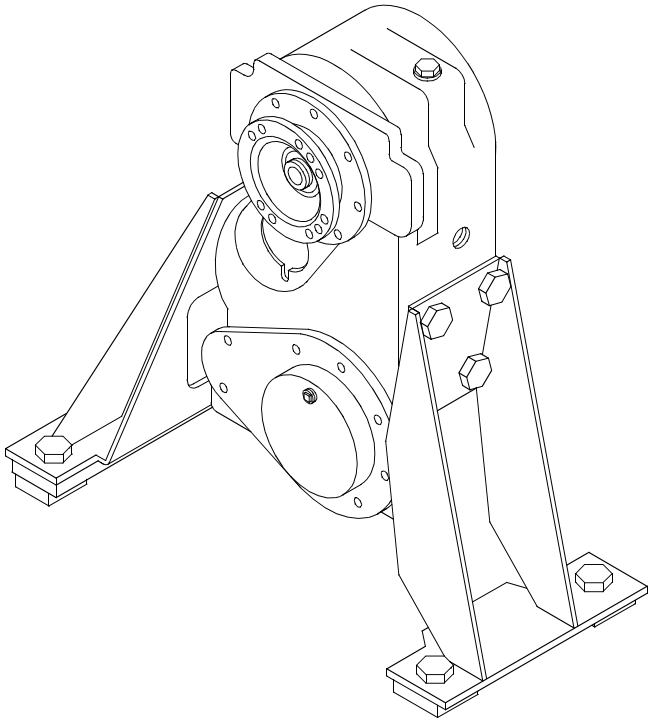
TM 55-1945-205-24-1-4

TECHNICAL MANUAL

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE MANUAL FOR

MODULAR CAUSEWAY SYSTEM (MCS) CAUSEWAY FERRY (CF) TRANSFER CASE 738AN4NL4F NSN PENDING



This manual supersedes TM 55-1945-205-24-4 dated 29 August 1997 including all changes.

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HEADQUARTERS, DEPARTMENT OF THE ARMY
OCTOBER 2003

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WASHINGTON, D.C. 1 OCTOBER 2003

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REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028-2 (Recommended Changes to Equipment Technical Publications), through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is http://aeps.ria.army.mil. If you need a password, scroll down and click on "ACCESS REQUEST FORM". The DA Form 2028 is located in the ONLINE FORMS PROCESSING section of the AEPS website. Fill out the form and click on "SUBMIT". Using this form on the AEPS website 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 letter, DA Form 2028, or DA Form 2028-2 directly to: Commander, U.S. Army Tank-Automotive and Armaments Command, ATTN: AMSTA-LC-CIP-WT, Rock Island, IL 61299-7630. The E-mail address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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HOW TO USE THIS MANUAL

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

a. Accessing Information

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

b. Illustrations

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

c. Using This Manual

When using this manual, read and understand the entire maintenance action before performing the task. Also, read and understand all warnings, cautions and notes as well as general safety precautions 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, *Description and Theory of Operation*. Under the chapter title you will find the work package titled *Location and Description of Major Components*. Turn to the work package indicated. This work package will give a brief description of the major components, and show an illustration of what the component looks like and its location.

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 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 malfunction, symptom 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 *Tool Identification List* located in Chapter 4, *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 *Tool Identification List* located in Chapter 4, *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 4, *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 3, *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 *Tool Identification List* located in Chapter 4, *Supporting Information.*

Materials/Parts: Lists all parts or materials necessary to perform the task. Expendable and durables are identified with an item number from the applicable work package located in Chapter 4, *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 4, *Supporting Information*.

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

Test Equipment: Lists all test equipment (standard or special) required to troubleshoot, test and inspect the equipment covered in this manual. The test equipment is identified with an item number and work package number from the *Tool Identification List* located in Chapter 4, *Supporting Information*.

Repair Parts and Special Tools List

Refer to TM 55-1945-205-24P-1 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 55-1945-205-24P-1. 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

DESCRIPTION AND THEORY OF OPERATION
FOR
MODULAR CAUSEWAY SYSTEM (MCS)
CAUSEWAY FERRY (CF) TRANSFER CASE

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
GENERAL INFORMATION

SCOPE

This manual contains descriptions and maintenance instructions for Unit, Direct Support and General Support Maintenance levels for the causeway ferry transfer case, model number 738AN4NL4F.

