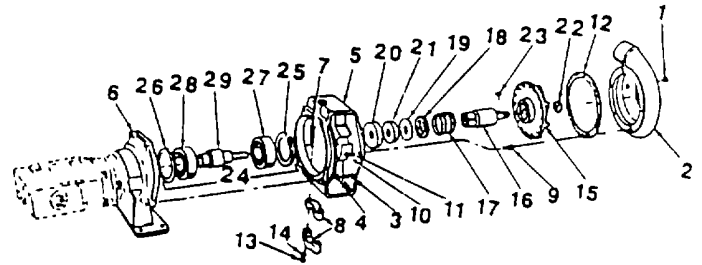
**DISASSEMBLY**

1. DISASSEMBLE BILGE PUMP.
  - a. Remove drain plugs (1) and drain housing (2) of any residual water.
  - b. Remove four capscrews (3) and lockwashers (4) holding the pump adapter (5) to the pedestal (6).
  - c. Loosen two bolts (7) in the clamps (8).
  - d. Remove six studs (9), nuts (10) and lockwashers (11) holding the adapter (5) to the housing (2), remove housing (2) and gasket (12).



**5-41 REPAIR BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY (Continued).**

- e. Remove the two bolts (7), nuts (13), and lockwashers (14) from the clamps (8). The impeller (15), shaft sleeve (16), spring (17), rubber bellows (18) and washer (19) will slide forward. (The seal seat (20) and seat cup (21) will remain in the pump adapter (5). Do not remove if not worn or damaged.)

**CAUTION**

**If it is necessary to remove the seal seat, use caution so as not to crack or distort the seal seat.**

- f. Insert a piece of wood or a screwdriver handle through the adapter from the drive end. With a sharp tap, knock out the seal seat (20) from the adapter counterbore.

**CAUTION**

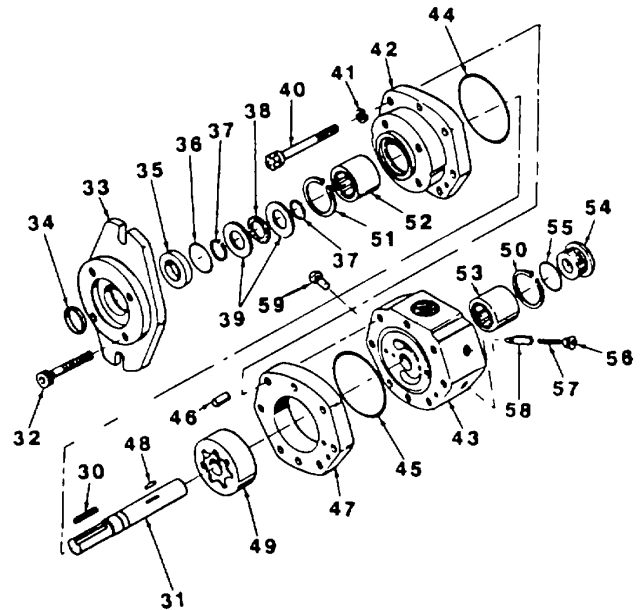
The rubber bellows will be bonded to the shaft sleeve. Use caution in removal in order not to damage the seal bellows.

- g. Remove the impeller locknut (22) from the end of the shaft sleeve (16).
- h. Slide the impeller (15) from the shaft sleeve (16) and remove the impeller Woodruff key (23).
- i. Remove the shaft assembly (24) from the pedestal (6). Remove snap rings (25 and 26). Do not remove bearings (27 and 28) from shaft (29) if not defective.



**5-41 REPAIR BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY (Continued).****2. DISASSEMBLE HYDRAULIC MOTOR**

- a. Remove shaft drive key (30) from the shaft (31).
- b. Remove four screws (32) from the face of the mounting flange (33). Remove mounting flange (33).
- c. Remove shaft dirt seal (34), high pressure shaft seal (35), 'O' ring (36), retainer rings (37), thrust bearing (38) and washers (39).
- d. Remove six screws (40), and lockwashers (41) securing the front bearing housing (42) to the motor body (43).
- e. Separate front bearing housing (42) from motor body (43); remove body and housing 'O' rings (44 and 45).
- f. Remove four locating dowels (46) from the gerotor housing (47).
- g. Remove gerotor drive key (48) and gerotor (49).
- h. Remove retainer rings (50 and 51). Do not remove roller bearings (52 and 53) from shaft (31). If not defective.
- i. Remove end plug (54) and 'O' ring (55) from motor body (43).
- j. Remove two check valve plugs (56), spring (57) and check valve poppets (58) from the motor body (43).
- k. Remove external drain plug (59) from motor body (43).



5-41 REPAIR BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY (Continued).

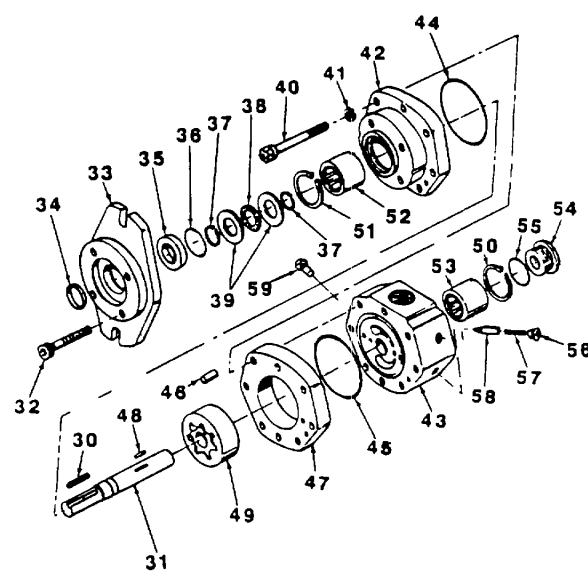
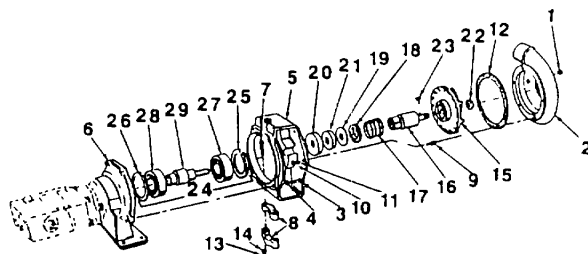
REPAIR

REPAIR BILGE PUMP/HYDRAULIC MOTOR

NOTE

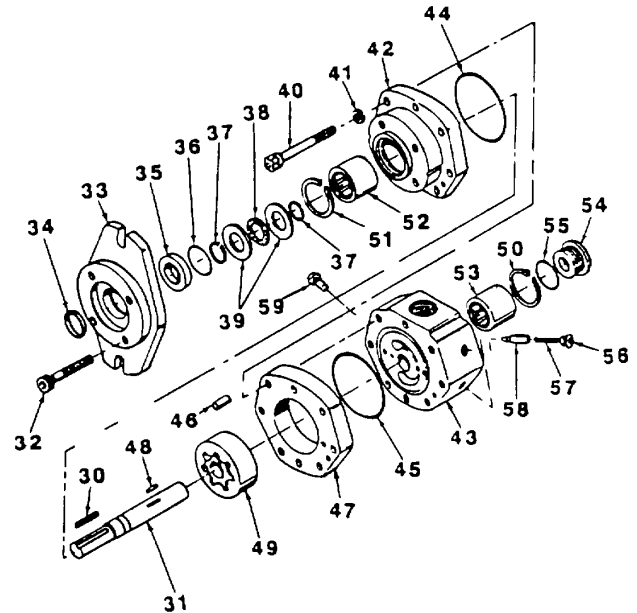
Clean all parts thoroughly in cleaning solvent P-D-680, Type 2. Do not use abrasives.

- a. Inspect the gasket (12). Replace if it is torn or damaged.
- b. Inspect the shaft sleeve (16) for nicks and burrs. Remove all nicks and burrs with crocus cloth. Replace if damaged.
- c. Inspect the seal seat (20) and seat cut (21) for grooves and scuff marks. Re-use if a perfect lapped surface remains on the seal seat, otherwise replace.
- d. Inspect washer (19) and bellows (18) for wear or deterioration. Replace if necessary.
- e. Inspect roller bearings (52 and 53) and shaft (31) for excessive wear. Replace if required.
- f. Inspect front bearing housing (42) and motor housing (43) faces for scratches, nicks, scoring or other damage. Re-machine if necessary.
- g. Replace 'O' rings (36, 44, 45 and 55) and seals (34 and 35).



**5-41 REPAIR BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY (Continued).****ASSEMBLY****1. ASSEMBLE HYDRAULIC MOTOR**

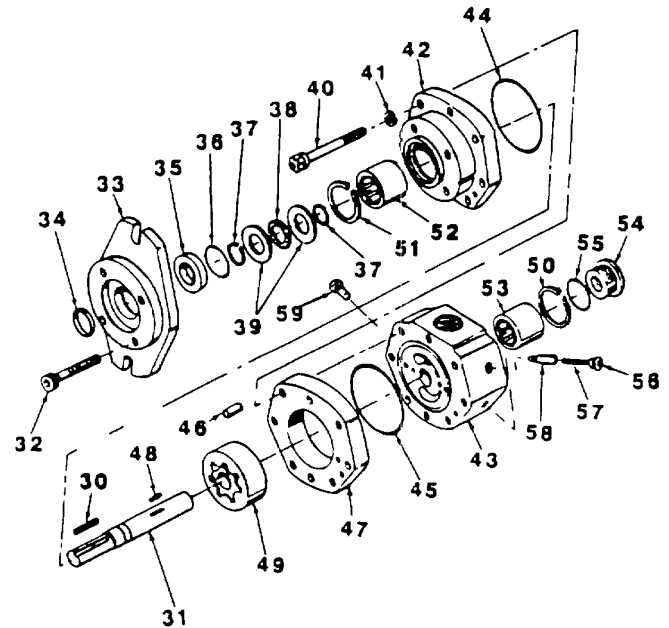
- a. Place gerotor drive key (48) in place on shaft (31) and slide gerotor (49) over it
- b. Install two roller bearings (52 and 53) and retainer rings (50 and 51), if removed.
- c. Assemble thrust bearing (38) on shaft (31) between thrust washers (29) and locate with retainer rings (37) on shaft. (Sharp edges of retainer rings should be away from the thrust washer. Gap in retainer rings must be located radially away from the milled slot in shaft).
- d. Place shaft assembly into front bearing housing (42).
- e. Install dowels (46) in gerotor housing (47), and place gerotor housing over gerotor (49). Ensure that 'O' rings (44) are located properly, and not pinched when gerotor housing (47) is firmly seated.
- f. Apply ample amount of clean petroleum oil to the gerotor (49) and place motor body (43) over the shaft (31).
- g. Secure front bearing housing (42), gerotor housing (47) and motor body (43) with screws (40) and lockwashers (41). Torque to 500 in-lbs.

**NOTE**

**Coat seals with grease before assembly.**

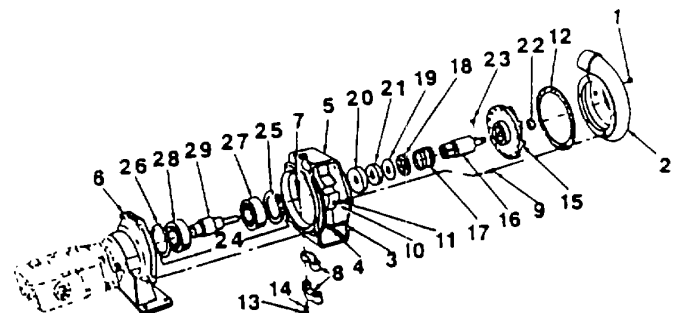
**5-41 REPAIR BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY (Continued).**

- h. Place mounting flange (33) which includes shaft dirt seal (34), high pressure shaft seal (35) and 'O' ring (36) over shaft and locate on front bearing housing (42).
- i. Place four screws (32) In flange (33) and torque to 90 in-lbs.
- j. Install shaft drive key (30) In shaft keyway.
- k. Install the two check valve poppets (58), spring (57) and plug (56) into the motor body (43) Install external drain plug (59).
- i. Place 'O' ring (44) over end plug (53) and install end plug (53) in the motor housing (43).



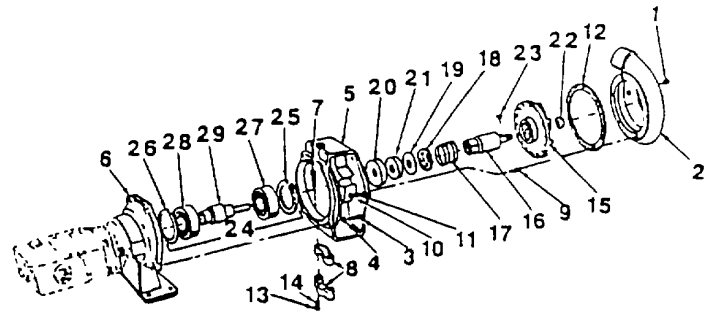
**2. ASSEMBLE BILGE PUMP**

- a. Lubricate the seal seat (20) and seat cup with liquid soap or clean grease. Press seal seat into adapter counterbore, seating it firmly and squarely.
- b. Install seal cup (21).
- c. Assemble shaft sleeve (16), impeller Woodruff key (23), impeller (15) and impeller locknut (22).
- d. Press bellows (18), washer (19) and spring assembly (17) onto the shaft sleeve (16).
- e. Slide impeller (15) and seal assembly into the adapter (5).
- f. Install gasket (12) on housing (2), and install on adapter (5). Secure with six studs (9), lockwashers (11) and nuts (10).
- g. If removed, assemble bearings (27 and 28) and snap rings (25 and 26) on the shaft (29).



**5-41 REPAIR BILGE PUMP/HYDRAULIC MOTOR ASSEMBLY (Continued).**

- h. Install shaft assembly (21) into shaft sleeve (16).
- i. Install drive clamps (8), bolts (7), lockwashers (14) and nuts (13), but do not tighten.
- j. Tighten bolts (7) in the drive clamp (8) assembly.
- k. Rotate the drive shaft (29) slowly by hand to make sure the impeller (15) does not rub or hit the housing (2).
- l. Adjust impeller clearance if impeller (2) is rubbing. Loosen bolts (7) in drive clamp assembly. Move impeller either forward or back. Use a screwdriver to move impeller (15) back or move shaft sleeve (16) forward.
- m. Install four capscrews (3) and lockwashers (4) to secure the adapter (5) to the pedestal (6).



**MAINTENANCE OF SEA WATER SYSTEM****5-42 REPLACE DUPLEX STRAINER (SEA WATER SYSTEM).**

This task covers:                      a. Removal                      b. Installation

**INITIAL SETUP**Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

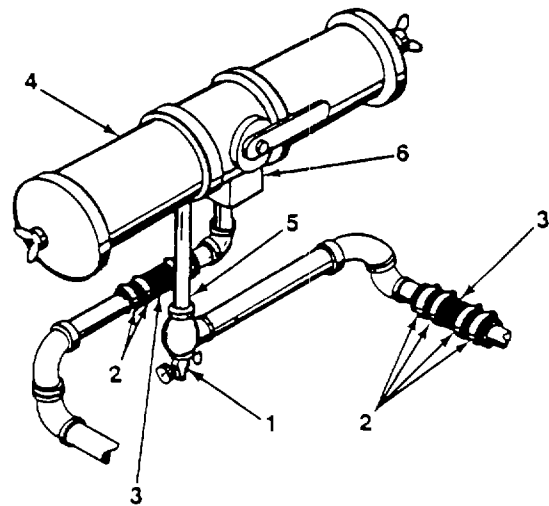
Equipment Conditions

Engine shut down  
Seawater system drained  
Seacock closed

**REMOVAL**

REMOVE DUPLEX STRAINER.

- a. Close seawater seacock.
- b. Open draincock (1) to drain strainers.
- c. Loosen hose clamps (2) and slide back over hoses (3).
- d. Remove hoses (3).
- e. Remove strainer (4) with associated piping attached.
- f. Remove pipe section (5) from strainer (4).
- g. Remove pipe section (6) from strainer (4).

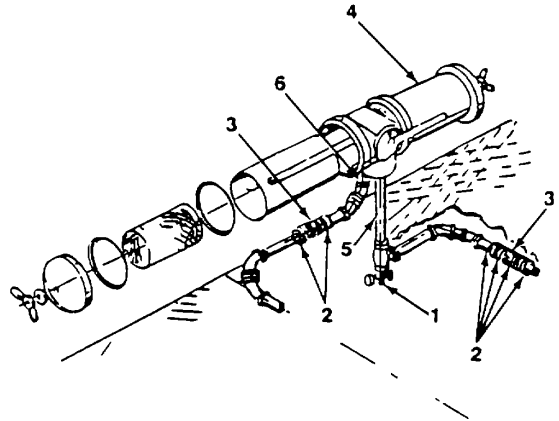
**INSTALLATION**

INSTALL DUPLEX STRAINER.

- a. Install pipe section (6) to strainer (4).
- b. Install pipe section (5) to strainer (4).

**5-42 REPLACE DUPLEX STRAINER (SEA WATER SYSTEM) (Continued).**

- c. Position strainer (4) In place.
- d. Slide hoses (3) over ends of pipes.
- e. Secure with hose clamps (2).
- f. Open draincock (1) and seawater seacock.



**MAINTENANCE OF SEAWATER SYSTEM**

**5-43 REPAIR DUPLEX STRAINERS (SEA WATER SYSTEM).**

This task covers	a. Disassembly	c. Assembly
	b. Repair	

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Reference  
Para. 5-42 Duplex strainers removed

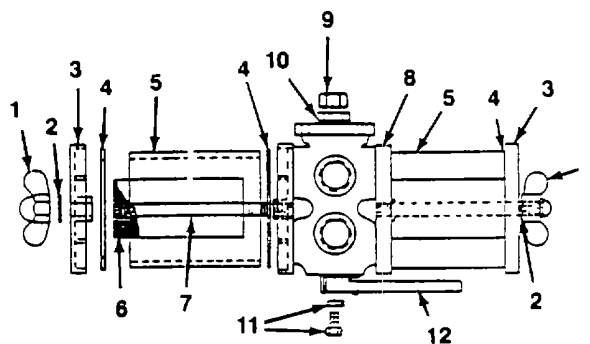
Materials/Parts:

Gasket  
P/N 10  
Screen  
P/N HD99A

**DISASSEMBLY**

DISASSEMBLE STRAINER

- Loosen and remove wing nut (1), lockwasher (2), end cap (3), and cylinder gasket (4) from cylinder (5). Discard gasket.
- Lift strainer screen (6) off of threaded rod (7).
- Remove lucite cylinder (5), and second cylinder gasket (4) from body (8) Discard gasket.
- Remove threaded rod (7).
- Disassemble other end of strainer in the same manner.
- Remove nut (9), washer (10), and screw and washer assembly (11) from body plug assembly (8).
- Remove handle (12) from body plug assembly (8).





**5-43 REPAIR DUPLEX STRAINERS (SEA WATER SYSTEM) (Continued).****REPAIR**

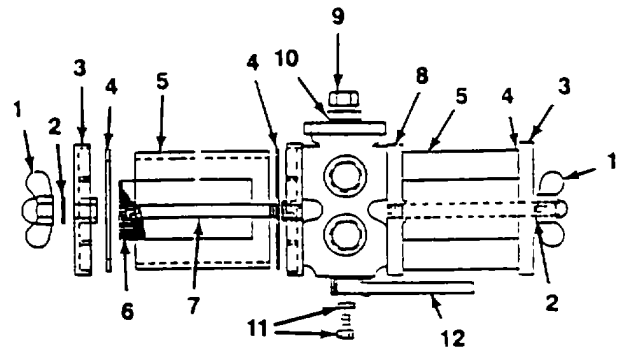
## REPAIR STRAINER

- a. Replace gaskets (4) Replace screens (6) as necessary.
- b. Straighten distorted threaded rods.

**ASSEMBLY**

## ASSEMBLE STRAINER

- a. Install threaded rod (7), if removed.
- b. Position gasket (4) in place on body (8) and insert strainer (6) over rod (7). Use new gasket.
- c. Place lucite cylinder (5) on body (8).
- d. Place gasket (4) over end of cylinder. Use new gasket.
- e. Install end cap (3) onto cylinder (5) with washer (2), and wing nut (1).
- f. Assemble other end of strainer in the same manner.



**MAINTENANCE OF HYDRAULIC STARTING SYSTEM****5-44 REPLACE RECHARGING PUMP.**

This task covers                      a. Removal                      b. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Equipment Conditions:**

Engine shut down. All fluid pressure on  
hydraulic starting system released.

**Materials/Parts:**

Gasket  
P/N 202082

**General Safety Instructions:**

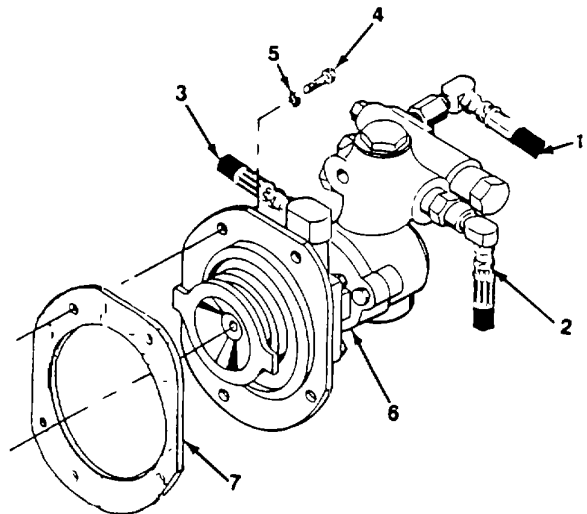
Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

**REMOVAL****WARNING**

The fluid pressure in the system must be released prior to servicing the engine-driven pump to prevent possible injury to personnel or damage to equipment.

**REMOVE HYDRAULIC RECHARGING PUMP**

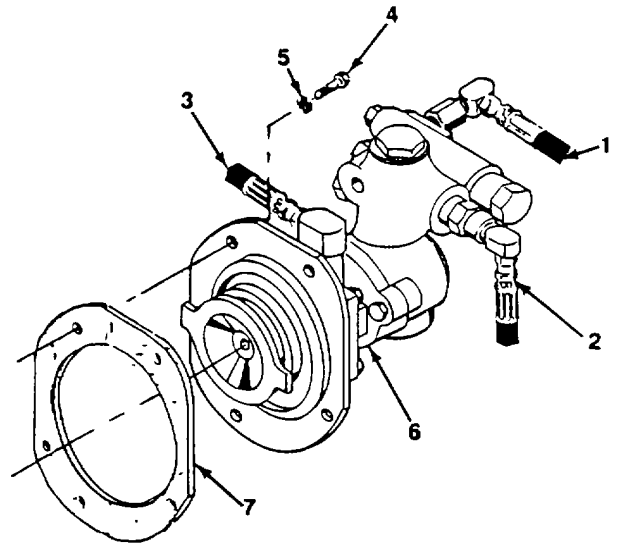
- a. Release oil pressure from hydraulic system.
- b. Clean all dirt from hydraulic pump and lines.
- c. Disconnect outlet hose (1), inlet hose (2), and return hose (3) at the elbows. Cap the hydraulic lines.
- d. Remove five bolts (4) and lockwashers (5) mounting pump to engine.
- e. Remove pump (6) and gasket (7).



**5-44 REPLACE RECHARGING PUMP (Continued).****INSTALLATION**

## INSTALL HYDRAULIC RECHARGING PUMP

- a. Install pump (6) and gasket (7) securing it to the engine with five bolts (4) and lockwashers (5).
- b. Remove protector caps. Re-connect return hose (3), inlet hose (2) and outlet hose (1) to pump.



**MAINTENANCE OF HYDRAULIC STARTING SYSTEM****5-45 REPLACE ACCUMULATOR.**

This task covers                      a. Removal                      b. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Equipment Conditions:**

Engine shut down. All fluid pressure on  
hydraulic starting system released.

**General Safety Instructions:**

Ensure that the hydraulic pressure in  
the system is relieved before working  
on system.

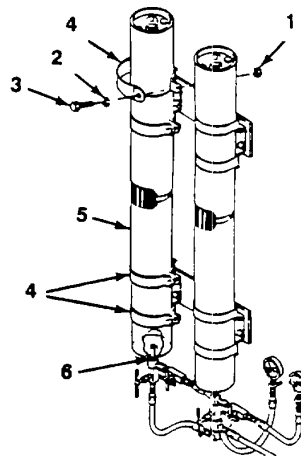
**REMOVAL****REMOVE ACCUMULATOR**

- a. Close valve on accumulators not being replaced.

**WARNING**

The fluid pressure in the system must be released prior to servicing the accumulator to prevent possible injury to personnel or damage to equipment.

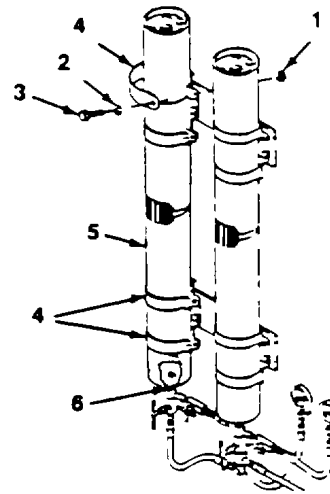
- b. Remove nuts (1), lockwashers (2), and bolts (3) from mounting brackets (4).
- c. Remove accumulator (5) from mounting brackets. Unscrew accumulator from bottom hydraulic connection (6).



**5-45 REPLACE ACCUMULATOR (Continued).****INSTALLATION**

INSTALL ACCUMULATOR.

- a. Screw bottom of accumulator (5) into hydraulic connection (6).
- b. Mount accumulator and install nuts (1), bolts (3), and lockwashers (2) to the accumulator brackets (4).

**NOTE**

All accumulators are replaced in the same manner.

**5-46 REPLACE FILTERS (STARTING SYSTEM).**

This task covers.

a. Removal	c. Cleaning	e. Installation
b. Disassembly	d. Assembly	

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down

Materials/Parts:

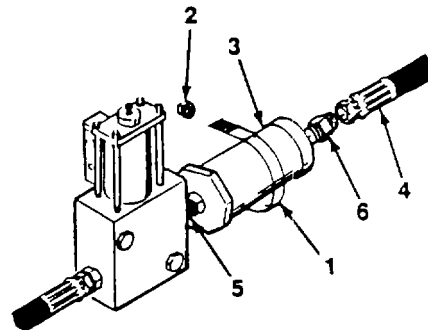
Cleaning Solvent  
Item 17, Appendix E  
Filter Element  
P/N FE 200575  
'O' Ring  
P/N GA 100201  
Hydraulic Fluid  
Item 12, Appendix E

General Safety Instructions:

Relieve pressure in the starting system  
before removing filters

**REMOVAL****REMOVE IN-LINE FILTER**

- Remove U-bolt (1) and nut (2) securing filter housing (3).
- Disconnect hose assembly (4) from inlet side of filter housing (3).
- Unscrew filter assembly from the reducing hex nipple (5) connecting the filter assembly and the control valve.
- Remove male connector (6) from the inlet port of the filter assembly.



**5-46 REPLACE FILTERS (STARTING SYSTEM) (Continued).****DISASSEMBLY**

1304 - 06

**DISASSEMBLE FILTER ASSEMBLY**

- a. Unscrew cap (7) and remove 'O' ring (8), filter element (9), seat guide (10) and spring (11) from filter housing (3).
- b. Discard 'O' ring (8) and filter element (9) - get new parts.

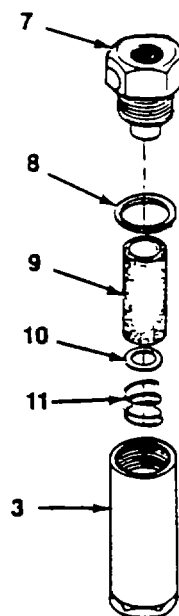
**CLEANING****CLEAN FILTER ASSEMBLY****WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100 $\pm$  - 138 $\pm$ F (38 $\pm$  - 59 $\pm$ C).

Clean all parts in cleaning solvent Fed. Spec. P-D-680

**ASSEMBLY****ASSEMBLE FILTER ASSEMBLY.**

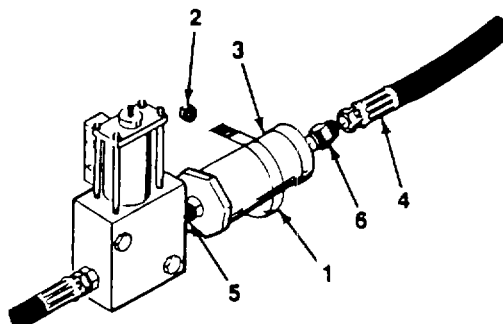
- a. Assemble spring (11), seat guide (10), filter element (9), and 'O' ring (8) in filter housing (3).
- b. Install cap (7).



**5-46 REPLACE FILTERS (STARTING SYSTEM) (Continued).****INSTALLATION**

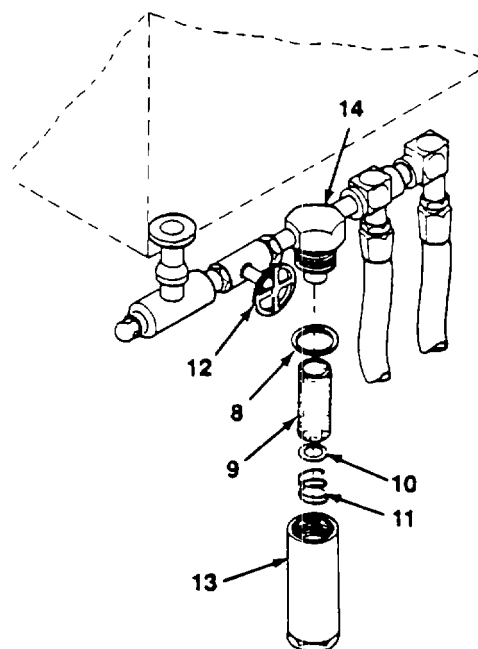
## INSTALL FILTER ASSEMBLY

- a. Install male connector (6) into the inlet port of the filter assembly.
- b. With the outlet port oriented towards the control valve, screw the filter assembly into the reducing hex nipple (5).
- c. Connect hose assembly (4) onto the male connector (6) on the inlet side of the filter assembly.
- d. Secure filter housing (3) with U-bolt (1) and nut (2).

**REMOVAL**

## REMOVE AND DISASSEMBLE T-TYPE FILTER

- a. Close starting system shutoff valve (12) in the suction line from the tank.
- b. Unscrew the filter housing (13) from the head (14).
- c. Remove and discard 'O' ring (8) and filter element (9). Get new parts.
- d. Remove seat guide (10) and spring (11) from filter housing (13).





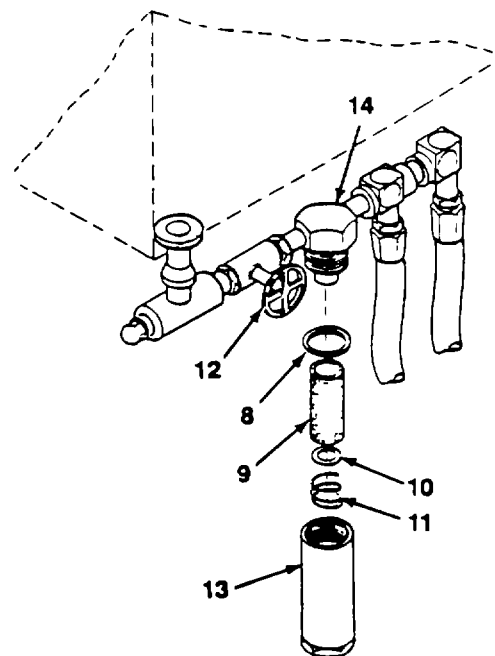
**5-46 REPLACE FILTERS (STARTING SYSTEM) (Continued).****CLEANING****CLEAN T-TYPE FILTER****WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100# - 138#F (38# - 59#C).

Clean all parts in cleaning solvent  
Fed Spec P-D-680.

**ASSEMBLY****ASSEMBLE AND INSTALL T-TYPE FILTER.**

- a. Assemble spring (11), seat guide (10), new filter element (9) and 'O' ring (8) into filter housing (13).
- b. Fill filter housing with hydraulic oil.
- c. Install filter housing (11) onto the head (12).



**MAINTENANCE OF HYDRAULIC STARTING SYSTEM****5-47 REPLACE CONTROL VALVE (STARTING SYSTEM).**

This task covers:                    a. Removal                    b. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Torque Wrench

**Equipment Conditions:**

Engine shut down  
Hydraulic starting system  
drained of oil at valve  
Accumulator valves closed

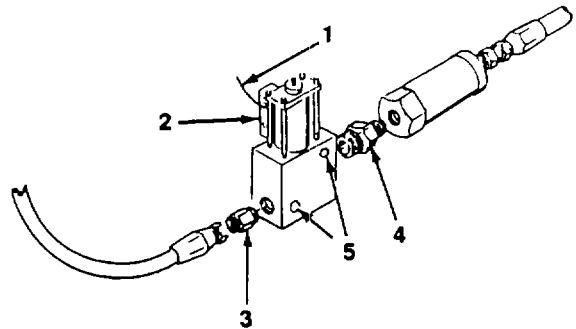
**General Safety Instructions**

Ensure that hydraulic pressure  
in the system is relieved before  
working on system

**REMOVAL****REMOVE CONTROL VALVE****WARNING**

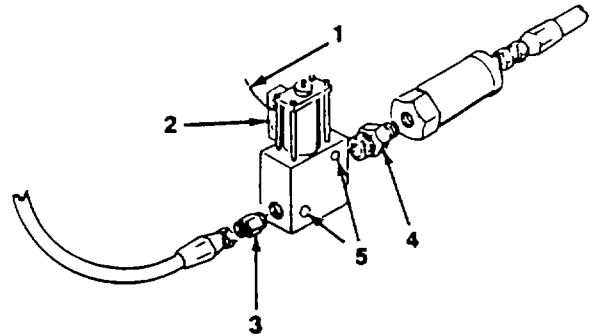
To prevent possible injury to personnel or damage to equipment, the oil pressure in the system must be released prior to servicing the hand pump or any other components of the system.

- a. Remove battery ground lead.
- b. Disconnect and tag electrical leads (1) at control valve (2).
- c. Relieve pressure in hydraulic starting system by opening accumulator blowdown valve.
- d. Remove male connector (3) from control valve discharge port. Remove reducing hex nipple (4) from control valve inlet port.
- e. Remove mounting bolts (5) and remove valve (2).



**5-47 REPLACE CONTROL VALVE (STARTING SYSTEM) (Continued).****INSTALLATION****INSTALL CONTROL VALVE**

- a. Install control valve (2) and secure with mounting bolts (5).
- b. With valve in place, torque bolts to 30-39 foot-pounds (40 7-52 9 Nm).
- c. Connect male connector (3) to control valve discharge port. Connect reducing hex nipple (4) to control valve inlet port
- d. Remove tags and connect electrical leads (1).
- e. Connect battery ground lead.
- f. Pressurize system using handpump.
- g. Purge system of air and check connections for leaks.



**MAINTENANCE OF HYDRAULIC STARTING SYSTEM****5-48 REPLACE STARTING MOTOR.**

This task covers:                    a. Removal                    b. Installation

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

**Equipment Conditions:**

Engine shut down  
Hydraulic starting system  
drained of oil at starting  
motor Accumulator valves  
closed

**General Safety Instruction:**

Ensure that hydraulic pressure  
in the system is relieved before  
working on system.

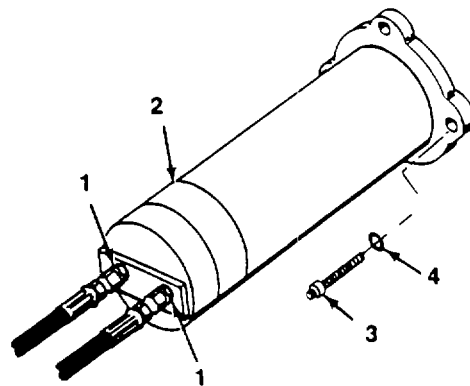
**REMOVAL****REMOVE STARTING MOTOR.**

- a. Close both accumulator valves.

**WARNING**

**To prevent possible injury, the oil pressure in the system must be released prior to servicing the starting motor or any other components of the system.**

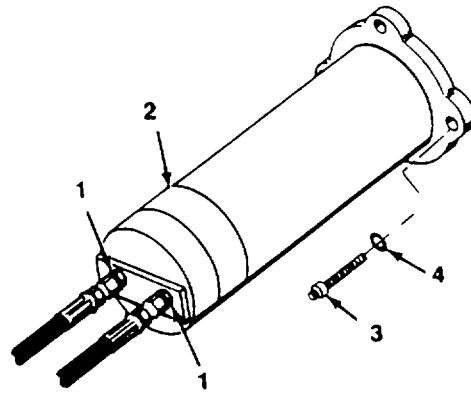
- b. Release pressure in hydraulic system.
- c. Clean all exterior dirt from the starting motor and hydraulic lines using detergent and water solution.
- d. Disconnect the male connector (1) from the starting motor (2). Cover the open ends with caps to prevent entry of any foreign matter.
- e. Remove the three retaining bolts (3) and lockwashers (4) and lift the starting motor away from the flywheel housing.



**5-48 REPLACE STARTING MOTOR (Continued).****INSTALLATION**

## INSTALL STARTING MOTOR

- a. Insert the starting motor (2) in the flywheel housing opening. When properly aligned, the pilot diameter of the hydraulic starting motor adapter will enter easily. **DO NOT USE FORCE.**
- b. Rotate the starting motor so that the bolt holes are aligned with the tapped holes in the flywheel housing. Secure to the flywheel with three lockwashers (4) and retaining bolts (3).
- c. Connect the male connectors (1) and hoses to the hydraulic starting motor.



**MAINTENANCE OF HYDRAULIC STARTING SYSTEM**

**5-49 REPLACE HAND PUMP (STARTING SYSTEM).**

This task covers:                      a. Removal                      b. Installation

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engines shut down  
Hydraulic starting system  
drained of oil at hand pump.  
Accumulator valves closed.

General Safety Instructions:

Ensure that hydraulic pressure in the  
system is relieved before working on  
system.

**REMOVAL**

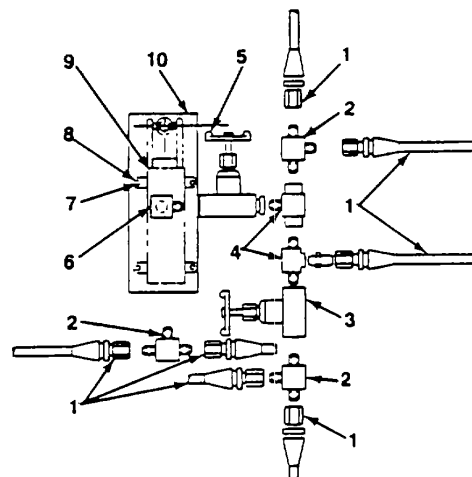
REMOVE HAND PUMP

- a. Close all accumulator valves.

**WARNING**

**To prevent possible injury to personnel or damage to equipment, the oil pressure in the system must be released prior to servicing the hand pump or any other components of the system.**

- b. Relieve the pressure in the hydraulic starting system.
- c. Disconnect hydraulic lines (1), tees (2) isolation valve (3).
- d. Remove remaining tees (4), valve (5) and elbow (6).
- e. Remove the attaching bolts (7) and lockwashers (8) and lift pump (9) from its foundation (10).



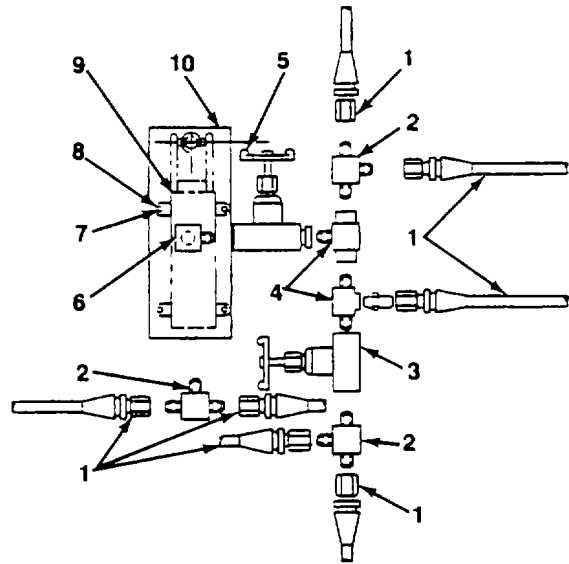
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**5-49 REPLACE HAND PUMP (STARTING SYSTEM) (Continued).**

---

**INSTALLATION****INSTALL HAND PUMP.**

- a Clean all exterior dirt from the pump and hydraulic lines using clean cloths, detergent and water solution
- b Secure pump (9) to its foundation (10) with lockwashers (8) and attaching bolts (7)
- c Apply a small amount of sealant to the male threads **ONLY** on hydraulic lines **DO NOT** apply any sealant to the thread nearest the open end.
- d Re-connect elbow (6), valve (5) and tees (4)
- e Re-connect isolation valve (3), tees (2) and hydraulic lines (1).



## MAINTENANCE OF ENGINE COOLING SYSTEM

### 5-50 REPLACE EXPANSION TANK.

This task covers      a Removal                      b Installation

#### INITIAL SETUP

##### Tools.

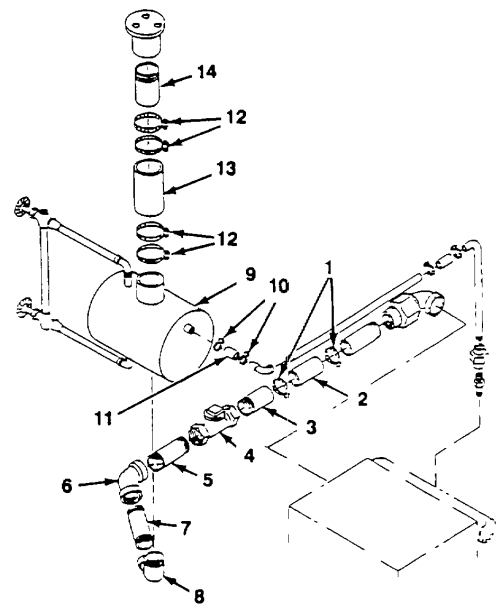
Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783

##### Equipment Conditions

Engine shut down  
Engine cooling system drained

#### REMOVAL

- 1 REMOVE EXPANSION TANK PIPING
  - a Drain system.
  - b Remove clamps (1) and hose (2).
  - c Remove pipe (3), swing check valve (4), pipe (5) and elbow (6).
  - d Remove pipe (7) and elbow (8) from expansion tank (9).
  - e Loosen hose clamps (10) and slide back on hose (11). Remove hose (11).
  - f Loosen clamps (12) and slide back on hose (13). Remove hose (13).





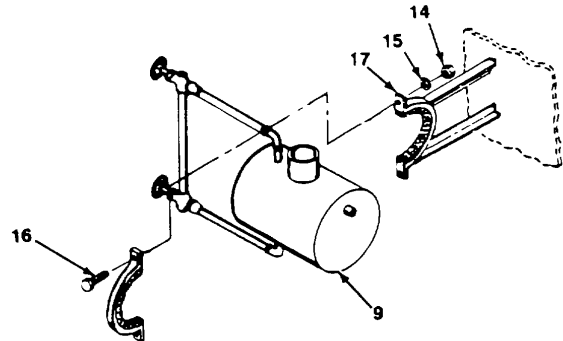
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**5-50 REPLACE EXPANSION TANK (Continued).**

---

**2 REMOVE EXPANSION TANK**

- a Remove four hex nuts (14), lockwashers (15), and capscrews (16) from brackets (17)

**NOTE**

**Two personnel are required to lift expansion tank from mounting brackets.**

- b Lift expansion tank (9) from mounting brackets (17), and place on a suitable work bench

5-50 REPLACE EXPANSION TANK (Continued).

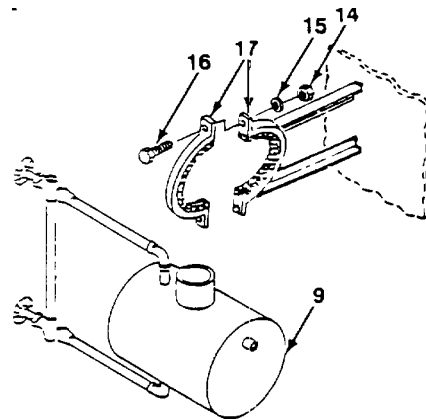
**INSTALLATION**

1. INSTALL EXPANSION TANK

**NOTE**

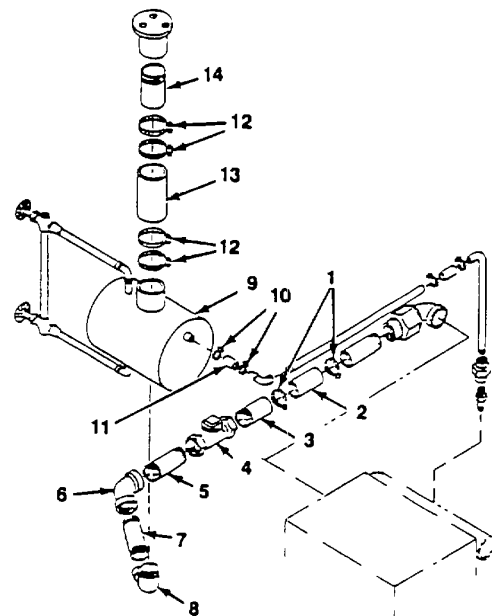
**Two personnel are required to lift expansion tank into mounting brackets.**

- a. Position expansion tank (9) in place in mounting brackets (17)
- b. Install brackets (17) to tank with four capscrews (16), lockwashers (15), and hex nuts (14).



