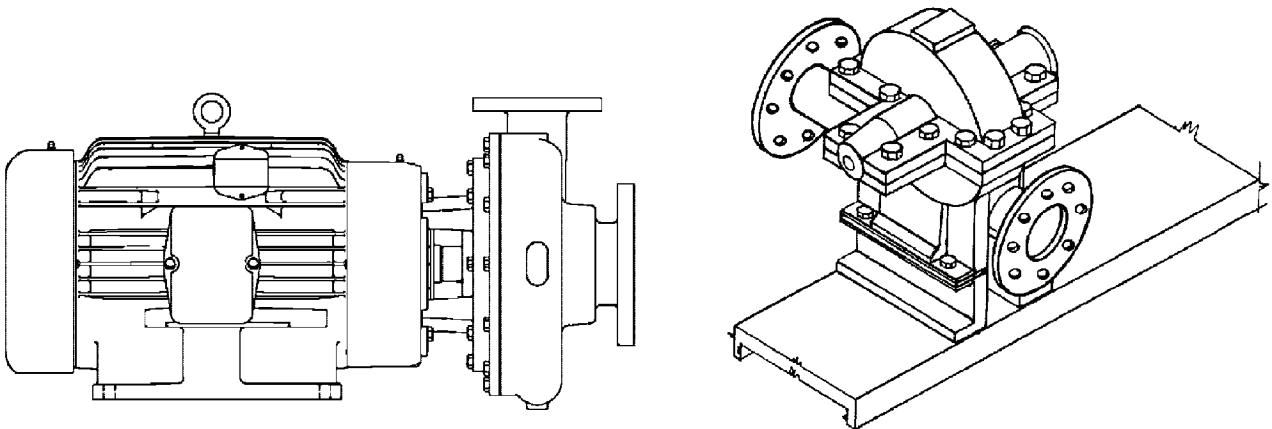


***TM 55-1905-223-24-12**

TECHNICAL MANUAL
FIELD AND SUSTAINMENT MAINTENANCE MANUAL
FOR
FIRE PUMP SUBSYSTEM
LANDING CRAFT UTILITY (LCU)
NSN 1905-01-154-1191



*Supersedes TM 55-1905-223-24-12, 17 January 1989, including all changes.

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

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JULY 2009

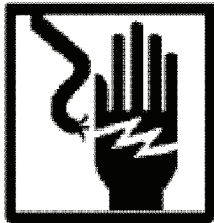
WARNING SUMMARY

First aid procedures for soldiers are contained in FM 4-25.11, First Aid.

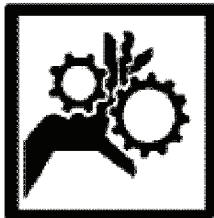
This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety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

Unauthorized modifications, alterations or installations of or to this equipment are prohibited and are in violation of AR 750-10. Any such unauthorized modifications, alterations or installations could result in death, injury or damage to the equipment.

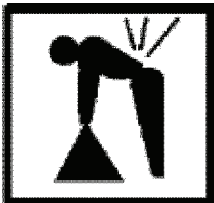
EXPLANATION OF SAFETY WARNING ICONS



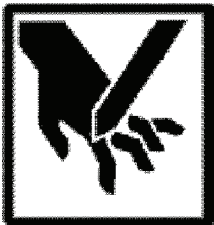
ELECTRICAL - electrical wire to hand with electricity symbol running through hand shows that shock hazard is present.



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

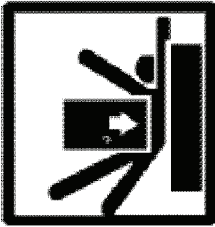


HEAVY OBJECT - human figure stooping over heavy object shows physical injury potential from improper lifting technique.

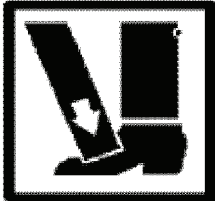


SHARP OBJECT - pointed object in hand shows that a sharp object presents a danger to limb.

EXPLANATION OF SAFETY WARNING ICONS - Continued



HEAVY PARTS - heavy object pinning human figure against wall shows that heavy, moving parts present a danger to life or limb.



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



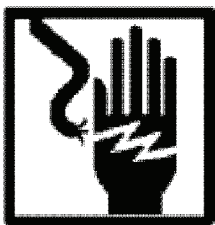
HEAVY PARTS - heavy object on human figure shows that heavy parts present a danger to life or limb.



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

GENERAL SAFETY WARNINGS DESCRIPTION

WARNING



Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized presents a shock hazard and may result in death or injury to personnel or equipment damage.

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

GENERAL SAFETY WARNINGS DESCRIPTION -Continued



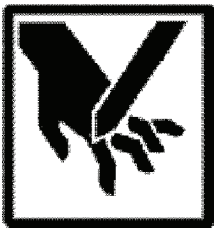
WARNING

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.



WARNING

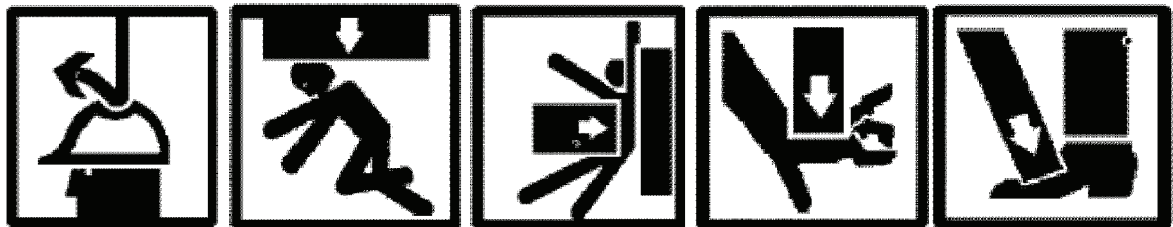
Handling heavily weighted objects can cause bodily injury. Do not lift materials or equipment over 50 lbs without using appropriate material handling equipment.



WARNING

Auxiliary Fire Pump assembly casing edges are machined and may contain sharp edges or burrs. Wear protective gloves to eliminate the risk of injury to personnel.

WARNING



All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

NOTE: This manual supersedes TM 55-1905-223-24-12 dated 17 Jan 1989. Zero in the "Change No." column indicates an original page or work package.

Date of issue for the original manual is:

Original 01 July 2009

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 30 AND THE TOTAL NUMBER OF WORK PACKAGES IS 26, CONSISTING OF THE FOLLOWING:

Page/WP No.	*Change No.	Page/WP No.	*Change No.
Front Cover	0	WP 0010 (2 pages).....	0
blank.....	0	WP 0011 (4 pages).....	0
Warning Summary (4 pages)	0	WP 0012 (10 pages)	0
i through v.....	0	WP 0013 (4 pages).....	0
vi blank	0	WP 0014 (2 pages).....	0
Chapter 1 title page.....	0	WP 0015 (6 pages).....	0
blank.....	0	WP 0016 (6 pages).....	0
WP 0001 (4 pages)	0	WP 0017 (4 pages).....	0
WP 0002 (4 pages)	0	WP 0018 (4 pages).....	0
WP 0003 (2 pages)	0	WP 0019 (8 pages).....	0
Chapter 2 title page.....	0	WP 0020 (4 pages).....	0
blank.....	0	WP 0021 (4 pages).....	0
WP 0004 (2 pages)	0	WP 0022 (2 pages).....	0
WP 0005 (2 pages)	0	Chapter 5 title page	0
WP 0006 (4 pages)	0	blank	0
Chapter 3 title page.....	0	WP 0023 (2 pages).....	0
blank.....	0	WP 0024 (4 pages).....	0
WP 0007 (2 pages)	0	WP 0025 (5 pages).....	0
WP 0008 (4 pages)	0	WP 0026 (4 pages).....	0
Chapter 4 title page.....	0	Index 1 through Index 4.....	0
blank.....	0	Inside back cover	0
WP 0009 (2 pages)	0	Back cover	0

*Zero in this column indicates an original page.

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 01 July 2009

TECHNICAL MANUAL
FIELD AND SUSTAINMENT MAINTENANCE MANUAL
FOR
FIRE PUMP SUBSYSTEM
LANDING CRAFT UTILITY (LCU)
NSN 1905-01-154-1191

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any errors, or if you would like to recommend any improvements to the procedures in this publication, please let us know. The preferred method is to submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms) through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <https://aeeps.ria.army.mil>. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, e-mail, or fax your comments or DA Form 2028 directly to the U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command, ATTN: AMSTA-LC-LMPP/TECH PUBS, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is tacomlcmc.daform2028@us.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

*Supersedes TM 55-1905-223-24-12, 17 January 1989, including all changes.

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HOW TO USE THIS MANUAL

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

a. Accessing Information

Information is accessed by referring to the Table of Contents, located in the front of this manual, or by looking in the Alphabetical Index, located in the back of this manual.

b. Illustrations

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

c. Using This Manual

When using this manual, read and understand the entire maintenance action before performing the task. Also, read and understand all warnings, cautions and notes that apply to the task to be performed. The warning summary will inform personnel of hazards associated with the equipment to be worked on. However, the summary is not all inclusive and personnel should be aware at all times of hazardous conditions that may arise.

Prior to starting the procedures in this manual, the initial setup requirements are located directly above each procedure. The information is given to ensure all materials, expendables, tools and any other equipment necessary are readily available for use. The initial setup will be accomplished prior to starting the actual steps of each maintenance procedure.

LOCATING MAJOR COMPONENTS

Obtain the manual for the system to be worked on. Open to the Table of Contents located in the front of this manual. Find Chapter 1, *General Information, Equipment Description and Theory of Operation*. Under the chapter title you will find the work package titled *Equipment Description and Data*. Turn to the work package indicated. Within this work package you will find a description of the major component(s) and an illustration of what the component(s) looks like.

The Alphabetical Index, located in the back of this manual, contains an alphabetical list of all sections of this manual. *Location and Description of Major Components* is found in section L. The work package is found on the right side of the title where the *Location and Description of Major Components* is located. Turn to the work package indicated to find the description and location of each component.

TROUBLESHOOTING PROCEDURES

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

Test Equipment: Lists all test equipment (standard or special) required to troubleshoot, test and inspect the equipment covered in this manual. The test equipment is identified with an item number and work package number from the *Tools and Test Equipment List* located in Chapter 5, *Supporting Information*.

Tools: Lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from the *Tools and Test Equipment List* located in Chapter 5, *Supporting Information*.

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

Equipment Condition: Notes the conditions that must exist before starting the task. The equipment condition will also include any prerequisite maintenance tasks to be performed with reference to the work package number or to the TM number.

References: Includes any other manuals necessary to complete the task. When there are no references listed, all steps necessary to complete the task are contained within this manual. A listing of reference materials is contained in the work package *References* in Chapter 5, *Supporting Information*.

MAINTENANCE INSTRUCTIONS

To locate a maintenance procedure, open the manual to the Table of Contents located in the front of this manual. Find Chapter 4, *Maintenance Instructions*, look down the list and find the maintenance procedure to be accomplished. On the right side of the maintenance procedure will be a work package number. Turn to the work package indicated. Before beginning the maintenance task, look through the procedure to familiarize yourself with the entire maintenance procedure. At the top of the task you will have a section called INITIAL SETUP. There are five basic headings listed under INITIAL SETUP.

Tools: Lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from the *Tools and Test Equipment List* located in Chapter 5, *Supporting Information*.

Materials/Parts: Lists all parts or materials necessary to perform the task. Expendable and durables are identified with an item number and work package number from the *Expendable and Durable Supplies and Materials List* located in Chapter 5, *Supporting Information*.

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

References: Includes any other manuals necessary to complete the task. When there are no references listed, all steps necessary to complete the task are contained within this manual. A listing of reference materials is contained in the work package *References* in Chapter 5, *Supporting Information*.

Equipment Condition: Notes the conditions that must exist before starting the task. The equipment condition will also include any prerequisite maintenance tasks to be performed with reference to the work package number or to the TM number.

Test Equipment: Lists all test equipment (standard or special) required to troubleshoot, test and inspect the equipment covered in this manual. The test equipment is identified with an item number and work package number from the *Tools and Test Equipment List* located in Chapter 5, *Supporting Information*.

REPAIR PARTS AND SPECIAL TOOLS LIST

Refer to TM 55-1905-223-24P-2/-4 when requisitioning parts, special tools and equipment.

Identify the mandatory repair parts required to perform this task listed at the top of the work package in the INITIAL SET-UP. Using the part number provided, refer to the part number index work package in TM 55-1905-223-24P-2. Look up the part number in the part number column and identify the figure and item number where the part is located. Turn to the figure and locate the item number listed. Verify that the item is correct.

CHAPTER 1

FIELD AND SUSTAINMENT MAINTENANCE FOR FIRE PUMP SUBSYSTEM

GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND THEORY OF OPERATION

**FIELD AND SUSTAINMENT MAINTENANCE
FOR
FIRE PUMP SUBSYSTEM
GENERAL INFORMATION**

SCOPE

The scope of this manual is as follows:

Type of Manual: Field and Sustainment maintenance manual.

Name of Equipment: The equipment covered by this manual is the fire pump subsystem that is installed aboard the LCU 2000 Class watercraft. See WP 0002, Figure 1. Operation of the fire pump subsystem is covered in TM 55-1905-223-10. Components of the fire pump subsystem are:

Auxiliary Fire Pump Assembly.
Centrifugal Pump Unit.

Purpose of Equipment: The fire pump subsystem pumps sea water into fire main piping for on-board or off-vessel firefighting and back up ballasting pumps.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army forms and procedures used for equipment maintenance are those prescribed by DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If your Fire Pump Subsystem needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. If you have internet access, the easiest and fastest way to report problems or suggestions is to go to <https://aeps.ria.army.mil/aepspublic.cfm> (scroll down and choose the "Submit Quality Deficiency Report" bar). The Internet form lets you choose to submit an Equipment Improvement Recommendation (EIR), a Product Quality Deficiency Report (PQDR) or a Warranty Claim Action (WCA). You may also submit your information using an SF 368 (Product Quality Deficiency Report). You can send your SF 368 via e-mail, regular mail, or facsimile using the addresses/facsimile numbers specified in DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual. We will send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items. Corrosion specifically occurs with metals. It is an electrochemical process that causes the degradation of metals. It is commonly caused by exposure to moisture, acids, bases, or salts. An example is the rusting of iron. Corrosion damage in metals can be seen, depending on the metal, as tarnishing, pitting, fogging, surface residue, and/or cracking. Plastics, composites, and rubber material can also degrade. Degradation is caused by thermal (heat), oxidation (oxygen), solvation (solvents), or photolytic (light, typically UV) processes. The most common exposures are excessive heat or light. Damage from these processes will appear as cracking, softening, swelling, and/or breaking. SF Form 368, Product Quality Deficiency Report should be submitted to the address specified in DA PAM 750-8, The Army Maintenance Management System (TAMMS) Users Manual.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

Refer to TM 750-244-3 for instructions covering the destruction of Army Materiel to prevent enemy use.

PREPARATION FOR STORAGE OR SHIPMENT

Administrative storage of equipment issued to and used by Army activities will have preventive maintenance performed in accordance with the Preventive Maintenance Checks and Services (PMCS) charts before storing. When removing the equipment from administrative storage, the PMCS should be performed to assure operational readiness.

LIST OF ABBREVIATIONS

Abbreviation/Acronym	Name
A/C	Alternating Current
Amps	Amperes
BT	Bottle
C	Centigrade
CN	Can
DA PAM	Department of Army Pamphlet
EA	Each
EIR	Equipment Improvement Recommendations
EOS	Engine Operating Station
F	Fahrenheit
FL. EFF.	Full Load Efficiency
Ft-lbs.	Foot Pounds
GL	Gallon
GPM	Gallon Per Minute
hp	Horsepower
In-lbs.	Inch Pounds
INS. CL.	Insulation Class
kgm	Kilogram
lb.	Pound
MAC	Maintenance Allocation Chart
MTOE	Modified Table of Organization and Equipment
Nm	Newton Meter
OCCM	On-Condition Cyclic Maintenance
P.F.	Power factor
PG	Package
PMCS	Preventive Maintenance Checks and Services
psi	Pounds Per Square Inch
PTO	Power Take Off
rpm	Revolutions Per Minute
RPSTL	Repair Parts and Special Tools List
SERV. FAC	Service Factor
SH	Sheet
SPEC	Specification Number
TAMMS	The Army Maintenance Management System
TDH	Total Discharge Head
TM	Technical Manual
TMDE	Test Measurement and Diagnostic Equipment
UV	Ultraviolet
WP	Work Package

QUALITY OF MATERIAL

Material used for replacement, repair, or modification must meet the requirements of this Field and Sustainment maintenance manual. If quality of material requirements are not stated in this Field and Sustainment maintenance manual, the material must meet the requirements of the drawings, standards, specifications, or approved engineering change proposals applicable to the subject equipment.

SAFETY, CARE AND HANDLING

Safety precautions must be observed at all times while performing maintenance. General WARNINGS and First Aid data appear in the front of this manual. Review all safety information before starting any task. Carefully read through an entire maintenance procedure before performing any maintenance function. Make sure the task can be done safely. All WARNINGS, CAUTIONS, and NOTES are of great importance to your personal safety and the safety of the equipment.

COMMON TOOLS AND EQUIPMENT

For authorized common tools and equipment, refer to the Modified Table of Organization and Equipment (MTOE), CTA 50-970, Expendable/Durable Items (Except: Medical, Class V, Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment or CTA 8-100, Army Medical Department Expendable/Durable Items, as applicable to your unit.

SPECIAL TOOLS, TMDE, AND SUPPORT EQUIPMENT

Special tools; test, measurement, and diagnostic equipment; and support equipment requirements are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P-4. These items are also listed in the Maintenance Allocation Chart (MAC), WP 0025 of this manual.

REPAIR PARTS

Repair parts are listed and illustrated in the Repair Parts and Special Tools List (RPSTL), TM 55-1905-223-24P-2.

END OF WORK PACKAGE

**FIELD AND SUSTAINMENT MAINTENANCE
FOR
FIRE PUMP SUBSYSTEM
EQUIPMENT DESCRIPTION AND DATA**

GENERAL DESCRIPTION:

The fire pump subsystem consists of three pump assemblies, associated piping, valves, manifolds, and gauges. The pumps provide water to the system from a sea chest in the vessel's hull bottom. Designated valves in the fire main system must be open to allow the system to be pressurized. Figure 1 shows the electric-driven and diesel-driven fire pump subassemblies.

CHARACTERISTICS, CAPABILITIES AND FEATURES:

A very broad view of the fire pump subsystem is as follows:

Characteristics:

- Two electric driven pumps.

- One diesel driven pump.

- Each can be controlled at the pump, in the pilot house, and in the EOS (Engine Operating Station).

Capabilities and Features:

- Provides emergency ballasting/deballasting.

- Provides additional firemain pressure.

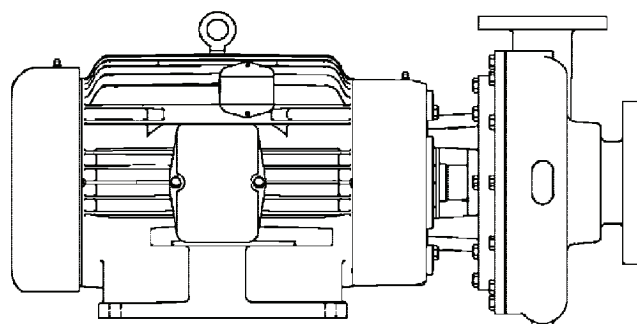
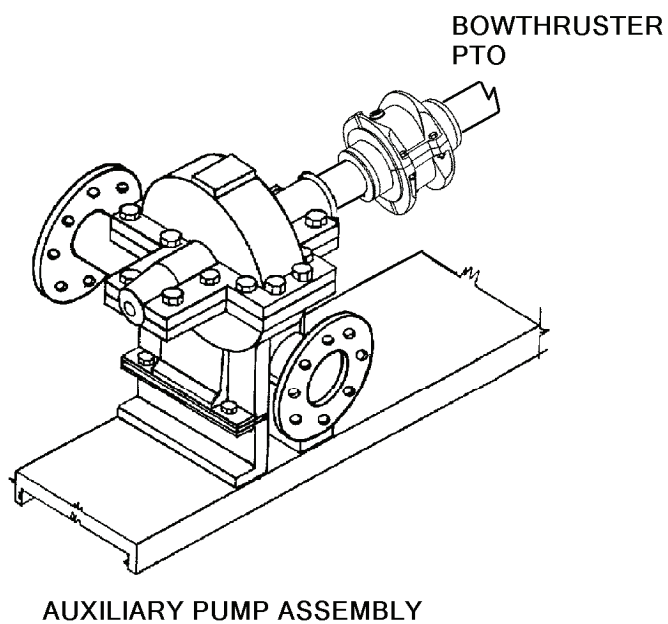
- Diesel-driven pump can be used when vessel has lost electrical power.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

Two electric driven, centrifugal fire pumps are located in the engine room, each with a rating of 250 GPM at 125 psi. Both of these pumps are connected directly to the ballast system to provide a water source if the vessel is unable to attain seawater suction, or if emergency ballasting or deballasting is required. The auxiliary fire pump assembly is located in the bowthruster machinery space and is driven by the bowthruster diesel engine. It has a rating of 500 GPM at 125 psi. This pump is used if the vessel loses electrical capabilities, or if additional firemain pressure is required. Start and stop controls for all pumps are located on or near each pump, with remote controls in the pilothouse.

EQUIPMENT DATA

Reference data for the fire pump subsystem is given in Table 1. Also, see the equipment data given in the operator's manual, TM 55-1905-223-10.



CENTRIFUGAL PUMP UNIT

Figure 1. Fire Pump Subsystem.

Table 1. Equipment Data Characteristics.

Characteristics	Reference Data
DIESEL DRIVEN PUMP	
Auxiliary Fire Pump Assembly	
Type	LH-411-BF Cast Iron
Manufacturer	Aurora
Size	4 X 6 X 18B
TDH	289 feet
Impeller Diameter	16.5 inches
Mechanical Seal Type	Standard John Crane Type 21 (712-1014-749)
rpm	1750
hp	300
Mounting	Horizontal
Rate	500 gpm @ 125 psi
Liquid	Raw Seawater
Seal	Mechanical
Coupling	Flexible Shaft
Driver Source	300 hp Diesel Engine
ELECTRIC DRIVEN PUMP DATA	
Fire Pump	
Pump	
Type	ZCH2
Manufacturer	Ampco Pumps
Size	3 X 2 X 9.5 inches
rpm	3,600 - max.
Mounting	Vertical
Rate	250 gpm @ 125 psi
Liquid	Raw Seawater
Seal	Mechanical
Driver Source	40 hp electric motor D.P. vertical
Motor	JMM4109T
Enclosure	TEFC
rpm	3,520
hp	40
SPEC	10F606X657
Nameplate	F
SERV. FAC	1.15
Code	JMM4109T
P.F.	90
Frame	324JM
Operating Temperature	70°F (21°C)
Volts	230/460
Hertz	60
Full Load Amps	90/45
Phase	3
INS. CL.	F
Design	B
Rating	40C AMB-CONT
FL. EFF.	91.7

END OF WORK PACKAGE

**FIELD AND SUSTAINMENT MAINTENANCE
FOR
FIRE PUMP SUBSYSTEM
THEORY OF OPERATION**

GENERAL

The firemain system is pressurized by two primary fire pumps and one Auxiliary Fire Pump assembly, with associated piping, valves, and manifolds. Each fire pump will take suction from a sea chest and discharge water into the system. The system is controlled by valve alignments. Each pump is controlled locally at the pump and remotely in the pilothouse. Each control station has a control panel that contains motor Start/Stop buttons (except for auxiliary pump), indicator lights, and a power switch. The indicator lights will indicate the operational status of the pumps. The Auxiliary Fire Pump assembly is driven by the bowthruster diesel engine (reference TM 55-1905-223-24-5) and is started or stopped by means of a hand lever on the side of the diesel engine clutch assembly or remote operations from the bridge or EOS console. The RPM of this pump is controlled by the RPM of the diesel engine, with a maximum pump RPM of 1,750. These pumps provide a total capacity of 1,000 GPM for onboard or off-vessel firefighting. Refer to the operator's manual, TM 55-1905-223-10, for more information on fire pump subsystem control.

END OF WORK PACKAGE

CHAPTER 2

**FIELD AND SUSTAINMENT
MAINTENANCE FOR
FIRE PUMP SUBSYSTEM**

TROUBLESHOOTING PROCEDURES

**FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS
FOR
FIRE PUMP SUBSYSTEM
TROUBLESHOOTING SYMPTOM INDEX**

TROUBLESHOOTING

Both a symptom index and troubleshooting tables (WP 0005 and 0006) are provided. The symptom index will help you locate the information you need for troubleshooting.

