

TM 5-2410-233-23

TECHNICAL MANUAL

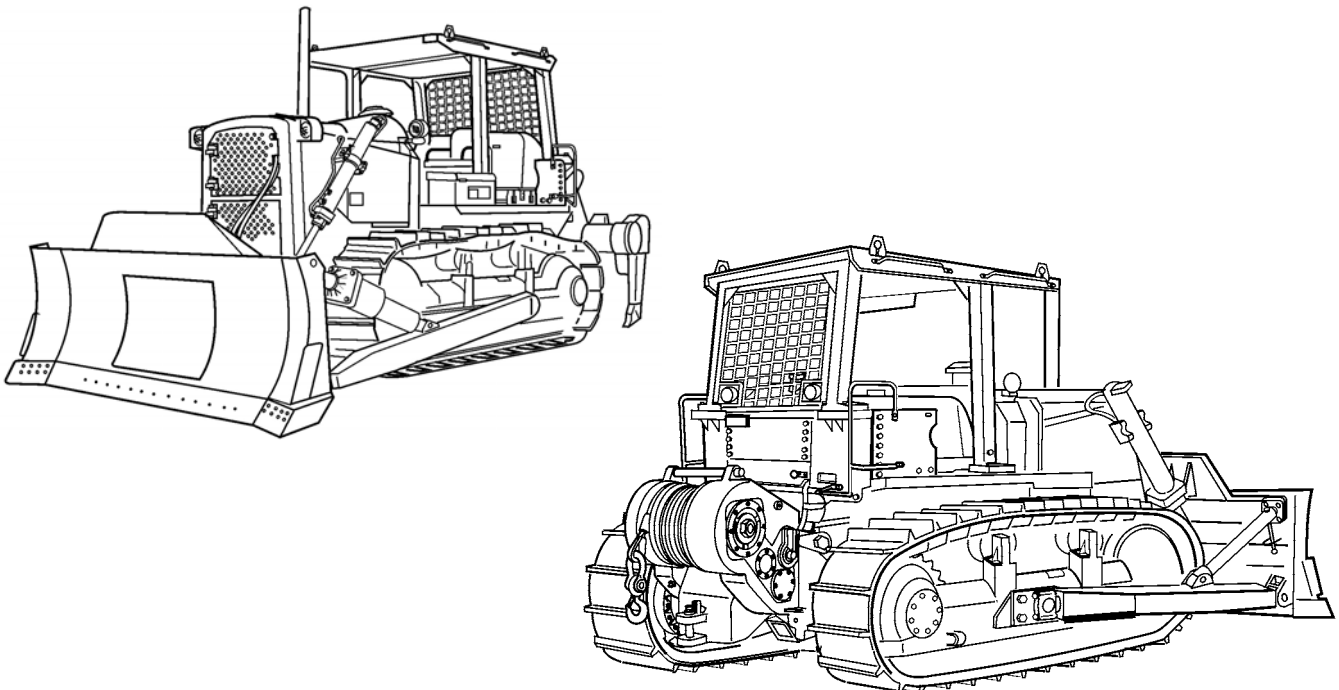
Unit and Direct Support Maintenance

FOR

**TRACTOR, FULL TRACKED, LOW SPEED:
DED, MEDIUM DRAWBAR PULL**

**TRACTOR WITH RIPPER; NSN 2410-00-185-9794 (EIC EAW)
TRACTOR WITH RIPPER AND WINTERIZED CAB; NSN 2410-00-300-6665
TRACTOR WITH WINCH; NSN 2410-00-185-9792 (EIC EA6)
TRACTOR WITH WINCH AND WINTERIZED CAB; NSN 2410-00-300-6664**

CATERPILLAR MODEL D7F



SUPERSEDURE NOTICE - This manual supersedes TM 5-2410-233-20, dated 31 August 1973,

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

HEADQUARTERS, DEPARTMENT OF THE ARMY

JULY 2005

WARNING SUMMARY

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.



BIOLOGICAL - abstract symbol bug shows that a material may contain bacteria or viruses that present a danger to life or health.



CHEMICAL - drops of liquid on hand shows that the material will cause burns or irritation to human skin or tissue.



EAR PROTECTION - Headphones over ears show that noise level will harm ears.



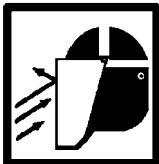
ELECTRICAL - electrical wire to arm with electricity symbol running through human body shows that shock hazard is present.



EYE PROTECTION - person with goggles shows that the material will injure the eyes.



FIRE - flame shows that a material may ignite and cause burns.



FLYING PARTICLES - arrows bouncing off face with face shield shows that particles flying through the air will harm face.



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



HOT AREA - hand over object radiating heat shows that part is hot and can burn.



HYDRAULIC FLUID PRESSURE - hydraulic fluid spraying human figure shows that fluid escaping under great pressure can cause injury or death.



RADIOACTIVE - identifies a material that emits radioactive energy and can injure human tissue or organs.



VAPOR - human figure in a cloud shows that material vapors present a danger to life or health.



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

FOR INFORMATION ON FIRST AID, REFER TO FM 4-25.11.



WARNING

CARBON MONOXIDE (EXHAUST GASES) CAN KILL!

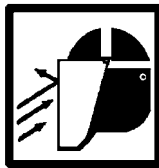
- Carbon monoxide is a colorless, odorless, deadly poison which, when breathed, deprives the body of oxygen and causes suffocation. Exposure to air containing carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, apparent drowsiness, and coma. Permanent brain damage or death can result from severe exposure.
 - Carbon monoxide occurs in exhaust fumes of internal combustion engines. Carbon monoxide can become dangerously concentrated under conditions of inadequate ventilation. The following precautions must be observed to ensure safety of personnel when engine of tractor is operated.
1. **DO NOT** operate tractor engine in enclosed areas.
 2. **DO NOT** idle tractor engine without adequate ventilation.
 3. **DO NOT** drive tractor with inspection plates or cover plates removed.
 4. **BE ALERT** for exhaust poisoning symptoms. They are:
 - Headache
 - Dizziness
 - Sleepiness
 - Loss of muscular control
 5. **If you see another person with exhaust poisoning symptoms:**
 - Remove person from area.
 - Expose to fresh air.
 - Keep person warm.
 - Do not permit physical exercise.
 - Administer cardiopulmonary resuscitation (CPR), if necessary.
 - Notify a medic.
 6. **BE AWARE.** The field protective mask for nuclear-biological-chemical (NBC) protection will not protect you from carbon monoxide poisoning.

The Best Defense Against Carbon Monoxide Poisoning Is Good Ventilation!



WARNING
BATTERIES

- To avoid injury, eye protection and acid-resistant gloves must be worn when working around batteries. Do not smoke, use open flame, make sparks or create other ignition sources around batteries. If a battery is giving off gases, it can explode and cause injury to personnel. Remove all jewelry such as rings, ID tags, watches, and bracelets. If jewelry or a tool contacts a battery terminal, a direct short will result in instant heating, damage to equipment, and injury to personnel.
 - Sulfuric acid contained in batteries can cause serious burns. If battery corrosion or electrolyte makes contact with skin, eyes or clothing, take immediate action to stop the corrosive burning effects. Failure to follow these procedures may result in death or serious injury to personnel.
- a. **Eyes.** Flush with cold water for no less than 15 minutes and seek medical attention immediately.
 - b. **Skin.** Flush with large amounts of cold water until all acid is removed. Seek medical attention as required.
 - c. **Internal.** If corrosion or electrolyte is ingested, drink large amounts of water or milk. Follow with milk of magnesia, beaten egg or vegetable oil. Seek medical attention immediately.
 - d. **Clothing/Equipment.** Wash area with large amounts of cold water. Neutralize acid with baking soda or household ammonia.



WARNING
COMPRESSED AIR

Particles blown by compressed air are hazardous. DO NOT exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. DO NOT direct compressed air against human skin. Failure to follow this warning may result in serious injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.



WARNING
FUEL HANDLING

- DO NOT smoke or permit any open flame in area of machine while you are servicing fuel system. Be sure hose nozzle is grounded against filler tube during refueling to prevent static electricity. Failure to follow this warning may result in injury to personnel or equipment damage.
- DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to machine and injury or death to personnel.



WARNING

ELECTRICAL SYSTEM MAINTENANCE

- Turn battery disconnect switch to OFF before working on any electrical system component. Failure to follow this warning could result in personal injury or damage to equipment.
- Ensure battery cables are disconnected before performing maintenance inside dash assembly. Failure to follow this warning could result in personal injury or damage to equipment.



WARNING

ETHER COLD START SYSTEM



Ether fuel is extremely flammable and toxic. DO NOT smoke and make sure you are in a well-ventilated area away from heat, open flames or sparks. Wear eye protection. Avoid contact with skin and eyes and avoid breathing ether fumes. If fluid enters or fumes irritate the eyes, wash immediately with large quantities of clean water for 15 minutes. Seek medical attention immediately if ether is inhaled or causes eye irritation. Failure to follow this warning may cause death or serious injury to personnel.



WARNING

EYE PROTECTION

- Eye protection must be worn when performing maintenance where components or particles could fly out during procedure. Failure to take precautions could cause injury to personnel.
- Some components are under spring tension. Wear eye protection and use extreme caution when disassembling them, to avoid serious injury to personnel.



WARNING

HAZARDOUS WASTE DISPOSAL

When servicing this machine, performing maintenance, or disposing of materials such as engine coolant, hydraulic fluid, lubricants, battery acids or batteries, and CARC paint, consult your unit/local hazardous waste disposal center or safety office for local regulatory guidance. If further information is needed, please contact The Army Environmental Hotline at 1-800-872-3845.



WARNING

HEARING PROTECTION

Your hearing can be **PERMANENTLY DAMAGED** if you are exposed to constant high noise levels of 85 DB or greater. Hearing protection is required when operating machine or when working on machine while it is operating. Failure to wear hearing protection may result in hearing loss.



WARNING

HOT COMPONENTS



Hot oil or metal parts can cause severe burns. Wear insulated gloves, long sleeves and eye protection when working with heated parts.



WARNING

HYDRAULIC SYSTEM PRESSURE



- Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then **SLOWLY** loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury or death.

- At operating temperature hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulics. Failure to do so could result in injury.



WARNING

LIFTING HEAVY PARTS



- Lifting equipment used for lifting machine must be in good condition and of suitable load capacity. Failure to follow this warning may result in injury or death to personnel and damage to equipment.
- Improper use of lifting equipment and improper attachment to machine can result in serious personnel injury and equipment damage. Observe all standard rules of safety.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

WARNING

MACHINE OPERATION

This machine must be operated only by authorized personnel who have satisfactorily completed a program of training which must include familiarity with safe operating procedures, characteristics and a knowledge of applicable codes, regulations and facilities directives. Untrained personnel subject themselves and others to the possibility of death or serious injury from the improper operation of this machine. Understand the equipment, its function and the controls before operation.

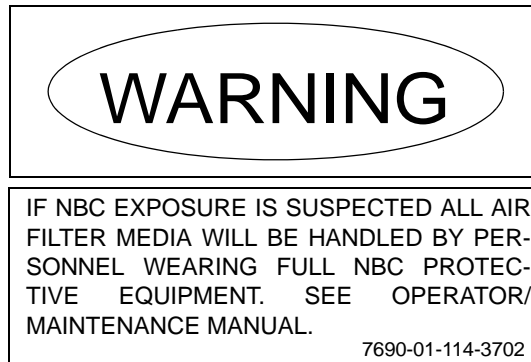


WARNING



NBC EXPOSURE

- If NBC exposure is suspected, personnel wearing protective equipment should handle all air cleaner media. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.
- NBC contaminated filters must be handled using adequate precautions and must be disposed of by trained personnel.



To order this NBC decal use:

National Stock Number (NSN) - 7690-01-114-3702

Part Number (PN) - 12296626

Commercial and Government Entity Code (CAGEC) - 19207



WARNING



PRESSURIZED COOLING SYSTEM

- **DO NOT** service cooling system unless engine has been allowed to cool down. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns.
- **DO NOT** remove cooling system radiator cap when engine is hot. Allow engine to cool down. Loosen cap to first stop and let any pressure out of cooling system, then remove cap. Failure to follow this warning may cause serious burns.
- Wear effective eye, glove, and skin protection when handling coolants. Failure to do so may cause injury.



WARNING

SILICONE RTV COMPOUND



- Exposure to silicone RTV compound may be hazardous to your health. Contact with eyes can cause severe irritation and burns. Compound can be absorbed into the skin and can cause irritation or skin sensitization. Inhalation of vapors can cause respiratory tract irritation; prolonged inhalation can result in an allergic reaction. Vapors are combustible. Do not use near open flame. Wear eye and skin protection and avoid inhalation of vapors. Use only in a well-ventilated area. Failure to follow this warning can cause injury or death.
- If compound gets into eyes, flush with large amounts of running water for at least 15 minutes and seek medical attention immediately. If compound gets on skin, remove as much as possible using mechanical/waterless methods, then flush with water. Seek medical attention for any burns or irritation. If inhaled, remove person to fresh air and provide oxygen if breathing is difficult, or perform cardio-pulmonary resuscitation (CPR). If injected, call physician immediately. If conscious, drink water.



WARNING

SOLVENT CLEANING COMPOUND



- Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.
- NOTE: P-D-680 Type II is no longer in use and has been replaced by MIL-PRF-680 Type III.



WARNING

TESTING/ADJUSTING HYDRAULIC SYSTEM

- When testing and adjusting hydraulic system. Always move machine away from traffic pattern and away from personnel. Allow only one person on the machine. Keep all other personnel off to one side and within view of the operator.
- When blade and/or ripper must be raised while tests and adjustments are being performed, ensure they are securely supported. Relieve hydraulic system pressure before disconnecting any line or fitting. Serious injury or death could result if system pressure is not relieved.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

Date of issue for original manual is:

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TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS TBD AND TOTAL NUMBER OF WORK PACKAGES IS 186 CONSISTING OF THE FOLLOWING:

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Includes Unit and Direct Support Maintenance

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TRACTOR WITH WINCH AND WINTERIZED CAB; NSN 2410-00-300-6664

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

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HOW TO USE THIS MANUAL

NOTE

If at any time you are unsure how to use this manual or you cannot locate the information you need, notify your supervisor.

INTRODUCTION

1. A Service Life Extension Program (SLEP) has been implemented on selected D7F Tractors.
2. The major differences between a non-SLEP and SLEP tractor are as follows:
 - a. A non-SLEP tractor is equipped with either a model D333 or early model 3306 engine. These engines use glow plugs for cold weather starting. In addition, there is no oil sampling valve for engine oil sampling.
 - b. A SLEP tractor is equipped with a later model 3306 engine, an ether starting aid system, an engine oil sampling valve and a protective screen on the ROPS. Some SLEP tractors may be equipped with a transmission oil sampling valve.
3. Refer to WP 0002 00, *Equipment Description and Data*, for further information on how to verify which tractor you have.
4. This revised manual is designed to help you perform lubrication, troubleshooting and maintenance on both configurations of D7F Tractors.
5. This manual is written in work package format.
6. Chapters divide the manual into major categories of information (e.g., *Introductory Information with Theory of Operation*, *Troubleshooting Procedures*, *Field Maintenance Procedures*, and *Supporting Information*).
 - c. Each chapter is divided into work packages, which are identified by a 6-digit number (e.g. 0001 00, 0002 00, etc.) located on the upper right-hand corner of each page. The work package page number (e.g. 0001 00-1, 0001 00-2, etc.) is located centered at the bottom of each page.
 - d. If a Change Package is issued to this manual, added work packages use the 5th and 6th digits of their number to indicate new material. For instance, work packages inserted between WP 0001 00 and WP 0002 00 are numbered WP 0001 01, WP 0001 02, etc.
7. Read through this manual to become familiar with its organization and contents before attempting to operate or maintain the equipment.
8. To ensure your safety and proper maintenance of the tractor, pay close attention to Chapter 4, General Maintenance Instructions.

CONTENTS OF THIS MANUAL

1. A *Warning Summary* is located at the beginning of this manual. Become familiar with these warnings before operating or performing troubleshooting or maintenance on the machine.
2. A *Table of Contents*, located in the front of the manual, lists all chapters and work packages in the publication.
 - a. The Table of Contents also provides *Reporting Errors and Recommending Improvements* information and DA Form 2028 addresses, for the submittal of corrections to this manual.
 - b. If you cannot find what you are looking for in the Table of Contents, refer to the alphabetical *Index* at the back of the manual.
3. Chapter 1, *Introductory Information with Theory of Information*, provides general information on the manual and the equipment.
4. Chapter 2 covers *Troubleshooting Procedures*. WP 0005 00 contains a *Troubleshooting Symptom Index*. If the machine malfunctions, this index should always be consulted to locate the appropriate troubleshooting procedure.
5. Chapter 3 deals with *Field Maintenance Procedures*: Major areas covered are *Service Upon Receipt*, *Preventive Maintenance Checks and Services (PMCS)* and all maintenance procedures authorized by the Maintenance Allocation Chart

(MAC) for this manual, organized in Functional Group Code (FGC) sequence. Refer to the *Table of Contents* for a complete listing of maintenance procedures.

6. Chapter 4 covers general maintenance information work packages. Before performing any maintenance procedure, read and understand the instructions in this chapter.
7. Chapter 5 includes *Supporting Information: References; Maintenance Allocation Chart (MAC) Introduction; Maintenance Allocation Chart (MAC); Expendable and Durable Items List; Tool Identification List; and Warranty Information.*

FEATURES OF THIS MANUAL

1. WARNINGS, CAUTIONS, NOTES, subject headings, and other important information are highlighted in **BOLD** print as a visual aid.

WARNING

A WARNING indicates a hazard which may result in death or serious injury.

CAUTION

A CAUTION is a reminder of safety practices or directs attention to usage practices that may result in damage to equipment.

NOTE

A NOTE is a statement containing information that will make the procedures easier to perform.

2. Statements and words of particular interest may be printed in CAPITAL LETTERS to create emphasis.
3. Within a procedural step, reference may be made to another work package in this manual or to another manual. These references indicate where you should look for more complete information.
If you are told: "Replace engine oil filter (WP 0010 00)", go to Work Package 0010 00 in this manual for instructions on replacing the filter.
4. Illustrations are placed after, and as close to, the procedural steps to which they apply. Callouts placed on the art may be text or numbers, or both; whichever method is easier for the soldier.
5. Numbers located at lower right corner of art (e.g. 386-001; 386-002, etc.) are art control numbers and are used for tracking purposes. Disregard these numbers.
6. Dashed leader lines used in the Lubrication Chart (WP 0008 00) indicate lubrication points that are located on both sides of the equipment.
7. Technical instructions include metric units as well as standard units. For your reference, a *Metric Conversion Chart* is located on the inside back cover of the manual.
8. The initial setup of each work package lists components necessary to perform the procedure. The number in parenthesis following the component references the callout number for the component within the work package art.

CHAPTER 1
INTRODUCTORY INFORMATION WITH
THEORY OF OPERATION

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SCOPE**NOTE**

- A Service Life Extension Program (SLEP) has been implemented on selected D7F Tractors. This revised manual is designed to help you perform lubrication, troubleshooting and maintenance on both configuration D7F Tractors.
- The major differences between a non-SLEP and SLEP tractor are as follows:
 - a. A non-SLEP tractor is equipped with either a Model D333 or early Model 3306 engine. These engines use glow plugs for cold weather starting. In addition, there is no oil sampling valve for engine oil sampling.
 - b. A SLEP tractor is equipped with a later Model 3306 engine, with an ether starting aid system and an engine oil sampling valve. Some SLEP tractors may be equipped with a transmission oil sampling valve.
- Refer to WP 0002 00, *Equipment Description and Data*, for further information on how to verify which tractor you have.

1. **Type of Manual.** This manual is for use in performing Field Maintenance on the Model D7F Tractor.
2. **Equipment Name and Model Number.**
 - a. Tractor, Full Tracked, Low Speed: DED, Medium Drawbar Pull, Caterpillar Model D7F.
 - b. The D7F Tractor is available in the following configurations:
 - (1) Tractor with Ripper; NSN 2410-00-185-9794 (EIC EAW)
 - (2) Tractor with Ripper and Winterized Cab; NSN 2410-00-300-6665
 - (3) Tractor with Winch; NSN 2410-00-185-9792 (EIC EA6)
 - (4) Tractor with Winch and Winterized Cab; NSN 2410-00-300-6664
3. **Purpose of Equipment.**
 - a. The D7F Tractor is designed for dozing soil and rocks and for clearing land of trees and brush.
 - b. Tractors equipped with ripper are designed for dozing and also for ripping soil, rocks, asphalt and concrete.
 - c. Tractors equipped with winch are designed for dozing and also for winching operations.

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 User's Manual for the Army Maintenance Management System (TAMMS)*, as contained in the Maintenance Management Update.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIRS)

If your tractor 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 Form 368 (*Product Quality Deficiency Report*). Mail it to us at: Commander, U.S. Army Tank-automotive and Armaments Command, ATTN: AMSTA-AC-NML, Rock Island, Illinois 61299-7630. We'll send you a reply.

CORROSION PREVENTION AND CONTROL (CPC)

1. 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.
2. 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 these materials may be a corrosion problem.
3. If a corrosion problem is identified, it can be reported using SF Form 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.

OZONE DEPLETING SUBSTANCES

There are no ozone depleting substances cited in this manual or used on the D7F Tractor.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For destruction of Army materiel to prevent enemy use, refer to TM 750-244-3.

PREPARATION FOR STORAGE OR SHIPMENT

For preparation for storage or shipment procedures, refer to WP 0179 00.

WARRANTY INFORMATION

SLEP machines are warranted by Caterpillar Inc. IAW *Warranty Information* (WP 0084 00). Record all deficiencies on DA Form 2404 or DA Form 5988-E, Equipment - Inspection and Maintenance Worksheet. Report all defects in materials or workmanship to your supervisor.

NOMENCLATURE CROSS-REFERENCE LIST

COMMON NAME	OFFICIAL NOMENCLATURE
Belly Pan	Crankcase or Transmission Guard
Dipstick	Oil Level Gage
Engine Coolant	Antifreeze, Ethylene Glycol Mixture
Rock Guard	Track Roller Frame Guard, Track Roller Guard

LIST OF ABBREVIATIONS/ACRONYMS

NOTE

Refer to ASME Y14.38-1999 for Abbreviations and Acronyms standard abbreviations.

ABBREVIATION/ACRONYMS	DEFINITION
AAL.....	Additional Authorization List
BDC.....	Bottom Dead Center
BII.....	Basic Issue Items
C.....	Centigrade or Celsius
CCA.....	Cold Cranking Amps
cm.....	Centimeter
COEI.....	Components of End Item
F.....	Fahrenheit
GVWR.....	Gross Vehicle Weight Rating
IAW.....	In Accordance With
kg.....	Kilogram
km.....	Kilometer
kN.....	kilowatt Newton
kPa.....	Kilopascal
kph.....	Kilometers per Hour
L.....	Liter
lb-ft.....	Pound Foot
mm.....	Millimeter
NATO.....	North Atlantic Treaty Organization
Nm.....	Newton Meter
PMCS.....	Preventive Maintenance Checks and Services
ROPS.....	Rollover Protective Structure
SLEP.....	Service Life Extension Program
SU (Bulldozer Blade).....	Semi-U (Bulldozer Blade)
TDC.....	Top Dead Center

END OF WORK PACKAGE

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EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES**NOTE**

Refer to *Equipment Data* at the end of this work package for machine dimensions, weights, fluid capacities and other miscellaneous equipment data.

1. The D7F Tractor is a full-tracked, low speed, medium drawbar pull machine designed for earthmoving and construction operations.
2. The three major assemblies of the tractor are a center section and two side sections.
 - a. The center section contains the power source, the operator's controls, and the rollover protective structure (ROPS).
 - b. The two side sections consist of track frames extending approximately the full length of the tractor.
3. The tractor can operate in mud or water as deep as the top of the final drive cover: 30 in. (76.2 cm).
4. Features of the D7F tractor include:
 - a. Caterpillar 6-cylinder, turbocharged diesel engine.
 - b. Caterpillar powershift, manual transmission with Neutral (N) and three forward and three reverse speeds and a transmission safety lock;
 - c. operator station with adjustable seat and seat belt;
 - d. ROPS canopy;
 - e. clutch-operated steering brakes with dual brake pedals and a brake lock lever that serves as a parking brake;
 - f. 24-volt electrical system with NATO slave receptacle;
 - g. front-mounted Semi-U (SU) bulldozer blade;
 - h. either rear-mounted ripper or rear-mounted reversible winch; and
 - i. a winterized cab installed on tractors operating in arctic conditions.
5. Tractors procured from 1971-1984, that have not gone through the Service Life Extension Program (SLEP), have the following features:

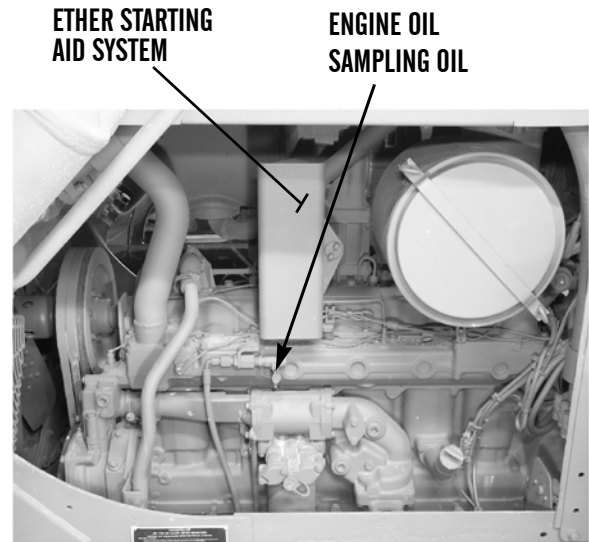
NOTE

If a non-SLEP tractor has had its original engine replaced, it may be equipped with a later model 3306 engine.

- a. engine model D333 or early model 3306 with precombustion chambers;
- b. glow plugs for cold weather starting; and
- c. old style (two-prong) NATO slave receptacle.

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES - CONTINUED

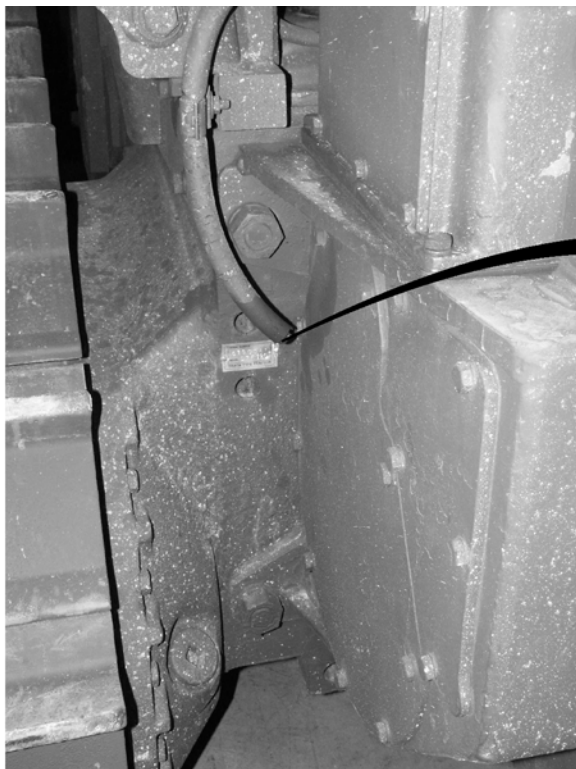
- 6. SLEP tractors have the following features:
 - a. later model 3306 engine;
 - b. direct injection fuel system;
 - c. ether starting aid system;
 - d. engine oil sampling valve;
 - e. selected tractors may have a transmission oil sampling valve;
 - f. backup alarm;
 - g. new style (single-prong) NATO slave receptacle; and
 - h. rear protective screen on ROPS.



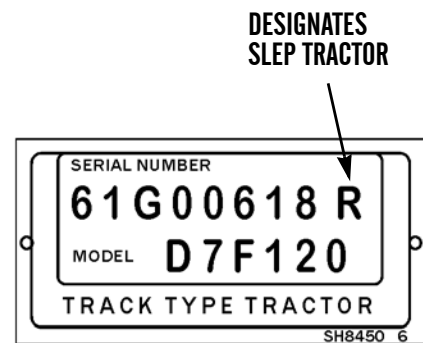
LATER MODEL 3306 ENGINE

386-684

- 7. To determine if you have a SLEP tractor, do the following:
 - a. On tractors equipped with a winch, look for the suffix “R” stamped after the serial number on the data plate at the left rear of the machine.



TRACTOR WITH WINCH



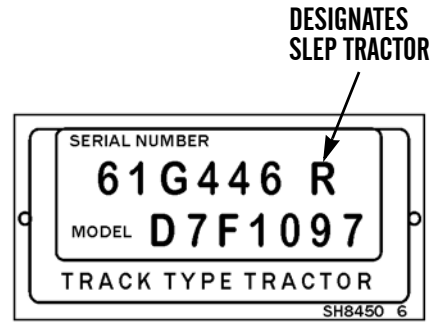
386-693

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES - CONTINUED

- b. On tractors equipped with a ripper, look for the suffix “R” stamped after the serial number on the data plate inside the operator station.

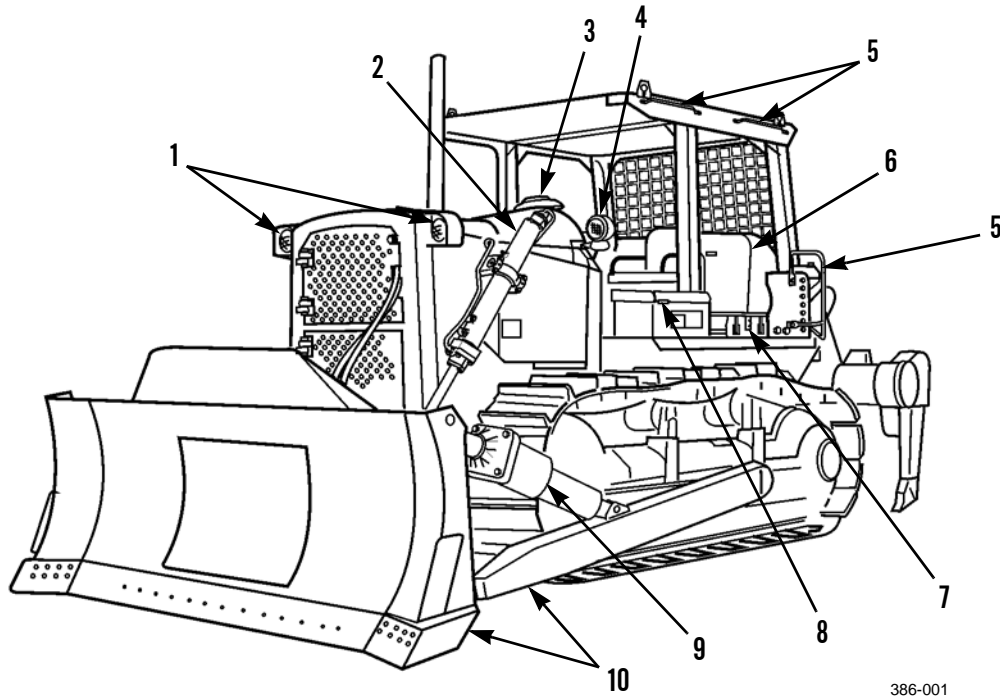


TRACTOR WITH RIPPER



386-718

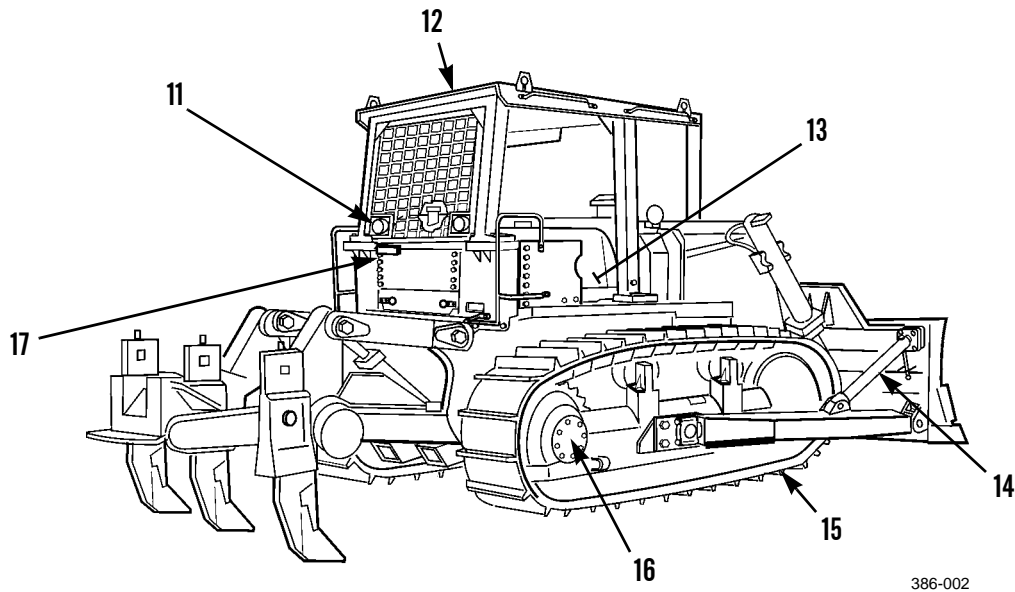
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS



386-001

KEY	COMPONENT	DESCRIPTION
1	Front Flood Lights	Illuminate work area to front of machine.
2	Lift Cylinders	Raise or lower bulldozer blade. Located on both sides of machine.
3	Engine Air Precleaner	Prevents debris from entering engine air intake system.
4	Center Flood Lights	Illuminate track and rear of blade.
5	Grabhandles	Provide a handhold for personnel climbing on machine.
6	Fuel Tank	Stores fuel supply for engine operation.
7	Toolbox	Provides stowage for tools or other items required by operator.
8	Battery Box	Enclosure protects batteries from damage. Two batteries inside are easily accessible for servicing.
9	Tilt Cylinder	Used in conjunction with brace (on right side) to adjust angle of bulldozer blade.
10	SU Blade Assembly	Used for earthmoving operations or as a push block. Consists of moldboard, removable cutting edges and end bits, and blade pusharms that connect blade to the tractor. Reinforced plate in center of blade is used to push-assist scrapers. Back-rip scarifiers are attached to the back of the blade and can be lowered and locked in place with pins for scarifying. Blade assembly controls are operated from operator seat.

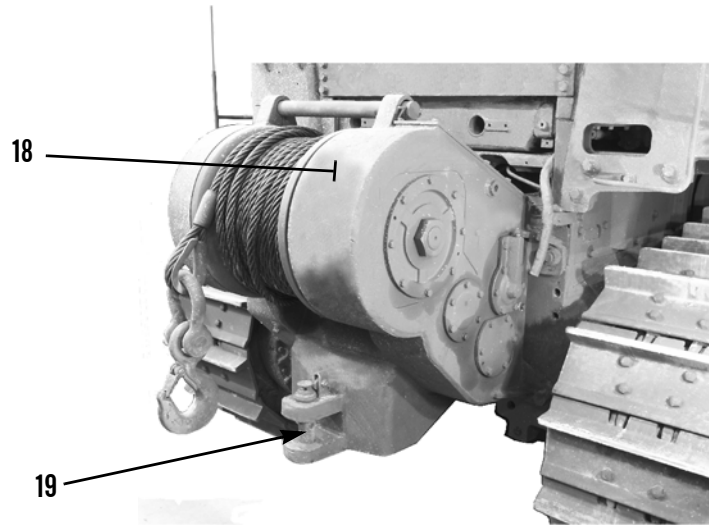
LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



386-002

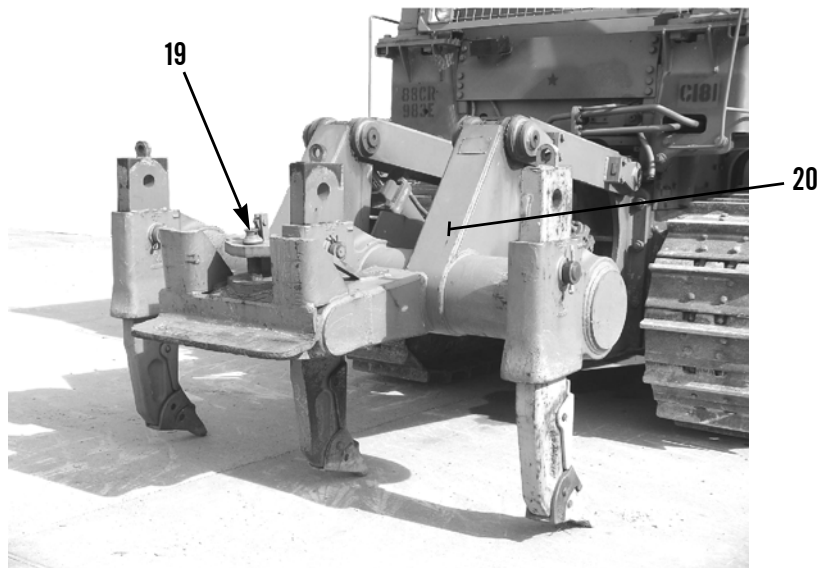
KEY	COMPONENT	DESCRIPTION
11	Rear Flood Lights	Illuminate work area at rear of machine.
12	ROPS	Provides rollover protection for operator.
13	Hydraulic Tank	Stores hydraulic oil used in machine hydraulic systems. Filler cap contains dipstick for oil level check.
14	Blade Tilt Brace	Allows for additional adjustment of blade tilt.
15	Tracks	Propel the tractor.
16	Final Drive	Provides power to the tracks.
17	Backup Alarm (If Equipped)	Alarm sounds when transmission is placed in reverse. Switch on back of alarm adjusts volume. Non-SLEP machines have no backup alarm.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS - CONTINUED



386-003

KEY	COMPONENT	DESCRIPTION
18	Winch	Driven by winch hydraulic pump mounted on engine auxiliary drive. Controls operated from operator seat.
19	Drawbar Pin	Used for towing compaction equipment, scrapers etc.



386-719

KEY	COMPONENT	DESCRIPTION
20	Ripper	Rear-mounted implement with three shanks used to loosen soil or rip through hard compacted surfaces. Ripper controls are operated from operator seat.

EQUIPMENT DESCRIPTION AND DATA - CONTINUED

0002 00

EQUIPMENT DATA

Dimensions:

Length:

With Ripper 287 in. (7.29 m)
 With Winch 232 in. (5.89 m)

Width:

With Dozer Blade 133 in. (3.38 m)
 Without Dozer Blade 105 in. (2.67 m)

Ground Clearance 14.7 in. (37.34 cm)

Height 121 in. (3.10 m)

Weights:

With Fuel and Lubricants:

With Winch and Dozer 49,400 lb (22,428 kg)
 With Ripper and Dozer 54,220 lb (24,220 kg)

Capacities:

Engine Crankcase (With Filter) 29 qt (27.4 l)
 Transmission, Bevel Gear and Steering Clutch Compartments 148 qt (140 l)
 Fuel Tank 115 gal. (435.3 l)
 Radiator 48 qt (45.4 l)
 Final Drive (Each) 36 qt (34.1 l)
 Hydraulic System 112 qt (106.0 l)
 Hydraulic Tank 88 qt (83.2 l)
 Winch 38 qt (36.0 l)

Speeds:

Forward:

1st 0-2.2 mph (0-3.5 kph)
 2nd 0-3.9 mph (0-6.3 kph)
 3rd 0-5.9 mph (0-9.5 kph)

Reverse:

1st 0-2.7 mph (0-4.3 kph)
 2nd 0-4.7 mph (0-7.6 kph)
 3rd 0-7.1 mph (0-11.4 kph)

Engine:

Manufacturer Caterpillar Inc.
 Type turbocharged, 4-stroke cycle
 Horsepower 208 @ 2,000 RPM
 Engine RPM 2,100 (high idle); 670 (low idle)
 Cylinders 6
 Fuel System:
 Model D333 and Early Model 3306 precombustion chambers/glow plugs
 Later Model 3306 direct injection

EQUIPMENT DESCRIPTION AND DATA - CONTINUED

0002 00

EQUIPMENT DATA - CONTINUED

Transmission:

ManufacturerCaterpillar Inc.
 Type powershift, manual
 Range Selection neutral (N); 3 speeds forward and 3
 speeds reverse

Steering and Brake System:

Steering Type mechanically-operated clutches
 dual brake pedals
 Brakes band-type

Electrical System:

System Voltage 24 volts
 Batteries:
 Quantity 2
 Voltage 12 volts each
 CCA 1200
 Starter Rating 24 volts
 Alternator Rating 24 volts, 50 amp

Winch:

Manufacturer Hyster
 Weight 3,080 lb (1,398 kg)
 Power Source hydraulic pump on engine
 auxiliary drive
 Drum Size:
 Barrel Diameter 12 in. (30.5 cm)
 Flange Diameter 22.5 in. (57.2 cm)
 Barrel Length 12.37 in. (31.4 cm)
 Wipe Rope 1-inch, 200 ft (61 m) long

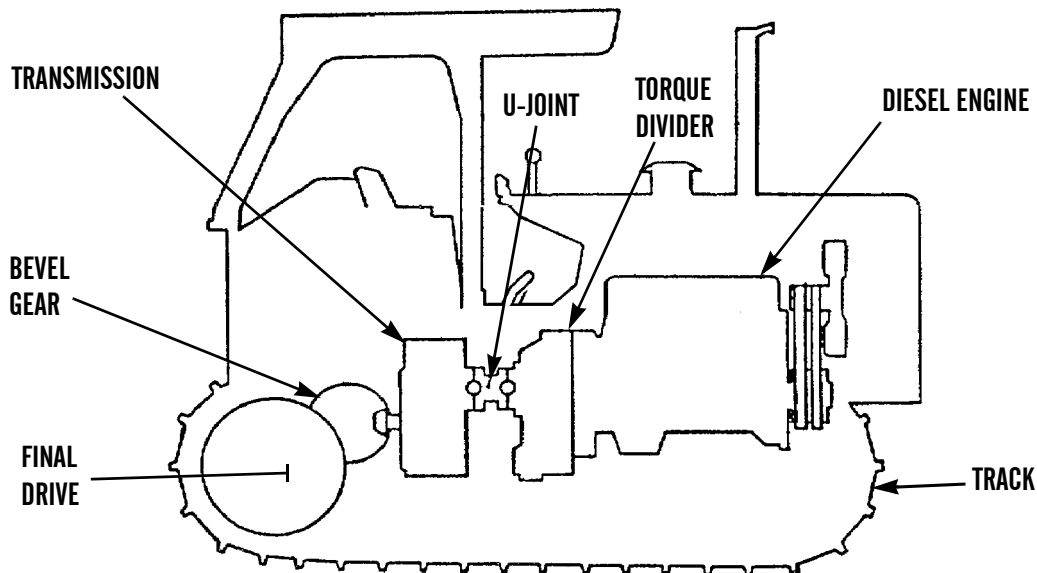
Ripper:

ManufacturerCaterpillar Inc.
 Weight 7,515 lb (3,412 kg)
 Number of Shanks 3

END OF WORK PACKAGE

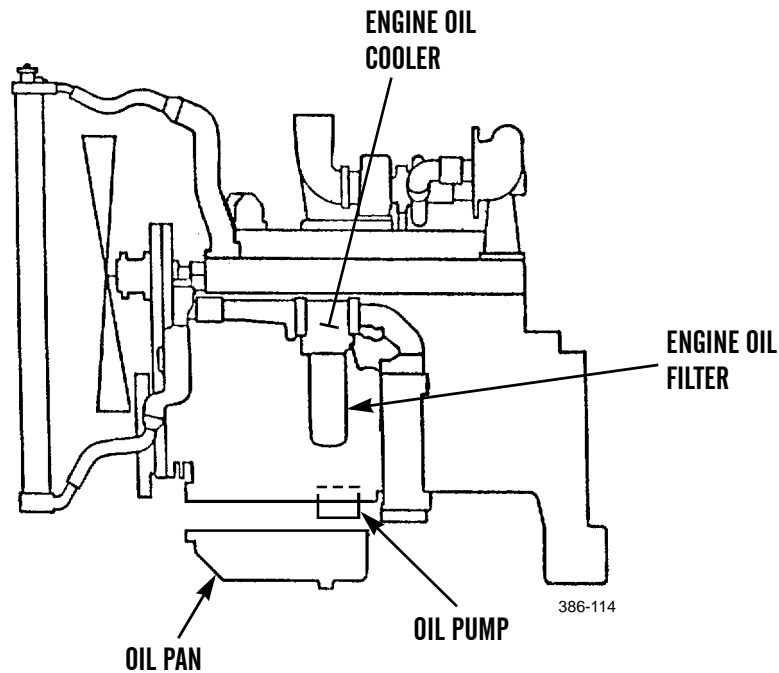
INTRODUCTION

This work package explains how components of the D7F Tractor work together. A functional description of equipment operation is given for the power train, engine lubrication system, fuel system, engine cooling system, steering and brake system, electrical system, dozer hydraulic system, ripper hydraulic system and winch hydraulic system.

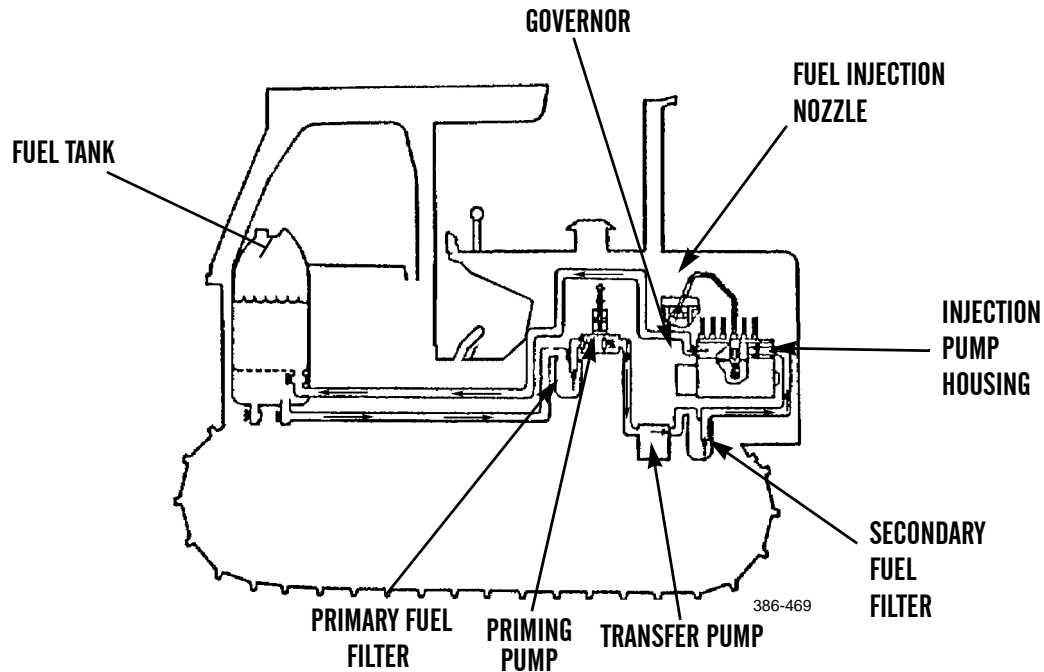
POWER TRAIN

386-467

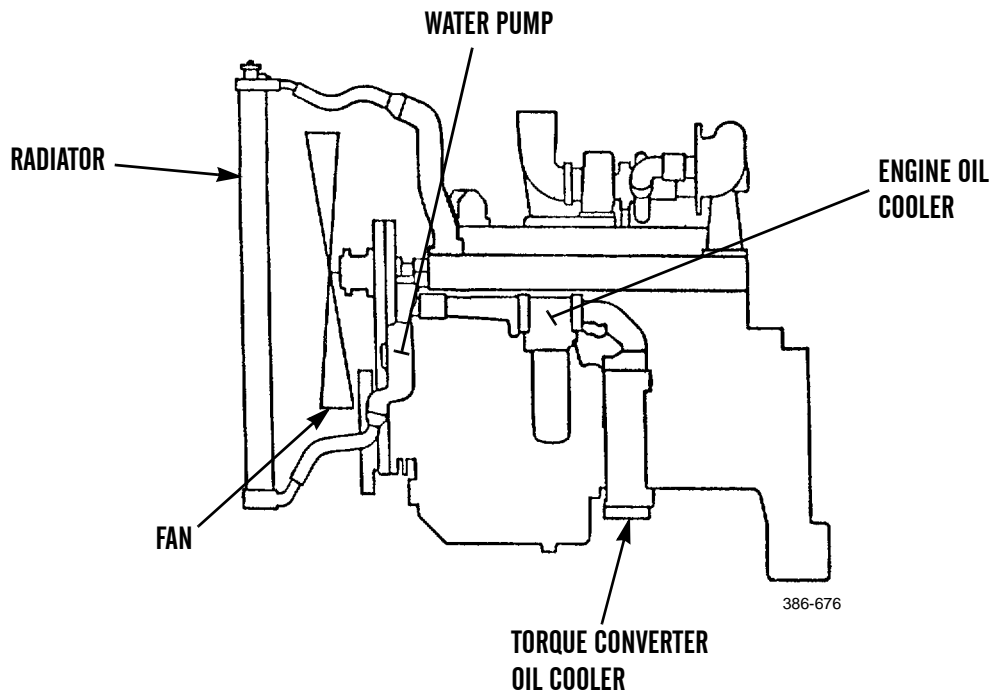
1. **Diesel Engine.** The tractor is powered by an in-line six cylinder diesel engine. SLEP engines have a direct injection fuel system. Non-SLEP engines use precombustion chambers/glow plugs.
2. **Torque Divider.** The torque divider connects the engine to the transmission. The torque divider will increase or decrease the torque from the engine depending on the load at which the tractor is working.
3. **U-Joint.** The U-joint transfers power from the torque divider to the transmission.
4. **Transmission.** The transmission controls the speed and direction of the tractor. At this point in the power train the operator can control the power by moving the transmission selector lever to neutral (N) or one of the three speeds in forward or reverse.
5. **Bevel Gear.** The bevel gear connects transmission to the final drives.
6. **Final Drive.** The final drive delivers the power of the power train to the sprocket on each side of the machine, which turns the track.
7. **Track.** The D7F has a steel roller-type track that is sealed and lubricated. Track tension may be adjusted by the operator.

ENGINE LUBRICATION SYSTEM

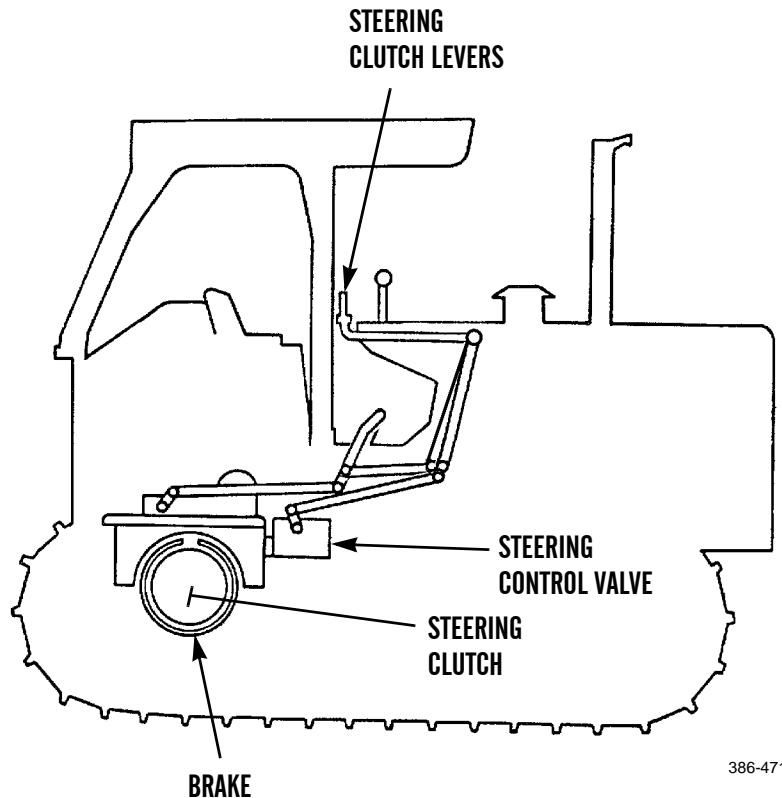
1. **Oil Pan.** The oil pan contains the oil that lubricates moving parts in the engine. It is attached to the bottom of the engine block.
2. **Oil Pump.** The pump is located just above the oil pan in the crankcase. The pump draws oil from the oil pan and sends it through the oil cooler, and then through the oil filter. From the filter the oil enters the cylinder block to lubricate the engine and is then returned to the oil pan. From the filter, oil is also sent through the turbocharger and then returned to the oil pan.
3. **Engine Oil Cooler.** Oil is sent through the oil cooler to lower its temperature.
4. **Engine Oil Filter.** The oil filter removes particles from the oil which could cause damage to the internal parts of the engine.

FUEL SYSTEM

1. **Fuel Tank.** The fuel tank provides containment for the fuel. A fuel strainer and the fuel level gage are contained in the filler neck of the tank.
2. **Priming Pump.** Primer pump is used to prime the fuel system.
3. **Primary Fuel Filter.** The primary fuel filter removes larger particles from the fuel before it reaches the transfer pump.
4. **Transfer Pump.** The transfer pump pulls fuel from the fuel tank through the primary fuel filter, and pushes it onto the secondary filter and the injection pump.
5. **Secondary Fuel Filter.** The secondary fuel filter removes smaller particles from the fuel before it reaches the injection pump.
6. **Injection Pump Housing.** The injection pump housing contains the fuel injection pumps which send an exact amount of fuel to the injection nozzles.
7. **Fuel Injection Nozzle.** The nozzles turn the stream of fuel into a fine spray which permits good combustion in the cylinders. There is one nozzle for each cylinder, and each nozzle has its own fuel injection pump.
8. **Governor.** The governor is attached to the fuel injection pump housing. It controls the amount of fuel needed by the engine to maintain a desired engine speed. The governor is controlled by the governor control lever in the operator station.

ENGINE COOLING SYSTEM

1. **Radiator.** The radiator has a filler cap which permits adding coolant to the system. Coolant circulates through the radiator to be cooled after leaving the cylinder block.
2. **Water Pump.** The water pump draws water from the radiator and sends it through the engine oil cooler, and then through the torque converter oil cooler. From the torque converter oil cooler, the coolant enters the cylinder block to cool the engine and then returns to the radiator.
3. **Engine Oil Cooler.** Coolant passes through water passages and cools the oil going through the oil passages of the cooler.
4. **Torque Converter Oil Cooler.** Coolant passes through the water passages and cools the oil going through the oil passages of the cooler.
5. **Fan.** The fan is powered by the engine. It helps lower the temperature of the coolant as it passes through the radiator.

STEERING AND BRAKE SYSTEM

1. **Steering Clutch Levers.** Levers serve as mechanical linkage to steering control valve.
2. **Steering Control Valve.** The valve is connected mechanically to the steering clutch levers. The valve directs the flow of pressurized oil in response to the movement of the levers.
3. **Steering Clutch.** There is one steering clutch for each track. They control the steering of the tractor. Mechanically operated, each steering clutch is controlled by the steering clutch lever in the operator's station. When turning left, the left clutch is released which causes the left track to stop moving and act as a pivot for the tractor to turn on. The same thing happens when turning right.
4. **Brakes.** The tractor has two band-type brakes (one on each steering clutch drum) which are used to stop the movement of the tractor and to assist with the steering of the tractor. When the steering clutch levers are pulled completely out or the brake pedals are depressed, the bands tighten around the steering clutch drum.

ELECTRICAL SYSTEM

1. **Batteries.** The batteries provide power for three circuits; the charging circuit, the starting circuit and the lighting (low amperage) circuit. Two 12-volt batteries are connected in series to provide 24-volt, 1200 CCA starting power.
2. **Alternator.** The 24-volt, 50-amp alternator, an integral part of the charging circuit, provides current when the engine is running.
3. **Starter Motor.** Part of the starting circuit, the starter motor is used to turn the engine flywheel fast enough to get the engine to start running.

ELECTRICAL SYSTEM - CONTINUED

4. **Circuit Breaker.** A switch that opens the battery circuit if the current in the electrical system goes higher than that for which the switch is rated. When the circuit is open, no current will flow through the electrical system.
5. **Battery Disconnect Switch.** A switch that is controlled by the operator. When it is in the OFF position, the battery circuit will be open so that no current is flowing through the electrical system.
6. **NATO Slave Receptacle.** Use by operator or maintenance personnel to slave start tractor.

DOZER HYDRAULIC SYSTEM

1. **Blade Control Valve.** This valve is connected mechanically to the blade control lever. The valve directs the flow of pressurized oil in response to the movement of the control lever.
2. **Tilt Cylinder.** This cylinder is on the left side of the machine. It is controlled by the blade control lever. When the lever is moved to the right, pressurized oil from the hydraulic tank causes the cylinder to extend. Moving the lever to the left causes the cylinder to retract.
3. **Lift Cylinders.** These are two cylinders which are controlled by the blade control lever. When the lever is pushed forward, pressurized oil causes the cylinders to extend and lower the blade. When the lever is pulled back, the cylinders retract and raise the blade.
4. **Hydraulic Tank.** This is the reservoir for the oil which controls the movement of both dozer and ripper cylinders.

RIPPER HYDRAULIC SYSTEM

1. **Ripper Control Valve.** This valve is located inside the hydraulic tank and is connected mechanically to the ripper control lever. This valve directs the flow of pressurized oil to the cylinders in response to the movement of the ripper control lever.
2. **Lift Cylinders.** These are two cylinders which are controlled by the ripper control lever. When the lever is moved to the left, pressurized oil causes the cylinders to extend and lift the ripper. When the lever is moved to the right, the cylinders retract and lower the ripper.
3. **Hydraulic Tank.** Oil to control ripper movement is stored in the same hydraulic tank as the machine's hydraulic system.

WINCH HYDRAULIC SYSTEM

1. **Reservoir.** The reservoir is integral to the winch. It contains oil which is used for winch lubrication and hydraulic control systems.
2. **Pump.** The pump is driven directly off the engine, and is responsible for the circulation of the oil. The pump is located under the floor plates in the operator's station, on the right side.
3. **Magnetic Strainer.** Oil is pulled from the reservoir and goes through the strainer before it enters the lubrication system and the hydraulic control system. The strainer removes harmful large metallic particles from the oil, which could cause damage to the systems.
4. **Filter.** Removes smaller harmful particles from the oil before the oil returns to the reservoir.
5. **Control Valve.** This valve responds to the winch selector lever. When you move the lever, the valve sends pressurized oil to engage or disengage directional clutches, which permit the drum to turn.
6. **Drum.** The gears which turn the drum are powered by the transmission. The direction the drum turns is controlled by moving the winch selector lever.

END OF WORK PACKAGE

CHAPTER 2
FIELD TROUBLESHOOTING PROCEDURES

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INTRODUCTION

1. Troubleshooting procedures in this chapter contain information you need to locate malfunctions on the D7F Tractor and its components.
2. Troubleshooting procedures are located as follows:
 - a. Tables 1 through 5 in WP 0006 00 contain mechanical troubleshooting procedures.
 - b. Table 6 in WP 0006 00 contains electrical troubleshooting procedures.
3. A *Troubleshooting Symptom Index* in WP 0005 00 is provided to aid in locating a malfunction or symptom and directs you to the appropriate troubleshooting procedure in WP 0006 00.
4. Troubleshooting procedures in this manual cannot provide all the answers or correct all malfunctions encountered. However, these procedures are an organized step-by-step approach to a problem, that direct tests and inspections toward the source of the problem and its successful resolution.
5. If a malfunction is not listed in the *Troubleshooting Symptom Index* in WP 0005 00, or stated tests or inspections and corrective actions do not correct the problem, notify your supervisor.
6. Before performing troubleshooting, read and follow all safety instructions found in the Warning Summary at the front of this manual.

PRELIMINARY TROUBLESHOOTING PROCEDURES

1. Before starting any specific troubleshooting procedures, perform the following:

NOTE**Fluid leaks are classified as either Class I, Class II or Class III.**

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/inspected.

Class III: Leakage of fluid great enough to form drops that fall from item being checked/inspected.

- a. Visually check for ruptured fluid hoses or tubes and for Class II or Class III leaks.
 - b. Check for mechanical jamming or binding caused by rocks or other foreign matter.
 - c. Check fluid levels in subject area and service as required (TM 5-2410-233-10 or WP 0008 00 and WP 0009 00 in this manual).
2. Ensure all applicable Operator Troubleshooting has been performed before proceeding.

EXPLANATION OF TROUBLESHOOTING TABLE COLUMNS

The columns in troubleshooting tables are defined as follows:

1. **MALFUNCTION**. Indicates fault that has occurred in system/equipment.
2. **TEST OR INSPECTION**. Indicates test or inspection to be performed to isolate probable cause for fault symptom.
3. **CORRECTIVE ACTION**. Indicates procedure to correct the problem.

ELECTRICAL TROUBLESHOOTING--GENERAL INFORMATION**NOTE**

Refer to *Electrical General Maintenance Instructions (WP 0177 00)* for instructions on using a multimeter to check for continuity or shorts and to perform voltage checks.

1. Analyze the symptoms and conditions and use common sense and logic to determine the most likely cause for the problem, then troubleshoot that circuit first. The more information you have concerning the problem, the easier it will be to troubleshoot.
2. Isolate to the subsystem level (in cases where more than one subsystem is involved); next isolate the problem to a single circuit within the subsystem; then, isolate the problem to the faulty component using the troubleshooting symptom index (WP 0005 00).
3. Frayed, broken, loose or corroded wiring is a common source of problems in any electrical circuit. Always make visual inspection before starting detail troubleshooting. Observe in particular contacts to ground. Components with case grounds are especially troublesome.

CAUTION

When making continuity checks, ensure the test equipment is isolated from power source.

4. Most of checks made are voltage checks. Pay particular attention to voltages being checked in procedures. This equipment is a 24 volt system. Instructions prior to the step instruct to disconnect at test point from the potential malfunctioning component. Once the check has been made, either repair the component or go to the referenced step. If going to another step, reconnect connection or do as otherwise instructed, such as install jumper wires using jumper wire kit. When ready to make the prescribed check, apply power to the circuit (if required). A helper may be required if the switch or power source is out of reach. Release the power function prior to going on, to avoid damage to equipment.

END OF WORK PACKAGE

NOTE

This work package contains Electrical Troubleshooting Symptom Index and Mechanical Troubleshooting Symptom Index.

ELECTRICAL TROUBLESHOOTING SYMPTOM INDEX

<u>Malfunction/Symptom</u>	<u>Troubleshooting Procedure Page</u>
AMMETER, HOURMETER AND WARNING SYSTEM	
Ammeter Inoperative.	0006 00-59
Backup Alarm Does Not Sound.	0006 00-60
BATTERY SYSTEM	
All Tractor Electrical Systems Inoperative.	0006 00-23
Batteries are Hot, Electrolyte is Boiling or Excessive Use of Water.	0006 00-21
Engine Will Not Crank.	0006 00-21
Specific Gravity Will Not Increase to 1.240 Under Charge.	0006 00-21
CHARGING SYSTEM	
Alternator Charge Too High (Ammeter in High Green Zone).	0006 00-45
Alternator Output Low (Ammeter Reading in Red Zone).	0006 00-45
Batteries Hot or Boiling, Corrected Specific Gravity of All Cells is 1.240.	0006 00-42
Batteries Run Down in Service.	0006 00-43
Batteries Use Excessive Water.	0006 00-43
No Alternator Output.	0006 00-44
ETHER STARTING AID SYSTEM	
Engine Cranks But Will Not Start in Cold Weather (Fuel System Operating Properly).	0006 00-54
LIGHTING SYSTEM	
Lamp(s) Will Not Light.	0006 00-47
STARTING SYSTEM	
Solenoid and Starting Motor Operate; Engine Cranks Slowly	0006 00-35
Starting Motor Inoperative.	0006 00-25
COOLING SYSTEM	
Engine Does Not Reach Normal Operating Temperature (According to Engine Water Temperature Gage).	0006 00-13
Engine Overheats (According to Engine Water Temperature Gage).	0006 00-12
Loss of Coolant.	0006 00-13
ENGINE	
Black or Gray Exhaust Smoke.	0006 00-9
Blue Exhaust Smoke.	0006 00-10
Coolant in Engine Lubricating Oil.	0006 00-11
Engine Cranks But Fails to Start.	0006 00-1
Engine Cranks Slowly, Hard to Start.	0006 00-2
Engine Fails to Crank.	0006 00-1

TROUBLESHOOTING SYMPTOM INDEX - CONTINUED

0005 00

MECHANICAL TROUBLESHOOTING SYMPTOM INDEX

<u>Malfunction/Symptom</u>	<u>Troubleshooting Procedure Page</u>
Engine Knocks (Excessive Mechanical Noise)	0006 00-8
Engine Knocks (Fuel Knock)	0006 00-7
Engine Lubricating Oil at Exhaust	0006 00-11
Engine Lubricating Oil in Cooling System.	0006 00-11
Engine Misfires or Runs Rough.	0006 00-3
Engine Speed Unstable or Surges at All Speeds.	0006 00-6
Engine Starting Motor Operates, Does Not Engage Flywheel Ring Gear.	0006 00-2
Engine Starts But Fails to Keep Running.	0006 00-4
Excessive Engine Vibration.	0006 00-6
Excessive Fuel Consumption	0006 00-10
Excessive Noise From Valve Mechanism (Clicking Sound).	0006 00-8
Excessive Oil Consumption.	0006 00-8
Low Oil Pressure.	0006 00-9
Poor Acceleration and/or Lack of Power.	0006 00-5
White Exhaust Smoke.	0006 00-9
ETHER STARTING AID SYSTEM	
Engine Cranks But Will Not Start in Cold Weather (Fuel System Operating Properly).	0006 00-54
EXHAUST SYSTEM	
Excessive Exhaust Fumes and/or Fumes in Cab (If Equipped).	0006 00-12
HYDRAULIC SYSTEM	
Blade Tilt Cylinder and Lift Cylinders Drift.	0006 00-19
Blade Tilt or Ripper Lift Circuit is Slow or Does Not Move.	0006 00-19
Hydraulic Oil is Overheating (Indicated by Blown Oil Seals, Decreased Life of Components).	0006 00-19
Hydraulic Pump Noisy.	0006 00-18
Hydraulic Pump Overheats.	0006 00-18
Irregular Cylinder Movement (Not Smooth).	0006 00-18
Ripper Moves Very Slowly/No Down Pressure in Lift Circuit (Blade Tilt Circuit OK).	0006 00-19
Slow Cylinder Movement.	0006 00-18
STEERING SYSTEM	
Slow Response to Steering Clutch Lever Movement.	0006 00-17
Tractor Turns When Both Steering Clutch Levers are Pulled at the Same Time.	0006 00-17
Tractor Will Not Turn in Either Direction.	0006 00-17
Tractor Will Not Turn in One Direction.	0006 00-17
TRANSMISSION	
Excessive Noise During Shifting.	0006 00-14
Incorrect Response to Transmission Selector Lever Movement.	0006 00-14
Loss of Torque Divider Oil.	0006 00-16
Low Transmission Oil Pressure.	0006 00-14
No Response to Transmission Selector Lever Movement.	0006 00-14

TROUBLESHOOTING SYMPTOM INDEX - CONTINUED

0005 00

MECHANICAL TROUBLESHOOTING SYMPTOM INDEX - CONTINUED

Malfunction/Symptom Troubleshooting Procedure Page

Torque Divider Overheats (According to Converter Oil Temperature Gage)	0006 00-16
Transmission Downshifts During Operation (No Transmission Selector Lever Movement).	0006 00-14
Transmission Noisy.	0006 00-15
Transmission Oil Dirty, Foamy, and/or Milky.	0006 00-15
Transmission Oil Leakage.	0006 00-15
Transmission Overheats.	0006 00-14

WINCH

Oil Leak at Both or One End of Winch Drum.	0006 00-20
Winch Does Not Hold Load With Control Lever in BRAKE ON Position.	0006 00-20
Winch Does Not Operate.	0006 00-20
Winch Operates in One Direction Only.	0006 00-20

END OF WORK PACKAGE

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Table 1. Engine Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
ENGINE		
<p>1. Engine Fails to Crank.</p>	<p>1. See <i>Electrical Troubleshooting</i>, Table 6.</p> <p>2. Check engine for seizure:</p> <p>a. Try to turn crankshaft manually.</p> <p>b. If crankshaft will not rotate, engine has internal damage.</p>	<p>Replace engine assembly (0019 00).</p>
<p>2. Engine Cranks But Fails to Start.</p>	<p>1. Check with operator to determine if fuel tank was filled with correct fuel.</p> <p>2. Check fuel for water or contamination.</p> <p>a. Remove primary fuel filter case. If case is 1/4 full of water or if dirt is evident, fuel is contaminated.</p> <p>b. Disconnect fuel lines between tank shutoff valve and primary fuel filter (WP 0055 00) and check for clogs and obstructions.</p> <p>3. Check fuel pressure gauge indicator.</p>	<p>1. If incorrect fuel was used, perform the following:</p> <p>a. Drain fuel system.</p> <p>b. Replace fuel filters (WP 0055 00 and 0056 00).</p> <p>c. Fill fuel tank with correct fuel (TM 5-2410-233-10).</p> <p>d. Prime fuel system (WP 0038 00).</p> <p>1. Drain fuel system.</p> <p>2. Replace fuel filters (WP 0055 00 and 0056 00).</p> <p>3. Fill fuel tank with correct fuel (TM 5-2410-233-10).</p> <p>4. Prime fuel system (WP 0038 00).</p> <p>1. Clean lines with compressed air or sturdy wire. Reconnect fuel lines (WP 0050 00).</p> <p>2. Replace fuel filters (WP 0055 00 and 0056 00).</p> <p>3. Prime fuel system (WP 0038 00).</p> <p>If indicator is in the red, replace fuel filters (WP 0055 00 and WP 0056 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>2. Engine Cranks But Fails to Start - Continued.</p>	<p>4. Inspect fuel lines and connections for leaks and/or damage.</p> <p>5. Inspect governor linkage for proper operation and adjustment.</p> <p>6. Check fuel injection timing (WP 0053 00).</p> <p>7. Perform cylinder cutout test (WP 0040 00).</p> <p>8. Check for slipping fuel injection pump drive. Remove access cover (WP 0039 00). Crank engine and look through fuel transfer pump mounting openings to see if pump shaft rotates.</p>	<p>a. If a leak is at a connection, tighten connection.</p> <p>b. If a leak results from cracked, split or damaged line, replace lines (WP 0050 00).</p> <p>If linkage does not operate properly or is out of adjustment, Adjust governor linkage (WP 0054 00).</p> <p>Adjust fuel injection timing (WP 0053 00).</p> <p>Replace nozzle for suspect cylinder (WP 0037 00).</p> <p>If shaft does not rotate, remove small cover from timing gear cover and tighten accessory drive gear retaining nut. If tightening corrects slipping condition, time fuel injection pump (WP 0057 00).</p>
<p>3. Engine Cranks Slowly, Hard to Start.</p>	<p>1. In cold weather, ensure proper engine oil is being used (WP 0008 00 and WP 0009 00).</p> <p>2. Check starting circuits. Refer to <i>Electrical Troubleshooting</i>, Table 6.</p>	<p>Replace engine oil (WP 0010 00).</p>
<p>4. Engine Starting Motor Operates, Does Not Engage Flywheel Ring Gear.</p>	<p>Check for broken or damaged teeth on flywheel assembly and starter drive.</p> <p>a. Remove starting motor (WP 0071 00) and check starter motor drive.</p> <p>b. Manually turn engine and inspect flywheel ring gear teeth through starting motor opening in flywheel housing.</p>	<p>Replace defective starting motor (WP 0071 00).</p> <p>Replace defective flywheel assembly (WP 0028 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Engine Misfires or Runs Rough.</p>	<ol style="list-style-type: none"> 1. Check service indicator and air cleaner for air restriction. <ol style="list-style-type: none"> a. Remove primary fuel filter case. If case is 1/4 full of water or if dirt is evident, fuel is contaminated. b. Disconnect fuel lines between tank shutoff valve and primary fuel filter (WP 0050 00) and check for clogs and obstructions. 2. Check fuel pressure gauge indicator.) 3. Inspect fuel lines and connections for leaks, obstructions and damage. 4. Check fuel injection lines for air. 5. Check valve clearance. 6. Check fuel injection timing (WP 0053 00). 7. Perform cylinder cutout test (WP 0040 00). 8. Check for worn, bent or broken push rod (WP 0017 00). 9. Remove cylinder head and inspect valve lifters (WP 0023 00). 	<p>Clean air inlet and service air cleaner filter elements (WP 0042 00).</p> <ol style="list-style-type: none"> 1. Drain fuel system. 2. Replace fuel filters (WP 0055 00 and 0056 00). 3. Fill fuel tank with correct fuel (TM 5-2410-233-10). 4. Prime fuel system (WP 0038 00). <ol style="list-style-type: none"> 1. Clean lines with compressed air or sturdy wire. Reconnect fuel lines (WP 0050 00). 2. Replace fuel filters (WP 0055 00 and 0056 00). 3. Prime fuel system (WP 0038 00). <p>If indicator is in the red, replace fuel filters (WP 0055 00 and WP 0056 00).</p> <ol style="list-style-type: none"> 1. If leak is at a connection, tighten connection. 2. Replace damaged fuel lines (WP 0050 00). <p>Bleed air from fuel injection lines (WP 0038 00).</p> <p>Adjust valve clearance (WP 0017 00).</p> <p>Adjust timing (WP 0053 00).</p> <ol style="list-style-type: none"> 1. Replace nozzle for suspect cylinder (WP 0037 00). 2. Replace fuel injection pump (WP 0051 00). <p>Replace push rod(s) (WP 0017 00).</p> <p>Replace damaged valve lifters (WP 0030 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>6. Engine Starts But Fails to Keep Running.</p>	<ol style="list-style-type: none"> 1. Check air cleaner for air restriction. 2. Check fuel for water or contamination. <ol style="list-style-type: none"> a. Remove primary fuel filter case. If case is 1/4 full of water, or if dirt is evident, fuel is contaminated. b. Disconnect fuel lines between tank shutoff valve and primary fuel filter (WP 0049 00) and check for clogs and obstructions. 3. Inspect fuel lines and connections for leaks, obstructions and damage. 4. Check fuel pressure at gage on filter base. Fuel transfer pump should supply enough pressure so that gage reads in green zone at idle. 5. Check for 25 psi (172 kPa) minimum at full load and 30 psi (207 kPa) minimum at high idle. 6. 7. Check engine low idle speed. 8. Perform cylinder cutout test (WP 0040 00). 9. Check for defective or leaking fuel injection pump(s). 	<p>Clean air inlet and service air cleaner filter elements (WP 0042 00).</p> <ol style="list-style-type: none"> 1. Drain fuel system. 2. Replace fuel filters (WP 0055 00 and 0056 00). 3. Fill fuel tank with correct fuel (TM 5-2410-233-10). 4. Prime fuel system (WP 0038 00). <ol style="list-style-type: none"> 1. Clean lines with compressed air or sturdy wire. Reconnect fuel lines (WP 0050 00). 2. Replace fuel filters (WP 0055 00 and 0056 00). 3. Prime fuel system (WP 0038 00). <ol style="list-style-type: none"> 1. If leak is at a connection, tighten connection. 2. Replace damaged fuel lines (WP 0050 00). <p>Replace gage (WP 0168 00)</p> <p>Replace transfer pump (WP 0039 00).</p> <p>Adjust governor low idle RPM (WP 0053 00).</p> <p>Replace nozzle for suspect cylinder (WP 0037 00).</p> <p>Replace fuel pump assembly (WP 0051 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>7. Poor Acceleration and/or Lack of Power.</p>	<ol style="list-style-type: none"> 1. Check with operator to determine if fuel tank was filled with correct fuel. 2. Check air cleaner for air restriction. 3. Remove and inspect fuel ratio air line from between turbocharger and governor housing. 4. Disconnect fuel lines between tank shutoff valve and primary fuel filter (WP 0050 00) and check for clogs and obstructions. 5. Inspect fuel lines and connections for leaks, obstructions and damage. 6. Check exhaust system for restrictions. 7. Perform cylinder cutout test (WP 0040 00). 	<ol style="list-style-type: none"> 1. If incorrect fuel was used, perform the following: <ol style="list-style-type: none"> a. Drain fuel system. b. Replace fuel filters (WP 0055 00 and 0056 00). c. Fill fuel tank with correct fuel (TM 5-2410-233-10). d. Prime fuel system (WP 0038 00). Clean air inlet and service air cleaner filter elements (WP 0042 00). Clean air line with compressed air or sturdy wire. Replace line if found to be damaged (WP 0050 00). 1. Clean lines with compressed air or sturdy wire. Reconnect fuel lines (WP 0050 00). 2. Replace fuel filters (WP 0055 00 and 0056 00). 3. Prime fuel system (WP 0038 00). 1. If leak is at a connection, tighten connection. 2. Replace damaged fuel lines (WP 0050 00). Remove restrictions and/or replace exhaust system part(s) (WP 0058 00). 1. If fuel pressure at suspect cylinder fuel injection nozzle appears to be equal to pressure at all other fuel injection nozzles, replace fuel injection pump as necessary (WP 0051 00).

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>7. Poor Acceleration and/or Lack of Power - Continued.</p>	<p>8. Check fuel injection timing (WP 0053 00).</p> <p>9. Inspect for full governor linkage travel.</p> <p>10. Check fuel pressure at fuel injector housing inlet. Pressure must be at least 15 psi (105 kPa).</p> <p>11. Check valve clearance.</p> <p>12. There may be internal failure of turbocharger.</p>	<p>2. If pressures are not equal, remove blockage from nozzle-to-pump fuel line or replace nozzle for suspect cylinder (WP 0037 00).</p> <p>Adjust timing (WP 0053 00).</p> <p>Adjust governor linkage travel (WP 0054 00).</p> <p>1. If fuel pressure is below 15 psi (105 kPa), replace primary fuel filter (WP 0053 00).</p> <p>2. If fuel pressure is still below 15 psi (105 kPa), replace fuel transfer pump (WP 0039 00).</p> <p>Adjust valve clearance (WP 0017 00).</p> <p>Replace turbocharger (WP 0045 01).</p>
<p>8. Engine Speed Unstable or Surges at All Speeds.</p>	<p>1. Remove and inspect fuel ratio air line from between turbocharger and governor housing.</p> <p>2. Disconnect fuel lines between tank shutoff valve and primary fuel filter (WP 0050 00) and check for clogs and obstructions.</p> <p>3. Inspect fuel lines and connections for leaks, obstructions and damage.</p> <p>4. Inspect governor linkage for proper operation and adjustment.</p>	<p>Clean air line with compressed air or sturdy wire. Replace line if found to be damaged (WP 0050 00).</p> <p>1. Clean lines with compressed air or sturdy wire. Reconnect fuel lines (WP 0050 00).</p> <p>2. Replace fuel filters (WP 0055 00 and 0056 00).</p> <p>3. Prime fuel system (WP 0038 00).</p> <p>1. If leak is at a connection, tighten connection.</p> <p>2. Replace damaged fuel lines (WP 0050 00).</p> <p>If linkage does not operate properly or is not correctly adjusted, make necessary adjustment (WP 0054 00).</p>
<p>9. Excessive Engine Vibration.</p>	<p>1. Perform cylinder cutout test (WP 0040 00).</p>	<p>Replace nozzle for suspect cylinder (WP 0037 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>9. Excessive Engine Vibration - Continued.</p>	<p>2. Check for loose or damaged vibration damper (WP 0027 00).</p> <p>3. Check for loose or damaged crankshaft pulley. (WP 0026 00).</p> <p>4. Check fan blade balance.</p> <p> a. Loosen or remove V-belts (WP 0069 00).</p> <p> b. Operate engine at RPM where vibration occurred.</p> <p>5. Inspect for loose or damaged engine mounts.</p>	<p>1. Tighten vibration damper capscrews to 75 lb-ft (102 Nm).</p> <p>2. Replace damaged vibration damper (WP 0027 00).</p> <p>1. Tighten pulley capscrews to 230 lb-ft (312 Nm).</p> <p>2. Replace damaged crankshaft pulley (WP 0026 00).</p> <p>1. If vibration is not noticeable, replace fan drive assembly (WP 0067 00).</p> <p>2. If vibration is noticeable, go to step 5.</p> <p>1. If engine mounts are loose because of wear or damage, replace mounts(s) (WP 0020 00 and WP 0021 00).</p> <p>2. If engine mounts are loose, tighten (WP 0020 00 and WP 0021 00).</p>
<p>10. Engine Knocks (Fuel Knock).</p>	<p>1. Check with operator to determine if fuel tank was filled with correct fuel.</p> <p>2. Check fuel injection lines for air.</p>	<p>1. If incorrect fuel was used, perform the following:</p> <p> a. Drain fuel system.</p> <p> b. Replace fuel filters (WP 0055 00 and WP 0056 00).</p> <p> c. Fill fuel tank with correct fuel (TM 5-2410-233-10).</p> <p> d. Prime fuel system (WP 0038 00).</p> <p>Bleed air from fuel injection lines (WP 0038 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
10. Engine Knocks (Fuel Knock) - Continued.	3. Perform cylinder cutout test (WP 0040 00). 4. Check fuel injection timing (WP 0053 00).	1. If fuel pressure at suspect cylinder fuel injection nozzle appears to be equal to pressure at all other fuel injection nozzles, replace fuel injection pump as necessary (WP 0051 00). 2. If pressures are not equal, remove blockage from nozzle-to-pump fuel line or replace nozzle for suspect cylinder (WP 0037 00). Adjust timing, if necessary (WP 0053 00).
11. Engine Knocks (Excessive Mechanical Noise).	Engine has internal damage.	Replace engine assembly (WP 0019 00).
12. Excessive Noise From Valve Mechanism (Clicking Sound).	1. Check valve clearance. 2. Inspect valve mechanism. Check valve springs and locks. Damaged or worn locks can cause valve to fall into cylinder, resulting in serious engine damage.	Adjust valves (WP 0017 00). 1. Replace damaged components. 2. Replace cylinder head assembly (WP 0023 00).
13. Excessive Oil Consumption.	1. Check engine oil level for over filling. 2. Check for external oil leaks. a. Clean edges of rocker arm cover, oil pan, oil filter, turbocharger, engine oil cooler and other external engine surfaces. Start engine and check for leaks. b. Check for oil leakage at turbocharger to inlet manifold connection. 3. Check for a plug in each end of rocker shaft (WP 0017 00). 4. Engine has internal damage.	If dipstick indicates excessive oil, drain crankcase to safe operating level (WP 0010 00). If leak (s) are found, tighten nuts, screws, lines and fittings and oil filter. If leakage is found, replace turbocharger (WP 0046 00). Replace rocker shaft if missing. Replace engine assembly (WP 0019 00).

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>14. Low Oil Pressure.</p>	<ol style="list-style-type: none"> 1. Check oil lines for looseness, cracks, splits, leaks, damage and obstructions. 2. Inspect oil filter for leaks or blockage. 3. Check for fuel in engine oil. 4. Inspect engine oil pump. 5. Remove oil pan (WP 0031 00). Check for restriction at oil pump inlet screen. 	<ol style="list-style-type: none"> 1. Tighten loose fittings and connections. 2. Clear clogged or obstructed lines with compressed air or sturdy wire. 3. Replace oil lines that are cracked, split or damaged (WP 0048 00). 1. Tighten oil filter (WP 0010 00). 2. If leaking continues or blockage is found, replace oil filter (WP 0010 00). Drain engine oil, install new oil filter and refill crankcase (WP 0010 00). 1. Clean inlet screen and inlet pipe, replace if damaged (WP 0033 00). 2. Replace engine oil pump (WP 0033 00).
<p>15. Black or Gray Exhaust Smoke.</p>	<ol style="list-style-type: none"> 1. Check air cleaner for air restriction. 2. Check for fuel in engine oil. If fuel is present, test fuel injection nozzles (WP 0037 00). 3. Check turbocharger for internal oil leak. 4. Check fuel injection timing (WP 0053 00). 	<p>Clean air inlet and service air cleaner filter elements (WP 0042 00).</p> <ol style="list-style-type: none"> 1. Replace defective nozzles (WP 0037 00). 2. Drain engine oil, install new oil filter and refill crankcase (WP 0010 00). <p>Replace turbocharger if signs of an internal oil leak are present (WP 0046 00).</p> <p>Adjust timing (WP 0053 00).</p>
<p>16. White Exhaust Smoke.</p>	<ol style="list-style-type: none"> 1. Check for coolant in engine oil. 	<p>If coolant is present in engine oil, replace cylinder head gasket (WP 0023 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>16. White Exhaust Smoke - Continued.</p>	<p>2. Start engine, check for white smoke and/or rough running engine, with engine running at operating temperature. If white smoke is present and engine runs rough, shut engine down.</p> <p>3. Inspect fuel lines and connections for leaks and damage.</p> <p>4. Check fuel injection timing (WP 0051 00).</p>	<p>See <i>Malfunction 5</i>.</p> <p>1. If leak is at a connection, tighten connection.</p> <p>2. Replace damaged fuel lines and connectors. (WP 0050 00).</p> <p>Adjust timing (WP 0053 00).</p>
<p>17. Blue Exhaust Smoke.</p>	<p>1. Check engine for dirty, contaminated oil.</p> <p>2. Check turbocharger for internal oil leak.</p> <p>3. Inspect valves guides and valves for damage.</p> <p>4. Piston rings may be damaged.</p>	<p>Drain engine oil, install new oil filter and refill crankcase (WP 0010 00).</p> <p>Replace turbocharger if signs of an internal oil leak are present (WP 0046 00).</p> <p>Replace cylinder head assembly if valve or guides are damaged (WP 0023 00).</p> <p>Replace engine assembly (WP 0019 00).</p>
<p>18. Excessive Fuel Consumption.</p>	<p>1. Check air cleaner for air restriction.</p> <p>2. Inspect fuel lines and connections for leaks, obstructions and damage.</p> <p>3. Check for fuel in engine oil.</p> <p>4. Perform cylinder cutout test (WP 0041 01).</p>	<p>Clean air inlet and service air cleaner filter elements (WP 0042 00).</p> <p>1. Tighten any loose connections.</p> <p>2. Replace leaking or damaged fuel lines and connections (WP 0050 00).</p> <p>Drain engine oil, install new oil filter and refill crankcase (WP 0010 00).</p> <p>Replace suspect nozzle(s) (WP 0037 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>19. Coolant in Engine Lubricating Oil.</p>	<ol style="list-style-type: none"> 1. Remove cylinder head Assembly (WP 0023 00). Inspect cylinder head for the following: <ol style="list-style-type: none"> a. Leaking head gasket. b. Damaged cylinder head or spacer plate. 2. Inspect cylinder block assembly and liners for cracks. 3. Inspect engine oil cooler for signs of damage. 	<p>Replace a damaged head gasket (WP 0023 00). Replace damaged cylinder head and/or spacer plate (WP 0023 00). Replace engine assembly if cracks are found (WP 0019 00). If internal damage or leaking is suspected, replace oil cooler (WP 0018 00).</p>
<p>20. Engine Lubricating Oil in Cooling System.</p>	<ol style="list-style-type: none"> 1. Remove cylinder head assembly (WP 0023 00). Inspect cylinder head for the following: <ol style="list-style-type: none"> a. Leaking head gasket. b. Damaged cylinder head or spacer plate. 2. Inspect cylinder block assembly for cracks. 3. Inspect engine oil cooler for signs of damage. 	<p>Replace a damaged head gasket (WP 0023 00). Replace damaged cylinder head and or spacer plate (WP 0023 00). Replace engine assembly if cracks are found (WP 0019 00). If internal damage or leaking is suspected, replace oil cooler (WP 0018 00).</p>
<p>21. Engine Lubricating Oil at Exhaust.</p>	<ol style="list-style-type: none"> 1. Inspect engine for slobbering at turbocharger. 2. Inspect exhaust side of turbocharger for signs of oil leak. 3. Remove cylinder head (WP 0023 00) and inspect for damaged or worn valve guides. 	<p>Run engine under full load for 30 minutes at operating temperature. Replace turbocharger is oil leak is present (WP 0046 00). 1. Replace cylinder head assembly if valve guides are worn or damaged (WP 0023 00). 2. Replace engine assembly (WP 0019 00).</p>
<p>22. Engine Cranks But Will Not Start in Cold Weather (Fuel System Operating Properly).</p>	<ol style="list-style-type: none"> 1. Check ether canister by removing from valve. Shake canister and listen for liquid splashing inside. 2. Check starting aid valve for proper operation. 3. Check starting aid valve tube assembly and fittings for damage. 	<p>Replace canister if empty (WP 0057 00). Refer to Table 6, <i>Electrical Trouble-shooting</i>. 1. If tube assembly is not damaged, replace starting aid valve (WP 0057 00). 2. Replace damaged tube assembly (WP 0057 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
EXHAUST SYSTEM		
23. Excessive Exhaust Fumes and/or Fumes in Cab (If Equipped).	<ol style="list-style-type: none"> 1. Inspect muffler for exhaust leaks and damage. 2. Inspect coupling between muffler and turbocharger for leaks or damage. 	<p>Replace muffler (WP 0058 00).</p> <p>Replace seal, coupling or preformed packing (WP 0058 00).</p>
COOLING SYSTEM		
24. Engine Overheats (According to Engine Water Temperature Gage).	<ol style="list-style-type: none"> 1. Check radiator for airflow obstructions. 2. Check coolant level. 3. Inspect for loose, missing and worn V-belts. 4. Inspect radiator, water pump, transmission oil cooler, engine oil cooler, hoses and hose connections and draincocks for leaks. 5. Perform radiator pressure test (WP 0061 00). 6. Inspect fan for cracked or missing blades. 7. Check fan operation. 8. Inspect cooling system. 	<p>Remove obstructions from radiator.</p> <p>If coolant is low, fill to proper level (WP 0060 00).</p> <ol style="list-style-type: none"> 1. Check V-belt tension and adjust as required (WP 0069 00). 2. Replace missing or worn V-belt (WP 0069 00). 1. Tighten hose clamps and fittings. 2. Tighten or close draincocks. 3. Replace damaged hose(s) (WP 0066 00). 4. Replace leaking water pump (WP 0065 00). 5. Replace leaking engine oil cooler (WP 0018 00). 6. Repair or replace leaking transmission oil cooler (WP 0087 00). <p>If radiator leaks, replace (WP 0063 00).</p> <p>Replace damaged fan (WP 0068 00).</p> <p>If fan does not turn or turn properly, replace fan drive (WP 0067 00).</p> <p>Clean and flush cooling system (WP 0060 00).</p>

Table 1. Engine Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>24. Engine Overheats (According to Engine Water Temperature Gage) - Continued.</p>	<p>9. Remove and test water temperature regulator for proper operation (WP 0064 00).</p>	<p>Replace water temperature regulator if defective (WP 0064 00).</p>
	<p>10. Check water pump for wear or damage.</p>	<p>Replace water pump (WP 0065 00).</p>
	<p>11. Check water temperature gage and sending unit.</p>	<p>Replace water temperature gage and sending unit.</p>
<p>25. Engine Does Not Reach Normal Operating Temperature (According to Engine Water Temperature Gage).</p>	<p>Remove and test water temperature regulator for proper operation (WP 0064 00).</p>	<p>1. Replace water temperature regulator if defective (WP 0064 00).</p>
		<p>2. Replace water temperature gage and sending unit.</p>
<p>26. Loss of Coolant.</p>	<p>1. Perform radiator pressure test (WP 0061 00).</p>	<p>Replace leaking radiator (WP 0063 00).</p>
	<p>2. Check cylinder head and spacer plate for defective gaskets. Inspect cylinder head and spacer plate (WP 0023 00).</p>	<p>1. Replace cylinder head and spacer plate gaskets (WP 0023 00). 2. Replace cylinder head and/or spacer plate (WP 0023 00).</p>
	<p>3. Check for cracked cylinder liners and block.</p>	<p>Replace engine assembly (WP 0019 00).</p>

Table 2. Transmission Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. No Response to Transmission Selector Lever Movement.</p>	<p>1. Check transmission oil level.</p> <p>2. Check transmission control linkage for correct adjustment.</p> <p>3. Check for air leaks at inlet side of transmission oil pump.</p>	<p>Add oil as required (WP 0086 00).</p> <p>Adjust transmission control linkage (WP 0083 00).</p> <p>Tighten connection or replace damaged elbow and seal (WP 0095 00).</p>
<p>2. Incorrect Response to Transmission Selector Lever Movement.</p>	<p>1. Check transmission oil level.</p> <p>2. Check transmission control linkage for correct adjustment.</p>	<p>Add oil as required (WP 0086 00).</p> <p>Adjust transmission control linkage (WP 0083 00).</p>
<p>3. Excessive Noise During Shifting.</p>	<p>1. Check transmission oil level.</p> <p>2. Inspect drive shaft and universal joint bearings for looseness, wear and damage.</p>	<p>Add oil as required (WP 0086 00).</p> <p>Tighten or replace damaged components (WP 0106 00).</p>
<p>4. Transmission Downshifts During Operation (No Transmission Selector Lever Movement).</p>	<p>Check for loss of transmission oil pressure caused by low fluid level.</p>	<p>Add oil as required (WP 0086 00).</p>
<p>5. Transmission Overheats.</p>	<p>1. Check transmission oil level.</p> <p>2. Check oil cooler and lines for damage.</p> <p>3. Perform transmission lubricating oil pressure test (WP 0098 00).</p> <p>4. Possible clutch discs and plates damage.</p>	<p>1. If overfill condition exists, drain oil to proper level (WP 0086 00).</p> <p>2. If low level is indicated, add oil as required (WP 0086 00).</p> <p>Replace oil cooler and/or damaged lines (WP 0087 00 and WP 0088 00).</p> <p>Replace transmission oil pump if pressures are not within required limits (WP 0095 00).</p> <p>Replace transmission assembly (WP 0093 00).</p>
<p>6. Low Transmission Oil Pressure.</p>	<p>1. Check transmission oil level.</p> <p>2. Check for damaged oil lines.</p> <p>3. Perform transmission oil pump pressure tests (WP 0098 00).</p>	<p>Add oil if necessary (WP 0086 00).</p> <p>Replace damaged oil line(s) (WP 0088 00).</p> <p>Replace transmission oil pump if pressures are still not within required limits (WP 0095 00).</p>

Table 2. Transmission Troubleshooting Procedures - Continued..

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
7. Transmission Oil Leakage.	<ol style="list-style-type: none"> 1. Inspect drain plug for leaks. 2. Inspect oil line connections for leaks. 3. Inspect oil lines for damage. 	<p>Tighten drain plug.</p> <p>Tighten oil connections.</p> <p>Replace damaged oil line(s) (WP 0088 00).</p>
8. Transmission Noisy.	<ol style="list-style-type: none"> 1. Check transmission oil level. 2. Possible clutch discs, plates, or internal damage. 	<p>Add oil if necessary (WP 0086 00).</p> <p>Replace transmission assembly (WP 0093 00).</p>
9. Transmission Oil Dirty, Foamy, and/or Milky.	<ol style="list-style-type: none"> 1. Inspect oil for dirt/grit. 2. Inspect for excessive foaming or milky oil. <ol style="list-style-type: none"> a. Inspect all external transmission lines and fittings for looseness. b. Ensure transmission has proper oil level (WP 0086 00). c. Inspect for milkiness in oil. 3. Inspect oil for particles. 	<p>Perform transmission assembly service (WP 0086 00).</p> <p>Tighten any lines or fittings found to be loose.</p> <p>Add or remove oil if necessary (WP 0086 00).</p> <p>1. If foaming continues, replace transmission oil filter (WP 0089 00).</p> <p>2. Replace transmission oil cooler (WP 0087 00).</p> <p style="text-align: center;">NOTE</p> <p>If any of the following type particles are found, it should be considered a preliminary analysis. Before replacing any components, oil samples should be processed through AOAP (Army Oil Analysis Program).</p> <p>1. If oil contains bronze-colored particles, replace transmission (WP 0093 00).</p> <p>2. If oil contains shiny steel particles, replace transmission oil pump (WP 0095 00).</p> <p>3. If oil contains aluminum particles, replace torque divider (WP 0088 00).</p>

Table 2. Transmission Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>10. Torque Divider Overheats (According to Converter Oil Temperature Gage).</p>	<ol style="list-style-type: none"> 1. Check transmission oil level. 2. Check V-belts. 3. Check converter oil temperature gage for proper operation using a gage known to be good. 4. Check for loose or damaged oil lines. 5. Check for obstruction at transmission breathers. 6. Check for excessive oil in engine flywheel housing and torque divider cover. 7. Perform transmission and torque converter pressure tests (WP 0096 00). 8. Check transmission oil cooler for leaks or damage. 	<p>Add oil as required (WP 0086 00).</p> <p>Adjust V-belt tension or replace V-belts (WP 0069 00).</p> <p>Replace faulty oil temperature gage.</p> <p>Tighten loose lines and fittings. Replace damaged oil line(s) (WP 0088 00).</p> <p>Clean or replace breathers (WP 0099 00).</p> <ol style="list-style-type: none"> 1. Clean torque divider junction screen (WP 0085 00). 2. Replace torque divider scavenge pump (WP 0097 00). 3. Replace torque divider (WP 0092 00). <ol style="list-style-type: none"> 1. Adjust outlet relief valve(s) (WP 0094 00). 2. Replace transmission oil pump if pressures are still not within required limits (WP 0095 00). <p>Replace transmission oil cooler (WP 0087 00).</p>
<p>11. Loss of Torque Divider Oil.</p>	<ol style="list-style-type: none"> 1. Check for oil around torque divider scavenge pump cover gasket. 2. Check for oil around flywheel housing-to-torque divider cover area. 3. Check for oil around torque divider output shaft. 4. Check for oil around flywheel housing-to-engine block area. 	<p>Replace cover gasket, if necessary (WP 0095 00).</p> <p>Replace flywheel housing-to-torque divider housing cover gasket (WP 092 00).</p> <p>Replace output shaft seal, if necessary (WP 0091 00) or replace torque divider (WP 0091 01).</p> <p>Replace leaking flywheel housing-to-engine block gasket (WP 0029 00).</p>

Table 3. Steering System Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Tractor Will Not Turn in One Direction.</p>	<p>1. Inspect steering clutch(es) linkage for proper adjustment and/or damage.</p> <p>2. Check steering brakes control linkage for proper adjustment and/or damage.</p>	<p>1. Adjust steering clutch linkage (WP 0122 00).</p> <p>2. Replace damaged linkage (WP 0123 00).</p> <p>1. Adjust brakes control linkage (WP 0126 00).</p> <p>2. If problem still exists, remove and repair steering clutch(es) (WP 0127 00).</p>
<p>2. Tractor Will Not Turn in Either Direction.</p>	<p>1. Inspect steering clutch(es) linkage for proper adjustment and/or damage.</p> <p>2. Check steering brakes control linkage for proper adjustment and/or damage.</p> <p>3. Perform pressure tests for steering clutch (WP 0096 00).</p>	<p>1. Adjust steering clutch linkage (WP 0122 00).</p> <p>2. Replace damaged linkage (WP 0123 00).</p> <p>1. Adjust brakes control linkage (WP 0126 00).</p> <p>2. If problem still exists, remove and repair steering clutch(es) (WP 0127 00).</p> <p>Replace transmission oil pump if pressures are not within required limits (WP 0095 00).</p>
<p>3. Tractor Turns When Both Steering Clutch Levers are Pulled at the Same Time.</p>	<p>1. Inspect steering clutch(es) linkage for proper adjustment and/or damage.</p> <p>2. Perform pressure test for steering clutch. (WP 0098 00).</p>	<p>1. Adjust steering clutch linkage (WP 0122 00).</p> <p>2. Replace damaged linkage (WP 0123 00).</p> <p>Replace transmission oil pump if pressures are not within required limits (WP 0095 00).</p>
<p>4. Slow Response to Steering Clutch Lever Movement.</p>	<p>1. Check fluid level of bevel gear and steering clutch compartments.</p> <p>2. Inspect steering clutch(es) linkage for proper adjustment and/or damage.</p> <p>3. Check steering brakes control linkage for proper adjustment and or damage.</p> <p>4. Perform pressure tests for steering clutch (WP 0098 00).</p>	<p>Add oil if required (WP 0086 00).</p> <p>1. Adjust steering clutch linkage (WP 0122 00).</p> <p>2. Replace damaged linkage (WP 0123 00).</p> <p>1. Adjust brakes control linkage (WP 0126 00).</p> <p>2. If problem still exists, remove and repair steering clutch(es) (WP 0127 00).</p> <p>Replace transmission oil pump if pressures are not within required limits (WP 0095 00).</p>

Table 4. Hydraulic System Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Irregular Cylinder Movement (Not Smooth).</p>	<p>1. Check hydraulic tank for correct oil level.</p> <p>2. Check hydraulic lines, hoses and fittings for signs of leaks and/or damage.</p>	<p>Add oil as required (WP 0165 00).</p> <p>1. Tighten loose fittings.</p> <p>2. Replace damaged lines, hoses and fittings (WP 0160 00).</p>
<p>2. Hydraulic Pump Noisy.</p>	<p>Check oil level in hydraulic tank.</p>	<p>1. Add oil as required (WP 0165 00).</p> <p>2. Remove air from pump lines.</p> <p>3. Repair or replace pump assembly (WP 00149 and WP 0148 00).</p>
<p>3. Hydraulic Pump Overheats.</p>	<p>1. Check oil level in hydraulic tank.</p> <p>2. Check hydraulic lines, hoses and fittings for signs of leaks and/or damage.</p> <p>3. Check with tractor operator to determine if hydraulic system (blade and/or ripper circuits) was operated with a short, rapid duty cycle prior to pump overheating. This can cause damage to seals in pump.</p>	<p>Add oil as required (WP 0163 00).</p> <p>1. Tighten loose fittings.</p> <p>2. Replace damaged lines, hoses and fittings (WP 0160 00).</p> <p>If seal damage is a possibility, repair or replace pump assembly (WP 0149 00 and WP 0148 00).</p>
<p>4. Slow Cylinder Movement.</p>	<p>1. Check for obstruction that could hinder cylinder movement.</p> <p>2. Check oil level in hydraulic tank.</p> <p>3. Check hydraulic lines, hoses and fittings for signs of leaks and/or damage.</p> <p>4. Check linkages and control valves for free movement and full travel.</p> <p>5. Check for low relief valve setting and low hydraulic pump output. Perform <i>Hydraulic System Tests</i> (WP 0167 00).</p>	<p>Remove obstruction.</p> <p>Add oil as required (WP 0163 00).</p> <p>1. Tighten loose fittings.</p> <p>2. Replace damaged lines, hoses and fittings (WP 0160 00).</p> <p>Adjust and/or replace blade control linkage (WP 0152 00), ripper control linkage (WP 0153 00) or replace main (bulldozer) control valve or ripper control valve (WP 0151 00).</p> <p>Adjust, repair or replace affected component as directed by test results (WP 0167 00).</p>

Table 4. Hydraulic System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Blade Tilt Cylinder and Lift Cylinders Drift.</p>	<ol style="list-style-type: none"> 1. Check oil level in hydraulic tank. 2. Check hydraulic lines, hoses and fittings for signs of leaks and/or damage. 3. Check linkages and control valves for free movement and full travel. 4. Perform <i>Hydraulic System Tests</i> (WP 0167 00). 	<p>Add oil as required (WP 0165 00).</p> <ol style="list-style-type: none"> 1. Tighten loose fittings. 2. Replace damaged lines, hoses and fittings (WP 0160 00). <ol style="list-style-type: none"> 1. Adjust and/or replace blade control linkage (WP 0152 00) 2. Replace main (bulldozer) control valve (WP 0151 00). <p>Adjust, repair or replace affected component as directed by test results (WP 0167 00).</p>
<p>6. Blade Tilt or Ripper Lift Circuit is Slow or Does Not Move.</p>	<ol style="list-style-type: none"> 1. Check oil level in hydraulic tank. 2. Check hydraulic lines, hoses and fittings for signs leaks and/ or damage. 3. Check linkages and control valves for free movement and full travel. 	<p>Add oil as required (WP 0165 00).</p> <ol style="list-style-type: none"> 1. Tighten loose fittings. 2. Replace damaged lines, hoses and fittings (WP 0160 00). <p>Adjust and/or replace blade control linkage (WP 0152 00), ripper control linkage (WP 0153 00) or replace main (bulldozer) control valve or ripper control valve (WP 0151 00).</p>
<p>7. Ripper Moves Very Slowly/No Down Pressure in Lift Circuit (Blade Tilt Circuit OK).</p>	<ol style="list-style-type: none"> 1. Check hydraulic lines, hoses and fittings for signs leaks and/or damage. 2. Check linkage and control valve for free movement and full travel. 	<ol style="list-style-type: none"> 1. Tighten loose fittings. 2. Replace damaged lines, hoses and fittings (WP 0160 00). <p>Adjust and/or replace ripper control linkage (WP 0153 00) and/or ripper control valve (WP 0151 00).</p>
<p>8. Hydraulic Oil is Overheating (Indicated by Blown Oil Seals, Decreased Life of Components).</p>	<p>Perform <i>Hydraulic System Tests</i> (WP 0167 00).</p>	<p>Adjust, repair or replace affected component as directed by test results (WP 0167 00).</p>

Table 5. Winch Troubleshooting Procedures.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>1. Winch Does Not Operate.</p>	<ol style="list-style-type: none"> 1. Check oil level in hydraulic tank. 2. Check hydraulic lines, hoses and fittings for signs of leaks and/ or damage. 3. Check winch control lever cables for proper adjustment. (WP 0141 00). 4. Check winch control lever cables for bends, kinks, breaks or damage. 5. Inspect winch control valve for damage and leaks. 6. Check winch gear pump for leaks and overheating. 7. Check for broken winch drive shaft. 	<p>Add oil as required (WP 0165 00).</p> <ol style="list-style-type: none"> 1. Tighten loose fittings. 2. Replace damaged lines, hoses and fittings (WP 0160 00). <p>Adjust control lever cables (WP 0139 00).</p> <p>Replace damaged control lever cables (WP 0142 00).</p> <ol style="list-style-type: none"> 1. Tighten loose fittings. 2. Replace control valve (WP 0140 00). <ol style="list-style-type: none"> 1. Tighten loose fittings. 2. Replace winch gear pump (WP 0147 00). <ol style="list-style-type: none"> 1. Replace driveshaft (WP 0137 00). 2. Replace winch assembly (WP 0139 00).
<p>2. Winch Operates in One Direction Only.</p>	<ol style="list-style-type: none"> 1. Check winch control lever cables for proper adjustment. (WP 0141 00). 2. Check winch control lever cables for bends, kinks, breaks or damage. 3. Inspect winch control valve for damage and leaks. 	<p>Adjust control lever cables (WP 0141 00).</p> <p>Replace damaged control lever cables (WP 0142 00).</p> <ol style="list-style-type: none"> 1. Tighten loose fittings. 2. Replace control valve (WP 0140 00). 3. Replace winch assembly (WP 0139 00).
<p>3. Winch Does Not Hold Load With Control Lever in BRAKE ON Position.</p>	<ol style="list-style-type: none"> 1. Check winch control lever cables for proper adjustment. (WP 0141 00). 	<ol style="list-style-type: none"> 1. Adjust control lever cables (WP 0141 00). 2. Replace winch assembly (WP 0139 00).
<p>4. Oil Leak at Both or One End of Winch Drum.</p>	<p>Internal damage to winch assembly.</p>	<p>Replace winch assembly (WP 0139 00).</p>

Table 6. Electrical System Troubleshooting Procedures.

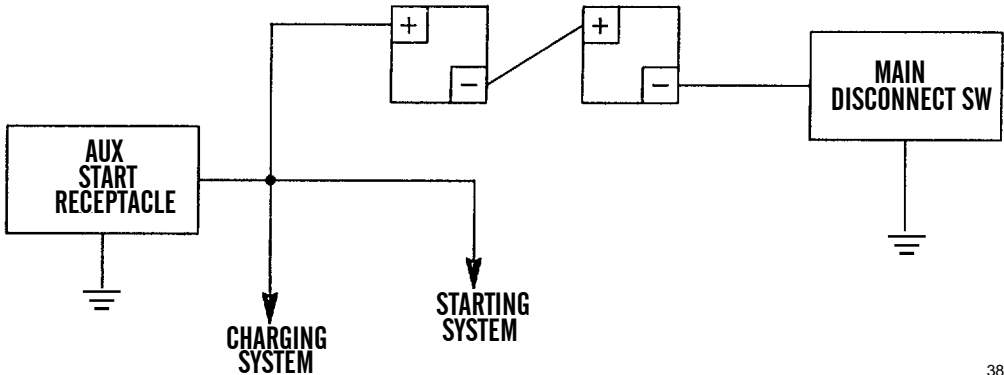
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>BATTERY SYSTEM</p> <p>24 VOLTS</p>  <p style="text-align: right;">386-478</p>		
<p>1. Batteries are Hot, Electrolyte is Boiling or Excessive Use of Water.</p>	<p>Check electrolyte temperature and specific gravity. Refer to TM 9-6140-200-14.</p>	<p>1. If temperature is over 120°F (490°C) and specific gravity is 1.300 or greater, batteries are being overcharged. Go to Table 6, <i>Malfunction 7</i>.</p> <p>2. If temperature is over 120°F (490°C), but specific gravity is 1.225-1.235, recharge battery. Refer to TM 9-6140-200-14.</p>
<p>2. Specific Gravity Will Not Increase to 1.240 Under Charge.</p>	<p>Check rate of charging. Place battery on charge, ensuring that cells are gassing freely. Maintain charge rate slightly below heavy gassing.</p>	<p>If specific gravity does not recover to 1.240 in 25 hours of charging, replace battery (WP 0081 00).</p>
<p>3. Engine Will Not Crank.</p>	<p>1. Inspect batteries.</p> <p>a. Visually inspect batteries for cracks, leaks and corroded or broken terminal posts.</p> <p>b. Check for loose, broken or worn terminals and cables.</p>	<p>1. Replace any cracked, leaking, corroded or broken batteries or batteries with loose or broken terminal posts (WP 0081 00).</p> <p>2. Clean corroded terminal posts.</p> <p>1. Tighten any loose terminal or cable.</p> <p>2. Replace any terminal or cable that is broken or worn (WP 0080 00).</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.


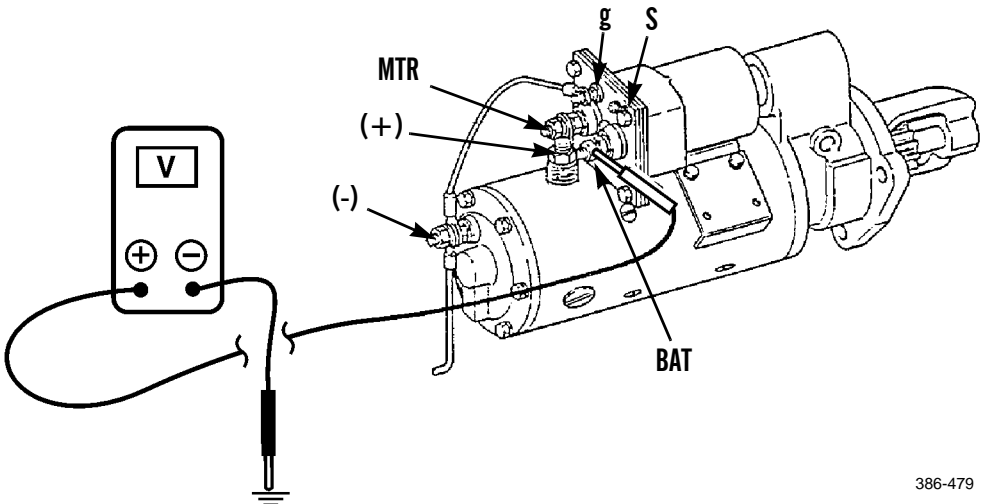
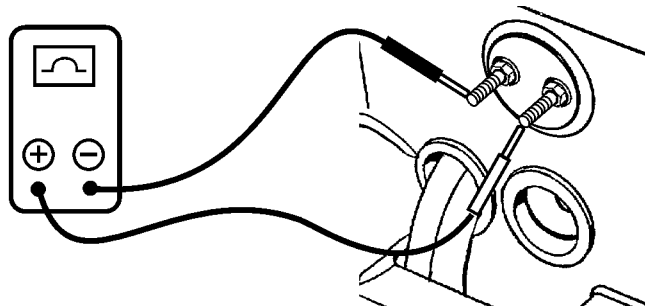
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>3. Engine Will Not Crank - Continued.</p>	<p>c. Check electrolyte level in each battery cell (TM 9-6410-200-14).</p> <p>d. Perform specific gravity test (TM 9-6410-200-14). Batteries must test 1.240 or greater, temperature corrected, and each cell in battery must test within 25 points of the others.</p> <div style="text-align: center;">  <p>WARNING</p> <p>Touch terminal connections one at a time; never touch both terminals at once. Be sure not to be grounded to the machine when checking. Failure to do so may cause serious injury or death to personnel.</p> </div> <p>e. Attempt to crank engine for 15 seconds. Place battery disconnect switch in OFF position and feel battery terminal connections.</p> <p>2. Test batteries under load to determine adequate current capability and voltage drop during a 15 second amperage load.</p>	<p>Fill each cell to fill ring with distilled water.</p> <ol style="list-style-type: none"> Charge all batteries not meeting requirements and recheck specific gravity. If 25 point variation still exists, replace battery (WP 0080 00). <ol style="list-style-type: none"> Tighten all loose connections at batteries. Tighten battery ground wire at tractor chassis ground. Tighten battery positive wire at starter solenoid. Go to <i>Malfunction 3, Test 2.</i>
<div style="text-align: center;">  </div> <p style="text-align: right;">386-479</p>		

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>3. Engine Will Not Crank - Continued.</p>	<ul style="list-style-type: none"> a. Set multimeter to appropriate voltage range (WP 0176 00). b. Connect multimeter positive lead to solenoid terminal BAT and negative lead to ground strap. c. Place battery disconnect switch in ON position. Multimeter should read battery voltage. d. With multimeter still connected as above, place light switch to ON position for approximately 15 seconds. Multimeter reading should not be below 18 volts. 	<p>Recharge batteries if voltage reading is low. Each cell of battery must show 1.6 volts.</p>
<p>4. All Tractor Electrical Systems Inoperative.</p>	<ul style="list-style-type: none"> 3. Test starting motor. Go to Table 6, <i>Malfunction 5</i>. 1. Test battery disconnect switch for continuity. <ul style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Disconnect negative battery cable from battery (WP 0080 00). c. Disconnect cables from battery disconnect switch (WP 0077 00). d. Set multimeter to the appropriate ohm (Ω) range (WP 0177 00). e. Connect multimeter between battery disconnect switch terminals. 	

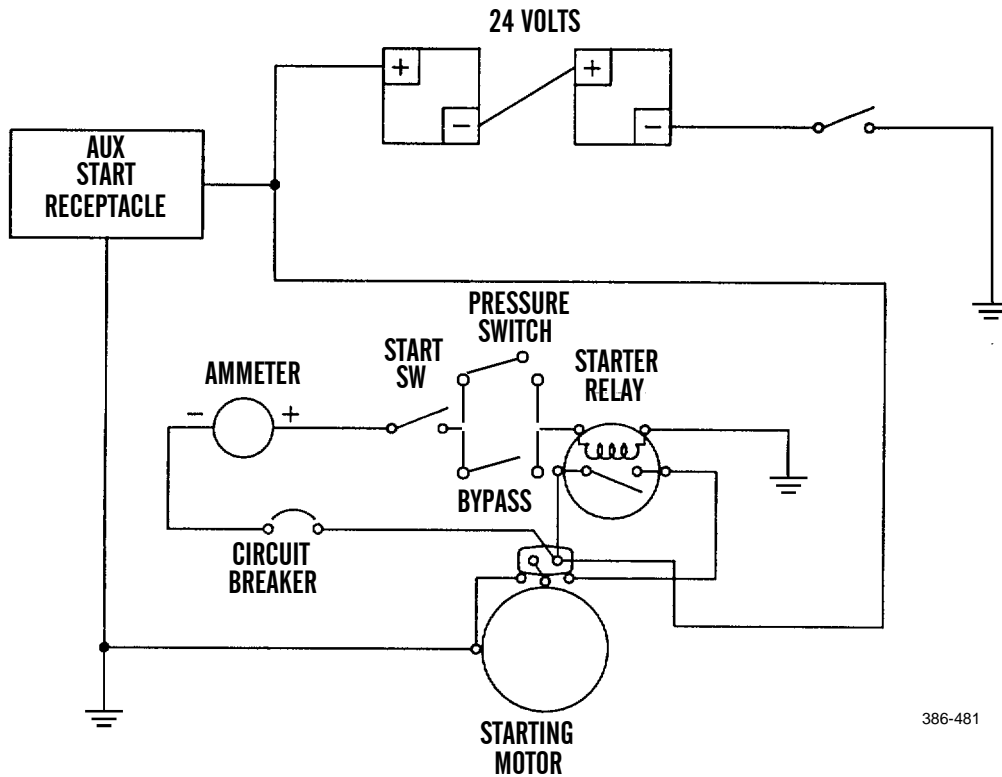


386-480

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>4. All Tractor Electrical Systems Inoperative - Continued.</p>	<p>f. Place battery disconnect switch in ON position.</p> <p>2. Check connection of battery cables and condition of terminals. Check that battery is correctly connected to batteries, starting motor and chassis ground.</p> <p>3. Perform Table 6, <i>Malfunction 3, Test 1.</i></p>	<p>If continuity is not indicated, replace battery disconnect switch (WP 0076 00).</p> <p>Clean and/or reconnect battery cables if necessary (WP 0080 00).</p>

STARTING SYSTEM

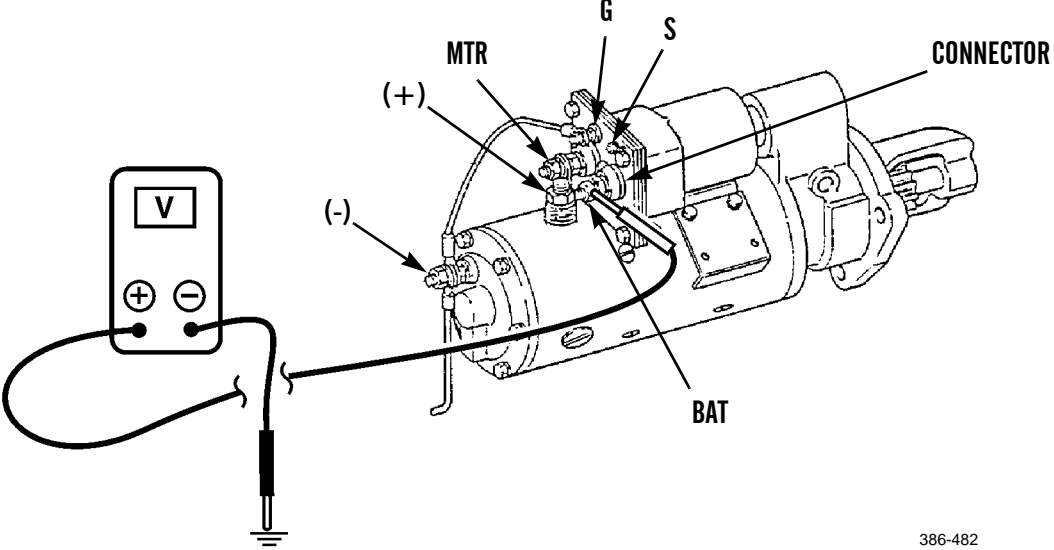


386-481

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative.</p>	<ol style="list-style-type: none"> 1. Check circuit breakers 2. Test solenoid operation. <ol style="list-style-type: none"> a. Place battery disconnect switching in ON position. Turn start switch fully to the right and listen for starting motor solenoid to energize. b. Place battery disconnect switch in OFF position. c. Check continuity of L-shaped connector between starter solenoid and starting motor (WP 0177 00). d. Inspect and clean ground connections on back of starting motor and tighten nut. 3. Test starter circuit source voltage. <ol style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Set multimeter to appropriate voltage range (WP 0177 00). c. Connect multimeter positive lead to BAT terminal on solenoid and negative lead to chassis ground. 	<p>Reset circuit breakers.</p> <ol style="list-style-type: none"> 1. If thump of starter solenoid energizing is heard, go to Test b. 2. If thump of starter solenoid energizing is not heard, go to <i>Malfunction 5, Test 3.</i> <ol style="list-style-type: none"> 1. If no continuity is indicated, repair connection (WP 0177 00). 2. If continuity is indicated, go to step d. <p>If starting motor is still inoperative, replace starting motor (WP 0071 00) and go to <i>Malfunction 5, Test 4.</i></p>

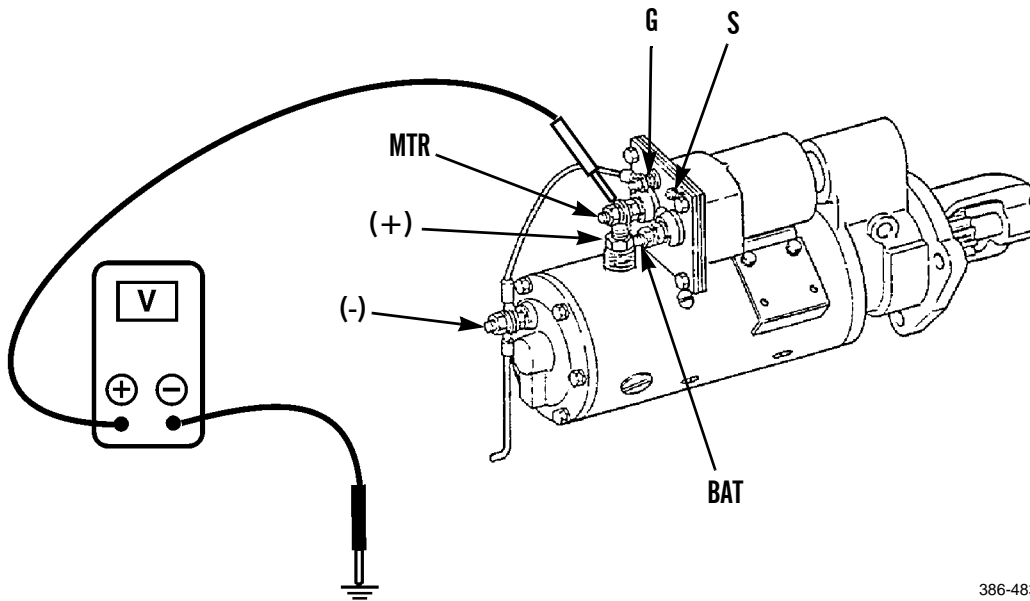
Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>d. Place battery disconnect switch in ON position.</p>  <p>e. If no voltage, check battery connections. Go to Table 6, <i>Malfunction 3, Test 1</i>.</p> <p>f. If battery disconnect switch and connections are OK, check wiring continuity (WP 0177 00).</p> <p>4. Check starting motor voltage.</p> <p>a. Connect multimeter positive lead to solenoid terminal MTR and negative lead to chassis ground.</p>	<p>If voltage is indicated, go to <i>Malfunction 5, Test 5</i>.</p> <p>Repair or replace broken wire(s) between battery and starting motor (WP 0177 00).</p>

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Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>b. Place battery disconnect switch in ON position.</p> <p>c. Momentarily turn start switch fully to the right and observe multimeter reading.</p>	<p>If voltage is indicated, replace starting motor (WP 0071 00).</p> <p>If voltage is not indicated, replace starting motor solenoid (WP 0072 00).</p>



386-483

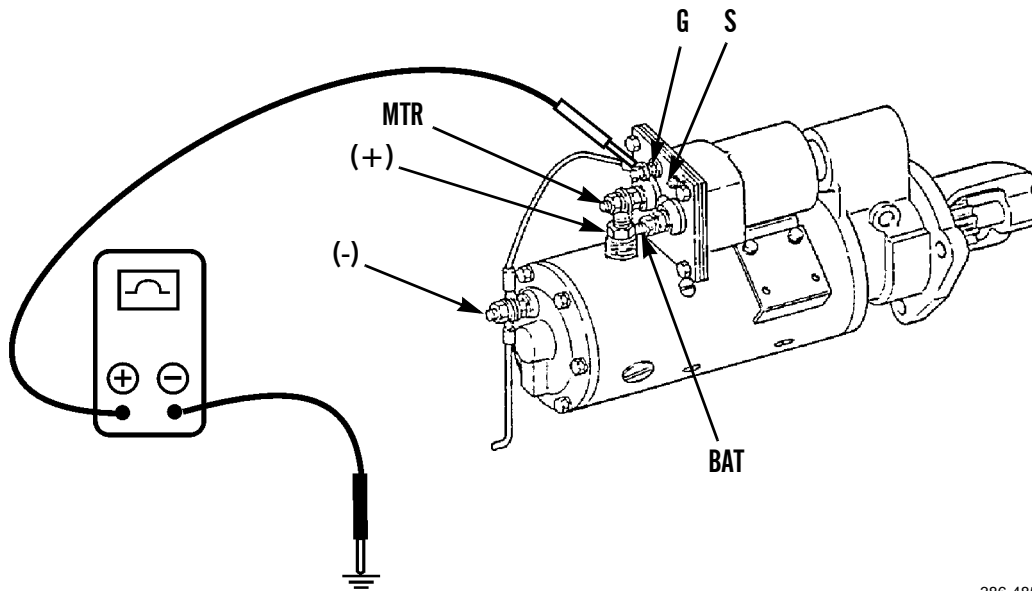
5. Check starter relay and solenoid.
 - a. Place battery disconnect switch in OFF position.
 - b. Set multimeter to appropriate voltage range.
 - c. Connect multimeter positive lead to terminal S on solenoid and negative lead to chassis ground.
 - d. Place battery disconnect switch in ON position.

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>e. Momentarily turn start switch fully to the right and observe multimeter reading.</p>	<p>1. If voltage is indicated, go to Table 6, <i>Malfunction 5, Test 6</i>.</p> <p>2. If voltage is not indicated, go to Table 6, <i>Malfunction 5, Test 7</i>.</p>
<p>The diagram shows a side view of a starting motor. A voltmeter is connected to the motor's terminals. The positive terminal is labeled '(+)' and the negative terminal is labeled '(-)'. The voltmeter has a 'V' symbol and '+' and '-' terminals. A ground symbol is shown at the end of the negative lead. Labels 'MTR', 'G', 'S', and 'BAT' point to various parts of the motor assembly.</p>		
<p>386-484</p>		
<p>6. Test G terminal for continuity to ground.</p> <p>a. Place battery disconnect switch in OFF position.</p> <p>b. Connect meter positive lead to G terminal on solenoid and negative lead to chassis ground.</p>		

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>c. Observe multimeter reading.</p>	<p>1. If continuity is indicated, replace starting motor solenoid (WP 0069 00).</p> <p>2. If no continuity is indicated, repair the ground circuit (WP 0177 00).</p>



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7. Test starter relay.
 - a. Place battery disconnect switch in OFF position.
 - b. Set multimeter to appropriate voltage range.
 - c. Connect multimeter positive lead to smaller gage wire with no insulation and negative lead to chassis ground.
 - d. Place battery disconnect switch in ON position.

Table 6. Electrical System Troubleshooting Procedures - Continued.

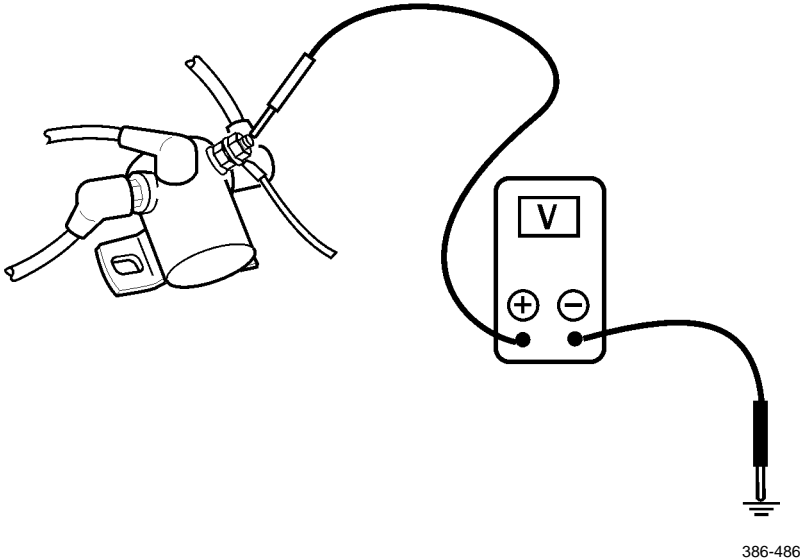
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>e. Momentarily turn start switch fully to the right and observe multimeter reading.</p>	<p>1. If voltage is indicated, go to Table 6, <i>Malfunction 5, Test 8</i>.</p> <p>2. If voltage is not indicated, place battery disconnect switch in OFF position, reconnect white wire and go to Table 6, <i>Malfunction 5, Test 11</i>.</p>
		
<p>8. Test for voltage between starter relay and chassis ground.</p> <p>a. Place battery disconnect switch in OFF position.</p> <p>b. Disconnect ground from starter relay.</p> <p>c. Connect multimeter positive lead to ground terminal on relay (relay side) and negative lead to chassis ground.</p>		

Table 6. Electrical System Troubleshooting Procedures - Continued.

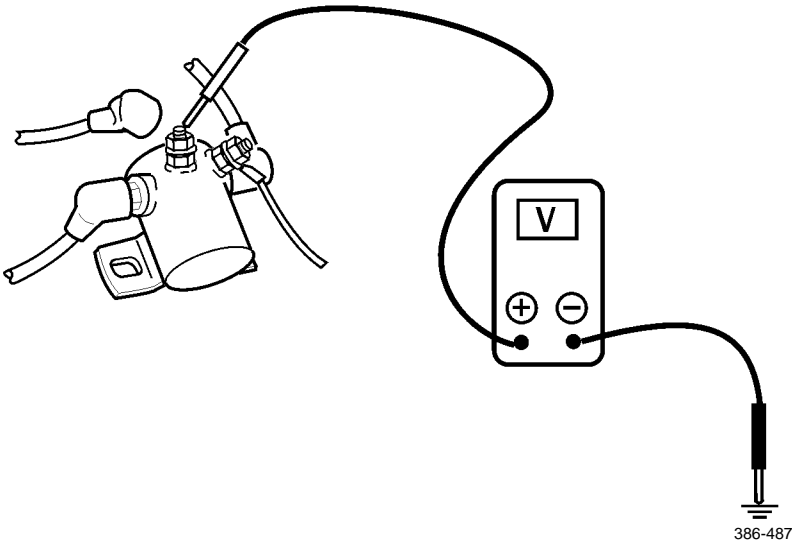
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>d. Place battery disconnect switch in ON position.</p> <p>e. Momentarily turn start switch fully to the right and observe multimeter reading.</p>	<p>1. If voltage is indicated, go to Table 6, <i>Malfunction 5, Test 9</i>.</p> <p>2. If voltage is not indicated, replace starter relay (WP 0177 00).</p>
		
	<p>9. Test for continuity between starter relay ground wire and chassis ground.</p> <p>a. Place battery disconnect switch in OFF position.</p> <p>b. Connect meter positive lead to ground wire for relay (harness side) and negative lead to chassis ground.</p> <p>c. Observe multimeter reading.</p>	<p>1. If continuity is indicated, go to Table 5, <i>Malfunction 5, Test 10</i>.</p> <p>2. If continuity is not indicated, repair ground (WP 0177 00).</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.

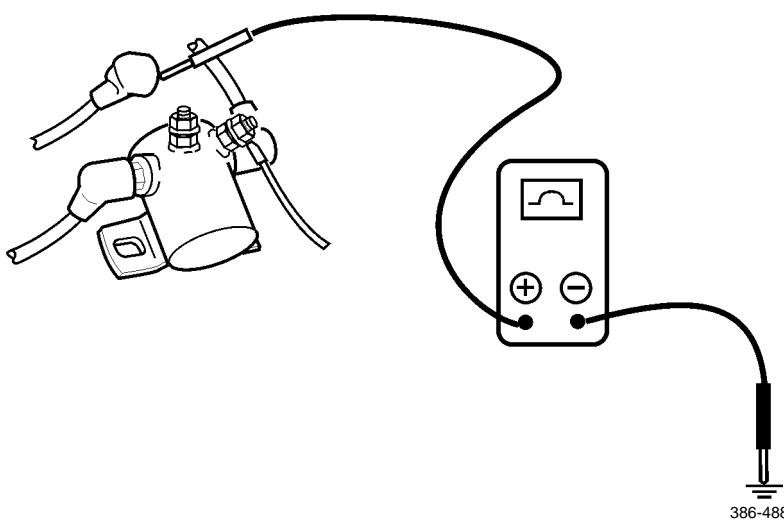
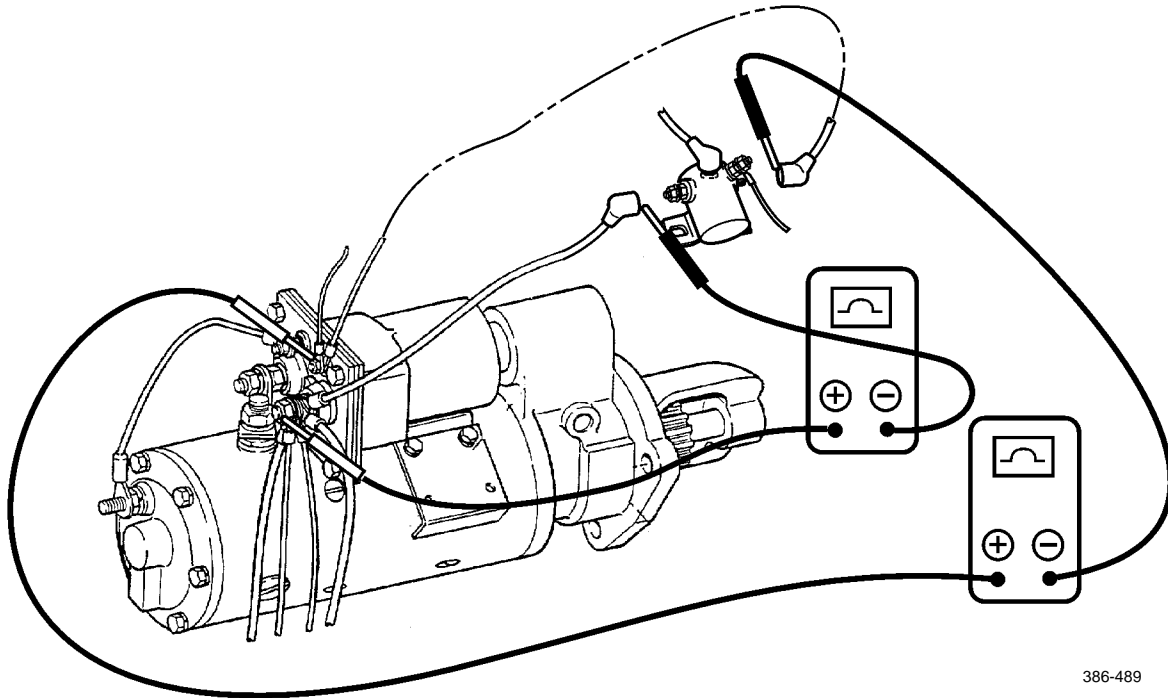
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>  <p>The diagram illustrates a continuity test setup. A continuity tester, a rectangular device with a bell-shaped icon and '+' and '-' terminals, is connected to a starter solenoid. One lead of the tester is connected to a terminal on the solenoid, and the other lead is connected to a ground symbol. The solenoid is shown with its internal components and two large gage wires. The ground symbol is labeled '386-488'.</p>	<p>10. Test for continuity between starter relay ground and starter solenoid.</p> <ol style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Disconnect both larger gage wires from starter relay. 	

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>c. Connect multimeter leads as shown in illustration below to measure continuity.</p> <p>d. Observe multimeter reading.</p>	<p>1. If continuity is indicated, replace starter relay (WP 0177 00).</p> <p>2. If continuity is not indicated, repair circuit(s) in question (WP 0177 00).</p>



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11. Test for voltage to start switch.
 - a. Place battery disconnect switch in OFF position.
 - b. Disconnect orange lead from start switch BAT terminal.
 - c. Set multimeter to appropriate voltage range.
 - d. Connect multimeter positive lead to orange lead (harness side) and negative lead to chassis ground.

Table 6. Electrical System Troubleshooting Procedures - Continued.

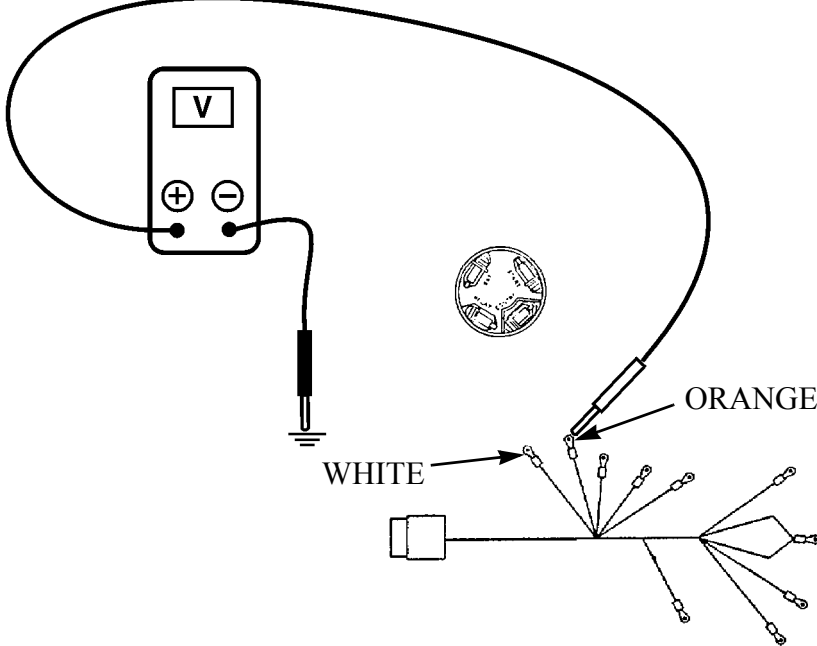
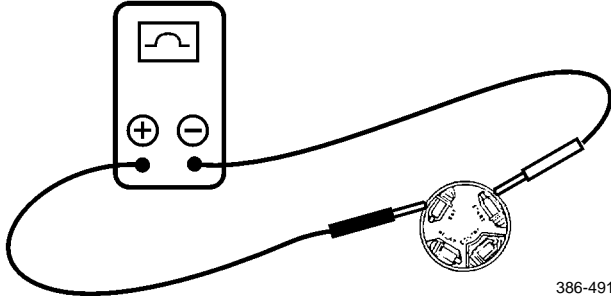

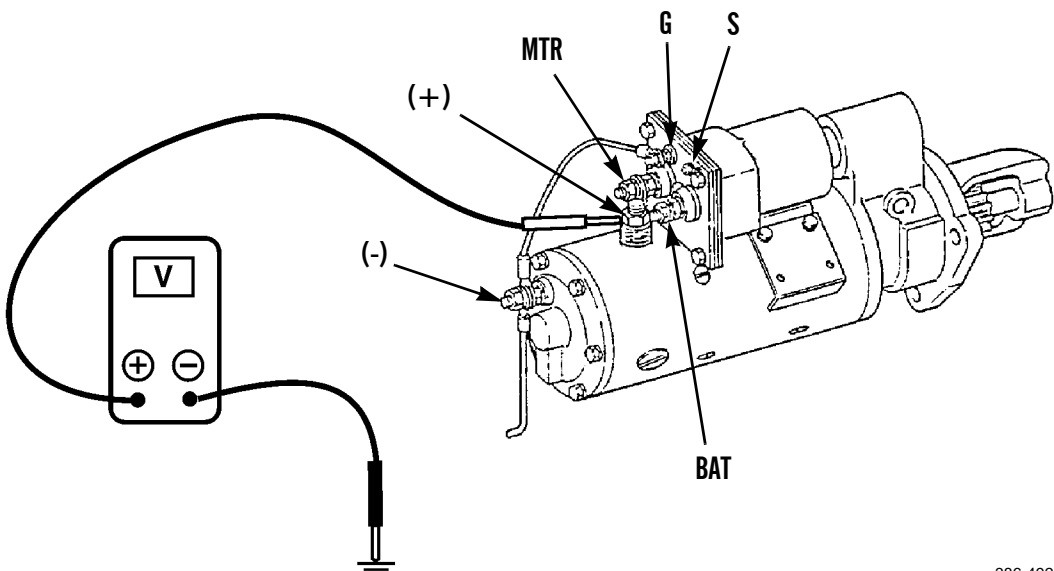
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>e. Place battery disconnect switch to ON position and observe multimeter reading.</p> <p>f. Place battery disconnect switch in OFF position and check wiring for continuity.</p>	<p>1. If voltage is indicated, go to Table 6, <i>Malfunction 5, Test 12</i>.</p> <p>2. If voltage is not indicated, perform Test f. Repair or replace broken wire(s) (WP 0177 00).</p> <p>If wiring is OK, replace ammeter (WP 0073 00).</p>
<div style="text-align: center;">  <p>WHITE</p> <p>ORANGE</p> </div> <p style="text-align: right;">386-490</p> <div style="border: 1px solid black; padding: 5px; margin-top: 20px;"> <p>12. Test engine start switch for continuity.</p> <p>a. Place battery disconnect switch in OFF position.</p> <p>b. Disconnect engine start switch.</p> </div>		

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>5. Starting Motor Inoperative - Continued.</p>	<p>c. Connect multimeter positive lead to terminal where orange lead connects (switch side) and negative lead to terminal where white lead connects (switch side).</p> <p>d. Turn start switch fully to the right.</p>	<p>1. If continuity is indicated, repair open circuit between engine start switch and starter relay (WP 0177 00).</p> <p>2. If continuity is not indicated, replace engine start switch (WP 0074 00).</p>
		
<p>6. Solenoid and Starting Motor Operate; Engine Cranks Slowly</p>	<p>1. Check batteries for overheating.</p> <p>a. Crank engine for 15 seconds.</p>	

386-491

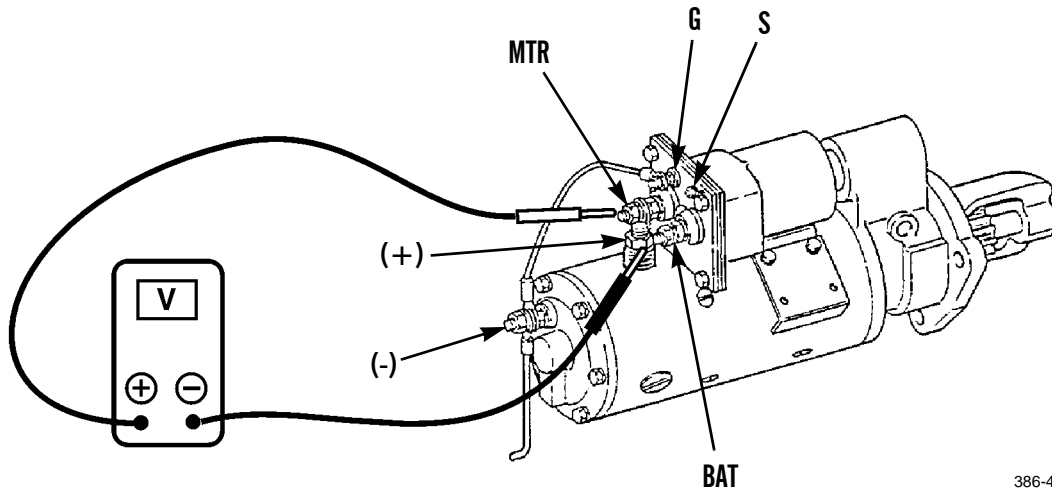
Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>6. Solenoid and Starting Motor Operate; Engine Cranks Slowly - Continued.</p>	<div style="text-align: center;">  <p>WARNING</p> <p>Touch terminal connections one at a time; never touch both terminals at once. Be sure not to be grounded to the machine when checking. Failure to do so may cause serious injury or death to personnel.</p> </div> <ol style="list-style-type: none"> b. Feel battery terminal connections. 2. Test specific gravity for each battery. Go to Table 6, <i>Malfunction 1</i>, Test 1. 3. Test starting motor. <ol style="list-style-type: none"> a. Set multimeter to appropriate voltage range. b. Connect meter positive lead to positive terminal on starting motor and negative meter lead to chassis ground. 	<p>If battery terminal(s) are hot, clean corroded connection(s) and tighten all loose connections at batteries, ground and starting motor.</p>
<div style="text-align: center;">  </div>		

386-492

Table 6. Electrical System Troubleshooting Procedures - Continued.

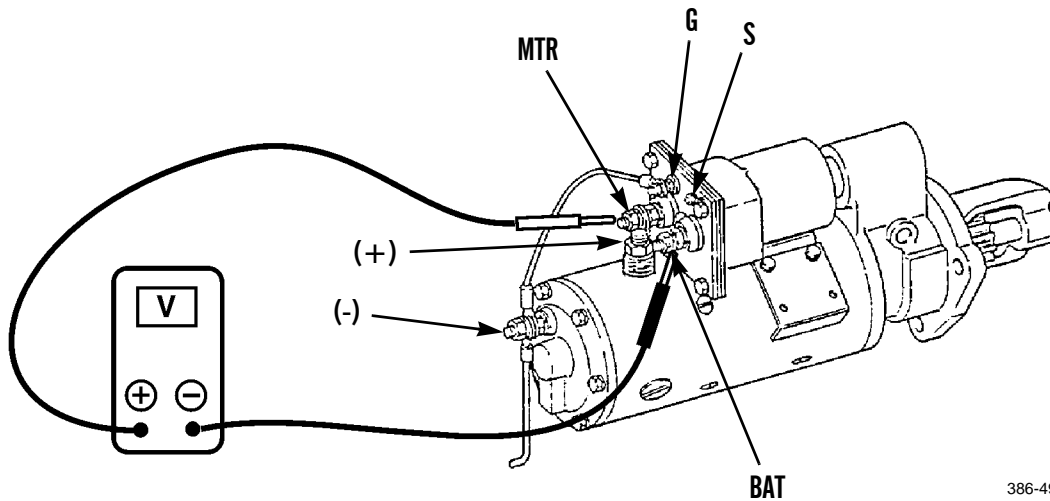
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>6. Solenoid and Starting Motor Operate; Engine Cranks Slowly - Continued.</p>	<p>c. Crank engine and observe voltage reading on meter. Voltage should exceed 22 volts.</p> <p>4. Perform voltage drop test on starting motor-to-solenoid connector (WP 0177 00).</p> <p>a. Connect meter negative lead to positive terminal on starting motor and meter positive lead to MTR terminal on solenoid.</p> <p>b. Crank engine and observe meter.</p>	<p>1. If voltage is low, place battery disconnect switch in OFF position and clean and tighten starting motor terminal connections.</p> <p>2. If problem still exists, go to Table 6, <i>Malfunction 6, Test 4</i>.</p> <p>If voltage reading exceeds 0.1 volt, place battery disconnect switch in OFF position and clean and tighten starting motor-to-solenoid connections. Replace if broken.</p>



386-493

Table 6. Electrical System Troubleshooting Procedures - Continued.

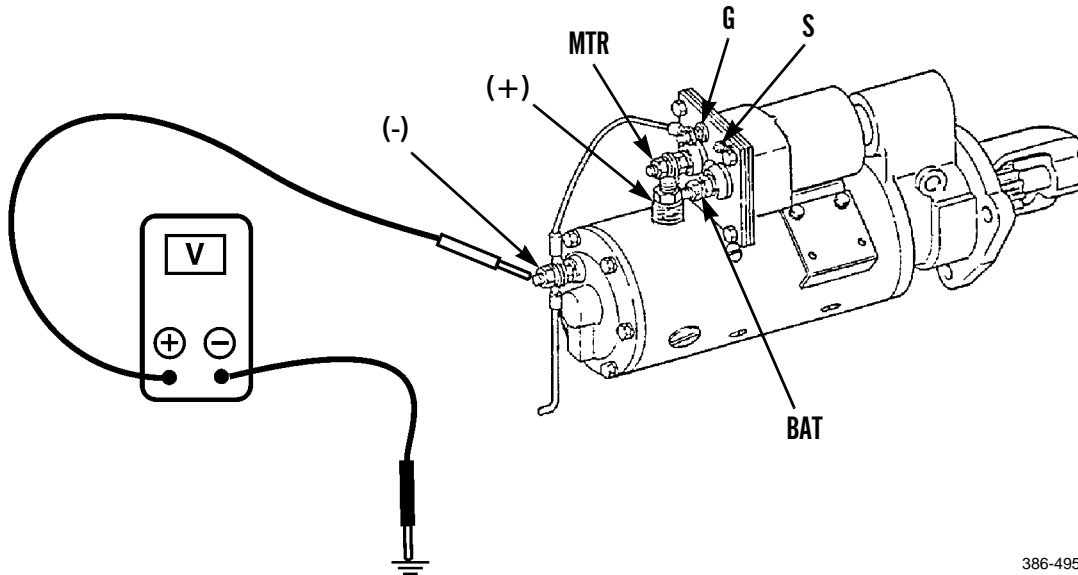
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>6. Solenoid and Starting Motor Operate; Engine Cranks Slowly - Continued.</p>	<p>5. Perform voltage drop test on solenoid contactors (WP 0177 00).</p> <p>a. Connect meter positive lead to solenoid BAT terminal and meter negative lead to solenoid MTR terminal.</p> <p>b. Crank engine and observe meter.</p>	<p>1. If voltage reading is 0.4 volts, replace solenoid (WP 0072 00).</p> <p>2. If malfunction still exists, go to Table 6, <i>Malfunction 6, Tests 6, 7 and 8.</i></p>
	<p>6. Test negative cable voltage drop from batteries to starting motor (WP 0177 00).</p> <p>a. Place battery disconnect switch in OFF position.</p>	



386-494

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>6. Solenoid and Starting Motor Operate; Engine Cranks Slowly - Continued.</p>	<p>b. Connect meter positive lead to negative terminal on starting motor and meter negative lead to chassis ground.</p> <p>c. Place battery disconnect switch to ON position.</p> <p>d. Crank engine and observe meter.</p>	<p>If voltage exceeds 0.4 volts, clean and tighten cable connections at batteries, starting motor and chassis ground points.</p>
	<p>7. Test positive cable voltage from batteries to solenoid (WP 0177 00).</p> <p>a. Place battery disconnect switch in OFF position.</p>	



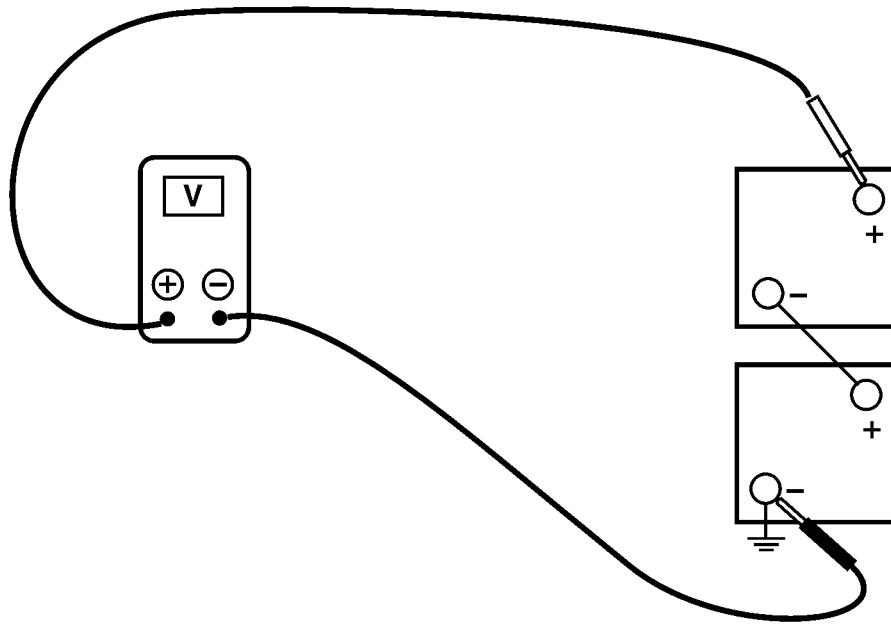
386-495

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>6. Solenoid and Starting Motor Operate; Engine Cranks Slowly - Continued</p>	<p>b. Connect meter positive lead to battery positive terminal and meter negative lead to solenoid BAT terminal.</p> <p>c. Place battery disconnect switch to ON position.</p> <p>d. Crank engine and observe meter.</p>	<p>If voltage exceeds 0.4 volts, clean and tighten cable connections at batteries, starting motor and chassis ground points.</p>
	<p>8. Test battery voltage after cranking load is applied (WP 0177 00).</p> <p>a. Set multimeter to appropriate voltage range.</p>	<p>386-496</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>6. Solenoid and Starting Motor Operate; Engine Cranks Slowly - Continued.</p>	<p>b. Connect meter lead directly across battery terminals as shown below.</p> <p>c. Push governor control lever forward past detent and crank engine for approximately 30 seconds. Observe meter reading after cranking has stopped.</p>	<p>1. If voltage is not 20 volts or more, go to Table 6, <i>Malfunction 2</i>.</p> <p>2. If voltage is satisfactory, replace starting motor (WP 0071 00).</p>



386-497

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>CHARGING SYSTEM</p>		
<p>7. Batteries Hot or Boiling, Corrected Specific Gravity of All Cells is 1.240.</p>	<p>Test charging voltage (WP 0177 00).</p> <p>a. Set multimeter to appropriate voltage range.</p>	

Table 6. Electrical System Troubleshooting Procedures - Continued.

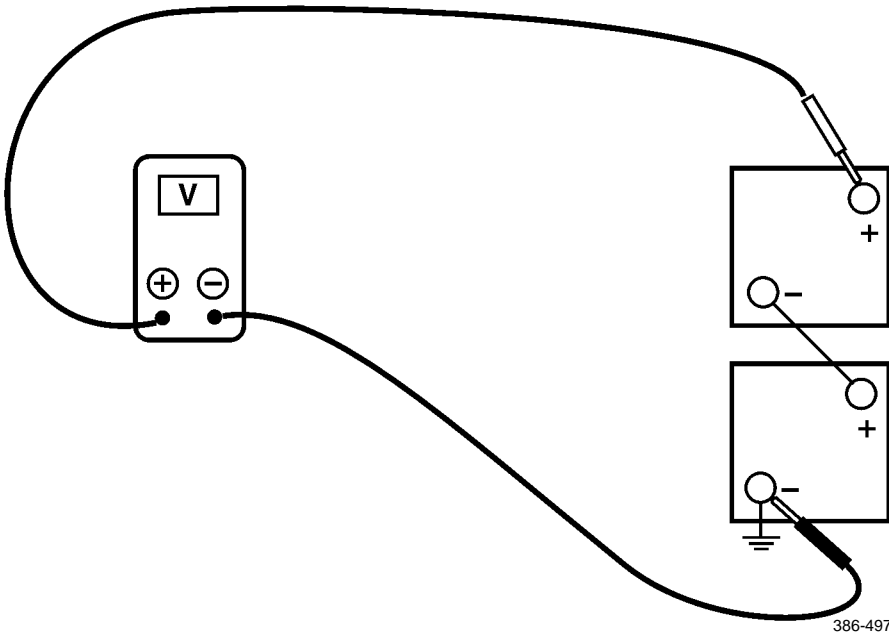
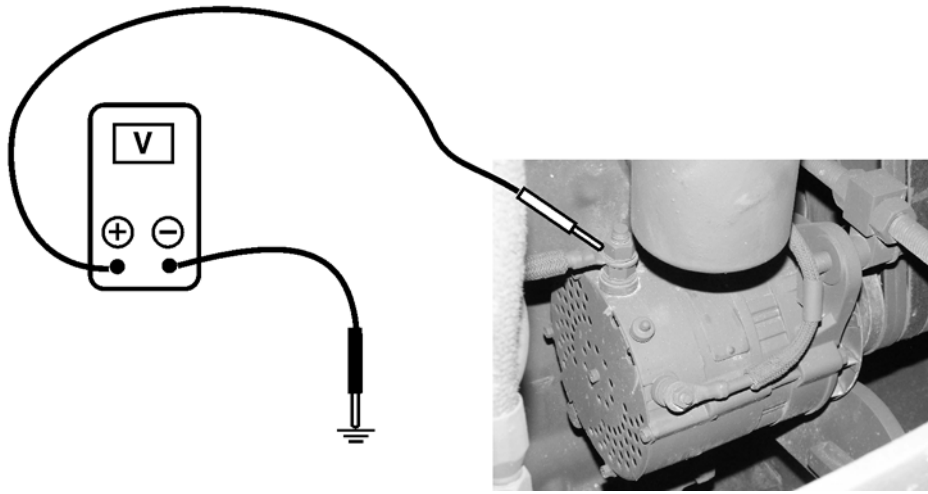
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>7. Batteries Hot or Boiling, Corrected Specific Gravity of All Cells is 1.240 - Continued.</p>	<p>b. Connect multimeter directly across battery terminals as shown.</p> <p>c. Start engine and allow it to stabilize at 2000-2090 RPM.</p>	<p>If meter does not indicate 26.6-28.3 volts, replace alternator (WP 0070 00).</p>
 <p style="text-align: right; margin-right: 50px;">386-497</p>		
<p>8. Batteries Use Excessive Water.</p>	<p>1. Visually inspect batteries for leaks.</p> <p>2. Test charging voltage. Go to Table 6, <i>Malfunction 7</i>.</p>	<p>Replace batteries as required (WP 0081 00).</p>
<p>9. Batteries Run Down in Service.</p>	<p>1. Check for loose, broken or missing alternator belts.</p> <p>2. Test charging voltage. Go to Table 6, <i>Malfunction 7</i>.</p>	<p>1. Adjust loose V-belts (WP 0069 00).</p> <p>2. Replace broken or missing V-belts (WP 0069 00).</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>10. No Alternator Output.</p>	<ol style="list-style-type: none"> 1. Check for loose, broken or missing alternator belts. 2. Test alternator circuit voltage (WP 0177 00). <ol style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Set multimeter to appropriate voltage range. c. Connect meter positive lead to orange lead disconnected from alternator positive terminal and meter negative lead to chassis ground. 	<ol style="list-style-type: none"> 1. Adjust loose V-belts (WP 0069 00). 2. Replace broken or missing V-belts (WP 0069 00).
	<ol style="list-style-type: none"> d. Place battery disconnect switch to ON position. e. If battery voltage is indicated, place battery disconnect switch in OFF position. 	<ol style="list-style-type: none"> 1. If battery voltage is not indicated, repair or replace alternator-to-ammeter wiring (WP 0177 00). 2. Repair or replace alternator ground (WP 0177 00).



386-053

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>10. No Alternator Output - Continued.</p>	<p>f. Check continuity between alternator and ground (WP 0177 00).</p>	<p>3. If wiring to chassis ground is OK, replace alternator (WP 0070 00).</p>
<p>11. Alternator Output Low (Ammeter Reading in Red Zone).</p>	<p>1. Check for loose, broken or missing alternator belts.</p> <p>2. Test charging voltage. Go to Table 6, <i>Malfunction 7</i>.</p>	<p>1. Adjust loose V-belts (WP 0069 00).</p> <p>2. Replace broken or missing V-belts (WP 0069 00).</p>
<p>12. Alternator Charge Too High (Ammeter in High Green Zone).</p>	<p>1. Test charging voltage. Go to Table 6, <i>Malfunction 7</i>.</p> <p>2. Check alternator for overheating.</p> <p>a. Run engine for approximately 10 minutes.</p> <p>b. With engine off, check alternator for high temperature by holding hand near alternator.</p> <p>c. Restart engine.</p>	<p>If alternator is hot, place battery disconnect switch to OFF position and allow alternator to cool.</p> <p>If ammeter returns to high green zone and alternator heats up again, replace alternator (WP 0070 00).</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>LIGHTING SYSTEM</p> <p>The diagram illustrates a 24-volt electrical system for lighting. It begins with a 24-volt battery. The positive terminal is connected to a battery disconnect switch. Following the switch, the circuit passes through a circuit breaker (CB). An ammeter is connected in series with the main power line. The circuit then branches into two parallel paths. The upper path includes a 15A circuit breaker, a dash lamp switch, and a dash lamp connected to ground. The lower path includes a 15A circuit breaker, an exterior light switch, and a parallel arrangement of a rear lamp and two headlamps, all connected to ground.</p>		
		386-499

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>13. Lamp(s) Will Not Light.</p> <div style="text-align: center;"> </div>	<ol style="list-style-type: none"> 1. Check for blown fuse(s). <ol style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Use multimeter to check for blown fuse in circuit with no light. 	<ol style="list-style-type: none"> 1. Replace blown fuse with a fuse of the same rating. 2. If fuse(s) continue to blow, check for short circuit (WP 0177 00). Refer to schematic diagram.
	<ol style="list-style-type: none"> 2. Check for defective lamp. <ol style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Replace lamp with one known to be OK. 	

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>13. Lamp(s) Will Not Light - Continued.</p>	<p>3. Check for corrosion or dirt in sockets or on terminals.</p> <p>4. Check lamp holders for loose connections and broken wire terminals.</p> <p>5. Test headlamp/rear floodlamp circuit.</p> <p>a. Place battery disconnect switch in OFF position.</p> <p>b. If none of the exterior floodlamps light, go to Step c.</p>	<p>1. Clean corroded connections.</p> <p>2. Clean dirt and rust from sockets and terminals.</p> <p>1. Tighten all loose connections.</p> <p>2. Repair or replace broken wire terminals (WP 0176 00).</p> <p style="text-align: center;">NOTE</p> <p>For headlamps or rear lamps, go to Table 6, Malfunction 13, Test 5. For dash lamps, go to Table 6, Malfunction 13, Test 7.</p> <p style="text-align: center;">NOTE</p> <p>If any of the following conditions exist, replace or repair broken wire between lamp and 15 amp fuse or between lamp and ground.</p> <ul style="list-style-type: none"> • One headlamp only will not light. • Both headlamps only will not light. • Rear floodlamp only will not light.

Table 6. Electrical System Troubleshooting Procedures - Continued.

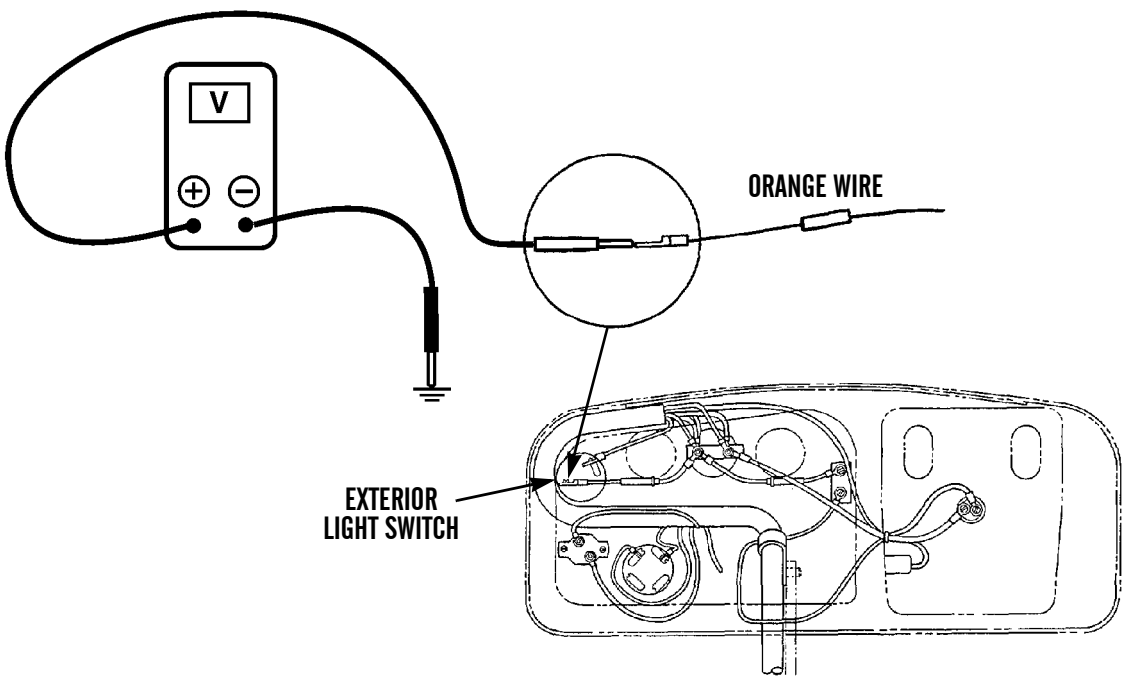
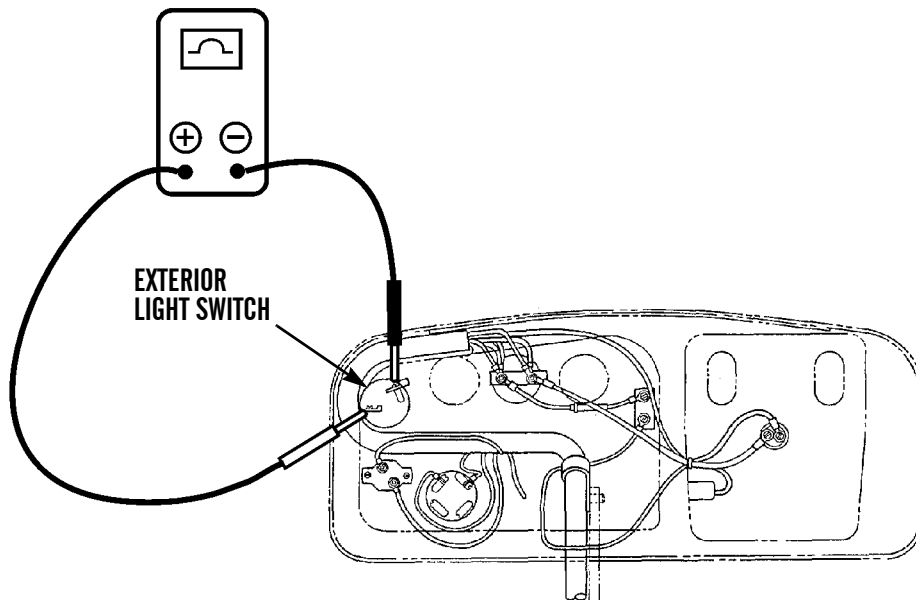
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>13. Lamp(s) Will Not Light - Continued.</p>	<p>c. Disconnect orange wire from light switch terminal B.</p> <p>d. Set multimeter to appropriate voltage range.</p> <p>e. Connect meter positive lead to disconnected orange wire and negative lead to chassis ground.</p>  <p style="text-align: right;">386-501</p>	<p>f. Place battery disconnect switch in ON position and observe meter reading.</p> <ol style="list-style-type: none"> 1. If voltage is indicated, go to Table 6, <i>Malfunction 13, Test 6</i> (WP 0177 00). 2. If voltage is not indicated, replace broken wire(s) to switch and/or light switch. fuse (WP 0177 00).

Table 6. Electrical System Troubleshooting Procedures - Continued.

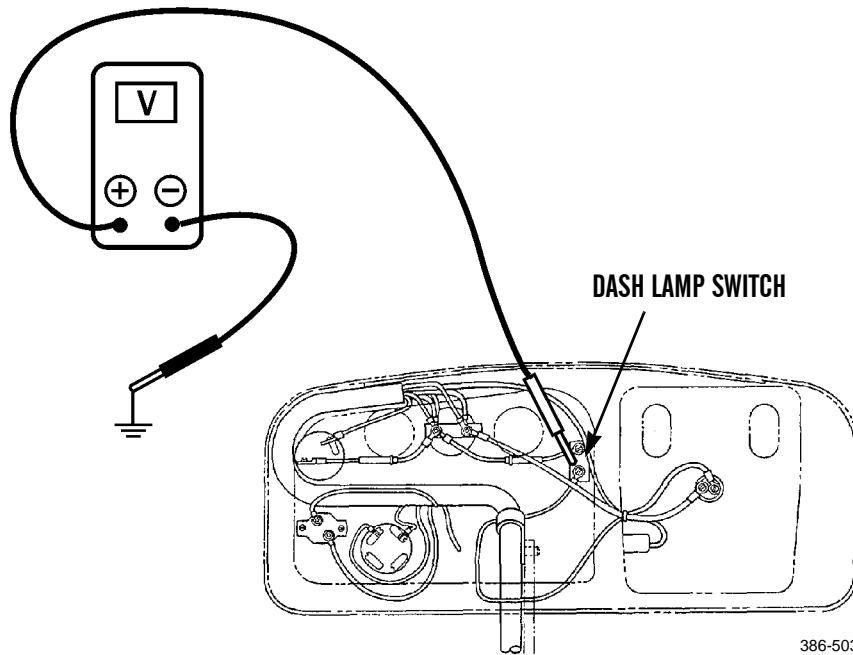
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>13. Lamp(s) Will Not Light - Continued.</p>	<p>6. Test exterior light switch.</p> <ol style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Set multimeter to appropriate ohm (Ω) range. c. Disconnect dark green wire from light switch. d. Connect meter as shown to measure continuity. 	<p>e. Turn exterior light switch to ON position.</p> <ol style="list-style-type: none"> 1. If continuity is indicated, repair open circuit in dark green wire (WP 0177 00). 2. If no continuity is indicated, replace exterior light switch.



386-502

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>13. Lamp(s) Will Not Light - Continued.</p>	<p>7. Test dash light circuit.</p> <ul style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Disconnect gray wire from dash lamp switch. c. Set multimeter to appropriate voltage range. d. Connect meter positive lead to switch terminal with disconnected lead and negative lead to chassis ground. 	



e. Place battery disconnect switch to ON position.

Table 6. Electrical System Troubleshooting Procedures - Continued.

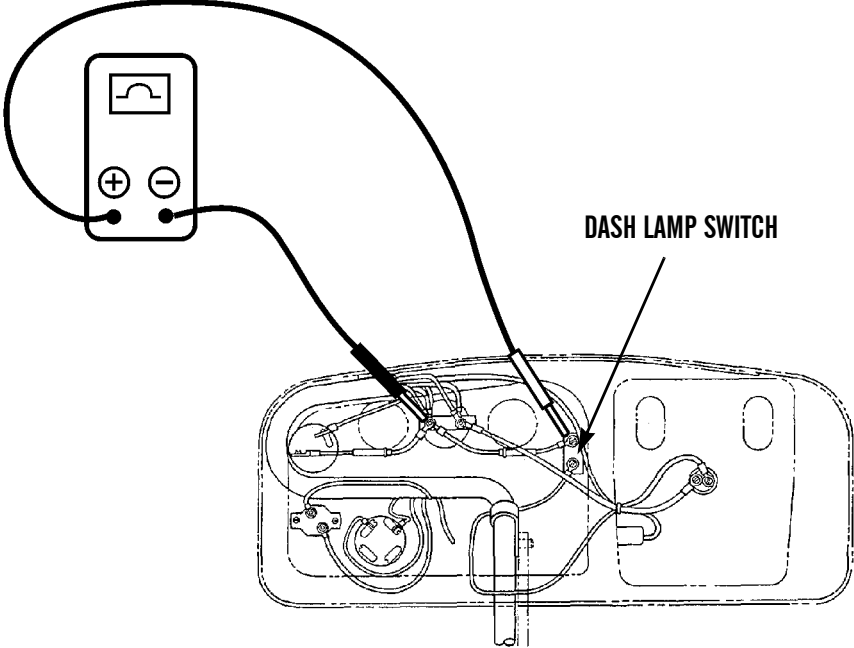
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>13. Lamp(s) Will Not Light - Continued.</p>	<p>f. Place dash light switch to ON position and observe meter.</p> <p>8. Test ammeter-to-dash lamp switch wire for continuity.</p> <p>a. Place battery disconnect switch to OFF position.</p> <p>b. Set multimeter to appropriate ohm (Ω) range.</p> <p>c. Connect meter positive lead to orange wire terminal on switch.</p>	<p>If voltage is indicated, replace dash lamp body assembly.</p>
 <p style="text-align: right; margin-right: 100px;">386-504</p>		

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>13. Lamp(s) Will Not Light - Continued.</p>	<p>d. Connect meter negative lead to orange wire terminal on ammeter.</p> <p>9. Test dash lamp ground wire for continuity.</p> <p>a. Place battery disconnect switch to OFF position.</p> <p>b. Remove dash lamp bulb from socket.</p> <p>c. Set multimeter to appropriate ohm (Ω) range.</p> <p>d. Connect meter positive lead to black wire terminal on socket.</p> <p>e. Connect meter negative lead to chassis ground.</p> <p>f. Place battery disconnect switch in ON position.</p>	<p>1. If continuity is indicated, replace dash lamp switch.</p> <p>2. If continuity is not indicated, repair open circuit in orange wire (WP 0177 00).</p> <p>1. If continuity is indicated, repair open circuit in gray wire (WP 0177 00).</p> <p>2. If continuity is not indicated, repair open circuit in black wire (WP 0177 00).</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
ETHER STARTING AID SYSTEM		
<p>14. Engine Cranks But Will Not Start in Cold Weather (Fuel System Operating Properly).</p>	<ol style="list-style-type: none"> 1. Check ether canister. Remove ether canister. Shake and listen for liquid splashing inside canister. 2. Check for a blown starting aid fuse. 3. Check starting aid valve operation. <ol style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Disconnect temperature switch lead from starting aid valve. 	<p>If canister is empty, replace with a full one (WP 0057 00).</p> <p>Replace blown fuse with a fuse of the same rating.</p>

386-505

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>14. Engine Cranks But Will Not Start in Cold Weather (Fuel System Operating Properly) - Continued.</p>	<p>c. Connect jumper wire between purple wire on valve and chassis ground.</p>	
<p>The diagram illustrates the electrical circuit for the starting aid valve. On the left, a 'TEMPERATURE SWITCH' is shown with a wire leading to a battery disconnect switch. From the battery disconnect switch, a wire goes to the 'STARTING AID VALVE'. A 'JUMPER WIRE' is shown connecting the purple wire on the starting aid valve to a chassis ground symbol. Another wire from the starting aid valve goes to another battery disconnect switch, which is also connected to the main power line.</p>		
<p>386-506</p>		
	<p>d. Crank engine, press starting aid button and listen for starting aid valve operation.</p> <p>4. Test temperature switch wire for continuity.</p> <p>a. Place battery disconnect switch in OFF position.</p> <p>b. Disconnect wire between temperature switch and starting aid valve at both ends.</p>	<p>1. If valve functions, go to Table 6, <i>Malfunction 14, Test 4</i>.</p> <p>2. If valve does not function, place battery disconnect switch in OFF position and reconnect temperature switch lead to starting aid valve. Go to Table 6, <i>Malfunction 14, Test 5</i>.</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>14. Engine Cranks But Will Not Start in Cold Weather (Fuel System Operating Properly) - Continued.</p>	<p>c. Set multimeter to appropriate ohm (Ω) range.</p> <p>d. Connect meter positive lead to one end of wire and negative lead to other end of wire.</p> <p>5. Test starting aid system voltage.</p> <p>a. Disconnect starting aid switch-to-valve lead at starting aid valve.</p> <p>b. Set multimeter to appropriate voltage range.</p>	<p>1. If continuity is indicated, replace temperature switch.</p> <p>2. If continuity is not indicated, repair open circuit in wire (WP 0177 00).</p>

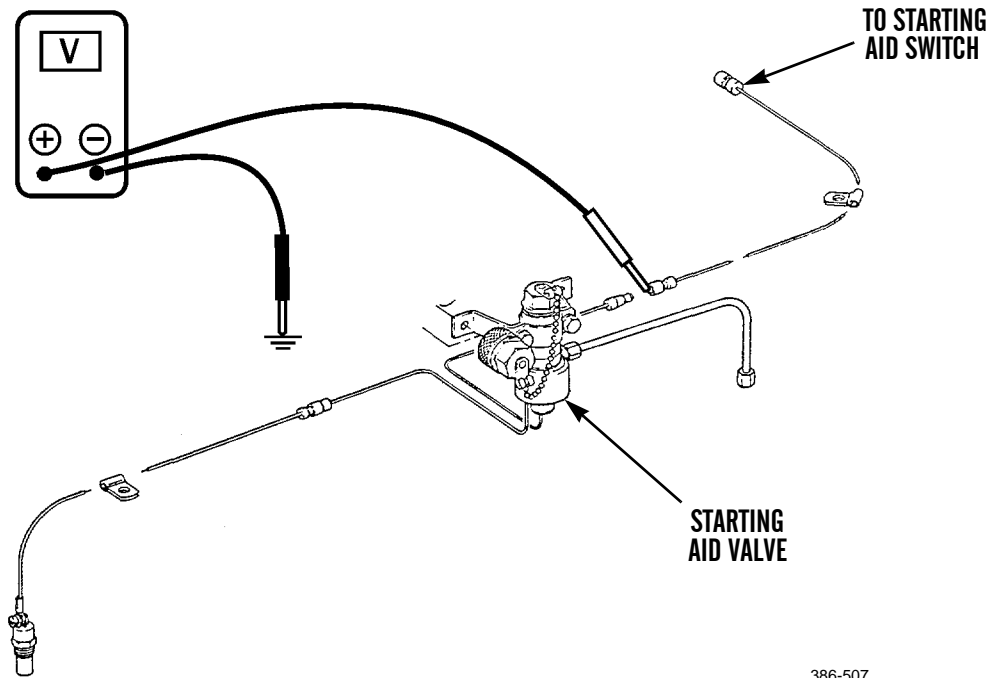


Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>14. Engine Cranks But Will Not Start in Cold Weather (Fuel System Operating Properly) - Continued.</p>	<ul style="list-style-type: none"> c. Connect meter positive lead to purple disconnected wire and meter negative lead to chassis ground. d. Crank engine, press starting aid button and observe meter. 6. Test starting aid wire for continuity. <ul style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Disconnect wire between starting aid switch and starting aid valve at both ends. c. Set multimeter to appropriate ohm (Ω) range. d. Connect meter positive lead to one end of wire. Connect meter negative lead to other end of wire. 	<p>If voltage is indicated, replace starting aid valve (WP 0057 00).</p> <p>1. If continuity is indicated, replace starting aid switch (WP 0075 00).</p> <p>2. If continuity is not indicated, repair open circuit in wire (WP 0177 00).</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.

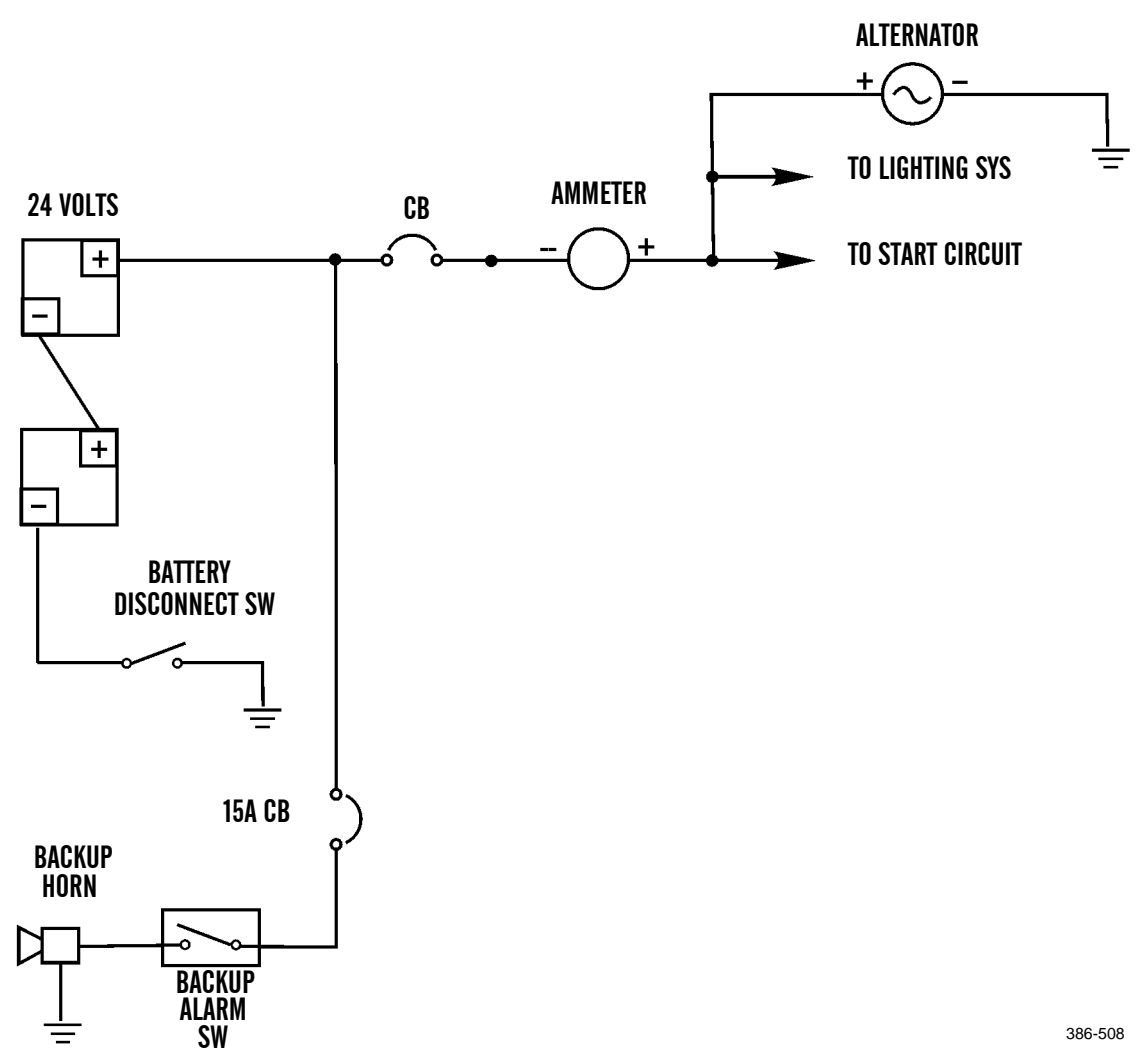
MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>AMMETER, HOURMETER AND WARNING SYSTEM</p>  <p>The diagram illustrates the electrical circuit for the ammeter, hourmeter, and warning system. It starts with a 24-volt battery system. A battery disconnect switch is connected to the negative terminal of the battery. A 15A circuit breaker (CB) is connected to the positive terminal of the battery. The circuit then passes through an ammeter (with '-' on the left and '+' on the right) and a 15A circuit breaker. From there, the circuit splits into two paths: one leading to the lighting system and another leading to the start circuit. An alternator is also connected to the system, with its positive terminal connected to the positive terminal of the battery and its negative terminal connected to ground. A backup horn and a backup alarm switch are also connected to the system.</p>		
		<p style="text-align: right;">386-508</p>

Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>15. Ammeter Inoperative.</p>	<ol style="list-style-type: none"> 1. Test tractor electrical system. Go to Table 6, <i>Malfunction 4</i>. 2. Check ammeter continuity. <ol style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Set multimeter to appropriate ohm (Ω) range. c. Touch meter positive lead to ammeter case and meter negative lead to chassis ground. 	<ol style="list-style-type: none"> 1. If continuity is indicated, replace ammeter (WP 0073 00). 2. If continuity is not indicated, clean and tighten ammeter mounting points.

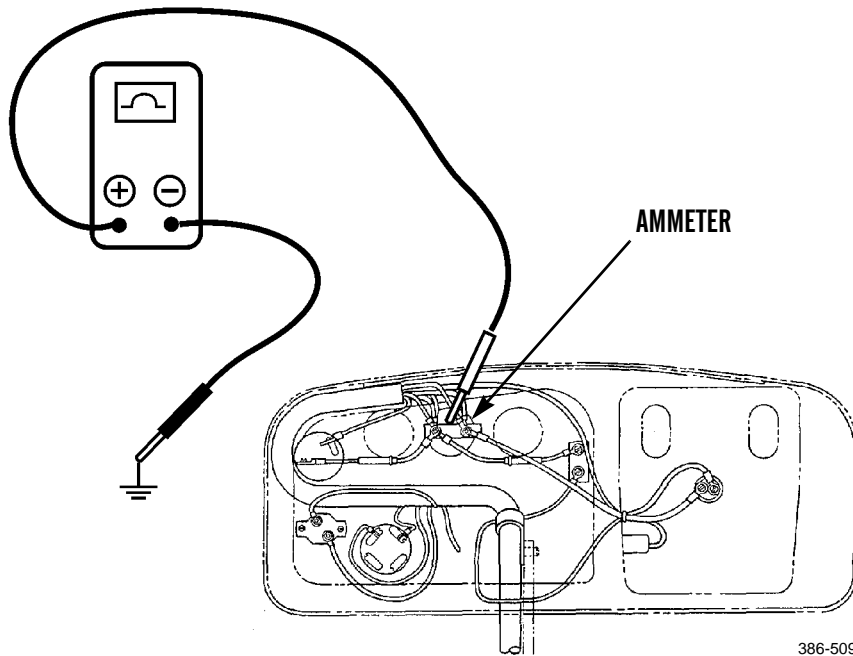


Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>16. Backup Alarm Does Not Sound.</p>	<p>1. Test backup alarm circuit voltage.</p> <p>a. Place battery disconnect switch in OFF position.</p> <p>b. Disconnect brown wire from backup alarm.</p> <p>c. Set multimeter to appropriate voltage range.</p> <p>d. Connect meter positive lead to brown wire and meter negative lead to chassis ground.</p>	<p>e. Place battery disconnect switch in ON position and transmission selector lever in one of the REVERSE positions. Observe meter.</p> <p>1. If voltage is indicated, go to Table 6, <i>Malfunction 16, Test 2</i>.</p> <p>2. If voltage is not indicated, place battery disconnect switch in OFF position and check for blown fuse. Replace blown fuse with same rated fuse.</p>

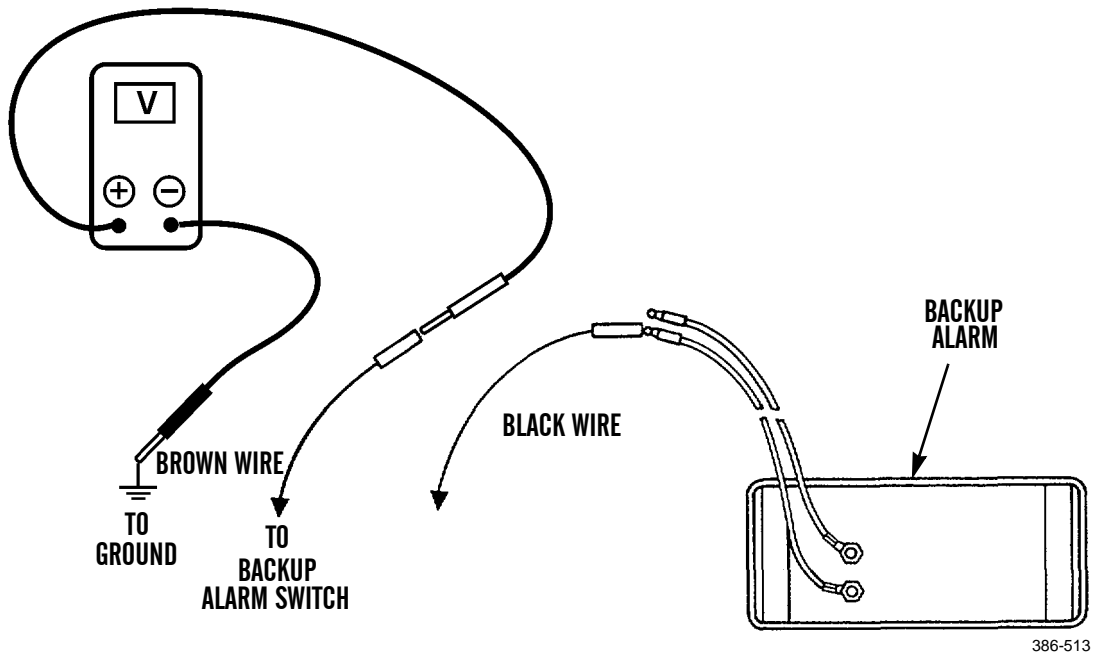


Table 6. Electrical System Troubleshooting Procedures - Continued.

MALFUNCTION	TEST OR INSPECTION	CORRECTIVE ACTION
<p>16. Backup Alarm Does Not Sound - Continued.</p>	<p>2. Test backup alarm ground circuit for continuity.</p> <ul style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Completely disconnect backup alarm harness. c. Set multimeter to appropriate ohm (Ω) range. d. Connect meter positive lead to alarm ground wire. Connect meter negative lead to chassis ground. e. Place battery disconnect switch in ON position and observe meter. <p>3. Test backup alarm switch for continuity.</p> <ul style="list-style-type: none"> a. Place battery disconnect switch in OFF position. b. Completely disconnect backup alarm switch harness. c. Set multimeter to appropriate ohm (Ω) range. d. Connect meter positive lead to one of the backup alarm switch terminals. Connect meter negative lead to other backup alarm switch terminal. e. Place transmission selector lever in one of the REVERSE positions and observe meter. 	<ul style="list-style-type: none"> 1. If continuity is indicated, replace backup alarm (WP 0078 00). 2. If continuity is not indicated, repair open circuit in ground wire (WP 0177 00). <ul style="list-style-type: none"> 1. If continuity is indicated, repair backup alarm circuitry (WP 0177 00). 2. If continuity is not indicated, replace backup alarm switch (WP 0079 00).

END OF WORK PACKAGE

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CHAPTER 3
FIELD MAINTENANCE INSTRUCTIONS

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GENERAL

1. When a used or reconditioned D7F Tractor is first received, determine whether it has been properly prepared for service and is in condition to perform its mission.
2. Follow the inspection and servicing instructions that follow.

INSPECTION INSTRUCTIONS

1. Read and follow all precautions and instructions on DD Form 1397, *Processing and Deprocessing Record for Shipment, Storage and Issue of Vehicles and Spare Engines*.
2. Remove all packing and shipping material, such as tape, tie downs, protective covers and shipping seals.



WARNING



Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

3. Clean any exposed metal parts coated with rust preventive compound. Use solvent cleaning compound (Item 4, WP 0184 00).
4. Inspect equipment for any damage incurred during shipment. Check if equipment has been modified.
5. Check equipment against packing slip to ensure that shipment is complete. Report any discrepancies on SF Form 368, *Product Quality Deficiency Report*.
6. Clean all external surfaces as needed. Touch up any paint scratches.
7. Remove all Basic Issue Item (BII), Additional Authorization List (AAL), and Components of End Item (COEI) equipment and stow in accordance with TM 5-2410-233-10.
8. Install exhaust extension on muffler (WP 0059 00).
9. If equipped with ripper, install ripper shanks (WP 0175 00).

SERVICING INSTRUCTIONS

1. Service machine in accordance with PMCS instructions in TM 5-2410-233-10 and PMCS instructions in this manual (WP 0008 00 and WP 0009 00). Schedule the next PMCS on DA Form 2404 or DA Form 5988-E, *Equipment Inspection and Maintenance Worksheet*.
2. Refer to TM 5-2410-233-10 and perform functional checks of all major machine systems to ensure machine is ready for operation. Remove all warning tags.

END OF WORK PACKAGE

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**UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS
AND SERVICES (PMCS) INTRODUCTION**

0008 00

GENERAL

1. To ensure that the D7F Tractor is ready for operation at all times, it must be lubricated and inspected on a regular basis so that defects may be found before they result in serious damage, equipment failure or injury to personnel.
2. The *KEY* in this work package lists the types, amounts and temperature ranges of the lubricants required for specified intervals.
3. The Lubrication Chart at the end of this work package shows all Unit Maintenance level lubrication points for the D7F Tractor.
4. Table 1 in WP 0009 00 contains systematic instructions on lubrications, inspections, adjustments and corrections to be performed by Unit Maintenance to keep the D7F Tractor in good operating condition and ready for its primary mission.
5. For information on Corrosion Prevention and Control (CPC), refer to WP 0001 00.

EXPLANATION OF TABLE ENTRIES

1. **Item Number (Item No.) Column.** Numbers in this column are for reference. When completing DA Form 2404 or DA Form 5988-E, *Equipment Inspection and Maintenance Worksheet*, include the item number for the check/service indicating a fault. Item numbers also appear in the order you must perform checks and services for the interval listed.

NOTE

If both an hours and calendar interval are provided, perform check or service at whichever interval comes first.

2. **Interval Column.** This column tells you when you must perform the procedure in the procedure column. Intervals are based on calendar dates or hours.
 - a. *Hours* procedures must be performed at the hour interval specified.
 - b. *Semiannual* procedures must be performed once every six months.
 - c. *Annual* procedures must be performed once each year.
 - d. *Biennial* procedures must be performed once every two years.
3. **Man-Hours Column.** This column indicates man-hours required to complete prescribed lubrication service.
4. **Item to Check/Service Column.** This column identifies the item to be checked or serviced.

NOTE

The WARNINGS and CAUTIONS appearing in your PMCS table should always be observed. WARNINGS and CAUTIONS appear before applicable procedures. These WARNINGS and CAUTIONS must be observed to prevent serious injury to yourself and others or to prevent your equipment from being damaged.

5. **Procedure Column.** This column gives the procedure you must perform to check or service the item listed in the Item to Check/Service column, to know if the equipment is ready or available for its intended mission or for operation. You must perform the procedure at the time stated in the interval column.

GENERAL LUBRICATION PROCEDURES**NOTE**

- **Lubrication instructions contained in this PMCS are MANDATORY.**
- **Dashed leader lines used in illustrations of lubrication points indicate that lubrication is required on both sides of the equipment.**

1. Recommended intervals are based on normal conditions of operation, temperature, and humidity. When operating under extreme conditions, such as high or low temperatures or exposure to sand or dust, lubricants should always be changed more frequently. Lubricants that have become contaminated will be changed regardless of interval. When in doubt, notify your supervisor.

**UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS
AND SERVICES (PMCS) INTRODUCTION - CONTINUED**

0008 00

GENERAL LUBRICATION PROCEDURES - CONTINUED**WARNING**

When servicing this machine, performing maintenance or disposing of materials such as engine coolant, hydraulic fluid, lubricants, battery acids or batteries, and CARC paint, consult your unit/local hazardous waste disposal center or safety office for local regulatory guidance. If further information is needed, please contact The Army Environmental Hotline at 1-800-872-3845.

2. Ensure that all fluids drained as a result of lubrication or maintenance are collected in a suitable container and disposed of in accordance with local policy and ordinances. Clean up any spills immediately.
3. Keep all lubricants in a closed container and store in a clean, dry place away from extreme heat. Keep container covers clean and do not allow dust, dirt or other foreign material to mix with lubricants. Keep all lubrication equipment clean and ready for use.
4. Maintain a good record of all lubrication performed and report any problem noted during lubrication. Refer to DA Pam 738-750 for maintenance forms and procedures to record and report any findings.

**WARNING**

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

5. Keep all external parts of equipment not requiring lubrication free of lubricants. Before lubrication, wipe lubrication fittings with a clean rag (Item 28, WP 0184 00) and solvent cleaning compound (Item 4, WP 0184 00). After lubrication, wipe off excess oil or grease to prevent accumulation of foreign matter.
6. Refer to FM 9-207, *Operations and Maintenance of Ordinance Material in Cold Weather* for lubrication instructions in cold weather.
7. Refer to AR 70-12, *Fuel and Lubricants Standardization Policy for Equipment* for use of standardized fuels and lubricants.
8. For equipment under manufacturer's warranty, hardtime oil service intervals shall be followed. Intervals shall be shortened if lubricants are known to be contaminated or if operation is under adverse conditions (i.e., longer-than-usual operating hours, extended idling periods or extreme dust).

NOTE

The D7F is no longer enrolled in the Army Oil Analysis Program (AOAP).

9. Engine, transmission and hydraulic system oil filters shall be changed when:
 - a. they are known to be contaminated or clogged; or
 - b. at prescribed hardtime intervals.

GENERAL PMCS PROCEDURES

1. Always perform PMCS in the same order so it gets to be a habit. Once you've had some practice, you'll spot anything wrong in a hurry. If any deficiency is discovered, perform the appropriate troubleshooting task in Chapter 2 of this manual. If any component or system is not serviceable, or if the given service does not correct the deficiency, notify your supervisor.

**UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS
AND SERVICES (PMCS) INTRODUCTION - CONTINUED**

0008 00

GENERAL PMCS PROCEDURES - CONTINUED

2. Before performing preventive maintenance, read all the checks required for the applicable interval and prepare all tools needed to make all checks. Have several clean rags (Item 28, WP 0184 00) handy. Perform ALL inspections at the applicable interval.
 - a. **Keep It Clean.** Dirt, grease, oil and debris get in the way and may cover up a serious problem. Clean as you work and as needed. Use detergent (Item 10, WP 0184 00) and water when you clean.
 - b. **Rust and Corrosion.** Check metal parts for rust and corrosion. If any bare metal or corrosion exists, clean and apply a light coat of lubricating oil (Item 25, WP 0184 00). Report it to your supervisor.
 - c. **Bolts, Nuts and Screws.** Check bolts, nuts and screws for obvious looseness, missing, bent or broken condition. You can't try them all with a tool, but look for chipped paint, bare metal or rust around bolt heads. If you find one you think is loose, tighten it.
 - d. **Welds.** Look for loose or chipped paint, rust or gaps where parts are welded together. If you find a bad weld, report it to your supervisor.
 - e. **Electric Wires and Connectors.** Look for cracked or broken insulation, bare wires and loose or broken connectors. Tighten loose connectors and ensure that the wires are in good condition.
 - f. **Hydraulic Hoses and Lines.** Look for wear, damage, and signs of leaks. Ensure that clamps and fittings are tight. Wet spots indicate leaks, but a stain around a fitting or connector can also mean a leak. If a leak comes from a loose fitting or connector, tighten it. If something is broken or worn out, correct it if authorized by the Maintenance Allocation Chart (WP 0183 00). If not authorized, notify your supervisor.
 - g. **Fluid Leakage.** It is necessary for you to know how fluid leakage affects the status of your machine. The following are definitions of the types/classes of leakage you need to know to be able to determine the status of your machine. Learn and be familiar with them, and remember - when in doubt, notify your supervisor.

Leakage Definitions for PMCS

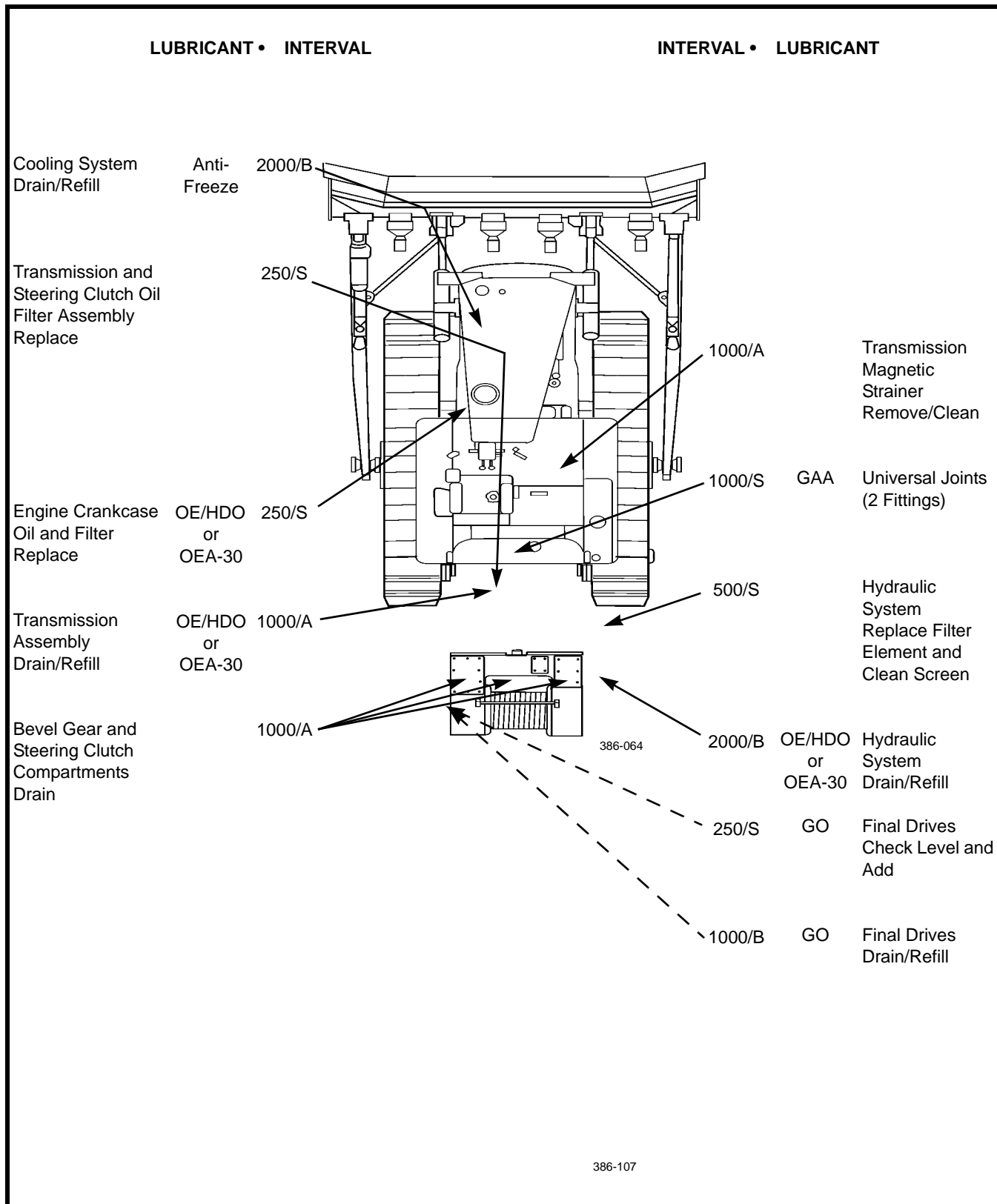
Class I	Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.
Class II	Leakage of fluid great enough to form drops, but not enough to cause drops to drip from item being checked/inspected.
Class III	Leakage of fluid great enough to form drops that fall from item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

CAUTION

Operation is allowable with Class I and Class II leakage. WHEN IN DOUBT, NOTIFY YOUR SUPERVISOR. When operating with Class I or Class II leaks, check fluid levels more frequently. Class III leaks must be reported immediately to your supervisor. Failure to do this will result in damage to vehicle and/or components.

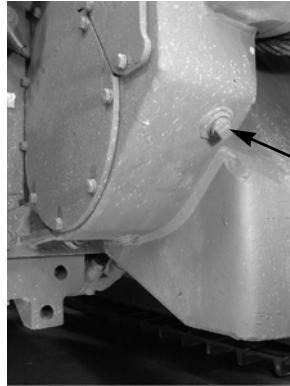
- KEY -

LUBRICANT/ COMPONENT	REFILL CAPACITY	EXPECTED TEMPERATURES*			INTERVALS
		Above +15°F (Above -9°C)	+40°F to -15°F (+4°C to -26°C)	+40°F to -65°F (+4°C to -54°C)	
OE/HDO Lubricating Oil, ICE, Tactical Service (MIL-PRF-2104)					H - Hours S - Semiannual A - Annual B - Biennial
OEA-30 Lubricating Oil, ICE, Arctic (MIL-PRF-46167)					
Engine Crankcase	29 qt. (27.4 L)	OE/HDO - 15/40 or OE/HDO-30 See Note	OE/HDO - 15/40 or OE/HDO-10 See Note	OEA-30	
Transmission, Bevel Gear and Steering Clutch Compartments	148 qt. (141.0 L)				
Towing Winch	38 qt. (36.0 L)				
Hydraulic Tank	88 qt. (83.2 L)	OE/HDO-15/40 or OE/HDO-10 See Note		OEA-30	
GO Lubricating Oil, Gear, Multipurpose					
Final Drives	9 gal. (Each) (34.1 L) (Each)	GO-75	GO-80/90	GO-85/140	
GAA Grease, Automotive and Artillery					
Driveshaft U-Joints	As Req'd	All Temperatures			
ANTIFREEZE Permanent, Ethylene Glycol, Inhibited (MILA46153)					
Cooling System	12 gal. (45.4 L)	Refer to PMCS Table			
* For arctic operation, refer to FM 9-207.					
Note: Grade 15W-40 (OE/HDO-15/40) is the preferred lubricant but should only be used when temperatures are above 0°F (-18°C).					



LUBRICANT • INTERVAL

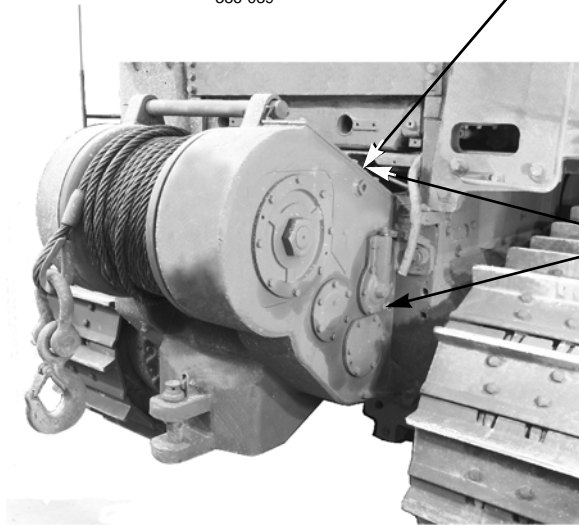
INTERVAL • LUBRICANT



386-039

B

OE/HDO Winch
or
OEA-30
Drain/Refill



386-003

S

OE/HDO Winch
or
OEA-30
Check Level/Add
Replace Filter
Element

END OF WORK PACKAGE

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS)

0009 00

THIS WORK PACKAGE COVERS

Tools, Materials, and Personnel required for Unit Maintenance PMCS and lubrication

INITIAL SETUP

Tools and Special Tools

- Shop equipment, common no.1 (Item 94, WP 0185 00)
- Shop equipment, common no. 2 (Item 95, WP 0185 00)
- Tool kit, general mechanic's (Item 12, WP 0185 00)

Materials/Parts

- Antifreeze (Item 1, WP 0184 00)
- Cleaning compound, solvent (Item 4, WP 0184 00)
- Cloth, abrasive, emery, fine (Item 5, WP 0184 00)
- Detergent (Item 10, WP 0184 00)
- Grease, GAA (Item 15, WP 0184 00)
- Oil, lubricating, OE/HDO-10 (Item 23, WP 0184 00)
- Oil, lubricating, OE/HDO-15/40 (Item 24, WP 0184 00)

Materials/Parts - Continued

- Oil, lubricating, OEA-30 (Item 22, WP 0184 00)
- Oil, lubricating, OE/HDO-30 (Item 25, WP 0184 00)
- Oil, lubricating, gear, GO-75 (Item 19, WP 0184 00)
- Oil, lubricating, gear, GO-80/90 (Item 20, WP 0184 00)
- Oil, lubricating, gear, GO-85/140 (Item 21, WP 0184 00)
- Rags (Item 28, WP 0184 00)
- Sodium bicarbonate (Item 32, WP 0184 00)

Personnel

Two

Equipment Condition

- Machine parked on level ground (TM 5-2410-233-10)
 - Engine OFF with engine oil warm (TM 5-2410-233-10)
-

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00

Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
1	250 Hours or Semi-annual	0.5 Hours	Engine Crankcase	<p align="center">NOTE</p> <ul style="list-style-type: none"> • Review all WARNINGS, CAUTIONS and NOTES before performing Unit Maintenance PMCS on the D7F Tractor. • Unless otherwise indicated, perform all lubrication and preventive maintenance with machine parked on level ground, transmission in N (Neutral), transmission lock lever in locked position, brake lock lever engaged, implements lowered to the ground and engine shut down. • Perform Operator PMCS prior to or in conjunction with Unit Maintenance if: <ul style="list-style-type: none"> a. There is a delay between daily operation of the machine and Unit Maintenance PMCS. b. The regular operator is not assisting.
				<p align="center">NOTE</p> <p align="center">Crankcase oil capacity is 7.25 gal. (27.4 l).</p> <ul style="list-style-type: none"> a. Drain oil from crankcase and replace oil filter element (WP 0010 00). b. Refill engine crankcase. Run engine and check for leaks (WP 0010 00). c. Remove crankcase breather and clean (WP 0014 00). Inspect breather seal and replace as needed. Reinstall breather.

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00

Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
2	250 Hours or Semi-annual		Engine Valve Lash	<p>NOTE</p> <ul style="list-style-type: none"> Valve lash should be adjusted the <u>first</u> time engine oil is changed on a replacement engine. Otherwise, valve lash should be adjusted at 2000 hours or annually. <p>Adjust valve clearance (WP 0017 00).</p>
3	250 Hours or Semi-annual		V-Belts	<p>a. Check condition of V-belts (TM 5-2410-233-10). If damaged, replace V-belts as a set (WP 0069 00).</p> <p>b. Check tension on V-belts and adjust as needed (WP 0069 00).</p>
4	250 Hours or Semi-annual	0.3 Hours	Final Drives	Check level of oil in final drives. Add oil as needed (WP 0099 00).
5	250 Hours or Semi-annual	0.7 Hours	Transmission Assembly	Replace transmission and steering clutch oil filter assembly (WP 0089 00).
6	250 Hours or Semi-annual		Brake Lock Lever and Linkage	Check that brake lock lever engages properly. Adjust lever as required (WP 0124 00).
7	250 Hours or Semi-annual		Brake Pedals and Linkage	Check travel of brake pedals. Adjust pedal if travel has reached 5-5.5 in. (12.70-13.97 cm) (WP 0126 00).
8	250 Hours or Semi-annual	0.5 Hours	Hydraulic System	<p>Remove hydraulic filter assembly from tank (WP 0162 00).</p> <p>a. Replace filter element.</p> <p>b. Clean screen assembly.</p> <p>c. Install hydraulic filter assembly in tank.</p>
9	Semiannual	0.7 Hours	Winch (If Equipped)	<p>a. Check oil level in winch reservoir and add as needed (WP 0138 00).</p> <p>b. Change winch oil filter element (WP 0143 00).</p>

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00



Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
10	Semiannual		Road Test	<p>NOTE</p> <ul style="list-style-type: none"> • Test drive machine over varied terrain for at least 15 minutes. • Perform all <i>During Operator PMCS</i> checks during road test (TM 5-2410-233-10). <ol style="list-style-type: none"> a. While cranking engine, listen for unusual noises and difficult cranking. b. Observe response to governor controls. Listen for unusual noises. Observe for hesitation, varying idle speed and sticking or binding of lever. c. Check for response to shifting and smoothness of operation in all speed ranges. d. Be alert for excessive vibration and the smell of fuel, oil, coolant and exhaust. e. Check all instrument and gages for proper readings (TM 5-2410-233-10). f. Operate all machine implements and note response of respective control levers. g. Lightly apply brake pedals with steady force. Machine should slow down immediately and stop smoothly. h. Park machine on level ground. Place transmission in neutral (N) with transmission lock lever in locked position. Engage brake lock lever. Lower implements to the ground and shut down engine. i. Perform a walk around inspection of machine. Check for evidence of leaks: oil, fuel and engine coolant. j. Ensure all data, caution and warning plates are present, securely mounted and legible.
11	Semiannual		Engine	<ol style="list-style-type: none"> a. Inspect oil lines and hoses for cracks, frays and wear that could cause leaks. b. Ensure engine oil filter assembly is securely mounted with no evidence of leaks. c. Inspect rocker arm (valve mechanism) cover for damage and leaks. d. Inspect all engine compartment wiring for frays, splits, missing insulation and poor connections. Replace any damaged wires and tighten any loose connection.

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00

Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
12	Semiannual		Fuel System	a. Inspect fuel filter housings for dents and cracks that could cause leaks. b. Inspect fuel transfer pump, fuel lines and fittings for damage and leaks. c. Service primary and secondary fuel filter assemblies (WP 0055 00 and WP 0056 00). d. Remove and disassemble fuel filler cap and strainer. Clean strainer and filler cap components. Assemble and install filler cap (WP 0049 00).
13	Semiannual		Cooling System	<div style="display: flex; justify-content: space-around; align-items: center;">  WARNING  </div> <ul style="list-style-type: none"> • DO NOT service cooling system unless engine has been allowed to cool down. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns. • DO NOT remove cooling system radiator cap when engine is hot. Allow engine to cool down. Loosen cap to first stop and let any pressure out of cooling system, then remove cap. Failure to follow this warning may cause serious burns. • Wear effective eye, glove, and skin protection when handling coolants. Failure to do so may cause injury. a. Inspect hoses for splits, dry rot, wear and cracks that could cause leaks. Inspect hose clamps for tightness. Replace any damaged hose and tighten any loose hose clamps. b. Inspect radiator, water pump, engine oil cooler and transmission oil cooler for leaks and secure mounting. Tighten any loose mounting hardware. c. Inspect radiator core for clogged or bent fins, leaks and protruding debris. Clean clogged core and remove debris. Straighten bent fins. d. Inspect fan blades for security, breaks and missing or loose cap-screws. e. Inspect engine water temperature sending unit for security of mounting. Inspect wiring for frays, splits, breaks and worn or missing insulation.

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00




Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
13 (Con't)				f. Check antifreeze solution for adequate freeze protection (TB 750-651).
14	Semiannual		Starting Motor	Inspect starting motor for security of mounting, corrosion and damaged or loose wiring. Tighten mounting capscrews and any loose connections.
15	Semiannual		Alternator	<p>a. Inspect alternator for secure mounting.</p> <p>b. Inspect alternator mounting bracket and attaching hardware for cracks, bends and secure mounting. Tighten any loose attaching hardware.</p> <p>c. Inspect alternator wiring for frays, bare wires, breaks and loose terminal connections. Tighten any loose terminal connections.</p> <p>d. Use a multimeter to check alternator output voltage. Voltage should read 27-29 volts (WP 0177 00).</p>
16	Semiannual		ROPS	<p>a. Inspect ROPS for cracks, breaks, bends or wear. Check for loose or missing mounting hardware.</p> <p>b. Inspect ROPS protective screen for damage or loose or missing mounting hardware.</p>
17	Semiannual		Steering and Brakes	<p>a. Inspect steering and brake linkages for bends, cracks or wear that could cause failure.</p> <p>b. Inspect brake pedals for signs of looseness or wear.</p>

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00

Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

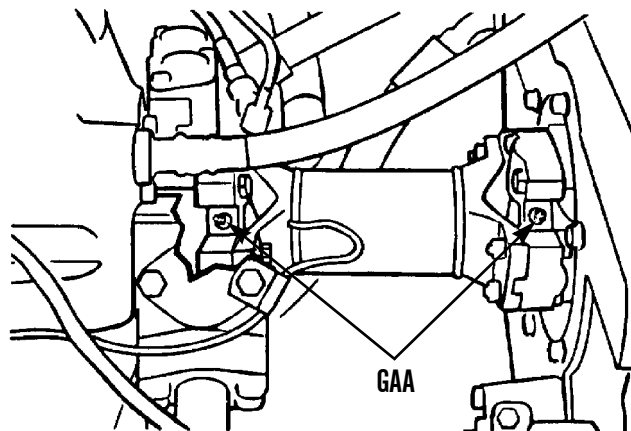
ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
18	Semiannual		Batteries	<div style="display: flex; justify-content: space-around; align-items: center;">   <div style="text-align: center;"> <p>WARNING</p> </div>  </div> <ul style="list-style-type: none"> • To avoid injury, eye protection and acid-resistant gloves must be worn when working around batteries. Do not smoke, use open flame, make sparks or create other ignition sources around batteries. If a battery is giving off gases, it can explode and cause injury to personnel. Remove all jewelry such as rings, ID tags, watches, and bracelets. If jewelry or a tool contacts a battery terminal, a direct short will result in instant heating, damage to equipment, and injury to personnel. • Sulfuric acid contained in batteries can cause serious burns. If battery corrosion or electrolyte makes contact with skin, eyes or clothing, take immediate action to stop the corrosive burning effects. Failure to follow these procedures may result in death or serious injury to personnel. <p style="text-align: center;">CAUTION</p> <ul style="list-style-type: none"> • If battery compartment is corroded, it will be necessary to remove batteries and clean compartment to remove acid residues and corrosion. • Buildup of dirt or corrosion on batteries can lead to electrical malfunctions. <p>Service batteries as follows:</p> <ol style="list-style-type: none"> a. Access batteries inside battery box on left side of machine. b. Check battery hold-down for looseness, corrosion or damage. Tighten if loose. c. Clean top of batteries with a rag (Item 28, WP 0184 00). d. Inspect batteries for evidence of cracked case and electrolyte leakage. e. Disconnect battery cables (WP 0080 00). f. As required, use a solution of 1-1/2 cups (340 grams) of baking soda (Item 32, WP 0184 00) with 1 gallon (3.8 l) of clean water to remove any acid film from batteries. Rinse with clean water.

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00

Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
18 (Con't)				<p>g. Clean battery terminals with a fine grade of sandpaper or emery cloth (Item 5, WP 0184 00).</p> <p>h. Ensure all battery filler caps are present.</p> <p>i. Remove filler caps and check electrolyte level in each battery cell. Electrolyte level should be up to triangle in filler openings. Add distilled water as required and reinstall filler caps snugly.</p> <p style="text-align: center;">CAUTION</p> <p>If battery requires charging, never exceed a charging voltage of 16 volts. Too much voltage will cause serious damage to battery.</p> <p>j. Check state of charge of battery, using a digital voltmeter (TM 9-6140-200-14). A reading of 12.4 volts or more indicates battery is sufficiently charged. If reading is below 12.4 volts, recharge battery.</p> <p>k. Check specific gravity of electrolyte IAW TM 9-6140-200-14.</p>
19	1000 Hours or Semi-annual	0.5 Hours	Driveshaft and U-Joints	<p>l. Connect battery cables (WP 0080 00).</p> <p>a. Remove floor plates to access driveshaft and U-joints (WP 0135 00).</p> <p>b. Inspect driveshaft for bends, cracks and twisted condition.</p> <p>c. Inspect U-joints for bends or cracks, play and broken or missing grease fittings. There must be no play in U-joints.</p> <p>d. Apply GAA grease (Item 15, WP 0184 00) to grease fitting at each U-joint.</p>



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UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00

Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
20	Semiannual		Undercarriage and Tracks	<p>a. Inspect equalizer bar for cracks, bends, breaks and loose or missing mounting hardware.</p> <p>b. Inspect track roller guards for cracks, bends and wear.</p> <p>c. Inspect the following components: track roller frame, idlers, track rollers, track carrier rollers and sprockets. Replace components that are damaged or worn beyond acceptable limits (WP 0120 00).</p> <p>d. Check recoil spring and track adjuster cylinder for damage or external leakage of grease. Replace as needed (WP 0113 00 or WP 0117 00).</p> <p>e. Inspect for damage or wear to track links and bushings. Inspect for cracked or missing track shoes. Replace any component that is broken, cracked, missing or worn beyond acceptable limits.</p> <p style="text-align: center;">NOTE</p> <p>The D7F uses two types of tracks: The Caterpillar “branded track” (identified by a Caterpillar logo) and the “classic track” (identified by a pictorial symbol of a track link). Inspection criteria and maintenance of both styles of tracks are the same. However, components of these tracks are NOT completely interchangeable. Before maintenance and requisitioning of parts, verify the type of track on the tractor and proceed accordingly.</p> <p>f. Check and adjust track tension if necessary (WP 0120 00).</p>
21	Semiannual		Hydraulic System	<p>a. Follow routing of lines, hoses and tubing for hydraulic system. Inspect for loose fittings, cracks, bends, breaks and leaks.</p> <p>b. Inspect blade lift cylinders and tilt cylinder and cylinder hydraulic lines for secure mounting, loose fittings and leaks.</p> <p>c. If equipped with ripper, inspect ripper lift cylinders and cylinder hydraulic lines for secure mounting, loose fittings and leaks.</p> <p>d. If equipped with winch, inspect winch hydraulic lines for secure mounting, loose fittings and leaks.</p>
22	Semiannual		Bulldozer Blade	<p style="text-align: center;">CAUTION</p> <p>If wear to cuttings edge and end bits is sufficient to cause wear to blade support, change cutting edge and install new end bits.</p> <p>Inspect cutting edge and end bits for damage, wear or loose or missing mounting hardware. Change cutting edge if damaged or worn to less than 3/4 in. (19 mm) (WP 0169 00). Install new end bits if worn/damaged (WP 0169 00).</p>

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00



Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
23	Semiannual		Dozer Push-arm Trunnions	Inspect trunnions on both sides of machine for structural damage and missing or loose mounting hardware.
24	Semiannual		Winterized Cab (If Equipped)	<ul style="list-style-type: none"> a. Inspect defrosters for proper operation and evidence of damage. b. Inspect heater for proper operation and evidence of damage. c. Inspect windshield wipers for proper operation and evidence of damage.
25	1000 Hours or Annual	1.1 Hours	Transmission Assembly	<ul style="list-style-type: none"> a. Inspect transmission control valves for leaks, wear or cracks that could cause failure. b. Inspect transmission body for cracks or loose capscrews that could cause leaks. c. Inspect transmission shift linkage for bends, cracks and wear that could cause failure. d. Perform complete transmission assembly service (WP 0086 00): <ul style="list-style-type: none"> (1) Drain oil from transmission assembly. <p style="text-align: center;">NOTE</p> <p>Breather is common to transmission and steering clutches/ final drives.</p> <ul style="list-style-type: none"> (2) Replace transmission breather (WP 0099 00). (3) Replace transmission and steering clutch filter assembly (WP 0089 00). (4) Clean transmission oil magnetic strainer assembly and check for leaks (WP 0085 00). (5) Refill transmission and check for leaks.
26	2000 Hours or Annual		Engine Valve Lash	Adjust valve clearance (WP 0017 00).
27	1000 Hours or Biennial	0.5 Hours	Final Drives	<ul style="list-style-type: none"> a. Inspect final drives for evidence of oil leakage. b. Drain final drives and refill (WP 0099 00).

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00

Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
28	2000 Hours or Biennial	0.5 Hours	Cooling System	<div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;"> <p>WARNING</p> <ul style="list-style-type: none"> • DO NOT service cooling system unless engine has been allowed to cool down. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns. • DO NOT remove cooling system radiator cap when engine is hot. Allow engine to cool down. Loosen cap to first stop and let any pressure out of cooling system, then remove cap. Failure to follow this warning may cause serious burns. • Wear effective eye, glove, and skin protection when handling coolants. Failure to do so may cause injury. </div>  </div> <p>Drain cooling system, change antifreeze solution and refill (WP 0060 00).</p>
29	2000 Hours or Biennial	0.7 Hours	Hydraulic System	<ol style="list-style-type: none"> a. Inspect hydraulic tank for cracks, breaks and leaks. b. Inspect hydraulic lines and fittings at tank for looseness, damage and leaks. c. Drain oil from hydraulic tank (WP 0165 00). d. Remove, clean and reinstall filler strainer (WP 0162 00). e. Remove hydraulic filter assembly, clean screen, replace filter element and reinstall filter assembly in tank (WP 0162 00). f. Refill hydraulic tank (WP 0165 00).

UNIT MAINTENANCE PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) - CONTINUED

0009 00

Table 1. Unit Maintenance Preventive Maintenance Checks and Services (PMCS) for the D7F Tractor - Continued.

ITEM NO.	INTERVAL	MAN-HOURS	LOCATION	PROCEDURE
			ITEM TO CHECK/SERVICE	
30	Biennial	0.8 Hours	Winch (If Equipped)	<ul style="list-style-type: none"> a. Inspect winch for cracks, breaks and leaks. b. Inspect winch mounting hardware for looseness, missing parts or damage. c. Inspect winch control levers for proper operation and linkage for cracks, bends and missing mounting hardware. d. Reel out winch wire rope assembly completely. Inspect wire rope assembly for kinks, frays and wear. Replace a frayed or damaged wire rope assembly (WP 0145 00). e. Drain oil from winch reservoir (WP 0138 00). f. Replace winch breather (WP 0144 00). g. Replace winch oil filter element (WP 0143 00). h. Refill winch reservoir (WP 0138 00).
31	Biennial		Frame	<ul style="list-style-type: none"> a. Inspect frame for cracks, breaks, bends, wear and corrosion. Make repairs as authorized. b. Inspect all areas of frame for missing rivets, capscrews and obstructions to other components. Move obstructions, if possible. Make repairs as required.
32	Biennial		Engine Mounts and Lifting Brackets	Inspect engine mounts and lifting brackets for security of mounting, wear, cracks, splits, broken welds and loose or missing mounting hardware.

END OF WORK PACKAGE

ENGINE OIL AND OIL FILTER ASSEMBLY MAINTENANCE

0010 00

THIS WORK PACKAGE COVERS

Changing Engine Oil, Oil Filter Replacement, Oil Filter Base: Removal, Disassembly, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

- Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Tubing, rubber or plastic, 1-1/2 in. I.D. x 9 in.
- Filter element, fluid (10)
- Gasket (19)
- O-ring (15)

References

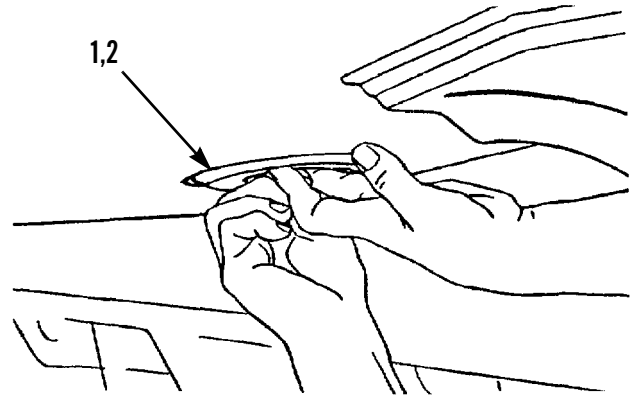
- WP 0008 00
- WP 0009 00
- WP 0014 00

Equipment Condition

- Tractor parked on level ground (TM 5-2410-233-10)
- Engine oil warm (TM 5-2410-233-10)
- Transmission in neutral (N) and locked (TM 5-2410-233-10)
- Engine OFF (TM 5-2410-233-10)

CHANGING ENGINE OIL

1. Loosen capscrew (1) and remove access cover assembly (2) from crankcase guard.



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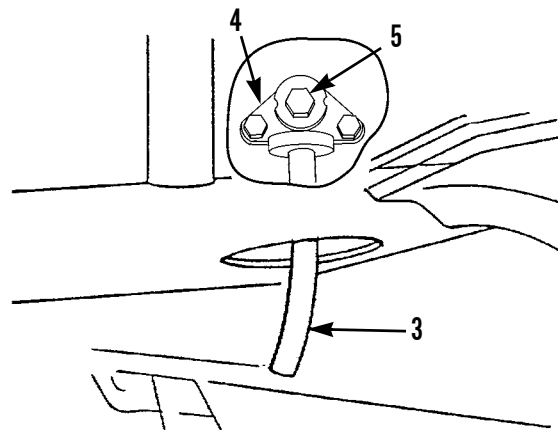
CHANGING ENGINE OIL - CONTINUED

2. Slide a piece of 1-1/2 in. I.D. soft rubber or plastic tubing (3) over bottom of oil drain plug adapter (4). Place a drain pan under drain opening and direct tubing into drain pan to catch oil.