2. INSTALL EXPANSION TANK PIPING

- a. Slide hose (13) over fill pipe and secure with hose clamps (12).
- b. Install hose (11) to tank (9), and tighten with clamps (10)
- c. Install elbow (8), pipe (7), elbow (6) and pipe (5).
- d. Install swing check valve (4), pipe (3), hose (2) and secure with clamps (1)
- e. Re-fill system.



## MAINTENANCE OF ENGINE COOLING SYSTEM

### 5-51 REPAIR EXPANSION TANK.

This task covers      a Disassembly      c Assembly  
                                  b Repair

#### INITIAL SETUP

##### Tools

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783  
 Machine, Welding

##### Equipment Conditions

Reference  
 Para 5-50. Expansion tank removed

##### Personnel Required

(1) Certified welder

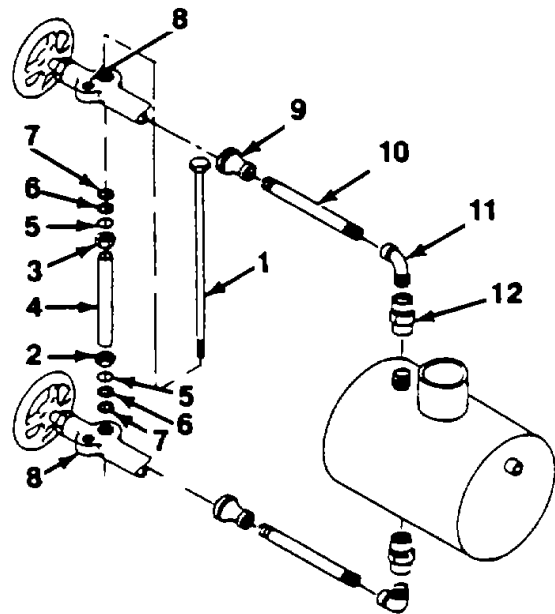
#### DISASSEMBLY

##### DISASSEMBLE EXPANSION TANK

#### CAUTION

Use extreme care when handling sightglass to avoid breakage.

- a. Remove rods (1)
- b. Unscrew collars (2 and 3) from valves
- c. Remove sightglass (4) Slide sightglass upward, and then down and out.
- d. Remove 'O' rings (5, 6, and 7) from valves (8). Discard if defective or damaged.
- e. Remove valves (8) from reducing couplings (9)
- f. Remove pipe nipples (10), and street elbows (11) from expansion tank coupling (12).



5-51 REPAIR EXPANSION TANK (Continued).

**REPAIR**

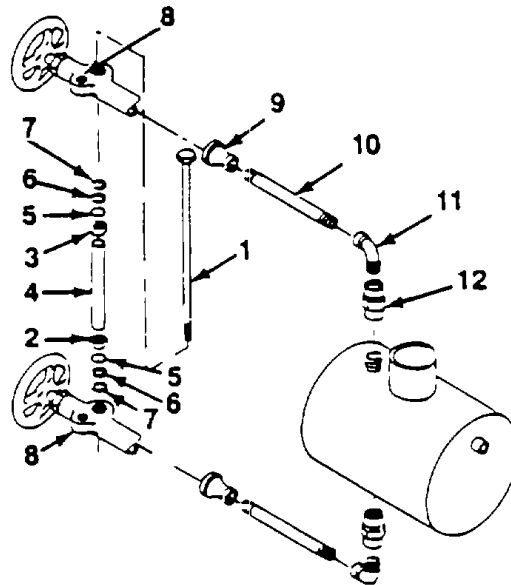
REPAIR EXPANSION TANK

- a Weld cracks or breaks in expansion tank
- b Replace defective hoses and hose clamps, and other defective threaded parts and valves
- c Replace 'O' rings in sight glass assembly
- d Replace defective sight glass
- e Replace expansion tank if damaged beyond repair

**ASSEMBLY**

ASSEMBLE EXPANSION TANK

- a Install street elbows (11) in expansion coupling tank (12)
- b Install pipe nipples (10), reducing couplings (9), and valves (8)
- c Install new 'O' rings (7, 6 and 5) into valves (8)
- d Slide new sight glass (4) into collars
- e Slide collars (3 and 2) onto valves (8), and tighten to secure
- f Install rods (1).



## CHAPTER 6

### INTERMEDIATE GENERAL SUPPORT MAINTENANCE

	Paragraph
Align Propeller and Propeller Shaft .....	6-24
Common Tools and Equipment.....	6-1
Inspect and Replace Anodes.....	6-27
Inspect and Service Propeller and Propeller Shaft .....	6-21
Inspect, Service, Test, Replace and Repair Keel Cooler.....	6-26
Repair Accumulator.....	6-18
Repair Alternator.....	6-5
Repair Counterbalance Valve.....	6-16
Repair Flow Divider.....	6-15
Repair Hand Pump (Starting System).....	6-20
Repair Helm Unit.....	6-14
Repair Parts 6-3	
Repair Propeller and Propeller Shaft.....	6-23
Repair Ramp Hoist Control Valve.....	6-7
Repair Ramp Hoist Hand Pump .....	6-8
Repair Ramp Hoist Hydraulic Pump .....	6-6
Repair Ramp Locking Hydraulic Cylinder .....	6-9
Repair Ramp Sheaves and Latch Mechanism.....	6-11
Repair Ramp Winch.....	6-10
Repair Recharging Pump.....	6-17
Repair Starting Motor .....	6-19
Repair Steering Cylinders .....	6-13
Repair Steering Pump.....	6-12
Repair Stuffing Box.....	6-25
Replace Propeller and Propeller Shaft.....	6-22
Special Tools, TMDE and Support Equipment.....	6-2
Troubleshooting Procedures.....	6-4

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

**6-1 COMMON TOOLS AND EQUIPMENT.**

For authorized common tools and equipment, refer to the Modified Table of Organizational Equipment (MTOE) applicable to your unit.

**6-2 SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT.**

Any special tools or equipment required by general support maintenance personnel to perform maintenance on the landing craft is listed in Appendix B of this manual

**6-3 REPAIR PARTS.**

Repair parts are listed and illustrated in the repair parts and special tools list (TM 55-1905-222-24P) covering general support maintenance of this equipment

**Section II. TROUBLESHOOTING**

**6-4 TROUBLESHOOTING PROCEDURES.**

This paragraph provides information useful in diagnosing and correcting unsatisfactory operation or failure of LCM-8 systems and equipment. Troubleshooting procedures in this manual are limited to the basic craft. Refer to TM 5-2815-231-14 for engine and transmission troubleshooting procedures. Before using the troubleshooting procedures, ensure that all applicable operating procedures have been performed

**NOTE**

**The table lists the malfunctions which may occur during the service life of the equipment. Replace all defective parts when repairing an equipment unless machining or other repair process can return the part to reusable condition.**

**Troubleshooting**

---

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

**RAMP SYSTEM**

1 CONTROL VALVE LEVER DOES NOT MOVE.

Test to see if control valve is defective

Repair control valve (para 6-7)

2 NOISY OPERATION OF PUMP

Test to see if pump is defective

Repair pump (para 6-6)

3 ERRATIC ACTION OF WINCH

Test to see if winch is defective.

Repair winch (para 6-10)

---

**STEERING SYSTEM**

STEERING WHEEL DIFFICULT TO TURN

Check to see if rudder is jammed or fouled

Remove obstruction

**Troubleshooting - Continued**

---

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

**STARTING SYSTEM**

1. ENGINE DRIVEN RECHARGING PUMP FAILS TO RAISE ACCUMULATOR PRESSURE

Test pump to see if it is defective by inserting it in a test circuit. The pump must fill a one gallon accumulator to 3000 psi (unloading valve cut out setting) with pump operating at 1750 RPM within 3 minutes

Repair pump (para 6-17) if it fails test

2. CRANKING SPEED TOO LOW

Test to see if starting motor is defective

Repair starting motor (para 6-19)

3. HAND PUMP FAILS TO CHARGE SYSTEM

Test to see if hand pump is defective

Repair hand pump (para 6-20)

4. LOW/LOSS OF ACCUMULATOR PRESSURE

Test to see if accumulator is defective

Repair accumulator (para. 6-18)

5. HIGH PRESSURE IN SYSTEM (ABOVE 3500 PSI)

Test to see if engine driven recharging pump is defective

Repair pump (para 6-17)

6. ENGINE FAILS TO START IN ALL STARTING MODES

Test to see if starting motor is defective

Repair starting motor (para 6-19)



**Troubleshooting**

---

MALFUNCTION

TEST OR INSPECTION

CORRECTIVE ACTION

---

**PROPELLER, PROPELLER SHAFT AND STUFFING BOX**

EXCESSIVE VIBRATION IN PROPELLER SHAFT.

Step 1 Check for misalignment of propeller coupling

Align propeller shaft (para 6-24).

Step 2 Check for bent or broken propeller.

Replace/repair propeller (para 6-23)

**MAINTENANCE OF ELECTRICAL SYSTEM**

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**6-5 REPAIR ALTERNATOR.**

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- This task covers
- |   |             |   |          |
|---|-------------|---|----------|
| a | Disassembly | d | Testing  |
| b | Cleaning    | e | Assembly |
| c | Inspection  |   |          |
- 

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's, Rail and Marine  
5180-00-629-9783  
Vise  
Arbor Press  
Bearing Puller  
Diode Tester  
Multimeter  
120 V AC Test Circuit

Materials/Parts

Rear Ball Bearing  
P/N 11-39  
Seals  
P/N 11-5  
Front Ball Bearings  
P/N 11-34  
Grease  
Item 22, Appendix E

Equipment Conditions

References

Para 4-12 Alternator removed from engine  
Para 5-6. Brush assembly removed from alternator

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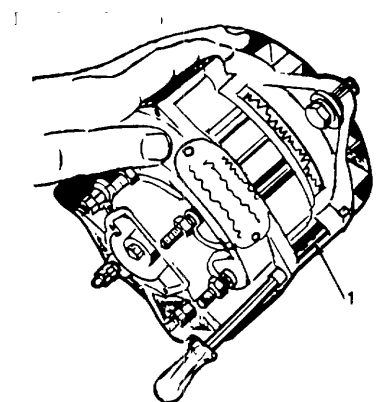
**DISASSEMBLY**

- 1 SEPARATE FRONT AND REAR HOUSING ASSEMBLIES

**NOTE**

**Get new thru-bolts if unusually easy to remove (indicating bolt abnormally loose in housing due to worn locking compound on threads)**

- a. Remove four thru-bolts (1)



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**6-5 REPAIR ALTERNATOR (Continued).**


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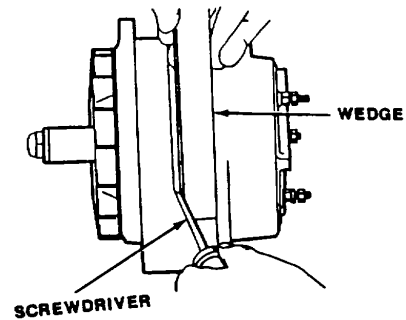
**CAUTION**

Be extremely careful when inserting sharp tools (screwdriver, etc.) between stator and housing. They may cause permanent damage to the stator windings or laminations.

**NOTE**

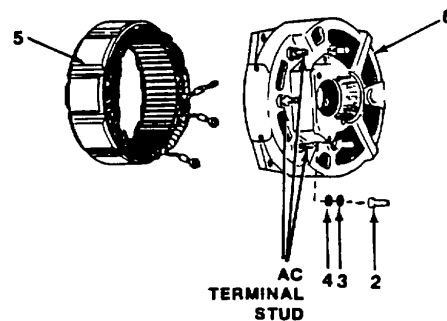
After this operation, the rear housing and stator are considered one assembly; front housing and rotor are another assembly.

- b Use a screwdriver and a wooden wedge to pry the halves apart at the ears



2. SEPARATE REAR HOUSING AND STATOR

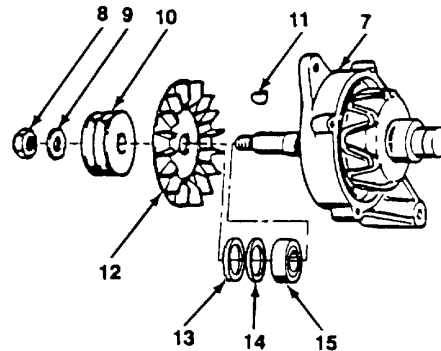
- a Remove plastic cap insulator (2) hex nuts (3), and lockwashers (4) from the three AC terminals.
- b Lift stator leads off terminal studs and separate stator (5) from rear housing (6).



**6-5 REPAIR ALTERNATOR (Continued).**

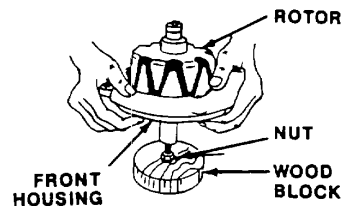
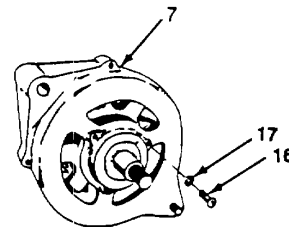
**3 REMOVE PULLEY AND FAN**

- a Clamp front housing (7) and rotor assembly in a vise using an old over-size belt to protect the pulley from the vise jaws.
- b Remove pulley hex nut (8), and flat washer (9) from shaft
- c Remove pulley (10), woodruff key (11) and fan (12)
- d Remove dust shield (13), felt shield (14) and fan spacer (15)



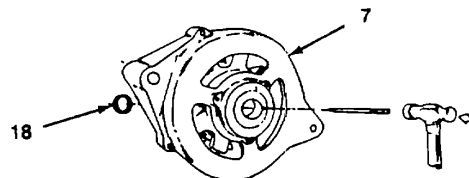
**4. SEPARATE ROTOR AND FRONT HOUSING.**

- a Remove front bearing retainer screws (16) and lockwashers (17)
- b Thread a nut on the shaft end to prevent possible thread damage. Tap the shaft on a wooden block to separate front housing from rotor



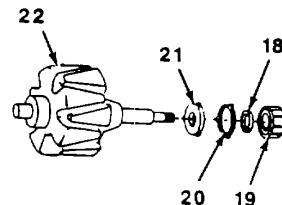
**5 REMOVE FRONT BEARING SEAL.**

Use a small pin punch to remove front bearing seal (18) from housing (7)



**6 REMOVE FRONT BEARING**

- a Use a bearing remover to remove front bearing (19).
- b. Remove another front bearing seal (18), front bearing gasket (20) and front bearing retainer (21) from shaft of rotor (22).



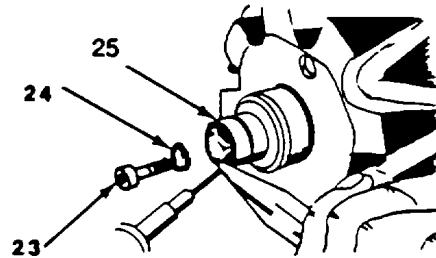
**6-5 REPAIR ALTERNATOR (Continued).**

**7 REMOVE SLIP RING**

**NOTE**

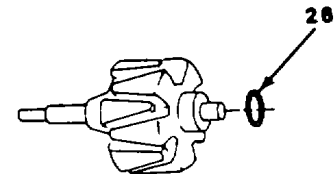
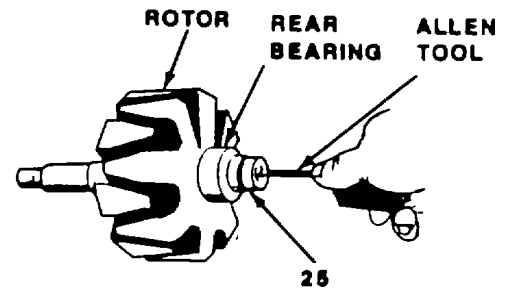
**Do not remove slip ring assembly unless rings are damaged/ worn or rear bearing is to be replaced.**

- a Unsolder the two rotor leads from the slip ring terminals Carefully unwind the leads.
- b Remove the hex lead capscrew (23) and lockwasher (24) from the end of the shaft
- c Thread a 1/4 in x 28 x 2 1/2 in capscrew into the slip ring hub, using an alien tool; when this screw bottoms, the slip ring assembly (25) will separate from the shaft. Remove slip ring terminal insulators.



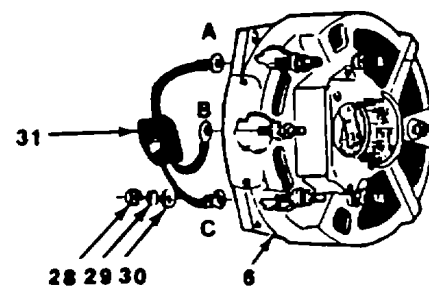
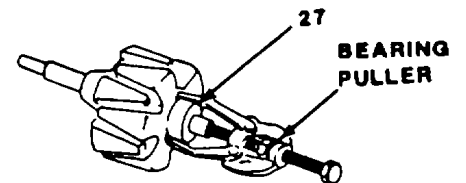
**8 REMOVE REAR BEARING RETAINER AND REAR BEARING**

- a Remove rear bearing retainer (26) with pliers
- b Dress rotor leads away from bearing puller contact area. Carefully remove rear bearing (27).



**9 REMOVE RFI CAPACITOR**

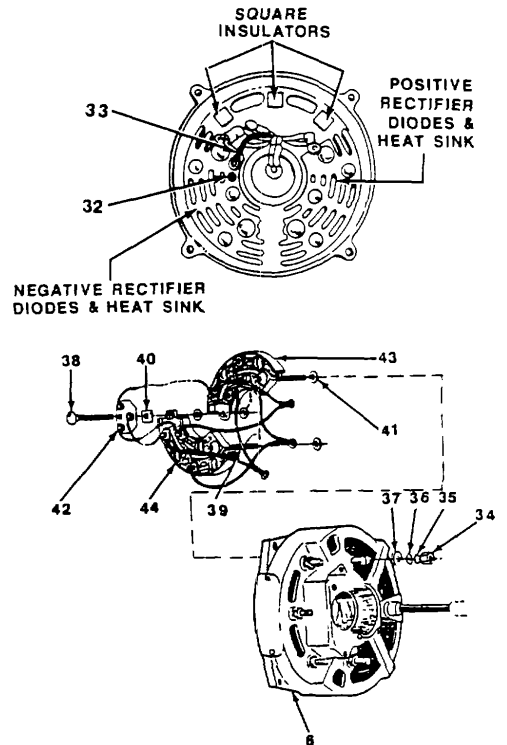
- a Remove locknuts (28) , lockwashers (29), and flat washer (30) from the three AC terminals studs, remove the RFI capacitor (31) from the rear housing (6).



**6-5 REPAIR ALTERNATOR (Continued).**

**10 REMOVE DIODES FROM REAR HOUSING**

- a Loosen screw (32) and remove negative brush lead (33) from diode heat sink
- b Remove nut (34), lockwasher (35), flat washer (36), and insulator washer (37) from positive, negative and regulator terminals
- c Remove regulator terminal carriage bolt (38), positive and negative carriage bolts (39) as well as square and round insulators (40 and 41) respectively.
- d Remove field diode (42)
- e Lift negative heat sink (43) and positive heat sink (44) out of rear housing (6)

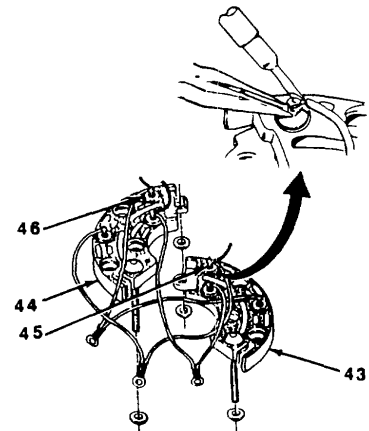


**11 REMOVE DEFECTIVE DIODES FROM HEAT SINK**

**CAUTION**

**A heat dam must be used for diode protection when soldering or unsoldering circuit leads to diode terminal. Grasp the diode connection terminal with long nose pliers between diode and soldering iron.**

- e Unsolder leads from defective diode (45 and 46) and remove diode from heat sink (43 and 44)
- f Get replacement diodes



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**6-5 REPAIR ALTERNATOR (Continued).**

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**CLEANING**

## CLEAN ALTERNATOR COMPONENTS.

- a Wipe front bearing seals with a clean lint-free cloth to remove foreign material and old grease

**CAUTION**

**Do not use compressed air on rotor or stator windings. Undetectable flaws may be created, making the assembly less than acceptable.**

- b Wipe off stator and rotor with a clean lint-free cloth
- c Clean front housing, rear housing, fan, and pulley with a clean lint-free cloth

**WARNING**

**Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59° C).**

- d. Clean ball bearings, retainers and washers in solvent P-D-680 and allow to air dry
- e Clean brush contacting surfaces of slip rings with fine crocus cloth to remove minor roughness. Replace slip ring assembly if necessary.

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**6-5 REPAIR ALTERNATOR (Continued).**

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**INSPECTIO  
N**

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**1 INSPECT STATOR ASSEMBLY**

Inspect stator assembly for physical damage. Look for evidence of the rotor striking lamination, broken insulation and foreign material that may restrict circulation of cooling air. Discoloration of the wire enamel is evidence of overheating that may result in a shorted or grounded wiring.

**2 INSPECT FAN AND PULLEY**

Inspect fan for bent fins, loose welds or excessive wear. Check drive surfaces and bore of pulley for wear. Replace if necessary.

**3 INSPECT BEARING SEALS AND GASKETS**

Inspect front bearing seals and gaskets for tear or other damage. Replace if necessary.

**4 INSPECT ROTOR**

- a Inspect rotor for stripped threads on shaft, worn key slot, scuffed pole finger or bent shaft.
- b Replace rotor assembly if any of the above defects are noted (New rotors include a new rear bearing and slip rings as part of the assembly).

**5 INSPECT BEARINGS**

- a Inspect bearing surfaces for wear.
- b Rotate the inner race to see if bearings turn freely.



**6-5 REPAIR ALTERNATOR (Continued).**

**6 INSPECT REAR HOUSING.**

Check for cracks due to improper drive belt tightening procedure  
 Check for stripped threads and broken webs. Check bearing bore for scuff marks and replace as necessary

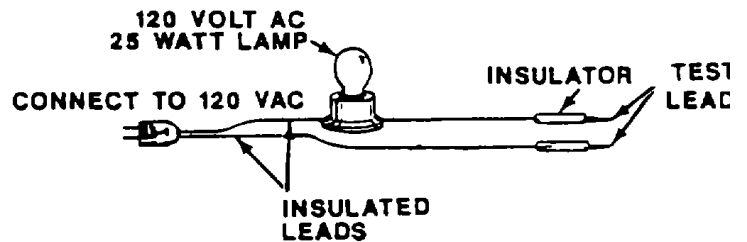
**7 INSPECT FRONT HOUSING.**

Check for stripped threads and broken webs. Check for wear in mounting foot and in bearing bore. Replace as necessary

**TESTING**

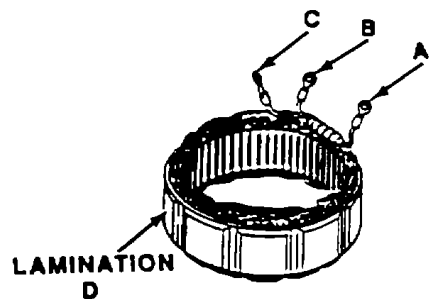
**1 TEST STATOR USING A 120 VOLT AC TEST LAMP.**

- a. Place test leads alternately between the three connector leads (A&B, A&C, B&C); test lamp should light indicating continuity. Open winding indicated if lamp fails to light
- b. Place one test lead on the stator lamination, place the other on each of the three connector leads (A&D, B&D, C&D); test lamp should not light, indicating no grounds from windings or lamination. Winding short circuit to lamination. Is indicated if lamp should light.
- c. Get a new stator if it fails any of the above tests.



**WINDING TEST**  
 APPLY TEST LEADS BETWEEN:  
 A & B } TEST LAMP  
 A & C } SHOULD LIGHT  
 B & C }  
 OPEN WINDING INDICATED IF LAMP FAILS TO LIGHT

**LAMINATION TEST**  
 APPLY TEST LEAD BETWEEN:  
 A & D } TEST LAMP  
 B & D } SHOULD NOT  
 C & D } LIGHT  
 WINDING SHORT CIRCUIT TO LAMINATION INDICATED IF LAMP SHOULD LIGHT



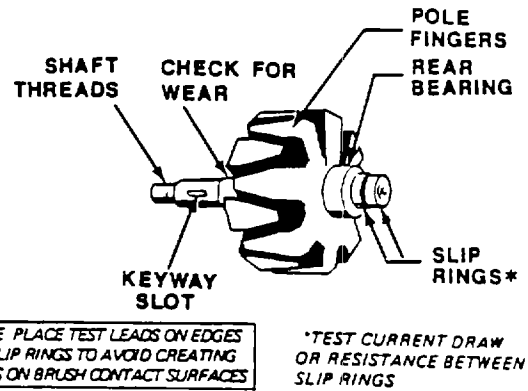
**2 TEST NEGATIVE BRUSH LEAD.**

Test negative brush lead for ground; test should show no circuit from lead to housing.

**6-5 REPAIR ALTERNATOR (Continued).**

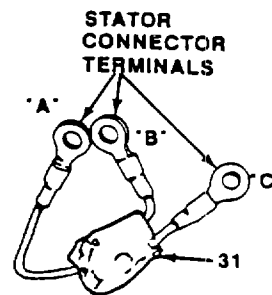
**3 TEST ROTOR ASSEMBLY**

- a Check rotor current draw or resistance of winding Correct current draw of 20 volts is 090-1 50 amps Correct winding resistance is 165 ohms + 10%
- b Test slip rings with Multimeter Test should show no circuit from slip rings to ground
- c Get a new rotor assembly if the old one falls the tests above



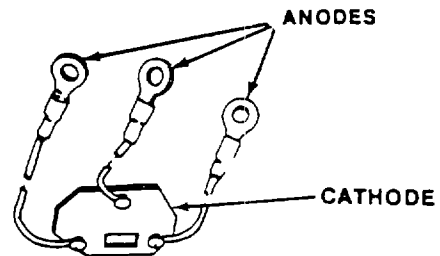
**4 TEST RFI CAPACITOR**

- a Use Multimeter and check for no circuit between leads A-B, B-C and A-C
- b Replace capacitor assembly (31) if any short condition is indicated



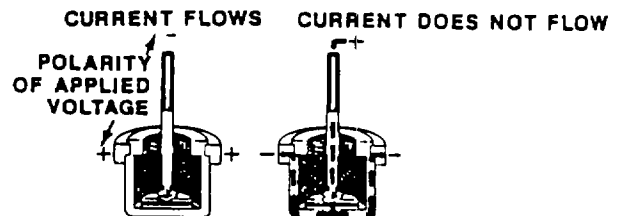
**5 TEST FIELD DIODE**

- a Test each anode lead to common cathode using a diode tester
- b Re-use field diode if it tests okay, otherwise replace



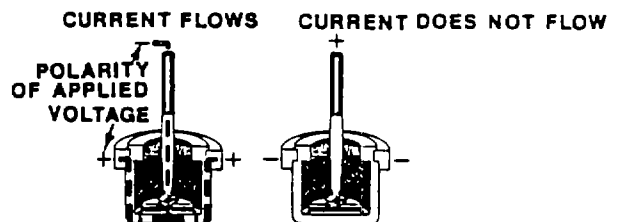
**6 TEST RECTIFIER DIODES IN POSITIVE HEAT SINK**

- a Test individual diodes as shown, using a diode tester
- b Replace Individual diodes as necessary



**7 TEST RECTIFIER DIODES IN NEGATIVE HEAT SINK**

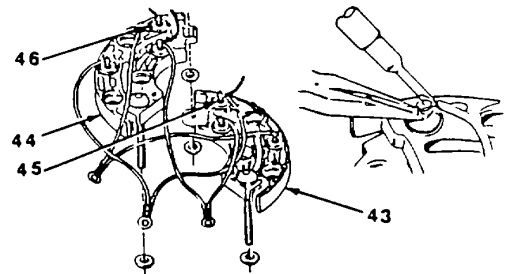
- a Test individual diodes as shown, using a diode tester
- b Replace Individual diodes as necessary



6-5 REPAIR ALTERNATOR (Continued).

**ASSEMBLY**

- 1 INSTALL NEW DIODES IN HEAT SINKS.



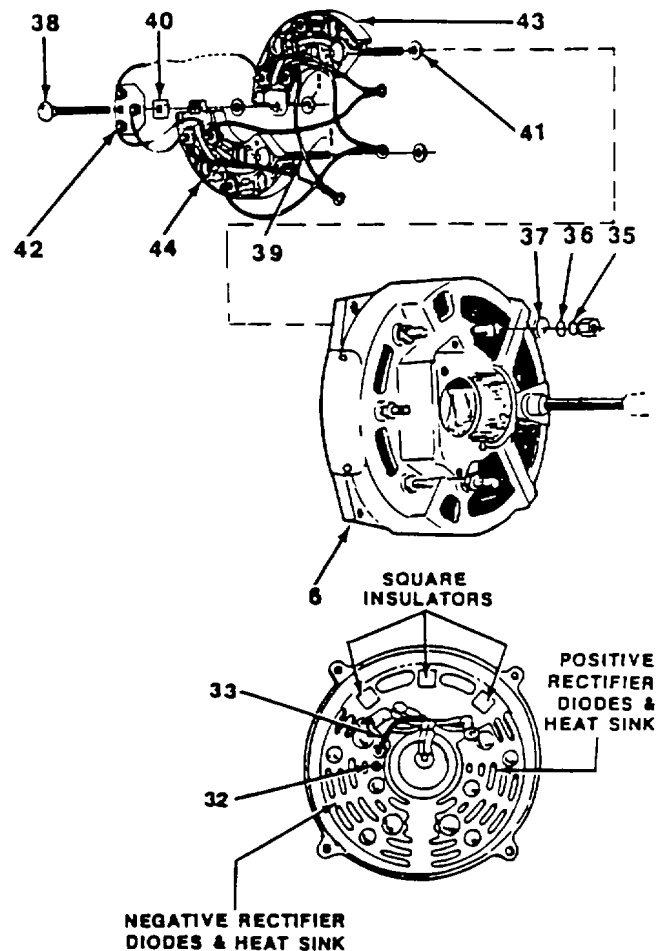
**CAUTION**

**A heat dam must be used for diode protection when soldering or unsoldering circuit leads to diode terminal. Grasp the diode connection terminal with long nose pliers between diode and soldering iron.**

Install new diode (45 or 46) in heat sink and solder leads to diode

- 2 ASSEMBLE DIODES IN REAR HOUSING.

- a Assemble field diode (42), square and round insulators (40 and 41), regulator terminal carriage bolt (38), positive and negative terminal carriage bolts (39) and heat sinks (43 and 44) as shown
- b Align and install diode assembly in rear housing (6)
- c Secure diode assembly with flat washer (36), lockwasher (35) and hex nut (34)
- d Re-connect negative brush lead (33) to negative heat sink (43) using screw (32)



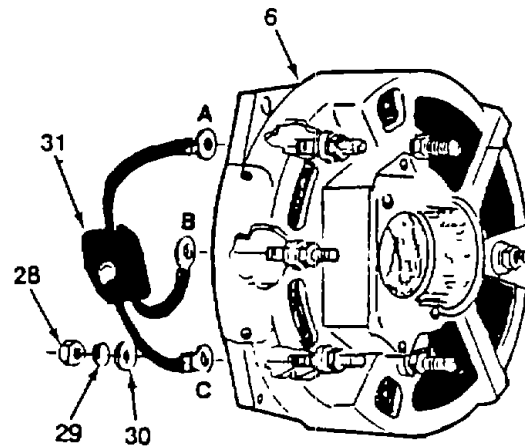
**6-5 REPAIR ALTERNATOR (Continued).**

**3 INSTALL RFI CAPACITOR**

Install new RFI capacitor (31) in rear housing and secure to the three AC terminals with flat washers (30), lockwashers (29) and locknuts (28)

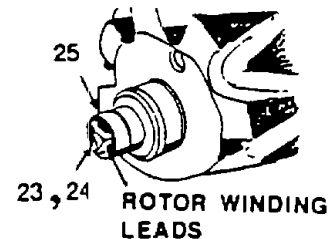
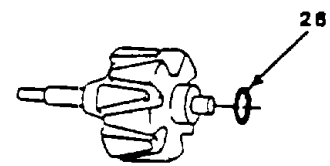
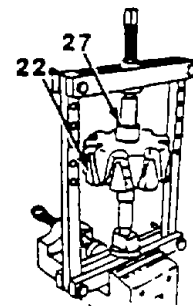
**4 INSTALL REAR BEARING AND REAR BEARING RETAINER**

- a. Support rotor (22) in arbor press and place the new rear bearing (27) over the end of the shaft.
- b. Dress rotor leads away from work area and press bearing (27) on shaft until Inner race contacts the shoulder
- c. Install bearing retainer (26)



**5 INSTALL SLIP RINGS.**

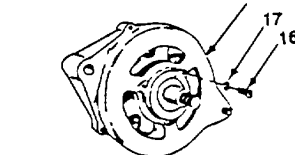
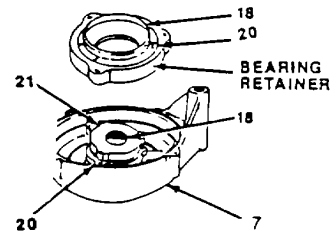
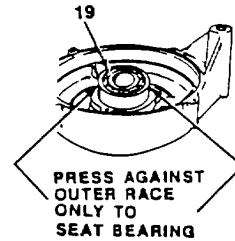
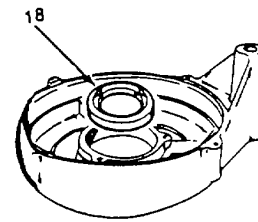
- a. Wrap leads around slip ring terminals, and solder with rosin core solder
- b. Re-test electrical circuit to insure that a short circuit or ground did not develop during repair operation.
- c. Guide both rotor winding leads through a single square passage in the slip ring hub. Hand press the slip rings (25) on the shaft while maintaining alignment of winding leads and passage.
- d. Install lockwashers (24) and cap screws (23); tighten to 45 inch pounds



**6-5 REPAIR ALTERNATOR (Continued).**

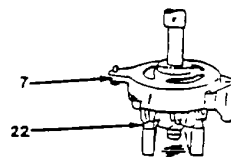
**6 INSTALL SEALS, GASKET, BEARING AND RETAINER IN FRONT HOUSING.**

- a. Apply a light coating of grease to all surfaces of seals. Fill seal reservoir 2/3 full with grease. Drive one seal (18) into the front housing.
- b. Lubricate new bearing (19) lightly and use a suitable driver to press bearing (19) into front housing.
- c. Insert gasket (20) and another seal (18) into bearing retainer (21). Pack seal reservoir 2/3 full with grease.
- d. Install gasket (20), seal (18) and retainer (21) assembly in front housing (7).
- e. Apply locktite No 242 to retainer screws. Secure assembly with lockwashers (17) and retainer screws (16).



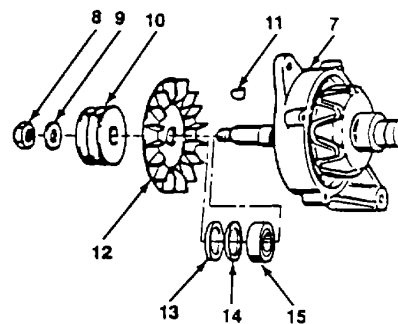
**7 ASSEMBLE FRONT HOUSING AND ROTOR**

- a. Place the rotor (22) on the bed of an arbor press, using two steel blocks for support.
- b. Place front housing (7) over rotor shaft. Using a drive sleeve that contacts inner bearing race only, press front housing down until inner bearing race contacts shoulder on the shaft.



**8 INSTALL FAN AND PULLEY**

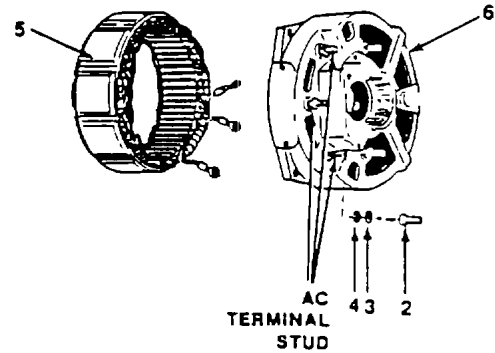
- a. Clamp front housing and rotor assembly in a vise. Install fan spacer (15), felt shield (14) and dust shield (13).
- b. Install fan (12), woodruff key (11) and pulley (10), secure with flat washer (9) and hex nut (8).



**6-5 REPAIR ALTERNATOR (Continued).**

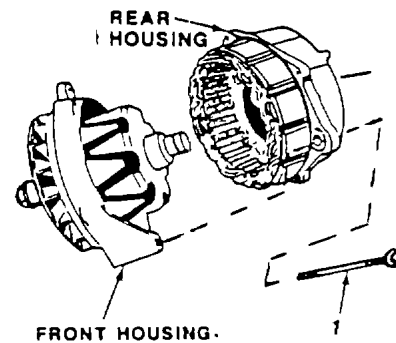
**9 INSTALL STATOR IN REAR HOUSING**

- a Install stator (5) in rear housing (6) so that stator leads pass through holes in rear housing
- b Install stator leads on AC terminals and secure with lockwashers (4), hex nuts (3) and plastic cap insulators (2)



**10 ASSEMBLE REAR AND FRONT HOUSING ASSEMBLIES**

- a Place rear housing (with mounting foot properly oriented) and stator assembly over the slip ring end of the rotor and hand press together
- b Install thru-bolts (1) and tighten evenly until castings and stator are securely fastened together. Fifty to sixty inch pounds of torque is adequate



**NOTE**

**FOLLOW-ON MAINTENANCE:**  
**Install brush assembly on alternator (para. 5-6)**

**MAINTENANCE OF RAMP HOIST HYDRAULIC PUMP**

**6-6 REPAIR RAMP HOIST HYDRAULIC PUMP.**

This task includes:      a   Disassembly b.    Cleaning            c   Inspection            d   Assembly

**INITIAL SETUP**

Tools

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Arbor Press  
Torque Wrench  
Soft Hammer

Materials/Parts  
Cartridge Kit  
P/N 578311

Seal Kit  
P/N 922851

Cleaning Solvent  
Item 17, Appendix E

Equipment Conditions

Reference  
Para 5-16 Pump removed

**DISASSEMBLY**

**DISASSEMBLE RAMP HOIST HYDRAULIC PUMP**

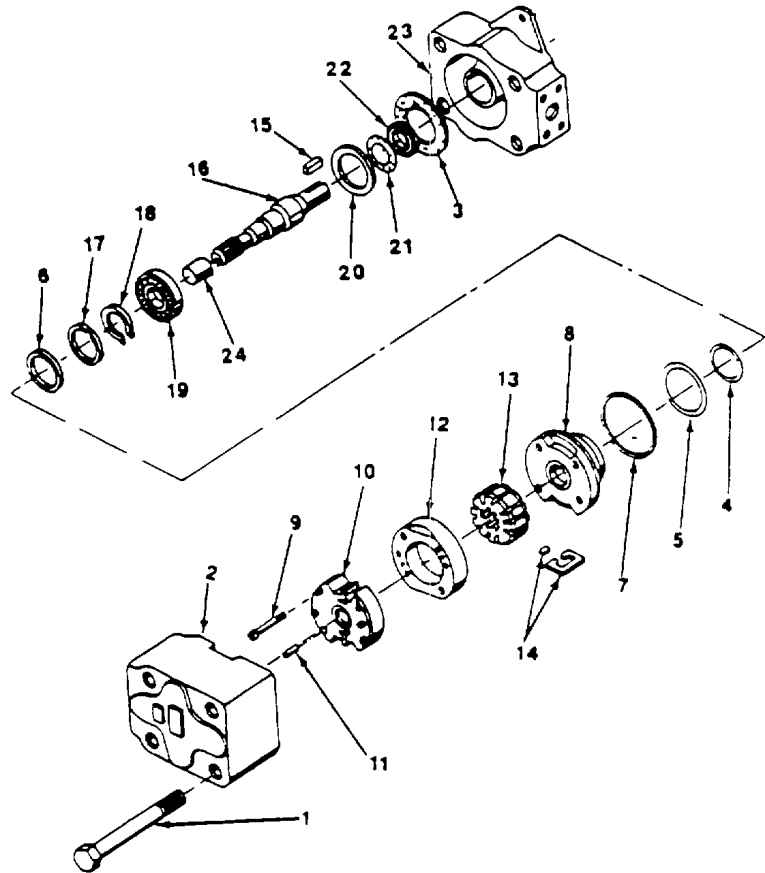
**NOTE**

Inlet cover (2) may need to be rotated to mount inlet hydraulic line

- a. Remove cover bolts (1), and cover (2) Note relative position of inlet port In cover to the outlet port In body for correct assembly
- b. Grasp the pump cartridge (inner assembly), and while turning, pull it from drive shaft Loosening the pump cartridge can be accomplished by prying under the flats of the ring with two screw drivers.
- c. Remove sealing ring (3) from recess in body

**6-6 REPAIR RAMP HOIST HYDRAULIC PUMP (Continued).**

- d Remove 'O' rings (4 and 5) and backup rings (6 and 7) from hub and outside diameter of pressure plate (8).
- e Remove two screws (9) from face of wear plate (10) Lift wear plate from locating pins (11), and remove pins
- f Remove ring (12) from around the rotor (13)
- g. Remove vanes and inserts (14) from rotor, and remove rotor from the pressure plate
- h Lift out shaft key (15) from its seat in shaft (16). Remove shaft snap ring (17) and bearing retaining ring (18), and fully remove drive shaft and bearing (19) from body by gently tapping the keyed end of shaft with a soft hammer. Check bearing for wear before removing it from shaft. Rotate bearing applying a little pressure to outer race, to determine if balls or races are pitted, galled, or cracked. Check for looseness If in doubt, remove bearing from shaft at point of contact with bushing and sealing lip of shaft oil seal. If excessive scoring or wear is noted, replace shaft.
- i. Remove washer (20) from bore in body. Using a suitable hooked tool or a drift, remove shaft oil seal (21), and felt seal (22) from body (23)



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PIN: 066281-005



6-6 REPAIR RAMP HOIST HYDRAULIC PUMP (Continued).

**CLEANING**

CLEAN ALL PUMP PARTS

**WARNING**

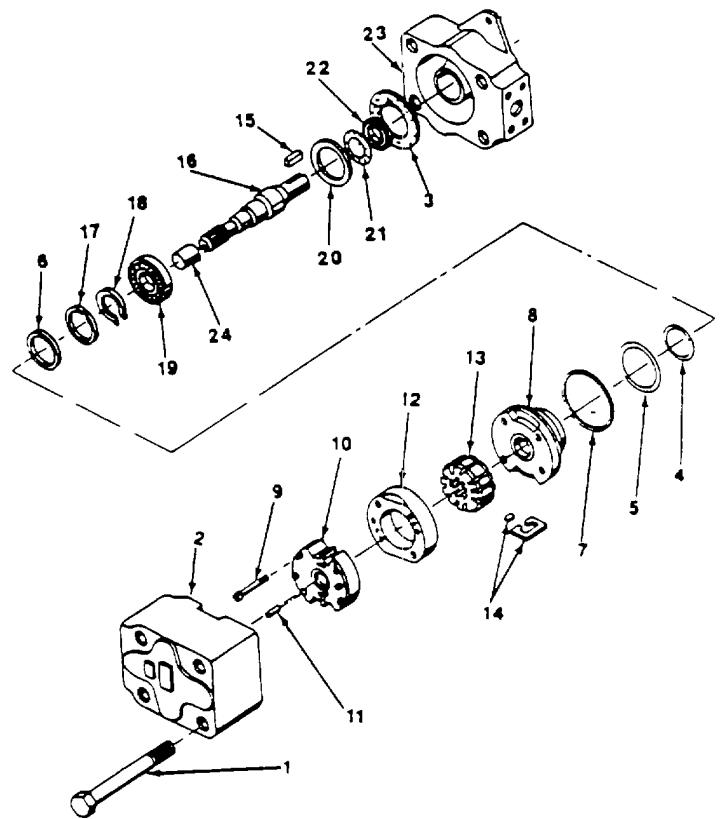
Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138°F (38°-59°C).

- a Wash all metal parts in cleaning solvent Fed Spec P-D-680.
- b Blow parts dry with filtered, dehydrated air and place them on a clean surface for inspection

**INSPECTION**

INSPECT RAMP HOIST HYDRAULIC PUMP

- a Inspect surfaces of wear plate, pressure plate, ring and rotor for scoring and excessive wear. Light scoring may be carefully stoned or lapped. Discard parts that are heavily scored
- b Check edges of vanes for wear. Vanes shall not have excessive play in rotor slots or burrs on edges.
- c Inspect inside diameter of bushing (24). Remove bushing if wear or scoring is evident. If wear plate is to be replaced, do not remove bushing, as a new plate comes with bushing inserted.
- d. Rotate the bearing while applying pressure to check for wear, looseness and pitted or cracked races.



**6-6 REPAIR RAMP HOIST HYDRAULIC PUMP (Continued).**

- e. Inspect bushing mating surfaces on the shaft for scoring or wear. Replace shaft if marks cannot be removed by light polishing.
- f. Discard the shaft seals and all 'O' rings. Replace defective or discarded parts from kits.

