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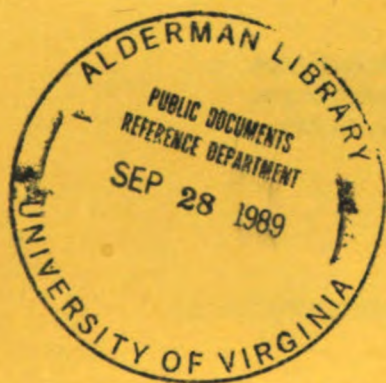


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-1940-221-12

TM 5-1940-221-12

TECHNICAL MANUAL

**OPERATOR AND ORGANIZATIONAL
MAINTENANCE MANUAL
BOAT, BRIDGE ERECTION;
INBOARD DIESEL ENGINE;
ALUMINUM HULL; 27 FT LG
(ALUMINUM COMPANY OF AMERICA
MODEL HICE-27D)
FSN 1940-182-3097**



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HEADQUARTERS, DEPARTMENT OF THE ARMY

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JUNE 1974

WARNING

DANGEROUS GASES

are generated as a result of operating this equipment.

DEATH

or severe injury in personnel may result if personnel fail to observe safety precautions.

Do not operate the engines in an enclosed area unless it is adequately ventilated.

Carbon monoxide is a colorless, odorless, deadly poisonous gas which when breathed, deprives the body of oxygen and causes suffocation.

Be alert to symptoms of exposure to carbon monoxide, which are headache, dizziness, drowsiness, loss of muscular control and coma.

WARNING

FIRE AND EXPLOSION HAZARD

Do not smoke or use open flame when servicing the batteries. Batteries generate hydrogen, which is a highly explosive gas. Also, be extremely careful to avoid grounding the positive terminal to the boat structure.

WARNING

CLEANING SOLVENT PD-680 is a potentially DANGEROUS CHEMICAL. Do not use near an open flame.

WARNING

NOISE HAZARD

Operation of this equipment presents a noise hazard. Wear ear muffs or ear plugs to avoid ear injury when noise level is excessive. There is a potential noise hazard when engine speed exceeds 1200 RPMs.

Wear a life preserver aboard the boat at all times.

Changes in force: 1, 2 and 3

TM 5-1940-221-12
C4

CHANGE

No. 4

HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, D.C., 20 June 1988

**Operator and Organizational Maintenance Manual
BOAT, BRIDGE ERECTION, INBOARD DIESEL ENGINE,
ALUMINUM HULL, 27 FT LG
(ALUMINUM COMPANY OF AMERICA MODEL HICE-27D)
(HIGHWAY PRODUCTS MODEL HPI-27C MODDED)
(HIGHWAY PRODUCTS MODEL HPI-27B MODDED)
(MARINETTE MARINE CORP. MODEL A27 MODDED)
NSN 1940-00-417-0526**

TM 5-1940-221-12, 17 June 1974, is changed as follows:

Pages B-1 through B-10, Appendix B, Section I through IV is superseded by new appendix B, Section I through IV.

APPENDIX B MAINTENANCE ALLOCATION CHART

Section I. INTRODUCTION

B-1. MAINTENANCE ALLOCATION CHART (MAC)

a. *General.* This MAC assigns maintenance functions in accordance with the Three Level Maintenance concept. The three levels are depicted on the MAC as:

UNIT level—corresponds to an O code in the Repair Parts and Special Tools List (RPSTL). A C code entry under UNIT denotes maintenance performed by the crew or operator within UNIT maintenance.

INTERMEDIATE level—corresponds to an F or an H code in the RPSTL.

DEPOT level—corresponds to a D code in the RPSTL.

b. *Unit Maintenance.* Maintenance to be performed in the Unit level is described as follows:

(1) Unit Maintenance activities are staffed and equipped to perform high frequency on equipment maintenance tasks required to retain or return equipment to a serviceable condition. These tasks include preventive maintenance and repair and replace functions associated with a high level of mission capability.

(2) Unit Maintenance inspection and servicing include daily (usually performed by operator or crew), periodic, and special inspections, as authorized by the MAC or higher headquarters.

(3) Unit level maintains a Combat Prescribed Load List (PPL) which consists of items on the Mandatory Parts List (MPL) and items which are demand supported.

(4) Unit level performs troubleshooting, replace, and limited repair functions as authorized by the MAC, RPSTL, and applicable technical manuals.

c. *Intermediate Maintenance.* Maintenance to be performed in the Intermediate level is described as follows:

(1) One stop maintenance support through use of mobile weapon system oriented maintenance teams to perform authorized maintenance (that exceeds Unit level capability) to effect quick repair and return to user capabilities.

(2) Maintains a Combat Authorized Stockage List (ASL), Mandatory Parts List (MPL), Direct Exchange (DX), and provides limited Operational Readiness Float (ORF) for supported units.

(3) Provides collection, classification, and recovery services for serviceable and unserviceable material and maintains a Battle Damage Assessment (BDA) capability.

(4) Provides maintenance support for the theater supply system through repair of components and DX items.

(5) Provides maintenance units composed of commodity oriented platoons which may be augmented by support teams that deploy forward if the tactical situation permits.

(6) Maintains Operational Readiness Float (ORF) stocks in support of the theater.

d. *Depot Maintenance.* Depot level functions are authorized as indicated by entries in the Depot (D) Maintenance level column (4) in the MAC.

B-2. USE OF THE MAINTENANCE ALLOCATION CHART, SECTION II

a. The MAC assigns maintenance functions based on the following considerations:

- (1) Skills available.
- (2) Work time required.
- (3) Tools and test equipment required and/or available.

b. If a lower level of maintenance identified in column (4) of the MAC cannot perform all tasks of a single maintenance function (e.g., test, repair), then the higher level that can perform other tasks of that function is also indicated.

c. Higher maintenance levels are automatically authorized to perform maintenance functions assigned to a lower maintenance level.

d. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the Commander who has authority to direct such tasking.

e. Assignment of a maintenance function in the MAC does not carry automatic authorization to carry the related spare or repair parts in stock. Information to requisition or secure parts will be as specified in the associated RPSTL.

f. Normally, there will be no deviation from the assigned level of maintenance. However, in cases of operational necessity, maintenance functions assigned a higher level may, at the request of the lower level, be assigned to the lower level on a one-time basis, if specifically authorized by the maintenance officer of the higher level to which the function is assigned. In such a case, the special tools, equipment, etc., required by the lower level to perform this function will be furnished by the higher level assigned the function. Also, transfer of a function to a lower level does not relieve the higher level of responsibility for the function, so the higher level will provide technical supervision and inspection of the function being performed at the lower level.

B-3. MAINTENANCE FUNCTIONS

Maintenance functions will be limited to and defined as follows:

a. *Inspect.* Two levels of inspect are covered in the MAC.

(1) When prescribed at the C or O element of Unit Maintenance level, inspect means to determine serviceability by comparing an item's physical, mechanical, and/or electrical characteristics with established standards through examination (i.e., by sight, sound, or feel). These inspections are included in preventive maintenance (PM) checks and services, such as PMCS, PMD.

(2) When prescribed at the Intermediate (F) or Depot (D) maintenance level, inspect refers to an initial inspection which is conducted prior to scheduling any repair on repairable items evacuated to this level. This inspection is made to determine whether an item qualifies for repair or discard.

b. *Test.* To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with prescribed standards.

- c. *Service.* Operations required periodically to keep an item in proper operating condition, i.e., to clean (includes decontaminate), to preserve, to drain, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.
- d. *Adjust.* To maintain within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to the specified parameters.
- e. *Align.* To adjust specified variable elements of an item to bring about optimum or desired performance.
- f. *Calibrate.* To determine and cause corrections to be made or to be adjusted on instruments or test measuring and diagnostic equipment used in precision measurement. Consists of comparison of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.
- g. *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.
- h. *Replace.* The act of substituting a serviceable like type part, a subassembly, or module (component or assembly) for an unserviceable counterpart.
- i. *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.
- j. *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 publications (i.e., DMWR). Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to a like new condition.
- k. *Rebuild.* Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

B-4. EXPLANATION OF COLUMNS IN THE MAC, SECTION II

- a. *Column (1), Group Number.* Column 1 lists functional group code numbers which are assigned to identify maintenance significant components, assemblies, subassemblies, and modules to their next higher assembly.
- b. *Column (2), Component/Assembly.* Column 2 contains the item names of components, assemblies, subassemblies, and modules for which group numbers (column 1) are assigned and for which maintenance is authorized.
- c. *Column (3), Maintenance Function.* Column 3 lists the functions to be performed on items listed in column 2. (Function definitions are contained in paragraph B-3).
- d. *Column (4), Maintenance Level.* The maintenance levels, Unit, intermediate, and Depot, are allotted separate subcolumns within column 4. Entry of a work time figure (such as 1.0, 0.2) in a subcolumn indicates that that level is authorized to perform the function listed in column 3, and the average time required to do the function is the work time figure. If the number or complexity of tasks within a maintenance function varies from one maintenance level to another, the applicable work time figure for each level will be entered for that function. The work time figure represents the average time it takes to restore a component/assembly to a serviceable condition under a typical field operating environment.

e. *Column (5), Tools and Equipment.* Column 5 specifies, by code, common tool sets (not individual tools from those sets), common TMDE, and special tools, TMDE, and support equipment required to perform a designated function. The code in Column 5 keys to the listing in Section III of the MAC.

f. *Column (6), Remarks.* This column, when applicable, contains a letter code which is keyed to an explanation of the code contained in Section IV of the MAC.

B-5. EXPLANATION OF COLUMNS IN THE MAC, SECTION III

a. *Column (1), Tool or Test Equipment Reference Code.* The tool or test equipment reference code correlates with a code used in the MAC, Section II, Column 5.

b. *Column (2), Maintenance Category.* The lowest category of maintenance authorized to use the tool or test equipment.

c. *Column (3), Nomenclature.* Name or identification of the tool or test equipment.

d. *Column (4), National/NATO Stock Number.* The national stock number of the tool or test equipment.

e. *Column (5), Tool Number.* The manufacturer's part number.

B-6. EXPLANATION OF COLUMNS IN THE MAC, SECTION IV

a. *Column (1), Reference Code.* The code recorded in Column 6, Section II.

b. *Column (2), Remarks.* This column lists information pertinent to the maintenance function being performed as indicated in the MAC, Section II.

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: Boat, Bridge Erection 27 FT. Aluminum Hull

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
01	LIGHTS								
	Running Lights Port and Std.	Inspect Replace Repair	0.1	0.3 0.4					
	Spot Light	Inspect Replace Repair	0.1	0.2 0.9					
	Range and Bow Lights	Inspect Replace Repair	0.1	0.1 0.3					
	Wiring	Inspect Replace Repair	0.2	0.5	1.0				
02	TOWING ATTACHMENTS ACCESSORY ITEMS								
	Bits, Shocks, and Cleats	Inspect Service Replace Repair	0.1 0.1	0.2	0.4			A-I	
	Sheans	Inspect Replace	0.1	0.2					
	Pushknees	Inspect Replace Repair	0.1	0.2	1.0			A-I	
	Couplings, Arms, Yoke Hook	Inspect Replace Repair	0.1	0.1 0.5					
	Cable Assemblies, Lashing Tiedown and Lifting Slings	Inspect Replace	0.1	0.5					
	Stern and Bow Cradles	Inspect Replace Repair	0.2	0.5	1.0			A-I	

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: Boat, Bridge Erection 27 FT. Aluminum Hull

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
02 (Cont.)	Boat Hook, Anchor and Ring Buoy	Inspect	0.1						
		Replace	0.2						
	Lines, Moring, Towing and Anchor	Inspect	0.1						
		Replace		0.2					
	Canvas Cover	Inspect	0.1						
		Replace		0.1					
03	ACCESS HATCH								
	Stern Hatch	Inspect		0.1					
		Replace			0.5				
		Repair			1.0	1.0		A-I	
	Engine Hatch	Inspect		0.1					
		Replace			0.8				
		Repair			2.0	1.0		A-I	
	Bow Hatch	Inspect		0.1					
Replace				0.4					
Repair				1.5	1.0		A-I		
Grating, Bow and Cockpit	Inspect		0.1						
	Replace			0.1					
	Repair				0.5		A-I		
Hull Drain Plugs	Inspect		0.1						
	Replace			0.1					
04	CONTROLS								
	Throttle and Transmission Control Cables and Brackets	Inspect		0.1					
		Align			0.2				
		Replace			1.0				
		Repair			0.5				
	Transmission and Throttle Control Head Assembly	Inspect		0.1					
		Align			0.2				
		Replace			1.2				
		Repair			2.0				
	Emergency Stop Cable	Inspect		0.1					
Replace				1.0					

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: Boat, Bridge Erection 27 FT. Aluminum Hull

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
09 (Cont.)	Voltage Regulator	Inspect Test Adjust Replace		0.1 0.4 0.5 0.5					
10	ENGINE								
	Mounts and Brackets	Inspect Adjust Replace		0.1 0.2 0.3					
	Engine Assembly	Inspect Test Service Replace	0.6	0.2	1.0 4.0				
		Repair Overhaul				—	10.00	I-I	B-I
	Shield Y-Belt	Inspect Replace	0.1	0.2					
	Y-Belt	Inspect Adjust Replace		0.1 0.1 0.2					
	Generator	Inspect Test Service Replace Repair	0.1	0.1 0.2 0.2	1.5				
	Starter and Solenoid	Inspect Test Service Replace Repair	0.1	0.1 0.2 0.3	1.5				
	Expansion Tank	Inspect Service Replace	0.1	0.1 0.4					
	Water Pump	Inspect Replace Repair	0.1	0.5	1.0				

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: Boat, Bridge Erection 27 FT. Aluminum Hull

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
06 (Cont.)	Fuel Strainer	Inspect	0.1						
		Service Replace	0.5	0.5					
07	ENGINE EXHAUST SYSTEM	Inspect							
		Replace		0.1					
		Repair		2.0					
08	ENGINE COOLING SYSTEM	Inspect							
		Replace		0.1					
09	ENGINE STARTING SYSTEM	Repair			2.0				
		Replace			2.5				
		Inspect	0.1						
		Replace		2.0					
09	ENGINE STARTING SYSTEM	Inspect							
		Replace		0.1					
		Inspect	0.1						
		Replace		0.5					
09	ENGINE STARTING SYSTEM	Inspect							
		Service	0.1						
		Replace		0.5					
		Inspect	0.1						
09	ENGINE STARTING SYSTEM	Test		0.1					
		Service	0.1						
		Replace		0.5					
09	ENGINE STARTING SYSTEM	Inspect							
		Test	0.1						
		Replace		0.2					
09	ENGINE STARTING SYSTEM	Inspect							
		Replace		0.5					

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: Boat, Bridge Erection 27 FT. Aluminum Hull

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
10 (Cont.)	Tachometer Drive	Inspect		0.1					
		Replace		0.5					
		Repair		0.5					
	Tube, Injector Control	Service				0.2			
		Replace				0.5			
		Repair				0.5			
	Crankshaft Pulley	Replace				0.4		9-I, 10-I	
	Front Cover and Oil Pump	Replace				1.0			
		Repair				1.0			
	Oil Pan	Replace				0.5			
	Dipstick Gauge	Replace		0.1					
	Flywheel and Housing	Replace				1.0			
	Connecting Rods	Replace					0.4		
		Repair					1.0		11-H, 12-H
	Piston and Sleeves	Replace					0.7		
Repair						1.0		12-A	
Main Benting	Replace					1.5			
Injector Lines and Fittings	Replace		0.1						
Rocker Arms, Shaft, Push Rods and Cam. Follower	Replace					0.7			
	Repair					0.9			
Injectors	Test					0.2			
	Adjust					0.5			
	Replace					0.2			
	Repair						1.0	3-D, 4-B, 5-I	
Cylinder Head Assembly	Inspect					0.1			
	Test					0.4			
	Replace					0.5			
	Repair					2.2			

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: Boat, Bridge Erection 27 FT. Aluminum Hull

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
10 (Cont.)	Valve and Spring	Adjust			0.1			6-H, 7-H, 8-H	
		Replace			0.3				
		Repair			0.5				
	Guides and Inserts	Replace			0.5				
		Repair			1.0				
Crankshaft	Replace				0.5				
	Rebuild					4.0			
Camshaft, Balance Shaft and Gears	Replace				1.0				
						0.5			
Engine Block	Replace				0.5	0.5			
11	TRANSMISSION								
	Oil Strainer	Inspect		0.1					
		Replace		0.2					
	Shaft Control	Inspect		0.1					
		Service		0.1					
		Replace		0.5					
		Repair		0.2					
	Lines and Fittings	Replace			0.2				
	Transmission Assembly	Inspect		0.1					
		Service		0.1					
Replace				1.0					
Repair Overhaul					4.0	6.0			
Reduction Gear Assembly	Inspect		0.1						
	Replace			1.0					
	Repair				3.0				
	Overhaul					4.0			
12	STEERING SYSTEM								
	Rudder Shaft, Strut and Bushings	Inspect		0.1					
		Service		0.1					
		Replace			2.0				
		Repair			1.5				

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: Boat, Bridge Erection 27 FT. Aluminum Hull

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
12 (Cont.)	Rudder	Inspect		0.1					
		Replace		0.8					
	Steering Linkage	Inspect	0.3		0.2				
		Service			1.0				
		Adjust Replace			4.0				
	Quadrant	Service		0.1					
		Replace Repair				0.5 0.5			
Steering Wheel	Inspect			0.1					
	Replace			0.5					
Box, Steering, Upper and Lower	Replace			0.3					
	Repair			0.3					
Universal Joints and Shaft	Inspect			0.1					
	Replace			0.5					
13	PROPELLER AND PROPELLER SHAFT								
	Propeller	Inspect		0.1					
		Replace				0.5			
		Repair					3.5		
	Shaft Coupling	Inspect			0.3				
		Replace			0.5				
	Propeller Shaft	Inspect			0.1				
		Replace				0.4			
Seal, Hose and Clamps	Inspect			0.1					
	Replace				0.2				
Propeller Strut Brace	Inspect			0.1					
	Replace				0.5				
Propeller Strut	Inspect			0.1					
	Replace				1.5				
Bearing	Inspect			0.1					
	Replace				0.7				

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: Boat, Bridge Erection 27 FT. Aluminum Hull

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT	(6) REMARKS
			UNIT		INTERMEDIATE		DEPOT		
			C	O	F	H	D		
14	BILGE PUMP								
	Bilge Pump Electric	Inspect Service Replace	0.1	0.1 0.3					
15	Bilge Pump Hand	Inspect Replace	0.1	0.2					
	FIRE EXTINGUISHER SYSTEM								
	Lines and Fitting	Inspect Replace		0.1 1.0					
16	Cylinders	Inspect Replace	0.1	0.2					
	DATA PLATES								
	Data Plates, Instruction and Identification	Inspect Replace	0.1	0.7					
17	HULL								
	Hull	Inspect Repair	0.1	4.0	5.0				A-I, C-I

Section III. SPECIAL TOOL AND SPECIAL TEST EQUIPMENT REQUIREMENTS

Reference code	Maintenance category	Nomenclature	Tool number
1-I	H	Plate, Engine Stand Adapter	4910-408-5576
2-J	H	Feeler Set	5210-363-7573
3-D	F	Gauge, Injector Timing	5220-387-9581
4-B	F	Gauge, Fuel Pressure Checking	6620-671-4509
5-I	H	Service Set, Injector	J23435 (33287)
6-H	F	Remover, Valve Seat Insert	5180-591-6631
7-H	F	Installer, Valve Seat Insert	4910-603-8925
8-H	F	Installer Set, Crankshaft Pulley	4910-779-6392
9-I	H	Reamer Set, Connecting Rod	5180-907-8988
10-I	H	Reamer Set, Piston Pin Bushing	5120-254-5023
11-I	H	Installer and Remover, Piston and Connecting Rod Bushings	5120-254-5022
12-I	H	Gauge, Cylinder Liner Depth	5310-023-4798

Section IV. REMARKS

Reference code	Remarks
A-I	Direct Support Repair by straightening and welding
B-I	See individual component repair time to perform maintenance function
C-I	Organizational repair by straightening, patching with rivets.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25A, Operator and Unit Maintenance requirements for Boat, Bridge Erection, Inboard Diesel Engine, 27 Ft. (HP1-27A, 27B, 27C, 27D)

CHANGE }
No. 3 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 21 July 1987

Operator and Organizational Maintenance Manual

**BOAT, BRIDGE ERECTION, INBOARD DIESEL ENGINE,
ALUMINUM HULL, 27 FT LG
(ALUMINUM COMPANY OF AMERICA MODEL HICE-27D)
(HIGHWAY PRODUCTS MODEL HPI-27C MODDED)
(HIGHWAY PRODUCTS MODEL HPI-27B MODDED)
(MARINETTE MARINE CORP. MODEL A27 MODDED)
NSN 1940-00-417-0526**

TM 5-1940-221-12, 17 June 1974, is changed as follows:

Page i, Table of Contents, Appendix C. Change "Basic Issue Items List and Items Troop Installed or Authorized" to "Components of End Item and Basic Issue Items Lists."

Page C-1. Delete entire Appendix C, "Basic Issue Items List and Items Troop Installed or Authorized" and add new Appendix C, "Components of End Item and Basic Issue Item Lists" as follows:

APPENDIX C

COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LISTS

SECTION I. INTRODUCTION

C-1. SCOPE

This appendix lists components of and basic issue items for the Boat, Bridge Erection to help you inventory items required for safe and efficient operation.

C-2. GENERAL

The Components of End Item List is divided into the following sections:

a. Section II. Components of the End Item. Not Used.

b. Section III. Basic Issue Items. These are minimum essential items required to place the Boat, Bridge Erection in operation, to operate it, and to perform emergency repairs. Although shipped separately packed they must accompany the unit during operation and whenever it is transferred between accountable officers. The illustrations will assist you with hard-to-identify items. This manual is your authority to requisition replacement BII, based on Table(s) of Organizational and Equipment (TOE)/Modification Table of Organization and Equipment (MTOE) authorization of the end item.

C-3. EXPLANATION OF COLUMNS.

a. Illustration. This column is divided as follows:

(1) Figure Number. Indicates the figure number of the illustration on which the item is shown (if applicable).

(2) Item Number. The number used to identify item called out in the illustration.

b. National Stock Number (NSN). Indicates the National Stock Number assigned to the item and which will be used for requisitioning.

c. Part Number (P/N). Indicates the primary number used by the manufacturer, which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

d. Description. Indicates the Federal item name and, if required, a minimum description to identify the item.

e. Location. The physical location of each item listed is given in this column. The lists are designed to inventory all items in one area of the major item before moving on to an adjacent area.

f. Usable on Code. "USABLE ON" codes are included to help you identify which component items are used on the different models. Identification of the codes used in these lists are:

CODE	USED ON
CCC	Highway Product, Model HP1-27C
CUA	Highway Product, Model HP1-27B
CUB	Marinette Marine, Model A-27
CUC	Aluminum of America, Model HICE-27D

g. Quantity Required (Qty Reqd). This column lists the quantity of each item required for a complete major item.

h. Quantity. This column is left blank for use during inventory. Under the Recv'd column, list the quantity you actually receive on your major item. The Date columns are for use when you inventory the major item at a later date, such as for shipment to another site.

Section II. COMPONENTS OF END ITEM

NOT APPLICABLE

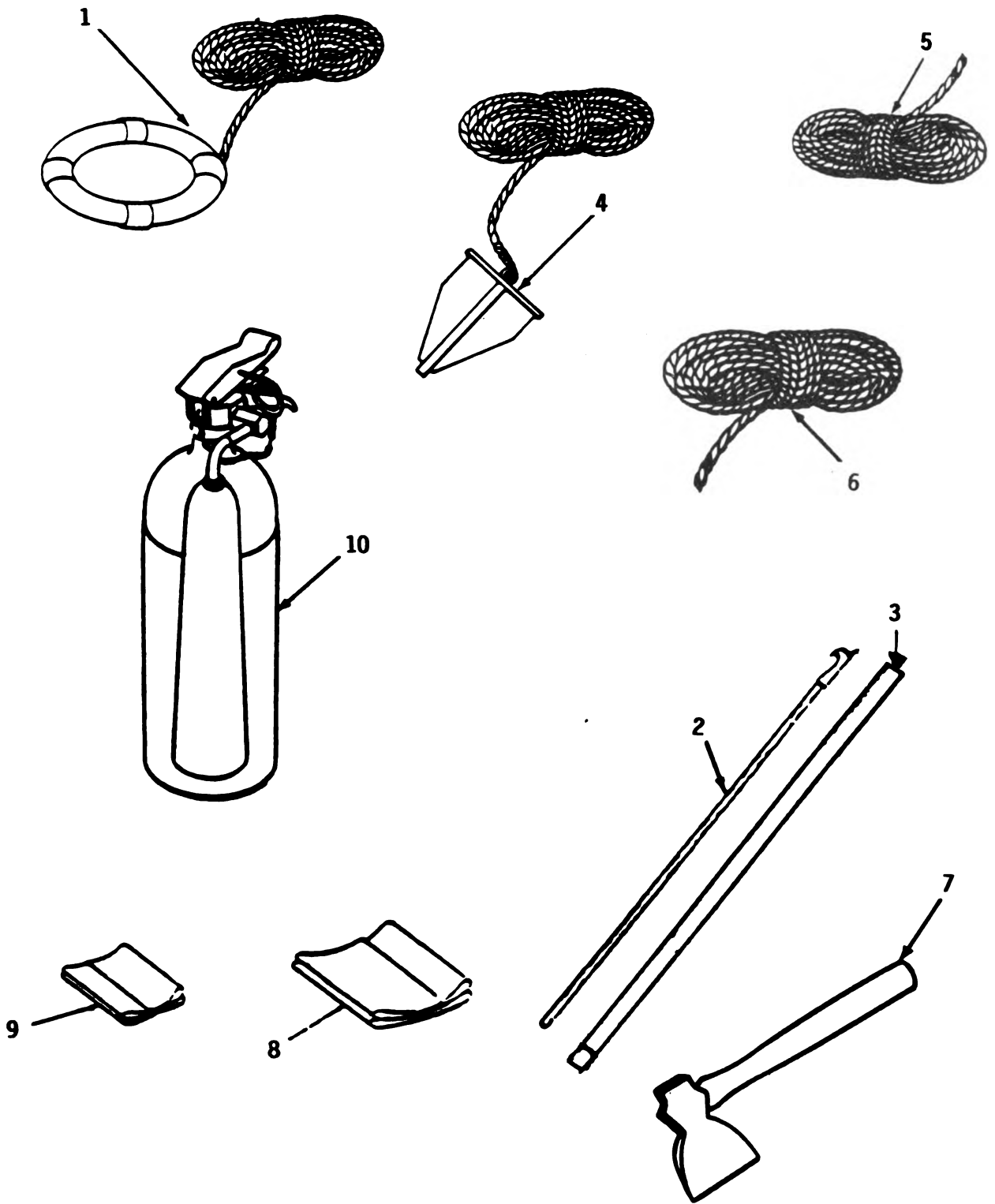


Figure C-1. Basic Issue Items

APPENDIX C

Section III. BASIC ISSUE ITEMS

(1) ILLUS. NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION FSCM and Part number	(4) U/M	(5) QTY rqr
1	4220-00-275-3156	Ring, Buoy 13213E5156-12 (97403)	EA	1
2	2040-00-007-1136	Hook, Boat 13216E9929 (97403)	EA	1
3	2090-00-368-8194	Cover, Pole 13213E5376 (97403)	EA	1
4	2040-00-997-6047	Anchor and Anchor Line 13213E5513 (97403)	EA	1
5	4020-00-033-4735	Line, Mooring 13213E5511 (97403)	EA	4
6	2930-00-997-6041	Line, Steering 13213E5510 (97403)	EA	2
7	5110-00-555-8868	Hatchet, Board GGG-H-131 (81348)	EA	1
8	2090-00-997-6049	Cover, Cargo Well 13213E5374 (97403)	EA	1
9	2040-00-997-6048	Cover, Cockpit 13213E5375 (97403)	EA	1
10	4210-00-270-4512	Fire Extinguisher 02910 (81349)	EA	1

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

OFFICIAL:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25A, Operator and Organizational Maintenance requirements for Boat, Bridge Erection, Inboard Diesel Engine, 27 Ft, (HPI-27A, 27B, 27C, 27D).

CHANGE }
NO. 1 }

HEADQUARTERS
DEPARTMENT OF THE ARMY,
WASHINGTON, D. C. 10 May 1978

Operator and Organizational Maintenance Manual

**BOAT, BRIDGE ERECTION, INBOARD DIESEL ENGINE,
ALUMINUM HULL, 27 FT LG
(ALUMINUM COMPANY OF AMERICA MODEL HICE-27D)
(HIGHWAY PRODUCTS MODEL HPI-27C MODDED)
(HIGHWAY PRODUCTS MODEL HPI-27B MODDED)
(MARINETTE MARINE CORP. MODEL A27 MODDED)
NSN 1940-00-417-0526**

TM 5-1940-221-12, 17 June 1974, is changed as follows:

Front Cover. Change "FSN 1940-183-3097" to read "NSN 1940-00-417-0526".

Front Cover. Add:
(HIGHWAY PRODUCTS MODEL HPI-27C
MODDED)
(HIGHWAY PRODUCTS MODEL HPI-27B
MODDED)
(MARINETTE MARINE CORP. MODEL A27
MODDED)

Page i. Change "FSN 1940-183-3097" to read "NSN 1940-00-417-0526".

Page i. Add:
(HIGHWAY PRODUCTS MODEL HPI-27C
MODDED)
(HIGHWAY PRODUCTS MODEL HPI-27B
MODDED)
(MARINETTE MARINE CORP. MODEL A27
MODDED)

Page iii. Figure Number 4-60. Change title to read: "Transmission oil strainer removal". Figure Number 4-61. Change title to read: "Draining the transmission oil."

Page 1-1, Section I, Paragraph 1-3 is superseded as follows:

1-3. Reporting of Errors.

You can improve this manual by calling attention to errors and by recommending improvements using DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 and mailing the form direct to Commander, Head-

quarters, U. S. Army Troop Support and Aviation Materiel Readiness Command, ATTN: DRSTS-MTPS, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished directly to you.

Page 1-1, Paragraph 1-7, *b* line 4. Change "1593 cubic inches" to read "159.3 cubic inches".

Page 1-8, Paragraph 1-7, *g* (3) line 8. Change "at 183-21 psi" to read "at approximately 12 psi".

Page 1-9, Paragraph 1-7, *g* (5) (*a*) line 6. Change to read "the dipstick with the engine stopped".

Page 1-9, Paragraph 1-7, *g* (5) (*b*) line 6. Change to read "(full) mark on the dipstick with the engine stopped".

Page 1-9, Paragraph 1-7, *h* Second and third sentences. Delete and add the following: "The system is powered by the engine driven generator, supplying power for lighting, instruments, alarm system, the stern bilge pump, and power for charging the batteries. The batteries supply power for starting and are a standby source of power when the generator is not operating."

Page 1-10, Paragraph 1-7, *h* (2) line 6. Delete "and current".

Page 1-10, Paragraph 1-7, *h* (3) Third sentence is superseded as follows:

"Each pair of batteries is connected in series providing a 24 volt supply. The two pairs are then connected in parallel to provide a greater ampere (current) capacity."

Page 1-11, Paragraph 1-7, *h* (6) (*b*) 4 line 3. Change to read "not sound, first check the ALARM fuse on fuse panel."

Page 1-13, Paragraph 1-8, b (1) is superseded as follows:

(1) General

(a) Manufacturer -- Aluminum Company of America.

National Stock Number -- 1940-00-417-0526.

Serial Number Range -- Hulls; 71-1 thru 71-46, 73-47 thru 73-139.

Hull Material -- Aluminum.

Operating Range (maximum load) -- 36 nautical miles.

(b) Manufacturer -- Highway Products

National Stock Number -- 1940-00-417-0526.

Serial Number Range -- Hulls; 66-1, 66-2, 66-3, 67-4 thru 67-140, 68-141 thru 68-297, 69-208 thru 69-308.

Hull Material -- Aluminum.

Operating Range (maximum load) -- 36 nautical miles.

(c) Manufacturer -- Highway Products

National Stock Number -- 1940-00-417-0526.

Serial Number Range -- Hulls; 60-500 thru 60-630, 61-361 thru 61-706, 62-707 thru 62-767.

Hull Material -- Aluminum.

Operating Range (maximum load) -- 36 nautical miles.

(d) Manufacturer -- Marinette Marine Corp.

National Stock Number -- 1940-00-417-0526.

Serial Number Range -- Hulls; 60-1 thru 60-107.

Hull Material -- Aluminum.

Operating Range (maximum load) -- 36 nautical miles.

Page 1-14, Paragraph 1-8, b (2). Change "Cooling system" from "4.75 gallons" to "6.5 gallons each engine system". After "Engine lubricating system, 9.5 quarts" add "each engine". After "Transmission lubricating system, 3 quarts" add "each transmission".

Page 1-14, Paragraph 1-8, b (6). Change "Cooling system capacity" from "4.75 gallons" to "6.5 gallons (each engine system)".

Page 1-14, Paragraph 1-8, b (9). Change "Connection" data to read "2 batteries connected in series to provide 24 volt. Two pairs connected in parallel".

Page 1-14, Paragraph 1-8, b (11). Change under Voltage regulator range limits, "Voltage setting" to read "28.5 volts d.c.".

Page 1-15, Paragraph 1-8, b (12). Change "Voltage draw" to read "Voltage".

Page 1-15, Paragraph 1-8, b. (13). Change "Type" to read "Heavy duty water resistance unit with spring loaded disc type contactor assembly".

Page 1-15, Paragraph 1-8, b (14) (a). Change "Voltage draw" to read "Voltage --- 24.0 volts d.c.".

Page 1-15, Paragraph 1-9 is superseded as follows:

"This manual covers Aluminum Company of America Model HICE-27D, Highway Products Models HPI-27C MODDED and HPI-27B MODDED and Marinette Marine Corp Model A27 MODDED Bridge Erection Boats. No differences exist for the four models covered in this manual"

Page 2-7, Table 2-2 Third column, line 9. Change "sy" to read "at".

Page 2-7, WARNING, change "1200 RPMs." to read "1200 RPM."

Page 2-11, Paragraph 2-8, e (1) (a). Delete the note.

Page 3-1, Section II, line 16. Change "2024" to read "2404".

Page 3-2, Table 3-1, 9. Change "Can security" to read "and security". Add "(fig. 3-4)" after second sentence.

Page 3-5, Figure 3-4. Change caption third sentence to read "If necessary, add distilled or clear drinking water to 3/8 inch above plates".

Page 3-7, Table 3-2. Change malfunction 7 to read "AMMETER OPERATING ABNORMALLY".

Page 3-7, Section IV Second sentence. Change "Section II" to read "Section I" and "Section III" to read "Section II".

Page 4-2, Sequence Number 15, Second column. Add "(Fig. 3-2)" after first sentence. Sequence Number 16, Second column. Add "(Fig. 3-3)" after second sentence.

Page 4-4, Table 4-2, Malfunction 5, Corrective Action. Change to read "Refer to Malfunction 2, step 4 above."

Page 4-15, Figure 4-8, Legend item 1. Change to read "Lacing wire".

Page 4-35, Paragraph 4-41. Change "paragraph 1-5." to read "paragraph 1-7.".

Page 4-43, Paragraph 4-48. Change "paragraph 1-5." to read "paragraph 1-7.".

Page 4-44, Paragraph 4-50, g (1). Change first line to read "(1) Polarizing the generator. Before starting the engine disconnect".

Page 4-45, Paragraph 4-50, g (2) (c) . Change second sentence to read "The closing voltage is 25 to 27 volts.".

Page 4-60, Figure 4-60. Change the figure title to read "Transmission oil strainer removal."

Page 4-60, Paragraph 4-62. Second sentence. Change "paragraph 1-5." to read "paragraph 1-7.".

Page 4-60, Paragraph 4-63, b (2) Change "fig. 4-60" to read "(fig. 4-61)".

Page 4-60, Paragraph 4-63, b (2) (b). Change "(fig. 4-60)" to read "(fig. 4-61)".

Page 4-60, Paragraph 4-63, b (3). Change "paragraph 4-68" to read "paragraph 4-64".

Page 4-60, Paragraph 4-64, b (2). Change "figure 4-61" to read "figure 4-60."

Page 4-60, Paragraph 4-64, d (2). Change "paragraph 4-70 c" to read "paragraph 4-63 c".

Page 4-61, Figure 4-61. Change the figure title to read "Draining the transmission oil."

Page 4-62, Paragraph 4-66. Change "paragraph 1-5." to read "paragraph 1-7."

By Order of the Secretary of the Army:

Official:

J. C. PENNINGTON
Brigadier General, United States Army
The Adjutant General

BERNARD W. ROGERS
General, United States Army
Chief of Staff

Distribution:

To be distributed in accordance with DA Form 12-25D, Operator maintenance requirements for Boat Bridge Erection.

CHANGE }
No. 2 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C. 21 September 1981

Operator and Organizational Maintenance Manual

**BOAT, BRIDGE ERECTION, INBOARD DIESEL ENGINE,
ALUMINUM HULL, 27 FT LG
(ALUMINUM COMPANY OF AMERICA MODEL HICE-27D)
(HIGHWAY PRODUCTS MODEL HPI-27C MODDED)
(HIGHWAY PRODUCTS MODEL HPI-27B MODDED)
(MARINETTE MARINE CORP. MODEL A27 MODDED)
NSN 1940-00-417-0526**

TM 5-1940-221-12, 17 June 1974, is changed as follows:

Page 1-1. Paragraph 1-3 is superseded as follows:

1-3. Reporting of Errors.

You can improve this manual by calling attention to errors and by recommending improvements using DA Form 2028 (Recommended Changes to Publications and Blank Forms) or DA Form 2028-2 and mailing the form direct to Commander, Headquarters, U.S. Army Troop Support and Aviation Materiel Readiness Command, ATTN: DRSTS-MTT, 4300 Goodfellow Blvd., St. Louis, MO 63120. A reply will be furnished directly to you.

Page 1-1. Paragraph 1-6.1 is added after paragraph 1-6.

1-6.1. Navigation Rules and Safety.

For navigation rules and safety, refer to TM 5-210, Chapter 2 and FM 5-12C1-2. In addition,

when personnel operate the bridge erection boat in foreign waters, they will become familiar with safety and navigation rules of the country.

Page 2-2. Paragraph 2-2c.1 is added after paragraph 2-2c.

c.1. Discharge of Oil Prohibited. The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into the water. Oil leaks or fuel leaks should be corrected while the boat is ashore. Oil or fuel spilled into the hull should be cleaned up prior to launching the boat. Use a cup, rags or absorbent pads/strips to remove oil slops. Bilge pumps should not be used to empty out any accumulation of oily slops except in an emergency.

Page 3-1. Table 3-1 is superseded as follows:

Table 3-1. OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES

ITEM NO.	INTERVAL			B-BEFORE OPERATION	A-AFTER OPERATION	EQUIPMENT IS NOT READY/ AVAILABLE IF:
	B	D	A	D-DURING OPERATION	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	
1	●			<p>BOW AND STERN ASSEMBLIES</p> <p>Hulls, Propellers, Shafts, Rudders, Struts, Interior Hulls, and Couplings</p>	<p>Before launching, visually inspect for structural damage, broken welds, and loose, missing, bent, cracked, or damaged parts or hardware. After launching, visually inspect for water leaking through the hulls. Check that all on board equipment is in its place and in good condition (fig. 1-1 and 1-2). Check that coupling arms, yokes and hooks are up tight, and pinned or locked in place (fig. 2-3).</p>	<p>A leak through the hull cannot be stopped or controlled. Coupling will not come up tight or lock in place.</p>
2	●			<p>ENGINE COMPARTMENT</p> <p>Filters, Lines, Connections, Engines, and Transmissions</p>	<p>Visually inspect fuel systems (fig. 1-6 and 4-26), oil systems (fig. 1-9), and coolant systems (fig. 1-8 and 4-39) for leaks. Check for loose bolts, nuts, and mountings. Check for loose or missing propeller shaft coupling bolts (fig. 1-5).</p>	<p>A fuel leak is detected. Bolts are missing from propeller shaft coupling.</p>
3	●			<p>Engine and Transmission Oil</p>	<p>Check oil levels when boat is in water. From low mark to full mark on dipstick, engine requires 1 quart of oil. From bottom of dipstick to full mark, transmission requires 2 pints of oil.</p> <p style="text-align: center;">CAUTION</p> <p>Engines should not be operated if oil levels are below "L" mark or above "F" mark on the dipstick.</p>	

Table 3-1. OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES (cont)

ITEM NO.	B	D	A	ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT IS NOT READY/ AVAILABLE IF:
4	●			Fire Extinguisher	<p>Inspect and replace a fire extinguisher if the seal is missing or broken, or if the extinguisher system is damaged (fig. 1-3).</p> <p style="text-align: center;"><u>WARNING</u></p> <p>Do not energize electrical circuits or start engines until fire extinguishers have been checked.</p>	Extinguisher system is damaged.
5	●			Steering System and Propeller Shaft Logs	<p>Check that transverse rod lock-nuts are tight (fig. 4-67). Turn steering wheel through full range and check for smooth and easy operation and that rudders respond in unison. Bleed propeller shaft logs (open vent cock until water appears and close fig. 2-4).</p>	Steering bind or if propeller shaft logs cannot be bled.
6			●	Fuel Level	<p>Check for a full tank of fuel. Fill fuel tank at completion of operation.</p> <p style="text-align: center;">NOTE</p> <p>When the master switch is placed in the on position, an alarm will sound. The alarm will turn off when either engine is running with a coolant temperature of less than 205° and oil pressure is above 13 psi.</p>	
7	●			Lights and Bilge Pumps	<p>Check the lights and bilge pumps for proper operation. Remove debris and any accumulation of water from the bilges.</p>	Bilge pumps do not operate or remove accumulated water.

Table 3-1. OPERATOR/CREW PREVENTIVE MAINTENANCE CHECKS AND SERVICES (cont)

ITEM NO.	B	D	A	ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT IS NOT READY/ AVAILABLE IF:
8	●	●		<p>Controls and Instruments</p> <p>a. Transmission oil pressure gage</p> <p>b. Coolant temperature gage</p> <p>c. Tachometer</p> <p>d. Engine oil pressure gage</p> <p>e. Battery ammeter</p>	<p>Check for proper operation and for the specified limits:</p> <p>Normal: 110 to 150 psi</p> <p>Normal: 160° to 185° F</p> <p>Normal: 500 to 3040 rpm</p> <p>Normal: 30 to 40 psi Min. at 2500 RPM: 32 psi Min. at 2200 RPM: 30 psi</p> <p>Normal: 1 to 20 amps on positive side of ammeter.</p>	<p>Pressure is below 110 psi.</p> <p>Temperature is above 200°F.</p> <p>Oil pressure is below 13 psi.</p> <p>Reading on negative side of ammeter.</p>

Page 4-1. Table 4-1 is superseded as follows:

Table 4-1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES

ITEM NO.	INTERVAL					ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT IS NOT READY/ AVAILABLE IF:
	W	M	Q	S	H			
1	●					Fuel Filters and Strainers	Drain water and sediment into a container. Stop as soon as clean, water free fuel runs out (fig. 3-1 and 3-3).	
2	●					Coolant Levels	Proper level is 2 inches below the filler neck. In cold weather, check that antifreeze has been added (fig. 3-1).	
3		●				Batteries	Check electrolyte levels. Prior to adding distilled water, perform a hydrometer check. Remove corrosion and check for loose terminals (fig. 3-4). <u>CAUTION</u> In freezing weather, charge batteries for a minimum of 30 minutes after adding water.	
4			●			V-Belts	Check for a cracked or worn belt. Adjust belt tension, proper adjustment is when the belt can be depressed to not more than 1/2 to 3/4 of an inch. Check shield for damage and insecure mounting (fig. 4-4 and 4-5).	
5			●			Engine and Transmission Mounts	Check that mount bolts and nuts are tight. Check that mount stud nuts are torqued to 100 to 120 ft lb (fig. 3-2)	

Table 4-1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (cont)

ITEM NO.	W	M	Q	S	H	ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT IS NOT READY/ AVAILABLE IF:
6			●			Propeller Strut and Rudder Plate Bolts	Check that propeller strut mounting bolts are torqued to 51 to 54 ft lb. Check that rudder plate bolts are torqued to 17 to 20 ft lb.	
7				●		Fire Extinguishers	Weigh cylinders. If the weight loss exceeds 10 percent of the net weight, recharge or replace cylinders. Refer to TM 5-687.	
8				●		Bow and Stern Assemblies	Inspect the hulls, hatches, gratings, cleats, towing hits, pushing knees (fig. 1-1 thru 1-3), heat exchanger (fig. 4-33), propellers, shafts, couplings (fig. 1-5), rudders, struts, and steering system (fig. 1-11) for structural damage, wear, deterioration, cracks, broken welds, looseness, or other damage. Make sure all bolts, nuts, screws, clamps, and mountings are tight. Clean and touch-up paint.	
9				●		Engine Compartment	Inspect the exhaust systems (fig. 1-7 and 4-32), coolant systems (fig. 1-8 and 4-39), fuel systems (fig. 1-6 and 4-26), oil systems (fig. 1-9), electrical system (fig. 1-10), air intake system (fig 4-18 thru 4-20), accessories (fig. 1-4), control cables (fig. 4-9 and 4-12 thru 4-14), engines (fig. 1-4 and 1-5), and transmissions (fig. 1-4 and 1-5) for leaks, wear, deterioration, cracks, broken welds, looseness, or other damage. Make sure all bolts, nuts, screws, clamps, and mountings are tight. Clean and touch-up paint.	

Table 4-1. ORGANIZATIONAL PREVENTIVE MAINTENANCE CHECKS AND SERVICES (cont)

ITEM NO.	W	M	Q	S	H	ITEM TO BE INSPECTED	PROCEDURES CHECK FOR AND HAVE REPAIRED OR ADJUSTED AS NECESSARY	EQUIPMENT IS NOT READY/ AVAILABLE IF:
10					300	Fuel Filters and Strainers	Replace fuel filter and strainer elements (fig. 4-27 and 4-28).	
11					300	Engine oil and Filters	Drain oil, replace oil filter elements, and refill with new oil (fig. 4-27 and 4-28).	

Page 4-23. Paragraph 4-23 is superseded as follows:

4-23. General

a. This section contains the maintenance procedures for the fuel system. A description of the fuel system is given in paragraph 1-5.

WARNING

Maintenance procedures for the fuel system must be performed in a well ventilated area. Do not allow any sparks or flames in the vicinity.

b. Discharge of Oil Prohibited. The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into the water. Fuel leaks from the engine, filters, lines or tank should be corrected while the boat is ashore. Fuel spilled into the hull should be cleaned up prior to launching the boat. Use a cup, rags or absorbent pads/strips to remove oily bilge slops. Bilge pumps should not be used to empty out an accumulation of oily slops except in an emergency.

Page 4-29. Paragraph 4-33c is added after paragraph 4-33d.

c. Discharge of Oil Prohibited. The Federal Water Pollution Control Act prohibits the discharge of oil or oily waste into the water. Oil leaks from the engine or filters should be corrected while the boat is ashore. Oil spilled into the hull should be cleaned up prior to launching the boat. Use a cup, rags or absorbent pads/strips to remove bilge oil slops. Bilge pumps should not be used to empty out an accumulation of oily slops except in an emergency.

Page A-1. Paragraph A-8 is added after paragraph A-7.

A-8. Navigation Rules and Safety.

- TM 5-210 Military floating Bridge Equipment
- FM 5-12C1-2 Soldiers Manual

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-25D, Organizational Maintenance requirements for Boat Bridge Erection.

**BOAT, BRIDGE ERECTION; INBOARD DIESEL ENGINE;
 ALUMINUM HULL; 27 FT LG
 (ALUMINUM COMPANY OF AMERICA MODEL HICE-27D)
 FSN 1940 182-3097**

		Paragraph	Page
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*This manual supersedes TM 5-1940-221-12, 5 October 1972, including all changes.

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CHAPTER 1

INTRODUCTION

Section I. GENERAL

1-1. Scope

This manual is for your use in maintaining the bridge erection boat. It provides information for the operation and maintenance of the equipment and its accessories as directed by the maintenance allocation chart.

1-2. Maintenance Forms and Records

Maintenance forms and records that you are required to use are explained in TM 38-750.

1-3. Reporting of Errors

You can improve this manual by calling attention to errors and by recommending improvements, using DA Form 2028 (Recommended Changes to Publications) or by letter, and mail direct to the

Commander, U. S. Army Troop Support Command, ATTN: AMSTS-MPP, 4300 Goodfellow Boulevard, St. Louis, MO. 63120. A reply will be furnished direct to you.

1-4. Equipment Serviceability Criteria (ESC)

This equipment is not covered by an ESC.

1-5. Destruction of Army Material to Prevent Enemy Use

Procedures to be used for destruction of the bridge erection boat to prevent enemy use are in TM 750-244-3.

1-6. Administrative Storage

For administrative storage instructions, refer to TM 740-90-1.

Section II. DESCRIPTION AND DATA

1-7. Description

a. General. The Bridge Erection Boat (fig. 1-1 and 1-2) is a 27-foot, diesel-powered, aluminum craft that is used to tow and maneuver components of floating bridges. The boat consists of two assemblies; the bow and the stern. Each assembly is transported on its own cradle. Upon arrival at the launching site, each assembly is lowered into the water independently and the two are then coupled together. The bow assembly contains a cargo well to carry gear and personnel. The bow assembly (fig. 1-3A) has a bow light and a manually-operated bilge pump. The stern assembly contains two three-cylinder diesel engines and the operator's cockpit (fig. 1-3B). The stern assembly has an electric bilge pump, running and stern lights, a portable spotlight, and fire extinguishers. The propellers are driven by the engines through transmissions with a 2.91:1 reduction ratio.

b. Engine. The two engines are vertical, three-cylinder, liquid-cooled, in-line, two-cycle diesels (fig. 1-4). They have four exhaust valves per cylinder, a displacement of 1593 cubic inches, a nominal compression ratio of 21 to 1, and a mechanical governor which limits engine rpm. Each engine is equipped with a gear-driven air blower, air silencer, emergency shutdown valve, belt-driven generator and water pump, gear-driven fuel pump, fuel filter, electric starting motor, oil cooler, oil filter, and gear-driven oil pump.

c. Transmission. The two transmissions are hydraulic-marine types. A gear is mounted on the aft end of the engine and its output shaft is connected by a flange-type coupling to the propeller shaft (fig. 1-5). Each gear consists of a hydraulically-operated multiple disc forward and reverse clutch, 2.91:1 ratio reduction gear, oil pump, oil screen, and oil pressure regulator valve. The oil is cooled by an engine-mounted oil cooler. The transmission oil system is inde-

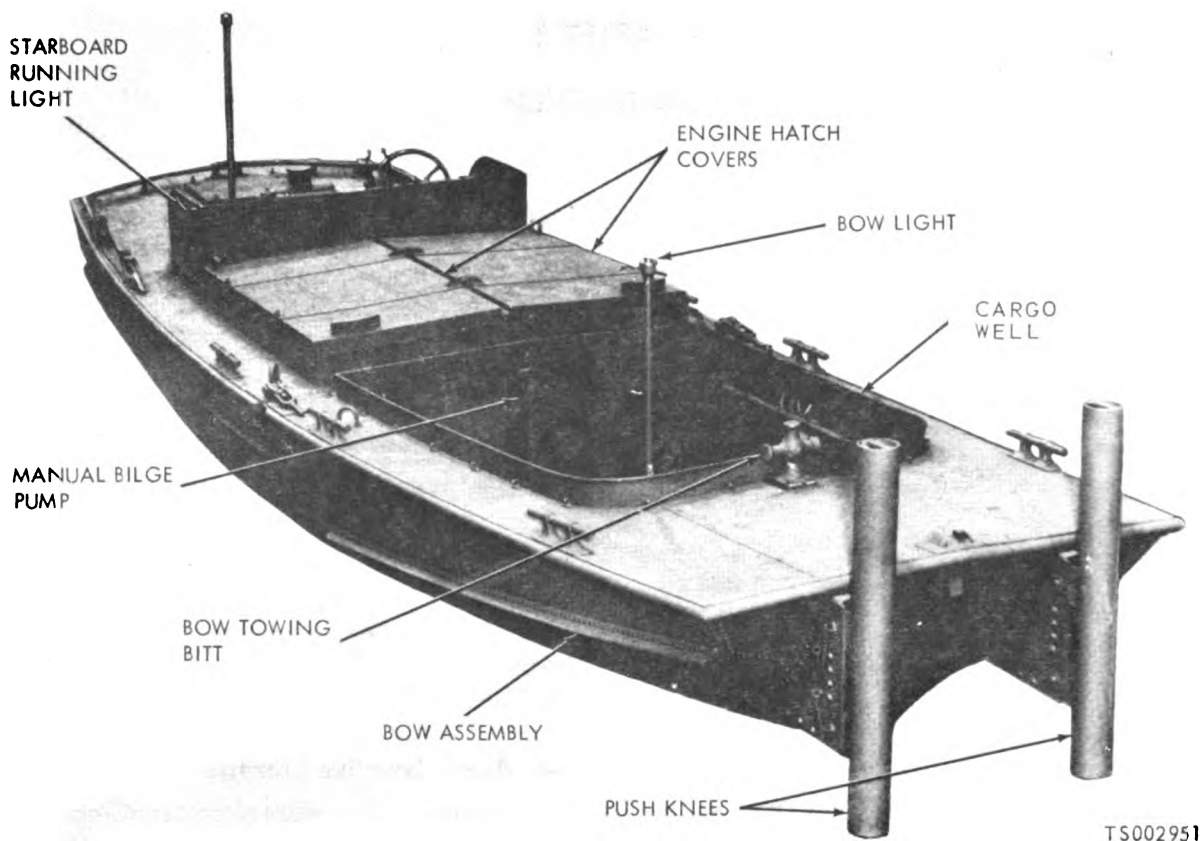


Figure 1-1. 27-Foot bridge erection boat, right front view.

pendent of the engine oil system. Transmission control is effected by control levers mounted in the operator's cockpit.

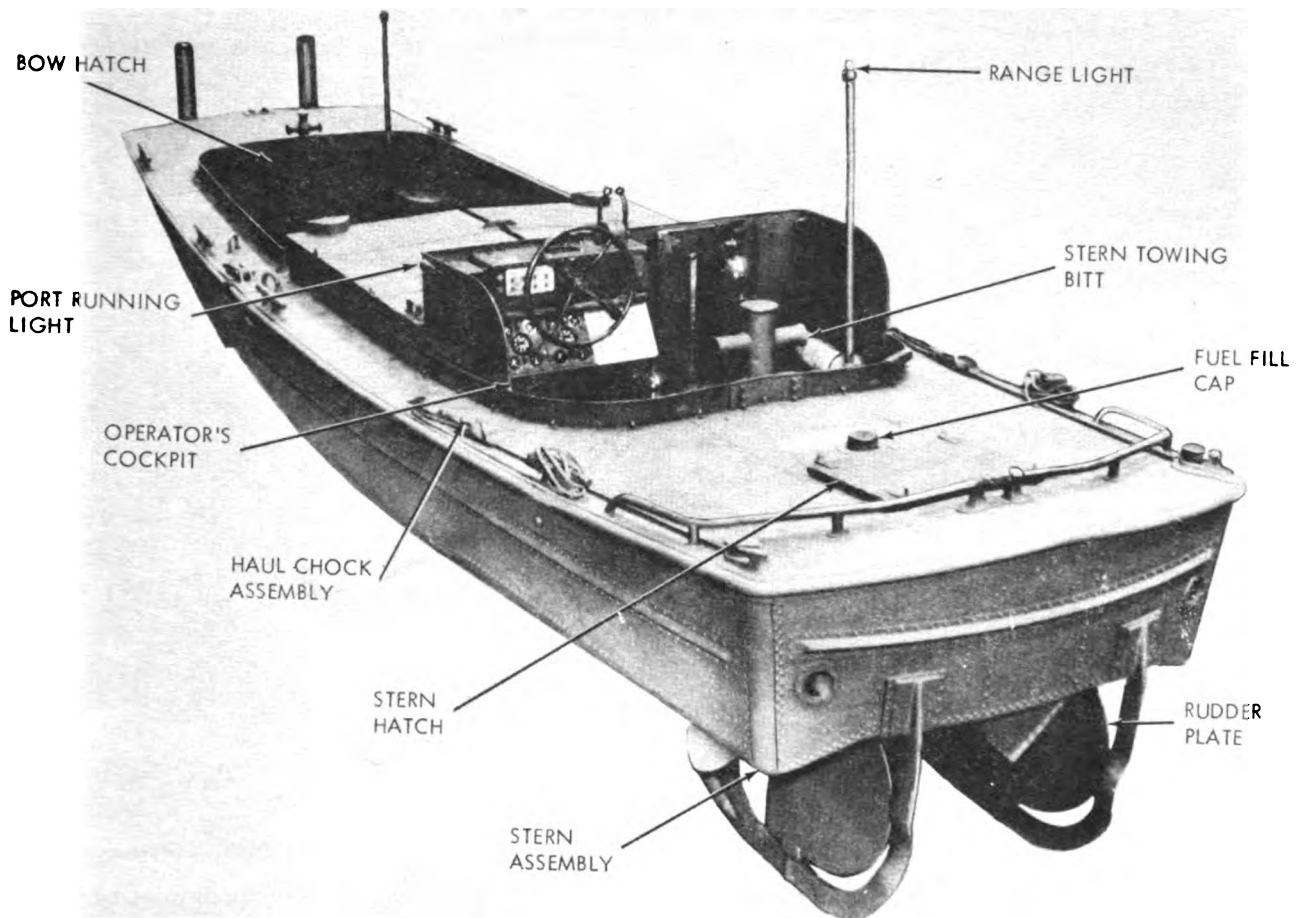
d. Fuel System. The fuel system (fig. 1-6) consists of a tank, filters, strainers, pump and injectors.

(1) *Fuel tank.* The 90-gallon capacity fuel tank (fig. 1-6) is located behind the operator's cockpit. The tank is equipped with baffles to stabilize fuel movement within the tank. A vent line passes from the tank through the hull on the port side. Fuel is supplied to each engine through two lines independently connected to the center forward portion of the tank. The fuel tank filler is located on the deck above the aft end of the tank. The cap is a non-vented type to avoid water entering the tank. A fuel quantity gage (dipstick) is on the forward bulkhead of the operator's cockpit (fig. 1-3).

(2) *Fuel filters, strainers, valves, and pumps.* One primary fuel strainer is located on

each side of the engine compartment and one shutoff valve on each side of the operator's cockpit. Fuel drawn from the tank passes through the manually-operated shutoff valve and primary strainer to the inlet side of the fuel pump mounted on the engine. Leaving the pump under pressure, the fuel is forced through a secondary filter into the fuel manifold which is an integral part of the cylinder head. The fuel is then transmitted through pipes to the inlet side of the fuel injectors.

(3) *Fuel injectors.* A fuel injector is installed in each engine cylinder. Each injector is actuated by a rocker arm to create the high fuel pressure needed to obtain atomizing. The injectors meter and inject the exact amount of fuel required for the desired engine speed. The injectors are automatically controlled by a limiting speed mechanical governor. Excess fuel is routed through outlet pipes into the return manifold and back to the tank.



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Figure 1-2. 27-Foot bridge erection boat, left rear view.

(4) *Limiting speed mechanical governor.* A limiting speed mechanical governor is mounted on the left side of each engine. The governor is a double-weight limiting-speed type and is gear driven by the engine. The governor serves to control the engine idle speed and to limit the maximum operating speed. The governor is connected to the injector control levers to regulate the amount of fuel delivered to the cylinders.

(5) *Control levers.* The control levers are mounted in a quadrant located to the right and forward of the steering wheel. The levers serve two purposes; they control the speed of the engines and also control the transmission. Each lever controls engine speed through a cable and linkage to a speed control lever on the governor, and controls the transmission gear engagement by a cable and linkage to a lever on the transmission. Initial movement of the control lever engages the transmission, further movement of the

lever increases engine speed. Forward movement of the lever engages the transmission in forward drive. Aft movement of the lever engages the transmission in reverse drive. The mid position of the lever disengages the transmission and the engine will idle. If engine speed variation is desired while the transmission is in neutral, the lever must be pulled out to the side (away from the control quadrant). This permits engine acceleration and deceleration while the transmission remains disengaged.

e. Air Induction and Exhaust Systems. The air induction and exhaust systems (fig. 1-7) provide the fresh air for engine combustion and the means for eliminating the products of combustion. The system for each engine consists of an air silencer, shutdown housing and control, blower, exhaust manifold, muffler, and connecting lines.