NOTE

- Place a suitable container under drain to collect drained oil.
- Dispose of oil IAW local policy and ordinances.
- Make sure all spills are cleaned up.
- Crankcase capacity is 7.25 gal. (27.4 l).

3. Open, but do not remove, drain valve (5) until oil flows. Allow oil to drain from engine. After oil has drained from engine, close drain valve and remove tubing (3).
4. Replace oil filter as necessary. See *Oil Filter Replacement*. Refer to PMCS in WP 0008 00 and WP 0009 00 for interval requirement.
5. Service crankcase breather (WP 0014 00).



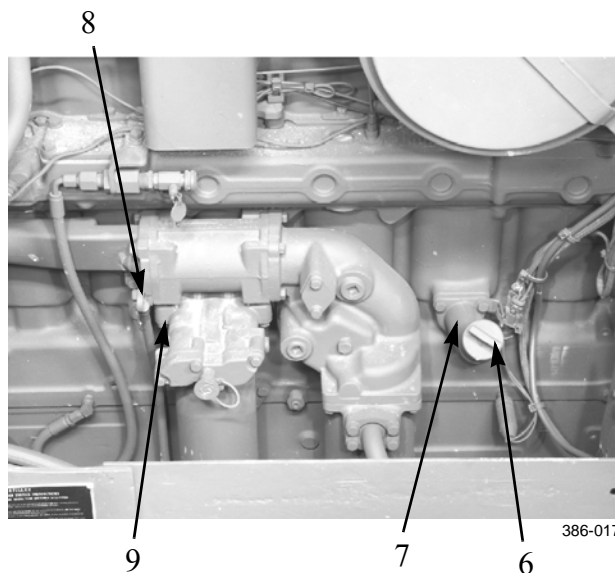
386-155

6. Remove cap (6) from fill pipe (7).
7. Fill crankcase with new oil. Refer to PMCS in WP 0008 00 and WP 0009 00 for oil grade and refill capacities.
8. Install cap (6) onto fill pipe (7).

NOTE

If it is desired to check oil with engine stopped, make sure level falls within SAFE STARTING RANGE on ENGINE STOPPED side of oil level gage.

9. Start engine and run for a few minutes at low idle to fill filter housing. Check oil level by pulling oil level gage (8) out with engine running and make sure oil falls between ADD and FULL marks on oil level gage (8).
10. If necessary, remove oil filler tube cap (6) and add more oil through fill pipe (7).
11. Check oil filter base (9) and drain plug (5) for leaks.

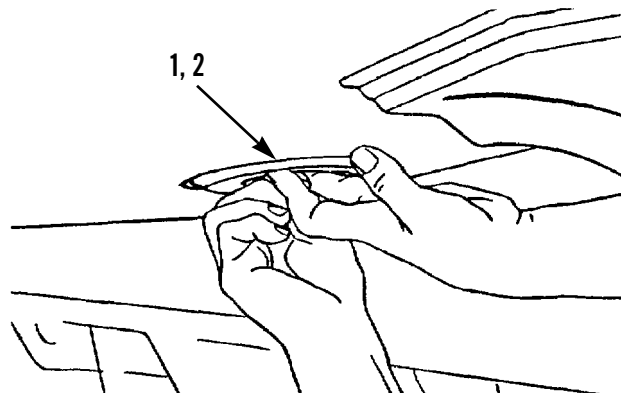


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CHANGING ENGINE OIL - CONTINUED**WARNING**

Never crawl under a running machine. Make sure engine is OFF. Failure to follow this warning may result in injury or death.

12. Install access cover assembly (2) and tighten cap-screw (1).



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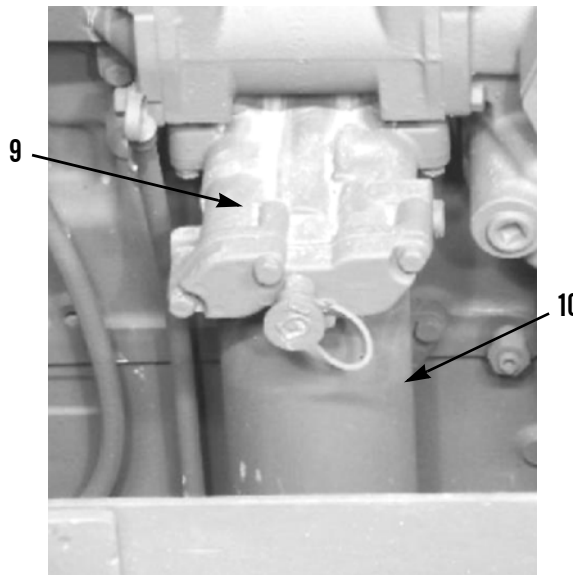
OIL FILTER REPLACEMENT

1. Drain engine oil. See *Changing Engine Oil* in this work package.

NOTE

Capacity of oil filter is approximately 2 qt (1.891 l).

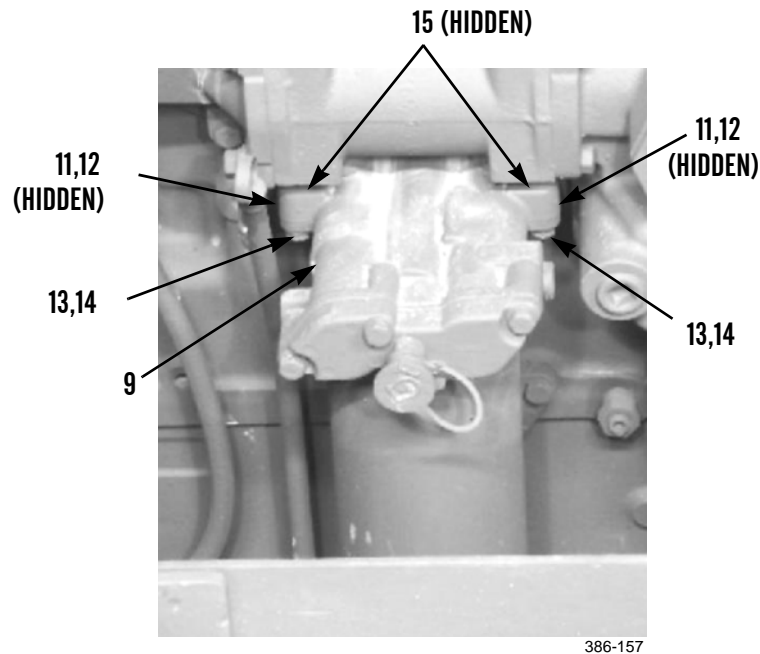
2. Use a strap wrench to remove oil filter (10). Discard filter.
3. Clean bottom of oil filter base (9) with a clean rag.
4. Apply a thin film of clean lubricating oil to gasket on base of new oil filter (10).
5. Install new oil filter (10) and tighten only until gasket on base of new oil filter touches oil filter base (9). Then tighten filter an additional 1/2 turn. Do not overtighten.
6. Fill crankcase with oil. See *Changing Engine Oil* in this work package.



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OIL FILTER BASE REMOVAL

1. Drain engine oil. See *Changing Engine Oil* in this work package.
2. Remove oil filter. See *Oil Filter Replacement* in this work package.
3. Remove inner capscrews (11), washer (12), outer capscrews (13), washers (14) and oil filter base (9) from engine.
4. Remove O-rings (15) from oil filter base (9). Discard O-rings.

**OIL FILTER BASE DISASSEMBLY****WARNING**

Covers hold springs under compression. Use care when removing them. Failure to follow this warning may cause injury.

1. Remove four capscrews (16), washers (17), two covers (18) and gaskets (19) from oil filter base (9). Discard gaskets.
2. Remove springs (20) and plungers (21) from oil filter base (9).

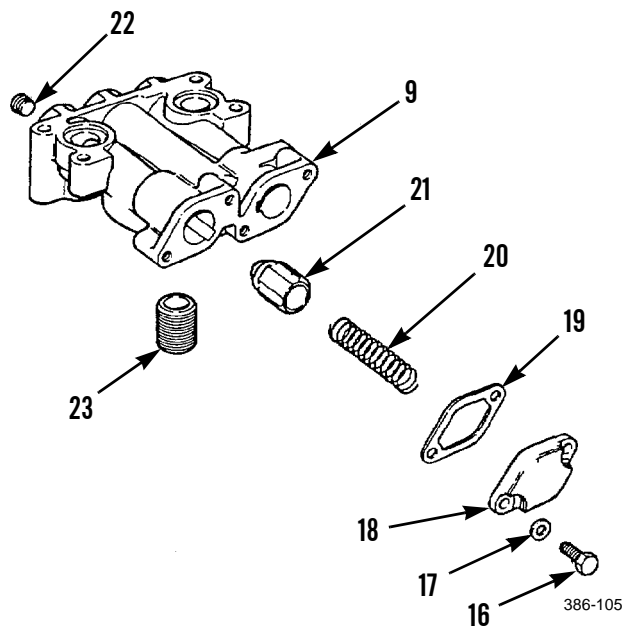
OIL FILTER BASE DISASSEMBLY - CONTINUED**NOTE**

Do not remove stud unless inspection shows need for replacement.

- Remove plug (22). If damaged, remove stud (23) from oil filter base (9).

OIL FILTER BASE ASSEMBLY

- Install plug (22) and, if removed, install stud (23) into oil filter base (9).
- Install plungers (21) and springs (20) into oil filter base (9).
- Place covers (18) with new gaskets (19) into position and install four washers (17) and capscrews (16).

**OIL FILTER BASE INSTALLATION**

- Install new O-rings (15) into oil filter base (9).
- Place oil filter base (9) into position on engine and install washer (12), capscrew (11), washers (14) and capscrews (13).
- Install oil filter. See *Oil Filter Replacement* in this work package.
- Fill crankcase with oil. See *Changing Engine Oil* in this work package.
- Run engine and inspect oil filter base (9), oil filter (10) and tubing for leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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OIL LEVEL GAGE AND GAGE TUBE REPLACEMENT

0011 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

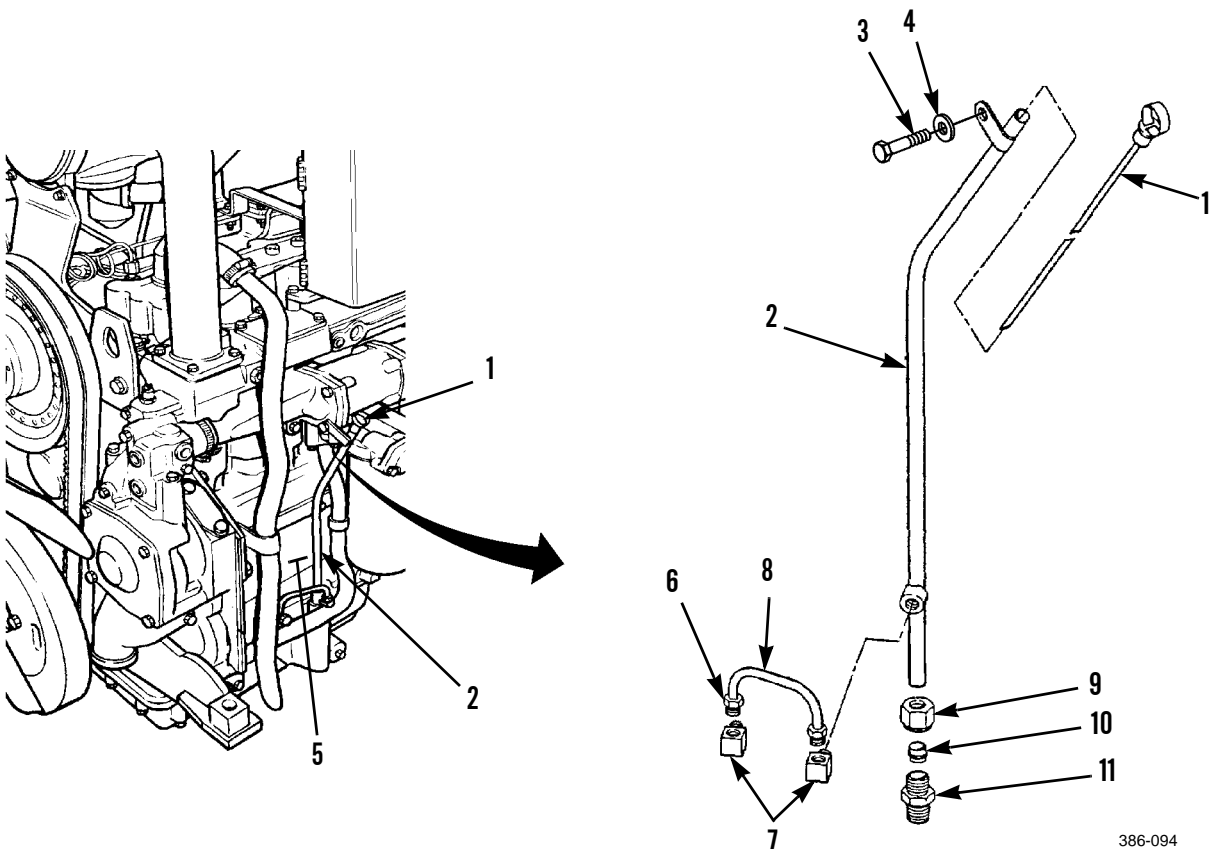
Tool kit, general mechanic's (Item 112, WP 0185 00)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

REMOVAL

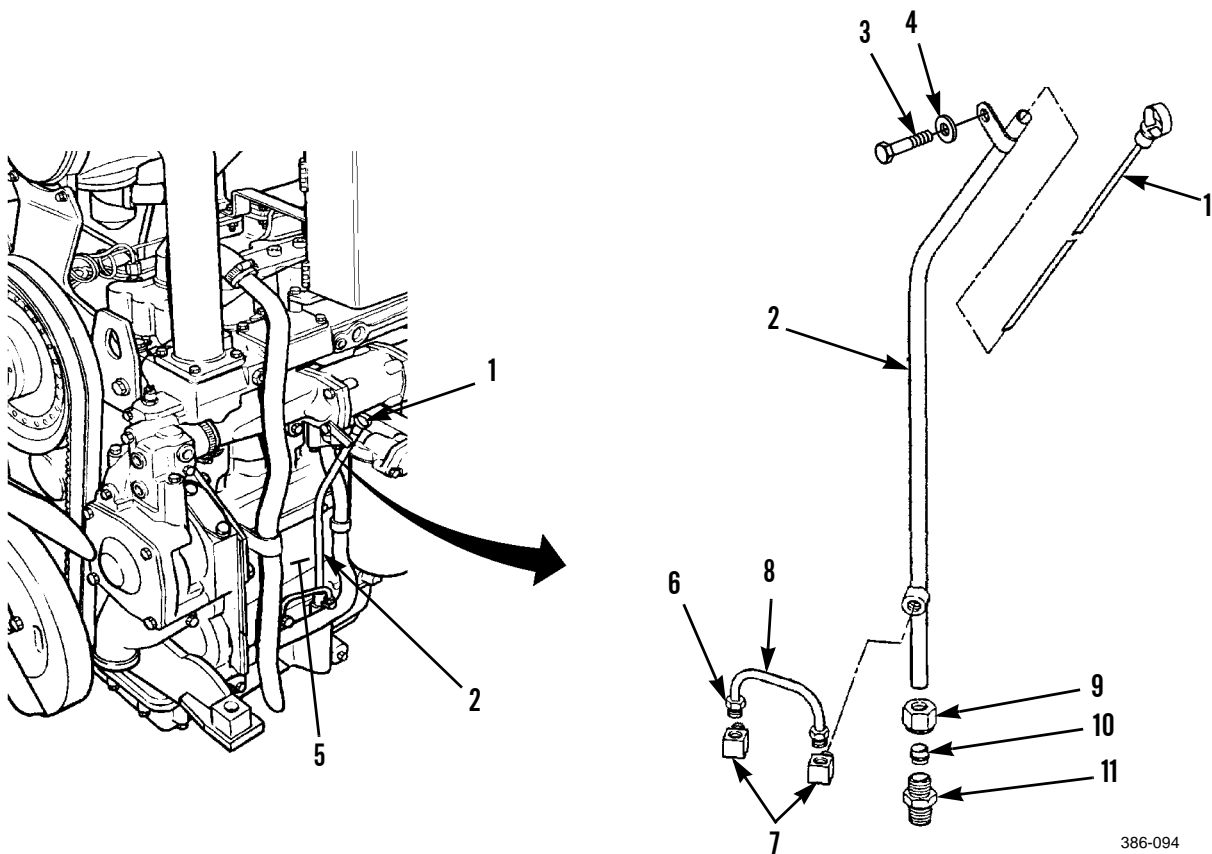
1. Remove oil level gage (1) from oil level gage tube (2).
2. Remove capscrew (3), washer (4) and oil level gage tube (2) from engine block (5).
3. Remove two oil relief tube compression nuts (6) from elbows (7) and remove oil relief tube (8).
4. Remove oil level gage tube nut (9) and sleeve (10) from connector (11) and remove oil level gage tube (2).
5. Remove two elbows (7) from engine block (5).



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OIL LEVEL GAGE AND GAGE TUBE REPLACEMENT - CONTINUED**0011 00****INSTALLATION**

1. Install two elbows (7) into engine block (5).
2. Place oil level gage tube nut (9) and sleeve (10) on oil level gage tube (2).
3. Position connector (11) onto engine block (5) and tighten.
4. Position oil level gage tube (2), oil level gage tube nut (9), sleeve (10) and oil level gage tube nut onto connector (11) and tighten.
5. Position oil relief tube (8) on elbows (7) and tighten two oil relief tube compression nuts (6). If oil relief tube (8) does not fit into elbows, adjust elbows accordingly.
6. Position capscrew (3) through washer (4) and oil level gage tube (2) mounting bracket and install onto engine block (5).
7. Tighten capscrew (3).
8. Install oil level gage (1) into oil level gage tube (2).



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END OF WORK PACKAGE

OIL FILLER TUBE REPLACEMENT

0012 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

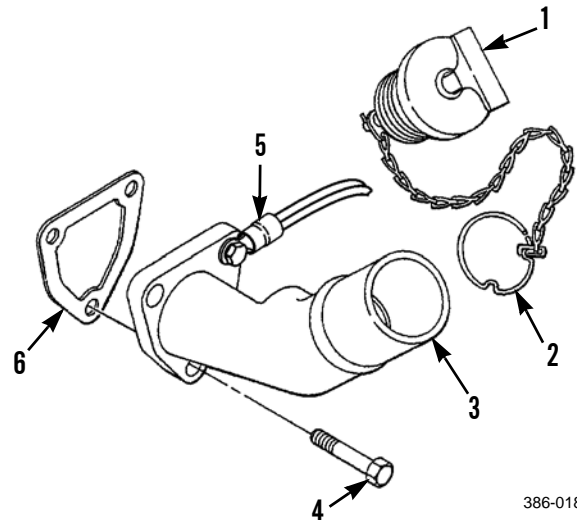
Materials/Parts

Compound, gasket forming (Item 7, WP 0184 00)

Gasket (6)

REMOVAL

1. Remove cap assembly (1) and chain hasp (2) from tube assembly (3).
2. Remove three capscrews (4), clamp (5), tube assembly (3) and gasket (6) from engine block. Discard gasket.



386-018

INSTALLATION

1. Clean gasket surface on tube assembly (3) and engine block.

NOTE

Evenly apply gasket forming compound on new gasket before installation.

2. Place new gasket (6) and tube assembly (3) on engine block, position clamp (5) and install three capscrews (4).
3. Install chain hasp (2) and cap assembly (1) on tube assembly (3).
4. Run engine and check for leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Materials/Parts - Continued

Rag, wiping (Item 28, WP 0184 00)
 O-ring (3)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

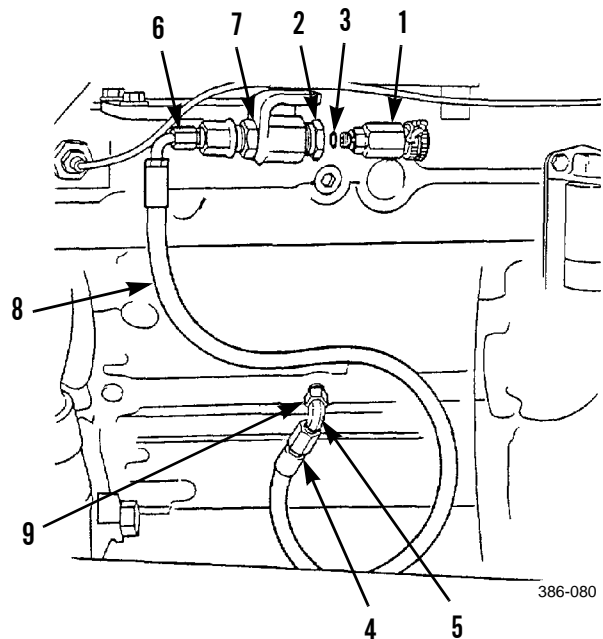
REMOVAL

1. Remove oil sampling valve (1) from adapter (2).
2. Remove O-ring (3) from valve (1). Discard O-ring.
3. Remove hose nut (4) from elbow (5) at engine block. Remove hose nut (6) from reducer (7). Remove hose (8).

CAUTION

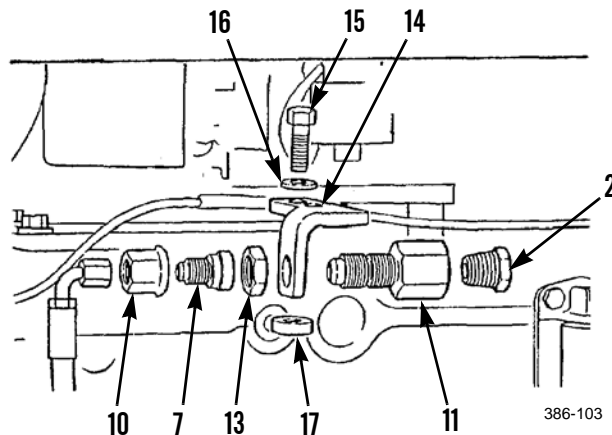
Do not remove adapter unless inspection shows need for replacement. Adapter may be damaged upon removal.

4. Remove elbow (5) from adapter (9) and remove adapter from engine block, if required.



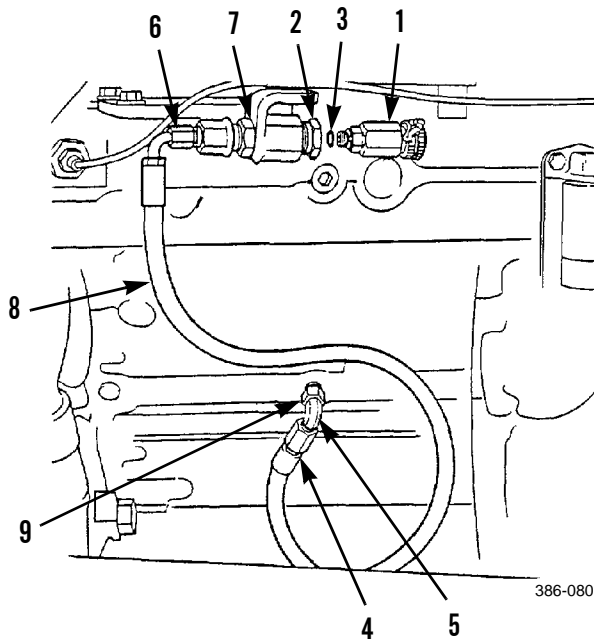
REMOVAL - CONTINUED

5. Remove nut (10) from connector (11) and remove nut and reducer (7).
6. Remove adapter (2) from connector (11).
7. Remove nut (13) from connector (11) and remove connector from bracket (14).
8. Remove capscrew (15), washer (16) and spacer (17) from bracket (14) and remove bracket from cylinder head.



INSTALLATION

1. Place spacer (17) and bracket (14) in position on cylinder head and install washer (16) and capscrew (15).
2. Place connector (11) in position on bracket (14). Install nut (13) to secure connector.
3. Install adapter (2) onto connector (11).
4. Place reducer (7) through nut (10) and install nut onto connector (11).
5. Install adapter (9) in engine block, if removed, and secure elbow (5) onto adapter.
6. Place hose (8) into position and install hose nut (4) onto elbow (5). Install hose nut (6) onto end of reducer (7).
7. Lightly coat with oil and install new O-ring (3) onto valve (1).
8. Install valve (1) into adapter (2) and tighten valve to 180 lb-in. (20 Nm).
9. Run engine and check for leaks (TM 5-2410-233-10).



END OF WORK PACKAGE

CRANKCASE BREATHER REPLACEMENT

0014 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

References

WP 0176 00

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)

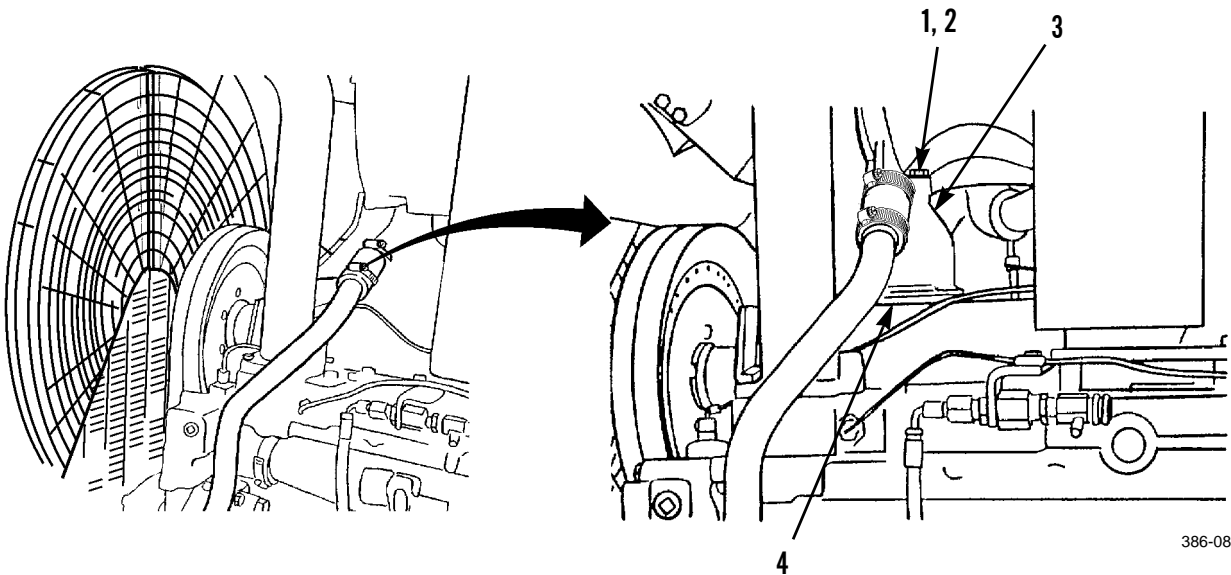
Seal (4)

Equipment Condition

Engine fumes disposal hose removed (WP 0015 00)

REMOVAL

1. Remove capscrew (1) and washer (2) from breather (3). Remove breather.
2. Remove seal (4) from breather (3). Discard seal.



386-086

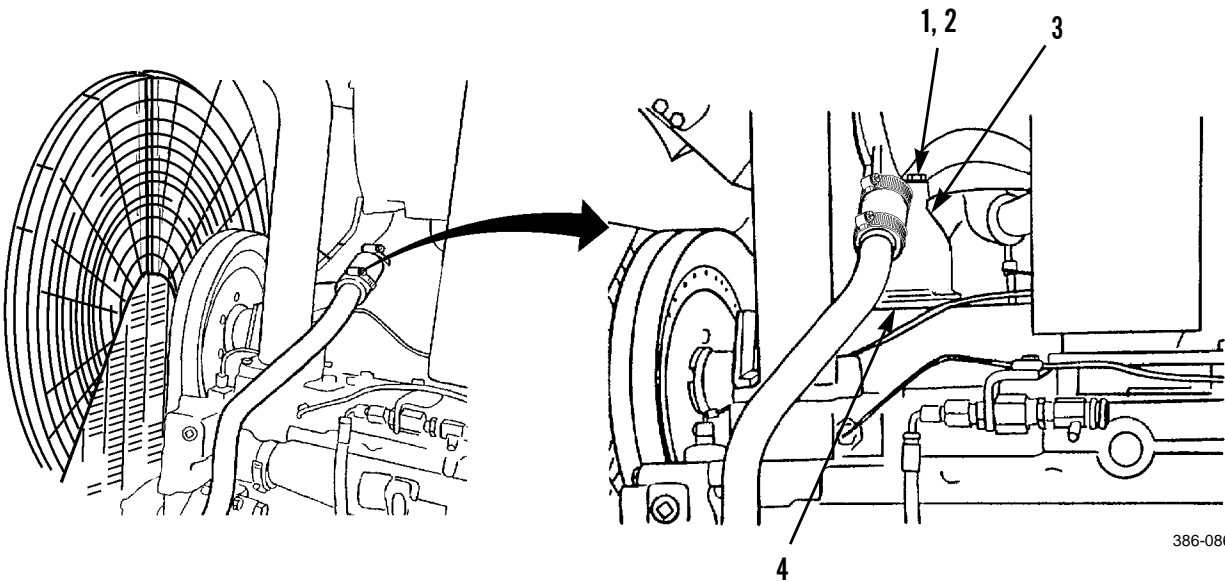
CLEANING**WARNING**

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

Clean breather IAW General Maintenance Instructions (WP 0176 00).

INSTALLATION

1. Install new seal (4) onto breather (3).
2. Position breather (3) onto valve cover.
3. Insert capscrew (1) through washer (2) and breather (3). Tighten capscrew to 120 lb-in. (14 Nm).
4. Install engine fumes disposal hose to breather (3) (WP 0015 00).



386-086

END OF WORK PACKAGE

ENGINE FUMES DISPOSAL HOSE AND TUBE ASSEMBLY REPLACEMENT

0015 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Equipment Condition

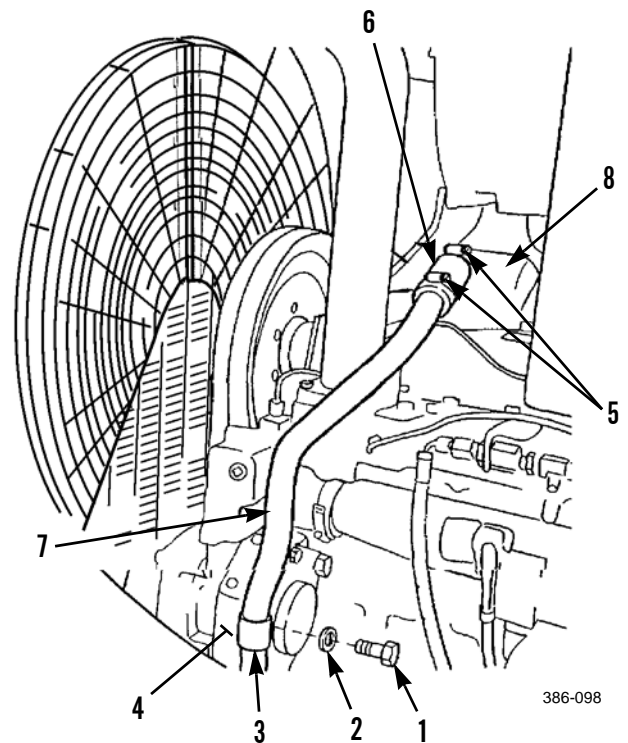
Engine OFF and cool (TM 5-2410-233-10)

REMOVAL

1. Remove capscrew (1) and washer (2) holding clip (3) to timing gear housing (4).
2. Loosen two hose clamps (5).
3. Remove hose (6), two hose clamps (5) and engine fumes disposal tube (7) from crankcase breather (8).

INSTALLATION

1. Install hose (6), two hose clamps (5) and engine fumes disposal tube (7) on crankcase breather (8).
2. Position hose clamps (5) and tighten.
3. Install clip (3) on timing gear housing (4) with washer (2) and capscrew (1).



386-098

END OF WORK PACKAGE

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VALVE MECHANISM COVER REPLACEMENT

0016 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

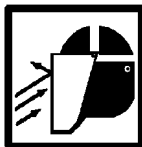
- Compound, gasket shellac (Item 8, WP 0184 00)
- Gasket (7)

Materials/Parts - Continued

- Lockwasher (3)

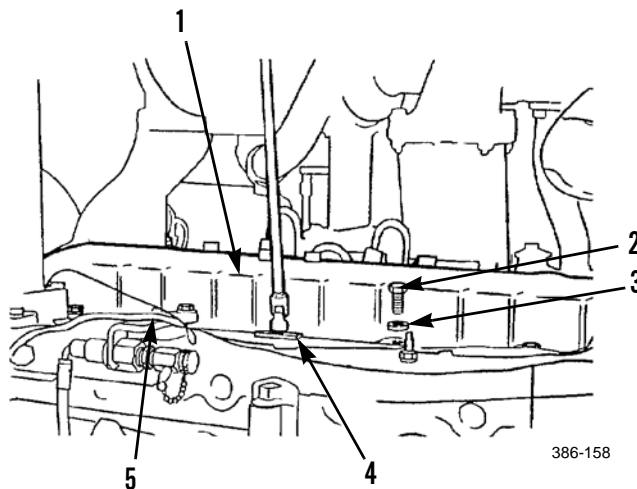
Equipment Condition

- Hood removed (WP 0136 00)
- Ether starting aid removed (WP 0057 00)
- Air cleaner removed (WP 0043 00)
- Crankcase breather removed (WP 0014 00)

REMOVAL**WARNING**

Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may cause injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

1. Use pressurized air to clean any loose particles from valve cover (1) before removal of cover.
2. Remove three capscrews (2), lockwashers (3) and clamps (4) securing wiring harness (5). Move wiring harness out of the way of valve cover (1).
3. Remove 12 capscrews (2), lockwashers (3) and clamps (4) that secure valve cover (1). Discard lockwashers.



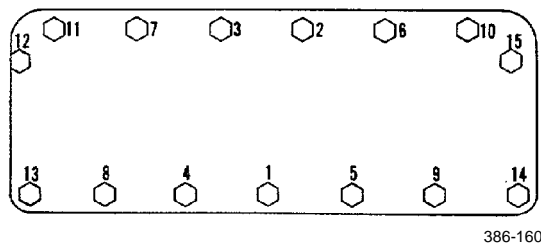
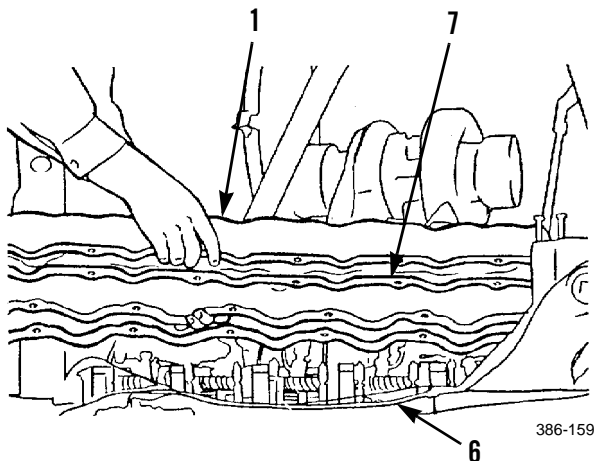
386-158

REMOVAL - CONTINUED

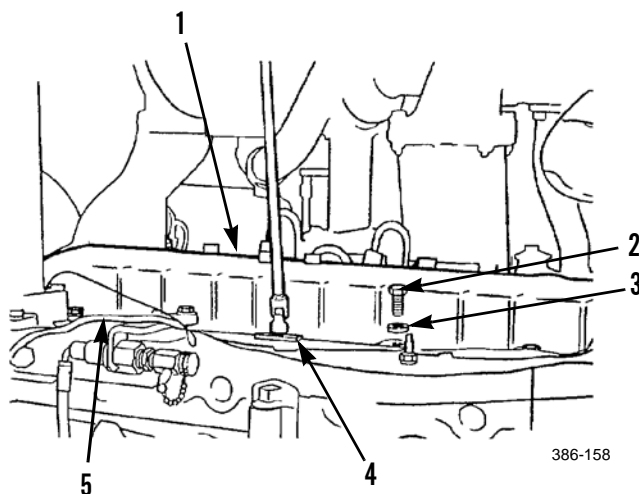
4. Remove valve cover (1) from cylinder head (6). Remove gasket (7) from valve cover and discard gasket.

INSTALLATION

1. Make sure that gasket surfaces are clean.
2. Apply gasket compound to face of valve cover (1) and install new gasket (7) to valve cover.
3. Install valve cover (1) onto cylinder head (6).
4. Position wiring harness (5) and install three clamps (4), new lockwashers (3) and capscrews (2) to secure wiring harness to valve cover (1). Do not tighten capscrews.



5. Install 12 clamps (4), new lockwashers (3) and cap-screws (2) to secure valve cover (1). Tighten cap-screws in number sequence shown to 96 lb-in. (11 Nm).



6. Install crankcase breather (WP 0014 00).
7. Install air cleaner (WP 0043 00).
8. Install ether starting aid (WP 0057 00).
9. Start engine and inspect mating surface of valve cover for oil leaks (TM 5-2410-233-10). Turn off engine.
10. Install hood (WP 0136 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Inspection, Assembly, Installation, Locating Top Dead Center (TDC) Compression Stroke for Number 1 Piston, Adjusting Valve Clearance

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 97, WP 0185 00)

Materials/Parts

- Cleaning compound, solvent (Item 4, WP 0184 00)
- Compound, antiseize (Item 6, WP 0184 00)
- OIL, lubricating (Item 24, WP 0184 00)
- Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

- Bolt, timing, 3/8 in. -16NC, 2 in. long
- O-ring (12)
- Pin (17)
- Plug (18)

References

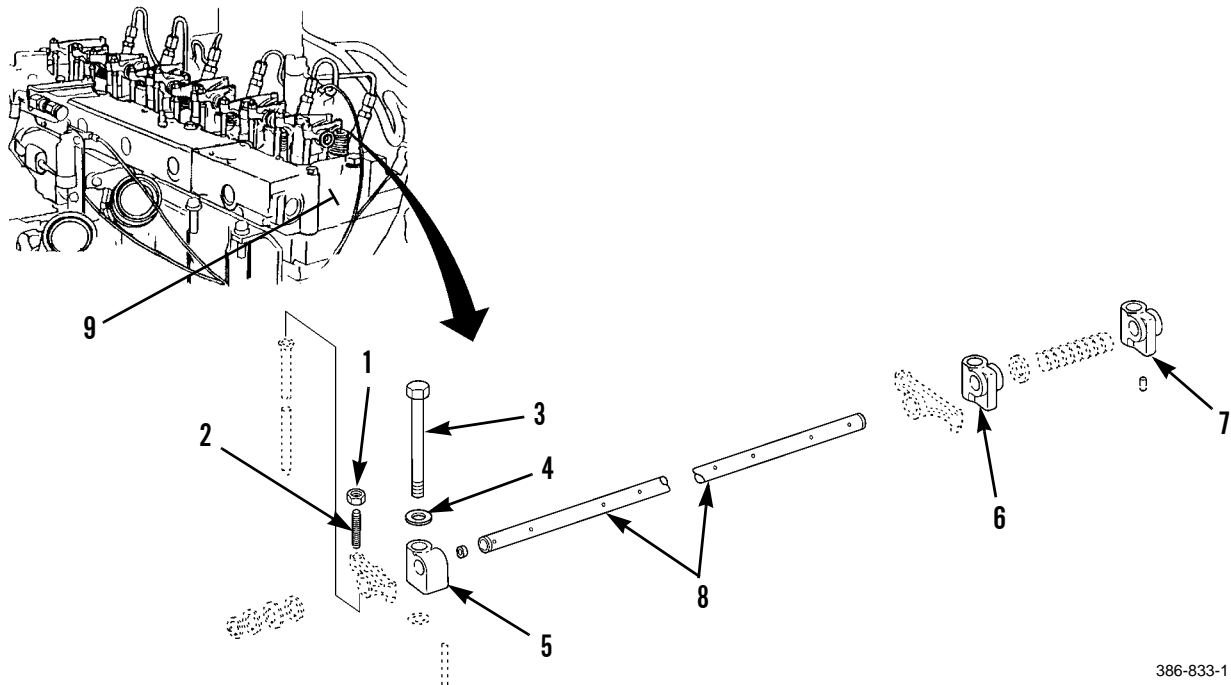
- WP 0176 00

Equipment Condition

- Valve mechanism cover removed (WP 0016 00)
- Crankcase guard removed (WP 0129 00)

REMOVAL

1. Loosen 12 nuts (1) and adjustment screws (2) to have maximum valve clearances.
2. Remove six capscrews (3) washers (4) from rear support bracket (5), four angle brackets (6) and eye bracket (7) that secure rocker shaft (8).
3. Remove rocker shaft (8) from cylinder head (9).

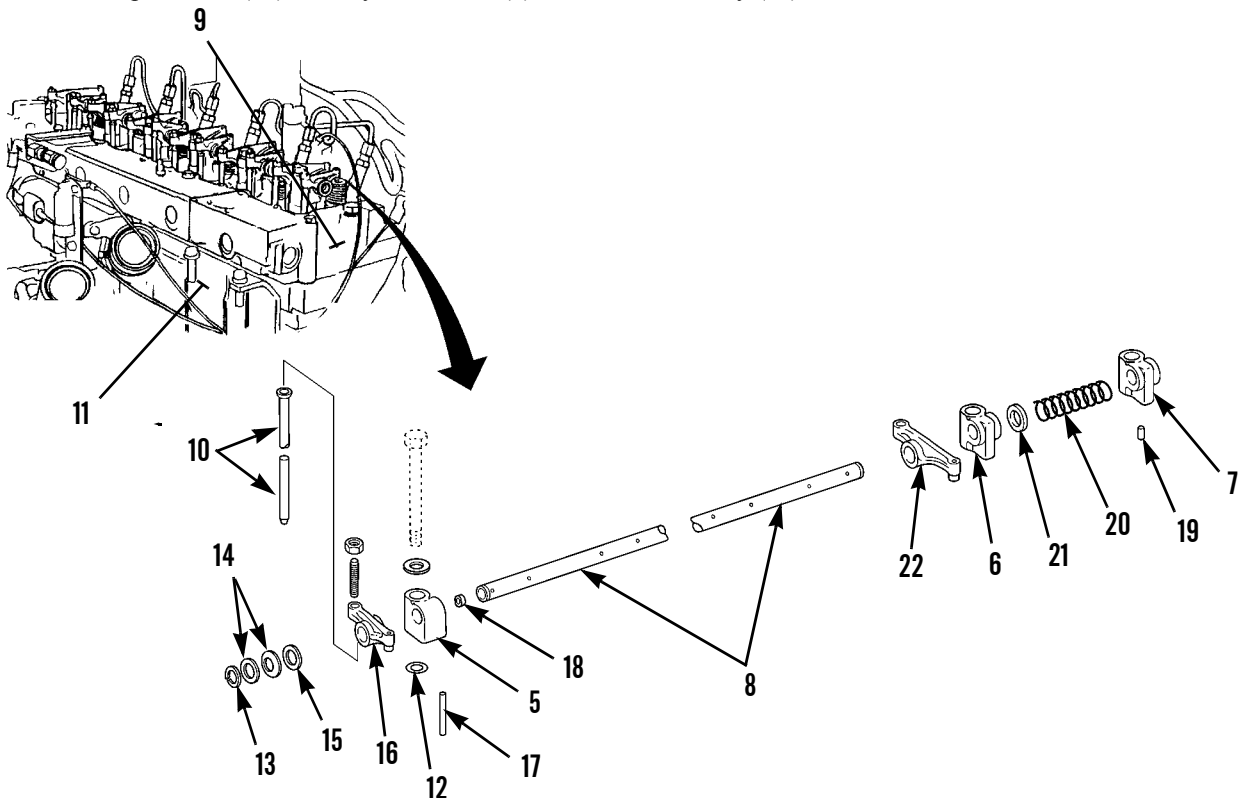


386-833-1

REMOVAL - CONTINUED**NOTE**

Tag push rods as they are removed to ensure push rods are installed in the same location.

- Remove 12 push rods (10) from cylinder head (9) and block assembly (11).

**DISASSEMBLY****NOTE**

Tag and identify all parts during disassembly and note order of sequence when removing each part.

- Remove and discard O-ring (12) from rear support bracket (5).
- Remove retaining ring (13), two spring tension washers (14), washer (15) and intake rocker arm (16) from rear of rocker shaft (8).
- Remove pin (17) and rear support bracket (5) from rear of rocker shaft (8). Discard pin.
- Remove two plugs (18) from each end of rocker shaft (8). Discard plugs.

NOTE

Smaller rocker arms are intake and larger rocker arms are exhaust.

- Remove dowel pin (19) and eye bracket (7) from front of rocker shaft (8).
- Remove five springs (20), twelve washers (21), angle bracket (6), six exhaust rocker arms (22) and five intake rocker arms (16) from rocker shaft (8).

CLEANING



WARNING

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

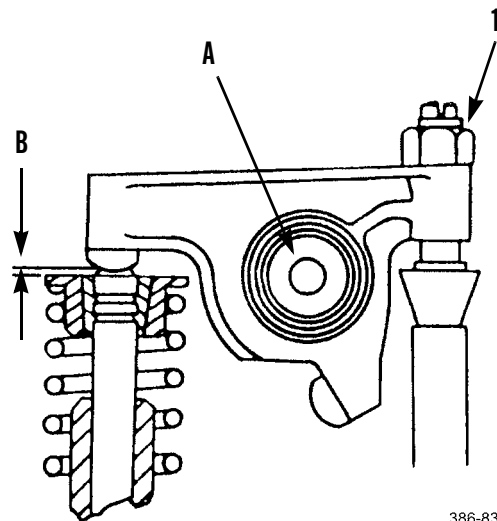
Thoroughly clean all parts in solvent cleaning compound and dry with low pressure air.

INSPECTION

NOTE

Refer to WP 0176 00 for general inspection instructions.

1. Inspect rocker shaft washers for distortion or other damage, and replace if necessary.
2. Inspect brackets for excessive wear, cracks or other damage, and replace if necessary.
3. Inspect rocker shaft springs for distortion, excessive wear, or other damage. Replace a damaged rocker shaft spring.
4. Inspect dowel pins for defects. Replace a bent or out-of-round pin.
5. Inspect rocker arms for any signs of excessive wear or other damage. Refer to Table 1 for rocker arm wear limits and specifications. If measurements are not within the specified limits, or if a rocker arm is damaged in any way, replace rocker arm.



386-834

Table 1. Rocker Arm Wear Limits and Specifications.

Bore (Dimension "A") in Bearing for Shaft (New)	18.448 +/- 0.013 mm (0.7263 +/- 0.0005 in.)
Diameter of Shaft (New)	18.402 +/- 0.013 mm (0.7245 +/- 0.0005 in.)
Maximum Permissible Clearance Between Bearing and Shaft (Worn)	0.20 mm (0.008 in.) x 0.008
Torque for Nut (1) on Valve Adjustment Screw	29 +/- 7 Nm (21 +/- 5 lb-ft)
Clearance (Dimension "B") for Valves:	
Intake Valves	0.38 mm (0.015 in.)
Exhaust Valves	0.64 mm (0.025 in.)

INSPECTION - CONTINUED

6. Inspect push rods (10) for a bent condition, excessive wear or other damage. Replace a damaged or defective push rod.
7. Inspect rocker shaft (8) for excessive wear, bent condition or other damage. Replace a damaged or defective rocker shaft.

ASSEMBLY

CAUTION

Do NOT use old plugs, as worn or defective plugs could cause loss of oil pressure, resulting in damage to engine.

1. Install new plug (18) into each end of rocker shaft (8).

NOTE

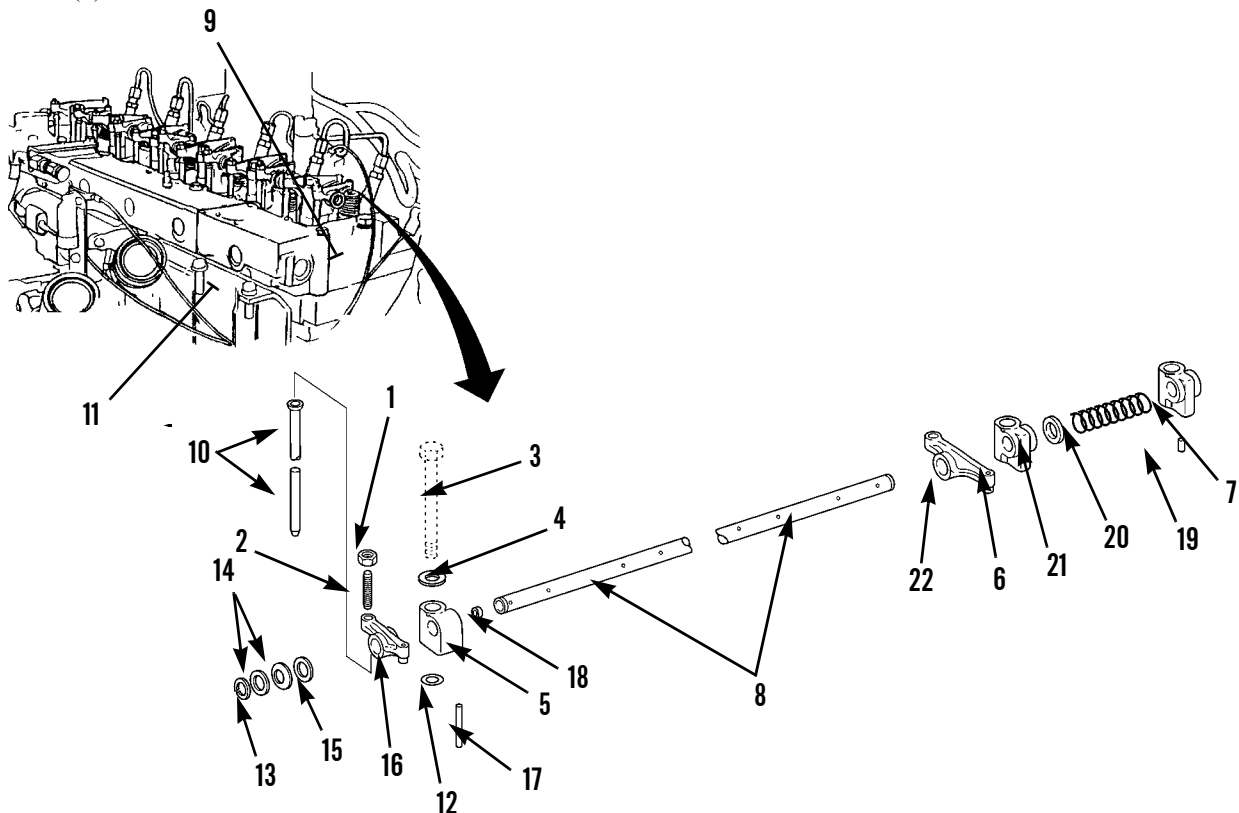
Ensure hole in rear bracket is in alignment with hole in rocker shaft during installation.

2. Install rear support bracket (5) and new pin (17) on rocker shaft (8). Pin must extend 0.378 in. (9.6 mm) above bracket.

NOTE

- **When installing one intake rocker arm in step 3, rocker arm is installed on outside of rear support bracket (5).**
- **Smaller rocker arms are intake and larger rocker arms are exhaust.**

3. Install intake rocker arm (16), washer (15), two spring tension washers (14) and retaining ring (13) on rear of rocker shaft (8).



ASSEMBLY - CONTINUED**NOTE**

During assembly, pay close attention and refer to order of assembly. Ensure exhaust and intake rocker arms, springs, washers and brackets are installed in correct sequence on rocker shaft.

4. Install six exhaust rocker arms (22), five intake rocker arms (16), angle brackets (6), twelve washers (21) and five springs (20) on rocker shaft (5).
5. Align hole in bracket (7) with hole in rocker shaft (8). Install dowel pin (19) into bracket and shaft. Pin must extend 0.378 in. (9.6 mm) above bracket.
6. Apply clean lubricating oil on all rocker shaft components after assembly.

INSTALLATION

1. Install 12 push rods (10) through cylinder head (9) and into block assembly (11).

NOTE

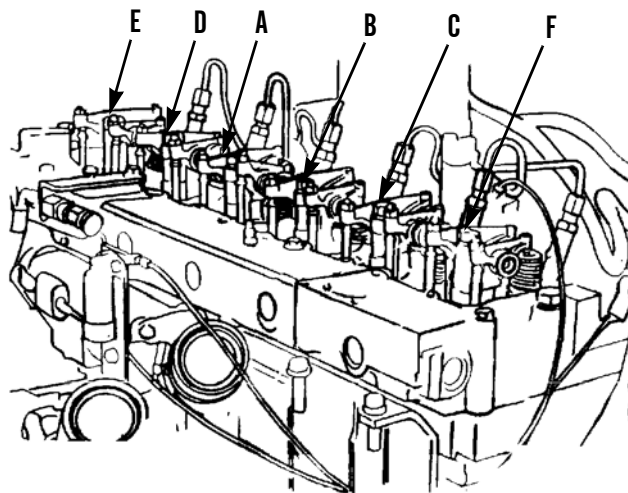
- **Each time a capscrew is removed from rear support bracket, a new O-ring must be installed.**
- **Apply clean lubricating oil to new O-ring prior to installation.**

2. Install new O-ring (12) in rear support bracket (5).
3. Place rocker shaft (8) into position on cylinder head (9).

CAUTION

Dowel pins on each end of rocker shaft and rocker arm must be in alignment with holes in cylinder head. If pins and holes are not properly aligned when rocker shaft capscrews are installed and tightened, damage to rocker shaft could occur.

4. Put antiseize compound on threads of capscrews (3) and install six washers (4) and capscrews to bracket (5, 6 and 7), to secure rocker shaft (8) to cylinder head (9).
5. Refer to illustration and tighten capscrews (3) as follows:
 - a. Tighten capscrews, in letter sequence, to 115 lb-ft (156 Nm).
 - b. Tighten capscrews, in letter sequence, to 185 lb-ft (251 Nm).
 - c. Tighten capscrews again in letter sequence, to 185 lb-ft (251 Nm).



386-835

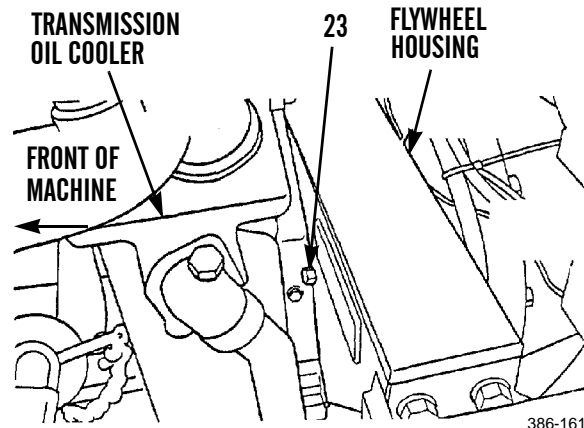
6. If new rocker arms (16 or 22) were installed, install 12 new adjustment screws (2) and nuts (1).
7. Adjust valve mechanism. See Valve Mechanism Adjustment in this work package.
8. Install valve mechanism cover (WP 0016 00).

LOCATING TOP DEAD CENTER (TDC) COMPRESSION STROKE FOR NUMBER 1 PISTON

NOTE

Engine is seen from vibration damper end when direction of crankshaft rotation is given.

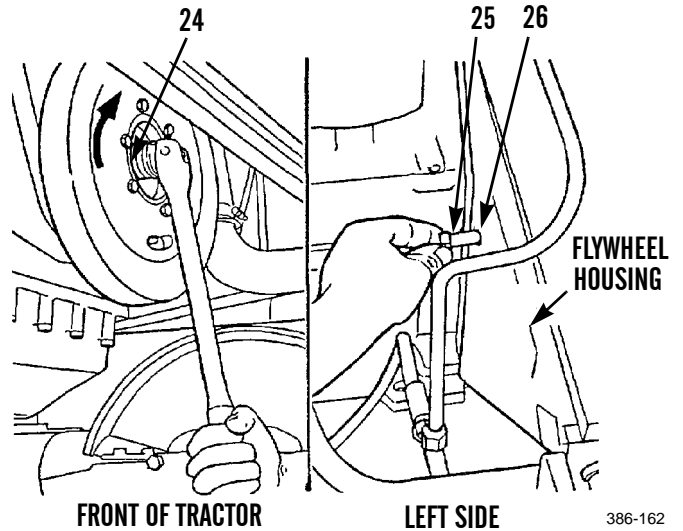
1. Remove plug (23) from flywheel housing.



NOTE

- Perform the following step to remove play from timing gears when engine is set at TDC.
- Do not use starter to rotate flywheel.

2. Place socket and breaker bar on mounting capscrew (24) of vibration damper. Turn vibration damper so that flywheel turns to the right. Turn flywheel until 3/8 in. -16NC bolt (25) can be installed through hole (26) of flywheel housing.

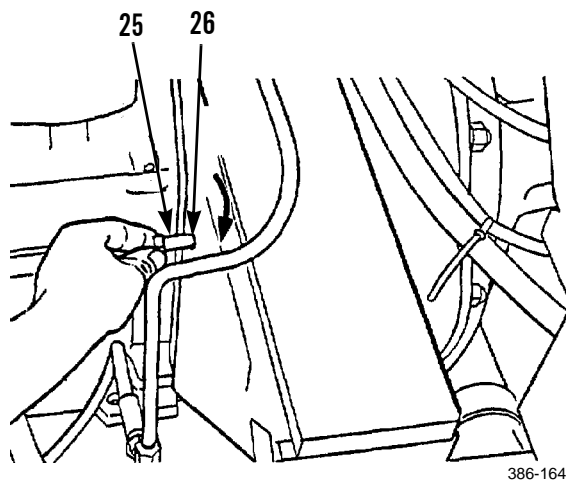
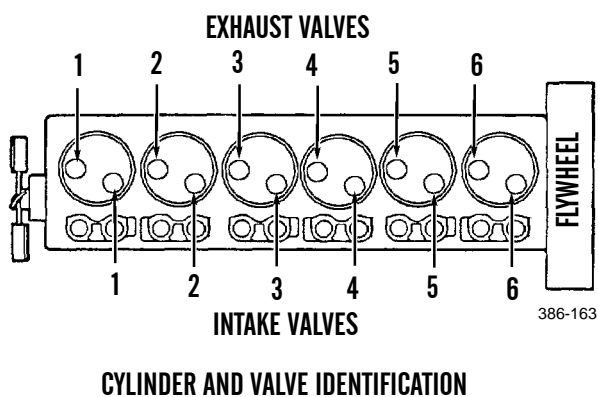


LOCATING TOP DEAD CENTER (TDC) COMPRESSION STROKE FOR NUMBER 1 PISTON - CONTINUED

NOTE

If piston is on compression stroke, valves will be closed on number 1 cylinder.

3. Try moving rocker arms over cylinder number 1 up and down. If arms do not move, valves are open and piston is not on compression stroke. Proceed to step 4.
4. Remove bolt (25) and turn flywheel 360 degrees to the right. Return bolt to hole (26). Number 1 piston is now at TDC on compression stroke.

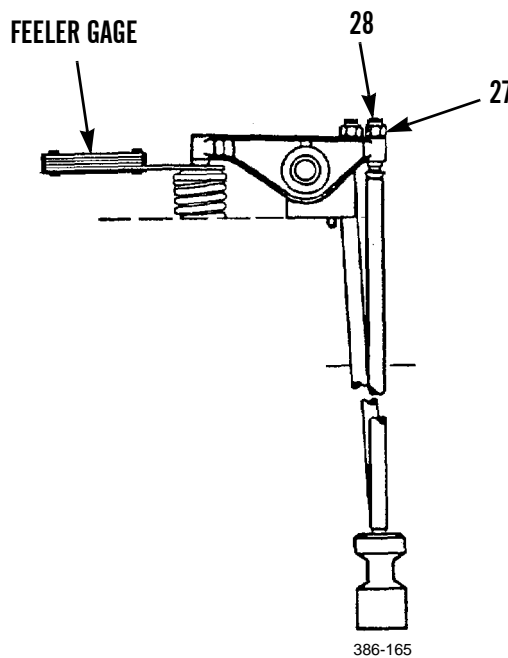


ADJUSTING VALVE CLEARANCE

NOTE

- Ensure pushrods are not bent before performing adjustment.
- When valve clearance is checked using a feeler gage, it is **NOT NECESSARY** to adjust valves if measurement falls within 0.022-0.028 in. (0.56-0.71 mm) for exhaust and within 0.012-0.018 in. (0.30-0.46 mm) for intake.

1. Loosen nut (27). Make adjustment to each valve by using a flat-tipped screwdriver and turning adjustment screw (28) to obtain correct reading with feeler gage.
2. After adjustment for each valve has been made, tighten nut (27) for valve adjustment screw (28) to 22 lb-ft (30 Nm), while holding screw.



ADJUSTING VALVE CLEARANCE - CONTINUED**NOTE**

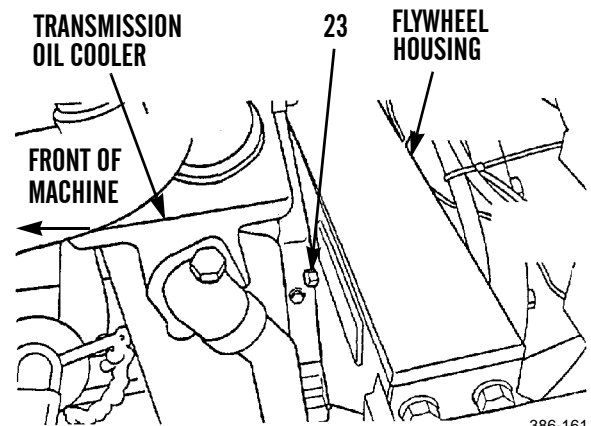
Set all valves that need adjustment to 0.025 in. (0.64 mm) for exhaust and to 0.015 in. (0.38 mm) for intake in the following manner.

3. With engine set with number 1 piston at TDC on compression stroke, make adjustments for valve clearance on intake valves for cylinders 1, 2 and 4. Make an adjustment to valve clearance on exhaust valves for cylinders 1, 3 and 5.
4. Remove bolt (25) from flywheel housing and turn flywheel 360 degrees to the right. This will put number 6 piston at TDC on compression stroke. Install bolt back into flywheel housing.
5. Make an adjustment to valve clearance on intake valves for cylinders 3, 5 and 6. Make an adjustment to valve clearance on exhaust valves for cylinders 2, 4 and 6.

CAUTION

Bolt will damage flywheel housing and flywheel if not removed and replaced by plug.

6. Remove bolt (25) and install plug (23) in flywheel housing.
7. Install valve mechanism cover (WP 0016 00).
8. Install crankcase guard (WP 0129 00).



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END OF WORK PACKAGE

ENGINE OIL COOLER REPLACEMENT

0018 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Gasket (6 and 10)

References

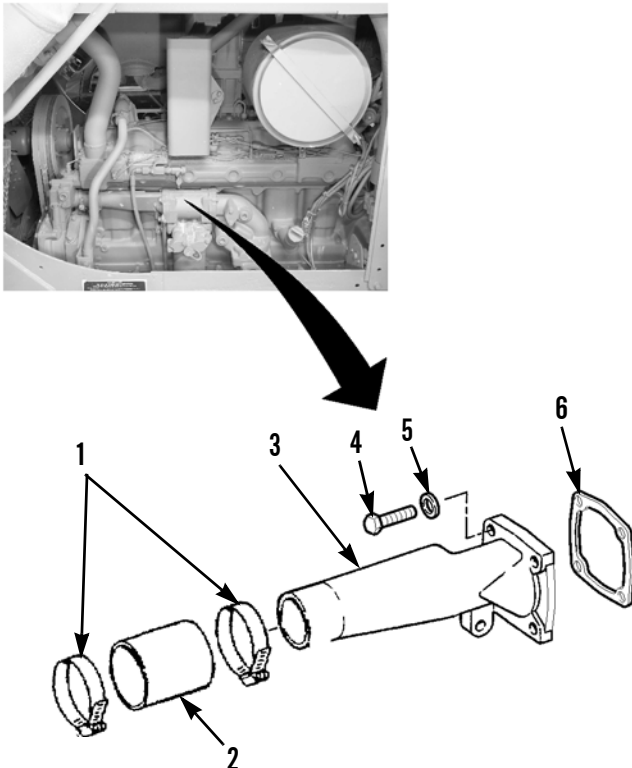
TM 5-2410-2-233-10
 WP 0011 00

Equipment Condition

Cooling system drained (WP 0060 00)
 Oil filter base removed (WP 0010 00)

REMOVAL

1. Loosen two hose clamps (1) and remove hose (2) from water inlet housing (3).
2. Remove oil level gage tube (WP 0011 00).
3. Remove three capscrews (4), washers (5), gasket (6) and water inlet housing (3). Discard gasket.



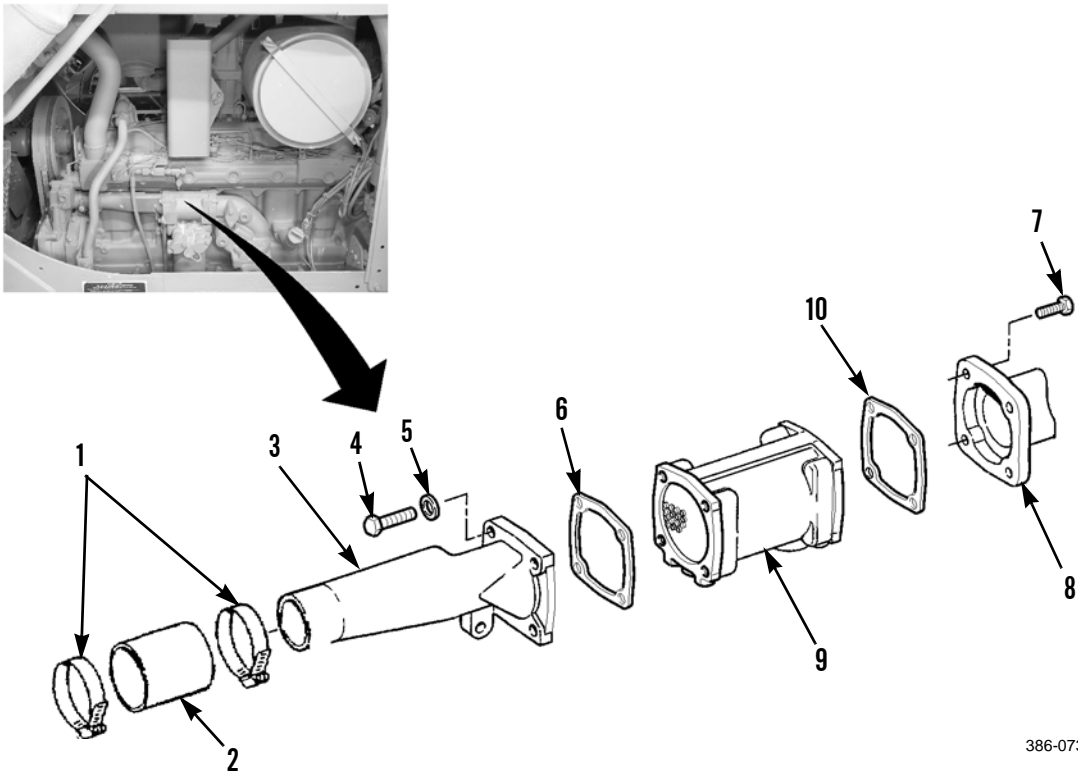
386-073

ENGINE OIL COOLER REPLACEMENT - CONTINUED**0018 00****REMOVAL - CONTINUED**

4. Remove four capscrews (7) from elbow assembly (8).
5. Remove engine oil cooler (9) and gasket (10) from elbow assembly (8). Discard gasket.

INSTALLATION

1. Install engine oil cooler (9) and new gasket (10) on elbow assembly (8) with four capscrews (7). Tighten capscrews to 32 lb-ft (45 Nm).
2. Install inlet housing (3) and new gasket (6) on engine oil cooler (9) with three washers (5) and capscrews (4). Tighten capscrews to 32 lb-ft (44 Nm).
3. Install engine oil level gage tube (WP 0011 00).
4. Position two clamps (1) onto hose (2).
5. Install hose (2) on water inlet housing (3) and tighten clamps (1).



386-073

6. Install oil filter base (WP 0010 00).
7. Fill cooling system (WP 0060 00).
8. Run engine and check for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose (Item 97, WP 0185 00)
- Leveler, load, 6000 lb capacity (Item 42, WP 0185 00)
- Engine stand, 4000 lb capacity
- Lifting equipment, 4000 lb capacity

Materials/Parts

- Cap set, protective (Item 2, WP 0184 00)
- Oil, lubricating (Item 22, 23, 24 and 25, WP 0184 00)
- Strap, tiedown (Item 34, WP 0184 00)
- Tag, marker (Item 35, WP 0184 00)
- Lockwasher (19)
- O-ring (13)

References

- WP 0020 00
- WP 0050 00
- WP 0051 00
- WP 0055 00

Personnel Required

Three

Equipment Condition

- Fuel shutoff valve to OFF position (TM 5-2410-233-10)
- Battery cables disconnected (WP 0080 00)
- Crankcase and transmission guards opened, if required (WP 0129 00)
- Floor plates removed (WP 0135 00)

Equipment Condition - Continued

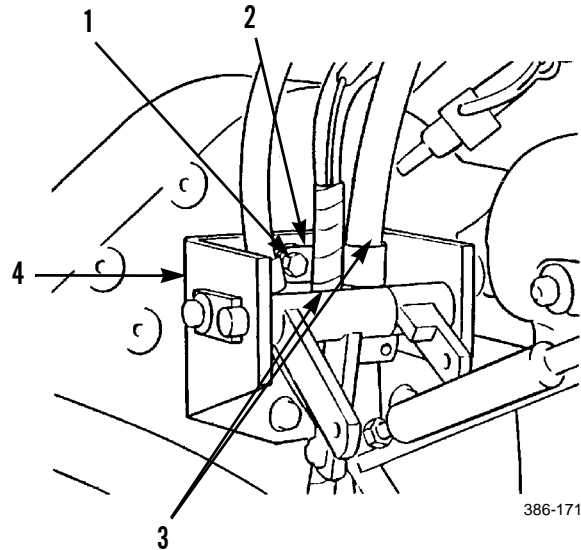
- Water pressure gage sensing line disconnected (WP 0063 00)
- Water pump hoses disconnected (WP 0066 00)
- Transmission oil drained (WP 0086 00)
- Fan guard removed (WP 0068 00)
- Radiator removed (WP 0063 00)
- Governor control linkage disconnected (WP 0054 00)
- Starter cables disconnected (WP 0071 00)
- Starter solenoid cables disconnected (WP 0072 00)
- Alternator wires disconnected (WP 0070 00)
- Transmission inlet and outlet oil cooler lines disconnected (WP 0087 00)
- Transmission vent line and oil outlet line removed (WP 0088 00)
- Transmission oil lines to torque divider disconnected (WP 0097 00)
- Driveshaft removed (WP 0106 00)
- Steering brake linkage disconnected (WP 0121 00)
- Steering clutch control lever disconnected (WP 0123 00)
- NATO starting receptacle disconnected (WP 0082 00)
- Hydraulic tank drained (WP 0165 00)
- Winch gear pump removed (if equipped) (WP 0147 00)
- Hydraulic pump removed (WP 0148 00)
- Torque converter outlet relief valve removed (WP 0096 00)

NOTE

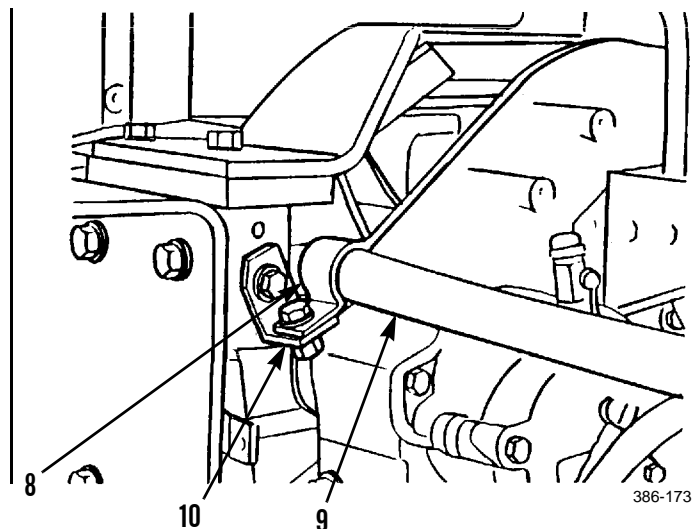
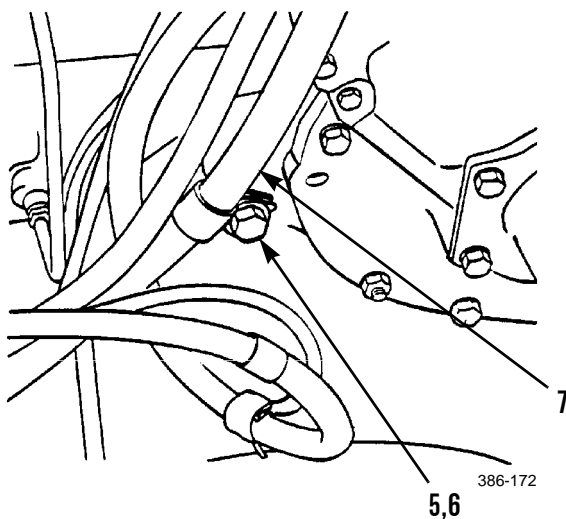
This work package covers replacement of a SLEP engine. Procedure will work to replace non-SLEP engines, with minor differences.

REMOVAL

1. Remove capscrew (1) and clip (2) that holds power cables (3) to governor control linkage bracket (4). Cut tiedown straps and pull wiring harness from engine and lay harness over transmission. Discard tiedown straps.

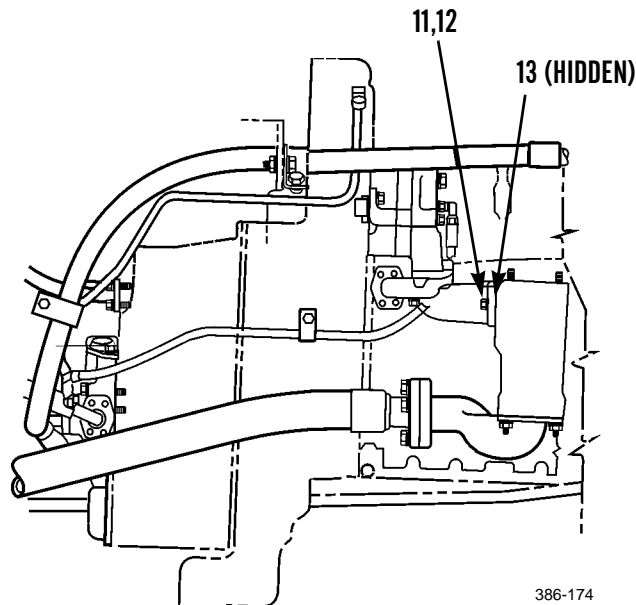


2. Remove capscrew (5) flatwasher (6) and clamp holding battery cable (7) to flywheel housing. Move battery cable out of the way of engine.
3. Remove capscrew and clamp (8) that holds transmission oil supply line (9) to fender. Move line and bracket (10) out of the way.



REMOVAL - CONTINUED

4. Remove two capscrews (11), washers (12) and O-ring (13) and discard O-ring. Lower magnetic screen assembly out of way.



CAUTION

Use caution to ensure fuel system does not become contaminated. Install protective caps and plugs on all lines as they are disconnected. Contamination of fuel system could result in premature failure.

5. Disconnect fuel supply line from primary fuel filter (WP 0055 00).
6. Disconnect fuel return line from fuel injection pump (WP 0051 00).
7. Disconnect fuel supply line from accessory drive housing (WP 0050 00).



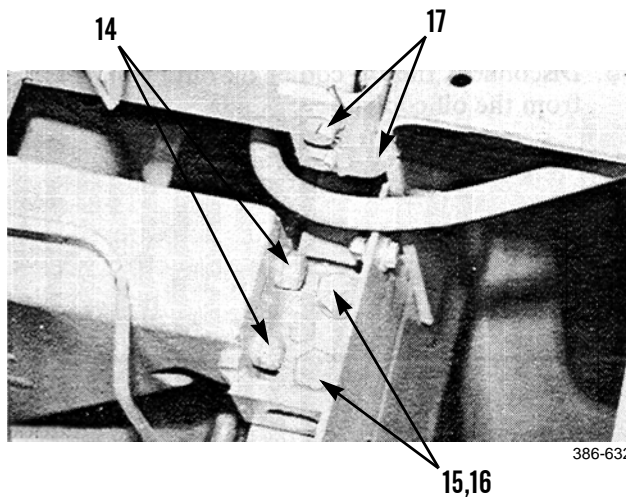
WARNING

DO NOT remove capscrews (14) on either side of the engine. Failure to follow this warning may result in injury.

NOTE

Make a final inspection to make sure oil lines, hoses, wiring and clips are clear of engine and other components.

8. Remove four capscrews (15) and washers (16) from rear engine mounting brackets.
9. Remove two dash support brace mounting capscrews (17).



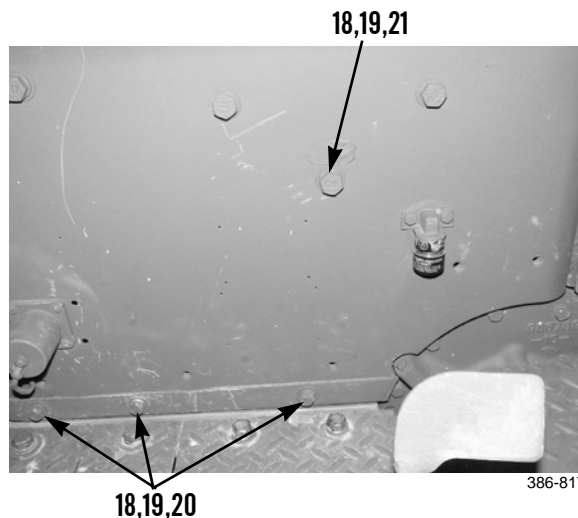
REMOVAL - CONTINUED

10. Remove three bolts (18), lockwashers (19) and washers (20) from bottom of dash. Discard lockwashers.

NOTE

Nut is accessible from engine compartment.

11. Remove nut (21), bolt (18) and lockwasher (19). Discard lockwasher.
12. Tilt dash rearward to gain access.

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

CAUTION

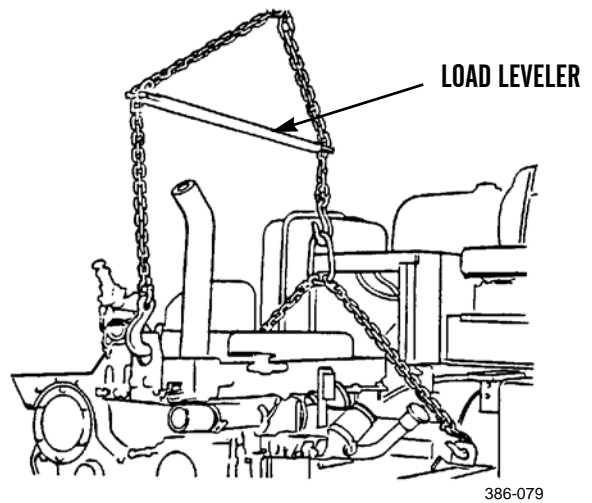
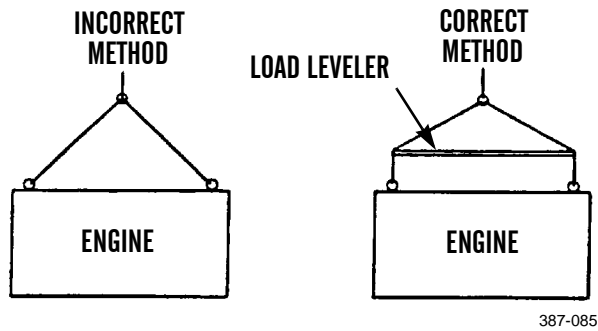
- Always use a load leveler while lifting engine assembly. This will keep lifting force vertical at all times, avoiding damage to lifting brackets.
- Engine assembly must be lifted so that crankshaft centerline is horizontal. This will prevent binding on rear engine mount locating pins.

NOTE

Weight of engine and torque divider is approximately 3,000 lb (1,361 kg).

13. Attach a load leveler and suitable lifting device to engine lifting brackets IAW illustration.

REMOVAL - CONTINUED



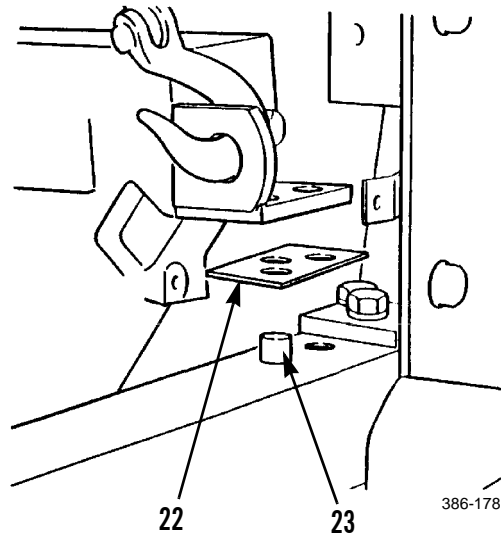
14. Remove engine front support mounting bolts (WP 0020 00).
15. Lift engine from machine and lower engine to a suitable repair stand.



WARNING

Be sure engine is clear before removing shims. Failure to follow this warning may cause injury.

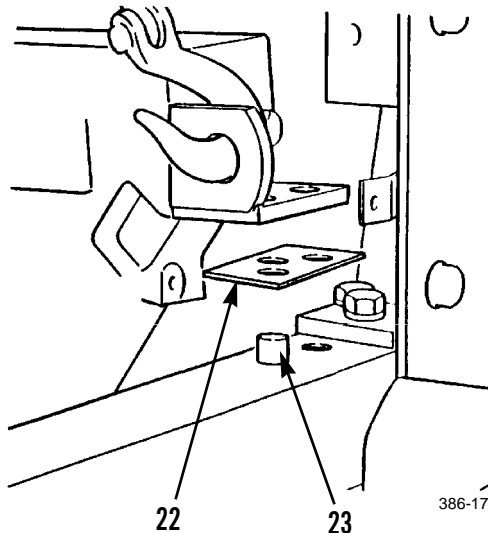
16. Remove shims (22) from locating pins (23) and rear mounting surface on main frame. Mark location on shims for correct installation.



INSTALLATION**CAUTION**

Remove caps from lines and remove plugs from openings as installations are made. Wipe all line ends, line fittings and mounting surfaces clean. Contamination of fuel system could result in premature failure.

1. Position shims (22) into the exact location from which they were removed. Be sure locating pins (23) are in position on main frame.

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

CAUTION

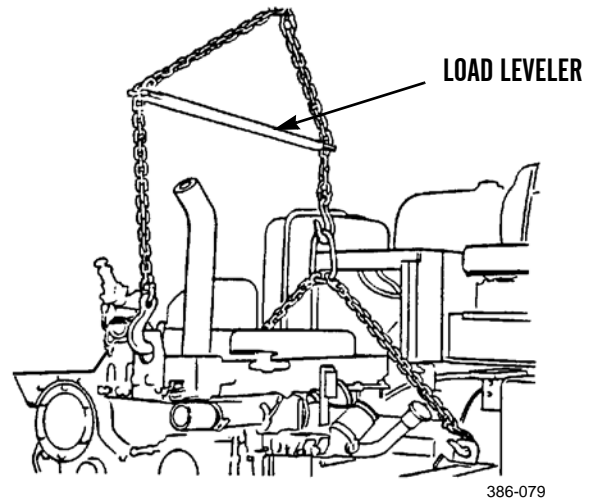
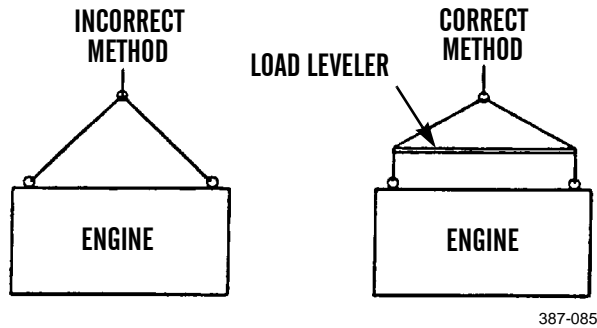
- Always use a load leveler when lifting engine assembly. This will keep lifting force vertical at all times, avoiding damage to lifting brackets.
- Engine assembly must be lifted so that crankshaft centerline is horizontal. This will prevent binding on rear engine mount locating pins.

NOTE

Weight of engine and torque divider is approximately 3,000 lb (1,361 kg).

2. Attach a load leveler and suitable lifting device to engine lifting brackets IAW illustration.

INSTALLATION - CONTINUED

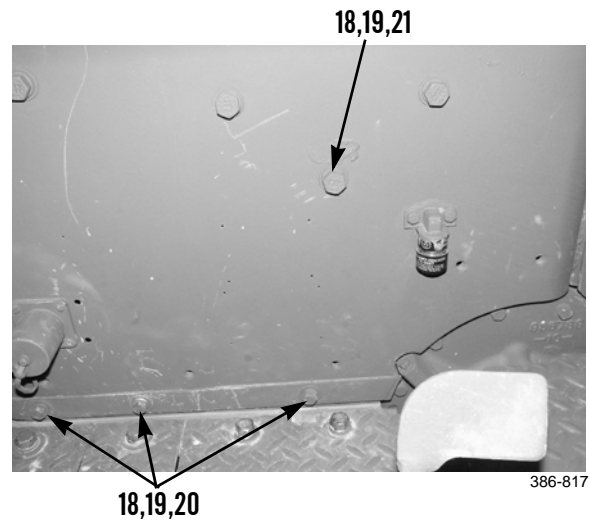


3. Install engine on machine, keeping crankshaft centerline horizontal. Make sure rear engine mounts fit onto locating pins (23) in frame.
4. Reposition dash in upright position.

NOTE

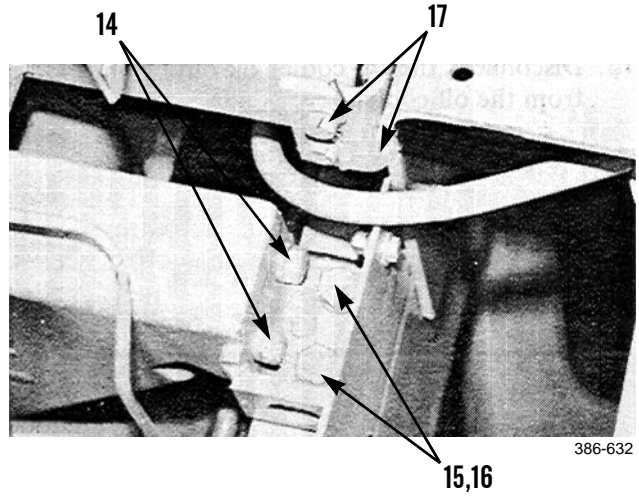
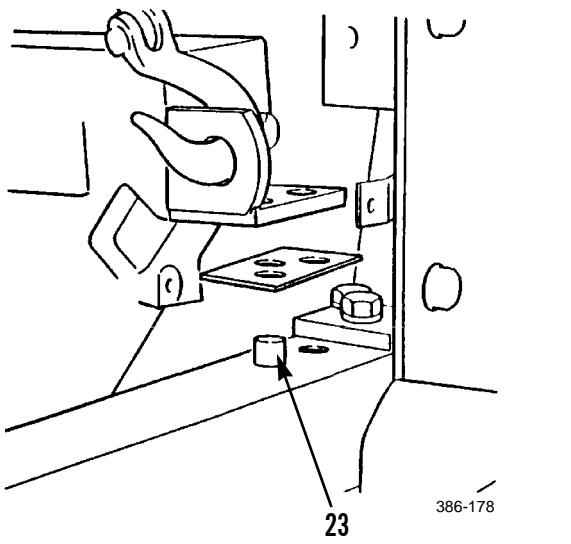
Do not fully tighten bolts until all bolts have been installed.

5. Install bolt (18), new lockwasher (19) and nut (21).
6. Install three bolts (18), new lockwashers (19) and washers (20) to bottom of dash.



INSTALLATION - CONTINUED

7. Install four washers (16) and capscrews (15) in rear engine mounting brackets. Tighten capscrews to 325 lb-ft (441 Nm).
8. Install two dash support brace mounting capscrews (17).

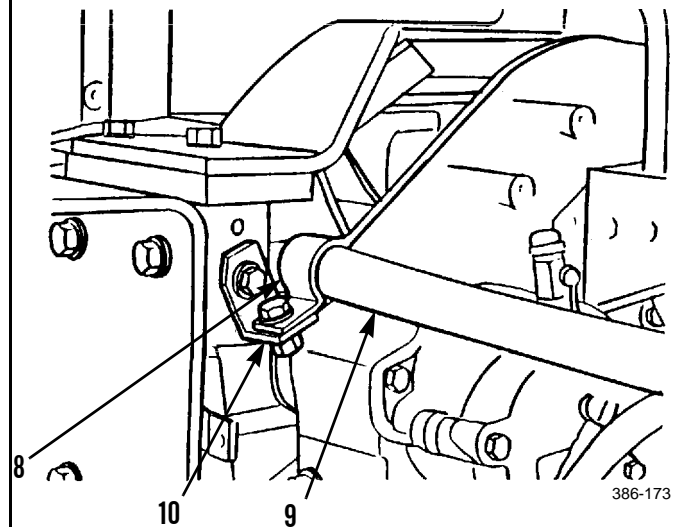
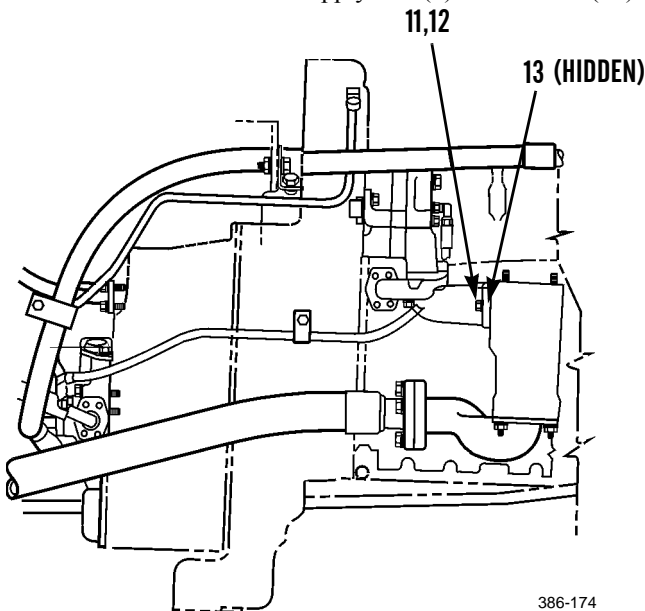


9. Connect fuel supply line to accessory drive housing. (WP 0050 00).
10. Connect fuel return line to fuel injection pump (WP 0051 00).
11. Connect fuel supply line to primary fuel filter (WP 0055 00).

NOTE

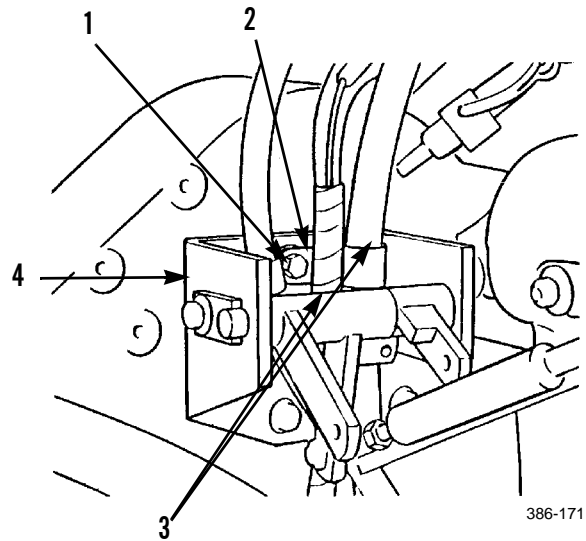
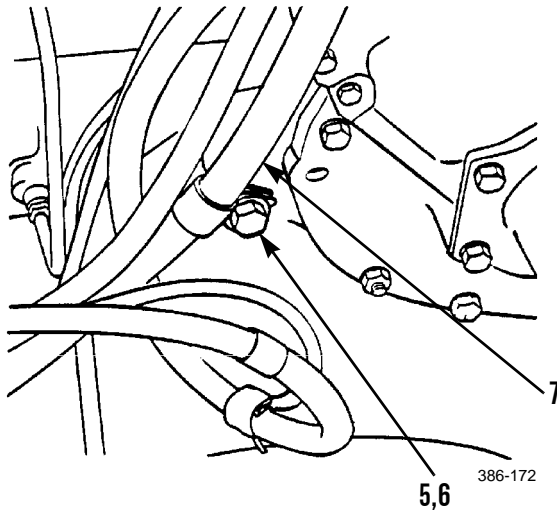
Lightly coat new O-ring with clean oil before installation.

12. Lift magnetic screen assembly into position and install new O-ring (13). Install two washers (12) and capscrews (11).
13. Place transmission oil supply line (9) and bracket (10) into position. Install clamp (8) that holds line to fender.



INSTALLATION - CONTINUED

14. Position battery cable (7) over flywheel housing and attach clamp to flywheel housing with flatwasher (6) and capscrew (5).
15. Position power cables (3) through governor control linkage bracket (4).
16. Attach clip (2) holding power cables (3) to bracket (4) and secure with capscrew (1).



17. Install torque converter outlet relief valve (WP 0096 00).
18. Install hydraulic pump (WP 0148 00).
19. Install winch gear pump (if equipped) (WP 0147 00).
20. Connect NATO starting receptacle (WP 0082 00).
21. Connect steering clutch control lever (WP 0123 00).
22. Connect steering brake linkage (WP 0121 00).
23. Install driveshaft (WP 0106 00).
24. Connect transmission oil lines to torque divider (WP 0097 00).
25. Connect transmission vent line and oil outlet line (WP 0088 00).
26. Connect transmission inlet and outlet oil cooler lines (WP 0087 00).
27. Connect alternator wires (WP 0070 00).
28. Connect starter solenoid cables (WP 0072 00).
29. Connect starter cables (WP 0071 00).
30. Connect governor control linkage and adjust (WP 0054 00).
31. Install radiator (WP 0063 00).
32. Connect water pump hoses (WP 0066 00).
33. Connect water pressure gage sensing line (WP 0063 00).
34. Replace any removed tiedown straps with new. Secure any loose tubes, hoses or wiring with new tiedown straps.
35. Close crankcase and transmission guards, if required (WP 0129 00).
36. Install floor plates (WP 0135 00).

INSTALLATION - CONTINUED

37. Install hood (WP 0136 00).
38. Fill hydraulic tank (WP 0165 00).
39. Fill transmission with oil (WP 0086 00).
40. Fill cooling system (WP 0060 00).
41. Fill engine with oil (WP 0010 00).
42. Connect battery cables (WP 0080 00).
43. Turn fuel shutoff valve to ON (TM 5-2410-233-10).
44. Run engine and check for leaks and proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

FRONT ENGINE SUPPORT REPLACEMENT

0020 00

THIS WORK PACKAGE COVERSRemoval, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
Shop equipment, general purpose repair (Item 97,
0185 00)
Suitable lifting device, 4000 lb capacity
Suitable jack stands, 4000 lb capacity

Materials/Parts

Wood cribbing, 2 ft x 2 in. x 8 in.

Personnel Required

Two

Equipment Condition

Crankcase guard removed, if required (WP 0129 00)
Crankshaft pulley removed (WP 0026 00)

REMOVAL**CAUTION**

- **Wood cribbing prevents damage to oil pan and flywheel housing when engine rear support-to-flywheel housing mounting hardware is loosened.**
- **Use wood cribbing slightly larger than width of pan to prevent damage to oil pan and flywheel housing.**

1. Use a suitable lifting device and place suitable wood cribbing under oil pan and flywheel housing.
2. Raise jack stands until wood cribbing is firmly against oil pan and flywheel housing.

REMOVAL - CONTINUED



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

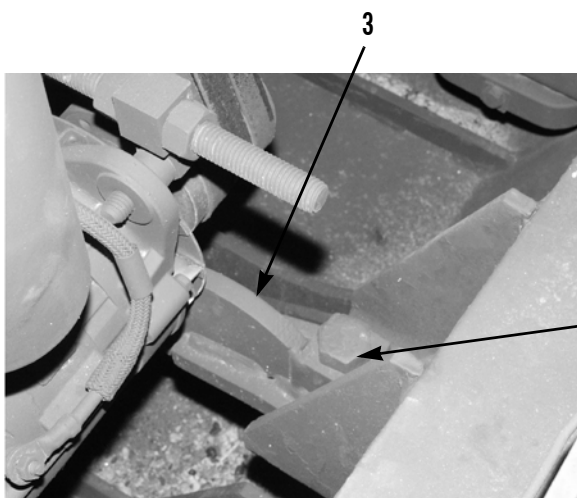
Weight of engine assembly is approximately 3,000 lb (1,362 kg).

3. Position lifting equipment to only lift front of engine.

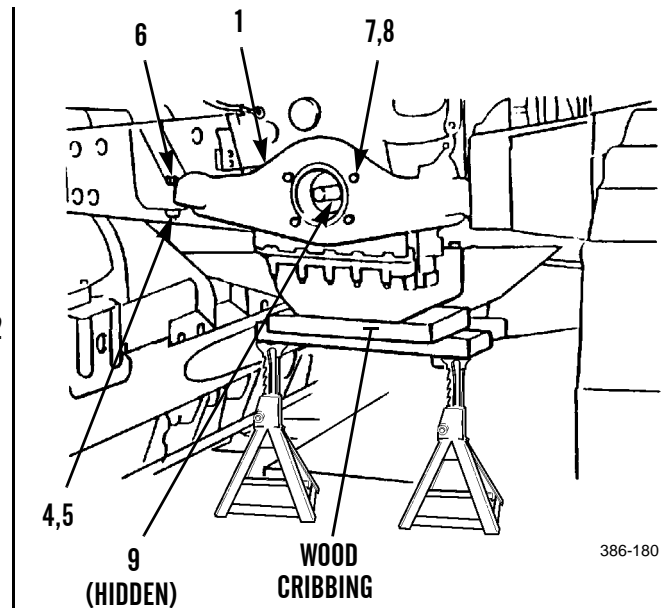
CAUTION

Do NOT remove engine rear support mounting capscrews.

4. Loosen three capscrews (2) attaching engine rear supports (3) at each side of flywheel housing.
5. Raise front of engine enough to take weight of engine off front support (1). Reposition jack stands.
6. Remove two nuts (4), washers (5) and capscrews (6) from engine front support (1).
7. Check to ensure front jack stands are firmly positioned against oil pan.
8. Remove four capscrews (7) and washers (8) attaching engine front support (1) to trunnion (9).
9. Turn engine front support (1) to the right (as seen from front of engine) and remove from engine.



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INSTALLATION

1. Install engine front support (1) in position on trunnion (9) and secure with four washers (8) and capscrews (7). Tighten capscrews to 75 lb-ft (102 Nm).
2. Lift engine slightly, remove jack stands and wood cribbing from under oil pan and flywheel housing.

NOTE

Prior to setting front of engine on frame, ensure front support and frame holes are aligned.

3. Lower front of engine until front support (1) is resting on frame.
4. Install two capscrews (6), washers (5) and nuts (4) on engine front support (1). Tighten capscrews to 150 lb-ft (203 Nm).
5. Tighten three capscrews (2) to 150 lb-ft (203 Nm) securing engine rear supports (3) to frame.
6. Install crankshaft pulley (WP 0026 00).
7. Run engine and check for proper operation and leaks (TM 5-2410-233-10).
8. If removed, install crankcase guard (WP 0129 00).

END OF WORK PACKAGE

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REAR ENGINE MOUNTS REPLACEMENT

0021 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Lockwasher (2)

Personnel Required

Two

Equipment Condition

Engine assembly removed (WP 0019 00)

REMOVAL

1. Remove two capscrews (1) and lockwashers (2) from each rear engine mount (3). Discard lockwashers.
2. Remove rear engine mounts (3).

NOTE

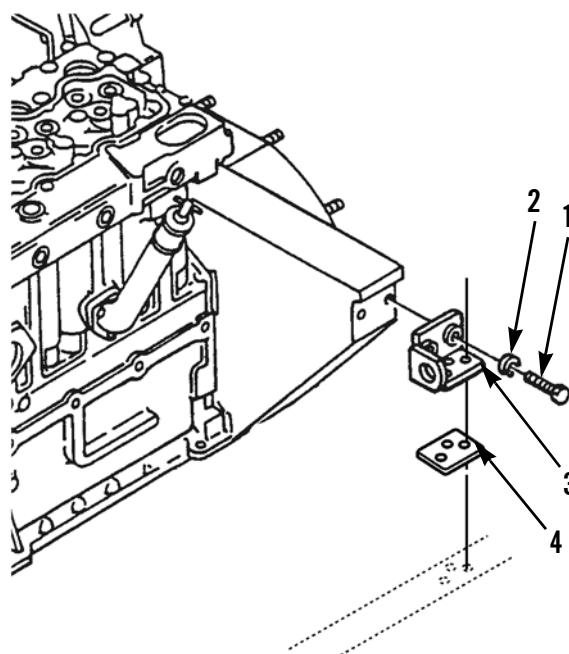
Prior to removal of shims, mark position of shim on frame to ensure correct placement at installation.

3. Remove shims (4) from frame. Note quantity and measure thickness of removed shims.

INSTALLATION**NOTE**

Place shims on frame in same position from which they were removed. If new shims are required, replace with shims of the same thickness as previously removed shims.

1. Position rear engine mounts (3) on flywheel housing.
2. Install two capscrews (1) and new lockwashers (2) to each rear engine mount (3). Tighten capscrews to 150 lb-ft (203 Nm).
3. Install engine assembly (WP 0019 00).



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END OF WORK PACKAGE

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ENGINE TRUNNION REPLACEMENT

0022 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

- Detergent (Item 10, WP 0184 00)
- O-ring (4)

Equipment Condition

Front engine support removed (WP 0020 00)

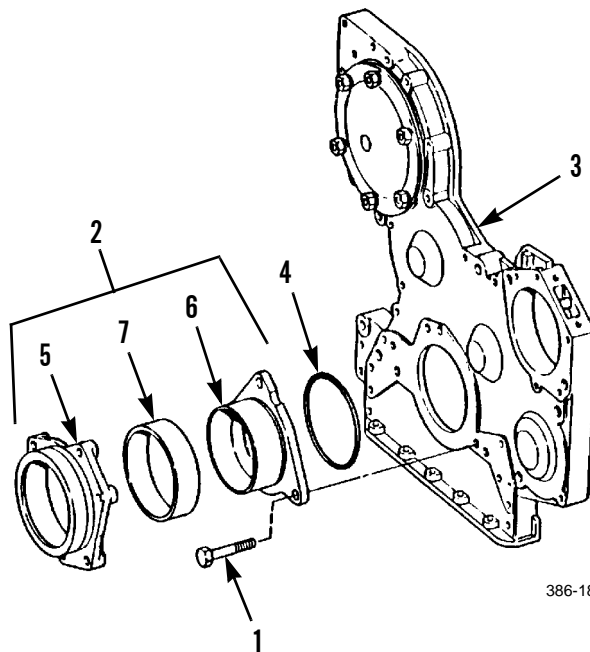
REMOVAL

1. Remove three capscrews (1) and trunnion assembly (2) from front housing (3).
2. Remove and discard O-ring (4).
3. Separate trunnion supports (5 and 6) and sleeve (7). Discard sleeve.

INSTALLATION**NOTE**

If any component of trunnion assembly is damaged, replace all components (trunnion supports and sleeve) as an assembly.

1. Install new O-ring (4) into front housing (3).
2. Install sleeve (7) into bore of support (5). Install trunnion support (6) into support (5).
3. Lubricate inside diameter of sleeve (7) with 3% detergent solution.
4. Position trunnion assembly (2) on front housing (3) and install three capscrews (1).
5. Tighten capscrews (1) to 75 lb-ft (102 Nm).
6. Install front engine support (WP 0020 00).



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END OF WORK PACKAGE

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CYLINDER HEAD ASSEMBLY AND SPACER PLATE REPLACEMENT**0023 00****THIS WORK PACKAGE COVERS**

Removal, Cleaning and Inspection, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Link, lifting (Item 44, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Lifting equipment, 400 lb capacity
 Bolt 5/8-11 x 1 1/2 in.

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)
 Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Gasket (21 and 25)
 Lockwasher (8)
 O-ring (26)
 Pin, cotter (10)
 Water seals (22 and 23)

References

TM 5-2410-233-10
 WP 0017 00
 WP 0176 00

Personnel Required

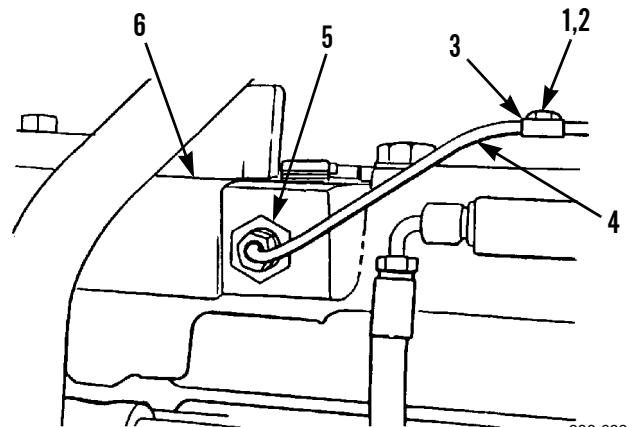
Two

Equipment Condition

Hood removed (WP 0136 00)
 Air cleaner removed (WP 0043 00)
 Muffler removed (WP 0058 00)
 Turbocharger removed (WP 0046 00)
 Exhaust manifold removed (WP 0034 00)
 Fuel injection lines removed (WP 0041 00)
 Fan drive removed (WP 0067 00)
 Ether starting aid removed (WP 0057 00)
 Water temperature regulator removed (WP 0064 00)
 Water pump lines removed (WP 0066 00)
 Engine oil sampling valve removed (WP 0013 00)
 Water outlet elbow removed (WP 0066 00)
 Crankcase breather removed (WP 0014 00)
 Valve mechanism cover removed (WP 0016 00)
 Valve mechanism removed (WP 0017 00)

REMOVAL

1. Remove capscrew (1), washer (2) and clamp (3) from water temperature gage sending unit tube (4).
2. Remove tube (4) and temperature gage sending unit (5) as an assembly from intake manifold (6).



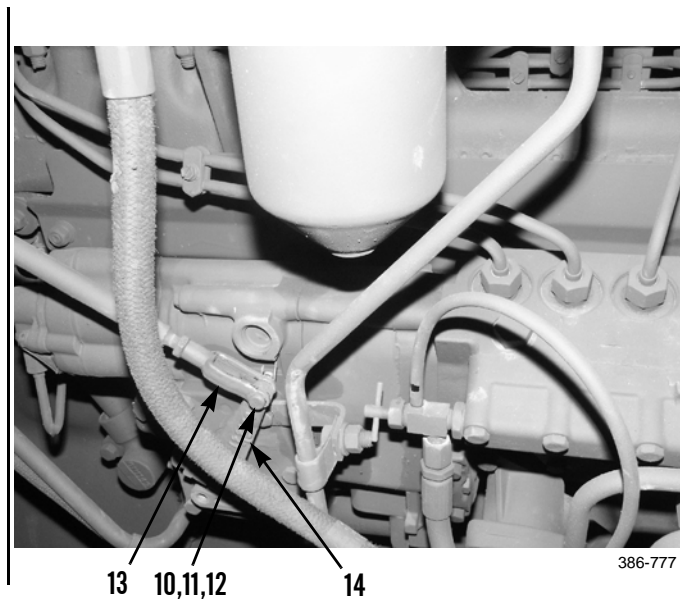
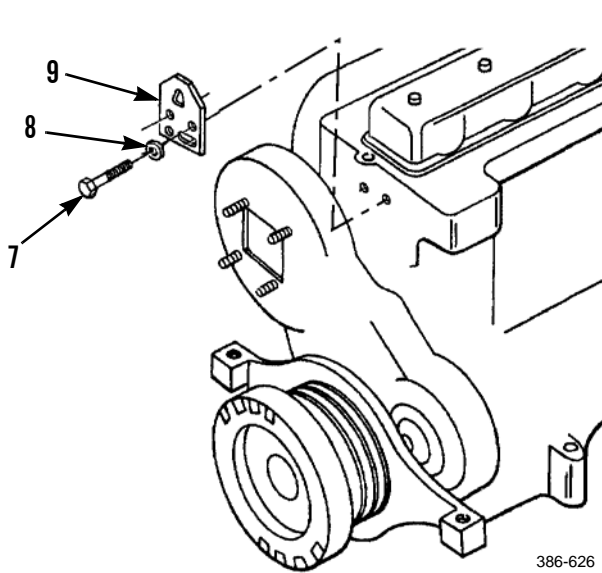
386-093

REMOVAL - CONTINUED

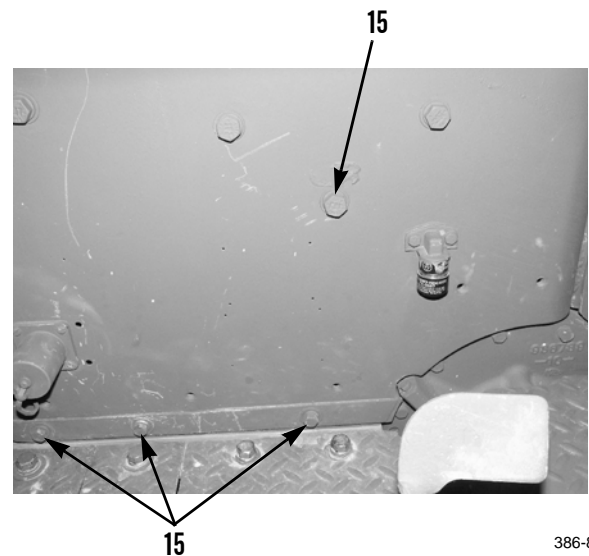
NOTE

The preferred method for removal is to remove front lifting bracket and install lifting links in front and rear of cylinder head assembly.

3. Remove two capscrews (7), lockwashers (8) and front engine lifting bracket (9). Discard lockwashers.
4. Remove cotter pin (10), washer (11) and pin (12) and disconnect governor control linkage (13) from lever (14) at governor. Discard cotter pin.

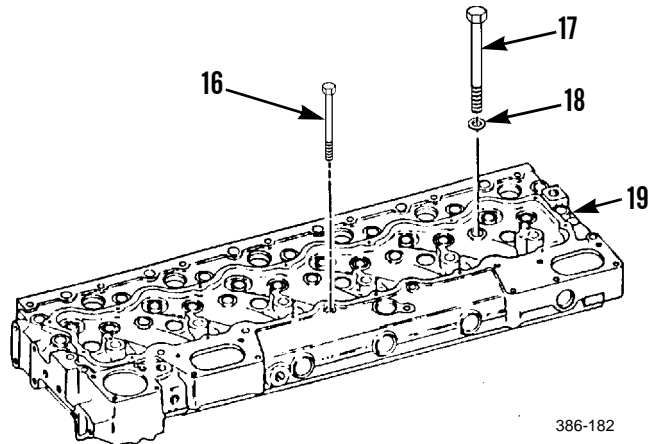


5. Remove three dash lower mounting bolts (15). Remove upper mounting bolt (15) and nut and tip dash toward rear of tractor.



REMOVAL - CONTINUED

6. Remove six capscrews (16), 20 capscrews (17) and washers (18) from cylinder head (19).



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**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

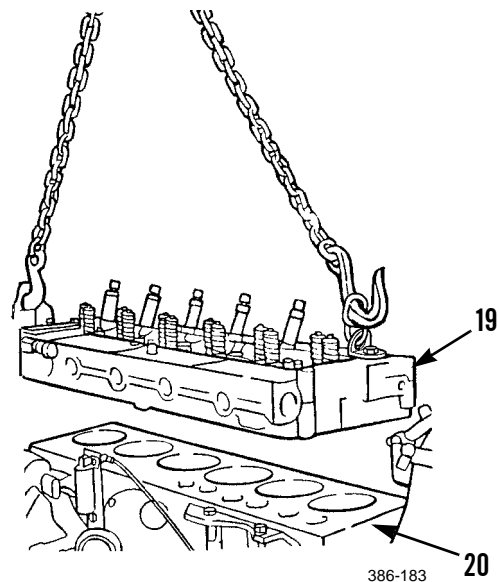
Cylinder head weighs approximately 200 lb (91 kg).

7. Install lifting links with 5/8 -11x 1-1/2 in. bolts or use lifting bracket at front and rear of cylinder head.
 8. Attach a nylon sling and a suitable lifting equipment to lifting points at front and rear of cylinder head (19).

CAUTION

Do not lower cylinder head onto a flat surface. This could damage valves.

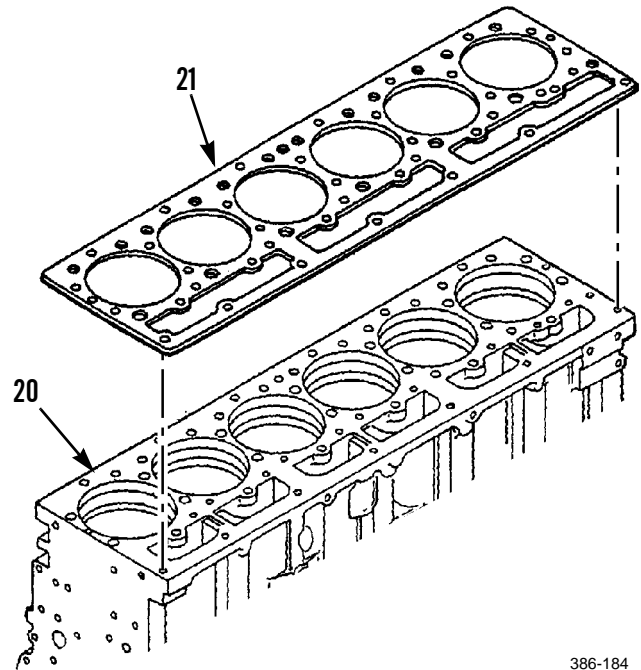
9. Slowly and carefully lift cylinder head (19) from cylinder block (20) and place it on a suitable stand or platform which will support bottom perimeter of cylinder head. Remove lifting links from cylinder head.



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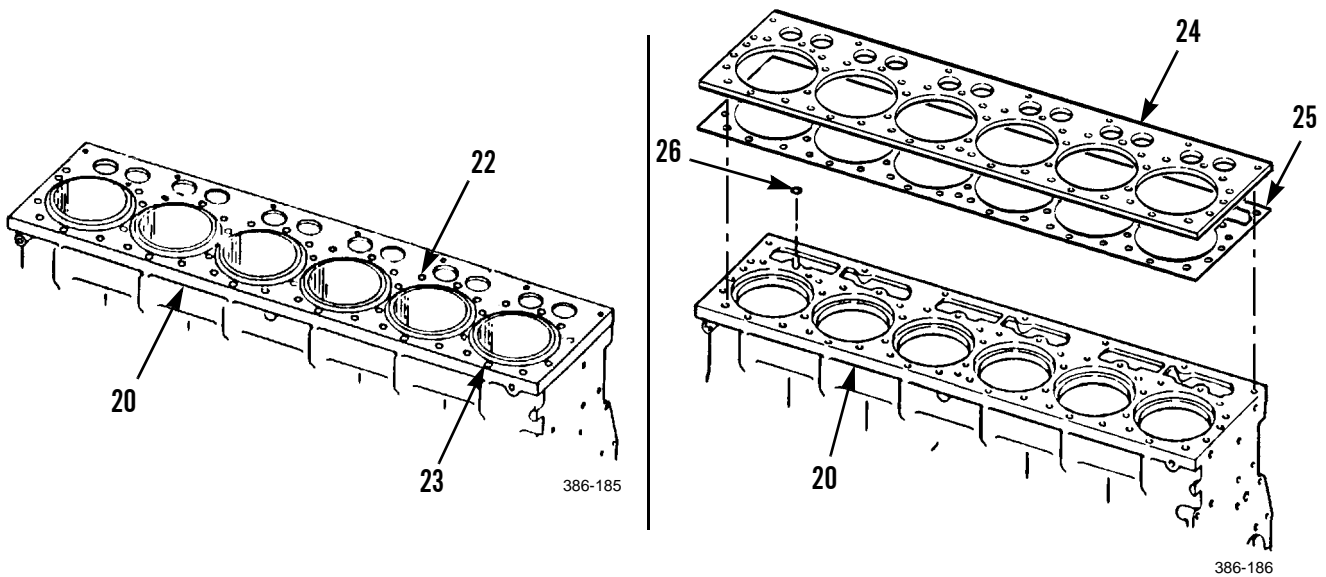
REMOVAL - CONTINUED

10. Remove cylinder head gasket (21) from cylinder block (20). Discard cylinder head gasket.



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11. Use snap ring pliers to remove 18 water seals (22) and six water seals (23) from spacer plate (24). Discard water seals.
12. Remove spacer plate (24) and gasket (25) from cylinder block (20). Discard gasket.
13. Remove O-ring (26) from dowel in cylinder block (20). Discard O-ring.



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CLEANING AND INSPECTION**WARNING**

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

CAUTION

Both surfaces of spacer plate, bottom surface of cylinder head, and top of cylinder block **MUST** be clean and dry. Do not use hard gasket scrapers or files to remove gasket material, grease or other particles from cylinder head, block or spacer plate surfaces. These tools could cause nicks or scratches which, in turn, could cause leaks or incorrect seat between cylinder head and spacer plate, and/or block and spacer plate.

NOTE

Refer to WP 0176 00 for additional cleaning and inspection instructions.

1. Thoroughly clean cylinder head with solvent cleaning compound or other approved method of carbon removal.
2. Thoroughly clean both surfaces of spacer plate using solvent cleaning compound.
3. Visually inspect cylinder head and spacer plate for cracks, heat deterioration or other damage. Replace damaged cylinder head and/or spacer plate.
4. Check cylinder head for warpage using a straightedge and feeler gage. Replace warped cylinder head.
5. Inspect cylinder head valves for damage. If damaged, notify your supervisor.

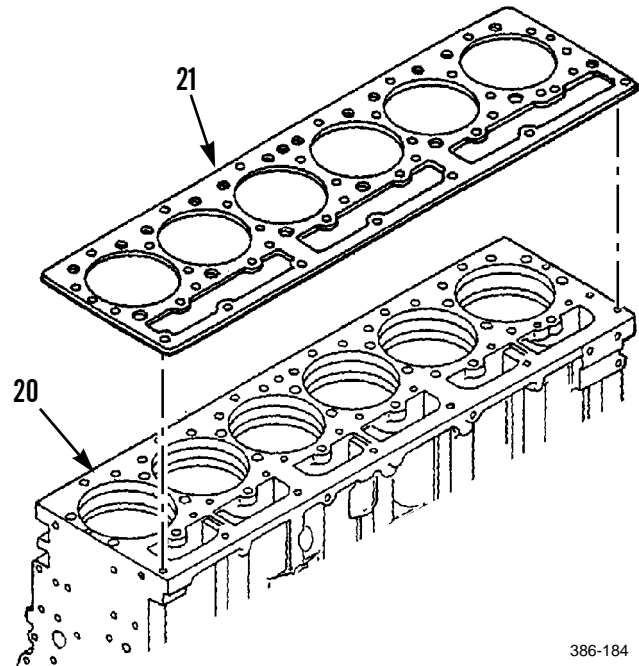
INSTALLATION**CAUTION**

To ensure there is no leakage resulting in loss of engine compression, ensure mating surfaces of cylinder block, cylinder head, spacer plate and all gaskets are clean and dry before installation.

1. Install new O-ring (26) on dowel in cylinder block (20).
2. Install new gasket (25) and spacer plate (24) on cylinder block (20).
3. Install six new water seals (23) and 18 new water seals (22) in spacer plate (24).

INSTALLATION - CONTINUED

4. Position new cylinder head gasket (21) on cylinder block (20).



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5. Install lifting links with 5/8 -11x 1-1/2 in. bolts or use lifting bracket at front and rear of cylinder head (19).

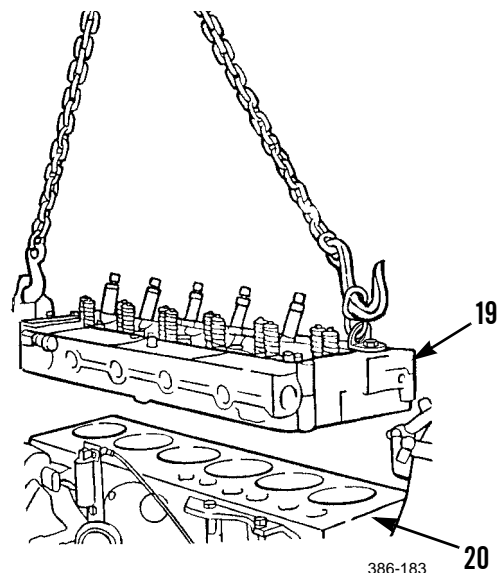
**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Cylinder head weighs approximately 200 lb (91 kg).

6. Attach a nylon sling and suitable lifting equipment to lifting points at front and rear of cylinder head (19).
7. Carefully lift cylinder head and place in correct position on cylinder block (20).
8. Remove lifting device, lifting links and bolts.



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INSTALLATION - CONTINUED

NOTE

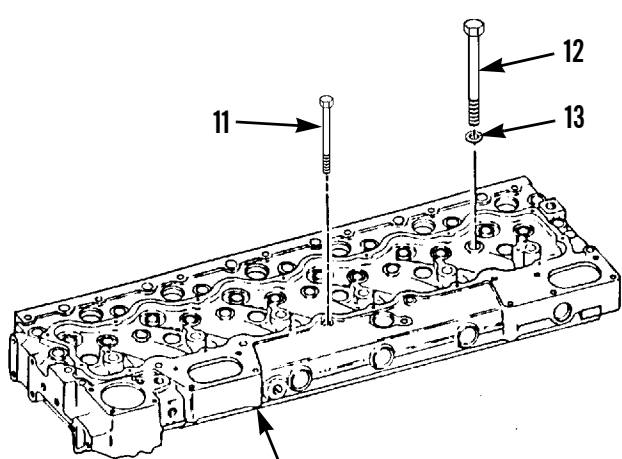
If engine cylinder head lifting brackets were used, lifting brackets remain on cylinder head.

9. Install front and rear engine lifting bracket, if removed.

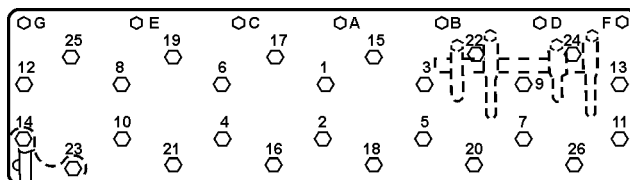
NOTE

Apply clean oil to threads of cylinder head capscrews.

10. Install 20 capscrews (17), washers (18) and six capscrews (16).
11. Tighten capscrews (16 and 17) in the following sequence:
 - a. Tighten all capscrews in number sequence to 115 lb-ft (156 Nm).
 - b. Retighten all capscrews in number sequence to 175 lb-ft (237 Nm).
 - c. Verify all capscrews in number sequence to 175 lb-ft (237 Nm).
 - d. Tighten all capscrews in letter sequence to 22 lb-ft (30 Nm).
 - e. Retighten all capscrews in letter sequence to 32 lb-ft (43 Nm).
 - f. Verify all capscrews in letter sequence to 32 lb-ft (43 Nm).



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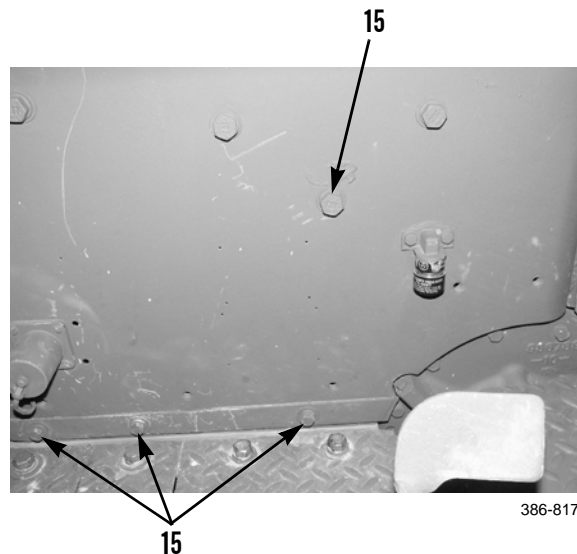
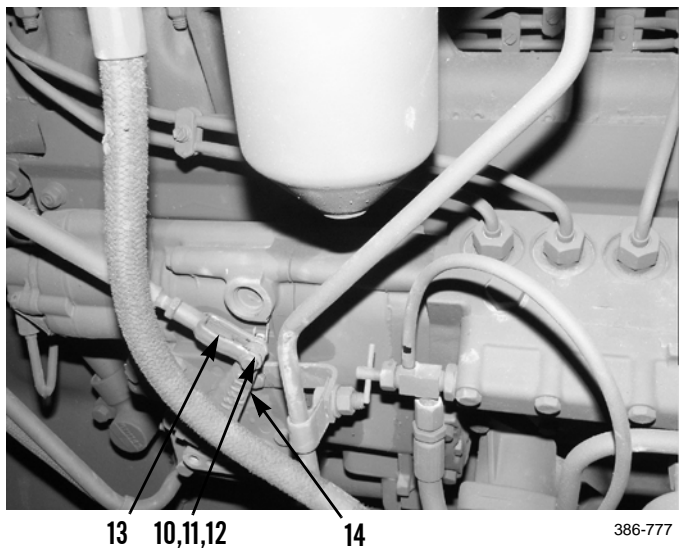


386-000

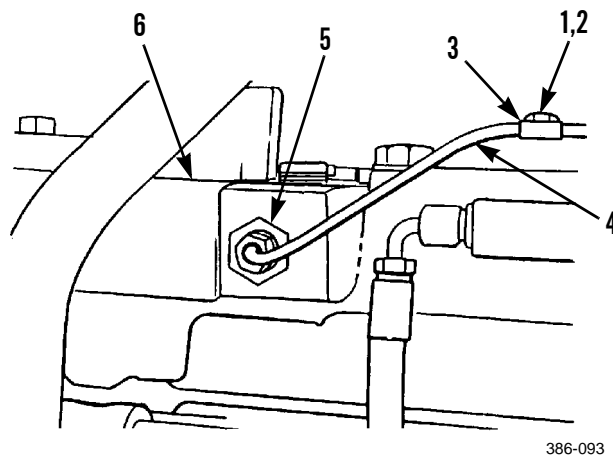
12. Install valve mechanism.
13. Adjust valves (WP 0017 00).
14. Install valve mechanism cover (WP 0016 00).

INSTALLATION - CONTINUED

15. Connect governor control linkage (13) to lever (14) at governor with pin (12), washer (11) and new cotter pin (10).
16. Position dash in upright position and install three lower mounting bolts (15) and upper mounting bolt (15) and nut.



17. Install crankcase breather (WP 0014 00).
18. Install water outlet elbow.
19. Install water pump lines (WP 0066 00).
20. Install engine oil sampling valve (WP 0013 00).
21. Install water temperature regulator (WP 0064 00).
22. Install ether starting aid (WP 0057 00).
23. Install fan drive (WP 0067 00).
24. Install fuel injection lines (WP 0041 00).
25. Install exhaust manifold (WP 0034 00).
26. Install turbocharger (WP 0046 00).
27. Install air cleaner (WP 0043 00).
28. Install muffler (WP 0058 00).
29. Install hood (WP 0136 00).
30. Install clamp (3), washer (2) and capscrew (1).
31. Install tube (4) and water temperature gage sending unit (5) into intake manifold (6). Be careful not to overtighten.
32. Run engine and check for proper operation and leaks (TM 5-2410-233-10).



END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Distorter, sleeve (Item 23, WP 0185 00)
- Installer (Item 39, WP 0185 00)
- Puller kit, universal (Item 79, WP 0185 00)
- Tool, distorter (Item 111, WP 0185 00)

Materials/Parts

- Oil, lubricating (Item 25, WP 0184 00)
- Primer coating (Item 27, WP 0184 00)

Materials/Parts - Continued

- Rag, wiping (Item 28, WP 0184 00)
- Sealing compound (Item 30, WP 0184 00)
- Seal (1)
- Sleeve, wear (4)

References

TM 5-2410-233-10

Equipment Condition

- Crankshaft pulley removed (WP 0026 00)
- Vibration damper removed (WP 0027 00)

REMOVAL

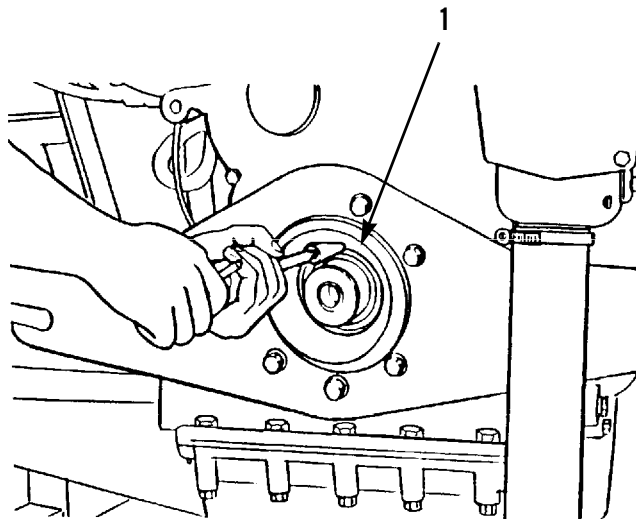
CAUTION

Use care not to damage crankshaft flange when removing seal.

NOTE

When replacing front crankshaft seal, front wear sleeve must also be replaced.

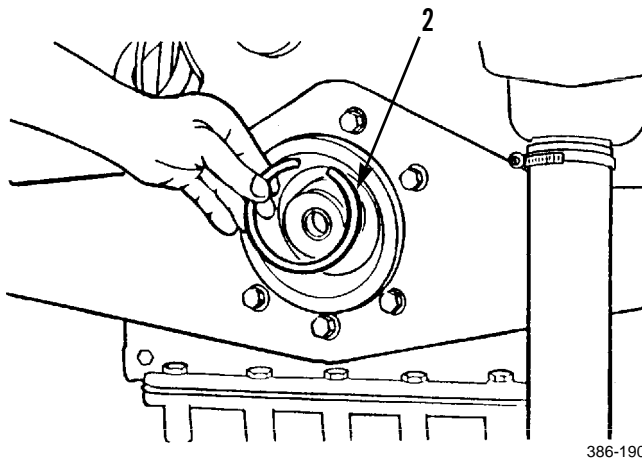
1. Drill three evenly spaced pilot holes in crankshaft front seal (1).
2. Using slide hammer puller, alternate between drilled holes to remove crankshaft front seal (1). Discard seal.



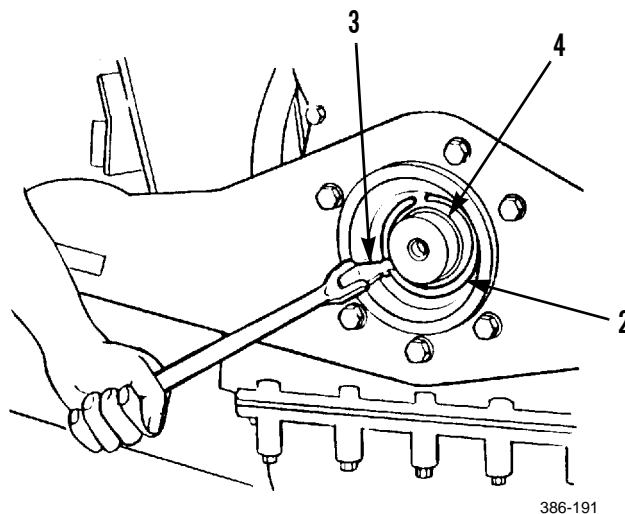
386-189

REMOVAL - CONTINUED

3. Insert distorter ring (2) into seal bore.



4. Place sleeve distorter (3) between distorter ring (2) and wear sleeve (4). Turn until edge of distorter makes a crease in wear sleeve. Make additional creases in wear sleeve, every 90 degrees, then every 45 degrees, until wear sleeve is loose. Remove distorter ring tool and wear sleeve. Discard wear sleeve.

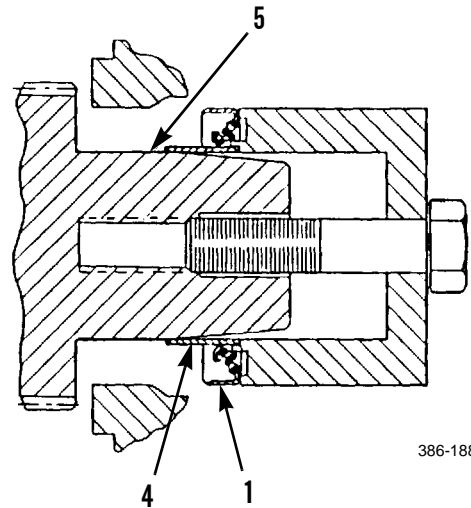
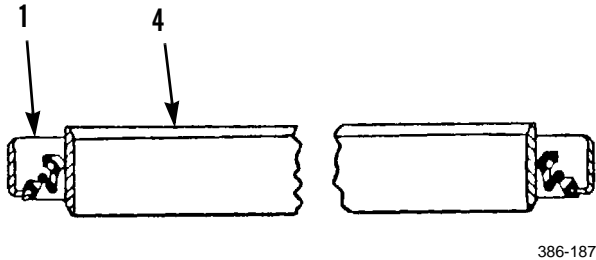
**INSTALLATION****NOTE**

Wear sleeve and crankshaft front seal must be installed together.

1. Apply clean lubricating oil on seal lip of new seal (1) and on outside diameter of new wear sleeve (4).
2. Install new seal (1) on new wear sleeve (4) as shown, with lip of seal towards side of wear sleeve that has chamfer on inside diameter.
3. Clean inside diameter of wear sleeve (4) and tapered surface of crankshaft (5) with quick cure primer coating.
4. Apply sealing compound to surfaces on inside diameter of wear sleeve (4) and on crankshaft (5).
5. Position wear sleeve (4) and seal (1) on crankshaft, with lip of seal towards engine.

INSTALLATION - CONTINUED

6. Install wear sleeve and seal installer tool. Apply a small amount of lubricating oil between capscrew and installer tool.
7. Tighten capscrew until inside surface of installer tool contacts end of crankshaft (5), wear sleeve (4) and seal (1). Seal is fully seated when it bottoms in timing gear cover. Remove wear sleeve and seal installer tool.



8. Install vibration damper (WP 0027 00).
9. Install crankshaft pulley (WP 0026 00).
10. Run engine and check for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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CRANKSHAFT REAR SEAL AND WEAR SLEEVE REPLACEMENT**0025 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Bolt, machine (Item 11, WP 0185 00)
- Installer (Item 39, WP 0185 00)
- Nut, sleeve (Item 51, WP 0185 00)
- Puller kit, universal (Item 79, WP 0185 00)
- Remover and replacer (Item 89, WP 0185 00)
- Ring, sleeve distorter (Item 92, WP 0185 00)
- Tool, distorter (Item 111, WP 0185 00)

Materials/Parts

- Oil, lubricating (Item 25, WP 0184 00)
- Sealing compound (Item 30, WP 0184 00)
- Seal (1)
- Sleeve, wear (4)

References

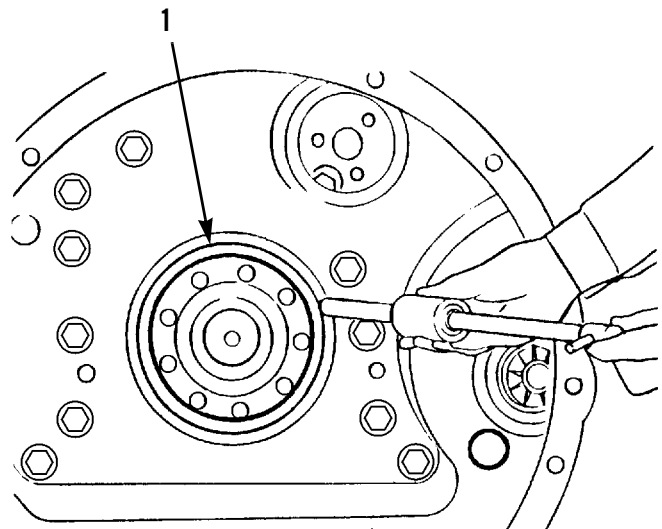
- TM 5-2410-233-10
- WP 0035 00

Equipment Condition

- Flywheel assembly removed (WP 0028 00)
- Rear accessory drive idler gear removed (WP 0035 00)

REMOVAL**CAUTION****Use care not to damage crankcase flange when removing seal.**

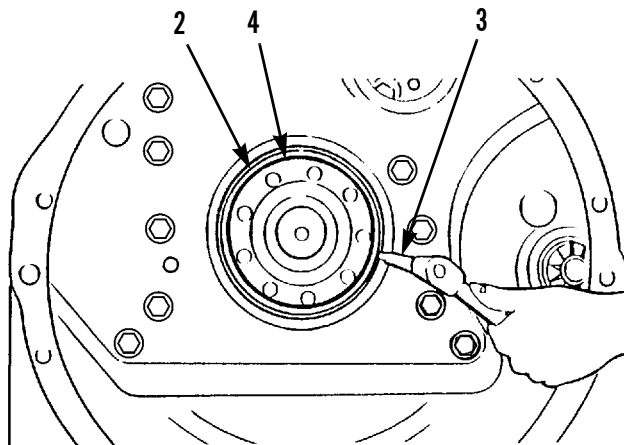
1. Drill three evenly spaced pilot holes in rear seal (1).
2. Using slide hammer puller, alternate between drilled holes to remove crankshaft rear seal (1). Discard rear pilot seal.



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REMOVAL - CONTINUED

3. Insert sleeve distorter ring (2) in rear seal bore.
4. Insert wear sleeve distorter (3) between sleeve distorter ring (2) and wear sleeve (4).
5. Turn distorter (3) until it makes a crease in wear sleeve (4). Make additional creases in wear sleeve, every 90 degrees, then every 45 degrees, until wear sleeve is loose.
6. Remove wear sleeve distorter (3) and wear sleeve (4). Discard wear sleeve.



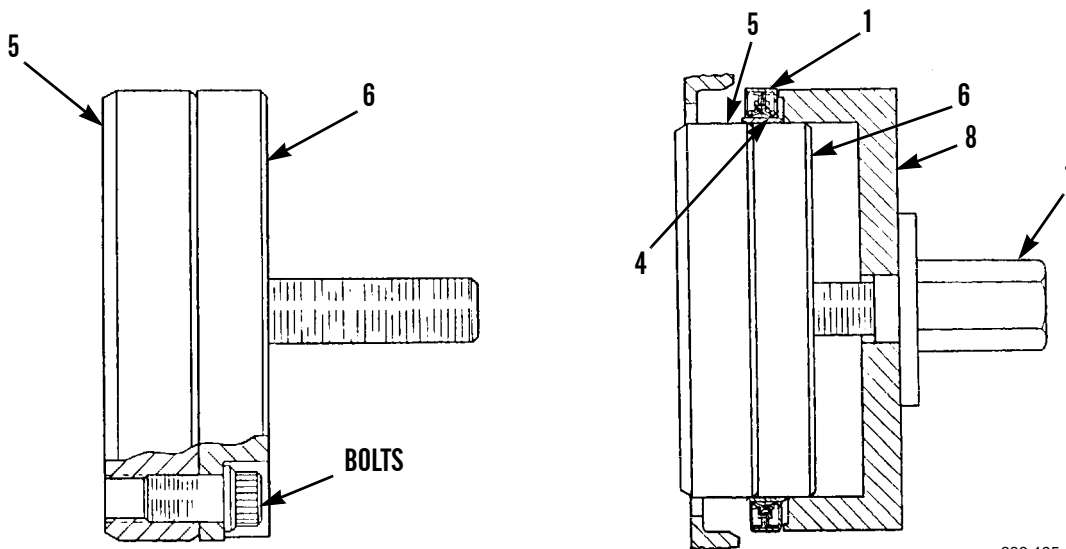
386-194

INSTALLATION

CAUTION

Do not separate new rear seal and wear sleeve assembly.

1. Clean outer diameter of crankshaft flange (5) and inside diameter of new wear sleeve (4).
2. Apply sealing compound on outer diameter of crankshaft flange (5) and on inside diameter of wear sleeve (4).



386-195

3. Install seal locator (6) to end of crankshaft (5) with three bolts.
4. Place new seal (1) and wear sleeve (4) assembly on locator (6), with part number on seal facing out.
5. Apply clean oil on washer face of nut (7). Place installer (8) on locator (6), then install nut.

INSTALLATION - CONTINUED

6. Turn nut (7) until inside surface of installer (8) comes in contact with locator (6). Rear seal (1) and wear sleeve (4) will be in the correct location.
7. Remove nut (7), installer (8), three bolts and locator (6).
8. Install rear accessory drive idler gear (WP 0035 00).
9. Install flywheel assembly (WP 0028 00).
10. Run engine and check for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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CRANKSHAFT PULLEY REPLACEMENT

0026 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

- Detergent (Item 10, WP 0184 00)
- Oil, lubricating (Item 25, WP 0184 00)

References

- TM 5-2410-233-10
- WP 0069 00
- WP 0176 00

Equipment Condition

- Radiator removed (WP 0063 00)
- Vibration damper removed (WP 0027 00)

REMOVAL

1. Loosen V-belts and remove from crankshaft pulley (WP 0069 00).

NOTE

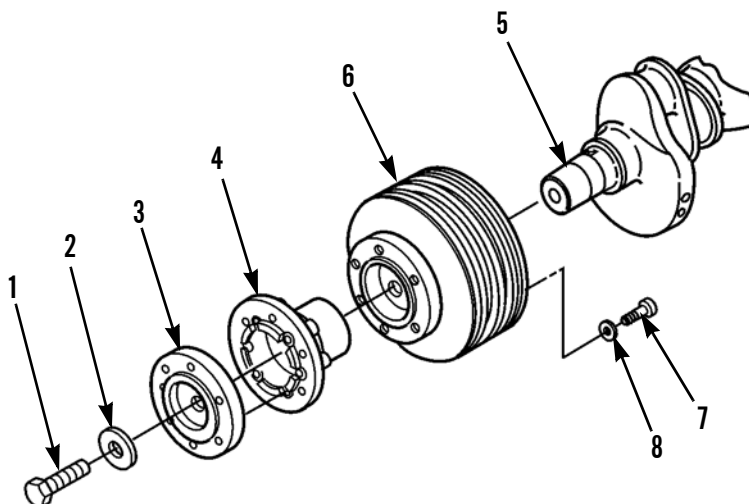
Use an impact wrench to loosen bolt so crankshaft does not turn.

2. Remove bolt (1) washer (2) and adapter (3) from hub (4) at end of crankshaft (5).

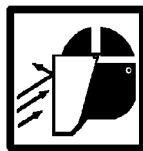
NOTE

Use an impact wrench on puller tool so that crankshaft does not turn.

3. Loosen hub (4) and crankshaft pulley (6) as an assembly using a suitable puller tool.
4. Remove six bolts (7), washers (8) attaching hub (4) to crankshaft pulley (6) and remove from crankshaft (5).



386-021

CLEANING**WARNING**

Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may cause injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

Clean removed parts with detergent. Dry parts with compressed air.

INSPECTION

1. Inspect hub and crankshaft pulley for cracks or other damage. Replace if necessary.
2. Inspect wear of pulley grooves. Measure distance that a new V-belt runs above or below top of each groove. If V-belt runs more than 1/16 in. (1.6 mm) below top of groove, replace pulley.
3. Refer to WP 0176 00 for additional inspection instructions.

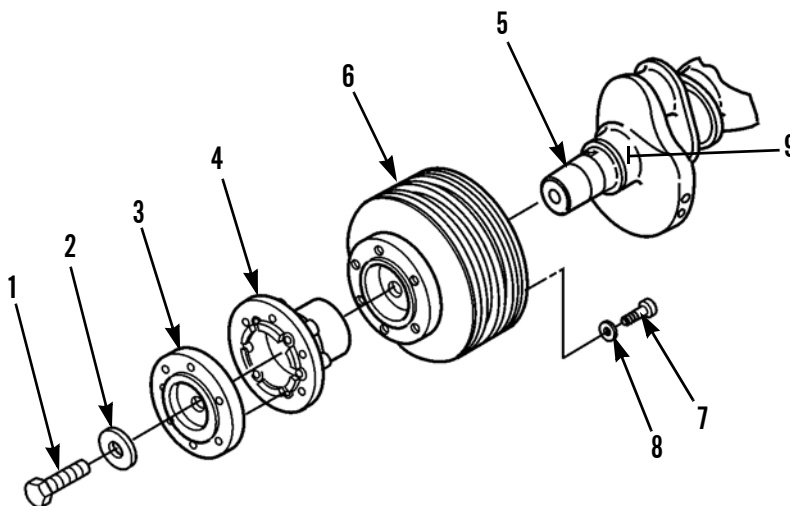
INSTALLATION

1. Apply coat of lubricating oil to exposed surface of crankshaft (5), front engine oil seal (9) and tapered surface inside hub (4).
2. Install hub (4) through crankshaft pulley (6) and secure with six washers (8) and bolts (7). Tighten bolts to 75 lb-ft (102 Nm).
3. Install hub (4) and crankshaft pulley (6) to end of crankshaft (5).

NOTE

- Position washer with large flat surface toward hub.
- Position damper on hub so holes in damper are aligned with hub.

4. Install adapter (3) and hub (4) to crankshaft end (5) with washer (2) and bolt (1). Tighten bolt to 230 lb-ft (312 Nm).
5. Tap end of bolt with a hammer and again tighten bolt to 230 lb-ft (312 Nm).



386-021

CRANKSHAFT PULLEY REPLACEMENT - CONTINUED

0026 00

INSTALLATION - CONTINUED

6. Install vibration damper (WP 0027 00).
7. Install radiator (WP 0063 00).
8. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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VIBRATION DAMPER REPLACEMENT

0027 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)

References

WP 0176 00

Equipment Condition

Crankcase guard removed (WP 0129 00)

**WARNING**

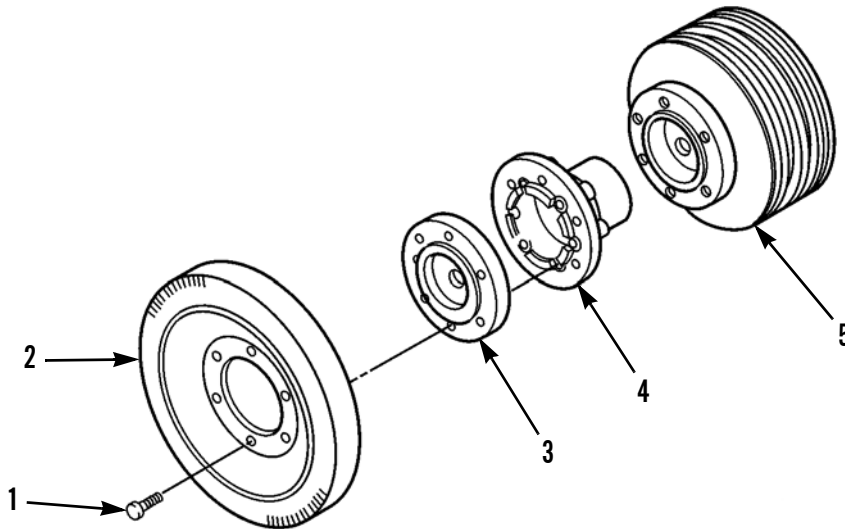
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

NOTE

Vibration damper weighs 44 lb (20 kg).

REMOVAL

Remove six cap screws (1), vibration damper (2) and adapter (3) from hub (4) and crankshaft pulley (5).



386-022

CLEANING**WARNING**

- Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.
- Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may cause injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

Clean removed parts with solvent cleaning compound. Dry thoroughly with compressed air.

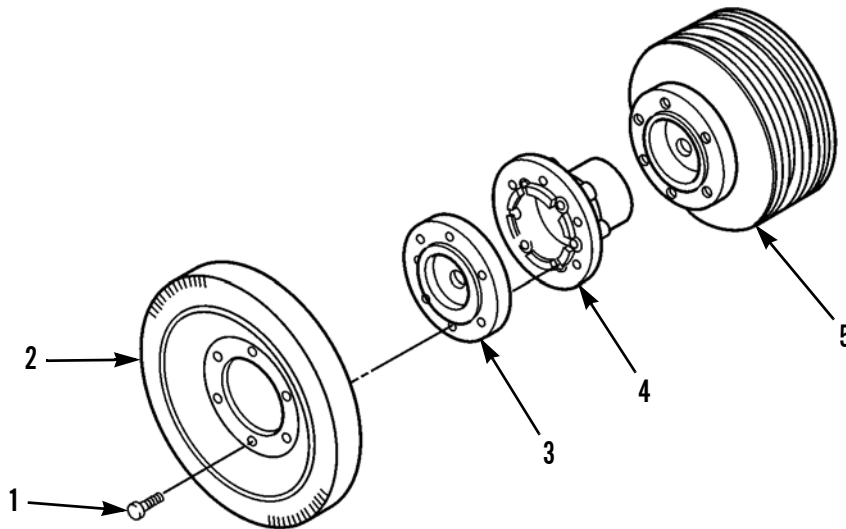
INSPECTION**NOTE**

Refer to WP 0176 00 for general inspection instructions.

1. Inspect vibration damper and adapter for cracks or other damage. Replace if necessary.
2. Check two dash marks on perimeter of vibration damper. If marks are not aligned, replace vibration damper.

INSTALLATION

1. Position adapter (3) to hub (4) and crankshaft pulley (5).
2. Position vibration damper (2) on adapter (3) and install six capscrews (1). Tighten capscrews to 75 lb-ft (102 Nm).



386-022

3. Install crankcase guard (WP 0129 00).

END OF WORK PACKAGE

FLYWHEEL ASSEMBLY REPLACEMENT

0028 00**THIS WORK PACKAGE COVERS**Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
Shop equipment, general purpose repair (Item 97, WP
0185 00)
Lifting equipment, 200 lb capacity

Materials/Parts

Bolt, guide, 5/8 in.-18NF, 8-1/2 in. long

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

Torque divider removed (WP 0092 00)

REMOVAL**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Some flywheel assemblies come from the manufacturer without drilled and tapped holes for installing lifting equipment. If flywheel assembly to be removed or replaced is missing drilled holes, contact your local Caterpillar dealer for assistance.

NOTE

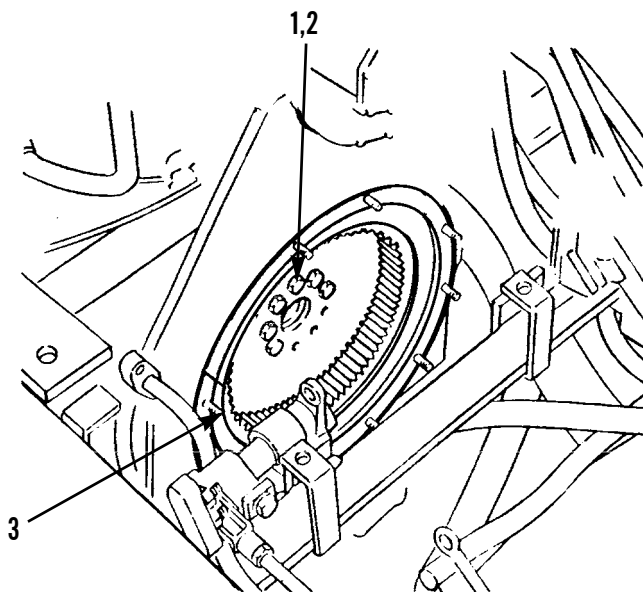
Flywheel assembly weighs 125 lb (57 kg).

1. Remove seven capscrews (1) and washers (2) from flywheel assembly (3).
2. Install two 5/8 in. -18NF guide bolts in crankshaft.
3. Remove two remaining capscrews (1) and washers (2).
4. Slide flywheel assembly (3) out on guide bolts until flywheel is sufficiently clear to install lifting equipment.
5. Fasten lifting equipment to flywheel assembly (3).

NOTE

Keep flywheel level during removal to prevent hydraulic pump gear from falling off front of flywheel.

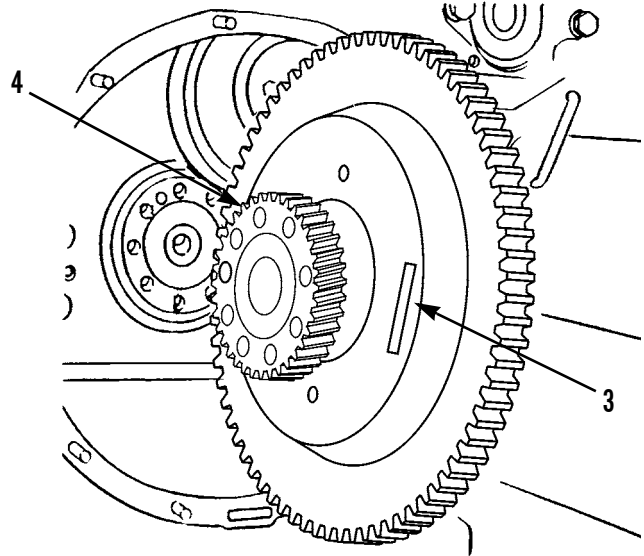
6. Lift flywheel assembly (3) clear and remove.



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REMOVAL - CONTINUED

7. Apply witness marks on hydraulic pump gear (4) and flywheel assembly (3) with paint or scribe.
8. Remove hydraulic pump gear (4) from back of flywheel assembly (3).



I

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INSTALLATION

1. Align witness marks on flywheel assembly (3) and hydraulic pump gear (4) and install gear on flywheel assembly.

NOTE

Flywheel assembly weighs 125 lb (57 kg).

2. Fasten lifting equipment to flywheel assembly (3).
3. Lift flywheel assembly (3) into place on two 5/8 in.-18NF guide bolts installed into crankshaft.
4. Align dash marks on flywheel assembly (3) and crankshaft and push flywheel assembly further in on guide bolts.
5. Remove lifting equipment from flywheel assembly (3).
6. Push flywheel assembly (3) all the way in against rear of crankshaft.
7. Install seven washers (2) and capscrews (1).
8. Remove 5/8 in. -18NF guide bolts from crankshaft.
9. Install two remaining washers (2) and capscrews (1). Tighten nine capscrews to 150 lb-ft (203 Nm).
10. Install torque divider (WP 0092 00).
11. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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FLYWHEEL HOUSING MAINTENANCE**0029 00****THIS WORK PACKAGE COVERS**

Removal, Disassembly, Assembly, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Lifting equipment, 500 lb capacity

Materials/Parts

Grease, GAA (Item 15, WP 0184 00)

Gasket (8 and 13)

References

TM 5-2410-233-10

WP 0029 00

WP 0035 00

References - Continued

WP 0135 00

Personnel Required

Two

Equipment Condition

Starting motor removed (WP 0071 00)

Oil pan plate removed (WP 0032 00)

Transmission oil pump removed (WP 0095 00)

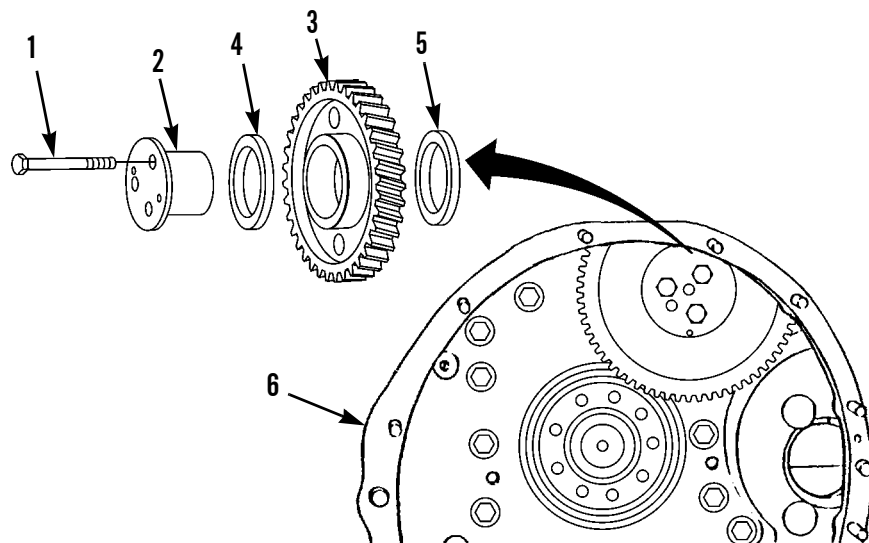
Engine assembly removed (WP 0019 00)

Accessory drive cover removed (WP 0036 00)

Flywheel assembly removed (WP 0028 00)

REMOVAL

1. Remove three capscrews (1).
2. Remove shaft assembly (2), and hydraulic pump idler gear (3). Remove bearing washer (4) from shaft assembly (2).
3. Remove bearing washer (5) from flywheel housing (6).



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REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

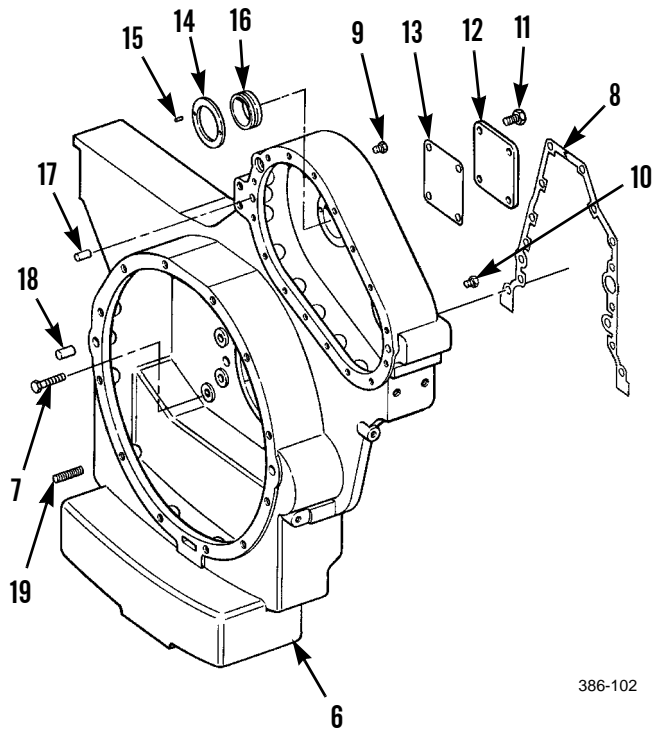
NOTE

Flywheel housing weighs approximately 350 lb (159 kg).

4. Fasten lifting equipment to flywheel housing (6).
5. Remove 13 capscrews (7) that hold flywheel housing (6) in place.
6. Remove flywheel housing (6).
7. Remove and discard gasket (8) from flywheel housing (6).

DISASSEMBLY

1. Remove rear accessory drive gears (WP 0035 00).
2. Remove mounting brackets from each side of flywheel housing (WP 0029 00).
3. Remove plug (9), if required.
4. Remove plug (10), if required.
5. Remove four capscrews (11), cover (12) and gasket (13). Discard gasket.
6. Remove two washers (14) and pins (15).
7. Use a bearing puller to remove two bearings (16).
8. If necessary, remove dowels (17 and 18) and stud (19) from flywheel housing (6).



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ASSEMBLY

1. If removed, install dowels (17 and 18) and stud (19) into housing (6). Tighten studs to 40 lb-ft (54 Nm).
2. Apply grease to two bearings (16) and with suitable driving tool, install bearings.
3. Install two washers (14) and pins (15).
4. Install cover (12) and new gasket (13) with four capscrews (11).
5. If removed, install plug (10).
6. If removed, install plug (9).
7. Install mounting brackets on each side of flywheel housing (6) (WP 0029 00).
8. Install rear accessory drive gears (WP 0035 00).

INSTALLATION



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

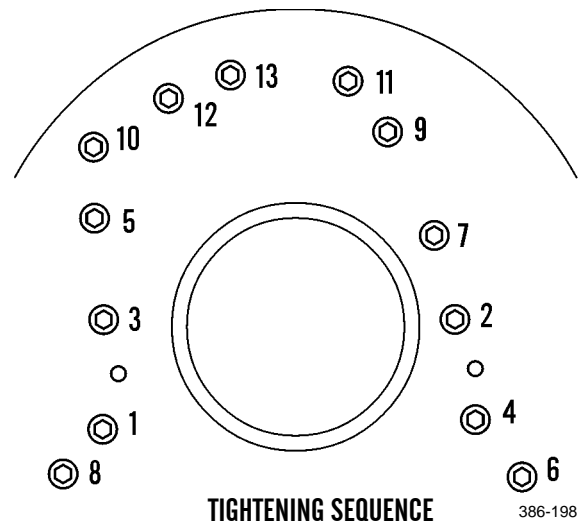
Flywheel housing weighs approximately 350 lb (159 kg).

1. Fasten lifting equipment to flywheel housing (6).

NOTE

Ensure all mating surfaces are clean and dry.

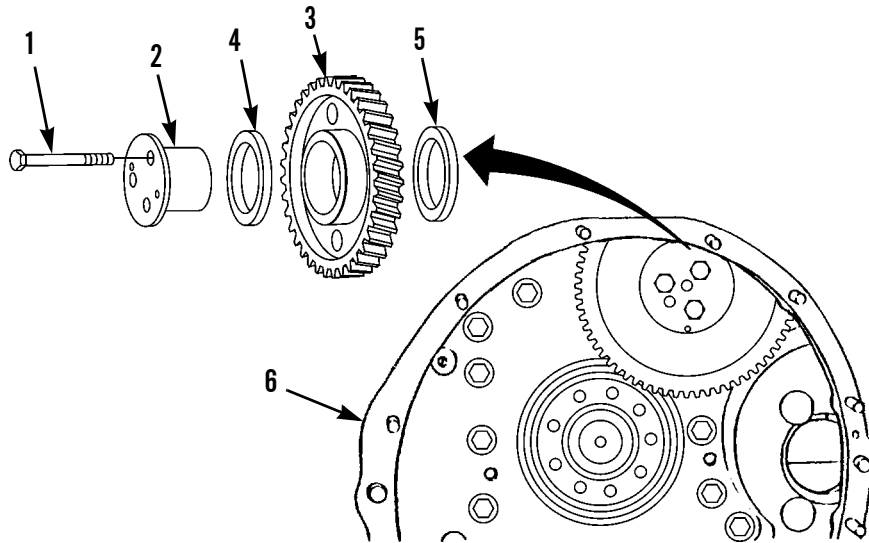
2. Install new gasket (8) on flywheel housing (6).
3. Use lifting equipment to place flywheel housing (6) in position against cylinder block.
4. Install 13 capscrews (7) to hold flywheel housing (6) in place. Ensure two shorter capscrews go into positions 7 and 2.
5. Tighten 13 capscrews (7) in number sequence shown to 75 lb-ft (102 Nm).



6. Cut gasket (8) even with oil pan face of cylinder block.

INSTALLATION - CONTINUED

7. Apply grease on bearing washer (5) and install washer in flywheel housing (6).
8. Install bearing washer (4) on shaft assembly (2).
9. Place hydraulic pump idler gear (3) and shaft assembly (2) in flywheel housing (6).
10. Install three capscrews (1) to hold shaft assembly (2) in place.



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11. Install flywheel assembly (WP 0028 00).
12. Install accessory drive cover (WP 0036 00).
13. Install engine assembly (WP 0019 00).
14. Install transmission oil pump (WP 0095 00).
15. Install oil pan plate (WP 0032 00).
16. Install starting motor (WP 0071 00).
17. Run engine and check for proper operation (TM 5-2410-233-10).
18. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

VALVE LIFTERS REPLACEMENT

0030 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)

Materials/Parts - Continued

Oil, lubricating (Item 25, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

References

TM 5-2410-233-10

Equipment Condition

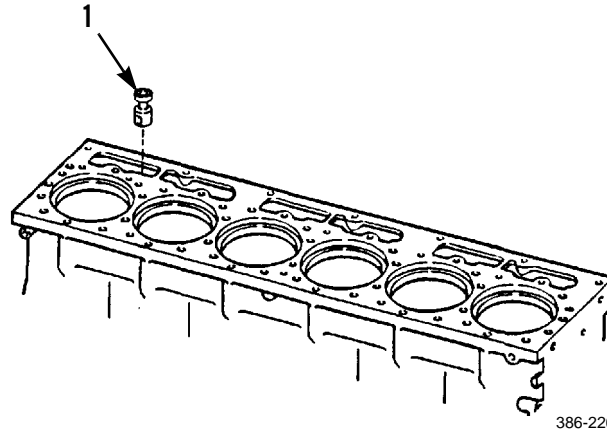
Cylinder head assembly removed (WP 0023 00)

REMOVAL

NOTE

If original lifters are to be reinstalled, they must be placed in their original locations.

1. Identify valve lifter locations.
2. Use a magnet to remove valve lifters (1).



CLEANING



WARNING



Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Clean valve lifters and valve lifter bores in cylinder block with solvent cleaning compound.

CLEANING - CONTINUED



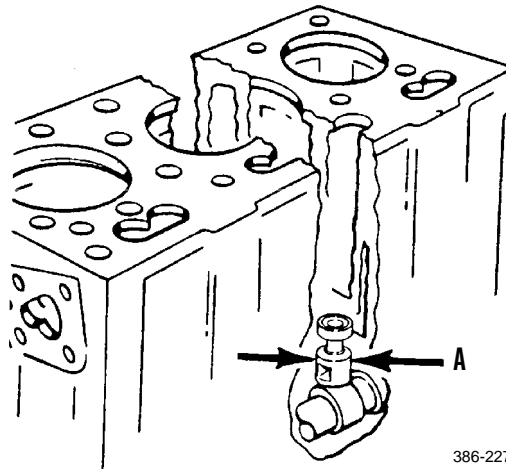
WARNING

Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may result in injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

2. Dry thoroughly using low pressure air.

INSPECTION

1. Inspect valve lifters for damage and corrosion. Replace valve lifters if found to be damaged.
2. Refer to Table 1 for wear limits and specifications applicable to valve lifters. If diameter of valve lifter is not within specified limits, replace valve lifter.



386-227

3. Refer to Table 1 for valve lifter bore specifications. If valve lifter bore in cylinder block is not within limits specified, engine must be rebuilt.

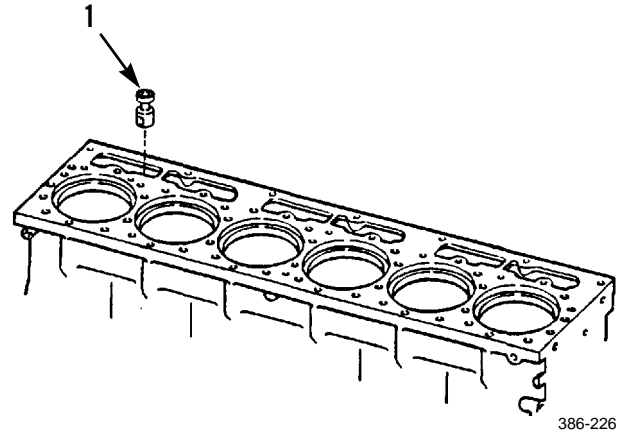
Table 1. Wear Limits and Specifications.

Diameter (dimension "A") of valve lifter (new)	1.3105 in. +/- 0.0005 in. (33.287 mm +/- 0.013 mm)
Bore (dimension "A") in block for valve lifter (new)	1.3145 in. +/- 0.0020 in. (33.388 mm +/- 0.050 mm)
Maximum permissible clearance between lifter and bore for valve lifter (worn)	0.012 in. (0.30 mm)

INSTALLATION**NOTE**

- If original valve lifters are being installed, they must be installed in their original locations.
- Coat valve lifters and camshaft lobes with clean oil before installation.

1. Use a magnet to install valve lifters (1) into cylinder block.



2. Install cylinder head assembly (WP 0023 00).
3. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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ENGINE OIL PAN REPLACEMENT

0031 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Compound, silicone, RTV (Item 9, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Gasket (12 and 19)

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

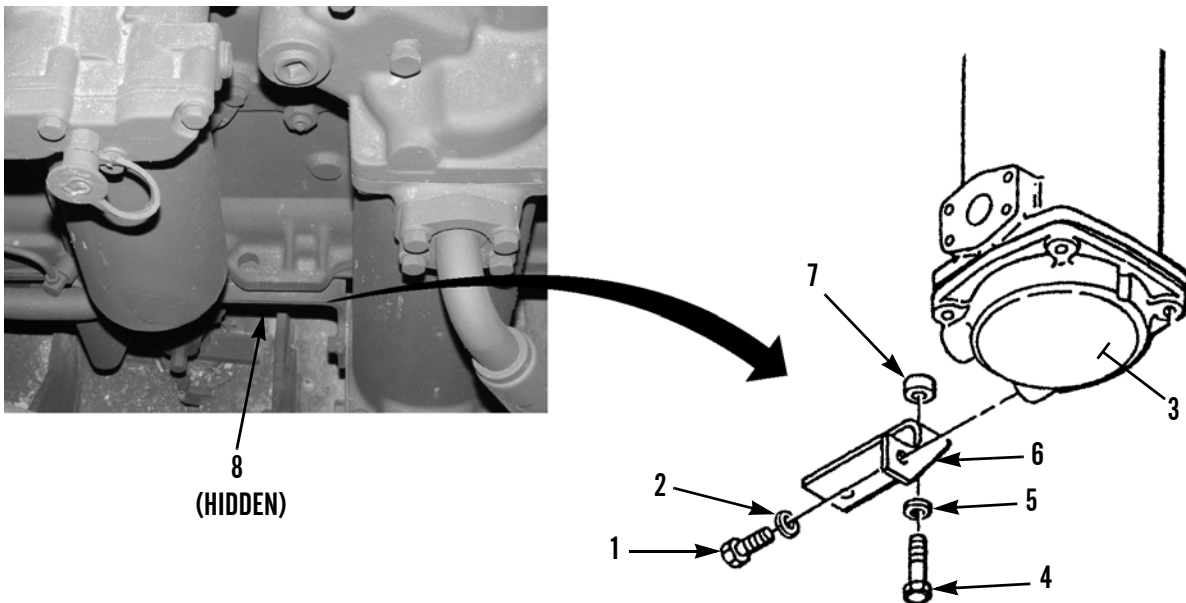
Crankcase guard removed (WP 0129 00)

Engine oil drained (WP 0010 00)

Engine oil level gage tube removed (WP 0011 00)

REMOVAL

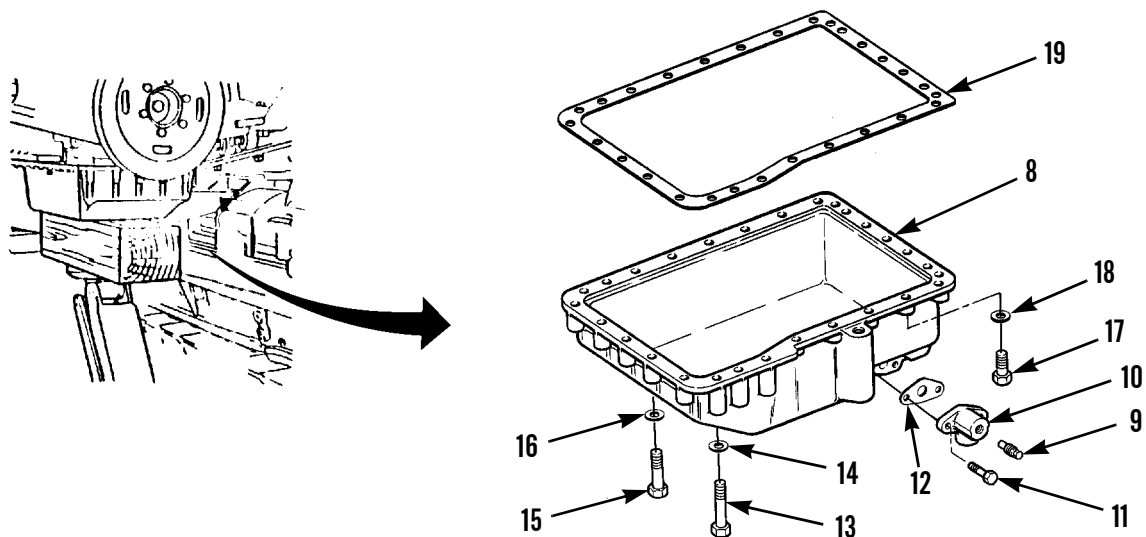
1. Remove capscrew (1) and washer (2) from transmission oil cooler (3).
2. Remove two capscrews (4) washers (5), bracket (6) and spacers (7) from oil pan (8).



386-024

REMOVAL - CONTINUED

3. Remove plug (9) from adapter (10).
4. Remove two capscrews (11), adapter (10) and gasket (12) from oil pan (8). Discard gasket.
5. Remove three 3-1/4 in. capscrews (13) and washers (14) from oil pan (8).
6. Remove five 2-3/4 in. capscrews (15) and washers (16) from oil pan (8).
7. Remove twenty 1-1/2 in. capscrews (17) and washers (18) from oil pan (8).
8. Remove oil pan (8) and gasket (19) from engine. Discard gasket.



386-199

INSTALLATION



Exposure to silicone RTV compound may be hazardous to your health. Contact with eyes can cause severe irritation and burns. Compound can be absorbed into the skin and can cause irritation or skin sensitization. Inhalation of vapors can cause respiratory tract irritation; prolonged inhalation can result in an allergic reaction. Vapors are combustible. Do not use near open flame. Wear eye and skin protection and avoid inhalation of vapors. Use only in a well-ventilated area. Failure to follow this warning can cause injury or death.

NOTE

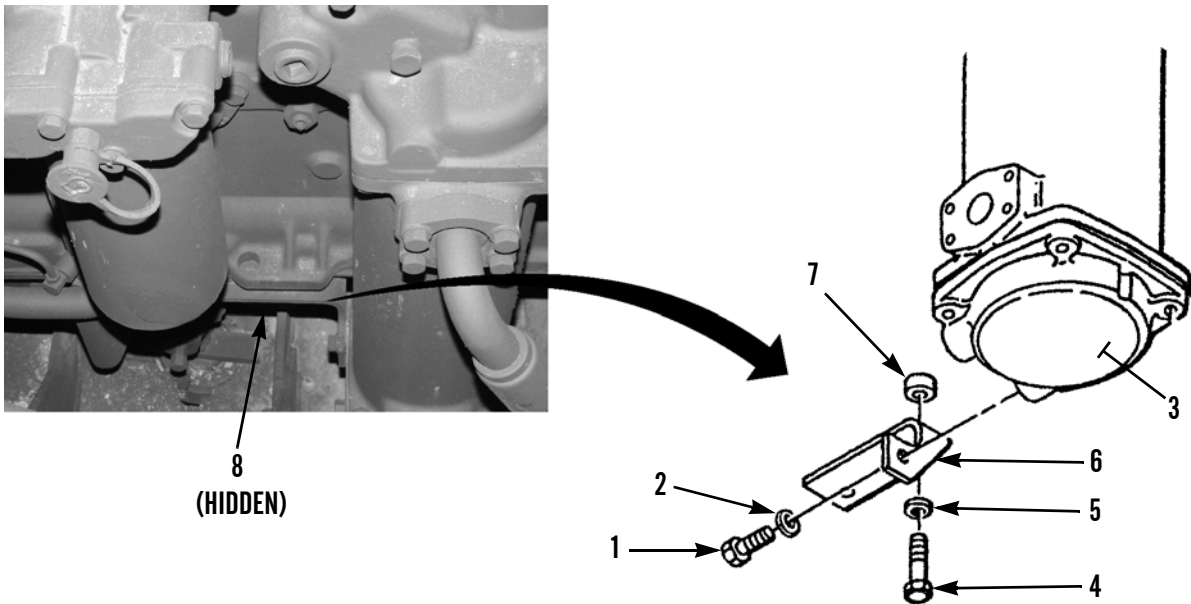
- Ensure mating surface on oil pan and engine is clean.
- Apply a thin layer of silicone compound on oil pan to provide a seal and to keep gasket in place.

1. Position new gasket (19) on oil pan (8), then apply silicone compound to top side of gasket.

INSTALLATION - CONTINUED**NOTE**

To ensure a leak-free seal, ensure capscrews are tightened evenly.

2. Install washers (18) and 20 1-1/2 in. capscrews (17) to secure oil pan (8) to engine.
3. Install five washers (16) and 2-3/4 in. capscrews (15) to oil pan (8).
4. Install three washers (14) and 3-1/4 in. capscrews (13) to oil pan (8).
5. Install new gasket (12) and adapter (10) to oil pan (8) and secure with two capscrews (11).
6. Install plug (9) in adapter (10).
7. Install two spacers (7), bracket (6), washers (5) and capscrews (4) to oil pan (8).
8. Install washer (2) and capscrews (1) to transmission oil cooler (3).



386-024

9. Install engine oil level gage tube (WP 0011 00).
10. Fill engine with oil (WP 0010 00).
11. Run engine and check for leaks and proper operation (TM 5-2410-233-10).
12. Install crankcase guard (WP 0129 00).

END OF WORK PACKAGE

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OIL PAN PLATE REPLACEMENT

0032 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

- Compound, silicone, RTV (Item 9, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

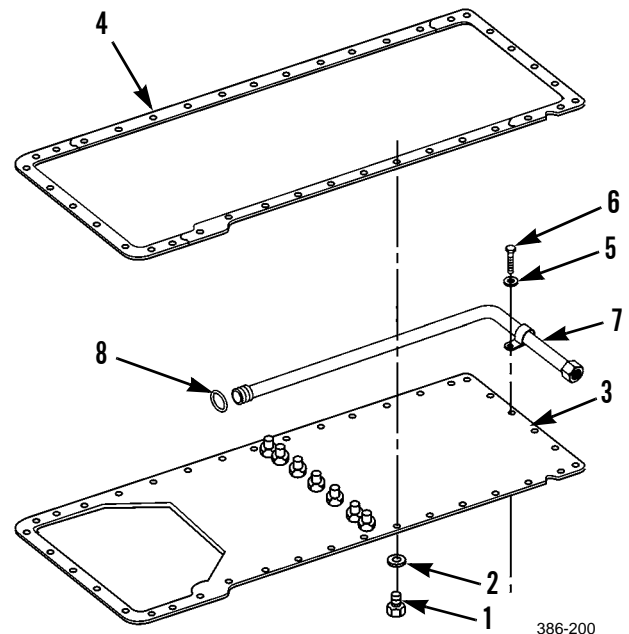
- Gasket (4)
- O-ring (8)

Equipment Condition

- Engine oil pan removed (WP 0031 00)
- Engine oil pump removed (WP 0033 00)

REMOVAL

1. Remove 18 capscrews (1) and washers (2) that hold oil pan plate (3) in place. Remove oil pan plate from engine block.
2. Remove and discard gasket (4) on oil pan plate (3).
3. Bend lock (5) down. Remove capscrew (6) which holds oil pickup tube (7) to oil pan plate (3).
4. Remove oil pickup tube (7) and O-ring (8). Discard O-ring.



386-200

INSTALLATION

1. Install oil pickup tube (7) and new O-ring (8) to oil pan plate (3).
2. Install lock (5) and capscrew (6) to secure oil pickup tube (7) on oil pan plate (3). Bend lock up.
3. Wipe surface of oil plate (3) clean.



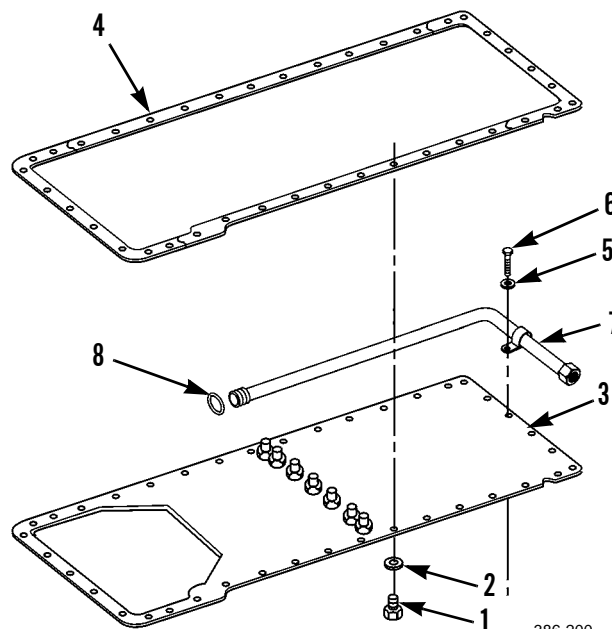
Exposure to silicone RTV compound may be hazardous to your health. Contact with eyes can cause severe irritation and burns. Compound can be absorbed into the skin and can cause irritation or skin sensitization. Inhalation of vapors can cause respiratory tract irritation; prolonged inhalation can result in an allergic reaction. Vapors are combustible. Do not use near open flame. Wear eye and skin protection and avoid inhalation of vapors. Use only in a well-ventilated area. Failure to follow this warning can cause injury or death.

4. Lightly coat both sides of new gasket (4) with silicone compound. Install gasket on oil pan plate (3).

NOTE

To ensure a leak-free seal, ensure capscrews are tightened evenly.

5. Position oil pan plate (3) onto engine block and secure with 18 washers (2) and capscrews (1).



386-200

6. Install engine oil pump (WP 0033 00).
7. Install oil pan (WP 0031 00).

END OF WORK PACKAGE

ENGINE OIL PUMP REPLACEMENT

0033 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Gasket (4 and 11)

References

TM 5-2410-233-10

Personnel Required

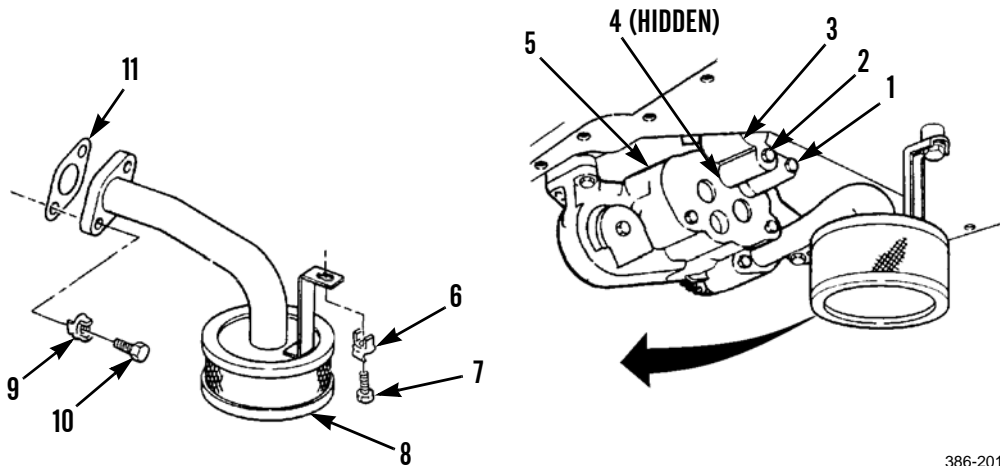
Two

Equipment Condition

Engine oil pan removed (WP 0031 00)

REMOVAL

1. Remove two capscrews (1 and 2) from elbow (3).
2. Remove elbow (3) and gasket (4) from oil pump (5) and slide elbow to the rear. Discard gasket.
3. Bend lock (6) away from capscrew (7) on strainer (8). Remove capscrew and lock.
4. Bend lock (9) away from two capscrews (10). Remove two capscrews and strainer (8) from oil pump (5). Remove and discard gasket (11).



386-201

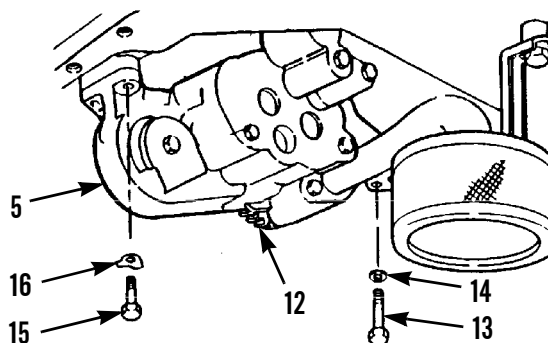
REMOVAL - CONTINUED



WARNING

Oil pump idler gear is free to fall when oil pump is removed.

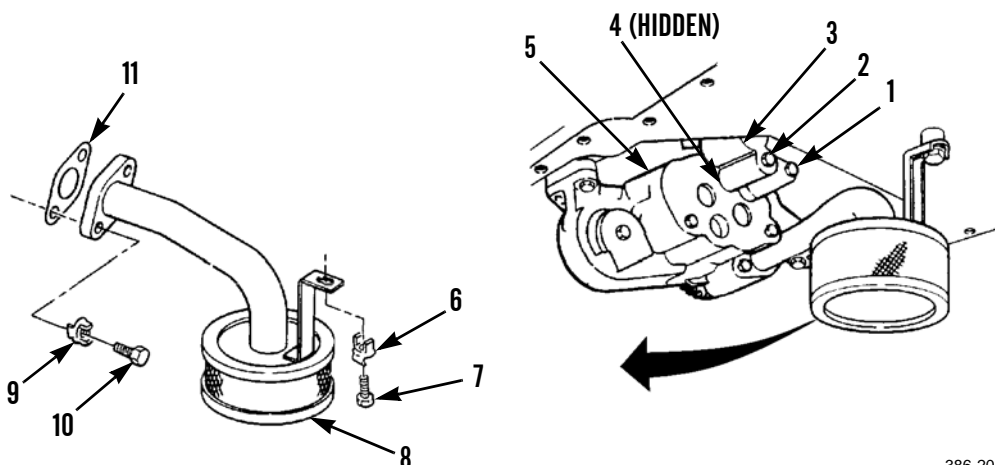
5. Have assistant hold onto oil pump (5) and idler gear (12). Remove two capscrews (13) and washers (14).
6. Remove two capscrews (15), locks (16) and oil pump (5).



386-202

INSTALLATION

1. While assistant holds oil pump (5) and idler gear (12), position oil pump on engine. Install two locks (16) and capscrews (15). Bend locks (16) to secure capscrews.
2. Install two washers (14) and capscrews (13).
3. Position strainer (8) with new gasket (11). Install lock (9) and two capscrews (10). Bend lock to secure capscrews.
4. Install lock (6) and capscrew (7) on strainer (8). Bend lock (9) to secure capscrew.
5. Reposition elbow (3) and install new gasket (4) and elbow to oil pump (5) with two capscrews (1 and 2).



386-201

6. Install engine oil pan (WP 0031 00).
7. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

EXHAUST MANIFOLD REPLACEMENT

0034 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)

Materials/Parts - Continued

Gasket (9)

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

Turbocharger removed (WP 0046 00)

Fuel injection lines removed (WP 0041 00)

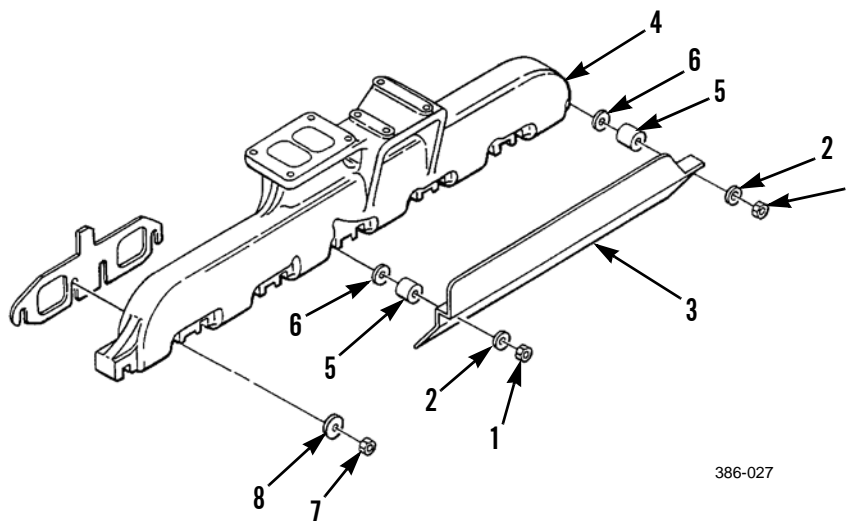
REMOVAL

1. Remove two nuts (1), washers (2) and heat shield (3) from exhaust manifold (4).

NOTE

Note position of spacers and washers to ensure correct installation.

2. Remove two spacers (5), washers (6) from exhaust manifold (4).



386-027

REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may cause injury.

NOTE

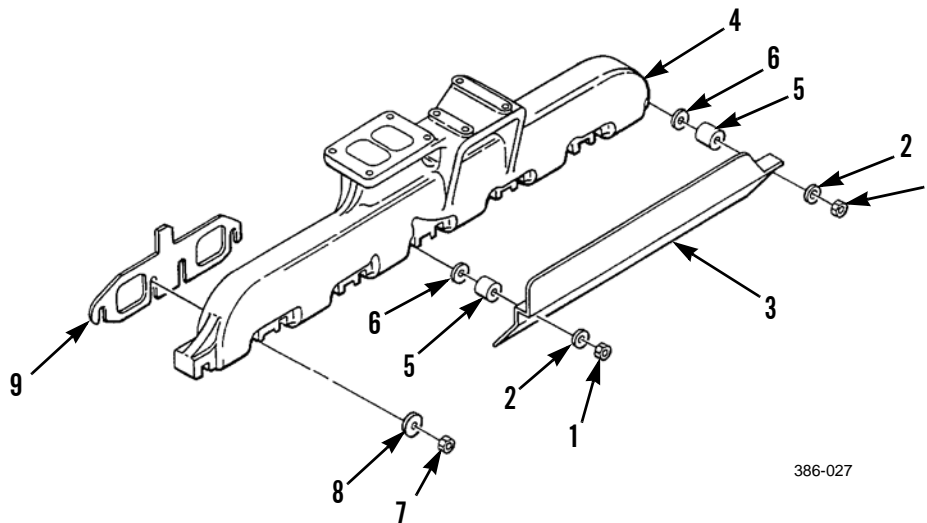
Exhaust manifold weighs 37 lb (17 kg).

3. Remove ten nuts (7) and washers (8) that hold exhaust manifold (4) to cylinder head.
4. Remove exhaust manifold (4) and three gaskets (9). Discard gaskets.

INSTALLATION**NOTE**

- If exhaust manifold studs are loose or if new exhaust manifold studs are installed, apply anti-seize compound on threads to be installed in cylinder head and tighten studs to 20 lb-ft (27 Nm).
- Ensure mating surfaces on exhaust manifold and cylinder head are clean and dry.

1. Install three new gaskets (9) on exhaust manifold studs.
2. Apply antiseize compound on threads of exhaust manifold studs.



386-027

INSTALLATION - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may cause injury.

NOTE

To ensure correct tightening, start with inner nuts and move to the outside.

3. Position exhaust manifold (4) on studs and install ten washers (8) and nuts (7). Tighten nuts to 32 lb-ft (43 Nm).
4. Install two washers (6) and spacers (5) in location as noted during removal.
5. Install heat shield (3) on exhaust manifold (4) with two washers (2) and nuts (1). Tighten nuts to 32 lb-ft (43 Nm)
6. Install fuel injection lines (WP 0041 00).
7. Install turbocharger (WP 0046 00).
8. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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REAR ACCESSORY DRIVE GEARS REPLACEMENT

0035 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

References

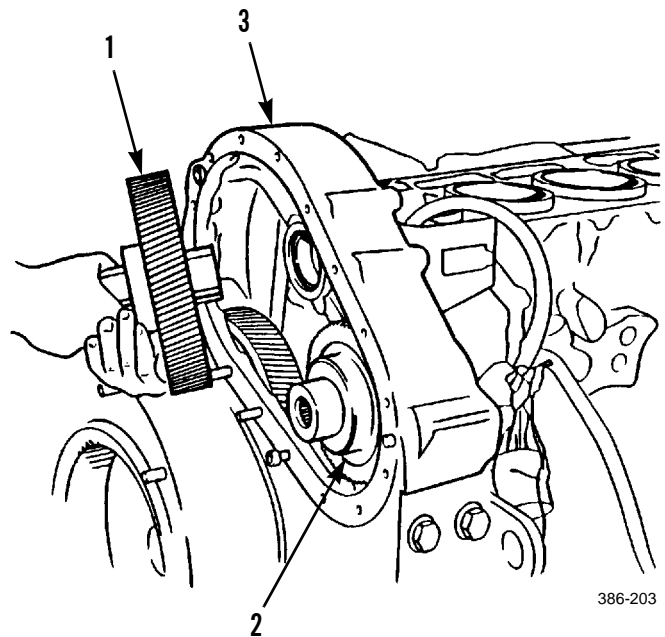
TM 5-2410-233-10

Equipment Condition

Rear accessory drive cover assembly removed (WP 0036 00)

REMOVAL

1. Remove drive gear (1) and then drive gear (2) from flywheel housing (3).



386-203

REAR ACCESSORY DRIVE GEARS REPLACEMENT - CONTINUED

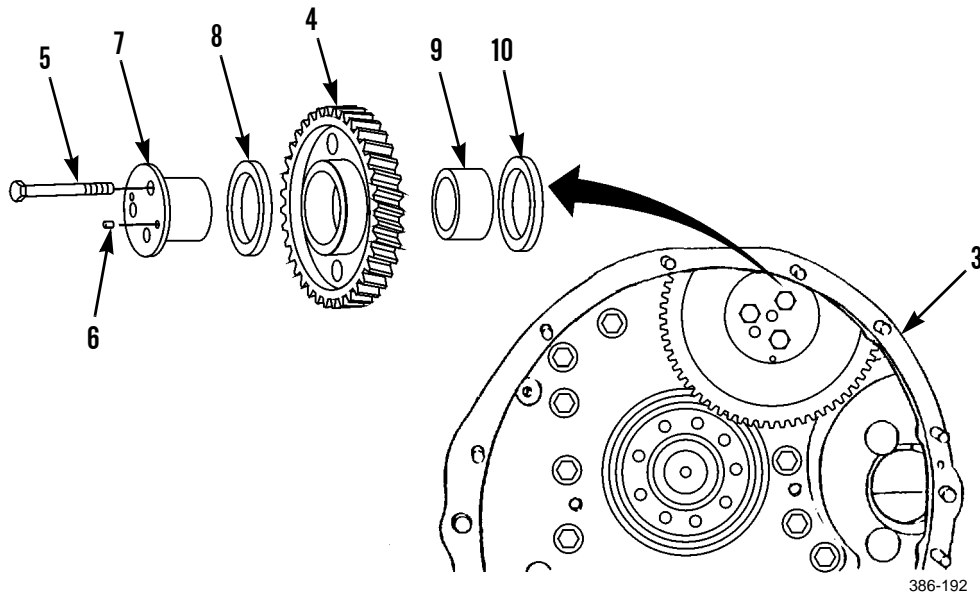
0035 00

REMOVAL - CONTINUED

2. If idler gear (4) is to be removed, perform the following steps:
 - a. Remove three capscrews (5), dowel (6), shaft (7), washer (8) and idler gear (4) from flywheel housing (3).
 - b. If necessary, use a bearing puller to remove bearing (9) and washer (10) from flywheel housing (3).

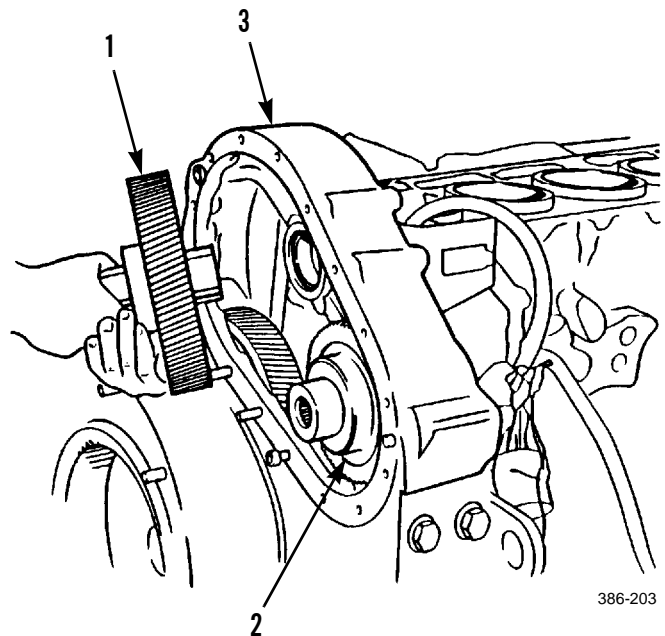
INSTALLATION

1. To install idler gear (4), perform the following steps:
 - a. Use driver to install bearing (9) and washer (10) into flywheel housing (3).
 - b. Place idler gear (4), washer (8), shaft (7) and dowel (6) into position. Install three capscrews (5) that secure shaft assembly to flywheel housing (3).



386-192

2. Install drive gear (2) and then drive gear (1) into flywheel housing (3).
3. Install rear accessory drive gear cover assembly (WP 0036 00).
4. Run engine and check for proper operation (TM 5-2410-233-10).



386-203

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Gasket (5)

Seal (6)

References

TM 5-2410-233-10

Equipment Condition

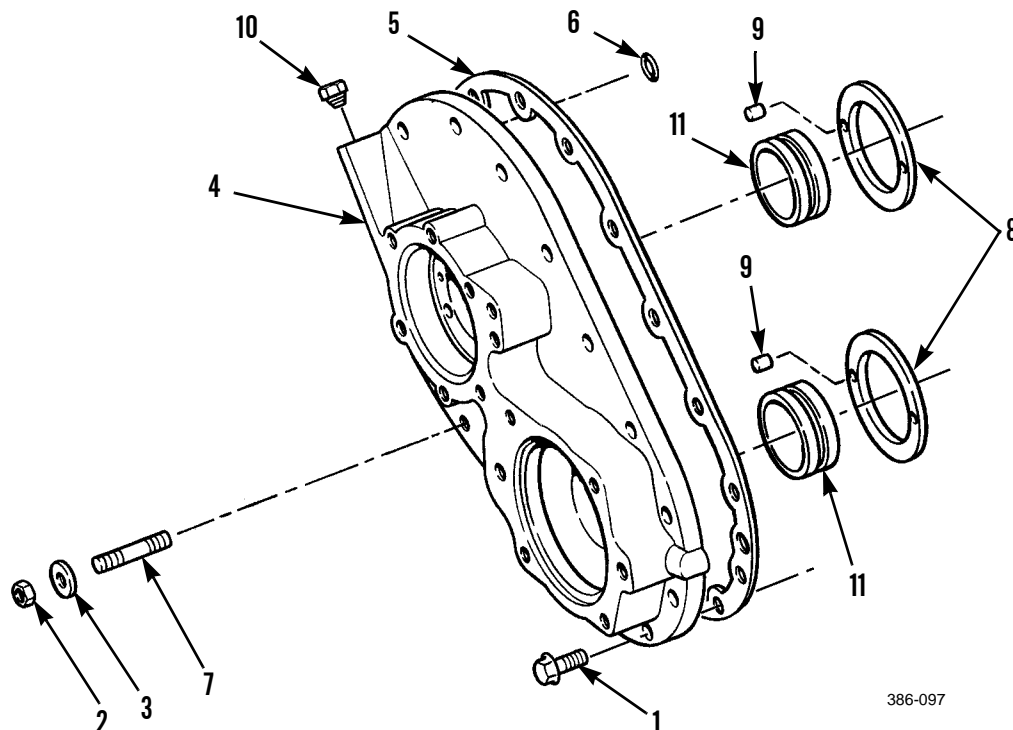
Right-front floor plate removed (WP 0135 00)

Hydraulic pump removed (WP 0148 00)

Winch gear pump removed (WP 0147 00)

REMOVAL

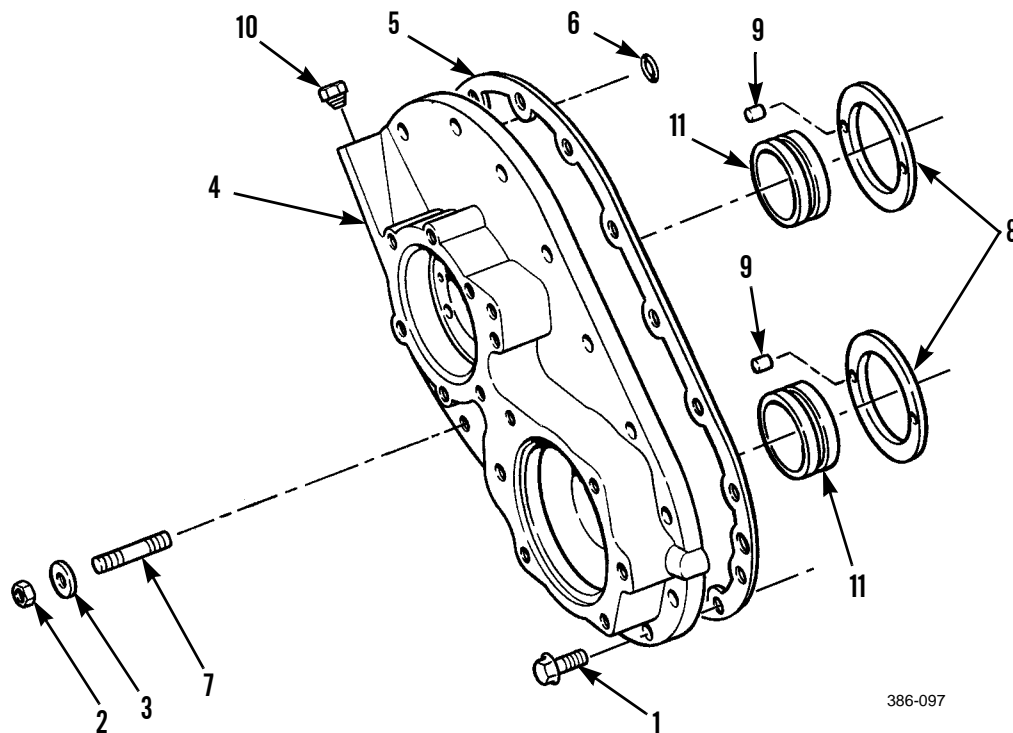
1. Remove 13 capscrews (1), three nuts (2) and washers (3). Remove cover (4).
2. Remove gasket (5) and seal (6). Discard gasket and seal.
3. If necessary, remove three studs (7) from flywheel housing.
4. If necessary, remove two washers (8), pins (9) and plug (10). Use a bearing puller to remove two bearings (11) from cover (4).



386-097

INSTALLATION

1. If removed, install two bearings (11) and pins (9) into cover (4) and place two washers (8) onto pins. Install plug (10).
2. If removed, insert three studs (7) into flywheel housing.
3. Install new seal (6) and new gasket (5) on cover (4).
4. Install cover (4) on three studs (7) on flywheel housing. Secure cover on studs with three washers (3) and nuts (2).
5. Install 13 capscrews (1) around cover (4).



386-097

6. Install winch gear pump (WP 0147 00).
7. Install hydraulic pump (WP 0148 00).
8. Install right-front floor plate (WP 0135 00).
9. Run engine and check for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

FUEL INJECTION NOZZLE REPLACEMENT

0037 00

THIS WORK PACKAGE COVERSRemoval, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanics (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Nozzle puller group (Item 48, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Seal, carbon (4)

Washer (5)

References

TM 5-2410-233-10

WP 0038 00

Equipment ConditionFuel injection line disconnected (WP 0041 00)

**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

CAUTION

Use caution to ensure fuel system does not become contaminated. Keep work area clean. Install protective caps and plugs as needed. Contamination of fuel system could result in premature failure.

NOTE

Use a suitable container to catch any fuel that may drain from system. Dispose of fuel IAW local policy and ordinances. Ensure all spills are cleaned up.

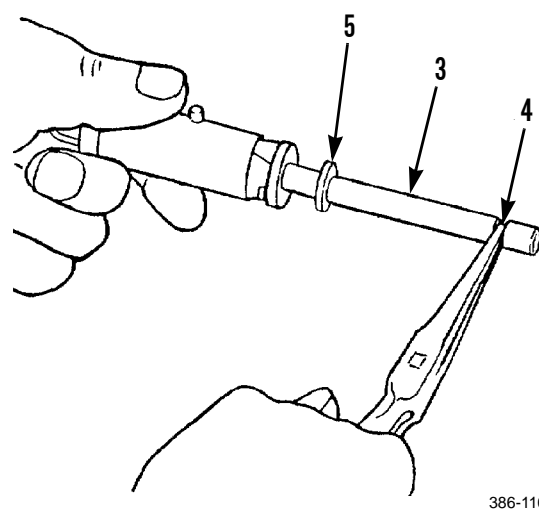
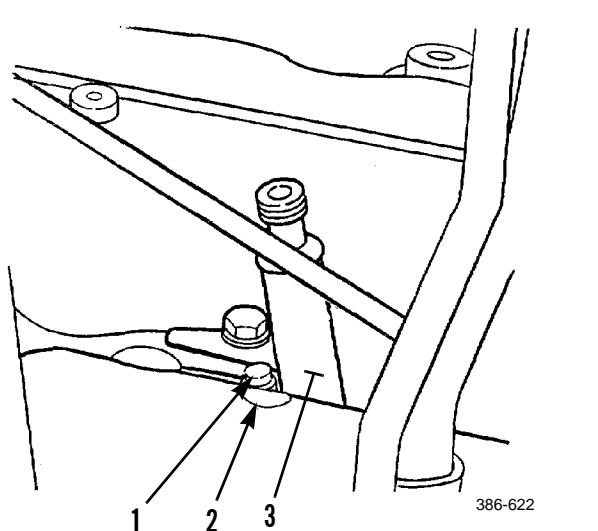
REMOVAL

1. Remove capscrew (1) and clamp (2) from fuel injection nozzle (3).

CAUTION

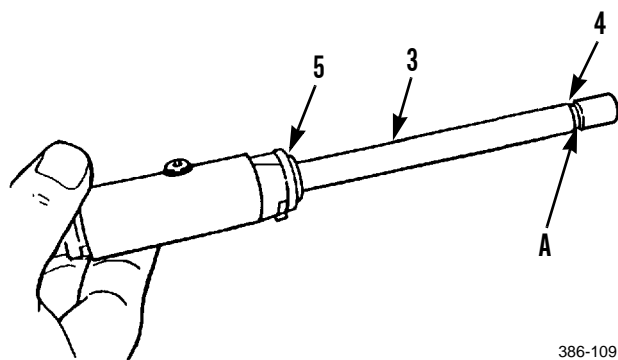
- Ensure puller tool is in alignment with fuel injection nozzle. This will prevent distortion of nozzle which can cause it to bend or break off during removal.
- Do not exceed 150 lb-ft (200 Nm) force on puller tool.

2. Position puller tool on fuel injection nozzle (3) and remove nozzle from cylinder head.
3. Remove carbon seal (4) from fuel injection nozzle (3). Discard carbon seal.
4. Remove washer (5) from fuel injector nozzle (3). Discard washer.



INSTALLATION

1. Install new washer (5) on fuel injection nozzle (3).
2. Install new carbon seal (4) in groove A on fuel injection nozzle (3).
3. Insert fuel injection nozzle (3) in cylinder head.
4. Install clamp (2) and capscrew (1) to secure fuel injection nozzle (3).



5. Connect fuel injection line (WP 0041 00).
6. Bleed air from fuel system (WP 0038 00).
7. Run engine and check for leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

FUEL PRIMING PUMP REPLACEMENT

0038 00

THIS WORK PACKAGE COVERS

Removal, Installation, Priming Fuel System

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Gasket (4)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

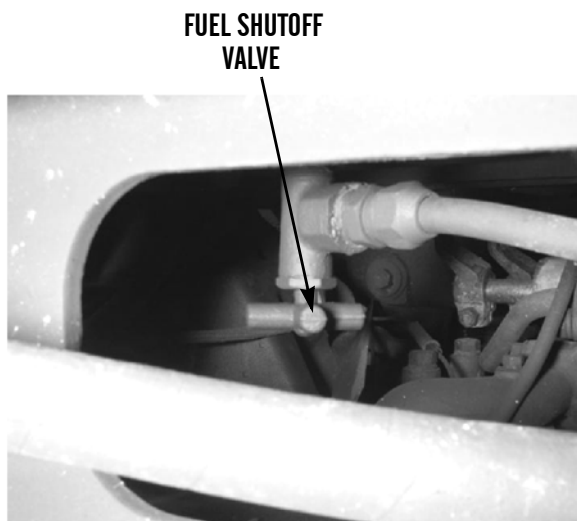


WARNING

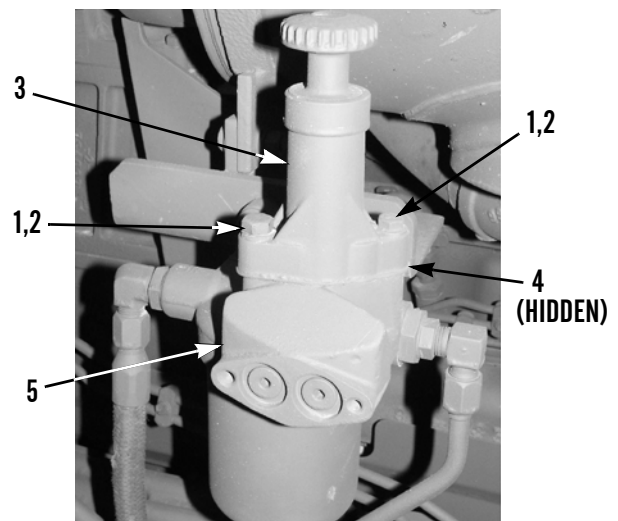
Do not perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

REMOVAL

1. Turn fuel shutoff valve at bottom of fuel tank to OFF position.
2. Remove two capscrews (1) and washers (2).
3. Remove fuel priming pump (3) and gasket (4) from primary fuel filter base (5). Discard gasket.



386-124



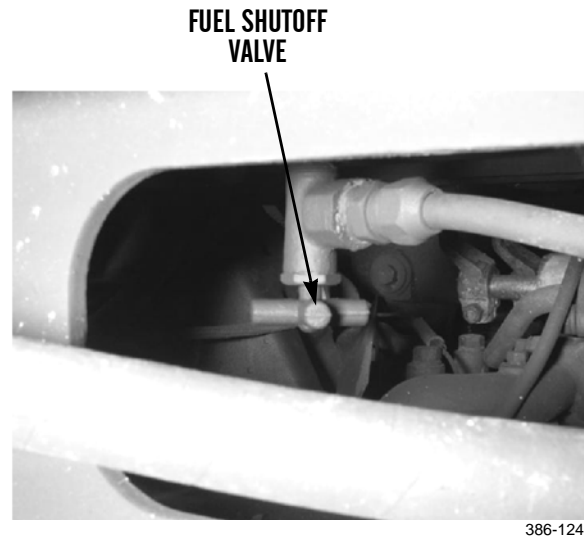
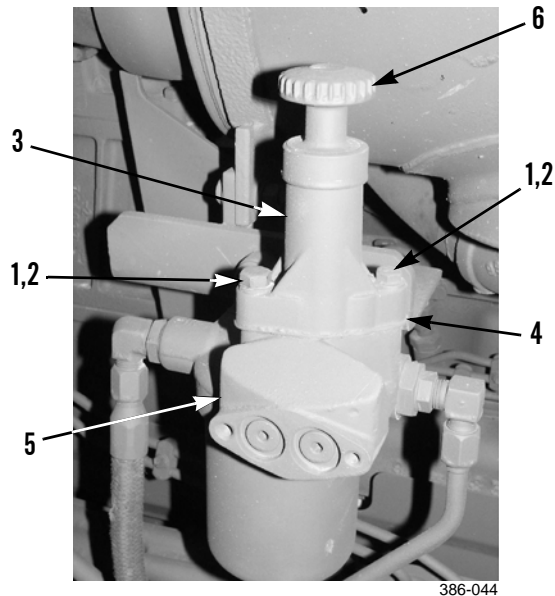
386-044

FUEL PRIMING PUMP REPLACEMENT - CONTINUED

0038 00

INSTALLATION

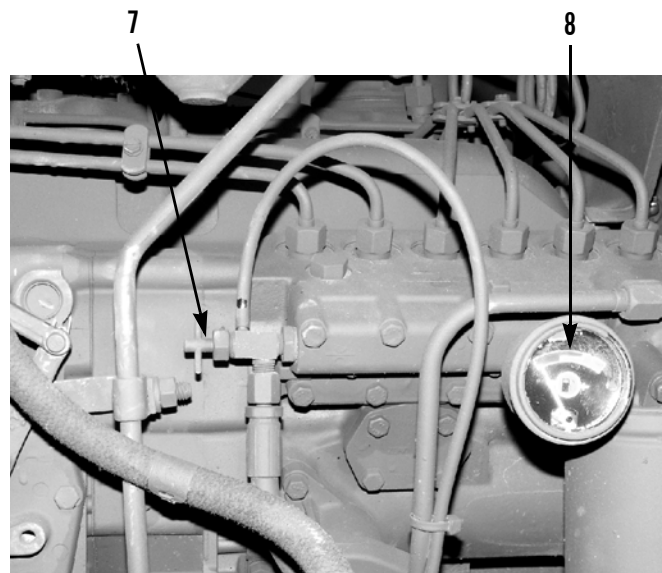
1. Position new gasket (4) and fuel priming pump (3) on primary fuel filter base (5).
2. Install two capscrews (1) and washers (2).
3. Turn fuel shutoff valve to ON position.



4. Prime fuel system. Refer to *Priming Fuel System* in this work package.

PRIMING FUEL SYSTEM

1. Unscrew knob (6) on fuel priming pump (3) until it is free to pump.
2. Place a suitable container under fuel system bleed valve drain hose and open fuel system bleed valve (7).
3. Pump several times. System is primed when fuel pressure gage (8) returns to zero immediately after pumping has stopped and fuel flows from bleed valve (7) without air bubbles.
4. Tighten knob (6) and close bleed valve (7).
5. Run engine and check for proper operation and fuel leaks (TM 5-2410-233-10).

**END OF WORK PACKAGE**

FUEL TRANSFER PUMP REPLACEMENT

0039 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 24, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Tag, marker (Item 35, WP 0184 00)

O-ring (8)

Packing, preformed (3)

References

WP 0038 00

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

Battery disconnect switch in OFF position (TM 5-2410-233-10)

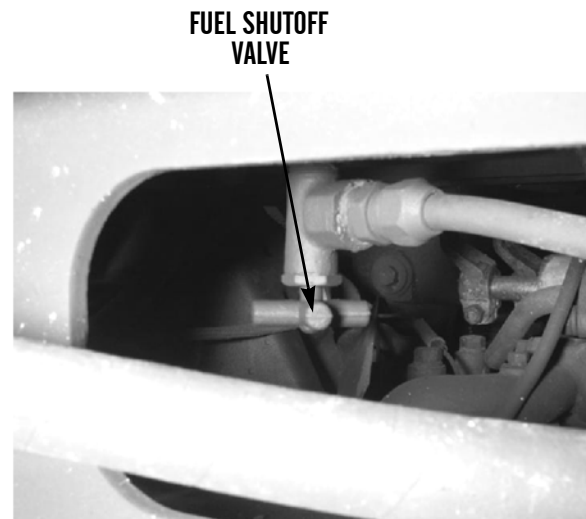
REMOVAL**WARNING**

Do not perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

CAUTION

Use caution to ensure fuel system does not become contaminated. Keep work area clean. Install protective caps and plugs as needed. Contamination of fuel system could result in premature failure.

1. At bottom of fuel tank, turn fuel shutoff valve to OFF position.

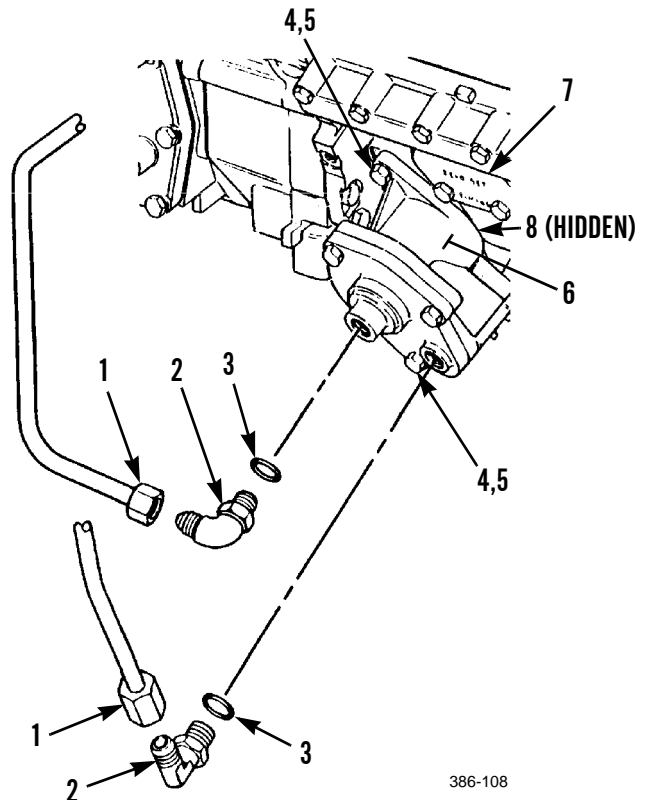


386-124

REMOVAL - CONTINUED**NOTE**

Tag fuel lines and fittings to ensure correct installation.

2. Disconnect two fuel lines (1) from elbows (2).
3. Remove two elbows (2) and preformed packings (3). Discard preformed packings.
4. Remove two capscrews (4) and washers (5) and remove fuel transfer pump (6) from fuel injection pump housing (7).
5. Remove O-ring (8) from fuel transfer pump (6). Discard O-ring (TM 5-2410-233-10).



386-108

INSTALLATION**NOTE**

Apply a thin coat of clean oil to new O-rings and preformed packings before installation.

1. Install new O-ring (8) on fuel transfer pump (6).
2. Position fuel transfer pump (6) on fuel injection pump housing (7). Install two washers (5) and capscrews (4).
3. Install new preformed packings (3) on elbows (2). Install elbows on fuel transfer pump (6).
4. Connect two fuel lines (1) to elbows (2).
5. Turn fuel shutoff valve to ON position.
6. Prime fuel system (WP 0038 00).
7. Run engine and check fuel transfer pump for proper operation and fuel leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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CYLINDER CUTOUT TEST

0040 00

THIS WORK PACKAGE COVERS

Test

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Rag, wiping (Item 28, WP 0184 00)

References

WP 0006 00

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

TEST**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to machine and injury or death to personnel or equipment damage.

CAUTION

- Use caution to ensure fuel system does not become contaminated. Keep work area clean. Contamination of fuel system could result in premature failure.
- Utilize line wrenches for removal of injector lines to avoid damage to fittings and connectors.

NOTE

Use a suitable container to catch any fuel that may drain from system. Dispose of fuel IAW local policy and ordinances. Ensure all spills are cleaned up.

**WARNING**

Eye protection must be worn when performing this test procedure. Failure to take precautions could cause injury to personnel.

NOTE

This on-vehicle test can be performed to find cylinder that is misfiring and causing erratic engine idle and black exhaust smoke.

1. While running engine at an RPM that makes symptom most evident, loosen fuel line nut at a fuel injection nozzle. This will stop flow of fuel to that cylinder.
2. Listen for a change in engine idle speed or for idle to become more erratic.
 - a. If change occurs, tighten fuel line nut and go to step 3.
 - b. If no change occurs, this cylinder is misfiring.
3. Repeat step 1 and 2 for each injector to be tested.
4. Record results of test and return to troubleshooting, if required (WP 0006 00).

END OF WORK PACKAGE

FUEL INJECTION LINES AND FITTINGS REPLACEMENT

0041 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Materials/Parts - Continued

Tag, marker (Item 35, WP 0184 00)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

Battery disconnect switch in OFF position (TM 5-2410-233-10)

**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

REMOVAL

1. At bottom of fuel tank, turn fuel shutoff valve to OFF position.

FUEL SHUTOFF

386-124

REMOVAL - CONTINUED**WARNING**

Use care in removal of fuel injection lines to prevent twisting or bending of lines, which can affect fuel flow to engine or cause fuel leaks and possible fire. Failure to follow this warning may cause injury or death.

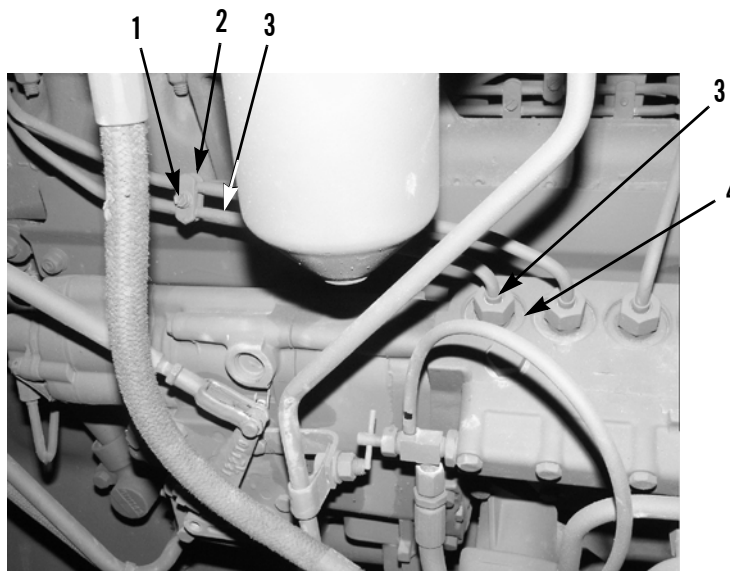
CAUTION

- Cap all fuel injection lines and plug all openings in fuel metering pump after removal to prevent dirt from getting into fuel system. Contamination of fuel system could result in premature failure.
- Fuel injection nozzles can be permanently damaged by twisting, if only one wrench is used to loosen or tighten fuel injection line nuts. Use one wrench to hold nozzle and a second wrench to loosen nut.

NOTE

- Use line wrenches when removing fuel injection lines.
- Removal procedures for all clamps securing fuel injection lines are the same. Tag and mark location of each clamp assembly to ensure correct installation.
- Removal procedures for fuel injection lines from fuel components are the same. Tag and mark routing and location of each fuel line removed, to ensure correct installation.

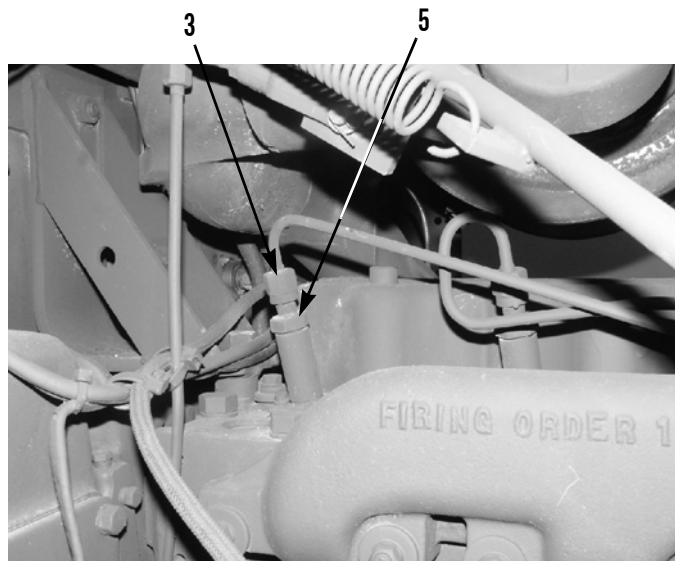
1. Remove capscrews (1) and clamps (2) from fuel injection line (3).
2. Disconnect fuel injection line (3) from fuel injection pump (4).



386-777

REMOVAL - CONTINUED

3. Disconnect fuel injection line (3) from fuel injection nozzle (5).
4. Remove fuel injection line (3) from machine.
5. Repeat steps (1 through 4) for all other fuel injection lines (3).



386-776

INSTALLATION**WARNING**

Use care in installation of fuel injection lines to prevent twisting or bending of lines, which can affect fuel flow to engine or cause fuel leaks and possible fire. Failure to follow this warning may cause injury or death.

CAUTION

- Make sure fuel injection lines are clean and dry. Remove plugs and caps only as lines are installed to prevent dirt from getting into fuel system. Contamination of fuel system could result in premature failure.
- Fuel injection nozzles can be permanently damaged by twisting, if only one wrench is used to tighten fuel injection line nuts. Use one wrench to hold nozzle and a second wrench to tighten nut.

NOTE

- Use line wrenches when installing fuel injection lines.
- Installation procedures for fuel injection lines to fuel components are the same. Use tags from removal, to ensure correct routing and location of each fuel line.
- Installation procedure for all clamps securing fuel injection lines are the same. Use tags from removal, to ensure correct routing and location of all fuel lines.

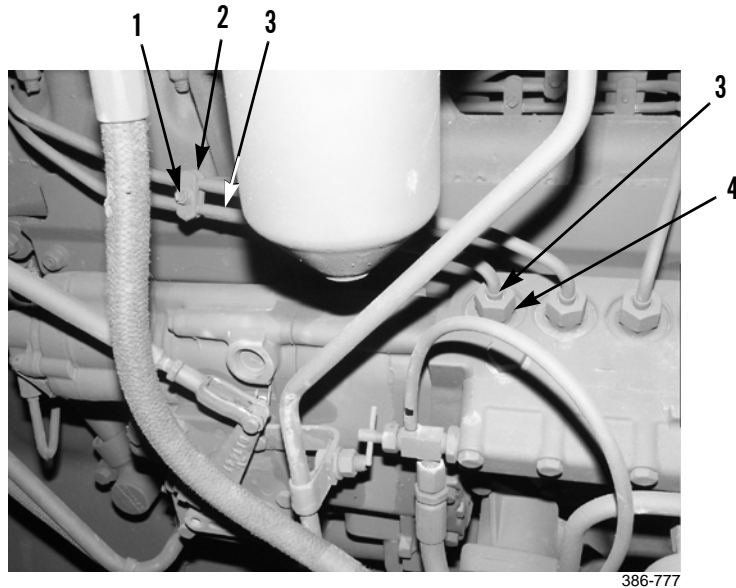
1. Route and position fuel injection line (3).
2. Install one end of fuel line (3) to fuel injection nozzle (5). Tighten fuel line nut to 30 lb-ft (41 Nm).