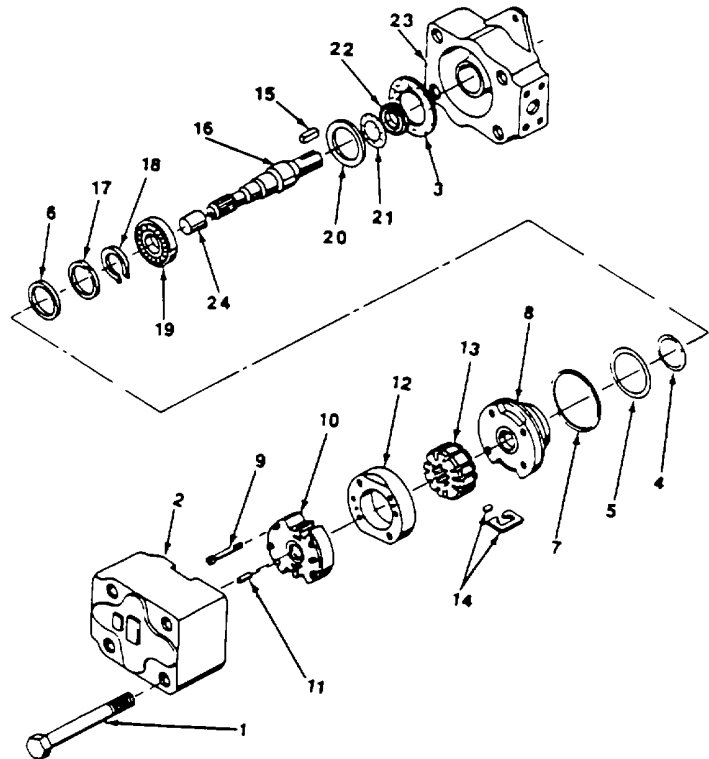
**ASSEMBLY**

ASSEMBLE RAMP HOIST HYDRAULIC PUMP

**NOTE**

**Lubricate parts before reassembly using clean hydraulic fluid.**

- a. Install a new wiper (22), shaft oil seal (21), and washers (20), in counterbore of body (23). Soak both seals thoroughly in hydraulic oil before installing. Make sure lipped edge of seal is toward inside of body. Use a suitable drift that will not damage the seal during installation. Lubricate the shaft oil seal journal with petroleum jelly.



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**6-6 REPAIR RAMP HOIST HYDRAULIC PUMP (Continued).**

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- b Position shaft bearing (19) in place on drive shaft, being careful not to cock the bearing Using an arbor press, support Inner race of bearing and press bearing against shoulder of shaft (16) Apply tape around the end of the shaft to protect the seal Install shaft and bearing Into body until bearing is fully seated If necessary, gently tap shaft with a soft hammer
- c Install shaft snap ring (17), and bearing retaining ring (18) Make sure that both parts are firmly seated in place Remove tape from end of shaft (16)
- d Install the shaft key (15)

**NOTE**

**Direction of rotation is designated as viewed from the shaft end of pump. R. H. rotation is clockwise; L. H. rotation is counterclockwise.**

- e Place rotor (13) on pressure plate (8) with arrow point in desired direction of rotation. Install inserts in vanes (14), and position both parts in rotor slots The sharp edges of the vanes must be toward the direction of rotation.
- f Install locating pins (11) In pressure plate (8) Install ring (12) over locating pins against pressure plate with arrow pointing in direction of shaft rotation. Lubricate rotor (13), and ring with clean hydraulic oil.

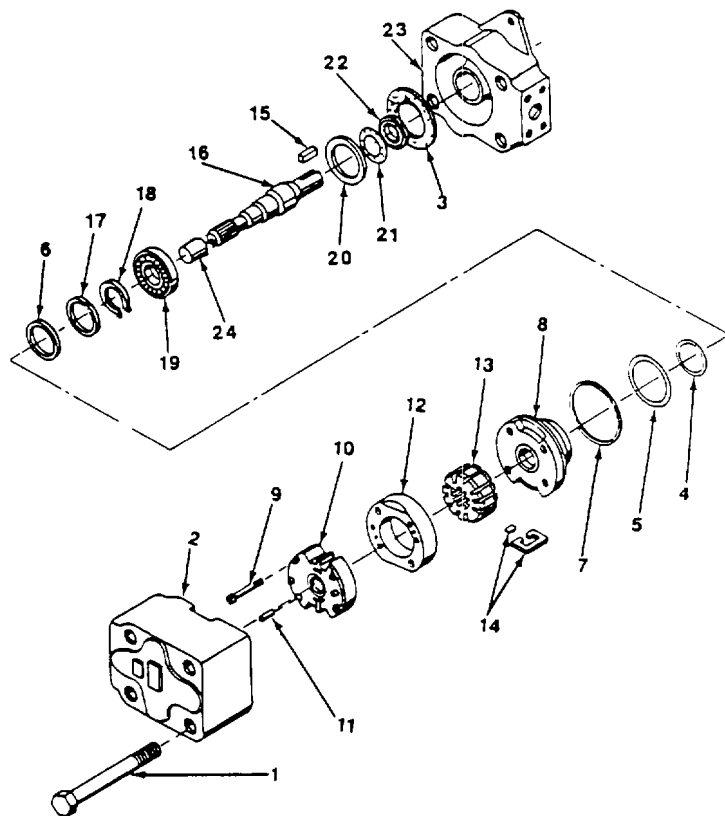
6-6 REPAIR RAMP HOIST HYDRAULIC PUMP (Continued).

- g Install 'O' ring (4), and backup ring (7) in groove on hub diameter of pressure plate (8) Install a backup ring (6) and 'O' ring (5) around large step diameter of pressure plate Make sure that the smooth sides of the backup rings face the sealing rings

NOTE

**Backup rings must always be installed away from the pressure chamber.**

- h Position sealing ring (3) in recess of body (23) Use petroleum jelly to hold 'O' ring in position during reassembly of pump cartridge
- i If wear plate bushing (24) was removed, press a new bushing into wear plate bore Install plate (10) on locating pin against ring Install two screws (9) and tighten
- j Carefully install pump cartridge on drive shaft, and seat it firmly in place in the body
- k Install cover (2) making certain that the two locating pins fit into holes inside cover Seat cover firmly and secure it in place with cover bolts (1). The threads of the bolts should be oiled lightly, and torqued to 85-95 ft lbs (115.2 - 128.8 Nm)
- l After the unit has been completely reassembled, pour a small quantity of clean hydraulic oil into the cover inlet port. Rotate the drive shaft several turns by hand to check for free rotation and to make sure of complete lubrication of the cartridge parts. Cap the pump inlet and outlet ports to prevent entrance of foreign materials.



**MAINTENANCE OF RAMP HOIST CONTROL VALVE****6-7 REPAIR RAMP HOIST CONTROL VALVE.**

This task covers.                    a. Disassembly                    c. Inspection  
    b. Cleaning                        d. Assembly

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

**Equipment Condition:**

Reference  
 Para 5-17. Control Valve removed

**Materials/Parts:**

Cleaning Solvent  
 Item 17, Appendix E  
 Kit  
 NSN 2030-113-9459

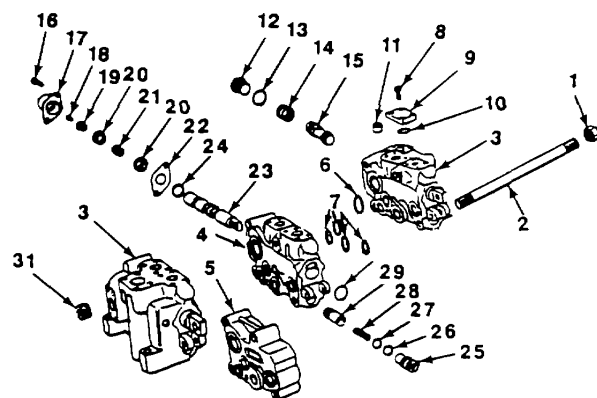
**DISASSEMBLY**

1. DISASSEMBLE RAMP HOIST CONTROL VALVE.

**NOTE**

During disassembly, particular attention should be given to identification of parts for reassembly. Spools are selectively fitted to valve bodies and must be returned to the same bodies from which they were removed. Valve sections should be reassembled in the same order.

- a. Remove hex nuts (1) from section mounting studs (2).
- b. Remove studs (2) and separate valve body (3) from sections (4 and 5). Then, separate section (4) from section (5).
- c. Remove packings (6 and 7) from body (3). Discard packing.
- d. Remove capscrews (8), plate (9), and plate packing (10). Discard packing.

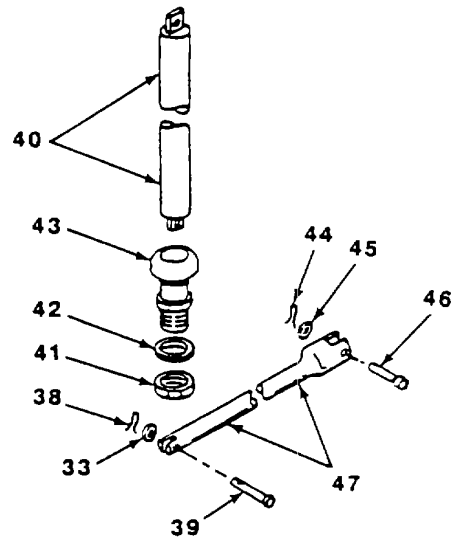
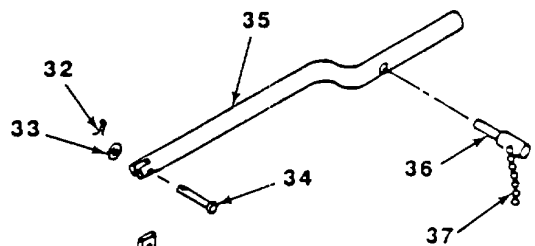
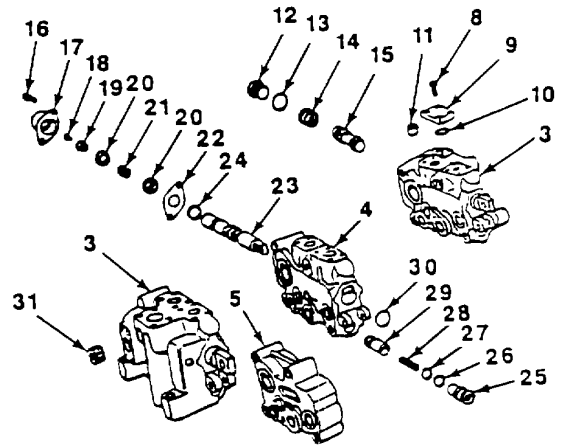


6-7 REPAIR RAMP HOIST CONTROL VALVE (Continued).

- e. Remove pipe plug (11) from body if damaged.
- f. Remove valve plug (12), packing (13), spring (14), and valve sub-assembly (15). Discard packing.
- g. Remove capscrews (16), and end cap (17).
- h. Remove guide mounting machine screws (18), guide (19), retainers (20), spring (21), and retainer (22).
- i. Withdraw valve spool (23) from section (4). Remove packings (24) from spool. Discard packing.
- j. Remove pipe plug (25), reinforcing ring (26), packing (27), spring (28), and poppet (29) from section (4). Discard packing.
- k. Remove packing (30) from section (4). Discard packing.
- l. Remove pipe plug (31) from outlet section (3).

2. DISASSEMBLE CONTROL VALVE LEVER.

- a. Remove cotter pins (32), washers (33), and clevis pin (34) from valve handle bar (35).
- b. Remove shear detect pin (36), and pin retainer chain (37) from pin, if damaged.
- c. Remove cotter pin (38), washer (33), clevis pin (39), and lever bar (40).
- d. Remove locknut (41), and sealing ring (42) from watertight connector.
- e. Remove watertight connector (43).
- f. Remove cotter pin (44), washers (45), and clevis pin (46) from valve control ramp lever (47).



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**6-7 REPAIR RAMP HOIST CONTROL VALVE (Continued).**

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**CLEANING**

INSPECT RAMP HOIST CONTROL  
VALVE

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 1000 138° F (38°- 59° C).

- a. Clean control valve parts. In mineral oil solvent, and place on a clean surface.
- b. Clean control lever parts In cleaning solvent Federal Specification P-D- 680, and dry thoroughly.

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**INSPECTION**

INSPECT CONTROL VALVE PARTS

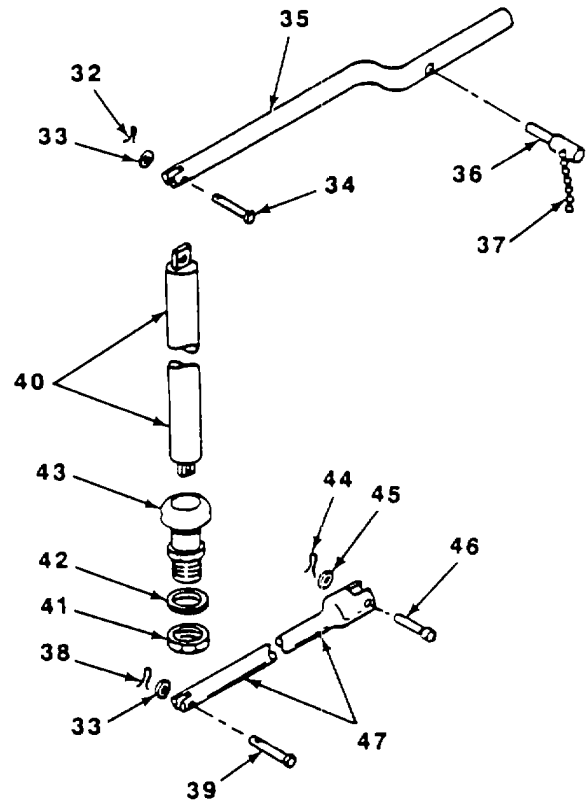
- a. Inspect springs for loss of tension or distortion.
- b. Inspect spool for nicks, burrs, or scores.
- c. Inspect threaded parts for thread damage.
- d. Inspect end caps and plates for burrs, nicks, or other damage.
- e. Inspect sealing surfaces of valve bodies, and sections for scores, burrs, or warpage.
- f. Inspect poppets for burrs or nicks.
- g. Replace packings.
- h. Replace all defective threaded parts.

**6-7 REPAIR RAMP HOIST CONTROL VALVE (Continued).**

- i. Remove score marks or burrs from sealing surfaces of bodies or sections, with extra fine emery cloth. Replace any section or body if warped.
- j. Replace other damaged or defective parts as required.

**ASSEMBLY****1. ASSEMBLE CONTROL VALVE LEVER**

- a. Insert watertight connector (43) into place.
- b. Install sealing ring (42) and locknut (41) onto connector.
- c. Insert lever bar (40) thru watertight connector.
- d. Insert ramp lever (47) into lever bar (40), and install clevis pin (39), washer (33), and cotter pin (38).
- e. Install clevis pin (46), washer (45), and cotter pin (44).
- f. Insert valve handle bar (35) into lever bar (40) and secure with clevis pin (34), washer (33), and cotter pin (32).
- g. Install shear detent pin (36) and chain (37), if removed.

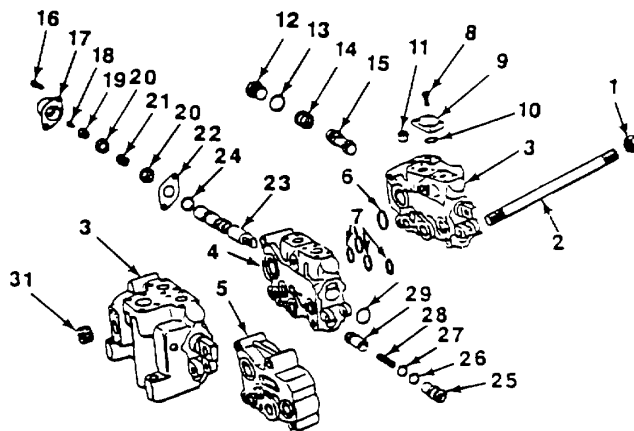
**2. ASSEMBLE RAMP HOIST CONTROL VALVE****NOTE**

Coat all parts with clean hydraulic oil to facilitate reassembly and provide Initial lubrication. Petroleum Jelly can be used to hold packings in place on the assembly.



6-7 REPAIR RAMP HOIST CONTROL VALVE (Continued).

- a. Install plug (31) in outlet body (3) DO NOT overtighten plug.
- b. Install packing (30) In section (4).
- c. Insert spring (28) into poppet (29). Then insert poppet into body section (4).
- d. Install packing (27) and reinforcing ring (26), and secure with pipe plug (25). Tighten plug securely. DO NOT OVERTIGHTEN PLUG.
- e. Place packings(24) in position on valve spool (23) Then, insert spool (23) into body section.
- f. Install retainer (22), retainer (20), spring (21), retainer (20), valve guide (19), and secure with guide mounting screw (18). Align flat retainer (22) by shifting spool. Spool bind is an indication of retainer misalignment.
- g. Install end cap (17), and secure with capscrews (16). Tighten end cap screws securely.
- h. Install valve sub-assembly (15), spring (14), packing (13), and secure with plug (12).
- i. Install pipe plug (11).
- j. Install plate packing (10), plate (9), and secure with screws (8).
- k. Install packings (6 and 7). in sections . Use petroleum jelly to hold packing in place in sections.



**CAUTION**

**Make sure all mating surfaces of valve bodies are free of burrs and paint.**

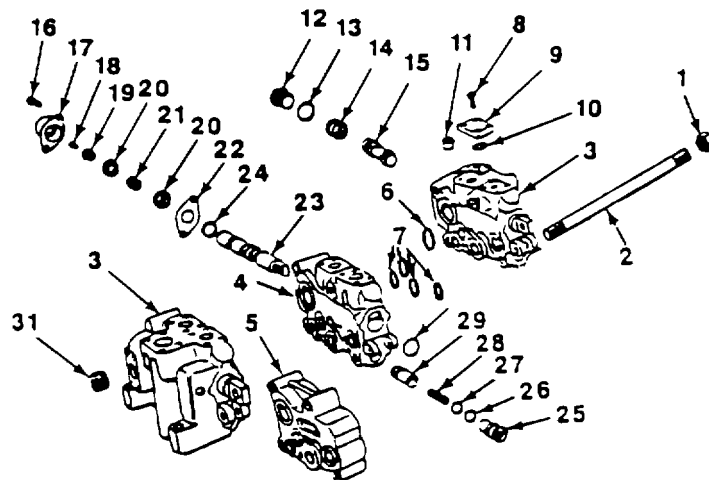
6-7 REPAIR RAMP HOIST CONTROL VALVE (Continued).

- I. With mounting feet on a flat surface, carefully place valve sections (3, 4, and 5) together.

NOTE

The mounting feet must be maintained in a flat plane to prevent spool bind (due to body distortion) when valve is mounted for operation.

- m. Secure sections together with mounting studs (2), and nuts (1) Torque stud nuts to 55-60 lb ft, (74 6-81 3 Nm).



**MAINTENANCE OF RAMP HOIST HAND PUMP**

**6-8 REPAIR RAMP HOIST HAND PUMP.**

This task covers                    a. Disassembly                    c. Inspection  
     b. Cleaning                        d. Assembly

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Equipment Conditions:

Reference  
 Para 5-20 Hand pump removed

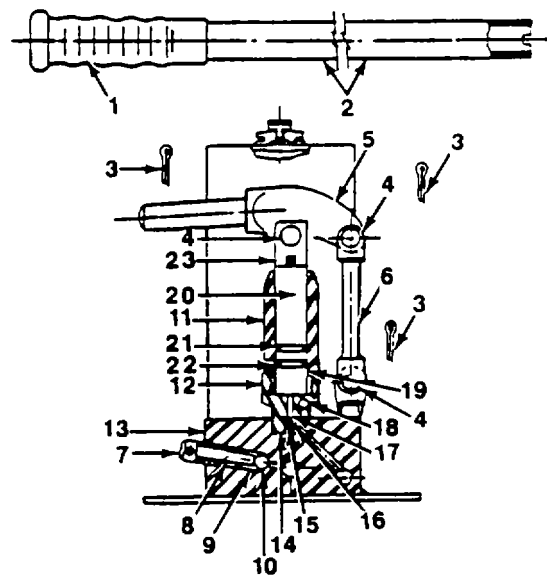
Materials/Parts'

Valve Spring  
 P/N 1000-23-0  
 Preformed Packing  
 P/N 1000-25-8  
 Seal Washers  
 P/N 1000-6-0  
 Crocus Cloth  
 Item 20, Appendix E  
 Cleaning Solvent  
 Item 17, Appendix E

**DISASSEMBLY**

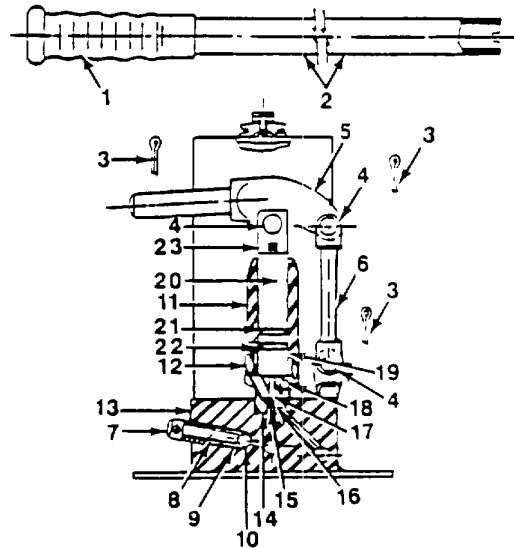
DISASSEMBLE RAMP HOIST HAND PUMP

- a. Remove rubber hand grip (1).
- b. Remove handle (2) from lever (5).
- c. Remove cotter pins (3), pins (4), and remove lever (5).
- d. Remove cotter pin (3), pin (4), and pump link (6).
- e. Remove release screw (7), seal washer (8), release ball cage (9), and release ball (10). Discard seal washer.



**6-8 REPAIR RAMP HOIST HAND PUMP (Continued).**

- f. Remove pump barrel (11), and pump valve block (12) as an assembly from block assembly (13).
- g. Remove valve spring seal washer (14) from pump block. Discard seal washer.
- h. Remove retaining ring (15), valve spring (16), and check ball (17).
- i. Remove pump barrel (11) from pump valve block (12).
- j. Remove pump valve ball (18), and preformed packing (19). Discard packing.
- k. Remove pump piston (20), packings (21), and reinforcing ring (22). Discard packing.
- l. Place pump piston (20) in a vise with soft jaws and unscrew clevis (23).

**CLEANING**

CLEAN ALL PARTS.

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59°C).

Clean all metal parts in solvent and dry thoroughly

**6-8 REPAIR RAMP HOIST HAND PUMP (Continued).****INSPECTION**

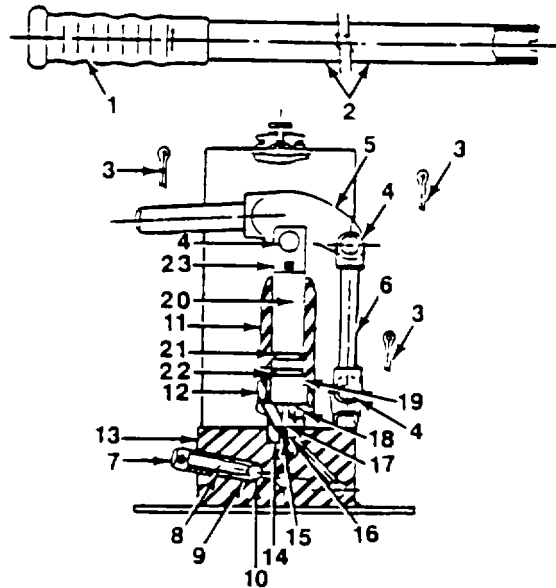
INSPECT RAMP HOIST HAND PUMP.

- a. Inspect springs for distortion, loss of tension or broken coils.
- b. Inspect pins, balls, piston, and blocks for burrs or nicks.
- c. Inspect hand grip for deterioration.
- d. Replace all packing and seals with new ones.
- e. Remove burrs or nicks with crocus cloth.
- f. Replace all defective parts as required.

**ASSEMBLY**

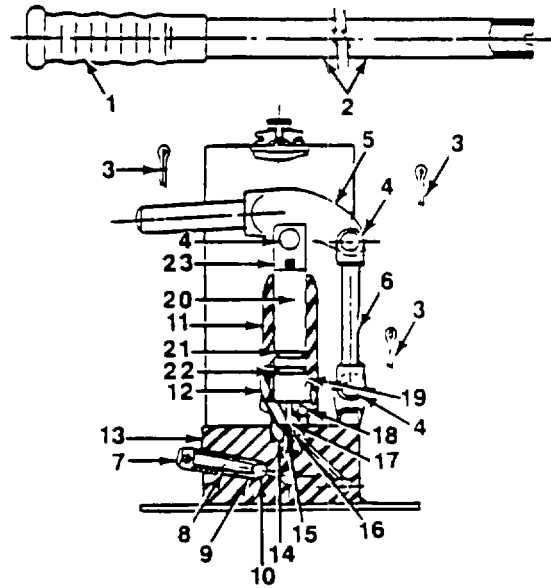
ASSEMBLE RAMP HOIST HAND PUMP

- a. Install clevis (23) onto pump piston (20).
- b. Install reinforcing ring (22), packing (21), and pump piston (20). Use new packing.
- c. Install preformed packing (19), and pump valve ball (18).
- d. Install check ball (17), valve spring (16), and secure with retaining ring (15).
- e. Install valve spring seal washer (14) in pump block (13).
- f. Install pump barrel (11), into pump valve block (12).



6-8 REPAIR RAMP HOIST HAND PUMP (Continued).

- g. Install assembled pump barrel and pump valve block into pump block (13).
- h. Install release ball (10), release ball cage (9), seal washer (8), and secure with release screw (7). Use new seal washer.
- i. Install pump link (6) using pump pin (4), and cotter pin (3).
- j. Install pump lever (5) using pump pin (4) and cotter pin (3).
- k. Install pump handle (2) into lever (5).
- l. Install rubber grip (1) onto pump handle (2).



**MAINTENANCE OF RAMP LOCKING CYLINDERS**

**6-9 REPAIR RAMP LOCKING HYDRAULIC CYLINDER.**

This task covers                    a. Disassembly                    c. Inspection  
     b. Cleaning                        d. Assembly

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783  
 Torque Wrench

Materials/Parts:

Cleaning Solvent  
 Item 17, Appendix E  
 Rod Wiper  
 P/N 50-00015-003

Materials/Parts:

Rod Gland  
 P/N 15-07028-001  
 Rod Gland OD Seal  
 P/N 50-00001-024  
 Rod Seal  
 P/N 50-00006-049  
 Barrel Seal  
 P/N 50-00001-029(2)  
 Piston OD Seal  
 P/N 50-00007-019

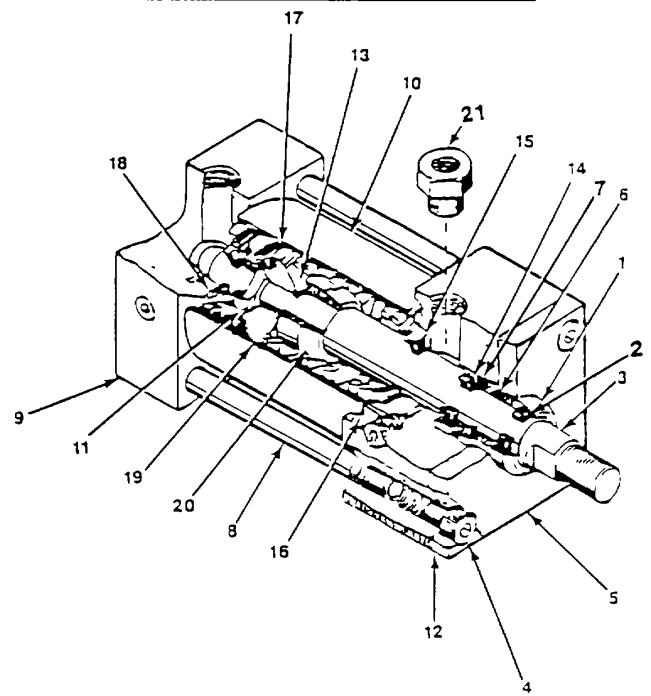
Equipment Conditions:

Reference  
 Para. 5-21. Locking cylinders removed

**DISASSEMBLY**

**DISASSEMBLE LOCKING CYLINDER**

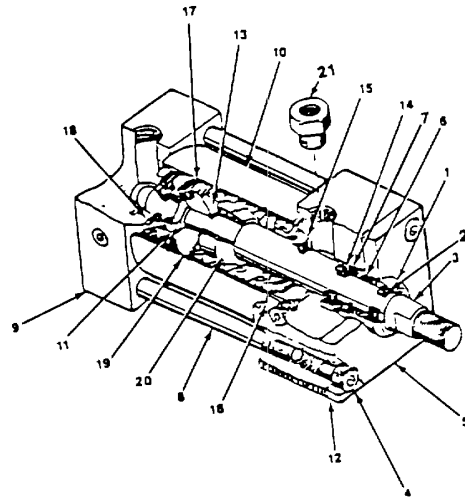
- a. Remove locknut (1) and rod wiper (2) from piston rod (3). Discard wiper.
- b. Remove four retainer plate bolts (4), and retainer plate (5).
- c. Remove rod gland (6), and rod gland OD seal (7). Discard glands and seals.
- d. Remove tie bolts (8), and separate cap (9) from barrel (10).
- e. Remove barrel (10) from head (12).
- f. Withdraw piston rod assembly (3), with piston (13) attached.



**6-9 REPAIR RAMP LOCKING HYDRAULIC CYLINDER (Continued).****NOTE**

**Do not remove piston from piston rod unless parts are damaged or definite leakage has occurred past the piston.**

- g. Remove rod seals (14), cushion ring assembly (15), and barrel seal (16). Discard seals.
- h. Remove piston cap (17), cushion ring assembly (18), and piston (13).
- i. Remove piston OD seal (19). Discard seals.
- j. Remove return spring (20).
- k. Remove breather plug (21).

**CLEANING**

CLEAN ALL PARTS

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100°F - 138°F (38°C - 59°C).

Clean all metal parts in solvent.  
Place them on a clean surface and dry thoroughly.



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**6-9 REPAIR RAMP LOCKING HYDRAULIC CYLINDER (Continued).**

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**INSPECTION**

## INSPECT LOCKING CYLINDER

- a. Inspect cylinder, piston rod, and piston for burrs and scores.
  - b. Inspect threaded parts for thread damage.
  - c. Inspect retainer plate, head and cap for cracks or breaks.
  - d. Inspect spring for loss of tension or distortion.
  - e. Remove burrs by light stoning or lapping.
  - f. Remove scoring from piston rod, cylinder and piston by light stoning or lapping.
  - g. Replace all seals and glands.
  - h. Replace other defective parts. As necessary.
- 

**ASSEMBLY**

## ASSEMBLE LOCKING CYLINDER.

**NOTE**

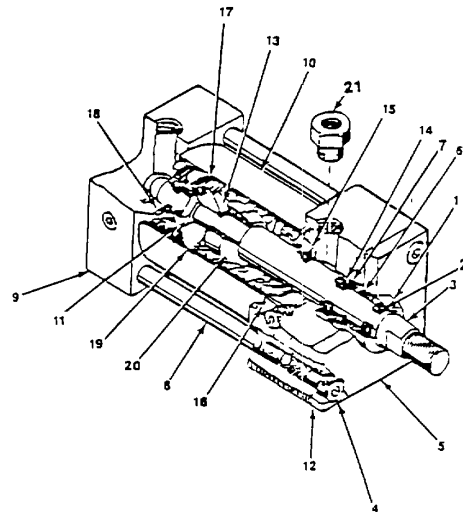
**Lubricate parts with clean hydraulic fluid before assembly.**

- a. Install breather plug (21).
- b. Install return spring (20).

**6-9 REPAIR RAMP LOCKING HYDRAULIC CYLINDER (Continued).**

- c. Install piston OD seal (19) onto piston rod. Use new seal.
- d. Install piston (13), cushion ring assembly (18), and piston cap (17) to piston rod.
- e. Install barrel seal (16), cushion ring assembly (15), and rod seals (14) onto piston rod. Use new seals.
- f. Install assembled piston rod assembly (3).
- g. Install barrel (10) in head (12) and if installed piston nut (11) was removed, torque piston nut to 55 lb ft (74.6 Nm).
- h. Position cap (9) into place on barrel (10), and install tie bolts (8) to secure head (12) and cap (9) to barrel (9). Torque tie bolts to 15 lb ft (20.3 Nm) a little at a time alternately, with opposite tie rods until correct torque is reached.
- i. Install rod gland OD seal (7) and rod gland (6).
- j. Secure retainerplate (5) to head (12) with four bolts (4). Tighten bolts to 15 lb ft (20.3 Nm).
- k. Install rod wiper (2), and locknut (1) onto piston rod assembly.

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**6-10 REPAIR RAMP WINCH.**

This task covers                      a. Disassembly                      c. Inspection  
    b. Cleaning                              d. Assembly

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783  
 Bearing puller  
 C13115  
 Bushing Installer  
 B1397 (Gearmatic)  
 Heel Bars  
 Pinch Bars

Materials/Parts:

Cleaning Solvent  
 Item 17, Appendix E  
 Grease (MIL-G-18709)  
 Item 22, Appendix E  
 Oil Seal  
 P/N 50482  
 Oil Seal  
 P/N 50483  
 'O' Ring  
 P/N 50328(2)

Materials/Parts:

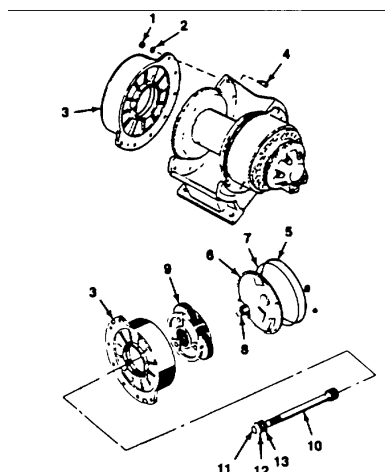
'O' Ring  
 P/N 50352  
 'O' Ring  
 P/N 50333  
 'O' Ring  
 P/N 50346 (2)  
 'O' Ring  
 P/N 50343  
 'O' Ring  
 P/N 50306 (2)  
 'O' Ring  
 P/N 50488  
 'O' Ring  
 P/N 50332  
 'O' Ring  
 P/N 50339  
 'O' Ring  
 P/N 50337

Equipment Conditions:

Reference  
 Para 5-22 Winch motor removed

**DISASSEMBLY**

1. REMOVE FINAL DRIVE ASSEMBLY.
  - a. Remove seven nuts (1) and lockwashers (2) from the final drive end of the winch.
  - b. Use two heel bars and remove the final drive housing (3) from the dowel bolts (4).



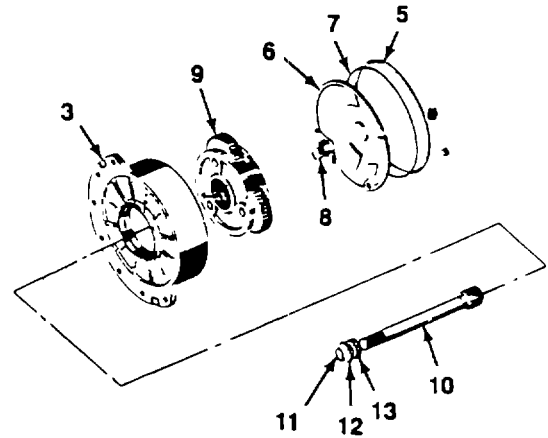
**6-10 REPAIR RAMP WINCH (Continued).**

- c. Remove and discard 'O' ring (7) from end cover (6).
- d. Remove thrust plate (8) from the final planet assembly (9).

**NOTE**

**Care must be taken not to damage the pilot bore in final drive housing that carries the end cover.**

- e. Using two pinch bars under rim of planet hub and against end of final drive housing (3), pull planet assembly (9) off splined end of drum.
- f. Remove sun gear shaft (10),. Then remove snap ring (11) and 'O' ring (12). Discard 'O' ring.

**NOTE**

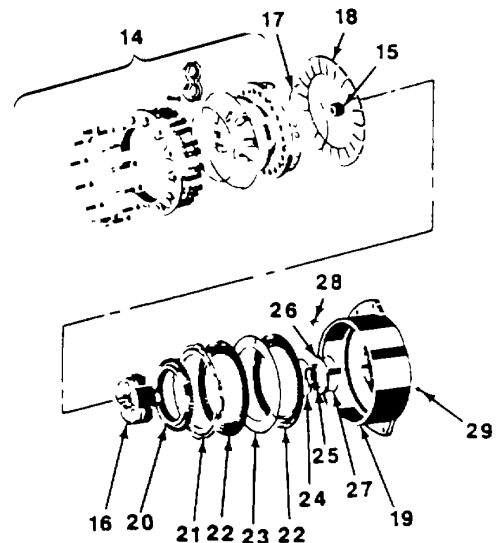
**Do not remove taper seal ring (13) unless tapered diameter has roughness or scratches.**

- g. Remove taper seal ring (13) using a punch between the gear teeth to drive the ring off the shaft.

**6-10 REPAIR RAMP WINCH (Continued).****3 DISASSEMBLE PRIMARY DRIVE ASSEMBLY****CAUTION**

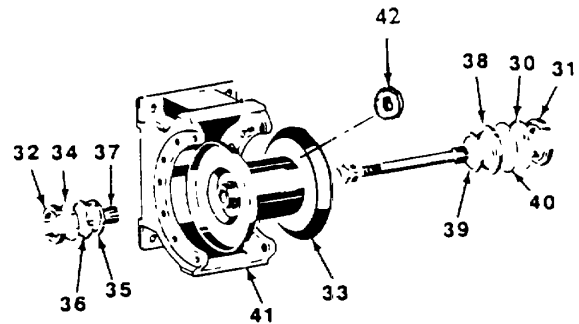
Do not remove this assembly as a unit as damage may be caused to the seal diameter of the primary planet hub and the tapered seal diameter of the taper seal ring on the sun gear shaft.

- a. Remove spring cover and motor assembly (14) (refer to para 5-24).
- b. Remove primary sun gear (15) from the bore of the primary planet assembly (16) if not already removed with the motor assembly.
- c. Remove retainer (17) from inside of the segments (18), then remove segments (18) from the primary housing (19).
- d. Remove primary planet assembly (16).
- e. Remove ring gear (20) backing plate (21), brake plates (22) and divider plate (23).
- f. Remove 'O' ring (24), oil seal (25), seal ring (26) and snap ring (27).
- g. Remove pipe plugs (28 and 29) from primary housing (19). Remove primary housing.



**6-10 REPAIR RAMP WINCH (Continued).****4. DISASSEMBLE BEARINGS AND SEALS FROM DRUM**

- a. Remove snap ring (30) then remove bearings (31 and 32) from drum (33) using bearing puller.
- b. Remove small seal ring (34) which contains oil seal (35) and 'O' ring (36). Remove and discard the 'O' ring and the oil seal.
- c. Remove drum bushing (37) with a bearing puller only if replacement is necessary.
- d. Remove large seal ring (38) which contains oil seal (39) and 'O' ring (40). Remove and discard 'O' ring and oil seal.
- e. Remove drum (33) from winch base (41).
- f. Remove hondu (42) from drum (33).

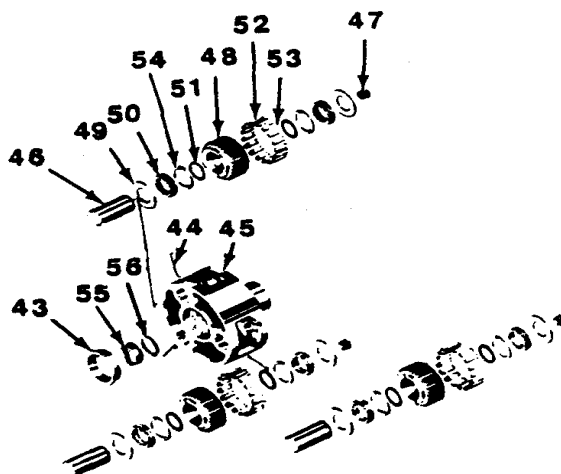
**5 DISASSEMBLE PRIMARY PLANET ASSEMBLY****NOTE**

**It is recommended that if this assembly does not function properly or is worn, it should be traded in complete for a new assembly. If the assembly is to be disassembled do so only if a clean, dust free work bench is available.**

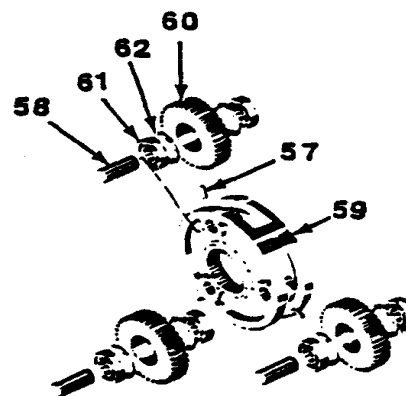
- a. Remove bushing (43).
- b. Using a 5/16" diameter pin punch drive pin (44) through the planet hub (45) until it can be removed through the bore which carries the bushing (43).

**6-10 REPAIR RAMP WINCH (Continued).**

- c. Remove the primary planet pin (46) by tapping it out of the planet hub (45) so that it is removed from the side of the planet hub which carries the bushing (43). Remove thrust plug (47) from primary planet pin (46).
- d. Remove the planet gear (48) with care so that the gear spacers (49) and the roller bearings (50) do not drop off the gear when removed.
- e. Remove the gear spacers (49), roller bearings (50), garter springs (51) and cam locks (52 and 53) and place on a perfectly clean surface. Remove one snap ring (54) from the primary gear (48) using suitable goose neck or water pump pliers.
- f. After all the planet gears have been removed, the thrust pad (55) and 'O' ring (56) can be removed from the planet hub. Remove and discard the 'O' ring (56).

**6 DISASSEMBLE FINAL PLANET ASSEMBLY.**

- a. Using a 1/4" diameter pin punch, drive pin (57) completely into the final planet pin (58).
- b. Remove the final planet pin (58) by tapping it out of the planet hub (59) so that it is removed from the splined bore side of the planet hub. Remove pin (57) from the planet pin (58).
- c. Now remove the planet gear (60).
- d. Drive the ball bearings (61) out of the planet gear (60) using a drift. Remove the snap rings (62) only if they are to be replaced because of damage.



**6-10 REPAIR RAMP WINCH (Continued).****CLEANING**

CLEAN FINAL DRIVE ASSEMBLY,  
PRIMARY DRIVE ASSEMBLY AND  
BEARINGS.

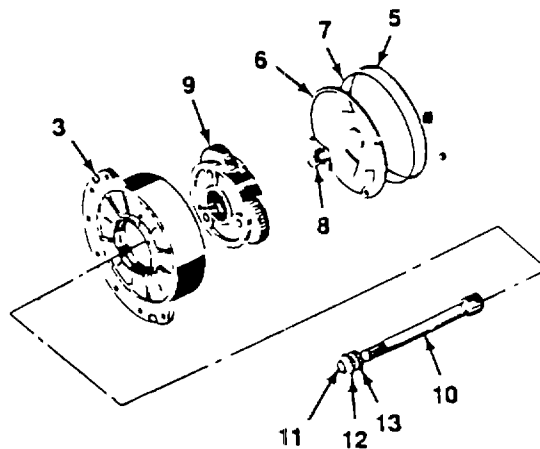
**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100# - 138#F (38°- 59°C).

- a. Wash all parts in cleaning solvent P-D-680. Dry thoroughly using compressed air or clean cloths.
- b. Allow bearings to air dry after cleaning in solvent P-D-680. Do not dry with compressed air.

**INSPECTION****1. INSPECT FINAL DRIVE ASSEMBLY**

- a. Inspect and replace all 'O' rings.
- b. Check snap rings (5 and 11) for flatness and that they form a true circle, replace if bent or damaged.
- c. Check for wear at the center of the thrust plate (8). The original thickness at the center of the thrust plate is 1 363 inches, replace if wear is greater than 3/32 inch.
- d. Check the final planet assembly for defects. Replace and send defective final planet assembly to general support for repair.
- e. Inspect the gear teeth in the final housing. If wear is greater than 0015 inch when compared to the unworn part of the teeth, replace final housing.





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**6-10 REPAIR RAMP WINCH (Continued).**

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- f. Check the large pilot bore at the end of the final housing used to carry the end cover. Remove all roughness and scores carefully using a scraper and extra fine emery cloth.
- g. Inspect sun gear shaft. Check gear teeth for wear. If wear is greater than .012 inch replace the sun gear shaft.
- h. Inspect taper seal ring for roughness or scratches. If these defects are found replace.

**2. INSPECT PRIMARY DRIVE ASSEMBLY.**

- a. Inspect and replace all 'O' rings.
- b. Inspect retainer for distortion. Be sure that it seats properly all around the bottom of the groove in the bore of the segments. Check segments for flatness, replace with new parts if bent or distorted.
- c. Inspect the primary planet assembly for defects. Replace if necessary and send defective primary planet assembly to general support for repairs.
- d. Inspect the teeth in the ring gear, replace if wear is excessive.
- e. Inspect the backing plate for wear or friction face. If wear exceeds 1/16 Inch replace with a new part (Original thickness - 0.627 inch). Check external teeth for wear and replace if necessary.
- f. Inspect friction surfaces of brake plates. Replace plates if wear has removed the grooves.

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**6-10 REPAIR RAMP WINCH (Continued).**

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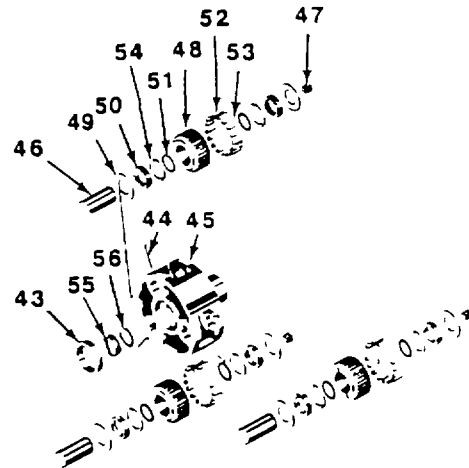
- g. Check divider plate for wear. If wear is excessive or if the plate is buckled or does not form a true circle, replace with a new part.

