TABLE OF CONTENTS PAGE i

## TECHNICAL MANUAL OPERATOR'S MAINTENANCE MANUAL



EQUIPMENT DESCRIPTION AND DATA PAGE 1-3

OPERATING INSTRUCTIONS PAGE 2-1

OPERATOR'S PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PCMS) PAGE 2-5

OPERATOR MAINTENANCE INSTRUCTIONS PAGE 3-1

OPERATOR/CREW TROUBLE-SHOOTING PROCEDURES PAGE 3-3

ALPHABETICAL INDEX PAGE INDEX 1

#### BARGE, LIQUID CARGO, NON-PROPELLED, STEEL 120 FEET, DESIGN 231C

#### NSN: 1930-01-313-9472

Approved for public release. Distribution is unlimited.

#### WARNING

A loading or unloading operation is a fire hazard. No smoking, open flames, open lights, or any repair work requiring the use of tools that could ignite the flammable cargo shall be permitted on the vessel or in the area adjacent to the vessel during cargo transfer operations.

Make sure hatch retaining pin is installed when hatch is opened. Failure to install pin can result in injury to personnel.

Petroleum vapors are both toxic and explosive. In sufficient concentration petroleum vapor may cause death within five minutes. In lesser concentrations, irritation of the eyes, sever headache, and mild exhilaration may be experienced. Tanks which are not ventilated and have remained empty for a while may be depleted in oxygen due to rusting. The oxygen content may not be enough to support life.

Do not breathe cleaning solvent vapors for long periods of time or use solvent near open flames. To avoid illness, explosion, or fire, only use solvent in well ventilated areas away from open flames.

Fight fire from the windward side, allowing the wind to blow heat away from the operator. The wind will also carry the carbon dioxide to the fire.

Avoid the use of carbon tetrachloride as a cleaning agent, because of the harmful vapors that it releases. Use perchloroethylene or trichloroethylene. However, while less toxic than other chlorinated solvents, use these cleaning agents with caution. Be sure the work area is adequately ventilated, and use protective gloves, goggles or face shield, and apron.

Use caution when welding on or near the fuel tank. Possible explosion could result if heat build-up inside the tank is sufficient.

Make sure all guards are in place.

Do not stick fingers in the ports of a pump. The close running parts will cause injury.

Loose clothing can get easily entangled in moving parts. When operating machines do not wear unbuttoned jackets, loose sleeve cuffs, or neckties.

Page

#### HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, D.C., 26 March 1990

#### OPERATOR'S MAINTENANCE MANUAL

#### BARGE, LIQUID CARGO, NON-PROPELLED, STEEL 120 FEET, DESIGN 231C NSN 1930-01-313-9472 Approved for public release. Distribution is unlimited.

#### **REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS**

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

#### Current as of 6 March 1990 TABLE OF CONTENTS

		i ugo
CHAPTER 1		1-1
Section I	General Information	
Section II	Equipment Description and Data	
Section III	Technical Principles of Operation	1-11
CHAPTER 2	OPERATING INSTRUCTIONS	2-1
Section I	Description and Use of Operator Controls and Indicators	2-1
Section II	Preventive Maintenance Checks and Services (PMCS)	2-5
Section III	Operation Under Usual Conditions	2-14
Section IV	Operation Under Unusual Conditions	2-27
CHAPTER 3	OPERATOR MAINTENANCE INSTRUCTIONS	
Section I	Lubrication Instructions	
Section II	Operator/Crew Troubleshooting Procedures	
Section III	Maintenance Instructions	
APPENDIX A	REFERENCES	A-1

Dago

#### **TABLE OF CONTENTS - Continued**

APPENDIX B	COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST	B-1
APPENDIX C	ADDITIONAL AUTHORIZATION LIST (AAL)	C-1
APPENDIX D	EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST	D-1
ALPHABETICAL IN	IDEX	Index 1

#### LIST OF ILLUSTRATIONS

#### Figure No. Title Page No. Liquid Cargo Barge.....1-0 1-1 Location and Description of Major Components ......1-5 1-2 1-3 Cargo Piping System 1-4 1-5 Data and Identification Plates ......1-8 2-1 Engine Control Panel Controls and Indicators ......2-1 2-2 Loading and Discharge Control Valves ......2-3 2-3 2-4 Loading Connections and Valves.....2-15 2-5 2-6 2-7 2-8 2-9 3-1 3-2 3-3 3-43-5 3-6 3-7 3-8 3-9 3-10 3-11 3-12 3-13 3-14 3 - 153-16 3-17 3-18 3-19 3-20 3-21 3-22 3-23

ii

#### LIST OF TABLES

#### Page No. Table No. Title 2-1 2-2 Cargo Control Valves......2-3 2-3 2-4 Operator/Crew Preventive Maintenance Checks and Services 2-5 Guide for Preparation of Antifreeze Solution......2-28 3-1



Figure 1-1. Liquid Cargo Barge.

#### CHAPTER 1 INTRODUCTION

Section I.GENERAL INFORMATIONSection II.EQUIPMENT DESCRIPTIONSection III.TECHNICAL PRINCPLES OF OPERATION

SECTION I.	
Para.	Para.
Glossary1-5	Reporting Equipment Improvement
List of Abbreviations1-4	Recommendations (EIR) 1-3
Maintenance Forms and Records1-2	Scope 1-1
1-1. SCOPE.	
a. Type of Manual	Operator's Maintenance Manual
b Model Number and	
Equipment Name	Barge Liquid Cargo Non-propelled
	Steel 120 Feet
	Design 231C
	NEN 1020 01 212 0472
	DC 9500 Thm DC 9500
	AK-WA, Inc.
	Tacoma, WA
d. Purpose of Equipment	Designed to transport bulk petroleum
	products on rivers and in harbors.

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

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

b. The following record and report forms are to be used by the operational personnel for recording and reporting operations:

DD Form 314	Preventive Maintenance Schedule and Record
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2407	Maintenance Request
DA Form 2407-1	Maintenance Request (Continuation Sheet)

#### 1-2. MAINTENANCE FORMS AND RECORDS - Continued.

DA Form 2408	Equipment Log Assembly (Record)
DA Form 2408-5	Equipment Modification Record
DA Form 2408-14	Uncorrected Fault Record

#### 1-3. REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR).

If the barge or associated equipment needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you do not like about your equipment. Let us know why you don't like the design. Put it on an SF 368 (Quality Deficiency Report). Mail it to us at Commander, U.S. Army Troop Support Command, ATTN: AMSTR-QX, 4300 Goodfellow Blvd., St. Louis, MO 631201798. We'll send you a reply.

#### 1-4. LIST OF ABBREVIATIONS.

CO. Company
ft foot (feet)
hp Horsepower
IN INCH(es)
lbs Pound(s)
no Number(s)
RPM Revolution per minute

#### 1-5. GLOSSARY.

Aft	Rear of Vessel
Bow	Front of Vessel
Port	Left Side of Vessel
Starboard	Right Side of Vessel

#### SECTION II. EQUIPMENT DESCRIPTION AND DATA

	Para.		Para.
Difference Between Models	.1-8	Equipment Data	1-9
Equipment Characteristics, Capa-		Location and Description of Major	
bilities, and Features	.1-6	Components	1-7

#### 1-6. EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES.

- •The barge is a large vessel of the nonpropulsion type and must be towed to desired locations.
- •Designed to transport bulk petroleum products in rivers and harbors.
- •There are six cargo compartments in the hull with a total cargo capacity of 4,495 bbls. or 576.15 long tons or 645.27 short tons.
- •Equipped with diesel engine driven rotary pump for transfer of cargo.
- •Equipped with hand operated bilge pump, cargo boom, two anchors, anchor windlass and davit.
- •Equipped with running and navigation lights.

#### 1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS. (Refer to figure 1-2).

a. <u>HULL.</u> The main body and frame of the barge.

b. DAVIT. Used to hoist and position anchors on deck.

c. <u>WINDLASS.</u> Used to hoist anchors.

d. <u>CARGO HOSE BOOM.</u> Used to hoist and support cargo hoses during loading or unloading operations.

e. MACHINERY HOUSE. Provides a shelter for cargo pump diesel engine and reduction gear.

f. <u>FUEL TANK.</u> Stores fuel for cargo pump diesel engine. Located on top of machinery house.

g. <u>EXHAUST MUFFLER.</u> Suppresses exhaust noise and sparks from cargo pump diesel engine. Located on top of machinery house.

h. <u>RUNNING LIGHTS.</u> Battery operated. Located at forward corners of deck, green on starboard side and red on port side, and centered on after deck, white 135 degrees.

i. <u>BILGE PUMP.</u> Hand operated. Used to remove bilge from cargo compartments. Two are located on the main deck.

j. <u>ANCHORS.</u> Two 300 pound (136 kg) anchors are secured forward on main deck.

k. <u>HATCHES.</u> Various hatches providing access to equipment and compartments are located on the main deck. The hatch above the aft rake compartment is illustrated.

I. <u>FILLING INLET AND DISCHARGE OUTLET VALVES.</u> Filling valve provides connection to shore storage facility. Discharge valve provides connection for cargo unloading. Both are located outside the machinery house on a single riser.

m. <u>SAFETY SHUT-DOWN CONTROL.</u> Hand operated remote control for stopping the pump engine in the event of any emergency. Located near compartment 3, center tank, port side.





Figure 1-2. Location and Description of Major Components.

# 1-7. LOCATION AND DESCRIPTION OF MAJOR COMPONENTS-Continued.

n. <u>CARGO PIPING SYSTEM.</u> Refer to figure 1-3. Used in loading and unloading of cargo and controlled by various valves in the system.



Figure 1-3. Cargo Piping System.

o. <u>DIESEL ENGINE</u>. Refer to Figure 1-4. Drives the cargo pump for unloading cargo. Located in machinery house.



Figure 1-4. Engine, Speed Reducer

p. <u>CARGO PUMP.</u> Driven by diesel engine through speed reducer. Used to unload liquid cargo. Located in aft rake compartment below engine.

- q. <u>COUPLING.</u> Couples the clutch and speed reducer.
- r. <u>SPEED REDUCER.</u> Reduces engine speed to cargo pump.
- s. DRIVE SHAFT. Connects speed reducer to cargo pump.

#### **1-8. DIFFERENCES BETWEEN MODELS.**

This manual covers only the Barge, Liquid Cargo, Nonpropelled, Steel, 4,495 bbl., 120 ft, design 231C.

1-9. EQUIPMENT DATA. (Refer to figure 1-5).

#### a. Data and Identification Plates.

- (1) The identification plate for the diesel engine is located on the right side of the cylinder block.
- (2) The identification plate for the power take off clutch is located on top of the clutch housing.
- (3) The data plate for the speed reducer is located at the rear of the speed reducer.
- (4) The data plate for the cargo pump is attached to the pump housing.



Figure 1-5. Data and Identification Plates.

# b. Tabulated Data.

PORT

(1) Barge, nonpropelled, design, 231C.

Length (over-all)	120 ft
Beam (molded)	33 ft
Depth, side	12 ft 6 in.
Depth, midships	10 ft 6 in.
Displacement, light	179 tons
Displacement, loaded	685 tons
Draft, loaded (forward)	7 ft 6 in.
Draft, loaded (aft)	7 ft 6 in.
Capacity (diesel oil)	
Cargo tank No. 1 Stbd	28,312 gal.
Cargo tank No. 2 Port	28,327 gal.
Cargo tank No. 3 Stbd	37,744 gal.
Cargo tank No. 4 Port	37,766 gal.
Cargo tank No. 5 Stbd	28,321 gal.
Cargo tank No. 6 Port	28,334 gal.
Total capacity	188,804 gal.
	or 4,495 bbl.

### **100 PERCENT CAPACITY**

TANK	TANK	
COMPARTMENT 2	COMPARTMENT 1	
28,327 GALLONS	28,312 GALLONS	
TANK	TANK	
COMPARTMENT 4	COMPARTMENT 3	
		STARBOARD
37,766 GALLONS	37,744 GALLONS	
ΤΔΝΚ	Τανικ	
COMPARTMENT 6	COMPARTMENT 5	
28,334 GALLONS	28,321 GALLONS	
85 PE	RCENT CAPACITY	

TANKS		
1/2	25034 Gallons	88.4%
3/4	31922 Gallons	84.6%
5/6	22850 Gallons	80.7%

# 1-9. EQUIPMENT DATA - Continued.

- b. Tabulated Data Continued.
  - (2) Diesel Engine.

Manufacturer Model Number of cylinders Displacement Bore and stroke Governor speed Brake horsepower Firing order Lubrication system Cooling system Starting method Fuel system	Detroit Diesel Engine Division of General Motors Corp. 1043-7000 4 283.7 cubic in. 4 1/4 in by 5 in. 1890 rpm 120 hp 1-3-4-2 Pressure Fresh water w/radiator Hydraulic starting Solid injection
Fuel	Diesel oil
(3) Pump Coupling Assembly.	
Manufacturer Type	The Falk Corporation T10
(4) Exhaust Fan.	
Manufacturer	Fan Engineering Co., Inc. L-07
Capacity	750 cfm/1700 rpm
(5) Cargo Pump.	
Manufacturer	Dover Corpora- tion/Blackmer Pump Division
Model Type Suction Discharge Fitted Capacity	HXL8F-N Vertical rotary 8 in. 8 in. Standard 1050 gpm at 150 rpm
(6) Bilge Pump.	
Manufacturer	Kolstrand Windward Mark
Model	AKPTDP30

(7) Speed Reducer.

Manufacturer ...... The Falk Corporation 

#### SECTION III. TECHNICAL PRINCIPLES OF OPERATION

Para.	Pa	ira.
General1-10	Precautions in Operations 1	-12
Operation of Equipment1-11		

#### 1-10. GENERAL.

The nonpropelled liquid cargo barge is designed to transport petroleum products on rivers and in harbors. It must be towed from one location to another and handled in the usual manner of a towing operation. Description and use of operator's controls and indicators are listed in paragraph 2-1. A crew of three persons are required to operate the barge. Crew consists of one chief engineer, one engine man, and one deck person.

#### 1-11. OPERATION OF EQUIPMENT.

a. The barge hull is divided into six compartments with a combined capacity of 4.495 barrels of liquid cargo. A diesel engine driven cargo pump is provided to unload the liquid cargo. Piping and valve arrangements are designed to facilitate loading and unloading of individual compartments.

b. The diesel engine drives the cargo pump through a right angle drive speed reduction gear system. The engine is started with a hydraulic cranking motor.

c. Fuel reaches the engine from a fuel tank secured on top of the machinery house which shelters the engine. Engine cooling is accomplished using fresh water circulated through a fan cooled radiator. There is a remote manual auxiliary shut-down device in the event of an emergency.

d. The barge is equipped with two 300 pound anchors which normally are secured on the main deck forward. A single davit, a roller chock, a hand operated windlass, and various lengths of line for handling the anchors are provided.

e. Bilge must be removed from the compartments at intervals depending on circumstances. Two hand operated bilge pumps are located on the main deck for this purpose.

f. Battery operated running and navigational lights are installed on the barge for towing operations. While under tow, it is the responsibility of the tug boat captain to see that proper navigation signals are displayed and proper sound signals are given.