SYMPTOM INDEX	
<u>Symptom/Malfunction</u>	<u>Troubleshooting Procedure Page</u>
AUXILIARY FIRE PUMP ASSEMBLY	
1. No Pump Discharge	WP 0005-1
3. Prime Mover Overload	WP 0005-2
2. Pump Operates Normally for a Short Time, Then Stops Pumping	WP 0005-2
4. Unusual Noise or Vibration.....	WP 0005-2
CENTRIFUGAL PUMP UNIT	
2. Low Pump Discharge	WP 0006-2
3. Low Pump Discharge Pressure.....	WP 0006-2
1. No Pump Discharge	WP 0006-1
5. Pump Draws Excessive Amperage	WP 0006-3
4. Pump Operates Normally for a Short Time, Then Stops Pumping	WP 0006-2
6. Unusual Noise or Vibration.....	WP 0006-3

WP 0005 and 0006 lists the common fault conditions that may be found during operation or maintenance of the equipment. Look for causes and do corrective actions in the order listed. This manual cannot list every symptom that may show up, and it cannot list all the possible causes and corrective actions. If a symptom is not listed, or if it keeps up after you have performed the corrective actions, notify your supervisor.

END OF WORK PACKAGE

**FIELD MAINTENANCE INSTRUCTIONS
FOR
FIRE PUMP SUBSYSTEM
AUXILIARY FIRE PUMP ASSEMBLY TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Thermometer, Infared (WP 0025, Item 9)

Personnel Required

Watercraft Engineer 88L

References

WP 0011
WP 0012
WP 0013
TM 55-1905-223-24-5
TM 55-1905-223-10
LO 55-1905-223-12

Equipment Condition

Firemain cross connect valve, Auxiliary Fire Pump assembly suction and discharge valves, and bowthrustrer diesel engine locked out and tagged out (FM 4-01.502).

Table 1. Auxiliary Fire Pump Assembly Troubleshooting Procedures.

SYMPTOM/MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE ACTION
1. No Pump Discharge.	1. Clogged Sea strainer or Sea Chest.	Clean Strainer or Clear Sea Chest.
	2. Loss of Prime.	Open petcock at top of Auxiliary Fire Pump bleed until a steady flow of water is present.
	3. Air Leak in suction piping.	Tighten loose suction piping and plugs. Open petcock at top of Auxiliary Fire Pump bleed until a steady flow of water is present.
	4. Auxiliary Fire Pump assembly is not up to operating speed.	Increase speed of Prime Mover (TM 55-1905-223-10).
	5. Discharge head pressure is to high.	Check for proper Valve alignment (TM 55-1905-223-10).
	6. Impeller passage restricted or impeller damaged.	1. Clear restriction (WP 0012). 2. Replace Auxiliary Fire Pump assembly (WP 0011).
	7. Air leak between shaft and shaft sleeve.	Disassemble Auxiliary Fire Pump assembly inspect, clean and repair (WP 0012).

Table 1. Auxiliary Fire Pump Assembly Troubleshooting Procedures - Continued.

SYMPTOM/MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE ACTION
2. Pump Operates normally for a short time, then stops pumping	Air leak on suction side of system.	Tighten loose suction piping and plugs. Open petcock at top of Auxiliary Fire Pump assembly; bleed until a steady flow of water is present.
3. Prime Mover Overload	1. Fire pump speed too high.	Reduce speed of prime mover.
	2. Excessive head pressure.	Check for proper valve alignment (TM 55-1905-223-10).
	3. Mechanical failure of the Auxiliary Fire Pump assembly.	Replace Auxiliary Fire Pump assembly (WP 0011).
	4. Power Take Off (PTO) bearing failure.	Disassemble PTO; inspect, repair and replace bearings (TM 55-1905-223-24-5).
4. Unusual noise or vibration.	1. Loose foundation bolts.	Tighten foundation bolts (WP 0011).
	2. Fouled pump impeller.	1. Reduce speed of prime mover; note at what speed noise or vibration goes away. If continues secure engine. 2. Disassemble Auxiliary Fire Pump assembly and remove obstruction (WP 0012).
	3. Pump coupling misalignment.	1. Realign Auxiliary Fire Pump assembly (WP 0013). 2. Check lubricant for proper grade. Refer to LO 55-1905-223-12.
	4. Loose flexible shaft coupling components.	Check alignment; tighten coupling hardware / fasteners.
	5. Pump bearing temperature exceeds 180° F.	Check lubricant for proper grade. Refer to LO 55-1905-223-12.
	6. Auxiliary Fire Pump assembly bearing failure.	Repair Auxiliary Fire Pump assembly (WP 0012).

END OF WORK PACKAGE

**FIELD MAINTENANCE INSTRUCTIONS
FOR
FIRE PUMP SUBSYSTEM
CENTRIFUGAL PUMP UNIT TROUBLESHOOTING PROCEDURES**

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)

Personnel Required

Watercraft Engineer 88L

References

WP 0016
WP 0017
WP 0018
WP 0019
WP 0021
TM 55-1905-223-10
TM 55-1905-223-24-18

Equipment Condition

Centrifugal pump motor controller and suction and discharge valves locked out and tagged out (FM 4-01.502).


Table 1. Centrifugal Pump Unit Troubleshooting Procedures.

SYMPTOM/MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE ACTION
1. No Pump Discharge.	1. Clogged sea strainer or sea chest.	Clean strainer or clear sea chest.
	2. Loss of prime.	Fill centrifugal pump and suction piping completely with water allowing all trapped air to escape.
	3. Air leak in suction piping.	Correct leaks in suction pipe joints and fittings, vent casing to remove accumulated air (TM 55-1905-24-18).
	4. Discharge head pressure is too high.	Check for proper valve alignment (TM 55-1905-223-10).
	5. Impeller passage restricted or impeller and wear ring damaged.	1. Clear restriction (WP 0021). 2. Replace fire pump impeller and wear ring (WP 0021).
	6. Alternating current motor rotating in the wrong direction.	Properly wire alternating current motor (WP 0016).

Table 1. Centrifugal Pump Unit Troubleshooting Procedures - Continued.

SYMPTOM/MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE ACTION
2. Low Pump Discharge.	1. Clogged sea strainer or sea chest.	Clean strainer or clear sea chest.
	2. Air leak in suction piping.	Correct leaks in suction pipe joints and fittings; vent casing to remove accumulated air (TM 55-1905-24-18).
	3. Discharge head pressure is too high.	Check for proper Valve alignment (TM 55-1905-223-10).
	4. Partially plugged Impeller.	Disassemble centrifugal pump and clear impeller (WP 0018).
	5. Defective Impeller, wear ring or mechanical seal.	Repair centrifugal pump unit (WP 0021).
	6. Alternating current motor wired incorrectly.	Properly wire alternating current motor (WP 0016).
3. Low Pump Discharge Pressure.	1. Clogged sea strainer or sea chest.	Clean strainer or clear sea chest.
	2. Leaks in suction piping.	Secure pump and check for suction side leaks and correct.
	3. Worn impeller and wear ring.	Repair centrifugal pump (WP 0021).
4. Pump operates normally for a short time, then stops pumping.	1. Incomplete system prime.	Purge pump, piping of air (TM 55-1905-223-24-18).
	2. Air leak in suction piping, drop in suction pressure.	Locate and correct suction leak (TM 55-1905-223-24-18).
	3. Alternating current motor thermal overload tripped.	1. Allow alternating current motor sufficient time to cool.

Table 1. Centrifugal Pump Unit Troubleshooting Procedures - Continued.

SYMPTOM/MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE ACTION
4. Pump operates normally for a short time, then stops pumping - Continued.		<p>WARNING</p>  <p>Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.</p>
5. Pump Draws Excessive Amperage.	1. Electrical problems. 2. Bent pump motor shaft. 3. Impeller and wear rings damage. 4. Defective mechanical seal. 5. Alternating current motor bearing failure. 6. Distorted centrifugal pump casing.	2. Inspect for restricted cooling air flow to alternating current motor. 3. Refer to troubleshooting symptom/malfunction 5 for excessive amperage. Test centrifugal pump alternating current motor (WP 0017). Replace alternating current motor (WP 0018). Repair centrifugal pump (WP 0021). Repair centrifugal pump (WP 0021). Repair alternating current motor (WP 0019). Disassemble centrifugal pump and replace all defective parts (WP 0021).
6. Unusual noise or Vibration.	1. Loose foundation bolts. 2. Bent pump motor shaft.	Tighten foundation bolts (WP 0016). Replace alternating current motor (WP 0018).

END OF WORK PACKAGE

CHAPTER 3

FIELD AND SUSTAINMENT MAINTENANCE FOR FIRE PUMP SUBSYSTEM

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) MAINTENANCE INSTRUCTIONS

**FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS
FOR
FIRE PUMP SUBSYSTEM
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) PROCEDURES INTRODUCTION**

GENERAL

PMCS is designed to keep the equipment in good working condition. This is accomplished by performing certain tests, inspections, and services. WP 0008, Table 1 lists items to be serviced and the procedures needed to accomplish the PMCS. If needed, PMCS may be performed more frequently than the indicated interval.

EXPLANATION OF PMCS TABLE

1. **Item Number (Item No.) Column.** Numbers in this column are for reference. If your equipment does not perform as required, refer to WP 0005 or WP 0006, Troubleshooting. Report any malfunctions or failures on a DA Form 2404/5988E, Equipment Inspection and Maintenance Worksheet. In the "Item Number" column on DA Form 2404/5988E, record the appropriate item number from the PMCS Table (WP 0008).
2. **Interval Column.** The "Interval" column tells you when to perform a check or service.
 - a. *Monthly* procedures must be accomplished once a month.
 - b. *Quarterly* procedures must be accomplished once every three months.
 - c. *Semiannually* procedures must be accomplished once every six months.
 - d. *Annually* procedures must be accomplished once every twelve months.
3. **Items To Be Inspected/Serviced.** The "Items To Be Inspected/Serviced" column provides the assembly or subassembly to be checked or serviced.

NOTE

The WARNINGS and CAUTIONS appearing in your PMCS table shall always be observed. WARNINGS and CAUTIONS appear before applicable procedures. You must observe these WARNINGS to prevent injury or death to personnel, and CAUTIONS to prevent your equipment from being damaged.

4. **Procedures.** The "Procedures" column tells you how to perform the required checks and services.
5. **Equipment not Ready/Available if.** Information in this column tells you what faults will keep your equipment from being capable of performing its primary mission. If you perform check/service procedures that show faults listed in this column, the equipment is not mission-capable. Follow standard operating procedures for maintaining the equipment or reporting equipment failure.

CLEANING AND LUBRICATION

CAUTION

Follow all cleaning and lubrication instructions carefully. Failure to do so can result in damage to equipment.

Proper cleaning and lubrication can aid in avoiding possible problems or trouble, so make it a habit to do the following:

1. Thoroughly wash all equipment exposed to salt spray with clean, fresh water.
2. Clean grease fittings before lubrication.
3. Lubricate all equipment at conclusion of the operation before equipment storage. Always use the PMCS lubrication instructions as a guide.
4. Never use too much lubricant.
5. Never use the wrong type or grade of lubricant.
6. Lubricate more during constant use and less during inactive periods.
7. Use the correct grade of lubricant for seasonal temperature expected.

FLUID LEAKAGE

It is necessary for you to know how fluid leakage affects the status of the fire pump subsystem. Following are types/classes of leakage you need to know to be able to determine the status of the fire pump subsystem. Learn these leakage definitions and remember - when in doubt, notify your supervisor. Equipment operation is allowed with minor leakage (Class I or II). Consideration must be given to fluid capacity in the item/system being checked/inspected. When in doubt, notify your supervisor.

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

Class III leaks should be reported immediately to your supervisor.

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

END OF WORK PACKAGE

**FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS
FOR
FIRE PUMP SUBSYSTEM
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)**

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)

Materials/Parts

Gloves, Rubber (WP 0026, Item 9)
Grease (WP 0026, Item 10)
Grease Gun (WP 0026, Item 11)
Rags, Wiping (WP 0026, Item 14)
Tag, Warning (WP 0026, Item 20)

Personnel Required

Watercraft Engineer 88L (2)

References

WP 0013
WP 0006
WP 0018
TM 55-1905-223-10
LO 55-1905-223-12

Equipment Condition

Firemain cross connect valve, Auxiliary Fire Pump assembly
suction and discharge valves, and bowthruster diesel
engine locked out and tagged out (FM 4-01.502).

Centrifugal pump motor controller and suction and discharge
valves locked out and tagged out (FM 4-01.502).

Table 1. Preventive Maintenance Checks and Services

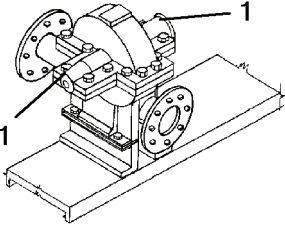
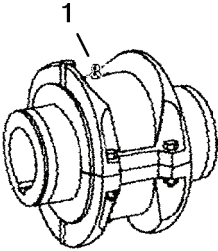
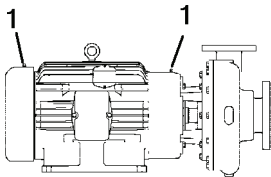
Item No.	Interval	Items To Be Inspected/Service	Procedures	Equipment not Ready/Available If:
1	Semiannually	Auxiliary Fire Pump Assembly	<p>Lubricate pump bearings (Figure 1, Item 1). Refer to LO 55-1905-223-12. Check for leaks.</p>  <p>Figure 1. Pump Bearings.</p>	Class III leakage.
2	Semiannually	Flexible Shaft Coupling	<p>Lubricate coupling (Figure 2, Item 1). Refer to LO 55-1905-223-12.</p>  <p>Figure 2. Coupling.</p>	
3	Semiannually	Centrifugal Pump Unit	<p>Lubricate motor bearings (Figure 3, Item 1). Refer to LO 55-1905-223-12. Check for leaks.</p>  <p>Figure 3. Motor Bearings.</p>	Class III leakage.

Table 1. Preventive Maintenance Checks and Services - Continued

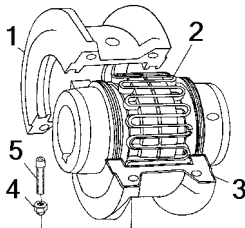
Item No.	Interval	Items To Be Inspected/Service	Procedures	Equipment not Ready/Available If:
4	Annually	Flexible Shaft Coupling	<p>Inspect grid member.</p> <p>a. Disassemble flexible shaft coupling.</p> <p>(1) Remove bolts and nuts from coupling guard; remove guard and retain.</p>  <p>Figure 4. Grid Member.</p> <p>(2) Scribe mark the coupling halves (Figure 4, Item 1).</p> <p>(3) Remove bolts and nuts (Figure 4, Items 4 and 5) from coupling halves.</p> <p>(4) Remove coupling halves and gasket (Figure 4, Items 1 and 3).</p> <p>(5) Clean grease from hub.</p> <p>(6) Inspect the grid member (Figure 4, Item 2) for damage or uneven wear, paying close attention to the contact point of the grid member to the hub surface corners. If any wear or damage is found repair flexible shaft coupling (WP-0015).</p>	Grid member is damaged, unevenly worn or broken.

Table 1. Preventive Maintenance Checks and Services - Continued

Item No	Interval	Items To Be Inspected/Service	Procedures	Equipment not Ready/Available If:
4	Annually	Flexible Shaft Coupling - Continued	b. Assemble flexible shaft coupling. (1) Install coupling halves and new gasket (Figure 4, Items 1 and 3). (2) Install new bolts and new nuts (Figure 4, Items 5 and 4) on coupling covers. (3) Lubricate flexible shaft coupling (Figure 2, Item 1). Refer to LO 55-1905-223-12. (4) Install coupling guard and secure with bolts and nuts.	

Table 2. PMCS Mandatory Replacement Parts List.

Item No.	Part Number (FSCM)	NSN	Nomenclature	QTY.
ANNUALLY				
1	1080T10-GA (0V235)		Gasket	1
2	1080T10-B (0V235)		Bolt, Machine With Lock Nut	4

END OF WORK PACKAGE

CHAPTER 4

**FIELD AND SUSTAINMENT
MAINTENANCE FOR
FIRE PUMP SUBSYSTEM**

MAINTENANCE INSTRUCTIONS

**FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS
FOR
FIRE PUMP SUBSYSTEM
MAINTENANCE INSTRUCTION INTRODUCTION**

GENERAL

This chapter provides field and sustainment maintenance for the diesel driven Auxiliary Fire Pump assembly, flexible shaft coupling assembly, and two electric driven centrifugal pump units. The tasks are for alignment, test, removal, repair and replacement of subassembly components. These tasks are addressed in the following work packages.

END OF WORK PACKAGE

**FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS
FOR
FIRE PUMP SUBSYSTEM
SERVICE UPON RECEIPT**

CHECKING UNPACKED EQUIPMENT

Inspect the equipment for damage incurred during shipment. If the equipment has been damaged, report the damage in accordance with the instructions of DA PAM 750-8.

Check the equipment against the packing slip to see if the shipment is complete. Report all discrepancies in accordance with the instructions of DA PAM 750-8.

Check to see whether the equipment has been modified.

Remove and replace protective caps, plugs, inserts, wrappings, and tape when inspection/inventory is completed. Inspect piping openings for damage. Wipe off dirt, grease, or protective films at time of installation.

Remove chocks from resilient mounted components.

DEPROCESSING UNPACKED EQUIPMENT

After receipt and inspection of unpacked equipment, make sure that all packing materials, temporary braces, masking tape, etc., are removed from the material before installation.

CAUTION

Ensure both bowthrustrer clutch and fire pump clutch are disengaged prior to starting prime mover.

INITIAL SETUP PROCEDURE

Includes operational checks and inspections that are not performed for a routine startup. Field and sustainment maintenance personnel will perform initial setup in accordance with the operator's manual TM 55-1905-223-10.

NORMAL STARTUP

Refer to operator's manual, TM 55-1905-223-10.

SHUTDOWN PROCEDURE (USUAL OR UNUSUAL)

Refer to operator's manual, TM 55-1905-223-10.

PRELIMINARY SERVICING AND ADJUSTMENT

It is important that careful preparations and inspection be made before the fire pumps are put in use.

Pre-Start Checks, Electric Driven Pumps

Before initial start of pumps, make the following inspection:

1. Check all connections to motor and starting pushbuttons with wiring diagram. Check voltage, phase and frequency on motor nameplate with line circuit (TM 55-1905-223-10).
2. Check suction and discharge piping and pressure gauges for proper operation (TM 55-1905-223-18-1/2).

Pre-Start Checks, Electric Driven Pumps- Continued

3. Check alternating current motor lubrication (WP 0008).
4. Ensure that pump is primed and all valves are properly set and operational, with the discharge valve closed, and the suction valve open (TM 55-1905-223-18-1/2).

CAUTION

Be sure that the motor operates in the direction indicated by the arrow on the pump casing. Serious damage can result if the pump is operated with the incorrect rotation.

5. Inspect rotation each time the motor leads have been disconnected (WP 0016).

Pre-Start Checks, Diesel Driven Pump

Before initial start of pumps, make the following inspection:

1. Check alignment between pump and bowthruster diesel engine (WP 0013).
2. Check suction and discharge piping and pressure gauges for proper operation (TM 55-1905-223-10).
3. Turn impeller and shaft assembly by hand to ensure that it rotates freely (TM 55-1905-223-24-5).
4. Check driver lubrication (TM 55-1905-223-24-5).
5. Refer to TM 55-1905-223-24-5, Bowthruster Diesel Engine, for pre-checks prior to engaging clutch to start pump.
6. Flush all foreign matter from lines and Auxiliary Fire Pump assembly (TM 55-1905-223-18-1/2).
7. Bleed all air from seal chamber. Do not run seal dry (TM 55-1905-223-10).
8. Make certain that flush lines to the seal chamber have not been damaged during installation. (TM 55-1905-223-18-1/2.)
9. Operate pump for a period up to 2 hours for seal run-in. Leakage may occur during this period, but should be ignored unless leakage increases rather than decreases (TM 55-1905-223-10).

END OF WORK PACKAGE

**FIELD MAINTENANCE
AUXILIARY FIRE PUMP ASSEMBLY
REPLACE**

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Wrench, Torque (30-200 Ft-lb)
(WP 0025, Item 3)
Lifting Sling (WP 0025, Item 5)
Hoist, Chain (WP 0025, Item 7)

Materials/Parts

Flange, Pipe (WP 0026, Item 6)
Pail, Utility (WP 0026, Item 12)
Tag, Warning (WP 0026, Item 20)
Nut, Self Locking

Personnel Required

Watercraft Engineer 88L (3)

References

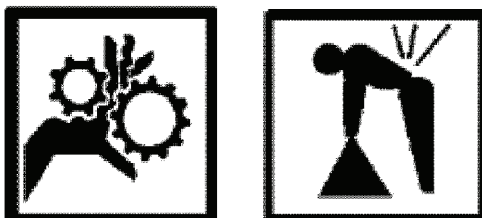
WP 0013
WP 0014
WP 0015

Equipment Condition

Firemain cross connect valve, Auxiliary Fire Pump assembly suction and discharge valves, and bowthruster diesel engine locked out and tagged out (FM 4-01.502).

REMOVAL

1. Verify valve isolation on discharge and suction sides of pump.

WARNING

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

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

2. Disassemble flexible shaft coupling (WP 0015).
3. Place pail under pump and remove plugs (Figure 1, Items 2 and 12) to drain pump.
4. Remove eight hexagon nuts (Figure 1, Item 5), hexagon machine bolts (Figure 1, Item 7), lock washers (Figure 1, Item 3) and two gaskets (Figure 1, Item 4) from pump suction and discharge piping flanges.

REMOVAL - Continued

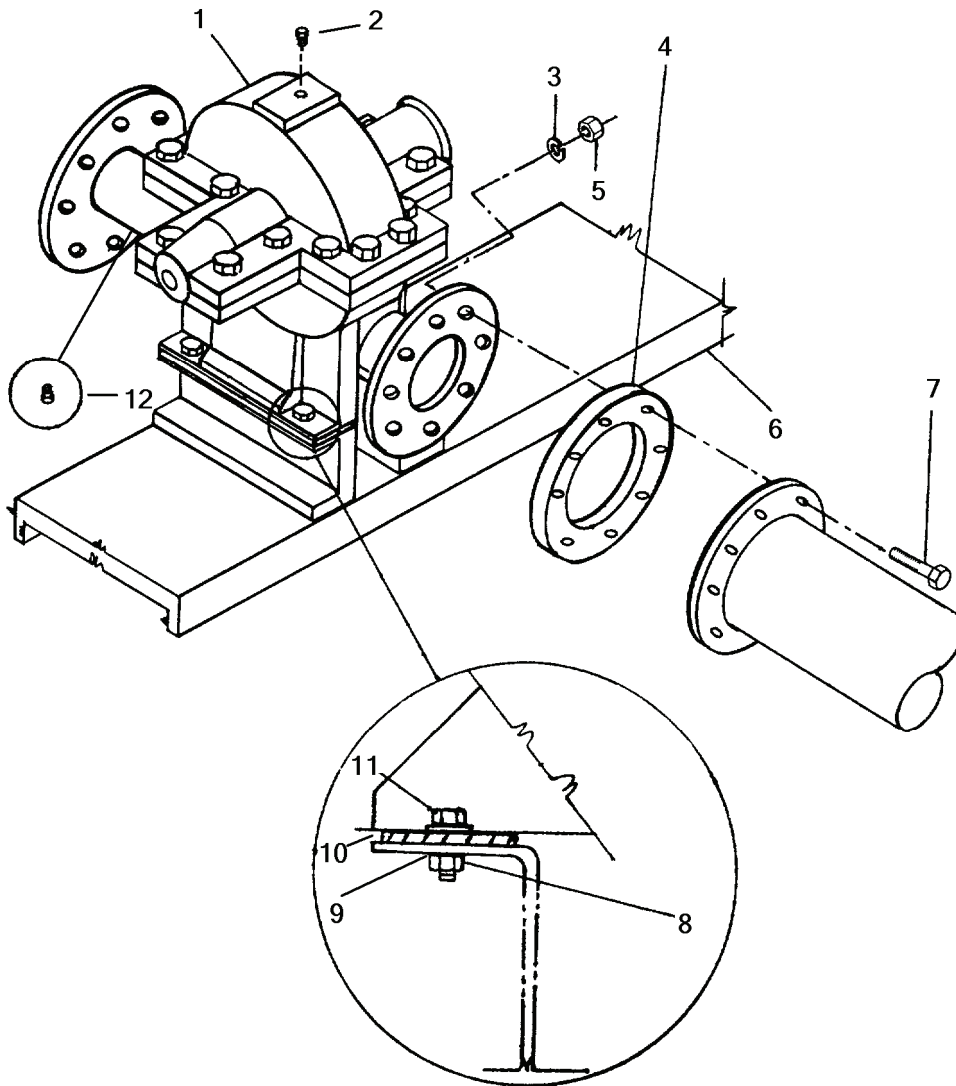
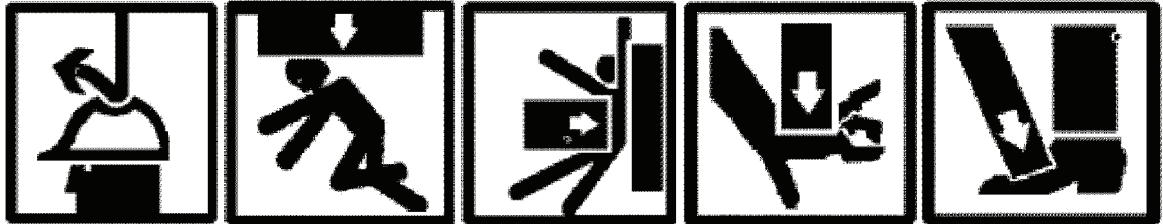


Figure 1. Replace Auxiliary Fire Pump Assembly.

