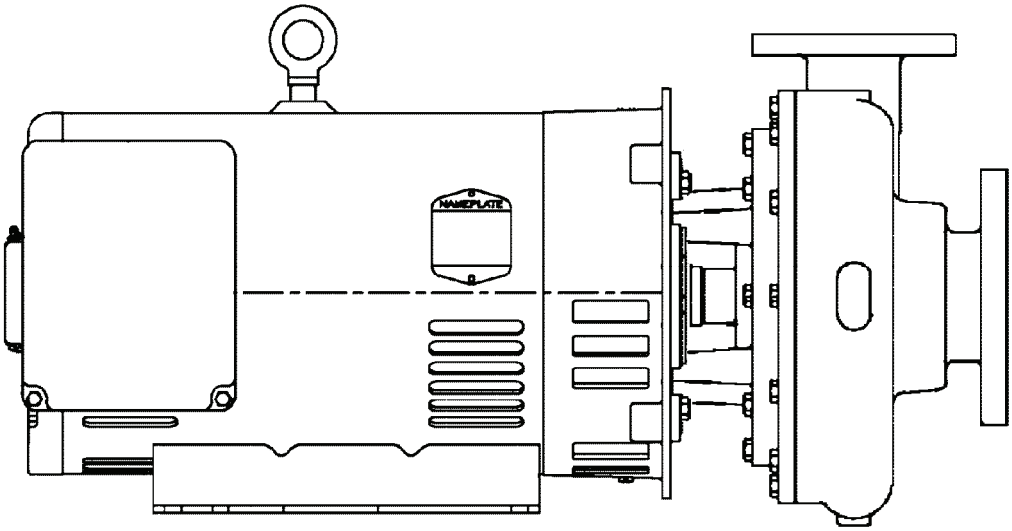
*TM 55-1905-223-24-13

TECHNICAL MANUAL

FIELD AND SUSTAINMENT MAINTENANCE MANUAL
FOR

BILGE/BALLAST PUMP

LANDING CRAFT UTILITY (LCU)
NSN 1905-01-154-1191



*Supersedes TM 55-1905-223-24-13, 17 January 1989, including all changes.

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 2009

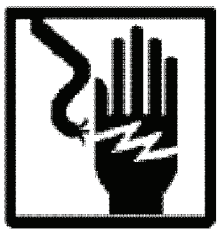
WARNING SUMMARY

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

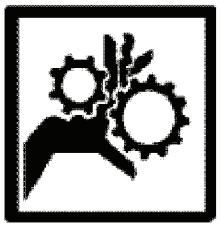
This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety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

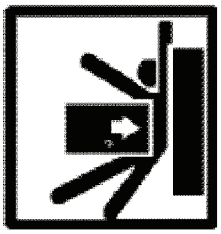


ELECTRICAL - electrical wire to hand with electricity symbol running through hand shows that shock hazard is present.



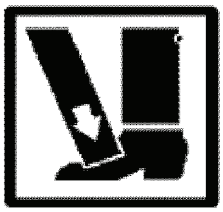
MOVING PARTS - hand with fingers caught between gears shows that the moving parts of the equipment present a danger to life or limb.

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



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

EXPLANATION OF SAFETY WARNING ICONS - Continued



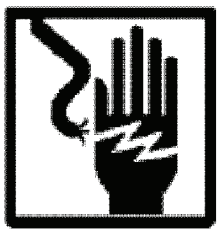
HEAVY PARTS- foot with heavy object on top shows that heavy parts can crush and harm.

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

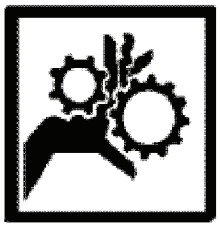
WARNING



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



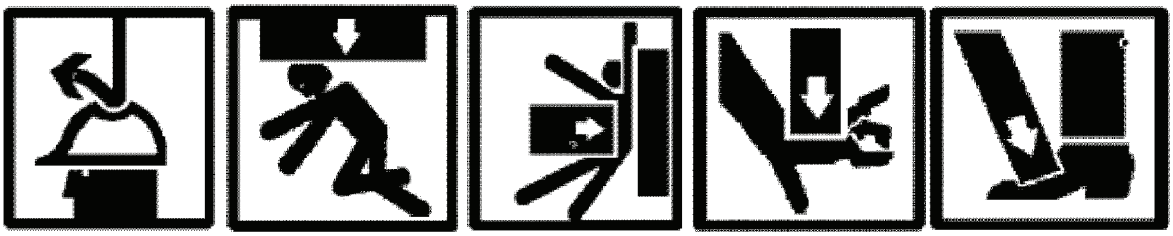
WARNING

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



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 55-1905-223-24-13 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 20, CONSISTING OF THE FOLLOWING:

*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

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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://aeps.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 55-1905-223-24-13, 17 January 1989, including all changes.

TABLE OF CONTENTS

TABLE OF CONTENTS – Continued

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.

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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 BILGE/BALLAST PUMP

GENERAL INFORMATION, EQUIPMENT DESCRIPTION AND THEORY OF OPERATION

FIELD AND SUSTAINMENT MAINTENANCE FOR BILGE/BALLAST PUMP GENERAL INFORMATION

SCOPE

The scope of this manual is as follows:

Type of Manual: Field and Sustainment maintenance manual.

Model Number and Equipment Name: Bilge/Ballast Pump: Model ZCH2, Size 4x3C. Motor: Type 286JM.

Purpose of Equipment: To provide water to the system from the sea chest in the vessel's hull bottom for the function of bilge drainage and ballast for vessel stability.

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 Bilge/Ballast Pump 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. Disassembly for repacking of equipment for shipment or short term storage, is covered in WP 0010.

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 0019 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 BILGE/BALLAST PUMP EQUIPMENT DESCRIPTION AND DATA

GENERAL DESCRIPTION:

The bilge/ballast subsystem consists of a primary pump and an auxiliary pump assembly, associated tanks, piping, valves, manifolds, indicators, alarms, and gauges. The pump provides water to the system from the sea chest in the vessel's hull bottom and transfers it through the piping to the seven ballast tanks as controlled by valve alignment.

CHARACTERISTICS, CAPABILITIES AND FEATURES:

A very broad view of the bilge/ballast pump subsystem is as follows:

Characteristics
- Motor driven, electric – 40 hp.
- Pump, centrifugal – 750 gpm.

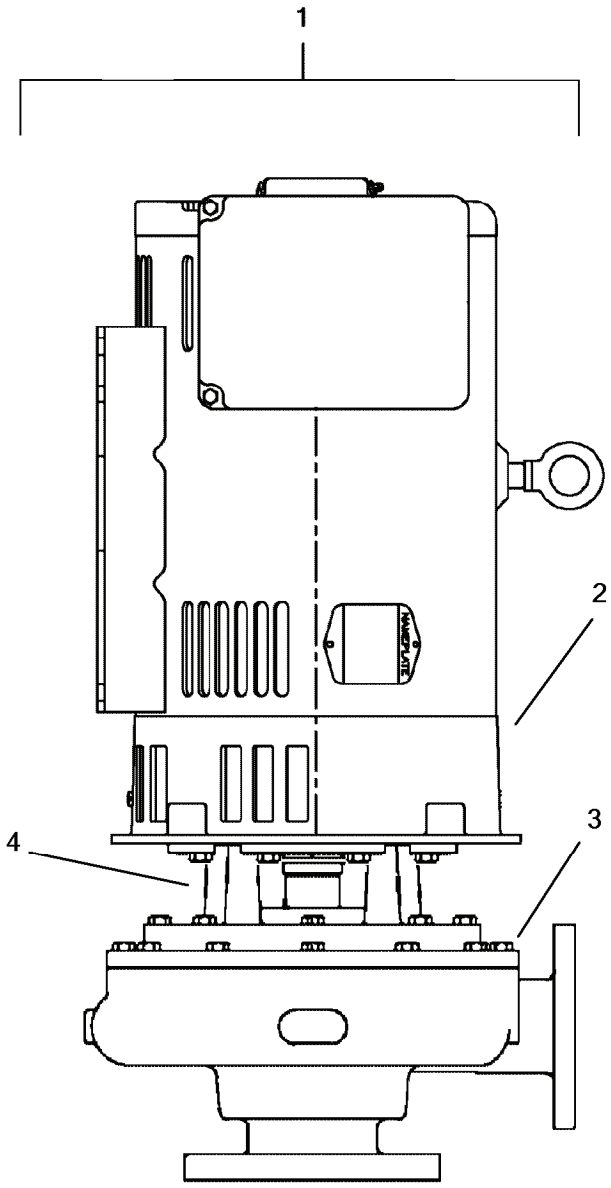
Capabilities and Features
- Can operate from one of two pump assemblies.
- Controlled from the pump or engineering control center.
- Transfers water to seven ballast tanks to provide vessel stability.
- Provides for bilge drainage.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

There are three ballast tanks forward in the vessel, two midships, and two aft. The bilge/ballast subsystem provides two functions: bilge drainage, and vessel stability. Start and stop controls for the pump are located on or near the pump and in the engineering control center (reference TM 55-1905-223-10). The major components of the bilge/ballast pump subsystem are the centrifugal pump, alternating current motor and motor adapter. The primary pump is located in the engine room. The pump is rated at 750 gpm at 150 ft TDH (total discharge head). Reference Figure 1 for major components of the primary bilge/ballast pump. See TM 55-1905-223-24-12 for information on the Fire Pump Subsystem.

EQUIPMENT DATA

Characteristics and reference data are provided in Table 1. Also see the equipment data given in the operator's manual, TM 55-1905-223-10.



LEGEND

1. Bilge/Ballast Pump
2. Alternating Current Motor
3. Centrifugal Pump
4. Motor Adapter

Figure 1. Bilge/Ballast Pump.