FUEL INJECTION LINES AND FITTINGS REPLACEMENT - CONTINUED

0041 00

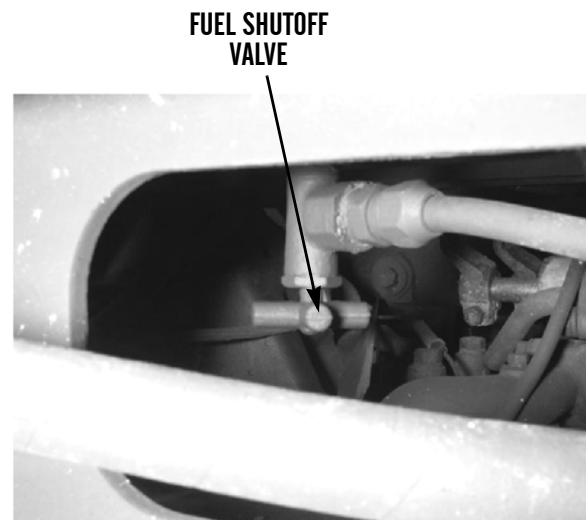
INSTALLATION - CONTINUED

3. Install other end of fuel injection line (3) on fuel injection pump (4). Tighten fuel line nut to 30 lb-ft (41 Nm).
4. Install clamps (2) on fuel injection line (3) with capscrews (1). Tighten capscrews to 108 lb-in. (12 Nm).
5. Repeat steps 1 and 4 for all other fuel injection lines (3).



386-777

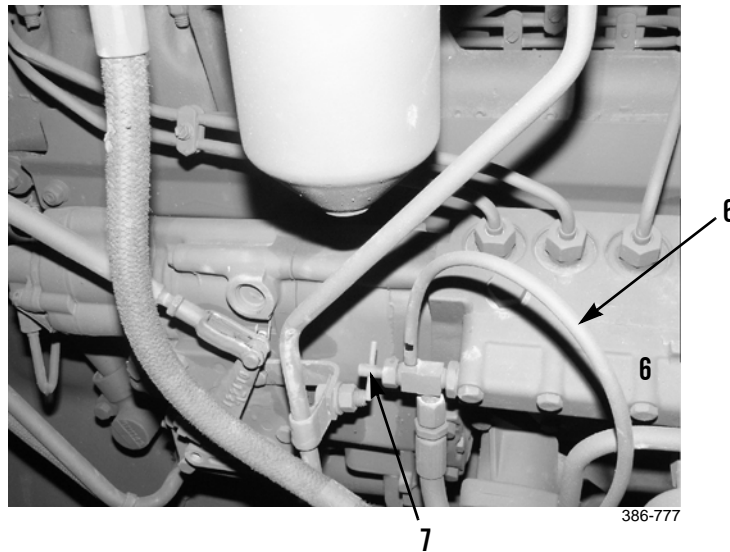
6. At bottom of fuel tank, turn fuel shutoff valve to ON position.



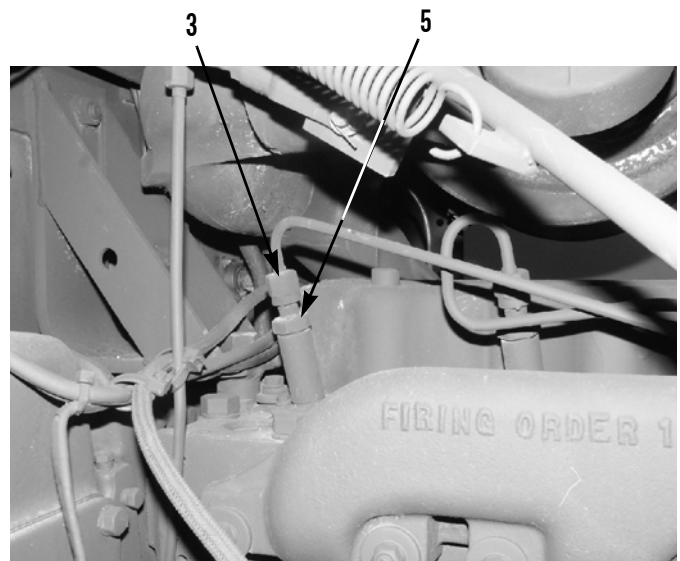
386-124

INSTALLATION - CONTINUED

7. Bleed air from fuel system as follows:
 - a. Place a suitable container under drain hose (6) at fuel system bleed valve petcock (7).
 - b. Open fuel system bleed valve petcock (7).
 - c. Operate fuel priming pump until no air bubbles can be seen in fuel.
 - d. Close fuel system bleed valve petcock (7).



- e. Loosen nut of fuel injection line (3) to fuel injection nozzle (5) at cylinder no. 6.
- f. Operate fuel priming pump until no air bubbles can be seen at fuel injection nozzle (5).
- g. Tighten fuel injection line nut at fuel injection nozzle (5) to 30 lb-ft (41 Nm).
- h. Repeat steps e, f and g, working from fuel injection nozzle (5) at cylinder no. 5 to cylinder no. 1.



8. Run engine and check for proper operation and fuel leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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AIR CLEANER FILTER ELEMENTS REPLACEMENT

0042 00

THIS WORK PACKAGE COVERS

Removal, Cleaning and Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Detergent (Item 10, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Gasket (4) (as required)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

REMOVAL



WARNING

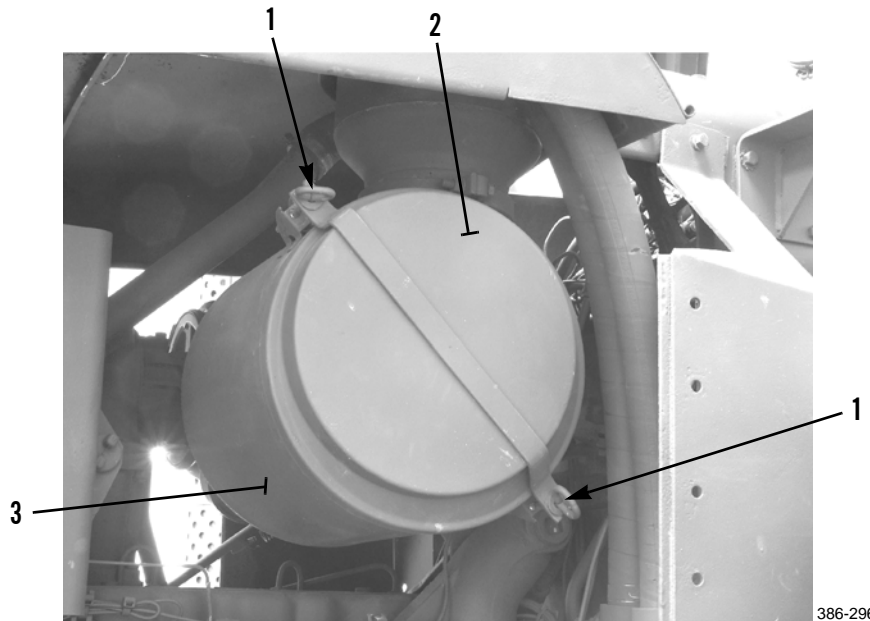


- If NBC exposure is suspected, personnel wearing protective equipment should handle all air cleaner media. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.
- NBC contaminated filters must be handled using adequate precautions and must be disposed of by trained personnel.
- Failure to follow this warning may cause injury or death.

CAUTION

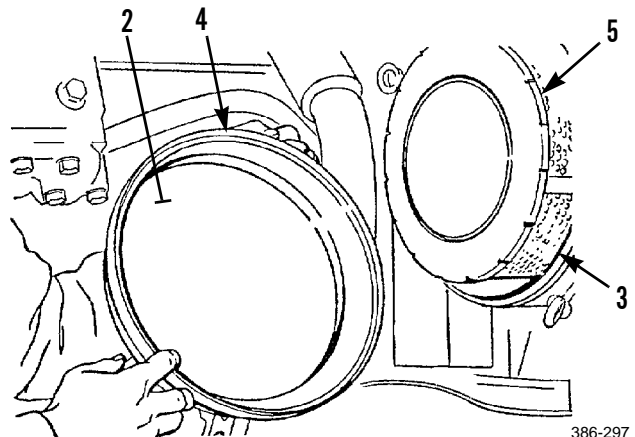
Never service air cleaner with engine running. Engine damage could result if service is performed with engine running.

1. Loosen two eye bolts (1) and remove cover (2) from air cleaner housing (3).



386-296

2. Inspect gasket (4) on inside of cap assembly (2). Remove and discard gasket only if damaged.
3. Remove primary filter element (5) from air cleaner housing (3).
4. Use a lint-free rag to thoroughly clean inside of air cleaner housing (3).

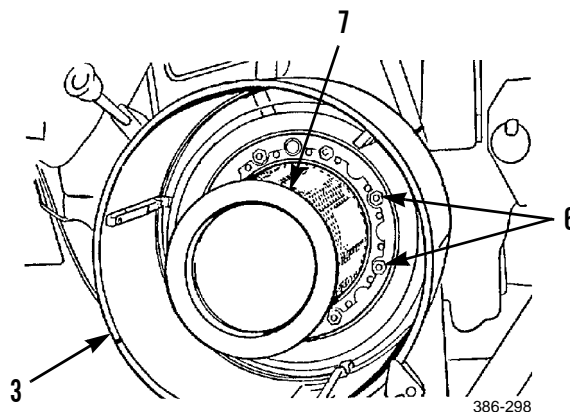


386-297

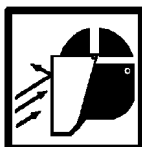
REMOVAL - CONTINUED**CAUTION**

If secondary filter element is difficult to remove, gasket on bottom of secondary filter element may be sticking to air cleaner housing. Ensure this area on filter housing is thoroughly cleaned prior to installation of secondary filter element to prevent an air leak past secondary filter.

- Remove eight nuts (6) and secondary filter element (7) from studs inside air cleaner housing (3).

**CLEANING AND INSPECTION**

- Check sealing surfaces on filter elements for dirt on the “clean” side. If this is evident, problem may be a damaged filter element, incorrect element fit or the need for cleaning and/or repair of gasketed surfaces.

**WARNING**

Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may cause injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

CAUTION

To prevent damage, do **NOT** clean primary filter element by bumping or tapping.

NOTE

- Use a light inside primary filter element to inspect filter for tears, holes or other damage before and after each cleaning process.
 - Discard primary filter element if any damage is evident.
- Direct compressed air inside primary filter element, along length of filter pleats.
 - Direct compressed air outside, along length of filter pleats.
 - Repeat step 2.

CLEANING AND INSPECTION - CONTINUED**CAUTION**

To prevent primary filter element damage, use a maximum of 40 psi (276 kPa) water pressure.

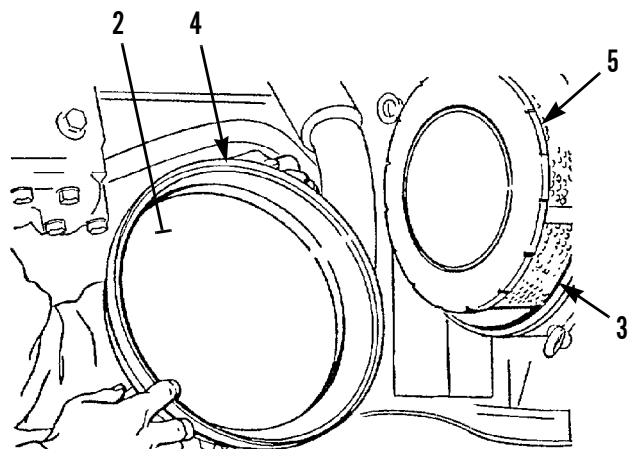
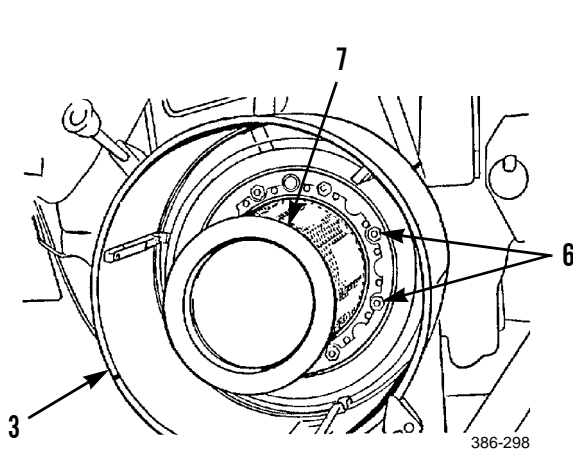
5. Direct water inside primary filter element, along length of filter pleats.
6. Direct water outside along length of pleats. Rinse and air dry primary filter element thoroughly.
7. Wash primary filter element in warm water and non-sudsing household detergent.
8. Rinse with clean water and air dry thoroughly.

INSTALLATION**CAUTION**

DO NOT attempt to reuse secondary filter element by cleaning.

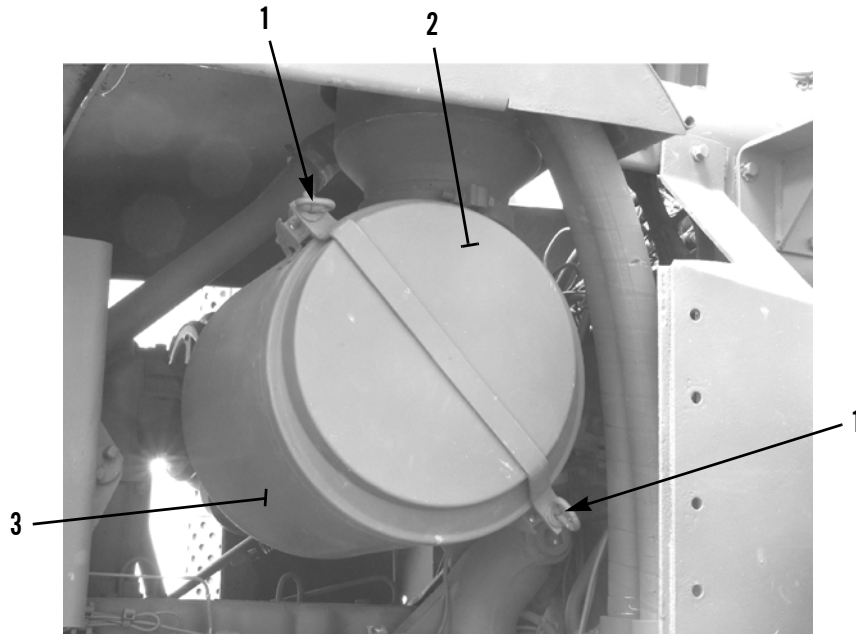
NOTE

- Primary filter element should be replaced once each year or after being cleaned a maximum of 6 times.
 - If indicator shows RED shortly after installation of primary filter element, which has been cleaned approximately 6 times, replace with another clean primary filter element.
 - If indicator still shows RED shortly after installation of clean primary filter element, change secondary filter element.
 - Replace secondary filter element if damaged or after every third primary filter element replacement.
1. Install secondary filter element (7) on eight studs inside air cleaner housing (3).
 2. Install eight nuts (6) on studs to secure secondary filter element (7). Tighten nuts to 27 lb-ft (37 Nm).
 3. Install primary filter element (5) in air cleaner housing (3).
 4. If removed, install new gasket (4) in cover (2). Position cover on air cleaner housing (3).



INSTALLATION - CONTINUED

- Secure cover (2) on air cleaner housing (3) with two eye bolts (1).



386-296

- Reset air filter indicator by pushing button on bottom of indicator (TM 5-2410-233-10).
- Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Detergent (Item 10, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Gasket (8)

Lockwasher (5)

References

TM 5-2410-233-10

Equipment Condition

Air cleaner filter elements removed (WP 0042 00)



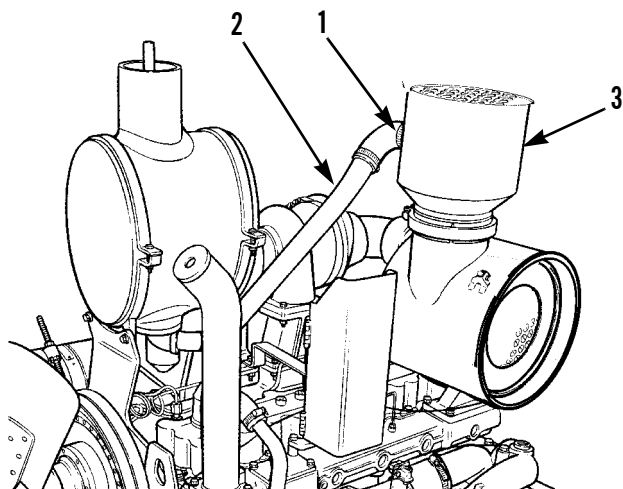
WARNING



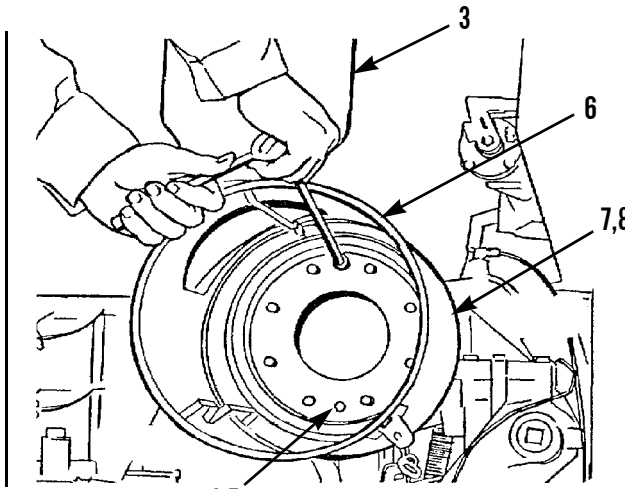
- If NBC exposure is suspected, personnel wearing protective equipment should handle all air cleaner media. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.
- NBC contaminated filters must be handled using adequate precautions and must be disposed of by trained personnel.
- Failure to follow this warning may cause injury or death.

REMOVAL

1. Loosen hose clamp (1) securing dust ejector tube (2) to filter body assembly (3). Remove tube.
2. Remove two capscrews (4) and lockwashers (5), slide air cleaner housing (6) off studs in air cleaner outlet pipe (7), and rotate slightly and remove from engine. Discard lockwashers.
3. Remove gasket (8) from pipe assembly (7). Discard gasket.



386-113



386-234

DISASSEMBLY

1. Loosen nut (9), capscrew (10) and clamp (11) from filter body assembly (3) and air cleaner housing (6).
2. Remove filter body assembly (3) and clamp (11) from air cleaner housing (6).

CLEANING

1. Using a rag, wipe air cleaner housing clean.

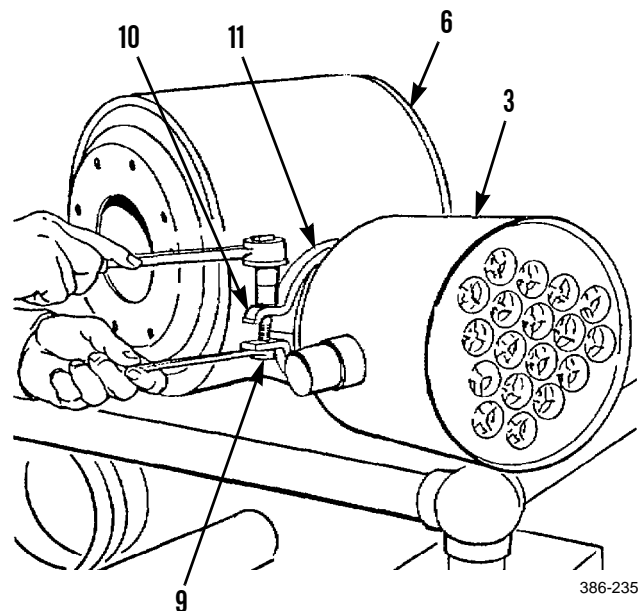
**WARNING**

Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may result in serious injury or death to personnel. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

2. Clean filter body assembly with compressed air, a stiff fiber brush or wash in detergent. Dry all parts before installation.

ASSEMBLY

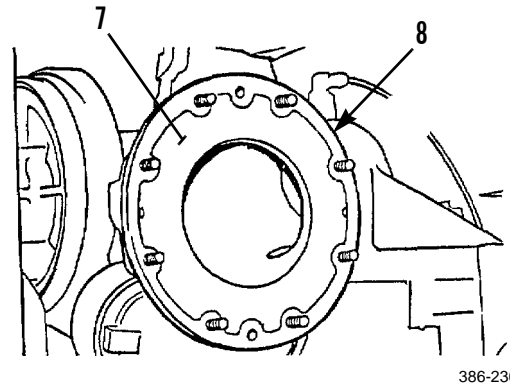
1. Install clamp (11) on filter body assembly (3) and assemble filter body assembly onto air cleaner housing (6).
2. Tighten capscrew (10) and nut (9) to secure filter body assembly (3) to air cleaner housing (6).



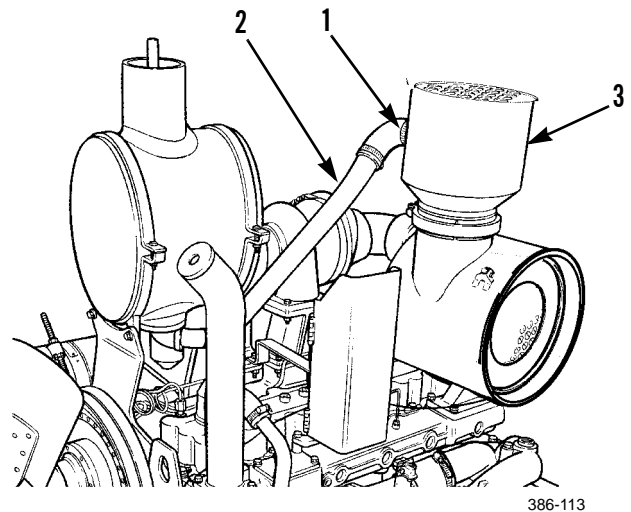
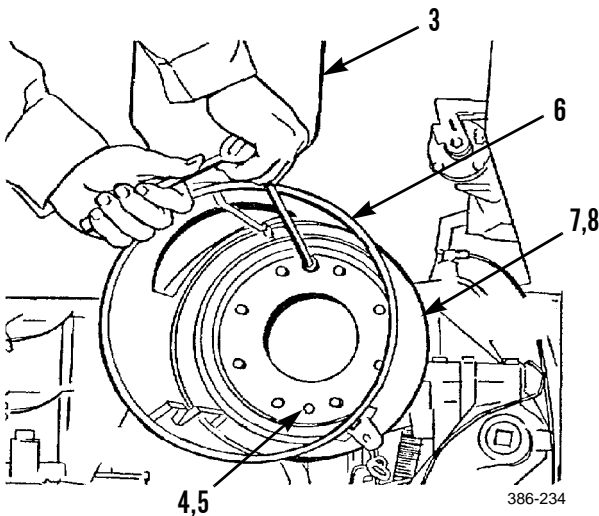
386-235

INSTALLATION

1. Install new gasket (8) over studs on air cleaner outlet pipe (7).



2. Position air cleaner housing (6) with filter body assembly (3) inserted up through opening in hood. Align eight holes in air cleaner housing with eight studs in air cleaner outlet pipe (7) and slide housing onto studs.
3. Install two new lockwashers (5) and capscrews (4). Tighten capscrews.
4. Slide tube (2) onto filter body assembly (3) and tighten hose clamp (1).



5. Install air cleaner filter elements (WP 0042 00).
6. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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ENGINE AIR CLEANER PRECLEANER REPLACEMENT

0044 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Rag, wiping (Item 28, WP 0184 00)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)



WARNING



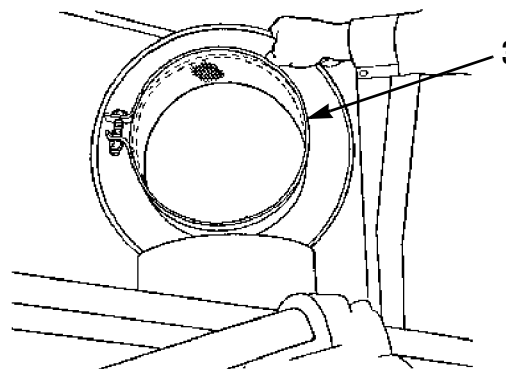
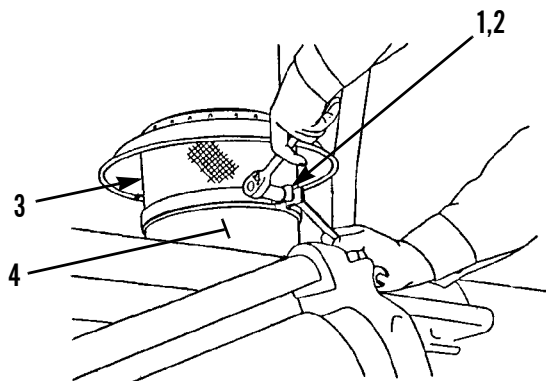
- If NBC exposure is suspected, personnel wearing protective equipment should handle all air cleaner media. Consult your NBC Officer or NBC NCO for appropriate handling or disposal procedures.
- NBC contaminated filters must be handled using adequate precautions and must be disposed of by trained personnel.
- Failure to follow this warning may cause injury or death.

REMOVAL

1. Loosen nut (1) and capscrew (2) securing precleaner (3) to filter body assembly (4).
2. Remove precleaner (3) from filter body assembly (4).

CLEANING

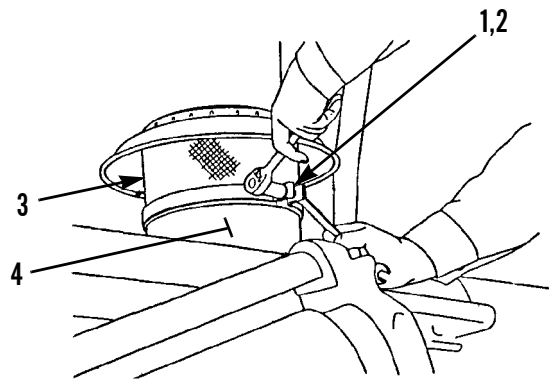
1. Remove all debris from precleaner (3).
2. Wipe precleaner (3) clean with a rag.



386-238

INSTALLATION

1. Position precleaner (3) onto filter body assembly (4).
2. Tighten capscrew (2) and nut (1).



386-826

END OF WORK PACKAGE

AIR CLEANER DUST EJECTOR REPLACEMENT

0045 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Equipment Condition

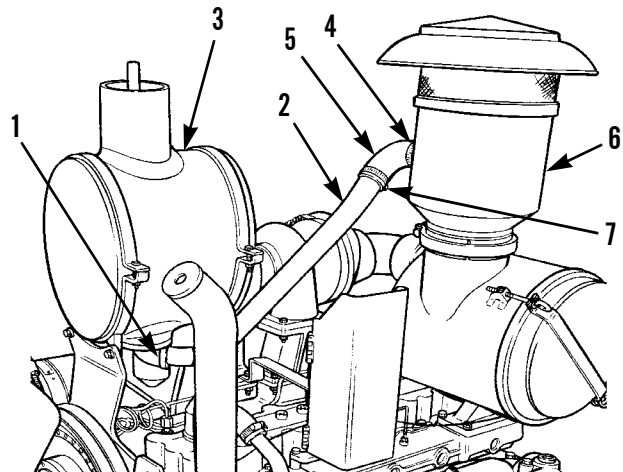
Engine OFF and cool (TM 5-2410-233-10)

REMOVAL

1. Remove two capscrews (1) from air cleaner dust ejector tube (2) at bottom of muffler (3).
2. Loosen hose clamp (4) holding dust ejector hose (5) on filter body (6).
3. Remove dust ejector tube (2) and hose (5) from filter body (6) and muffler (3).
4. Loosen hose clamp (7) and separate dust ejector hose (5) and tube (2).

INSTALLATION

1. Assemble dust ejector tube (2) and hose (5) and tighten hose clamp (7).
2. Slide dust ejector hose (5) onto tube in filter body (6) and tighten clamp (4).
3. Install dust ejector tube (2) to bottom of muffler (3) with two capscrews (1).



386-115

END OF WORK PACKAGE

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TURBOCHARGER ASSEMBLY REPLACEMENT

0046 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)
 Oil, lubricating (Item 23, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Gasket (12 and 15)
 Seal (4)

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

Muffler removed (WP 0058 00)
 Turbocharger oil lines removed (WP 0048 00)
 Air cleaner removed (WP 0043 00)

**WARNING**

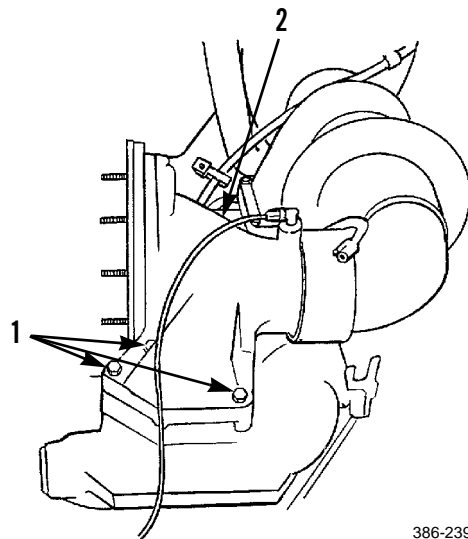
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury or death to personnel.

NOTE

Turbocharger weighs approximately 50 lb (23 kg).

REMOVAL

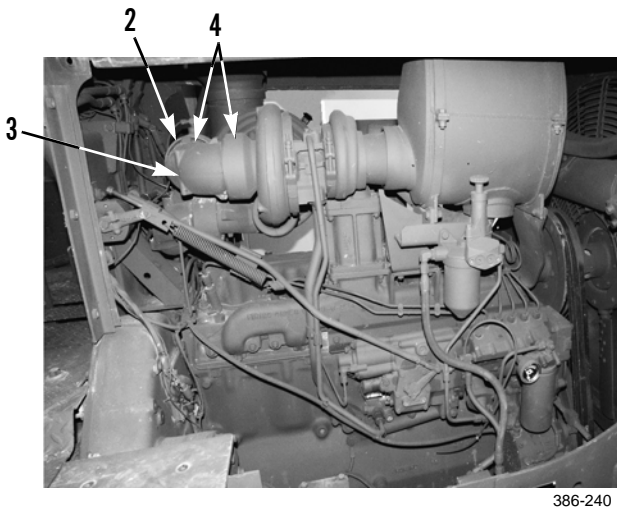
1. Remove four capscrews (1) from air cleaner outlet (2).



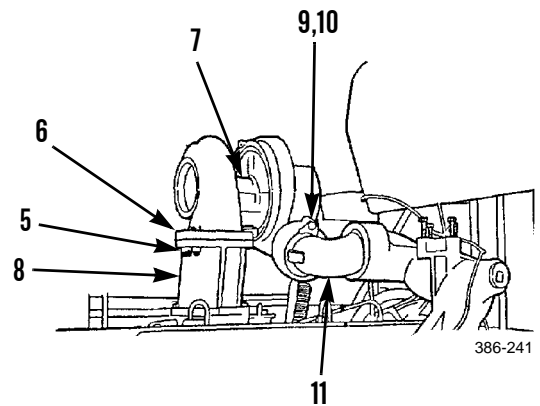
386-239

REMOVAL - CONTINUED

2. Remove air cleaner outlet (2) and turbocharger elbow (3).
3. Remove two seals (4) from each end of elbow (3). Discard seals.
4. Remove four nuts (5) and capscrews (6) from turbocharger (7) and adapter (8).
5. Remove capscrew (9) and retainer (10) from elbow (11) and turbocharger (7).



386-240



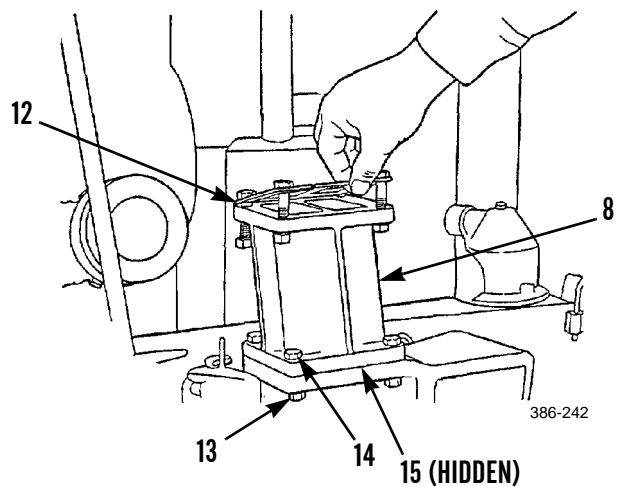
386-241

6. Carefully lift turbocharger (7) off adapter (8) and remove it from elbow (11) on output side of turbocharger (7).
7. Remove gasket (12) from adapter (8). Discard gasket.

NOTE

If it is necessary to remove adapter, use the following procedure.

8. Remove four nuts (13), capscrews (14), adapter (8) and gasket (15). Discard gasket.

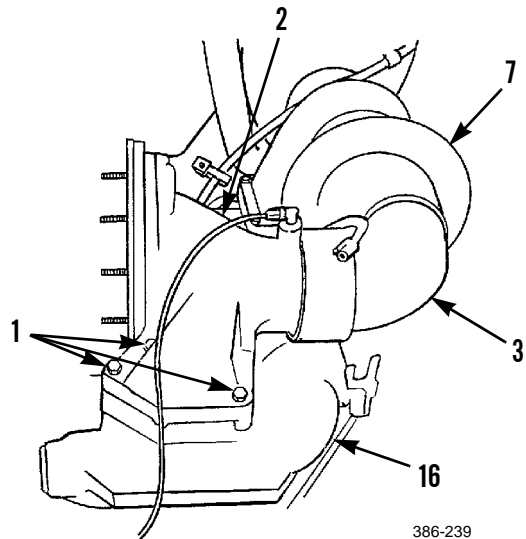


386-242

INSTALLATION**NOTE**

- **If adapter has been removed, perform step 1. If it has not been removed, start installation of turbocharger at step 2.**
- **Wipe all sealing surfaces clean and dry before installing new seals and gaskets. Apply a light film of clean lubricating oil to new seals prior to installation.**

1. Install new gasket (15) and adapter (8) on exhaust manifold with four capscrews (14) and nuts (13).
2. Position new gasket (12) on adapter (8).
3. Position turbocharger (7) on adapter (8) and insert elbow (11) in output side of turbocharger.
4. Apply antiseize compound to four capscrews (6).
5. Align bolt holes in turbocharger (7), gasket (12) and adapter (8). Install four capscrews (6) and nuts (5).
6. Install capscrew (9) and retainer (10) to elbow (11) and turbocharger (7).
7. Install two new seals (4) on each end of turbocharger elbow (3) and insert one end of elbow in air cleaner outlet (2).
8. Insert elbow (3) in turbocharger (7) and install air cleaner outlet (2) on engine intake pipe (16) with four capscrews (1).



9. Install air cleaner (WP 0043 00).
10. Install turbocharger oil lines (WP 0048 00).
11. Install muffler (WP 0058 00)
12. Crank engine for 10 seconds before starting to pre-lubricate turbocharger.
13. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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TURBOCHARGER AIR LINE REPLACEMENT

0047 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)
 Oil, lubricating (Item 23, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Gasket (11)

Materials/Parts - Continued

O-ring (6)
 Seal (3)

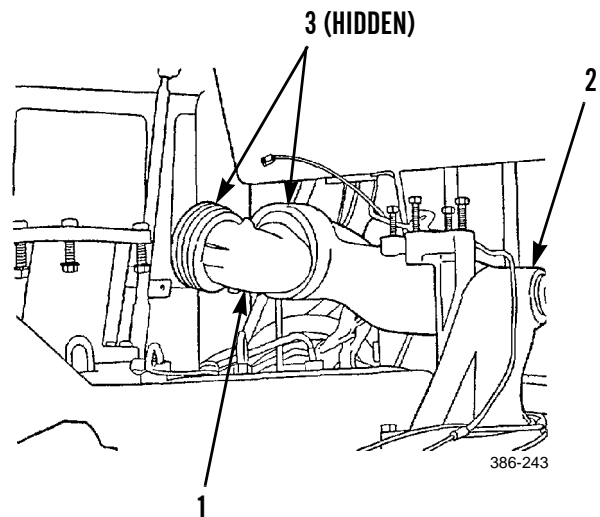
References

TM 5-2410-233-10

Equipment Condition

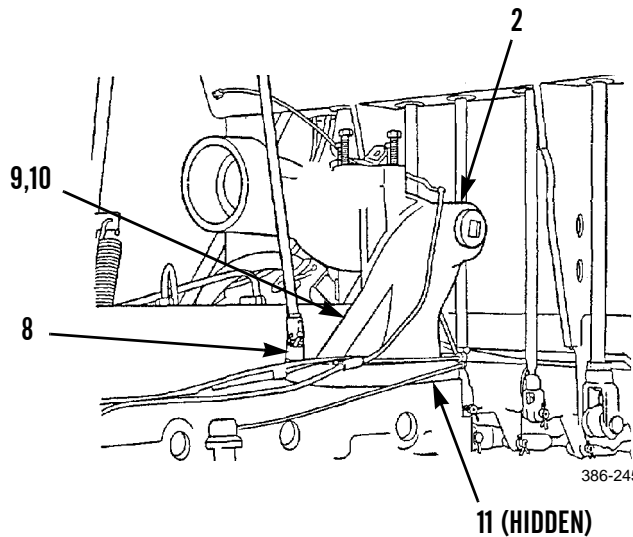
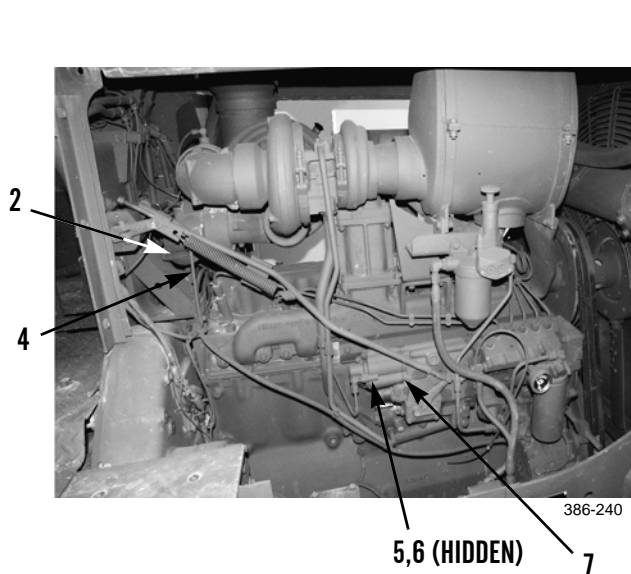
Muffler removed (WP 0058 00)
 Turbocharger oil lines removed (WP 0048 00)
 Turbocharger removed (WP 0046 00)
 Air cleaner removed (WP 0043 00)

1. Remove elbow (1) from engine intake pipe (2). Remove two seals (3) from each end of elbow. Discard seals.



REMOVAL - CONTINUED

2. Remove upper end of tube assembly (4) from engine intake pipe (2).
3. Remove lower end of tube assembly (4), adapter (5) and O-ring (6) from governor (7). Discard O-ring.
4. Remove five short capscrews (8), long capscrew (9), washer (10), engine intake pipe (2) and gasket (11) from intake manifold. Discard gasket.



INSTALLATION

NOTE

- **Wipe all sealing surfaces clean and dry before installing new gasket and O-ring. Apply a light film of clean lubricating oil to new O-ring and seals before installation.**

1. Install new gasket (11) and engine intake pipe (2) on intake manifold with five short capscrews (8), washer (10) and long capscrew (9).
2. Install new O-ring (6), adapter (5) and lower end of tube assembly (4) to governor (7).
3. Install upper end of tube assembly (4) to engine intake pipe (2).
4. Install two new seals (3) on each end of elbow (1) and insert one end of elbow in engine intake pipe (2).
5. Install air cleaner (WP 0043 00).
6. Install turbocharger (WP 0046 00).
7. Install turbocharger oil lines (WP 0048 00).
8. Install muffler (WP 0058 00)
9. Crank engine for 10 seconds before starting to pre-lubricate turbocharger.
10. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

TURBOCHARGER OIL LINES AND MOUNTING BRACKET REPLACEMENT

0048 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Oil, lubricating (Item 24, WP 0184 00)
Gasket (15, 16 and 17)

Materials/Parts - Continued

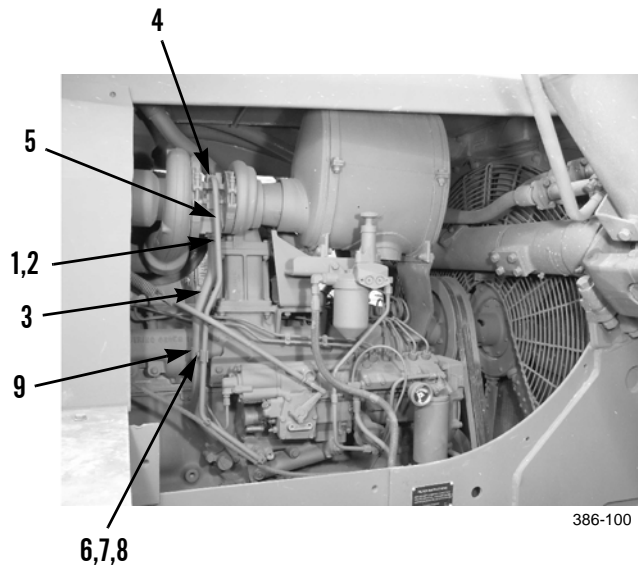
O-ring (22, 23 and 24)
Seal (14)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

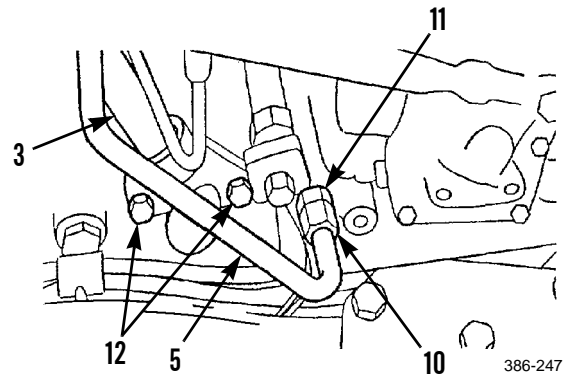
REMOVAL

1. Remove two capscrews (1) and washers (2) from oil line (3).
2. Remove two capscrews (4) from top of oil line (5).
3. Remove nut (6), capscrew (7) and two washers (8).
4. Remove clamp (9) from lines (3 and 5).

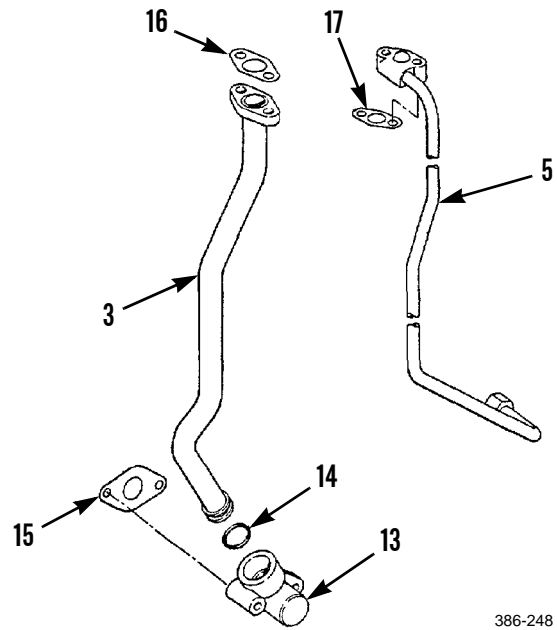


REMOVAL - CONTINUED

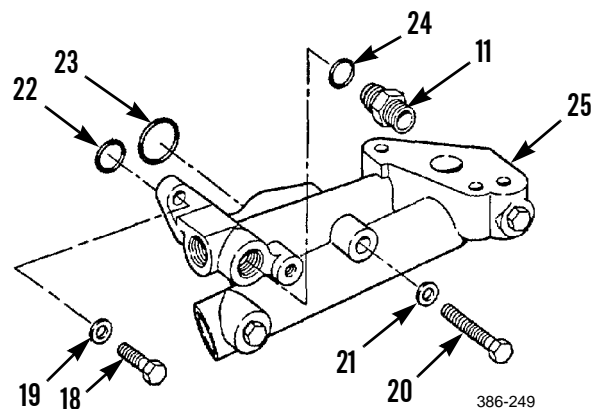
5. Unscrew nut (10) from connector (11). Remove line (5).
6. Remove two capscrews (12) from the bottom of oil line (3). Remove line.



7. Separate line (3) from adapter (13). Remove seal (14) and gasket (16) from line and gasket (15) from adapter. Discard seal and gaskets.
8. Remove gasket (17) from line (5). Discard gasket.



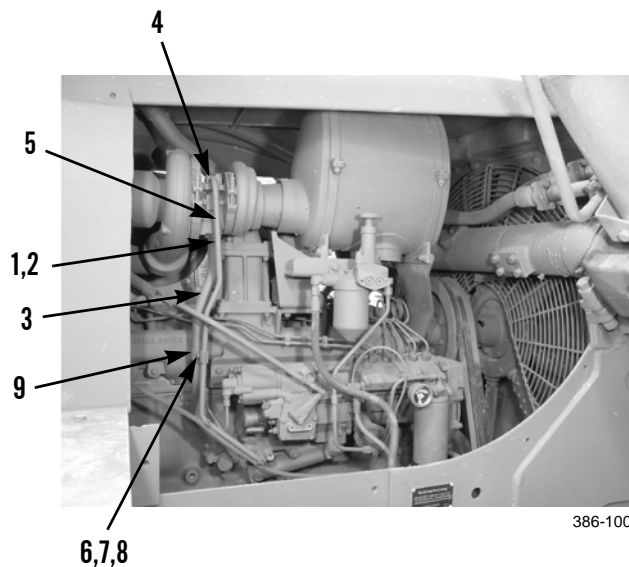
9. Remove two capscrews (18) and washers (19).
10. Remove capscrew (20) and washer (21). Remove mounting bracket assembly (25) from engine block.
11. Remove O-rings (22 and 23) from mounting bracket assembly (25). Discard O-rings.
12. Remove connector (11) and O-ring (24) from mounting bracket assembly (25). Discard O-ring.



INSTALLATION**NOTE**

Lightly coat new O-rings with clean oil before installation.

1. Install new O-ring (24) on connector (11) and install connector on mounting bracket assembly (25).
2. Install new O-rings (22 and 23) on mounting bracket assembly (25).
3. Place mounting bracket assembly (25) in position on engine block and install two capscrews (18) and washers (19).
4. Install capscrew (20) and washer (21).
5. Place new gasket (17) in position on line (5).
6. Place new seal (14) on line (3) and slide line into adapter (13).
7. Place new gasket (15) on adapter (13) and new gasket (16) at the top of line (3).
8. Place line (3) in position and install two capscrews (12).
9. Place line (5) in position and tighten nut (10) to connector (11).
10. Install two capscrews (4) to top of oil line (5).
11. Install two capscrews (1) and washers (2).
12. Place clamp (9) in position on lines (3 and 5) and install capscrew (7), two washers (8) and nut (6).



386-100

13. Run engine and check for proper operation and oil leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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FUEL TANK ASSEMBLY MAINTENANCE

0049 00**THIS WORK PACKAGE COVERS**

Filler Cap, Gage Rod and Strainer: Disassembly, Cleaning and Inspection, Assembly
Fuel Tank: Draining, Removal, Installation, Filling

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
Shop equipment, common no. 1 (Item 94, WP 0185 00)
Sling, nylon (Item 100, WP 0185 00)
Lifting equipment, 500 lb capacity
Suitable fuel container, 115 gal. (435 l) capacity

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)
Fuel (Item 12, 13 or 14, WP 0184 00)
Oil, lubricating (Item 24, WP 0184 00)
Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Tag, marker (Item 35, WP 0184 00)
Gasket (4 and 6)
O-ring (19 and 20)

References

TM 5-2410-233-10
WP 0038 00

Personnel Required

Three

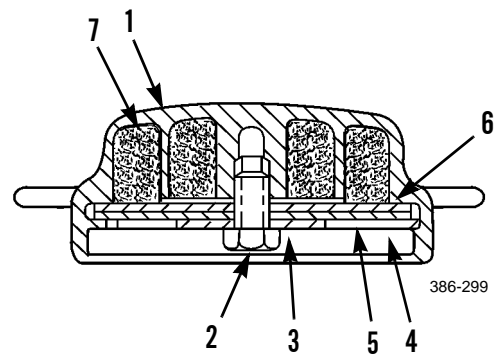
Equipment Condition

ROPS removed, if replacing fuel tank (WP 0131 00).

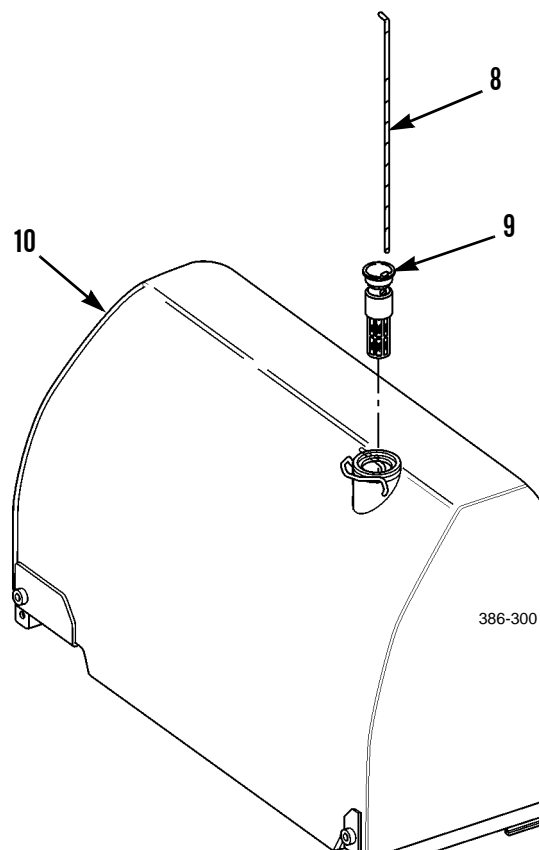
FILLER CAP, GAGE ROD AND STRAINER DISASSEMBLY**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

1. Remove filler cap (1) from fuel tank (TM 5-2410-233-10).
2. Disassemble filler cap (1) as required to clean and inspect filler cap:
 - a. Remove screw (2), washer (3), gasket (4), baffle (5) and gasket (6) from filler cap (1). Discard gaskets.
 - b. Remove filter element (7) from filler cap (1).



3. Remove gage rod (8) and strainer (9) from fuel tank (10).



FILLER CAP, GAGE ROD AND STRAINER CLEANING AND INSPECTION**WARNING**

- Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.
- Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may result in injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

1. Clean filler cap components and strainer in solvent cleaning compound.
2. Use compressed air to dry components.
3. Inspect components for cracks, corrosion, wear or other damage. Replace any damaged component.

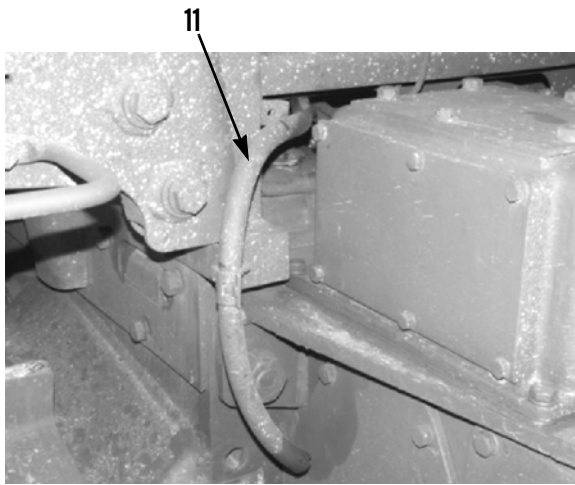
FILLER CAP, GAGE ROD AND STRAINER ASSEMBLY

1. Install gage rod (8) and strainer (9) in fuel tank (10).
2. Assemble filler cap (1) as follows:
 - a. Apply a light coat of oil to filter element (7).
 - b. Install filter element (7) into filler cap (1).
 - c. Install new gasket (6), baffle (5), new gasket (4), washer (3) and screw (2).
3. Install filler cap (1) to fuel tank (10) and tighten (TM 5-2410-233-10).

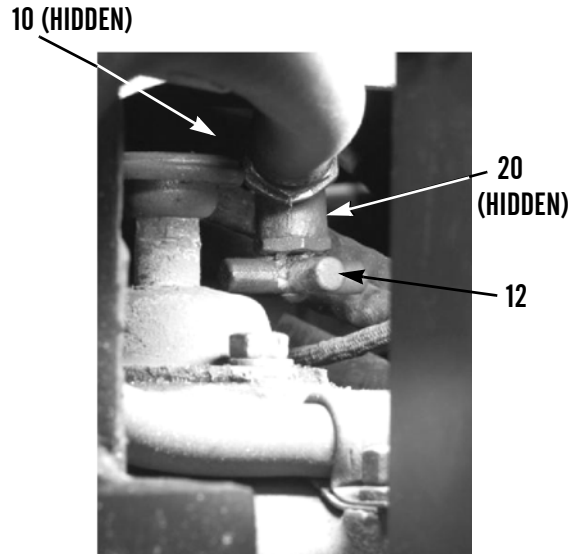
FUEL TANK DRAINING

NOTE

- Fuel tank capacity is 115 gal. (435 l).
 - Ensure any fuel spills are cleaned up.
1. Place a suitable container under fuel drain line (11).
 2. Rotate drain valve handle counterclockwise to open fuel drain valve (12), located at the bottom of the fuel tank (10), and drain fuel tank. Dispose of fuel IAW local policy and ordinances.



386-205

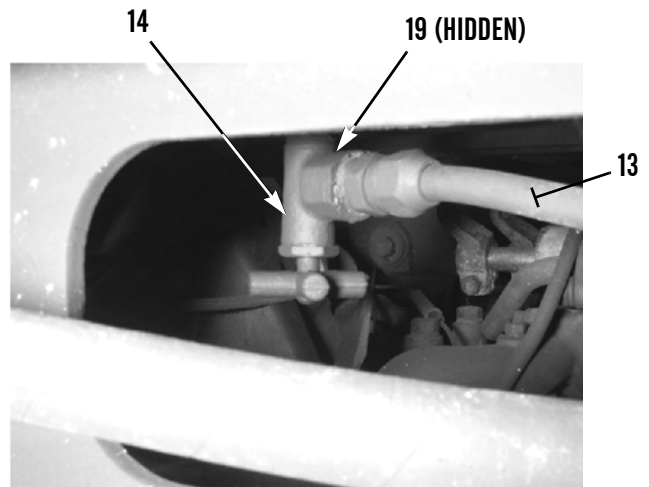


386-204

FUEL TANK REMOVAL

NOTE

- Tag fuel lines to ensure correct installation.
 - Fuel drain line may be removed from fuel drain valve after fuel tank is removed if necessary.
1. Remove fuel drain line (11) from fuel drain valve (12).
 2. Disconnect fuel supply line (13) from fuel shutoff valve (14).



386-124

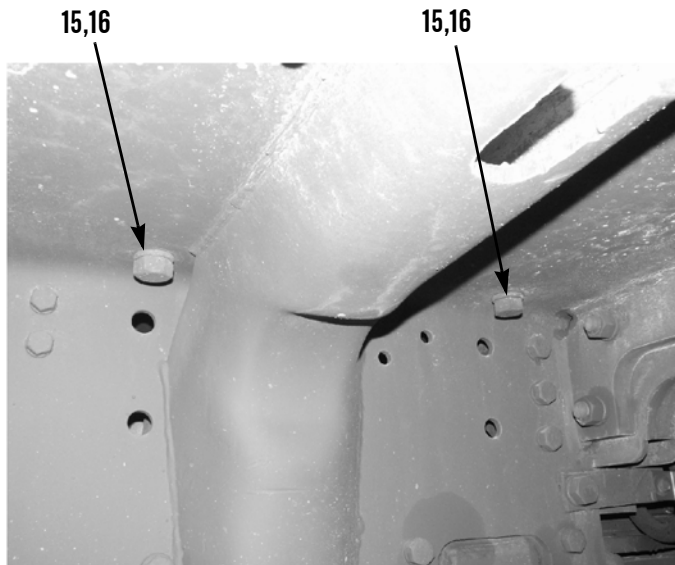
FUEL TANK REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

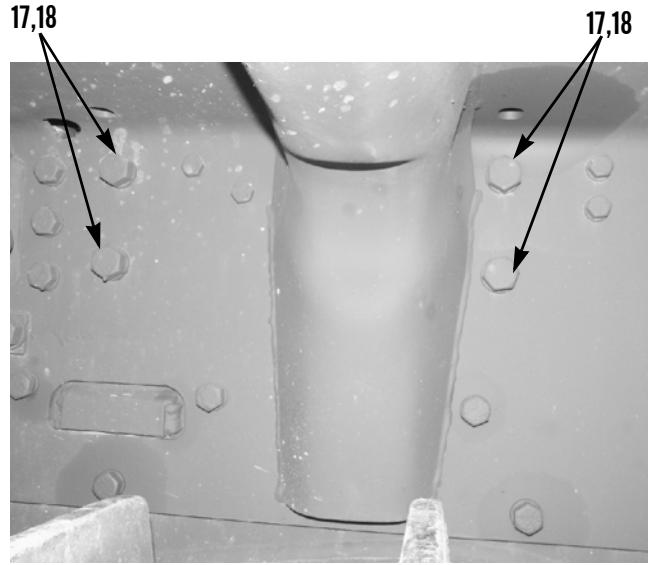
NOTE

Fuel tank weighs 375 lb (170 kg).

3. Attach nylon slings to a suitable lifting device.
4. Remove two bolts (15) and washers (16) from underneath left fender.
5. Remove four bolts (17) and washers (18) from underneath right fender.
6. Lift fuel tank (10) clear of machine.



386-778



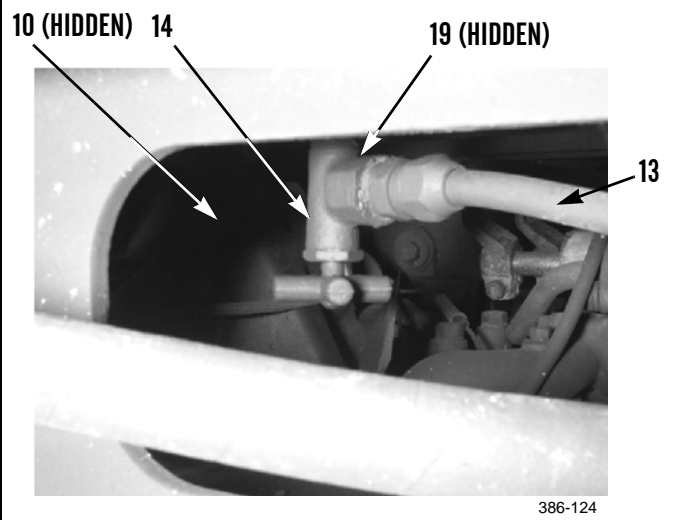
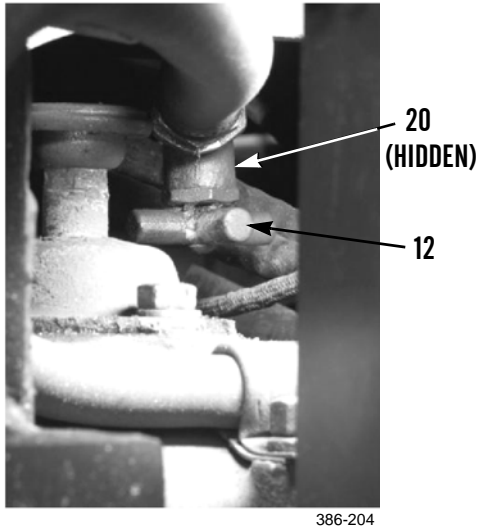
386-779

7. Remove fuel shutoff valve (14) and O-ring (19) from bottom of fuel tank (10). Discard O-ring.
8. Remove fuel drain valve (12) and O-ring (20) from bottom of fuel tank (10). Discard O-ring.

FUEL TANK INSTALLATION**NOTE**

Lightly coat new O-rings with clean fuel before installation.

1. Install new O-ring (20) and fuel drain valve (12) on fuel tank (10).
2. Install new O-ring (19) and fuel shutoff valve (14) on fuel tank (10).



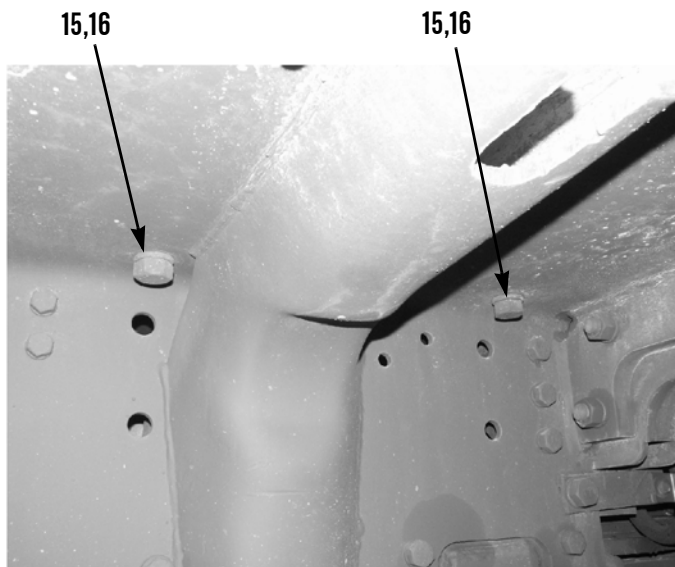
FUEL TANK INSTALLATION - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

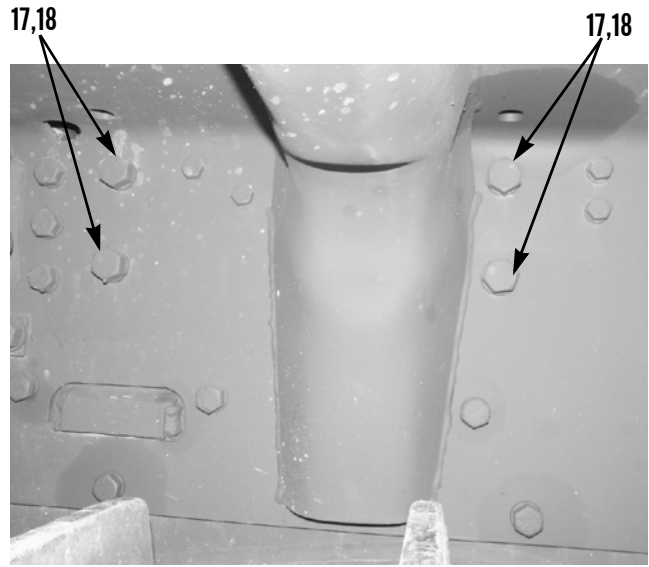
NOTE

Fuel tank weighs 375 lb (170 kg).

3. Attach nylon slings and a suitable lifting device to fuel tank (10). Position fuel tank on machine.
4. Install four washers (18) and bolts (17) from underneath right fender.
5. Install two washers (16) and bolts (15) from underneath left fender.
6. Remove lifting device and nylon slings.



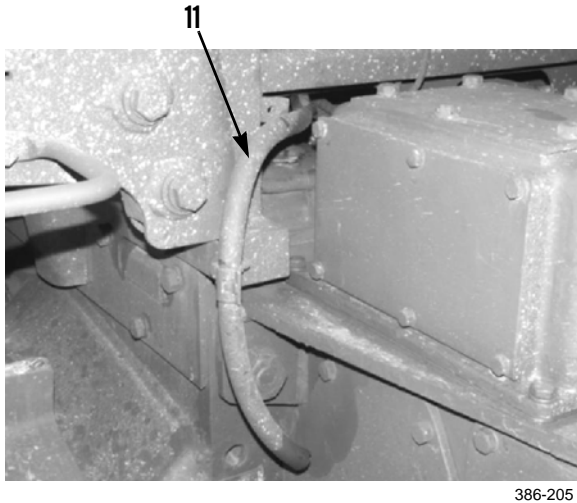
386-778



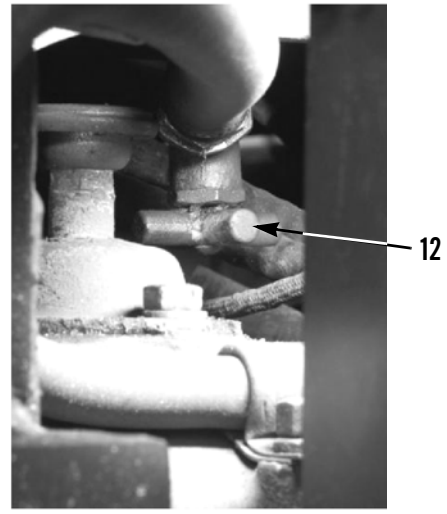
386-779

FUEL TANK INSTALLATION - CONTINUED

7. Install fuel drain line (11) to fuel drain valve (12).

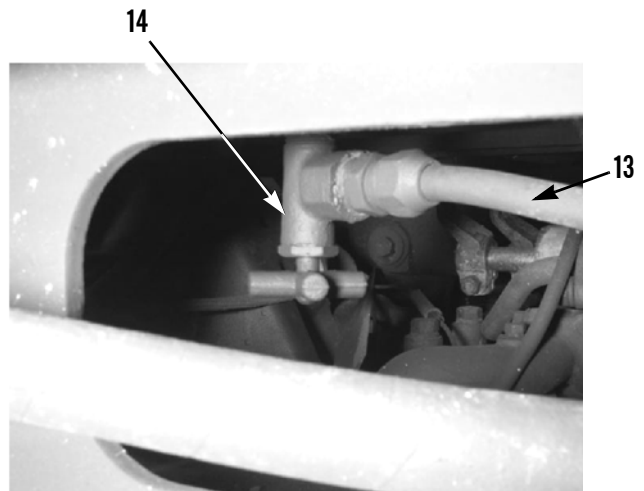


386-205



386-204

8. Connect fuel supply line (13) to fuel shutoff valve (14).
9. Place fuel shutoff valve (14) in ON position.



386-124

FUEL TANK FILLING

1. Fill fuel tank with fuel (TM 5-2410-233-10) and check for leaks. If any leaks are detected, drain fuel tank and correct leaks.
2. If removed, install ROPS (WP 0131 00).
3. Prime fuel system (WP 0038 00).

END OF WORK PACKAGE

FUEL LINES AND FITTINGS REPLACEMENT

0050 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Fuel (Item 12, 13 or 14 WP 0184 00)

Materials/Parts - Continued

Rag, wiping (Item 28, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

O-ring (20, 23, 29, 38, 39, 46 and 47)

References

TM 5-2410-233-10

WP 0038 00

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Engine OFF and cool (TM 5-2410-233-10)

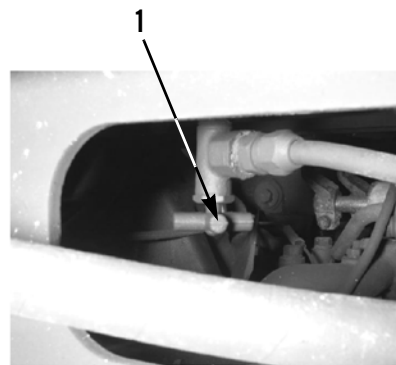
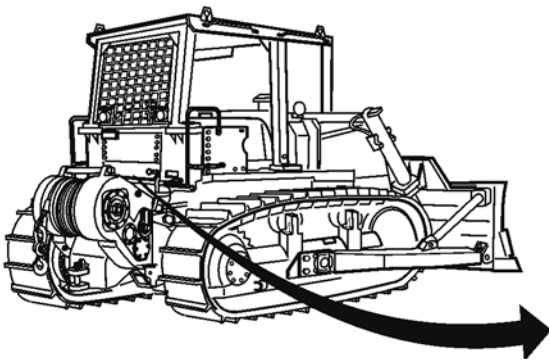
REMOVAL**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

NOTE

- When removing fuel shutoff valve or fuel drain valve, drain fuel tank completely (WP 0049 00). Capacity of fuel tank is 115 gal. (435 l).
- Use a suitable container to capture any fuel which may drain from lines. Dispose of fuel IAW local policy and ordinances. Ensure all spills are cleaned up.
- Fuel line routing and components shown are typical.
- Tag lines to ensure correct installation if removing more than one line.

1. Turn fuel shutoff valve (1) to OFF position.



386-417

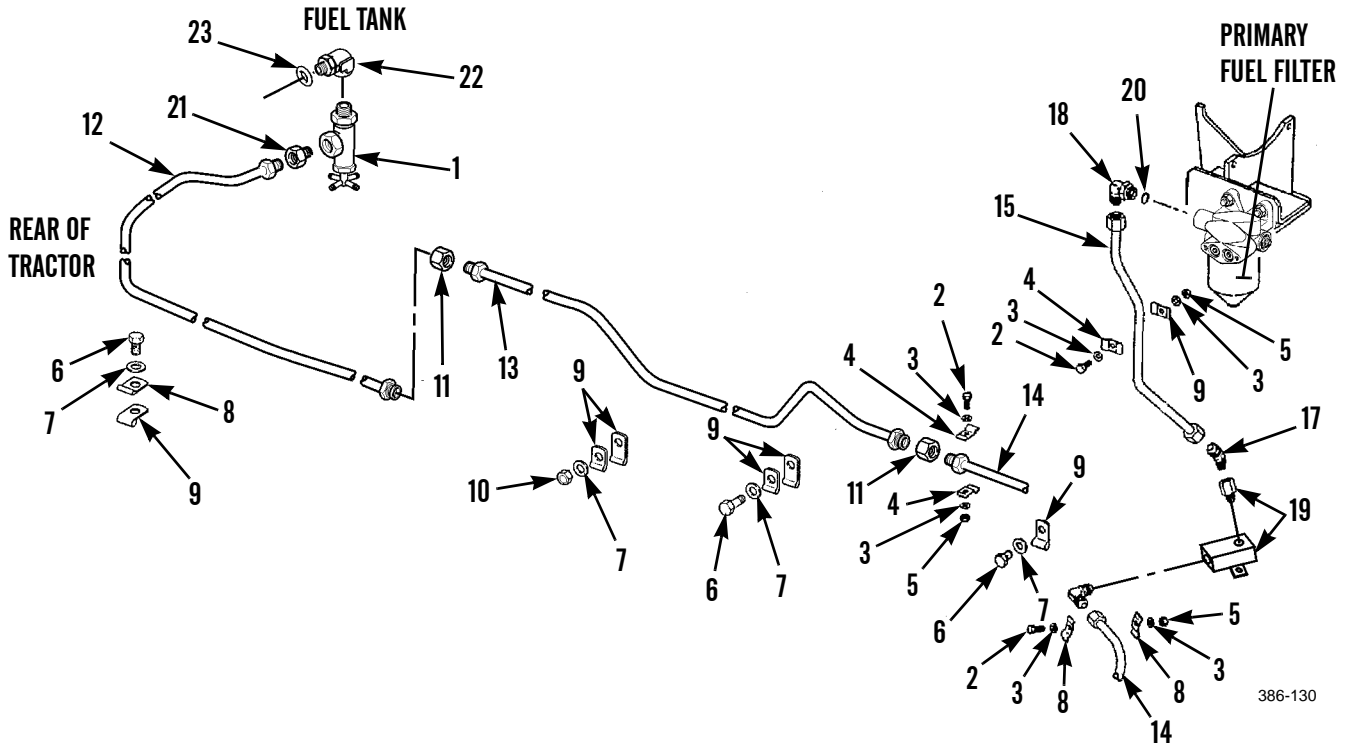
2. Remove three bolts (2), six washers (3), clamps (4) and three nuts (5).
3. Remove three bolts (6), washers (7), small clips (8) and four large clips (9).
4. Remove nut (10), washer (7) and two large clips (9).

CAUTION

Wipe area clean around all fuel connections to be opened during removal. Cap lines and plug openings after removing lines. Contamination of fuel system could result in premature failure.

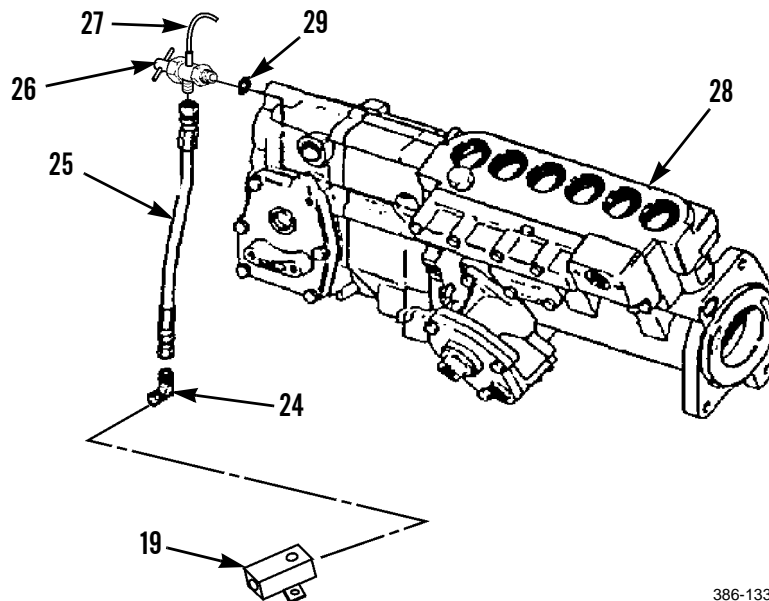
5. Disconnect unions (11) from tube assemblies (12, 13 and 14).
6. Disconnect tube assemblies (14 and 15) from elbows (16, 17 and 18).
7. Disconnect elbows (16 and 17) from junction block assembly (19).
8. Remove elbow (18) from primary filter base. Remove and discard O-ring (20).
9. Disconnect tube assembly (12) from fitting (21).
10. Remove fitting (21) from fuel flow control valve (1).
11. Remove fuel shutoff valve (1) from elbow (22).
12. Remove elbow (22) from fitting in bottom of fuel tank. Remove and discard O-ring (23).

REMOVAL - CONTINUED



386-130

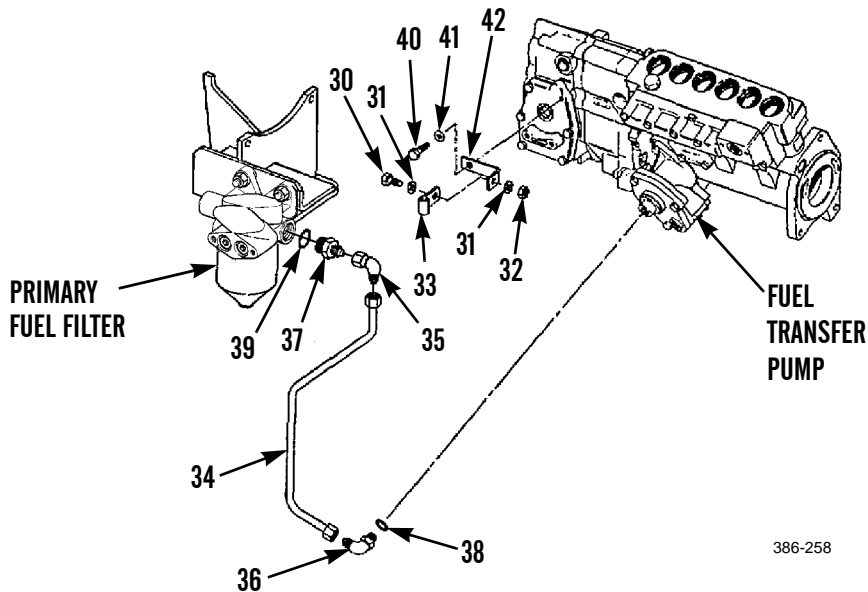
13. Remove elbow (24) from hose assembly (25) and disconnect hose assembly from valve assembly (26).
14. Remove hose (27) from valve assembly (26).
15. Remove valve assembly (26) from fuel injection housing (28). Remove and discard O-ring (29).



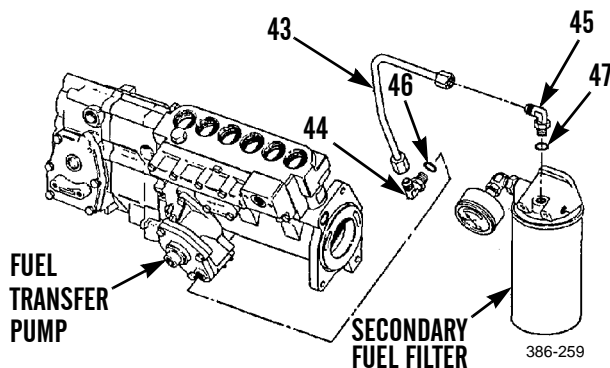
386-133

REMOVAL - CONTINUED

16. Remove bolt (30), two washers (31), nut (32) and clip (33).
17. Remove tube assembly (34) from elbows (35 and 36). Remove tube assembly.
18. Remove elbows (35 and 36) from connector (37) and fuel transfer pump. Remove and discard O-ring (38).
19. Remove connector (37) from primary fuel filter base. Remove and discard O-ring (39).



20. If required, remove bolt (40), washer (41) and bracket (42).
21. Disconnect tube assembly (43) from elbows (44 and 45).
22. Remove elbows (44 and 45). Remove and discard O-rings (46 and 47).



INSTALLATION

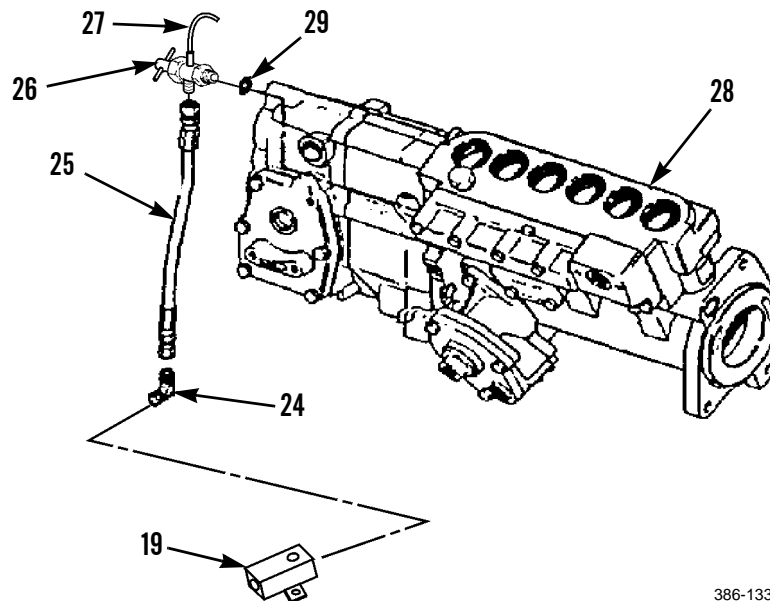
NOTE

Coat all new O-rings with clean fuel before installation.

1. Place new O-ring (46) in position on elbow (44). Install elbow on fuel transfer pump. Place new O-ring (47) in position on elbow (45). Install elbow on secondary fuel filter base.
2. Connect tube assembly (43) to elbows (44 and 45).

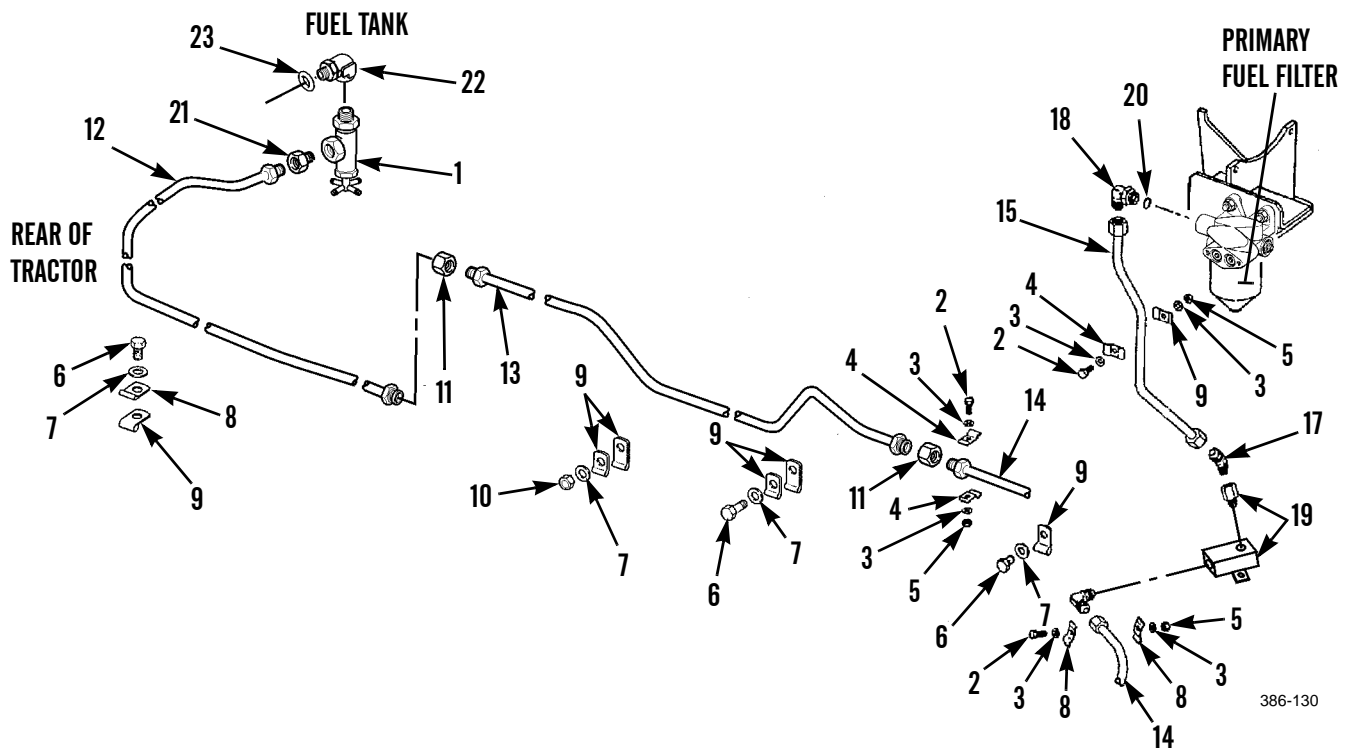
FUEL LINES AND FITTINGS REPLACEMENT - CONTINUED**0050 00****INSTALLATION - CONTINUED**

3. If removed, install bracket (42) with bolt (40) and washer (41).
4. Place new O-ring (39) in position on connector (37). Install connector to primary fuel filter base.
5. Install elbow (35) to connector (37).
6. Place new O-ring (38) in position on elbow (36). Install elbow to fuel transfer pump.
7. Connect tube assembly (34) to elbows (35 and 36).
8. Place clip (33) around tube assembly (34) and align clip with bracket (42). Install bolt (30), two washers (31) and nut (32).
9. Place new O-ring (29) in position on valve assembly (26). Install valve assembly to fuel injection housing (28).
10. Install elbow (24) to hose assembly (25) and connect hose assembly to valve assembly (26).
11. Connect hose (27) to valve assembly (26).



INSTALLATION - CONTINUED

12. Place new O-ring (23) in position on elbow (22). Install elbow to fuel tank fitting.
13. Install fuel shutoff valve (1) to elbow (22). Install fitting (21) to fuel shutoff valve.
14. Connect tube assembly (12) to fitting (21).
15. Connect tube assemblies (12, 13 and 14) with two unions (11).
16. Place new O-ring (20) in position on elbow (18). Install elbow in primary fuel filter.
17. Install tube assembly (15) to elbow (18). Install elbow (17) to junction block assembly (19). Install elbow (16) on tube assembly (14).
18. Connect hose assembly (19) to elbows (16 and 17).
19. Install three bolts (2), six washers (3), clamps (4) and three nuts (5).
20. Install three bolts (6), washers (7), small clip (8) and four large clips (9).
21. Install nut (10), washer (7), and two large clips (9).

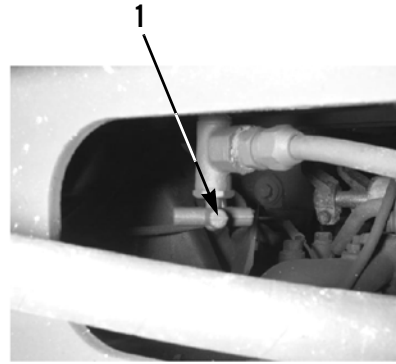
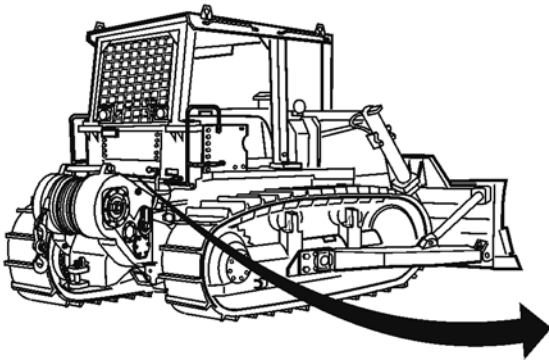


FUEL LINES AND FITTINGS REPLACEMENT - CONTINUED

0050 00

INSTALLATION - CONTINUED

22. Check fuel level in tank and add as needed (TM 5-2410-237-10).
23. Turn fuel shutoff valve (1) to ON position.



386-417

24. Prime fuel system (WP 0038 00).
25. Run engine and check for proper operation and fuel leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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GOVERNOR AND FUEL INJECTION PUMP HOUSING REPLACEMENT

0051 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Adapter, torque wrench (Item 8, WP 0185 00)
- Pin, timing (Item 60, WP 0185 00)
- Puller group (Item 75, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Lifting equipment, 100 lb capacity

Materials/Parts

- Oil, lubricating (Item 24, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Gasket (4 and 15)
- O-ring (12 and 13)

References

- WP 0014 00
- WP 0017 00

Personnel Required

Two

Equipment Condition

- Battery disconnect switch in OFF position (TM 5-2410-233-10)
 - Hood removed (WP 0136 00)
 - Fuel shutoff valve under fuel tank in OFF position (WP 0038 00)
 - Fuel injection lines disconnected (WP 0041 00)
 - Governor control linkage disconnected from governor (WP 0054 00)
 - Fuel supply line disconnected (WP 0050 00)
 - Primary fuel filter assembly removed (WP 0055 00)
 - Secondary fuel filter assembly removed (WP 0056 00)
-

REMOVAL



WARNING

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

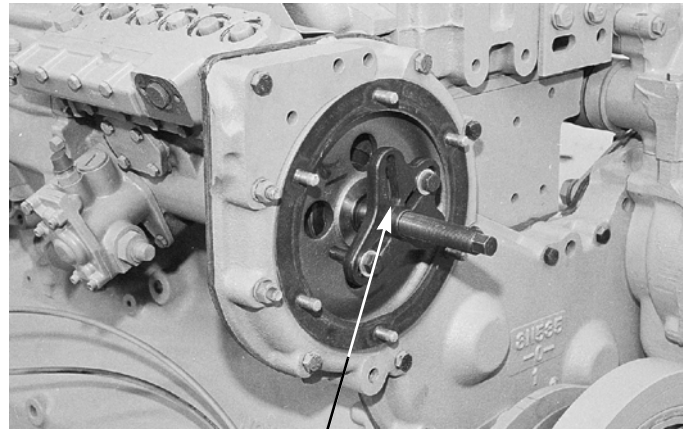
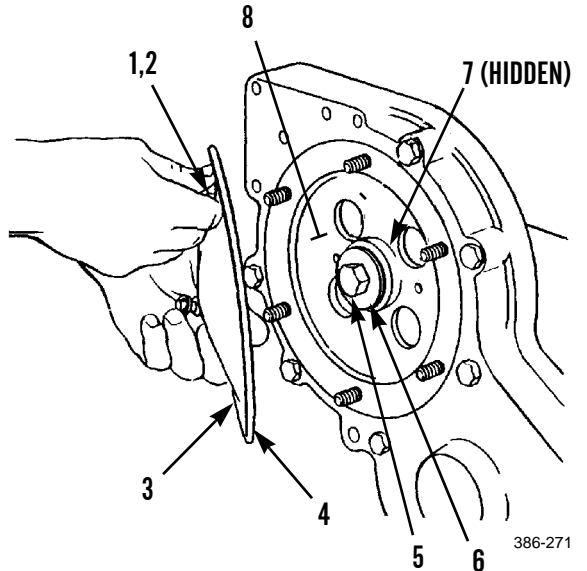
CAUTION

Use caution to ensure fuel system does not become contaminated. Keep work area clean. Install protective caps and plugs as needed. Contamination of fuel system could result in premature failure.

NOTE

Use a suitable container to catch any fuel that may drain from system. Dispose of fuel IAW local policy and ordinances. Ensure all spills are cleaned up.

1. Remove crankcase breather from valve cover to access rocker arms (WP 0014 00).
2. Perform steps 1-4 of WP 0017 00 to find top dead center (TDC) compression stroke for no. 1 piston.
3. Remove six nuts (1), washers (2), pump drive gear cover (3) and gasket (4). Discard gasket.
4. Remove capscrew (5) and washer (6) from fuel pump camshaft (7).
5. Install gear puller, as shown, and loosen drive gear (8) from taper on fuel pump camshaft (7).



GEAR PULLER



WARNING

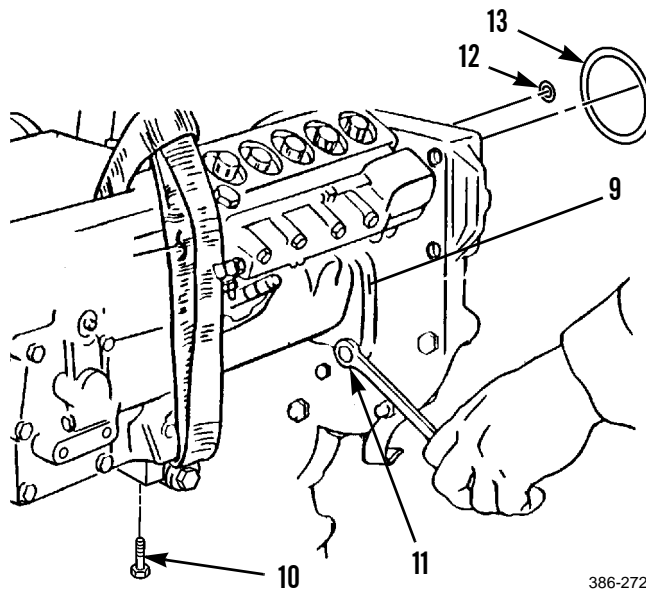
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Governor and fuel injection pump housing weighs 56 lb (25 kg).

REMOVAL - CONTINUED

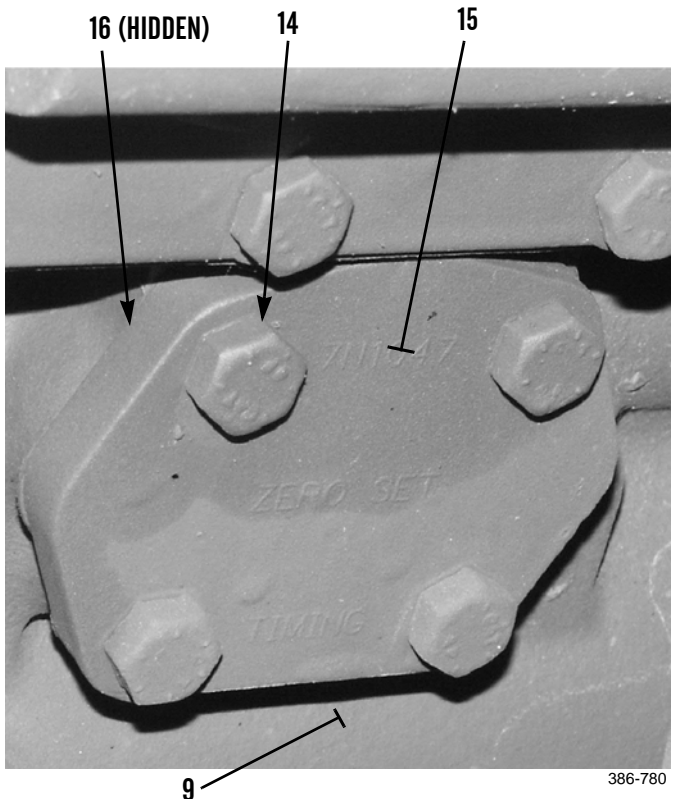
6. Wrap a nylon sling around governor and fuel injection pump housing (9). Attach sling to suitable lifting device.
7. Remove two bolts (10) from oil manifold and governor and fuel injection pump housing (9).
8. Remove three nuts (11) and separate governor and fuel injection pump housing (9) from engine.
9. Remove two O-rings (12 and 13) from governor and fuel injection pump housing (9). Discard O-rings.



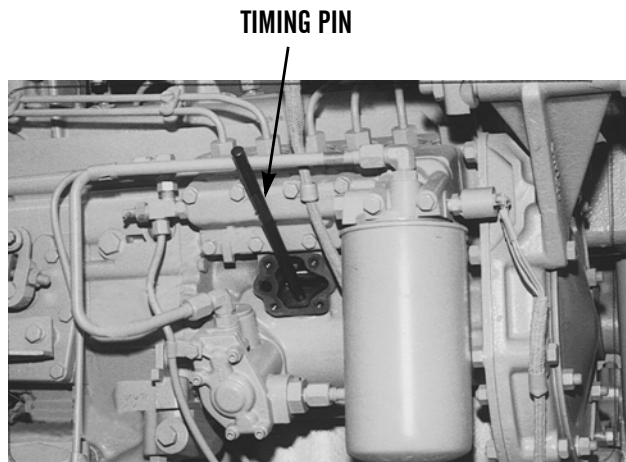
386-272

INSTALLATION

1. Adjust timing on bench by timing pin method:
 - a. Remove four bolts (14) and timing cover (15) from governor and fuel injection pump housing (9). Remove gasket (16) and discard.
 - b. Install timing pin and turn camshaft until timing pins goes in groove in fuel pump camshaft.



386-780



386-784

INSTALLATION - CONTINUED

CAUTION

Wipe area clean around mating surface of engine and governor and fuel injection pump housing prior to installation. Contamination of fuel system could result in premature failure.

NOTE

Apply a light film of clean oil to new O-rings before installation.

2. Install two new O-rings (12 and 13) on governor and fuel injection pump housing (9).



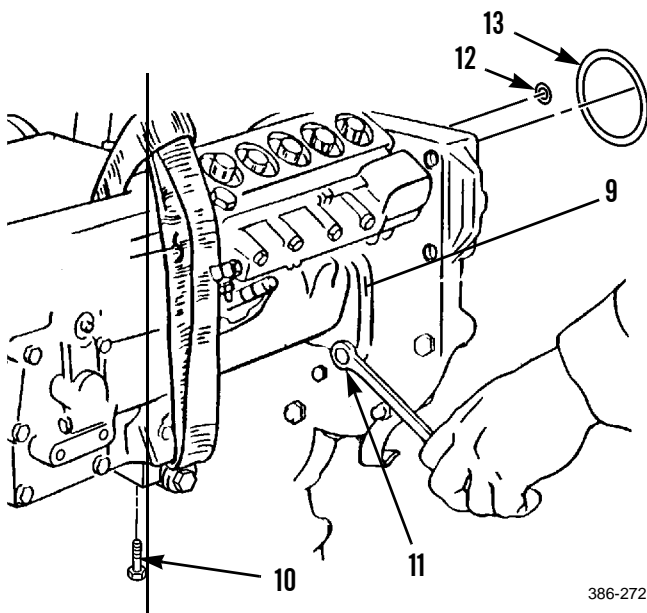
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

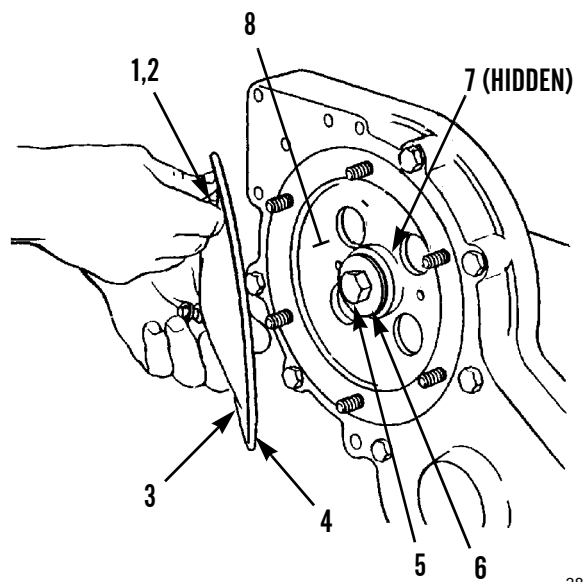
NOTE

Governor and fuel injection pump housing weighs 56 lb (25 kg).

3. Wrap a nylon sling around governor and fuel injection pump housing (9) and attach sling to suitable lifting device.
4. Position governor and fuel injection pump housing (9) on engine and secure with three nuts (11).
5. Secure governor and fuel injection pump housing (9) to oil manifold with two bolts (10).
6. Install pump drive gear (8) on taper of fuel pump camshaft (7).
7. Install washer (6) on fuel pump camshaft (7).



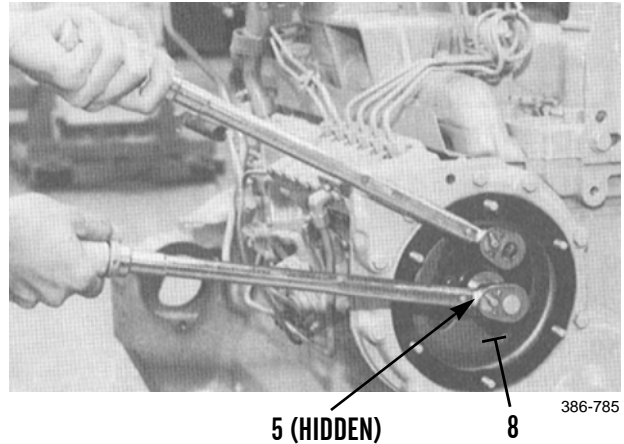
386-272



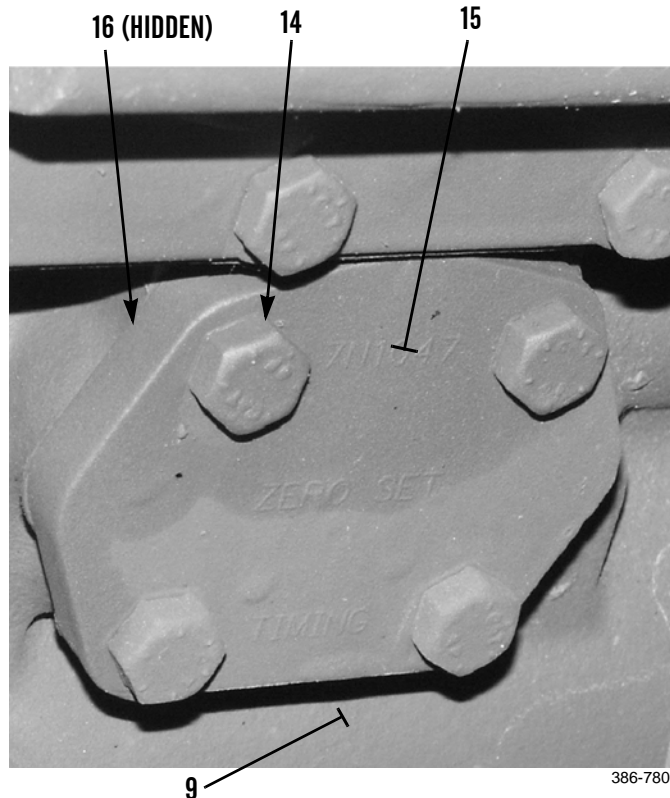
386-271

INSTALLATION - CONTINUED

8. Install torque wrench adapter on pump drive gear (8). Use two 3/8 in.-24NF bolts, 1 in. (25.4 mm) long, to secure adapter to puller holes in gear. Install capscrew (5). Hold torque of 45-50 lb-ft (61-68 Nm) on adapter in a rotation to the right, and tighten capscrew to 200 ± 20 lb-ft (270 ± 30 Nm).



9. Remove timing pin and install new gasket (16) and timing cover (15) to governor and fuel injection pump housing (9) with four bolts (14).
10. Remove flywheel bolt and install plug (WP 0017 00).



11. Install new gasket (4) and pump drive gear cover (3) with six washers (2) and nuts (1).

INSTALLATION - CONTINUED

12. Install secondary fuel filter assembly (WP 0056 00).
13. Install primary fuel filter assembly (WP 0055 00).
14. Connect fuel supply line (WP 0050 00).
15. Connect governor control linkage to governor (WP 0054 00).
16. Install fuel injection lines (WP 0041 00).
17. Turn fuel shutoff valve under fuel tank to ON position (WP 0038 00).
18. Install hood (WP 0136 00).
19. Place battery disconnect switch in ON position (TM 5-2410-233-10).
20. Operate machine and check for proper operation and fuel leaks at governor and fuel injection pump housing (TM 5-2410-233-10).
21. Operate tractor and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

GOVERNOR SHAFT SEAL REPLACEMENT

0052 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Oil, lubricating (Item 24, WP 0184 00)
Seal (7)

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Engine OFF and cool (TM 5-2410-233-10)

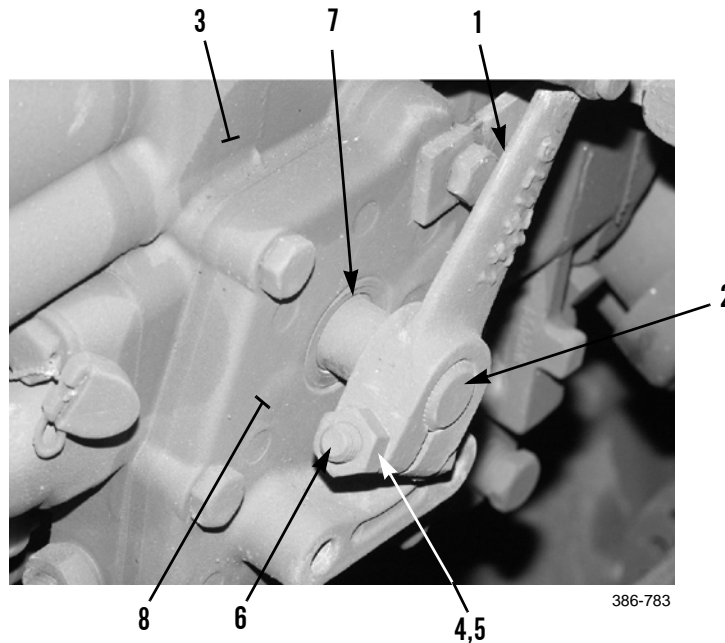
REMOVAL

1. Mark location of lever (1) on end of throttle shaft (2) of fuel injection pump governor (3).
2. Remove nut (4), two washers (5) and capscrew (6) from lever (1).
3. Remove lever (1) from end of throttle shaft (2) and position lever aside.

NOTE

Note position of seal in cover to ensure correct installation.

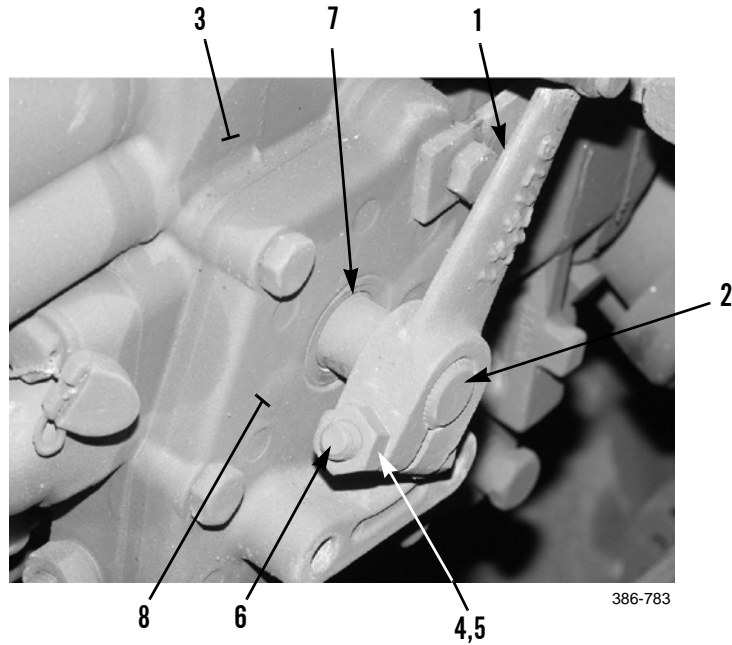
4. Remove seal (7) from cover (8). Discard seal.



INSTALLATION**NOTE**

Lightly coat new O-ring with clean oil before installation.

1. Install new seal (7) into cover (8).
2. Align two marks made during removal and install lever (1) on end of throttle shaft (2).
3. Install capscrew (6), two washers (5) and nut (4) to secure lever (1).



END OF WORK PACKAGE

FUEL INJECTION PUMP AND GOVERNOR TIMING AND ADJUSTMENT**0053 00****THIS WORK PACKAGE COVERS**

Adjust Timing by Timing Pin Method, Governor Adjustment

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Adapter, torque wrench (Item 8, WP 0185 00)
 Pin, timing (Item 60, WP 0185 00)
 Puller group (Item 75, WP 0185 00)
 Tachometer, stroboscopic (Item 109, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Bolt, timing, 3/8 in.-16 NC, 2 in. long

References

WP 0014 00
 WP 0017 00
 WP 0054 00

Personnel Required

Two

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to machine and injury or death to personnel or equipment damage.

CAUTION

Use caution to ensure fuel system does not become contaminated. Keep work area clean. Install protective caps and plugs as needed. Contamination of fuel system could result in premature failure.

NOTE

Use a suitable container to catch any fuel that may drain from system. Dispose of fuel IAW local policy and ordinances. Ensure all spills are cleaned up.

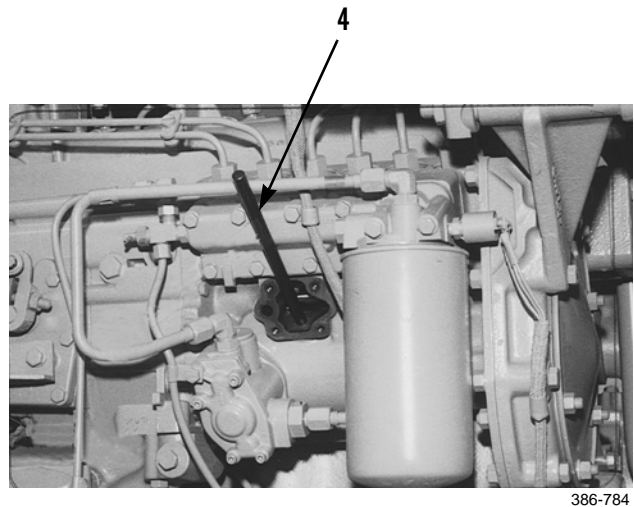
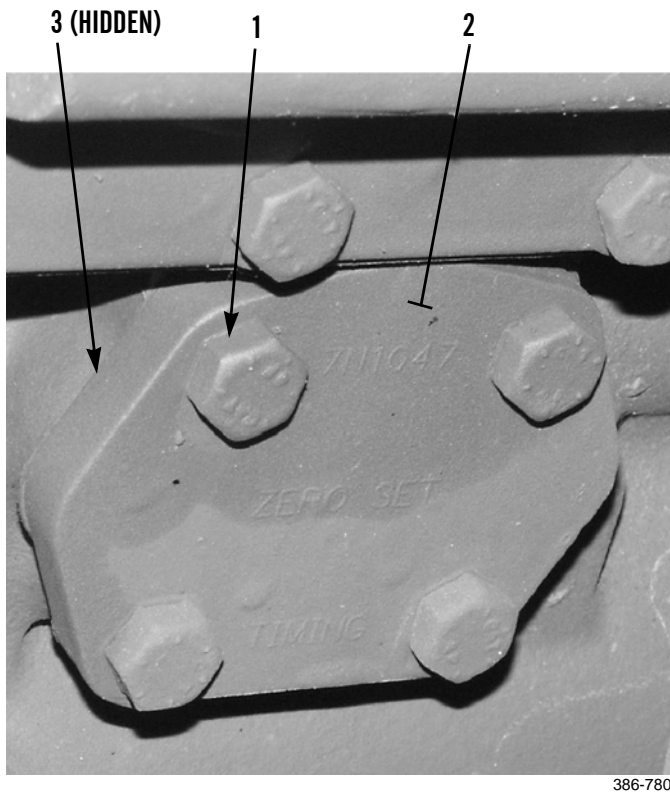
ADJUST TIMING BY TIMING PIN METHOD

1. Place battery disconnect switch in OFF position (TM 5-2410-233-10).
2. Remove crankcase breather from valve cover to access rocker arms (WP 0014 00).
3. Perform steps 1-4 of WP 0017 00 to find top dead center (TDC) compression stroke for no. 1 piston.

CAUTION

Turn flywheel slowly to avoid damaging fuel injection pump, camshaft and timing pin.

4. Rotate engine so flywheel turns approximately 30° clockwise, as seen from flywheel end.
5. Remove four bolts (1) and timing cover (2) from governor and fuel injection pump housing. Remove and discard gasket (3). Install timing pin (4) in plug hole of fuel injection pump housing.

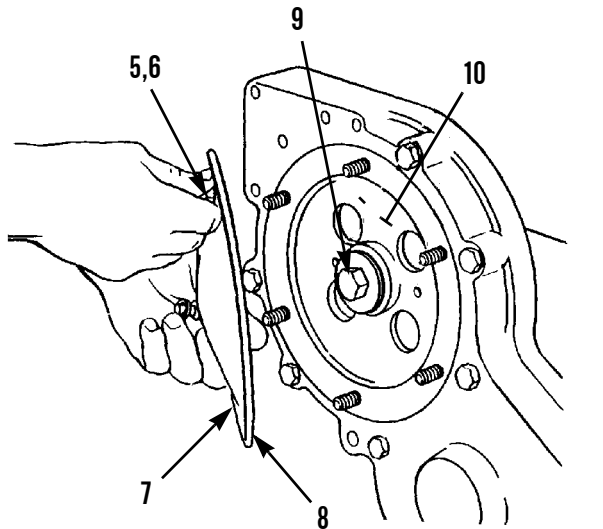


386-784

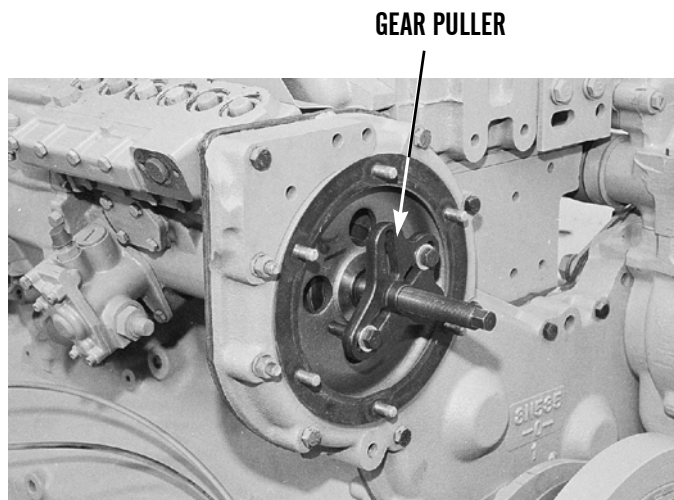
6. Rotate engine flywheel (as seen from rear of engine) slowly to the left, until timing pin goes in notch of injector pump camshaft.
7. Try to insert a 3/8 in.-16NC bolt in timing hole in flywheel housing.
 - a. If timing bolt can be installed in hole of flywheel, timing of fuel injection pump is correct. Proceed to step 8.
 - b. If timing bolt cannot be installed in hole of flywheel, timing of fuel injection pump is not correct. Perform the following steps to adjust timing:
 - (1) Remove six nuts (5), washers (6), pump drive gear cover (7) and gasket (8) from timing gear housing. Discard gasket.
 - (2) Loosen capscrew (9) that holds drive gear (10) to fuel pump camshaft. Turn capscrew out three turns to the left.

ADJUST TIMING BY TIMING PIN METHOD - CONTINUED

- (3) Install gear puller, as shown, and loosen drive gear (10) from fuel pump camshaft.

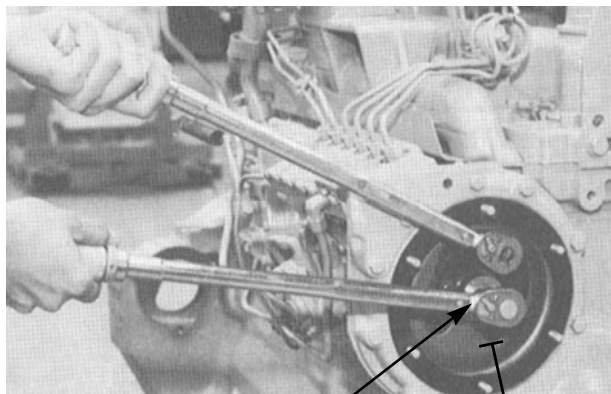


386-271



386-781

- (4) Rotate engine 60 degrees to the right to put no. 1 piston at top dead center.
- (5) Tighten capscrew (9) finger-tight. Ensure timing pin (4) is in groove of fuel pump camshaft.
- (6) Slowly rotate engine to the left until timing bolt can be installed in flywheel.
- (7) Install torque wrench adapter on drive gear (10). Use two 3/8 in.-24NF bolts, 1 in. (25.4 mm) long, to secure adapter to puller holes in gear.
- (8) Hold torque of 45-50 lb-ft (61-68 Nm) on torque wrench adapter in a rotation to the right, and tighten capscrew (9) to 200 lb-ft (271 Nm).



386-785

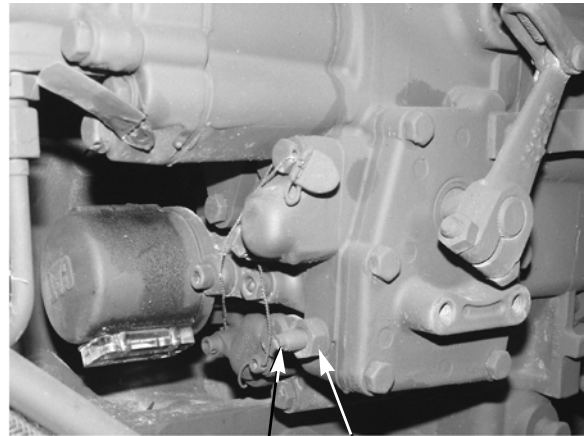
- (9) Remove timing bolt from flywheel. Remove timing pin (4) from fuel pump camshaft.
 - (10) Rotate engine two revolutions to the left. If timing bolt can be installed in flywheel and timing pin (4) can be installed in fuel pump camshaft, timing is correct. Return to step 8.
 - (11) If either timing pin or timing bolt cannot be installed, repeat steps 1-10.
- 8. Remove 3/8 in.-16NC bolt from timing hole in flywheel housing and install plug.
 - 9. Remove timing pin. Install new gasket (3) and timing cover (2) to side of fuel injection pump housing with four bolts (1).

GOVERNOR ADJUSTMENT**NOTE**

- To perform these adjustments, governor and fuel injector pump housing is installed on engine and engine is at operating temperature.
- Engine low idle speed should be 670 +/- 30 RPM.
- Engine high idle speed should be 2100 +/- 30 RPM.
- Engine loaded rate should be 2000 RPM +/- 10 RPM.

1. **Governor Low Idle Adjustment.**

- Install photo tachometer and check engine low and high RPM on engine. Task complete if RPM is correct. If RPM fails specification, continue with governor adjustments.
- Disconnect governor control linkage (WP 0054 00).
- Adjust engine low idle RPM. Loosen locknut (11) for low idle screw (12). Turn idle screw to get correct low idle RPM.
- Increase engine speed and return to low idle and check low idle speed again. Hold idle screw (12) and tighten locknut (11) if low idle RPM is correct.
- Connect governor control linkage (WP 0054 00).
- Operate machine and check for proper operation.



386-325

12 11

2. **Governor High Idle Adjustment.****NOTE**

If engine does not achieve 2100 RPM, refer to WP 0054 00 to adjust governor control linkage.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation, Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Pin, cotter (7, 12, 18, 22, 31, 35, 55, 62 and 72)

Lockwasher (2, 43, 46 and 53)

References

TM 5-2410-233-10

Equipment Condition

Battery cables disconnected (WP 0080 00)

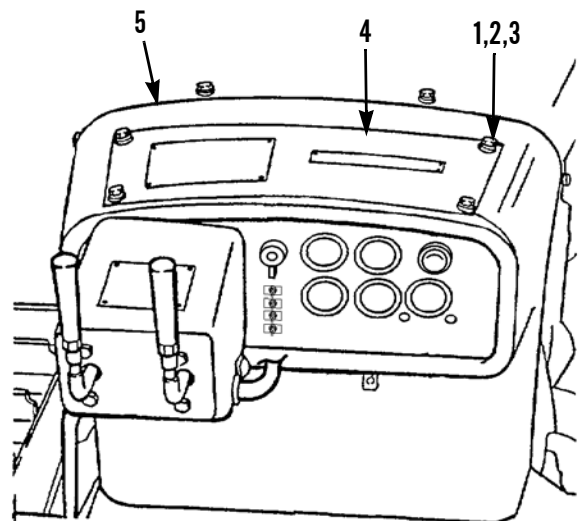


WARNING

Ensure battery cables are disconnected before performing maintenance inside dash assembly. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

1. Remove four capscrews (1), lockwashers (2), washers (3) and cover (4) from top of dash assembly (5). Discard lockwashers.



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REMOVAL - CONTINUED

NOTE

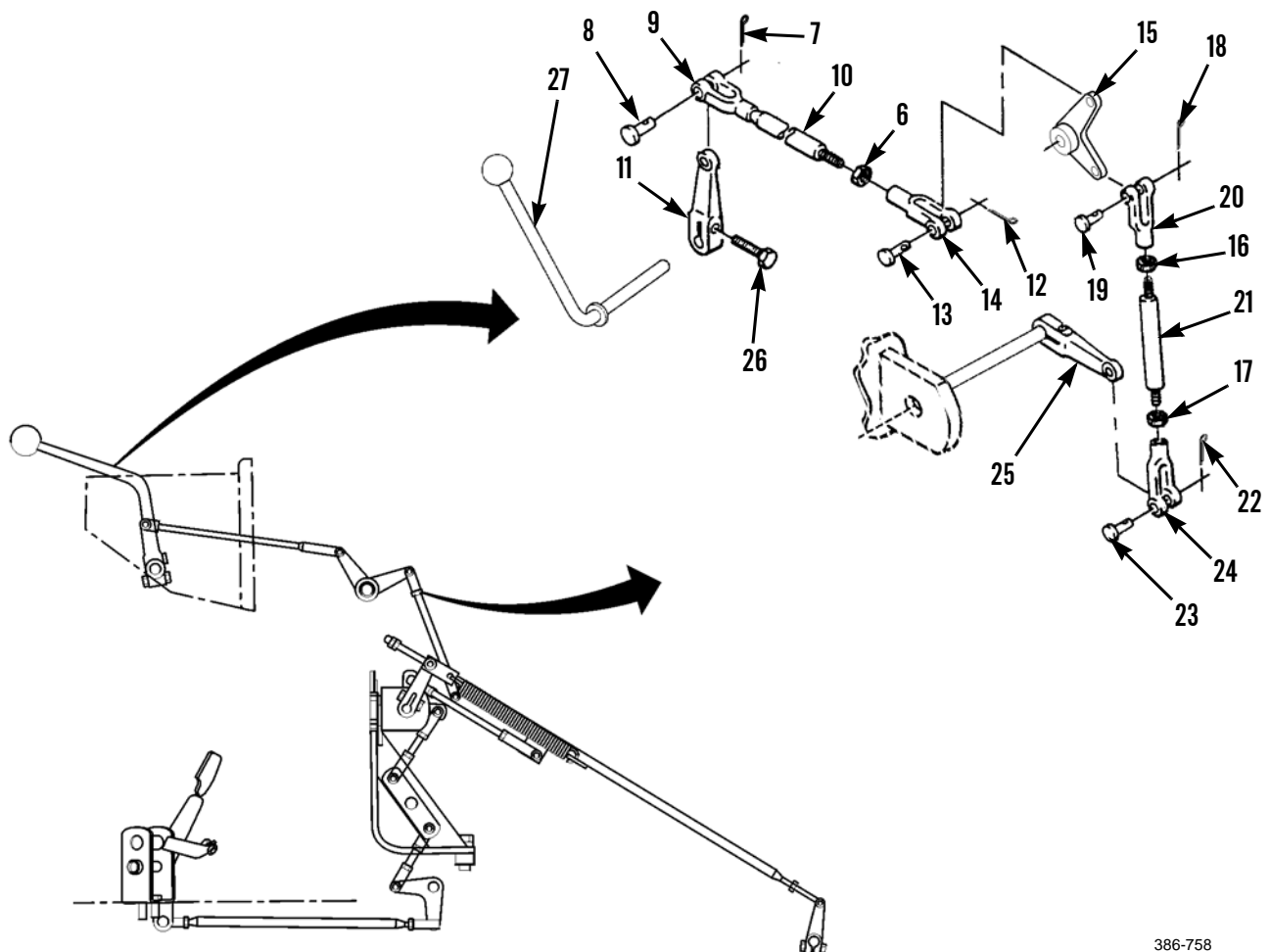
Components shown are typical. There may be variations on your machine.

2. Loosen jam nut (6) and remove cotter pin (7) and pin (8) from clevis (9). Remove upper end of rod (10) from lever (11). Discard cotter pin.
3. Remove cotter pin (12) and pin (13) from clevis (14). Remove lower end of rod (10) from bell crank (15). Discard cotter pin.
4. Remove rod assembly (10).
5. Loosen jam nuts (16 and 17) and remove cotter pin (18), pin (19) from clevis (20). Remove upper end of rod (21) from bell crank (15). Discard cotter pin.
6. Remove cotter pin (22) and pin (23) from clevis (24) and remove lower end of rod (21) from lever (25). Discard cotter pin.
7. Remove rod assembly (21).

NOTE

If lever or component inside of a lever requires removal, drive small chisel into slot in lever to open it up for removal.

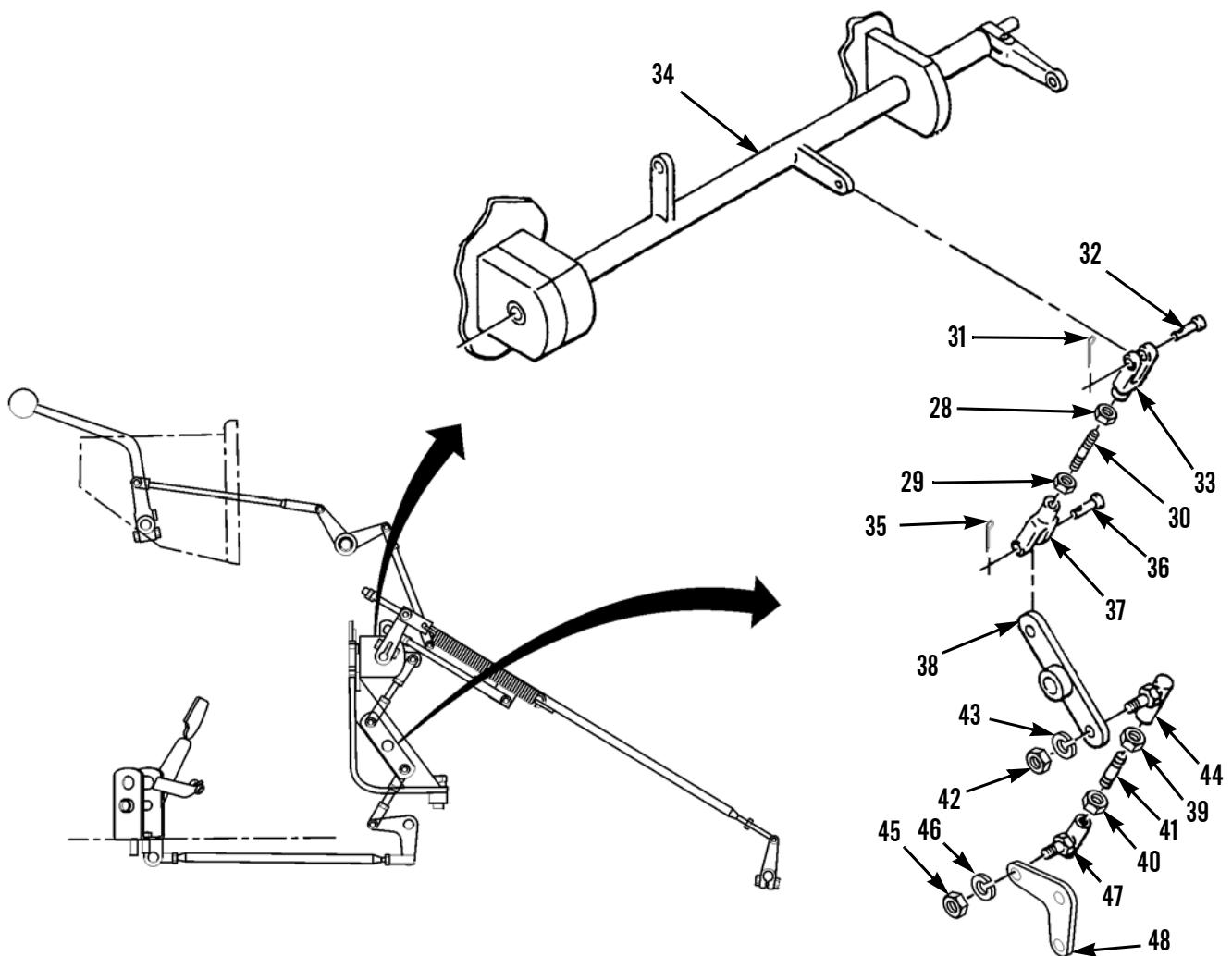
8. Remove capscrew (26) from lever (11) and remove throttle lever (27) from back of dash assembly.



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REMOVAL - CONTINUED

9. Loosen jam nuts (28 and 29) on rod (30).
10. Remove cotter pin (31) and pin (32) from clevis (33) and remove upper end of rod (30) from bell crank (34). Discard cotter pin.
11. Remove cotter pin (35) and pin (36) from clevis (37) and remove lower end of rod (30) from lever (38) at back of dash assembly. Discard cotter pin.
12. Loosen jam nuts (39 and 40) on rod (41).
13. Remove nut (42), lockwasher (43) and ball joint (44) from lever (38) and remove upper end of rod (41). Discard lockwasher.
14. Remove nut (45), lockwasher (46) and ball joint (47) from lever (48) and remove lower end of rod (41). Discard lockwasher.



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REMOVAL - CONTINUED

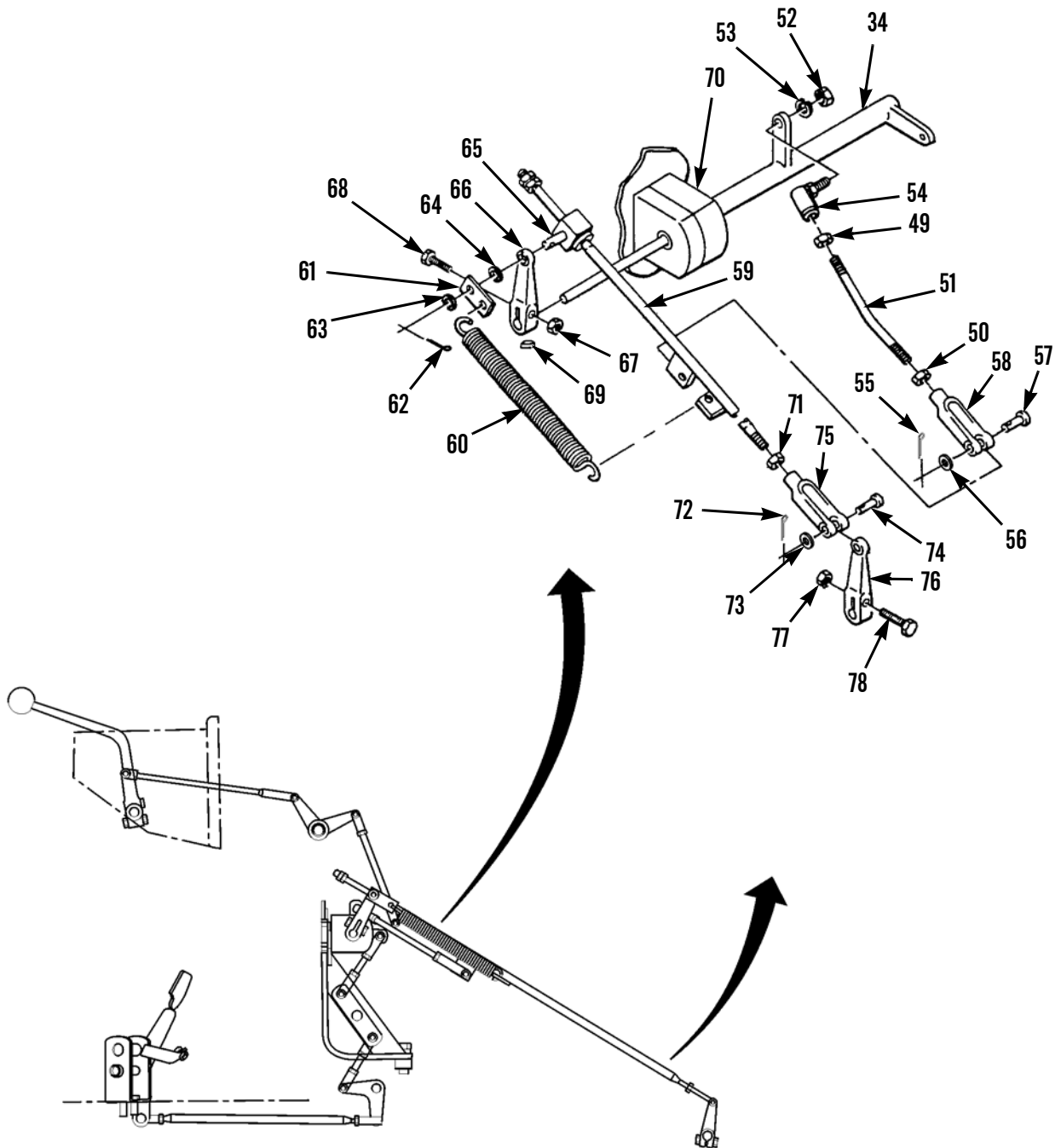
15. Loosen jam nuts (49 and 50) at each end of rod (51).
16. Remove nut (52), lockwasher (53) and ball joint (54) from bellcrank (34). Remove upper end of rod (51). Discard lockwasher.
17. Remove cotter pin (55), washer (56) and pin (57) from clevis (58). Remove lower end of rod (51) from governor control link (59). Discard cotter pin
18. Remove spring (60) from lower end of governor control link (59) and from plate (61).
19. Remove cotter pin (62), washer (63), plate (61), washer (64) and rod end connector (65) from lever (66). Discard cotter pin.

NOTE

If lever or component inside of a lever requires removal, drive small chisel into slot in lever to open it up for removal.

20. If lever (66) requires removal, remove nut (67), capscrew (68), lever and key (69) from support (70)
21. Loosen jam nut (71) and remove cotter pin (72), washer (73) and pin (74) from clevis (75). Remove lower end of governor control link (59). Discard cotter pin.
22. If governor control lever (76) requires removal, remove nut (77), capscrew (78) and governor control lever from governor.

REMOVAL - CONTINUED



386-762

INSTALLATION**NOTE**

- **Components shown are typical. There may be variations on your machine.**
- **Use a rag to wipe contact surfaces of all moving parts clean prior to installation.**
- **Drive small chisel into slot in lever to open it up for installation on shaft.**

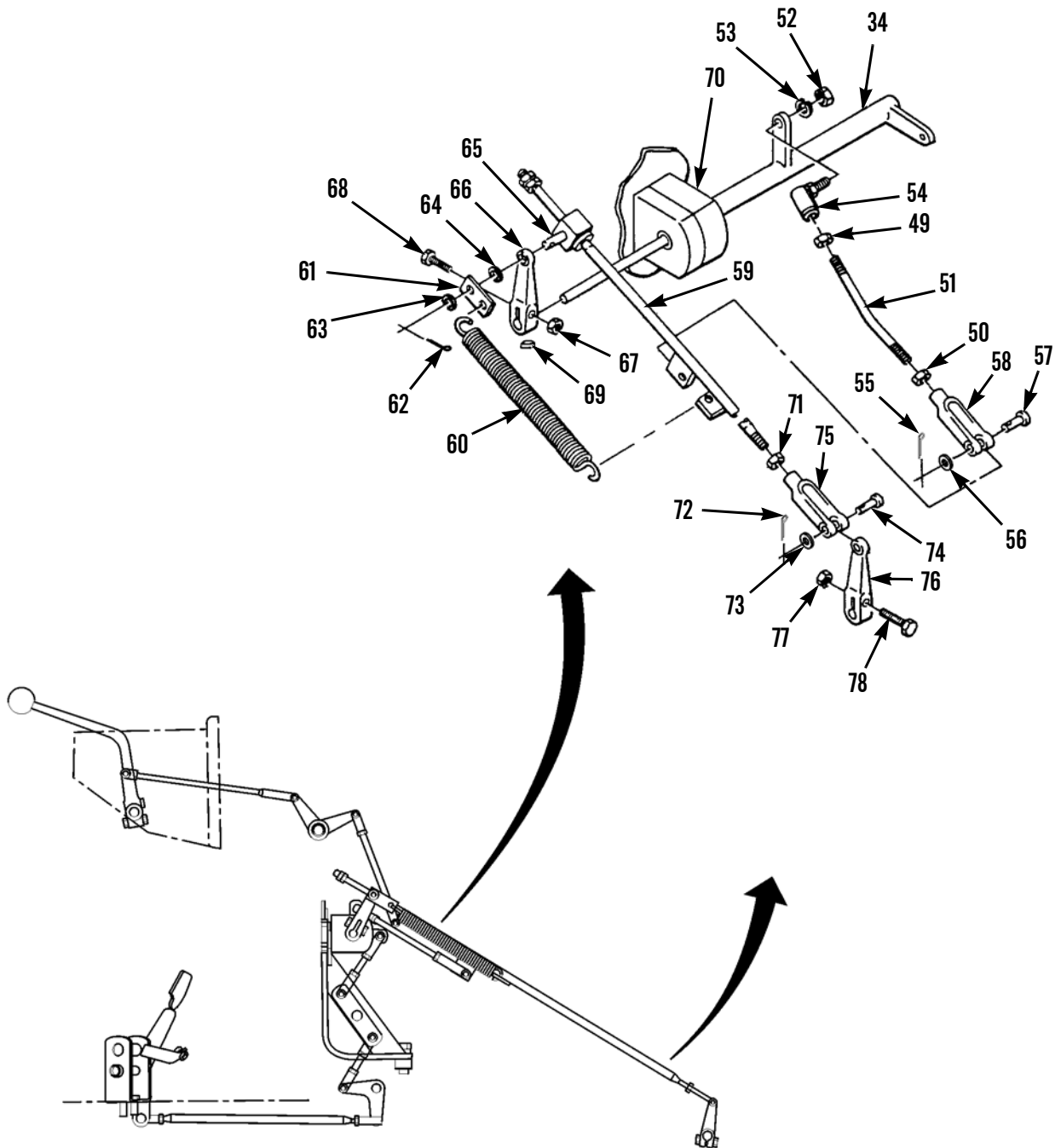
1. If removed, install governor control lever (76) on governor with capscrew (78) and nut (77).
2. Install jam nut (71) on lower end of governor control link (59).
3. Connect lower end of governor control link (59) to clevis (75). Install clevis to governor control lever (76) with pin (74), washer (73) and new cotter pin (72).

NOTE

If lever or component inside of a lever requires installation, drive small chisel into slot in lever to open it up for installation.

4. If removed, install key (69) and lever (66) on support (70) with capscrew (68) and nut (67).
5. Connect governor control connector (65) to lever (66) with washer (64), plate (61), washer (63) and new cotter pin (62).
6. Install spring (60) to plate (61) and to lower end of governor control link (59). Adjust *IAW Adjustment* at the end of this work package.
7. Install jam nuts (49 and 50) on rod (51).
8. Connect lower end of rod (51) to clevis (58). Install clevis to governor control link (59) with pin (57), washer (56) and new cotter pin (55).
9. Connect upper end of rod (51) to ball joint (54). Install ball joint to bell crank (34) with new lockwasher (53) and nut (52). Adjust *IAW Adjustment* at the end of this work package.

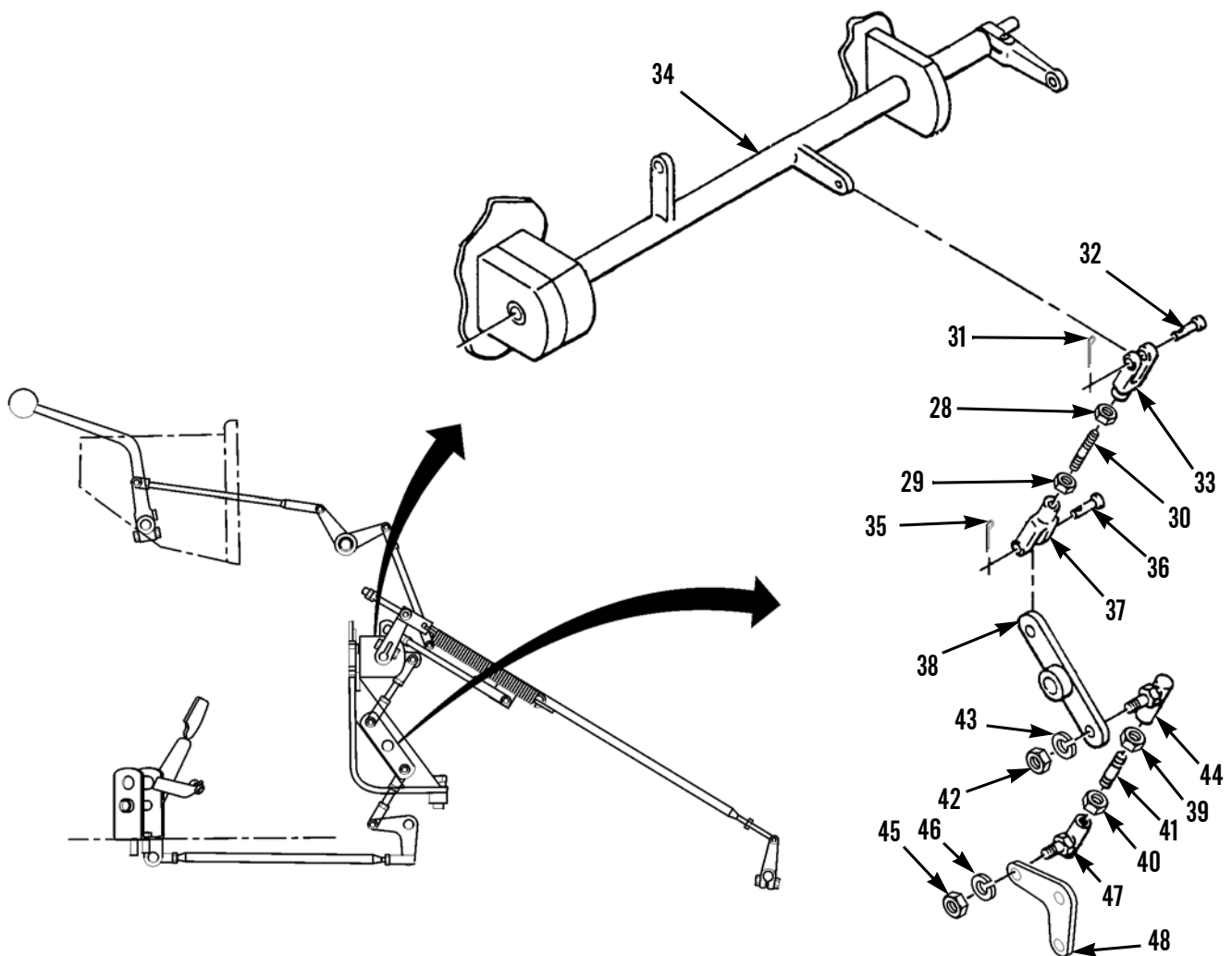
INSTALLATION - CONTINUED



386-762

INSTALLATION - CONTINUED

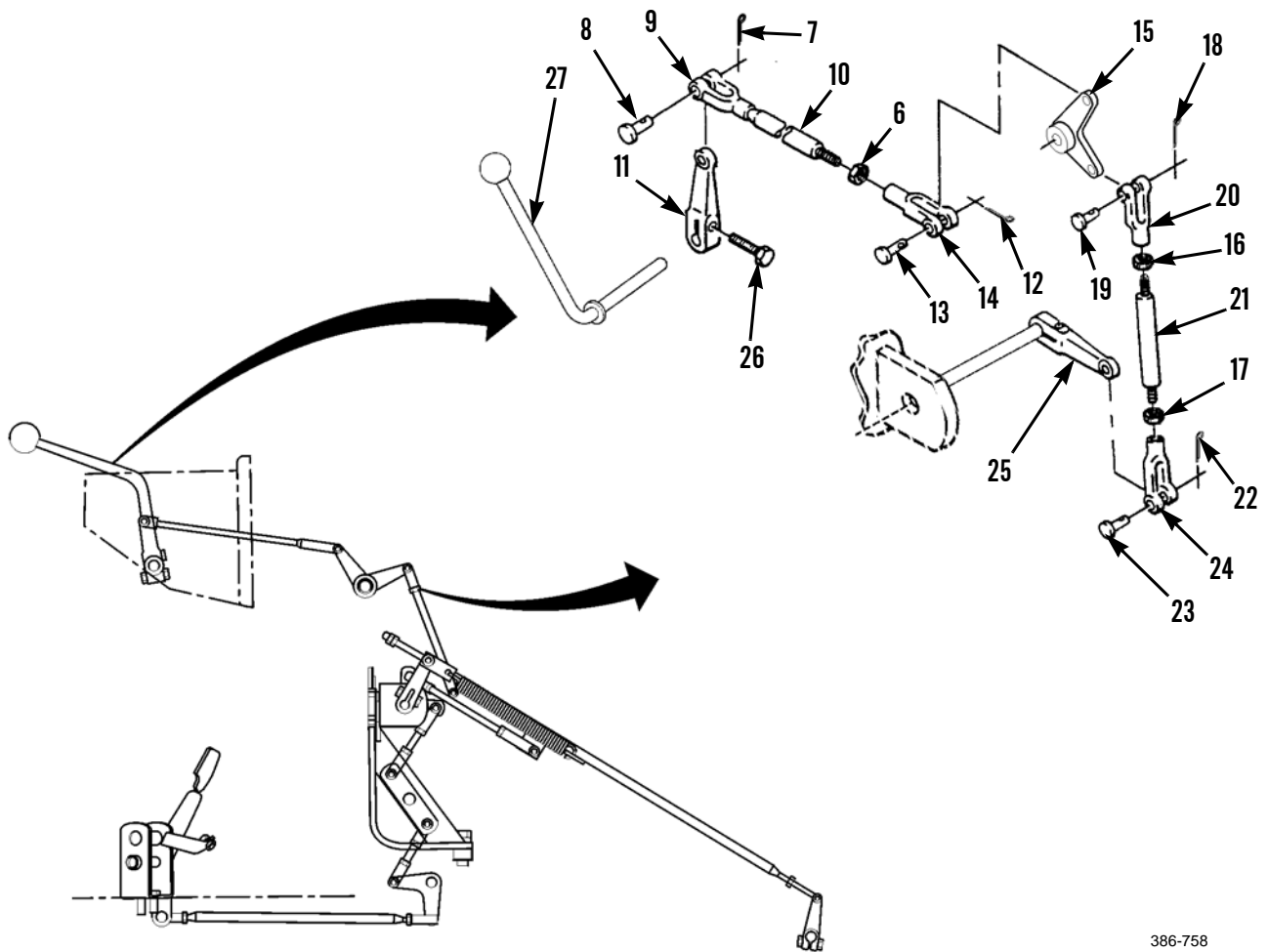
10. Install jam nuts (39 and 40) on rod (41).
11. Connect lower end of rod (41) to ball joint (47) and install ball joint on lever (48) with new lockwasher (46) and nut (45).
12. Connect upper end of rod (41) to ball joint (44) and install ball joint on lever (38) with new lockwasher (43) and nut (42). Adjust *IAW Adjustment* at the end of this work package.
13. Install jam nuts (28 and 29) on rod (30).
14. Connect upper end of rod (30) to clevis (33). Install clevis on bell crank (34) with pin (32) and new cotter pin (31).
15. Connect lower end of rod (30) to clevis (37). Install clevis on lever (38) in back of dash assembly with pin (36) and new cotter pin (35). Adjust *IAW Adjustment* at the end of this work package.



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INSTALLATION - CONTINUED

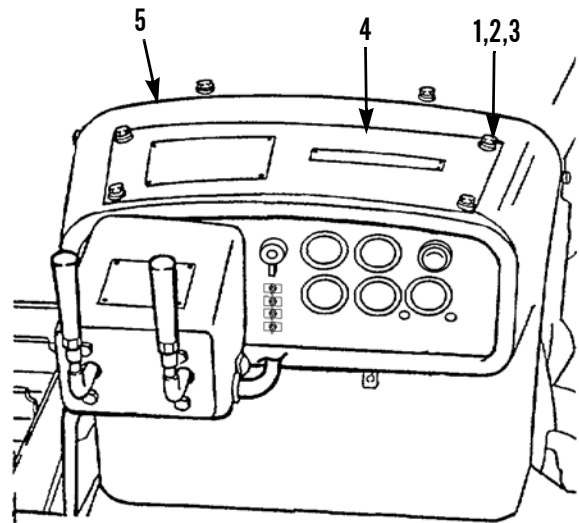
16. Install throttle lever (27) through lever (11) and secure with capscrew (26) in back of dash assembly.
17. Install jam nuts (16 and 17) to rod (21).
18. Connect lower end of rod (21) to clevis (24). Install clevis on lever (25) with pin (23) and new cotter pin (22).
19. Connect upper end of rod (21) to clevis (20). Install clevis on bell crank (15) with pin (19) and new cotter pin (18).
- Adjust IAW *Adjustment* at the end of this work package.
20. Install clevis (14) on bellcrank (15) with pin (13) and new cotter pin (12).
21. Install clevis (9) on lever (11) with pin (8) and new cotter pin (7). Adjust IAW *Adjustment* at the end of this work package.



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INSTALLATION - CONTINUED

22. Make final adjustments to linkages. See *Adjustment* at the end of this work package.
23. Install cover (4) on top of dash assembly (5) with four washers (3), new lockwashers (2) and capscrews (1).



386-651

ADJUSTMENT

1. Ensure all linkage mounting bolts are tight before performing adjustment.
2. Refer to Table 1 for adjustment procedures and specifications.

Table 1. Governor Control Linkage Adjustments.

LOCATION	ADJUSTMENTS FROM THROTTLE, BRAKE AND GOVERNOR CONTROL LINKAGES		CORRECTIVE ACTION
	DISTANCE	MEASUREMENT	
Rod assembly (10)	Distance (A) to (B)	12.9 in. (328 mm)	Adjust, tighten jam nut (6).
Rod assembly (21)	Distance (C) to (D)	8.1 in. (206 mm)	Adjust, tighten jam nuts (16 and 17).
Governor control link (59)	Distance (E) to (F)	29.61 in (752 mm)	Adjust, tighten jam nut (71).

ADJUSTMENT - CONTINUED

Table 1. Governor Control Linkage Adjustments - Continued.

LOCATION	ADJUSTMENTS FROM THROTTLE, BRAKE AND GOVERNOR CONTROL LINKAGES		CORRECTIVE ACTION
	DISTANCE	MEASUREMENT	
Rod assembly (51)	Distance (G) to (H)	8.9 in (226 mm)	Adjust, tighten jam nuts (49 and 50).
Rod assembly (30)	Distance (I) to (J)	5.3 in (135 mm)	Adjust, tighten jam nuts (28 and 29).
Rod assembly (41)	Distance (K) to (L)	4.5 in (114 mm)	Adjust, tighten jam nuts (39 and 40).

- Run machine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

PRIMARY FUEL FILTER ASSEMBLY MAINTENANCE

0055 00

THIS WORK PACKAGE COVERS

Filter Element Service

Primary Fuel Filter Assembly: Removal, Disassembly, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Fuel (Item 12, 13 or 14, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

Filter element, fluid (6)

Materials/Parts - Continued

Gasket (5)

Packing, preformed (15 and 18)

References

WP 0038 00

WP 0050 00

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

Battery disconnect switch in OFF position (TM 5-2410-233-10)

FILTER ELEMENT SERVICE



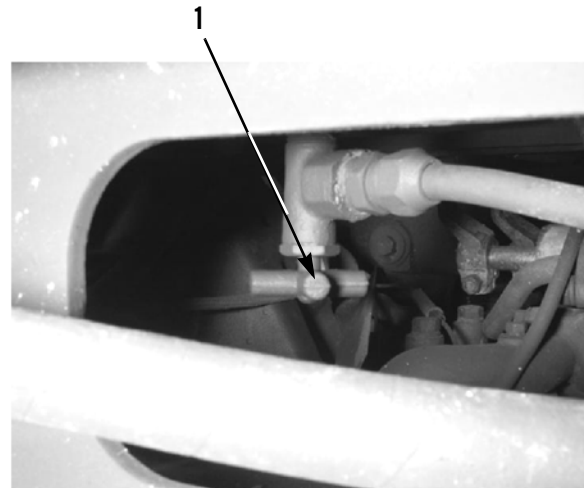
WARNING

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

CAUTION

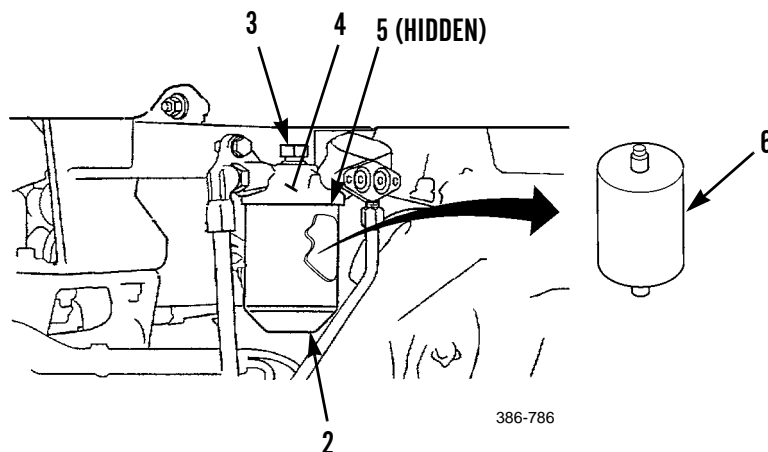
Use caution to ensure fuel system does not become contaminated. Keep work area clean. Install protective caps and plugs as needed. Contamination of fuel system could result in premature failure.

1. Turn fuel shutoff valve (1) at bottom of fuel tank to OFF position.



386-124

2. Hold filter case (2) and loosen nut sleeve (3) from top of filter base (4).
3. Remove filter case (2) from filter base (4). Remove and discard gasket (5).
4. Remove filter element (6) from filter case (2).
5. Drain fuel inside filter case (2) into a suitable container.
6. Use a soft bristle brush to remove foreign particles from filter element (6).



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FILTER ELEMENT SERVICE - CONTINUED

7. Inspect filter element (6) for dents, contamination or other damage. Replace if damaged.
8. Place filter element (6) onto stud in filter case (2).
9. Coat new gasket (5) with fuel and position onto filter case (2).
10. Position filter case (2) onto filter base (4) and hand-tighten nut sleeve (3) until filter case is snug against filter base.

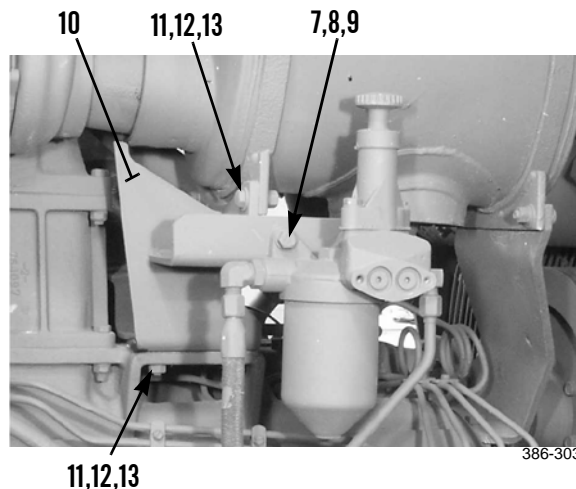
CAUTION

Do NOT overtighten or fuel leaks could result.

11. Hold filter case (2) and wrench-tighten nut sleeve (3) an additional 3/4 turn.
12. Turn fuel flow control valve (1) at bottom of fuel tank to ON.
13. Prime fuel system (WP 0038 00).
14. Check for any leaks by visually inspecting area.

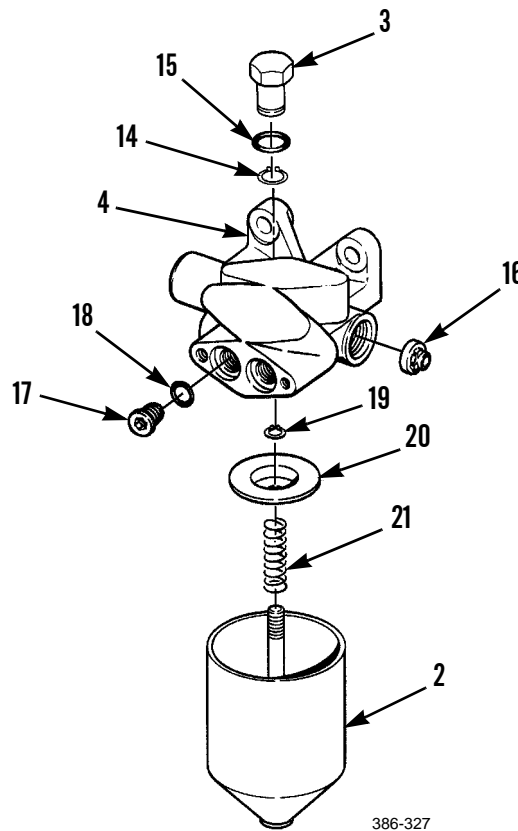
PRIMARY FUEL FILTER ASSEMBLY REMOVAL

1. Remove filter case and filter element. See *Filter Element Service* in this work package.
2. Remove fuel priming pump (WP 0038 00).
3. Disconnect fuel lines from filter base (WP 0050 00).
4. Remove two capscrews (7), four washers (8) and two nuts (9). Remove filter base (4) from support assembly (10).
5. If removal of support assembly (10) is required, remove four capscrews (11), washers (12) and nuts (13) that secure support assembly to muffler support bracket.



PRIMARY FUEL FILTER ASSEMBLY DISASSEMBLY

1. Remove nut sleeve (3), snap ring (14) and preformed packing (15) from filter base (4). Discard preformed packing.
2. Remove valve assembly (16) from filter base (4).
3. Remove two plugs (17) and preformed packings (18) from filter base (4). Discard preformed packings.
4. Remove snap ring (19) from filter case (2) and remove retainer (20) and spring (21).



386-327

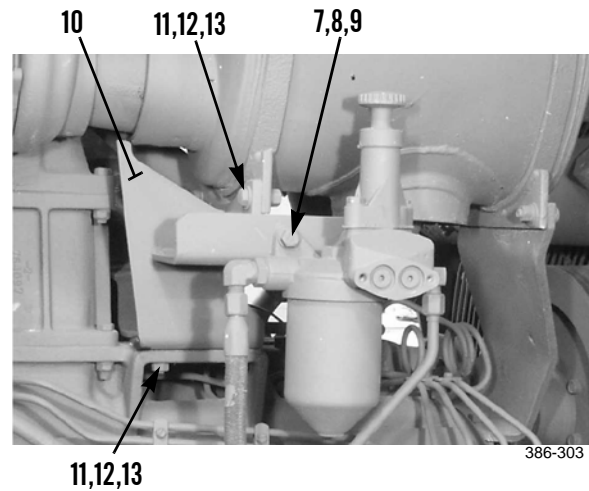
PRIMARY FUEL FILTER ASSEMBLY ASSEMBLY**NOTE**

- **Wipe all sealing surfaces and internal parts clean before assembly.**
- **Lightly coat new preformed packings with clean fuel before assembly.**

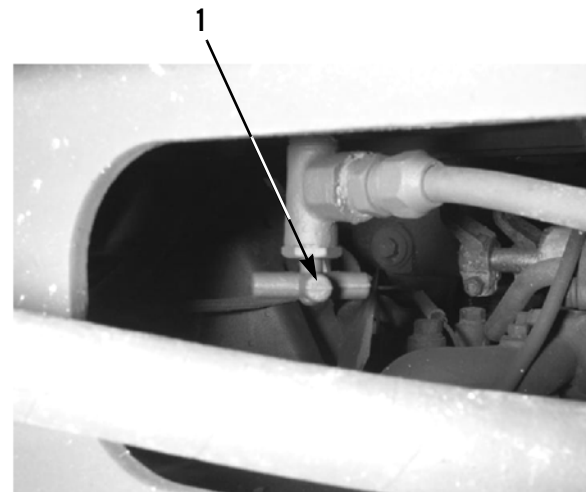
1. Place spring (21) and retainer (20) onto stud on filter case (2).
2. Install snap ring (19) to hold retainer (20) in place.
3. Install two new preformed packings (18) and plugs (17) into filter base (4).
4. Install valve assembly (16) into filter base (4).
5. Install new preformed packing (15) and snap ring (14) onto nut sleeve (3). Place nut sleeve (3) into position and secure to filter base (4).

PRIMARY FUEL FILTER ASSEMBLY INSTALLATION

1. If support assembly (10) was removed, position support assembly and install four capscrews (11), washers (12) and nuts (13) that secure supports to muffler and engine.
2. Position filter base (4) on support assembly (10) and install two capscrews (7), four washers (8) and two nuts (9).



3. Connect fuel lines to filter base (WP 0050 00).
4. Install fuel priming pump (WP 0038 00).
5. Install filter element and filter case. See *Filter Element Service* in this work package.
6. Turn fuel shutoff valve (1) to ON position.
7. Prime fuel system (WP 0038 00).
8. Visually inspect to check for any leaks.
9. Run engine and check for proper operation and fuel leaks (TM 5-2410-233-10).



END OF WORK PACKAGE

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SECONDARY FUEL FILTER ASSEMBLY MAINTENANCE

0056 00

THIS WORK PACKAGE COVERS

Filter Element Replacement
Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185
00)

Shop equipment, common no. 1 (Item 94, WP 0185
00)

Materials/Parts

Fuel (Item 12, 13 or 14, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Filter element, fluid (2)

Materials/Parts - Continued

Gasket (9)

O-ring (6)

References

WP 0038 00

WP 0168 00

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

Battery disconnect switch in OFF position (TM 5-
2410-233-10)

FILTER ELEMENT REPLACEMENT**WARNING**

DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing injury or death, or equipment damage.

CAUTION

Use caution to ensure fuel system does not become contaminated. Keep work area clean. Install protective caps and plugs as needed. Contamination of fuel system could result in premature failure.

1. Turn fuel shutoff valve (1) at bottom of fuel tank to OFF position.



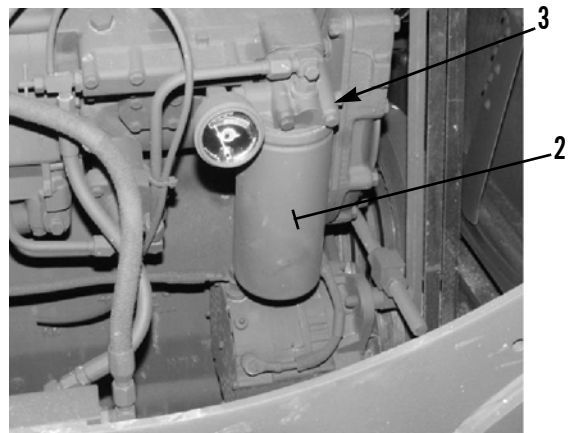
386-124

2. Remove filter element (2) and discard.
3. Wipe sealing surfaces of filter base (3) clean and dry.
4. Coat seal on new filter element (2) with clean fuel.

CAUTION

Do NOT overtighten or fuel leaks could result.

5. Install new filter element (2) by hand until seal on element contacts filter base (3). Tighten element an additional 3/4 turn.

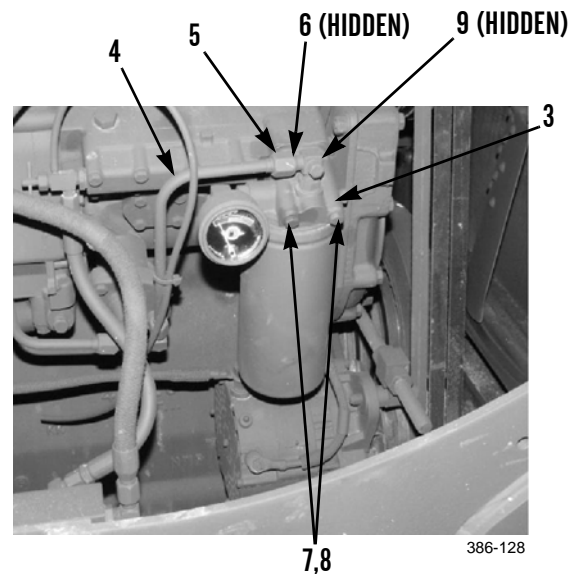


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6. Turn fuel shutoff valve (1) at bottom of fuel tank to ON position.
7. Prime fuel system (WP 0038 00).
8. Run engine and check for proper operation and fuel leaks (TM 5-2410-233-10).

REMOVAL

1. Remove filter element. See *Filter Element Replacement* in this work package.
2. Remove fuel pressure gage (WP 0168 00).
3. Disconnect fuel inlet line (4) from elbow (5).
4. Remove elbow (5) from filter base (3). Remove and discard O-ring (6).
5. Remove two capscrews (7) and flatwashers (8).
6. Remove filter base (3) and gasket (9). Discard gasket.

**INSTALLATION****NOTE**

- **Wipe all sealing surfaces clean and dry before installation.**
- **Lightly coat new O-ring with clean fuel before installation.**

1. Install new gasket (9) and filter base (3) with two capscrews (7) and flatwashers (8).
2. Install new O-ring (6) and elbow (5) to filter base (3).
3. Connect fuel inlet line (4) to elbow (5).
4. Install filter element. See *Filter Element Replacement* in this work package.
5. Install fuel pressure gage (WP 0168 00).
6. Prime fuel system (WP 0038 00).
7. Run engine and check for proper operation and fuel leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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ETHER STARTING AID MAINTENANCE

0057 00

THIS WORK PACKAGE COVERS

Service, Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Tag, marker (Item 35, WP 0184 00)
 Canister, ether (3)
 Pin, cotter (42)

References

WP 0060 00

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

Battery disconnect switch in OFF position (TM 5-2410-233-10)

**WARNING**

Ether fuel is extremely flammable and toxic. DO NOT smoke and make sure you are in a well-ventilated area away from heat, open flames or sparks. Wear eye protection. Avoid contact with skin and eyes and avoid breathing ether fumes. If fluid enters or fumes irritate the eyes, wash immediately with large quantities of clean water for 15 minutes. Seek medical attention immediately if ether is inhaled or causes eye irritation. Failure to follow this warning may cause injury or death.

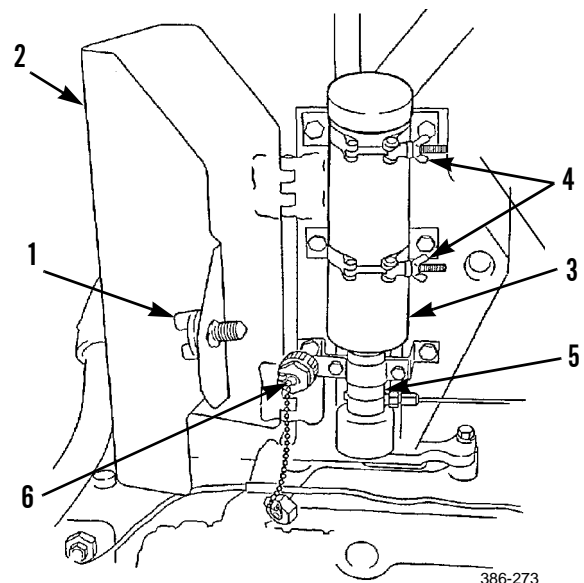
SERVICE

1. Loosen thumbscrew (1) on cover (2).
2. Open cover (2) to expose ether canister (3).
3. Loosen two clamp assemblies (4) and remove ether canister (3) from valve (5). Dispose of ether canister IAW local policy and ordinances.

NOTE

Ether canister should be removed and not replaced when ambient temperature is above 32°F (0°C).

4. If ether canister (3) is not being installed, unscrew cap (6) from its storage position and install on valve (5) in place of ether canister.
5. If ether canister (3) is being installed, screw canister into position and tighten clamp assemblies (4).
6. Close door (2) and secure with thumbscrew (1).



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REMOVAL

1. Remove ether canister. See *Service* in this work package.

NOTE

Complete draining is not required.

2. Partially drain coolant (WP 0060 00).
3. Remove tube assembly (7) from valve adapter (8) and cylinder head adapter (9).
4. Remove adapter (8) and adapter (9).

CAUTION

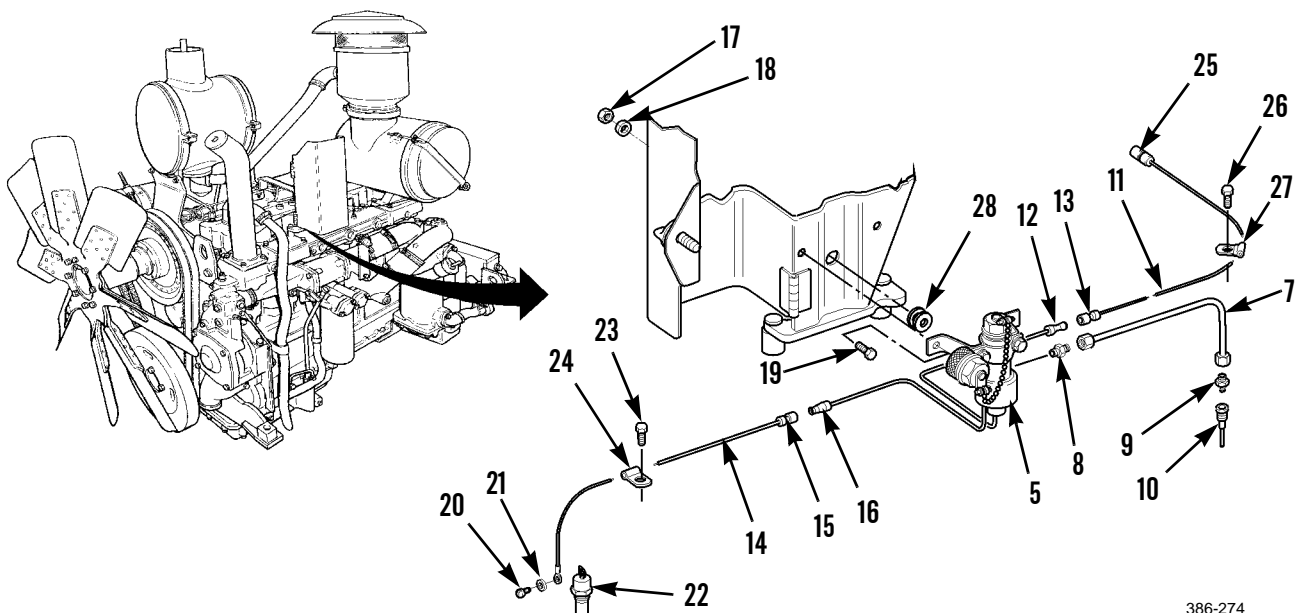
Cover or plug hole in cylinder head so that dirt cannot enter.

5. Remove nozzle (10) from engine intake manifold.

NOTE

Tag wires to ensure correct installation.

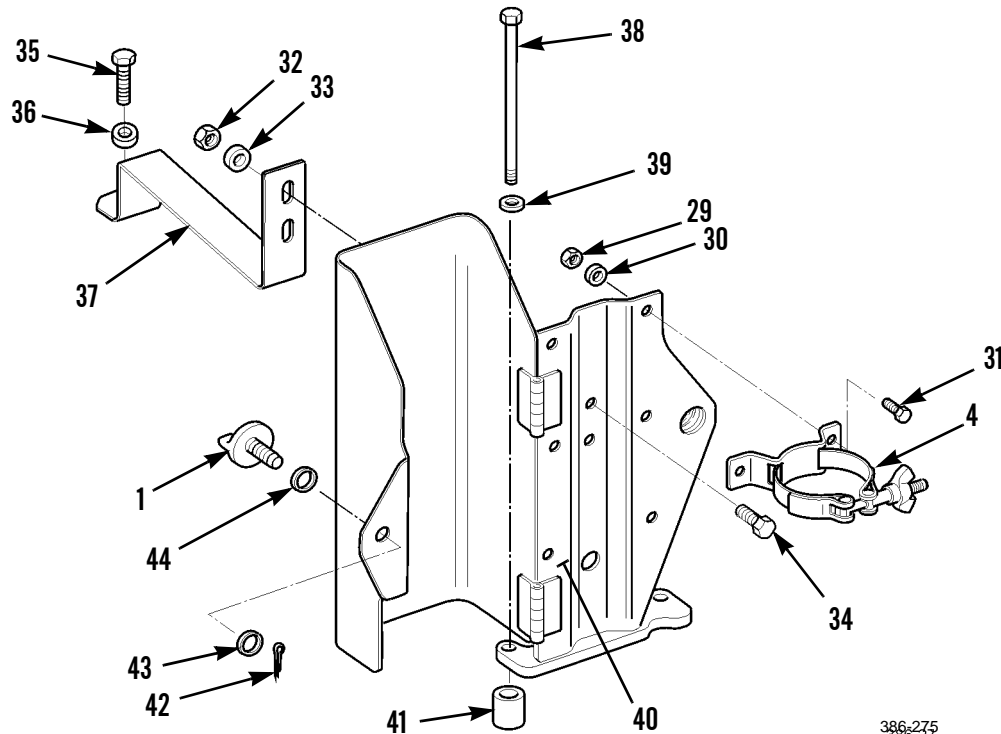
6. Disconnect wire assembly (11) at connectors (12 and 13) and wire assembly (14) at connectors (15 and 16).
7. Remove two nuts (17), flatwashers (18) and capscrews (19) and remove valve (5).
8. Remove screw (20) and washer (21) from temperature switch (22).
9. Remove temperature switch (22).
10. Remove capscrew (23) from clamp (24) and remove wire assembly (14).
11. Separate connector (25) from wiring harness.
12. Remove capscrew (26) from clamp (27) and remove wire assembly (11).
13. Remove grommet (28).



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REMOVAL - CONTINUED

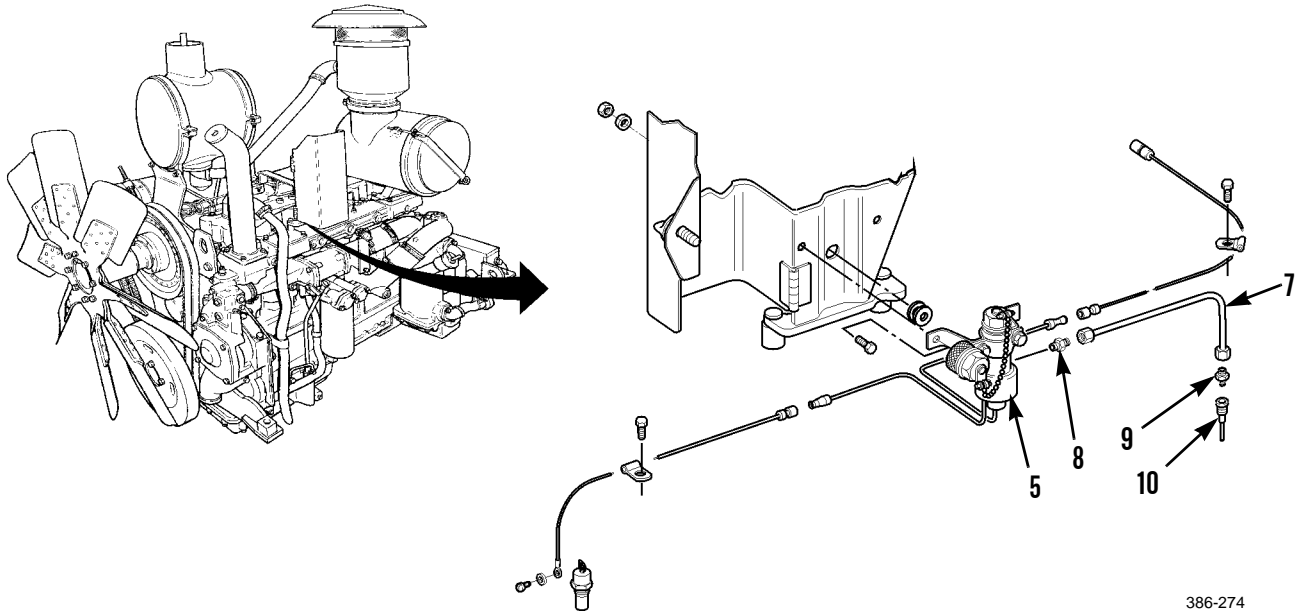
14. Remove four nuts (29), washers (30) capscrews (31) and remove two clamp assemblies (4).
15. Remove two nuts (32), washers (33) and capscrews (34).
16. Remove capscrew (35), flatwasher (36) and bracket (37).
17. Remove two capscrews (38), washers (39), box assembly (40) and spacers (41) from cylinder head.
18. Remove cotter pin (42), washer (43), thumbscrew (1) and washer (44). Discard cotter pin.

**INSTALLATION**

1. Install thumbscrew (1), washer (44), washer (43) and new cotter pin (42).
2. Position box assembly (40) and spacers (41) on cylinder head and install two washers (39) and capscrews (38).
3. Install bracket (37) with capscrew (35), flatwasher (36), two washers (33), capscrews (34) and nuts (32).
4. Install two clamp assemblies (4), four capscrews (31), washers (30) and nuts (29).
5. Install grommet (28).
6. Thread valve wires through grommet and install valve (5), two capscrews (19), washers (18) and nuts (17).
7. Place wire assembly (11) in position and connect connectors (12 and 13).
8. Connect connector (25) to wiring harness.
9. Place clamp (27) around wire assembly (11) and install capscrew (26).
10. Place wire assembly (14) in position and connect connectors (15 and 16).
11. Install temperature switch (22).
12. Attach wire assembly (14), screw (20) and washer (21) to temperature switch (22).
13. Place clamp (24) around wire assembly (14) and install capscrew (23).

INSTALLATION - CONTINUED

14. Install adapter (8) into valve (5).
15. Position nozzle (10) and install into engine intake manifold. If alignment marks are present on nozzle, make sure they are aligned with longitudinal axis of intake manifold.
16. Install adapter (9) to nozzle (10).
17. Install tube assembly (7) to adapters (8 and 9).



18. Install ether canister. See *Service* in this work package.
19. Fill cooling system (WP 0060 00).
20. Check ether starting aid for leaks. Be alert for odor of leaking ether.

END OF WORK PACKAGE

MUFFLER REPLACEMENT

0058 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Seal ring, metal (10)

Lockwasher (14)

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

Exhaust extension removed (WP 0059 00)

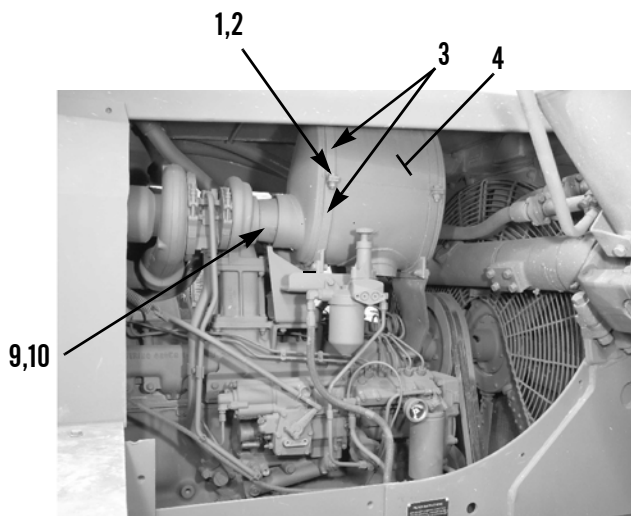
Hood removed (WP 0136 00)

**WARNING**

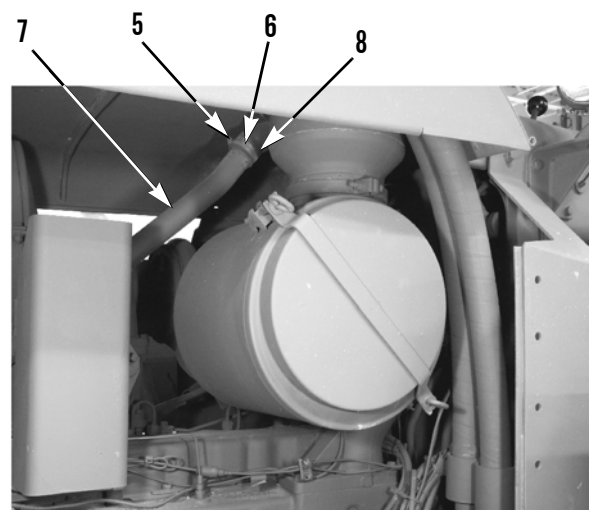
- **Ensure muffler is cool before beginning task. Failure to do so could result in serious burns.**
- **Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may cause injury.**

REMOVAL

1. Remove four capscrews (1), nuts (2) and top and bottom clamp halves (3) from muffler (4).
2. Loosen screw (5) on hose clamp (6). Separate ejector tube (7) from dust ejector hose (8).
3. Slide muffler (4) away from turbocharger coupling (9) and metal seal ring (10). Lift muffler with dust ejector tube (7) from engine assembly. Remove metal seal ring from coupling and discard.



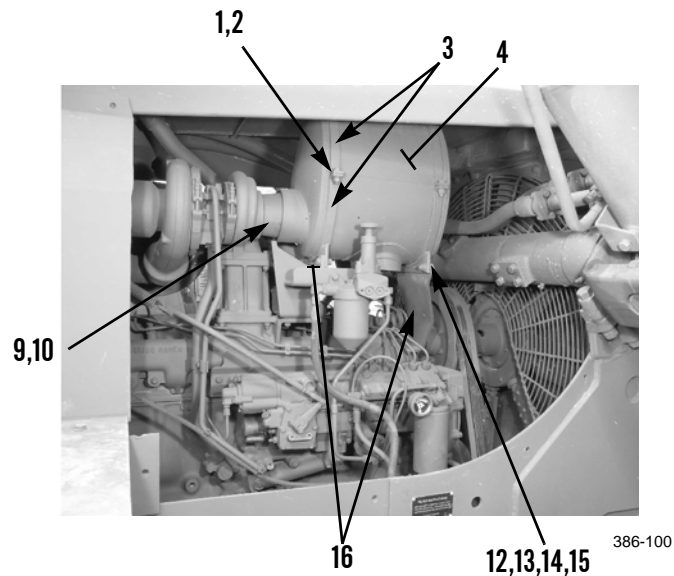
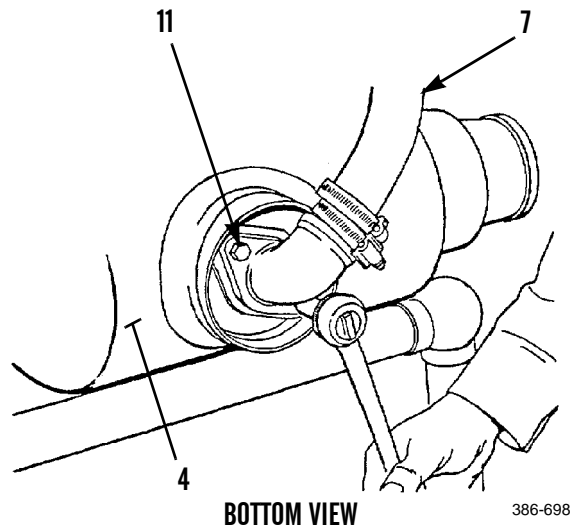
386-100



386-101

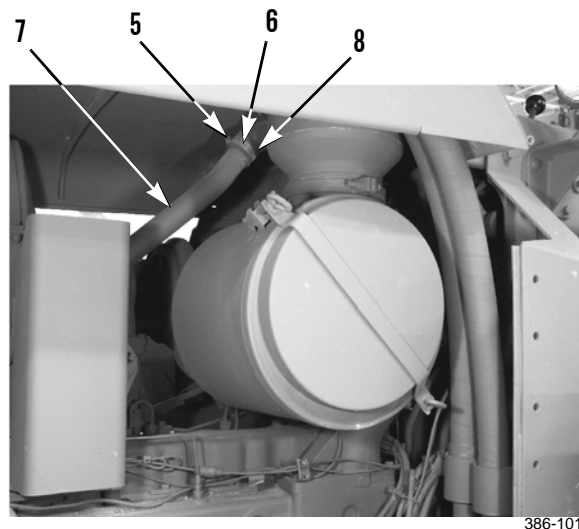
REMOVAL - CONTINUED

4. Remove two capscrews (11) and separate dust ejector tube (7) from bottom of muffler (4).
5. To remove bottom clamp halves (3), remove four capscrews (12), nuts (13), lockwashers (14) and washers (15) from brackets (16). Discard lockwashers.



INSTALLATION

1. Position dust ejector tube (7) on bottom of muffler (4) and install two capscrews (11).
2. Position bottom clamp halves (3) on brackets (16) and install four capscrews (12), new lockwashers (14), washers (15) and nuts (13).
3. Slide new metal seal ring (10) on groove of turbocharger coupling (9).
4. With assistance, slide muffler (4) on turbocharger coupling (9).
5. Position dust ejector tube (7) on dust ejector hose (8) and tighten screw (5) on hose clamp (6).
6. Install top clamp halves (3) on muffler (4) with four capscrews (1) and nuts (2).



7. Install hood (WP 0136 00).
8. Install exhaust extension (WP 0059 00).
9. Run engine and check muffler for proper operation and evidence of leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

EXHAUST EXTENSION REPLACEMENT

0059 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

**WARNING**

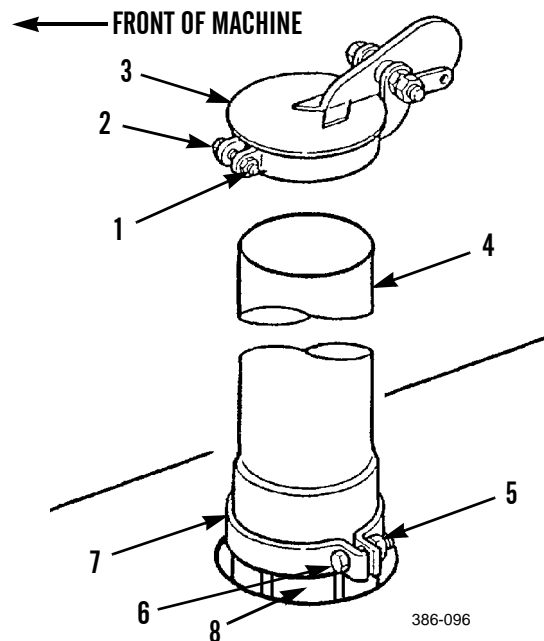
Ensure exhaust extension is cool before beginning task. Failure to do so could result in serious burns.

REMOVAL

1. Remove nut (1), capscrew (2) and cap assembly (3) from exhaust pipe (4).
2. Remove nut (5) and capscrew (6) from clamp (7).
3. Remove exhaust pipe (4) from muffler (8).

INSTALLATION

1. Position exhaust pipe (4) on muffler (8).
2. Position clamp (7) and secure with capscrew (6) and nut (5).
3. Install cap assembly (3) on exhaust pipe (4) with capscrew (2) and nut (1).
4. Run engine and check exhaust extension for evidence of leaks (TM 5-2410-233-10).

**END OF WORK PACKAGE**

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COOLING SYSTEM SERVICE

0060 00

THIS WORK PACKAGE COVERS

Draining, Flushing, Filling

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Antifreeze (Item 1, WP 0184 00)

Cleaning compound, engine cooling system (Item 3, WP 0184 00)

Materials/Parts - Continued

Rag, wiping (Item 28, WP 0184 00)

References

TB 750-651

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

Crankcase guard opened (WP 0129 00)

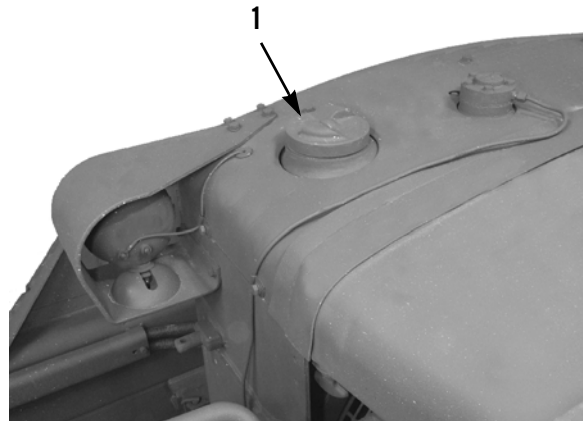
DRAINING**WARNING**

- **DO NOT** service cooling system unless engine has been allowed to cool down. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns.
- **DO NOT** remove cooling system radiator cap when engine is hot. Allow engine to cool down. Loosen cap to first stop and let any pressure out of cooling system, then remove cap. Failure to follow this warning may cause serious burns.
- Wear effective eye, glove and skin protection when handling coolants. Failure to do so may cause injury.

NOTE

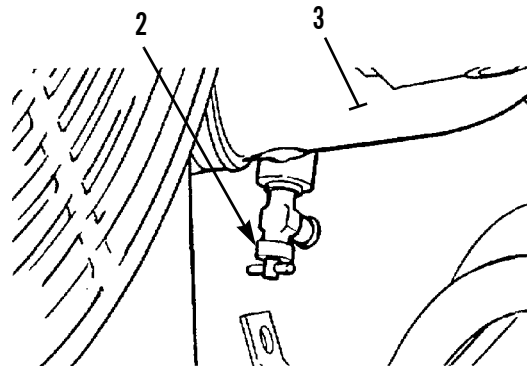
- Cooling system capacity is 12 gal. (45 l).
- If machine is to be stored in or shipped to an area with below freezing temperatures, cooling system must be protected to lowest expected ambient temperature.

1. Slowly loosen filler cap (1) to relieve pressure from the radiator. Remove filler cap.



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2. Place a suitable container beneath drain valve (2) on outlet pipe (3). Open radiator drain valve and allow coolant solution to drain.



386-139

DRAINING - CONTINUED

- Place a suitable container under left side of engine block. Remove drain plug (4) and allow coolant solution to drain.



386-787

FLUSHING

- Flush system with clean water. DO NOT run engine while flushing.

NOTE

Refer to TB 750-651 for use of engine cooling system cleaning compound.

- Use engine cooling system cleaning compound when necessary to clean heavily rusted or partially clogged cooling system, to neutralize residual acids and to coat interior with silicate.
- Repeat flushing until draining water is clear.

FILLING

- Close radiator drain valve (2) on outlet pipe (3).
- Install drain plug (4) in engine block.

CAUTION

Antifreeze should never exceed 60% by volume. Failure of cooling system can occur.

- Mix 12 gal. (45 l) of antifreeze solution to provide protection to the lowest expected ambient temperature.
- Add coolant slowly, 5 gal. (19 l) per minute or less, until level of coolant is within 1/2 in. (13 mm) of bottom of fill pipe.
- With filler cap (1) removed, start engine and run for 15 minutes. Check for coolant leaks. Stop engine and recheck coolant level. Add coolant as needed.
- Install filler cap (1).
- Close crankcase guard (WP 0129 00).

END OF WORK PACKAGE

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RADIATOR PRESSURE TESTING

0061 00

THIS WORK PACKAGE COVERS

Pressure Testing

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

References

WP 0060 00

WP 0062 00

Equipment Condition

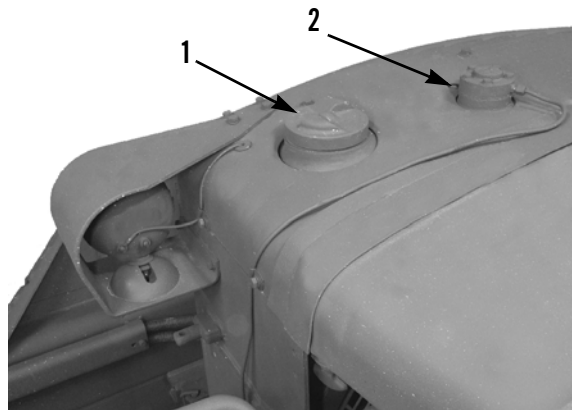
Engine OFF and cool (TM 5-2410-233-10)

**WARNING**

- **DO NOT** service cooling system unless engine has been allowed to cool down. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns.
- **DO NOT** remove cooling system radiator cap when engine is hot. Allow engine to cool down. Loosen cap to first stop and let any pressure out of cooling system, then remove cap. Failure to follow this warning may cause serious burns.
- **Wear effective eye, glove and skin protection when handling coolants. Failure to do so may cause injury.**

PRESSURE TESTING

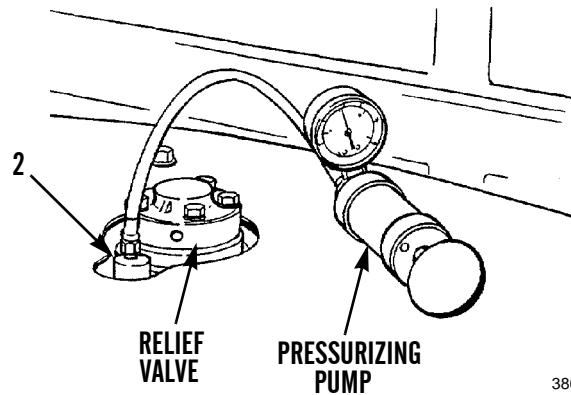
1. Slowly loosen filler cap (1) to relieve pressure from radiator.
2. Remove filler cap (1) and check coolant level. Ensure that coolant level is within 1/2 in. (13 mm) of bottom of fill pipe. Add coolant as required (WP 0060 00). Install filler cap.
3. Remove plug (2) from top of radiator.



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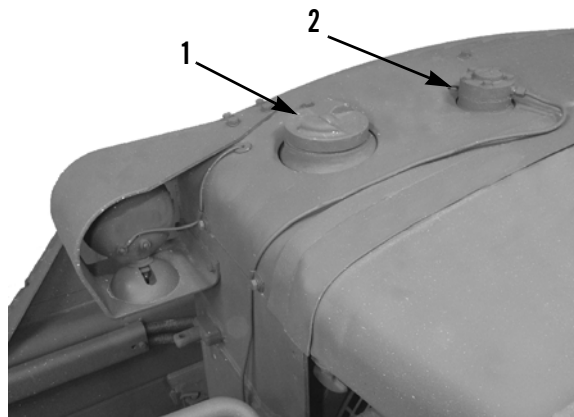
PRESSURE TESTING - CONTINUED

4. Install pressurizing pump at location where plug (2) was removed.



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5. Inspect radiator for outside leakage. Check all cooling system connections and hoses to ensure there is no external leakage.
6. Pump air into radiator until pressure reading on gage reads 10 psi (69 kPa).
7. If no external leakage is evident and pressure reading on gage remains constant for five minutes, there is no internal leakage in system.
8. If no external leakage is evident and pressure reading on gage falls, there is internal leakage. Cooling system may require repair.
9. If no internal or external leakage is found, increase pressure to 14 psi (96 kPa). Observe if there is coolant flow from overflow tube. Relief valve must open at 13 psi (90 kPa). If no coolant is present through overflow tube, replace relief valve (WP 0062 00).
10. When test is completed, open bleed valve on pump to release pressure in radiator.
11. Remove pressurizing pump from radiator and install plug (2). Tighten plug.



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12. Fill cooling system, if required (WP 0060 00).

END OF WORK PACKAGE

RADIATOR FILLER CAP AND RELIEF VALVE REPLACEMENT

0062 00

THIS WORK PACKAGE COVERS

Radiator Filler Cap: Replacement

Relief Valve: Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Gasket (7)

References

WP 0061 00

Equipment Condition

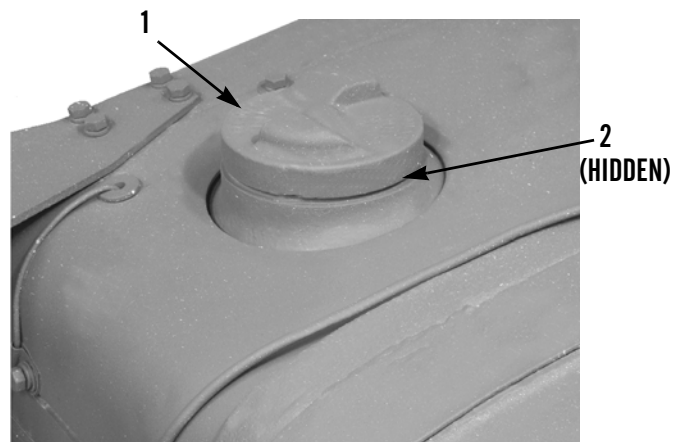
Engine OFF and cool (TM 5-2410-233-10)

**WARNING**

- **DO NOT** service cooling system unless engine has been allowed to cool down. This is a pressurized cooling system and escaping steam or hot coolant will cause serious burns.
- **DO NOT** remove cooling system radiator cap when engine is hot. Allow engine to cool down. Loosen cap to first stop and let any pressure out of cooling system, then remove cap. Failure to follow this warning may cause serious burns.
- Wear effective eye, glove and skin protection when handling coolants. Failure to do so may cause injury.

RADIATOR FILLER CAP REPLACEMENT

1. Remove filler cap (1) from radiator.
2. Inspect gasket (2) in filler cap (1). If gasket is damaged, replace.
3. Install filler cap (1) on radiator and tighten securely.
4. Start engine and check filler cap (1) for coolant leaks.
5. Pressure test radiator as needed to verify cooling system does not leak (WP 0061 00).



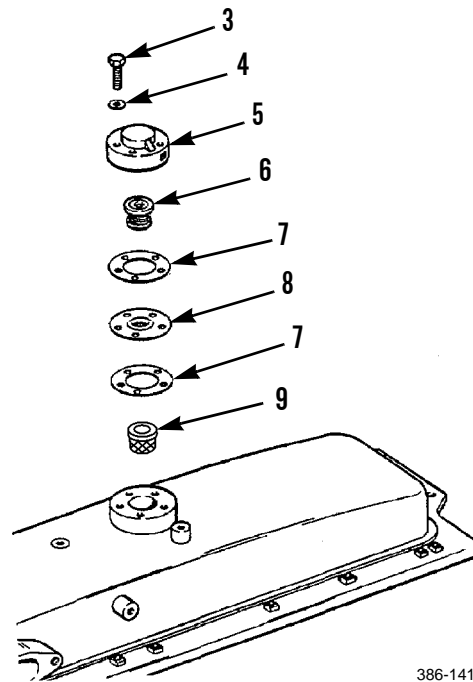
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RELIEF VALVE REMOVAL

1. Remove five capscrews (3), washers (4) and access cover (5).
2. Remove flow control thermostat (6).
3. Remove two gaskets (7) with plate (8). Discard gaskets.
4. Remove strainer (9).

RELIEF VALVE INSTALLATION

1. Install strainer (9).
1. Install two new gaskets (7) with plate (8).
2. Install flow control thermostat (6).
3. Install access cover (5).
4. Install five washers (4) and capscrews (3).



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5. Pressure test radiator as needed to verify cooling system has no leaks and to verify operation of relief valve (WP 0061 00).
6. Start engine and check for coolant leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

RADIATOR MAINTENANCE

0063 00

THIS WORK PACKAGE COVERSRemoval, Disassembly, Assembly, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Link, lifting (Item 43, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Lifting equipment, 500 lb capacity

Materials/Parts

Antifreeze (Item 1, WP 0184 00)

Detergent (Item 10, WP 0184 00)

Materials/Parts - Continued

Gasket (13, 19, 61 and 66)

Lockwasher (2, 5, 12, 18, 22, 26, 32, 39, 47, 50, 54, 60 and 63)

References

TB 750-651

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

Hood removed (WP 0136 00)

Head lamp protective guard removed

Cooling system drained (WP 0060 00)

Fan guard removed (WP 0068 00)

REMOVAL



WARNING



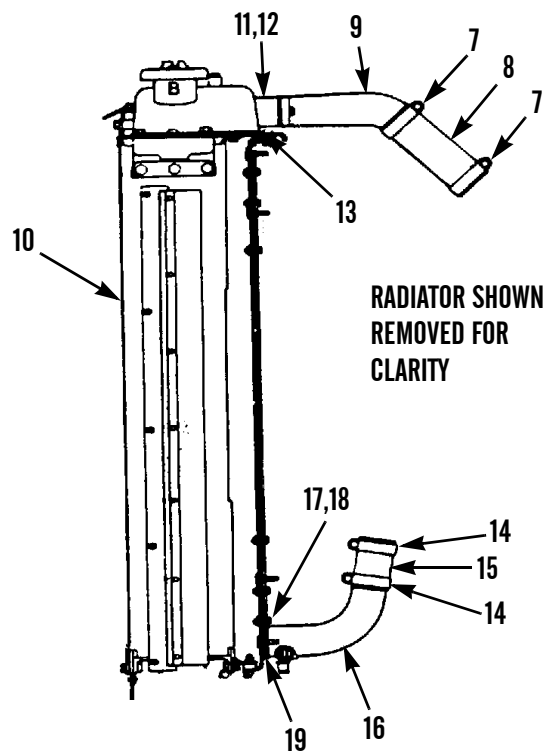
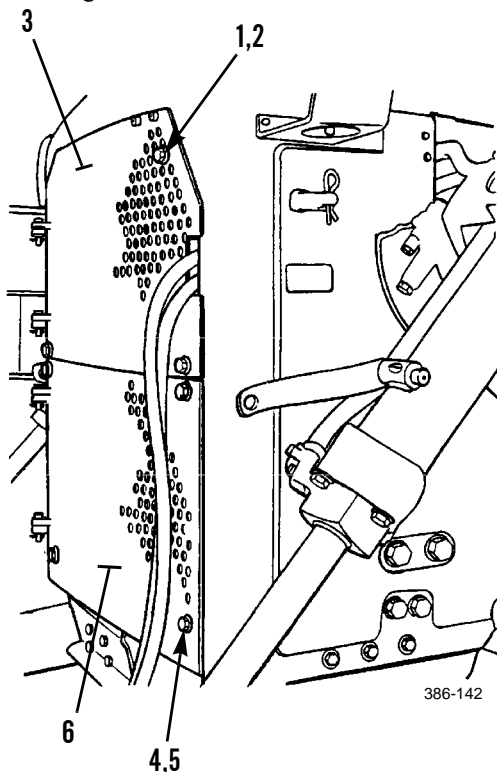
- **DO NOT** service cooling system unless engine has been allowed to cool down. This is a pressurized cooling system and escaping steam or hot coolant may cause serious burns.
- **DO NOT** remove cooling system radiator cap when engine is hot. Allow engine to cool down. Loosen cap to first stop and let any pressure out of cooling system, then remove cap. Failure to follow this warning may cause serious burns.
- **Wear effective eye, glove and skin protection when handling coolants. Failure to do so may cause injury.**

1. Remove three capscrews (1), lockwashers (2) and open upper radiator grille (3). Discard lockwashers.
2. Remove four capscrews (4), lockwashers (5), and open lower radiator grille (6). Discard lockwashers.

NOTE

Use a suitable container to capture any residual coolant in hoses. Dispose of coolant IAW local policy and ordinances. Ensure all spills are cleaned up.

3. Loosen two clamps (7) and remove hose (8) from elbow flange (9) at top of radiator (10).
4. Remove two capscrews (11), lockwashers (12), elbow flange (9) and gasket (13) from top of radiator (10). Discard lockwashers and gasket.
5. Loosen two clamps (14) and remove hose (15) from elbow flange (16) at bottom of radiator (10).
6. Remove four capscrews (17), lockwashers (18), elbow flange (16) and gasket (19) from bottom of radiator (10). Discard lockwashers and gasket.

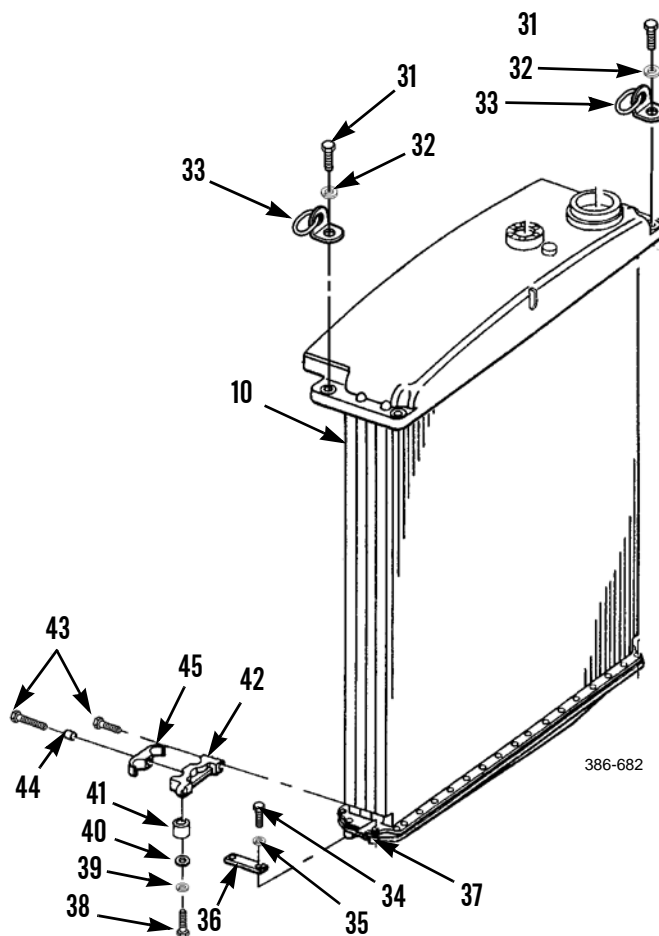
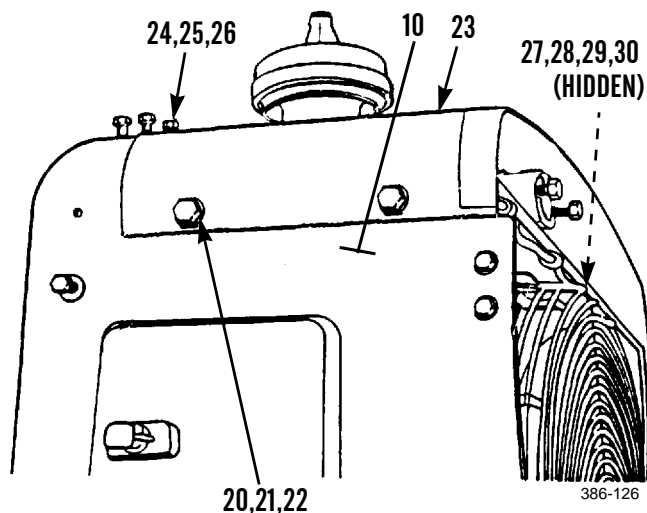


RADIATOR MAINTENANCE - CONTINUED

0063 00

REMOVAL - CONTINUED

7. Remove two capscrews (20), lockwashers (21) and washers (22) from radiator cover (23). Discard lockwashers.
8. Repeat step 7 on other side of radiator cover (23).
9. Remove three capscrews (24), washers (25) and lockwashers (26) from top of radiator cover (23). Discard lockwashers.
10. Remove ten capscrews (27), washers (28), two shrouds (29) and two shields (30).
11. Disconnect water pressure relief line from top of radiator (10).
12. Remove two capscrews (31) and lockwashers (32) and install two lifting links (33), lockwashers and capscrews.
13. Attach a nylon sling and a suitable lifting device to lifting links (33).
14. Remove capscrew (34), washer (35) and retainer (36) from radiator mount brace (37).
15. Remove two capscrews (38), lockwashers (39), washers (40) and bumpers (41) from lower mount bracket (42) on lower back side of radiator (10). Discard lockwashers.
16. Remove two capscrews (43), retainer (44), strap (45) and lower mount bracket (42) from lower backside on radiator (10).
17. Repeat step 14 through 16 for other side of radiator (10).



REMOVAL - CONTINUED

18. Remove capscrew (46) and lockwasher (47) from front mounting bracket (48). Discard lockwasher.
19. Remove nut (49), lockwasher (50) and capscrew (51) from front angle bracket (52). Discard lockwasher.
20. Remove three inner top radiator mounting nuts (53), lockwashers (54), capscrews (55) and washers (56). Separate front angle bracket (52) and double-angle front mounting bracket (57). Discard lockwashers.
21. Remove bushing (58) from front mounting bracket (48), if required.
22. Repeat step 18 through 21 for other side of radiator (10).



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death to personnel.

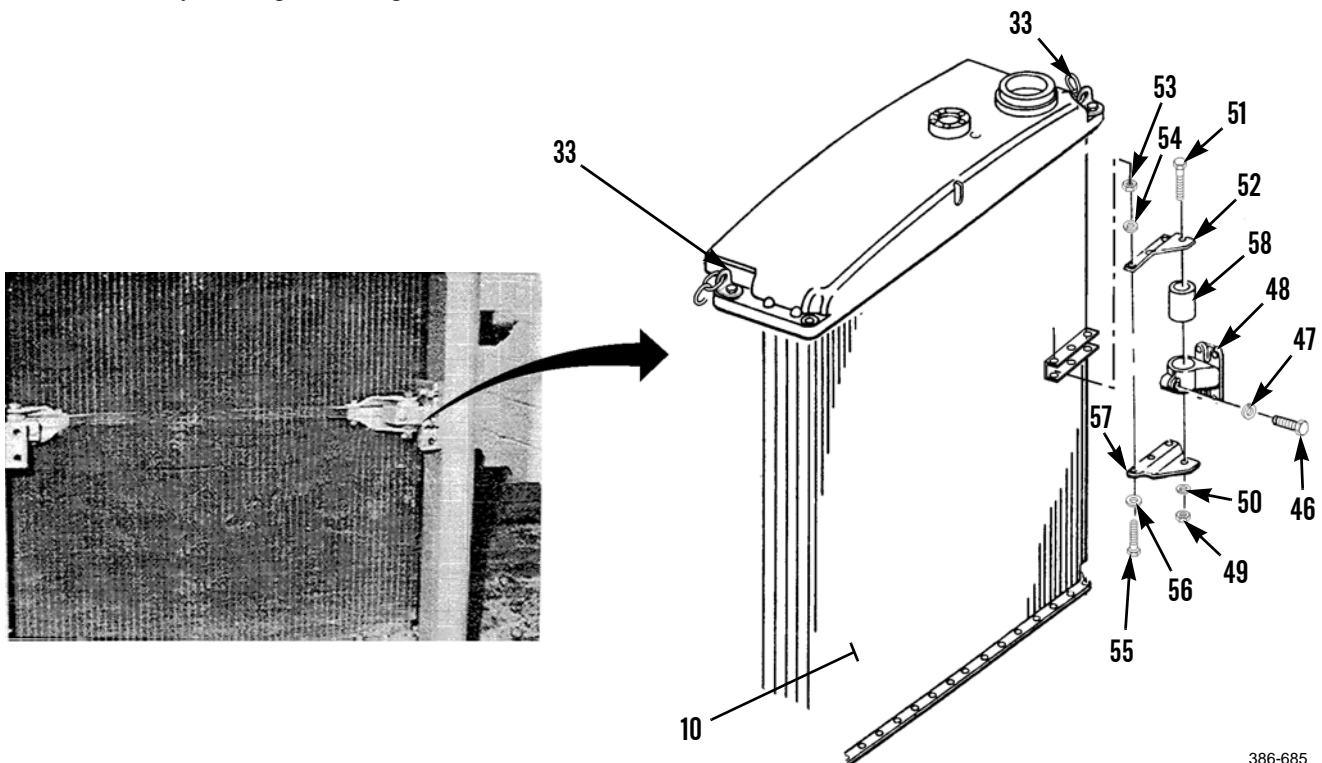
CAUTION

Ensure that wiring harness from flood lights, located between radiator and support, is clear of radiator. Lift radiator slowly and carefully to avoid damage to wiring harness.

NOTE

Radiator weighs 450 lb (204 kg)

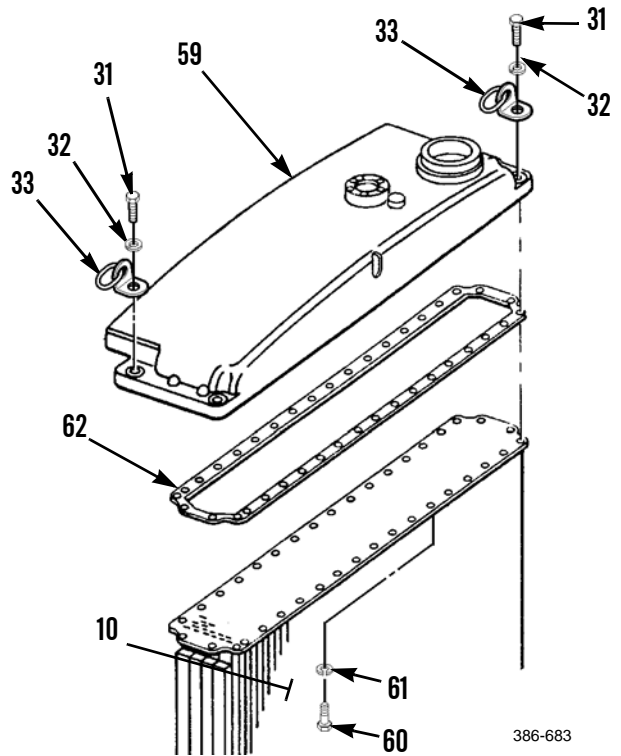
23. With suitable lifting device attached to lifting links (33), lift radiator (10) clear of machine.
24. Remove nylon sling and lifting device.



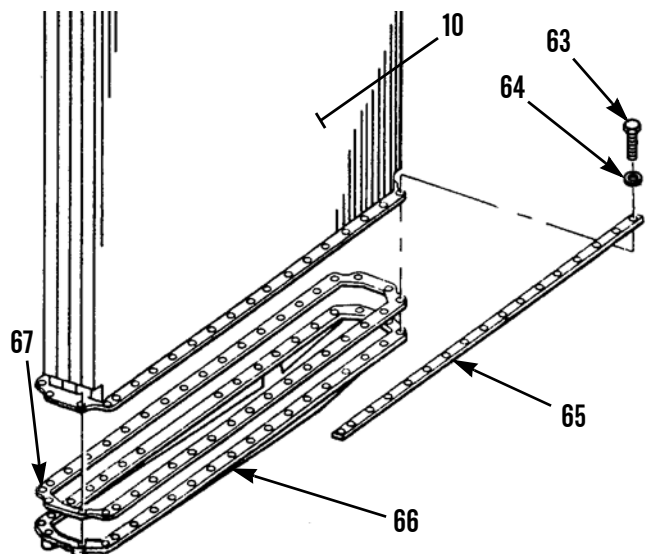
386-685

DISASSEMBLY

1. Remove four capscrews (31) and lockwashers (32) and two lifting links (33) from tank (59). Discard lockwashers.
2. Remove 36 capscrews (60) and lockwashers (61) from lower part of tank (59). Discard lockwashers
3. Remove tank (59) and gasket (62) from top of radiator (10). Discard gasket.

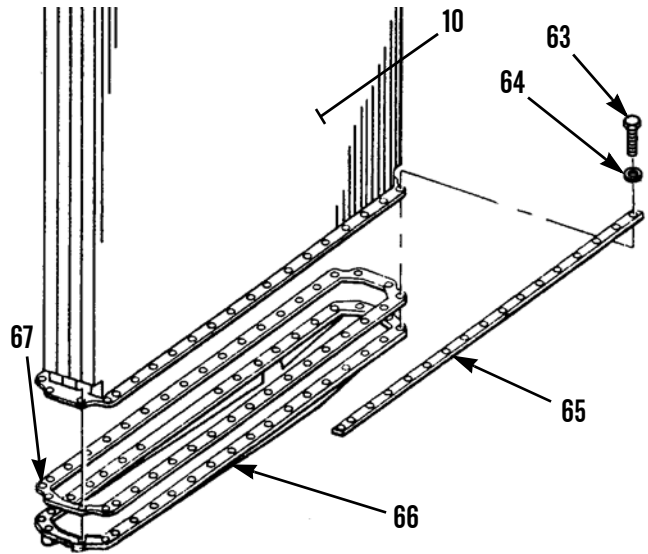


4. Remove 32 bolts (63), lockwashers (64), four strips (65), bottom (66) and gasket (67) from radiator (10). Discard lockwashers and gasket.



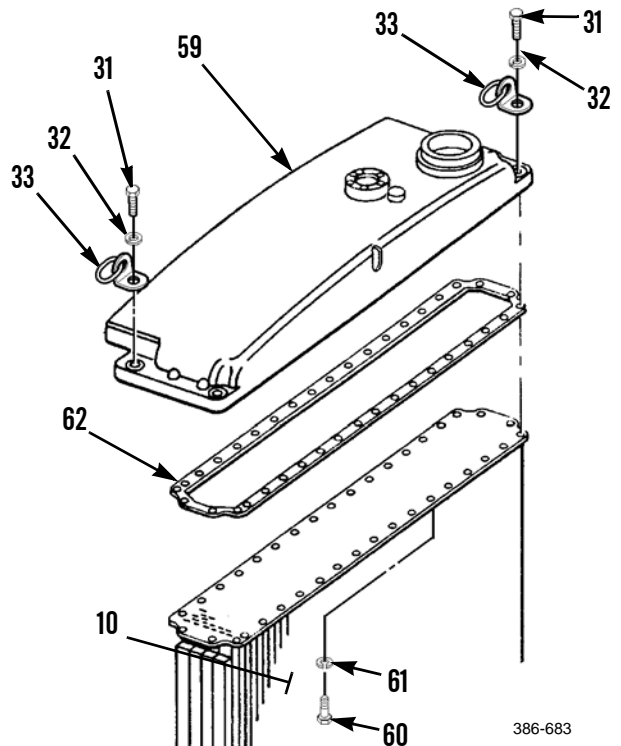
ASSEMBLY

1. Install new gasket (67), bottom (66), four strips (65), 32 new lockwashers (64) and bolts (63) on radiator (10).



386-811

2. Install new gasket (62) on radiator (10).
3. Position tank (59) on radiator (10) and install two lifting links (33), four new lockwashers (32) and capscrews (31).
4. Install 36 new lockwashers (61) and capscrews (60) between tank (59), gasket (62) and radiator (10).



386-683

INSTALLATION



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

CAUTION

Ensure that wiring harness from flood lights, located between radiator and support, is clear of radiator. Lower radiator slowly and carefully to avoid damage to wiring harness.

NOTE

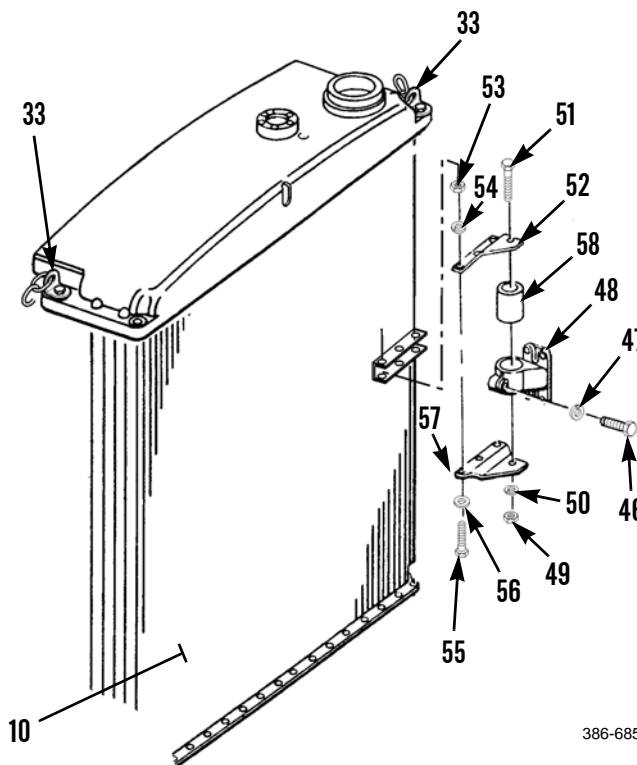
Radiator weighs 450 lb (204 kg).

1. Attach a nylon sling and a suitable lifting device to lifting links (33) and lift radiator (10) into radiator guard on machine.
2. If removed, install bushing (58) through front mounting bracket (48).

NOTE

Do not tighten capscrews until all radiator mounting hardware has been installed.

3. Position double-angle front mounting bracket (57) and front angle bracket (52) and install capscrew (51), new lockwasher (50) and nut (49).
4. Install three washers (56), capscrews (55), new lockwashers (54) and nuts (53) to secure radiator (10).
5. Install new lockwasher (47) and capscrew (46) to front mounting bracket (48).
6. Repeat step 2 through 5 for other side of radiator (10).



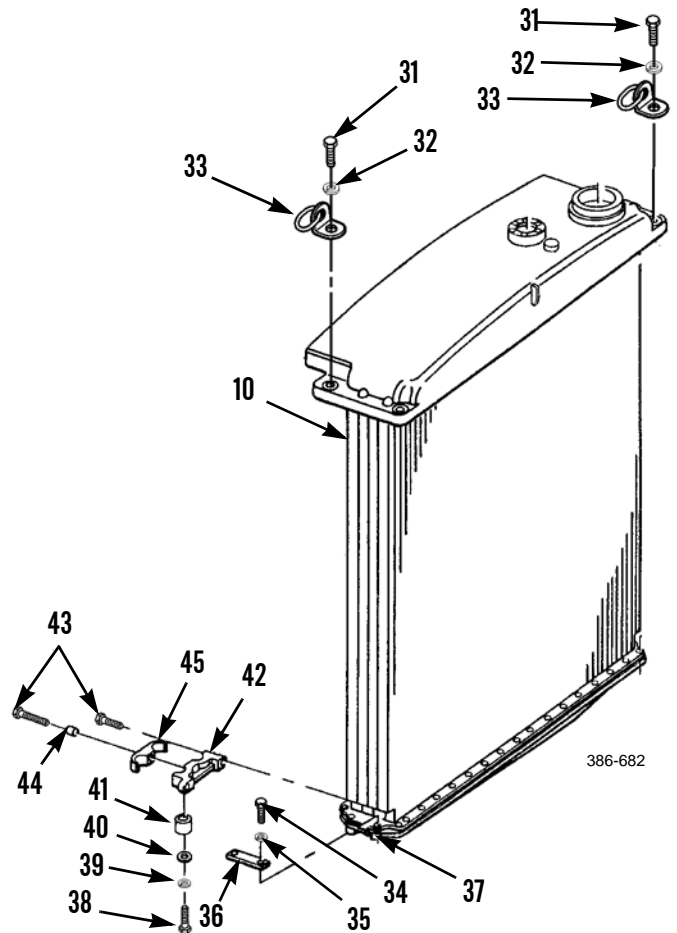
386-685

RADIATOR MAINTENANCE - CONTINUED

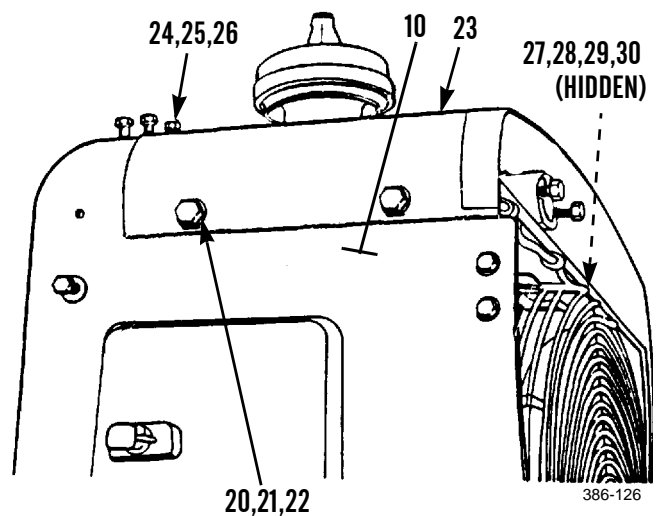
0063 00

INSTALLATION - CONTINUED

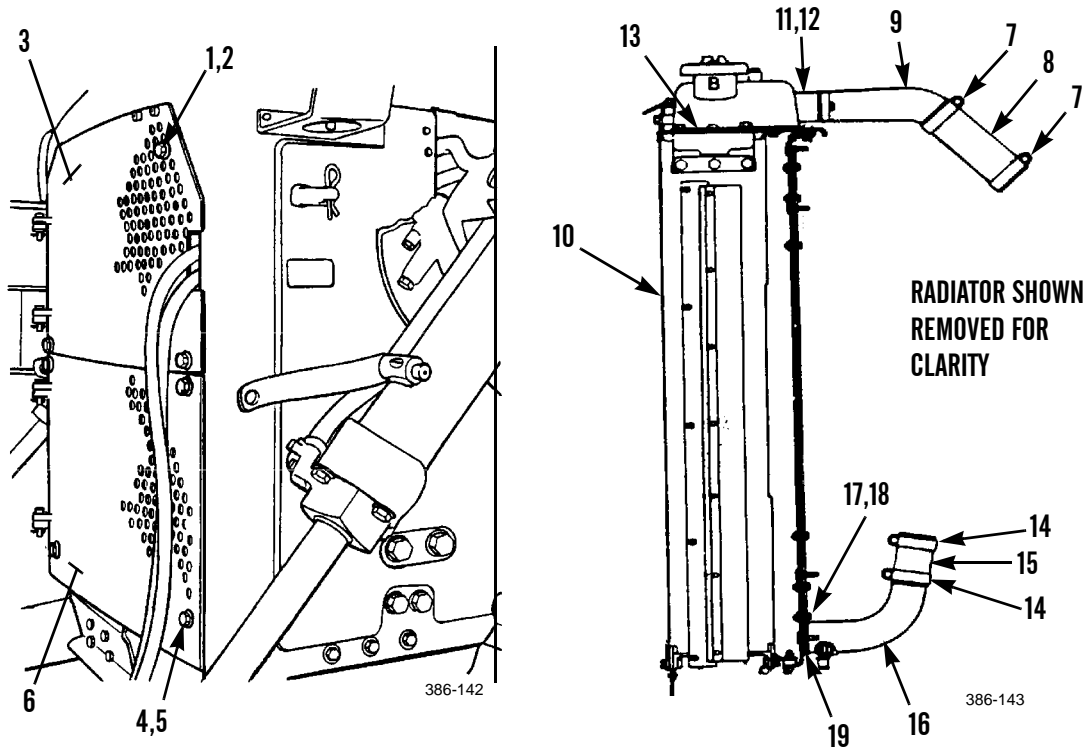
7. Position retainer (36) to radiator mount brace (37) and install washer (35) and capscrew (34).
8. Position lower mount bracket (42) on lower backside on radiator (10) and install two bumpers (41), washers (40), new lockwashers (39) and capscrews (38).
9. Position strap (45) and install retainer (44), and two capscrews (43) on lower mount bracket (42).
10. Repeat steps 7 through 9 for other side of radiator (10).
11. Tighten all mounting hardware, remove lifting device and two lifting links (33).
12. Install two new lockwashers (32) and capscrews (31) on tank.



13. Connect water pressure relief line to top of radiator (10).
14. Install two shields (30) and two shrouds (29) with ten washers (28) and capscrews (27).
15. Install radiator cover (23) with three new lockwashers (26), washers (25) and capscrews (24).
16. Install two washers (22), new lockwashers (21) and capscrews (20) on one side of radiator cover (23).
17. Repeat step 16 on other side of radiator cover (33).
18. Install new gasket (19), elbow flange (16) and four new lockwashers (18) and capscrews (17) to bottom of radiator (10).
19. Install hose (15) and two hose clamps (14) on elbow flange (16) at bottom of radiator (10).
20. Install new gasket (13), elbow flange (9) and two new lockwashers (12) and capscrews (11) to top of radiator (10).
21. Install hose (8), two hose clamps (7) on elbow flange (9) at top of radiator (10).



INSTALLATION - CONTINUED



22. Close lower radiator grille (6) and install four new lockwashers (5) and capscrews (4).
23. Close upper radiator grille (3) and install three new lockwashers (2) and capscrews (1).
24. Install fan guard (WP 0068 00).
25. Refill cooling system (WP 0060 00).
26. Run engine and check for leaks (TM 5-2410-233-10).
27. Install headlamp protective guard (TM 5-2410-233-10).
28. Install hood (WP 0136 00).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Test, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Antifreeze (Item 1, WP 0184 00)

Materials/Parts - Continued

Gasket (6)

References

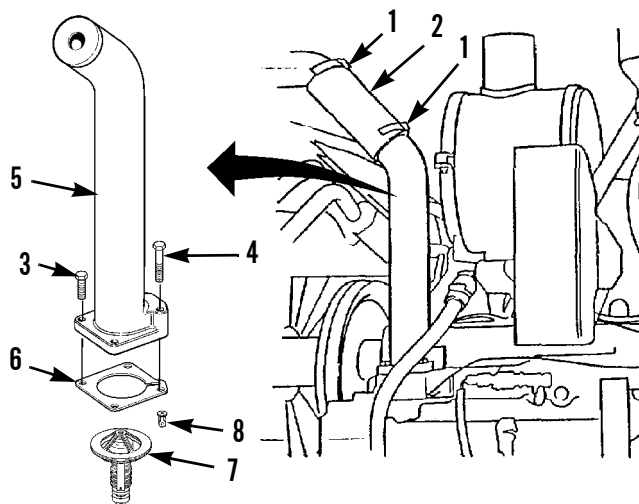
WP 0061 00

Equipment Condition

Coolant drained (WP 0060 00)

REMOVAL

1. Loosen two clamps (1) and slide hose (2) toward radiator.
2. Remove three capscrews (3), capscrew (4), elbow flange (5) and two gaskets (6) from cylinder head. Discard gasket.
3. Remove water temperature regulator (7) and flow control (bypass) valve (8) from cylinder head.