REMOVAL - Continued

5. Gently swing back and secure, both the suction and discharge piping enough to provide clearance between piping and pump flanges.
6. Remove the four self locking nuts (Figure 1, Item 8), machine bolts (Figure 1, Item 11) and washers (Figure 1, Item 9) from the pump foundation (Figure 1, Item 6).

WARNING

All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

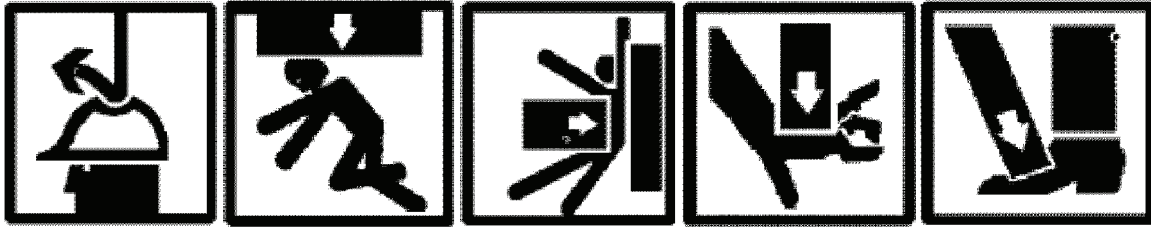
7. Using a chain hoist and lifting sling, slowly lift pump assembly from foundation high enough to remove the shims (Figure 1, Item 10).
8. Remove shims (Figure 1, Item 10), mark and tag with shim locations.
9. Remove pump assembly from foundation.
10. Remove flexible shaft coupling hub (WP 0014).
11. If system will not be replaced by the end of the workday, blank off suction and discharge piping flanges.

END OF TASK**INSTALLATION****WARNING**

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

1. Install flexible shaft coupling hub to pump (WP 0014).

INSTALLATION - Continued

WARNING

All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

2. Using a chain hoist and lifting sling, set pump assembly (Figure 1, Item 1) onto pump foundations (Figure 1, Item 6).
3. Install shims (Figure 1, Item 10) to their original locations.
4. Install four washers (Figure 1, Item 9), bolts (Figure 1, Item 11) and new locking nuts (Figure 1, Item 8). Hand tighten.
5. Install gaskets (Figure 1, Item 4) and connect pump suction and discharge piping flanges to piping with eight bolts (Figure 1, Item 7), washers (Figure 1, Item 3), nuts (Figure 1, Item 5) and hand tighten.
6. Align coupling (WP 0013).
7. Assemble coupling (WP 0015).
8. Install two plugs (Figure 1, Item 12).

CAUTION

Operating the pump without bleeding the air from the system will cause serious damage to the pump

9. Bleed the air from pump by removing plug (Figure 1, Item 2).
10. Once a steady stream of water is observed, replace plug (Figure 1, Item 2).
11. Operate pump and check for leaks, correct as necessary.

END OF TASK

END OF WORK PACKAGE

**FIELD MAINTENANCE
AUXILIARY FIRE PUMP ASSEMBLY
REPAIR**

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Tool Set, Measuring Machinist's (WP 0025, Item 2)
Wrench, Torque (5-75 Ft-lb) (WP 0025, Item 4)
Lifting Sling (WP 0025, Item 5)
Press, Hydraulic, Portable (WP 0025, Item 6)
Hoist, Chain (WP 0025, Item 7)
Puller, Mechanical (WP 0025, Item 10)
Pliers Set, Retaining Ring (WP 0025, Item 13)

Materials/Parts

O-ring, P/N 364-0375-457
Shaft Collar, P/N 224-0176-208
Protective Dust Cap, P/N 624-0081-087
Seal, Plain P/N 712-1014-749
Gasket P/N 364-0801-598
Gasket P/N 364-1311-614

Dishwashing Compound (WP 0026, Item 4)
Sealing Compound (WP 0026, Item 15)

Personnel Required

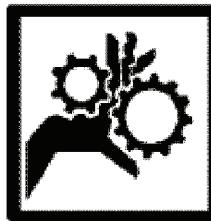
Watercraft Engineer 88L (2)

References

WP 0011
WP 0013
WP 0014
WP 0015

Equipment Condition

Firemain cross connect valve, Auxiliary Fire Pump assembly suction and discharge valves, and bowthruster diesel engine locked out and tagged out (FM 4-01.502).

DISASSEMBLY**WARNING**

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

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

CAUTION

Strict attention to detail is paramount in keeping track of the order of piece parts during disassembly. Clean all components and replace parts as necessary before assembly.

1. Disassemble flexible shaft coupling (WP 0015).

DISASSEMBLY - Continued

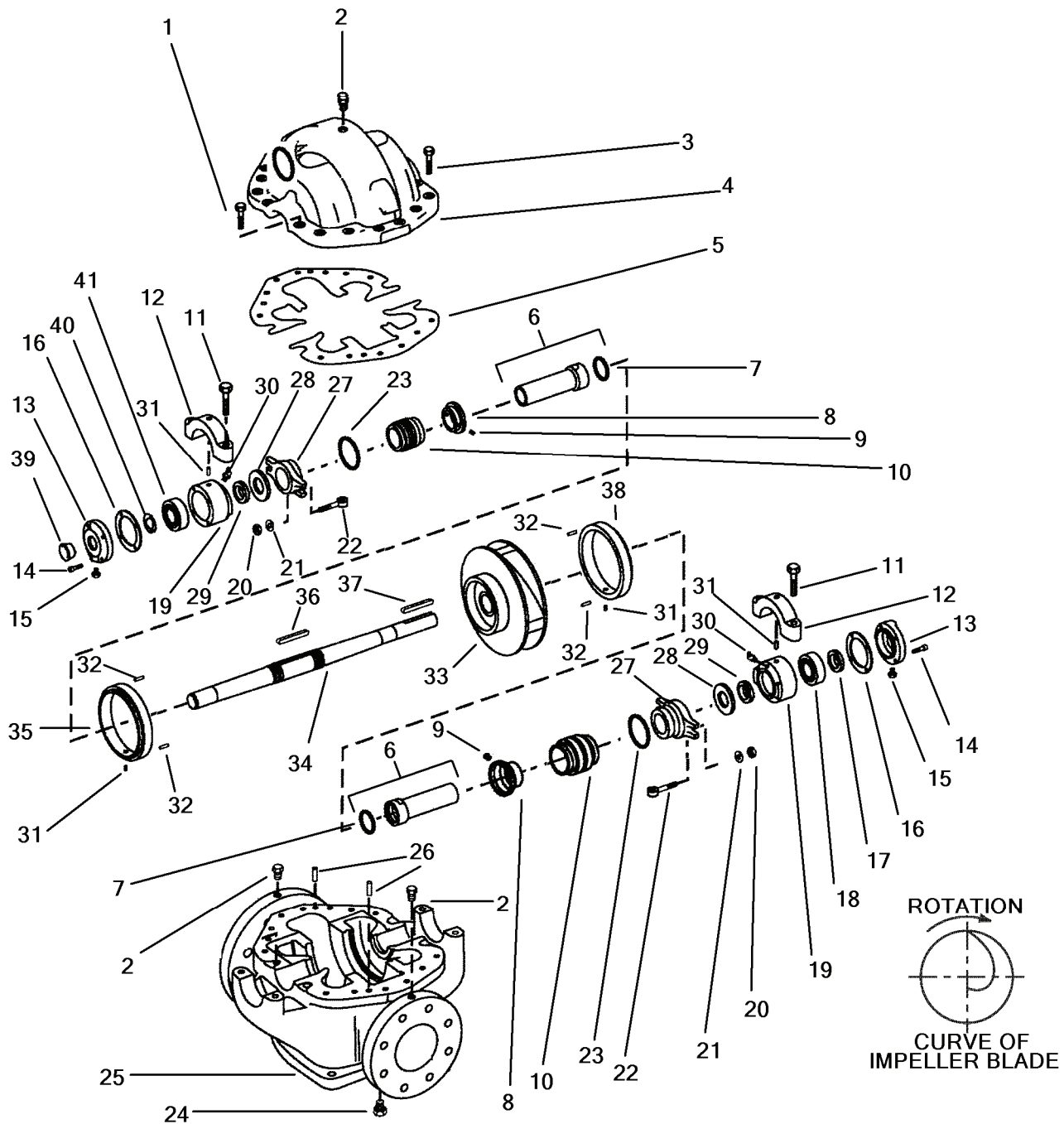
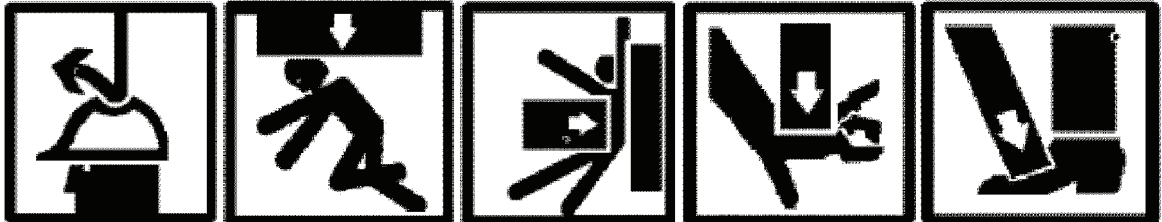


Figure 1. Disassembly of Auxiliary Fire Pump Assembly.

2. Remove Auxiliary Fire Pump assembly (WP 0011)
3. Remove four nuts and washers (Figure 1, Items 20 and 21) from swing bolts (Figure 1, Item 22); remove four capscrews and swing bolts (Figure 1, Items 1 and 22) from upper casing half (Figure 1, Item 4).

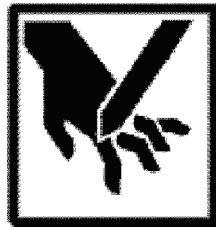
DISASSEMBLY

4. Scribe mark upper casing half to lower casing half to ensure correct orientation during assembly.
5. Remove twenty capscrews (Figure 1, Item 3) from upper casing half (Figure 1, Item 4).

WARNING

All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

WARNING

Auxiliary Fire Pump assembly casing edges are machined and may contain sharp edges or burrs. Wear protective gloves to eliminate the risk of injury to personnel.

CAUTION

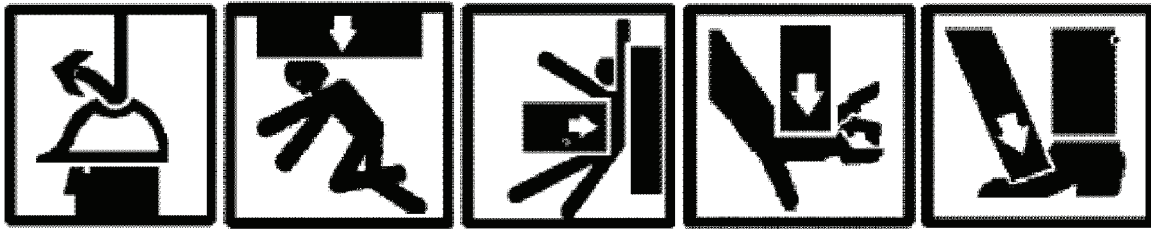
Use extreme care when lifting. Extensive damage to pump can occur if casing half falls from sling.

6. Using two Jacking Bolts (Figure 1, Item 3) to split upper casing half (Figure 1, Item 4) from lower casing half (Figure 1, Item 25) and gently lift off upper casing half (Figure 1, Item 4) using a lifting sling around cast hooks and under casing half.
7. Remove gasket (Figure 1, Item 5). Gently scrape mating surfaces, removing all remaining gasket material, taking care not to scratch or mar surface.
8. Mark caps (Figure 1, Item 12) and pins (Figure 1, Item 31) to ensure correct orientation during assembly.
9. Remove four capscrews (Figure 1, Item 11) from two bearing caps (Figure 1, Item 12) and remove bearing caps with the two headless straight pins.

DISASSEMBLY - Continued**CAUTION**

Use extreme care when lifting impeller and shaft assembly to ensure impeller, ceramic seats and other components are not damaged. Sliding may occur during movement causing impeller marring or ceramic seats to crack.

10. Wrap both plain seals (Figure 1, Item 10) with a clean cloth, to prevent movement during removal.

WARNING

All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

CAUTION

Take care not to dent or damage impeller and/or other components. Use supporting cradle or work stand to support impeller and shaft assembly .

11. Using a lift sling around shaft (Figure 1, Item 34), gently remove the impeller and shaft assembly from the lower casing half (Figure 1, Item 25); place impeller and shaft assembly on a support stand or cradle in a clean work area.
12. Scribe mark the case wearing rings (Figure 1, Items 35 and 38) to ensure proper orientation for reassembly. Remove wear rings (Figure 1, Item 35 and 38) from impeller (Figure 1, Item 34).
13. Remove flexible shaft coupling hub (WP 0014).

NOTE

The impeller and shaft assembly contains a mechanical seal assembly on each side of the impeller (Figure 1, Item 33). Each seal assembly (outboard side and coupling side) have the same components and disassembly procedures.

14. Remove four capscrews (Figure 1, Item 14), plug (Figure 1, Item 15) and cartridge caps (Figure 1, Item 13) from bearing cartridges (Figure 1, Item 19).
15. Remove lubrication fitting (Figure 1, Item 30) from cartridge (Figure 1, Item 19).

DISASSEMBLY - Continued**NOTE**

Procedure for outboard side bearing and coupling side bearing is the same, except outboard side has retainer ring (Figure 1, Item 40) and coupling has a seal (Figure 1, Item 17).

16. Remove gasket (Figure 1, Item 16) from cartridge (Figure 1, Item 19).
17. Using retaining ring pliers remove outboard retainer ring (Figure 1, Item 40) from outboard bearing.
18. Using a bearing puller; remove cartridge (Figure 1, Item 19), plain seal (Figure 1, Item 29) and bearing (Figure 1, Items 18 or 41). Remove dirt and liquid deflector (Figure 1, Item 28).
19. Remove gland seal (Figure 1, Item 27) with O-ring (Figure 1, Item 23) and plain seal (Figure 1, Item 10), taking care not to mar the mating surfaces.
20. Scribe mark the sleeves (Figure 1, Item 6) to ensure proper orientation of shaft collar (Figure 1, Item 8) during reassembly. Remove setscrews (Figure 1, Item 9) from shaft collar.
21. Remove shaft collar (Figure 1, Item 8) from shaft (Figure 1, Item 34).

NOTE

When disassembling the entire impeller and shaft assembly; removal of the outboard sleeve (Figure 1, Item 6) can only be accomplished by removing impeller and machine key (Figure 1, Items 33 and 36) first.

22. Unscrew the sleeve (Figure 1, Item 6) with O-ring (Figure 1, Item 7) from the shaft (Figure 1, Item 34) and remove.
23. Using a mechanical puller, remove impeller (Figure 1, Item 34) and machine key (Figure 1, Item 36).
24. Unscrew the sleeve (Figure 1, Item 6) with O-ring (Figure 1, Item 7) from the shaft (Figure 1, Item 34) and remove.
25. If replacement is required remove headless straight pins (Figure 1, Items 26 and 31) from casing lower half (Figure 1, Item 25).

END OF TASK**REPAIR**

Repair of the Auxiliary Fire Pump assembly is by replacement of any worn or damaged component and the following mandatory replacement parts:

1. Gasket (Figure 1, Item 16).
2. O-ring (Figure 1, Item 23).
3. Gasket (Figure 1, Item 5).
4. Plain Seal (Figure 1, Item 10).

REPAIR - Continued

5. Shaft Collar (Figure 1, Items 8).
6. Protective Dust Cap (Figure 1, Item 39).

END OF TASK**ASSEMBLY****NOTE**

The impeller and shaft assembly contains a seal assembly on each side of the impeller (Figure 3, Item 33). Each seal assembly (outboard side and coupling side) essentially has the same components and assembly procedures.

When assembling the entire impeller and shaft assembly, perform assembly procedures for the outboard side first.

1. Replace (if removed) headless straight pins (Figure 3, Items 26 and 31) into lower casing half (Figure 3, Item 25), gently tapping in place.

NOTE

Outboard sleeve (Figure 3, Item 6) location is measured from outboard bearing seat ridge of shaft (Figure 3, Item 34) to inboard side of sleeve. Correct measured distance is $7 \frac{55}{64}$ inches (Figure 2).

2. Screw outboard sleeve (Figure 3, Item 6) with O-ring (Figure 3, Item 7) onto the shaft (Figure 3, Item 34). Keyway on sleeve will match keyway on shaft when in correct position (Figure 2).

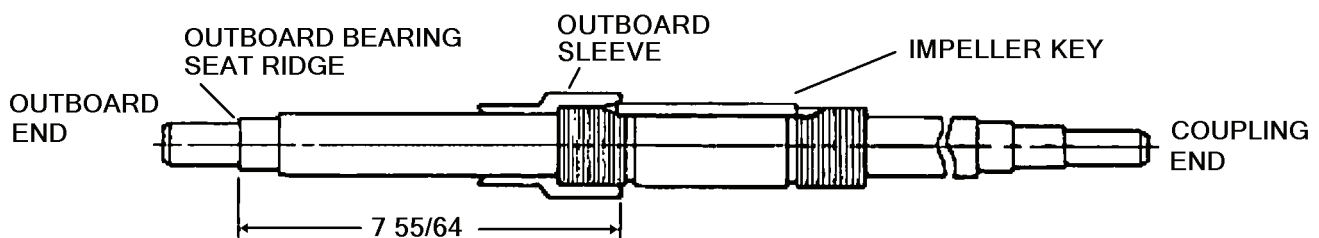


Figure 2. Outboard Sleeve Location Measurements.

3. Coat machine key (Figure 3, Item 36) and keyway with sealing compound. Insert key into keyway, tapping firmly into place. Ensure key sets into keyway of outboard sleeve (Figure 2).
4. Coat impeller (Figure 3, Item 33) keyway with sealing compound. Slide impeller onto shaft (Figure 3, Item 34) to outboard sleeve (Figure 3, Item 6).
5. Screw coupling side sleeve (Figure 3, Item 6) with O-ring (Figure 3, Item 7) onto shaft (Figure 3, Item 34) firmly against impeller (Figure 3, Item 33).
6. Replace shaft collar (Figure 3, Item 8), matching scribe marks.
7. Install setscrew (Figure 3, Item 9) into shaft collar (Figure 3, Item 8).

ASSEMBLY - Continued

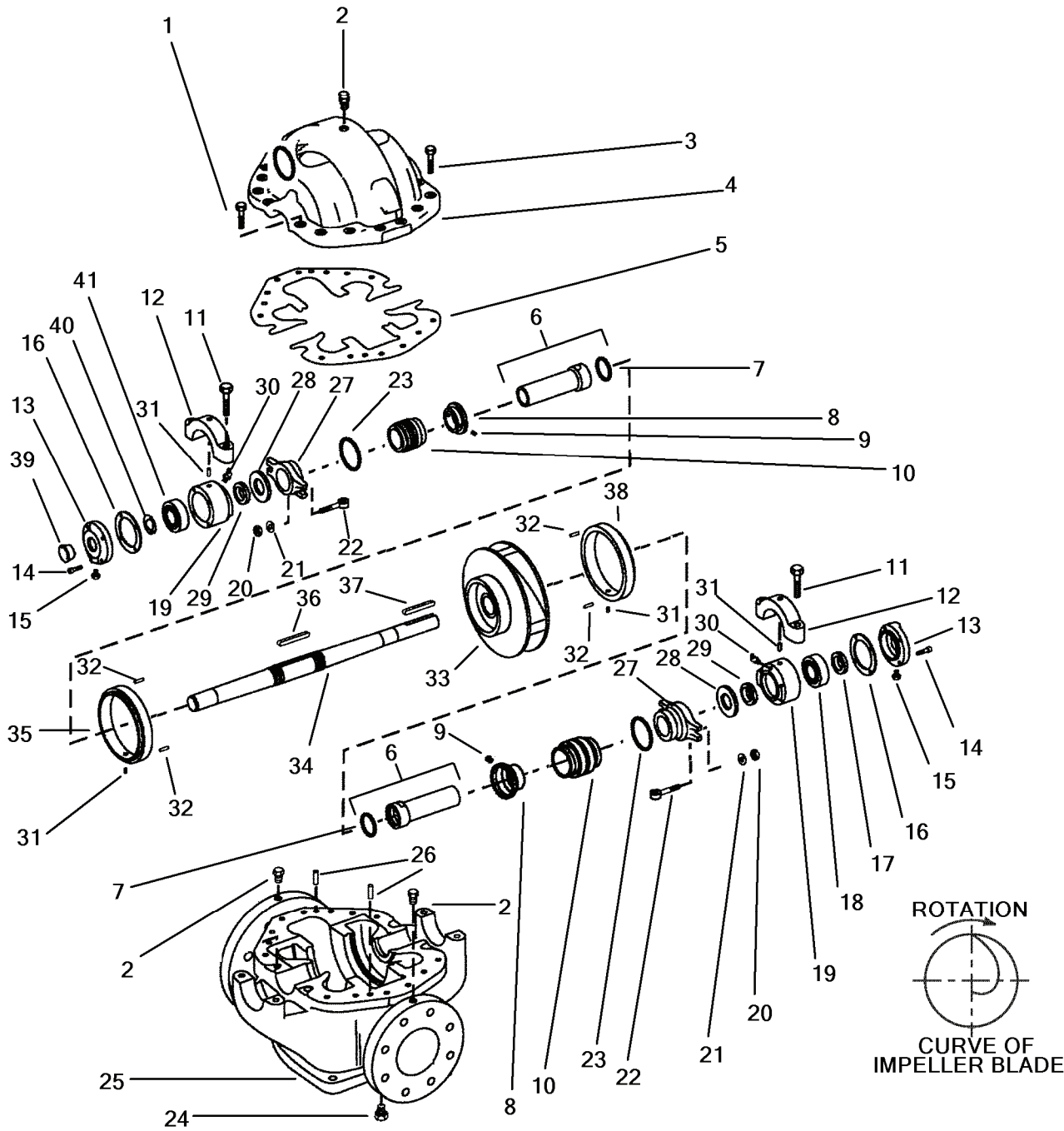


Figure 3. Assembly of Auxiliary Fire Pump Assembly.

ASSEMBLY - Continued**CAUTION**

Inspect the mating surfaces of plain seal (Figure 3, Item 10); remove any foreign particles with a lint-free cloth or tissue.

Do not use grease or allow grease on the sealing surfaces. Avoid skin contact on mating surfaces of plain seal (Figure 3, Item 10). Greases and oils will cause premature failure of the seal.

8. Place a small amount of dish detergent on shaft and install plain seal (Figure 3, Item 10).
9. Replace gland seal with O-ring (Figure 3, Items 27 and 23).
10. Replace dirt and liquid deflector (Figure 3, Item 28). Press plain seal (Figure 3, Item 29) into cartridge (Figure 3, Item 19) and slide onto shaft (Figure 3, Item 34).

NOTE

Procedures for outboard side bearing and coupling side bearing are the same, except outboard side has retainer ring (Figure 3, Item 40) and coupling has a seal (Figure 3, Item 17).