Type of Manual: Organizational, Direct Support and General Support Maintenance.

Purpose of Equipment: Transfer power from the engine to the pump-jet.

MAINTENANCE FORMS, RECORDS AND REPORTS

Department of the Army forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, Functional Users Manual for The Army Maintenance Management System (TAMMS); and AR 700-138, Army Logistics Readiness and Sustainability

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

If any component in your system needs improvement, let us know. Send us an EIR. You, the user, are the only one who can tell us what you don't like about your equipment. Let us know why you don't like the design or performance. Put it on an SF 368, Product Quality Deficiency Report. Mail it to the address specified in DA PAM 738-750, or as specified by the contracting activity. We will send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

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.

While corrosion is typically associated with rusting of metals, it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling or breaking of the materials may be a corrosion problem. If a corrosion problem is identified, it can be reported using an SF 368, Product Quality Deficiency Report. Use of key words, such as “corrosion”, “rust”, “deterioration” or “cracking”, will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA PAM 738-750, Functional Users Manual for The Army Maintenance Management System (TAMMS).

OZONE DEPLETING SUBSTANCES (ODS)

The continued use of ODS has been prohibited by Executive Order 12856 of 3 August 1993.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

The procedures for destruction of Army materiel to prevent enemy use are contained in TM 750-244-6.

PREPARATION FOR STORAGE AND SHIPMENT REFERENCE

Reference WP 0024 00 for preparation of storage or shipment of transfer case model number 738AN4NL4F.

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES AND FEATURES

TRANSFER CASE

The transfer case is an integral part of the drive train of the causeway ferry. The transfer case compensates for the offset alignment between the lower position of the output shaft from the marine gear and the higher position of the input shaft of the pump-jet. Its gear ratio is 1:1 and, consequently, rotates at the same maximum speed of 2100 RPM as the engine and pump-jet.

The transfer case has its own oil cooler powered by a gear driven pump that is operated by rotation of the transfer case gearing. Lubricating oil circulates from the transfer case through external lines to a heat exchanger which cools the oil. Cooled oil is returned to the top of the transfer case, lubricating the upper gears and bearings and simultaneously cooling the entire transfer case.

There are two transfer cases per powered section: one for the starboard engine/drive train and one for the port engine/drive train.

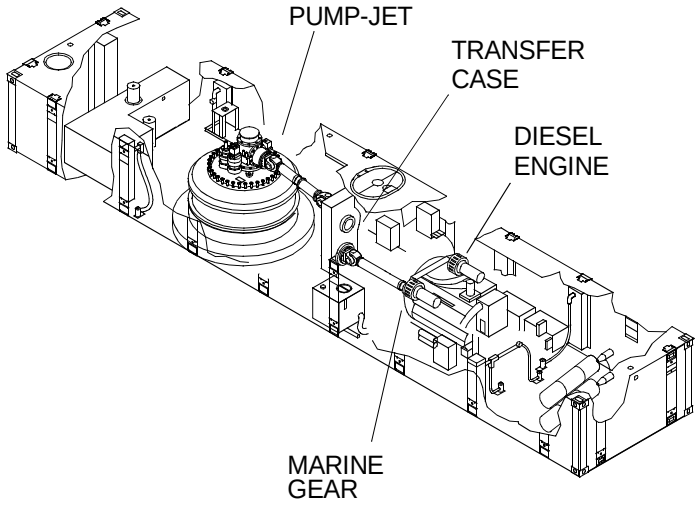
UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
DESCRIPTION AND DATA

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

TRANSFER CASE

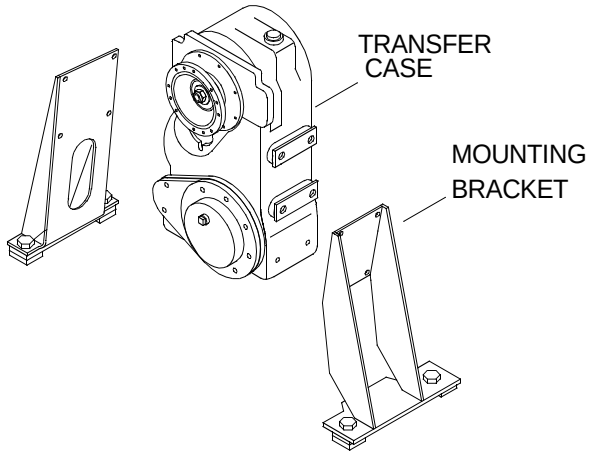
Location

The transfer case is located between the marine gear and the pump-jet and is connected to both with drive shafts. There are two transfer cases: one for the starboard engine and one for the port engine.