Table 1. Equipment Data

Characteristics	Reference Data
Bilge/Ballast	
Pump	
Type	ZCH2
Manufacturer	Ampco Pumps
Size	4 X 3 X 7.875 inches
rpm	3,600 - max.
Mounting	Vertical
Rate	750 gpm @ 150 psi
Liquid	Raw Seawater
Seal	Mechanical
Driver Source	40 hp electric motor D.P. vertical
Motor	JMM2538T
Enclosure	Open Drip-Proof (ODP) Vertical Enclosure
rpm	3,500
hp	40
SPEC	39N090W857H1
Nameplate	F
SERV. FAC	1.15
Code	JMM2538T
P.F.	91
Frame	286JM
Operating Temperature	70°F (21°C)
Volts	230/460
Hertz	60
Full Load Amps	90/45
Phase	3
INS. CL.	B
Design	B
Rating	40C AMB-CONT
FL. EFF.	91.7

END OF WORK PACKAGE

FIELD AND SUSTAINMENT MAINTENANCE FOR BILGE/BALLAST PUMP THEORY OF OPERATION

GENERAL

The bilge/ballast system is pressurized by a close coupled electric pump with associated piping, valves, indicator gauges, and manifolds. With valve alignment arranged for ballasting, the pump will take suction from the sea chest and discharge water through the piping into each of the seven ballast tanks until filled to the desired capacity. With the valve alignment arranged for trimming the vessel, the pump will move water through the system to strategic tanks or discharge the water directly overboard until the vessel has reached the desired trim. With valve alignment arranged to pump bilges, the pump will take suction through a pipe-mounted strainer located in the lowest accessible point in the bilges of the engine room, auxiliary machinery room, bowthruster machinery room, and tunnel. Water will discharge directly overboard (reference TM 55-1905-223-24-18, Basic Craft Hull and Outfitting).

Bilge/Ballast Pump Assembly. The bilge/ballast pump is controlled locally on or near the pump and in the engine room control booth. Pressing the START pushbutton energizes the electric motor, which is close coupled to the pump. The shaft in turn drives the pump, which takes a suction from the sea chest, bilge strainer, or ballast tank according to desired service.

One of two fire pumps serves as an auxiliary bilge/ballast pump. Reference TM 55-1905-223-24-12, Fire Pump Subsystem.

END OF WORK PACKAGE

CHAPTER 2

FIELD AND SUSTAINMENT MAINTENANCE FOR BILGE/BALLAST PUMP

TROUBLESHOOTING PROCEDURES

FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS FOR BILGE/BALLAST PUMP TROUBLESHOOTING SYMPTOM INDEX

TROUBLESHOOTING

Both a symptom index and a troubleshooting table (WP 0005, Table 1) are provided. The symptom index will help you locate the information you need for troubleshooting.

SYMPTOM INDEX

WP 0005, Table 1 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 AND SUSTAINMENT MAINTENANCE INSTRUCTIONS FOR BILGE BALLAST PUMP TROUBLESHOOTING PROCEDURES

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0019, Item 1)

Personnel Required

Watercraft Engineer 88L

References

WP 0010
WP 0011
WP 0012
WP 0013
WP 0015
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).

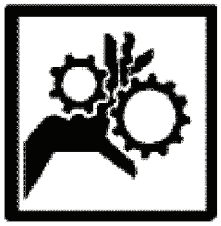
Table 1. Troubleshooting Procedure.

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 to 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 0015). 2. Replace centrifugal pump impeller and wear ring (WP 0015).
	6. Alternating current motor rotating in the wrong direction.	Properly wire alternating current motor (WP 0011).

Table 1. Troubleshooting Procedure - 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 to high.	Check for proper Valve alignment (TM 55-1905-223-10).
	4. Partially plugged Impeller.	Disassemble centrifugal pump and clear impeller. (WP 0015).
	5. Defective Impeller, wear ring or mechanical seal.	Repair centrifugal pump unit (WP 0015).
	6. Alternating current motor rotating in the wrong direction.	Properly wire alternating current motor. (WP 0011).
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 unit (WP 0015).
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. Troubleshooting Procedure - Continued

SYMPTOM/MALFUNCTION	POSSIBLE CAUSE	CORRECTIVE ACTION
4. Pump operates normally for a short time, then stops pumping - 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.	
		2. Inspect for restricted cooling air flow to alternating current motor. 3. Refer to troubleshooting symptom/malfunction 5 for excessive amperage.
5. Pump Draws Excessive Amperage.	1. Electrical problems.	Test centrifugal pump alternating current motor (WP 0011).
	2. Bent pump motor shaft.	Replace alternating current motor (WP 0012).
	3. Impeller and wear rings damage.	Repair centrifugal pump (WP 0015).
	4. Defective mechanical seal.	Repair centrifugal pump (WP 0015).
	5. Alternating current motor bearing failure.	Repair alternating current motor (WP 0013).
	6. Distorted centrifugal pump casing.	Disassemble centrifugal pump and replace all defective parts (WP 0015).
6. Unusual noise or Vibration.	1. Loose foundation bolts.	Tighten foundation bolts (WP 0010).
	2. Bent pump motor shaft.	Replace alternating current motor (WP 0012).

END OF WORK PACKAGE

CHAPTER 3

FIELD AND SUSTAINMENT MAINTENANCE FOR BILGE/BALLAST PUMP

PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) MAINTENANCE INSTRUCTIONS

FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS FOR BILGE/BALLAST PUMP 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 0007, 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 is this column are for reference. If your equipment does not perform as required, refer to WP 0004 and WP 0005, 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 0007).

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 it 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
BILGE/BALLAST PUMP
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0019, Item 1)

Materials/Parts

Gloves, Rubber (WP 0020, Item 7)
Grease (WP 0020, Item 8)
Grease Gun (WP 0020, Item 9)
Rags, Wiping (WP 0020, Item 12)
Tag, Warning (WP 0020, Item 16)

Personnel Required

Watercraft Engineer 88L

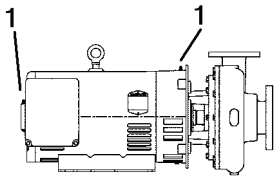
References

LO 55-1905-223-12

Equipment Condition

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/Serviced	Procedures	Equipment not Ready/Available If:
1	Semiannually	Centrifugal Pump Unit	Lubricate motor bearings (Figure 1, Item 1). Refer to LO 55-1905-223-12. Check for leaks.  Figure 1. Motor Bearings.	Class III leakage.

END OF WORK PACKAGE

CHAPTER 4

FIELD AND SUSTAINMENT MAINTENANCE FOR BILGE/BALLAST PUMP

MAINTENANCE INSTRUCTIONS

FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS FOR BILGE/BALLAST PUMP MAINTENANCE INSTRUCTION INTRODUCTION

GENERAL

This chapter provides field and sustainment maintenance for the bilge/ballast pump. The tasks are for test, replace and repair of components. These tasks are addressed in the following work packages.

END OF WORK PACKAGE

FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS FOR BILGE/BALLAST PUMP 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.

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 bilge/ballast pump is in use.

Pre-Start Checks

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).

3. Check alternating current motor lubrication (WP 0007).

Pre-Start Checks- Continued

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 0010).

END OF WORK PACKAGE

FIELD MAINTENANCE
BILGE/BALLAST PUMP
REPLACE

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0019, Item 1)
Wrench, Torque (30-200 Ft-lb) (WP 0019, Item 2)
Lifting Sling (WP 0019, Item 4)
Hoist, Chain (WP 0019, Item 6)
Tool Kit, Electrical Repair (WP 0019, Item 7)

Materials/Parts

Flange, Pipe (WP 0020, Item 5)
Gasket Material (WP 0020, Item 6)
Pail, Utility (WP 0020, Item 10)
Rag, Wiping (WP 0020, Item 12)
Tag, Warning (WP 0020, Item 16)

Personnel Required

Watercraft Engineer 88L

References

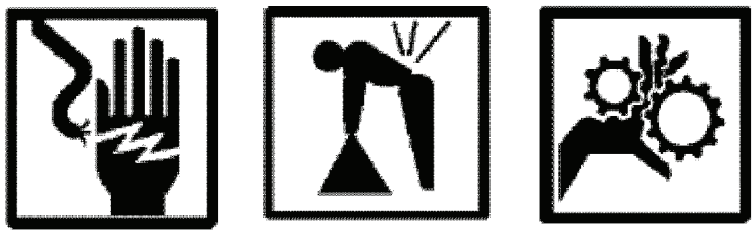
TM 55-1905-223-10

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 2) remove cover machine bolts (Figure 1, Item 1) and cover.