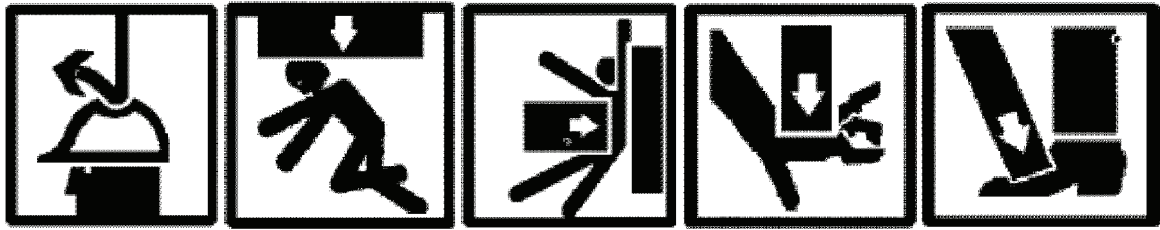
11. Press bearing (Figure 3, Item 41) onto shaft (Figure 3, Item 34) and into cartridge (Figure 3, Item 19).
12. Press bearing (Figure 3, Item 18) onto shaft (Figure 3, Item 34) and into cartridge (Figure 3, Item 19). Install seal (Figure 3, Item 17).
13. Install retainer ring (Figure 3, Item 40) in place to secure bearing.
14. For outboard side replace protective dust cover (Figure 3, Item 39) in cartridge cap (Figure 3, Item 13).
15. Position gaskets (Figure 3, Item 16) with cartridge caps (Figure 3, Item 13) on cartridges (Figure 3, Item 19); secure with capscrews (Figure 1, Item 14).
16. Replace lubrication fitting (Figure 3, Item 30) into cartridge (Figure 3, Item 19).
17. Replace plug (Figure 3, Item 15) into cartridge cap (Figure 3, Item 13).
18. Replace case wear rings (Figure 3, Items 35 and 38) onto impeller (Figure 3, Item 33).

CAUTION

Use extreme care when lifting impeller and shaft assembly to ensure impeller, ceramic seats and other components are not damaged. Sliding may occur during movement causing impeller marring or ceramic seats to crack.

19. Wrap both plain seals (Figure 3, Item 10) with a clean cloth, to prevent movement during installation.

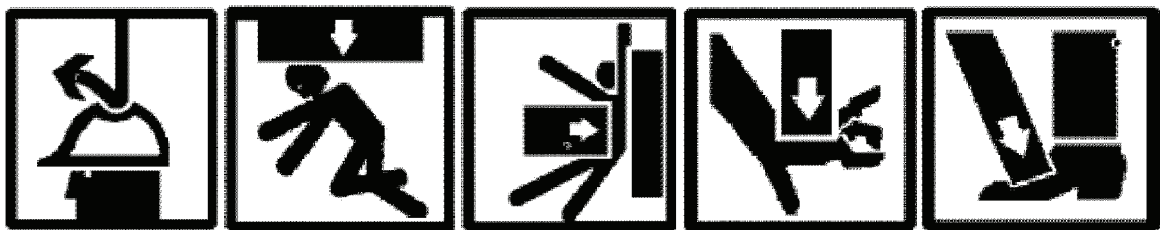
ASSEMBLY - Continued

WARNING

All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

20. Using a lifting sling around shaft (Figure 3, Item 34), gently place the impeller and shaft assembly into the lower casing half (Figure 3, Item 25); match holes in case wear rings (Figure 3, Items 35 and 38) with headless straight pins (Figure 3, Item 31).
21. Replace four nuts (Figure 3, Item 20), washers (Figure 3, Item 21) and swing bolts (Figure 3, Item 22) onto seal gland (Figure 3, Item 27); secure loosely.
22. Replace bearing caps (Figure 3, Item 12), ensuring the scribe marks are aligned, with two headless straight pins (Figure 3, Item 31); secure with capscrews (Figure 3, Item 11).
23. Place new gasket (Figure 3, Item 5) onto lower casing half (Figure 3, Item 25)

WARNING

All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

CAUTION

Use extreme care when lifting. Extensive damage to pump can occur if casing half falls from sling.

24. Using a lifting sling around cast hooks and under casing half; place upper casing half (Figure 3, Item 4) over lower casing half (Figure 3, Item 25), ensuring scribe marks are aligned, using headless straight pins (Figure 3, Item 26) as guides.

ASSEMBLY - Continued

25. Insert capscrews (Figure 3, Item 1) into upper and lower casing halves (Figure 3, Items 4 and 25); ensure capscrews go through eyes of swing bolts (Figure 3, Item 22).
26. Replace capscrews (Figure 3, Item 3); tighten alternately.
27. Replace plugs (Figure 3, Items 2 and 24).
28. Replace flexible shaft coupling (WP 0014).
29. Install Auxiliary Fire Pump assembly (WP 0011).
30. Align flexible shaft coupling (WP 0013).
31. Assemble flexible shaft coupling (WP 0015).

END OF TASK**END OF WORK PACKAGE**

**FIELD MAINTENANCE
COUPLING SHAFT FLEXIBLE
ALIGN**

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Tool Set, Measuring Machinists
(WP 0025, Item 2)
Lifting Sling (WP 0025, Item 5)
Hoist, Chain (WP 0025, Item 7)

Personnel Required

Watercraft Engineer 88L (2)

References

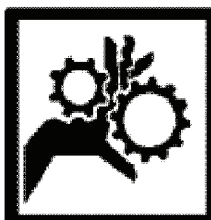
WP 0015

Materials/Parts

Rags, Wiping (WP 0026, Item 14)
Shims, (WP 0026, Items 16 and 17)
Straight Edge, (WP 0026, Item 18)
Tag, Warning (WP 0026, Item 20)

Equipment Condition

Firemain cross connect valve, Auxiliary Fire Pump assembly suction and discharge valves, and bowthruster diesel engine locked out and tagged out (FM 4-01.502).

ALIGNMENT**WARNING**

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

1. Disassemble Coupling (WP 0015).
2. Loosen the eight bolts (Figure 1, Item 4) and hexagon nuts (Figure 1, Item 5) on both the suction and discharge pipe flange.
3. Loosen the four bolts (Figure 1, Item 7) and hexagon nuts (Figure 1, Item 5) on the auxiliary pump assembly foundation (Figure 1, Item 3).

ALIGNMENT - Continued

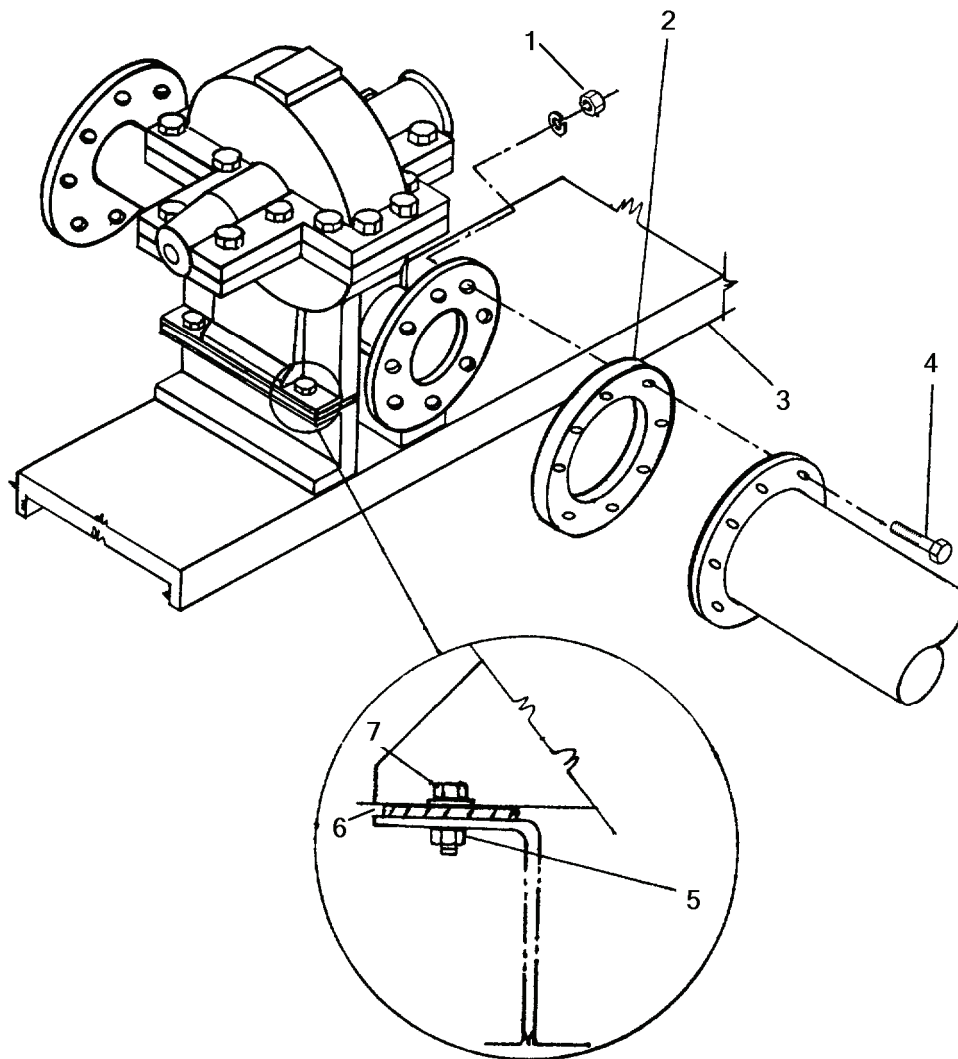


Figure 1. Flexible Shaft Coupling Alignment.

ALIGNMENT - Continued

4. Perform angular alignment as follows:
 - a. Insert a 0.125 inch feeler gauge or 1/8 inch stock (Figure 2, Item 1) into the gap of the coupling hubs to a depth of 1 inch.
 - b. With out rotating the coupling add additional feeler gauges to measure the clearance at 90 degree intervals and record measurements. The clearance must be less than or equal to 0.010 inch.

NOTE

Use a chain hoist and lifting sling to raise and lower the pump when adding and removing shims.

- c. Adjust the angular alignment of pump by adding or removing shims as required.
- d. Perform angular alignment steps until clearance is less than or equal to 0.010 inch.

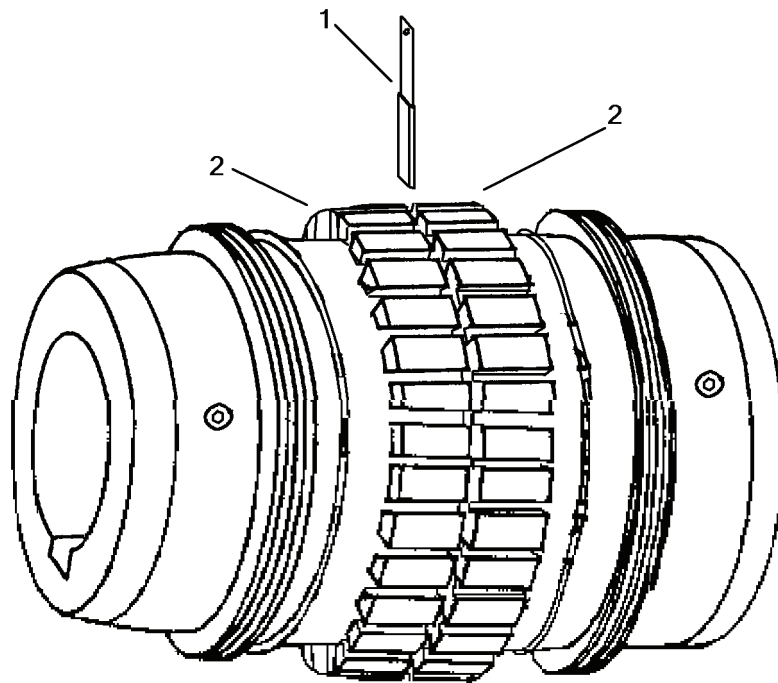


Figure 2. Flexible Shaft Coupling Gap and Angular Alignment.

ALIGNMENT - Continued

5. Perform offset alignment as follows:

- a. Position a straight edge (Figure 3, Item 1) squarely across both hubs (Figure 3, Item 2) of coupling.
- b. Without rotating the coupling use feeler gauges (Figure 3, Item 3) to measure the clearance between straight edge (Figure 3, Item 1) and hubs (Figure 3, Item 2) at 90 degree intervals and record measurements. The clearance must be less than or equal to 0.010 inch.

NOTE

Use a chain hoist and lifting sling to raise and lower the pump when adding and removing shims.

- c. Adjust offset alignment of pump by adding or removing shims as required.
- d. Perform offset alignment steps until clearance is less than or equal to 0.010 inch.

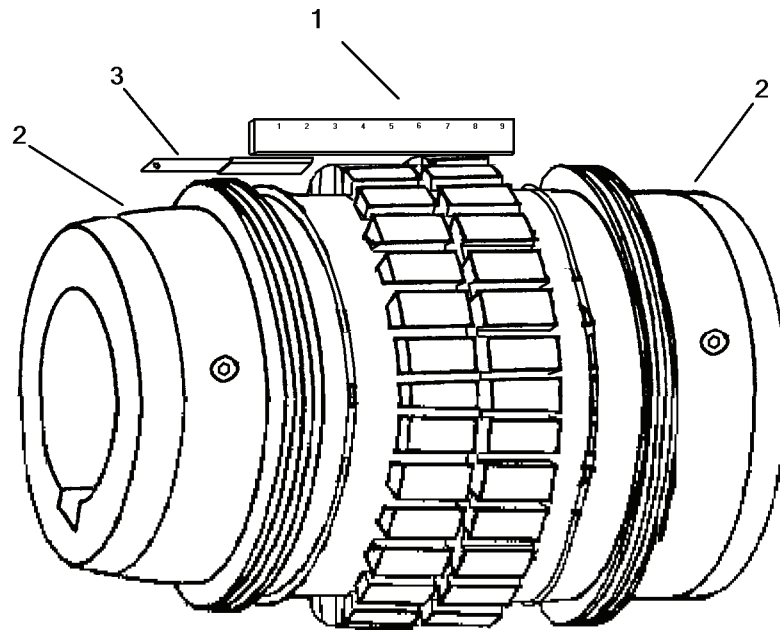


Figure 3. Flexible Shaft Coupling Offset Alignment.

6. Tighten the four bolts (Figure 1, Item 7) and hexagon nuts (Figure 1, Item 5) on the Auxiliary Fire Pump assembly foundation (Figure 1, Item 3).
7. Tighten the eight bolts (Figure 1, Item 4) and hexagon nuts (Figure 1, Item 1) on both the suction and discharge pipe flange.
8. Verify that both the angular and offset alignment measurements are less than or equal to 0.010 inch.
9. Assemble coupling (WP 0015)

END OF TASK

END OF WORK PACKAGE

FIELD MAINTENANCE COUPLING SHAFT FLEXIBLE REPLACE

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)

Materials/Parts

Mechanical Equipment Seal Replacement
Kit, P/N 1080T10-SEAL
Antiseize Compound (WP 0026, Item 1)
Paper, Abrasive (WP 0026, Item 13)
Rag, Wiping (WP 0026, Item 14)
Tag, Warning (WP 0026, Item 20)

Personnel Required

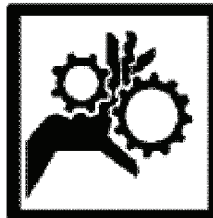
Watercraft Engineer 88L (2)

References

WP 0011
WP 0013
WP 0015

Equipment Condition

Firemain cross connect valve, Auxiliary Fire Pump assembly
suction and discharge valves, and bowthruster diesel
engine locked out and tagged out (FM 4-01.502).

REMOVAL**WARNING**

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

1. Disassemble Coupling (WP 0015).
2. Remove Auxiliary Fire Pump assembly (WP 0011).
3. Slide seals (Figure 1, Item 2) off hubs (Figure 1, Item 1), onto power take off (PTO) and pump shafts (Figure 1, Item 4).
4. Scribe marks on the shafts (Figure 1, Item 4) to mark the position of hubs (Figure 1, Item 1).
5. Loosen setscrews (Figure 1, Item 3). Using a mechanical puller, remove hubs (Figure 1, Item 1) from shafts.
6. Remove key from both the pump and PTO shaft keyway.

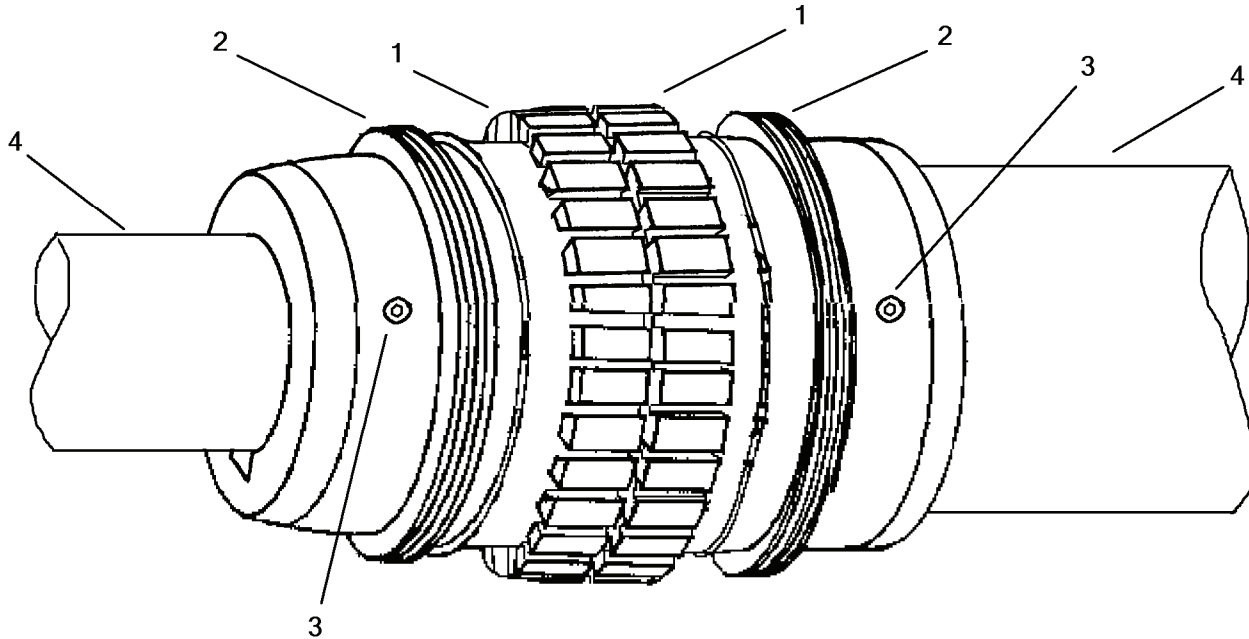
REMOVAL - Continued

Figure 1. Flexible Shaft Coupling Replacement.

7. Remove seals (Figure 1, Item 2) from shafts (Figure 1, Item 4).
8. Using abrasive paper, remove any burrs or scars from shafts.

END OF TASK**INSTALLATION**

1. Slide seals (Figure 1, Item 2) onto pump and PTO shafts (Figure 1, Item 4).
2. Lubricate inside of hubs and keyways with anti-seize.
3. Install keys onto both the pump and PTO shaft keyways.
4. Slide hubs (Figure 1, Item 1) onto shafts (Figure 1, Item 4) and align scribe marks. Secure with setscrews (Figure 1, Item 3).
5. Position seals (Figure 1, Item 2) onto hubs (Figure 1, Item 1).
6. Perform Auxiliary Fire Pump assembly installation procedure (WP 0011) to install pump onto foundation.
7. Align coupling (WP 0013).
8. Assemble coupling (WP 0015).

END OF TASK**END OF WORK PACKAGE**

FIELD MAINTENANCE COUPLING SHAFT FLEXIBLE REPAIR

INITIAL SETUP:**Personnel Required****Tools and Special Tools**

Watercraft Engineer 88L (2)

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Tool Set Measuring, Machinists
(WP 0025, Item 2)

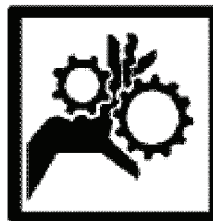
References

WP 0013
WP 0014
TM 55-1905-223-10

Materials/Parts**Equipment Condition**

Gasket P/N 1080T-GA
Bolt, Machine with Lock Nut P/N 1080T10-B
Grease, General Purpose (WP 0026, Item 9)
Grease Gun (WP 0026, Item 10)
Rag, Wiping (WP 0026, Item 14)
Straight Edge (WP 0026, Item 18)
Tag, Warning (WP 0026, Item 20)

Firemain cross connect valve, Auxiliary Fire Pump assembly suction and discharge valves, and bowthruster diesel engine locked out and tagged out (FM 4-01.502).

DISASSEMBLY**WARNING**

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

1. Remove four bolts (Figure 1, Item 2) and nuts (Figure 1, Item 3) from flexible shaft coupling guard; remove guard (Figure 1, Item 1) and retain.
2. Scribe marks on coupling cover halves (Figure 2, Item 9).
3. Remove bolts (Figure 2, Item 8) and nuts (Figure 2, Item 7) from coupling cover halves (Figure 2, Item 9).
4. Remove coupling covers (Figure 2, Item 9) and gaskets (Figure 2, Item 6).
5. Insert a screwdriver into the open loop ends of the gridmember (Figure 2, Item 2) and pry it out.
6. Clean grease from hubs (Figure 2, Item 4).

DISASSEMBLY - Continued

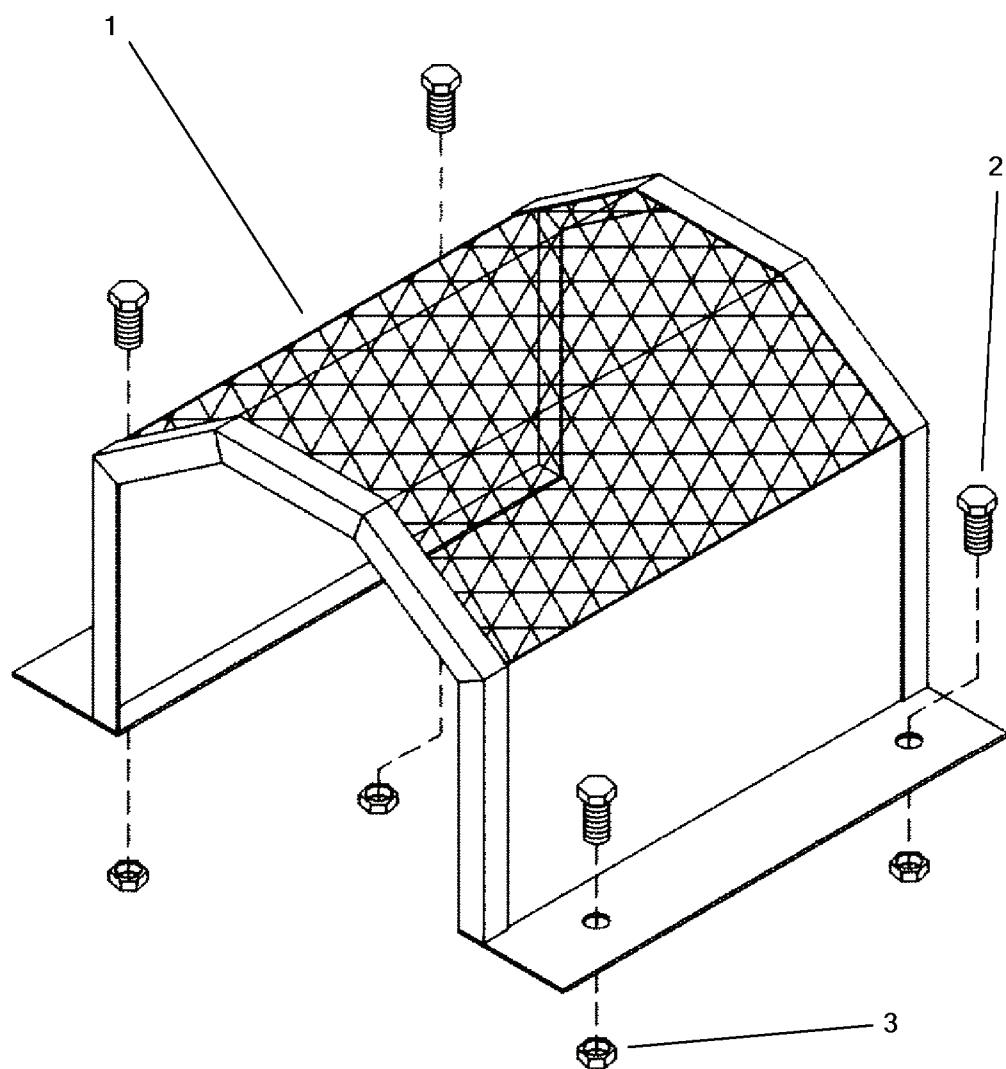


Figure 1. Flexible Shaft Coupling Guard.