(1) *Blower.* An air blower is mounted on the right side of each engine and provides the air

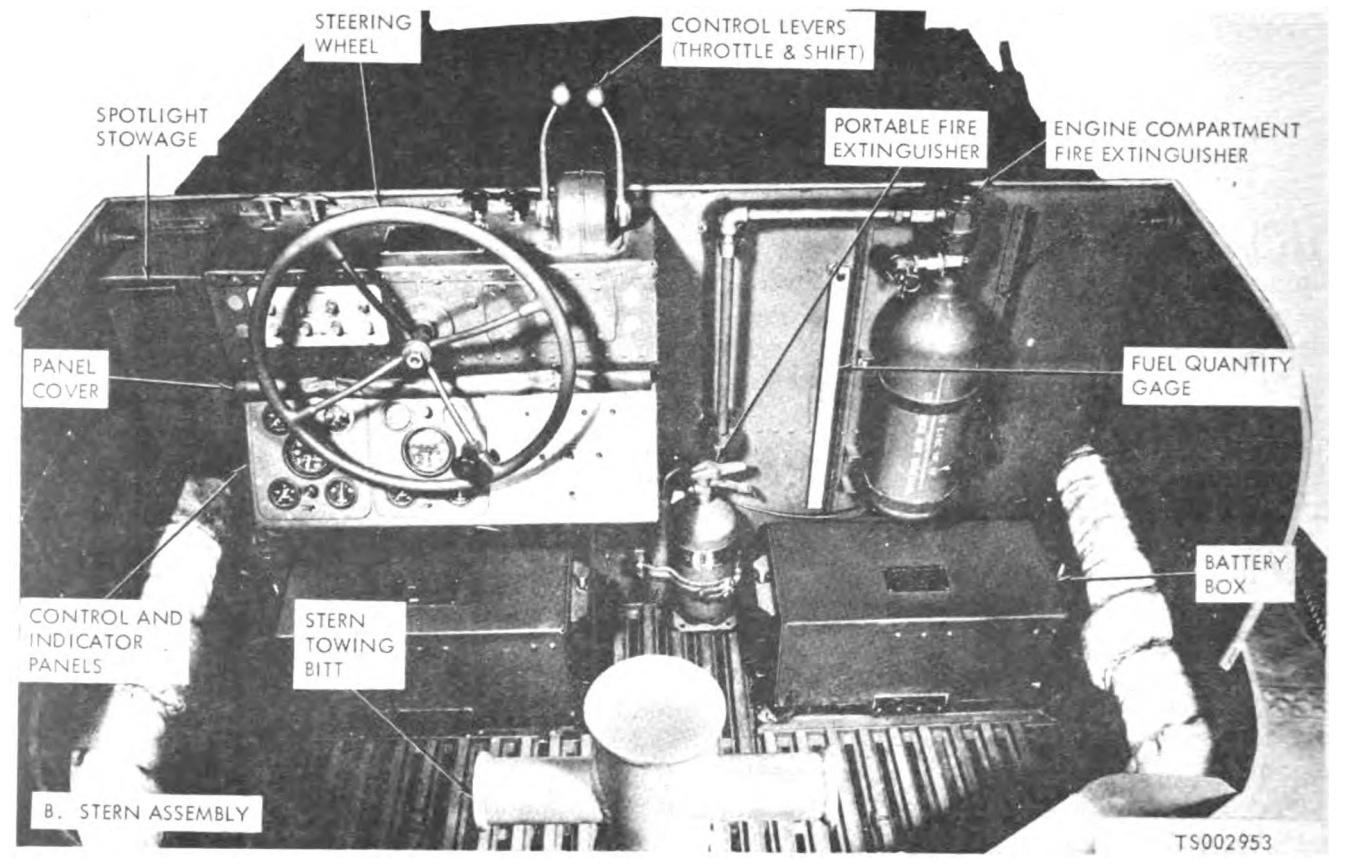
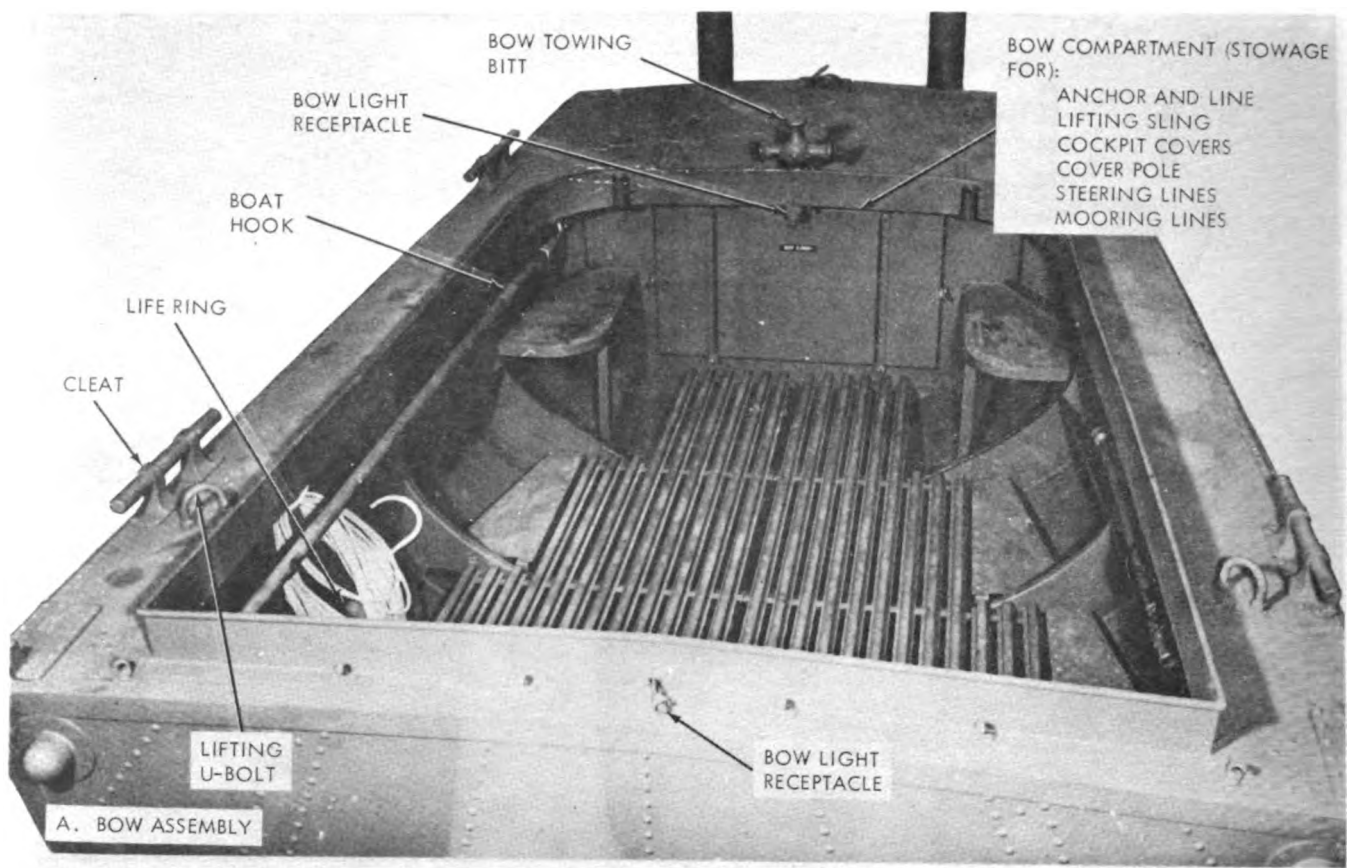


Figure 1-8. Bridge erection boat orientation.

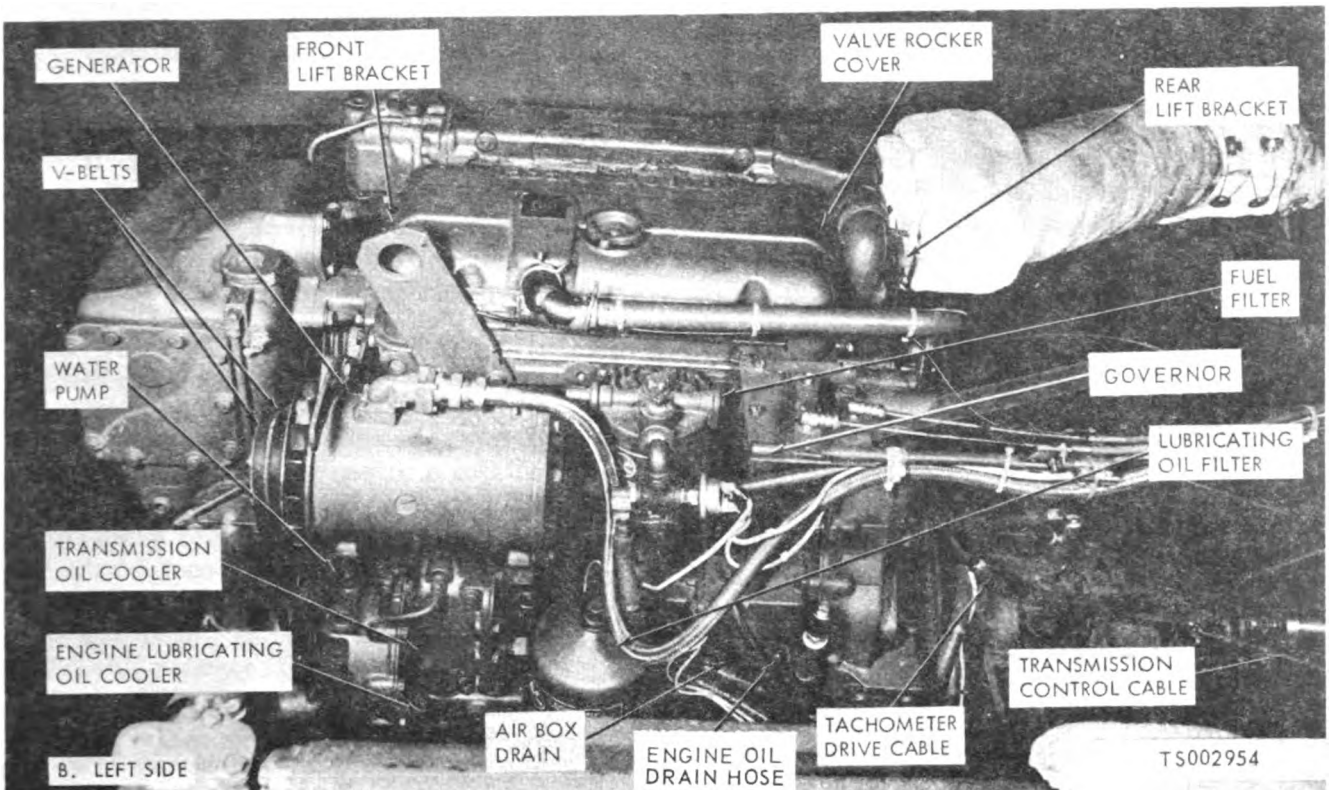
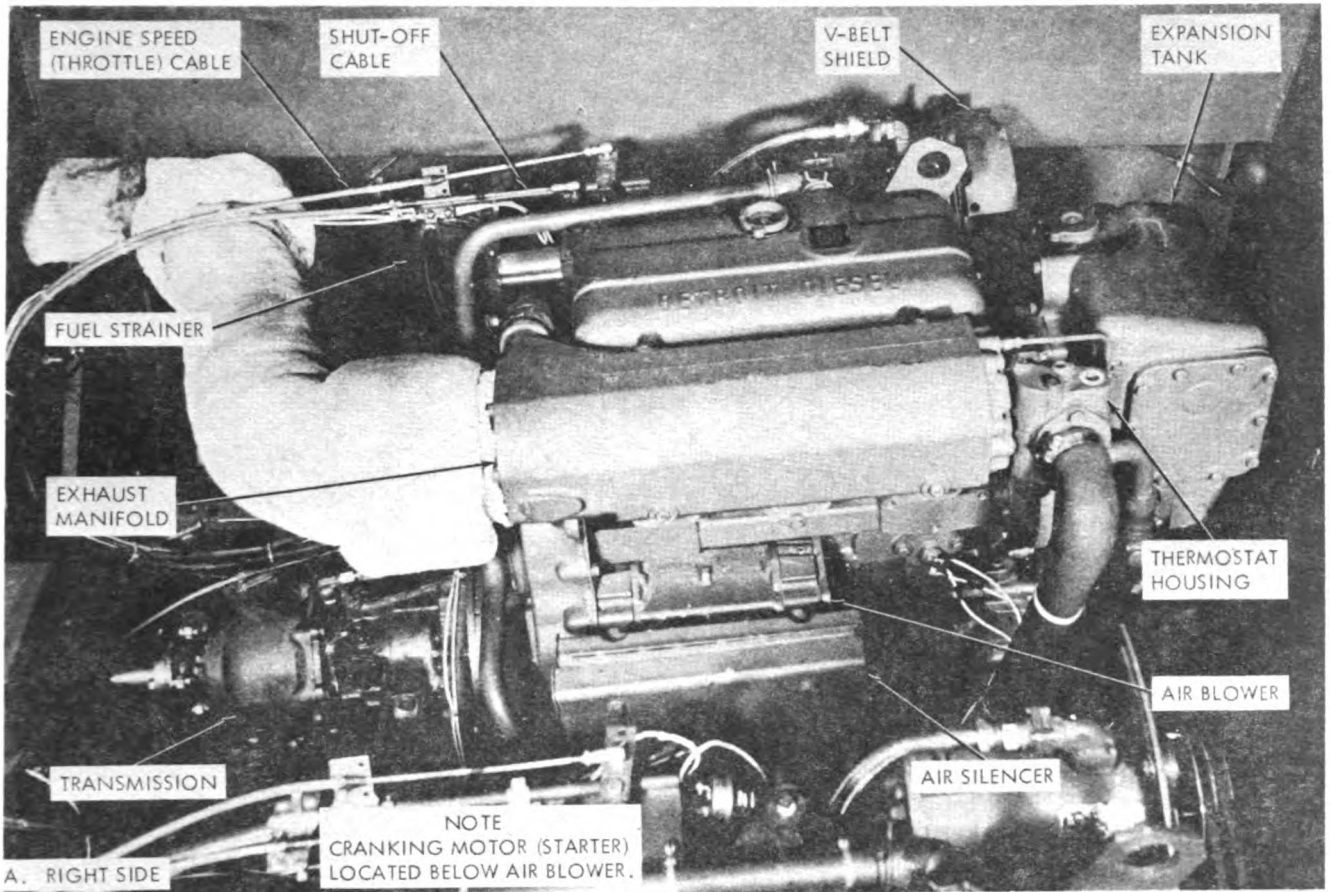
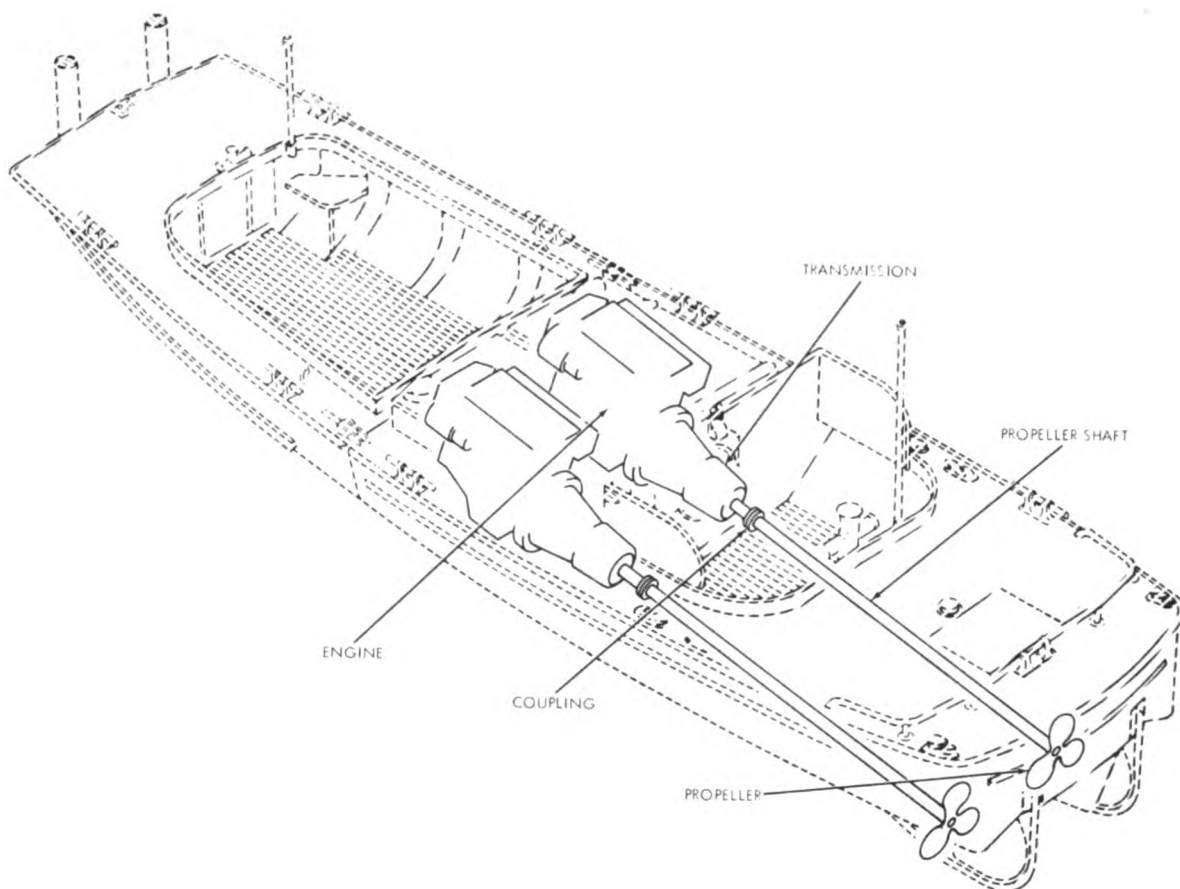


Figure 1-4. Engine and transmission.



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Figure 1-5. Power arrangement.

for combustion and scavenging. The blower is bolted to the engine and is gear driven. During the scavenging process, fresh air is forced through the intake ports into the cylinder and thoroughly eliminates all of the burned gases out through the exhaust valve ports. Fresh air then remains in the cylinder for combustion.

(2) *Air shut-down housing.* The air shut-down housing is mounted on the side of the blower. The air shutdown housing contains a valve that, in an emergency, cuts off the air supply and stops the engine. The air shutoff valve is manually operated. The EMERGENCY STOP control handles are located in front and to the left of the steering wheel. The manual controls are connected to the air shutoff valve by a cable and linkage. Pulling out a handle will close the valve and stop engine operation.

CAUTION

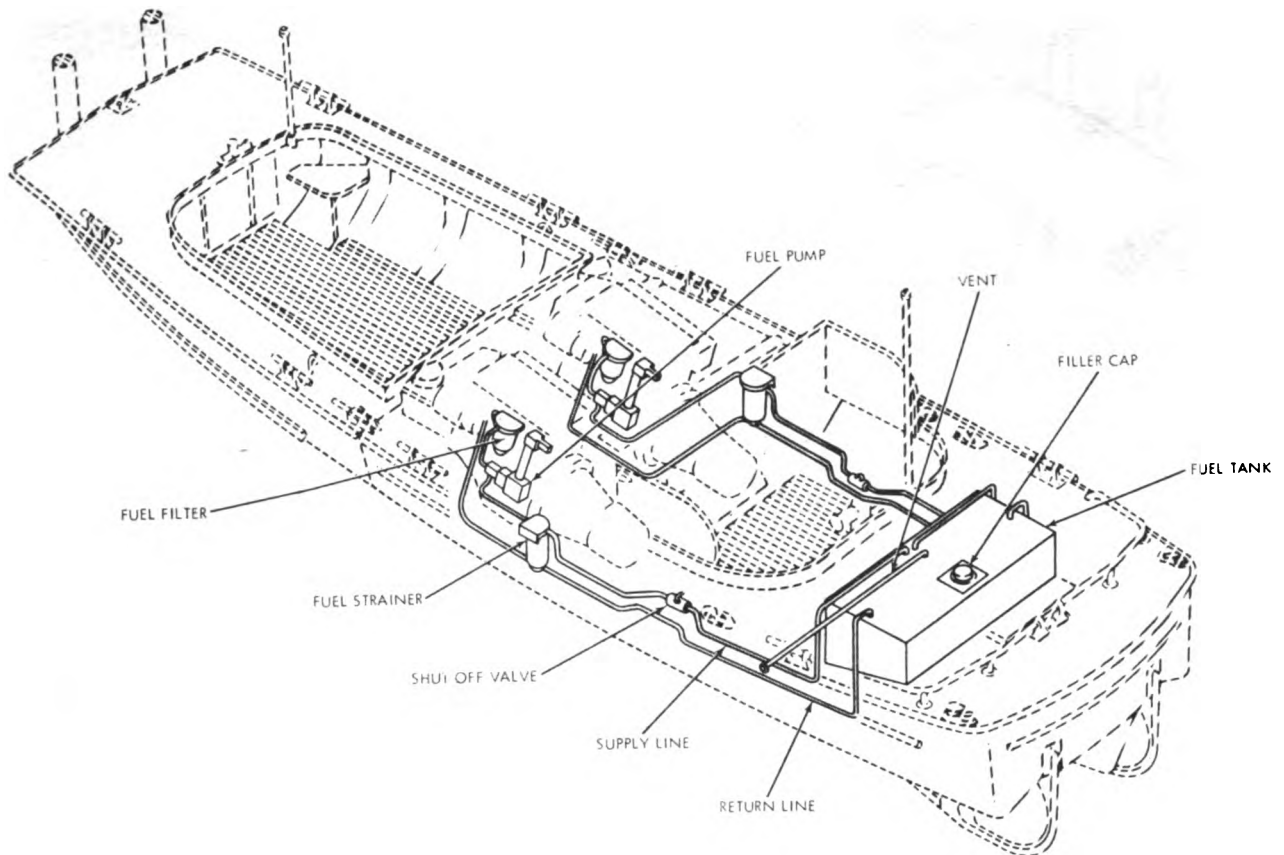
If the EMERGENCY STOP handle has inadvertently been pulled while the engine is stopped or idling, the air shut-

down valve must be manually reset. If the handle was pulled because of a runaway engine, do not attempt to restart the engine until it has been inspected by direct support personnel.

(3) *Air silencer.* An air silencer is mounted on each air shutdown housing. The silencer serves two purposes; it contains sound absorbent material to quiet the rush of air into the system; and it contains a screen so that foreign objects cannot be drawn into the blower.

(4) *Exhaust system.* The burned gases from the engine pass through a water-cooled exhaust manifold, which is connected by piping to a muffler in the stern. The muffler is joined to a tail pipe which exhausts above the water line. The muffler and piping are wrapped with asbestos blanketing for personnel protection.

f. *Cooling System.* The cooling system (fig. 1-8), for each engine consists of a water pump, heat exchanger, thermostat, expansion tank, and associated lines and fittings.



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Figure 1-6. Fuel systems.

(1) *Heat exchangers.* Two heat exchangers, one for each engine, are mounted outside the hull on either side of the keel next to the propeller shafts. The engine coolant is circulated through the exchangers and the heat from the coolant is transferred to the water surrounding the boat. The exchangers are fitted with zinc anodes which prevent corrosion to the heat exchangers and the hull caused by electrolytic action of the surrounding water.

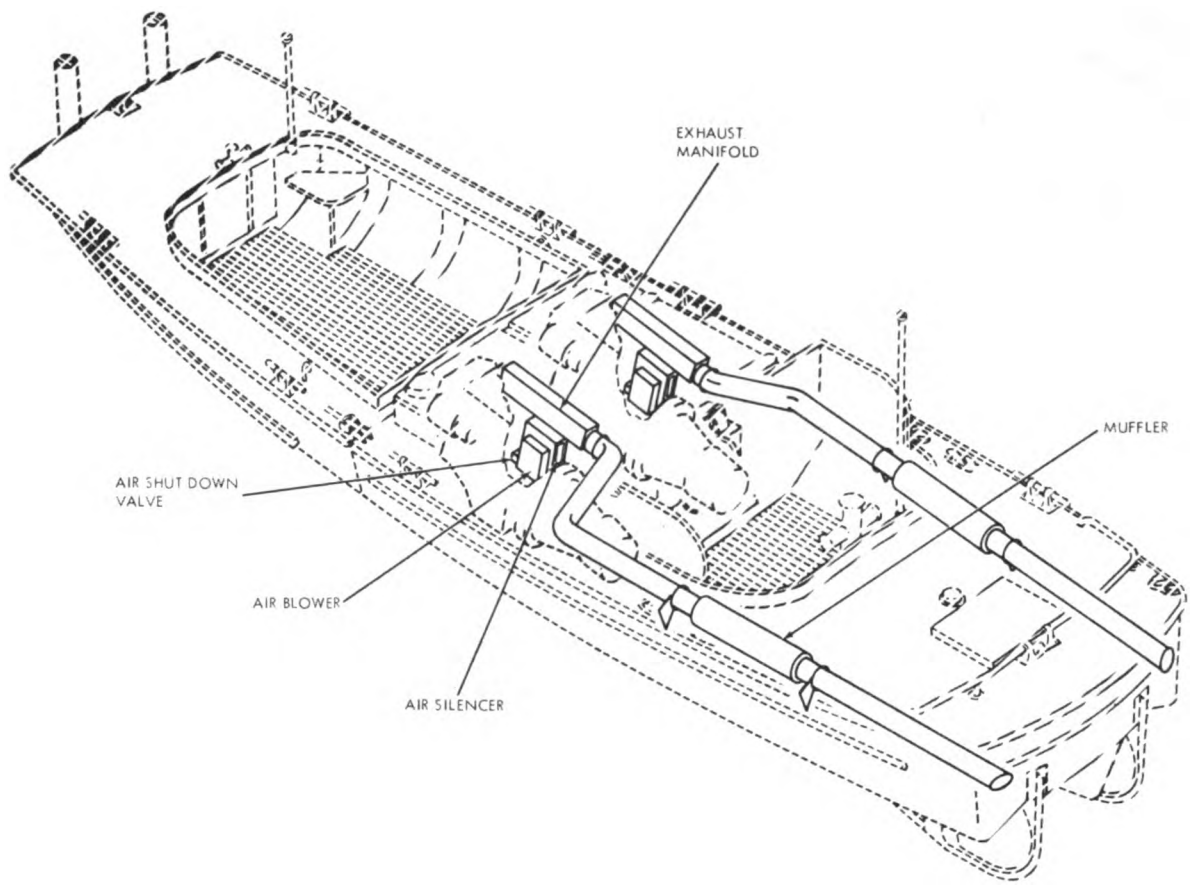
(2) *Water pumps.* A centrifugal-type water pump is mounted on top of the engine oil cooler housing at the left front corner of each engine. The pump is belt driven by a pulley mounted on the camshaft. The pump circulates coolant drawn from the expansion tank through the oil cooler, cylinder block, cylinder heads, thermostat housing, and, if too warm, the heat exchangers.

(3) *Thermostat.* A thermostat housing is attached to the water outlet (forward) end of each exhaust manifold. The housing contains a blocking type thermostat that automatically controls the temperature of the coolant. A bypass tube is

connected between the thermostat housing and the water tank. At coolant temperatures below approximately 170°F, the thermostat valve remains closed and blocks the flow of coolant to the heat exchanger. This causes the coolant to circulate through the cylinder block and heat back to the suction side of the pump. When the coolant temperature rises, the thermostat valve opens, the bypass section is restricted, and the coolant passes to the heat exchanger.

g. Lubricating Oil System. The lubricating oil system (fig. 1-9), for each engine includes an oil intake screen and tube assembly, oil pump, oil pressure regulator, oil filter with bypass valve, oil cooler, and oil cooler bypass valve. Lubricating oil from the pump passes through the engine front cover and into passages in the cylinder block. From the block, the oil passes through the filter to the oil coolers. The oil then flows through the cooler and back into the engine front cover.

(1) *Oil pump.* The oil pump is a rotary type and is mounted on the inside of the engine



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Figure 1-7. Air induction and exhaust systems.

lower front cover. The pump is driven directly by the crankshaft. As the pump rotor revolves, a vacuum is formed on the inlet side of the pump and oil is drawn from the crankcase and forced out under pressure through the discharge port of the pump.

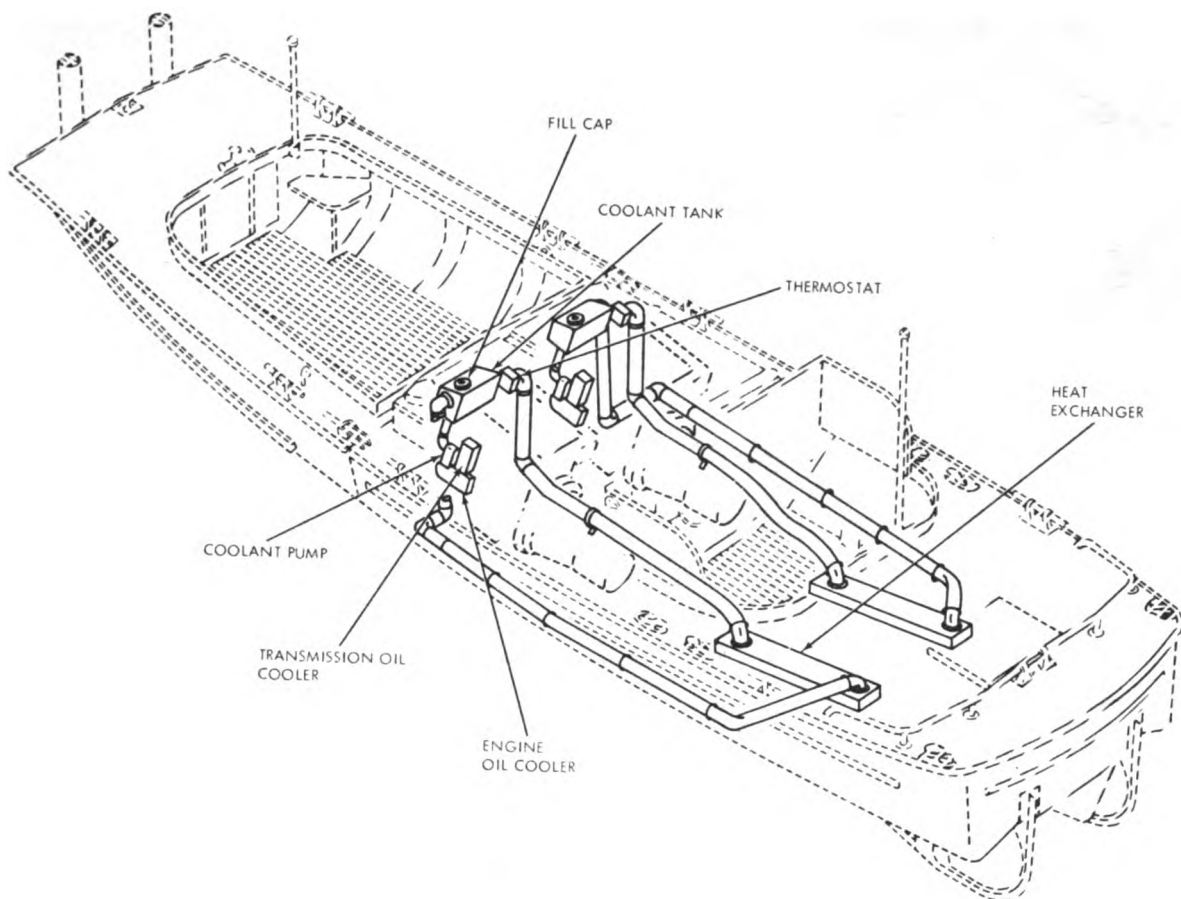
(2) *Oil pressure regulator.* The oil pressure regulator is installed in the engine lower front cover. The regulator consists basically of a spring-loaded piston-type valve. When the oil pressure exceeds 51 psi, the valve is forced from its seat, and the oil is bypassed into the engine oil pan.

(3) *Oil filter.* The lubricating oil filter is the full-flow type and is mounted between the oil pump and cooler. Oil is forced by pump pressure through a passage in the filter base to the space around the filter element. Impurities are filtered out as the oil is forced through the element and it then passes to the oil cooler. A valve, which opens at 183-21 psi, is located in the filter base and will bypass the oil directly to the cooler if the filter is clogged.

(4) *Oil coolers.*

(a) *Engine cooler.* The engine oil cooler is mounted on the left side of the cylinder block at the lower front corner. Coolant from the engine cooling system circulates through the oil cooler and completely surrounds the oil cooler core. Oil flows from the oil filter through the cooler core and then to the cylinder block oil galleries. The core is cooled by the circulating engine coolant. A bypass valve is located in the right side of the lower engine front cover. If the oil cooler should become plugged, the valve will open at approximately 52 psi and pass the oil directly to the galleries in the cylinder block.

(b) *Transmission oil cooler.* The transmission oil cooler is mounted over engine oil cooler on the left side of the cylinder block. Oil flows from the transmission through the cooler core and back to the transmission. The core is cooled by the circulating engine coolant.



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Figure 1-8. Cooling system.

(5) Oil level dipsticks.

(a) **Engine dipstick.** A steel ribbon-type dipstick is mounted in a tube on the left side of the engine. The dipstick has markings to check the amount of oil in the engine oil pan. The oil level should always be at the F (full) mark on the dipstick.

CAUTION

The engine should not be operated if the oil is below the L mark on the dipstick.

(b) **Transmission dipstick.** A dipstick and plug assembly is threaded into the upper left side of the transmission housing. The dipstick has markings to check the amount of oil in the transmission. The level should be maintained at the F (full) mark on the dipstick.

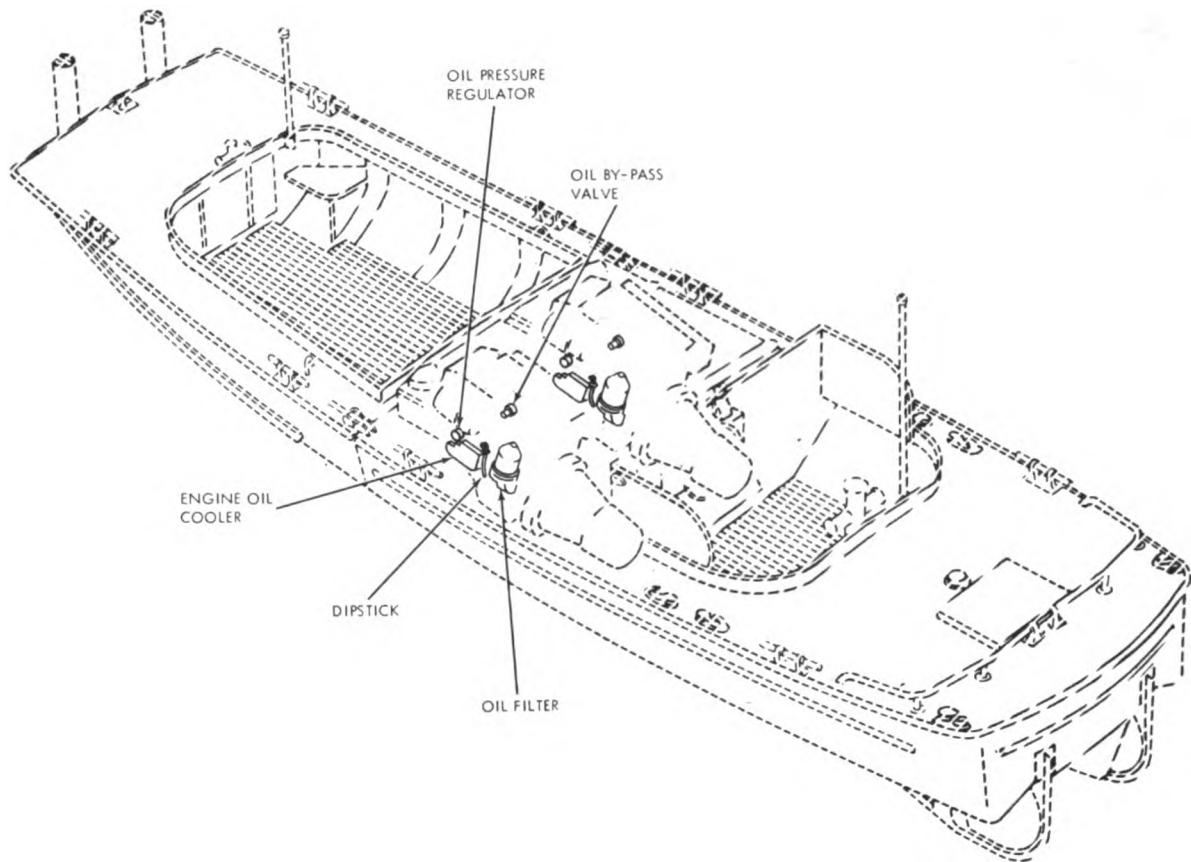
(6) **Oil filler cap and oil sump drain.** The engine lubricating oil filler cap is located in the valve rocker cover. When adding oil, care should always be taken to be sure that no dirt or other

foreign matter enters the filler. Oil is drained from the sump by means of a manually-operated pump through a tube located at the left side of the engine. The tube has a threaded plug which is removed and the pump fitting attached.

h. Electrical System. The electrical system (fig. 1-10) is a 24-volt direct current with negative-to-ground. The system is powered by batteries which are charged by the engine-driven generator. The batteries supply the power for lighting, starting, instruments, the alarm system, and the stern bilge pump.

(1) **Generator.** The generator is mounted at the left forward portion of the engine. It is a 24-volt, hinge-mounted, two-brush shunt unit with sealed ball bearings. The generator is belt driven by a pulley mounted on the camshaft. The generator supplies current to charge the batteries through a voltage regulator.

(2) **Generator regulator.** The generator regulators are mounted on the aft bulkhead of the engine compartment. The regulators are 24-volt,



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Figure 1-9. Engine lubricating oil system.

18-ampere, heavy-duty, water-tight units. The regulators are limiting devices designed to protect the system from excessive voltage and current.

(3) *Batteries.* The four batteries are mounted in pairs in two battery boxes located on the deck at the forward position of the operator's cockpit. The batteries are lead-acid types. Each pair of batteries is connected in series. The two pairs are then connected in parallel to provide a 24-volt supply. The batteries are charged by the engine-driven generators.

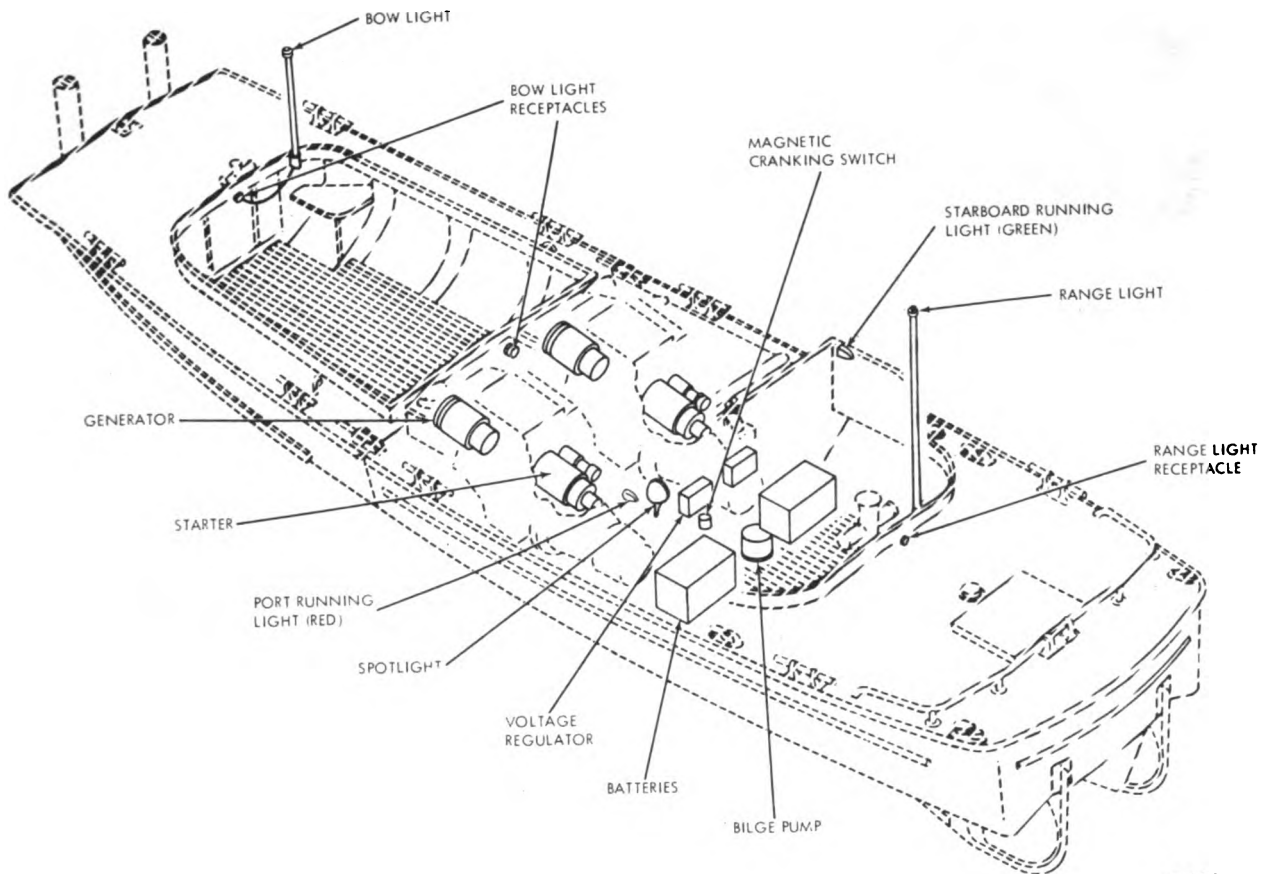
(4) *Starting motor.* The starting motor is a heavy duty type with totally enclosed shift lever and solenoid plunger. The starting motor is located on the lower left side of each engine. When the STARTER switch, located on the switch panel, is engaged, the solenoid is energized and shifts the starting motor pinion in mesh with the engine flywheel gear ring. This also closed the main contacts within the solenoid and allows battery current to flow to the motor causing the armature to turn. As the engine starts, an over-

running clutch drive turns faster than the armature and the pinion disengages to protect the armature from excessive speed.

(5) *Magnetic cranking switch.* A solenoid-operated cranking switch is mounted on the aft bulkhead of the engine compartment. The cranking switch connects the batteries in parallel.

(6) *Alarm system.*

(a) The boat is provided with an alarm system to alert the operator when an engine malfunction exists. The system consists basically of a bell located below the instrument panels in the operator's cockpit and three sensors. One sensor is mounted in the right forward portion of the cylinder block and will close the circuit when coolant temperature exceeds $205^{\circ} \pm 5^{\circ}\text{F}$. and sound the alarm. Another sensor, located at the lubricating oil filter, will close the circuit when oil pressure drops below 10 ± 2 psi and will sound the alarm. A third sensor is located at the outlet of the fuel pump. This sensor establishes the circuit in an operating condition when the engine is started.



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Figure 1-10. Electrical system.

NOTE

Any time the MASTER switch is in the ON position the alarm will sound if both engines are not running. This will occur before engine starting and after shut down. When either engine is running, the alarm system will be deactivated if the oil pressure and coolant temperature are within limits.

(b) In the event the alarm bell rings, the actions to be performed are as follows:

1. If both engines are stopped, the MASTER switch should be placed in the OFF position.

2. If one engine is running, the water temperature and engine oil pressure gages for that engine should be checked to determine which gage reflects an abnormal condition. Then the engine should be shut down and the MASTER switch placed in the OFF position.

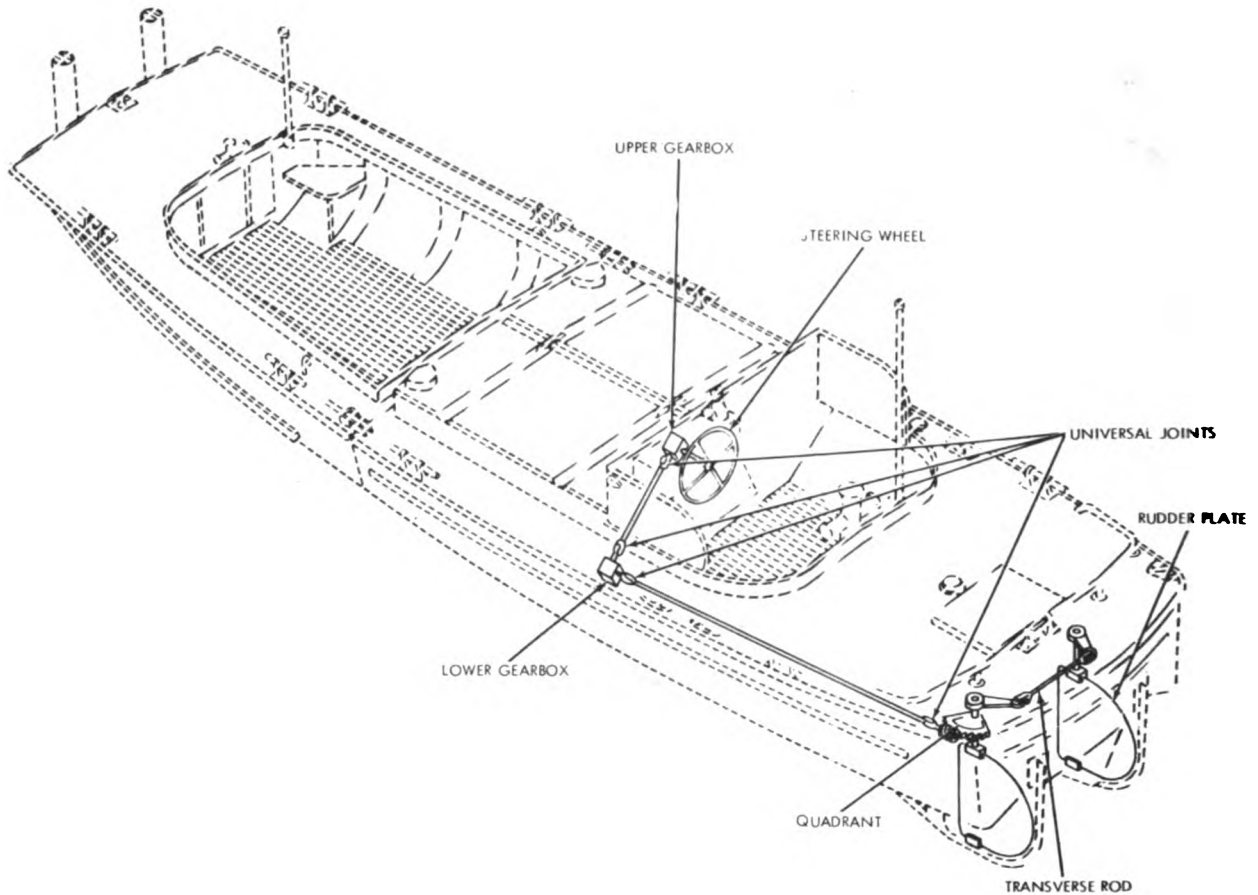
3. If both engines are running, the water temperature and engine oil pressure gages

should be checked to determine which engine is operating abnormally and what the abnormal condition is. Then the malfunctioning engine should be shut down.

4. With both engines stopped and master switch is in ON position, if the alarm does not sound, replace ALARM fuse on fuse panel.

i. *Steering System.* The steering system (fig. 1-11) consists essentially of a steering wheel, gear boxes, rods, quadrant, and rudders. Rotary motion of the steering wheel turns bevel gears in the upper gear box. This box transmits this motion through a rod to the lower gear box and in turn to another rod which engages the teeth of the rudder quadrant. A shaft is mounted to the quadrant and controls positioning of the port rudder plate. A transverse rod is connected between the quadrant and the starboard rudder shaft.

j. *Fire Extinguisher System.* The fire extinguisher system (fig. 1-12) consists basically of a fire extinguisher bottle installed at the forward



TS002961

Figure 1-11. Steering system.

starboard portion of the cockpit and a nozzle located in the engine compartment. The system is a carbon-dioxide type and is suitable for all fires including electrical. The system is actuated manually by a lever type control on the top of the bottle. Once the lever is actuated, it will discharge all the carbon dioxide in the cylinder. A small portable carbon dioxide extinguisher is located next to the installed bottle.

k. Bilge Pumps and Drain Plugs.

(1) An electric bilge pump is located in the forward center portion of the stern assembly (fig. 1-10). It is controlled by a toggle switch mounted on the switch panel. A manual bilge pump is installed in the aft portion of the bow assembly (fig. 1-1).

(2) A drain plug is provided at the forward center portion of the stern assembly, and another is located at the aft center portion of the box assembly. These are screw-type fittings with a T-handle.

l. On-Board Equipment. The boat is equipped with accessory equipment as follows:

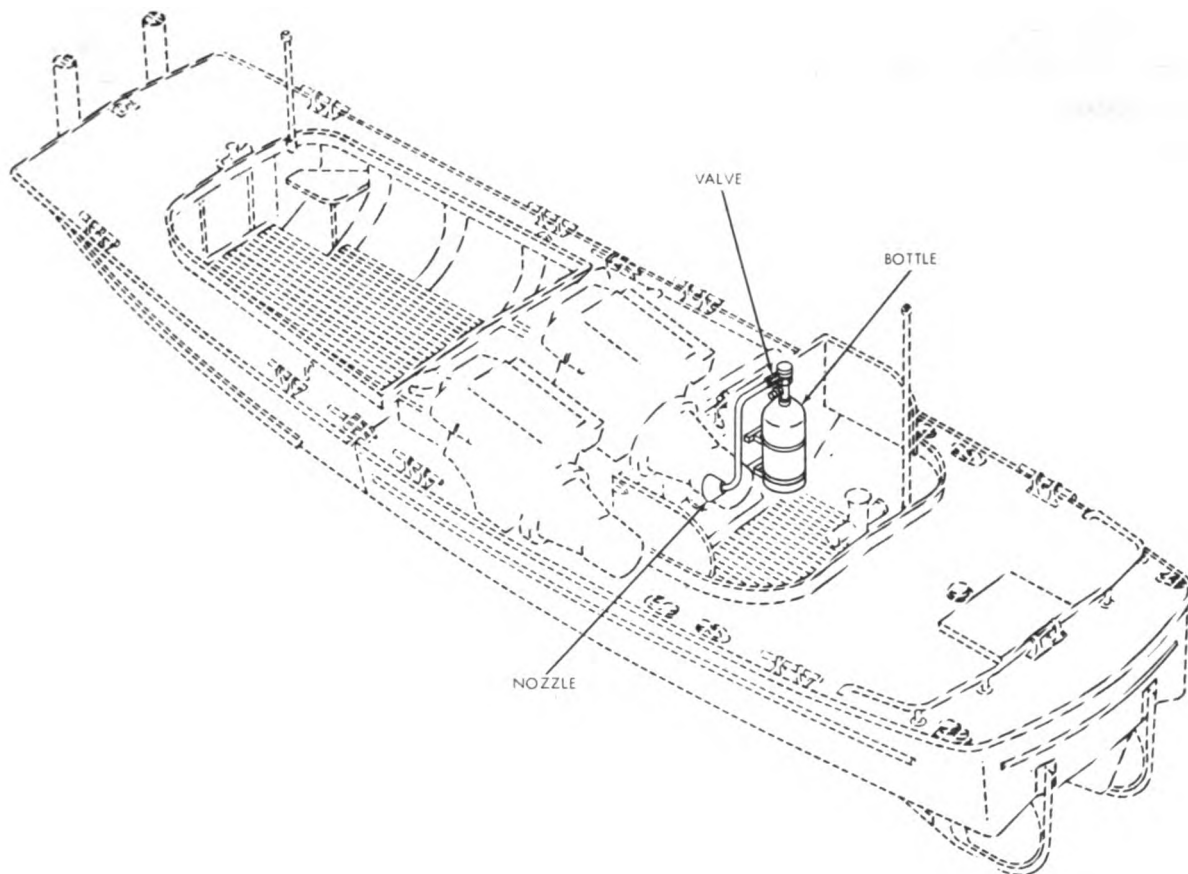
(1) A 22-pound anchor with a 100-foot long 1/2-inch diameter nylon line is stowed in the bow compartment. Two steering lines, four mooring lines, and a lifting sling are also stowed in the bow compartment.

(2) A 7-foot boat hook is stowed in clips on the port side of the forward cockpit.

(3) A canvas cover, support pole, and 30-foot of manila line are provided to cover the forward cockpit. A canvas cover and 30-foot line is supplied for the operator's cockpit. All the items are stowed in the bow compartment.

(4) A ring buoy with line attached is stowed in a bracket on the port side of the forward cockpit.

(5) An engine lubricating oil drain pump is stowed in a bracket on the forward starboard side of the engine compartment.



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Figure 1-18. Fire extinguisher system.

1-8. Identification and Tabulated Data

a. *Identification.* There are 13 identification and 2 instruction plates on the bridge erection boat. Two additional instruction plates are located on the cradles.

(1) The boat identification plate is located in the operator's cockpit on the port side skirting. This gives the end item dimensions, weight, and Federal Stock Number.

(2) An engine identification plate appears on the left side of the valve rocker cover on each engine. This gives the manufacturer's name, model, serial number, component type numbers, and engine rating.

(3) An identification plate is located on the left of each transmission. This gives the manufacturer's name, model, serial number, and gear ratio.

(4) An identification plate is located on the base of each generator regulator. This gives the manufacturer's name, serial number, and rating.

(5) An identification plate is located on the right side of each generator. This gives the man-

ufacturer's name, model, serial number, and rating.

(6) An identification plate is located on the bottom of each starter. This gives the manufacturer's name, model, serial number, and rating.

(7) An identification plate is located on the upper left side of each governor. This gives the manufacturer, serial number, and idle range.

(8) A caution plate is located forward of the steering wheel. This gives drain plug instructions and battery handling.

(9) A wiring instruction plate is located on the top of each battery box.

(10) A loading diagram is located on the right forward side of the bow cradle.

(11) A loading diagram is located on the right forward side of the stern cradle.

b. Tabulated Data.

(1) *General.*

Manufacturer	-----	Aluminum Company of America
Federal stock number	-----	1940-182-3097
Serial number range	-----	Hulls 71-1, 71-2 thru 71-46, 73-47 thru 73-189

Hull material ----- Aluminum

Operating range

(maximum load) ----- 36 miles

(2) Capacities.

Fuel (diesel) ----- 90 gallons

Cooling system ----- 4.75 gallons

Engine lubricating system -- 9.5 quarts

Transmission lubricating system ----- 3 quarts

Bilge pump:

Electrical ----- 15 gallons per minute

Manual ----- 3 gallons per minute

(3) Performance data.

Speed (maximum load) ---- 6 miles per hour

Turning radius:

Full speed ahead ----- 70 feet

Full speed astern ----- 28 feet

Fuel consumption

(2800 rpm) ----- 12.4 gallons per hour

(4) Dimensions and weights.

Dimensions:

Length ----- 27 feet

Beam ----- 8 feet, 2 inches

Height ----- 6 feet, 5 inches

Draft (maximum) ----- 3 feet, 4 inches

Cargo well capacity ---- 2400 lb. load

Weights:

Bow assembly (unloaded) ----- 1150 pounds

Stern assembly (unloaded) ----- 6000 pounds

Total (unloaded) ----- 7150 pounds

(5) Engine.

Manufacturer ----- Detroit Diesel Division
General Motors Corp.

Model ----- 5032-4000

Type ----- Diesel, 2 cycle, in-line

Horsepower ----- 92 shp @ 2800 rpm

Governed speed (maximum) -- 3040 rpm

Idle speed ----- 500-600 rpm

Number of cylinders ----- 3

Firing order ----- 1-2-3

Cylinder arrangement (front to rear) ----- 1-2-3

Diesel fuel specification ---- VV-F-800

Lubrication specification -- MIL-M-2104

(6) Water pump.

Manufacturer ----- Detroit Diesel Engine Division,
General Motors Corp.

Type ----- Belt driven impeller

Coolant ----- Fresh water

Pump pressure (max) ---- 10 pounds per inch

Cooling system capacity ---- 4.75 gallons (with expansion tank and heat exchangers)

(7) Thermostat

Manufacturer ----- Detroit Diesel Engine Division,
General Motors Corp.

Type ----- Bimetallic valve installed horizontally in housing

Temperature range ----- 165°-180° Fahrenheit

(8) Fuel pump.

Manufacturer ----- Detroit Diesel Engine Division
General Motors Corp.

Type ----- Positive displacement gear

Fuel flow ----- 60 gallons per hour

Drive ----- Governor, driven via square coupling

(9) Electrical system, 24 volts direct current.

Batteries:

Voltage ----- 12

Numbered required ----- 4

Connection ----- 2 pairs in series then each connected in parallel to provide 24 volts

Wiring diagram ----- See figure 1-13

(10) Generator.

Manufacturer ----- Delco Remy Division, General Motors Corp.

Model ----- 1105998

Type ----- Belt driven internally grounded, two brush shunt unit

Voltage output (unregulated) ----- 28.5 volts d.c. @ 1.775 rpm engine speed

Voltage output (regulated) - 24.0 volts d.c. @ 1.775 rpm engine speed

Current output (max) ---- 18.0 amperes (regulated) @ 1.775 engine rpm

Field coil draw (max) ---- 0.91 to 0.98 amperes @ 24.0 volts d.c.

Armature rotation ----- Clockwise

Brush spring tension (max) 28 ounces

Bearing type ----- Sealed ball bearings at drive and commutator end plates

(11) Generator regulator.

Manufacturer ----- Delco Remy Division, General Motors Corp.

Model ----- 1118644

Type ----- Heavy duty, 24 volt d.c., 18 ampere fungus, water and corrosion proofed negative-to-ground unit

Voltage regulator range limits ----- 27.5 to 29.5 volts d.c. (test)

Voltage setting ----- 28.2 volts d.c.

Air gap setting ----- 0.087 inch

Current regulator range limits ----- 16.0 to 20.0 amperes (test)

Current setting -----18.0 amperes
 Air gap setting -----0.087 inch
 Cutout relay closing range --25.0 to 27.0 volt d.c. (test)
 Voltage setting -----24.0 volts d.c.
 Air gap setting -----0.048 inch
 Points -----Platinum and tungsten
 Point opening -----0.035 inch

(12) Cranking motor (starter)

Manufacturer -----Delco Remy Division, General Motors Corp.
 Type -----Heavy duty motor equipped with an intermediate duty overrunning spray clutch drive
 Cranking rotation -----Counterclockwise (drive end)
 Voltage draw -----24 volts d.c.
 Drive linkage -----Solenoid actuated shift lever enclosed
 Drive pinion clearance (max) 0.010 to 0.040 inch

(13) Magnetic cranking switch.

Manufacturer -----Leeco-Neville Company
 Model -----S001-4924SC
 Type -----Heavy duty water resistance unit with spring loaded disc type contactor assembly paralleling series con-

nected 12 volt d.c. batteries
 Closing voltage -----13.4 volts d.c.
 Field coil current flow ----3.2 amperes

(14) Accessories.

(a) Electric bilge pump.

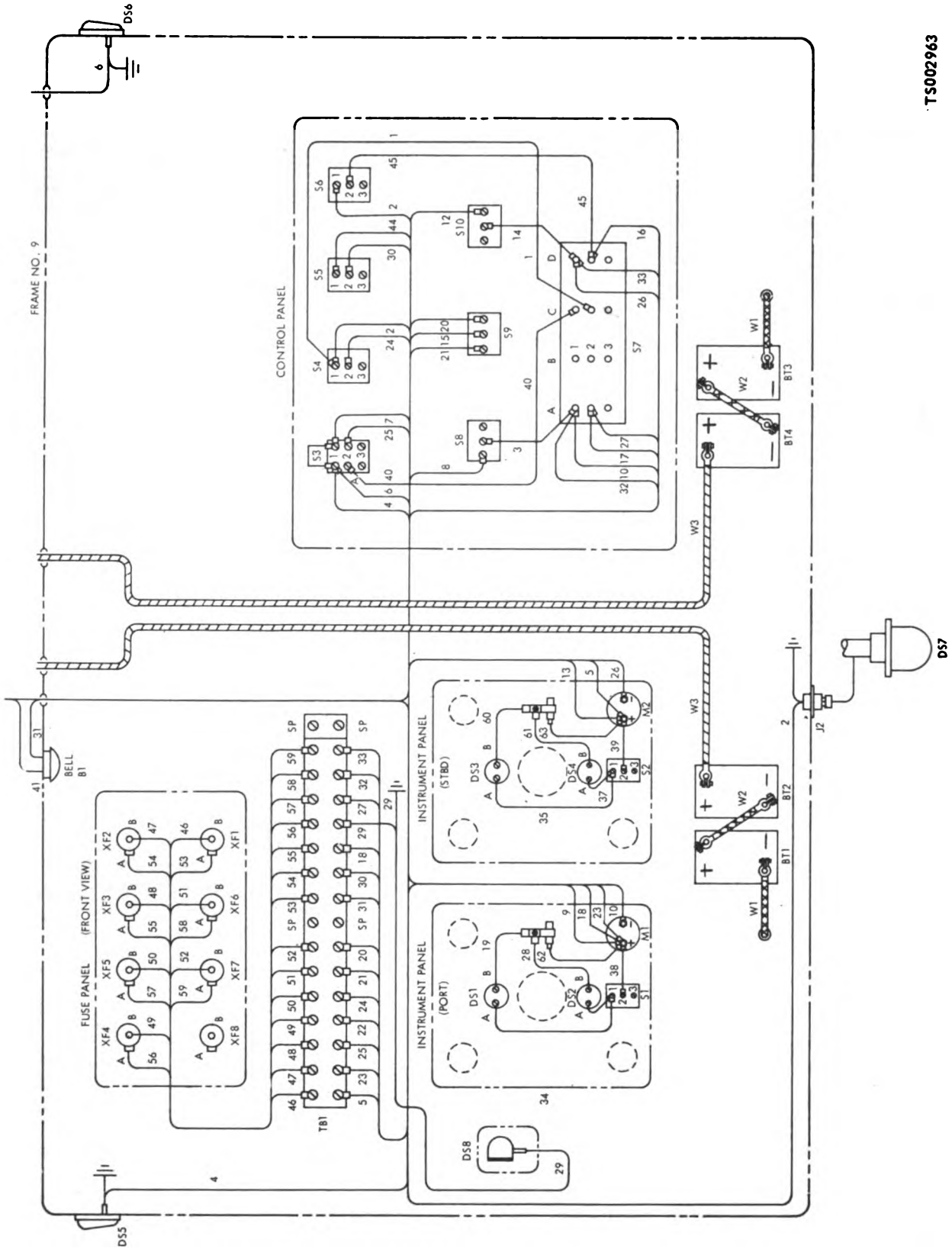
Manufacturer -----Gross Mechanical Laboratories, Inc.
 Type -----Heavy duty enclosed motor driven impeller
 Voltage draw -----12.0 volts d.c.
 Discharge rate -----15.0 gallons per minute
 Discharge venting -----Hose discharge in vent hole on starboard side of hull

(b) Manual bilge pump.

Manufacturer -----Wilcox-Crittenden Co.
 Model -----5392W
 Type -----Hand-operated piston pump

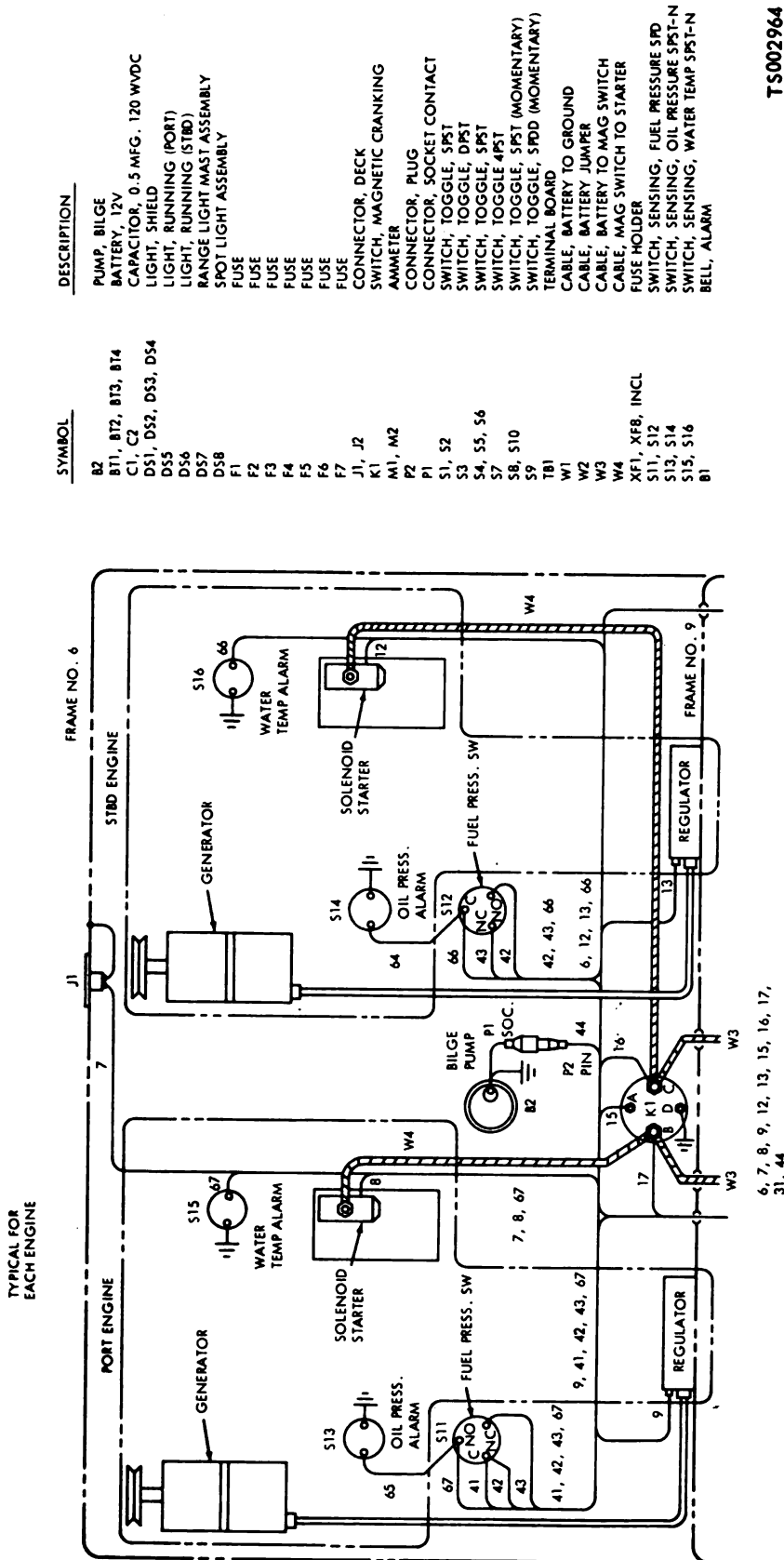
1-9. Differences in Models

This manual covers only the Aluminum Company of America Model HICE-27D Bridge Erection Boat. No differences exist for the model covered in this manual.



TS002963

Figure 1-18. Wiring diagram (sheet 1 of 2).



TS002964

Figure 1-18. Wiring diagram (sheet 2 of 3).

6, 7, 8, 9, 12, 13, 15, 16, 17, 31, 44

CHAPTER 2

OPERATING INSTRUCTION

Section I. OPERATING PROCEDURES

WARNING

If equipment fails to operate refer to troubleshooting procedures in Chapter 3.

2-1. Inspecting the Equipment

a. Inspect the lifting slings for damaged cables and tiedowns, for kinks, fraying and loose cable ends before installing the sling to the equipment. After installation, check to insure that all tiedowns are properly attached and tight.

b. Refer to figure 2-1 and remove the bow and stern assemblies with their cradles from the transport vehicle. Set the loaded cradles on a strong flat surface.