386-127

TEST

1. Place thermometer in container with water. Heat water to 175°F (79°C).
2. Submerge water temperature regulator (7) in heated water.

NOTE

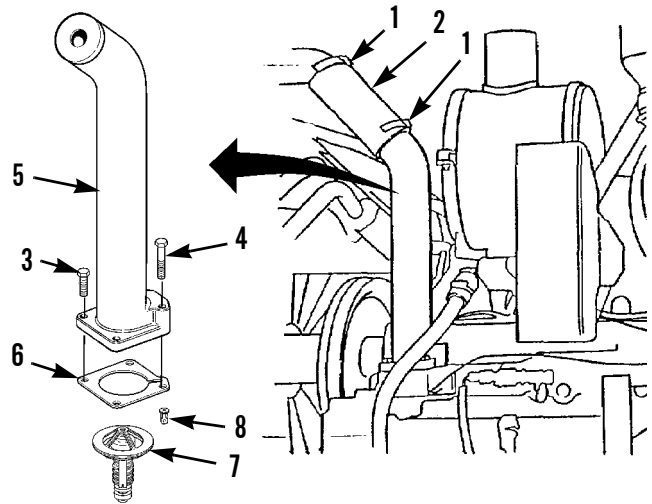
Water temperature regulator should start to open at 175°F (79°C) and be fully open at 195°F (91°C) maximum.

3. Read temperature on thermometer when water temperature regulator (7) starts to open.
4. Discard water temperature regulator if not fully open at 195°F (91°C).

INSTALLATION**CAUTION**

If water temperature regulator is installed wrong, engine will overheat.

1. Install water temperature regulator (7) in cylinder head, with spring toward inside of engine. Install flow control (bypass) valve (8).
2. Install two new gaskets (6) and elbow flange (5) over water temperature regulator (7).
3. Install three capscrews (3) and capscrew (4).
4. Slide hose (2) into position and tighten two clamps (1).



386-127

5. Fill cooling system (WP 0060 00).
6. Run engine and check for leaks (TM 5-2410-233-10) or pressure test system (WP 0061 00).

END OF WORK PACKAGE

WATER PUMP ASSEMBLY REPLACEMENT

0065 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Antifreeze (Item 1, WP 0184 00)

Oil, lubricating (Item 25, WP 0184 00)

Materials/Parts - Continued

Packing, preformed (4)

References

TM 5-2410-233-10

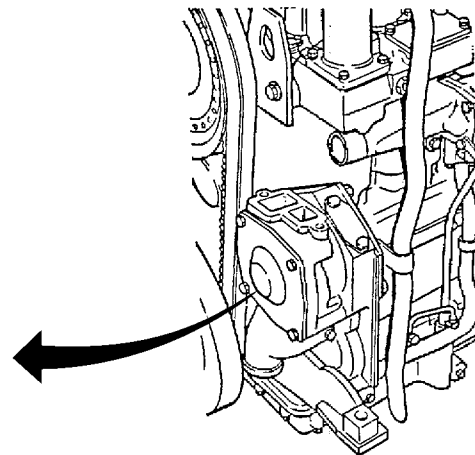
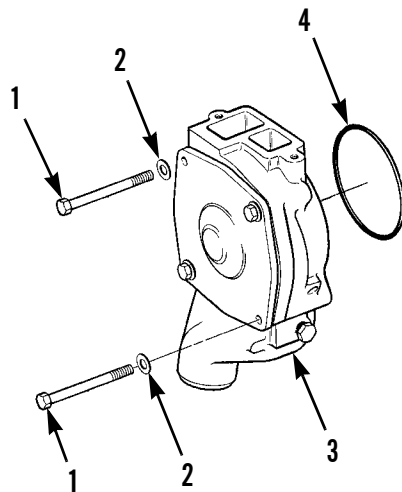
Equipment Condition

Coolant drained (WP 0060 00)

Water pump lines and hoses removed (WP 0066 00)

REMOVAL

1. Remove two capscrews (1), washers (2) and water pump (3) from timing gear cover.
2. Remove and discard preformed packing (4).



386-460

INSTALLATION

1. Lightly lubricate new preformed packing (4) with clean oil and install on water pump (3).
2. Position water pump (3) on timing gear cover and install two capscrews (1) and washers (2).
3. Install water pump lines and hoses (WP 0066 00).
4. Fill cooling system (WP 0060 00).
5. Run engine and check for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Antifreeze (Item 1, WP 0184 00)

Compound, gasket forming silicone (Item 7, WP 0184 00)

Materials/Parts - Continued

Gasket (13 and 14)

References

TM 5-2410-233-10

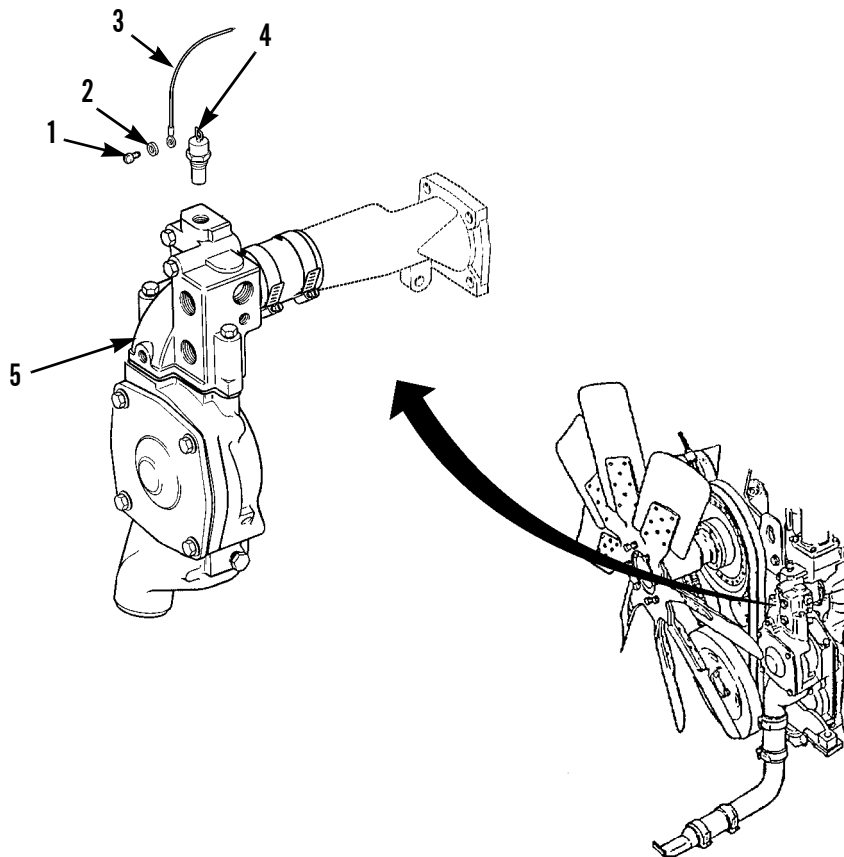
WP 0061 00

Equipment Condition

Coolant drained (WP 0060 00)

REMOVAL

1. Remove screw (1) washers (2) and wire (3) from top of sending unit (4). Remove sending unit from elbow (5).



386-838

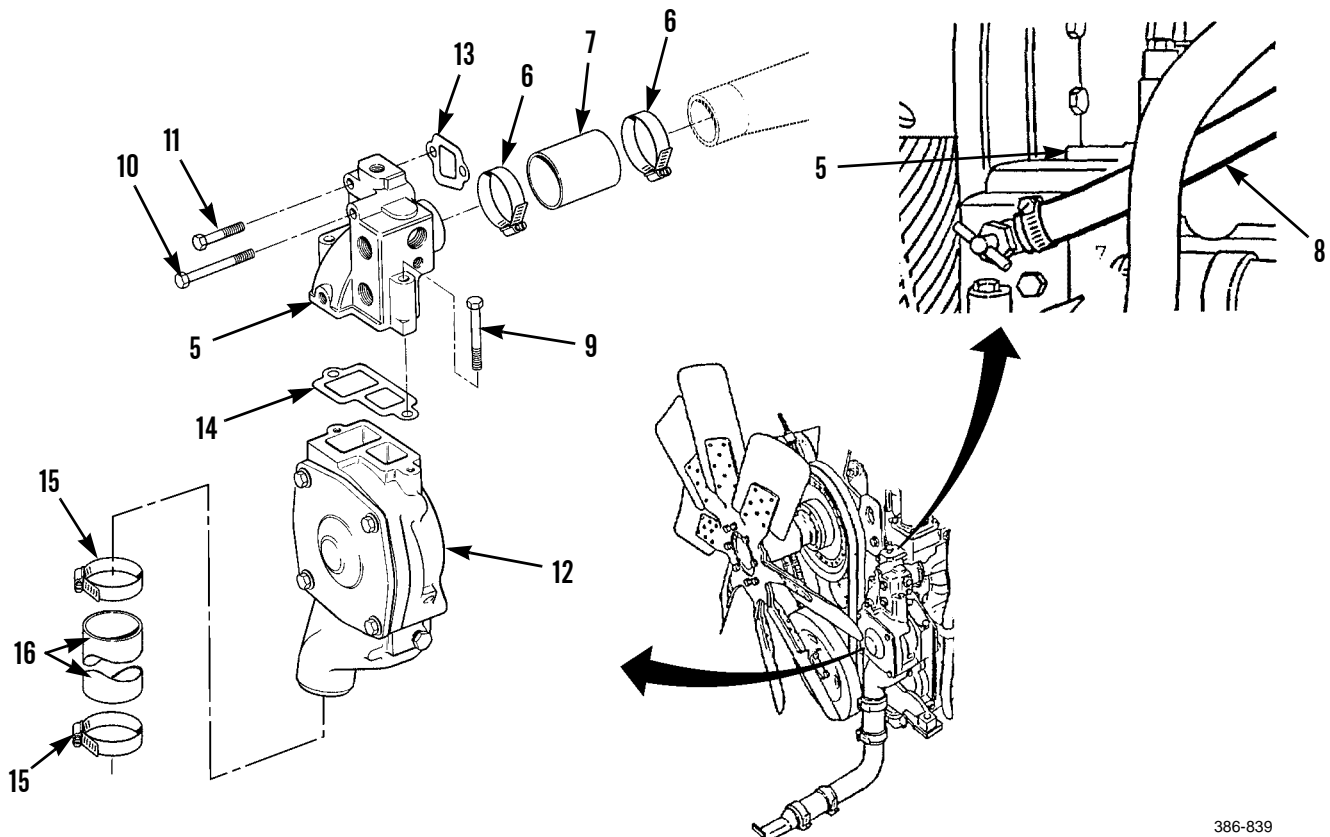
REMOVAL - CONTINUED

- Loosen two clamps (6) from hose (7).

NOTE

Perform step 3 only if tractor is equipped with a winterized cab.

- If equipped, disconnect heater hose (8) from elbow (5).
- Remove two capscrews (9) and capscrews (10 and 11).
- Carefully separate elbow (5) from engine and top of water pump (12) and remove hose (7).
- Remove gaskets (13 and 14) from mating surfaces. Discard gaskets.
- Loosen two clamps (15) and slide hose (16) off bottom of water pump (12).



386-839

INSTALLATION**NOTE**

- Ensure mating surfaces are clean and dry.
- Use silicone gasket forming compound on mating surfaces to aid gasket placement and to seal between components.

- Position hose (16) at bottom of water pump (12) and tighten two clamps (15).

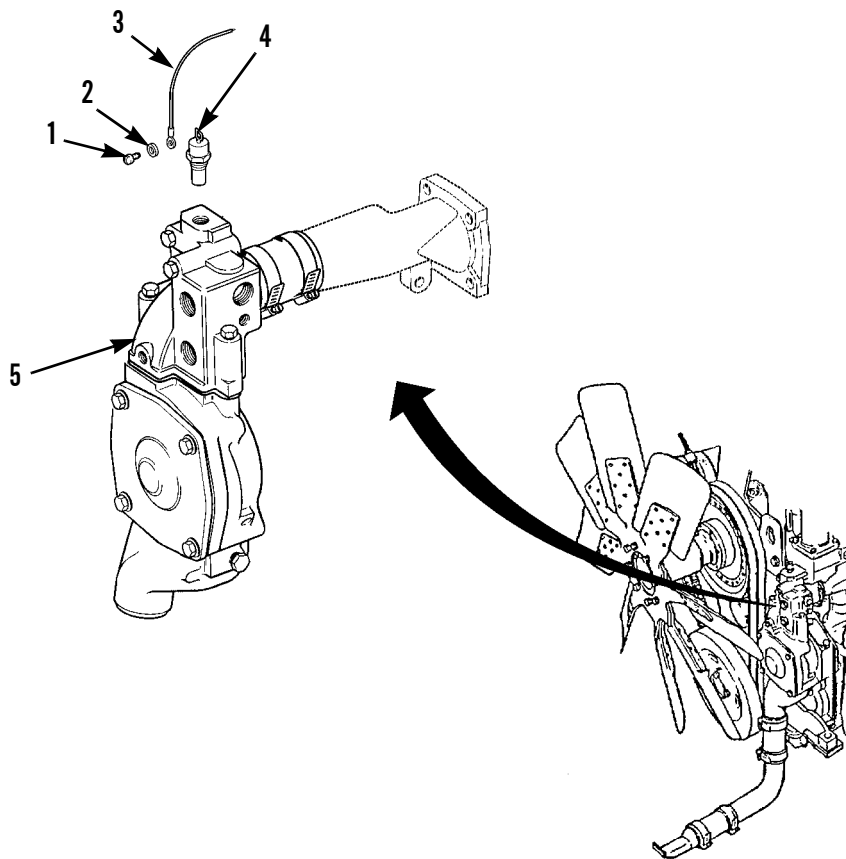
INSTALLATION - CONTINUED

2. Install hose (7) on elbow (5).
3. Position new gaskets (14 and 13) on elbow (5).
4. Position elbow (5) on engine and top of water pump (12).
5. Secure elbow (9) to water pump (12) and engine with two capscrews (9) and capscrews (11 and 10).

NOTE

Perform step 6 only if tractor is equipped with a winterized cab.

6. If removed, connect heater hose (8) to elbow (5).
7. Position two clamps (6) and tighten.
8. Install sending unit (4) in elbow (5) and tighten.
9. Position wire (3) on top of sending unit (4) and install washer (2) and screw (1).



386-838

10. Fill cooling system (WP 0060 00).
11. Run engine and check for proper operation (TM 5-2410-233-10) and coolant leaks or perform pressure test (WP 0061 00).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning and Inspection, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)
- Bushing driver set (Item 13, WP 0185 00)

Materials/Parts

- Grease, GAA (Item 15, WP 0184 00)
- Bolt, self-locking (6)

Materials/Parts - Continued

- O-ring (4)
- Seal (12)

References

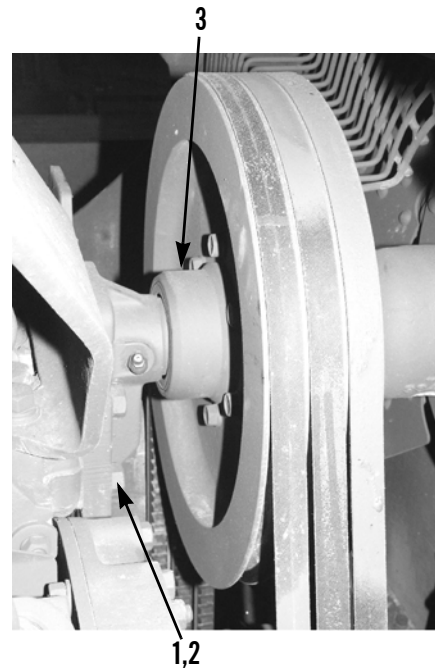
- TM 5-2410-233-10
- WP 0176 00

Equipment Condition

- V-belts removed (WP 0069 00)

REMOVAL

Remove four capscrews (1), washers (2) and fan drive assembly (3) from engine block.



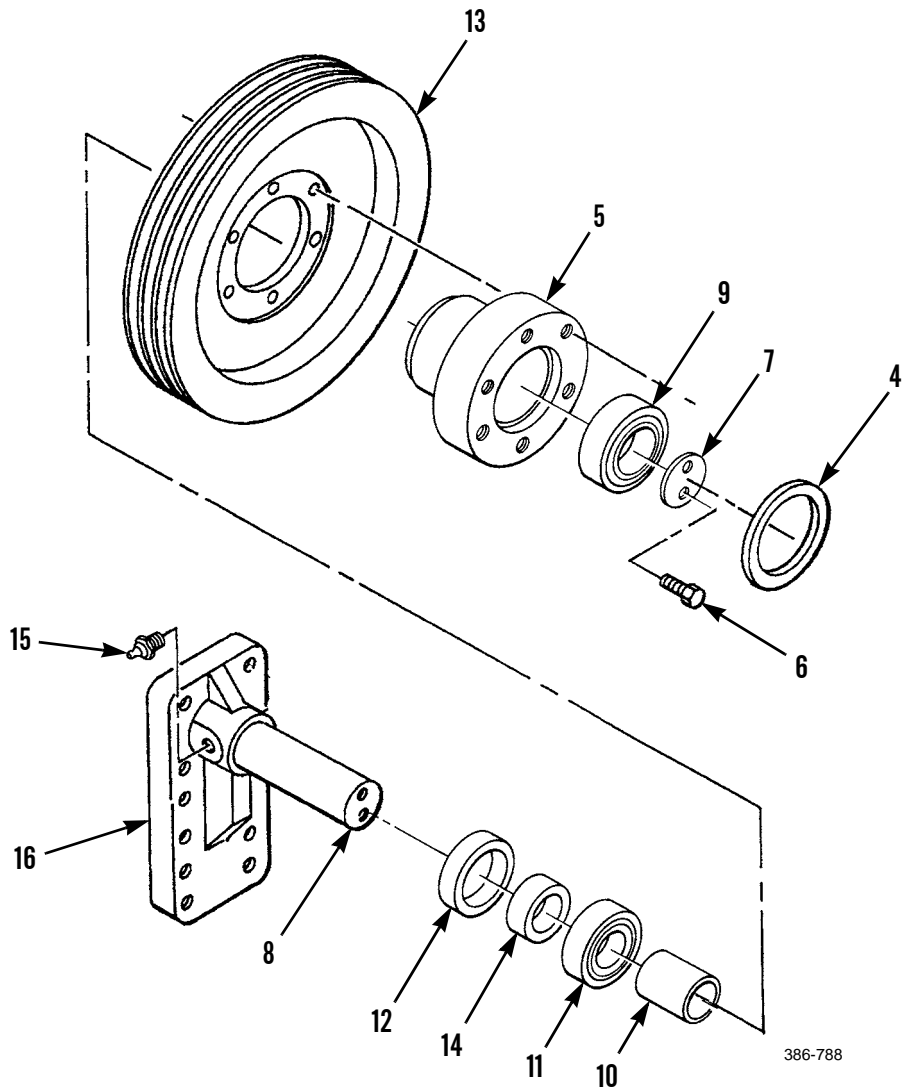
DISASSEMBLY

1. Remove O-ring (4) from hub (5). Discard O-ring.
2. Remove two self-locking bolts (6) and spacer plate (7) from end of shaft (8). Discard self-locking bolts.
3. Remove bearing (9), spacer (10) and bearing (11) from hub (5).

NOTE

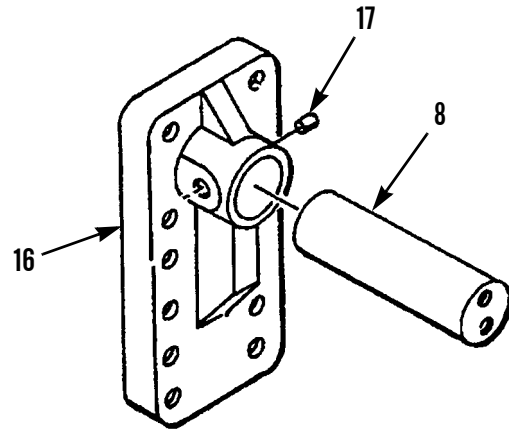
Note position of seal to ensure correct installation of a new seal.

4. Remove seal (12) from hub (5). Discard seal.
5. Remove pulley (13) from shaft (8).
6. Remove spacer (14) from shaft (8).
7. Remove grease fitting (15) from bracket (16).



DISASSEMBLY - CONTINUED

8. Remove pin (17) and separate shaft (8) from bracket (16).



386-789

CLEANING AND INSPECTION

1. Clean and inspect all components IAW WP 0176 00.
2. Replace any damaged component.

ASSEMBLY

1. Assemble shaft (8) to bracket (16) with pin (17).
2. Position pulley (13) over shaft (8) on bracket (16).
3. Install spacer (14) over shaft (8) on bracket (16).
4. Install new seal (12) to hub (5).
5. Install hub (5) over shaft (8) on bracket (16).
6. Install bearing (11) in hub (5).
7. Install spacer (10) in hub (5).

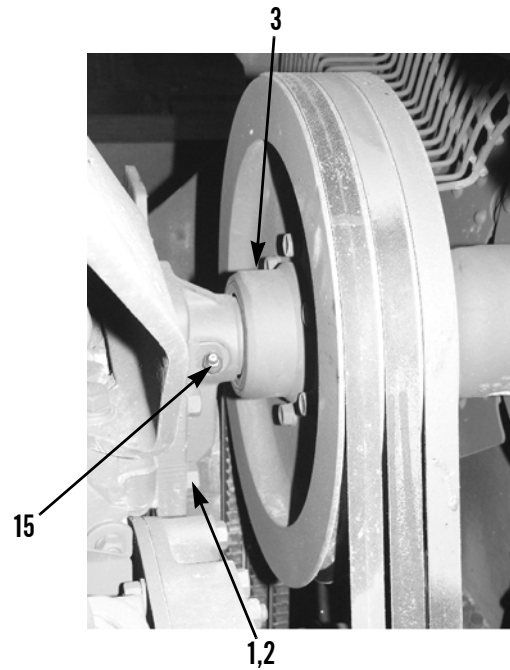
NOTE

Ensure bearing is fully seated in hub counterbore.

8. Install bearing (9) in hub (5).
9. Install spacer plate (7) to end of shaft (8) with two new self-locking bolts (6).
10. Install new O-ring (4) to hub (5).
11. Install grease fitting (15) to bracket (16).

INSTALLATION

1. Position fan drive assembly (3) on engine block and install four washers (2) and capscrews (1).
2. Install V-belts (WP 0069 00).
3. Lubricate fan drive assembly grease fitting (15) with GAA grease.
4. Start engine and check fan for proper operation (TM 5-2410-233-10).

**END OF WORK PACKAGE**

FAN AND FAN GUARD REPLACEMENT

0068 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Lifting equipment, 100 lb capacity

Materials/Parts

Lockwasher (2 and 6)

Personnel Required

Two

Equipment Condition

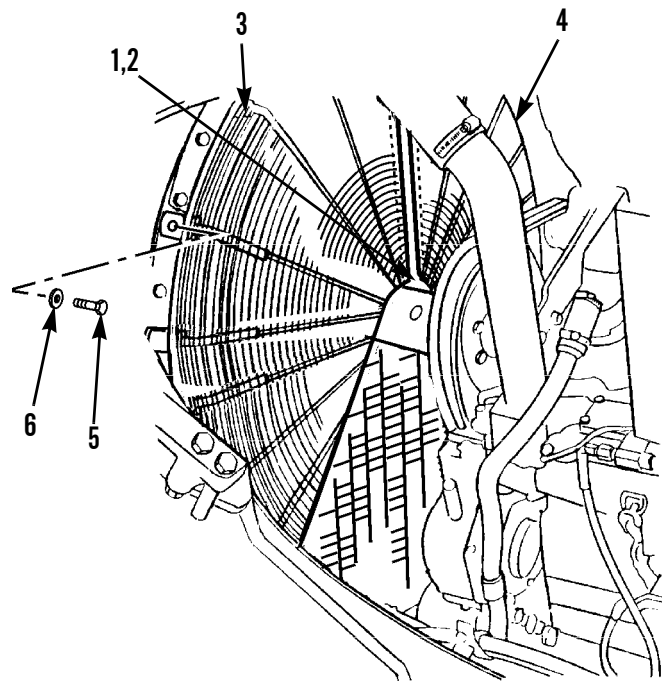
Engine OFF and cool (TM 5-2410-233-10)

Blade lift cylinder mounting tube removed, if necessary (WP 0159 00)

Radiator removed, if removing fan (WP 0063 00)

REMOVAL

1. Remove capscrew (1) and lockwasher (2) to separate left and right fan guards (3 and 4). Discard lockwasher.
2. Remove five capscrews (5), lockwashers (6) and left fan guard (3). Discard lockwashers.
3. Repeat step 2 for right fan guard (4).



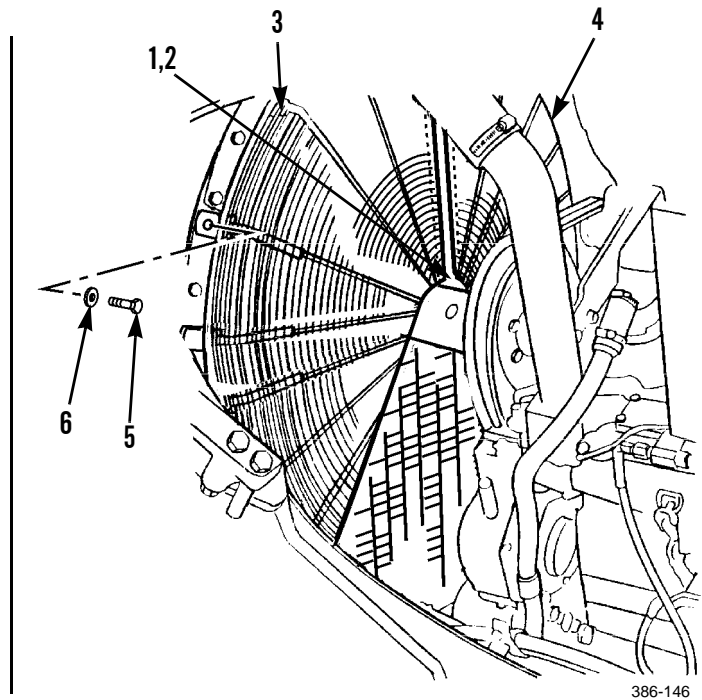
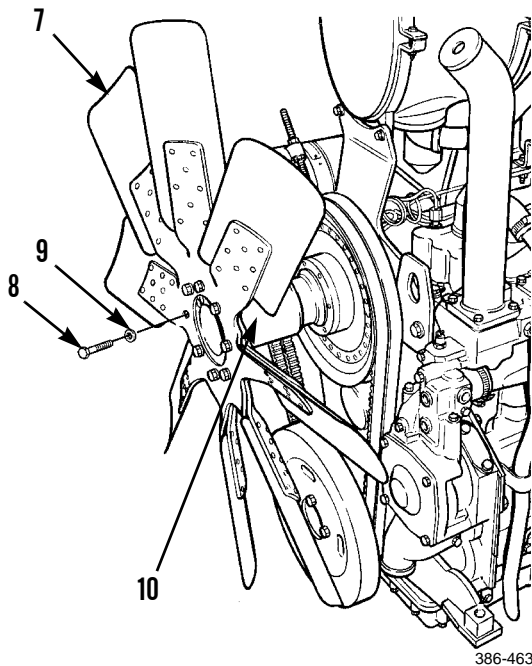
386-146

REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

- Fan weighs 65 lb (30 kg).
 - Prior to removal, note position of fan blades for correct installation.
4. Secure fan (7) with a nylon sling and attach sling to a suitable lifting device. Remove eight capscrews (8), washers (9) and fan from hub (10).



INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

- Fan weighs 65 lb (30 kg).
 - Ensure fan blades are oriented the same as noted during removal.
1. Secure fan (7) with a nylon sling and attach sling to a suitable lifting device. Lower fan into position at hub (10). Install eight washers (9) and capscrews (8).
 2. Install left fan guard (3) around fan (7) and secure with five new lockwashers (6) and capscrews (5).
 3. Repeat step 2 for right fan guard (4).
 4. Install capscrew (1) and new lockwasher (2) attaching left and right fan guards (3 and 4).
 5. If removed, install radiator (WP 0063 00).
 6. Install blade lift cylinder mounting tube (WP 0159 00).
 7. Run engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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V-BELTS REPLACEMENT

0069 00

THIS WORK PACKAGE COVERS

Removal, Installation, Adjustment

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)
- Sling, nylon (Item 100, WP 0184 00)
- Lifting equipment, 100 lb capacity

Personnel Required

Two

Equipment Condition

Hood removed (WP 0136 00)

REMOVAL

NOTE

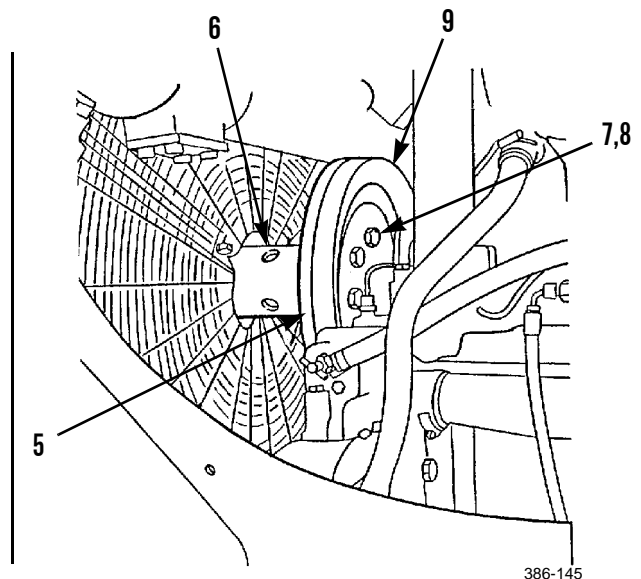
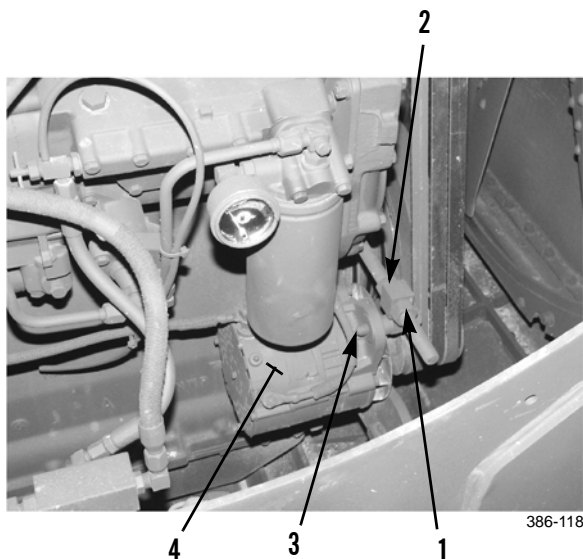
Mark location on both adjusting nuts for a guide during installation.

1. Loosen alternator adjuster nuts (1 and 2).
2. Remove mount bolt (3) and pivot alternator (4) until three V-belts (5) are loose on alternator pulley.
3. Attach a nylon sling to fan hub (6) and attach sling to a suitable lifting device. Take up slack to provide support.
4. Remove six capscrews (7) and washers (8) holding fan and fan hub (6) to fan drive assembly.

CAUTION

Use care to avoid damaging radiator core when fan is close to or placed against radiator.

5. Push fan and fan hub (6) assembly just enough toward radiator core to remove three V-belts (5) from fan pulley (9).



INSTALLATION

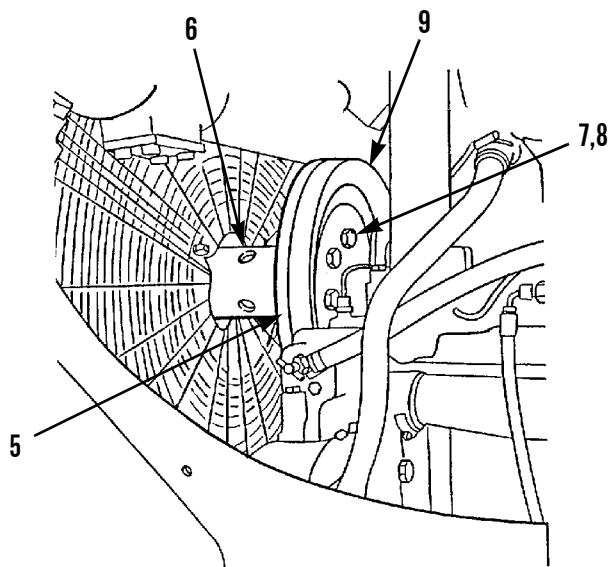
NOTE

V-belts are replaced only as a matched set. Avoid mixing new and used belts.

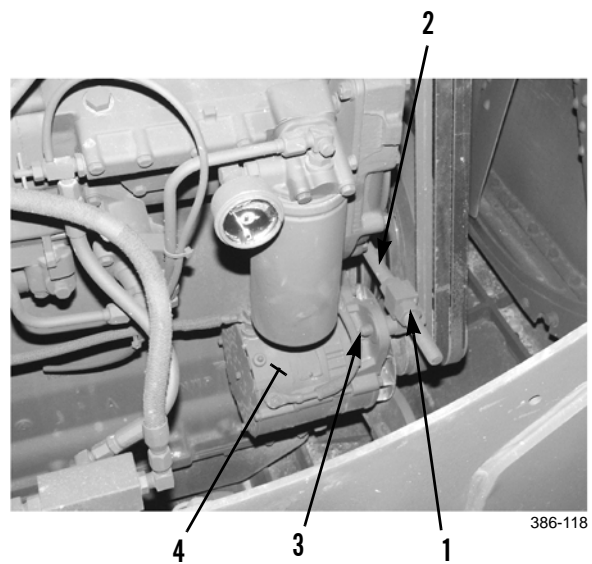
1. Loosely install three V-belts (5) on fan pulley (9).
2. Install fan hub (6) on fan drive assembly with six washers (8) and capscrews (7).
3. Remove lifting device and nylon sling from fan hub (6).

ADJUSTMENT

1. Pivot alternator (4) and install mount bolt (3).
2. Install alternator adjuster nuts (1 and 2) close to markings (made during removal of bolts). Turn adjusting nuts until deflection on V-belts (5) is 1/2 in. (13 mm). When correct belt deflection is obtained, tighten nuts (1 and 2).
3. Operate tractor for 30 minutes and recheck belt tension. Adjust position of both alternator adjusting nuts (1 and 2) as necessary to achieve correct belt deflection.



386-145



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4. Install hood (WP 0136 00).

END OF WORK PACKAGE

ALTERNATOR REPLACEMENT

0070 00**THIS WORK PACKAGE COVERS**Removal, Installation

INITIAL SETUP**Tools and Special Tools**Tool kit, general mechanic's (Item 112, WP 0185
00)Shop equipment, common no. 1 (Item 94, WP 0185
00)**Materials/Parts**

Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

Lockwasher (14)

Washer, star (10)

References

TM 5-2410-233-10

Equipment Condition

Battery cables disconnected (WP 0080 00)

V-belts removed (WP 0069 00)

REMOVAL



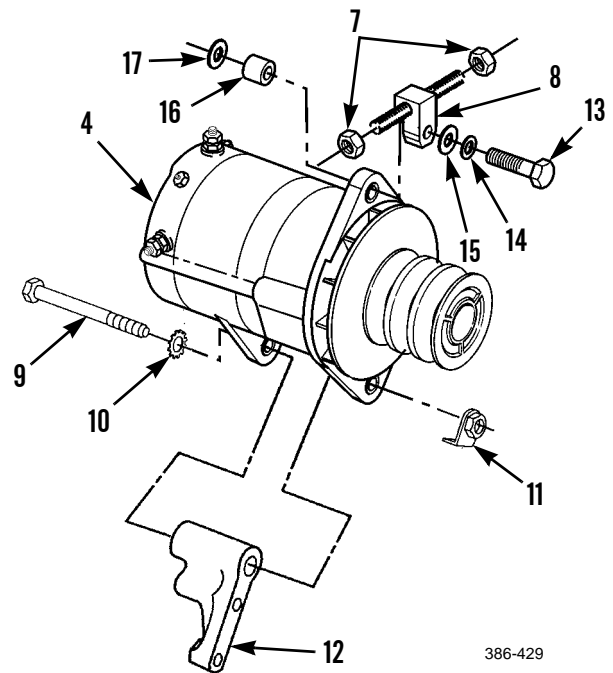
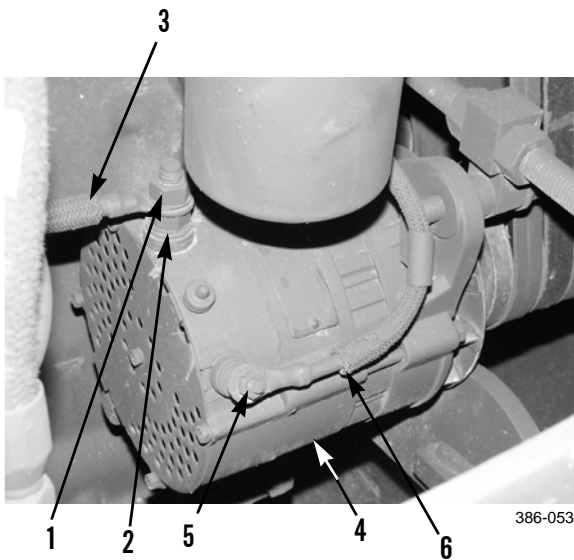
WARNING

Ensure battery cables are disconnected before replacing alternator. Failure to follow this warning could result in injury or damage to equipment.

NOTE

Tag wires to ensure correct installation.

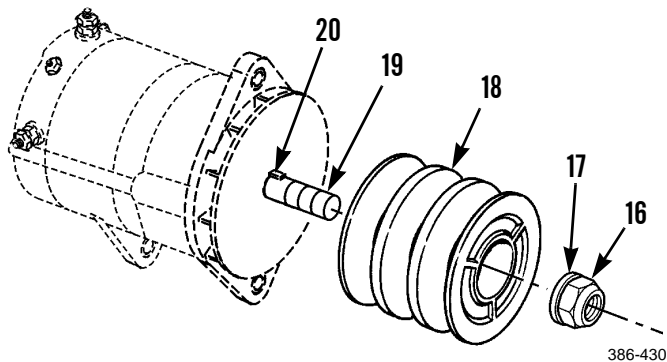
1. Remove nut (1), washer (2) and disconnect wire (3) from alternator (4).
2. Remove nut (5) and wire (6) from alternator (4).
3. Loosen both adjuster nuts (7) from alternator clamp block (8).
4. Remove bolt (9), star washer (10) and nut (11) from engine accessory bracket (12) and alternator (4).
5. Support alternator (4), remove bolt (13), lockwasher (14), washer (15), spacer (16) and washer (17) from alternator clamp block (8). Discard lockwasher.
6. Remove alternator (4).



REMOVAL - CONTINUED**NOTE**

If alternator requires replacement, continue with steps 7 and 8

7. Remove nut (16), washer (17) and pulley (18) from alternator shaft (19).
8. If required, remove key (20) from alternator shaft (19).

**INSTALLATION**

1. If removed, install key (20) on alternator shaft (19).
2. Install pulley (18) onto alternator shaft (19) and secure with washer (17) and nut (16). Tighten nut to 76 lb-ft (103 Nm).

NOTE

Do NOT tighten alternator mounting capscrews until V-belt adjustment is complete.

3. Position alternator (4) on engine accessory bracket (12) and install bolt (9), new star washer (10) and nut (11).
4. Install washer (17), spacer (16), washer (15), new lockwasher (14) and bolt (13) to alternator (4) and alternator clamp block (8).
5. Connect wire (6) and install nut (5).
6. Connect wire (3) and install washer (2) and nut (1).
7. Install V-belts and adjust (WP 0069 00).
8. Connect battery cables (WP 0080 00).
9. Start engine and check for proper operation of charging system (TM 5-2410-233-10).

END OF WORK PACKAGE

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STARTING MOTOR REPLACEMENT

0071 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Lifting equipment, 100 lb capacity

Materials/Parts

- Tag, marker (Item 35, WP 0184 00)
- Gasket (22)

Materials/Parts - Continued

- Lockwasher (2, 6, 10 and 21)

References

- TM 5-2410-233-10

Personnel Required

- Two

Equipment Condition

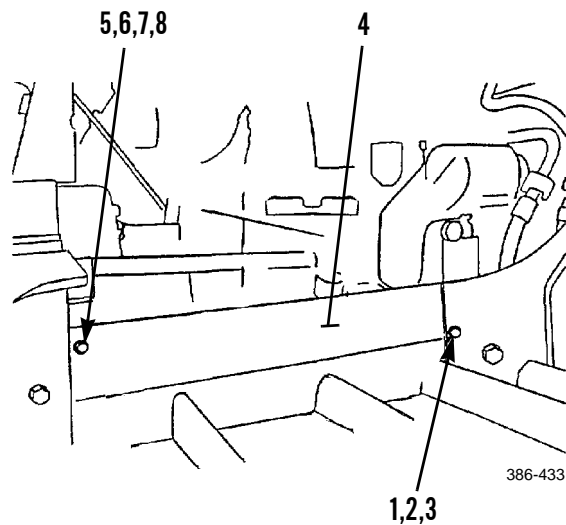
- Battery cables disconnected (WP 0080 00)

**WARNING**

Ensure battery cables are disconnected before replacing starting motor. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

1. If required for clearance, remove four capscrews (1), lockwashers (2) and washers (3) from guard panel (4). Discard lockwashers.
2. Remove one capscrew (5), lockwasher (6), washer (7), nut (8) and guard panel (4). Discard lockwasher.



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REMOVAL - CONTINUED**NOTE**

Tag wires to ensure correct installation.

3. Remove nut (9), lockwasher (10) and three wires (11) from negative terminal of starting motor (12).
4. Remove nut (13), washer (14) and four wires (15) from positive terminal of solenoid (16).
5. Remove nut (17) and two wires (18) from solenoid (16) and relay (19) located on cylinder block.

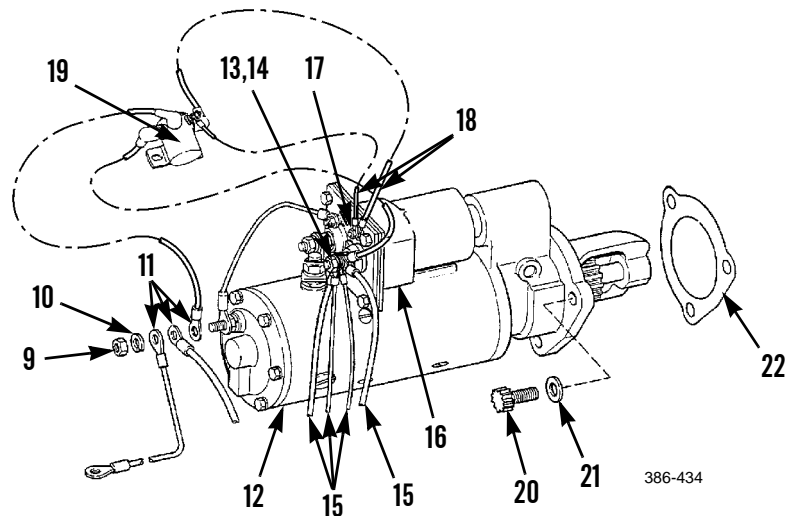
**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Starting motor weighs 80 lb (36 kg).

6. Attach a nylon sling and a suitable lifting device to starting motor (12).
7. Remove three capscrews (20), lockwashers (21) and starting motor (12) from flywheel housing. Discard lockwashers.
8. Remove and discard gasket (22).



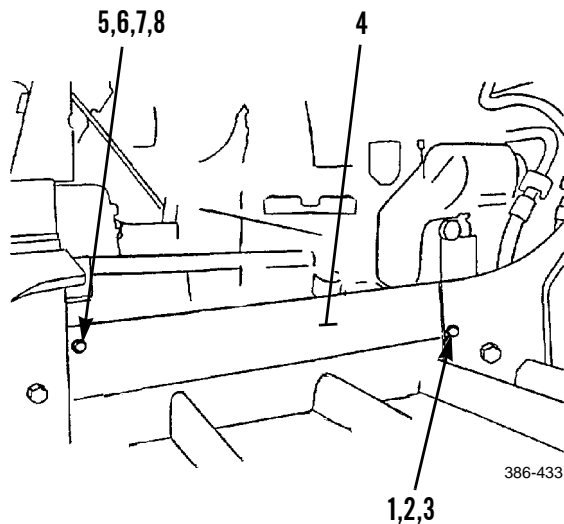
INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

- Starting motor weighs 80 lb (36 kg).
- During installation of starting motor, ensure gear splines on starting motor mesh smoothly with flywheel teeth.

1. Attach a nylon sling and a suitable lifting device to starting motor (12) and position motor at flywheel housing.
2. Install three new lockwashers (21), capscrews (20) and new gasket (22) on starting motor (12) and to flywheel housing. Tighten capscrews to 158 lb-ft (214 Nm).
3. Install two wires (18) and nut (17) to solenoid (16) and relay (19).
4. Install four wires (15) on positive terminal of solenoid (16) and secure with washer (14) and nut (13). Tighten nut to 9 lb-ft (12 Nm).
5. Install three wires (11) on negative terminal of starting motor (12) and secure with new lockwasher (10) and nut (9).
6. If removed, position guard panel (4) and install one capscrew (5), new lockwasher (6), washer (7) and nut (8).
7. Install four capscrews (1), new lockwashers (2) and washers (3) to guard panel (4).
8. Connect battery cables (WP 0080 00).
9. Place battery disconnect switch in ON position (TM 5-2410-233-10).
10. Start engine to ensure starting motor operates (TM 5-2410-233-10).

**END OF WORK PACKAGE**

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STARTING MOTOR SOLENOID REPLACEMENT

0072 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

References

TM 5-2410-233-10

Equipment Condition

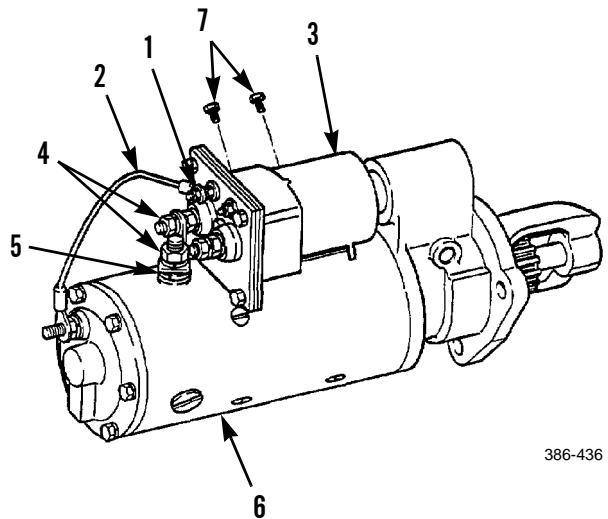
Starting motor removed (WP 0071 00)

REMOVAL

1. Remove nut (1) and wire (2) from ground terminal on solenoid (3).
2. Remove two nuts (4) and connector (5) from solenoid (3) and starting motor (6).
3. Remove two capscrews (7) and separate solenoid (3) from starting motor (6).

INSTALLATION

1. Position solenoid (3) on starting motor (6) and install two capscrews (7).
2. Install connector (5) on terminals of starting motor (6) and solenoid (3) and secure with two nuts (4).
3. Install wire (2) on ground terminal and secure with nut (1).



386-436

4. Install starting motor (WP 0071 00).
5. Start and run engine to check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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AMMETER REPLACEMENT

0073 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Tag, marker (Item 35, WP 0184 00)

Lockwasher (3 and 9)

Materials/Parts - Continued

Seal (12)

References

TM 5-2410-233-10

Equipment Condition

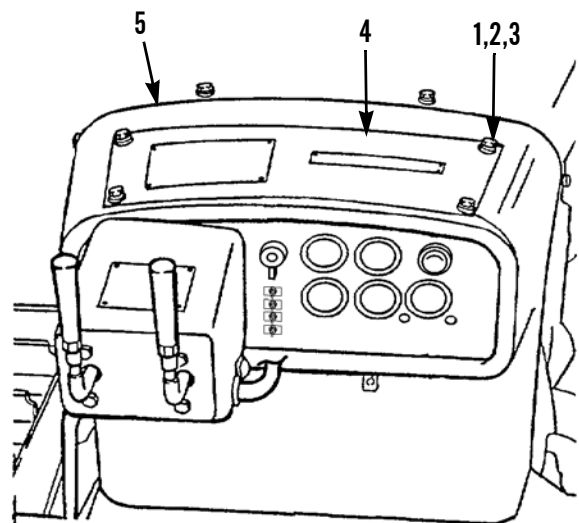
Battery cables disconnected (WP 0080 00)

**WARNING**

Ensure battery cables are disconnected before performing maintenance inside dash assembly. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

1. Remove four capscrews (1), washers (2), lockwashers (3) and cover (4) from top of dash assembly (5). Discard lockwashers.



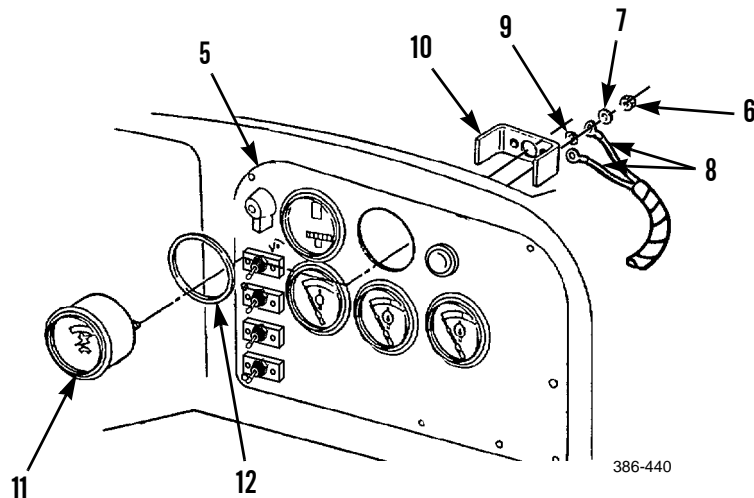
386-651

REMOVAL - CONTINUED

NOTE

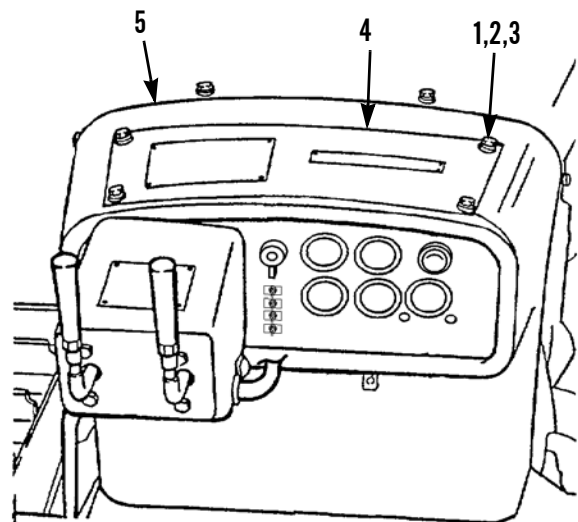
Tag wires to ensure correct installation.

2. Remove two nuts (6), washers (7), two wires (8), two lockwashers (9) and bracket (10) from back of ammeter (11). Discard lockwashers.
3. Slide ammeter (11) with seal (12) out through front of dash assembly (5).
4. Remove seal (12) from ammeter (11). Discard seal.



INSTALLATION

1. Install new seal (12) on ammeter (11).
2. Insert ammeter (11) into position on dash assembly (5).
3. Install two new lockwashers (9), wires (8), washers (7) and nuts (6) on bracket (10) to back of ammeter (11).
4. Install cover (4) on top of dash assembly (5) with four capscrews (1), washers (2) and new lockwashers (3).
5. Connect battery cables (WP 0080 00).
6. Turn battery disconnect switch to ON position (TM 5-2410-233-10).
7. Start engine and check for proper operation of ammeter (TM 5-2410-233-10).



END OF WORK PACKAGE

ENGINE START SWITCH REPLACEMENT

0074 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Tag, marker (Item 35, WP 0184 00)

Lockwasher (3, 7 and 15)

References

TM 5-2410-233-10

Equipment Condition

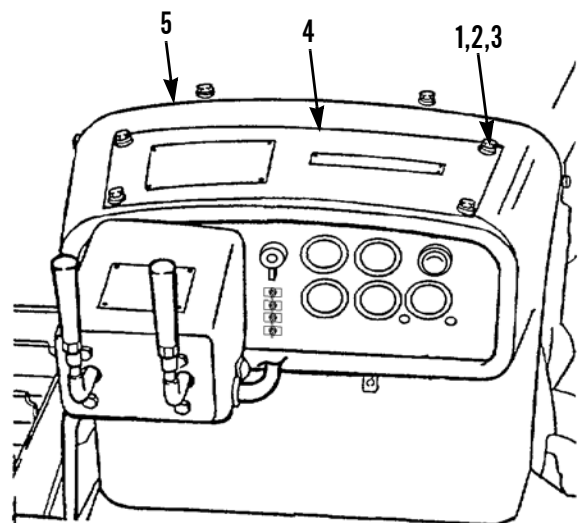
Battery cables disconnected (WP 0080 00)

**WARNING**

Ensure battery cables are disconnected before performing maintenance inside dash assembly. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

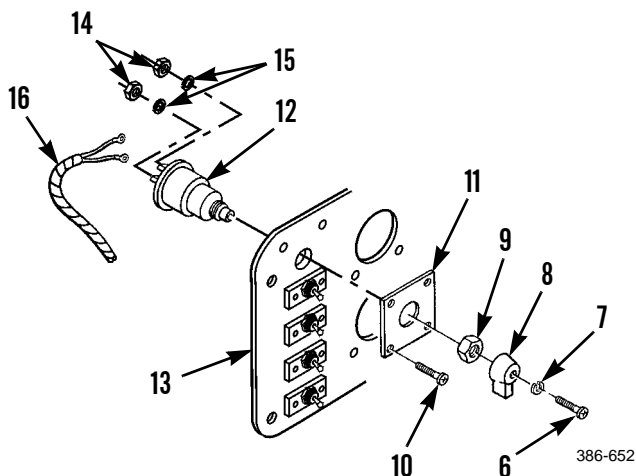
1. Remove four capscrews (1), washers (2), lockwashers (3) and cover (4) from top of dash assembly (5). Discard lockwashers.



386-451

REMOVAL - CONTINUED

2. Remove screw (6) and lockwasher (7) from engine start switch knob (8). Discard lockwasher.
3. Remove nut (9).
4. If damaged, remove four screws (10) and remove plate (11).
5. Remove engine start switch (12) through back of dash panel (13).



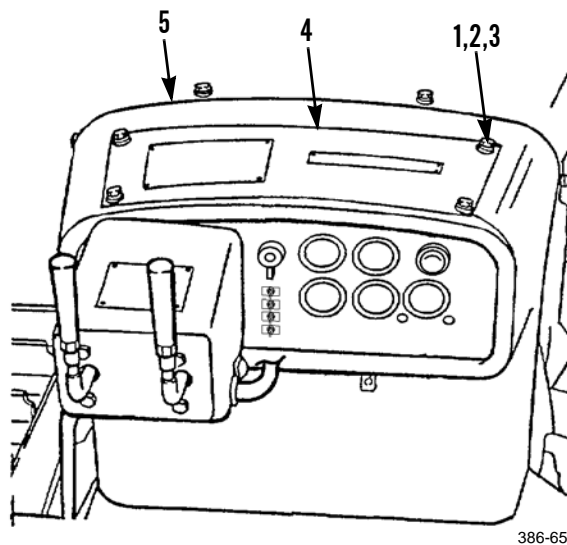
NOTE

Tag wires to ensure correct installation.

6. Remove two nuts (14) and lockwashers (15) from back of engine start switch (12). Discard lockwashers.
7. Disconnect two wires (16) from engine start switch (12).

INSTALLATION

1. Connect two wires (16) to engine start switch (12) with two new lockwashers (15) and nuts (14).
2. If removed, install plate (11) with four screws (10).
3. Position engine start switch (12) in dash panel (13) and install nut (9).
4. Install engine start switch knob (8) with new lockwasher (7) and screw (6).
5. Install cover (4) on top of dash assembly (5) with four capscrews (1), new lockwashers (3) and washers (2).



6. Connect battery cables (WP 0080 00).
7. Turn battery disconnect switch to ON position (TM 5-2410-233-10).
8. Start engine and verify switch operation (TM 5-2410-233-10).

END OF WORK PACKAGE

ETHER STARTING AID SWITCH REPLACEMENT

0075 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Tag, marker (Item 35, WP 0184 00)

Lockwasher (3 and 11)

References

TM 5-2410-233-10

Equipment Condition

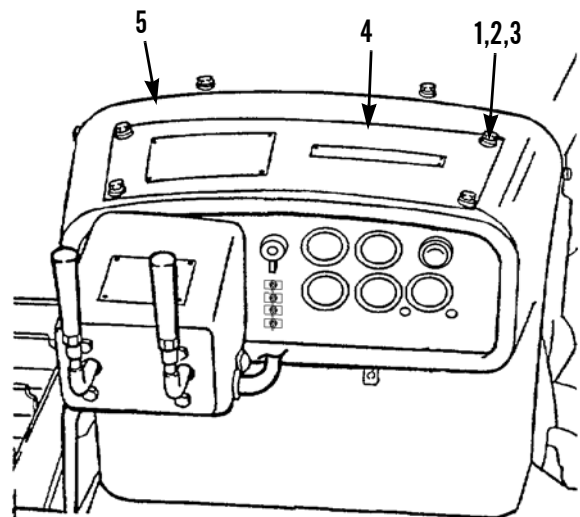
Battery cables disconnected (WP 0080 00)

**WARNING**

Ensure battery cables are disconnected before performing maintenance inside dash assembly. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

1. Remove four capscrews (1), washers (2), lockwashers (3) and cover (4) from top of dash assembly (5). Discard lockwashers.



386-651

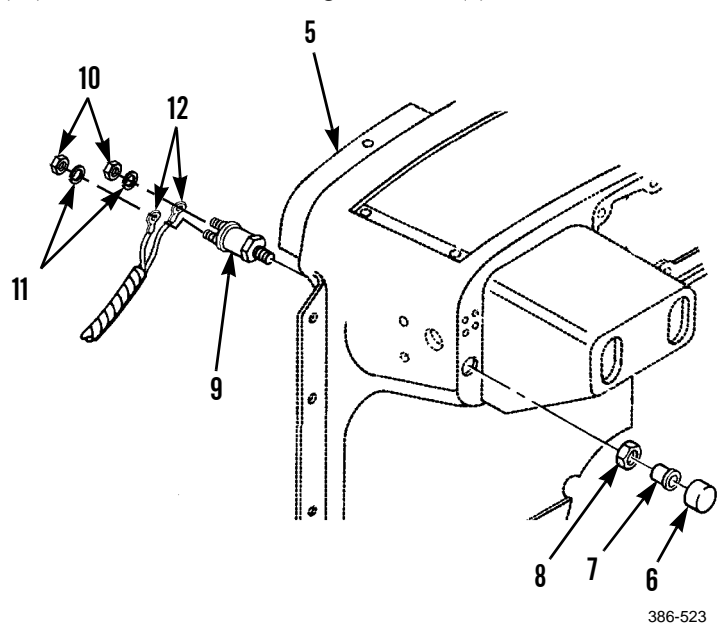
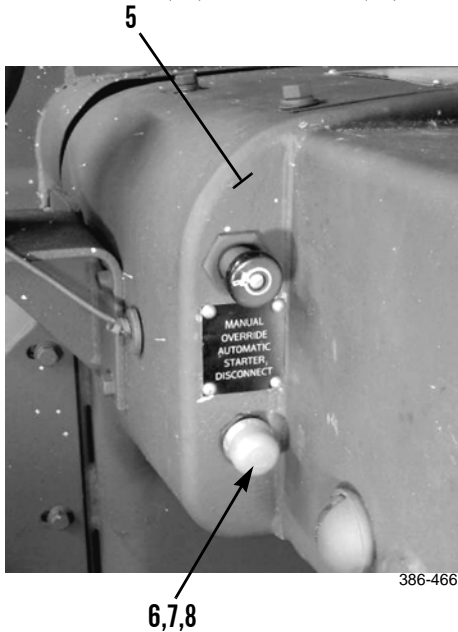
REMOVAL - CONTINUED

- Remove cover (6), button assembly (7) and nut (8) from front of ether starting aid switch (9). Remove switch from back of dash assembly (5).

NOTE

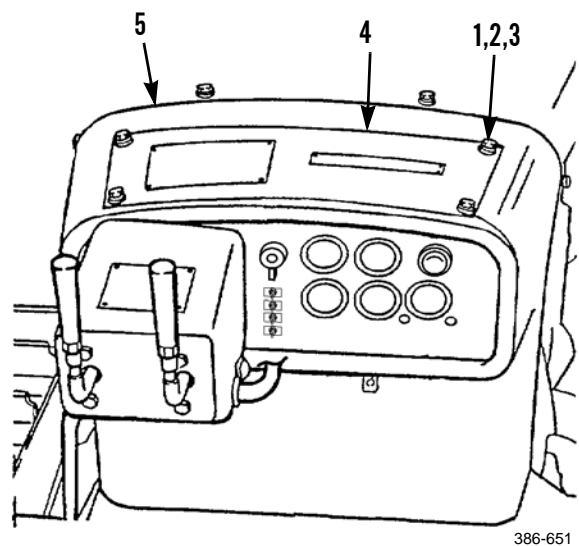
Tag wires to ensure correct installation.

- Remove two nuts (10), lockwashers (11) and wires (12) from back of ether starting aid switch (9). Discard lockwashers.



INSTALLATION

- Install two wires (12) to back of ether starting aid switch (9) with two new lockwashers (11) and nuts (10).
- Insert ether starting aid switch (9) through back of dash assembly (5).
- Install nut (8), button assembly (7) and cover (6) on front of ether starting aid switch (9).
- Install cover (4) on top of dash assembly (5) with four capscrews (1), washers (2) and new lockwashers (3).
- Connect battery cables (WP 0080 00).
- Turn battery disconnect switch to ON position (TM 5-2410-233-10).
- Check ether starting aid switch for proper operation (TM 5-2410-233-10).



END OF WORK PACKAGE

BATTERY DISCONNECT SWITCH REPLACEMENT

0076 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/PartsTag, marker (Item 35, WP 0184 00)
Lockwasher (4, 6 and 9)**References**

TM 5-2410-233-10

Equipment Condition

Battery cables disconnected (WP 0080 00)

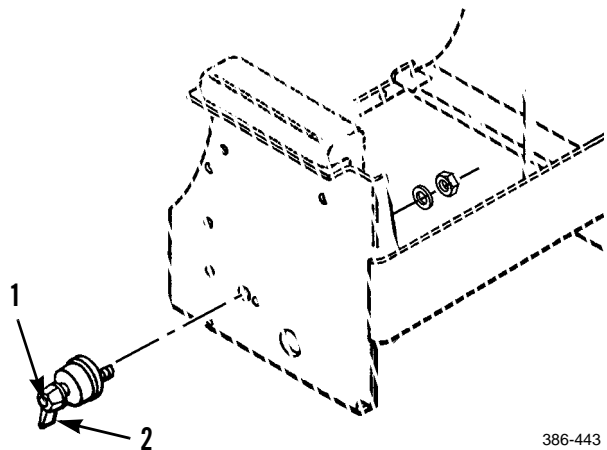
Battery disconnect switch in OFF position (TM 5-2410-233-10)

**WARNING**

Ensure battery cables are disconnected before replacing battery disconnect switch. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

1. Remove screw (1) and knob (2).
2. Tilt seat forward (TM 5-2410-233-10).

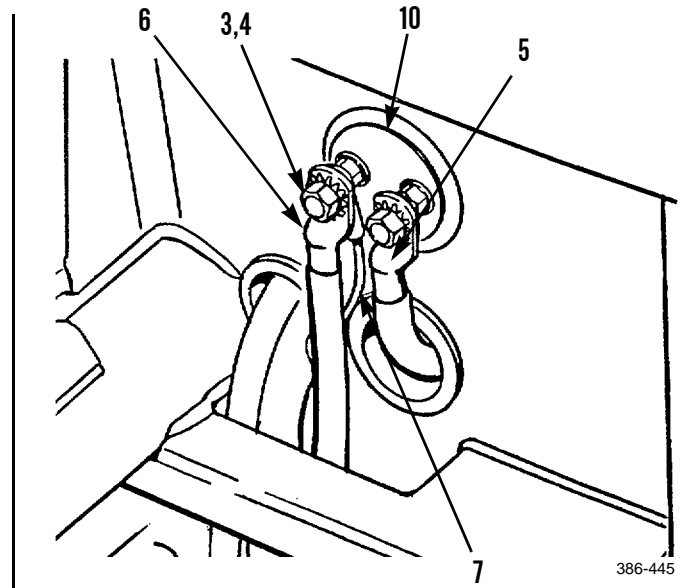
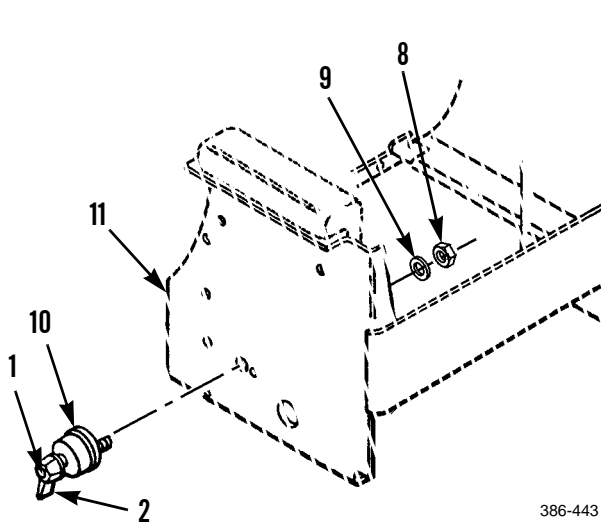


386-443

REMOVAL - CONTINUED**NOTE**

Tag cables to ensure correct installation.

3. Remove two nuts (3) and lockwashers (4). Discard lockwashers.
4. Remove cables (5 and 6) and wire (7).
5. Remove nut (8) and lockwasher (9) from switch mounting stud. Discard lockwasher.
6. Remove switch assembly (10) from seat base (11).

**INSTALLATION**

1. Position switch assembly (10) onto seat base (11).
2. Install new lockwasher (9) and nut (8) to switch mounting stud.
3. Install wire (7) and cables (5 and 6) with two new lockwashers (4) and nuts (3).
4. Return seat to normal position (TM 5-2410-233-10).
5. Install switch knob (2) and screw (1).
6. Connect battery cables (WP 0080 00).
7. Turn battery disconnect switch to ON position (TM 5-2410-233-10).
8. Check operation of switch.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Tag, marker (Item 35, WP 0184 00)

Lockwasher (3 and 12)

Materials/Parts - Continued

Seal (15)

References

TM 5-2410-233-10

Equipment Condition

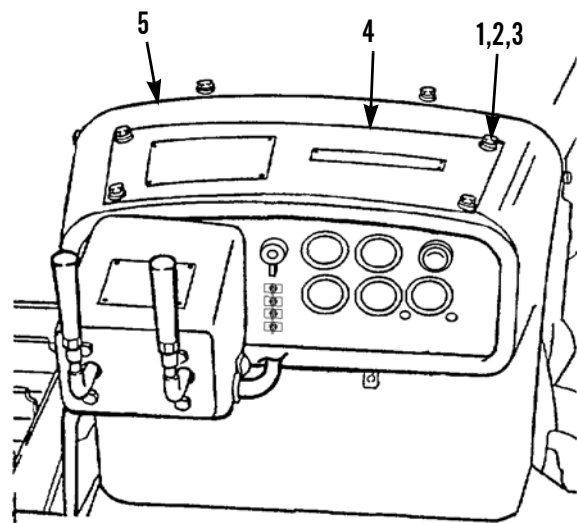
Battery cables disconnected (WP 0080 00)

**WARNING**

Ensure battery cables are disconnected before performing maintenance inside dash assembly. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

1. Remove four capscrews (1), washers (2), lockwashers (3) and cover (4) from top of dash assembly (5). Discard lockwashers.



386-651

REMOVAL - CONTINUED**NOTE**

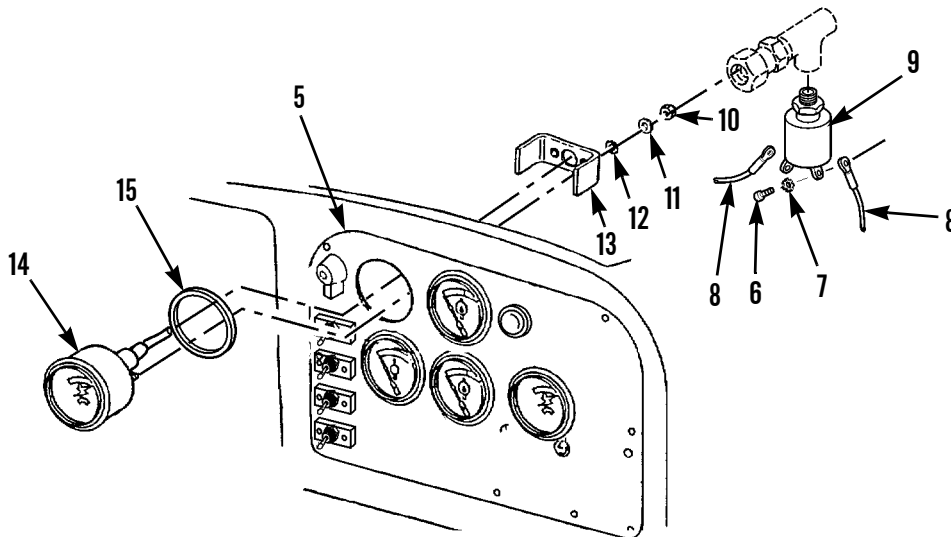
Tag wires to ensure correct installation.

2. Remove two screws (6), washers (7) and wires (8) from oil pressure switch (9).
3. Remove oil pressure switch (9).

NOTE

If oil pressure gage removal is required, continue with steps 5 through 7.

4. Remove two nuts (10), flatwashers (11), lockwashers (12) and bracket (13) from back of oil pressure gage (14). Discard lockwashers.
5. Slide oil pressure gage (14) with seal (15) out through front of dash assembly (5).
6. Remove seal (15) from oil pressure gage (14). Discard seal.



386-518

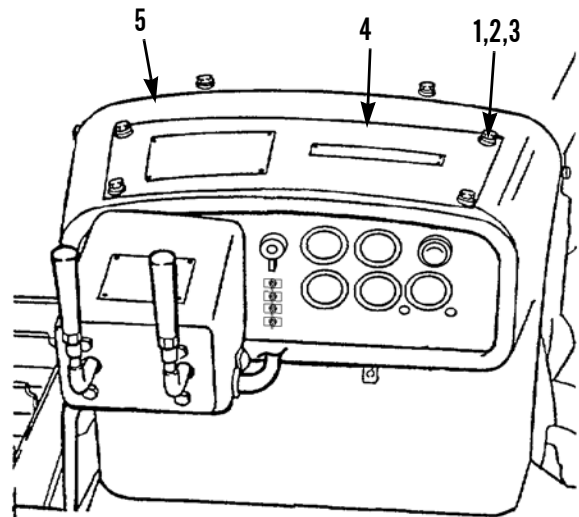
INSTALLATION**NOTE**

If oil pressure gage was removed, perform steps 1 through 3.

1. Install new seal (15) on oil pressure gage (14).
2. Install oil pressure gage (14) into position on dash assembly (5).
3. Install bracket (13), two new lockwashers (12), flatwashers (11) and nuts (10) to back of oil pressure gage (14).
4. Install oil pressure switch (9) and tighten.
5. Connect wires (8) to oil pressure switch (9) with two washers (7) and screws (6).

INSTALLATION - CONTINUED

6. Install cover (4) on top of dash assembly (5) with four capscrews (1), washers (2) and new lockwashers (3).



386-651

7. Connect battery cables (WP 0080 00).
8. Place battery disconnect switch in ON position (TM 5-2410-233-10).
9. Start engine and check for proper oil pressure switch operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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BACKUP ALARM REPLACEMENT

0078 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools/Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

References

TM 5-2410-233-10

Materials/Parts

Tag, marker (Item 35, WP 0184 00)
Lockwasher (2)

Equipment Condition

Battery disconnect switch in OFF position (TM 5-2410-233-10)

REMOVAL**WARNING**

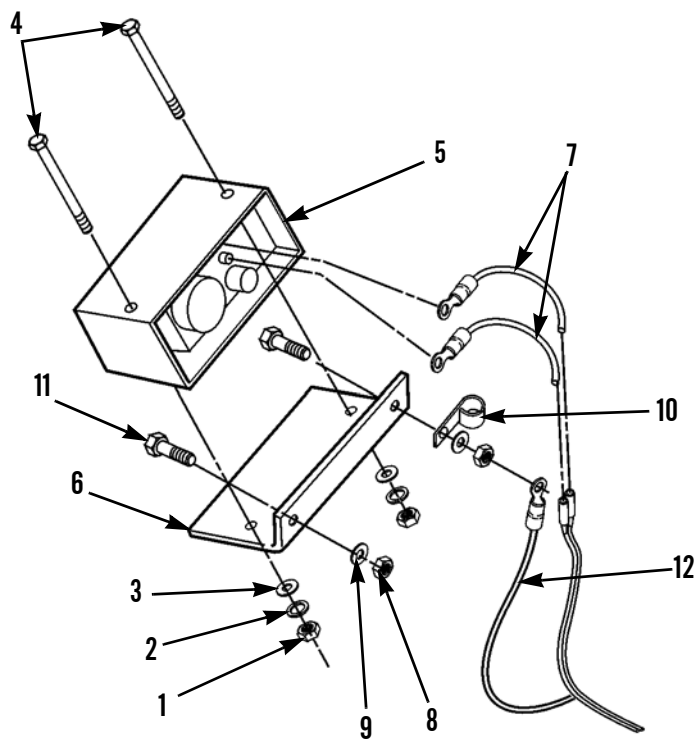
Ensure battery disconnect switch is in the OFF position before replacing backup alarm. Failure to follow this warning could result in injury or damage to equipment.

1. Remove two nuts (1), lockwashers (2), washers (3) and capscrews (4) that hold alarm (5) to bracket (6). Discard lockwashers.

NOTE

Tag wires to ensure correct installation.

2. Disconnect two wires (7) from back of alarm (5).
3. Remove alarm (5) from bracket (6).
4. To remove bracket (6) from rear plate, remove two nuts (8), washers (9), clamp (10), two capscrews (11) and ground wire (12).



401-446

INSTALLATION

1. Position bracket (6) on rear plate and install ground wire (12), clamp (10), two capscrews (11), washers (9) and nuts (8).
2. Connect two wires (7) to back of alarm (5).
3. Place alarm (5) in position on bracket (6) and install two capscrews (4), washers (3), new lockwashers (2) and nuts (1).
4. Turn battery disconnect switch to ON position (TM 5-2410-233-10).
5. Check backup alarm for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

BACKUP ALARM SWITCH REPLACEMENT

0079 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

Rivet (5)

Equipment Condition

Battery disconnect switch in OFF position (TM 5-2410-233-10)

Transmission selector knob and lock knob removed (WP 0083 00)

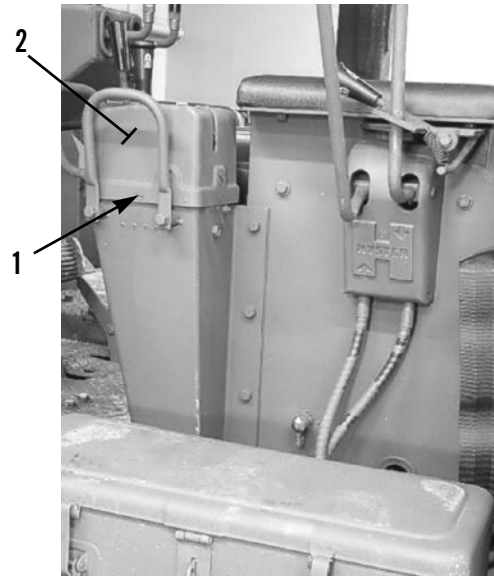


WARNING

Ensure battery disconnect switch is in OFF position before replacing backup alarm switch. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

1. Remove four screws (1) and lift guide cover (2) from transmission shift console.

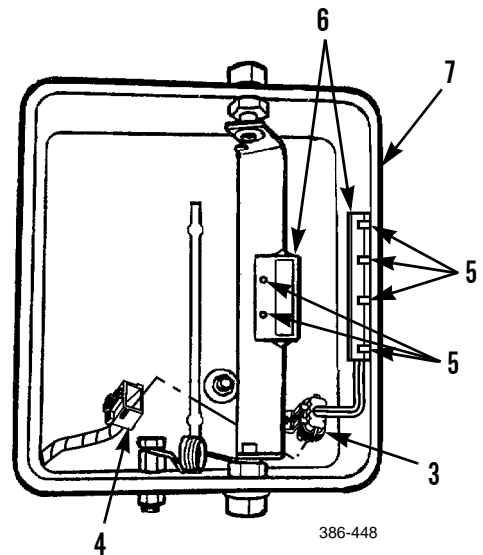


386-447

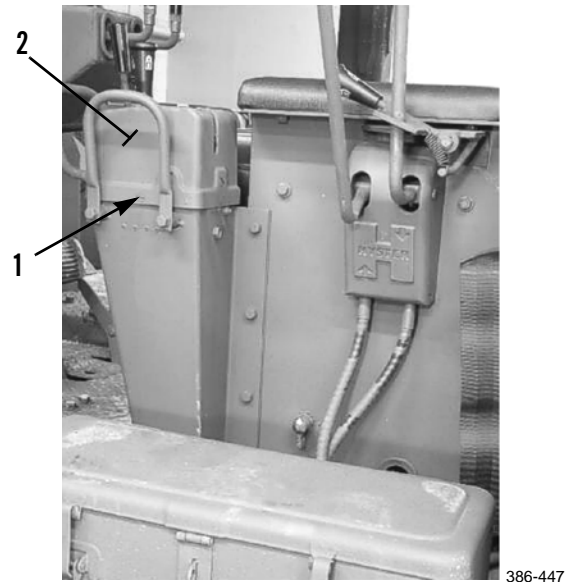
REMOVAL - CONTINUED**NOTE**

Tag connectors to ensure correct installation.

2. Disconnect switch connectors (3) from harness connectors (4).
3. Drill out six rivets (5) and remove switch (6) from transmission selector housing (7). Discard rivets.

**INSTALLATION**

1. Position switch (6) and install six new rivets (5) to secure switch to transmission selector housing (7).
2. Connect switch connectors (3) to harness connectors (4).
3. Place guide cover (2) into position on transmission shift console and secure with four screws (1).



4. Install transmission selector knob and lock knob (WP 0083 00).
5. Turn battery disconnect switch to ON position (TM 5-2410-233-10).
6. Check backup alarm switch for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

BATTERY CABLES REPLACEMENT

0080 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Rag, wiping (Item 28, WP 0184 00)

Strap, tiedown (Item 34, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

Nut, self-locking (28)

References

WP 0135 00

Equipment Condition

Battery disconnect switch in OFF position (TM 5-2410-233-10)

Battery box cover opened (TM 5-2410-233-10)

REMOVAL**WARNING**

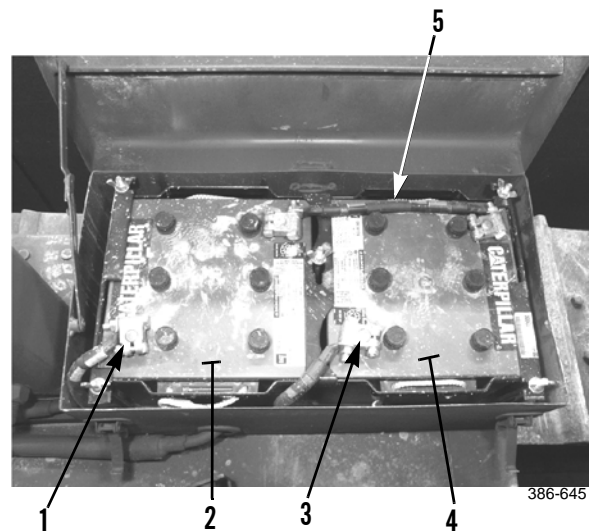
- Turn battery disconnect switch to OFF position before working on battery cables. Failure to follow this warning could result in injury or damage to equipment.
- To avoid injury, eye protection and acid-resistant gloves must be worn when working around batteries. Do not smoke, use open flame, make sparks or create other ignition sources around batteries. If a battery is giving off gases, it can explode and cause injury to personnel. Remove all jewelry such as rings, ID tags, watches, and bracelets. If jewelry or a tool contacts a battery terminal, a direct short will result in instant heating, damage to equipment and injury to personnel.
- Sulfuric acid contained in batteries can cause serious burns. If battery corrosion or electrolyte makes contact with skin, eyes or clothing, take immediate action to stop the corrosive burning effects. Failure to follow these procedures may result in injury or death.

1. Remove floor plates for access to remove cables (WP 0135 00).

NOTE

- **Tag cables to ensure correct installation.**
- **Lift up rubber boots for access to cable terminals.**

2. Loosen nut and disconnect negative battery cable (1) from negative post of battery (2).
3. Loosen nut and disconnect positive battery cable (3) from positive post of battery (4).
4. Loosen two nuts and disconnect battery cable (5) from between posts of batteries (2 and 4).

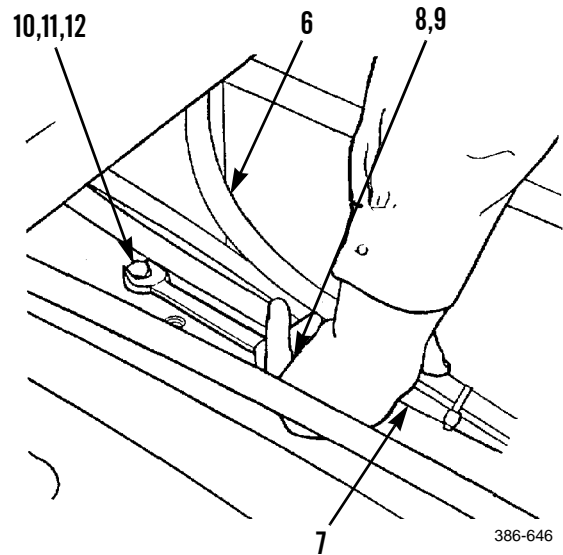


386-645

REMOVAL - CONTINUED**NOTE**

Routing shown is typical.

5. Remove and discard tiedown straps securing cables (6 and 7) to frame. Remove two capscrews (8) and clamps (9).
6. Remove capscrew (10) and flatwasher (11) to disconnect cable (12) from frame.

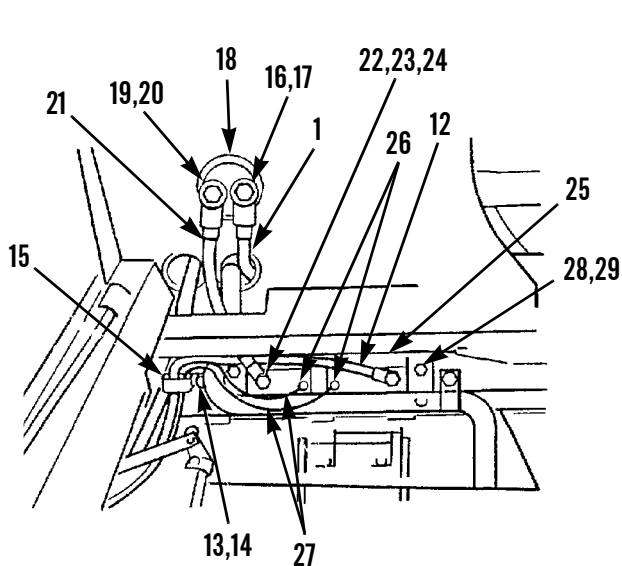


BATTERY CABLES REPLACEMENT - CONTINUED

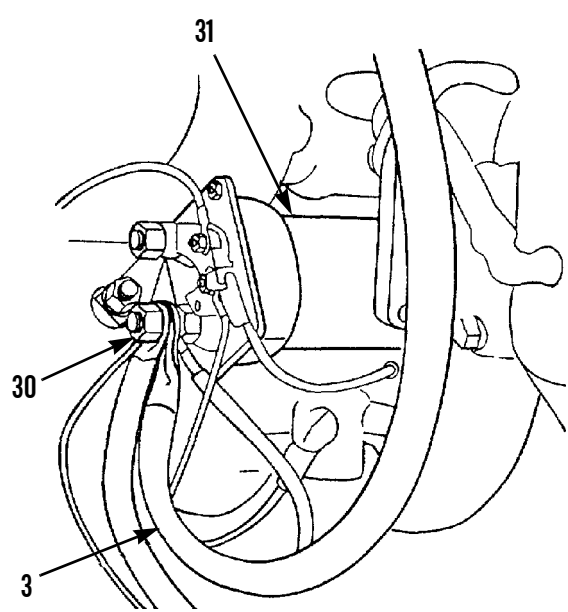
0080 00

REMOVAL - CONTINUED

7. Remove three capscrews (13), flatwashers (14) and clamps (15).
8. Remove nut (16), starwasher (17) and negative battery cable (1) from battery disconnect switch (18). Pull out cable from battery side.
9. Remove nut (19), starwasher (20) and disconnect cable (21) from negative post of battery disconnect switch (18).
10. Remove two nuts (22), flatwashers (23), starwashers (24) and cables (12 and 21) from shunt (25).
11. Remove two screws (26) and disconnect two wires (27) from shunt (25).
12. Remove two self-locking nuts (28), capscrews (29) and shunt (25). Discard self-locking nuts.

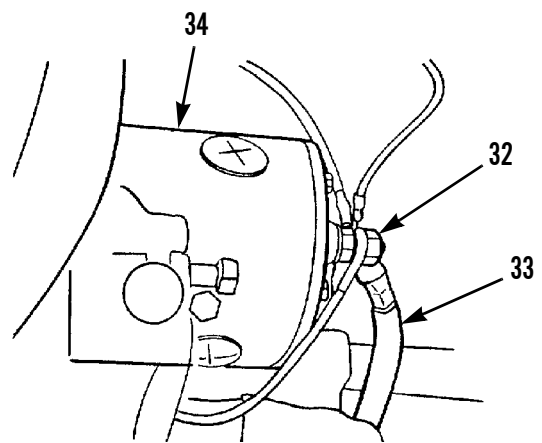


386-647



386-648

13. Remove nut (30) and remove positive battery cable (3) from starting motor solenoid (31). Pull out cable toward starting motor solenoid.
14. Remove nut (32) and disconnect negative cable (33) from starting motor (34).



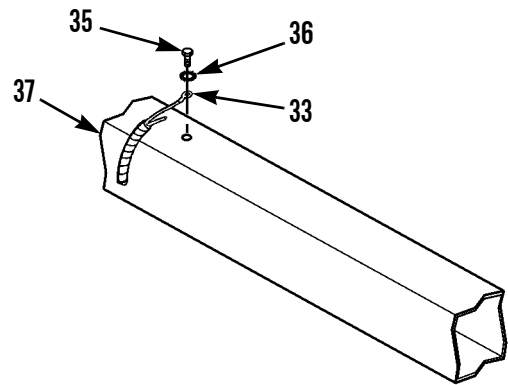
386-649

BATTERY CABLES REPLACEMENT - CONTINUED

0080 00

REMOVAL - CONTINUED

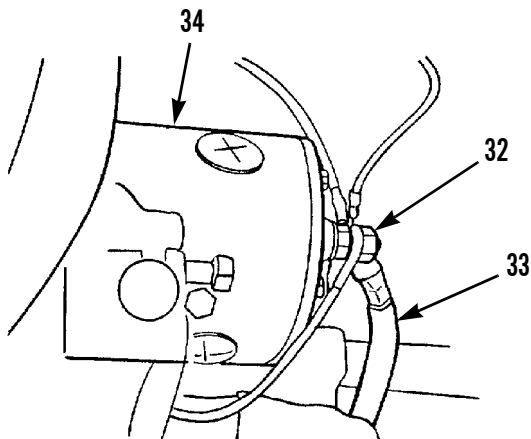
15. Remove capscrew (35), starwasher (36) and negative cable (33) from frame (37).



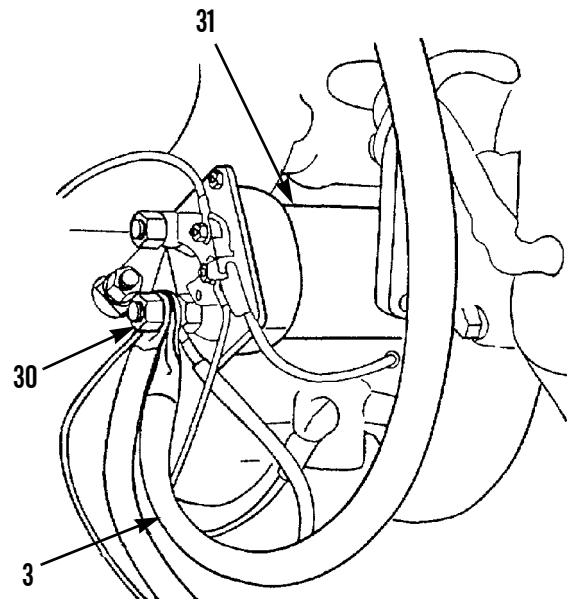
386-637

INSTALLATION

1. Install negative cable (33) to frame (37) with capscrew (35) and starwasher (36).
2. Connect negative cable (33) to starting motor (34) with nut (32).



386-649



386-648

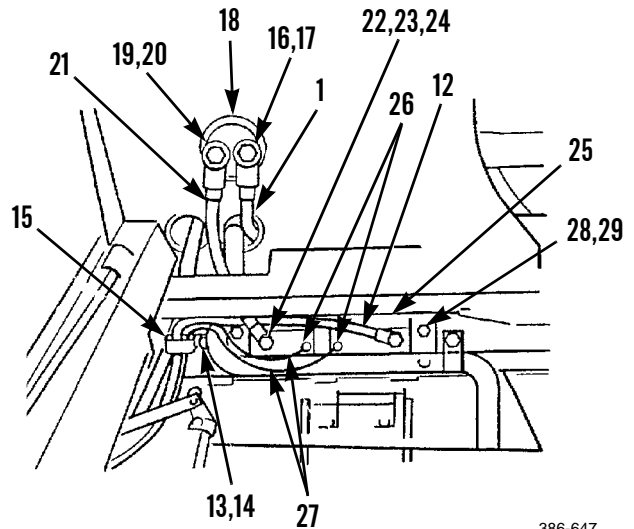
3. Connect positive battery cable (3) to starting motor solenoid (31) with nut (30). Pull cable out toward battery.

BATTERY CABLES REPLACEMENT - CONTINUED

0080 00

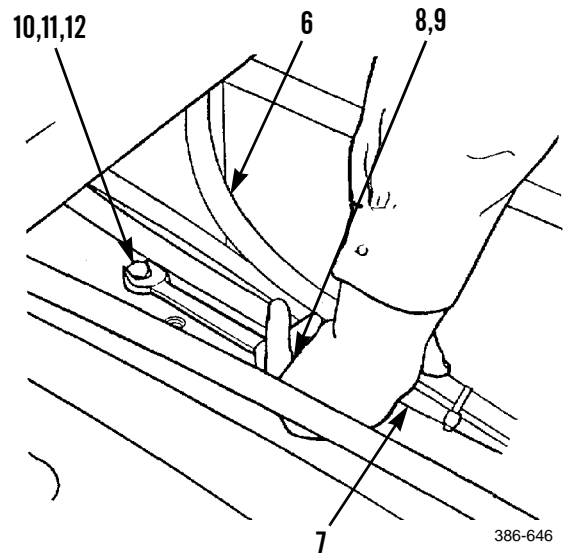
INSTALLATION - CONTINUED

4. Position shunt (25) onto seat frame. Install shunt with two capscrews (29) and new self-locking nuts (28).
5. Connect two wires (27) to shunt (25) with two screws (26).
6. Connect cables (12 and 21) to shunt (25) with two starwashers (24), flatwashers (23) and nuts (22).
7. Connect cable (21) to negative post on battery disconnect switch (18) with starwasher (20) and nut (19).
8. Install negative battery cable (1) through battery side and connect to battery disconnect switch (18) with starwasher (17) and nut (16).



386-647

9. Install three clamps (15) with three flatwashers (14) and capscrews (13).
10. Connect cable (12) to tractor frame with flatwasher (11) and capscrew (10).
11. Install two clamps (9) with two capscrews (8).
12. Install new tiedown straps to secure cables (6 and 7) to frame.



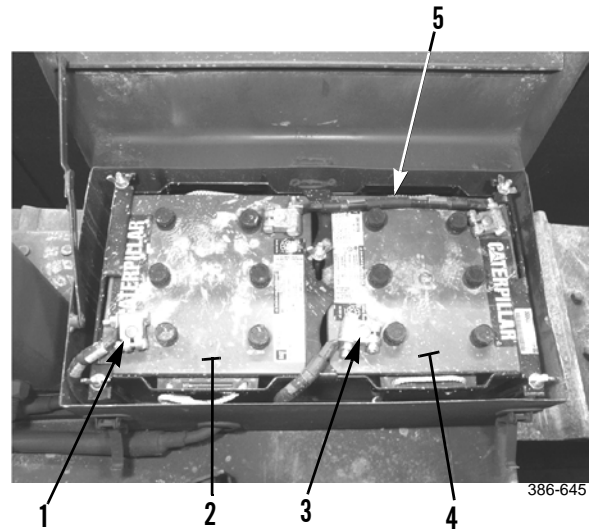
386-646

BATTERY CABLES REPLACEMENT - CONTINUED

0080 00

INSTALLATION - CONTINUED

13. Connect battery cable (5) between posts of batteries (2 and 4) and tighten two nuts.
14. Connect positive battery cable (3) to positive post of battery (4) and tighten nut.
15. Connect negative battery cable (1) to negative post of battery (2) and tighten nut.



16. Close battery box cover (TM 5-2410-233-10).
17. Install floor plates (WP 0135 00).
18. Turn battery disconnect switch to ON position (TM5-2410-233-10).
19. Start engine (TM 5-2410-233-10) and check for proper operation.

END OF WORK PACKAGE

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BATTERY MAINTENANCE

0081 00

THIS WORK PACKAGE COVERSRemoval, Service, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Personnel Required

Two

References

TM 5-2410-233-10

TM 9-6140-200-14

Equipment ConditionBattery cables disconnected from battery posts (WP 0080 00)

**WARNING**

- **To avoid injury, eye protection and acid-resistant gloves must be worn when working around batteries. Do not smoke, use open flame, make sparks or create other ignition sources around batteries. If a battery is giving off gases, it can explode and cause injury to personnel. Remove all jewelry such as rings, ID tags, watches, and bracelets. If jewelry or a tool contacts a battery terminal, a direct short will result in instant heating, damage to equipment, and injury to personnel.**
- **Sulfuric acid contained in batteries can cause serious burns. If battery corrosion or electrolyte makes contact with skin, eyes or clothing, take immediate action to stop the corrosive burning effects. Failure to follow these procedures may result in death or serious injury to personnel.**

BATTERY MAINTENANCE - CONTINUED

0081 00

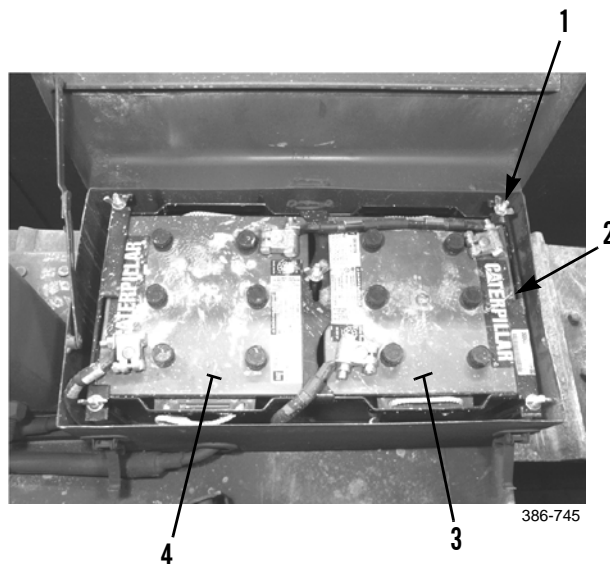
REMOVAL

1. Loosen five wing nuts (1) and remove battery hold-down bracket (2).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

2. With assistance, use handles of battery (3) and lift battery from battery box.
3. Repeat step 2 for other battery (4).

**SERVICE**

Service batteries IAW TM 9-6140-200-14.

INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

1. With assistance, use handles of battery (4) and lower battery into battery box.
2. Repeat step 1 for other battery (3).
3. Install battery hold-down bracket (2) over studs of battery box. Tighten five wing nuts (1).
4. Connect battery cables to battery posts (WP 0080 00).
5. Start engine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tool and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Tag, marker (Item 35, WP 0184 00)
Lockwasher (6)

References

TM 5-2410-233-10

Equipment Condition

Battery cables disconnected (WP 0080 00)



WARNING

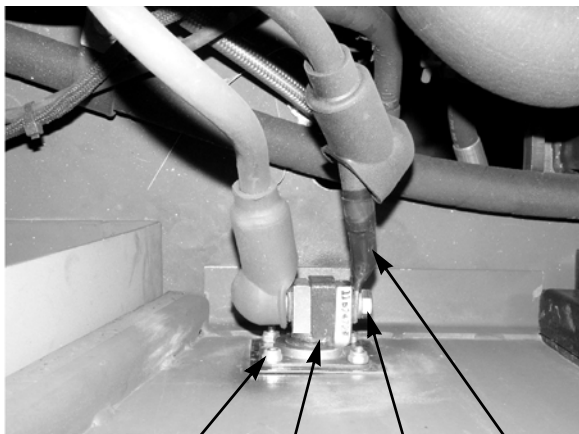
Ensure battery cables are disconnected before replacing NATO starting receptacle. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

NOTE

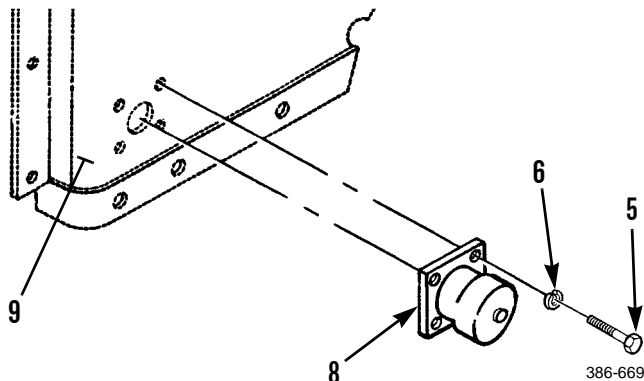
Tag cables to ensure correct installation.

1. Remove two nuts (1), washers (2) and disconnect two cables (3) from back of receptacle (4).
2. Remove four capscrews (5), lockwashers (6) and nuts (7). Discard lockwashers.
3. Remove NATO starting receptacle (8) from panel (9).



7 4 1,2 3

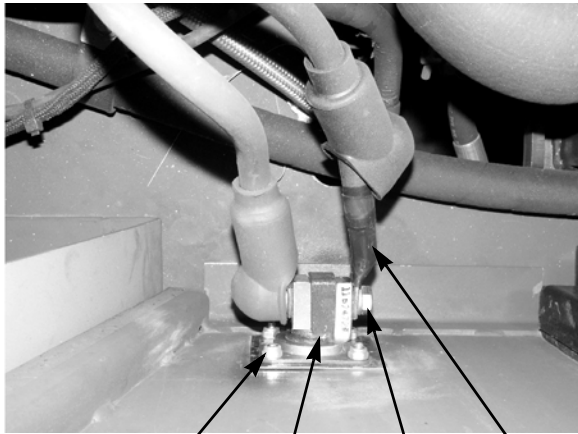
386-670



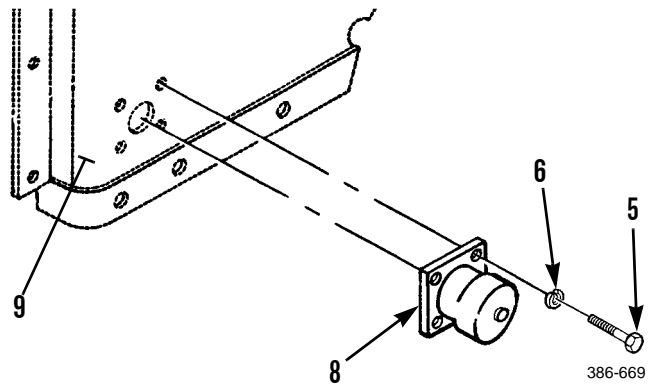
386-669

INSTALLATION

1. Position NATO starting receptacle (8) at panel (9) and install four capscrews (5), new lockwashers (6) and nuts (7).
2. Connect two cables (3) to back of receptacle (4) and secure with two washers (2) and nuts (1).



7 4 1,2 3
386-670



3. Connect battery cables (WP 0080 00).
4. Check and ensure NATO starting receptacle is operating properly (TM 5-2410-233-10).

END OF WORK PACKAGE

TRANSMISSION SELECTOR LEVER AND LINKAGE MAINTENANCE**0083 00****THIS WORK PACKAGE COVERS**

Removal, Installation, Adjustment

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Lockwasher (4, 8, 22, 27 and 36)

Nut, self-locking (32)

Equipment Condition

Battery disconnect switch in OFF position (TM 5-2410-233-10)

Floor plates removed (WP 0135 00)

Seat with vertical adjuster removed (WP 0137 00)

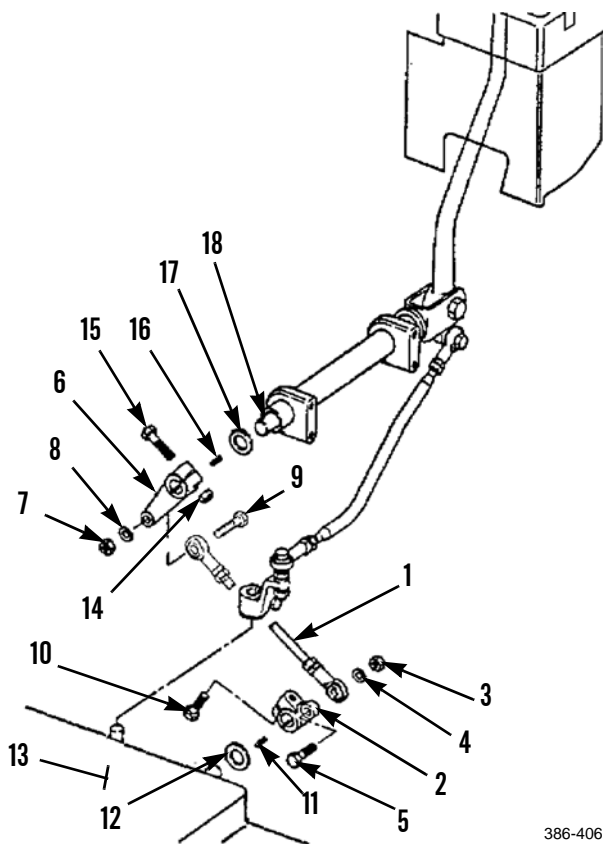
Transmission selector lever, guard and guide cover removed (WP 0084 00)

**WARNING**

Ensure battery disconnect switch is in OFF position before performing maintenance on transmission selector lever and linkage. Failure to follow this warning could result in injury or damage to equipment.

REMOVAL

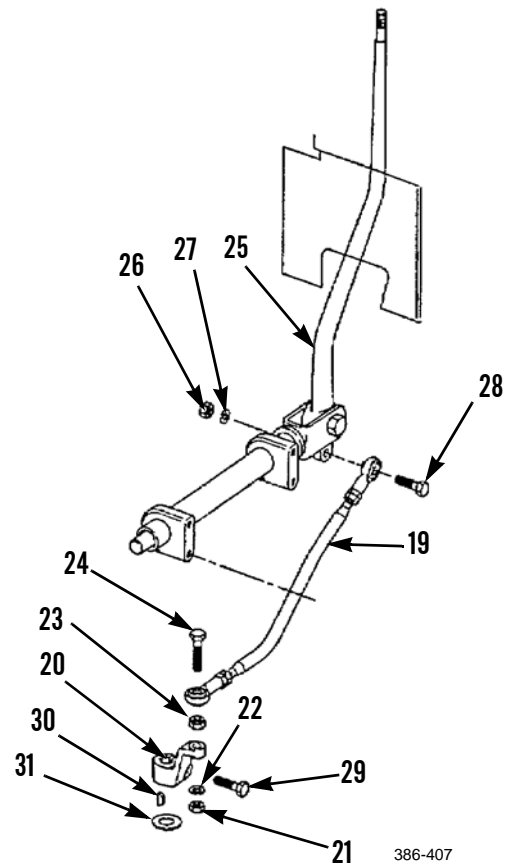
1. Disconnect one end of rod assembly (1) from lever (2) by removing nut (3), lockwasher (4) and capscrew (5). Discard lockwasher.
2. Disconnect other end of rod assembly (1) from lever (6) by removing nut (7), lockwasher (8) and capscrew (9). Discard lockwasher. Remove rod assembly.
3. Loosen capscrew (10) and remove lever (2), key (11) and washer (12) from transmission (13).
4. Remove nut (14) and capscrew (15) from lever (6) and slide lever, key (16) and spacer (17) from shaft (18).



386-406

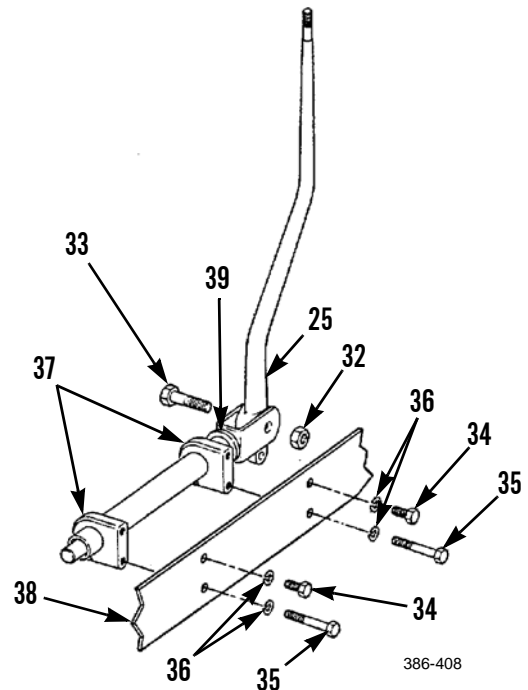
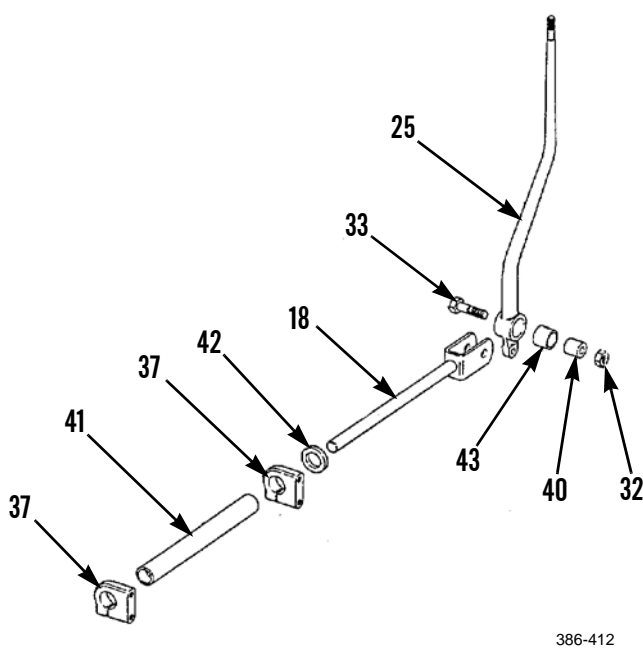
REMOVAL - CONTINUED

5. Disconnect one end of rod assembly (19) from lever (20) by removing nut (21), lockwasher (22), nut (23) and capscrew (24). Discard lockwasher.
6. Disconnect other end of rod assembly (19) from selector lever (25) by removing nut (26), lockwasher (27), and capscrew (28). Remove rod assembly.
7. Loosen capscrew (29) and remove lever (20), key (30) and washer (31) from transmission (13).



REMOVAL - CONTINUED

8. Remove self-locking nut (32) from capscrew (33). Discard self-locking nut.
9. Remove two short capscrews (34), two long capscrews (35) and four lockwashers (36) from two clamps (37) and plate (38). Discard lockwashers.
10. Move shaft assembly (39) from selector lever (25) and remove capscrew (33) and spacer (40).
11. Slide support (41) and spacer (42) from shaft (18).
12. Remove clamps (37) from support (41).
13. If damaged, press bushing (43) from selector lever (25).



INSTALLATION

1. If removed, press bushing (43) into selector lever (25).
2. Position two clamps (37) on support (41).
3. Install spacer (42) and support (41) on shaft (18).
4. Hold shaft assembly (39) and selector lever (25) in place and install capscrew (33) and spacer (40).
5. Hold shaft assembly (39) in position and align holes in clamps (37) with holes in plate (38).

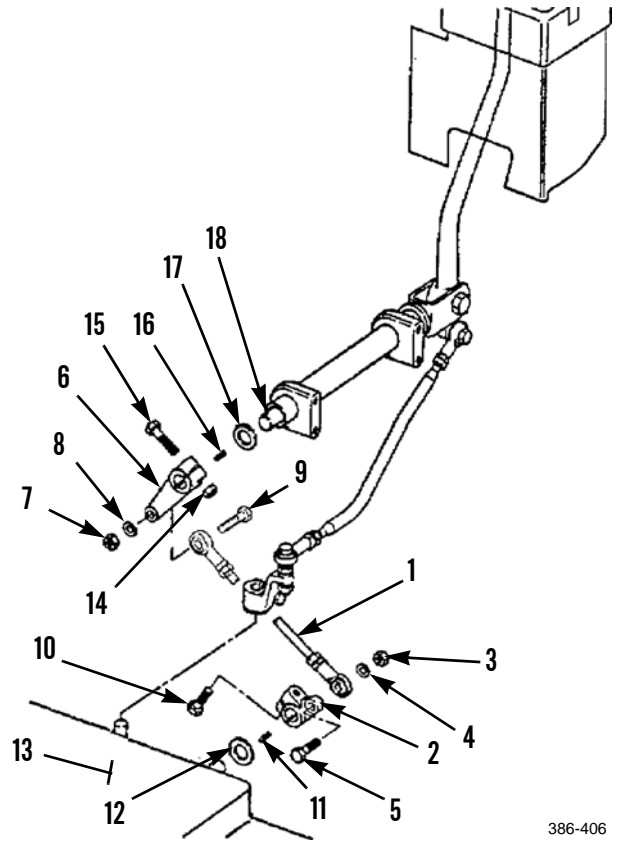
NOTE

Short capscrews must be installed in top holes of clamp and long capscrews in bottom holes of clamp.

6. Install clamps (37) to plate (38) with four new lockwashers (36) and two short capscrews (34) and two long capscrews (35).
7. Install new self-locking nut (32) on capscrew (33).
8. Position washer (31), lever (20) and key (30) on transmission (13) and tighten capscrew (29).
9. Install one end of rod assembly (19) to selector lever (25) with capscrew (28), new lockwasher (27) and nut (26).
10. Install other end of rod assembly (19) to lever (20) with capscrew (24), nut (23), new lockwasher (22) and nut (21).

INSTALLATION - CONTINUED

11. Install spacer (17), lever (6) and key (16) on shaft (18) with capscrew (15) and nut (14).
12. Position washer (12), lever (2) and key (11) on transmission (13) and tighten capscrew (10).
13. Install one end of rod assembly (1) to lever (6) with capscrew (9), new lockwasher (8) and nut (7).
14. Install other end of rod assembly (1) to lever (2) with capscrew (5), new lockwasher (4) and nut (3).



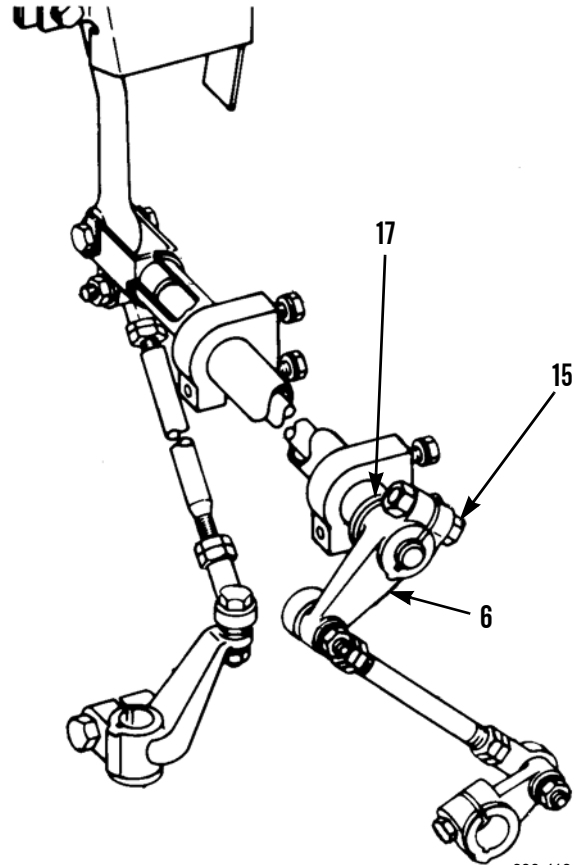
386-406

15. Install transmission selector lever, guard and guide cover (WP 0084 00).

ADJUSTMENT**NOTE**

- **Engine must be OFF to perform adjustment.**
- **Ensure all linkage mounting bolts are tight before performing adjustment.**

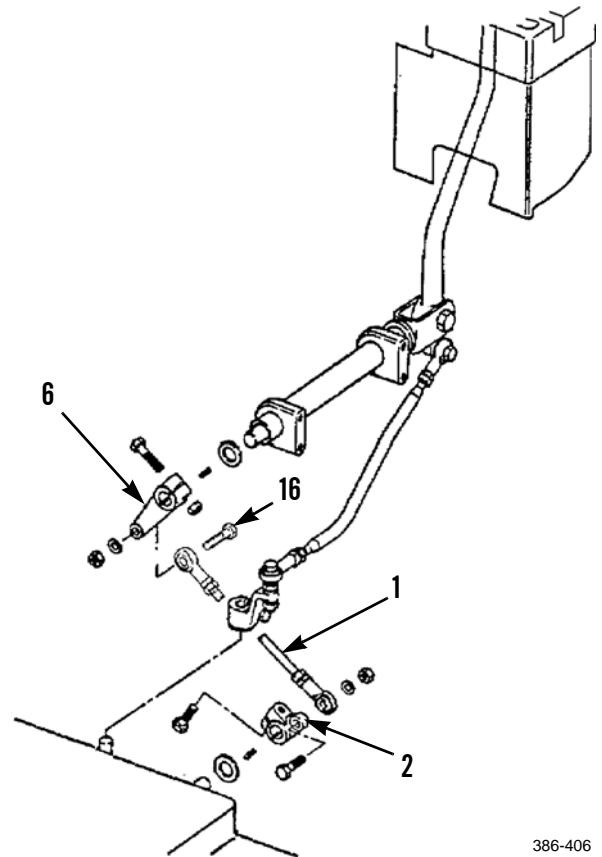
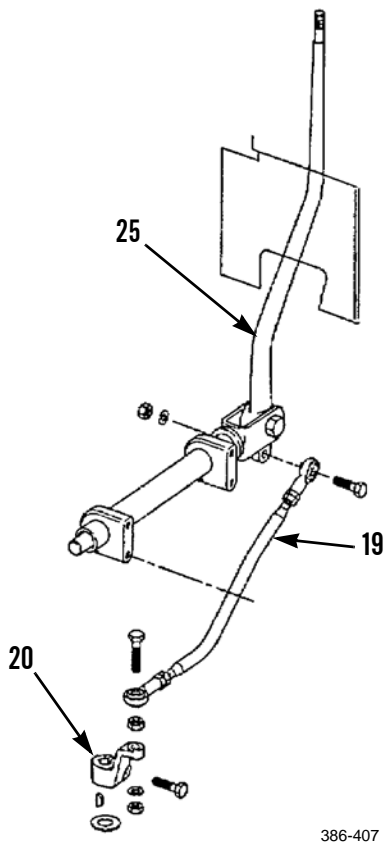
1. Loosen capscrew (15) on lever (6). Place a 0.012 in. (0.30 mm) thickness feeler gage between spacer (17) and lever.
2. Make necessary adjustment to lever (6) and tighten capscrew (15).



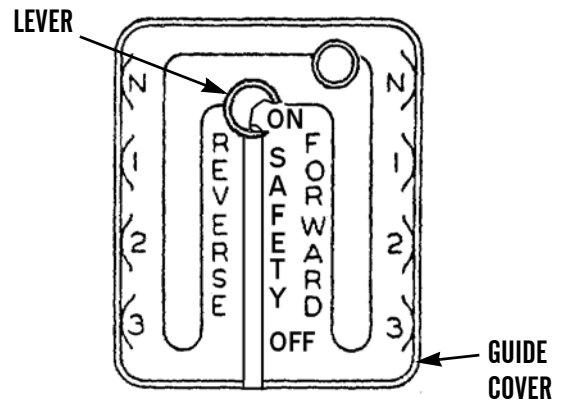
386-413

ADJUSTMENT - CONTINUED

3. Disconnect rod assembly (19) from levers (20 and 25). See *Removal*, steps 8 and 9.
4. Put lever (20) in FORWARD "F" detent.
5. Disconnect rod assembly (1) from levers (2 and 6). See *Removal*, steps 4 and 5.
6. Put lever (2) in NEUTRAL "N" detent.



7. Position lever in center of neutral (N) opening of guide cover.



ADJUSTMENT - CONTINUED

8. Adjust rod ends of rod assembly (1) until rod assembly can be installed between levers (2 and 6).
9. Connect rod assembly (1) to levers (2 and 6). See *Installation*, steps 13 and 14.
10. Position lever in front of FORWARD slot of NEUTRAL opening of guide cover.
11. Adjust rod ends of rod assembly (19) until rod assembly can be installed between levers (20 and 25).
12. Connect rod assembly (19) to levers (20 and 25). See *Installation*, steps 9 and 10.
13. Install seat with vertical adjuster (WP 0137 00).
14. Install floor plates (WP 0135 00).
15. Turn battery disconnect switch to ON position (TM 5-2410-233-10).
16. Test drive tractor in all speeds (TM 5-2410-233-10).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Lockwasher (2)

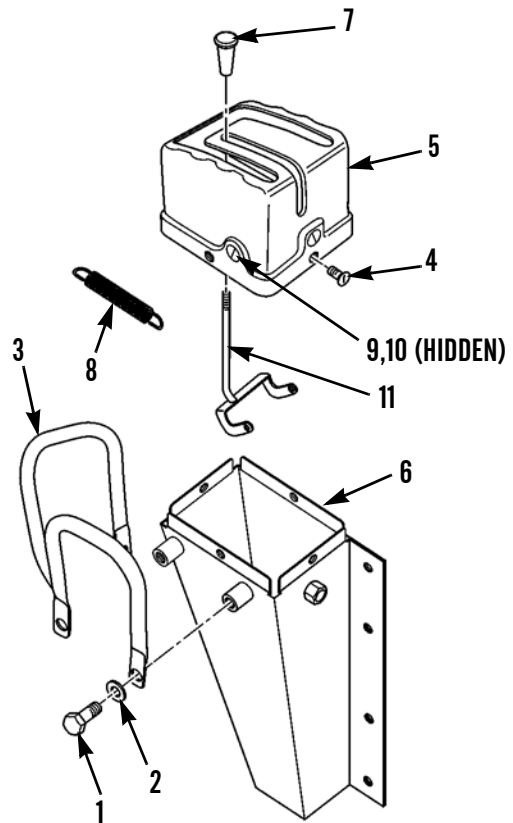
Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Engine OFF and cool (TM 5-2410-233-10)

REMOVAL

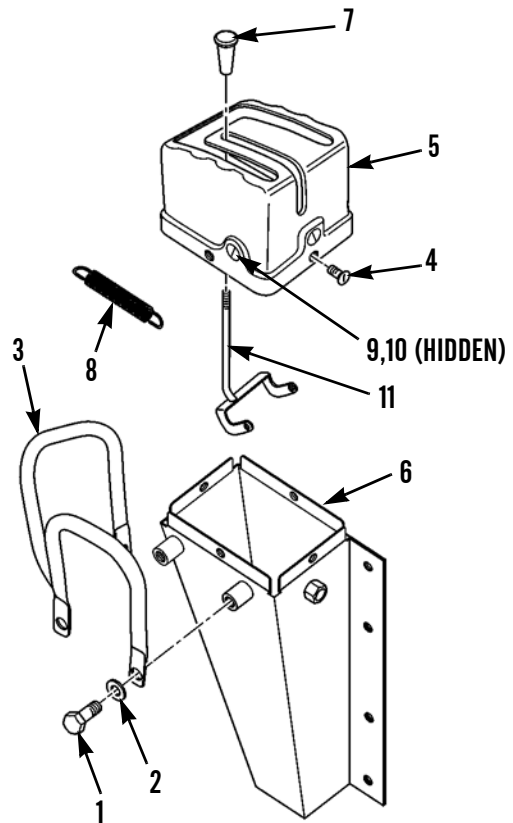
1. Remove three capscrews (1), lockwashers (2) and guard (3). Discard lockwashers.
2. Remove four screws (4) from guide cover (5) and remove guide cover from transmission control box (6).
3. Remove transmission safety lock lever knob (7).
4. Remove spring (8).
5. Remove two screws (9) and washers (10) from guide cover (5).
6. Remove transmission safety lock lever (11).



386-418

INSTALLATION

1. Position transmission safety lock lever (11) in guide cover (5).
2. Install two washers (10) and screws (9).
3. Install spring (8).
4. Install transmission safety lock lever knob (7).
5. Position guide cover (5) on transmission control box (6). Ensure transmission selector lever is in the proper guide cover slot.
6. Install four screws (4).
7. Install guard (3) with three new lockwashers (2) and capscrews (1).
8. Check transmission safety lock lever for proper operation (TM 5-2410-233-10).



386-418

END OF WORK PACKAGE

**TRANSMISSION MAGNETIC STRAINER ASSEMBLY AND TORQUE
DIVIDER SUCTION SCREEN MAINTENANCE**

0085 00

THIS WORK PACKAGE COVERS

Magnetic Strainer Assembly: Removal, Cleaning and Inspection, Installation

Suction Screen: Removal, Cleaning and Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)

Compound, sealing (Item 9, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Gasket (18)

Materials/Parts - Continued

Lockwasher (11)

Nut, self-locking (14)

O-ring (8)

References

WP 0086 00

WP 0129 00

WP 0176 00

Equipment Condition

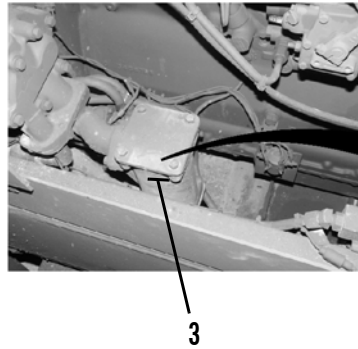
Engine OFF and cool (TM 5-2410-233-10)

**TRANSMISSION MAGNETIC STRAINER ASSEMBLY AND TORQUE
DIVIDER SUCTION SCREEN MAINTENANCE - CONTINUED**

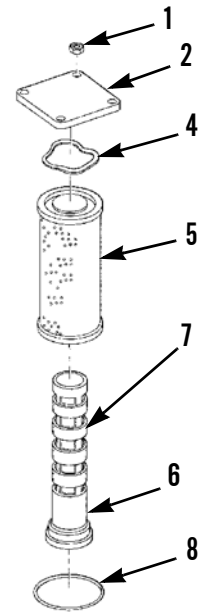
0085 00

MAGNETIC STRAINER ASSEMBLY REMOVAL

1. Remove four nuts (1) and cover (2) from housing (3).
2. Remove spring washer (4) from top of magnetic strainer assembly (5).
3. Remove magnetic strainer tube (6) and four magnets (7) as an assembly from housing (3).
4. Remove O-ring (8) from housing (3) and discard.



386-343

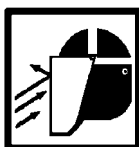
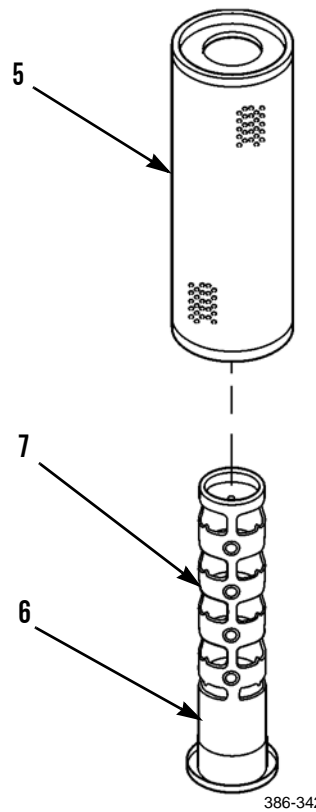


MAGNETIC STRAINER ASSEMBLY CLEANING AND INSPECTION

NOTE

Dropping a magnet may result in demagnetization. Do not drop magnets.

1. Disassemble magnetic strainer (5) by removing tube (6) and four magnets (7) from strainer.
2. Inspect strainer assembly for damage.
3. Inspect tube and magnets for metal shavings, particles and damage. If metal shavings are found, contact Direct Support Maintenance.



WARNING



- Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.
- Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may result in serious injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

4. Clean components with solvent cleaning compound and dry using pressurized air.

**TRANSMISSION MAGNETIC STRAINER ASSEMBLY AND TORQUE
DIVIDER SUCTION SCREEN MAINTENANCE - CONTINUED**

0085 00

MAGNETIC STRAINER ASSEMBLY INSTALLATION

1. Place four magnets (7) over tube (6) and place into strainer (5) with "THIS SIDE OUT" notice on screen toward top.
2. Install magnetic strainer assembly (5) into housing (3).

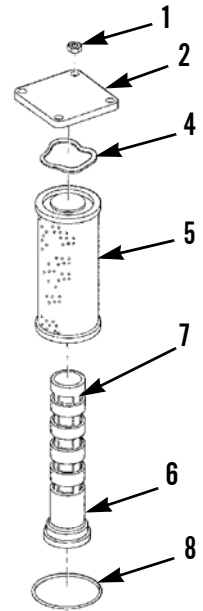
NOTE

Lubricate new O-ring with a thin coating of clean oil before installation.

3. Install new O-ring (8) in housing (3).
4. Install spring washer (4) on top of magnetic screen (5).
5. Place cover (2) on housing (3) and install four nuts (1).
6. Check level of oil in transmission and add as needed (WP 0086 00).
7. Operate machine and check for leaks (TM 5-2410-233-10).



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**TRANSMISSION MAGNETIC STRAINER ASSEMBLY AND TORQUE DIVIDER
DIVIDER SUCTION SCREEN MAINTENANCE - CONTINUED**

0085 00

SUCTION SCREEN REMOVAL

NOTE

Clean suction screen whenever common oil compartment is drained for repairs on brakes, transmission or torque divider.

1. Open crankcase guard (WP 0129 00).

NOTE

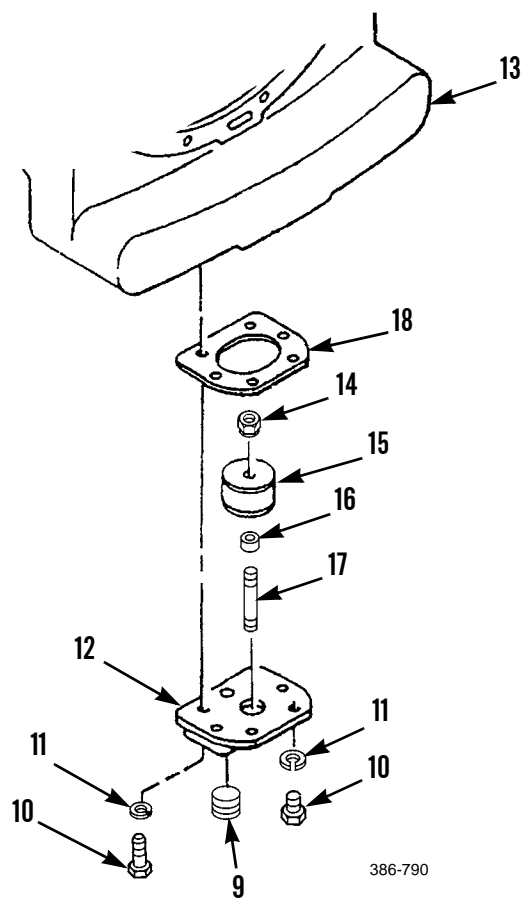
Use a suitable container to capture draining oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

2. Remove drain plug (9) and drain oil into a suitable container.

NOTE

Bolts must be installed in same locations from which they were removed. Tag each bolt and its corresponding mounting location, to ensure correct installation.

3. Remove six bolts (10), lockwashers (11) and cover (12) with assembled parts from flywheel housing (13). Discard lockwashers.
4. Remove self-locking nut (14) and disassemble suction screen (15) and spacer (16) from stud (17). Discard self-locking nut.
5. Remove gasket (18) from flywheel housing (13) or cover (12). Discard gasket.



**TRANSMISSION MAGNETIC STRAINER ASSEMBLY AND TORQUE
DIVIDER SUCTION SCREEN MAINTENANCE - CONTINUED**

0085 00

SUCTION SCREEN CLEANING AND INSPECTION**WARNING**

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Clean suction screen in solvent cleaning compound IAW WP 0176 00.
2. Inspect suction screen for damage IAW WP 0176 00.
3. Replace any damaged component.

SUCTION SCREEN INSTALLATION

1. Install new gasket (18) on cover (12).
2. Assemble spacer (16) and suction screen (15) onto stud (17). Install with new self-locking nut (14).

NOTE

Ensure bolts are installed in same locations from which they were removed.

3. Install cover (12) with assembled parts on underside of flywheel housing (13) with six new lockwashers (11) and bolts (10).
4. Apply sealing compound to threads of drain plug (9). Install plug and tighten.
5. Check level of oil in transmission and add as needed (WP 0086 00).
6. Start engine and check for leaks (TM 5-2410-233-10).
7. Close crankcase guard (WP 0129 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Service

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Oil, lubricating (Item 22, 23, 24 or 25 WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

References

WP 0008 00

References - Continued

WP 0085 00

WP 0087 00

WP 0089 00

WP 0099 00

Equipment Condition

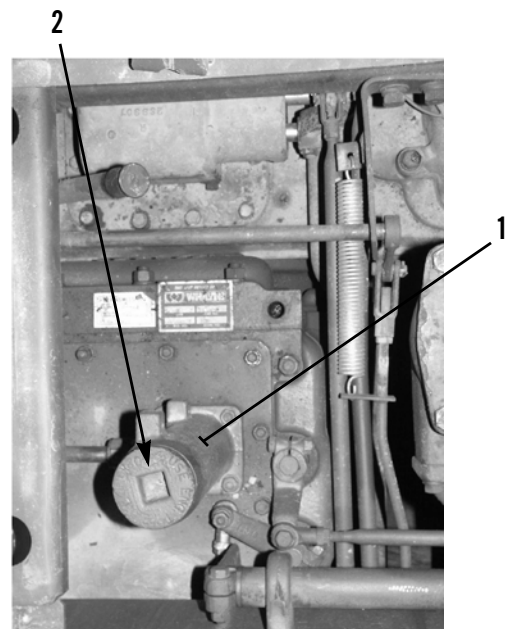
Machine parked on level surface (TM 5-2410-233-10)

Transmission warm, in neutral (N) and locked (TM 5-2410-233-10)

Engine OFF and cool (TM 5-2410-233-10)

SERVICE

1. Tilt seat forward to access and fill tube (1). Remove fill tube cap (2).



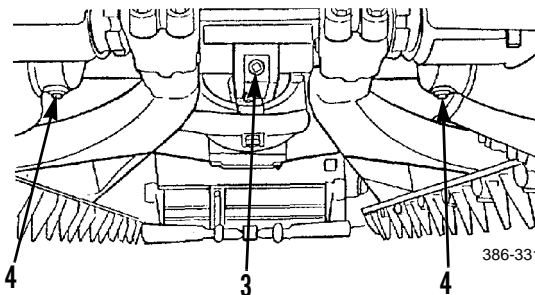
386-016

SERVICE - CONTINUED

NOTE

Use a suitable container to capture draining oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

2. Remove bevel gear drain plug (3) and steering clutch drain plugs (4) and allow transmission oil to drain.
3. Remove breather and clean (WP 0099 00).

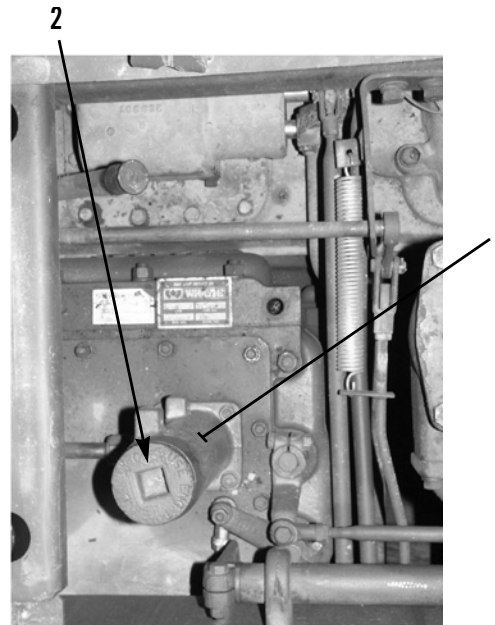


4. Install breather (1) and tighten (WP 0099 00).
5. Drain transmission oil cooler (WP 0087 00).
6. Remove plug from flywheel housing and drain oil (WP 0085 00).
7. Replace transmission and steering clutch oil filter assembly (WP 0089 00).
8. Remove, clean and reinstall transmission oil magnetic screen assembly and torque divider suction screen (WP 0085 00).
9. Install bevel gear drain plug (3) and steering clutch drain plugs (4).
10. Reinstall drain plug at transmission oil cooler (WP 0087 00).

NOTE

Refer to KEY in WP 0008 00 for appropriate grade of oil to add based on expected temperature range of operation.

11. Fill transmission with oil through fill tube (1).
12. Install fill tube cap (2).
13. Start engine and allow to warm up.
14. Check for transmission oil leaks (TM 5-2410-233-10).
15. Remove transmission oil level gage and check level. Oil should be at FULL mark on transmission oil level gage. Add oil as needed. Shut down engine.



END OF WORK PACKAGE

TRANSMISSION OIL COOLER REPLACEMENT

0087 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Gasket (19 and 22)

O-ring (9 and 14)

References

WP 0086 00

Personnel Required

Two

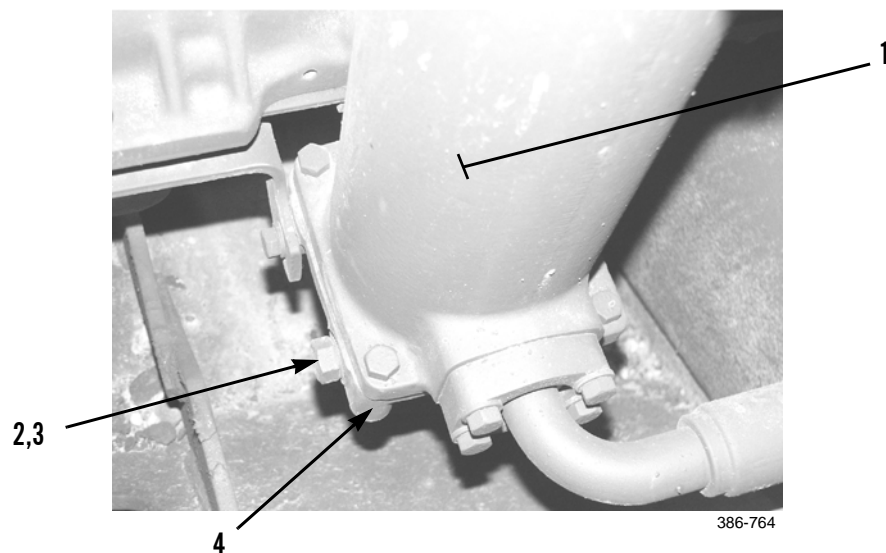
Equipment Condition

Engine coolant drained (WP 0060 00)

REMOVAL**NOTE**

Use a suitable container to capture residual draining oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

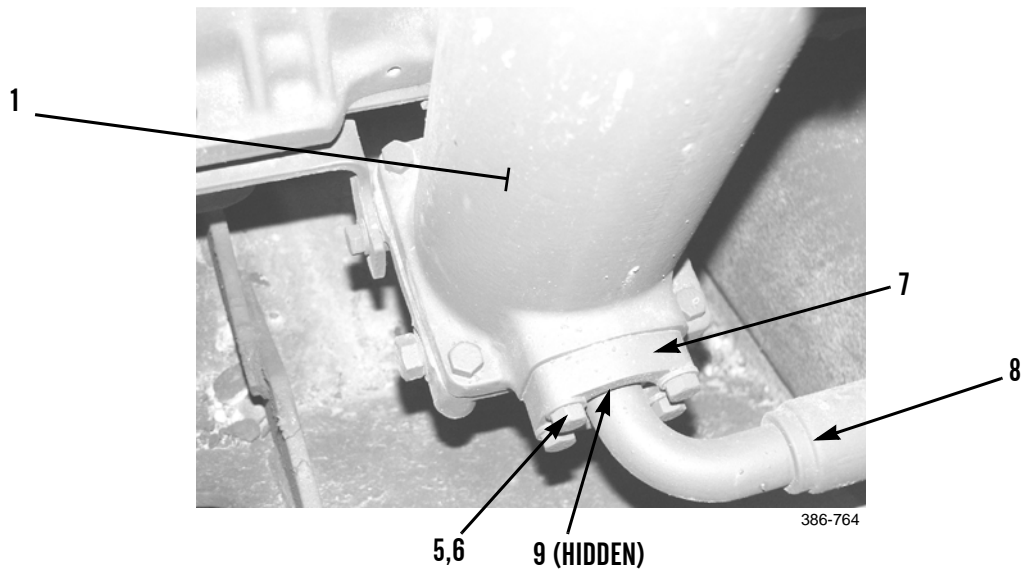
1. Place a drain pan under oil cooler (1) on L.H. side of engine compartment.
2. Remove drain plug (2) and washer (3) from bonnet (4) and drain any residual transmission oil.



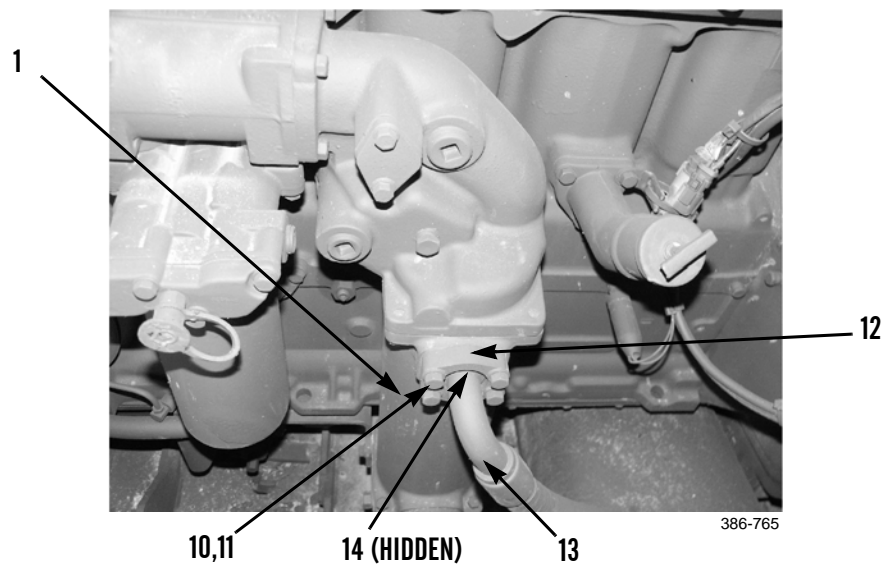
REMOVAL - CONTINUED**CAUTION**

Place protective caps or plugs on all openings to prevent foreign matter from contaminating system.

3. Remove four bolts (5), washers (6), two flanges (7) and hose (8) from bottom of oil cooler (1). Remove and discard O-ring (9).



4. Remove four bolts (10), washers (11), two flanges (12) and hose (13) from top of oil cooler (1). Remove and discard O-ring (14).



REMOVAL - CONTINUED

5. Remove capscrew (15) and washer (16) from bracket (17) and bonnet (4).



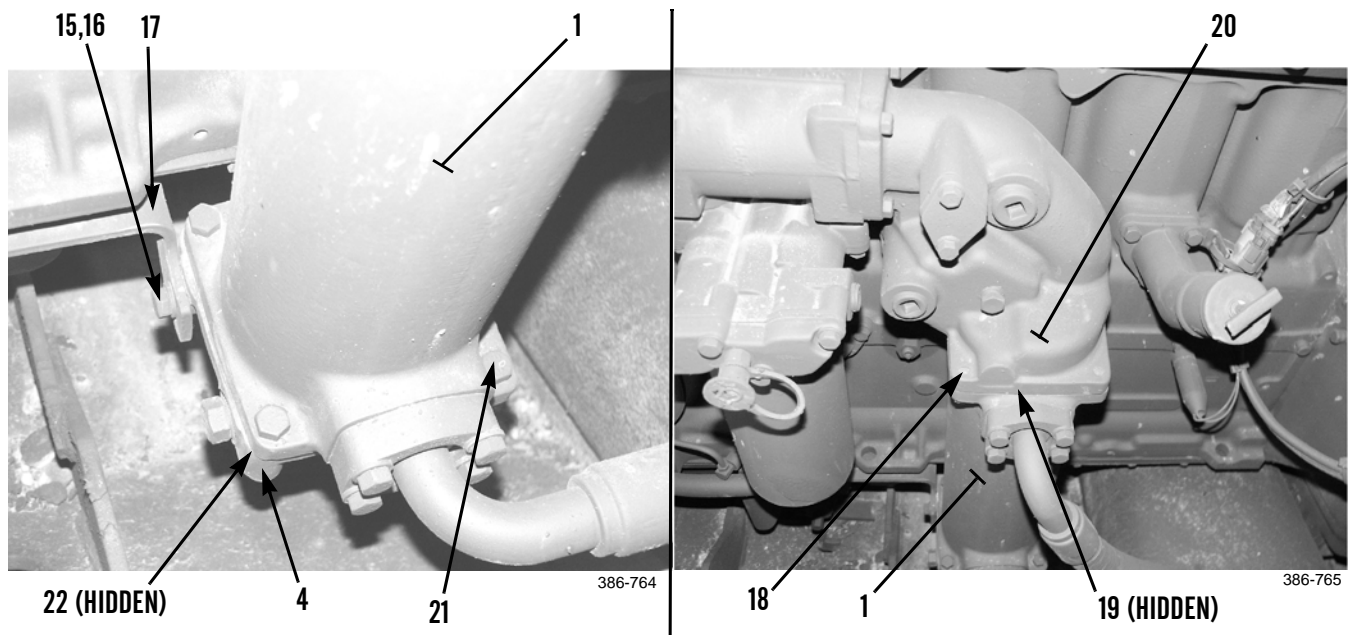
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

NOTE

Oil cooler weighs 29 lb (13 kg).

6. While supporting oil cooler (1), remove four bolts (18), oil cooler (1) and gasket (19) from housing (20). Discard gasket.
7. Remove oil cooler (1) from housing (20).
8. Remove four bolts (21), bonnet (4) and gasket (22) from oil cooler (1). Discard gasket.



INSTALLATION

NOTE

Ensure all mating surfaces are clean before installation.

1. Position new gasket (22) and bonnet (4) on bottom of oil cooler (1) and install four bolts (21).

INSTALLATION - CONTINUED



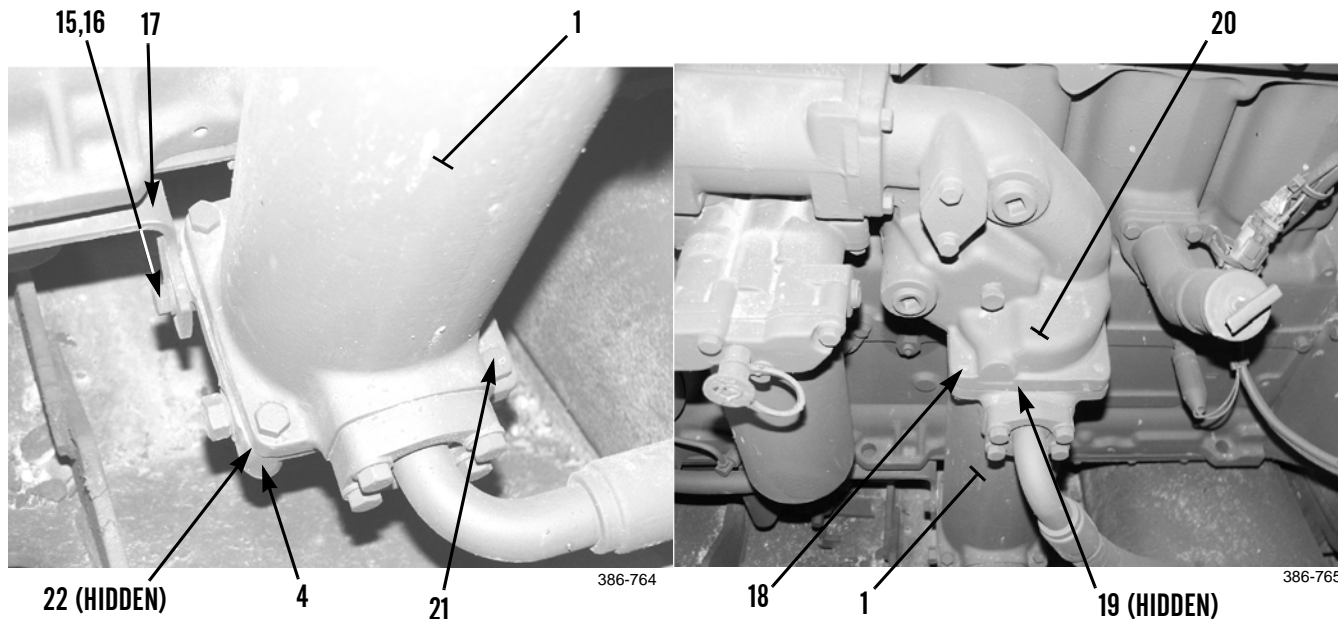
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

NOTE

Oil cooler weighs 29 lb (13 kg).

2. Install new gasket (19) and top of oil cooler (1) to housing (20) with four bolts (18). Do NOT fully tighten bolts.
3. Install bonnet (4) to bracket (17) with washer (16) and capscrew (15).
4. Fully tighten four bolts (18).



CAUTION

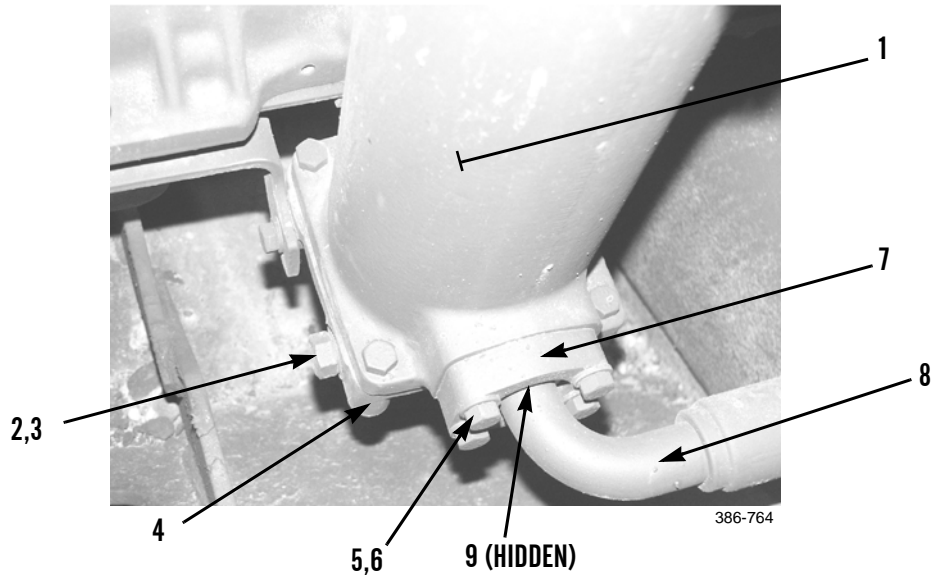
Wipe all lines and fittings clean as connections are made to prevent contamination from entering system.

NOTE

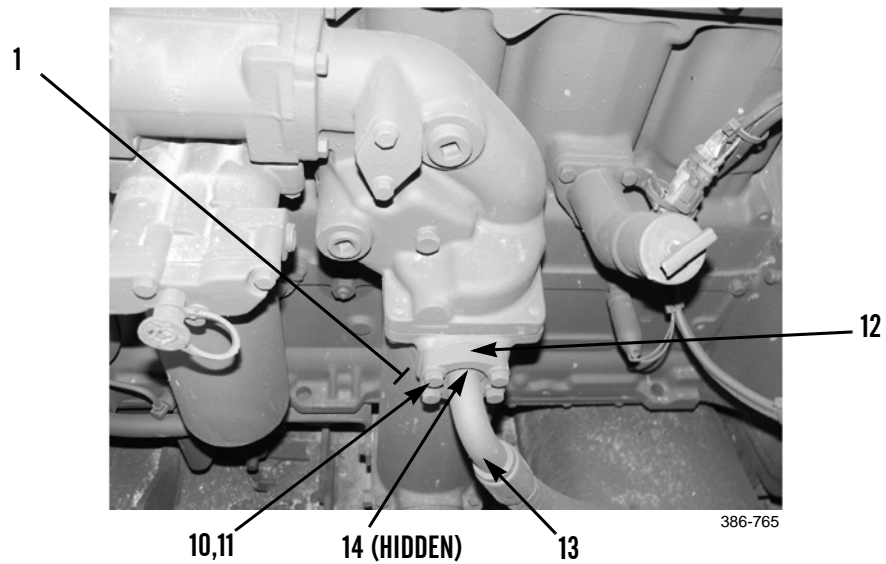
Lightly coat new O-rings with clean oil before installation.

5. Install new O-ring (9) and hose (8) to bottom of oil cooler (1) with two flanges (7), four washers (6) and bolts (5).
6. Install washer (3) and drain plug (2) to bonnet (4).

INSTALLATION - CONTINUED



7. Install new O-ring (14) and hose (13) to top of oil cooler (1) with two flanges (12), four washers (11) and bolts (10).



8. Check level of transmission oil and add as needed (WP 0086 00).
9. Refill cooling system (WP 0060 00).

END OF WORK PACKAGE

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TRANSMISSION OIL LINES REPLACEMENT

0088 00**THIS WORK PACKAGE COVERS**Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Tag, marker (Item 35, WP 0184 00)

Lockwasher (2) (as required)

O-ring (10) (as required)

Equipment Condition

Transmission oil drained, as required (WP 0086 00)

Floor plates removed (WP 0135 00)

Seat tilted forward, if required for access (TM 5-2410-233-10)

REMOVAL**NOTE**

This procedure provides general instructions for replacement of transmission oil lines. The examples provided are typical examples only. The replacement of a specific line should vary only slightly.

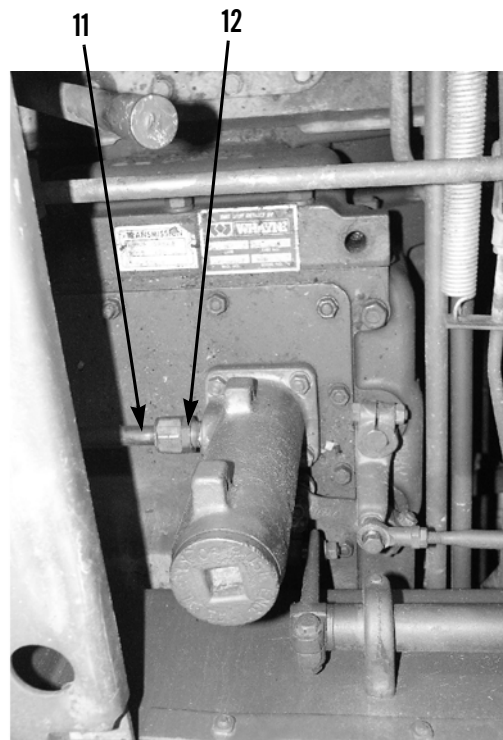
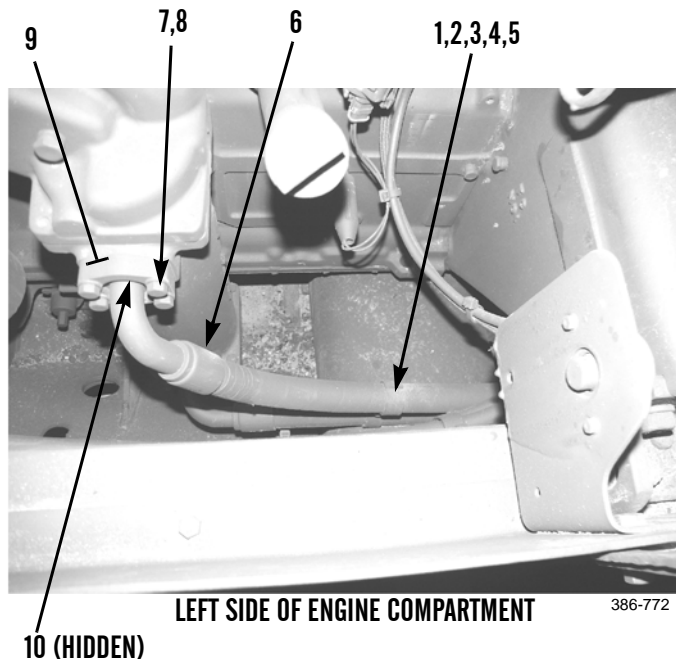
CAUTION

Place protective caps or plugs on all transmission system openings to prevent foreign matter from contaminating system.

NOTE

- Use a suitable container to capture residual draining oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- Tag lines before removal to ensure correct installation.
- Hose clamp mounting hardware differs depending on location of clamp.

1. Remove nuts (1), lockwashers (2), washers (3) and capscrews (4) from hose clamps (5) along entire length of line (6). Discard lockwashers.
2. If removing a line with a single or split flanged mounting, remove four capscrews (7), washers (8) and flange(s) (9) from each end of line (6).
3. Remove and discard O-ring (10) from each end of line (6).
4. Remove line (6) from machine.
5. If removing a line (11) that connects to a connector (12), disconnect each end of line from connector.
6. Repeat step 1 as required to remove hose clamps (5) along entire length of line (11).
7. Remove line (11) from machine.



INSTALLATION**CAUTION**

Remove caps and/or plugs from lines and openings and wipe lines and fittings clean as connections are made, to prevent contamination from entering transmission.

1. Route line (6 or 11) along its proper path.
2. If installing a line (11) that connects to a connector (12), connect line to connector at each end of line.

NOTE

Lightly coat new O-rings with clean oil before installation.

3. If installing a line (6) with a single or split flanged mounting, install new O-ring (10) to each end of line.
4. Install each end of line (6) with flange(s) (9), four washers (8) and capscrews (7).

NOTE

Hose clamp mounting hardware differs depending on location of clamp.

5. Install hose clamps (5), in their original location, to secure line (6 or 11). Secure hose clamps with capscrews (4), washers (3) new lockwashers (2) and nuts (1).
6. Add oil to transmission as required (WP 0086 00).
7. Operate machine and check for leaks (TM 5-2410-233-10).
8. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

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TRANSMISSION AND STEERING CLUTCH OIL FILTER ASSEMBLY MAINTENANCE

0089 00

THIS WORK PACKAGE COVERS

Service, Removal, Disassembly, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Element, filter (5)

Lockwasher (12 and 17)

O-ring (4, 10, 15 and 28)

Seal (30)

References

WP 0086 00

Equipment Condition

Seat tilted forward (TM 5-2410-233-10)

SERVICE

NOTE

Use a suitable container to capture any residual draining oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

TRANSMISSION AND STEERING CLUTCH OIL FILTER ASSEMBLY MAINTENANCE - CONTINUED 0089 00

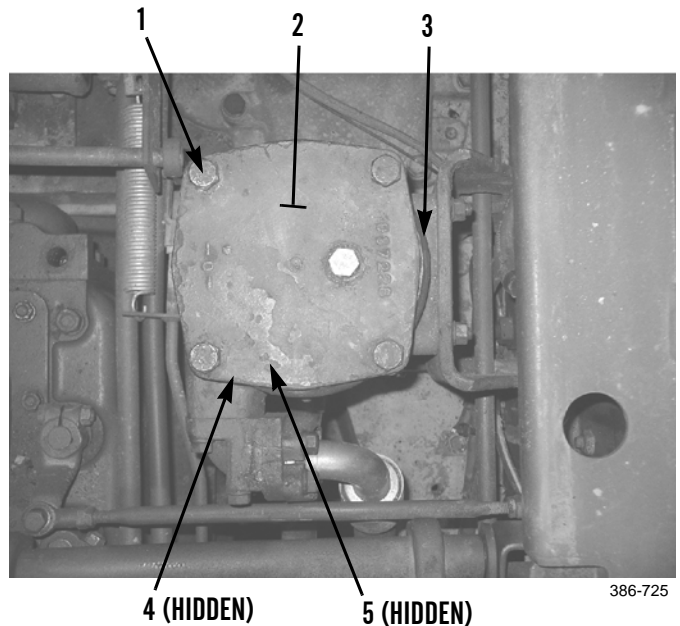
SERVICE - CONTINUED

1. Remove four bolts (1) from cover (2).
2. Remove cover (2) from filter housing (3).
3. Remove O-ring (4) from cover (2). Discard O-ring.
4. Remove filter element (5) from filter housing (3). Discard filter element.
5. Siphon transmission oil from filter housing (3) and wipe housing clean with a rag.
6. Install new filter element (5) into filter housing (3).

NOTE

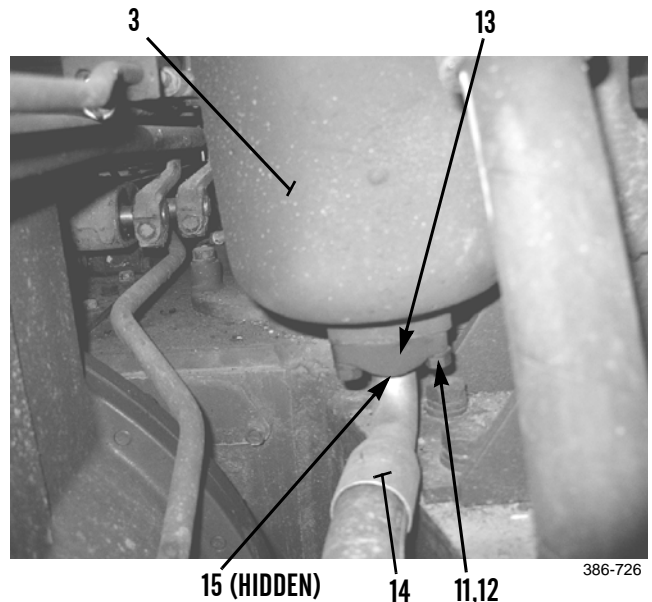
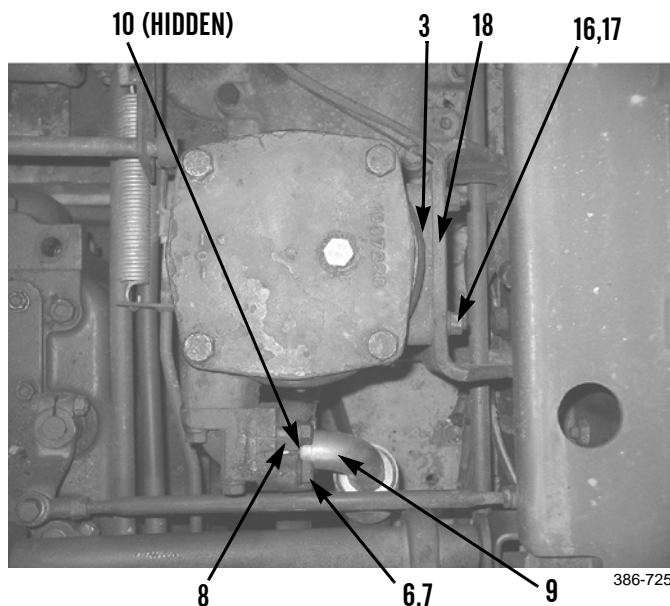
- **Ensure O-ring groove is clean before installing O-ring.**
- **Lightly coat new O-ring with clean oil before installation.**

7. Install new O-ring (4) onto cover (2).
8. Install cover (2) to filter housing (3) with four bolts (1).
9. Check transmission oil level and add as needed. (WP 0086 00).



REMOVAL

1. Perform *Service* steps 1 through 6.
2. Remove four bolts (6), washers (7), two flanges (8) and hose assembly (9) from top of filter housing (3). Remove O-ring (10) from hose assembly and discard.
3. Remove four capscrews (11), lockwashers (12), two flanges (13) and hose assembly (14) from base of filter housing (2). Remove O-ring (15) from hose assembly. Discard lockwashers and O-ring.
4. Remove nuts (16), lockwashers (17) and filter housing (3) from bracket (18). Discard lockwashers.



TRANSMISSION AND STEERING CLUTCH OIL FILTER ASSEMBLY MAINTENANCE - CONTINUED 0089 00

DISASSEMBLY

1. Use a hammer and punch to remove pin (19) from tube (20).
2. Remove tube (20), recessed washer (21), spring (22) and valve seat (23) from cover (2).
3. Remove retainer (24), spring (25) and sleeve spacer (26) from filter housing (3).
4. Remove plug (27) and O-ring (28) from cover (2). Discard O-ring.
5. Remove plug (29) and seal (30) from bottom of filter housing (3). Discard seal.
6. If necessary, remove four studs (31) from filter housing (3).

ASSEMBLY

1. If removed, install four studs (31) into filter housing (3).

NOTE

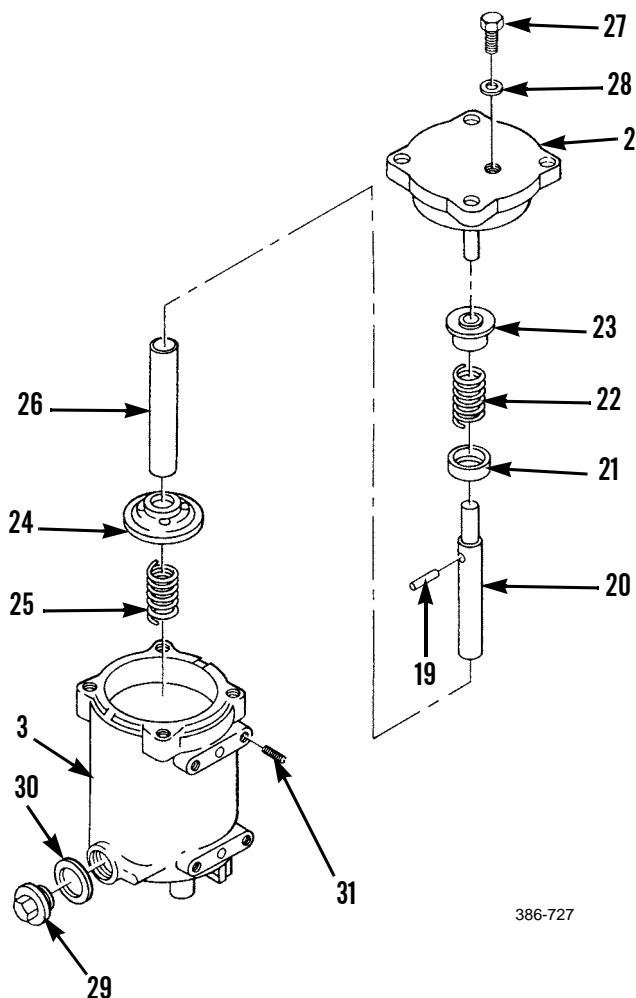
Lightly coat new seal and new O-ring with clean oil before installation.

2. Install new seal (30) and drain plug (29) to bottom of filter housing (3).
3. Install new O-ring (28) and plug (27) to cover (2).
4. Install sleeve spacer (26), spring (25) and retainer (24) into filter housing (3).
5. Install valve seat (23), spring (22), recessed washer (21) and tube (20) onto cover (2).

NOTE

Ensure pin is not damaged. If damaged, it must be replaced.

6. Install pin (19) into tube (20).



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TRANSMISSION AND STEERING CLUTCH OIL FILTER ASSEMBLY MAINTENANCE - CONTINUED 0089 00

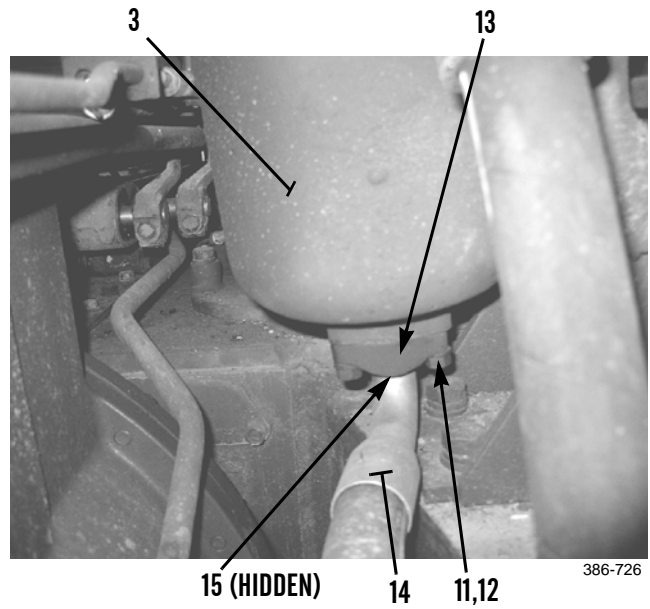
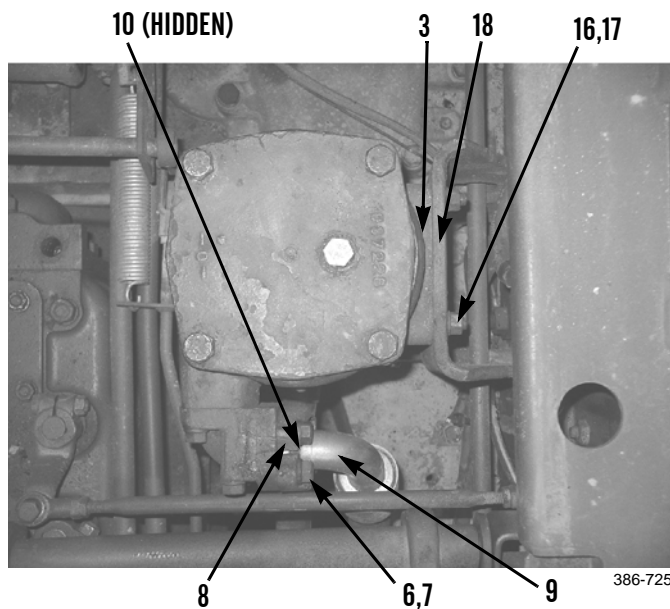
INSTALLATION

1. Install filter housing (3) to bracket (18) with four new lockwashers (17) and nuts (16).

NOTE

- **Ensure O-ring grooves are clean before installation.**
- **Lightly coat new O-rings with clean oil before installation.**

2. Install new O-ring (15) to hose assembly (14).
3. Install hose assembly (14) to base of filter housing (3) with two flanges (13), four new lockwashers (12) and capscrews (11).
4. Install new O-ring (10) to hose assembly (9).
5. Install hose assembly (9) to top of filter housing (3) with two flanges (8), four washers (7) and bolts (6).



6. Perform *Service*, steps 7 through 10.
7. Operate machine and check for leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

TRANSMISSION OIL SAMPLING VALVE REPLACEMENT

0090 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0184 00)

Materials/Parts

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)
O-ring (2)

References

TM 5-2410-233-10

Equipment Condition

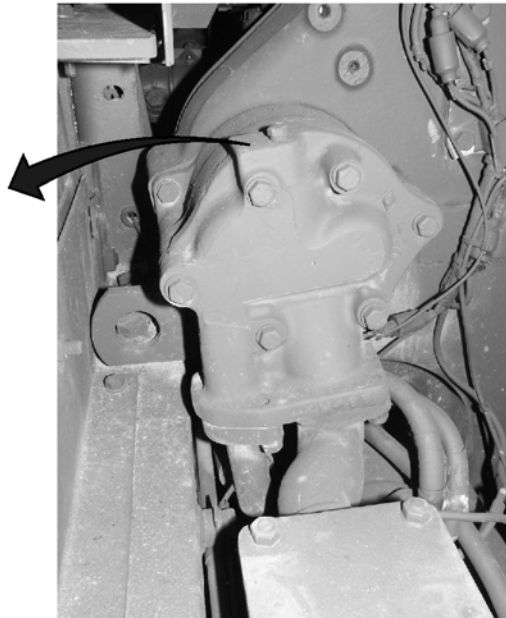
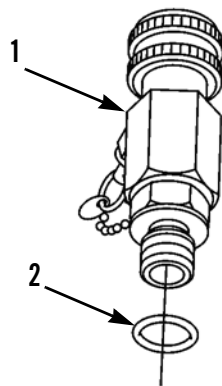
Machine parked on level ground (TM 5-2410-233-10)
Engine OFF (TM 5-2410-233-10)

NOTE

Selected D7F Tractors may be equipped with a transmission oil sampling valve. If equipped, valve is installed on transmission pump, at right rear of engine compartment.

REMOVAL

1. Remove oil sampling valve (1) (if equipped) from top of transmission oil pump.
2. Remove and discard O-ring (2).



386-322

INSTALLATION**NOTE**

Lightly coat new O-ring with clean oil before installation.

1. Install new O-ring (2) on oil sampling valve (1).
2. Install oil sampling valve (1) onto transmission oil pump.
3. Check oil sampling valve for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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TORQUE DIVIDER OUTPUT SHAFT SEAL REPLACEMENT

0091 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Compound, silicone, RTV (Item 9, WP 0184 00)

Grease, GAA (Item 15, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Materials/Parts - Continued

Rag, wiping (Item 28, WP 0184 00)

Seal (5)

References

TM 5-2410-233-10

WP 0086 00

WP 0135 00

Equipment Condition

Driveshaft removed (WP 0106 00)

REMOVAL**CAUTION**

Wipe area clean around output shaft flange. Debris falling into torque divider could result in premature failure.

NOTE

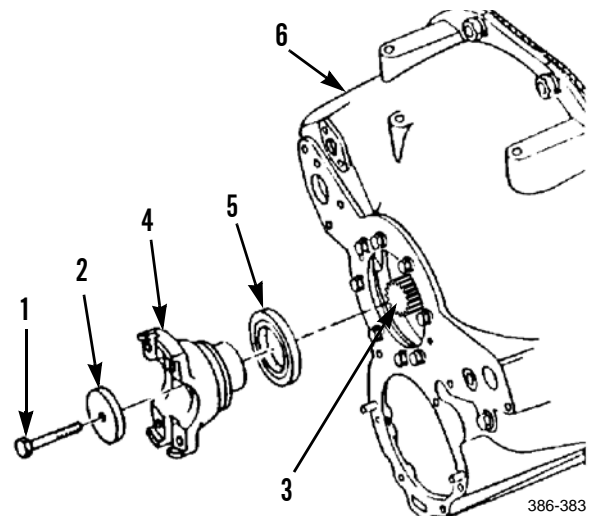
Use a suitable container to catch any oil that may drain from system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

1. Remove capscrew (1) and washer (2) from output shaft (3).

NOTE

Retain output shaft to ensure it does not fall out.

2. Remove flange (4) from output shaft (3).
3. Remove seal (5) from torque divider housing (6). Discard seal.



386-383

INSTALLATION**NOTE**

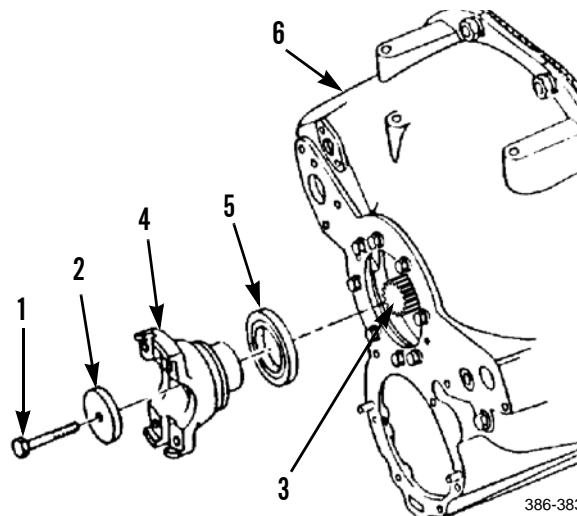
- Apply clean grease to new seal before installation.
- Ensure flat side of seal faces transmission when installing.

1. Install new seal (5) into torque divider housing (6).
2. Install flange (4) onto output shaft (3) until fully seated.

**WARNING**

Exposure to silicone RTV compound may be hazardous to your health. Contact with eyes can cause severe irritation and burns. Compound can be absorbed into the skin and can cause irritation or skin sensitization. Inhalation of vapors can cause respiratory tract irritation; prolonged inhalation can result in an allergic reaction. Vapors are combustible. Do not use near open flame. Wear eye and skin protection and avoid inhalation of vapors. Use only in a well-ventilated area. Failure to follow this warning can cause injury or death.

3. Apply silicone RTV compound to underside of washer (2). Install washer and capscrew (1). Tighten capscrew to 40 lb-ft (54 Nm).
4. Install driveshaft (WP 0106 00). DO NOT install floor plates.
5. Check level of oil in transmission and add as needed (WP 0086 00).
6. Test drive and check torque divider for proper operation and leaks (TM 5-2410-233-10).
7. Install floor plates (WP 0135 00).



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END OF WORK PACKAGE

TORQUE DIVIDER REPLACEMENT

0092 00**THIS WORK PACKAGE COVERS**Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Link, lifting (Item 44, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Lifting equipment, 400 lb capacity
 Bolts, 5/8 -11 x 1-1/2 in.

Materials/Parts

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Wire, nonelectrical (Item 37, WP 0184 00)
 Gasket (15)
 Screw, forcing, 3/8 in. - 16NC (5)
 Washer, lock (4)

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

ROPS removed (WP 0131 00)
 Floor plates removed (WP 0135 00)
 Dash assembly removed
 Seat and seat base assembly removed (WP 0137 00)
 Brake pedal assembly removed (WP 0121 00)
 Driveshaft removed (WP 0106 00)
 Transmission guard removed (WP 0129 00)
 Steering clutch linkage that crosses over torque divider disconnected (WP 0123 00)
 Brake lock linkage that crosses over torque divider disconnected (WP 0124 00)
 Torque divider and transmission oil drained (WP 0086 00)
 Transmission oil lines disconnected from torque divider (WP 0088 00)
 Transmission oil cooler lines disconnected from torque divider (WP 0087 00)
 Torque converter outlet relief valve removed (WP 0096 00)
 Torque divider scavenge pump removed (WP 0097 00)

REMOVAL

1. Fasten two lifting links (1) with 5/8 -11x 1-1/2 in. bolts to holes on top of torque divider (2).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

NOTE

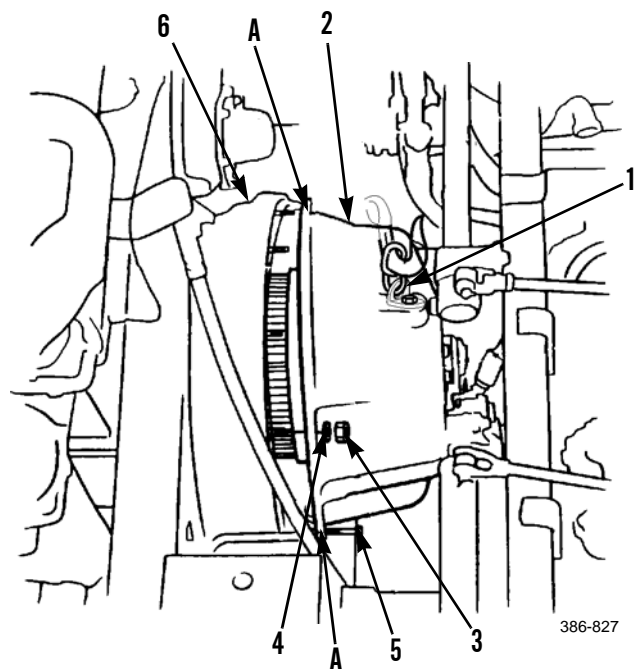
- Torque divider weighs 300 lb (136 kg).
- Use a suitable container to catch any oil that may drain from torque divider. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

2. Fasten a nylon sling and a suitable lifting device to lifting links (1).
3. Remove 12 nuts (3) and lockwashers (4). Discard lockwashers.
4. Install two 3/8 in. -16NC forcing screws (5) into torque divider (2) at locations (A).
5. Slowly turn forcing screws (5) in until enough pressure is applied to separate torque divider (2) from flywheel housing (6).

NOTE

Do NOT remove torque divider at this point.

6. Back torque divider (2) away from flywheel housing (6) just enough to slide a piece of wire around planetary carrier. Connect each end of wire to forcing screws (5). This will ensure that planetary carrier assembly does not fall when torque divider is removed.
7. Slowly back torque divider (2) away from flywheel housing (6) and lift out torque divider. Remove forcing screws (5) from torque divider.



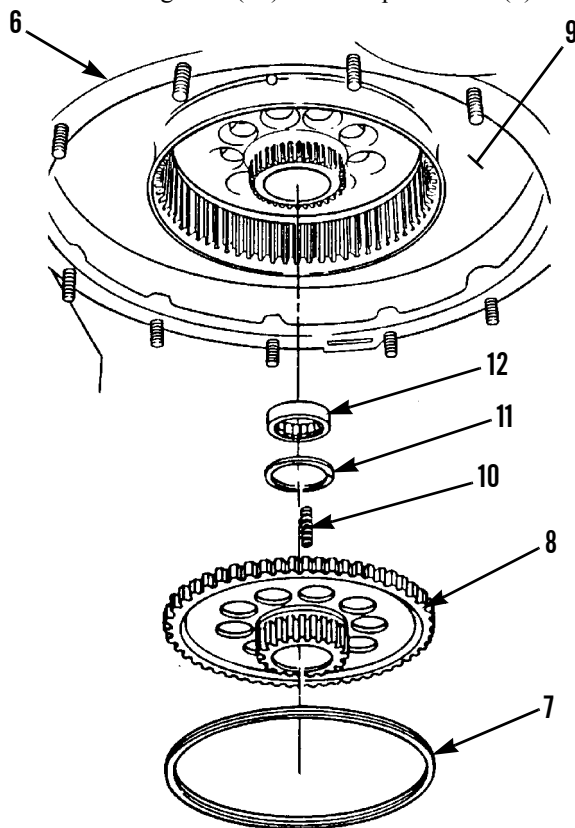
386-827

TORQUE DIVIDER REPLACEMENT - CONTINUED

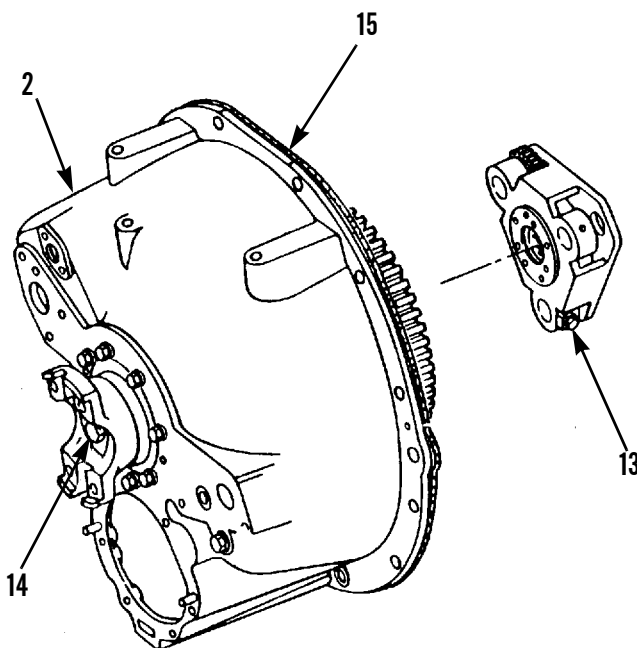
0092 00

REMOVAL - CONTINUED

8. Remove ring (7) and gear (8) from flywheel (9).
9. Remove three springs (10) from behind gear (8).
10. Remove retaining ring (11) from flywheel (9).
11. Remove bearing (12) from flywheel (9).
12. Remove wire from around torque divider (2) and carefully slide planetary carrier assembly (13) off of output shaft (14).
13. Remove gasket (15) from torque divider (2) or flywheel housing (6). Discard gasket.



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386-829

INSTALLATION

1. Install bearing (12) into flywheel (9).
2. Install retaining ring (11) and three springs (10) into flywheel (9).
3. Install gear (8) and ring (7) into flywheel (9). Be sure to align marks between ring and flywheel.
4. Slide planetary carrier assembly (13) onto output shaft (14) and wrap a wire around torque divider (2) and planetary carrier assembly to prevent assembly from sliding off shaft during installation.

NOTE

Ensure mating surfaces on flywheel housing and torque divider are clean before installing new gasket.

5. Install two lifting links (1) with 5/8 -11x 1-1/2 in. bolts into housing of torque divider (2). Place new gasket (15) on flywheel housing (6).

INSTALLATION - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in death or injury to personnel.

NOTE

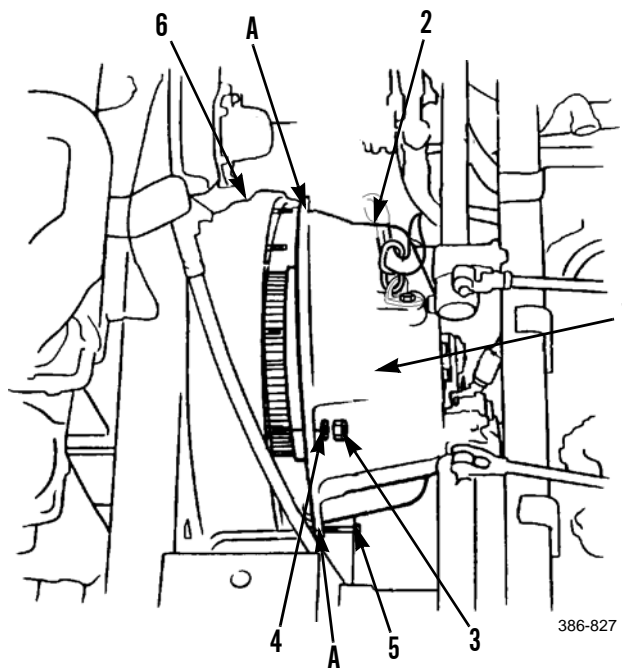
Torque divider weighs 300 lb (136 kg).

6. Fasten a nylon sling and a suitable lifting device to two lifting links (1) and carefully lift torque divider (2) into position.
7. Slide torque divider (2) onto studs on flywheel housing (6). Remove wire.

NOTE

Carefully maneuver torque divider onto flywheel housing so that planetary gears engage with flywheel.

8. Install 12 new lockwashers (4) and nuts (3). Tighten nuts to 75 lb-ft (102 Nm).
9. Remove lifting equipment, two bolts, and lifting links (1) from top of torque divider (2).
10. Install torque divider scavenge pump (WP 0097 00).
11. Install torque converter outlet relief valve (WP 0096 00).
12. Connect transmission oil lines to torque divider (WP 0088 00).
13. Connect transmission oil cooler lines to torque divider (WP 0087 00).
14. Connect brake lock linkage (WP 0124 00).
15. Connect steering clutch linkage (WP 0123 00).
16. Install driveshaft (WP 0106 00).
17. Install brake pedal assembly (WP 0121 00).
18. Install seat and seat base assembly (WP 0137 00).
19. Install dash assembly.
20. Install floor plates (WP 0135 00).
21. Install ROPS (WP 0131 00).
22. Install transmission guard (WP 0129 00).
23. Refill torque divider and transmission (WP 0086 00).
24. Run engine and test drive in all speeds (TM 5-2410-233-10).



386-827

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Link, lifting (Item 44, WP 0185 00)
- Stand, transmission (Item 107, WP 0185 00)
- Lifting equipment, 2,000 lb capacity
- Bolt 3/4 -10 x 1-1/2 in.

Materials/Parts

- Cap set, protective (Item 2, WP 0184 00)
- Compound, silicone, RTV (Item 9, WP 0184 00)
- Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Tag, marker (Item 35, WP 0184 00)
- Gasket (7)
- Lockwasher (6)

References

- WP 0080 00
- WP 0088 00
- WP 0094 00
- WP 0121 00
- WP 0127 00
- WP 0147 00

Personnel Required

Three

Equipment Condition

- Machine parked on level surface (TM 5-2410-233-10)
- Battery disconnect switch in OFF position (TM 5-2410-233-10)
- Floor plates removed (WP 0135 00)
- Transmission system oil drained (WP 0086 00)
- Transmission guard opened (WP 0129 00)
- Driveshaft and U-joint removed (WP 0106 00)
- ROPS removed (WP 0131 00)
- Winterized cab removed, if equipped
- Seat and seat base assembly removed (WP 0137 00)
- Batteries removed (WP 0081 00)
- Transmission selector linkage removed (WP 0083 00)
- Steering clutch levers and linkage removed (WP 0123 00)
- Winch removed, if equipped (WP 0139 00)

REMOVAL

CAUTION

Wipe area clean around all hydraulic connections to be opened during removal. Cap oil lines and plug openings after removing lines. Contamination of transmission could result in premature failure.

NOTE

- Tag wires and lines as needed, to ensure correct installation.
- Use a suitable container to catch any oil that may drain from system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- For machines with ripper, ensure divertor manifold is clear of transmission.

REMOVAL - CONTINUED

1. Disconnect vent tube (1) from torque divider case.
2. Disconnect two rods from steering brake at crossbeam (WP 0121 00).
3. Remove two control rods from steering clutch control valve (WP 0123 00).
4. Disconnect hose from hydraulic pressure control valve (WP 0094 00).
5. Disconnect oil lines from transmission and manifold (WP 0088 00).
6. For machines equipped with winch, disconnect hose from gear pump (WP 0147 00).
7. Install four lifting links (2) with 3/4 -10 x 1-1/2 in. bolts to bosses on transmission assembly (3).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Transmission assembly weighs 1,150 lb (522 kg).

8. Attach a suitable lifting device to lifting links (2) on transmission assembly (3) and take up slack.
9. Disconnect hose from steering clutch relief valve (WP 0127 00).
10. Remove ten nuts (4) and lockwashers (5) from transmission assembly (3) and bevel gear case studs. Discard lockwashers.

CAUTION

Transmission assembly must be lifted so that locator studs are level. This prevents binding and damage to bottom locator studs.

11. Remove transmission assembly (3) from machine. Place assembly on transmission stand or suitable cribbing.
12. Remove gasket (6) from bevel gear case studs. Discard gasket.

INSTALLATION

1. Install four lifting links (2) with 3/4 -10 x 1-1/2 in. bolts to bosses on transmission assembly (3).

**WARNING**

Exposure to silicone RTV compound may be hazardous to your health. Contact with eyes can cause severe irritation and burns. Compound can be absorbed into the skin and can cause irritation or skin sensitization. Inhalation of vapors can cause respiratory tract irritation; prolonged inhalation can result in an allergic reaction. Vapors are combustible. Do not use near open flame. Wear eye and skin protection and avoid inhalation of vapors. Use only in a well-ventilated area. Failure to follow this warning can cause injury or death.

INSTALLATION - CONTINUED**NOTE**

Ensure mounting surfaces are clean and dry before installation.

- Apply silicone RTV compound to both sides of new gasket (6). Place new gasket on bevel gear case studs.

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

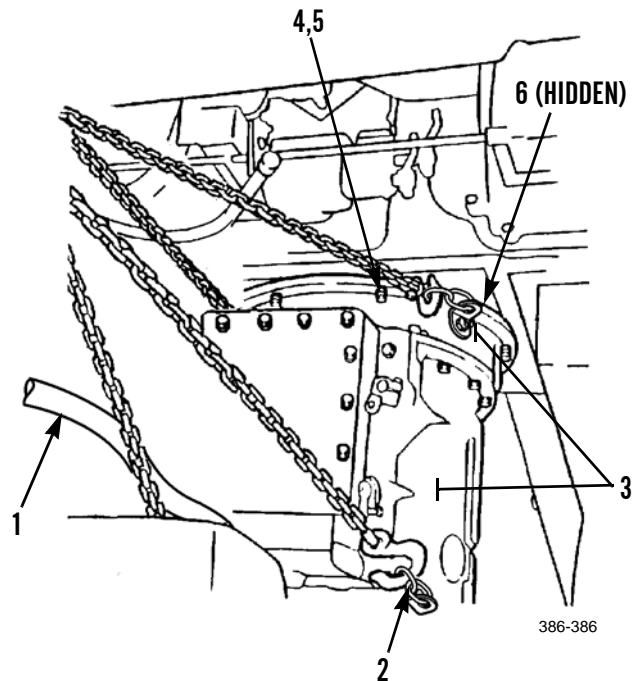
CAUTION

Transmission assembly must be lifted so that locator studs are level. This prevents binding and damage to bottom locator studs.

NOTE

Transmission assembly weighs 1,150 lb (522 kg).

- Attach a suitable lifting device to lifting links (2). Install transmission assembly (3) in machine.
- Install six new lockwashers (5) and nuts (4) to secure transmission assembly (3) to bevel gear case.
- Connect hose to steering clutch relief valve (WP 0127 00).
- Remove lifting device, four bolts and lifting links (2).
- For tractors equipped with winch, connect hose to gear pump (WP 0147 00).
- Connect oil lines to transmission and manifold (WP 0088 00).
- Connect hose to hydraulic pressure control valve (WP 0094 00).
- Connect two control rods to steering clutch control valve (WP 0123 00).
- Connect vent tube (1) to torque divider case.



TRANSMISSION ASSEMBLY REPLACEMENT - CONTINUED

0093 00***INSTALLATION - CONTINUED***

10. Connect two rods to steering brake at crossbeam (WP 0121 00).
11. If removed, install winch (WP 0139 00).
12. Connect steering clutch levers and linkage (WP 0123 00).
13. Install transmission selector linkage (WP 0083 00).
14. Install batteries (WP 0081 00) and connect battery cables (WP 0080 00).
15. Install seat base and assembly (WP 0137 00).
16. If removed, install winterized cab.
17. Install ROPS (WP 0131 00).
18. Install driveshaft and U-joint (WP 0106 00).
19. Close transmission guard (WP 0129 00).
20. Fill transmission assembly and bevel gear case (WP 0086 00).
21. Run engine and test drive transmission assembly in all speeds. Check for leaks (TM 5-2410-233-10).
22. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

TRANSMISSION CONTROL VALVES REPLACEMENT

0094 00

THIS WORK PACKAGE COVERS

Removal, Installation, Relief Valve Setting Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Gasket (8 and 21)

Materials/Parts - Continued

Lockwasher (2, 7, 10, 14 and 19)

O-ring (25, 26, 31, 32, 34, 38 and 39)

References

TM 5-2410-233-10

WP 0083 00

WP 0098 00

Equipment Condition

Floor plates removed (WP 0135 00)

Seat and seat base assembly removed (WP 0137 00)

REMOVAL

CAUTION

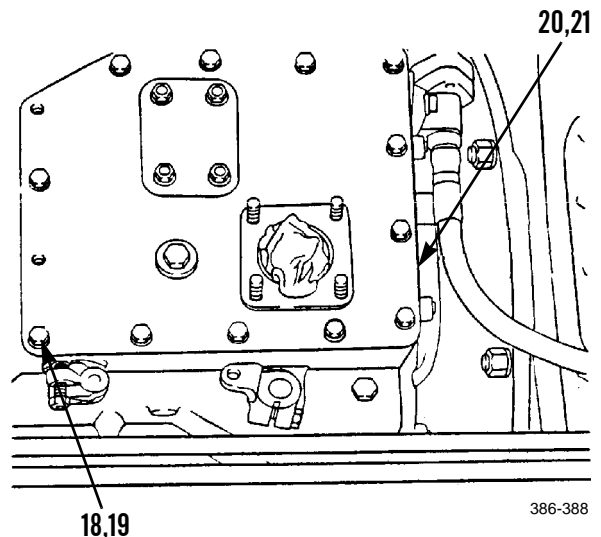
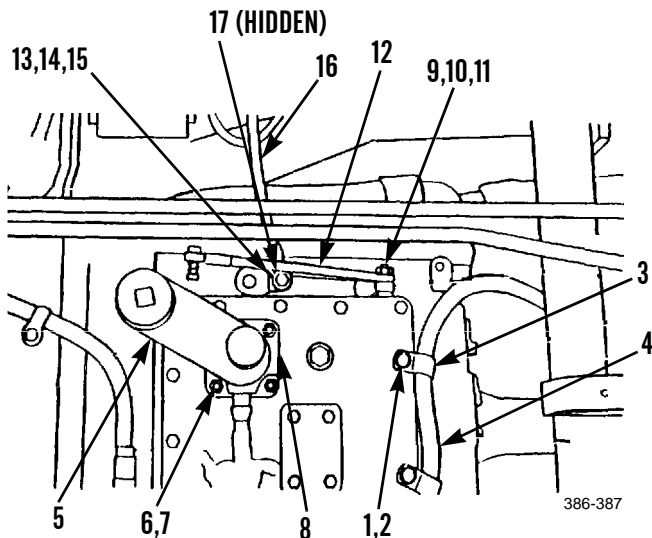
Wipe area clean around all transmission components before removal. Cap oil lines and plug openings after removing lines. Contamination of transmission could result in premature failure.

TRANSMISSION CONTROL VALVES REPLACEMENT - CONTINUED

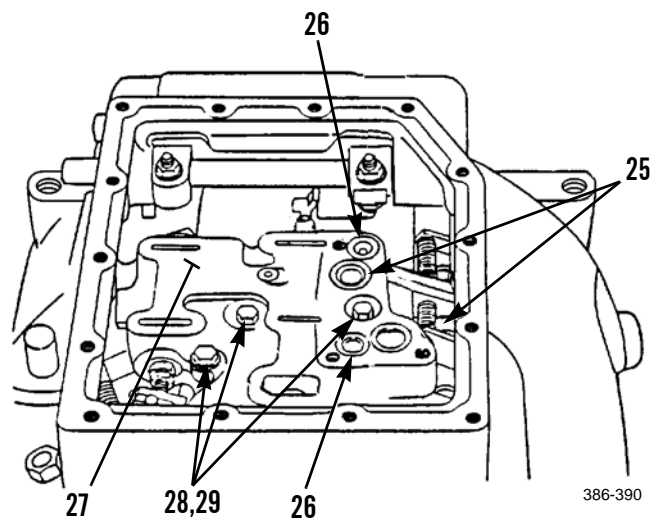
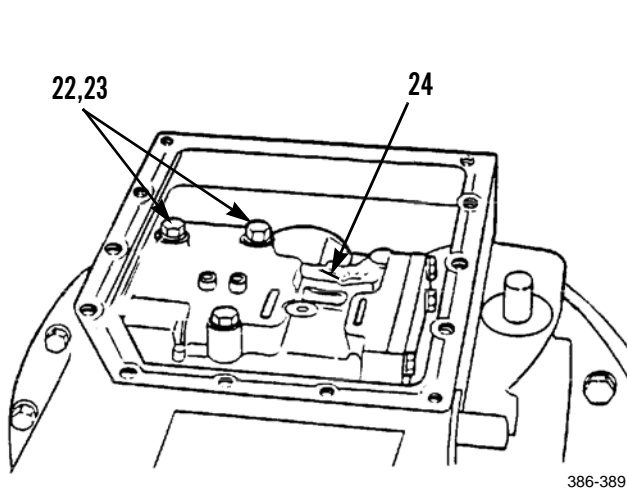
0094 00

REMOVAL - CONTINUED

1. Remove two capscrews (1), lockwashers (2) and clips (3). Discard lockwashers.
2. Disconnect hose assembly (4) from spout (5). Plug end of hose assembly.
3. Remove four nuts (6), lockwashers (7), spout (5) and gasket (8) from transmission. Discard lockwashers and gasket.
4. Remove nut (9), lockwasher (10) and capscrew (11) and disconnect rod (12) from transmission. Discard lockwasher.
5. Remove nut (13), lockwasher (14) and capscrew (15) and disconnect rod (16) from transmission. Discard lockwasher. Remove nut (17).
6. Remove 14 capscrews (18), lockwashers (19) and cover (20). Discard lockwashers. Remove and discard gasket (21).

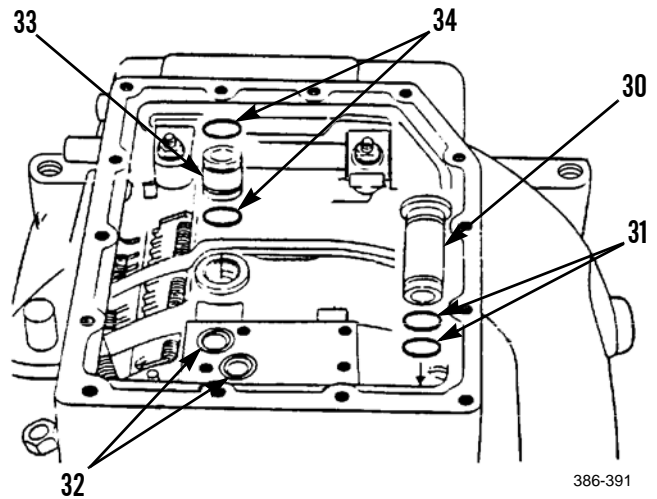


7. Remove three capscrews (22), washers (23) and pressure control valve (24) from transmission.
8. Remove four O-rings (25 and 26) from top of selector valve (27). Discard O-rings.
9. Remove three capscrews (28), washers (29) and selector valve (27) from transmission.



REMOVAL - CONTINUED

10. Remove sleeve (30) from transmission. Remove two O-rings (31) from sleeve. Discard O-rings.
11. Remove two O-rings (32) and discard.
12. Remove three sleeves (33). Remove two O-rings (34) from each sleeve. Discard O-rings.

**INSTALLATION****CAUTION**

Ensure all components are clean prior to installation. Perform installation in a clean work environment. Contamination of transmission could result in premature failure.

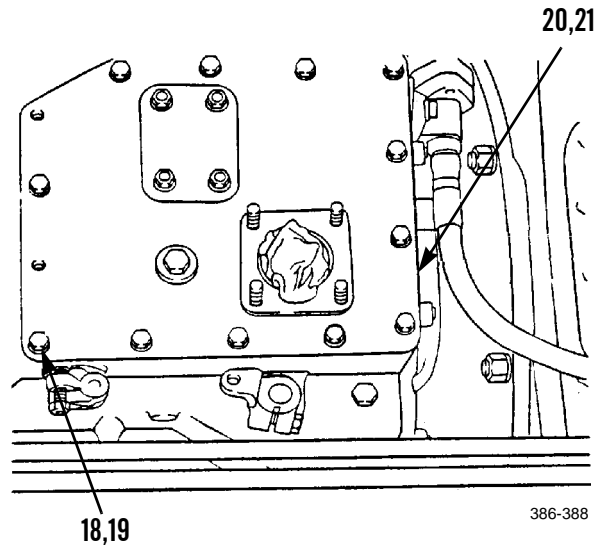
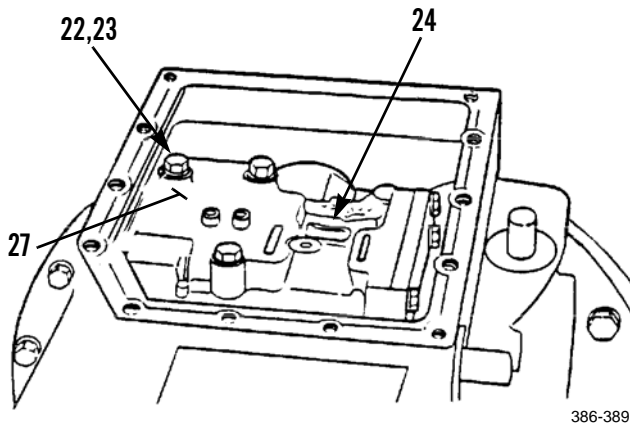
NOTE

Lightly coat all components with clean oil before installation.

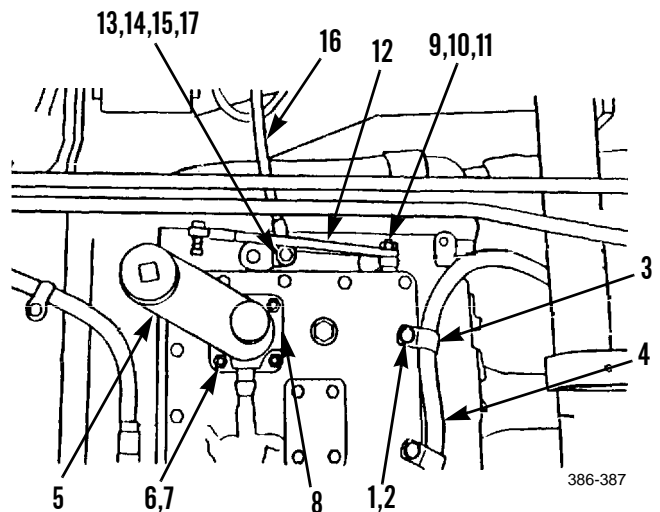
1. Install two new O-rings (34) onto each sleeve (33). Install three sleeves into transmission.
2. Install two new O-rings (32).
3. Install two new O-rings (31) onto sleeve (30). Install sleeve in transmission.
4. Position selector valve (27) in transmission. Ensure that sleeves (30 and 33) align with holes in selector valve and that links on ends of valve spools are in position on control levers.
5. Secure selector valve (27) with three washers (29) and capscrews (28). Tighten capscrews to 35 lb-ft (47 Nm).
6. Install four new O-rings (25 and 26) into top of selector valve (27).

INSTALLATION - CONTINUED

7. Position pressure control valve (24) on top of selector valve (27). Secure with three washers (23) and capscrews (22). Tighten capscrews to 35 lb-ft (47 Nm).
8. Install new gasket (21) and cover (20) to transmission with 14 new lockwashers (19) and capscrews (18).



9. Install nut (17) and rod (16). Install capscrew (15), new lockwasher (14) and nut (13).
10. Install rod (12) onto transmission with capscrew (11), new lockwasher (10) and nut (9).
11. Adjust rods (12 and 16) as required (WP 0083 00).
12. Install new gasket (8) and spout (5) on transmission with four new lockwashers (7) and nuts (6).
13. Remove plug from end of hose assembly (4). Connect hose assembly to spout (5).
14. Secure hose assembly (4) to transmission with two clips (3), new lockwashers (2) and capscrews (1).



15. Check and adjust relief valve setting IAW *Relief Valve Setting Adjustment* below.
16. Install seat and seat base assembly (WP 0137 00).
17. Install floor plates (WP 0135 00).

RELIEF VALVE SETTING ADJUSTMENT

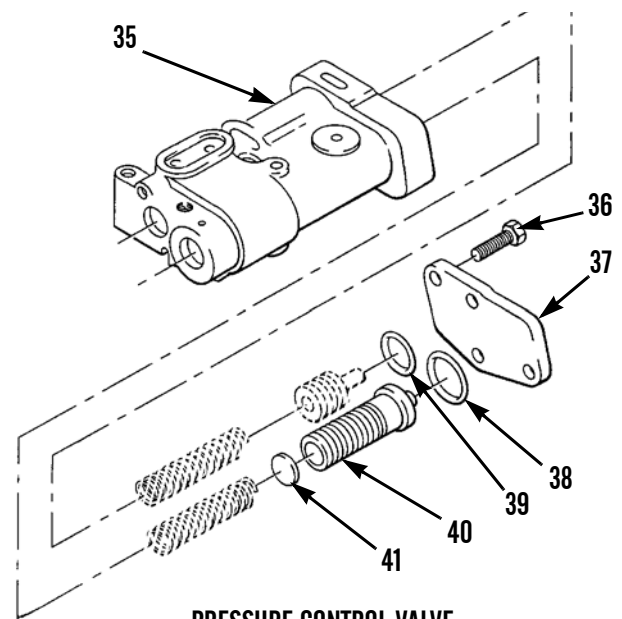
1. Perform direction clutch test (primary setting) (WP 0098 00).

CAUTION

Wipe valve body clean prior to disassembly. Perform disassembly in a clean work environment. Contamination of transmission could result in premature failure.

NOTE

- Disassembly of pressure control valve is authorized to add or remove spacers in order to adjust relief valve setting.
 - Each 0.062 in. spacer will change setting by 15 psi (103 kPa).
 - Each 0.036 in. spacer will change setting by 8.5 psi (59 kPa).
 - Each 0.010 in. spacer will change setting by 2.5 psi (17 kPa).
 - Lightly coat all components with clean oil before installation.
2. Add or remove spacers (41) to valve body (35) of pressure control valve to adjust relief valve setting:
 - a. Remove bolts (36) and cover (37) from valve body (35).
 - b. Remove two O-rings (38 and 39) and discard.
 - c. Remove piston (40). Add or remove spacers (41) to achieve correct relief valve setting.
 - d. Install piston (40) and two new O-rings (38 and 39).
 - e. Install cover (37) to valve body (35) with bolts (36). Tighten bolts to 35 lb-ft (47 Nm).



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3. Operate machine and check transmission for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Lockwasher (3)

O-ring (12 and 13)

References

WP 0086 00

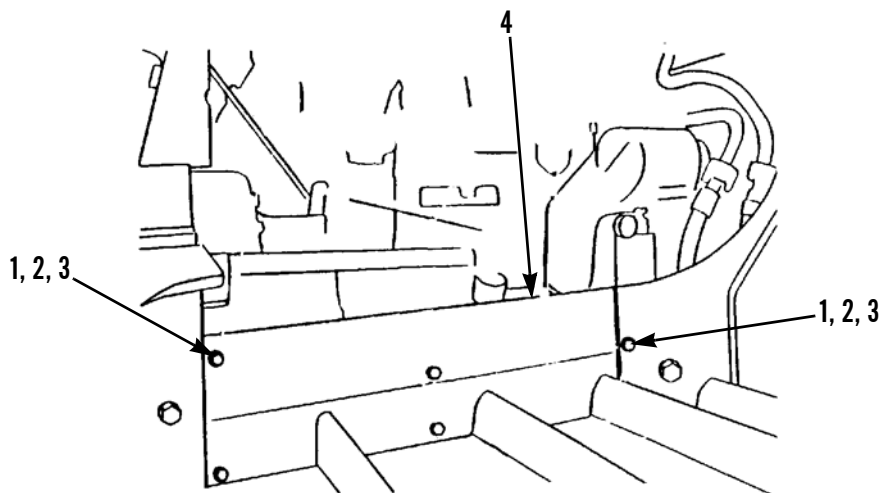
Equipment Condition

Battery disconnect switch in OFF position (TM 5-2410-233-10)

Transmission oil sampling valve removed, if equipped (WP 0090 00)

REMOVAL

1. Remove three capscrews (1), flatwashers (2) and lockwashers (3) from R.H. guard assembly (4). Remove guard assembly. Discard lockwashers.



386-404

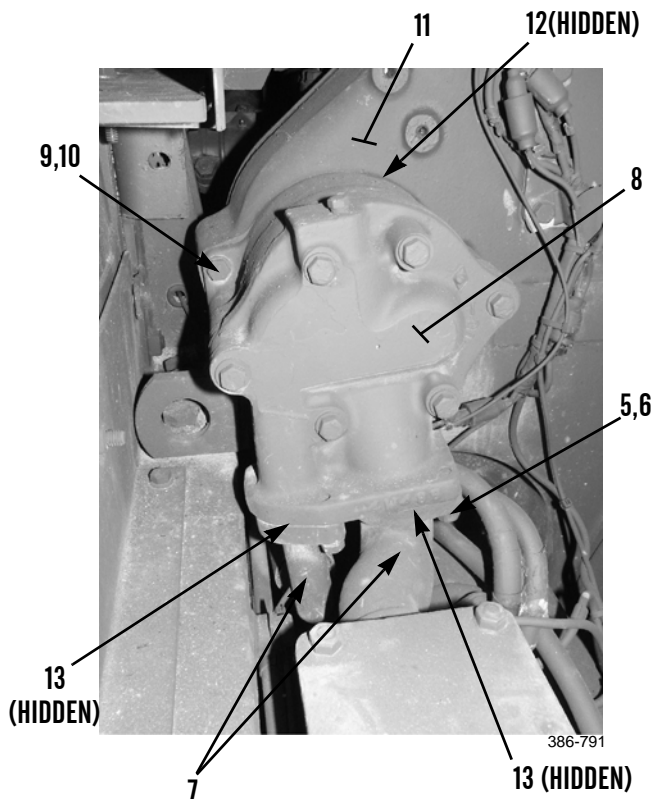
REMOVAL - CONTINUED**CAUTION**

Wipe area clean around all hydraulic connections to be opened during removal. Cap lines and plug openings after removing lines. Contamination of transmission could result in premature failure.

NOTE

Use a suitable container to capture any residual oil in lines. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

2. Remove four capscrews (5) and flatwashers (6) from two tubes (7) and pump (8).
3. Remove two capscrews (9) and flatwashers (10) from pump (8).
4. Remove pump (8) from flywheel housing (11). Remove O-ring (12) and two O-rings (13). Discard O-rings.

**INSTALLATION****NOTE**

- Ensure all mating surfaces on pump and flywheel housing are clean and dry before installation.
- Ensure splines on drive gear of oil pump are free of burrs.
- Lightly coat new O-rings with clean oil before installation.

1. Position two new O-rings (13) and new O-ring (12).

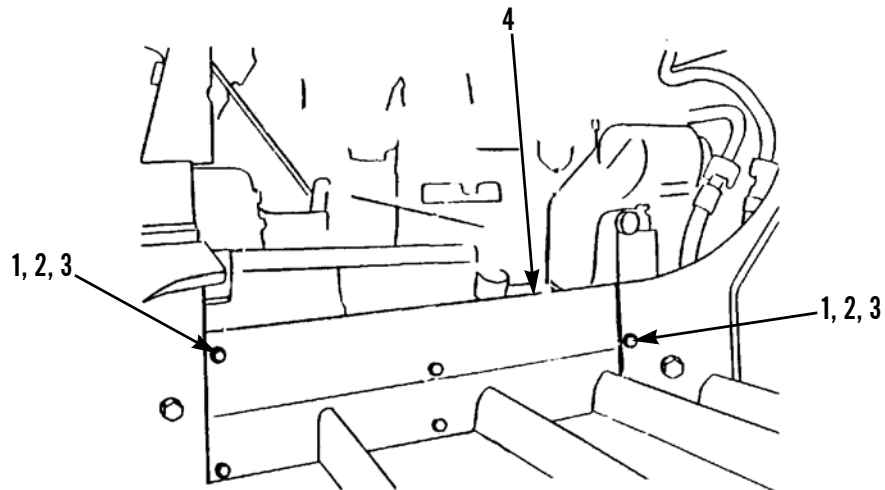
NOTE

Mesh splines on drive gear of oil pump with flywheel teeth. Ensure they mesh together smoothly.

2. Install pump (8) on flywheel housing (11) with two flatwashers (10) and capscrews (9).
3. Secure two tubes (7) to pump (8) with four flatwashers (6) and capscrews (5).

INSTALLATION - CONTINUED

4. Install R.H. guard assembly (4) with three new lockwashers (3), flatwashers (2) and capscrews (1).
5. Install transmission oil sampling valve, if equipped (WP 0090 00).
6. Check transmission oil level and add as required (WP 0086 00).
7. Run engine and check for leaks at pump (TM 5-2410-233-10).



386-404

END OF WORK PACKAGE

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TORQUE CONVERTER OUTLET RELIEF VALVE REPLACEMENT

0096 00

THIS WORK PACKAGE COVERS

Removal, Installation, Relief Valve Setting Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)
 Oil lubricating (Item 22, 23, 24 or 25, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Gasket (8)

Materials/Parts - Continued

Lockwasher (10 and 14)
 O-ring (8, 11, 12 and 16)

References

WP 0086 00
 WP 0098 00

Equipment Condition

Floor plates removed (WP 0135 00)

REMOVAL

CAUTION

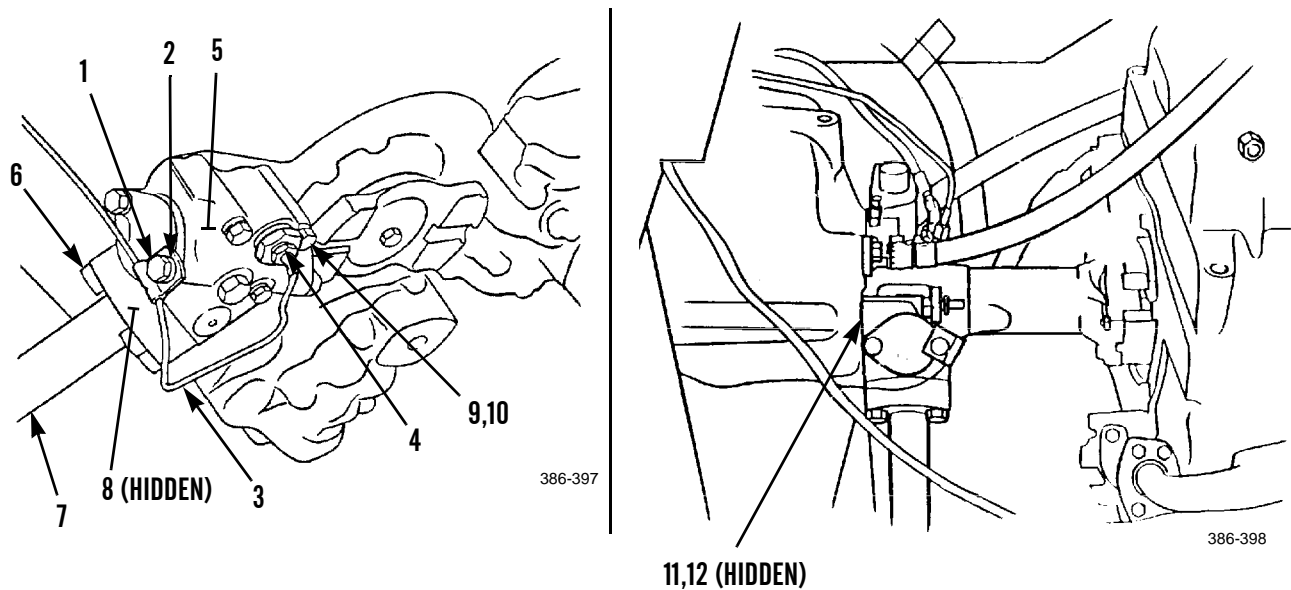
Wipe area clean around all hydraulic connections to be opened during removal. Cap oil lines and plug openings after removing lines. Contamination of transmission could result in premature failure.

NOTE

Use a suitable container to capture any residual oil that may drain from lines. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

REMOVAL - CONTINUED

1. Remove capscrew (1) and clip (2) from oil temperature sending unit line (3).
2. Remove oil temperature sending unit (4) from relief valve (5).
3. Remove four capscrews (6) and outlet tube (7) from relief valve (5). Remove O-ring (8) and discard.
4. Remove three capscrews (9), lockwashers (10) and relief valve (5) from torque divider. Discard lockwashers.
5. Remove two O-rings (11 and 12) from relief valve (5). Discard O-rings.

**INSTALLATION****CAUTION**

Care should be taken not to contaminate transmission oil system during installation of lines. Transmission contamination can result in premature failure.

NOTE

- Wipe area clean around torque divider, relief valve and all lines before installation.
- Lightly coat new O-rings with clean oil before installation.

1. Install two new O-rings (11 and 12) on relief valve (5).
2. Position relief valve (5) on torque divider and install three new lockwashers (10) and capscrews (9).
3. Install new O-ring (8) in outlet tube (7).
4. Install outlet tube (7) to relief valve (5) with four capscrews (6).
5. Install oil temperature sending unit (4) in relief valve (5) and secure with clip (2) and capscrew (1).
6. Check transmission oil level and add as needed (WP 0086 00).

INSTALLATION - CONTINUED

7. Perform power train hydraulic system tests (WP 0098 00) as required. Perform *Relief Valve Setting Adjustment* below, as required.
8. Run engine and test drive in all speeds (TM 5-2410-233-10).
9. Install floor plates (WP 0135 00).

RELIEF VALVE SETTING ADJUSTMENT**NOTE**

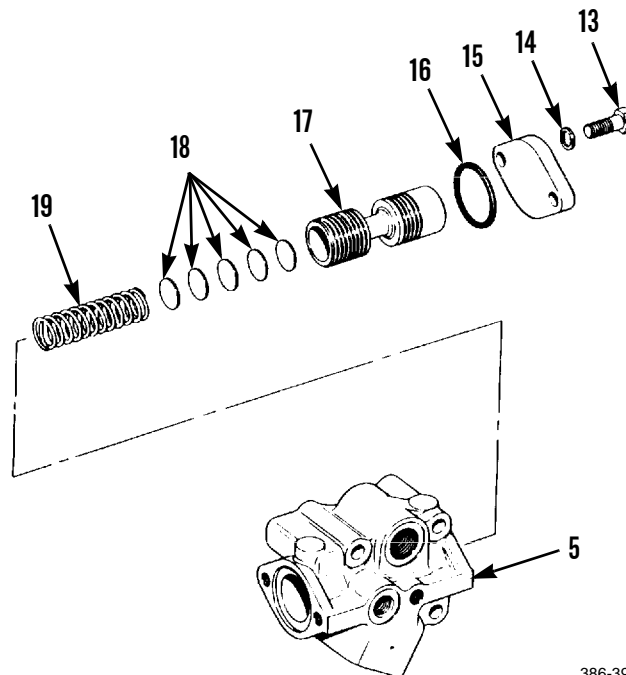
Adjustment can be performed without removing valve from torque divider.

1. Remove two capscrews (13), lockwashers (14), cover (15) and O-ring (16) from relief valve (5). Discard O-ring and lockwashers.
2. Remove valve (17), five spacers (18) and spring (19).
3. Add spacers (18) to increase relief valve setting. Remove spacers to decrease setting. Each 0.083 in. (21 mm) spacer will change pressure by 2.7 psi (19 kPa).
4. Install spring (19), required quantity of spacers (18) and valve (17).

NOTE

Lightly coat new O-ring with clean oil before installation.

5. Position new O-ring (16) in relief valve (5) and install cover (15) with two new lockwashers (14) and capscrews (13). Tighten capscrews to 18 lb-ft (24 Nm).



386-399

END OF WORK PACKAGE

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TORQUE DIVIDER SCAVENGE PUMP REPLACEMENT

0097 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Compound, silicone, RTV (Item 9, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Gasket (8)

Lockwasher (7)

Screw, forcing, 3/8 in. x 3 in. -16NC

References

TM 5-2410-233-10

WP 0086 00

Equipment Condition

Transmission guard opened (WP 0129 00)

Transmission oil drained from flywheel housing (WP 0085 00)

REMOVAL

CAUTION

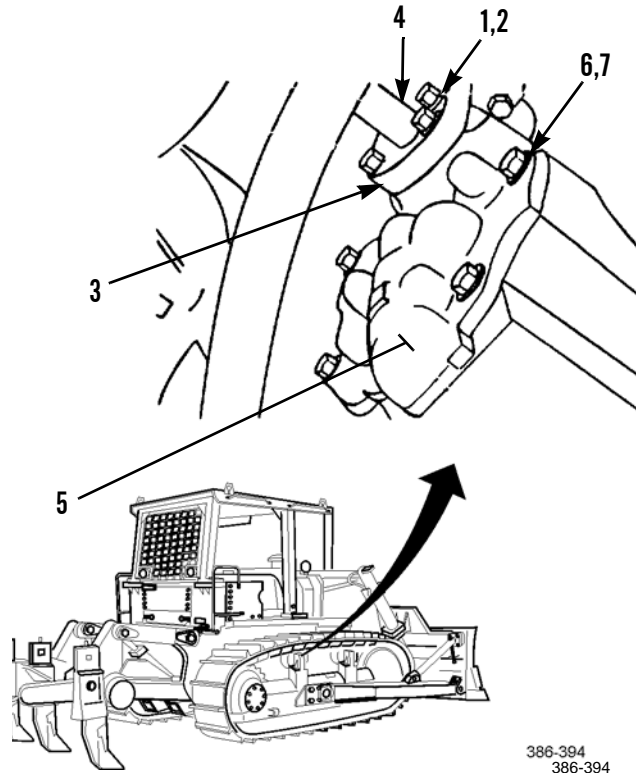
Wipe area clean around all hydraulic connections to be opened during removal. Cap oil lines and plug openings after removing lines. Contamination of transmission could result in premature failure.

REMOVAL - CONTINUED

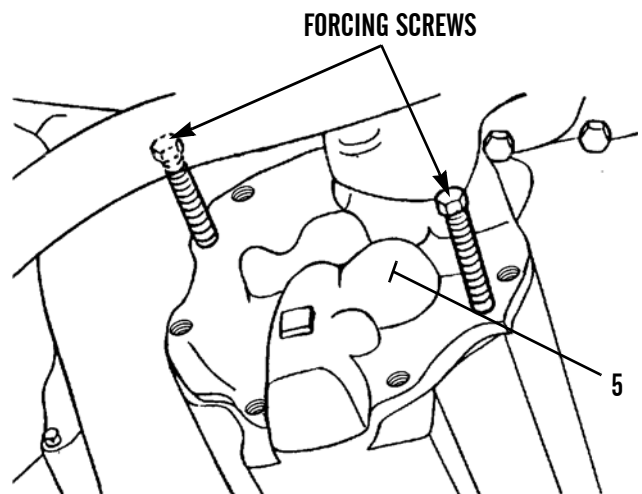
NOTE

Use a suitable container to capture any draining oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

1. Remove four capscrews (1), washers (2) and split-type flange (3).
2. Remove oil line (4) from scavenge pump (5).
3. Remove six capscrews (6) and lockwashers (7) that hold scavenge pump (5) to flywheel housing. Discard lockwashers.

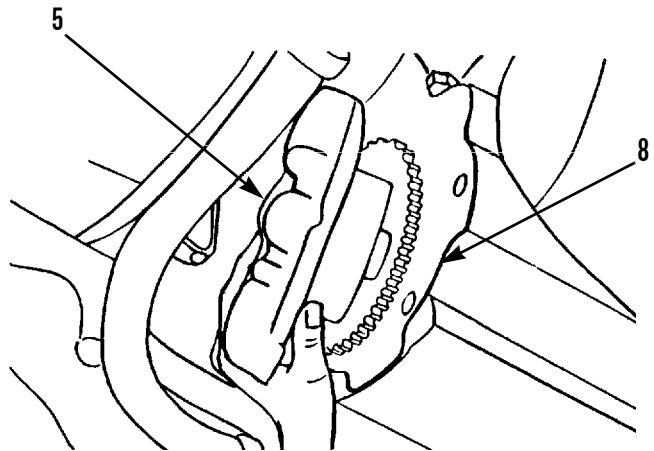


4. Install two 3/8 in. -16NC forcing screws into scavenge pump (5).
5. Slowly and evenly turn forcing screws until scavenge pump (5) pulls free from flywheel housing.



REMOVAL - CONTINUED

6. Remove scavenge pump (5) from flywheel housing. Remove and discard gasket (8).
7. Remove forcing screws from scavenge pump (5).



386-396

INSTALLATION**WARNING**

Exposure to silicone RTV compound may be hazardous to your health. Contact with eyes can cause severe irritation and burns. Compound can be absorbed into the skin and can cause irritation or skin sensitization. Inhalation of vapors can cause respiratory tract irritation; prolonged inhalation can result in an allergic reaction. Vapors are combustible. Do not use near open flame. Wear eye and skin protection and avoid inhalation of vapors. Use only in a well-ventilated area. Failure to follow this warning can cause injury or death.

CAUTION

Wipe area clean around mating surfaces of flywheel housing and scavenge pump before installation. Contamination of transmission could result in premature failure.

1. Apply silicone RTV compound to both sides of new gasket (8). Position new gasket on flywheel housing.
2. Position scavenge pump (5) on flywheel housing. Ensure gear on scavenge pump is in alignment with drive gear in torque divider.
3. Install six new lockwashers (7) and capscrews (6).
4. Install oil line (4) on scavenge pump (5) with split-type flange (3), four washers (2) and capscrews (1).
5. Check transmission oil level and add as needed (WP 0086 00).
6. Run engine and check scavenge pump for leaks (TM 5-2410-233-10).
7. Close transmission guard (WP 0129 00).

END OF WORK PACKAGE

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POWER TRAIN HYDRAULIC SYSTEM TESTS**0098 00****THIS WORK PACKAGE COVERS**

General Information, Visual Checks, Pressure Tests

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Tool outfit, hydraulic system test and repair (Item 113, WP 0185 00)

References

TM 5-2410-233-10

WP 0094 00

WP 0096 00

Personnel Required

Two

Equipment Condition

Transmission oil level correct (WP 0086 00)

Floor plates removed (WP 0135 00)

Transmission, brake and steering control linkage adjustments correct (WP 0083 00, WP 0122 00 and WP 0126 00)

Seat and seat base assembly removed (WP 0137 00)

GENERAL INFORMATION

1. Correct oil flow and pressure are necessary for any hydraulic system operation. Output from pump (pump flow) increases with an increase in engine RPM and decreases when RPM is decreased. Oil pressure is caused by resistance to oil flow.
2. Visual checks should be done before performing pressure tests.

VISUAL CHECKS

1. Perform visual inspection of power train hydraulic system with engine OFF and all implements lowered to the ground.
2. Inspect all lines and connections for damage and/or leaks. Repair as needed.
3. Inspect control linkages for bent, broken or damaged components. Repair as needed.
4. Verify that transmission oil level is correct before proceeding to pressure tests.

PRESSURE TESTS**WARNING**

ONLY authorized personnel are allowed on tractor during pressure tests. Do NOT perform pressure tests on power train unless tractor is secured against movement, with brake lock engaged, all implements lowered to ground and tracks blocked. Failure to follow this warning may result in serious injury or death.