DISASSEMBLY - Continued

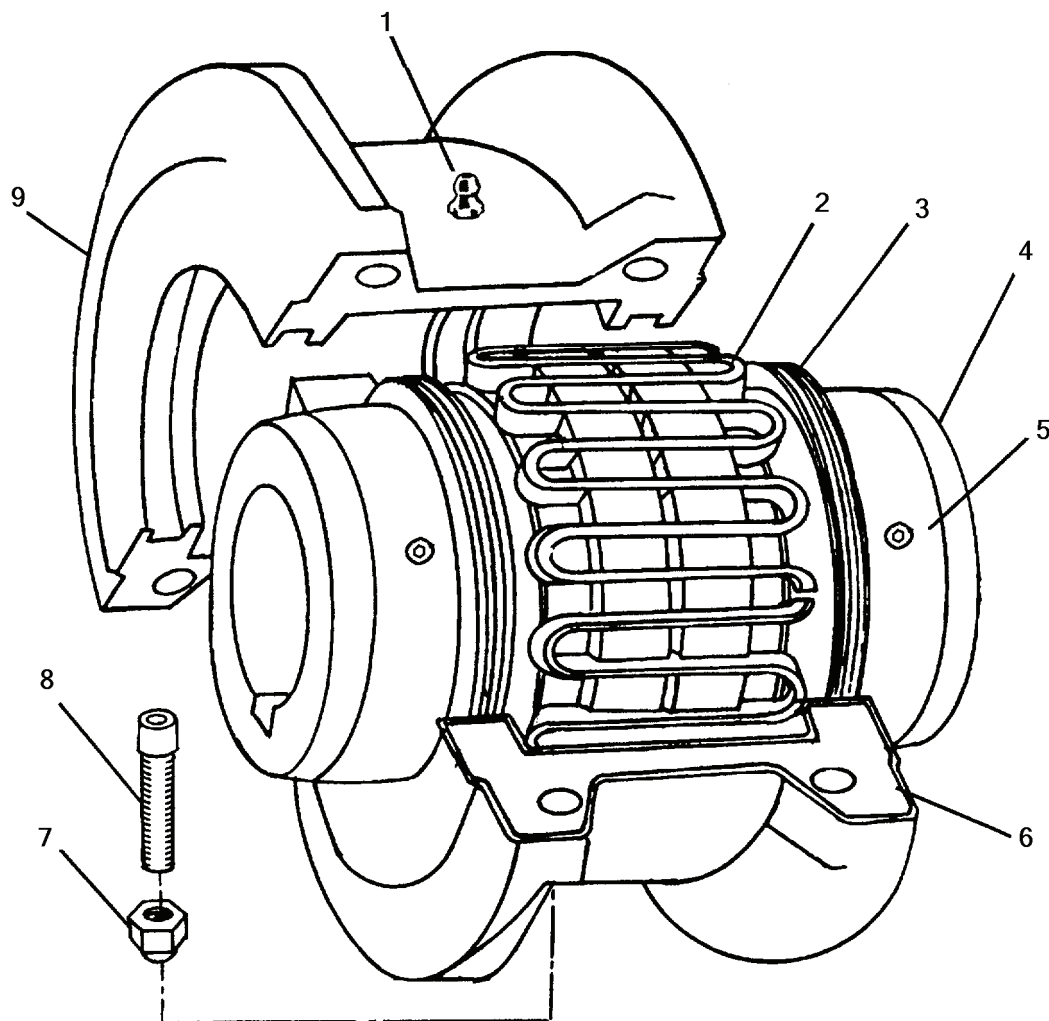


Figure 2. Flexible Shaft Coupling Repair.

END OF TASK

REPAIR

1. The repair of the coupling consists of the replacement of any worn or damaged parts and the following mandatory replacement parts.
 - a. Gasket (Figure 2, Item 6).
 - b. Bolt (Figure 2, Item 8) with locknut (Figure 2, Item 7).
2. Inspect hubs (Figure 2, Item 4). If leading edges of hubs are excessively worn, replace coupling (WP 0014).
3. Inspect seals (Figure 2, Item 3). If seals are torn, deformed or show signs of leaking remove coupling (WP 0014), replace seals and install coupling (WP 0014).

REPAIR- Continued

4. Inspect gridmember (Figure 2, Item 2). If gridmember is cracked broken or unevenly worn perform the following:
 - a. Verify Angular Alignment:
 - (1) Insert a 0.125 inch feeler gauge (Figure 3, Item 1) or 1/8 inch stock into the gap of the coupling hubs (Figure 1, Item 2) to a depth of 1 inch.
 - (2) Without rotating the coupling add additional feeler gauges to measure the clearance at 90 degree intervals and record measurements. The clearance must be less than or equal to 0.010 inch.
 - (3) If clearance is less than or equal to 0.010 inch verify offset alignment. If clearance is not less than or equal to 0.010 inch, align flexible shaft coupling (WP 0013) and replace gridmember (Figure 2, Item 2).

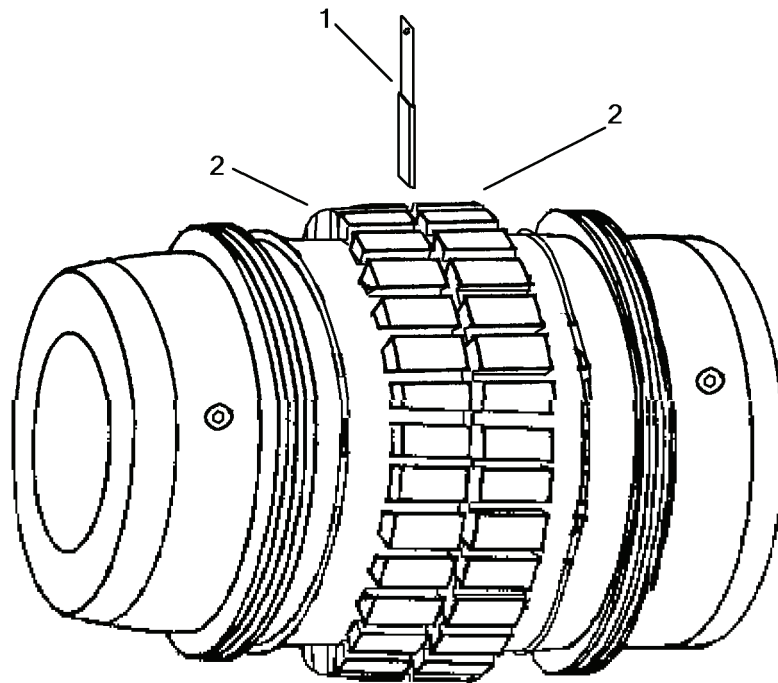


Figure 3. Flexible Shaft Coupling Angular Alignment.

- b. Verify Offset Alignment:
 - (1) Position a straight edge (Figure 4, Item 1) squarely across both hubs (Figure 4, Item 2) of the coupling.
 - (2) Without rotating the coupling use feeler gauges (Figure 4, Item 3) to measure clearance between the straight edge (Figure 4, Item 1) and hubs (Figure 4, Item 2) at 90 degree intervals and record measurements. The clearance must be less than or equal to 0.010 inch.
 - (3) If clearance is less than or equal to 0.010 inch replace gridmember. If clearance is not less than or equal to 0.010 inch, align flexible shaft coupling (WP 0013) and replace gridmember (Figure 2, Item 2).

REPAIR- Continued

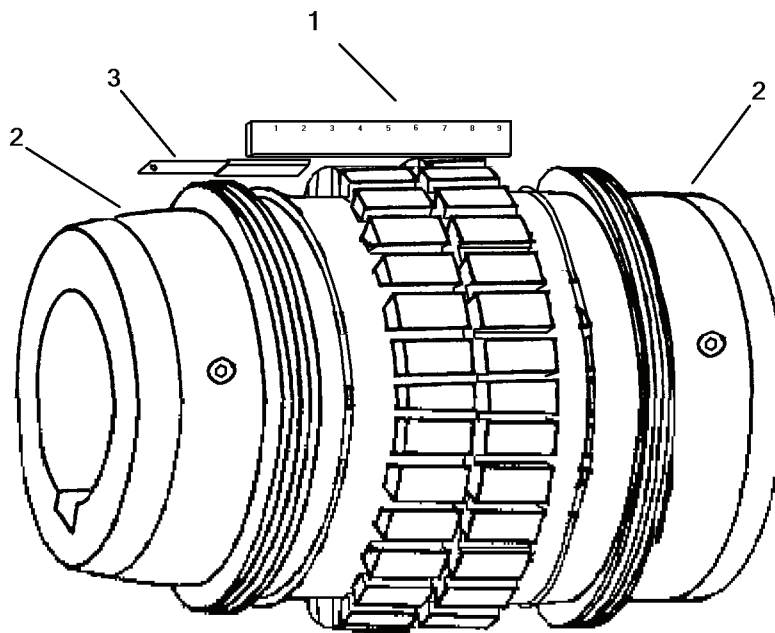


Figure 4. Flexible Shaft Coupling Offset Alignment.

END OF TASK

ASSEMBLY

NOTE

When coupling gridmembers are furnished in two or more segments, install them so that all cut ends extend in the same direction to permit easy cover installation.

1. Spread coupling gridmember (Figure 2, Item 2) lightly to pass over coupling teeth and tap in place with soft mallet.
2. Pack spaces between and around coupling gridmember (Figure 2, Item 2) with lubricant and wipe excess flush with top of grid.
3. Position seals (Figure 2, Item 3) on hubs to line up with cover grooves.
4. Position gaskets (Figure 2, Item 6) on flanges of lower cover half.
5. Assemble covers (Figure 2, Item 9) so that the scribe marks are on the same side and install new machine bolts (Figure 2, Item 8) with new nuts (Figure 2, Item 7).
6. Using grease gun on zerk fitting (Figure 2, Item 1), fill coupling with grease.

ASSEMBLY - Continued

7. Reattach coupling guard (Figure 1, Item 1) with retained mounting hardware.
8. Clear "Out of Service" tags and restore system to normal, reference TM 55-1905-223-10.
9. Operate system and check for leaks.

END OF TASK**END OF WORK PACKAGE**

FIELD MAINTENANCE PUMP UNIT CENTRIFUGAL REPLACE

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Wrench, Torque (30-200 Ft-lb) (WP 0025, Item 3)
Lifting Sling (WP 0025, Item 5)
Hoist, Chain (WP 0025, Item 7)
Tool Kit, Electrical Repair (WP 0025 Item 8)

Personnel Required

Watercraft Engineer 88L (2)

References

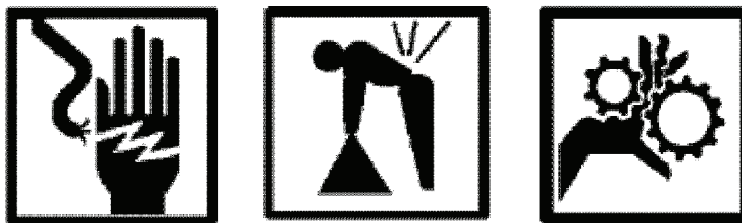
TM 55-1905-223-10

Materials/Parts

Flange, Pipe (WP 0026, Item 6)
Gasket Material (WP 0026, Item 7)
Pail, Utility (WP 0026, Item 12)
Rag, Wiping (WP 0026, Item 14)
Tag, Warning (WP 0026, Item 20)

Equipment Condition

Centrifugal pump motor controller and suction and discharge valves locked out and tagged out (FM 4-01.502).

REMOVAL**WARNING**

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized presents a shock hazard and may result in death or injury to personnel or equipment damage.

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

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

1. Ensure nearest suction and discharge isolation valves are secured.
2. From electric motor conduit box (Figure 1, Item 1) remove four cover machine bolts (Figure 1, Item 2), cover, and gasket.

REMOVAL - Continued

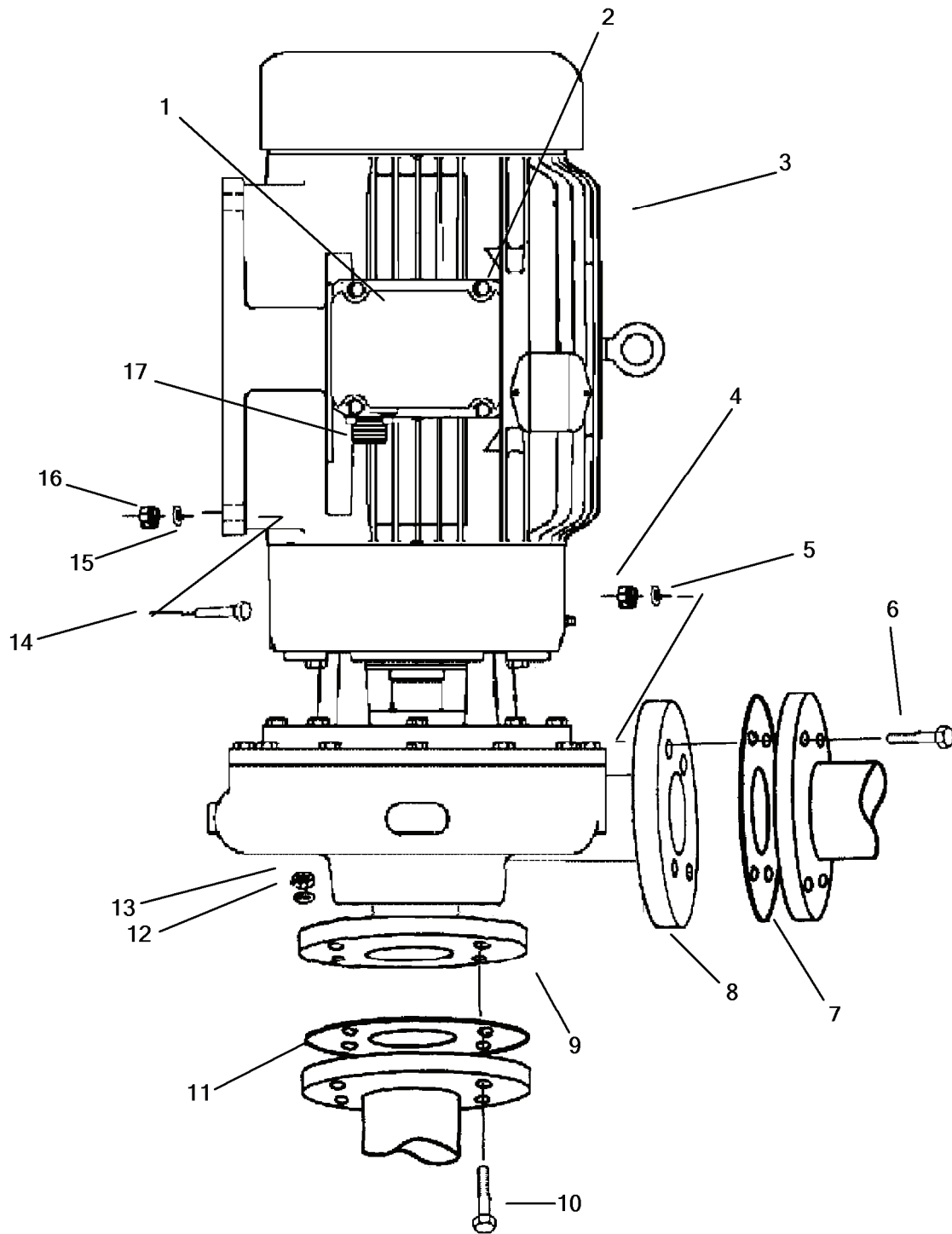
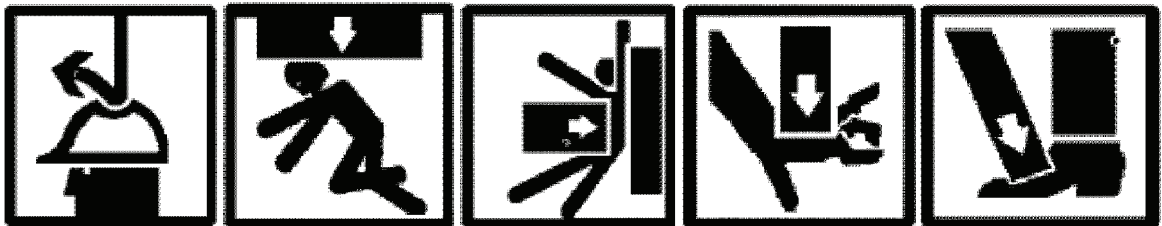


Figure 1. Centrifugal Pump Unit Replacement.

REMOVAL - Continued

3. Using a multimeter, verify no electrical power at motor.
4. Disconnect and label electric cables from motor at electric motor conduit box (Figure 1, Item 1).
5. Loosen stuffing tube (Figure 1, Item 17) and remove electrical cables from conduit box (Figure 1, Item 1).
6. Place a utility pail under discharge flange (Figure 1, Item 8). Loosen four bolts (Figure 1, Item 6) and nuts (Figure 1, Item 4); drain centrifugal pump unit (Figure 1, Item 3).
7. Place utility pail under suction flange (Figure 1, Item 9). Loosen four bolts (Figure 1, Item 10) and nuts (Figure 1, Item 12); drain remaining fluid from centrifugal pump unit (Figure 1, Item 3).
8. Remove suction and discharge (Figure 1, Items 8 and 9) flange mounting hardware (Figure 1, Items 4, 5, 6, 10, 12 and 13).
9. Using lifting sling, spring back and secure discharge piping enough to provide clearance between piping and pump flanges.

WARNING

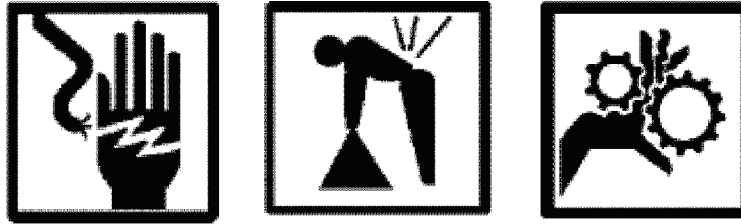
All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

10. Using lifting sling and chain hoist, rig centrifugal pump unit (Figure 1, Item 3) for removal. Remove all slack in lifting sling to support centrifugal pump unit.
11. Remove foundation mounting hardware (Figure 1, Items 14, 15 and 16).
12. Remove centrifugal pump unit (Figure 1, Item 3) from foundation.
13. Remove suction and discharge flange gasket material (Figure 1, Item 7 and 11).
14. If system will not be replaced by the end of the workday, blank off suction and discharge piping flanges.

END OF TASK

INSTALLATION

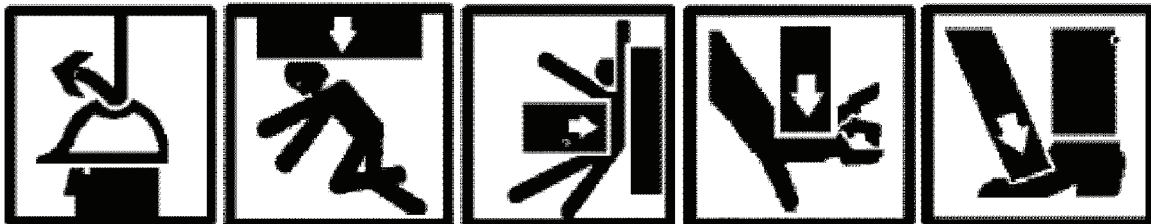
WARNING

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized presents a shock hazard and may result in death or injury to personnel or equipment damage.

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

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

1. Cut gaskets (Figure 1, Item 7 and 11) for suction and discharge flanges (Figure 1, Items 8 and 9); place one gasket in position on suction flange (Figure 1, Item 9).

WARNING

All personnel in the vicinity of the lifting operations should wear appropriate safety equipment including gloves, hard hat, and safety shoes. Failure to comply can result in death or serious injury.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

2. Using lifting sling and chain hoist, rig new centrifugal pump unit (Figure 1, Item 3) into place.
3. Realign pump unit to foundation, suction, and discharge piping flanges. Position gasket (Figure 1, Item 7) at discharge flange (Figure 1, Item 8).
4. Install four foundation bolts (Figure 1, Item 14), washers (Figure 1, Item 15) and nuts (Figure 1, Item 16).
5. Install suction and discharge flange (Figure 1, Items 8 and 9) mounting hardware (Figure 1, Items 4, 5, 6, 10, 12, and 13).

INSTALLATION - Continued

6. Install electric cables through stuffing tube (Figure 1, Item 17) into conduit box.
7. Connect electrical cables to motor leads according to labels.
8. Install cover gasket, cover (Figure 1, Item 1), and four bolts (Figure 1, Item 2) onto conduit box.
9. Clear "Out of Service" tags and restore system to normal, reference TM 55-1905-223-10.

NOTE

Proper motor rotation is counterclockwise facing shaft end. If motor rotation is not counterclockwise reverse any two incoming power leads.

10. Operate the centrifugal pump unit (TM 55-1905-223-10) and check covers, gaskets and piping for leaks, correct as necessary.

END OF TASK**END OF WORK PACKAGE**

**FIELD MAINTENANCE
MOTOR ALTERNATING CURRENT
TEST**

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Tool Kit, Electrical Repair (WP 0025 Item 8)
Insulation Tester (WP 0025, Item 14)

References

WP 0018
TM 55-1905-223-10
TM 55-1905-223-24-18-1/2

Materials/Parts

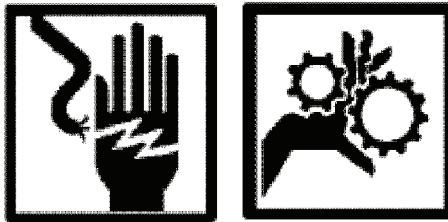
Tag, Warning (WP 0026, Item 20)

Equipment Condition

Centrifugal pump motor controller and suction and discharge valves locked out and tagged out (FM 4-01.502).

Personnel Required

Watercraft Engineer 88L (2)

TEST**WARNING**

Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized presents a shock hazard and may result in death or injury to personnel or equipment damage.

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

1. Ensure nearest suction and discharge isolation valves are secured.
2. From electric motor conduit box (Figure 1, Item 1) remove four cover machine bolts (Figure 1, Item 2), cover, and gasket.
3. Using a multimeter, verify no electrical power at motor.
4. Disconnect and tag electric cables from motor at electric motor conduit box (Figure 1, Item 1).

TEST - Continued

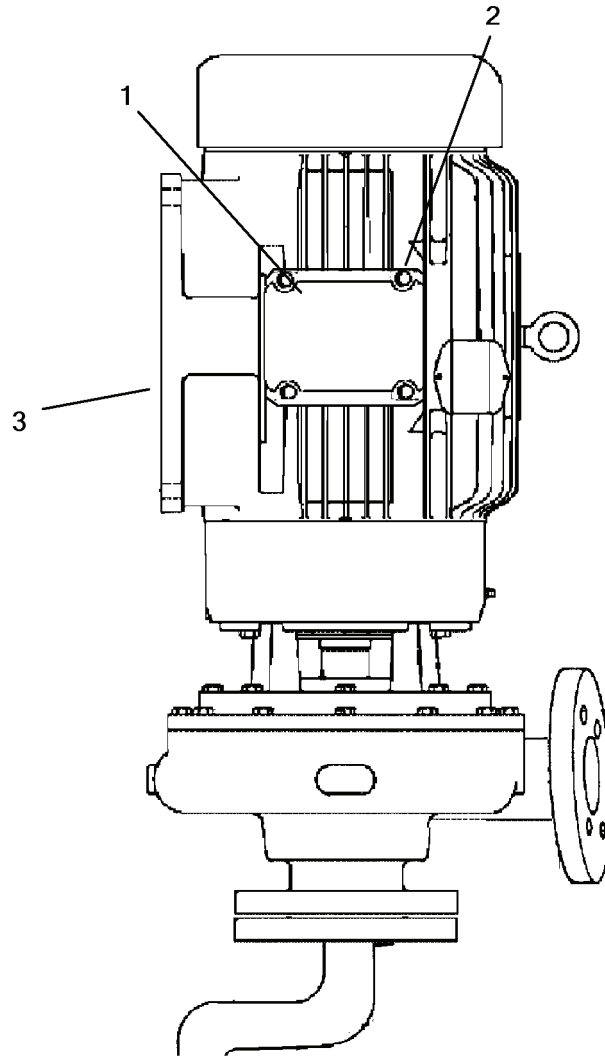


Figure 1. Test Alternating Current Motor.

5. Using a multimeter set to the ohms scale, test continuity of the delta wound motor windings by performing the following:
 - a. Measure the resistance between the blue, T-1 (Figure 2, Item 1) wire and the white, T-2 (Figure 2, Item 2) wire; rating should be less than 10 ohms.
 - b. Measure the resistance between the white, T-2 (Figure 2, Item 2) wire and the orange, T-3 (Figure 2, Item 3) wire; rating should be less than 10 ohms.
 - c. Measure the resistance between the orange, T-3 (Figure 2, Item 3) wire and the blue, T-1 (Figure 2, Item 1) wire; rating should be less than 10 ohms.
 - d. If ratings are not below 10 ohms, replace motor (WP 0018).