**3. INSPECT DRUM AND BEARINGS.**

- a. Inspect and replace all 'O' rings and oil seals.
- b. Check seal diameters at each end of drum for roughness. Clean and polish the seal diameters, using extra fine emery cloth. Check the bearing hub diameters for scores and wear. Replace drum if necessary.
- c. Inspect 'O' ring seal face in bore of drum at the splined end. Polish face with extra fine emery cloth if roughness and scratches are found. Replace drum if damage is excessive.
- d. Inspect drum bushing for bruises, scores and wear. Use a scraper to remove all high spots. The original inside diameter of bushing is 2.190 inch. If wear is greater than 0.010 inch, replace bushing.
- e. Inspect all ball bearings for wear and pitting at the balls and ball grooves. Replace bearings if worn or pitted.

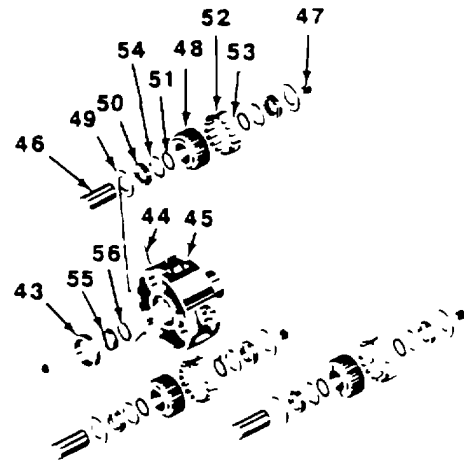
**6-10 REPAIR RAMP WINCH (Continued).****4 INSPECT PRIMARY PLANET ASSEMBLY**

- a. Inspect and replace snap ring (54), garter spring (51) and 'O' ring (56).
- b. Check the planet hub (45). Inspect the seal diameter for scores or roughness. Try removing roughness with extra fine emery cloth. If roughness can not be removed completely in this way, replace the planet hub (45).
- c. Inspect the planet pin bores for scores and bruises which may have been caused in removing the planet pins (46). Remove the high spots of any scores or bruises carefully with a scraper, sufficiently to allow a planet pin (46) to be pressed into each bore by hand.
- d. Inspect the pins (44) for damage. If they are bent or distorted, discard them.
- e. Inspect the planet pins (46) for excessive wear at the bearing and cam lock areas. If the wear at the bearing and cam lock areas is greater than 0.001" on the diameter when compared with the unworn areas, the planet pins (46) should be replaced.
- f. Inspect the bore of the planet gears (48) for ridges in the center area of the bore and for wear at the center and ends of the bore. If there are definite ridges at the center of the bore or wear at any part of the bore greater than 0.001" in diameter, the gears will require replacement. The original bore diameter was 1.7852".



**6-10 REPAIR RAMP WINCH (Continued).**

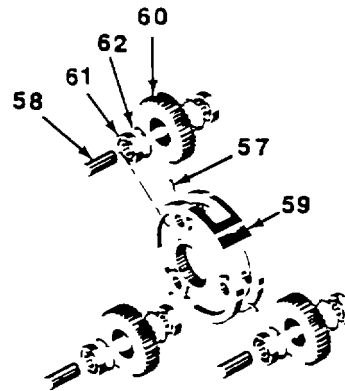
- g. Inspect the roller bearings (50) for freeness of rollers. Check for pits, broken rollers or excessive wear, also damage or excessive wear on the bronze bearing cage or flange, and replace the bearings (50) if any of these conditions exist.
- h. Check the cam locks (52 and 53) for wear at the points where they contact the planet pin (46) and gear (48). If flats are worn on the cam locks at these points, they will require replacement.
- i. Check the gear spacers (49) for flatness and wear.
- j. Check thrust plug (47) for wear on flange end. If flange has worn down to 1/32" thick, the thrust plugs (47) will require replacement.
- k. Check thrust pad (55) for wear on slotted face. If wear exceeds 1/8", replace. Original thickness of the thrust pad (55) was 0.562".
- l. Check bushing (43) for wear on the bore. If flange has worn to 1/32" thick or if bore has worn more than 0.010, replace the bushing (10). Original bore was 2.253".

**NOTE**

**If planet pins (46), gears (48), bearings (50) or cam locks (52 and 53) require replacement, all these parts must be replaced at the same time.**

**6-10 REPAIR RAMP WINCH (Continued).****5 INSPECT FINAL PLANET ASSEMBLY**

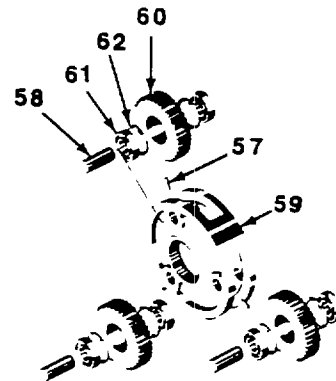
- a. Inspect the planet pin bores in the planet hub (59) for scores or bruises which may have been caused in removing the planet pins. Remove the high spots of any scores or bruises carefully with a scraper, sufficiently to allow a planet pin to be pressed into each bore by hand.
- b. Inspect the planet pin (58) for excessive wear at the bearing area. If wear exceeds 0.001" on the diameter, the pins should be replaced.
- c. Check the planet gears (60) for wear and damage on the gear teeth. If wear is excessive, replace the planet gears (60).
- d. Inspect the ball bearings (61) for wear and pitting at the balls and ball grooves. Replace bearings if worn or pitted.

**ASSEMBLY****1. ASSEMBLE FINAL PLANET ASSEMBLY.**

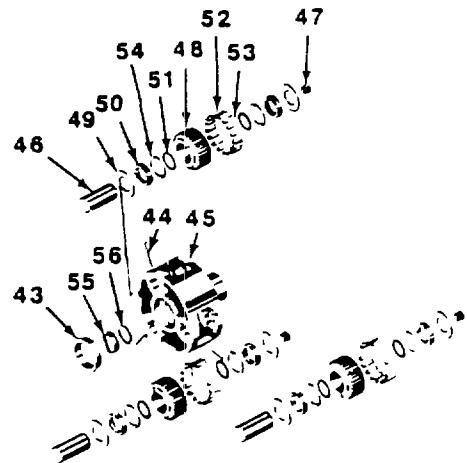
- a. Install the snap rings (62) in the bore of the planet gear (60). Press the ball bearings (61) into the final planet gear (60) so that the ends of the bearings shoulder against the snap rings (62).
- b. Place the final planet gear (60) into the final planet hub (59) so that the bore of the bearing lines up with a planet pin hole.
- c. Install a final planet pin (58) in the final planet hub (59) so that it passes through the ball bearings (61) in the planet gear and the drilled hole in the final planet pin lines up with the hole in the rim of the final planet hub.

**6-10 REPAIR RAMP WINCH (Continued).**

- d. Install pin (57) and, using 3/16" diameter pin punch, drive the pin in until the outer end of the pin is 7/16" below the outside diameter of the final planet hub (59).
- e. Repeat the above for the remaining two final planet gears (60) and check that all the gears run freely.

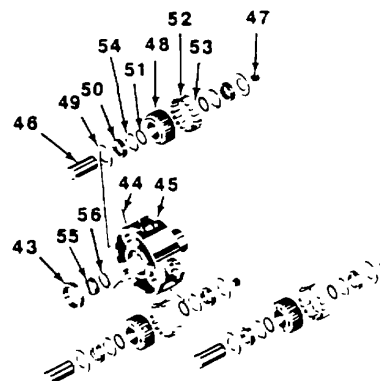
**2. ASSEMBLE PRIMARY PLANET ASSEMBLY.**

- a. Lubricate 'O' ring (56) and install its groove in the thrust pad (55). Give 'O' ring an additional coat of grease and install the thrust pad (55) in its recess in the inside wall of the primary planet hub (45) so that the slotted face of the thrust pad is outward.
- b. Press the thrust plugs (47) into the ends of the primary planet pins (46).



**6-10 REPAIR RAMP WINCH (Continued).**

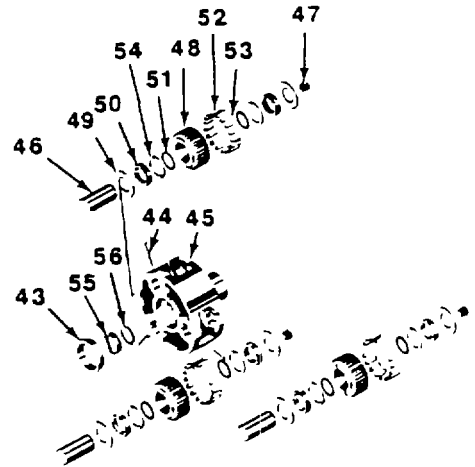
- c. Assemble the primary planet gears (48) with cam locks (52 and 53), garter springs (51) and roller bearings (50) as follows.
- (1). Install one snap ring (54) in a primary planet gear (48). Grip the primary planet pin (46) on the thrust plug end and install a roller bearing (50) over the end of the primary planet pin (46) so that it rests on your hand. Then place the primary planet gear (48), assembled with the snap ring (54) as above, over the planet pin so that the bearing (50) pilots into the bore of the primary planet gear and locates against the snap ring (54).
  - (2). Now take sixteen cam locks (52) and one copper colored cam lock (53) and assemble them so that they stand on end between the primary planet pin (46) and the bore of the planet gear (48).
  - (3). Install a second snap ring (54) and make sure that it is properly seated in the bottom of the snap ring groove all the way around the gear. Place a roller bearing (50) in the bore of the planet gear so that it rests on the snap ring (54).

**NOTE**

**Before installing the garter spring (51) check to see that the groove formed by the notches at the end of the cam locks (52 and 53), next to the snap ring (54), is fully exposed.**

**6-10 REPAIR RAMP WINCH (Continued).**

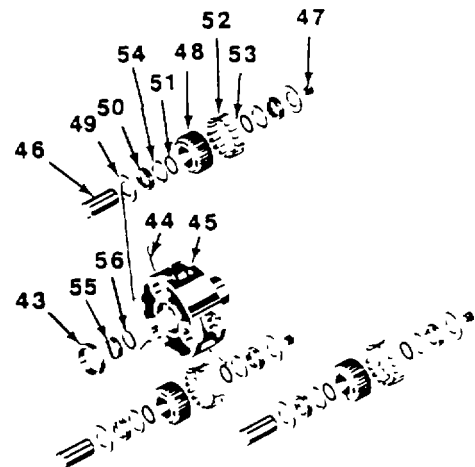
- (4) Install the garter spring (51) so that it engages under the projecting ends of the cam locks (52 and 53). Turn the complete assembly over and slide the planet pin (46) down through the planet gear until the groove formed on the end of the cam locks (52 and 53), next to the snap ring (54), is fully exposed. It may be necessary to rotate the planet gear (48) in the direction of free rotation in order to allow the planet pin (46) to slide through the assembly.
- (5). Install the second garter spring (51) through the bore of the roller bearing (50). Now slide the planet pin (46) up through the gear assembly as before, so that it is central in the planet gear (48).
- d. To check that the primary planet gear (48), assembled according to steps c1 through c5, rotates freely in the correct direction of rotation proceed as follows. Hold the primary planet pin (46) stationary with one hand and view the end of the gear assembly while the thrust plug (47) points away from you. With the other hand try to rotate the gear in both directions. If the cam locks have been assembled correctly according to steps c1 through c5 above, the gear will rotate freely in a clockwise direction and "lock up" in the opposite direction.





**6-10 REPAIR RAMP WINCH (Continued).**

- e. Take the primary planet gear which has been checked for rotation, as above, and place one spacer (49) on each side of the primary planet gear next to the roller bearings. (50) Hold this assembly opposite one of the gear openings in the primary planet hub (45) so that the cross hole drilled in the end of the primary planet pin (46) is on the same side of the gear openings as the drilled rim of the primary planet hub (45). Now hold the primary planet gear (48) across the spacers (49) with one hand, and remove the primary planet pin (46) by gripping it on the drilled end with the other hand.
- f. Insert the gear assembly into the planet hub so that the bore of the gear lines up with the planet pin hole in the planet hub (45).
- g. Install a primary planet hub (45). As the primary planet pin (46) enters the primary planet gear (6), rotate the gear slowly in the direction for free rotation so that the primary planet pin (46) will pass freely through the cam locks (52 and 53). Tap the primary planet pin (1) through the planet hub (45) until the drilled hole in the end of the primary planet pin (46) lines up with the hole in the rim of the planet hub (45).
- h. When the hole in the end of the primary planet pin (46) is lined up with the mating hole in the rim of the planet hub (45), install pin (44). Drive pin (13) into the planet hub (45) until it is approximately 1/32" away from the bore in the planet hub that carries the bushing (43).

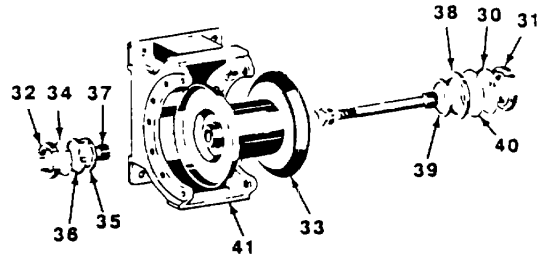


**6-10 REPAIR RAMP WINCH (Continued).**

1. Repeat the above steps, from step b, for all three primary planet gears (48) and, when they are installed, check that all the gears rotate freely in the correct direction.

**3. ASSEMBLE BEARINGS AND SEALS IN DRUM.**

- a. Install oil seal (35) in small seal ring (34) so that the lip of the oil seal is at the end of the seal ring farthest from the 'O' ring groove.
- b. Lubricate 'O' ring (36) with grease and install it in the groove on the outside diameter of the seal ring (34).
- c. Lubricate the oil seal (35), give the 'O' ring an additional coat of grease, and carefully install this assembly on the non-splined end of the drum (33). The lip of the oil seal should be towards the drum. Pack the seal with grease around the seal diameter of the drum.
- d. Install oil seal (39) in large seal ring (38) so that the lip of the seal is at the end of the seal ring which has the projecting diameter at the bore.
- e. Lubricate 'O' ring (40) with grease and install it in the groove on the outside of the seal ring.
- f. Lubricate the oil seal (39), give the 'O' ring (40) an additional coat of grease and carefully install this assembly on the splined end of the drum (33). Pack the seal with grease around the seal diameter of the drum.



6-10 REPAIR RAMP WINCH (Continued).

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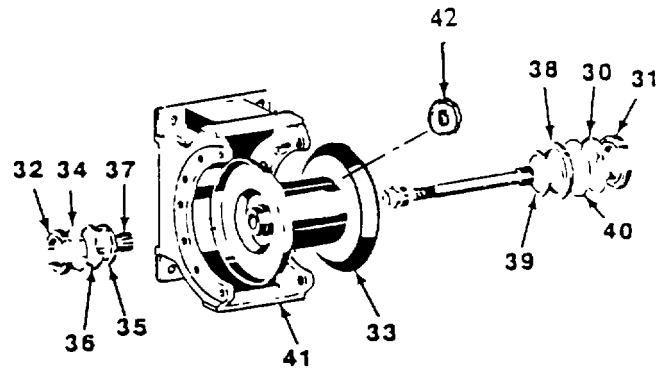
g. Install ball bearing (32) on the non-splined end of the drum (33) so that the groove on the outside diameter of the bearing is installed towards the drum. Pack the bearing with ball bearing grease.

h. Install snap ring (30) on the outside diameter of ball bearing (31).

i. Install ball bearing (31) on the splined end of the drum (33) so that the snap ring (30) on the bearing is installed towards the drum.

j. Install the hondu (42) in its slot in the drum (33) so that the small end of the hondu enters the wide end of the slot.

k. Press bushing (37) into drum (33) using a sizing mandrel which is 21885 inches in diameter. Install bushing so that the end of the bushing is flush with the end of the drum.



4. ASSEMBLE FINAL DRIVE ASSEMBLY.

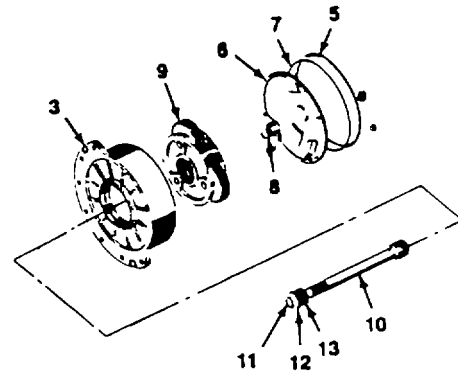
NOTE

**Before starting this assembly the drum must be mounted between the final and primary housing, and secured to the winch base.**

a. Install taper seal ring (13) on the sun gear shaft (10).

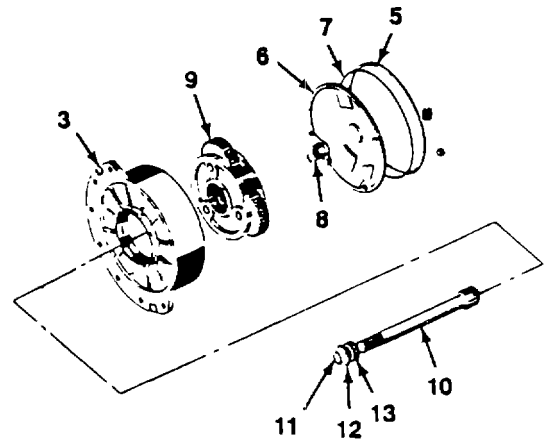
b. Install snap ring (11) on the sun gear shaft (10).

c. Lubricate 'O' ring (12) with grease and install it over the taper seal ring (13) on the sun gear shaft.



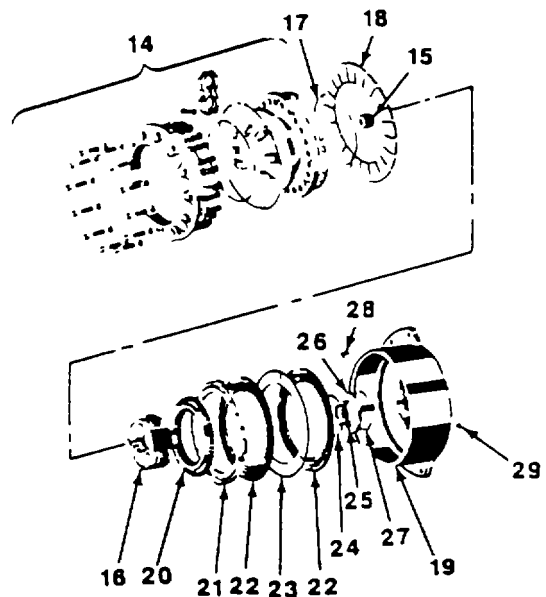
**6-10 REPAIR RAMP WINCH (Continued).**

- d. Install the sun gear shaft in the winch so that it engages in the splined bore of the primary planet hub. Slide the sun gear shaft (10) in until the snap ring (5) contacts the end of the primary planet hub. At the same time 'O' ring (12) will contact the seal face on the end of the drum and be pushed up the tapered diameter of the tapered seal ring (13).
- e. Install the final planet assembly (9) so the planet gears engage in the Internal teeth of the final housing (3). Tap the planet assembly (9) into place until it contacts the bearing that carries the drum in the final housing (3).
- f. Install thrust plate (8) in the end of the final planet assembly (9).
- g. Lubricate 'O' ring (7) with grease and install in its groove in the end cover (6). Give 'O' ring an additional coat of grease.
- h. Install end cover (6) in final housing (3) so that the filler boss is located at the bottom of the final housing when the winch is mounted. Make sure that the end cover is properly seated against the gear teeth in the final housing.
- i. Install snap ring (5) and make sure it is properly seated in the bottom of the snap ring groove all the way around the housing (3).
- j. Fill the final housing (3) with SAE 90 transmission oil to the level of the filler hole and install the filler plug.



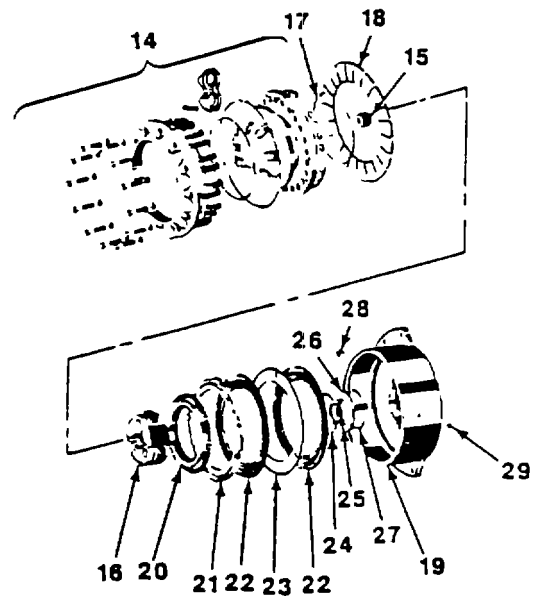
**6-10 REPAIR RAMP WINCH (Continued).****5. ASSEMBLE PRIMARY DRIVE ASSEMBLY**

- a. Set the partly completed winch on end so that it rests on the end of the primary housing (19). Check that the drum bearing which is carried in the primary housing has been thoroughly packed with grease.
- b. Lubricate 'O' ring (24) and oil seal with grease and install in the seal ring (26). Give 'O' ring (24) and oil seal (25) an additional coat of grease. Install the seal ring (26) in the base of the primary housing (19) so that the countersunk seal face is out towards the open end of the housing.
- c. Tap the seal ring (26) into place with a soft hammer so that it locates against the snap ring which was previously installed.
- d. Install the primary planet assembly (16) so that the projecting boss locates the bushing at the end of the drum. When this assembly is in place, rotate it by hand to make sure it is free to turn.
- e. Install ring gear (20) over the primary planet assembly so that it engages with the teeth of the planet gears.
- f. Install first brake plate (22) so that it engages over the teeth of the ring gear (20) and against the brake face in the primary housing.
- g. Install divider plate (23) so that it engages in the internal gear teeth of the primary housing. Now install the second brake plate (22), and backing plate (21) and lubricate thoroughly with grease.



**6-10 REPAIR RAMP WINCH (Continued).**

- h. Install the segments (18) in the groove next to the internal teeth in the primary housing (19). Make sure thinnest side of groove is next to the brake piston.
- i. Install the retainer (17) in the groove formed on the inside of the segments (18) so that the ends of the retainer (17) rest in center of one of the segments.
- j. Install the primary sun gear (15) in the primary planet assembly (16) so that the teeth on the outside diameter engage with the gears in the primary planet assembly.

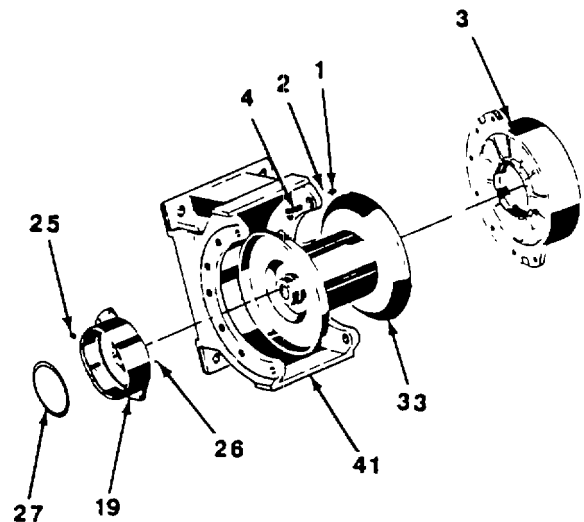


**NOTE**

**FOLLOW-ON MAINTENANCE:  
Install motor assembly (para. 5-22).**

**6. INSTALL DRUM ASSEMBLY, FINAL HOUSING AND PRIMARY HOUSING ON WINCH BASE.**

- a. Place the winch base (41) on a work bench so that the final drive side is facing up.
- b. Attach the final housing (3 ) to the winch base (41) using seven dowel bolts (4), lockwashers (2) and nuts (1).
- c. Turn the assembly over so that it rests on the end of the final housing.
- d. Install the drum assembly and pilot the bearing on the splined end of the drum into the bore of the final housing (3).



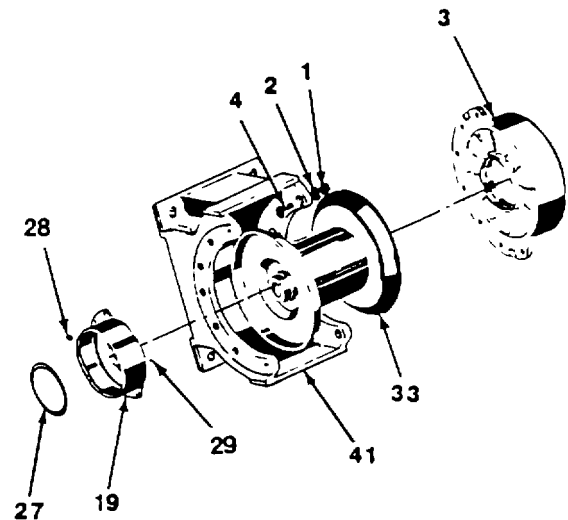
**6-10 REPAIR RAMP WINCH (Continued).**

- e. Tap the drum assembly at the splined end of the drum assembly down until the snap ring on the bearing at the splined end of the drum is properly seated on the end of the final housing bore. There will be approximately 1/16 inch clearance between the final housing and the end of the drum flange when the bearing snap ring is seated.

**NOTE**

**If the drum has a flange diameter larger than standard, steps a through e can not be used. In this case, install drum assembly by nesting it into the winch base.**

- f. Take the primary housing (19) and install the snap ring (27) in the snap ring groove that is closest to the large open end of the housing.
- g. Pilot the primary housing (19) over the bearing on the plain end of the drum (non-splined end) so that the dowel bolts will locate in the flange of the primary housing on the drum until its flange contacts the winch base.
- h. Secure the primary housing (19) to the winch base (41), using seven lockwashers (2) and nuts (1) on the dowel bolts (4). Torque load nuts (1) to 75 pounds foot.
- i. Install pipe plugs (28 and 29) on the primary housing (19).



**MAINTENANCE OF RAMP SHEAVES AND LATCH MECHANISM**

**6-11 REPAIR RAMP SHEAVES AND LATCH MECHANISM.**

This task covers:                    a. Disassembly                    c. Inspection  
    b. Cleaning                        d. Assembly

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Equipment Conditions:

Reference  
 Para 5-27 & 6-11 Sheaves and  
 latch mechanism removed

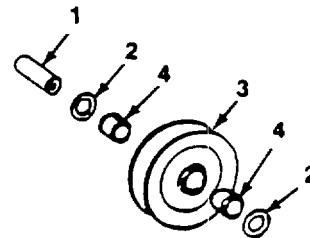
Materials/Parts:

Cleaning Solvent  
 Item 17, Appendix E  
 Grease  
 Item 22, Appendix E

**DISASSEMBLY**

DISASSEMBLE RAMP SHEAVES.

- a. Remove sheave pin (1).
- b. Remove flat thrust washers (2) from sheave (3).
- c. Remove bushing halves (4) from sheave (3).  
 Use arbor press to remove.



**CLEANING**

CLEAN ALL PARTS.

**WARNING**

**Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 1380F (38° - 59° C).**

Clean parts in cleaning solvent Fed.  
 Spec P-D-680 and dry thoroughly.

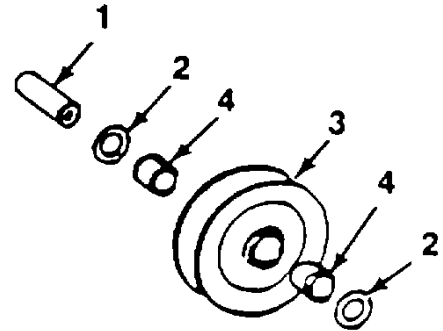


**6-11 REPAIR RAMP SHEAVES AND LATCH MECHANISM (Continued).**

**INSPECTION**

INSPECT RAMP SHEAVES.

- a. Inspect wire rope for broken strands, kinks or other damage.
- b. Inspect cable sheave, bushings, pins, and thrust washers for cracks, breaks or burrs.
- c. Replace defective parts as required with a serviceable-like item.
- d. Remove burrs by grinding smooth or light stoning.
- e. Replace gaskets and seals.



**ASSEMBLY**

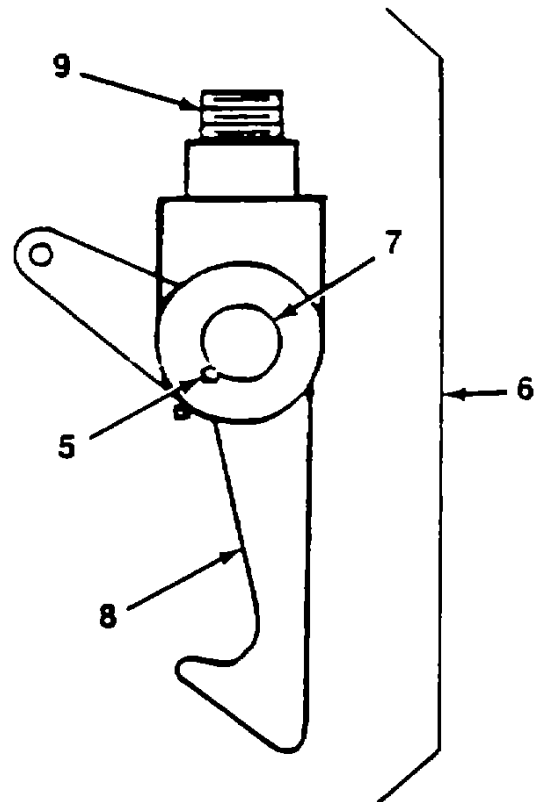
ASSEMBLE RAMP SHEAVES.

- a. Press bushing halves (4) into sheaves (3). Use arbor press.
- b. Install thrust washers (2) in sheave (3).
- c. Install sheave pin (1).

**DISASSEMBLY**

DISASSEMBLE LATCH MECHANISM

- a. Remove lube fittings (5) from latch (6).
- b. Remove pin (7) from latch (6).
- c. Remove latch arm (8) from clevis (9).



**6-11 REPAIR RAMP SHEAVES AND LATCH MECHANISM (Continued)****INSPECTION**

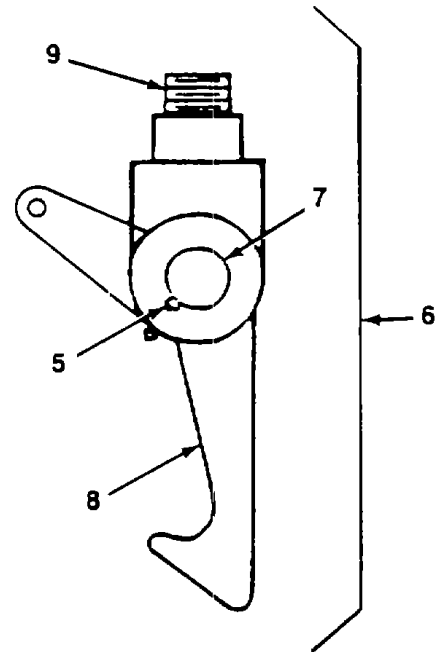
INSPECT LATCH MECHANISM.

- a. Inspect latch pins for burrs or cracks, threaded parts for thread damage, clevis and latch for cracks or breaks.
- b. Replace defective parts as required with a serviceable-like item.
- c. Remove burrs by grinding smooth or light sanding.
- d. Replace gaskets and seals.

**ASSEMBLY**

ASSEMBLE LATCH MECHANISM.

- a. Install clevis (9) on latch arm (8) with pin (7).
- b. Install lube fitting (5) to latch (6).
- c. Grease latch mechanism using MIL-G-18709.



**MAINTENANCE OF HYDRAULIC STEERING PUMP**

**6-12 REPAIR STEERING PUMP.**

- This task covers:
- |                |               |
|----------------|---------------|
| a. Disassembly | c. Inspection |
| b. Cleaning    | d. Assembly   |

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Bench Vise  
Pin Punch

Equipment Conditions:

Reference  
Para 5-29 Pump removed

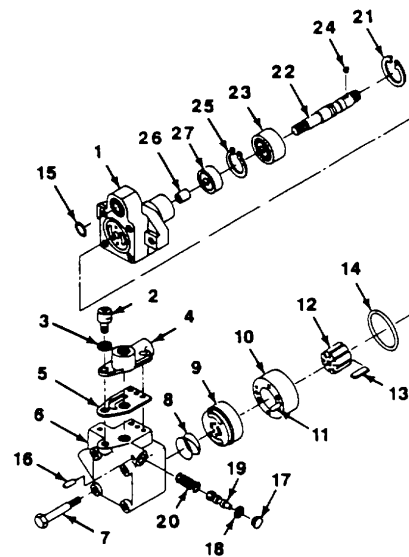
Materials/Parts:

Cleaning Solvent  
Item 17, Appendix E  
Cartridge Kit  
P/N 912056L  
Cartridge Kit  
P/N 912056  
Gasket Kit  
P/N 922793

**DISASSEMBLY**

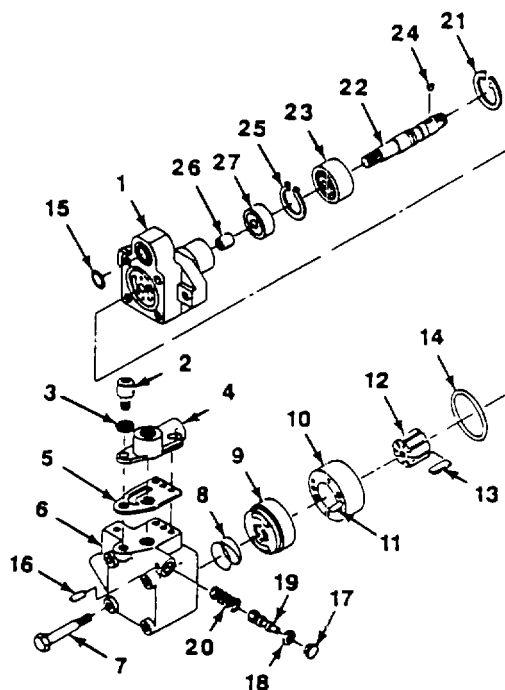
DISASSEMBLE STEERING PUMP.

- Clamp mounting flange of body (1) in bench vise. Use protective jaws.
- Remove screws (2), washer (3), manifold (4) and gasket (5) from cover (6).
- Remove four screws (7) from cover (6). Separate cover (6) from body (1).
- Remove spring (8) and pressure plate (9) from the body (1).



**6-12 REPAIR STEERING PUMP (Continued).**

- e. Remove cam ring (10), pins (11), rotor (12), vanes (13) and two 'O' rings (14 and 15) from body (1).
- f. Clamp cover (6) in bench vise. Drive out retaining pin (16) with a pin punch.
- g. Remove plug (17), 'O' ring (18), control valve (19) and spring (20) from cover (6).
- h. Remove retaining ring (21). Press shaft (22) and bearing (23) from the body (1) as a subassembly. Remove the Woodruff key (24). Do not remove retaining ring (25) from shaft (22) unless bearing (23) is defective.
- i. Use a pin punch and hammer to tap the needle bearing (26) and shaft seal (27) if defective.

**CLEANING**

CLEAN ALL PARTS

**WARNING**

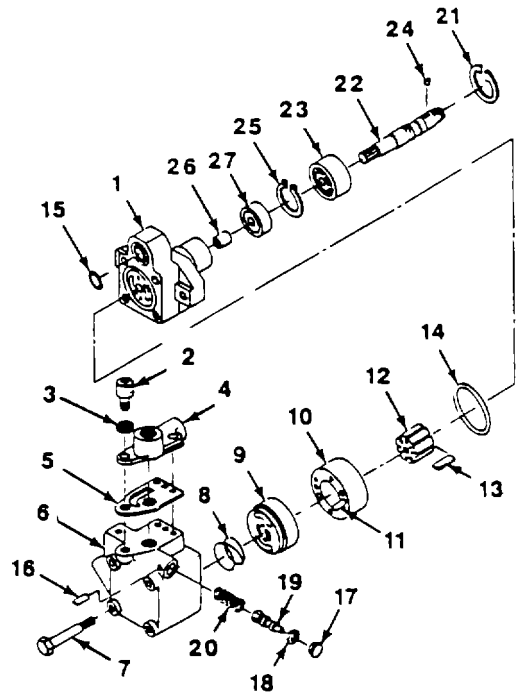
Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59° C).

- a. Clean bearings in solvent P-D-680 to remove dirt and old lubricant. Do not spin ball bearings or use compressed air to dry bearings after cleaning. Allow bearings to air dry.
- b. Clean metal parts in solvent P-D- 680.

**6-12 REPAIR STEERING PUMP (Continued).****INSPECTION**

## INSPECT ALL PARTS

- a. Discard and replace the used shaft seal (27) and all 'O' rings (14, 15 and 18).
- b. Check the bearings (23 and 26) for wear and looseness. Check for pitted or cracked races. Replace all defective bearings with new ones.
- c. Check the body (1), pressure plate (9), cam ring (10) and rotor (12) for scoring and wear, replace as necessary.
- d. Inspect the shaft seal mating surface on the shaft (22) for scoring.
- e. Inspect shaft (22) for burrs or nicks. If marks on the shaft cannot be removed by light polishing, replace the shaft (22).
- f. Inspect the vanes (13) for burrs, wear and excessive play in rotor (12) slots. Replace vanes (13) and rotor (12) if slots are worn.
- g. Stone all mating surfaces of body (1) and cover (6) to remove burrs and sharp edges. Wash and blow dry after stoning.
- h. Insert control valve (19) into. Its bore within the cover (16). Rotate the control valve (19) through 360 degrees while moving in and out of the bore to test for bind. Check the valve for wear and replace if worn or the lands are scratched.



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**6-12 REPAIR STEERING PUMP (Continued).**

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- i. Inspect the valve plug (17) torque by first placing the control valve (19) in a bench vise, then tightening the vise enough to prevent the plunger from turning. Use a torque wrench and appropriate socket to check the torque of the valve plug (17). The plug should be torqued to a value of 5 to 6 lb ft.

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**ASSEMBLY**

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**ASSEMBLE STEERING PUMP****NOTE**

**Tools for installing needle bearings can be made from round tubular stock. The outside diameter of the round stock must be slightly smaller than the outside diameter of the needle bearing.**

- a. Press needle bearing (26) into body (1), using a needle bearing pressing tool (noted above) and an arbor press.

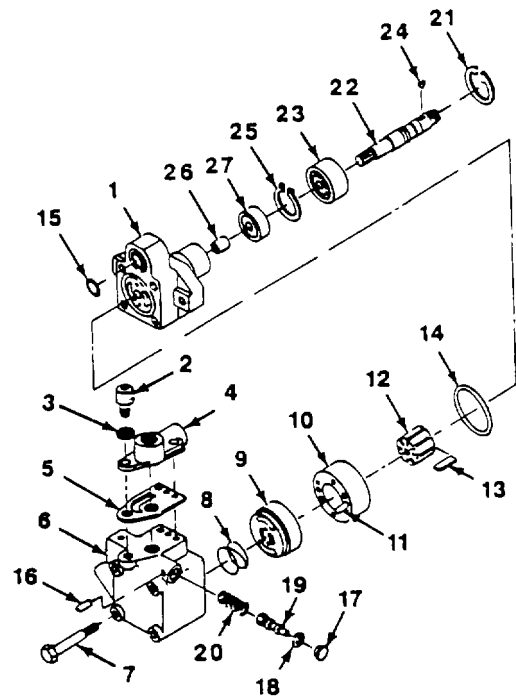
**NOTE**

**A shaft driver must be used to insure installation of the shaft seal without damage.**

- b. Position the shaft seal (27) with spring side of seal facing body (1). Press shaft seal (27) in place until it engages the shoulder within the body.
- c. If removed or found defective, press a new bearing (23) on shaft (22), using an arbor press. (All force should be applied to the inner race of the bearing.)
- d. Install the small retaining ring (25) in place within its groove on the shaft (22). (The sharp break edge of the retaining ring must be facing the bearing at assembly.)

**6-12 REPAIR STEERING PUMP (Continue(d)).**

- e. Slide the shaft assembly (22, 24 and 25) into the body (1).
- f. Install large retaining ring (21) into retaining ring groove of the body (1).
- g. Insert Woodruff key (24) into the shaft (22). Tap in place with a small hammer to seat the key.
- h. Install body (1) mounting flange into a bench vise with shaft end down. Install 'O' rings (15 and 14) into grooves.
- i. Insert vanes (13) into rotor (12) with radius edge toward the cam ring (10). Place the rotor (12) and vanes (13) on top of the body (1) with the rotor counterbore toward the body.
- j. Insert pins (11) through cam ring (10) and place the cam ring over rotor (12) and vanes (13). Check the model code for direction of rotation and position arrow on the cam ring to agree with model code (R - clockwise, L - counterclockwise as viewed from the shaft end).
- k. Install pressure plate (9) over pins (11) and up against the cam ring (10), rotor (12) and vanes (13).
- l. Place spring (8) on top of pressure plate (9), then install cover (6) over spring (8).
- m. Line up cover screw holes with body (1), thread four screws (7) through cover (6) and into body (1). Torque screws (7) to 25-30 lb ft.
- n. Insert spring (20) into control valve bore of cover (6).

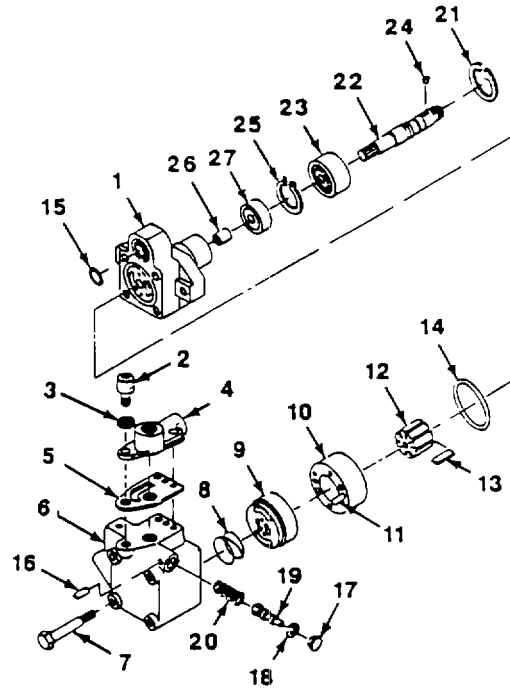


6-12 REPAIR STEERING PUMP (Continued).

**CAUTION**

**If the control valve is reversed in the counterbore, the unit will malfunction and pressure will rise dangerously high.**

- o. Install control valve (19) with the hex head going first into the bore.
- p. Install a new 'O' ring (18) on plug (17) and slide the plug into the cover (6). Press plug fully and insert tapered pin (16) to retain the plug in place. Tap the tapered pin (16) to lock in place.
- q. Install gasket (5). Locate gasket on top of cover mounting surface.
- r. Place manifold (4) over gasket (5) and align holes to cover (6).
- s. Install copper washer (3) over screws (2) and thread screws (2) into cover (6). Torque to 90-100 lb in.
- t. Install copper washer (3) over screws (2) and thread screws (2) into cover (6). Torque to 90-100 lb in.





**MAINTENANCE OF STEERING CYLINDERS****6-13 REPAIR STEERING CYLINDERS.**

This task covers:                    a. Disassembly                    c. Inspection  
    b. Cleaning                        d. Assembly

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Equipment Conditions:

Reference  
 Para 5-30. Cylinder removed.

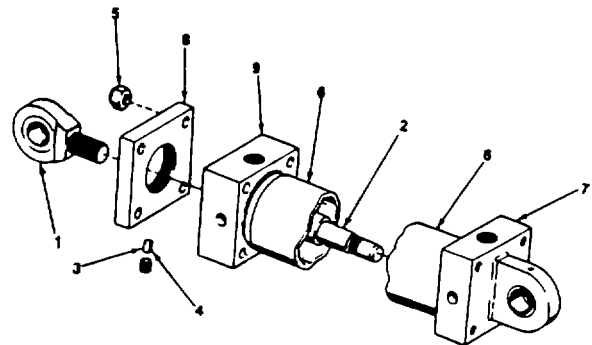
Materials/Parts:

Cleaning Solvent  
 Item 17, Appendix E  
 Hydraulic Fluid  
 Item 22, Appendix E

**DISASSEMBLY**

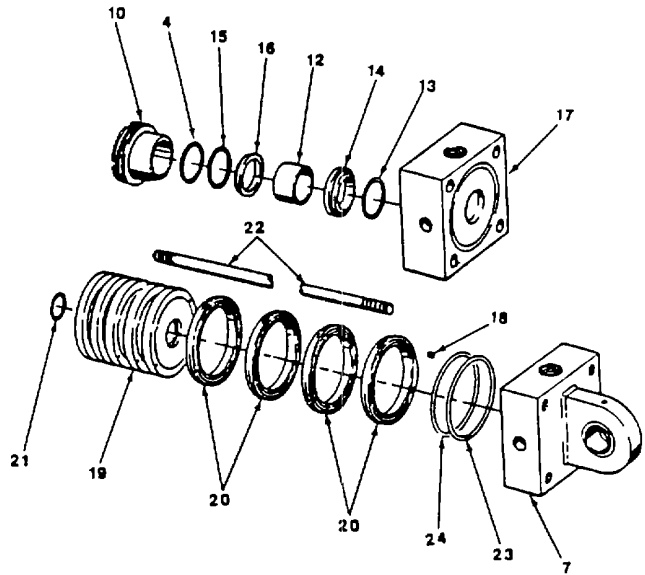
## DISASSEMBLE STEERING CYLINDERS.

- a. Drain hydraulic fluid by manually cycling cylinders. Compressed air can be used.
- b. Remove stud (1) from end of piston rod (2). Use flat on piston rod.
- c. Remove cartridge setscrew (3) and slug (4).
- d. Remove tie rod nuts (5).
- e. Withdraw piston rod (2) assembly from cylinder (6).
- f. Remove cylinder (6) from end cap cover (7).
- g. Remove cartridge retainer plate (8) and head end cover (9) from cylinder rod (6).