WARNING

Before proceeding, check the cradle assemblies for signs of damage, missing parts, and security. The cradle assemblies support heavy loads and structural failure could result in damage to the equipment and possible injury to personnel.

c. Remove the bow assembly cover (steps 3, 4, and 5, fig. 2-2(1)A) and the stern assembly cover (steps 3 and 4, fig. 2-2(1)B).

d. Make a thorough inspection of the entire boat for loss of parts and components or damage that may have occurred during loading or shipment.

e. Inspect the hull for dents, distortions, and cracks. Check that all hatches open freely and close securely.

f. Inspect the instrument, switch, and fuse panels for cracked or broken gages, and condition of switches and fuse holders.

g. Inspect all tubing, pipes, hoses, and electrical wiring for loose connections, breaks, or other damage.

h. Check propellers, propeller shafts, and rudders for damage.

i. Operate the steering wheel and control levers, and check that they move smoothly and freely.

j. Refer to the Items Troop Installed or Authorized List (App C Section III) and make sure that all items listed are with the boat and in serviceable condition.

2-2. Launching and Coupling

a. *Launching.* Refer to figure 2-2(2) and launch the bridge erection boat. Be sure to attach a line between the bow and stern assemblies and the shore before the assemblies are placed in the water.

b. *Coupling Bow and Stern Assemblies.* The coupling operation must be performed by two men. Station one man in the bow assembly, and the other man in the forward portion of the engine compartment. Then proceed as given in figure 2-3.

c. *Bleeding Propeller Shaft Logs.* Bleed both propeller shaft logs as given in figure 2-4.

CAUTION

The logs must be bled each time the boat is placed in the water; otherwise, the water-lubricated shaft bearings will burn out when the propeller shaft rotates.

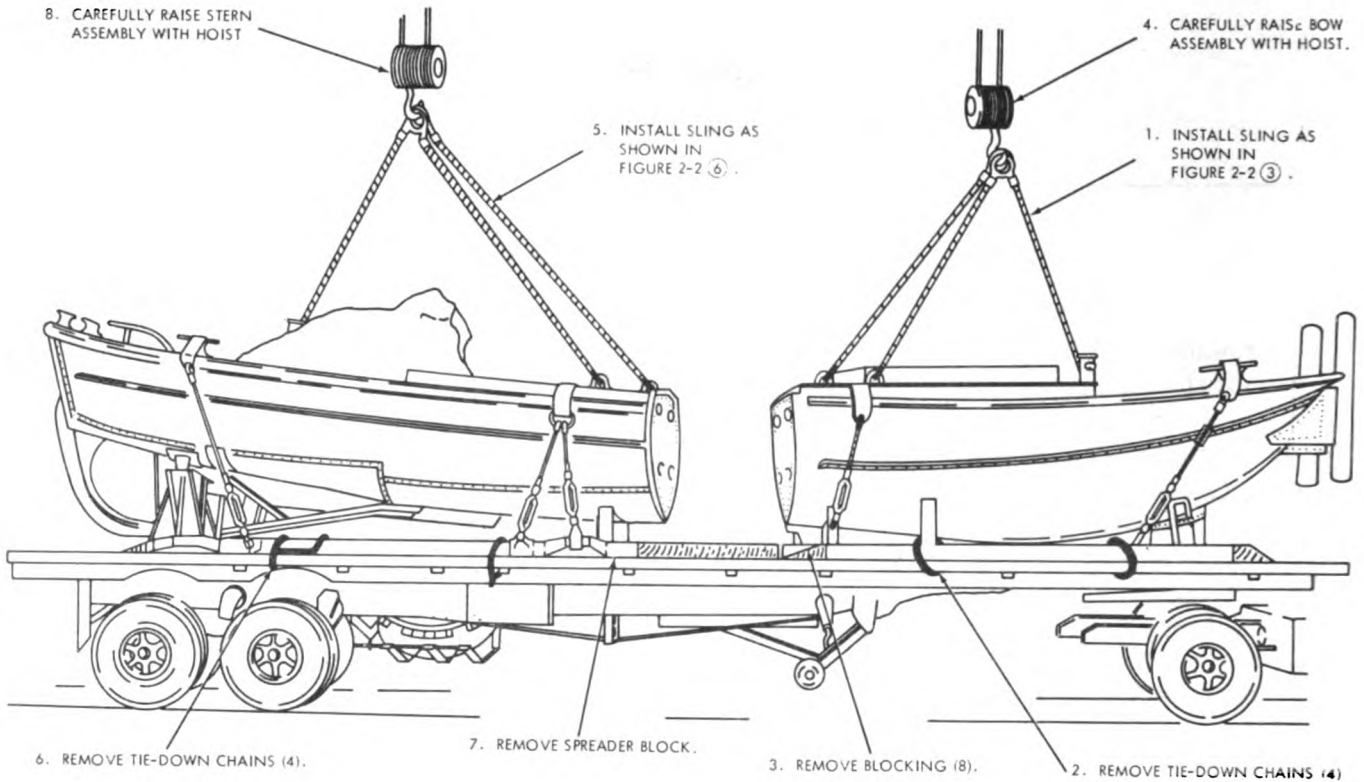
2-3. Servicing

WARNING

Do not take fuel, lubricants or other volatile materials aboard, energize electrical circuits, or start engines until the fire extinguishers have been inspected and are known to be in good working order.

a. *General.* Perform the daily preventive maintenance services given in chapter 3, section III, that do not require starting the engines.

WARNING
LIFT THE COMPONENTS WITH
A CRANE HAVING AT LEAST
A 5-TON CAPACITY.



TS002965

Figure 2-1. Removing the bridge erection boat from the transport vehicle.

b. Lubrication. Lubricate the equipment in accordance with the instructions given in chapter 3, section II.

c. Fuel System. Fill the fuel tank with the proper grade and amount of fuel. The bridge erection boat requires 90 gallons of diesel fuel oil for operation. No. 1D (FSN 9140-286-5286) oil is used in the winter and No. 2D (FSN 9140-286-5294) in the summer.

d. Cooling System. Remove the cap from the expansion tank and check the coolant level. If the tank is empty, check that all drains are closed, and fill the system with coolant. If freezing temperatures are expected, be sure that anti-freeze is used.

e. Batteries. Check the level of the electrolyte in the batteries, and fill with distilled water if necessary. Service the batteries in accordance with instructions given in TM 9-6140-200-14.

WARNING

Do not smoke or use an open flame in the vicinity servicing the batteries. Batteries generate hydrogen, a highly explosive gas.

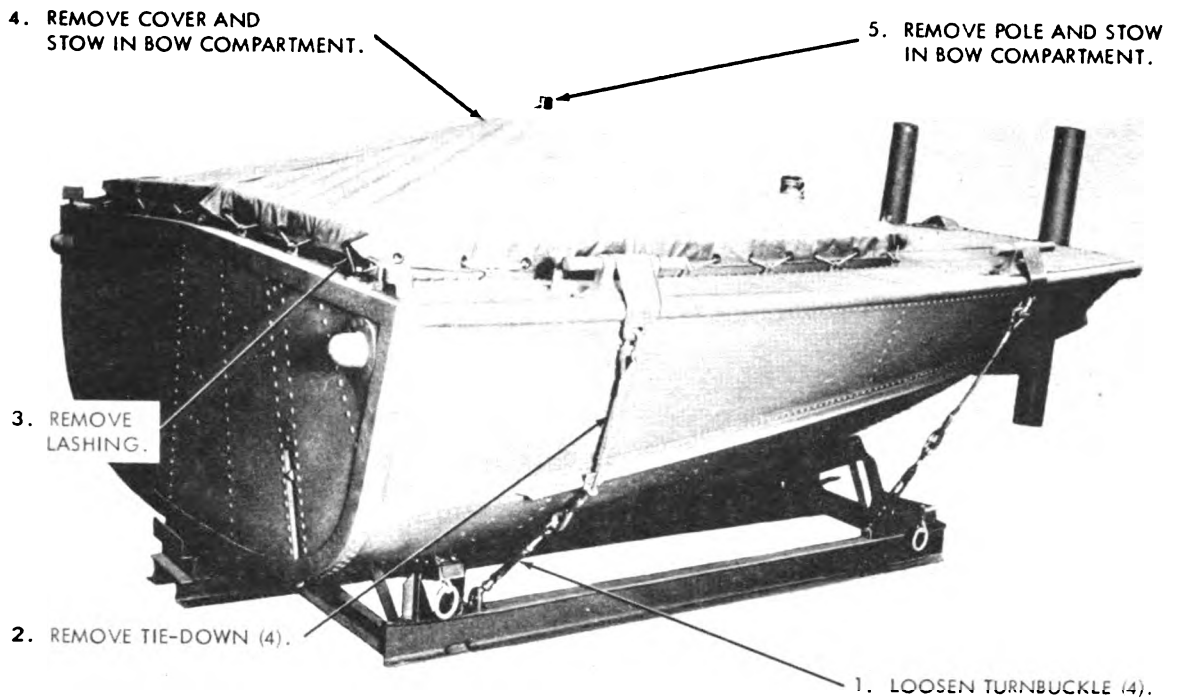
2-4. Movement to a New Worksite

a. Dismantling for Movement. To dismantle and load the boat, reverse the procedures given on figure 2-3.

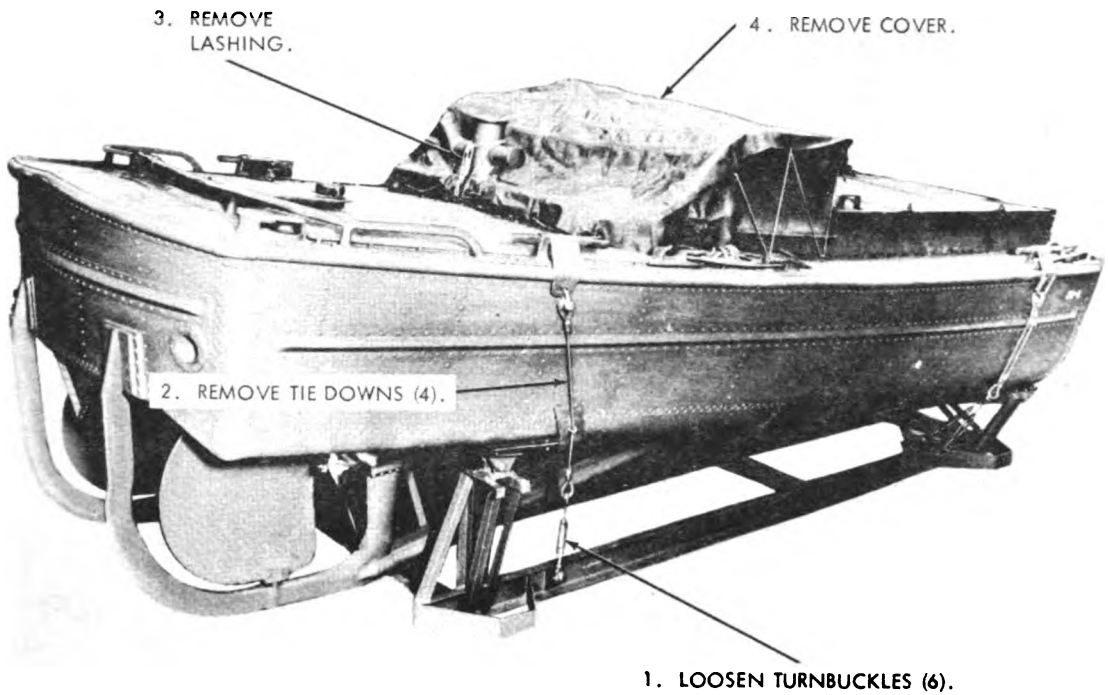
b. Reinstallation after Movement. Refer to paragraphs 2-1, 2-3, and 2-4 and proceed in the same manner for reinstallation after movement.

2-5. Controls and Instruments

a. General. This section describes, locates, illustrates (fig. 2-5) and provides the operator/crew with the necessary information concerning the controls and instruments to properly operate the boat.



A. BOW ASSEMBLY TIE-DOWN AND COVER REMOVAL



B. STERN ASSEMBLY TIE-DOWN AND COVER REMOVAL

TS002966

Figure 2-2. Preparation for launching (sheet 1 of 2).

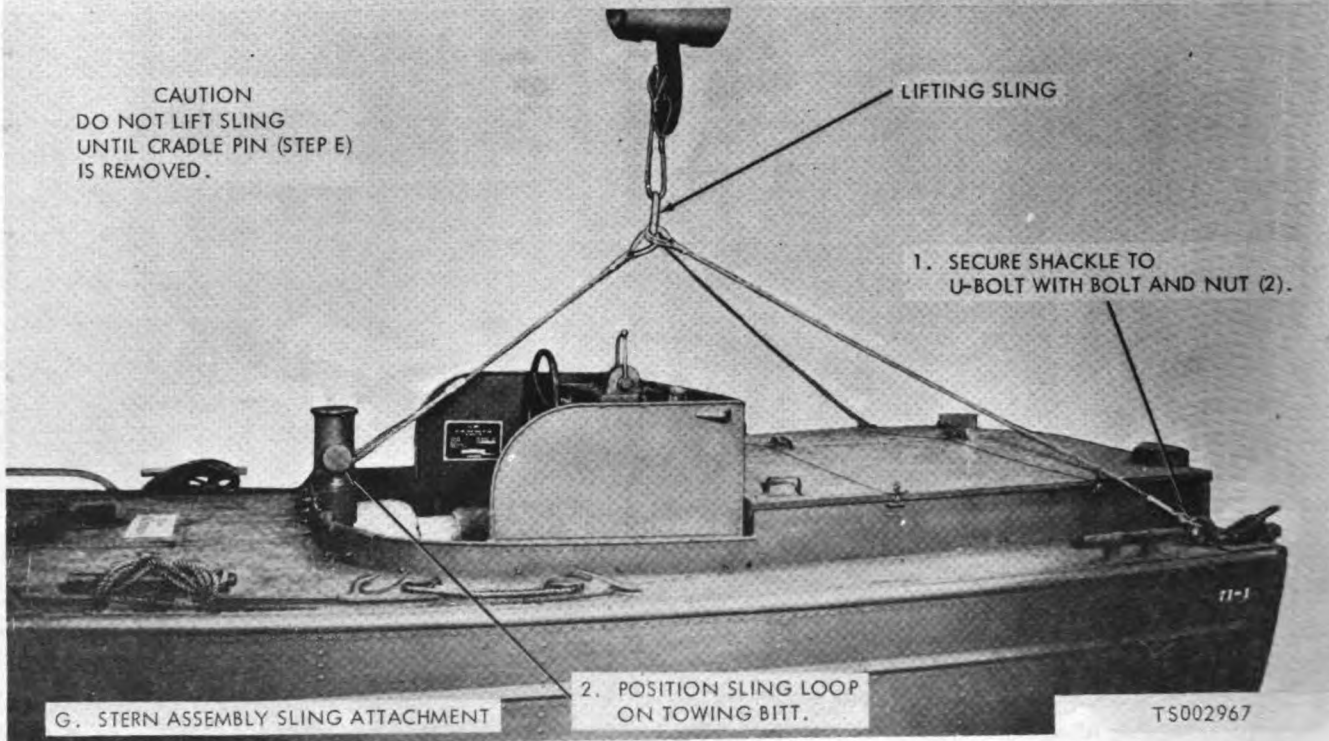
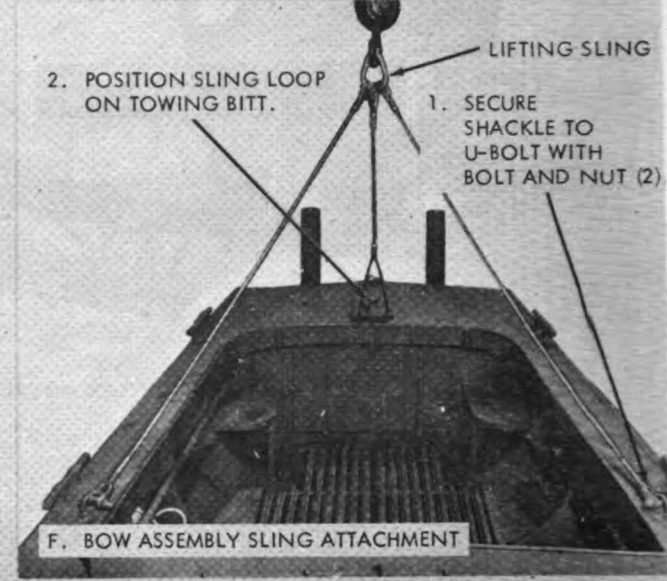
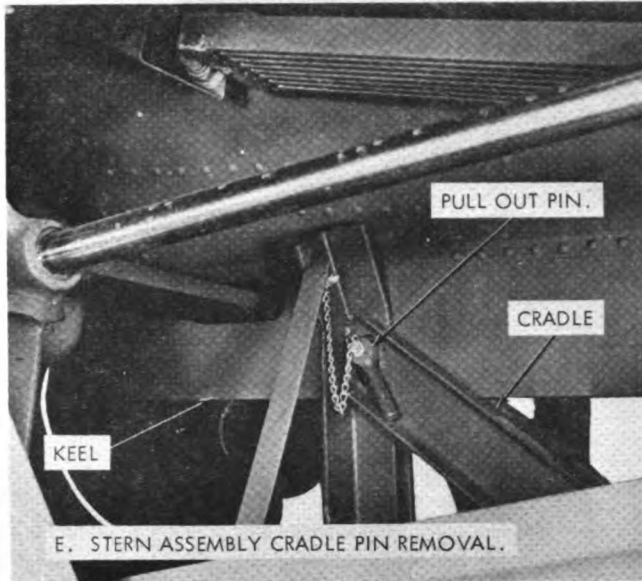
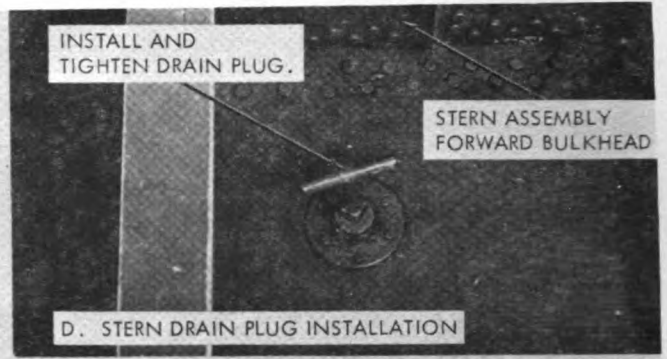
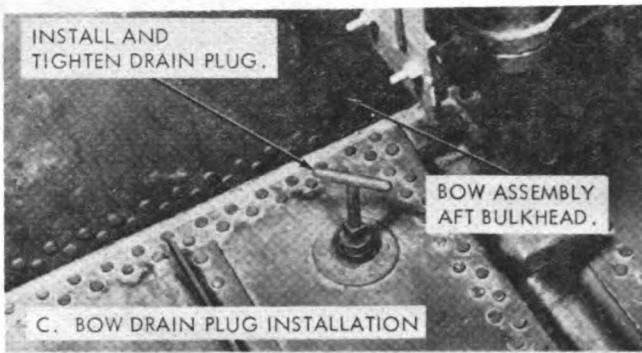
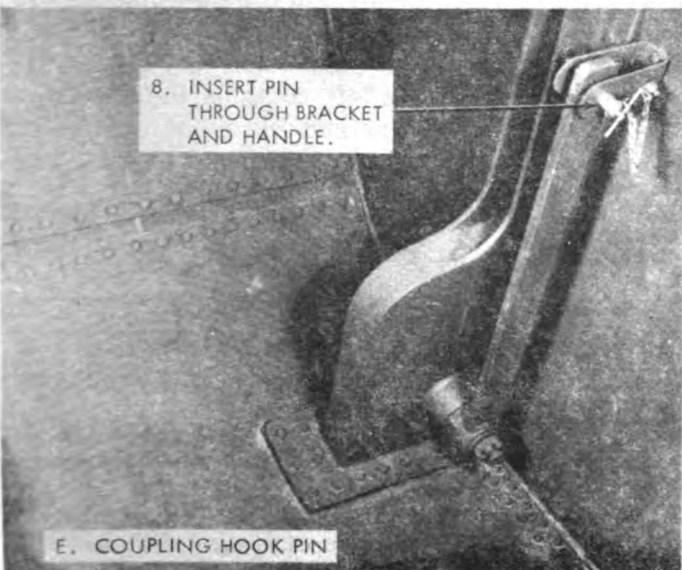
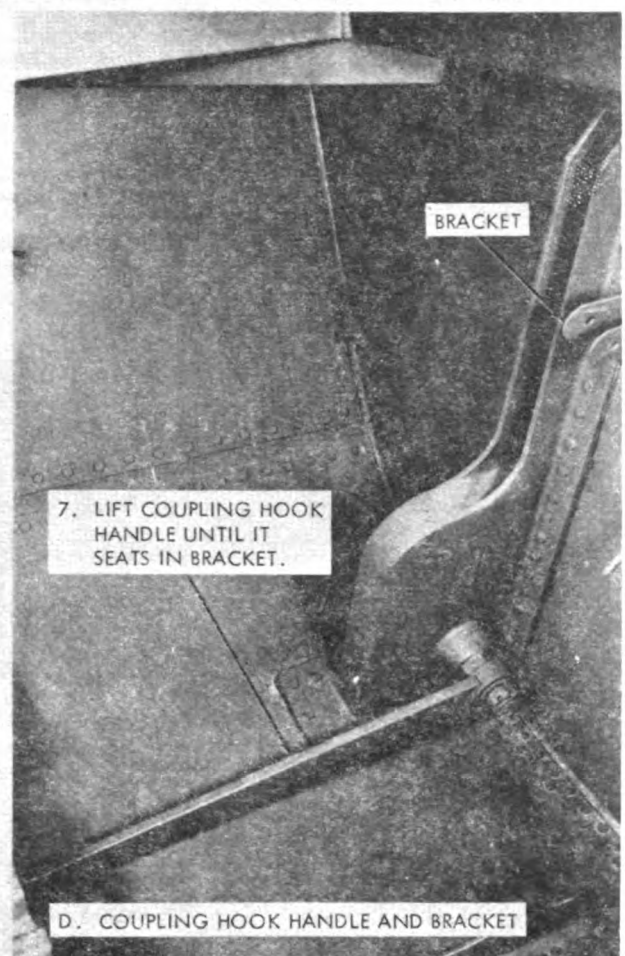
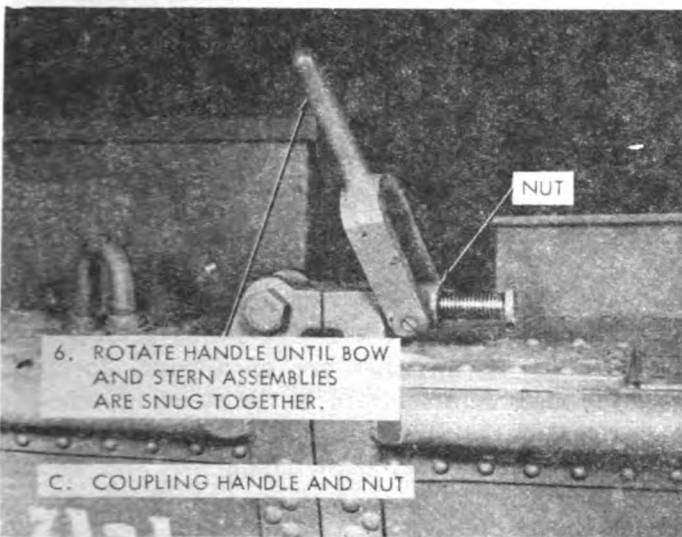
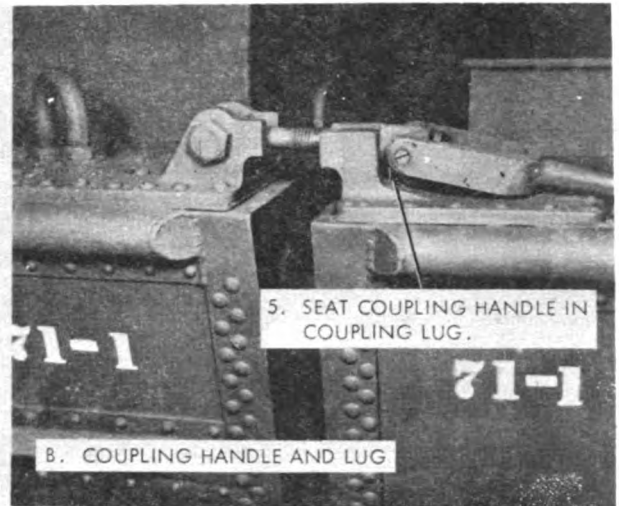
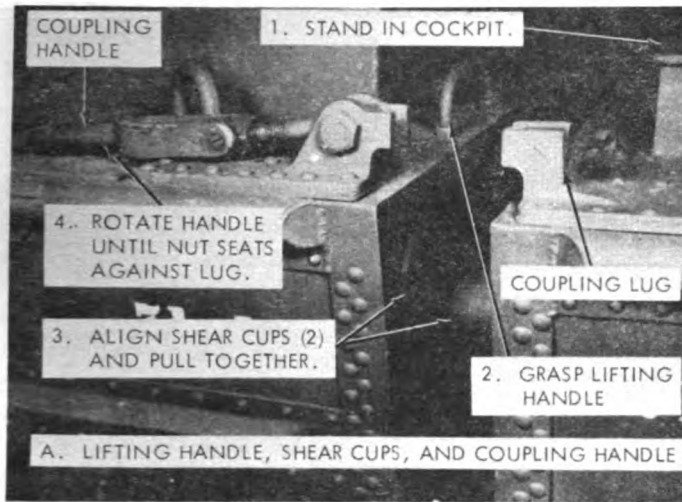
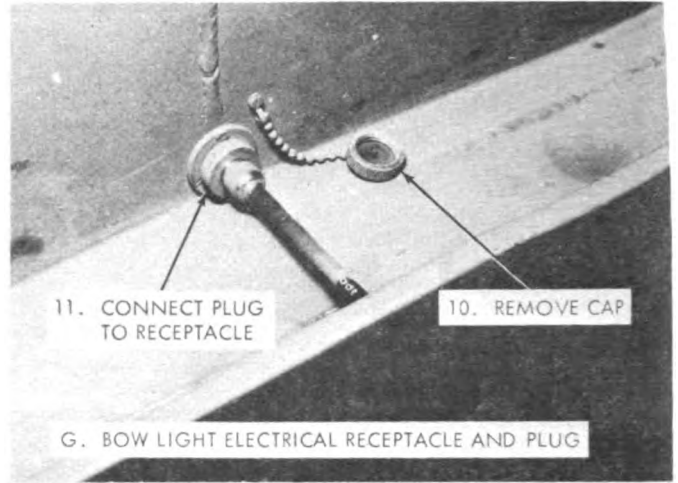
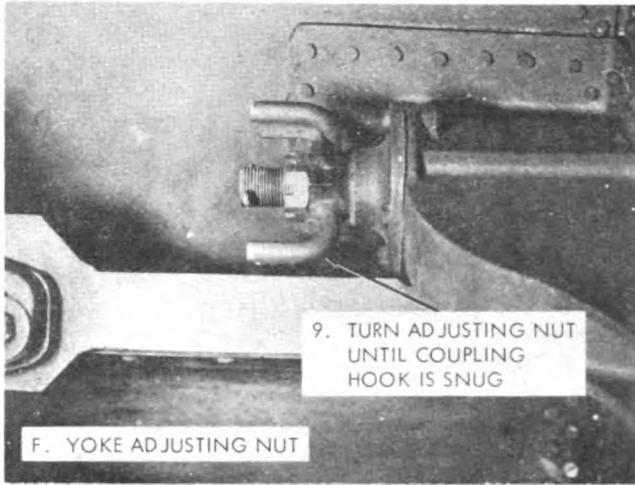


Figure 2-2. Preparation for launching (sheet 2 of 2).



TS002968

Figure 2-3. Coupling bow and stern assemblies (sheet 1 of 2).



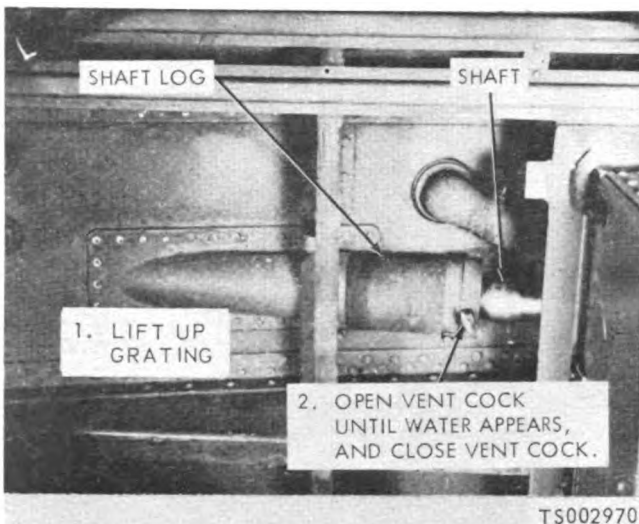
TS002969

Figure 2-3. Coupling bow and stern assemblies (sheet 2 of 2).

b. Controls and Instruments.

(1) *Controls and switches.* All the engine controls are located forward of the steering wheel (A, fig. 2-5(1)). The two fuel shutoff valves are located on the port and starboard sides of the operator's cockpit (E, fig. 2-5(2)). All except one of the switches are on a panel located to the right and forward of the steering wheel (C, fig. 2-5(1)). The spotlight pushbutton switch is located in the spotlight handle (D, fig. 2-5(2)). The controls and switches are listed and described in table 2-1.

(2) *Instruments.* All the instruments are located on two adjacent panels located below and forward of the steering wheel (B, fig. 2-5(2)). The panel on the left contains the instruments for the port engine and the panel on the right, the instruments for the starboard engine. The instruments are listed in table 2-2.



TS002970

Figure 2-4. Shaft log bleeding.

Table 2-1. Controls and Switches

Nomenclature	Description	Purpose
Steering wheel	Rotary with knob	Controls position of rudders.
Engine PORT and STBD EMERGENCY STOP controls.	Push-pull handle	Shut off air supply to engines.
Engine SHUTOFF controls	Push-pull handle	Cut off fuel supply to engines.
Throttle and transmission controls	Rotary lever	Control engine power and transmission gear selection.
Fuel shutoff valves	Manual handle	Control fuel supply to engines.
RUNNING LIGHTS switch	DPST toggle	Energizes port and starboard running lights.
ANCHOR LIGHT switch	SPST toggle	Energizes bow and range lights.
BILGE PUMP switch	SPST toggle	Energizes stern bilge pump.
SEARCH LIGHT switch	SPST toggle	Energizes spot light.

Nomenclature	Description	Purpose
Spotlight handle switch	SPST toggle	Actuates spotlight lamp.
BATTERY PARALLEL switch	SPST toggle	Energizes magnetic cranking switch.
PORT AND STBD START switches	Momentary SPST toggle	Energize starter solenoids.
MASTER switch	SPST toggle	Energizes electrical system.

LEGEND: SPST — Single pole single throw
 DPST — Double pole single throw
 SPDD — Single pole double duty

Table 2-8. Instruments.

Nomenclature	Description	Purpose
TRANSMISSION OIL	Pressure gage	Reflect transmission oil pressure. 110 -115 psi, normal.
WATER TEMP	Temperature gage	Reflect engine water temperature. 160°-185° F. normal.
RPM	Tachometer	Reflect speed of engine crankshaft and hours of operation.
AMPERES	Ammeter	Reflect output current generators.
OIL PRESSURE	Pressure gage	Reflect engine oil pressure: 40-60 psi normal, 32 psi minimum at 2500 rpm and 30 psi minimum at 2200 rpm.

WARNING

Wear ear muffs or ear plugs to avoid injury when noise level is excessive. There is a potential noise hazard when engine speed exceeds 1200 RPMs.

b. Emergency Stopping. In the event of a runaway engine that cannot be stopped with the black shut off handles, the red emergency handle must be pulled.

CAUTION

This procedure should not be used under any circumstances other than an uncontrollable runaway engine. Lubricating oil may be sucked up into the cylinders and cause engine damage. Therefore, do not attempt to restart the engine until it has been inspected by direct support personnel.

2-6. Starting

a. Preparation for Starting.

- (1) Perform the preventive maintenance checks and services as given in paragraph 3-5.
- (2) Inspect the on-board equipment and be sure it is aboard and properly stowed.
- (3) Secure all hatches.
- (4) Check that the fire extinguishers have not been discharged.
- (5) Place the MASTER switch in the ON position and all other switches off, and push down the shutoff and emergency stop handles.
- (6) Position the control levers in the vertical (neutral-idle) position.

b. Starting.

- (1) Refer to figure 2-5E and open the fuel line shutoff valves.
- (2) Refer to figure 2-6 and start the engines.

2-7. Stopping

a. Normal Stopping.

- (1) Secure the boat to its berth with the mooring lines.
- (2) Refer to figure 2-7 and stop the engines.
- (3) Turn off the fuel line shutoff valves.

2-8. General Operation

a. General. This paragraph describes in general how the boat is to be operated. It gives general information on pushing and towing components of floating bridges and rafts, and on docking and casting off the tow. Specific instructions are published in the applicable floating bridge manuals for bridge erection boat's operating personnel.

(1) *Control lever operation.* The engine speed control (throttle) and transmission forward-reverse control for the bridge erection boat are incorporated in the same lever. Refer to figure 2-8 for control lever operation.

(2) *Steering gear.* Both rudders are operated simultaneously by the steering wheel. Turning the wheel to port will cause the boat to move to port. A knob is installed on the wheel

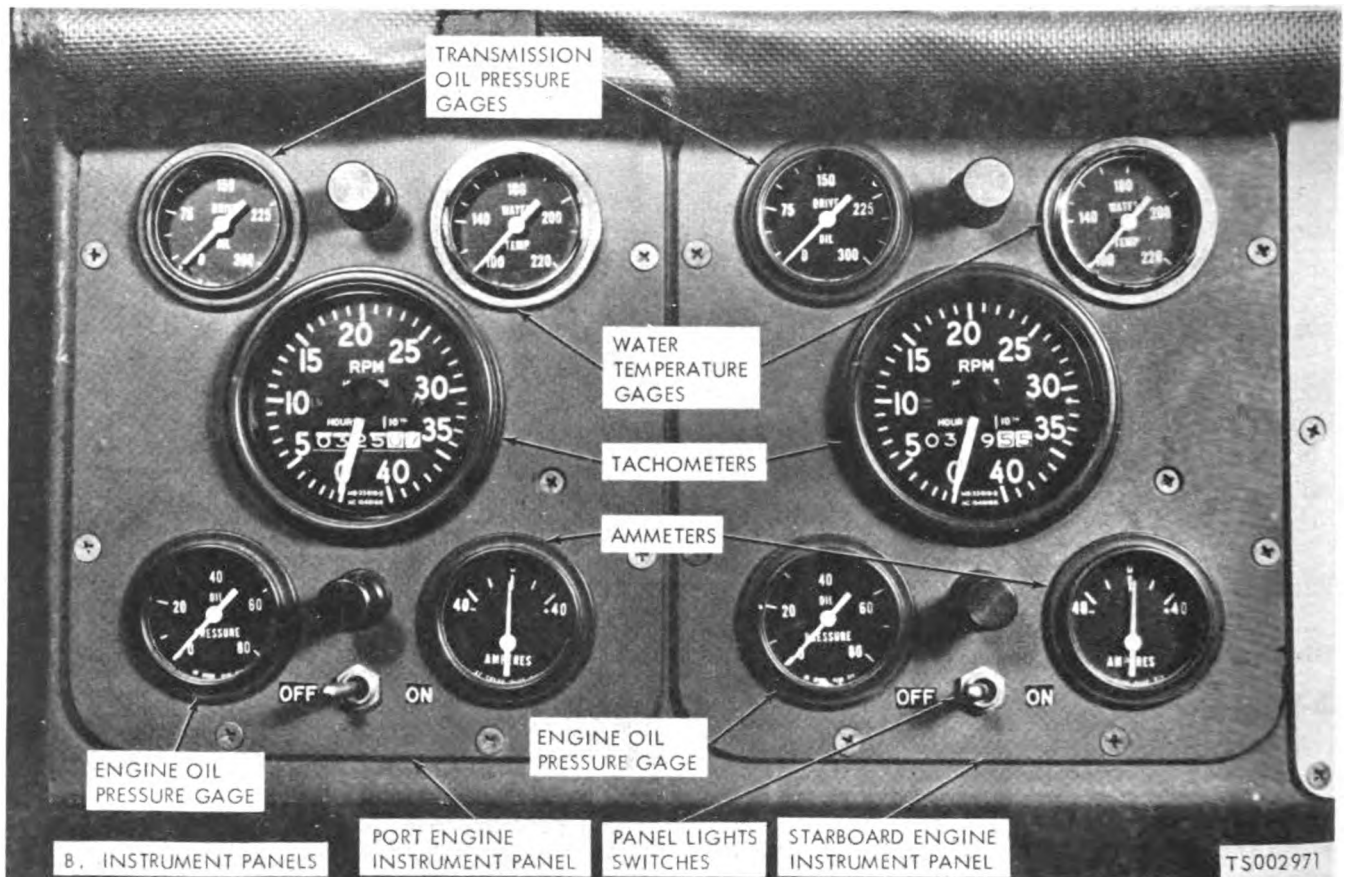
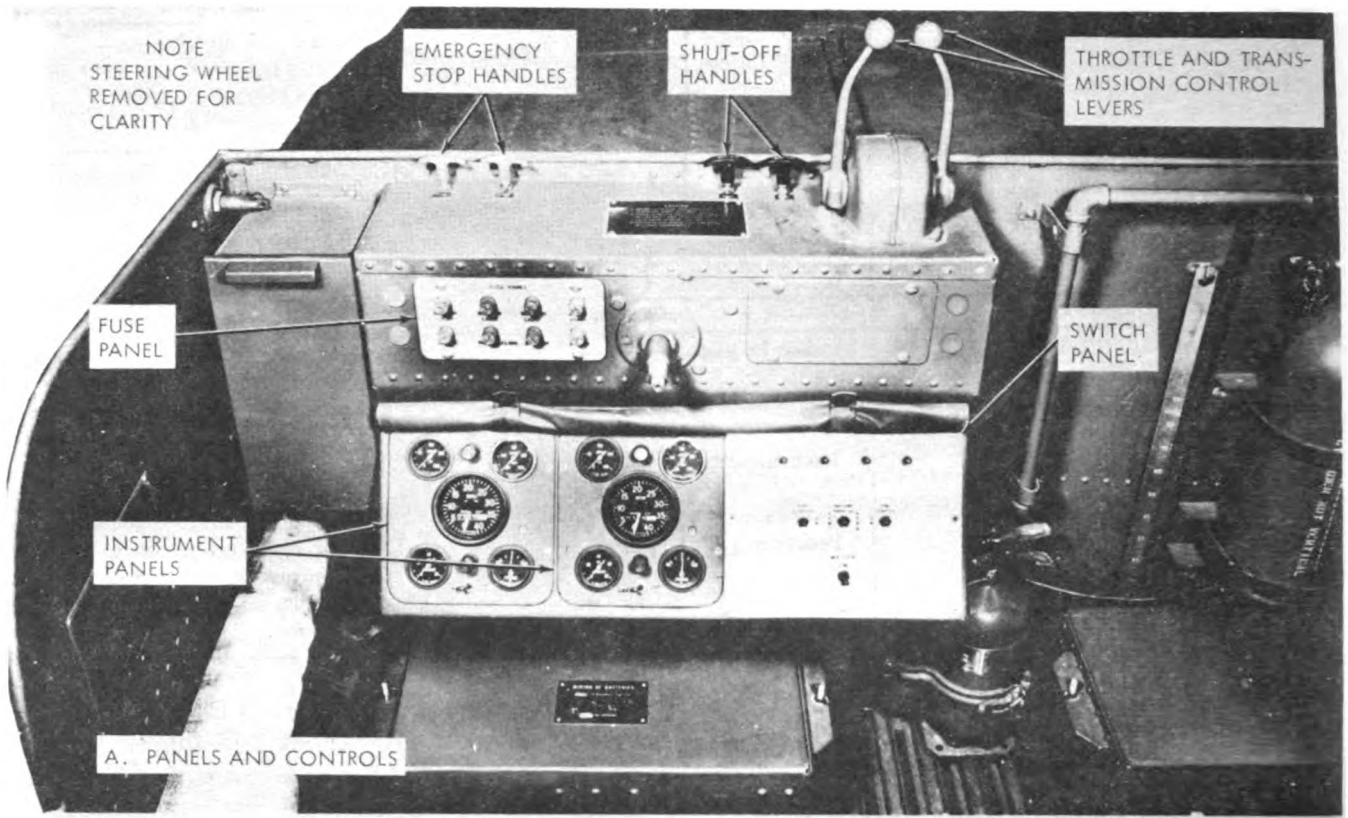
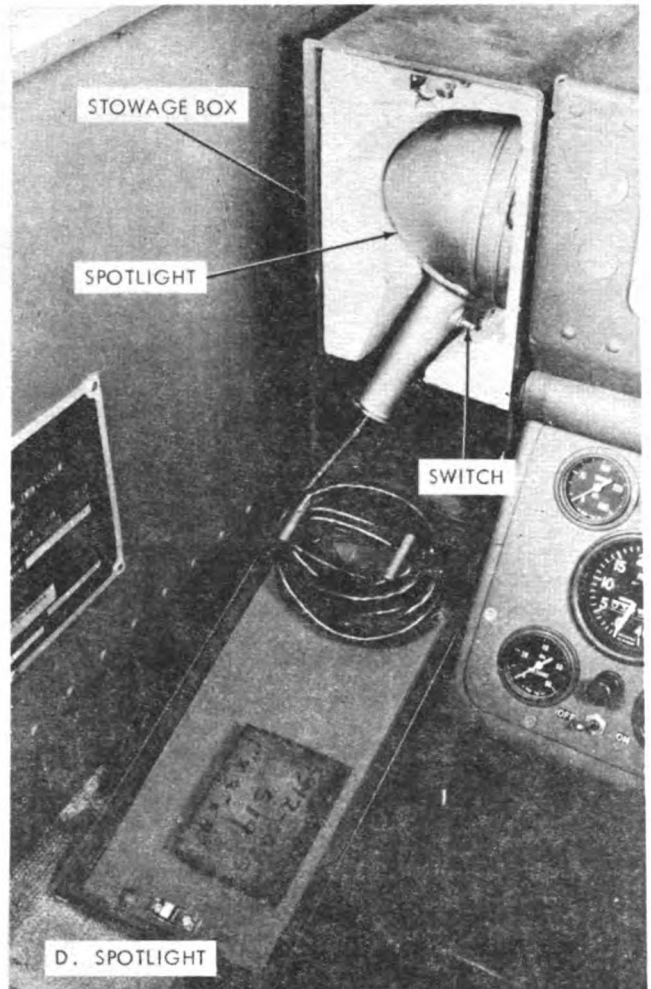
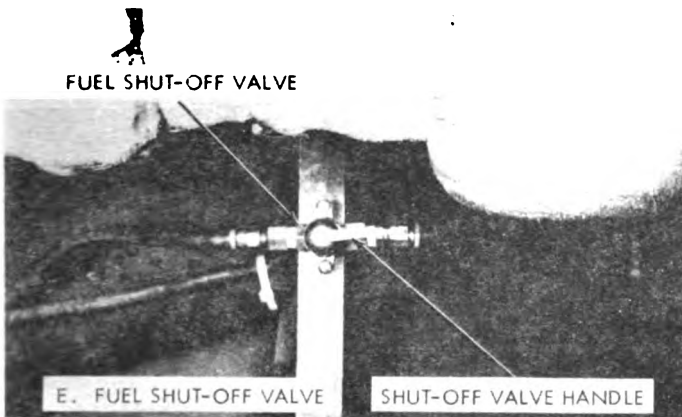
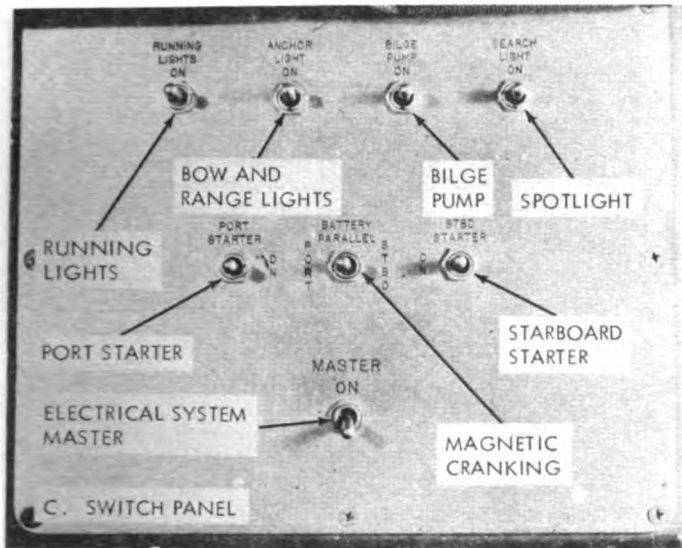


Figure 2-5. Controls and instruments (sheet 1 of 2).



TS002972

Figure 2-5. Controls and instruments (sheet 2 of 2).

so that while maneuvering, the operator can easily steer the boat with his left hand, leaving his right free to manipulate the control levers.

CAUTION

Keep a firm grip on steering wheel and avoid excessive speed when moving astern. Damage to rudder lever may result if steering wheel is allowed to spin.

b. Getting Under Way Forward From a Berth. Assuming that the boat is positioned with its port side toward the berth, proceed as follows:

- (1) Cast off the mooring lines.
- (2) Rotate the steering wheel to starboard.
- (3) Push the port control lever forward and leave the starboard control lever in neutral.

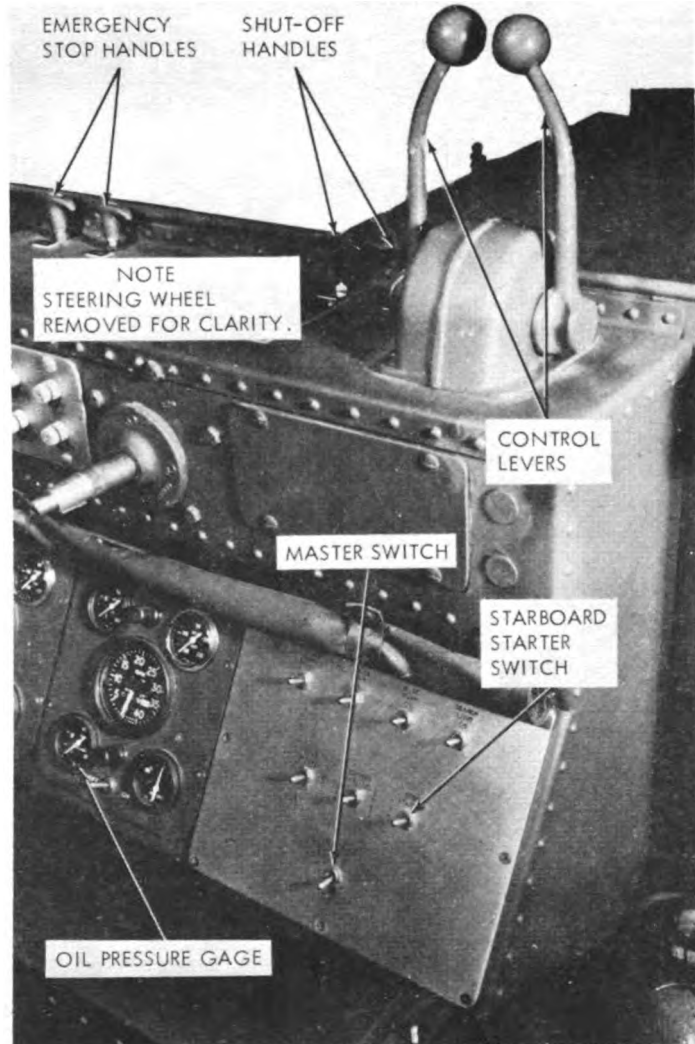
(4) When the boat is clear of the berth, advance the starboard control lever to the same position as the port lever.

(5) When clear of all obstacles, position the steering wheel as required and advance both control levers to the desired operating speed.

(6) If the boat was moored with the starboard side toward the berth, proceed in the same manner as in steps 1 through 5 above but use opposite control lever and steering wheel positions.

c. Getting Under Way Astern From a Berth. Assuming that the boat is positioned with its port side toward the berth, proceed as follows:

- (1) Cast off the mooring lines and rotate the steering wheel to starboard.
- (2) Pull the port control lever aft, and leave the starboard control lever in neutral.



1. CHECK THAT HANDLES ARE ALL THE WAY DOWN.
2. PLACE BOTH CONTROL LEVERS IN NEUTRAL (VERTICAL) POSITION.
3. PLACE MASTER SWITCH IN ON POSITION.
4. PLACE STARBOARD ENGINE STARTER SWITCH IN ON POSITION UNTIL ENGINE STARTS. IF ENGINE FAILS TO START AFTER 30 SECONDS, RELEASE STARTER SWITCH AND LET STARTER MOTOR COOL FOR A FEW MINUTES. IF PROLONGED CRANKING IS REQUIRED, SWITCH THE BATTERY PARALLELING SWITCH TO PORT OR STARBOARD AS REQUIRED FOR STARTING.

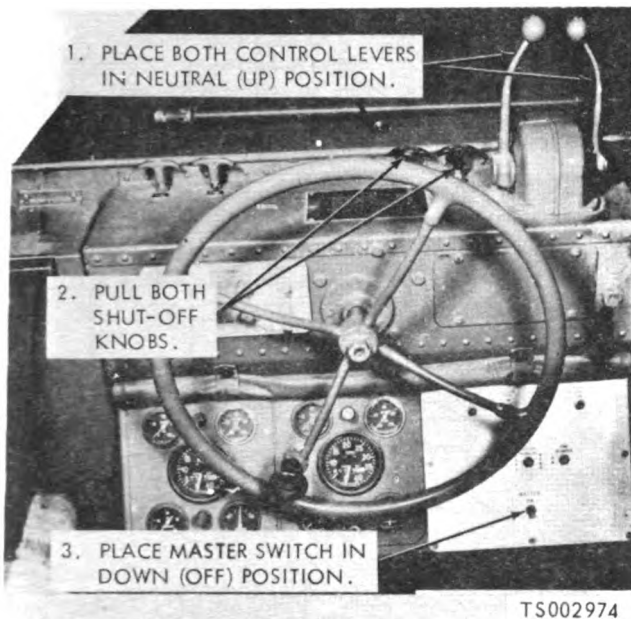
CAUTION

DO NOT PLACE STARTER SWITCH IN ON POSITION IF STARTER MOTOR IS STILL ROTATING TO AVOID DAMAGING STARTER.

5. OBSERVE OIL PRESSURE GAGE. IF GAGE DOES NOT REGISTER PRESSURE IN 15 SECONDS, SHUT DOWN ENGINE.
6. REPEAT STEPS 4 AND 5 FOR PORT ENGINE.

TS002973

Figure 2-6. Engine starting procedures.



TS002974

Figure 2-7. Engine stopping procedures.

(3) When the boat is clear of the berth, position the starboard control lever in the same position as the port lever and position the steering wheel as required.

d. Getting Under Way from an Anchorage. Assuming the boat has been anchored, proceed as follows:

(1) Position a man in the bow and have him haul the anchor aboard.

(2) If the man is unable to break the anchor free from the bottom, move both control levers slowly forward just until the marine gears engage.

(3) Move forward slowly until the anchor has broken free from the bottom and have the anchor hauled in.

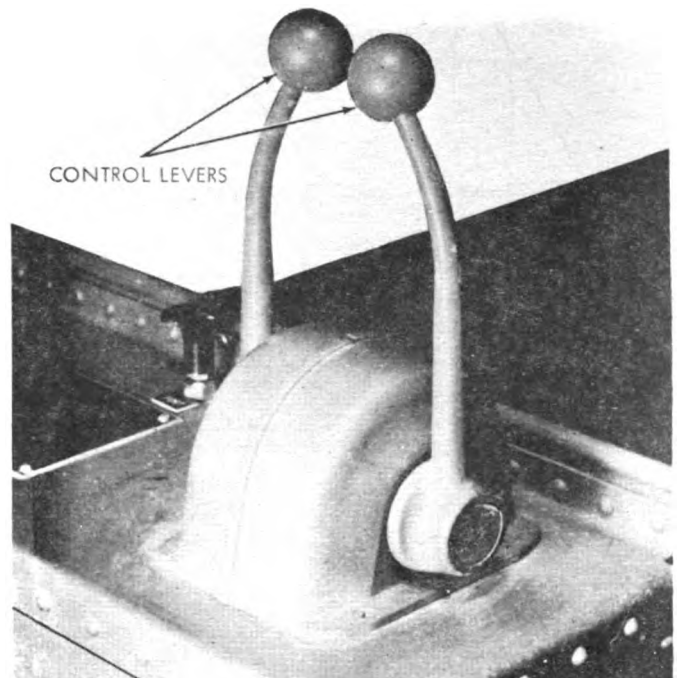
e. Maneuvering Rafts.

(1) *Pushing.* The most efficient method of maneuvering rafts is pushing. This method provides maximum stability and maneuverability. Proceed as follows to push a raft:

(a) Approach the raft to be maneuvered as shown in figures 2-9 and 2-10, and secure the lines as shown. The spring lines shown in figure 2-9 are only used in high winds or strong currents. If there is any current, position the boat downstream of the raft.

NOTE

Always use a pushing balk as shown in figure 2-10 when pushing between ponton and use a pushing bracket when pushing against a ponton. The balk is part of the rafting equipment.



1. PUSH LEVER FORWARD TO ENGAGE FORWARD GEAR (INITIAL MOVEMENT OF LEVER FROM NEUTRAL ENGAGES TRANSMISSION).
2. CONTINUE TO MOVE LEVER FORWARD TO INCREASE ENGINE SPEED.

NOTE

PAUSE MOMENTARILY IN THE IDLE-NEUTRAL POSITION WHEN SHIFTING FROM FORWARD TO REVERSE OR VICE VERSA DURING NORMAL OPERATION.

3. PULL LEVER BACK TO ENGAGE REVERSE GEAR (INITIAL MOVEMENT OF LEVER FROM NEUTRAL ENGAGES TRANSMISSION).
4. CONTINUE TO MOVE LEVER BACK TO INCREASE ENGINE SPEED.
5. TO VARY ENGINE SPEED WHILE TRANSMISSION REMAINS IN NEUTRAL, PULL LEVER OUT (AWAY FROM HOUSING) AND MOVE LEVER AS DESIRED.

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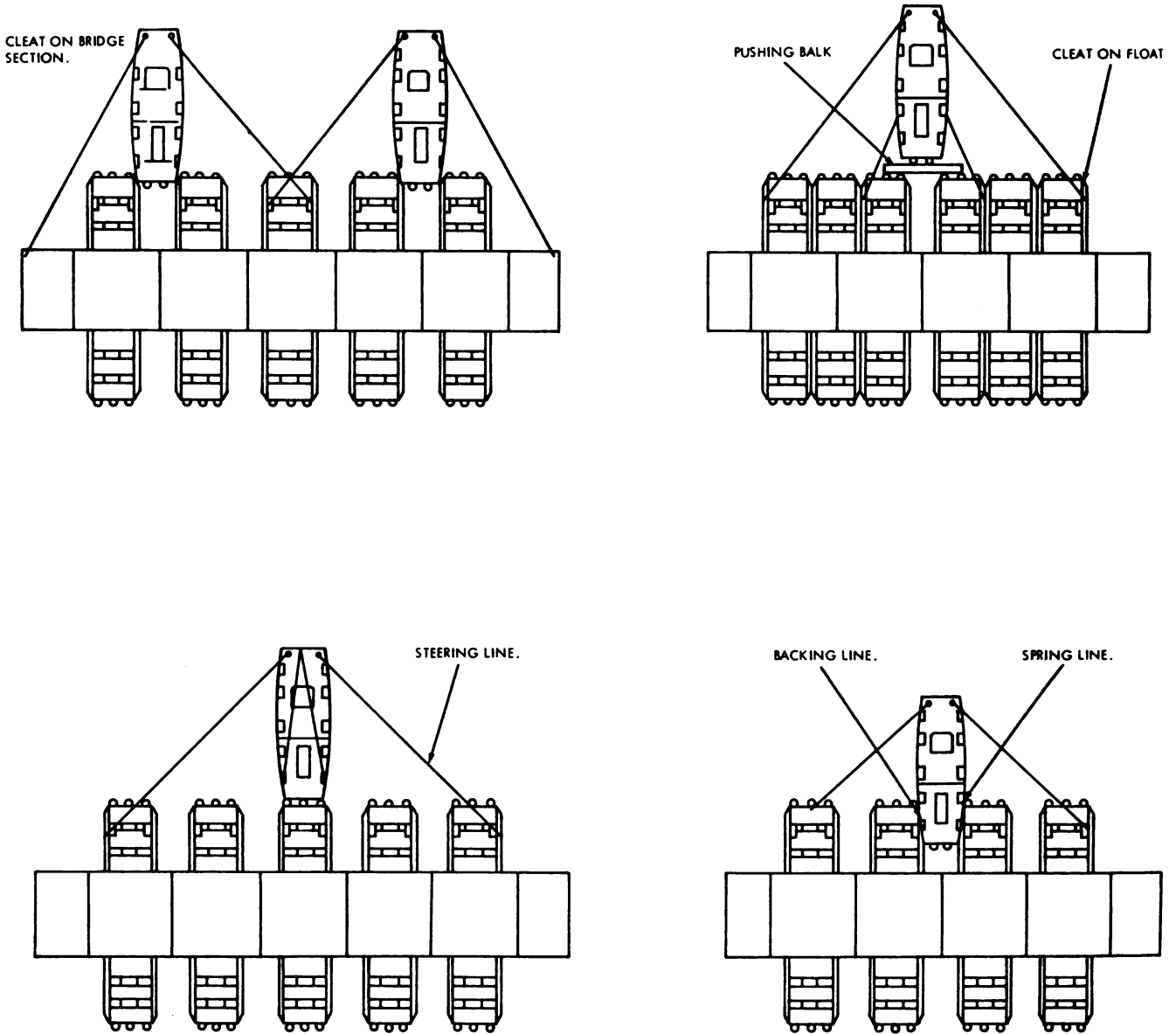
Figure 2-8. Control lever operation.

(b) Station one man in the bow to man the lines. Tighten the steering lines by swinging the stern of the boat with engine power and, at the same time, pull on the haul cleats.

(2) *Towing astern.*

(a) Place the center loop of the 60-foot towline over the stern towing bitt.

(b) Secure the two loops at the ends of the line fast to the raft being towed.



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Figure 2-9. Line arrangement for maneuvering 60 class rafts.

(3) Towing alongside.

(a) Come alongside the raft to be towed and secure a 1-inch diameter line to the forward stern cleat. Secure the other end of the line to a point amidships of the raft to be towed.

(b) Secure another 1-inch diameter line to the rear bow cleat, and to the same midship point on the raft as the first line.

(c) Secure a third 1-inch diameter line to the rear stern cleat, run the line between the push knees, and secure it at a point forward on the raft.

(4) Berthing a raft.

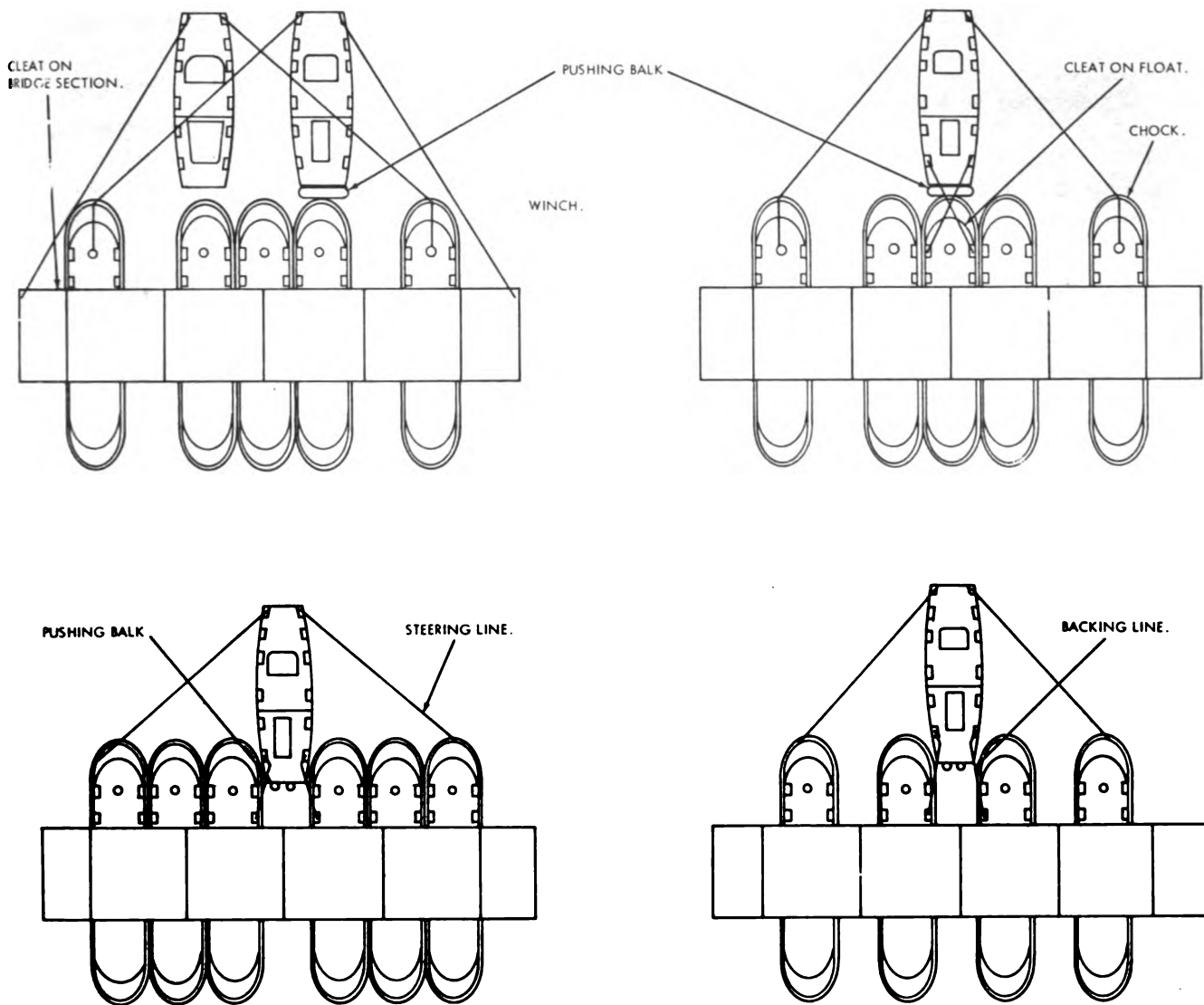
NOTE

Whenever possible, maneuver into the current or wind.

(a) Approach the berth at a right angle. This will bring the bow of the raft to the berth.

(b) Have the bow of the raft secured to the berth.

(c) Maneuver the stern of the raft alongside the berth and secure the stern.



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Figure 2-10. Line arrangement for maneuvering M-4 type rafts.

Section II. OPERATION OF AUXILIARY EQUIPMENT

2-9. General

This section contains operating instructions for auxiliary equipment furnished with the bridge erection boat. The operator should become familiar with the use of this equipment and its location aboard the boat before attempting operation.

2-10. Portable Fire Extinguisher

a. General. The portable fire extinguisher is a four-pound carbon dioxide bottle. It is mounted in brackets on the forward bulkhead of the operator's cockpit below and to the right of the steer-

ing wheel (fig. 1-3(2)). The extinguisher is suitable for any fire, including electrical.

b. Operation.

- (1) Pull the extinguisher from its bracket.
- (2) Pull out the safety pin.
- (3) Aim the discharge nozzle at the fire, and depress the trigger.
- (4) Continue to operate the extinguisher until the fire is out.
- (5) Upon return, immediately exchange the extinguisher for a fully charged one and place it in the bracket.

2-11. Spotlight

a. General. The spotlight is a portable manual lamp that is stowed in a box to the left of the steering wheel (fig. 1-3). The light is connected to the left of the steering wheel (fig. 1-3). The light is connected by a cable to the boat electrical system. The light is energized through the SEARCH LIGHT switch located on the switch panel (fig. 2-5(1)). The lamp is actuated by a toggle switch in the light handle.

b. Operation.