#### **1-12. PRECAUTIONS IN OPERATIONS.**

a. The handling of flammable liquids is hazardous. Every safety precaution must be taken to minimize the chance of fire and explosion. Observe all warnings and cautions in this manual.

b. Unusual situations may arise making it necessary to transport liquids other than gasoline or fuel oil and possibly different products in different compartments. Every precaution must be taken to avoid mixing and contaminating the various products.

c. When hatches are opened, make sure pin is installed to prevent hatch from falling on personnel.

#### **CHAPTER 2**

#### **OPERATING INSTRUCTIONS**

Section I.	DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS
Section II.	PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)
Section III.	OPERATION UNDER USUAL CONDITIONS
Section IV.	OPERATION UNDER UNUSUAL CONDITIONS

## SECTION I. DESCRIPTION AND USE OF OPERATOR'S CONTROLS AND INDICATORS

	Para.		Para.
Engine Assembly Controls and		Introduction	2-1
Indicators	.2-2		

#### 2-1. INTRODUCTION.

This section describes the controls and indicators you, as the operator will be using. Table 2-1 will give you a brief description of each control and indicator.

#### 2-2. ENGINE ASSEMBLY CONTROLS AND INDICATORS. (Refer to figure 2-1 and table 2-1).



Figure 2-1. Engine Control Panel Controls and Indicators.

Table 2-1. Engine Controls and indicators

KEY	CONTROL OR INDICATOR	FUNCTION
1	Water Temperature Gage	Indicates engine coolant temperature. Nor- mal temperature is approximately 165°F (73.9°C).
2	Ammeter	Not used on this end item.
3	Oil Pressure Gage	Indicates pressure of engine lubricating oil. Safe pressure is between 30 to 60 psi.
4	Quick Start Control	Controls flow of ether from ether control valve to engine intake.
5	Throttle Control	Controls engine speed.
6	Tachometer	Indicates engine speed in revolutions per minute.
7	Pressure Gage	Indicates hydraulic starter accumulator pressure.
8	Hand Pump	Used to pump hydraulic starter accumulator pressure. Operating pressure is 3000 psi.
9	Hydraulic Pump	Pressurizes hydraulic starter accumulator when engine is running.
10	Control Valve	Controls hydraulic starter.Open the valve to energize the starter and close the valve when the engine starts.
11	Safety Control	Shuts down the engine during low oil pressure or high temperature conditions exist. It is also hooked up with the emergency shutdown control, which is located on the deck.
12	Clutch Control	Engages or disengages clutch to start or stop pumping operations.
13	Ether Control Valve	Controls ether flow to engine intake.
14	Fuel Control Valve	Controls fuel from tank to engine.
15	Fuel Control Valve	Controls engine return fuel to fuel tank.

# 2-3. LOADING AND DISCHARGE CONTROL VALVES. (Refer to figure 2-2 and table 2-2).



Figure 2-2. Loading and Discharge Control Valves.

Table 2-2. Cargo Control Valves					
KEY	CONTROL OR INDICATOR	FUNCTION			
1	Bypass Valve	Eight inch globe valve, which isolates cargo pump during loading operations, and is used to control the flow of cargo during unloading operations.			
2	Discharge Valve	Provides connection for cargo unloading hoses.			
3	Suction Valve and Discharge Valve	Controls flow of cargo during unloading operations to and from cargo pump and are not to be used for flow control.			
4	Filling Valve	Filling valve provides connection to shore storage facility.			
5	Tank Valves (6 Each)	Controls flow of cargo to and from each cargo compartment during loading and unloading operations.			

2-4. CARGO PRESSURE GAGE. (Refer to figure 2-3 and table 2-3).



Figure 2-3. Cargo Pressure Gage.

	Table	2-3. Cargo Pressure Gage
KEY	CONTROL OR INDICATOR	FUNCTION
1	Cargo Pressure Gage (2 Each)	Indicates pressure of cargo during loading or unloading operation. One is located in in the pump compartment, the other one is located in the machinery house on bulkhead behind the speed reducer.

Table 2-3.	Cargo Pressure	Gage
10010 2 0.	ourgorrooouro	Ougo

Para.

#### SECTION II. PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

Para. General......2-5 

# 2-5. GENERAL.

a. To ensure that the vessel is ready for operation at all times, it must be inspected systematically so defects may be discovered and corrected before they result in serious damage or failure. The necessary preventive maintenance checks and services (PMCS) that are to be performed by operator/crew personnel are listed and described in table 2-1.

b. Before You Operate. Always keep in mind the CAUTIONS and WARNINGS. Perform your Before (B) PMCS.

- c. While You Operate. Always keep in mind the CAUTIONS and WARNINGS. Perform your During (D) PMCS.
- d. After You Operate. Be sure to perform your After (A) PMCS.

e. If your equipment fails to operate, troubleshoot with proper equipment. Report any deficiencies using the proper forms. (See DA PAM 738-750.)

#### 2-6. OPERATOR/CREW PMCS PROCEDURES.

a. General. To extend the service life and obtain maximum performance of the vessel, the operator/crew must adhere to the schedule and instructions in table 2-4.

b. Item Number Column. Item numbers in this column indicate the order in which PMCS should be performed. These numbers shall also be used as the item numbers for the TM NUMBER column on DA Form 2404, Equipment Inspection and Maintenance Worksheet, in recording results of PMCS.

c. Interval Column. Items to be inspected are indicated by a dot in the appropriate interval column. If items are to be inspected in two or more intervals, they will be indicated by a dot in the appropriate interval columns, i.e. before, during, or after operation.

d. Procedures Column. The procedures column of your PMCS table tells you how to do the required checks and services. Carefully follow these instructions.

e. Equipment is Not Ready/Available If: Column. This column contains the criteria that will cause the equipment to be classified as not ready/available because of inability to perform its primary mission. An entry in this column:

(1) Identifies conditions that make the equipment not ready/available for readiness reporting purposes.

#### 2-6. OPERATOR/CREW PMCS PROCEDURES - Continued.

#### e. Equipment is Not Ready/Available If: Column- Continued.

(2) Denies use of the equipment until corrective maintenance has been performed.

f. If it is necessary for you to know how fluid leakage affects the status of your vessel. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your vessel. Learn, then be familiar with them and REMEMBER WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR.

Leakage Definitions for Operator PMCS

- CLASS I Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
- CLASS II Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.
- CLASS III Leakage of great enough to form drops that fall from the item being checked/inspected.

# CAUTION

•Equipment operation is allowable with minor leakage (Class I or II). Of course, consideration must be given to the fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

•When operating with Class I or Class II leaks, continue to check fluid levels as required in your PMCS.

•Class III leaks should be reported to your supervisor or to direct support maintenance.

		INT	ERVAL		PROCEDURES	EQUIPMNET IS
ITEM NO	в	D	Α	ITEM TO BE INSPECTED	CHECK FOR AND HAVE REPAIRED OR ADJUST AS NECESSARY	NOT READY/ AVAILABLE IF:
1	•			HULL	Inspect for corrosion, leaks, and loose parts. If corrosion is found, clean and paint. Tighten mounting hardware for all loose parts. If hull leaks are found notify gen- eral support maintenance	Hull leaks are found.
2	•			ULLAGE ASSEM- BLY	Inspect for corrosion. Clean and paint areas with corrosion. Inspect screen for clogging. Clean if dirty. Inspect gasket for damage. Replace a damaged gasket.	
3	•			FLAME SCREEN	Inspect flame screen for clogging or damage. Clean if dirty and replace if damaged.	
4	•			ENGINE SHUT- DOWN	Lift cover. Inspect switch mechanism for ease of oper- ation. Lubricate switch handle rod. Lower cover. Inspect the line from switch to engine and conduit. Re- place if damaged. Perform operational test with engine running at no load.	Engine shutdown does not operate.
5	•			HOUSE, MA- CHINERY	Inspect for rust or corro- sion. Inspect for breaks in framing. Inspect door hard- ware for damage, rust, or corrosion. Inspect door seal gasket. Replace if damaged. Wire brush and paint where necessary. No- tify general support mainte- nance of breaks in floor or walls that need welding re- pairs.	

## Table 2-4. Operator/Crew Preventive Maintenance Checks and Services (PMCS

		INT	ERVAL		PROCEDURES	EQUIPMNET IS
ITEM NO	в	D	Α	ITEM TO BE INSPECTED	CHECK FOR AND HAVE REPAIRED OR ADJUST AS NECESSARY	NOT READY/ AVAILABLE IF:
6	•	•		MUFFLER FAN EXHAUST	Inspect for damage or deter- ioration. Replace defective muffler. Inspect flange connection. Inspect support brackets. Wire brush and paint rust areas. Inspect for missing, frayed or broken drive belts. Re- place damaged belts. With drive belts removed, rotate blower shaft and check for noisy bearings. Notify di-	
8	•			FUEL TANK, ENGINE	rect support maintenance if noisy bearings are found. Inspect for obstructions. Clean as necessary. Inspect for leaks. Inspect for damage or deteriora- tion. Inspect fuel lines for leaks. Notify direct support maintenance if tank leaks or damaged fuel lines	Class III fuel leak is present.
9	•	•		BOOM, CARGO	are found. Service fuel tank by adding fuel oil (item 9, Appendix D). Inspect for rust or corro- sion. Wire brush and paint rust areas. Lubricate in accordance with paragraph 3-1. Inspect tackle blocks and lines for breaks or ex-	
10	•			DAVIT, ANCHOR	cessive wear. Notify direct support maintenance if blocks or lines are damaged. Inspect for corrosion. Clean and paint. Lubricate in accordance with paragraph 3-1. Inspect vans lines for fraying. Inspect shackle for damage. Notify general support maintenance if vans lines or shackle is damaged.	

# Table 2-4. Operator/Crew Preventive Maintenance Checks and Services (PMCS- Continued

		INT	ERVAL			EQUIPMNET IS
NO	в	D	Α	INSPECTED	OR ADJUST AS NECESSARY	AVAILABLE IF:
11	•			BILGE PUMP AND PIPING	Visually inspect for leaks or damage. Notify direct support maintenance.	
12	•	•		WINCH	Inspect windlass for loose or missing mounting hard- ware. Tighten or replace loose or missing mounting hardware. Lubricate in ac- cordance with paragraph 3-1. Inspect for kinked or im- proper seated cable on drum. Notify direct support main- tenance.	
13	•		•	ANCHOR	Inspect for corrosion. Clean and paint. Inspect latches and toggle pins. Clean and paint. Notify general support mainte- nance if anchor is damaged.	
14	•	•		CONTROL VALVE	Inspect control valve for signs of damage. Refer to paragraph 3-13 and replace control valve.	Class III leaks are present.
15	•	•		FILTER	Inspect for loose or mis- sing mounting hardware. Inspect filter hoses and fittings for leaks. Refer to paragraph 3-14 for ser- vicing filter.	Class III leaks are present.
16	•			RESERVOIR	Inspect for loose or mis- sing mounting hardware. Tighten or replace loose or missing hardware. Inspect reservoir for leaks. Noti- fy direct support mainte- nance of a damaged reser- voir. Service reservoir by adding hydraulic fluid (item 10, Appendix D).	Class III leaks are present.

Table 2-4	Operator/Crew Preventive Maintenance Checks and Services	(PMCS-Continued
10010 2 1.		

	INTERVAL				PROCEDURES	EQUIPMNET IS
ITEM NO	в	D	Α	ITEM TO BE INSPECTED	CHECK FOR AND HAVE REPAIRED OR ADJUST AS NECESSARY	NOT READY/ AVAILABLE IF:
17	•			ACCUMULATOR	Inspect accumulator for loose or missing mounting hardware. Tighten or re- place loose or missing hardware.	
18	•			ENGINE, DIE- SEL	Inspect components for loose or missing mounting hard- ware. Tighten or replace loose or missing hardware.	
19	•			AIR CLEANER	Inspect air cleaner for dam- age. Refer to paragraph 3-15 for servicing.	
20	•	•		FUEL LINES AND FITTINGS	Visually inspect all fuel lines and fittings for signs of leaks. Notify tify direct support main- tenance.	Class III leaks are present.
21	•			FUEL STRAINER AND FUEL FIL- TER	Inspect fuel strainer and fuel filter for damage. Refer to paragraph 3-16 or 3-17 and replace or service fuel strainer or fuel filter.	Class II leaks are present.
22	•	•		LUBRICATION FILTER	Visually inspect filter for damage or leaks. Refer to paragraph 3-18 to service or replace filter.	Class III leaks are present.
23	•	•		OIL COOLER	Inspect for loose or mis- sing hardware. Inspect for signs of leakage. Notify direct support maintenance.	Class III leaks are present.
24	•	•		PUMP, FRESH WATER	Inspect for signs of leak- age. Inspect for loose or missing hardware. Notify direct support maintenance.	

# Table 2-4. Operator/Crew Preventive Maintenance Checks and Services (PMCS-Continued

	INTERVAL				PROCEDURES	EQUIPMNET IS
ITEM NO	в	D	Α	ITEM TO BE INSPECTED	CHECK FOR AND HAVE REPAIRED OR ADJUST AS NECESSARY	NOT READY/ AVAILABLE IF:
25	•			DRIVE BELT, FANS	Inspect for cracks, breaks, and/or signs of fraying. Notify direct support main- tenance.	Belts are frayed or cracked.
26	•	•		RADIATOR	Inspect radiator for signs of leakage or loose or mis- sing hardware. Notify di- rect support maintenance. Remove radiator cap and add coolant or anti-freeze (item 11, Appendix D) as needed.	
27	•	•		HOSES, WATER	Inspect for cracks or leaks. Refer to paragraph 3-20 and replace hoses.	Class III leaks are present.
28	•	•		MANIFOLD, WATER	Inspect water manifold for leaks. Notify direct sup- port maintenance.	Class III leaks are present.
29	•	•		HOUSING, THERMOSTAT	Inspect housing for leaks. Notify direct support main- tenance.	Class III leaks are present.
30	•			TACHOMETER DRIVE	Inspect for secure mounting or signs of damage. Notify direct support maintenance.	
31	•			PULLEY, CRANKSHAFT	Inspect pulley for cracks, or loose mounting hardware. Notify direct support main- tenance.	Pulley is cracked or hardware is loose.
32	•			COVER, BAL- ANCE WEIGHT	Inspect cover for cracks or loose mounting hardware. Notify direct support main- tenance.	
33	•			ENGINE SUP- PORTS AND LIFTING BRACKETS	Inspect engine supports and lifting brackets for cracks or loose mounting hardware. is loose.	Engine supports are cracked or mounting hardware
34	•			MANIFOLD, EXHAUST	Inspect exhaust manifold for leaks and tightness of retaining nuts. Notify direct support maintenance.	