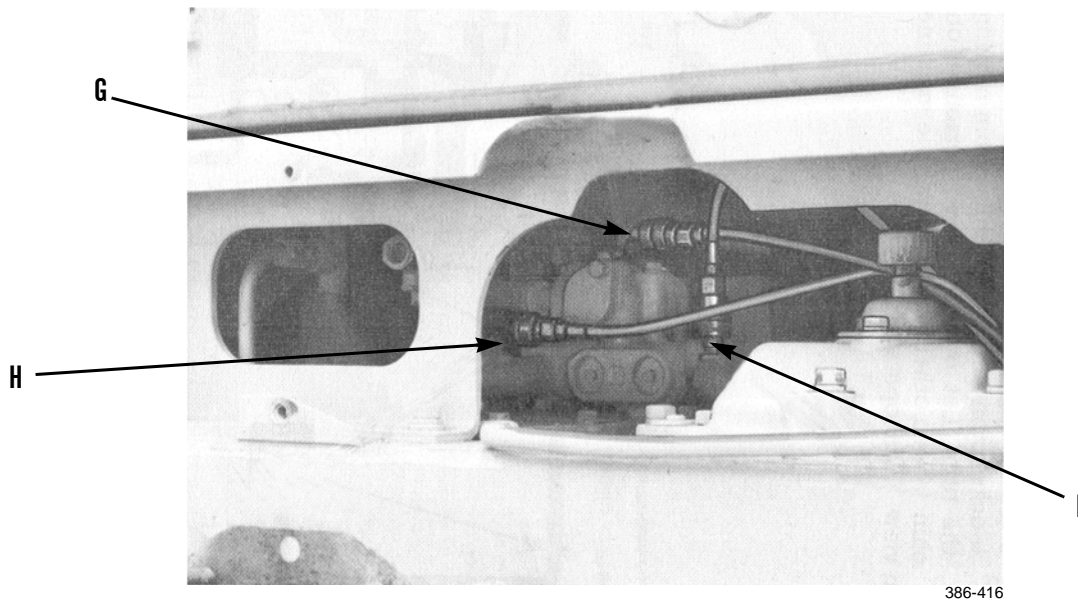
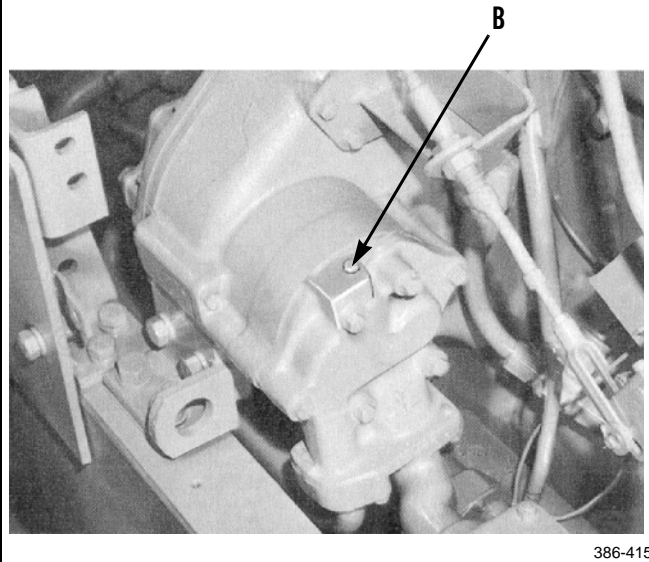
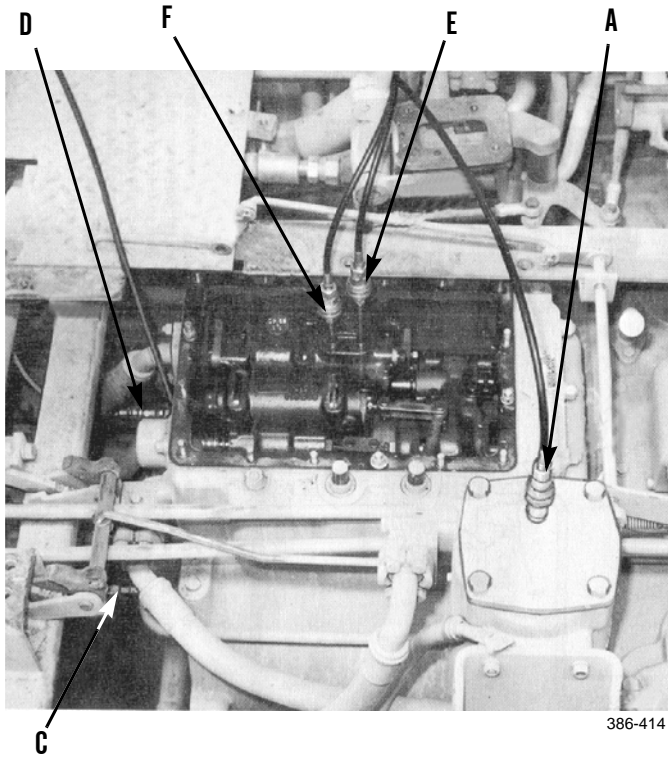
NOTE

Ensure all linkage adjustments and transmission oil level are correct before proceeding.

1. Engage brake lock lever (TM 5-2410-233-10).
2. Place transmission selector lever in appropriate position for test to be performed (TM 5-2410-233-10).
3. Lower all implements to the ground (TM 5-2410-233-10).
4. Block tracks.
5. Run machine until power train is at operating temperature (TM 5-2410-233-10).

PRESSURE TESTS - CONTINUED

6. Illustrated below are all pressure tap locations.



POWER TRAIN HYDRAULIC SYSTEM TESTS - CONTINUED

0098 00

PRESSURE TESTS - CONTINUED

7. Refer to Table 1 to perform power train pressure tests.

Table 1. Power Train Pressure Tests.

PRESSURE AT	PRESSURE TAP LOCATION	PRESSURE MEASURED WITH GOVERNOR CONTROL LEVER AT:		ADJUSTMENT
		LOW IDLE SETTING	HIGH IDLE SETTING	
Pump	Filter (A) Pump (B)	300 psi (2068 kPa) min. Selector lever in Neutral (N).	350 psi (2413 kPa). Selector lever in Neutral (N).	NONE. NOTE: Adjustment is controlled by modulating relief valve (inside pressure control valve).
Outlet from Torque Converter	Outlet from Torque Converter (C)		42 +/- 5 psi (289 +/- 341 kPa) with selector lever in THIRD SPEED, brakes activated, resulting in stalled converter.	Add or remove spacers to adjust converter outlet relief valve (WP 0096 00).
Transmission Lubrication Oil	(D)	1/2 to 5 psi (3.44 to 34 kPa). Selector lever in Neutral (N).	12 +/- 3 psi (82 +/- 20 kPa). Selector lever in Neutral (N).	NONE.
Speed Clutch	Pressure Control Valve Port (E)	Earlier pressure control valve with 9S6939 load piston:		
		385 psi (2654 kPa) minimum. Selector lever in neutral (N).	425 psi (2930 kPa). Selector lever in neutral (N).	Add or remove spacers to adjust outlet relief valve (WP 0094 00).
		Later pressure control valve with 2P4494 load piston:		
		250 psi (1723 kPa) minimum. Selector lever in neutral (N).	300 +/- 10 psi (2068 +/- 68 kPa). Selector lever in neutral (N).	Add or remove spacers to adjust outlet relief valve (WP 0094 00).
Direction Clutch (Primary Setting)	Pressure Control Valve Port (F)	30 psi (206 kPa) minimum with check valve held open. Selector lever in neutral (N).		NONE. NOTE: Adjustment is controlled by modulating relief valve (inside pressure control valve).
Direction Clutch	Pressure Control Valve Port (F)	55 +/- 8 psi (379 +/- 55 kPa) less than pressure of speed clutch. Selector lever in Neutral (N).	55 +/- 8 psi (379 +/- 55 kPa) less than pressure of speed clutch. Selector lever in Neutral (N).	NONE.
PRESSURE TESTS FOR STEERING CLUTCH CONTROLS				
Pump	(G)		350 psi (2413 kPa)	NONE.
Piston for Steering Clutch	(H) or (I)	370 psi (2551 kPa) with steering clutches released.	290 psi (1999 kPa) with steering clutches released.	NONE.

PRESSURE TESTS - CONTINUED

8. Install seat base assembly and seat (WP 0137 00).
9. Install floor plates (WP 0135 00).
10. Remove track blocks.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Service

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185)

Materials/Parts

- Cleaning compound, solvent (Item 4, WP 0184 00)
- Oil, lubricating (Item 19, 20 or 21, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

- Gasket (2)

References

- WP 0008 00

Equipment Condition

- Machine parked on level ground (TM 5-2410-233-10)

NOTE

Perform this service on both sides of tractor.

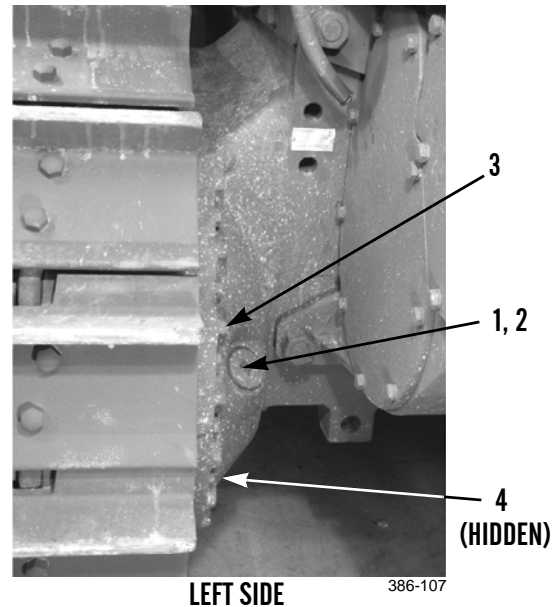
SERVICE

1. Remove fill plug (1) and gasket (2) from final drive housing (3). Discard gasket.

NOTE

- Place a suitable container under final drive drain and fill plugs to collect drained oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- Capacity of each final drive is 9 gal. (34.1 l).

2. Remove drain plug (4) from final drive housing (3) and allow oil to drain.
3. Inspect oil and drain plug for metal shavings and foreign particles. If found, final drive may require repair.
4. Wipe drain plug clean and install in final drive housing (3).
5. Fill final drive housing (3) through fill plug (1) opening until level is up to fill plug opening. For correct oil grade, refer to WP 0008 00.



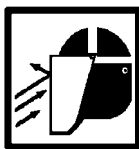
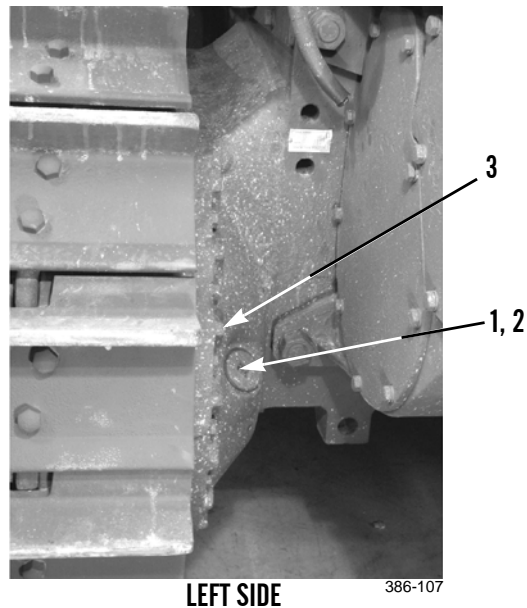
SERVICE - CONTINUED

6. Install new gasket (2) and fill plug (1) in final drive housing (3).

NOTE

Each final drive and transmission share a common breather. Repeat step 7 for breather on each side.

7. Remove breather (5) from steering clutch and final drive case cover.

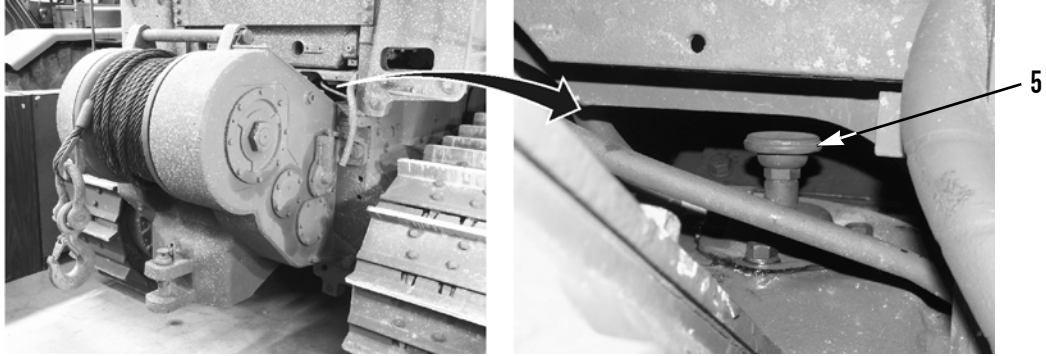
**WARNING**

- Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.
- Particles blown by compressed air are hazardous. DO NOT exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. DO NOT direct compressed air against human skin. Failure to follow this warning may result in serious injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

8. Clean breather (5) with solvent cleaning compound and dry with compressed air.

SERVICE - CONTINUED

9. Reinstall breather (5) in steering clutch and final drive case cover.



RIGHT SIDE

386-792

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Cleaning, Inspection, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Link, lifting (Item 44, WP 0185 00)
- Link, lifting (Item 124, WP 0185 00)
- Pin, shoulder (Item 57, WP 0185 00)
- Press, arbor (Item 65, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Lifting equipment, 400 lb capacity
- Bolt, 5/8 -11 x 2 in.
- Bolt, 3/8 -16 x 1-1/2 in.

Materials/Parts

- Compound, gasket shellac (Item 8, WP 0184 00)
- Grease, GAA (Item 15, WP 0184 00)
- Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Wire, nonelectrical (Item 37, WP 0184 00)
- Capscrew, forcing, 1/2 in. -13NC (5)
- Capscrew, 1/4 in. -20NC

Materials/Parts - Continued

- Lock (18 and 25)
- Lockwasher (2)
- Pin, guide, 5/8 in. - 11NC
- Plug (9)
- Retainer (23)
- Screw, #10-32
- Wood blocks, 4 in. x 4 in. x 3 ft long

References

- TM 5-2410-233-10
- WP 0086 00
- WP 0176 00

Personnel Required

Two

Equipment Condition

Track drive sprocket removed (WP 0118 00)



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

REMOVAL

NOTE

This procedure applies to either R.H. or L.H. final drive assembly.

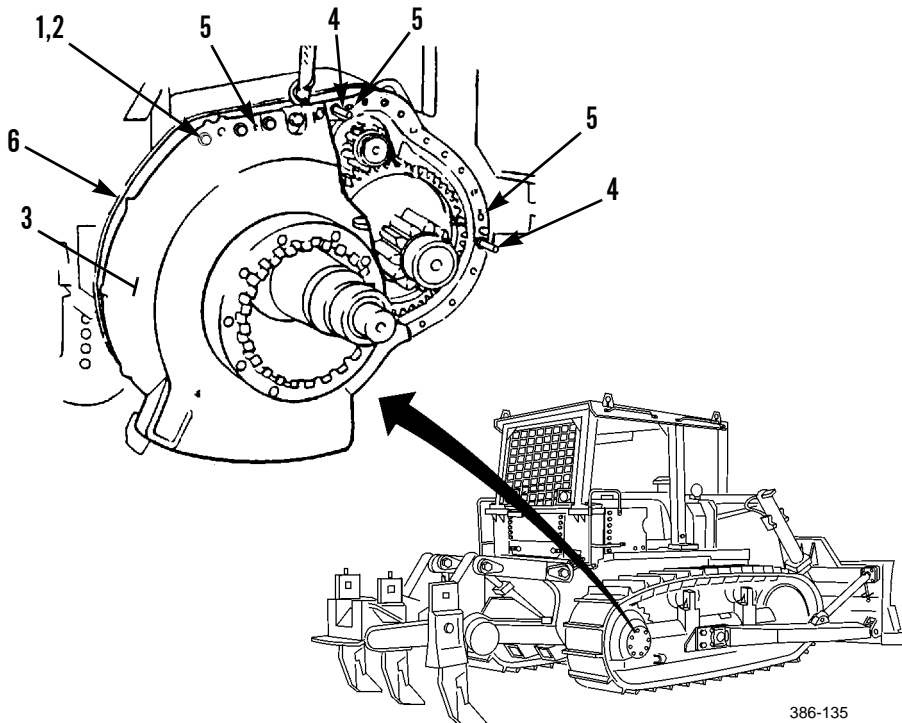
1. Remove two capscrews (1) and lockwashers (2) from final drive case (3). Discard lockwashers.



WARNING

Guide pins must be installed as instructed to avoid injury to personnel.

2. Install two 5/8 in. -11NC guide pins (4) and three 1/2 in. -13NC forcing screws (5) in final drive case (3).
3. Remove 29 remaining capscrews (1) and lockwashers (2) from final drive case (3). Discard lockwashers.
4. Tighten forcing screws (5) evenly until final drive case (3) is approximately 0.25 in. (6.3 mm) away from steering clutch case (6).



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REMOVAL - CONTINUED

CAUTION

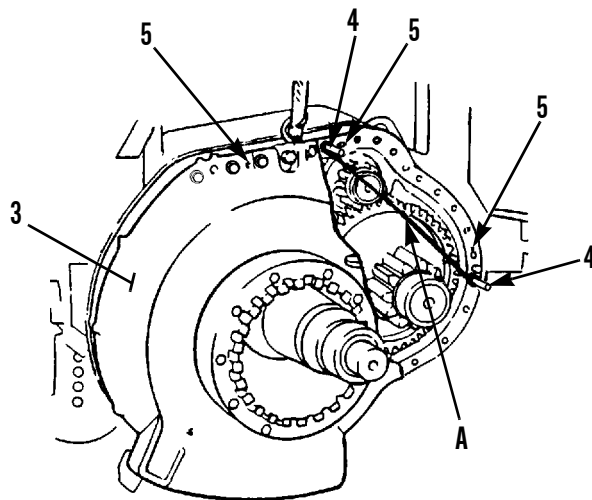
Use a piece of wire to keep idler pinion in position so it will not fall from steering clutch case when final drive case is removed.

5. Install a piece of wire (A) around two guide pins (4) and across face of idler pinion to hold idler pinion in place.

NOTE

Weight of final drive case is 280 lb (127 kg).

6. Tighten three forcing screws (5) until two lifting links can be attached to final drive case (3). Attach two lifting links with 5/8 -11 x 2 in. bolts, nuts and washers to final drive case (3).
7. Attach a suitable lifting device to lifting links and remove final drive case. Remove forcing screws.

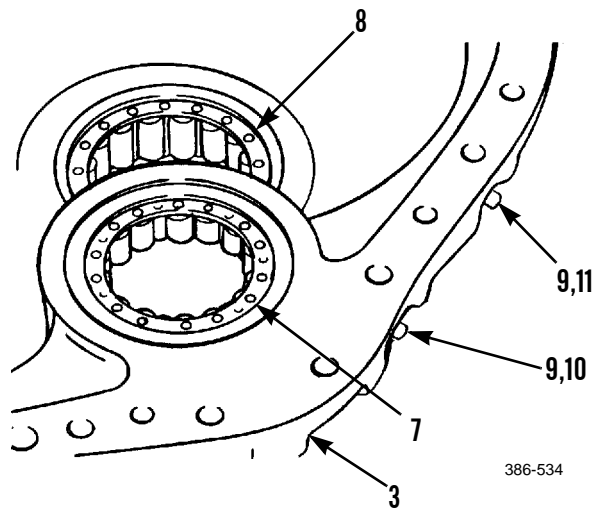


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NOTE

Plugs are destroyed during removal.

8. If necessary to remove race and roller bearing assemblies (7 and 8), remove two plugs (9) from dowel holes in final drive case (3) with a slide puller. Discard plugs.
9. Use a #10-32 screw to remove dowel (10), holding race and roller assembly (7), from final drive case (3). Remove screw from dowel.
10. Use a 1/4 in. -20 NC capscrew to remove dowel (11), holding race and roller assembly (8), from final drive case (3). Remove capscrew from dowel.
11. Pull race and roller assemblies (7 and 8) from final drive case (3).



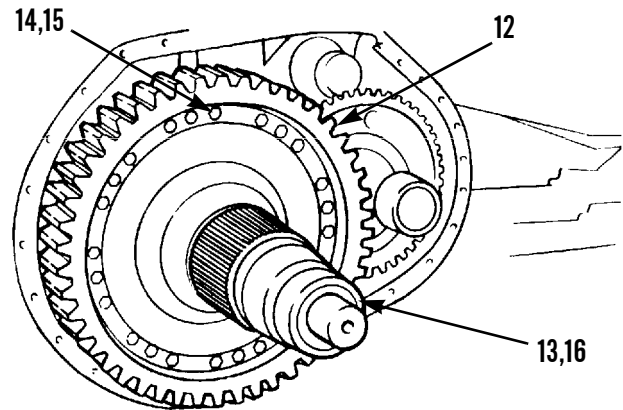
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REMOVAL - CONTINUED

NOTE

Weight of gear and hub is 350 lb (159 kg).

12. Pull out on gear (12) and hub (13) enough for access. Remove one nut (14) and bolt (15). Install lifting link with 5/8 -11 x 2 in. bolt, nut and washer in hole in gear.
13. Attach a nylon sling and a suitable lifting device to lifting link. Remove gear (12), hub (13) and key (16) as an assembly from sprocket shaft.
14. Place gear (12) and hub (13) on wood cribbing with hub pointing down. Remove nylon sling and lifting device.



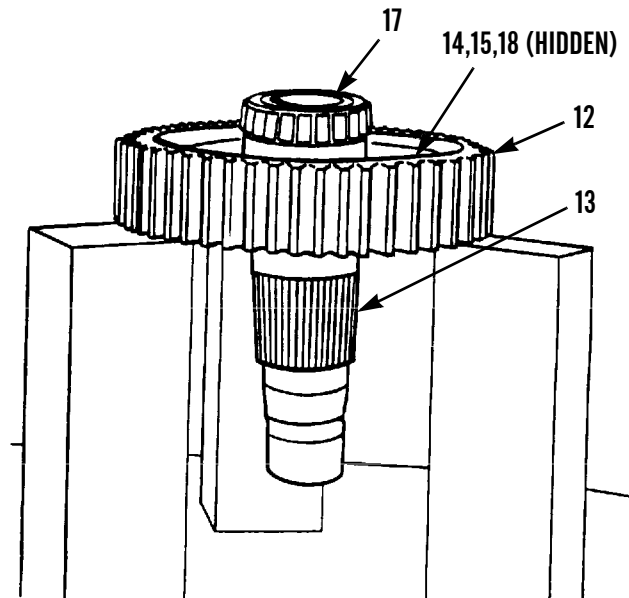
386-535

15. Pull bearing cone (17) from hub (13).
16. Flatten eight locks (18) for removal from hub (13).
17. Remove 15 remaining nuts (14) and eight locks (18) from 15 bolts (15). Remove bolts from hub (13). Discard locks.

NOTE

- **Weight of hub is 218 lb (99 kg).**
- **Use a nylon strap and a pin or cap-screw that is longer than bottom end of hub is wide, to attach lifting device to hub.**

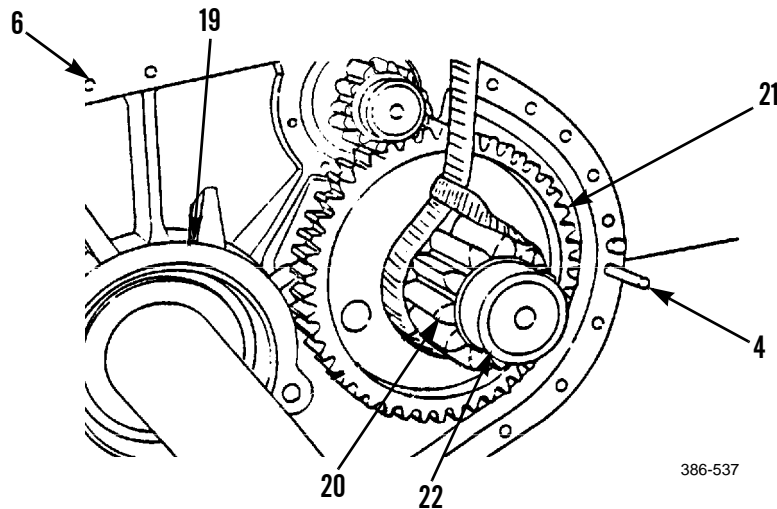
18. Remove hub (13) from gear (12).



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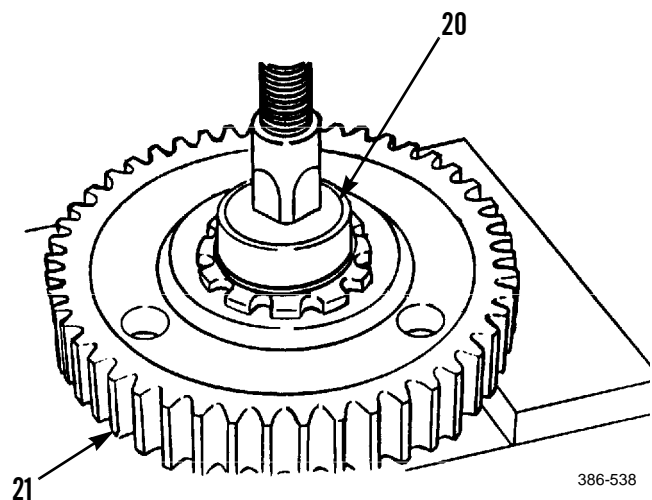
REMOVAL - CONTINUED

19. If necessary, pull bearing cup (19) from steering clutch case (6).
20. Attach a nylon sling and lifting device to idler pinion (20). Remove wire from guide pins (4) that hold idler pinion and gear (21) in place. Remove gear and idler pinion from steering clutch case (6).
21. Pull bearing race (22) from one end of idler pinion (20) shaft.

**CAUTION**

Too much pressure on idler pinion shaft can cause damage to gear.

22. Place gear (21) and idler pinion (20) in a press. Apply a small amount of pressure on idler pinion shaft with press.

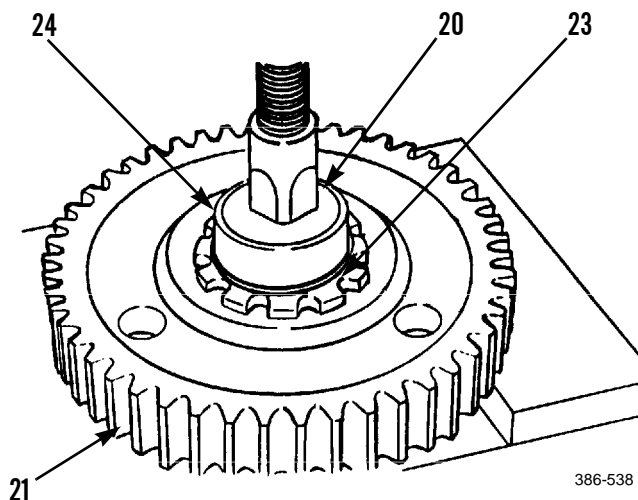


REMOVAL - CONTINUED

NOTE

Weight of idler pinion is 85 lb (39 kg).

- 23. Push retainer (23) in groove on shaft of idler pinion (20). Retainer will stay in groove because of pressure on idler pinion shaft. When retainer is completely in groove, idler pinion shaft will slide out of gear (21). Discard retainer.
- 24. Pull bearing race (24) from other end of idler pinion (20) shaft.

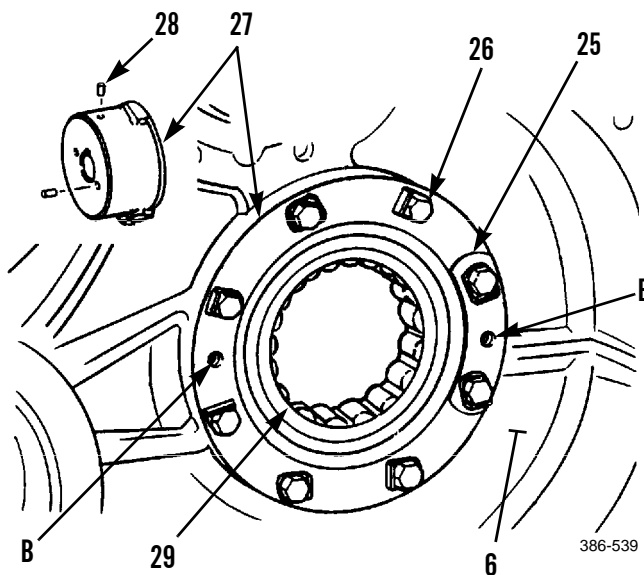


- 25. Drain oil from bevel gear case and applicable steering clutch compartment (WP 0086 00).
- 26. Bend four locks (25) down. Remove eight capscrews (26) and four locks from bearing cage (27). Discard locks.
- 27. Install two 1/2 in. -13NC forcing screws in bearing cage (27) at tapped holes (B). Tighten forcing screws evenly and remove bearing cage from steering clutch case (6). Remove forcing screws from bearing cage.

NOTE

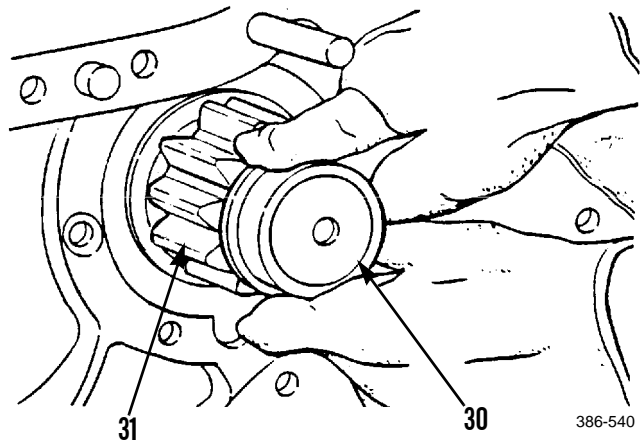
Dowel is located behind flange of bearing cage.

- 28. Use a 1/4 in. -20NC capscrew to remove dowel (28) from bearing cage (27). Remove capscrew from dowels.
- 29. Pull race and roller assembly (29) from bearing cage (27).



REMOVAL - CONTINUED

30. If necessary, pull bearing race (30) from pinion shaft (31).

**CLEANING**

1. Wipe clean and dry all bearing mounting surfaces in openings and on shafts.
2. Wipe all gears clean.
3. Clean all gasket sealing surfaces before installation of new gasket compound.

INSPECTION

See WP 0176 00 for general inspection instructions.

INSTALLATION**WARNING**

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.
- Wear hand protection when handling both hot and cold components to prevent injury.

NOTE

This procedure applies to either R.H. or L.H. final drive assembly.

1. Heat bearing race (30) evenly to a maximum temperature of 275°F (135°C). Install bearing race on pinion shaft (31).
2. Lower temperature of race and roller assembly (29). Align hole in race and roller assembly with hole in bearing cage (27) and install race and roller assembly in cage.
3. Use a 1/4 in. -20NC capscrew to install dowel (28) in bearing cage (27). Remove capscrew.
4. Apply gasket compound on contact surfaces of bearing cage (27) and steering clutch case (6). Install bearing cage in steering clutch case with oil groove next to race and roller assembly (29) at bottom of hole.
5. Install four new locks (25) and eight capscrews (26) to secure bearing cage (27) to steering clutch case (6). Bend locks up against flats of capscrew heads.

INSTALLATION - CONTINUED

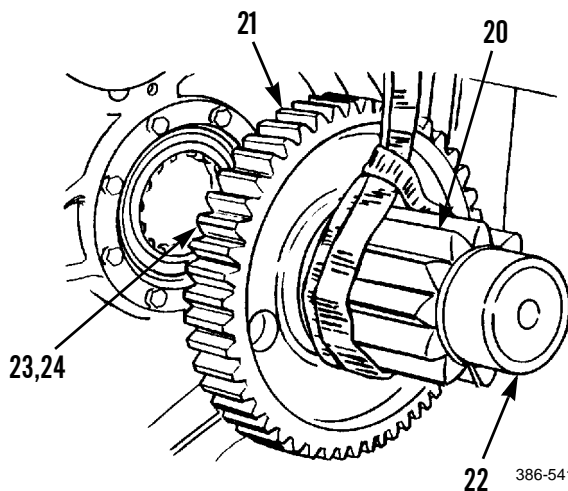
- Install new retainer (23) in idler pinion (20). Install gear (21) over idler pinion so that deep chamfer puts retainer under compression. Retainer must be engaged in groove of gear.



WARNING

Wear hand protection when handling hot components to prevent burns.

- Heat two bearing races (22 and 24) to a maximum temperature of 275°F (135°C) and install them on each end of idler pinion (20).



NOTE

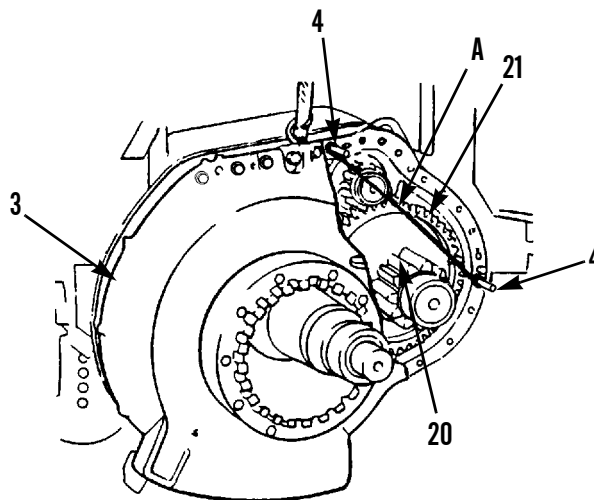
- Apply gear lubricating oil in all race and roller assemblies to hold rollers in position for installation of inner races.
- Weight of gear and idler pinion assembly is 120 lb (55 kg).

- Attach a nylon sling and a suitable lifting device to gear (21) and idler pinion (20) assembly and install assembly in roller assembly (29) in cage assembly (27).

NOTE

Wire will hold gear and idler pinion in position until final drive case is installed.

- Fasten wire (A) around guide pins (4) to hold gear (21) and idler pinion (20) in place.

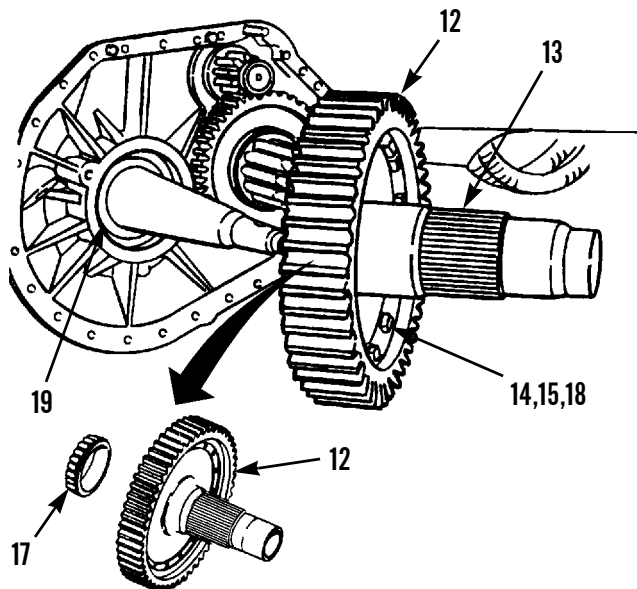


INSTALLATION - CONTINUED

NOTE

Weight of hub is 218 lb (99 kg).

10. Attach lifting device to hub (13) and put it in position in gear (12) with long neck side of hub up.
11. Install 15 bolts (15) through hub (13) and gear (12) and secure with eight new locks (18) and 15 nuts (14). Bend locks up against flats of bolt heads.
12. Attach a lifting link to hole in gear (12). Attach a nylon sling to lifting link and to a suitable lifting device. Turn assembly over and position it on blocks with long neck side of hub (13) down.



WARNING

Wear hand protection when handling hot components to prevent burns.

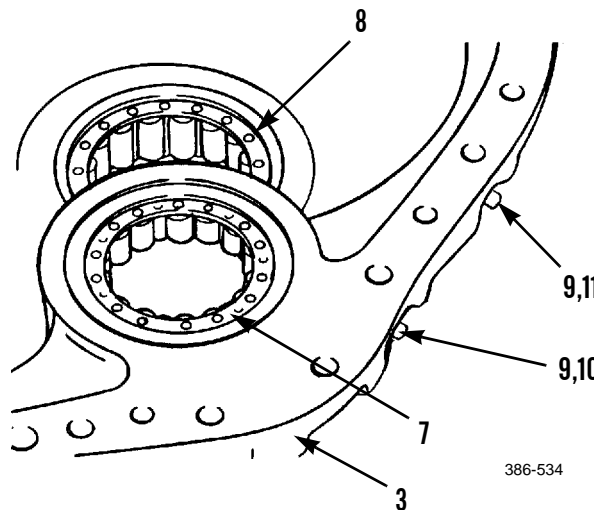
13. Heat bearing cone (17) to a maximum temperature of 275°F (135°C). Install bearing cone on hub (13).
14. If removed, install bearing cup (19).

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NOTE

Weight of gear and hub is approximately 350 lb (159 kg).

15. Install key (16). Use lifting link, nylon strap and lifting device to put gear (12) and hub (13) part way onto sprocket shaft. Remove lifting link, nylon sling and lifting device.
16. Install one remaining bolt (15) and nut (14). Bend remaining tab of one lock (18) against bolt head.
17. Push gear (12) and hub (13) fully onto sprocket shaft.
18. Lower temperature of race and roller assemblies (7 and 8). Install race and roller assemblies in final drive case (3) with dowel hole in race and roller assemblies in line with dowel hole in final drive case.
19. Use a 1/4 in. -20NC capscrew to install dowel (11) for race and roller assembly (8). Remove capscrew.
20. Use a #10 - 32 screw to install dowel (10) for race and roller assembly (7). Remove screw.
21. Install two new plugs (9) in dowel holes in drive case (3).
22. Apply gasket compound on contact surfaces of steering clutch case and final drive case (3).



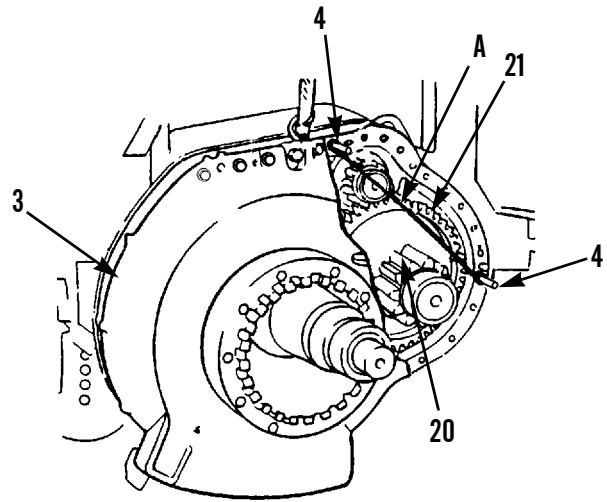
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INSTALLATION - CONTINUED

NOTE

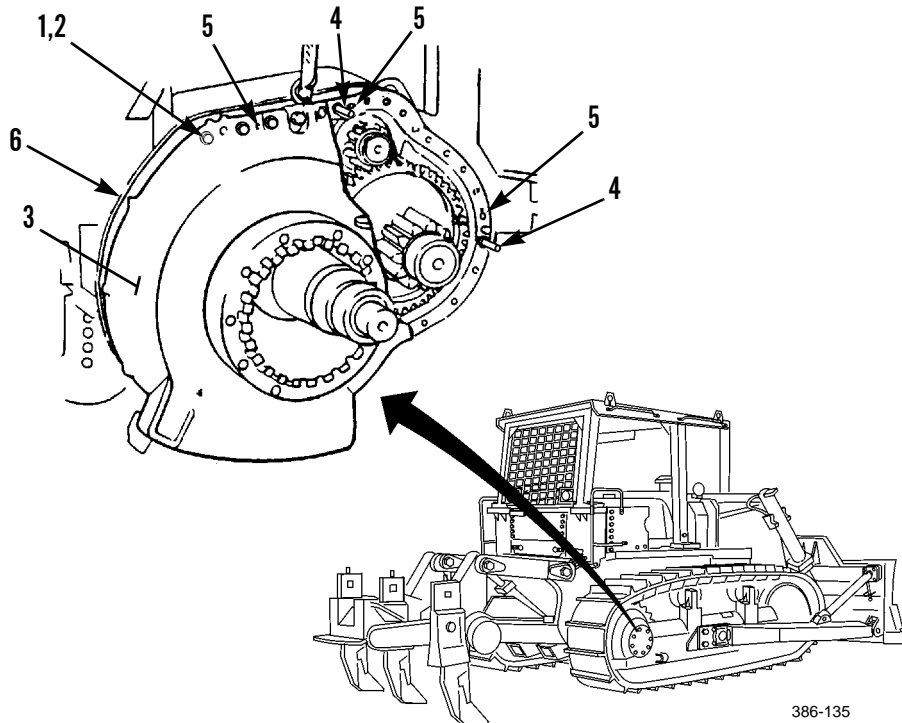
Weight of final drive case is 280 lb (127 kg).

23. Attach two lifting links with 3/8 -16 x 1-1/2 in. bolts to forcing screw holes on final drive case (3). Attach lifting device to lifting links and position final drive case on guide pins (4). Remove wire (A) used to hold gear (21) and idler pinion (20).



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24. Push final drive case (3) against steering clutch case (6). Install 29 capscrews (1) and washers (2). Remove two guide pins (4) and install two remaining capscrews and washers. Tighten all capscrews to 200 lb-ft (271 Nm).
25. Remove lifting device and lifting links from final drive case (3).



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26. Install track drive sprocket (WP 0118 00).
27. Check level of transmission oil and add as needed (WP 0086 00).
28. Start engine and test drive machine. Check for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

FINAL DRIVE PINIONS AND FLANGES MAINTENANCE**0101 00****THIS WORK PACKAGE COVERS**

Removal, Disassembly, Cleaning and Inspection, Assembly, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, contact maintenance (Item 96, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Adapter (Item 1, WP 0185 00)
 Adapter, coupling (Item 5, WP 0185 00)
 Adapter, socket wrench (Item 7, WP 0185 00)
 Adjusting tool, bearing (Item 10, WP 0185 00)
 Bolt, machine (Item 11, WP 0185 00)
 Bushing driver set (Item 14, WP 0185 00)
 Clip, retaining (Item 16, WP 0185 00)
 Collar, shaft (Item 17, WP 0185 00)
 Coupling tool (Item 20, WP 0185 00)
 Cylinder assembly, actuating, linear (Item 22, WP 0185 00)
 Head, socket install (Item 31, WP 0185 00)
 Hose assembly (Item 32, WP 0185 00)
 Inserter, seal (Item 33, WP 0185 00)
 Inserter, seal (Item 34, WP 0185 00)
 Inserter, seal (Item 35, WP 0185 00)
 Leg, mechanical puller (Item 40, WP 0185 00)
 Leg, mechanical puller (Item 41, WP 0185 00)
 Link, pin (Item 45, WP 0185 00)
 Pin, lock (Item 56, WP 0185 00)
 Pin, shoulder, headless (Item 57, WP 0185 00)
 Puller attachment, mechanical (Item 71, WP 0185 00)
 Puller attachment, mechanical (Item 72, WP 0185 00)
 Puller attachment, mechanical (Item 73, WP 0185 00)
 Puller, crank pulley (Item 74, WP 0185 00)
 Puller, hydraulic (Item 76, WP 0185 00)
 Puller, hydraulic (Item 77, WP 0185 00)
 Puller, mechanical (Item 80, WP 0185 00)

Tools and Special Tools - Continued

Pump, hydraulic ram, hand driven (Item 84, WP 0185 00)
 Pumping unit, hydraulic, power driven (Item 85, WP 0185 00)
 Pusher, rollover (Item 86, WP 0185 00)
 Repair tool, special purpose (Item 91, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Socket, socket wrench (Item 101, WP 0185 00)
 Spacer (Item 102, WP 0185 00)
 Spacer, sleeve (Item 103, WP 0185 00)
 Stand assembly (Item 104, WP 0185 00)
 Stand, lifting (Item 105, WP 0185 00)
 Step plate, mechanical puller (Item 108, WP 0185 00)
 Tool, special (Item 115, WP 0185 00)
 Washer, flat (Item 118, WP 0185 00)
 Wrench, ratchet (Item 119, WP 0185 00)
 Wrench, torque multiplier: 1 in. square drive (Item 122, WP 0185 00)
 Lifting equipment, 200 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)
 Compound, gasket forming, silicone (Item 7, WP 0184 00)
 Oil, lubricating (Item 25, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Block of wood, 2 in. x 8 in. x 2 ft long
 Screw, #10-32
 Screw, forcing, 3/8 in. - 16 NC
 Gasket (9)
 Packing (11)
 Retainer (10)

References

TM 5-2410-233-10
 TM 9-214
 WP 0176 00

Personnel Required

Two

Equipment Condition

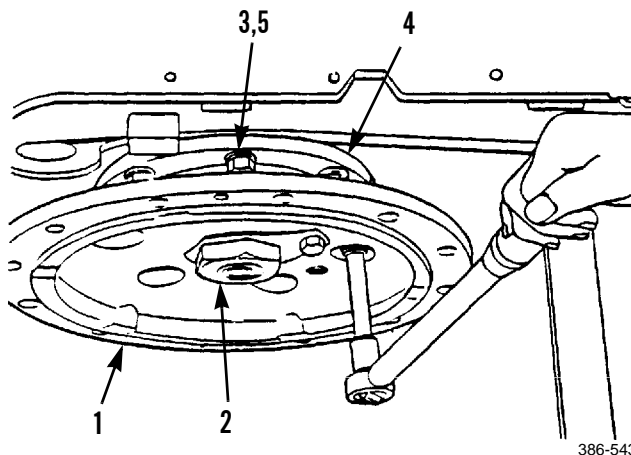
Steering clutches removed (WP 0127 00)

REMOVAL

NOTE

If final drive pinion and flange are to be disassembled, nut must be loosened.

1. Wedge block of wood behind final drive flange (1) to prevent it from turning. Loosen nut (2).
2. Attach lifting equipment to track and pull track slightly forward to align holes in final drive flange (1) with capscrews (3) in bearing cage (4).



NOTE

Final drive flange may have to be rotated slightly to gain access to some capscrews.

3. Remove seven capscrews (3) and washers (5) from bearing cage (4).

4. Rotate flange (1) enough to align holes in flange with forcing screw holes in bearing cage (4) and install two 3/8 -16NC forcing screws in bearing cage.
5. Turn forcing screws evenly until bearing cage (4) is free of bevel gear case.



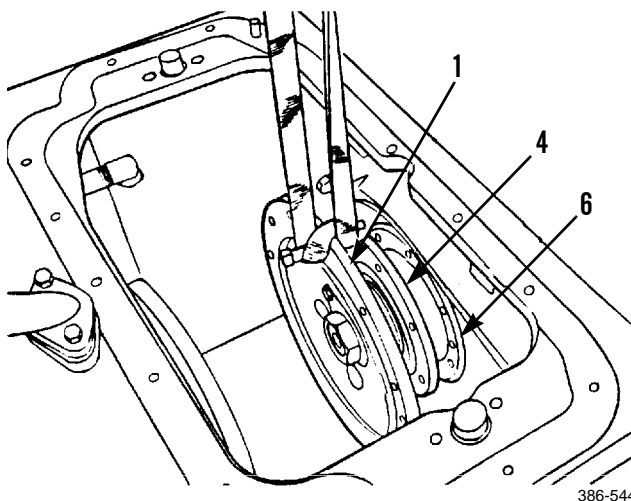
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury.

NOTE

Weight of final drive pinion and flange as a unit is 80 lb (36 kg).

6. Attach a nylon sling and a suitable lifting device to final drive pinion (6) and flange (1) as a unit and remove from gear case.



DISASSEMBLY

1. Remove nut (2) from shaft of final drive pinion (6).
2. Remove capscrew (7) and lock (8) from flange (1).

WARNING

Because flange is installed on shaft of final drive pinion with a force of 35-40 tons (312-356 kn), ensure nut is installed to prevent flange from coming off and causing personal injury.

3. Reinstall nut (2) on shaft of final drive pinion (6), with a distance of 0.125 in. (3.2 mm) between nut and flange (1).

**WARNING**

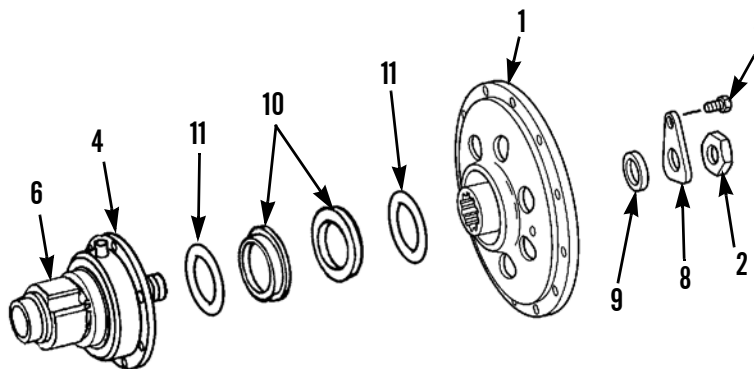
Keep hands clear of puller when removing flange. Failure to do so could cause injury.

4. Install puller on flange (1) and apply pressure to break flange loose from shaft of final drive pinion (6).
5. Remove puller, nut (2) and flange (1) from shaft of final drive pinion (6).
6. Remove gasket (9) from hub of flange (1). Discard gasket.

NOTE

Duo-cone seal assembly is a two-piece seal. One half of seal is in flange (1); the other half is in bearing cage (4).

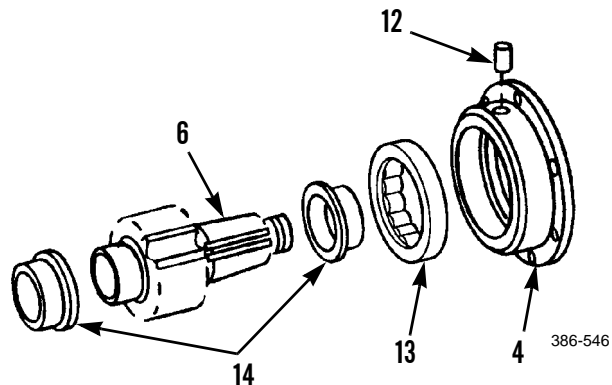
7. Remove retainer (10) with packing (11) from flange (1). Remove retainer (10) with packing (11) from bearing cage (4).
8. Discard packings (11) and retainers (10).
9. Remove bearing cage (4) from shaft of final drive pinion (6).



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DISASSEMBLY - CONTINUED

10. Install #10-32 screw in dowel (12) and pull on screw to remove dowel from bearing cage (4). Remove screw from dowel.
11. Remove race and roller assembly (13) from bearing cage (4).
12. Remove bearing race (14) from one end of final drive pinion (6) shaft.
13. Repeat step 12 at other end of final drive pinion (6) shaft.

**CLEANING AND INSPECTION****WARNING**

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Clean all parts with solvent cleaning compound.
2. Refer to WP 0176 00 for general inspection instructions.
3. Refer to TM 9-214 for inspection of roller bearing.
4. Replace damaged parts as necessary.
5. Remove gasket material and clean all mating surfaces before assembly or installation.

ASSEMBLY**WARNING**

Wear hand protection when handling hot components to prevent serious burns.

1. Heat two bearing races (14) to a maximum temperature of 275°F (135°C) and install one race at each end of final drive pinion (6) shaft. Races must contact shoulders on final drive pinion shaft.
2. Allow bearing races (14) to cool and install roller assembly (13) in bearing cage (4) with hole in outer race in line with dowel hole in cage.
3. Use a #10-32 screw to install dowel (12) in bearing cage (4), securing bearing race (14) and roller assembly (13). Remove screw from dowel.
4. Install bearing cage (4) on spline end of final drive pinion (6) shaft with flange toward splines.

ASSEMBLY - CONTINUED

CAUTION

Duo-cone seal assembly is a two-piece seal. It must be used as a matched pair or failure will result. Do not separate.

5. Install new packings (11) on retainers (10).

CAUTION

Seals and seal contact surfaces must be kept clean. Do NOT touch after being cleaned or leaks can result.

NOTE

Do NOT apply oil to packings.

6. Install retainer (10) with packing (11) in bearing cage (4). Clean metal contact surface of seal, then apply a thin film of clean oil to metal contact surface.
7. Install retainer (10) with packing (11) in flange (1). Clean metal contact surface of seal, then apply a thin film of clean oil to metal contact surface.
8. Clean and dry splines on shaft of final drive pinion (6).



WARNING

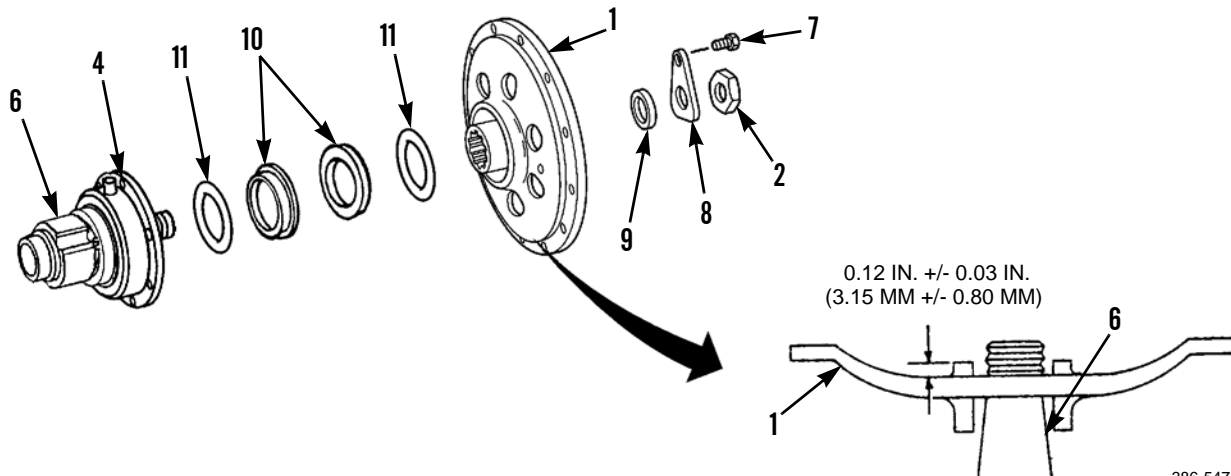
Keep hands clear of puller when installing flange. Failure to do so could cause personal injury.

9. Position flange (1) on splines of final drive pinion (6) shaft, install puller, and press flange on final drive pinion shaft with a force of 35-40 tons (312-356 kn). Remove puller.
10. Measure distance from shoulder on final drive pinion (6) shaft to hub face in center of flange (1). This distance must be 0.12 in. +/- 0.03 in. (3.15 mm +/- 0.80 mm).
11. If distance in step 10 is less than 0.09 in. (2.29 mm), replace flange (1) and final drive pinion (4). If distance exceeds 0.15 in. (3.81 mm), remove flange and clean final drive pinion and shaft splines. Reinstall flange.
12. Install new gasket (9) in hub of flange (1).
13. Install lock (8) on flange (1) with capscrew (7).

NOTE

Nut (2) is tightened and lock (8) is bent to secure nut after final drive pinion and flange assembly is installed in bevel gear case.

14. Install nut (2) on shaft of final drive pinion (6) finger tight.



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INSTALLATION

1. Apply silicone gasket forming compound on flange of bearing cage (4) and cage mounting surface on bevel gear case.



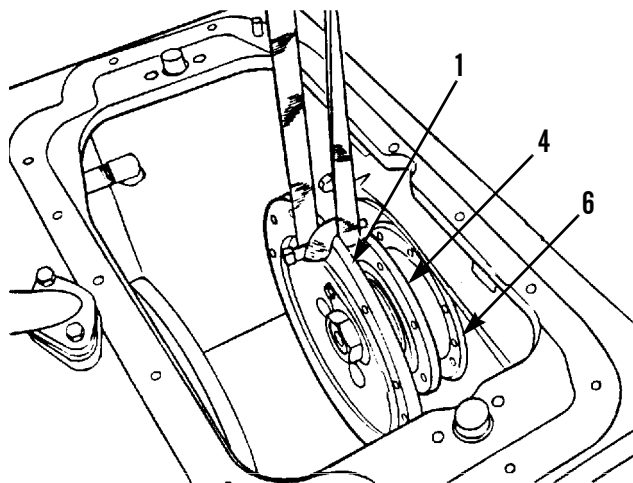
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury.

NOTE

Weight of final drive pinion and flange as a unit is 80 lb (36 kg).

2. Use a nylon sling and a suitable lifting device to install final drive pinion (6) and flange (1) as a unit on bevel gear case. Ensure unit is positioned as follows:
 - a. Engage unit with teeth on final drive gear inside bevel gear case.
 - b. Seat final drive pinion bearing race (14) in bearing inside bevel gear case.
 - c. Position bearing cage (4) flange with dowel hole up, oil hole down and capscrew holes aligned with holes in bevel gear case.
3. Attach lifting equipment to track and move track to align holes in flange (1) with holes in bearing cage (4).



386-544

NOTE

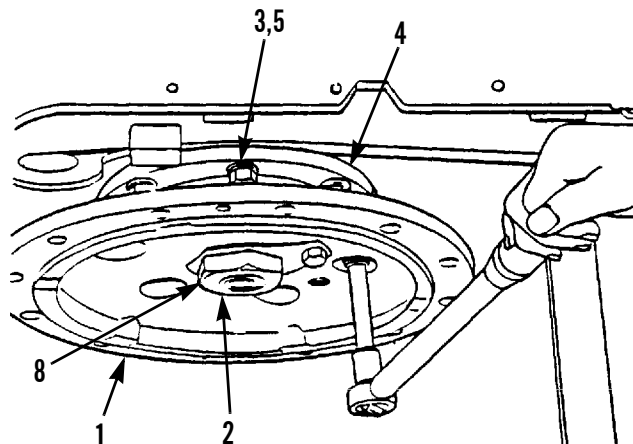
Flange may have to be rotated slightly to gain access to some capscrews.

4. Install seven washers (5) and capscrews (3) to secure bearing cage (4). Tighten capscrews to 100 lb-ft (136 Nm).

NOTE

If final drive pinion and flange were NOT disassembled, skip step 5.

5. Tighten nut (2) on shaft of final drive pinion (6) to 700 lb-ft (949 Nm).
6. Bend lock (8) against nut (2).
7. Install steering clutches (WP 0127 00).
8. Run engine and test drive in all speeds (TM 5-2410-233-10).



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END OF WORK PACKAGE

BEVEL GEAR AND SHAFT REPLACEMENT

0102 00

THIS PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
Shop equipment, general purpose repair (Item 97, WP 0185 00)
Bushing driver set (Item 14, WP 0185 00)
Sling, nylon (Item 100, WP 0185 00)
Lifting equipment, 100 lb capacity

Materials/Parts

Pigment, paint products (Item 26, WP 0184 00)
Rag, wiping (Item 28, WP 0184 00)
Sealing compound (Item 31, WP 0184 00)
Tag, marker (Item 35, WP 0184 00)
Bar stock, 1/4 in. x 1 in. x 8 in. long

Materials/Parts - Continued

Capscrew, forcing, 1/2 in. - 13NC
Lockwasher (6 and 8)
Wood, block 2 in. x 4 in. x 2 ft long

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

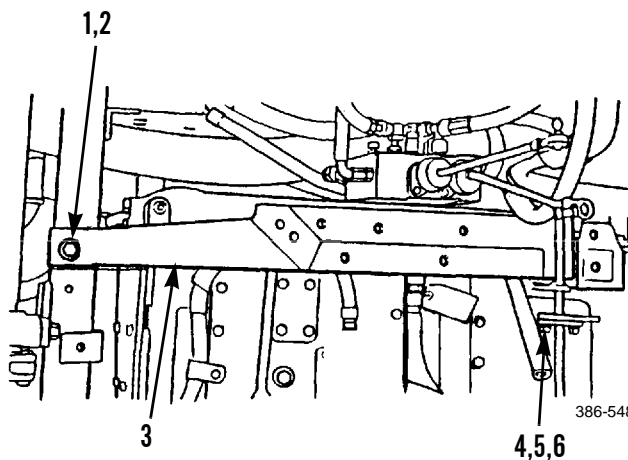
Fuel tank removed (WP 0049 00)
Steering clutch hubs removed (WP 0128 00)
Final drive drained (WP 0099 00)

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

REMOVAL

1. Remove capscrew (1) and washer (2) from end of support assembly (3) at gear case.
2. Remove two capscrews (4), nuts (5) and lockwashers (6) from other end of support assembly (3) and remove support assembly. Discard lockwashers.

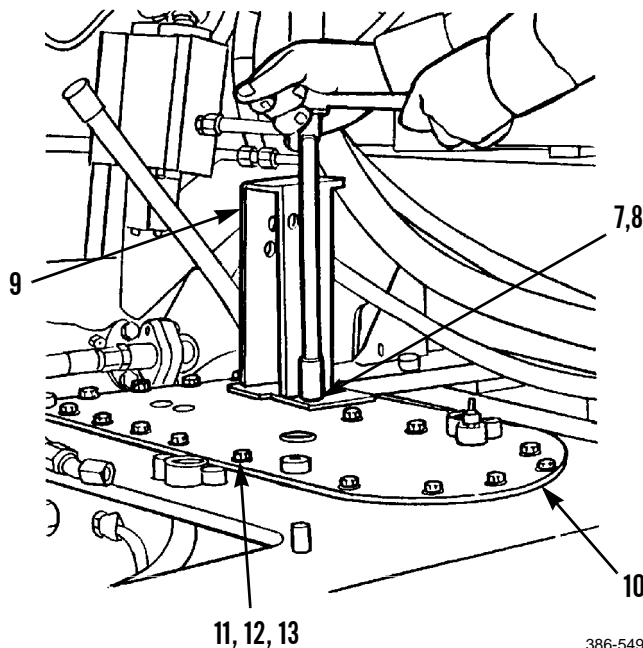


3. Remove four capscrews (7), lockwashers (8) and bracket assembly (9) from top of gear case cover (10). Discard lockwashers.
4. Remove 19 capscrews (11), washers (12), three spacers (13) and cover (10) from bevel gear case.
5. Remove oil lines from two bearing cages (14 and 15).
6. Use a piece of bar stock between teeth in bevel gear (16) and bottom of gear case to hold gear while removing 10 nuts (17) and washers (18).

NOTE

Weight of bevel gear shaft is 46 lb (21 kg).

7. Attach a nylon sling and a suitable lifting device to bevel gear shaft (19) for support.
8. Remove eight capscrews (20) and lockwashers (21) from bearing cage (14) at bevel gear end of bevel gear shaft (19). Discard lockwashers.
9. Install two 1/2 in. -13NC forcing screws in bearing cage (14) and turn screws evenly to remove cage. Remove forcing screws from bearing cage.

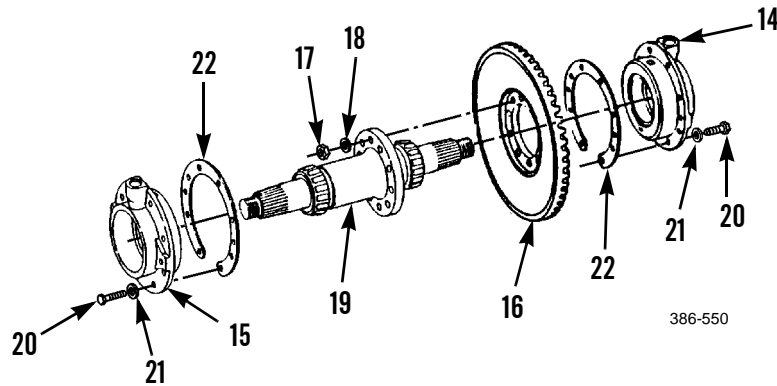


REMOVAL - CONTINUED

NOTE

Keep shims together for each bearing cage for installation purposes.

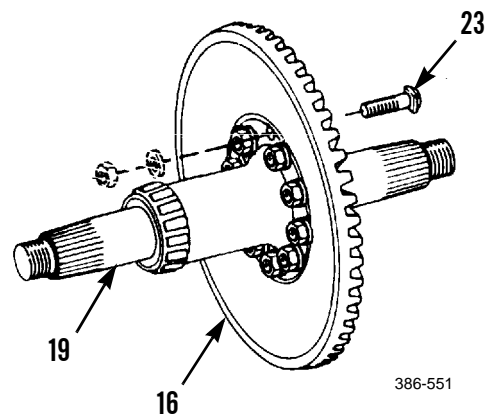
10. Remove shims (22) from bearing cage (14).
11. Repeat steps 8 through 10 for bearing cage (15) at steering clutch end of bevel gear shaft (19).



CAUTION

Install large nut on each end of bevel gear shaft to protect threads from damage.

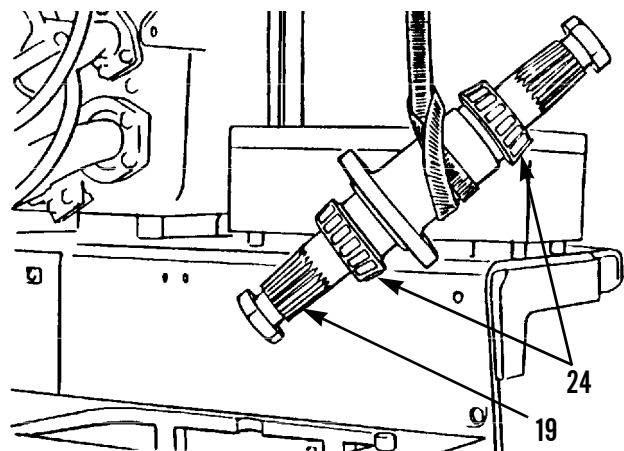
12. Slide bevel gear shaft (19) 3/4 in. toward clutch compartment and remove 10 capscrews (23) from bevel gear (16).



NOTE

Put wood block under bevel gear during removal of gear shaft.

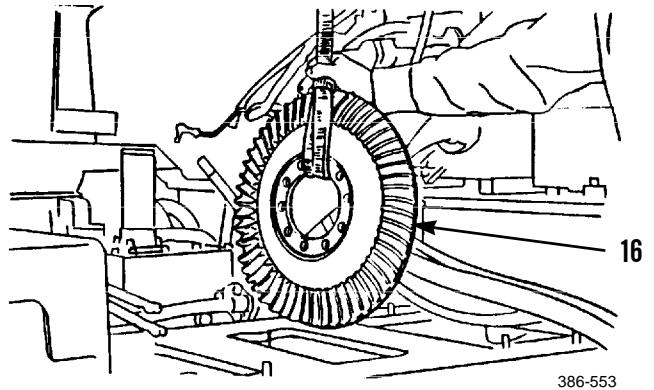
13. Use lifting device to slowly remove bevel gear shaft (19) through steering clutch compartment.
14. Remove large nut from each end of bevel gear shaft (19). Use a puller to remove two bearings (24).



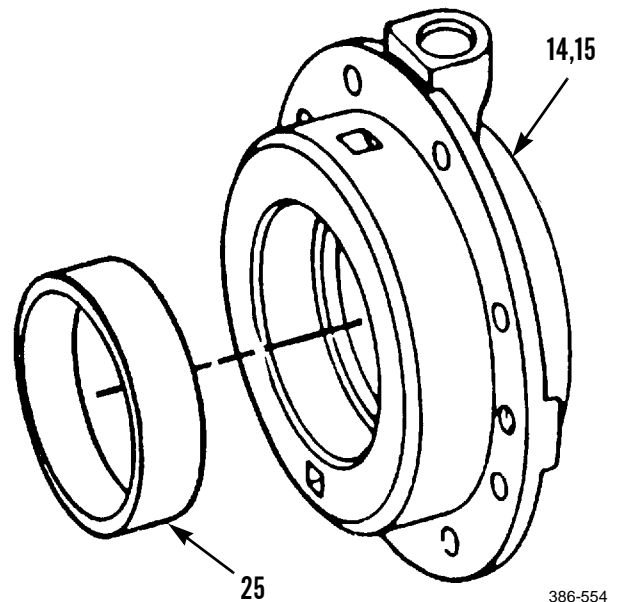
REMOVAL - CONTINUED**NOTE**

Weight of bevel gear is 54 lb (24 kg).

15. Use lifting device to remove bevel gear (16) from gear case.



16. Use a puller to remove bearing races (25) from bearing cages (14 and 15).

**INSTALLATION**

1. Lower temperature of two bearing races (25) and use bearing installation tool to install in bearing cage (14 and 15).

INSTALLATION - CONTINUED**WARNING**

Wear hand protection when handling hot components to prevent serious burns.

- Heat two bearings (24) to maximum temperature of 275°F (135°C) and install one on each end of bevel gear shaft (19).

CAUTION

Install large nut on each end of bevel gear shaft to protect threads from damage.

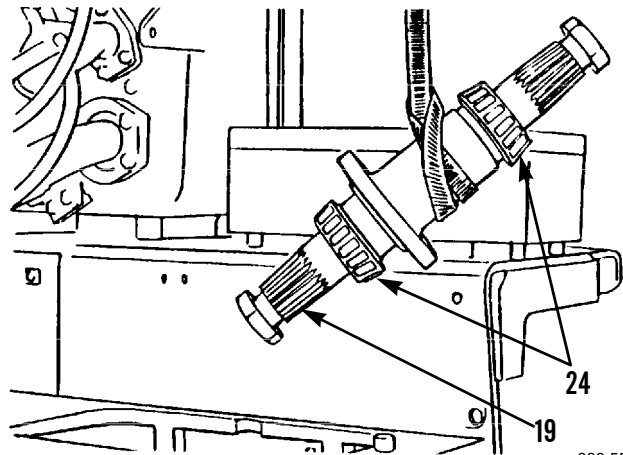
NOTE

- If transmission is in machine, install bevel gear shaft without bevel gear and follow installation procedure starting at step 3.**
 - If transmission is not in machine, install bevel gear shaft with bevel gear and follow installation procedure starting at step 5.**
 - Weight of bevel gear shaft is 46 lb (21 kg).**
- Use a suitable lifting device to position bevel gear shaft (19) in bevel gear case.

NOTE

Leave lifting device attached to bevel gear shaft for support during bearing adjustment procedure.

- Adjust bearings (24) on bevel gear shaft (19) as follows:



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INSTALLATION - CONTINUED**WARNING**

Wear hand protection when handling hot components to prevent serious burns.

NOTE

Thickness of full shim pack is 0.119-0.125 in. (3.02-3.18 mm).

- a. Heat two bearing cones (24) to a maximum temperature of 275°F (135°C) and install on bevel gear shaft (19).
- b. Install bearing cups in bearing cages.

NOTE

Weight of bevel gear shaft is 46 lb (21 kg).

- c. Use a nylon sling and a suitable lifting device to install bevel gear shaft (19). Hand-tighten nuts.
- d. Install bearing cage (14) with two packages of shims (22), but without two 0.007 in. (0.18 mm) shims. The thickness of a full shim pack (22) is 0.122 +/- 0.003 in. (3.10 +/- 0.08 mm). Install four bolts (20) with even spacing and with no washers. Tighten bolts (20) to 100 lb-ft (135 Nm).
- e. Install bearing cage (15) with no shims (22). Install four bolts (20) with no washers in even spaces. Tighten bolts (20) to 100 lb-ft (136 Nm).
- f. Tighten nuts (23) on bevel gear (16) to 215 lb-ft (160 Nm).
- g. Rotate bevel gear shaft (19) slowly for a minimum of 5 revolutions. This step will seat the roller bearings.
- h. Install dial indication (gage) against machined face of bearing cage (6). Align with vertical centerline of face of bevel gear case.

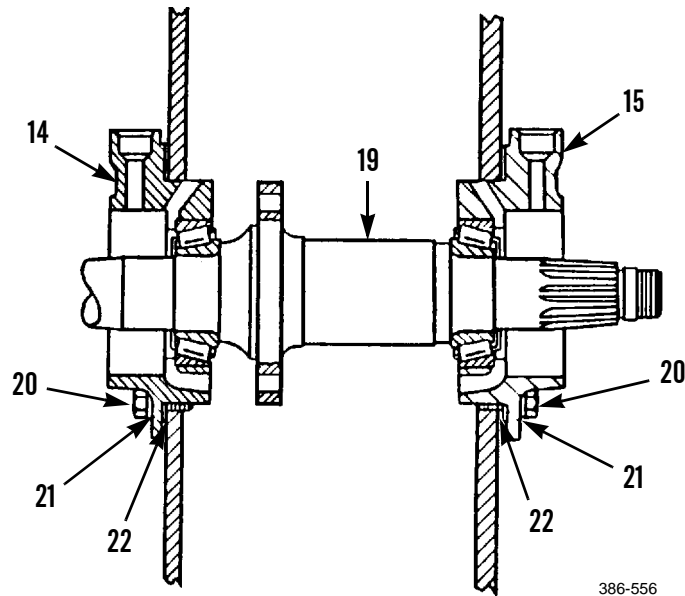
NOTE

Ensure base of gage is attached to bevel gear case in an area that will not deflect. Suitable areas include the top or bottom of case.

- i. Set gage reading to zero.
- j. Loosen bolts (20) on side opposite the gage.
- k. If deflection range is 0.0037 +/- 0.0007 in. (0.095 +/- 0.019 mm), bearing preload is set correctly. Continue to step m. If deflections is not in range, adjustment of shim packs (22) is required. Continue with step l.
- l. If deflection is less than required, bevel gear shaft (16) is too loose. Remove some shims (22) and tighten bolts (20) to 100 lb-ft (135 Nm). Repeat steps g through k. If deflection is more than required, bevel gear shaft (16) is too tight. Add some shims (22) and tighten bolts (20) again to 100 lb-ft (136 Nm). Repeat steps g through k.
- m. Adjust clearance between bevel gear and pinion (backlash) by moving appropriate number of shims from one side to other side in bevel gear case.

INSTALLATION - CONTINUED**NOTE**

- If you move shims from one side to other side, bearing preload will not change. You must keep same amount of shims.
 - Whenever bearing cage is loosened or removed, repeat step g. This step ensures that bearings have been seated, and bearing preload is set correctly.
 - Previous models used lockwashers. Replace all lockwashers with part number 5P8245 hard washers (21).
- n. When all procedures for bevel gear and pinion are completed, install remaining bolts (20) and hard washers (21) in cage. Tighten bolts to 100 lb-ft (136 Nm).



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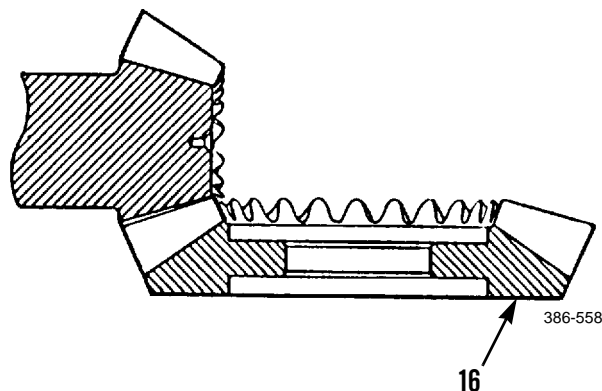
INSTALLATION - CONTINUED

5. Make adjustments to bevel gear position for correct gear clearance (backlash) between bevel gear (16) and bevel pinion (from transmission) as follows:
 - a. Position magnetic-based dial indicator so indicator tip contacts a tooth on bevel pinion.
 - b. Wedge block of wood between bevel gear (16) and case so bevel gear will not turn.

NOTE

Ensure bevel pinion (from transmission) is held as far as possible toward front of machine when gear clearance (backlash) is measured. Correct backlash is 0.015 in. + 0.004 in. or - 0.003 in. (0.38 mm + 0.10 mm or - 0.08 mm).

- c. Push bevel pinion toward front of machine as far as possible. Move bevel pinion clockwise and then counterclockwise. The free movement (backlash) will be the difference in values read on dial indicator.
- d. Repeat steps b and c at three more points around bevel gear (16) to find smallest gear clearance (backlash).

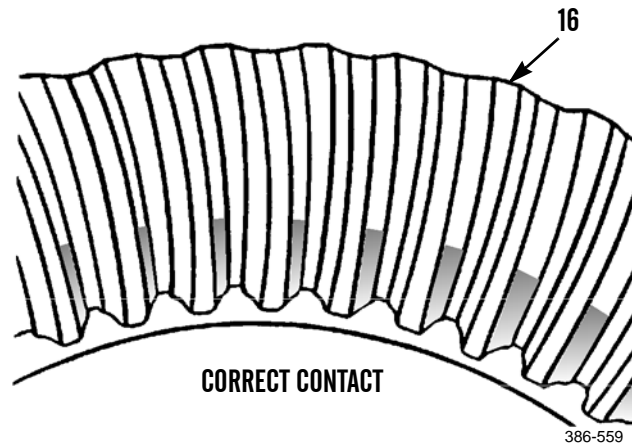
**NOTE**

Adjustment of bearings for bevel gear shaft (19) will not change by movement of shims from one bearing cage to the other as long as total thickness of shims is the same.

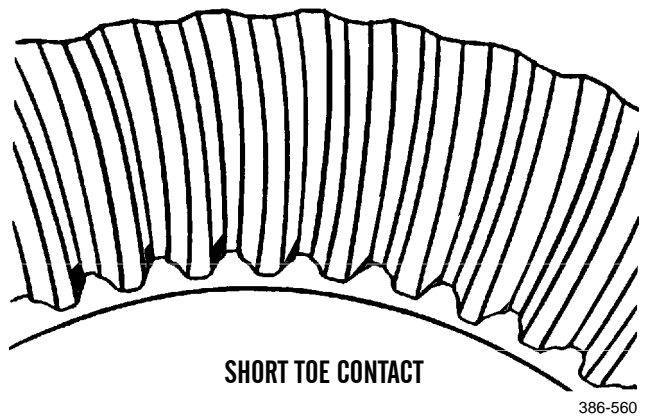
- e. If measurement of smallest gear clearance (backlash) is too large, remove some shims (22) from behind bearing cage (14). Install removed shims behind bearing cage (15).
 - f. If measurement of smallest gear clearance (backlash) is too small, remove some shims (22) from behind bearing cage (15). Install removed shims behind bearing cage (14).
6. After bevel gear bearing preload and gear clearance (backlash) adjustments have been made, check tooth contact setting between bevel gear (16) and bevel pinion shaft as follows:
 - a. Apply thin coat of prussian blue on bevel gear teeth. Turn bevel pinion shaft and check marks made on bevel gear teeth.

INSTALLATION - CONTINUED

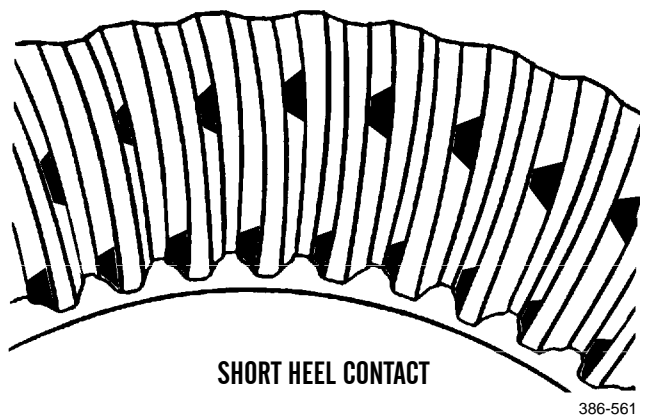
- b. With no load, correct tooth setting is as shown. The area of contact starts near toe of gear and goes 30% up length of tooth. With this setting, when load is put on gear it will be over correct area of teeth.



- c. If bevel pinion shaft is too far away from bevel gear, short toe contact results. The teeth of bevel pinion shaft will be in contact with toe ends of convex faces (part that makes a curve toward outside), and top edge of heel end of concave faces (part that makes a curve toward inside). To correct this, add shims between bevel pinion shaft and bearing cage of transmission. Check gear clearance (backlash) and tooth contact again.



- d. If bevel pinion shaft is too close to center of bevel gear, short heel contact results. The teeth of bevel pinion shaft will be in contact with toe ends of concave faces (part that makes a curve towards the inside) and the heel ends of convex faces (part that makes a curve toward the outside). To correct this, move pinion shaft away from bevel gear by removal of shims between bearing cage of transmission and bevel pinion shaft. After doing this, check gear clearance (backlash) and tooth contact again.

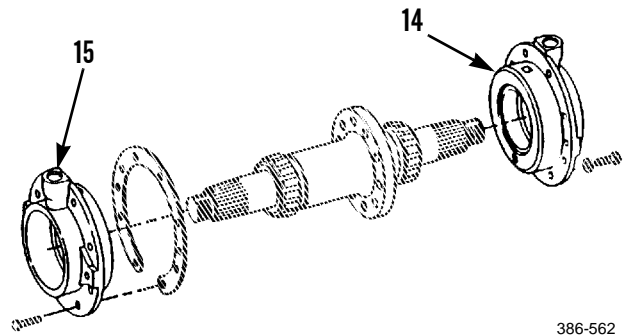


INSTALLATION - CONTINUED

NOTE

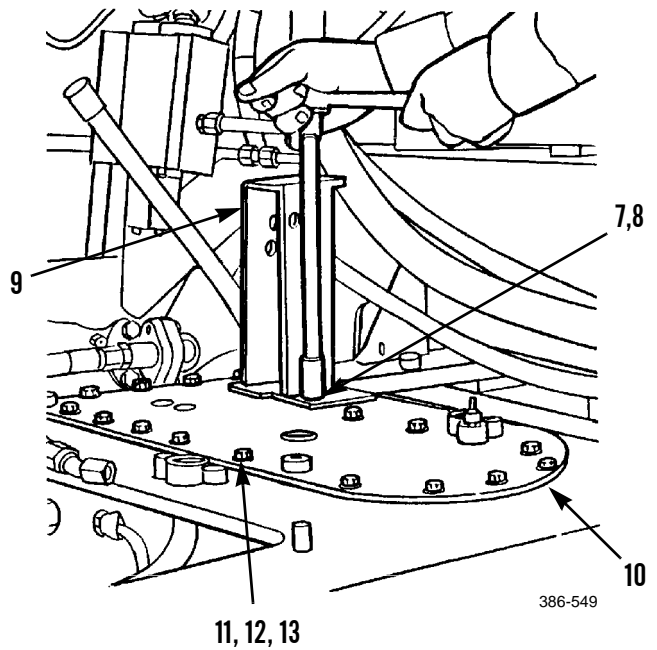
Several adjustments must be made for correct tooth contact setting. If gear clearance (backlash) is changed, tooth contact setting will change.

7. Install oil lines in bearing cages (14 and 15).



386-562

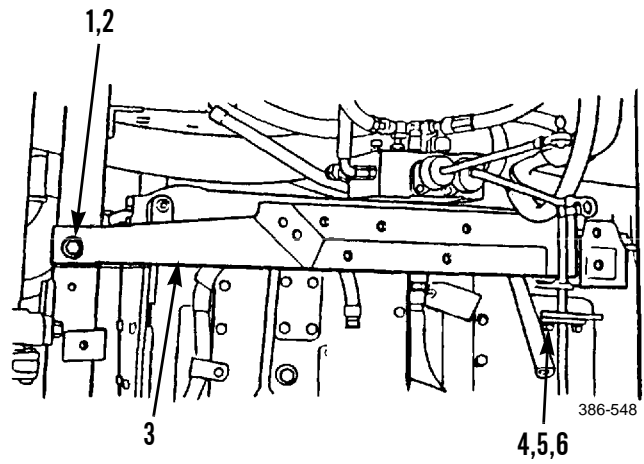
8. Place a bead of sealing compound on cover (10). Install cover on bevel gear case with 19 capscrews (11), flatwashers (12) and three spacers (13).
9. Install bracket (9) on gear case cover (10) with four capscrews (7) and new lockwashers (8).



386-549

INSTALLATION - CONTINUED

10. Position support assembly (3) and install one end of support assembly with two capscrews (4), new lock-washers (6) and nuts (5).
11. Install other end of support assembly (3) with capscrew (1) and flatwasher (2).



12. Install steering clutch hubs (WP 0128 00).
13. Install fuel tank (WP 0049 00).
14. Fill final drive (WP 0099 00).
15. Run engine and test drive in all speeds (TM 5-2410-233-10).

END OF WORK PACKAGE

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DRIVE SPROCKET SHAFT REPLACEMENT**0103 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Adapter (Item 2, WP 0185 00)
- Adapter, coupling (Item 5, WP 0185 00)
- Adapter, pin (Item 6, WP 0185 00)
- Clip, retaining (Item 16, WP 0185 00)
- Forcing screw, mechanical puller (Item 24, WP 0185 00)
- Head, socket install (Item 31, WP 0185 00)
- Link, pin (Item 45, WP 0185 00)
- Nut, plain, round (Item 50, WP 0185 00)
- Pin (Item 55, WP 0185 00)
- Pin, lock (Item 56, WP 0185 00)
- Pin, straight, headless (Item 59, WP 0185 00)

Tools and Special Tools - Continued

- Puller, hydraulic (Item 76, WP 0185 00)
- Puller, hydraulic (Item 77, WP 0185 00)
- Puller, mechanical (Item 80, WP 0185 00)
- Pump, hydraulic ram (Item 84, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Spacer, sleeve (Item 103, WP 0185 00)
- Wrench, spanner (Item 120, WP 0185 00)
- Lifting equipment, 400 lb capacity

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

- Track roller frame removed (WP 110 00)
- Track drive sprockets/hubs removed (WP 0118 00)
- Final drive case, gears, idler pinions and bearings removed (WP 0100 00)

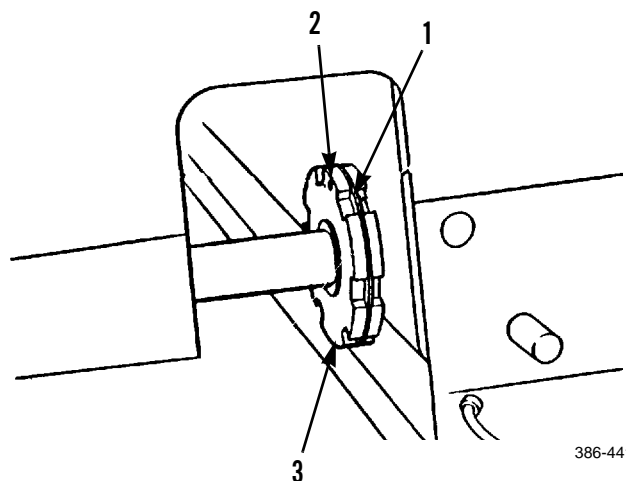
REMOVAL

1. Remove lockring (1) and pin (2) from nut (3) at steering clutch case.

CAUTION

DO NOT remove nut from threaded portion of sprocket shaft. Failure to follow this caution could result in thread damage on shaft and in steering clutch case.

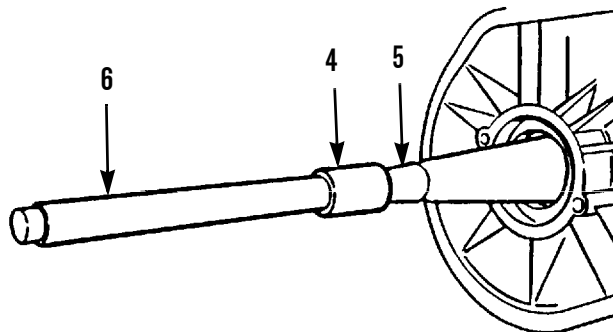
2. Loosen nut (3) on steering clutch case until there is a 1/8 in. (3.2 mm) gap between nut and steering clutch case.



386-441

REMOVAL - CONTINUED

3. Install threaded adapter (4) on sprocket shaft (5) and turn until all threads are engaged.
4. Install and turn stud extension (6) completely into adapter (4).

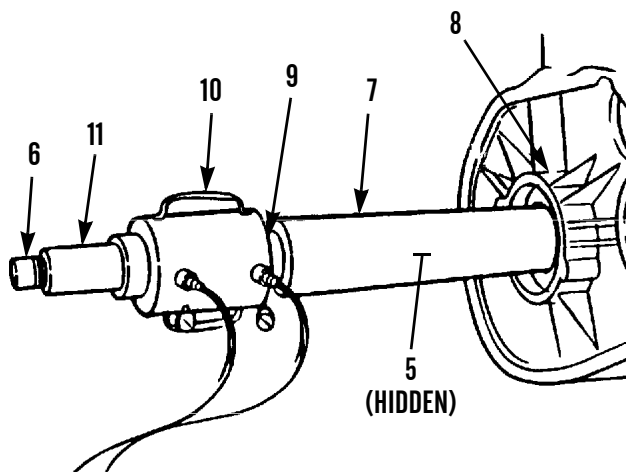


386-289

NOTE

When installing protective sleeve, ensure slot opening is away from bevel gear case.

5. Install protective sleeve (7) over stud extension (6) until sleeve contacts bevel gear case (8).
6. Install head (9) into protective sleeve (7).
7. Install cylinder (10) on stud extension (6) and against head (9) and secure with nut (11).
8. Connect hydraulic pump to cylinder (10) and hold protective sleeve (7) and head (9) in alignment.
9. Apply pressure to sprocket shaft (5) to loosen from taper.



386-290

WARNING

Ensure piston of cylinder is retracted and pressure is off prior to removal of tools. Failure to follow this warning could result in personal injury.

10. Remove tooling from sprocket shaft (5).

REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

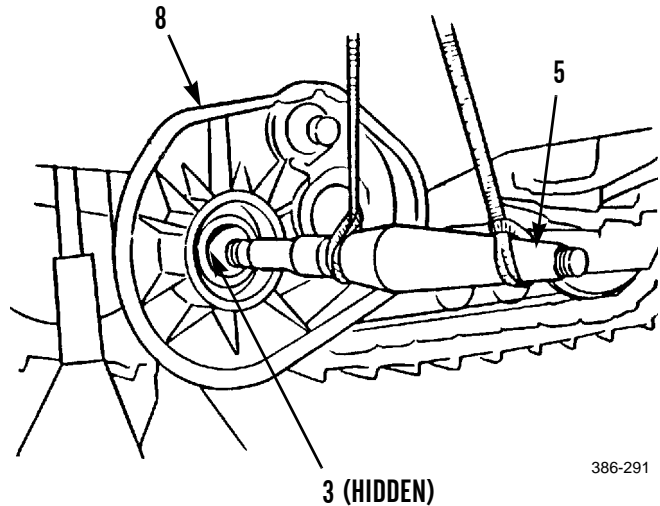
Sprocket shaft weighs approximately 200 lb (91 kg).

11. Attach a nylon sling and a suitable lifting device to sprocket shaft (5) close to bevel gear case (8) and raise lifting device to take weight off shaft.
12. Remove nut (3) from opposite end of sprocket shaft (5).

CAUTION

Use caution and remove sprocket shaft slowly to avoid damage to threads on shaft and in gear case.

13. Remove sprocket shaft (5) from bevel gear case (8).



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INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

CAUTION

Use caution and install sprocket shaft slowly to avoid damage to threads on shaft and in gear case.

NOTE

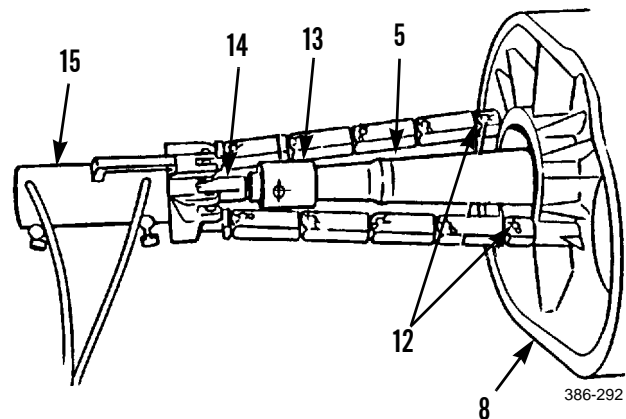
Sprocket shaft weighs approximately 200 lb (91 kg).

1. Use a nylon sling and a suitable lifting device and position sprocket shaft (5) on bevel gear case (8).
2. Push sprocket shaft (5) into bevel gear case (8) as far as possible using only hand pressure.
3. Attach hydraulic pump for installation of sprocket shaft (5).

CAUTION

To avoid damage to bevel gear case threads, ensure adapters are installed in bevel gear case so that shoulder of adapter is against bevel gear case. After shoulder of adapter comes in contact with bevel gear case, adapters can be tightened a maximum of 1/8 turn or loosened a maximum of 3/8 turn to put adapter in correct position so that remainder of tools can be installed. With all tools installed, do not let weight of tools or lifting device put a load on adapters. Keep all tools level.

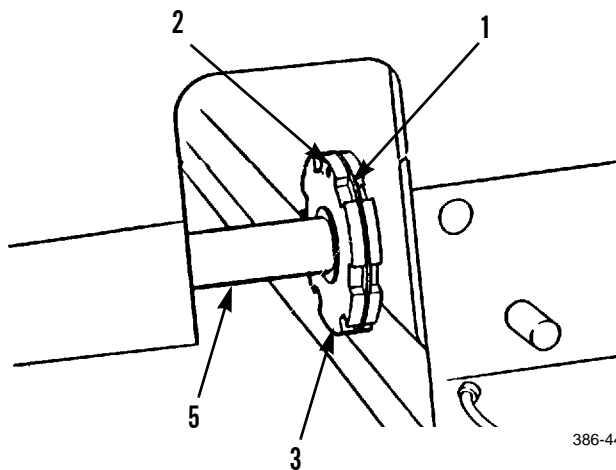
4. Install two adapters (12) into large threaded holes in bevel gear case (8).
5. Install adapter (13) on end of sprocket shaft (5) and connect rod (14) to adapter.
6. Connect hydraulic cylinder (15) to adapters (12) in bevel gear case (8).



INSTALLATION - CONTINUED**NOTE**

Maintain force on sprocket shaft while installing and applying torque to nut.

7. Attach hydraulic pump to hydraulic cylinder (15). Apply 55-60 tons (489-534 kN) of force to push sprocket shaft (5) into position.
8. Install nut (3) on end of sprocket shaft (5). Tighten nut to 750 lb-ft (1017 Nm).



386-441

9. Release pressure on hydraulic cylinder (15).

WARNING

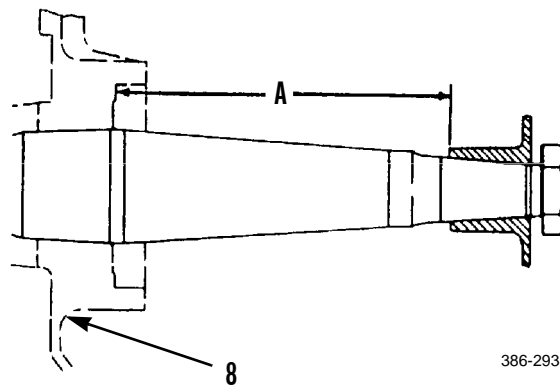
Ensure pressure is off cylinder before attempting to remove hydraulic pump. Failure to follow this warning may result in injury to personnel and damage to equipment.

10. Remove tooling from sprocket shaft (5) and bevel gear case (8).
11. Measure distance (A) from inner edge of holder assembly to bottom of counterbore for inner bearing cup in gear case (8). Distance should be 17.258 +/- 0.062 in. (438.35 +/- 1.57 mm).

NOTE

If original nut and sprocket shaft are used and holes for pin installation line up, proceed to step 13.

12. Drill a 0.368 in. (0.935 mm) hole in one of the grooves through nut (3) perpendicular to centerline of sprocket shaft (5) and 0.56 in. deep into shaft.
13. Install pin (2) into sprocket shaft (5) through hole in nut (3).
14. Install lockring (1) in groove in nut (3) to secure pin (2).
15. Install final drive cases, gears, idler pinions and bearings (WP 0100 00).
16. Install track drive sprockets/hubs assembly (WP 0118 00).
17. Install track roller frame (WP 0110 00).
18. Test drive and check drive sprocket shaft for proper operation (TM 5-2410-233-10).



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END OF WORK PACKAGE

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FINAL DRIVE BEARINGS ADJUSTMENT

0104 00

THIS WORK PACKAGE COVERS

Adjustment

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Adjusting tool, bearing (Item 10, WP 0185 00)

Materials/Parts

- Compound, silicone, RTV (Item 9, WP 0184 00)
- Grease, GAA (Item 15, WP 0184 00)
- Oil, lubricating (Item 19, 20 or 21, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Gasket (7)
- Lockwasher (5)

References

- WP 0009 00
- WP 0120 00

Personnel Required

Two

Equipment Condition

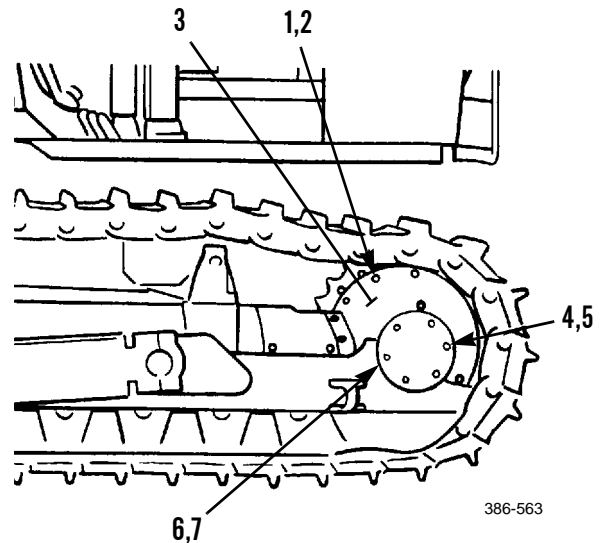
- Track loosened (WP 0119 00)
- Machine lifted off ground (WP 0178 00)

ADJUSTMENT

NOTE

- **When adjusting bearings, track must stay loosened, not removed.**
- **Sprocket assembly must turn while adjustment to final drive bearing is made.**

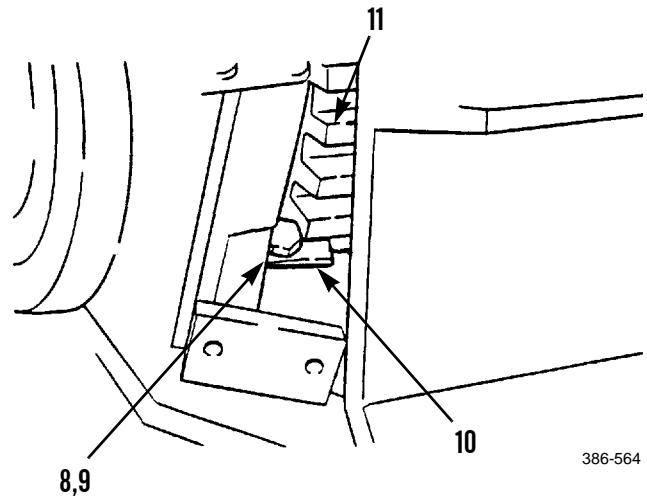
1. Remove six bolts (1), washers (2) and guard (3) from track roller frame.
2. Remove six bolts (4), lockwashers (5) and cap (6) from support. Discard lockwashers.
3. Remove and discard gasket (7).



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ADJUSTMENT - CONTINUED

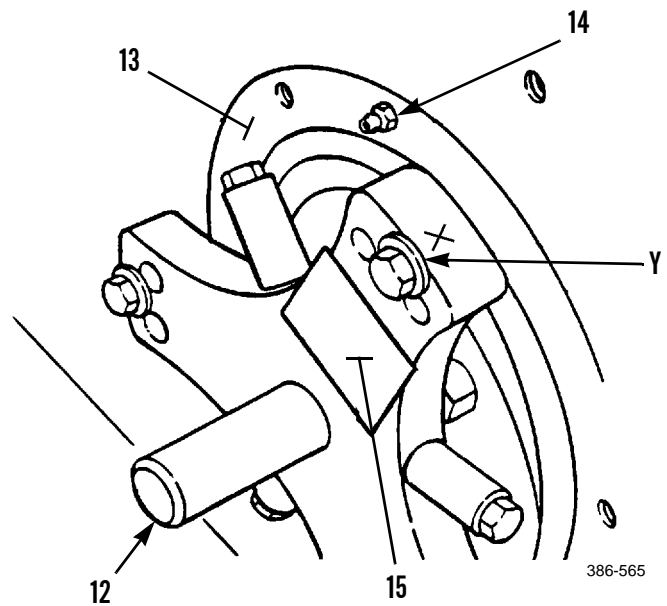
4. Remove capscrew (8), nut (9) and lock (10) from adjusting nut (11).



NOTE

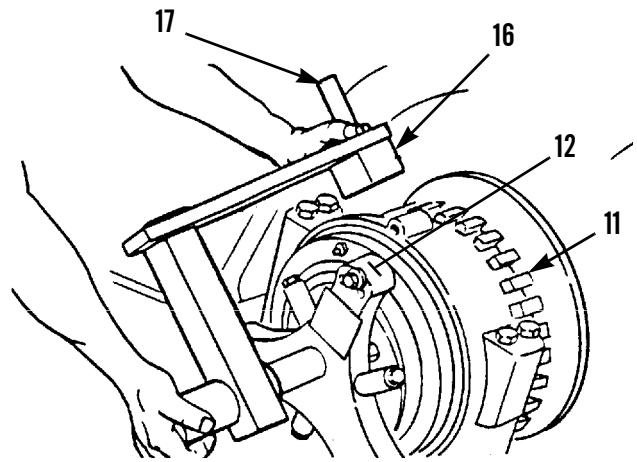
All parts must be clean. Bearings must have lubricating oil on them. Adjusting nut must turn freely on threads and bearing cage must move freely in holder.

5. Install stand, bearing adjusting tool, washers and cap-screws as follows:
 - a. Install trunnion group (12) on track roller frame support assembly (13) using holes marked "Y". Trunnion arm with identification "X" must be fastened to first hole with threads located to the right from grease fitting (14). See instructions on decal (15).



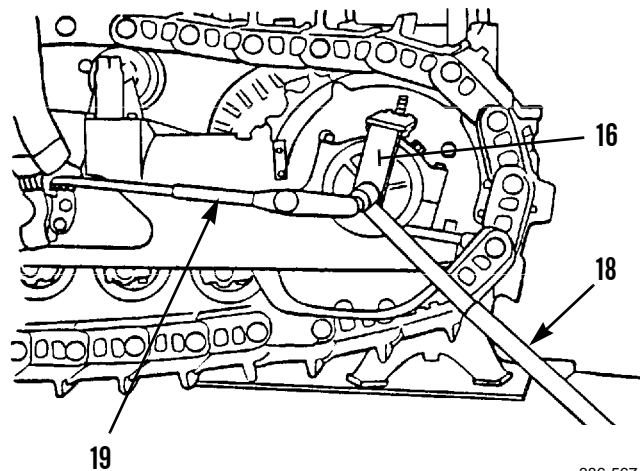
ADJUSTMENT - CONTINUED

- b. Install driver group (16) on trunnion group (12). Pin (17) must be in retracted position as shown.
- c. Push pin (17) down between two lugs on adjusting nut (11).



386-566

6. Install torque multiplier (18) and torque wrench (19) over driver group (16). Start machine and turn sprocket slowly while adjusting nut (11) is turned to the left to tighten to 2500 lb-ft (3390 Nm).



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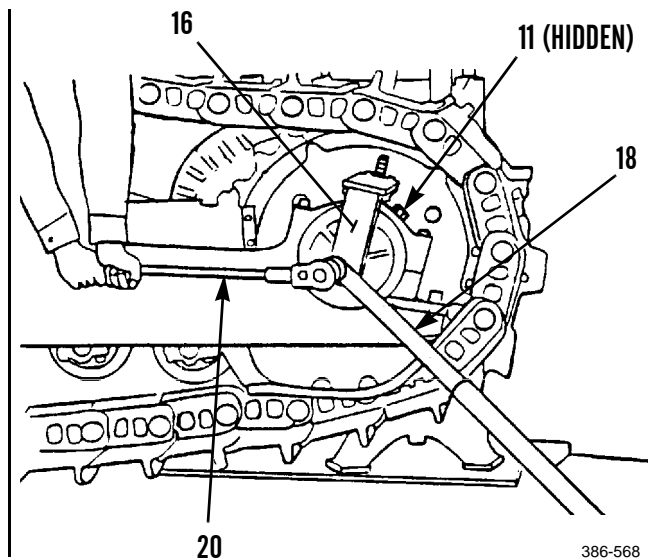
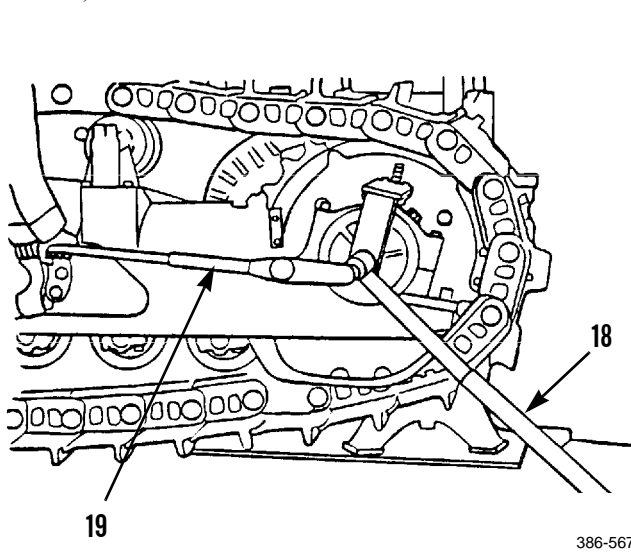
ADJUSTMENT - CONTINUED

7. Remove torque wrench (19) and install ratchet wrench (20). Turn adjusting nut (11) to the right (six to ten lugs) and lower torque to less than 350 lb-ft (475 Nm).

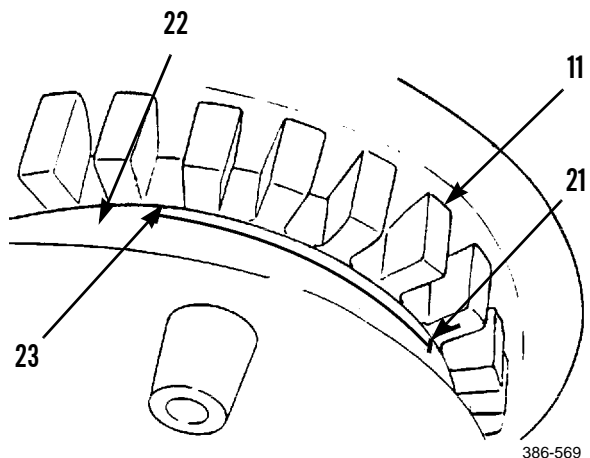
NOTE

If it is not possible to get a torque below 350 lb-ft (475 Nm) after adjusting nut is loosened, a track separation must be made (WP 0119 00) to make adjustment of bearings.

8. Remove torque multiplier (18) and install torque wrench (19) and adapter. Tighten adjusting nut (11) to 350 lb-ft (475 Nm).



9. Move driver group (16) out of the way and put a mark (21) on adjusting nut (11) and holder assembly (22) in alignment with each other. Mark (23) on holder assembly (22) should be placed to the left from mark (21) and 5.84 in. +/- 0.06 in. (148.3 mm +/- 1.5 mm) (distance "Z") from mark (21).
10. Install driver group (16) on shaft of trunnion group.
11. Install torque multiplier (18) and tighten adjusting nut (11) until marks (21 and 23) are in alignment.

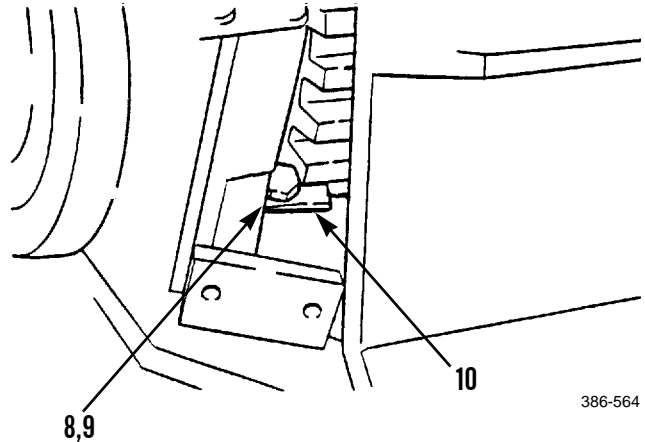


ADJUSTMENT - CONTINUED

NOTE

If necessary, tighten adjusting nut to install lock in one adjusting nut.

12. Install lock (10) with capscrew (8) and nut (9).



386-564

13. Remove the following tools: capscrews, washers, bearing adjusting tool and stand.



WARNING

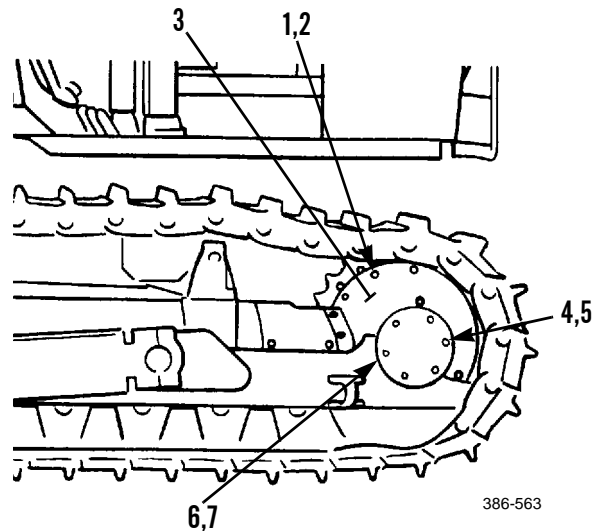


Exposure to silicone RTV compound may be hazardous to your health. Contact with eyes can cause severe irritation and burns. Compound can be absorbed into the skin and can cause irritation or skin sensitization. Inhalation of vapors can cause respiratory tract irritation; prolonged inhalation can result in an allergic reaction. Vapors are combustible. Do not use near open flame. Wear eye and skin protection and avoid inhalation of vapors. Use only in a well-ventilated area. Failure to follow this warning can cause injury or death.

NOTE

Coat both sides of new gasket (7) with silicone RTV compound.

14. Position new gasket (7) and cap (6) and install six bolts (4) and new lockwashers (5).
15. Install guard (3) with six bolts (1) and new lockwashers (2).
16. Lubricate track roller frame outer bearings by filling retainer cavity with GAA grease (WP 0009 00).
17. Lower machine to ground (WP 0178 00).
18. Adjust track (WP 0120 00).



386-563

END OF WORK PACKAGE

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STEERING CLUTCH AND FINAL DRIVE CASE TOP COVERS REPLACEMENT

0105 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Link, lifting (Item 124, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Lifting equipment, 200 lb capacity
 Bolt, 3/8 -16 x 1-1/2 in.

Materials/Parts

Compound, silicone, RTV (Item 9, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Gasket (8)

Materials/Parts - Continued

Lockwasher (3 and 7)
 Screw, forcing (two), 1/2 in. -13NC

Personnel Required

Two

Equipment Condition

Seat and seat base assembly removed (WP 0137 00)
 Fuel tank removed (WP 0049 00)
 Steering brake linkage disconnected from brake actuating mechanism (WP 0121 00)
 Breather removed from cover (WP 0099 00)

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

REMOVAL



WARNING

Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may cause injury.

NOTE

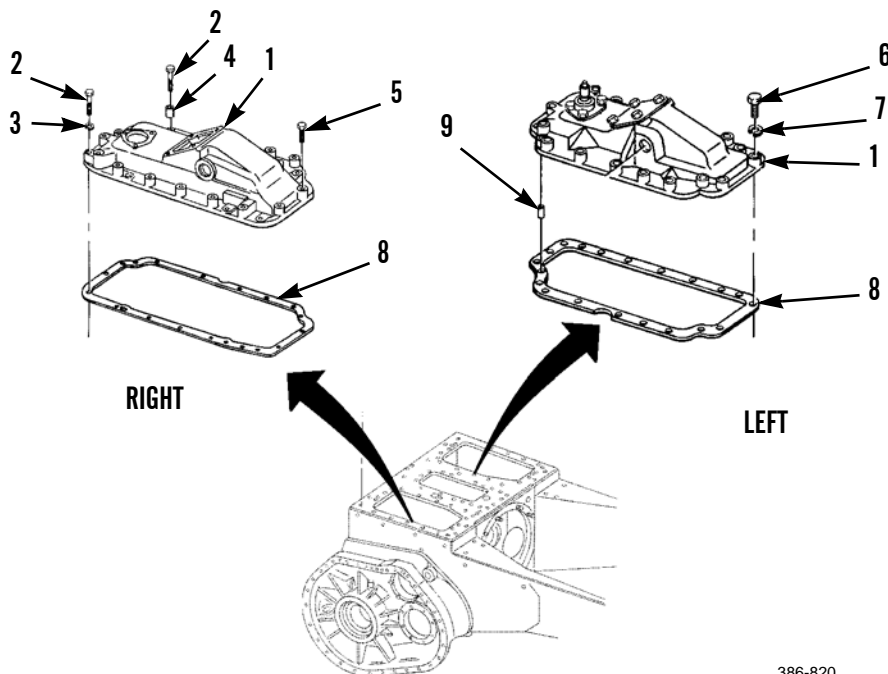
Removal of right and left covers is the same except for minor differences in mounting hardware.

1. If removing cover (1) on right side, remove 15 bolts (2), lockwashers (3), two spacers (4) and bolt (5). Discard lockwashers.
2. If removing cover (1) on left side, remove 16 bolts (6) and lockwashers (7). Discard lockwashers.

NOTE

Cover weighs 65 lb (30 kg).

3. Install two lifting links with 3/8 -16 x 1-1/2 in. bolts in cover (1), positioned to ensure a balanced lift.
4. Attach a nylon sling to lifting links and attach sling to a suitable lifting device. Take up slack in sling.
5. Install two forcing screws in cover (1) and separate cover from steering clutch and final drive case.
6. Lift cover (1) from steering clutch and final drive case and remove.
7. Remove forcing screws from cover (1).
8. If cover (1) is being replaced, remove lifting device, sling, bolts, and lifting links from cover.
9. Remove gasket (8) and discard.
10. If damaged, remove four pins (9) from steering clutch and final drive case where left cover (1) was installed.



386-820

INSTALLATION

1. Wipe mating surfaces clean with a rag. Ensure all gasket material is removed and mounting surfaces are clean and dry.
2. If removed, install four pins (9) to left side of steering clutch and final drive case.

**WARNING**

Exposure to silicone RTV compound may be hazardous to your health. Contact with eyes can cause severe irritation and burns. Compound can be absorbed into the skin and can cause irritation or skin sensitization. Inhalation of vapors can cause respiratory tract irritation; prolonged inhalation can result in an allergic reaction. Vapors are combustible. Do not use near open flame. Wear eye and skin protection and avoid inhalation of vapors. Use only in a well-ventilated area. Failure to follow this warning can cause injury or death.

3. Apply silicone RTV compound to both sides of new gasket (8). Position gasket on steering clutch and final drive case, with bolt holes aligned.

**WARNING**

Use caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may cause injury.

NOTE

Cover weighs 65 lb (30 kg).

4. If removed, install two lifting links with 3/8 -16 x 1-1/2 in. bolts in cover (1), positioned to ensure a balanced lift.
5. If removed, attach a nylon sling to lifting links and attach sling to a suitable lifting device.
6. Lift cover (1) into position on gasket (8) and align mounting bolt holes.
7. Remove lifting device, bolts and lifting links from cover (1).
8. If installing cover (1) on right side, install 15 new lockwashers (3), bolts (2), two spacers (4) and bolt (5).
9. If installing cover (1) on left side, install 16 new lockwashers (7) and bolts (6).
10. Tighten bolts (2 and 6) to 100 lb-ft (136 Nm).
11. Install breather in cover (WP 0099 00).
12. Connect steering brake linkage to brake actuating mechanism (WP 0121 00).
13. Install fuel tank (WP 0049 00).
14. Install seat and seat base assembly (WP 0137 00).

END OF WORK PACKAGE

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DRIVESHAFT AND U-JOINT REPLACEMENT

0106 00**THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Materials/Parts

Grease, GAA (Item 15, WP 0184 00)

Lockwasher (3 and 6)

Personnel Required

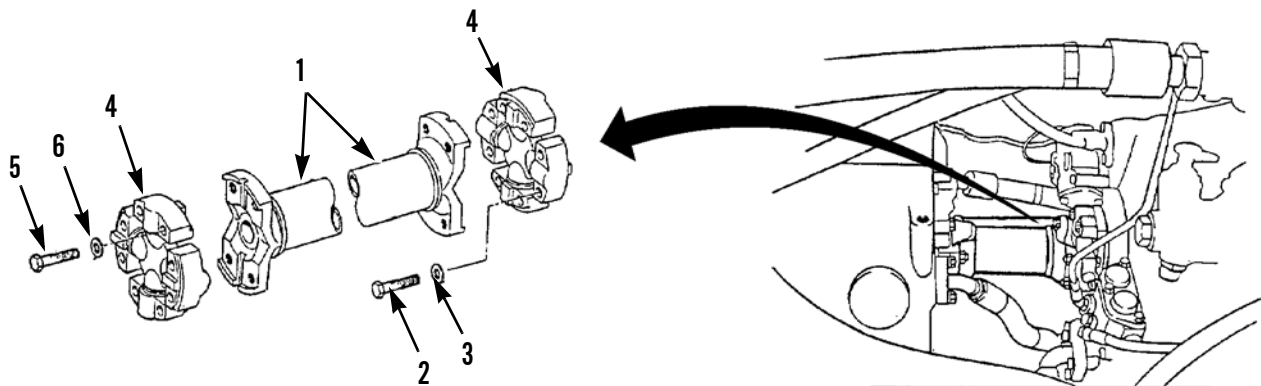
Two

Equipment Condition

Floor plates removed (WP 0135 00)

REMOVAL

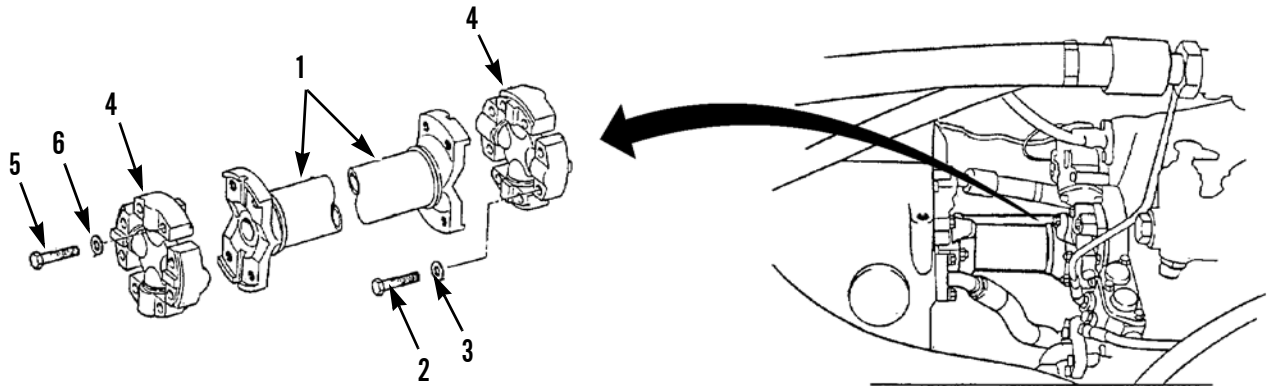
1. Use a nylon sling to support driveshaft (1). Remove eight capscrews (2) and lockwashers (3) from U-joints (4), transmission and torque divider. Remove driveshaft with U-joints. Discard lockwashers.
2. Remove four capscrews (5), lockwashers (6) and U-joint (4) from each end of driveshaft (1). Discard lockwashers.



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DRIVESHAFT AND U-JOINT REPLACEMENT - CONTINUED**0106 00****INSTALLATION**

1. Install U-joint (4) to each end of driveshaft (1) with four new lockwashers (6) and capscrews (5). Tighten capscrews to 40 lb-ft (54 Nm).
2. Use a nylon sling to support driveshaft (1) with U-joints (4). Install on transmission and torque divider with eight new lockwashers (3) and capscrews (2).



386-134

3. As required, apply grease to each U-joint grease fitting.
4. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)

Oil, lubricating (Item 25, WP 0184 00)

Lockwasher (2, 6 and 9)

Personnel Required

Two

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

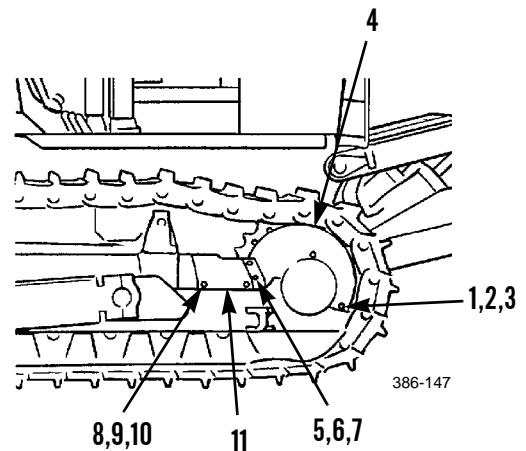
Machine parked on level ground (TM 5-2410-233-10)

NOTE

Use this procedure for either side of track.

REMOVAL

1. Remove three bolts (1), lockwashers (2) and washers (3) from guard (4). Discard lockwashers.
2. Remove two bolts (5), lockwashers (6), washers (7) and guard (4). Discard lockwashers.
3. Remove four bolts (8), lockwashers (9), washers (10) and guard (11). Discard lockwashers.

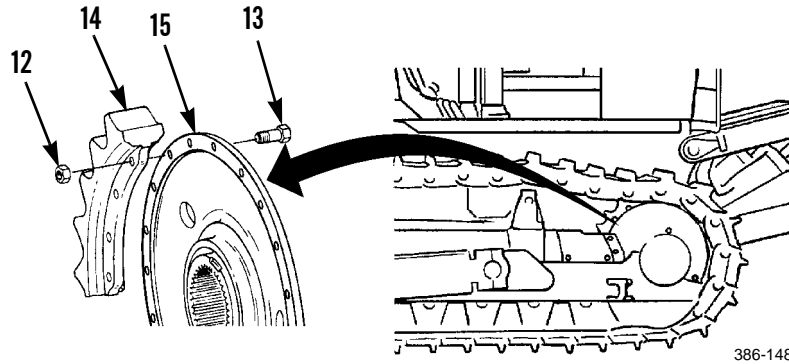


REMOVAL - CONTINUED

NOTE

Move tractor at intervals and inspect five sprocket segments per track for cracked or broken teeth and loose or missing nuts and capscrews.

4. Remove four nuts (12), bolts (13) and sprocket segment (14) from hub (15).



INSTALLATION

NOTE

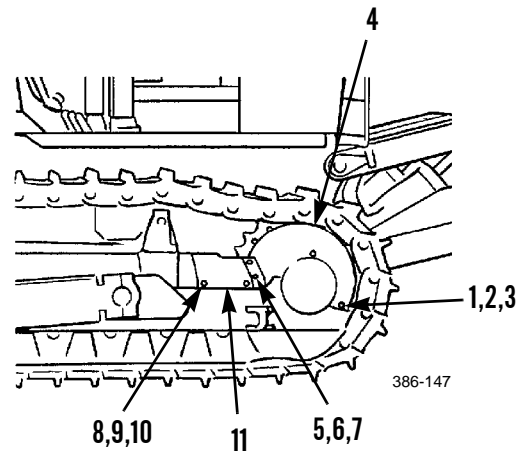
- Ensure mounting surfaces are clean.
- Lightly coat bolt threads with oil before installation.

1. Install sprocket segment (14) to hub (15) with four bolts (13) and nuts (12). Tighten nuts to a wet torque of 220 lb-ft (298 Nm), then tighten 1/3 turn more.

NOTE

Apply antiseize compound to all guard mounting bolts before installation.

2. Install guard (11) with four washers (10), new lockwashers (9) and bolts (8).
3. Install two washers (7), new lockwashers (6) and bolts (5) to guard (4).
4. Install three washers (3), new lockwashers (2) and bolts (1) to guard (4).



5. Test drive and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

EQUALIZER BAR ASSEMBLY REPLACEMENT**0108 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

Wood block, 4 in. x 4 in. x 12 in.

Lockwasher (2)

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

Right-front track carrier roller removed (WP 0114 00)

Two frontmost track roller frame guards removed (WP 0111 00)

Crankcase and transmission guards opened (WP 0129 00)

Machine lifted off ground (WP 0178 00)

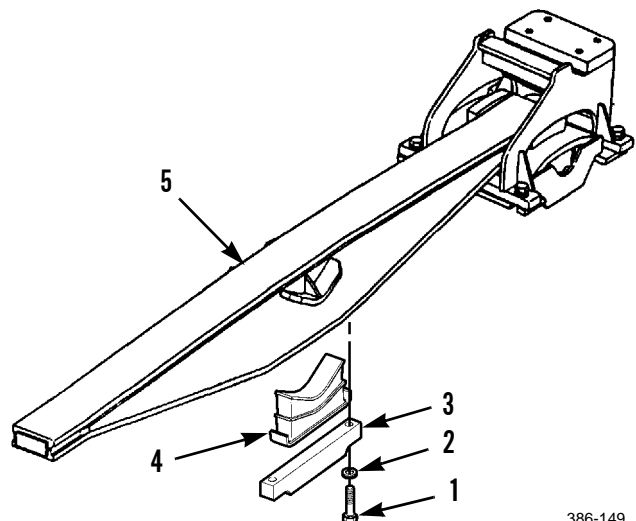
REMOVAL**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Equalizer bar weighs 300 lb (136 kg).

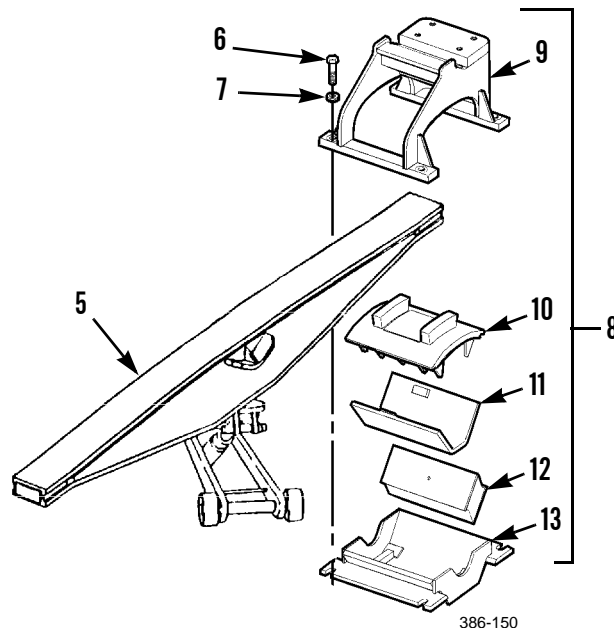
1. Remove two bolts (1), lockwashers (2), plates (3) and pads (4) from equalizer bar (5). Discard lockwashers.
2. From rear of tractor, position hydraulic floor jack under equalizer bar (5). Raise jack until it contacts equalizer bar.



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REMOVAL - CONTINUED

3. Remove four bolts (6) and washers (7) from right support assembly (8) on right track roller frame.
4. Use hydraulic floor jack to lift equalizer bar (5) enough to remove right support (9).
5. Carefully remove equalizer bar (5) by rotating bar and pulling floor jack towards rear of tractor. Lower equalizer bar as soon as bar clears track roller frames.
6. Use a suitable lifting device to remove equalizer bar (5) from floor jack.
7. If necessary, remove remaining right support assembly (8) from right track roller frame as follows:
 - a. Remove upper plate (10).
 - b. Remove lower plate (11).
 - c. Remove two pads (12).
 - d. Remove lower suspension (13).
 - e. Remove bar.
8. If necessary, remove left front track carrier roller (WP 0114 00) and repeat step 3 to remove left support assembly.
9. Repeat step 7, a through d, for left support assembly, if necessary.

**INSTALLATION****WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Equalizer bar weighs 300 lb (136 kg).

1. Install right support assembly (8) as follows:
 - a. Install bar.
 - b. Install lower suspension (13).
 - c. Install two pads (12).
 - d. Install lower plate (11).
 - e. Install upper plate (10).
2. If removed, repeat step 1, a through e, for left support assembly (8).
3. Install left support (9) with four washers (7) and bolts (6). Tighten bolts to 350 lb-ft (475 Nm).
4. Use a suitable lifting device to place equalizer bar (5) on hydraulic floor jack.

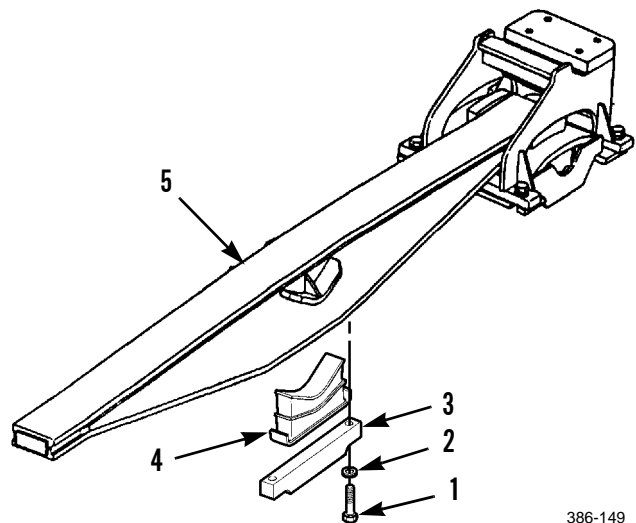
EQUALIZER BAR ASSEMBLY REPLACEMENT - CONTINUED**0108 00****INSTALLATION - CONTINUED**

5. Push floor jack with equalizer bar (5) between tracks at rear of tractor. Rotate bar to align one end with left support assembly (8).
6. Move floor jack forward to position other end of equalizer bar in line with right upper plate (10).
7. Install right support (9) over end of equalizer bar (5) and on track roller frame.

NOTE

Make sure equalizer bar is centered on upper plate.

8. Lower hydraulic jack until weight of equalizer bar (5) is on right upper plate (10).
9. Install four washers (7) and bolts (6) on right support (9). Tighten capscrews to 350 lb-ft (475 Nm).
10. Install two pads (4), plates (3), new lockwashers (2) and bolts (1) on equalizer bar (5).
11. Tighten bolts (1) to 350 lb-ft (475 Nm).
12. Lower machine to ground (WP 0178 00).
13. Close transmission and crankcase guards (WP 0129 00).
14. Install track roller frame guards (WP 0111 00).
15. Install right-front track carrier roller. If removed, install left-front carrier roller (WP 0114 00).
16. Operate tractor and check for proper operation (TM 5-2410-233-10).



386-149

END OF WORK PACKAGE

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TRACK ROLLERS REPLACEMENT

0109 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, machine shop (Item 98, WP 0185 00)
- Lifting equipment, 200 lb capacity

Materials/Parts

- Lockwasher (2)

References

- TM 5-2410-233-10
- WP 0119 00
- WP 0120 00
- WP 0178 00

Personnel Required

Two

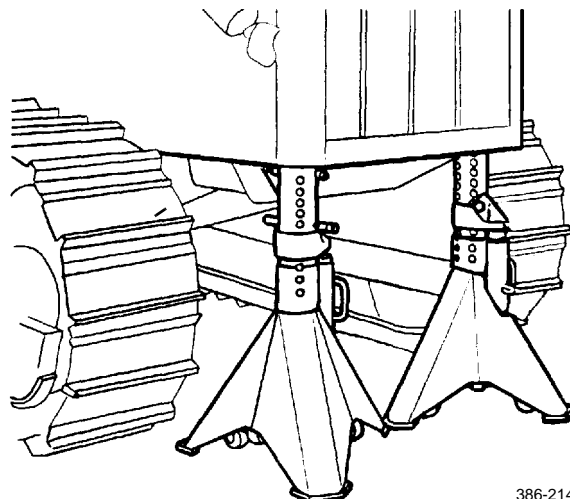
Equipment Condition

- Track outer roller guard removed (WP 0112 00)
 - Machine lifted off ground (WP 0178 00)
-

REMOVAL

NOTE

If tractor has less than 1000 hours on it, you may have to separate track to remove track rollers (WP 0119 00).



386-214

REMOVAL - CONTINUED**WARNING**

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.
- Use assistance and extreme caution when using a chain and tanker bar to stabilize track roller. Ensure track roller is securely supported prior to loosening mounting hardware.

NOTE

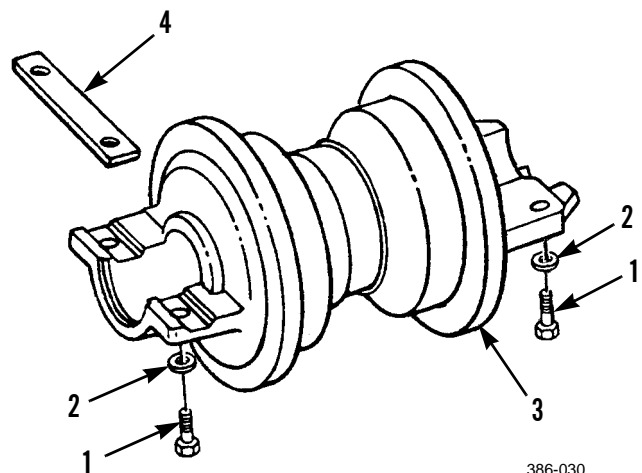
- Weight of a single-flanged roller is 195 lb (88 kg). Weight of a double-flanged roller is 215 lb (98 kg).
- To remove an end roller, it may be necessary to remove roller next to it for clearance.

1. Adjust track (WP 0120 00) until it is tight against track rollers.

NOTE

A single-flanged roller is illustrated. Location of capscrews is the same for both single-flanged and double-flanged rollers.

2. Attach a suitable lifting device to chain and pry bar under track roller (3) to hold roller in position.
3. Remove four capscrews (1) and lockwashers (2) that secure track roller (3) in place. Discard lockwashers.
4. Open track adjusting relief valve (WP 0120 00). Lower track until track roller clears frame.
5. Remove lock collar (4) and track roller (3).



386-030

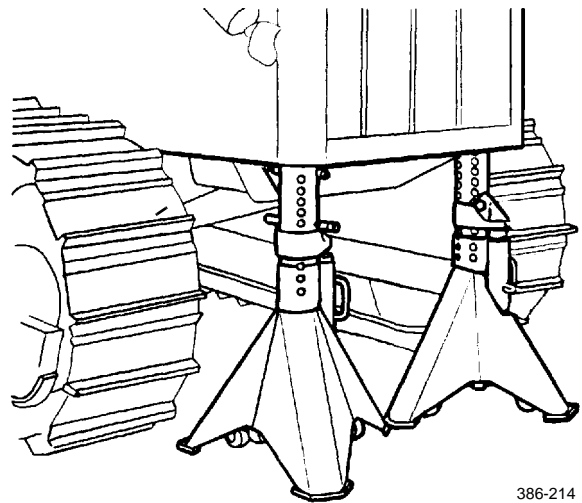
INSTALLATION**WARNING**

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.
- Use assistance and extreme caution when using a chain and tanker bar to stabilize track roller. Ensure track roller is securely supported.

NOTE

Weight of a single-flanged roller is 195 lb (88 kg). Weight of a double-flanged roller is 215 lb (98 kg).

1. Attach a suitable lifting device to chain and pry bar under track roller (3) to hold roller in position.
2. Install track roller (3) in lock collar (4) and position track roller.
3. Adjust track to tighten (WP 0120 00) so track roller is placed into position and aligned with holes.
4. Install four new lockwashers (2) and capscrews (1) to secure track roller (3). Tighten capscrews to 550 lb-ft (746 Nm).



386-214

5. Lower machine to ground (WP 0178 00).
6. Adjust track (WP 0120 00).
7. Install outer track roller guard (WP 0112 00).
8. Test drive and check track for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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TRACK ROLLER FRAME ASSEMBLY REPLACEMENT

0110 00

THIS WORK PACKAGE COVERS

Removal, Installation, Alignment

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Link, lifting, (Item 44, WP 0185 00)
- Puller, ratchet lever, cable type (Item 82, WP 0185 00)
- Lifting equipment, 5,000 lb capacity
- Bolt, 3/4 -10 x 1-1/2 in.

Materials/Parts

- Lockwasher (7, 13 and 16)
- Wood block, 4 in. x 4 in. x 12 in.

References

- TM 5-2410-233-10
- WP 0118 00
- WP 0120 00
- WP 0178 00

Personnel Required

Three

Equipment Condition

- Track removed (WP 0119 00)
- Track roller frame guards removed (WP 0111 00)

REMOVAL



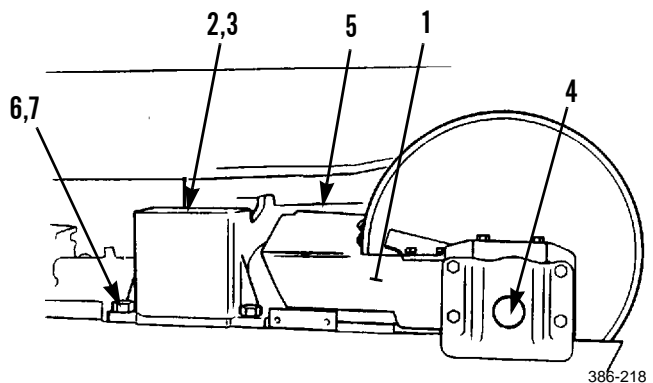
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Weight of an assembled track roller frame is 4,000 lb (1,804 kg).

1. Attach ratchet puller to front of track roller frame (1).
2. Install two lifting links (2) with 3/4 -10 x 1-1/2 in. bolts and attach a suitable lifting device to both points on front of track roller frame (3 and 4).
3. Insert a block of wood between equalizer bar and frame.
4. Attach ratchet puller to lifting device at point (4).
5. Lift track roller frame (1) and use ratchet puller to raise evenly and remove tension on equalizer bar (5).
6. Remove four capscrews (6) and lockwashers (7) that secure front support assembly (3) to track roller frame (1). Discard lockwashers.



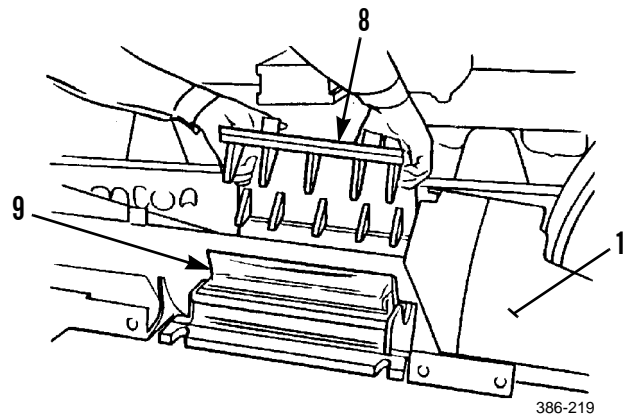
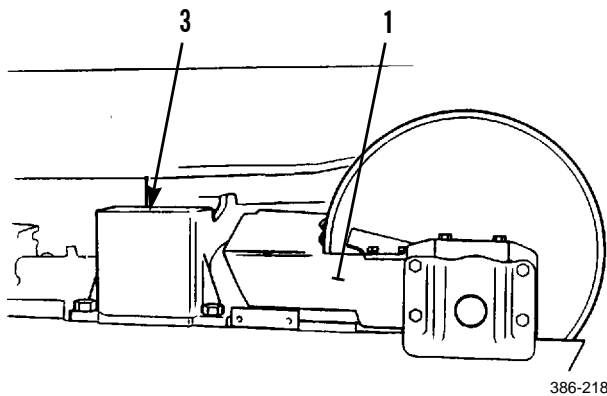
REMOVAL - CONTINUED**WARNING**

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.
- Ratchet puller must be attached to track roller frame in a manner to evenly distribute weight of frame. Failure to do so may cause frame to tip, causing personal injury or death.

NOTE

Weight of front support assembly is approximately 70 lb (32 kg).

7. Lower front of track roller frame (1) onto track and remove front support assembly (3).
8. Remove plate (8) and pads (9) from track roller frame (1).



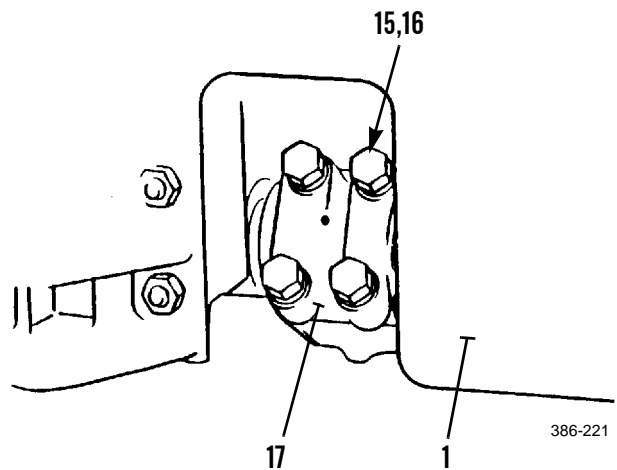
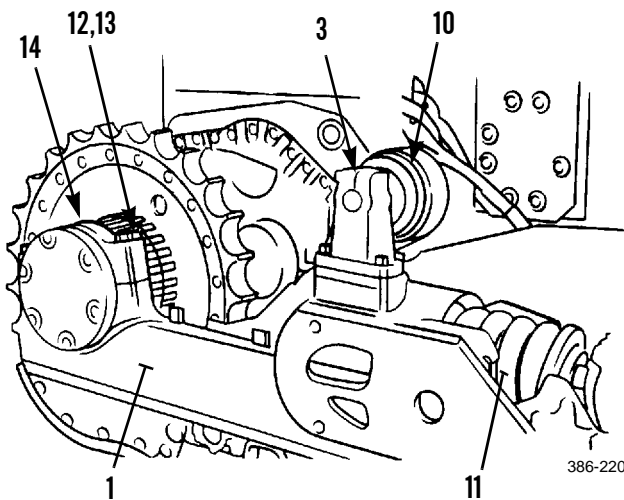
REMOVAL - CONTINUED



WARNING

Ratchet puller must be attached to track roller frame in a manner to evenly distribute weight of frame. Failure to do so may cause frame to tip, which may cause injury or death.

9. Attach lifting device to rear track carrier roller (10) and ratchet puller to lifting device and to recoil spring (11).
10. Adjust ratchet puller so rear track carrier roller (10), rear support assembly (3) and recoil spring (11) are level and balanced.
11. Remove four capscrews (12), lockwashers (13) and remove cap (14) from track roller frame (1). Discard lockwashers.
12. Remove four capscrews (15), lockwashers (16) and remove cap (17) from rear of track roller frame (1). Discard lockwashers.



13. Lower track roller frame (1) onto track.
14. Remove track roller frame (1) from track.

INSTALLATION**WARNING**

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.
- Ratchet puller must be attached to track roller frame in a manner to evenly distribute weight of frame. Failure to do so may cause frame to tip, causing personal injury or death.

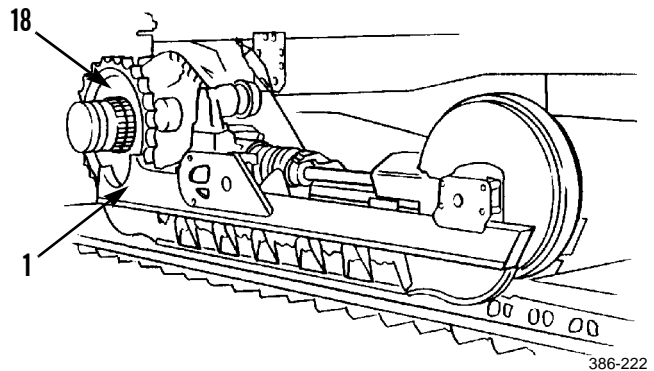
NOTE

Weight of an assembled track roller frame is 4,000 lb (1,804 kg).

1. Attach lifting device to rear of track roller frame (1).
2. Place track roller frame (1) in position on track.
3. Lift rear of track roller frame (1) in position on final drive sprocket outer hub (18).

**WARNING**

Ratchet puller must be attached to track roller frame in a manner to evenly distribute weight of frame. Failure to do so may cause frame to tip, which may cause injury or death.



4. Attach lifting device to rear track carrier roller (10) and ratchet puller to lifting device and to recoil spring (11).
5. Adjust ratchet puller so rear track carrier roller (10), rear support assembly (3) and recoil spring (11) are level and balanced.
6. Install cap (14) to track roller frame (1) with four new lockwashers (13) and capscrews (12). Tighten capscrews to 375 lb-ft (509 Nm).
7. Install cap (17) to track roller frame (1) with four new lockwashers (16) and capscrews (15). Tighten capscrews to 375 lb-ft (509 Nm).
8. Install pads (9) and plate (8) in position on track roller frame (1).

INSTALLATION - CONTINUED**WARNING**

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.
- Ratchet puller must be attached to track roller frame in a manner to evenly distribute weight of frame. Failure to do so may cause frame to tip, causing personal injury or death.

NOTE

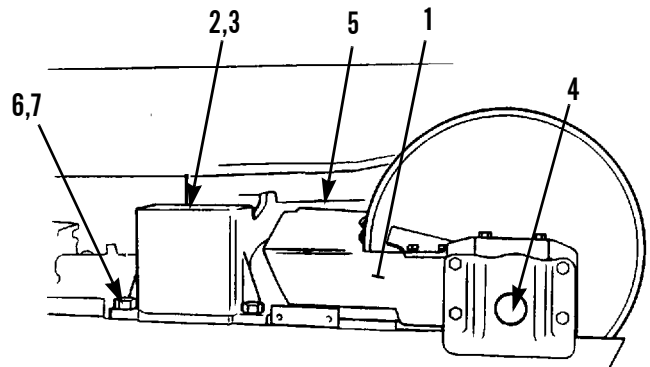
Weight of front support assembly is approximately 70 lb (32 kg)

9. Attach lifting device to lifting links (2) and both lifting points (3 and 4) on front of track roller frame (1).
10. Attach ratchet puller to front of track roller frame (1) and lifting point (4).

NOTE

Do not hit front support assembly when track roller frame is put into position under equalizer bar.

11. Lift track roller frame (1) into position on equalizer bar (5).
12. Lift track roller frame (1) and use ratchet puller to raise evenly until capscrew holes in front support assembly (3) are aligned with capscrew holes in track roller frame.
13. Install front support assembly (3) to track roller frame (1) with four new lockwashers (7) and capscrews (6). Tighten capscrews to 350 lb-ft (475 Nm).
14. Lower track roller frame (1) until weight is on equalizer bar (5). Remove lifting device, bolts, lifting links and ratchet puller.



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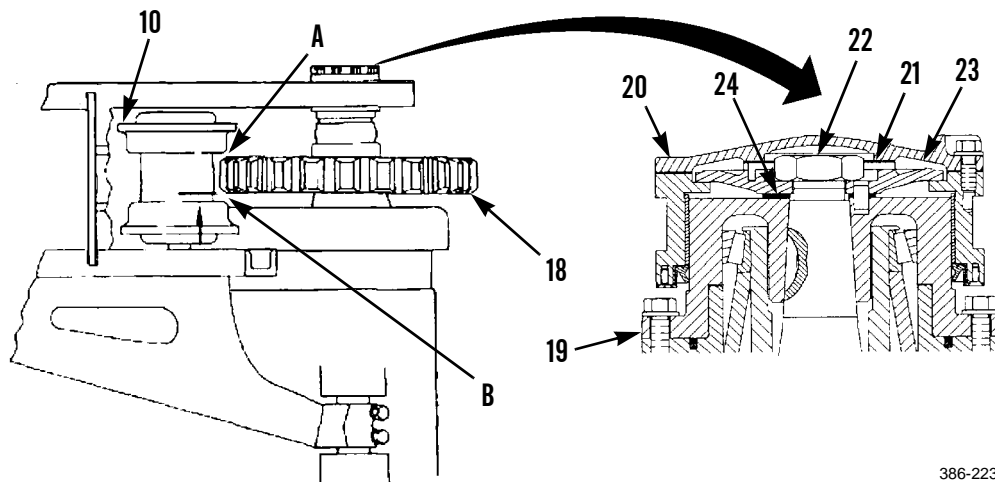
15. Install track roller frame guards (WP 0111 00).
16. Install track (WP 0119 00).

ALIGNMENT**NOTE**

The following steps must be completed on each side of machine.

1. Place machine on flat and level surface.
2. Measure and mark centerline of sprocket (18) and centerline of rear track carrier roller (10). Centerlines should be lined up with each other. Distance A should equal distance B.
3. If centerline of sprocket (18) is more than 0.06 in. (1.5 mm) from centerline of rear track carrier roller (10), perform steps 4-12 to align track roller frame.

ALIGNMENT - CONTINUED



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

4. Raise machine (WP 0178 00) until both tracks are off ground.
5. Release tension from tracks (WP 0119 00).

NOTE

Refer to WP 0118 00 for assistance in performing steps 6-9.

6. Remove holder assembly (19).
7. Remove cap (20), lock (21), nut (22), retainer assembly (23) and shims (24).

NOTE

Thickness of one shim is 0.036 in. (0.91 mm). Use the least amount of shims and do NOT use more than seven shims on either side of machine.

8. Change alignment of rear track carrier roller (10) to sprocket (18) by installing or removing shim(s) (24) from final drive support.
 - a. Install shim(s) (24) between retainer assembly (23) and holder (19) of final drive to move track roller frame out to make distance A more.
 - b. Remove shim(s) (24) between retainer assembly (23) and holder (19) of final drive to move track roller frame in to make distance A less.
9. Install retainer assembly (23), nut (22), lock (21), and cap (20).
10. Lower machine to ground and remove lifting device (WP 0178 00).
11. Adjust track (WP 0120 00).
12. Run machine and check track for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

TRACK ROLLER FRAME GUARDS REPLACEMENT

0111 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Personnel Required

Two

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)
Lockwasher (2, 6, 10 and 14)

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

REMOVAL

NOTE

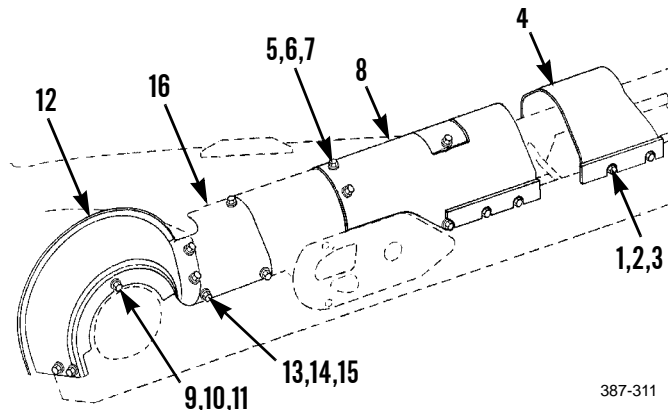
Guard (4) weighs 23 lb (10 kg).

1. Remove five bolts (1), lockwashers (2), washers (3) and guard (4) from front end of track roller frame. Discard lockwashers.

NOTE

Guard (8) weighs 37 lb (17 kg). All other guards weigh less than 23 lb (10 kg).

2. Remove eight bolts (5), lockwashers (6), washers (7) and guard (8) from center of roller frame. Discard lockwashers.
3. Remove five bolts (9), lockwashers (10), washers (11) and guard (12). Discard lockwashers.
4. Remove three bolts (13), lockwashers (14), washers (15) and guard (16) from rear end of roller frame. Discard lockwashers.

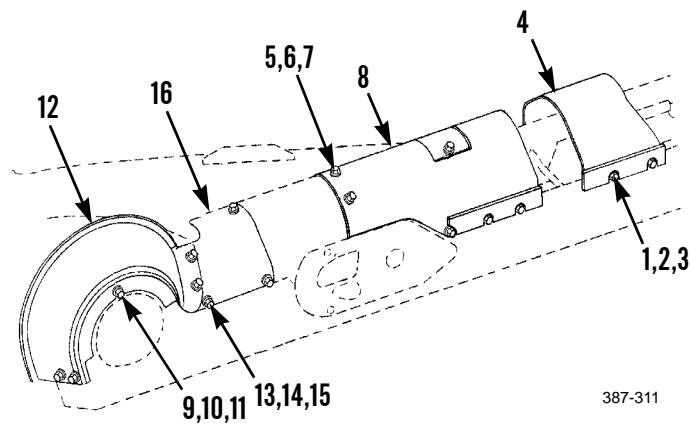


387-311

INSTALLATION**NOTE**

- **Guard (8) weighs 37 lb (17 kg). All other guards weigh less than 23 lb (10 kg).**
- **Apply antiseize compound to all guard mounting bolts before installation.**

1. Install guard (16) with three washers (15), new lockwashers (14) and bolts (13).
2. Install guard (12) with five washers (11), new lockwashers (10) and bolts (9).
3. Install guard (8) with eight washers (7), new lockwashers (6) and bolts (5).
4. Install guard (4) with five washers (3), new lockwashers (2) and bolts (1).

**END OF WORK PACKAGE**

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 2 (Item 82, WP 0185 00)

Materials/Parts

- Compound, antiseize (Item 6, WP 0184 00)
- Lockwasher (2 and 6)

Materials/Parts - Continued

- Two wood blocks, 4 in. x 4 in. x 20 in. long

Personnel Required

- Two

Equipment Condition

- Machine parked on level ground (TM 5-2410-233-10)



WARNING

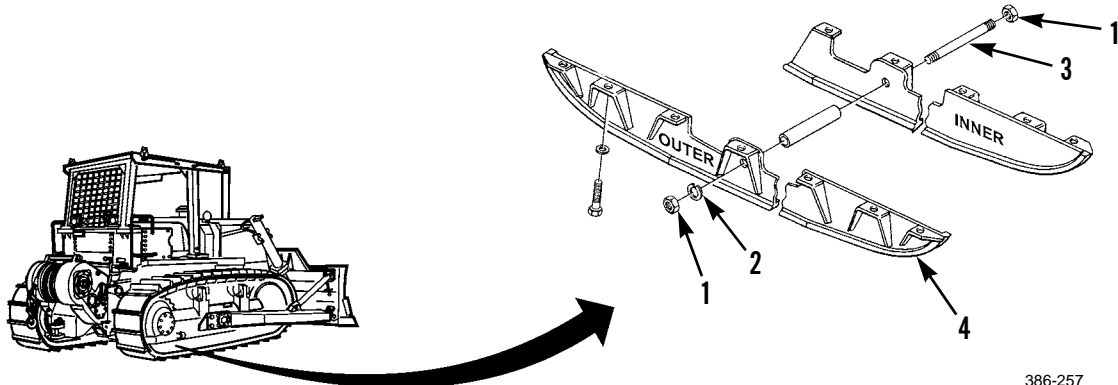
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury or death to personnel.

NOTE

- Inner guard weighs 133 lb (60 kg).
- Outer guard weighs 161 lb (73 kg).
- Right-side inner and outer track roller guards are replaced in this task. Left-side inner and outer track roller guards are replaced the same way.

REMOVAL

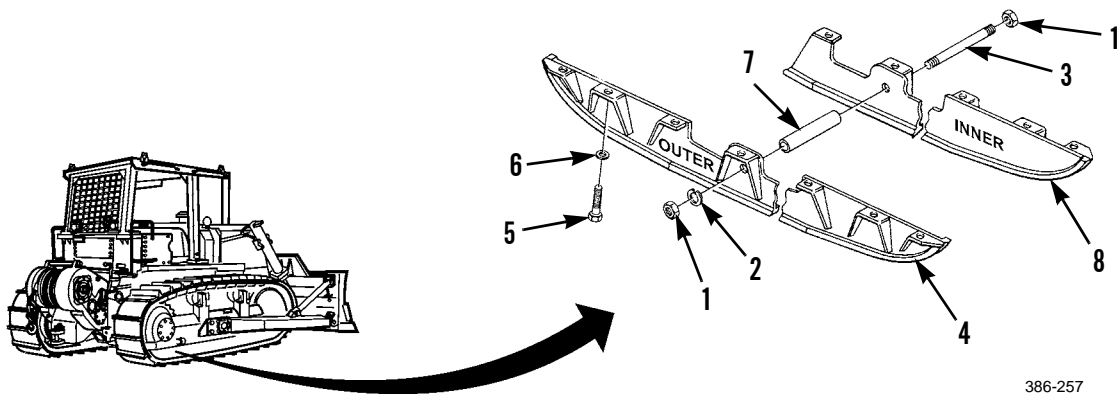
1. Remove five nuts (1) and lockwashers (2). Push rods (3) through outer guard (4). Discard lockwashers.



386-257

REMOVAL - CONTINUED

2. Place wooden blocks between track assembly and outer guard (4) at each end.
3. Remove 11 bolts (5) and washers (6) that secure outer guard (4). Use bolts to lower outer guard onto wooden blocks. Remove outer guard.
4. Remove five spacers (7) from inner rods (3).
5. Remove five rods (7) from inner guard (8).
6. Place wooden blocks between track assembly and inner guard (8) at each end.
7. Remove nine bolts (5) and washers (6) that hold inner guard (8). Use bolts to lower inner guard onto wooden blocks. Remove inner guard.



386-257

INSTALLATION**NOTE**

Apply antiseize compound to all guard mounting bolts before installation.

1. Position inner guard (8) on track roller frame and loosely install nine bolts (5) and washers (6).
2. Feed rods (3) through outer guard (4).
3. Place spacers (7) over rods (3).
4. Position outer guard (4) on track roller frame and loosely install 11 bolts (5) and washers (6).
5. Feed rods (3) through outer guard (4).
6. Loosely install five new lockwashers (2) and nuts (1) on ends of rod (3) on outer guard side.
7. Fully tighten 20 bolts (5) on outer and inner guards (4 and 8) to 500 lb-ft (678 Nm).
8. Tighten ten nuts (1) on rods (3) to 265 lb-ft (359 Nm).

END OF WORK PACKAGE

RECOIL SPRING REPLACEMENT**0113 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Press, arbor (Item 65, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Lifting equipment, 350 lb capacity

Materials/Parts

Lockwasher (8)

Personnel Required

Two

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

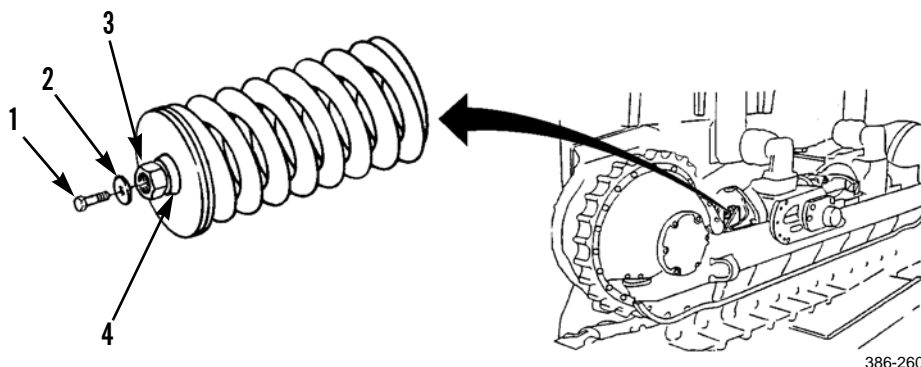
Track roller frame guards removed (WP 0111 00)

Track adjuster cylinder removed (WP 0117 00)

REMOVAL**WARNING**

- **Recoil spring is under spring tension. Use extreme caution when disassembling to avoid injury or death.**
- **Ensure there is no spring pressure on two front stops. Do NOT remove recoil spring from track roller frame until pressure is released from two front spring stops.**

1. Remove bolt (1) and washer (2).
2. Tighten nut (3) against recoil spring rear pilot (4) to relieve pressure against recoil spring stops (5).



386-260

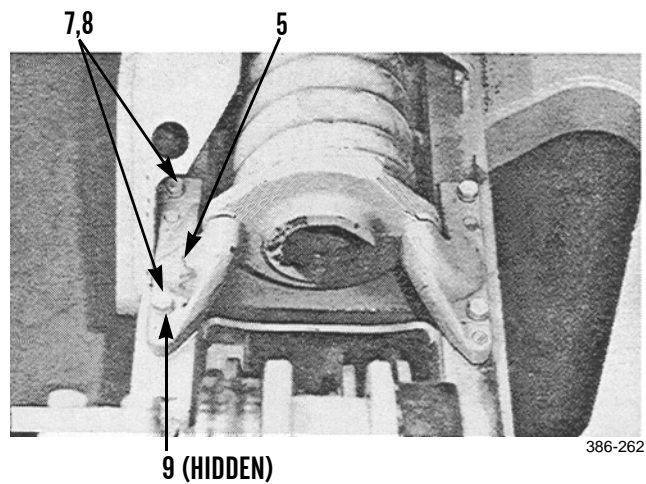
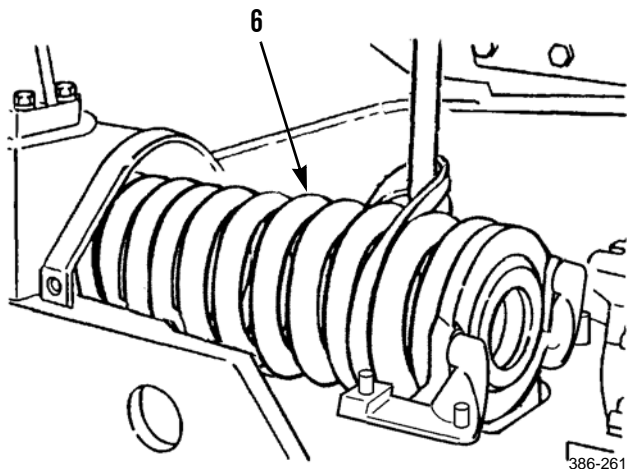
REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Recoil spring weighs 300 lb (136 kg).

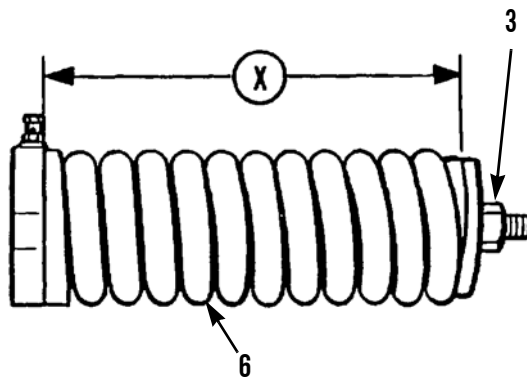
3. Attach a nylon sling and a suitable lifting device to recoil spring (6).
4. Remove four capscrews (7), lockwashers (8) and spacers (9) from two front stops (5). Discard lockwashers.
5. Remove two front stops (5) and recoil spring (6) from track roller frame.



INSTALLATION**WARNING**

- Recoil spring is under spring tension. Use extreme caution when assembling to avoid injury or death.
- Ensure that press is equipped with guards to hold spring assembly in position while it is under compression.

1. If recoil spring (6) is to be replaced, put recoil spring in a press and put spring under compression.
 - a. Remove nut (3) and slowly release spring. Spring is under compression until length of spring is 31.61 in. (80.29 cm)
 - b. Put new spring in position and put spring under compression until distance (X) is 24.75 in. (62.87 cm). Tighten nut (3) to hold spring and retainers.

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

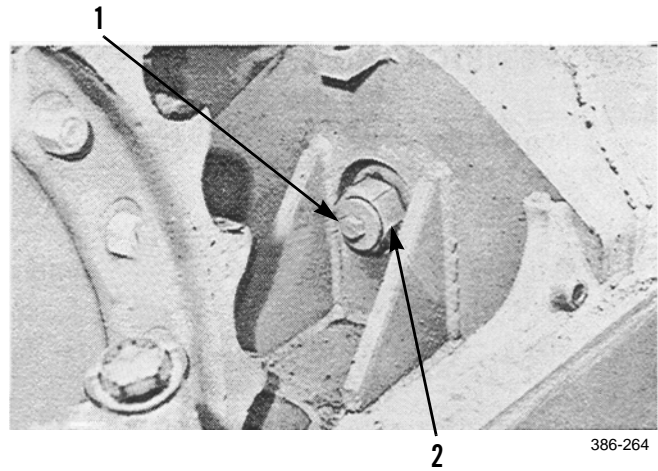
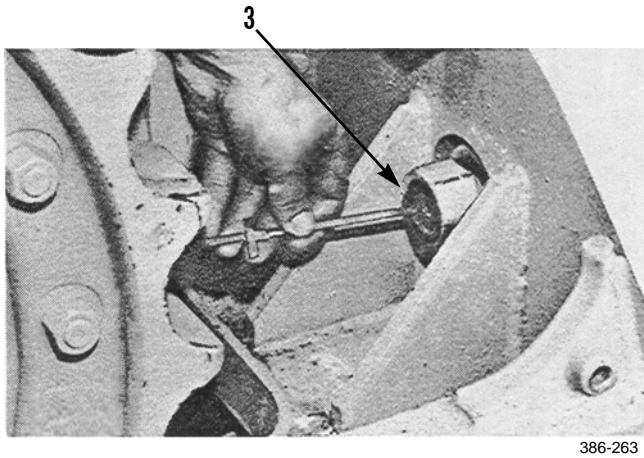
NOTE

Recoil spring weighs 300 lb (136 kg).

2. Attach a nylon sling and a suitable lifting device and position recoil spring (6) in track roller frame.
3. Install spacers (9) and recoil front stops (5) in position.
4. Install four new lockwashers (8), and capscrews (7) securing two front stops (5). Tighten capscrews to 200 lb-ft (271 Nm).

RECOIL SPRING REPLACEMENT - CONTINUED**0113 00****INSTALLATION - CONTINUED**

5. Install washer (2) and bolt (1).
6. Loosen recoil spring compression nut (3) until it extends 0.06 in. (1.5 mm) past end of bolt.



7. Install track adjuster cylinder (WP 0117 00).
8. Install track roller frame guards (WP 0111 00).
9. Test drive and check recoil spring for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

TRACK CARRIER ROLLERS REPLACEMENT

0114 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanics (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Lifting equipment, 200 lb capacity

Materials/Parts

- Compound, antiseize (Item 6, WP 0184 00)
- Lockwasher (4 and 7)
- Block, wood (4 in. x 4 in. x 12 in.)

References

- TM 5-2410-233-10
- WP 0120 00

Personnel Required

Two

Equipment Condition

Track loosened (WP 0119 00)

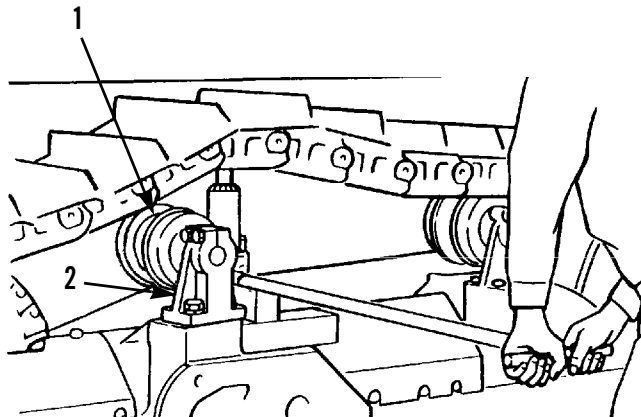
REMOVAL**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Carrier roller assembly weighs 120 lb (55 kg).

1. Place a block and hydraulic jack under track, near carrier roller (1) and lift track up and away from carrier roller.
2. Fasten a nylon sling and a lifting device to carrier roller (1) and bracket (2).



386-524

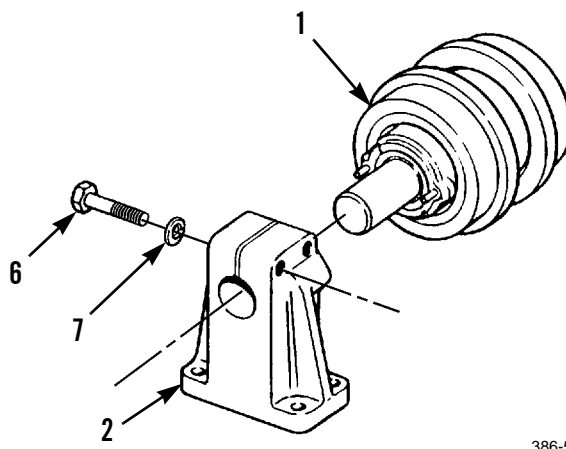
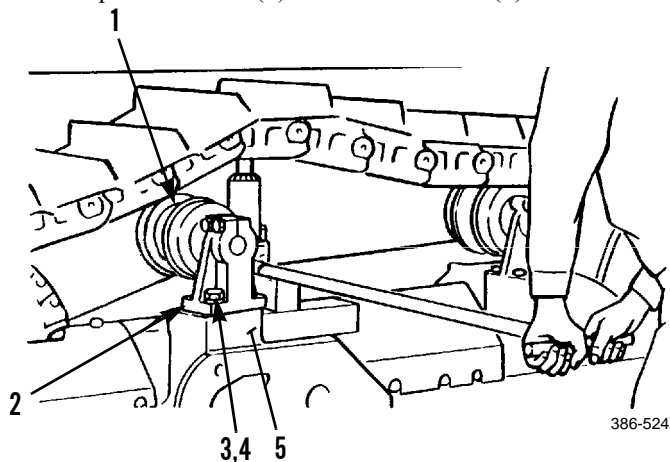
REMOVAL - CONTINUED

3. Remove four capscrews (3) and lockwashers (4) that secure bracket (2) to track roller frame (5). Discard lockwashers.
4. Remove carrier roller (1) and bracket (2) as a unit from track roller frame (5).

NOTE

Secure bracket in vise to permit removal of capscrews.

5. Remove two capscrews (6) and lockwashers (7). Discard lockwashers.
6. Separate bracket (2) from carrier roller (1).



INSTALLATION

NOTE

- **Secure bracket in vise to permit installation of carrier roller to bracket.**
- **Apply antiseize compound to all capscrews before installation.**

1. Install carrier roller (1) on bracket (2).
2. Install two new lockwashers (7) and capscrews (6).



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Carrier roller assembly weighs 120 lb (55 kg).

1. Fasten a nylon sling and a suitable lifting device and position carrier roller (1) and bracket (2) as a unit on track roller frame (5).

INSTALLATION - CONTINUED

2. Secure bracket (2) to track roller frame (5) with four new lockwashers (4) and capscrews (3).
3. Use a block and hydraulic jack and lower track into carrier roller (1).
4. Adjust track (WP 0120 00).
5. Test drive and check track for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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TRACK IDLER REPLACEMENT

0115 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Sling, nylon (2) (Item 100, WP 0185 00)
- Lifting equipment, 1,000 lb capacity

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

Track separated (WP 0119 00)

Materials/Parts

- Compound, antiseize (Item 6, WP 0184 00)
- Lockwasher (3, 13 and 17)

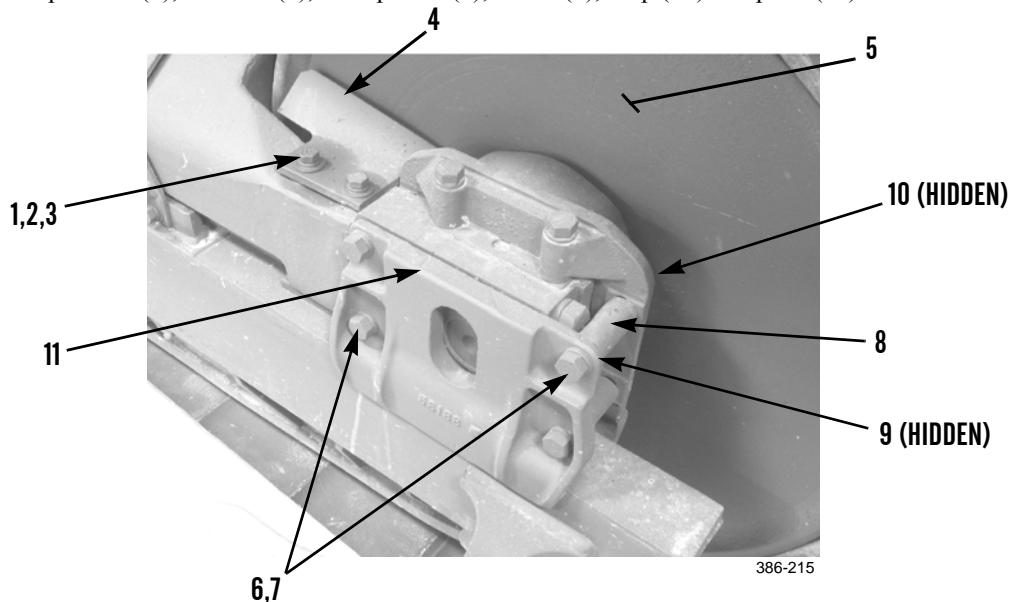
REMOVAL

1. Remove two capscrews (1), washers (2), lockwashers (3) and guard (4) from both sides of idler (5). Discard lockwashers.

NOTE

Keep shims with respective plates for installation.

2. Remove four capscrews (6), washers (7), two spacers (8), shims (9), strip (10) and plate (11) from both sides of idler (5).



REMOVAL - CONTINUED

- Remove two capscrews (12) and lockwashers (13) from bearing (14) and yoke (15) on both sides of idler (5). Discard lockwashers.

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

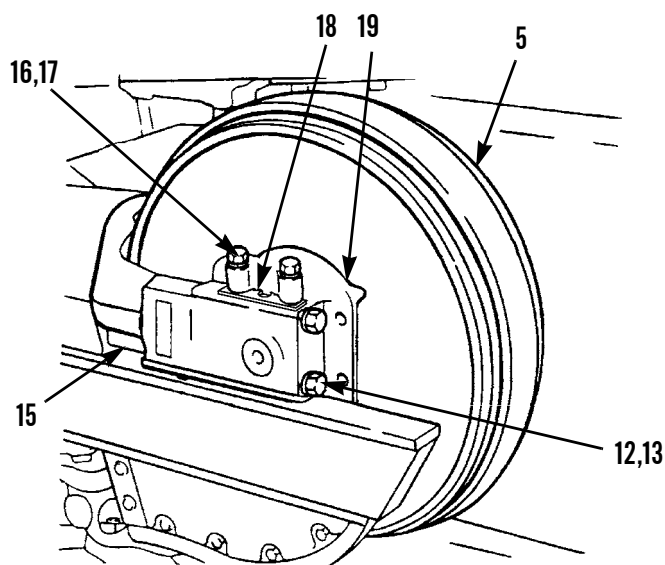
Idler weighs 500 lb (227 kg).

- Attach a nylon sling and a suitable lifting device to each side of idler (5) and support.

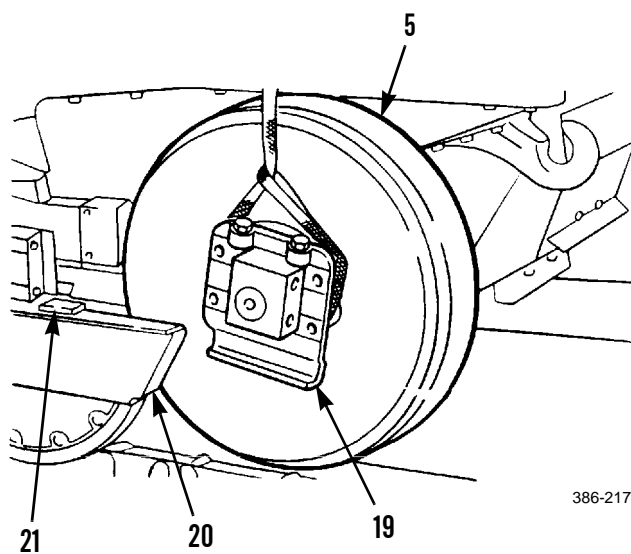
NOTE

Keep shims together with their respective collar for assembly.

- Remove two capscrews (16), lockwashers (17) and shims (18) at top of collar assembly (19) at end of yoke (15), on both sides of idler (5). Discard lockwashers.
- Move idler (5) forward until collar assembly (19) clears end of track roller frame (20).
- Remove idler (5).



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386-217

INSTALLATION



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

- Idler weighs 500 lb (227 kg).
- Apply antiseize compound to all capscrews before installation.

1. Attach a nylon sling and a suitable lifting device to each side of idler (5). Lift idler into position on track roller frame (20).
2. Install two new lockwashers (13) and capscrews (12) through bearing (14) into yoke (15) on each side of idler (5).

NOTE

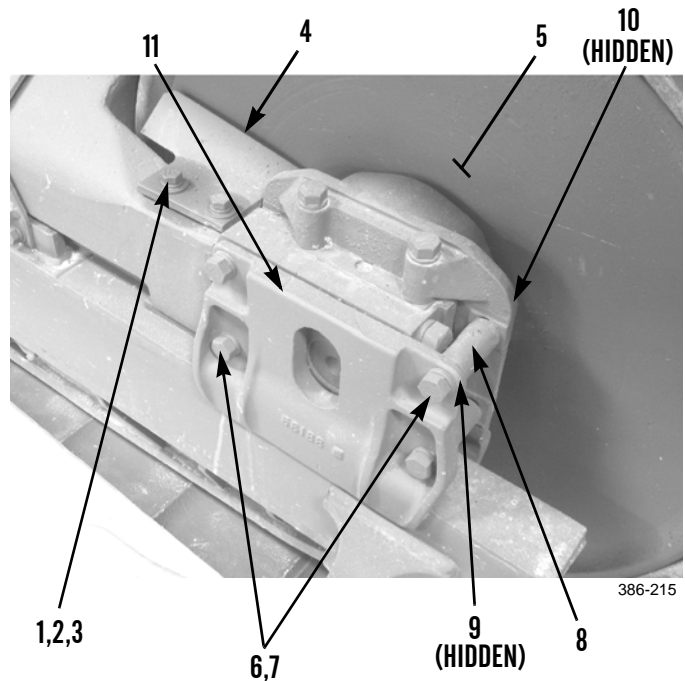
Minimum clearance must be 0.030-0.075 in. (0.76-1.91 mm) between yoke (15) and plate assembly (21). Add or remove shim(s) (18) as necessary.

3. Install shims (18), two new lockwashers (17) and capscrews (16) at top of collar (19) and bearing (14) on each side of idler (5).
4. Install plate (11), two spacers (8), four new lockwashers (7), capscrews (6) and two strips (10) to each side of idler (5). Leave capscrews loose for shimming.

NOTE

Add or remove shims (9) as needed to provide a clearance of 0.030 in. +/- 0.020 in. (0.76 mm +/- 0.51 mm) between plate (11) and track roller frame (20).

5. Remove two capscrews (6) and lockwashers (7) and install shims (9) between plate (11) and spacers (8) on each side of idler (5).
6. Reinstall capscrews (6) and lockwashers (7). Tighten capscrews to 200 lb-ft (271 Nm).
7. Install guard (4) with two capscrews (1), new lockwashers (3) and washers (2) on each side of idler (5).
8. Connect track (WP 0119 00).
9. Test drive and check track for proper operation (TM 5-2410-233-10).



END OF WORK PACKAGE

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TRACK IDLER YOKE REPLACEMENT

0116 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Lifting equipment, 200 lb capacity

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

Track idler removed (WP 0115 00)

Materials/Parts

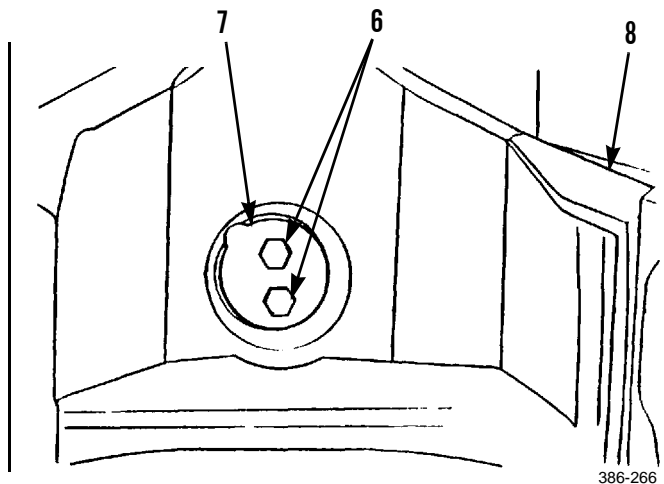
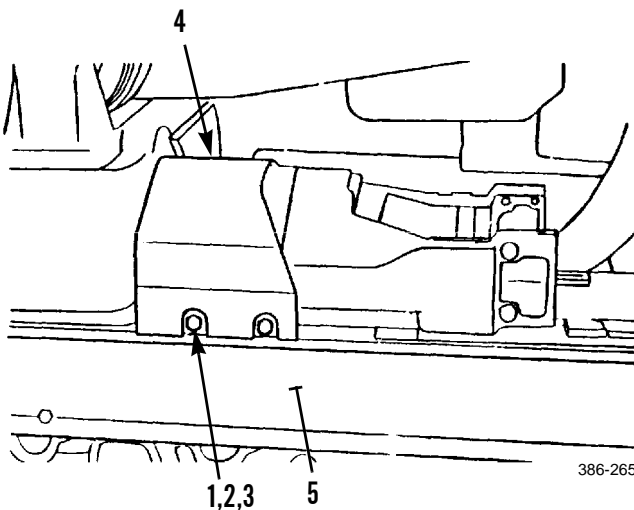
- Compound, antiseize (Item 6, WP 0184 00)
- Lockwasher (3)

NOTE

Guard weighs 23 lb (10 kg).

REMOVAL

1. Remove five bolts (1), washers (2), lockwashers (3) and, with assistance, remove guard (4) from track roller frame (5). Discard lockwashers.
2. Remove two bolts (6) and plate (7) from center of yoke (8).



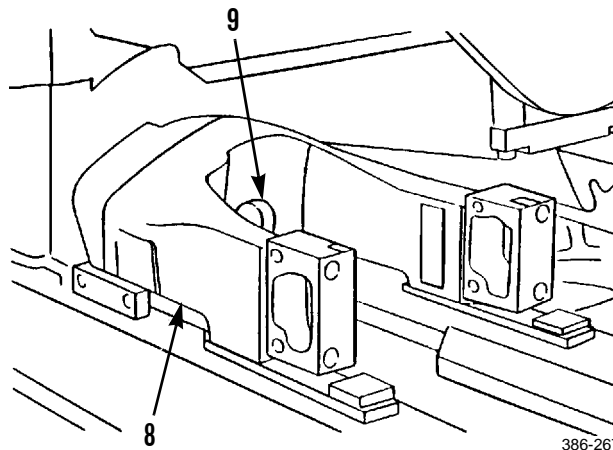
REMOVAL - CONTINUED

3. Strike rod (9) inside center of yoke (8) to break rod taper loose and free yoke. Pull yoke away from rod.



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.



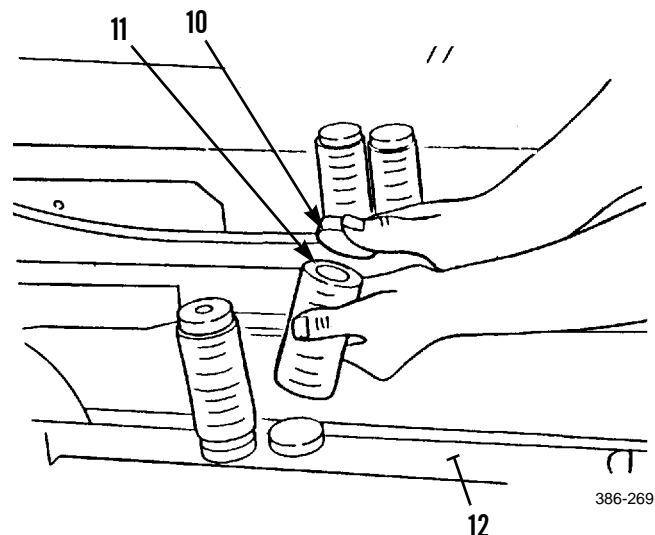
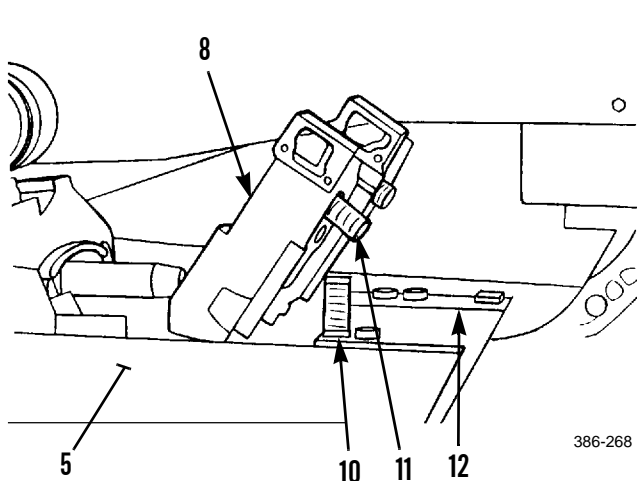
NOTE

Yoke weighs 110 lb (50 kg).

4. Use a nylon sling and a suitable lifting device to raise open end of yoke (8) and remove four plates (10), springs (11) and two plate assemblies (12).
5. Remove yoke (8) with lifting device.

INSTALLATION

1. Position two plate assemblies (12) on track roller frame (5).
2. Install two springs (11) and plates (10) on each plate assembly (12).



INSTALLATION - CONTINUED



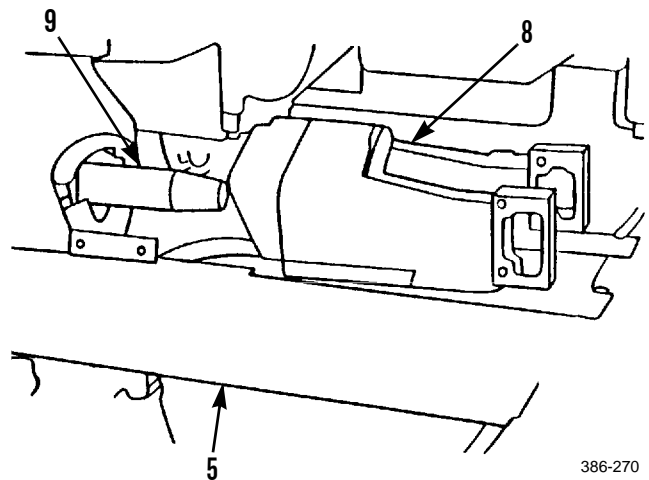
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Yoke weighs 110 lb (50 kg).

3. Use a nylon sling and a suitable lifting device to lift yoke (8) into position on track roller frame (5) and lower yoke over plates (10) and springs (11).
4. Push yoke (8) onto end of rod (9).

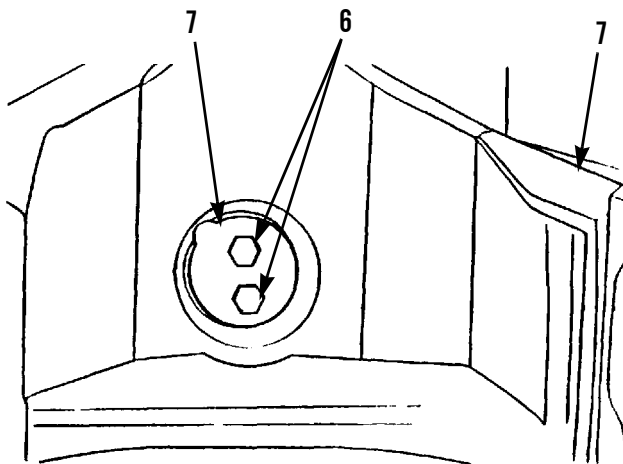


386-270

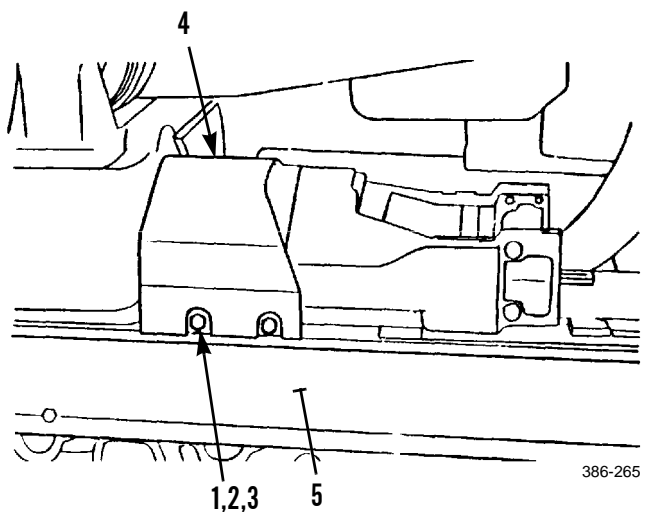
NOTE

Apply antiseize compound to all bolts before installation.

5. Install plate (7) and two bolts (6) over end of rod (9).
6. Install guard (4) on track roller frame (5) with five washers (2), new lockwashers (3) and bolts (1).



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TRACK IDLER YOKE REPLACEMENT - CONTINUED

0116 00

INSTALLATION - CONTINUED

7. Install track idler (WP 0115 00).
8. Test drive and check track for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

TRACK ADJUSTER CYLINDER REPLACEMENT

0117 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment general purpose repair, (Item 97, WP 0185 00)

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)

Grease, GAA (Item 15, WP 0184 00)

Oil, lubricating (Item 25, WP 0184 00)

Materials/Parts - Continued

Gasket (9)

Lockwasher (2)

Seal (8, 10 and 13)

References

TM 5-2410-233-10

Equipment Condition

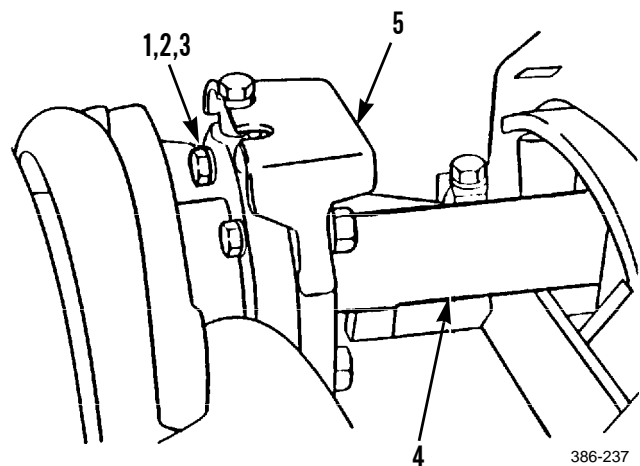
Track separated (WP 0119 00)

Track roller frame guards removed (WP 0111 00)

REMOVAL**WARNING**

Ensure hydraulic pressure in track adjusting mechanism is completely released before removing hydraulic track adjuster. Failure to follow this warning may result in injury.

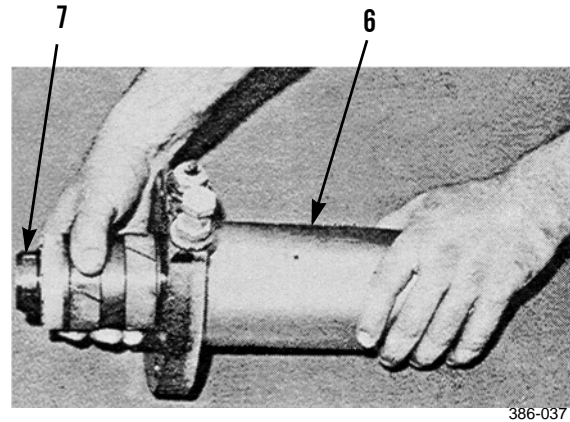
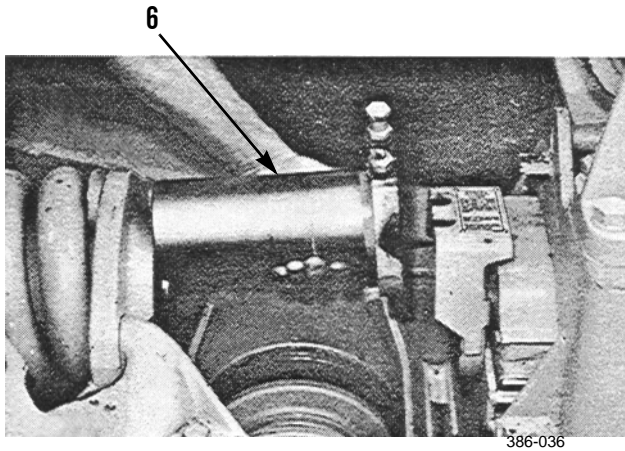
1. Remove five nuts (1), lockwashers (2) and bolts (3) that hold recoil rod to cylinder (4). Discard lockwashers.
2. Slide recoil rod (4) and idler (5) as far forward on track roller frame as possible.



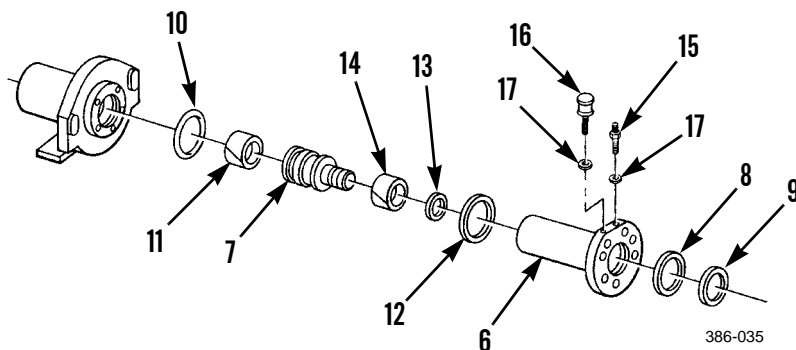
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REMOVAL - CONTINUED

3. Remove adjuster cylinder (6) as a unit.
4. Remove piston (7) as an assembly from cylinder (6) by pushing the piston out of the rear of cylinder.



5. Remove seal (8) and gasket (9) from front of recoil spring. Discard seal and gasket.
6. Remove seal (10) and ring (11) from piston (7). Discard seal.
7. Remove ring (12), seal (13) and ring (14) from piston (7). Discard seal.
8. Remove grease fitting (15), relief valve (16) and two washers (17) from cylinder (6).



INSTALLATION

1. Install grease fitting (15), relief valve (16) and two washers (17) in cylinder (6). Tighten both valves to 25 lb-ft (34 Nm).
2. Install ring (14) on piston (7) and new seal (13) on piston with sealing lip toward ring (12).
3. Install ring (12) flush to secure seal (13) on piston (7).

INSTALLATION - CONTINUED**NOTE**

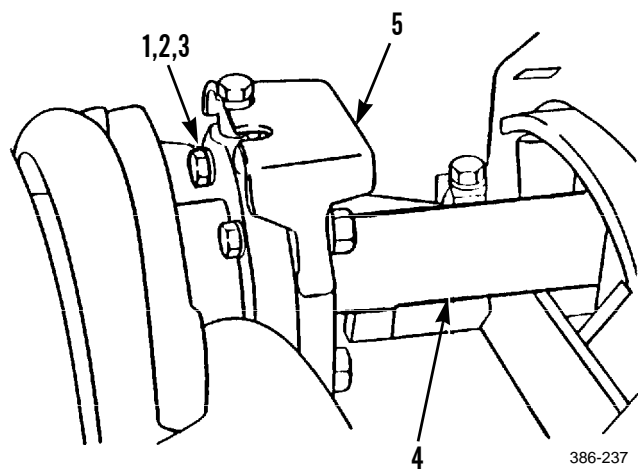
Lubricate new seal with a thin coating of clean oil prior to installation.

4. Install ring (11) on piston (7) and position new seal (10) with chamber toward cylinder (6) seated flush with ring.
5. Install piston (7) as an assembly in cylinder (6).
6. Install new seal (8) and gasket (9) in front pilot of recoil spring. Apply clean grease on seal.
7. Install piston (7) as an assembly into cylinder (6).
8. Install hydraulic track adjuster assembly in position in front pilot of recoil spring.
9. Move front idler and recoil rod (4) toward hydraulic track adjuster. Ensure hydraulic track adjuster is against yoke.

NOTE

Apply antiseize compound to bolts before installation.

10. Install five bolts (3), new lockwashers (2), and nuts (1) that hold hydraulic track adjuster to yoke (4).



11. Connect track (WP 0119 00).
12. Install track roller frame guards (WP 0111 00).
13. Test drive and check track for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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TRACK DRIVE SPROCKETS/HUBS REPLACEMENT

0118 00**THIS WORK PACKAGE COVERS**Removal, Cleaning, Inspection, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Adapter (Item 3, WP 0185 00)
 Adapter (Item 4, WP 0185 00)
 Adapter, coupling (Item 5, WP 0185 00)
 Adapter, sprocket installation (Item 9, WP 0185 00)
 Clip, retaining (Item 16, WP 0185 00)
 Forcing screw, mechanical puller (Item 24, WP 0185 00)
 Handle, extension wrench (Item 29, WP 0185 00)
 Head (Item 30, WP 0185 00)
 Inserter, seal (Item 34, WP 0185 00)
 Lock (Item 46, WP 0185 00)
 Nut, plain, round (Item 49, WP 0185 00)
 Nut, plain, round (Item 50, WP 0185 00)
 Pin (Item 53, WP 0185 00)
 Pin (Item 54, WP 0185 00)
 Pin (Item 55, WP 0185 00)
 Pin, straight, headless (Item 58, WP 0185 00)
 Plate, intermediate, friction (Item 61, WP 0185 00)
 Plate assembly (Item 63, WP 0185 00)
 Puller assembly (Item 70, WP 0185 00)
 Puller attachment, mechanical (Item 71, WP 0185 00)
 Puller attachment, mechanical (Item 72, WP 0185 00)
 Puller, hydraulic (Item 76, WP 0185 00)
 Puller, mechanical (Item 80, WP 0185 00)
 Puller, sprocket arm (Item 83, WP 0185 00)
 Pump, hydraulic ram, hand driven (Item 84, WP 0185 00)
 Remover, bearing and bushing (Item 90, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)

Tools and Special Tools - Continued

Socket, socket wrench (Item 101, WP 0185 00)
 Spacer, sleeve (Item 103, WP 0185 00)
 Step plate, mechanical puller (Item 108, WP 0185 00)
 Wrench, spanner (Item 121, WP 0185 00)
 Yoke (Item 123, WP 0185 00)
 Lifting equipment, 1,000 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)
 Grease, GAA (Item 15, WP 0184 00)
 Oil, lubricating (Item 24, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Gasket (4 and 22)
 Lock, retainer (28)
 Lockwasher (2 and 14)
 Packing, preformed (21, 26, 43 and 45)
 Seal (11)
 Seal assembly (20, 25, 42 and 44)

References

TM 5-2410-233-10
 WP 0104 00
 WP 0119 00
 WP 0176 00

Personnel Required

Two

Equipment Condition

Track roller frame removed (WP 0110 00)
 Final drive drained (WP 0099 00)

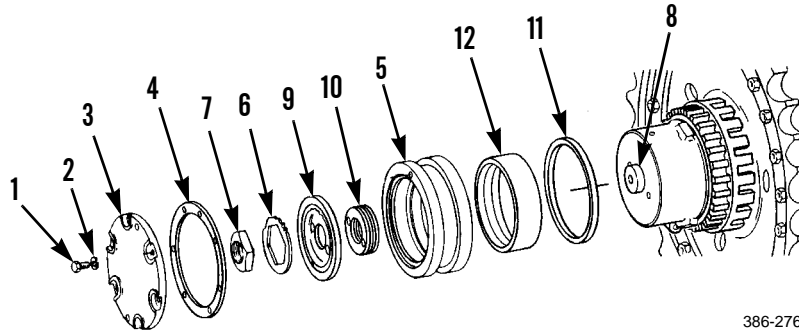
REMOVAL

1. Remove six capscrews (1), lockwashers (2), plate (3) and gasket (4) from support (5). Discard lockwashers and gasket.
2. Remove retainer (6) and nut (7) from sprocket shaft (8).

NOTE

Note arrangement and quantity of shims.

3. Remove retainer packing (9), shims (10) and support (5).
4. Remove seal (11) and bearing sleeve (12) from support (5). Discard seal.



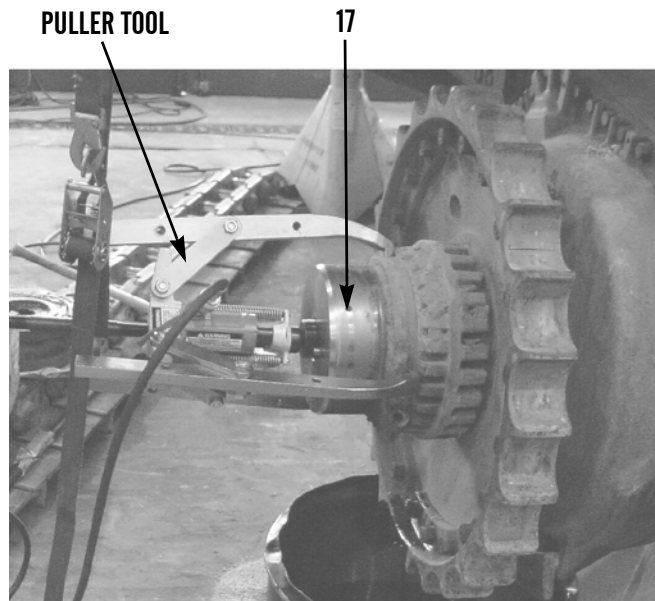
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5. Remove nut (13), lockwasher (14), capscrew (15) and retainer (16) from holder (17). Discard lockwasher.

NOTE

Do not use more than 50 tons of pressure to loosen holder.

6. Install puller on holder (17) and loosen holder from taper on sprocket shaft (8).
7. Remove puller from holder (17).



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REMOVAL - CONTINUED



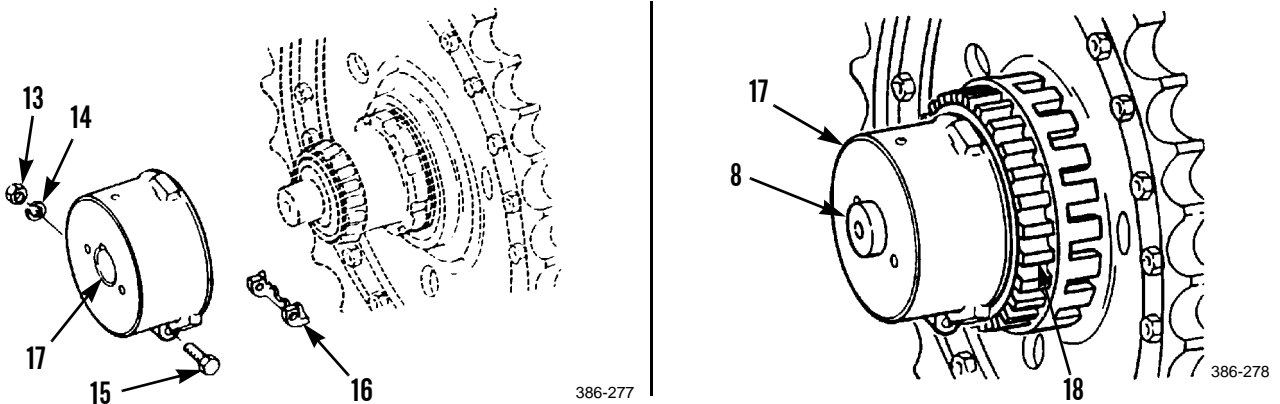
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

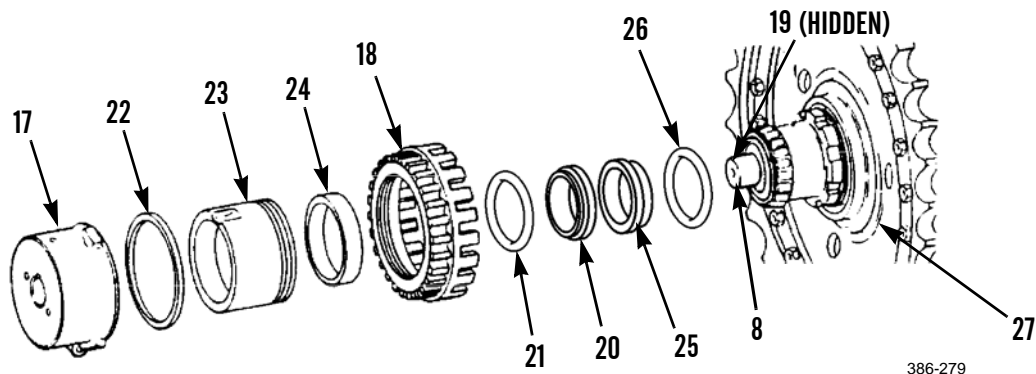
NOTE

Weight of holder and adjusting nut as a unit is approximately 93 lb (42 kg).

8. Use a nylon sling and a suitable lifting device and remove holder (17) and adjusting nut (18) as a unit.



9. Remove woodruff key (19) from sprocket shaft (8).
10. Remove seal assembly (20) and preformed packing (21) from inside adjusting nut (18). Discard seal assembly and preformed packing.
11. Remove adjusting nut (18) from holder (17).
12. Remove gasket (22) from holder (17). Discard gasket.
13. Remove cage (23) from holder (17).
14. Remove bearing cup (24) from cage (23).
15. Remove seal assembly (25) and preformed packing (26) from sprocket (27). Discard seal assembly and preformed packing.



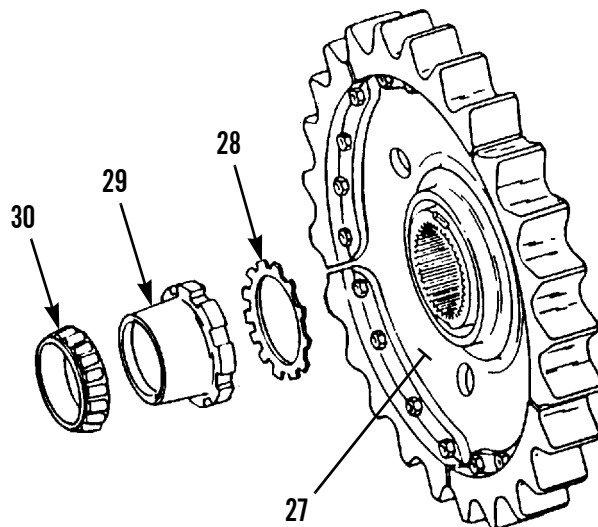
REMOVAL - CONTINUED

16. Unbend tabs of retainer lock (28).
17. Loosen nut (29) until there is a 1 in. (25.4 mm) gap between nut and sprocket (27).
18. Turn nut (29) toward sprocket (27) until remover tool can be inserted between nut and bearing (30).

CAUTION

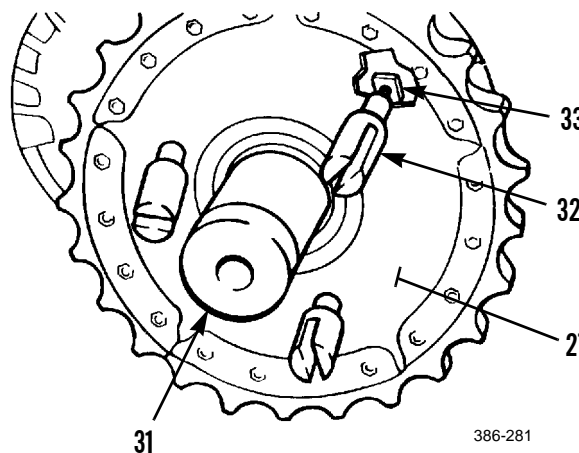
Use care when removing bearing and nut. Haste or improper choice of removal tool will damage parts.

19. Turn nut (29) away from sprocket (27) and remove bearing (30).
20. Remove removal tool, nut (29) and retainer lock (28). Discard retainer lock.



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21. Install an adapter (31) on drive hub and turn to within 0.25 in. (6.3 mm) of sprocket (27).
22. Install three adapters (32) in three puller holes in sprocket (27).
23. Install three nuts (33) on adapters (32) with angle side toward sprocket (27) and flat side even with threaded end of adapter (31). Position drill point on nut toward outer edge of sprocket.



386-281

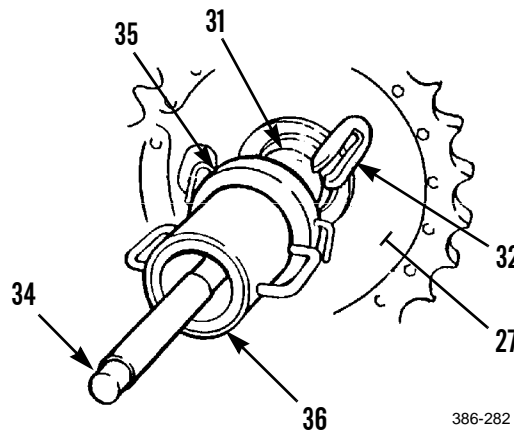
REMOVAL - CONTINUED

- 24. Install stud (34) in adapter (31).

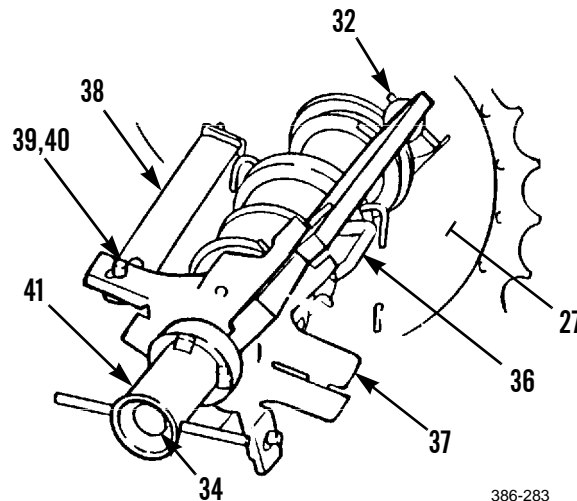
NOTE

Piston end of cylinder should face away from sprocket.

- 25. Install plate (35) and cylinder (36) on stud (34) and against adapter (31).



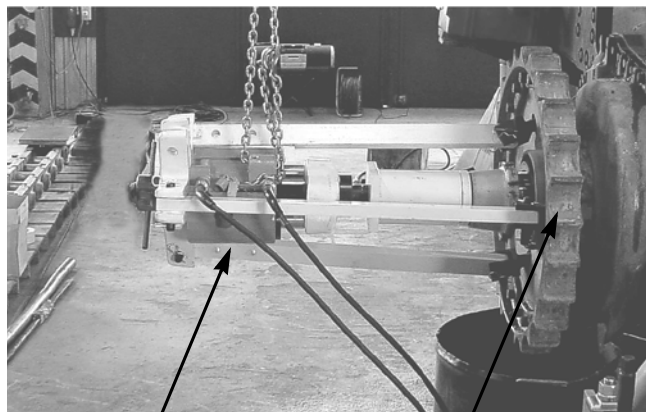
- 26. Install head (37) on stud (34) with flat side against cylinder (36).
- 27. Install three arms (38) to connect head (37) with adapters (32) in sprocket (27) and secure arms with pins (39) and lock pins (40) at each end.
- 28. Install nut (41) on stud (34) within 1 in. (25.4 mm) from head (37).



WARNING

Sprocket is installed with 60-65 tons (534-578 kn) of force and requires considerable force to loosen. Stand clear of sprocket during loosening procedure to avoid personal injury.

- 29. Connect hydraulic pump to cylinder (36) and apply pressure to break sprocket (27) loose. Remove hydraulic pump.



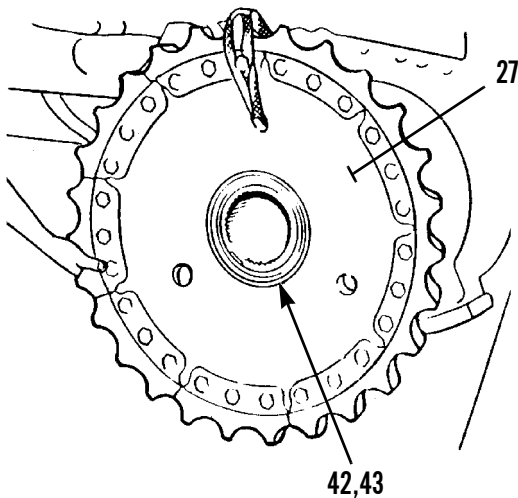
REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

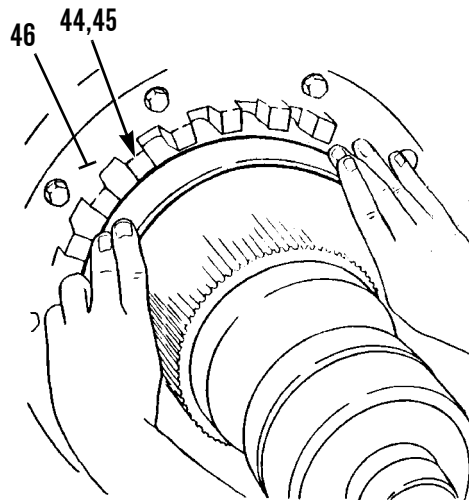
NOTE

Sprocket weighs 400 lb (181 kg).

30. Use a nylon sling and a suitable lifting device to carefully remove sprocket (27) from hub.
31. Remove seal assembly (42) and preformed packing (43) from hub of sprocket (27). Discard seal assembly and preformed packing.
32. Remove seal assembly (44) and preformed packing (45) from final drive (46). Discard seal assembly and preformed packing.



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CLEANING**WARNING**

- Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.
- Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may result in serious injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

1. Clean all removed components with solvent cleaning compound.
2. Thoroughly dry components with compressed air or clean rags.
3. Ensure mating surfaces in final drive are clean.

INSPECTION

1. Inspect all removed components IAW (WP 0176 00).
2. Ensure mating surfaces in final drive are free of damage.

INSTALLATION**CAUTION**

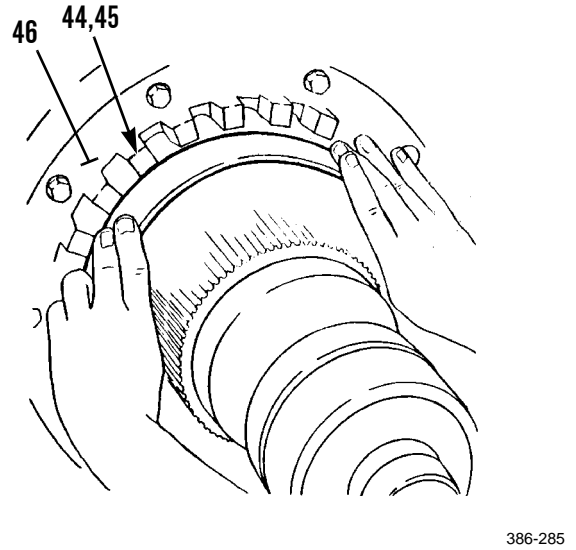
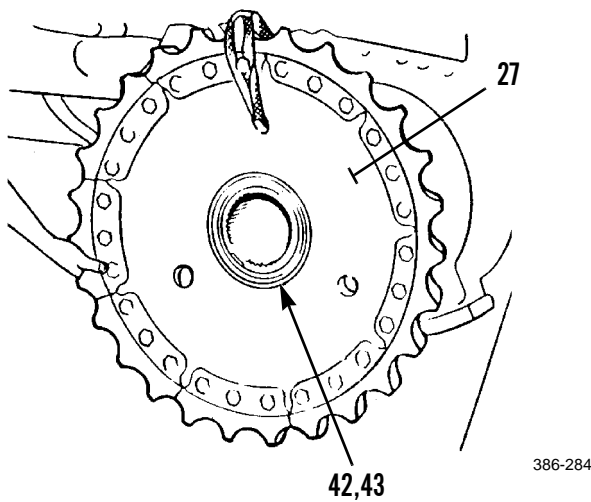
- New seal assemblies and new preformed packings must be used as matched pairs or failure will result. Do not separate.
- Seal and seal contact surfaces must be kept clean. Do NOT touch after being cleaned or leaks can result.

NOTE

Do NOT apply oil to preformed packings.

1. Install new seal assembly (44) and new preformed packing (45) on final drive (46). Clean metal contact surface of seal assembly. Then apply a thin film of clean oil to metal contact surface.
2. Install new seal assembly (42) and new preformed packing (43) in hub of sprocket (27). Clean metal contact surface of seal assembly, then apply a thin film of clean oil to metal contact surface.

INSTALLATION - CONTINUED



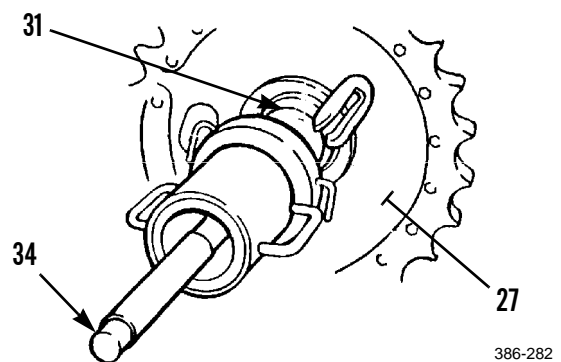
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

CAUTION

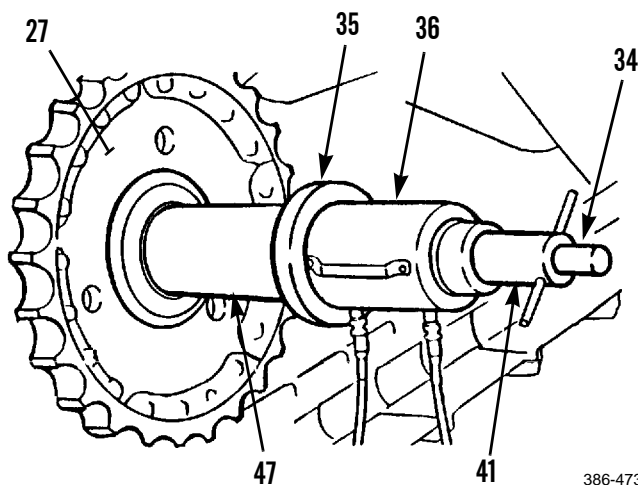
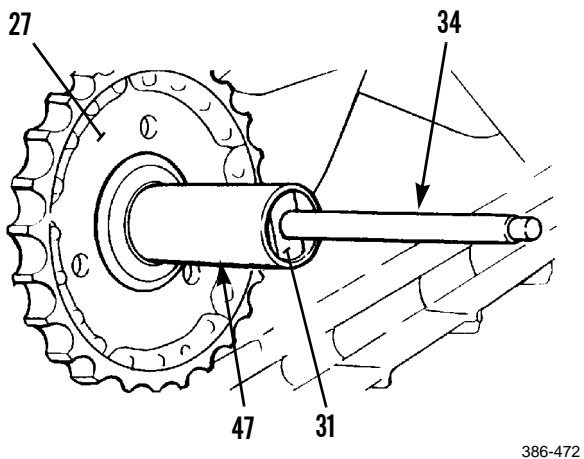
Sprocket weighs 400 lb (181 kg).

3. Use a nylon sling and a suitable lifting device to lift sprocket (27) into position at end of drive hub. Align splines carefully and push sprocket onto drive hub as far as possible by hand.
4. Install adapter (31) on drive hub and turn adapter until it is fully on drive hub.
5. Install stud (34) in adapter (31).



INSTALLATION - CONTINUED

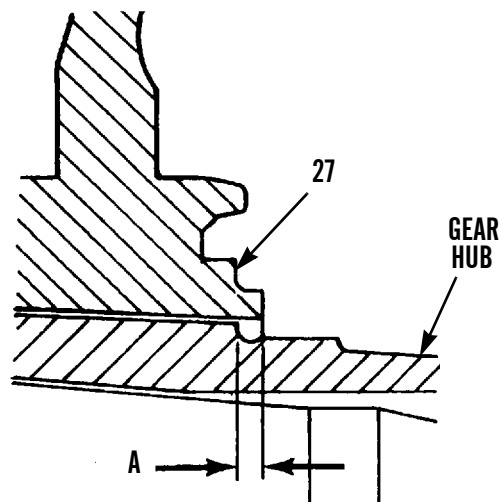
6. Install sleeve (47) over stud (34) and adapter (31) until it makes contact with sprocket (27).
7. Install plate (35) on stud (34) until it makes contact with sleeve (47).
8. Install retracted cylinder (36) on stud (34) until it makes contact with plate (35). Piston end of cylinder should face away from sprocket (27).
9. Install nut (41) on stud (34) to within 1 in. (2.54 cm) of cylinder (36).
10. Connect hydraulic pump to cylinder (36) and apply 60-65 tons (534-578 kn) of pressure to force sprocket (27) fully onto drive hub.



WARNING

Ensure pressure is off cylinder of sprocket installation tool before trying to remove tool. Failure to follow this warning may result in injury or death to personnel.

11. Remove sprocket installation tooling.
12. Check distance from hub face of sprocket (27) to spline shoulder on final drive gear hub. Dimension (A) must be 0.500 +/- 0.060 in. (12.7 +/- 1.52 mm).
13. If distance measured in step 12 is less than 0.44 in. (11.18 mm), replace sprocket (27) and final drive gear hub. If distance exceeds 0.560 in. (14.22 mm), remove sprocket, clean hub splines and reinstall sprocket.



INSTALLATION - CONTINUED

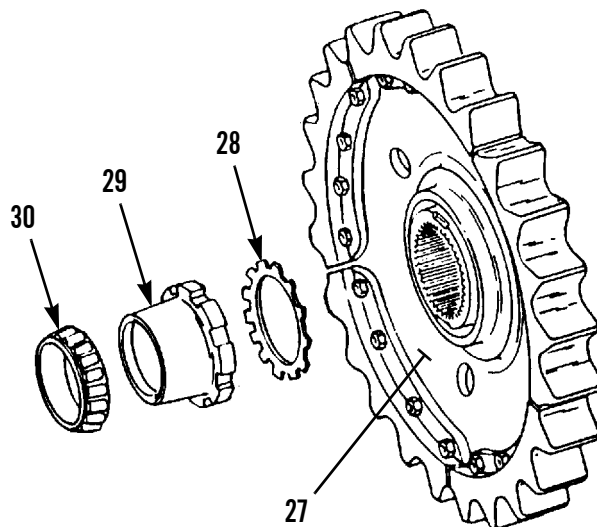
14. Install new retainer lock (28) and nut (29).
15. Bend one tab of retainer lock (28) in notch of nut (29) and one tab in notch of hub of sprocket (27).



WARNING

Use insulated gloves for handling hot parts to avoid personal injury.

16. Heat bearing (30) to 275°F (135°C) maximum. Install bearing on final drive hub against nut (29).



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17. Lower temperature of bearing (30) and install bearing cup (24) in cage (23).
18. Align slot in cage (23) over dowel in holder (17) and install cage in holder.
19. Install new gasket (22) in groove in holder (17).
20. Apply clean grease to threads of adjusting nut (18) and on face of nut that contacts gasket (22) in holder (17).
21. Install adjusting nut (18) on holder (17) and tighten completely to end of thread travel.

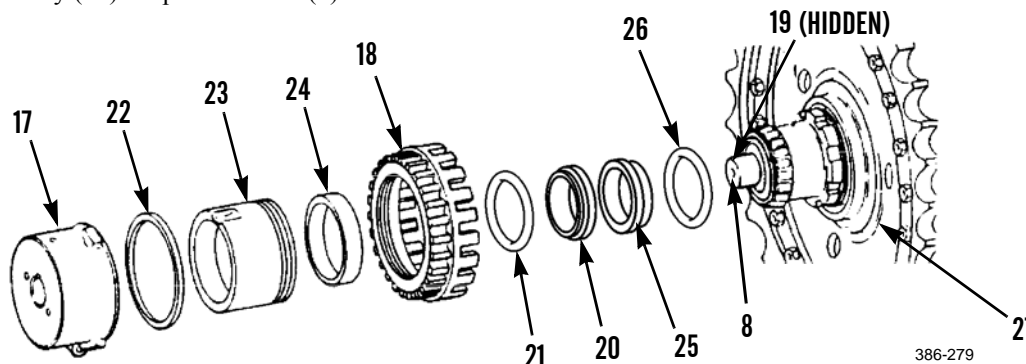
CAUTION

- New seal assemblies and new preformed packings must be used as matched pairs or failure will result. Do not separate.
- Seal and seal contact surfaces must be kept clean. Do NOT touch after being cleaned or leaks can result.

NOTE

Do NOT apply oil to preformed packings.

22. Install new seal assembly (20) and new preformed packing (21) inside adjusting nut (18). Clean metal contact surface of seal assembly, then apply a thin film of clean oil to metal contact surface.
23. Install new seal assembly (25) and new preformed packing (26) in hub of sprocket (27). Clean metal contact surface of seal assembly, then apply a thin film of clean oil to metal contact surface.
24. Install woodruff key (19) in sprocket shaft (8).



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INSTALLATION - CONTINUED



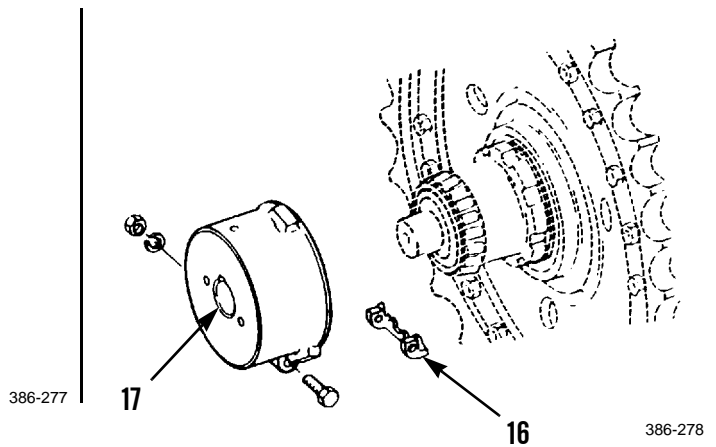
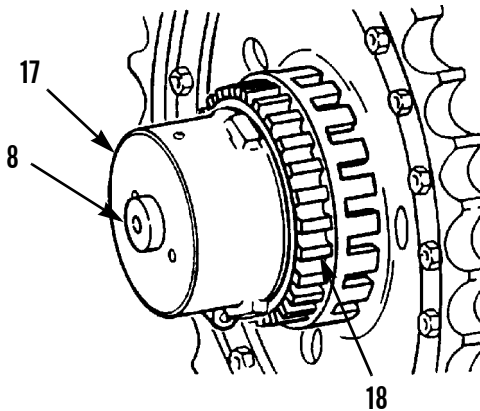
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

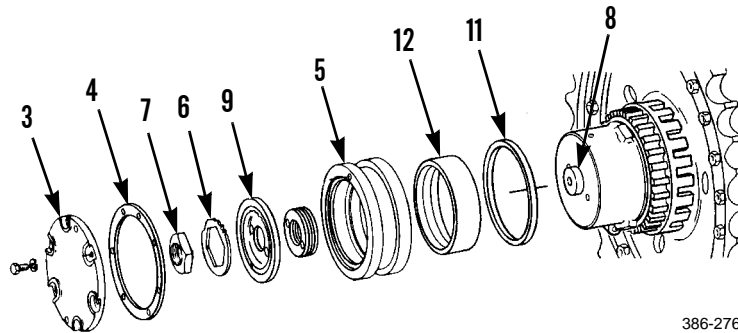
Weight of holder and adjusting nut as a unit is approximately 93 lb (42 kg).