**6-13 REPAIR STEERING CYLINDERS (Continued).**

- h. Remove bearing cartridge (10), rod wiper (11), and rod bearing (12). Discard rod wiper.
- i. Remove rod packing retaining ring (13) and packing (14). Discard packing.
- j. Remove cartridge ring (15) and preformed packing (16) from head end cover (17). Discard packing.
- k. Remove piston retaining lock screw (18), piston (19), piston ring packings (20), and preformed packing (21). Discard packings.
- l. Unscrew tie rods (22) from end cap cover (7).
- m. Remove 'O' ring retainer (23) and packing (24) from end cap cover (7). Discard packing.



**CLEANING**

CLEAN ALL PARTS

**WARNING**

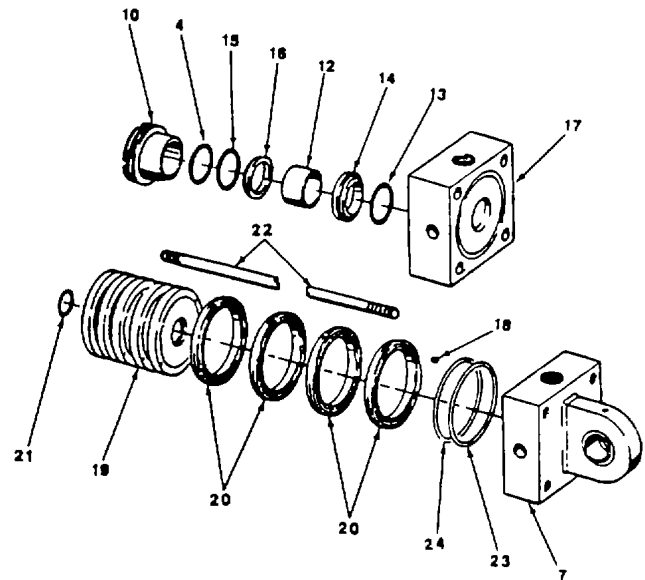
Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59° C).

Clean all metal parts using cleaning solvent, Fed. Spec. P-D-680, and dry thoroughly.

**6-13 REPAIR STEERING CYLINDERS (Continued).****INSPECTION**

## INSPECT CYLINDER PARTS

- a. Inspect piston rod for scoring.
- b. Inspect threaded parts for thread damage.
- c. Inspect end covers for nicks, burrs, cracks, or other damage.
- d. Inspect cylinder bore for wear.
- e. Replace damaged parts with a serviceable-like item as required.

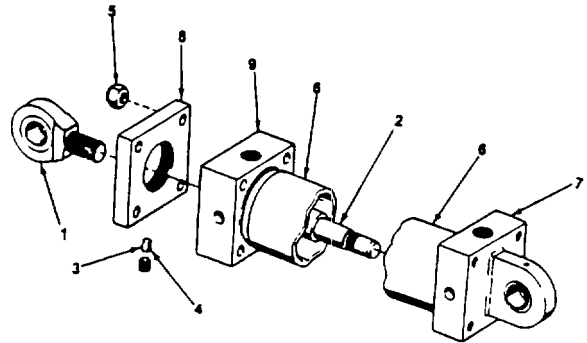
**ASSEMBLY**

## ASSEMBLE STEERING CYLINDER

- a. Lightly lubricate all parts before installation. Use hydraulic fluid MIL-L-17272B.
- b. Install 'O' ring retainer packing (24) and retainer (23) in end cap cover (7) Use new packing.
- c. Thread tie rods (22) into end cap cover (7).
- d. Install preformed packing (21), piston ring packings (20), piston (19), and secure with piston retaining lockscrew (18). Use new packings.
- e. Install cartridge ring packing (16) and cartridge ring (15) in head end cover (17). Use new packing.
- f. Install head end cover (17) on piston rod (2).

**6-13 REPAIR STEERING CYLINDERS (Continued).**

- g. Install rod packing (14) and retaining ring (13). Use new packing.
- h. Install rod bearing (12), rod wiper (11), and bearing cartridge (10).
- i. Install cartridge retainer plate (8) on head end cover (9).
- j. Install cylinder (6) and piston rod (2) assembled into end cap cover (7).
- k. Install tie rod nuts (5).
- l. Install cartridge slug (4) and setscrew (3).
- m. Install stud (1) onto end of piston rod (2).



**MAINTENANCE OF HYDRAULIC STEERING SYSTEM**

**6-14 REPAIR HELM UNIT.**

- This task covers:
- |                |               |
|----------------|---------------|
| a. Disassembly | c. Inspection |
| b. Cleaning    | d. Assembly   |

**INITIAL SETUP**

Tools:

Tool Kit, Mechanic's Rail  
and Marine  
5180-00-629-9783  
Helm Unit Valve Spring Installer  
J600057 (96151)

Equipment Conditions:

Reference  
Para 5-31 Helm unit  
removed

Materials/Parts:

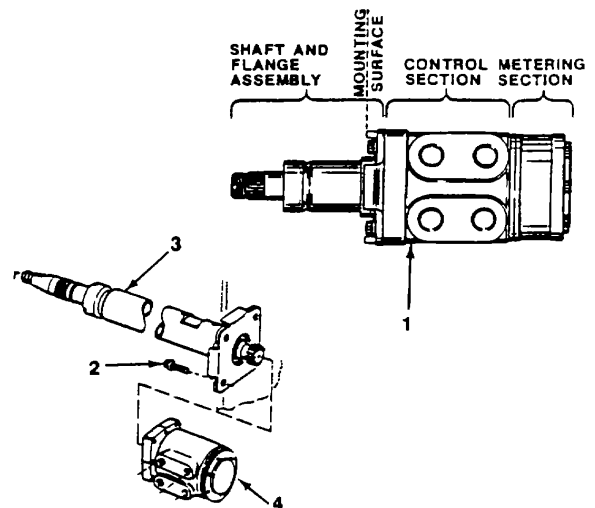
Cleaning Solvent  
Item 17, Appendix E  
Seal Kit  
P/N 5140(96151)  
600 Grit Abrasive Paper  
Item 21, Appendix E

**DISASSEMBLY**

**NOTE**

**Perform maintenance in a clean work area. The introduction of foreign material into hydraulic components is undesirable.**

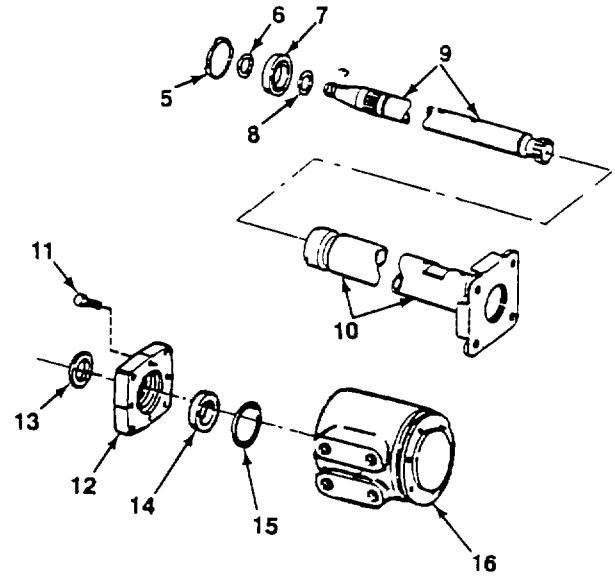
1. REMOVE SHAFT AND FLANGE ASSEMBLY FROM HELM UNIT.
  - a. Grip the main body of the helm unit (1) in a vise, using protective jaws.
  - b. Remove four mounting bolts (2) and separate the shaft and flange assembly (3) from the control and metering assembly (4).



**6-14 REPAIR HELM UNIT (Continued).**

**2. DISASSEMBLE SHAFT AND FLANGE ASSEMBLY.**

- a. Remove retaining rings (5 and 6), bearing (7) and retaining ring (8).
- b. Remove shaft (9) from tube and flange unit (10).



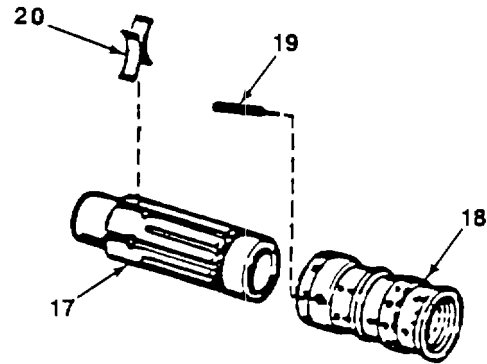
**3. DISASSEMBLE CONTROL SECTION.**

- a. With control section supported in a vise, loosen four capscrews (11) and remove mounting plate (12).
- b. Remove oil seal (13) and bushing (14); remove preformed parking (15) from the face of the housing (16).

**CAUTION**

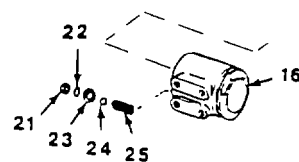
**When removing the spool and sleeve assembly, be extremely careful to prevent these parts from binding, as they are very closely fitted. They must generally be rotated slightly as they are withdrawn.**

- c. Place housing (16) on a solid surface with port face down, so that it can be held securely, remove control spool (17) and control sleeve (18) from housing (16).
- d. Push inside lower edge of control spool (17) so that spool moves toward splined end (19) from control sleeve (18).
- e. Remove centering spring set (20) out of spring slot in control spool (17).

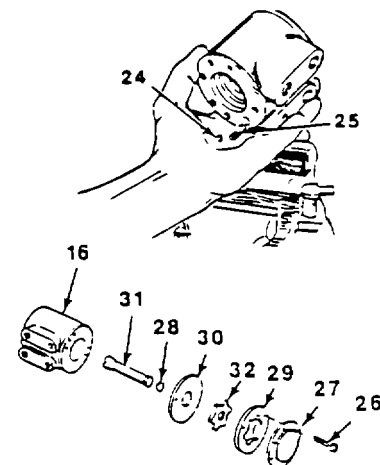


**6-14 REPAIR HELM UNIT (Continued).**

- f. Remove seal plug (21), packing (22), unscrew check valve seat (23), using a 3/16 hex wrench.
- g. Position housing in hand and tap lightly to remove steel ball (24) and compression spring (25).

**4. DISASSEMBLE METERING SECTION.**

- a. Loosen six capscrews (26) from the end of the housing (16) and remove end cap (27).
- b. Remove shaft spacer (28), meter gear (29), plate (30) and drive shaft (31) from housing (16). Remove meter gear star (32) from meter gear (29).

**CLEANING**

CLEAN ALL PARTS OF THE HELM UNIT.

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59° C).

- a. Clean all parts, except packing, in cleaning solvent Fed. Spec. P-D-680.
- b. Set parts on clean paper towel to dry.
- c. Remove burrs from all surfaces of the material sections with 600 grit abrasive paper by polishing.
- d. After polishing each part, rinse clean in solvent and blow dry. Keep these parts absolutely clean until they are assembled.

**6-14 REPAIR HELM UNIT (Continued).**

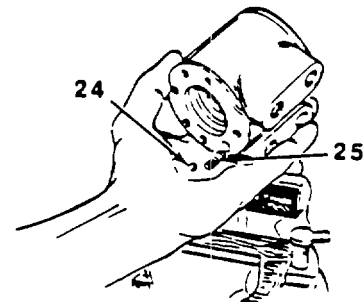
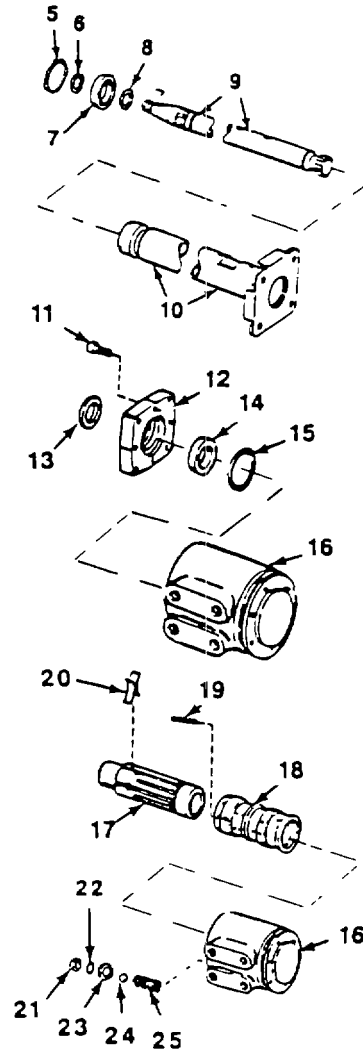
**INSPECTION**

1. INSPECT SHAFT AND FLANGE ASSEMBLY.

- a. Inspect retaining rings (5, 6, and 8) and bearing (7) for damage. Replace with new parts as necessary.
- b. Check to see if shaft (9) is bent, scored or otherwise damaged. Remove minor defects or replace as necessary.

2. INSPECT CONTROL SECTION.

- a. Inspect mounting plate (12), and bushing for cracks, scoring or otherwise damage. Replace as necessary.
- b. Inspect and discard oil seal (13) and preformed packing (15). Replace with new parts.
- c. Check spring set (20) for loss of tension, replace as necessary.
- d. Inspect splines on control spool (17) for nicks and burrs. Remove defects or replace entire control spool as necessary.
- e. Inspect sleeve (18) for wear, replace as necessary.
- f. Discard seal plug (21), packing (22); unscrew check valve seat (23), steel ball and springs (25); get new parts from the replacement kit.
- g. Inspect threaded parts for thread damage. Re-thread or replace part as necessary.

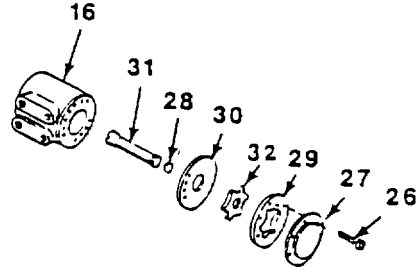




**6-14 REPAIR HELM UNIT (Continued).**

3. INSPECT METERING SECTION.

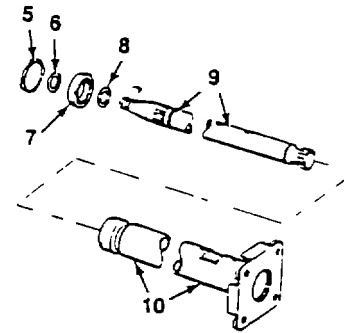
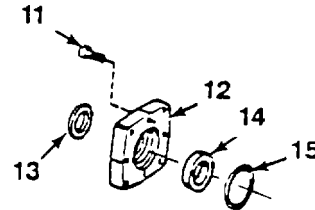
- a. Inspect end cap for cracks or other damage.
- b. Inspect set and plate (30) for burrs, nicks or other damage. Remove minor defects or replace entire part as necessary.
- c. Inspect spacer (28) and drive shaft (31) for cracks, burrs, wear or other damage. Repair/replace as necessary.



**ASSEMBLY**

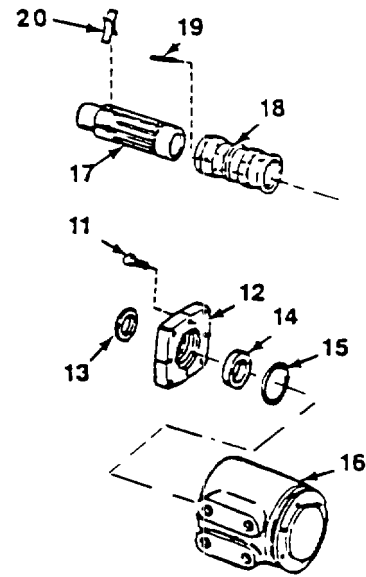
1. ASSEMBLE CONTROL SECTION.

- a. Position housing (16) in a vise with control end up.
- b. Install check valve compression spring (25) with large end down. Drop steel ball (24) into the check valve hole and ensure that it rests on top of the small end of the compression spring (25).
- c. Install check valve seat (23) using a 3/16 hex wrench. Tighten check valve seat. Test check ball action by pushing ball with a small clean pin against spring force. Ball need not be snug against seat for proper functioning.
- d. Install new packing (22) and seal plug (21) using a steady pressure.
- e. Install control spool (17) in control sleeve (18) carefully, so that spring slots of both parts are on the same end. Rotate while sliding parts together. Spool should rotate freely in sleeve.



**6-14 REPAIR HELM UNIT (Continued).**

- f. Align spring slots of control spool (17) and sleeve (18) and install spring set (20) using spring installation tool J600057.
- g. Install centering pin (19) through control spool and sleeve assembly
- h. Install control spool and sleeve assembly in housing (16) so that the splined end of the spool enters first. With the control spool and sleeve assembly in this flush position, check for free rotation within the housing.
- i. Install new preformed packing (15) and bushing (14) on housing (16).
- j. Install oil seal (13) in counter bore of mounting plate (12) and install mounting plate on housing (16). Secure with four capscrews (11). Torque evenly to 250 pound-inches.

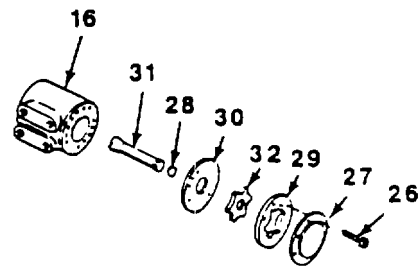


**2. ASSEMBLE METERING SECTION.**

**CAUTION**

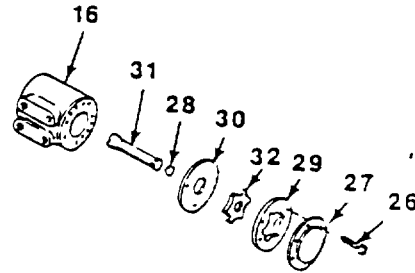
**Alignment of the cross slot in the drive with valleys between the teeth of the meter gear star determines proper valve timing of the unit. There are 12 teeth on the spline and 6 pump teeth on the star. Alignment is exactly right in 6 positions and exactly wrong in 6 positions. If the parts slip out of position during this part of the assembly, repeat until you are certain that correct alignment is obtained.**

- a. Place the plate (30) over the housing (16) so that both holes in the plate align with the tapped holes in the housing. Place the meter gear (29) on the assembly as the bolt holes align.



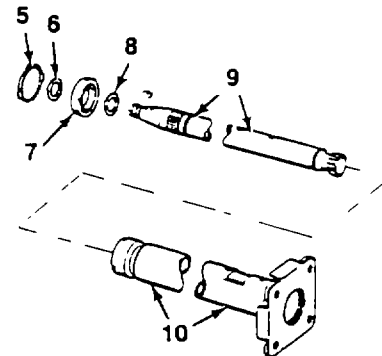
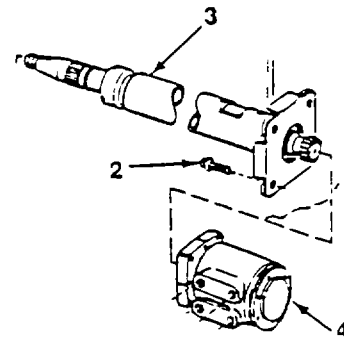
**6-14 REPAIR HELM UNIT (Continued).**

- b. Place the splined end of the drive shaft (31) within the meter gear star (32) so that the slot at the control end of the drive shaft is in alignment with the valleys between the meter gear teeth. Push the splined end of the drive shaft (31) through the meter gear star (32) so that the spline extends about one half its length beyond the meter gear star.
- c. Install the drive shaft and meter gear star assembly onto the housing so that the meter gear star (32) fits into the meter gear (29).
- d. Rotate the meter gear star (32) slightly to bring the cross slot of the drive shaft (31) into engagement with the centering pin.
- e. Install the spacer (28) in the slot of the meter gear star (32) so that it is flush with the gear surface. (If the spacer does not drop flush with the gear surface, the drive has not properly engaged the centering pin.
- f. Install the end cap (27) and secure with six capscrews (26). Torque evenly to 150 pound-inches.



**3. ASSEMBLE AND INSTALL SHAFT AND FLANGE ASSEMBLY.**

- a. Install retaining ring (8), bearing (7) and retaining ring (6 and 5) onto shaft (9).
- b. Install shaft assembly into flange unit (10).
- c. Install shaft and flange assembly (3) into the control and metering assembly (4).
- d. Secure unit with four mounting bolts (2).



**MAINTENANCE OF STEERING SYSTEM FLOW DIVIDER****6-15 REPAIR FLOW DIVIDER.**

This task covers:                    a. Disassembly                    c. Inspection  
     b. Cleaning                        d. Assembly

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

Equipment Conditions:

Reference  
 Para 5-34. Flow Divider removed.

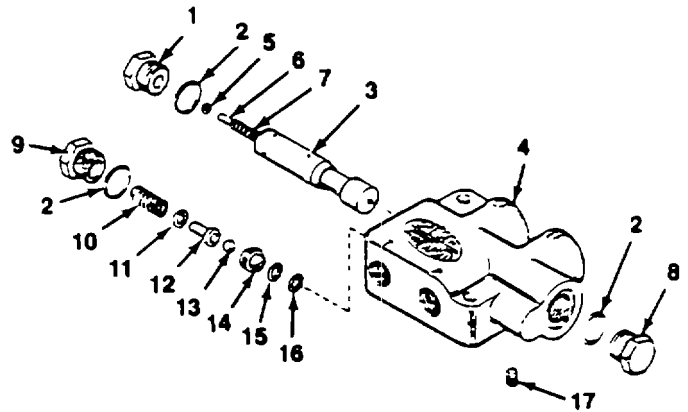
Materials/Parts:

Cleaning Solvent  
 Item 17, Appendix E  
 Preformed Packing  
 P/N 2707 & 2503  
 'O' Ring Set Washer  
 P/N 1453  
 Relief Spring  
 P/N 1450

**DISASSEMBLY**

## DISASSEMBLE FLOW DIVIDER.

- a. Remove hollow spool cap (1) and preformed packing (2).
- b. Remove spool (3) from housing (4).
- c. Remove spool spring shim (5), guide (6), and spring (7) from spool.
- d. Remove solid spool cap (8) and packing (2).
- e. Remove relief cap (9) and preformed packing (2).
- f. Remove relief spring (10), shim (11), guide (12), and relief ball (13).
- g. Remove seat (14), 'O' ring set washer (15), and preformed packing (16).



**6-15 REPAIR FLOW DIVIDER (Continued).**

- h. Remove pipe plug (17) from bottom of housing (4).

**CLEANING**

CLEAN ALL PARTS

**WARNING**

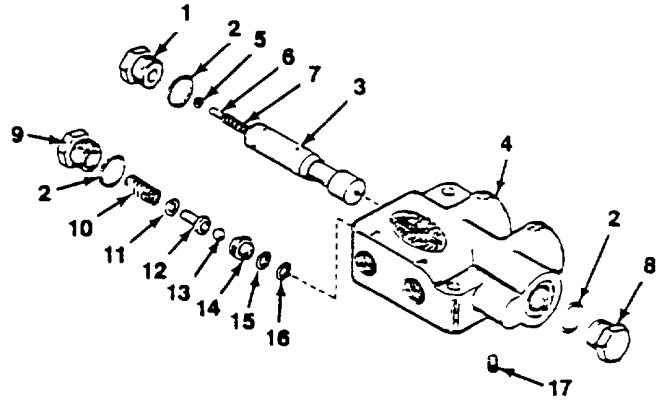
Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59° C).

Clean metal parts in cleaning solvent, Fed Spec. P-D-680, and dry thoroughly.

**INSPECTION**

INSPECT FLOW DIVIDER.

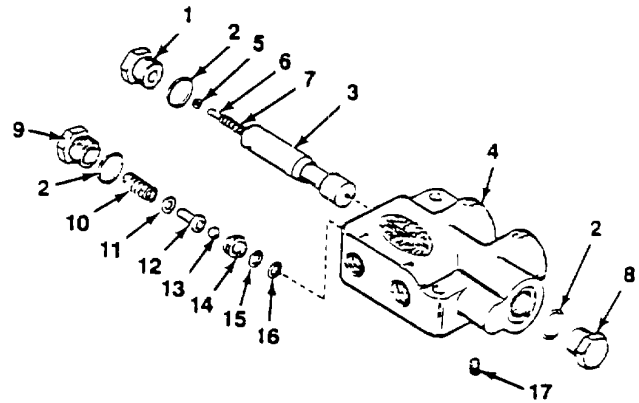
- a. Inspect springs for distortion or loss of tension.
- b. Inspect threaded parts for thread damage.
- c. Inspect spool for burrs, scoring or plugged ports.
- d. Inspect shims for wear.
- e. Inspect ball for burrs or flat spots.
- f. Inspect guides for burrs or wear.
- g. Inspect housing for cracks.
- h. Replace all packings.
- i. Replace defective springs.
- j. Replace damaged threaded parts.



**6-15 REPAIR FLOW DIVIDER (Continued).****ASSEMBLY**

## ASSEMBLE FLOW DIVIDER.

- a. Install pipe plug (17) in bottom of housing.
- b. Install preformed packing (16), 'O' ring set washer (15), and seat (14).
- c. Install ball (13), guide (12), shim (10) and relief spring (10).
- d. Secure with packing (2) and relief cap (9).
- e. Install packing (2) and solid spool cap (8) in housing (4).
- f. Place spring (7), guide (6), and shim (5) on end of spool (3).
- g. Insert spool (3) into housing (4) and secure with packing (2) and hollow spool cap (1)



**MAINTENANCE OF COUNTERBALANCE VALVE****6-16 REPAIR COUNTERBALANCE VALVE.**

This task covers:

a. Disassembly	c. Inspection
b. Cleaning	d. Assembly

**INITIAL SETUP**Tools:

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Reference  
Para 5-35. Counterbalance valve  
removed.

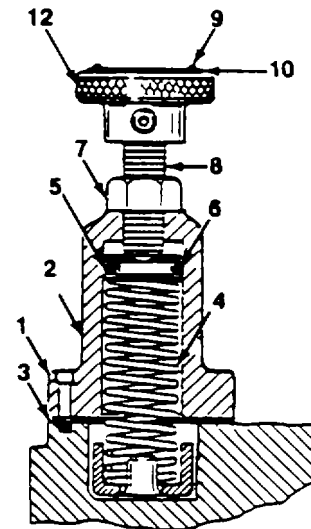
Materials/Parts:

Cleaning Solvent  
Item 17, Appendix E  
Preformed Packing  
P/N 82-20007-01,82-20210-01  
and AN 6227-22  
Cap Gasket  
P/N 10-01256-02  
Check Spring  
P/N 10-00159-02

**DISASSEMBLY**

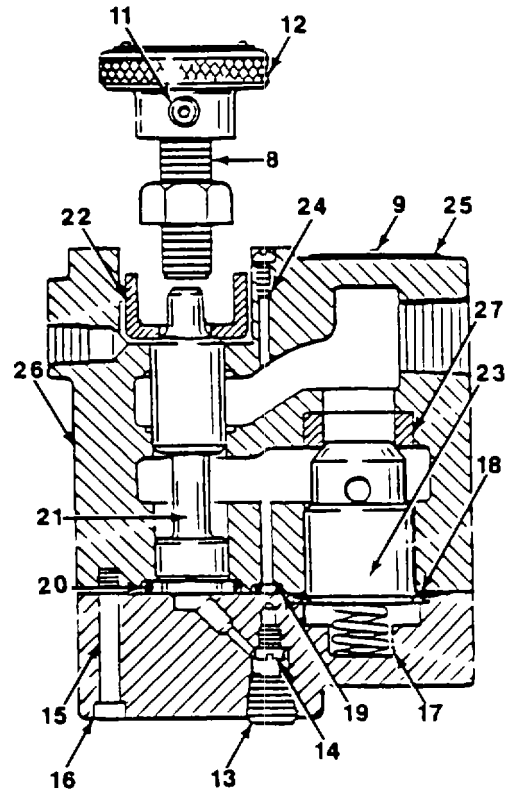
## DISASSEMBLE COUNTERBALANCE VALVE.

- Remove setscrews (1) and top cap (2).
- Remove top cap gasket (3).
- Remove main spring (4).
- Remove spring follower (5) and preformed packing (6).
- Loosen locknut (7) and remove setscrew (8) with attached parts. Do not remove locknut unless damaged.
- If damaged or illegible, remove drive screws (9) and identification plate (10) from adjusting knob (12).



**6-16 REPAIR COUNTERBALANCE VALVE (Continued).**

- g. If damaged or defective, loosen setscrew (11) and remove adjusting knob (12) from setscrew (8).
- h. Remove pipe plug (13) and plug (14) from bottom cap (16), if necessary (16).
- j. Remove check spring (17) and preformed packings (18, 19 and 20).
- k. Remove main spool (21) and spring stop and seat (22).
- l. Remove check spool (23).
- m. Remove machine screw (24).
- n. If damaged or illegible, remove drive screw (9) and identification plate (25) from body (26).
- o. Remove check spool seat (27).



**CLEANING**

CLEAN ALL PARTS.

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100° - 138° F (38° - 59° C).

Clean all metal parts in cleaning solvent P-D-680 and dry thoroughly.



**6-16 REPAIR COUNTERBALANCE VALVE (Continued).**

**INSPECTION**

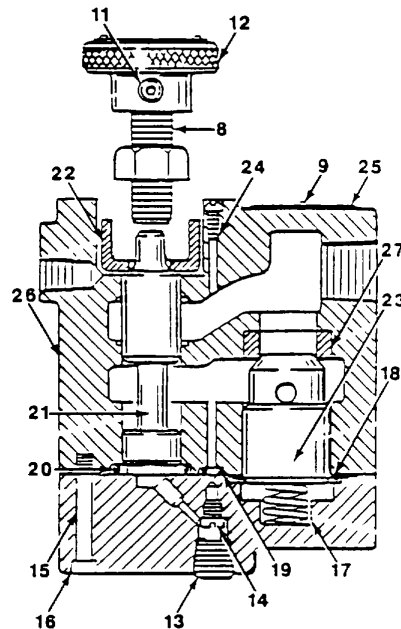
**INSPECT COUNTERBALANCE VALVE**

- a. Inspect threaded parts for thread damage.
- b. Inspect identification plates for legibility.
- c. Inspect springs for distortion or loss of tension.
- d. Inspect spools for burrs or score marks
- e. Inspect spring stop and seat for wear.
- f. Replace all packings and gaskets.
- g. Replace defective springs.
- h. Replace defective threaded parts.

**ASSEMBLY**

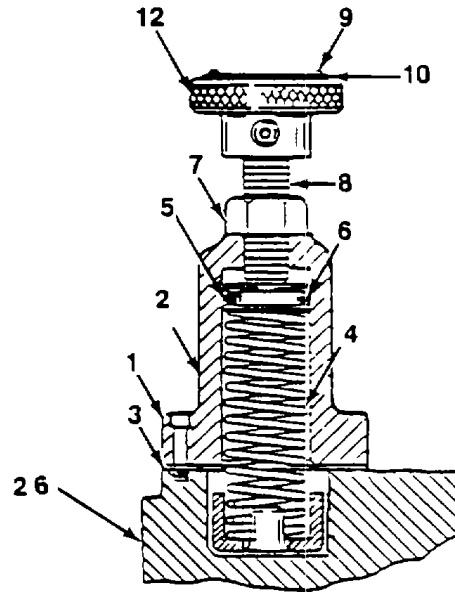
**ASSEMBLE COUNTERBALANCE VALVE.**

- a. Install check spool seat (27).
- b. If removed, install identification plate (25) with drive screws (9).
- c. Install machine screw (24) in body (26).
- d. Install check spool (23), spring stop and seat (22) and main spool (21).
- e. Install packings (20, 19, and 18) and check spring (17).
- f. Secure bottom cap (16) to body (26) with socket head screws (15).
- g. Install plug (14) and pipe plug (13) into bottom cap.



**6-16 REPAIR COUNTERBALANCE VALVE (Continued).**

- h. If removed, install adjusting knob (12) onto setscrew (8) with setscrew (11).
- i. If removed, install identification plate (10) onto adjusting knob (12) with drive screws (9).
- j. If removed, install locknut (7) onto setscrew (8) and insert adjusting knob and associated parts into top cap (3).
- k. Insert preformed packing (6) into spring follower (5) and install spring follower (5) and main spring (4).
- l. Position top cap gasket (3) in place on body (26).
- m. Install assembled top cap (2) to valve body (26) with setscrews (1).
- n. Refer to para. 2-7.10 for adjustment.



**6-17 REPAIR RECHARGING PUMP.**

- This task covers
- |                |               |               |
|----------------|---------------|---------------|
| a. Disassembly | c. Inspection | e. Adjustment |
| b. Cleaning    | d. Assembly   |               |

INITIAL SETUP

Tools

Tool Kit, Mechanic's, Rail and Marine  
 5180-00-629-9783  
 Vice  
 Installer, Shaft Seal (EHS 41-1533)

Equipment Conditions:

Reference  
 Para. 5-44 Recharging pump removed.

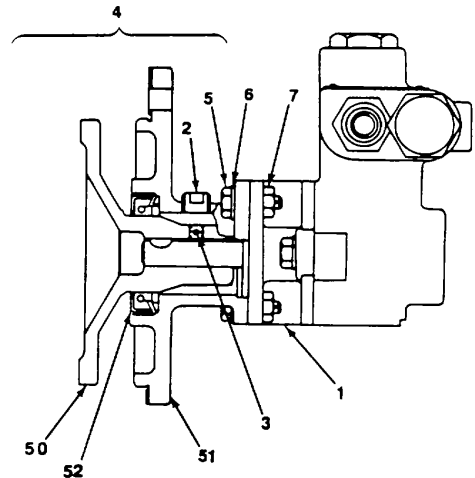
Materials/Parts

'O' Rings  
 P/N GA 1129-5, GA 1129-1, GA 1129-2 and GA 1129-4  
 Back-up Ring  
 P/N RG 1138 and RG 100157  
 Oil Seals  
 P/N SE 100082 and SE 1047  
 General Purpose Grease  
 Item 22, Appendix E  
 Cleaning Solvent  
 Item 17, Appendix E

DISASSEMBLY

**1. SEPARATE PUMP ASSEMBLY AND DRIVE ASSEMBLY**

- a. Clamp pump assembly (1) in a vise
- b. Remove pipe plug (2) and setscrew (3) from drive assembly (4)
- c. Remove four screws (5), lockwashers (6) and nuts (7) from the pump and drive assembly
- d. Use a wedge to separate the drive assembly (4) from the pump assembly (1).



## 6-17 REPAIR RECHARGING PUMP (Continued).

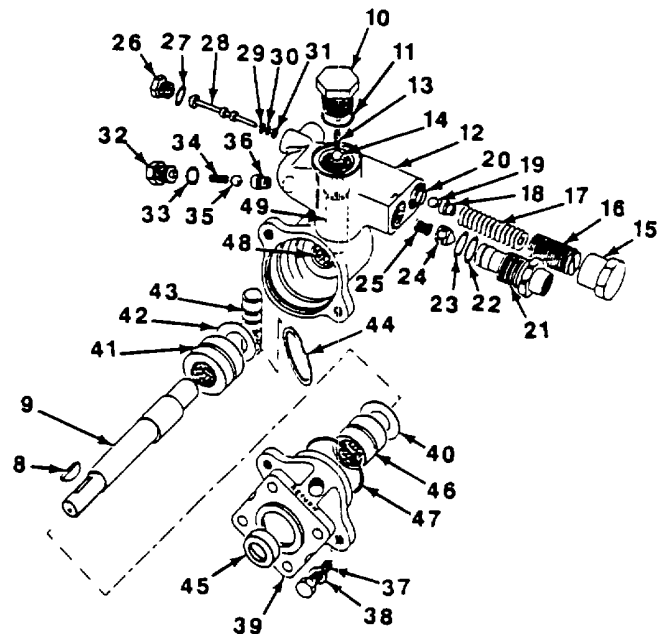
### 2. DISASSEMBLE PUMP

- a. Remove Woodruff key (8) from drive shaft (9)
- b. Remove hex plug (10) and 'O' Ring (11) from the top of pump housing (12) This will allow valve spring (13) and check ball (14) to be removed.
- c. Remove unloading valve cap (15), adjusting screw (16), spring (17), valve seat (18) and steel ball (19)

#### NOTE

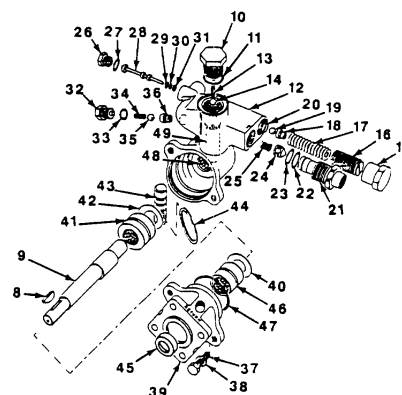
**Do not remove valve seat (20) unless replacement is required.**

- d. Remove adapter fitting (21), back-up ring (22), 'O' ring (23), inlet valve (24) and inlet valve spring (25)
- e. Remove hex plug (26) and 'O' ring (27) Insert a dowel in the opposite side and push valve plunger (28) out
- f. Remove back-up ring (29), 'O' ring (30) and back-up ring (31)
- g. Remove hex plug (32), 'O' ring (33), spring (34), check ball (35) and valve seat (36).
- h. Remove two screws (37) and lock-washers (38) holding mounting flange assembly (39)



**6-17 REPAIR RECHARGING PUMP (Continued).**

- i. Remove drive shaft (9), washer (40), needle bearing (41) and washer (42)
- j. Remove piston (43) and retaining rings (44)
- k. Press oil seal (45) and roller bearing (46) from mounting flange assembly (39) using an arbor press Remove and discard 'O' ring (47)



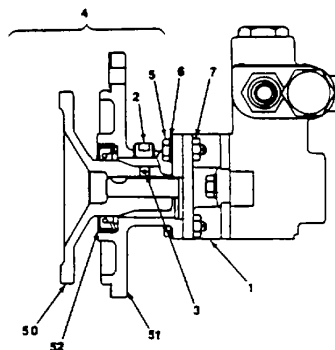
**NOTE**

The carrier needle bearing (48) in housing (12) should only be removed if it is to be replaced.

Sleeve (49) has been shrink-fitted into the housing. It is not replaceable.

**3. DISASSEMBLE DRIVE ASSEMBLY**

- a. Separate intermediate drive (50) from flange assembly (51)
- b. Remove oil seal (52) from flange assembly (51)



**CLEANING**

**CLEAN PUMP PARTS.**

**WARNING**

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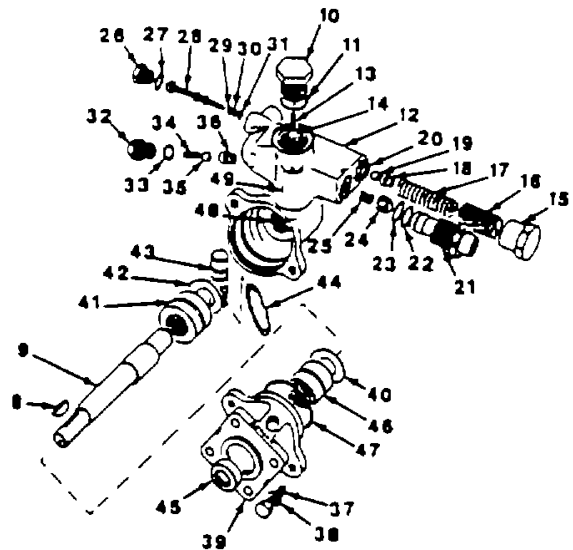
- a. Clean all parts thoroughly in cleaning solvent, Fed Spec P-D-680.

**6-17 REPAIR RECHARGING PUMIP (Continued).**

- b. Blow dry all parts, except needle bearings, with compressed air. Allow needle bearings to air dry.
- c. Remove foreign material from bleed hole of piston.

**INSPECTION****1. INSPECT PUMP COMPONENTS**

- a. Discard all 'O' rings (11, 23, 27, 30, 33 and 47) and oil seal (45), replace with new parts.
- b. Examine springs (13, 17, 25 and 34) to be sure that they are not bent, chaffed or otherwise deformed, replace springs as necessary.
- c. Inspect all check balls (14, 19, and 35) and valve seats (18 and 36) for scoring or other damage, replace as necessary.
- d. Inspect piston (43) for scratches or scoring, replace as necessary.
- e. Examine shaft (9) to be sure that it is free of burrs. Check to be sure the keyway is not broken or rounded over, replace as necessary.
- f. Inspect needle and roller bearings (41, 46 and 48) for wear, scoring, or grooving, replace as necessary.
- g. Examine pump housing (12) for cracks or other damage. Check threads for damage; replace as necessary.



**6-17 REPAIR RECHARGING PUMP (Continued).**

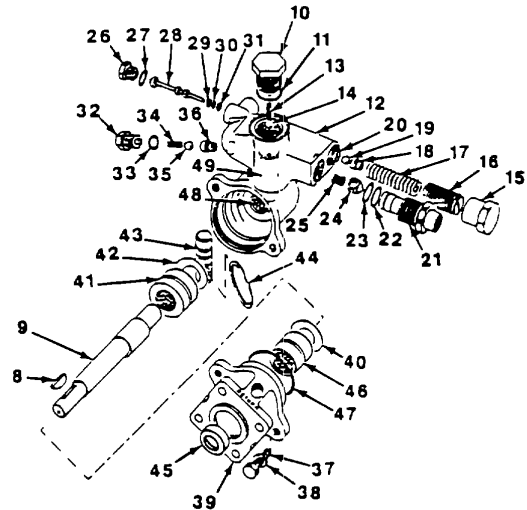
**2. INSPECT DRIVE COMPONENTS**

- a. Inspect intermediate drive for cracks and wear, replace as necessary
- b. Inspect flange assembly for cracks, wear and damaged threads, replace as necessary
- c. Inspect oil seal for physical damage, replace as necessary.
- d. Inspect pipe plug and setscrew for thread damage; replace as necessary

**ASSEMBLY**

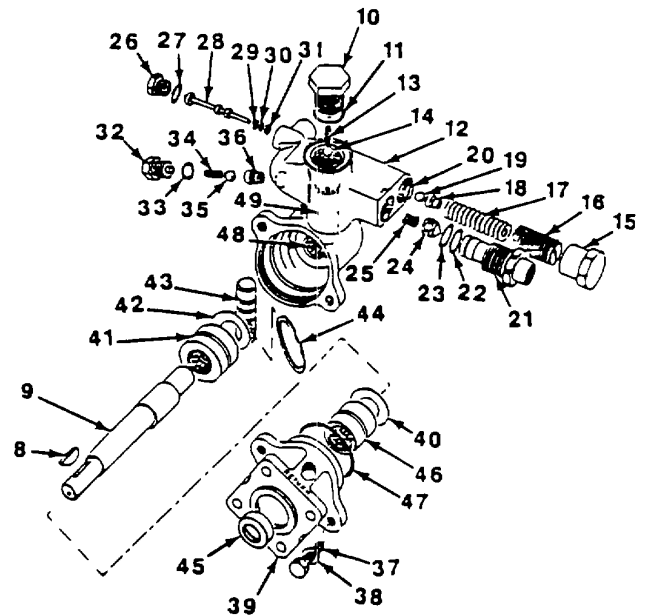
**1. ASSEMBLE PUMP**

- a. Press needle bearing (48) into pump housing (12), if it has been removed.
- b. Install two piston retaining rings (44) on piston (43). Be sure rings do not overlap each other. Put a light coat of grease on piston (43) and slide piston (43) with retaining rings (44) into sleeve (49). (Bleed hole in piston must be facing the inlet).
- c. Install needle bearing (41) and washer (42) on drive shaft (9) and then install drive shaft (9) into pump housing (12). Ensure that drive shaft enters needle bearing (48) freely



**6-17 REPAIR RECHARGING PUMP (Continued).**

- d. Put a light coat of grease or petroleum jelly on the outside diameter of the roller bearing (46) Press the roller bearing (46) into the bore of the mounting flange assembly (39) until it is flush with the surface
- e. Lubricate new oil seal (45) and press into the bore of the mounting flange assembly (39) to a depth of 1/4 inch below the surface of the flange Ensure that the garter spring in the oil seal is facing in the direction of the roller bearing.
- f. Install washer (40) on drive shaft (9) Using a shaft seal installation tool (Part No EHS 41-1533), Install mounting flange assembly (39) and 'OO' ring (47) over drive shaft (9)
- g. Secure mounting flange assembly (39) with two bolts (37) and lockwashers (38) before removing shaft seal installation tool
- h. Install check ball (14), spring (13) and hex plug (10) with a new 'O'ring (11).
- i. Install spring (25), inlet valve (24), and adapter fitting (21) with new 'O' ring (23) and back-up ring (22).
- j. Install valve seat (20) if removed. Install, check ball (19), valve seat (18), spring (17) and adjusting screw (16) Install unloading valve cap (15) loosely until final pressure adjustment is obtained
- k. Install back-up ring (29), 'O' ring (30) and back-up ring (31) on valve plunger (28). Install plunger assembly into pump housing (12). Install 'O' ring (27) on hex plug (26) and screw into pump housing (12)





**6-17 REPAIR RECHARGING PUMP (Continued).**

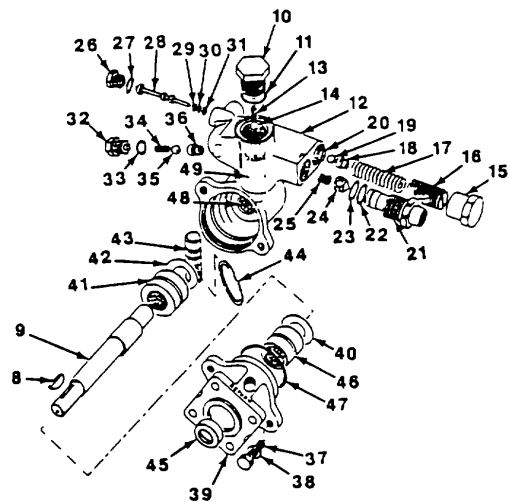
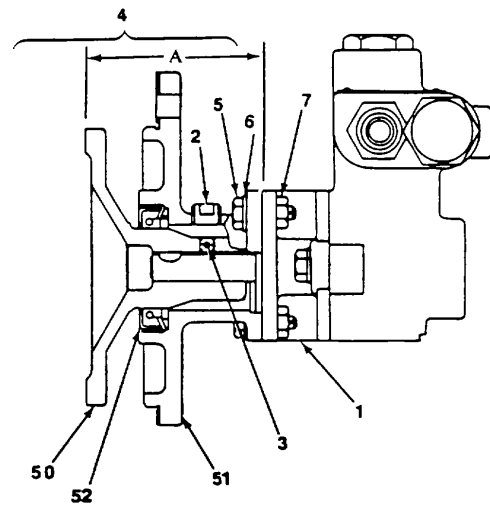
- l. Install valve seat (36), check ball (35) and spring (34). Install hex plug (32) with a new 'O' ring (33)
- m. Install Woodruff key (18) In the drive shaft (9) and check once more for free rotation of the shaft

**2. ASSEMBLE DRIVE ASSEMBLY**

- a. Lubricate new oil seal (52) and install into flange assembly (51)
- b. Install intermediate drive (50) in flange assembly (51)

**3. ASSEMBLE DRIVE ASSEMBLY AND PUMP ASSEMBLY**

- a. Install pump assembly drive shaft (9) with key (8) in place into drive assembly (4)
- b. Secure both assemblies with four screws (5), lockwashers (6) and nuts (7)
- c. Check distance 'A' - should measure 2 594 inches (65 888 mm) before tightening screws (5)
- d. Install setscrew (3) and pipe plug (2) in drive assembly (4)



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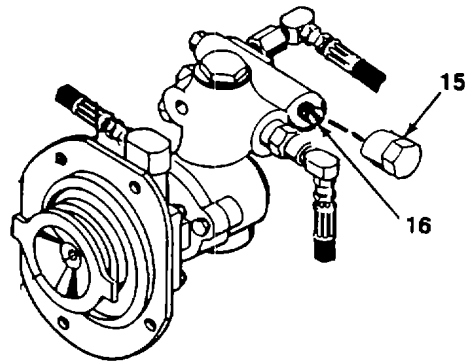
**6-17 REPAIR RECHARGING PUMP (Continued).**

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**ADJUSTMENT****ADJUST PUMP.****NOTE**

**Pump should be installed in its hydraulic circuit or test stand for adjustment to be made.**

- a. Start engine served by pump requiring adjustment.
- b. Remove unloading valve cap (15) to gain access to adjusting screw (16).
- c. Use a screwdriver to turn adjusting screw (16) clockwise to increase setting or counterclockwise to decrease setting. Set the adjusting screw for the pump to unload at 3000 psi.