# Table 2-4. Operator/Crew Preventive Maintenance Checks and Services (PMCS-Continued

	INTERVAL				PROCEDURES	EQUIPMNET IS
ITEM NO	в	D	Α	ITEM TO BE INSPECTED	CHECK FOR AND HAVE REPAIRED OR ADJUST AS NECESSARY	NOT READY/ AVAILABLE IF:
35	•			COVER, ROCKER ARM	Inspect cover for damage or oil leaks. Notify direct support maintenance.	Class III oil leak is present.
36	•			PAN, OIL	Inspect pan for damage or oil leaks. Notify direct support maintenance.	Class III oil leak is present.
37	•			PANEL, IN- STRUMENT	Inspect panel for secure mounting and damage. Notify direct support maintenance.	
38	•			GAGES	Inspect gages for broken glass or damaged dial. Re- fer to paragraph 3-21 or 3-22 and replace a damaged gage.	
39	•			ETHER START- ING AID	Visually inspect for secure mounting or a damaged line. Refer to paragraph 3-23 and replace damaged parts.	
40	•			CLUTCH/PTO	Inspect clutch for secure mounting or damage. Notify direct support maintenance. Service in accordance with paragraph 3-1.	
41	•	•		REDUCER, SPEED	Inspect reducer for secure mounting or leaks. Notify direct support maintenance. Service in accordance with paragraph 3-1	
42	•	•		COUPLING AS- SEMBLY	Inspect coupling for secure mounting hardware. Notify direct support maintenance. Service in accordance with paragraph 3-1.	

# Table 2-4. Operator/Crew Preventive Maintenance Checks and Services (PMCS-Continued

	INTERVAL				PROCEDURES EQUIPMNET IS		
ITEM NO	в	D	Α	ITEM TO BE INSPECTED	CHECK FOR AND HAVE REPAIRED OR ADJUST AS NECESSARY	NOT READY/ AVAILABLE IF:	
43	•	•	•	SHAFT ASSEM- BLY, UNIVER- SAL	Inspect shaft assembly for secure mounting or damaged universal yoke. Notify direct support maintenance. Service in accordance with paragraph 3-1.	Universal yoke is damaged.	
44	•		•	PUMP, TRANS- FER	Inspect pump for secure mounting or damage. Noti- fy direct support mainte- nance. Service in accor- dance with paragraph 3-1.		
45	•	•		VALVE, RELIEF	Visually inspect valve for damage. Notify direct sup- port maintenance		
46	•	•		LIGHTING	Inspect lights for secure mounting hardware, broken lens, or burnt out lamp unit. Repair in accordance with paragraph 3-25.	Lights are inop- erable.	
47	•	•	•	PIPING, TRANSFER	Visually inspect for leaks or damage. Notify general support maintenance.		
48	•	•		VALVES, CARGO	Check valves for ease of operation and signs of leaks. Notify general sup- port maintenance.	Class III leak is present.	
49	•	•		GAGE, PRESSURE	port maintenance. Visually inspect for damage to gage or leaks. Notify direct support maintenance.		

# Table 2-4. Operator/Crew Preventive Maintenance Checks and Services (PMCS

#### SECTION III. OPERATION UNDER USUAL CONDITIONS

Para.	
.2-9	Pre
.2-12	Tai
	Pre
.2-13	Pre
.2-8	Un
.2-15	
	Para. .2-9 .2-12 .2-13 .2-8 .2-15

	Para.
Precaution on Entering Cargo	
Tanks	2-14
Preparation to Load	2-7
Preparation to Unload	2-11
Under Tow	2-10

#### 2-7. PREPARATION TO LOAD.

#### WARNING

A loading or unloading operation is a fire hazard. No smoking, open flames, open lights, or any repair work requiring the use of tools that could ignite the flammable cargo shall be permitted on the vessel or in the area adjacent to the vessel during cargo transfer operations.

- a. Moor vessel to berth and provide safe passage to shore. Move tug away.
- b. Record forward and aft draft readings.

#### WARNING

Make sure hatch retaining pin is installed when hatch is opened. Failure to install pin can result in injury to personnel.

c. Inspect cargo tanks for cleanliness and residue of previous cargo.

d. Connect ground cable from vessel to shore ground.

e. Connect cargo hose to aft filling connection. Use new gasket and install a minimum of three bolts. Place drip pan under connection.

- f. Support the hose with the cargo boom to allow for movement.
- g. Inspect unused filling connection for secure mounting.
- h. Close all hatches. Place pins in ullage holes. Close but do not dog down ullage caps.
- i. Display warning sign at gangway or point of approach.
- j. Display a red flag during daylight and a red lantern at night in a prominent position as a warning to other vessels.

- k. To load a full mixed cargo, set the valves as follows (refer to figure 2-4):
  - (1) Open all tank valves (1).
  - (2) Open filling valve (2).
  - (3) Open bypass valve (3).
  - (4) Close suction valve (4).
  - (5) Close discharge valve (5).



Figure 2-4. Loading Connections and Valves.

I. Insure terminal representative is satisfied that vessel is ready to receive cargo.

m. Request dock side personnel to commence loading at a reduced rate. Ensure everything is in good order and no leaks exist.

n. Increase loading rate to maximum safe speed.

#### 2-8. DURING LOADING.

#### NOTE

•Due to possible loading rate fluctuations, at least one crew member must be in constant attendance on deck at all times to observe the loading process.

•The load will be up to 85 percent of capacity. The soundings required for specific hulls and draft readings for this capacity are available in the tank calibration charts and vessel prints stored in the technical data box.

a. Use the following procedure for loading a full, unmixed load.

(1) Set the filling valve on each tank to control the individual tank filling rate. The tanks nearest the loading connection tend to fill faster. Adjust valves as necessary. Overall filling rate is determined by:

- •Pressure available on shore.
- •Size of shore vessel cargo hose.

#### NOTE

The loading and topping off procedure is largely a matter of choice and personal experience and may also be affected by exceptional conditions. The procedure outline which follows is recommended for the loading of a full, unmixed cargo under normal conditions.

(2) Commence loading with all tank valves wide open.

(3) Fill a pair of athwartship tanks faster than the others. Allow the valves to these tanks to remain wide open and set the valves to the remaining tanks for a slower rate of loading.

#### NOTE

Soon after the tanks are filled and secured, check and insure that no more cargo is entering through an incompletely closed or faulty valve.

(4) Secure the valves to the filled pair of tanks. Open valves wide to another athwartship pair of tanks.

(5) Secure the valves to the second pair of tanks when filled. Open valves wide to remaining tanks.

(6) Secure valves when tanks are filled.

b. Use the following procedure for loading individual or paired tanks.

#### NOTE

- •To load tanks individually. It is recommended that the tank valve be adjusted to the dockside flow rate.
- •The following procedures also apply to filling tanks in groups to less than a full load.
  - (1) Open tank filling valve of single tank to be loaded.
  - (2) Close remainder of tank valves.
  - (3) Proceed as in loading a full cargo.
  - (4) At completion of loading, blow compressed air from shore facility through main filling valve.
  - (5) Secure individual tank and valve.

#### 2-9. AFTER LOADING.

The following procedural steps are to be taken after the vessel has received its cargo:

- a. Disconnect cargo hose and bolt flange on filling connection.
- b. Disconnect shore filling connection.
- c. Disconnect grounding cable.
- d. Empty drip pan into a suitable container on shore.
- e. Wipe up spilled liquids.
- f. Sound all cargo tanks and record the readings in the presence of the terminal representative.
- g. Take and record forward and aft draft readings with as much accuracy as possible.
- h. Dog down all ullage caps.
- i. Inspect rake compartments for evidence of cargo leaks.
- j. Do not remove red flag or red lantern. Display red flag at all times during the day or the red lantern at night.
- k. Secure machinery house doors, ports, and hatches. Stow all loose gears.
- I. The vessel is now ready to receive a tug.

#### 2-10. UNDER TOW.

While under tow, it is the responsibility of the tug boat captain to see that all lines are secure, that proper navigation signals are displayed, and that no hazardous conditions are allowed to develop.

#### 2-11. PREPARATION TO UNLOAD.

#### WARNING

A loading or unloading operation is a fire hazard. No smoking, open flame, open lights, or any repair work requiring the use of tools that could ignite the flammable cargo shall be permitted on the vessel or in the area adjacent to the vessel during cargo transfer operations.

- a. Moor vessel to berth and provide safe passage to shore. Move tug away.
- b. Record forward and aft draft readings.

#### NOTE

Thieving is the procedure for determining the presence and quantity of water at the bottom of a tank containing a petroleum product. A water indicating paste is applied to a sounding bob. The bob is lowered to the bottom of the tank and then withdrawn. Water is indicated by the color change of the paste on the bob.

- c. Sound and thieve cargo tanks and record readings in the presence of the terminal representative.
- d. Connect ground cable from vessel to shore ground.
- e. Connect cargo hose to the aft manifold only. Place drip pan under connection.
- f. Support the hose with the cargo boom to allow for movement and change of draft of vessel.
- g. Inspect all blanked connections for tightness.
- h. Close all hatches. Place pins in ullage holes, close ullage caps but do not dog down.
- i. Display warning at gangway or point of approach.
- j. Display a red flag during daylight and a red lantern at night in a prominent position as a warning to other vessels.

#### NOTE

Cargo pump should always be disengaged when not in use.
k. Prior to starting engine perform the following steps. (Refer to figure 2-5).

(1) Disengage clutch (1) by pushing down on handle (2).

(2) Open control valve (3) on fuel feed line from fuel tank.

(3) Open control valve (4) on fuel return line from engine to fuel tank.

(4) Set throttle control to approximately 350 rpm.

(5) Move the reset lever (5), located on safety control to the "RUN" position and hold it there. Then move the reset latch (6) to the "START" position, and release the reset lever.

(6) Insure hydro-start system is pressurized to 3000 psi, if not, operate hand pump (7) until 3000 psi is obtained.

I. Slowly open manual start valve (8) to engage starter pinion to flywheel, then open valve wide open. As soon as engine starts, close manual start valve (8).

m. As soon as engine starts, check for proper lubricating pressure (30 to 60 psi). When the engine oil pressure builds up to 30 psi, the reset latch should move to the "RUN" position. If the reset latch does not move to the "RUN" position within one minute, manually return the reset latch to the "RUN" position, which will trip the automatic safety control, and shut down the engine. Notify direct support maintenance.

n. DO NOT engage clutch until water coolant temperature reaches 160°F (71.1 °C.



Figure 2-5. Engine Starting Controls.

# 2-11. PREPARATION TO UNLOAD - Continued.

o. If a full unmixed cargo is to be unloaded, set the valves after the engine is running satisfactorily. (Refer to figure 2-6).

- (1) Open valves to tanks 1 thru 6 (1).
- (2) Open suction valve (2).
- (3) Open discharge valve (3).
- (4) Close filling valve (4).
- (5) Close bypass valve (5).
- (6) Open discharge valve (6).



- p. Notify dock personnel that the vessel is prepared to unload cargo.
- q. Adjust engine speed to approximately 500 rpm. Engage clutch to start pump.
- r. Insure no leaks exist at hose and other connection points on deck.

#### NOTE

If leaks exist, stop pump and do not restart operations until all deficiencies have been corrected.

s. Check pump room for leaks, particularly the pump seals. Recheck at least once every hour during unloading operations. If leakage is excessive, the seals must be replaced.

t. When all is in order, obtain permission from dock personnel to increase discharge rate.

u. With permission granted, increase engine speed approximately fifty percent.

#### NOTE

•At least one crew member must be in constant attendance on deck at all times to observe the unloading process.

•While discharging, tank levels may be checked through ullage openings. Always replace screen after observing level.

v. Use the following procedure for unloading a full, unmixed load.

#### NOTE

The unloading and stripping procedure is largely a matter of choice and personal experience and may also be affected by exceptional conditions. The procedure outline which follows is recommended for the unloading of a full, unmixed cargo under normal conditions.

(1) Commence unloading tanks 1 thru 4.

(2) If all is in order, allow valves to tanks 1 and 2 to remain wide open. Throttle down valves to tanks 3 and 4 just enough so that these tanks will be from 1/2 to 3/4 full when tanks 1 and 2 are empty.

#### NOTE

During unloading, valves must be also adjusted to maintain the vessel on an even keel.

(3) When tanks 1 and 2 are nearly empty (approximately six inches remaining), close valves to tanks 2, 3, and 4. Throttle down valve to tank 1.

(4) When the sucking of air is heard from tank 1, close valve to tank 1. Throttle open valve to tank 4 to prime pump. Throttle open valve to tank 1 until air is heard again. Repeat as often as necessary to strip the tank.

(5) Use the same procedures and unload and strip tank 2. Use the cargo in tank 3 to prime the pump.

(6) Close valves to tanks 1 and 2. Repeat the unloading operations and unload tanks 3 and 4 using tanks 5 and 6 to prime the pump.

(7) Close valves to tanks 3 and 4. Set valve to tank 6 wide open.

# 2-11. PREPARATION TO UNLOAD - Continued.

(8) Adjust valve to tank 5 for a discharge rate that will insure most of the cargo in tank 5 remains when tank 6 is empty.

(9) Empty and strip tank 6 by methods described using tank 5 to prime the pump.

#### NOTE

At this point, tank 5 will be the only tank containing cargo.

(10) Open value to tank 5. When tank is almost empty, throttle down engine to approximately 500 rpm. Throttle down value to tank 5.

# CAUTION

Complete closing of the valve to tank 5 can only be for a few seconds.

(11) When the sucking of air is heard from tank 5, close valve completely for a few seconds.

(12) Repeat opening and closing of valve to tank 5 until it is impossible to remove any more cargo.

# CAUTION

The cargo pump is lubricated internally by the cargo passing through it. Do not operate the pump dry for any length of time. Damage to pump will result.

(13) Clear the cargo lines and hose if necessary. Operate cargo pump with suction valve wide open for a short period of time. Do not overheat cargo pump.

(14) Disengage clutch. Adjust engine speed to 500 rpm and allow engine to idle five minutes. Refer to figure 2-5 and move reset lever (5) to the stop position and shut down the engine.

w. The following information is provided as guidance for unloading mixed loads.

(1) Every precaution must be taken to avoid mixing and contaminating the various products.

(2) Insure no cargo leaks through valves or bulkheads.

(3) Keep a constant check during operations to insure all valves are set properly.

(4) Do not use dissimiliar products for stripping tanks.

(5) The senior crewman must outline his plan for unloading in advance and insure that vessel and terminal personnel are thoroughly familiar with the plan and each knows his particular duties.