25. Use a nylon sling and a suitable lifting device to position holder (17) and adjusting nut (18) on sprocket shaft (8), being careful to align keyway in holder with woodruff key in shaft. Do NOT install retainer (16) on holder at this time, to allow for bearing adjustment.



INSTALLATION - CONTINUED

26. Install bearing sleeve (12) in support (5).
27. Install new seal (11) in support (5) with lip of seal toward and even with outside edge of support. Apply clean oil to lip of seal.
28. Apply clean grease on inside diameter of support (5) and install support over holder (17).
29. Refer to WP 0104 00 for shimming procedure and specifications on sprocket shaft, for correct alignment of sprocket and track roller frame.
30. Fill inside of retainer packing (9) with clean grease and install retainer packing on dowels in holder (17).
31. Install nut (7) on sprocket shaft (8). Tighten nut to 1100-1200 lb-ft (1492-1627 Nm).
32. Tighten adjusting nut (18) until snug. Final tightening will occur during adjustment.
33. Install retainer (6) over nut (7) on sprocket shaft (8). Do NOT install new gasket (4) or plate (3) at this time. These components need to be removed to perform bearing adjustment.



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34. Adjust final drive bearings (WP 0104 00).
35. Install track roller frame (WP 0110 00).
36. Fill final drive (WP 0099 00).
37. Connect track (WP 0119 00).
38. Test drive and check track for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

TRACK ASSEMBLY REPLACEMENT

0119 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)
- Tool set, track repair (Item 114, WP 0185 00)
- Lifting equipment, 500 lb capacity
- Pin, drawbar (TM 5-2410-233-10, BII Item 5)

Materials/Parts

- Block, Wood 2-1/4 in.
- Compound, antiseize (Item 6, WP 0184 00)

References

WP 0120 00

Personnel Required

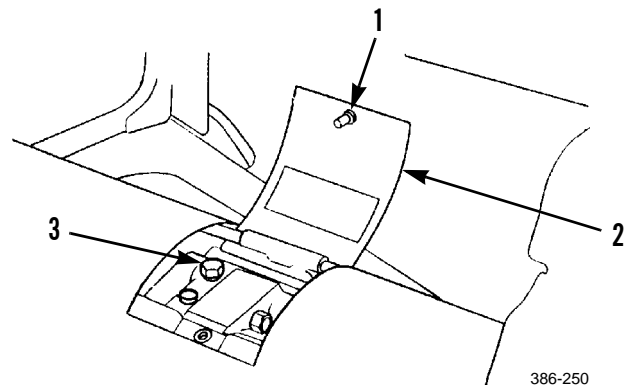
Two

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

REMOVAL

1. Remove all dirt and debris that may prevent retraction of the idler.
2. Loosen bolt (1) and open track adjuster access panel (2).
 - **Adjuster cylinder for track is under high pressure. Use the following procedure to relieve this pressure and observe relaxing of tension on track.**
 - **Wear eye protection and use extreme caution. Do NOT observe grease coming from relief valve.**
 - **Do NOT, under any circumstances, attempt to relieve pressure by excessive loosening or removal of relief valve. Failure to follow this warning may result in injury or death to personnel.**
3. Turn relief valve (3) one turn counterclockwise to release grease from vent hole below relief valve.



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REMOVAL - CONTINUED**NOTE**

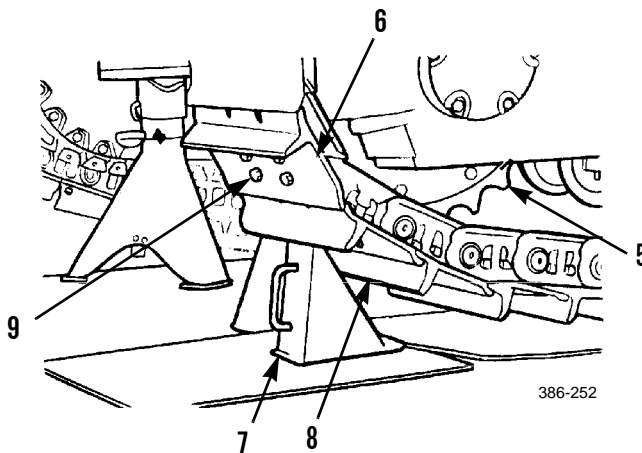
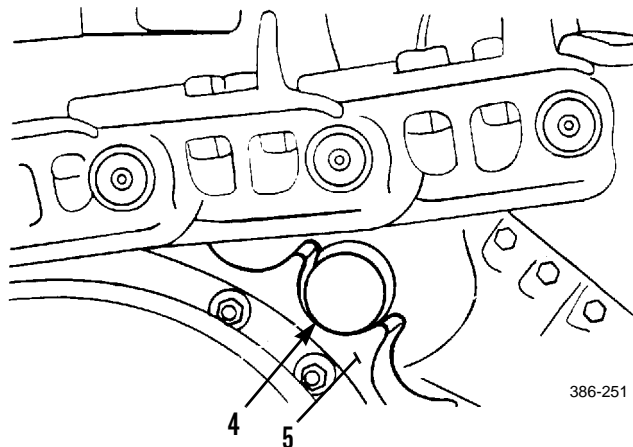
- Steel slug must have contact with track bushing when sprocket is turned in reverse.
- Position drawbar pin evenly on sprocket.

4. Install drawbar pin (4) between teeth of sprocket (5).

**WARNING**

Keep all personnel clear of front and rear of machine. If track separation occurs, track movement is fast and uncontrolled. At least 20 ft (6 m) of clearance is required in front and rear of machine. Failure to follow this warning may result in injury or death to personnel.

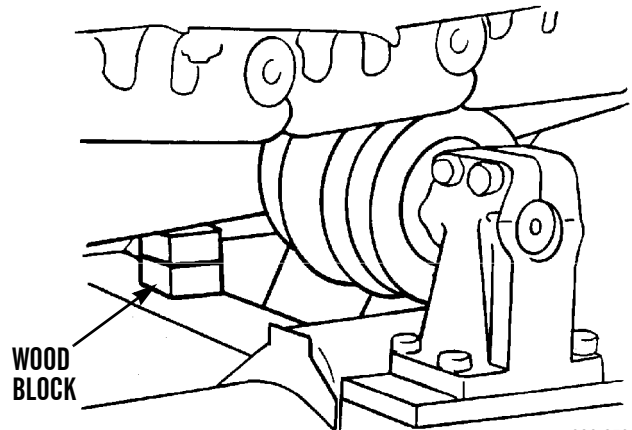
5. Start machine (TM 5-3410-233-10).
6. Move machine to the rear, until drawbar pin (4) is in 9 o'clock position (3 o'clock position for left-hand track), to put tension to the rear against force of recoil spring and push grease out of vent holes.
7. Move machine forward to release tension on track.
8. Remove drawbar pin (4) from teeth of sprocket (5).
9. Move machine until master link (6) is in 8 o'clock position (4 o'clock position for left-hand track) on sprocket (6).
10. Install track block (7) under track shoe (8) next to master link (6) and move track until track shoe makes contact with track block.



REMOVAL - CONTINUED**WARNING**

To compensate for weight imbalance when removing one track, a metal block must be placed between frame and equalizer bar on same side from which track is to be removed. Failure to follow this precaution can result in injury or death to personnel and damage to equipment.

11. Install wood block, approximately 2-1/4 in. (5.7 cm) thick, between frame and equalizer bar.



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12. Remove four capscrews (9) and master link (6) from track.

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

13. Use a suitable lifting device to lift track and remove track block (7) from under track. Ensure that track still makes contact with sprocket.
14. Slowly move machine forward to separate and remove track from roller frame.

INSTALLATION

1. Position machine, with master link (6) one link past bottom center line of sprocket (5).



WARNING

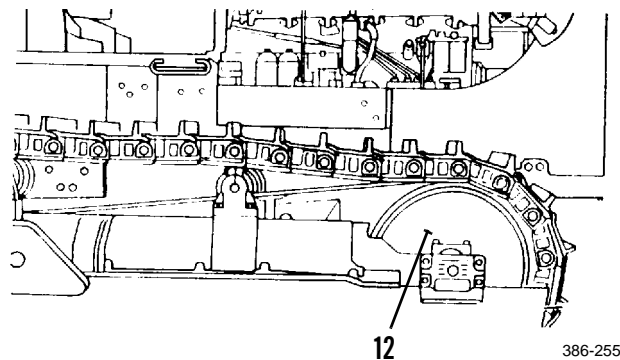
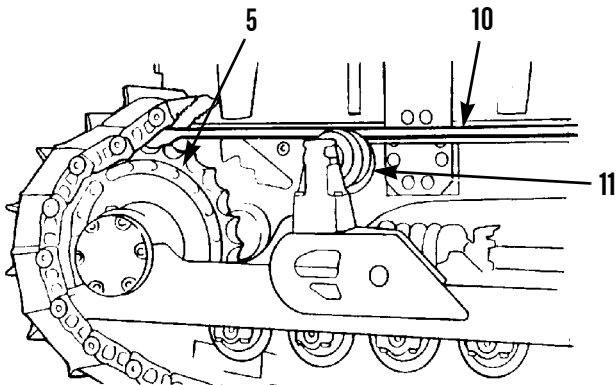
Keep all personnel clear of front and rear of machine. If track separation occurs, track movement is fast and uncontrolled. At least 20 ft (6 m) of clearance is required in front and rear of machine. Stand at side of track when installing master link and bolts. Failure to follow this warning may result in injury or death to personnel.

2. Slowly move machine rearward until track is pulled at least one link past top center line of sprocket.

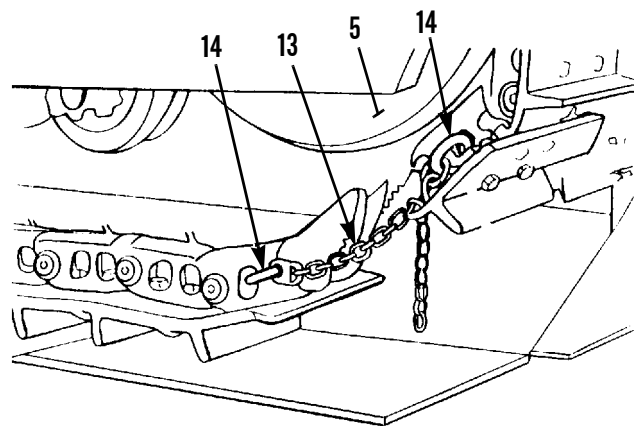
NOTE

Use long bar to keep track taut during installation.

3. Position a long bar (10) across track carrier roller (11) and between track and sprocket (5).
4. Slowly move machine rearward and slowly feed track over front idler (12) and two carrier rollers (11). Use bar (10) to guide track and move bar along with track. Stop rotation when first link reaches the 4 o'clock position (8 o'clock position on left-hand track) on front idler.



5. Install chain (13) and links (14) between track links in ends of track. Leave about 4 in. (10.2 cm) clearance between chain and track pins.
6. Move machine rearward until bottom link is below a horizontal line through center of sprocket (5).



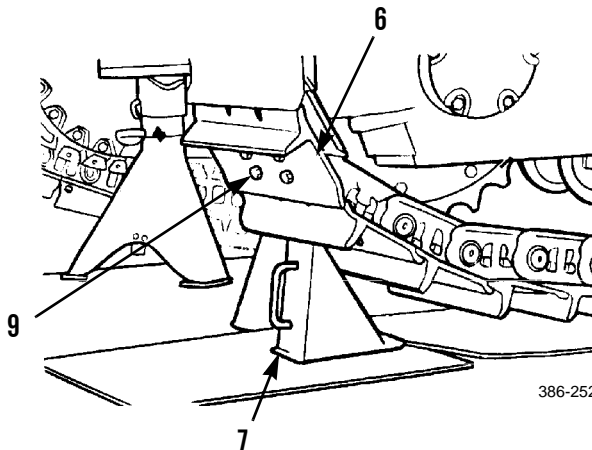
INSTALLATION - CONTINUED

7. Put track block (7) in position under track. Remove chain (13) and links (14).

NOTE

Some adjustment of master link angle will be needed to engage teeth.

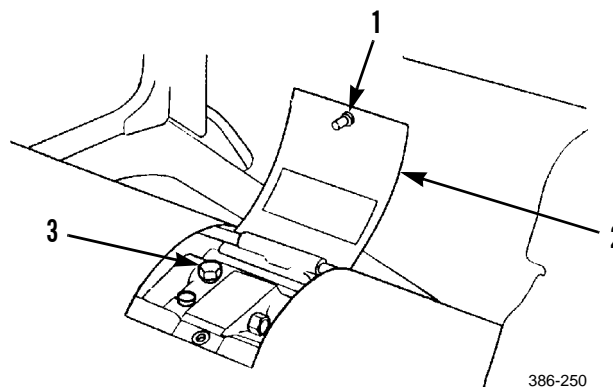
8. Move machine rearward until upper end of master link (7) is in alignment with lower end of master link. Make sure teeth of both ends of master link are engaged. Check for hole alignment with a capscrew (9) and adjust if necessary.



NOTE

Prior to installation, apply antiseize compound to capscrews.

9. Install four capscrews (9) on master link (6). Tighten capscrews to 220 lb-ft (298 Nm). Turn capscrews an additional 180° (1/2 turn).
10. Move machine forward and remove track block (7).
11. Remove metal block from between frame and equalizer bar.
12. Tighten relief valve (3) to 25 lb-ft (34 Nm).
13. Adjust track (WP 0120 00).
14. Close track adjuster access panel (2) and tighten bolt (1).
15. Test drive and check track for proper operation (TM 5-2410-233-10).



END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Inspection, Adjustment

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)
- Gage, sprocket wear (Item 25, WP 0185 00)
- Pin, drawbar (TM 5-2410-233-10, BII Items)

Materials/Parts

- Grease, GAA (Item 15, WP 0184 00)
- Rag, wiping (Item 28, WP 018400)

References

- WP 0107 00
- WP 0109 00
- WP 0112 00
- WP 0114 00
- WP 0115 00
- WP 0119 00

Personnel Required

Two

Equipment Condition

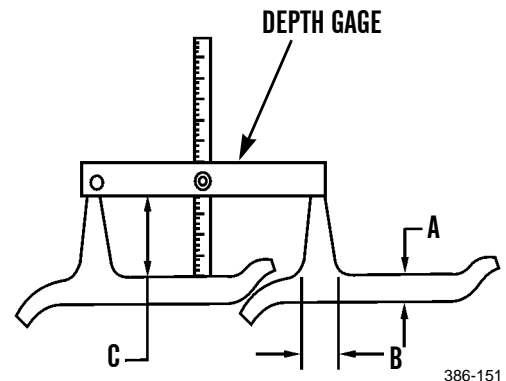
Machine parked on level ground (TM 5-2410-233-10)

INSPECTION

NOTE

- **Inspection includes all moving parts and guides of undercarriage because of their functional relationship. Wear of one item directly affects other items. Inspection should include all listed items.**
- **Undercarriage components are considered rebuildable if in range of 80-100% worn condition. Components at 120% worn condition are considered beyond repair and must be replaced.**

1. **Track Shoes.** Measure track shoe grouser height and refer to Table 1. Replace track assembly as necessary (WP 0119 00).



INSPECTION - CONTINUED

Table 1. Track Shoe Dimensions.

SHOE	GROUSER DIMENSIONS (NEW)			GROUSER HEIGHT WEAR		
	A (Thickness)	B (Width)	C (Height)	80%	100%	120%
Shoe Type						
Standard Single Grouser	0.56 in. (14 mm)	1.04 in. (26 mm)	2.76 in. (7 cm)	1.36 in. (3.4 cm)	1.00 in. (25 mm)	0.64 in. (16 mm)
Extended Service Grouser	0.66 in. (17 mm)	1.32 in. (34 mm)	2.81 in. (7.1 cm)	1.77 in. (4.5 cm)	1.5 in. (3.8 cm)	1.26 in. (3.2 cm)

2. **Track Chain.**

NOTE

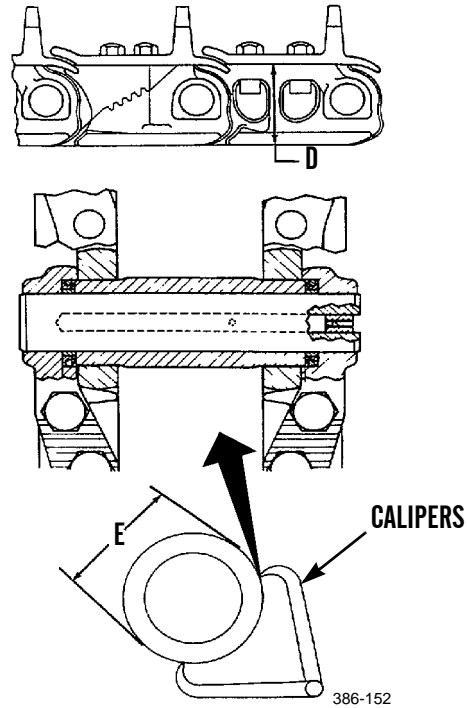
Tractor uses a sealed, lubricated track chain which means there is virtually no wear on track pins as long as seals retain lubricating oil in bushing.

- a. Measure link rail height (dimension D) and refer to Table 2. Replace track assembly as necessary (WP 0119 00).

NOTE

Check for “dry” track pin and bushing joints by feeling bushings or link pin bosses for higher temperatures compared to other joints of chain.

- b. Measure bushing external diameter (dimension E) and refer to Table 2. If bushings are between 80 and 100% worn dimension, replace track assembly (WP 0119 00).



Track Chain Dimensions.

MEASUREMENT	NEW	80%	100%	120%
Chain Link Rail Height D	4.94 in. (12.5 cm)	4.62 in. (11.7 cm)	4.50 in. (11.4 cm)	4.30 in. (11 cm)
Chain Bushing External Diameter E	2.94 in. (7.4 cm)	2.80 in. (7.1 cm)	2.74 in. (6.9 cm)	2.67 in. (6.8 cm)

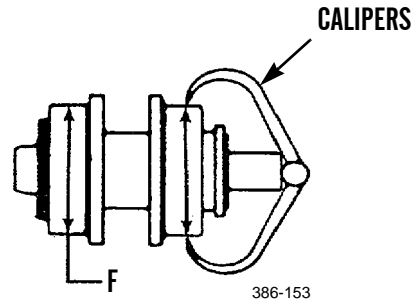
INSPECTION - CONTINUED

3. **Track Carrier Rollers.**

NOTE

Front and rear carrier rollers can be switched to balance tread wear between front and rear rollers.

Measure carrier roller tread diameter (dimension F) and refer to Table 3. Replace carrier roller as necessary (WP 0114 00).



Track Carrier Roller Dimensions.

MEASUREMENT	NEW	80%	100%	120%
Carrier Roller Tread Diameter F	7.50 in. (19 cm)	6.91 in. (17.6 cm)	6.75 in. (17.1 cm)	6.46 in. (16.4 cm)

4. **Track Rollers.**

NOTE

Front and rear track rollers wear faster. Switch front and rear rollers with intermediate rollers to balance tread wear and prolong roller wear.

Measure track roller tread diameter (dimension G) and refer to Table 4. Replace track roller as necessary (WP 0109 00).

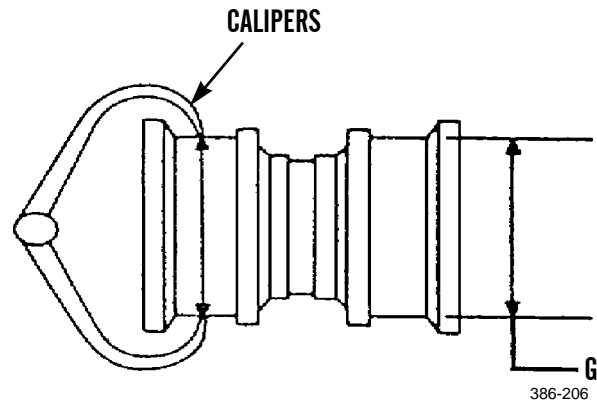
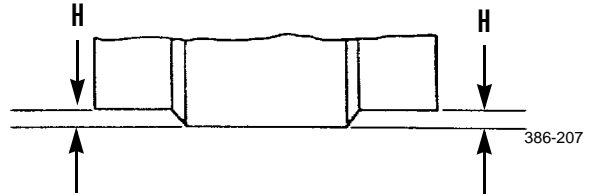


Table 4. Track Roller Dimensions.

MEASUREMENT	NEW	80%	100%	120%
Track Roller Tread Diameter G	8.75 in. (22.2 cm)	8.11 in. (20.1 cm)	7.87 in. (20 cm)	7.48 in. (19 cm)

INSPECTION - CONTINUED

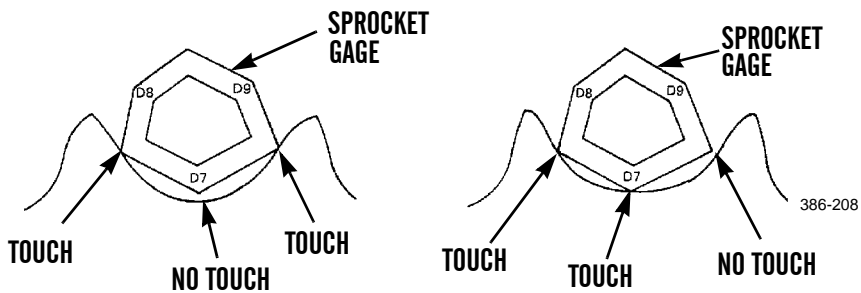
5. **Track Idler.** Measure track idler tread wear (dimension H) and refer to Table 5. Replace track idler (WP 0115 00) as necessary.



Track Idler Dimensions.

MEASUREMENT	NEW	80%	100%	120%
Track Idler Tread Wear H	0.86 in. (21.9 cm)	1.04 in. (26 mm)	1.24 in. (3.1 cm)	1.44 in. (3.7 cm)

6. **Track Drive Sprocket.**
 - a. Measure drive sprocket wear using sprocket wear gage.
 - b. If sprocket touches outer two points and not center point of gage, sprocket can be used with a new track (WP 0119 00).
 - c. If sprocket does not touch on one of two outer points of gage, sprocket segment must be replaced (WP 0107 00).

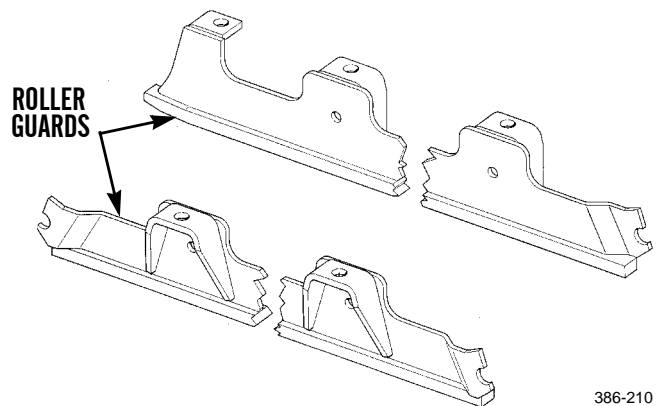


7. **Track Roller Guards.**

NOTE

Track roller guards provide some guiding effect. They serve mainly to keep foreign debris from entering roller areas. In some instances, track roller guards can increase wear on chain and pin ends.

Replace roller guards if cracked, bent or worn (WP 0112 00).



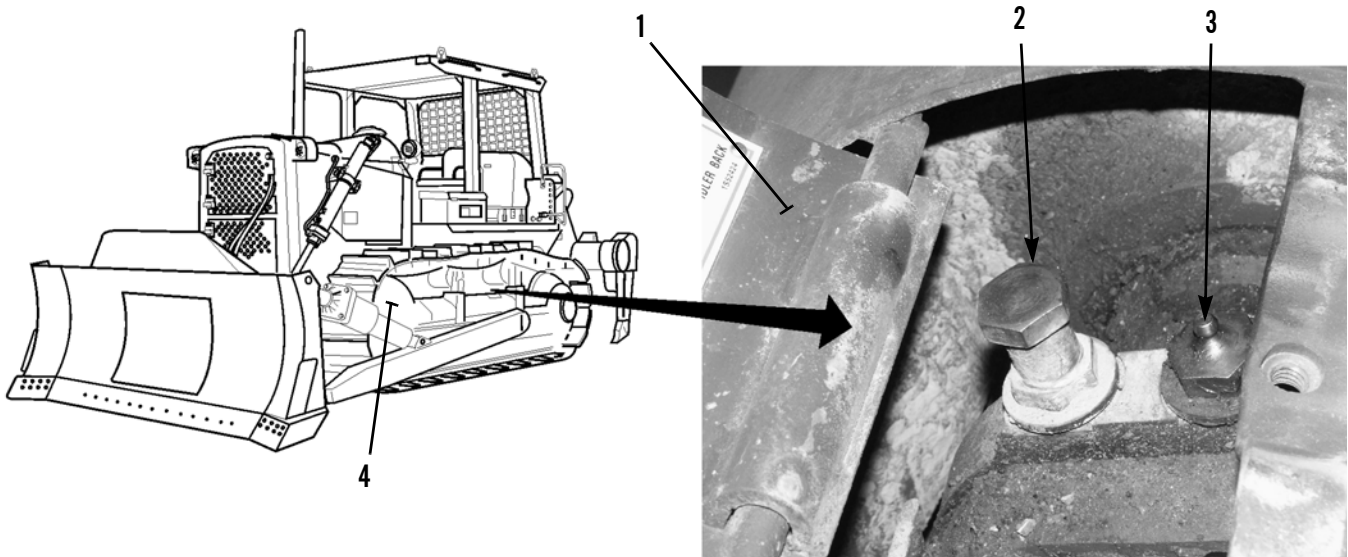
ADJUSTMENT**NOTE**

- Track adjustment should be performed on level ground and on same surface conditions on which machine is operated.
 - Packed dirt should not be removed from track, if packing conditions exist on the job.
1. Move machine forward a distance of at least twice its length. Allow machine to coast to a stop. Do NOT apply brakes. Shut down engine.
 2. Loosen bolt and open recoil mechanism access cover (1).
 3. Wipe clean relief valve (2).

**WARNING**

Wear eye protection and keep face clear when venting grease from relief valve during track adjustment. NEVER visually inspect relief valve to see if grease is escaping. Always observe track to see it has loosened. Failure to follow this warning could cause eye injury or blindness.

4. Open relief valve (2) and allow grease to escape and track tension to release.
5. Close relief valve (2). Clean area around relief valve and fill valve (3).
6. Connect grease gun to fill valve (3). Pump grease into fill valve until track idler (4) moves forward toward front of tractor. STOP pumping when track idler stops moving.



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ADJUSTMENT - CONTINUED

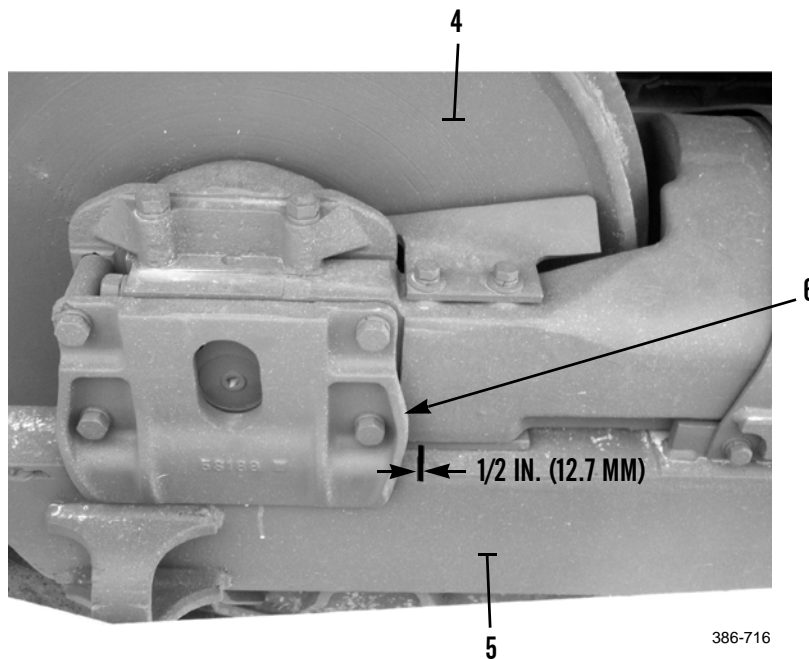
7. Mark a line on track roller frame (5) 1/2 in. (12.7 mm) from rear face of idler bearing support (6).



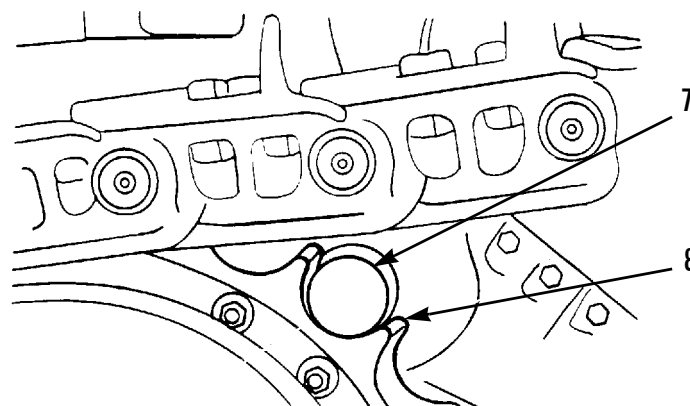
WARNING

Wear eye protection and keep face clear when venting grease from relief valve during track adjustment. NEVER visually inspect relief valve to see if grease is escaping. Always observe track to see it has loosened. Failure to follow this warning could cause eye injury or blindness.

8. Open relief valve (2) no more than one turn and allow grease to escape and track idler (4) to move back.

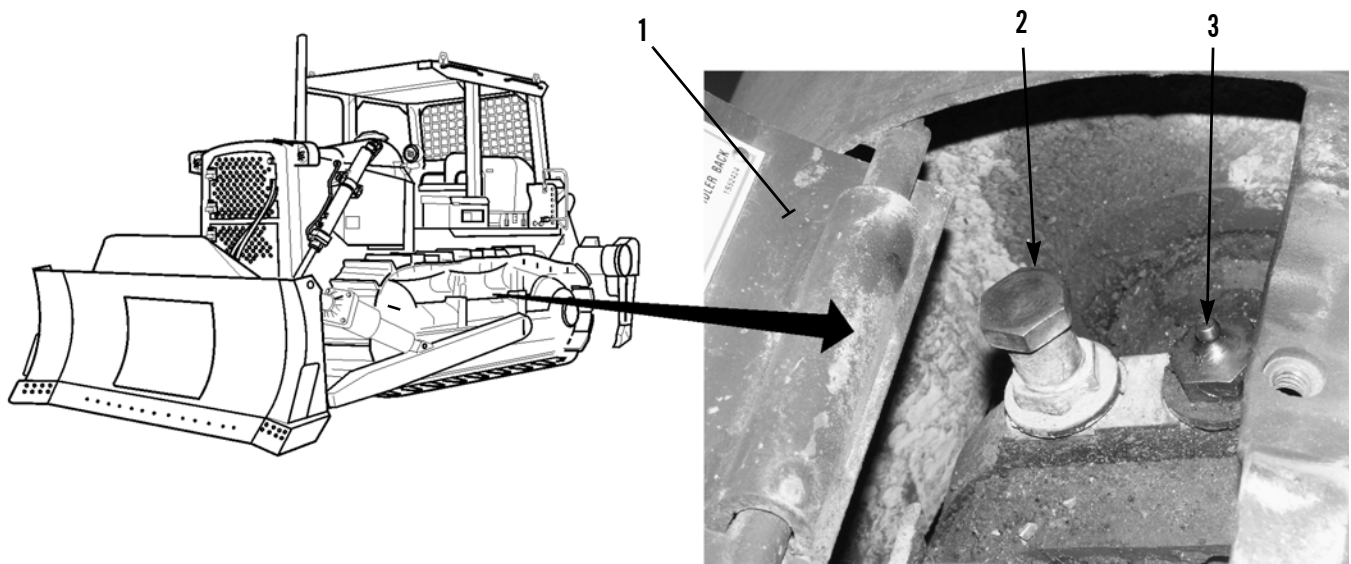


9. Put a drawbar pin (7), or a length of steel pipe, between teeth at top of track drive sprocket (8) near track link.



ADJUSTMENT - CONTINUED

10. Start engine and move machine in reverse until rear face of idler bearing support (6) moves past mark made on track roller frame (5).
11. Move machine forward until pin (7) is free of track drive sprocket (8). Shut down engine and remove pin.
12. Connect grease gun to fill valve (3). Close relief valve (2).
13. Pump grease into fill valve (3) until rear face of idler bearing support (6) lines up with mark made on track roller frame (5).
14. Close recoil mechanism access cover (1) and tighten bolt.
15. Test drive and check track for proper operation (TM 5-2410-233-10).

**END OF WORK PACKAGE**

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STEERING BRAKE PEDALS AND LINKAGE MAINTENANCE

0121 00**THIS WORK PACKAGE COVERS**Removal, Disassembly, Cleaning, Assembly, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Grease, GAA (Item 15, WP 0184 00)

Rag, wiping (Item 28, WP 018400)

Pin, cotter (1, 5, and 15)

Lockwasher (10 and 24)

References

TM 5-2410-233-10

WP 0126 00

Equipment Condition

Floor plates removed (WP 0135 00)

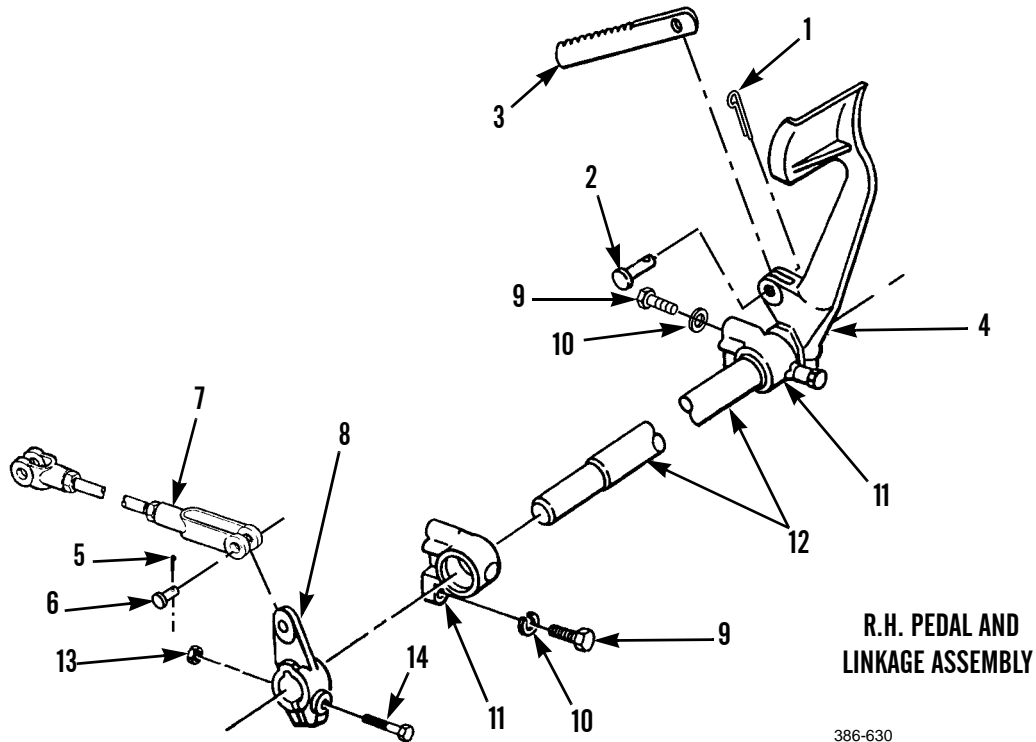
Seat and seat base removed, if replacing rearmost linkage at brake actuating mechanism, (WP 0137 00)

Fuel tank removed, if replacing rearmost linkage at brake actuating mechanism, (WP 0049 00)

REMOVAL**NOTE**

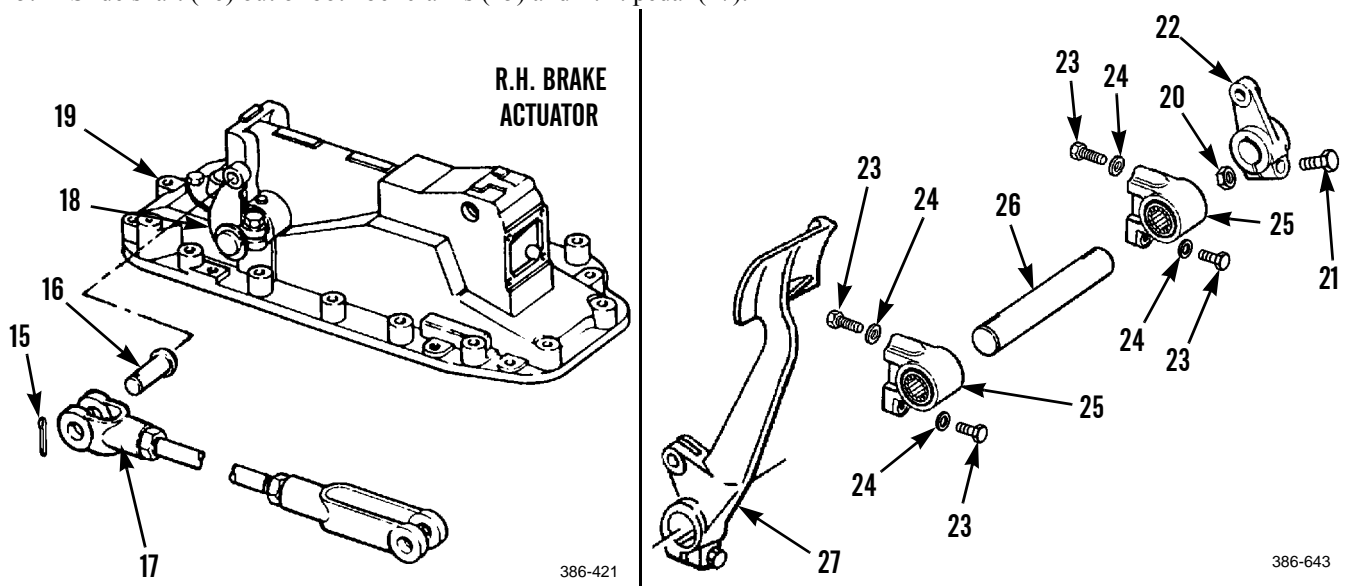
This procedure is to be used for R.H. or L.H. brake pedal and linkages.

1. Remove cotter pin (1), pin (2) and ratchet (3) from R.H foot pedal (4). Discard cotter pin.
2. Repeat step 2 for ratchet (3) on L.H foot pedal.
3. Remove cotter pin (5), pin (6) and disconnect R.H. rod end (7) from lever (8). Discard cotter pin.
4. Repeat step 3 for L. H. side to remove rod end (7).
5. Remove four bolts (9) and lockwashers (10) from two bellcranks (11). Discard lockwashers.
6. Remove shaft (12), R. H. foot pedal (4), bellcranks (11) and lever (8) as an assembly from machine.
7. Remove nut (13), bolt (14) and lever (8) from shaft (12).
8. Slide shaft (12) out of both bellcranks (11) and R.H. pedal (4).



REMOVAL - CONTINUED

9. Remove cotter pin (15) and pin (16) from rod end (17). Discard cotter pin.
10. Remove rod end (17) from lever (18) on brake actuating mechanism (19).
11. Remove nut (20) and bolts (21) from lever (22).
12. Remove four bolts (23) and lockwashers (24) from both bellcranks (25). Discard lockwashers.
13. Remove shaft (26), L. H. foot pedal (27), bellcranks (25) and lever (22) as an assembly from crossbeam under floor.
14. Remove lever (22) from end of shaft (26).
15. Slide shaft (26) out of both bellcranks (25) and L.H. pedal (27).

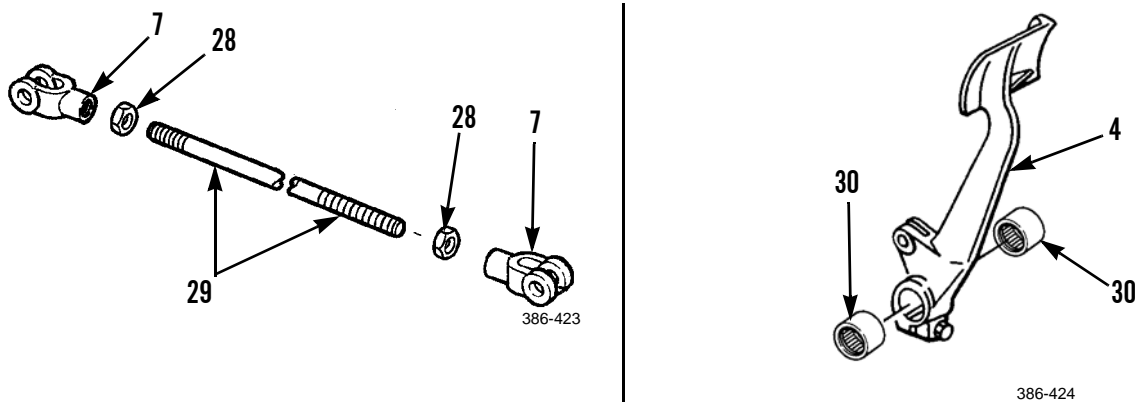


DISASSEMBLY

NOTE

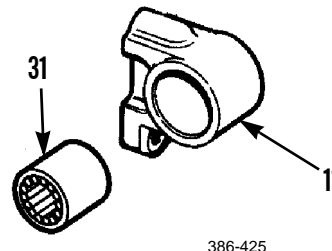
Only one rod, brake pedal and bellcrank are shown. Procedures for disassembly are the same for all others.

1. Loosen nut (28) from each end of rod (29). Remove nuts and two rod ends (7).
2. Remove two bearings (30) from foot pedal (4).



DISASSEMBLY - CONTINUED

3. Remove bearing (31) from bellcrank (11).



CLEANING

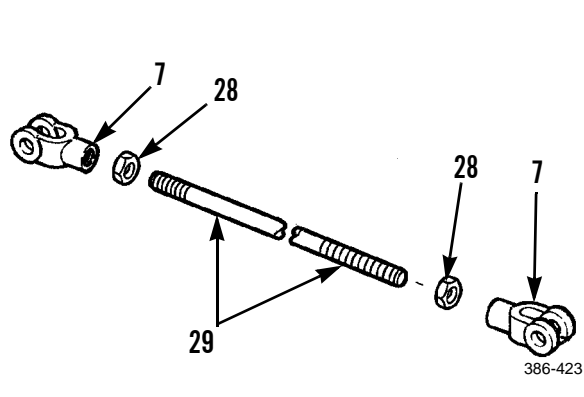
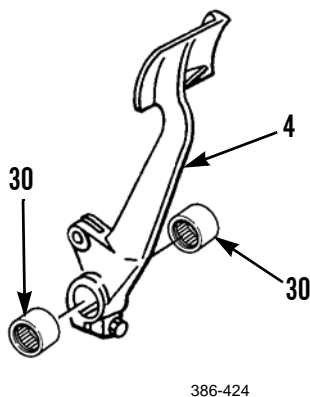
1. Wipe bearing surfaces of bellcranks and foot pedals clean and dry.

ASSEMBLY

NOTE

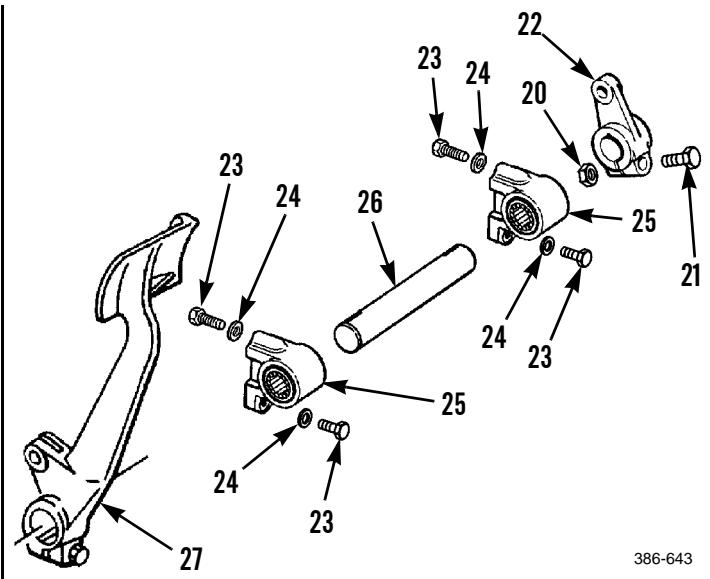
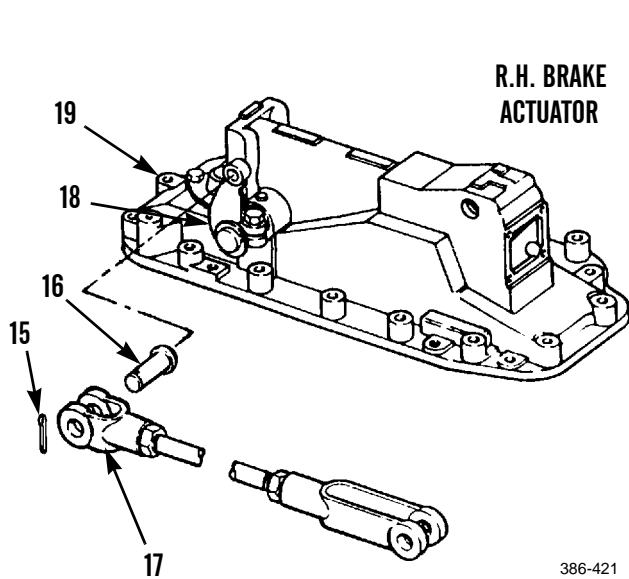
- Lightly coat bearing surfaces and bearings with grease before installation. After installation, remove excess grease with a rag.
- Only one rod, brake pedal and bellcrank are shown. Procedures for assembly are the same for all others.

1. Install bearing (31) into bellcrank (11).
2. Install two bearings (30) in foot pedal (4).
3. Install two nuts (28) on each end of rod (29).
4. Install two rod ends (7) on each end of rod (29). Adjust rod ends to a distance of 19.25 in. (48.90 cm) between center lines of holes in rod ends.
5. Tighten two nuts (28) against rod ends (7) to 75 lb-ft (102 Nm).



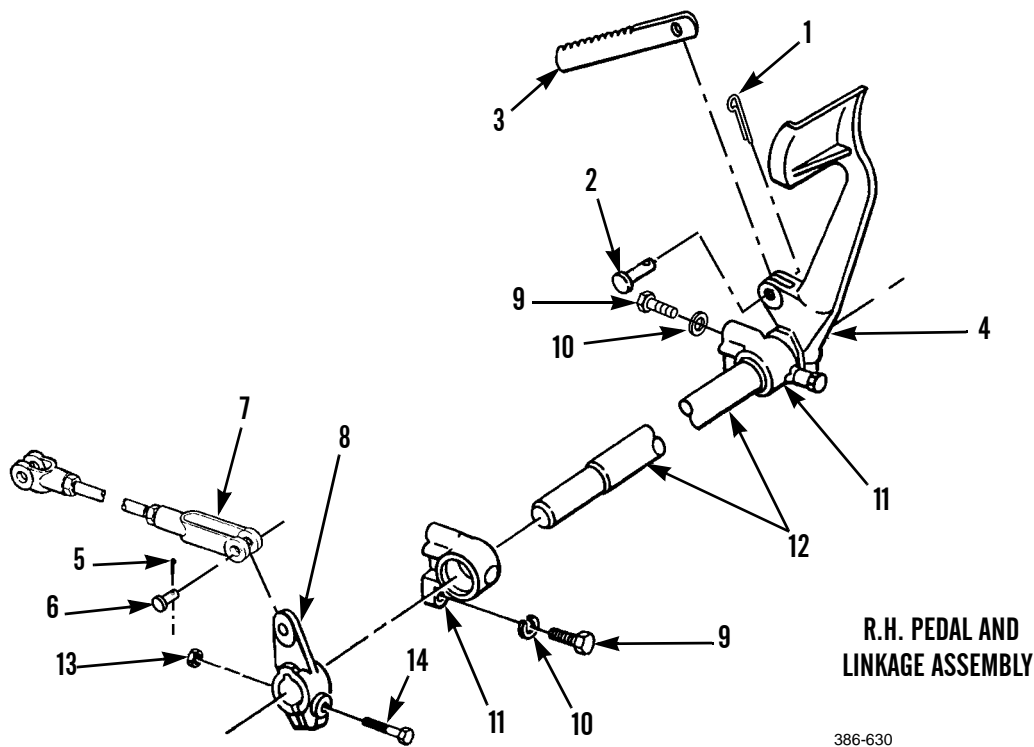
INSTALLATION

6. Install rod end (17) to lever (18) on brake actuating mechanism (19) with pin (16) and new cotter pin (15).
7. Install lever (22) on end of shaft (26).
8. Install capscrew (21) and nut (20) in lever (22) to secure lever to shaft (26).
9. Install two bellcranks (25) and L.H. foot pedal (27) on shaft (26) and install as an assembly on crossbeam under floor using four bolts (23) and new lockwashers (22).



INSTALLATION - CONTINUED

10. Install lever (8) on end of shaft (12).
11. Install bolt (14) and nut (13) in lever (8) to secure lever to shaft (12).
12. Install two bellcranks (11) and R.H foot pedal (4) on shaft (12) and install as an assembly on crossbeam under floor using four bolts (9) and new lockwashers (10).
13. Install rod end (7) on lever (8) with pin (6) and new cotter pin (5).
14. Install ratchet (3) on R. H. foot pedal (4) with pin (2) and new cotter pin (1).
15. Repeat step 14 for L H. foot pedal.



16. Adjust linkages (WP 0126 00).
17. Install floor plates (WP 0135 00).
18. If removed, install fuel tank (WP 0049 00).
19. If removed, install seat and seat base assembly (WP 0137 00).
20. Test drive and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

STEERING CLUTCH LEVERS AND LINKAGE ADJUSTMENT

0122 00

THIS WORK PACKAGE COVERS

Adjustment

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Equipment Condition

Battery cables disconnected (WP 0080 00)
Floor plates removed (WP 0135 00)

Materials/Parts

Lockwasher (2 and 7)
Pin, cotter (11)

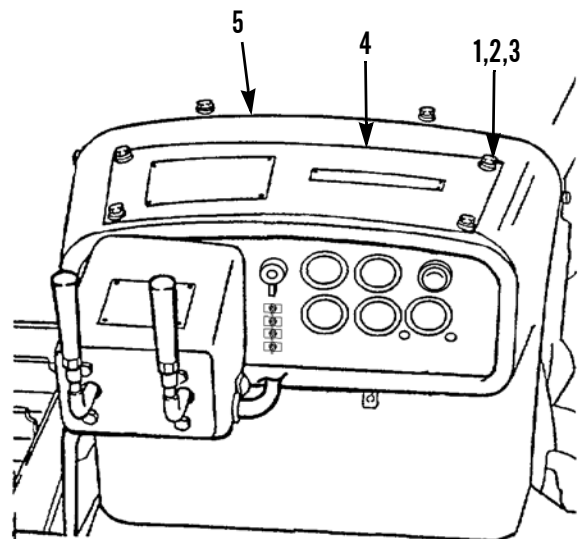
**WARNING**

Ensure battery cables are disconnected before performing maintenance inside dash assembly. Failure to follow this warning could result in personal injury or damage to equipment.

ADJUSTMENT**NOTE**

- Ensure all linkage mounting bolts are tight before performing adjustment.
- Adjustment of one steering clutch lever and linkage is described. Both are adjusted the same way.
- Adjust right and left steering clutch levers and linkage at the same time.

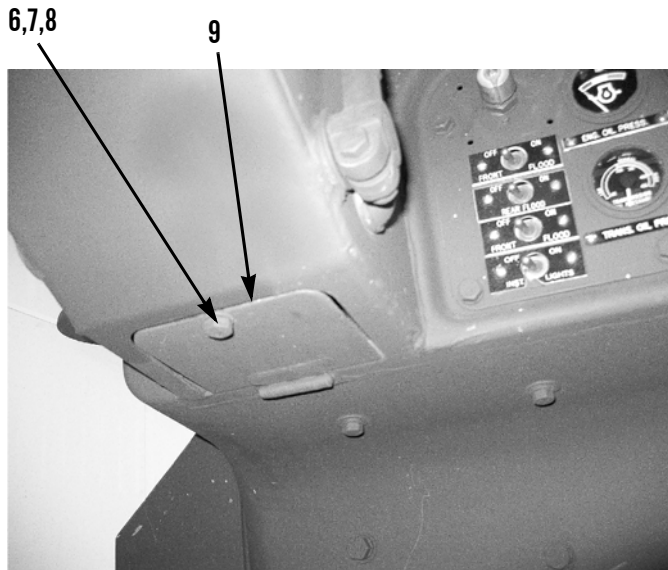
1. Remove four capscrews (1), lockwashers (2), washers (3) and cover (4) from top of dash assembly (5). Discard lockwashers.



386-651

ADJUSTMENT - CONTINUED

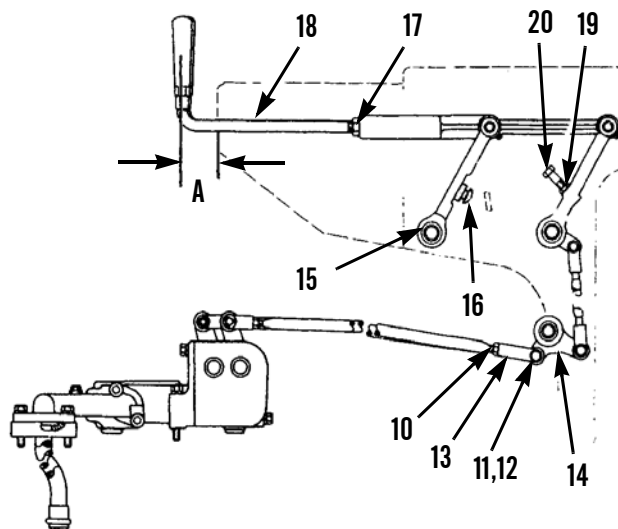
2. Remove capscrew (6), lockwasher (7) and washer (8) and open access cover (9) on underside of governor control console. Discard lockwasher.



386-767

3. Loosen self-locking nut (10), remove cotter pin (11) and pin (12), and disconnect rod end (13) from bellcrank (14). Discard cotter pin.
4. Push lever (15) to clutch engaged position, all the way toward front of machine against bumper (16).
5. Adjust rod end (13) so pin holes in rod end are aligned with holes in bellcrank (14).
6. Turn rod end (13) an additional 1/2 turn to shorten overall length of control rod.
7. Tighten self-locking nut (10) and install pin (12) and new cotter pin (11) to connect rod end (13) to bellcrank (14).
8. Loosen self-locking nut (17) and, with lever (15) forward in the clutch engaged position, adjust steering clutch control lever (18) so distance (A) between center line of lever and face of dash is 2.50 in. (6.35 cm).

9. Tighten self-locking nut (17).
10. Loosen nut (19) on stop bolt (20). Turn stop bolt into lever to provide clearance between bolt head and stop plate.
11. Pull steering clutch control lever (18) back slowly until a definite resistance is felt. Turn stop bolt (20) out until head of stop bolt contacts stop plate. Turn stop bolt out an additional 1/2 turn (to lengthen).

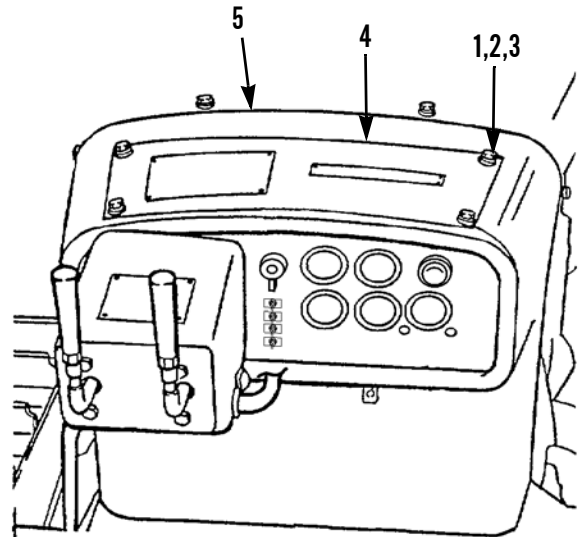


386-736

12. Tighten nut (19).
13. Close access cover (9) at governor control console and secure with washer (8), new lockwasher (7) and cap-screw (6).

ADJUSTMENT - CONTINUED

14. Install cover (4) on dash assembly (5) with four washers (3), new lockwashers (2) and capscrews (1).
15. Install floor plates (WP 0135 00).
16. Connect battery cables (WP 0080 00).
17. Test drive and check for proper operation (TM 5-2410-233-10).



386-651

END OF WORK PACKAGE

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STEERING CLUTCH LEVERS AND LINKAGE MAINTENANCE**0123 00****THIS WORK PACKAGE COVERS**

Removal, Disassembly, Assembly, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Key (30)

Lockwasher (2)

Pin, cotter (6, 9, 16, 19, 22 and 25)

References

TM 5-2410-233-10

WP 0122 00

Equipment Condition

Battery cables disconnected (WP 0080 00)

Floor plates removed (WP 0135 00)

**WARNING**

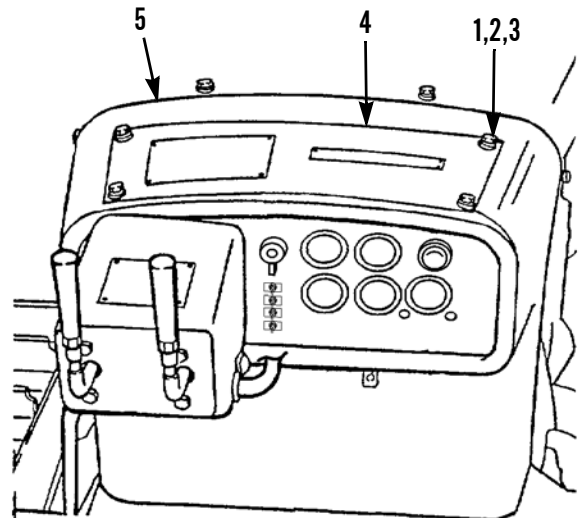
Ensure battery cables are disconnected before performing maintenance inside dash assembly. Failure to follow this warning could result in personal injury or damage to equipment.

NOTE

This procedure to be used for either R.H. or L.H. steering clutch control.

REMOVAL

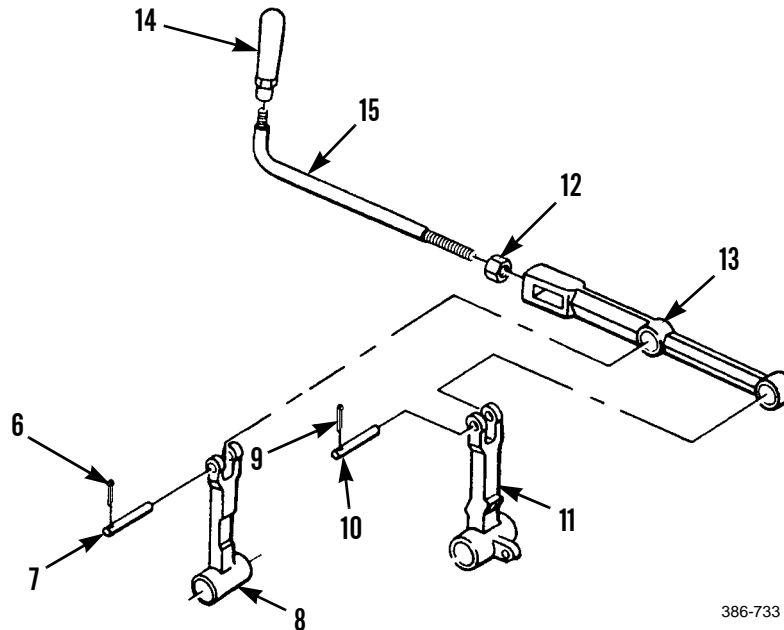
1. Remove four capscrews (1), lockwashers (2), flatwashers (3) and cover (4) from top of dash assembly (5). Discard lockwashers.



386-651

REMOVAL - CONTINUED

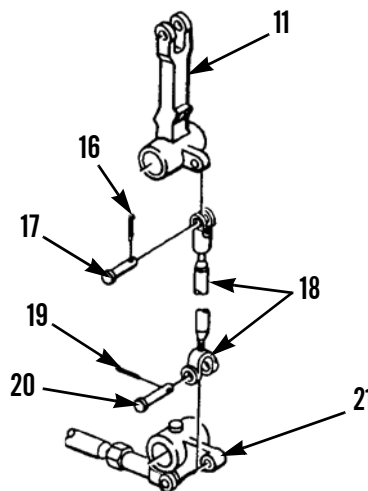
2. Remove cotter pin (6) and pin (7) from lever (8) inside dash assembly (5). Discard cotter pin.
3. Remove cotter pin (9) and pin (10) from lever (11) inside dash assembly (5). Discard cotter pin.
4. Loosen nut (12) and remove levers (8 and 11) from bar (13).
5. Remove handle (14) from rod (15).
6. Remove rod (15) from bar (13).



386-733

DISASSEMBLY

1. Remove cotter pin (16) and pin (17) from top end of rod (18) at lever (11). Discard cotter pin.
2. Remove cotter pin (19) and pin (20) from bottom end of rod (18) and bellcrank (21). Discard cotter pin.



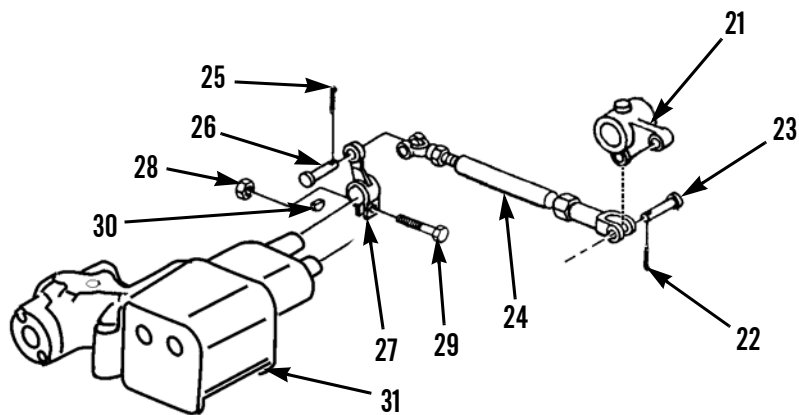
386-734

DISASSEMBLY- CONTINUED

3. Remove cotter pin (22) and pin (23) from end of rod (24) at bellcrank (21). Discard cotter pin.
4. Remove cotter pin (25) and pin (26) from end of rod (24) at control valve lever (27). Remove rod. Discard cotter pin.
5. Remove nut (28), capscrew (29), control valve lever (27) and key (30) from control valve (31). Discard key.

ASSEMBLY

1. Install control valve lever (27) on control valve (31) with new key (30) and capscrew (29) and nut (28).
2. Connect one end of rod (24) to lever (27) with pin (26) and new cotter pin (25).
3. Connect other end of rod (24) to bellcrank (21) with pin (23) and new cotter pin (22).

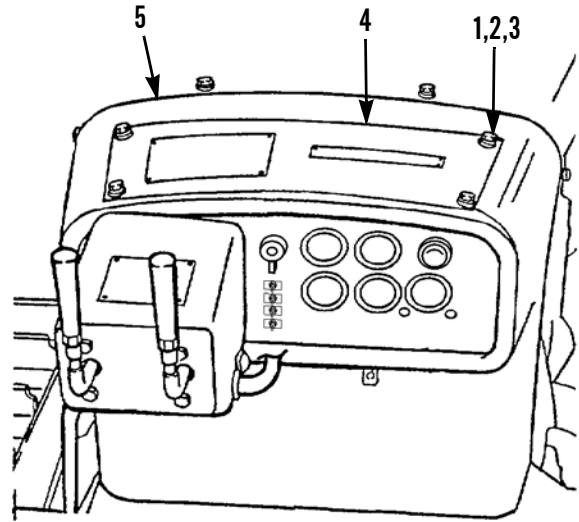


4. Connect bottom end of rod (18) to bellcrank (21) with pin (20) and new cotter pin (19).
5. Connect top end of rod (18) to lever (11) with pin (17) and new cotter pin (16).
6. Position bar (13) inside dash assembly.
7. Install nut (12) loosely on rod (15) and insert rod into bar (13).
8. Install handle (14) on rod (15).
9. Position levers (8 and 11) on bar (13).
10. Install pin (10) and new cotter pin (9) to secure lever (11) to bar (13).
11. Install pin (6) and new cotter pin (7) to secure lever (8) to bar (13).
12. Tighten nut (12) against rod (15).

386-735

INSTALLATION - CONTINUED

13. Adjust steering linkage (WP 0122 00).
14. Install cover (4) on top of dash assembly (5) with four capscrews (1), new lockwashers (2) and flatwashers (3).
15. Install floor plates (WP 0135 00).
16. Connect battery cables (WP 0080 00).
17. Test drive and check steering for proper operation (TM 5-2410-233-10).



386-651

END OF WORK PACKAGE

STEERING BRAKE LOCK LEVER AND LINKAGE REPLACEMENT

0124 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

References

TM 5-2410-233-10

Materials/Parts

Pin, cotter (1, 5, 10, 17 and 24)

Equipment Condition

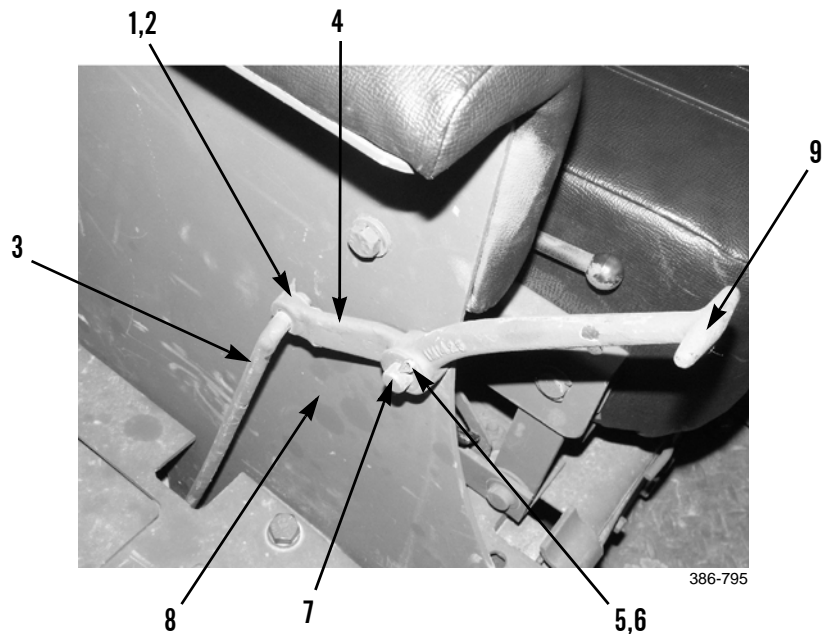
Floor plates removed from floor and from right side of seat (WP 0135 00)

REMOVAL

1. Remove cotter pin (1), washer (2) and disconnect rod end (3) from connector (4). Discard cotter pin.

NOTE**Pin (7) may be tack welded to seat base.**

2. Remove cotter pin (5), washer (6), pin (7) and slide pin out of seat base (8). Discard cotter pin.
3. Remove lever (9) and connector (4).



REMOVAL - CONTINUED

4. Remove cotter pin (10), washer (11) and slide rod end (3) from lever (12). Discard cotter pin.

WARNING

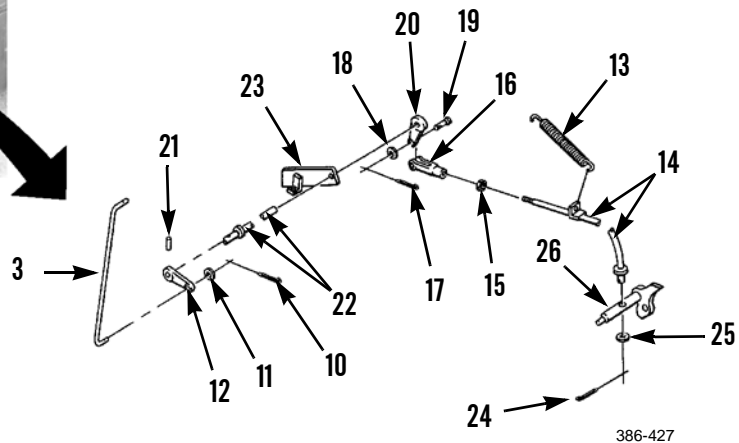
Spring is under tension. Wear eye protection and use extreme caution when removing spring. Failure to follow this warning may result in injury to personnel.

5. Remove spring (13) from rod (14).

NOTE

Make a mark on rod prior to loosening adjuster nut for adjustment procedure.

6. Loosen adjusting nut (15) from clevis (16).
7. Remove cotter pin (17), washer (18) and pin (19) and slide clevis (16) from lever (20). Discard cotter pin.
8. Remove pin (21) and slide rod (22) through bracket (23) and from machine.
9. Remove cotter pin (24), washer (25) and remove rod (14) from shaft (26). Discard cotter pin.



INSTALLATION

1. Position rod (14) into shaft (26) and install washer (25) and new cotter pin (24).
2. Connect clevis (16) to lever (20) and install pin (19), washer (18) and new cotter pin (17).
3. Install spring (13) on rod (14).

NOTE

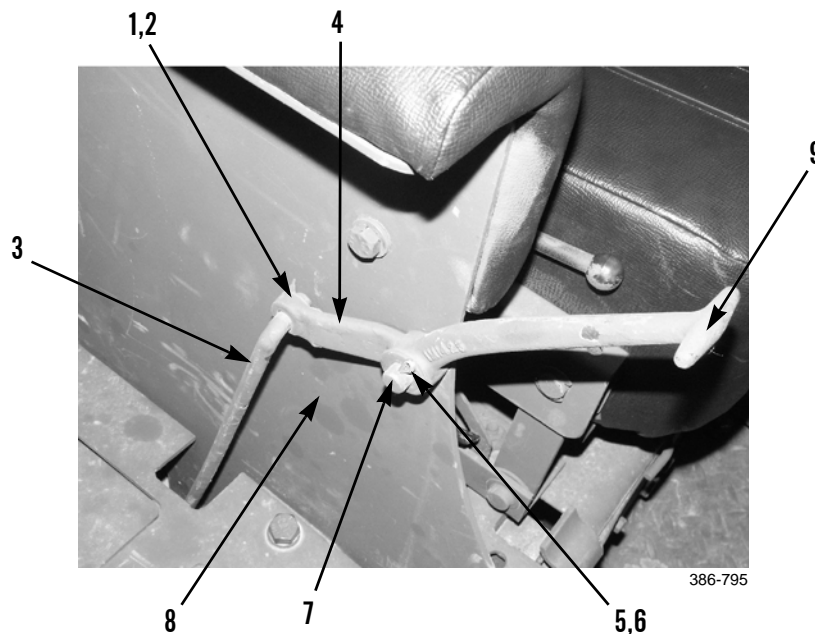
Do not tighten adjusting nut on clevis. Adjustment is performed in step 9.

4. Slide rod (22) through bracket (23) into lever (20).
5. Connect rod (22) to lever (12) and install pin (21)
6. Connect rod end (3) to lever (12) with washer (11) and new cotter pin (10).
7. Connect rod end (3) to connector (4) and install washer (2) and new cotter pin (1).

NOTE

Pin (7) may be tack welded to seat base.

8. Install pin (7) through seat base (8) and lever (9) and install washer (6) and new cotter pin (5).
9. Adjust rod (14) so thread measures 3/4 in. (19 mm) inside of clevis (16).
10. Pull on lever (9) to obtain full travel of handle.



11. Check steering brake lock for proper operation (TM 5-2410-233-10).
12. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

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STEERING BRAKE ACTUATING MECHANISM MAINTENANCE

0125 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning and Inspection, Assembly, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Lifting equipment, 200 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Lockwasher (6 and 53)

Materials/Parts - Continued

Pin, cotter (7, 16, 20 and 45)
 Wood blocks, 6 in. x 4 in. x 4 in.

References

TM 5-2410-233-10

Personnel Required

Two

Equipment Condition

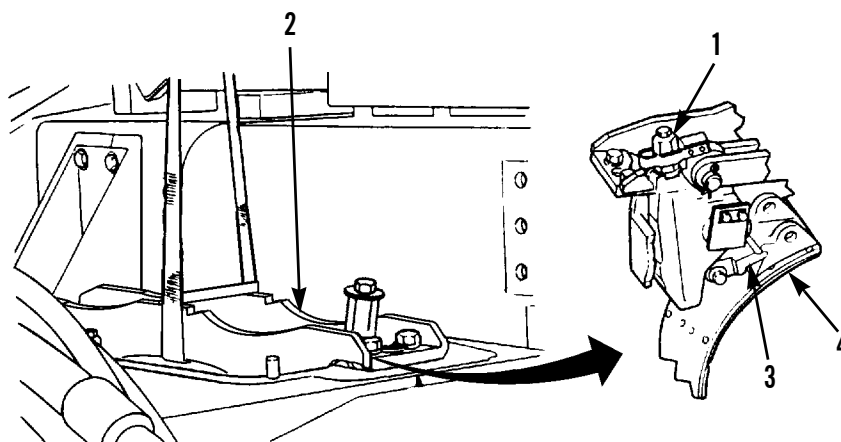
Steering clutch and final drive top cover removed
 (WP 0105 00)

NOTE

R.H. and L.H. steering brake actuating mechanisms are the same. This procedure covers one side.

REMOVAL

1. Loosen socket (1) in actuating mechanism (2) to disengage struts (3) from brake band (4).



386-332

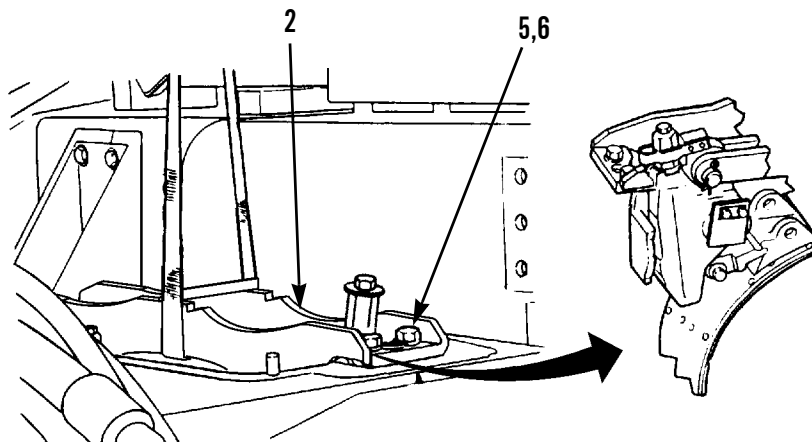
REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Steering brake actuating mechanism weighs 90 lb (41 kg).

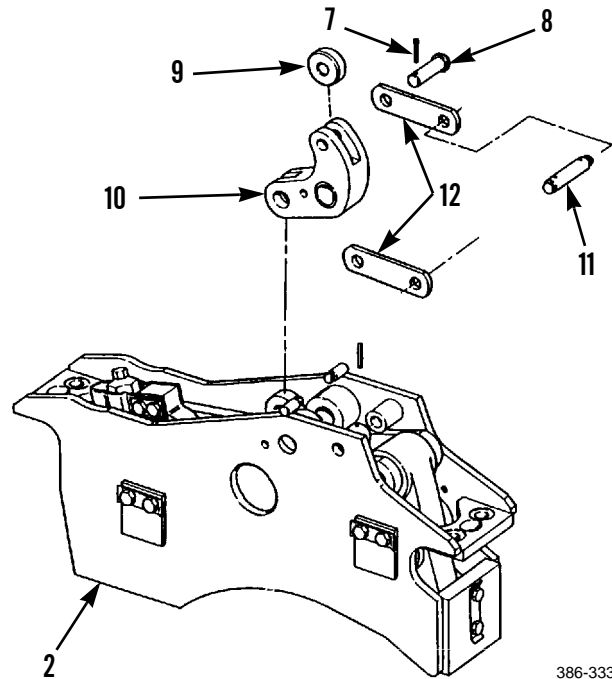
2. Attach a nylon sling and a suitable lifting device to actuating mechanism (2) and take up slack in lifting device.
3. Remove four bolts (5) and lockwashers (6) from actuating mechanism (2). Discard lockwashers.
4. Use lifting device and, if necessary, a pry bar to lift actuating mechanism (2) from gear case.



386-332

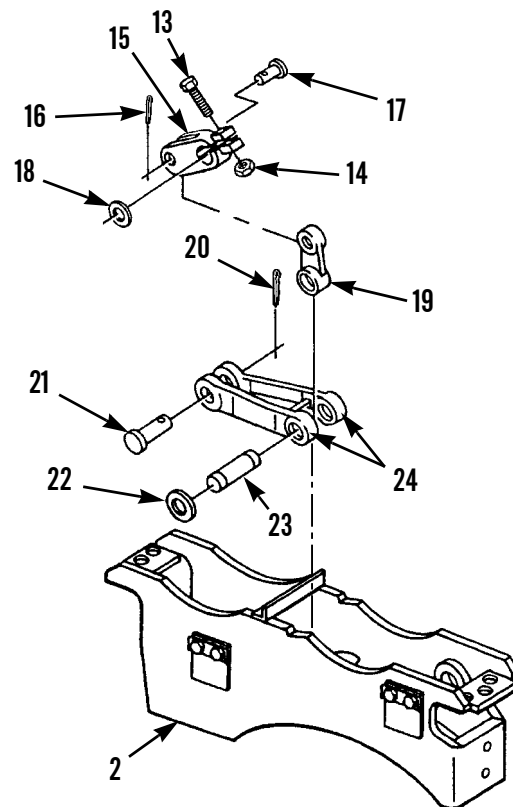
DISASSEMBLY

1. Place actuating mechanism (2) on work bench and support 4-6 in. (10-15 cm) off work surface on two wood blocks.
2. Remove cotter pin (7), pin (8), and roller (9) from bellcrank (10). Discard cotter pin.
3. Remove dowel (11), two links (12) and bellcrank (10) from actuating mechanism (2).



386-333

4. Remove capscrew (13) and nut (14) from lever (15).
5. Remove cotter pin (16), pin (17), washer (18) and lever (15) from connector (19). Discard cotter pin.
6. Remove cotter pin (20), pin (21), washer (22), dowel (23), two links (24) and connector (19) from actuating mechanism (2). Discard cotter pin.



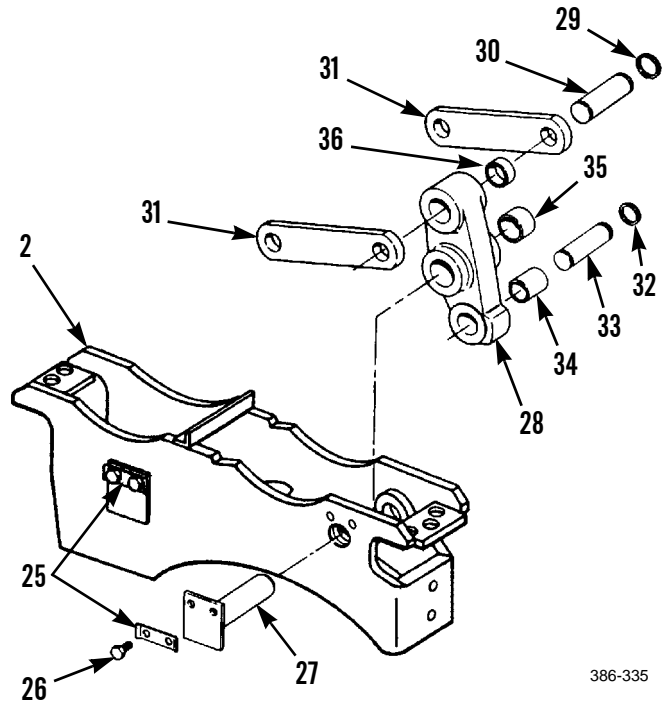
386-334

DISASSEMBLY - CONTINUED

NOTE

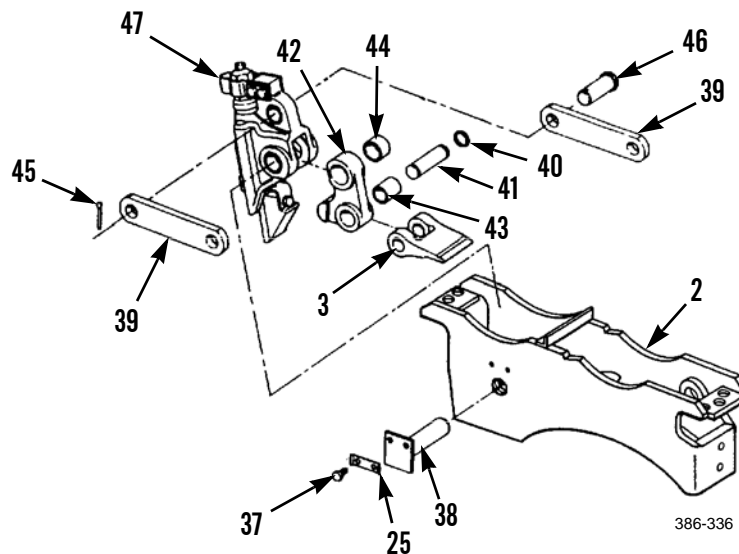
Turn actuating mechanism over on its side, with capscrews facing up, to complete disassembly.

7. Flatten two locks (25) and remove two capscrews (26), shaft (27) and lever (28) from actuating mechanism (2).
8. Remove retaining ring (29), pin (30) and two links (31) from one end of lever (28). If necessary, remove other retaining ring from pin.
9. Remove retaining ring (32) and pin (33) from other end of lever (28). If necessary, remove other retaining ring from pin.
10. Remove bearings (34, 35 and 36) from lever (28).



386-335

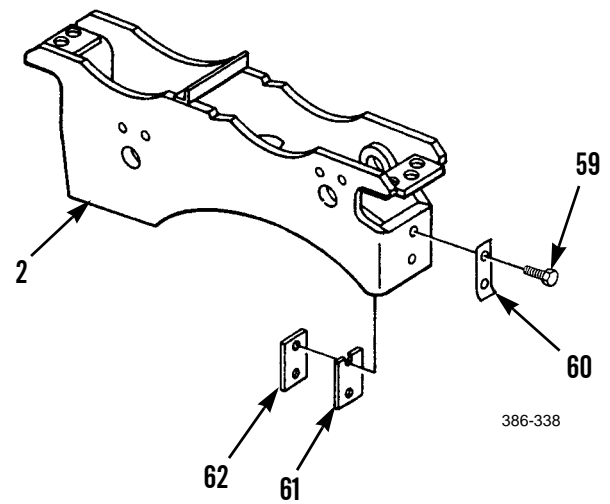
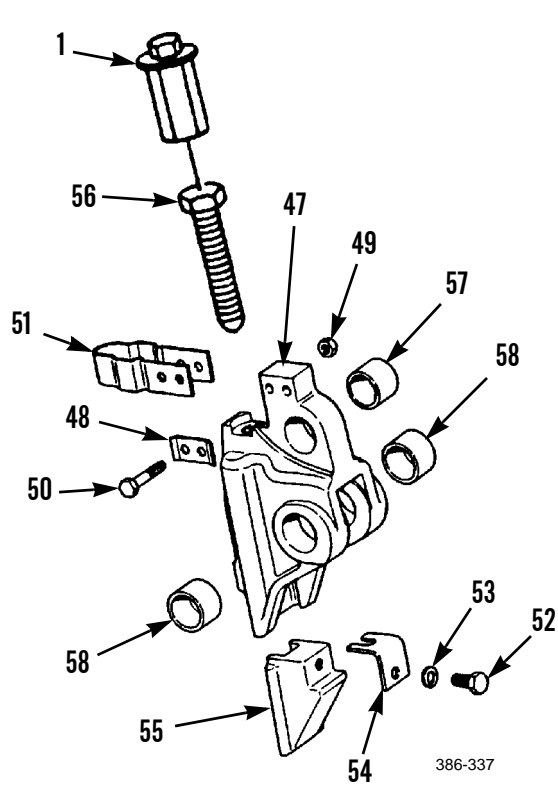
11. Remove two capscrews (37), lock (25), shaft (38) and two links (39) from other end of actuating mechanism (2).
12. Remove retaining ring (40), pin (41) and strut (3) from lever (42). If necessary, remove other retaining ring from pin.
13. Remove small bearing (43) and larger bearing (44) from lever (42).
14. Remove cotter pin (45), pin (46) and two links (39) from lever (47). Discard cotter pin.



386-336

DISASSEMBLY - CONTINUED

15. Flatten lock (48) and remove two nuts (49), capscrews (50), lock spring (51) and socket (1) from lever (47).
16. Remove capscrew (52), lockwasher (53), spring (53) and wedge (55) from lever (47). Discard lockwasher.
17. Remove adjusting screw (56) from top of lever (47).
18. Remove small bearing (57) and two larger bearings (58) from lever (47).
19. Remove two capscrews (59), lockplate (60), shim (61) and plate (62) from end of actuating mechanism (2).



CLEANING AND INSPECTION**WARNING**

Solvent cleaning, compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Clean all removed components in solvent cleaning compound.
2. Wipe components clean with a rag.
3. Inspect for bends, breaks, cracks, corrosion or other damage.
4. Replace any damaged component.

ASSEMBLY**NOTE**

For ease of assembly, position actuating mechanism securely on wood blocks 4-6 in. (10-15 cm) above work surface.

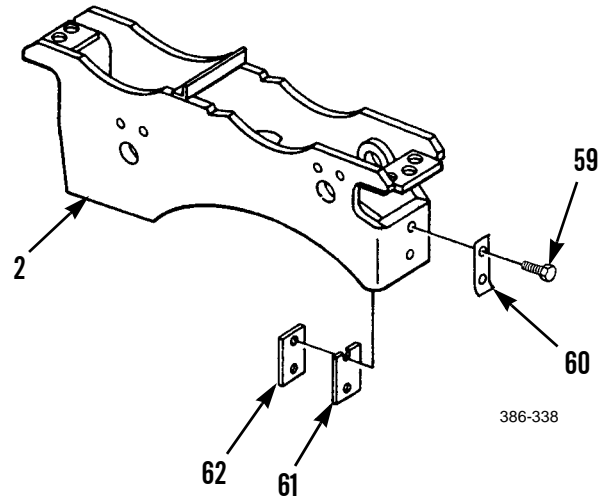
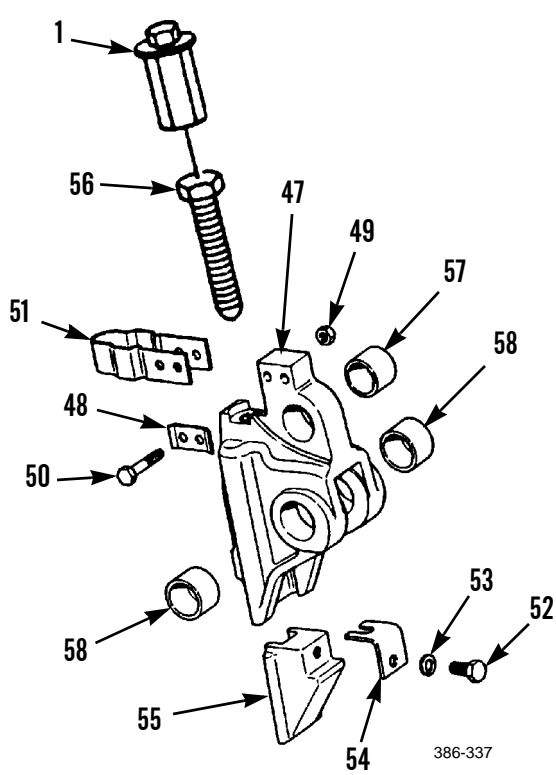
1. Install shim (61), plate (62), lockplate (60) and two capscrews (59) on end of actuating mechanism (2). Bend lockplate.

NOTE

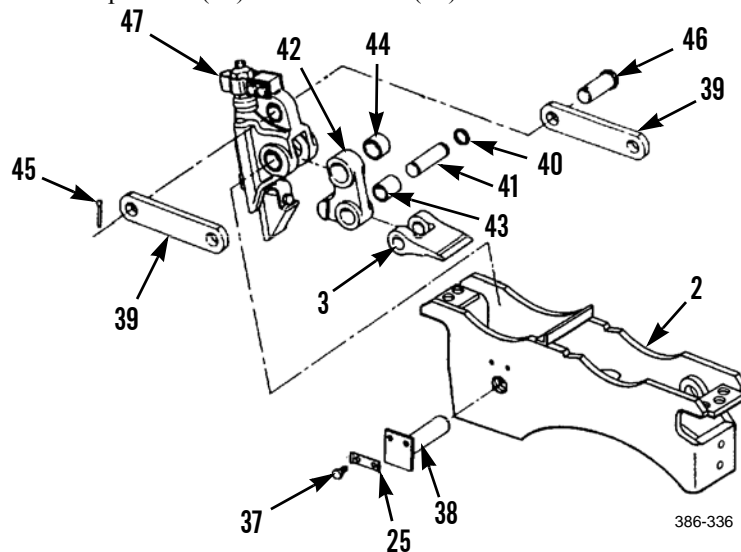
All bearings must be centered from side to side in bearing holes.

2. Install two larger bearings (58) and smaller bearing (57) in lever (47).
3. Install adjusting screw (56) through top of lever (47) and install wedge (55) in bottom of lever until it contacts end of adjusting screw.
4. Install spring (54) with new lockwasher (53) and capscrew (52) in wedge (55), with open end of spring in groove at end of adjusting screw (56).
5. Install socket (1) over adjusting screw (56). Secure socket with spring (51), two capscrews (50), lock (48) and two nuts (49) on lever (47).

ASSEMBLY - CONTINUED

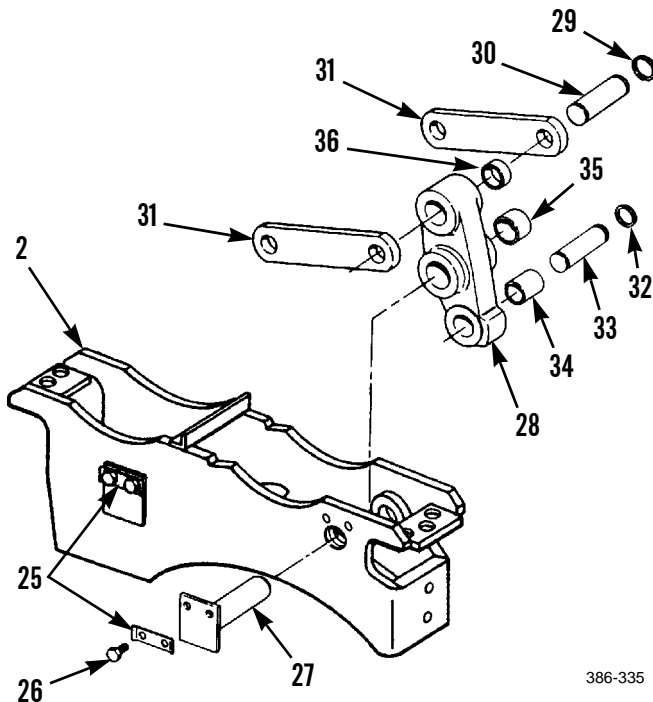


6. Install two links (39) on lever (47) with pin (46) and new cotter pin (45).
7. Install smaller bearing (43) and larger bearing (44) in lever (42).
8. Install strut (3) on lever (42) with pin (41) and retaining ring (40). If removed, install other retaining ring on pin.
9. Position lever (42) with assembled components in actuating mechanism (2). Line up holes and partially insert shaft (38) into one side of lever.
10. Position lever (42) with strut (3) in lever (47). Line up holes and insert shaft (38) through both levers (42 and 47) and actuating mechanism (2).
11. Install lock (25) and two capscrews (37) to secure shaft (38). Bend lock.



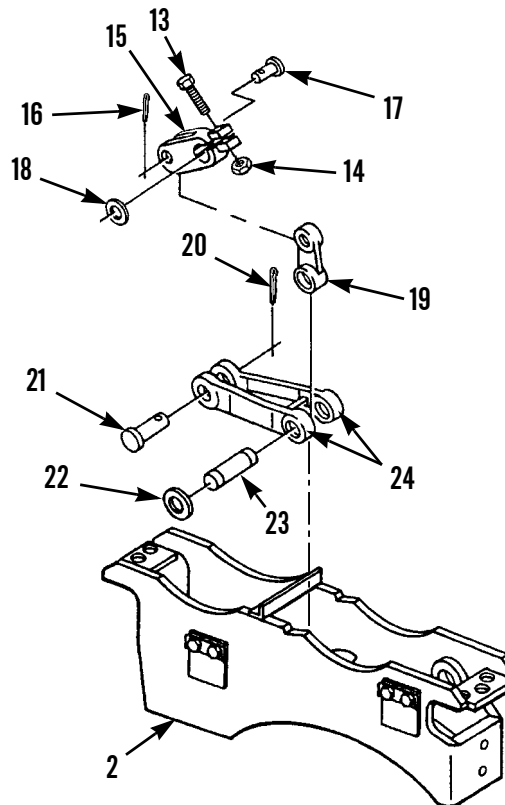
ASSEMBLY - CONTINUED

12. Install bearings (36, 35 and 34) in lever (28).
13. Install strut (3) on lever (28) with pin (33) and retaining ring (32). If removed, install other retaining ring in pin.
14. Install two links (31) on other end of lever (28) with pin (30) and retaining ring (29). If removed, install other retaining ring in pin.
15. Position lever (28) and strut (3) in actuating mechanism (2). Line up holes and insert shaft (27) through actuating mechanism and lever.
16. Install two locks (25) and capscrews (26) to secure shaft (27). Bend locks.



386-335

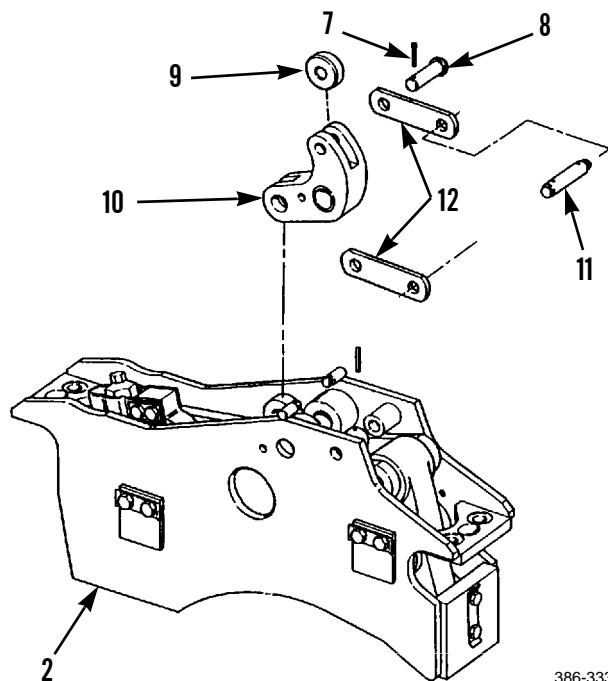
17. Install pin (21) and new cotter pin (20) in two links (24).
18. Install connector (19) in two links (24) and position in actuating mechanism (2).
19. Line up bottom hole in connector (19) with holes in two links (24) and in actuating mechanism (2), and insert dowel (23) and washer (22).
20. Line up bottom hole in lever (15) with top hole in connector (19) and insert pin (17) and new cotter pin (16).
21. Install capscrew (13) and nut (14) and tighten.



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ASSEMBLY - CONTINUED

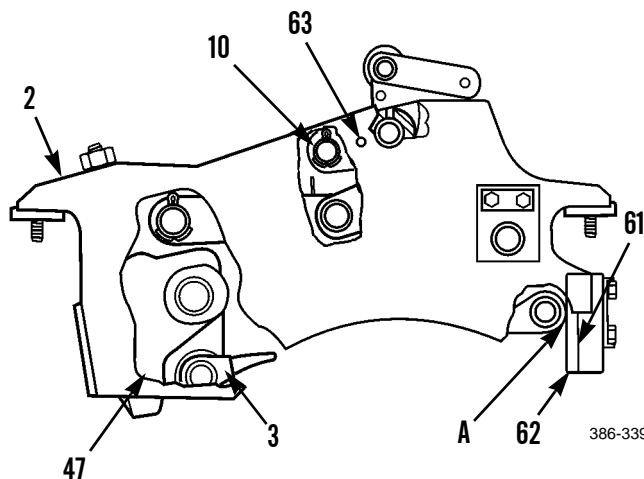
22. Position roller (9) in bellcrank (10).
23. Position two links (11) on bellcrank (10) and install pin (8) and new cotter pin (7).
24. Position other ends of two links (12) in actuating mechanism (2) and install dowel (11) through links.



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25. Adjust actuating mechanism (2) as follows:

- a. Install drift pin (63) through holes in actuating mechanism (2) and bellcrank (10).
- b. Hold lever (47) against back plate of actuating mechanism (2).
- c. Separate struts (3) in order to remove slack in linkage.
- d. Measure distance (A) between strut (3) and plate (62) with a feeler gage. Correct distance is 0.010 +/- 0.005 in. (0.25 +/- 0.13 mm).
- e. Add or remove shims (61) as needed to adjust distance (A).



386-339

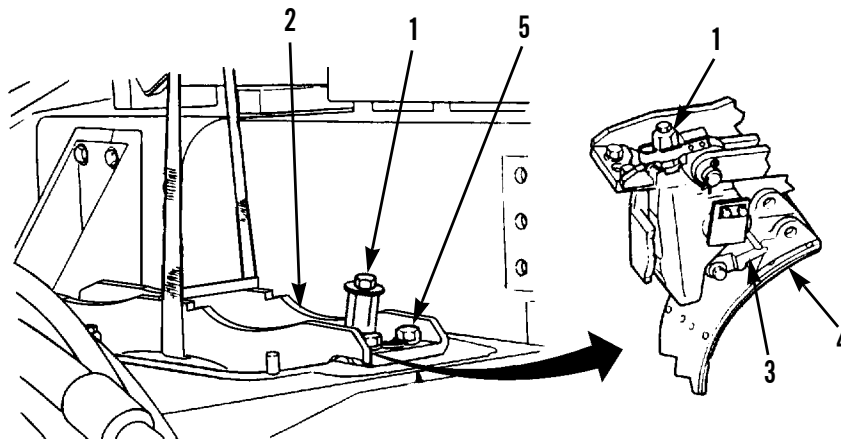
INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Steering brake actuating mechanism weighs 90 lb (41 kg).

1. Attach a nylon sling and a suitable lifting device to actuating mechanism (2) and lift actuating mechanism into position in gear case.
2. Adjust socket (1) to allow struts (3) to engage brake band (4).
3. Install four new lockwashers (6) and bolts (5) to secure actuating mechanism (2).



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4. Install steering clutch and final drive top cover (WP 0105 00).
5. Test drive and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Gasket (4)
 Lockwasher (2)
 Pin, cotter (9)

Equipment Condition

Battery disconnect switch in OFF position (TM 5-2410-233-10)
 Floor plates removed (WP 0135 00)

NOTE

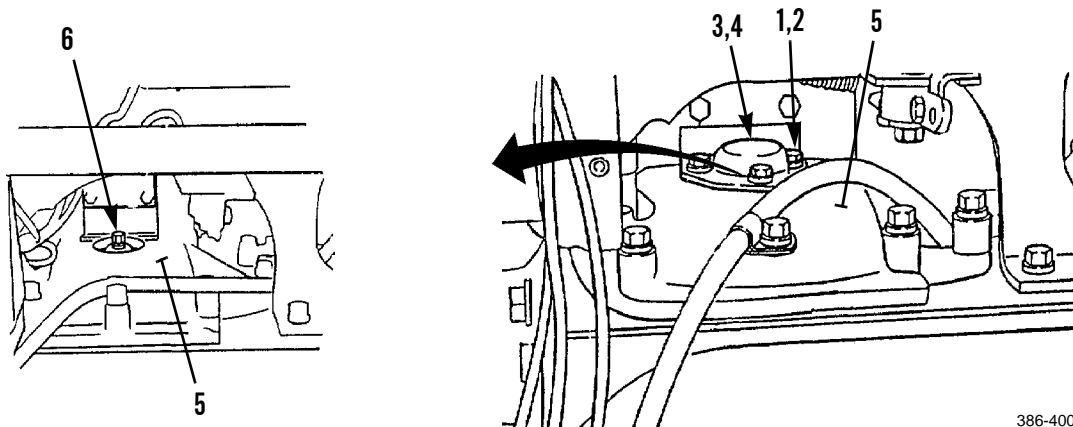
- Perform all adjustment steps in this procedure to properly adjust steering brakes.
- Ensure all linkage mounting bolts are tight before performing adjustment.

ADJUSTMENT

NOTE

The following procedure is for brake drum adjustment. Perform adjustment on both sides.

1. Remove three bolts (1) and lockwashers (2) from cover (3). Discard lockwashers.
2. Remove cover (3) and gasket (4) from top of steering clutch and final drive top cover (5) to gain access to brake band adjusting screw (6). Discard gasket.
3. Turn brake band adjusting screw (6) to the right until band is tight, then loosen screw 1-1/2 turns (9 clicks) to the left.
4. Install new gasket (4) and cover (3) with three new lockwashers (2) and bolts (1).



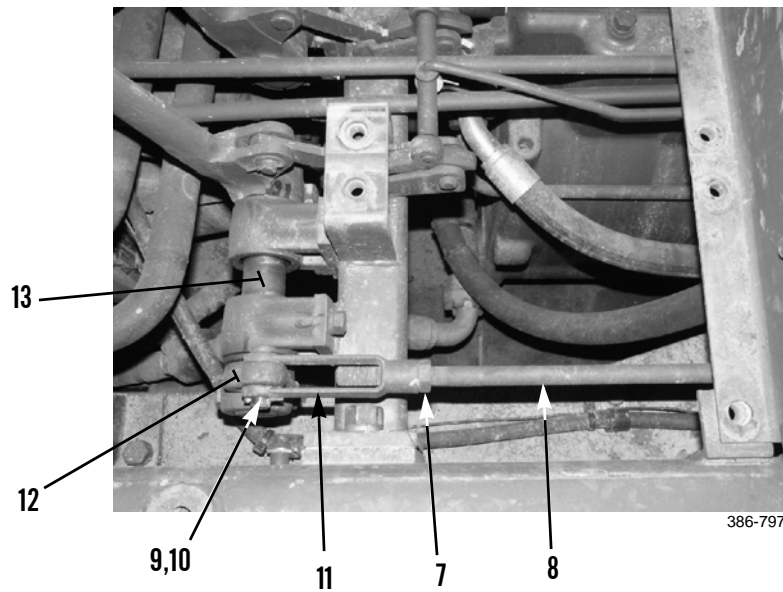
386-400

ADJUSTMENT - CONTINUED

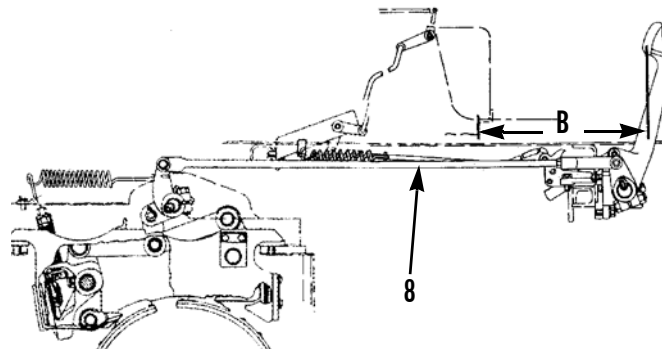
NOTE

The following procedure is for L.H. brake pedal adjustment. Repeat procedure for R.H brake pedal.

5. Loosen self-locking nut (7) on rod (8).
6. Remove cotter pin (9) and pin (10) and disconnect rod end (11) from lever (12) at shaft (13). Discard cotter pin.



7. Turn rod (8) so that distance (B) is 17.75 in. (450.9 mm) between rear face of brake pedal and front face of seat base.



8. Connect rod end (11) to lever (12) and install pin (10) and new cotter pin (9).
9. Tighten self-locking nut (7).

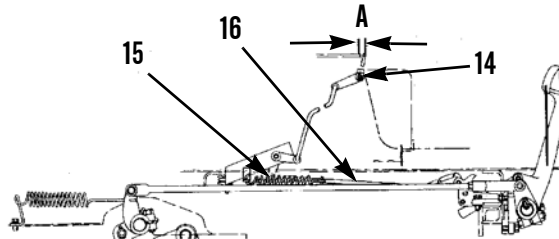
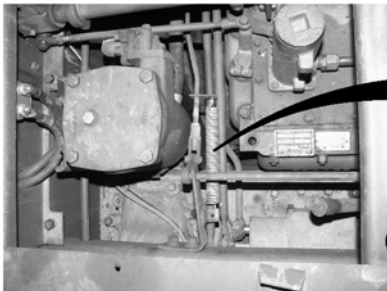
**STEERING BRAKE DRUM, BRAKE PEDALS AND
PARKING BRAKE LEVER ADJUSTMENT- CONTINUED**

0126 00

ADJUSTMENT - CONTINUED**NOTE**

The following procedure is for parking brake lever adjustment.

10. Move parking brake lever (14) to NOT ENGAGED position.
11. Disconnect spring (15).
12. Turn rod (16) so distance (A) is 0.88 in. (22.4 mm), measured between front face of seat arm rest support and center line of parking brake lever (14).
13. Reconnect spring (15).
14. Install floor plates (WP 0135 00).
15. Turn battery disconnect switch to ON position (TM 5-2410-233-10).
16. Test drive and check for proper operation of brakes (TM 5-2410-233-10).



386-403

END OF WORK PACKAGE

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STEERING CLUTCH ASSEMBLY MAINTENANCE

0127 00

THIS WORK PACKAGE COVERS

Removal, Disassembly, Assembly, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Links, lifting (Item 43, WP 0185 00)
- Plate (Item 62, WP 0185 00)
- Plate, compressor (Item 64, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Stand, steering clutch (Item 106, WP 0185 00)
- Lifting equipment, 500 lb capacity
- Bolt, 1/2-13 x 1 in.
- Rod, 3/8 in. -16NC x 4 in.
- Nut, hex, 3/8 in. -16NC

Materials/Parts

- Compound, antiseize (Item 6, WP 0184 00)
- Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Tag, marker (Item 35, WP 0184 00)

Personnel Required

Two

References

- TM 5-2410-233-10
- WP 0086 00
- WP 0126 00

Equipment Condition

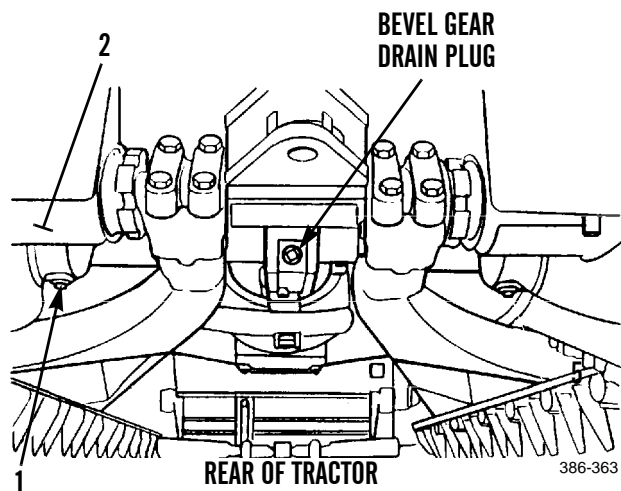
Steering brake actuating mechanism removed (WP 0125 00)

REMOVAL

NOTE

Use a suitable container to capture any draining oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

1. Remove drain plug (1) from bottom of steering clutch case (2) and bevel gear.



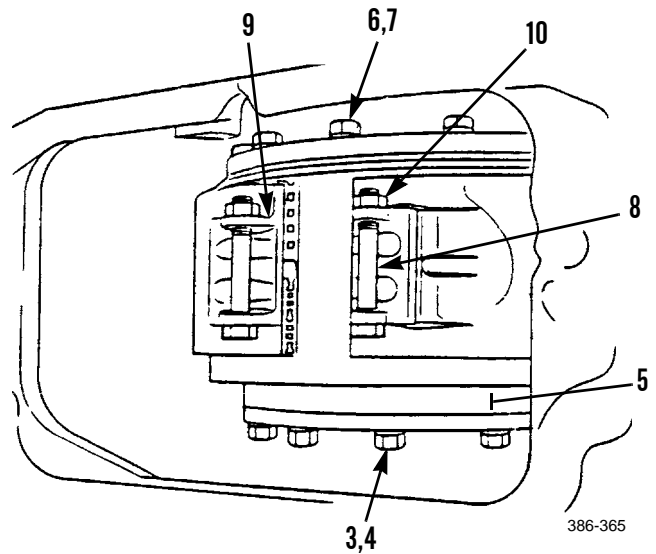
REMOVAL - CONTINUED**WARNING**

Do not remove all capscrews until steering clutch assembly is fully supported by lifting device. Leave one capscrew on each side of steering clutch. Failure to follow this warning may result in injury to personnel or equipment damage.

NOTE

It will be necessary to move tractor forward or rearward approximately 2 ft. (0.6 m) to gain access to all 24 steering clutch capscrews.

2. Remove 11 capscrews (3) and washers (4) from hub side of steering clutch (5) assembly.
3. Remove 11 capscrews (6) and washers (7) on flange side of steering clutch (5) assembly.
4. Install two 3/8 in. -16NC x 4 in. long rods (8) through brake band (9) clamp and secure rods with two 3/8 in. hex nuts (10).



REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

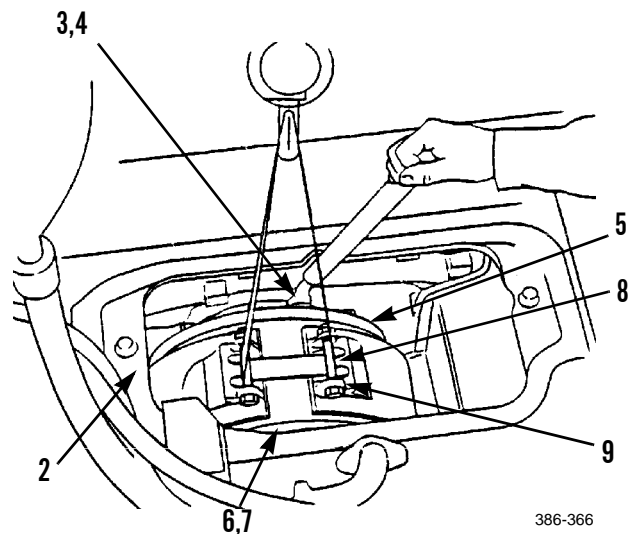
Steering clutch assembly weighs 250 lb (104 kg).

5. Attach a nylon sling and suitable lifting device to rods (8) in brake band (9) clamps. Raise lifting equipment to take up slack.
6. Remove remaining capscrew (3) and washer (4) from hub side of steering clutch (5) assembly. Remove capscrew (6) and washer (7) from flange side.

NOTE

- Keep steering clutch assembly level while lifting. Clutch is free to slide out of outer drum.
- It maybe necessary to pry inner drum away from shoulder of the hub.

7. Lift steering clutch (5) assembly from clutch case (2).



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DISASSEMBLY**WARNING**

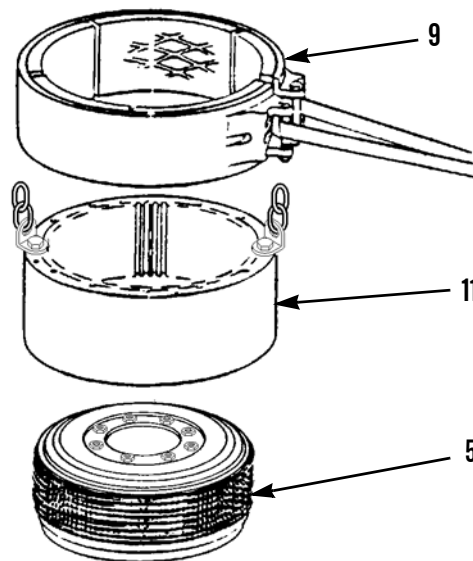
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

1. Use a nylon sling and suitable lifting device to position steering clutch (5) assembly on bench with capscrew side up.
2. Remove lifting equipment and nylon sling. Remove brake band (9) from steering clutch (5).
3. Install two lifting links with 1/2-13 x 1 in. bolt in outer drum (11) 180° apart.

NOTE

Outer drum weighs 85 lb (39 kg).

4. Use a nylon sling and suitable lifting device to remove outer drum (11) from steering clutch (5).



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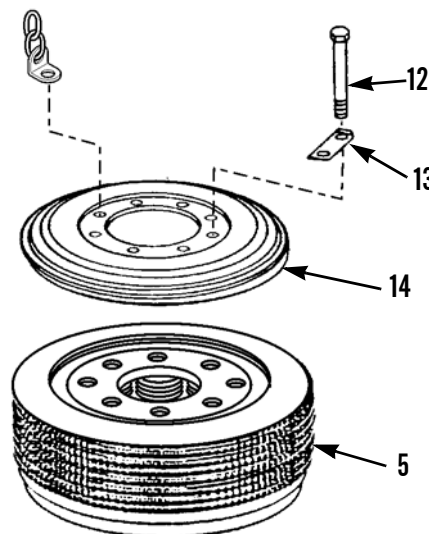
NOTE

Steering clutch weighs 160 lb (73 kg).

5. Attach lifting equipment to steering clutch (5).
6. Install plate on steering clutch stand. Use lifting equipment to place steering clutch (5) over plate on stand. Remove two lifting links and bolts.
7. Install compressor plate over steering clutch (5). Secure compressor plate with retaining nut.
8. Apply pressure to steering clutch (5) and remove eight bolts (12). Remove retaining nut from compressor plate.
9. Release pressure and remove compressor plate and four lock plates (13). Discard lock plates.

DISASSEMBLY - CONTINUED

10. Install two lifting links with 1/2-13 x 1 in. bolt, 180° apart, in pressure plate (14).
11. Use a nylon sling and a lifting device to remove pressure plate (14) from steering clutch (5).
12. Measure height of disc stack. Disc stack height must be a minimum of 2.812 in. (71.42 mm). Compare height with height of a new stack: 3.060 to 3.382 in. (77.72 to 85.90 mm). Replace discs or stack as necessary.



386-368

NOTE

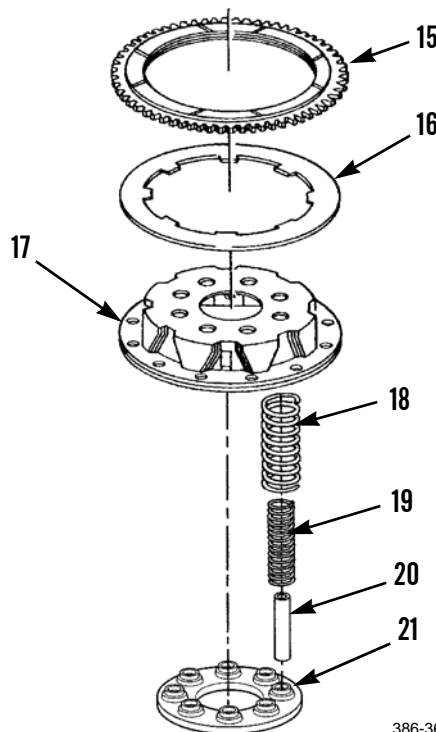
Tag disc assemblies and discs for assembly sequencing as they are disassembled.

13. Remove 12 disc assemblies (15) and 11 discs (16) from inner drum (17).

NOTE

Inner drum weighs 50 lb (23 kg).

14. Use lifting device to remove inner drum (17).
15. Remove eight outer springs (18), inner springs (19) and sleeves (20) from retainer (21).
16. Remove retainer (21) from plate and steering clutch stand.



386-369

ASSEMBLY

1. Install plate on steering clutch stand. Position retainer (21) on plate.
2. Install eight outer spring (18), inner springs (19) and sleeves (20) onto retainer (21).



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

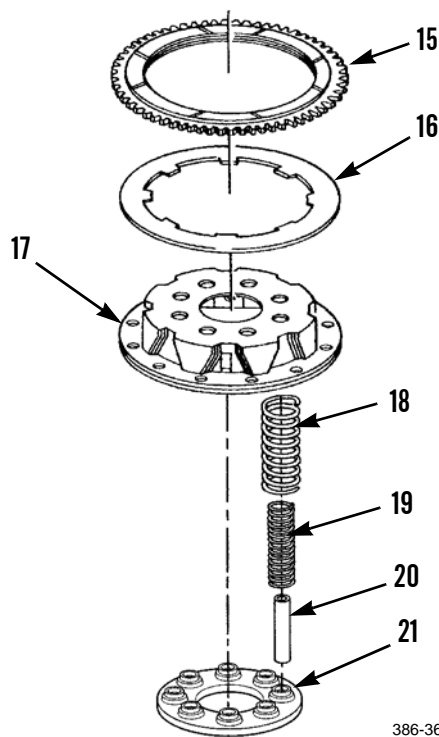
Inner drum weighs 50 lb (23 kg).

3. Use lifting device to install inner drum (17).

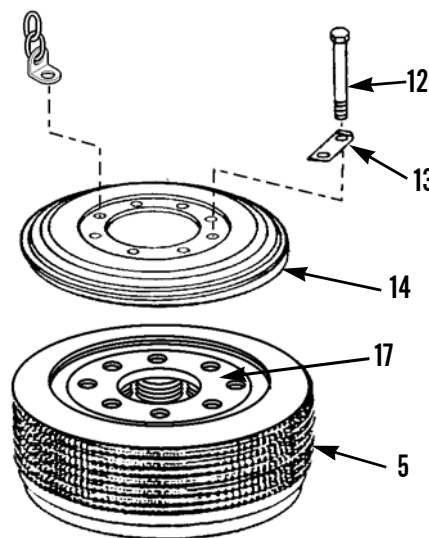
NOTE

If assembling same disc assemblies and discs as were disassembled, install disc assemblies and discs in reverse order of disassembly, to ensure better wear distribution. For example, top is now installed on bottom.

4. Beginning with a disc assembly (15), alternately install 12 disc assemblies and 11 discs (16).
5. Install two lifting links with 1/2-13 x 1 in. bolt to pressure plate (14). Use a nylon sling and lifting device to install pressure plate, with bolt holes aligned with bolt holes in inner drum (17). Remove lifting links.
6. Position four new lock plates (13) and eight bolts (12) in steering clutch (5).
7. Position compressor plate on pressure plate (14) and secure with retaining nut.
8. Compress steering clutch (5) and tighten eight bolts (12) to 150 lb-ft (203 Nm).
9. Bend down lock plates (13).



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ASSEMBLY - CONTINUED**NOTE**

Steering clutch weighs 160 lb (73 kg).

10. Install lifting device to steering clutch (5). Lift steering clutch onto work bench.
11. Install two lifting links with 1/2-13 x 1 in. bolt in outer drum (11) 180° apart.

CAUTION

Use caution not to bend teeth on disc assemblies when positioning outer drum.

NOTE

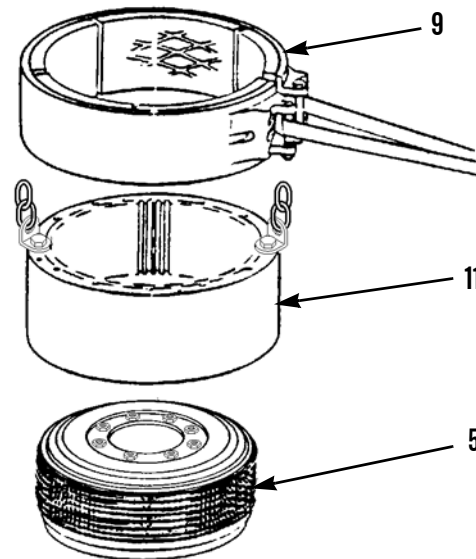
Outer drum weighs 85 lb (39 kg).

12. Use lifting device to lower outer drum (11) into position on steering clutch (5). Remove lifting links and bolts.
13. Install brake band (9).

NOTE

Steering clutch assembly weighs 250 lb (104 kg).

14. Use lifting device to place steering clutch (5) assembly in upright position.



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INSTALLATION

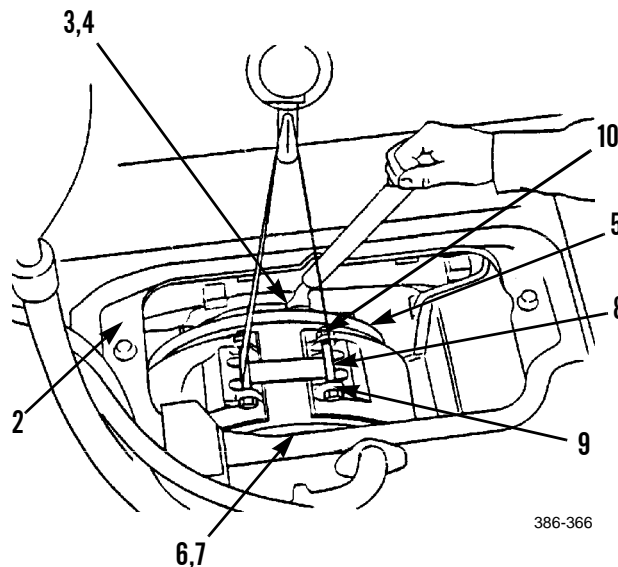
1. Install two 3/8 in. -16NC x 4 in. long rods (8) through brake band (9) clamps and secure rods with two 3/8 in. -16 hex nuts (10).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

- Steering clutch assembly weighs 250 lb (104 kg).
 - Ensure steering clutch stays level so that clutch does not come apart.
2. Attach a nylon sling and suitable lifting device to rods (8) in brake band (9). Lift steering clutch (5) assembly into clutch case (2) between hub and flange.
 3. Put antiseize compound on threads of all capscrews (3 and 6).
 4. Install one capscrew (3) and washer (4) on hub side of steering clutch (5). Tighten capscrew to 200 lb-ft (271 Nm).
 5. Install one capscrew (6) and washer (7) on flange side of steering clutch (5). Tighten capscrew to 200 lb-ft (271 Nm).
 6. Remove lifting equipment, two nuts (10) and rods (8).

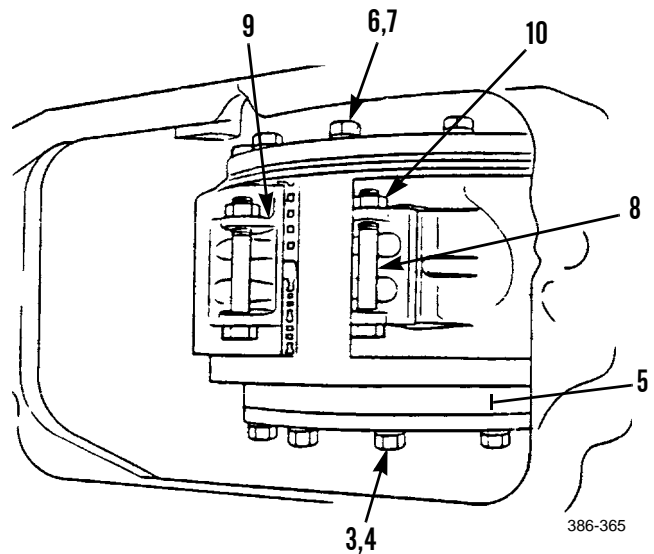


386-366

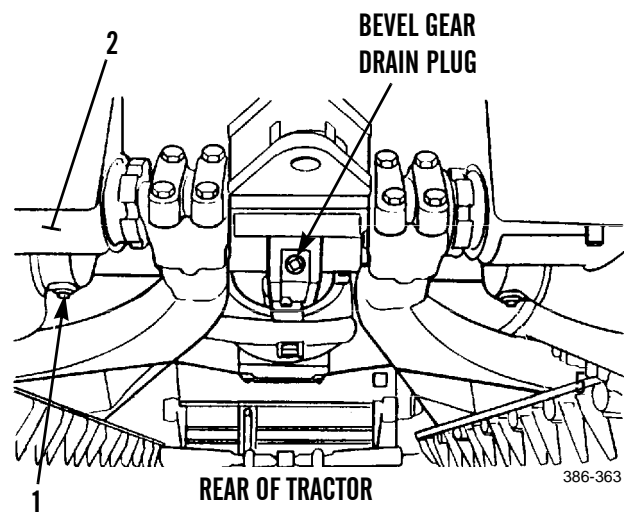
INSTALLATION - CONTINUED**NOTE**

Tractor must be moved, using jack, to position clutch for installation of remaining capscrews and washers.

7. Install 11 capscrews (6) and washers (7) on flange side of steering clutch (5). Tighten capscrews to 200 lb-ft (271 Nm).
8. Install 11 capscrews (3) and washers (4) on hub side of steering clutch (5). Tighten capscrew to 200 lb-ft (271 Nm).



9. Install drain plug (1) in bottom of steering clutch case (2) and at bevel gear.



10. Install steering brake actuating mechanism (WP 0125 00).
11. Fill steering clutch case with oil IAW expected temperature range (WP 0086 00).
12. Adjust brakes (WP 0126 00).
13. Test drive and check steering for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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STEERING CLUTCH HUB REPLACEMENT**0128 00****THIS WORK PACKAGE COVERS**

Removal, Cleaning, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Adapter (Item 1, WP 0185 00)
- Bolt, machine (Item 12, WP 0185 00)
- Puller (Item 69, WP 0185 00)
- Puller, hydraulic (Item 78, WP 0185 00)
- Puller, mechanical (Item 81, WP0185 00)
- Screw, cap, hexagon head (Item 93, WP 0185 00)
- Spacer (Item 102, WP 0185 00)
- Washer (Item 117, WP 0185 00)

Materials/Parts

- Grease, GAA (Item 15, WP 0184 00)
- Oil, lubricating (Item 24, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Bolt, 3/4 in. -10NC, 9 in. long
- Packing, preformed (13)
- Retainer (5)
- Ring (4, 10 and 11)
- Screw, anchor (1), 3/8 in. -16NC, 3 in. long

References

TM 5-2410-233-10

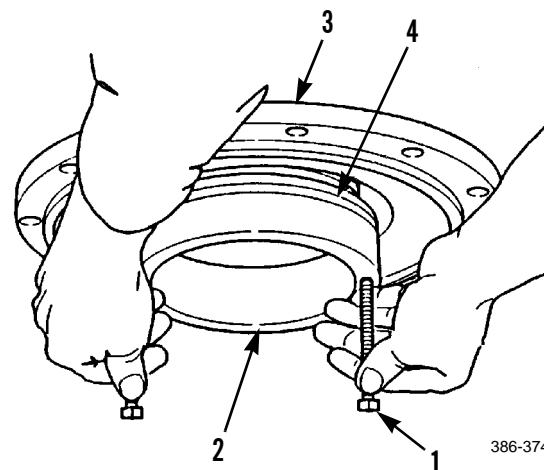
Equipment Condition

Steering clutch removed (WP 0127 00)

REMOVAL**NOTE**

- **This procedure applies to R.H. or L.H. steering clutch hub.**
- **Ensure anchor screws are turned evenly during removal.**

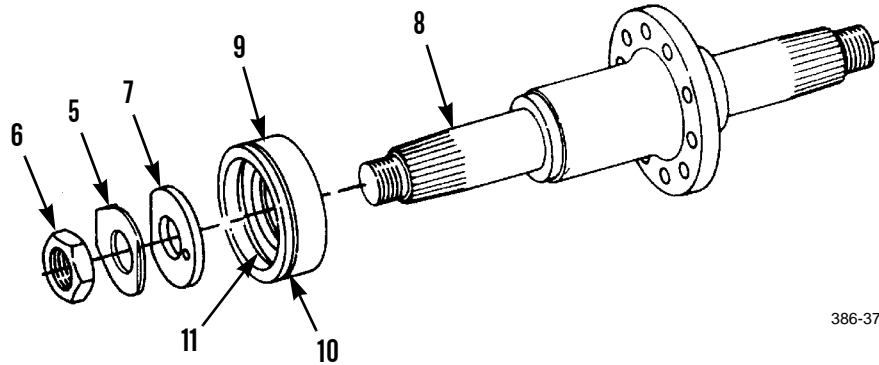
1. Install two 3/8 in. anchor screws (1) and remove piston (2) from steering clutch hub (3).
2. Remove ring (4) from piston (2). Discard ring.



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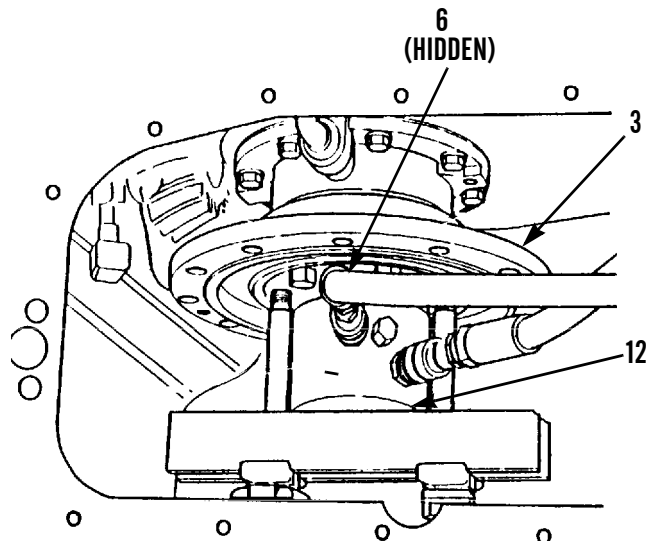
REMOVAL - CONTINUED

3. Bend retainer (5) straight from under nut (6).
4. Remove nut (6), retainer (5) and washer (7) from bevel gear shaft (8). Discard retainer.
5. Remove clutch retainer (9) from bevel gear shaft (8).
6. Remove ring (10) from outside and ring (11) from inside of clutch retainer (9). Discard rings.



386-375

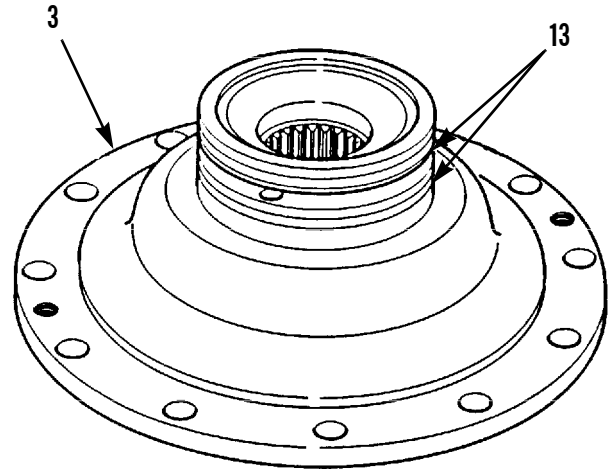
7. Install nut (6) on bevel gear shaft (8), with clearance of 0.375 in. (9.52 mm) between nut and steering clutch hub (3).
8. Install hydraulic puller (12) on steering clutch hub (3) and break steering clutch hub loose from bevel gear shaft (8).
9. Remove nut (6) from bevel gear shaft (8) and hydraulic puller (12) from steering clutch hub (3).
10. Remove steering clutch hub (3) from bevel gear shaft (8).



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REMOVAL - CONTINUED

11. Remove two preformed packings (13) from steering clutch hub (3). Discard preformed packings.



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CLEANING

1. Wipe splines on bevel gear shaft and steering clutch hub clean and dry.
2. Wipe ring grooves on steering clutch hub, piston and clutch retainer clean and dry.

INSTALLATION**NOTE**

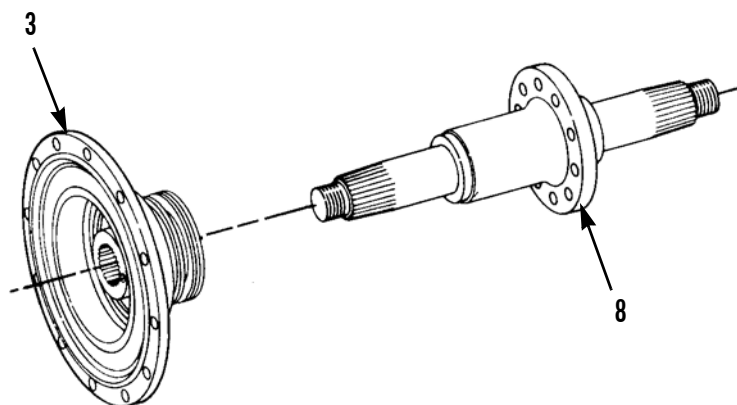
Lightly coat new preformed packings with clean oil before installation.

1. Install two new preformed packings (13) on steering clutch hub (3).

NOTE

Apply a light film of clean grease on splines before installation.

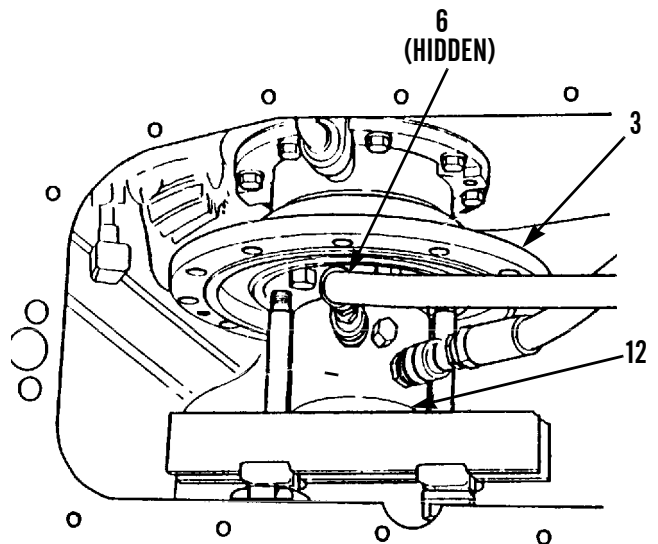
2. Position steering clutch hub (3) on bevel gear shaft (8), align splines and slide hub on bevel gear shaft as far as possible.



386-378

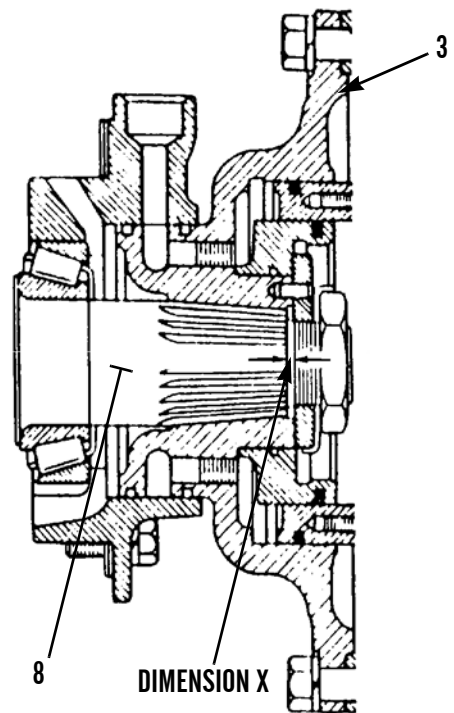
INSTALLATION - CONTINUED

3. Install nut (6) and hydraulic puller (12) on bevel gear shaft (8). Apply a force of 35-40 tons (312-356 kn) to seat steering clutch hub (3).
4. Remove nut (6) and hydraulic puller (12).



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5. Measure distance between face of steering clutch hub (3) and shoulder of bevel gear shaft (8). Dimension X must be 0.12 in. +/- 0.03 in. (3.05 mm +/- 0.76 mm).



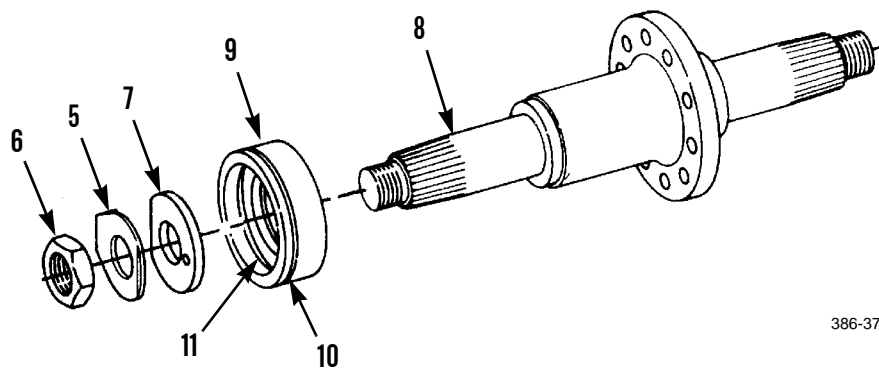
386-379

INSTALLATION - CONTINUED

NOTE

Lightly coat new rings with clean oil before installation.

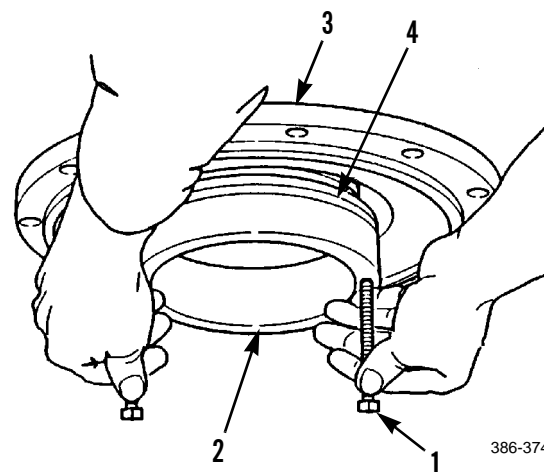
6. Install new ring (11) on inside and new ring (10) on outside of clutch retainer (9).
7. Install clutch retainer (9), washer (7), new retainer (5) and nut (6) on bevel gear shaft (8).
8. Tighten nut (6) to 700 lb-ft (949 Nm).
9. Bend retainer (5) on nut (6) to secure.



NOTE

Lightly coat new ring with clean oil before installation.

10. Install new ring (4) on piston (2).
11. Install piston (2) in steering clutch hub (3) as far as possible.
12. Install two 3/8 in. anchor screws (1) in outer circle of threaded bores in steering clutch hub (3).
13. Install hydraulic puller over piston (2) and press piston into steering clutch hub (3).
14. Remove hydraulic puller and anchor screws (1).
15. Install steering clutch (WP 0127 00).



16. Test drive machine and check steering for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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TRANSMISSION AND CRANKCASE GUARDS REPLACEMENT

0129 00

THIS WORK PACKAGE COVERS

Transmission Guard: Removal, Installation

Crankcase Guard: Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)

Wood block, 2 in. x 4 in. x 18 in. long

Clip, retaining (7)

Materials/Parts - Continued

Lockwasher (3, 5, 10 and 12)

References

WP 0178 00

Personnel Required

Two

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Engine OFF and cool (TM 5-2410-233-10)

**WARNING**

- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.
- Dirt and rocks under guards can significantly add to their weight.

NOTE

- Transmission guard weighs 350 lb (159 kg).
- Crankcase guard weighs 335 lb (152 kg).

TRANSMISSION GUARD REMOVAL

1. Raise bulldozer blade, install hydraulic jack stands under blade and lower blade onto jack stands (WP 0178 00). Shut down engine.

NOTE

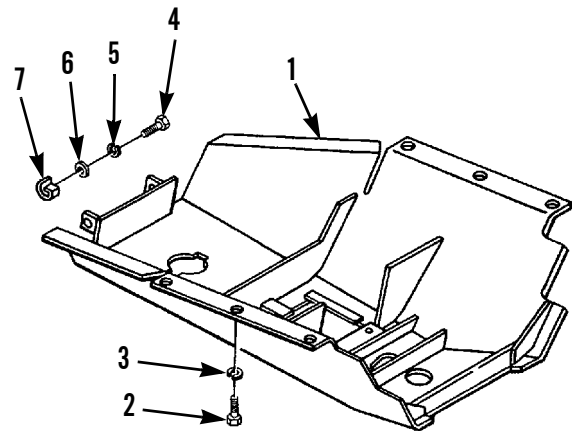
An 18 in. piece of 2 x 4 wood block should be placed on jack to facilitate transmission guard removal.

2. Apply light pressure to transmission guard (1) with hydraulic floor jack.

NOTE

Transmission guard is equipped with a hinge for ease of access to tractor components.

3. Remove six capscrews (2) and lockwashers (3) and lower hydraulic floor jack and transmission guard (1). Discard lockwashers.



386-519

NOTE

If complete removal of transmission guard is required, continue with step 4 and 5.

4. Remove capscrew (4), lockwasher (5), lock plate (6) and retaining clip (7). Discard lockwasher and retaining clip.
5. Lower hydraulic floor jack and remove transmission guard (1) from tractor.

TRANSMISSION GUARD INSTALLATION**NOTE**

An 18 in. piece of 2 x 4 wood block should be placed on jack to facilitate transmission guard installation.

1. Place transmission guard (1) on hydraulic floor jack and raise into position.
2. Position hinge of transmission guard (1) and align holes.
3. Apply enough pressure on jack to hold transmission guard (1) in position.

NOTE

Apply antiseize compound to threads of mounting capscrews.

4. Install capscrew (4), new lockwasher (5) lock plate (6) and new retaining clip (7).

NOTE

Do not tighten capscrews on transmission guard until all capscrews have been installed.

5. Install six new lockwashers (3) and capscrews (2). Tighten capscrews.
6. Raise bulldozer blade and remove hydraulic jack stands from blade (WP 0178 00). Lower blade.

CRANKCASE GUARD REMOVAL

1. Raise bulldozer blade, install hydraulic jack stands under blade and lower blade onto jack stands (WP 0178 00). Shut down engine.

NOTE

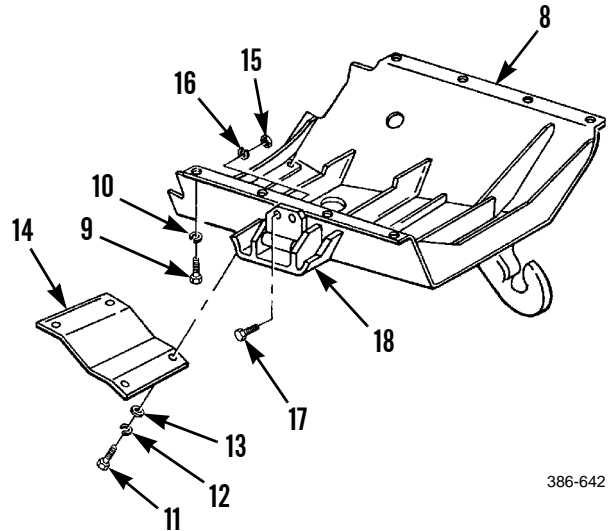
An 18 in. piece of 2 x 4 wood block should be placed on jack to facilitate crankcase guard removal.

2. Apply light pressure to crankcase guard (8) with hydraulic floor jack.

NOTE

Crankcase guard is equipped with a hinge for ease of access to tractor components.

3. Remove eight capscrews (9) and lockwashers (10) and lower hydraulic floor jack and crankcase guard (8). Discard lockwashers.



386-642

NOTE

If complete removal of crankcase guard is required, continue with step 4 and 5.

4. Remove four capscrews (11), lockwashers (12), washers (13) and access cover (14). Discard lockwashers
5. Remove two nuts (15), lockwashers (16), capscrews (17) and hinge (18) from side of crankcase guard (8). Discard lockwasher.

CRANKCASE GUARD INSTALLATION**NOTE**

- **An 18 in. piece of 2 x 4 wood block should be placed on jack to facilitate crankcase guard installation.**
- **Apply antiseize compound to threads of mounting capscrews.**

1. Install hinge (18) on side of crankcase guard (8) with two capscrews (17), new lockwashers (16) and nuts (15).
2. Place crankcase guard (8) on hydraulic jack and raise into position. Apply light pressure on jack to hold guard in position.
3. Install access cover (14) with four washers (13), new lockwashers (12) and capscrews (11).

NOTE

Do not tighten capscrews on crankcase guard until all capscrews have been installed.

4. Install eight new lockwashers (10) and capscrews (9). Tighten capscrews.
5. Raise bulldozer blade and remove hydraulic jack stands from blade (WP 0178 00). Lower blade.

END OF WORK PACKAGE

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BATTERY BOX REPLACEMENT

0130 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Lockwasher (3)

References

TM 5-2410-233-10

Equipment Condition

Batteries removed (WP 0081 00)

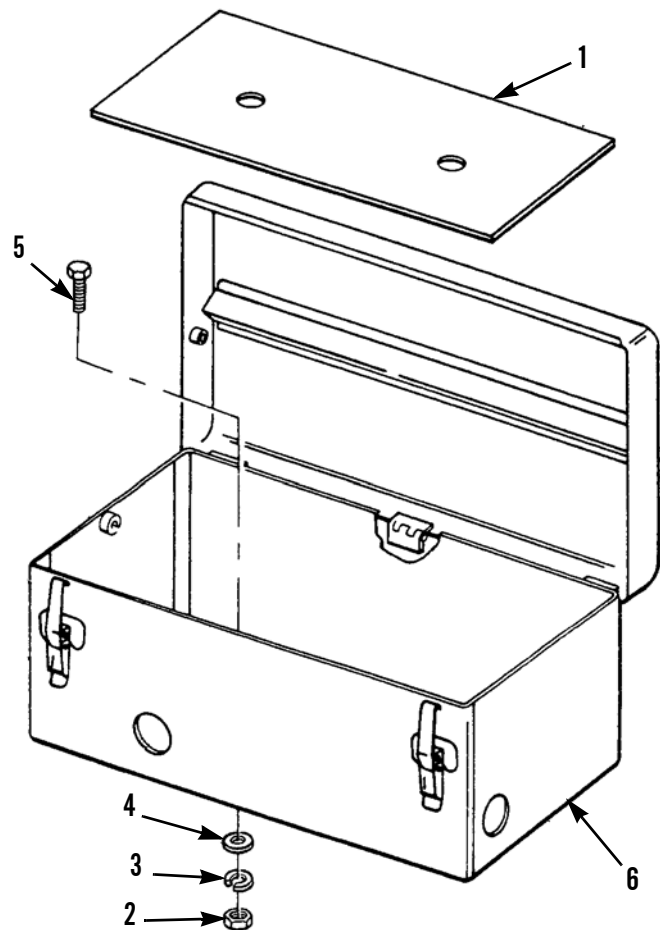
REMOVAL

1. Remove pad cushion (1).
2. Remove four nuts (2), lockwashers (3) and washers (4) from underneath fender. Discard lockwashers.
3. Remove four capscrews (5) from battery box (6).

NOTE

Remove and save instruction plates if replacement of battery box is required.

4. Lift battery box (6) from tractor.

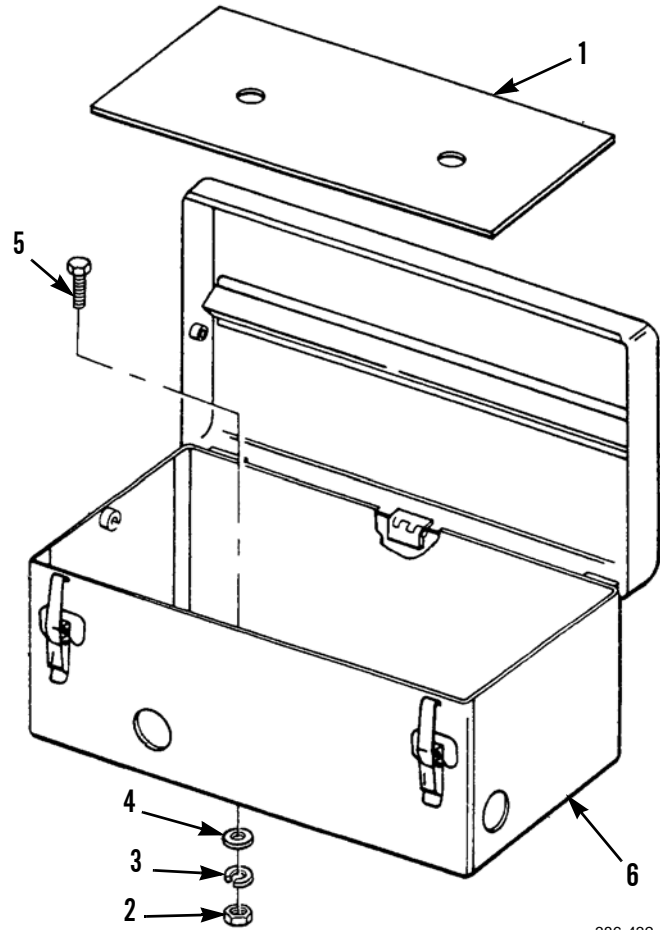


386-432

INSTALLATION**NOTE**

Prior to installing battery box, mount instruction plates in appropriate location (TM 5-2410-233-10).

1. Place battery box (6) in position on tractor.
2. Install four capscrews (5) through inside of battery and fender.
3. Install four washers (4), new lockwashers (3) and nuts (2) underneath fender.
4. Install pad cushion (1).
5. Install batteries (WP 0081 00).



386-432

END OF WORK PACKAGE

ROLLOVER PROTECTIVE STRUCTURE (ROPS) REPLACEMENT

0131 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 2 (Item 95, WP 0185 00)
- Lifting equipment, 4,000 lb. capacity

Materials/Parts

- Compound, antiseize (Item 6, WP 0184 00)
- Lockwasher (3)

Reference

WP 0133 00

Personnel Required

Three

Equipment Condition

- Tractor parked on level ground (TM 5-2410-233-10)
 - Protective screen removed from ROPS, if equipped with screen (WP 0134 00)
-



WARNING

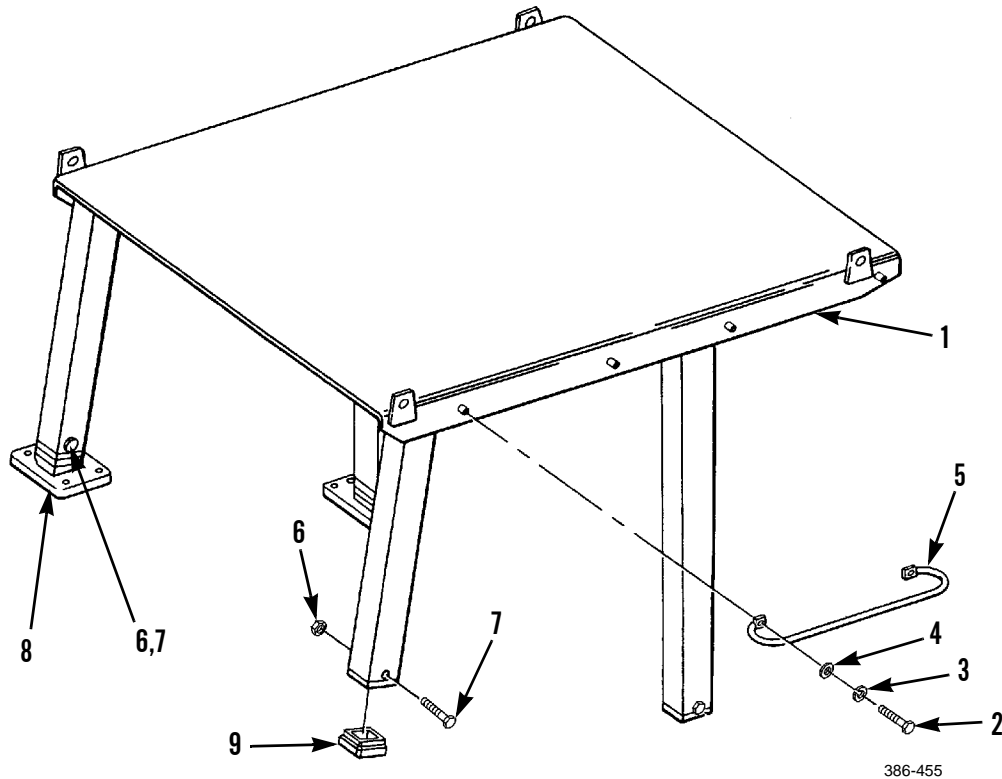
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

ROPS weighs approximately 1,800 lb (817 kg).

REMOVAL

1. Attach a suitable lifting device to lift points on roof of ROPS (1).
2. Remove two capscrews (2), lockwashers (3), flatwashers (4) and grabhandle (5) from ROPS (1). Discard lockwashers.
3. Repeat step 2 for other grabhandles (5).
4. Remove nut (6), and capscrew (7), from each leg of ROPS (1).
5. Lift ROPS (1) and remove from mounts (8). Remove four pads (9).

**INSTALLATION****NOTE**

If ROPS has been replaced, notify Direct Support Maintenance to install protective screen angle brackets by welding (WP 0133 00).

1. Attach a suitable lifting device to lift points on roof of ROPS (1) and lift ROPS into position over mounts (8).
2. Install pad (9) to each leg of ROPS (1).

NOTE

Apply antiseize compound to threads of all capscrews before installation.

3. Install capscrew (7) and nut (6) to each leg of ROPS (1). Tighten capscrews to 900 lb-ft (1220 Nm).
4. Install grabhandle (5) on ROPS (1) with two capscrews (2), new lockwashers (3) and flatwashers (4).
5. Repeat step 4 for other grabhandles (5).
6. Install protective screen (WP 0134 00).

END OF WORK PACKAGE

ROPS SUPPORT PADS AND MOUNTING PLATES REPLACEMENT

0132 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)

Lockwasher (2, 6, 10, 15 and 19)

References

WP 0180 00

Personnel Required

Two

Equipment Condition

ROPS removed (WP 0131 00)

Rear floodlamp removed, if removing ROPS rear mounting pad

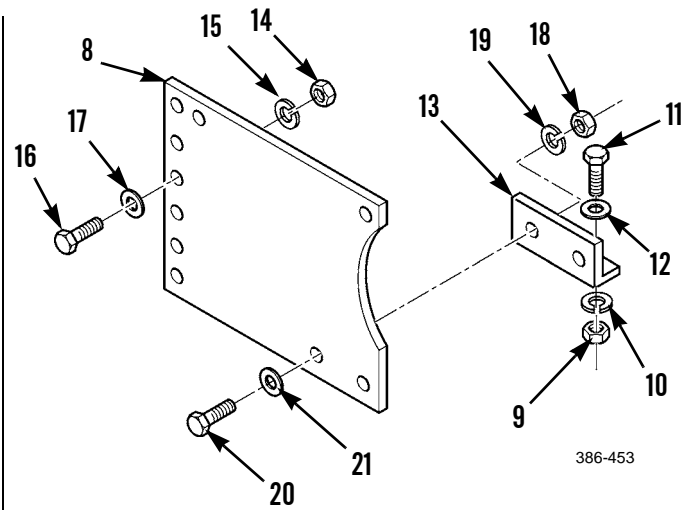
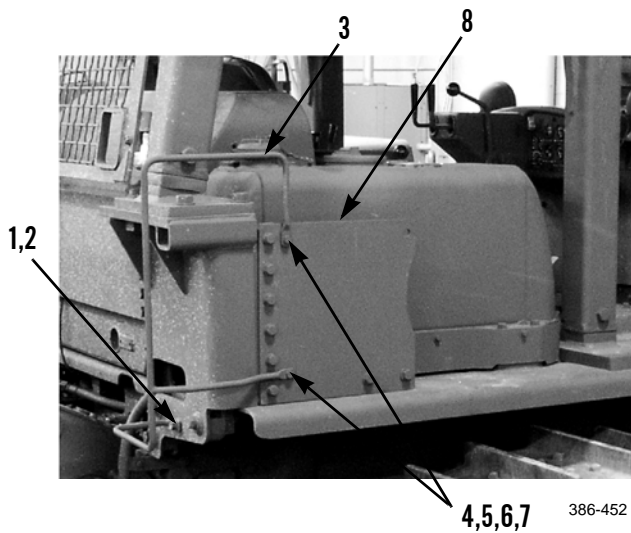
REMOVAL

1. Remove capscrew (1) and lockwasher (2) from grabhandle (3) at rear of machine. Discard lockwasher.
2. While supporting grabhandle (3), remove two nuts (4), four washers (5), two lockwashers (6), capscrews (7) and remove grabhandle from R.H. plate (8). Discard lockwashers.

NOTE

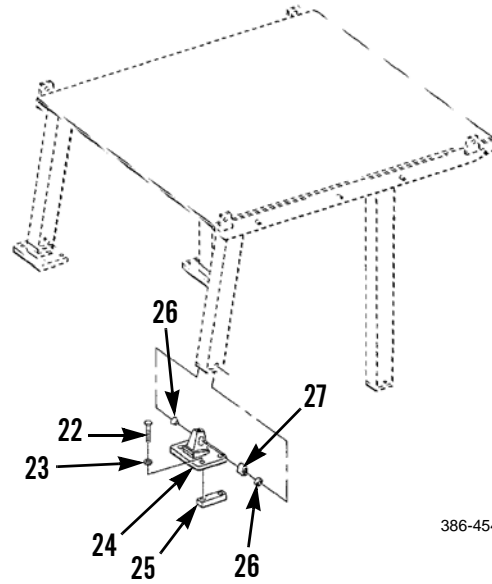
- **Removal of L.H. and R.H. plate is the same. R.H. plate is shown.**

3. Remove two nuts (9), lockwashers (10), capscrews (11), and washers (12) from angle bracket (13) and fender. Discard lockwashers.
4. Remove six nuts (14), lockwashers (15), capscrews (16), washers (17) and remove R.H. plate (8) from right rear of machine. Discard lockwashers.
5. Remove two nuts (18), lockwashers (19), capscrews (20), washers (21) and angle bracket (13) from R.H. plate (8). Discard lockwashers.

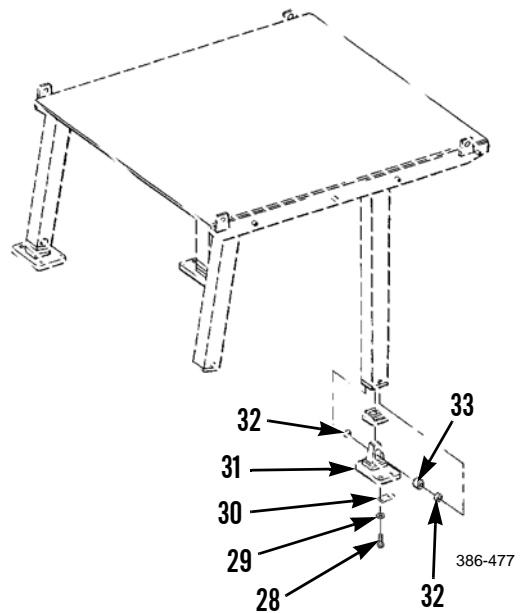


REMOVAL - CONTINUED

6. Remove four bolts (22) and washers (23) from rear support pad (24).
7. Remove rear support pad (24) and remove two nut strips (25) from under rear support pad.
8. Repeat steps 7 and 8 to remove rear support pad (24) on other side of machine.
9. If required, remove two wedges (26) and bushing (27) from each rear support pad (24).



10. Remove four bolts (28), washers (29) and shims (30) from under front support pad (31).
11. Remove front support pad (31) from machine.
12. Repeat steps 11 and 12 to remove front support pad (31) on other side of machine.
13. If required, remove two wedges (32) and bushing (33) from each front support pad (31).

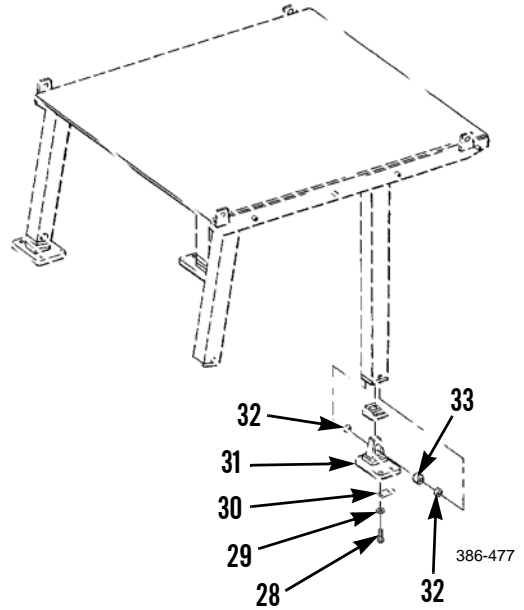


INSTALLATION

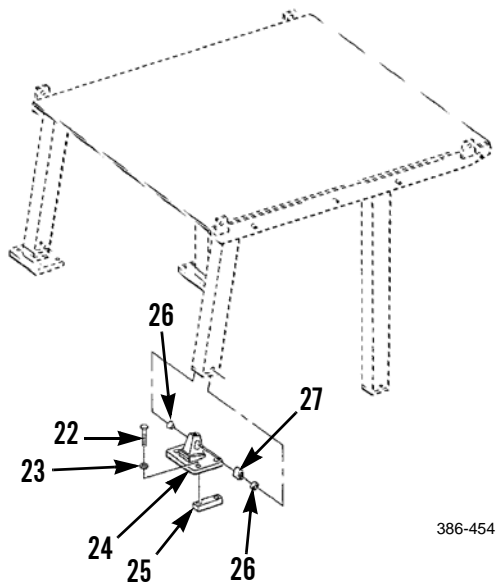
NOTE

- Ensure all ROPS support pad mounting hardware is tightened IAW *Torque Limits, WP 0180 00*.
- Apply antiseize compound to threads of all mounting bolts before installation.

1. If removed, install bushing (33) and two wedges (32) on each front support pad (31).
2. Position shims (30) and front support pad (31) on machine.
3. Install four bolts (28) and washers (29) on front support pad (31). Do NOT tighten bolts.
4. Repeat steps 1 through 3 to install other front support pad (31).
5. Tighten bolts (28) 900 lb-ft (1220 Nm).

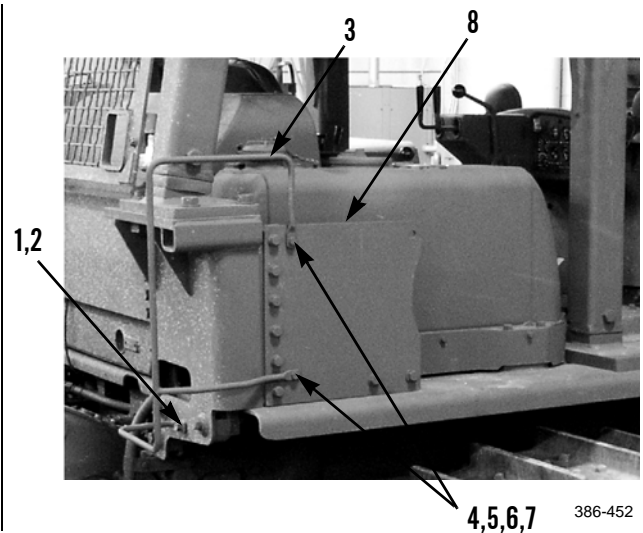
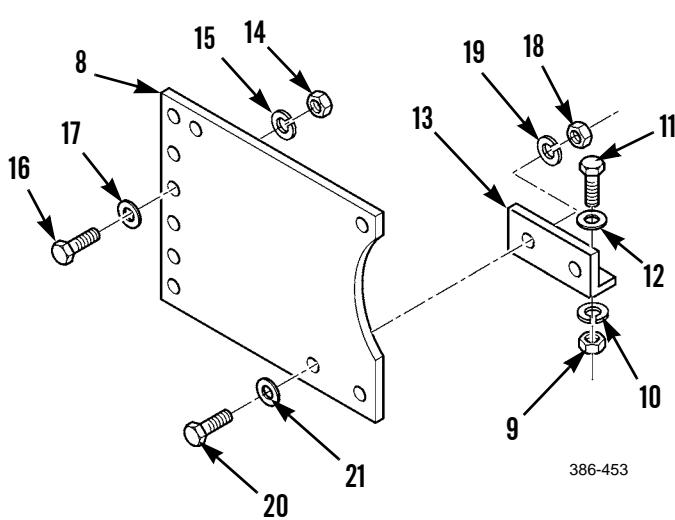


6. If removed, install bushing (27) and two wedges (26) on each rear support pad (24).
7. Position rear support pad (24) on machine.
8. Position two nut strips (25) under mount frame and install four bolts (22) and washers (23) on rear support pad (24). Do NOT tighten bolts.
9. Repeat steps 6 through 8 to install other rear support pad (24).
10. Tighten bolts (22) to 900 lb-ft (1220 Nm).



INSTALLATION

11. Install angle bracket (13) on R.H. plate (8) with two capscrews (20), washers (21), new lockwashers (19) and nuts (18).
12. Position R.H. plate (8) to right rear of machine. Loosely install six capscrews (16), washers (17), new lockwashers (15) and nuts (14).
13. Secure angle bracket (13) to fender with two capscrews (11), washers (12), new lockwashers (10) and nuts (9).
14. Tighten six nuts (14) and two nuts (9).
15. Support grabhandle (3) and position at R. H. plate (8). Secure with two capscrews (7), new lockwashers (6), four washers (5) and two nuts (4).
16. Secure grabhandle (3) to rear of machine with new lockwasher (2) and capscrew (1).



17. If removed, install rear floodlamp.
18. Install ROPS (WP 0131 00).

END OF WORK PACKAGE

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WELDING PROCEDURE TO INSTALL PROTECTIVE SCREEN ANGLE BRACKETS**0133 00****THIS WORK PACKAGE COVERS**

Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, welding (Item 99, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Lifting equipment, 100 lb capacity

References

TC 9-237

Personnel Required

Two

Equipment Condition

Protective screen removed (WP 0134 00)

NOTE

- **If ROPS is replaced, new ROPS will not come with welded-on angle brackets to mount protective screen. Perform this task to weld angle brackets on new ROPS.**
- **ROPS certification will not be affected if welding is done IAW instructions in this work package. A certified welder is required.**

INSTALLATION

1. Install four angle brackets to protective screen (WP 0134 00).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

Protective screen weighs 60 lb (27 kg).

2. Attach a nylon sling and a suitable lifting device to protective screen.
3. Lift protective screen into position at ROPS.
4. Mark outline of angle brackets on ROPS to indicate bracket location.
5. Lower protection screen to the ground.
6. Weld each angle bracket to ROPS IAW TC 9-237, *Operator's Circular for Welding Theory and Application*.
7. Install protective screen (WP 0134 00).

END OF WORK PACKAGE

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PROTECTIVE SCREEN REPLACEMENT

0134 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Lifting equipment, 100 lb capacity

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)

References

WP 0133 00

Personnel Required

Two

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

REMOVAL**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

- Screen weighs 60 lb (27 kg).
- Screen mounting hardware may vary from one machine to another.

1. Attach a nylon sling and a suitable lifting device to screen (1). Take up all slack in sling.
2. Remove two nuts (2), four washers (3) and two bolts (4) at top of screen (1).
3. Remove two nuts (5), four washers (6) and two bolts (7) at bottom of screen (1) and remove screen from four angle brackets that are welded to ROPS (8).

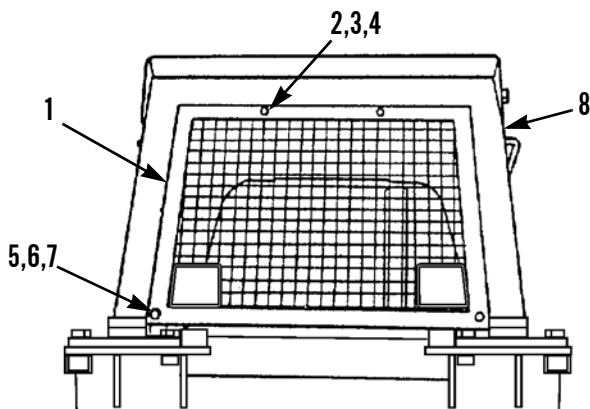
NOTE

If angle brackets are damaged, they may be replaced by Direct Support Maintenance IAW welding instructions in WP 0133 00.

INSTALLATION**NOTE**

Apply antiseize compound to mounting bolts before installation.

1. Attach a nylon sling and a suitable lifting device to screen (1) and position screen at four angle brackets that are welded to ROPS (8). Install two bolts (7), four washers (6) and two nuts (5) at bottom of screen.
2. Install two bolts (4), four washers (3) and two nuts (2) at top of screen (1).



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END OF WORK PACKAGE

FLOOR PLATES REPLACEMENT

0135 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Compound, antiseize (Item 6, WP 0184 00)

Materials/Parts - Continued

Lockwasher (2, 11, 15, 21, 25 and 29)

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

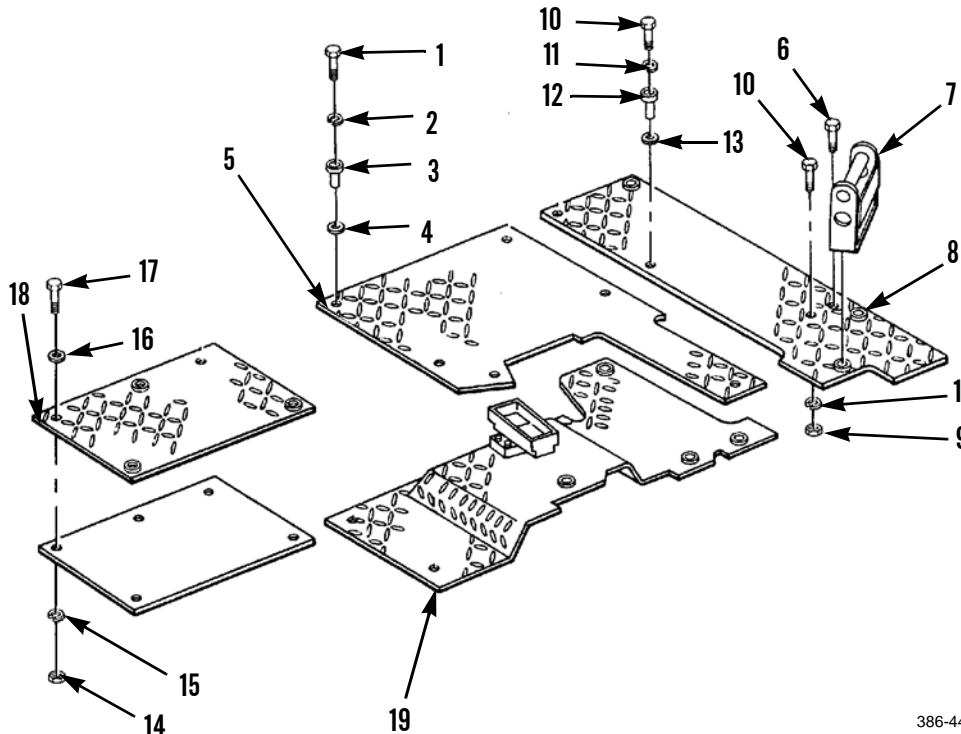
Heater removed (tractor with winterized cab)

NOTE

Floor plate mounting hardware on your tractor may vary.

REMOVAL

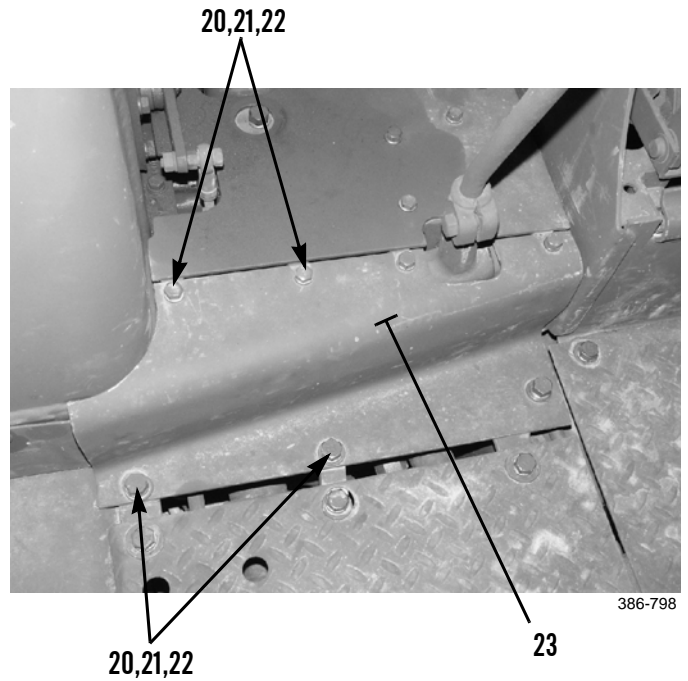
1. If equipped, remove floor mat from winterized cab.
2. Remove bolts (1), lockwashers (2), spacers (3) and washers (4) from front floor plate (5). Discard lockwashers.
3. Remove front floor plate (5).
4. Remove bolts (6) and footrest (7) from L.H. floor plate (8).
5. Remove nut (9), bolts (10), lockwashers (11), spacers (12) and washers (13) from L.H. floor plate (8). Discard lockwashers.
6. Remove L.H. floor plate (8) from tractor.
7. Remove nuts (14), lockwashers (15), washers (16), and bolts (17). Set decelerator pedal and footrest aside. Discard lockwashers.
8. Remove R.H. floor plate (18) and front floor plate (19) from tractor.



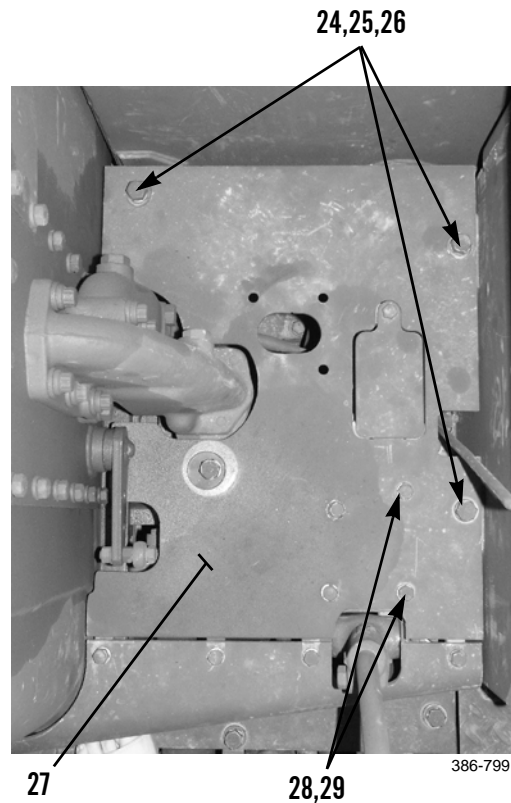
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FLOOR PLATES REPLACEMENT- CONTINUED**0135 00****REMOVAL - CONTINUED**

9. Remove seven bolts (20), lockwashers (21), washers (22) and floor plate (23) from right side of seat. Discard lockwashers.



10. Remove three bolts (24), lockwashers (25) and washers (26) from floor plate (27). Discard lockwashers.
11. Remove four capscrews (28) and lockwashers (29) from floor plate (27) and blade control lever bracket under floor plate. Discard lockwashers.
12. Remove floor plate (27) from right side of seat

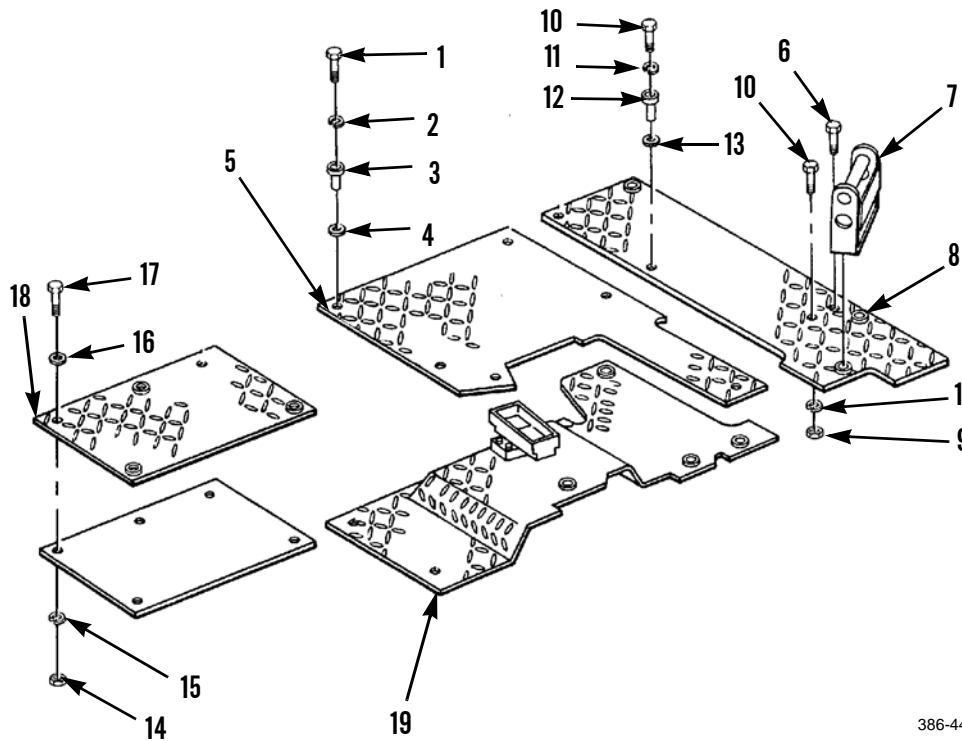


INSTALLATION

NOTE

- **Apply antiseize compound to threads of all mounting bolts before installation.**
- **Tighten mounting hardware of floor plates after all floor plates are positioned and loosely installed.**

1. Position floor plate (27) to right side of seat.
2. Install four new lockwashers (29) and capscrews (28) to floor plate (27) and blade control lever bracket under floor plate.
3. Install three washers (26), new lockwashers (25) and bolts (24) to floor plate (27).
4. Install seven washers (22), new lockwashers (21) and bolts (20) to floor plate (23).
5. Tighten capscrews (28) and bolts (20 and 24).
6. Position front floor plate (19) in tractor.
7. Position R.H floor plate (18) in tractor.
8. Reposition footrest and deceleration pedal. Install bolts (17), washers (16), new lockwashers (15) and nuts (14).
9. Position L.H. floor plate (8) in tractor. Install bolt (10), new lockwasher (11) and nut (9).
10. Install footrest (7) to L.H. floor plate (8) with bolts (6).
11. Install bolts (10), new lockwashers (11), spacers (12) and washers (13) on L.H. floor plate (8).
12. Position front floor plate (5) in tractor.
13. Install bolts (1), new lockwashers (2), spacers (3) and washers (4) in front floor plate (5).
14. Tighten all bolts (1, 6, 10 and 17).



386-442

15. If equipped, install floor mat in winterized cab.
16. If equipped, install heater in winterized cab.

END OF WORK PACKAGE

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HOOD REPLACEMENT

0136 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 0112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Lifting equipment, 100 lb capacity

Materials/Parts

Lockwasher (2)

Materials/Parts - Continued

Pin, cotter (6)

Personnel Required

Two

Equipment Condition

Exhaust extension removed (WP 0059 00)

Engine air cleaner precleaner removed (WP 0044 00)

**WARNING**

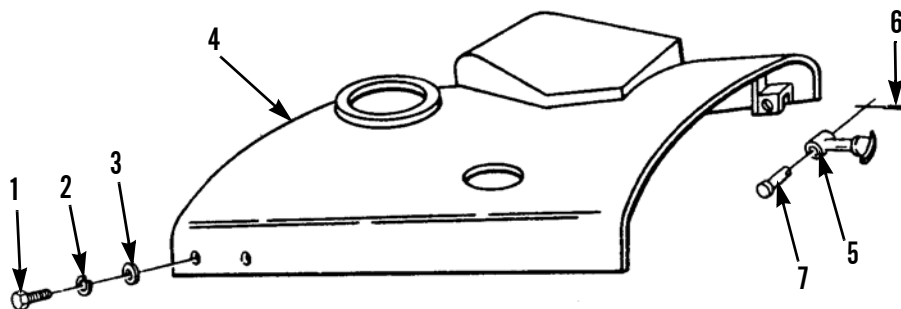
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Hood weighs 60 lb (27 kg).

REMOVAL

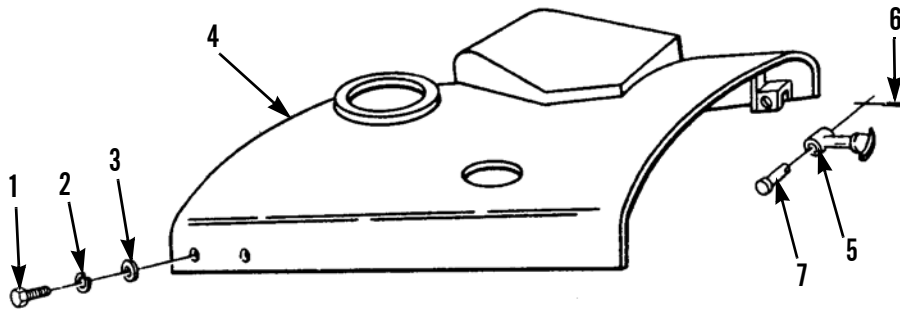
1. Remove three capscrews (1), lockwashers (2) and washers (3) at cab end of hood (4). Discard lockwashers.
2. Release two latches (5) at radiator end of hood (4).
3. Attach a nylon sling and a suitable lifting device to hood (4). Remove hood from tractor.
4. If required, remove two cotter pins (6), pins (7) and latches (5) from hood (4). Discard cotter pins.



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HOOD REPLACEMENT - CONTINUED**0136 00****INSTALLATION**

1. If removed, position latches (5) and install pins (7) through latches and hood (4). Secure with two new cotter pins (6).
2. Attach a nylon sling and a suitable lifting device to hood (4). Position hood on tractor.
3. Install three washers (3), new lockwashers (2) and capscrews (1) at cab end of hood (4). Remove nylon sling and lifting device.
4. Latch two latches (5) at radiator end of hood (4).



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5. Install engine air cleaner precleaner (WP 0044 00).
6. Install exhaust extension (WP 0059 00).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Lifting equipment, 200 lb capacity

Materials/Parts

- Lockwasher (7, 13 and 17)

References

- WP 0076 00
- WP 0080 00

References - Continued

- WP 0083 00
- WP 0084 00
- WP 0124 00
- WP 0135 00
- WP 0142 00

Personnel Required

Two

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

REMOVAL

1. Pull rod assembly (1) at front of seat vertical adjuster (2) forward to release seat lock.
2. Tilt seat (3) forward then slide seat back and straight up so hinge pins (4) slide out of seat base assembly (5).



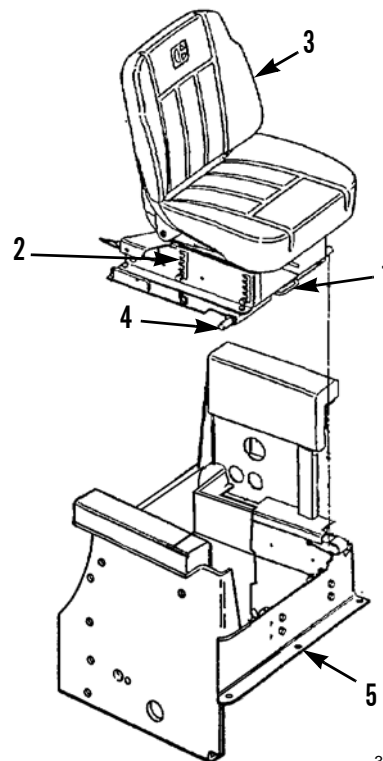
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may cause injury.

NOTE

Seat with vertical adjuster weighs 46 lb (21 kg).

3. Remove seat (3) with vertical adjuster (2) from tractor.

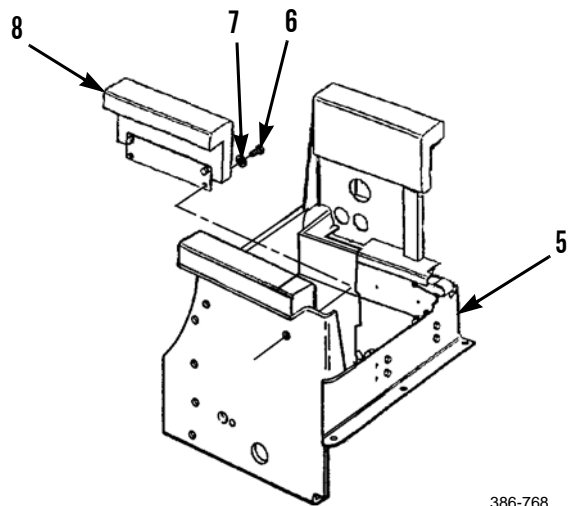


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REMOVAL - CONTINUED**NOTE**

Perform steps 4 through 16 only if seat base is to be removed.

4. Remove floor plates (WP 0135 00).
5. Disconnect battery cables (WP 0080 00).
6. Remove transmission selector knob, guard and guide cover (WP 0084 00).
7. Remove brake lock lever and linkage (WP 0124 00).
8. Remove winch controls, if equipped (WP 0142 00).
9. Remove four capscrews (6), lockwashers (7) and two armrest assemblies (8) from seat base assembly (5). Discard lockwashers.



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10. Remove battery disconnect switch (WP 0076 00).
11. Pull battery cables free of seat base.
12. Disconnect transmission linkages and remove selector lever and bracket support from seat base assembly (5) (WP 0083 00).
13. Remove two nuts (9), eye bolts (10) and each seat belt (11) from seat base assembly (5).

**WARNING**

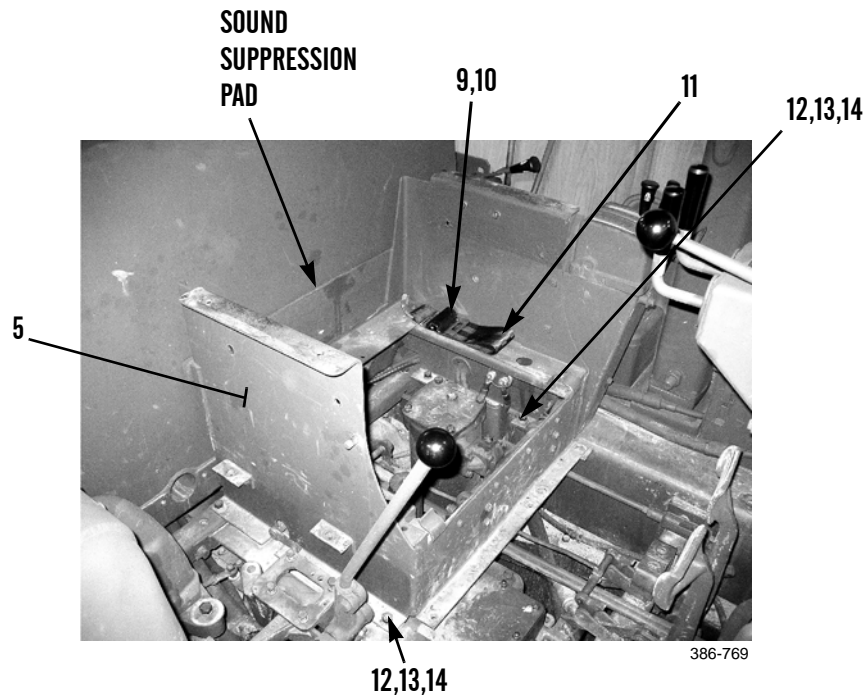
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Seat base assembly weighs 85 lb (39 kg).

14. Attach nylon slings and a suitable lifting device to seat base assembly (5).
15. Remove six bolts (12), lockwashers (13) and washers (14) from seat base assembly (5). Discard lockwashers.
16. Lift seat base assembly (5) from tractor. Remove nylon slings and lifting device from seat base assembly.

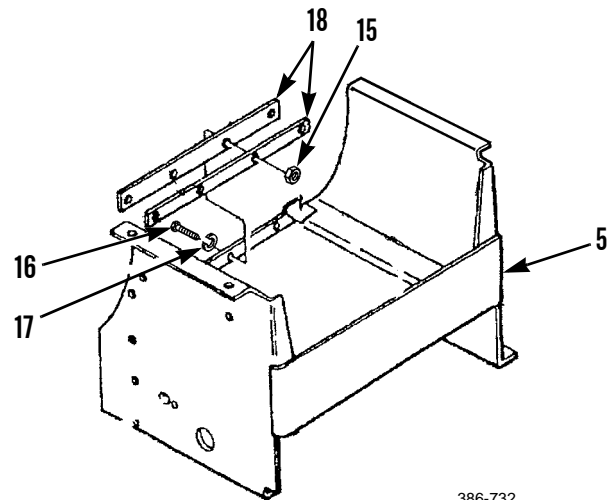
REMOVAL - CONTINUED



17. Remove four nuts (15), capscrews (16), lockwashers (17) and plates (18) from seat base assembly (5). Discard lockwashers.

INSTALLATION

1. Install plates (18) on seat base assembly (5) with four capscrews (16), new lockwashers (17) and nuts (15).



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INSTALLATION - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

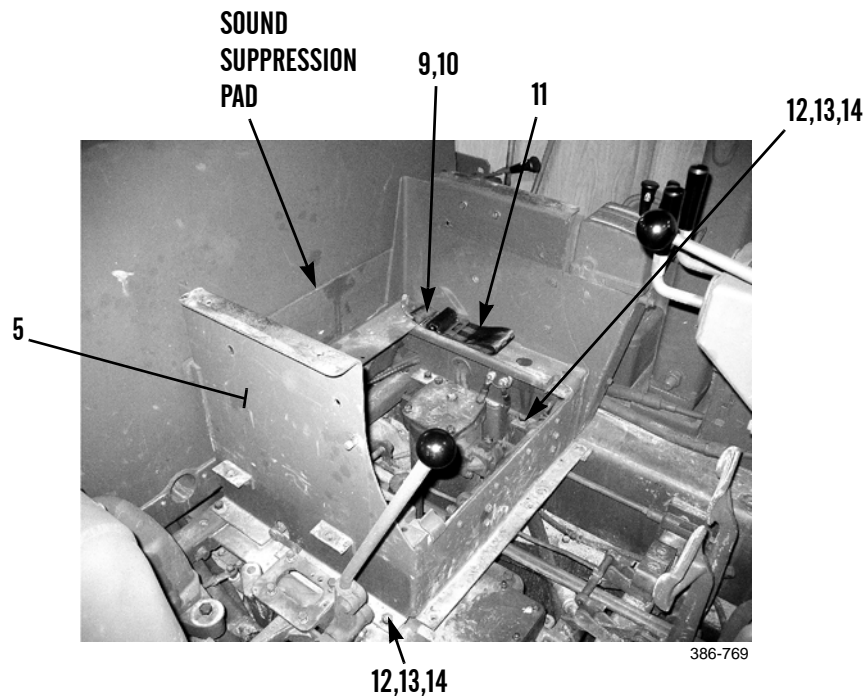
Seat base assembly weighs 85 lb (39 kg).

2. Attach nylon slings and a suitable lifting device to seat base assembly (5).
3. Lift seat base assembly (5) into position on tractor. Leave lifting equipment attached.

NOTE

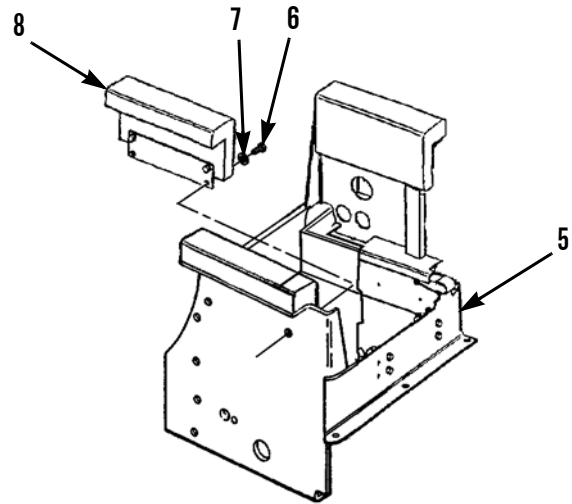
Do NOT tighten seat base mounting bolts until all have been loosely installed.

4. Install six washers (14), new lockwashers (13) and bolts (12) to seat base assembly (5).
5. Remove nylon slings and lifting device from seat base assembly (5).
6. Install each seat belt (11) to seat base assembly (5) with eyebolt (10) and nut (9).
7. Pull battery cables through seat base assembly (5).



INSTALLATION - CONTINUED

8. Install battery disconnect switch (WP 0076 00).
9. Install bracket support, selector lever and connect transmission linkage to seat base assembly (5) (WP 0083 00).
10. Position both armrest assemblies (8) on seat base assembly (5). Install four new lockwashers (7) and capscrews (6).
11. Connect transmission linkages and install selector lever and bracket support to seat base assembly (5) (WP 0083 00).



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12. Install guide cover, guard and transmission selector lever (WP 0084 00).
13. Install winch controls (WP 0142 00).
14. Install brake lock lever and linkage (WP 0124 00).
15. Connect battery cables (WP 0080 00).

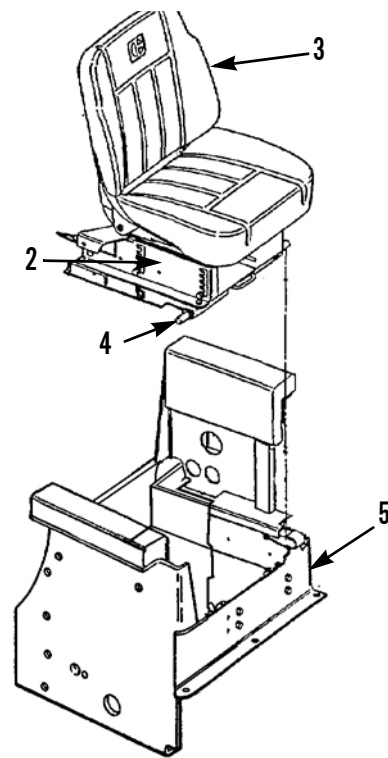
INSTALLATION - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may cause injury.

NOTE

Seat with vertical adjuster weighs 46 lb (21 kg).

16. Lift seat (3) with vertical adjuster (2) and position in seat base assembly (5).
17. Tilt seat (3) forward, then slide seat forward and place hinge pins (4) into hooks in seat base assembly (5).
18. Push back of seat (3) down until locks snap into position.



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19. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

CHANGING WINCH ASSEMBLY OIL

0138 00

THIS WORK PACKAGE COVERS

Draining Oil, Refilling Oil

INITIAL SETUP

Applicable Configuration

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

References

WP 0008 00

WP 0143 00

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Winch oil warm (winch operated for about 5 minutes) (TM 5-2410-233-10)

Engine OFF and cool (TM 5-2410-233-10)

DRAINING OIL

CAUTION

Wipe area clean around plugs before they are removed to prevent contamination of winch oil.

NOTE

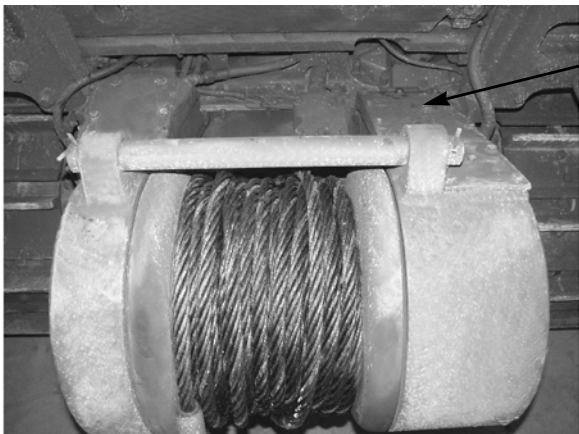
- Place a suitable container under winch drain and filler plugs to collect oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- Winch assembly oil capacity is approximately 16 gal. (60.6 l).

1. Remove fill plug (1).
2. Remove drain plug (2) and allow oil to drain completely.

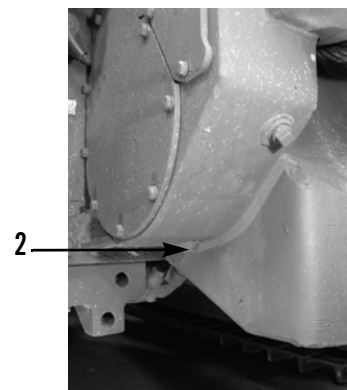
NOTE

If noticeable amounts of metal particles are present in winch oil, replacement of winch may be required.

3. Inspect winch oil and drain plug (2) for metal particles. Wipe drain plug clean and reinstall.



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4. Replace winch oil filter (WP 0143 00).

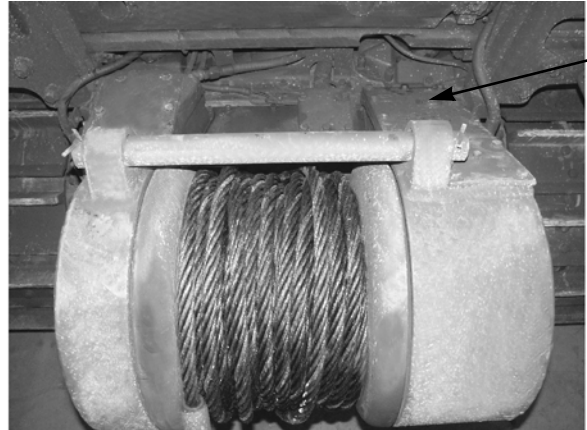
CHANGING WINCH ASSEMBLY OIL - CONTINUED**0138 00****REFILLING OIL**

1. Remove fluid level inspection plug (3).
2. Fill winch with oil at fill plug (1) until oil begins to flow out of fluid level inspection plug hole. Refer to WP 0008 00 for proper grade of oil to use IAW expected temperature range of operation.
3. Wipe area clean around fluid inspection plug hole and install inspection plug (3) and fill plug (1).



386-040

3



386-038

4. Operate winch and recheck oil level. Add oil if necessary.

END OF WORK PACKAGE

WINCH ASSEMBLY REPLACEMENT

0139 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Applicable Configuration

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 2 (Item 95, WP 0185 00)

Link, lifting (Item 44, WP 0185 00)

Lifting equipment, 5,000 lb. capacity

Wood cribbing, 4 ft x 4 in. x 4 in.

Bolt, 3/4 x 10 -1-1/2 in.

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

Gasket (3)

Lockwasher (2 and 12)

Personnel Required

Three

References

TM 5-2410-233-10

TM 5-2410-233-23P

WP 0141 00

WP 0142 00

WP 0143 00

WP 0147 00

Equipment Condition

Tractor parked on level ground (TM 5-2410-233-10)

Winch wire rope assembly removed, if required (WP 0145 00)

Winch oil drained (WP 0138 00)

NOTE

- **Tag hoses prior to removal to ensure proper installation.**
- **Use a suitable container to catch any oil that may drain from system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.**
- **Use two wrenches when disconnecting and connecting hoses connections.**

REMOVAL

1. Clean external surfaces of winch to remove accumulated grease and dirt.

NOTE

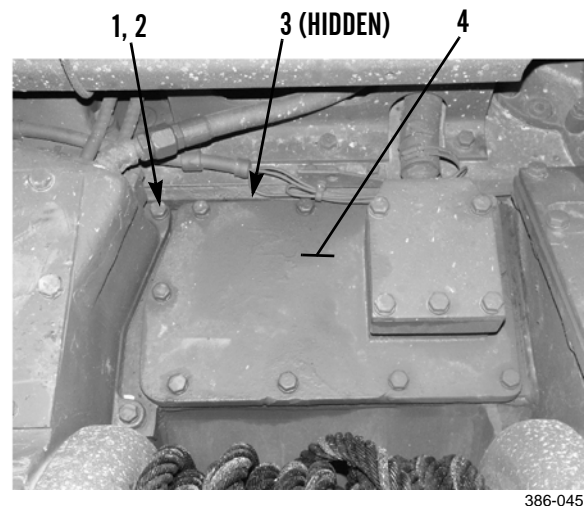
Tractor will be immobilized when winch is removed. If tractor must be moved, perform step 2 to isolate winch gear pump.

2. Remove winch gear pump from rear of engine auxiliary drive (WP 0147 00). Cover opening where pump was removed with plate that is listed and illustrated in TM 5-2410-233-23P.
3. Disconnect linkage from winch control valve (WP 0142 00).
4. Remove suction hose from oil filter assembly (WP 0143 00).

REMOVAL - CONTINUED**NOTE**

When removing transmission cover, be careful not to lose detent ball and spring.

5. Remove seven capscrews (1), lockwashers (2) and gasket (3) from transmission cover (4). Discard lockwashers and gasket.

**CAUTION**

Keep work area clean. Wipe area clean around all hose fittings and couplings. Cap openings to prevent contamination of winch, which could result in premature failure.

NOTE

Use a suitable container to catch any oil that may drain from system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

6. Disconnect coupling (5) and remove winch pump pressure line (6) from valve housing (7).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

- Winch assembly weighs approximately 3,600 lb (1,634 kg).
 - Use a tap to chase and clean threaded holes in bosses to which chain end links are attached.
7. Attach two lifting links with 3/4 -10 x 1-1/2 in. bolts in threaded boss (8) on each side of winch (9).

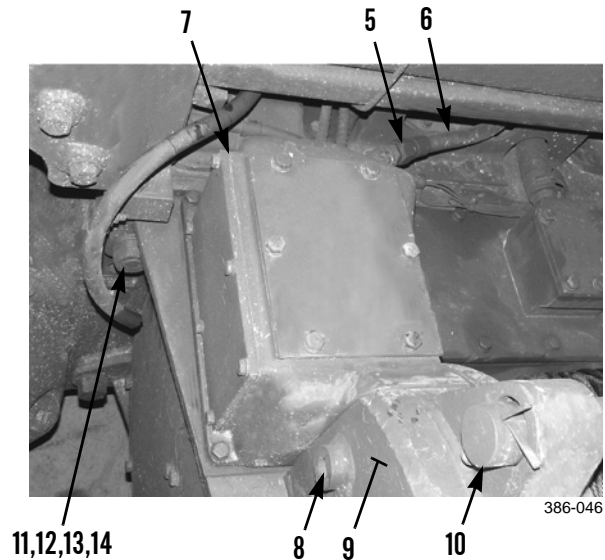
REMOVAL - CONTINUED

8. Attach a suitable three-point lifting device to each lifting link end and to bar (10).

CAUTION

- When removing mounting nuts, loosen all nuts slightly, then pry winch away from mounting pad. Continue this sequence until winch can be removed.
- Remove winch slowly and carefully to prevent damage to mounting studs, transmission and drive shaft.
- Adjust lifting device as necessary to remove load from mounting studs.

9. Remove six nuts (11) and lockwashers (12) from studs (13). Discard lockwashers.
10. Use lifting device to move winch (9) straight back until winch drive shaft (14) is clear of tractor.
11. Place winch (9) on wood cribbing to prevent tipping.



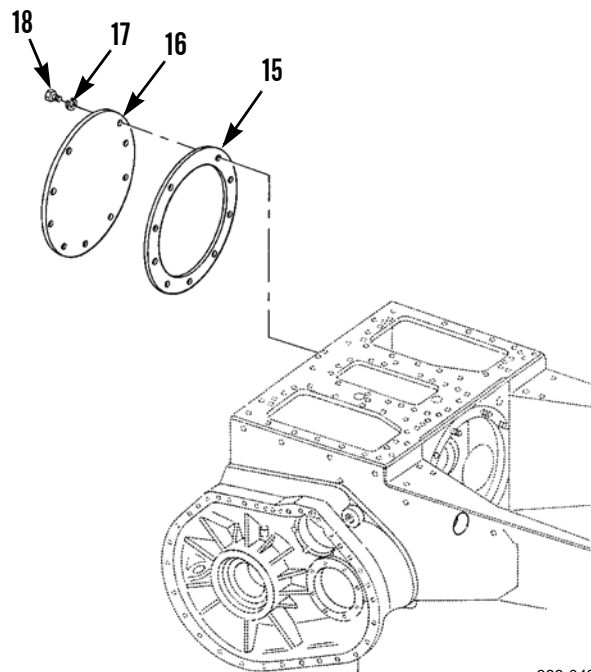
CAUTION

Cover and gasket must be installed to prevent dirt and other damaging contaminants from entering final drive case if required to operate machine without winch.

NOTE

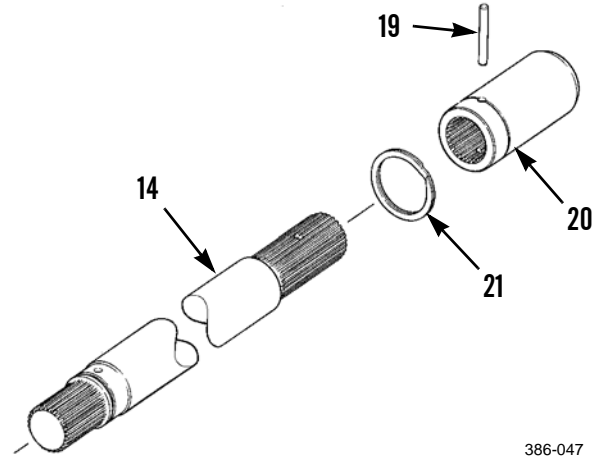
Round cover, gasket and mounting hardware are listed and illustrated in TM 5-2410-233-23P.

12. Install gasket (15) and round cover (16) over opening in final drive case at rear of tractor. Secure with nine new lockwashers (17) and capscrews (18).



REMOVAL - CONTINUED

13. Remove pin (19), coupling (20) and retaining ring (21) from transmission end of winch drive shaft (14).

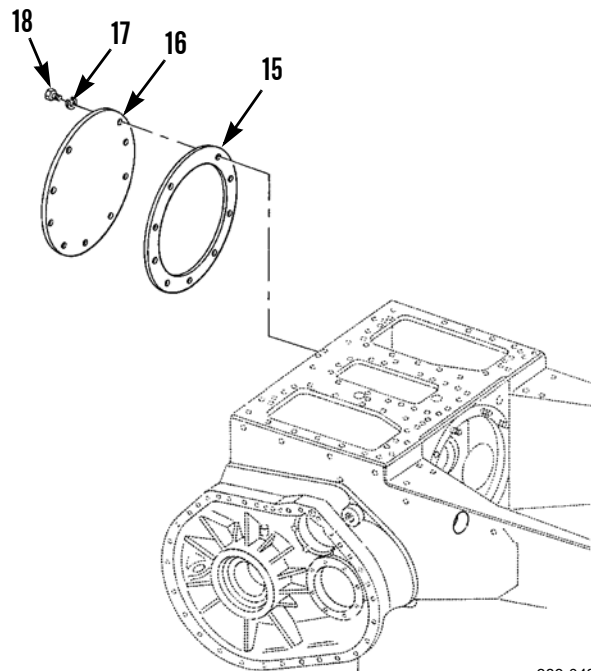


INSTALLATION

NOTE

- Winch assembly weighs approximately 3,600 lb (1,634 kg).
- Prior to installation, ensure all traces of paint or rust have been removed from mounting surfaces of winch and tractor and from mounting studs.
- Wipe clean all retaining rings and grooves in components.

1. Lightly lubricate, then temporarily position retaining ring (21) on groove end of coupling (20). Do NOT install retaining ring in groove at this time.
2. Install coupling (20) on winch drive shaft (14), align holes and install pin (19). Retain pin by sliding retaining ring (21) into groove in coupling.



NOTE

If cover is installed, perform Step 3.

3. Remove nine cap screws (18), lockwashers (17), round cover (16) and gasket (15) from drive shaft opening in final drive case at rear of tractor. Discard lockwashers and gasket.

INSTALLATION - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Use a tap to chase and clean threaded holes in bosses to which chain end links are attached.

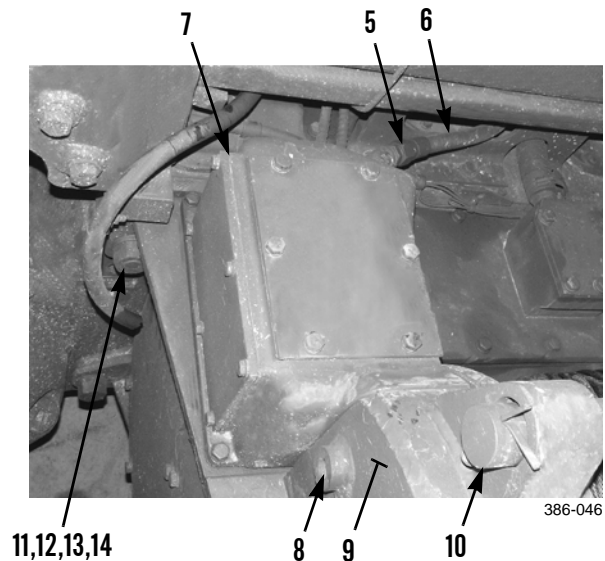
4. Attach two lifting links with 3/4 -10 x 1-1/2 in. bolts in threaded boss (8) on each side of winch (9).
5. Attach a suitable three-point lifting device to two lifting links on each side of winch (9) and to bar (10).

CAUTION

Use caution when aligning drive shaft to drive shaft opening at rear of tractor. Install winch slowly and carefully. Failure to maintain control of winch while it is inserted could cause damage to mounting studs, drive shaft and transmission.

NOTE

- Assistance is required to align winch drive shaft with transmission coupling and output shaft.
- Adjust lifting device as needed until correct alignment is achieved.



6. Align winch drive shaft (14) with opening in back of tractor. Rotate winch drive shaft to ensure that splines of transmission coupling and output shaft line up.

NOTE

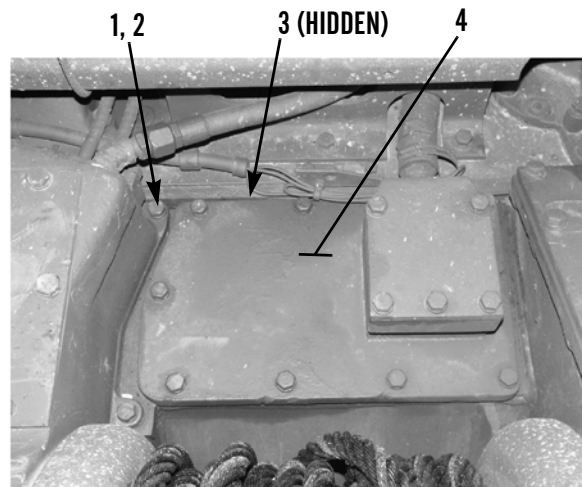
Winch is correctly aligned and installed when winch case is flush against rear of tractor.

7. Slowly move winch (9) toward tractor until coupling (20) on drive shaft (14) is seated in transmission and winch is mounted on studs (13).
8. Install six washers (12) and nuts (11) on studs (13).
9. Tighten four nuts (11) at four larger mounting studs to 1500 lb-ft (2034 Nm).
10. Tighten two nuts (11) at two smaller studs (13) to 1000 lb-ft (1356 Nm).
11. Remove lifting device and two lifting links from threaded boss (8) on each side of winch (9).
12. Connect coupling (5) of winch pump pressure line (6) to valve housing (7).

INSTALLATION - CONTINUED**NOTE**

When installing transmission cover, be careful to ensure dent ball and spring is positioned correctly.

13. Position new gasket (3) and transmission cover (4) on winch and secure with seven new lockwashers (2) and capscrews (1).



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14. Install suction hose to oil filter assembly housing (WP 0143 00).
15. Install linkage to winch control valve (WP 0142 00).
16. Adjust linkage (WP 0141 00).

NOTE

As required, perform the following step to install winch gear pump, if it was removed prior to removing winch.

17. Remove plate and install winch gear pump (WP 0147 00).
18. Fill winch oil to proper level (WP 0138 00).
19. Check winch for proper operation and leaks.
20. Recheck oil level and add oil as needed (WP 0138 00).

END OF WORK PACKAGE

WINCH CONTROL VALVE REPLACEMENT

0140 00

THIS WORK PACKAGE COVERSRemoval, Installation

INITIAL SETUP**Applicable Configuration**

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

Gasket (4, 9 and 24)

O-ring (23)

Lockwasher (2, 7, 19 and 22)

References

WP 0138 00

WP 0141 00

WP 0142 00

WP 0147 00

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Engine OFF and cool (TM 5-2410-233-10)

CAUTION

Wipe area clean around all connections to be opened during procedure. Cap oil lines and plug openings to prevent contamination of winch, which could result in premature failure.

NOTE

- **Tag lines prior to removal to ensure proper installation.**
- **Use a suitable container to catch any oil that may drain from system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.**
- **Use two wrenches when disconnecting and connecting connections.**

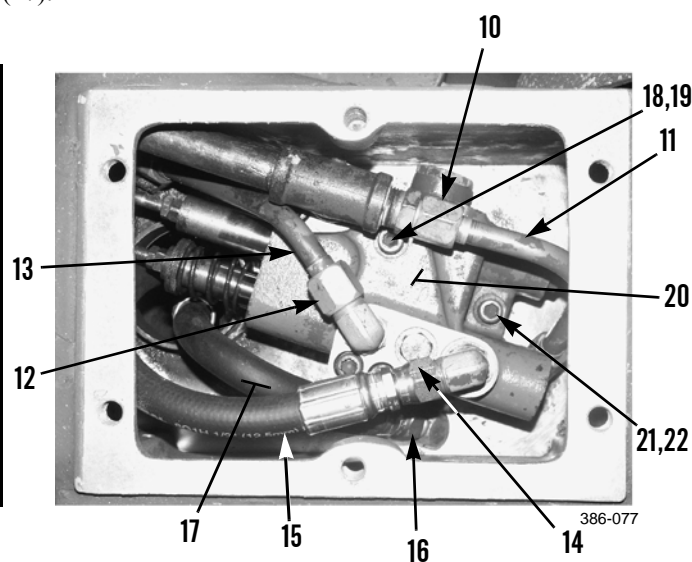
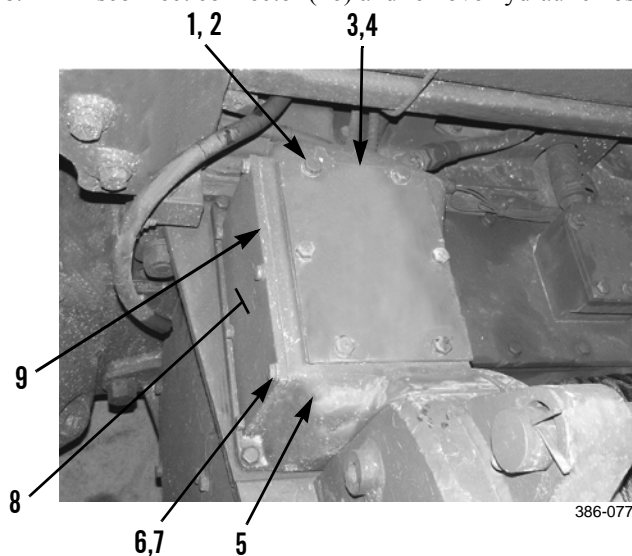
REMOVAL

1. Remove six capscrews (1), lockwashers (2) top access cover (3) and gasket (4) from valve housing (5). Discard lockwashers and gasket.
2. Remove six capscrews (6), lockwashers (7), side access cover (8) and gasket (9) from valve housing (5). Discard lockwashers and gasket.
3. Disconnect winch gear pump pressure hose (WP 0147 00).
4. Remove winch control lever and cable (WP 0142 00).

NOTE

Remove and discard all O-rings.

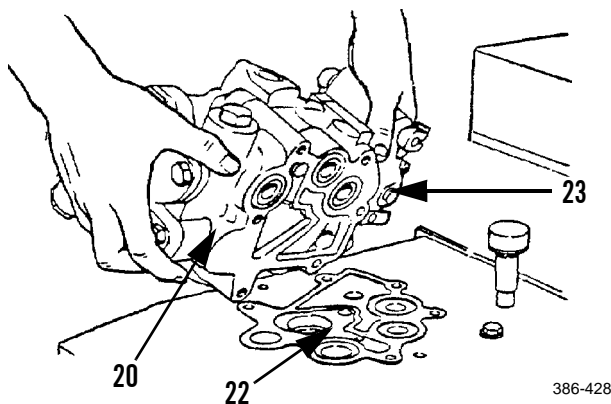
5. Disconnect connector (10) and remove tube (11).
6. Disconnect connector (12) and remove tube (13).
7. Disconnect connector (14) and remove hydraulic hose (15).
8. Disconnect connector (16) and remove hydraulic hose (17).



NOTE

- **If valve is to be replaced, transfer elbows and fittings to new valve. Use new O-rings.**
- **Note size of socket head capscrews and their mounting location to ensure correct installation.**

9. Remove two 5-3/4 in. long socket head capscrews (18) and lockwashers (19) from control valve (20). Discard lockwashers.
10. Remove two 4 in. socket head capscrews (21) and lockwashers (22) from control valve (20). Discard lockwashers.
11. Remove control valve (20) from winch. Remove and discard three O-rings (23) and gasket (24).



INSTALLATION**NOTE**

Lightly coat new O-rings with clean oil before installation.

1. Position three new O-rings (23) on control valve (20).
2. Position new gasket (24) on mating surface of winch.
3. Place control valve (20) into position on winch.

NOTE

Note size of socket head capscrews and their mounting location to ensure correct installation.

4. Install two new lockwashers (22) and 4 in. socket head capscrews (21) to secure control valve (20).
5. Install two new lockwashers (19) and 5-3/4 in. long allen capscrews (18) to secure control valve (20).
6. Connect hydraulic hose (17) and tighten connector (16).
7. Connect hydraulic hose (15) and tighten connector (14).
8. Connect tube (13) and tighten connector (12).
9. Connect tube (11) and tighten connector (10).
10. Connect winch gear pump pressure hose (WP 0147 00).
11. Install winch control lever and cable (WP 0142 00).
12. Perform winch control lever and cable adjustment (WP 0141 00).
13. Position new gasket (9) and side access cover (8) on valve housing (5). Install six new lockwashers (7) and capscrews (6).
14. Position new gasket (4) and top access cover (3) on valve housing (5). Install six new lockwashers (2) and capscrews (1).
15. Check winch oil level and add as needed (WP 0138 00).
16. Check winch for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Adjustment

INITIAL SETUP

Applicable Configuration

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00).

References

TM 5-2410-233-10

Equipment Condition

Winch control valve access cover removed (WP 0140 00)

Winch control levers and control bracket removed from seat base (WP 0142 00)

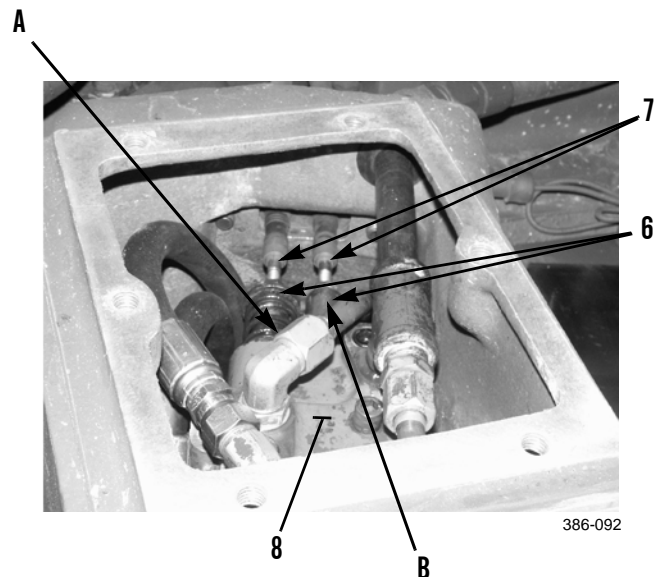
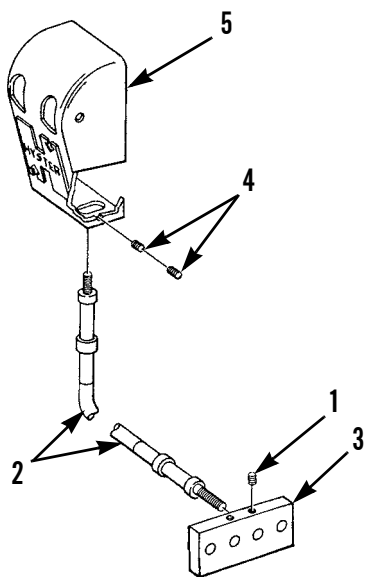
ADJUSTMENT

1. Loosen two setscrews (1) and release control cables (2) from control block (3).
2. Loosen two setscrews (4) and release control cables (2) from control bracket (5).

NOTE

Control valve (A) is the winch brake valve and control valve (B) is the winch cable valve.

3. Completely loosen two nuts (6) from brake and winch cable rod ends (7) at winch control valve (8).



ADJUSTMENT - CONTINUED

4. Completely loosen two nuts (9) from brake and winch cable rod ends (7) at clevises (10) in control bracket (5).

NOTE

Both cable rod ends may need to be removed from clevises to turn other end of cable rod to specification.

5. At winch end, adjust both control cable rod ends (7) evenly so when threading rod ends into brake and winch control valves measurement is 0.50 in. (13 mm) in length.

NOTE

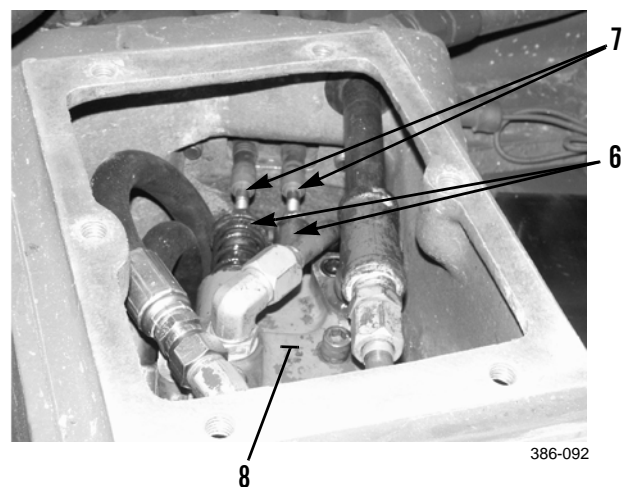
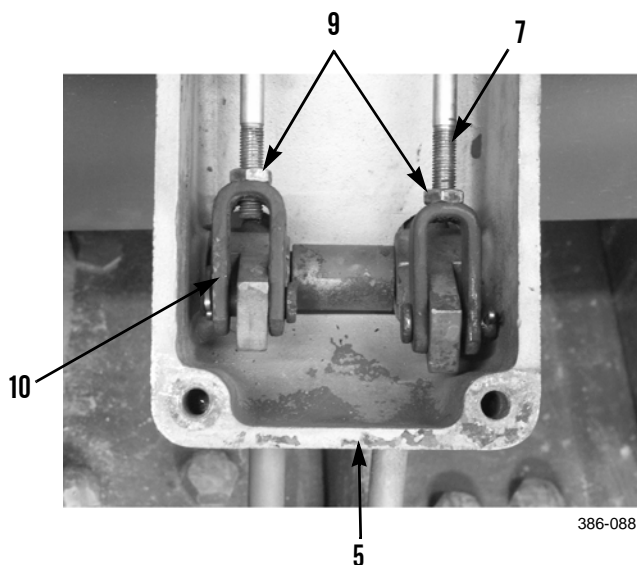
Measurement from top of threads on control cable to clevis is 3/4 in. (19 mm).

6. At winch control lever end, thread both control cable rod ends (7) evenly into brake and winch control clevises (10).
7. Position winch control lever centered in neutral position.

NOTE

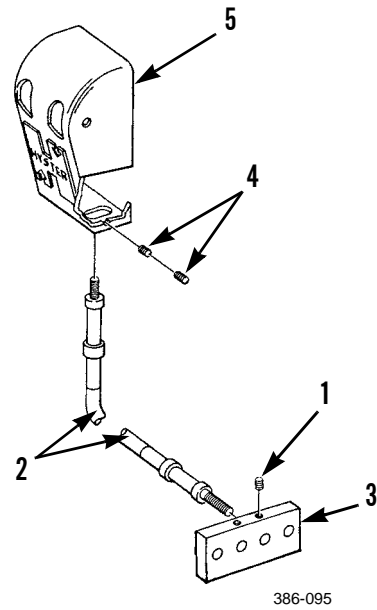
- **Adjustment procedure for brake and winch cables is done in the same manner.**
- **Both cables are turned evenly from either end in 1/2 turn increments.**

8. If winch control lever will not position in neutral, adjust control cable rod ends (7) evenly until lever is in neutral position.
9. Measure distance between knob of winch brake lever and knob of winch control lever in neutral position. Adjustment between two levers is 7 in. (18 cm).
10. Tighten two nuts (9) to secure cable rod ends (7) to clevises (10).



ADJUSTMENT - CONTINUED

11. Tighten two setscrews (4) to secure control cables (2) on control bracket (5).
12. Tighten two setscrews (1) to secure control cables (2) to control block (3).
13. Install winch control levers and control bracket to seat base (WP 0142 00).
14. Install winch control valve access cover (WP 0140 00).
15. Operate winch and check for proper operation (TM 5-2410-233-10).