**MAINTENANCE OF HYDRAULIC STARTING SYSTEM**

**6-18 REPAIR ACCUMULATOR.**

This task covers:      a. Disassembly      c. Inspection      e. Charging  
                                  b. Cleaning            d. Assembly

**INITIAL SETUP**

Test Equipment:

Hose Assembly, Accumulator  
 Charging P/N TSE8600  
 4780-00-412-3805  
 Gauge Assembly, Accumulator  
 P/N TSE8601

Tools:

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783  
 Torque Wrench  
 Drop Light

Materials/Parts:

Preformed Packing  
 P/N GA 100117, GA 100475 and  
 GA 1128-9  
 Nitrogen Gas Cylinder  
 Item 26, Appendix E  
 Cleaning Solvent  
 Item 17, Appendix E  
 Lubricant  
 Item 4, Appendix E

Equipment Conditions:

Reference  
 Para 5-45. Accumulator removed

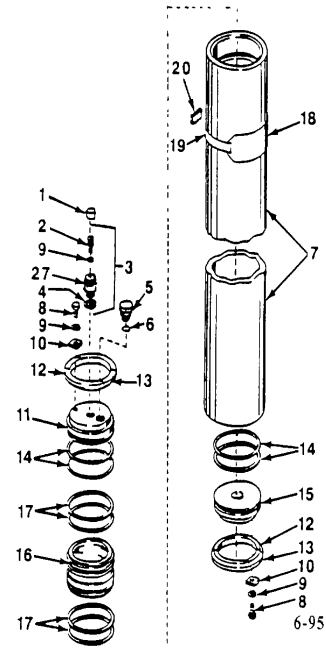
**DISASSEMBLY**

**DISASSEMBLE ACCUMULATORS**

**NOTE**

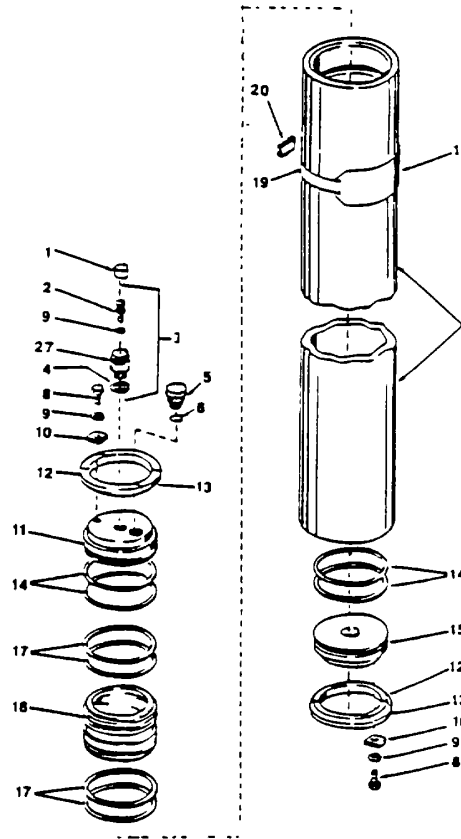
**Prior to any disassembly, the nitrogen gas must be released from the accumulator.**

- a. Remove protection cap (1).
- b. Loosen air valve (2) until gas escapes
- c. Remove air valve assembly (3), and gasket (4) Discard gasket.
- d. Remove fusible plug (5) and gasket (6) Discard gasket
- e. Secure housing (7) In a vise



**6-18 REPAIR ACCUMULATOR (Continued).**

- f. Remove screws (8), lockwashers (9), and retaining plate (10) from end cap.
- g. Screw a 1/2 - 20 fitting into air valve assembly (3) port.
- h. Push end cap (11) away from ring segments (12 and 13).
- i. Remove ring segments (12 and 13), and remove end cap (11) Discard gaskets.
- j. Remove back-up seal rings (14).
- k. Repeat steps a thru e. and remove oil end cap (15) using proper fitting for oil port size.
- l. Using a wooden dowel, push piston (16) out of housing (7).
- m. Remove seal rings (17) from piston (16) Discard gaskets.
- n. Remove nameplate (18), strap (19) and locking clip (20) Remove only if damaged or defaced.



**CLEANING**

**CLEAN ACCUMULATOR PARTS.**

**WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100°- 138°F( 38°- 59°C).

Clean metal parts in cleaning solvent P-D-680 and dry thoroughly.

**6-18 REPAIR ACCUMULATOR (Continued).**

**INSPECTION**

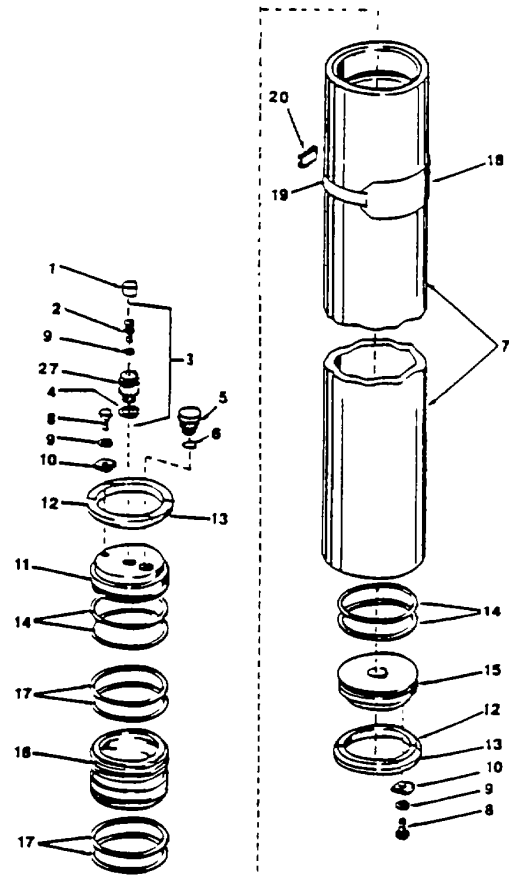
**INSPECT ACCUMULATOR PARTS**

- a. Use a drop-light to examine the bore of the cylinder. The bore must be smooth and free of scratches. Check segment ring grooves.
- b. Examine caps for damage. Check fitting threads, valve threads, and fuse holder thread if holder has been removed.
- c. Examine piston for scratches or scoring on O D. The piston must be checked in cylinder to be sure it moves freely throughout the entire length of cylinder.
- d. Examine air valve threads and replace if damaged. Check for damaged valve seat.
- e. Inspect seal rings for damage.
- f. Replace any accumulator damaged beyond repair.
- g. Replace all gaskets.
- h. Replace other defective parts as found in inspection.

**ASSEMBLY**

**ASSEMBLE ACCUMULATOR**

- a. If removed, install nameplate (18), strap (19), and locking clip (20) onto housing (7).
- b. Install seal rings (17) onto piston (16). Lubricate seal with OE-10.
- c. Coat inside diameter of housing (7) with light oil.



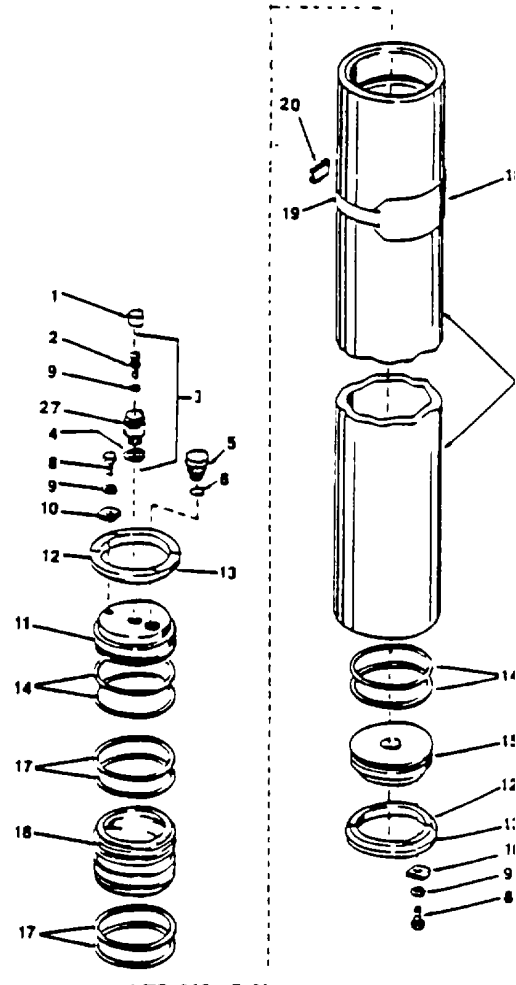
**6-18 REPAIR ACCUMULATOR (Continued).**

- d. Using a loading sleeve, covering the spilt ring groove, insert piston (16) into housing bore with the closed end first. Check seal rings to be sure they are not twisted or otherwise damaged.
- e. Push piston half way down in housing bore.
- f. Install back-up seal rings (14) to oil end cap (15). Coat seal rings with light grease BM1546 to hold in place.
- g. Slide end cap (15) with oil port into housing (7) beyond the normal position. Use loading sleeve.

**NOTE**

**Be sure end cap is on side with head of the piston.**

- h. Install ring segments (13 and 12) and hold in place.
- i. Push piston (16) against oil end cap (15) to position end cap against retainer plate.
- j. Install retainer plate (10). Then, secure end cap (15) with lockwashers (9), and screws (8).
- k. Install back-up seal rings (14) to end cap (11). Coat seal rings with light grease BM1546 to hold in place.
- l. Slide end cap (11) into housing (7) beyond the normal position.
- m. Install ring segments (13 and 12) and hold in place.
- n. Apply pneumatic or mechanical force of 50 PSI (344.7 kPa) maximum to position end cap against retainer plate (10).

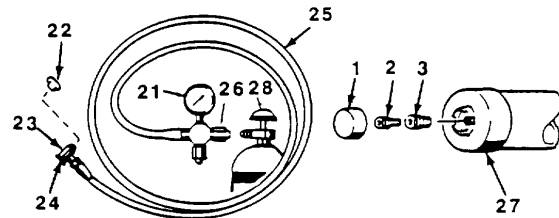


**6-18 REPAIR ACCUMULATOR (Continued).**

- o. Install retainer plate (10) Then, secure assembly with lockwashers (9), and screws (8).
- p. Release pressure and remove assembly fittings.
- q. Install fuse assembly gasket (6), and fusible plug (5) Torque to 20-25 lbs ft (27.1 - 33.9 N•m).
- r. Install air valve gasket (4) and air valve (3). Torque to 45-50 lb ft (61.0 - 67.8 N•m) DO NOT tighten air valve (2)

**CHARGING****CHARGING ACCUMULATOR**

- a. Attach gauge (21) end of the charging kit to nitrogen tank.
- b. Install air valve stem extension (22) on the air check valve (23).
- c. Completely back off shaft pin in the air check valve connector (24) on the charging kit hose (25).

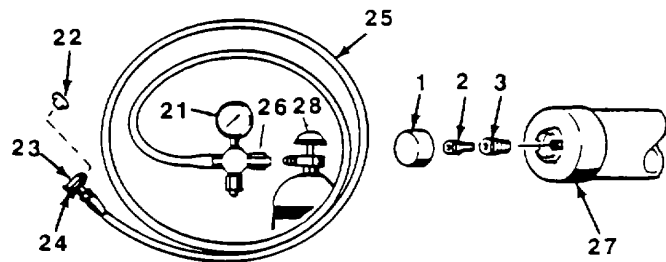


- (1) Install connectors on the air valve stem extension (22)
- (2) Draw swivel nut (26) up tight.
- d. Loosen air valve (2) on the accumulator air valve stem.
  - (1) Turn counterclockwise.
  - (2) Turn locknut 1-1/2 turns only.
- e. Turn the shaft pin In the air check valve connector (27) clockwise until the valve core air valve is depressed.

**6-18 REPAIR ACCUMULATOR (Continued).**

f. Open valve (28) on the nitrogen tank, and allow small flow of nitrogen to enter the accumulator until the charging kit gauge registers 1300 PSI (8964 kPa) Close nitrogen tank valve (28).

- (1) Check the precharge pressure during charging.
- (2) Shut off the valve to nitrogen tank
- (3) Allow time for pressure to stabilize
- (4) Pressure indicated on pressure gauge is accumulator precharge pressure.



g. Back off the shaft pin in air check valve (23) Tighten hex locknut (2) on accumulator valve stem. Torque to 140-160 In Lbs (6.4 - 6.6 N•m).

h. Disconnect the accumulator charging kit.

- (1) From accumulator.
- (2) From nitrogen tank.

i. Replace cap on air valve (27) and accumulator cap (1).



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**MAINTENANCE OF HYDRAULIC STARTING SYSTEM**


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**6-19 REPAIR STARTING MOTOR.**

This task covers            a. Disassembly            c. Inspection  
                                       b. Cleaning                d. Assembly

---

**INITIAL SETUP****Tools**

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783  
 Vice

**Equipment Conditions**

Reference  
 Para 5-48 Starting motor removed

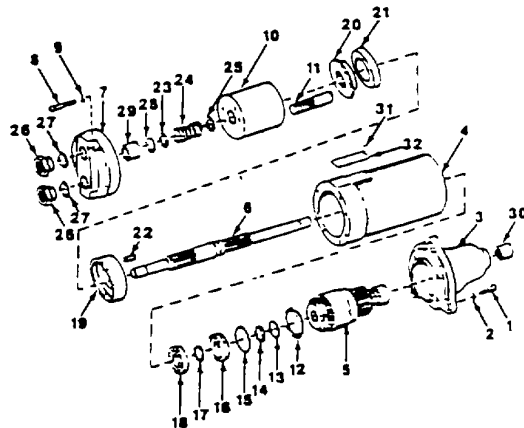
**Materials/Parts:**

Preformed Packing GA100064,  
 GA 100061, GA100067  
 Cleaning Solvent  
 Item 17, Appendix E  
 Lubricating Oil  
 Item 4, Appendix E

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**DISASSEMBLY****DISASSEMBLE STARTING MOTOR**

- a. Clamp starter motor housing in a vise.
- b. Remove four screws (1), and lockwashers (2).
- c. Remove pinion gear housing (3) from motor housing (4).



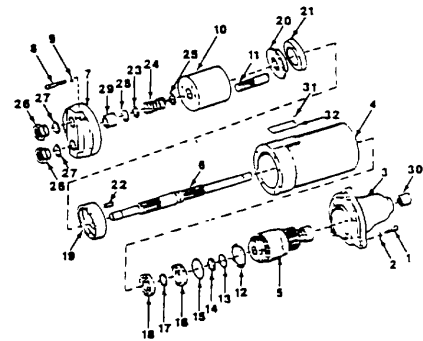
**6-19 REPAIR STARTING MOTOR (Continued)**

- d. Slide drive assembly pinion gear (5) from drive shaft (6).
- e. Scribe an index mark on port plate (7), and motor housing (4) This enables proper positioning of port plate at assembly.

**NOTE**

**There is a slight spring load on the port plate. Upon loosening the screw, any oil left in the housing will drain out.**

- f. Remove port plate screws (8), and lockwashers (9) from the port plate, and remove port plate (7)
- g. Invert housing (4) allowing barrel (10) and pistons (11) to slide off drive shaft (6).
- h. Remove pistons (11) from barrel (10).
- i. Remove retaining ring (12) from drive shaft
- j. Press drive shaft (6) out of housing (4) from port plate end Seals (13, 14 and 15), seal holder (16), retaining ring (17), and shaft ball bearing (18) will come out with shaft.
- k. Remove inner seal (13), slipper seal (14), outer seal (15), and seal holder (16) from drive shaft Remove only it defective
- l. Remove retaining ring (17), and shaft ball bearing (18) from drive shaft
- m. Press against thrust bearing housing (19) with a little pressure and remove thrust bearing assembly.
- n. Remove thrust bearing plate (20).



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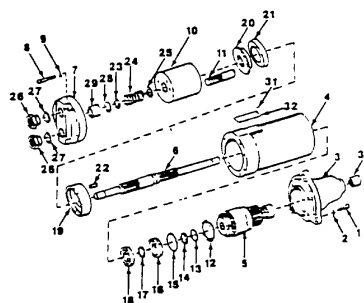
**6-19 REPAIR STARTING MOTOR (Continued)**

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**CAUTION**

**Do not apply excessive heat to thrust bearing. Do not remove thrust bearing unless it is to be replaced.**

- o. Apply heat to thrust bearing housing (19) and press out thrust bearing (21). Remove thrust bearing only if damaged or defective.
- p. Remove dowel pin (22), washer (23), spring (24) and washer (25) from barrel (10).
- q. Remove adapter fittings (26) and gasket (27) from port plate (7).
- r. Remove retaining ring (28) and roller bearing (29) from port plate.
- s. Press needle bearing (30) from pinion gear housing (3).
- t. Remove screws (31) and remove nameplate (32).



**6-19 REPAIR STARTING MOTOR (Continued)**

**CLEANING**

**CLEAN ALL PARTS**

**WARNING**

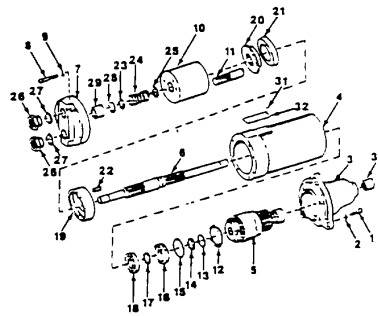
Dry cleaning solvent, P-D-680, used to clean part, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100°-138°F (38°- 59°C).

Clean metal parts in P-D-680, and dry thoroughly.

**INSPECTION**

**INSPECT STARTING MOTOR**

- a. Visually check pinion gear housing (3) for cracks or other damage. Examine bearing (30) for damage or wear. Replace if necessary.
- b. Examine drive assembly pinion gear (5) to be sure that the teeth are not worn excessively or chipped from interference with ring gear. Check to insure that the compressing spring is not damaged or broken.
- c. The port plate face, where cylinder rides, must be smooth and free of scoring. Also check the bearing (29).



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**6-19 REPAIR STARTING MOTOR (Continued)**

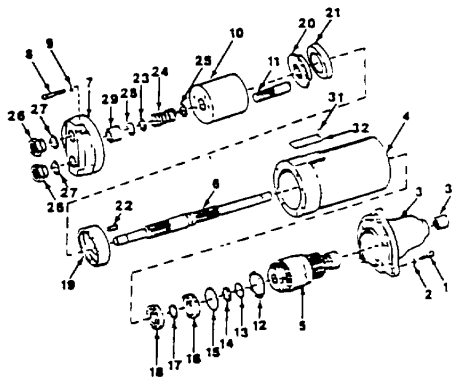

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- d. Examine the motor barrel (10) potted face of the cylinder for scratching or scoring. Slight scuff marks can be removed by lapping on a surface plate. The bores of the cylinder should be smooth and free of scoring.
- e. The diameter of the pistons (1) should be smooth and free of scoring. The closed end of the pistons may show brinnelling where they contact the thrust bearing plate (20), but no burrs or flat spots are permissible.
- f. Check the ends of the shaft for wear or scoring. The splines should be smooth and free of nicks. Check bearing (18).

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**ASSEMBLY**
**ASSEMBLE STARTING MOTOR**

- a. Lubricate parts with clean, light engine oil before assembly. Use oil OE-10 MIL-L-2104.
- b. If removed, install nameplate (32) using two screws (31).
- c. If removed, press needle bearing (30) into pinion gear housing (3).

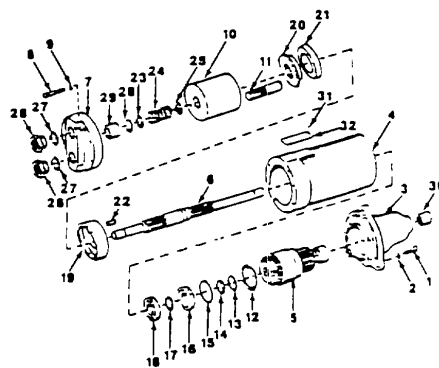


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**6-19 REPAIR STARTING MOTOR (Continued)**


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- d. If removed, install roller bearing (29) in port plate (7), securing with retaining ring (28)
- e. If removed, install adapter fitting gaskets (27), and adapter fittings (26).
- f. Install washer (25), spring (24), and washer (23) onto motor barrel (10).
- g. If removed, install dowel pin (22).
- h. Press thrust bearing (21) into housing (19), and Install housing (19), and thrust bearing plate (20). Press in housing until it bottoms against housing (4). Be sure dowel pin (22) is in place
- i. Install drive shaft ball bearing (18) on drive shaft, and secure with retaining ring (17)
- j. Install with seal holder (16).
- k. Install outer seal (15), slipper seal (14), and inner seal (13) onto drive shaft
- l. Press assembled drive shaft (6) into housing (4) from port plate end (7).
- m. Secure with retaining ring (12).
- n. Install pistons (11) onto barrel (10), and install barrel (10).
- o. Position assembled port plate (7) onto motor housing (4).
- p. Align scribe marks on port plate (7) and motor housing (4).
- q. Secure with lockwashers (9) and screws (8) Torque screws to 300 lb in (33 89 Nm).



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**6-19 REPAIR STARTING MOTOR (Continued)**

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- r. Install drive assembly pinion gear (5)  
onto drive shaft (6)
  
- s Position pinion gear housing (3) in place  
on motor housing (4)
  
- t Secure with four lockwashers (2), and  
screws (1) Tighten screws

**MAINTENANCE OF HYDRAULIC STARTING SYSTEM****6-20 REPAIR HAND PUMP (STARTING SYSTEM).**

This task covers:      a. Disassembly              c. Inspection  
                                  b. Cleaning                      d. Assembly

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
 and Marine  
 5180-00-629-9783

**Equipment Conditions:**

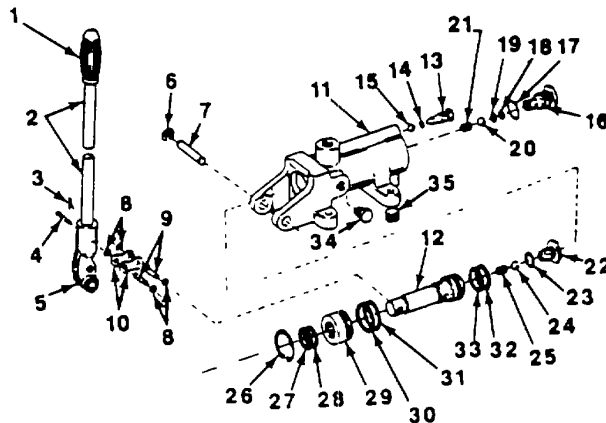
Reference  
 Para 5-49 Hand Pump removed

**Materials/Parts:**

Repair Kit KT202565  
 Cleaning Solvent  
 Item 17, Appendix E  
 Sealant  
 Crocus Cloth  
 Item 20, Appendix E

**DISASSEMBLY****DISASSEMBLE HAND PUMP**

- a. Pull pump handle grip (1) from hand pump operating handle (2). Only if grip is damaged
- b. Remove cotter pins (3) and (4) Lift handle (2) from operating lever (5)
- c. Remove retaining rings (6) from clevis pin (7)
- d. Remove retaining ring (8), clevis pin (9), and links (10), to remove hand pump operating lever (5) from the pump body (11)
- e. Remove retaining rings (8), clevis pin (9), and links (10) from plunger (12)
- f. Remove bleeder screw (13), 'O' ring gasket (14), and bleeder ball valve (15) from pump body (11) Discard 'O' ring gasket



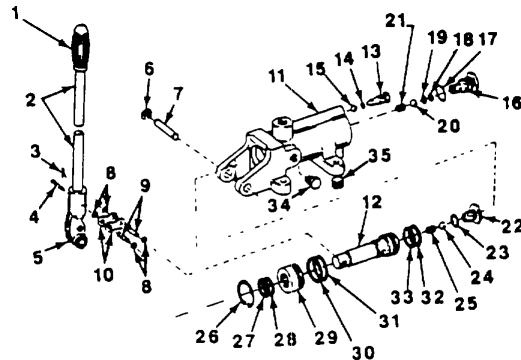


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**6-20 REPAIR HAND PUMP (Continued).**


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- g. Remove inlet oil fitting (16) 'O' ring gasket (17), back-up ring (18), 'O' ring gasket (19), ball check valve (20), and spring (21) from pump body (11) Discard 'O' ring gasket (17), back-up ring (18), 'O' ring gasket (19), and spring (21)
- h. Remove seat check valve (22), 'O' ring gasket (23), ball check valve (24), and spring (25) Discard 'O' ring gasket (23), and spring (25)
- i. Remove retaining ring (26), back-up ring (27), 'O'ring gasket (28), plunger gland (29), back-up ring (30), and 'O'ring gasket (31). Discard back-up ring (27), 'O' ring gasket (28), back-up ring (30), and 'O' ring gasket (31).
- j. Remove back-up ring (32), 'O' ring gasket (33), and plunger (12) Discard back-up ring (32) and 'O' ring gasket (33)
- k. Remove pipe plugs (34 and 35) If necessary.



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**6-20 REPAIR HAND PUMP (Continued).**

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**CLEAN****CLEAN ALL PARTS.****WARNING**

Dry cleaning solvent, P-D-680, used to clean parts, is potentially dangerous to personnel and property. Avoid repeated or prolonged skin contact. Do not use near open flame or excessive heat. Flash point of solvent is 100°-138°F (38°-59°C).

Clean metal parts in cleaning solvent P-D-680 and dry thoroughly

**INSPECTION****INSPECT HAND PUMP**

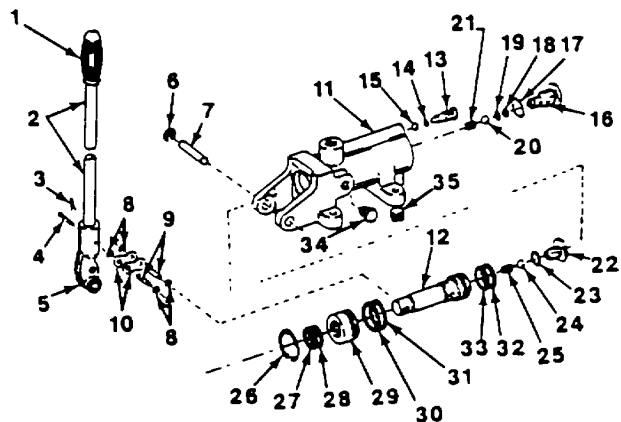
- a. Inspect springs for distortion loss of tension or broken coils
- b. Inspect pins, balls piston for burrs or nicks
- c. Inspect hand grip for deterioration
- d. Replace all packing and seals with new ones
- e. Remove burrs or nicks with crocus cloth.
- g. Replace all defective parts as required

**6-20 REPAIR HAND PUNMP (Continued).**

**ASSEMBLY**

**ASSEMBLE HAND PUMP**

- a. Install 'O' ring gasket (31), back-up ring (30), plunger gland (29), 'O' ring gasket (28), back-up ring (27), and retaining ring (26) Thoroughly soak new back-up rings (27, 30, and 33) In warm oil Use repair kit for back-up ring (27), gasket (28), back-up ring (30), and gasket (31)
- b. Insert plunger (12)
- c. Install 'O' ring gasket (33), back-up ring (32), spring (25), ball check valve (24), 'O' ring gasket (23), and seat check valve (22) on plunger Use repair kit for back-up ring (32), 'O' ring gasket (33), spring (25), and 'O' ring gasket (23).
- d. Install spring (21), ball check valve (20), 'O' ring gasket (19), back-up ring (18), 'O' ring gasket (17), and Inlet oil fitting (16), Into pump body (11).
- e. Use repair kit for spring (21), 'O' ring gasket (17), back-up ring (18), and 'O' ring gasket (19).
- f. Install 'O' ring gasket (14) onto bleeder screw valve (13) Use repair kit for 'O' ring gasket (14) Insert bleeder ball valve (15) in place
- g. Secure with bleeder screw valve (13)
- h. Install retaining rings (8), clevis pin (9), and links (10) to hand pump operating lever (5) and plunger (12)
- i. Insert clevis pin (7), and retaining ring (6) into hand pump operating lever (5), and pump body (11)



**6-20 REPAIR HAND PUMP (Continued).**

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- j. Insert handle (2), pin (4), and cotter pin (3) into hand pump operating lever (5).
- k. Install grip (1).
- l. Install pipe plugs (34 and 35) if removed.

**6-21 INSPECT AND SERVICE PROPELLER AND PROPELLER SHAFT.**

This task covers:            a. Inspection            b. Service

**INITIAL SETUP**

Equipment Conditions

Engine shut down

Boat in dry dock. (This procedure may be done with the boat beached)

**INSPECTION**

**1. INSPECT PROPELLER**

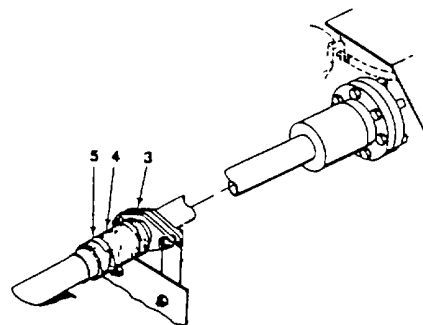
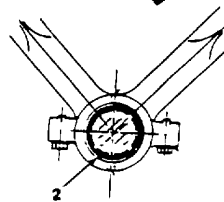
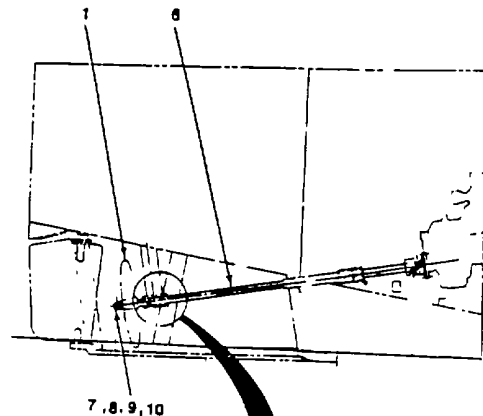
- a. Inspect propeller (1) for cracks, bends, corrosion and other defects
- b. Repair propeller as necessary (para 6-23)

**2. INSPECT CUTLESS BEARING**

- a. Inspect cutless bearing (2) for tear and wear.
- b. Get a new cutless bearing if above conditions are found (para. 6-22)

**3. INSPECT STUFFING BOX AND HOSE ASSEMBLY**

- a. Inspect stuffing box (3) for cracks and corrosion.
- b. Get new stuffing box if necessary, use a grinding machine to remove corrosion (para 6-25).

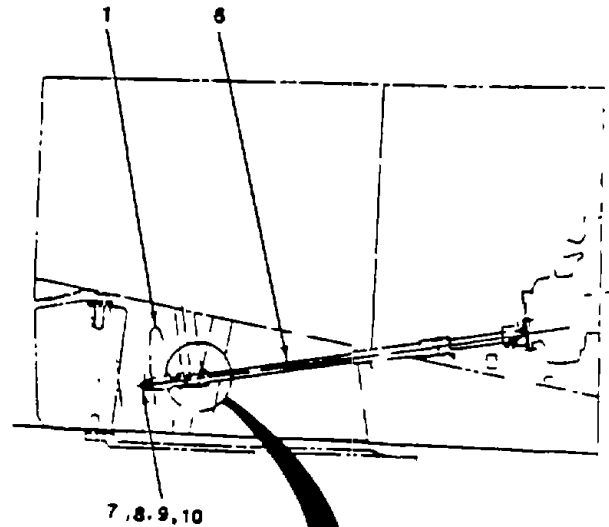


**6-21 INSPECT AND SERVICE PROPELLER AND PROPELLER SHAFT (Continued).**

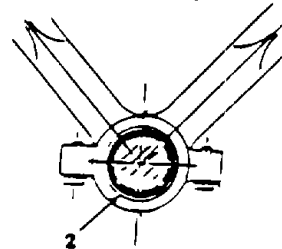
- c. Inspect packing for deterioration. If necessary, cut new packing to same length as old packing from 7/16-inch commercially quality flax (para. 6-25)
- d. Inspect flexible hose (4) for tear, wear and leakage. Check hose clamps (5) to see if self-locking feature is still good.
- e. Get new flexible hose and hose clamps if necessary (para 6-25)

**4. INSPECT PROPELLER SHAFT AND HARDWARE**

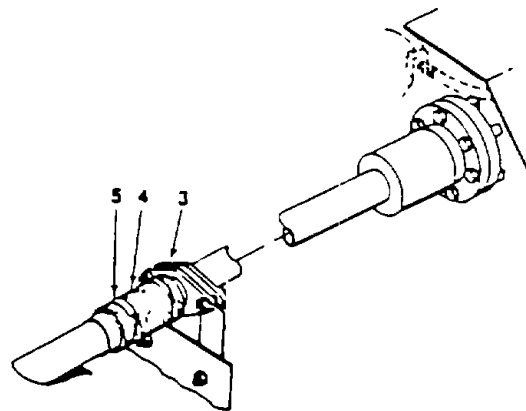
- a. Inspect propeller shaft (6) for pitting, cracks, corrosion, bends, thread damage or other damage.
- b. Get a new shaft if necessary Repair shaft if necessary (refer to para 6-23).
- c. Inspect cotter pin (7), plain hex nut (8), jam hex nut (9) and key (10) for damage, replace as necessary (para 6-23)



7, 8, 9, 10

**SERVICE**

Service of the propeller and propeller shaft consists of replacing defective parts (para 6-23)



**6-22 REPLACE PROPELLER AND PROPELLER SHAFT.**

This task covers                      a. Removal                      b. Installation

**INITIAL SETUP**Tools:

Tool Kit, Mechanics Rail  
and Marine  
5180-00-629-9783  
Propeller Puller  
S00-372-0652  
Wrench, Box, Propeller Nut  
5120-00-277-1575  
Wrench, Box, Shaft  
5120-00-277-1576

Materials/Parts:

Cutless Bearing (2 1/2 in ID x 3 s/8 In  
OD x 10 in L-Brass/Rubber)  
Cotter Pin  
MS 24665-641  
Cotter Pin  
MS 24665-519  
Washer  
MS 15795-832  
Flexible Hose  
4720-00-288-9761  
Hose Clamps  
4730-00-197-1595  
Packing  
7/16 in flax, Item 28, Appendix E  
Graphite  
Item 23, Appendix E  
Grease  
Item 22, Appendix E

Equipment Conditions:

Engine shut down.  
  
Boat in dry dock (This  
procedure may be done  
with the boat beached).

Personnel:

Two (2)

General Safety Instructions:

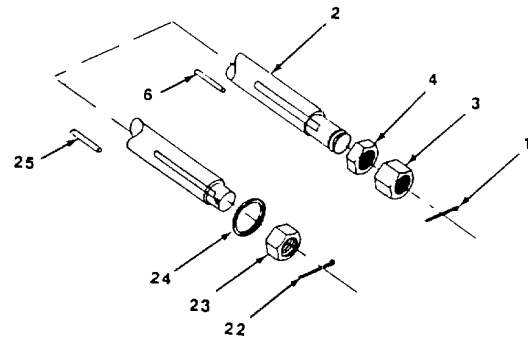
Do not attempt to remove  
propeller and shaft by  
yourself.

**6-22 REPLACE PROPELLER AND PROPELLER SHAFT (Continued).**

**REMOVAL**

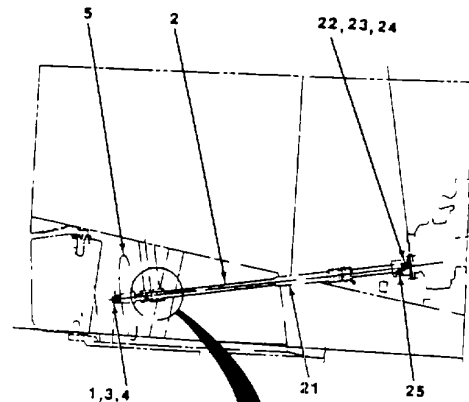
**1. REMOVE PROPELLER.**

- a. Remove cotter pin (1) from end of propeller shaft (2).
- b. Remove plain hex nut (3) and jam hex nut (4) from propeller shaft (2).
- c. Slide propeller (5) off the tapered shaft and remove key (6). Use a propeller puller.



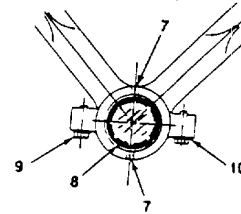
**2. REMOVE CUTLASS BEARING.**

- a. Remove four small capscrews (7) securing the cutless bearing (8).
- b. Loosen eight large capscrews (9) from the upper and lower strut casting. Do not remove lockwashers (10).
- c. Remove cutless bearing (8) from the strut castings.



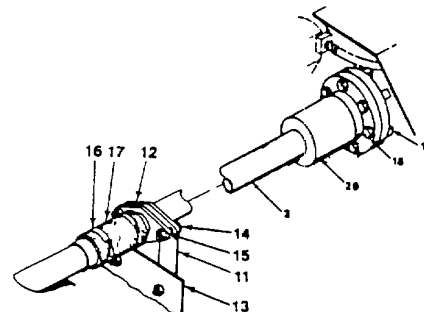
**3. REMOVE PACKING BRACE AND FLEXIBLE HOSE.**

- a. Remove packing brace (11) from stuffing box (12) and mounting plate (13) by removing four bolts (14) and nuts (15).
- b. Loosen hose clamps (16) from the flexible hose (17).



**4. REMOVE PROPELLER SHAFT AND SHAFT COUPLING**

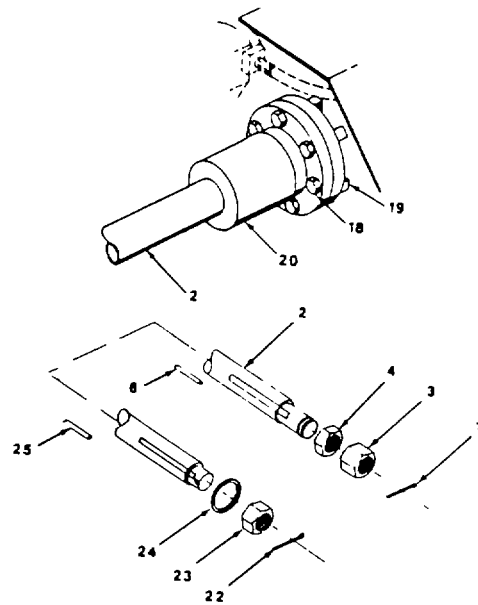
- a. Remove eight bolts (18) and nuts (19) from the shaft coupling (20).





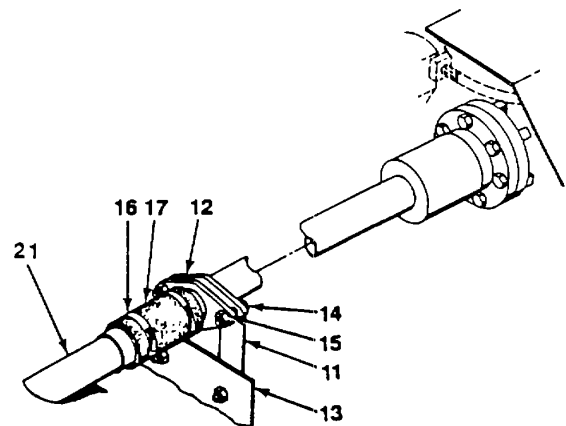
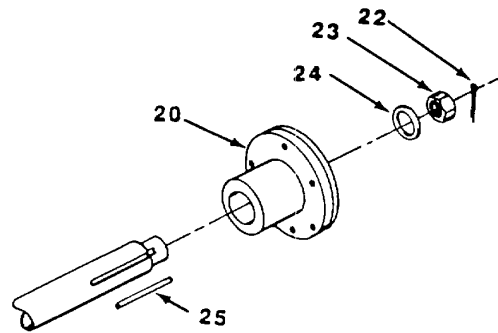
**6-22 REPLACE PROPELLER AND PROPELLER SHAFT (Continued).**

- b. Slide propeller shaft (2) down through the stern tube (21). Obtain enough clearance at the coupling end.
- c. Remove cotter pin (22), slotted heavy hex nut (23) and washer (24) from coupling end of shaft.
- d. Pound the coupling end of the propeller shaft (2) with a sledge hammer and remove coupling (20) and key (25).
- e. Withdraw the propeller shaft (2) through the stuffing box (12), flexible hose (17), stern tube (21) and strut castings.



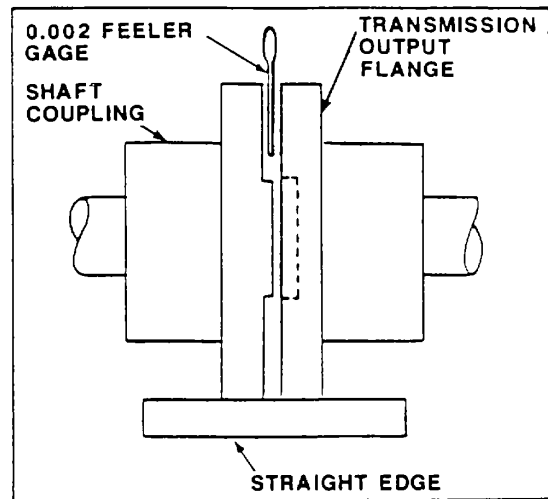
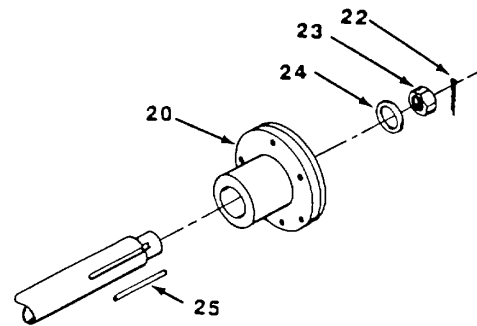
**6-22 REPLACE PROPELLER AND PROPELLER SHAFT (Continued).****INSTALLATION**

1. INSTALL PROPELLER SHAFT AND COUPLING.
  - a. Install propeller shaft through strut castings stern tube (21), flexible hose (17), hose clamps (16) and stuffing box (12).
  - b. Apply a light coat of graphite and grease on the shaft taper.
  - c. Install key (25) and shaft coupling (20) on coupling end of shaft. Ensure that key is aligned in keyway.



**6-22 REPLACE PROPELLER AND PROPELLER SHAFT (Continued).**

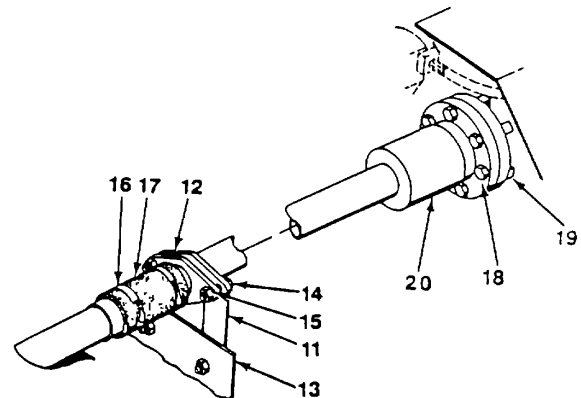
- d. Install washer (24), slotted heavy hex nut (23) and cotter pin (22).
- e. Match shaft coupling (20) and transmission output flange and prepare for bolting together.
- f. Place a straight edge across edges of flanges at top and side to check parallel alignment of coupling edges.
- g. Place a 0.002-inch feeler gauge between flanges of coupling and slide feeler gauge completely around coupling.
- h. Rotate transmission flange coupling 90, 180 and 270 degrees while moving feeler gauge around the flange in each successive position. If the alignment is correct, the feeler gauge will fit snugly, with some tension all around flange coupling.
- i. Bolt transmission output flange and shaft coupling (20) together with eight bolts (18) and nuts (19).