(1) Open the stowage box and remove the spotlight.

(2) Place the SEARCH LIGHT switch on the switch panel in the ON position.

(3) Actuate the toggle switch in the handle.

2-12. Electric Bilge Pump

a. General. The electric bilge pump is located in the forward portion of the stern assembly. The pump is energized through the BILGE PUMP switch on the switch panel (fig. 2-5(1)).

b. Operation. Place the BILGE PUMP switch in the ON position.

2-13. Manual Bilge Pump

a. General. The manual bilge pump is mounted in the after portion of the bow assembly (fig. 1-1).

b. Operation. Grasp the handle on the pump and actuate it up and down.

Section III. OPERATION UNDER UNUSUAL CONDITIONS**2-14. Operation in Extreme Cold**

a. Hull and Decks. Examine the hull for any evidence of ice damage. Be careful to check that ice has not formed between the bow and stern assemblies and damaged the couplings.

b. Cooling System. Have organizational maintenance drain and flush the cooling system and refill it with the approved antifreeze. Inspect all hoses, components, and fittings to be sure each is tight after filling the cooling system.

c. Electrical System.

(1) *General.* Clean the batteries and cables, and inspect for cracked or damaged cases. Be sure the battery terminals are tight, clean, and lightly greased. Check that the battery vent holes are open. Keep the batteries fully charged to prevent them from freezing.

(2) *Batteries.* A battery can deliver only half the energy at 15°F that it can at 80°F. Oil thickens and makes cranking difficult in cold weather. Only a fully charged battery in good condition can operate satisfactorily under these conditions. If it becomes necessary to add water to the batteries, operate the engines for at least one hour to mix the water and electrolyte and lessen the chances of freezing the battery. A paralleling switch (fig. 2-5c) is provided that permits the use of all batteries for starting each engine. When the parallel switch is positioned to port or starboard the service of both sets of batteries is available for starting. This increases the amperage but the voltage remains at 24 volts. Using the parallel switch during cold weather will prolong the life of all batteries and avoid discharging one set of batteries in attempting to start a cold engine.

CAUTION

Do not turn engine with starter for longer than 45 seconds at a time. Allow starter to cool between attempts to start.

d. Fuel System. Keep the fuel tank full to prevent condensation. Accumulated moisture will freeze and clog the fuel lines, filters, and strainers. Service the fuel filters and strainers more often than usual.

CAUTION

When operating at temperatures below 32°F, use fuel conforming to Federal Specification VV-F-800, Symbol DF-1, winter grade.

e. Lubrication. Lubricate the bridge erection boat for cold weather conditions in accordance with the current lubrication order.

f. Bilge Pumps. Check that the pumps and their outlets are free of ice and operating. If necessary, thaw the pumps with warm water.

g. Steering System. Operate the steering gear to ensure it moves freely.

2-15. Operation in Extreme Heat

a. Engine. Frequently check the temperature gages.

b. Cooling System. Keep the coolant level at maximum. Inspect the level at the end of each operating period.

c. Lubrication. Lubricate the boat in accordance with the current lubrication order.

d. Fuel System. Do not fill the fuel tank to its maximum capacity. Allow room for expansion of the fuel.

2-16. Operation in Salt Water

a. General. Operation in salt water requires special precautions due to the extremely corrosive actions that is encountered. Rust and corrosion formation are greatly accelerated in a salt-water environment. If possible, the boat should be hosed down with fresh water whenever removed from salt water.

b. Engines. Always keep the engine hatch covers closed to keep salt water spray from the engines and their accessories. After each operation, wipe dry the exteriors of the engine and their accessories. Keep the engine compartment

as dry as possible at all times. Do not allow any water to accumulate in the bilge.

c. Hull. Check the hull frequently for signs of corrosion. Corrosion is most likely to occur at the exhaust flanges, bilge discharge openings, and areas subject to wear, such as the rail and gratings. Signs of corrosion and bare spots in painted surfaces should be corrected as soon as practicable.

d. Fittings. Often check the fittings for signs of corrosion. Keep all parts clean, painted, and, if required, lubricated.

e. Accessories. Frequently inspect the lights, bilge pumps, fire extinguishers, electrical connections, manila lines, and canvas covers for signs of corrosion and salt accumulation. Wipe metal items frequently and repaint or lubricate as required.

CHAPTER 3

OPERATOR/CREW MAINTENANCE INSTRUCTIONS

Section I. LUBRICATION INSTRUCTIONS

This section contains lubrication instructions which are supplemental to, and not specifically covered in the lubrication order.

a. Storage. Keep all lubricants in closed containers and store in a clean, dry place away from heat. Do not allow dust, dirt, or other foreign material to mix with the lubricants. Keep all lubrication equipment clean and ready to use.

WARNING

Dry cleaning solvent PD-680, used for cleaning is a POTENTIALLY DANGEROUS CHEMICAL. Do not use near open flame. Flash point of solvent is 100 F - 138 F.

b. Cleaning. Keep all external parts not requiring lubrication clean of lubricants. Before lubricating the equipment, wipe all lubrication points free of dirt and grease. Clean all lubrication points after lubricating to prevent accumulation of foreign matter.

c. Points of Lubrication. Lubricate the bridge erection boat at proper intervals as given in lubrication order.

d. OES Oil.

(1) The crankcase oil level must be checked frequently, as oil consumption may increase.

(2) The oil may require changing more frequently than usual because contamination by fuel dilution and sludge formation will increase under cold weather operation conditions.

Section II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

To insure that the bridge erection boat is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The maintenance checks and services to be performed by the operator are listed as described in Table 3-1. The item numbers indicate the sequence of inspection requirements. Defects discovered during operation of the unit

will be noted for future correction to be made as soon as operation has ceased. Stop operation immediately if a deficiency is noted during operation which would damage the equipment if operation were continued. All deficiencies and shortcomings will be recorded together with the corrective action taken on DA Form 2024 at the earliest possible opportunity.

Table 3-1. Operator/Crew Preventive Maintenance Checks and Services.

D -- Daily Time required: 5.7		W -- Weekly Time required:	WORK TIME (M/H)
Interval and Sequence No.	Item to be Inspected Procedure		
D	W		
1	Hull Check for structural damage. Check fittings for security and damage.		0-4
2	Sheaves Check for damage and wear. Check for secure mounting and proper operation.		0.1 0.1
3	Lights Inspect for dirt, security, or damage. Check operation.		0.6
4	Steering system Check for security of mounting. Turn wheel through its full range and check that system operates smoothly and easily.		0.8

TM 5-1940-221-12

D -- Daily
Time required: 5.7

W -- Weekly
Time required:

Interval and Sequence No.		Item to be Inspected Procedure	WORK TIME (M/E)
D	W		
5		Fire extinguishers Check for security of mounting and that seals are intact.	0.1
6		Controls and instruments Inspect security of mounting and for signs of damage. Check controls for proper operation. When engines are running, check gages for proper indication. After engines are shut down, check that gages indicate properly.	0.9
7		Fuel system Inspect condition of tank, security of mountings, check lines for leaks and tight connections. Examine filters for security and leaks. Drain water from filters and strainers. Refill tank after operation to avoid condensation. (Figs 3-1, 3-2 and 3-3).	0.9
8		Bilge pumps Check bilge and remove any debris. Check pump operation and remove any accumulation of water.	0.2
9	15	Batteries Inspect for leaks, cracks, can security of mounting and connections. Check that electrolyte level is 3/8 inch above plates. Fill with distilled water if necessary.	0.3
10	16	Coolant system Check coolant level, and examine lines and connections for signs of leaks. Add coolant if necessary. Check antifreeze in cold weather. (Fig. 3-1).	0.3
11		Engine lubricating oil system (Fig. 3-1). Check crankcase oil level with dipstick. Dipstick should indicate FULL. Fill with proper grade of lubricating oil if necessary. Check oil filter, cooler and lines for security and leaks. (Fig. 3-1).	0.6
12		Transmission Check for leaks, damage, and security of mounting. Check oil level with dipstick. Fill with proper grade of oil. (Figs. 3-1 and 3-2).	0.1
13		V-belts Check for tension, cracks, or shredding.	0.1
14		Equipment Check that all on-board equipment is in place and in good condition.	0.7

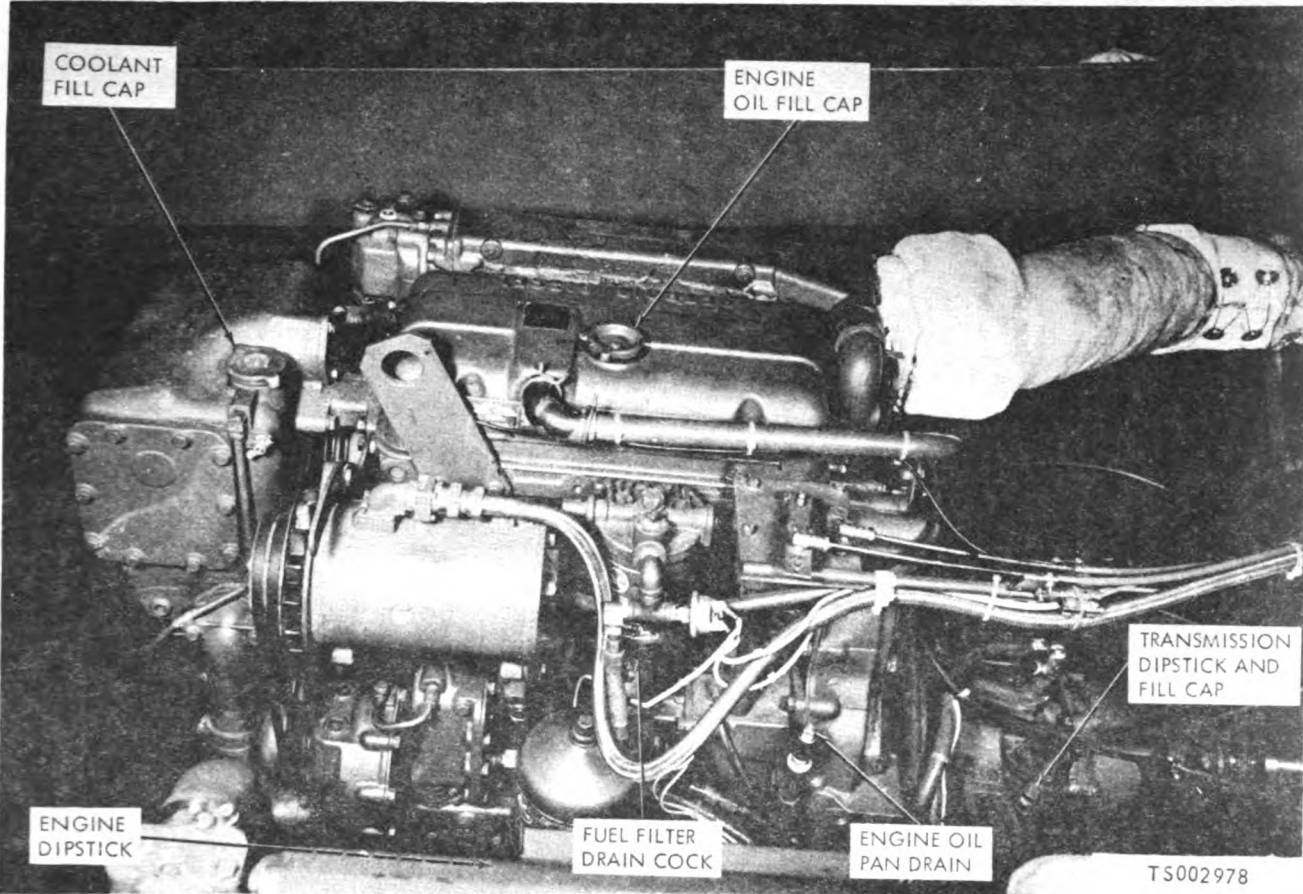


Figure 3-1. Engine and transmission servicing.

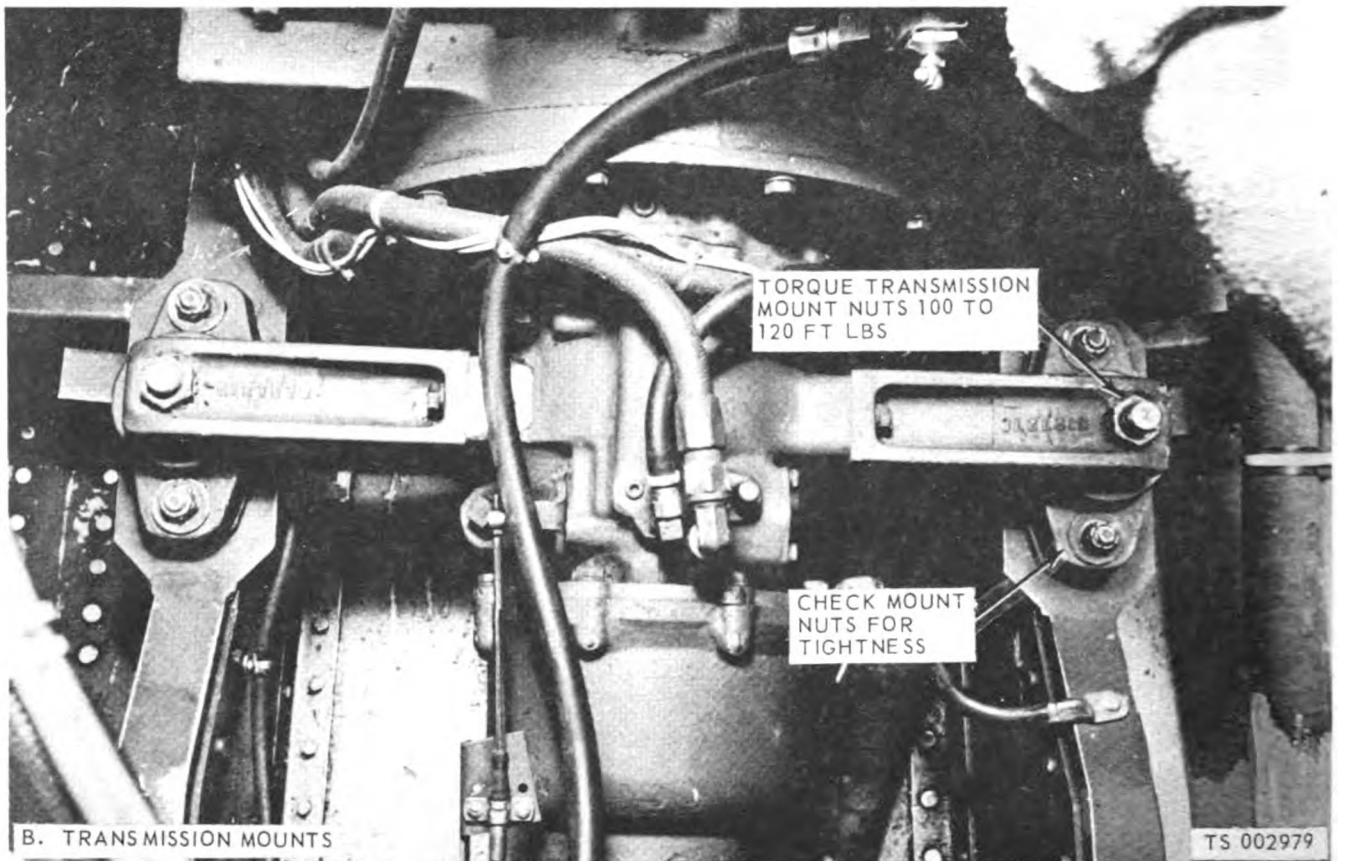
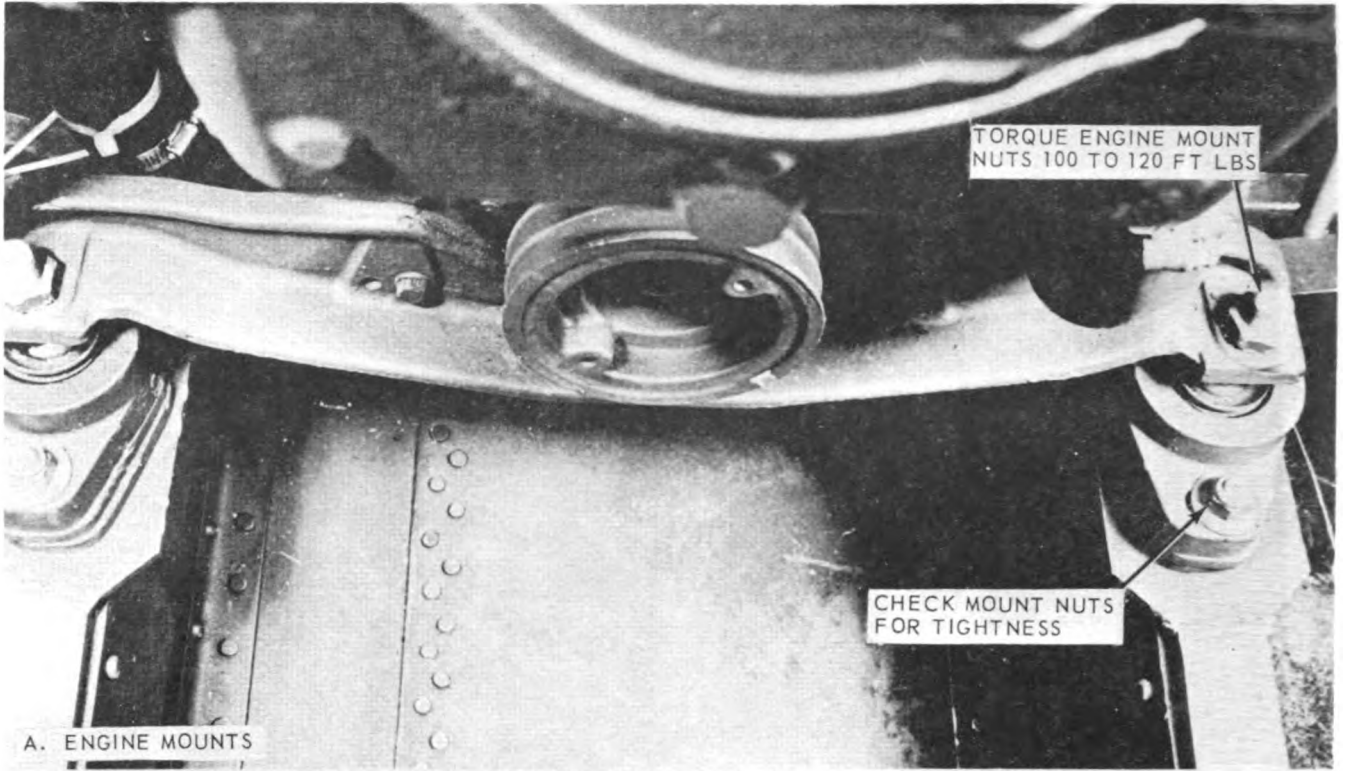
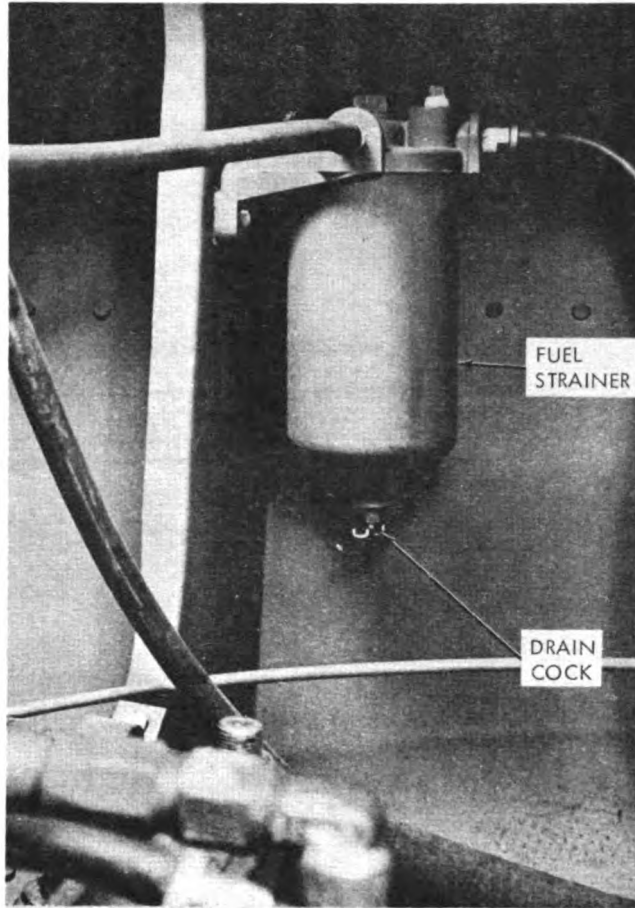


Figure 3-2. Engine and transmission mounts servicing.



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Figure 3-3. Fuel strainer servicing.

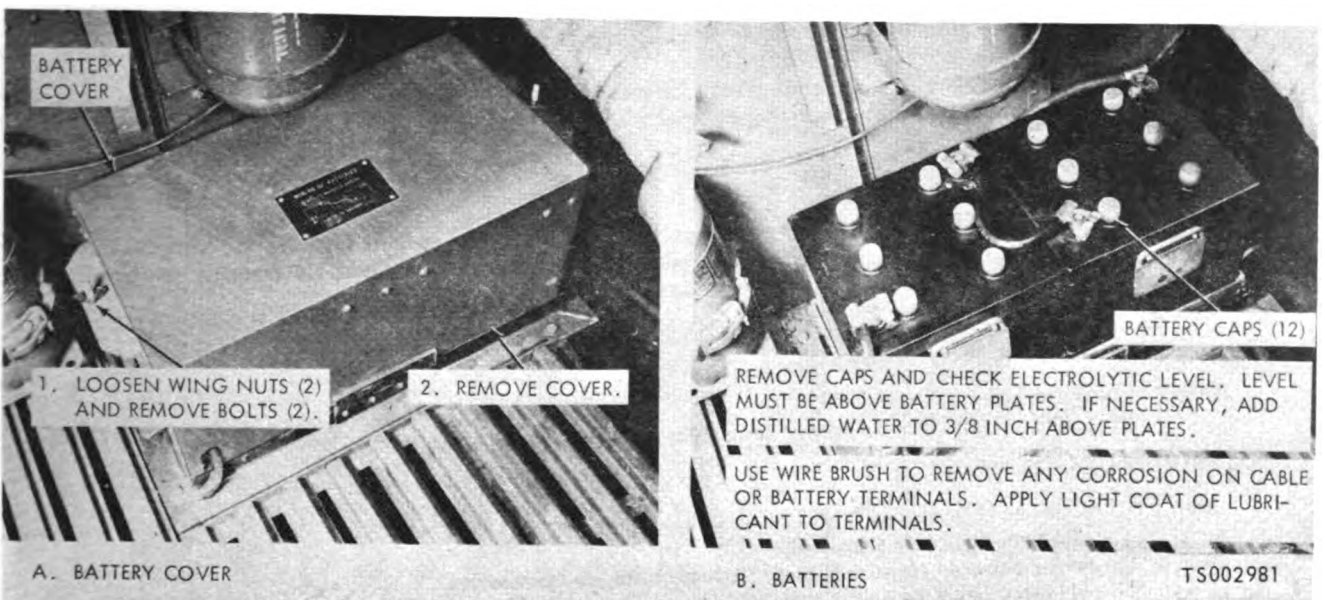


Figure 3-4. Battery servicing.

Section III. TROUBLESHOOTING

This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the bridge erection boat. Each malfunction for an individual component, unit, or system is followed by a list of tests or inspections which will help you to determine probable causes and corrective action to take. You should perform the 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 listed corrective actions, notify organizational maintenance personnel.

NOTE

Before you use this table, be sure you have performed all applicable operating checks.

Table 3-2. Operator/Crew Troubleshooting

Malfunction	Test or Inspection	Corrective Action
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ENGINE

1. STARTING MOTOR DOES NOT CRANK ENGINE WHEN STARTER SWITCH IS ACTUATED

- Check master switch for ON position.
- Place master switch in the ON position.

2. ENGINE TURNS OVER BUT FAILS TO START

- Step 1. Check to see if shut down handle is pulled.
 - Push in the handle.
- Step 2. Check for empty fuel tank.
 - Fill the fuel tank with diesel oil, use No. 1D (FSN 9140-286-5286) in the winter and No. 2D (FSN 9140-286-5294) in the summer.
- Step 3. Check shut-off valve for OPEN position.
 - Place fuel line shut-off valve in OPEN position.

3. ENGINE STARTS BUT MISFIRES OR DOES NOT RUN SMOOTHLY OR DEVELOP FULL POWER

- Check fuel oil for proper grade and type.
 - Drain and refill fuel tank with fuel oil No. 1D (FSN 9140-286-5286) in the winter and No. 2D (FSN 9140-286-5294) in the summer.

4. LOW ENGINE OIL PRESSURE

- Check for very low engine oil level.
 - a. Add oil and fill to proper level. Remove the oil filter cap on the rocker cover and add lubrication oil per LO 5-1940-221-12.
 - b. Start the engine and check for leaks. Stop the engine. Allow 5 minutes for oil to drain to the crankcase and check the oil level with the dipstick.

5. ENGINE OVERHEATS

- Step 1. Check for a low coolant level.
 - Remove the cap from the expansion tank and check the coolant level. If the tank is empty, check that all the drains are closed, and fill the system with coolant. If freezing temperatures are expected, be sure that antifreeze is used.
- Step 2. Check to see if the pressure cap is sealing properly or if it is missing.
 - Replace the pressure cap.
- Step 3. Check for low engine oil level.
 - Add oil and fill to proper level (see para 4 above).

6. EXCESSIVE FUEL CONSUMPTION

- Step 1. Check to see if improper fuel is being used.
 - Replace fuel (see para 3 above).
- Step 2. Check for loose or ruptured lines, fittings, tank, or accessories.
 - Tighten loose lines and fittings.
- Step 3. Check to see if the emergency-stop air valve is partially closed.
 - Make certain the emergency-stop linkage works freely. Check that the stop handle is all the way down during engine operation.

Malfunction	Test or Inspection	Corrective Action
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ELECTRICAL SYSTEM

7. AMMETER OPERATING ABNORMALLY OR SHOWING NO VOLTAGE INDICATION

Check for loose or corroded battery cable terminals and clamps.
Clean or tighten the battery cable terminals.

8- OIL PRESSURE GAGE OPERATING ABNORMALLY OR SHOWS NO INDICATION

Check for low engine oil level.
Add oil and fill to proper level (see para 4 above).

PROPELLER AND SHAFT

9. EXCESSIVE HULL VIBRATION

Step 1. Check for a fouled propeller.
Clear the propeller.
Step 2. Check for a loose defective coupling.
Tighten a loose coupling.

HULL

10. WATER IN THE BILGE

Check for a loose or defective drain plug.
Tighten or replace the drain plug.

11. THE BOW AND STERN ASSEMBLY JOINT LOOSE

Step 1. Check for a loose coupling handle nut.
Tighten the coupling handle nut.
Step 2. Check for a loose coupling hook nut.
Tighten the coupling hook nut.

Section IV. OPERATOR'S MAINTENANCE

The only maintenance functions that the operator is authorized to perform are those that are preventive. Lubrication instructions are presented in Section II in this Chapter, and preventive maintenance

checks and services in Section III. Any corrective maintenance procedures are the responsibility of organizational and higher levels of maintenance personnel.

CHAPTER 4

ORGANIZATIONAL MAINTENANCE INSTRUCTIONS

Section I. SERVICE UPON RECEIPT OF EQUIPMENT

4-1. Inspecting and Servicing the Equipment

Refer to table 4-1 and perform the preventive maintenance checks upon receipt of equipment.

4-2. Installation of Separately Packed Components

a. Place two mooring and two steering lines on the after deck of the stern assembly.

b. Place the anchor and line, and two mooring lines on the forward deck of the bow assembly.

c. Place the ring buoy in the bracket on the port side of the bow cockpit and the boathook in the spring clips.

d. Stow the bow cover and cover pole, and the stern cover in the bow compartment.

e. Place the engine lubricating oil drain pump in the bracket on the starboard side of the engine compartment.

Section II. REPAIR PARTS, SPECIAL TOOLS, AND EQUIPMENT

4-3. Special Tools and Equipment

No special tools or equipment are required for organizational maintenance.

4-4. Maintenance Repair Parts

Organizational maintenance repair parts are listed and illustrated in TM 5-1940-221-20P.

Section III. PREVENTIVE MAINTENANCE CHECKS AND SERVICES

4-5. General

To insure that the boat is ready for operation at all times, it must be inspected systematically so that defects may be discovered and corrected before they result in serious damage or failure. The preventive maintenance checks and services to be performed by organizational maintenance personnel are listed and described in table 4-1. The item numbers indicate the sequence of inspection requirements. Defects discovered during operation of the unit will be noted for future correction, to be made as soon as operation has ceased. All deficiencies and short-comings will be recorded to-

gether with the corrective action taken on DA Form 2404 (Equipment Inspection and Maintenance Worksheet) at the earliest possible opportunity.

4-6. Quarterly Preventive Maintenance Checks and Services

a. Table 4-1 presents a listing of the quarterly preventive maintenance checks and services.

b. A quarterly preventive maintenance check and service is equivalent to three calendar months or 500 operating hours, whichever comes first.

Table 4-1. Organizational Preventive Maintenance Checks and Services

Q -- Quarterly
Total man-hours required: 10.4

Sequence Number	Item to be Inspected Procedure	WORK TIME (M/H)
1	Lubricate in accordance with Lubrication Order (LO 5-1940-221-12). EXTERNAL HULL AREA External hull Inspect for cracks, loose rivets, and broken welds. Check fittings for security, damage and wear.	0.4

Q -- Quarterly
 Total man-hours required: 10.4

Sequence Number	Item to be Inspected Procedure	WORK TIME (M/H)
2	Hatches and gratings Inspect for cracks, loose or damaged hinge pins, broken welds and bent or damaged hatch covers.	0.4
3	Propellers shafts, and struts Inspect propellers for nicks, dents, breaks, distortion, and security.	0.4
4	Rudders and struts Inspect struts for damage and security. Check drain cocks for proper fit. Inspect for damage, cracks, distortion. Check torque of propeller strut mounting bolts to 51-54 ft lbs, and rudder plate mounting bolts to 17-20 ft lbs. Check rudder upper bearing capscrews for tightness and lower strut brace spring pins for proper seating.	0.4
5	Heat exchangers Inspect for damage, cracks, distortion, and security of mounting. Check zinc anodes for deterioration.	0.3
6	Running lights, bow and range lights Inspect for broken lenses, burned out bulbs, security of mounting, and defective wiring and connections.	0.2
OPERATOR'S COCKPIT AREA		
7	Fire extinguishers Refer to TM 5-687 and weigh cylinders every 100 hours. Check security of mountings and conditions of nozzles, lines, and fittings.	0.2
8	Controls and instruments Check for proper operation, security of mounting and broken glass lens.	0.9
9	Lights Check lights and switches for proper operation. Inspect spotlight for cracked or broken lens, burned out bulb, and condition of wiring.	0.6
10	Batteries Check that cables and mounting are tight. Remove corrosion. Check specific gravity.	0.3
11	Steering system Check that steering wheel turns smoothly and easily and that rudders respond in unison. Check gear boxes, quadrant, rods, and fittings, for damage, distortion, and security of mounting. Check universal joint spring pins for proper seating.	0.3
12	Shaft logs Check for leaks.	0.1
18	Fuel tank, lines, and fittings. Inspect filler, lines, valves, fittings, and tank for leaks, damage, and security.	0.2
ENGINE COMPARTMENT		
14	Compartment Check for indications of fuel, lubricating oil, and coolant leaks at all lines, connections, and engine. Inspect all wiring for damage and security of connections.	0.2
15	Engines Inspect engine mounts for torque of 100-to 120-ft lbs.	0.3
16	Fuel filters and strainers Change elements. Check for leaks. Check for evidence of water.	0.7
17	Expansion tanks Check coolant level. Inspect lines and tanks for leaks and damage.	0.1
18	V-belts Check and adjust belt tension. Inspect for cracks and shredding. Inspect shield for cracks, tightness and other damage.	0.3

Q - Quarterly
Total man-hours required: 10.4

Sequence Number	Item to be Inspected Procedure	WORK TIME (M/H)
ENGINE COMPARTMENT CONTINUED		
19	Water pumps Inspect pumps for leaking seals and security of mounting.	0.1
20	Oil coolers. Check oil coolers and connections for leaks and security of mounting.	0.2
21	Fuel pumps Check pumps and connections for leaks and security of mounting.	0.1
22	Governors Inspect condition of cables and linkage. Insure that governor control cable mounting hardware is secure and that governor throttle shaft and shut down lever is secure on shaft.	0.1
23	Generators Check generators for proper output and adjust, if necessary. Inspect condition of cable and security of mounting.	0.4
24	Generator regulators Check regulators for proper operation and adjust, if necessary.	1.0
25	Starter motors Check condition of cables and security of solenoid and motor mounting.	0.4
26	Exhaust system Inspect manifolds and pipes for damage and evidence of leakage during operation.	0.8
27	Air intake system Inspect silencer, shutoff valve housing, and blower for damage and security of mounting. Check shutoff valve linkage for proper operation. Manually reset the valve at the engine.	0.2
28	Transmissions Check for leaks, security and condition of mounts, and air breather spring action.	0.1
29	Power lever cables Inspect for kinks, breaks, or ther damage. Check operation of linkages.	0.1
30	Propeller shaft couplings Check for loose or missing coupling bolts.	0.4
31	Electric bilge pump Check that operation is satisfactory. Check condition of wiring and connections and security of mounting. Inspect hose and fittings for leaks and damage.	0.1
CARGO WELL		
32	Manual bilge pump Check for proper operation and security of mounting. Inspect hose and fittings for leaks and damage. Check that screen is clean.	0.1
33	On-board equipment Check that all equipment is present and stowed in proper place. Inspect all equipment for damage.	0.7

Section IV. TROUBLESHOOTING

4-7. General

a. This section contains troubleshooting information for locating and correcting most of the operating troubles which may develop in the

bridge erection boat. Each malfunction for an individual component, unit, or system is followed by a list of tests or inspections which will help you to determine probable causes and corrective actions in the order listed.

b. 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 listed corrective actions, notify your supervisor.

NOTE

Before you use this table, be sure you have performed all applicable operating checks.

Table 4-2. Organizational Troubleshooting

Malfunction	Test or Inspection	Corrective Action
ENGINE		
1. ENGINE FAILS TO CRANK OR CRANKS SLOWLY		
	Step 1. Check for loose wiring or connections, at the battery, the battery to the frame, starter switch, the starter terminal stud or engine to frame cable.	Tighten any loose connections as required.
	Step 2. Check the battery charge.	Replace a dead battery. Remove the battery box cover. Loosen the battery cable clamps, remove the cables and remove the battery.
	Step 3. Check for a defective starter (cranking motor).	Replace the starter. Turn off the master switch and disconnect the batteries. Remove the starter cables. Remove the starter mounting screws and washers and remove the starter.
2. ENGINE CRANKS BUT FAILS TO START		
	Step 1. Check for fuel line leaks.	Tighten loose fuel connectors or replace a defective line. Remove a defective line as shown in figure 4-1. If lines or fittings located between the fuel tank and the shutoff valve are to be removed, drain the tank using a suitable syphon. If the lines between the shutoff valve and the engine are to be removed, close the shutoff valve.
	Step 2. Check to see if the fuel filter and strainer are clogged.	Replace a clogged fuel filter element. Place a suitable container under the filter, open the drain cock (3, fig. 4-2) and drain the fuel. Support the shell (6) with one hand. Unscrew the screw (4) and remove the shell (6), element (8), and gasket (7). Discard the element and gasket. Install the gasket (7), element (8), shell (6), and secure with screw (4), but do not replace plug (15). Fill the filter with fuel and install the plug (15).
	Step 3. Check for a defective fuel pump.	Replace a defective fuel pump. Refer to figure 4-3 and remove the fuel pump. To install the fuel pump, place the pump in position (fig. 4-3) and secure with 3 screws and washers. Connect inlet and outlet hoses.
	Step 4. Check for a clogged or defective air intake.	Replace a clogged air silencer screen or a defective air silencer assembly. Remove four mounting screws and washers and remove the air silencer. Replace the screen or the complete assembly.
3. ENGINE STARTS BUT FAILS TO KEEP RUNNING		
	Step 1. Check the fuel system for fuel line leaks, for a clogged fuel filter or strainer, or for a defective fuel pump.	Refer to malfunction 2 above.
4. ENGINE STARTS BUT MISFIRES. RUNS ROUGH		
	Check the fuel system for fuel line leaks, for a clogged fuel filter or strainer, or for a defective fuel pump.	Refer to malfunction 2 above.
5. ENGINE DOES NOT DEVELOP FULL POWER		
	Check for a clogged or defective air intake.	Refer to malfunction 2, step 5 above.
6. ENGINE OVERHEATS		
	Step 1. Check to see if coolant level is low.	Replenish the coolant. Fill to a level slightly below the bottom of the tank filler neck. If freezing temperatures are expected, be sure that anti-freeze is used.
	Step 2. Check for loose or worn V-belts.	Adjust belt tension or replace a worn belt. Refer to figure 4-4 and remove the V-belt shield and to figure 4-5 and remove the V-belts. Refer to figures 4-4 and 4-5 and install the V-belt and shield.

Malfunction	Test or Inspection	Corrective Action
	Step 3. Check to see if cooling system is clogged.	Flush the cooling system.
	Step 4. Check for faulty thermostat.	Refer to figure 4-6 and remove the thermostat housing. Replace the thermostat if defective. Replace the gaskets. Close the engine oil cooler drain cock and fill the cooling system. Refer to figure 4-6 and install the thermostat housing.
	Step 5. Check for a leak in the cooling system.	Repair any leaks in the cooling system.
	Step 6. Check if the temperature gage, sending unit, or the wiring is defective.	Replace defective wiring. Refer to figure 4-7 and replace defective temperature gage or sending unit.

7. ENGINE OIL PRESSURE LOW

- Step 1. Check for a defective oil pressure gage or for defective wiring.
Repair or replace the wiring. Replace a defective oil pressure gage (fig. 4-7).
- Step 2. Check for a defective oil filter or dirty filter element.
Replace a defective oil filter or dirty filter element (fig. 4-2).

8. EXCESSIVE FUEL CONSUMPTION

- Step 1. Check the tank, lines, and fittings for leaks.
Refer to malfunction 2.
- Step 2. Check for a defective fuel pump.
Refer to malfunction 2.

9. ENGINE MAKES UNUSUAL NOISE

- Step 1. Check the exhaust muffler, manifold or exhaust pipes for breaks or cracks.
Refer to figure 4-8 and replace a defective muffler, manifold, or pipe.
- Step 2. Check for loose exhaust connections or damaged gaskets.
Replace any damaged gaskets and tighten any loose connections (fig. 4-8).

TRANSMISSION

10. HARD SHIFTING

- Check to see if shifting linkage is out of adjustment.
Adjust the shifting linkage.
 - a. Place the transmission control lever in the neutral position.
 - b. Refer to figure 4-9 and remove the cotter pin.
 - c. Place the transmission shift lever in the neutral position.
 - d. Adjust the control cable terminal, shown in figure 4-9, to align with the shift lever.

11. TRANSMISSION SLIPS OUT OF GEAR

- Check to see if shifting linkage is out of adjustment.
Adjust the shifting linkage. Refer to malfunction 10 above.

12. TRANSMISSION OIL LEAKAGE

- Check to see if transmission oil level is too high.
Drain the oil to the proper level.
 - a. Remove the dipstick.
 - b. Using the hand pump furnished, insert the drain hose into the dipstick opening and pump the oil into suitable receptical.

ELECTRICAL SYSTEM

18. ALL ELECTRICAL SYSTEMS INOPERATIVE OR WEAK

- Step 1. Check for a defective battery or battery connections.
Replace or recharge a defective or weak battery. Tighten or replace loose or defective terminals.
- Step 2. Check the generator to see if it is charging.
Replace a defective generator.

Malfunction	Test or Inspection	Corrective Action
-------------	--------------------	-------------------

14. **INDIVIDUAL LIGHTS INOPERATIVE**

- Step 1. Check for burned out bulb.
Replace a burned out light bulb.
- Step 2. Check for loose or broken wiring.
Tighten or repair loose or broken wiring.

15. **LIGHTS OPERATE INTERMITTENTLY**

- Step 1. Check for loose terminals.
Tighten loose terminals.
- Step 2. Check for loose or broken wiring.
Tighten or repair loose or broken wiring.
- Step 3. Check for a defective switch.
Replace a defective switch.

16. **THE ELECTRIC BILGE PUMP DOES NOT DISCHARGE WATER**

- Step 1. Check for a defective pump, switch, or wiring.
Replace a defective pump or switch. Repair any defective wiring.
- Step 2. Check to see if the inlet is clogged.
Clean a clogged inlet.

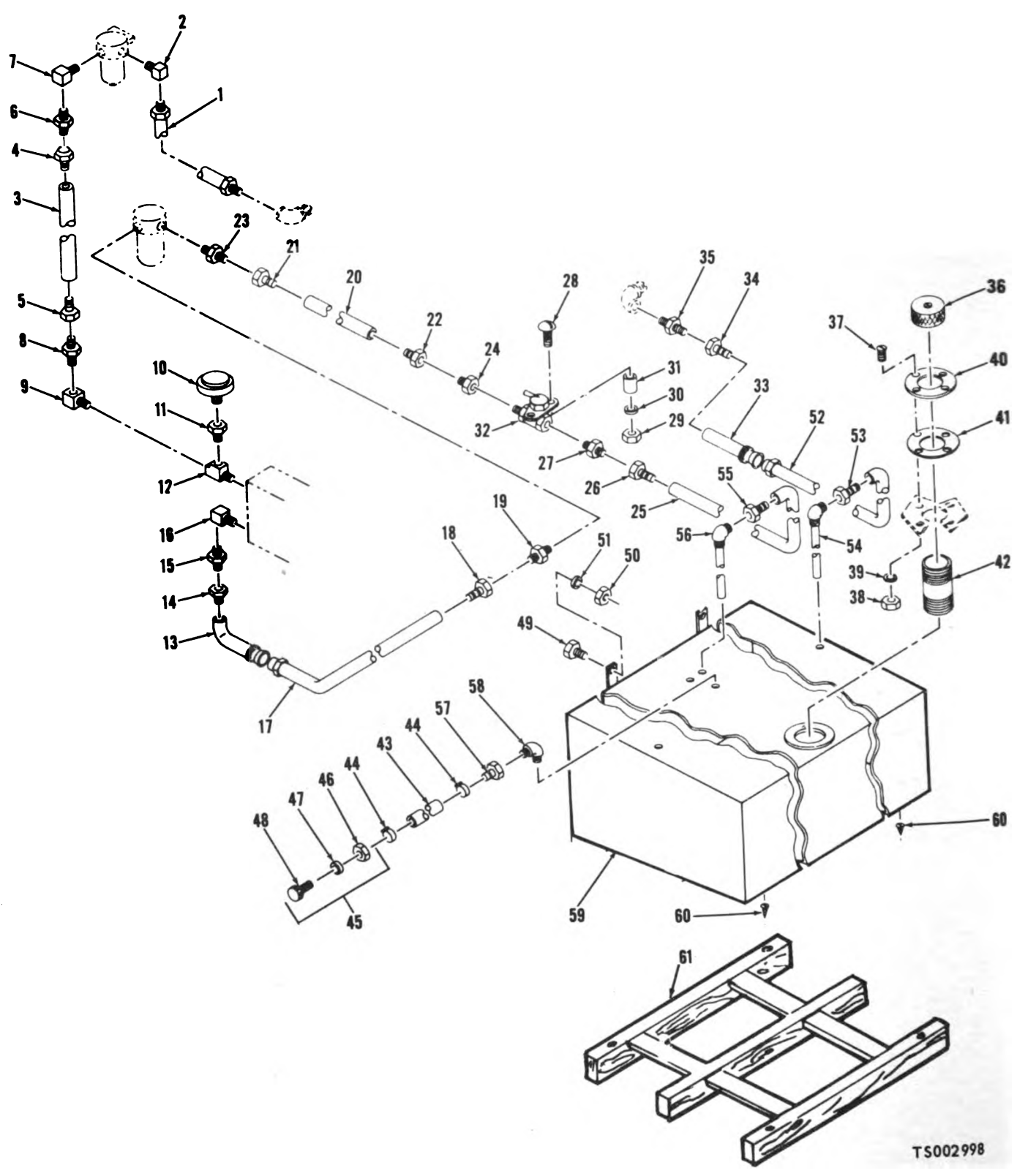
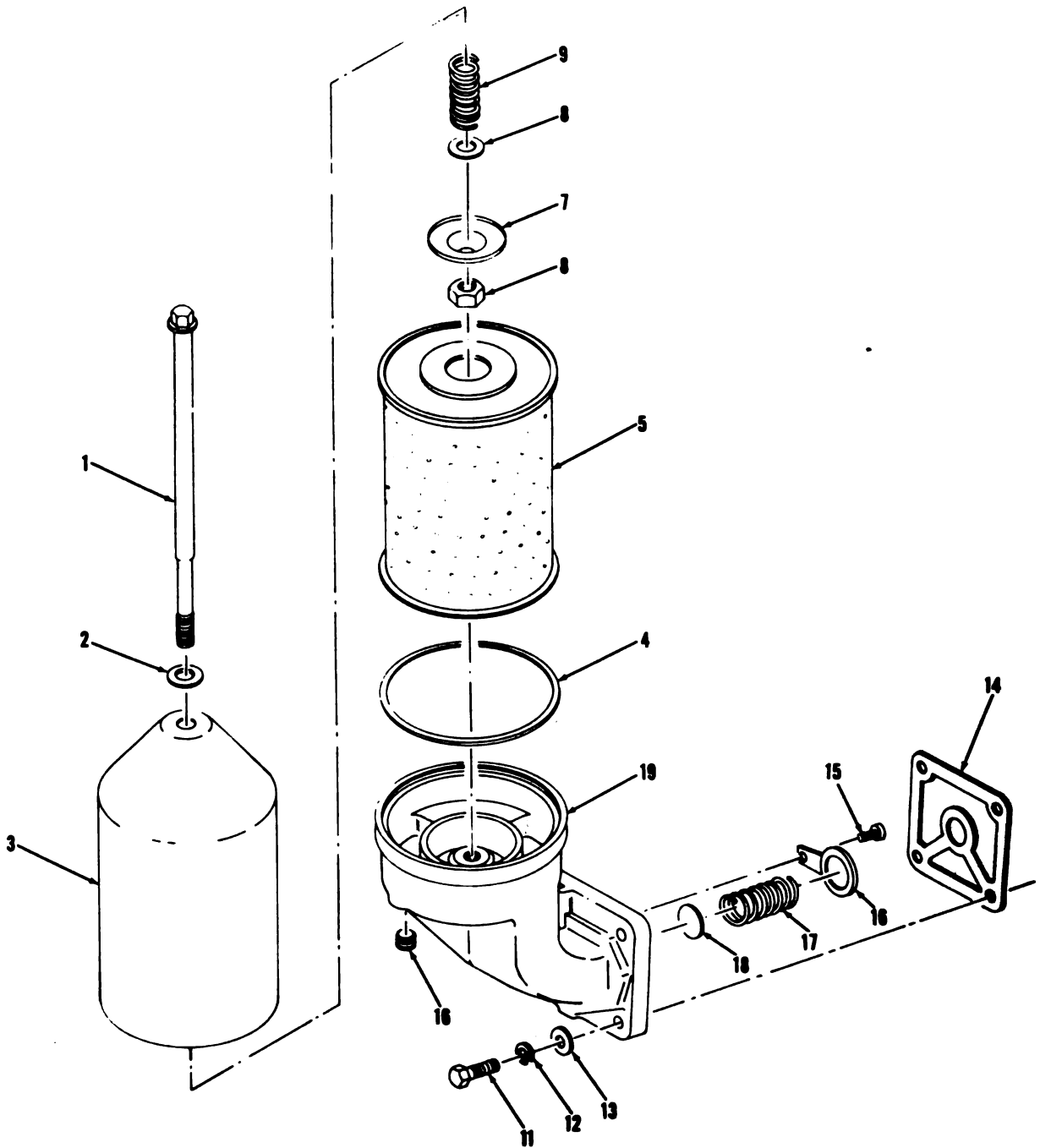


Figure 4-1. Fuel lines and fittings, exploded view.

TS002998

1. Hose assembly
2. Elbow
3. Hose assembly
4. Adapter
5. Adapter
6. Bushing
7. Elbow
8. Bushing
9. Elbow
10. Alarm switch
11. Bushing
12. Pipe tee
13. Hose assembly
14. Adapter
15. Bushing
16. Elbow
17. Hose assembly
18. Adapter
19. Bushing
20. Hose
21. Adapter
22. Adapter
23. Bushing
24. Bushing
25. Hose
26. Adapter
27. Bushing
28. Screw
29. Nut
30. Lockwasher
31. Spacer
32. Shutoff valve
33. Hose assembly
34. Adapter
35. Bushing
36. Cap
37. Screw
38. Nut
39. Flat washer
40. Shield
41. Gasket
42. Nipple
43. Hose
44. Clamp
45. Vent assembly
46. Nut
47. Washer
48. Vent
49. Bolt
50. Nut
51. Flat washer
52. Hose assembly
53. Adapter
54. Suction pipe
55. Adapter
56. Suction pipe
57. Adapter
58. Elbow
59. Tank
60. Screw
61. Support

Figure 4-1 — Continued.



- 1. Bolt
- 2. Washer
- 3. Shell
- 4. Gasket
- 5. Element
- 6. Nut
- 7. Retainer

- 8. Washer
- 9. Spring
- 10. Plug
- 11. Screw
- 12. Washer
- 13. Washer
- 14. Gasket

- 15. Screw
- 16. Retainer
- 17. Spring
- 18. Valve
- 19. Adapter

TS003000

Figure 4-2. Engine lubricating oil filter and element.

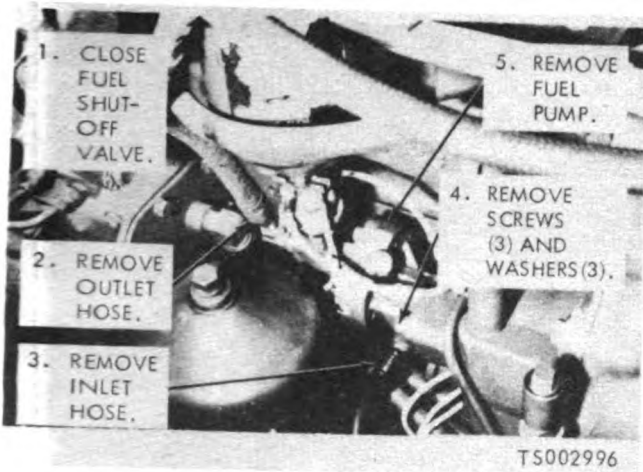


Figure 4-3. Fuel pump removal.

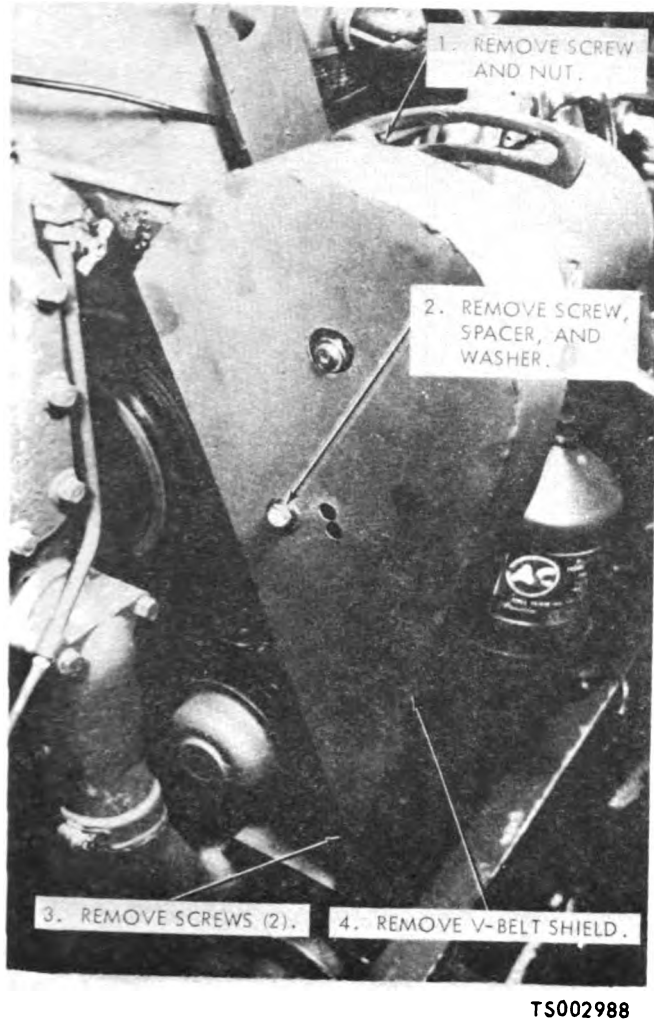


Figure 4-4. V-belt shield removal.

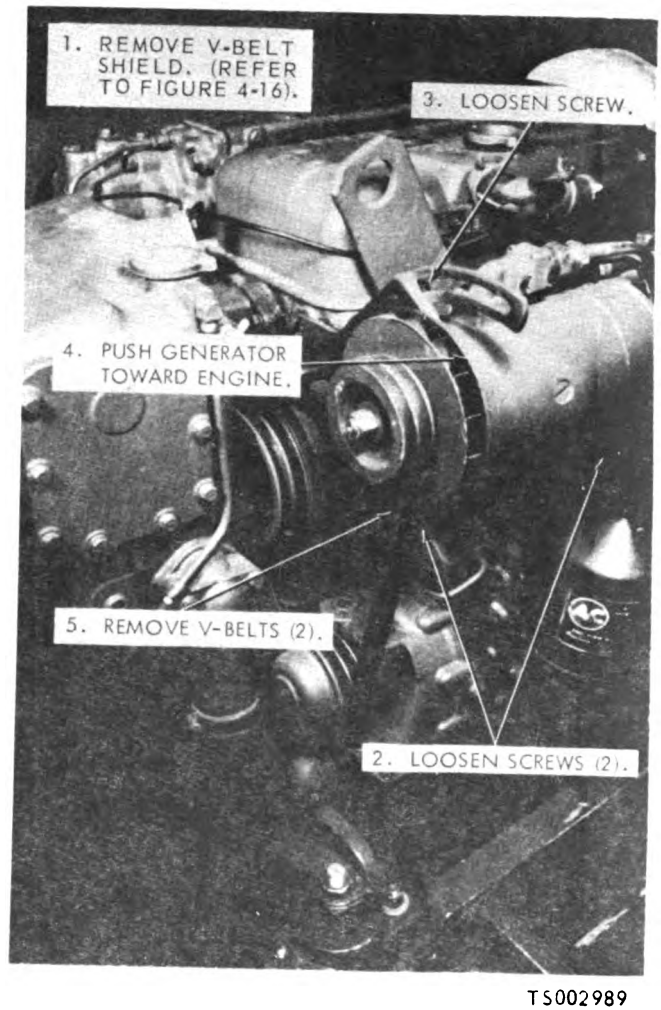
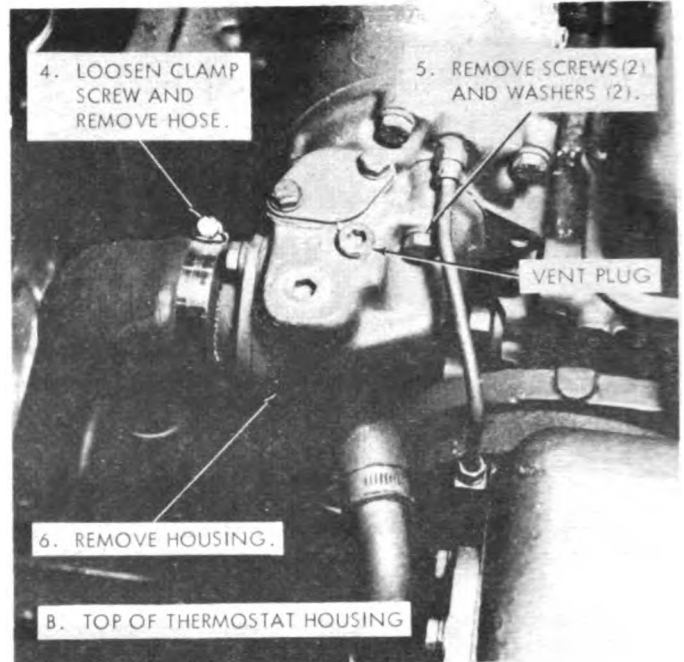
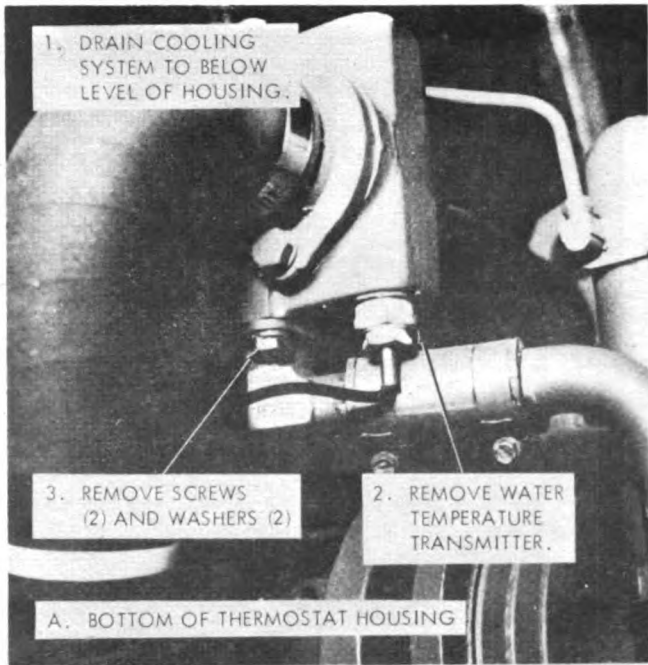
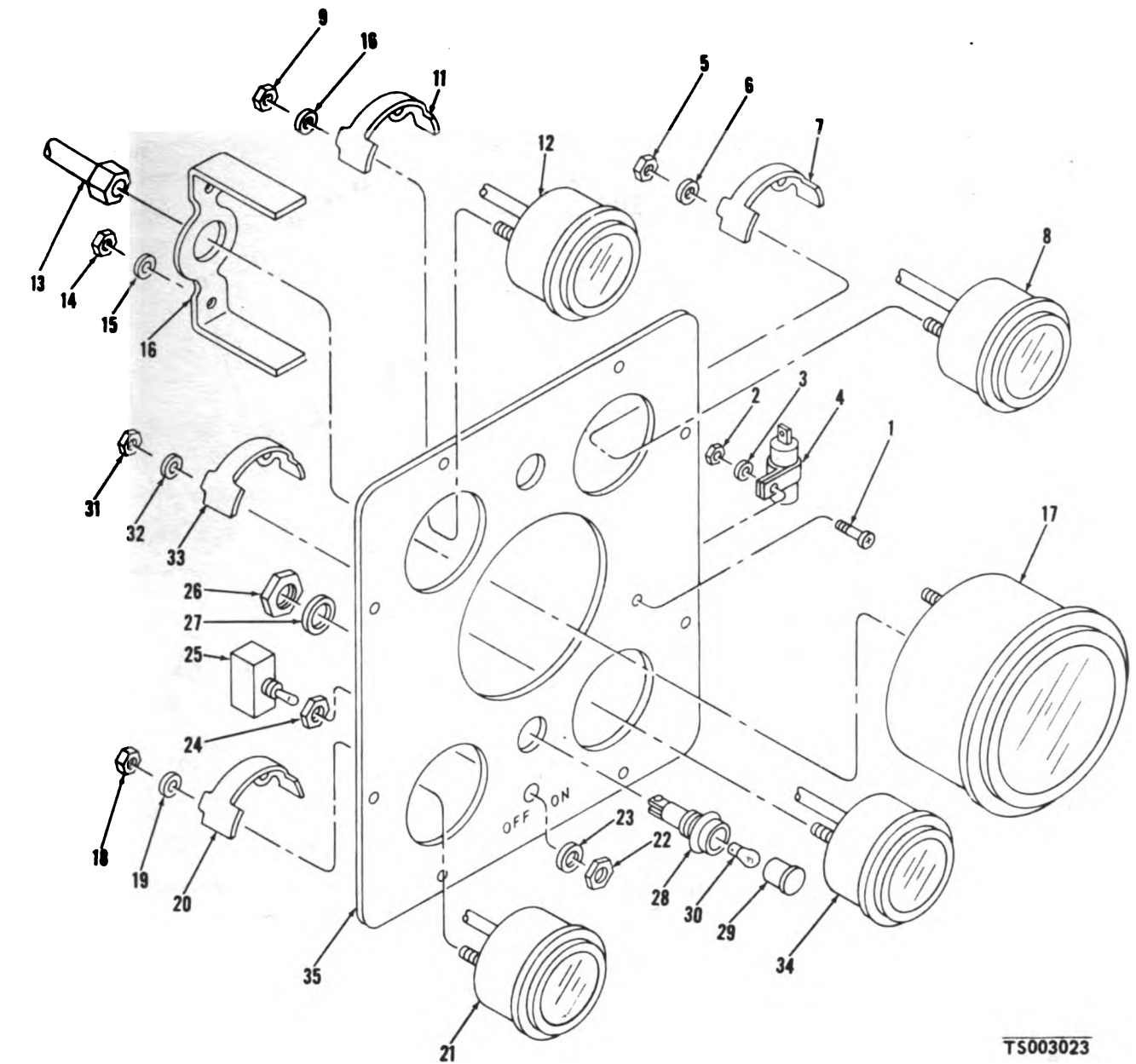


Figure 4-5. V-belt removal.



TS003009

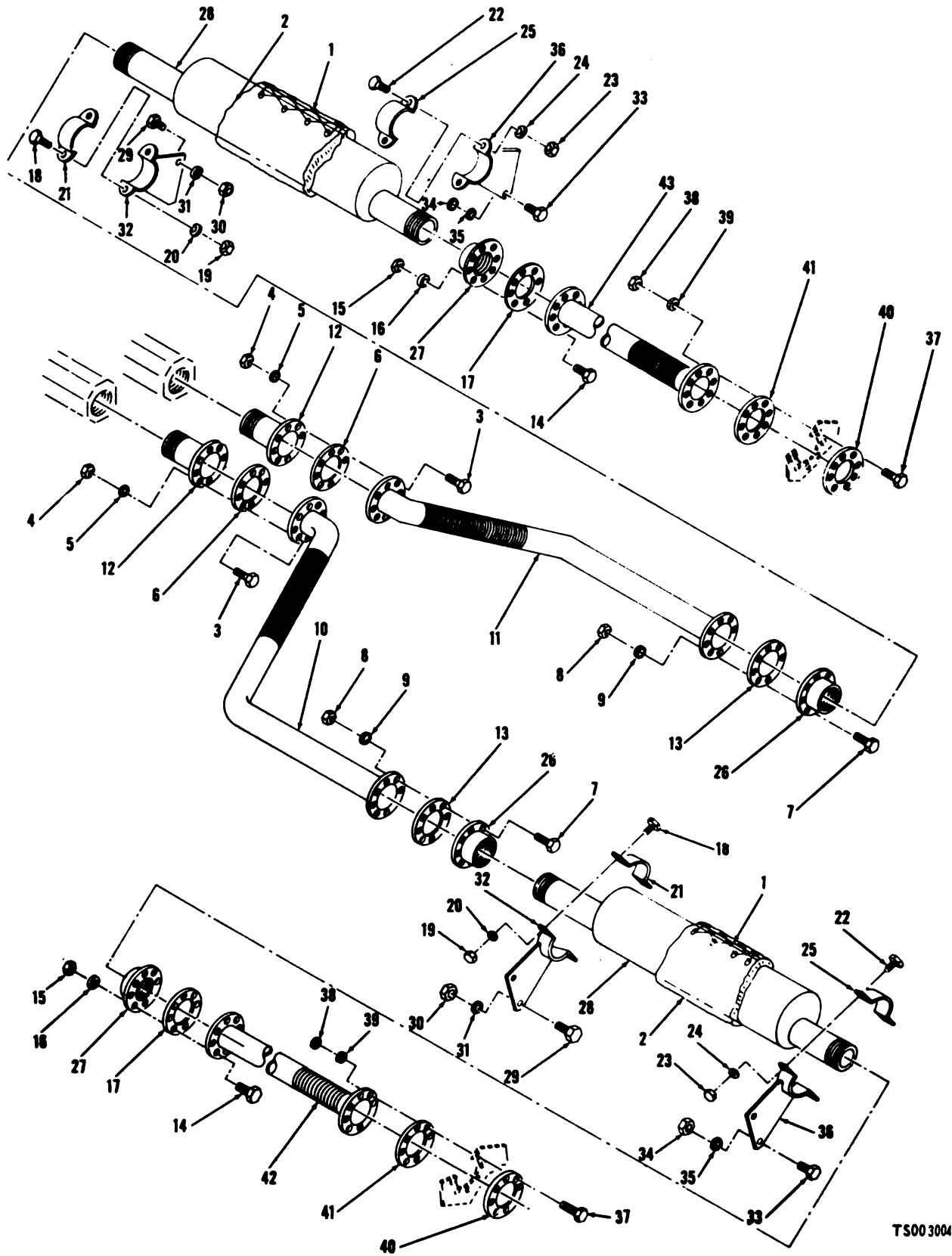
Figure 4-6. Thermostat housing removal.