**END OF WORK PACKAGE**

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WINCH CONTROL LEVERS AND LINKAGE REPLACEMENT

0142 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Applicable Configuration

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

- Grease, GAA (Item 15, 0184 00)
- Tag, marker (Item 35, WP 0184 00)
- Lockwasher (4 and 20)
- Pin, cotter (10)

References

- WP 0137 00
- WP 0140 00
- WP 0141 00

Equipment Condition

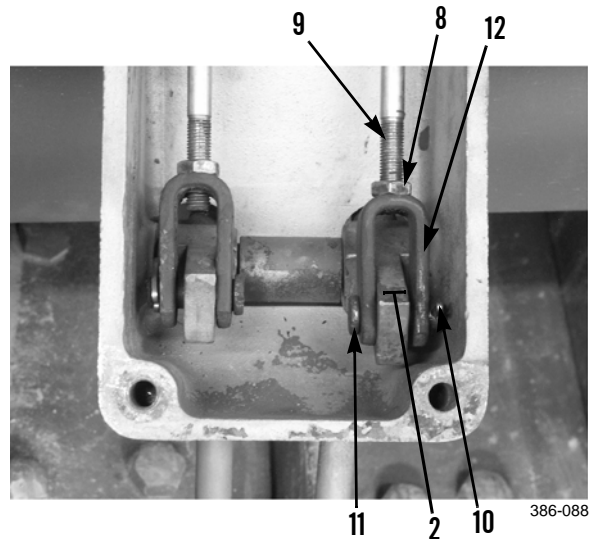
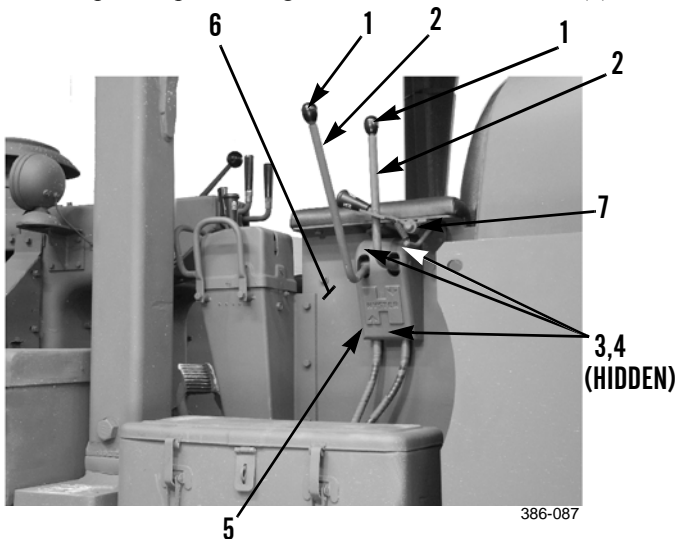
- Machine parked on level ground (TM 5-2410-233-10)
- Engine OFF and cool (TM 5-2410-233-10)
- Winch cool (TM 5-2410-233-10)

REMOVAL

NOTE

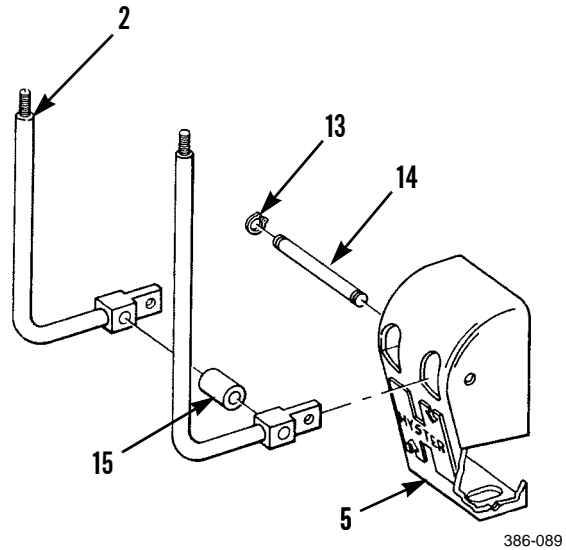
If tractor is equipped with a winterized cab, remove sound suppression panels.

1. Remove two knobs (1) from winch control levers (2).
2. Remove left armrest from seat base (WP 0137 00).
3. Remove three capscrews (3) and lockwashers (4) that secure control bracket (5) to seat base (6). Discard lockwashers.
4. Remove control bracket (5) from seat base (6). Remove control lock (7).
5. Completely back off nut (8) on control cable (9).
6. Remove cotter pin (10), pin (11) and clevis (12) from winch control lever (2). Discard cotter pin.
7. Remove control cable (9) from clevis (12).
8. Repeat steps 5 through 7 for other control cable (9).



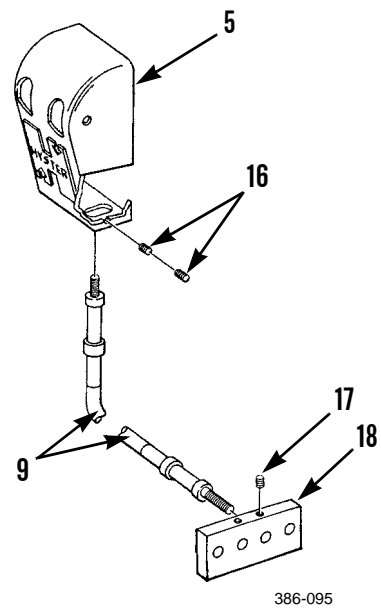
REMOVAL- CONTINUED

9. Remove snap ring (13), pin (14) and spacer (15) securing control levers (2) to control bracket (5).

**NOTE**

Tag control cables to ensure correct installation.

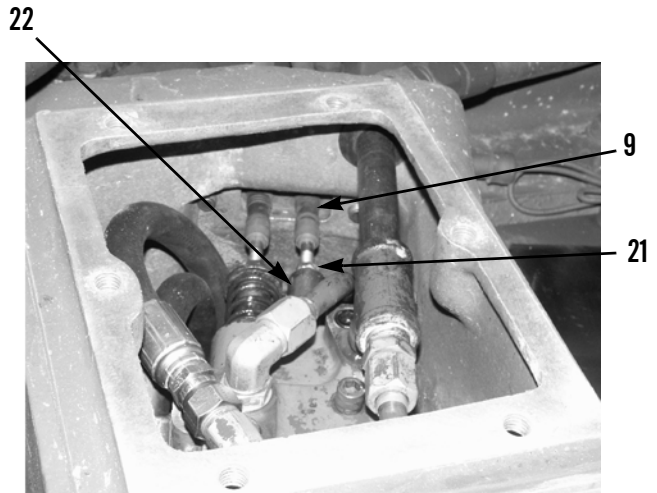
10. Remove setscrew (16) to release control cable (9) from control bracket (5). Repeat step for other cable.
11. Remove two setscrews (17) from cable block (18).
12. Remove two capscrews (19) and lockwashers (20) from cable block (18). Discard lockwashers.



13. Remove top access cover from winch control valve housing (WP 0140 00).

REMOVAL- CONTINUED

14. Completely loosen nut (21) on control cable (9) and remove control cable from control valve (22). Repeat step for other cable.



386-092

INSTALLATION**NOTE**

Both control cable ends are threaded into control valves approximately 1/4 in. (6 mm). Adjustment of cables is performed later in installation step 10.

1. Thread end of control cable (9) into control valve (22) and thread nut (21) to control valve. Do NOT tighten nut. Repeat step for other control cable.
2. Position cable block (18) and secure with two new lockwashers (20) and capscrews (19).
3. Install two setscrews (17) in cable block (18) to secure both control cables (9).
4. Position cable (9) through control bracket (5) and install setscrews (16). Repeat step for other cable.

NOTE

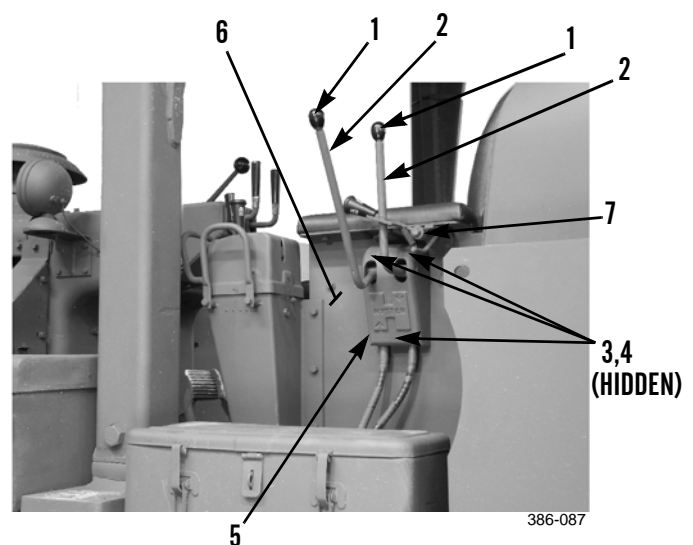
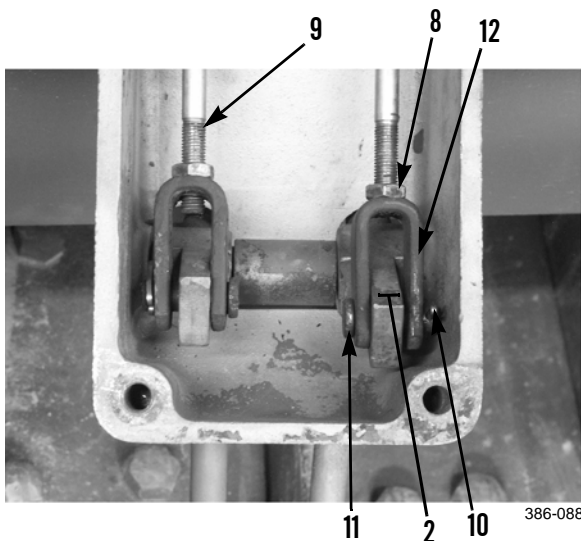
Apply a light coat of clean grease to pin before installation.

5. Position spacer (15) between both control levers (2).
6. Install pin (14) and snap ring (13) to secure control levers (2) to control bracket (5).

INSTALLATION - CONTINUED**NOTE**

Both control cable ends are threaded in clevis approximately 1/4 in. (6 mm). Adjustment of cables is performed later in installation step 10.

7. Thread nut (8) onto control cable (9). Install control cable through clevis (12).
8. Install clevis (12) to winch control lever (2) and secure with pin (11) and new cotter pin (10). Thread nut (8) to clevis. Do NOT fully tighten nut.
9. Repeat steps 7 and 8 for other control cable (9).
10. Adjust winch control cables (WP 0141 00).
11. Position control bracket (5) and control lock (7) as an assembly on seat base (6).
12. Install three new lockwashers (4) and capscrews (3) to secure control bracket (5) to seat base (6).
13. Install left armrest on seat base (WP 0137 00).
14. Install two knobs (1) to winch control levers (2).

**NOTE**

If tractor is equipped with a winterized cab, install sound suppression panels.

15. Install top access cover to winch control valve housing (WP 0140 00).
16. Operate winch and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Applicable Configuration

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25 WP 0184 00)

Materials/Parts - Continued

Rag, wiping (Item 28, WP 0184 00)

Filter element, fluid (8)

Gasket (4)

Lockwasher (2)

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

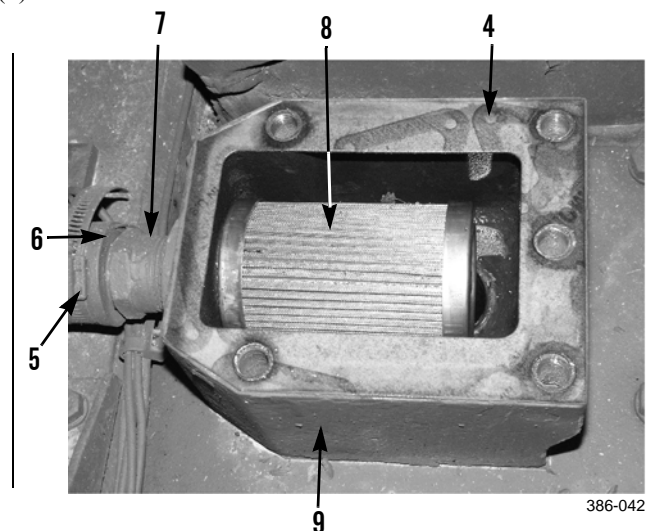
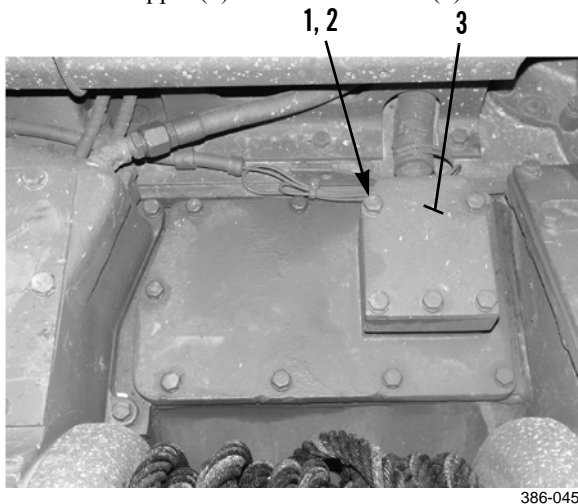
Engine OFF (TM 5-2410-233-10)

CAUTION

Wipe area clean around cover to prevent contamination of winch, which could result in premature failure.

REMOVAL

1. Remove five capscrews (1) and lockwashers (2) from cover (3). Discard lockwashers.
2. Remove cover (3) and gasket (4). Discard gasket.
3. Remove hose clamp (5) and suction hose (6) from nipple (7).
4. Remove nipple (7) and filter element (8) from housing (9). Discard filter element.



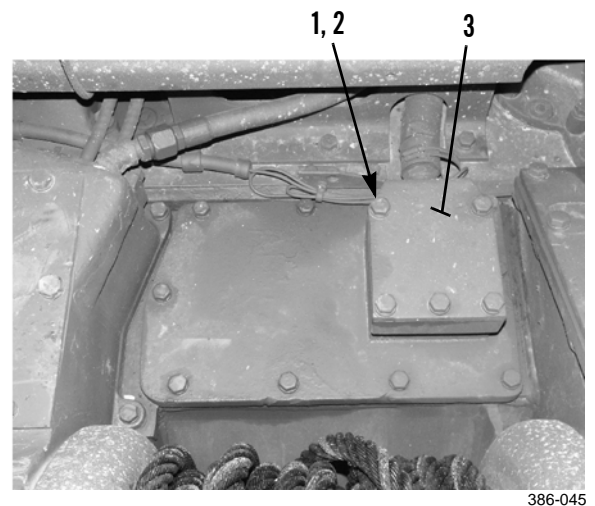
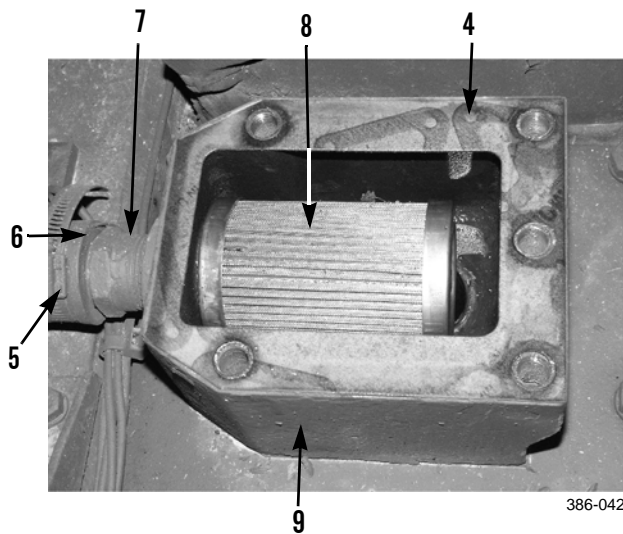
INSTALLATION**CAUTION**

Ensure mounting surfaces are clean before installation. Failure to provide clean mounting surface may cause contamination of winch.

NOTE

Lightly coat new filter element seal with clean oil before installation.

1. Position new filter element (8) in housing (9).
2. Install nipple (7) and tighten into filter element (8).
3. Connect suction hose (6) to nipple (7) and secure with hose clamp (5).
4. Install new gasket (4) on housing (9).
5. Position cover (3) and install five new lockwashers (2) and capscrews (1). Tighten capscrews to 40 lb-ft (54 Nm).



6. Operate winch and check for leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

WINCH BREATHER REPLACEMENT

0144 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Applicable Configuration**

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Equipment Condition

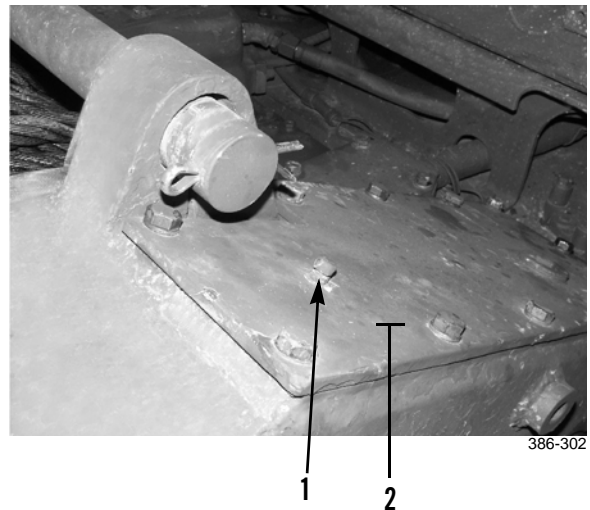
Machine parked on level ground (TM 5-2410-233-10)

CAUTION**Ensure opening in winch is covered, when breather is removed, to prevent dirt from contaminating winch.****REMOVAL**

1. Remove breather (1) from gear cover (2).
2. Install protective cap to plug breather hole.

INSTALLATION

1. Remove protective cap from breather hole and wipe breather hole clean.
2. Install breather (1) on gear cover (2). Tighten breather.

**END OF WORK PACKAGE**

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THIS WORK PACKAGE COVERS

Removal, Disassembly, Cleaning and Inspection, Assembly, Installation

INITIAL SETUP**Applicable Configuration**

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Lockwasher (2)

References

FM 5-125

Personnel Required

Two

Equipment Condition

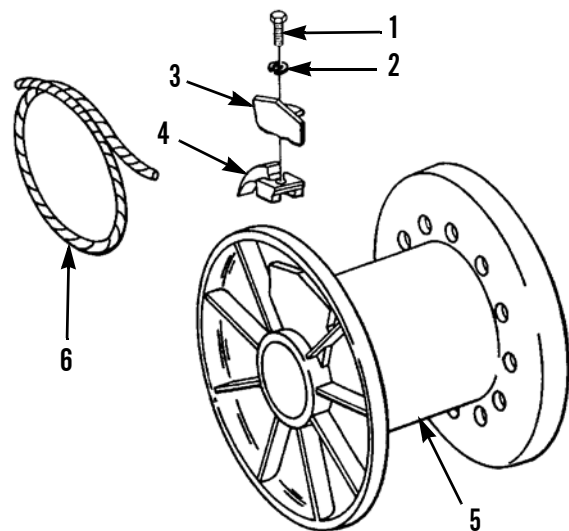
Winch wire rope reeled out (TM 5-2410-233-10)

WARNING

Wear heavy gloves when handling wire rope to protect hands against injury.

REMOVAL

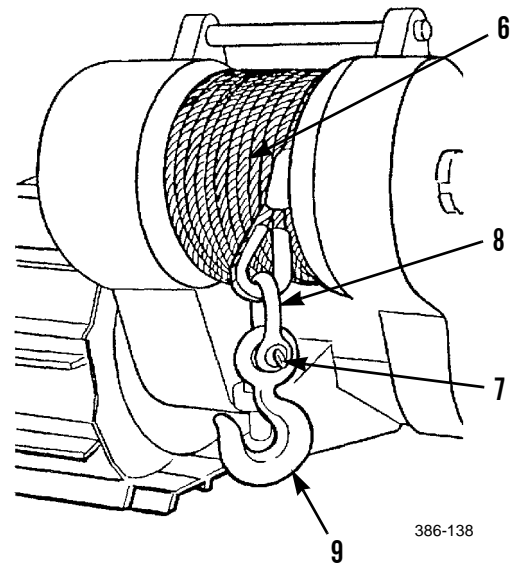
1. Remove capscrew (1) and lockwasher (2). Discard lockwasher.
2. Remove wire rope ferrule (3) and filler (4) from winch drum (5).
3. Remove wire rope (6) from winch drum (5).



386-050

DISASSEMBLY

1. Remove pin (7) from clevis (8) and remove hook (9).
2. Remove clevis (8) from wire rope (6).



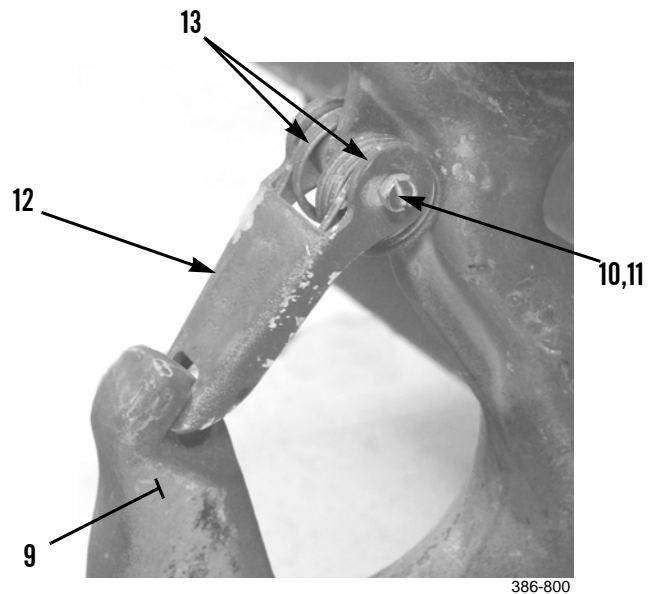
WARNING

Wear eye protection when disassembling latch to prevent injury.

NOTE

Note location of two springs and how they are installed to ensure correct assembly.

3. Remove nut (10) and screw (11) from latch (12) and hook (9).
4. Remove latch (12) and two springs (13) from hook (9).



CLEANING AND INSPECTION**WARNING**

- Wear eye protection when using wire brush to protect against injury.
- Failure to replace a damaged wire rope assembly could result in injury or death in the event wire rope breaks when loaded.

NOTE

Refer to FM 5-125, *Rigging Techniques, Procedures, and Applications* for further information.

1. Clean entire length of wire rope with a wire brush.
2. Inspect entire length of wire rope for flat spots, fraying, kinks and evidence of rusting.
3. Replace wire rope if any frays or kinks are evident, or if any flat spot is more than 1/2 the diameter of wire rope.

ASSEMBLY**WARNING**

Wear eye protection when assembling latch to prevent injury.

1. Position latch (12) and two springs (13) to hook (9).
2. Install screw (11) through hook (9), springs (13) and latch (12) and secure with nut (10).
3. Position clevis (8) in loop at end of wire rope (6).
4. Position eye of hook (9) in clevis (8) and install pin (7).

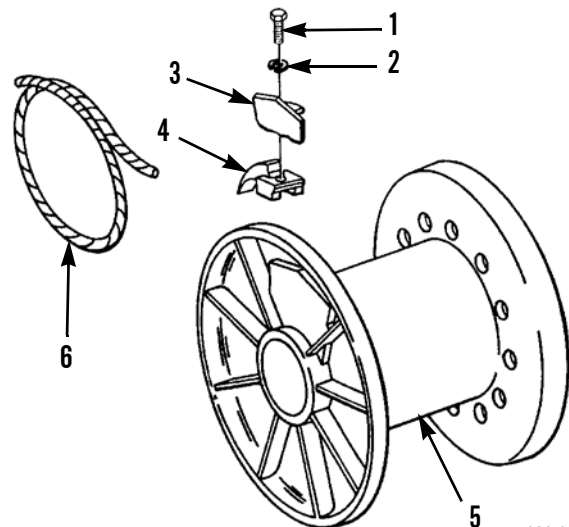
INSTALLATION

1. Lay wire rope (6) in a straight line behind tractor.

NOTE

When installing wire rope for standard speed winch, ensure wire rope is wound over top of winch drum.

2. Position one end of wire rope (6) on winch drum (5).
3. Install filler (4) and wire rope ferrule (3) over end of wire rope (6) on winch drum (5).
4. Install new lockwasher (2) and capscrew (1).
5. Start engine and wind wire rope on drum (TM 5-2410-233-10).



386-050

END OF WORK PACKAGE

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DRAWBAR PIN AND LATCH REPLACEMENT

0146 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Applicable Configuration**

Tractor with winch

Materials/Parts

Pin, cotter (5)

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Equipment Condition

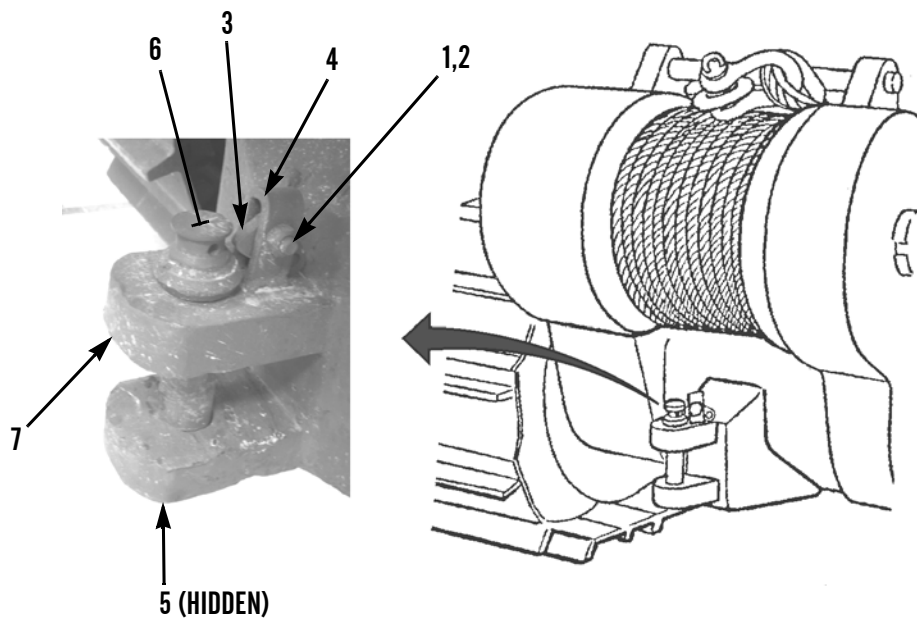
Machine parked on level ground (TM 5-2410-233-10)

REMOVAL

1. Remove nut (1), bolt (2) and latch (3) from weldment (4).
2. Remove cotter pin (5) and drawbar pin (6) from bracket (7). Discard cotter pin.

INSTALLATION

1. Install drawbar pin (6) in bracket (7).
2. Install new cotter pin (5) in drawbar pin (6).
3. Install latch (3) to weldment (4) with bolt (2) and nut (1).
4. Ensure latch (3) moves freely. Loosen or tighten nut (1) as needed.

**END OF WORK PACKAGE**

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WINCH GEAR PUMP REPLACEMENT

0147 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Applicable Configuration

Tractor with winch

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23, 24 or 25, WP 0184 00)

Rag, wiping (Item 28, WP 0182 00)

Materials/Parts - Continued

Gasket (9 and 13)

Lockwasher (8 and 12)

References

WP 0138 00

Personnel Required

Two

Equipment Condition

Tractor parked on level ground (TM 5-2410-233-10)

Engine OFF and cool (TM 5-2410-233-10)

Floor plates removed (WP 0135 00)

CAUTION

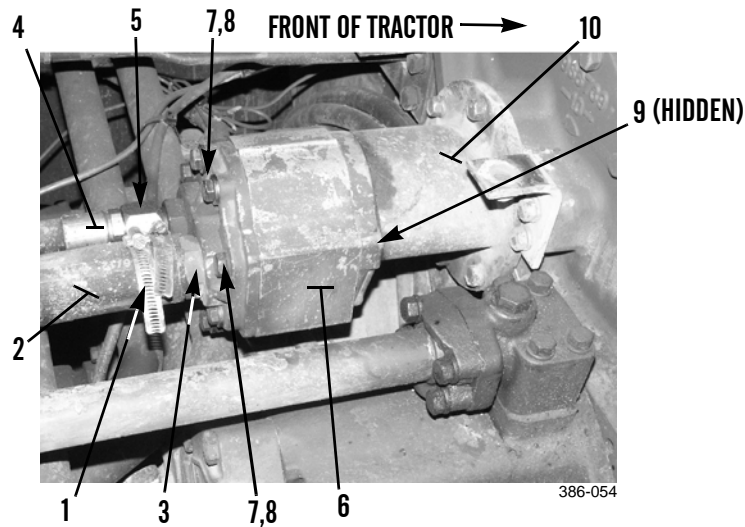
Wipe area clean around all connections to be opened during procedure. Cap oil lines and plug openings after removing lines. Contamination of winch could result in premature failure.

NOTE

Use a suitable container to capture any oil that may drain from system. Dispose of oil IAW local policy and ordinances. Clean up all spills.

REMOVAL

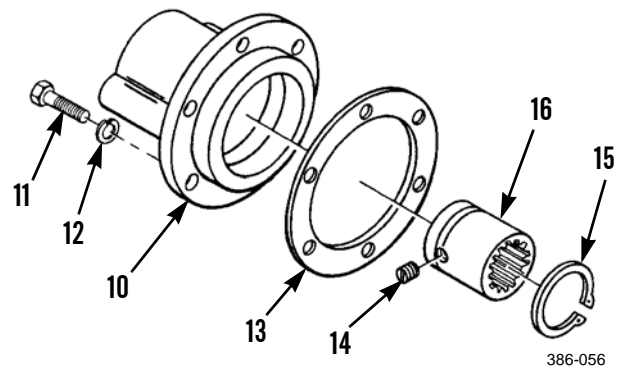
1. Remove two hose clamps (1) and disconnect suction hose (2) from connector (3).
2. Disconnect oil pressure line (4) from connector (5) and remove connector from pump (6). Discard O-ring.
3. Remove two capscrews (7), lockwashers (8) and remove pump (6) and gasket (9) from mounting bracket (10). Discard lockwashers and gasket.



NOTE

Perform steps 4 through 6 only if winch pump mounting bracket requires replacement.

4. Remove six capscrews (11), lockwashers (12) from mounting bracket (10). Discard lockwashers.
5. Remove mounting bracket (10) and gasket (13) from auxiliary drive cover. Discard gasket.
6. Remove setscrew (14), snap ring (15) and coupling (16) from engine auxiliary drive gear shaft.



INSTALLATION**CAUTION**

Ensure mounting surfaces are clean before installation. Failure to provide clean mounting surfaces may cause contamination of winch.

NOTE

Perform steps 1 through 3 only if winch pump mounting bracket was removed.

1. Install coupling (16), snap ring (15) and setscrew (14) in engine auxiliary drive gear shaft.
2. Install new gasket (13) on mounting bracket (10).
3. Install mounting bracket (10) on engine auxiliary drive gear cover and secure with six new lockwashers (12) and capscrews (11).
4. Install two new lockwashers (8) and capscrews (7) into pump (6).

NOTE

Position new gasket onto ends of capscrews (7) to keep gasket in position.

5. Install new gasket (9) on pump (6).
6. Install pump (6) on mounting bracket (10) by fully tightening capscrews (7).

NOTE

Lightly coat new O-ring with clean oil before installation.

7. Install new O-ring on connector (5) and install connector to pump (6).
8. Connect oil pressure line (4) to connector.
9. Position suction hose (2) on connector (3) and install two hose clamps (1).
10. Check winch oil level and add oil as needed (WP 0138 00).
11. Start engine and run at low idle. Check winch for proper operation and leaks (TM 5-2410-233-10).
12. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

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HYDRAULIC PUMP REPLACEMENT

0148 00**THIS WORK PACKAGE COVERS**Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Lifting equipment, 100 lb capacity

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23 or 24 WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Tag, marker (Item 35, WP 0184 00)

O-ring (5, 11 and 18)

Personnel Required

Two

Equipment Condition

Hydraulic system pressure relieved (WP 0176 00)

Hydraulic tank drained (WP 0165 00)

Floor plates removed (WP 0135 00)

REMOVAL**WARNING**

Do **NOT** remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then **SLOWLY** loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.

CAUTION

Wipe area clean around all hydraulic connections to be opened during removal. Cap oil lines and plug openings after removing lines. Contamination of hydraulic system could result in premature failure.

NOTE

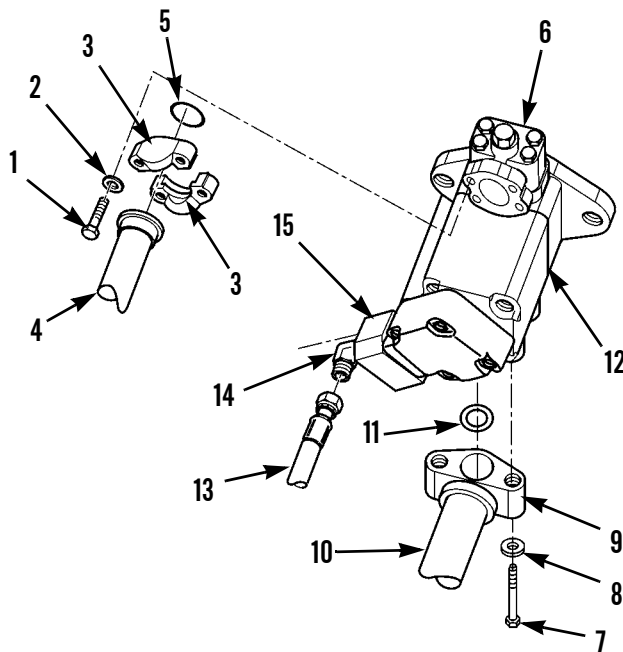
Tag hydraulic hoses to ensure correct installation.

1. Remove four capscrews (1), flatwashers (2) and split flange (3). Separate hose (4) and O-ring (5) from elbow (6). Discard O-ring.
2. Remove two capscrews (7), flatwashers (8) and flange (9). Separate large hose (10) and O-ring (11) from bottom of hydraulic pump (12). Discard O-ring.
3. Disconnect hose (13) from elbow (14) on hydraulic pump (12).

NOTE

On tractors with ripper attachment, a second hose is connected to tee at hydraulic pump.

4. If equipped with ripper, repeat step 3 to disconnect ripper hose from tee (15).



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REMOVAL - CONTINUED



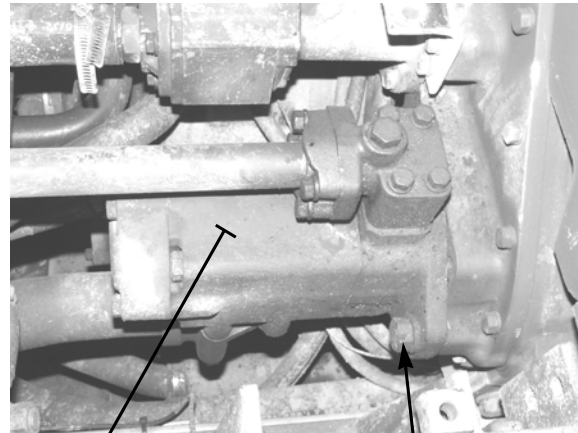
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Hydraulic pump weighs 50 lb (23 kg).

5. Attach a nylon sling and a suitable lifting device to hydraulic pump (12).
6. Remove two capscrews (16) and flatwashers (17) from hydraulic pump (12). Lift pump free of engine auxiliary drive cover.

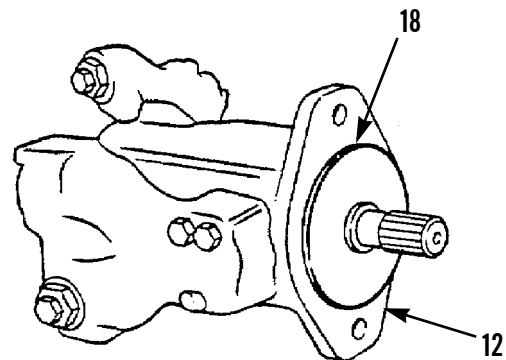


386-664

12

16,17

7. Remove O-ring (18) from hydraulic pump (12). Discard O-ring.



386-600

INSTALLATION**CAUTION**

Wipe all sealing surfaces and hose connections clean and dry prior to installation. Contamination of hydraulic system could result in premature failure.

NOTE

Lightly coat new O-rings with clean oil before installation.

1. Install new O-ring (18) on hydraulic pump (12).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

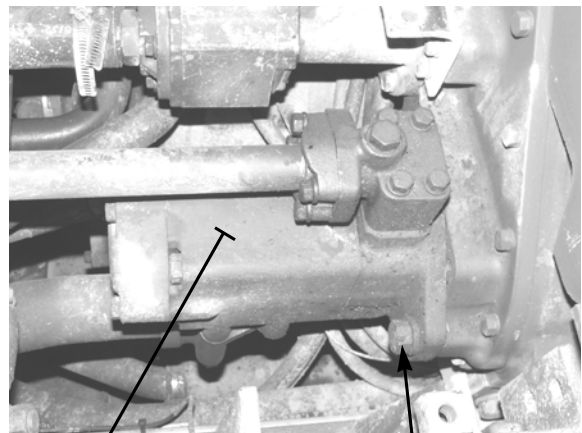
CAUTION

Ensure splines on pump shaft are aligned with internal splines on engine auxiliary drive gear.

NOTE

Hydraulic pump weighs 50 lb (23 kg).

2. Attach a nylon sling and a suitable lifting device to hydraulic pump (12) and lift assembly into position on engine auxiliary drive cover.
3. Secure hydraulic pump (12) on engine auxiliary drive cover with two flatwashers (17) and capscrews (16).



386-664

12

16,17

HYDRAULIC PUMP REPLACEMENT - CONTINUED

0148 00

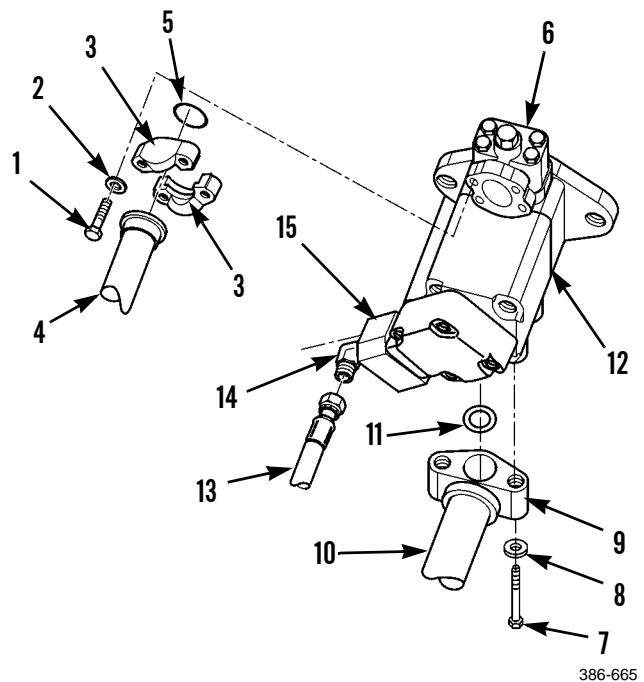
INSTALLATION - CONTINUED

4. Connect hose (13) to elbow (14) on hydraulic pump (12).

NOTE

On tractors with ripper attachment, a second hose is connected to tee at hydraulic pump (12).

5. If equipped with ripper, repeat step 4 to connect ripper hose to tee (15).
6. Install new O-ring (11) and large hose (10) on bottom of hydraulic pump (12) and secure flange (9) with two capscrews (7) and flatwashers (8).
7. Install new O-ring (5) and hose (4) on elbow (6) with split flange (3), four capscrews (1) and flatwashers (2).



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8. Refill hydraulic tank and bleed air from system (WP 0165 00).
9. Check hydraulic pump for leaks and proper operation (TM 5-2410-233-10).
10. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

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HYDRAULIC PUMP REPAIR

0149 00

THIS WORK PACKAGE COVERS

Disassembly, Cleaning and Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)

Materials/Parts

- Cleaning compound, solvent (Item 4, WP 0184 00)
- Oil, lubricating oil (Item 22, 23 or 24 WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Lockwasher (5 and 12)
- O-ring (7, 9, 14 and 35)

Materials/Parts - Continued

- Pipe, 1 in. diameter x 8 in. long
- Retainer (19)
- Ring, felt (34)
- Seal (17, 18, 20, 23, 24, 25, 33 and 35)

References

- WP 0167 00
- WP 0176 00

Equipment Condition

- Hydraulic pump removed (WP 0148 00)
-

DISASSEMBLY

CAUTION

To prevent contamination from entering hydraulic system, ensure components are kept clean during disassembly.

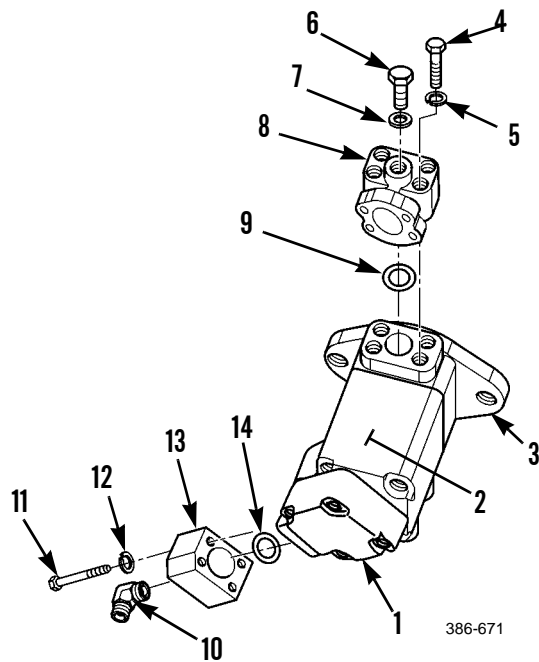
1. Wipe outside of pump body and cover clean.

DISASSEMBLY - CONTINUED

NOTE

Reference marks will ensure correct assembly of pump.

2. Put reference marks between end cover (1) and pump body (2) and between pump body and front pump housing (3).
3. Remove four bolts (4), lockwashers (5), plug (6) and O-ring (7) from elbow (8). Discard lockwashers and O-ring.
4. Remove elbow (8) and O-ring (9) from front pump housing (3). Discard O-ring.
5. Remove elbow (10), four capscrews (11), lockwashers (12), tee (13) and O-ring (14) from end cover (1). Discard lockwashers and O-ring.

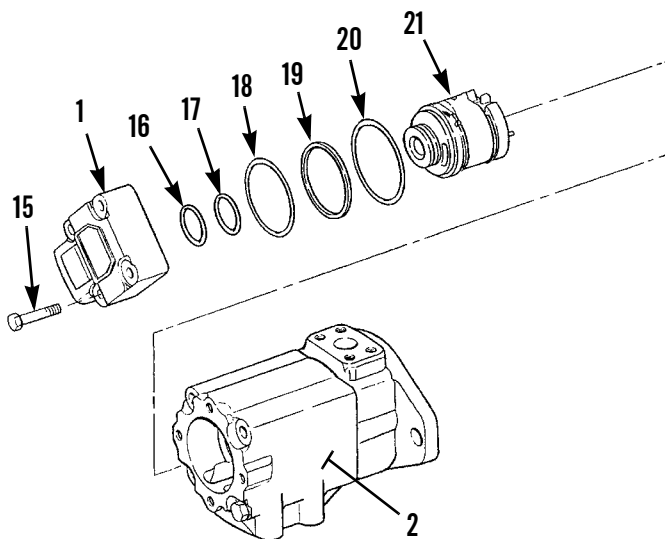


6. Remove four capscrews (15) and end cover (1) from pump body (2).

NOTE

Note orientation of cartridge assembly during disassembly to ensure correct assembly.

7. Remove washer (16) two seals (17 and 18), retainer (19), seal (20) and front cartridge assembly (21) from pump body (2). Discard seals and retainer.



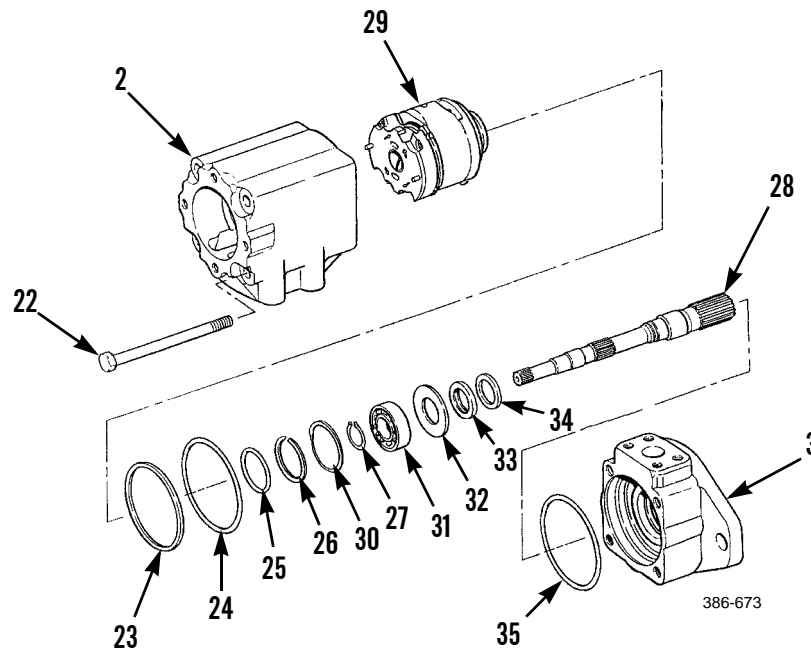
DISSASSEMBLY - CONTINUED

8. Remove four capscrews (22) and separate pump body (2) from front pump housing (3).
9. Remove three seals (23, 24 and 25) and retaining ring (26). Discard seals.
10. Remove retaining ring (27) from shaft (28).

NOTE

Note orientation of cartridge assembly during disassembly to ensure correct assembly.

11. Press shaft (28) from pump body (2) and slide rear cartridge assembly (29) from shaft.
12. Remove retaining ring (30), bearing (31) and washer (32) from front pump housing (3).
13. Remove seal (33) and felt ring (34) from front pump housing (3). Discard seal and felt ring.
14. Remove large O-ring (35) from front pump housing (3).



CLEANING AND INSPECTION**WARNING**

- Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.
- Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may result in serious injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

1. Thoroughly clean all parts in solvent cleaning compound.
2. Dry parts thoroughly with compressed air.

NOTE

If any component of pump and housings (with the exception of seals and retainers) is damaged, replace pump assembly.

3. Inspect all components for damage or wear IAW instructions in WP 0176 00. Replace defective components.

ASSEMBLY**CAUTION**

Ensure all components are kept clean during assembly. Failure to follow this caution could cause contamination of hydraulic system.

NOTE

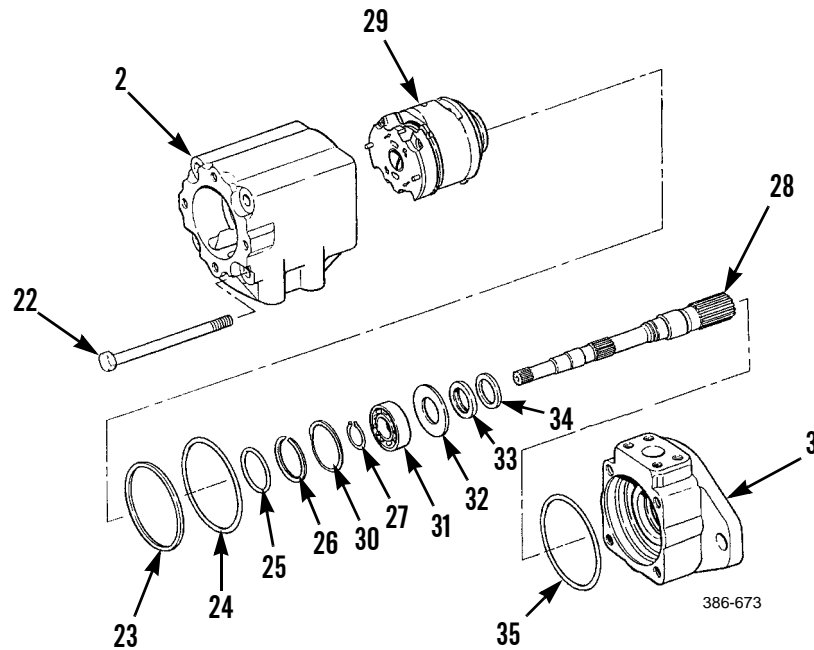
- Prior to assembly, lightly coat all sub-assembly components, new seals and new O-rings with clean oil.
- During assembly, ensure reference marks for end cover, pump and front pump body are in alignment.
- During assembly, all components must be installed in correct direction of pump rotation. Pump rotation as seen from splined end of shaft is to the left.

1. Install new large O-ring (35) in front pump housing (3).
2. Turn front pump housing (3) over and install new felt ring (34) and seal (33) in front pump housing, with spring-loaded lip toward pump bearing.
3. Install washer (32), bearing (31) and new retaining ring (30) in front pump housing (3).
4. Put a piece of 1 in. diameter pipe, 8 in. long, in position against inner race of bearing (31). Use a driver tool, pipe and a press to install shaft (28).

ASSEMBLY - CONTINUED**NOTE**

Ensure cartridge assembly is assembled in the same orientation as noted during disassembly.

5. Install shaft (28) through front pump housing (3) and slide rear cartridge assembly (29) on shaft. Position so that pins in plate of cartridge are in alignment with mounting holes of pump body. Install retaining ring (27) on shaft.
6. Install new retaining ring (26) and new seals (23, 24 and 25) in front pump housing (3).
7. Align pins in plate of rear cartridge assembly (29) with holes in center of pump body (2). Install front pump housing (3) and cartridge assembly in pump body according to orientation noted during disassembly.
8. Install four capscrews (22) and tighten to 70 lb-ft (95 Nm).

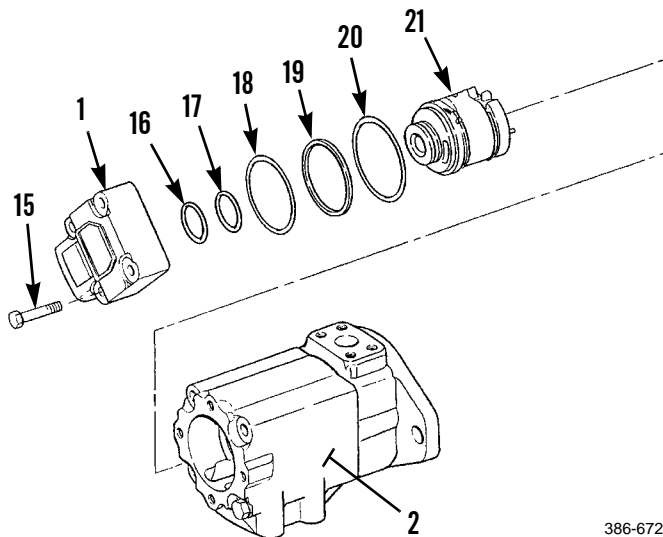


ASSEMBLY - CONTINUED

NOTE

Ensure cartridge assembly is assembled in the same orientation as noted during disassembly.

9. Install new seal (20), new retainer (19), two new seals (17 and 18) and washer (16) on front cartridge assembly (21), with seals installed toward pressure source.
10. Install front cartridge assembly (21) on end cover (1), with cartridge positioned so pins in plate are in alignment with mounting holes in pump body (2).
11. Install end cover (1) with four capscrews (15). Tighten capscrews to 45 lb-ft (61 Nm).

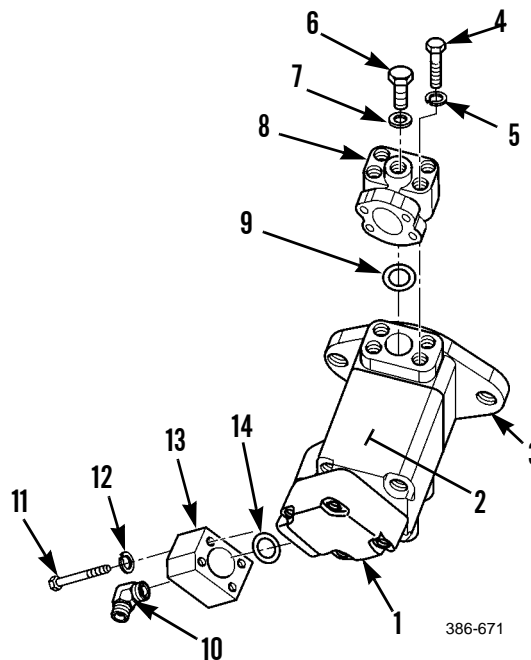


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NOTE

After assembly of pump, pump shaft must turn by hand.

12. Verify that pump shaft turns by hand. If not, pump must be disassembled and assembled again.
13. Install new O-ring (14) and tee (13) on end cover (1) with four new lockwashers (12) and capscrews (11).
14. Install elbow (10) on tee (13).
15. Install new O-ring (9) and elbow (8) on top of front pump housing (3). Secure with four new lockwashers (5) and bolts (4).
16. Install new O-ring (7) and plug (6) in elbow (8).



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17. Install hydraulic pump (WP 0148 00).
18. Before returning machine to service, perform pump tests to ensure pump operation is correct (WP 0167 00).

END OF WORK PACKAGE

HYDRAULIC TILT CONTROL VALVE REPLACEMENT

0150 00**THIS WORK PACKAGE COVERS**

Removal, Inspection, Relief Valve Setting Adjustment, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Compound, gasket forming (Item 7, WP 0184 00)

Oil, lubricating (Item 22, 23 or 24, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

Gasket (10)

Materials/Parts - Continued

Lockwasher (5, 7, 12, 14, 19 and 24)

O-ring (15 and 17)

References

TM 5-2410-233-10

WP 0167 00

Personnel Required

Two

Equipment Condition

Hydraulic tank drained (WP 0165 00)

Floor plates removed (WP 0135 00)

Blade control lever and linkages disconnected (WP 0152 00)

REMOVAL**CAUTION**

- **Wipe area clean around all hydraulic connections to be opened during removal.**
- **Cap oil lines and plug opening after removing lines. Contamination of hydraulic system could result in premature failure.**

NOTE

- **Blade tilt control valve and mounting plate can be removed from hydraulic tank without removing tank from machine.**
- **Use a suitable container to catch any hydraulic oil that may drain from system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.**
- **Tag all oil lines prior to removal to assist in installation.**

REMOVAL - CONTINUED

1. Disconnect hydraulic lines (1 and 2) from manifold (3).
2. Remove two capscrews (4) and lockwashers (5) from manifold (3). Discard lockwashers.
3. Remove 18 capscrews (6) and lockwashers (7) from mounting plate (8) on hydraulic tank (9). Discard lockwashers.

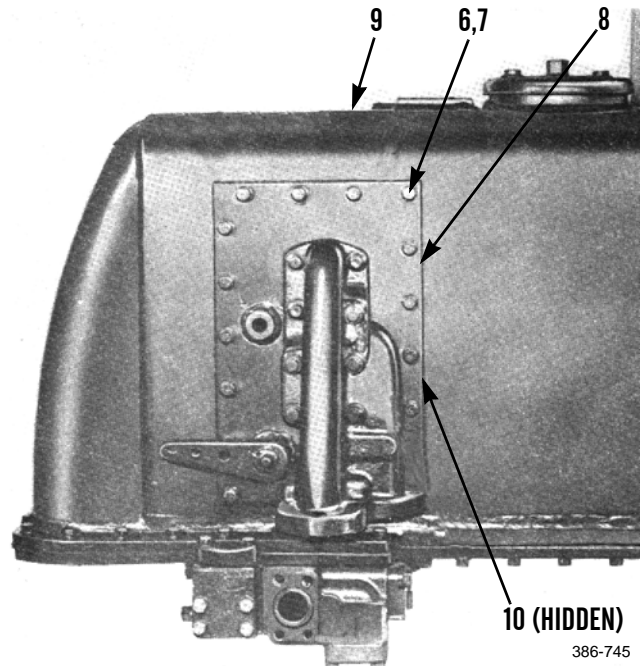
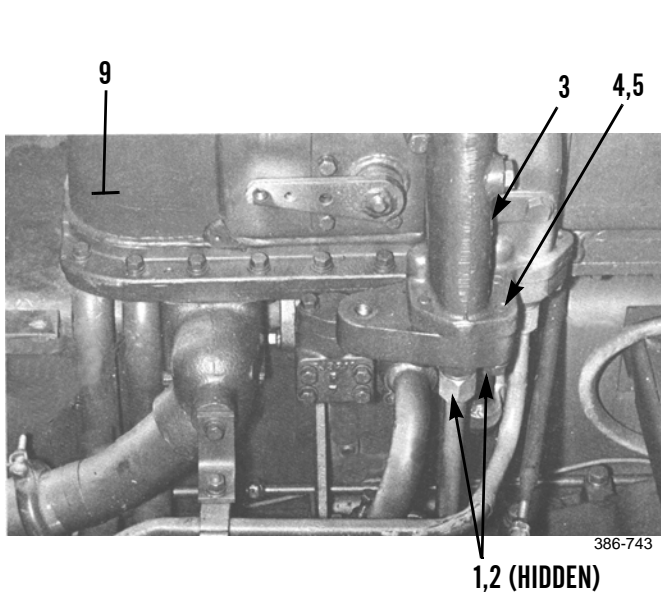


WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

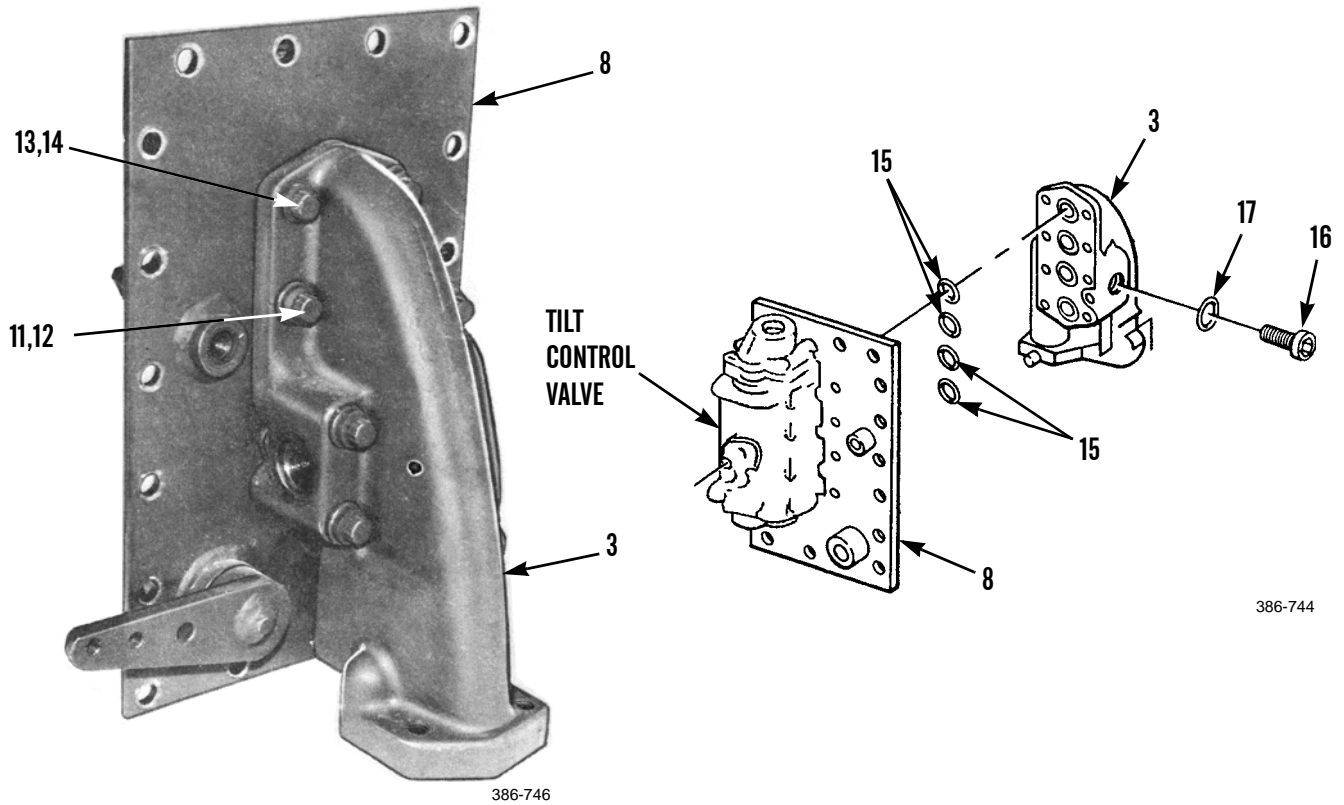
NOTE

- Tilt control valve, manifold and mounting plate as an assembly weighs 70 lb (35 kg).
 - Tilt control valve is mounted to back surface of mounting plate.
4. With assistance, remove mounting plate (8), manifold (3), and tilt control valve as an assembly from hydraulic tank (9). Remove gasket (10) and discard.



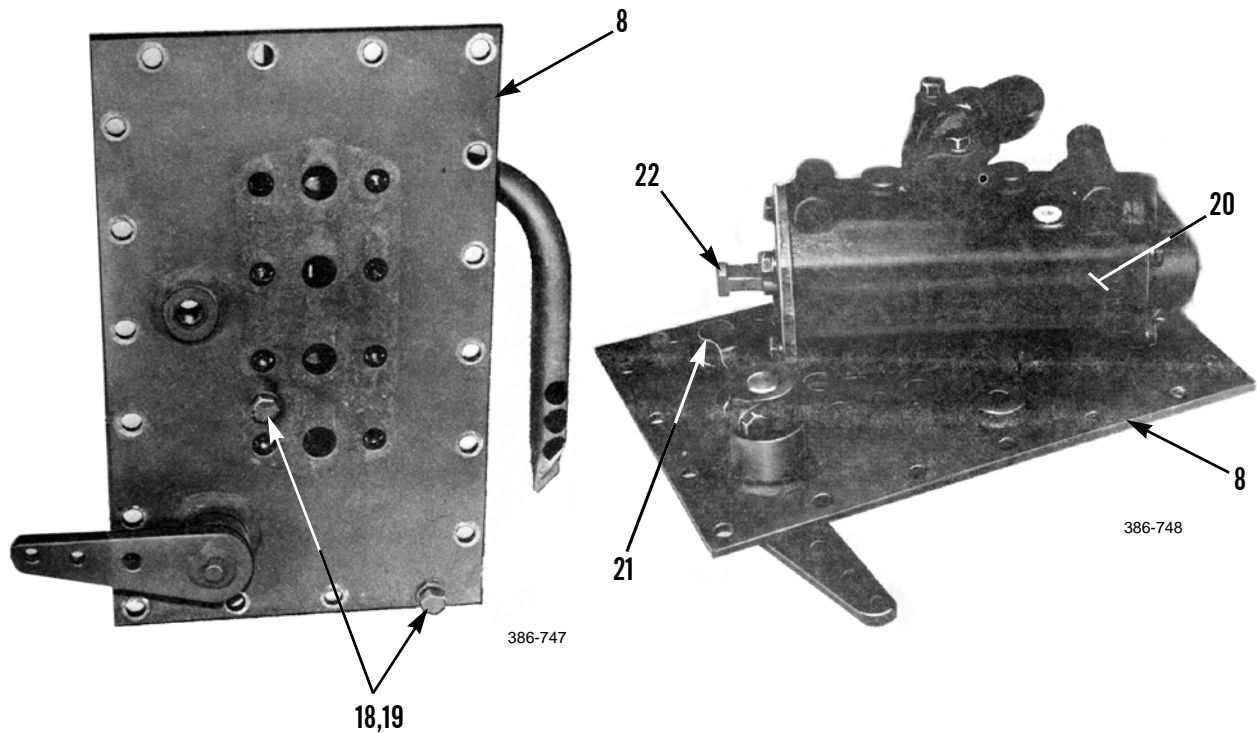
REMOVAL - CONTINUED

5. Remove six capscrews (11), lockwashers (12), two bolts (13) and lockwashers (14) from manifold (3). Discard lockwashers.
6. Separate manifold (3) from mounting plate (8). Remove and discard four O-rings (15) from bores of manifold.
7. If required for cleaning and inspection, remove plug (16) and O-ring (17) from manifold (3). Discard O-ring.



HYDRAULIC TILT CONTROL VALVE REPLACEMENT - CONTINUED**0150 00****REMOVAL - CONTINUED**

8. Remove two capscrews (18) and lockwashers (19) from mounting plate (8) and tilt control valve (20). Discard lockwashers.
9. Disconnect lever (21) from valve spool (22).
10. Remove tilt control valve (20) from mounting plate (8).

**INSPECTION**

1. Examine exterior of tilt control valve for cracks. Replace valve if cracks are found.
2. Clean and wipe all parts with a clean rag.

RELIEF VALVE SETTING ADJUSTMENT**CAUTION**

Ensure work area is clean to prevent contamination of hydraulic system.

1. Remove tilt control valve IAW *Removal* in this work package.

RELIEF VALVE SETTING ADJUSTMENT - CONTINUED

2. Remove four bolts (23), lockwashers (24) and cover (25) from tilt control valve (20). Discard lockwashers.
3. Remove sleeve (26), spring (27), three disks (28) and pilot valve (29).
4. Remove shims (30) from between spring (27) and sleeve (26).

NOTE

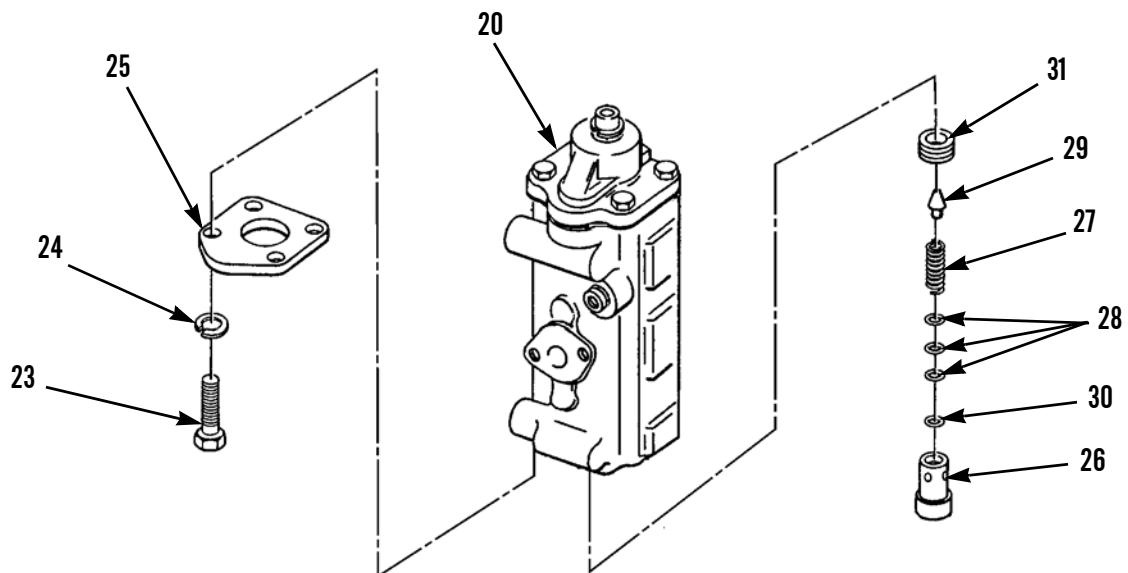
Adding one shim increases pressure by 35 PSI (2.5 kg/cm²) Removing one shim decreases pressure by the same value.

5. Determine number of shims (30) needed to achieve proper relief valve setting (WP 0165 00).
6. Ensure valve seat (31) is bottomed square against shoulder in control valve body.

NOTE

Ensure spring is seated in its groove in valve seat.

7. Install pilot valve (29), three disks (28) and spring (27).
8. Install correct number of shims (30) as determined in step 5.
9. Install sleeve (26).
10. Install cover (25) with four new lockwashers (24) and bolts (23).



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INSTALLATION

NOTE

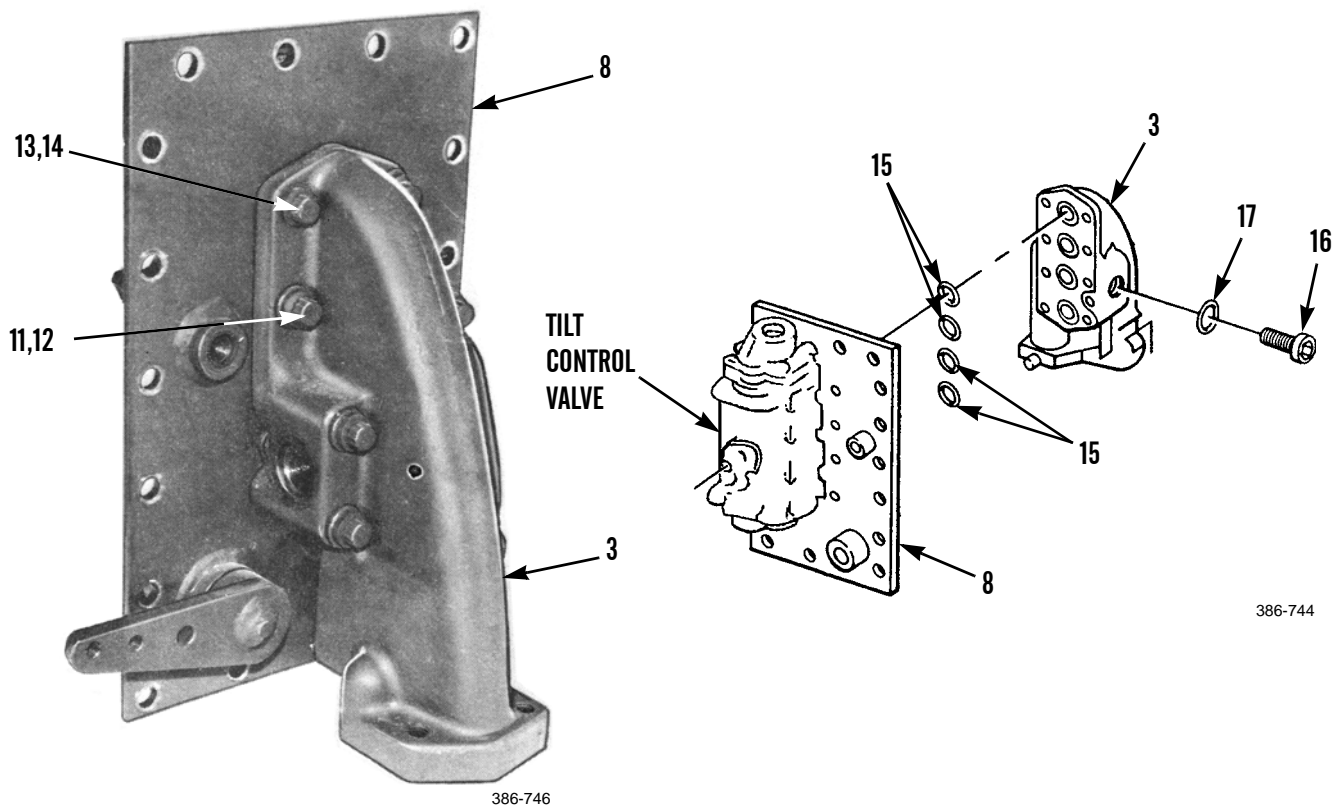
Lightly coat new O-rings with clean oil before installation.

1. Position tilt control valve (20) on mounting plate (8).

NOTE

Position machined flats on spool valve so it will align with control lever.

2. Connect lever (21) to spool valve (22) on tilt control valve (20).
3. Install two new lockwashers (19) and capscrews (18) to secure mounting plate (8) to tilt control valve (20). Tighten capscrews to 60 lb-ft (81 Nm).
4. Install four new O-rings (15) in bores of manifold (3).
5. If removed for inspection and cleaning, install new O-ring (17) and plug (16) in manifold (3)
6. Position manifold (3) and align holes with mounting plate (8).
7. Install six new lockwashers (12) and capscrews (11) to manifold (3), mounting plate (8) and tilt control valve (20).
8. Install two new lockwashers (14) and bolts (13) to manifold (3) and mounting plate (8).
9. Tighten capscrews (11) and bolts (13) to 60 lb-ft (81 Nm).



INSTALLATION - CONTINUED



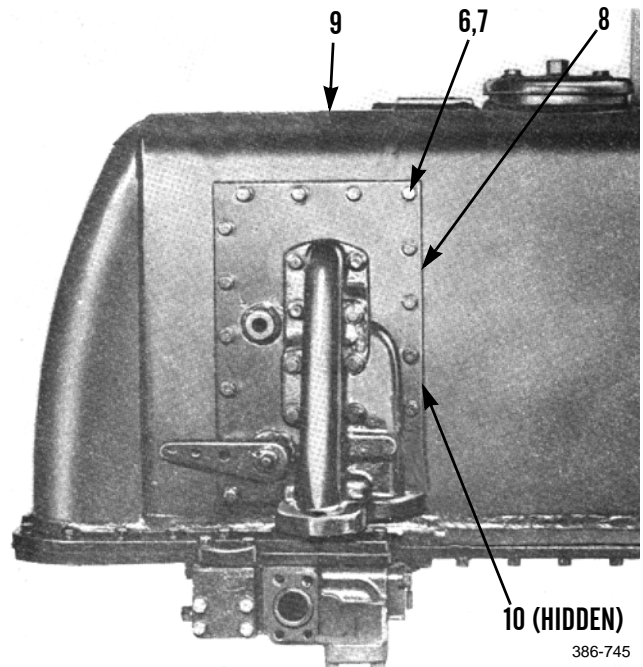
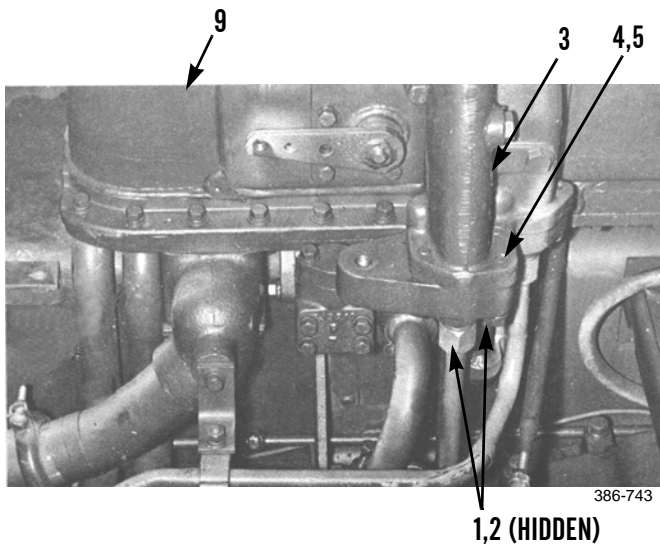
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

NOTE

- Tilt control valve, manifold and mounting plate as an assembly weighs 70 lb (35 kg).
- Apply a small amount of gasket forming compound on hydraulic tank to keep gasket in place.

10. Position new gasket (10) on mounting plate (8). With assistance, install mounting plate (8), manifold (3) and tilt control valve (20) as an assembly on hydraulic tank (9).
11. Install 18 new lockwashers (7) and capscrews (6) securing assembly to hydraulic tank (9).
12. Install two new lockwashers (5) and capscrews (4) to manifold (3).
13. Connect hydraulic lines (1 and 2) to manifold (3).



14. Connect blade control lever and linkages (WP 0152 00).
15. Refill hydraulic tank and bleed air from system, as required (WP 0165 00).
16. Operate tractor and ensure hydraulic tilt control valve is operating properly and no leaks are evident. Check tilt circuit pressures and adjust as needed (WP 0167 00).
17. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

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**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT**

0151 00

THIS WORK PACKAGE COVERS

Main (Bulldozer) Control Valve: Removal, Installation
 Ripper Control Valve: Removal, Installation
 Relief Valve: Removal, Installation, Relief Valve Setting Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Link, lifting (Item 43, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Lifting equipment, 250 lb capacity
 Bolt, 1/2 -13 x 1 in.

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)
 Compound, sealing (Item 9, WP 0184 00)
 Oil, lubricating (Item 22, 23 or 24, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

Gasket (24 and 31)
 Lockwasher (10, 19, 22, 26, 33, 35, 43, 46, and 53)
 O-ring (48 and 55)

References

WP 0135 00
 WP 0165 00
 WP 0167 00
 WP 0180 00

Personnel Required

Two

Equipment Condition

Hydraulic tank removed (WP 0166 00)
 Hydraulic tilt control valve removed (WP 0150 00).

CAUTION

- **To prevent contamination of hydraulic system, keep work area clean.**
- **Place protective caps or plugs on all hydraulic system openings as components are removed. Wipe all components clean before they are installed. Failure to do so could result in equipment damage due to contamination of hydraulic system.**

MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE AND RELIEF VALVE REPLACEMENT - CONTINUED

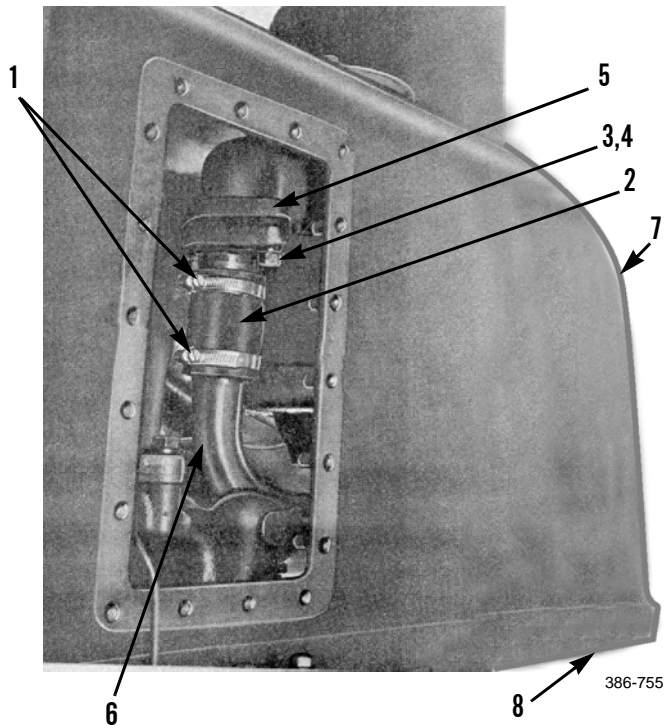
0151 00

MAIN (BULLDOZER) CONTROL VALVE REMOVAL

NOTE

Use a suitable container to capture residual draining oil. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

1. Loosen two hose clamps (1) on hose (2).
2. Remove two bolts (3) and washers (4) securing extension tube (5) to pump suction tube (6). Rotate extension tube within hydraulic tank (7) so it will not interfere with removal of tank from bottom plate (8).
3. Install lifting link with 1/2-13 x 1 in. bolt in center threaded hole on top of hydraulic tank (7).



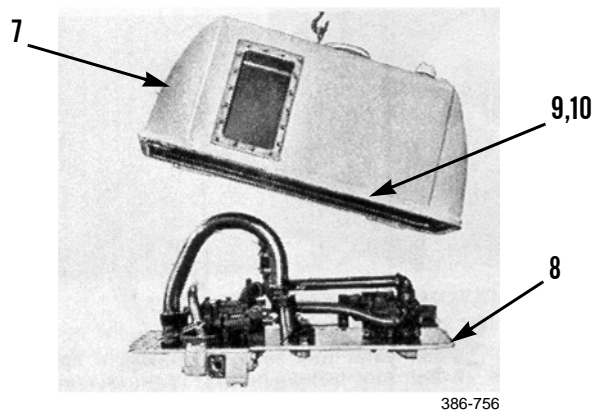
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

Hydraulic tank weighs approximately 226 lb (103 kg).

4. Attach a nylon sling and suitable lifting device to lifting link on hydraulic tank (7).
5. Remove 20 bolts (9) and lockwashers (10) and lift hydraulic tank (7) from bottom plate (8). Discard lockwashers.

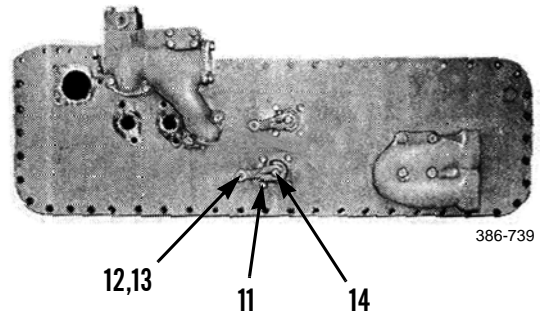


**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

0151 00

MAIN (BULLDOZER) CONTROL VALVE REMOVAL - CONTINUED

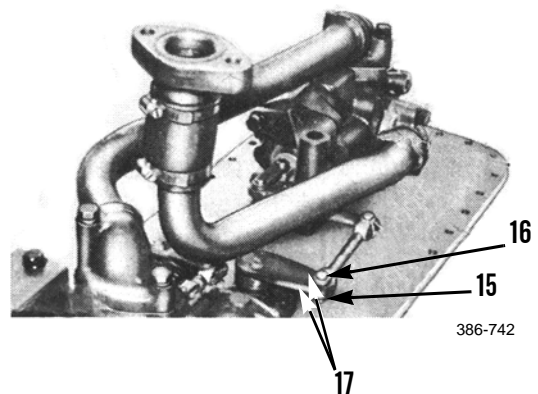
6. Loosen bolt (11) and remove main (bulldozer) control valve lever (12) and key (13) from shaft (14).



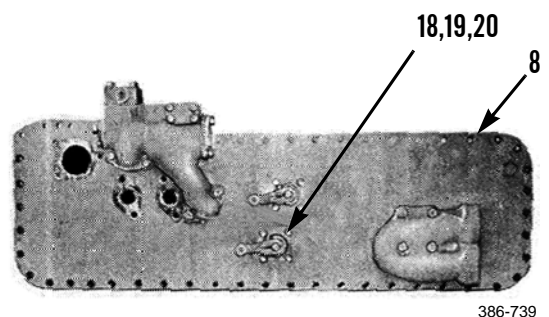
NOTE

- **Main (bulldozer) control valve and ripper control valve internal linkages are disconnected and removed in the same manner.**
- **Ripper control valve linkage is shown because it can be clearly shown in art.**

7. Remove retaining clip (15) and pin (16) from links (17).
8. Separate links (17) from top of shaft (14).



9. Remove four bolts (18) and lockwashers (19) securing lever group (20) to bottom plate (8). Remove lever group and discard lockwashers.

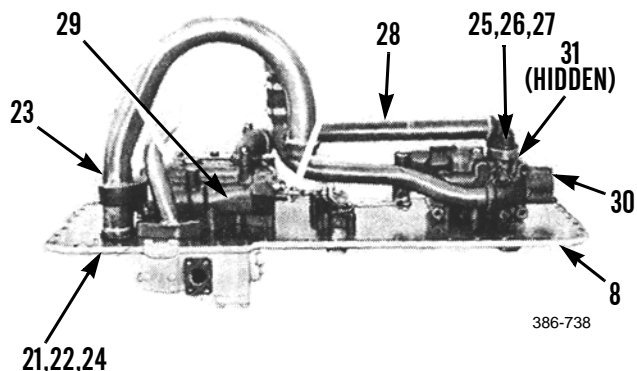


**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

0151 00

MAIN (BULLDOZER) CONTROL VALVE REMOVAL - CONTINUED

10. Remove three bolts (21), lockwashers (22), pump suction tube (23) and gasket (24) from bottom plate (8). Discard lockwashers and gasket.
11. Remove two bolts (25) and lockwashers (26) from end caps (27) of oil line (28) between main (bulldozer) control valve (29) and ripper control valve (30). Discard lockwashers.
12. Remove oil line (28) with end caps (27) and gaskets (31). Discard gaskets.



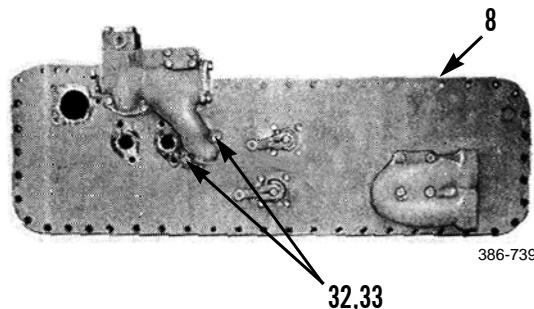
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

Main (bulldozer) control valve weighs approximately 75 lb (32 kg).

13. Remove two bolts (32), lockwashers (33) and main (bulldozer) control valve (29) from bottom plate (8). Discard lockwashers.



**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

0151 00

MAIN (BULLDOZER) CONTROL VALVE INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

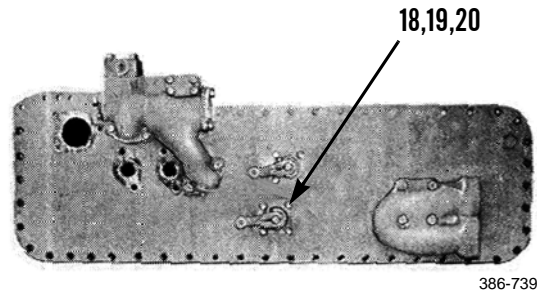
- **Tighten all mounting bolts IAW with *Torque Limits* (WP 0180 00).**
 - **Main (bulldozer) control valve weighs approximately 75 lb (32 kg).**
 - **Apply sealing compound to control valve mounting bolts before installation.**
1. Position main (bulldozer) control valve (29) on bottom plate (8).
 2. Install two new lockwashers (33) and bolts (32) to secure main (bulldozer) control valve (29) to bottom plate (8).
 3. Position new gaskets (31) and oil line (28) with end caps (27) on main (bulldozer) control valve (29) and ripper control valve (30). Secure with two new lockwashers (26) and bolts (25) in each end cap.
 4. Position new gasket (24) and pump suction tube (23) on bottom plate (8). Secure with three new lockwashers (22) and bolts (21).

**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

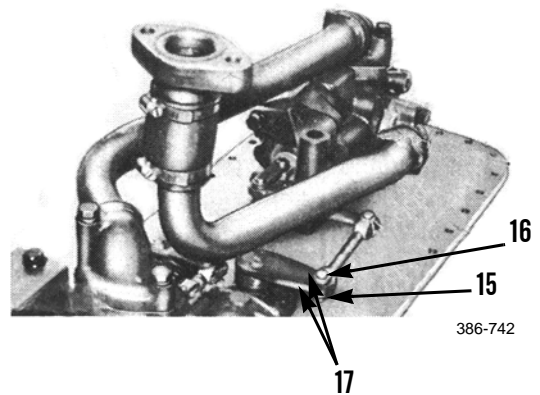
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MAIN (BULLDOZER) CONTROL VALVE INSTALLATION - CONTINUED

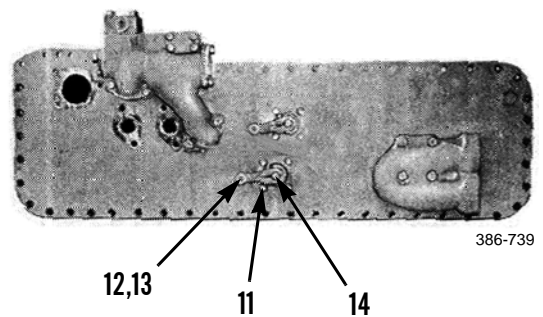
5. Position lever group (20) on bottom plate (8). Secure with four new lockwashers (19) and bolts (18).



6. Position links (17) to top of shaft (14). Install pin (16) and retaining clip (15) to links.



7. Install main (bulldozer) control valve lever (12) and key (13) on shaft (14). Tighten bolt (11).



MAIN (BULLDOZER) CONTROL VALVE INSTALLATION - CONTINUED

8. Install lifting link with 1/2-13 x 1 in. bolt to center threaded hole on top of hydraulic tank (7).

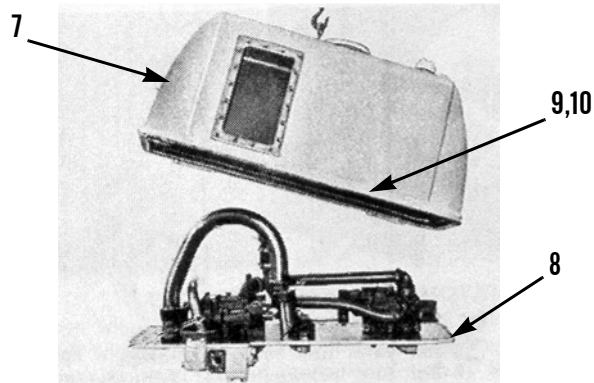
**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

Hydraulic tank weighs approximately 226 lb (103 kg).

9. Attach a nylon sling and suitable lifting device to lifting link.
10. Lift hydraulic tank (7) into position over bottom plate (8), with bolt holes aligned.
11. Install 20 new lockwashers (10) and bolts (9) to hydraulic tank (7) and bottom plate (8).



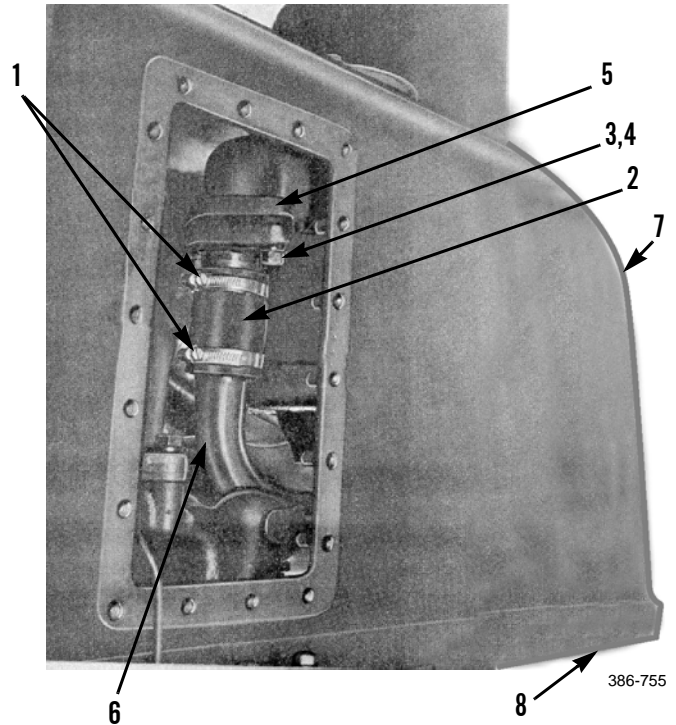
386-756

**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

0151 00

MAIN (BULLDOZER) CONTROL VALVE INSTALLATION - CONTINUED

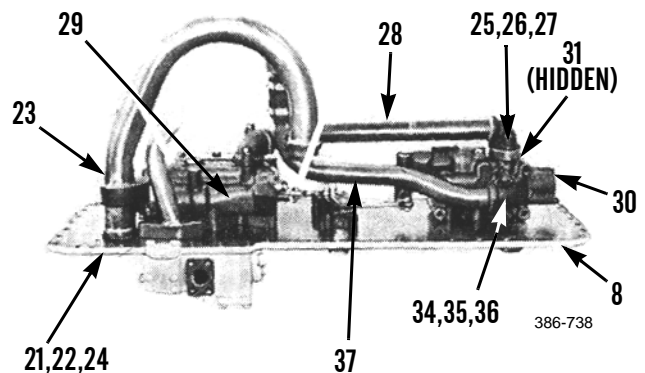
12. Position extension tube (5) at pump suction tube (6) and install two washers (4) and bolts (3).
13. Tighten two hose clamps (1) on hose (2).



14. Install hydraulic tilt control valve (WP 0150 00).
15. Install hydraulic tank (WP 0166 00).
16. Refill hydraulic tank and bleed air from system (WP 0165 00).
17. Perform hydraulic system pressure tests and adjust as needed (WP 0167 00).
18. Operate machine and check for leaks and proper operation (TM 5-2410-233-10).

RIPPER CONTROL VALVE REMOVAL

1. Perform steps 1 through 5 of *Main (Bulldozer) Control Valve Removal* to access ripper control valve (30) on bottom plate (8)
2. Remove four bolts (25) and lockwashers (26) from end caps (27) of oil line (28) between main (bulldozer) control valve (29) and ripper control valve (30). Discard lockwashers.
3. Remove oil line (28) with end caps (27) and gaskets (31). Discard gaskets.
4. Remove two bolts (34) and lockwashers (35) from end cap (36) of ripper control valve oil return line (37). Discard lockwashers.

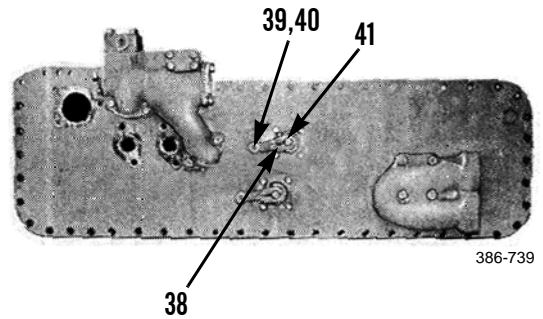


**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

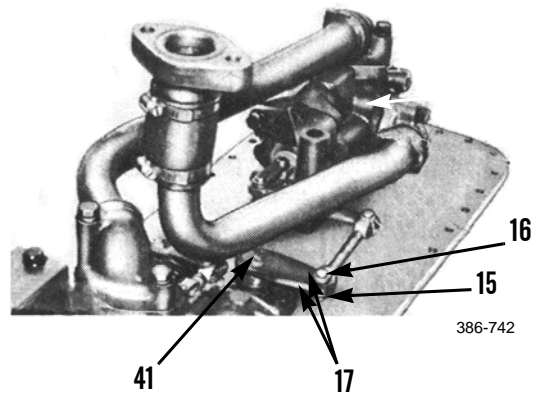
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RIPPER CONTROL VALVE REMOVAL - CONTINUED

5. Loosen bolt (38) and remove ripper control valve lever (39) and key (40) from shaft (41).



6. Remove retaining clip (15) and pin (16) from links (17).
7. Separate links (17) from top of shaft (41).



**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

0151 00

RIPPER CONTROL VALVE REMOVAL - CONTINUED

8. Remove four bolts (42) and lockwashers (43) securing lever group (44) to bottom plate (8). Discard lockwashers.

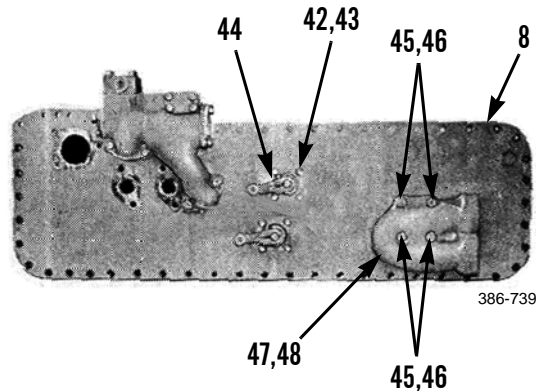
**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

NOTE

Ripper control valve weighs 50 lb (23 kg).

9. Remove four bolts (45) and lockwashers (46) that mount ripper control valve (30) and manifold (47) to bottom plate (8). With assistance, remove valve and manifold from bottom plate. Remove and discard two O-rings (48).

**RIPPER CONTROL VALVE INSTALLATION****WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury.

NOTE

Ripper control valve weighs 50 lb (23 kg).

NOTE

- Tighten all mounting bolts IAW with *Torque Limits* (WP 0180 00).
- Apply sealing compound to control valve mounting bolts before installation.
- Lightly coat new O-rings with clean oil before installation.

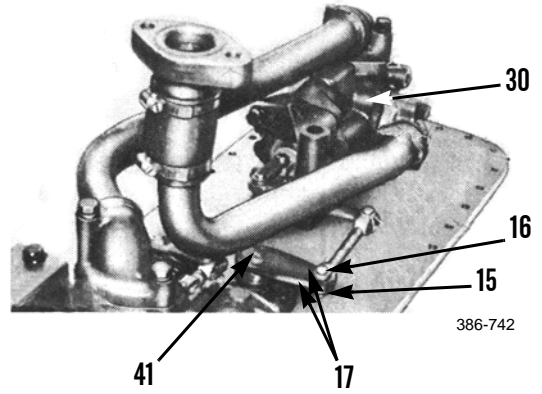
1. Position ripper control valve (30), two new O-rings (48) and manifold (47) on bottom plate (8) and secure with four new lockwashers (46) and bolts (45).
2. Position lever group (44) on bottom plate (8). Secure with four new lockwashers (43) and bolts (42).

**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

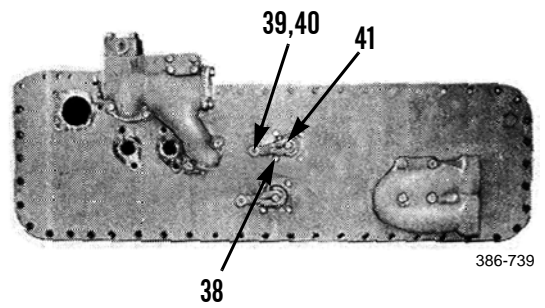
0151 00

RIPPER CONTROL VALVE INSTALLATION - CONTINUED

3. Position links (17) to top of shaft (41). Install pin (16) and retaining clip (15) to links.



4. Install ripper control valve lever (39) and key (40) on shaft (41). Tighten bolt (38).

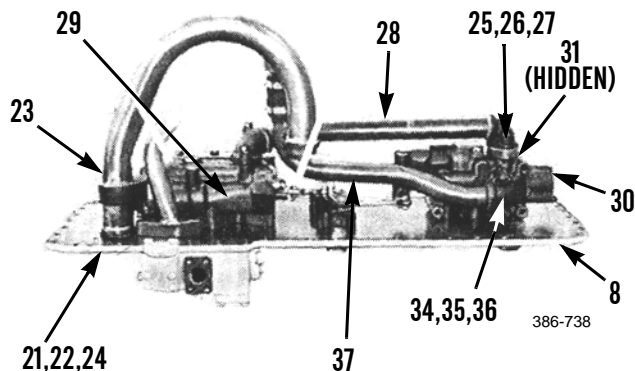


**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

0151 00

**RIPPER CONTROL VALVE INSTALLATION -
CONTINUED**

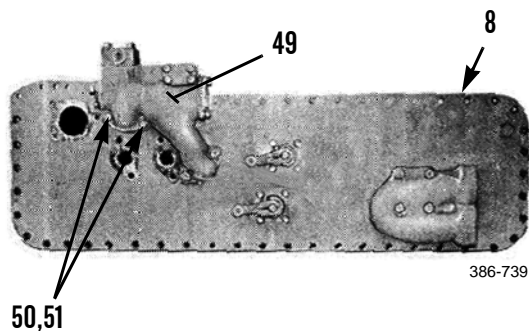
5. Install two new lockwashers (35) and bolts (34) to end cap (36) of ripper control valve oil return line (37).
6. Position two new gaskets (31) and each end cap (27) of oil line (28) between main (bulldozer) control valve (29) and ripper control valve (30). Install four new lockwashers (26) and bolts (25).



7. Perform steps 8 through 18 of *Main (Bulldozer) Control Valve Installation*.

RELIEF VALVE REMOVAL

1. Perform steps 1 through 5 of *Main (Bulldozer) Control Valve Removal* to access relief valve (49) on bottom plate (8).
2. Remove four bolts (50), lockwashers (51) and relief valve (49) from bottom plate (8). Discard lockwashers.



RELIEF VALVE INSTALLATION

NOTE

- Tighten all mounting bolts IAW with *Torque Limits (WP 0180 00)*.
- Apply sealing compound to relief valve mounting bolts before installation.

1. Position relief valve (49) on bottom plate (8) and install four new lockwashers (51) and bolts (50).
2. Perform steps 8 through 18 of *Main (Bulldozer) Control Valve Installation*.

**MAIN (BULLDOZER) CONTROL VALVE, RIPPER CONTROL VALVE
AND RELIEF VALVE REPLACEMENT - CONTINUED**

0151 00

RELIEF VALVE SETTING ADJUSTMENT**NOTE**

Adjustment can be performed without removing valve.

1. Remove floor plates (WP 0135 00).

CAUTION

To prevent contamination of hydraulic system, keep work area clean.

2. Remove two bolts (52), lockwashers (53), and cover (54) from valve body. Discard lockwashers.
3. Remove two O-rings (55) from cover (54). Discard O-rings.
4. Remove three disks (56) and shims (57) from spring (58).

NOTE

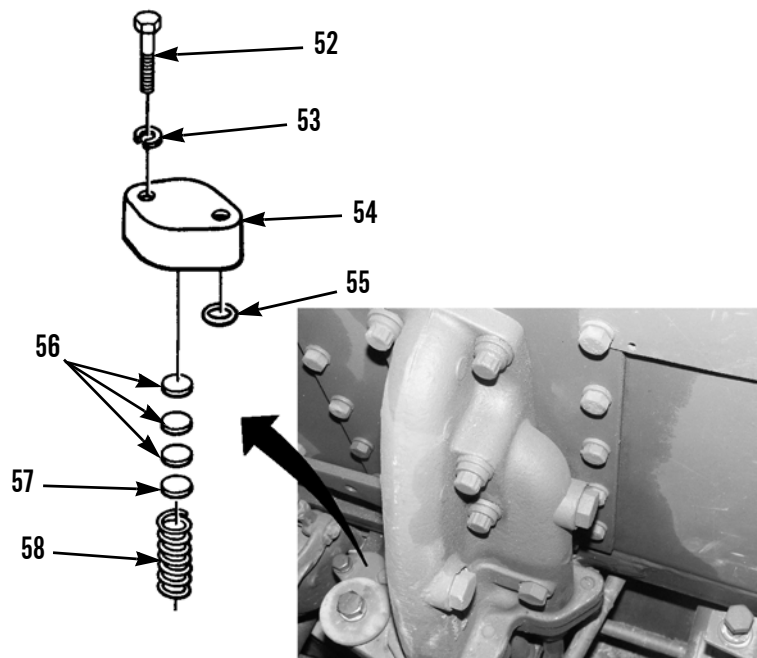
Adding one shim increases pressure by 35 psi (241.3 kPa). Removing one shim decreases pressure by the same valve.

5. Determine number of shims (57) needed to achieve proper relieve valve setting (WP 0167 00).
6. Install correct number of shims (57) and three disks (56) on spring (58).

NOTE

Lightly coat new O-rings with clean oil before installation.

7. Install two new O-rings (55) in cover (54).
8. Install cover (54) with two new lockwashers (53) and bolts (52).
9. Install floor plates (WP 0135 00).



386-824

END OF WORK PACKAGE

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BLADE CONTROL LEVER AND LINKAGES REPLACEMENT

0152 00

THIS WORK PACKAGE COVERS

Removal, Cleaning and Inspection, Installation, Adjustment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)

Rag, wiping (Item 28 WP 0184 00)

Lockwasher (2)

References

TM 5-2410-233-10

TM 5-2410-233-23P

WP 0166 00

Equipment Condition

Hydraulic system pressure relieved (WP 0176 00)

Floor plates removed (WP 0135 00)



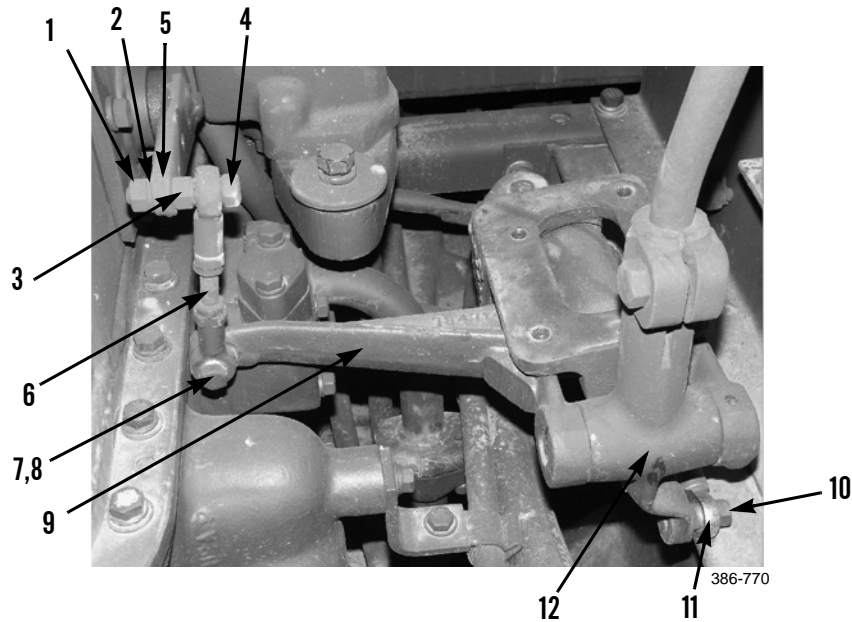
WARNING



Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.

REMOVAL

1. Remove nut (1), lockwasher (2), nut (3) and bolt (4) from tilt control lever (5) and tilt control linkage (6). Discard lockwasher.
2. Remove nut (7) and bolt (8) from tilt control linkage (6) and bell crank (9). Remove tilt control linkage.
3. Remove bolt (10) from linkage (11) and control lever (12).

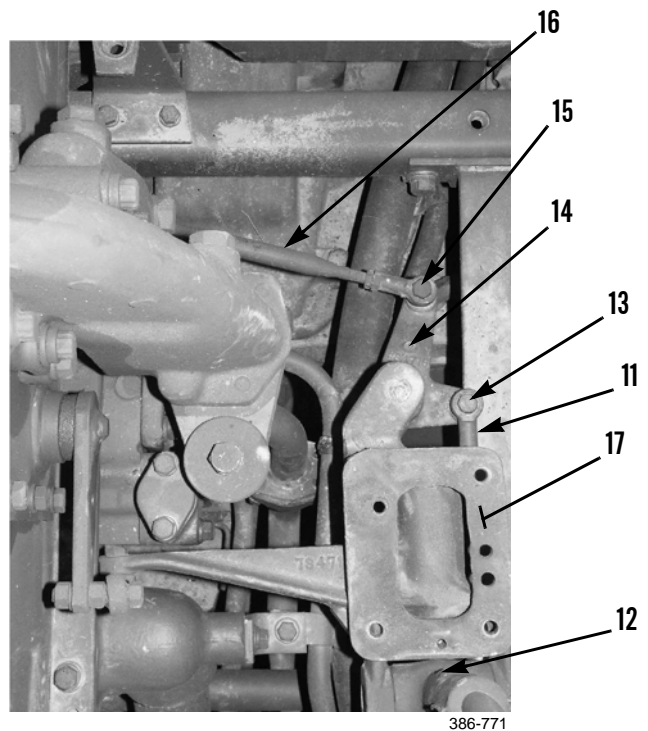


4. Remove bolt (13) from linkage (11) and bell crank (14). Remove linkage from control lever (12) and bell crank.
5. Remove bolt (15) from linkage (16) and bell crank (14). Remove linkage from bell crank.

NOTE

Linkage is connected to main (bulldozer) control valve lever under hydraulic tank.

6. If removal of linkage (16) is necessary, refer to *Hydraulic Tank Replacement (WP 0166 00)*.
7. Remove linkage bracket assembly (17) from machine.



CLEANING AND INSPECTION**WARNING**

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Clean all parts of control linkages with solvent cleaning compound and dry rags.
2. Inspect all parts and replace any damaged items. Refer to TM 5-2410-233-23P for required replacement parts.

INSTALLATION

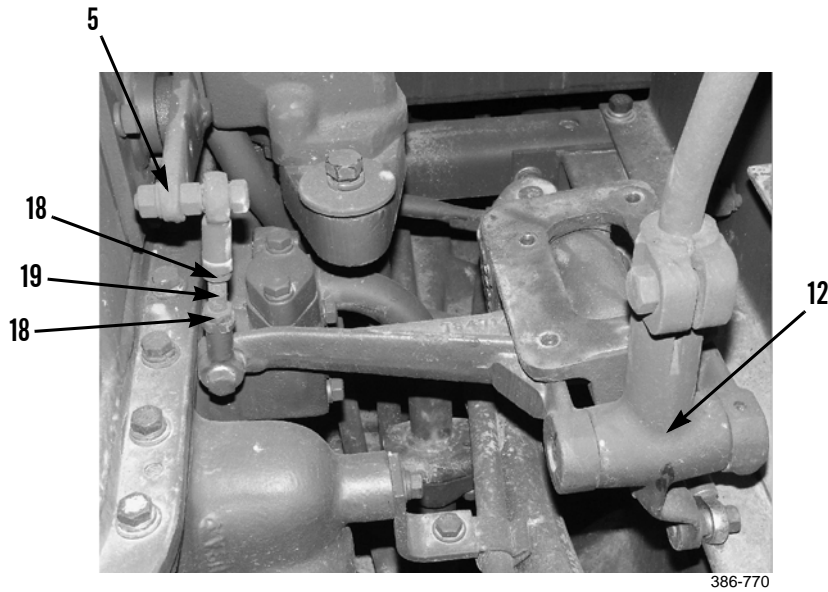
1. Position linkage bracket assembly (17) to machine.
2. If removed, connect linkage (16) to main (bulldozer) control valve lever located under hydraulic tank (WP 0166 00).
3. Position linkage (16) to bell crank (14) and install bolt (15).
4. Position linkage (11) to bell crank (14) and install bolt (13).
5. Position other end of linkage (11) to control lever (12) and install bolt (10).
6. Position tilt control linkage (6) to bell crank (9) and install bolt (8) and nut (7).
7. Position other end of tilt control linkage (6) to tilt control lever (5) and install nut (3), new lockwasher (2) and nut (1).
8. Perform *Adjustment* in this work package.
9. Install floor plates (WP 0135 00).
10. Check for proper operation of blade controls (TM 5-2410-233-10).

ADJUSTMENT**NOTE**

Adjustment of blade control lever and linkages is required when the following conditions occur:

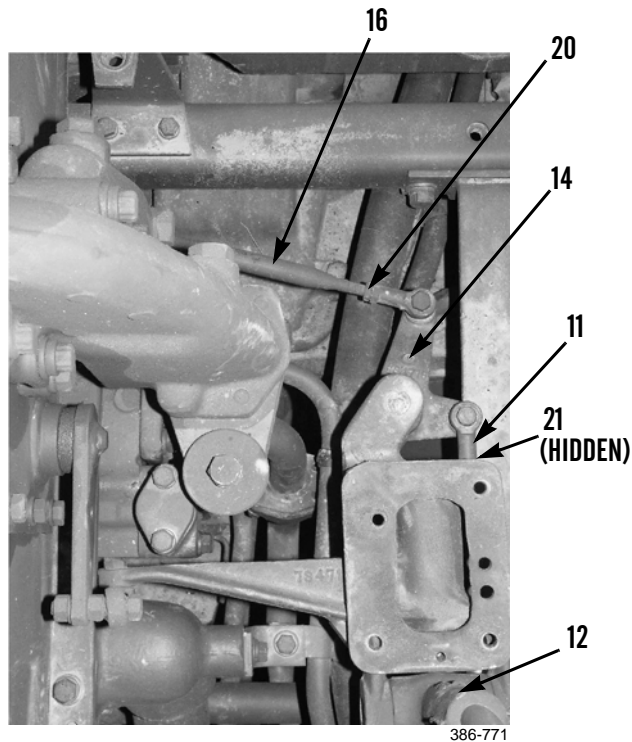
- Bulldozer blade raises, lowers or tilts without operator moving control lever.
- Bulldozer blade does not have full travel in one or all directions.
- Blade control lever and linkages have been removed, replaced or repaired.

1. Adjust tilt control linkage:
 - a. Loosen two jam nuts (18) and turn linkage rod (19) until both blade control lever (12) and tilt control lever (5) are in center of travel position.
 - b. Tighten jam nuts (18) while holding linkage rod (19).



ADJUSTMENT - CONTINUED

2. Adjust blade control linkages:
 - a. Loosen two jam nuts (20) on linkage rod (16) between bell crank (14) and main (bulldozer) control valve lever located under hydraulic tank.
 - b. Loosen two jam nuts (21) on linkage rod (11) between bell crank (14) and blade control lever (12).
 - c. Turn linkage rods (16 and 11) until blade control lever (12) and main (bulldozer) control valve lever are in center of travel position.
 - d. Tighten jam nuts (20 and 21) while holding linkage rods (16 and 11).

**END OF WORK PACKAGE**

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RIPPER CONTROL LEVER AND LINKAGE REPLACEMENT

0153 00**THIS WORK PACKAGE COVERS**

Removal, Installation, Adjustment

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)

Rag, wiping (Item 28 WP 0184 00)

References

TM 5-2410-233-10

TM 5-2410-233-23P

WP 0166 00

Equipment Condition

Hydraulic system pressure relieved (WP 0176 00)

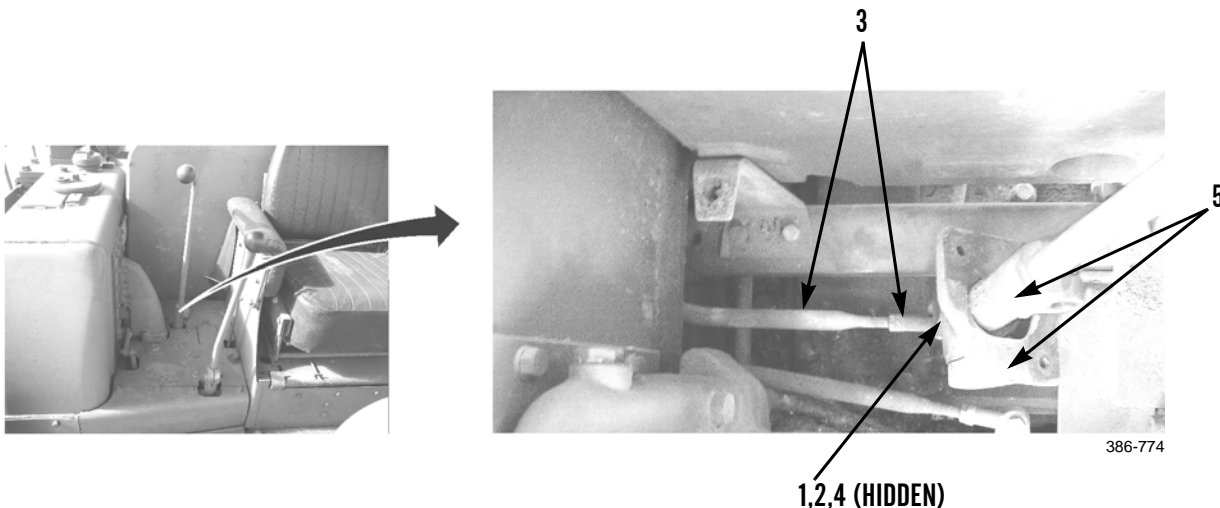
Floor plates removed (WP 0135 00)

**WARNING**

Do **NOT** remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then **SLOWLY** loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.

REMOVAL

1. Remove nut (1) and bolt (2) from ripper control lever linkage (3) and bell crank (4).
2. Remove ripper control lever assembly (5).



NOTE

Ripper control linkage is connected to ripper control valve under hydraulic tank.

3. To remove ripper control lever linkage (3) from ripper control valve lever under hydraulic tank, refer to *Hydraulic Tank Replacement* (WP 0166 00).

CLEANING AND INSPECTION



Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Clean all parts of control linkage with solvent cleaning compound and dry rags.
2. Inspect all parts and replace any damaged items. Refer to TM 5-2410-233-23P for required replacement parts.

INSTALLATION

1. If removed, install ripper control lever linkage (3) to ripper control valve lever located under hydraulic tank (WP 0166 00).
2. Position ripper control lever linkage (3) to bell crank (4) and install bolt (2) and nut (1) to ripper control lever assembly (5).

INSTALLATION - CONTINUED

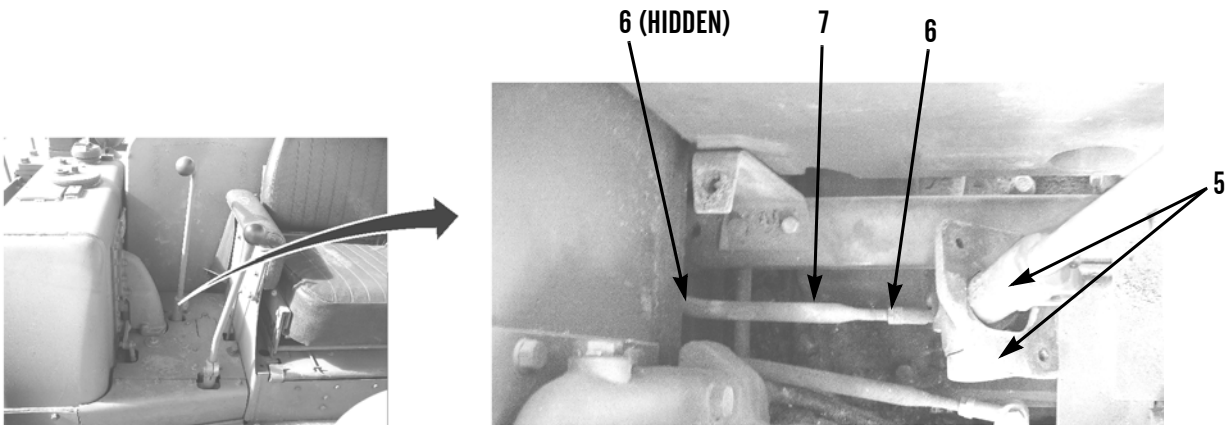
3. Perform *Adjustment* below.
4. Install floor plates (WP 0135 00).
5. Check for proper operation of ripper controls (TM 5-2410-233-10).

ADJUSTMENT**NOTE**

Adjustment of ripper control linkage is required when the following conditions occur:

- **Ripper raises or lowers without operator moving control lever.**
- **Ripper does not have full travel up or down.**
- **Ripper control lever and linkage have been removed, replaced or repaired.**

1. Adjust ripper control lever linkage by loosening jam nut (6) at each end of rod (7).
2. Turn rod (7) until ripper control lever assembly (5) is in center of travel position.
3. Tighten jam nuts (6) while holding rod (7).



386-774

END OF WORK PACKAGE

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BLADE TILT CYLINDER REPLACEMENT

0154 00

THIS WORK PACKAGE COVERS

Removal, Installation, Adjustment

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, common no. 1 (Item 94, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Lifting equipment, 1,000 lb capacity

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)
 Grease, GAA (Item 15, WP 0184 00)
 Oil, lubricating (Item 22, 23 or 24 WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

Lockwasher (2 and 11)
 O-ring (9)
 Pin, cotter (15)

References

WP 0165 00

Personnel Required

Three

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)
 Hydraulic system pressure relieved (WP 0176 00)

**WARNING**

Do NOT remove hydraulic tank filler cap, disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin causing serious injury or death.

REMOVAL**CAUTION**

Wipe area clean around all hydraulic connections to be opened during removal. Cap lines and plug openings after removing hydraulic lines. Contamination of hydraulic system could result in premature failure.

NOTE

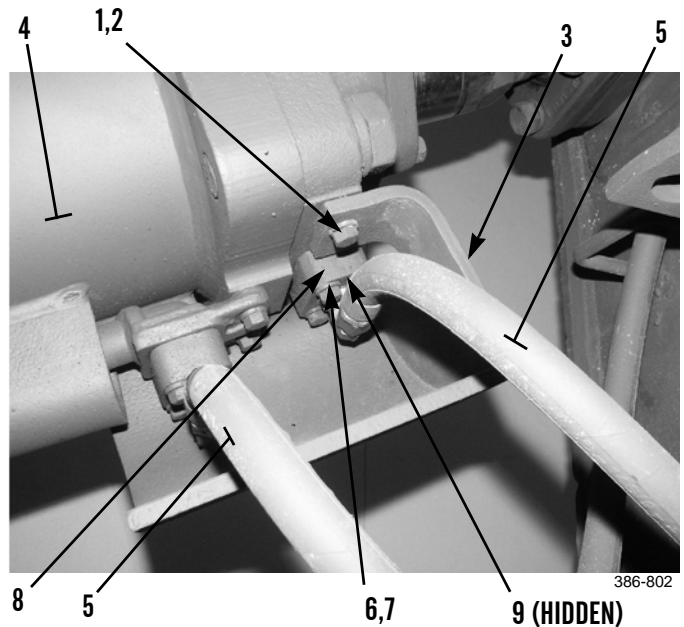
- **Tag hydraulic hoses to ensure correct installation.**
- **Use a suitable container to catch any hydraulic oil that may drain from hoses or system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.**

BLADE TILT CYLINDER REPLACEMENT - CONTINUED

0154 00

REMOVAL - CONTINUED

1. Remove four capscrews (1), lockwashers (2) and hose guard (3) from tilt cylinder (4) on left side of machine. Discard lockwashers.
2. Tag two hydraulic hoses (5).
3. Remove four capscrews (6), flatwashers (7), two flanges (8), O-ring (9) and one hydraulic hose (5). Discard O-ring.
4. Repeat step 3 for other hydraulic hose (5).

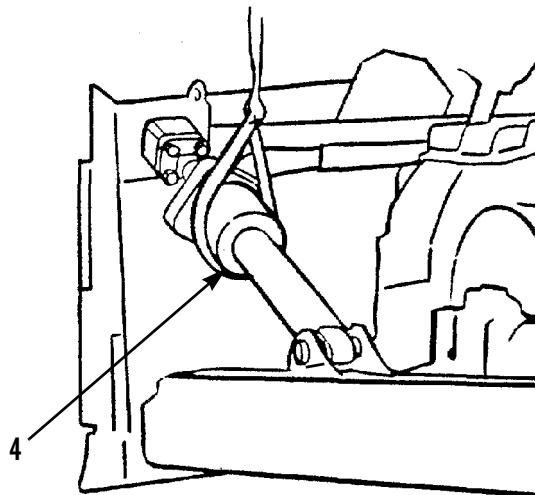
**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

Tilt cylinder weighs 418 lb (190 kg).

5. Attach a nylon sling and a suitable lifting device to center of tilt cylinder (4).



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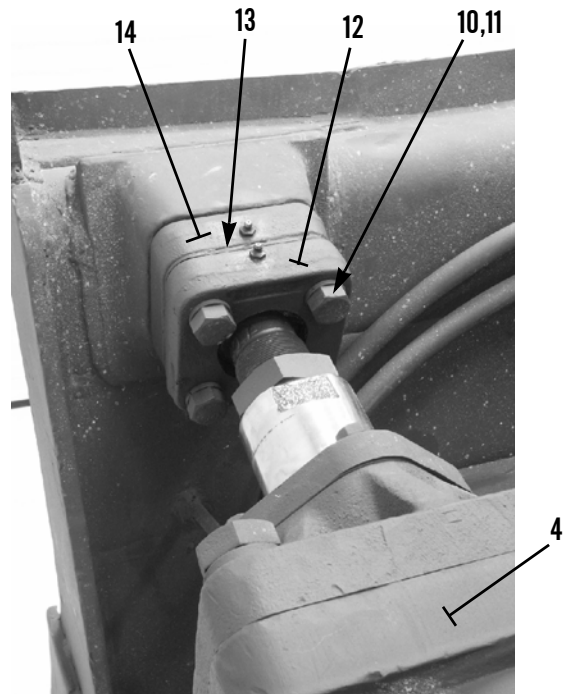
BLADE TILT CYLINDER REPLACEMENT - CONTINUED

0154 00

REMOVAL - CONTINUED**NOTE**

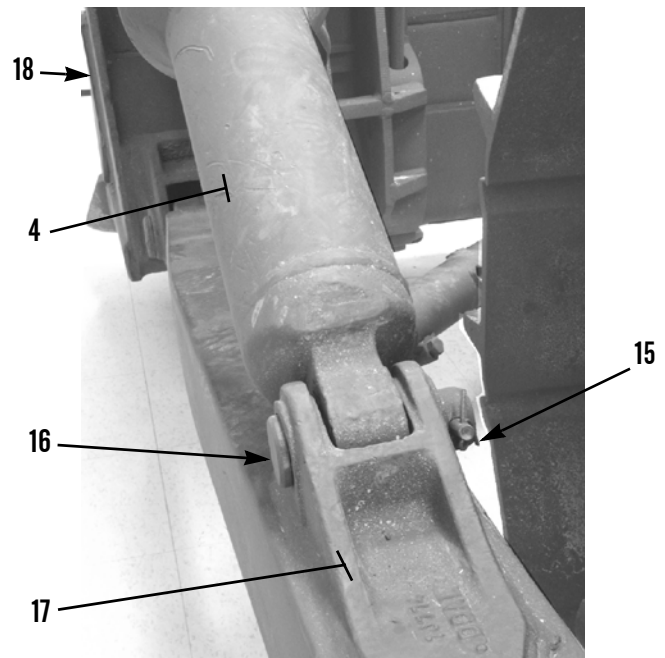
Ball joint socket (12) stays with tilt cylinder. It can only be removed by disassembling cylinder.

6. Remove four capscrews (10), lockwashers (11), ball joint socket (12), shims (13) and ball joint socket (14) at blade end of tilt cylinder (4). Discard lockwashers.



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7. Remove cotter pin (15) and pin (16) from pusharm (17). Remove tilt cylinder (4) from bulldozer blade (18) and pusharm. Discard cotter pin.



386-803

INSTALLATION



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

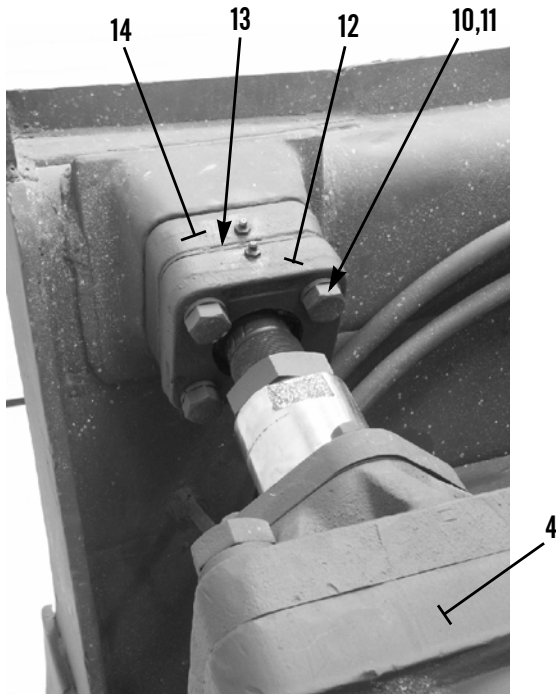
Tilt cylinder weighs 418 lb (190 kg).

1. Attach a nylon sling and a suitable lifting device to center of tilt cylinder (4).
2. Position tilt cylinder (4) to bulldozer blade (18) and pusharm (17).
3. Install tilt cylinder (4) and ball joint sockets (12 and 14) at blade end with four capcrews (10). Do NOT install lockwashers (11) or shims (13).

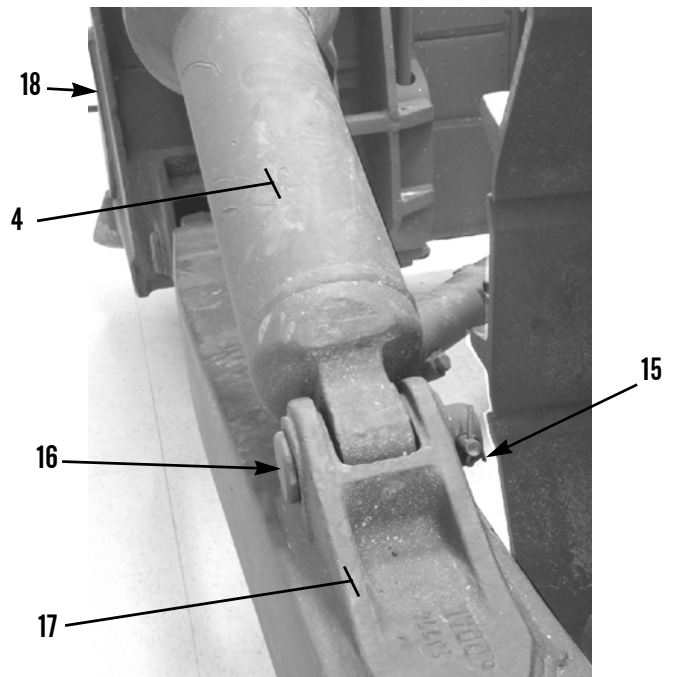
NOTE

Push or pull tilt cylinder as needed to line up cylinder with pusharm.

4. Position tilt cylinder (4) on pusharm (17) and install pin (16) and new cotter pin (15).



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INSTALLATION - CONTINUED

5. Perform *Adjustment* steps 1-3, to install shims (13) and adjust as required. After performing *Adjustment* steps 1-3, return to *Installation* step 6.

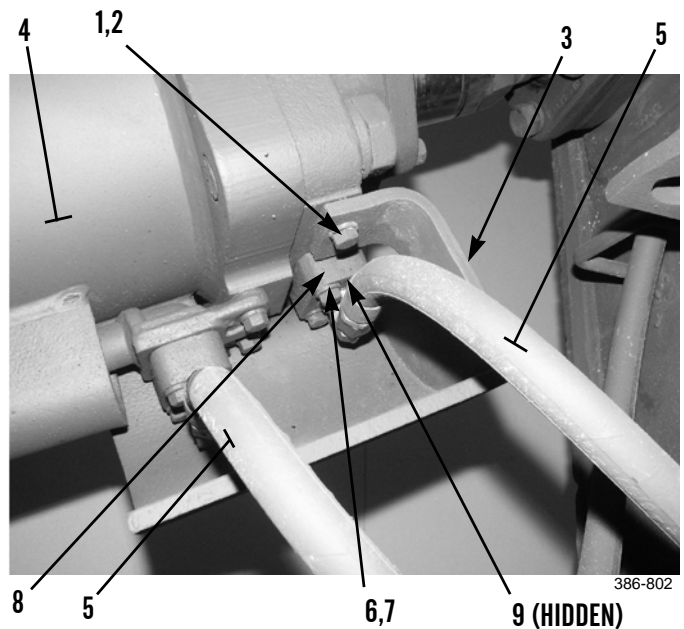
CAUTION

Wipe all sealing surfaces and hose connections clean and dry before installation. Contamination of hydraulic system could result in premature failure.

NOTE

Lightly coat new O-rings with clean oil before installation.

6. Install hydraulic hose (5) with new O-ring (9), two flanges (8), four flatwashers (7) and capscrews (6).
7. Repeat step 6 for other hydraulic hose (5).
8. Install hose guard (3) on tilt cylinder (4) with four new lockwashers (2) and capscrews (1).
9. Ensure there is enough slack in hoses to permit rod extension.
10. Check oil level in hydraulic tank. Refill hydraulic tank and bleed air from system as required (WP 0165 00).
11. Apply GAA grease to two ball joint grease fittings.
12. Start engine and check blade tilt cylinder for correct operation and leaks (TM 5-2410-233-10).



ADJUSTMENT



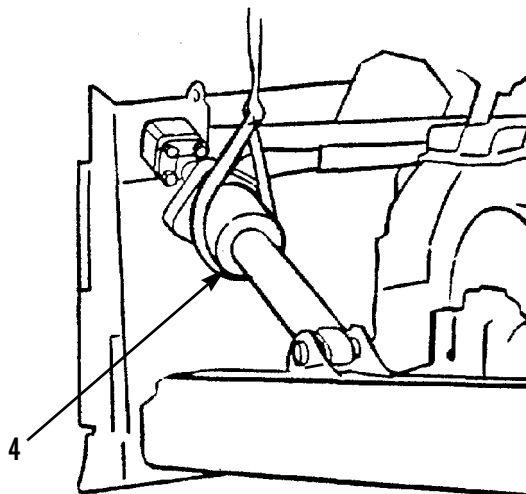
WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Tilt cylinder weighs 418 lb (190 kg).

1. Use a nylon sling and a suitable lifting device to hold tilt cylinder (4) during adjustment.

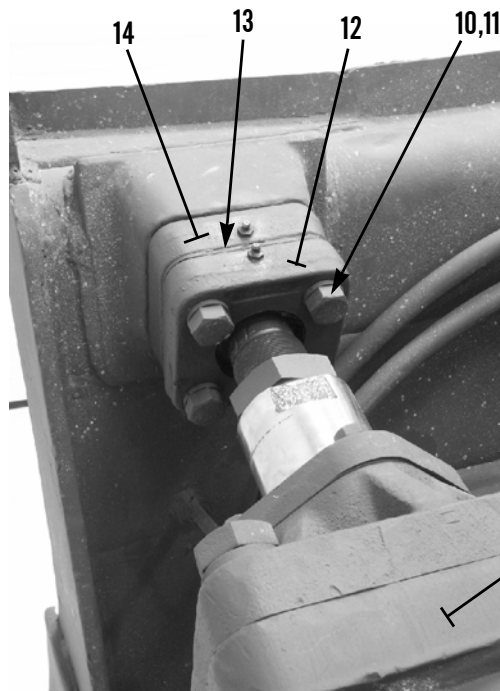


386-583

NOTE

All shims must be removed before adjustment is made. Refer to *Removal* above.

2. Measure gap between two ball joints (12 and 14) without shims (13).
3. Remove four capscrews (10). Install shims (13) equal in thickness to measured gap, plus add ONE shim. Reinstall capscrews and new lockwashers (11).
4. Check blade tilt cylinder for proper operation and leaks.



386-804

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Disassembly, Cleaning and Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Guide, seal (Item 27, WP 0185 00)
- Inserter, seal (Item 38, WP 0185 00)

Materials/Parts

- Cap set, protective (Item 2, WP 0184 00)
- Cleaning compound, solvent (Item 4, WP 0184 00)
- Cloth, abrasive, emery (Item 5, WP 0184 00)
- Oil, lubricating (Item 22, 23 or 24, WP 0184 00)

Materials/Parts - Continued

- Rag, wiping (Item 28, WP 0184 00)
- Sealant, quick-cure (Item 29, WP 0184 00)
- Lockwasher (4)
- Nut, self-locking (8)
- O-ring (11)
- Ring, backup (12)
- Ring, piston (16)
- Seal (10, 14 and 15)

Personnel Required

Two

Equipment Condition

Blade tilt cylinder removed (WP 0154 00)



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

CAUTION

Wipe area clean around all hydraulic connections to be opened during disassembly. Install protective caps and plugs as needed. Contamination of hydraulic system could result in premature failure.

NOTE

- Use a suitable container to catch any hydraulic oil that may drain from cylinder. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- Tilt cylinder weighs 418 lb (190 kg).

DISASSEMBLY**NOTE**

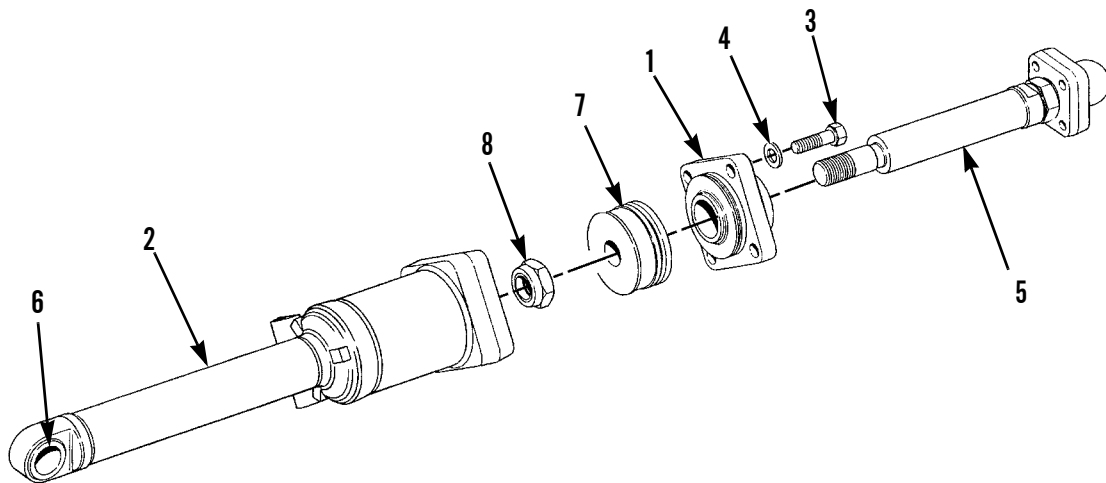
Prior to disassembly of tilt cylinder, inspect external casing for serviceability (cracks and damage). If not serviceable, replace tilt cylinder.

1. Scribe a mark on head (1) and cylinder housing (2) for correct alignment at assembly.
2. Remove four capscrews (3) and lockwashers (4) from head (1). Discard lockwashers.
3. Pull piston rod (5) and piston assembly slowly from cylinder housing (2) to allow oil to escape.
4. Inspect bearing sleeve (6) for serviceability. Replace tilt cylinder if not serviceable.

CAUTION

Protect piston rod and use care when placing into vise.

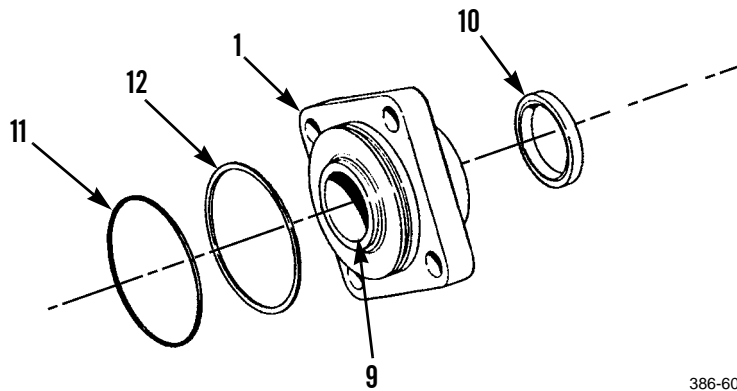
5. Place piston rod (5) in vise and remove self-locking nut (8) from piston rod. Discard self-locking nut.
6. Remove piston (7) from piston rod (5).



386-605

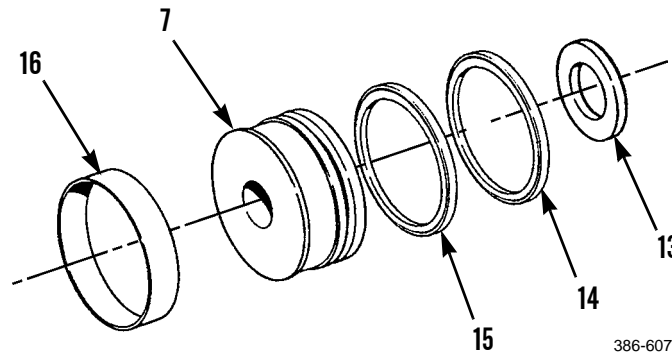
DISASSEMBLY - CONTINUED

7. Inspect bearing sleeve (9) for serviceability. If not serviceable, replace tilt cylinder.
8. Remove seal (10) from head (1). Discard seal.
9. Remove O-ring (11) and backup ring (12) from inner groove of head (1). Discard O-ring and backup ring.



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10. Remove washer (13), seals (14 and 15) and piston ring (16) from piston (7). Discard seals and piston ring.



386-607

CLEANING AND INSPECTION**WARNING**

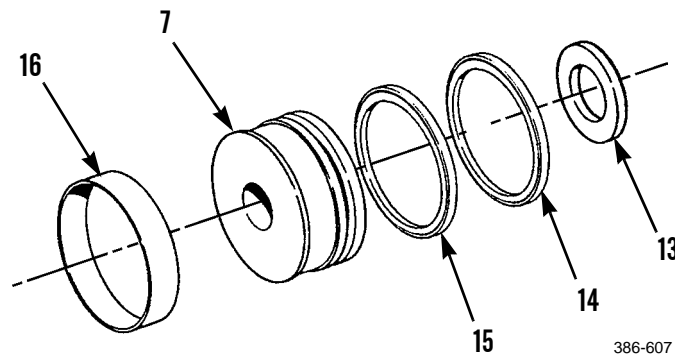
Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Clean all sealing surfaces and tube assembly connections with solvent cleaning compound and allow to dry.
2. Inspect internal casing of cylinder and internal parts of cylinder for cracks, wear, scoring or other damage. If components are not serviceable, replace tilt cylinder.
3. Ensure mating surfaces for bearing sleeves are clean and not damaged.

ASSEMBLY**NOTE**

- Lightly coat bearing sleeves, new O-rings, new backup, new piston ring and new seals with clean oil before assembly.
- Ensure new seals face toward cylinder housing when installed.

1. Install new piston ring (16), new seals (14 and 15) and washer (13) on piston (7).



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ASSEMBLY - CONTINUED

2. Install new backup ring (12) and new O-ring (11) in inner groove of head (1).
3. Use sandpaper or emery cloth to scuff surfaces of counterbore in head (1) and outside diameter of new seal (10). Clean counterbore in head and scuffed surface of seal thoroughly with quick-cure primer, until neither component discolors a clean white towel. After cleaning, do NOT touch cleaned surfaces. Handle seal by lip only.

NOTE

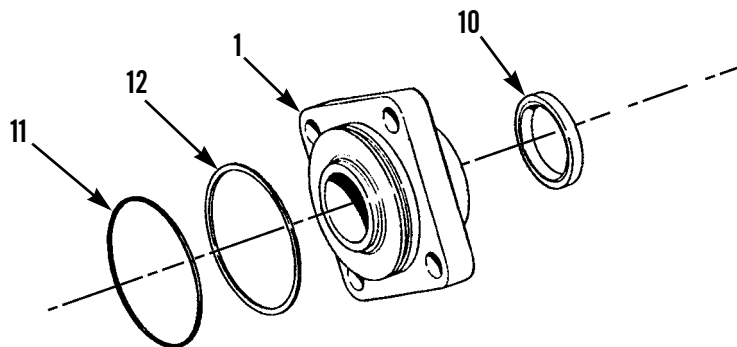
Quick-cure primer will dry in approximately 30 seconds.

4. Apply quick-cure primer to counterbore of head (1) and to metal shell of seal (10) and allow to dry.

NOTE

Do NOT allow bearing mount compound to contact sealing lip.

5. Apply bearing mount compound evenly but not excessively to counterbore of head (1) and to metal shell of seal (10).
6. Install new seal (10) into counterbore of head (1), with sealing lip facing inward. Seat seal firmly against bottom of counterbore. Wipe away excess bearing mount compound. Allow coating 15 minutes to dry.



386-606

ASSEMBLY - CONTINUED

7. Place head (1) on cylinder housing (2) and install two capscrews (3) to hold head in place.

CAUTION

Piston rod must be supported and kept level at all times to avoid damaging seals in head.

8. Place seal guide on piston end of piston rod (5). Push piston rod into head (1) as far as possible.
9. Remove two capscrews (3) and separate head (1) and piston rod (5) as a unit from cylinder housing (2).

CAUTION

Protect piston rod and use care when placing in vise.

NOTE

- **Lightly coat threads of piston rod and piston with clean oil before assembly.**
- **Ensure seal guide is installed on end of piston rod before assembly.**

10. Install piston (7) on piston rod (5).
11. Install new self-locking nut (8) on piston rod (5) and tighten to 1600 lb-ft (2169 Nm).

NOTE

To ensure proper alignment and fit, ensure scribe marks on head and cylinder housing are in alignment.

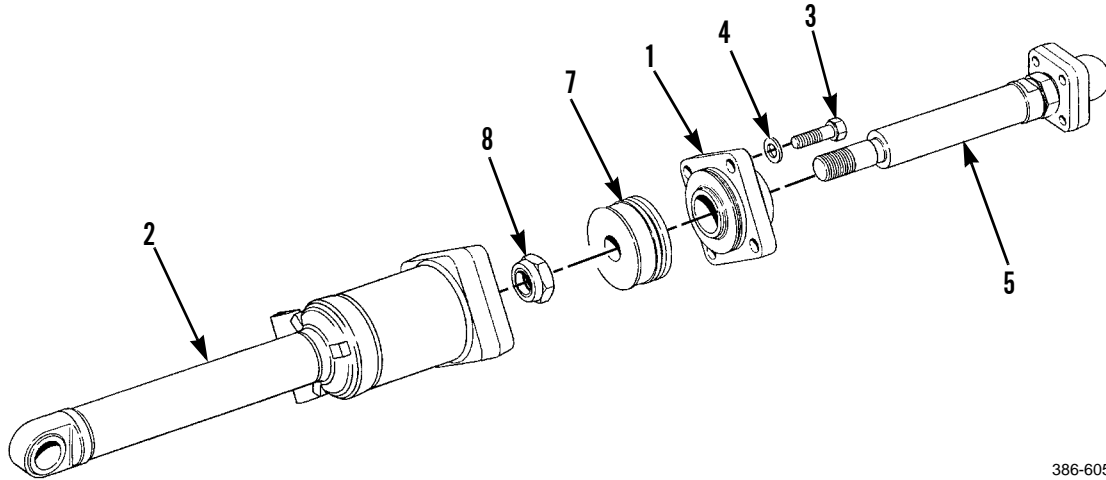
12. Install head (1) and piston rod (5) into cylinder housing (2).

NOTE

- **Tighten capscrews evenly to draw head all the way on cylinder housing.**
- **Piston rod must be fully extended when capscrews are tightened for correct alignment of cylinder housing and head.**

13. Install four new lockwashers (4) and capscrews (3) on head (1). Tighten capscrews to 265 lb-ft (359 Nm).

ASSEMBLY - CONTINUED



14. Install blade tilt cylinder (WP 0154 00).

386-605

END OF WORK PACKAGE

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BLADE TILT ADJUSTABLE BRACE REPLACEMENT

0156 00

THIS WORK PACKAGE COVERS

Removal, Cleaning, Installation and Adjustment

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, common no. 1 (Item 94, WP 0185 00)
 Sling, nylon (Item 100, WP 0185 00)
 Lifting equipment, 200 lb capacity

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)
 Grease, GAA (Item 15, WP 0184 00)

Materials/Parts - Continued

Rag, wiping (Item 28, WP 0184 00)
 Lockwasher (9)
 Pin, cotter (5)

Personnel Required

Two

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

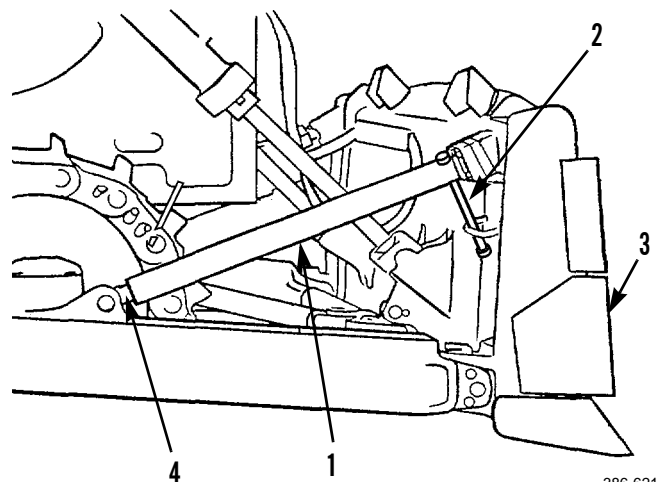
REMOVAL

1. Turn brace (1) using brace handle (2) so that brace handle is centered in loop at rear of bulldozer blade (3).

NOTE

Blade tilt adjustable brace weighs approximately 60 lb (27 kg).

2. Attach a nylon sling and suitable lifting device to rear of brace (1) near rod (4). Take up slack.



386-621

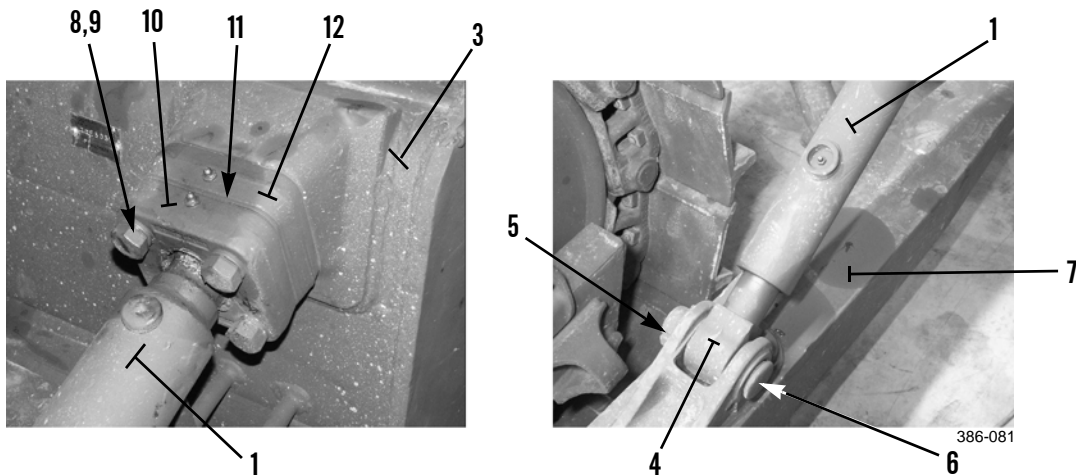
REMOVAL - CONTINUED

3. Remove cotter pin (5) and pin (6) from rod (4) and pusharm (7). Discard cotter pin.
4. Lower brace (1) and move nylon sling and lifting device to blade end of brace.
5. Remove four bolts (8), lockwashers (9), ball joint socket (10), shims (11) and ball joint socket (12) from bulldozer blade (3). Discard lockwashers.

CAUTION

Use care to avoid damage to brace handle as brace is removed from tractor.

6. Remove brace (1) from machine.
7. If ball joint socket (10) needs replacing, brace (1) must be disassembled.



CLEANING



WARNING

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

Use solvent cleaning compound to clean grease from ball joint sockets, shims and socket of bulldozer blade.

INSTALLATION AND ADJUSTMENT**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

NOTE

Blade tilt adjustable brace weighs approximately 60 lb (27 kg).

1. Use a nylon sling and a suitable lifting device to position brace (1) at pusharm (7). Secure rod (4) to pusharm with pin (6) and new cotter pin (5).
2. Lengthen brace (1) as needed and adjust sling and lifting device.
3. Install ball joint sockets (12 and 10) to bulldozer blade (3) with four bolts (8). DO NOT install lockwashers (9) or shims (11). Tighten bolts evenly.
4. Measure gap between two ball joint sockets (10 and 12) without shims (11).
5. Remove four bolts (8) and shorten brace (1). Install shims (11) equal in thickness to measure gap, plus add ONE shim.
6. Lengthen brace (1) and install four new lockwashers (9) and bolts (8).
7. Apply GAA grease to grease fittings at ball joint sockets (10 and 12) and to grease fitting at brace screw threads.
8. Check bulldozer blade for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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BLADE LIFT CYLINDER REPLACEMENT**0157 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Lifting equipment, 1,000 lb capacity

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Grease, GAA (Item 15, WP 0184 00)

Oil, lubricating (Item 22, 23 or 24, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

Lockwasher (2, 13 and 16)

O-ring (4)

References

WP 0165 00

Personnel Required

Three

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Hydraulic system pressure relieved (WP 0176 00)

**WARNING**

Do **NOT** remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then **SLOWLY** loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.

REMOVAL**CAUTION**

Wipe area clean around all hydraulic connections to be opened during removal. Cap lines and plug openings after removing hydraulic lines. Contamination of hydraulic system could result in premature failure.

REMOVAL - CONTINUED**NOTE**

- **Tag all hydraulic hoses to ensure correct installation.**
 - **Use a suitable container to capture any oil that may drain from system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.**
1. Remove four bolts (1), lockwashers (2), two split flanges (3), tube (4) and O-ring (5) from lift cylinder (6). Discard O-ring.
 2. Repeat step 1 at the other end of tube (4) and remove tube from manifold (7).
 3. Repeat steps 1 and 2 to remove tube (8).

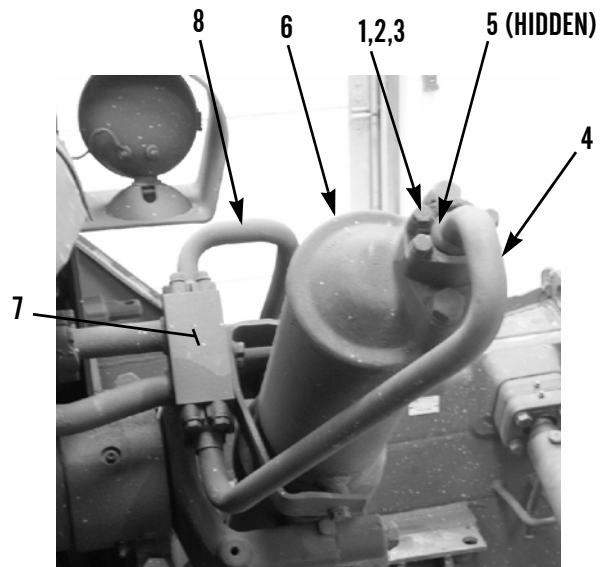
**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Lift cylinder weighs 242 lb (110 kg).

4. Attach a nylon sling and a suitable lifting device to upper part of lift cylinder (6).



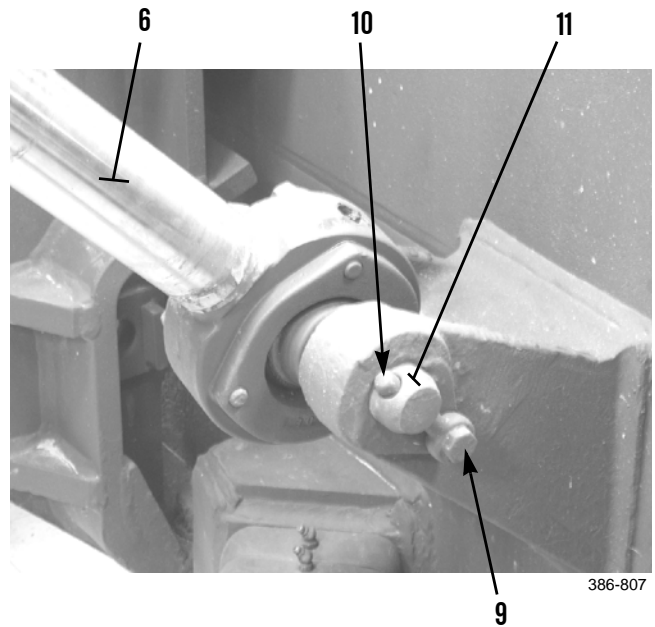
386-805

BLADE LIFT CYLINDER REPLACEMENT - CONTINUED

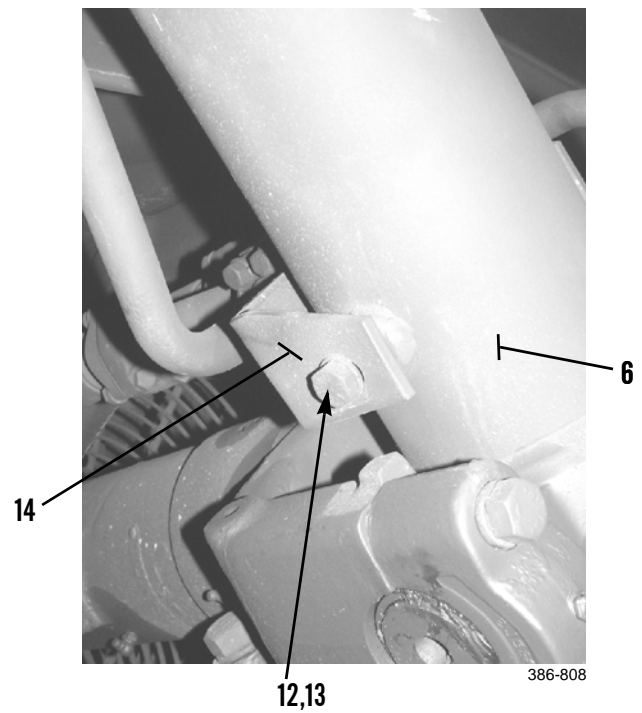
0157 00

REMOVAL - CONTINUED

5. Remove capscrew (9), retainer (10) and pin (11) from rod end of lift cylinder (6). Retract lift cylinder.

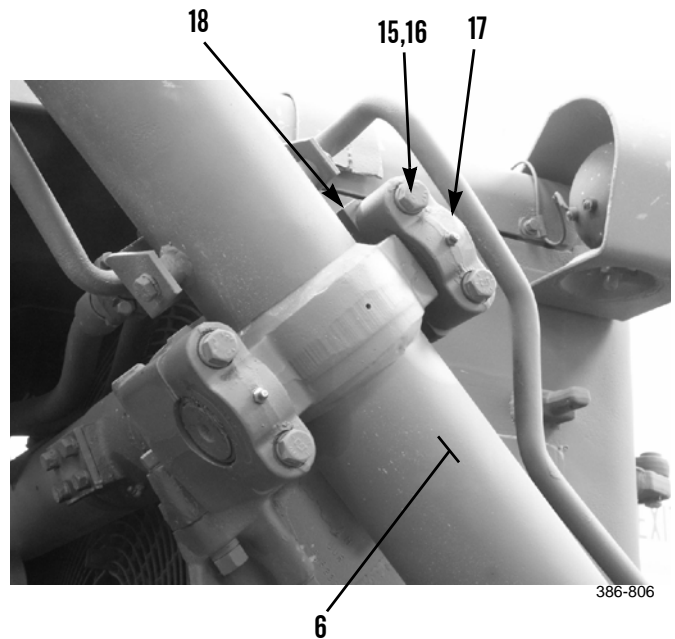


6. Remove two bolts (12) and lockwashers (13) to separate lift cylinder (6) from bracket (14). Discard lockwashers.



REMOVAL - CONTINUED

7. Remove four bolts (15), lockwashers (16), two end caps (17) and lift cylinder (6) from mounting tube yoke (18). Discard lockwashers.
8. Inspect two bearings from pivots on lift cylinder (6).

**INSTALLATION****NOTE**

- Before installation of bearings, lubricate bearing with clean GAA grease.
- Ensure mating surfaces for bearings are clean and not damaged.

1. If removed, install two bearings on pivots of lift cylinder (6).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

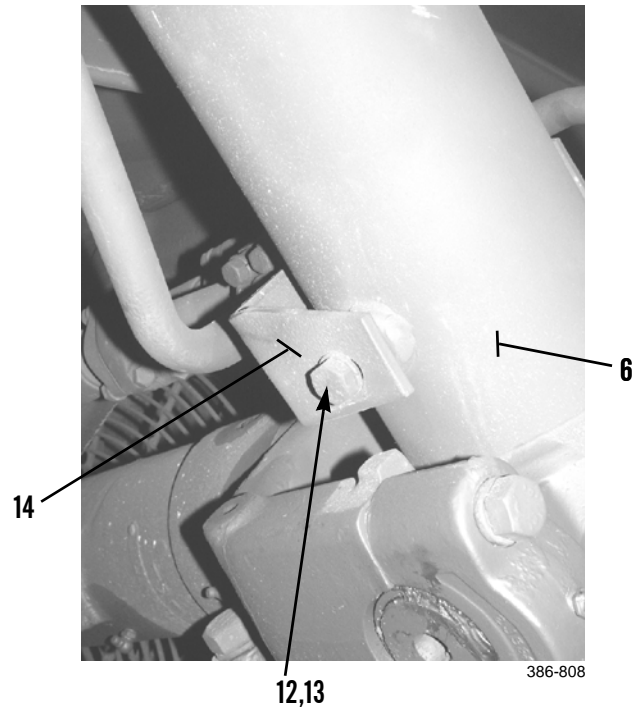
NOTE

Lift cylinder weighs 242 lb (110 kg).

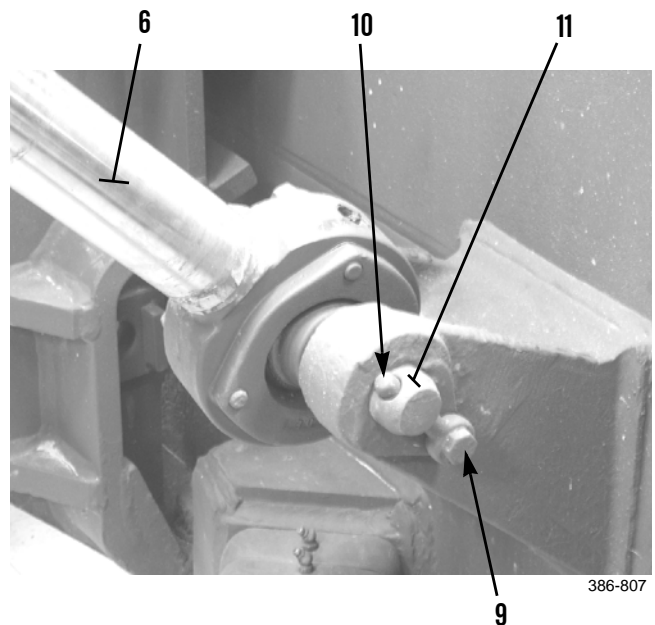
2. Attach a nylon sling and a suitable lifting device to upper part of lift cylinder (6) and position lift cylinder pivots at mounting yoke (18).
3. Install two end caps (17) to lift cylinder mounting tube yoke (18) with four new lockwashers (15) and bolts (16).

INSTALLATION - CONTINUED

- Secure lift cylinder (6) to bracket (14) with two new lockwashers (13) and bolts (12).



- Extend lift cylinder (6) until contact is made with blade mounting bracket. Install pin (11), retainer (10) and capscrew (9).
- Remove lifting device and nylon sling from lift cylinder. (6).



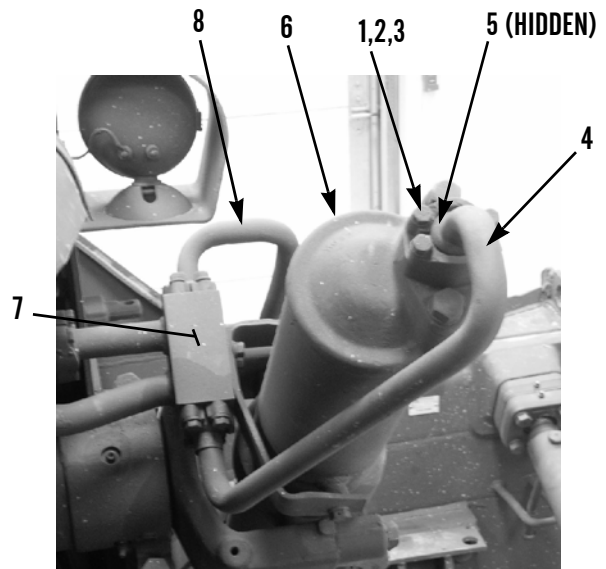
INSTALLATION - CONTINUED**CAUTION**

Wipe all sealing surfaces and hose connections clean and dry before installation. Contamination of hydraulic system could result in premature failure.

NOTE

Lightly coat new O-rings with clean oil before installation.

7. Install new O-ring (5) and tube (4) to lift cylinder (6) with two split flanges (3), four new lockwashers (2) and bolts (1).
8. Repeat step 7 to install other end of tube (4) to manifold (7).
9. Repeat steps 7 and 8 to install tube (8).



386-805

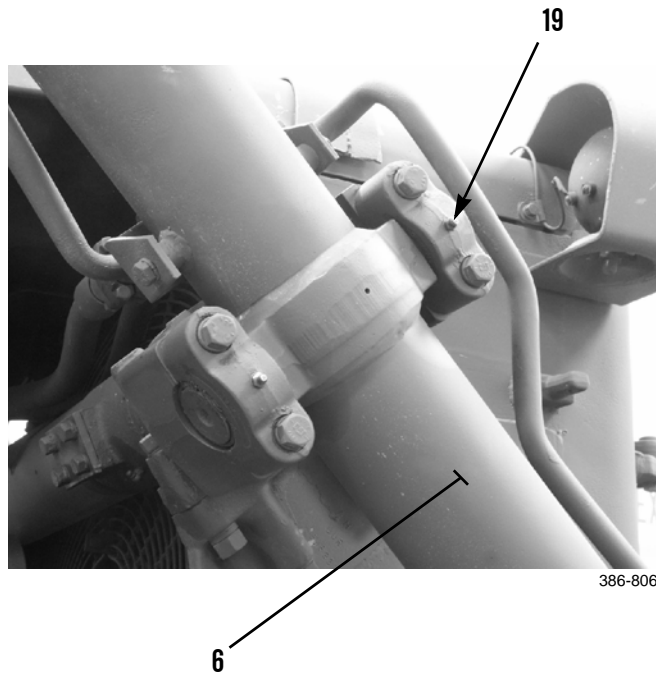
386-805

BLADE LIFT CYLINDER REPLACEMENT - CONTINUED

0157 00

INSTALLATION - CONTINUED

10. Refill hydraulic tank and bleed air from system if necessary (WP 0165 00).
11. Apply GAA grease to two grease fittings on cap (14) and to grease fitting at rod end of lift cylinder (6).



12. Start engine, operate lift cylinders and check for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Disassembly, Cleaning and Inspection, Assembly

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Guide, seal (Item 28, WP 0185 00)
- Insertor, seal (Item 37, WP 0185 00)

Materials/Parts

- Cap set, protective (Item 2, WP 0184 00)
- Cleaning compound, solvent (Item 4, WP 0184 00)
- Cloth, abrasive, emery (Item 5, WP 0184 00)
- Oil, lubricating (Item 22, 23, or 24 WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

- Sealant, quick-cure (Item 29, WP 0184 00)
- Lockwasher (4)
- Nut, self-locking (7)
- O-ring (12)
- Packing (10)
- Packing, preformed (11 and 14)
- Retainer, packing (13)
- Spacer, ring (15)

Personnel Required

Two

Equipment Condition

Blade lift cylinder removed (WP 0157 00)



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

CAUTION

Wipe area clean around all hydraulic connections to be opened during disassembly. Install protective caps and plugs as needed. Contamination of hydraulic system could result in premature failure.

NOTE

- Use a suitable container to catch any hydraulic oil that may drain from cylinder. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- Lift cylinder weighs 242 lb. (110 kg.)

DISASSEMBLY**NOTE**

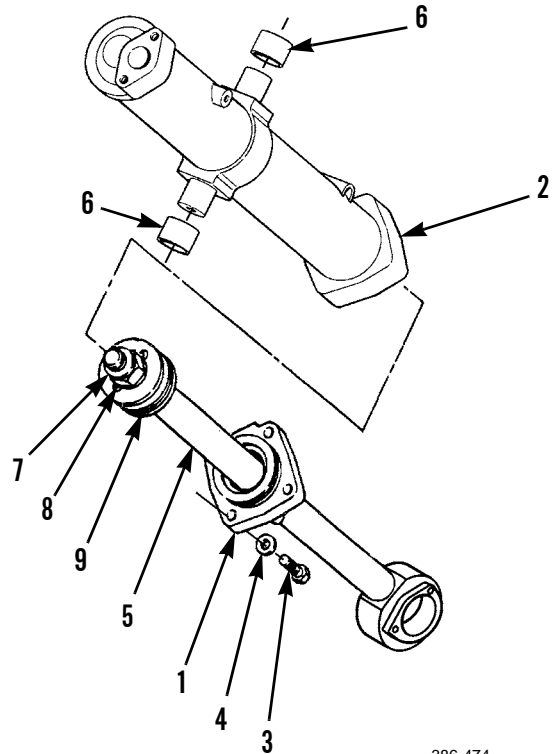
Prior to disassembly of lift cylinder, inspect external casing of lift cylinder for serviceability (cracks and other damage). If not serviceable, replace lift cylinder assembly.

1. Scribe a mark on head (1) and cylinder housing (2) for correct alignment at assembly.
2. Remove four bolts (3) and lockwashers (4) from head (1). Discard lockwashers.
3. Pull piston rod (5) with piston assembly slowly from cylinder housing (2) to allow oil to escape.
4. Inspect two bearing sleeves (6) for serviceability. Replace bearing sleeves if not serviceable.

CAUTION

Protect piston rod and use care when placing into vise.

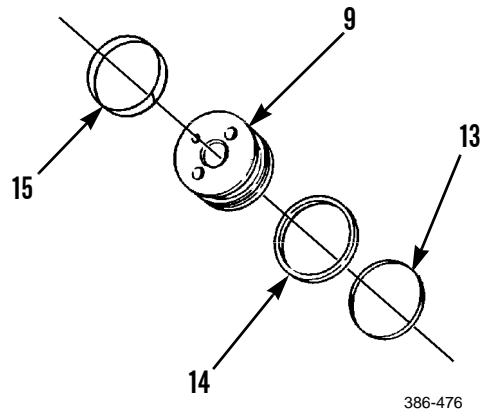
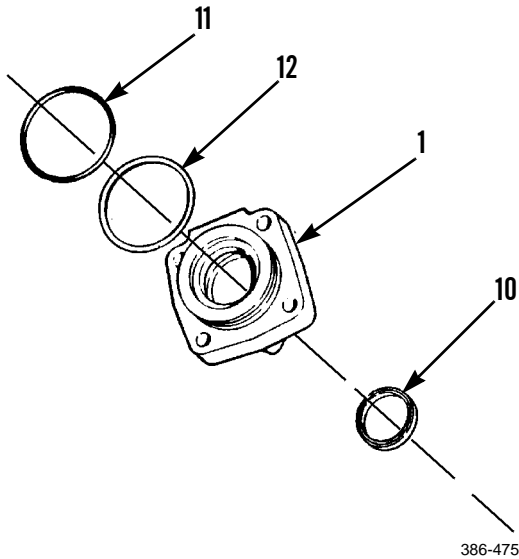
5. Place piston rod (5) into vise and remove self-locking nut (7) and washer (8) from piston rod. Discard self-locking nut.
6. Remove piston (9) from piston rod (5).



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DISASSEMBLY - CONTINUED

7. Remove packing (10) from head (1). Discard packing.
8. Remove preformed packing (11) and O-ring (12) from inner groove on head (1). Discard preformed packing and O-ring.
9. Remove packing retainer (13), preformed packing (14) and ring spacer (15) from piston (9). Discard packing retainer, preformed packing and ring spacer.



CLEANING AND INSPECTION



WARNING



Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

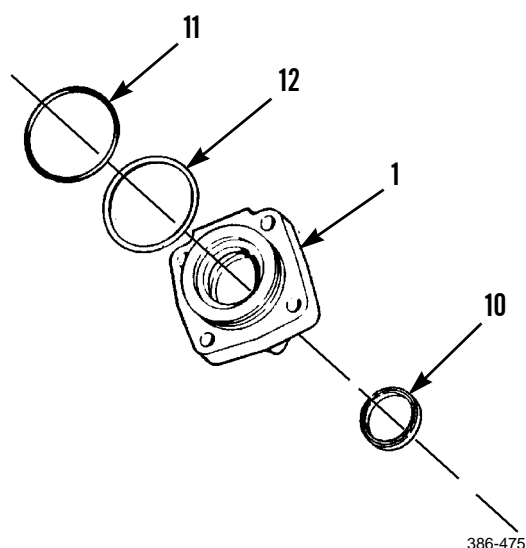
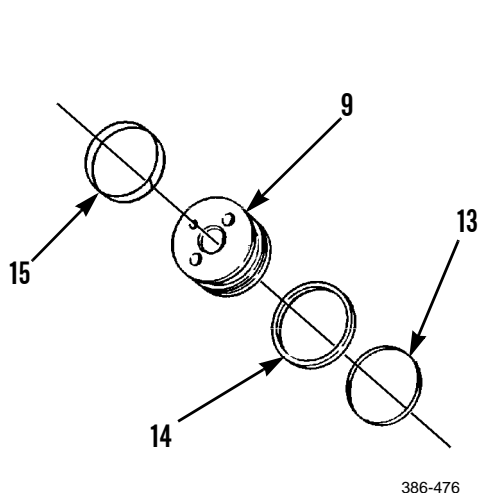
1. Clean all sealing surfaces and tube assembly connections with solvent cleaning compound and allow to dry.
2. Inspect internal casing of cylinder and internal parts of cylinder for cracks, wear, scoring and damage. If components and parts are not serviceable, replace lift cylinder.
3. Ensure mating surfaces for bearing sleeves are clean and not damaged.

ASSEMBLY

NOTE

- Lightly coat bearing sleeves, new O-rings, new packing, new preformed packings, new ring spacer and new packing retainer with clean oil before assembly.
- Ensure preformed packing and packing retainer face toward cylinder housing when installed.

1. Install new ring spacer (15), new preformed packing (14) and new packing retainer (13) on piston (9).
2. Install new O-ring (12) and new preformed packing (11) in inner groove of head (1).



3. Use sandpaper or emery cloth to scuff surfaces of counterbore in head (1) and outside diameter of new packing (10). Clean counterbore in head and scuffed surface of packing thoroughly with quick-cure primer, until neither component discolors a clean white towel. After cleaning, do NOT touch cleaned surfaces. Handle packing by lip only.

NOTE

Quick-cure primer will dry in approximately 30 seconds.

4. Apply quick-cure primer to counterbore of head (1) and to metal shell of packing (10) and allow to dry.

NOTE

Do NOT allow bearing mount compound to contact sealing lip.

5. Apply bearing mount compound evenly but not excessively to counterbore of head (1) and to metal shell of packing (10).
6. Install packing into counterbore of head (1), with sealing lip facing inward. Seat packing firmly against bottom of counterbore. Wipe away excess bearing mount compound. Allow compound 15 minutes to dry.
7. Place head (1) on cylinder housing (2) and install two bolts (3) to hold head in place.

ASSEMBLY - CONTINUED**CAUTION**

Piston rod must be supported and kept level at all times to avoid damaging seals in head.

8. Place seal guide on piston end of piston rod (5). Push piston rod into head (1) as far as possible.
9. Remove two bolts (3) and separate head (1) and piston rod (5) as a unit from cylinder housing (2).

CAUTION

Protect piston rod and use care when placing in vise.

NOTE

- **Apply clean lubricating oil on threads on piston rod and piston before assembly.**
- **Ensure seal guide is installed on end of piston rod before assembly.**

10. Install piston (9) on piston rod (5).
11. Install washer (8) and new self-locking nut (7) on piston rod (5) and tighten to 1180 lb-ft (1600 Nm).

NOTE

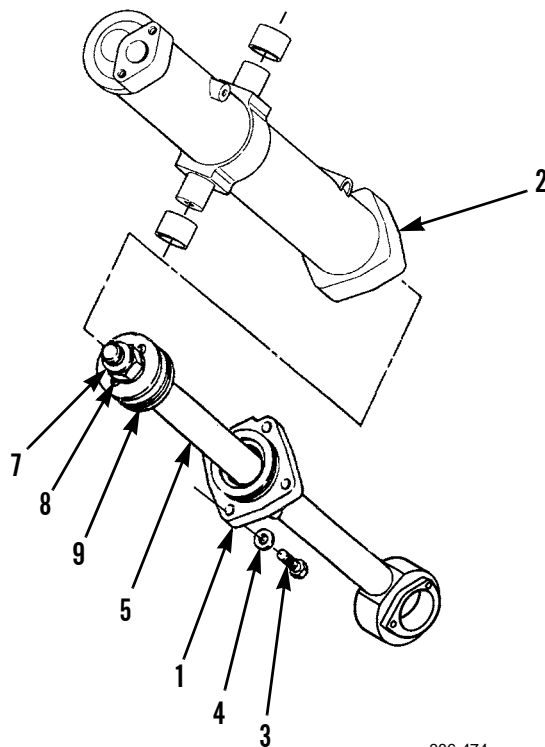
To ensure proper alignment and fit, ensure scribe marks on head and cylinder housing are in alignment.

12. Install head (1) and piston rod (5) into cylinder housing (2).

NOTE

- **Tighten bolts evenly to draw head all the way on cylinder housing.**
- **Piston rod must be fully extended when bolts are tightened for correct alignment of cylinder housing and head.**

13. Install four new lockwashers (4) and bolts (3) on head (1) and tighten to 465 lb-ft (631 Nm).



ASSEMBLY - CONTINUED

14. Install blade lift cylinder (WP 0157 00).
15. Operate machine and check blade for proper operation and lift cylinder for leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

BLADE LIFT CYLINDER MOUNTING TUBE REPLACEMENT

0159 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Lifting equipment, 1,000 lb capacity

Materials/Parts

- Grease, GAA (Item 15, WP 0184 00)

References

WP 0160 00

Personnel Required

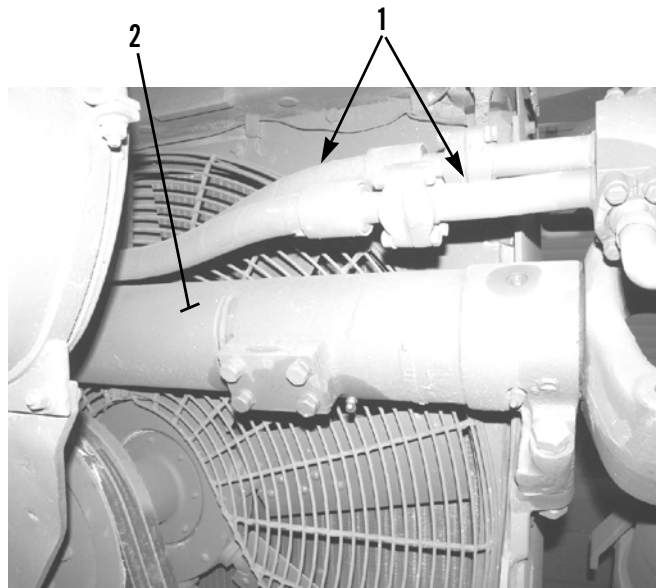
Two

Equipment Condition

- Blade lift cylinders removed (WP 0158 00)
- Hood removed (WP 0136 00)

REMOVAL

1. Remove hydraulic lines (1) and fittings that are routed above tube (2) (WP 0160 00).



386-809

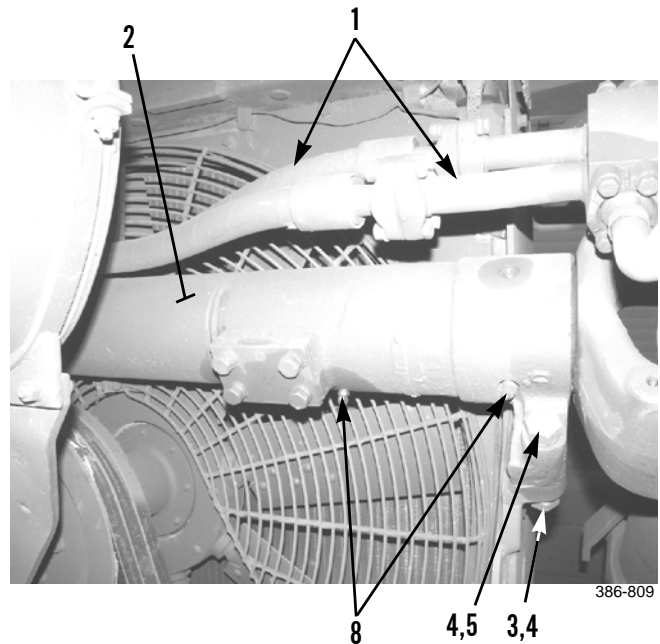
REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

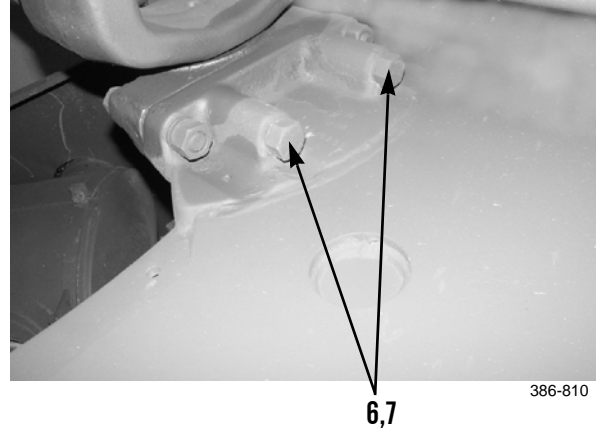
Blade lift cylinder mounting tube weighs approximately 426 lb (193 kg).

2. Attach a nylon sling and a suitable lifting device to tube (2). Take up all slack in sling.
3. Remove two nuts (3), four washers (4) and two bolts (5) from each end of tube (2).



REMOVAL - CONTINUED

4. Remove two bolts (6) and washers (7) from underside of tube mounting at each end.

**CAUTION**

Use caution not to damage fan guard and radiator as tube is lifted clear of frame.

5. Remove tube (2) from frame.
6. If damaged, remove two grease fitting (8) from each end of tube (2).

INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

Blade lift cylinder mounting tube weighs approximately 426 lb (193 kg).

1. Attach a nylon sling and a suitable lifting device to tube (2).

CAUTION

Use caution not to damage fan guard and radiator as tube is positioned at frame.

2. Lift tube (2) into position on frame.
3. Install two washers (7) and bolts (6) to underside of tube mounting at each end.
4. Install two bolts (5), four washers (4) and two nuts (3) to each end of tube (2).
5. If removed, install two grease fittings (8) to each end of tube (2).
6. Apply GAA grease, as needed, to grease fittings (8) on tube (2).
7. Install hydraulic lines (1) and fittings that are routed above tube (2).
8. Install hood (WP 0136 00).
9. Install blade lift cylinders (WP 0158 00).

END OF WORK PACKAGE

HYDRAULIC SYSTEM LINES AND FITTINGS REPLACEMENT

0160 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP
Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23 or 24, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Materials/Parts

Lockwasher (as required)

O-ring (as required)

References

TM 5-2410-233-10

WP 0165 00

Equipment Condition

Hydraulic system pressure relieved (WP 0176 00)

**WARNING**

- **Do NOT** remove or disconnect any hydraulic tube, hose or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then **SLOWLY** loosen hydraulic tank filler cap. After replacement, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, resulting in injury or death to personnel.
- **At operating temperature** hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulics. Failure to do so could result in injury to personnel.
- **Eye protection** must be worn when replacing tubes, hoses and fittings. Failure to take precautions could result in injury to personnel.

NOTE

This work package provides general instructions for replacement of hydraulic tubes, hoses and fittings. The examples provided are only typical. However, the replacement of a specific tube, hose or fitting should vary only slightly.

REMOVAL**CAUTION**

Keep work area clean. Wipe area clean around all hydraulic fittings and couplings. Cap or plug openings to prevent contamination of hydraulic system, which could result in premature failure.

NOTE

- Tag all hydraulic tubes and hoses to ensure correct installation.
- Use a suitable container to capture any oil leakage. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- Mounting hardware (nuts, bolts, washers, lockwashers and spacers) will vary depending on type and location of clamp, clip or retaining strap.

1. Tube Assembly with Split-Flanged Mounting.

- Remove clamps (1), clips (2) and/or retaining straps (3) along entire length of tube assembly (4) as follows:
 - Clamp. Remove nut (5), lockwasher (6), bolt (7), washer (8) and clamp (1). Discard lockwasher.
 - Clip. Remove nut (9), lockwasher (10), bolt (11) and clip (2). Discard lockwasher.
 - Retaining strap. Remove bolt (12), lockwasher (13), spacer (14) and retaining strap (3). Discard lockwasher.
- Remove four capscrews (15), lockwashers (16), two flanges (17), tube assembly (4) and O-ring (18). Discard lockwashers and O-ring.
- Repeat step b for other end of tube assembly (4) and remove tube assembly.

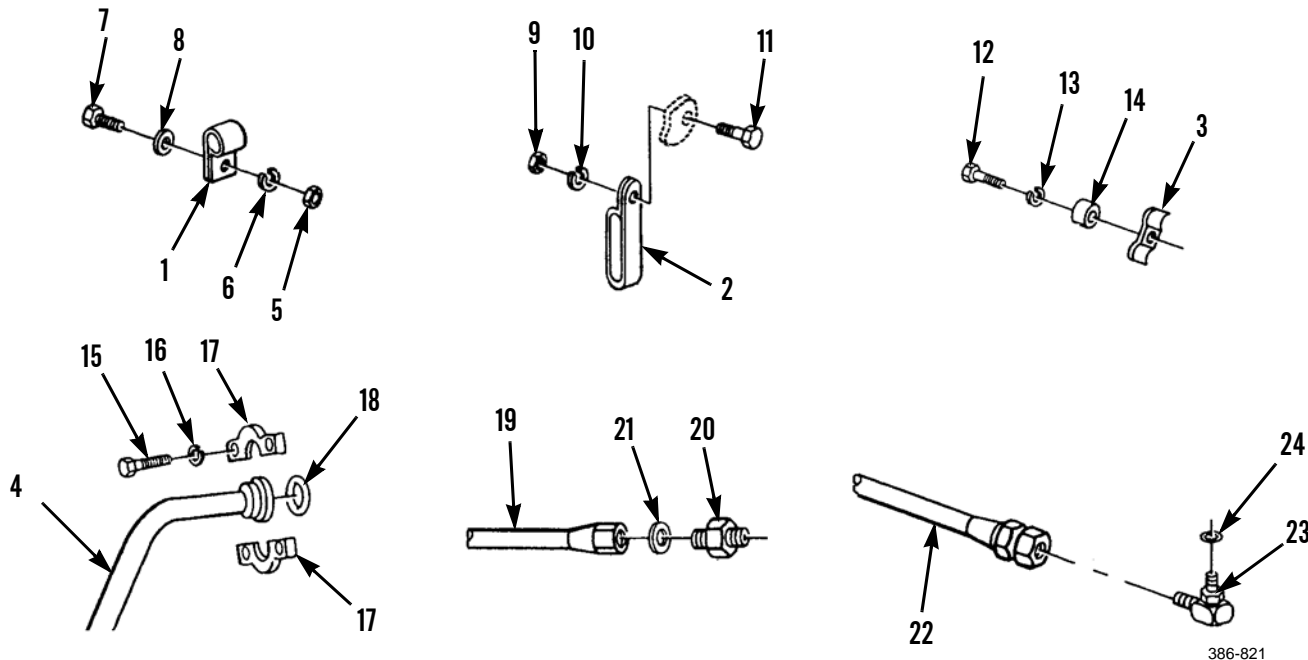
2. Tube or Hose Assembly Connected to Adapter.

- Remove clamps (1), clips (2) and/or retaining straps (3) along entire length of tube or hose assembly (19) as specified in step 1a above.
- Use two wrenches to disconnect tube or hose assembly (19) from adapter (20).
- Remove O-ring (21) and adapter (20). Discard O-ring.
- Repeat steps b and c for other end of tube or hose assembly (19) and remove tube or hose assembly.

3. Tube or Hose Assembly Connected to Elbow.

- Remove clamps (1), clips (2) and/or retaining straps (3) along entire length of tube or hose assembly (22) as specified in step 1a above.
- Use two wrenches to disconnect tube or hose assembly (22) from elbow (23).
- Remove elbow (23) and O-ring (24). Discard O-ring.
- Repeat steps b and c for other end of tube or hose assembly (22) and remove tube or hose assembly.

REMOVAL - CONTINUED



INSTALLATION

CAUTION

Remove cap and/or plugs from tubes, hoses and openings and wipe tubes, hoses and fittings clean as connections are made, to prevent contamination from entering hydraulic system.

NOTE

Lightly coat new O-rings with clean oil before installation.

1. **Tube or Hose Assembly Connected to Elbow.**
 - a. Route tube or hose assembly (22) along its proper path.
 - b. Install new O-ring (24) and elbow (23).
 - c. Use two wrenches to connect tube or hose assembly (22) to elbow (23).
 - d. Repeat steps b and c for other end of tube or hose assembly (22).
 - e. Install retaining straps (3), clips (2) and/or clamps (1) along entire length of tube or hose assembly (22) as follows:
 - (1) Retaining strap. Install retaining strap (3), spacer (14), new lockwasher (13) and bolt (12).
 - (2) Clip. Install clip (2), bolt (11), new lockwasher (10) and nut (9).
 - (3) Clamp. Install clamp (1), washer (8), bolt (7), new lockwasher (6) and nut (5).
 - f. Refill hydraulic tank and bleed air from system, if necessary (WP 0165 00).
 - g. Check for proper operation and leaks (TM 5-2410-233-10).

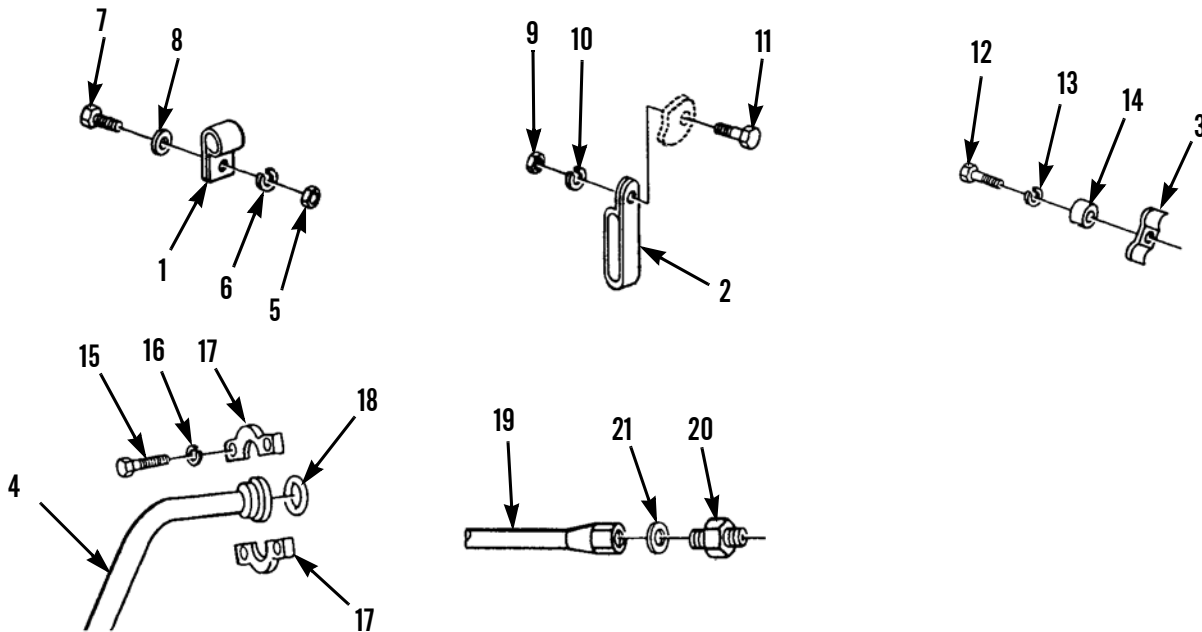
INSTALLATION - CONTINUED

2. **Tube or Hose Assembly Connected to Adapter.**

- a. Route tube or hose assembly (19) along its proper path.
- b. Install adapter (20) and new O-ring (21).
- c. Use two wrenches to connect tube or hose assembly (19) to adapter (20).
- d. Repeat steps b and c for other end of tube or hose assembly (19).
- e. Install retaining straps (3), clips (2) and/or clamps (1) along entire length of tube or hose assembly (19) as specified in step 1e above.
- f. Refill hydraulic tank and bleed air from system, if necessary (WP 0165 00).
- g. Check for proper operation and leaks.

3. **Tube Assembly with Split-Flanged Mounting.**

- a. Route tube assembly (4) along its proper path.
- b. Install new O-ring (18), tube assembly (4), two flanges (17), four new lockwashers (16) and capscrews (15).
- c. Repeat step b for other end of tube assembly (4).
- d. Install retaining straps (3), clips (2) and/or clamps (1) along entire length of tube assembly (4) as specified in step 1e above.



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- e. Refill hydraulic tank and bleed air from system, if necessary (WP 0165 00).
- f. Check for proper operation and leaks.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Introduction, Disassembly, Cleaning and Inspection, Repair, Fabrication of Hose Assembly

INITIAL SETUP

Tools and Special Tools

Tool outfit, hydraulic system test and repair (HSTRU) (Item 113, WP 0185 00)

Press, hydraulic, portable (Item 68, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23 or 24, WP 0184 00)

Materials/Parts - Continued

Rag, wiping (Item 28, WP 0184 00)

Couplings (as required)

Hose (as required)

References

TM 9-4940-468-13

Equipment Condition

Hydraulic system pressure relieved (WP 0176 00)

INTRODUCTION

1. This work package and referenced technical manual (TM 9-4940-468-13) for the Hydraulic System Test and Repair, (HSTRU) provides all the required WARNINGS, CAUTIONS, NOTES and procedures for the maintenance of hydraulic hose assemblies.
2. Before attempting to disassemble, repair, or fabricate any hydraulic hose(s) utilizing the HSTRU, read and understand all WARNINGS, CAUTIONS and NOTES in this work package and in TM 9-4940-468-13.



WARNING



- Eye protection must be worn when performing maintenance on hose assemblies. Failure to take precautions could cause injury to personnel.
- Before installation of a coupling that has been used before, inside diameter of stem must be returned to original specifications. Ensure that reconditioning has been performed correctly and completely. Do NOT use damaged or defective couplings. Failure to do so may cause hose failure. Personal injury could result.

CAUTION

Keep work area clean. Wipe area clean around all hydraulic hose fittings and couplings. Cap openings to prevent contamination of hydraulic system, which could result in premature failure.

DISASSEMBLY

Refer to TM 9-4940-468-13.

CLEANING AND INSPECTION

Refer to TM 9-4940-468-13.

HYDRAULIC SYSTEM LINES AND FITTINGS REPAIR- CONTINUED

0161 00

REPAIR

Refer to TM 9-4940-468-13.

FABRICATION OF HOSE ASSEMBLY

Refer to TM 9-4940-468-13.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Filter Element: Removal, Cleaning and Inspection, Installation

Filler Strainer: Removal, Cleaning and Inspection, Installation

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cleaning compound, solvent (Item 4, WP 0184 00)

Oil, lubricating (Item 22, 23 or 24, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Filter element, fluid (13)

Materials/Parts - Continued

Gasket (5)

O-ring (3)

Pin, cotter (8)

References

WP 0165 00

Equipment Condition

Hydraulic system pressure relieved (WP 0176 00)



WARNING



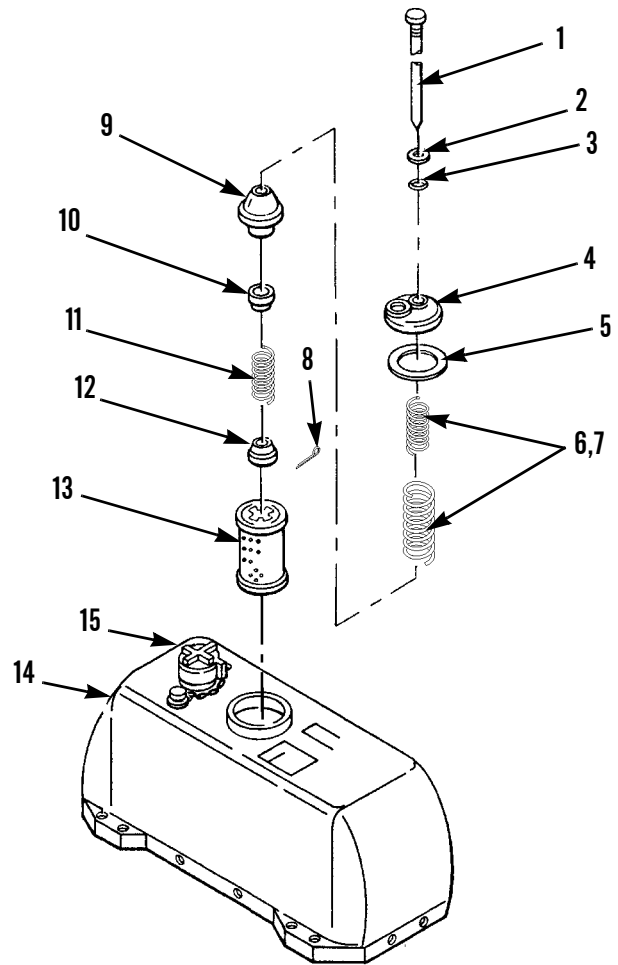
- Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.
- At operating temperature hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulics. Failure to do so could result in injury. Insert pipe nipple, located in tractor toolbox, into hydraulic tank drain valve.

CAUTION

Wipe area clean around openings into hydraulic tank and cover openings to ensure dirt or debris does not fall into tank and contaminate hydraulic system.

FILTER ELEMENT REMOVAL

1. Remove capscrew (1), washer (2) and O-ring (3) from cover (4). Discard O-ring.
2. Lift cover (4) and remove gasket (5) and springs (6 and 7). Discard gasket.
3. Remove cotter pin (8), seat assembly (9), seat valve (10) and spring (11). Discard cotter pin.
4. Remove retaining nut (12) and filter element (13) from hydraulic tank (14). Discard filter element.



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FILTER ELEMENT CLEANING AND INSPECTION**WARNING**

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Use solvent cleaning compound to clean components.
2. Replace any damaged component.

FILTER ELEMENT INSTALLATION

1. Install new filter element (13) in hydraulic tank (14) with retaining nut (12).
2. Install springs (11), seat valve (10), seat assembly (9) and new cotter pin (8).
3. Install spring (6 and 7) and position new gasket (5) on cover (4). Install cover.

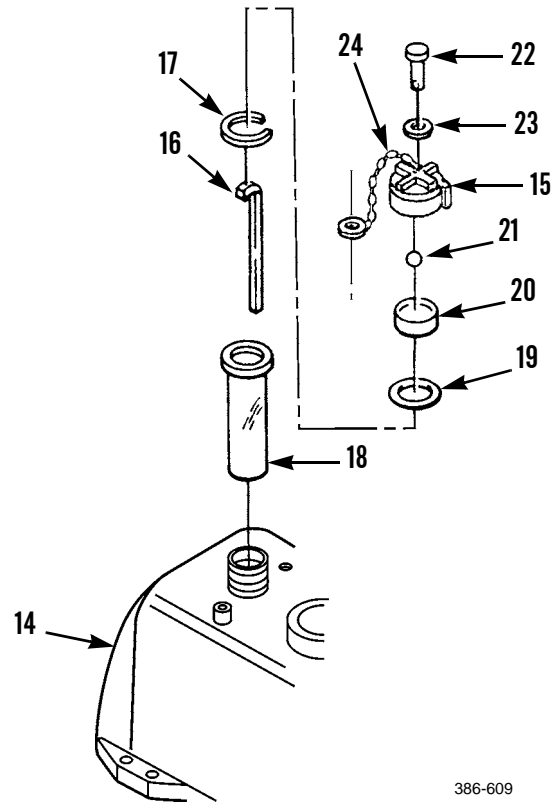
NOTE

Lightly coat new O-ring with clean oil before installation.

4. Install new O-ring (3), washer (2) and capscrew (1).
5. Check oil level in hydraulic tank (14). Add oil if necessary (WP 0165 00).
6. Retighten filler cap (15) on hydraulic tank (14).

FILLER STRAINER REMOVAL

1. Remove filler cap (15) and dipstick (16) from hydraulic tank (14).
2. Remove retaining ring (17) and filler strainer (18).
3. Inspect filler cap gasket (19) for damage. Replace if damaged.
4. Remove cover (20) and ball (21) from filler cap (15).
5. If filler cap (15) is damaged, remove pin (22), washer (23) and chain (24) from filler cap. Remove filler cap.



386-609

FILLER STRAINER CLEANING AND INSPECTION

WARNING



Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

1. Use solvent cleaning compound to clean components.
2. Replace any damaged component.

FILLER STRAINER INSTALLATION

1. If filler cap (15) was replaced, secure filler cap to chain (24) with washer (23) and pin (22).
2. Install ball (21) and cover (20) into filler cap (15).
3. If replaced, install new gasket (19) on cover (20). Ensure gasket is seated in groove of filler cap (15).
4. Install filler strainer (18) in hydraulic tank (14) and secure with retaining ring (17).
5. Install dipstick (16) into hydraulic tank (14).
6. Check oil level in hydraulic tank (14). Add oil if necessary (WP 0165 00).
7. Install filler cap (15) and tighten.

END OF WORK PACKAGE

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RIPPER LIFT CYLINDER REPLACEMENT**0163 00****THIS WORK PACKAGE COVERS**

Removal, Installation

INITIAL SETUP**Applicable Configuration**

Tractor with ripper

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Lifting equipment, 1,000 lb capacity

Wood blocks (2) 4 in. x 8 in. x 4 ft.

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Grease, GAA (Item 15, WP 0184 00)

Materials/Parts - Continued

Oil, lubricating (Item 22, 23 or 24, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Tag marker (Item 35, WP 0184 00)

O-ring (4)

References

WP 0165 00

Personnel Required

Three

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Hydraulic system pressure relieved (WP 0176 00)

**WARNING**

Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.

CAUTION

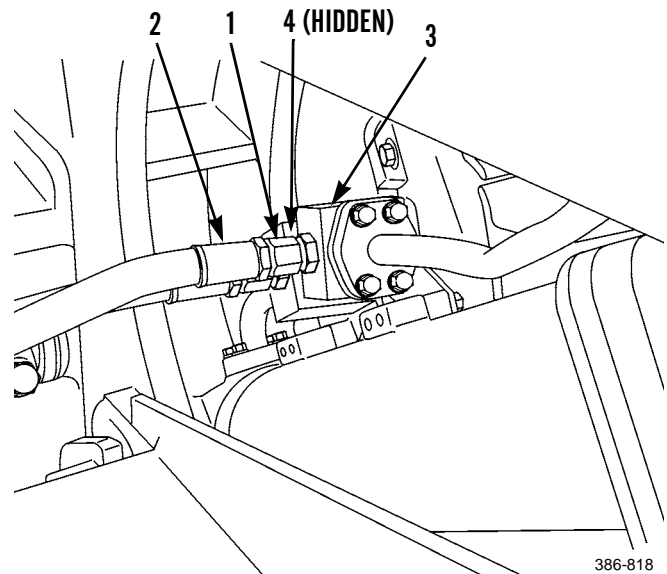
Wipe area clean around all hydraulic connections to be opened during removal. Cap lines and plug openings after removing hydraulic lines. Contamination of hydraulic system could result in premature failure.

NOTE

- Tag all hydraulic lines to ensure correct installation.
- Use a suitable container to capture any oil leakage. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- This procedure replaces right ripper lift cylinder. Procedure for the left ripper lift cylinder is the same.

REMOVAL

1. Loosen nut (1) and remove hose (2) from junction box (3). Remove and discard O-ring (4).
2. Repeat step 1 for other hose (2).



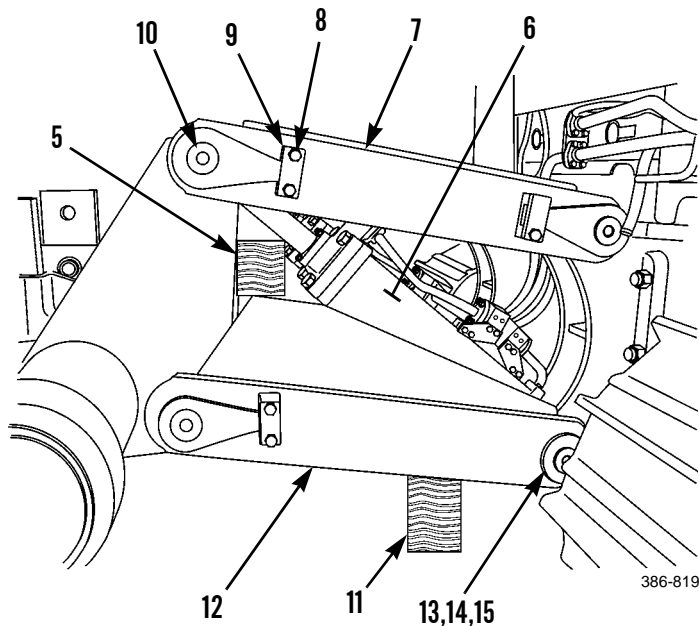
3. Place wood block (5) under lift cylinder (6) and connecting link (7).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

NOTE

- Ripper lift cylinder weighs 206 lb (93 kg).
 - Connecting link weighs 227 lb (126 kg).
4. Attach a nylon sling and a suitable lifting device to lift cylinder (6) and connecting link (7).
 5. Remove two bolts (8), plate (9) and pin assembly (10).
 6. Lower lift cylinder (6) and connecting link (7) to wood block (5).
 7. Remove nylon sling and lifting device from lift cylinder (6) and connecting link (7).
 8. Attach nylon sling and lifting device to lift cylinder (6).
 9. Place wood block (11) under frame assembly (12).
 10. Remove two bolts (13), plate (14) and pin assembly (15).
 11. Remove lift cylinder (6).
 12. Remove nylon sling and lifting device from lift cylinder (6).

REMOVAL - CONTINUED**INSTALLATION****WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

NOTE

- Ripper lift cylinder weighs 206 lb (93 kg).
- Connecting link weighs 227 lb (126 kg)

1. Attach a nylon sling and a suitable lifting device to lift cylinder (6) and move oil lift cylinder into position at frame assembly (12).
2. Install pin assembly (15), plate (14) and two bolts (13).
3. Lower lift cylinder (6) to wood block (5).
4. Remove nylon sling and lifting device from lift cylinder (6).
5. Attach nylon sling and lifting device to connecting link (7) and lift cylinder (6).
6. Align hole in connecting link (7) with hole in lift cylinder (6) and install pin assembly (10), plate (9) and two bolts (8).
7. Remove nylon sling and lifting device from connecting link (7) and cylinder (6).
8. Remove wood blocks (11 and 5).

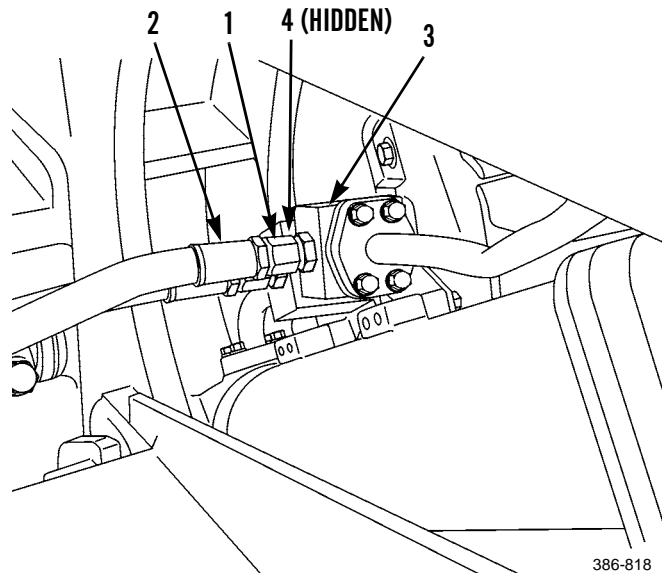
INSTALLATION - CONTINUED**CAUTION**

Wipe all sealing surfaces and hose connections clean and dry before installation. Contamination of hydraulic system could result in premature failure.

NOTE

Lightly coat new O-rings with clean oil before installation.

9. Install new O-ring (4) in hose (2).
10. Install hose (2) to junction box (3) and tighten nut (1).
11. Repeat step 8 for other hose (2).



12. Apply GAA grease to grease fittings at lift cylinder, connecting link and frame assembly.
13. Refill hydraulic tank and bleed air from system, if necessary (WP 0165 00).
14. Start engine, operate ripper lift cylinder, and check for proper operation and leaks (TM 5-2410-233-10).

END OF WORK PACKAGE

RIPPER LIFT CYLINDER REPAIR

0164 00

THIS WORK PACKAGE COVERSDisassembly, Cleaning and Inspection, Assembly

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, general purpose repair (Item 97, WP 0185 00)
 Guide, seal (Item 26, WP 0185 00)
 Inserter, seal (Item 36, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)
 Cleaning compound, solvent (Item 4, WP 0184 00)
 Cloth, abrasive, emery (Item 5, WP 0184 00)
 Oil, lubricating (Item 22, 23 or 24, WP 0184 00)
 Rag, wiping (Item 28, WP 0184 00)
 Sealant, quick-cure (Item 29, WP 0184 00)

Materials/Parts - Continued

Gasket (22)
 Nut, self-locking (17)
 O-ring (10 and 23)
 Packing, preformed (21)
 Ring (26)
 Ring, backup (24)
 Ring, piston (27)
 Seal (20 and 25)

Personnel Required

Two

Equipment ConditionRipper lift cylinder removed (WP 0163 00)

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

CAUTION

Wipe area clean around all hydraulic connections to be opened during disassembly. Install protective caps and plugs as needed. Contamination of hydraulic system could result in premature failure.

NOTE

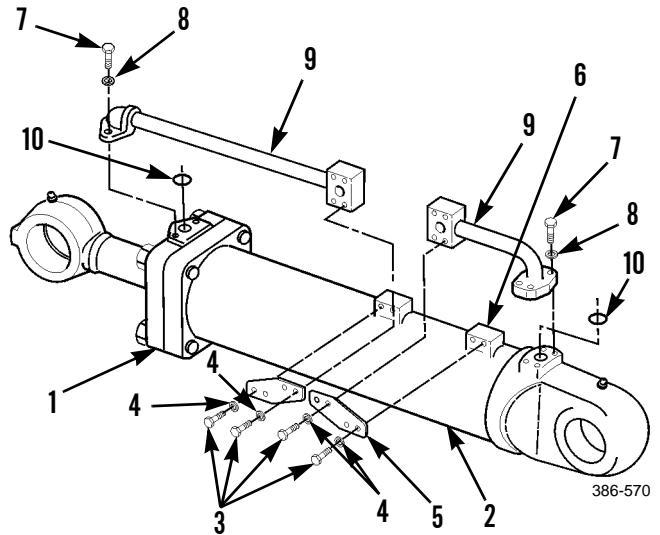
- Use a suitable container to catch any hydraulic oil that may drain from cylinder. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
- Ripper lift cylinder weighs 206 lb (94 kg).

DISASSEMBLY

NOTE

Prior to disassembly of lift cylinder, inspect external casing of lift cylinder for serviceability (cracks and damage). If not serviceable, replace lift cylinder.

1. Scribe a mark on head (1) and cylinder housing (2) for correct alignment at assembly.
2. Remove eight capscrews (3) and washers (4) holding two plates (5) to bosses (6) on cylinder housing (2).
3. Remove six capscrews (7), washers (8), two tube assemblies (9) and O-rings (10) from head (1) and cylinder housing (2). Discard O-rings.

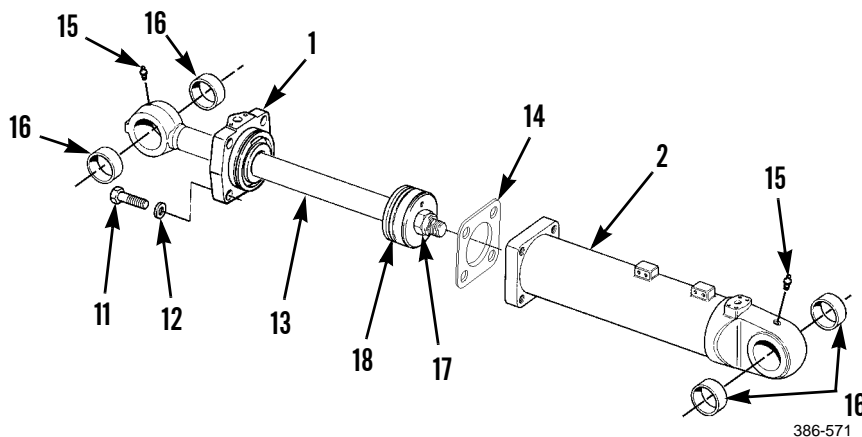


4. Remove four capscrews (11) and washers (12) from head (1).
5. Pull piston rod (13) and piston assembly slowly from cylinder housing (2) to allow oil to escape.
6. Remove shim pack (14) from head (1). Discard shim pack if found worn or damaged.
7. If required, remove two grease fittings (15) from cylinder housing (2) and piston rod (13).
8. Inspect four bearing sleeves (16) for serviceability. Replace lift cylinder if not serviceable.

CAUTION

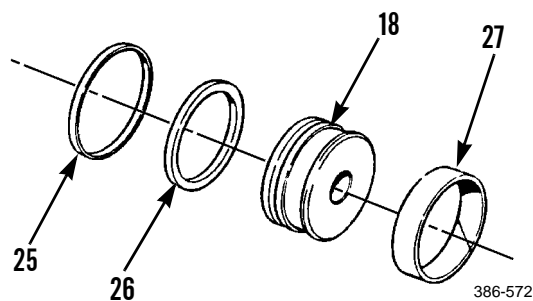
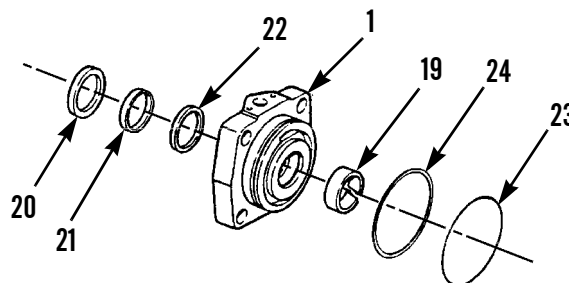
Protect piston rod and use care when placing in vise.

9. Place piston rod (13) in vise and remove self-locking nut (17) from piston rod. Discard self-locking nut.
10. Remove piston (18) from piston rod (13).



DISASSEMBLY - CONTINUED

11. Inspect bearing sleeve (19) for serviceability. If not serviceable, replace lift cylinder.
12. Remove seal (20), preformed packing (21) and gasket (22) from head (1). Discard seal, preformed packing and gasket.
13. Remove O-ring (23) and backup ring (24) from inner groove of head (1). Discard O-ring and backup ring.
14. Remove seal (25), ring (26) and piston ring (27) from piston (18). Discard seal, ring and piston ring.



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CLEANING AND INSPECTION**WARNING**

Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, it may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.

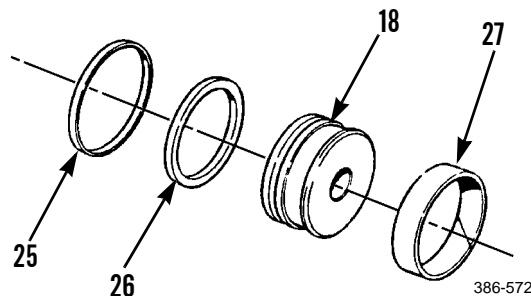
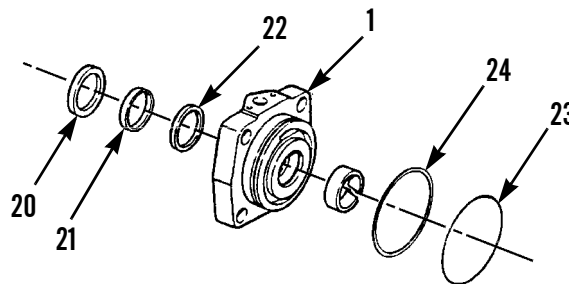
1. Clean all sealing surfaces and tube assembly connections with solvent cleaning compound and allow to dry.
2. Inspect internal casing of cylinder and internal parts of cylinder for cracks, wear, scoring and damage. If components and parts are not serviceable, replace ripper lift cylinder.
3. Ensure mating surfaces for bearing sleeves are clean and not damaged.

ASSEMBLY

NOTE

- Lightly coat bearing sleeves, new O-rings, new preformed packing, new ring, new backup ring, new piston ring and new seals with clean oil before assembly
- Remove protective caps and plugs from openings prior to assembly.

1. Install new piston ring (27), new ring (26) and new seal (25) on piston (18).
2. Install new backup ring (24) and new O-ring (23) into inner groove on head (1).
3. Install new gasket (22) and new preformed packing (21) in head (1).
4. Use sandpaper or emery cloth to scuff surfaces of counterbore inside of head (1) and outside diameter of new seal (20). Clean counterbore in head and scuffed surface of seal thoroughly with quick-cure primer, until neither component discolors a clean white towel. After cleaning, do NOT touch cleaned surfaces. Handle seal by lip only.



NOTE

Quick-cure primer will dry in approximately 30 seconds.

5. Apply quick-cure primer to counterbore of head (1) and to metal shell of seal (20) and allow to dry.

NOTE

Do NOT allow bearing mount compound to contact sealing lip.

6. Apply bearing mount compound evenly but not excessively to counterbore of head (1) and to metal shell of seal (20).
7. Install seal (20) into counterbore of head (1), with sealing lip facing inward. Seat seal firmly against bottom of counterbore. Wipe away excess bearing mount compound. Allow compound 15 minutes to dry.

NOTE

Do NOT install shim pack at this time.

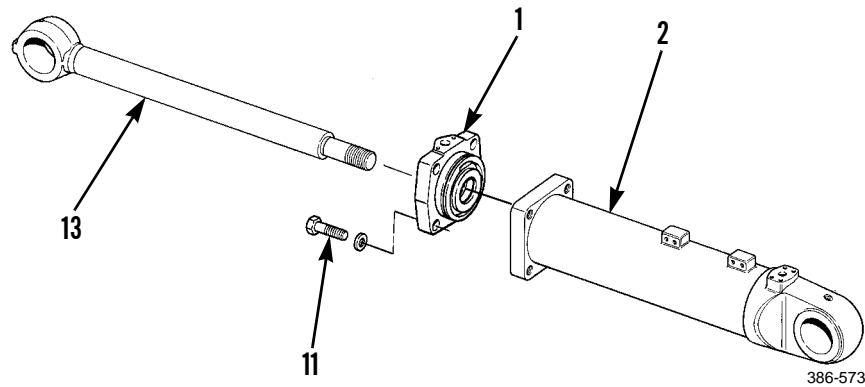
8. Place head (1) on cylinder housing (2) and install two capscrews (11) to hold head in place.

ASSEMBLY - CONTINUED

CAUTION

Piston rod must be supported and kept level at all times to avoid damaging seals in head.

9. Place seal guide on piston end of piston rod (13). Push piston rod into head (1) as far as possible.
10. Remove two capscrews (11) and separate head (1) and piston rod (13) as a unit from cylinder housing (2).



11. If removed, install grease fitting (15) on piston rod (13) and cylinder housing (2).

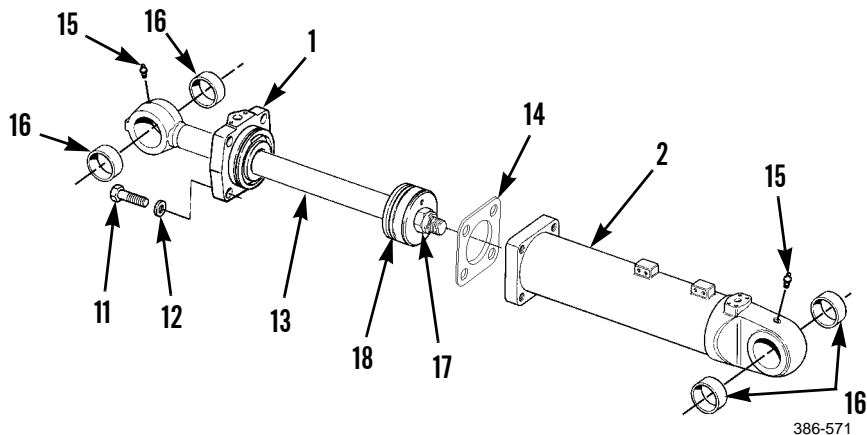
CAUTION

Protect piston rod and use care when placing in vise.

NOTE

- Lightly coat threads of piston rod and piston with clean oil before assembly.
- Ensure seal guide is installed on end of piston rod before assembly.

12. Install piston (18) on piston rod (13).
13. Install new self-locking nut (17) on piston rod (13) and tighten to 1620 lb-ft (2197 Nm)
14. Install shim pack (14) on head (1).



ASSEMBLY - CONTINUED

NOTE

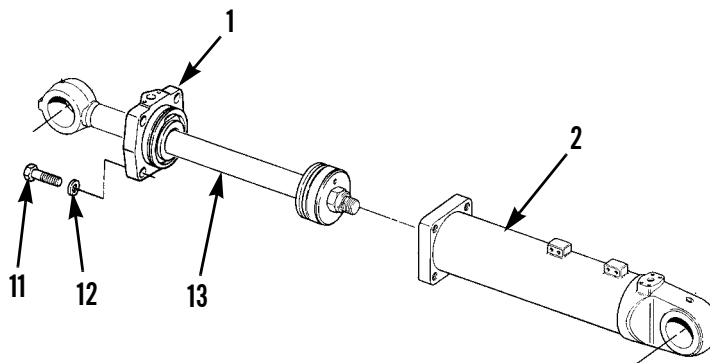
To ensure proper alignment and fit, ensure scribe marks on head and cylinder housing are in alignment.

15. Install head (1) and piston rod (13) into cylinder housing (2).

NOTE

- Tighten capscrews evenly to draw head all the way on cylinder housing.
- Piston rod must be fully extended when capscrews are tightened for correct alignment of cylinder housing and head.

16. Install four washers (12) and capscrews (11) on head (1) and tighten to 465 lb-ft (631 Nm).



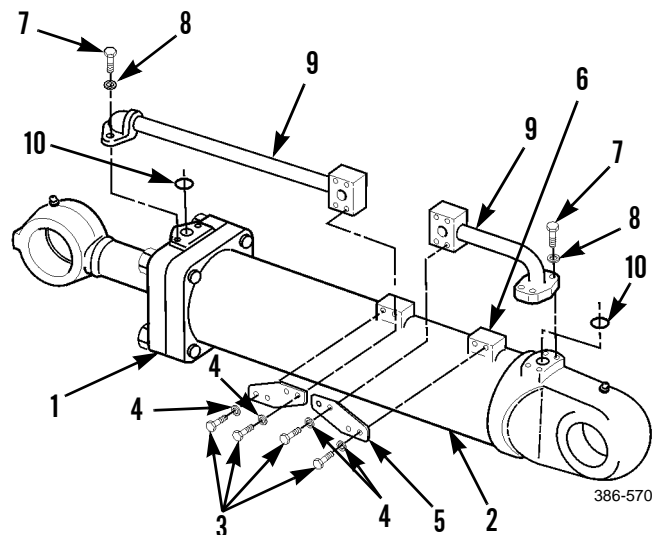
386-571

17. Install two plates (5) to bosses (6) on cylinder housing (2) and secure with eight washers (4) and capscrews (3).

NOTE

Insert all washers and capscrews to tube assemblies and hand-tighten first, then fully tighten.

18. Install two new O-rings (10) and tube assemblies (9) to cylinder housing (2) and head (1) and secure with six washers (8) and capscrews (7).



386-570

19. Install ripper lift cylinder (WP 0163 00).
20. Operate machine and check ripper system for proper operation and leaks.

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Draining, Filling, Bleeding System

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)

References

- WP 0008 00
- WP 0162 00

Materials/Parts

- Cleaning compound, solvent (Item 4, WP 0184 00)
- Oil, lubricating (Item 22, 23 or 24, WP 0184 00)

Equipment Condition

- Machine parked on level ground (TM 5-2410-233-10)
- Engine OFF and cool (TM 5-2410-233-10)
- Hydraulic pressure relieved (WP 0176 00)

Materials/Parts - Continued

- Rag, wiping (Item 28, WP 0184 00)



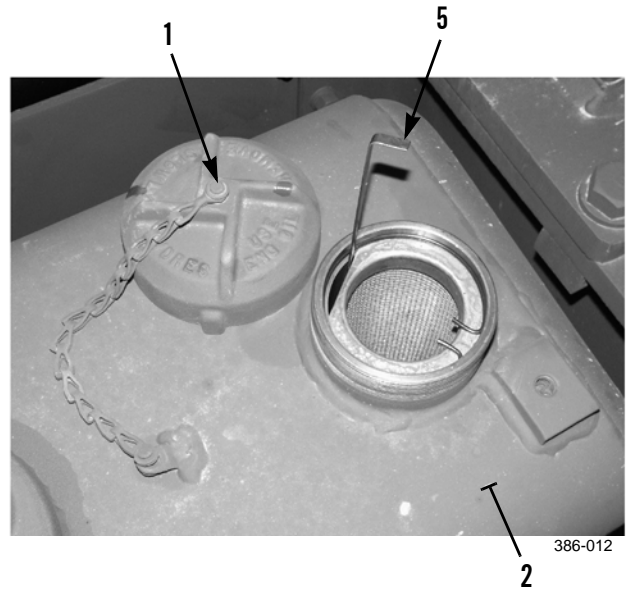
WARNING



- **Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.**
- **To effectively drain hydraulic system, oil must be warm. Use caution when draining oil to avoid burns.**

DRAINING

1. Slowly remove filler cap (1) from hydraulic tank (2).



NOTE

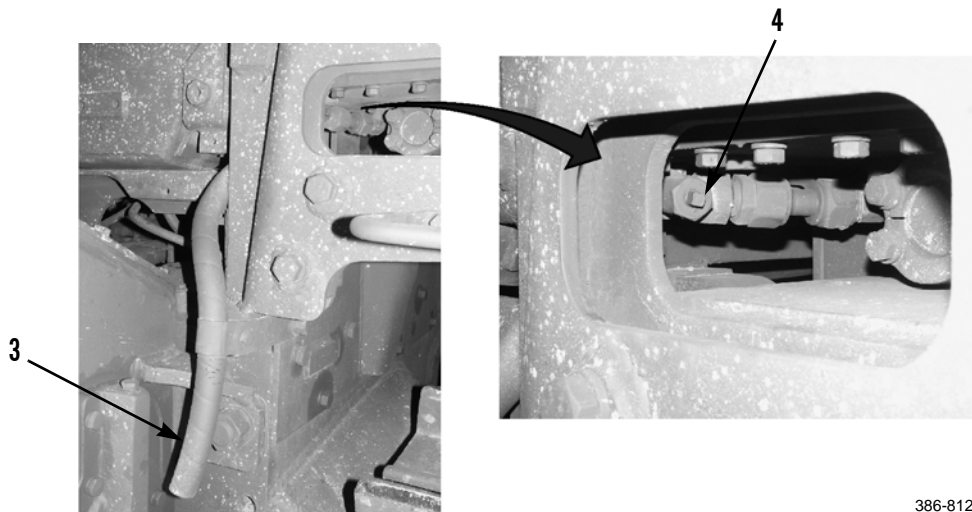
Capacity of hydraulic tank is 21 gal. (79.5 l).

2. Position a suitable container under hydraulic tank drain hose (3) located at right-rear of machine.
3. Turn drain valve (4) to the left to OPEN position.

NOTE

Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

4. Drain hydraulic oil from hydraulic tank (2).
5. Turn drain valve (4) to the right to CLOSE position.



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CHANGING HYDRAULIC SYSTEM OIL - CONTINUED

0165 00

FILLING

1. Remove, clean and reinstall filler strainer (WP 0162 00).
2. If required, change hydraulic filter element (WP 0162 00).

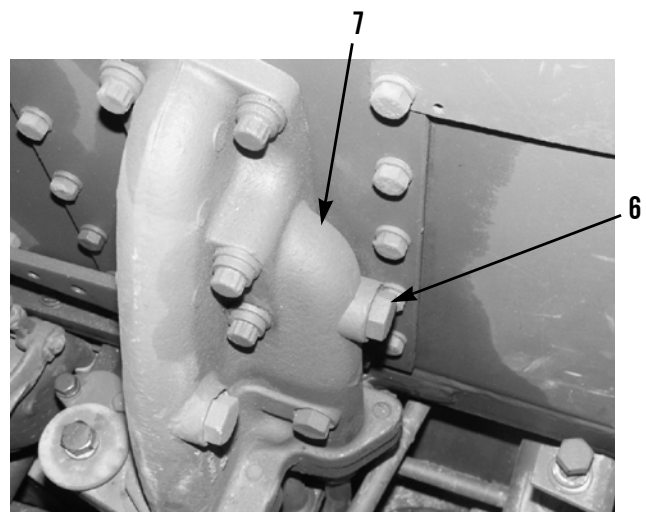
NOTE

- To ensure an accurate reading on dipstick, oil in tank must be cool (at ambient temperature).
- Refer to **KEY** in **PMCS Introduction (WP 0008 00)** for correct grade of oil for expected temperature range of operation.

3. Add oil to hydraulic tank (2) until oil is visible on dipstick (5).

BLEEDING SYSTEM

1. Start engine and run at idle.
2. Loosen plug (6) from pressure tap on manifold (7) to right of seat.
3. Let air escape and tighten plug (6) as soon as oil starts to run out.



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4. Allow hydraulic system to cool, then check and fill hydraulic tank (2), as required.
5. Install cap (1) on hydraulic tank (2).
6. Operate machine and check for leaks and proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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HYDRAULIC TANK REPLACEMENT

0166 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, general purpose repair (Item 97, WP 0185 00)
- Link, lifting (Item 43, WP 0185 00)
- Sling, nylon (Item 100 WP 0185 00)
- Lifting equipment, 500 lb capacity
- Bolt, 1/2-13 x 1 in.