## NOTE

The vessel has no heating coils. It will be the responsibility of the loading terminal to determine prior to loading the temperature to which a viscous cargo should be heated so it will be sufficiently fluid upon arrival at the discharge point. Calculations are based on duration of voyage and water temperatures with an added safety factor.

(6) When carrying a heated viscous cargo, the responsible person at discharge point should be notified as to the nature of the cargo so that priority can be granted.

(7) Reduce speed of cargo pump while unloading viscous cargo.

(8) Clear cargo lines and hose after unloading a particular product. Open suction valve and operate pump for a short period of time.

#### 2-12. AFTER UNLOADING.

- a. Disconnect cargo hose.
- b. Disconnect shore filling connection.
- c. Disconnect grounding cable.
- d. Empty drip pan into suitable container on shore.
- e. Wipe up all spilled liquids.

## 2-13. CLEANING AND GAS FREEING OF CARGO TANKS.

When it is required that repairs to be made or when under certain conditions, a different grade of cargo is to be loaded. It is necessary to clean and gas-free the cargo tanks and pump room. Two principles are involved:

•Removal of as much cargo residue and scale as possible.

•Ventilation of tanks to drive out remaining gases.

#### NOTE

Cleaning requires steam and/or hot water. The vessel requires support from shore or a vessel moored along side for steam and hot water.

a. Hand cleaning consists of washing down the tank with a stream of hot water. Operate the cargo pump to remove water and scale from the tank.

## 2-13. CLEANING AND GAS FREEING OF CARGO TANKS - Continued.

#### NOTE

Provisions must be made for disposal of waste water pumped from tanks. It must not be dumped into harbor or coastal waters. It may be temporarily pumped into another tank and later disposed of. Preferably, it should be pumped into a shore waste line or another barge.

b. After washing, ventilate the tank with a windsail. Keep hatches open for ventilation. The tanks must be certified gas free before any work is performed in them.

#### 2-14. PRECAUTION ON ENTERING CARGO TANKS.

## WARNING

Petroleum vapors are both toxic and explosive. In sufficient concentration petroleum vapor may cause death within five minutes. In lesser concentrations, irritation of the eyes, severe headache, and mild exhilaration may be experienced. Tanks which are not ventilated and have remained empty for a while may be depleted in oxygen due to rusting. The oxygen content may not be enough to support life.

a. Extreme caution must be exercised if it becomes necessary to enter a cargo tank that is not known to be gas free and certified safe.

b. If it is absolutely necessary to enter a tank that has not been certified gas free, observe the following precautions:

(1) Ventilate the tank with windsail or mechanical blower.

(2) Secure a harness and a safety line to the person entering the tank.

(3) Assign an observer on deck with no other duty except to watch the person in the cargo tank and assist the person from the tank if necessary.

(4) The person entering the cargo tank should carry no tools, flashlight, or anything capable of producing a spark.

c. Use the following equipment if available:

(1) Portable testing apparatus to measure gas concentration.

(2) Flame safety lamp to determine oxygen content but only if gas concentration is within safe limit.

(3) Oxygen breathing apparatus if oxygen level is low and gas concentration is within safe limit.

# 2-15. OPERATION OF ACCESSORY EQUIPMENT.

- a. Dropping Anchor. (Refer to figure 2-7).
  - (1) Unfasten anchor from mounting.
  - (2) Position davit over anchor. Secure tag lines.

(3) Secure winch cable to anchor with shackle. Secure winch hoist block to anchor shackle. Secure davit to anchor trip hook.

- (4) Lift anchor with davit and swing davit to position anchor above bow.
- (5) Insure anchor is free for lowering and all personnel are clear.
- (6) Rotate the holding dog release lever over to the rear of winch.

(7) Place one foot on the foot brake and strike the holding dog release lever with a mallet until the holding dog is released.

- (8) Control the spin of the handwheel with the foot brake.
- (9) Lower away with winch until anchor is just over side and release hook.
- (10) When anchor grounds, take up desired slack on anchor line with the winch.



Figure 2-7. Dropping Anchor.

## 2-15. OPERATION OF ACCESSORY EQUIPMENT- Continued.

- b. Retracting Anchor. (Refer to figure 2-8).
  - (1) Move holding dog release lever to the front of winch.

(2) Rotate the handwheel and pull up on the anchor, until it is above the bow. If necessary use ratchet lever extension to raise anchor.

- (3) Swing the davit around and secure it to the anchor shackle.
- (4) Lift anchor with the davit and swing davit around, until the anchor is over its mounting block.
- (5) Lower the anchor onto its mounting blocks. Disconnect the winch and davit from the anchor.
- (6) Secure anchor to its mounting blocks.
- (7) Swing davit to its stowed position and wind up and stow the winch line and hook



Figure 2-8. Retracting Anchor.

c. Hand Bilge Pump.

(1) Drainage of vessel is necessary at certain times, especially during heavy weather. Two hand operated bilge pumps are mounted on the main deck. Both are connected by piping to suction strainers in the bottom of the vessel.

- (2) Insert bar into socket on pump.
- (3) Rock bar backward and forward.

# NOTE

If gasoline or any other cargo product is pumped, or if the cargo product is mixed with the pumped water it must be discharged into a container. Dispose of the contents of the container in a suitable, safe manner on shore.

## SECTION IV. OPERATION UNDER UNUSUAL CONDITIONS

	Para.		Para.
Operation in Extreme Cold	2-17	Operation in Extreme Heat	2-16

## 2-16. OPERATION IN EXTREME HEAT.

Operation in extremely high temperatures (tropical or semi-tropical) will present no particular difficulties. It should be remembered that at higher temperatures a gasoline cargo will tend to give off more vapors than other liquid cargos and suitable precautions should be taken.

#### 2-17. OPERATION IN EXTREME COLD.

- a. Freezing rain or snow may cause malfunctions of:
  - •Cargo valve reach rods
  - •Ullage covers
  - •Safety vents
  - •Deck tackle
- b. Keep all moving parts free of snow, ice, or slush.
- c. If parts freeze, rock parts back and forth to break ice. Never use a flame to melt ice.
- d. If deck becomes slick with ice:
  - •Secure chain side rails around deck.
  - •Secure additional safety lines on deck as necessary.

e. An accumulation of snow or ice is a menace to the stability of the vessel. Snow and/or ice must be removed from deck and structures. Break ice with a sledge and heave overboard.

f. Drain bilge pump lines if sub-freezing temperatures are anticipated. Drain by lifting the check of the nonreturn valve in the suction bell off its seat.

g. It is not advisable to attempt starting the diesel engine at temperatures below  $10^{\circ}F$  (- $23^{\circ}C$ ) without the use of the ether starting aid.

h. Keep engine in best mechanical condition.

i. Take special precautions to minimize the danger of condensation in the fuel system freezing and blocking fuel flow.

# 2-17. OPERATION IN EXTREME COLD - Continued.

- •Keep filler caps tight to prevent moisture from entering system.
- •Keep fuel tank full when engine is not in use.
- •Remove snow and ice from filler cap area before taking on fuel.
- j. Prepare cooling system for sub-freezing temperatures.
  - •Check for leaks. Repair leaks.
  - •Drain coolant and flush with water until clear.

•Add antifreeze solution (item 11, Appendix D) to protect engine at 10 degrees below lowest temperature anticipated. Refer to the following guide:

Temperature °F ℃	Pints of antifreeze per gallon of coolant	Liters of antifreeze per liter of coolant
20 -6.7	1 1/2	0.0187
10 -12.2	2	0.250
0 -17.8	2 3/4	0.344
-10 -23.3	3 1/4	0.406
-20 -28.9	3 1/2	0.438
-30 -34.4	4	0.500
-40 -40.0	4 1/4	0.531
-50 -45.6	4 1/2	0.562
-60 -51.1	4 3/4	0.594

Table 2-5. Guide for Preparation of Antifreeze Solution

k. The ether starting aid provides a means of starting the engine if the temperature is as low as -10°F (-23°C). Refer to figure 2-9.

#### NOTE

Never discharge ether into the manifold of a hot engine.

(1) Install fuel cylinder (1) in valve (2).

(2) Insure hydro-start system is pressurized to 3000 psi, if not, operate hand pump until 3000 psi is attained.

(3) Move the reset lever (3), located on safety control to the "RUN" position, and hold it there. Then move the reset latch (4) to the "START" position, and release the reset lever.

(4) Pull out on the quick start actuator cable (5) for one or two seconds, then push it in.

(5) Start engine by slowly opening manual start valve (6) to engage starter pinion to flywheel, then open valve wide open. Close manual start valve as soon as engine starts.

(6) Repeat the procedure if the engine does not start on the first attempt.







Figure 2-9. Cold Weather Starting.

# **CHAPTER 3**

# **OPERATOR MAINTENANCE INSTRUCTIONS**

Section I.LUBRICATION INSTRUCTIONSSection II.OPERATOR/CREW TROUBLESHOOTING PROC7DURESSection III.MAINTENANCE PROCEDURES

# SECTION I. LUBRICATION INSTRUCTIONS

#### 3-1. GENERAL.

This section includes mandatory lubrication instructions for the vessel.

a. Engine and Power Take-Off.

(1) Daily check and maintain oil level to "FULL MARK" on dipstick. Use oil, engine, MIL-L-2104D (item 4, Appendix D) for engine, oil temperature ranges.

(2) Weekly remove "AIR CLEANER" housing from air cleaner bowl. Clean sludge from bowl and thoroughly wash with clean diesel fuel. Clean element by immersing in clean diesel fuel, allow to dry thoroughly before installing in housing. Refill bowl with MIL-L-2104D oil (item 4, Appendix D) to oil level indicated on bowl. Install bowl on air cleaner housing.

(3) Every 150 hours of operation change engine oil and oil filter elements.

(a) Remove oil pan drain plug and allow oil to drain in a bucket (item 16, Appendix D).

(b) Remove oil filter drain plug and drain oil filter. Unscrew bowl and remove filter element. Wash filter bowl with clean diesel fuel. Reassemble, using new filter element. Tighten filter bowl. Install drain plug.

(c) Fill crankcase with MIL-L-2104D oil (item 4, Appendix E), to "FULL MARK" on dipstick.

(4) Weekly lubricate power take-off with MIL-L-18709 grease (item 6, Appendix D). Apply no more than 2 or 3 shots with grease gun.

(5) Weekly lubricate fan bearing with MIL-E-18709 grease (item 6, Appendix D). Apply no more than 1 shot with grease gun.

# 3-1. GENERAL- Continued.

b. Speed Reducer.

(1) Daily check oil level. Add lubricating oil, gear MIL-L-2105 (item 5, Appendix D) to bring oil level to "FULL MARK".

(2) Every 6 months or 2500 operating hours, remove drain plug and allow oil to drain. Install drain plug and fill with MIL-L-2105 oil to "FULL MARK".

(3) Temperature ranges above +32°F (0°C) use MIL-L-2105, GO-90, +32°F (0°C) to 0°F (-18°C) use MIL-L-2105, GO-70, below 0°F (-18°C) use MIL-L-2105 GOS.

c. <u>Flexible Coupling.</u> Yearly, remove flexible coupling cover, clean with solvent, (SD) type II and dry thoroughly. Install flexible coupling cover. Remove lubrication plug from both covers, install lubrication fitting in one cover. Using a grease gun filled with MIL-G-10924 (item 7, Appendix D), fill flexible coupling until an excess amount of grease appears at opposite cover hole. Remove lubrication fitting and install lubrication plug in each cover.

d. <u>Pump Drive Shaft Assembly.</u> Monthly lubricate drive shaft assembly with MIL-G-10924 (item 7, Appendix D). Apply no more than 2 shots from grease gun.

e. <u>Rotary Pump.</u> Monthly lubricate pump with MIL-E-18709 (item 6, Appendix D). Apply no more than 3 shots from grease gun.

f. <u>Valve Remote Operator Assembly.</u> Monthly lubricate hinged joint with MIL-G-10924 grease (item 7, Appendix D). Apply no more than 2 shots from grease gun.

g. <u>Hatches, Doors and Ventilators.</u> Monthly lubricate hatch holddown latches with MIL-G-10924 (item 7, Appendix D). Apply no more than 1 shot from grease gun.

h. <u>Winch.</u> Monthly lubricate with MIL-G-10924 grease (item 7, Appendix D). Apply no more than 2 shots from grease gun. Monthly coat gears with MIL-G-10924 grease (item 7, Appendix D).

## SECTION II. OPERATOR/CREW TROUBLESHOOTING PROCEDURES

## 3-2. OPERATOR/CREW TROUBLESHOOTING PROCEDURES.

a. Table 3-1 lists the common malfunctions which you may find during the operation or maintenance of the vessel or its components. You should perform the tests/inspections 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.

## Table 3-1. Operator/Crew Troubleshooting

MALFUNCTION		
TEST OR INSPECTION		
CORRECTIVE ACTION		

#### TRANSFER OF CARGO

1. CARGO WILL NOT ENTER VESSEL.

Step 1. Insure valves are open.

Open valves if closed.

Step 2. Check if valves on dock are properly lined up.

Notify dock representative.

Step 3. Check pressure on shore line.

Notify dock representative.

Step 4. Inspect for disengaged valve stem.

Stop operations. Notify higher level maintenance for repair.

#### 2. REDUCTION GEAR RUNS EIOT.

Step 1. Check level of lubricating oil.

Drain or add oil as required to bring to proper level.

Step 2. Check for misalignment.

Report misalignment to higher level maintenance.

## Table 3-1. Operator/Crew Troubleshooting - Continued

# MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

- 3. CARGO ENTERING TOO SLOWLY.
  - Step 1. Check for low pressure on shore line.

Notify dock representative.

Step 2. Check for throttled individual or main valve.

4. CARGO ENTERING TOO FAST.

Check for too high pressure on shore line.

Request dock representative to reduce loading rate.

5. CARGO LEAKS AT HOSE JOINT.

Step 1. Check tightness of gasket.

Stop operations. Tighten gasket.

Step 2. Inspect gasket.

Stop operations. Replace defective gasket.

Step 3. Inspect hose face for damage.

If damaged, replace hose.

Step 4. Inspect flange face for damage.

If damaged, report damage to higher level maintenance for repair.

#### 6. VALVE GLANDS LEAK.

Step 1. Check for looseness.

Tighten gland nut.

Step 2. Inspect for insufficient or dried out packing.

Check for proper type of packing. Report defective packing to higher level maintenance for repair.

#### MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

- 7. ENGINE RUNS, CARGO PUMP WILL NOT RUN.
  - Step 1. Check clutch for engagement.

If not engaged, engage clutch.

Step 2. Inspect coupling for loose or missing hardware.

Tighten or replace loose or missing hardware.

Step 3. Inspect drive shaft for worn universal joints.

Notify higher level maintenance.