Description

The transfer case compensates for offset alignment between the output flange of the marine gear and the input flange of the pump-jet. It has a 1:1 gear ratio. It utilizes spur gears throughout and is equipped with an oil pump that circulates lubricating oil from its gearcase, through an oil cooler connected to the engine raw water cooling system and back to the top of the transfer case to lubricate the upper gears. Weight of the transfer case is approximately 450 lb dry.



UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
DESCRIPTION AND DATA

EQUIPMENT DATA

The following table provides data applicable to major component levels.

Table 1. CF Equipment Data.

ITEM CHARACTERISTIC	DESCRIPTION
TRANSFER CASE (2 PER CF)	
Weight, Dry	450 lb (204.11 kg)
Oil Capacity	11 Pints (5.2 liter)
Ratio	1:1
Torque Rating, Continuous Duty	3725 ft lbs (5051.1 N-m)
Maximum Operating Speed	5000 RPM

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
THEORY OF OPERATION

SYSTEM THEORY

The transfer case is used to compensate for the offset alignment between the output flange of the marine gear and the input flange of the pump-jet. It has a 1:1 gear ratio that utilizes spur gears throughout. The transfer case is equipped with an oil pump that circulates lubrication oil from its gearcase, through an oil cooler, plumbed off of the engine raw water cooling system, then back to the top of the transfer case to lubricate the upper gearing. The transfer case is connected to the marine gear and the pump-jet via drive shafts.

CHAPTER 2

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT TROUBLESHOOTING PROCEDURES FOR MODULAR CAUSEWAY SYSTEM (MCS) CAUSEWAY FERRY (CF) TRANSFER CASE

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
TROUBLESHOOTING PROCEDURES INDEX

MALFUNCTION/SYMPTOM	TROUBLESHOOTING PROCEDURE
Oil Level Increases In The Sump	WP 0007 00
Oil Level Decreases In The Sump	WP 0008 00

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
TROUBLESHOOTING PROCEDURES

INITIAL SETUP:

Personnel Required
Engineer 88L

References
TM 55-1945-205-10-1

TROUBLESHOOTING PROCEDURE

OIL LEVEL INCREASES IN THE SUMP

SYMPTOM

Oil level increases.

MALFUNCTION

Oil cooler cooling tubes leaking, causing raw water to enter transfer case.

CORRECTIVE ACTION

Replace oil cooler. (WP 0019 00)

Service transfer case. (WP 0013 00)

Perform operational check of drive train. (TM 55-1945-205-10-1)

END OF WORK PACKAGE

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
TROUBLESHOOTING PROCEDURES

INITIAL SETUP:

Personnel Required
Engineer 88L

References
TM 55-1945-205-10-1

TROUBLESHOOTING PROCEDURE

OIL LEVEL DECREASES IN THE SUMP

SYMPTOM

Oil level decreases.

MALFUNCTION

Oil cooler cooling tubes leaking, causing transfer case oil to escape with the raw water.

CORRECTIVE ACTION

Replace oil cooler. (WP 0019 00)

Perform operational check of drive train. (TM 55-1945-205-10-1)

MALFUNCTION

Transfer case lines, hoses or fittings leaking.

CORRECTIVE ACTION

Replace leaking lines, hoses and fittings. (WP 0018 00)

Perform operational check of drive train. (TM 55-1945-205-10-1)

MALFUNCTION

Rotating shaft seals are leaking.

CORRECTIVE ACTION

Replace rotating seals. (WP 0020 00, WP 0021 00 and WP 0022 00)

Perform operational check of drive train. (TM 55-1945-205-10-1)

MALFUNCTION

Gaskets are leaking.