TS003023

- | | | |
|------------------------------------|------------------------------|-------------|
| 1. Screw | 13. Tachometer cable | 26. Nut |
| 2. Nut | 14. Nut | 27. Washer |
| 3. Washer | 15. Washer | 28. Base |
| 4. Capacitor | 16. Bracket | 29. Shade |
| 5. Nut | 17. Tachometer | 30. Lamp |
| 6. Washer | 18. Nut | 31. Nut |
| 7. Clamp | 19. Washer | 32. Washer |
| 8. Coolant temperature gage | 20. Clamp | 33. Clamp |
| 9. Nut | 21. Engine oil pressure gage | 34. Ammeter |
| 10. Washer | 22. Nut | 35. Panel |
| 11. Clamp | 23. Washer | |
| 12. Transmission oil pressure gage | 24. Nut | |
| | 25. Switch | |

Figure 4-7. Instrument panel components, exploded view.



TS003004

Figure 4-8. Mufflers and exhaust piping, exploded view.

- | | | |
|-----------------------|----------------|------------------------|
| 1. Lancing wire | 15. Nut | 30. Nut |
| 2. Insulation blanket | 16. Lockwasher | 31. Lockwasher |
| 3. Bolt | 17. Gasket | 32. Bracket |
| 4. Nut | 18. Bolt | 33. Bolt |
| 5. Lockwasher | 19. Nut | 34. Nut |
| 6. Gasket | 20. Lockwasher | 35. Lockwasher |
| 7. Bolt | 21. Clamp | 36. Bracket |
| 8. Nut | 22. Bolt | 37. Capscrew |
| 9. Lockwasher | 23. Nut | 38. Nut |
| 10. Port header | 24. Lockwasher | 39. Lockwasher |
| 11. Starboard header | 25. Clamp | 40. Ring |
| 12. Flange | 26. Flange | 41. Gasket |
| 13. Gasket | 28. Muffler | 42. Port tailpipe |
| 14. Bolt | 29. Bolt | 43. Starboard tailpipe |

Figure 4-8 — Continued.

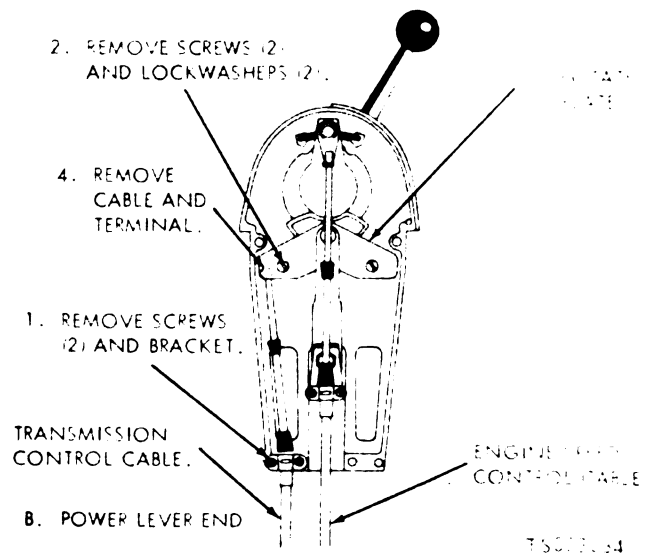
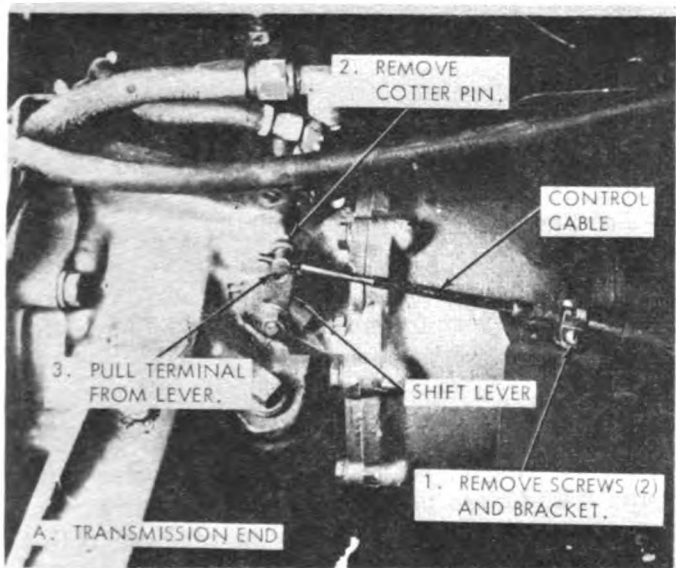


Figure 4-9. Transmission control cable removal.

Section V. RADIO INTERFERENCE SUPPRESSION

4-8. General

Essentially, suppression is attained by providing a low resistance path to ground for stray currents. The methods used on the boat include using shielding, capacitors, and ground straps.

4-9. Definitions

a. Interference. The term "interference" as used herein applies to electrical disturbances in the radio frequency range which are generated by the boat and which may interfere with the proper

operation of radio receivers or other electronic equipment.

b. Interference Suppression. The term "interference suppression" as used herein applies to the method used to eliminate or effectively reduce radio interference generated by the boat.

4-10. Radio Interference Suppression Components

Radio interference suppression consists of a 0.5 mfd, 100 wvdc capacitor (fig. 4-10) mounted on the inside of each instrument panel.

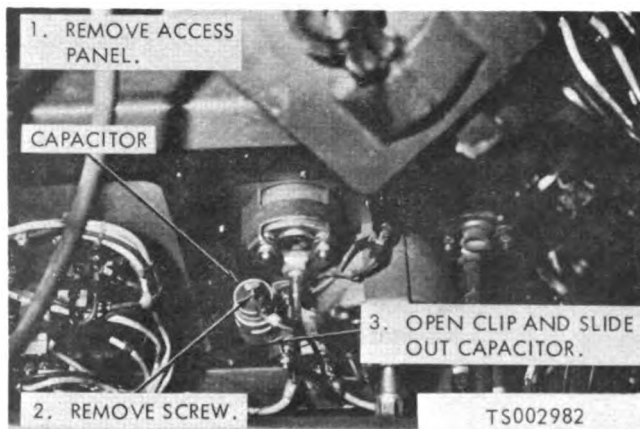


Figure 4-10. Radio interference suppression capacitor removal.

Section VI. MAINTENANCE OF ENGINES

4-12. General

The engines are installed side by side in the forward portion of the stern assembly. All location references to the engines are based on viewing the engines from the rear (transmission end). Those procedures which are authorized for organizational personnel are listed in the Maintenance Allocation Chart.

4-13. Tachometer Cable

a. Inspection. Remove the access panel (fig. 4-71). Inspect cable for loose connections, kinks, or sharp bends. Inspect for cracks or breaks in the cable housing.

b. Removal.

(1) Disconnect the cable from the tachometer.

(2) Remove all the ties and clamps holding the cable in place and remove the cable.

c. Installation.

(1) Position the cable and secure with ties and clamps.

(2) Connect the cable to the tachometer.

(3) Install the access panel.

4-14. Tachometer Drive

a. General. The tachometer drive is mounted on the rear of the engine. The drive has a shaft which engages the engine camshaft. The shaft is connected through an adapter to a cable which, in turn, drives the tachometer mounted on the instrument panel. Tachometer maintenance is presented in paragraph 4-61.

4-11. Testing of Radio Interference Suppression Components

Test the capacitors for leaks or shorts with a capacitance tester. If a tester is not available and interference is indicated, isolate the cause by replacing each capacitor in turn until the cause of interference is eliminated. Replace the capacitors with new capacitors that have exactly the same rating. It is essential that a good metal-to-metal contact with washers and terminals is achieved to ensure that proper radio interference suppression is maintained.

b. Removal. Refer to figure 4-11 and remove the tachometer drive.

c. Cleaning, Inspection, and Repair.

(1) Clean the tachometer drive in clean fuel oil and dry with compressed air.

(2) Inspect for rust, burrs, nicks, or cracks. Check for damaged or defective parts.

d. Repair.

(1) Rust on polished non-mating surfaces may be removed with a fine oxide-abrasive paper and the surface polished with crocus cloth.

(2) Nicks and burrs may be removed with a smooth file or hone.

(3) Damaged painted surfaces should be repainted as soon as possible to prevent corrosion.

e. Installation. Install the tachometer drive in the reverse order of removal.

4-15. Engine Control Cables

a. Engine Speed (Throttle) Cable. The push-pull engine speed (throttle) cable is attached between the control lever in the operator's cockpit and the speed control lever on the governor.

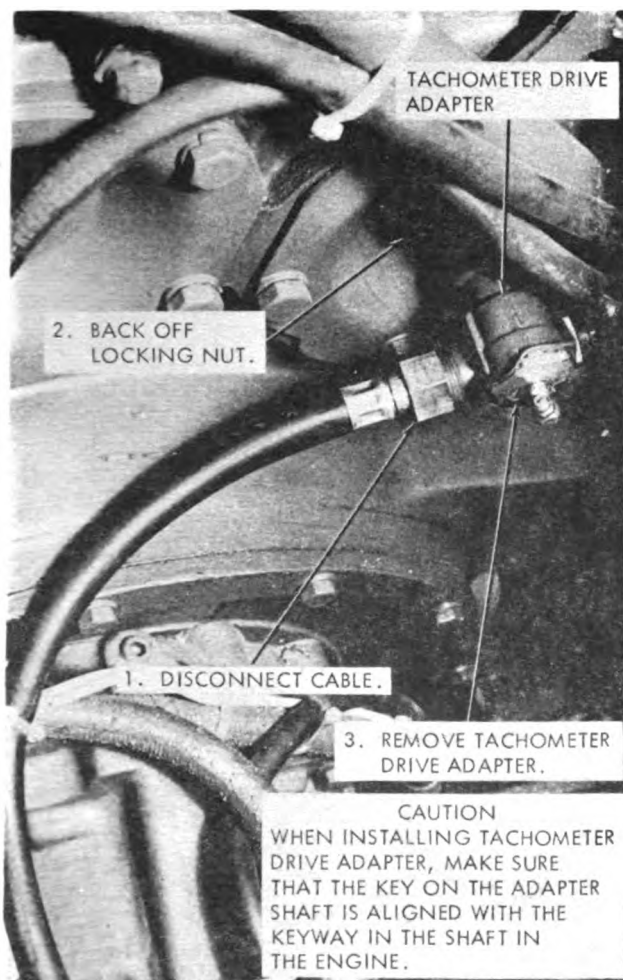
(1) *Removal.*

(a) Remove access panel (fig. 4-71).

(b) Refer to A, figure 4-12 and remove the end of the cable that attaches to the governor.

(c) Refer to A, figure 4-62 and remove the end of the cable that attaches to the transmission lever.

(d) Refer to figure 4-14 and remove the applicable control lever housing.



TS002983

Figure 4-11. Tachometer drive removal and installation.

(e) Refer to B, figure 4-12 and remove the end of the cable that attaches to the trans-control lever.

(2) *Inspection.*

(a) Check that the cable is free of kinks, cracks, or breaks.

(b) Inspect condition of threads.

(3) *Installation.* Install the cable in the reverse order of removal.

b. *Engine Shut-Off Cable.* The enginee shutoff cable is a push-pull type attached between a T-handle in the operator's cockpit and the stop lever on the governor.

(1) *Removal.*

(a) Refer to A, figure 4-12 and remove the end of the cable that is attached to the governor.

(b) Remove access panel (fig. 4-71).

(c) Refer to C, figure 4-12 and remove the handle and cable.

(2) *Inspection.*

(a) Check that the cable is free of kinks, cracks, or breaks.

(b) Inspect condition of threads.

(c) Check handle for cracks or breaks.

(3) *Installation.* Install the cable in the reverse order of removal.

c. *Emergency Stop Cable.* The engine emergency stop cable is a push-pull type attached between a T-handle in the operator's cockpit and the valve in the air shut-down housing.

(1) *Removal.*

(a) Refer to A, figure 4-13 and remove the end of the cable that is attached to the air shut-down housing.

(b) Remove access panel (fig. 4-71).

(c) Refer to B, figure 4-13 and remove the handle and cable.

(2) *Inspection.*

(a) Check cable for kinks, cracks, or breaks.

(b) Inspect condition of threads.

(c) Check handle for cracks or breaks.

(3) *Installation.* Install the cable in the reverse order of removal.

4-16. Control Head

a. *General.* The control head is located in front of and to the right of the steering wheel. The levers and mechanisms are contained in two identical housings, mounted together to form a single control quadrant. The levers actuate the cables controlling engine speed and transmission gear engagement.

b. *Removal.*

(1) Remove the engine speed control cable as given in paragraph 4-15a(1)(c) and the transmission control cable as given in paragraph 4-68.

(2) Refer to figure 4-14 and remove the control head housing from its mounting.

c. *Disassembly.* Disassemble the control head in the order of the key index numbers in figure 4-15.

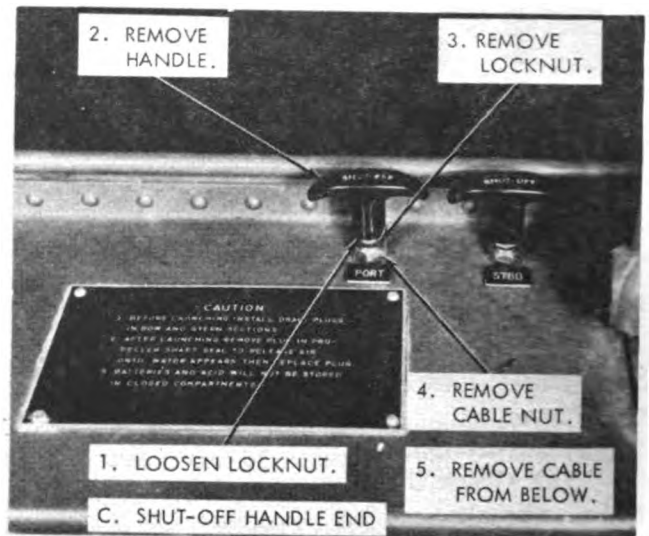
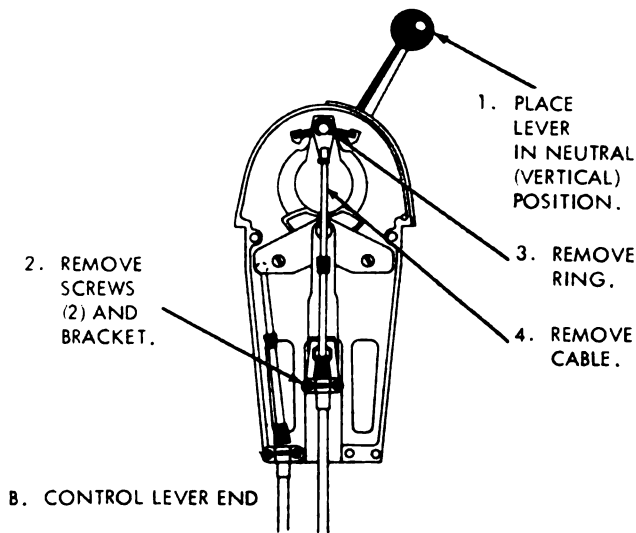
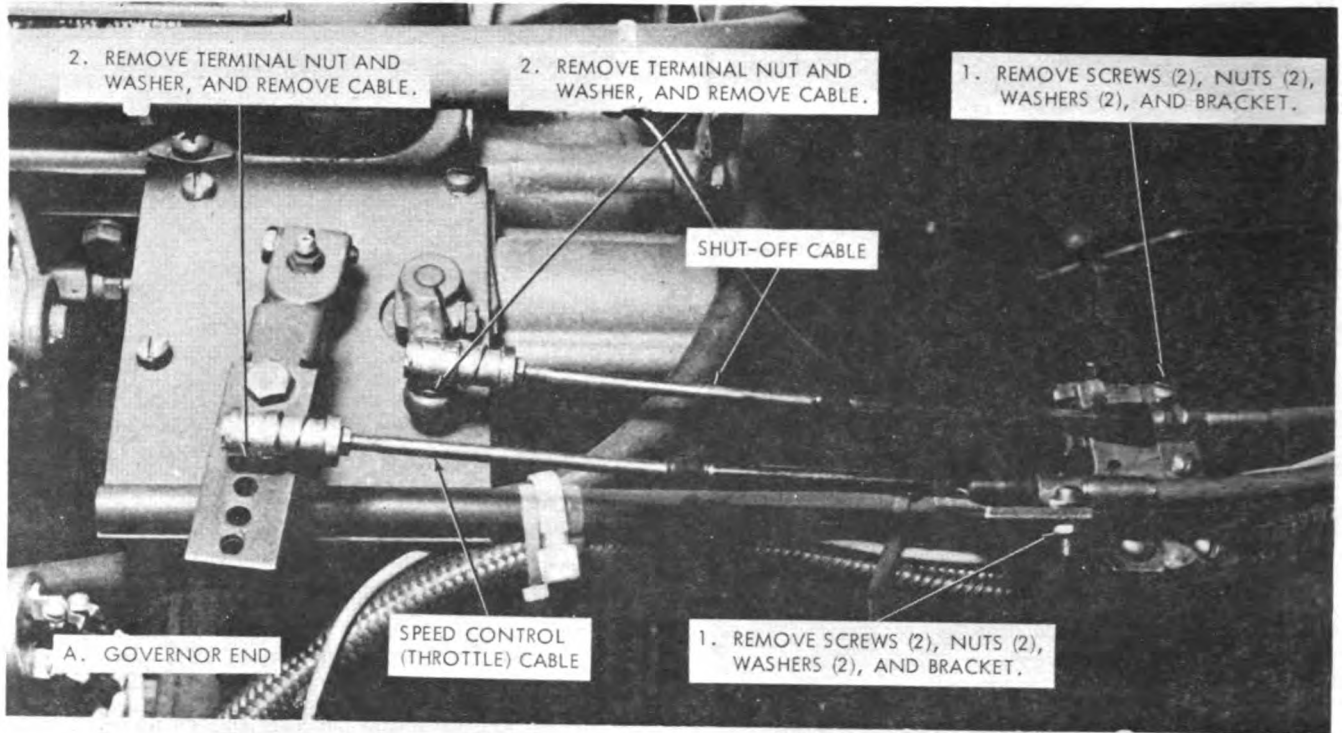
d. *Cleaning, Inspection, and Repair.*

(1) Wash all parts with an approved cleaning solvent and dry with a clean lint-free cloth.

(2) Check all parts for breaks, cracks, burs, distortion, or corrosion.

(3) Remove any corrosion with crocus cloth. Replace any damaged part.

e. *Reassembly and Installation.* Reassemble and install the control head in the reverse order of disassembly and removal.



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Figure 4-12. Speed control (throttle) and shut-off cable removal.

4-17. V-Belt Shield

a. *General.* The V-belt shield is mounted on the left front of the engine and serves as protective cover for the V-belts and pulleys.

b. *Removal.* Refer to figure 4-16 and remove the V-belt shield.

c. *Installation.* Install the V-belt shield in the reverse order of removal.

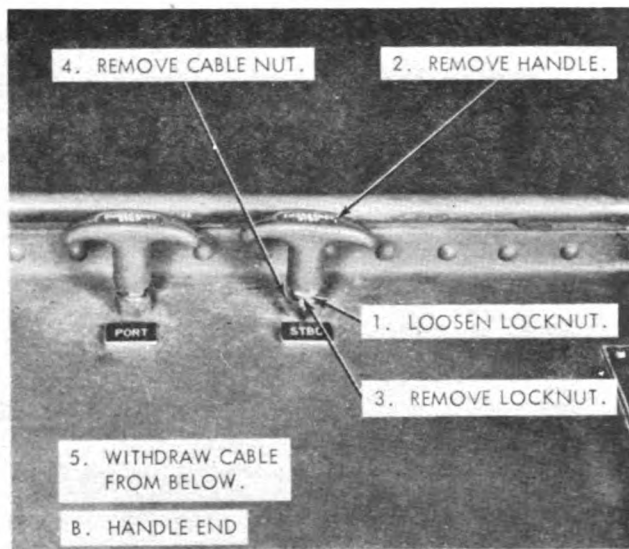
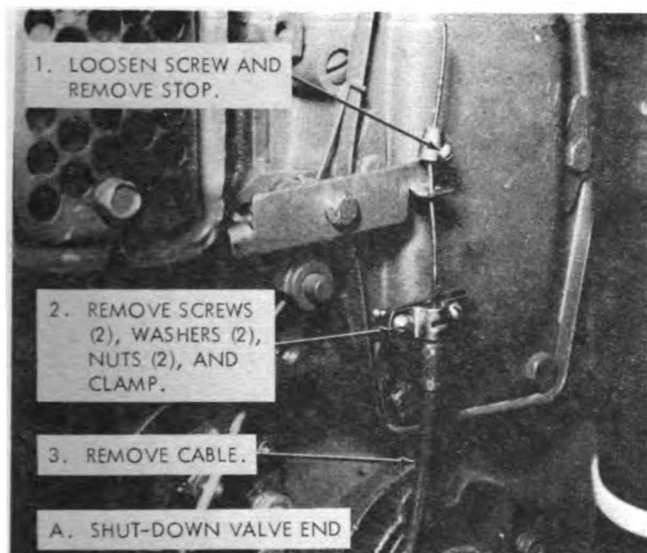
4-18

4-18. V-Belts

a. *General.* The V-belts are mounted at the front of the engine around the camshaft, water pump, and generator pulleys. The V-belts drive the battery charging generator and the water pump.

b. *Removal.*

(1) Refer to figure 4-16 and remove the V-belt shield.



TS002985

Figure 4-13. Emergency stop cable removal.

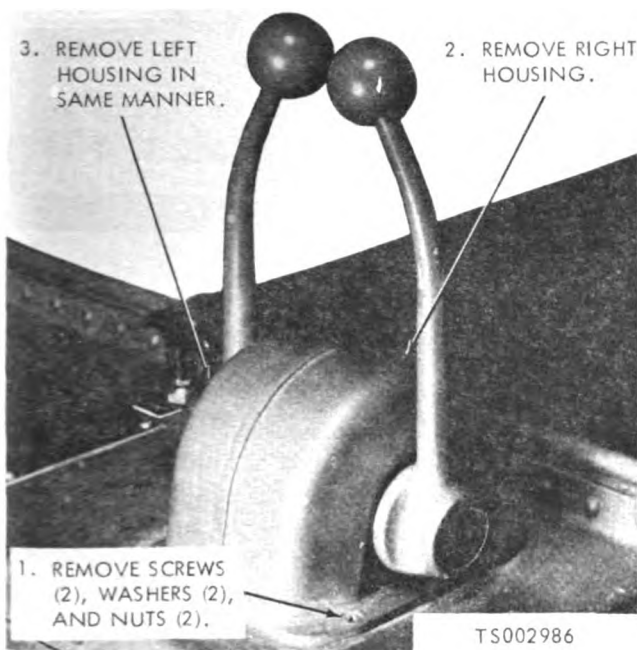


Figure 4-14. Control head removal.

(2) Refer to figure 4-17 and remove the V-belts.

c. Inspection.

- (1) Inspect V-belts for cuts and deterioration.
- (2) Inspect pulleys for burs and nicks.

d. Repair.

(1) Replace both belts if one is worn. Single belts of similar size should not be used as a substitute for a matched set. Premature wear can result because of belt length variation.

(2) Remove pulley nicks and burs with fine emery cloth.

e. Installation.

(1) Install the V-belts in the reverse order of removal.

(2) Install the V-belt shield in the reverse order of removal.

f. Adjustment. Position the generator so that a firm push with the thumb, at a point midway between the generator and water pump pulleys, will depress the belt 1/2-to-3/4 inch.

4-19. Air Silencer

a. General. The air silencer is attached to the intake side of the air shutoff valve housing on the right side of the engine to reduce the sound level of air entering the blower. The silencer has a sheet metal partition which divides the silencer into two sections. The section on the engine side forms an air duct to the blower intake; the other (outer) section is filled with sound absorbent, flame-proof, felted-cotton waste.

b. Removal. Refer to figure 4-18 and remove the air silencer.

c. Installation. Install the air silencer in the reverse order of removal.

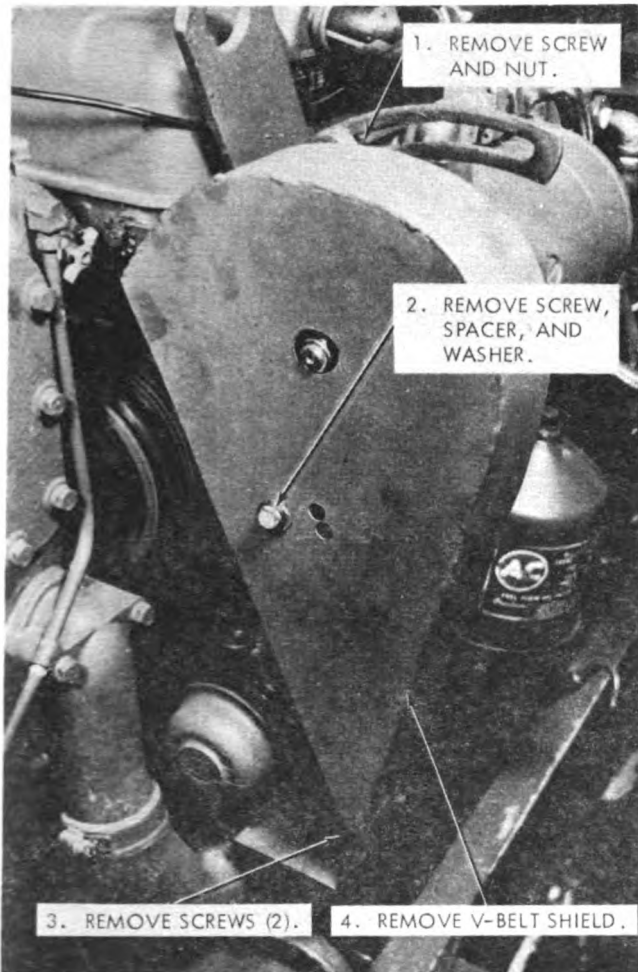


Figure 4-16. V-belt shield removal.

4-20. Air Shutdown Valve Housing and Blower Screen

a. General. The air shutdown valve housing is located between the air silencer and blower. The housing contains a valve, which in the event an emergency shutdown is required, blocks the passage of air to the blower. The valve is actuated by a control handle in the operator's cockpit. The screen is located between the housing and the blower, and is provided to prevent any objects from entering the blower.

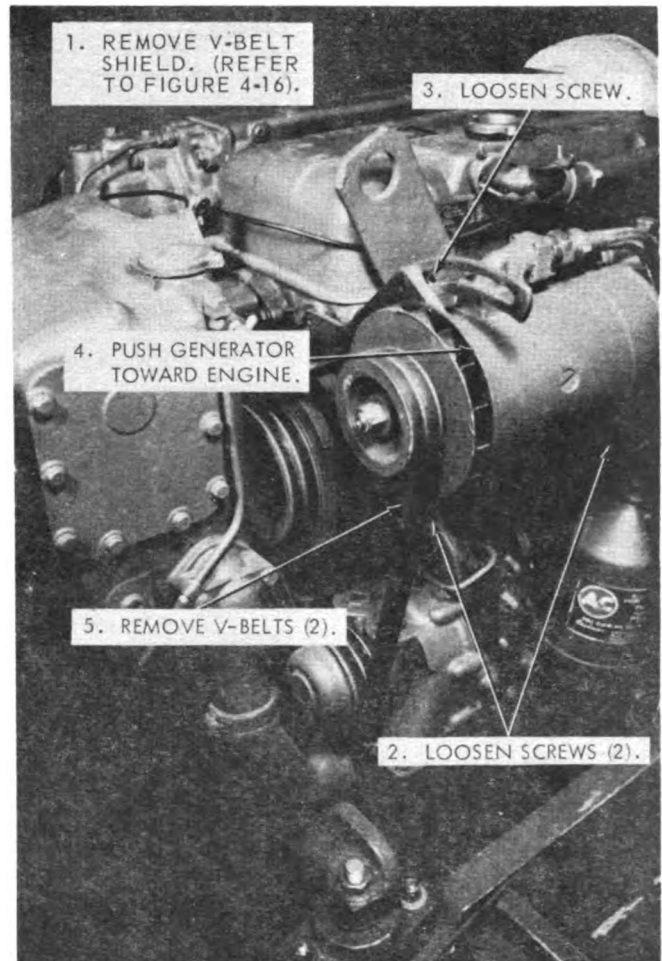
b. Inspection.

(1) Check that shutoff valve operates smoothly and easily and that it seats completely.

(2) Check all parts for cracks, breaks, distortion, or other damage.

c. Removal.

(1) Refer to figure 4-18 and remove the air silencer.



TS002989

Figure 4-17. V-belts removal.

(2) Refer to A, figure 4-13 and remove the control cable.

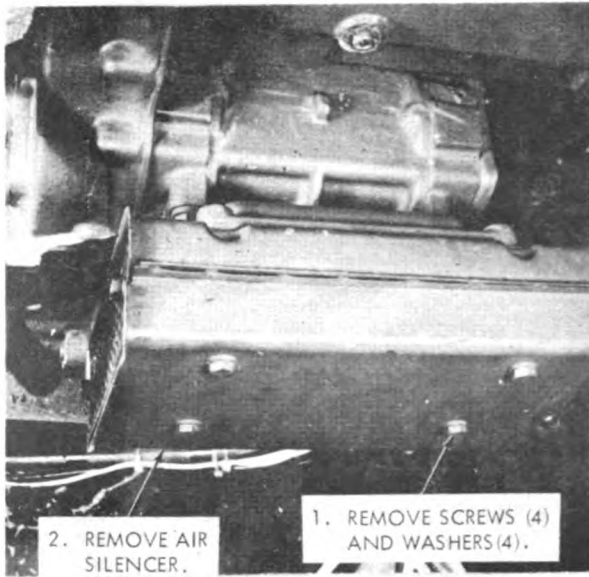
(3) Refer to figure 4-19 and remove the air shutdown housing and blower screen.

d. Cleaning. Clean the blower air shutoff valve housing screen with fuel oil and dry with compressed air.

e. Installation. Install the air shutoff valve housing and blower screen in the reverse order of removal.

4-21. Air Box Drain

a. General. The air box drain is mounted on the left side of the cylinder block below the governor. During normal engine operation, water vapor from the air charge and a slight amount of fuel and lubricating oil fumes condense and settle on the bottom of the air box in the cylinder



TS002990

Figure 4-18. Air silencer removal.

block. This condensate is removed by air box pressure through the air box drain tube. The drain tube should be checked occasionally to ensure that air is flowing from the tube; if it is not, the tube must be cleaned out.

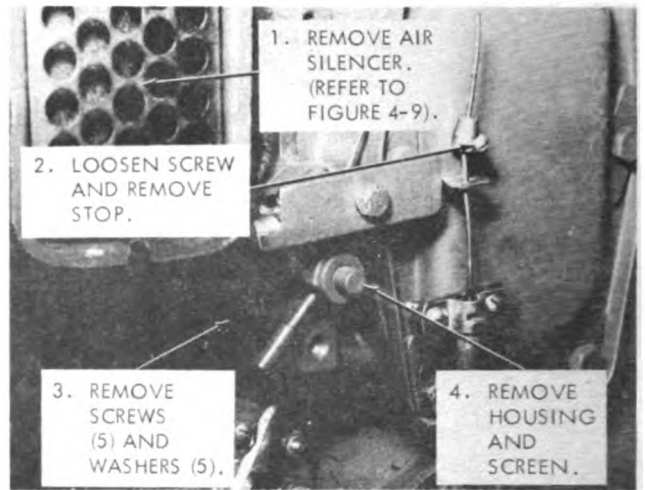
b. Removal. Refer to figure 4-20 and remove the drain tube.

c. Cleaning. Blow out the drain tube with compressed air and flush it with fuel oil.

d. Installation. Install the air box drain tube in the reverse order of removal.

4-22. Valve Rocker Cover

a. General. The valve rocker cover encloses the valve and injector rocker arms at the top of the



TS002991

Figure 4-19. Air shut-down housing removal.

cylinder head. The cover includes a breather assembly and an oil filler cap.

b. Removal.

(1) Refer to figure 4-21 and remove the valve rocker cover.

(2) Remove all traces of old gasket from cover and cylinder head.

c. Inspection.

(1) Check that sealing edge of cover is free of dents, nicks, and distortion.

(2) Check that breathing tube is securely seated in cover.

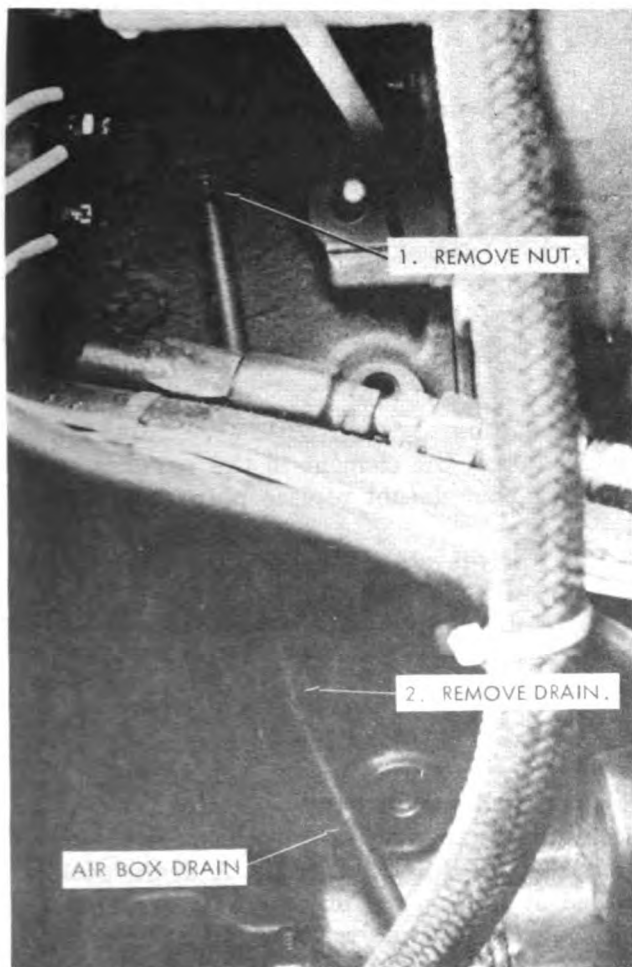
(3) Inspect condition of filler cap and gasket.

d. Replacement.

(1) Replace the cover gasket.

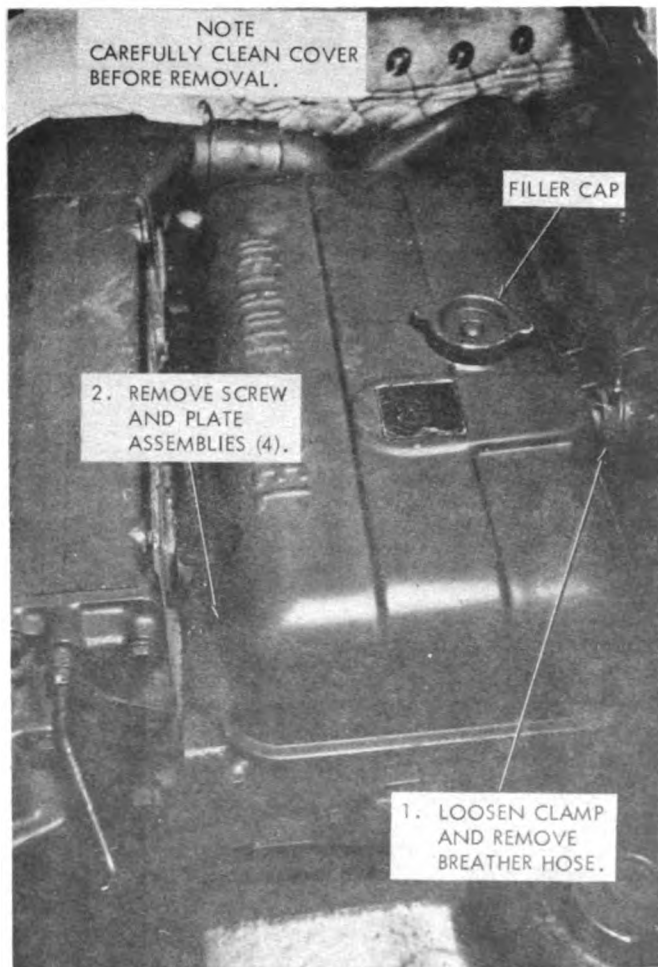
(2) Replace cover or cap if damaged.

e. Installation. Install the valve rocker cover in the reverse order of removal.



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Figure 4-20. Air box drain removal.



TS002993

Figure 4-21. Valve rocker cover removal.

Section VII. MAINTENANCE OF FUEL SYSTEM

4-23. General

This section contains the maintenance procedures for the fuel system. A description of the fuel system is given in paragraph 1-5.

WARNING

Maintenance procedures for the fuel system must be performed in a well ventilated area. Do not allow any sparks or flames in the vicinity.

4-24. Fuel Strainer

a. General. A fuel strainer is located on the inside of the hull next to each engine in the line between the fuel shutoff valve and the fuel pump. The strainer contains a density type ele-

ment capable of filtering out particles of 30 microns. A drain cock is provided at the bottom of the strainer shell to permit removal of dirt and water accumulations.

b. Removal.

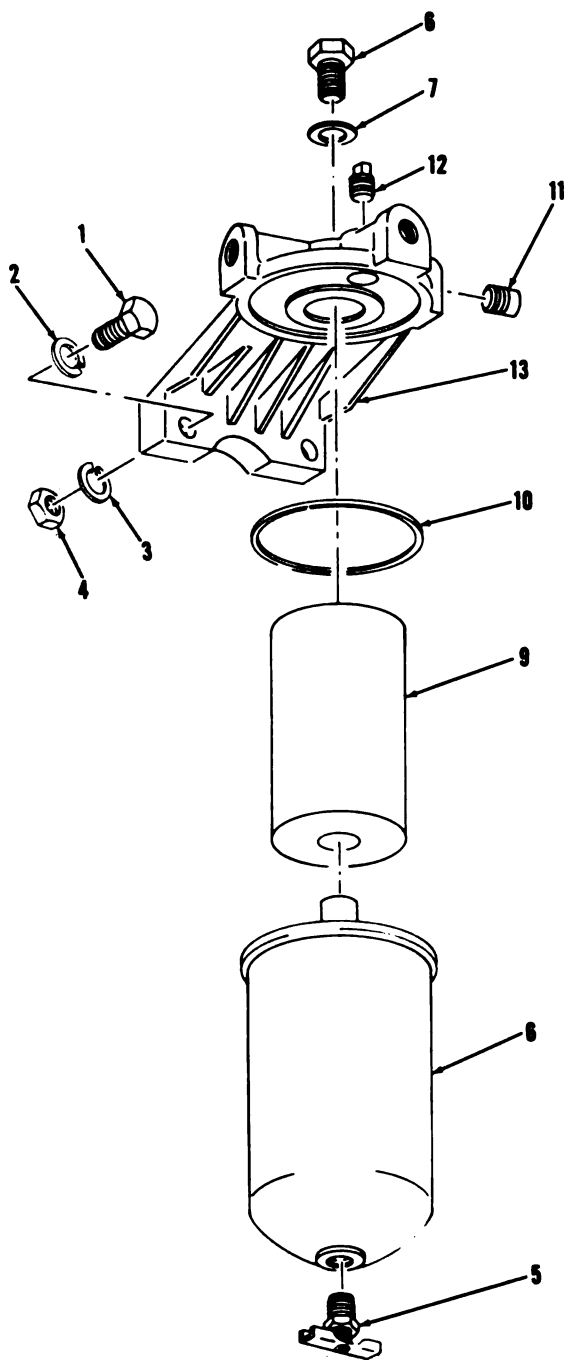
(1) Place a container under the strainer assembly, remove plug (12, fig. 4-22), open drain cock (5), and drain fuel.

(2) Disconnect hose assemblies from strainer and cap hose openings.

(3) Support the shell (8), remove nuts (4), lockwashers (2 and 3), and screws (1) and remove the strainer assembly.

c. Installation.

(1) Install the strainer assembly in the reverse order of removal, but do not replace plug (12, fig. 4-22)).



TS00299a

- | | |
|---------------|------------|
| 1. Screw | 8. Shell |
| 2. Lockwasher | 9. Element |
| 3. Lockwasher | 10. Gasket |
| 4. Nut | 11. Plug |
| 5. Cock | 12. Plug |
| 6. Screw | 13. Cover |
| 7. Washer | |

Figure 4-22. Fuel strainer and element, exploded view.

(2) Fill the strainer with fuel and install plug (12).

(3) Start engine and check filter for leaks.

4-25. Fuel Strainer Element Replacement

a. Removal.

(1) Place a suitable container under the strainer, remove plug (12, fig. 4-22) and open drain cock (5). Allow fuel to drain.

(2) Support shell (8) with one hand. Unscrew screw (6), and remove shell (8), element (9), and gasket (10). Discard element and gasket.

b. Installation.

(1) Install the element in the reverse order of removal, but do not replace plug (12, fig. 4-22).

(2) Fill the strainer with fuel and install plug (12).

(3) Start engine and check filter for leaks.

4-26. Fuel Filter

a. General. The fuel filter is mounted on the left side of the engine in the line between the fuel pump and the fuel inlet manifold. The filter contains a paper-type element that can remove particles as small as 10 microns. A drain cock is installed at the bottom of the filter shell to allow removal of dirt and water accumulations.

b. Removal.

(1) Place a suitable container under the fuel filter. Remove plug (15, fig. 4-23) open drain cock (3), and drain fuel.

(2) Disconnect hose assemblies.

(3) Support the shell (6); remove bolts (1), lockwashers (2), and remove the filter.

c. Installation.

(1) Install the filter in the reverse order of removal, but do not replace plug (15, fig. 4-23).

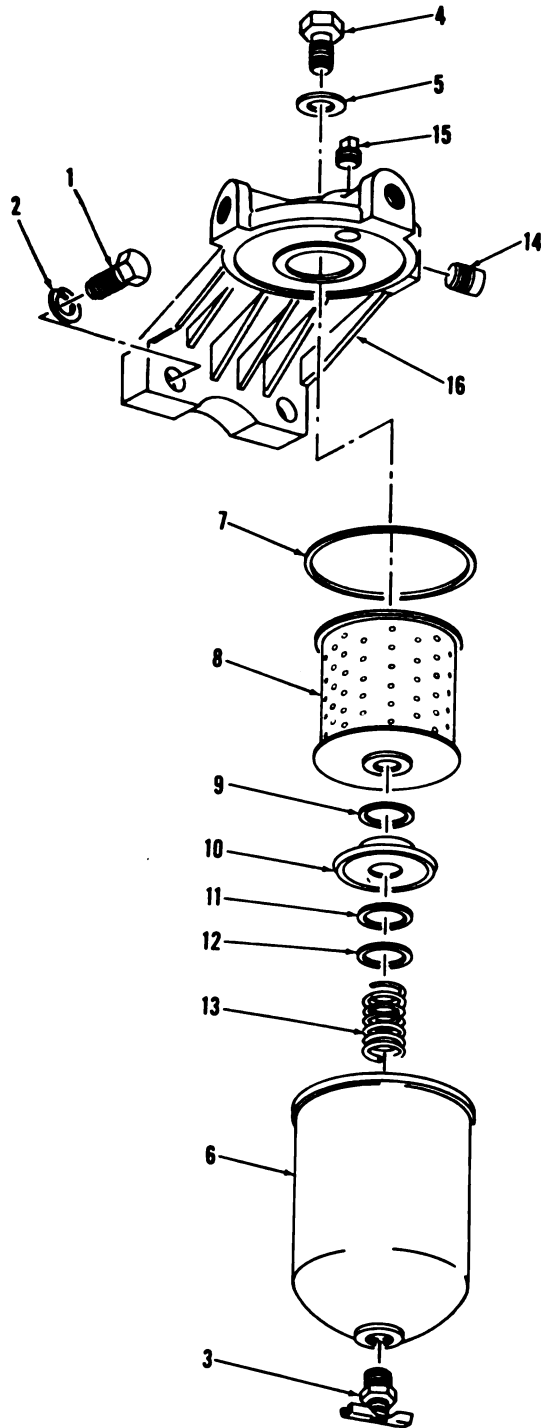
(2) Fill the filter with fuel and replace plug (15).

4-27. Fuel Filter Element Replacement

a. Removal.

(1) Place a suitable container under the filter, remove plug (15, fig. 4-23) and open drain cock (3). Allow fuel to drain.

(2) Support shell (6) with one hand. Unscrew screw (4), and remove shell (6), element (8), and gasket (7). Discard element and gasket.



TS002995

- | | |
|---------------|-------------|
| 1. Screw | 9. Retainer |
| 2. Lockwasher | 10. Seal |
| 3. Cock | 11. Seal |
| 4. Screw | 12. Seat |
| 5. Washer | 13. Spring |
| 6. Shell | 14. Plug |
| 7. Gasket | 15. Plug |
| 8. Element | 16. Cover |

Figure 4-23. Fuel filter and element, exploded view.

b. Installation.

- (1) Install the element in the reverse order of removal, but do not replace plug (15, fig. 4-23).
- (2) Fill the filter with fuel and install plug (15).

4-28. Fuel Pump

a. General. The positive displacement gear-type pump is mounted on the governor weight housing on the left side of the engine. It is driven by the governor shaft. The pump transfers fuel from the tank to the fuel injectors. The pump supplies fuel to the injectors under pressure.

b. Removal. Refer to figure 4-24 and remove the fuel pump.

c. Installation. Install the fuel pump in the reverse order of removal.

4-29. Fuel Shut Off Valve

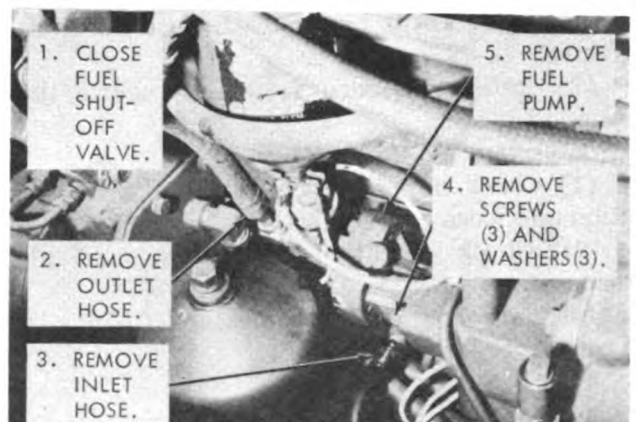
a. General. A manually-operated shutoff valve is located in each fuel line on each side of the operator's cockpit. The valves control the flow of fuel from the tank to the strainers in the engine compartment.

b. Removal.

- (1) Use a suitable syphon and drain the fuel tank.
- (2) Refer to figure 4-25 and remove the valve.

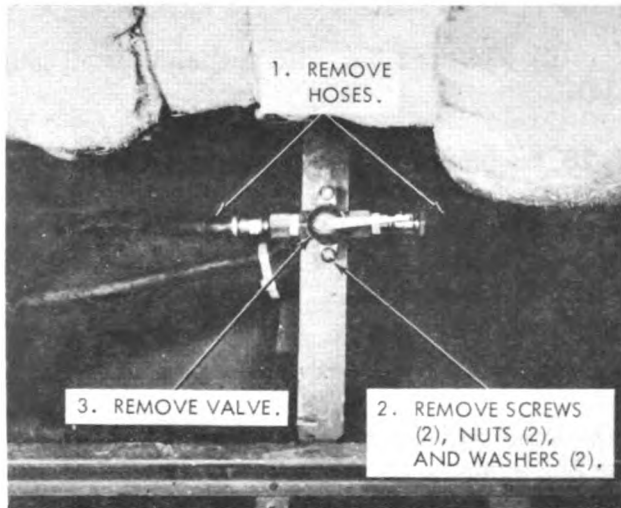
c. Inspection.

- (1) Check that the valve handle operates smoothly.
- (2) Check condition of threads.



TS002996

Figure 4-24. Fuel pump removal.



TS002997

Figure 4-25. Fuel shut-off valve removal.

d. Installation. Install the valve in the reverse order of removal.

4-30. Fuel Lines and Fittings

a. General. Fuel is provided to each engine by a separate supply system. Fuel is drawn from the tank by the engine fuel pump. The fuel is routed through hoses from the tank to a fuel shutoff valve, then to a strainer, and on to the engine. Excess fuel is returned to the fuel tank by way of a separate return hose from each engine.

b. Removal.

(1) If any of the lines or fittings located between the fuel tank and shutoff valve are to be removed, drain the tank using a suitable syphon. If the lines between the shutoff valve and the engine are to be removed, close the shutoff valve.

(2) Refer to figure 4-26 and remove the lines and fittings.

c. Inspection.

(1) Check hoses for cracks, breaks, deterioration and loose connections.

(2) Check condition of fittings and all threads.

d. Installation. Install the lines and fittings in the reverse order of removal.

4-31. Fuel Tank

a. General. The fuel tank is located behind the operator's cockpit. The tank has a capacity of 90 gallons and is provided with a vent tube, a filler

port, two fuel suction outlets and two return fuel inlets.

b. Removal.

(1) Refer to figure 4-74 and remove the stern towing bit.

(2) Turn both fuel shutoff valves (fig. 4-26, item 32) to OFF position.

(3) Remove a fuel cap and drain fuel from tank, using a suitable syphon.

(4) Remove screws (37), nuts (38), washers (39), shield (40), gasket (41), and nipple (42).

(5) Remove mounting bolts (49), nuts (50), and washers (51), from both securing points.

(6) Loosen clamp (44), and remove vent hose (43), from adapter (57).

(7) Remove the suction hose (25) from the adapter (55) and return hose (52) from adapter (53). Repeat this step for the other suction and return hoses.

(8) Slide fuel tank into operators cockpit and remove from boat.

c. Inspection.

(1) Check tank for leaks, cracks, and corrosion.

(2) Check the inside of the tank through the filler nipple opening for signs of contamination and corrosion.

d. Cleaning and Repair

(1) *Cleaning exterior.* Wash all exterior metal surfaces with a solution of trisodium-phosphate, Federal Specification O-T-671, and water; rinse thoroughly and dry.

(2) *Cleaning interior.*

(a) Drain all liquid from the tank.

(b) Fill the tank with cold water and overflow for five minutes. Drain completely.

(c) Purge the tank with a mixture of water and purging chemical.

(d) Repeat step (b) above.

(3) *Repairs.*

(a) Repair leaks, breaks, and other damage.

(b) Damaged painted exterior surfaces should be repainted as soon as possible to prevent corrosion.

e. Installation. Install the fuel tank in reverse order of removal.

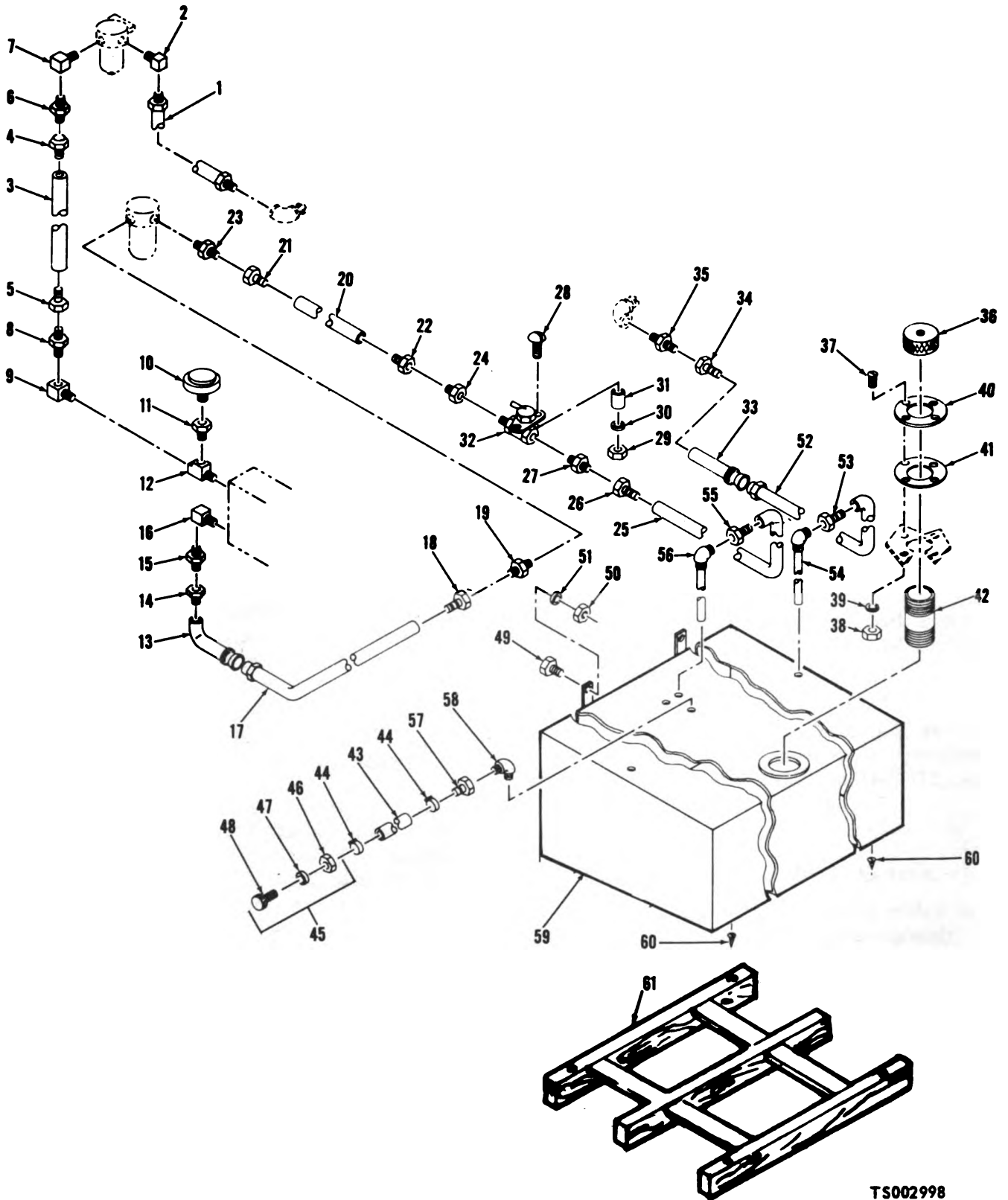


Figure 4-26. Fuel lines and fittings, exploded view.

1. Hose assembly	22. Adapter	43. Hose
2. Elbow	23. Bushing	44. Clamp
3. Hose assembly	24. Bushing	45. Vent assembly
4. Adapter	25. Hose	46. Nut
5. Adapter	26. Adapter	47. Washer
6. Bushing	27. Bushing	48. Vent
7. Elbow	28. Screw	49. Bolt
8. Bushing	29. Nut	50. Nut
9. Elbow	30. Lockwasher	51. Flat washer
10. Alarm switch	31. Spacer	52. Hose assembly
11. Bushing	32. Shut-off valve	53. Adapter
12. Pipe tee	33. Hose assembly	54. Suction pipe
13. Hose assembly	34. Adapter	55. Adapter
14. Adapter	35. Bushing	56. Suction pipe
15. Bushing	36. Cap	57. Adapter
16. Elbow	37. Screw	58. Elbow
17. Hose assembly	38. Nut	59. Tank
18. Adapter	39. Flat washer	60. Screw
19. Bushing	40. Shield	61. Support
20. Hose	41. Gasket	
21. Adapter	42. Nipple	

Figure 4-26. — Continued.

Section VIII. MAINTENANCE OF ENGINE LUBRICATION SYSTEM

4-32. General

This section contains the maintenance procedures for the engine lubricating oil system. The lubricating system for the transmission is presented in Section XIV. The transmission oil system is independent of the engine system. A description of the engine lubrication oil system is given in paragraph 1-5.

4-33. Oil Change

a. Oil Draining. Due to the lack of room between the oil pan and the hull, the oil must be pumped out of the crankcase. A manual pump (fig. 4-27) has been provided for this purpose. The pump is stowed on a bracket forward on the starboard side of the engine compartment. The oil capacity of the engine is 9.5 quarts.

(1) Remove plug from drain tube and attach pump intake hose to drain tube (fig. 4-27).

(2) Place a suitable container (at least 10 quart capacity) in the bilge, position the pump outlet hose over the container and pump the pump until oil ceases to discharge from the outlet hose.

(3) Remove the pump intake hose from the drain tube and replace the plug.

b. Oil Filling.

(1) Replace oil filter element (para 4-35).

(2) Remove oil filler cap on valve rocker cover and add 9.5 quarts of oil. Replace cap.

(3) Start engine and check for leaks. Stop engine. Allow 5 minutes for oil to drain to crankcase and check oil level with dipstick.

CAUTION

Do not operate the engine if the oil level is below the "L" mark or above the "F" mark on the dipstick.

4-34. Lubricating Oil Filter

a. General. The engine lubricating full-flow oil filter is mounted on the left side of the engine and collects impurities in the oil. A valve, which opens at approximately 18-to-20 psi, is located in the filter base to bypass the oil directly to the oil cooler should the filter become clogged.

b. Removal.

(1) Place a suitable container beneath the filter, remove plug (10, fig. 4-28), and drain the oil.

(2) Support the shell (3), remove screws (11), lockwashers (12), and washer (13); and remove filter and gasket (14).

c. Installation.

(1) Place the oil filter in position using a new gasket (14) and secure with screws (11), lockwashers (12), and washers (13).

(2) Add one quart of lubricating oil through the valve rocker cover fillcap hole.

(3) Start the engine and check the oil filter for leaks. Stop the engine. Allow five minutes for the oil to drain into the crankcase and check the oil level.

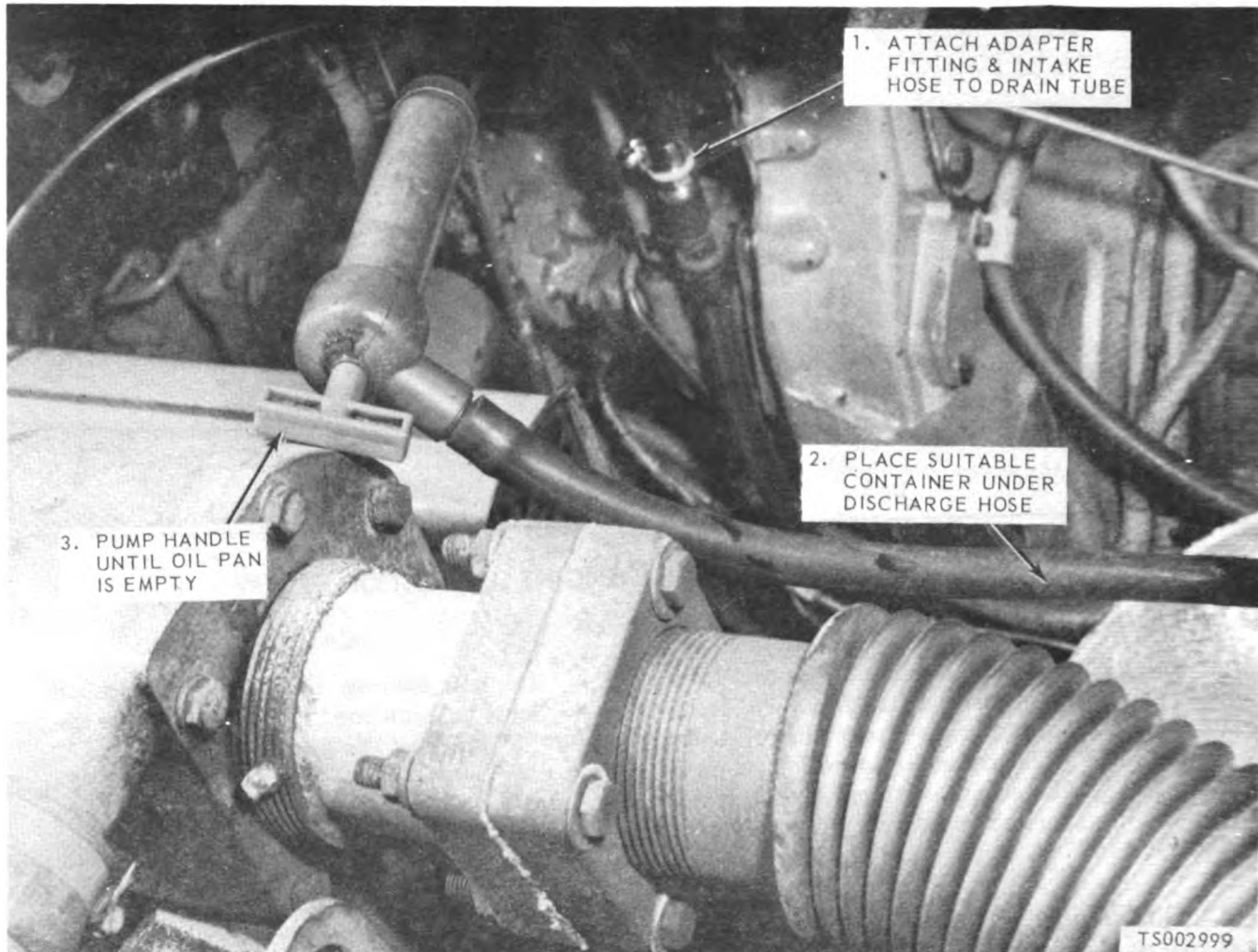


Figure 4-27. Engine lubricating oil drain pump.

4-35. Lubricating Oil Filter Element

a. Removal.

(1) Place a suitable container under the filter, remove plug (10, fig. 4-28) and drain the oil.

(2) Loosen bolt (1) until shell (3) is free, and remove shell. Remove and discard element (5) and gasket (4).

b. Installation.

(1) Install plug (10, fig. 4-28) and gasket (4).

(2) Insert element (5) in shell (3) and attach shell to adapter (19) by holding gasket (4) in position and allow shell to work gasket into cover groove while tightening bolt (1).

(3) Add one quart of lubricating oil through valve rocker cover fillcap hole.