REMOVAL - Continued

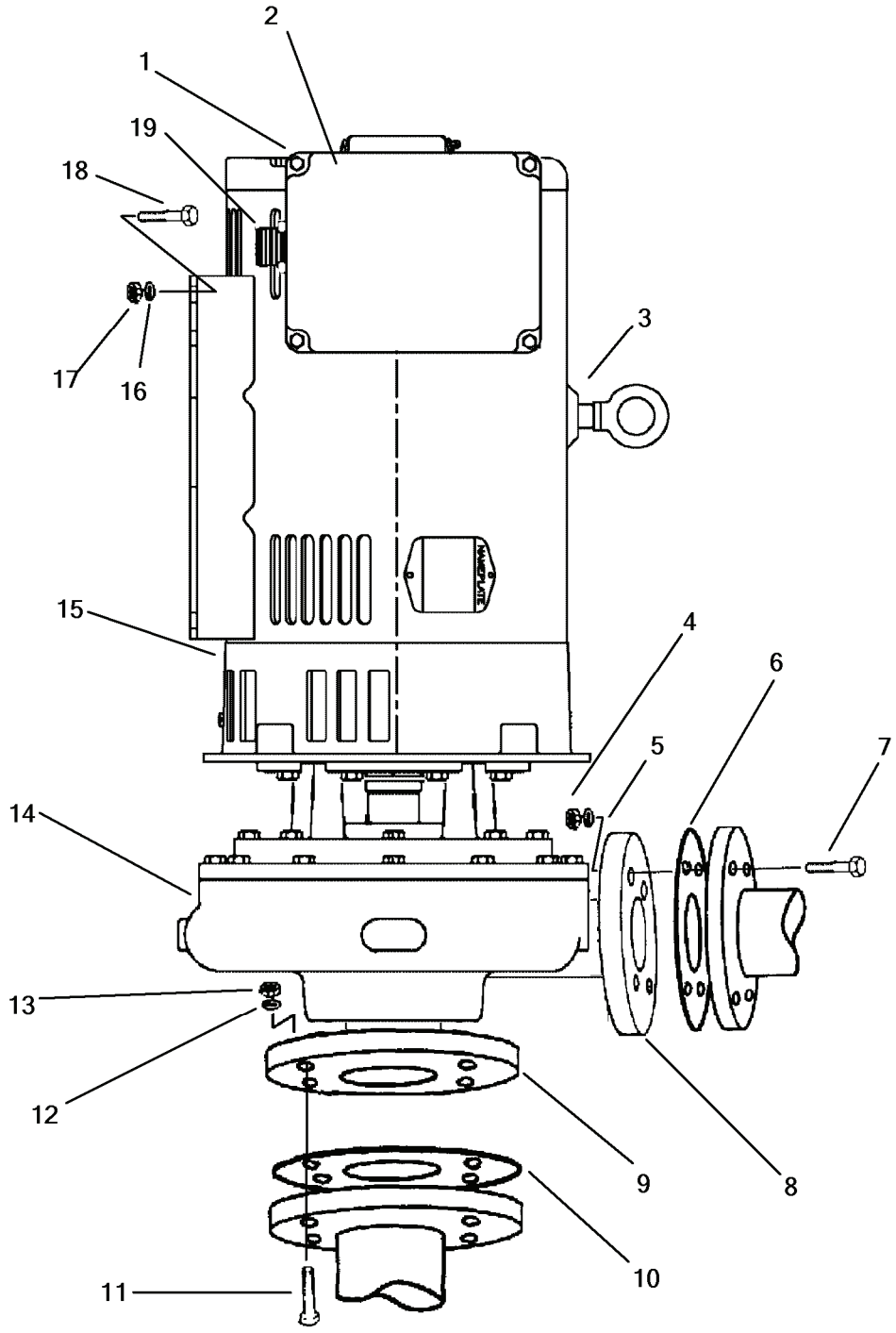
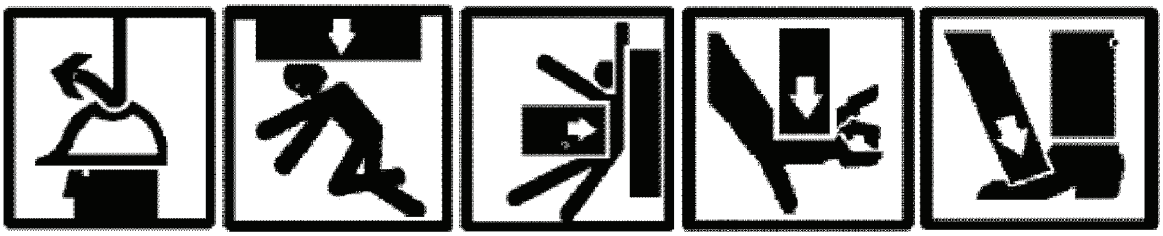


Figure 1. Bilge/Ballast Pump Unit Replacement.

REMOVAL - Continued

3. Using a multimeter, verify no electrical power at motor.
4. Disconnect and tag electric cables from motor (Figure 1, Item 15).
5. Loosen stuffing tube (Figure 1, Item 19) and remove electrical cables from conduit box.
6. Place a utility pail under discharge flange (Figure 1, Item 8). Loosen four bolts (Figure 1, Item 7) and nuts (Figure 1, Item 4); drain centrifugal pump (Figure 1, Item 14).
7. Place utility pail under suction flange (Figure 1, Item 9). Loosen eight bolts (Figure 1, Item 11); drain remaining fluid from centrifugal pump (Figure 1, Item 14).
8. Remove suction and discharge (Figure 1, Items 8 and 9) flange mounting hardware (Figure 1, Items 4, 5, 7, 11, 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 for removal. Remove all slack in lifting sling to support centrifugal pump unit.
11. Remove foundation mounting hardware (Figure 1, Items 16, 17 and 18) and pump mounting hardware if applicable.
12. Remove centrifugal bilge/ballast pump (Figure 1, Item 3) from foundation.
13. Remove suction and discharge flange gasket material (Figure 1, Item 6 and 10).
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

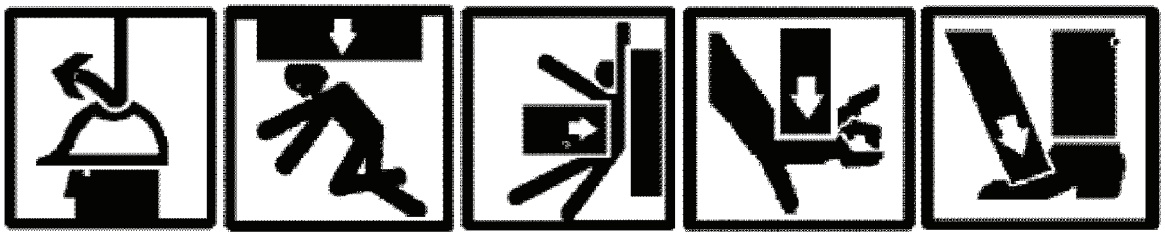
Always ensure affected circuits have been secured, locked out and tagged out. Performing maintenance with circuits energized presents a shock hazard and may result in death or injury to personnel or equipment damage.

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, Items 6 and 10) 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 bilge/ballast pump (Figure 1, Item 3) into place.

3. Realign pump unit to foundation, suction, and discharge piping flanges. Position gasket (Figure 1, Item 6) at discharge flange (Figure 1, Item 8).

4. Install foundation mounting hardware (Figure 1, Items 16, 17 and 18) and pump mounting hardware if applicable.

5. Install suction and discharge flange (Figure 1, Items 8 and 9) mounting hardware (Figure 1, Items 4, 5, 7, 11, 12 and 13).

INSTALLATION - Continued

6. Install electric cables through stuffing tube (Figure 1, Item 19) into conduit box.
7. Connect electrical cables to motor leads according to tags.
8. Install cover (Figure 1, Item 2), and bolts (Figure 1, Item 1) 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

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0019, Item 1)
Tool Kit, Electrical Repair (WP 0019 Item 7)
Insulation Tester (WP 0019, Item 12)

Materials/Parts

Tag, Warning (WP 0020, Item 16)

Personnel Required

Watercraft Engineer 88L (2)

References

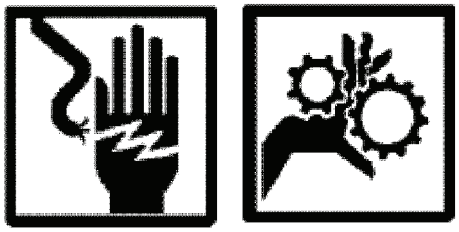
WP 0012
TM 55-1905-223-10
TM 55-1905-223-24-18-1/2

Equipment Condition

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

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 2) remove two cover machine bolts (Figure 1, Item 1) and cover.
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 2).

TEST - Continued

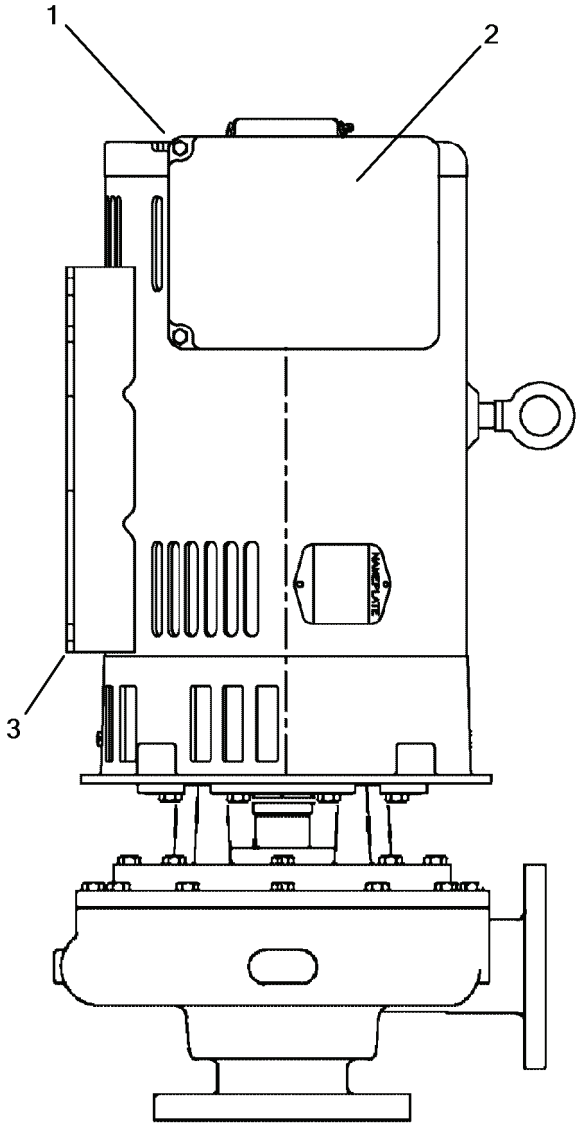


Figure 1. Test Alternating Current Motor.