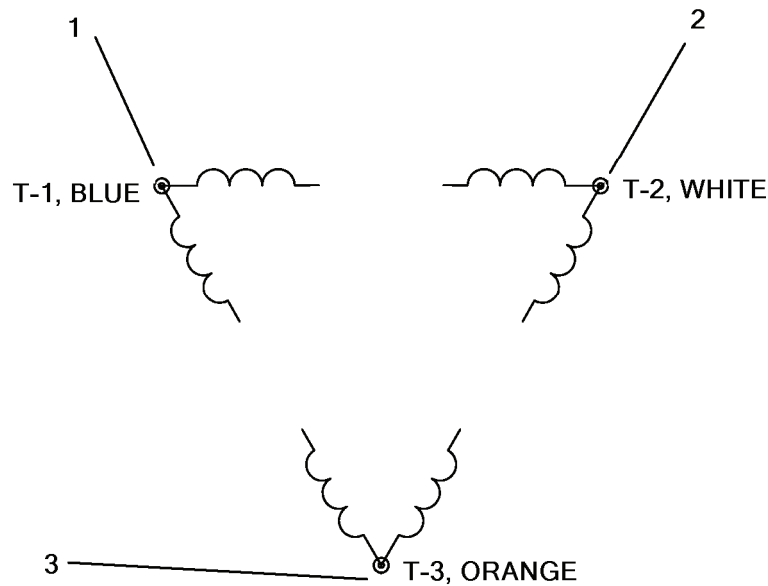
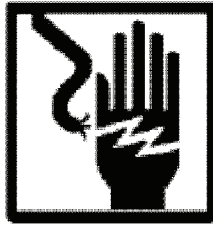
TEST - Continued

Figure 2. Test Alternating Current Motor Windings.

6. Using an insulation tester, check for insulation breakdown to ground by performing the following:
 - a. Measure the resistance between the blue, T-1 (Figure 2, Item 1) and motor foundation (Figure 1, Item 3).
 - b. Measure the resistance between the white, T-2 (Figure 2, Item 2) and motor foundation (Figure 1, Item 3).
 - c. Measure the resistance between the orange, T-3 (Figure 2, Item 3) and motor foundation (Figure 1, Item 3).
 - d. If readings are not infinity or very high and equal between readings, replace motor (WP 0018).
7. Connect electrical cables to motor leads according to tags.
8. Open nearest suction and discharge isolation valves.
9. Restore electrical power and operate the pump.

TEST - Continued**WARNING**

Under no circumstances should repair or adjustment of energized equipment be attempted alone. The immediate presence of someone capable of rendering aid is required. Before making adjustments, be sure to protect against grounding. If possible, adjustments should be made with one hand, with the other hand free and clear of equipment. Even when power has been removed from equipment circuits, dangerous potentials may still exist due to retention of charges by capacitors. Circuits must be grounded and all capacitors discharged prior to attempting repairs.

10. Using a multimeter set to the volts A/C scale at 500 volts, test the pump voltage input by performing the following:
 - a. Measure the voltage between the blue, T-1 (Figure 2, Item 1) wire and the white, T-2 (Figure 2, Item 2) wire; rating should be less than +/- 10% of 230 volts.
 - b. Measure the voltage between the white, T-2 (Figure 2, Item 2) wire and the orange, T-3 (Figure 2, Item 3) wire; rating should be less than +/- 10% of 230 volts.
 - c. Measure the voltage between the orange, T-3 (Figure 2, Item 3) wire and the blue, T-1 (Figure 2, Item 1) wire; rating should be less than +/- 10% of 230 volts.
 - d. If ratings are not less than +/- 10% of 230 volts, repair motor controller (TM 55-1905-223-24-18-1/2).
11. Secure electrical power to the pump.
12. Install cover gasket, cover (Figure 1, Item 1), and four bolts (Figure 1, Item 2) onto conduit box.
13. Clear "Out of Service" tags and restore system to normal, reference TM 55-1905-223-10.

NOTE

Proper motor rotation is counterclockwise facing shaft end. If motor rotation is not counterclockwise reverse any two incoming power leads.

14. Operate the centrifugal pump unit (TM 55-1905-223-10) and check covers, gaskets and piping for leaks, correct as necessary.

END OF TASK**END OF WORK PACKAGE**

FIELD MAINTENANCE MOTOR ALTERNATING CURRENT REPLACE

INITIAL SETUP:**Tools and Special Tools**

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Wrench, Torque (30-200 Ft-lb) (WP 0025, Item 3)
Wrench, Torque Kit (5-75 Ft-lb) (WP 0025, Item 4)
Lifting Sling (WP 0025, Item 5)
Hoist, Chain (WP 0025, Item 7)

Materials/Parts

Motor, Alternating Current TEFC P/N JMM4109T
Gasket, Stuffing Box, P/N GX5041900
Centrifugal Pump Parts Kit, P/N GS8107770
Dishwashing Compound (WP 0026, Item 4)

Personnel Required

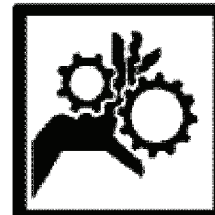
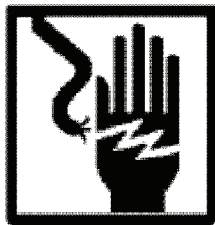
Watercraft Engineer 88L (2)

References

WP 0016

Equipment Condition

Centrifugal pump motor controller and suction and discharge valves locked out and tagged out (FM 4-01.502).

REMOVAL**WARNING**

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1. Remove centrifugal pump unit (WP 0016).
2. Move centrifugal pump unit to a clean and level workstation.

REMOVAL - Continued

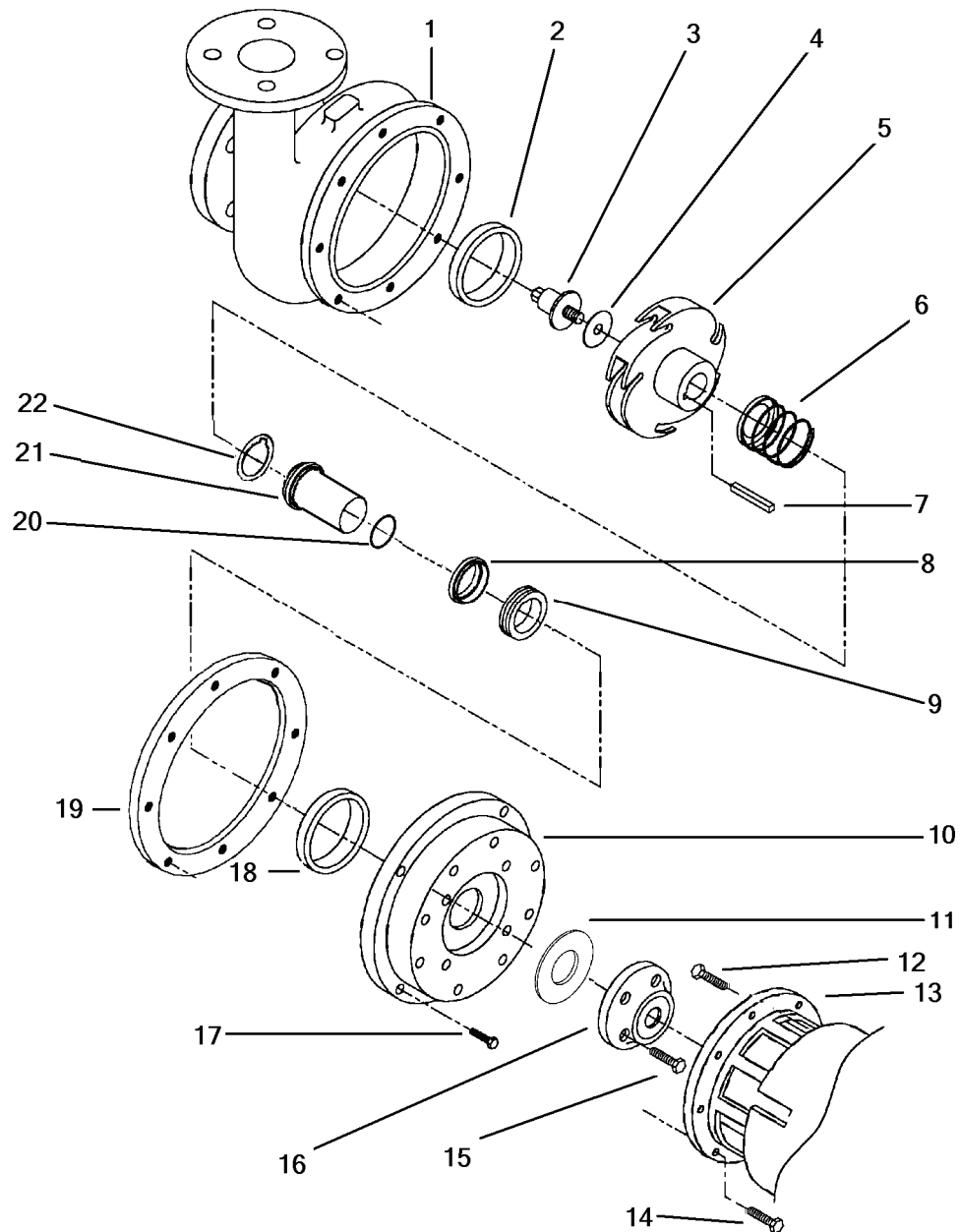


Figure 1. Replace Alternating Current Motor.

REMOVAL - Continued

3. Remove twelve bolts (Figure 1, Item 17) from backplate cover (Figure 1 Item 10).
4. Using two jacking bolts remove pump casing (Figure 1, Item 1) and casing gasket (Figure 1, Item 19).
5. Hold pump impeller (Figure 1, Item 5) with a strap wrench.
6. Remove impeller screw (Figure 1, Item 3) by turning counterclockwise.
7. Use mechanical puller to remove pump impeller (Figure 1, Item 5). Remove screw gasket (Figure 1, Item 4) and machine key (Figure 1, Item 7) from shaft.
8. Remove mechanical spring (Figure 1, Item 6).
9. Remove shaft sleeve (Figure 1, Item 21) and gasket (Figure 1, Item 22).
10. Remove ceramic insert (Figure 1, Item 8) and O-ring (Figure 1, Item 20) from shaft sleeve (Figure 1, Item 21).
11. Remove eight bolts (Figure 1, Item 14) to remove back plate cover (Figure 1, Item 10).
12. Remove four bolts (Figure 1, Item 15) from stuffing box (Figure 1, Item 16); remove stuffing box with stuffing box gasket (Figure 1, Item 11).
13. Finger press stationary seal (Figure 1, Item 9) from stuffing box (Figure 1, Item 16).
14. Remove four bolts (Figure 1, Item 12) and motor adapter (Figure 1, Item 13).

INSTALLATION

1. Install motor adaptor (Figure 1, Item 13) with four bolts (Figure 1, Item 12).

CAUTION

Inspect the carbon sealing face, and remove any foreign particles with a lint-free cloth or tissue.

Do not use grease or allow grease on the sealing surfaces. Avoid skin contact on mating surfaces of ceramic insert (Figure 1, Item 8) and stationary seal (Figure 1, Item 9). Greases and oils will cause premature failure of the seal.

2. Press stationary seal (Figure 1, Item 9) into stuffing box (Figure 1, Item 16).
3. Replace stuffing box gasket (Figure 1, Item 11) and install stuffing box (Figure 1, Item 16); secure with four bolts (Figure 1, Item 15).
4. Secure backplate (Figure 1, Item 10) to motor adapter (Figure 1, Item 13) with eight bolts (Figure 1, Item 14).
5. Insert O-ring (Figure 1, Item 20) into shaft sleeve (Figure 1, Item 21).
6. Place a small amount of dish detergent on shaft sleeve (Figure 1, Item 21) and install ceramic insert (Figure 1, Item 8). Install shaft sleeve (Figure 1, Item 21) onto motor shaft.
7. Position key (Figure 1, Item 7) in shaft keyway, tapping firmly in place.

INSTALLATION - Continued

8. Place mechanical spring (Figure 1, Item 6) and gasket (Figure 1, Item 22) in position.
9. Align pump impeller (Figure 1, Item 5) keyway with key; install pump impeller.
10. Install Impeller screw (Figure 1, Item 3) and impeller screw gasket (Figure 1, Item 4) into motor shaft and impeller to ensure free movement.
11. Place casing gasket (Figure 1, Item 19) in position on backplate cover (Figure 1, Item 10).
12. Align pump casing (Figure 1, Item 1) with gasket (Figure 1, Item 19) and casing backplate (Figure 1, Item 10); secure with twelve bolts (Figure 1, Item 17).
13. Install centrifugal pump unit (WP 0016).

END OF TASK**END OF WORK PACKAGE**

FIELD MAINTENANCE ALTERNATING CURRENT MOTOR REPAIR

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Lifting Sling (WP 0025, Item 5)
Hoist, Chain (WP 0025, Item 7)
Puller, Mechanical, (WP 0025, Item 10)

Paper, Abrasive (WP 0026, Item 13)
Stud, Alignment (WP 0026, Item 19)

Personnel Required

Watercraft Engineer 88L (2)

Materials/Parts

Washer, Spring Tension, P/N HW5100A11
Seal Ring, Metal, P/N RM1002A02
Gasket, P/N RM 1002A04
Lock washer, P/N HW1005W12
Gasket, P/N 10GS1000
Brush, Cleaning, (WP 0026, Item 2)
Dry Cleaning Solvent, (WP 0026, Item 5)

References

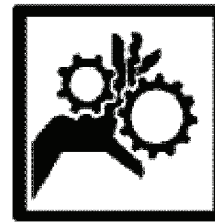
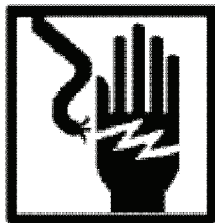
WP 0016
WP 0018

Equipment Condition

Centrifugal pump motor controller and suction and discharge valves locked out and tagged out (FM 4-01.502).

DISASSEMBLY

WARNING



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1. Remove centrifugal pump unit (WP 0016).
2. Move centrifugal pump unit to clean and level work station.

DISASSEMBLY - Continued

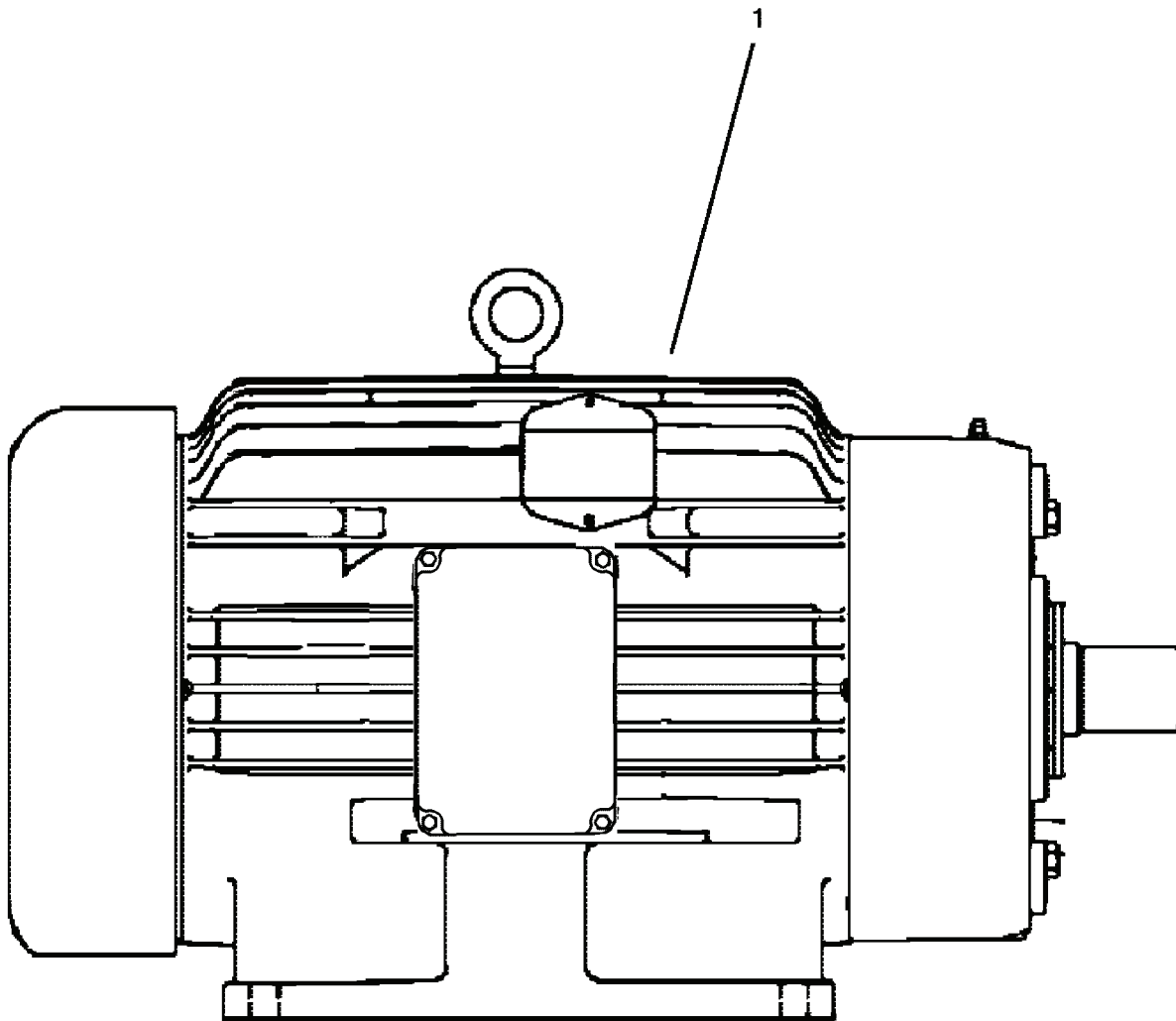


Figure 1. Repair Alternating Current Motor.

3. Remove alternating current motor (WP 0018).
4. Remove four bolts (Figure 2, Item 1) and four lock washers (Figure 2, Item 2) from fan housing (Figure 2, Item 3); remove fan housing from fan side endbell (Figure 2, Item 8).
5. Remove lubrication fitting (Figure 2, Item 9) from fan side endbell (Figure 2, Item 8).

DISASSEMBLY - Continued

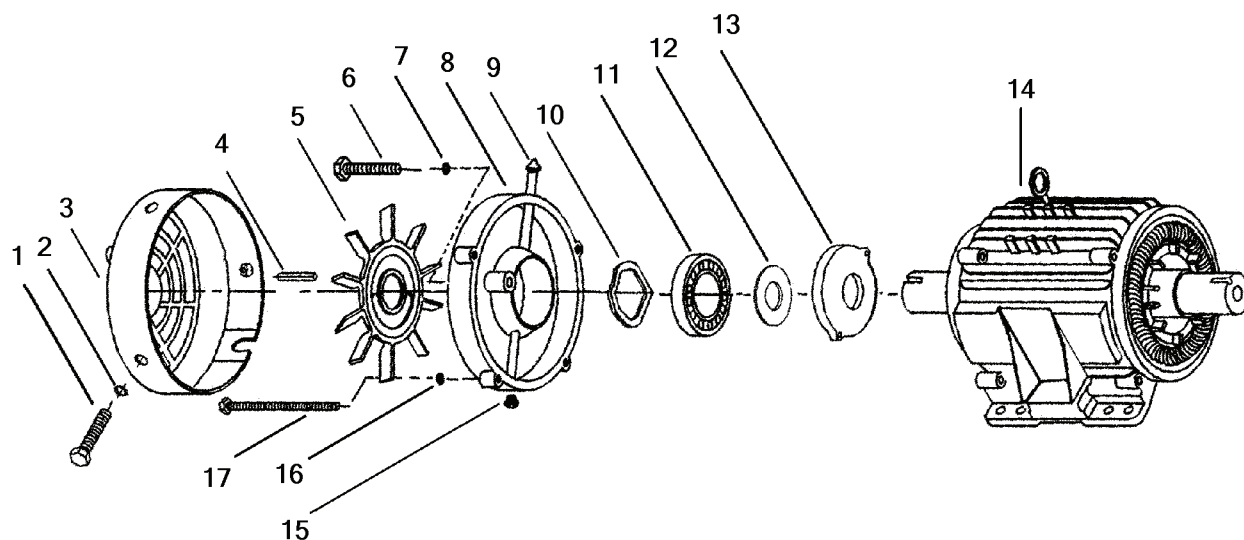


Figure 2. Fan Side Endbell Disassembly.

6. Loosen screw for axial fan impeller (Figure 2, Item 5); remove fan and machine key (Figure 2, Item 4).
7. Scribe mark both endbells to stator assembly (Figure 2, Item 14); remove four nuts (Figure 3, Item 12), four lock washers (Figure 3, Item 13), four bolts (Figure 2, Item 17) and four lock washers (Figure 2, Item 16) from stator assembly (Figure 2, Item 14).
8. Remove two bolts (Figure 2, Item 6) and two lock washers (Figure 2, Item 7) from fan side endbell (Figure 2, Item 8).
9. Remove fan side endbell (Figure 2, Item 8) and spring tension washer (Figure 2, Item 10).
10. Using a puller remove annular ball bearing (Figure 2, Item 11).
11. Remove metal seal ring (Figure 2, Item 12) and retaining ring (Figure 2, Item 13).

DISASSEMBLY - Continued

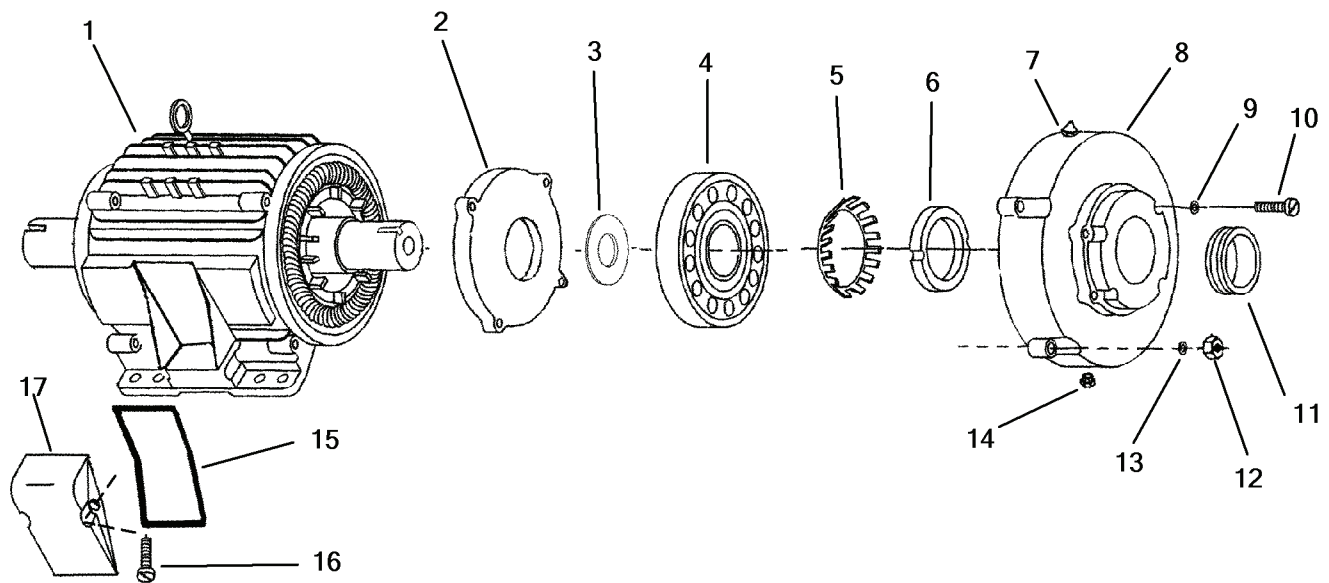


Figure 3. Drive Side Endbell Disassembly.

12. Remove dirt and liquid deflector (Figure 3, Item 11).
13. Remove four bolts (Figure 3, Item 10) and four lock washers (Figure 3, Item 9) from drive side endbell (Figure 3, Item 8) and remove endbell.
14. Locate tab of lock washer (Figure 3, Item 5) bent into groove of round plain nut (Figure 3, Item 6); push out to same distance as remaining tabs.
15. Unscrew round plain nut (Figure 3, Item 6); remove nut and lock washer (Figure 3, Item 5).
16. Using a bearing puller, remove annular ball bearing (Figure 3, Item 4).
17. Remove gasket (Figure 3, Item 3) and retaining ring (Figure 3, Item 2).
18. Remove grease reliefs (Figure 2, Item 15 and Figure 3, Item 14) from fan side endbell (Figure 2, Item 8) and drive side endbell (Figure 3, Item 8).
19. Remove lubrication fitting (Figure 3, Item 7) from drive side endbell (Figure 3, Item 8).