CORRECTIVE ACTION

Replace gaskets. (WP 0023 00)

Perform operational check of drive train. (TM 55-1945-205-10-1)

END OF WORK PACKAGE

CHAPTER 3

UNIT, DIRECT SUPPORT AND GENERAL SUPPORT MAINTENANCE INSTRUCTIONS FOR MODULAR CAUSEWAY SYSTEM (MCS) CAUSEWAY FERRY (CF) TRANSFER CASE

DIRECT SUPPORT MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
SERVICE UPON RECEIPT

INITIAL SETUP:

Tools

Tool Kit, General Mechanic's (Item 13, WP 0030 00)
Pan, Drain (Item 9, WP 0030 00)
Goggles, Industrial (Item 7, WP 0030 00)
Gloves, Chemical (Item 5, WP 0030 00)
Apron, Utility (Item 1, WP 0030 00)
Sling, Engine and Transmission, Motor Vehicle (Item 12, WP 0030 00)

Materials/Parts

Spill Clean-Up Kit, Hazardous Material (Item 6, WP 0029 00)

Personnel Required

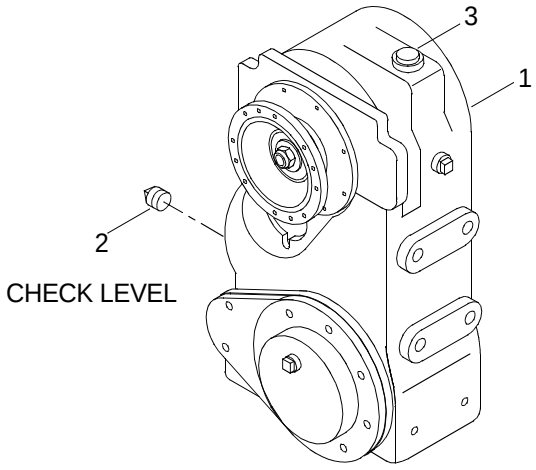
Engineer 88L

SERVICE UPON RECEIPT

WARNING

HEAVY OBJECTS

1. Using an engine and transmission sling, remove transfer case (1) from shipping container.



2. Inspect transfer case for damage that might have occurred during shipment. Report any damage to your supervisor.

3. Check the equipment against the packing slip to see if shipment is complete. Report all discrepancies to your supervisor.

4. Drain transfer case lubricating oil to correct operating level using check level (2) opening.

   a. Place a drain pan under check level plug (2) and loosen breather (3).

WARNING

CHEMICAL EYE PROTECTION

   b. Remove check level plug (2) and allow oil to drain down to check level opening.

   c. Install check level plug (2).

   d. Tighten breather (3).

WARNING

CHEMICAL EYE PROTECTION

5. Remove drain pan and dispose of contents in accordance with local procedures.

WARNING

CHEMICAL EYE PROTECTION SLICK FLOOR

6. Clean up spilled fluid with a spill kit and dispose of spill kit waste in accordance with local procedures.

END OF WORK PACKAGE

UNIT LEVEL MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)
INTRODUCTION

INTRODUCTION

General

Preventive Maintenance Checks and Services (PMCS) are performed to keep the causeway ferry transfer case in operating condition. The checks are used to find, correct or report problems.

Do “Hourly PMCS” at the designated hours. If equipment has not been operated for the prescribed hours do the “Monthly PMCS”.

Do “Monthly PMCS” once a month.

If you find something wrong when performing PMCS, fix it, if you can, using troubleshooting procedures and/or maintenance procedures.

The right-hand column of the PMCS table lists conditions that make the equipment not fully mission capable. Write up items not fixed on DA Form 2404 for your support maintenance personnel. For further information on how to use this form, see DA PAM 738-750.

Leakage Definition

CAUTION

Equipment operation is allowable with minor leakages (Class I or II) except for fuel leaks. Of course, consideration must be given to the fluid capacity of the item or system being checked. When in doubt, ask your supervisor. Failure to comply could result in damage to equipment.

NOTE

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS. Class III leaks should be reported immediately to your supervisor.

Leakage definitions for Unit, Direct Support and General Support PMCS.

It is necessary to know how fluid leakage affects the status of the equipment. The following are definitions of the classes of leakage an operator or crew member needs to know to be able to determine the condition of the leak. Learn and then be familiar with them, and REMEMBER - WHEN IN DOUBT, ASK YOUR SUPERVISOR.

CLASS I - Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

CLASS II - Leakage of fluid great enough to form drops, but not enough to cause drops to drip from item being checked.

CLASS III - Leakage of fluid great enough to form drops that fall from the item being checked.

Inspection

Look for signs of a problem or trouble. Senses help. You can feel, smell, hear or see many problems. Be alert when operating the equipment.