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 0012).

TEST - Continued

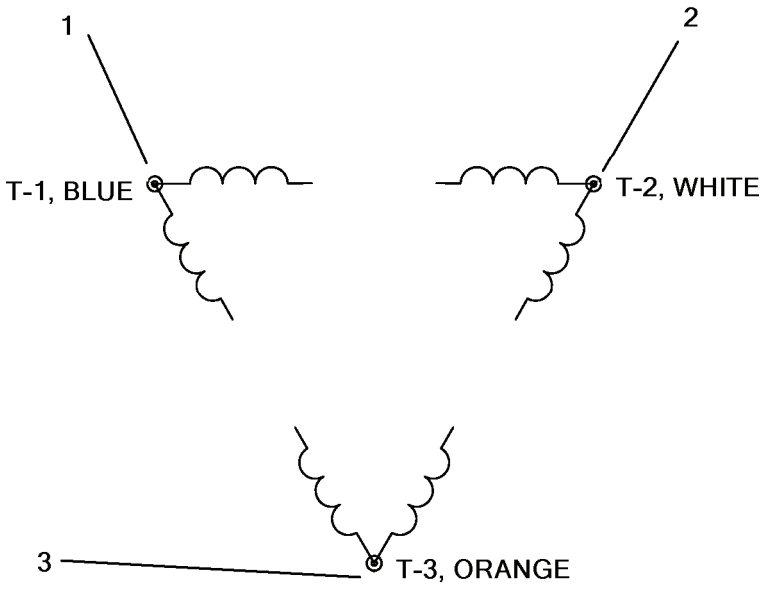
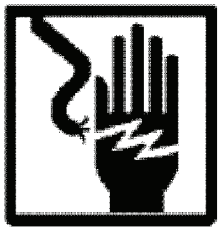


Figure 2. Test Alternating Current Motor Windings.

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 0012).
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 then +/- 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 then +/- 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 then +/- 10% of 230 volts.

    d. If ratings are not less then +/- 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 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

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0019, Item 1)
Wrench, Torque (30-200 Ft-lb) (WP 0019, Item 2)
Wrench, Torque Kit (5-75 Ft-lb) (WP 0019, Item 3)
Lifting Sling (WP 0019, Item 4)
Hoist, Chain (WP 0019, Item 6)
Puller, Mechanical (WP 0019, Item 9)

Materials/Parts

Motor, Alternating Current ODP P/N JMM2538T
Centrifugal Pump Parts Kit, P/N GS8107720
Pump Shaft Sleeve, P/N BX8107641
Dishwashing Compound (WP 0020, Item 3)

Personnel Required

Watercraft Engineer 88L (2)

References

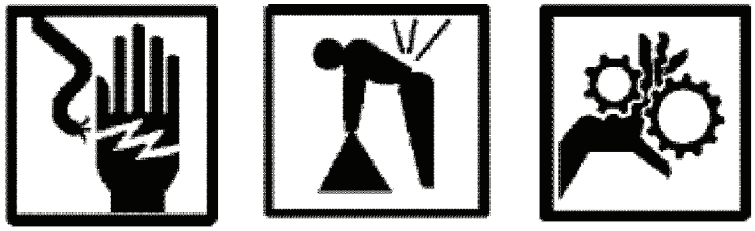
WP 0010

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 bilge/ballast pump (WP 0010).
2. Move bilge/ballast pump to a clean and level workstation.
3. Remove twelve bolts (Figure 1, Item 17) from backplate cover (Figure 1, Item 10).

REMOVAL - Continued

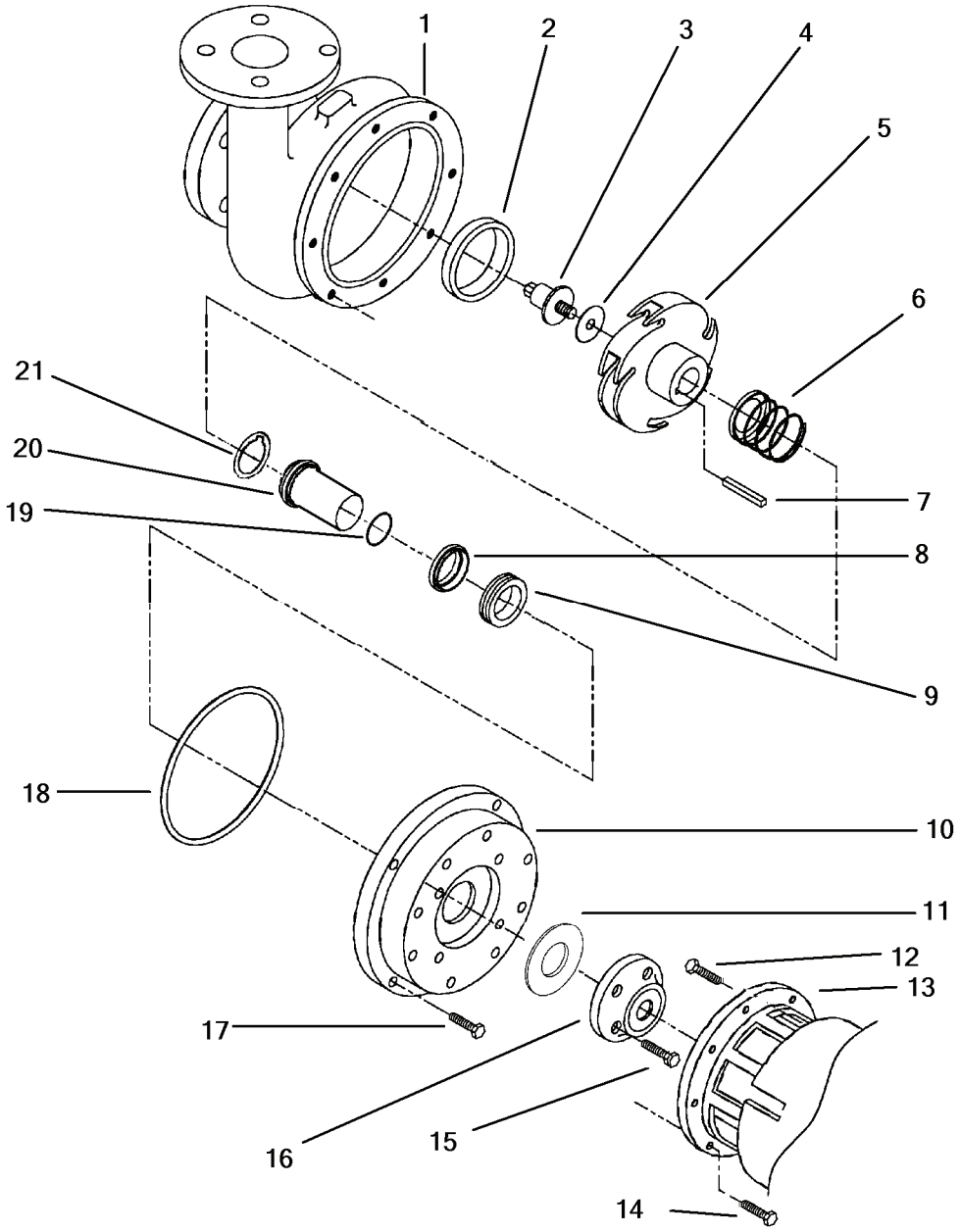


Figure 1. Alternating Current Motor Replacement.

REMOVAL - Continued

4. Using two jacking bolts, remove pump casing (Figure 1, Item 1) and casing gasket (Figure 1, Item 18).
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 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) and gasket (Figure 1, Item 21).
9. Remove eight bolts (Figure 1, Item 14) and slide backplate cover (Figure 1, Item 10) with mechanical seal (Figure 1, Items 8, 9, 19, and 20) off shaft.
10. Remove O-ring (Figure 1, Item 19), ceramic insert (Figure 1, Item 8) and shaft sleeve (Figure 1, Item 20) from backplate cover (Figure 1, Item 10).
11. Remove four bolts (Figure 1, Item 15) from stuffing box (Figure 1, Item 16).
12. Remove stuffing box (Figure 1, Item 16), stuffing box gasket (Figure 1, Item 11) and stationary seal (Figure 1, Item 9) from backplate cover (Figure 1, Item 10).
13. Remove 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).

END OF TASK

INSTALLATION

1. Install motor adapter (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 (Figure1, 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 19) into shaft sleeve (Figure 1, Item 20).

INSTALLATION - Continued

6. Place a small amount of dish detergent on shaft sleeve (Figure 1, Item 20) and install ceramic insert (Figure 1, Item 8). Install shaft sleeve (Figure 1, Item 20) 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 21) 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 18) in position on backplate cover (Figure 1, Item 10).
12. Align pump casing (Figure 1, Item 1) with gasket (Figure 1, Item 18) and casing backplate (Figure 1, Item 10); secure with twelve bolts (Figure 1, Item 17).
13. Install bilge/ballast pump (WP 0010).

END OF TASK

END OF WORK PACKAGE

FIELD MAINTENANCE
MOTOR, ALTERNATING CURRENT
REPAIR

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0019, Item 1)
Lifting Sling (WP 0019, Item 4)
Hoist, Chain (WP 0019, Item 6)
Puller, Mechanical (WP 0019, Item 9)

Materials/Parts

Spring Tension Washer, P/N HW5100A08
Lock Washer, P/N HW1005W12
Rag, Wiping (WP 0020, Item 12)
Rod, Threaded, 5/16 (WP 0020, Item 15)

Personnel Required

Watercraft Engineer 88L (2)

References

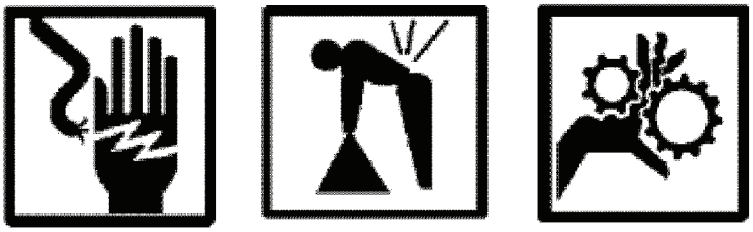
WP 0010
WP 0012

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 bilge/ballast pump (WP 0010).
2. Move bilge/ballast pump to clean and level work station.