- 8. CARGO PUMP RUNS BUT WILL NOT PUMP.
  - Step 1. Check for closed valve.

Open appropriate valve.

Step 2. Inspect suction strainer.

Stop operations. Clean clogged strainer.

Step 3. Check if pump is pumping from empty tank.

If cargo tank is empty, disengage pump. Adjust valves to resume pumping from proper tank.

Step 4. Check for defective relief valve.

Stop operations. Notify higher level maintenance for repair.

- 9. CARGO PUMP DISCHARGE PRESSURE AND CAPACITY BELOW NORMAL.
  - Step 1. Check for throttled valves.

Open valves wide.

Step 2. Check engine speed.

If too low, increase engine speed.

Step 3. Inspect suction strainer.

Stop operation. Clean clogged strainer.

## Table 3-1. Operator/Crew Troubleshooting - Continued

# MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

9. CARGO PUMP DISCHARGE PRESSURE AND CAPACITY BELOW NORMAL - Continued.

Step 4. Check relief valve for leaks.

Notify higher level maintenance.

Step 5. Consider viscosity of liquid being pumped.

There is no remedy for the slow rate of flow for a viscous liquid. Reduce engine speed to prevent unloading.

Step 6. Check for air reaching pump.

Go to step 7.

Step 7. Inspect for leaks in suction line.

Notify higher level maintenance.

## 10. ENGINE STOPS SUDDENLY OR STALLS FREQUENTLY.

Step 1. Check if fuel system is primed.

Loosen high pressure line fitting. If no fuel is flowing, prime fuel system.

## Step 2. Check for insufficient fuel.

- a. If tank is empty, refill tank.
- b. If shut-off valve is closed, open valve.
- Step 3. Inspect for leaks in fuel lines.
  - a. Tighten fittings.
  - b. Report defective lines to higher level maintenance for repair.

# 11. LOSS OF POWER.

Step 1. Check for air in fuel lines.

a. Tighten fittings.

#### MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

- b. Bleed air from fuel system.
- c. Report defective lines to higher level maintenance.
- Step 2. Check for clogged air cleaner.

Clean and service air cleaner per paragraph 3-15.

## 12. ENGINE OVERHEATS DURING OPERATION.

Step 1. Check coolant level.

Replenish coolant as required.

Step 2. Inspect cooling system for leaks.

Report leaks to higher level maintenance for repairs.

Step 3. Inspect for scale, deposits, or other obstructions.

Clean and flush cooling system.

Step 4. Check for worn water pump.

Report defective pump to higher level maintenance.

Step 5. Check for engine overload.

Reduce engine loading.

Step 6. Inspect for collapsed or disintegrated hoses.

Replace a defective hose per paragraph 3-20.

Step 7. Inspect fan belts for proper adjustment.

Adjust fan belt per paragraph 3-19.

# 13. LOW LUBRICATING OIL PRESSURE.

Step 1. Check oil level in crankcase.

Replenish oil as required.

Step 2. Check for clogged oil filter.

Service as necessary per paragraph 3-16.

## Table 3-1. Operator/Crew Troubleshooting - Continued

# MALFUNCTION TEST OR INSPECTION CORRECTIVE ACTION

14. ENGINE FAILS TO START AT TEMPERATURES ABOVE 32°F (0°C).

- Step 1. Check for insufficient fuel.
  - a. If tank is empty, refill tank.
  - b. If shut-off valve is closed, open valve.
- Step 2. Check governor stop control.
  - If in STOP position, put control in operating position.
- Step 3. Check for water in fuel supply.

Drain and clean entire system. Prime before starting.

## 15. ENGINE CRANKING SPEED IS TOO LOW.

Step 1. Check level of fluid in reservoir.

Fill to proper level.

Step 2. With pressure in the system, check all hoses and fittings for leaks.

Replace a bad hose.

Tighten a loose fitting.

Step 3. Insure control valve is fully open.

Open control valve.

Step 4. During the cranking cycle, watch closely for fluid leaking from the hydro-starter.

Replace starter.

Step 5. Hand pump will not recharge system when operated.

Replace hand pump per paragraph 3-10.

# SECTION III. MAINTENANCE INSTRUCTIONS

	Para.		Para.
Air Cleaner Assembly	3-15	Hose, Water	3-20
Control Valve	3-13	Hatches	3-5
Cranking Motor	3-11	Hydraulic Pump	
Engine Shutdown	3-8	Ladder	3-7
Ether Starting Aid	3-23	Lighting	3-25
Fan Belts	3-19	Muffler	3-9
Hydraulic Filter Maintenance	3-14	Oil Filter	3-18
Flame Screen	3-6	Oil Pressure Gage	3-22
Fuel Filter	3-16	Ullage Assembly	3-4
Fuel Strainer	3-17	Valve Relief	
Hand Pump, Hydraulic	3-10	Water Temperature Gage	3-21

# 3-3. GENERAL.

The following paragraphs contain operator/crew maintenance procedures for the vessel as authorized by the Maintenance Allocation Chart (MAC).

#### 3-4. ULLAGE ASSEMBLY MAINTENANCE.

This tas	This task covers:										
	a.	Removal	b.	Inspection	c.	Service	d.	Installation			
SET-UF	SET-UP:										
<u>Tools R</u> Too	<u>Tools Required:</u> Tool Kit, General Mechanic's										
Materials Required: Pin, Cotter P/N UL-102-14											
Equipm Eng Ve	Equipment Conditions: Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).										

# 3-4. ULLAGE ASSEMBLY MAINTENANCE - Continued.

- a. Removal.
  - (1) Loosen handle (1) and move away from ullage assembly (4).
  - (2) Remove two cotter pins (2), pin (3), ullage assembly (4), and gasket (5).
  - (3) Remove screen (6).

# b. Inspection.

- (1) Inspect for corrosion.
- (2) Inspect for damage or broken welds. Replace a damaged ullage.
- (3) Inspect gasket for damage. Replace a damaged gasket.
- (4) Inspect screen for dirt or debris. Clean or replace damaged screen.
- c. Service. Lubricate in accordance with paragraph 3-1.

# d. Installation.

- (1) Install screen (6).
- (2) Install gasket (5) on ullage assembly (4).
- (3) Position ullage assembly (4) on pin lugs and secure with pin (3), and two cotter pins (2).
- (4) Swing handle (1) over ullage assembly and tighten.



Figure 3-1. Ullage Assembly Maintenance, Removal/Installation

# **3-5. HATCH MAINTENANCE.**

This task covers: a. Removal b. Inspection c. Service d. Installation SET-UP: **Tools Required:** Tool Kit, General Mechanic's Materials Required: Gasket P/N 1081-470 Pin, Cotter P/N MS24665-389 Washer, Lock P/N MS35338-146 Equipment Conditions: Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7). a. <u>Removal.</u> (Refer to figure 3-2). (1) Remove two cotter pins (1), four washers (2), and two pins (3). (2) Remove hatch (4), brace (5), and toggle bolt (6). (3) Remove two cotter pins (7), four washers (8), and two pins (9). (4) Remove hatch (10) and gasket (11). b. Inspection. (1) Inspect hatches for broken welds or cracks. (2) Inspect brace for cracks or bends. c. Service. Lubricate in accordance with paragraph 3-1.

- d. Installation.
  - (1) Install toggle bolt (11) on hatch (10).
  - (2) Install hatch (10) and secure with two pins (9), four washers (8), and two cotter pins (7).
  - (3) Install toggle bolt (6) and brace (5) on hatch (4).
  - (4) Install hatch (4) and secure with two pins (3), four washers (2), and two cotter pins (1).



Figure 3-2. Hatch, Removal/Installation.

# 3-6. FLAME SCREEN MAINTENANCE.

This task covers: a. Removal b. Inspection C. Cleaning d. Installation SET-UP: **Tools Required:** Tool Kit, General Mechanic's Materials Required: Brush, Wire (Item 8, Appendix D) Gasket P/N STYLE 3000 Solvent, Dry Cleaning (Item 1, Appendix D) Equipment Conditions: Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

- a. Removal. (Refer to figure 3-3).
  - (1) Remove eight nuts (1), eight screws (2), six inch check valve (3), and gasket (4). Discard gasket (4).
  - (2) Remove three screws (5) and flame screen (6).
  - (3) Remove three inch check valve (7) by unscrewing from pipe.
  - (4) Remove three screws (8) and flame screen (9).
- b. Inspection.
  - (1) Inspect both screens for dirt or debris.
  - (2) Inspect flame screen for corrosion or damage. Replace a damaged screen.
- c. Cleaning.

#### WARNING

Do not breathe cleaning solvent vapors for long periods of time or use solvent near open flames. To avoid illness, explosion, or fire, only use solvent in well ventilated areas away from open flames.

- (1) Clean flame screen with cleaning solvent (item 1, Appendix D).
- (2) Allow to dry.

- (3) Clean corrosion from mesh screen using a wire brush (item 8, Appendix D) and paint as necessary.
- d. Installation.
  - (1) Install flame screen (9) on check valve (7) and secure with three screws (8).
  - (2) Screw check valve (7) on pipe.
  - (3) Install flame screen (6) on check valve (3) and secure with three screws (5).
  - (4) Install gasket (4), check valve (3), and secure with eight screws (2) and eight nuts (1).



Figure 3-3. Check Valves and Flame Screen, Removal/Installation.

# 3-7. LADDER MAINTENANCE.

This task co	overs:					
a.	Removal	b.	Installation			
SET-UP:						
<u>Tools Requ</u> Tool K	<u>ired:</u> it, General Me	chanic	's			
<u>Materials R</u> Washe Washe	<u>equired:</u> er, Lock P/N M er, Lock P/N M	S3533 S3533	8-143 8-46			

#### Equipment Conditions:

Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

- a. <u>Removal.</u> (Refer to figure 3-4).
  - (1) Remove four nuts (1), four lockwashers (2), four bolts (3), and machinery house ladder (4).
  - (2) Remove four nuts (5), four lockwashers (6), four bolts (7), and ladder (8).
  - (3) Remove eight nuts (9), eight lockwashers (10), eight bolts (11), and ladder (12).
  - (4) Remove six nuts (13), six bolts (14), and ladder (15).
  - (5) Remove six nuts (16), six lockwashers (17), six bolts (18), and two rails (19).
  - (6) Remove four nuts (20), four bolts (21), and ladder (22).

#### b. Installation.

- (1) Install ladder (22) and secure with four bolts (21) and four nuts (20).
- (2) Install two rails (19) and secure with six bolts (18), six lockwashers (17), and six nuts (16).
- (3) Install ladder (15) and secure with six bolts (14) and six nuts (13).
- (4) Install ladder (12) and secure with eight bolts (11), eight lockwashers (10), and eight nuts (9).
- (5) Install ladder (8) and secure with four bolts (7), four lockwashers (6), and four nuts (5).

12

(6) Install ladder (4) and secure with four bolts (3), four lockwashers (2), and four nuts (1).





Figure 3-4. Ladder Maintenance, Removal/Installation.

# 3-8. ENGINE SHUTDOWN MAINTENANCE.

This task co	vers:				
а.	Inspection	b.	Service	C.	Test
SET-UP:					
<u>Tools Requi</u> Tool Ki	<u>red:</u> t, General Mechar	nic's			
Equipment ( Engine	<u>Conditions:</u> shut down (paragi is moored (paragr	raph 2-	11).		
V 63361	is moored (paragi	apri 2- <i>i</i>	).		
a. <u>Insp</u>	ection.				
(1)	) Inspect connection	ons at b	ox and engir	ne for s	secure mounting.
(2)	) Inspect cable for	signs o	f wear or bro	ken sti	trands.
(3)	) Inspect each pull	ey for s	secure moun	ing.	
b. <u>Ser</u>	<u>vice.</u>				
(1)	) Apply a few drop	s of oil	to each pulle	ey.	
(2)	) Clean and paint a	as requ	ired.		

- c. <u>Test.</u>
  - (1) Start engine in accordance with paragraph 2-11.

# NOTE

# Do not engage clutch.

(2) Lower cover on box, pull handle. Insure engine stops. If engine does not stop, notify higher level maintenance.

# 3-9. MUFFLER, EXHAUST AND PIPES MAINTENANCE.

This ta:	sk cov	vers:							
	a.	Removal	b.	Inspection	C.	. Installation			
SET-U	P:								
Tools F	Requir	<u>ed:</u>							
To	ool Kit	, General Mec	hanic	'S					
Tool Kit, General Mechanic's <u>Materials Required:</u> Gasket P/N GRAPH-LOCK/4 In. Gasket P/N GRAPH-LOCK/3 1/2 In. Insulation Blanket P/N 1081-493 (Item 13, Appendix D) Mastic, Polyvinyl P/N 1081-492 (Item 14, Appendix D) Washer, Lock P/N MS35338-143 Washer, Lock P/N MS35338-145 Washer, Lock P/N MS35338-50 Wire, Safety, 18 Gage (Item 15, Appendix D)									
Equipm	nent C	onditions:							
Er	ngine	shut down (pa	ragrap	oh 2-11).					
Ve	essel i	s moored (par	agrap	n 2-7).					

# **3-9. MUFFLER, EXHAUST AND PIPES MAINTENANCE - Continued.**

- a. <u>Removal.</u> (Refer to figure 3-5).
  - (1) Remove two nuts (1), two lockwashers (2), and U-bolt (3).

(2) Remove eight nuts (4), eight lockwashers (5), and eight screws (6). Remove pipe (7) and gasket (8). Discard gasket (8).

(3) Remove wire (9) and blanket assemblies (10 thru 13).

(4) Remove eight nuts (14), eight lockwashers (15), and eight screws (16). Remove muffler (17) and gasket (18).

(5) Remove two nuts (19), two lockwashers (20), two screws (21), and hanger assembly (22).

(6) Remove eight nuts (23), eight lockwashers (24), eight screws (25), pipe assembly (26), gasket (27), and expansion joint (28). Discard gasket (27).

#### NOTE

Pipe assembly (26) and hanger assembly (22) require the use of a welding machine and acetylene torch to remove, therefore refer removal to higher level maintenance.

#### b. Inspection.

- (1) Inspect for loose or missing mounting hardware. Tighten or replace loose or missing hardware.
- (2) Inspect mounting straps for damage.
- (3) Inspect for corrosion.
- (4) Inspect all connections for signs of leakage.
- c. Installation.
  - (1) Install expansion joint (28) on exhaust manifold flange.

(2) Install a new gasket (27) between expansion joint (28) and pipe assembly (26). Secure expansion joint with eight screws (25), eight lockwashers (24), and eight nuts (23).

(3) Install hanger assembly (22) and secure with two screws (21), two lockwashers (20), and two nuts (19).

(4) Install a new gasket (18) between pipe assembly (26) and muffler (17). Install muffler (17) and secure with eight screws (16), eight lockwashers (15), and eight nuts (14).