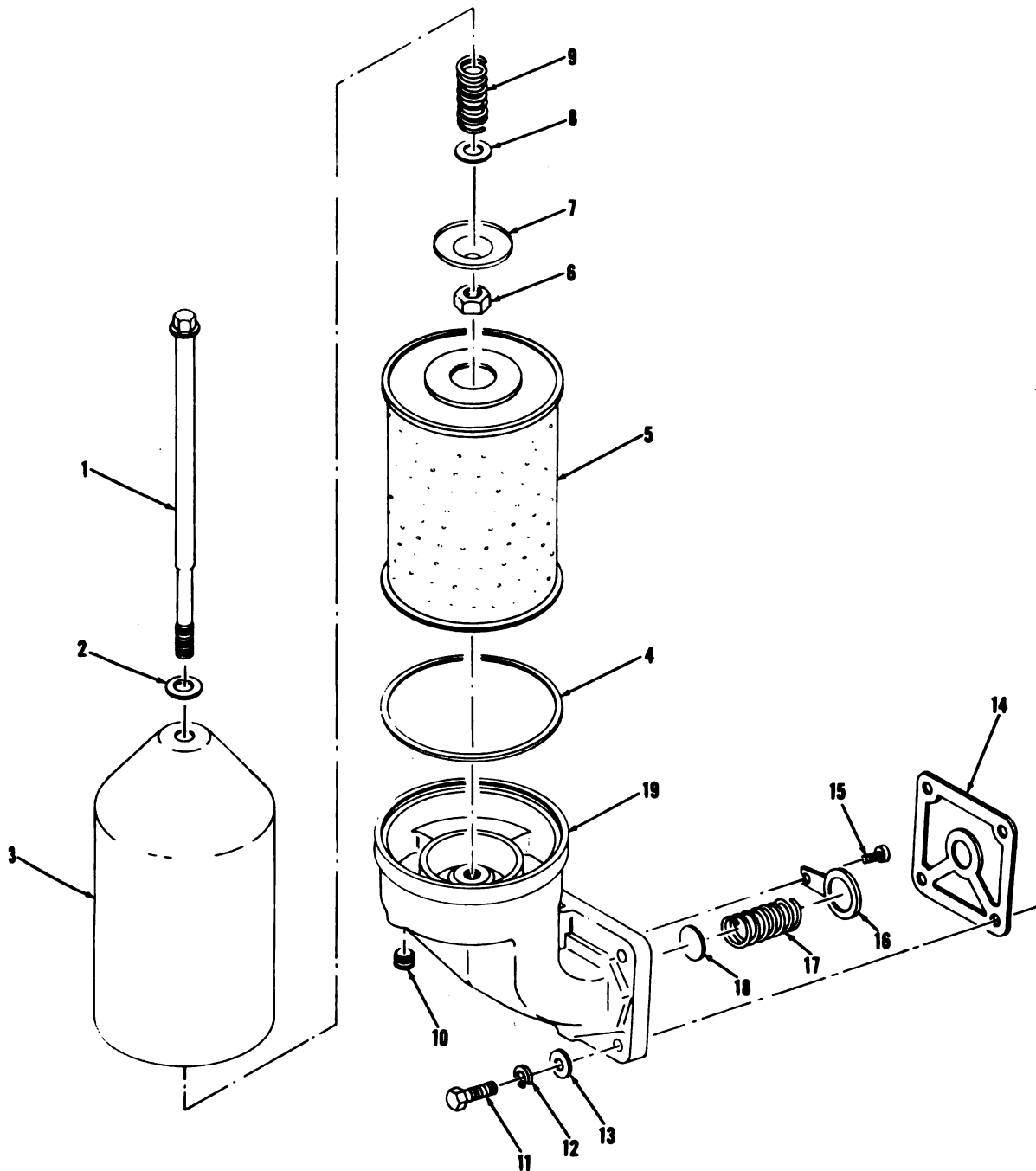
(4) Start engine and check oil filter for leaks. Stop engine. Allow five minutes for oil to drain into crankcase and check oil level.

4-36. Transmission Oil Cooler

a. *General.* The transmission oil cooler is located on the left forward portion of the cylinder block. Return oil from the transmission circulates through a core within the cooler. Surrounding the core is a housing through which the coolant flows. Heat from the oil is transferred to the coolant. From the cooler, the oil returns to the transmission. The coolant used is from the engine cooling system.

b. Removal.

(1) Open the engine lubricating oil cooler drain cock (fig. 4-29) and drain the cooling system.



- 1. Bolt
- 2. Washer
- 3. Shell
- 4. Gasket
- 5. Element
- 6. Nut
- 7. Retainer

- 8. Washer
- 9. Spring
- 10. Plug
- 11. Screw
- 12. Lockwasher
- 13. Washer
- 14. Gasket

- 15. Screw
- 16. Retainer
- 17. Spring
- 18. Valve
- 19. Adapter

TS003000

Figure 4-28. Engine lubricating oil filter and element, exploded view.

(2) Refer to figure 4-29 and remove the transmission oil cooler.

c. Replacement. Discard and replace the gasket.

d. Installation.

(1) Install the oil cooler in the reverse order of removal.

(2) Refill the cooling system and the transmission.

4-37. Engine Lubricating Oil Cooler

a. General. The engine lubricating oil cooler is mounted on the lower left side of the engine at the front of the cylinder block. The cooler contains a core through which the oil circulates. Surrounding the core is a housing through which the

coolant flows. Heat from the oil is transferred to the coolant. From the cooler, the oil and the coolant pass to the cylinder block. A valve is incorporated in the cooler which opens at 52 psi and bypasses the cooler. This allows the oil to flow directly from the pump to the cylinder block if the cooler should become clogged.

b. Removal.

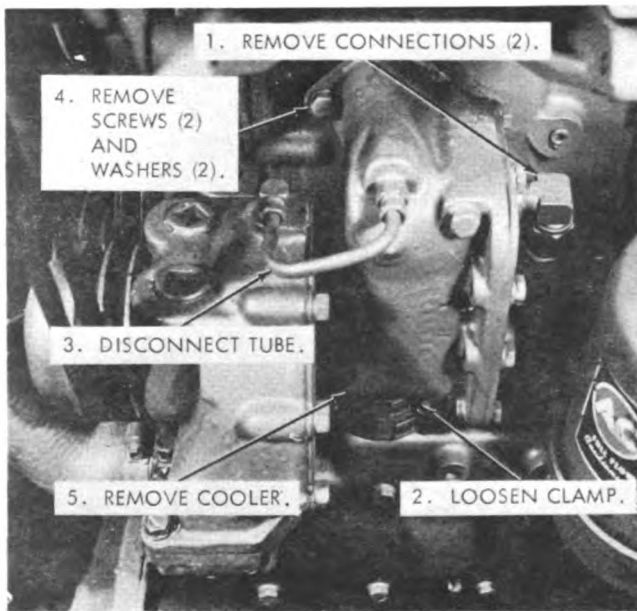
(1) Drain engine coolant and lubricating oil.

(2) Remove the water pump (fig. 4-34).

(3) Refer to figure 4-30 and remove the oil cooler.

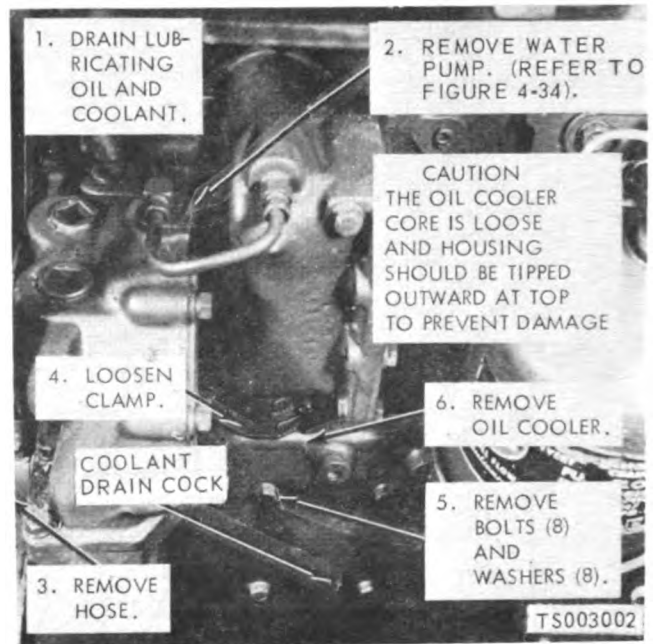
c. Replacement. Discard and replace the gasket.

d. Installation. Install the oil cooler in the reverse order of removal.



TS003001

Figure 4-29. Transmission oil cooler removal.



TS003002

Figure 4-30. Engine lubricating oil cooler, removal.

Section IX. MAINTENANCE OF EXHAUST SYSTEM

4-38. General

This section contains the maintenance procedures for the engine exhaust system. A description of the exhaust system is presented in paragraph 1-5.

4-39. Exhaust Manifold

a. General. The exhaust manifold is mounted on the right side of the cylinder head. The manifold consists of an iron casting containing an exhaust chamber that is surrounded by a water

jacket. Coolant flows from the rear of the cylinder head through the water jacket to the thermostat housing.

b. Removal.

(1) Open the oil cooler drain cock and drain the cooling system to below the level of the exhaust manifold.

(2) Refer to figure 4-31 and remove the exhaust manifold.

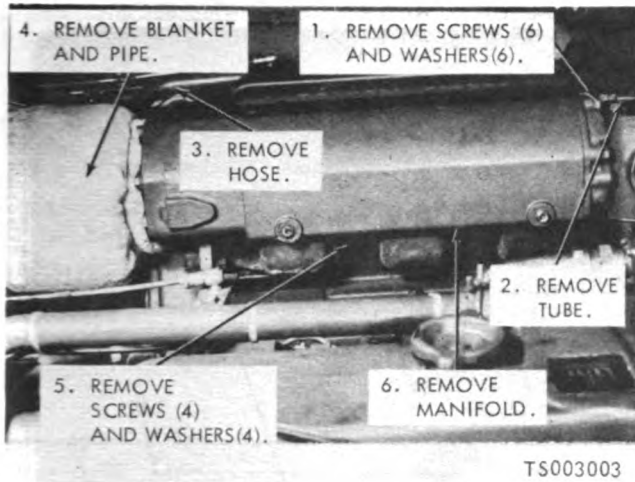


Figure 4-31. Exhaust manifold, removal.

c. Cleaning.

(1) Remove any loose scale and carbon that accumulated on the internal walls of the manifold.

(2) Clean all traces of gasket material from the cylinder head and manifold.

d. Inspection.

(1) Examine the studs for damage and condition of threads.

(2) Check all parts for breaks, cracks, distortion or other damage.

e. Installation. Replace the gasket. Install the exhaust manifold in the reverse order of removal. After the manifold is installed, perform the following:

(1) Close the oil cooler drain cock and fill the cooling system.

(2) Start the engine and check for leaks.

4-40. Mufflers and Exhaust Piping

a. General. The mufflers, one for each engine, are located on each side of the hull behind the operator's cockpit. Piping is connected between the rear of each exhaust manifold and its respective muffler and between the muffler and the tail pipe in the stern which vents overboard. The piping and the mufflers are wrapped in asbestos blanketing secured with lacing.

b. Inspection.

(1) Check the pipes and mufflers for cracks, breaks, or other damage.

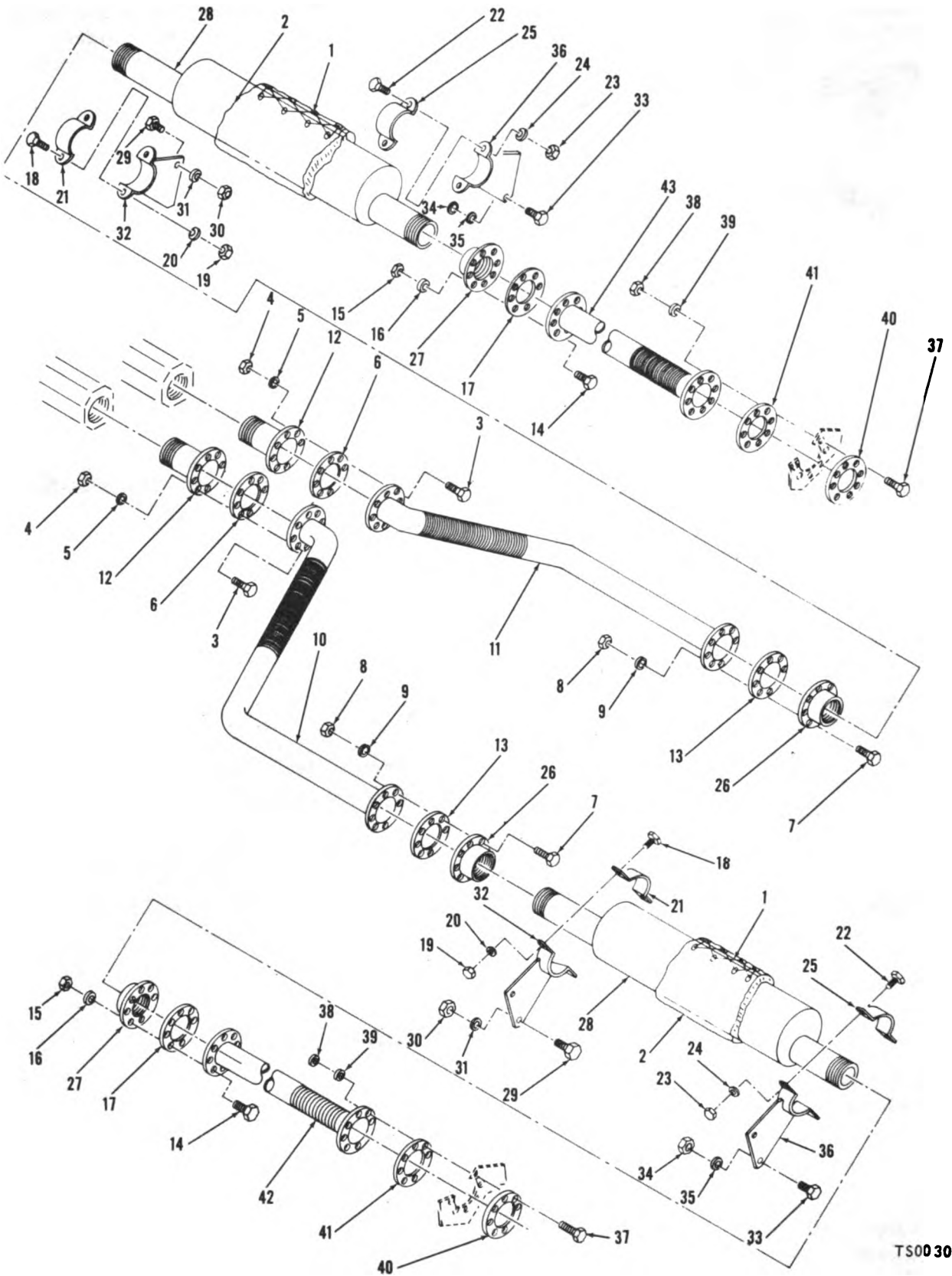
(2) Examine the fittings for condition and security of mounting.

(3) Inspect the asbestos blanketing for condition and security of lacing.

c. Removal. Refer to figure 4-32 and remove mufflers and piping.

d. Replacement. Replace any damaged part.

e. Installation. Install the mufflers and pipes in the reverse order of removal.



TS003004

Figure 4-32. Mufflers and exhaust piping, exploded view.

- | | | |
|-----------------------|----------------|------------------------|
| 1. Lacing wire | 16. Lockwasher | 31. Lockwasher |
| 2. Insulation blanket | 17. Gasket | 32. Bracket |
| 3. Bolt | 18. Bolt | 33. Bolt |
| 4. Nut | 19. Nut | 34. Nut |
| 5. Lockwasher | 20. Lockwasher | 35. Lockwasher |
| 6. Gasket | 21. Clamp | 36. Bracket |
| 7. Bolt | 22. Bolt | 37. Capcrew |
| 8. Nut | 23. Nut | 38. Nut |
| 9. Lockwasher | 24. Lockwasher | 39. Lockwasher |
| 10. Port header | 25. Clamp | 40. Ring |
| 11. Starboard header | 26. Flange | 41. Gasket |
| 12. Flange | 27. Flange | 42. Port tailpipe |
| 13. Gasket | 28. Muffler | 43. Starboard tailpipe |
| 14. Bolt | 29. Bolt | |
| 15. Nut | 30. Nut | |

Figure 4-32 — Continued

Section X. MAINTENANCE OF COOLING SYSTEM

4-41. General

This section contains the maintenance instructions for the engine cooling system. A description of the cooling system is contained in paragraph 1-5.

4-42. Cooling System Maintenance

a. General. The engine coolant absorbs the heat developed by the combustion in the engine cylinders. Most of this heat is absorbed by the coolant in water jackets surrounding the exhaust valves, cylinder liners, and pistons. In addition, heat absorbed by the lubricating oil is transferred to the coolant by the engine and transmission oil coolers.

NOTE

The boat must be removed from the water to perform maintenance on the heat exchangers.

b. Inspection.

(1) Inspect the heat exchangers for leakage, drainage, and condition of connections. Tighten hose clamps on fittings. Replace defective hoses. Report a defective heat exchanger to direct support maintenance.

(2) Check that the heat exchanger drain plug and engine oil cooler drain cock are securely closed.

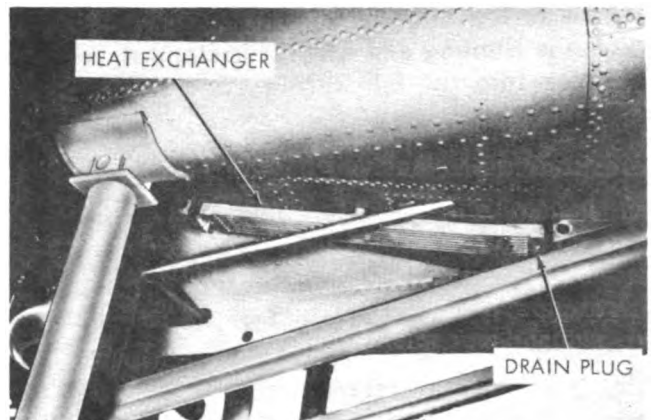
(3) Check that expansion tank fillcap valve seats operate freely and that cap securely mounts on expansion tank neck. Replace a defective cap.

(4) Inspect all hoses and fittings for deterioration, security, and leakage. Tighten loose connections. Replace defective hoses or fittings.

c. Draining.

(1) Remove expansion tank fill cap.

(2) Remove drain plug (fig. 4-33) from heat exchanger, and open engine oil cooler drain cock (fig. 4-30).



TS003005

Figure 4-33. Heat exchanger drain plug.

(3) After the system has drained, replace the heat exchanger drain plug and close the oil cooler drain cock.

CAUTION

If the engine is not to be used and freezing weather is anticipated, the system will not be filled with antifreeze; leave the drain plug out and the drain cock open. Water trapped within the engine will expand when frozen and possibly cause damage.

d. Seasonal Flushing. The cooling system should be flushed in the spring and fall. Flushing cleans the system of antifreeze in the spring and of the summer rust inhibitor in the fall.

(1) Drain the system as given in paragraph c above.

(2) Fill the system with soft, clean water.

CAUTION

If the engine is hot, fill the system slowly to prevent rapid cooling and distortion of parts.

- (3) Start the engine and operate it for 15 minutes to thoroughly circulate the water.
- (4) Stop the engine and drain the system completely.
- (5) Refill the system with the proper coolant for the season.

e. Contaminated Engine Flushing. When the engine cooling or lubricating system becomes contaminated, it should be flushed thoroughly immediately to remove the contaminants before serious engine or transmission damage occurs. One possible cause of such contamination is a cracked oil cooler core. With a cracked core, oil will be forced into the cooling system while the engine is running and when it is stopped, coolant will leak into the lubricating system. If engine contamination is suspected, report to direct support maintenance immediately.

f. Filling.

- (1) Install the heat exchanger drain plug, and close the oil cooler drain cock.
- (2) Remove the expansion tank fill cap and add coolant to within 2 inches of the fill neck and replace the cap.

CAUTION

If the engine is hot, fill the system slowly to prevent rapid cooling and distortion of the parts.

- (3) Remove the vent plug (B, fig. 4-37) from the thermostat housing to vent any air in the system. Excessive amounts of air can hinder flow due to pump cavitation or can cause hot spots.
- (4) Replace the thermostat housing vent plug.
- (5) Start the engine and after the engine has attained its normal operating temperature, again vent the thermostat housing and check the coolant level. The coolant level should be within 2 inches of the filler neck. If necessary, add coolant.

4-43. Water Pump

a. General. The water pump is mounted on top of the engine oil cooler housing on the left of the engine. The pump is a centrifugal-type that circulates the coolant from the expansion tank to the oil coolers and the engine. The pump

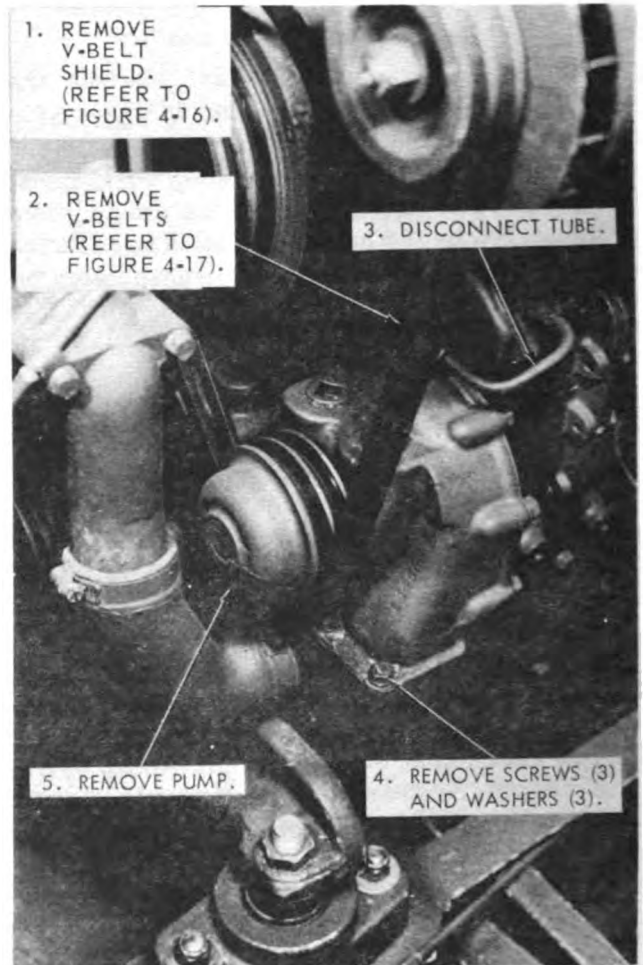
is driven by the engine camshaft through pulleys and a V-belt.

b. Removal.

- (1) Open the engine oil cooler drain cock (fig. 4-30) and drain the cooling system.
- (2) Refer to figure 4-34 and remove the pump.

c. Installation.

- (1) Remove all traces of gasket material from the pump and oil cooler, discard the gasket, and replace it.
- (2) Install the water pump in the reverse order of removal.
- (3) Close the engine oil cooler drain cock and fill the cooling system.



TS003006

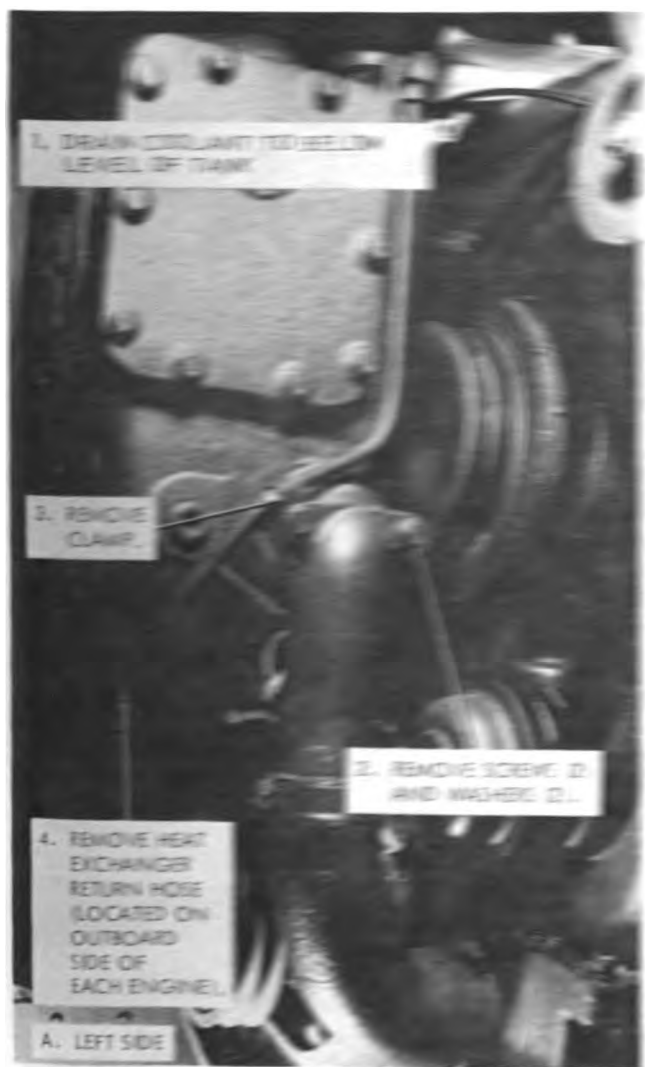
Figure 4-34. Water pump removal.

1. Drain Coolant to Below Level of Tank

2. REMOVE CLAMP.

3. REMOVE SCREW (2) AND WASHER (2).

4. REMOVE HEAT EXCHANGER RETURN HOSE (LOCATED ON OUTBOARD SIDE OF EACH ENGINE).



5. REMOVE SCREW (2) AND WASHER (2).

6. REMOVE SCREWS (2), WASHERS (2), AND SPACERS (2).

7. REMOVE SCREW (2) AND WASHER (2).

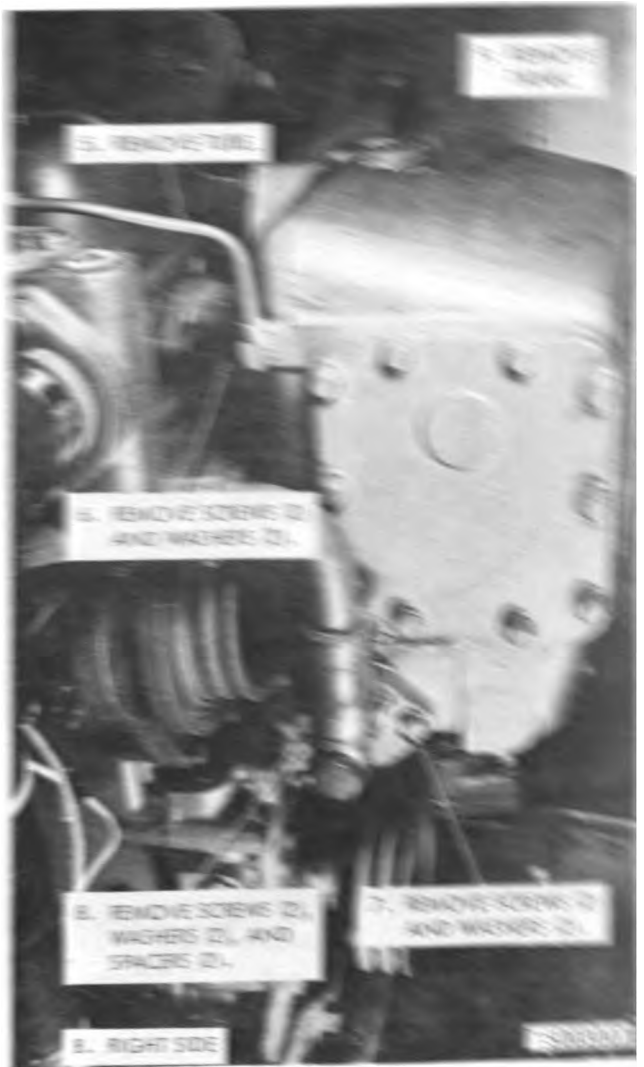


Figure 4-8. Expansion tank removal.

CAUTION.

If the engine is hot, fill the system slowly to prevent rapid cooling and distortion of parts.

(3) Start the engine and operate it for 15 minutes to thoroughly circulate the water.

(4) Stop the engine and drain the system completely.

(5) Refill the system with the proper coolant for the season.

e. Contaminated Engine Flushing. When the engine cooling or lubricating system becomes contaminated, it should be flushed thoroughly immediately to remove the contaminants before serious engine or transmission damage occurs. One possible cause of such contamination is a cracked oil cooler core. With a cracked core, oil will be forced into the cooling system while the engine is running and when it is stopped, coolant will leak into the lubricating system. If engine contamination is suspected, report to direct support maintenance immediately.

f. Filling.

(1) Install the heat exchanger drain plug, and close the oil cooler drain cock.

(2) Remove the expansion tank fill cap and add coolant to within 2 inches of the fill neck and replace the cap.

CAUTION

If the engine is hot, fill the system slowly to prevent rapid cooling and distortion of the parts.

(3) Remove the vent plug (B, fig. 4-37) from the thermostat housing to vent any air in the system. Excessive amounts of air can hinder flow due to pump cavitation or can cause hot spots.

(4) Replace the thermostat housing vent plug.

(5) Start the engine and after the engine has attained its normal operating temperature, again vent the thermostat housing and check the coolant level. The coolant level should be within 2 inches of the filler neck. If necessary, add coolant.

4-43. Water Pump

a. General. The water pump is mounted on top of the engine oil cooler housing on the left of the engine. The pump is a centrifugal-type that circulates the coolant from the expansion tank to the oil coolers and the engine. The pump

is driven by the engine camshaft through pulleys and a V-belt.

b. Removal.

(1) Open the engine oil cooler drain cock (fig. 4-30) and drain the cooling system.

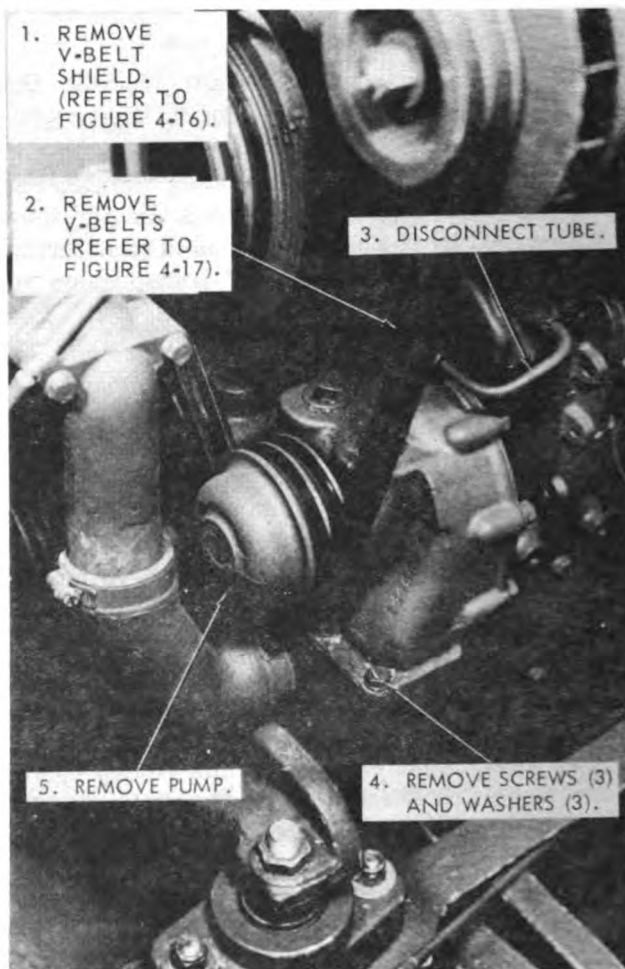
(2) Refer to figure 4-34 and remove the pump.

c. Installation.

(1) Remove all traces of gasket material from the pump and oil cooler, discard the gasket, and replace it.

(2) Install the water pump in the reverse order of removal.

(3) Close the engine oil cooler drain cock and fill the cooling system.



TS003006

Figure 4-34. Water pump removal.

4-44. Expansion Tank

a. General. The expansion tank is located at the front of the engine. Coolant is drawn from the tank by the water pump and is circulated through the cooling system. Coolant is returned to the tank from the heat exchanger or the thermostat housing.

b. Removal.

- (1) Open the engine oil cooler drain cock (fig. 4-30) and drain the cooling system.
- (2) Refer to figure 4-35 and remove the expansion tank.

c. Inspection.

- (1) Check the expansion tank valves for proper operation.
- (2) Examine the tank for cracks, breaks, and other damage.

d. Installation.

- (1) Refer to figure 4-35 and install the expansion tank in reverse order of removal, using new gaskets.
- (2) Close the engine oil cooler drain cock and fill the cooling system.

4-45. Thermostat and Housing

a. General. The thermostat is in a housing mounted on the water outlet (forward) end of the exhaust manifold. The thermostat is a blocking type, and automatically controls the temperature of the engine coolant. At coolant temperatures below approximately 170 F, the thermostat valve remains closed and routes the coolant to the expansion tank. As the coolant temperature rises, the valve begins to open, restricting the passage to the expansion tank and the coolant passes to the heat exchanger.

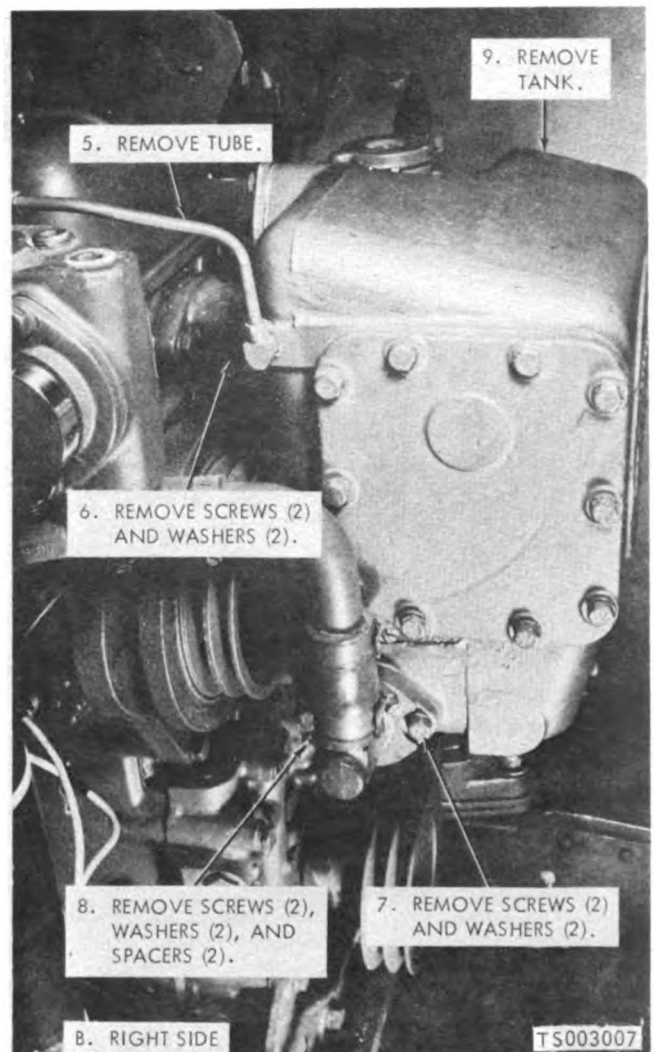
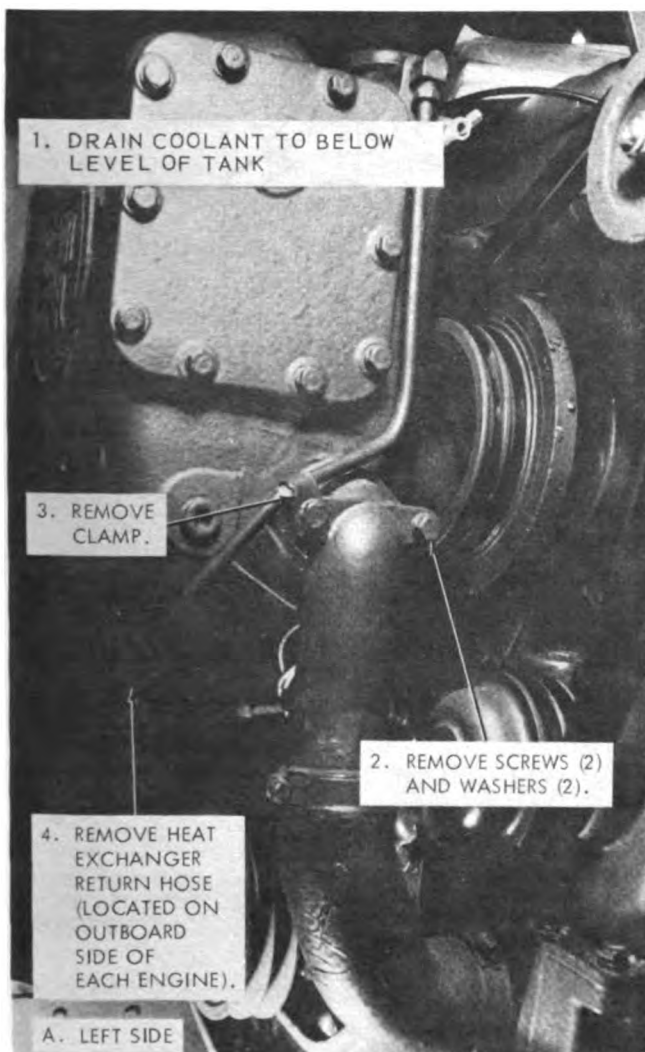


Figure 4-35. Expansion tank removal.

b. Thermostat.

(1) Removal.

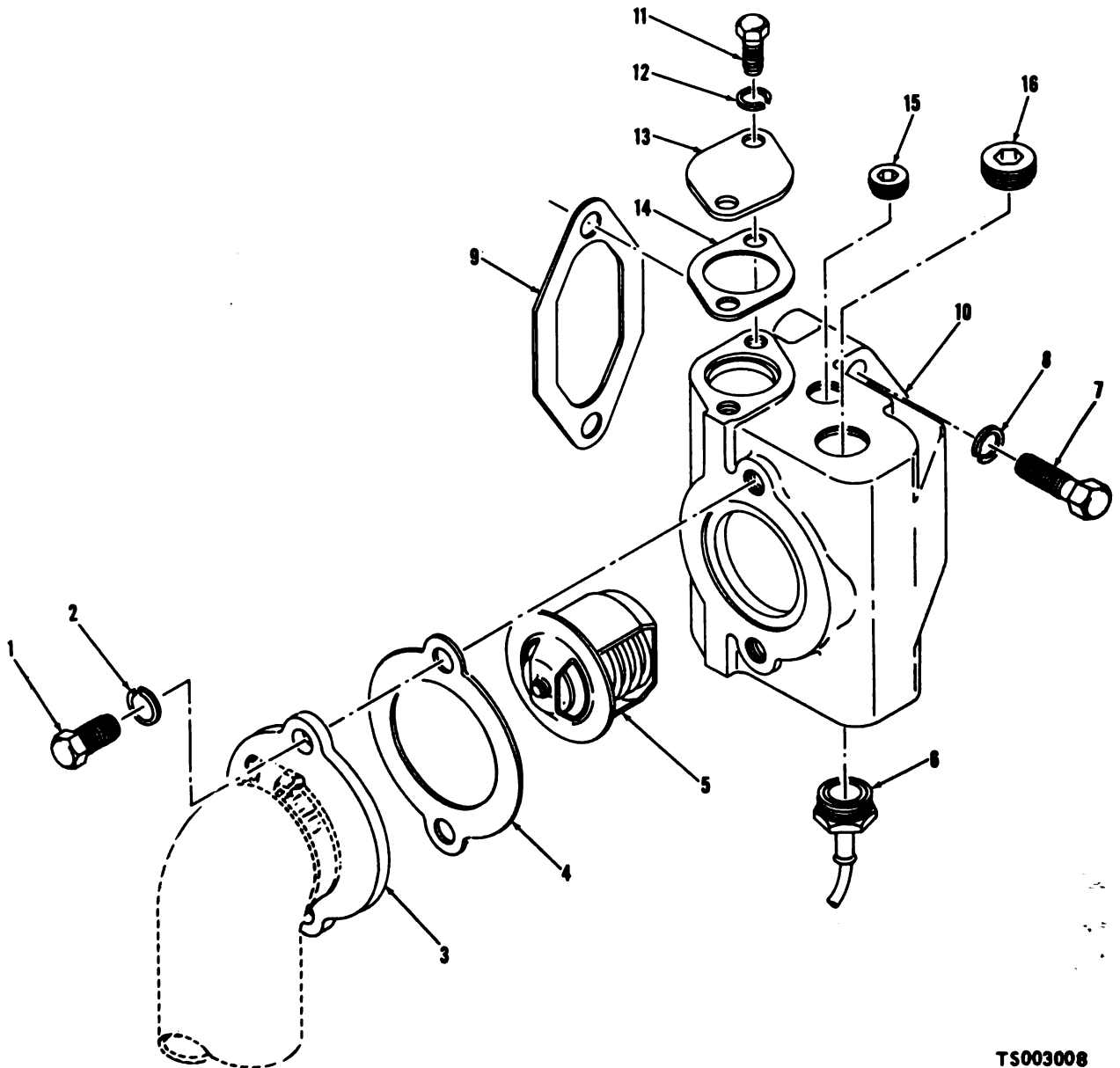
(a) Open the oil cooler drain cock (fig. 4-30) and drain the cooling system below the level of the thermostat.

(b) Remove screws (1, fig. 4-36), lock-washers (2), flange (3), gasket (4), and thermostat (5). Discard the gasket and remove all gasket material from housing and flange.

(2) Inspection.

(a) Immerse the thermostat in water and suspend a thermometer in the water.

(b) Heat the water. The thermostat valve should begin to open when the water temperature reaches 167 F to 172 F. The valve should be fully open at approximately 190F to 192F.



TS003008

- 1. Bolt
- 2. Washer
- 3. Flange
- 4. Gasket
- 5. Thermostat
- 6. Sensor

- 7. Bolt
- 8. Washer
- 9. Gasket
- 10. Housing
- 11. Bolt
- 12. Washer

- 13. Flange
- 14. Gasket
- 15. Plug
- 16. Plug

Figure 4-36. Thermostat housing, exploded view.

(c) Check the cleanliness of the thermostat seating surface in the housing and the water outlet elbow.

(3) *Replacement.* If the thermostat fails the inspection in the above paragraph, replace the thermostat.

(4) *Installation.* Using new gasket, install the thermostat in the reverse order of removal.

c. Thermostat Housing.

(1) *Removal.*

(a) Open the engine oil cooler drain cock (fig. 4-30) and drain the cooling system below the level of the thermostat housing.

(b) Refer to figure 4-37 and remove the thermostat housing.

(2) *Inspection.* Check the operation of the thermostat as given in paragraph 4-45b above.

(3) *Replacement.*

(a) Replace the thermostat if defective.

(b) Discard the gaskets. Remove all traces of gasket material from parts.

(4) *Installation.*

(a) Using a new gasket, install the housing in the reverse order of removal.

(b) Close the engine oil cooler drain cock and fill the cooling system.

4-46. Anodes

a. General. Anodes are provided to neutralize the electrolytic action of the surrounding water on the hull of the boat. The anodes and bolt are mounted in guards located forward of and behind each heat exchanger.

b. Removal.

(1) Remove the boat from the water.

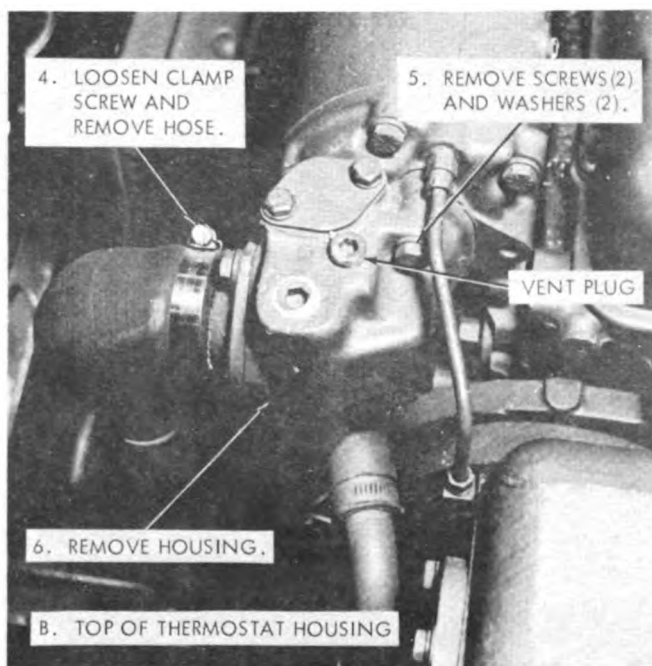
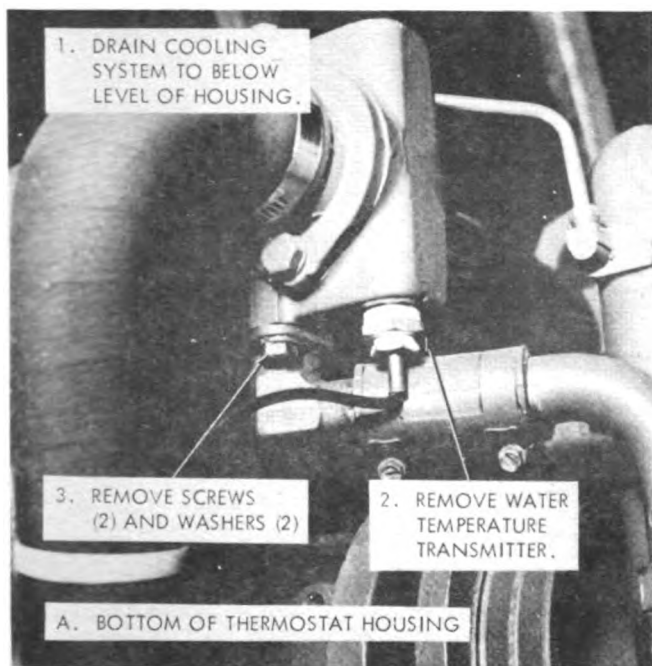
(2) Refer to figure 4-38 and remove the anodes.

c. Inspection and Replacement.

(1) Examine the anode rings for deterioration.

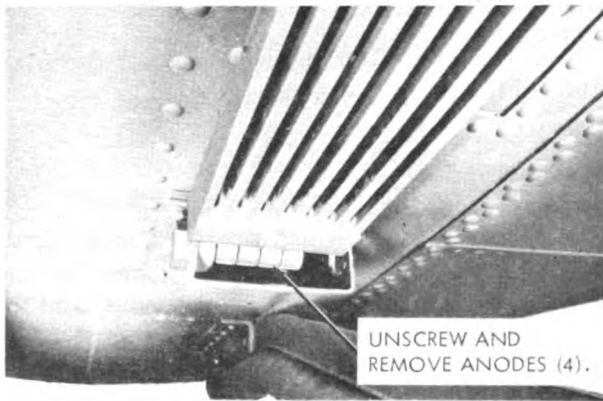
(2) Replace the anodes if erosion is evident.

d. Installation. Install the anodes in reverse order of removal.



TS003009

Figure 4-37. Thermostat housing removal.



TS003010

Figure 4-38. Anode removal.

4-47. Cooling System Hoses and Fittings

a. Removal.

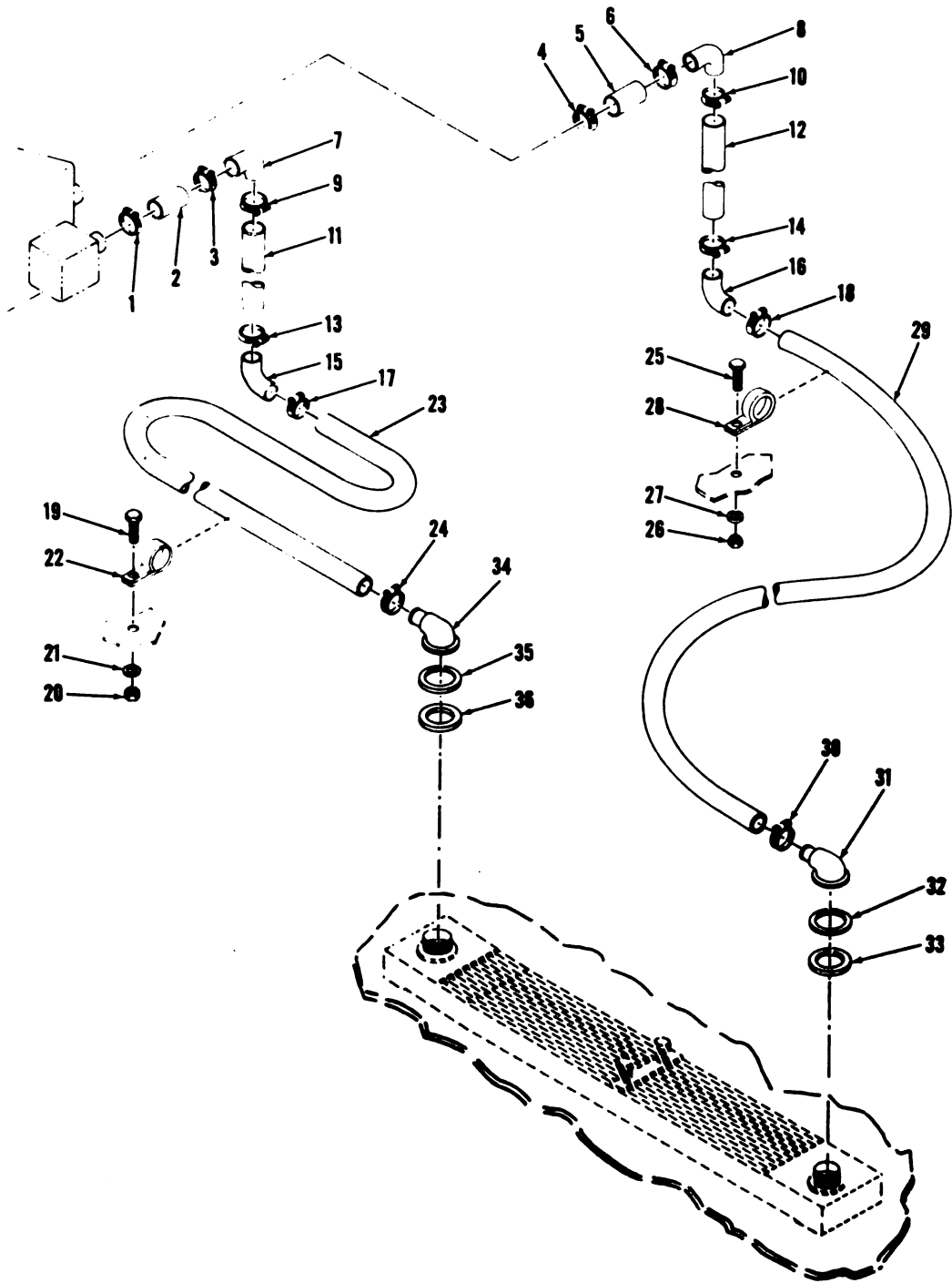
- (1) Drain the cooling system.
- (2) Refer to figure 4-39 and remove lines, hoses, and fittings as required.

b. Inspection and Replacement.

- (1) Check all hoses for kinks, cracks, breaks, and signs of deterioration.
- (2) Check fittings for condition of threads and security.
- (3) Replace any defective part.

c. Installation.

- (1) Install the lines, hoses, and fittings in the reverse order of removal.
- (2) Fill the cooling system.
- (3) Start the engine and inspect for leaks.



TS 003011

- | | | |
|----------|-----------|-----------|
| 1. Clamp | 6. Clamp | 11. Hose |
| 2. Hose | 7. Elbow | 12. Hose |
| 3. Clamp | 8. Elbow | 13. Clamp |
| 4. Clamp | 9. Clamp | 14. Clamp |
| 5. Hose | 10. Clamp | 15. Elbow |

Figure 4-39. Cooling system hoses and fittings, exploded.

- | | | |
|----------------|----------------|------------|
| 16. Elbow | 23. Hose | 30. Clamp |
| 17. Clamp | 24. Clamp | 31. Elbow |
| 18. Clamp | 25. Screw | 32. Washer |
| 19. Screw | 26. Nut | 33. Seal |
| 20. Nut | 27. Lockwasher | 34. Elbow |
| 21. Lockwasher | 28. Clamp | 35. Washer |
| 22. Clamp | 29. Hose | 36. Seal |

Figure 4-39 — Continued.

Section XI. MAINTENANCE OF ELECTRICAL SYSTEM

4-48. General

This section contains the maintenance instructions for the boat electrical system. A description of the electrical system is presented in paragraph 1-5. The system wiring diagram is shown in figure 1-13.

WARNING

Before performing any repair on the electrical system, place the MASTER switch in the OFF (down) position and disconnect the battery negative cables.

4-49. Generator

a. General. The 24-volt generator is mounted on the upper left side of the engine. The generator is driven by the engine crankshaft through pulleys and a V-belt. The generator supplies charging current to the batteries through a generator regulator. Before attempting maintenance of the generator, inspect and test it as given in the following paragraphs to determine if replacement is necessary.

b. Inspection.

- (1) Check the lights. Dim or extremely bright lights may indicate a faulty generator.
- (2) Check the ammeter for sudden fluctuations or indication of extreme discharge or charge.
- (3) Check V-belt for proper tension. The tension is correct if a firm push with thumb on the V-belt at a point midway between the generator and water pump pulleys depresses the belt 1/2-to 3/4-inches.
- (4) Check generator mounting and cable connection for security.
- (5) Check that generator is not excessively noisy.

c. Test. To test the generator while it is installed in the boat, disconnect the generator cable and perform the following:

- (1) Check field for open circuit by using test points and a test lamp. Place the test points in each receptacle terminal and operate the engine at 2800 rpm. If the lamp does not light, the

circuit is open. If the circuit is open due to a broken lead or bad connection, repair the lead or connection. If the open is due to a bad field coil, replace the generator.

(2) If the field is not open, check for a shorted field by connecting a 24-volt battery and an ammeter in series with the field circuit. The field draw at 24 volts should be 0.91-to 0.98-amperes. Excessive current draw indicates a shorted field and the generator should be replaced.

d. Removal.

(1) Turn off MASTER switch and disconnect the batteries.

(2) Refer to figure 4-40 and remove the generator.

e. Installation.

(1) Install the generator in the reverse order of removal.

(2) Connect the batteries.

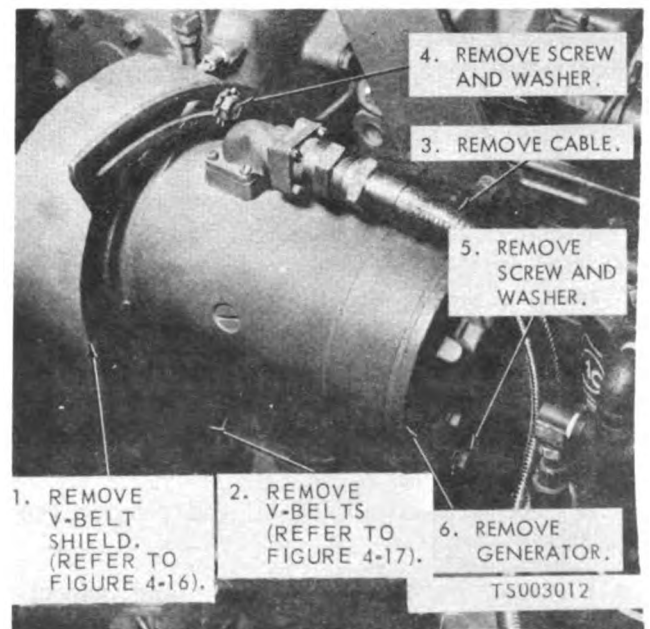


Figure 4-40. Generator removal.

4-50. Generator Regulator

a. General. The generator regulator is a heavy duty, 14-volt, 18-ampere unit. The regulator is mounted on the rear bulkhead of the engine compartment behind its respective engine. The regulator incorporates three features; a cutout relay, a current regulator, and a voltage regulator.

b. Inspection. A generator regulator malfunction may be indicated by a high charging rate with fully charged batteries, or low batteries with a low charging rate or no rate. Always check the wiring and connections for security before replacing a regulator.

c. On-Equipment Test (Generator and Regulator).

(1) *Fully charged battery and high charging rate.*

(a) Remove shielded cable from generator and regulator and insert test harness or adapter.

(b) Open the field circuit and operate the generator at medium speed. If the output remains high, the generator or the wiring harness is defective. If no output is obtained, the regulator is defective or requires adjustment.

(2) *Low battery and low or no charging rate.*

(a) Remove shielded cable from generator and regulator and insert test harness or adapter.

(b) Operate generator at medium speed and momentarily connect a jumper lead between the armature and field leads; increase generator speed. If the output does not increase, the generator is defective. If the output increases, the regulator is defective.

CAUTION

A burned resistance unit, regulator winding, or fused contacts can result from open-circuit or extreme resistance in the charging circuit. When these conditions exist, check all wiring before re-installing regulator.

d. Removal.

(1) Turn off the MASTER switch and disconnect the batteries.

(2) Refer to figure 4-41 and remove the regulator.

e. Cleaning and Inspection. Clean and inspect. Replace a defective generator regulator.

f. Adjustments, Mechanical.

(1) *Cover removal.* Remove four screws, lockwashers, cover, and gasket from regulator.

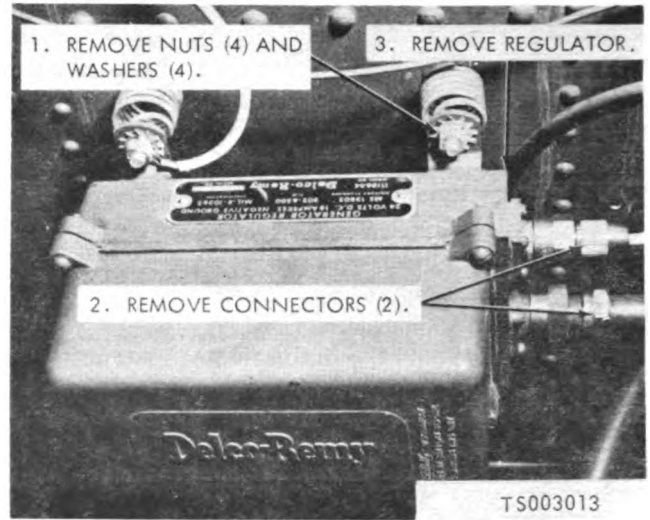


Figure 4-41. Generator regulator removal.

(2) *Cutout relay air gap adjustment.* Measure air gap (fig. 4-42) between armature and core (not between the brass pin and core) with contact points barely touching. Adjust to 0.048 inch by raising or lowering the lower contact bracket.

(3) *Cutout relay contact point adjustment.*

(a) Adjust contact point opening to 0.035 inch by bending upper armature stop as required.

(b) Be certain that both contacts are alined and have same point opening.

(4) *Voltage regulator air gap adjustment.*

(a) Loosen locknut on voltage regulator unit (fig. 4-43) and insert the 0.087 inch gage between the armature and the part of the core next to the residual pin.

(b) Press armature down against gage and hold it in place while turning the contact screw until the contacts barely touch.

(c) Turn contact screw clockwise or counterclockwise to obtain an air gap setting of 0.087 inch.

(5) *Current regulator air gap adjustment.*

Adjust current regulator air gap in the same manner as the regulator air gap (4) above. The correct current regulator air gap adjustment is 0.087 inch.

g. Adjustments on Equipment.

(1) *Polarizing the generator.* Disconnect the lead from the field terminal of the regulator and momentarily touch this lead to the regulator battery terminal. This allows a momentary surge of current to flow through the generator field windings which correctly polarize the generator. Failure to do this may result in severe damage

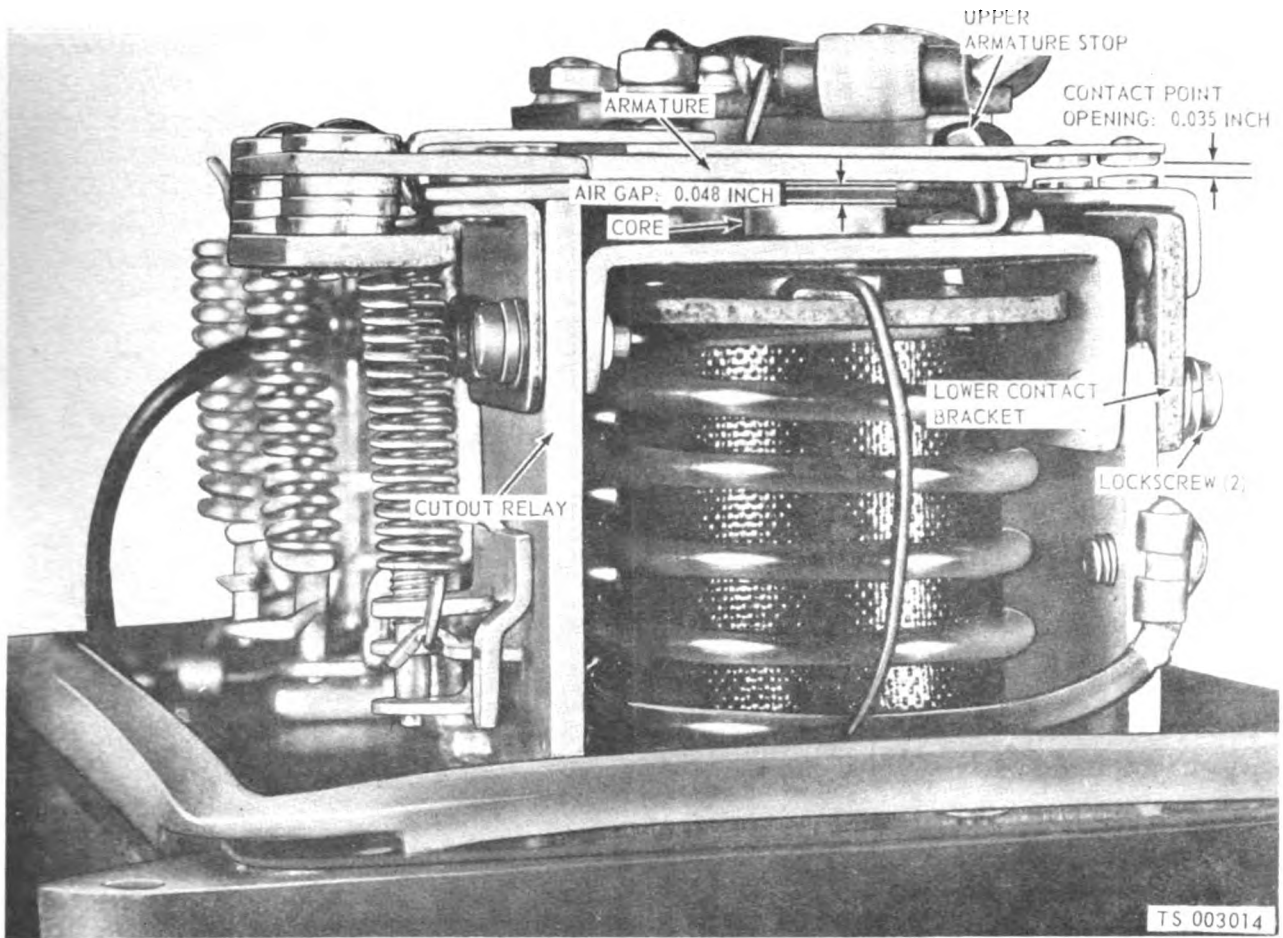


Figure 4-42. Cutout relay air gap and contact point adjustment.

since reversed generator polarity causes vibration, heavy arcing, and burning of relay contact points.

(2) Cutout relay closing voltage.

(a) Connect regulator to generator and battery terminals as shown on figure 4-44.

(b) Connect a voltmeter between the armature terminal of the regulator and the ground screw at the end of the regulator.

(c) Gradually increase generator speed and note voltage at which the cutout relay contact points close. The current closing voltage is 25-to 27 volts.

(d) Turn the spring tension adjusting screw on the cutout relay unit (fig. 4-43) clockwise to decrease the closing voltage and counterclockwise to increase the closing voltage.

(3) Regulator voltage setting.

(a) Connect a voltmeter from the regulator armature terminal to the regulator ground as shown on figure 4-45.

NOTE

Make certain that the lead from the regulator battery terminal is disconnected.

(b) With the generator operating at specified speed and the regulator at operating temperature, note the voltage setting. The correct setting is 28.5 volts.