END OF TASK

REPAIR

1. Repair of the alternating current motor (Figure 1, Item 1) is by replacement of worn or damaged components and the following mandatory replacement parts:
 - a. Spring tension washer (Figure 2, Item 10)
 - b. Metal seal ring (Figure 2, Item 12)
 - c. Gasket (Figure 3, Item 3)
 - d. Lock washer (Figure 3, Item 5)
 - e. Gasket (Figure 2, Item 15)
2. Clean all parts thoroughly with cleaning solvent and brush.
3. Remove any burrs or scratches with emery cloth.

END OF TASK

ASSEMBLY

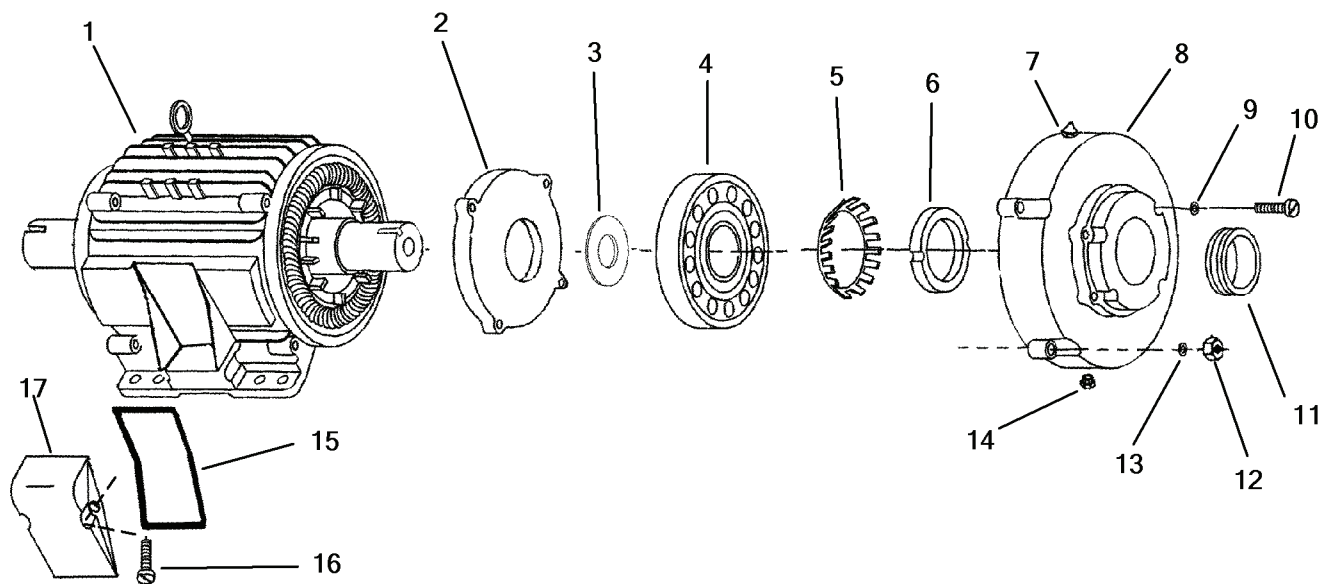


Figure 4. Drive Side Endbell Assembly.

1. Install retaining ring (Figure 4, Item 2) and gasket (Figure 4, Item 3) onto stator assembly shaft (Figure 4, Item 1).
2. Install annular ball bearing (Figure 4, Item 4) onto shaft.
3. Replace lock washer (Figure 4, Item 5); screw round plain nut (Figure 4, Item 6) onto shaft.

ASSEMBLY - Continued

4. Locate groove of round plain nut (Figure 4, Item 6) that has tab of lock washer (Figure 4, Item 5) in same position. If no tabs match groove, slightly unscrew nut (Figure 4, Item 6) until first tab matches; pull tab out to lock in groove.
5. Install two alignment studs into bolt holes of retaining ring (Figure 4, Item 2).
6. Place drive side endbell (Figure 4, Item 8) in position on shaft using the alignment studs as a guide.
7. Gently thread two bolts (Figure 4, Item 10) with lock washers (Figure 4, Item 9) into retaining ring (Figure 4, Item 2); once the two bolts have been started, remove alignment studs and replace with bolts and lock washers and tighten.

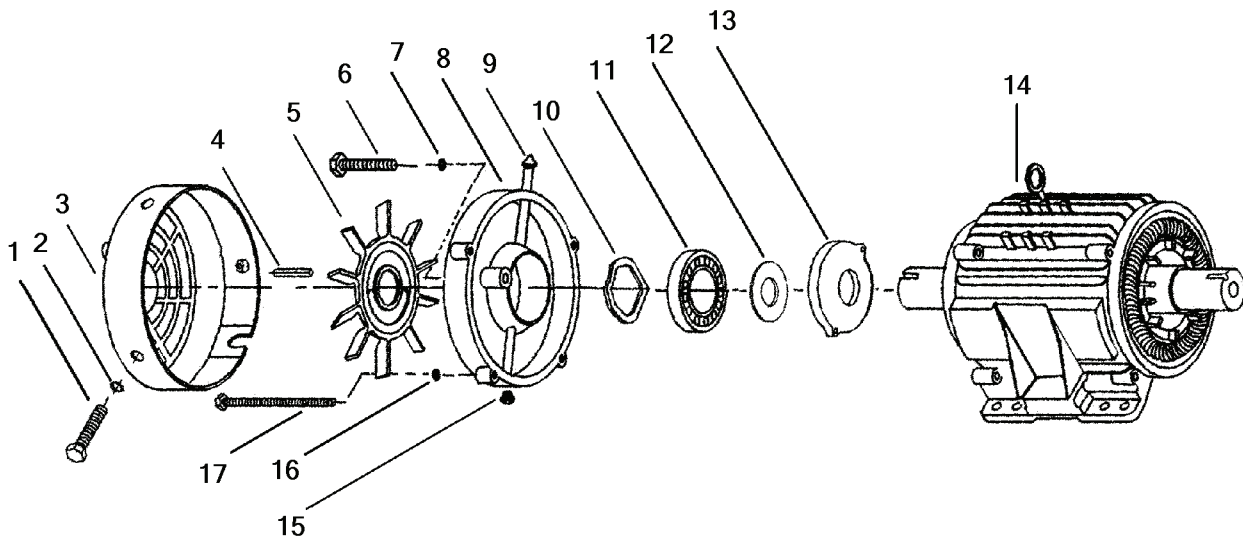


Figure 5. Fan Side Endbell Assembly.

8. Install retaining ring (Figure 5, Item 13) and metal seal ring (Figure 5, Item 12) onto stator assembly (Figure 5, Item 14).
9. Install two alignment studs into bolt holes of retaining ring (Figure 5, Item 13).
10. Install annular ball bearing (Figure 5, Item 11) onto shaft.
11. Replace spring tension washer (Figure 1, Item 10).
12. Ensure scribe marks are aligned. Place fan side endbell (Figure 5, Item 8) in position on shaft, using alignment studs as a guide. Gently lift endbell to ensure a proper seat into the stator assembly (Figure 5, Item 14).
13. Remove one alignment stud.
14. Gently thread bolt (Figure 5, Item 6) with lock washer (Figure 5, Item 7) into retaining ring (Figure 5, Item 13). Remove alignment stud and install bolt (Figure 5, Item 6) with lock washer (Figure 5, Item 7) and tighten evenly.

ASSEMBLY - Continued

15. Insert four bolts (Figure 5, Item 17) with four lock washers (Figure 5, Item 16) through fan side endbell (Figure 5, Item 8), stator assembly (Figure 5, Item 14) and drive side endbell (Figure 4, Item 8); secure with four lock washers and four nuts (Figure 4, Items 13 and 12).
16. Install key (Figure 5, Item 4) into keyway on shaft; tapping into place.
17. Align axial fan (Figure 5, Item 5) keyway with machine key (Figure 5, Item 4); install and tighten screw.
18. Position fan housing (Figure 5, Item 3) on fan side endbell (Figure 5, Item 8); secure with four screws and lock washers (Figure 2, Items 1 and 2).
19. Gently push dirt and liquid deflector (Figure 4, Item 11) onto shaft and align deflectors v-notch with drive side endbell (Figure 4, Item 8).
20. Install lubrication fitting (Figure 4, Item 7) into drive side endbell (Figure 4, Item 8) and lubrication fitting (Figure 5, Item 9) into fan side end bell (Figure 5, Item 8)
21. Install grease reliefs (Figure 4, Item 14 and Figure 5, Item 15) into fan side endbell (Figure 4, Item 8) and drive side endbell (Figure 5, Item 8).
22. Perform centrifugal pump assembly procedures (WP 0021).
23. Move centrifugal pump unit to foundation.
24. Install centrifugal pump unit (WP 0016).

END OF TASK

END OF WORK PACKAGE

FIELD MAINTENANCE CENTRIFUGAL PUMP REPLACE

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Wrench, Torque (30-200 Ft-lbs)
(WP 0025, Item 3)
Wrench, Torque (5-75 Ft-lbs)
(WP 0025, Item 4)
Lifting Sling (WP 0025, Item 5)
Hoist, Chain (WP 0025, Item 7)
Wrench, Strap (WP 0025, Item 15)

Materials/Parts

Pump, Centrifugal,
P/N ABZCH2-32-320F

Personnel Required

Watercraft Engineer 88L (2)

References

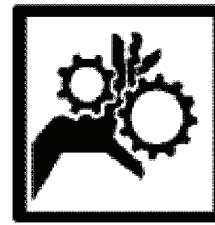
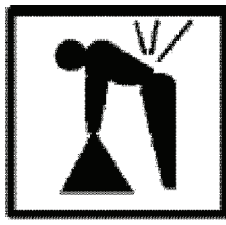
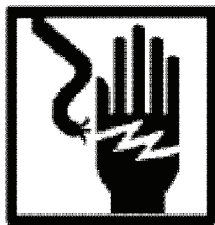
WP 0016

Equipment Condition

Centrifugal pump motor controller and suction and discharge valves locked out and tagged out (FM 4-01.502).

REMOVAL

WARNING



Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized presents a shock hazard and may result in death or injury to personnel or equipment damage.

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

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

1. Remove centrifugal pump unit (WP 0016).
2. Move centrifugal pump unit to clean and level work station.

REMOVAL - Continued

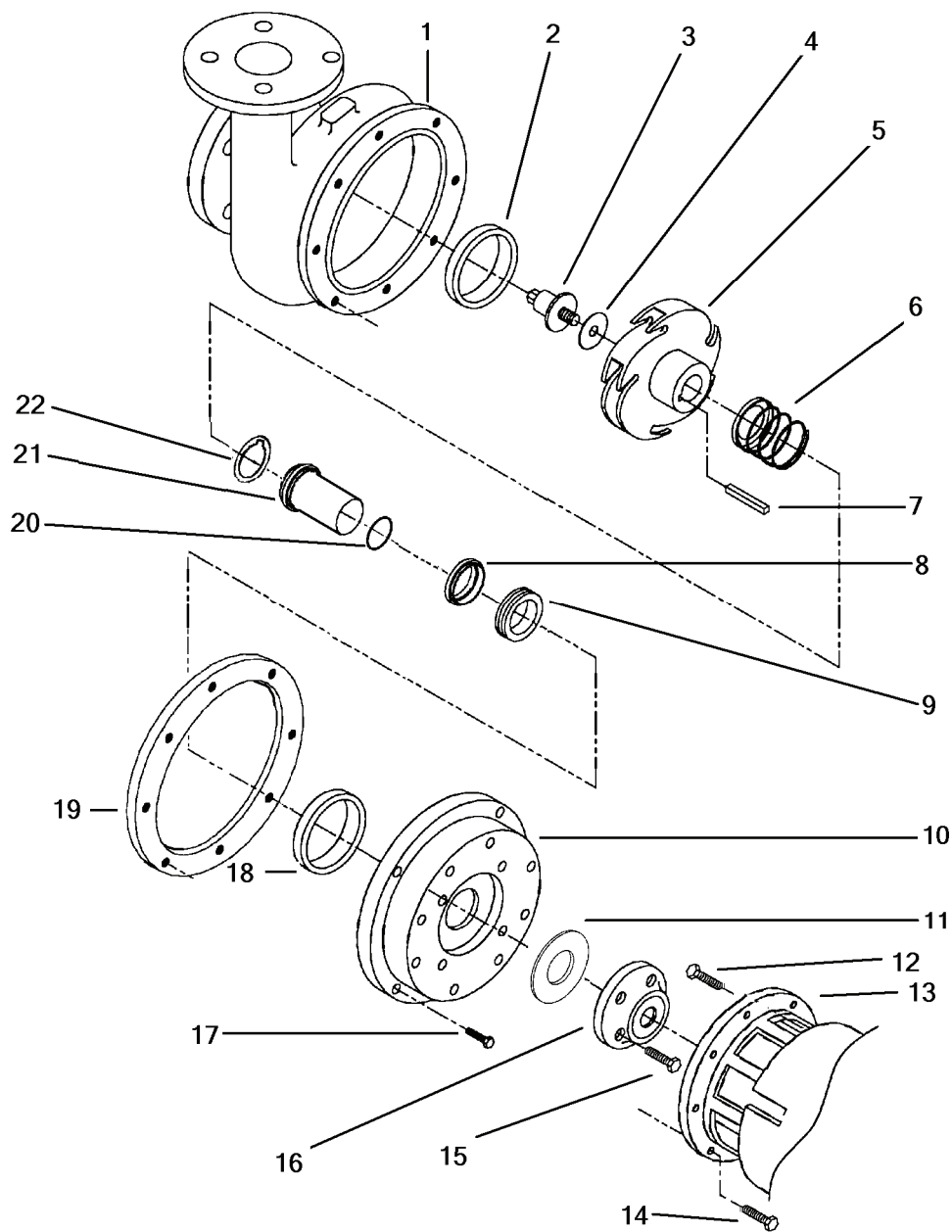


Figure 1. Replace Centrifugal Pump.

3. Remove twelve bolts (Figure 1, Item 17) from backplate cover (Figure 1, Item 10).
4. Using two jacking bolts, remove pump casing (Figure 1, Item 1) and casing gasket (Figure 1, Item 19).
5. Hold pump impeller (Figure 1, Item 5) with a strap wrench.
6. Remove impeller screw (Figure 1, Item 3) by turning counterclockwise.

REMOVAL - Continued

7. Use mechanical puller remove pump impeller (Figure 1, Item 5). Remove screw gasket (Figure 1, Item 4) and machine key (Figure 1, Item 7) from shaft.
8. Remove mechanical spring (Figure 1, Item 6).
9. Remove shaft sleeve (Figure 1, Item 21) and gasket (Figure 1, Item 22).
10. Remove ceramic insert (Figure 1, Item 8) and O-ring (Figure 1, Item 20) from shaft sleeve (Figure 1, Item 21).
11. Remove eight bolts (Figure 1, Item 14) to remove back plate cover (Figure 1, Item 10).

END OF TASK**INSTALLATION**

1. Secure backplate (Figure 1, Item 10) to motor adapter (Figure 1, Item 13) with eight bolts (Figure 1, Item 14).

CAUTION

Inspect the carbon sealing face, and remove any foreign particles with a lint-free cloth or tissue.

Do not use grease or allow grease on the sealing surfaces. Avoid skin contact on mating surfaces of ceramic insert (Figure 1, Item 8) and stationary seal (Figure 1, Item 9). Greases and oils will cause premature failure of the seal.

2. Press stationary seal (Figure 1, Item 9) into stuffing box (Figure 1, Item 16).
3. Insert O-ring (Figure 1, Item 9) into shaft sleeve (Figure 1, Item 21).
4. Place a small amount of dish detergent on shaft sleeve (Figure 1, Item 21) and install ceramic insert (Figure 1, Item 8). Install shaft sleeve onto motor shaft.
5. Position key (Figure 1, Item 7) in shaft keyway, tapping firmly in place.
6. Place mechanical spring (Figure 1, Item 6) and gasket (Figure 1, Item 22) in position.
7. Align pump impeller (Figure 1, Item 5) keyway with key; install pump impeller.
8. Install Impeller screw (Figure 1, Item 3) and impeller screw gasket (Figure 1, Item 4) into motor shaft and rotate impeller to ensure free movement.
9. Place casing gasket (Figure 1, Item 19) in position on backplate cover (Figure 1, Item 10).
10. Align pump casing (Figure 1, Item 1) with gasket (Figure 1, Item 19) and casing backplate (Figure 1, Item 10); secure with twelve bolts (Figure 1, Item 17).
11. Install centrifugal pump unit (WP 0016).

END OF TASK**END OF WORK PACKAGE**

FIELD MAINTENANCE CENTRIFUGAL PUMP REPAIR

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0025, Item 1)
Wrench, Torque (30-200 Ft-lbs)
(WP 0025, Item 3)
Wrench, Torque (5-75 Ft-lbs)
(WP 0025, Item 4)
Lifting Sling (WP 0025, Item 5)
Hoist, Chain (WP 0025, Item 7)
Puller, Mechanical (WP 0025, Item 10)
Drill, Electric Portable, 3/8" cap.
(WP 0025, Item 11)
Drill Set, Twist, Set 2, (WP 0025, Item 12)
Wrench, Strap (WP 0025, Item 15)

Materials/Parts

Gasket, Stuffing Box, P/N GX5041900
Centrifugal Pump Parts Kit, P/N GS8107770

Brush, Cleaning, (WP 0025, Item 2)
Dishwashing Compound (WP 0026, Item 4)
Dry Cleaning Solvent, (WP 0026, Item 5)
Paper, Abrasive (WP 0026, Item 13)

Personnel Required

Watercraft Engineer 88L (2)

References

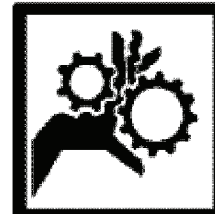
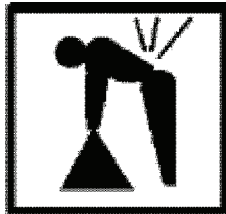
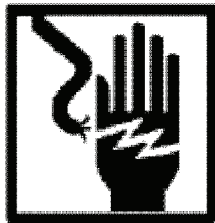
WP 0016

Equipment Condition

Centrifugal pump motor controller and suction and discharge valves locked out and tagged out (FM 4-01.502).

DISASSEMBLY

WARNING



Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized presents a shock hazard and may result in death or injury to personnel or equipment damage.

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

Always ensure affected systems have been secured, locked out and tagged out to prevent accidental energizing of equipment that can result in the entanglement of limbs and clothing in moving parts. Performing maintenance with systems energized may result in death or serious injury to personnel or equipment damage.

1. Remove centrifugal pump unit (WP 0016).

DISASSEMBLY - Continued

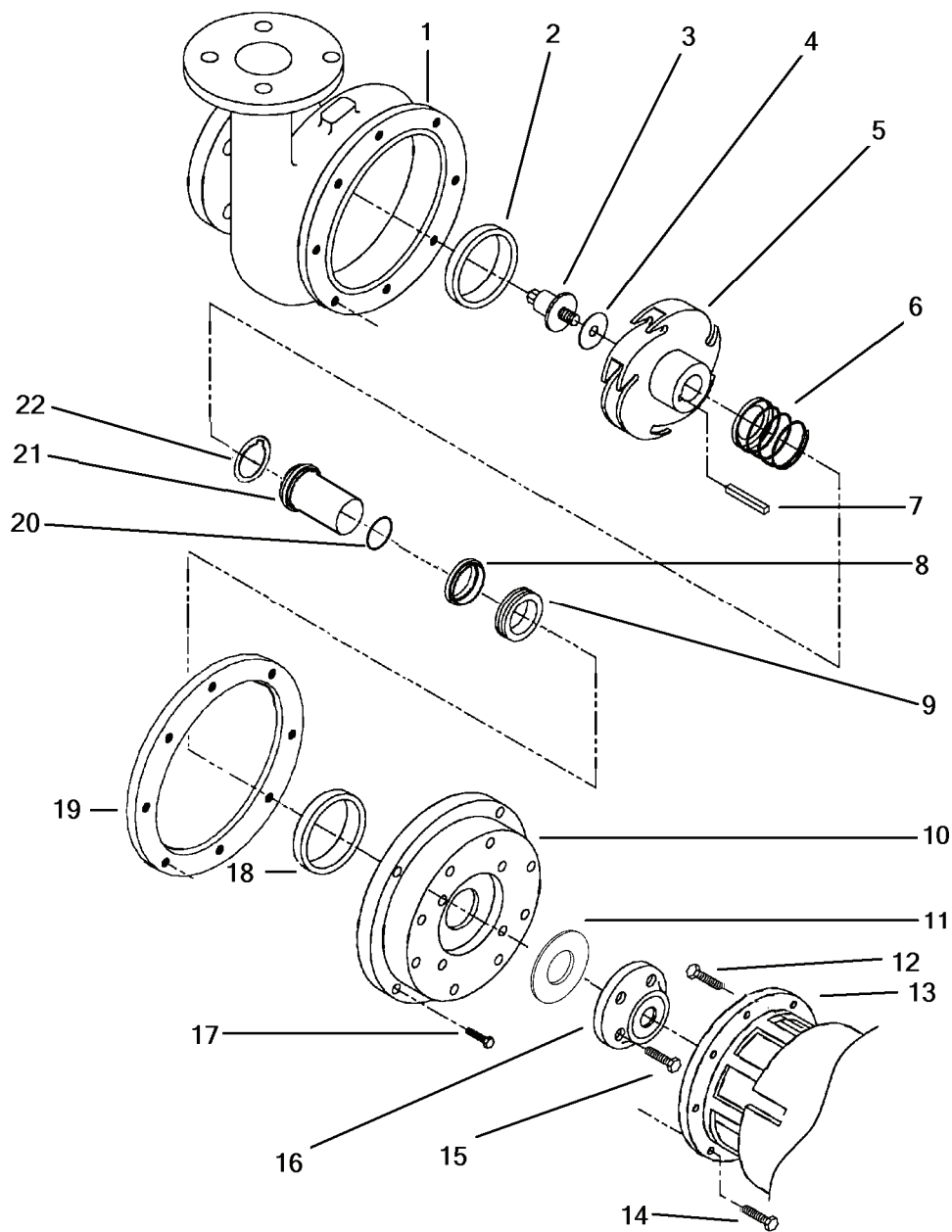


Figure 1. Repair Centrifugal Pump.

2. Move centrifugal pump unit to clean and level work station.
3. Remove twelve bolts (Figure 1, Item 17) from backplate cover (Figure 1, Item 10).
4. Using two jacking bolts, remove pump casing (Figure 1, Item 1) and casing gasket (Figure 1, Item 19).
5. Hold pump impeller (Figure 1, Item 5) with a strap wrench.
6. Remove impeller screw (Figure 1, Item 3) by turning counterclockwise.

DISASSEMBLY - Continued

7. Use mechanical puller to remove impeller (Figure 1, Item 5). Remove screw gasket (Figure 1, Item 4) and machine key (Figure 1, Item 7) from shaft.
8. Remove mechanical spring (Figure 1, Item 6).
9. Remove shaft sleeve (Figure 1, Item 21) and gasket (Figure 1, Item 22).
10. Remove ceramic insert (Figure 1, Item 8) and O-ring (Figure 1, Item 20) from shaft sleeve (Figure 1, Item 21).
11. Remove eight bolts (Figure 1, Item 14) to remove back plate cover (Figure 1, Item 10).
12. Remove four bolts (Figure 1, Item 15) from stuffing box (Figure 1, Item 16); remove stuffing box with stuffing box gasket (Figure 1, Item 11).
13. Finger press stationary seal (Figure 1, Item 9) from stuffing box (Figure 1, Item 16).
14. If replacement is required, remove the impeller wear rings (Figure 1, Items 2 or 18). It may be necessary to drill two axial holes into either ring, approximately 180° apart, being careful not to drill into casing (Figure 1, Item 1) or backplate cover (Figure 1, Item 10). Split wear rings (Figure 1, Item 2 or 18) using a chisel; remove ring halves.

END OF TASK**REPAIR**

1. Repair of the centrifugal pump is by replacement of any worn or damaged components and the following mandatory replacement parts:
 - a. Impeller screw gasket (Figure 1, Item 4)
 - b. Mechanical Spring (Figure 1, Item 6)
 - c. Stationary seal (Figure 1, Item 9)
 - d. O-ring (Figure 1, Item 20)
 - e. Stuffing box gasket (Figure 1, Item 11)
 - f. Casing gasket (Figure 1, Item 19)
 - g. Ceramic insert (Figure 1, Item 8)
 - h. Pump shaft sleeve (Figure 1, Item 21)
 - i. Gasket (Figure 1 Item, 22)
2. Clean all parts thoroughly with cleaning solvent and brush.
3. Remove any burrs or scratches with emery cloth.

END OF TASK

ASSEMBLY

1. If removed, install suction side wear ring (Figure 1, Item 2) into pump casing (Figure 1, Item 1) or wear ring (Figure 1, Item 18) into backplate cover (Figure 1, Item 10).

CAUTION

Inspect the carbon sealing face, and remove any foreign particles with a lint-free cloth or tissue.