(5) Install blanket assemblies (10 thru 13) and secure with wire (9) (item 15, Appendix D). Cover blanket assembly (10) with insulation blanket (item 13, Appendix D) and apply a coat of mastic polyvinyl (item 14, Appendix D).

(6) Install a new gasket (8) between muffler (12) and pipe (7). Install pipe (7) and secure with eight screws (6), eight lockwashers (5), and eight nuts (4).

(7) Install U-bolt (3) and secure with two lockwashers (2) and two nuts (1).



Figure 3-5. Muffler and Pipes, Removal/Installation.

# 3-10. HAND PUMP, HYDRAULIC START SYSTEM.

This ta	This task covers:										
	a. e.	Removal Repair	b. f.	Disassembly Reassembly	c. g.	Cleaning Installation	d.	Inspection			
SET-L	JP:										
<u>Tools</u> T	<u>Tools Required:</u> Tool Kit, General Mechanic's										
Materi B C C C C C C C C C C C C C C C C C C	ials Reg Brush, N Cloth, S Gland P D-Ring I D-Ring I D-Ring I D-Ring I D-Ring I Ring P/R Ring P/R Sealant, Vasher Solvent,	quired: Medium Bristle oft (Item 2, Ap /N BG200603 /N GA100213 P/N GA100213 P/N GA100213 P/N GA100113 P/N GA100114 N GA100214 N RG100209 N RG100208 , Pipe (Item 12 , Lock P/N MS Dry Cleaning	e (Item opend 3 5 3 8 0 1 2, App 35338 (Item	3, Appendix D) ix D) endix D) 3-46 1, Appendix D)							
Equip	ment C	onditions:									

Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

- a. Removal. (Refer to figure 3-6).
  - (1) Open relief valve on hand pump and release system pressure.
  - (2) Remove hoses (1 thru 4).
  - (3) Remove two tees (5), gage (6), elbow (7), and tee (8).
  - (4) Remove valve (9) and elbow (10).
  - (5) Remove four nuts (11), four lockwashers (12), four bolts (13), and hand pump (14).



Figure 3-6. Hydraulic Star System Hand Pump, Removal/Installation

# 3-10. HAND PUMP, HYDRAUUC START SYSTEM- Continued.

b. Disassembly. (Refer to figure 3-7).

(1) Remove two retaining rings (1) and pin (2).

(2) Remove grip (3) from handle (4).

- (3) Remove link assembly (5) and lever (6).
- (4) Remove retaining ring (7) from pump housing.
- (5) Remove plunger (8) and gland (9) from pump housing.

(6) Remove back-up rings (10 and 11) and O-rings (12 and 13) from gland (9). Discard back-up rings (10 and 11) and O-rings (12 and 13).

(7) Remove valve seat (14), seal (15), ball (16), and spring (17). Discard seal (15).

(8) Remove back-up ring (18) and O-ring (19). Discard back-up ring (18) and O-ring (19).

(9) Remove inlet fitting (20), O-ring (21), back-up ring (22), O-ring (23), ball (24), and spring (25). Discard O-rings (21 and 23) and back-up ring (22).

(10) Remove bleeder screw (26), O-ring (27), ball (28), and plug (29) from housing (30). Discard O-ring (27).



Figure 3-7. Hydraulic Start System Hand Pump. Disassembly/Reassembly.
## 3-10. HAND PUMP, HYDRAULIC START SYSTEM- Continued.

- c. <u>Cleaning.</u>
  - (1) Remove all build up of dirt or oil on all parts by wiping with a soft cloth (item 2, Appendix D).

# WARNING

Do not breathe cleaning solvent vapors for long periods of time or use solvent near open flames. To avoid illness, explosion, or fire, only use solvent in well ventilated areas away from open flames.

(2) Clean all metal parts using a clean, soft cloth (item 2, Appendix D) or a medium bristle brush (item 3, Appendix D) and cleaning solvent (item 1, Appendix D).

(3) Allow all parts to dry.

d. Inspection.

(1) Inspect housing (30) for cracks or other visible damage. Bore of cylinder must be smooth with no pitting or scoring.

(2) Inspect inlet fitting (20) check valve seat for nicks or scratches.

(3) Inspect inlet fitting (20) check valve ball (24) and spring (25) for damage.

(4) Inspect plunger (8) for scoring on large diameter and on plunger shank where it rides in plunger gland (9).

(5) Inspect all threaded components for damaged threads.

e. <u>Repair.</u> Repair is limited to replacement of any components found defective during inspection. Discard all seal, O-rings, and back-up rings.

f. <u>Reassembly.</u> (Refer to figure 3-7).

### NOTE

Make sure all parts are clean before assembly. To facilitate assembly, apply a coat of light oil on O-rings and back-up rings.

(1) Install plug (29) and ball (28) into housing (30). Position O-ring (27) on bleeder screw (26). Install bleeder screw (26) into housing (30).

(2) Install spring (25) and ball (24) into housing (30). Position O-rings (23 and 21) and back-up ring (22) on inlet fitting (20). Install inlet fitting (20) into housing (30). Tighten fitting securely, being sure ball (24) seats properly in end of inlet fitting (20).

### NOTE

Back-up rings must be installed before O-rings.

(3) Install spring (17) and ball (16) into plunger (8). Install seal (15) and valve seat (14) into plunger and tighten securely. Install back-up ring (18) and O-ring (19) on plunger (8).

(4) Install back-up rings (11 and 10) and O-rings (13 and 12) on gland (9).

(5) Insert plunger (8) into housing (30), bottoming plunger in pump bore.

(6) Install gland (9) being sure that external O-ring (12) is closest to leading edge. Press gland (9) in until groove for retaining ring is uncovered, then insert retaining ring (7).

(7) Insert grip (3) on handle (4). Install handle into lever (6).

(8) Insert link assembly (5) onto lever (6).

(9) Insert lever (6) onto housing (30) and secure with clevis pin (2) and two retaining rings (1).

g. Installation. (Refer to figure 3-6).

(1) Install hand pump (14) on mounting bracket and secure with four bolts (13), four lockwashers (12) and four nuts (11).

(2) Install elbow (10) onto pump. Install valve (9) onto elbow (10). Install tee (8), elbow (7), and gage (6), tighten all fittings. Use pipe sealant (item 12, Appendix D) before installing any fittings.

(3) Install two tees (5) and connect hoses (4 thru 1), tighten all hoses and fittings.

(4) Recharge the accumulator with the hand pump.

### 3-11. CRANKING MOTOR, HYDRAULIC START SYSTEM MAINTENANCE.

This task covers:

a. Removal b. Installation

SET-UP:

Tools Required: Tool Kit, General Mechanic's

Materials Required: Sealant, Pipe (Item 12, Appendix D) Seal P/N GA100104 Seal P/N GA100088 Seal P/N RG1136 Washer, Lock P/N WA6-10OBL Washer, Lock P/N WA-8BL

Equipment Conditions: Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

- a. <u>Removal.</u> (Refer to figure 3-8).
  - (1) Open relief valve on hand pump and release system pressure.
  - (2) Disconnect hoses (1 and 2).
  - (3) Remove connector (3), valve (4), and two connectors (5).
  - (4) Remove three screws (6), three lockwashers (7), and remove cranking motor (8).
- b. Installation.
  - (1) Position cranking motor (8) on flywheel housing and secure with three screws (6) and three lockwashers (7).

(2) Install two connectors (5), valve (4), and connector (3). Use pipe sealant (item 12, Appendix D) on connectors before installing.

- (3) Connect hoses (2 and 1).
- (4) Recharge the accumulator using the hand pump.



Figure 3-8. Cranking Motor, Removal/Installation.

## 3-12. HYDRAULIC PUMP.

This task covers:								
а.	Removal	b.	Installation					
SET-UP:								
<u>Tools Requi</u> Tool Ki	<u>red:</u> t, General Mec	hanic	's					
<u>Materials Re</u> Washe	equired: r, Lock P/N W <i>i</i>	A5-10	OCA					
Equipment Engine Vessel	<u>Conditions:</u> shut down (pa is moored (par	ragrap agrap	oh 2-11). h 2-7).					

- a. <u>Removal.</u> (Refer to figure 3-9).
  - (1) Open relief valve on hand pump and release system pressure.
  - (2) Disconnect hoses (1 thru 3).
  - (3) Remove adapter (4), elbows (5 and 6), and nipple (7).
  - (4) Remove four screws (8), four lockwashers (9), and pump (10).
- b. Installation.
  - (1) Install pump (10) on engine and secure with four lockwashers (9) and four screws (8).
  - (2) Install nipple (7), elbows (6 and 5), and adapter (4).
  - (3) Connect hoses (3 thru 1).



Figure 3-9. Hydraulic Pump, Removal/Installation.

## 3-13. CONTROL VALVE MAINTENANCE.

This task covers:									
a.	Removal	b.	Installation						
SET-UP:									
<u>Tools Requ</u> Tool k	<u>iired:</u> it, General Me	chanic	's						
<u>Materials R</u> Seala	<u>equired:</u> nt, Pipe (Item 1	2, App	pendix D)						
Equipment	Conditions:								

Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

- a. Removal.
  - (1) Open relief valve on hand pump and release system pressure.
  - (2) Disconnect hose (1).
  - (3) Remove connector (2) and valve (3).
- b. Installation.
  - (1) Apply pipe sealant (item 12, Appendix D) on valve (3) and connector (2).
  - (2) Install valve (3) and connector (2).
  - (3) Connect hose (1).
  - (4) Recharge the accumulator using the hand pump.



Figure 3-10. Control Valve, Removal/Installation

## 3-14. HYDRAULIC FILTER MAINTENANCE.

This task covers:

- a. Removal b. Disassembly c. Inspection d. Reassembly
- e. Installation

### SET-UP:

Tools Required: Tool Kit, General Mechanic's

#### Materials Required:

O-Ring P/N GA100201 Sealant, Pipe (Item 12, Appendix D)

## **Equipment Conditions:**

Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

a. Removal. (Refer to figure 3-11).

(1) Open relief valve on hand pump and release system pressure.

(2) Remove two nuts (1), two lockwashers (2), and three screws (3). Remove top of pipe hanger.

(3) Disconnect hoses (4 and 5).

(4) Remove two connectors (6) and filter (7).



Figure 3-11. Filter, Removal/Installation.

- b. Disassembly. (Refer to figure 3-12).
  - (1) Remove end cap (1) and O-ring (2). Remove and discard O-ring (2).
  - (2) Remove filter element (3), plate (4), and spring (5). Discard filter element (3).
- c. Inspection.
  - (1) Inspect end cap (1) and filter housing (6) for damaged threads.
  - (2) Inspect plate (4) and spring (5) for damage.
- d. Reassembly.
  - (1) Install spring (5), plate (4) and new filter element (3) in filter housing (6).
  - (2) Install new O-ring (2) and end cap (1).



Figure 3-12. Filter, Servicing and Inspection.

# 3-14. HYDRAULIC FILTER MAINTENANCE - Continued.

- e. Installation. (Refer to figure 3-11).
  - (1) Apply pipe sealant (item 12, Appendix D) on connector (5).
  - (2) Install filter (6) and connector (5).
  - (3) Connect hose (4).
  - (4) Position top of pipe hanger over filter and secure with two screws (3), two lockwashers (2), and two nuts (1).
  - (5) Recharge the accumulator using the hand pump.

### 3-15. AIR CLEANER ASSEMBLY.

This ta	This task covers:								
	a.	Removal	b.	Inspect	C.	Service	d.	Installation	
SET-l	JP:								
<u>Tools</u>	<u>Tools Required:</u>								
T	Tool Kit, General Mechanic's								
<u>Mater</u>	<u>Materials Required:</u>								
S	Solvent, Cleaning (Item 1, Appendix D)								
C	Oil, Lubricating (Item 4, Appendix D)								
C	Oil, Fuel (Item 9, Appendix D)								
F	Packing P/N 1543005								
<u>Equip</u>	<u>Equipment Conditions:</u>								
E	Engine shut down (paragraph 2-11).								

a. <u>Removal.</u> (Refer to figure 3-13).

- (1) Remove bolt (1), retainer (2), and gasket (3). Discard gasket (3).
- (2) Remove upper shell (4), retaining ring (5), baffle (6), cup (7), and packing (8). Discard packing (8).
- b. Inspection.
  - (1) Inspect cup (7) for damage.
  - (2) Inspect upper shell (4) for damage to housing or internal filter element. Filter element cannot be replaced.

### c. <u>Service.</u>

(1) Use a suitable container and pour oil from cup (7).

### WARNING

Do not breathe cleaning solvent vapors for long periods of time or use solvent near open flames. To avoid illness, explosion, or fire, only use solvent in well ventilated areas away from open flames.

(2) Clean upper shell element with fuel oil (item 9, Appendix D). Allow to drain and dry thoroughly before installing.

(3) Clean cup (7) with cleaning solvent (item 1, Appendix D). Fill cup with lubricating oil (item 4, Appendix D) to the oil level mark.

d. Installation.

(1) Install new packing (8) and cup (7) on air intake.

(2) Install baffle (6), retaining ring (5), and upper shell (4).

(3) Install retainer (2), new gasket (3), and bolt (1).



Figure 3-13. Air Cleaner, Removal/Installation.

## **3-16. FUEL FILTER ASSEMBLY.**

This task covers:

a. Removal b. Installation

SET-UP:

Tools Required: Tool Kit, General Mechanic's

Materials Required: Washer, Lock P/N MS35338-46

Equipment Conditions: Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

- a. Removal. (Refer to figure 3-14).
  - (1) Remove tube assembly (1) and tube (2).
  - (2) Remove two elbows (3), elbow (4), and adapter (5).
  - (3) Remove fuel cartridge (6).
  - (4) Remove two screws (7), two lockwashers (8), and cover (9).
- b. Installation.
  - (1) Position cover (9) on engine and secure with two lockwashers (8) and two screws (7).
  - (2) Install fuel cartridge (6).
  - (3) Install adapter (5), elbow (4), and two elbows (3).
  - (4) Connect tube assembly (1) and tube (2).



Figure 3-14. Fuel Filter Assembly, Removal/Installation.

## 3-17. FUEL STRAINER.

- a. <u>Removal.</u> (Refer to figure 3-15).
  - (1) Remove screw (1), flat washer (2), and clamp (3).
  - (2) Remove tube (4), elbow (5), and adapter (6).
  - (3) Remove two clamps (7), hose (8), and adapter (9).
  - (4) Remove fuel cartridge (10).
  - (5) Remove two nuts (11), two lockwashers (12), two screws (13), and remove cover (14).
  - (6) Remove two screws (15), two lockwashers (16), and bracket (17).
- b. Installation.
  - (1) Position bracket (17) on engine and secure with two lockwashers (16) and two screws (15).