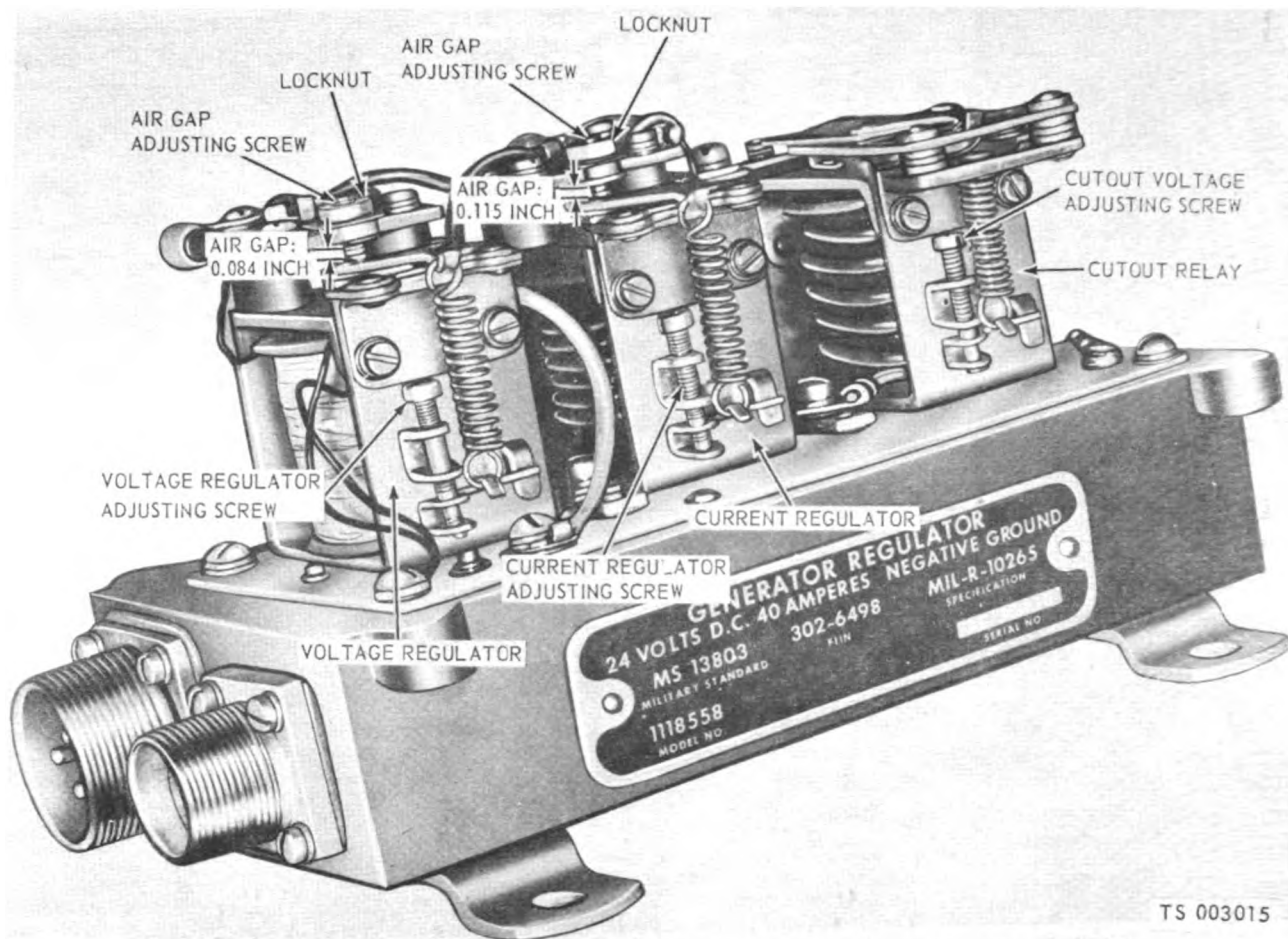
(c) Turn the spring tension adjusting screw on the voltage regulator (fig. 4-43) clockwise to decrease the voltage setting and counterclockwise to increase the voltage setting.

NOTE

After each change of adjustment momentarily open the voltage regulator points by hand before taking voltage reading.

(4) Current regulator current setting.

(a) Connect an accurate ammeter in series into the charging circuit at the regulator battery terminal to measure the current regulator setting (fig. 4-46).



TS 003015

Figure 4-48. Voltage and current regulator air gap adjustment.

(b) Place a jumper wire across the voltage regulator contact points so the voltage regulator cannot operate.

(c) Connect a load of approximately 18 amperes across the battery by using a carbon pile rheostat or a bank of lights.

(d) Turn the spring tension adjusting screw on the current regulator (fig. 4-43) clockwise to decrease the current setting or counter-clockwise to increase the current setting.

(e) Adjust the regulator current setting to 18 amperes.

h. Cover Installation. Position the gasket and cover on the regulator and install the four lock-washers and screws.

i. Installation.

(1) Install the regulator in the reverse order of removal.

(2) Connect the batteries.

4-51. Cranking Motor (Starter)

a. General. The cranking motor is mounted at the right side of the engine on the flywheel housing. When the motor is energized, a solenoid mounted on the motor engages a spline drive with the engine ring gear.

b. Testing. Refer to figure 4-47 and test the cranking motor.

c. Removal.

(1) Turn off the MASTER switch and disconnect the batteries.

(2) Refer to figure 4-48 and remove the cranking motor (starter).

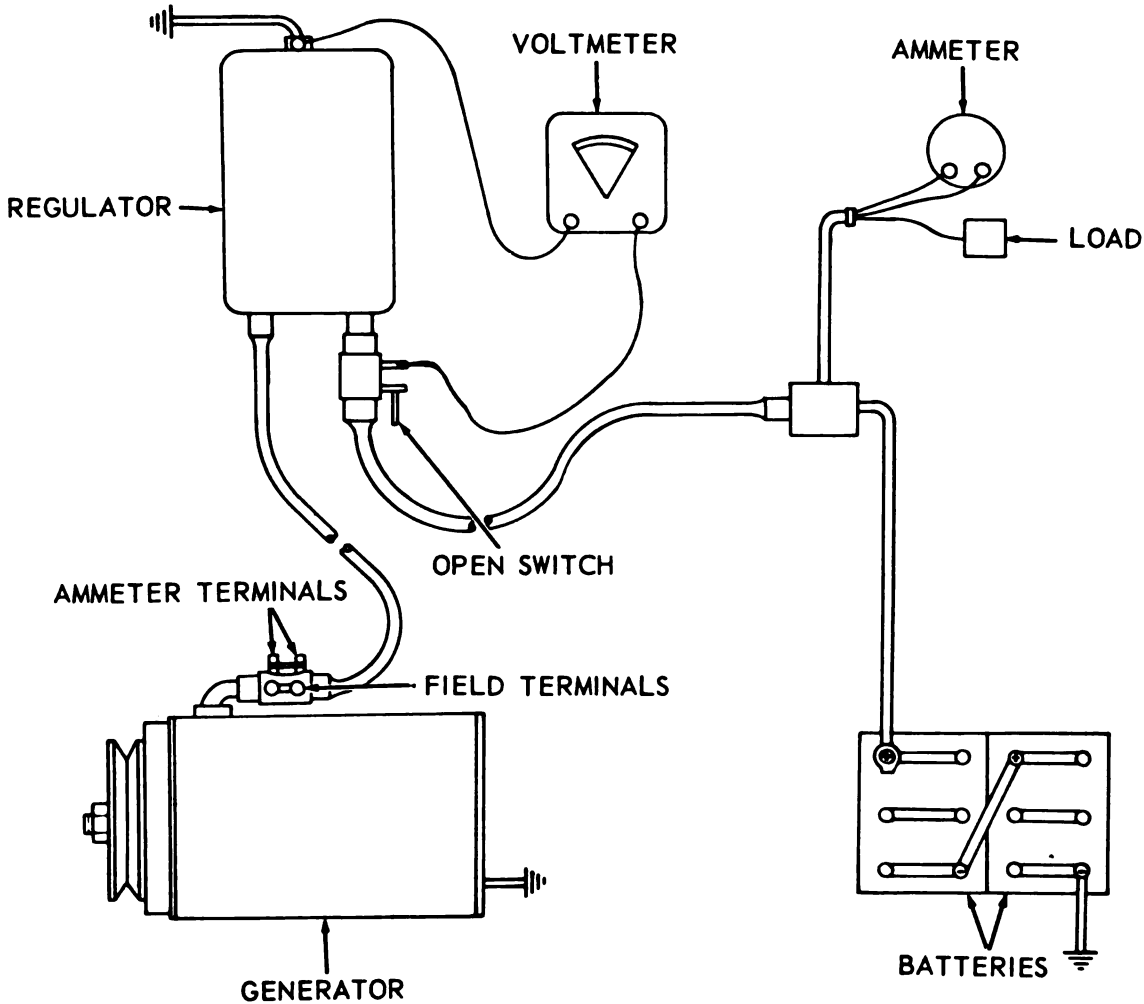
d. Inspection.

(1) Check condition of plunger teeth.

(2) Examine electrical terminals for security and condition.

(3) Check security of solenoid mounting and wiring.

NOTE: VOLTMETER READING
27-1/2 TO 29-1/2 VOLTS



TS 003017

Figure 4-45. Testing voltage regulator setting.

d. Installation.

- (1) Install the switch in the reverse order of removal.
- (2) Connect the batteries.

b. Removal.

- (1) Refer to A, figure 3-4 and remove the battery box cover.

WARNING

Batteries generate hydrogen, a highly explosive gas. Do not smoke or allow open spark or flame in the vicinity of the batteries.

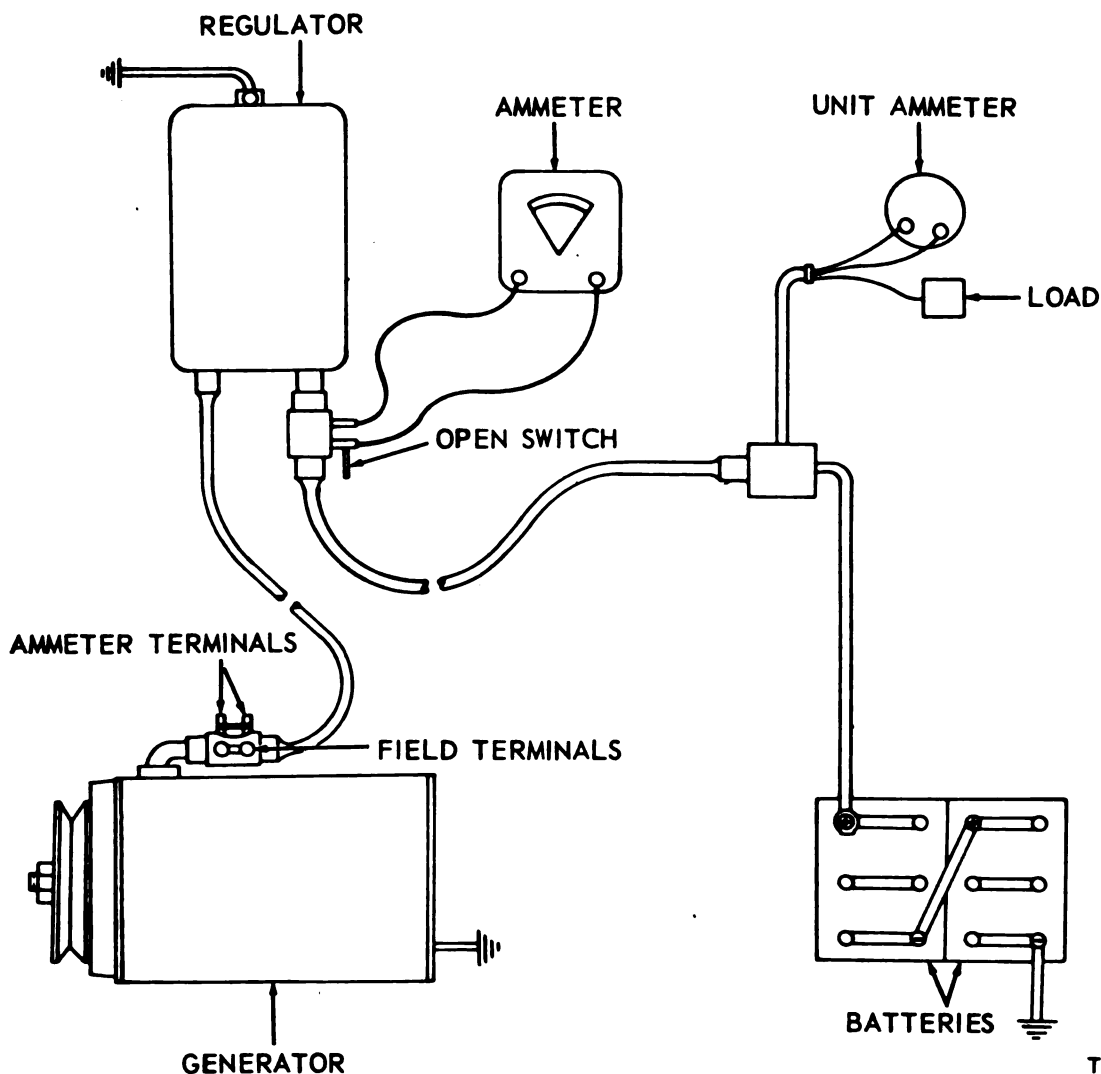
- (2) Refer to figure 4-50 and remove the cables and batteries.

c. Cleaning.

- (1) Mix a solution of bicarbonate of soda and water. Make sure that all battery caps are securely screwed down as this solution could contaminate the electrolytic.

NOTE

This electrical system is negative to ground.



TS 003018

Figure 4-46. Testing current regulator current setting.

(2) Brush the solution on the terminals and the cable clamps. When the solution has stopped foaming, flush the solution off with clean water and dry with a clean cloth.

(3) Clean the battery tray and box in the same manner as in step (2) above.

d. Inspection.

(1) Inspect the battery cases for cracks and leaks, and security of terminals.

(2) Examine condition of cable insulation and clamps.

e. Installation. Install the batteries in the reverse order of removal.

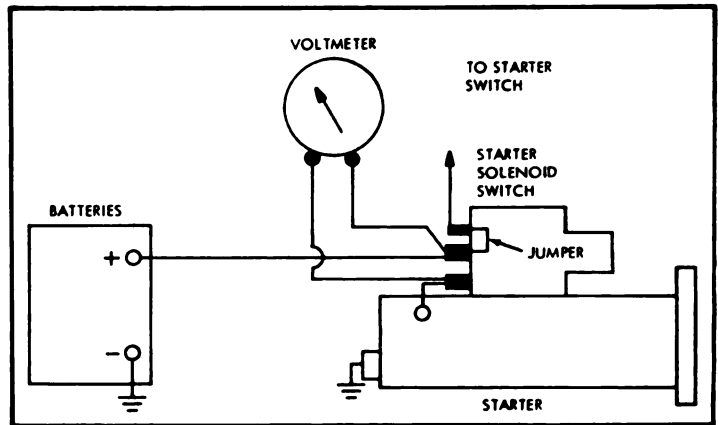
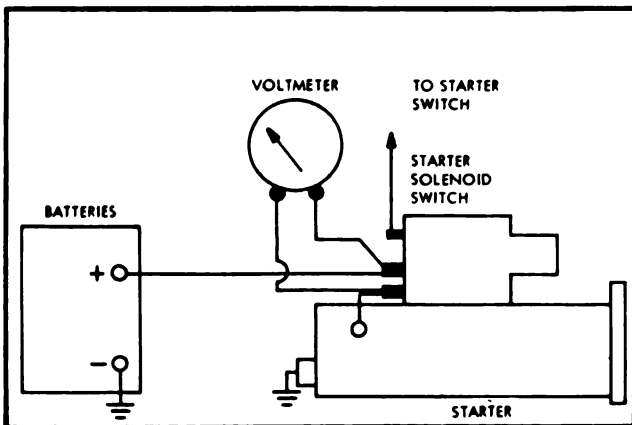
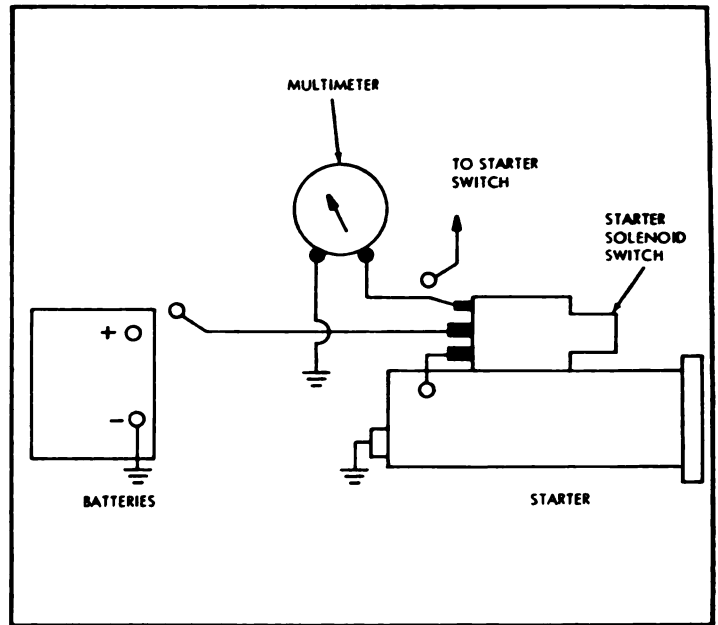
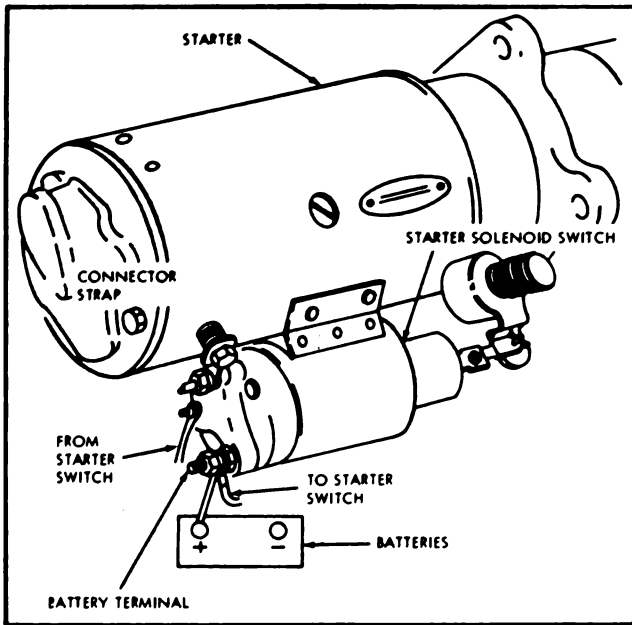
4-54. Instrument Panel Components

a. General. All the engine instruments are mounted on two panels located forward of the steering wheel. Each panel also includes a switch and two lamps for night illumination. The ammeters are the only instruments that are dependent upon the boat electrical system; all the others are independently actuated. The gages are described in paragraph 2-8. Maintenance procedures for the tachometer drive are given in paragraph 4-14.

b. Removal.

(1) Turn the MASTER switch off.

(2) Remove the access panel to reach the rear of the instrument panel components (fig. 4-71).



1. DETERMINE THAT BATTERIES ARE FULLY CHARGED AND THAT ALL BATTERY AND STARTER CABLES ARE SERVICEABLE AND PROPERLY INSTALLED.
2. CONNECT A MULTIMETER AS SHOWN IN B ABOVE. CHECK THE CONTINUITY OF THE SOLENOID WITH THE MULTIMETER IN THE UNIT (R-1) POSITION. A GOOD SOLENOID WILL INDICATE APPROXIMATELY 1.2 OHM RESISTANCE.
3. INSTALL THE SOLENOID-TO-STARTER CONNECTOR.
4. CONNECT VOLTMETER AS SHOWN IN C ABOVE. IF BATTERY VOLTAGE (24 VOLTS) IS NOT INDICATED, THE STARTER IS DEFECTIVE AND MUST BE REPLACED.
5. MOMENTARILY CONNECT A JUMPER AS SHOWN IN D ABOVE. THE VOLTMETER READING SHOULD DROP TO ZERO AND STARTER SHOULD CRANK ENGINE. IF VOLTMETER READING DOES NOT DROP TO ZERO, STARTER SOLENOID SWITCH IS DEFECTIVE AND MUST BE REPLACED. IF VOLTMETER READING DROPS TO ZERO BUT STARTER FAILS TO CRANK ENGINE, STARTER IS DEFECTIVE AND MUST BE REPLACED.

TS003019

Figure 4-47. Cranking motor (starter) on board testing.

(3) Refer to figure 4-51 and remove the defective component.

c. Inspection.

- (1) Inspect leads for security.
- (2) Inspect component and fittings for damage.

d. Installation.

- (1) Install the components and panel in the reverse order of removal.
- (2) Start engine and check operation of component.

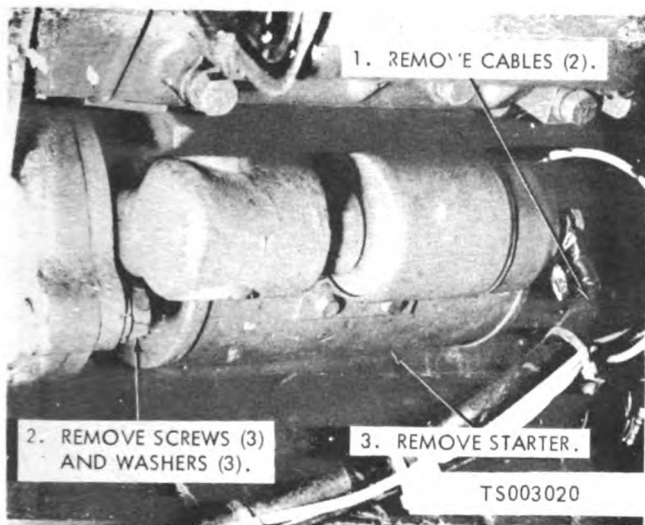


Figure 4-48. Cranking motor (starter) removal.

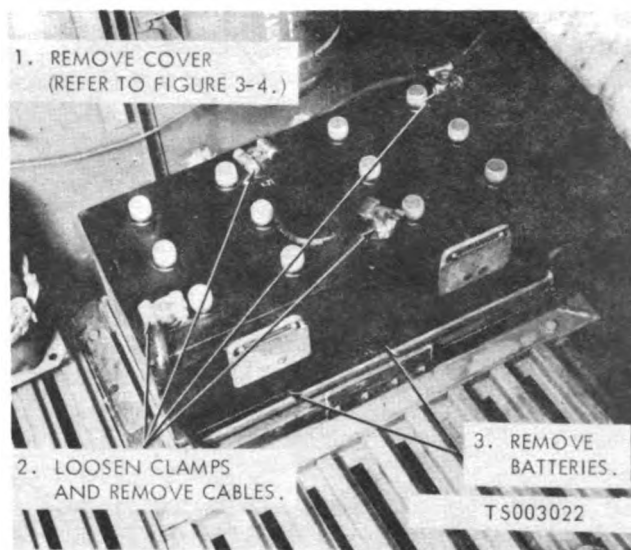


Figure 4-50. Batteries, removal.

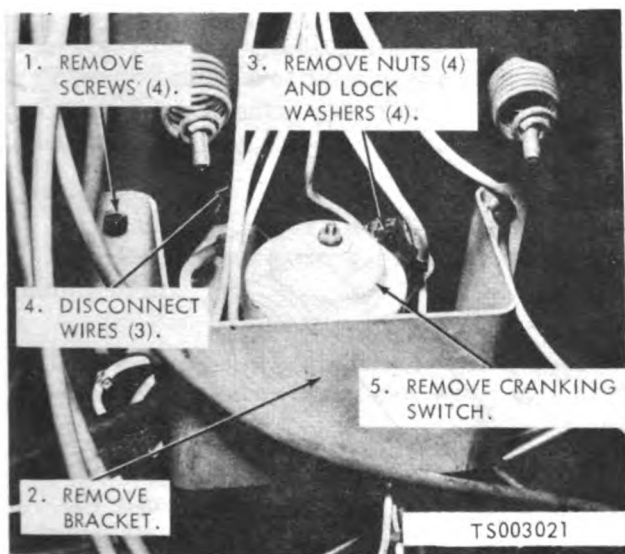


Figure 4-49. Magnetic cranking switch, removal.

4-55. Fuse Panel

a. *General.* The fuse panel is located in front of the steering wheel. All seven of the fuses for the boat are mounted on this panel. A spare fuse is provided in the lower left fuse holder.

b. Removal.

- (1) Turn off the MASTER switch.
- (2) Refer to figure 4-52 to remove fuses and/or panel.

c. Installation.

- (1) Install the fuses and/or panel in the reverse order of removal.

- (2) Turn on MASTER switch and applicable switch for affected circuit and check operation.

4-56. Switch Panel

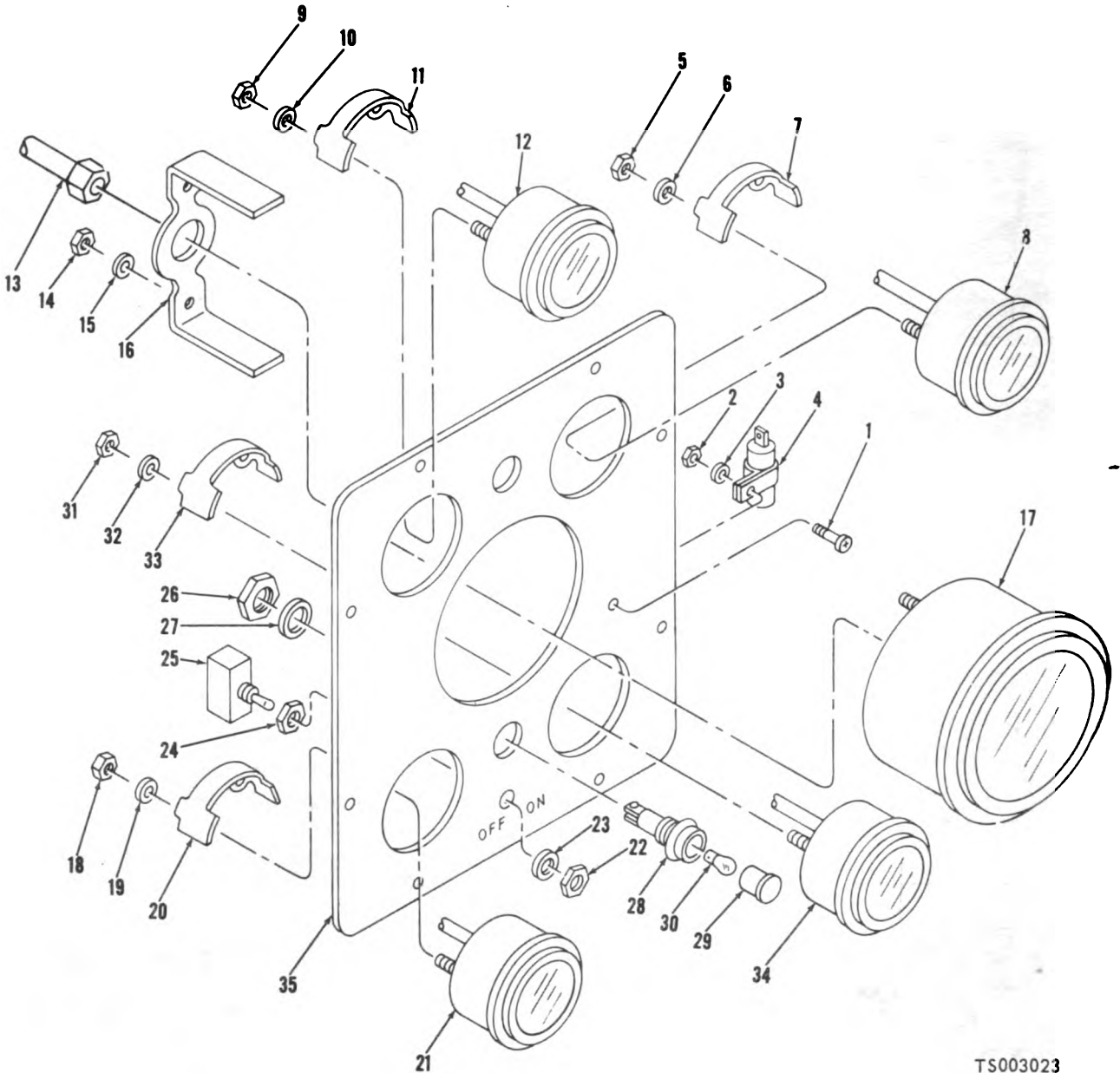
a. *General.* The switch panel is located in front of and to the right of the steering wheel. This panel contains all the manually-operated switches on the boat except for the spotlight switch incorporated in the handle of the light.

b. Removal.

- (1) Turn off the MASTER switch and disconnect the batteries.
- (2) Remove the screws (1, fig. 4-53) and pull the panel out only far enough to gain access to the rear of the defective switch.
- (3) Disconnect the electrical lead from the switch.
- (4) Refer to figure 4-53 and remove the nut, washer, and bezel securing the defective switch.

c. Installation.

- (1) Refer to figure 4-53 and install the switch in the panel (11).
- (2) Connect the electrical lead to the switch.
- (3) Position the panel and secure with screws (1).
- (4) Connect the batteries.
- (5) Turn on the MASTER switch and check the operation of the replacement switch.



TS003023

- | | | |
|------------------------------------|------------------------------|----------------|
| 1. Screw | 18. Tachometer cable | 26. Nut |
| 2. Nut | 14. Nut | 27. Washer |
| 3. Lockwasher | 15. Lockwasher | 28. Base |
| 4. Capacitor | 16. Bracket | 29. Shade |
| 5. Nut | 17. Tachometer | 30. Lamp |
| 6. Lockwasher | 18. Nut | 31. Nut |
| 7. Clamp | 19. Lockwasher | 32. Lockwasher |
| 8. Coolant temperature gage | 20. Clamp | 33. Clamp |
| 9. Nut | 21. Engine oil pressure gage | 34. Ammeter |
| 10. Lockwasher | 22. Nut | 35. Panel |
| 11. Clamp | 23. Washer | |
| 12. Transmission oil pressure gage | 24. Nut | |
| | 25. Switch | |

Figure 4-51. Instrument panel components, exploded view.

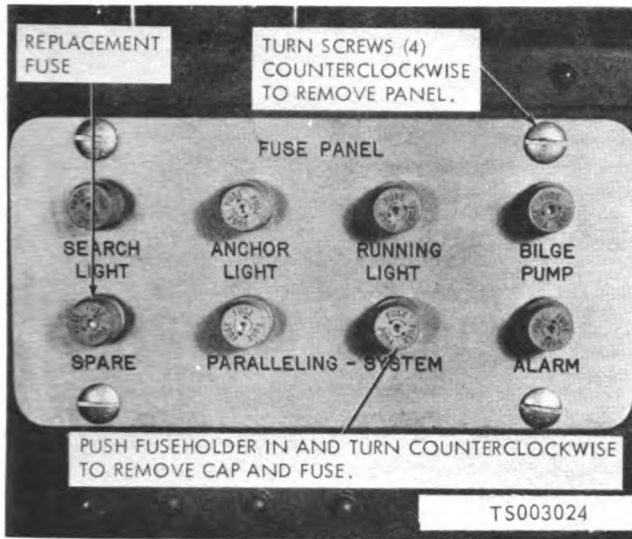


Figure 4-52. Fuse removal.

4-57. Running Lights

a. General. The running lights are located on the port and starboard sides of the cockpit. When replacing lamps make sure that the green lens is on the starboard and the red lens on the port.

b. Removal.

- (1) Turn off MASTER switch.
- (2) Refer to figure 4-54 and remove the running light.

NOTE

If only replacement of the lamp or lens is necessary, proceed as given in B, figure 4-54.

c. Inspection.

- (1) Examine lens for cracks or breaks.
- (2) Check condition of gasket, hardware, and electrical connections.

d. Installation.

- (1) Install the light in the reverse order of removal.
- (2) Turn on the MASTER switch and the RUNNING LIGHTS switch and check operation.

4-58. Bow Light

a. General. The bow light is on a mast that mounts in a bracket at the forward coaming of the cargo well. The light connector mates with a receptacle in the coaming. Another connector joins with one from the stern assembly.

b. Removal.

- (1) Turn off the ANCHOR LIGHTS switch.

- (2) Refer to figure 4-55 and remove bow light.

c. Disassembly. Refer to figure 4-56 and disassemble the bow light in the order of the index numbers.

d. Inspection.

- (1) Examine lens for cracks or breaks.
- (2) Check condition of gasket, hardware, and electrical connections.
- (3) Inspect wiring for kinks, breaks, and damaged insulation.

e. Reassembly. Reassemble the bow light in the reverse order of disassembly.

f. Installation.

- (1) Install the bow light in the reverse order of removal.
- (2) Turn on the MASTER switch and the ANCHOR LIGHTS switch and check operation.

4-59. Range Light

a. General. The range light is on a mast that mounts in a bracket on the after coaming of the operator's cockpit. The light connector mates with a receptacle adjacent to the mast bracket.

b. Removal.

- (1) Turn off the ANCHOR LIGHTS switch.
- (2) Refer to figure 4-57 and remove the range light.

c. Disassembly. Refer to figure 4-58 and disassemble the range light in the order of the index numbers.

d. Inspection.

- (1) Examine lens for breaks and cracks.
- (2) Check condition of gasket, hardware, and electrical connectors.
- (3) Inspect wiring for kinks, breaks, and damaged insulation.

e. Reassembly. Reassemble the range light in the reverse order of disassembly.

f. Installation.

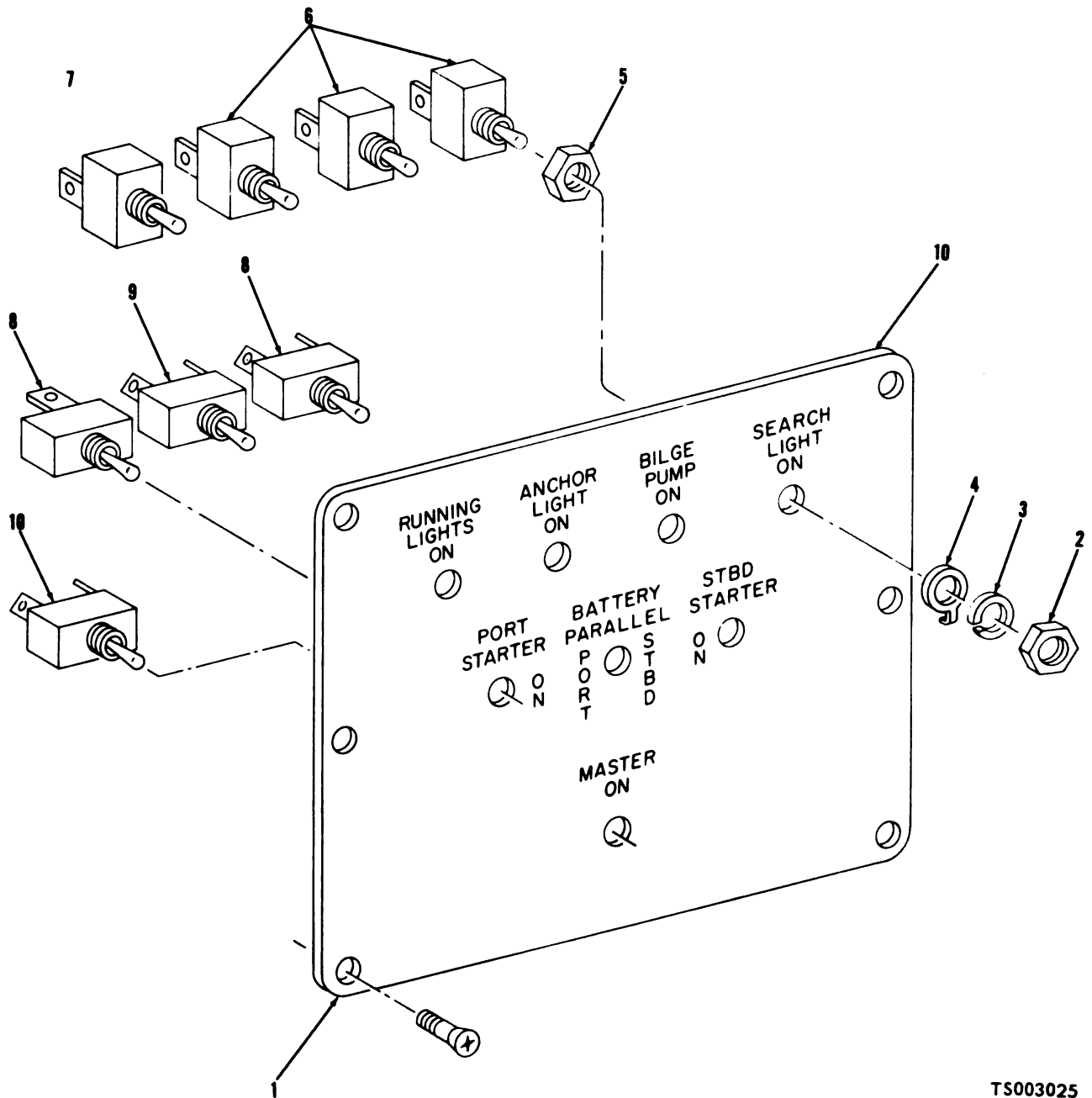
- (1) Install the range light in the reverse order of removal.
- (2) Turn on the MASTER switch and ANCHOR LIGHTS switch and check operation.

4-60. Spotlight

a. General. The spotlight is located in a stowage box forward on the port side of the operator's cockpit. The light is permanently connected to the boat electrical system.

b. Removal.

- (1) Turn off the MASTER switch and spotlight switch.



TS003025

- 1. Screw
- 2. Nut
- 3. Lockwasher
- 4. Bushing

- 5. Nut
- 6. Switch
- 7. Switch
- 8. Switch

- 9. Switch
- 10. Switch
- 11. Panel

Figure 4-53. Switches, exploded view.

(2) Disconnect the cable (7, fig. 4-59) at lugs (3), from the terminal block.

c. Disassembly. Refer to figure 4-59 and disassemble the spotlight in the order of the index number.

d. Inspection.

- (1) Examine the lens for cracks or breaks.
- (2) Inspect condition of hardware and electrical connections.

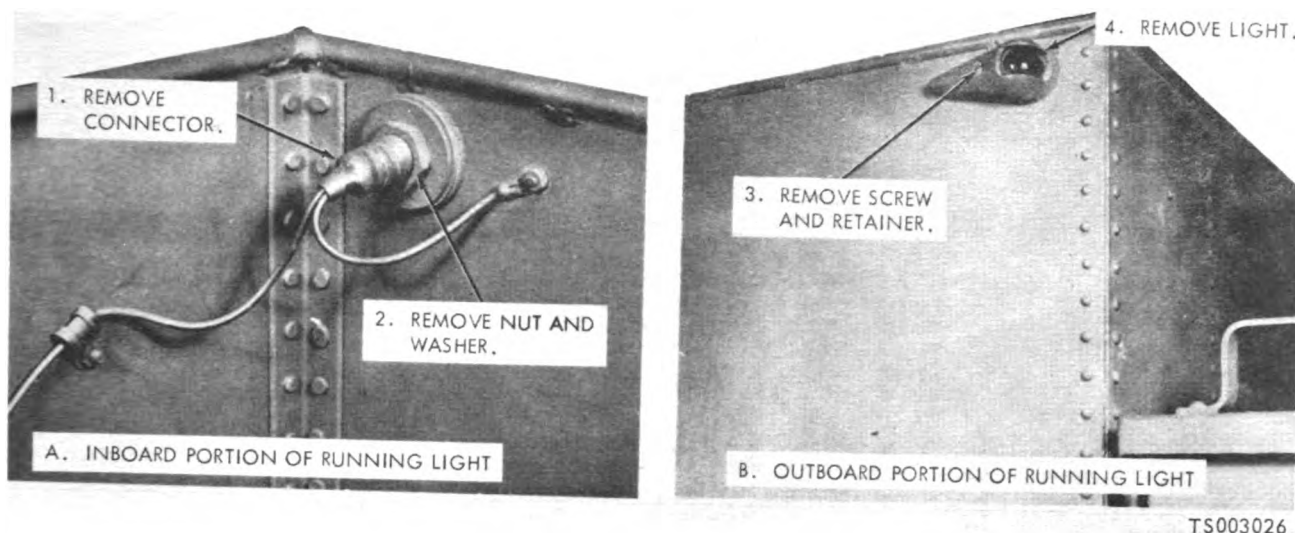


Figure 4-54. Running light removal.

e. Reassembly. Refer to figure 4-59 and reassemble the spotlight in the reverse order of the index numbers.

f. Installation.

(1) Connect the cable (7) at lug (3) to the terminal block.

(2) Turn on the MASTER switch and spotlight switch. Actuate the pushbutton switch in the spotlight handle and check the operation.

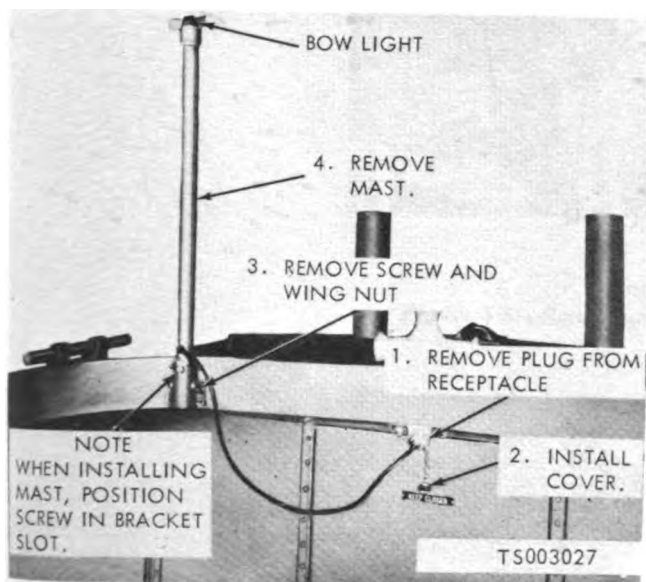


Figure 4-55. Bow light, removal and installation.

4-61. Storage Box

a. General. The storage box is located forward on the port side of the operators cockpit. The storage box provides a watertight housing and storage location for the spotlight. The storage box contains a molded polystyrene pad which protects the spotlight from vibrations and breakage.

b. Disassembly.

(1) Remove 2 each mounting bolts and remove storage box.

(2) Remove pad from inside of box.

(3) Remove 2 flat head machine screws from catch and remove upper catch.

(4) Remove 2 oval head machine screws from lid catch and remove catch.

(5) Remove electrical cable clamp and rubber grommet.

c. Inspection.

(1) Inspect for condition of latch assembly.

(2) Insure proper fit of spotlight in pad.

(3) Inspect pad and box for cracks.

(4) Inspect interior of storage box for evidence of water leaks.

d. Reassembly. Reassemble the storage box in the reverse order of disassembly, paragraph b above.

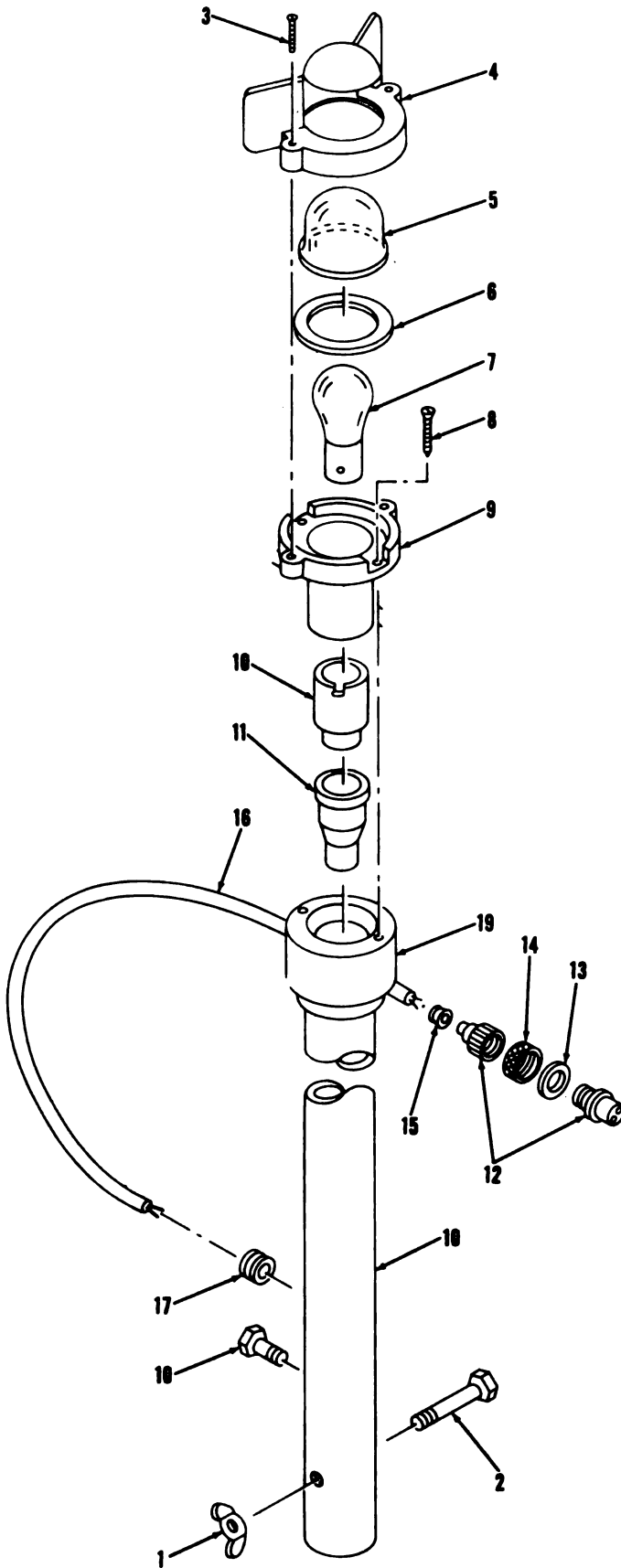


Figure 4-56. Bow light, exploded view.

TS003028

- 1. Wing nut
- 2. Screw
- 3. Screw
- 4. Retainer
- 5. Globe

- 6. Gasket
- 7. Lamp
- 8. Screw
- 9. Base
- 10. Socket

- 11. Nipple
- 12. Plug assembly
- 13. Gasket
- 14. Cap
- 15. Grommet

- 16. Cable
- 17. Grommet
- 18. Nut
- 19. Post

Figure 4-56 — Continued.

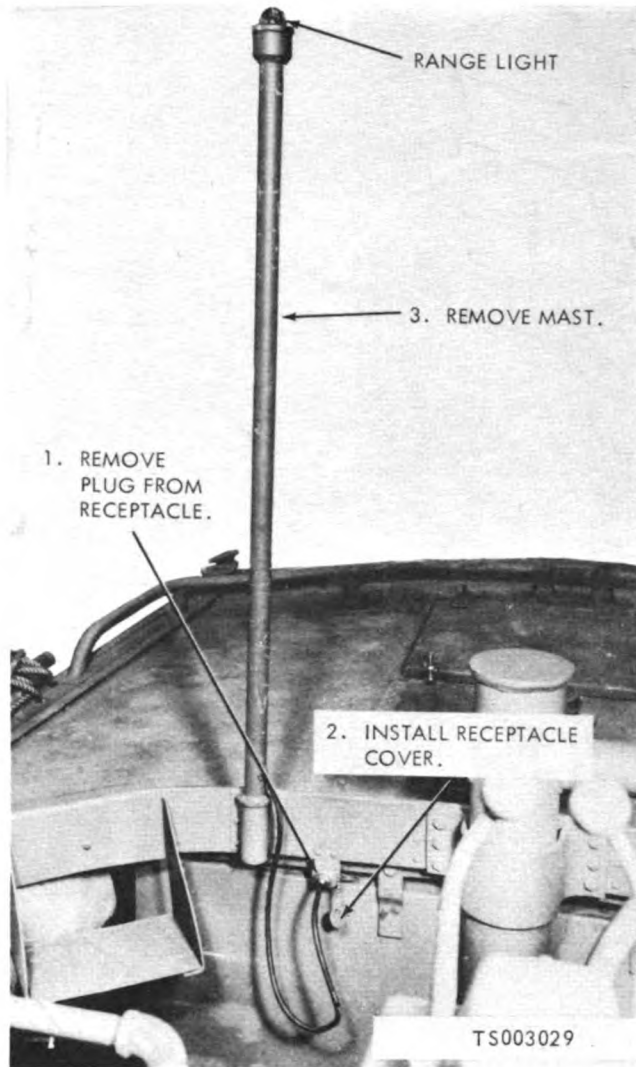


Figure 4-57. Range light removal and installation.

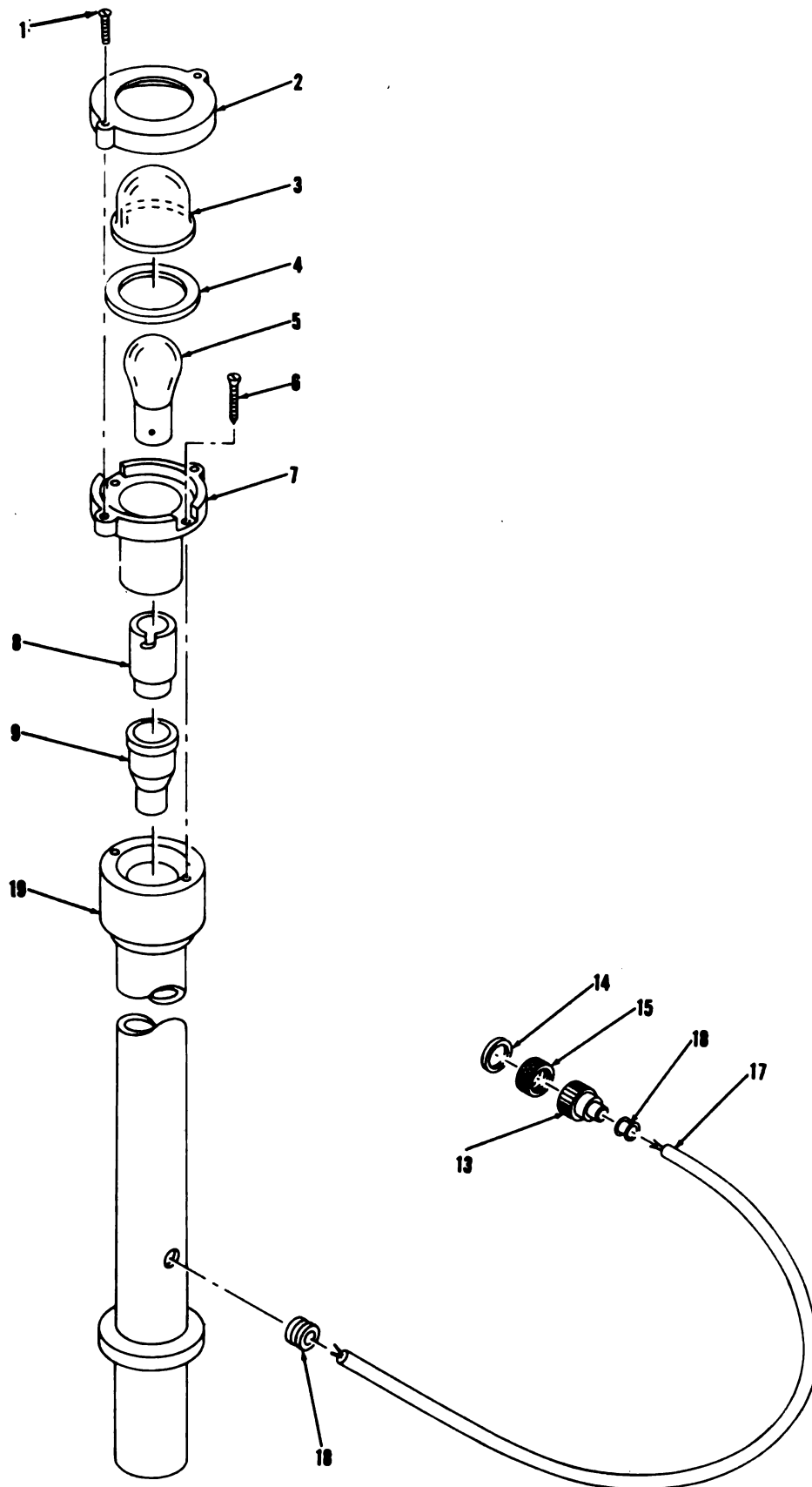


Figure 4-58. Range light, exploded view.

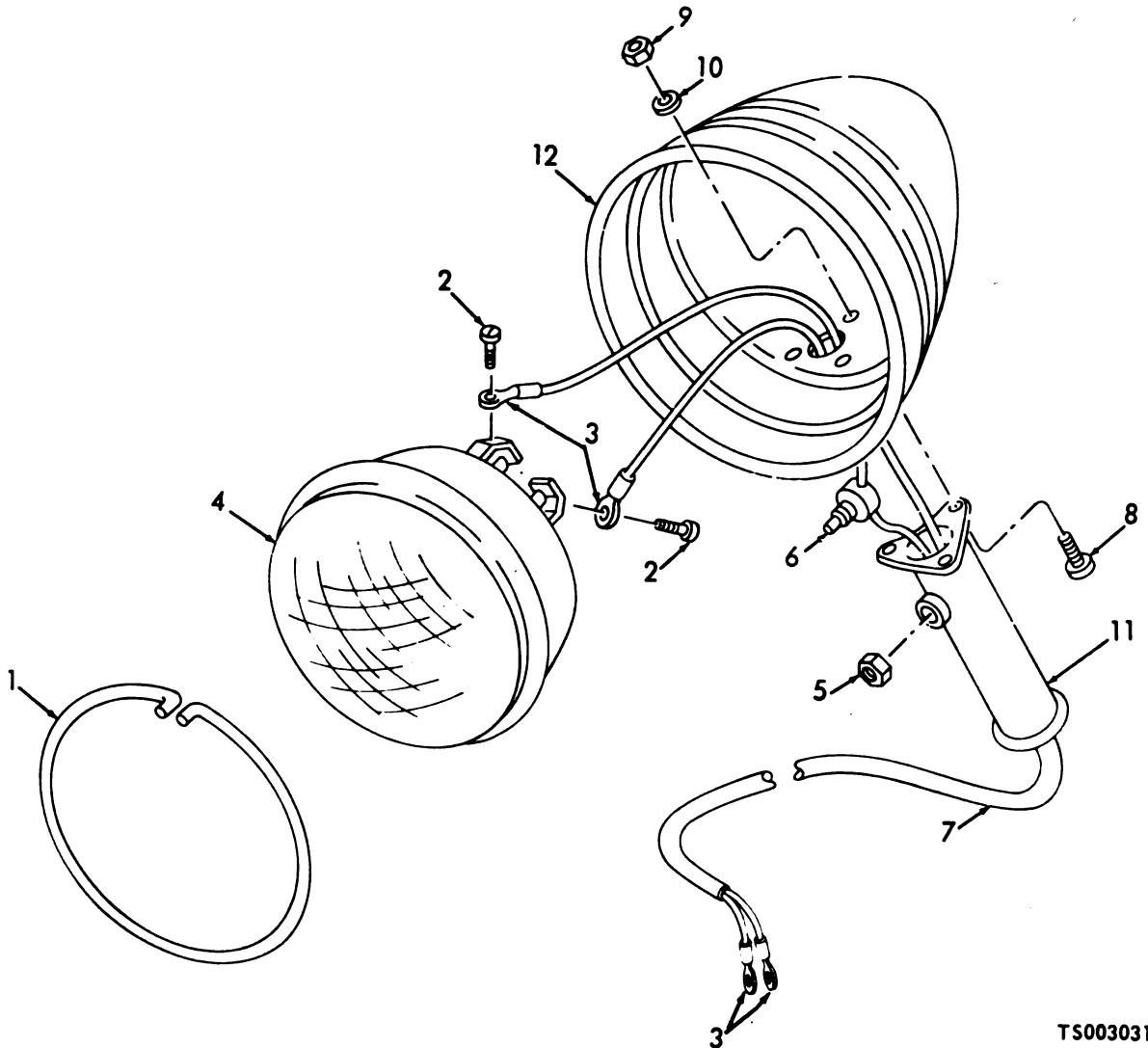
TS003030

- 1. Screw
- 2. Retainer
- 3. Globe
- 4. Gasket
- 5. Lamp
- 6. Screw

- 7. Base
- 8. Socket
- 9. Nipple
- 10. Plug
- 11. Gasket
- 12. Cap

- 13. Grommet
- 14. Cable
- 15. Grommet
- 16. Mast

Figure 4-58 — Continued.



TS003031

- 1. Ring
- 2. Screw
- 3. Lug
- 4. Lamp

- 5. Nut
- 6. Switch
- 7. Cable
- 8. Screw

- 9. Nut
- 10. Washer
- 11. Handle
- 12. Shell

Figure 4-59. Spotlight, exploded view.

Section XII. MAINTENANCE OF TRANSMISSION

4-62. General

This section contains the maintenance instructions for the transmission that are responsibility of organizational maintenance. The transmission is described in paragraph 1-5.

4-63. Transmission Maintenance

a. *General.* The only servicing that can be performed on the transmission by organizational maintenance is draining and replenishing the oil. The transmission oil is the same as that used for engine lubrication. Corrective maintenance procedures are limited to replacing the strainer and control cable.

Two types of dipstick assemblies are used on this transmission, one being a dipstick with an attached pipe plug and the other a dipstick with an attached T-handle and rubber expansion plug.

b. *Draining Oil.*

- (1) Remove the dipstick assembly.
- (2) Using the suction pump (fig. 4-60), pump out the oil.

(a) Remove the fitting from the suction hose.

(b) Insert the short suction hose (fig. 4-60) into the dipstick opening and the long discharge hose into a suitable receptacle.

(c) Pump the oil into the receptacle.

(3) Refer to paragraph 4-68 and service the oil strainer.

c. *Oil Filling.*

(1) Remove the dipstick assembly and add the same type and grade of oil as the engine lubricating oil. Fill until the level reflects "FULL" on the dipstick, approximately 3 quarts. The bottom of the dipstick must make contact with the transmission housing to get a correct reading on the dipstick.

(2) Make sure the transmission oil cooler return line is securely connected.

(3) Install the dipstick assembly, tightening it enough to prevent oil leakage.

(4) Start the engine and run it at idle speed for 5 minutes until the oil cooler and lines are filled. Check the oil level.

4-64. Transmission Oil Strainer

a. *General.* The oil strainer is located on the lower right side of the transmission housing, just below and forward of the mounting bracket. The strainer cleans any impurities from the oil as it enters the return line to the cooler. The

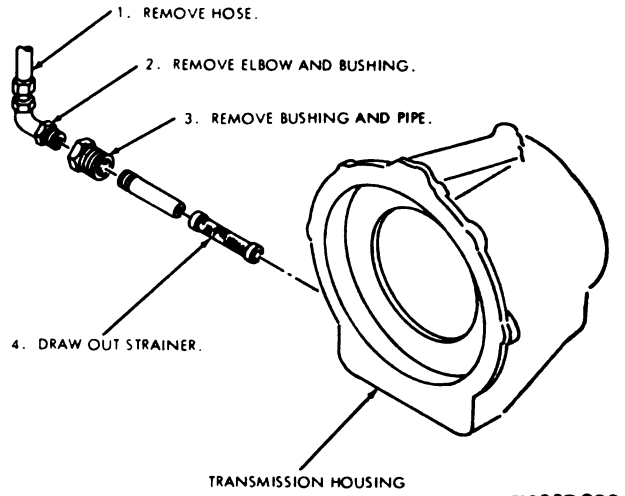


Figure 4-60. Draining the transmission oil.

strainer should be cleaned each time the oil is drained.

b. *Removal.*

(1) Drain the transmission as given in paragraph 4-63b.

(2) Refer to figure 4-61 and remove the strainer.

c. *Cleaning and Inspection.*

(1) Wash the strainer with fuel oil and dry with clean compressed air.

(2) Examine the strainer for clogged openings, breaks, cracks, distortion, or other damage.

d. *Installation.*

(1) Install the strainer in the reverse order of removal.

(2) Fill the transmission with oil as given in paragraph 4-70c.

4-65. Transmission Control Cable

a. *General.* The transmission is controlled by a cable connected between the shift lever on the left side of the transmission and the power control lever in the operator's cockpit.

b. *Removal.*

(1) Refer to A, figure 4-62 and remove the transmission shift lever end of the control cable.

(2) Remove the engine speed control cable (para 4-15).

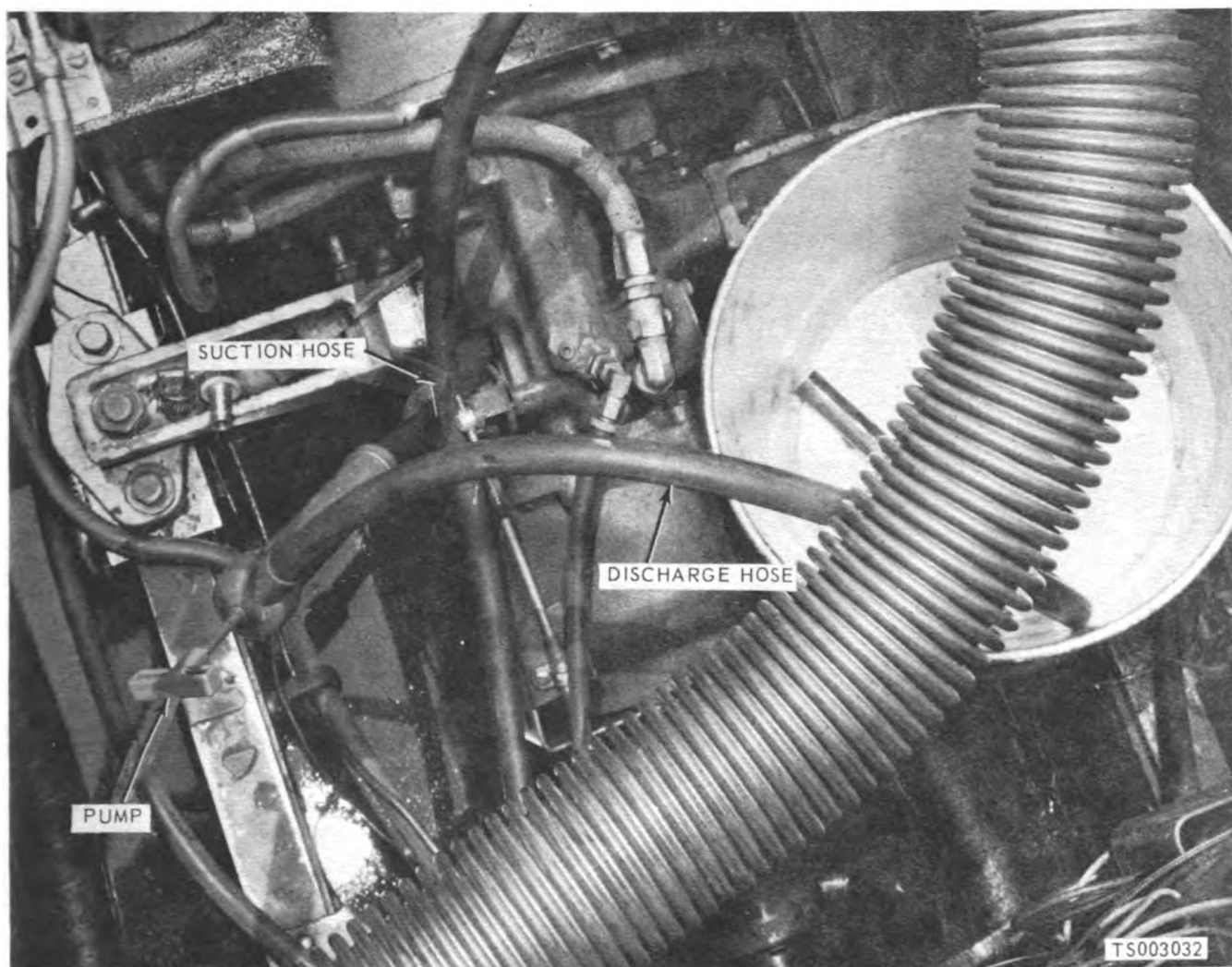


Figure 4-61. Transmission oil strainer removal.

(3) Refer to figure 4-14 and remove the control head.

(4) Refer to B, figure 4-62 and remove the control lever end of the cable.

c. Inspection.

(1) Check cable for kinks, cracks, or other damage.

(2) Check security of fittings and condition of threads.

d. Installation. Install the control cable in the reverse order of removal.