DISASSEMBLY - Continued

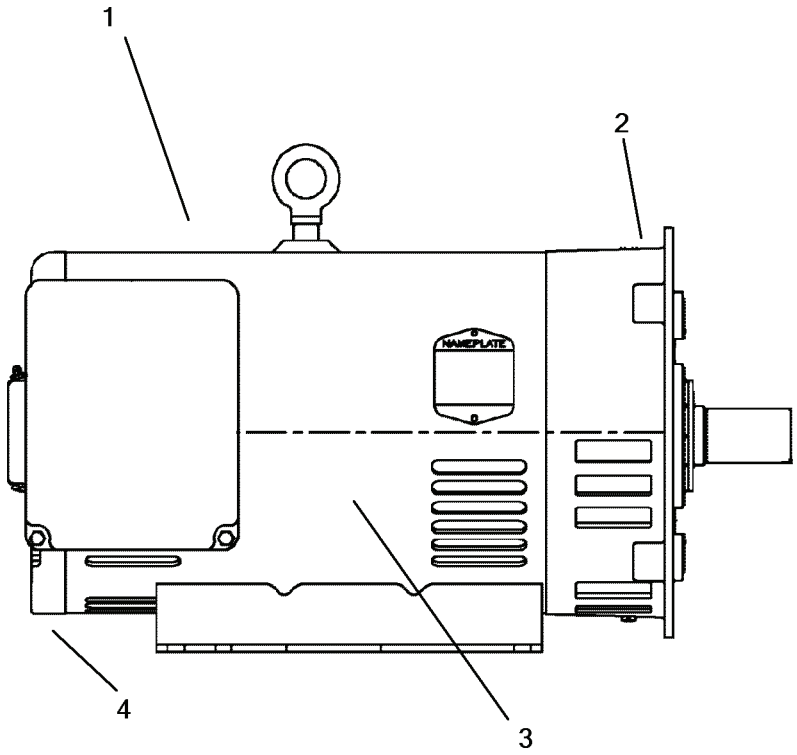


Figure 1. Alternating Current Motor.

3. Disassemble centrifugal pump (WP 0012).

4. Remove four bolts (Figure 3, Item 13), washers (Figure 3, Item 14), splashplate (Figure 3, Item 11) and slinger (Figure 3, Item 12).

5. Scribe both endbells (Figure 1, Items 2 and 4) to stator case (Figure 1, Item 3) for assembly.

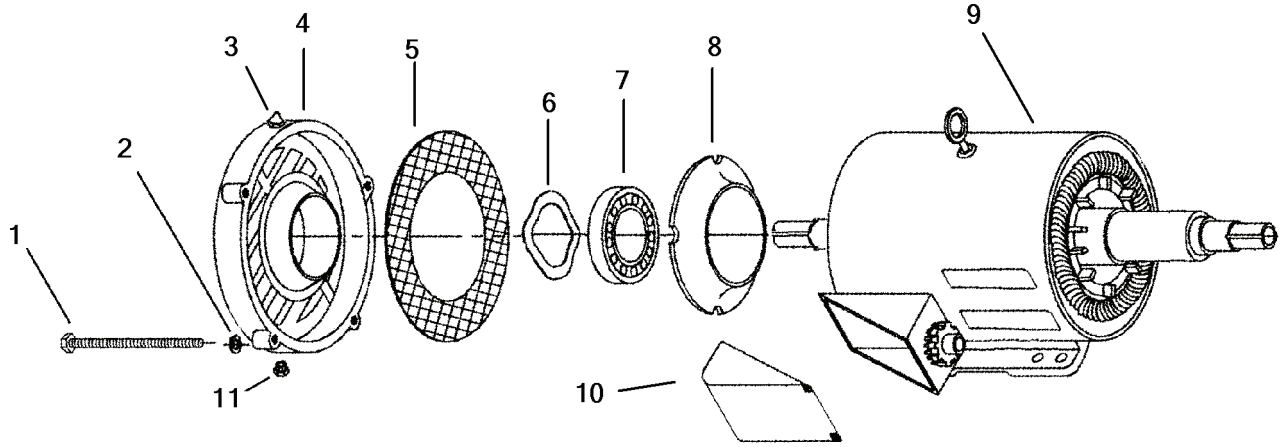


Figure 2. Open Face Endbell Disassembly.

6. Remove four bolts with washers (Figure 2, Items 1 and 2).

DISASSEMBLY - Continued

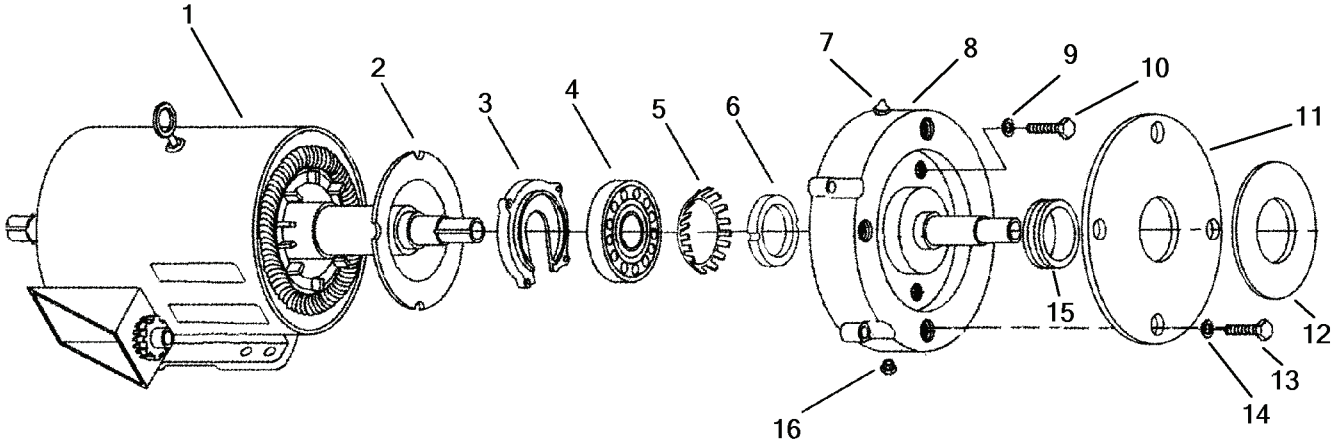


Figure 3. Drive Side Endbell Disassembly.

7. Remove open face endbell (Figure 2, Item 4) with screen (Figure 2, Item 5) and remove spring tension washer (Figure 2, Item 6).
8. Scribe baffle plate (Figure 2, Item 8) to stator case (Figure 2, Item 9) for assembly.
9. Using a puller, remove annular ball bearing (Figure 2, Item 7).
10. Remove baffle plate (Figure 2, Item 8).
11. Remove four hexagon head screws (Figure 3, Item 10) with washers (Figure 3, Item 9).
12. Remove dirt and liquid deflector (Figure 3, Item 15).
13. Gently remove drive side endbell (Figure 3, Item 8) and scribe baffle plate (Figure 3, Item 2) to stator case (Figure 3, Item 1) for assembly.
14. Remove ball bearing retainer (Figure 3, Item 3) from motor shaft.
15. Locate tab of lock washer (Figure 3, Item 5) bent into groove of ball bearing lock nut (Figure 3, Item 6); push out to same distance as remaining tabs.
16. Unscrew ball bearing lock nut (Figure 3, Item 6); remove nut and lock washer (Figure 3, Item 5).
17. Using a bearing puller, remove annular ball bearing (Figure 3, Item 4).
18. Remove baffle plate (Figure 3, Item 2).
19. Remove plugs (Figure 2, Item 11 and Figure 3, Item 16).
20. Remove lubrication fittings (Figure 2, Item 3 and Figure 3, Item 7).

END OF TASK

REPAIR

1. Clean endbells with lint free rags.
2. Repair of the alternating current motor (Figure 1, Item 1) is by replacement of any worn or damaged components and the following mandatory parts:
   a. Spring Tension Washer (Figure 2, Item 6).
   b. Lock Washer (Figure 3, Item 5).

END OF TASK

ASSEMBLY

1. Replace plugs (Figure 4, Item 16 and Figure 5, Item 11).
2. Replace lubrication fittings (Figure 4, Item 7 and Figure 5, Item 3).
3. Set baffle plate (Figure 4, Item 2) in position on motor shaft.
4. Press annular ball bearing (Figure 4, Item 4) onto motor shaft.
5. Replace lock washer (Figure 4, Item 5); secure in position with ball bearing lock nut (Figure 4, Item 6).