(2) Position cover (14) on bracket (17) and secure with two screws (13), two lockwashers (12), and two nuts (11).

- (3) Install fuel cartridge (10).
- (4) Install adapter (9), hose (8), and two clamps (7).
- (5) Install adapter (6), elbow (5), and tube (4).
- (6) Install clamp (3) and secure with flat washer (2) and screw (1).



Figure 3-15. Fuel Strainer, Removal/Installation.

## 3-18. OIL FILTER.

This task covers:

a. Removal b. Inspection c. Installation

SET-UP:

Tools Required: Tool Kit, General Mechanic's

Equipment Conditions: Engine shut down (paragraph 2-11).

- a. <u>Removal.</u> (Refer to figure 3-16).
  - (1) Remove filter element (1) by turning to the left.
  - (2) Remove plug (2), gasket (3), spring (4), and valve (5).
- b. Inspection.
  - (1) Inspect spring and valve for damage.
  - (2) Inspect oil filter adapter for cracks and other damage.
- c. Installation.
  - (1) Install valve (5), spring (4), gasket (3), and plug (2) into adapter.
  - (2) Install a new filter element (1).



Figure 3-16. Oil Filter, Removal/Installation

## 3-19. FAN BELTS.

This task covers:

a. Removal b. Adjust

SET-UP:

Tools Required: Tool Kit, General Mechanic's

### Equipment Conditions:

Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

a. Inspection.

(1) Inspect fan belts for cracks, fraying, or signs of deterioration.

- (2) Notify direct support maintenance of a damaged belt.
- b. Adjust. (Refer to figure 3-17).

(1) Loosen four screws (1) and screw (2) until pulley and hub assembly (3) will slide up or down.

(2) Pry up on pulley and hub assembly (3) until a firm push with the thumb, at a point midway between the two pulleys, will depress the belt 1/2" to 3/4".

(3) Tighten four screws (1) and screw (2).



Figure 3-17. Fan Belt Adjustment.

## 3-20. HOSES, WATER.

This task covers:

a. Removal b. Installation

SET-UP:

Tools Required: Tool Kit, General Mechanic's

Equipment Conditions: Engine shut down (paragraph 2-11).

- a. <u>Removal.</u> (Refer to figure 3-18).
  - (1) Use a suitable container, open oil cooler drain cock and drain radiator.
  - (2) Loosen two hose clamps (1) and remove hose (2). Remove both hose clamps (1) from hose.
  - (3) Loosen two hose clamps (3) and remove hose (4). Remove both clamps (3) from hose.
- b. Installation.

(1) Install two hose clamps (3) on hose (4). Connect hose (4) to lower radiator connection and oil cooler inlet. Tight both clamps (3).

(2) Install two hose clamps (1) on hose (2). Connect hose (2) to upper radiator connection and thermostat housing. Tighten both clamps (1).

(3) Refer to paragraph 2-17 and service the radiator.



Figure 3-18. Radiator Hoses, Removal/Installation

## 3-21. WATER TEMPERATURE GAGE.

This task covers:

a. Removal b. Inspection c. Installation

SET-UP:

Tools Required: Tool Kit, General Mechanic's

Materials Required: Washer, Lock P/N 120217

Equipment Conditions: Engine shut down (paragraph 2-11).

- a. Removal. (Refer to figure 3-19).
  - (1) Disconnect tube (4) from water manifold.
  - (2) Remove four nuts (1), two lockwashers (2), and gage (3). Remove tube (4) from gage (3).
- b. Inspection.
  - (1) Inspect gage for broken lens or damage to dial.
  - (2) Inspect tube for kinks or other damage.

#### c. Installation.

- (1) Connect tube (4) to gage (3).
- (2) Inspect gage (3) into instrument panel and secure with two lockwashers (2) and four nuts (1).
- (3) Connect tube (4) to water manifold.



Figure 3-19. Water Temperature Gage, Removal/Installation.

## 3-22. OIL PRESSURE GAGE.

- Vessel is moored (paragraph 2-7).
  - a. <u>Removal.</u> (Refer to figure 3-20).
    - (1) Disconnect oil line (1) from rear of gage (4).
    - (2) Remove two nuts (2) and two lockwashers (3), and remove gage (4) from front of panel (5).
    - (3) Remove screw (6), lockwasher (7), clamp (8), and tube (9).
    - (4) Remove elbow (10), bushing (11), and tee (12).
  - b. Inspection.
    - (1) Inspect gage for damage to the face.
    - (2) Inspect oil line for bends, kinks, or leaks.
  - c. Installation.
    - (1) Install tee (12), bushing (11), and elbow (10).
    - (2) Install tube (9), clamp (8), lockwasher (7), and screw (6).
    - (3) Install gage (4) in panel (5) and secure with two lockwashers (3) and two nuts (2).
    - (4) Connect oil line (1) to gage (4).



Figure 3-20. Oil Pressure gage, Removal/Installation.

## 3-23. ETHER STARTING AID.

This	task co					
	a.	Removal	b.	Service	C.	Installation
SET	-UP:					
<u>Tool</u>	<u>s Requi</u> Tool Ki	<u>red:</u> t, General Meo	chanic	:'s		
Equi	oment (	Conditions:				

Engine shut down (paragraph 2-11).

- a. Removal. (Refer to figure 3-21).
  - (1) Loosen wing nut (1) and unscrew ether bottle (2).
  - (2) Remove two nuts (3), two screws (4), and clamp (5).
  - (3) Remove tube (6) and atomizer (7).
  - (4) Remove two nuts (8), two screws (9), clamp (10), and control (11).
  - (5) Remove two screws (12), clamp (13), valve (14), and bracket (15).
- b. <u>Service</u>. Service is limited to replacing the ether bottle.
- c. Installation.
  - (1) Install valve (14), and clamp (13) on bracket (15). Secure clamp (13) with two screws (12).

(2) Install bracket (15) and valve on panel. Install control (11) and clamp (10) and secure on bracket (15) with two screws (9) and two nuts (8).

- (3) Install atomizer (7) and tube (6).
- (4) Install clamp (5) on panel and secure with two screws (4) and two nuts (3).
- (5) Screw ether bottle (2) into valve (14) and tighten wing nut (1).



Figure 3-21. Ether Staring Aid, Removal/Installation

3-53

### 3-24. VALVE, RELIEF TRANSFER PUMP.

This task covers:

a. Test b. Adjustment

SET-UP:

Tools Required: Tool Kit, General Mechanic's

#### Equipment Conditions:

Engine shut down (paragraph 2-11). Vessel is moored (paragraph 2-7).

a. <u>Test.</u> (Refer to figure 3-22).

(1) Close two discharge valves on deck. Use hand wheel and open discharge valve.

(2) Refer to paragraph 2-11 and prepare to unload.

(3) Refer to paragraph 2-11, start engine and engage clutch. Relief valve should operate when pump exceeds 125 psi. If relief does not operate properly, refer to paragraph b. for adjustment.

### b. Adjustment.

(1) With pump running, remove cap (1) and loosen nut (2).

(2) Turn adjusting screw (3) clockwise to increase the pressure setting and counterclockwise to decrease the pressure.

(3) Tighten nut (2) and install cap (1) when desired pressure is obtained.

(4) Refer to paragraph 2-11 and shutdown the engine.



Figure 3-22. Relief Valve Testing and Adjustment.

# 3-25. LIGHTING.

This tas	This task covers:								
	a. e.	Removal Reassembly	b. f.	Inspection Installation	C.	Disassembly	d.	Repair	
SET-UF	SET-UP:								
<u>Tools R</u> To	<u>Tools Required:</u> Tool Kit, General Mechanic's								
<u>Material</u> O-l Wa	<u>Materials Required:</u> O-Ring P/N 8020-0102 Washer, Lock P/N MS35338-140								
<u>Equipm</u> En Ve	<u>ent Co</u> gine sl ssel is	onditions: hut down (para moored (para	agrap grap	bh 2-11). h 2-7).					

- a. <u>Removal.</u> (Refer to figure 3-23).
  - (1) Remove four nuts (1), four lockwashers (2), and four bolts (3).
  - (2) Remove battery box and light as an assembly.

### NOTE

There are five lights on the barge. The only difference between the lights is the color of their lens and bulb amperes.

### b. Inspection.

- (1) Inspect each light for broken lens.
- (2) Inspect each light for burned out lamps.
- (3) Inspect each light photo cell for proper operation.
- (4) Inspect each light for a damaged switch.
- (5) Inspect each light for broken or frayed wiring in battery box.
- (6) Inspect power cable for damaged connector, or broken or frayed wiring in battery box.



Figure 3-23. Lightning, Removal/Installation

### 3-25. LIGHTING - Continued.

- c. Disassembly.
  - (1) Refer to figure 3-23 and disconnect power cable (4) from light base.
  - (2) Loosen four screws (5) and remove battery box cover and light.
  - (3) Remove four nuts (6), four lockwashers (7), four screws (8), and remove light (9) from battery box cover.
  - (4) Remove four screws (10) and open lens.
  - (5) Remove three screws (11), ring (12), and lens (13).
  - (6) Rotate four lamps (14) to the left and remove.
  - (7) Tag and disconnect leads to lampholder. Remove two screws (15) and lampholder (16).
  - (8) Tag and disconnect leads to photocell and switch. Remove photocell (17) and switch (18).
  - (9) Tag and disconnect wiring to batteries and remove batteries (19). Remove O-ring (20).
- d. <u>Repair.</u> Repair is limited to replacing defective parts.
- e. Reassembly.
  - (1) Refer to figure 3-23 and install O-ring (20) and batteries (19) in box, connect wiring and remove tags.
  - (2) Install switch (18) and photocell (17), connect wiring and remove tags.
  - (3) Install lampholder (16) and secure with two screws (15). Install four lamps (14).
  - (4) Install lens (13) and ring (12) and secure with three screws (11).
  - (5) Close lens and secure with four screws (10).
  - (6) Install light (9) on battery box cover and secure with four screws (8), four lockwashers (7), and four nuts (6).
  - (7) Install battery box cover and secure with four screws (5).
  - (8) Connect power cable (4) to light.
- f. Installation.
  - (1) Refer to figure 3-23 and install battery box and light.
  - (2) Secure battery box and light with four bolts (3), four lockwashers (2), and four nuts (1).

# APPENDIX A

### REFERENCES

## A-1. SCOPE.

This appendix lists all forms, technical manuals, and miscellaneous publications referenced in this manual.

# A-2. FORMS.

Preventive Maintenance Schedule and Record	
Recommended Changes to Publications and Blank Forms	DA Form 2028
Recommended Changes to DA Publications	DA Form 2028-2
Equipment Inspection and Maintenance Worksheet	DA Form 2404
Maintenance Request	DA Form 2407
Maintenance Request (Continuation Sheet)	DA Form 2407-1
Equipment Log Assembly (Record)	DA Form 2408
Equipment Modification Record.	DA Form 2408-5
Uncorrected Fault Record	DA Form 2408-14
Quality Deficiency Report	

## A-3. TECHNICAL MANUALS.

The Army Maintenance Management S	System (TAMMS)	DA PAM 738-750
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### APPENDIX B COMPONENTS OF END ITEM AND BASIC ISSUE ITEMS LIST

### SECTION I. INTRODUCTION

### B-1. SCOPE.

This appendix lists components of end item and basic issue items for the liquid cargo barge to help you inventory items required for safe and efficient operation.

#### B-2. GENERAL.

The Components of End Item and Basic Issue Items List are divided into the following sections:

a. <u>Section II. Components of End Item</u>. This listing is for informational purposes only, and is not authority to requisition replacements. These items are part of the end item, but are not removed separately packaged for transportation or shipment. As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Illustrations are furnished to assist you in identifying the items.

b. <u>Section III. Basic Issue Items.</u> These are the minimum essential items required to place the heater unit in operation, to operate it, and to perform emergency repairs. Although shipped separately packaged, BII must be with the vessel during operation and whenever it is transferred between property accounts. The illustrations will assist you with hard-to-identify items. This manual is your authority to request/requisition replacement BII, based on TOE/MTOE authorization of the end item.

### B-3. EXPLANATION OF COLUMNS.

a. <u>Column (1) - Illustration Number (Illus. Number)</u>. This column indicates the number of the illustration in which the item is shown.

b. <u>Column (2) - National Stock Number (NSN)</u>. Indicates the national stock number assigned to the item and will be used for requisitioning purposes.

c. <u>Column (3) - Description.</u> Indicates the Federal item and name and, if required, a minimum description to identify and locate the item. The last line for each item indicates the FSCM (in parentheses) followed by the part number.

d. <u>Column (4) - Unit of Measure (U/M).</u> Indicates the measure used in performing the actual operational/maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g.; ea., in, pr).

e. Column (5) - Quantity Required (Qty rqr). Indicates the quantity of the item authorized with/on the equipment.

SECTION II.	COMPONENTS	OF	ITEM	LIST
		•••		

(1)	(2)	(3) DESCRIPTION	(4)	(5)	
ILLUS NO.	NATIONAL STOCK NUMBER	USABLE ON CODE	U/M	QTY REQ'D	
1		Reel, Grounding	EA	1	
2	4120-00-142-4949	(61349) ML-2930-8 Ax 6" Pick Head	EA	1	
3	4010-00-194-1219	(81348) GGG-A-926 Wire Rope, 3/4 in. dia.	FT	300	
4	4220-00-834-0708	(61346) KR-W-410 Rope, 1 1/8 in. dia. Manila T-R-605	FT	100	
5		(81348) 1-R-605 Block, Tackle, Double, Regular	EA	1	
6		Block, Tackle, Double, Regular	EA	1	
7	4030-00-129-9394	(75535) 5-22-B Shackle, Anchor, 1/2 in.	EA	1	
8	4030-00-369-3687	(61346) RR-C-271 Shackle, Anchor, 3/8 in. (81349) MIL-S-24214	EA	1	
9		Winch, Hand (12437) D10007	EA	2	
10		Sheave, Block, Triple	EA	2	
11		(64921) 2001407 Sheave, Block, Double (64921) 2001406	EA	1	
12		Sheave, Block, Double (64921) 2001405	EA	1	
13	5340-00-188-0328	(04921) 2001403 Turnbuckle, Size .25 in. X 20 THD (96906) MS51574-1	EA	4	
14	4010-01-215-2603	Cable, Aircraft (81349) MII -W-83420/4	FT	365	
15	4220-00-275-3157	(81349) MIL-W-03420/4 Ring, Life Buoy (81349) MIL-R-16847	EA	2	
(1)	(2)	(3) DESCRIPTION		(4)	(5)
--------------	--------------------------	--------------------------------------	-------------------	-----	--------------
ILLUS NO.	NATIONAL STOCK NUMBER		USABLE ON CODE	U/M	QTY REQ'D
16	6230-01-143-4778	Illumination Marker (80064) L-289		EA	2

# SECTION III. BASIC ISSUE ITEMS

(1)	(2)	(3) DESCRIPTION		(4)	(5)	
ILLUS NO.	NATIONAL STOCK NUMBER			USABLE ON CODE	U/M	QTY REQ'D
17		TM 55-1930-208-10	Operator's Ma nance Manua	ainte- I	EA	1



Figure B-1. Components of End Item List.