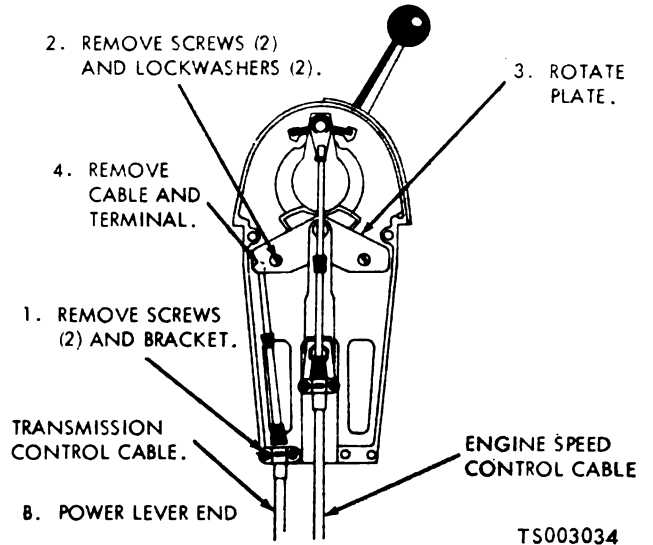
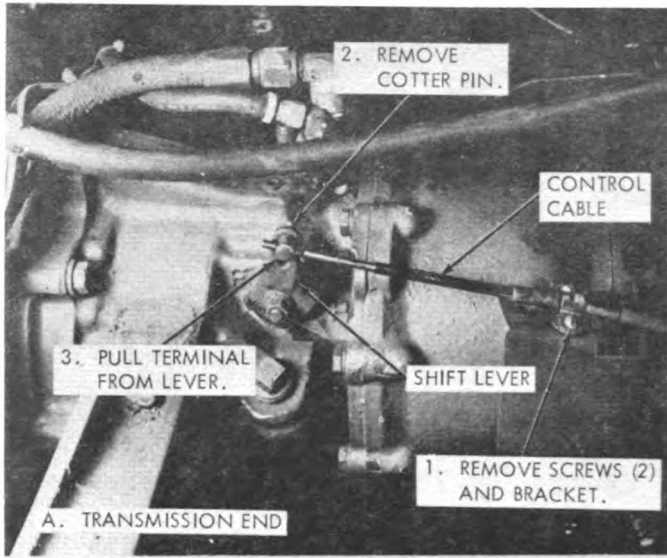


Figure 4-62. Transmission control cable removal.

Section XIII. MAINTENANCE OF STEERING SYSTEM

4-66. General

This section contains the maintenance instructions for the steering system. A description of the steering system and its operation are presented in paragraph 1-5.

4-67. Steering Wheel

a. Removal. Refer to figure 4-63 and remove the steering wheel.

b. Inspection.

(1) Check the wheel for cracks, breaks, or distortion.

(2) Check the condition of the threads on the shaft of the upper gear box and wheel retaining nut. If the threads in the nut are damaged, replace the nut. If the threads are damaged on the shaft, replace the upper gear box as given in paragraph 4-76.

c. Installation. Install the steering wheel in the reverse order of removal.

4-68. Steering Gear Universal Joints

a. General. The steering gear has four universal joints; one is located at the output shaft of the upper gear box, two are located at the input and output shafts of the lower gear box, and one is located at the steering quadrant. The following procedure applies to all the universal joints, as they are identical.

b. Removal. Refer to figure 4-64 and remove the universal joint.

c. Inspection.

(1) Check the universal joints for breaks, cracks, distortion, or other damage.

(2) Check that pin is firmly in place and there is no excessive backlash.

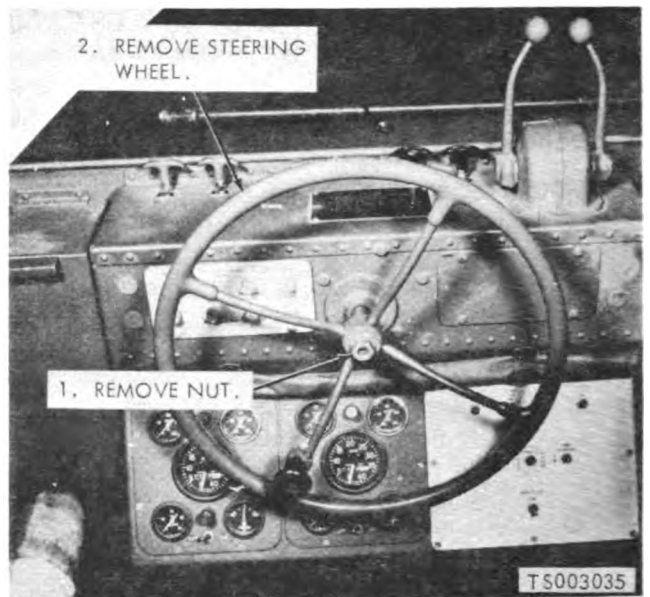


Figure 4-63. Steering wheel removal.

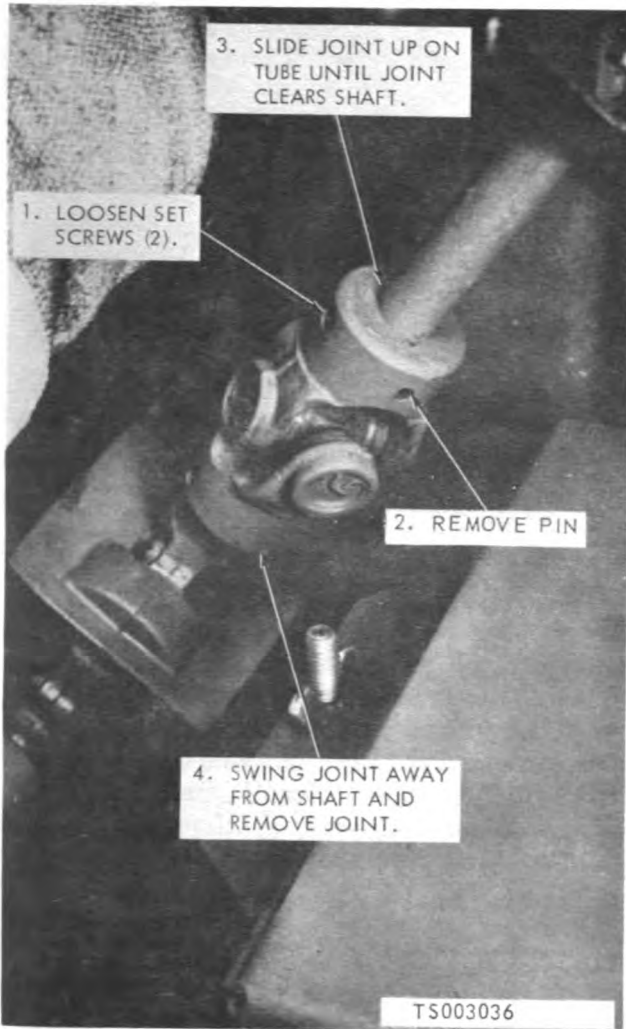


Figure 4-64. Universal joint removal.

d. Installation. Install the universal joint in the reverse order of removal.

4-69. Upper Gear Box

a. Removal.

(1) Refer to figure 4-71 and remove the access panel.

(2) Refer to figure 4-65 and remove the upper gear box.

b. Inspection.

(1) Check the gear box for breaks, cracks, distortion, or other damage.

(2) Rotate one of the gear box shafts and check that operation is smooth.

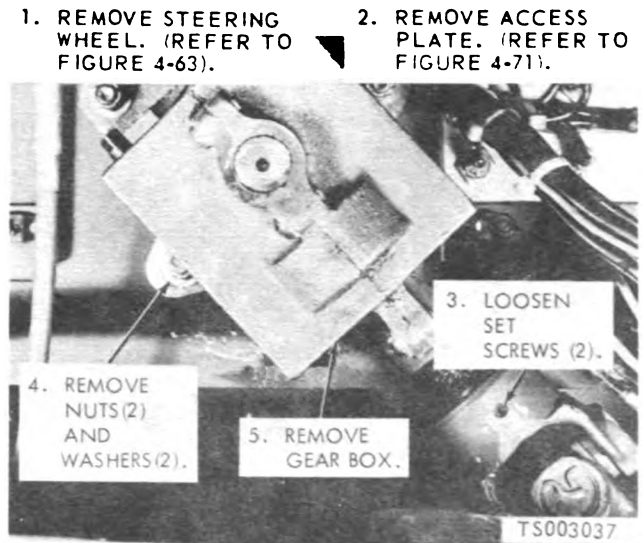


Figure 4-65. Upper gear box removal.

c. Installation. Install the upper gear box in the reverse order of removal.

4-70. Lower Gear Box

a. Removal. Refer to figure 4-66 and remove the lower gear box.

b. Inspection.

(1) Check the gear box for breaks, cracks, distortion, or other damage.

(2) Rotate one of the gear box shafts and check that operation is smooth.

c. Installation. Install the lower gear box in the reverse order of removal.

4-71. Steering Gear Transverse Rod

a. Removal.

(1) Open the stern hatch.

(2) Refer to figure 4-67 and remove the transverse rod.

b. Inspection.

(1) Check rod for cracks, breaks, distortion, or other damage.

(2) Examine the hardware for security and condition.

c. Installation. Install the transverse rod in the reverse order of removal.

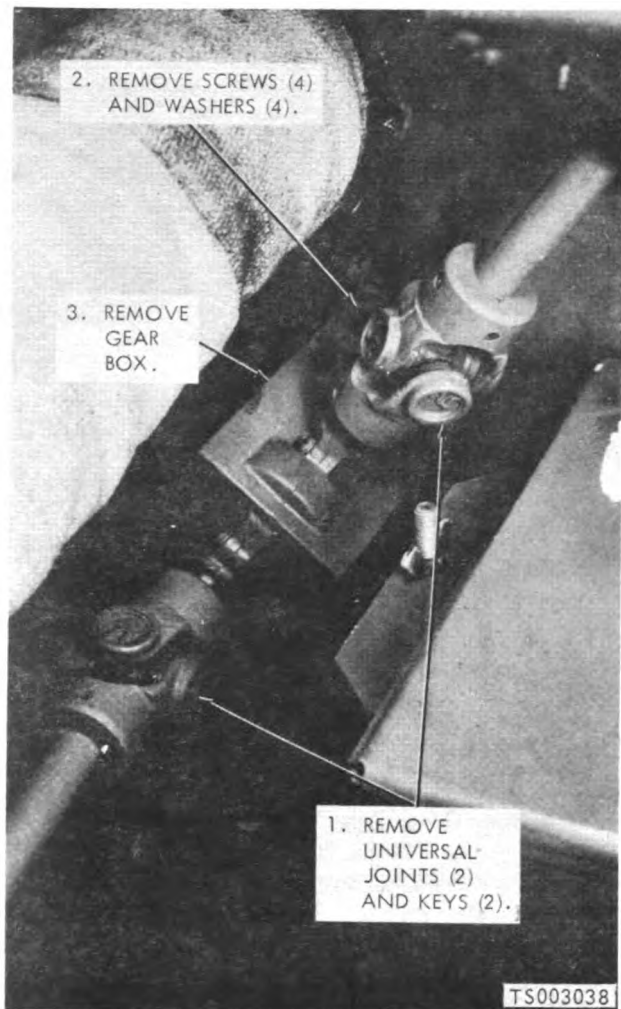


Figure 4-68. Lower gear box removal.

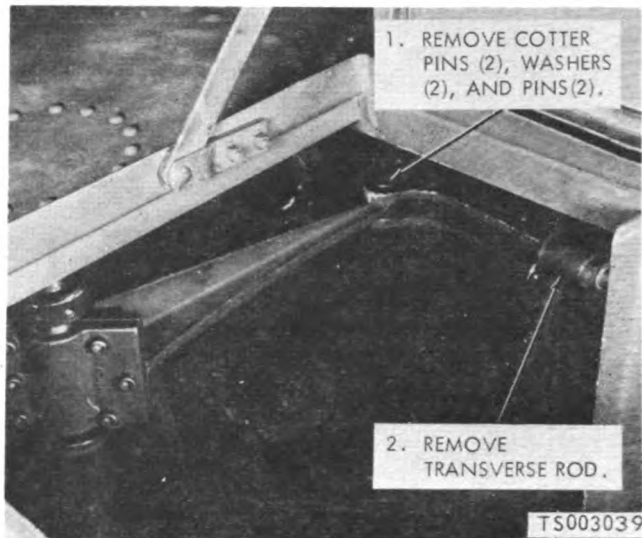


Figure 4-67. Steering gear transverse rod removal.

Section XIV. MAINTENANCE OF PROPELLER AND SHAFT

4-72. General

This section contains the maintenance procedures for the propeller shaft coupling. All other maintenance procedures for the propellers and shafts are the responsibility of direct and general support maintenance.

4-73. Propeller Shaft Coupling

a. General. The propeller shaft coupling is a flanged type with two halves secured to each other with nuts and bolts. The after-half is

keyed to the propeller and shaft and retained by a nut on the threaded end of the shaft.

b. Inspection.

(1) Check the condition of the shaft, bolt, and nut threads.

(2) Check coupling for breaks, cracks, or distortion.

(3) Attempt to insert an 0.0015-inch feeler gage around several points between the couplings. If the gage can be inserted at any point, report to direct support maintenance.

Section XV. MAINTENANCE OF BOAT FRAME ASSEMBLY

4-74. General

This section contains the maintenance instructions for the hatch covers, access covers and the towing attachments that are the responsibility of organizational maintenance.

4-75. Engine Hatch Covers

a. General. The engine hatch covers are mounted on the skirt above the engine compartment. The two covers are hinged with pins and secured by toggle bolts.

b. Removal. Refer to figure 4-68 and remove the hatches.

c. Inspection and Repair.

(1) *Inspection.* Inspect the hatch covers for corrosion, cracks, bends, breaks, and damaged welds. Check for loose or missing rivets, bent or missing hinge pin, and other damaged hardware.

(2) *Repair.* Repair cracks and straighten bends. Replace missing or damaged rivets, hinge pins, and other hardware.

d. Installation. Install the engine hatches in the reverse order of removal.

4-76. Stern Hatch Cover

a. General. The stern hatch cover is located on the after deck of the stern assembly. The cover affords access to the steering gear quadrant and transverse rod.

b. Removal. Refer to figure 4-69 and remove the stern hatch cover.

c. Inspection and Repair.

(1) *Inspection.* Inspect the hatch cover for corrosion, cracks, bends, breaks, and damaged weld. Check for loose or missing rivets, bent or missing hinge pins and other hardware.

(2) *Repair.* Repair cracks and breaks and straighten bends. Replace missing or damaged rivets, hinge pins and other hardware.

d. Installation. Install the stern hatch cover in the reverse order of removal.

4-77. Bow Hatch Cover

a. General. The bow hatch cover is located on the forward bulkhead of the bow cockpit. The hatch affords access to the bow compartment. The compartment serves as a stowage area for the on-board equipment.

b. Removal. Refer to figure 4-70 and remove the bow hatch cover.

c. Inspection and Repair.

(1) *Inspection.* Inspect the bow hatch cover for bends, breaks, cracks, damaged welds and other damage. Check for loose, bent, or missing rivets, hinge pins and other hardware.

(2) *Repair.* Repair cracks and breaks. Straighten bends. Replace missing or damaged rivets, hinge pins, and other hardware.

d. Installation. Install the bow hatch cover in the reverse order of removal.

4-78. Access Panel

a. General. The access panel is located behind the port engine hatch. The panel provides access to the steering system upper gear box and the rear of the instrument panel.

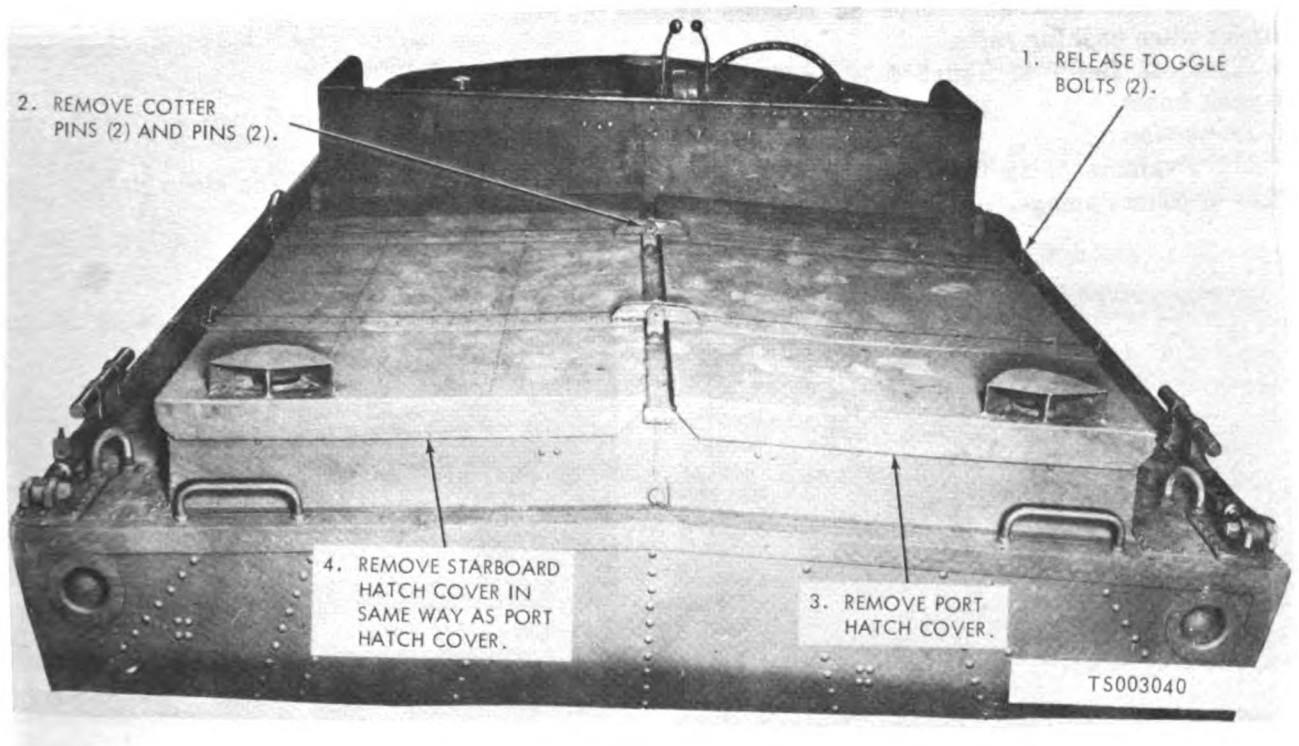


Figure 4-68. Engine hatch covers removal.

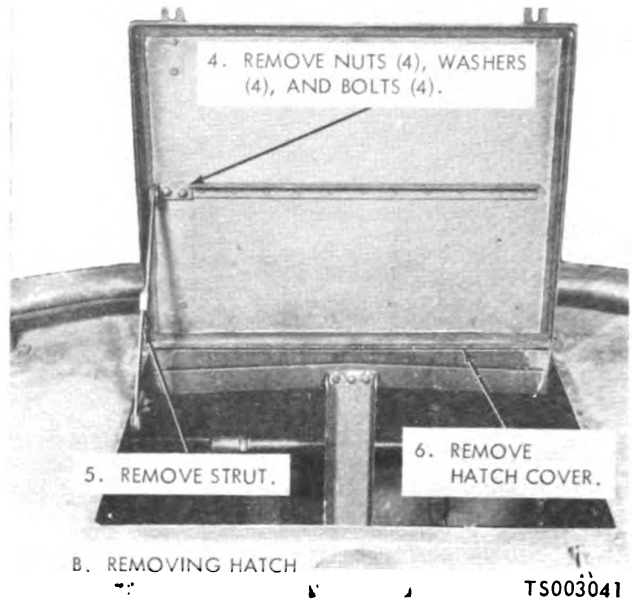
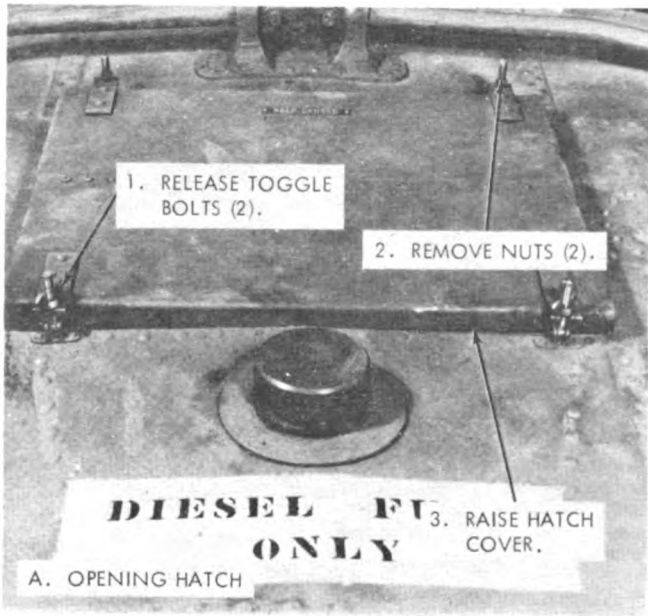


Figure 4-69. Stern hatch cover removal.

b. *Removal.* Refer to figure 4-71 and remove the access panel.

c. *Installation.* Install the access panel in the reverse order of removal.

4-79. Push Knees

a. *General.* The two push knees are located at the bow of the boat and serve as fenders or bumpers when pushing rafts.

b. *Removal.* Refer to figure 4-72 and remove the push knees.

c. *Inspection.*

(1) Examine parts for cracks, breaks, distortion or other damage.

(2) Check for loose or missing hardware.

d. *Installation.* Install the push knees in the reverse order of removal.

4-80. Bow Towing Bitt

a. *Removal.* Refer to figure 4-73 and remove the bow towing bitt.

b. *Installation.* Install the bow towing bitt in the reverse order of removal.

4-81. Stern Towing Bitt

a. *Removal.* Refer to figure 4-74 and remove the stern towing bitt.

b. *Installation.* Install the stern towing bitt in the reverse order of removal.

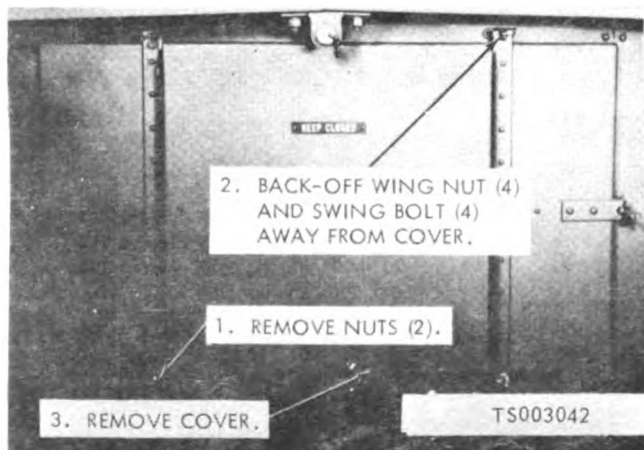


Figure 4-70. Bow hatch cover removal.

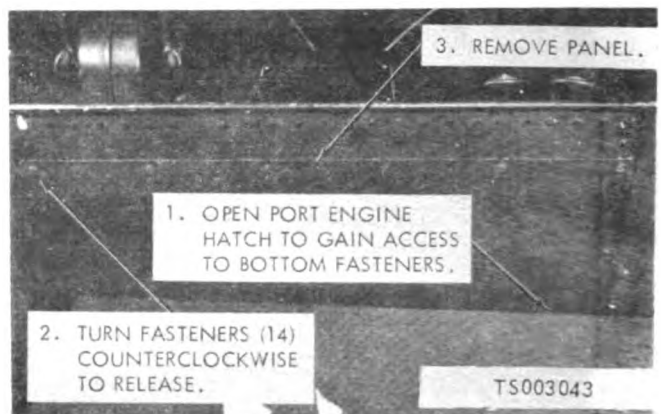


Figure 4-71. Access panel removal.

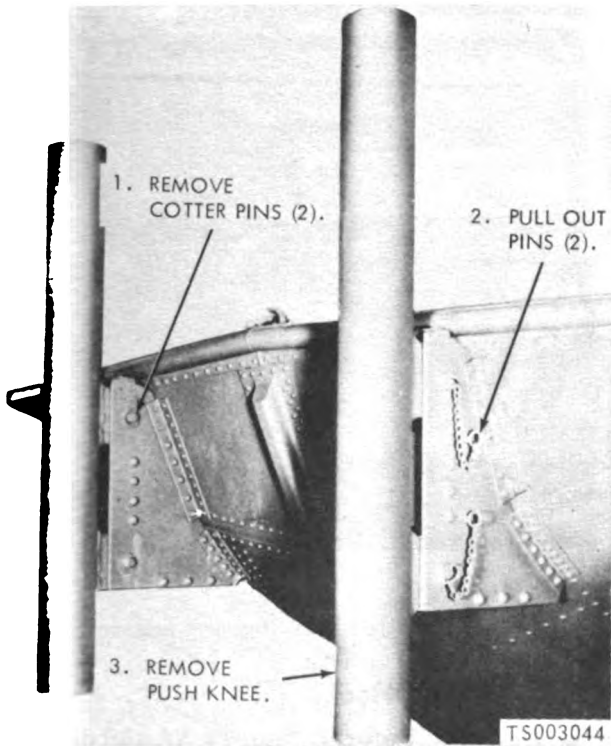


Figure 4-72. Push knee removal.

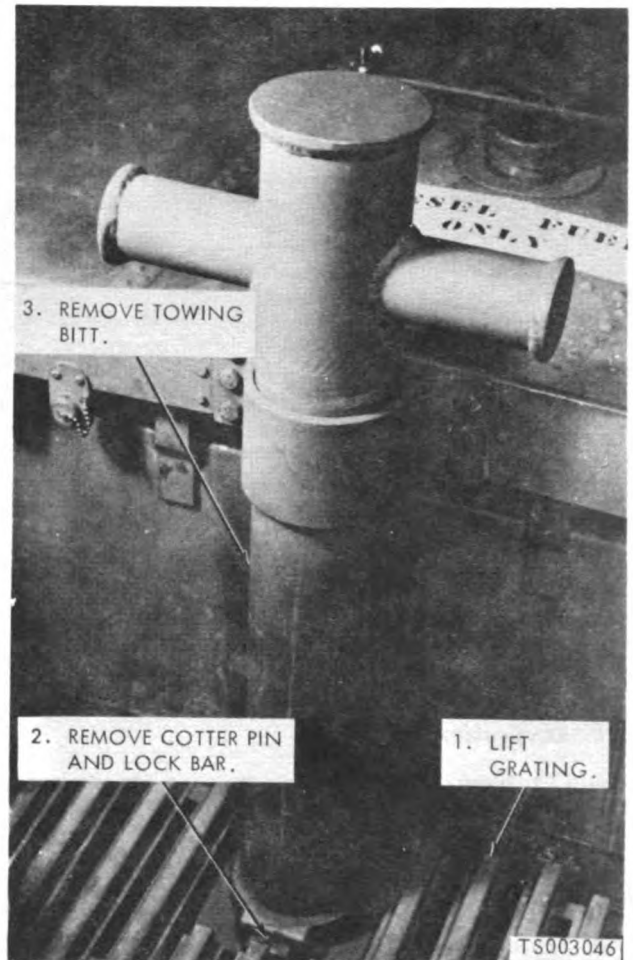


Figure 4-74. Stern towing bitt removal.

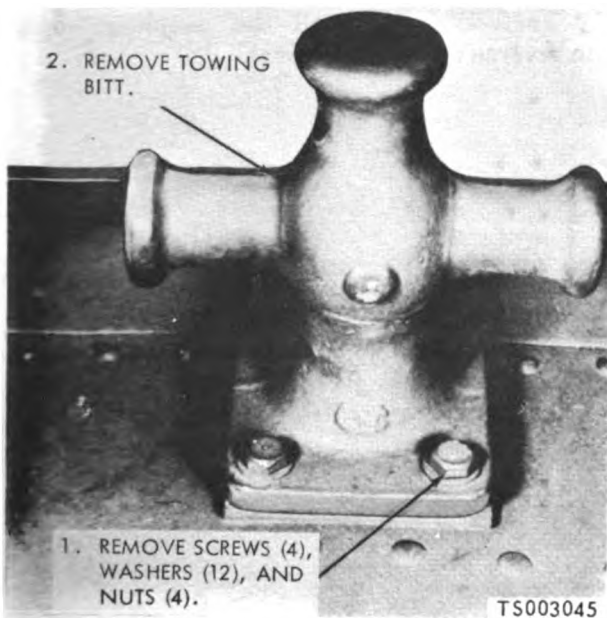


Figure 4-73. Bow towing bitt removal.

4-82. Base Haul Check

a. *Removal.* Refer to figure 4-75 and remove the haul check.

b. *Inspection.*

- (1) Check sheave for freedom of movement.
- (2) Examine parts for breaks, cracks, distortion or other damage.
- (3) Check condition of rope and splicing.

c. *Installation.* Install the haul check in the reverse order of removal.

4-83. Coupling Arm

a. *Removal.* Refer to figure 4-76 and remove the coupling arm.

b. *Inspection.*

- (1) Check parts for breaks, cracks, distortion, or other damage.
- (2) Check condition of threads and that the nut turns smoothly.

c. *Installation.* Install the coupling arm in the reverse order of removal.

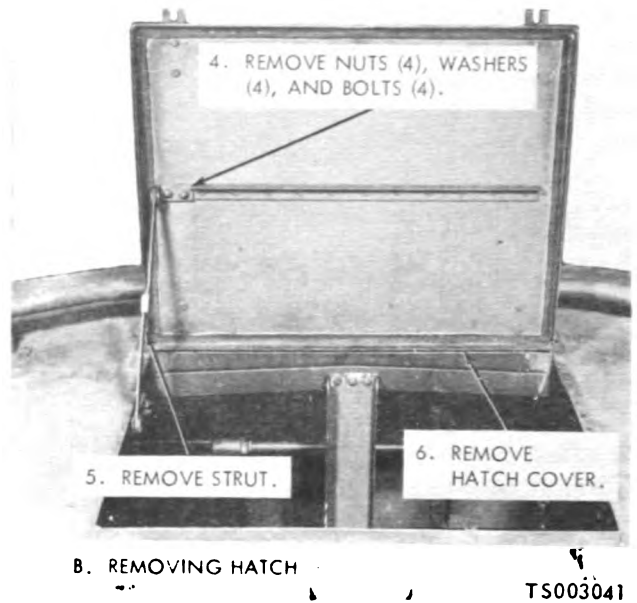
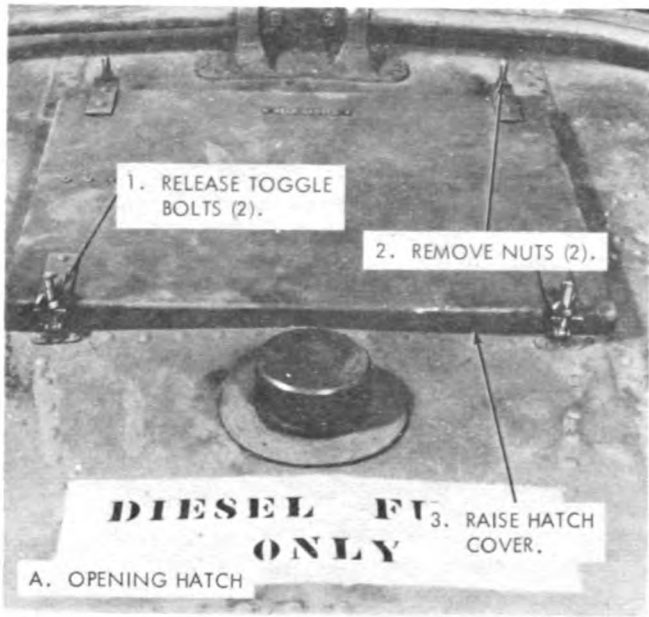


Figure 4-69. Stern hatch cover removal.

b. *Removal.* Refer to figure 4-71 and remove the access panel.

c. *Installation.* Install the access panel in the reverse order of removal.

4-79. Push Knees

a. *General.* The two push knees are located at the bow of the boat and serve as fenders or bumpers when pushing rafts.

b. *Removal.* Refer to figure 4-72 and remove the push knees.

c. *Inspection.*

(1) Examine parts for cracks, breaks, distortion or other damage.

(2) Check for loose or missing hardware.

d. *Installation.* Install the push knees in the reverse order of removal.

4-80. Bow Towing Bitt

a. *Removal.* Refer to figure 4-73 and remove the bow towing bitt.

b. *Installation.* Install the bow towing bitt in the reverse order of removal.

4-81. Stern Towing Bitt

a. *Removal.* Refer to figure 4-74 and remove the stern towing bitt.

b. *Installation.* Install the stern towing bitt in the reverse order of removal.

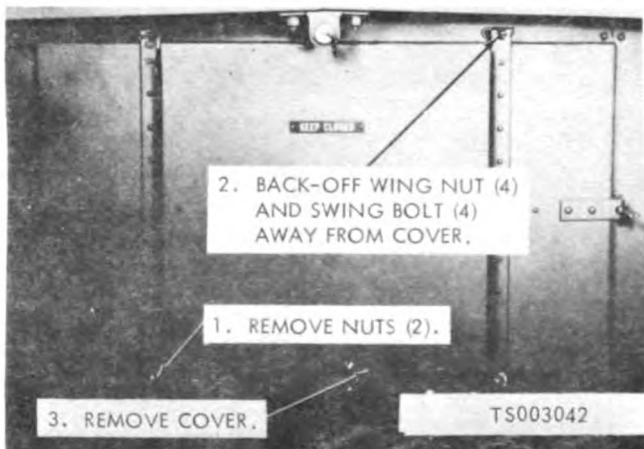


Figure 4-70. Bow hatch cover removal.

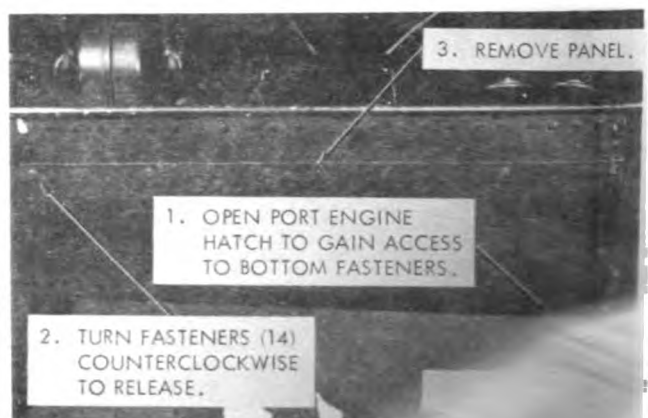


Figure 4-71.

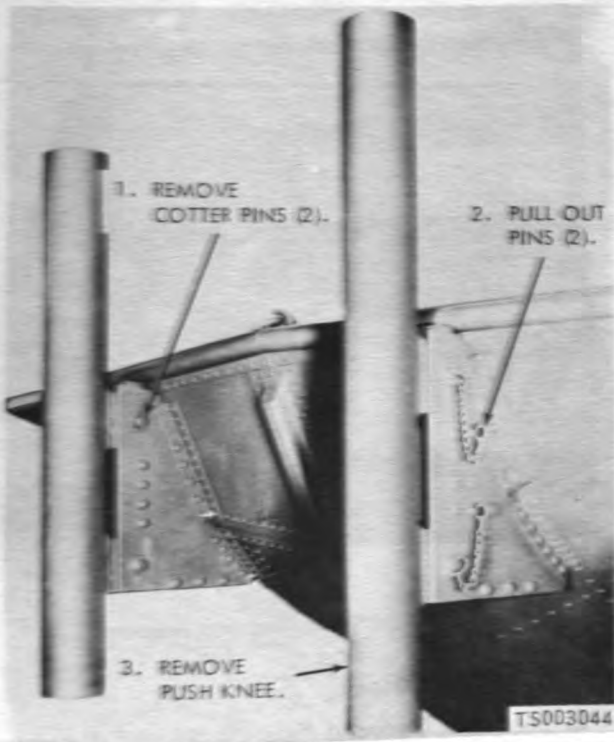


Figure 4-72. Push knee removal.

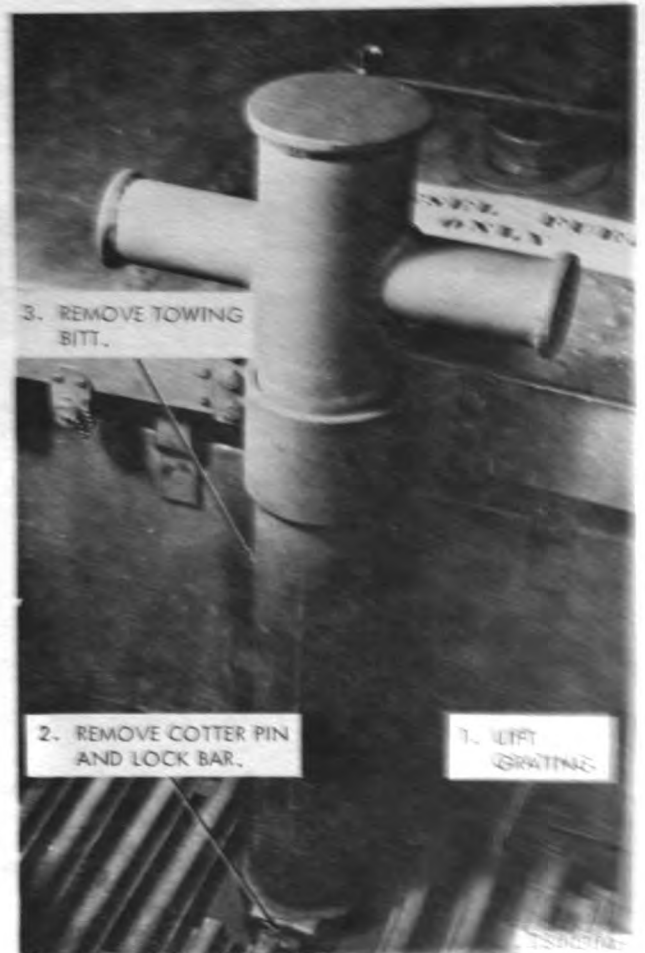


Figure 4-74. Stern towing bit removal.



4-82. Base Haul Check

a. Removal. Refer to figure 4-82 for the haul check.

b. Inspection.

- (1) Check sheave for wear.
- (2) Examine parts for wear, distortion or other damage.
- (3) Check condition of sheave.

c. Installation. Install in the reverse order of removal.

4-83. Coupling Arm

- Removal/Installation:
- (1) Remove coupling arm.
 - (2) Inspect:
 - (a) Check parts for wear, distortion or other damage.
 - (b) Check condition of sheave.
- Installation: Install in the reverse order of removal.

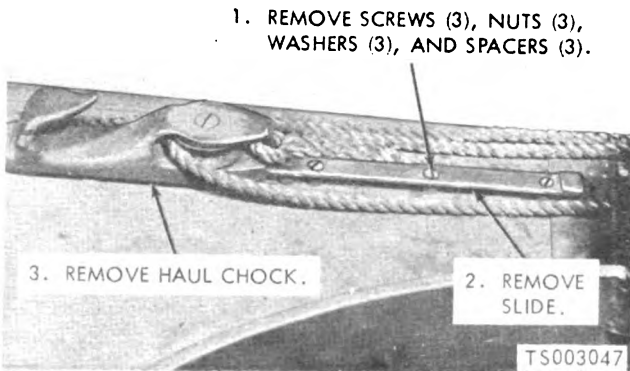


Figure 4-75. Haul chock removal.

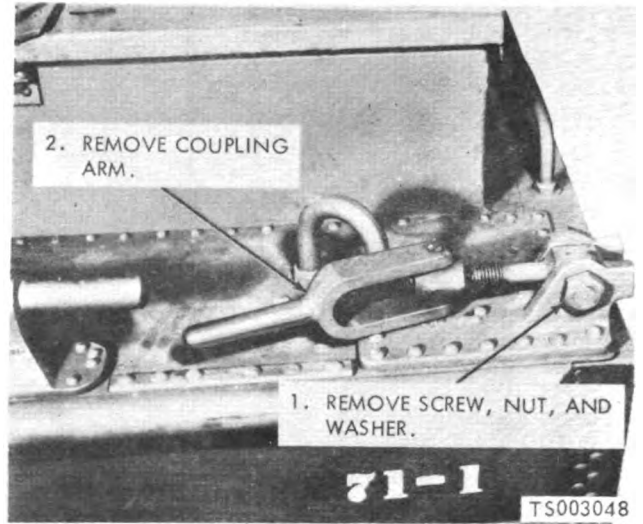


Figure 4-76. Coupling arm removal.

4-84. Coupling Yoke

a. *Removal.* Refer to figure 4-77 and disassemble coupling yoke in the order of the index numbers.

b. *Inspection.*

(1) Examine all parts for cracks, breaks, distortion, or other damage.

(2) Check condition of threads and that the nut turns smoothly.

c. *Installation.* Install the coupling yoke in the reverse order of removal.

4-85. Coupling Hook

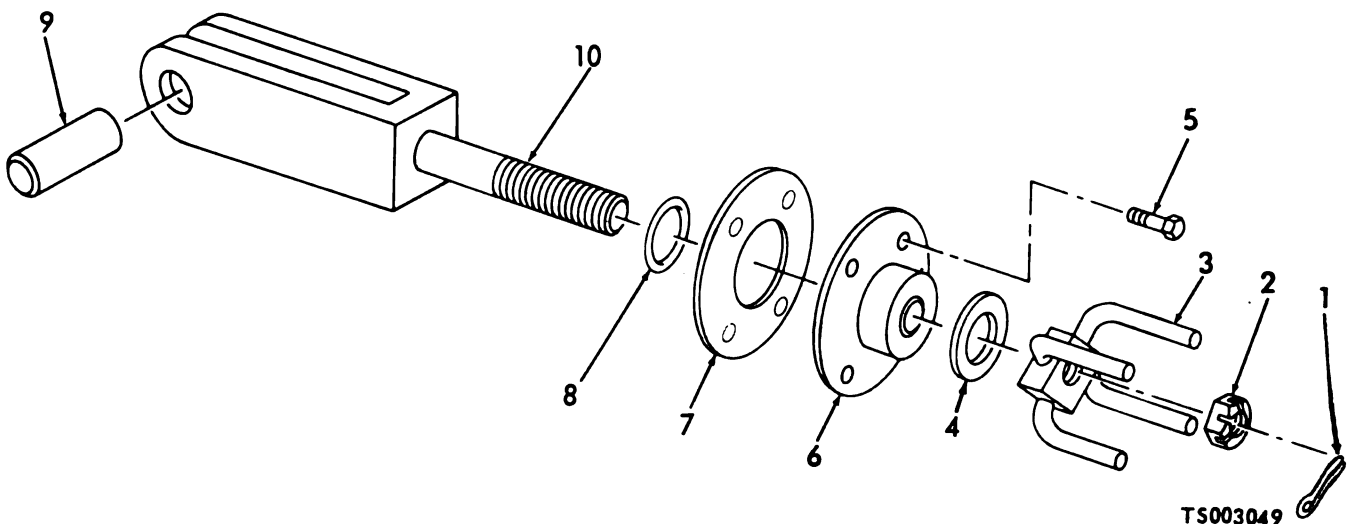
a. *Removal.* Refer to figure 4-78 and disassemble the coupling hook in the order of the index numbers.

b. *Inspection.*

(1) Check all parts for cracks, breaks, distortion, and other damage.

(2) Check condition of all threads.

c. *Installation.* Install the coupling hook in the reverse order of removal.



- 1. Pin
- 2. Nut
- 3. Nut

- 4. Spacer
- 5. Screw
- 6. Retainer

- 7. Gasket
- 8. Packing
- 9. Pin

- 10. Yoke

Figure 4-77. Coupling yoke, exploded view.

CHAPTER 5

MAINTENANCE OF MATERIAL USED IN CONJUNCTION WITH MAJOR ITEM

Section I. FIRE EXTINGUISHER SYSTEM

5-1. General

The fire extinguishers are carbon dioxide types. They are located at the forward right portion of the operator's cockpit (fig. 1-2) and are suitable for electrical and flammable liquid fires. One extinguisher is fixed in place and is provided for protection of the engine compartment. The other extinguisher is a portable bottle-type.

NOTE

Fire extinguisher to be weighed every 12 months with a maximum allowable loss of 10%.

5-2. Removal

Refer to figure 5-1 to remove the fire extinguisher cylinders and to figure 5-2 to remove the lines.

5-3. Installation

Install the fire extinguisher and lines in the reverse order of removal (para 5-2).

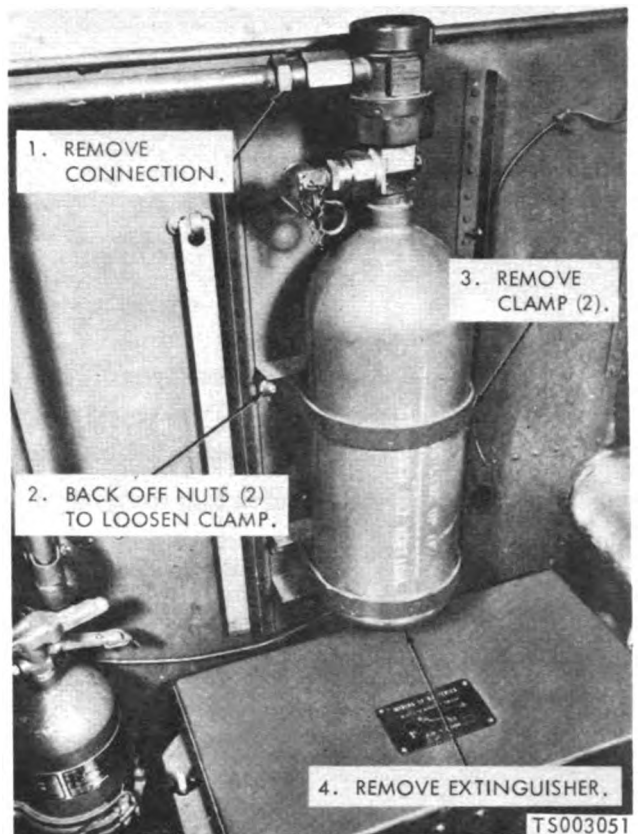
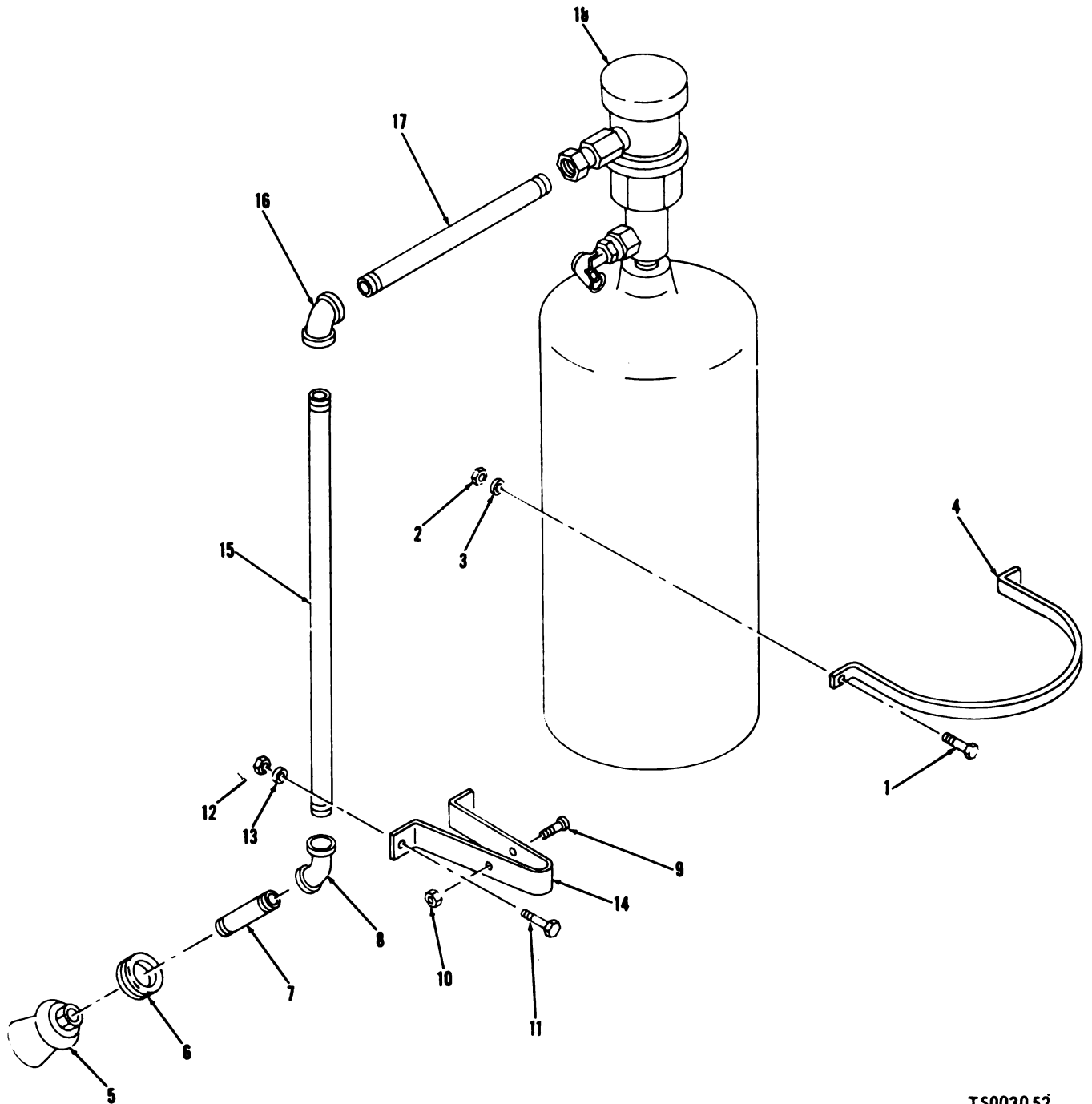


Figure 5-1. Fire extinguisher removal.



TS003052

- | | | |
|------------|-----------|-----------------------------|
| 1. Screw | 7. Pipe | 13. Washer |
| 2. Nut | 8. Elbow | 14. Clamp |
| 3. Washer | 9. Screw | 15. Pipe |
| 4. Bracket | 10. Nut | 16. Elbow |
| 5. Nozzle | 11. Screw | 17. Pipe |
| 6. Grommet | 12. Nut | 18. Tank and valve assembly |

Figure 5-2. Fire extinguisher lines and fittings.

Section II. ELECTRIC BILGE PUMP

5-4. General

The electric bilge pump is mounted in the bilge of the engine compartment just forward of the aft bulkhead. The pump is connected by a hose to a thru-hull fitting on the port side of the hull. The pump is actuated by the BILGE PUMP switch on the switch panel. A description of the pump is given in paragraph 1-5.

5-5. Removal

- a. Turn off the MASTER switch.
- b. Refer to figure 5-3 and remove the pump.

5-6. Inspection

- a. Check all parts for breaks, cracks, or other damage.
- b. Check wiring and connections for condition and security of fittings.

5-7. Installation

Install the pump in the reverse order of removal.

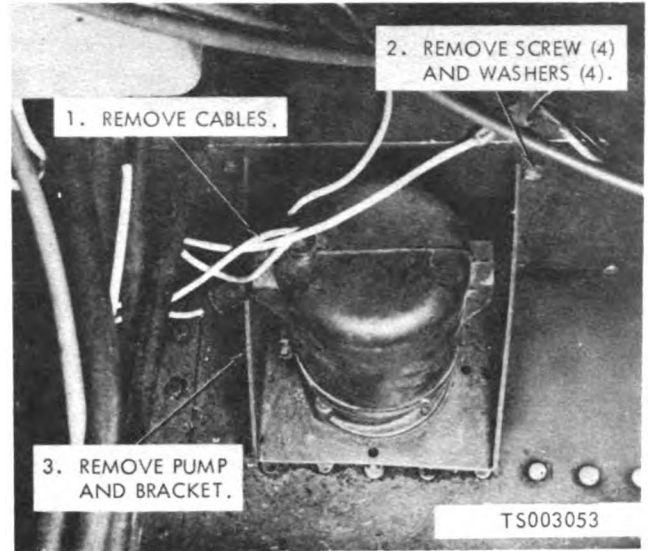


Figure 5-3. Electric bilge pump removal.

Section III. MANUAL BILGE PUMP

5-8. General

A manual bilge pump is mounted at the rear of the cargo well (fig. 1-1). The pump is hand-operated piston-type, the outlet of which is connected by a rubber hose to a thru-hull fitting on the port side.

5-9. Removal

Refer to figure 5-4 and remove the pump.

5-10. Disassembly

- a. Unscrew strainer (5, fig. 5-5) and nipple (6).
- b. Unscrew the piston assembly (7) from the tube (21) at the cap (15) and remove the piston assembly (7), the gasket (8), and the valve washer (9).
- c. Unscrew the valve washer (8), from the rod (18) and remove the valve (10), cup (11), washer (12), pin (13), and collar (14).
- d. Remove the cap (15) from the rod (18), and remove the nut (17), and packing (16), from the cap (15).
- e. Remove the plug (19) and connection (20) from the tube (21).

5-11. Inspection and Repair

- a. Check all parts for cracks, breaks, distortion, and other damage.
- b. Replace any defective part.

5-12. Reassembly

- a. Install the connection (20, fig. 5-5) and plug (19) on the tube (21).
- b. Install the nut (17), packing (16), cap (15), on the rod (18).
- c. Install the nut (17), and packing (16) in the cap (15). Do not tighten nut.
- d. Install the collar (14), pin (13), washer (12), and cup (11), on the rod (18) and secure them to the rod with the valve seat (10).
- e. Install the valve washer (9), gasket (8), and piston assembly (7), into the tube (21) and secure it by screwing it in at the cap (15). Install nipple (6), and strainer (5), on connection (20).

5-13. Installation

Refer to figure 5-4 and install the pump in reverse order of removal.

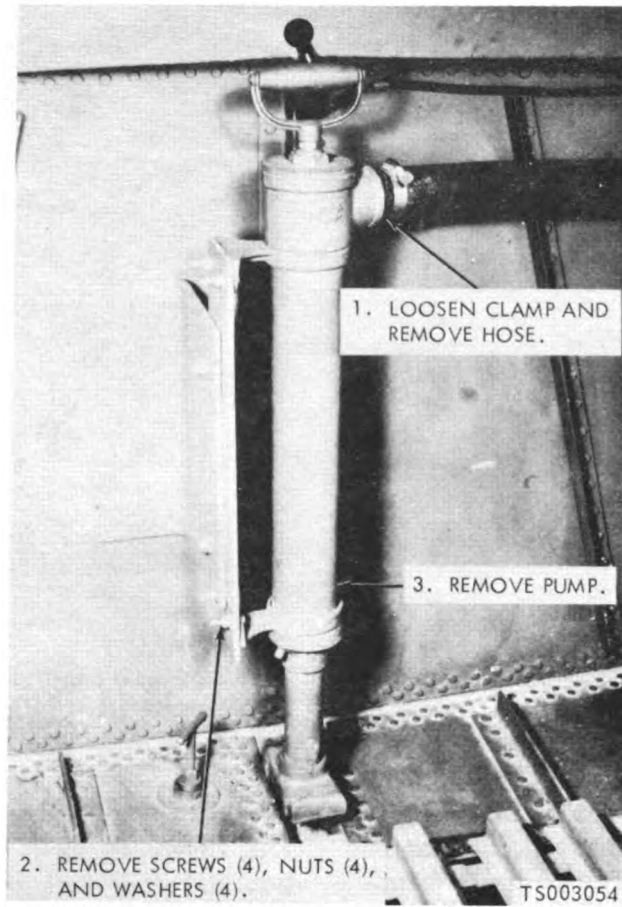
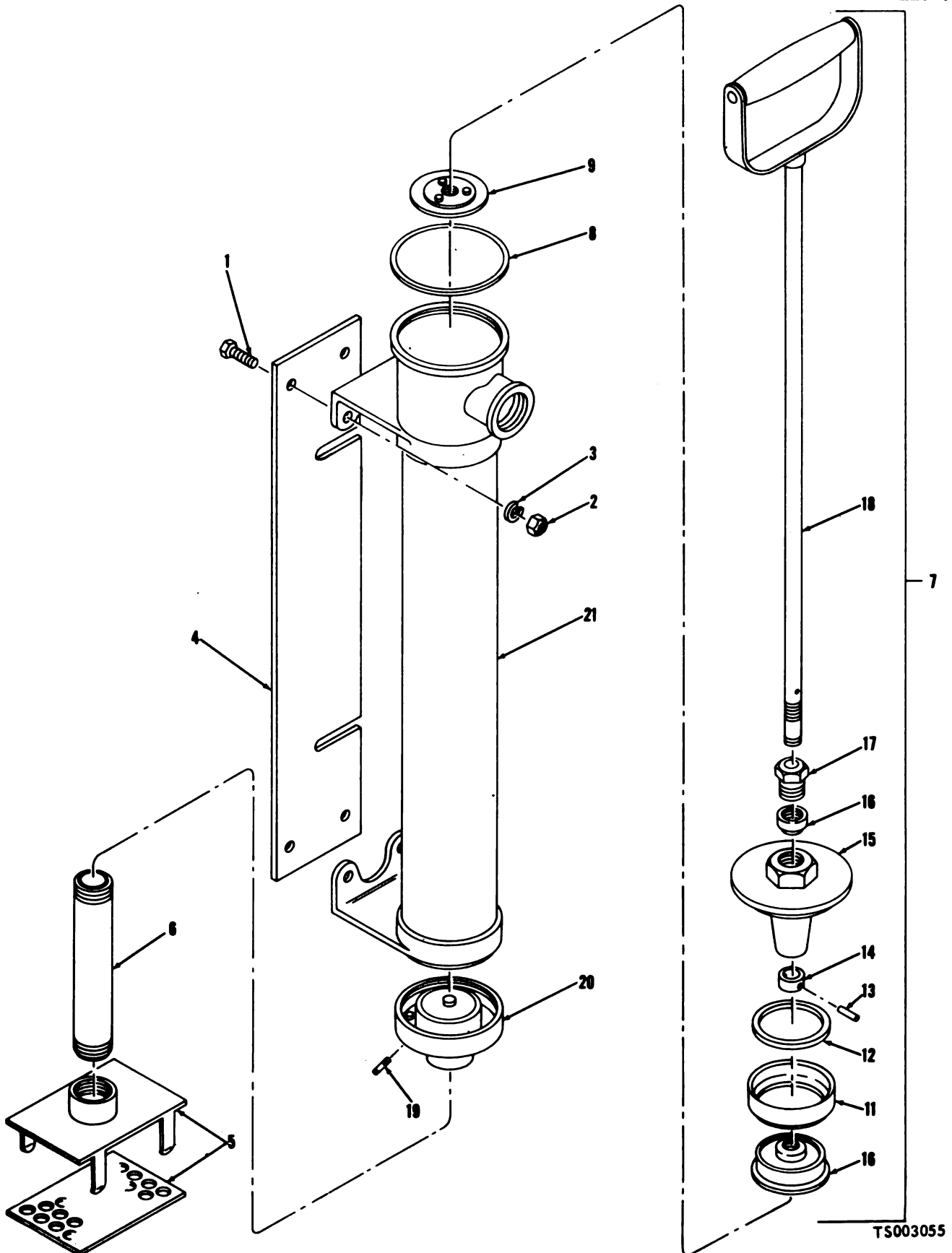


Figure 5-4. Manual bilge pump removal.



- | | | | | | | |
|-----------|-------------|--------------------|----------------|------------|-------------|----------------|
| 1. Screw | 4. Bracket | 7. Piston assembly | 10. Valve seat | 13. Pin | 16. Packing | 19. Plug |
| 2. Nut | 5. Strainer | 8. Gasket | 11. Cup | 14. Collar | 17. Nut | 20. Connection |
| 3. Washer | 6. Nipple | 9. Washer, valve | 12. Washer | 15. Cap | 18. Rod | 21. Tube |

Figure 5-5. Manual bilge pump, exploded view.

APPENDIX A

REFERENCES

A-1. Fire Protection

TB 5-4200-200-10 Hand Portable Fire Extinguishers Approved for Army Users

A-2. Lubrication

C9100-IL Identification List for Fuels, Lubricants, Oils and Waxes End Item LO
also.
LO 5-1940-221-12 Lubrication Order

A-3. Radio Suppression

TM 11-488 Radio Interference Suppression

A-4. Maintenance

TM 9-218 Painting Instructions for Field Use
TB 750-651 Use of Antifreeze Solutions and Cleaning Compounds in Engine Cooling
System.
TM 38-750 The Army Maintenance Management System
TM 5-1940-221-34 Direct and General Support Maintenance
TM 5-1940-221-20P Organizational Repair Parts and Special Tools List for 27-Foot Bridge
Erection Boat.
TM 5-1940-221-34P Direct and General Support Repair Parts and Special Tools List for 27-
Foot Bridge Erection Boat
TM 9-6140-200-14 Operation and Organizational, Field, and Depot Maintenance: Storage
Batteries, Lead-Acid Type.
TB 385-101 Equipment Near Electric Power Lines

A-5. Shipment and Storage

TM 740-90-1 Administrative Storage of USAMEC Mechanical Equipment
TB 740-93-4 Preservation of Vessels for Storage

A-6. Radioactive Material

TB 750-248 Instructions for Safe Handling, Maintenance, Storage, and Disposal of
Radioactive Commodities Managed by U. S. Army Mobility Equipment
Command

A-7. Destruction to Prevent Enemy Use

TM 750-244-3 Procedures for Destruction of Equipment to Prevent Enemy Use

APPENDIX C

BASIC ISSUE ITEM LIST AND ITEMS TROOP INSTALLED OR AUTHORIZED

Section I. INTRODUCTION

C-1. Scope

This appendix lists basic issue items, items troop installed or authorized which accompany the bridge erection boat and required by the crew/operator for operation, installation, or operator's maintenance.

C-2. General

The basic issue items, items troop installed or authorized list is divided into the following sections:

a. Basic Issue Items List—Section II. (Not applicable).

b. Items Troop Installed or Authorized List—Section III. A list, in alphabetical sequence of items which at the discretion of the unit commander may accompany the end item, but are NOT subject to be turned in with the end item.

C-3. Explanation of Columns

The following provides an explanation of columns in the tabular list of Basic Issue Items List, Section II, and Items Troop Installed or Authorized, Section III.

a. Source, Maintenance, and Recoverability Code(s) (SMR):

(1) Source code indicates the source for the listed item. Source codes are:

<i>Code</i>	<i>Explanation</i>
P	Repair parts, special tools and test equipment supplied from GSA/DSA or Army supply system and authorized for use at indicated maintenance levels.
P2	Repair parts, special tools and test equipment which are procured and stocked for insurance purposes because the combat or military essentiality of the end item dictates that a minimum quantity be available in the supply system.

(2) Maintenance code indicates the lowest level of maintenance authorized to install the listed item. The maintenance level code is:

<i>Code</i>	<i>Explanation</i>
C	Crew/Operator

(3) Recoverability code indicates whether unserviceable items should be returned for recovery or salvage. Items not coded are nonrecoverable. Recoverability codes are:

<i>Code</i>	<i>Explanation</i>
R	Applied to repair parts (assemblies and components), special tools and test equipment which are considered economically repairable at direct and general support maintenance levels.
S	Repair parts, special tools, test equipment and assemblies which are economically repairable at DSU and GSU activities and which normally are furnished by supply on an exchange basis.

b. Federal Stock Number. This column indicates the Federal stock number assigned to the item and will be used for requisitioning purposes.

c. Description. This column indicates the Federal item name and any additional description of the item required.

d. Unit of Measure (U/M). A two-character alphabetic abbreviation indicating the amount or quantity of the item upon which the allowances are based, e.g., ft, ea, pr, etc.

e. Quantity Furnished With Equipment (BILL only). This column indicates the quantity of an item furnished with the equipment.

f. Quantity Authorized (Items Troop Installed or Authorized Only). This column indicates the quantity of the item authorized to be used with the equipment.

Section III. ITEMS TROOP INSTALLED OR AUTHORIZED LIST

Federal stock number	Description	U/M	Qty auth
4320-775-3793	Pump Reciprocating, Hand Oil 13213E5470 (97403)	EA	1
4210-270-4512	Extinguisher, Fire 02910 (81349)	EA	1
2090-997-6049	Cover, Cargo Well 13213E5374 (97403)	EA	1
	Pole Cover 13213E5376 (97403)	EA	1
2030-997-6041	Line, Steering 13213E5510 (97403)	EA	2
2030-033-4735	Line, Mooring 13213E5511 (97403)	EA	4
2040-997-6047	Anchor and Anchor Line Assembly 13216E9929	EA	1
2040-007-1136	Hook, Boat 13216E9929 (97403)	EA	1
2040-997-6048	Cover, Cockpit 13213E5375 (97403)	EA	1
4220-275-3156	Ring, Buoy 13213E5468 (97403)	EA	1

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