Inspect to see if items are in good condition. Are they correctly assembled, stowed, secured, excessively worn, leaking, corroded or properly lubricated? Correct any problems found or notify your supervisor.

There are some common items to check all over the equipment. These include the following.

1. Bolts, clamps, nuts and screws: Continuously check for looseness. Look for chipped paint, bare metal, rust or corrosion around bolt and screw heads and nuts. Tighten them when you find them loose.

2. Welds: Many items on the equipment are welded. To check these welds, look for chipped paint, rust, corrosion or gaps.

3. Electrical wires, connectors and harnesses: Tighten loose connectors. Look for cracked or broken insulation, bare wires and broken connectors.

4. Hoses and fluid lines: Look for wear, damage and leaks and make sure clamps and fittings are tight. Wet spots mean a leak. A stain by a fitting or connector can also mean a leak.

Lubrication Service Intervals - Normal Conditions

For safer, more trouble free operations, make sure that your equipment is serviced when it needs it. For the proper lubrication and service intervals, see the PMCS table.

Lubrication Service Intervals - Unusual Conditions

Your equipment will require extra service and care when you operate under unusual conditions. High or low temperatures, long periods of hard use or continued use in blowing sand, dust or in a salty spray type of environment will break down lubricants, requiring the addition or changing of lubricants more often.

Lubrication Symbols

There are no lubrication symbols used in this manual.

Lubrication Intervals

The following lubrication intervals are used in the PMCS table.

H - hours operated
M - monthly

CLEANING AND LUBRICATION

CAUTION

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

Keeping equipment cleaned and properly lubricated will help to avoid possible problems or premature equipment failure.

1. Thoroughly wash all equipment exposed to salt spray with clean, fresh water.

2. Lubricate all equipment at conclusion of the operation and prior to equipment storage.

3. Clean the exterior of the components with a clean, dry cloth or a soft bristled brush.

Army Oil Analysis Program

Engine oil/transmission oil/hydraulic fluids must be sampled at 90 days or 100 operating hours as prescribed by DA PAM 738-750, Functional Users Guide for the Army Maintenance Management System (TAMMS)

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.

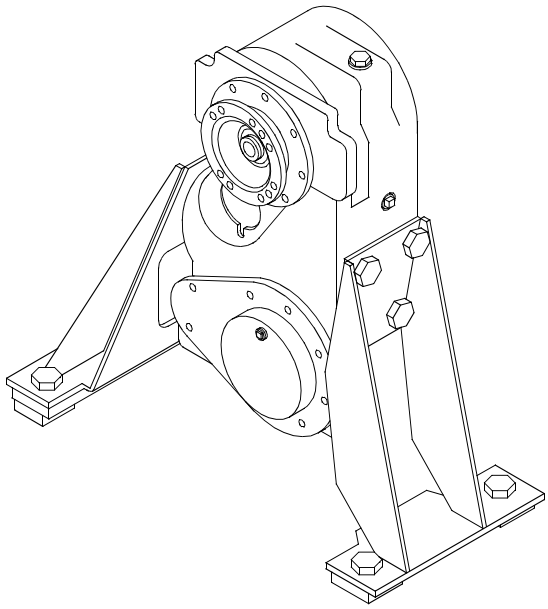
Corrosion is typically associated with rusting of metals or galvanic corrosion, which produces a white powder. The category of corrosion also includes deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling or breaking of the materials may be a corrosion problem. If a corrosion problem is identified, it can be reported using an SF 368, Product Quality Deficiency Report. Use of key words, such as “corrosion”, “rust”, “deterioration” or “cracking”, will ensure that the information is identified as a CPC problem. The form should be submitted to the address specified in DA PAM 738-750.

UNIT LEVEL MAINTENANCE
CAUSEWAY FERRY
TRANSFER CASE
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)
AND LUBRICATION PROCEDURES

INITIAL SETUP:

Tools
Tool Kit, General Mechanic's (Rail and Marine) (Item 14, WP 0030 00)

Personnel Required
Engineer 88L



TRANSFER CASE

Table 1. Preventive Maintenance Checks and Services and Lubrication Procedures. (PMCS)

ITEM NO.	INTERVAL	MAN-HOURS	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	24 Operating Hours	1.5	Transfer Case	Change oil after first 24 hours of operation. (WP 0013 00)	
1	Monthly	1.5	Transfer Case	Change oil monthly. (WP 0013 00)	

END OF WORK PACKAGE