# APPENDIX C ADDITIONAL AUTHORIZATION LIST (AAL)

# SECTION I. INTRODUCTION

# C-1. SCOPE.

This appendix lists additional items you are authorized for the support of the liquid cargo barge.

### C-2. GENERAL.

This list identifies items that do not have to accompany the liquid cargo barge and that do not have to be turned in with it. These items are all authorized to you by CTA, MTOE, TDA, or JTA.

# C-3. EXPLANATION OF LISTING.

National stock numbers, descriptions, and quantities are provided to help you identify and request the additional items you require to support this equipment. The items are listed in alphabetical sequence by item name under the type document (i.e., CTA, MTOE, TDA, or JTA) which authorizes the item(s) to you.

# SECTION II. ADDITIONAL AUTHORIZATION LIST (AAL)

NONE AUTHORIZED

# APPENDIX D EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

# SECTION I. INTRODUCTION

# D-1. SCOPE.

This appendix lists expendable supplies and materials you will need to operate and maintain the liquid cargo barge. These items are authorized to you by CTA 50-970, Expendable/Durable Items (except Medical, Class V, Repair Parts and Heraldic Items), or CTA 8-100, Army Medical Department.

# D-2. EXPLANATION OF COLUMNS.

a. <u>Column 1 - Item Number</u>. This number is assigned to the entry in the listing and is referenced in the narrative instructions to identify the material (e.g., "Use sealing compound, Item 6, Appendix D").

b. <u>Column 2 - Category</u>. This column identified the lowest category of maintenance that required the listed item:

#### C - Operator/Crew

c. <u>Column 3 - National Stock Number</u>. This is the national stock number assigned to the item; use it to request or requisition the item.

d. <u>Column 4 - Description</u>. Indicates the federal item name and, if required, a description to identify the item. The last line for each item indicates the part number followed by the Federal Supply Code for Manufacturer (FSCM) in parentheses, if applicable.

e. <u>Column 5 - Unit of Measure (U/M)</u>. Indicates the measure used in performing the actual maintenance function. This measure is expressed by a two-character alphabetical abbreviation (e.g., ea., in, pr). If the lowest unit of measure differs from the rest of the issue, requisition the lowest unit of issue that will satisfy your requirements.

# SECTION II. EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

(1)	(2)	(3)	(4)	(5)
ITEM NUMBER	LEVEL	NATIONAL STOCK NUMBER	ITEM NAME, DESCRIPTION CAGEC, PART NUMBER	U/M
1	С	6850-00-264-9038	CLEANING SOLVENT (81348) P-D-680	gal
2	C	7920-00-205-1711	COTTON RAGS (58536) A-A-2522	bl
3	С	8020-00-559-0389	MEDIUM BRISTLE BRUSH (81348) H-B-491	ea
4	С	9150-01-152-4117	LUBRICATING OIL, ENGINE (81349) MIL-L-2104D	qt
5	С	9150-00-226-1409	LUBRICATING OIL, GEAR (81349) MIL-L-2105	qt
6	С	9150-00-663-9795	GREASE (81349) MIL-G-18709	lb
7	С	9150-00-530-6814	GREASE (81349) MIL-G-18458/SHIP	lb
8	С	7920-00-291-5815	WIRE BRUSH (81348) H-B-178	ea
9	С	9140-00-273-2377	FUEL OIL, DIESEL	bk
10	С	9150-00-223-4134	(81349) MIL-F-16884 HYDRAULIC FLUID (81349) MIL H 5606	gal
11	С	6850-00-174-1806	(81349) MIL-H-3606 ANTIFREEZE, ARTIC (81349) MIL-A-11755	gal
12	С	8030-00-616-7694	(81349) MIL-7-11733 PIPE SEALANT (81349) MIL-T-83489	pt
13	С	5640-00-132-9750	INSULATION BLANKET (81349) MIL-I-2781	ft
14	С	7510-00-074-4961	MASTIĆ, POLYVINYL (81348) PPP-T-60	pt
15	С	9505-00-995-3177	WIRE, SAFETY, 18 GAGE (96906) MS9226-04	rl
16	С	7240-00-246-1097	BUCKET (81348) L-P-65	ea

# ALPHABETICAL INDEX

# Para. Page

-A-		Ŭ
Abbreviations, List of	1-4	1-2
Accessory Equipment, Operation of	2-15	2-25
After Loading	2-9	2-17
After Unloading	2-12	2-23
Air Cleaner Assembly	3-15	3-36
Anchor, Dropping	2-15a	2-25
Anchor, Retracting	2-15b	2-26
Anchors	1-7j	1-4

-В-		
Belts, Fan	3-19	3-44
Bilge Pump	1-7i	1-4
Bilge Pump, Hand	2-15c	2-26
Boom, Cargo Hose	1-7d	1-4

# -C-

Cargo Hose Boom	1-7d	1-4
Cargo Piping System	1-7n	1-6
Cargo Pressure Gage	2-4	2-4
Cargo Pump	1-7p	1-7
Cargo Tanks, Cleaning and Gas Freeing of	2-13	2-23
Cargo Tanks, Precaution on Entering	2-14	2-24
Cleaning and Gas Freeing of Cargo Tanks	2-13	2-23
Controls and Indicators, Description and Use of Operator	2-1	2-1
Controls and Indicators, Engine Assembly	2-2	2-1
Control Valve Maintenance	3-13	3-32
Control Valves, Loading and Discharge	2-3	2-3
Coupling	1-7q	1-7
Coupling, Flexible	3-1c	3-2
Cranking Motor, Hydraulic Start System Maintenance	3-11	3-28

# -D-

Davit	1-7b	1-4
Description and Use of Operator Controls and Indicators	2-1	2-1
Diesel Engine	1-7o	1-7
Differences Between Models	1-8	1-8
Discharge Control Valves, Loading and	2-3	2-3
Discharge Outlet Valves, Filling Inlet and	1-71	1-4
Drive Shaft	1-7s	1-7
Drive Shaft Assembly, Pump	3-1d	3-2
Dropping Anchor	2-15a	2-25
During Loading	2-8	2-16

# **ALPHABETICAL INDEX - Continued**

	Para.	Page
-Е-		Ū
Engine and Power Take-Off	3-1a	3-1
Engine Assembly Controls and Indicators	2-2	2-1
Engine, Diesel	1-70	1-7
Engine Shutdown Maintenance	3-8	3-18
Equipment Characteristics, Capabilities, and Features	1-6	1-3
Equipment Data	1-9	1-8
Data and Identification Plates	1-9a	1-8
Tabulated Data	1-9b	1-9
Ether Starting Aid	3-23	3-52
Exhaust and Pipes Maintenance, Muffler	3-9	3-19
Exhaust Muffler	1-7g	1-4
Extreme Cold, Operation In	2-17	2-27
Extreme Heat, Operation In	2-16	2-27

#### -F-

Fan Belts	3-19	3-44
Features, Equipment Characteristics, Capabilities and	1-6	1-3
Filling Inlet and Discharge Outlet Valves	1-71	1-4
Filter Maintenance, Hydraulic	3-14	3-34
Filter, Oil	3-18	3-42
Flame Screen Maintenance	3-6	3-14
Flexible Coupling	3-1c	3-2
Forms and Records, Maintenance	1-2	1-1
Fuel Filter Assembly	3-16	3-38
Fuel Strainer	3-17	3-40
Fuel Tank	1 <b>-</b> 7f	1-4

# -G-

General Information	.1-1	1-1
Glossary	.1-5	1-2

# -H-

		0
Hand Pump, Hydraulic Start System	-10 :	3-22
Hatches1	-7k <sup>-</sup>	1-4
Hatches and Doors and Ventilators	-1g :	3-2
Hatch Maintenance	-5 🗧	3-12
Hoses, Water	-20 🗧	3-46
Hull	-7a <sup>-</sup>	1-4
Hydraulic Filter Maintenance	-14 :	3-34
Hydraulic Pump	-12 :	3-30
Hydraulic Start System Maintenance, Cranking Motor	-11 :	3-28

	Para.	Page
- -	4.0-	4.0
Identification Plates, Data and	1-9a	1-8
-I-		
Ladder Maintenance	3-7	3-16
Lighting	3-25	3-56
Lighting	1-7h	1-4
Lights Running	1-7h	1-4
List of Abbreviations	1-4	1-2
Loading After	2-9	2-17
Loading and Discharge Control Valves	2-3	2-3
Loading During	2-8	2-16
Load Preparation to	2-7	2-14
Location and Description of Major Components.		1-4
Anchors		1-4
Bilge Pump		1-4
Cargo Hose Boom	1-7d	1-4
Cargo Piping System	1-7n	1-6
		1-7
Coupling		1-7
Davit		1-4
Diesel Engine		1-7
Drive Shaft	1-7s	1-7
Exhaust Muffler	1-7a	1-4
Filling Inlet and Discharge Outlet Valves	1-71	1-4
Fuel Tank	1-7f	1-4
Hatches	1-7k	1-4
Hull	1-7a	1-4
Machinery House	1-7e	1-4
Running Lights	1-7h	1-4
Safety Shutdown Switch	1-7m	1-4
Speed Reducer	1-7r	1-7
Windlass	1-7c	1-4
Lubrication Instructions		3-1

_	М	_

1-1
3-9
1-4
3-19

Oil Filter	3-42
Oil Pressure Gage	3-50

# **ALPHABETICAL INDEX - Continued**

	Para.	Page
-O (Continued)-		U
Operating Instructions	2-1	2-1
Operation In Extreme Cold	2-17	2-27
Operation In Extreme Heat	2-16	2-27
Operation of Accessory Equipment	2-15	2-25
Dropping Anchor	2-15a	2-25
Hand Bilge Pump	2-15c	2-26
Retracting Anchor	2-15b	2-26
Operation of Equipment	1-11	1-11
Operation Under Unusual Conditions	2-16	2-27
Operation Under Usual Conditions	2-7	2-14
Operator Controls and Indicators, Description and Use of	2-1	2-1
Operator/Crew PMCS Procedures	2-6	2-5
Operator/Crew Troubleshooting Procedures	3-2	3-3
Operator Maintenance Instructions	3-1	3-1

#### -P-

Pipes Maintenance, Muffler, Exhaust and	3-9	3-19
Piping System, Cargo	1-7n	1-6
Power Take-Off, Engine and	3-1a	3-1
Precaution On Entering Cargo Tanks	2-14	2-24
Precautions In Operations	1-12	1-12
Preparation to Load	2-7	2-14
Preparation to Unload	2-11	2-18
Pressure Gage, Cargo	2-4	2-4
Pressure Gage, Oil	3-22	3-50
Preventive Maintenance Checks and Services (PMCS)	2-5	2-5
Principles of Operation, Technical	1-10	1-11
Pump, Bilge	1-7i	1-4
Pump, Cargo	1-7p	1-7
Pump Drive Shaft Assembly	3-1d	3-2
Pump, Hand Bilge	2-15c	2-26
Pump, Hand, Hydraulic Start System	3-10	3-22
Pump, Hydraulic	3-12	3-30
Pump, Rotary	3-1e	3-2

#### -R-

Reducer, Speed	1-7r	1-7
	3-1b	3-2
Relief Transfer Pump, Valve	3-24	3-54
Reporting Equipment Improvement Recommendations (EIR)	1-3	1-2
Retracting Anchor	2-15b	2-26
Rotary Pump	3-1e	3-2
Running Lights	1-7h	1-4

Page

Para.

-S-Safety Shutdown Control.....1-7m 1-4 1-1 3-14 3-2 Shaft, Drive......1-7s 1-7 3-18 1-7 3-1b 3-2 3-52 3-22 3-40

#### -T-

-U-

Tabulated Data	1-9b	1-9
Tank, Fuel	1-7f	1-4
Technical Principles of Operation	1-10	1-11
Temperature Gage, Water	3-21	3-48
Tow, Under	2-10	2-18
Transfer Pump, Relief Valve	3-23	3-52
Troubleshooting Procedures, Operator/Crew	3-2	3-3

Ullage Assembly Maintenance	4 3-9
Under Tow	10 2-18
Unloading, After2-	12 2-23
Unload, Preparation to	11 2-18
Unusual Conditions, Operation Under2-	16 2-27
Usual Conditions, Operation Under	7 2-14

Valve Maintenance, Control	.3-13	3-32
Valve. Relief Transfer Pump	.3-24	3-54
Valve Remote Operator Assembly	.3-1f	3-2
Ventilators. Hatches and Doors and	.3-1a	3-2

#### -W-

-V-

Water Hoses	3-46
Water Temperature Gage	3-48
Winch	3-2
Windlass1-7c	1-4

# By Order of the Secretary of the Army:

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#### The Metric System and Equivalents

## Linear Measure

- 1 centimeter = 10 millimeters = .39 inch
- 1 decimeter = 10 centimeters = 3.94 inches
- 1 meter = 10 decimeters = 39.37 inches
- 1 dekameter = 10 meters = 32.8 feet
- 1 hectometer = 10 dekameters = 328.08 feet
- 1 kilometer = 10 hectometers = 3,280.8 feet

# Weights

- 1 centigram = 10 milligrams = .15 grain 1 decigram = 10 centigrams = 1.54 grains feet
- 1 gram = 10 decigram = .035 ounce
- 1 decagram = 10 grams = .35 ounce acres
- 1 hectogram = 10 decagrams = 3.52 ounces
- 1 kilogram = 10 hectograms = 2.2 pounds
- 1 quintal = 100 kilograms = 220.46 pounds
- 1 metric ton = 10 quintals = 1.1 short tons

# Liquid Measure

- 1 centiliter = 10 milliters = .34 fl. ounce
- 1 deciliter = 10 centiliters = 3.38 fl. ounces
- 1 liter = 10 deciliters = 33.81 fl. ounces
- 1 dekaliter = 10 liters = 2.64 gallons
- 1 hectoliter = 10 dekaliters = 26.42 gallons
- 1 kiloliter = 10 hectoliters = 264.18 gallons

# Square Measure

- 1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
- 1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
- 1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq.
- 1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
- 1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47
- 1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

# **Cubic Measure**

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch 1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches 1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

# Approximate Conversion Factors

To change	То	Multiply by	To change	То	Multiply by
inches	centimeters	2.540	ounce-inches	Newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	s .405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	Newton-meters	1.356	metric tons	short tons	1.102
pound-inches	Newton-meters	.11296			

# Temperature (Exact)

°F

Fahrenheit temperature 5/9 (after subtracting 32)

Celsius °C temperature

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