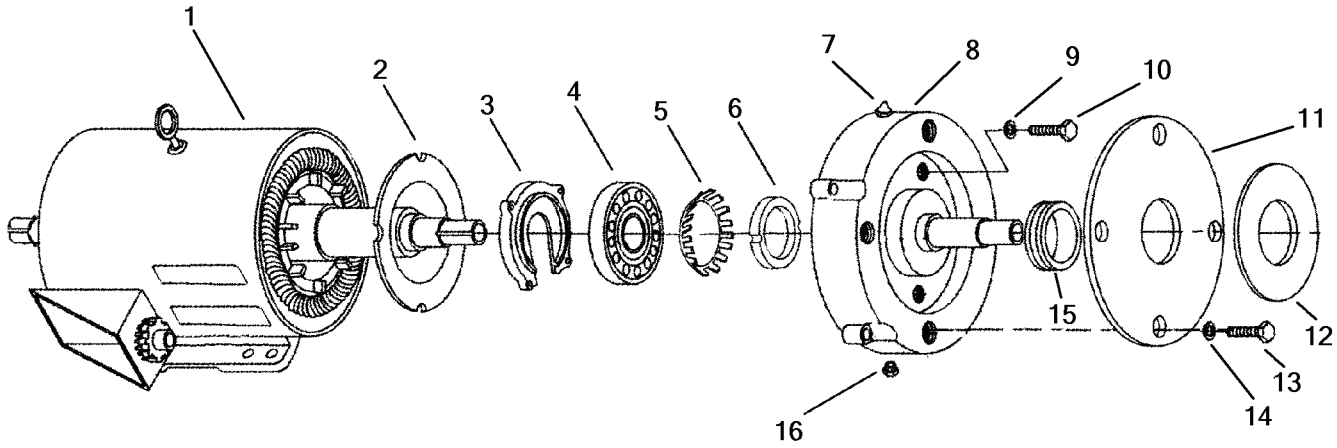


Figure 4. Drive Side Endbell Assembly.

6. Locate groove of ball bearing lock 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.
7. Set ball bearing retainer (Figure 4, Item 3) on motor shaft between baffle plate (Figure 4, Item 2) and bearing (Figure 4, Item 4).
8. Install four 5/16x4 inch threaded rods (alignment studs) into bolt holes of retaining ring (Figure 4, Item 3).

ASSEMBLY - Continued

9. Place drive side endbell (Figure 4, Item 8) in position on motor shaft using alignment studs as a guide.

10. Install nuts on alignment studs and tighten evenly using cross pattern until bearing (Figure 4, Item 4) is fully seated into endbell (Figure 4, Item 8).

11. Remove alignment studs one at a time and replace with bolts (Figure 4, Item 10) and lock washers (Figure 4, Item 9).

12. Torque bolts (Figure 4, Item 10) to 10 Ft-lbs.

13. Gently push dirt and liquid deflector (Figure 4, Item 15) over motor shaft into drive side endbell (Figure 4, Item 8); position dirt and liquid deflector so that endbell is set in groove.

14. Set baffle plate (Figure 5, Item 8) into position on motor shaft.

15. Press annular ball bearing (Figure 5, Item 7) onto motor shaft.

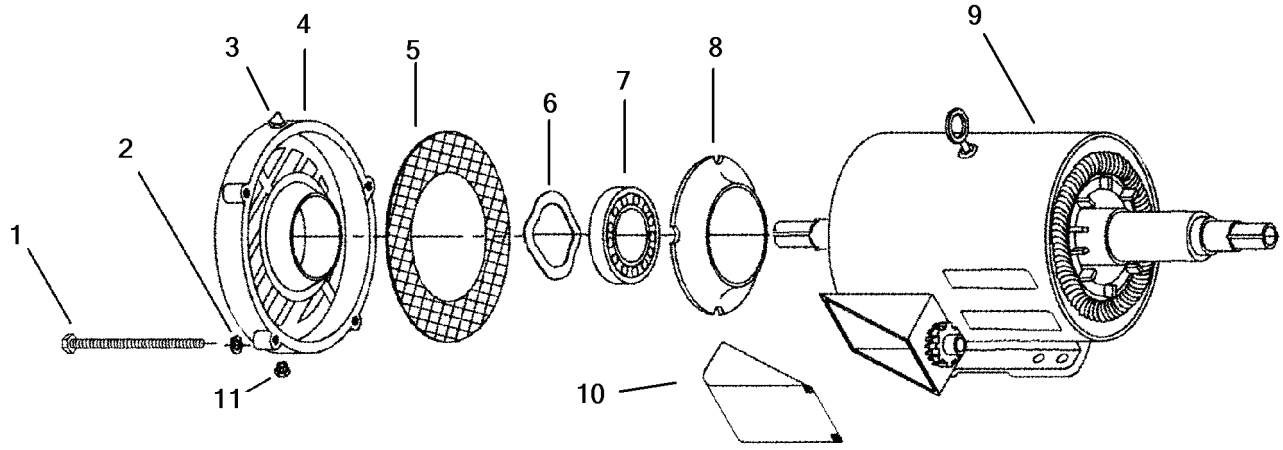


Figure 5. Open Face Endbell Assembly.

16. Place screen (Figure 5, Item 5) and spring tension washer (Figure 5, Item 6) into open face endbell (Figure 5, Item 4); set endbell into position over annular ball bearing (Figure 5, Item 7).

17. Ensure scribe marks are aligned; thread four thrubolts (Figure 5, Item 1) with washers (Figure 5, Item 2) through open face endbell (Figure 5, Item 4), stator assembly (Figure 5, Item 9) and drive side endbell (Figure 4, Item 8).

18. Alternately tighten thrubolts (Figure 5, Item 1) to evenly secure drive side endbell (Figure 4, Item 8), ball bearing retainer (Figure 4, Item 3) and open face endbell (Figure 5, Item 4).

19. Position splash plate (Figure 4, Item 11) on drive side endbell (Figure 4, Item 8); install with four bolts (Figure 4, Item 13) and washers (Figure 4, Item 14), hand tight.

ASSEMBLY - Continued

20. Install slinger (Figure 4, Item 12) on shaft.
21. Assemble centrifugal pump (WP 0012).
22. Install bilge/ballast pump (WP 0010).

END OF TASK

END OF WORK PACKAGE

FIELD MAINTENANCE
CENTRIFUGAL PUMP
REPLACE

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0019, Item 1)
Wrench, Torque (5-75 Ft-lbs)
(WP 0019, Item 3)
Lifting Sling (WP 0019, Item 4)
Hoist, Chain (WP 0019, Item 6)
Wrench, Strap (WP 0019, Item 13)
Puller, Mechanical (WP 0019, Item 9)

Materials/Parts

Pump, Centrifugal,
P/N ABZCH2-43C-280F

Personnel Required

Watercraft Engineer 88L (2)

References

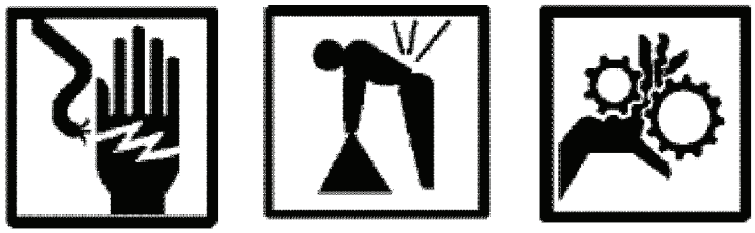
WP 0010

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 bilge/ballast pump (WP 0010).
2. Move bilge/ballast pump to clean and level work station.
3. Remove twelve bolts (Figure 1, Item 17) from backplate cover (Figure 1, Item 10).

REMOVAL - Continued

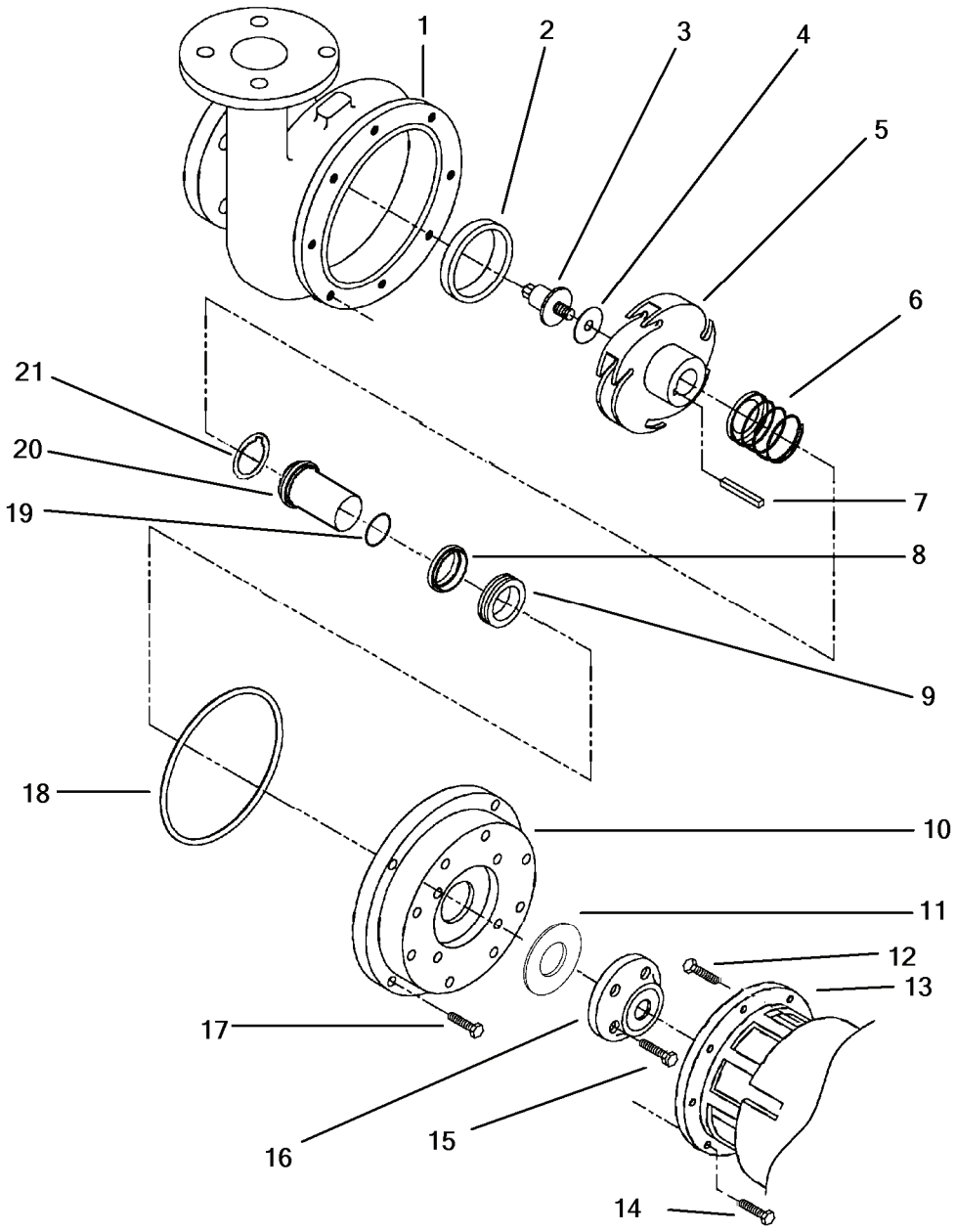


Figure 1. Replace Centrifugal Pump.