Materials/Parts

- Cap set, protective (Item 2, WP 0184 00)
- Oil, lubricating (Item 22, 23 or 24, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Tag, marker (Item 35, WP 0184 00)

Materials/Parts - Continued

- Lockwasher (2, 15, 18, and 25)
- O-ring (21)

Personnel Required

Two

Equipment Condition

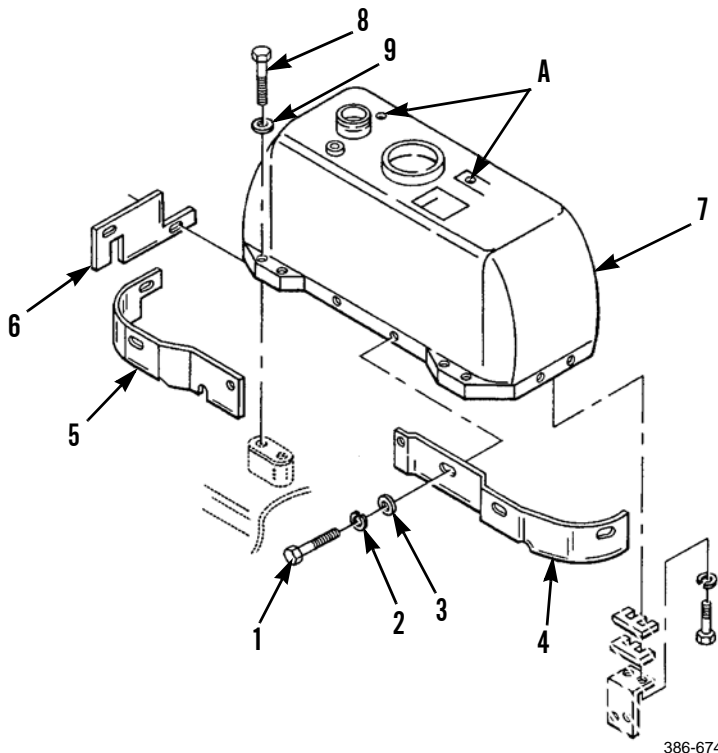
- Hydraulic tank drained (WP 0165 00)
 - Blade control linkages disconnected (WP 0152 00)
 - If equipped, ripper control linkage disconnected (WP 0153 00)
-

REMOVAL**CAUTION**

Install protective caps and plug openings in tank and hoses after removal of hydraulic hoses, to ensure contamination does not enter hydraulic system.

NOTE

- Use a suitable container to capture any residual oil that may drain from hoses as they are disconnected. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.
 - Tag hoses as they are removed to ensure correct installation.
1. Remove six capscrews (1), lockwashers (2) and washers (3) from front, middle and rear guards (4, 5 and 6) and hydraulic tank (7). Remove guards and discard lockwashers.
 2. Remove four capscrews (8) and washers (9) from hydraulic tank (7).
 3. Install two lifting links with 1/2 -13 x 1 in. bolts in threaded holes (A) on top of hydraulic tank (7).



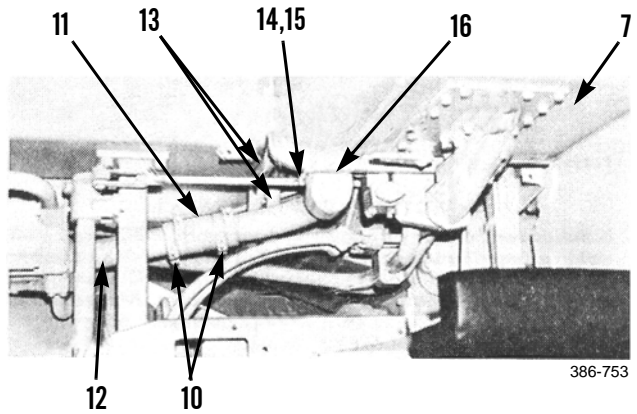
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HYDRAULIC TANK REPLACEMENT - CONTINUED

0166 00

REMOVAL - CONTINUED

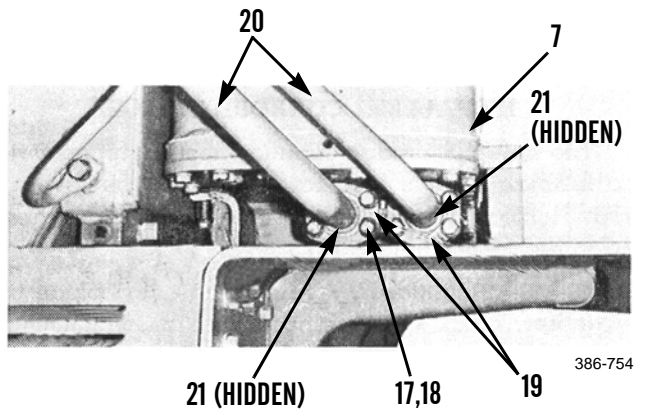
4. Loosen two hose clamps (10) and slide hose (11) off tube (12).
5. Disconnect two blade cylinder oil lines (13) at connections located beneath hose (12).
6. Remove two capscrews (14) and lockwashers (15) from mounting bracket (16). Discard lockwashers.



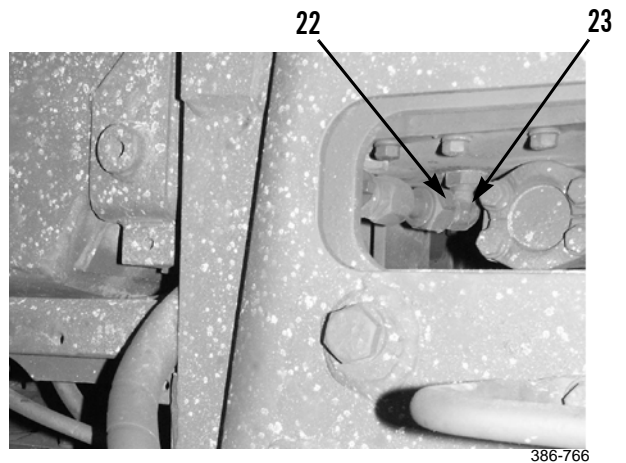
NOTE

Perform steps 7 and 8 only if machine is equipped with a ripper.

7. Remove eight capscrews (17), lockwashers (18) and four split flanges (19) from both ripper cylinder oil lines (20). Discard lockwashers.
8. Remove both ripper cylinder oil lines (20) from hydraulic tank (7). Remove O-rings (21) from lines and discard.



9. Disconnect hydraulic tank drain hose (22) from elbow fitting (23).



REMOVAL - CONTINUED**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

NOTE

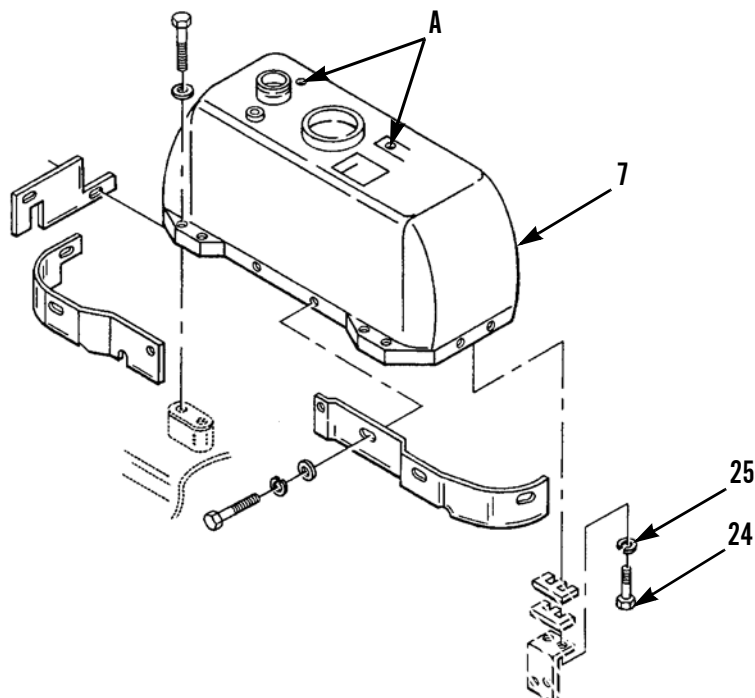
Hydraulic tank weighs 248 lb (113 kg).

10. Attach a nylon sling to lifting links to support hydraulic tank (7).
11. Remove four capscrews (24) and lockwashers (25) from hydraulic tank (7) on underside of fender. Discard lockwashers.
12. Use nylon sling and lifting device to remove hydraulic tank (7) from fender.

NOTE

Chain end links may remain installed to top of hydraulic tank, if hydraulic tank is to be separated from bottom plate.

13. Remove two lifting links from hydraulic tank (7).



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INSTALLATION**CAUTION**

Wipe area clean around openings in tank and hydraulic lines before installation, to ensure contamination does not enter hydraulic system.

1. If removed, install two lifting links with 1/2 -13 x 1in. bolts in threaded holes (A) in top of hydraulic tank (7).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

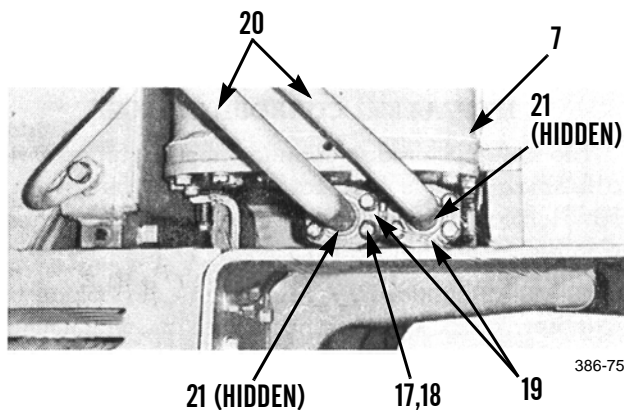
Hydraulic tank weighs is 248 lb (113 kg).

2. Attach a nylon sling to lifting links on hydraulic tank (7).
3. Use nylon sling and lifting device to position hydraulic tank (7) on fender, with mounting holes in tank aligned with holes in fender.
4. Secure hydraulic tank (7) to fender with four new lockwashers (25) and capscrews (24).

NOTE

- Perform steps 5 and 6 only if machine is equipped with a ripper.
- Lightly coat new O-rings with clean oil before installation.

5. Install new O-rings (21) to ripper cylinder oil lines (20).
6. Install ripper cylinder oil lines (20) to hydraulic tank (7) with four split flanges (19), eight new lockwashers (18) and capscrews (17).

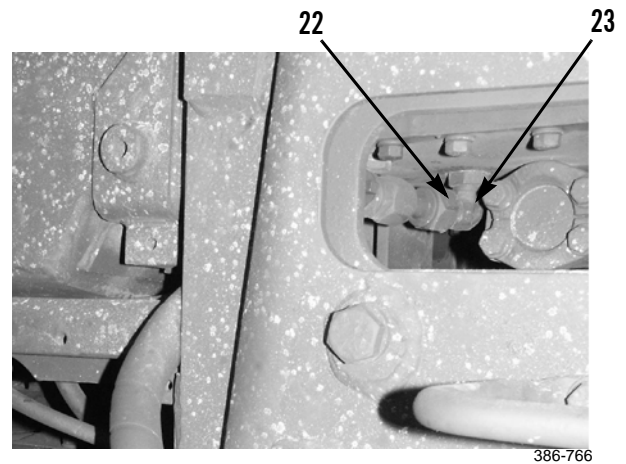


HYDRAULIC TANK REPLACEMENT - CONTINUED

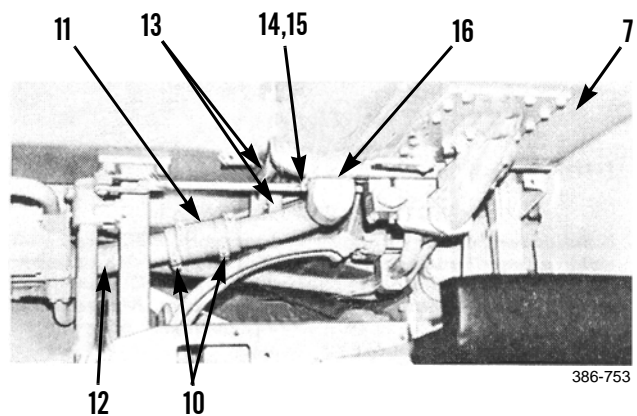
0166 00

INSTALLATION - CONTINUED

7. Connect hydraulic tank drain hose (22) to elbow fitting (23).

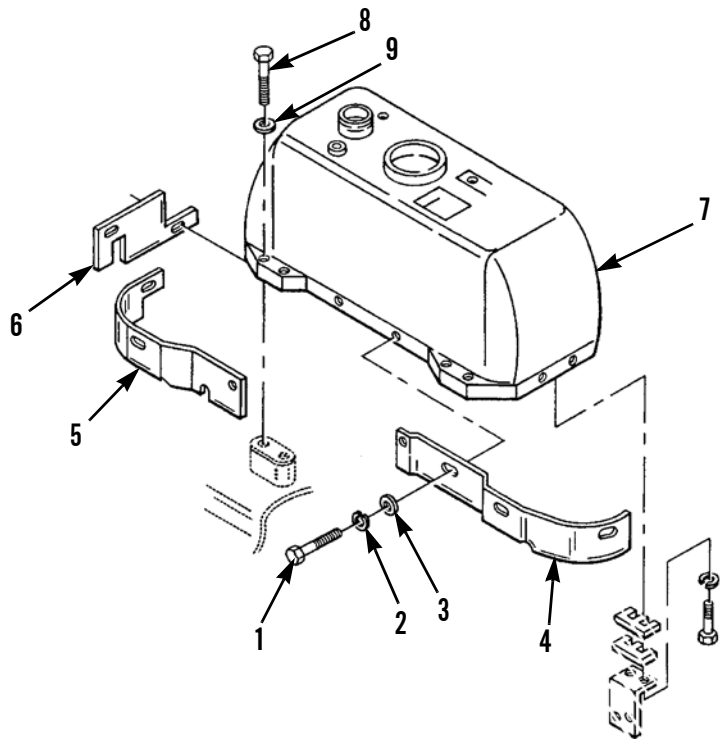


8. Position mounting bracket (16) and secure with two new lockwashers (15) and capscrews (14).
9. Connect two blade cylinder oil lines (13).
10. Slide hose (11) onto tube (12) and tighten two hose clamps (10).



INSTALLATION - CONTINUED

11. Remove both lifting links from top of hydraulic tank (7).
12. Install four washers (9) and capscrews (8) on hydraulic tank (7).
13. Install rear, front and middle guards (6, 4 and 5) on side of hydraulic tank (7) with six washers (3), new lockwashers (2) and capscrews (1).



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14. If equipped, connect ripper control linkage (WP 0153 00).
15. Connect blade control linkage (WP 0152 00).
16. Refill hydraulic tank and bleed air from system (WP 0165 00).
17. Operate machine and check for leaks and proper hydraulic system operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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HYDRAULIC SYSTEM TESTS

0167 00

THIS WORK PACKAGE COVERS

Preliminary Checks; Test Setup and Operational Checks; Tilt, Lift and Ripper Circuit Speed Tests; Hydraulic System Test Procedures; Pressure Relief Valve Tests; Pump Efficiency Test (On Machine); Restoring Equipment

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, general purpose repair (Item 97, WP 0185 00)

Cover, access (Item 21, WP 0185 00)

O-ring (Item 52, WP 0185 00)

Tool outfit, hydraulic system test and repair (HSTRU) (Item 113, WP 0185 00)

Materials/Parts

Cap set, protective (Item 2, WP 0184 00)

Oil, lubricating (Item 22, 23, or 24, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

References

WP 0008 00

WP 0009 00

WP 0150 00

WP 0151 00

WP 0160 00

WP 0162 00

WP 0165 00

Personnel Required

Two

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Floor plates removed (WP 0135 00)

**WARNING**

- **Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.**
- **At operating, temperature hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulics. Failure to do so could result in injury.**

CAUTION

Wipe area clean around all hydraulic connections to be opened during removal. Cap oil lines and plug openings after removing lines. Contamination of hydraulic system could result in premature failure

NOTE

- **Hydraulic system tests are performed when required by troubleshooting to confirm a problem or identify a faulty component within the system. These tests can also be performed after repair operations to ensure faults have been corrected and performance is within specifications.**
- **Hydraulic system tests consist of operating checks and analysis of test results to indicate if corrective action is needed.**
- **Perform PMCS for hydraulic system as outlined in WP 0008 00 and WP 0009 00 before performing hydraulic system tests.**

PRELIMINARY CHECKS

1. A visual inspection of the system with the engine stopped should be the first step when performing hydraulic system tests.
2. With the blade and ripper (if equipped) resting on the ground and oil cool, perform the following inspections:
 - a. Check oil level in hydraulic tank and add oil as needed (WP 0165 00).
 - b. Remove filter element and filler strainer and check for foreign matter. Clean strainer and replace filter element as needed (WP 0162 00).
 - c. Inspect all lines, fittings and cylinders for damage or leakage. Make repairs as needed.
 - d. Inspect all control linkages for bent, damaged or broken components. Make repairs as needed.

TEST SETUP AND OPERATIONAL CHECKS

WARNING

When testing and adjusting hydraulic system, always move machine away from traffic pattern and away from personnel. Allow only one person on the machine. Keep all other personnel off to one side and within view of the operator.

1. Park machine in a safe location to perform tests.
2. Start engine and lower blade.
3. Warm up hydraulic system.

NOTE

An operational check of the hydraulic system is useful in detecting possible internal leakage, faulty valves or a faulty pump.

4. Perform the following operational checks:
 - a. Raise, lower and tilt blade several times. If equipped with ripper, raise and lower ripper several times.
 - (1) Watch cylinder extension and retraction for rough movement.
 - (2) Listen for pump noise.
 - b. Test and check adjustment of any area if a problem is found.
5. Verify high idle is 2100 RPM +/- 65 RPM.
6. Perform *Tilt, Lift and Ripper Circuit Speed Tests* below.

TILT, LIFT AND RIPPER CIRCUIT SPEED TESTS

1. Hydraulic filter elements should be changed, if dirty, before performing the following speed tests.
2. Oil must be of recommended viscosity and at normal operating temperature to ensure accurate test results.
3. Speed tests are made with engine at high idle.
4. Speeds in Table 1 are those of a machine equipped with a tilt, lift and ripper circuit.
5. System speeds similar to speeds given indicate that circuits are operating normally. However, relief valves should be tested to ensure they are set at proper settings.
6. If only lift circuit or only tilt circuit has slow speeds, check slow circuit for excessive drifting.

Table 1. Tilt, Lift and Ripper Circuit Speed Tests.

CIRCUIT SPEED TEST	TRAVEL TIME SPEED IN SECONDS
Tilt Circuit Time needed to move tilt cylinder rod from fully retracted to fully extended position.	2.2
Time needed to move tilt cylinder rod from fully extended to fully retracted position.	1.7
Lift Circuit Time needed to raise blade from ground level to maximum height.	2.9 to 3.0
Ripper Time needed to raise ripper from fully extended to fully retracted position.	4.8

7. If all circuits are slow, check for pump malfunctioning. Also check main pressure relief valve for leakage or low pressure setting. Refer to *Pump Efficiency Tests (On Machine)* and *Pressure Relief Valve Tests* in this work package.

HYDRAULIC SYSTEM TEST PROCEDURES

1. **Introduction.**
 - a. Check relief valve setting at low idle. Refer to *Pressure Relief Valve Tests* in this work package. If relief valve pressure can be obtained at low idle, pump is working correctly.
 - b. If machine is equipped with a tilt and/or ripper circuit, put a tap into these circuits and check for relief valve pressure at low idle. If relief pressure cannot be read on gage in all circuits, pump or relief valve is probably bad. If pressure cannot be read in only one circuit, refer to drift tests for that circuit for further testing.

HYDRAULIC SYSTEM TEST PROCEDURES - CONTINUED

2. **Lift Circuit Drift Tests.**

- a. **TEST NO. 1:** Raise front of machine off ground by lowering a level blade. Put blade control lever in HOLD position. Shut off engine and watch for lift cylinder rods to retract.
- b. **TEST NO. 2:** Raise front of machine off ground lowering a level blade. Shut off engine. Hold blade lever in LOWER position. Watch for lift cylinder rods to retract.
- c. **TEST NO. 3:** Raise blade off ground. Put blade control lever in HOLD position. Shut off engine and watch for lift cylinder rods to extend.
- d. **TEST NO. 4:** Raise blade off ground. Shut off engine. Hold blade control lever in RAISE position. Watch for lift cylinder rods to extend.

Lift Circuit Drift Tests.

TEST RESULTS	MOST PROBABLE CAUSES
Drifting occurs in Tests No. 1 and No. 2	Lift circuit make-up valve (head ends) leaking.
Drifting occurs in Test No. 3 and No. 4	Lift circuit make-up valve (rod ends) leaking.
Drifting occurs in Tests No. 2, No. 3 and No. 4	Leakage between pistons and cylinders. Bad piston valves in cylinders.
Drifting occurs in Tests No. 2 and No. 4	Lift circuit check valve leaking. Leakage between valve and seat and/or seat and body.
NOTE: Remember that an O-ring seal failure in circuit will have same effect as a major component failure.	

3. **Tilt Circuit Drift Tests (Left-Side Cylinder).**

- a. **TEST NO. 1:** Put blade flat on ground. Raise front of machine off ground by lowering right side of blade (TILT RIGHT). Put tilt circuit in HOLD position. Shut off engine and watch for tilt cylinder rod to retract.
- b. **TEST NO. 2:** Put blade flat on ground. Raise front of machine off ground by lowering right side of blade (TILT RIGHT). Shut off engine. Put tilt circuit in TILT RIGHT position. Watch for tilt cylinder rod to retract.
- c. **TEST NO. 3:** Put blade flat on ground. Raise front of machine off ground by lowering left side of blade (TILT LEFT). Put tilt circuit in HOLD position. Shut off engine and watch for tilt cylinder rod to extend.
- d. **TEST NO. 4:** Put blade flat on ground. Raise front of machine off ground by lowering left side of blade (TILT LEFT). Shut off engine. Put tilt circuit in TILT LEFT position. Watch for tilt cylinder rod to extend.

Tilt Circuit Drift Tests (Left-Side Cylinder).

TEST RESULTS	MOST PROBABLE CAUSES
Drifting occurs in Tests No. 1 and No. 3	1. Leakage between piston and cylinder. 2. Leakage between tilt circuit valve spool and body.
Drifting occurs in Tests No. 2 and No. 4	Tilt circuit check valve leaking. Leakage between valve and seat and/or seat and body.
NOTE: Remember that an O-ring seal failure in circuit will have same effect as a major component failure.	

HYDRAULIC SYSTEM TEST PROCEDURES - CONTINUED

4. **Ripper Circuit Drift Tests.**

- a. **TEST NO. 1:** Raise rear of machine off ground by lowering ripper. Put ripper control lever in HOLD position. Shut off engine and watch for ripper cylinder rods to retract.
- b. **TEST NO. 2:** Raise rear of machine off ground by lowering ripper. Shut off engine. Hold ripper control lever in LOWER position. Watch for ripper cylinder rods to retract.
- c. **TEST NO. 3:** Raise ripper off ground. Put ripper control lever in HOLD position. Shut off engine and watch for ripper cylinder rods to extend.
- d. **TEST NO. 4:** Raise ripper off ground. Shut off engine. Hold ripper control lever in RAISE position. Watch for ripper cylinder rods to extend.

Ripper Circuit Drift Tests.

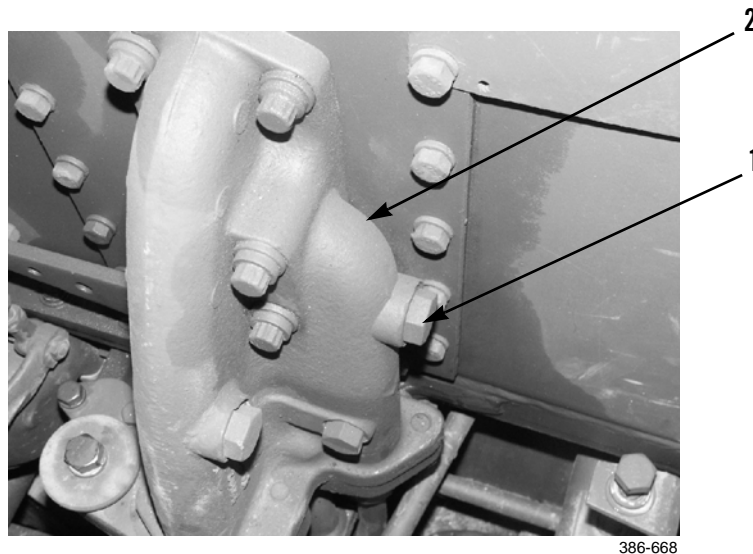
TEST RESULTS	MOST PROBABLE CAUSES
Drifting occurs in Tests No. 1 and No. 3	1. Leakage between piston and cylinder. 2. Leakage between ripper circuit valve spool and body.
Drifting occurs in Tests No. 2 and No. 4	Ripper circuit check valve leaking. Leakage between valve and seat and/or seat and body.
NOTE: Remember that an O-ring seal failure in circuit will have same effect as a major component failure.	

PRESSURE RELIEF VALVE TESTS**WARNING**

- Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury or death.
- At operating temperature hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulics. Failure to do so could result in injury.

1. **Tilt Relief Valve.**

- Operate machine until hydraulic system is at operating temperature. Lower implements to the ground, so that bulldozer blade is level. Shut down engine. Move all hydraulic control levers to all positions to relieve pressure in lines. Return all control levers to HOLD position.
- Install a 0-4000 psi (0-281.2 kg/cm²) gage in pressure tap (1) located on tilt valve inlet manifold (2).



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- Raise blade high enough to allow for maximum tilt in either direction.
- With engine at low idle, extend or retract tilt cylinder to full extent of travel. Observe gage reading. Maximum gage reading should be 2450 psi \pm 25 psi (16892 kPa \pm 172 kPa).
- Return blade to level position and lower to the ground.

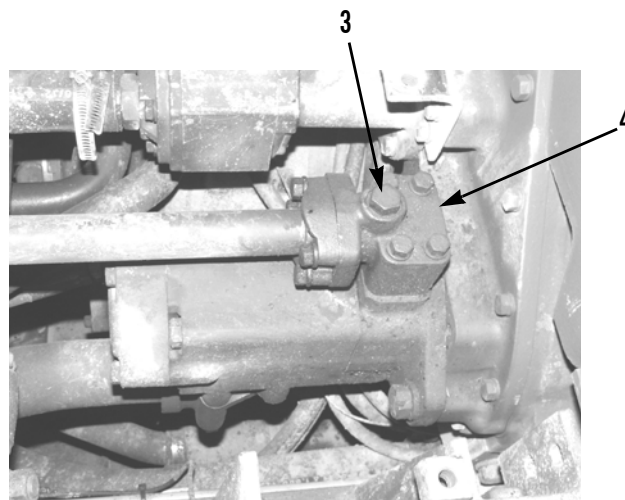
NOTE

One shim (part number 3J747) changes pressure by 35 psi (241 kPa).

- To adjust tilt relief valve setting, remove tilt control valve and perform *Relief Valve Setting Adjustment* (WP 0150 00).

PRESSURE RELIEF VALVE TESTS - CONTINUED2. Main Relief Valve.**WARNING**

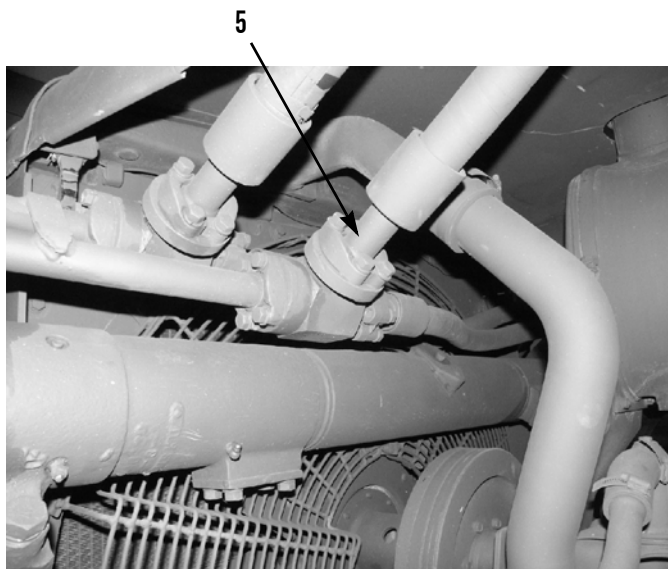
- Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury or death.
 - At operating temperature hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulics. Failure to do so could result in injury.
- a. Operate machine until hydraulic system is at operating temperature. Lower implements to the ground, so that bulldozer blade is level. Shut down engine. Move all hydraulic control levers to all positions to relieve pressure in lines. Return all control levers to HOLD position.
 - b. Install a 0-4000 psi (0-2,7579 kPa²) gage in pressure tap (3) located in output line from large section (4) of pump.



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PRESSURE RELIEF VALVE TESTS - CONTINUED

- c. If equipped with a ripper, run engine at low idle and raise ripper until lift cylinders bottom out. Main relief valve should open 2250 + 50 or 0 psi (158.2 + 3.5 or 0.0 kg/cm²).
- d. If equipped with a winch, block line to head end of blade lift cylinders, located on left side of engine compartment above lift cylinder mounting tube.
 - (1) Disconnect hose (5) (WP 0160 00).
 - (2) Install O-ring and cover and reconnect hose (5).



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- e. With engine at low idle, operate blade control lever to extend lift cylinders. Main relief valve should open at 2250 + 50 or 0 psi (158.2 + 3.5 or 0.0 kg/cm²).
- f. Return blade to lowered position. Remove cover and O-ring and reconnect hose (5) (WP 0160 00).

NOTE

One shim (part number 3J743) changes pressure by 35 psi (241 kPa).

- g. To adjust main relief valve setting, perform *Relief Valve Setting Adjustment* in WP 0151 00.

PUMP EFFICIENCY TEST (ON MACHINE)

1. Install flow meter.
2. Start engine and run at 2000 RPM.
3. Measure pump flow at 100 psi (7.0 kg/cm²) with engine at 2000 RPM.
4. Measure pump flow at 1000 psi (70.3 kg/cm²) with engine at 2000 RPM.
5. Calculate percentage of flow loss using the following formula:

$$\left(\frac{\text{gpm @ 100 psi} - \text{gpm @ 1000 psi}}{\text{gpm @ 100 psi}} \right) \times 100 = \text{Percentage of flow loss}$$

6. If percentage of flow loss is more than 10%, pump performance is not sufficient.

RESTORING EQUIPMENT

1. Remove all test equipment and install any removed plugs.
2. Check oil level in hydraulic tank. Add oil as needed. Bleed air from system (WP 0165 00).
3. Operate tilt, lift and ripper (if equipped) circuits and check for proper operation.
4. Shut off engine and check for oil leaks (TM 5-2410-233-10).
5. Recheck oil level in hydraulic tank (WP 0165 00).
6. Install floor plates (WP 0135 00).

END OF WORK PACKAGE

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FUEL PRESSURE GAGE REPLACEMENT

0168 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Fuel (Item 12, 13 or 14, WP 0184 00)

Rag, wiping (Item 28, WP 0184 00)

Equipment Condition

Engine OFF and cool (TM 5-2410-233-10)

**WARNING**

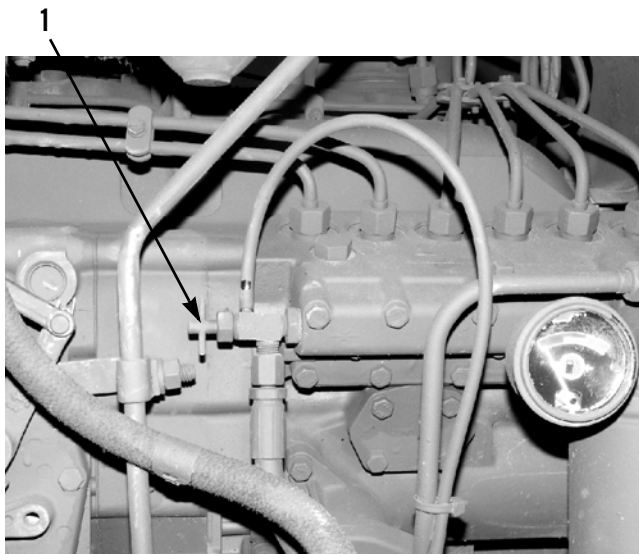
DO NOT perform fuel system checks, inspections or maintenance while smoking or near fire, flames or sparks. Fuel may ignite, causing damage to machine and injury or death to personnel.

CAUTION

Clean area to remove dirt before removing gage and fittings. Cover opening in filter base to prevent contamination of fuel system.

REMOVAL

1. Turn fuel bleed valve petcock (1) to the right to OFF position.



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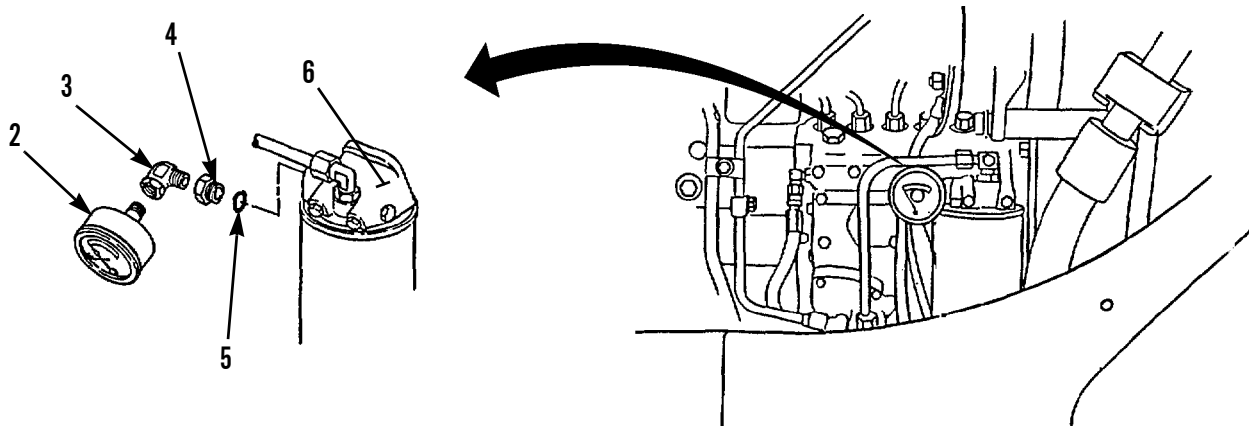
FUEL PRESSURE GAGE REPLACEMENT - CONTINUED

0168 00

REMOVAL - CONTINUED**NOTE**

Some fuel may drain when removing pressure gage. Use a suitable container to capture any fuel. Dispose of fuel IAW local policy and ordinances. Ensure all spills are cleaned up.

- Remove fuel pressure gage (2) from elbow (3).



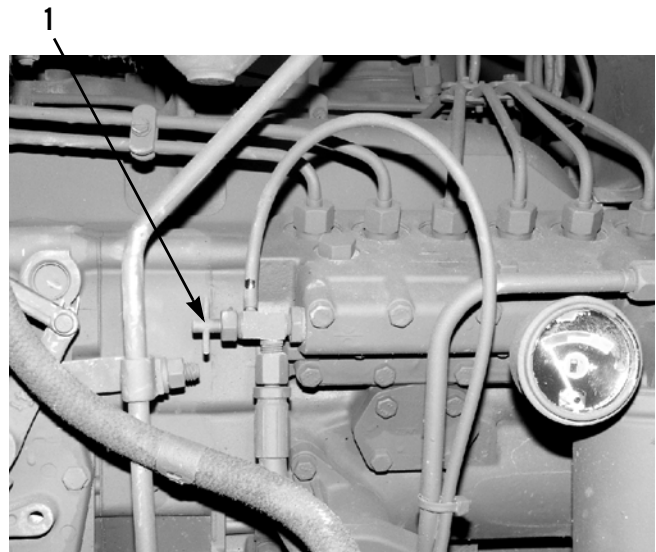
386-431

- If necessary, remove elbow (3) from adapter (4).
- If necessary, remove adapter (4) and O-ring (5) from secondary fuel filter base (6). Discard O-ring.

INSTALLATION**NOTE**

Lightly coat new O-ring with clean fuel before installation.

- If removed, install new O-ring (5) and adapter (4) to secondary fuel filter base (6).
- If removed, install elbow (3) to adapter (4).
- Install fuel pressure gage (2) to elbow (3).
- Turn fuel bleed valve petcock (1) to the left to ON position.
- Start engine and check fuel pressure gage for proper operation and leaks (TM 5-2410-233-10).



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END OF WORK PACKAGE

BLADE CUTTING EDGE AND END BITS REPLACEMENT

0169 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 2 (Item 95, WP 0185 00)

Materials/Parts

Wood cribbing, 4 in. x 4 in. x 12 in. long

Personnel Required

Three

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

NOTE

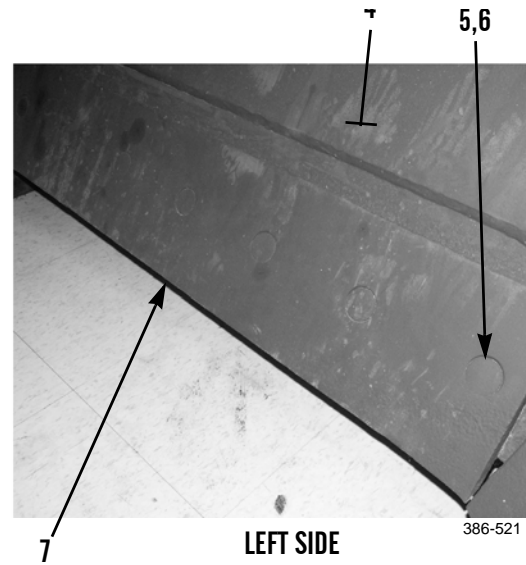
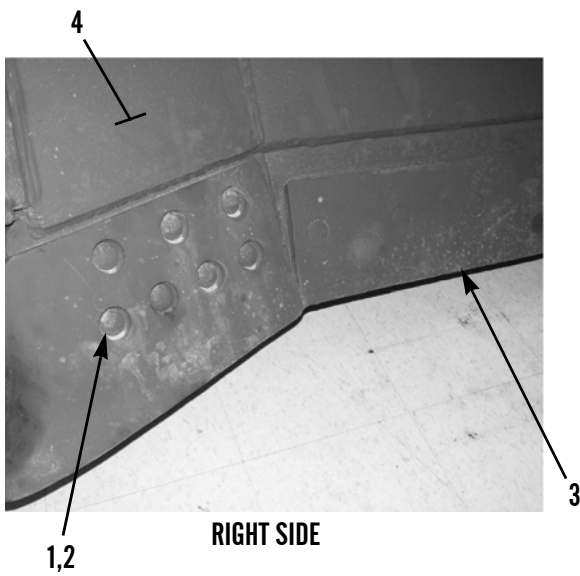
- Left side end bit weighs 39 lb (18 kg).
- Right side end bit weighs 41 lb (19 kg).
- Cutting edge weighs 275 lb (125 kg).

REMOVAL

1. Raise blade approximately 12 in. (30.5 cm) and block right and left pusharms securely at blade end.
2. Shut off engine.

REMOVAL - CONTINUED

3. Remove 7 nuts (1), bolts (2) and end bit (3) from moldboard (4).
4. Repeat step 3 to remove end bit (3) at other side of blade.
5. Remove 17 nuts (5), bolts (6) and cutting edge (7) from moldboard (4).
6. If welded reinforcements are damaged, notify Direct Support to replace by welding.



INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

CAUTION

If cutting edge is worn beyond limits, it can be rotated. If both edges of cutting edge are worn, replace cutting edge to prevent wear on moldboard.

NOTE

- Cutting edge and end bits worn to less than 3/4 in. (19 mm) from edge of moldboard are not serviceable.
- Left side end bit weighs 39 lb (18 kg).
- Right side end bit weighs 41 lb (19 kg).
- Cutting edge weighs 275 lb (125 kg).

1. Thoroughly clean mounting surfaces of moldboard (4), cutting edge (7) and end bit (3).

NOTE

Beveled edge of cutting edge must be facing moldboard.

2. Install cutting edge (7) with 17 bolts (6) and nuts (5).
3. Tighten nuts (5) to 565 lb-ft (766 Nm).
4. Install end bit (3) with seven bolts (2) and nuts (1).
5. Tighten nuts (1) to 565 lb-ft (766 Nm).
6. Repeat steps 4 and 5 to install end bit (3) at other end of blade.

**WARNING**

Wear safety glasses whenever striking metal objects with a hammer. Failure to follow this warning may result in injury.

7. Seat all bolts heads firmly in countersink with a hammer.
8. Tighten nuts (1 and 5) again to 565 lb-ft (766 Nm).
9. Raise blade and remove blocking from under pusharms.
10. Check blade for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

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THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 2 (Item 95, WP 0185 00)
- Lifting equipment

Materials/Parts

- Oil, lubricating (Item 22, 23 or 24, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)
- Tag, marker (Item 35, WP 0184 00)
- Lockwasher (2, 7, and 22)
- Wire, 1/16 in. dia x 24 in. long
- Wood cribbing, 4 in. x 4 in. x 12 in. long

References

- TM 5-2410-233-10
- WP 0157 00
- WP 0165 00
- WP 0180 00

Personnel Required

Three

Equipment Condition

- Machine parked on level surface (TM 5-2410-233-10)
- Implements fully lowered to ground (TM 5-2410-233-10)
- Hydraulic system pressure relieved (WP 0176 00)



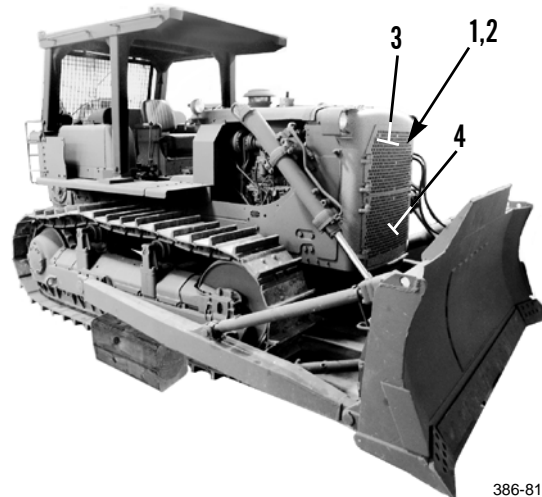
WARNING



- **Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.**

REMOVAL

1. Place wood cribbing under pusharms of tractor.
2. Remove four bolts (1), lockwashers (2) and open upper radiator grille (3).
3. Repeat step 2 to open lower radiator grille (4).



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4. Remove nut (5), bolt (6), lockwasher (7) and clamp (8) from tilt cylinder hoses (9 and 10) and radiator guard. Discard lockwasher.
5. Remove bolt (6), lockwasher (7) and clamp (11) from tilt cylinder hoses (12 and 13) and radiator guard. Discard lockwasher.

CAUTION

Before disconnecting hydraulic lines and fittings, clean area to prevent contamination and premature failure of hydraulic system.

NOTE

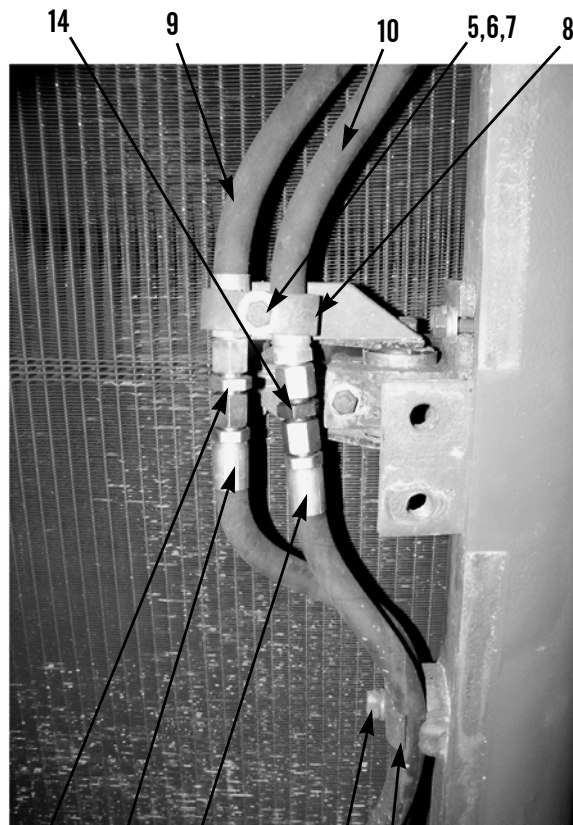
- Tag hydraulic hoses to ensure correct installation.
- Use a suitable container to catch any oil that may drain from system. Dispose of oil IAW local policy and ordinances. Ensure all spills are cleaned up.

6. Remove hose (10) and hose (13) from nipple (14) and separate hoses.
7. Repeat step 6 to separate hoses (9 and 12) from nipple (15).

NOTE

Forming a loop will close system and prevent dirt and moisture contamination.

8. Assemble hose (9), nipple (15) and hose (10).
9. Assemble hose (12), nipple (14) and hose (13).



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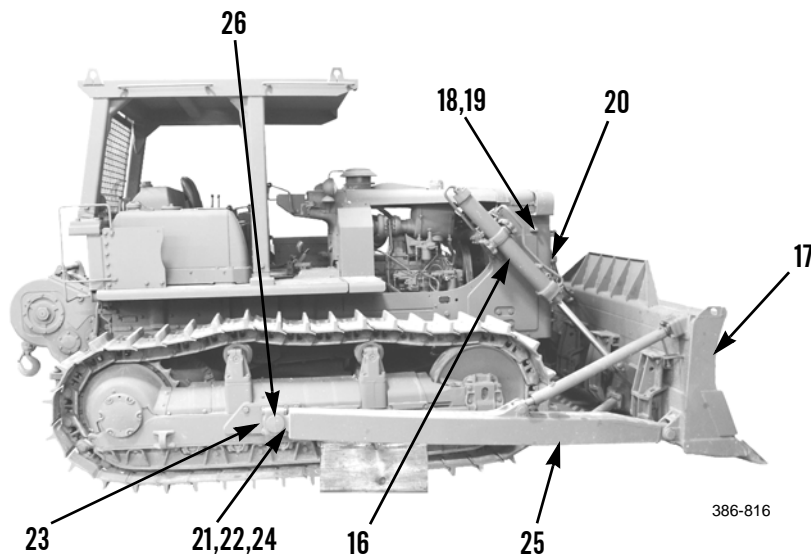
REMOVAL - CONTINUED

10. Disconnect both lift cylinders (16) from blade (17) (WP 0157 00).

CAUTION

When retracting cylinders, have an assistant guide cylinder rod to prevent damage to rod from contact with track or other parts of tractor.

11. Retract both lift cylinders (16).
12. Remove pin (18) from post (19). Line up bracket (20) on cylinder with post. Install bracket on post and secure with pin.
13. Repeat step 12 for other cylinder, and secure both cylinder rods in position with wire.
14. Remove two bolts (21), lockwashers (22), cap (23) and nuts (24) from pusharm (25).
15. Repeat step 14 on other pusharm (25).

**WARNING**

Use extreme caution and ground guide assistance to prevent injury or death.

16. Carefully back tractor away from pusharm and blade assembly (TM 5-2410-233-10).

INSTALLATION**WARNING**

Use extreme caution and ground guide assistance to prevent injury or death.

1. Drive tractor up to blade and pusharm assembly. Use assistance to guide tractor into position (TM 5-2410-233-10).
2. Place cap (23) in position on trunnion (26) and install two nuts (24), new lockwashers (22) and bolts (21). Tighten nuts IAW Torque Limits (WP 0180 00). Repeat step for other pusharm (25).
3. Remove wires securing rods to lift cylinders (16). Remove pins (18) from posts (19). Remove lift cylinders and brackets (20) from posts. Reinstall pins in posts.
4. Connect lift cylinders (16) to blade (17) (WP 0157 00).

INSTALLATION - CONTINUED

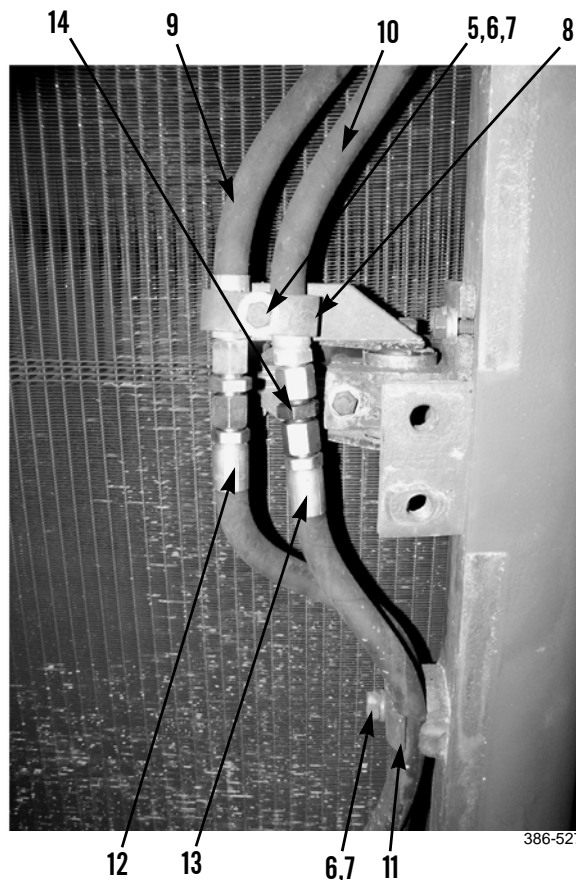


WARNING



- Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,237 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic oil under pressure can penetrate the skin, causing serious injury or death.
- At operating temperature hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulics. Failure to do so could result in injury. Insert pipe nipple, located in tractor toolbox, into hydraulic tank drain valve.

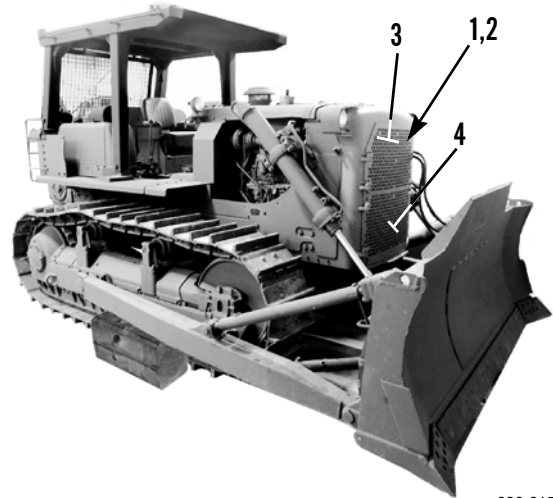
5. Relieve hydraulic system pressure (WP 0176 00).
6. Disassemble hose (13), nipple (14) and hose (12).
7. Disassemble hose (10), nipple (15) and hose (9).
8. Assemble hose (9), nipple (15) and hose (12).
9. Assemble hose (10), nipple (14) and hose (13).
10. Secure tilt cylinder hoses (12 and 13) to radiator guard with clamp (11), new lockwasher (7) and bolt (6).
11. Secure tilt cylinder hoses (9 and 10) to radiator guard with clamp (8), bolt (6), new lockwasher (7) and nut (5).



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INSTALLATION - CONTINUED

12. Close upper radiator grille (3) and install four new lockwashers (2) and bolts (1).
13. Repeat step 12 to close lower radiator grille (4).
14. Raise blade and remove wood cribbing from under pusharms.
15. Check level of oil in hydraulic tank. Add oil and bleed system as needed (WP 0165 00).
16. Check blade and pusharm assemblies for proper operation (TM 5-2410-233-10).



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END OF WORK PACKAGE

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BLADE DIAGONAL (ADJUSTABLE) BRACE REPLACEMENT

0171 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 1 (Item 94, WP 0185 00)
- Sling, nylon (Item 100, WP 0185 00)
- Lifting equipment, 200 lb capacity

Materials/Parts

- Grease, GAA (Item 15, WP 0184 00)
- Rag, wiping (Item 28, WP 0184 00)

Materials/Parts - Continued

- Lockwasher (7)
- Pin, cotter (2)

Personnel Required

Two

Equipment Condition

- Machine parked on level ground (TM 5-2410-233-10)
 - Blade lowered to the ground
-



WARNING

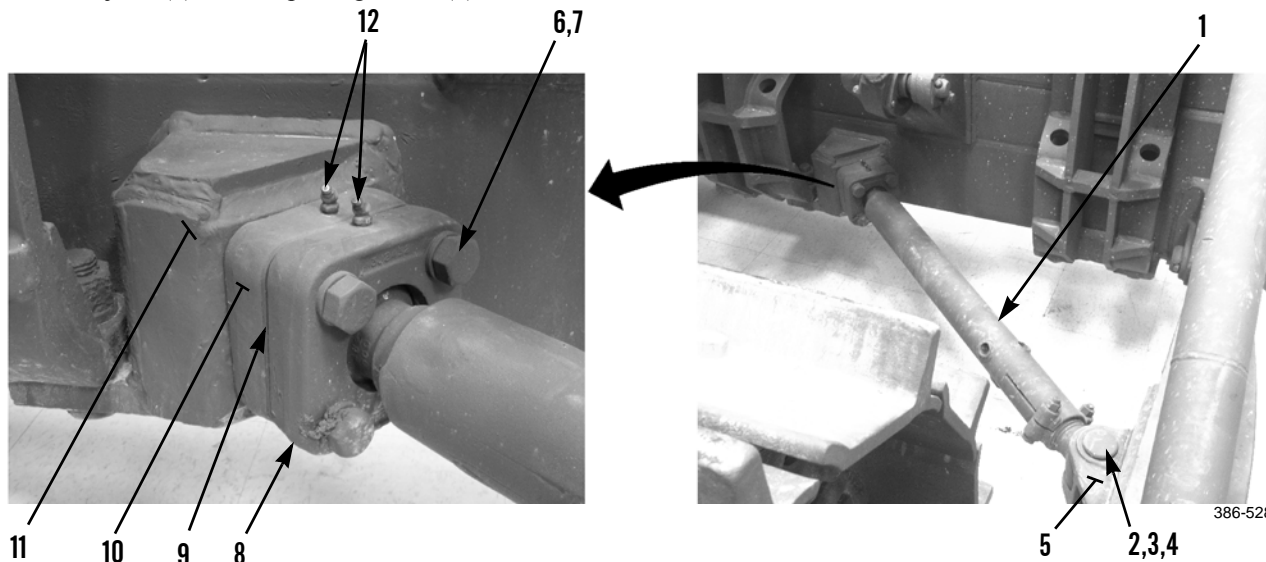
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may cause injury or death.

REMOVAL

NOTE

Blade diagonal brace weighs 91 lb (41 kg).

1. Attach a nylon sling and a suitable lifting device to brace (1).
2. Remove cotter pin (2), pin (3) and pin (4) from brace (1) and pusharm (5). Lower brace and rest on ground. Discard cotter pin.
3. Adjust sling and lifting device to support blade end of brace (1).
4. Remove four bolts (6), lockwashers (7), ball joint socket (8), shims, (9) and ball joint socket (10) from weldment (11) on blade. Discard lockwashers.
5. Use nylon sling and lifting device to remove brace (1).
6. If ball joint (8) needs replacing, brace (1) must be disassembled.



INSTALLATION

NOTE

Blade diagonal brace weighs 91 lb (41 kg).

1. Attach a nylon sling and a suitable lifting device to brace (1) and position brace at pusharm (5).
2. Install brace (1) to pusharm (5) with pin (4), pin (3) and new cotter pin (2).
3. Adjust sling and lifting device to support and position other end of brace (1) at weldment (11) on blade.
4. Install brace (1) and ball joint sockets (8 and 10) to weldment (11) with four bolts (6). Do NOT install lockwashers (7) or shims (9).
5. Measure gap between ball joint sockets (8 and 10) without shims (9).
6. Remove four bolts (6) and install shims (9) equal to measured gap plus ONE shim.
7. Install four new lockwashers (7) and bolts (6).
8. Apply GAA grease to ball and socket grease fittings (12).
9. Operate machine and check for proper operation (TM 5-2410-233-10).

END OF WORK PACKAGE

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Tools and Special Tools

- Tool kit, general mechanic's (Item 112, WP 0185 00)
- Shop equipment, common no. 2 (Item 95, WP 0185 00)
- Materials/Parts
- Rag, wiping (Item 28, WP 0184 00)
- Lockwasher (2)

Reference

WP 0180 00

Personnel Required

Two

Equipment Condition

Blade and pusharm assembly removed (WP 0170 00)



WARNING

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in injury to personnel.

REMOVAL

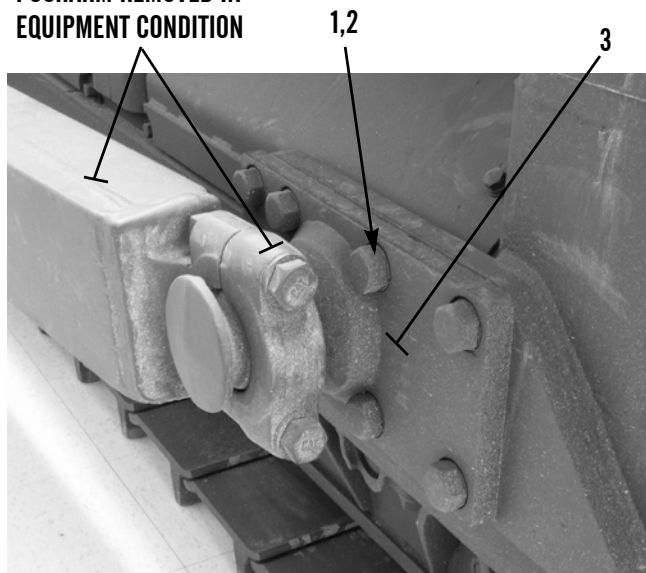
1. Remove two bolts (1) and lockwashers (2) from each side of trunnion (3). Discard lockwashers.

NOTE

Trunnion weighs 25 lb (11 kg).

2. Support trunnion (3) and remove remaining two bolts (1) and lockwashers (2) from each side. Remove trunnion. Discard lockwashers.

PUSHARM REMOVED IN EQUIPMENT CONDITION



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INSTALLATION

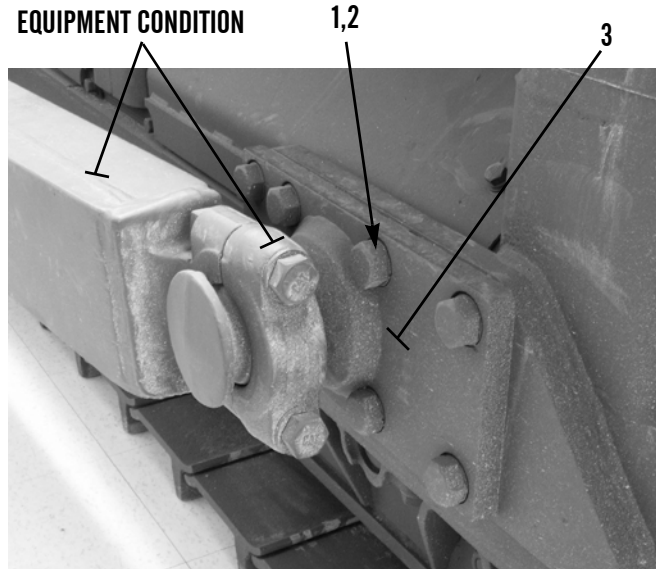
1. Wipe trunnion mounting surfaces clean before installation.

NOTE

Trunnion weighs 25 lb (11 kg).

2. Position trunnion (3) and line up bolt holes.
3. Install trunnion (3) with eight new lockwashers (2) and bolts (1). Torque bolts to 850 lb-ft (1152 Nm).
4. Install blade and pusharm assembly (WP 0170 00).

**PUSHARM REMOVED IN
EQUIPMENT CONDITION**



386-814

END OF WORK PACKAGE

RIPPER ASSEMBLY MAINTENANCE

0173 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP**Applicable Configuration**

Tractor with ripper

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Sling, nylon (Item 100, WP 0185 00)

Cribbing, 2 ft x 8 in. x 8 in.

Lifting equipment, 3,000 lb capacity

Materials/Parts

Grease, GAA (Item 15, WP 0184 00)

Materials/Parts - Continued

Rag, wiping (Item 28, WP 0184 00)

Tag, marker (Item 35, WP 0184 00)

Lockwasher (20)

References

TM 5-2410-233-10

WP 0160 00

WP 0165 00

Personnel Required

Three

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

Ripper shanks removed (WP 0175 00)

Hydraulic system pressure relieved (WP 0176 00)

**WARNING**

- **Do NOT** remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,238 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then **SLOWLY** loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury or death.
- Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

REMOVAL**NOTE**

- Beam weighs 2,000 lb (908 kg).
- Frame assembly weighs 990 lb (449 kg).
- Connecting link weighs 227 lb (126 kg).
- Ripper lift cylinder weighs 206 lb (93 kg).

1. Place cribbing underneath beam (1) and frame assembly (2).
2. Cut locking wire and remove four bolts (3) and two plates (4) from connecting link (5).
3. Attach a nylon sling and a suitable lifting device to connecting link (5).
4. Place a bar between lift cylinder (6) and frame assembly (2), to prevent damage and movement of lift cylinder during removal of two pin assemblies (7).

CAUTION

Be careful not to damage lift cylinder or valve hoses and fittings while removing pin assemblies.

NOTE

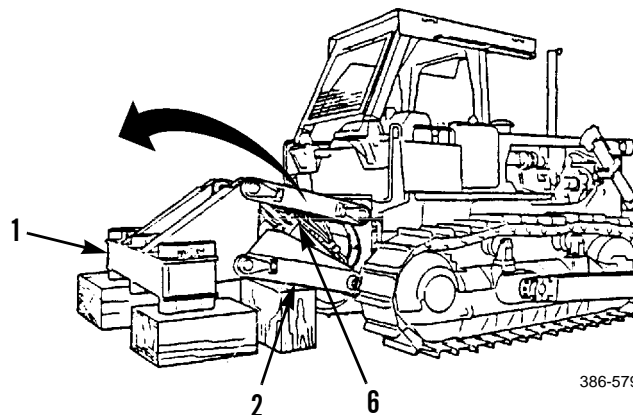
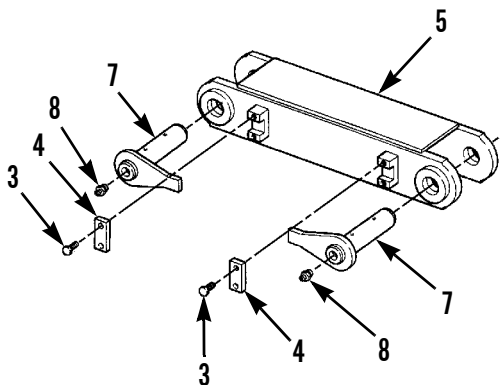
Mark all pin assemblies for installation.

5. Remove two pin assemblies (7) from connecting link (5).
6. Remove grease fitting (8) from each end of each pin assembly (7), if required.

NOTE

Mark connecting link to indicate sides, front, rear, up and down.

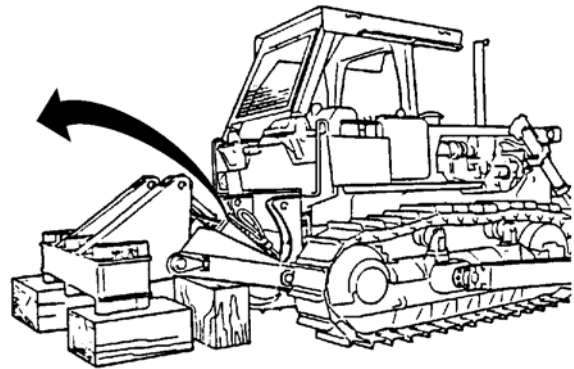
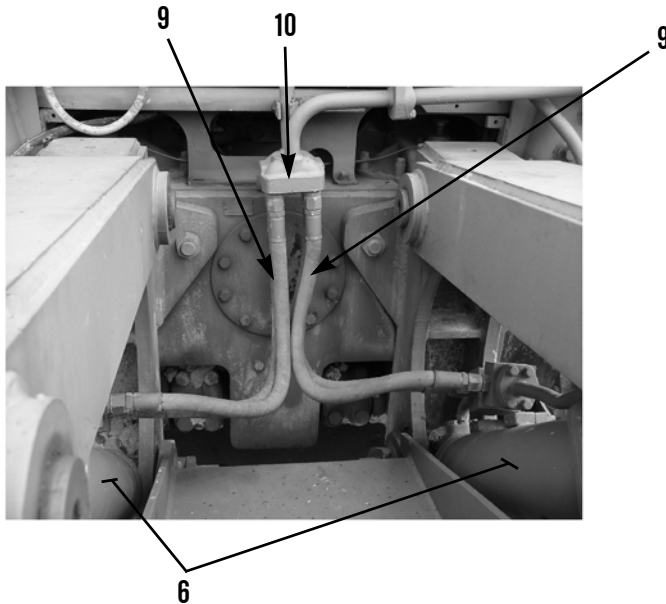
7. Lift and remove connecting link (5) from machine. Remove nylon sling and lifting device from connecting link.
8. Repeat steps 2 through 7 for connecting link (5) on other side of ripper.



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REMOVAL - CONTINUED

9. Remove four hoses (9) between manifold (10) and two lift cylinders (6) (WP 0160 00).



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10. Attach a nylon sling and a suitable lifting device to lift cylinder (6). Raise cylinder up and toward mounting bracket (11). Use chains to secure cylinder to mounting bracket.
11. Repeat step 10 for lift cylinder (6) on other side of ripper.

REMOVAL - CONTINUED

12. Install a draft pin through front pin holes (12) of beam (1).
13. Attach a suitable lifting device on bar between two lift points (13) on beam (1).
14. Remove two bolts (14) and plate (15) from pin assembly (16) securing frame assembly (2) to beam (1).
15. Repeat step 14 to remove pin assembly (16) on other side of frame assembly (2) and beam (1).
16. Remove grease fitting (17) from each end of each pin assembly (16), if required.

NOTE

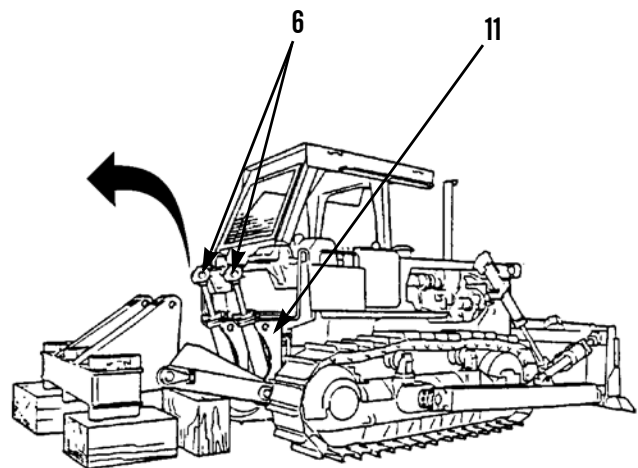
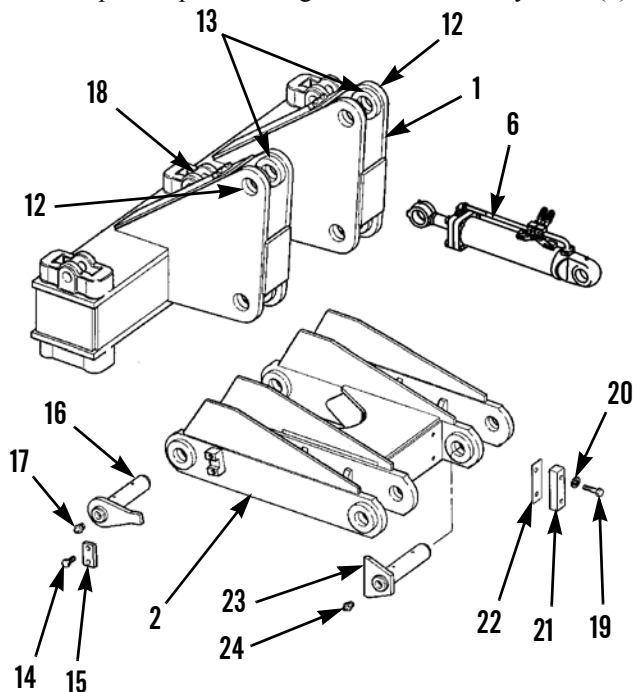
Put slack in slings before attaching chains.

17. Install a bar through bore (18) and, with a suitable three-point lifting device, remove beam (1) from frame assembly (2).
18. Attach a suitable lifting device to frame assembly (2) and lift frame so it is level with tractor. Place blocks underneath frame assembly.

NOTE

Before removal, tag lift cylinders as left and right to ensure correct installation.

19. With a nylon sling and a suitable lifting device attached, release lift cylinder (6) from mounting bracket (11). Remove two bolts (19), lockwashers (20), plate (21) and spacers (22) from each side of frame assembly (2). Discard lockwashers.
20. Remove pin assembly (23) from frame assembly (2) that attaches lift cylinder (6) to mounting bracket (11).
21. Remove grease fitting (24) from each end of pin assembly (23), if required.
22. Remove lift cylinder (6) from frame assembly (2).
23. Repeat steps 19 through 22 for other lift cylinder (6).



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24. Use a suitable lifting device to remove frame assembly (2) from back of tractor.

INSTALLATION**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death.

NOTE

- **Beam weighs 2,000 lb (908 kg).**
 - **Frame assembly weighs 990 lb (449 kg).**
 - **Connecting link weighs 227 lb (126 kg).**
 - **Ripper lift cylinder weighs 206 lb (93 kg).**
 - **Clean all parts, pins and bores thoroughly before installation.**
 - **It may be necessary to temporarily install lower pins to achieve proper alignment of frame assembly and mounting brackets.**
 - **Lubricate pin assemblies with clean grease before installation.**
1. Attach a suitable lifting device to frame assembly (2) and align frame assembly to mounting brackets (11) on back of tractor. Place blocks underneath frame assembly. Remove lifting equipment.

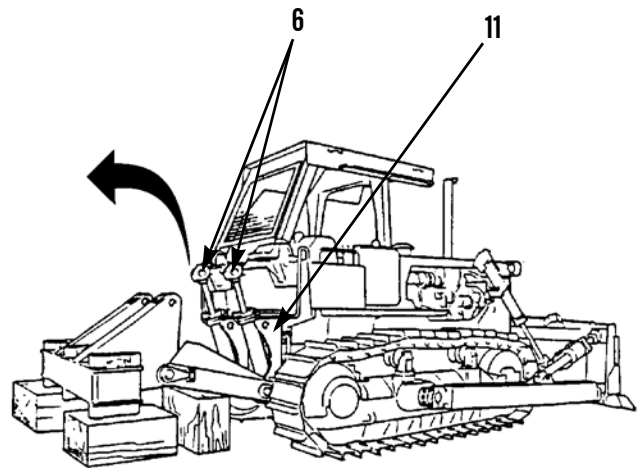
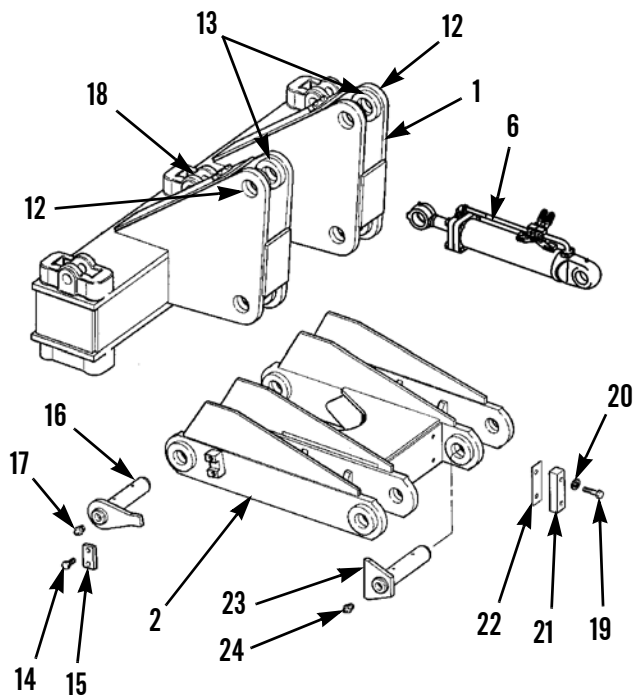
NOTE

Install lift cylinder with cylinder eye toward machine and port tubing up.

2. Use a nylon sling and a suitable lifting device to position and align lift cylinder (6) in frame assembly (2).
3. Install pin assembly (23) through inside of frame assembly (2) and mounting bracket (11), to secure lower portion of lift cylinder (6). Place a block underneath cylinder and lower lift cylinder on block.
4. If removed, install grease fitting (24) in pin assembly (23).
5. Install two spacers (22), plate (21), two new lockwashers (20) and bolts (19) to each side of frame assembly (2).
6. Repeat steps 2 through 5 for other lift cylinder (6).

INSTALLATION - CONTINUED

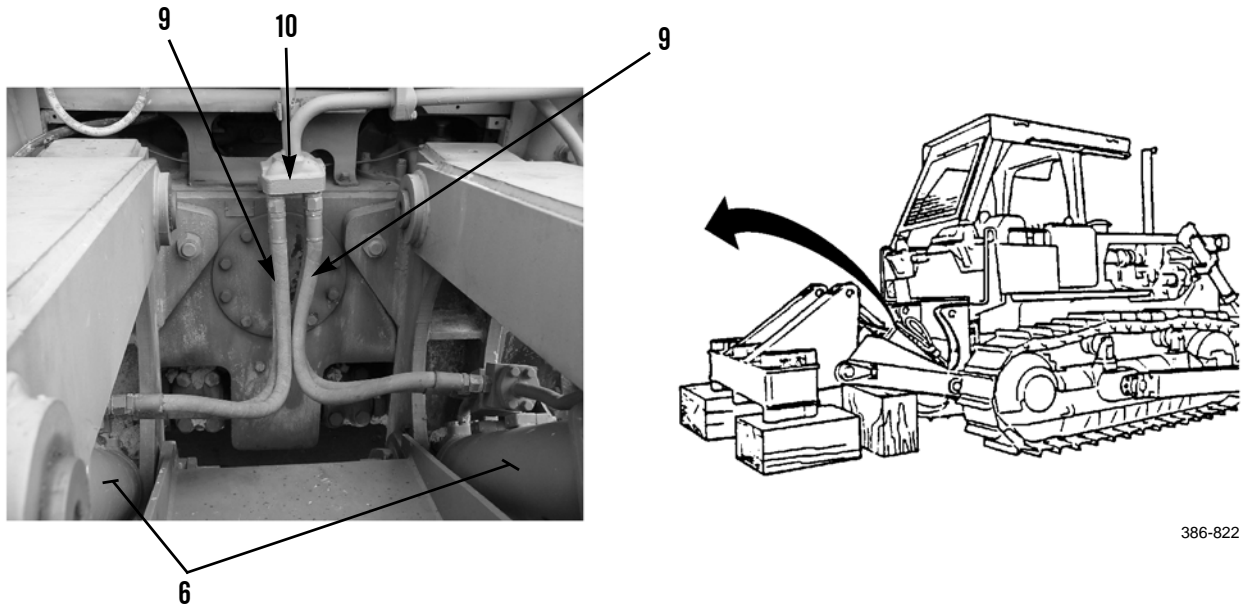
7. Use nylon sling and lifting device to raise lift cylinder (6) up and toward mounting bracket (11). Use chains to secure cylinder to mounting bracket.
8. Repeat step 7 for other lift cylinder (6).
9. Install a bar through front pin holes (12) of beam assembly (1). Install a bar through bore (18).
10. Attach a suitable three-point lifting device to two lift points (13) on beam (1) and to bar. Through bore (18). Align beam with frame assembly (2).
11. Install pin assembly (16) in outside of frame assembly (2) and through beam (1).
12. If removed, install grease fitting (17) in each pin assembly (16).
13. Install plate (15) and two bolts (14) over pin assembly (16).
14. Repeat steps 11 through 13 to install pin assembly (16) on other side.



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INSTALLATION - CONTINUED

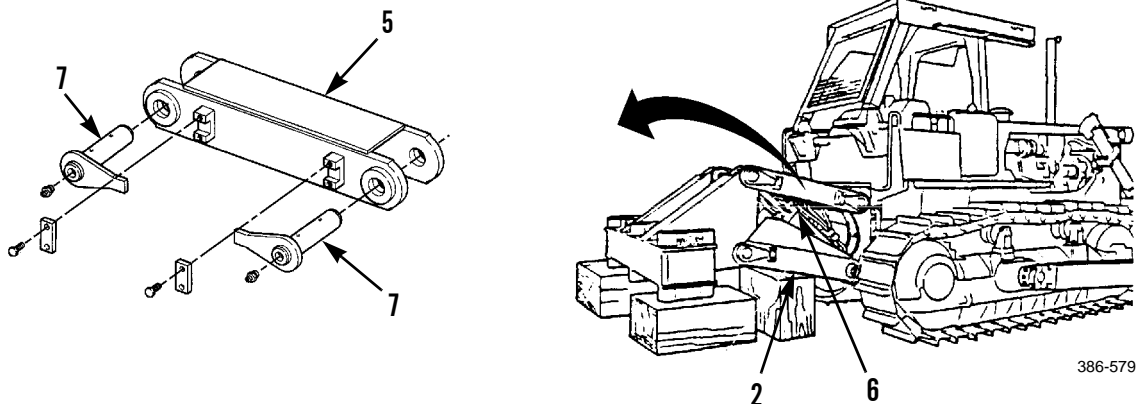
15. Install four hoses (9) between two lift cylinders (6) and manifold (10) (WP 0160 00).



CAUTION

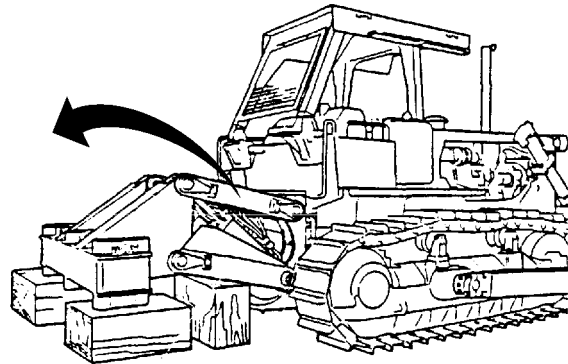
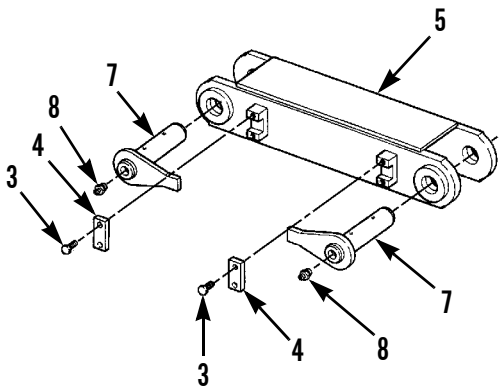
- Be careful not to damage cylinder or valve hoses and fittings while installing pin assemblies.
- Ensure markings of sides, front, rear, up and down are facing correctly before installation of connecting link.

16. Attach a nylon sling and a suitable lifting device to connecting link (5).
17. Place a bar between lift cylinder (6) and frame assembly (2), to prevent damage and movement of lift cylinder during installation of two pin assemblies (7).



INSTALLATION - CONTINUED

18. Position connecting link (5).
19. Install two pin assemblies (7) through connecting link (5).
20. If removed, install grease fitting (8) to each side of each pin assembly (7).
21. Install plate (4) at each end of connecting link (5) with two bolts (3).
22. Repeat steps 16 through 21 for connecting link (5) on other side of ripper.
23. Fill hydraulic tank and bleed system as needed (WP 0165 00).
24. Install ripper shanks (WP 0175 00).
25. Apply GAA grease to 20 ripper assembly grease fittings (TM 5-2410-233-10).
26. Check ripper for proper operation (TM 5-2410-233-10).



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END OF WORK PACKAGE

RIPPER TOOTH REPLACEMENT

0174 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Applicable Configuration

Tractor with ripper

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Blocks, 4 in. x 4 in.

References

TM 5-2410-233-10

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

REMOVAL**WARNING**

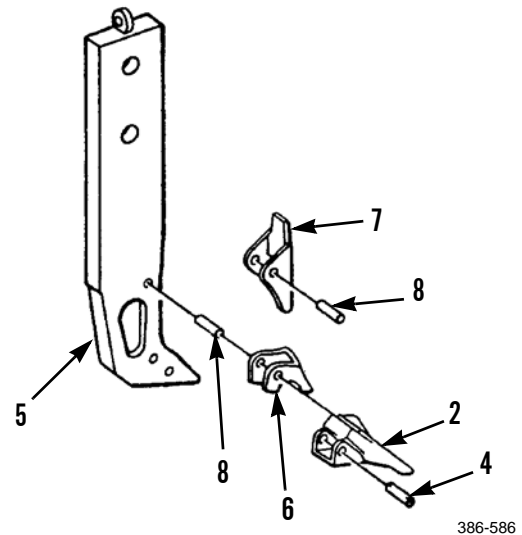
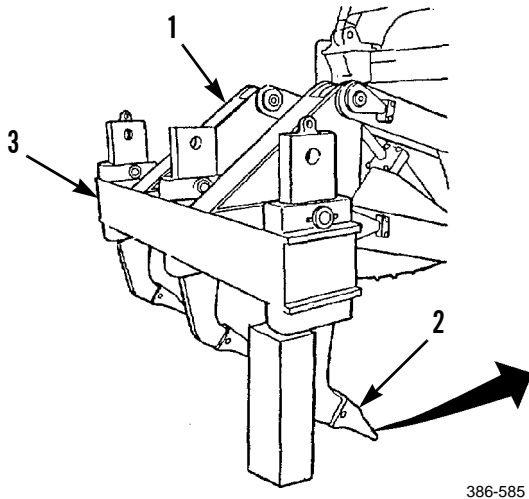
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Failure to follow this warning may result in death or injury to personnel.

1. Raise ripper assembly (1) until teeth (2) are approximately 6 in. (15.2 cm) off ground.
2. Place blocks under ripper beam (3). Shut down engine.

NOTE

Ripper tooth weighs 24 lb (11 kg).

3. While facing rear of tractor, drive pin (4) from side of tooth (2).
4. Remove tooth (2) from end of shank (5).
5. Repeat steps 3 and 4 for other teeth.
6. If guard (6) or guard (7) is damaged, drive out pin (8) and remove guard.



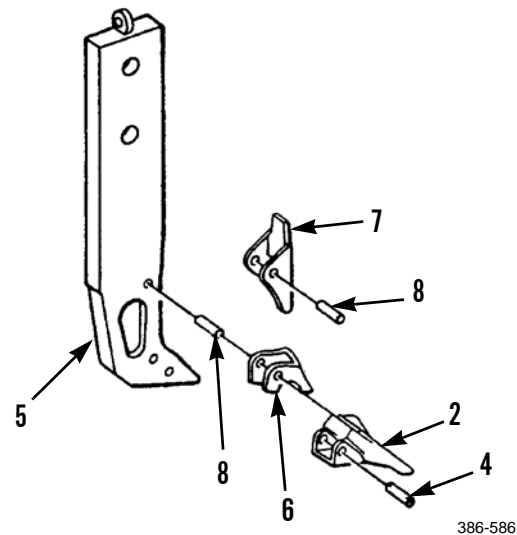
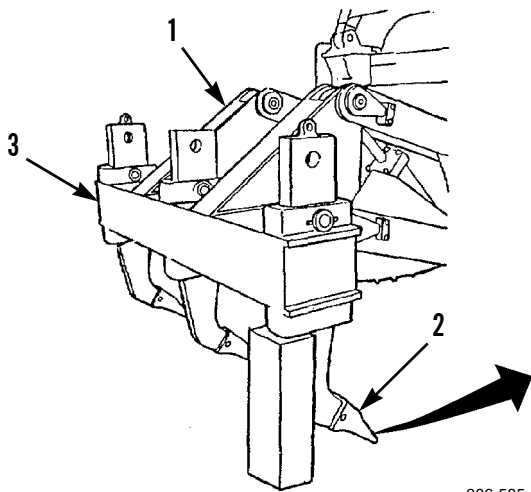
INSTALLATION

1. If removed, install guard (6) or guard (7) by positioning guard and driving in pin (8).

NOTE

Ripper tooth weighs 24 lb (11 kg).

2. Slide tooth (2) over end of shank (5). Slide tooth (2) over end of shank (5).
3. Insert pin (4) through tooth (2) and shank (5).
4. From L.H. side of tooth (2), drive pin (4) until flush on both sides of tooth.



5. Repeat steps 2 through 4 for other teeth.
6. Start engine, raise ripper, remove blocks, lower ripper and turn off engine (TM 5-2410-233-10).

END OF WORK PACKAGE

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RIPPER SHANK REPLACEMENT

0175 00

THIS WORK PACKAGE COVERS

Removal, Installation

INITIAL SETUP

Applicable Configuration

Tractor with ripper

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Shop equipment, common no. 1 (Item 94, WP 0185 00)

Sling, nylon (Item 100, WP 0184 00)

Lifting equipment, 1,000 lb capacity

Materials/Parts

Blocks, 8 in. x 8 in. x 5 ft long

Pin, cotter (5)

References

WP 0174 00

Personnel Required

Three

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

REMOVAL**WARNING**

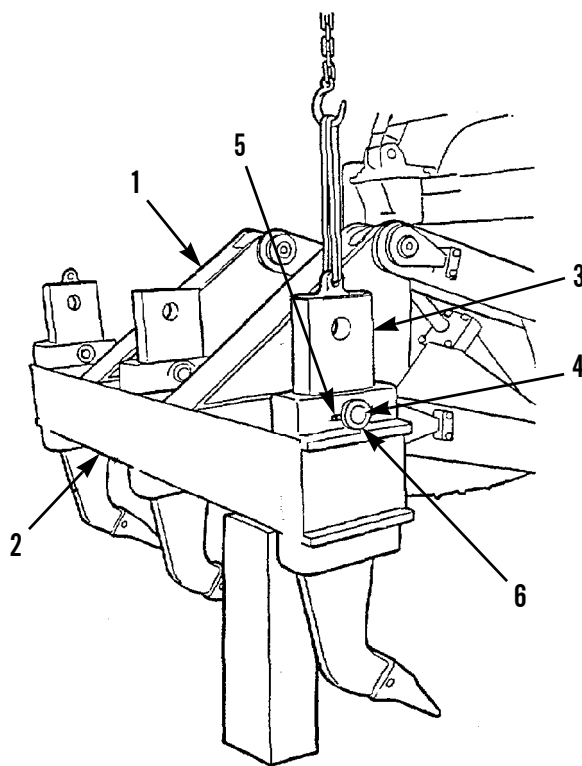
Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

1. Raise ripper (1) to its maximum raised position.
2. Place suitable block(s) under beam (2) and shut down engine.

NOTE

Ripper shank weighs 328 lb (149 kg).

3. Attach a nylon sling and a suitable lifting device to shank (3). Remove slack in lifting device.



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NOTE

- Use lifting device to take pressure off pin.
- When removing center shank, remove cotter pins and retainers from both ends of pin. Push pin to the right so that end of pin enters hole in ripper beam brace.

4. Remove cotter pin (5) and retainer (6) from each end of pin (4). Discard cotter pins.
5. Drive pin (4) from beam (2) and shank (3).
6. Lower lifting equipment until shank (3) is resting on ground.

INSTALLATION

1. Position shank (3) under beam (2).

**WARNING**

Use extreme caution when handling heavy parts. Provide adequate support and use assistance during procedure. Ensure that any lifting device used is in good condition and of suitable load capacity. Keep clear of heavy parts supported only by lifting device. Failure to follow this warning may result in injury or death to personnel.

NOTE

- Ripper shank weighs 328 lb (149 kg).
 - If installing on a hard surface, remove ripper tooth for clearance (WP 0174 00). If installing on a soft surface, a small hole about 10 in. (25.4 cm) deep can be dug to provide enough clearance.
2. Attach a nylon sling and a suitable lifting device to lifting eye in shank (3). Feed sling up through opening in bottom of beam (2).
 3. Lift shank (3) into position and insert pin (4). Drive pin through beam (2) and shank.
 4. Install retainer (6) at each end of pin (4). Align holes in retainers and pin, and install new cotter pin (5) at each end of pin.
 5. Start engine, raise ripper and remove blocks.
 6. Remove nylon sling and lifting device from shank (3).
 7. Check ripper for proper operation (TM 5-2410-233-10).
 8. Lower ripper and shut down engine (TM 5-2410-233-10).

END OF WORK PACKAGE

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CHAPTER 4
GENERAL MAINTENANCE INSTRUCTIONS

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NOTE

Refer to WP 0177 00 for *Electrical General Maintenance Instructions*.

SCOPE

These general maintenance instructions contain general shop practices and specific methods you must be familiar with to properly maintain the D7F Tractor. You should read and understand these practices and methods before starting maintenance tasks on the machine.

WORK SAFETY

1. Before starting a task, think about the risks and hazards to your safety as well as others. Wear protective gear such as safety goggles or lenses, safety shoes, rubber apron or gloves. Protect yourself against injury.
2. Observe all WARNINGS and CAUTIONS.
3. When lifting heavy parts, have someone help you. Make sure that lifting equipment is working properly, that it is suitable for the task assigned, of sufficient load capacity and is secured against slipping.
4. Always use power tools carefully.
5. Before beginning a procedure, ensure that the following conditions have been observed, unless otherwise specified:
 - a. Machine must be parked on level ground with implements lowered to the ground.
 - b. Transmission must be in N (Neutral) with transmission lock lever in locked position.
 - c. Brake lock lever must be engaged and tracks blocked.
 - d. Engine must be off.
 - e. Components which are hot at operating temperatures (i.e., cooling, exhaust and hydraulic systems) must cool down before they are removed.
 - f. Components must, however, be at operating temperature to be tested.
 - g. Battery disconnect switch must be in OFF position and/or batteries disconnected when performing electrical system maintenance.
 - h. Hydraulic system pressure must be relieved before disconnecting any hydraulic system line or fitting. Refer to *Relieving Hydraulic System Pressure* below.

RELIEVING HYDRAULIC SYSTEM PRESSURE**WARNING**

- **Do NOT remove hydraulic tank filler cap or disconnect or remove any hydraulic system line or fitting unless hydraulic system pressure has been relieved. Hydraulic system pressure can be over 2500 psi (17,238 kPa), even with engine and pump OFF. To relieve pressure, lower all hydraulic attachments to the ground and shut down engine. Move control levers through all operating positions, then SLOWLY loosen hydraulic tank filler cap. After maintenance, tighten all connections before applying pressure. Escaping hydraulic fluid under pressure can penetrate the skin, causing serious injury or death.**
- **At operating temperature hydraulic oil is hot. Allow hydraulic oil to cool before disconnecting any hydraulics. Failure to do so could result in injury.**

1. Lower all machine implements to the ground.
2. Shut down engine.
3. Move all control levers through all operating positions. Return levers to HOLD position.
4. Slowly loosen hydraulic tank filler cap and allow any pressure to escape.
5. Before beginning a task, find out how much repair, modification or replacement is needed to fix the equipment as described in this manual. Sometimes the reason for equipment failure can be seen right away and complete teardown is not necessary. Disassemble the equipment only as far as necessary to repair or replace damaged or broken parts.
6. All tags and forms attached to the equipment must be checked to learn the reason for removal from service. Check all Modification Work Orders (MWOs) and Technical Bulletins (TBs) for equipment changes and updates.
7. In some cases a part may be damaged by removal. If the part appears to be good, and other parts behind it are not defective, leave it on and continue the procedure. Here are a few simple rules:
 - a. Do not remove dowel pins or studs unless loose, bent, broken or otherwise damaged.
 - b. Do not pull bearings or bushings unless damaged. If you must get at parts behind them, pull out bearings or bushings carefully.
 - c. Replace all gaskets, seals, preformed packings, O-rings, cotter pins, spring pins, self-locking nuts, and lockwashers.

CLEANING INSTRUCTIONS**WARNING**

- Solvent cleaning compound MIL-PRF-680 Type III is an environmentally compliant and low toxic material. However, It may be irritating to the eyes and skin. Use protective gloves and goggles. Use in well-ventilated areas. Keep away from open flames and other sources of ignition.
- Improper cleaning methods and use of unauthorized cleaning solvents may injure personnel and damage equipment. Refer to TM 9-247, materials used for cleaning, preserving, abrading, and cementing ordnance materiels and related materiels including chemicals, for correct information.
- Fire extinguishers should be placed nearby when using solvent cleaning compound.
- Cloths or rags saturated with solvent cleaning compound must be disposed of IAW authorized facilities' procedures.
- Eye shields must be worn when cleaning with a wire brush. Flying rust and metal particles may cause injury.
- Particles blown by compressed air are hazardous. **DO NOT** exceed 15 psi (103 kPa) nozzle pressure when drying parts with compressed air. Use a maximum of 30 psi (207 kPa) when cleaning components. **DO NOT** direct compressed air against human skin. Failure to follow this warning may result in injury or death. Make sure air stream is directed away from user and other personnel in the area. To prevent injury, user must wear protective goggles or face shield.

1. General.

- a. Cleaning instructions are the same for the majority of parts and components of the D7F Tractor.
- b. The importance of cleaning must be thoroughly understood by maintenance personnel. Great care and effort are required in cleaning. Dirt and foreign material are a constant threat to satisfactory maintenance. The following should apply to all cleaning, inspection, repair and assembly operations.
 - (1) Clean all parts before inspection, after repair and before assembly.
 - (2) To prevent contamination, hands should be kept free of accumulation of grease, which can collect dust, dirt or grit.
 - (3) After cleaning, all parts should be covered or wrapped to protect them from dust and dirt. Parts that are subject to rust should be lightly oiled.

CLEANING INSTRUCTIONS - CONTINUED2. **External Engine Cleaning.**

- a. Protect all electrical equipment that could be damaged by the steam or moisture before steam cleaning.
- b. Cover all openings before steam cleaning.
- c. After cleaning, dry and apply a light coat of oil (Item 25, WP 0184 00) to all parts subject to rust.
- d. Clear out all tapped (threaded) holes with compressed air to remove dirt and cleaning fluid.

3. **Cleaning Disassembled Parts.**

- a. Place all disassembled parts in wire baskets for cleaning.
- b. Dry and cover all cleaned parts.
- c. Place parts on or in "racks" and hold for inspection or repair.
- d. All parts subject to rusting must be lightly oiled and wrapped.
- e. Keep all related parts and components together. Do not mix parts.

4. **Castings.**

- a. Clean inner and outer surfaces of castings and all areas subject to grease and oil with solvent cleaning compound (Item 4, WP 0184 00).
- b. Use a stiff brush to remove sludge and gum deposits.
- c. Clear out all tapped (threaded) holes with compressed air to remove dirt and cleaning solvent.

5. **Oil Passages.** Particular attention must be given to all oil passages in castings and machined parts. Oil passages must be clean and free of any obstructions.

- a. Clean passages with wire probes to break up any sludge or gum deposits.
- b. Wash passages by flushing with solvent cleaning compound (Item 4, WP 0184 00).
- c. Dry passages with compressed air.

6. **Oil Seals, Electrical Cables and Flexible Hoses.****CAUTION**

Washing oil seals, electrical cables and flexible hoses with dry cleaning solvents or mineral spirits will cause serious damage or destroy the material.

- a. Wash electrical cables and flexible hoses with a mild solution of detergent (Item 10, WP 0184 00) and water and wipe dry.
- b. Oil seals are generally damaged during removal; cleaning will not be necessary since new seals will be used in assembly.

7. **Bearings.** Refer to TM 9-214, Inspection, Care and Maintenance of Antifriction Bearings, (WP 0181 00) for complete instructions.8. **Machined Surfaces.**

- a. Clean machined surfaces with solvent cleaning compound (Item 4, WP 0184 00).
- b. Dry surfaces with compressed air.

CLEANING INSTRUCTIONS - CONTINUED

9. **Mated Surfaces.**
 - a. Remove old gasket and/or sealing compound using a wire brush and solvent cleaning compound (Item 4, WP 0184 00).
 - b. Lightly coat with oil (Item 25, WP 0184 00) and wrap all parts subject to rust before storing.
10. **Rusted Surfaces.** Clean all rusted surfaces using wire brush and crocus cloth.
11. **Oil-Bathed Internal Parts.** Wipe oil-bathed internal parts clean with a lint-free cloth.
12. **Air-Actuated Internal Parts.** Wash air-actuated internal parts clean with a lint-free cloth.
13. **Externally Exposed Parts.** Wash externally exposed parts with detergent (Item 10, WP 0184 00) and water. Rinse thoroughly and air dry.

INSPECTION INSTRUCTIONS

1. **General.** All components and parts must be carefully checked to determine if they are serviceable for reuse, if they can be repaired or if they must be scrapped.
2. **Drilled and Tapped (Threaded) Holes.**
 - a. Inspect for wear, distortion (stretching), cracks or any other damage in or around holes.
 - b. Inspect threaded areas for wear, distortion or evidence of cross-threading.
 - c. Mark all damaged areas for repair or replacement.
3. **Metal Lines, Flexible Lines (Hoses) and Fittings.**
 - a. Inspect lines for sharp kinks, cracks, bends or dents.
 - b. Inspect flexible lines for fraying, evidence of leakage or loose fittings or connectors.
 - c. Check all fittings and connectors for thread damage. Check for hex heads that are worn or rounded by poorly fitting wrenches.
 - d. Mark all damaged material for repair or replacement.
4. **Castings.**
 - a. Inspect all ferrous and nonferrous castings for cracks using a magnifying glass and strong light.
 - b. Particularly check areas around studs, pipe plugs, threaded inserts and sharp corners. Replace all cracked castings.
 - c. Inspect machined surfaces for nicks, burrs or raised metal. Mark damaged areas for repair or replacement.
 - d. Inspect all pipe plugs, pipe plug openings, screws and screw openings for damaged or stripped threads.
 - e. Check all gasket mating surfaces, flanges on housings and supports for warpage with a straightedge or surface plate. Inspect mating flanges for discoloration that may indicate persistent oil leakage.
5. **Bearings.** Refer to TM 9-214 (WP 0181 00) for inspection of bearings. Damaged bearings must be replaced.
6. **Studs, Bolts and Screws.** Replace if threads are damaged, bent, loose or stretched.
7. **Gears.**

NOTE

When gear teeth wear limits are not established, good judgement is required to determine if gear replacement is necessary.

- a. Inspect all gears for cracks using a magnifying glass and strong light. No cracks are permissible.
- b. Inspect gear teeth for wear, sharp fins, burrs, and galled or pitted surfaces.
- c. Check keyway slots for wear or damage. If keyways are worn, damaged or elongated, replace gear.

INSPECTION INSTRUCTIONS - CONTINUED

8. **Bushing and Bushing Type Bearings.**
 - a. Check all bushings and bushing type bearings for secure fit, evidence of overheating, wear, burrs, nicks and out-of-round condition. Replace as necessary.
 - b. Check for dirt in lubrication holes or grooves. Holes and grooves must be clean and free from damage.
9. **Oil Seals.** Oil seals are mandatory replacement items.
10. **Core Hole Expansion Plugs.** Inspect for leakage. Replace plugs when leakage is present.
11. **Machine-Tooled Parts.** Inspect for cracks, breaks, elongated holes, wear and chips. Replace any damaged parts.
12. **Machined Surfaces.** Inspect for cracks, evidence of wear, galled or pitted surface, burrs, nicks and scratches.
13. **Mating Surfaces.** Inspect for remains of old gasket, seal, secure fit, pitting and evidence of leakage.
14. **Rusted Surfaces.** Inspect for pitting, holes and severe damage.
15. **Oil-Bathed Internal Parts.** Inspect for cracks, nicks, burrs, evidence of overheating and wear.
16. **Internal Parts.** Inspect for cracks, nicks, burrs, evidence of overheating and wear.
17. **Externally Exposed Parts.** Inspect for breaks, cracks, rust damage and wear.
18. **Springs.** Inspect for broken, collapsed and twisted coils.

REPAIR INSTRUCTIONS

1. **General.**
 - a. Any repair procedure peculiar to a specific part or component is covered in the work package relating to that item.

CAUTION

Repaired items must be thoroughly cleaned to remove metal chips and abrasives, to prevent these from entering working parts of the machine.

- b. After repair, clean all parts thoroughly to prevent dirt, metal chips or other foreign material from entering any working parts.
2. **Castings.**
 - a. Only minor repairs to machined surfaces, flanges and gasket mating surfaces are permitted. Remove minor nicks, burrs and scratches with:
 - (1) Fine mill file.
 - (2) Crocus cloth dipped in cleaning solvent.
 - (3) Lapping across a surface plate.
 - b. Remachining of machined surfaces to repair damage, warpage or uneven surfaces is not permitted. Replace castings.
 - c. Repair damaged threaded pipe plug or screw threads with a tap. Repair oversize holes with threaded inserts.

REPAIR INSTRUCTIONS - CONTINUED**3. Studs.**

- a. Repair minor thread damage with a thread die.
- b. Replace studs having stripped or damaged threads as outlined below:
 - (1) Remove using a stud remover. Back studs out slowly to avoid heat buildup and seizure that can cause stud to break off.

CAUTION

Refer to TC 9-237, Operator's Circular for Welding Theory and Application, (WP 0181 00) to avoid damage to castings if welding method is used.

- (2) If studs break off too short to use a stud remover, use a stud extractor to remove or use "welding method": weld bar stock or a nut to stud and remove with a wrench.
- (3) Install replacement stud slowly to prevent heat buildup and snapping off.

4. Gears.

- a. Remove gears using pullers.
- b. Only minor repairs to gears are permitted. Remove minor nicks, burrs or scratches on gear teeth with:
 - (1) Fine mill file
 - (2) Crocus cloth dipped in solvent cleaning compound (Item 4, WP 0184 00).

5. **Bushings and Bushing Type Bearings.** When bushings and bushing type bearings seize to a shaft and spin in the bore, associated parts must also be replaced.

6. Oil Seals.

- a. Remove oil seals by pressing or prying out, being careful not to damage casting or adapter bore.
- b. Always install new seal in bore using proper seal installation tool.

7. **Painting.** Upon installation, restored parts must be painted IAW TB 43-0209 (WP 0181 00).

LUBRICATION INSTRUCTIONS**NOTE**

Refer to TM 5-2410-233-10 and to Unit Maintenance PMCS (WP 0008 00 and WP 0009 00) for detailed, illustrated instructions on proper lubrication. The following are some general practices to remember:

1. Use the correct lubricant.
2. Keep lubricants clean.
3. Clean all fittings and area around fill and drain points before lubrication.
4. Lubricate clean disassembled and new parts to prevent rust.

STANDARD TOOL REQUIREMENTS

1. The following are general practices regarding the use of tools:
 - a. Always use the proper tool kit and tools for the procedure being performed.
 - b. Ensure that tools are clean and lubricated to reduce wear and to prevent rust.
 - c. Keep track of tools. Do not be careless with them.
 - d. Return tools to toolbox when finished with repair or maintenance.
 - e. Return toolboxes and tools to tool storage when not in use.

GENERAL MAINTENANCE INSTRUCTIONS - CONTINUED

0176 00

STANDARD TOOL REQUIREMENTS - CONTINUED

- f. Inventory tools before and after each use.
2. Some maintenance tasks may require special or fabricated tools. The “Initial Setup” of the procedure will specify any special or fabricated tools needed to perform that procedure. Use these special tools only for the maintenance procedures for which they are designed or called out. If you are unfamiliar with a required tool, see your supervisor.

APPLYING TORQUE

1. When tightening fasteners, use torque value as specified in *Torque Limits*, WP 0180 00.
2. If a unique torque value is required, it will be provided in the procedural step of the task.

TAGGING INSTRUCTIONS

1. Use marker tags (Item 35, WP 0184 00) to identify all electrical wires, fuel, oil, coolant, and hydraulic lines, and any other parts which may be hard to identify or replace later. Fasten tags to parts during removal by wrapping wire fasteners around or through parts and twisting ends together. Position tags to be out of the way during cleaning, inspection, and repair. Mark tags with a pencil, pen or marker.
2. Whenever possible, identify electrical wires with the number of the terminal or wire to which it connects. If no markings can be found, tag both wires or wire and terminal, and use the same identifying mark for both. If you cannot tag a wire because it must fit through a small hole or you cannot reach it, write down the description of the wire and the point to which it connects or draw a simple diagram on paper. Be sure to write down enough information so you will be able to properly connect the wires during assembly. If you need to identify a loose wire, look for identifying number near end of the wire, stamped on a permanent metal tag. Compare the number to wire numbers on the appropriate electrical schematic.
3. Identify fuel, oil, coolant, and hydraulic lines when you are taking off more than one line at the same time. Mark tags with points to which lines and hoses must be connected. If it is not obvious which end of a line goes where, tag each end of the line.
4. Identify and tag other parts as required by name and installed location.

LINES AND PORTS

To keep dirt from contaminating fluid systems when removing and installing fuel, oil, coolant, and hydraulic lines, perform the following steps:

- a. Clean fittings and surrounding area before disconnecting lines.
- b. Cover, cap, plug (Item 2, WP 0184 00) or tape lines and ports after disconnecting lines. When these are not available, use plastic bags and rubber bands, clean rags (Item 28, WP 0184 00), duct tape (Item 36, WP 0184 00) or other similar materials to prevent dirt from entering system.
- c. Ensure that new and used parts are clean before installing.
- d. Replace all removed tiedown straps.
- e. Wait to remove cover, cap, plug or tape from lines and ports until just before installing lines.

FLUID DISPOSAL**WARNING**

When servicing this vehicle, performing maintenance, or disposing of materials such as engine coolant, hydraulic fluid, lubricants, battery acids or batteries, consult your unit/local hazardous waste disposal center or safety office for local regulatory guidance. If further information is needed, please contact The Army Environmental Hotline at 1-800-872-3845.

Dispose of contaminated drained fluids in IAW the Standard Operating Procedures (SOP) of your unit.

END OF WORK PACKAGE

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ELECTRICAL GENERAL MAINTENANCE INSTRUCTIONS

0177 00**THIS WORK PACKAGE COVERS**

Receptacle Connector Repair
 Waterproof Connector Repair
 Military Connector Repair
 Ring Terminal Repair

Splicing Wires
 Electrical Ground Points
 Multimeter Usage
 Relay Inspection and Test

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, common no. 1 (Item 94, WP 0185 00)

Materials/Parts

Cloth, abrasive (Item 5, WP 0184 00)
 Detergent (Item 10, WP 0184 00)
 Flux, soldering (Item 11, WP 0184 00)

Materials/Parts - Continued

Grease, electrically conductive (Item 16, WP 0184 00)
 Insulating sleeving (Item 17, WP 0184 00)
 Insulating varnish, electrical (Item 18, WP 0184 00)
 Solder, lead-tin alloy (Item 34, WP 0184 00)
 Tag, marker (Item 35, WP 0184 00)

NOTE

- **Use electrically conductive grease on unprotected (exposed to weather) electrical connectors before connections are made.**
- **Use electrical insulating varnish on all electrical connections that are mounted outside of machine and are exposed to harsh weather and/or spray from the ground.**
- **Tag and mark position of wires in electrical connector to ensure correct installation.**

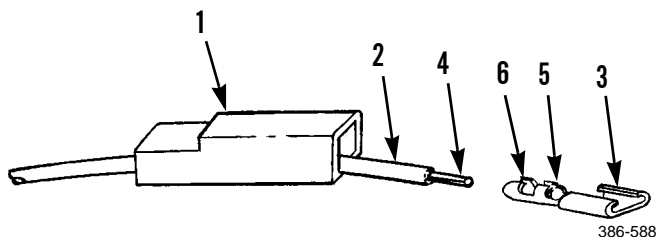
RECEPTACLE CONNECTOR REPAIR

1. While releasing locking tab through front of connector (1), push wire (2) and receptacle (3) through front of connector.
2. If defective, remove receptacle (3) from wire (2) by cutting through wire just behind receptacle. Discard receptacle.

NOTE

Perform steps 3 through 6 only if receptacle was removed.

3. Slide connector (1) back on wire (2).
4. Strip insulation of wire (2) to expose ¼ in. (6 mm) length of metal strands (4).
5. Securely crimp tabs (5) of new receptacle (3) over metal strands (4).
6. Crimp tabs (6) of receptacle (3) over insulation of wire (2).
7. Slide connector (1) forward over receptacle (3) until locking tab of receptacle snaps into place.

**WATERPROOF CONNECTOR REPAIR**

1. Remove end cover (7) and gasket (8) from front of connector (9).
2. Remove seal (10) from rear of connector (9) and slide seal back on wire (11).

NOTE

Perform the following steps for each wire of connector.

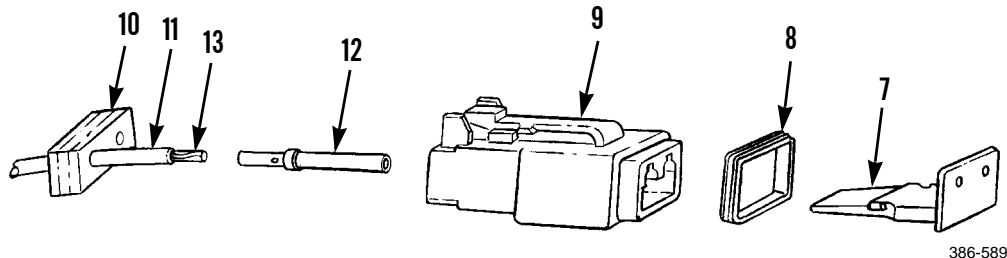
3. While releasing locking tab through front of connector (9), remove wire (11) and pin (12) through rear of connector.
4. If defective, remove pin (12) from wire (11) by cutting just behind pin. Discard pin.

NOTE

Perform steps 5 through 8 only if pin was removed.

5. Strip insulation of wire (11) to expose ¼ in. (6 mm) length of metal strands (13).
6. Insert metal strands (13) of wire (11) fully into rear of new pin (12).
7. Securely crimp pin (12) to metal strands (13) of wire (11).
8. Push pin (12) into rear of connector (9) until fully seated.
9. Install seal (10) on rear of connector (9).
10. Install gasket (8) and end cover (7) on front of connector (9).

WATERPROOF CONNECTOR REPAIR - CONTINUED



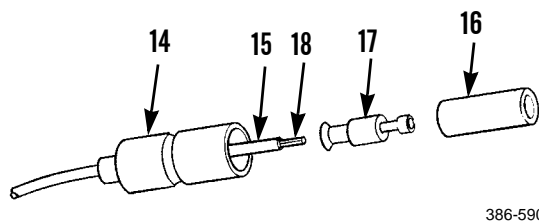
MILITARY CONNECTOR REPAIR

1. Slide shell (14) back on wire (15) to expose sleeve (16).
2. Remove sleeve (16) from terminal (17) by pulling sleeve forward.
3. If defective, remove terminal (17) from wire (15) by cutting through wire just behind terminal. Discard terminal.

NOTE

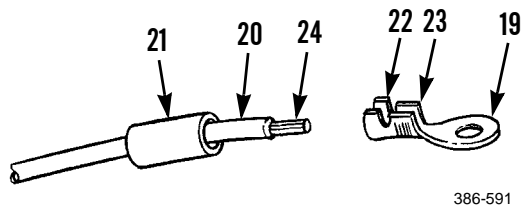
Perform steps 4 through 6 only if terminal was removed.

4. Strip insulation of wire (15) to expose length of metal strands (18) equal to depth of new terminal (17).
5. Securely crimp new terminal (17) to metal strands (18) of wire (15).
6. Install sleeve (16) to terminal (17) by pushing sleeve over front of terminal until fully seated.
7. Slide shell (14) up wire (15) and over sleeve (16).



RING TERMINAL REPAIR

1. Remove ring terminal (19) from wire (20) by cutting through wire just behind heat shrink tubing (21). Discard terminal.
2. Cut new heat shrink tubing (21) to length sufficient to cover tabs (22 and 23) of ring terminal (19) and ¼ in. (6 mm) of wire (20).
3. Slide heat shrink tubing (21) back on wire (20).
4. Strip insulation of wire (20) to expose proper length of metal strands (24).
5. Securely crimp tabs (23) of new ring terminal (19) over metal strands (24).
6. Crimp tabs (22) of ring terminal (19) over insulation of wire (20).
7. Slide heat shrink tubing (21) over tabs (22 and 23) of ring terminal (19).
8. Using heat gun, apply heat to heat shrink tubing (21) until tubing snugly conforms to ring terminal (19) and insulation of wire (20).



SPLICING WIRES**NOTE**

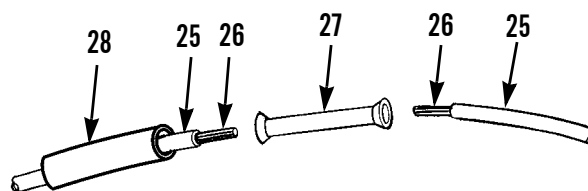
The selection of crimping tool and type of splice connectors is optional.

1. Inspect each end of wire (25). Trim insulation and metal strands (26) of wire back, as necessary, to ensure integrity of wire.
2. Strip each end of wire (25) to expose length of metal strands (26) to suit type of splice connector (27) used.

NOTE

Perform steps 3 and 4 at each end of splice connector.

3. Insert metal strands (26) of wire (25) fully into splice connector (27).
4. Cut length of insulation sleeving (28) at least 3/4 in. (19 mm) longer than length of splice connector (27) and slide insulation sleeving over one wire (25).
5. Securely crimp splice connector (27) to metal strands (26) of wire (25).
6. Center insulation sleeving (28) over splice connector (27) and use heat gun to shrink insulation sleeving.



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ELECTRICAL GROUND POINTS

Many electrical problems are the result of poor ground connections. Ensure that ground connections are good by performing the following steps:

**WARNING**

Although battery disconnect switch must be ON to test electrical circuit voltage, turn battery disconnect switch to OFF before performing resistance tests or replacing parts. Failure to follow this warning may result in injury to personnel and damage to parts or equipment.

- a. Remove screw, lockwasher, nut, etc. connecting ground wire terminal to machine ground point.
- b. If necessary, clean mounting hardware, wire terminal, and ground point with detergent and a scrub brush.
- c. Remove any rust or corrosion from ground point with a wire brush and abrasive cloth.
- d. Replace defective mounting hardware and wire terminal as necessary.
- e. Install wire terminal to ground point with screw, lockwasher, nut, etc. and tighten securely.

MULTIMETER USAGE

1. **General.** A multimeter is used to troubleshoot the electrical system of the machine. The multimeter ohms scale is used to test for continuity, shorts and resistance. The multimeter voltmeter scale is used to test voltage levels in the electrical system.
2. **Continuity Tests.** Continuity tests are performed to check for breaks in a circuit (such as a fuse, switch, light bulb connector or electrical wiring).

MULTIMETER USAGE - CONTINUED**NOTE**

If readout will not zero properly, replace batteries and repeat zeroing procedure. If readout will not zero after batteries have been replaced, notify your supervisor.

a. Zero Multimeter.

- (1) Set multimeter to ON.
- (2) Select OHMS.
- (3) Select LOWEST VOLTAGE/OHMS scale.
- (4) Touch black and red probes together and check for a zero indication on digital readout.

CAUTION

Before performing a continuity test, always place battery disconnect switch in OFF position and disconnect circuit to be tested. Failure to follow this caution may damage multimeter.

b. Testing for Continuity.

- (1) Zero multimeter.
- (2) Connect black and red probes to both terminals of circuit being tested.
- (3) Observe readout and interpret results as follows:
 - (a) If readout indicates any numeric value, circuit has continuity.
 - (b) If readout does not indicate any numeric value, or value is over the limits of the meter, circuit is open.

CAUTION

Before performing a continuity test, always place battery disconnect switch in OFF position and disconnect circuit to be tested. Failure to follow this caution may damage multimeter.

c. Testing for Shorts. A short (or short circuit) occurs when two circuits that should not be connected have continuity with each other. A short also occurs when a circuit that should not touch ground has continuity with ground.

- (1) Zero multimeter.
- (2) Connect black probe to one pin and red probe to either ground or another pin.
- (3) Observe readout and interpret results as follows:
 - (a) If readout indicates any numeric value above 0 (zero) but less than the meter's limits, circuits are shorted or circuit is grounded, if testing to ground.
 - (b) If readout does not indicate a numeric value or value does not change when connected to circuit(s) in question, circuits are not shorted.
 - (c) If readout jumps or flickers, circuits are shorted or grounded intermittently.

CAUTION

Before performing a continuity test, always place battery disconnect switch in OFF position and disconnect circuit to be tested. Failure to follow this caution may damage multimeter.

d. Testing for Resistance. Allowable resistance readings depend on circuit being tested. Refer to the particular section dealing with that circuit or component for allowable readings.

- (1) Zero multimeter.

MULTIMETER USAGE - CONTINUED

- (2) Select OHMS.
- (3) Select lowest VOLTAGE/OHMS range. If test specifies ohms range, select required range.
- (4) Connect black and red probes across circuit to be tested.
- (5) Observe readout and interpret results as circuit resistance.

3. **Voltage Tests.**

a. **Measuring DC Voltage.**

- (1) Set multimeter to ON.
- (2) Select lowest possible DC VOLTAGE range that is still higher than voltage to be measured.
- (3) Connect red probe to positive (+) pin and black probe to negative (-) pin.
- (4) Observe readout and interpret results as DC voltage in circuit being tested.

b. **Measuring DC Voltage Drop.**

NOTE

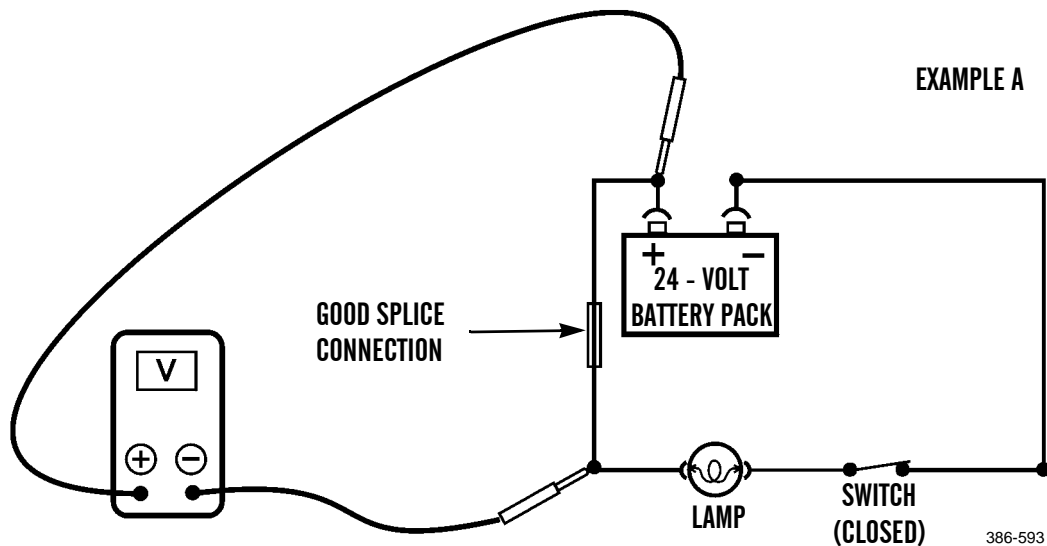
Voltage drop is defined as the amount of voltage loss that occurs through all or part of a circuit due to resistance.

- (1) Set multimeter to ON.
- (2) Select lower possible DC VOLTAGE range that is still higher than voltage to be measured.
- (3) Connect red probe to test location closest to positive (+) side. Connect probe to test location closest to ground.
- (4) Observe readout and interpret results as DC voltage in circuit being tested.

c. **DC Voltage Drop Examples.**

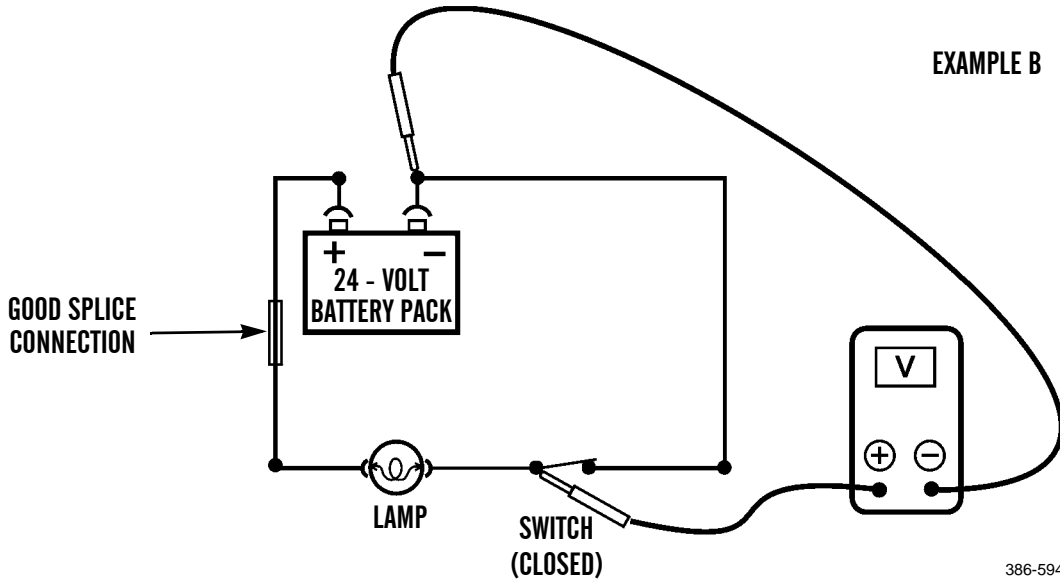
(1) **Good Voltage Drop.**

- (a) Example A shows how to measure voltage drop across a good splice connection. Voltage reading at multimeter should be low (about 0.1 volt). This means that resistance across this splice is low, resulting in low voltage drop.

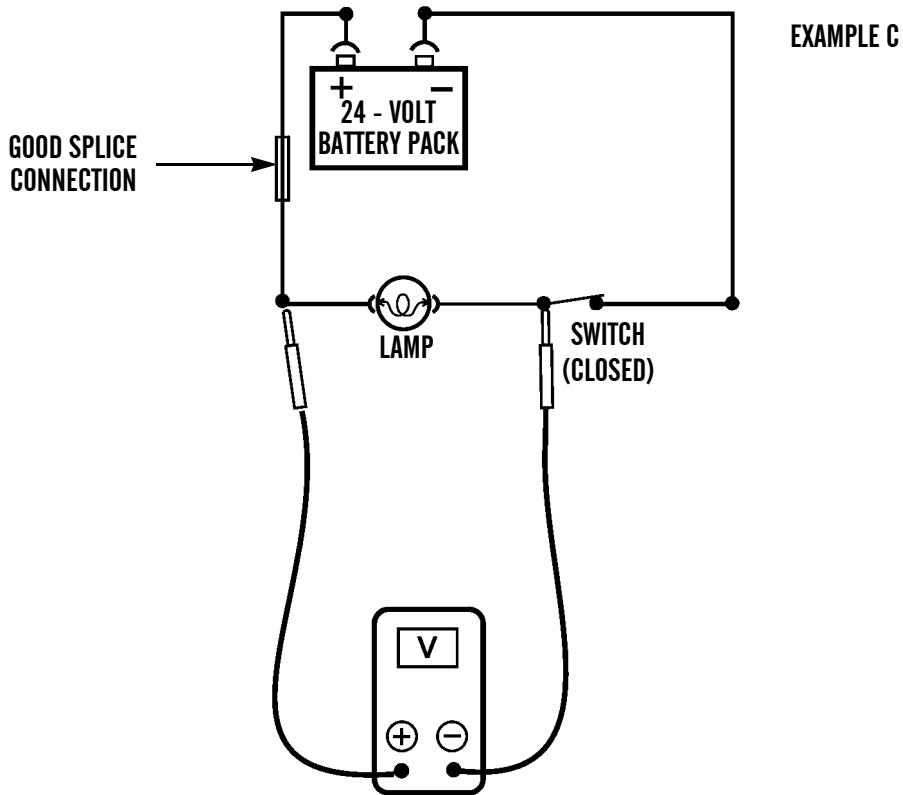


- (b) Example B shows how to measure voltage drop across a closed switch. Voltage reading at multimeter also should be low (about 0.1 volt). This means that resistance across this switch is low, resulting in low voltage drop.

MULTIMETER USAGE - CONTINUED



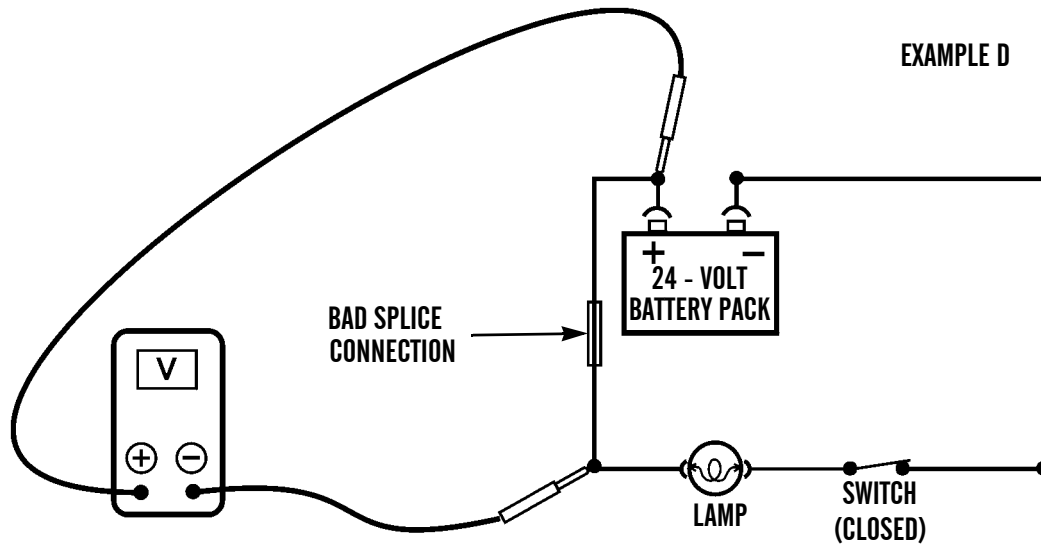
- (c) Example C shows how to measure voltage drop across a load, in this case a lamp. If voltages in Examples A and B are 0.1 volt each, voltage reading at multimeter in Example C will equal 23.8 volts. This is because the sum of all voltage drops in a circuit is equal to the source voltage.



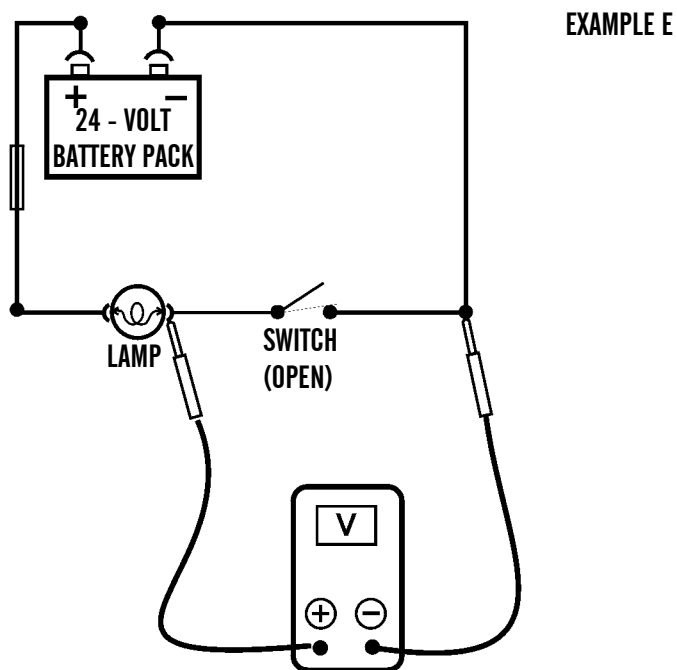
MULTIMETER USAGE - CONTINUED

(2) Bad Voltage Drop.

- (a) Example D shows how to measure voltage drop across a bad splice connection. The voltage reading at multimeter is high (for example 7 volts). This means the resistance across this splice is high, resulting in high voltage drop. This would cause lamp to be dimly lit when switch is closed.



- (b) Example E shows how to measure voltage drop across an open circuit, in this case an open switch. This could also be used to demonstrate the reading in a circuit with a broken wire. The voltage reading at multimeter will be approximately 24 volts. This means that an open circuit or an open switch has infinite resistance, causing all voltage to be lost.



RELAY INSPECTION AND TEST

1. **Inspecting Relays.**
 - a. Check for bent or damaged pins.
 - b. Check for burned or damaged relay case.
2. **Testing Relays.**

NOTE

When testing relays, always refer to circuit diagram printed or stamped on relay case.

- a. Using a multimeter, check for continuity across relay coil.
- b. Using a multimeter, check open or closed contacts within relay.

END OF WORK PACKAGE

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GROUND HANDLING PROCEDURES**0178 00****THIS WORK PACKAGE COVERS**

Operating/Adjusting Hydraulic Jack Stands, Raising Tractor off Ground, Lowering Tractor to Ground

INITIAL SETUP**Tools and Special Tools**

Tool kit, general mechanic's (Item 112, WP 0185 00)
 Shop equipment, common no. 2 (Item 95, WP 0185 00)
 Cap, protective, dust (Item 15, WP 0185 00)
 Collar, shaft (Item 17, WP 0185 00)
 Coupling assembly (Item 18, WP 0185 00)
 Coupling half, quick (Item 19, WP 0185 00)
 Cylinder assembly, actuating (Item 22, WP 0185 00)
 Hose assembly (Item 32, WP 0185 00)
 Nipple, pipe (Item 47, WP 0185 00)
 Pin, shoulder (Item 57, WP 0185 00)
 Plug, pipe (Item 66, WP 0185 00)
 Plug, protective, dust (Item 67, WP 0185 00)
 Pumping unit, hydraulic (Item 85, WP 0185 00)
 Reducer, pipe (Item 87, WP 0185 00)
 Reducer, pipe (Item 88, WP 0185 00)
 Repair tool, special purpose (Item 91, WP 0185 00)

Tools and Special Tools - Continued

Stand assembly (Item 104, WP 0185 00)
 Stand, lifting (Item 105, WP 0185 00)
 Tee, pipe (Item 110, WP 0185 00)
 Tool, special (Item 115, WP 0185 00)
 Valve, needle (Item 116, WP 0185 00)

Materials/Parts

Wood blocks, 8 in. x 8 in. x 18 in. long

References

WP 0120 00

Personnel Required

Two

Equipment Condition

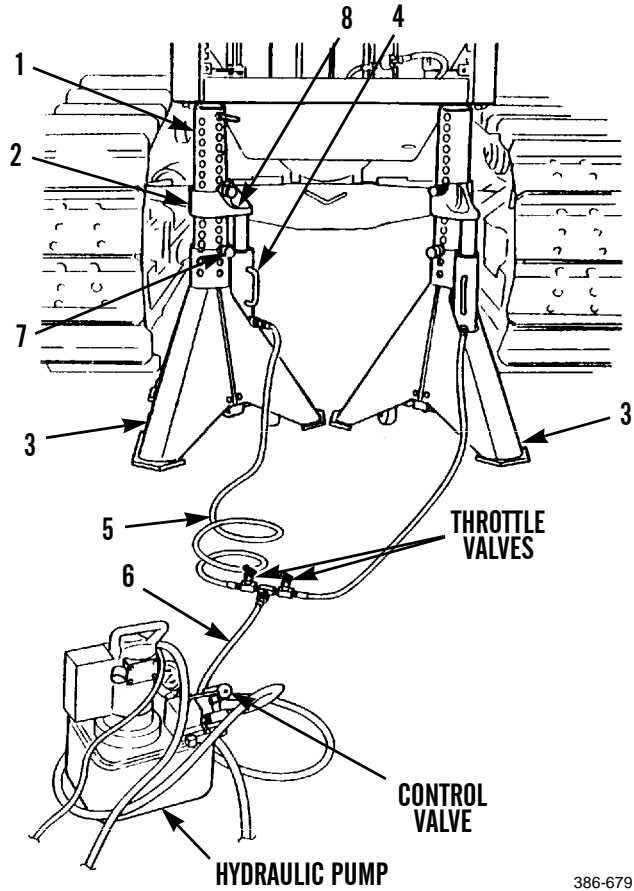
Blade and pusharm assembly removed (WP 0170 00)
 Rear implement removed (WP 0173 00 for ripper or WP 0139 00 for winch)
 Track tension released, if required (WP 0119 00)

**WARNING**

- **This task must be performed on a flat, level concrete surface. Hydraulic jack stands can become unstable if used on any other surface. Instability could cause tractor to fall, causing personal injury or death.**
- **All damage or leaks to hydraulic jack stands must be repaired before use. Failure to make repairs can cause injury or death.**
- **Always use handle any time extension tube on hydraulic jack stand is manually extended or retracted. Failure to follow this warning may cause injury.**

OPERATING/ADJUSTING HYDRAULIC JACK STANDS - CONTINUED

1. Assemble hydraulic jack stands as follows:
 - a. Install extension tube (1) and collar (2) on jack stand (3).
 - b. Install hydraulic cylinder (4) in jack stand (3) and under tab of collar (2).
 - c. Repeat steps a and b for other jack stand (3).
 - d. Connect hydraulic lines (5) from throttle valves to each hydraulic cylinder (4).
 - e. Connect hose (6) from valve tee to hydraulic pump.
 - f. Open both throttle valves and control valve on hydraulic pump and ensure cylinders (4) are fully retracted. If necessary, push down on extension tube (1).



WARNING

Ensure all jack stands and blocking are properly placed and secure, to prevent movement of item to be lifted. Failure to follow this precaution could result in serious injury or death.

2. Put jack stand under area to be lifted. Ensure lifting point is sturdy.



**RIGHT SIDE REAR.
LEFT SIDE IS THE SAME**

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OPERATING/ADJUSTING HYDRAULIC JACK STANDS - CONTINUED

3. Lift item using the following procedure:
 - a. Close control valve on hydraulic pump.

CAUTION

Extension tube may bind in stand when tube is lifted by hydraulic cylinder. Observe jack stands carefully during lifting procedure. Tapping with hammer may free binding.

- b. Operate hydraulic pump to raise jack stands.

**WARNING**

Ensure jack stands raise evenly to provide a balanced lift. Failure to raise evenly could cause an unstable condition. Serious injury or death could result.

- c. If jack stands do not raise evenly, partially close throttle valve connected to higher jack stand. While pumping, close valve until jack stands raise evenly when operating hydraulic pump.

**WARNING**

Extension tube can only be raised until bottom hole of extension tube is aligned with top hole of jack stand. Hydraulic jack stands become unstable if raised higher. Instability can allow item to fall, causing personal injury or death.

- d. If hydraulic cylinders (4) are fully extended, but item is not lifted enough, install pin (7) through each jack stand and extension tube (1). This will keep jack stand raised while cylinders are retracted. If jack stands are high enough, go to step j.
 - e. Open control valve on hydraulic pump and remove pin (8) above each collar (2).
 - f. Retract hydraulic cylinder (4) and lower collar (2).
 - g. Install pin (8) in first hole above collar (2).
 - h. Close control valve on hydraulic pump and operate pump to raise jack stands.
 - i. Repeat steps d through h only until item is lifted high enough or bottom hole of extension tube (1) is aligned with top hole of jack stand.
 - j. Install pin (7) through each jack stand and extension tube (1) to secure jack stand in raised position. Remove hydraulic pressure by opening control valve on hydraulic pump.
4. Slowly lower item, using the following procedure:

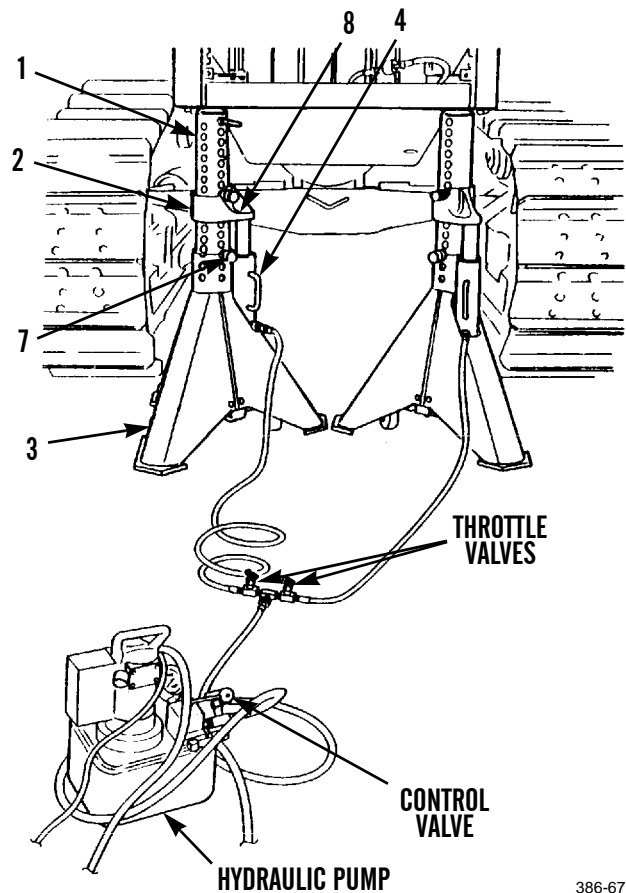
CAUTION

Extension tube may bind in jack stand when extension tube is lowered by retracting hydraulic cylinder. Observe jack stands carefully during lowering procedure. Tapping tube with a hammer may free binding.

- a. Slowly open control valve on hydraulic pump. Allow hydraulic cylinders to retract completely.

OPERATING/ADJUSTING HYDRAULIC JACK STANDS - CONTINUED

- b. If hydraulic cylinders (4) are fully retracted, but item is not lowered completely, close control valve on hydraulic pump.
- c. Operate hydraulic pump until a hole in extension tube (1) and jack stand are in alignment. Install pin (7) in this hole for each jack stand.
- d. Open control valve on hydraulic pump to retract hydraulic cylinders (4). Remove pin (8) from above each collar (2).
- e. Close control valve on hydraulic pump. Operate pump to extend hydraulic cylinders (4) and raise collars (2). Do not extend cylinders completely. Cylinders must be extended to remove weight from lower pins (7).



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- f. Install pins (8) in first hole above collars (2).
- g. Operate hydraulic pump to lift item so lower pins (7) can be removed.
- h. Repeat steps a through g until weight of item is completely off jack stands.
- i. Remove hydraulic jack stands.

RAISING TRACTOR OFF GROUND**WARNING**

Ground guide assistance is required to position tracks of tractor on wood blocks. All other personnel must stand clear, to prevent serious injury or death.

1. Put four wood blocks in front of each track. Drive tractor up on wood blocks so that both front and rear of tractor are totally supported by blocks.

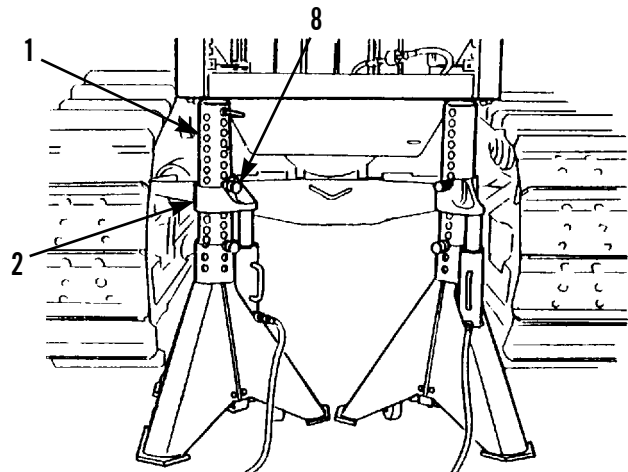
WARNING

Tracks must be securely blocked so that tractor will not move backwards when front of tractor is lifted with hydraulic jack stands.

2. Engage parking brake. Put wood blocks behind tracks at rear of tractor.

RAISING TRACTOR OFF GROUND - CONTINUED

3. Move transmission gear selector to neutral and shut down engine.
4. Assemble hydraulic jack stands IAW step 1 of *Operating/Adjusting Hydraulic Jack Stands*.
5. Place hydraulic jack stands under main frame at front of tractor, IAW step 2 of *Operating/Adjusting Hydraulic Jack Stands*.
6. Move extension tube (1) of hydraulic jack stands up to bottom of main frame. Install pin (8) in first hole above collar (2). Ensure pin fits into groove of collar.
7. Lift front of tractor using hydraulic jack stands, IAW step 3 of *Operating/Adjusting Hydraulic Jack Stands*.



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WARNING

Keep tractor level when tractor is elevated on jack stands to maintain stability and safety.

8. Repeat steps 4-7, to place hydraulic jack stands underneath steering clutch cases and raise rear of tractor.



**RIGHT SIDE REAR
LEFT SIDE IS THE SAME**

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RAISING TRACTOR OFF GROUND - CONTINUED**WARNING**

Tractor must be kept level and lowest track grouser must be 2 in. (5 cm) off floor when tractor is elevated. DO NOT lift tractor any higher than necessary. Stability and safety will then be maintained.

9. Continue to raise front and rear of tractor evenly, until lowest track grouser is 2 in. (5 cm) off floor and tractor is level.

WARNING

Ensure all jack stands and blocking are properly placed and secure to prevent movement of tractor. Use extreme care when operating tractor in elevated position.

10. If tractor operation is necessary with tractor in raised position, use extreme care and slow engine speed ONLY.

LOWERING TRACTOR TO GROUND**WARNING**

Parking brake must be engaged to prevent tractor from moving backwards when rear of tractor is lowered to the ground.

1. Ensure parking brake is engaged.

NOTE

- **Wood blocks must be installed under tracks to allow for clearance to remove hydraulic jack stands after tractor is lowered.**
 - **Tractor may have to be raised to install wood blocks.**
2. Put wood blocks under front and rear of both tracks.

WARNING

Tracks must be securely blocked so that tractor will not move backwards when rear of tractor is lowered with hydraulic jack stands.

3. Slowly lower rear of tractor onto wood blocks IAW step 4 in *Operating/Adjusting Hydraulic Jack Stands*. Install two more blocks behind tracks at rear of tractor to prevent it from moving. Remove hydraulic jack stands from rear.
4. Slowly lower front of tractor IAW step 4 in *Operating/Adjusting Hydraulic Jack Stands*, until weight of tractor is completely off hydraulic jack stands. Remove hydraulic jack stands from front.
5. Start engine and apply brakes.
6. Remove blocks from behind tracks at rear of tractor.

WARNING

Ground guide assistance is required when driving tractor off wood blocks. All other personnel must stand clear, to prevent serious injury or death.

7. Release parking brake. Slowly drive tractor off wood blocks.
8. Make track adjustments, if required (WP 0120 00).
9. Install blade and pusharm assembly (WP 0170 00).
10. Install rear implement: ripper (WP 0173 00) or winch (WP 0139 00).

END OF WORK PACKAGE

PREPARATION FOR STORAGE AND SHIPMENT

0179 00

THIS WORK PACKAGE COVERS

Preparation for storage

Preparation for shipment

INITIAL SETUP

Tools and Special Tools

Tool kit, general mechanic's (Item 112, WP 0185 00)

Materials/Parts

Grease (Item 15, WP 0184 00)

Tape (Item 36, WP 0184 00)

References

TM 5-2410-233-10

WP 0008 00

WP 0009 00

Equipment Condition

Machine parked on level ground (TM 5-2410-233-10)

PREPARATION FOR STORAGE

1. Perform Operator Preventive Maintenance Checks and Services (PMCS) (TM 5-2410-233-10).
2. Perform Unit Maintenance Preventive Maintenance Checks and Services (PMCS) contained in WP 0008 00 and WP 0009 00 of this manual.
3. Schedule the next PMCS on DD Form 814, *Preventive Maintenance Schedule and Record*.
4. Store tractor with blade (and ripper if equipped) lowered. Cycle controls after engine shutdown to relieve any hydraulic pressure in system.
5. Seal exhaust stack opening and engine air cleaner precleaner opening with tape.
6. Coat exposed metal portions of blade (and ripper if equipped) cylinder rods with grease.
7. Cover seat, armrests and dash with protective plastic wrap.
8. Fill fuel tank completely.
9. Ensure that fuel drain valve handle, battery box, engine oil filler tube, fuel tank cap, engine oil level gage, hydraulic tank cover, dash cover, seat assembly and radiator cover are protected.
10. Ensure that tractor is fully equipped. Refer to TM 5-2410-233-10HR.
11. Fill in DD Form 1397 completely and attach to a conspicuous part of the tractor.

PREPARATION FOR SHIPMENT

1. Perform Operator Preventive Maintenance Checks and Services (PMCS) contained in TM 5-2410-233-10.
2. Perform Unit Maintenance Preventive Maintenance Checks and Services (PMCS) contained in WP 0008 00 and WP 0009 00 of this manual.
3. Schedule the next PMCS on DD Form 814, *Preventive Maintenance Schedule and Record*.
4. Seal exhaust stack opening and engine air cleaner precleaner opening with tape.
5. Consult shipping and transportation data on data plate (TM 5-2410-233-10).

END OF WORK PACKAGE

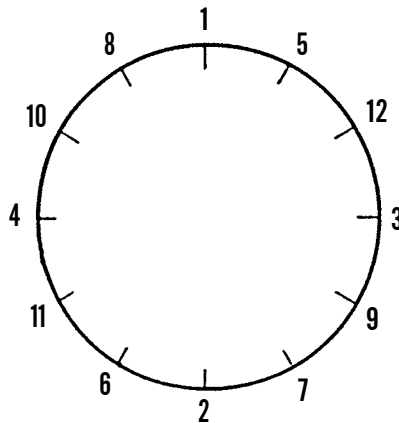
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SCOPE

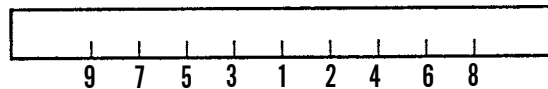
This work package lists standard torque values and provides general information for applying torque. Special torque values and tightening sequences are indicated in the maintenance procedures for applicable components.

GENERAL

1. Always use torque values listed in Tables 1 and 2 when a maintenance procedure does not give a specific torque value.
 - a. Table 1 provides torque limits for SAE standard fasteners.
 - b. Table 2 provides torque limits for metric fasteners.
2. Unless otherwise indicated, standard torque tolerance shall be $\pm 10\%$.
3. Torque values listed are based on clean, dry threads. Reduce torque by 10% when engine oil is used as a lubricant. Reduce torque by 20% if new plated capscrews are used.
4. If the maintenance procedures do not specify a tightening order, use the following guides:
 - a. Unless otherwise specified, lubricate threads of fasteners with oil (OE/HDO-10 or OEA-30).
 - b. When tightening fasteners above 30 lb-ft (41 Nm), use the torque pattern but only tighten to 70% of final value (multiply final value by 0.7). Repeat pattern until final value is reached.
 - c. Tighten circular patterns using circular torque pattern and tighten straight patterns using straight torque pattern.



CIRCLULAR TORQUE PATTERN




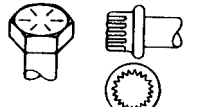


STRAIGHT TORQUE PATTERN

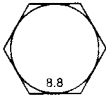
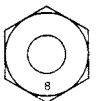
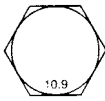
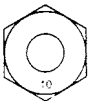
CAUTION

If replacement capscrews are of higher grade than originally supplied, use torque specifications for the original. This will prevent equipment damage due to overtorquing.

Table 1. Torque Limits - SAE Standard Fasteners.

Current Usage	Much Used	Much Used	Used at Times	Used at Times
QUALITY OF MATERIAL	INDETERMINATE	MINIMUM COMMERCIAL	MEDIUM COMMERCIAL	BEST COMMERCIAL
SAE Grade Number	1 or 2	5	6 or 7	8
Cap Screw Head Markings				
Manufacturer's marks may vary				
These are all SAE Grade 5 (3 line)				
CAP SCREW BODY SIZE IN. - THREAD	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)	TORQUE LB-FT (NM)
1/4 20 28	5 (7) 6 (8)	8 (11) 10 (14)	10 (14)	12 (16) 14 (19)
5/16 18 24	11 (15) 13 (18)	17 (23) 19 (26)	19 (26)	24 (33) 27 (37)
3/8 16 24	18 (24) 20 (27)	31 (42) 35 (47)	34 (46)	44 (60) 49 (66)
7/16 14 20	28 (38) 30 (41)	49 (66) 55 (75)	55 (75)	70 (95) 78 (106)
1/2 13 20	39 (53) 41 (56)	75 (102) 85 (115)	85 (115)	105 (142) 120 (163)
9/16 12 18	51 (69) 55 (75)	110 (149) 120 (163)	120 (163)	155 (210) 170 (231)
5/8 11 18	83 (113) 95 (129)	150 (203) 170 (231)	167 (226)	210 (285) 240 (325)
3/4 10 16	105 (142) 115 (156)	270 (366) 295 (400)	280 (380)	375 (508) 420 (569)
7/8 9 14	160 (217) 175 (237)	395 (536) 435 (590)	440 (597)	605 (820) 675 (915)
1 8 14	235 (319) 250 (339)	590 (800) 660 (895)	660 (895)	910 (1234) 990 (1342)

Torque Limits - Metric Fasteners.

Torque values for metric thread fasteners with lubricated* or plated threads†				
Thread Diameter-Pitch				
	Class 8.8 Bolt	Class 8 Nut	Class 10.9 Bolt	Class 10 Nut
	Torque: lb-ft (Nm)		Torque: lb-ft (Nm)	
M6	5 (7)		7 (9)	
M8	12 (16)		17 (23)	
M8 x 1	13 (18)		18 (24)	
M10	24 (33)		34 (46)	
M10 x 1.25	27 (37)		38 (52)	
M12	42 (57)		60 (81)	
M12 x 1.5	43 (58)		62 (84)	
M14	66 (89)		95 (129)	
M14 x 1.5	72 (98)		103 (140)	
M16	103 (140)		148 (201)	
M16 x 1.5	110 (149)		157 (213)	
M18	147 (199)		203 (275)	
M18 x 1.5	165 (224)		229 (310)	
M20	208 (282)		288 (390)	
M20 x 1.5	213 (313)		320 (434)	
M22	283 (384)		392 (531)	
M22 x 1.5	315 (427)		431 (584)	
M24	360 (488)		498 (675)	
M24 x 2	392 (531)		542 (735)	
M27	527 (715)		729 (988)	
M27 x 2	569 (771)		788 (1068)	
M30	715 (969)		990 (1342)	
M30 x 2	792 (1074)		1096 (1486)	

* All plated and unplated fasteners should be coated with oil before installation.

† Use these torque values if either the bolt or nut is lubricated or plated (zinc-phosphate conversion-coated, cadmium-plated, or waxed).

END OF WORK PACKAGE

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CHAPTER 5
SUPPORTING INFORMATION

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REFERENCES

0181 00

SCOPE

This work package lists all forms, field manuals, technical bulletins, technical manuals and other publications referenced in this manual and which apply to maintenance of the D7F Tractor.

PUBLICATION INDEXES

The following indexes should be consulted frequently for latest changes or revisions and for new publications relating to material covered in this technical manual.

- Consolidated Army Publications and Forms Index DA Pam 25-30
- Functional User's Manual for the Army Maintenance Management System DA Pam 738-750

FORMS

NOTE

Refer to DA Pam 738-750, *The Army Maintenance Management System (TAMMS)*, for instructions on the use of maintenance forms.

- Equipment Inspection and Maintenance Worksheet DA Form 2404, DA Form 5988-E
- Preventive Maintenance Schedule and Record DD Form 314
- Processing and Deprocessing Record for Shipment, Storage and Issue of Vehicles and Spare Engines DD Form 1397
- Product Quality Deficiency Report SF Form 368
- Recommended Changes to Publications and Blank Forms DA Form 2028

FIELD MANUALS

- Operations and Maintenance of Ordnance Materiel in Cold Weather FM 9-207

TECHNICAL BULLETINS

- CARC Spot Painting TB 43-0242
- Color, Marking, and Camouflage Painting of Military Vehicles, Construction Equipment and Materials Handling Equipment TB 43-0209
- Use of Antifreeze Solutions, Antifreeze Extender, Cleaning Compounds and Test Kit in Engine Cooling Systems TB 750-651

TECHNICAL MANUALS

- Inspection, Care and Maintenance of Antifriction Bearings TM 9-214
- Materials Used for Cleaning, Preserving, Abrading and Cementing Ordnance Materiel and Related Materiel Including Chemicals TM 9-247
- Operation, Unit, Direct Support and General Support Maintenance Manual for Lead-Acid Storage Batteries TM 9-6140-200-14

REFERENCES - CONTINUED

0181 00

TECHNICAL MANUALS - CONTINUED

Operator's Manual for D7F Tractor TM 5-2410-233-10

Operator's, Unit, and Direct Support Maintenance Manual for Tool Outfit, Hydraulic Systems Test and
Repair Unit (HSTRU) (NSN 4940-01-036-5784) (EIC:2DD) TM 9-4940-468-13

Operator's, Unit, Direct Support and General Support
Maintenance Manual for Lead-Acid Storage Batteries TM 9-6140-200-14

Painting Instructions for Army Materiel TM 43-0139

Procedures for Destruction of Equipment to Prevent Enemy Use (Mobility Equipment Command) TM 750-244-3

Transportability Guidance, Tractor, Full-Track, Low-Speed DED, Medium Drawbar Pull TM 55-2410-237-14

Unit, Direct Support and General Support Including Depot Maintenance RPSTL for D7F Tractor TM 5-2410-233-23P

OTHER PUBLICATIONS

Abbreviations and Acronyms ASME Y14.38-1999

Army Medical Department Expendable/Durable Items CTA 8-100

Expendable/Durable Items (Except Medical, Class V, Repair Parts and Heraldic Items) CTA 50-970

Fuels and Lubricants Standardization Policy for Equipment AR 70-12

Operator's Circular for Welding Theory and Application TC 9-237

END OF WORK PACKAGE

THE ARMY MAINTENANCE SYSTEM MAC

1. 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.
2. The MAC immediately following this 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 in the MAC (WP 0183 00) in column (4) as:

Field - includes subcolumns:

- C - Operator/Crew
- O - Unit
- D - Direct Support

Sustainment - includes subcolumns:

- H - General Support
- D - Depot

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

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).
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.
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. **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.
9. **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.

MAINTENANCE FUNCTIONS - CONTINUED**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 and 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.
10. **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.
11. **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 materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (hours/miles, etc.) considered in classifying Army equipment/components.

EXPLANATION OF COLUMNS IN THE MAC, TABLE 1

1. **Column (1) - Group Number.** Column (1) lists Group numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).
2. **Column (2) - Component/Assembly.** Column (2) contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.
3. **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).
4. **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 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 - Operator/Crew Maintenance
- O - Unit Maintenance
- D - Direct Support Maintenance

Sustainment:

- H - General Support Maintenance
- D - Depot Maintenance

MAINTENANCE FUNCTIONS - CONTINUED**NOTE**

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

5. **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.
6. **Column (6) - Remarks Code.** When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries (Table 3).

EXPLANATION OF COLUMNS IN THE TOOLS AND TEST EQUIPMENT REQUIREMENTS, TABLE 2

1. **Column (1) - Tool or Test Equipment Reference Code.** The tool and test equipment reference code correlates with a code used in column (5) of the MAC.
2. **Column (2) - Maintenance Level.** The lowest level of maintenance authorized to use the tool or test equipment.
3. **Column (3) - Nomenclature.** Name or identification of the tool or test equipment.
4. **Column (4) - National Stock Number (NSN).** The NSN of the tool or test equipment.
5. **Column (5) - Tool Number.** The manufacturer's part number, model number, or type number.

EXPLANATION OF COLUMNS IN THE REMARKS, TABLE 3

1. **Column (1) - Remarks Code.** The code recorded in column (6) of the MAC.
2. **Column (2) - Remarks.** This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

END OF WORK PACKAGE

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MAINTENANCE ALLOCATION CHART (MAC)

0183 00

Table 1. MAC for the D7F Tractor.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
01	ENGINE								
0100	Engine Assembly:	Inspect	0.2					A	
		Test		1.5			139		
		Service		0.5			117,139	B	
		Replace			16.4		54,120,139		
		Repair			46	80	120,121,139		
	Front Engine Support	Replace			3		120,139		
	Engine Trunnion Assembly	Replace			1		120,139		
	Rear Engine Mounts	Replace			4.3				
0101	Crankcase, Block, Cylinder Head:								
	Cylinder Head	Replace			2		55,120,123,139		
		Repair				4	20,32,120,139		
	Block, Cylinder	Replace				40	97,98,112		
		Repair				16	23,82,97,98,112		
0102	Crankshaft:								
	Crankshaft Pulley				1		120,139		
	Crankshaft Assembly Bearings	Replace				24	120,139		
	Front Seal and Wear Sleeve	Replace			4		29,51,99,120,138,139		
	Rear Seal and Wear Sleeve	Replace			4		15,51,64,99,111,114,120,138,139		
0103	Flywheel Assembly:								
	Flywheel Assembly	Replace			4.3		55,120,139		
	Flywheel Housing	Replace			10		55,120,139		
0105	Valves, Camshafts and Timing Systems:								
	Covers, Front Housing	Replace				12	120,139		
	Cover, Valve Mechanism	Replace		1.5			117,139		

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
03	FUEL SYSTEM								
0301	Fuel Injection:								
	Fuel Injection Nozzles	Test Replace			0.5 1			120,139 61,120,139	
0302	Fuel Pumps:								
	Pump, Transfer	Replace			0.5			120,139	
	Pump, Priming	Replace		0.3				117,139	
	Pump, Injection	Replace Repair				2 1.5		120,139 12,67,116,120, 139	
	Lines and Fittings, Fuel Injection	Replace		0.5				117,139	
	Fuel Injection Pump and Governor Assembly	Test Adjust Replace			1 0.5 2			120,139 8,77,95,120, 136,139 8,77,95,120, 136,139	
		Repair				4		12,67,73,77, 107,120,139	
0304	Throttle Seal			0.5				139	
	Air Cleaner:								
		Replace		1				120,139	
		Repair		0.5				139	
	Elements	Service	0.2	0.2				120,139	
		Replace		0.5				120,139	
	Precleaner	Service		0.2				139	
		Replace		0.5				139	
	Dust Ejector	Replace		0.2				139	
0305	Turbocharger:								
	Turbocharger	Replace Repair		3		2		139 33,35,120,139	
	Turbocharger Air Lines	Replace		1				139	
	Oil Lines	Replace		1				139	

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE	
			FIELD		SUSTAINMENT					
			UNIT		DS	GS	DEPOT			
			C	O	F	H	D			
03	FUEL SYSTEM - Continued									
0306	Tanks, Lines, Fittings and Headers:									
	Tank, Fuel	Service	0.1				117,139			
		Replace	1.2				117,123,139			
	Lines and Fittings, Fuel	Replace	1.5				117,139			
	Drain Lines and Drain Valve	Replace	1.5				117,139			
0309	Fuel Filters:									
	Filter Assembly, Primary Fuel	Service	0.4				139			
		Replace	0.5				139			
	Filter Assembly, Secondary Fuel	Service	0.2				117,139			
		Replace	0.5				117,139			
0311	Ether Starting Aids:	Service	0.2				139	K		
		Replace	2				139			
0312	Accelerator and Throttle Controls:									
	Governor Controls and Linkage	Adjust	0.5				117,139			
		Replace	2.2				117,139			
04	EXHAUST SYSTEM									
0401	Muffler and Pipes:									
	Muffler	Replace	0.7				139			
	Exhaust Extension	Replace	0.2				139			
05	COOLING SYSTEM									
0501	Radiator:									
	Radiator	Inspect	0.5					L		
		Test	1				117,139			
		Service	0.5				117,139			
		Replace	3.2				55,117,123,139			
		Repair		4.4			120,122			
	Cap and Relief Valve	Replace	0.1				117,139			

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
05	COOLING SYSTEM - Continued								
0503	Water Manifold, Headers, Thermostats and Housing Gasket:								
	Water Temperature Regulator	Test Replace	1 0.5				117,139 117,139		
0504	Water Pump:								
	Pump Assembly	Replace	2.5				139		
	Water Lines	Replace	1				139		
0505	Fan Assembly:								
	Fan Drive Assembly	Replace Repair	1.5 1				117,139 17,117,139		
	Fan and Fan Guard	Replace	0.3				117,123,139		
	Belts, V-	Adjust Replace	0.2 0.5				117,139 117,123,139		
06	ELECTRICAL SYSTEM								
0601	Alternator, Generator:								
	Alternator	Test Replace		0.5			120 117,139		
	Brackets, Alternator Mounting	Replace	1				117,139		
	Generator	Test Replace		0.5			120 117,139		
	Regulator	Test Replace		0.5			120 117,139		
0603	Starting Motor:								
	Starting Motor	Test Replace	0.5 2				117 117,123,139		
	Starting Motor Solenoid	Replace	0.3				139		

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE	
			FIELD		SUSTAINMENT					
			UNIT		DS	GS	DEPOT			
			C	O	F	H	D			
06	ELECTRICAL SYSTEM - Continued									
0606	Engine Safety Controls: Engine Safety Control Components	Replace		0.5				139		
0607	Instrument Control Panel: Lamps	Inspect Replace	0.1					139		
	Ammeter	Inspect Replace	0.1					139		
	Water Temperature, Engine	Inspect Replace	0.1					139		
	Oil Temperature, Torque Converter	Inspect Replace	0.1					139		
	Switches, Miscellaneous	Replace		0.5				139		
	Switch, Battery Disconnect	Replace		0.5				139		
	Reset, Circuit Breaker	Replace		0.5				139		
	Fuses	Replace		0.3				139		
0609	Lights: Head Lamps and Rear Floodlamp	Replace		0.5				139		
	Protective Covers, Head Lamps and Rear Floodlamp	Replace		0.3				139		
0610	Sending Units and Warning Switches Backup Alarm	Inspect Replace	0.1					K 139		
	Switch, Backup Alarm	Test Replace	0.2		1			K 117,139		

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
06	ELECTRICAL SYSTEM - CONTINUED								
0612	Batteries, Storage: Batteries	Test		0.5				117	
		Service		0.4				117,139	
		Replace		1				117,139	
	Cables and Terminals	Service		0.2				117,139	
		Replace		0.4				117,139	
0613	Chassis Wiring Harness:	Replace		2.5				139	
		Repair		0.5				117,139	
	NATO Starting Receptacle	Replace		0.5				139	
07	TRANSMISSION								
0705	Transmission Shifting Control Components:								
	Lever and Linkage, Transmission	Adjust		1				139	
		Replace		3				139	
	Safety Lock Lever, Transmission	Replace		1				139	
	Selector/Directional Valves	Replace			2.5			120,139	
	Pressure Control Valve	Adjust			1			120,139	
		Replace			2.5			120,139	
0708	Torque Converter:								
	Torque Divider	Service		0.2				120,139	
		Replace			6			55,120,123,139	
		Repair				11		120,139	
	Seal, Output Shaft	Replace			3			120,139	

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
07	TRANSMISSION - Continued								
0710	Transmission Assembly and Associated Parts:								
	Transmission Assembly	Inspect Test	0.2		1			120,139,140	P Q
		Service		0.2				117,139	
		Replace			3.6			56,120,133,139	
		Repair				40		120,139	
	Input Seal	Replace			2			120,139	
0721	Coolers, Pumps and Motors:								
	Cooler Lines	Replace		1				117,139	
	Pump, Oil	Test			1.5			120,139,140	
		Replace			0.2			120,139	
	Oil Lines, Transmission	Replace		1				117,139	
	Oil Filter Assembly	Service		0.2				117,139	
		Replace		0.7				117,139	
		Repair		0.4				117,139	
	Oil Cooler, Transmission	Replace		1				117,139	
	Outlet Relief Valve, Torque Converter	Adjust			2			120,139	
		Replace			1			120,139	N
	Scavenge Pump, Torque Divider	Replace			1			120,139	
	Magnetic Strainer	Service		0.5				117,139	R
		Replace		0.5				117,139	
	Oil Sampling Valve, Transmission	Replace		0.5				139	

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
08	FINAL DRIVE ASSEMBLY								
0801	Final Drive Assembly:	Service		0.5				117,139	
		Adjust			3			10,120,139	S
		Repair				4		13,14,30,42,59, 66,74,120,139	
	Frame and Case Assembly	Repair			2	12		120,122,139	T
	Final Drive Cases, Gears, Idler Pinions and Bearings	Replace			20			55,72,88,120, 123,139	
	Bevel Gear and Shaft	Replace			6			18,120,123,139	
	Final Drive Pinions and Flanges	Replace			1			120,123,139	
		Repair			1			1,5,7,10,15,18, 21,22,26,28,43, 44,45,46,47,52, 53,55,56,57,71, 72,91,92,93,94, 96,97,101,105, 106,108,113, 123,124,125, 128,130,131, 135,143,147, 150,154	
	Shaft, Drive Sprocket	Replace				4		2,5,6,21,34,43, 57,63,70,71,76, 96,97,101,105, 120,123,128, 139,151	
		Repair				4		100,120,139	
09	PROPELLER AND PROPELLER SHAFTS								
0900	Propeller Shafts:								
	Drive Shafts and Universal Joints	Service		0.5				139	
		Replace		1.5				117,123,139	

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
13	WHEELS AND TRACKS								
1301	Suspension Assembly:								
	Equalizer Bar Assembly	Replace			1.5			120,139	U
	Track Roller Guards	Inspect	0.1						V
		Replace		1				118,139	
	Track Roller Frame Guards	Inspect	0.1						V
		Replace		1				139	
	Track Rollers	Replace			1			121,139	U
	Frame Assembly, Track Roller	Replace			4				
	Recoil Spring	Replace			2.8			55,103,120,139	
								85,120,123,139	
1302	Track Support Rollers and Brackets:								
	Track Carrier Rollers	Replace			0.5			120,123,139	
1303	Track Idlers and Brackets:								
	Track Idlers	Replace			1.7			120,123,139	
	Track Idler Yokes	Replace			0.5			120,123,139	
	Track Adjuster	Replace			3.2			120,139	
1304	Track Drive Sprockets:								
	Track Drive Sprockets/Hubs	Replace			4			3,4,5,9,21,34,40,41,46,58,62,63,68,69,70,75,78,80,90,91,92,96,101,104,105,112,120,123,124,128,138,139,152,155	
	Sprocket Segments	Inspect	0.5						W
		Replace		1				117,139	
1305	Track Assembly:								
	Track Assembly	Inspect		0.2				36,117,139	
		Adjust	0.5	0.5				139	
		Replace		4				117,139,142	

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
14	STEERING								
1403	Steering Brakes:	Test	0.5						
	Actuating Mechanism, Steering Brakes	Replace			6		120,123,139		
		Repair			6		120,139		
	Pedals and Linkage, Steering Brakes	Adjust		0.5			139		
		Replace		3.6			117,139		
		Repair		2			117,139		
	Brake Lock Lever, Steering	Replace		1			139		
	Steering Clutch	Replace			4		55,120,123,139		
		Repair			10		79,81,120,132,139		
	Steering Clutch Hubs	Replace			1		1,16,89,98,102,115,120,125,139,146		
	Steering Clutch Levers and Linkage	Adjust		0.5			139		
		Replace		1.6			139		
		Repair		3			139		
18	BODY, CAB AND HOOD								
1801	Body, Cab and Hood Assemblies:								
	Crankcase and Transmission Guards	Inspect	0.1					V	
		Replace		1			117,139		
	Radiator Guard	Inspect	0.1						
		Replace		0.5			118,123,139		
	Hood	Replace		0.2			117,123,139		
	Dash	Replace		1			117,123,139		
		Repair		0.5			117,139		
	Battery Box	Replace		1			117,139		
	Rollover Protective Structure (ROPS) Assembly	Replace		0.7			118,139		
	ROPS Support Pads and Mounting Plates	Replace		0.5			117,123,139		

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL				(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE	
			FIELD		SUSTAINMENT				
			UNIT		DS	GS			DEPOT
			C	O	F	H			D
18	BODY, CAB AND HOOD - Continued								
	Protective Screen	Replace		0.2			123,139	K	
	Winterized Cab	Replace		3			117,139		
		Repair		6			117,139	X	
	Windshield Glass	Replace		2			139		
1802	Fenders and Running Boards with Mounting and Attaching Parts:								
	Fenders	Replace			1		120,139		
1805	Floors, Subfloors and Related Components:								
	Floorplates	Replace		0.4			139		
1806	Upholstery Seats and Carpets:								
	Seat and Seat Base Assembly	Replace		1			117,123,139		
		Repair		2			117,139		
1808	Storage Racks, Boxes, Straps and Carrying Cases:								
	Tool Box	Replace		1			139		
20	HOIST, WINCH, CAPSTAN, WINDLASS, POWER CONTROL UNIT AND POWER TAKEOFF								
2001	Hoist, Capstan, Windlass and Winch Assembly:								
	Winch Assembly	Inspect	0.2					Y	
		Service		0.3			117,139	R,Z	
		Replace		8			56,118,139		
		Repair				36	120,139		

Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE	
			FIELD		SUSTAINMENT					
			UNIT		DS	GS	DEPOT			
			C	O	F	H	D			
20	HOIST,WINCH, CAPSTAN, WINDLASS, POWER CONTROL UNIT AND POWER TAKEOFF - Continued	Winch Control Valve	Replace	0.7				117,139	AA	
			Repair			2	120,139			
		Winch Control Lever and Linkage	Adjust	0.2				139		
			Replace	0.8				139		
		Winch Oil Filter Assembly	Service	0.5				117,139		
			Replace	0.5				117,139		
		Drawbar Pin	Replace	0.5				139		
		Wire Rope Assembly	Replace	1.5				117,139		
			Repair	2				117,139		
		Gear Pump	Replace	2				117,139		
		Winch Lines and Fittings	Replace	0.5			1.0	117,120,139		BB
		22	ACCESSORY ITEMS							
2210	Data Plates and Instruction Holders:									
	Data Plates	Replace	1				117,139			
24	HYDRAULIC AND FLUID SYSTEMS									
2401	Pump and Motor: Pump	Inspect	0.2					27,65,120,139, 140	CC	
		Test			4					
		Test			1.3		27,65,120,139, 140			
	Replace		1				117,123,139			
	Repair				1		120,139			

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

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Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
24	HYDRAULIC AND FLUID SYSTEMS - Continued								
2402	Manifold and Control Valves:								
	Main (Bulldozer) Control Valve	Replace			3			56,120,123,139	
	Ripper Control Valve	Replace			3			56,120,123,139	
	Tilt Control Valve	Adjust			1			120,139	N
		Replace		2				117,139	
	Relief Valve	Adjust			1			120,139	N
		Replace			3			56,120,123,139	
2403	Hydraulic and Manual Controls:								
	Blade Control Lever and Linkage	Adjust		1.5				139	
		Replace		1.5				139	
	Ripper Control Lever and Linkage	Adjust		1.1				139	
		Replace		1.1				139	
2404	Tilt Cylinders:								
	Cylinder, Hydraulic, Blade Tilt	Adjust		0.6				117,123,139	
		Replace		0.6				117,123,139	
		Repair			1			38,50,120,139	DD
	Adjustable Brace, Blade Tilt	Adjust		0.6				117,123,139	
		Replace		1				117,123,139	
2405	Mast Column:								
	Cylinder, Hydraulic, Blade Lift	Replace		0.6				117,123,139	
		Repair			1			39,49,120,139	DD
	Blade Lift Cylinder Mounting Tube	Replace		1				117,123,139	
2406	Strainers, Filters, Lines and Fittings:								
	Ripper Lines	Replace		1				117,139	
		Repair			0.5			88,140	EE
	Blade Lines	Replace		1				117,139	
		Repair			0.5			88,140	EE

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

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Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE
			FIELD		SUSTAINMENT				
			UNIT		DS	GS	DEPOT		
			C	O	F	H	D		
24	HYDRAULIC AND FLUID SYSTEMS - Continued								
	Tilt Cylinder Lines, Blade	Replace Repair		1				117,139 88,140	EE
	Pump Lines, Hydraulic	Replace Repair		1		0.5		117,139 88,140	EE
	Filter Element and Filler Strainer, Hydraulic Tank	Service Replace		0.2 0.5				117,139 117,139	
2407	Hydraulic Cylinders: Cylinder, Ripper Lift	Replace Repair		1				117,123,139 88,140	DD
2408	Liquid Tanks or Reservoirs: Hydraulic Tank	Service Replace Repair		0.5		1.2 4		117,139 56,120,123,139 120,122,139	FF T
47	GAGES (NON- ELECTRICAL), WEIGHING AND MEASURING DEVICES								
4702	Pressure Indicators: Fuel Pressure	Inspect Replace	0.1						117,139
	Oil Pressure, Engine	Inspect Replace	0.1			0.5			117,139
	Air Filter Indicator	Inspect Replace	0.1			0.5			139
4703	Hourmeter Hourmeter	Inspect Replace	0.1			0.5			139

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

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Table 1. MAC for the D7F Tractor - Continued.

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL				(5) TOOLS AND EQUIPMENT REF CODE	(6) REMARKS CODE	
			FIELD		SUSTAINMENT				
			UNIT		DS	GS			DEPOT
			C	O	F	H			D
74	GRADERS, DOZERS AND EARTH MOVING EQUIPMENT COMPONENTS:								
7435	Moldboard Assembly:								
	Blade Assembly	Inspect	0.2				GG		
	Cutting Edge	Replace		1.5			118,139		
	End Bit	Replace		1			118,139		
7436	Lift Arms and Pivot Assemblies:								
	Blade and Push Arm Assembly	Replace		2.5			118,139		
	Blade Diagonal (Adjustable) Brace	Replace		1.0			117,123,139		
	Trunnion	Replace		0.5			118,139		
7440	Scarifier Assembly								
	Scarifier	Replace		0.2			117,139		
7465	Rooters, Rippers, Plows, Harrows and Rotary Tillers								
	Ripper Assembly:	Inspect	0.2						
		Replace		4			117,123,139		
		Repair		6			117,123,139		
	Ripper Tooth	Replace		0.2			139		
	Ripper Shank	Replace		0.2			118,139		

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

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Table 2. Tools and Test Equipment Requirements for the D7F Tractor.

(1) TOOLS OR TEST EQUIPMENT REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER (NSN)	(5) TOOL NUMBER
1	F	Adapter	5120-01-518-9738	6V3094
2	F	Adapter	5120-01-119-1713	1P3054
3	F	Adapter		6V3123
4	F	Adapter	5120-01-119-1764	7M9773
5	F	Adapter, Coupling	5120-01-119-1765	7M9774
6	F	Adapter, Pin	5120-01-119-1715	1P3053
7	F	Adapter, Socket Wrench	5120-01-508-9182	2P8261
8	F	Adapter, Torque Wrench	5120-01-359-2644	6V6175
9	F	Adapter, Sprocket Installation	5120-01-512-7168	5P6222
10	F	Adjusting Tool, Bearing	5120-01-272-4054	6V0082
11	H	Bit		6V4163
12	H	Bit, Ball End		6V6072
13	H	Bolt, Machine	5306-01-127-9361	0S1585
14	H	Bolt, Machine	5306-00-809-7134	2B0947
15	F	Bolt, Machine	5306-01-026-9992	9S8890
16	F	Bolt, Machine	5306-00-426-3150	1A8537
17	F	Bushing Driver Set	5120-01-030-1626	1P0510
18	F	Bushing Driver Set	5120-01-039-4811	1P0520
19	F	Cap, Protective, Dust	5340-01-292-1734	1P7437
20	H	Clamp	5120-01-484-9390	6V2163
21	F	Clip, Retaining	5340-00-377-8758	7B2499
22	F	Collar, Shaft	3040-01-295-2500	8S7625
23	H	Cone, Base		9U6630
24	F	Coupling Assembly	4730-01-275-0057	1P2376
25	F	Coupling Half, Quick	4730-01-295-3790	1P237
26	O	Coupling Tool		1P7402
27	F	Cover, Access	5340-01-162-8676	5H4018
28	F	Cylinder Assembly, Actuating, Linear	3040-01-264-9538	8S7650
29	F	Distorter, Sleeve	5120-01-119-1750	5P7315
30	H	Driver	5120-01-119-1751	5P8631
31	H	Driver		6V3164
32	H	Extractor, Group Val	4910-01-296-3862	1667441
33	H	Fixture Assembly, Tu	4910-01-264-4024	9S6363

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 2. Tools and Test Equipment Requirements for the D7F Tractor - Continued.

(1) TOOLS OR TEST EQUIPMENT REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER (NSN)	(5) TOOL NUMBER
34	F	Forcing Screw, Mechanical Puller	5120-01-513-9583	5P5207
35	H	Gage Set, Inspection	5280-01-505-8509	6V7926
36	O	Gage, Sprocket Wear	5210-01-225-1132	5P8617
37	F	Guide, Seal		2P8301
38	F	Guide, Seal		5P6156
39	F	Guide, Seal		5P8565
40	F	Handle, Extension, Wrench	5120-01-512-9821	5P8675
41	F	Head		6V4000
42	H	Head, Driver Assembly	5120-01-272-0763	5P8630
43	F	Head, Socket Install	5120-00-972-0345	9H3992
44	F	Hose Assembly	3442-00-876-6522	8F0024
45	F	Insertor, Seal	5120-01-119-1736	5M2162
46	F	Insertor, Seal	5120-01-286-4205	8M9395
47	F	Insertor, Seal		1U8842
48	F	Insertor, Seal	5120-01-289-0635	4S9453
49	F	Insertor, Seal	5120-01-289-0637	4S9450
50	F	Insertor, Seal	5120-01-295-1535	4S9456
51	F	Installer	5120-01-349-0341	6V7876
52	F	Leg, Mechanical Puller	5120-00-227-0633	1107
53	F	Leg, Mechanical Puller	5120-00-633-5075	1110
54	O	Leveler, Load: 6000 lb Capacity	3950-01-263-9513	60842
55	O	Link, Bearing (Lifting)	5120-01-451-1391	1387575
56	O	Link, Chain, End	4010-01-268-9869	5P9736
57	F	Link, Pin	5120-01-119-1714	1P3052
58	F	Lock		6V3127
59	H	Multiplier, Torque Wrench	5120-01-296-4235	6V6080
60	O	Nipple, Pipe	4730-01-162-0102	5P8998
61	F	Nozzle Puller Group	2910-01-250-1608	6V6980
62	F	Nut, Plain, Round	5310-01-507-2374	6V3124
63	F	Nut, Plain, Round	5310-01-507-2390	5P5208
64	F	Nut, Sleeve	5310-01-038-8318	9S8858
65	F	O-ring	5331-00-741-0674	5F1678
66	H	O-ring	5331-00-590-1064	5H7370
67	H	Parts Kit, Diesel Engine Governor	2990-01-343-0876	5P6577
68	F	Pin	5315-01-119-1754	6H4158

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 2. Tools and Test Equipment Requirements for the D7F Tractor - Continued.

(1) TOOLS OR TEST EQUIPMENT REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER (NSN)	(5) TOOL NUMBER
69	F	Pin	5315-01-265-0418	5F9892
70	F	Pin	5315-01-270-5495	7S7112
71	F	Pin, Lock	5315-00-931-8963	3J1770
72	F	Pin, Shoulder, Headless	5315-01-270-2832	8S7615
73	H	Pin, Shoulder, Headless	5315-01-285-3476	3P1544
74	H	Pin, Shoulder, Headless	5315-01-270-1888	5P8635
75	F	Pin, Straight, Headless	5315-01-506-5030	6V3126
76	F	Pin, Straight, Headless	5315-00-922-2595	7M9772
77	F	Pin, Timing	2815-01-268-2194	6V4186
78	F	Plate, Intermediate, Friction Clutch	2520-01-408-9279	1P492
79	F	Plate	5120-01-119-1733	5F5096
80	F	Plate Assembly		5P5212
81	F	Plate, Compressor, Steering	5120-00-371-9610	5F5034
82	H	Plate, Mechanical Puller	5120-01-338-7733	1P2393
83	H	Pliers	5120-01-484-9388	1P1854
84	H	Pliers	5120-01-484-9391	1P1860
85	F	Press, Arbor, Hand Operated	3444-00-449-7295	AA59384
86	F	Plug, Pipe	4730-00-089-2515	5M6213
87	F	Plug, Protective, Dust	5340-01-371-2357	1P2377
88	F	Press, Hydraulic, Portable	4940-01-272-2839	2159672
89	F	Puller	5130-01-289-0100	8M9011
90	F	Puller Assembly		1U6415
91	F	Puller Attachment, Mechanical	5120-01-512-7167	1H3112
92	F	Puller Attachment, Mechanical	5120-00-288-6756	8B7541
93	F	Puller Attachment, Mechanical	5120-00-293-1430	8B7544
94	F	Puller, Crank Pulley	5120-01-124-1732	1P0820
95	F	Puller Group	5120-01-128-0725	8S2264
96	F	Puller, Hydraulic	5130-01-288-2786	9S8900
97	F	Puller, Hydraulic	5130-01-480-6682	5P5201
98	F	Puller, Hydraulic		1S4233
99	F	Puller Kit, Universal	5180-01-124-1903	1P3075
100	H	Puller, Mechanical	5120-01-119-1931	5S1430
101	F	Puller, Mechanical	5120-00-633-5074	939
102	F	Puller, Mechanical	5120-00-633-5085	8B7548
103	F	Puller, Ratchet Lever, Cable Type	5120-01-275-2286	8S9906

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 2. Tools and Test Equipment Requirements for the D7F Tractor - Continued.

(1) TOOLS OR TEST EQUIPMENT REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER (NSN)	(5) TOOL NUMBER
104	F	Puller, Sprocket Arm	5120-00-971-5407	5F9306
105	F	Pump, Hydraulic Ram, Hand Driven	4320-01-271-9831	304401
106	O	Pumping Unit, Hydraulic, Power Driven	4320-01-068-6009	3S6224
107	H	Punch Driver	5120-01-484-9392	6V4818
108	F	Pusher, Rollover	5120-01-119-1773	8S9903
109	F	Reducer, Pipe	4730-00-726-1103	5S2403
110	F	Reducer, Pipe	4730-01-373-5625	5B6009
111	F	Remover and Replacer	5120-01-030-3575	9S8871
112	F	Remover, Bearing and Bushing	5120-01-393-3420	3P2248
113	O	Repair Tool, Special Purpose	4910-01-264-4778	8S7621
114	F	Ring, Sleeve Distorter	5120-01-119-1749	5P7313
115	F	Screw, Cap, Hexagon Head	5305-01-271-2044	8F1156
116	H	Screwdriver, Torque		4C9738
117	O	Shop Equipment, Automotive Maintenance and Repair: Common No. 1, Less Power, SC4910-95-CL- A74	4910-00-754-0654	SC4910-95CLA74
118	O	Shop Equipment, Automotive Maintenance and Repair: Common No. 2, Less Power, SC4910-95-CL- A72	4910-00-754-0650	SC4910-95CLA72
119	O	Shop Equipment, Contact Maintenance: Truck Mounted, SC4040-95-CL-B04	4940-00-294-9518	MILS45854
120	F	Shop Equipment, General Purpose Repair: Semitrailer Mounted, SC4940-95-CL-B02	4940-00-287-4894	MILS45438
121	F	Shop Equipment, Machine Shop: Field Maintenance, Basic, SC3470- 95-CL-A02	3470-00-754-0708	SC3470-95CLA02
122	F	Shop Equipment, Welding, SC3470-95-CL-A08	4940-00-357-7268	SC3470-95CLA08
123	O	Sling, Nylon	2835-01-078-2081	4-8FTX2IN
124	F	Socket, Socket Wrench	5120-01-233-0320	5S6087
125	F	Spacer	5365-01-119-1769	8M9008

MAINTENANCE ALLOCATION CHART (MAC) - CONTINUED

0183 00

Table 2. Tools and Test Equipment Requirements for the D7F Tractor - Continued.

(1) TOOLS OR TEST EQUIPMENT REFERENCE CODE	(2) MAINTENANCE LEVEL	(3) NOMENCLATURE	(4) NATIONAL STOCK NUMBER (NSN)	(5) TOOL NUMBER
126	H	Spacer, Sleeve	5365-01-506-1837	5P5215
127	H	Spacer, Sleeve	5365-01-270-2772	5P8634
128	F	Spacer, Sleeve	5365-01-506-1820	5P6220
129	H	Spring, Helical, Comp	5360-01-336-7960	1M9351
130	F	Stand Assembly	4910-01-264-4777	8S7640
131	F	Stand, Lifting	5120-01-343-8085	4C6486
132	F	Stand, Steering Clutch		FT0610
133	F	Stand, Transmission	4910-01-265-2624	1P2420
134	H	Step Plate, Mechanical Puller	5120-01-510-5653	1P0464
135	F	Step Plate, Mechanical Puller	5120-00473-6921	8B7560
136	F	Tachometer, Stroboscopic	6680-01-354-7805	1U6602
137	F	Tee, Pipe	4730-00-119-9861	MS14303-2R06
138	F	Tool, Distorter, Wear Sleeve	5120-01-119-1748	5P7312
139	O	Tool Kit, General Mechanic's: Automotive, SC5180-90-CL-N05	5180-00-699-5273	SC5180-90-CL-N05
140	F	Tool Outfit, Hydraulic System Test and Repair (HSTRU), SC3470-95- CL-B07	4940-01-036-5784	13221E6850
141	H	Tool Set, Off-Engine Lifter Setting	5180-01-358-3781	6V4180
142	O	Tool Set, Track Repair	5120-00-513-1788	5P2379
143	F	Tool, Special	4910-01-265-0428	8S7611
144	H	Trunnion	5120-01-119-1752	5P8632
145	F	Valve, Needle	4810-01-127-5377	1S8937
146	F	Washer		3H467
147	F	Washer, Flat	5310-00-308-2227	4B5273
148	H	Wrench, Injector Pump Removal	5120-01-266-7433	8T5287
149	H	Wrench, Precombustion	5120-00-157-0718	5F8353
150	F	Wrench, Ratchet	5120-01-123-5881	8H0684
151	F	Wrench, Spanner		2P2345
152	F	Wrench, Spanner	5120-01-512-8936	5P3520
153	H	Wrench, Torque	5120-01-123-6269	9S7351
154	F	Wrench, Torque Multiplier: 1 in. Square Drive	5120-01-507-6929	5P3508
155	F	Yoke	5120-00-426-3787	2B2003

Table 3. Remarks for the D7F Tractor.

(1) REFERENCE CODE	(2) REMARKS
A	Inspect by checking lubricating oil level and checking for leaks.
B	Service by changing oil.
C	Valve mechanism adjustment consists of measuring clearance between rocker arm and valve turning adjustment screw. Procedure also indicates how to locate Top Dead Center (TDC) compression stroke for no. 1 piston.
D	Includes removal of suction bell.
E	Service by cleaning.
F	Includes priming fuel system.
G	Fuel injection pump timing checks can be performed with engine installed or removed.
H	Checking timing by timing pin method.
J	Setting idle speed.
K	Only on D7F after going through rebuild (SLEP) program.
L	Inspect by checking coolant level and by checking for leaks.
M	Battery service instructions are provided in TM 9-6140-200-14.
N	Adjustment consists of limited disassembly to add or remove shims.
O	Service consists of removing and cleaning suction screen.
P	Inspect by checking transmission oil level and checking for leaks.
Q	Test consists of pressure tests and performance tests.
R	Service by cleaning screen.
S	Adjust final drive bearings.
T	Limited repair authorized (minor welding).
U	Ground handling task is required.
V	Check for damage and missing or loose bolts.
W	Check for excessive wear and missing or broken segments.
X	Includes removal of insulation panels.
Y	Inspect by checking condition of wire rope, hook and safety latch and checking for leaks.
Z	Service by changing winch oil.
AA	Service by replacing filter element.
BB	Accessible lines are replaced by Unit Maintenance; internal lines by Sustainment Maintenance.
CC	Inspect by checking oil level and checking for leaks and excessive wear or damage to lines.
DD	Limited repair authorized to replace seals, gaskets, wipers and rings.
EE	Hose assemblies may be replaced by manufactured hoses with reusable couplings.
FF	Service by changing hydraulic system oil.
GG	Check cutting edge and end bits for excessive wear and damage (wear tolerance).
HH	Check for missing or damaged teeth and shanks.

END OF WORK PACKAGE

SCOPE

This work package lists expendable and durable items you will need to maintain the D7F Tractor. This listing 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)*, or CTA 8-100, *Army Medical Department Expendable/Durable Items*.

EXPLANATION OF COLUMNS

1. **Column (1) - Item Number.** This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item [e.g., Use antifreeze (Item 1, WP 0184)].
2. **Column (2) - Level.** This column identifies the lowest level of Field Maintenance that requires the listed item.
 - C - Operator/Crew
 - O - Unit Maintenance
 - F - Direct Support Maintenance
3. **Column (3) - National Stock Number.** This is the NSN assigned to the item which you can use to requisition it.
4. **Column (4) - Description, Commercial and Government Entity Code (CAGEC), and Part Number.** This provides the other information you need to identify the item.
5. **Column (5) - Unit of Measure (U/M).** This code shows the physical measurement or count of an item, such as gallon, dozen, gross, etc.

Table 1. Expendable and Durable Items List.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
1	C		ANTIFREEZE: Permanent, Ethylene Glycol, Inhibited (81349) MILA46153	
		6850-00-181-7929	1 Gallon Bottle	GAL
		6850-00-181-7933	5 Gallon Can	GAL
		6850-00-181-7940	55 Gallon Drum	GAL
2	O	5340-00-450-5718	CAP SET, PROTECTIVE: Dust and Moisture Seal (19207) 10935405	EA
3	O	6850-00-598-7328	CLEANING COMPOUND: Engine Cooling System (81349) MIL-C-10597	KIT
4	C		CLEANING COMPOUND: Solvent, Type III (81349) MIL-PRF-680	
		6850-01-474-2318	1 Gallon Can	GAL
		6850-01-474-2320	5 Gallon Can	GAL
		6850-01-474-2321	55 Gallon Drum	GAL
5	O		CLOTH: Abrasive, Emery, Fine (80204) ANSI B74.18	
		5350-00-584-4654	50 Sheet Package	EA
6	O		COMPOUND: Antiseize (05972) 76764	
		8030-00-251-3980	1 Pound Can	LB
7	O		COMPOUND: Gasket Forming, Silicone (05972) 77C	
8	O		13 Ounce Cartridge	OZ
		8040-00-664-4134	COMPOUND: Gasket Shellac (62377) INDIAN HEAD 1 Pint Bottle	PT

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
9	O	6850-01-159-4844	COMPOUND: Silicone, RTV (7X677) 12346193 10 1/7 Ounce Tube	OZ
10	C	7930-00-282-9699	DETERGENT: General Purpose, Liquid (83421) 7930-00-282-9699 1 Gallon Can	GAL
11	O	3439-00-255-9935	FLUX: Soldering (58536) A-A-51145TY1 FORM A 1 Pound Can	LB
12	C	9140-00-286-5286 9140-00-286-5287 9140-00-286-5288	FUEL: Diesel, DF-1 Grade, Winter (81346) ASTM D 975 Bulk 5 Gallon Can 55 Gallon Drum	GAL GAL GAL
13	C	9140-00-286-5294 9140-00-286-5295 9140-00-286-5296	FUEL: Diesel, DF-2 Grade (81346) ASTM D 975 Bulk 5 Gallon Can 55 Gallon Drum	GAL GAL GAL
14	C	9130-01-031-5816	FUEL, TURBINE: Aviation (81349) MILT83133 GR JP8	GAL
15	C	9150-01-197-7688 9150-01-197-7690 9150-01-197-7692 9150-01-197-7693	GREASE: Automotive and Artillery, GAA (81349) M-10924-A 2-1/4 Ounce Tube (81349) M-10924-C 1-3/4 Pound Can (81349) M-10924-E 35 Pound Can (81349) M-10924-B 14 Ounce Cartridge	OZ LB LB OZ
16	O	9150-01-361-8919	GREASE: Electrically Conductive (53711) 5190179	OZ

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
17	O	5970-00-815-1295	INSULATING SLEEVING: Electrical (81343) M23053/5-106-0 250 Foot Spool	FT
18	O	5970-00-815-1295	INSULATING VARNISH: Electrical, Dielectric (75037) 1602 250 Foot Spool	FT
19	O	9150-01-035-5390 9150-01-035-5391	OIL: Lubricating, GO-75 (81349) MIL-PRF-2105 1 Quart Can 5 Gallon Can	QT GAL
20	O	9150-01-035-5392 9150-00-001-9395 9150-01-035-5394	OIL: Lubricating, GO-80/90 (81349) MIL-PRF-2105 1 Quart Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL
21	O	9150-01-048-4591 9150-01-035-5395 9150-01-035-5396	OIL: Lubricating, GO-85/140 (81349) MIL-PRF-2105 1 Quart Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL
22	C	9150-00-402-4478 9150-00-402-2372 9150-00-491-7197	OIL: Lubricating, OEA-30, Arctic (81349) MIL-L-46167 1 Quart Can (81349) MIL-PRF-46167 5 Gallon Can (81349) MIL-PRF-46167 55 Gallon Drum	QT GAL GAL

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
23	C	9150-00-189-6727 9150-00-186-6668 9150-00-191-2772	OIL: Lubricating, OE/HDO-10 (81349) MIL-PRF-2104 1 Quart Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL
24	C	9150-01-152-4117 9150-01-152-4118 9150-01-152-4119	OIL: Lubricating, OE/HDO-15/40 (81349) MIL-PRF-2104 1 Quart Can 5 Gallon Can 55 Gallon Drum	QT GAL GAL
25	C	9150-00-186-6681 9150-00-188-9858	OIL: Lubricating, OE/HDO-30 (81349) MIL-PRF-2104 1 Quart Can 5 Gallon Can	QT GAL
26	O	8010-00-664-1414	PIGMENT, PAINT PRODUCTS: Prussian Blue (58536) AA3108-2A-001Q 1 Quart Can	QT
27	O	8010-00-145-0312	PRIMER COATING (81348) TTP1757-1CG-001P 1 Pint Can	PT
28	C	7290-00-205-1711	RAG: Wiping (64067) 7920-00-205-1711 50 Pound Bale	LB
29	F		SEALANT: Quick Cure (11083) 173-0531	KIT
30	O	8030-00-246-0931	SEALING COMPOUND (81349) MIL-S-15204 5 Ounce Tube	OZ

Table 1. Expendable and Durable Items List - Continued.

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER	(4) DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/M
31	O	8030-01-155-3238	SEALING COMPOUND (61603) 392430 Box of 6 Tubes, 50 ML Each	ML
32	O	6810-00-264-6618	SODIUM BICARBONATE: Technical (58536) AA374-2) 1 Pound Box	LB
33	O	3439-00-555-4629	SOLDER: Lead-Tin Alloy, Rosin Core (81348) QQ-S-571 1 Pound Spool	LB
34	O	5975-00-903-2284	STRAP: Tiedown, Electrical Components (96906) MS3367-4-0 4 Inch Length, Black Package of 100	EA
		5975-00-984-6582	(96906) MS3367-1-0 6 Inch Length, Black Package of 100	EA
		5975-00-935-5946	(96906) MS3367-2-1 13.35 Inch Minimum Length, Brown Package of 100	EA
35	O	9905-00-537-8954	TAG: Marker (64067) 9905-00-537-8954 Pack of 50	EA
36	O	5640-00-103-2254	TAPE: Duct, 2 Inches Wide (39482) 1791K70 60 Yard Roll	YD
37	O	9905-00-596-0191	WIRE: Nonelectrical (81346) ASTM A641 5 Pound Coil	LB

END OF WORK PACKAGE

TOOL IDENTIFICATION LIST

0185 00**SCOPE**

This work package lists all common tools and supplements and special tools/fixtures needed to maintain the D7F Tractor.

EXPLANATION OF COLUMNS IN THE TOOL IDENTIFICATION LIST

1. **Column (1) - Item Number (No.)**. This number is assigned to the entry in the list and is referenced in the initial setup to identify the item (e.g., Tool kit, general mechanic's, Item 112, WP 0185 00).
2. **Column (2) - Item Name**. This column lists the item by noun nomenclature and other descriptive features (e.g., Adapter, Coupling).
3. **Column (3) - National Stock Number**. This is the National Stock Number (NSN) assigned to the item; use it to requisition the item.
4. **Column (4) - Part Number/CAGEC**. Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity) which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items. The manufacturer's Commercial and Government Entity Code (CAGEC) is also included.
5. **Column (5) - Reference**. This column identifies the authorizing supply catalog or RPSTL for selected tool.

TOOL IDENTIFICATION LIST - CONTINUED

0185 00

TOOL IDENTIFICATION LIST**Table 1. Tool Identification List.**

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
1	Adapter	5120-01-518-9738	6V3094 (11083)	TM 5-2410-233-23P
2	Adapter	5120-01-119-1713	1P3054 (11083)	TM 5-2410-233-23P
3	Adapter		6V3123 (11083)	TM 5-2410-233-23P
4	Adapter	5120-01-119-1764	7M9773 (11083)	TM 5-2410-233-23P
5	Adapter, Coupling	5120-01-119-1765	7M9774 (11083)	TM 5-2410-233-23P
6	Adapter, Pin	5120-01-119-1715	1P3053 (11083)	TM 5-2410-233-23P
7	Adapter, Socket Wrench	5120-01-508-9182	2P8261 (11083)	TM 5-2410-233-23P
8	Adapter, Torque Wrench	5120-01-359-2644	6V6175 (11083)	TM 5-2410-233-23P
9	Adapter, Sprocket Installation	5120-01-512-7168	5P6222 (11083)	TM 5-2410-233-23P
10	Adjusting Tool, Bearing	5120-01-272-4055	6V0082 (11083)	TM 5-2410-233-23P
11	Bolt, Machine	5306-01-026-9992	9S8890 (11083)	TM 5-2410-233-23P
12	Bolt, Machine	5306-00-426-3150	1A8537 (11083)	TM 5-2410-233-23P
13	Bushing Driver Set	5120-01-030-1626	1P0510 (11083)	TM 5-2410-233-23P
14	Bushing Driver Set	5120-01-039-4811	1P0520 (11083)	TM 5-2410-233-23P
15	Cap, Protective, Dust	5340-01-292-1734	1P7437 (11083)	TM 5-2410-233-23P
16	Clip, Retaining	5340-00-377-8758	7B2499 (11083)	TM 5-2410-233-23P
17	Collar, Shaft	3040-01-295-2500	8S7625 (11083)	TM 5-2410-233-23P
18	Coupling Assembly, Quick Disconnect	4730-01-275-0057	1108 (97111)	TM 5-2410-233-23P
19	Coupling Half, Quick	4730-01-295-3790	1P2375 (11083)	TM 5-2410-233-23P
20	Coupling Tool		1P7402 (11083)	TM 5-2410-233-23P
21	Cover, Access	5340-01-162-8676	5H4018 (11083)	TM5-2410-233-23P
22	Cylinder Assembly, Actuating, Linear	3040-01-264-9538	8S7650 (11083)	TM 5-2410-233-23P
23	Distorter, Sleeve	5120-01-119-1750	5P7315 (11083)	TM 5-2410-233-23P
24	Forcing Screw, Mechanical Puller	5120-01-513-9583	5P5207 (11083)	TM 5-2410-233-23P
25	Gage, Sprocket Wear	5210-01-225-1132	5P8617 (11083)	TM 5-2410-233-23P
26	Guide, Seal		2P8301 (11083)	TM 5-2410-233-23P
27	Guide, Seal		5P6156 (11083)	TM 5-2410-233-23P
28	Guide, Seal		5P8565 (11083)	TM 5-2410-233-23P
29	Handle, Extension, Wrench	5120-01-512-9821	5P8675 (11083)	TM 5-2410-233-23P
30	Head		6V4000 (11083)	TM 5-2410-233-23P
31	Head, Socket Install	5120-00-972-0345	9H3992 (11083)	TM 5-2410-233-23P
32	Hose Assembly	3442-00-876-6522	8F0024 (11083)	TM 5-2410-233-23P

TOOL IDENTIFICATION LIST - CONTINUED

Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
33	Insertor, Seal	5120-01-119-1736	5M2162 (11083)	TM 5-2410-233-23P
34	Insertor, Seal	5120-01-286-4205	8M9395 (11083)	TM 5-2410-233-23P
35	Insertor, Seal		1U8842 (11083)	TM 5-2410-233-23P
36	Insertor, Seal	5120-01-289-0635	4S9453 (11083)	TM 5-2410-233-23P
37	Insertor, Seal	5120-01-289-0637	4S9450 (11083)	TM 5-2410-233-24P
38	Insertor, Seal	5120-01-295-1535	4S9456 (11083)	TM 56-2410-233-24P
39	Installer	5120-01-349-0341	6V7876 (11083)	TM 5-2410-233-23P
40	Leg, Mechanical Puller	5120-00-227-0633	1107 (45225)	TM 5-2410-233-23P
41	Leg, Mechanical Puller	5120-00-633-5075	1110 (45225)	TM 5-2410-233-23P
42	Leveler, Load: 6000 lb Capacity	3950-01-263-9513	60842 (45225)	TM 5-2410-233-23P
43	Link, Bearing (Lifting)	5120-01-451-1401	1387575 (11083)	TM 5-2410-233-23P
44	Link, Bearing (Lifting)	5340-01-476-1734	1387574 (11083)	TM 5-2410-233-23P
45	Link, Pin	5120-01-119-1714	1P3052 (11083)	TM 5-2410-233-23P
46	Lock		6V3127 (11083)	TM 5-2410-233-24P
47	Nipple, Pipe	4730-01-162-0102	5P8998 (11083)	TM 5-2410-233-23P
48	Nozzle Puller Group	2910-01-250-1608	6V6980 (11083)	TM 5-2410-233-24P
49	Nut, Plain, Round	5310-01-507-2374	6V3124 (11083)	TM 5-2410-233-23P
50	Nut, Plain, Round	5310-01-507-2390	5P5208 (11083)	TM 5-2410-233-23P
51	Nut, Sleeve	5310-01-038-8318	9S8858 (11083)	TM 5-2410-233-23P
52	O-ring	5331-00-741-0674	5F1678 (11083)	TM 5-2410-233-24P
53	Pin	5315-01-119-1754	6H4158 (11083)	TM 5-2410-233-23P
54	Pin	5315-01-265-0418	5F9892 (11083)	TM 5-2410-233-23P
55	Pin	5315-01-270-5495	7S7112 (11083)	TM 5-2410-233-23P
56	Pin, Lock	5315-00-931-8963	3J1770 (11083)	TM 5-2410-233-23P
57	Pin, Shoulder, Headless	5315-01-270-2832	8S7615 (11083)	TM 5-2410-233-23P
58	Pin, Straight, Headless	5315-01-506-5030	6V3126 (11083)	TM 5-2410-233-23P
59	Pin, Straight, Headless	5315-00-922-2595	7M9772 (11083)	TM 5-2410-233-23P
60	Pin, Timing	2815-01-268-2194	6V4186 (11083)	TM 5-2410-233-23P
61	Plate, Intermediate, Friction Clutch	2520-01-408-9279	1P492 (11083)	TM 5-2410-233-23P
62	Plate	5120-01-119-1733	5F5096 (11083)	TM 5-2410-233-23P
63	Plate Assembly		5P5212 (11083)	TM 5-2410-233-23P
64	Plate, Compressor, Steering	5120-00-371-9610	5F5034 (11083)	TM 5-2410-233-23P

TOOL IDENTIFICATION LIST - CONTINUED

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TOOL IDENTIFICATION LIST - CONTINUED

Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
65	Press, Arbor, Hand Operated	3444-00-449-7295	AA59384 (52536)	TM 5-2410-233-23P
66	Plug, Pipe	4730-00-089-2515	5M6213 (11083)	TM 5-2410-233-23P
67	Plug, Protective, Dust	5340-01-371-2357	1P2377 (11083)	TM 5-2410-233-23P
68	Press, Hydraulic, Portable	4940-01-272-2839	2159672 (11083)	TM 5-2410-233-23P
69	Puller	5130-01-289-0100	8M9011 (11083)	TM 5-2410-233-24P
70	Puller Assembly		1U6415 (11083)	TM 5-2410-233-23P
71	Puller Attachment, Mechanical	5120-01-512-7167	1H3112 (11083)	TM 5-2410-233-23P
72	Puller Attachment, Mechanical	5120-00-288-6756	8B7551 (11083)	TM 5-2410-233-23P
73	Puller Attachment, Mechanical	5120-00-293-1430	8B7554 (11083)	TM 5-2410-233-23P
74	Puller, Crank Pulley	5120-01-124-1732	1P0820 (11083)	TM 5-2410-233-23P
75	Puller Group	5120-01-128-0725	8S2264 (11083)	TM 5-2410-233-23P
76	Puller, Hydraulic	5130-01-288-2786	9S8900 (11083)	TM 5-2410-233-23P
77	Puller, Hydraulic	5130-01-480-6682	5P5201 (11083)	TM 5-2410-233-23P
78	Puller, Hydraulic		1S4233 (11083)	TM 5-2410-233-24P
79	Puller Kit, Universal	5180-01-124-1903	1P3075 (11083)	TM 5-2410-233-23P
80	Puller, Mechanical	5120-00-633-5074	939 (45225)	TM 5-2410-233-23P
81	Puller, Mechanical	5120-00-633-5085	8B7548 (11083)	TM 5-2410-233-23P
82	Puller, Ratchet Lever, Cable Type	5120-01-275-2286	8S9906 (11083)	TM 5-2410-233-23P
83	Puller, Sprocket Arm	5120-00-971-5507	5F9306 (11083)	TM 5-2410-233-23P
84	Pump, Hydraulic Ram, Hand Driven	4320-01-271-9831	304401 (45225)	TM 5-2410-233-23P
85	Pumping Unit, Hydraulic, Power Driven	4320-01-068-6009	3S6224 (11083)	TM 5-2410-233-23P
86	Pusher, Rollover	5120-01-119-1773	8S9903 (11083)	TM 5-2410-233-23P
87	Reducer, Pipe	4730-00-726-1103	5S2403 (11083)	TM 5-2410-233-23P
88	Reducer, Pipe	4730-01-373-5625	5B6009 (11083)	TM 5-2410-233-23P
89	Remover and Replacer	5120-01-030-3575	9S8871 (11083)	TM 5-2410-233-23P
90	Remover, Bearing and Bushing	5120-01-393-3420	3P2248 (11083)	TM 5-2410-233-23P
91	Repair Tool, Special Purpose	4910-01-264-4778	8S7621 (11083)	TM 5-2410-233-23P
92	Ring, Sleeve Distorter	5120-01-119-1749	5P7313 (11083)	TM 5-2410-233-23P
93	Screw, Cap, Hexagon Head	5305-01-271-2044	8F1156 (11083)	TM 5-2410-233-24P

TOOL IDENTIFICATION LIST - CONTINUED

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TOOL IDENTIFICATION LIST - CONTINUED

Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
94	Shop Equipment, Automotive Maintenance and Repair: Common No. 1, Less Power, SC4910-95-CL-A74	4910-00-754-0654	SC4910-95CLA74 (19204)	
95	Shop Equipment, Automotive Maintenance and Repair: Common No. 2, Less Power, SC4910-95-CL-A72	4910-00-754-0650	SC4910-95CLA72 (19204)	
96	Shop Equipment, Contact Maintenance: Truck Mounted, SC4040-95-CL-B04	4940-00-294-9518	MILS45855 (81349)	
97	Shop Equipment, General Purpose Repair: Semitrailer Mounted, SC4940-95-CL-B02	4940-00-287-4894	MILS45538 (81349)	
98	Shop Equipment, Machine Shop: Field Maintenance, Basic, SC3470-95-CL-A02	3470-00-754-0708	SC3470-95CLA02 (19204)	
99	Shop Equipment, Welding, SC3470-95-CL-A08	4940-00-357-7268	SC3470-95CLA08 (19204)	
100	Sling, Nylon	2835-01-078-2081	4-8FTX2IN (91796)	TM 5-2410-233-24P
101	Socket, Socket Wrench	5120-01-233-0320	5S6087 (11083)	TM 5-2410-233-23P
102	Spacer	5365-01-119-1769	8M9008 (11083)	TM 5-2410-233-23P
103	Spacer, Sleeve	5365-01-506-1820	5P6220 (11083)	TM 5-2410-233-23P
104	Stand Assembly	4910-01-264-4777	8S7640 (11083)	TM 5-2410-233-23P
105	Stand, Lifting	5120-01-343-8085	4C6486 (11083)	TM 5-2410-233-23P
106	Stand, Steering Clutch		FT0610 (11083)	TM 5-2410-233-23P
107	Stand, Transmission	4910-01-265-2624	1P2420 (11083)	TM 5-2410-233-23P
108	Step Plate, Mechanical Puller	5120-00473-6921	8B7560 (11083)	TM 5-2410-233-23P
109	Tachometer, Stroboscopic	6680-01-355-7805	1U6602 (11083)	TM 5-2410-233-23P
110	Tee, Pipe	4730-00-119-9861	MS14303-2R06 (96906)	TM 5-2410-233-23P
111	Tool, Distorter, Wear Sleeve	5120-01-119-1748	5P7312 (11083)	TM 5-2410-233-23P
112	Tool Kit, General Mechanic's: Automotive, SC5180-90-CL-N05	5180-00-699-5273	SC5180-90-CL-N05 (50980)	
113	Tool Outfit, Hydraulic System Test and Repair (HSTRU), SC3470-95-CL-B07	4940-01-036-5784	13221E6850 (97403)	

TOOL IDENTIFICATION LIST - CONTINUED

Table 1. Tool Identification List - Continued.

(1) ITEM NO.	(2) ITEM NAME	(3) NATIONAL STOCK NUMBER	(4) PART NUMBER/ CAGEC	(5) REFERENCE
114	Tool Set, Track Repair	5120-00-513-1788	5P2379 (11083)	TM 5-2410-233-23P
115	Tool, Special	4910-01-265-0428	8S7611 (11083)	TM 5-2410-233-23P
116	Valve, Needle	4810-01-127-5377	1S8937 (11083)	TM 5-2410-233-23P
117	Washer		3H467 (11083)	TM 5-2410-233-23P
118	Washer, Flat	5310-00-308-2227	4B5273 (11083)	TM 5-2410-233-23P
119	Wrench, Ratchet	5120-01-123-5881	8H0684 (11083)	TM 5-2410-233-23P
120	Wrench, Spanner		2P2345 (11083)	TM 5-2410-233-23P
121	Wrench, Spanner	5120-01-512-8936	5P3520 (11083)	TM 5-2410-233-23P
122	Wrench, Torque Multiplier: 1 in. Square Drive	5120-01-507-6929	5P3508 (11083)	TM 5-2410-233-23P
123	Yoke	5120-00-426-3787	2B2003 (11083)	TM 5-2410-233-23P
124	Link, Bearing (Lifting)	4940-01-268-2201	1387573 (11083)	TM 5-2410-233-23P

END OF WORK PACKAGE

Effective with sales to the first user on or after July 1, 2000

CATERPILLAR BATTERY LIMITED WARRANTY

USA and Canada

Caterpillar Inc. or any of its subsidiaries ("Caterpillar") warrants new batteries sold by it and used within the geographic area serviced by authorized USA and Canadian Caterpillar dealers, to be free from defects in material and workmanship.

In other areas, different warranties may apply. Copies of applicable warranties may be obtained by writing to Caterpillar, Inc., 100 N.E. Adams St., Peoria, IL USA 61629.

This warranty is subject to the following:

1. The warranty period is as follows, starting from the date of battery sale or product delivery to the first user.

Application	Battery Type & Warranty Period	
	Premium, High Output	General Service Line
On-Highway vehicles up to 680 kilograms (3/4 ton) capacity with charging systems in a personal, family or household use application.	72 Months	72 Months
On-Highway vehicles up to 680 kilograms (3/4 ton) capacity with charging systems in other than a personal, family or household use application.	36 Months	36 Months
All on-highway vehicles over 680 kilograms (3/4 ton) capacity with charging systems.	36 Months	30 Months
Earthmoving, construction, materials handling, paving and off-highway equipment, agricultural, industrial engine, electric power generation and marine products with charging systems.	36 Months	24 Months
For deep cycle applications or applications without constant battery charging systems (i.e. auxiliary batteries for marine pleasure craft or recreational vehicles; electric trolling motor or golf cart applications which use batteries as their motive power; lawn garden applications, etc.).	3 Months	(See Note)

Note: For "General Service Line" batteries in deep cycle applications or applications without constant battery charging systems, the warranty period is as follows:

BCI group sizes U-1R, U-1, 8V, and GC-2: 18 Months
 BCI group sizes 24 M and 27M: 30 Months
 The warranty period for all other batteries is 3 Months.

2. Within the periods stated in Item 1, Caterpillar will replace a battery which it finds to be defective in material or workmanship with a new battery at the following cost to the user:

For the first 18 months from date of sale or delivery for PHO group 31 batteries used in on-highway applications, 12 months for Cat PHO batteries not used in the aforementioned on-highway applications and 3 months for "General Service Line" category batteries, or batteries in deep cycle applications or applications without constant battery charging systems, there is no charge to the user. After this time period, user cost is determined by the following formula:

$$\frac{\text{Current Consumer's Battery Price}}{\text{Months in Warranty Period}} \times \frac{\text{Months of Service}}{\text{Service}} = \text{User Cost}$$

3. This warranty will be honored upon return of the battery, during normal working hours, to a Caterpillar dealer or other source approved by Caterpillar.
4. Taxes, installation, or transportation costs, which may result from replacement, are not included in this warranty.

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NEITHER THE FOREGOING EXPRESS WARRANTY NOR ANY OTHER WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED, IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS WHICH IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISION OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN. CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION (CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS) IS EXCLUDED IN ITS ENTIRETY.

For personal or family use batteries used in the USA, its territories and possessions, some states do not allow limitations on how long an implied warranty may last nor allow the exclusion or limitation of incidental or consequential damages. Therefore, the previously expressed exclusion may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary by jurisdiction. To find the location of the nearest Caterpillar dealer or authorized repair facility, call (877) 228-9900. If you have questions concerning this warranty or its application, call or write: NACD Business Operations, Caterpillar Inc., 100 N. E. Adams St., Peoria, IL 61629-1250 Telephone:(309)675-4037.

Effective with sales to the first user on or after September 1, 1999

CATERPILLAR WARRANTY

Ground Engaging Tools Worldwide

(excluding the commonwealth of Independent States)

Caterpillar Inc. or any of its subsidiaries ("Caterpillar") warrants the following Ground Engaging Tools (and every major component thereof) sold by it, and used outside the Commonwealth of Independent States (formerly USSR), against breakage. This warranty is applicable after the expiration of any standard machine or parts warranty to:

- Tips and adapters used on buckets, rippers and scrapers
- End bits and router bits
- Side cutters and sidebar protectors
- Uni-tooth components
- Modulok and HD Mining System components
- MEGS (Mining Edge Guard System) components
- Mechanically-attached adapter systems and wear plates
- Lip Protection System components
- Base edge assemblies, bolt-on flat plate or half arrow segments and cutting edges (except high carbon motor grader cutting edges)
- Ripper shank protectors and multi-piece ripper protectors
- Scarifier tips
- Compactor feet
- Landfill compactor tips and chopper blades (an additional warranty applies to Long Life Plus Tips)
- Bolt-on wear plates and sole plates
- Loader bucket cutting edge corner components
- Grader Bit and Mining Bit adapters

- Grader Bit, Mining Bit assemblies and tungsten carbide motor grader cutting edges (except for carbide element)
- Percussive drill products

This warranty also covers the parent material of the Ground Engaging Tools covered if Caterpillar-sourced Abrasion-Resistant Material (ARM) has been applied by a Caterpillar dealer.

This warranty is subject to the following:

Warranty Period

The warranty period is not limited by time and is applicable throughout the *useful life* of the Ground Engaging Tools covered.

Caterpillar Responsibilities

If a breakage occurs during normal operation, Caterpillar will, during normal working hours and at a place of business of a Caterpillar dealer or other source approved by Caterpillar:

- Provide (at Caterpillar's choice) new or Caterpillar-approved repaired parts or assembled components needed to correct the defect.

Note: Items replaced under this warranty become the property of Caterpillar.

User Responsibilities

The user is responsible for:

- Labor (including welding) and hardware costs associated with removal and installation.
- Parts shipping charges in excess of those which are usual and customary.
- Local taxes, if applicable.
- Giving timely notice of a warrantable failure and promptly making the product available for repair.

Limitations

Caterpillar is not responsible for failures resulting from:

- Any use or installation which Caterpillar judges improper.
- Breakage of Ground Engaging Tools due to worn mating components or those that have been hardfaced or improperly welded.
- Attachments of competitive parts to Caterpillar components.
- Cracks in the ARM weld and chipping of hard particles out of the weld. This is not considered "breakage" under the terms of this warranty.
- Abuse, neglect and/or improper repair.

A different warranty statement applies to Ground Engaging Tools used in the Commonwealth of Independent States. Copies of this warranty may be obtained by writing Caterpillar Inc., 100 N.E. Adams St., Peoria, IL USA 61629.

For products operating outside of Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

NEITHER THE FOREGOING EXPRESS WARRANTY NOR ANY OTHER WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED, IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS WHICH IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISION OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN. CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION (CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS) IS EXCLUDED IN ITS ENTIRETY.

For products operating in Australia, Fiji, Nauru, New Caledonia, New Zealand, Papua New Guinea, the Solomon Islands and Tahiti, the following is applicable:

THIS WARRANTY IS IN ADDITION TO WARRANTIES AND CONDITIONS IMPLIED BY STATUTE AND OTHER STATUTORY RIGHTS AND OBLIGATIONS THAT BY ANY APPLICABLE LAW CANNOT BE EXCLUDED, RESTRICTED OR MODIFIED ("MANDATORY RIGHTS"). ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED (BY STATUTE OR OTHERWISE), ARE EXCLUDED.

NEITHER THIS WARRANTY NOR ANY OTHER CONDITION OR WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED (SUBJECT ONLY TO THE MANDATORY RIGHTS), IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS WHICH IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

TO THE EXTENT PERMITTED UNDER THE MANDATORY RIGHTS, IF CATERPILLAR IS THE SUPPLIER TO THE USER, CATERPILLAR'S LIABILITY SHALL BE LIMITED AT ITS OPTION TO (a) IN THE CASE OF SERVICES, THE SUPPLY OF THE SERVICES AGAIN OR THE PAYMENT OF THE COST OF HAVING THE SERVICES SUPPLIED AGAIN, AND (b) IN THE CASE OF GOODS, THE REPAIR OR REPLACEMENT OF THE GOODS, THE SUPPLY OF EQUIVALENT GOODS, THE PAYMENT OF THE COST OF SUCH REPAIR OR REPLACEMENT OR THE ACQUISITION OF EQUIVALENT GOODS.

CATERPILLAR EXCLUDES ALL LIABILITY FOR OR ARISING FROM ANY NEGLIGENCE ON ITS PART OR ON THE PART OF ANY OF ITS EMPLOYEES, AGENTS OR REPRESENTATIVES IN RESPECT OF THE MANUFACTURE OR SUPPLY OF GOODS OR THE PROVISION OF SERVICES RELATING TO THE GOODS.

CATERPILLAR IS NOT LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES UNLESS IMPOSED UNDER MANDATORY RIGHTS.

IF OTHERWISE APPLICABLE, THE VIENNA CONVENTION (CONTRACTS FOR THE INTERNATIONAL SALE OF GOODS) IS EXCLUDED IN ITS ENTIRETY.

Claims under this warranty should be submitted to a place of business of a Caterpillar dealer or other source approved by Caterpillar. For further information concerning either the location to submit claims or Caterpillar as the issuer of this warranty, write Caterpillar Inc., 100 N. E. Adams St., Peoria, IL USA 61629.

Effective with sales to the first user on or after June 1, 2001

CATERPILLAR WARRANTY

Earthmoving, Construction, and Material Handling Machines Rebuilt As Part Of The Service Life Extension Program

Caterpillar warrants products rebuilt to be free from defects in material and workmanship.

This warranty is subject to the following:

Warranty Period

For rebuilt machines and attachments, the warranty period is 18 months or 500 operating hours, whichever occurs first, starting from date of delivery to the user.

An additional warranty against breakage is applicable to certain Caterpillar brand Ground Engaging Tools. Refer to the applicable warranty statement for coverage detail.

An additional prorated warranty applies to Caterpillar brand batteries after the 18-month or 500 hours. Refer to applicable warranty statement for coverage detail.

Caterpillar Responsibilities

If a defect in material or workmanship is found during the warranty period, Caterpillar will, during normal working hours and at a place of business of a Caterpillar dealer or other source approved by Caterpillar:

- Provide (at Caterpillar's choice) new, remanufactured, or Caterpillar-approved repaired parts or assembled components needed to correct the defect.
- Provide reasonable and customary labor needed to correct the defect.
- The costs associated with transporting the product, or reasonable travel by dealer mechanic.

User Responsibilities

The user is responsible for:

- Providing proof of the delivery date to the user.
- Labor costs, except as stated under "Caterpillar Responsibilities".
- Local taxes, if applicable.

- Parts shipping charges in excess of those which are usual and customary.
- Costs to investigate complaints, unless the problem is caused by a defect in Caterpillar material or workmanship.
- Giving timely notice of a warrantable failure and promptly making the product available for repair.
- Performance of the required maintenance (including use of proper fuel, oil, lubricants and coolant) and replacement of items due to normal wear and tear.
- Allowing Caterpillar access to all electronically stored data.

Limitations

Caterpillar is not responsible for failures resulting from:

- Any use or installation which Caterpillar judges improper.
- Attachments, accessory items and parts not sold or approved by Caterpillar.
- Abuse, neglect and/or improper repair.
- User's delay in making the product available after being notified of a potential product problem.
- Unauthorized repair or adjustments, and unauthorized fuel setting changes.

NEITHER THE FOREGOING EXPRESS WARRANTY BY CATERPILLAR, EXPRESS OR IMPLIED, IS APPLICABLE TO ANY ITEM CATERPILLAR SELLS WHICH IS WARRANTED DIRECTLY TO THE USER BY ITS MANUFACTURER.

THIS WARRANTY IS EXPRESSLY IN LIEU OF ANY OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, EXCEPT CATERPILLAR EMISSION-RELATED COMPONENTS WARRANTIES FOR NEW ENGINES, WHERE APPLICABLE. REMEDIES UNDER THIS WARRANTY ARE LIMITED TO THE PROVISION OF MATERIAL AND SERVICES, AS SPECIFIED HEREIN. CATERPILLAR IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

As used in this warranty, the term "Caterpillar" means Caterpillar, Inc., or one of its subsidiaries, except Caterpillar Overseas S.A., Caterpillar France S.A., Caterpillar (U.K.) Limited, or Caterpillar Belgium S.A., whichever last sold the product involved.

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By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:


SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army
0515123

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

PUBLICATION/FORM NUMBER TM 5-2410-233-23	DATE 15 July 2005	TITLE Field Maintenance Manual for Tractor, Full Tracked, Low Speed: Diesel Engine Driven, Medium Drawbar Pull, D7F
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ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON
	0007 00-1					Part number supplied for item 2 is incorrect.
SAMPLE						

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

TYPED NAME, GRADE OR TITLE Johnny Wilson, E-5, MOTOR SGT	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION DSN 867-7967	SIGNATURE
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PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER			DATE	TITLE				
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 *(Use for general remarks, references, or suggestions for improvement of publications and catalogs. Additional sheets may be used if space is needed.)*

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THE METRIC SYSTEM AND EQUIVALENTS

<p>Linear Measure</p> <p>1 Centimeter = 10 Millimeters = 0.01 Meters = 0.3937 Inches 1 Meter = 100 Centimeters = 1000 Millimeters = 39.37 Inches 1 Kilometer = 1000 Meters = 0.621 Miles</p> <p>Weights</p> <p>1 Gram = 0.001 Kilograms = 1000 Milligrams = 0.035 Ounces 1 Kilogram = 1000 Grams = 2.2 Pounds 1 Metric Ton = 1000 Kilograms = 1 Megagram = 1.1 Short Tons</p> <p>Liquid Measure</p> <p>1 Milliliter = 0.001 Liters = 0.0338 Fluid Ounces 1 Liter = 1000 Milliliters = 33.82 Fluid Ounces</p>	<p>Square Measure</p> <p>1 Sq Centimeter = 100 Sq Millimeters = 0.155 Sq Inches 1 Sq Meter = 10,000 Sq Centimeters = 10.76 Sq Feet 1 Sq Kilometer = 1,000,000 Sq Meters = 0.386 Sq Miles</p> <p>Cubic Measure</p> <p>1 Cu Centimeter = 1,000 Cu Millimeters = 0.06 Cu Inches 1 Cu Meter = 1,000,000 Cu Centimeters = 35.31 Cu Feet</p> <p>Temperature</p> <p>$5/9 (^{\circ}\text{F} - 32) = ^{\circ}\text{C}$ 212° Fahrenheit is equivalent to 100° Celsius 90° Fahrenheit is equivalent to 32.2° Celsius 32° Fahrenheit is equivalent to 0° Celsius $9/5 \text{ C}^{\circ} + 32 = \text{F}^{\circ}$</p>
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APPROXIMATE CONVERSION FACTORS

To Change	To	Multiply By
Inches	Centimeters	2.540
Feet	Meters	0.305
Yards	Meters	0.914
Miles	Kilometers	1.609
Sq Inches	Sq Centimeters	6.451
Sq Feet	Sq Meters	0.093
Sq Yards	Sq Meters	0.836
Sq Miles	Sq Kilometers	2.590
Acres	Sq Hectometers	0.405
Cubic Feet	Cubic Meters	0.028
Cubic Yards	Cubic Meters	0.765
Fluid Ounces	Milliliters	29.573
Pints	Liters	0.473
Quarts	Liters	0.946
Gallons	Liters	3.785
Ounces	Grams	28.349
Pounds	Kilograms	0.454
Short Tons	Metric Tons	0.907
Pound-Feet	Newton-Meters	1.356
Pounds per Sq Inch	Kilopascals	6.895
Miles per Gallon	Kilometers per Liter	0.425
Miles per Hour	Kilometers per Hour	1.609

To Change	To	Multiply By
Centimeters	Inches	0.394
Meters	Feet	3.280
Meters	Yards	1.094
Kilometers	Miles	0.621
Sq Centimeters	Sq Inches	0.155
Sq Meters	Sq Feet	10.764
Sq Meters	Sq Yards	1.196
Sq Kilometers	Sq Miles	0.386
Sq Hectometers	Acres	2.471
Cubic Meters	Cubic Feet	35.315
Cubic Meters	Cubic Yards	1.308
Milliliters	Fluid Ounces	0.034
Liters	Pints	2.113
Liters	Quarts	1.057
Liters	Gallons	0.264
Grams	Ounces	0.035
Kilograms	Pounds	2.205
Metric Tons	Short Tons	1.102
Newton-Meters	Pound-Feet	0.738
Kilopascals	Pounds per Sq Inch	0.145
Kilometers per Liter	Miles per Gallon	2.354
Kilometers per Hour	Miles per Hour	0.621