Do not use grease or allow grease on the sealing surfaces. Avoid skin contact on mating surfaces of ceramic insert (Figure 1, Item 8) and stationary seal (Figure 1, Item 9). Greases and oils will cause premature failure of the seal.

2. Press stationary seal (Figure 1, Item 9) into stuffing box (Figure 1, Item 16).
3. Replace stuffing box gasket (Figure 1, Item 11) and install stuffing box (Figure 1, Item 16); secure with four bolts (Figure 1, Item 15).
4. Secure backplate (Figure 1, Item 10) to motor adapter (Figure 1, Item 13) with eight bolts (Figure 1, Item 14).
5. Insert O-ring (Figure 1, Item 20) into shaft sleeve (Figure 1, Item 21).
6. Place a small amount of dish detergent on shaft sleeve (Figure 1, Item 21) and install ceramic insert (Figure 1, Item 8). Install shaft sleeve (Figure 1, Item 21) onto motor shaft.
7. Position key (Figure 1, Item 7) in shaft keyway, tapping firmly in place.
8. Place mechanical spring (Figure 1, Item 6) and gasket (Figure 1, Item 22) in position.
9. Align pump impeller (Figure 1, Item 5) keyway with key; install pump impeller.
10. Install Impeller screw (Figure 1, Item 3) and impeller screw gasket (Figure 1, Item 4) into motor shaft and rotate impeller to ensure free movement.
11. Place casing gasket (Figure 1, Item 19) in position on backplate cover (Figure 1, Item 10).
12. Align pump casing (Figure 1, Item 1) with gasket (Figure 1, Item 19) and casing backplate (Figure 1, Item 10); secure with twelve bolts (Figure 1, Item 17).
13. Install centrifugal pump unit (WP 0016).

END OF TASK**END OF WORK PACKAGE**

**FIELD AND SUSTAINMENT MAINTENANCE
FIRE PUMP SYSTEM
FIRE PUMP SUBSYSTEM
TORQUE VALUES**

SCOPE

SAE capscrews are graded according to the strength of the capscrew. They are marked on the head so the correct strength and torque value are known. The tables in this appendix will list the capscrew markings with correct torque values as well as values for pipe plugs and metric bolts.

CAUTION

When replacing capscrews, always use a capscrew of the same measurement and strength as the capscrew being replaced. Using incorrect capscrews can result in equipment damage. Bolts threaded into aluminum require much less torque.

NOTE

Always use torque values listed in the tables when specific torque values are unknown. The torque values listed in the tables are based on the use of lubricated threads.

Table 1. Capscrew Markings and Torque Values

Capacity Body size		SAE Grade # 5 Cast Iron or Steel			SAE Grade # 6 or # 7 Cast Iron or Steel			SAE Grade #8 Cast Iron or Steel		
Inches-Thread		TORQUE			TORQUE			TORQUE		
		Ft-lb	kgm	Nm	Ft-lb	kgm	Nm	Ft-lb	kgm	Nm
1/4	-20	8	1.1064	10.8465	10	1.3630	13.5582	12	1.6596	16.2698
	-28	10	1.3830	13.5582				14	1.9362	18.9815
5/16	-18	17	2.3511	23.0489	19	2.6277	25.7605	24	3.3192	32.5396
	-24	19	2.6277	25.7605				27	3.7341	36.6071
3/8	-16	31	4.2873	42.0304	34	4.7022	46.0978	44	6.0852	59.6560
	-24	35	4.8405	47.4536				49	6.7767	66.4351
7/16	-14	49	6.7767	66.4351	55	7.6065	74.5700	70	9.6810	94.9073
	-20	55	7.6065	74.5700				78	10.7874	105.753
1/2	-13	75	10.3725	101.6863	85	11.7555	115.2445	105	14.5215	142.3609
	-20	85	11.7555	115.2445				120	16.5860	162.6960
9/16	-12	110	15.2130	149.1380	120	16.5960	162.6960	155	21.4365	210.1490
	-18	120	16.5960	162.6960				170	23.5110	230.4860
5/8	-11	150	20.7450	203.3700	167	23.0961	226.4186	210	29.0430	284.7180
	-18	170	23.5110	230.4860				240	33.1920	325.3920
3/4	-10	270	37.3410	366.0660	280	38.7240	379.6240	375	51.825	508.4250
	-16	295	40.7985	399.9610				420	58.0860	568.4360
7/8	9	395	54.6285	535.5410	440	60.8520	596.5520	605	83.6715	820.2590
	-14	435	60.1605	589.7730				675	93.3525	915.1650

Table 1. Capscrew Markings and Torque Values Cont

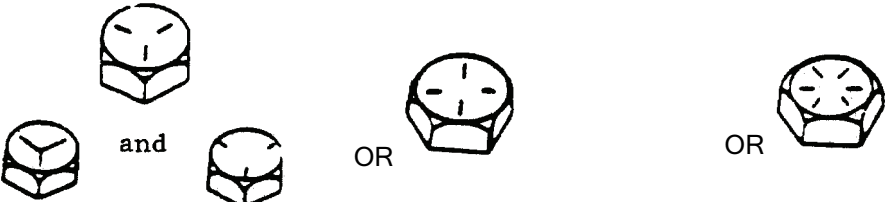
Capacity Body size		SAE Grade # 5 Cast Iron or Steel			SAE Grade # 6 or # 7 Cast Iron or Steel			SAE Grade #8 Cast Iron or Steel		
Inches-Thread		TORQUE			TORQUE			TORQUE		
		Ft-lb	kgm	Nm	Ft-lb	kgm	Nm	Ft-lb	kgm	Nm
1.0	-8	590	81.5970	799.9220	660	91.2780	894.8280	910	125.8530	1233.7780
	-14	660	91.2780	849.8280				990	136.9170	1342.2420
Capscrew Head Markings										

Table 2. Pipe Plug Torque Values

Thread	Size		In Aluminum Components Torque		In Cast Iron or Steel Components Torque	
	Actual	Thread O.D				
in	Nm	(in)	Nm	(Ft-lbs)	Nm	(Ft-lbs)
1/16	8.1	(0.32)	5	(45 In-lbs)	15	(10)
1/8	10.4	(0.41)	15	(10)	20	(15)
1/4	13.7	(0.54)	20	(15)	25	(20)
3/8	17.3	(0.68)	25	(20)	35	(25)
1/2	21.6	(0.85)	35	(25)	55	(40)
3/4	26.7	(1.05)	45	(35)	75	(55)
1	33.5	(1.32)	60	(45)	95	(70)
1-1/4	42.2	(1.66)	75	(55)	115	(85)
1-1/2	48.3	(1.90)	85	(65)	135	(100)

Table 3. Metric Bolt Torque Values

Thread for general purposes (size x pitch (mm))	Cast Iron or Steel			
	Head Mark 4 Torque		Head Mark 7 Torque	
	Ft-lb.	(Nm)	Ft-lb.	(Nm)
6 x 1.0	2.2 to 2.9	(3.0 to 3.9)	3.6 to 5.8	(4.9 to 7.8)
8 x 1.25	5.8 to 8.7	(7.9 to 12)	9.4 to 14	(13 to 19)
10 x 1.25	12 to 17	(16 to 23)	20 to 29	(27 to 39)
12 x 1.25	21 to 32	(29 to 43)	35 to 53	(47 to 72)
14 x 1.5	35 to 52	(48 to 70)	57 to 85	(77 to 110)
16 x 1.5	51 to 77	(67 to 100)	90 to 120	(130 to 160)
18 x 1.5	74 to 110	(100 to 150)	130 to 170	(180 to 230)
20 x 1.5	110 to 140	(150 to 190)	190 to 240	(160 to 320)
22 x 1.5	150 to 190	(200 to 260)	250 to 320	(340 to 430)
24 x 1.5	190 to 240	(260 to 320)	310 to 410	(420 to 550)

END OF WORK PACKAGE

CHAPTER 5

**FIELD AND SUSTAINMENT
MAINTENANCE FOR
FIRE PUMP SUBSYSTEM**

SUPPORTING INFORMATION

**FIELD AND SUSTAINMENT MAINTENANCE
FIRE PUMP SYSTEM
FIRE PUMP SUBSYSTEM
REFERENCES**

SCOPE

This work package lists the manuals, bulletins, specifications, and miscellaneous publications referenced in this manual or required for maintenance activities.

Field Manuals.

FM 4-25.11	First Aid
FM 31-70	Basic Cold Weather Manual
FM 55-501	Marine Crewman's Handbook
FM 4-01.502	Army Watercraft Safety

Technical Manuals.

TM 55-1905-223-10	Operator's Manual for Landing Craft, Utility (LCU)
TM 55-1905-223-24-18-1/2	LCU 2000 Class Basic Craft Maintenance Manual
TM 55-1905-223-24P-1/2/3/4	Repair Parts and Special Tools List for the LCU 2000 Class Watercraft
TM 750-244-3	Destruction of Army Materiel to Prevent Enemy Use
TM 43-0139	Painting Instructions for Army Material

Technical Bulletins.

TB 43-0144	Painting of Watercraft
TB 55-1900-207-24	Treatment of Cooling Water in Marine Diesel Engines
TB 740-97-4	Preservation of Vessels for Storage
TB 55-1900-204-24	Welding on Watercraft

Military Specifications.

MIL-STD-107	Preparation And Handling Of Industrial Plant Equipment (IPE) For Shipment And Storage
MIL-STD-129	Military Standard Marking for Shipment and Storage
MIL-PRF-16173	Corrosion Preventive Compound, Solvent Cutback, Cold-Application
MIL-PRF-32033	Performance Specification, Lubricating Oil, General Purpose, Preservative (Water-Displacing, Low Temperature)
MIL-PRF-21260	Lubricating Oil, Internal Combustion Engine, Preservative Break-In

Miscellaneous Publications.

DA PAM 750-8	The Army Maintenance Management System (TAMMS) Users Manual
LO 55-1905-223-12	Lubrication Order for the LCU 2000 Class Watercraft
AMC-R 750-11	Use of Lubricants, Fluids, and Associated Products

Forms.

DA Form 2028	Recommended Changes to Equipment Technical Publications Blank Forms
DA Form 2404	Equipment Maintenance and Inspection Worksheet
DA Form 2408-16	Logsheet
DA Form 2410	Logsheet
SF Form 368	Product Quality Deficiency Report

END OF WORK PACKAGE

**FIELD AND SUSTAINMENT MAINTENANCE
FIRE PUMP SUBSYSTEM
MAINTENANCE ALLOCATION CHART (MAC) INTRODUCTION**

MAINTENANCE ALLOCATION CHART (MAC)**INTRODUCTION****The Army Maintenance System MAC**

This introduction provides a general explanation of all maintenance and repair functions authorized at the two maintenance levels under the Two-Level Maintenance System concept.

This MAC (immediately following the introduction) designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

Field - includes two subcolumns, Crew (C) and Maintainer (F).

Sustainment - includes two subcolumns, Below Depot (H) and Depot (D)

The maintenance to be performed at field and sustainment levels is described as follows:

1. Crew maintenance. The responsibility of a using organization to perform maintenance on its assigned equipment. It normally consists of inspecting, servicing, lubricating, adjusting, and replacing parts, minor assemblies, and subassemblies. The replace function for this level of maintenance is indicated by the letter "C" in the third position of the SMR code. A "C" appearing in the fourth position of the SMR code indicates complete repair is possible at the crew maintenance level.
2. Maintainer maintenance. Maintenance accomplished on a component, accessory, assembly, subassembly, plug-in unit, or other portion either on the system or after it is removed. The replace function for this level of maintenance is indicated by the letter "F" appearing in the third position of the SMR code. An "F" appearing in the fourth position of the SMR code indicates complete repair is possible at the field maintenance level. Items are returned to the user after maintenance is performed at this level.
3. Below depot sustainment. Maintenance accomplished on a component, accessory, assembly, subassembly, plug-in unit, or other portion either on the system or after it is removed. The replace function for this level of maintenance is indicated by the letter "H" appearing in the third position of the SMR code. An "H" appearing in the fourth position of the SMR code indicates complete repair is possible at the below depot sustainment maintenance level. Items are returned to the supply system after maintenance is performed at this level.
4. Depot sustainment. Maintenance accomplished on a component, accessory, assembly, subassembly, plug-in unit, or other portion either on the system or after it is removed. The replace function for this level of maintenance is indicated by the letter "D" or "K" appearing in the third position of the SMR code. Depot sustainment maintenance can be performed by either depot personnel or contractor personnel. A "D" or "K" appearing in the fourth position of the SMR code indicates complete repair is possible at the depot sustainment maintenance level. Items are returned to the supply systems after maintenance is performed at this level.

The tools and test equipment requirements table (immediately following the MAC) lists the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC. The remarks table (immediately following the tools and test equipment requirements) contains supplemental instructions and explanatory notes for a particular maintenance function.

INTRODUCTION - CONTINUED

Maintenance Functions

Maintenance functions are limited to and defined as follows:

1. **Inspect.** To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel). This includes scheduled inspection and gaugings and evaluation of cannon tubes.
2. **Test.** To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.
3. **Service.** Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases. This includes scheduled exercising and purging of recoil mechanisms. The following are examples of service functions:
 - a. **Unpack.** To remove from packing box for service or when required for the performance of maintenance operations.
 - b. **Repack.** To return item to packing box after service and other maintenance operations.
 - c. **Clean.** To rid the item of contamination.
 - d. **Touch up.** To spot paint scratched or blistered surfaces.
 - e. **Mark.** To restore obliterated identification.
4. **Adjust.** To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.
5. **Align.** To adjust specified variable elements of an item to bring about optimum or desired performance.
6. **Calibrate.** To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.
7. **Remove/Install.** To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.
8. **Paint (ammunition only).** To prepare and spray color coats of paint so that the ammunition can be identified and protected. The color indicating primary use is applied, preferably, to the entire exterior surface as the background color of the item. Other markings are to be repainted as original so as to retain proper ammunition identification.
9. **Replace.** To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

INTRODUCTION - CONTINUED

10. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

NOTE

The following definitions are applicable to the "repair" maintenance function:

Services. Inspect, test, service, adjust, align, calibrate, and/or replace.

Fault location/troubleshooting. The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).

Disassembly/assembly. The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

Actions. Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

11. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.
12. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of material maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

Explanation of Columns in the MAC

Column (1) Group Number. Column (1) lists Functional Group Code (FGC) numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

Column (2) Component/Assembly. Column (2) contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

Column (3) Maintenance Function. Column (3) lists the functions to be performed on the item listed in column (2). (For a detailed explanation of these functions refer to "Maintenance Functions" outlined above).

Column (4) Maintenance Level. Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating

INTRODUCTION - CONTINUED

conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

Field:

- C - Crew maintenance
- F - Maintainer maintenance

Sustainment:

- L - Specialized Repair Activity (SRA)
- H - Below depot maintenance
- D - Depot maintenance

NOTE

The "L" maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by work time figure in the "H" column of column (4), and an associated reference code is used in the REMARKS column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

Column (5) Tools and Equipment Reference Code. Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

Column (6) Remarks Code. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

Explanation of Columns in the Tools and Test Equipment Requirements

Column (1) - Tool or Test Equipment Reference Code. The tool or test equipment reference code correlates with a code used in column (5) of the MAC.

Column (2) - Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

Column (3) - Nomenclature. Name or identification of the tool or test equipment.

Column (4) - National Stock Number (NSN). The NSN of the tool or test equipment.

Column (5) - Tool Number. The manufacturer's part number.

Explanation of Columns in the Remarks

Column (1) - Remarks Code. The code recorded in column (6) of the MAC.

Column (2) - Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

END OF WORK PACKAGE

**FIELD AND SUSTAINMENT MAINTENANCE
FIRE PUMP SYSTEM
MAINTENANCE ALLOCATION CHART (MAC)**

Table 1. MAC for Fire Pump Subsystem.

(1) GROUP NUMBER	(2) COMPONENT ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL				(5) TOOLS AND EQUIPMENT REFERENCE CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT			
			CREW	MAINTAINER	BELOW DEPOT	DEPOT		
			C	F	H	D		
12	FIRE PUMP SUBSYSTEM							
1201	AUXILIARY FIRE PUMP ASSEMBLY	INSPECT SERVICE REPLACE REPAIR OVERHAUL	1.0	0.5 4.0 4.0		--	1, 9 1, 3, 5, 7 1, 2, 4-7, 10, 13	A
120101	COUPLING SHAFT FLEXIBLE	INSPECT SERVICE ALIGN REPLACE REPAIR	1.0	1.5 0.5 2.0 4.0 1.5			1 1, 2, 5, 7 1 1, 2	B
1202	PUMP UNIT CENTRIFUGAL	INSPECT SERVICE REPLACE	1.0	0.3 2.0			1 1, 3, 5, 7, 8	
120201	MOTOR ALTERNATING CURRENT	TEST REPLACE REPAIR		1.0 2.0 2.5			1, 8, 14 1, 3-5, 7 1, 5, 7, 10	
120202	PUMP CENTRIFUGAL	REPLACE REPAIR		2.0 2.5			1, 3-5, 7, 15 1, 3-5, 7, 11, 12, 15	

Table 2. Tools and Test Equipment for Fire Pump Subsystem.

Tools or Test Equipment Ref Code	Maintenance Level	Nomenclature	National Stock Number	Tool Number
1	F	Tool Kit, General Mechanic's, Rail And Marine	5180-00-629-9783	(50980) SC-5180-90-CL-N55
2	F	Tool Set, Measuring, Machinist's	5280-00-278-9919	(19204) SC5280-95CLA01
3	F	Wrench, Torque 1/2" DR, 30-200 Ft-lb	5120-01-125-5190	(05047) B107.14
4	F	Wrench, Torque, 3/8" DR, 5-75 Ft-lb	5120-01-355-1734	(55719) QD2FR75
5	F	Lifting Sling	3940-01-183-9412	(15434) 3375958
6	F	Press, Hydraulic, Portable	4940-00-360-2752	(81349) MIL-P-12199
7	F	Hoist, Chain	3950-00-235-4235	(81349) M1LH904CLASS1T YPEHSTYLE1
8	F	Tool Kit, Electrical Repair	5180-00-391-1087	(80244) 5180-00-391-1087
9	F	Thermometer, Infrared	6685-01-480-2988	(3Q8A5) ST652
10	F	Puller, Mechanical	5120-00-499-1489	(55719) CJ83C
11	F	Drill, electric Portable 3/8" Cap	5130-00-473-6224	(80244) 5130-00-473-6224
12	F	Drill Set, Twist, Str Short Shank, SE 2 of 29, Frac sizes 1/16" to 1/2" by 64ths	5133-00-293-0983	(81348) GGG-D-751
13	F	Pliers Set, Retaining Ring	5120-00-595-9551	(79588) 407
14	F	Insulation Tester	6625-01-223-2980	(72915) 8174880
15	F	Wrench, Strap		

Table 3. Remarks for Fire Pump Subsystem.

Remark Code	Remarks
A	Depot Level Maintenance will be accomplished through the use of commercial activities on as needed basis or through the On-Condition Cyclic Maintenance (OCCM) Program in accordance with AR 750-1, Para 6-16.
B	Annually: Inspect the coupling grid member for damage or uneven wear.

END OF WORK PACKAGE

**FIELD AND SUSTAINMENT MAINTENANCE
FIRE PUMP SUBSYSTEM
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST**

SCOPE

This work package lists expendable and durable items that you will need to operate and maintain the fire pump subsystem. This list is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items), CTA 50-909, Field and Garrison Furnishings and Equipment or CTA 8-100, Army Medical Department Expendable/Durable Items.

Explanation of Columns

Column (1) Item No. This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., Use brake fluid (WP 0098, Item 5)).

Column (2) Level. This column identifies the lowest level of maintenance that requires the listed item (F = Maintainer or ASB).

Column (3) National Stock Number (NSN). This is the NSN assigned to the item which you can use to requisition it.

Column (4) Item Name, Description, Part Number/(CAGEC). This column provides the other information you need to identify the item. The last line below the description is the part number and the Commercial and Government Entity Code (CAGEC) (in parentheses).

Column (5) U/I. Unit of Issue (U/I) code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.”

Table 1. Expendable/Durable Supplies and Materials List.

(1) ITEM No.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, PART NUMBER/(CAGEC)	(5) U/I
1	F	8030-00-549-5024	Antiseize Compound 10662267 (18876)	TU
2	F	7920-00-205-2401	Brush, Cleaning, Tool And Parts, Fiber, Tampico 7920-00-205-2401 (80244)	EA
3	F	8030-00-231-2345	Corrosion Preventive Compound, Class 1, Grade1 945011 (19203)	CN
4	F	7930-00-880-4454	Dishwashing Compound, Hand, Liquid, Nonabrasive 7930-00-880-4454 (83421)	BT
5	F	6850-00-110-4498	Dry Cleaning Solvent, Liquid, Type II AA59601-2C (58536)	BT
6	F		Flange, Pipe (Bench Stock)	EA
7	F	5330-00-641-1193	Gasket Material, Asbestos HH-P-46, Class 1 HH-P-46 (81348)	SH
8	F	8415-00-266-8677	Gloves, Rubber, Industrial MIL-DTL-32066 (81349)	PR
9	F	9150-00-180-6382	Grease, General Purpose, Corrosion And Water Resistant MIL-PRF-24139 (81349)	CN
10	F	4930-00-287-5419	Grease Gun, Type 2, Class C, Style 2 And 3 GGG0591 (81348)	EA
11	F	9150-00-111-3199	Lubricating Oil, 10W Grade, Type 1 M21260-3-10W (81349)	CN
12	F	7240-01-094-4305	Pail, Utility, Plastic, Polyethylene, High Density 450 (0REY5)	EA
13	F	5350-00-186-8858	Paper, Abrasive A-A-1049 TY2 (80244)	PG
14	F	7920-00-205-1711	Rag, Wiping, Cotton, Unbleached DDD-R-30 (81348)	EA
15	F	8030-01-014-5869	Sealing Compound, Type 2, Grade N, Thread Locking Compound 2A269 (25795)	BT
16	F	5365-01-203-0284	Shim, 0.005 in, A34B, Non-Circular W/Rounded Corners 3026312 (15434)	EA

Table 1. Expendable/Durable Supplies and Materials List - Continued.

(1) ITEM No.	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) ITEM NAME, DESCRIPTION, PART NUMBER/(CAGEC)	(5) U/I
17	F	5365-01-203-0283	Shim, 0.0010 in, A34B, Non-Circular W/Rounded Corners 3026313 (15434)	EA
18	F	4921-00-381-2733	Straight Edge 692117 (10001)	EA
19	F		Studs, Alignment (Bench Stock)	EA
20	F	2835-00-015-0246	Tag, Warning S8145-55 (70210)	EA
21	F	5970-00-185-8531	Tape, Insulation, Electrical, Pressure Sensitive A-A-2094 1 IN. X 85 FT (58536)	RO

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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is ODISC4.						Use Part II (reverse) for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).		DATE Date you filled out this form.	
TO: <i>(Forward to proponent of publication or form) (Include ZIP Code)</i> U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LC-LMPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630						FROM: <i>(Activity and location) (Include ZIP Code)</i> Your mailing address			
PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS									
PUBLICATION/FORM NUMBER TM 55-1905-223-24-12						DATE 01 July 2009		Title Maintenance Manual for Fire Pump Subsystem Landing Craft Utility (LCU)	
ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO. *	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Provide exact wording of recommended changes, if possible).			
<i>*Reference to line numbers within the paragraph or subparagraph.</i>									
TYPED NAME, GRADE OR TITLE Your Name				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION			Signature Your Signature		

TO: (Forward direct to addressee listed in publication) U. S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LC-LMPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630				FROM: (Activity and location) (Include ZIP Code) Your address				DATE Date you filled out this form	
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PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION	
<div style="font-size: 100px; opacity: 0.5;">SAMPLE</div>									
PART III – REMARKS (Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)									
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TYPED NAME, GRADE OR TITLE				TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION			SIGNATURE		

By Order of the Secretary of the Army:

Official:

A handwritten signature in black ink, reading "Joyce E. Morrow". The signature is written in a cursive, flowing style.

JOYCE E. MORROW
*Administrative Assistant to the
Secretary of the Army*
0807301

GEORGE W. CASEY, JR.
General, United States Army
Chief of Staff

DISTRIBUTION:

To be distributed in accordance with the initial distribution number (IDN) 253661, requirements for TM 55-1905-223-24-12.

The Metric System and Equivalents

Linear Measure

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

Weights

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

Liquid Measure

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

Square Measure

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

Cubic Measure

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

Approximate Conversion Factors

<i>To change</i>	<i>To</i>	<i>Multiply by</i>	<i>To change</i>	<i>To</i>	<i>Multiply by</i>
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.983	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29.573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C
----	------------------------	----------------------------	---------------------	----

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