*Checking Alignment (Parallelism) of Coupling and Propeller Flanges*

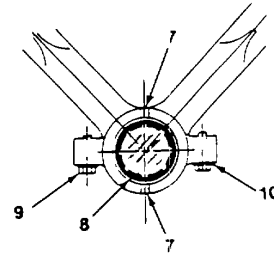
**2. INSTALL PACKING AND SECURE STUFFING BOX AND HOSE ASSEMBLY.**

- a. Install new packing in stuffing box (12).
- b. Install packing brace (11) and secure to stuffing box (12) and mounting plate using four bolts (14) and nuts (15). Adjust stuffing box (12) as required (para. 3-18).
- c. Slide up flexible hose (17) against stuffing box (12) and secure with hose clamps (16).

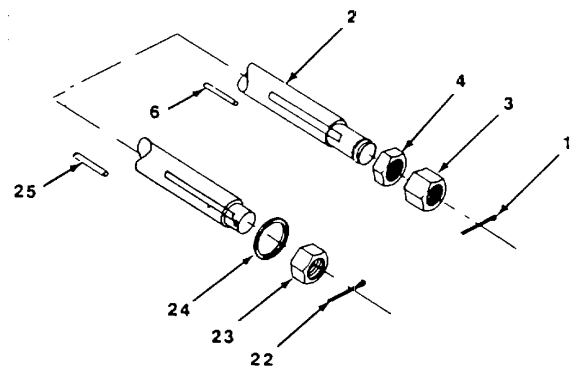


**6-22 REPLACE PROPELLER AND PROPELLER SHAFT (Continued).****3. INSTALL CUTLESS BEARING**

- a. Install cutless bearing (8) in strut castings.
- b. Secure strut castings by tightening eight large capscrews (9).
- c. Secure cutless bearing (8) with four small capscrews (7).

**4. INSTALL PROPELLER.**

- a. Install key (6) and propeller (5) onto propeller shaft (2). Ensure that key is aligned in keyway.
- b. Install jam hex nut (4), plain hex nut (3) onto propeller shaft (2) and secure assembly with cotter pin (1).



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**6-23 REPAIR PROPELLER AND PROPELLER SHAFT.**

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**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783  
Blacksmith's Forge  
Anvil  
Machine, Welding

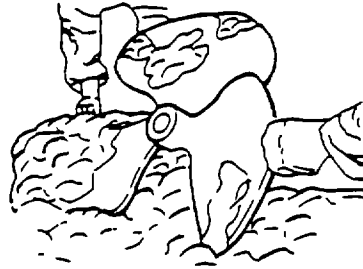
**Equipment Conditions:**

Reference  
Para 6-23. Propeller and shaft  
removed.

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**REPAIR****1. REPAIR PROPELLER.**

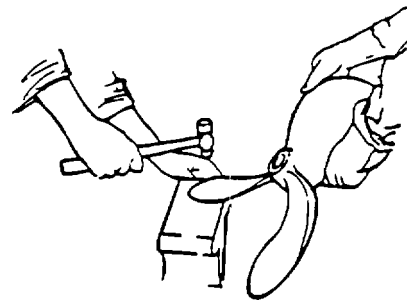
- a. Heating Propellers. Small bends or depressions in bronze propellers can be straightened while the propeller is cold. Because cold working hardens bronze, large bends or irregularities must be repaired using heat to prevent cold cracks from occurring. When heat is used, heat propeller to a dull red color in a forge or with a gas flame. For overall heating where large surfaces are involved, the forge is faster and gives a more uniform application of heat. Figure at right shows a propeller being heated with a forge. For small or localized repairs, a gas flame should be used.

**CAUTION**

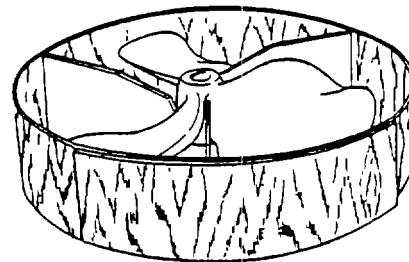
**Bronze becomes weak at high temperatures and the propeller, if struck, can sag or break. Exercise care when handling or repairing a heated propeller.**

**6-23 REPAIR PROPELLER AND PROPELLER SHAFT (Continued).**

- b. Straightening the Blade. On small propellers, tightly rolled bends are unrolled with blacksmith's tongs. Other irregularities are peened. It is advantageous to peen a bend on its concave or hollow side. On small propellers, strike the blade with a light hammer while backing the peening with the blade on an anvil. A typical peening operation is shown at right. Large propellers are peened by using air hammers with a round edge caulking tool. The metal unrolls like wet leather under the hammer when the blade is at the correct temperature. Work should be stopped and the propeller reheated when the sound of the metal under the hammer changes from a dull, flat sound to a sharper, ringing sound. Most blades can be reshaped with two or three heatings. During straightening operations the propeller should be compared occasionally to a propeller pitch block.



- c. Making and Using a Pitch Block. A pitch block can be made by pouring concrete in a plywood box and shaping the upper surface of the concrete to fit a new propeller. The figure at right shows a badly damaged propeller on a block before straightening.



Refer to the figure showing the propeller on the pitch block after straightening. In figure at right the upper edges of the blade are about an inch above the pitch block. This is because the pitch block is for a propeller with a pitch of 17 inches, where the propeller is a 24 inch diameter propeller with a pitch of 18 inches. An efficient blacksmith with an eye for blade configuration can determine the amount of shaping and pitch alignment.

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**6-23 REPAIR PROPELLER AND PROPELLER SHAFT (Continued).**

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- d. Damaged. Notched Edges. The edges of the straightened propeller shown in the figure have notches. Normally notches of the size shown are not filled. If other vessels are deadlined for repair, damaged edge repair is covered in paragraphs i, j and k below.
- e. Repairs by Welding. The location of the repair governs the kind of weld used and the care necessary. Root sections of the blade carry more stress than sections near the tip and therefore are critical. All metal deposits above the surface of the blade will have to be removed.
- f. Repair of Root Sections. Because of the high stress on the blade between the hub and 0.4 radius, any repair in the root section is considered major repair, and a welding procedure that can be depended upon to produce a strong, sound weld substantially free of residual stresses should be used. Metallic arc welding, multiple-layer gas welding, and the hot-flow process are approved methods for root section repair.
- g. Repairs In Sections Outside The 0.4 Radius. Repairs in these areas are relatively minor and can be accomplished with the use of multiple-layer gas welding or metallic arc welding.

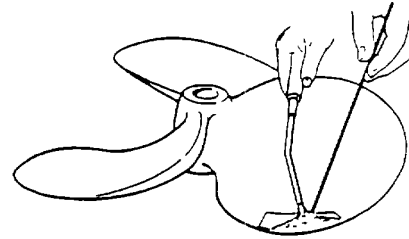
**NOTE**

**The use of silver brazing alloy or any other low temperature brazing alloy is not an approved method, as these alloys have insufficient hardness to resist the erosive action of high velocity water.**

**6-23 REPAIR PROPELLER AND PROPELLER SHAFT (Continued).**

(1). Repair of Cavitation Pits. Cavitation pits can be weld- filled, using any approved method.

(2). Repair of Blade Edges. Broken propeller edges can be replaced by welding a corresponding edge from a discarded propeller, see figure at right. Cracks are ground or cut open and then welded together. The entire crack must be round out or it will start cracking again. If necessary, blades can be built up with the same welding rods used in the process of welding. Small notches in the edges are sometimes filled by welding.



h. Finishing Welded Areas. Beads should be ground or filed smooth to match original surface contours. Splatter and flux should be removed by scraping, chipping, and/or grinding or filing. Welded areas should be annealed if required.

i. Metallic Arc Welding. For major or minor repair to manganese-bronze propellers, a covered aluminum- bronze electrode composed of 90 percent copper and 10 percent aluminum should be used. Phosphorous bronze rods should only be used for minor repairs, as these rods have only about one half the strength of the base metal. Each edge of the repair selections should be beveled 45 degrees (included angle 90 degrees) and the root of the bevel should be rounded to a minimum 1/4 inch radius; however, if the depth is over 1 inch, the sides can be beveled at 15 degrees after the width of the groove at the top exceeds 1-1/2 inches. The section to be repaired should be chipped to sound metal and positioned for



**6-23 REPAIR PROPELLER AND PROPELLER SHAFT (Continued).**

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down-hand welding. Welds can be made in the vertical position, however, suitable copper or carbon dams should be used to aid in supporting the weld metal. In order to obtain a proper joint, it is imperative that the base metal be locally preheated. The preheat temperature should be between 600°F and 826°F (316°C and 427°C). In an emergency, a temperature of 400°F (204°C) can be used. An approved rod of 1/4-, 5/16- or 3/8- inch diameter should be used, especially on propeller sections over 3/8 inch thick. Smaller diameters, 5/32 inch and 3/16 inch, should not be used unless absolutely necessary, and then only when considerable preheating has been done. With sufficient preheat, lower values of the current ranges recommended by the electrode manufacturer can be used. Although lower currents are desirable, the operator's skill and experience must be considered. Therefore, higher currents are preferable to currents too low. Higher currents risk fine porosity in the weld metal, but currents too low risk poor fusion and slag inclusions.

- j. Hot-Flow Process. The hot-flow process provides a satisfactory method for major repairs. This process consists of flowing molten metal of approximately the same chemical composition as the base metal into the joint. This flow washes away and replaces the parent metal and forms a continuous member upon solidification. Foundry and mold equipment is necessary for the use of this process.

**6-23 REPAIR PROPELLER AND PROPELLER SHAFT (Continued).**

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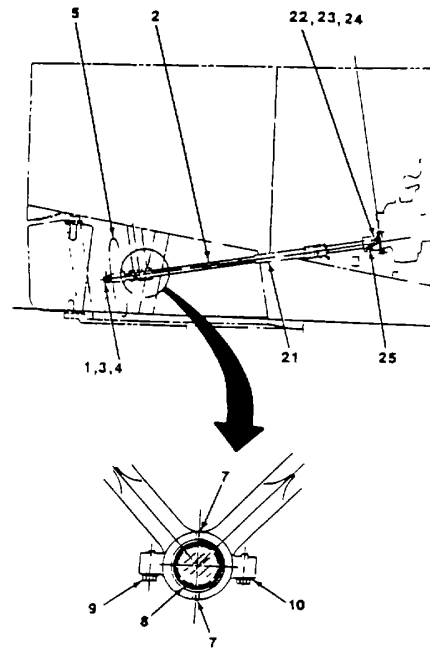
- k. Multiple-Layer Gas Welding. The multiple-layer gas welding method is an approved for major and minor repairs of propellers. The edges to be welded are beveled to form a 75 degree, single V-groove weld for thicknesses less than 1-1/2 inches. A 75 degree double V-groove is used if the thickness of the section is greater than 1-1/2 inches (381 cm) A copper-zinc, low-fuming, welding rod of the proper size and in accordance with Military Specification MIL-R-19631 is used with a suitable brazing flux for repair of manganese-bronze propellers. A carefully adjusted oxidizing flame is essential for sound welds. A forehand method of welding should be used and the weld metal deposited in beads with limited oscillation not exceeding 1-1/2 times the diameter of the welding rod.
- l. Welding-Preheat and Stress Relief  
Because copper-zinc alloys are susceptible to stress-corrosion or season cracking, stress must be relieved, as the propeller can crack after being returned to service. The use of local preheat above 400°F (204°C), preferably between 600°F and 800°F (315°C and 427°C), will preclude the accumulation of harmful stresses. Hot-flow welds and large gas welds are automatically preheated and slowly cooled, and stress relief can be safely omitted after welding. Arc welds and small gas welds should be preheated with a torch or other suitable means and then cooled slowly. If it is considered more desirable to stress relief after welding, the following procedure is recommended. Heat slowly to 750°F (399°C) and hold at this temperature for at least 1 hour per inch of thickness of metal. In the welded area, cool slowly, approximately 2°F (1°C), per minute,

**6-23 REPAIR PROPELLER AND PROPELLER SHAFT (Continued).**

until metal is below 250°F (121°C), after which air-cooling is permissible. During all preheating, welding, or stress relieving, the propeller should be well supported in order to avoid sagging and distortion. Repairs, particularly to heavier sections of the propeller, should be performed with care in order to avoid thermal cracks or tears due to shrinkage stresses which can be imposed on the base metal.

**2. REPAIR PROPELLER SHAFT.**

- a. Pitted Shafting. Cases of severe pitting in outboard shafting, resulting from damaged or porous covering, should be reported to the appropriate authority who will decide whether the shaft is suitable for further service. If the pitted shafting is approved for reconditioning, the sharp edges of the pits should be well rounded by grinding and the corroded areas should be dressed down to the solid metal surface. Ground out pits and corroded areas, if extensive and of shallow depth, should be filled with approved cavity build-up material. Pits and corroded areas beyond allowable depth should be build-up by welding and covered with a protective rubber or plastic material.
- b. Vibrations . If objectionable vibrations exist, the shafting sections should be removed and checked for straightness. Dial indicator runouts of shafting ends, measured at the propeller or coupling tapers, should total less than 0.003 inch (0.0015-inch eccentricity), which should prevent excitation of the first-order vibrations (one vibration per shaft revolution). Runouts in excess of



**6-23 REPAIR PROPELLER AND PROPELLER SHAFT (Continued).**

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0.003 inch total, giving an unacceptable performance, must be rectified or replaced by a new shaft section.

- c. Bent Shafting. Approval by the appropriate authority should be obtained prior to straightening severely bent shafting. Repair to the shafting sections can be done by the spot heating method, or electric induction heating, after which the shaft is straightened by mechanically controlled forces.
- d. Cracks In Shafting. Cracks found in propulsion shafting should be thoroughly probed to determine the depth and length of the cracks. If shafting is determined to be repairable, weld crack by an approved method.
- e. Eccentricity. The dial indicator runout for any length of shafting, with respect to the axis of rotation and exclusive of journals and ends, should be limited to an eccentricity of approximately 0003 inch. If, when the shafting is rotated 360 degrees, runouts greater than this figure are found, this eccentricity should be reduced to the lowest possible limit. A record should be kept of all installed shafting where eccentricities exceed 0 003 inch. Shafting should be replaced if objectionable vibration is still present.
- f. Electrolytic Action. Zinc protector collars on the shafting should be replaced as necessary. Steel shafting that is exposed to sea water should be protected from electrolyte action by a rubber or plastic protective covering when electrolytic action occurs between the steel shaft and the bronze bearing journal sleeve.

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**6-23 REPAIR PROPELLER AND PROPELLER SHAFT (Continued).**

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- g. Plugging Shaft Ends. All shafting that is exposed to sea water and has been bored throughout its entire length must have both ends plugged to prevent water from seeping into the hollow shaft and into the vessel. One method is by tapping the shaft bore with a tapered pipe thread in this method, a threaded plug is fitted and installed with thread compound to insure the watertightness of the plug.

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**6-24 ALIGN PROPELLER AND PROPELLER SHAFT.**

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**INITIAL SETUP**Tools:

Tool Kit, Mechanics Rail  
and Marine  
5180-00-629-9783  
Dial Indicator

Equipment Conditions:

LCM-8 out of water.  
LCM-8 water-borne.

Materials/Parts:

Piano Wire  
Item 27, Appendix E

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**ALIGNMENT**

## ALIGN PROPELLER SHAFT.

- a. Alignment of shaft and bearings is not permanently fixed. The alignment changes with every docking due to changes in the keel blocking, temperature variations, and the direction of the sun's rays relative to the fore and aft line of the vessel. The alignment of shafting and bearings is affected by the temporary removal of machinery attached to the shafting or in the vicinity of the shafting because of the redistribution of weights and stresses. The alignment is not the same when the vessel is waterborne as when it is in drydock. The final alignment and bolting of the main propulsion shafting should always be done when the vessel is waterborne.
- b. The primary purpose for providing correct alignment is to eliminate shaft excited vibrations and to prevent an excessive pressure upon any localized portion of the shafting bearing surfaces (journal bearing areas). The longitudinal line connecting the lowest extremities of all shafting journals having the same diameter should form a continuous-faired line when the machinery is at

**6-24 ALIGN PROPELLER AND PROPELLER SHAFT (Continued).**

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operating temperature. When the shafting is correctly aligned.

At rest, the bottoms of the shaft journals should be in contact with the bearing material. The bearing clearance at the horizontal centerline of the journal should be equally divided.

- c. In order to obtain and maintain acceptable alignment, the fundamentals of long-established and good practice are as follows:
  - (1) Each bearing shall guide and support the proportionate share of the shafting weight and load.
  - (2) When shaft couplings are broken, each overhanging shaft length will deflect from the true shaft centerline, depending upon the amount of overhanging shaft weight, the loading and the location of the bearing supports.
  - (3) Alignment of sag charts have been prepared for most vessels showing relative flange positions and the angular slopes of shafting with the coupling bolts have been removed. With tie bearings adjusted to obtain these measurements, proper alignment of the shafting is insured when the coupling bolts are secured.
- d. Methods of Determining Alignment.
  - (1) The proper location of the bearings on main propulsion shafting may be checked by running a line wire. This consists of rigging supports

**6-24 ALIGN PROPELLER AND PROPELLER SHAFT (Continued).**

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just clear of the end of the outer bearings of the set to be aligned. A length of piano wire is stretched between the supports. The supports must be rigid and not subject to deflection when the wire is put under tension. The wire should be attached to the supports. In such a way that it can be accurately centered in the end bearings. After the wire has been centered in the end bearings, the wire forms the line of reference (when corrected for sag) for all the intervening bearings.

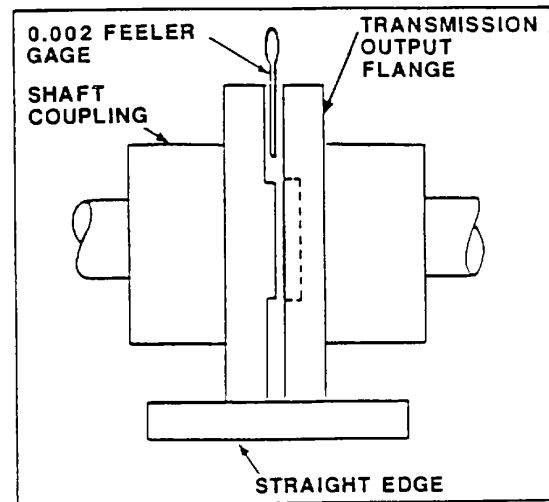
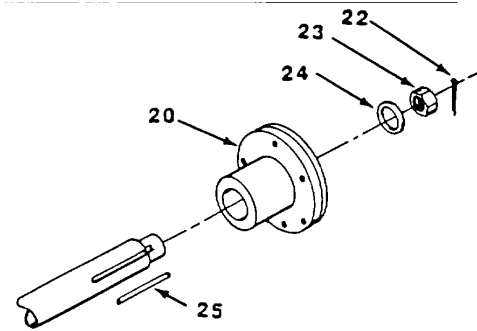
- (2) Alignment of shafting by the optical method makes use of the line of sight, which for all practical purposes is a true line. This method consists of boring a large hole in the end of two boards. One board is fitted at each end bearing of the set to be aligned. A small hole (about 1/16 to 1/8 inch) is drilled in two pieces of thin sheet metal. The sheet metal is placed on the boards and the small holes are adjusted so that they are aligned with the center of the end bearings. A light is placed behind the board on one end and observed through the hole in the board at the other end. The intermediate boards are adjusted so that the light can be seen through all the holes. The center of these holes serves to establish the reference line.
- (3) When it is suspected that the shaft is out of alignment, it should be checked by slacking the coupling bolts at a coupling.



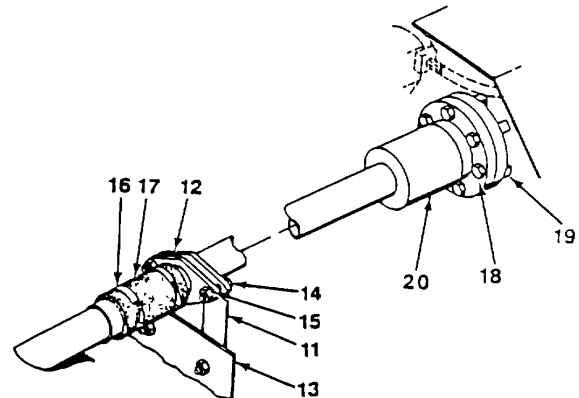
6-24 ALIGN PROPELLER AND PROPELLER SHAFT (Continued).

near the suspected area on the shaft. Feelers are inserted between the coupling flanges, and if there is a greater distance between the faces at one part of the coupling than at another, the shafts are out of alignment at these places.

- e. Place a straight edge across edges of flanges at top and side to check parallel alignment of coupling edges.
- f. Place a 0.002-inch feeler gauge between flanges of coupling and slide feeler gauge completely around coupling.
- g. Rotate transmission flange coupling 90, 180 and 270 degrees while moving feeler gauge around the flange in each successive position. If the alignment is correct, the feeler gauge will fit snugly, with same tension all around flange coupling.
- h. Bolt transmission output flange and shaft coupling (20) together with eight bolts (18) and nuts (19).



Checking Alignment (Parallelism) of Coupling and Propeller Flanges



**6-25 REPAIR STUFFING BOX.**

This task covers                      a. Removal                      b. Installation                      c. Installation                      c. Adjustment

**INITIAL SETUP**Tools:

Tool Kit, Mechanics Rail  
and Marine  
5180-00-629-9783

Equipment Conditions:

Engine shut down.

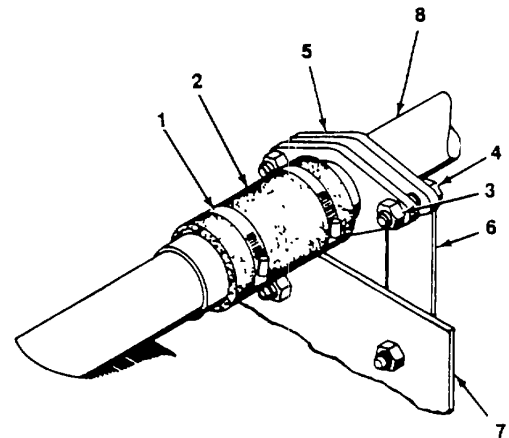
Material/Parts:

Packing Material  
(7/16 inch flax)  
Item 25, Appendix E

**REMOVAL**

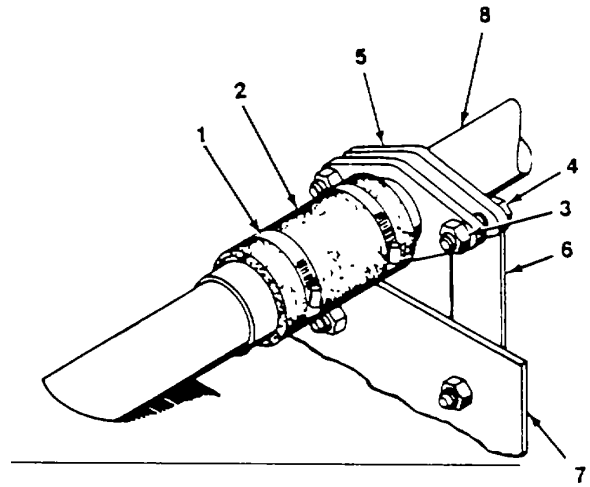
## REMOVE PACKING.

- a. Loosen hose clamps (1). Slide flexible hose (2).
- b. Remove two upper bolts (3) and nuts (4) securing stuffing box (5) to packing brace (6).
- c. Loosen two lower bolts (3) and nuts (4) securing the packing brace (6) to the mounting plate (7).
- d. Withdraw first half of the stuffing box up the shaft (8). Remove the old packing from underneath second half of stuffing box (5).



**6-25 REPAIR STUFFING BOX (Continued).****INSTALLATION****INSTALL PACKING**

- a. Cut new packing to same length as old packing from 7/16 inch commercial quality flax.
- b. Install new packing, slide down first half of stuffing box (5) onto shaft (8), and secure to second half with two upper bolts (3) and nuts (4).
- c. Slide up flexible hose (2) against stuffing box (5) and secure with hose clamps (1).

**ADJUSTMENT****ADJUST STUFFING BOX**

Tighten all four bolts (3) and nuts (4) evenly until seepage reaches a minimum.

**MAINTENANCE OF KEEL COOLER**

---

**6-26 INSPECT, SERVICE, TEST, REPLACE AND REPAIR KEEL COOLER.**

---

This task covers:

a. Inspection	c. Removal	e. Repair
b. Service	d. Testing	f. Installation

---

**INITIAL SETUP****Tools:**

Tool Kit, Mechanics Rail  
and Marine  
5180-00-629-9783  
Air Compressor  
Tank of Water to Accommodate Keel Cooler  
Torque Wrench

**Equipment Conditions:**

Vessel in drydock and cooling  
system drained.

---

**INSPECTION****INSPECT KEEL COOLER**

- a. Inspect keel cooler for evidence of leaking.
- b. Inspect for loose or missing mounting hardware.
- c. Inspect hoses for cracks, breaks, and deterioration and leaking conditions.
- d. Inspect hose clamps for looseness. Tighten as required.

**SERVICE****SERVICE KEEL COOLER**

- a. If craft is taking on water through bottom penetrations, replace appropriate gaskets (8 or 11).
- b. If cooling system leaks through flexible hose (2), then replace it.

**6-26 INSPECT, SERVICE, TEST, REPLACE AND REPAIR KEEL COOLER (Continued).**

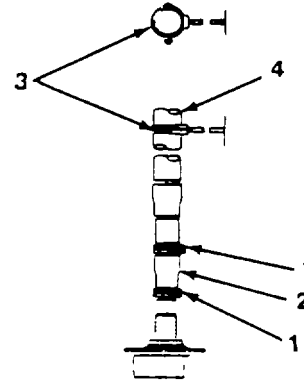
**REMOVAL**

1. REMOVE KEEL COOLER PIPING.

**NOTE**

**Prior to removal of keel cooler, drain cooling system by removing drain plug from each end of the cooler.**

- a. Loosen hose clamps (1) and slide onto flexible hose (2).
- b. Remove hose (2). Do Not remove hose clamps unless hose is to be replaced or clamp(s) are damaged.
- c. Remove other hose in the same manner.
- d. Remove pipe hanger (3) and pipe (4), if required.

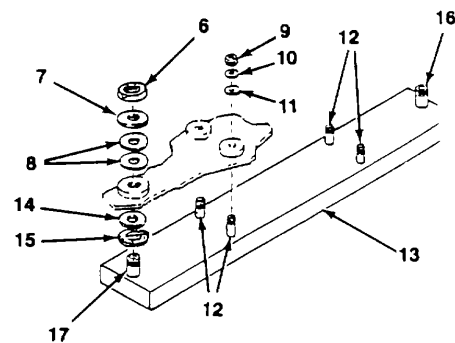


2. REMOVE KEEL COOLER.

**CAUTION**

**Before further removal, station personnel beneath keel cooler to lower it when completely detached from recess to avoid damage to the cooler if it should fall.**

- a. Remove nuts (6), copper washers (7), and neoprene gasket (8) from each end of keel cooler. Discard gasket.
- b. Remove nuts (9), flat washer (10) and neoprene gaskets (11) from mounting studs (12). Discard gasket.
- c. Remove keel cooler (13) from hull.
- d. Remove copper washer (14) and neoprene gaskets (15) from cooler (13). Discard gasket.



---

**6-26 INSPECT, SERVICE, TEST, REPLACE AND REPAIR KEEL COOLER (Continued).**

---

**TESTING**

## TEST KEEL COOLER

- a. Provide seal for one inlet to hold air under pressure (approximately 20 psi [137.8 kPa]).
- b. Prepare fitting for second inlet that has air line fitting.
- c. Install both Inlet fittings
- d. Pressurize cooler to approximately 10 psi (68.9 kPa) and submerge cooler in clear water not allowing "seals" to be submerged.
- e. Observe any air bubble that would indicate a leak.
- f. If a leak is found, cooler must be replaced.

**REPAIR**

## REPAIR KEEL COOLER

- a. Replace keel cooler if leak(s) were found or keel cooler is damaged beyond repair.
- b. Replace all gaskets.
- c. Replace all damaged or defective hardware.
- d. Replace defective hoses or hose clamps.
- e. Replace defective piping.

**6-26 INSPECT, SERVICE, TEST, REPLACE AND REPAIR KEEL COOLER (Continued).**

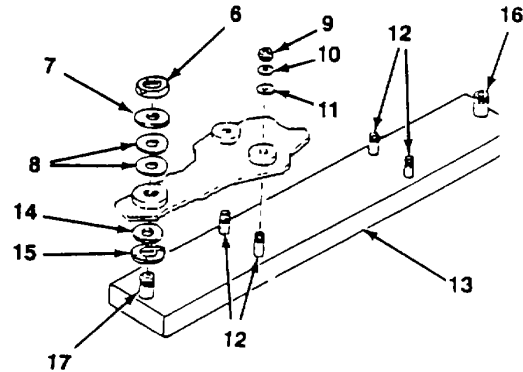
**INSTALLATION**

1. INSTALL KEEL COOLER.

**NOTE**

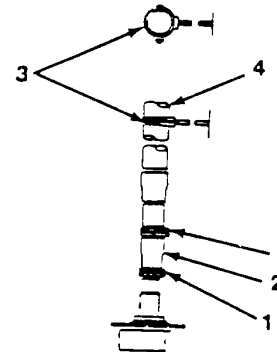
**Two (2) personnel are required to lift cooler into recess of hull for mounting.**

- a. Place neoprene gaskets (15) and flat washers (14) over pipes (16 and 17).
- b. Place cooler (13) into recess of hull for mounting.
- c. Place neoprene gaskets (11) and flat washers (10) onto over mounting studs (12).
- d. Install nuts (9) to torque nuts to 7-9 ft lb. (9.5-122 Nm).
- e. Place neoprene gaskets (8) and copper washers (7) onto pipes (16 and 17).
- f. Install nuts (6). Torque nuts to 7-9 ft lb. (95-122 Nm).



2. INSTALL KEEL COOLER PIPING.

- a. If removed, install pipe hanger (3), and pipe (4).
- b. Place hose clamps (1) over hose (2).
- c. Place hose (2) over ends of piping (6 and 5).
- d. Slide hose clamps (1) into position and tighten securely.
- e. Repeat steps to install other cooler.



**MAINTENANCE OF ANODES****6-27 INSPECT AND REPLACE ANODES.**

---

This task covers:                    a. Inspection                    c. Installation  
    b. Removal

---

**INITIAL SETUP****Tools:**

Tool Kit, Mechanic's, Rail  
and Marine  
5180-00-629-9783

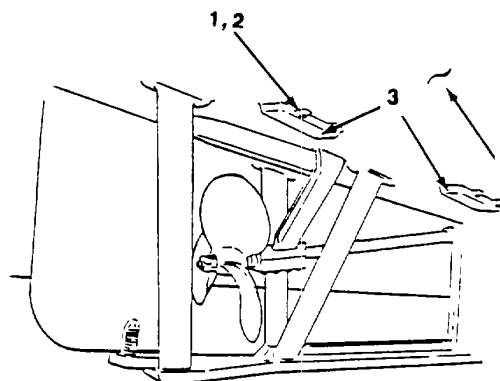
**Equipment Condition:**

Vessel in drydock

---

**INSPECTION****INSPECT ANODES.**

- a. Inspect anodes for loose mounting and missing hardware.
- b. Inspect for deterioration and corrosion.
- c. Insure that anodes have not wasted away to the point that they fall to provide adequate mass and surface area.

**REMOVAL****REMOVE ANODES.**

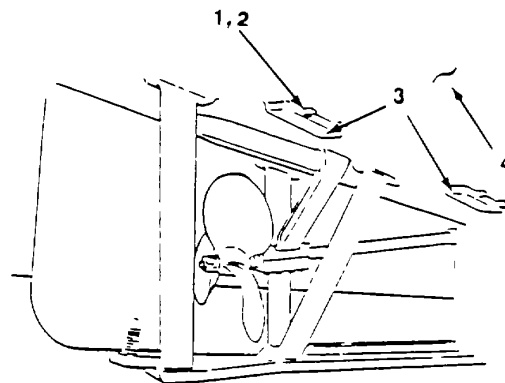
- a. Remove mounting nuts (1) and washers (2) (if used) from anodes.
- b. Remove anodes (3) from hull (4).



**6-27 INSPECT AND REPLACE ANODES (Continued).****INSTALLATION**

INSTALL ANODES.

- a. Position anode(s) (3) in place on hull (4).
- b. Secure with washers (2) (if used) and nuts (1). Tighten securely.



## APPENDIX A

### REFERENCES

**A-1 SCOPE.** This appendix lists all publications, manuals, directives and forms used in this technical manual, including reference material furnished by the Government.

**A-2 ARMY REGULATIONS.**

AR 55-19	Marine Casualties
AR 56-9	Watercraft

**A-3 DEPARTMENT OF THE ARMY PAMPHLET.**

DA PAM 738-750	The Army Maintenance Management System (TAMMS)
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**A-4 FIELD MANUALS.**

FM55-50	Army Water Transport Operations
FM55-501	Marine Crewman's Handbook
FM55-501-1	Landing Craft Operator's Handbook
FM55-506-2	Marine Engineman's Electrical Handbook

**A-5 FORMS.**

DA FORM 285	US Army Accident Investigation Report
DA FORM 2028	Recommended Changes to DA Publications
DA FORM 2404	Equipment Inspection and Maintenance Worksheet
DA FORM 2407	Maintenance Request
DA FORM 4640	Harbor Boat Deck Department Log for Class A and B Vessels
DA FORM 4993	Harbor Boat Engine Department Log for Class A and C-1 Vessels
RCS CSGLD-13 14	Report of Marine Casualty
SF 368	Quality Deficiency Report
USCG FORM CG 4602	Oil Record Book for Non-Tankers

**A-6 LUBRICATION ORDERS.**

LO 55-1905-222-12 Landing Craft, Mechanized (LCM-8) (Rohr and Gunderson Models)  
(1905-01-284-2647 and 1905-01-284-2648).

**A-7 TECHNICAL BULLETINS.**

TB 54200-200-10 Hand Portable Fire Extinguishers Approved for Army Users

TB 43-0117 Watercraft Electronics Configuration Directory

TB 43-0144 Painting of Vessels

TB 55-1900-201-45/1 Guide to Army Watercraft Survey Inspections, Repair Procedures and  
Repair Specifications Preparation

TB 55-1900-202-12/1 US Army Mobility Equipment Center Floating Craft Preventive  
Maintenance

TB 55-1900-202-12/2 Time Between Overhauls for All Marine Engines

TB 55-1900-204-24 Arc Welding on Water-Borne Vessels

TB 55-1900-205-24 Watercraft Information and Reporting System

TB 55-1900-206-14 Control and Abatement of Pollution by Army Watercraft

TB 55-1900-207-24 Treatment of Cooling Water in Marine Diesel Engines

TB 55-6605-262-24 Calibration, General Support Maintenance and Troubleshooting for  
Remote Magnetic Heading System (RMHS) Magnetic Compass,  
Mk 27, MOD 0 and MOD 1 Gyrocompass System.

TB 750-651 Use of Antifreeze Solutions and Cleaning Compounds in Engine  
Cooling System

TB 740-97-2 Preservation of USAMECOM Mechanical Equipment for Shipment and  
Storage

TB 740-97-4 Preservation of Vessels for Storage

**A-8 TECHNICAL MANUALS.**

TM55-2090-201-14&P	Operator, Organizational, Direct and General Support Maintenance Manual (Including Repair Parts and Special Tools List) 5GPM Oil/Water Separator
TM9-6140-200-14	Operator, Organizational, Direct and General Support Maintenance Manual for Lead-Acid Storage Batteries
TM11-5820-401-12	Operator and Organizational Maintenance Manual (Including Repair Parts and Special Tools List) Radio Set AN/VRC-46 and AN/VRC-47
TM11-5820-401-34-2	Direct Support and General Support Maintenance Manual Radio Sets AN/VRC-46 and AN/VRC-47
TM11-5820-401-34-3	Direct Support and General Support Maintenance Manual Radio Sets AN/VRC-46 and AN/VRC-47
TM11-5820-401-ESC-2	Equipment Serviceability Criteria for Radio Set AN/VRC-46
TM11-5820-401-ESC-4	Equipment Serviceability Criteria for Radio Set AN/VRC-47
TM 11-5820-820-12	Operator and Organizational Maintenance Manual (Including Repair Parts and Special Tools List) Radio Sets AN/VRC-80 (V) 1 and AN/VRC-80 (V) 3
TM11-5820-820-30	Direct Support Maintenance Manual Radio Set AN/VRC-80 (V) 1/3
TM11-5915-224-14	Operator, Organizational, Direct and General Support Maintenance Manual Suppressor, Electrical Transient MX-
7778A/GRC	
TM11-5915-224-24P.	Organizational, Direct Support and General Support Repair Parts and Special Tools List (Including Depot Maintenance Repair Parts And Special Tools)- Suppressor, Electrical Transient, MX9778/GRC
TM55-1905-222-24P	Operator, Unit and Intermediate (Direct and General Support) Repair Parts and Special Tools List for Landing Craft, Mechanized (Rohr and Gunderson Models)

TM 5-2815-231-14	Operator, Unit and Intermediate (Direct and General Support) Maintenance Manual for Engine, Diesel, V-12 (Rohr and Gunderson Models)
TM 5-2815-231-24P	Operator, Unit and Intermediate (Direct and General Support) Repair Parts and Special Tools List for Engine, Diesel, V-12 (Rohr and Gunderson Models)
TM 740-97-4	Preservation of Vessels for Storage
TM 750-244-3	Procedures for Destruction of Equipment To Prevent Enemy Use
TM 55-500	Marine Equipment Characteristics and Data
TM 55-503	Marine Salvage and Hull Repair
TM 9-237	Welding

## APPENDIX B

## MAINTENANCE ALLOCATION CHART

## SECTION I INTRODUCTION

**B-1 GENERAL**

a. This section provides a general explanation of all maintenance and repair functions authorized at various maintenance levels.

b. Section II designates overall responsibility for the performance of maintenance functions on the identified end item or component and the work measurement time required to perform the functions by the designated maintenance level. The implementation of the maintenance functions upon the end item or components will be consistent with the assigned maintenance functions.

c. Section III lists the tools and test equipment required for each maintenance function as referenced from Section II.

d. Section IV lists the remarks referenced from Section II.

**B-2 EXPLANATION OF COLUMNS IN SECTION II**

a. Column (1). Group Number. Column 1 lists group numbers to identify related components, assemblies, subassemblies, and modules with their next higher assembly. The applicable groups are listed in the MAC In disassembly sequence beginning with the first group removed.

b. Column (2). Component/Assembly. This column contains the known names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

c. Column (3). Maintenance Functions. This column lists the functions to be performed on the item listed in Column 2. The maintenance functions are defined as follows:

(1) Inspect. To determine serviceability of an item by comparing its physical, mechanical, or electrical characteristics with established standards through examination.

(2) Test. To verify serviceability and to detect incipient failure by measuring the mechanical or electrical characteristics of an item, and comparing those characteristics with prescribed standards.

(3) Service. Operations required periodically to keep an item in proper operating condition, i.e., to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

(4) Adjust. To maintain within prescribed limits, by grinding into proper or exact 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 equipments used In precision measurement. Consists of comparison or 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) Install. The act of emplacing, seating, or fixing into position an item, part, or module (component or assembly) In a manner to allow the proper functioning of an equipment or system.

(8) Replace. The act of substituting a serviceable like type part, subassembly or module (component or assembly) for an unserviceable counterpart.

(9) Repair. The application of maintenance services (inspect, test, service, adjust, align, calibrate, or replace) or other maintenance actions (welding, grinding, riveting, straightening, facing, remachining or resurfacing) to 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.

(10) Overhaul. That maintenance effort (service/action) necessary to restore an Item to a completely serviceable/operational condition as prescribed by maintenance standards in appropriate technical manuals. Overhaul Is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an Item to a 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 organizational manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc. ) considered to classifying Army equipments/components.

d. Column (4) - Maintenance Level. This column is made up of sub-columns for each category of maintenance Work time figures are listed In these subcolumns for the lowest level of maintenance authorized to perform the function listed in Column 3 These figures Indicate the average active time required to perform the maintenance function at the indicated category of maintenance under typical field operating conditions

e. Column (5). Tools and Equipment. This column is provided for referencing by code, the common tool sets (not individual tools), special tools, test and support equipment required to perform the designated functions

f. Column (6). Remarks. This column is provided for referencing by code of the remarks pertaining to the designated functions

### **B-3 EXPLANATION OF COLUMNS IN SECTION III**

a. Column (1). Reference Code. The tool and test equipment referenced code correlates with a maintenance function on the Identified end item or component.

b. Column (2). Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

c. Column (3). Nomenclature. Name or Identification of the tool or test equipment.

- d. Column (4). National/NATO Stock Number. The National or NATO stock number of the tool or test equipment.
- e. Column (5). Tool Number. The manufacturer's part number.



Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
01	Navigational Aids								
0101	Navigation Lights Bulbs and Lens Housing	Inspect Replace	5 1.0					18	
010101	Fixtures and Switches	Inspect Replace	0.5	1.0				18	
0102	Search Light Bulb, Reflector, Glass and Fixture	Inspect Service Replace	0.2 0.5	1.0				18	
0103	Electric Horn	Inspect Replace		0.2 1.0				18	
02	Electrical System								
0201	Batteries and Cables	Inspect Service Test Replace	0.1 0.3	1.0 1.5			17, 18		
0202	Alternator and Belts	Inspect Service Test Replace Repair	0.1 0.5 0.5	1.0				2, 15, 16, 18	
0203	Voltage Regulator	Inspect Adjust Replace	0.1	1.0 1.0	4.0		8.0	18	A
0204	Voltage Protector	Inspect Replace	0.1	1.0			18		

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
0205 Panel	Control and Distribution	Inspect Repair	2.0	2.0				18	B
0206	Lighting Fixtures and Switches	Inspect Replace Repair	0.1	1.0 1.0				18	
03	Pilothouse								
0301	Canopy, Mast, Windows, Wipers and Wiper Motor	Inspect Service Replace Repair	0.5 0.5	4 5	6.0			18	
0302	Propulsion Controls and Linkages								
030201	Propulsion Control Head	Inspect Service Replace	0.5 2.0	4.0				18	
030202	Throttle Linkage	Inspect Adjust Replace	0.5	1.5	4.0			18	
030203	Clutch Linkage	Inspect Adjust Replace	0.5	1.5	3.0			18	
0303	Control Console, Instrument Lights, and Switch	Inspect Service Replace	0.5 1.0	2.0				18	

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
030301	Engine/ Transmission Instruments	Replace			2.0			18	
030302	Hydraulic Gauges, Rudder Angle Indicator and Ammeter	Replace			2.0			18	
0304	Engine Shutdown Control and Emergency Engine Shutdown Control	Replace		2.0				18	
04	Sanitation System								
0401	MSD Assembly Treatment Tank, Receiving Tank, Filter, Disinfection Unit, Retention Canisters, Hoses and Valves	Inspect Service Replace	1.0 2.0	6.0				18	C
0402	MSD Pump and Motor Assembly	Inspect Service Replace Repair		0.1 0.1 1.0 1.0				18	

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
05	Communication Equipment								
0501	Radio Set AN/VRC-46/47	Refer to TM 55-5820-401	2						
0502 AN/VRC-80	Radio Set	Refer to TM 11-5820-820	2						
0503 JRC-92	Radio Set	Refer to TM 11-5820-873	2						
06	Compass System	Refer to TB 55-6005-262	4						
07	Hull, above Water-Line								
0701	Hull, Bitts, Chocks, Tie-Downs, Stanchions, Life-Lines, Hatches and Void Covers	Inspect Service Replace Repair	1.5 8.0	6.0 4.0				18	D
0702	Voids and Compartment	Inspect Service Repair	4.0 30.0	16.0				18	E
08	Ramp System								
0801	Valves, Piping, Hoses and Fittings	Inspect Replace	1.5	3.0				18	F

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
0802	Ramp Hoist Hydraulic Pump	Inspect Replace Repair	0.5		6.0	4.0		16, 18	
0803	Ramp Hoist Control Valve	Inspect Replace Repair	0.5		3.0	3.5		18	
0804	Ramp Hoist Hydraulic Check Valve	Inspect Replace Repair	0.5		2.5 4.0				
0805	Ramp Hoist Hand Pump	Inspect Service Replace Repair	0.5 0.5		3.0	4.0		18	
0806	Ramp Locking Hydraulic Cylinders	Inspect Service Replace Repair	0.5 0.5		2.5	4.0		18	
0807	Ramp Winch Hydraulic Motor	Inspect Service Replace Repair	1.0	1.0	6.0 4.0			18	
0808	Ramp Winch	Inspect Service Replace Repair	1.0 1.0		8.0	12.0		7, 8, 18	

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
0809	Ramp Reservoir, Strainers and Filters	Inspect Service	0.5 1.0					18	G
0810	Ramp, Ramp Cables, Chains, Sheaves, Latch Mechanisms, Seal and Hinge Pins	Inspect Service Replace Repair	2.5 3.5		4.0	5.0		18	
09	Steering System								
0901	Hydraulic System Valves, Piping Hoses and Fittings	Inspect Replace	0.5	3.0				18	H
090101	Steering Pump	Inspect Service Replace Repair	0.5 0.5		1.0	4.0		16, 18	
090102	Steering Cylinders	Inspect Service Replace Repair	0.5 0.5		1.0	4.0		18	
090103	Helm Unit	Inspect Service Replace Repair	1.0 1.5		3.0	6.0		6, 18	
090104	Relief Valve	Inspect Service Replace Repair	0.1 0.1		1.0 1.0			18	

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
090105	Flow Divider	Inspect Service Replace Repair	0.1 0.1		1.0	2.0		18	
090106	Counter-balance Valve	Inspect Service Adjust Replace Repair	0.1 0.1	1.0	1.5	3.0		18	
090107	Check Valve	Inspect Service Replace Repair	0.1 0.2	1.0	1.0			18	
090108	Hydraulic Reservoir, Filter and Strainers	Inspect Service	0.3 0.5					18	G
0902	Rudder and Tiller Repair	Inspect Service Replace	1.0	1.0	16.0 24.0			18	
0903	Rudder Angle Transmitter (Follow-Up Unit)	Inspect Replace		1.0	2.0			18	
10	Bilge System								
1001	Piping, Valves, Strainers, Hoses and Fittings	Inspect Service Replace	2.0 2.0	8.0				18	H

B-10

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
1002	Bilge Pump/ Hydraulic Motor Assembly	Inspect Service Replace Repair	1 1		2.5 3.5			18	
11 12	Oil Water Separator Sea Water System	Refer To TM 55-200-201-14&P							
1201	Piping, Hoses and Valves Replace	Inspect Service	0.5 0.5	4.0				18	
1202	Duplex Strainer Replace Repair	Inspect Service	0.2 0.5		1.5 1.0			18	
13	Hydraulic Starting System								
1301	Starting System Valves, Piping, Hoses and Fittings	Inspect Replace	0.5	3.0				18	H
1302	Recharging Pump	Inspect Replace Repair	0.5		2.0	3.0		1, 16, 18	



Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
1303	Accumulator	Inspect Service Replace	0.5	1.5	1.5	3.5		3, 4, 18	I
1304	Reservoir and Filters	Inspect Service Replace	0.1 0.5		3.0			18	G
1305	Control Valve	Inspect Replace	0.2		1.5			18	
1306	Starting Motor	Inspect Service Replace Repair	0.5 0.5		1.5	4.0		18	
1307	Hand Pump	Inspect Service Replace Repair	0.5 0.5		1.5	2.5		18	
14	Fuel System								
1401	Tank, Piping, Valves, Hoses and Fittings	Inspect Service Replace	0.5 2.5	3.0				18	E H
1402	Fuel Strainer	Inspect Service Replace	0.1 0.5 1.0					18	
1403	Fuel Filter/ Water Separator	Inspect Service Replace	0.1 0.2 0.5					18	

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
15	Engine Cooling System								
1501	Piping, Hoses and Valves	Inspect Service Replace	0.5 0.5 1.5						
1502	Expansion Tank	Inspect Replace Repair	0.1		2.0 2.0			18	
16	Exhaust System								
1601	Mufflers, Piping and Lagging	Inspect Replace Repair	0.1	30 4.0				18	J
17	Main Engine	Refer to TM 5-2815-231--4							
18	Marine Gear	Refer to TM 5-2815-231-'4							
19	Tachometer Drive Gear and Cable	Refer to TM 5-2815-231-14							
20	Hull (below water-line)								
2001	Propeller, Propeller Shaft, Cutless Bearing Repair Align	Inspect Adjust Replace				2.5 1.0 4.0 12.0 4.0		9,10 13, 14, 18 (based on usage)	K
2002	Stuffing Box Service Adjust Repair	Inspect	0.2 0.2 0.3			2.0			

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: LANDING CRAFT, MECHANIZED (LCM-8)

GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	MAINTENANCE LEVEL					TOOLS AND EQUIP	REMARKS
			UNIT		INTERMEDIATE DEPOT				
			C	O	F	H	D		
2003	Keel Cooler Service Test Replace Repair	Inspect				2.5 0.4 1.0 5.0 8.0	18	L	
2004	Anodes Replace	Inspect				0.1 1.0	18	M	

**Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS  
FOR LANDING CRAFT, MECHANIZED (LCM-8)**

Tool or Test Equipment Ref. Code	Maintenance Category	Nomenclature	National/ NATO Stock Number	Tool Number
1	H	Installer Recharging Pump Shaft Seal		EHS41-1533
2	H	Tester, Diode		
3	F&H	Hose Assembly, Accumulator Charging	4730-00-412-3805	TSE8600(01843)
4	F&H	Gauge Assembly Accumulator		TSE8601(33287)
5	F&H	Wrench, Torque, 1/2" Drive, 0-200- Ft Lb		J1264(3387)
6	F&H	Installer Helm Unit Valve Spring		600057(96151)
7	F&H	Puller Bearing, Ramp Winch (Gunderson)		C13115(36581)
8	F&H	Installer Bushing, Ramp Winch (Gunderson)		B1397(36581)
9	H	Grinding Tool	5130-00-226-5389	W-G-633-(81348)
10	H	Pitch Block		
11	F&H	Wrench, Torque, 3/4" Drive 0-300 Ft Lb		J9187(33287)
12	H	Propeller Puller	5120-00-372-0652	
13	H	Wrench, Box, Propeller, Nut	5120-00-277-1575	
14	H	Wrench, Box, Shaft Nut	5120-00-277-1576	
15	C,O&F	Multimeter	6625-00-553-0142	TS-352 B/U
16	O,&H	Vise	5120-00.188-1182	
17	C,F&O	Tester, Battery	6630-00.171-5126	GG-T-258 (81348)

**Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS  
FOR  
LANDING CRAFT, MECHANIZED (LCM-8)**

(1) Tool or Test Equipment Ref. Code	(2) Maintenance Category	(3) Nomenclature	(4) National/ NATO Stock Number	(5) Tool Number
18	C, O, F & H	Tool Kit, Mechanic's Rail & Marine	5180-00629-9783	SM55-4-5180SO2 (81996)
19	H	Welding Machine		
20	F	Sledge Hammer, 3 lb	5120-00-242-3915	
21	F	Hoisting Device, 2 Ton	3950-00-965-0096	MIL-H-904 (81349)
22	F	Arbor Press		
23	H	120 Vac Test Lamp		
24	H	Heel Bar		
25	H	Pinch Bar, 3/4 Did	5120-00-224-1376	GGG-8-10 (81348)
26	H	Drop Light, Extension	6230-00-268-9246	MIL--L4020 (81349)
27	H	Blacksmill Forge		
28	H	Anvil	5120-00-180-2885	
29	H	Dial Indicator		J8165-2 (33287)
30	H	Air Compressor, 40 CFM, Type 1	4310-00-085-2032	FN 10 (1 1568)
31	O	Water Hose		
32	H	Jib Crane		J-33050A (25341)
33	H	Load Rotor		J-36130-812 (25341)
34	H	Positioning Sling		J-36130-806 (25341)

**Section IV. REMARKS**

<b>REFERENCE CODE</b>	<b>MAINTENANCE ALLOCATION CHART REMARKS</b>
A	Repair at F level involves replacement of brushes.
B	Repair is limited to replacement of switches and fuses.
C	Service includes periodic replenishment of disinfectant tablets in the disinfection unit and the addition of Sani-Start activator through the marine head by flushing
D	Service of hull, bitts, chocks, tiedowns, stanchions, lifelines, hatches and void covers includes removing paint and rust, cleaning gaskets (on hatches) and painting. Dogs and hinges on hatches are to be freed, and cleaned of paint.
E	Tank/compartment is to be free of explosive/combustible fumes/liquids prior to any spark causing or hot work.
F	"Replace" involves changing hoses and hose fittings. System valves and piping will be replaced on a case by case basis (refer to RPSTL).
G	Service includes replacement of filter elements. System valves and piping will be replaced on a case by case basis (refer to RPSTL).
H	Refer to para 4-30 for maintenance procedure.
I	Repair of accumulator includes charging accumulator with nitrogen gas.
J	"Replace" includes exhaust insulation.
K	Repair includes straightening, metalizing and balancing.
L	When the keel cooler has been removed from the vessel for repairs, test the keel cooler before replacing it.
M	Inspection of anodes may be accomplished in dry dock or by divers with vessel in water.

## APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

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## Section I. INTRODUCTION

**C-1. Scope.** This appendix lists components of the end item and basic issue items for the LCM- 8 to help you inventory the items for safe and efficient operation of the equipment.

**C-2. General.** The Components of End Item and Basic Issue Items Lists are divided into the following sections

a. Section II, Components of End Item (COEI). This listing is for information purposes only, and is not authority to requisition replacements. These items are part of the LCM8, but they are to be removed and separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to help you find and identify the items.

b. Section III, Basic Issue Items (BII). These essential items are required to place the LCM -8 in operation, operate it, and to do emergency repairs Although shipped separately packaged, BII must be with the LCM 8 during operation and when it is transferred between property accounts. Listing items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

**C-3. Explanation of columns.**

a. Column (1), Item Number, gives you the number of the item.

b. Column (2), National Stock Number, identifies the stock number of the item to be used for requisitioning purposes.

c. Column (3), Description and Useable On Code, identifies the Federal item name (in all capital letters) followed by a minimum description when needed The last line below the description is the CAGEC (Commercial and Government entity code) (in parenthesis) and the part number.

Used On  
(Model No.)

d. Column (4), U/I (unit of issue), indicates how the item is issued for the National Stock Number shown on column two.

e. Column (5), Qty Rqd, indicates the quantity required.

## Section II. COMPONENTS OF END ITEM LIST

(1) Item Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable On Code	(5) Qty rqr
1		Ammunition Box (Main Deck)	EA	3
2	2040-00-377-8599	Anchor, marine, 75 lb, (81349) MIL-A-15707	EA	1
3		Battery, Storage, 12V (96906) MS52149-1 Type 6TL	EA	2
4	6350-00-256-9601	Bell, Ship 20 lb (81349) B-674	EA	1
5	4010-00-555-9510	Chain Assembly, Anchor, 3/8 In. (81349) C-2683	EA	1
6	4210-00-889-2491	Extinguisher, Fire, Dry Chemical, 10 lb, A-B-C, USCG Approved (81348) O-E910	EA	4
7	4720-00-494-2527	Hydraulic Hose, all sizes, 4720-00-702-5214, 4620-00-986-3967	EA	4
8		Locker, Parts (Lazerette)	EA	1
9		Locker, Weapons	EA	1
10		Mast, Aluminum	EA	1
11		Mount, Machine Gun (50 cal)	EA	2
12	6005-01-069-7004	Remote Magnetic Heading Sys. (RMHS)	EA	1
13	6005-01-106-9560	RMHS, Indicator	EA	1
14	5820-00-097-0082	Single Side Band (SSB) Radio	EA	1
15	8345-00-935-3120	Transportation Corps Flag	EA	1
16		Tiler, Steering Emergency	EA	1



## Section III. BASIC ISSUE ITEMS LIST

(1) Item Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable On Code U/I	(5) Qty rqr
1	6135-00-120-1020	Battery (Light Marker)	EA	1
2	7510-00-889-3439	Binder-Equipment Log Book (81349) B43064	EA	1
3	6650-00-530-0974	Binocular, 7 X 50, Type M17a1	EA	1
4	7240-00-782-3236	Can, Water, 5 gal	EA	4
5	5120-00-529-4124	Carrier, Battey, Hand (81349) C-19482	EA	1
6	4240-00-022-2946	Ear Protector, MIL-P-38268	EA	6
7	2040-00-565-9142	Fender, Marine 18" dia X 36" long (14348) Fendaire	EA	8
8	8345-00-245-0040	Flag, National, U.S. 1' 6" x 2' 2" (81348) DDD-F-416, Type III Class 2	EA	1
9	6230-00-264-8261	Flashlight, Watertight, 2 Cell (81349) F-3747	EA	1
10	4930-00-965-0285	Flexible Extension, (Grease Gun)	EA	1
11	2040-01-107-1164	Fuel, Sounding Tape or Rod	EA	II
12	4240-00-052-3776	Goggles, Plastic, Safety (81348) GG-G-531	EA	3
13	4930-00-253-2478	Grease Gun, Hand, 16 oz (81349) G-3859	EA	2
14	5120-00-224-4111	Hammer, Scaling, Hand, 1 lb (81348) GGG-H-86	EA	2
15	3950-00-235-4239	Hoist, Chain (81349) H-904	EA	2
16	2040-00-268--9250	Hook, Boat, Wood 10 feet (81348) H-3496	EA	2
17	6545-00-922-1200	Kit, First Aid, Gen Purpose, 12 Units (33333) NORFF	EA	1
18	6230-00-781-3189	Lantern, Electric, 6V, W/O Relay (96906)100-2	EA	2
19	4220-00-200-0538	Life Preserver, Adult (81349) MIL-L-10845	EA	6
20	5120-00-293-1039	Lifter, Scrapper, Battery (74267) 177	EA	1
21	6260-01-086-8077	Light, Life Preserver (81349) L-573	EA	16
22	6230-00-782-0643	Light, Marker Distress (80064) 815-119249	EA	2
23	4930-00-266-9182	Oiler, Hand, 8 oz (81348) GGG-0-591	EA	1
24	5120-00-372-0652	Puller, Propeller (72201) Size 8	EA	1
25	4320-00-574-7645	Pump, Reap., Hand (Engine Sump) (46643) 3799	EA	1

## Section III. BASIC ISSUE ITEMS LIST (Continued)

(1) Item Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable On Code U/I	(5) Qty rqr
26	4240-01-179-0126	Respirator, Air Filtering	EA	2
27	4220-00-275-3157	Ring, Buoy, Floating 30" OD w/Line (81349)	EA	3
28	4020-00-919-3443	Rope, Nylon, 1" Dia (Anchor/Mooring) (81349) MIL-R-17343	EA	1
29		Rope, Nylon, 48' Mfr from (81349) MIL-R-17343	EA	2
30		Rope, Nylon, 18' Mfr from (81349) MIL-R-17343	EA	2
31		Rope, Nylon, 90' Mfr from (81349) MIL-R-17343	EA	1
32		Rope, Nylon, Anchor Line, 125' Mfr from (81349) MIL-R-17343	EA	1
33	5110-00-240-3094	Scrapper, Ship All Metal, 15" Long	EA	1
34	1370-01-030-8330	Signal, Distress, Orange Smoke, Red Illum.	EA	12
35	8340-00-753-6438	Tarpaulin, #6 Cargo Cover (81348) K-P-1 46	EA	1
36	6630-00-171-5126	Tester, Battery (81348) GGG-T-258, GSA FSS	EA	1
37	5180-00-629-9783	Tool Kit, Mechanic's Rail and Marine (50980) SC 51 80-90-CL-NSS	EA	1
38	6850-00-001-4194	Water Indicator Paste	EA	1
39	4220-00-276-8926	Buoyant Vest, Work Type	EA	6
40	5120-00-277-1575	Wrench, Box, Prop NUT (81345) GGG-W-636	EA	1
41	5120-00-277-1576	Wrench, Box, Shaft NUT (81348) GGG-W-636	EA	1
42	5120-00-712-0517	Wrench, Fuel Sounding Tube (80064) LCM-8S55D1 H1387536	EA	1
43	5120-00-277-1247	Wrench, Dog, 1-5/16 inches (80244) GGG-W-636 Ty5	EA	2
44	8465-00-254-8803	Whistle, Life Jacket, w/Lanyard (81349) MIL-W-1053	EA	16
45	5330-00-929-8730	Gasket, Cylinder 10 (72922)	EA	4
46	3030-00-180-2102	Belt V, Matched Set B-42 (24161)	ST	2
47	2010-00-540-7689	Shafts and Propellers: Propeller, Seagull Type 1 LH	EA	1
48	2010-00-540-7690	Propeller, Seagull Type 1 RH	EA	1

## Section III. BASIC ISSUE ITEMS LIST (Continued)

(1) Item Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable On Code U/I	(5) Qty rqr
49	2010-01-347-6850	Shaft, Propeller, 6 Type 630 (81346)	EA	2
50	5920-00-686-9548	Electrical Control Panel Fuse, Cartridge, 10AF09A250V1 OA (81349)	EA	10
51	5920-00-280-3168	Fuse, Cartridge, Fo7A32 Visa (81349)	EA	10
52	5920-00-296-0445	Remote Magnetic Heading Sys. (RMHS) Fuse, Cartridge F60C500 VSA (81349)	EA	2
53	2040-00-288-5055	Bearing Sleeve 2-1/2" I D. X 3-3/8" O.D. X 10" Long Cutlass Rubber Stern Tube	EA	2
54	4330-01-046-3399	On-Board Repair Parts for Engine, Diesel V-12: (73370) CS3504	EA	4
55	3030-00-528-7921	30 Micron (Racor)	PR	2
56	6240-12-157-4150	V-Belts, Matched Pair, 1/2 width X 42 3 out-side length (24161) A-41	EA	51
57	4330-00-073-0371	Bulb, Incandescent, 24 V, 10 W (61204) 00400044	EA	4
58	4510-00-875-1565	Filter Element (02249) K22001 Marland 55-40 Type II, Sanitation System-	EA	1
59		Head, MSD "Skipper, " Repair Kit (Marland) (79577) # 1539	EA	1
60		Holder (Marland) (65379) 31680	EA	1
61		Gasket (Marland) (65379) 31740	EA	1
62		Impeller Kit (Marland) (65379) 31837	EA	1
63		Seal Kit (Marland) (65379) 31838	EA	1
64	2910-00-089-6012	Sani-Start, 1 lb Bottle (Marland) (65379) 31848 Note: Ordering Information for MSD Exstar Intl Corp 6502 Windmill Way, Wilmington, N C 28405, Phone (919) 452-4737	EA	6
65	2940-01-197-7106	Fuel Filter Element, 10 Micron (24617) TP624	EA	12
		Lube Oil Filter Element (72582) PF911	EA	

Section III. BASIC ISSUE ITEMS LIST (Continued)

(1) Item Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable On Code U/I	(5) Qty rqr
66	2940-00-143-9204	Lube 011 Filter Element (Twin Disc) (61 208)ump	EA	4
67	4320-00-099-1060	Impeller, Raw Water Pump (72582) 5193602	EA	6
68	6240-01-170-0702	Bulb, Incandescent 24V, 25 W (61204) 904-00003	EA	7
69	2090-00-058-3737	Battle Damage Equipment Shoring, Steel, Adjustable, Short 3' to 5"	EA	1
	2090-00-052-1581	Shoring, Steel, Adjustable, Long 6' to 11'	EA	1
	5510-00-260-8953	Plug, Soft Wood 1" X 0' X 3" Long	EA	5
	5510-00-260-8962	Plug, Soft Wood 3" X 0" X 8" Long	EA	10
	5510-00-260-8969	Plug, Soft Wood 7" X 3" X 10" Long	EA	5
	5510-00-268-3479	Wedge, Plug, Tapered, hardwood 2" X 2" X 8" Long	EA	6
	5510-00-268-3475	Wedge, Shoring, Tapered, Hardwood 1- 1/2" X 2" X 12" Long	EA	6
	4240-01-116-9888	Emergency Escape Breathing Device (EEBD)	EA	1
	4240-00-022-2522	Harness, Safety, Torso	EA	2
	4240-00-022-2518	Lanyard, Safety, Harness	EA	2
	4210-00-142-4949	Fire Axe	EA	1
	4240-01-258-1245	Fountain, Eye and Face Wash, Portable, 16 Gallons	EA	1
	6840-01-315-9841	Bacteriostatic Additive (Eye & Face Wash Fountain)	BX	1
	4020-01-344-0552	Line Heaving, Safety, 100'	EA	2
	8415-00-935-3139	Hard Hat, White	EA	1
	8415-00-935-3136	Hard Hat, Orange	EA	3
		Bum Dressing Kit: 8" X 18" Dressing	EA	2
		4" X 16" Dressing	EA	1
		4" X 4" Dressing	EA	4
		12" X 16" Face Mask Dressing	EA	2
		Bum-Jel Topical Dressing	PK	1
		Ordering Information: Water-Jel Awk Kit H & H Associates, Inc P O. Box 4469 Alexandria, Va. 22303 Phone 1-800-236-5708		

Section III. BASIC ISSUE ITEMS LIST (Continued)

(1) Item Number	(2) National Stock Number	(3) Description CAGEC and Part Number	(4) Usable On Code U/I	(5) Qty rqr
		Fire Blanket, 72" X 60 Ordering Information Water-Jel Awk Krt H & H Associates, Inc PO Box 4469 Alexandria, Va. 22303 Phone 1-800-236-5708	EA	1
	4240-00-190-6432	Goggle, Industrial, No Vents, (Chemical Splash)	EA	1
	4240-00-542-2048	Face Shield, Industrial, Tilting	EA	1
	8415-01-268-3473	Hood, Anti-Rash	EA	6
	8415-01-267-9661	Gloves, Anti-Flash	PR	6
	9390-01-078-8660	Tape, Retroreflective, 3" X 50 yds Long Coverall, Anti-exposure, Stems Model 1 FS-580, Orange Ordering Information Lifesaving Systems Corp. 720 4th St. SW Ruskin, FL 33570-1829 Phone (813) 645-2768	EA	4
	8465-01-004-2893	Goggles, Safety, Wind, Dust, Sand, Spray	EA	4
	5120-00-255-1476	Maul, Ship's 5 lb, (Damage Control Plugs)	EA	1
	8345-00-935-0445	Flag, Signal, "A" Intn'l Code, Size 6 (81349) MIL-F-2692	EA	1
	8345-00-926-6803	Flag, Signal, "B" Intn'l Code, Size 6 (81349) MIL-F-2692	EA	1
	8345-00-935-0451	Flag, Signal, "O" Intn'l Code, Size 6 (81349) Mil-F-2692	EA	1
	8345-00-926-6814	Flag, Signal, "U" Intn'l Code, Size 6 (81349) MIL-F-2692	EA	1
	8345-00-935-0455	Flag, Signal, "V" Intn'l Code Size 6 (81349) MIL-F-2692	EA	1
	8345-00-935-0456	Flag, Signal, "W" Intn'l Code, Size 6 (81349) MIL-F-2692	EA	1

**APPENDIX D**

**ADDITIONAL AUTHORIZATION LIST**

**SECTION 1. INTRODUCTION**

**D-1. SCOPE**

This appendix lists additional Items you are authorized for the support of the LCM 8

**D-2. GENERAL**

This list identifies items that do not have to accompany the LCM 8 and that do not have to be turned in with it. These Items are all authorized to you by CTA, MTOE, TDA, or JTA

**D-3. EXPLANATION OF LISTING**

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you. These codes are identified as:

Code	Used On
PAA	Model 114
PAB	Model 114A
PAC	Model 114B

## Section II. ADDITIONAL AUTHORIZATION LIST

(1) National Stock Number	(2) Description FSCM & Part Number      Usable On Code	(3) U/M	(4) Qty Auth
6605-01-069-7004	Remote Magnetic Heading (RMHS) (07187) 4008833-902	EA	1
6605-00-106-9560	Indicator, RMHS (07187) 2590057-901	EA	1
3950-00-235-4239	Hoist, Chain (81349) H-904	EA	1
5820-00-097-0082	Radio (SSB)	EA	3
8340-00-753-6438	Tarpaulin, #6 Cargo Cover (81348) K-P-146	EA	1
4220-00-200-0538	Life Preserver, Adult (81349) MIL-L-10845	EA	6
6230-00-782-0643	Light, Marker, Distress, Rail (80064) 815-119249	EA	2
6230-00-255-0166	Light, Life Preserver (81349) L-573	EA	6

**APPENDIX E****EXPENDABLE SUPPLIES AND MATERIALS LIST****SECTION 1. INTRODUCTION****E-1. SCOPE**

This appendix lists expendable supplies and materials you will need to operate and maintain the LCM 8. These items are authorized to you by CTA 50-970, Expendable Items (Except Medical, Class V, Repair Parts, and Heraldic Items).

**E-2. EXPLANATION OF COLUMNS**

a. Column (1) - Item Number This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use cleaning compound, item 5, App.E").

b. Column (2) - Level. This column identifies the lowest level of maintenance that requires the listed item.

(enter as applicable)

C - Operator/Crew

O - Organizational Maintenance

F - Direct Support Maintenance

H - General Support Maintenance

c. Column (3) - National Stock Number This is the National stock number assigned to the item, use it to request or requisition the item.

d. Column (4) - Description Indicates the Federal item name and, if required, a description to identify the item. The last line for each item indicates the Federal Supply Code for Manufacturer (FSCM) in parenthesis followed by the part number.

e. Column (5) - Unit of Measure (U/M) Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea, in, pr). If the unit of measure differs from the unit of issue, requisition the lowest unit of issue that will satisfy your requirements.



## Section II. Expendable Supplies And Materials List

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
1	C	8030-00-251-3980	Compound, Antiseize (81349) MIL-A-907	CN
2	C	9150-00-190-0904	Grease, Auto and Artillery (81349) MIL-G-1026	PL
3	C	9150-00-530-6814	Grease, Wire Rope Exposed (81349) MIL-G-18458	CN
4	C	9150-00-188-9858	Lubrication Oil, Engine OE (5 Gal) (87349) MIL-L-2104	CN
5	C	7920-00-291-8305	Broom, Upright, Corn (81348) H-B-51	EA
6	C	7920-00-240-6358	Brush, Dusting Bench (81348) H-B-180	EA
7	C	7920-00-224-8308	Pan, Dust (81348) RR-D-800	EA
8	C	7920-00-267-1218	Hand Mop, Wood (81348) NN-H-101	EA
9	C	7920-00-171-1148	Mophead, Wet, Cotton (81348) T-M-561	EA
10	C	8540-00-530-3770	Paper, Toilet (81348) UU-P-00556	EA
11	C	7920-00-205-1711	Rag, Wiping, 25 lb Bale (81348) A-A-53146	BL
12	C	9150-00-582-5480	Hydraulic Fluid (81349) MIL-L-17672	DR
13	C	Flushing Compound	GL No 8509 (Spec AF-3595)	
14	C	8030-00-889-3535	Sealant (tape, Antiseizing) (81349) MIL-T-27730-1/2 in wide	RO
15	C		Disinfection Tablets, Calcium Hypo- chlorite Tablets, 6 lb (531084) HTH	LB

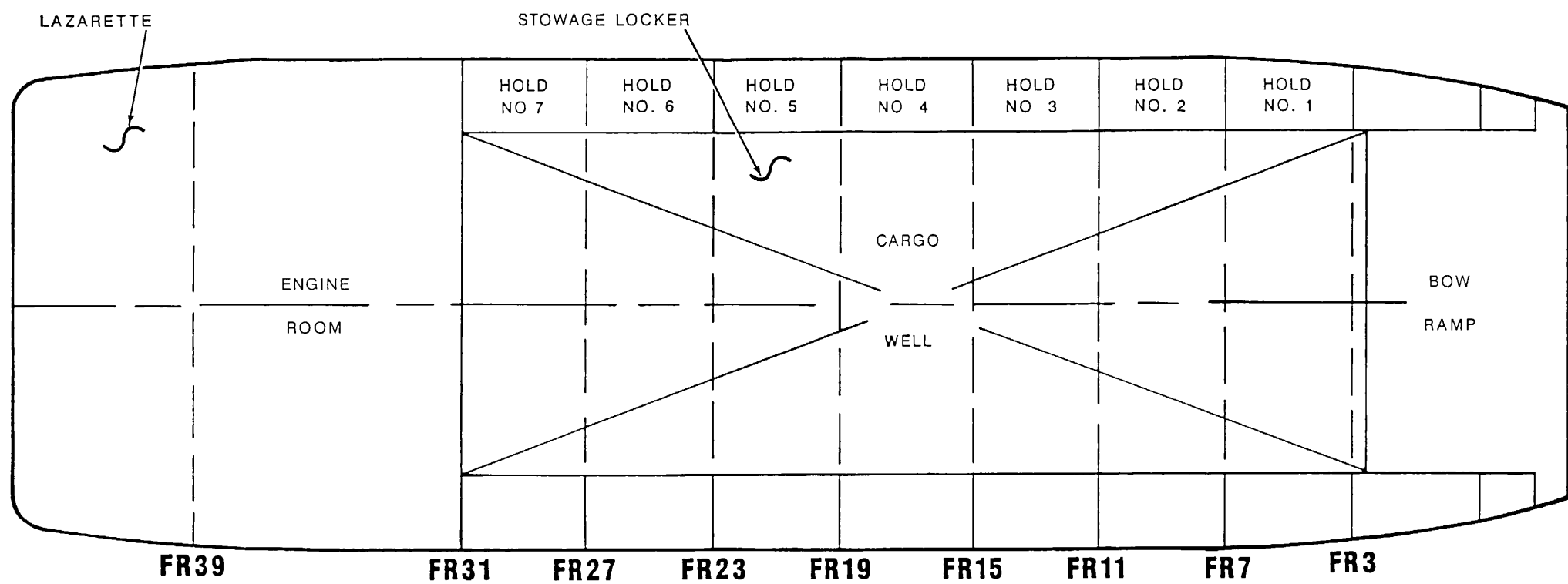
\* U.S GOVERMENT PRINTING OFFICE:1996-755-1 19/400 C

## Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
16	C		Sani-Start Activator (51195)31848	LB
17	C	6850-00-281-1985	Cleaning Solvent PD 680	GL
18	F	8940-00-145-0020	Adhesive (RTV)	TU
19	F		Transmission Oil SAE90	CN
20	H	5350-00-221-0872	Crocus Cloth (81348) A-A- 1206 Type I	EA
21	F	5350-00-224-7215	Abrasive Paper, 600 Grit (81348) A-A- 1200	EA
22	C	9450-00-526-4205	Grease (81349) M I L-G- 18709	CN
23	F	9620-00-233-6712	Graphite, Dry (81348) SS-G-659	LB
24	C	9150-00-111-6256	Hydraulic Fluid (81349) MIL-H-46170B	GL
25	F		Piano Wire #6	RO
26	H		Nitrogen Gas (81348) BB-N-411	CF
27	C	6240-00-132-5355	Lamp, Incandescent (1 A406) 50ARS32V	EA
28	F		Packing, Flax, 7/16 in	LB
29	O		Gasket (81349) MIL-G-14243 CLI	EA
30	O	6240-00-143-3124	Lamp, Incandescent, 100 Watt	EA
31	C	7240-00-160-0440	Can, Garbage, 32 gal	EA

Section II. EXPENDABLE SUPPLIES AND MATERIALS LIST

(1) Item Number	(2) Level	(3) National Stock Number	(4) Description	(5) U/M
32	C		Cover, Can, Garbage	EA
33	C		Antifreeze, Ethylene Glycol, Inhibited	CN
34	C		Heavy Duty, 5 gal 1 CN	
35	C	7920-00-772-6800	Oil, Lubricant, OE-10, 5 gal	CN
36	0	6840-01-279-3951	Brush, Sanitary	EA
37	0		Deodorant, Chemical, Container (OLIN) (53048) HTH	EA
			Filter Cartridge (61195)31749	EA



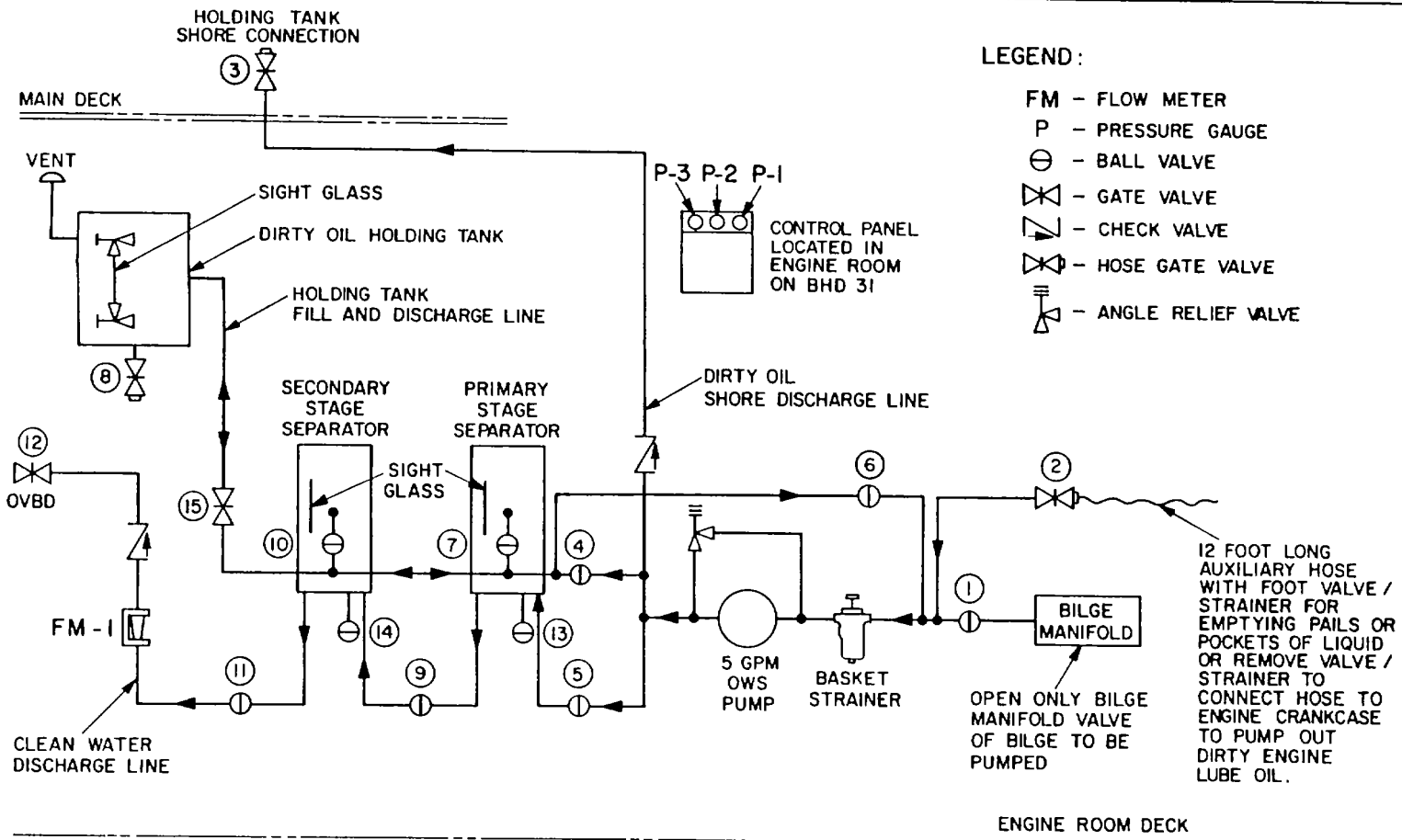
FO-1. LCM-8 PLAN VIEW, HULL STRUCTURE FEATURES

FP-1/(FP-2 blank)

**LCM-8 OIL/WATER SEPARATOR AND BILGE PUMPING SYSTEM OPERATING INSTRUCTION PLACARD**

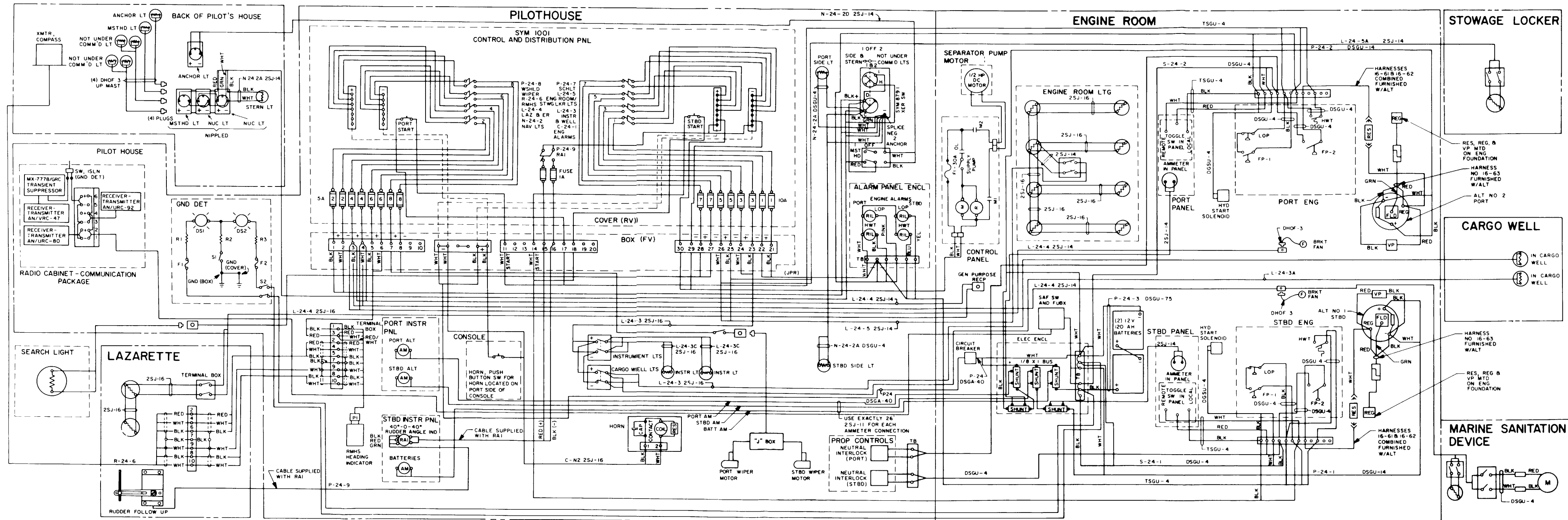
**OIL/WATER SEPARATOR OPERATIONAL FLOW CONTROL CHART  
LANDING CRAFT MECHANIZED LCM-8**

SYSTEM DIAGRAM



**OPERATIONAL FLOW CONTROL**

SYMBOL	DESCRIPTION	LOCATION	FUNCTION	START-UP POSITION	NORMAL OPERATING POSITION	NOTES
①	1" NPT BALL VALVE	NEAR BILGE MANIFOLD	ALLOWS FLOW OF BILGE WATER TO PUMP	OPEN		CLOSE VALVE WHEN AUXILIARY SUCTION HOSE IS USED OR WHEN PUMPING FROM DIRTY OIL TANK TO SHORE DISCHARGE.
②	1/2" NPT GATE VALVE	NEAR BILGE MANIFOLD	ALLOWS USE OF AUXILIARY SUCTION HOSE	CLOSED	CLOSED	OPEN VALVE WHEN AUXILIARY SUCTION HOSE IS USED FOR FLUID PICK-UP OR TO DRAIN ENGINE CRANKCASE LUBE OIL.
③	3/4" NPT GATE VALVE	MAIN DECK NEAR PILOTHOUSE	ALLOWS DISCHARGE OF DIRTY OIL TO SHORE FACILITY	CLOSED	CLOSED	OPEN VALVE WHEN DISCHARGING DIRTY OIL TO SHORE FACILITY.
④	1" NPT BALL VALVE	NEAR PRIMARY STAGE SEPARATOR	ALLOWS DIRTY OIL FROM CRANKCASE TO FLOW TO DIRTY OIL HOLDING TANK	CLOSED	CLOSED	OPEN VALVE WHEN PUMPING OIL FROM CRANKCASE TO HOLDING TANK.
⑤	1" NPT BALL VALVE	AT PUMP OUTLET	ALLOWS FLOW TO PRIMARY STAGE SEPARATOR	OPEN	OPEN	CLOSE VALVE TO SERVICE PUMP OR PRIMARY STAGE SEPARATOR OR WHEN PUMPING CRANKCASE OIL TO HOLDING TANK.
⑥	1" NPT BALL VALVE	BEHIND BASKET STRAINER	ALLOWS DIRTY OIL FROM HOLDING TANK TO FLOW TO PUMP	CLOSED	CLOSED	OPEN VALVE TO PUMP DIRTY OIL FROM HOLDING TANK TO SHORE CONNECTION.
⑦	1/2" NPT BALL VALVE	PRIMARY STAGE SEPARATOR	ALLOWS MANUAL DISCHARGE OF OIL FROM PRIMARY STAGE SEPARATOR TO HOLDING TANK	CLOSED	CLOSED	VALVE MUST BE OPENED WHEN OIL LEVEL (1-INCH MAXIMUM) APPEARS IN SIGHT GLASS. CLOSE VALVE 2 SECONDS AFTER OIL DISAPPEARS. SEE NOTE FOR VALVE ⑩.
⑧	1" NPT HOSE GATE VALVE	BOTTOM OF HOLDING TANK	ALLOWS DRAINING OF HOLDING TANK	CLOSED	CLOSED	OPEN ONLY TO DRAIN HOLDING TANK.
⑨	1" NPT BALL VALVE	BETWEEN BOTH STAGE SEPARATORS	ALLOWS FLOW FROM PRIMARY TO SECONDARY STAGE SEPARATOR	OPEN	OPEN	CLOSE TO ISOLATE STAGES FOR SERVICING.
⑩	1/2" NPT BALL VALVE	SECONDARY STAGE SEPARATOR	ALLOWS MANUAL DISCHARGE OF OIL FROM SECONDARY STAGE SEPARATOR TO HOLDING TANK	CLOSED	CLOSED	VALVE MUST BE OPENED WHEN OIL LEVEL (1-INCH MAXIMUM) APPEARS IN SIGHT GLASS. CLOSE VALVE 2 SECONDS AFTER OIL DISAPPEARS. SEE NOTE FOR VALVE ⑩.
⑪	1" NPT BALL VALVE	CLEAN WATER OUTLET OF SECONDARY STAGE SEPARATOR	ALLOWS FLOW OF CLEAN WATER TO OVERBOARD DISCHARGE	OPEN	OPEN	CLOSE TO ISOLATE SECOND STAGE FOR SERVICING. CLOSE WHEN DISCHARGING OIL FROM SEPARATORS, USING ⑦ OR ⑩.
⑫	1" NPT GATE VALVE	PORT OVERBOARD DISCHARGE NEAR BHD 35	ALLOWS FLOW OF CLEAN WATER DIRECTLY OVERBOARD	OPEN	OPEN	CLOSE ONLY WHEN SERVICING OVERBOARD DISCHARGE LINE.
⑬	1/2" NPT BALL VALVE	BOTTOM OF PRIMARY STAGE SEPARATOR	ALLOWS DRAINING OR SAMPLING FROM PRIMARY STAGE SEPARATOR	CLOSED	CLOSED	OPEN WHEN SYSTEM IS SHUT DOWN TO SAMPLE OR DRAIN PRIMARY STAGE SEPARATOR.
⑭	1/2" NPT BALL VALVE	BOTTOM OF SECONDARY STAGE SEPARATOR	ALLOWS DRAINING OR SAMPLING FROM SECOND STAGE SEPARATOR	CLOSED	CLOSED	OPEN WHEN SYSTEM IS SHUT DOWN TO SAMPLE OR DRAIN SECOND STAGE SEPARATOR.
⑮	1/2" NPT GATE VALVE	HOLDING TANK FILL AND DISCHARGE LINE	ALLOWS DIRTY OIL TO FLOW TO AND FROM HOLDING TANK AND PREVENTS SIPHONING OF TANK IF LINE IS DISCONNECTED	OPEN	OPEN	CLOSE TO ISOLATE HOLDING TANK OR SECOND STAGE SEPARATOR.
FM-1	FLOW METER FLOAT TYPE	NEAR CLEAN WATER OVERBOARD DISCHARGE	INDICATES RATE OF FLOW OF WATER DISCHARGE	0	5 GPM MAX	USE TO OBSERVE QUALITY OF WATER BEING DISCHARGED.
P-1	PRESSURE GAUGE 0-100 PSIG	CONTROL PANEL	SHOWS FLUID PRESSURE AT INLET TO PRIMARY STAGE SEPARATOR	0	0-45 PSIG	DIFFERENTIAL PRESSURE BETWEEN P-1 AND P-2 SHALL NOT EXCEED 30 PSIG AND BETWEEN P-2 AND P-3 SHALL NOT EXCEED 25 PSIG. WHEN DIFFERENTIAL PRESSURE ACROSS A SEPARATOR STAGE REACHES 30 PSIG ON THE PRIMARY STAGE, OR 25 PSIG ON THE SECONDARY STAGE, CHANGE THE FILTER ELEMENT IN THAT STAGE.
P-2	PRESSURE GAUGE 0-100 PSIG	CONTROL PANEL	SHOWS FLUID PRESSURE AT INLET TO SECONDARY STAGE SEPARATOR	0	0-45 PSIG	
P-3	PRESSURE GAUGE 0-100 PSIG	CONTROL PANEL	SHOWS FLUID PRESSURE AT OUTLET OF SECONDARY STAGE SEPARATOR	0	0-45 PSIG	



FO-3. ELECTRICAL WIRING DIAGRAM

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By Order of the Secretary of the Army

CARL E. VUONO  
General, United States Army  
Chief of Staff

Official

WILLIAM J. MEEHAN, II  
Brigadier General, United States Army  
The Adjutant General

**DISTRIBUTION**

To be distributed in accordance with DA Form 12-25A, Operator, Unit Intermediate Direct Support and Intermediate General Support Maintenance requirements for Landing Craft, Mechanized, Steel design LCM-8, Model 1, Mark VII, 74 Ft

# 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 decagram = 10 grams = .35 ounce  
 1 hectogram = 10 decagrams = 3.52 ounces  
 1 kilogram = 10 hectograms = 2.2 pounds  
 1 quintal = 100 kilograms = 220.46 pounds  
 1 metric ton = 10 quintals = 1.1 short tons

## Liquid Measure

1 centiliter = 10 milliliters = .34 fl. ounce  
 1 deciliter = 10 centiliters = 3.38 fl. ounces  
 1 liter = 10 deciliters = 33.81 fl. ounces  
 1 dekaliter = 10 liters = 2.64 gallons  
 1 hectoliter = 10 dekaliters = 26.42 gallons  
 1 kiloliter = 10 hectoliters = 264.18 gallons

## Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch  
 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches  
 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet  
 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet  
 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres  
 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

## Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch  
 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches  
 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet


## Approximate Conversion Factors

To change	To	Multiply by	To change	To	Multiply by
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

## Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
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RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

 <div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block; margin-left: 10px;"> <p style="font-size: small; margin: 0;"><i>THEN...JOT DOWN THE DOPE ABOUT IT ON THIS FORM. CAREFULLY TEAR IT OUT, FOLD IT AND DROP IT IN THE MAIL.</i></p> </div>		SOMETHING WRONG WITH PUBLICATION	
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