4. Using two jacking bolts, remove pump casing (Figure 1, Item 1) and casing gasket (Figure 1, Item 18).
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 to remove impeller (Figure 1, Item 5). Remove impeller screw gasket (Figure 1, Item 4) and machine key (Figure 1, Item 7) from shaft.

8. Remove mechanical spring (Figure 1, Item 6) and gasket (Figure 1, Item 21).

9. Remove eight bolts (Figure 1, Item 14) and slide backplate cover (Figure 1, Item 10) with mechanical seal (Figure 1, Item 8, 9 ,19, and 20) off shaft.

10. Remove O-ring (Figure 1, Item 19), ceramic insert (Figure 1, Item 8) and shaft sleeve (Figure 1, Item 20) from backplate cover (Figure 1, Item 10).

11. Remove four bolts (Figure 1, Item 15) from stuffing box (Figure 1, Item 16).

12. Remove stuffing box (Figure 1, Item 16), stuffing box gasket (Figure 1, Item 11) and stationary seal (Figure 1, Item 9) from backplate cover (Figure 1, Item 10).

13. Remove stationary seal (Figure 1, Item 9) from stuffing box (Figure 1, Item 16).

END OF TASK

INSTALLATION

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.

1. Press stationary seal (Figure 1, Item 9) into stuffing box (Figure 1, Item 16).

2. Replace stuffing box gasket (Figure1, Item 11) and install stuffing box (Figure 1, Item 16); secure with four bolts (Figure 1, Item 15).

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

4. Insert O-ring (Figure 1, Item 19) into shaft sleeve (Figure 1, Item 20).

5. Place a small amount of dish detergent on shaft sleeve (Figure 1, Item 20) and install ceramic insert (Figure 1, Item 8). Install shaft sleeve (Figure 1, Item 20) onto motor shaft.

6. Position key (Figure 1, Item 7) in shaft keyway, tapping firmly in place.

7. Place mechanical spring (Figure 1, Item 6) and gasket (Figure 1, Item 21) in position.

INSTALLATION - Continued

8. Align pump impeller (Figure 1, Item 5) keyway with key; install pump impeller.

9. 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.

10. Place casing gasket (Figure 1, Item 18) in position on backplate cover (Figure 1, Item 10).

11. Align pump casing (Figure 1, Item 1) with gasket (Figure 1, Item 18) and casing backplate (Figure 1, Item 10); secure with twelve bolts (Figure 1, Item 17).

12. Install bilge/ballast pump (WP 0010).

END OF TASK

END OF WORK PACKAGE

FIELD MAINTENANCE
CENTRIFUGAL PUMP
REPAIR

INITIAL SETUP:

Tools and Special Tools

Tool Kit, General Mechanic's
(WP 0019, Item 1)
Wrench, Torque (5-75 Ft-lbs)
(WP 0019, Item 3)
Lifting Sling (WP 0019, Item 4)
Hoist, Chain (WP 0019, Item 6)
Drill, Electric Portable, 3/8" cap.
(WP 0019, Item 10)
Drill Set, Twist, Set 2, (WP 0019, Item 11)
Wrench, Strap (WP 0019, Item 13)
Puller, Mechanical (WP 0019, Item 9)

Materials/Parts

Pump Shaft Sleeve, P/N BX8107641
Centrifugal Pump Parts Kit, P/N GS8107720
Brush, Cleaning, (WP 0020, Item 2)
Dishwashing Compound (WP 0020, Item 3)
Dry Cleaning Solvent, (WP 0020, Item 4)
Paper, Abrasive (WP 0020, Item 11)

Personnel Required

Watercraft Engineer 88L (2)

References

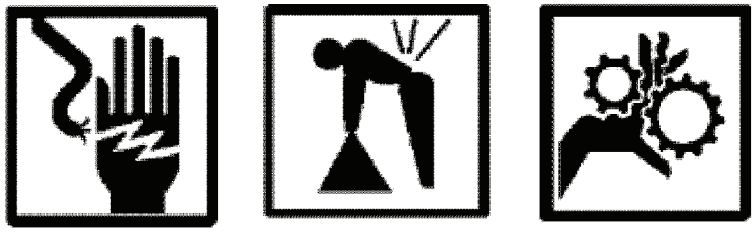
WP 0010

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 bilge/ballast pump (WP 0010).

DISASSEMBLY - Continued

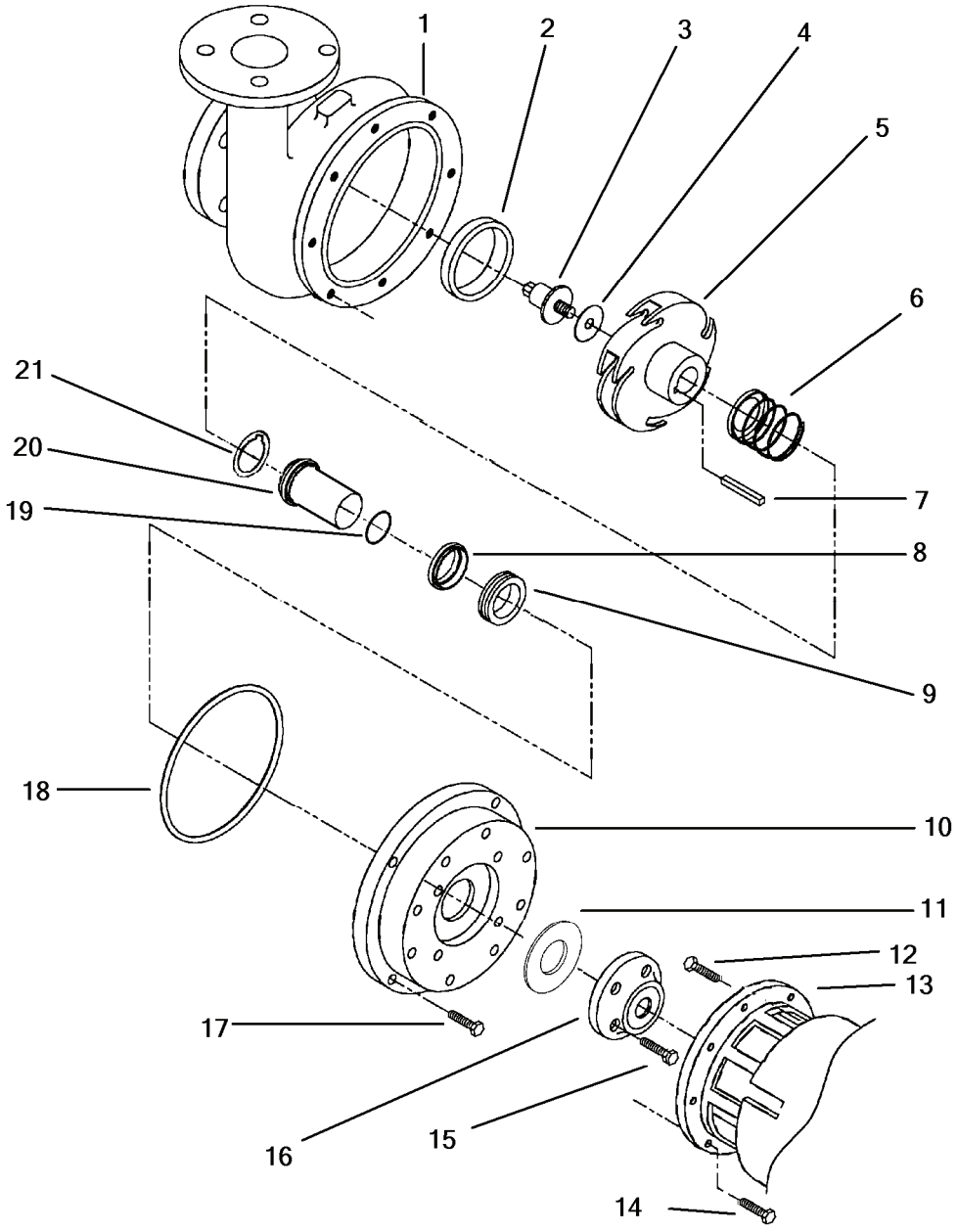


Figure 1. Repair Centrifugal Pump.

2. Move bilge ballast pump 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 18).
5. Hold pump impeller (Figure 1, Item 5) with a strap wrench.

DISASSEMBLY - Continued

6. Remove impeller screw (Figure 1, Item 3) by turning counterclockwise.

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) and gasket (Figure 1, Item 21).

9. Remove eight bolts (Figure 1, Item 14) and slide back plate cover (Figure 1, Item 10) with mechanical seal (Figure 1, Item 8, 9, 19, and 20) off shaft.

10. Remove O-ring (Figure 1, Item 19), ceramic insert (Figure 1, Item 8) and shaft sleeve (Figure 1, Item 20) from back plate cover (Figure 1, Item 10).

11. Remove four bolts (Figure 1, Item 15) from stuffing box (Figure 1, Item 16).

12. Remove stuffing box (Figure 1, Item 16), stuffing box gasket (Figure 1, Item 11) and stationary seal (Figure 1, Item 9) from backplate cover (Figure 1, Item 10).

13. Remove stationary seal (Figure 1, Item 9), from stuffing box (Figure 1, Item 16).

14. If replacement is required, remove the impeller wear ring (Figure 1, Item 2). It may be necessary to drill two axial holes into the ring, approximately 180° apart, being careful not to drill into casing (Figure 1, Item 1). Split wear ring (Figure 1, Item 2) 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. O-ring (Figure 1, Item 19).

    b. Stuffing Box Gasket (Figure 1, Item 11).

    c. Casing Gasket (Figure 1, Item 18).

    d. Pump Shaft Sleeve (Figure 1, Item 20).

    e. Gasket (Figure 1, Item 21).

    f. Ceramic Insert (Figure 1, Item 8).

    g. Impeller Screw Gasket (Figure 1, Item 4).

    h. Stationary Seal (Figure 1, Item 9).

    i. Mechanical Spring (Figure 1, Item 6).

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 wear ring (Figure 1, Item 2) into pump casing (Figure 1, item 1); press ring evenly into position.

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 (Figure1, 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 19) into shaft sleeve (Figure 1, Item 20).
6. Place a small amount of dish detergent on shaft sleeve (Figure 1, Item 20) and install ceramic insert (Figure 1, Item 8). Install shaft sleeve (Figure 1, Item 20) 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 21) 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 18) in position on backplate cover (Figure 1, Item 10).
12. Align pump casing (Figure 1, Item 1) with gasket (Figure 1, Item 18) and casing backplate (Figure 1, Item 10); secure with twelve bolts (Figure 1, Item 17).
13. Install bilge/ballast pump (WP 0010).

END OF TASK

END OF WORK PACKAGE

FIELD AND SUSTAINMENT MAINTENANCE INSTRUCTIONS
BILGE/BALLAST PUMP
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 work package 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
	-18	17	2.3511	23.0489	19	2.6277	25.7605	24	3.3192	32.5396
5/16	-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 - Continued

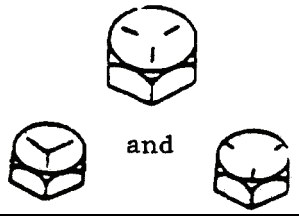
Capacity Body size		SAE Grade # 5 Cast Iron or Steel			SAE Grade # 6 or # 7 Cast Iron or Steel			SAE Grade #8 Cast Iron or Steel		
Inches-Thread		TORQUE			TORQUE			TORQUE		
		Ft-lb	kgm	Nm	Ft-lb	kgm	Nm	Ft-lb	kgm	Nm
1.0	-8	590	81.5970	799.9220	660	91.2780	894.8280	910	125.8530	1233.7780
	-14	660	91.2780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

Table 2. Pipe Plug Torque Values

Size			In Aluminum Components Torque		In Cast Iron or Steel Components Torque	
Thread	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

	Cast Iron or Steel			
Thread for general purposes	Head Mark 4 Torque		Head Mark 7 Torque	
(size x pitch (mm)	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 BILGE/BALLAST PUMP

SUPPORTING INFORMATION

FIELD AND SUSTAINMENT MAINTENANCE
BILGE/BALLAST PUMP
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 of the LCU 2000 Class Watercraft
TM 750-244-3	Destruction of Army Material to Prevent Enemy Use
TM 43-0139	Painting Instructions for Army Material

Technical Bulletins.

TB 43-0144	Painting of Watercraft
TB 5-1900-207-24	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
BILGE/BALLAST PUMP
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
BILGE/BALLAST PUMP
MAINTENANCE ALLOCATION CHART (MAC)

Table 1. MAC for Bilge/Ballast Pump

(1)	(2)	(3)	(4) MAINTENANCE LEVEL				(5)	(6)
			FIELD		SUSTAINMENT			
			CREW	MAINTAINER	BELOW DEPOT	DEPOT	TOOLS AND EQUIPTMENT	
GROUP NUMBER	COMPONENT ASSEMBLY	MAINTENANCE FUNCTION	C	F	H	D	REFERENCE CODE	REMARKS CODE
13	BILGE/BALLAST PUMP	INSPECT SERVICE REPLACE	0.3	 0.3 2.0			 1 1, 2, 4, 6, 7	
1301	MOTOR ALTERNATING CURRENT	TEST REPLACE REPAIR		1.0 2.0 2.5			1, 7, 12 1-5, 6 1, 4, 6, 9	
1302	PUMP CENTRIFUGAL	REPLACE REPAIR		2.0 2.5			1, 3, 4, 6, 13 1, 3, 4, 6, 10, 11, 13	

Table 2. Tools and Test Equipment for Bilge/Ballast Pump.

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	Wrench, Torque 1/2" DR, 30-200 Ft-lb	5120-01-125-5190	(05047) B107.14
3	F	Wrench, Torque, 3/8" DR, 5-75 Ft-lb	5120-01-355-1734	(55719) QD2FR75
4	F	Lifting Sling	3940-01-183-9412	(15434) 3375958
5	F	Press, Hydraulic, Portable	4940-00-360-2752	(81349) MIL-P-12199
6	F	Hoist, Chain	3950-00-235-4235	(81349) M1LH904CLASS1TYPEHSTYLE1
7	F	Tool Kit, Electrical Repair	5180-00-391-1087	(80244) 5180-00-391-1087
8	F	Thermometer, Infrared	6685-01-480-2988	(3Q8A5) ST652
9	F	Puller, Mechanical	5120-00-499-1489	(55719) CJ83C
10	F	Drill, electric Portable 3/8" Cap	5130-00-473-6224	(80244) 5130-00-473-6224
11	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
12	F	Insulation Tester	6625-01-223-2980	(72915) 8174880
13	F	Wrench, Strap		

END OF WORK PACKAGE

FIELD AND SUSTAINMENT MAINTENANCE
BILGE/BALLAST PUMP
EXPENDABLE/DURABLE SUPPLIES AND MATERIALS LIST

SCOPE

This work package lists expendable and durable items that you will need to operate and maintain the bilge/ballast pump. 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	7930-00-880-4454	Dishwashing Compound, Hand, Liquid, Nonabrasive 7930-00-880-4454 (83421)	BT
4	F	6850-00-110-4498	Dry Cleaning Solvent, Liquid, Type II AA59601-2C (58536)	BT
5	F		Flange, Pipe (Bench Stock)	EA
6	F	5330-00-641-1193	Gasket Material, Asbestos HH-P-46, Class 1 HH-P-46 (81348)	SH
7	F	8415-00-266-8677	Gloves, Rubber, Industrial MIL-DTL-32066 (81349)	PR
8	F	9150-00-180-6382	Grease, General Purpose, Corrosion And Water Resistant MIL-PRF-24139 (81349)	CN
9	F	4930-00-287-5419	Grease Gun, Type 2, Class C, Style 2 And 3 GGG0591 (81348)	EA
10	F	7240-01-094-4305	Pail, Utility, Plastic, Polyethylene, High Density 450 (0REY5)	EA
11	F	5350-00-186-8858	Paper, Abrasive A-A-1049 TY2 (80244)	PG
12	F	7920-00-205-1711	Rag, Wiping, Cotton, Unbleached DDD-R-30 (81348)	EA
13	F	5365-01-203-0284	Shim, 0.005 in, A34B, Non-Circular W/Rounded Corners 3026312 (15434)	EA
14	F	5365-01-203-0283	Shim, 0.0010 in, A34B, Non-Circular W/Rounded Corners 3026313 (15434)	EA
15	F		Rod, Threaded 5/16 (Bench Stock)	EA
16	F	2835-00-015-0246	Tag, Warning S8145-55 (70210)	EA
17	F	5970-00-185-8531	Tape, Insulation, Electrical, Pressure Sensitive A-A-2094 1 IN. X 85 FT (58536)	RO

END OF WORK PACKAGE

INDEX

INDEX - Continued

INDEX - Continued

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: *(Forward to proponent of publication or form) (Include ZIP Code)* U.S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LC-LMP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	FROM: *(Activity and location) (Include ZIP Code)* Your mailing address	

PART I – ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	Title
TM 55-1905-223-24-13	01 July 2009	Maintenance Manual for BILGE/BALLAST Pump 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).

**Reference to line numbers within the paragraph or subparagraph.*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	Signature
Your Name		*Your Signature*

DA FORM 2028, FEB 74 REPLACES DA FORM 2028, 1 DEC 68, WHICH WILL BE USED. USAPPC V3.00

TO: (Forward direct to addressee listed in publication)	FROM: (Activity and location) (Include ZIP Code)	DATE
U. S. Army TACOM Life Cycle Management Command ATTN: AMSTA-LC-LMPP/TECH PUBS 1 Rock Island Arsenal, Rock Island, IL 61299-7630	Your address	Date you filled out this form

PART II – REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 55-1905-223-24-13	01 July 2009	Maintenance Manual for BILGE/ BALLAST Pump Landing Craft Utility (LCU)

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

SAMPLE

PART III – REMARKS **(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)**

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Your Name		Your Signature

USAPPC V3.00

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
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By Order of the Secretary of the Army:

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

Official:

JOYCE E. MORROW
Administrative Assistant to the
Secretary of the Army
0807302

DISTRIBUTION:

To be distributed in accordance with the initial distribution number (IDN) 253662, requirements for TM 55-1905-223-24-13.

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

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

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

Square Measure

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

Cubic Measure

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

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.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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